

**SOKKIA**

**SETX**

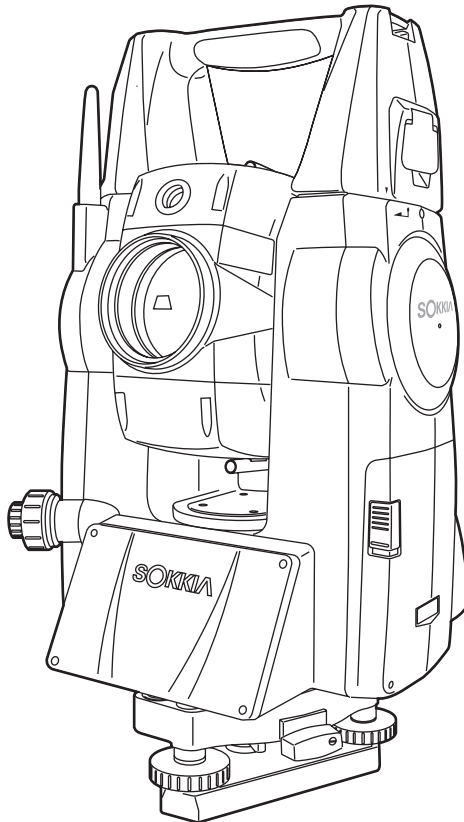
**SET1X**

**SET2X**

**SET3X**

**SET5X**

**Total Station**



Class 3R Laser Product

**OPERATOR'S MANUAL**



**Li-ion**

CONTAINS Li-ion BATTERY.  
MUST BE RECYCLED OR DISPOSED OF PROPERLY.

**JSIMA**

This is the mark of the Japan Surveying  
Instruments Manufacturers Association.

**SOKKIA**

**SETX**

**SET1X**

**SET2X**

**SET3X**

**SET5X**

Total Station

Class 3R Laser Product




**OPERATOR'S MANUAL**

- Thank you for selecting the SET1X/2X/3X/5X.
- Please read this operator's manual carefully, before using this product.
- Verify that all equipment is included.  
☞ "34. STANDARD EQUIPMENT"
- SETX has a function to output data to a connected host computer. Command operations from a host computer can also be performed. For details, refer to "Interfacing with the SOKKIA SDR Electronic Field Book" and Command Explanations manuals and ask your local dealer.
- The specifications and general appearance of the instrument may be altered at any time and may differ from those appearing in brochures and this manual.
- The content of this manual may be altered at any time.
- Some of the diagrams shown in this manual may be simplified for easier understanding.

# HOW TO READ THIS MANUAL

## Regarding other manuals

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- Manuals 2 and 3 below are electronic manuals provided on a CD-ROM in PDF format (  ). Adobe Reader is necessary in order to view these documents. The latest version of Acrobat Reader can be downloaded from the Adobe homepage.
- The SETX comes equipped with 3 manuals for operation information:
  1. SETX Operator's Manual (this manual):  
Explains basic operation and functions of the SETX.
  2. Spectrum Survey Field Program Explanations  :  
Explains advanced measurement operations using Spectrum Survey Field software.
  3. SFX Dial-Up Program Explanations  :  
Explains how to send and receive data using the SFX function.

## Symbols

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The following conventions are used in this manual.



: Indicates precautions and important items which should be read before operations.



: Indicates the chapter title to refer to for additional information.



: Indicates supplementary explanation.



: Indicates an explanation for a particular term or operation.


**[Softkey]** etc. : Indicates softkeys on the display and window dialog buttons.


**{Key}** etc. : Indicates keys on the operation panel.

<Screen title> etc.: Indicates screen titles.

## Notes regarding manual style

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- Except where stated, "SETX" means SET1X/2X/3X/5X in this manual.
- Except where stated, "SSF" means Spectrum Survey Field in this manual.
- Screens and illustrations appearing in this manual are of SET3X (with *Bluetooth* module and display on face 1 only). Face 2 display is available as standard or as a factory option depending on the country of purchase.
- Location of softkeys in screens used in procedures is based on the factory setting. It is possible to change the allocation of softkeys.  
 Softkey allocation: "29.6 Allocating Key Functions"

- Learn basic operations in "4. PRODUCT OUTLINE" and "5. BASIC OPERATION" before you read each measurement procedure. An overview of the available SETX functions is given in "4.1 Functions". For selecting options and inputting figures, see "5.1 Basic Key Operation".
- Measurement procedures are based on continuous measurement. Some information about procedures when other measurement options are selected can be found in "Note" ()
- KODAK is a registered trademark of Eastman Kodak Company.
- *Bluetooth*<sup>®</sup> is a registered trademark of Bluetooth SIG, Inc.
- Windows and Windows CE are registered trademarks of Microsoft Corporation.
- All other company and product names featured in this manual are trademarks or registered trademarks of each respective organization.

# CONTENTS

1. PRECAUTIONS FOR SAFE OPERATION .....	1
2. PRECAUTIONS .....	4
3. LASER SAFETY INFORMATION .....	7
4. PRODUCT OUTLINE .....	9
4.1 Functions .....	9
4.2 Parts of the Instrument .....	11
4.3 Mode Structure .....	14
4.4 Bluetooth Wireless Technology .....	15
5. BASIC OPERATION .....	17
5.1 Basic Key Operation .....	17
5.2 Display Functions .....	22
5.3 Inputting Characters using the Input Panel .....	28
5.4 SETTINGS Mode .....	29
6. USING THE CF CARD SLOT .....	30
6.1 Inserting/Removing the CF Card .....	30
7. USING THE BATTERY .....	32
7.1 Battery Charging .....	32
7.2 Installing/Removing the Battery .....	33
8. SETTING UP THE INSTRUMENT .....	36
8.1 Centering .....	36
8.2 Levelling .....	37
9. POWER ON/OFF .....	40
9.1 Resolving Software Issues .....	41
9.2 Configuring the Touch Panel .....	41
10. CONNECTING TO EXTERNAL DEVICES .....	43
10.1 Wireless Communication using Bluetooth Technology ...	43
10.2 Communication between the SETX and Companion Device	46
10.3 Connecting to USB devices .....	48
10.4 Connection via RS232C cable .....	50
11. FOCUSING AND TARGET SIGHTING .....	51
12. ANGLE MEASUREMENT .....	52
12.1 Measuring the Horizontal Angle between Two Points (Horizontal Angle 0°) .....	52
12.2 Setting the Horizontal Angle to a Required Value (Horizontal Angle Hold) .....	53

# CONTENTS

12.3	Angle measurement and Outputting the Data .....	54
13.	DISTANCE MEASUREMENT .....	55
13.1	Returned Signal Checking .....	55
13.2	Distance and Angle Measurement .....	57
13.3	REM Measurement .....	58
13.4	Distance Measurement and Outputting the Data .....	58
14.	TOPOGRAPHY MEASUREMENT .....	61
14.1	Entering Instrument Station Data .....	61
14.2	Azimuth Angle Setting .....	63
14.3	Topography Measurement .....	66
15.	COORDINATE MEASUREMENT .....	68
15.1	Entering Instrument Station Data .....	68
15.2	Azimuth Angle Setting .....	69
15.3	3-D Coordinate Measurement .....	72
15.4	Reading in Registered Coordinate Data from Memory mode 74	
16.	RESECTION MEASUREMENT .....	76
16.1	Coordinate Resection Measurement .....	77
16.2	Height Resection Measurement .....	81
17.	SETTING-OUT MEASUREMENT .....	86
17.1	Using the Guide Light .....	86
17.2	Distance Setting-out Measurement .....	87
17.3	Coordinates Setting-out Measurement .....	93
17.4	REM Setting-out Measurement .....	96
18.	POINT PROJECTION .....	100
18.1	Defining Baseline .....	100
18.2	Point Projection .....	103
19.	Offset Measurement .....	105
19.1	Single-distance Offset Measurement .....	105
19.2	Angle Offset Measurement .....	108
19.3	Two-distance Offset Measurement .....	110
20.	MISSING LINE MEASUREMENT .....	113
20.1	Measuring the Distance between 2 or more Points .....	113
20.2	Changing the Starting Point .....	115
21.	SURFACE AREA CALCULATION .....	117
22.	ROUTE SURVEYING .....	122

# CONTENTS

22.1	Instrument Station Settings .....	122
22.2	Straight Line Calculation .....	123
22.3	Circular Curve Calculation .....	126
22.4	Clothoid Curve .....	128
22.5	3 Point Calculation .....	133
22.6	Intersection Angle/Azimuth Angle Calculation .....	136
22.7	Route Calculation .....	139
23.	CROSS SECTION SURVEY .....	152
23.1	Instrument Station Settings .....	152
23.2	Cross Section Survey .....	153
24.	REGISTERING/reviewing DATA .....	158
24.1	Registering Known Point Data .....	158
24.2	Registering Notes .....	159
24.3	Reviewing Data .....	160
25.	SELECTING / DELETING A JOB .....	162
25.1	Selecting a JOB .....	162
25.2	Deleting a JOB .....	164
26.	RECEIVING COORDINATE DATA .....	165
27.	OUTPUTTING JOB DATA .....	168
28.	REGISTERING/DELETing CODE .....	172
29.	CHANGING THE SETTINGS .....	174
29.1	Observation Conditions .....	174
29.2	Instrument Configuration .....	176
29.3	EDM Settings .....	178
29.4	Allocating User-defined Tabs .....	182
29.5	Customizing Screen Controls .....	184
29.6	Allocating Key Functions .....	186
29.7	Changing Status Bar Icons .....	189
29.8	Units .....	191
29.9	Changing Password .....	192
29.10	Restoring Default Settings .....	193
29.11	Date and Time .....	193
30.	WARNING AND ERROR MESSAGES .....	194
31.	CHECKS AND ADJUSTMENTS .....	198
31.1	Plate Level .....	198



# CONTENTS

31.2	Circular Level .....	199
31.3	Tilt Sensor .....	200
31.4	Collimation .....	203
31.5	Reticle .....	204
31.6	Optical Plummet .....	206
31.7	Additive Distance Constant .....	207
32.	Power Supply System .....	209
33.	Target System .....	210
34.	STANDARD EQUIPMENT .....	212
35.	Optional Accessories .....	216
36.	SPECIFICATIONS .....	218
37.	EXPLANATIONS .....	223
37.1	Manually Indexing the Vertical Circle by Face Left, Face Right Measurement .....	223
38.	REGULATIONS .....	224
39.	INDEX .....	228








# 1. PRECAUTIONS FOR SAFE OPERATION

For the safe use of the product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this operator's manual.

The definitions of the indications are listed below. Be sure you understand them before reading the manual's main text.







## Definition of Indication

	<b>WARNING</b>	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.
	<b>CAUTION</b>	Ignoring this indication and making an operation error could possibly result in personal injury or property damage.


-  This symbol indicates items for which caution (hazard warnings inclusive) is urged. Specific details are printed in or near the symbol.
-  This symbol indicates items which are prohibited. Specific details are printed in or near the symbol.
-  This symbol indicates items which must always be performed. Specific details are printed in or near the symbol.

## General

### **Warning**





-  Do not use the unit in areas exposed to high amounts of dust or ash, in areas where there is inadequate ventilation, or near combustible materials. An explosion could occur.
-  Do not perform disassembly or rebuilding. Fire, electric shock, burns, or hazardous radiation exposure could result.
-  Never look at the sun through the telescope. Loss of eyesight could result.
-  Do not look at reflected sunlight from a prism or other reflecting object through the telescope. Loss of eyesight could result.
-  Direct viewing of the sun using the telescope during sun observation will cause loss of eyesight. Use a solar filter (option), such as that in "35. OPTIONAL ACCESSORIES", for sun observation.
-  When securing the instrument in the carrying case make sure that all catches, including the side catches, are closed. Failure to do so could result in the instrument falling out while being carried, causing injury.

### **Caution**

-  Do not use the carrying case as a footstool. The case is slippery and unstable so a person could slip and fall off it.

## 1. PRECAUTIONS FOR SAFE OPERATION














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-  Do not place the instrument in a case with a damaged catch, belt or handle. The case or instrument could be dropped and cause injury.
-  Do not wield or throw the plumb bob. A person could be injured if struck.
-  Secure handle to main unit with handle locks. Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.
-  Tighten the adjustment tribrach clamp securely. Failure to properly secure the clamp could result in the tribrach falling off while being carried, causing injury.

### Power Supply

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#### **Warning**

-  Do not short circuit. Heat or ignition could result.
  -  Do not place articles such as clothing on the battery charger while charging batteries. Sparks could be induced, leading to fire.
  -  Do not use voltage other than the specified power supply voltage. Fire or electrical shock could result.
  -  Do not use batteries other than those designated. An explosion could occur, or abnormal heat generated, leading to fire.
  -  Do not use damaged power cords, plugs or loose outlets. Fire or electric shock could result.
  -  Do not use power cords other than those designated. Fire could result.
  -  Use only the specified battery charger to recharge batteries. Other chargers may be of different voltage rating or polarity, causing sparking which could lead to fire or burns.
  -  Do not use the battery, charger or AC (power) cable for any other equipment or purpose. Fire or burns caused by ignition could result.
  -  Do not heat or throw batteries into fire. An explosion could occur, resulting in injury.
  -  To prevent shorting of the battery in storage, apply insulating tape or equivalent to the terminals. Otherwise shorting could occur resulting in fire or burns.
  -  Do not use batteries or the battery charger if wet. Resultant shorting could lead to fire or burns.
  -  Do not connect or disconnect power supply plugs with wet hands. Electric shock could result.
- #### **Caution**
-  Do not touch liquid leaking from batteries. Harmful chemicals could cause burns or blisters.

### Tripod

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#### **Caution**

-  When mounting the instrument to the tripod, tighten the centering screw securely. Failure to tighten the screw properly could result in the instrument falling off the tripod, causing injury.
-  Tighten securely the leg fixing screws of the tripod on which the instrument is mounted. Failure to tighten the screws could result in the tripod collapsing, causing injury.
-  Do not carry the tripod with the tripod shoes pointed at other persons. A person could be injured if struck by the tripod shoes.
-  Keep hands and feet away from the tripod shoes when fixing the tripod in the ground. A hand or foot stab wound could result.
-  Tighten the leg fixing screws securely before carrying the tripod. Failure to tighten the screws could lead to the tripod legs extending, causing injury.

### Bluetooth wireless technology

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#### **Warning**

-  Do not use within the vicinity of hospitals. Malfunction of medical equipment could result.
-  Use the instrument at a distance of at least 22 cm from anyone with a cardiac pacemaker. Otherwise, the pacemaker may be adversely affected by the electromagnetic waves produced and cease to operate as normal.
-  Do not use onboard aircraft. The aircraft instrumentation may malfunction as a result.
-  Do not use within the vicinity of automatic doors, fire alarms and other devices with automatic controls as the electromagnetic waves produced may adversely affect operation resulting in an accident.

# 2. PRECAUTIONS

## Telescope

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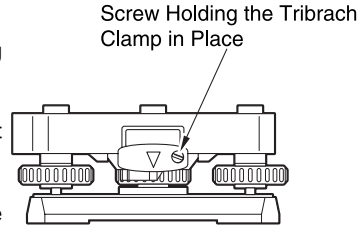
- Aiming the telescope at the sun will cause internal damage to the instrument. Use the solar filter when observing the sun.

☞ "35. OPTIONAL ACCESSORIES"

## Tribrach Clamp and Handle

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- When the instrument is shipped, the tribrach clamp is held firmly in place with a locking screw to prevent the instrument from shifting on the levelling base. Before using the instrument the first time, loosen this screw with a screwdriver. And before transporting it, tighten the locking screw to fasten the tribrach clamp in place so that it will not shift on the levelling base.
- The SETX handle can be removed. When operating the SETX with the handle attached, always make sure that the handle is securely fixed to the SETX body with the handle locks.



## Precautions concerning water and dust resistance

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SETX conforms to IP65 specifications for waterproofing and dust resistance when the CF card cover and battery cover are closed.

- Make sure that moisture or dust particles do not come in contact with the terminal or connectors. Operating the instrument with moisture or dust on the terminal or connectors may cause damage to the instrument.
- Be sure to correctly attach the connector caps to protect the SETX from moisture and dust particles when the connector is not in use.
- Make sure that the inside of the carrying case and the instrument are dry before closing the case. If moisture is trapped inside the case, it may cause the instrument to rust.

## The Lithium Battery

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- The lithium battery is used to maintain the SETX Calendar & Clock function. It can back up data for approximately 5 years of normal use and storage (Temperature = 20°, humidity = about 50%), but its lifetime may be shorter depending on circumstances.

## Vertical and horizontal clamps

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- Always fully release the vertical/horizontal clamps when rotating the instrument or telescope. Rotating with clamp(s) partially applied may adversely affect accuracy.

## Backing up data

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- Data should be backed up (transferred to an external device etc.) on a regular basis to prevent data loss.



### Other precautions

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- Never place the instrument directly on the ground. Sand or dust may cause damage to the screw holes or the centering screw on the base plate.
- Do not perform vertical rotation of the telescope when using the lens hood, diagonal eyepiece, or solar filter. Such accessories may strike the SETX causing damage.
- Protect the instrument from heavy shocks or vibration.
- Protect the instrument from rain or drizzle with an umbrella or waterproof cover.
- When the operator leaves the instrument attached to the tripod, the vinyl cover should be placed on the instrument.
- Never carry the instrument on the tripod to another site.
- Turn the power off before removing the battery.
- Remove the battery before placing the SETX in its case.
- Make sure that the instrument and the protective lining of the carrying case are dry before closing the case. The case is hermetically sealed and if moisture is trapped inside, the instrument could rust.
- Consult your local dealer before using the instrument under special conditions such as long periods of continuous use or high levels of humidity. In general, special conditions are treated as being outside the scope of the product warranty.

### Maintenance

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- Wipe off moisture completely if the instrument gets wet during survey work.
- Always clean the instrument before returning it to the case. The lens requires special care. First, dust it off with the lens brush to remove tiny particles. Then, after providing a little condensation by breathing on the lens, wipe it with the wiping cloth.
- If the display is dirty, carefully wipe it with a soft, dry cloth. To clean other parts of the instrument or the carrying case, lightly moisten a soft cloth in a mild detergent solution. Wring out excess water until the cloth is slightly damp, then carefully wipe the surface of the unit. Do not use any alkaline cleaning solutions, alcohol, or any other organic solvents on the instrument or display.  
 For de-activating the touch panel, see "5.2 Display Functions", "29. CHANGING THE SETTINGS"
- Store the instrument in a dry room where the temperature remains fairly constant.
- Check the tripod for loose fit and loose screws.
- If any trouble is found on the rotatable portion, screws or optical parts (e.g. lens), contact your local dealer.
- When the instrument is not used for a long time, check it at least once every 3 months.  
 "31. CHECKS AND ADJUSTMENTS"
- When removing the instrument from the carrying case, never pull it out by force. The empty carrying case should be closed to protect it from moisture.
- Check the instrument for proper adjustment periodically to maintain the instrument accuracy.

### Exceptions from responsibility

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- The user of this product is expected to follow all operating instructions and make periodic checks (hardware only) of the product's performance.
- The manufacturer, or its representatives, assumes no responsibility for results of faulty or intentional usage or misuse including any direct, indirect, consequential damage, or loss of profits.
- The manufacturer, or its representatives, assumes no responsibility for consequential damage, or loss of profits due to any natural disaster, (earthquake, storms, floods etc.), fire, accident, or an act of a third party and/or usage under unusual conditions.

## 2. PRECAUTIONS

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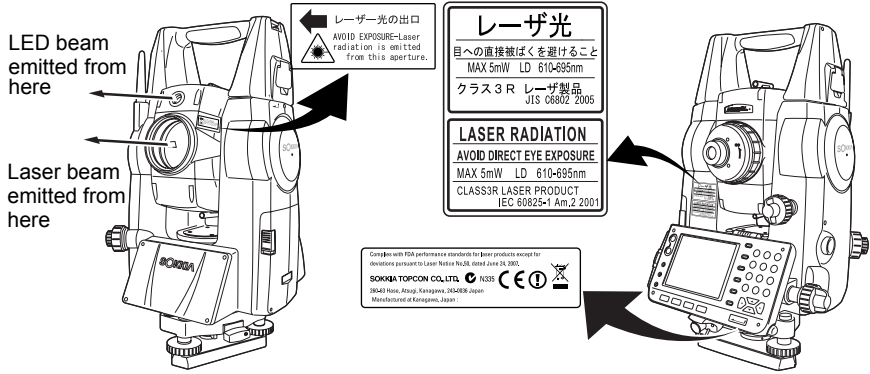
- The manufacturer, or its representatives, assumes no responsibility for any damage (change of data, loss of data, loss of profits, an interruption of business etc.) caused by use of the product or an unusable product.
- The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by usage different to that explained in the operator's manual.
- The manufacturer, or its representatives, assumes no responsibility for damage caused by incorrect operation, or action resulting from connecting to other products.



# 3. LASER SAFETY INFORMATION

SETX is classified as a Class 3R Laser Product and Class 1 LED Product according to IEC Standard Publication 60825-1 Amd. 2: 2001 and United States Government Code of Federal Regulation FDA CDRH 21CFR Part 1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.50, dated July 26, 2001.)

- EDM device in objective lens: Class 3R Laser Product
- (When using prism or reflective sheet as target) Class 1 Laser Product
- Guide light: Class 1 LED product



- EDM device is classified as Class 3R Laser Product when reflectorless measurement is selected. When the prism or reflective sheet is selected as target, the output is equivalent to the safer class 1.


## ⚠ Warning

- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Follow the safety instructions on the labels attached to the instrument as well as in this manual to ensure safe use of this laser and LED product.
- Never point the laser beam at another person. If the laser beam strikes skin or an eye, it could cause serious injury.
- Do not look directly into the laser beam source or guide light source. Doing so could cause permanent eye damage.
- Do not stare at the laser beam. Doing so could cause permanent eye damage.
- If an eye injury is caused by exposure to the laser beam, seek immediate medical attention from a licensed ophthalmologist.
- Never look at the laser beam through a telescope, binoculars or other optical instruments. Doing so could cause permanent eye damage.
- Sight the target so that the laser beam does not stray from them.

### 3. LASER SAFETY INFORMATION

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#### **Caution**

- Perform checks at start of work and periodic checks and adjustments with the laser beam emitted under normal conditions.
- When the instrument is not being used, turn off the power and replace the lens cap.
- When disposing of the instrument, destroy the battery connector so that the laser beam cannot be emitted.
- Operate the instrument with due caution to avoid injuries that may be caused by the laser beam unintentionally striking a person in the eye. Avoid setting the instrument at heights at which the path of the laser beam may strike pedestrians or drivers at head height.
- Never point the laser beam at mirrors, windows or surfaces that are highly reflective. The reflected laser beam could cause serious injury.
- When using the laser-pointer function, be sure to turn OFF the output laser after distance measurement is completed. Even if distance measurement is canceled, the laser-pointer function is still operating and the laser beam continues to be emitted.
- Only those who have been received training as per the following items shall use this product.
  - Read the Operator's manual for usage procedures for this product.
  - Hazardous protection procedures (read this chapter).
  - Requisite protective gear (read this chapter).
  - Accident reporting procedures (stipulate procedures beforehand for transporting the injured and contacting physicians in case there are laser induced injuries).
- Persons working within the range of the laser beam are advised to wear eye protection which corresponds to the laser wavelength of the instrument being used
- Areas in which the lasers are used should be posted with laser warning notices.
- The LED beam is emitted when the guide light is set to ON and the power is turned ON. Before turning ON the power check that there are no persons in the LED beam path. Alternatively, always set the guide light to OFF when you have finished measurement.  
 Guide light settings for setting-out: "17.1 Using the Guide Light"

# 4. PRODUCT OUTLINE

## 4.1

## Functions

SETX has the following features to make operation more efficient.

1. High accuracy with reflectorless measurement



SOKKIA own optics, electrical circuits, and processing algorithms combine to provide superior reflectorless accuracy at distances as short as 30cm.



2. Various interface options




Data link options for the SETX include both a CF card slot and USB ports.

3. Full colour touch panel display




Not only does the colour screen improve usability, but the Graphic option allows the user to visualise setting out operations. In addition to the operation keys, the touch panel with stylus pen offers another user-friendly method for selecting screens and inputting characters.

 "5.2 Display Functions"

4. Guide light



Setting-out measurement etc. can be carried out effectively using the guide light. The guide light is composed of a light that is divided into green and red sections. A poleman can ascertain whether to move to the right or left by checking the guide light color.

 "17.1 Using the Guide Light"

5. Trigger Key for Easier Operation




Each screen contains a number of softkeys. Softkeys displayed in bold type control the flow of measurement operation. Pressing the trigger key located on the side of the SETX will perform exactly the same operation as the bolded softkey in the current screen. This allows the user to continue operation without having to return to the display to press softkeys.

 "4.2 Parts of the Instrument"  Trigger key"

6. Wide range of advanced programs



One touch of the **{PROGRAM}** key allows the user to switch from Basic mode to the program selection screen in order to use advanced measurement programs.

 Switching modes: 4.3 Mode Structure


## 4. PRODUCT OUTLINE

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### 7. SETTINGS Mode



One-touch of the **{SETTINGS}** key allows the user to jump to and from the SETTINGS mode during operation without exiting measurement.

 "4.3 Mode Structure", "5.4 SETTINGS Mode"

### 8. *Bluetooth* wireless technology (Models with *Bluetooth* module only)



*Bluetooth* technology removes the need for cumbersome cables and provides wireless communication functionality between the SETX and data collectors for even greater efficiency gains in the field.

 "10. CONNECTING TO EXTERNAL DEVICES"




Use of this technology must be authorized according to telecommunications regulations of the country where the instrument is being used.

 "38. REGULATIONS"

### 9. SOKKIA original Independent Angle Calibration System (IACS) technology

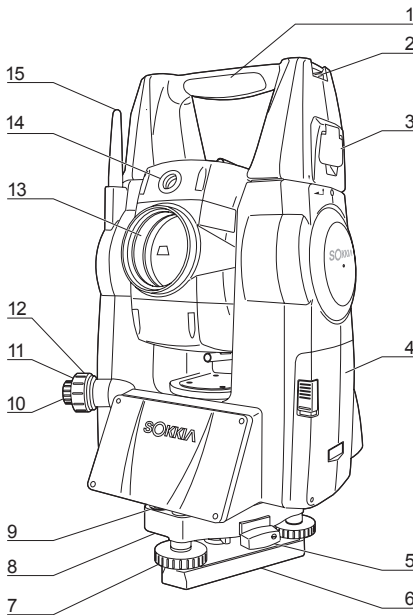


This revolutionary technology provides an even higher level of stability and reliability for angle measurement. With IACS technology, the SETX independently calibrates angle to a high degree of accuracy, and eliminates the need for a reference standard instrument when performing calibration.

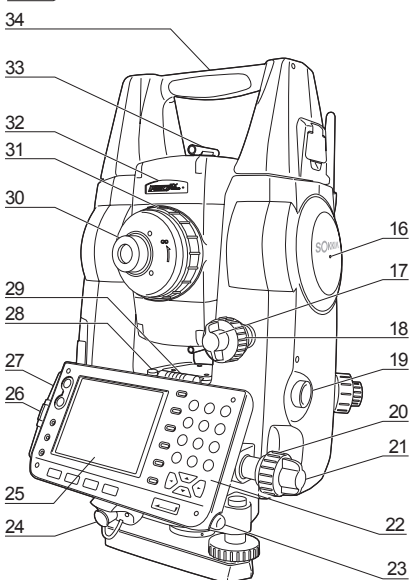
 Independent angle calibration cannot be performed by the user. Consult your local dealer.

4.2 Parts of the Instrument

Parts and functions of the instrument



- 1 Handle
- 2 Tubular compass slot
- 3 Handle lock
- 4 Battery cover
- 5 Tribrach clamp
- 6 Base plate
- 7 Levelling foot screw
- 8 Circular level adjusting screws
- 9 Circular level
- 10 Optical plummet eyepiece
- 11 Optical plummet reticle cover
- 12 Optical plummet focussing ring
- 13 Objective lens  
(Includes "☐ Laser-pointer function")
- 14 ☐ Guide light
- 15 Bluetooth antenna



- 16 ☐ Instrument height mark
- 17 Vertical clamp
- 18 Vertical fine motion screw
- 19 ☐ Trigger key
- 20 Horizontal fine motion screw
- 21 Horizontal clamp
- 22 Keyboard ☐ "5.1 Basic Key Operation"
- 23 Stylus pen holder
- 24 Combined communications and power supply connector
- 25 Display
- 26 CF card slot  
☐ "6. USING THE CF CARD SLOT"
- 27 USB ports  
☐ "10. CONNECTING TO EXTERNAL DEVICES"
- 28 Plate level adjusting screw
- 29 Plate level
- 30 Telescope eyepiece screw
- 31 Telescope focussing ring
- 32 ☐ Laser radiation warning indicator
- 33 ☐ Peep sight
- 34 Instrument center mark

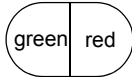
## 4. PRODUCT OUTLINE

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### Guide light


Setting-out measurement etc. can be carried out effectively using the guide light. The guide light is composed of a light that is divided into green and red sections. A poleman can ascertain the present position by checking the guide light color.



Indication for positioning target during setting-out measurement

Light status	Meaning
Increased flashing speed	(From position of poleman) Move target toward SETX
Decreased flashing speed	(From position of poleman) Move target away from SETX
Fast flashing	Target is at correct distance
Red	(From position of poleman) Move target left
Green	(From position of poleman) Move target right
Red and Green	Target is at correct horizontal position

The guide light indicator is lit or flashes depending on the status of the guide light.

 "17.1 Using the Guide Light"



### Laser radiation warning indicator

Laser radiation warning indicator is red when laser beam is emitted or laser-pointer is used, allowing the status of the laser beam to be ascertained from the telescope eyepiece side.



### Peep sight

Use peep sight to aim the SETX in the direction of the measurement point.

Turn the instrument until the apex of the triangle in the peep sight is aligned with the target. A circle surrounds the triangle to make it easier to locate.



### Instrument height mark

The height of the SETX is 236mm (from tribrach dish to this mark). "Instrument height" is input when setting instrument station data and is the height from the measuring point (where SETX is mounted) to this mark.



### Trigger key

When the Trigger key is pressed SETX carries out the operation indicated by the softkey in bold type on the screen. This allows the user to continue operation without having to return to the display to press softkeys.



### Laser-pointer function

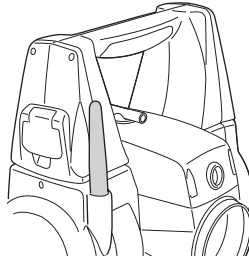
A target can be sighted with a red laser beam in dark locations without the use of the telescope.

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***Bluetooth antenna (Models with Bluetooth module only)***

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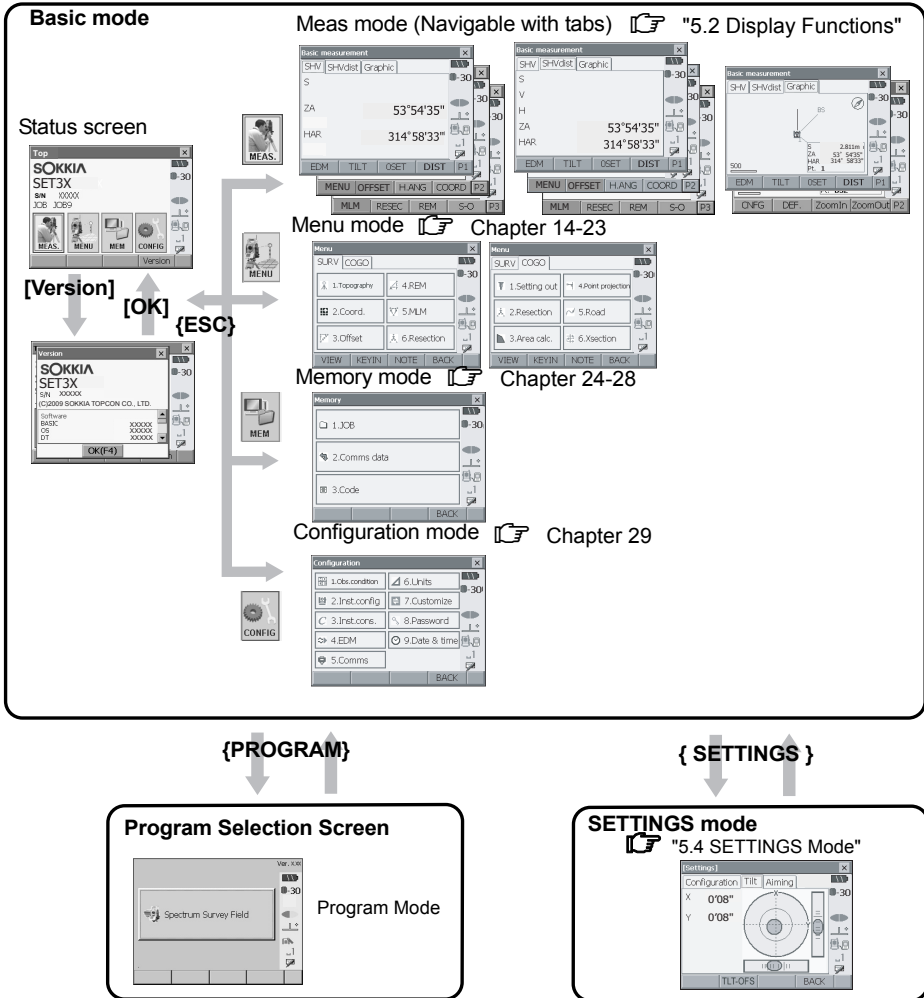
The *Bluetooth* antenna allows communication via *Bluetooth* wireless technology.



- Handle the antenna with care. The antenna may be damaged if struck during operation or while being stored in the carrying case.

### 4.3 Mode Structure

The diagram below describes the different modes of the SETX and key operations for navigating between them. Managing data functions are contained in Memory mode.




- Switching between modes is not possible during distance measurement.



## 4.4

**Bluetooth Wireless Technology**

- *Bluetooth* communication is only possible with instruments incorporating the *Bluetooth* module.
- Use of this technology must be authorized according to telecommunications regulations of the country where the instrument is being used. Contact your local dealer in advance.
-  "38. REGULATIONS"
- Sokkia Topcon Co., Ltd. is not liable for the content of any transmission nor any content related thereto. When communicating important data, run tests beforehand to ascertain that communication is operating normally.
- Do not divulge the content of any transmission to any third party.

**Radio interference when using *Bluetooth* technology**

*Bluetooth* communication with the SETX uses the 2.4 GHz frequency band. This is the same band used by the devices described below.

- Industrial, scientific, and medical (ISM) equipment such as microwaves and pacemakers.
- portable premises radio equipment (license required) used in factory production lines etc.
- portable specified low-power radio equipment (license-exempt)
- IEEE802.11b/IEEE802.11g standard wireless LAN devices

The above devices use the same frequency band as *Bluetooth* communications. As a result, using the SETX within proximity to the above devices may result in interference causing communication failure or reduction of transmission speed.

Although a radio station license is not required for this instrument, bear in mind the following points when using *Bluetooth* technology for communication.

- Regarding portable premises radio equipment and portable specified low-power radio equipment:
  - Before starting transmission, check that operation will not take place within the vicinity of portable premises radio equipment or specified low-power radio equipment.
  - In the case that the instrument causes radio interference with portable premises radio equipment, terminate the connection immediately and take measures to prevent further interference (e.g. connect using an interface cable).
  - In the case that the instrument causes radio interference with portable specified low-power radio equipment, contact your local dealer.
- When using the SETX in proximity to IEEE802.11b or IEEE802.11g standard wireless LAN devices, turn off all devices not being used.
  - Interference may result, causing transmission speed to slow or even disrupting the connection completely. Turn off all devices not being used.
- Do not use the SETX in proximity to microwaves.
  - Microwave ovens can cause significant interference resulting in communication failure. Perform communication at a distance of 3m or more from microwave ovens.
- Refrain from using the SETX in proximity to televisions and radios.
  - Televisions and radios use a different frequency band to *Bluetooth* communications.

## 4. PRODUCT OUTLINE

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However, even if the SETX is used within proximity to the above equipment with no adverse effects with regard to *Bluetooth* communication, moving a *Bluetooth* compatible device (including the SETX) closer to said equipment may result in electronic noise in sound or images, adversely affecting the performance of televisions and radios.

### Precautions regarding transmission

---

- For best results

- The usable range becomes shorter when obstacles block the line of sight, or devices such as PDAs or computers are used. Wood, glass and plastic will not impede communication but the usable range becomes shorter. Moreover, wood, glass and plastic containing metal frames, plates, foil and other heat shielding elements as well as coatings containing metallic powders may adversely affect *Bluetooth* communication and concrete, reinforced concrete, and metal will render it impossible.
- Use a vinyl or plastic cover to protect the instrument from rain and moisture. Metallic materials should not be used.
- The direction of the *Bluetooth* antenna can have adverse effects upon usable range.

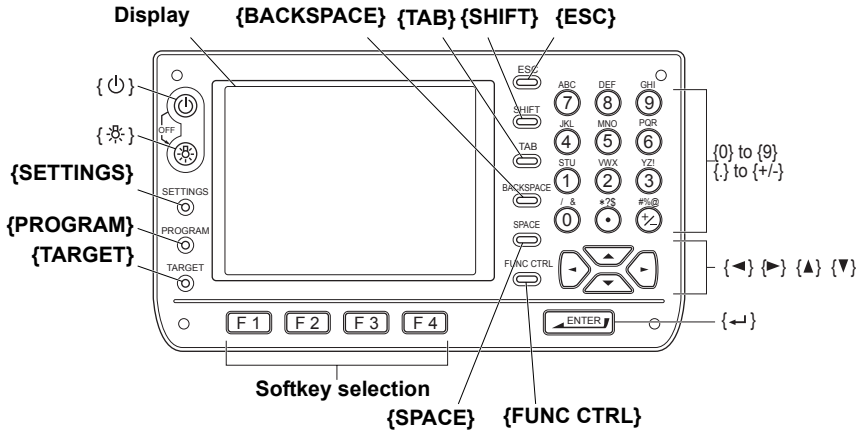
- Reduced range due to atmospheric conditions

The radio waves used by the SETX may be absorbed or scattered by rain, fog, and moisture from the human body with the limit of usable range becoming lower as a result. Similarly, usable range may also shorten when performing communication in wooded areas. Moreover, as wireless devices lose signal strength when close to the ground, perform communication at as high a position as possible.

# 5. BASIC OPERATION

Learn basic key operations here before you read each measurement procedure.

## 5.1 Basic Key Operation



- **Power ON/OFF**

{POWER}	Power ON
{POWER} (while pressing) + {OFF}	Power OFF

- **Lighting up the reticle/keys and selecting screen backlight brightness**

{OFF}	Switches the reticle illumination/key backlight ON/OFF
	Switches the screen backlight brightness setting

"29.2 Instrument Configuration"

- **Switching to SETTINGS mode**

{SETTINGS}	Switches to screens for tilt correction, returned signal checking and general configuration
{SETTINGS}/{ESC}	Returns to the previous screen (mode)

"5.4 SETTINGS Mode"

- **Switching to Program Selection Screen/SSF**

{PROGRAM}	Switches between Basic mode and Spectrum Survey Field
-----------	---

- **Switching target type**

{TARGET}	Switches between target types
----------	-------------------------------

"29.3 EDM Settings"


**Note**



- Changes can also be made by tapping the status bar icon with the stylus pen.

"5.2 Display Functions"

## 5. BASIC OPERATION

### ● Switching the laser-pointer/guide light ON/OFF

{  }	Turns the laser-pointer/guide light ON/OFF
---	--

 Selecting laser-pointer/guide light after pressing {}: "29.3 EDM Settings"

- Changes can also be made by tapping the status bar icon with the stylus pen.

 "5.2 Display Functions"

### ● Softkey operation

Softkeys are displayed on the bottom line of the screen.






{F1} to {F4}	Select the function matching the softkeys
{FUNC CTRL}	Toggle between softkey pages

### ● Inputting letters/figures






Character input method can be selected from upper case alphabetic, lower case alphabetic and numeric characters.

#### Note





- A selection can also be made by tapping the status bar icon with the stylus pen.

{0} to {9}	Input numeral or symbol printed above the key (during numeric input mode)
	Input alphabetic character in the order they are listed (in alphabetic input mode)
{.}	Input a decimal point (during numeric input mode)
{+/-}	Input a plus or minus sign (during numeric input mode)
{ESC}	Cancel the input data
{TAB}	Shift to the next item
{BACKSPACE}	Delete the character to the left
{SPACE}	Input a blank space (increments by 1 when setting the date and time)
{  }/ 	Move the cursor left/right during character input
{  }/ 	Move the cursor up/down during character input
{ 	Select/accept input word/value


### ● Selecting options

{  }/ 	Move the cursor/selection item up/down
{  }/ 	Move the cursor/selection item left/right or select other option
{TAB}	Shift to the next item
{SPACE}	Display other options
{ 	Select/accept the option

### ● Selecting tabs

{  }/ 	Move tab/cursor in tab up/down
{  }/ 	Display next tab at left/right

- Other operation

{ESC}	Return to previous screen
	Tabs: "5.2 Display Functions"

### Example: Entering "computer" (lower case) as the name of a new device

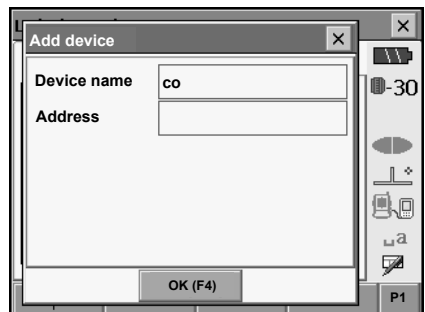
1. Tap the input mode icon in the status bar (second from bottom) until "\_a" is displayed.



2. Press {7} three times. "c" is displayed.



3. Press {5} three times. "o" is displayed.



## 5. BASIC OPERATION

- Press **▶**.  
Press **{5}**. "m" is displayed.

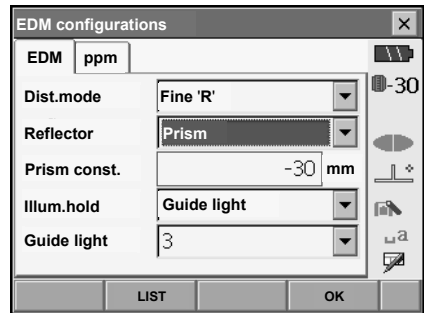


- Continue to input letters. Press **{←}** to complete inputting.

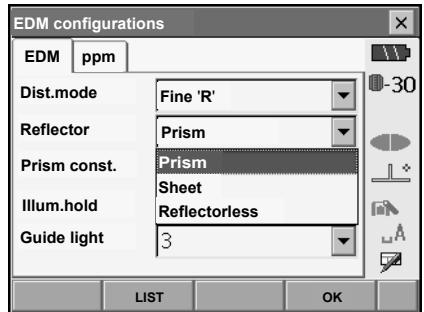
### Example: selecting a reflector type

#### (Method 1)

- Select **[EDM]** in the first page of Meas mode or "EDM" in SETTINGS mode/Configuration mode.



- Move to "Reflector" using **{▲}/(▼)/(TAB)**.
- Press **{SPACE}** to display a list of all options.



- Select an option using **{▲}/(▼)**.
- Press **{←}** to confirm selection.

**(Method 2)**

1. Select **[EDM]** in the first page of Measure mode or "EDM" in SETTINGS mode/Configuration mode.
2. Move to "Reflector" using **{▲}/{▼}/{TAB}**.
3. Switch between Prism, Sheet, and Reflectorless using **{◀}/{▶}**.
4. Press **{←}** to confirm selection.

## 5.2 Display Functions

Screens can be selected/operated using the keys on the keyboard or the touch panel. The touch panel can be operated using either the stylus pen provided or your fingers.

It is also possible to de-activate the touch panel.

 "29. CHANGING THE SETTINGS"




- Do not scratch the display or use any sharp implement other than the stylus pen to operate the touch panel.

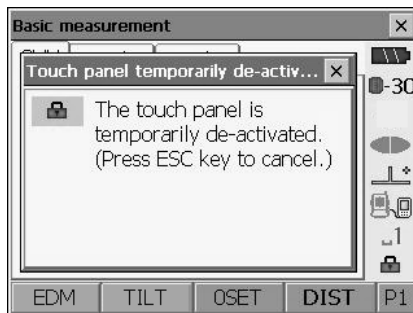
### Using the stylus

The stylus pen can be used to select menus and buttons on the screen and operate the scroll bar. The touch panel supports "tap", "double tap", and "drag" operations.

Operation	Method
Tap	Lightly tap the display once. This operation is equivalent to the clicking of a mouse button when using a computer.
Double tap	Lightly tap the display twice on the same point. This operation is equivalent to the "double-click" for a computer mouse.
Drag	Lightly apply the point of the stylus pen to the display and move in the desired direction, maintaining contact between the stylus and display all the time.

### Temporarily de-activating the touch panel

The touch panel can be temporarily de-activated. This is especially useful when cleaning the display. To de-activate, tap  on the status bar. <Touch panel temporarily de-activated> is displayed.



The touch panel cannot be operated while the above message is displayed. Press **{ESC}** to cancel the message and re-activate the touch panel.

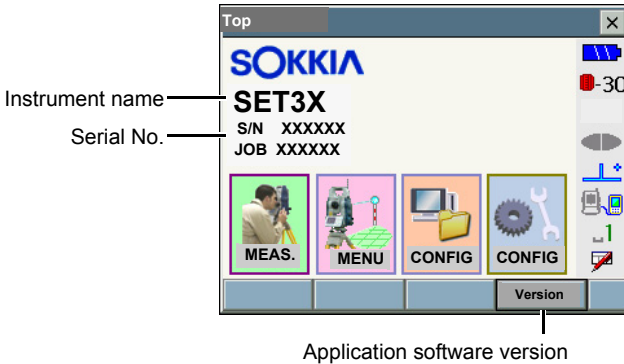


## Displaying and operating screens

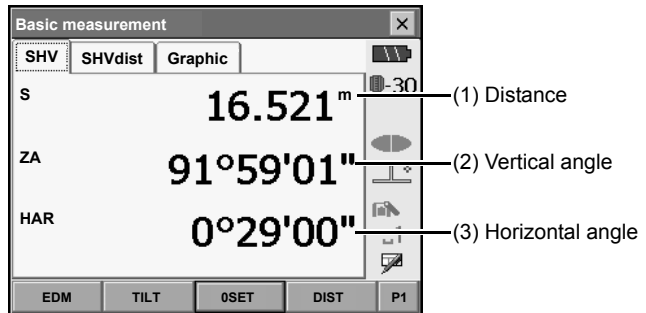
- To close a screen, tap the cross in the top right corner, or press **{ESC}**.
- Tabs, softkey allocations, displayed tab items, and character sizes can all be changed in accordance with user preferences.

"29. CHANGING THE SETTINGS"

### ● Status screen



### ● Basic measurement screen



#### (1) Distance

Press **[SHV]** to switch between the SHV and SHVdist tabs. An SHVdist tab will be created when one does not exist.

"29.1 Observation Conditions"

"29.6 Allocating Key Functions"

#### (2) Vertical angle

The Vertical angle display can be switched between Zenith ( $Z=0^\circ$ )/Horiz ( $H=0^\circ$ )/Horiz ( $H=\pm 90^\circ$ )  
To switch vertical angle/slope in %, press **[ZA/%]** when allocated to the Meas mode screen. The capitalized letter in the softkey indicates the currently selected mode.

"29.1 Observation Conditions"

## 5. BASIC OPERATION

### (3) Horizontal angle

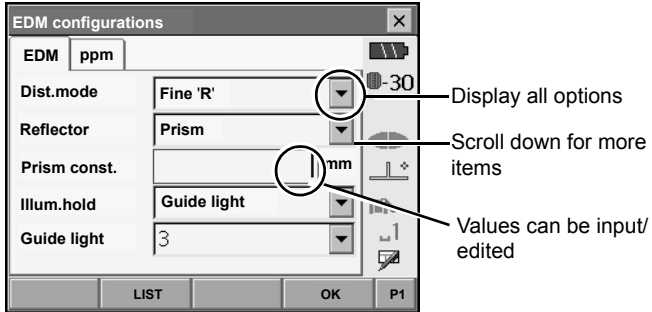
Press **[R/I]** when allocated to the Meas mode screen to switch the display status. The capitalized letter in the softkey indicates the currently selected mode.

HAR : Horizontal angle right

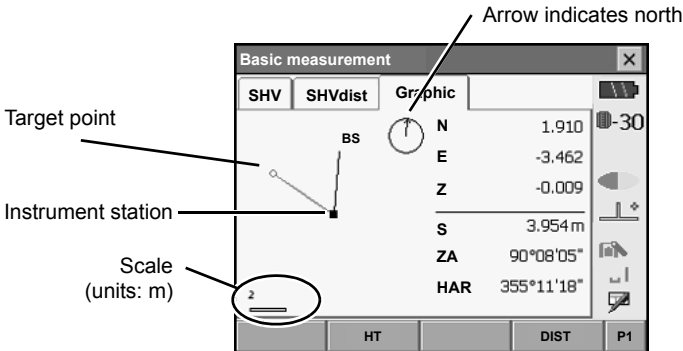
HAL : Horizontal angle left

"29.6 Allocating Key Functions"

### ● Input screen/configuration screen



### ● Graphic tab



The Graphic tab display can be modified using the softkeys in the second page.

**[CNFG]:** In <Graphic configuration> the user can specify the orientation of the graphic tab display and which point, target or station, to set at the center of the display.

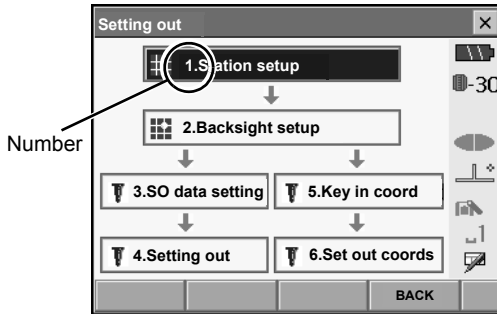
**[DEF.]:** Returns to the original orientation display.

**[ZoomIn]:** Zooms in.

**[ZoomOut]:** Zooms out.

● **Selecting menus**

To select a menu, tap the touch panel or press the relevant number key.



● **Status bar**

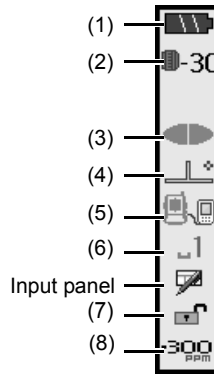
Indicates the current status of the instrument.

Tapping icons (1) to (8) will switch between the relevant options for that item. Tapping and holding will display a list of all available options for that item and, in certain cases, a link to the configuration screen for that item.

☞ Settings: "29. CHANGING THE SETTINGS"

It is possible to re-arrange status bar icons.

☞ "29.7 Changing Status Bar Icons"



(1) Remaining battery power

Remaining battery power indicator and configuration of auto-power function (BDC58/BDC46B/ external battery BDC61, Temperature = 20°C, EDM on).

The remaining battery power displayed when distance measurement or motor operation is in progress may differ to that displayed at other times.

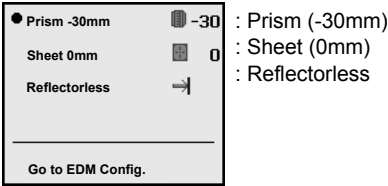
- : Level 3 Full power
- : Level 2 Plenty of power remains
- : Level 1 Half or less power remains
- : Level 0 Little power remains. Prepare a replacement battery where available (Flashes red and black)
- : No power (Red display in the center of the screen) Stop measurement and charge the battery

☞ "7. USING THE BATTERY"

## 5. BASIC OPERATION

### (2) Target display

Selection of target type and configuration of prism constant.




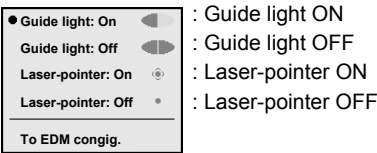
Target information can be edited/recorded in <Reflector setting>.

 "29.3 EDM Settings"

### (3) Laser-pointer/guide light

Configuration of laser-pointer/guide light status.

 Switching the laser-pointer/guide light ON/OFF: "5.1 Basic Key Operation"

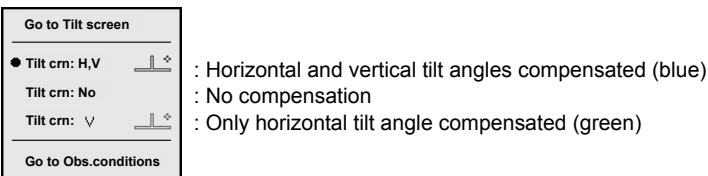


### Note


- The laser-pointer will be automatically switched OFF during distance measurement.

### (4) Tilt angle compensation

The vertical and horizontal angles are automatically compensated for small tilt errors using the SETX's dual-axis tilt sensor. This icon displays the status of this function.






### Note



-  is displayed when the instrument is out of level.

### (5) Communication status with external devices

Selection and configuration of communication status with external devices. This icon is not displayed in Program mode. *Bluetooth* settings can only be selected when using instruments incorporating the *Bluetooth* module.

Serial port 	: Connection via RS232C cable
Bluetooth - Master 	: Connection via <i>Bluetooth</i> wireless technology (SETX set as "Master" device) (blue antenna)
● Bluetooth - Slave 	: Connection via <i>Bluetooth</i> wireless technology (SETX set as "Slave" device) (green antenna)
Go to Comms Setup	


**Note**

- When *Bluetooth* communication is selected (SETX set as "Master" device) a connection can be initiated/canceled
- by tapping  /  .
- This icon is not displayed in SSF.


Connection status to external devices is displayed as follows.

i) Connection via *Bluetooth* wireless technology


When SETX is set as the "Master" device the antenna mark is blue. When the SETX is set as the "Slave" device the antenna mark is green.

 : Connecting

 : Canceling connection


 : (Antenna is purple - moving)

SETX set to "Master": Inquiring about other *Bluetooth* devices

 : (Antenna is purple - stationary)



Communication settings in progress/Preparing for

communication (Instrument just powered ON or just switched to "Slave")

 : Connection error (icon flashes green and red)

ii)  : Connection via RS232C cable

**Note**

- An arrow (e.g.  /  ) is displayed to indicate that data transmission is in progress. A red arrow indicates that data transmission has failed and data needs to be sent again.

(6) Input mode

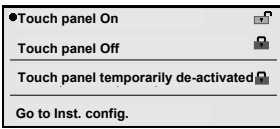
Selection of input mode

_1	Inputting numbers and symbols
_A	Inputting upper case alphabetic characters
_a	Inputting lower case alphabetic characters

## 5. BASIC OPERATION

### (7) Touch panel

De-activates/re-activates the touch panel.



- : Touch panel ON
- : Touch panel OFF
- : Touch panel temporarily de-activated.

### Note

- This icon cannot be operated during distance measurement, or during data transmission.

### (8) Atmospheric correction factor (ppm)

Configuration of atmospheric correction factor status

: Current atmospheric correction factor setting



### Note

- This icon cannot be operated during distance measurement, or during data transmission.

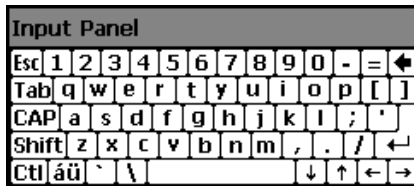
## 5.3 Inputting Characters using the Input Panel

Tap to display <Input Panel>. This keyboard can be used to input numeric and alphabetic characters as well as symbols. Tap the icon again to close.

### Note

- When <Input Panel> is covering the icon of the status bar, use the stylus pen to drag the input panel to another part of the screen so that you can access the icon.

### Input panel

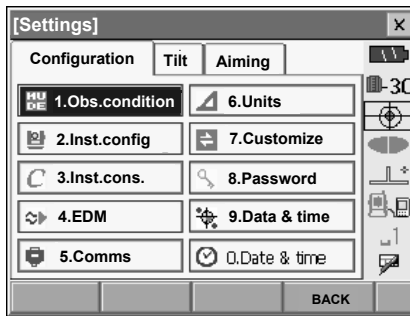


- Esc : Deletes all input characters
- Tab : Moves the cursor to the next text box
- CAP : Alternates between upper and lower case alphabetic characters and numbers/symbols
- Shift : Alternates between upper and lower case alphabetic characters and numbers/symbols. Is canceled after inputting a single character.

Ctl	: No function
Del/↵	: Delete the character to the left/right or deletes the entire text in the active section
← →	: Move the cursor left/right
⬅	: Accept input characters
Space	: Input a blank space
áü	: Accesses further Latin/Germanic characters/symbols

## 5.4 SETTINGS Mode

Press **{SETTINGS}** to switch to screens for tilt correction, returned signal checking and general configuration.



☞ Performing settings: "29. CHANGING THE SETTINGS", Tilt settings: "8.2 Levelling", Returned signal checking: "13.1 Returned Signal Checking".

# 6. USING THE CF CARD SLOT

CF (Compact Flash) cards, for saving surveying and other data, are supported by the SETX. Management of JOB and survey data is done in Memory mode.

## Note

- Contact your local dealer for details regarding communication formats for CF card input/output.
- Data can also be transferred to an external device with memory capabilities for storage and/or editing using the SETX's USB ports.

☞ "10. CONNECTING TO EXTERNAL DEVICES"

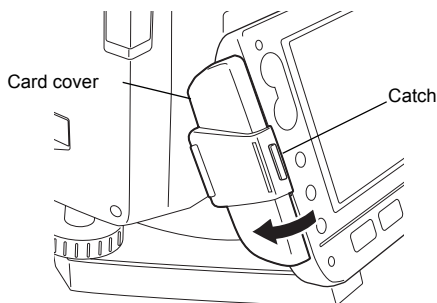
## 6.1 Inserting/Removing the CF Card



- Do not remove the CF card during data read/write.
- Make sure the eject button is fully depressed when a CF card is inserted. A protruding eject button will be depressed when the card cover is closed causing the card to be ejected.
- Always close the card cover before moving the instrument. The card cover can be damaged if forced open beyond a certain angle.

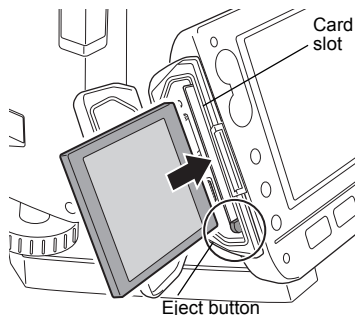
### PROCEDURE Inserting the CF card

1. Push the catch on the card cover away from the display to open.



2. Insert the CF card.

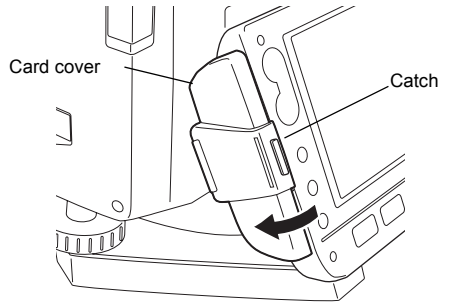
3. Close the card cover.



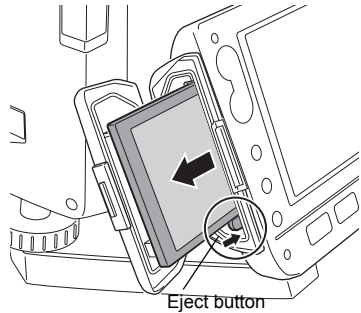


**PROCEDURE Removing the CF card**

1. Push the catch on the card cover away from the display to open.



2. Press the eject button once to release. Once the eject button is fully protruded, press once more to remove the card from the card slot.



3. Check that the eject button is not protruding, then close the card cover. Make sure the cover is properly closed.

# 7. USING THE BATTERY

Types of power source: "32. POWER SUPPLY SYSTEM"

## 7.1 Battery Charging

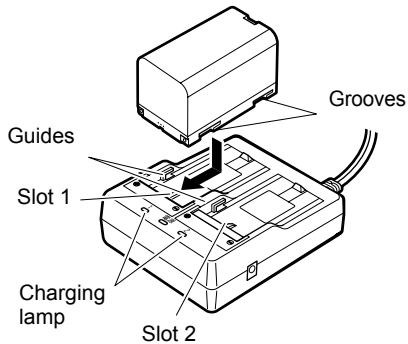
The battery was not charged at the factory. Charge the battery fully before using the SETX.



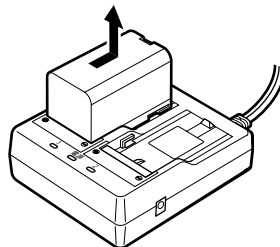
- The charger will become rather hot during use. This is normal.
- Do not use to charge batteries other than those specified.
- The charger is for indoor use only. Do not use outdoors.
- Batteries cannot be charged, even when the charging lamp is flashing, when the temperature is outside the charging temperature range.
- Remove batteries from the charger before putting into storage.
- When not in use, disconnect the power cable plug from the wall outlet.

### PROCEDURE

1. Connect the power cable to the charger and plug the charger into the wall outlet.
2. Mount the battery in the charger by matching the grooves on the battery with the guides on the charger.



3. When charging starts, the lamp starts blinking.
4. The lamp lights when charging is finished.
5. Remove the battery and unplug the charger.





- Slots 1 and 2:  
The charger starts charging the battery mounted first. If you place two batteries in the charger, the battery in slot 1 is charged first, and then the battery in slot 2. (☞ step 2)
- Charging lamp:  
The charging lamp is off when the charger is outside the charging temperature range or when the battery is mounted incorrectly. If the lamp is still off after the charger falls within its charging temperature range and the battery is mounted again, contact your local dealer. (☞ steps 2 and 3)
- Charging time per battery (at 25°C):
 

BDC46B:	about 2.5 hours
BDC58:	about 4 hours

(Charging can take longer than the times stated above when temperatures are either especially high or low.)

## 7.2 Installing/Removing the Battery

Mount the charged battery.



- Before removing the battery, turn off the power to the instrument. If the battery is removed while the power is switched on, a warm boot occurs. File and folder data may be lost as a result.
- When installing/removing the battery, make sure that moisture or dust particles do not come in contact with the inside of the instrument.
- Remove batteries from the surveying instrument or charger before putting into storage.
- Store the battery in a dry room where the temperature is within the following ranges

Storage period	Temperature range
1 week or less	-20 to 50°C
1 week to 1 month	-20 to 45°C
1 month to 6 months	-20 to 40°C
6 months to 1 year	-20 to 35°C

- For long-term storage, the battery should be charged at least once every six months.
- The BDC46B and BDC58 generate power using a chemical reaction and as a result have a limited lifetime. Even when in storage and not used for long periods, battery capacity deteriorates with the passage of time. This may result in the operating time of the battery shortening despite having been charged correctly. In this event, a new battery is required.

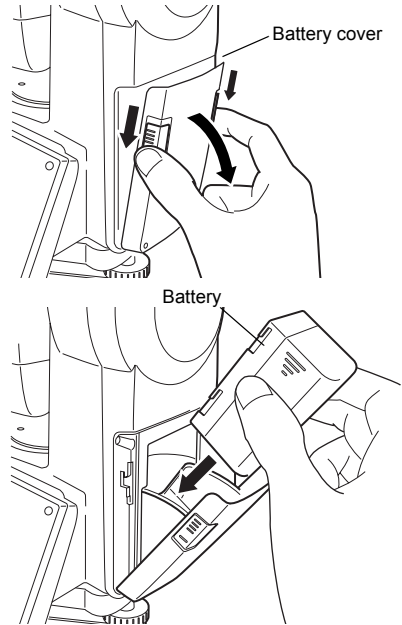
## 7. USING THE BATTERY

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### PROCEDURE Mounting the battery

---

1. Slide down the catches on the battery cover to open.
2. Insert the battery in the direction of the arrow on the side of the battery.
3. Close the battery cover. A click is heard when the cover is secure.



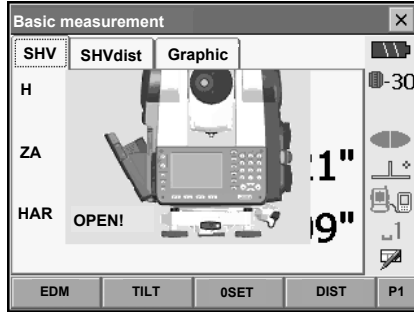
### PROCEDURE Removing the battery

---

1. Slide down the catches on the battery cover to open.
2. Grip the battery by the arrow symbols printed on the side and slide out.
3. Close the battery cover. A click is heard when the cover is secure.

**Note**

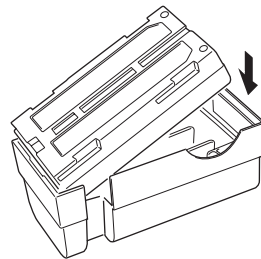
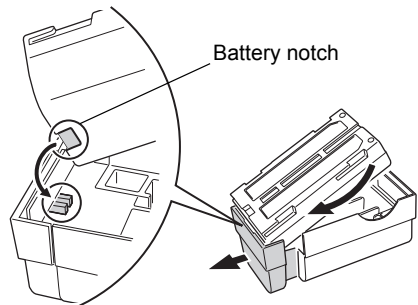
- Battery cover  
If the battery cover is open during power ON, SETX notifies you by displaying the screen below and beeping.
- When the battery cover is closed, the previous screen is restored.



### PROCEDURE Using the Battery adapter

Insert the BDC46B into the battery adapter. The battery can now be mounted in the same way as the BDC58.

1. Align the notch in the battery with the battery adapter as shown at right. With the terminals-end of the battery inserted, push until the battery adapter is fully extended.
2. Slot the top end of the battery into the battery adapter. The extendable portion of the battery adapter will automatically retract and hold the battery in place.



**Note**

- To remove, grip both sides of the battery towards the terminals-end and pull out.
- It is possible to charge the BDC46B without removing from the battery adapter.

# 8. SETTING UP THE INSTRUMENT

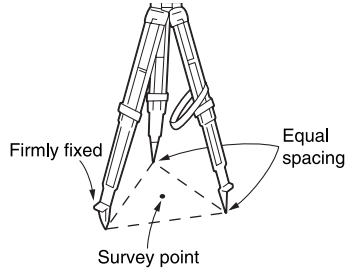


- Mount the battery in the instrument before performing this operation because the instrument will tilt slightly if the battery is mounted after levelling.

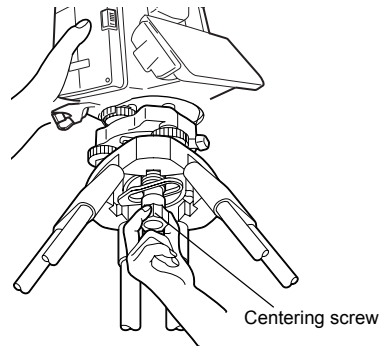
## 8.1 Centering

### PROCEDURE

1. Make sure the legs are spaced at equal intervals and the head is approximately level. Set the tripod so that the head is positioned over the survey point. Make sure the tripod shoes are firmly fixed in the ground.

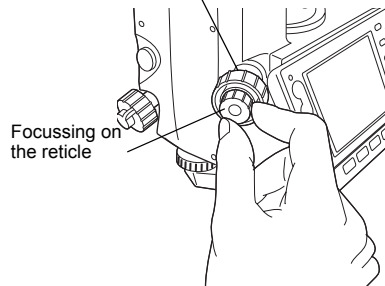


2. Place the instrument on the tripod head. Supporting it with one hand, tighten the centering screw on the bottom of the unit to make sure it is secured to the tripod.




3. Looking through the optical plummet eyepiece, turn the optical plummet eyepiece to focus on the reticle. Turn the optical plummet focusing ring to focus on the survey point.

Focussing on the survey point



## 8.2 Levelling

Instrument can be levelled using the screen.

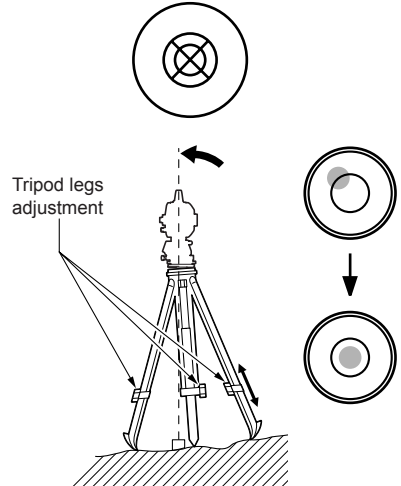
 **Note** Levelling on the screen"

### PROCEDURE

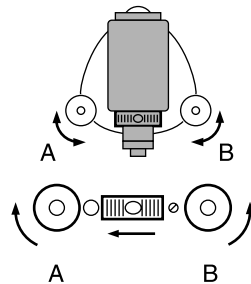
1. Adjust the levelling foot screws to center the survey point in the optical plummet reticle.

2. Center the bubble in the circular level by either shortening the tripod leg closest to the offcenter direction of the bubble or by lengthening the tripod leg farthest from the offcenter direction of the bubble. Adjust one more tripod leg to center the bubble.

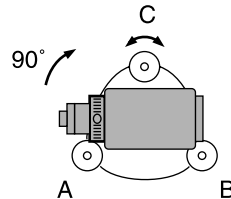
Turn the levelling foot screws while checking the circular level until the bubble is centered in the center circle.



3. Turn the upper part of the instrument until the plate level is parallel to a line between levelling foot screws A and B. Center the air bubble using levelling foot screws A and B simultaneously. The bubble moves towards a clockwise rotated levelling foot screw.



4. Turn the upper part of the instrument though  $90^\circ$ . The plate level is now perpendicular to a line between levelling foot screws A and B. Center the air bubble using levelling foot screw C.




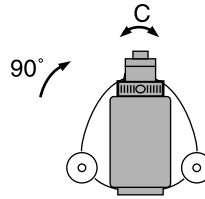
## 8. SETTING UP THE INSTRUMENT

---

5. Turn another 90° and check bubble position  
Turn the upper part of the instrument a further 90° and check to see if the bubble is still in the center of the plate level. If the bubble is off-center, perform the following:
  - a. Turn levelling foot screws A and B equally in opposite directions to remove half of the bubble displacement.
  - b. Turn the upper part a further 90°, and use levelling foot screw C to remove half of the displacement in this direction.



Or adjust the plate level.

-  "31.1 Plate Level"
6. Turn the instrument and check to see if the air bubble is in the center position in all directions.  
If it is not, repeat the levelling procedure.
7. Loosen the centering screw slightly.  
Looking through the optical plummet eyepiece, slide the instrument over the tripod head until the survey point is exactly centered in the reticle.  
Retighten the centering screw securely.
8. Check again to make sure the bubble in the plate level is centered.  
If not, repeat the procedure starting from step 3.



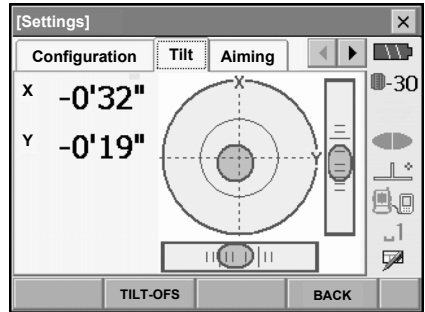
### PROCEDURE Levelling on the screen

---

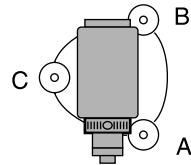
1. Press {  } to power on.  
 "9. POWER ON/OFF"
2. Press { **SETTINGS** } to enter SETTINGS mode.



- Select the Tilt tab to display the circular level on the screen.  
 "●" indicates the bubble in circular level. The range of the inside circle is  $\pm 2.5'$  and the range of the outside circle is  $\pm 4.5'$ .



- Center "●" in the circular level.  
 [F] "8.2 Levelling" steps 1 to 2
- Turn the instrument until the telescope is parallel to a line between levelling foot screws A and B.



- Set the tilt angle to  $0^\circ$  using foot screws A and B for the X direction and levelling screw C for the Y direction.
- Press **{ESC}** to return to Meas mode.


### Note

- Press **[TLT-OFS]** to enter <Tilt offset/Meas.>.  
 [F] "31.3 Tilt Sensor"

# 9. POWER ON/OFF

## PROCEDURE Power ON


---

1. Press {  }.

When the power is switched on, a self-check is run.  
The Meas mode screen is displayed.

If "Out of range" is displayed, the instrument tilt sensor is indicating that the instrument is out of level. Level the instrument once again and the horizontal and vertical angles will be displayed.

### Note

- "Tilt crn." in "Obs. condition" should be set to "No" if the display is unsteady due to vibration or strong wind.  
 "29.1 Observation Conditions"



### Resume function


The Resume function redisplay the screen appearing before the instrument was powered OFF when the instrument is powered back ON. All parameter settings are also saved. Even if remaining battery power is completely depleted, this function will remain active for 1 minute, after which it is canceled. Replace a depleted battery as soon as possible.

## PROCEDURE Power OFF

---

Press {  } while pressing {  }.



- When there is almost no battery power remaining, the battery mark in the status bar will start to blink. In this event, stop measurement, switch off the power and charge the battery or replace with a fully charged battery.
- To save power, power to the SETX is automatically cut off if it is not operated for a fixed period of time. This time period can be set in "Power off" in <Inst.config.>.  
 "29.2 Instrument Configuration"


## 9.1 Configuring the Touch Panel

When using for the first time, or after performing a cold boot, the screen for configuring the touch panel will be displayed.

Follow the instructions on the screen. Tap the cross-hairs at the center of the display with the stylus pen. Tap 5 times. Press {←} to complete touch panel configuration. Press {ESC} to retain previous settings. For units with a display on both the F1 and F2 faces (option):  
After tapping 5 times the display backlight will dim and the display on the reverse face will illuminate. Tap the cross-hairs on the reverse face display a further 5 times.

Carefully press and briefly hold stylus on the center of the target.  
Repeat as the target moves around the screen.  
Press the Esc key to cancel.



- Touch panel configuration can be performed at any time during normal operation by pressing [PNL CAL] in <Inst.config.>.  
 "29.2 Instrument Configuration"

## 9.2 Resolving Software Issues

If you are experiencing problems with the SETX and suspect a fault in the program, you should try a warm boot. If the problem is not resolved with a warm boot the next step is to perform a cold boot. A warm boot will not erase surveying data in Memory mode and SSF but will cancel the resume function. Whenever possible transmit the data to a personal computer before rebooting.

### PROCEDURE


1. Power OFF the instrument.
2. Press {⏻} while pressing {←}.  
The instrument is reset and powers ON as normal.



#### Cold boot

If the problem is not resolved with a warm boot the next step is to perform a cold boot. A cold boot will not erase surveying data in Memory mode and SSF but all the parameters will be changed to the factory settings. If the data in the memory is necessary, **BE SURE TO TRANSFER IT TO A PERSONAL COMPUTER BEFORE PERFORMING A COLD BOOT.**

To perform a cold boot, while holding {F3}, {F1}, and {BACKSPACE}, press {⏻}.  
The instrument is reset and powers ON as normal.

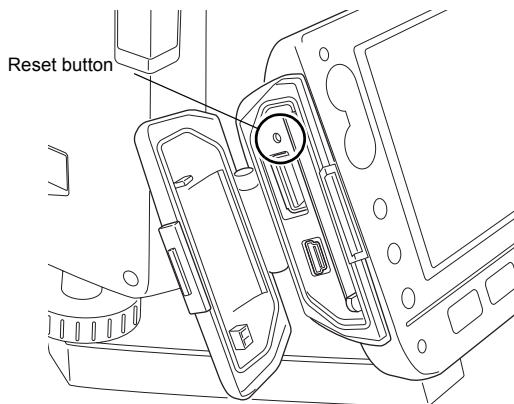
 "29.11 Restoring Default Settings"



### Problems Powering OFF

When the instrument cannot be powered OFF as normal, depress the reset button with the tip of the stylus pen. Then, power ON as normal.


- Pressing the Reset button may result in file and folder data being lost.



# 10. CONNECTING TO EXTERNAL DEVICES

The SETX supports both USB and *Bluetooth* wireless technology for communication with data collectors etc.

Read this manual in conjunction with the operator's manual for the relevant external device.

 *Bluetooth* communication: "4.4 Bluetooth Wireless Technology"

Transferring data using the SFX function: SFX Dial-Up Program Explanations,  
Output format and command operations: Interfacing with the SOKKIA SDR Electronic Field Book and Command Explanations manuals



• *Bluetooth* communication is only possible with instruments incorporating the *Bluetooth* module.

## 10.1 Wireless Communication using *Bluetooth* Technology

The *Bluetooth* module incorporated in the SETX can be used for communication with Bluetooth devices such as data collectors.




### *Bluetooth* connections

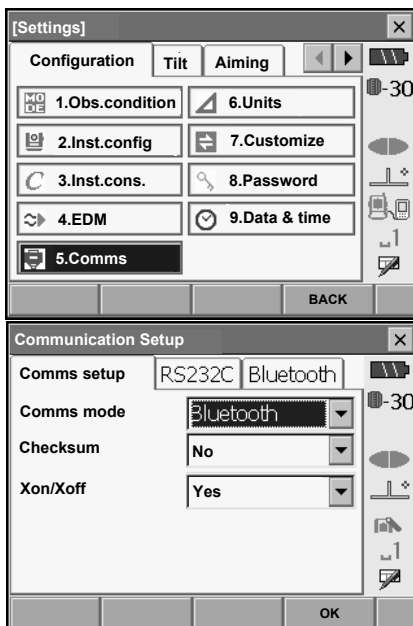
Communication between a pair of *Bluetooth* devices requires one device to be set as the "Master" and the other as the "Slave". To initiate connections from the SETX side, set the SETX as the "Master" device. To initiate connections from the paired device side, set the SETX as the "Slave" device. The factory setting is "Slave".

### PROCEDURE Necessary settings for *Bluetooth* communication

1. Select "Comms" in SETTINGS mode. Set Comms mode in the Comms setup tab to "*Bluetooth*".



- Changing communication settings during *Bluetooth* communication will cancel the connection.
- The  status bar icon cannot be tapped in <Communication Setup>.





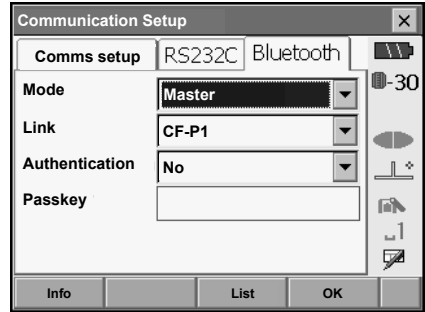
## 10. CONNECTING TO EXTERNAL DEVICES

2. Select a mode for the SETX in the *Bluetooth* tab. The factory setting is "Slave".


Register companion devices.

- "Master" cannot be selected when no companion devices have been registered.

 "Master"/"Slave": " *Bluetooth* connections"



3. Select, in "Link", a companion device from among the *Bluetooth* devices already registered in the SETX.

 Registering devices: "PROCEDURE Registering *Bluetooth* companion devices"

- Companion devices cannot be selected when the SETX is set as "Slave".

4. Set "Authentication" to "Yes" or "No".

If "Authentication" is set to "Yes" for the SETX the passkey will also need to be input on the companion device.

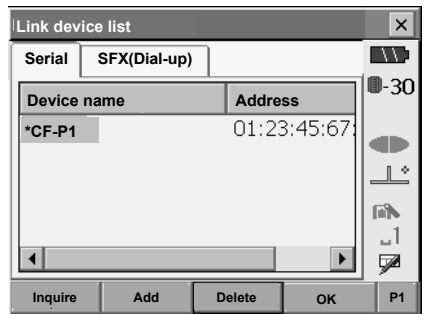
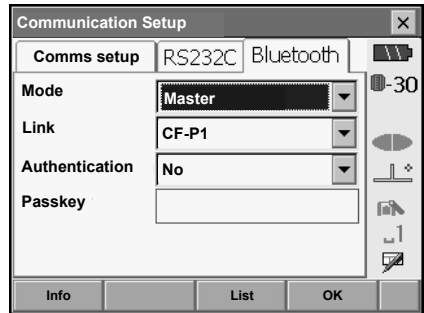
5. When "Authentication" is set to "Yes", input the same passkey as that for the intended companion device. Even if "Authentication" is set to "No", a passkey is requested when authentication is set on the companion device being used.

- Up to 16 numeral characters can be input. Input characters will be displayed as asterisks (e.g. "\*\*\*\*\*"). The passkey was set to "0123" at the factory.

6. Press **[OK]** to finish settings.

## PROCEDURE Registering *Bluetooth* companion devices

1. Power on the companion device.
2. Select ""*Bluetooth*"" in "Comms mode" in the Comms setup tab.
3. Press **[LIST]** to display a list of all registered devices.  
Data collector devices can be set in the Serial tab and devices for use with the SFX Dial-Up Program in the SFX (Dial-Up) tab.



4. Register your *Bluetooth* device(s).

Press **[Add]** to display <Add device>. Input the device name and *Bluetooth* address and press **[OK]**. Both should be 12 characters (numbers 0 to 9 and letters from A to F) in length.



## 10. CONNECTING TO EXTERNAL DEVICES

Press **[Inquire]** to inquire about *Bluetooth* devices in the immediate vicinity of the SETX and display their device name and address in a list. Select a device from this list and press **[OK]** to add to the Link device list in step 3.

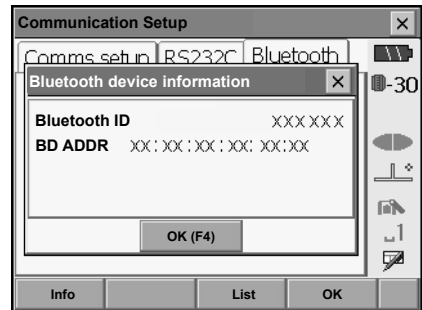
Press **[Delete]** to delete the selected device name. Deleted device names cannot be retrieved.

- Select a device and press **[Edit]** in the second page to update the device name and/or device address.
5. Press **[OK]** to complete registration and return to the screen in step 2.



### PROCEDURE Displaying *Bluetooth* information for the SETX

1. Select "Comms" in SETTINGS mode.
2. Press **[Info]** in the *Bluetooth* tab to display information for the SETX. Register the *Bluetooth* address (BD ADDR) displayed here in the paired device set as "Master".



#### **Bluetooth device address**

This is a number unique to one particular *Bluetooth* device used to identify devices during communication. This number consists of 12 characters (numbers 0 to 9 and letters from A to F). Some devices may be referred to by their *Bluetooth* device address.

## 10.2


### Communication between the SETX and Companion Device




- *Bluetooth* communication causes SETX battery power to be depleted at a rate higher than that for normal operation.
- Check that the companion device (data collector, computer, or cellular phone etc.) is turned on and the relevant *Bluetooth* settings are complete.




- All communication settings will be changed to factory settings when a cold boot is performed. Comms setup will need to be performed again.

 "10.1 Wireless Communication using Bluetooth Technology"


1. Complete the necessary SETX settings for *Bluetooth* communication.

 "10.1 Wireless Communication using Bluetooth Technology"

2. Start communication

When SETX is set as the "Master" device, the **[Connect]** softkey is allocated to the fourth page of Meas mode. When **[Connect]** is pressed the SETX searches for the device selected in "Link" and a connection starts. When a connection has been successfully established  is displayed in the status bar.

The establishing of a connection can also be initiated by tapping  in the status bar.


 Status bar, communication status:  
"5.2 Display Functions"

### Note

- When SETX is set as the "Slave" device, the establishing of a connection can only be initiated/ canceled by the companion device set as "Master".

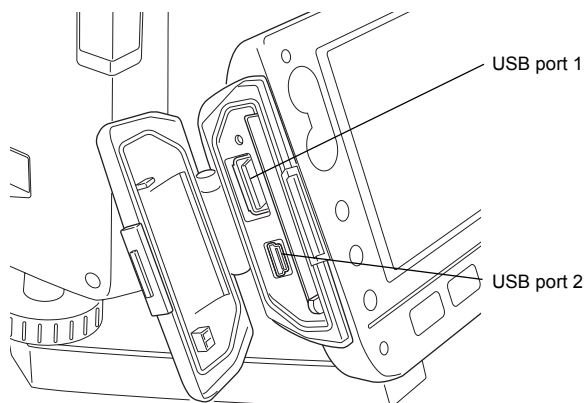
3. Press **[Cancel]** in the fourth page of Meas mode to terminate the connection.

A connection can also be terminated by tapping

 in the status bar.

### 10.3 Connecting to USB devices

SETX has two different USB ports. Sokkia Topcon Co., Ltd. cannot guarantee that all USB devices are compatible with the SETX USB ports.





Each port is used for connection to different types of devices.

Port name	Device type
USB port 1	USB memory devices etc.
USB port 2	computers etc.

#### Connecting the SETX to a computer to transfer data from Memory mode

1. Power OFF the SETX. Connect the SETX and computer using the USB cable.  
☞ "9. POWER ON/OFF"




- The computer does not need to be turned off before connection.
2. Press {  } while pressing {  }. "USB Mode" will be displayed on the screen of the SETX. After a short period (approx. 1 minute) <Removable disk> will be displayed on the computer screen.
  3. The JOB data and observation data displayed in <Removable disk> can be copied and/or transferred to the computer.

### Note

- The computer display may vary depending on Windows settings.



Follow the instructions below to ensure that the SETX continues to operate normally during USB transfer.

- Do not change the folder hierarchy or folder names in <Removable Disk>.
  - Do not format the removable disk.
4. Double-click  in the computer task bar. "Safely Remove Hardware" is displayed. Select "USB Mass Storage Device" and press "Stop". After confirming the subsequent prompt, disconnect the USB cable from the computer and SETX.
  5. Press { ⏻ } while pressing { ⚙️ }. The next time the SETX is powered ON, the Meas mode screen will be displayed.

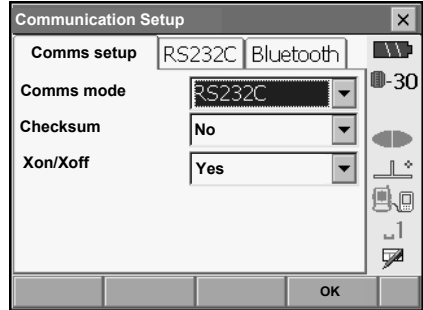


- Do not disconnect the USB cable or turn off the SETX or computer while files are being copied/ transferred.

## 10.4 Connection via RS232C cable

### PROCEDURE Basic cable settings

1. Connect the cable.  
🔌 Cables: "35. OPTIONAL ACCESSORIES"
2. Select "Comms" in SETTINGS mode.  
Set communication conditions in the Comms setup tab. Set "Comms mode" to "RS232C".



3. Set options in the RS232C tab according to the selection made in the Comms setup tab.  
\*: factory settings

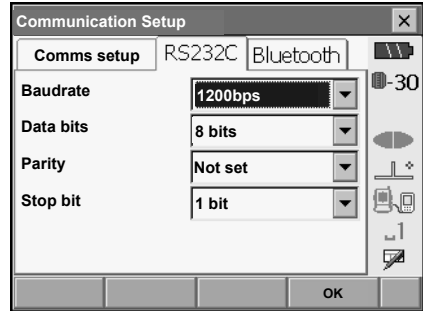
Baud rate:

1200\*/2400/4800/9600/19200/38400bps

Data bits: 7/8\* bits

Parity: Not set\*/Odd/Even

Stop bit: 1\*/ 2



# 11.FOCUSSING AND TARGET SIGHTING

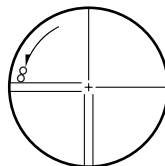


- When sighting the target, strong light shining directly into the objective lens may cause the instrument to malfunction. Protect the objective lens from direct light by attaching the lens hood. Observe to the same point of the reticle when the telescope face is changed.

## PROCEDURE

---

1. Focus on the reticle  
Look through the telescope eyepiece at a bright and featureless background.  
Turn the eyepiece screw clockwise, then counterclockwise little by little until just before the reticle image becomes focussed.  
Using these procedures, frequent reticle refocussing is not necessary since your eye is focussed at infinity.
2. Sight the target  
Loosen the vertical and horizontal clamps, then use the peep sight to bring the target into the field of view. Tighten both clamps.
3. Focus on the target  
Turn the telescope focussing ring to focus on the target.  
Turn the vertical and horizontal fine motion screws to align the target with the reticle.  
The last adjustment of each fine motion screw should be in the clockwise direction.
4. Readjust the focus until there is no parallax  
Readjust the focus with the focussing ring until there is no parallax between the target image and the reticle.



### Eliminating parallax

This is the relative displacement of the target image with respect to the reticle when the observer's head is moved slightly before the eyepiece.

Parallax will introduce reading errors and must be removed before observations are taken.

Parallax can be removed by refocussing the reticle.

# 12. ANGLE MEASUREMENT

This section explains the procedures for basic angle measurement in Basic mode.

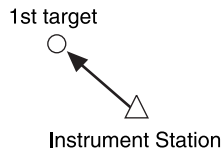
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

## 12.1 Measuring the Horizontal Angle between Two Points (Horizontal Angle 0°)

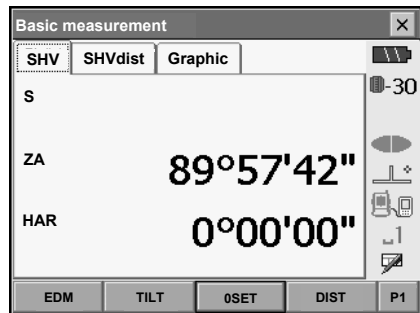
Use the "0SET" function to measure the included angle between two points. The horizontal angle can be set to 0 at any direction.

### PROCEDURE

1. Sight the first target as at right.  
☞ "11. FOCUSING AND TARGET SIGHTING"

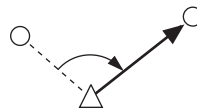


2. In the first page of Meas mode, press [0SET].  
[0SET] will flash, so press [0SET] again.  
The horizontal angle at the first target becomes 0°.

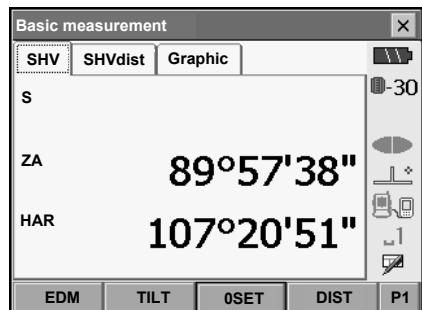


3. Sight the second target.

2nd Target



The displayed horizontal angle (HAR) is the included angle between two points.




## 12.2 Setting the Horizontal Angle to a Required Value (Horizontal Angle Hold)

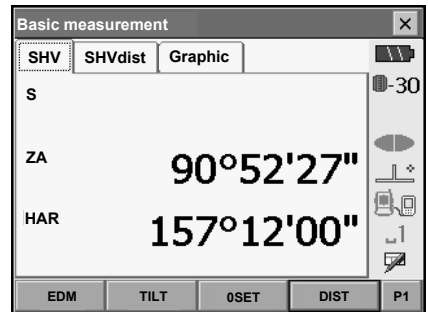
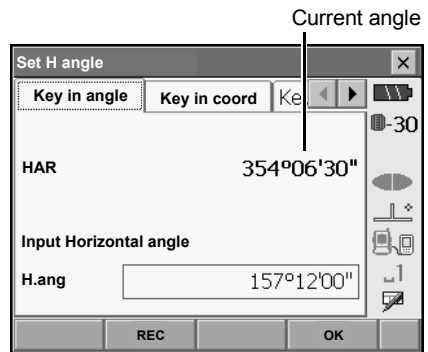
You can reset the horizontal angle to a required value and use this value to find the horizontal angle of a new target.

### PROCEDURE

1. Sight the first target.
2. In the second page of Meas mode, press **[H.ANG]**. <Set H angle> is displayed.
3. Enter the angle you wish to set, then press **[OK]**. The value that is input as the horizontal angle is displayed.


- The same setting can also be performed with coordinate and azimuth input.  
 "15.2 Azimuth Angle Setting"
- Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**.

4. Press **[OK]** to confirm the input value and display the new horizontal angle.



5. Sight the second target.  
The horizontal angle from the second target to the value set as the horizontal angle is displayed.

#### Note

- Pressing **[HOLD]** performs the same function as above.
- Press **[HOLD]** to set the displayed horizontal angle. Then, set the angle that is in hold status to the direction you require.  
 Allocating **[HOLD]**: "29.6 Allocating Key Functions"

### 12.3 Angle measurement and Outputting the Data

The following explains angle measurement and the features used to output measurement results to a computer or other external devices.

☞ "10. CONNECTING TO EXTERNAL DEVICES", Cables: "35. OPTIONAL ACCESSORIES",  
Output format and command operations: Interfacing with the SOKKIA SDR Electronic Field Book and Command Explanations manuals

#### PROCEDURE


---

1. Connect SETX and external device.
2. Sight the target point.
3. Press **[HV out]** in Meas mode to output target measurement results to the external device.



# 13.DISTANCE MEASUREMENT

Perform the following settings as preparation for distance measurement in Basic mode.

- Distance measurement mode
- Target type
- Prism constant correction value
- ppm
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
 "29.6 Allocating Key Functions"

## Caution

- When using the laser-pointer function, be sure to turn OFF the output laser after distance measurement is completed. Even if distance measurement is canceled, the laser-pointer function is still operating and the laser beam continues to be emitted.



- Make sure that the target setting on the instrument matches the type of target used. SETX automatically adjusts the intensity of the laser beam and switches the distance measurement display range to match the type of target used. If the target does not correspond to the target settings, accurate measurement results cannot be obtained.
- Accurate measurement results cannot be obtained if the objective lens is dirty. Dust it off with the lens brush first, to remove minute particles. Then, after providing a little condensation by breathing on the lens, wipe it off with the wiping cloth.
- During reflectorless measurement, if an object with a high reflective factor (metal or white surface) is positioned between the SETX and the target, accurate measurement results may not be received.
- Scintillation may affect the accuracy of distance measurement results. Should this occur, repeat measurement several times and use the averaged value of the obtained results.

## 13.1 Returned Signal Checking

Check to make sure that sufficient reflected light is returned by the target sighted by the telescope. Checking the returned signal is particularly useful when performing long distance measurements.

## Caution

- The laser beam is emitted during returned signal checking.



- When the light intensity is sufficient even though the center of the reflective prism and the reticle are slightly misaligned (short distance etc.), "●" will be displayed in some cases, but in fact, accurate measurement is impossible. Therefore make sure that the target center is sighted correctly.

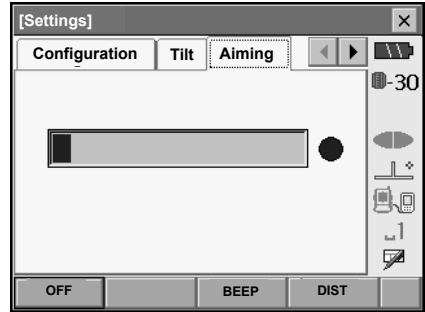
## PROCEDURE

---

1. Accurately sight the target.

## 13. DISTANCE MEASUREMENT

2. Press **{SETTINGS}** to switch to SETTINGS mode and select the Aiming tab or press **[AIM]** in Meas mode.  
☞ Allocating **[AIM]**: "29.6 Allocating Key Functions"



When **[AIM]** is pressed, a gauge indicating light intensity is displayed.

- The more ████████ displayed, the greater the quantity of reflected light.
- If "●" is displayed, only enough light for the measurement is returned.
- When "●" is not displayed, accurately resight the target.

**[BEEP]/[OFF]**: Sets a buzzer sound when measurement is possible. Press to switch on and off.

**[DIST]**: Returns to Meas mode and starts angle and distance measurement. This softkey is not displayed when the returned signal checking function is accessed from SSF.

3. Press **[OFF]** to finish signal checking.  
Press **{ESC}** or tap the cross in the top-right corner to return to the previous screen.

### Note

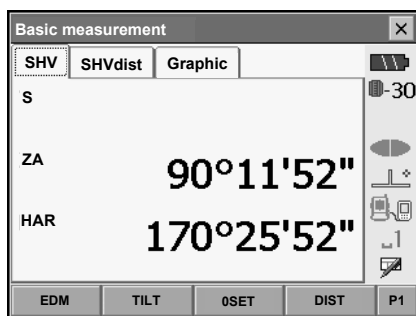
- When ████████ is displayed persistently, but "●" is not, contact your local dealer.
- If no key operations are performed for two minutes, the display automatically returns to the previous screen.

## 13.2 Distance and Angle Measurement

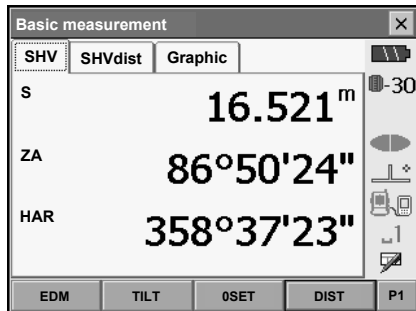
An angle can be measured at the same time as distance.

### PROCEDURE

1. Face the SETX in the direction of the target  
Use the peep sight to aim the SETX and telescope toward the target.  
☞ "11. FOCUSING AND TARGET SIGHTING"
2. Start measurement.  
Press **[DIST]** in the first page of Meas mode to start measurement.



The measured distance data (S), vertical angle (ZA), and horizontal angle (HAR) are displayed.



3. Press **[STOP]** to quit distance measurement.

#### Note

- If the single measurement mode is selected, measurement automatically stops after a single measurement.
- During fine average measurement, the distance data is displayed as S1, S2,... to S9. When the designated number of measurements has been completed, the average value of the distance is displayed in the "SA" line.
- The distance and angle that are most recently measured remain stored in the memory until the power is off and can be displayed at any time by pressing **[RCL]**.  
☞ Allocating **[RCL]**: "29.6 Allocating Key Functions"

### 13.3 Distance Measurement and Outputting the Data

The following explains distance measurement and the features used to output measurement data to a computer or external devices.

☞ "10. CONNECTING TO EXTERNAL DEVICES", Communication cables: "35. OPTIONAL ACCESSORIES". Output format and command operations: Interfacing with the SOKKIA SDR Electronic Field Book and Command Explanations manuals

#### PROCEDURE

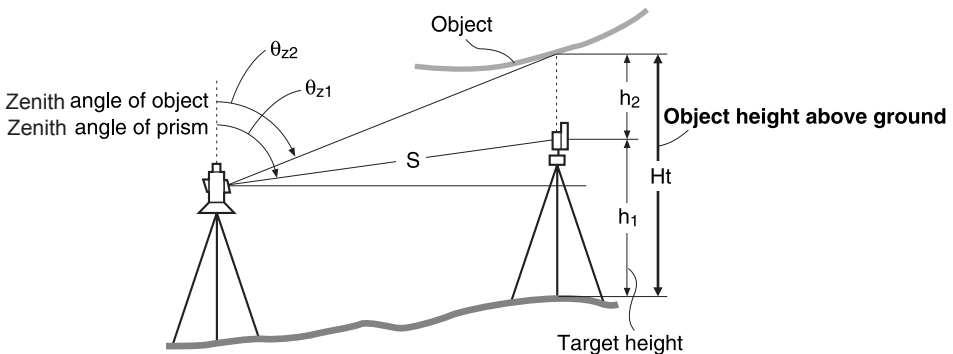
1. Connect SETX and external device.
2. Sight the target point.
3. Press **[HVD out]** in Meas mode to start distance measurement. Target measurement results are output to the external device.  
☞ Allocating **[HVD out]**: "29.6 Allocating Key Functions", "29.1 Observation Conditions"
4. Press **[STOP]** to finish data output and return to the Meas mode.

### 13.4 REM Measurement

An REM measurement is a function used to measure the height to a point where a target cannot be directly installed such as power lines, overhead cables and bridges, etc. The height of the target is calculated using the following formula.

$$H_t = h_1 + h_2$$

$$h_2 = S \sin \theta_{z1} \times \cot \theta_{z2} - S \cos \theta_{z1}$$

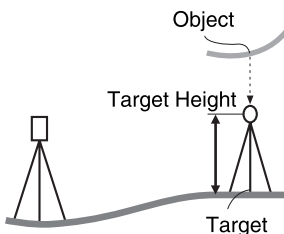


- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

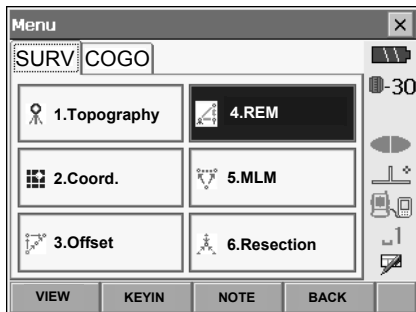
**PROCEDURE**

1. Set the target directly under or directly over the object and measure the target height with a tape measure etc.

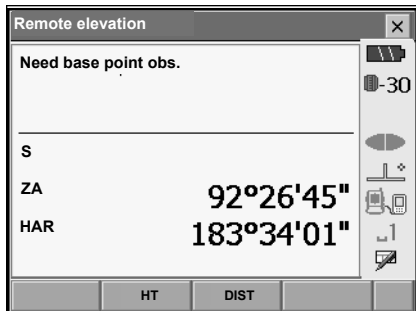
Press **[HT]** and enter the target height.



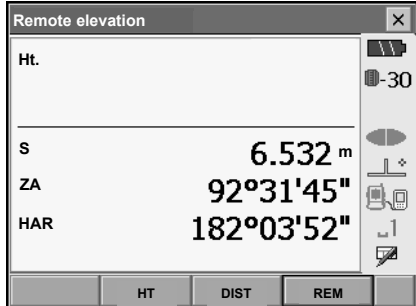
2. Select "REM" in the "SURV" tab of <Menu>.



3. Sight the target and press **[DIST]** to start measurement. Press **[STOP]** to stop the measurement.



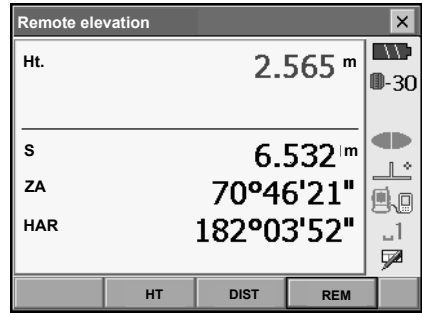
The measured distance data, vertical angle and horizontal angle are displayed.



### 13. DISTANCE MEASUREMENT

---

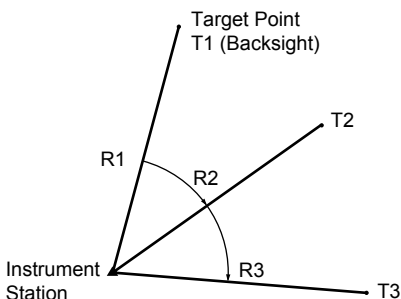
4. Sight the object, then press **[REM]** to start REM measurement is started. The height from the ground to the object is displayed in "Ht.". Press **[STOP]** to stop the measurement.
- To re-observe the target, sight the target then press **[DIST]**.
  - To continue REM measurement, press **[REM]**.



- When measurement data already exists, select **[REM]** in <Menu> as in step 2 to proceed to step 4 and start REM measurement. Press **[STOP]** to stop the measurement.

# 14. TOPOGRAPHY MEASUREMENT

It is possible to find angle and distance to the target based on station point coordinates, instrument height, target height, and azimuth angles of the backsight station which are entered in advance. Measurement can be continuously performed and recorded.



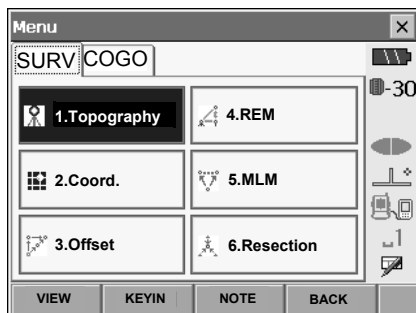
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

## 14.1 Entering Instrument Station Data

Before performing topography measurement, enter instrument station coordinates and instrument height.

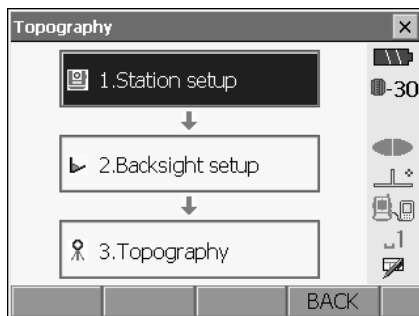
### PROCEDURE

1. First measure instrument height with a tape measure, etc.
2. Select "Topography" in the "SURV" tab of <Menu>.

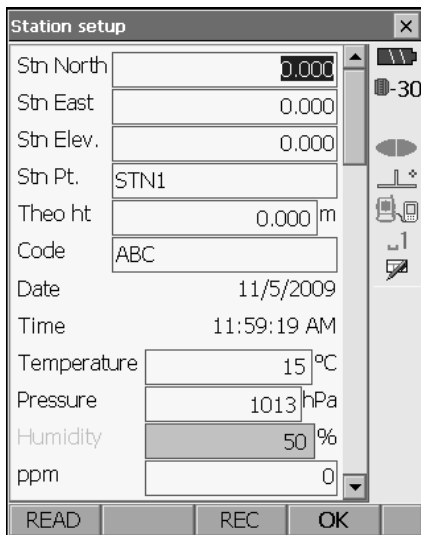


## 14. TOPOGRAPHY MEASUREMENT

3. Select "Station setup" in <Topography> and enter instrument station coordinates, point number, instrument height and code.



- Press **[READ]** to read in coordinate data registered in Memory mode.  
☞ "15.4 Reading in Registered Coordinate Data from Memory mode"



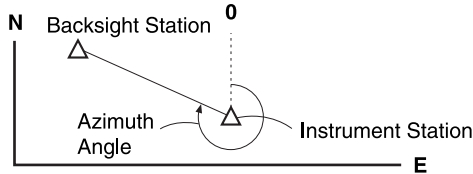
4. Press **[OK]** to set the input values. <Set H angle> is displayed.

- When **[REC]** is pressed, instrument station data is stored in the current JOB and the input values are set.



## 14.2 Azimuth Angle Setting

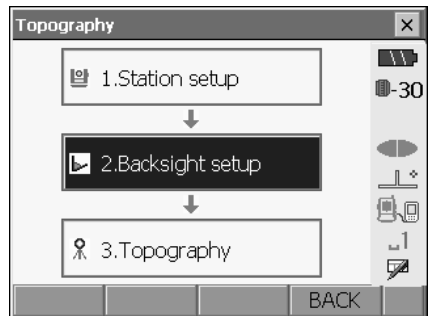
Based on the instrument station coordinates and backsight station coordinates already been set, the azimuth angle of the backsight station is calculated.



### PROCEDURE Entering coordinates

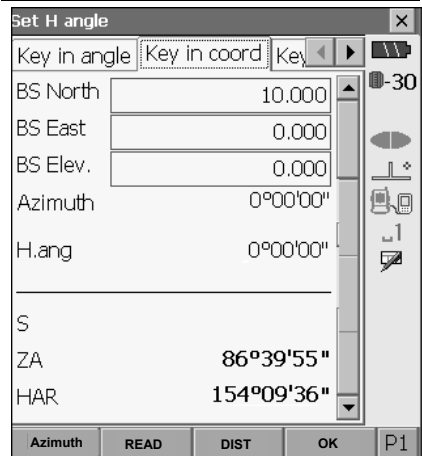
1. Select "Backsight setup" in <Topography>. <Set H angle> is displayed.

- <Set H angle> can also be displayed from the screen in step 4 of "14.1 Entering Instrument Station Data".



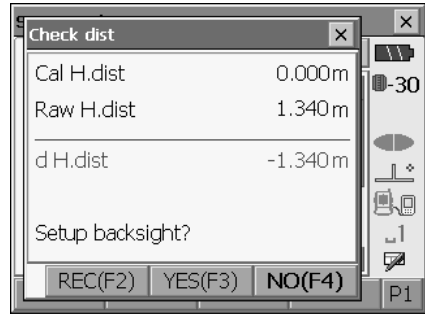
2. Select the Key in coord tab and enter the backsight station coordinates.

- **[READ]**: Reads in coordinate data registered in Memory mode.
- **[Azimuth]**: Switches horizontal angle setting method.  
  Horizontal angle settings



## 14. TOPOGRAPHY MEASUREMENT

- Sight the backsight station and press **[DIST]**. Press **[STOP]** to display the distance calculated from coordinates, the measured distance, and the difference between the two. Press **[YES]** to set the azimuth angle and return to <Topography>. Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**.



3. Press **[OK]** to set the azimuth angle. <Topography> is displayed.

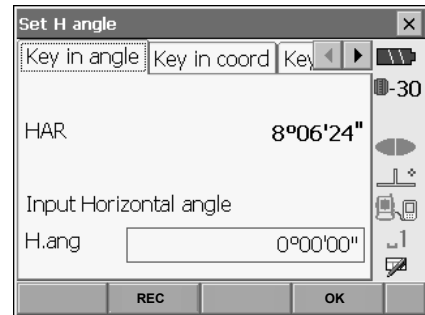
### PROCEDURE Entering angle

1. Select "Backsight setup" in <Topography>. <Set H angle> is displayed.

<Set H angle> can also be displayed from the screen in step 4 of "14.1 Entering Instrument Station Data".

2. Select the Key in angle tab and enter the desired angle in "H.angle".

- Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**.




3. Press **[OK]** to set the input values. <Topography> is displayed.

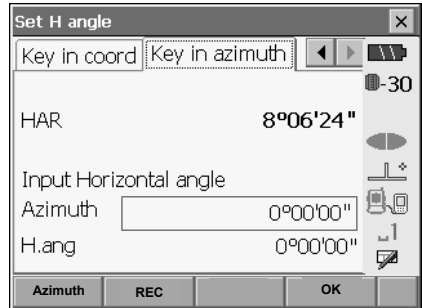
## PROCEDURE Entering azimuth

1. Select "Backsight setup" in <Topography>. <Set H angle> is displayed.

- <Set H angle> can also be displayed from the screen in step 4 of "14.1 Entering Instrument Station Data".

2. Select the Key in azimuth tab and enter the desired angle in "Azimuth".

- **[Azimuth]**: Switches horizontal angle setting method.  
 "Horizontal angle settings"  
 • Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**.



3. Press **[OK]** to set the input values. <Topography> is displayed.



### Horizontal angle settings

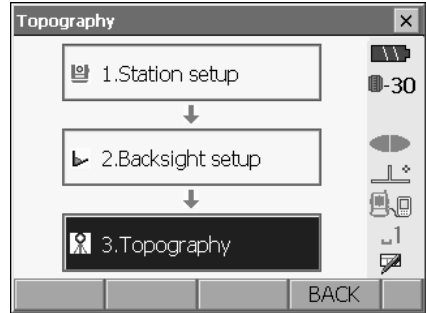
Azimuth (set both horizontal and azimuth angles to the same value)/H.ANG (input both horizontal and azimuth angles)/None (input azimuth angle only)/0 SET (horizontal angle set to 0°)

## 14.3 Topography Measurement


The angle and distance to a target can be found by measuring the target based on the settings of the instrument station and backsight station.

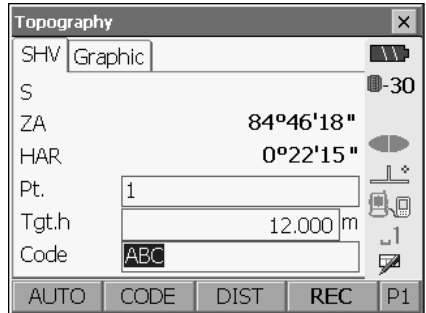
### PROCEDURE

1. Sight the target at the target point.
2. Select "Topography" in <Topography>.



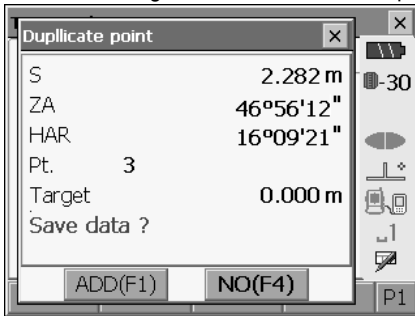
Press **[DIST]** to start measurement. Press **[STOP]** to stop the measurement. The measurement results are displayed. Select the Graphic tab to display measurement results on a graph.

- When recording data in the current JOB, input point number, target height, and code, then press **[REC]**.
  - Press **[AUTO]** to perform coordinate measurement and automatically record the results. **[AUTO]** is convenient for recording measurement data when point number, code, and target height are not set.
  - Press **[A-OFS]/[D-OFS]** on the second page to perform angle/distance offset measurement.  
 "19. OFFSET MEASUREMENT"
3. Sight the next target and press **[DIST]** to begin measurement. Continue until all targets have been measured.
  4. When topography measurement is completed, press **{ESC}** or tap the cross in the top-right corner to return to <Topography>.



**Note**

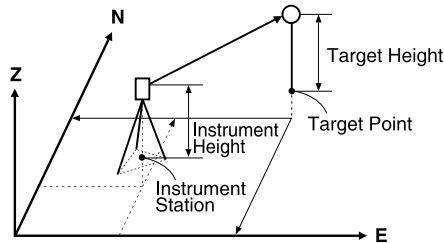
- If the same point number is input, the following screen is displayed. Recording instrument station data and backsight station data is an exception.



Press **[ADD]** to record the point as another record with the same name.  
Press **[NO]** to input a new name.

# 15.COORDINATE MEASUREMENT

By performing coordinate measurements it is possible to find the 3-dimensional coordinates of the target based on station point coordinates, instrument height, target height, and azimuth angles of the backsight station which are entered in advance.



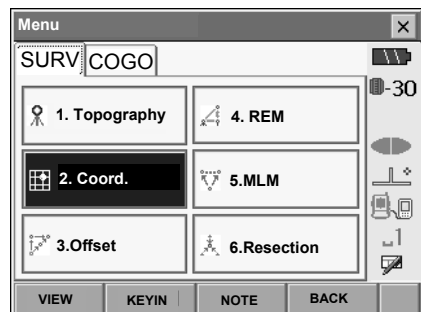
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

## 15.1 Entering Instrument Station Data

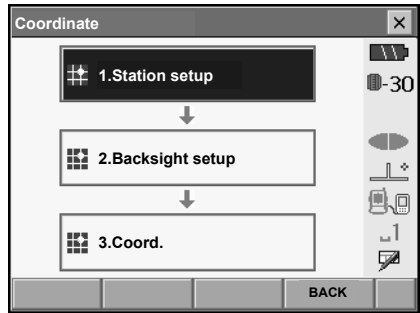
Before performing coordinate measurement, enter instrument station coordinates and instrument height.

### PROCEDURE

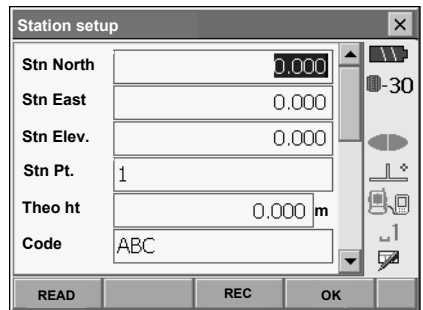
1. First measure the instrument height with a tape measure, etc.
2. Select "Coord." in the "SURV" tab of <Menu>.



3. Select "Station setup" and enter instrument station coordinates, point number, instrument height and code.



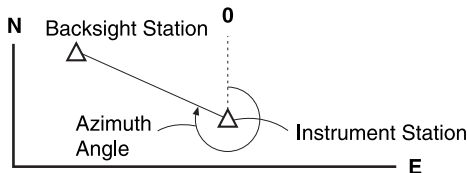
- Press **[READ]** to read in coordinate data registered in Memory mode.  
 ↳ "15.4 Reading in Registered Coordinate Data from Memory mode"



4. Press **[OK]** to set the input values. <Set H angle> is displayed again.
  - When **[REC]** is pressed, instrument station data is stored in the current JOB and the input values are set.

## 15.2 Azimuth Angle Setting

Based on the instrument station coordinates and backsight station coordinates which have already been set, the azimuth angle of the backsight station is calculated.

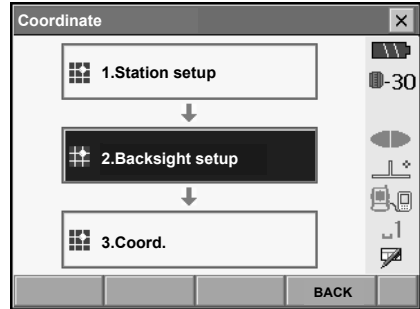


## 15. COORDINATE MEASUREMENT

### PROCEDURE Entering coordinates

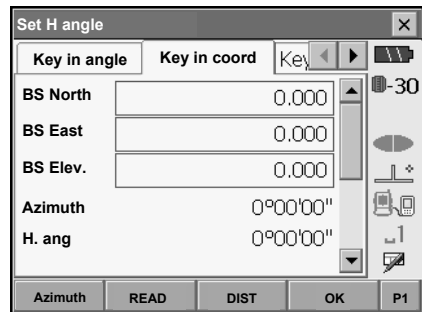
1. Select "B backsight setup" in <Coordinate>. <Set H angle> is displayed.

- <Set H angle> can also be displayed from the screen in step 4 of "15.1 Entering Instrument Station Data".

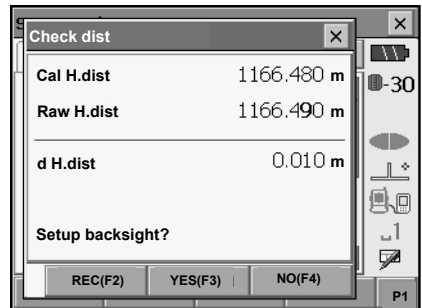


2. Select the Key in coord tab and enter the backsight station coordinates.

- **[READ]**: Reads in coordinate data registered in Memory mode.  
☞ "15.4 Reading in Registered Coordinate Data from Memory mode"
- **[Azimuth]**: Switches horizontal angle setting method.  
☞ ☑ Horizontal angle settings



- Sight the backsight station and press **[DIST]**. Press **[STOP]** to display the distance calculated from coordinates, the measured distance, and the difference between the two. Press **[YES]** to set the azimuth angle and display <Coord. measurement>.
- Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**.

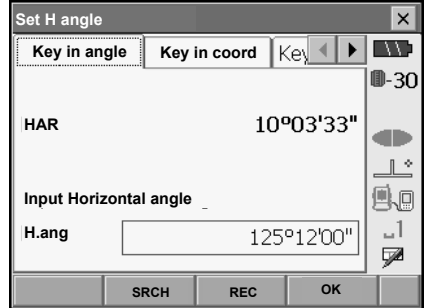


3. Press **[OK]** to set the azimuth angle. <Coord. measurement> is displayed.



**PROCEDURE Entering angle**

1. Select "Backsight setup" in <Coordinate>. <Set H angle> is displayed.
- <Set H angle> can also be displayed from the screen in step 4 of "15.1 Entering Instrument Station Data".
2. Select the Key in angle tab and enter the desired angle in "H.ang".

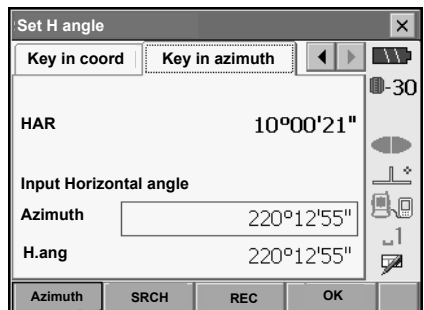


3. Press **[OK]** to set the input values. <Coord. measurement> is displayed.
- Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**. <Coord. measurement> is displayed.

**PROCEDURE Entering azimuth**

1. Select "Backsight setup" in <Coordinate>. <Set H angle> is displayed.
- <Set H angle> can also be displayed from the screen in step 4 of "15.1 Entering Instrument Station Data".
2. Select the Key in azimuth tab and enter the desired angle in "Azimuth".

- **[Azimuth]**: Switches horizontal angle setting method.  
 "Horizontal angle settings"



## 15. COORDINATE MEASUREMENT

- Press **[OK]** to set the input values. <Coord. measurement> is displayed.
  - Press **[REC]** to store the backsight station data in the current JOB. Input point number, target height and code, then press **[OK]**. <Coord. measurement> is displayed.



### Horizontal angle settings

Azimuth (set both horizontal and azimuth angles to the same value)/H.ANG (input both horizontal and azimuth angles)/None (input azimuth angle only)/0 SET (horizontal angle set to 0°)

## 15.3 3-D Coordinate Measurement

The coordinate values of the target can be found by measuring the target based on the settings of the instrument station and backsight station.

The coordinate values of the target are calculated using the following formulae.

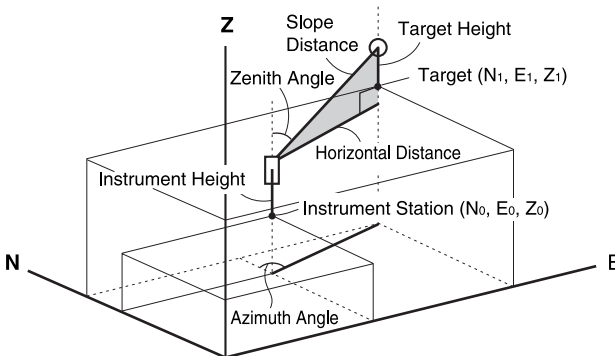
$$N1 \text{ Coordinate} = N0 + S \times \sin Z \times \cos Az$$

$$E1 \text{ Coordinate} = E0 + S \times \sin Z \times \sin Az$$

$$Z1 \text{ Coordinate} = Z0 + S \times \cos Z + ih - fh$$

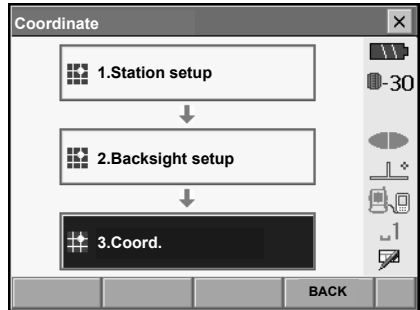
N0: Station point N coordinate    S: Slope distance    ih: Instrument height  
E0: Station point E coordinate    Z: Zenith angle    fh: Target height  
Z0: Station point Z coordinate    Az: Direction angle

"Null" coordinates will not be included in calculations. "Null" is not the same as zero.




## PROCEDURE

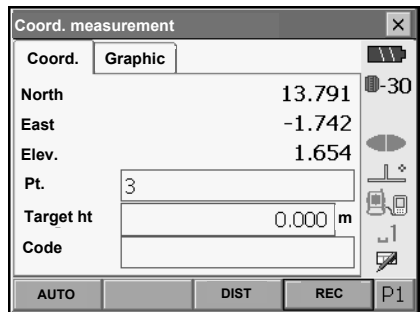
1. Sight the target at the target point.
2. Select "Coord." in <Coordinate>.



Press **[DIST]** to start measurement. Press **[STOP]** to stop the measurement. The coordinates of the target point are displayed. Select the Graphic tab to display coordinates on a graph.

- When recording data in the current JOB, input point number, target height, and code, then press **[REC]**.
- Press **[AUTO]** to perform coordinate measurement and automatically record the results. **[AUTO]** is convenient for recording measurement data when not setting point number, code, and target height.
- Press **[A-OFS]/[D-OFS]** on the second page to perform angle/distance offset measurement.  
 "19. OFFSET MEASUREMENT"

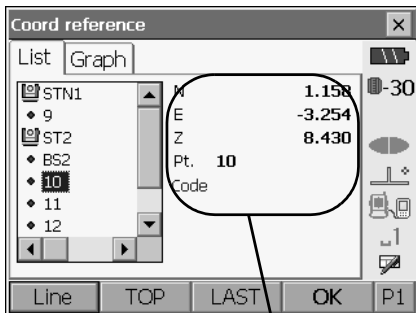
3. Sight the next target and press **[DIST]** to begin measurement. Continue until all targets have been measured.
4. When coordinate measurement is completed, press **{ESC}** or tap the cross in the top-right corner to return to <Coordinate>.



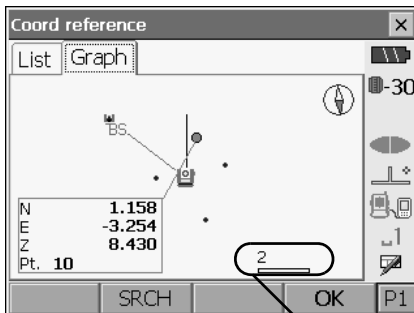
## 15.4 Reading in Registered Coordinate Data from Memory mode

### 16.4.1 Selecting points from registered coordinates

When **[READ]** is pressed, coordinate data stored in the current JOB and the coordinate search JOB is recalled and displayed in <Coord reference>. The points thus displayed can then be selected as points for the current operation. The List and Graphic tabs are linked so that when a particular point is selected in one tab, the same point is automatically selected in the other tab.



Details of the selected data



Scale bar

The screen contains the following softkeys:

**[Line]/[Page]:** Switch the operation of **{▲}**/**{▼}** from page scroll to point scroll.

**[TOP]:** Select the first point in the list.

**[LAST]:** Select the last point in the list.

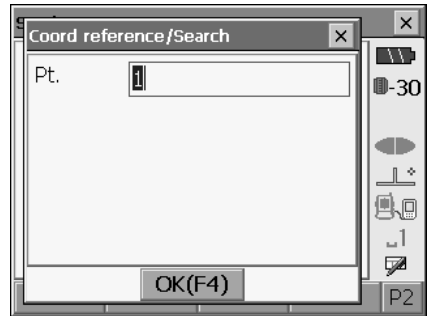
**[SRCH]:** Search for point number.

**[CNFG]** (on the second page):  
Change the display setting.

**[DEF.]** (on the second page):  
Return to the default display format.

### 16.4.2 Searching for a point

1. Press **[SRCH]** in <Coord reference>.
2. Enter a point number and press **[OK]** or **{←}** to start the search. Up to 14 characters can be input. Any existing point with a matching number will be displayed at the bottom of the list.



### 16.4.3 Configuration

1. Press **[CNFG]** on the second page of <Coord reference> to change the display setting.
2. Change the settings.

JOB data and Coord JOB:

Displayed JOB can be selected.

Settings:

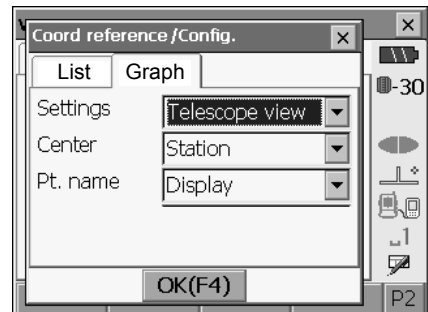
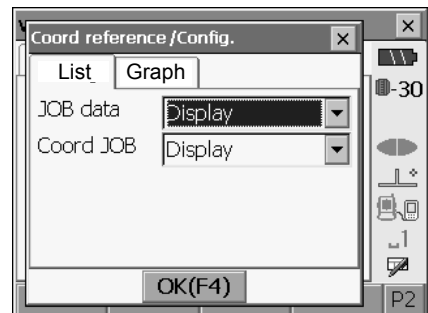
Orientation of the display can be selected from telescope direction, north or south.

Center:

Center point for the display can be selected from instrument station or target point.

Pt.name:

Switch point name display on/off.

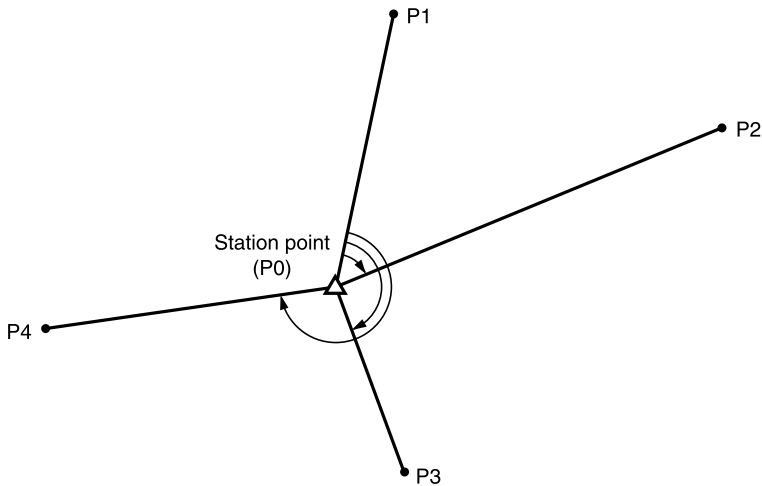


3. Press **[OK]** to confirm the settings.


# 16. RESECTION MEASUREMENT

Resection is used to determine the coordinates of an instrument station by performing multiple measurements of points whose coordinate values are known. Registered coordinate data can be recalled and set as known point data. Residual of each point can be checked, if necessary

Entry	Output
Coordinates of known point	: $(N_i, E_i, Z_i)$ Station point coordinates : $(N_0, E_0, Z_0)$
Observed horizontal angle	: $H_i$
Observed vertical angle	: $V_i$
Observed distance	: $D_i$



- Between 2 and 10 known points can be measured by distance measurement, and between 3 and 10 known points by angle measurement.
- The more known points there are and the more points there are whose distance can be measured, the higher the precision of the coordinate value calculation.
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.

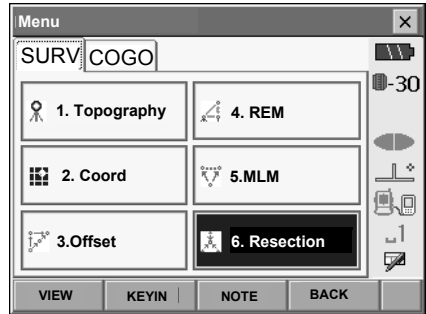
 "29.6 Allocating Key Functions"

## 16.1 Coordinate Resection Measurement

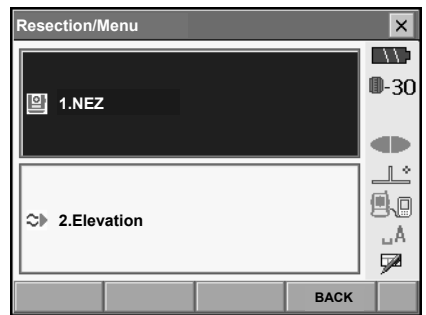
N, E, Z of an instrument station is determined by the measurement.

### PROCEDURE

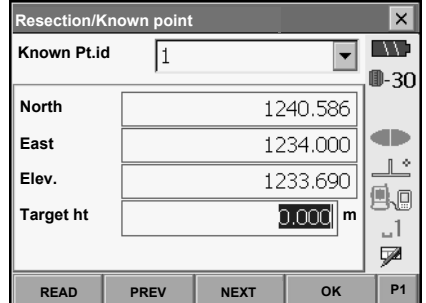
1. Select "Resection" in the "SURV" tab of <Menu>.



2. Select "NEZ" to display <Resection/Known point>.



3. Input the known point.  
After setting the coordinates and target height for the first known point press **[NEXT]** to move to the second point.
  - Press **[READ]** to read in coordinate data registered in Memory mode.  
"15.4 Reading in Registered Coordinate Data from Memory mode"
  - Press **[PREV]** to return to settings for the previous point.
  - When recording known point data in the current JOB, press **[REC]** on the second page.
 When all required known points have been set, press **[OK]**.



## 16. RESECTION MEASUREMENT

4. Sight the first known point and press **[DIST]** to begin measurement.  
The measurement results are displayed on the screen.

- When **[ANGLE]** has been selected, the distance cannot be displayed.

Resection/measurement known points	
Pt. 1	
North	1240.586
East	1234.000
Elev.	1233.690
S	1.865 m
ZA	90°43'22"
HAR	249°01'55"

Buttons: ANGLE, DIST

5. Press **[YES]** to use the measurement results of the first known point.

- You can also input target height here.
- Press **[NO]** to return to the screen in step 4 and perform measurement again.

Resection/result	
S	5.018 m
ZA	92°59'42"
HAR	246°11'09"
Target ht	<input type="text" value="0.000"/> m

Buttons: YES(F1), NO(F4)

6. Repeat procedures 4 to 5 in the same way from subsequent points.

When the minimum quantity of observation data required for the calculation is present, **[CALC]** is displayed.

Resection/result	
S	5.279 m
ZA	90°00'07"
HAR	242°29'06"
Target ht	<input type="text" value="0.000"/> m

Buttons: CALC(F1), YES(F3), NO(F4)

7. Press **[CALC]** or **[YES]** to automatically start calculations after observations of all known points are completed.

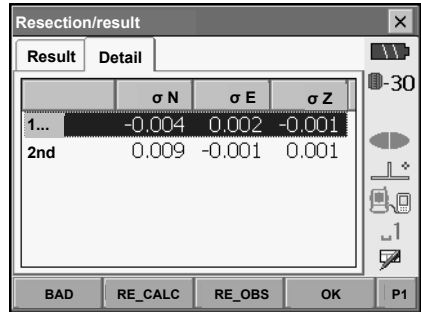
- Instrument station coordinates, station elevation, and standard deviation, which describes the measurement accuracy, are displayed.
- When recording instrument station data in the current JOB, press **[REC]**.

Resection/result	
Result	Detail
Stn North	1234.568
Stn East	9012.346
Stn Elev.	789.012
σ N	0.0071
σ E	0.0038
σ Z	0.0001

Buttons: RE\_OBS, REC, OK



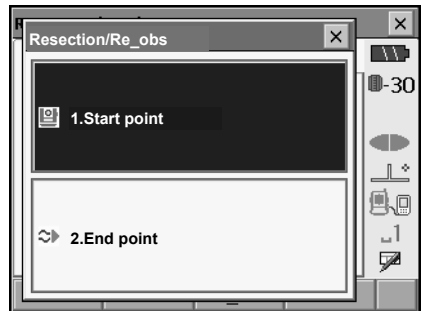
Standard deviation for the northing, easting and elevation coordinates of each point are displayed in the Detail tab.



- If there are problems with the results of a point, align the cursor with that point and press **[BAD]**. "BAD" is displayed to the right of the point. Repeat for all results that include problems.



- Press **[RE CALC]** to perform calculation again without the point designated in step 8. The result is displayed.
  - If there are no problems with the result, go to step 10.
  - If problems with the result occur again, perform the resection measurement from step 4.
    - Press **[RE OBS]** to measure the point designated in step 8.
      - If no points are designated in step 8, all the points or only the final point can be observed again.
    - Press **[ADD]** when there is a known point that has not been measured or when a new known point is added.



- Press **[OK]** in <Resection/result> to display <Resection/Set h angle>.

## 16. RESECTION MEASUREMENT

11. Select an angle mode and press **[YES]** to set the azimuth angle of the first known point as the backsight point and return to <Resection/Menu>.
12. Press **[NO]** to return to <Resection/Menu> without setting the azimuth angle.



### Horizontal angle settings

H (set horizontal angle to measured value)/H=Az (set horizontal angle to the same value as azimuth angle)/Az (set azimuth angle only)



- It is also possible to perform resection measurement by pressing **[RESEC]** in the third page of Meas mode.

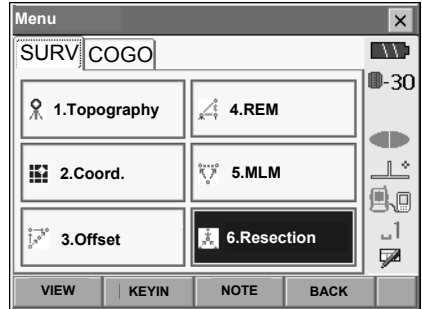
## 16.2 Height Resection Measurement

Only Z (height) of an instrument station is determined by the measurement.

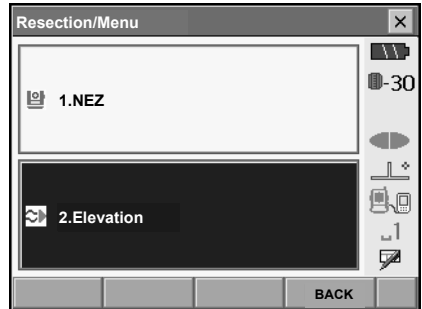
- Known points must be measured by distance measurement only.
- Between 1 and 10 known points can be measured.

### PROCEDURE

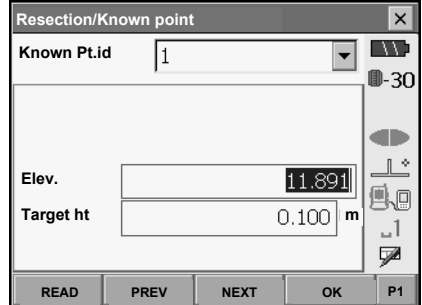
1. Select "Resection" in the "SURV" tab of <Menu>.



2. Select "Elevation" to display <Resection/Known point>.



3. Input the known point.  
After setting the elevation and target height for the first known point press **[NEXT]** to move to the second point.
  - Press **[READ]** to read in coordinate data registered in Memory mode.  
 15.4 Reading in Registered Coordinate Data from Memory mode
  - Press **[PREV]** to return to settings for the previous point.
  - When recording known point data in the current JOB, press **[REC]** on the second page.  
When all required known points have been set, press **[OK]**.



## 16. RESECTION MEASUREMENT

4. Sight the first known point and press **[DIST]** to begin measurement.  
The measurement results are displayed on the screen.

Pt. 1	
Elev.	11.891
S	
ZA	89°59'56"
HAR	3°52'43"

**DIST**

5. If measuring two or more known points, repeat procedures 4 in the same way from the second point.

S	5.389 m
ZA	91°08'52"
HAR	241°42'02"
Target ht	0.100 m

**CALC(F1)    YES(F3)    NO(F4)**

6. Press **[CALC]** or **[YES]** to automatically start calculations after observations of all known points are completed.
- Instrument station elevation and standard deviation, which describes the measurement accuracy, are displayed in the Result tab.
  - When recording instrument station data in the current JOB, press **[REC]**.

Stn Elev.	789.012
$\sigma Z$	0.006

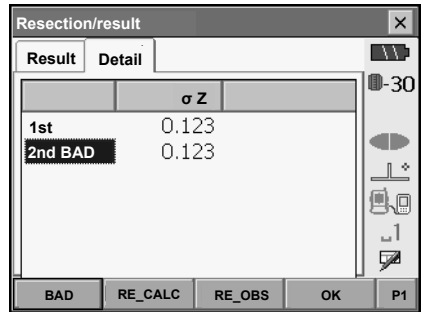
**RE\_OBS    REC    OK**

Standard deviation values for each point are displayed in the Detail tab.

	$\sigma Z$
1...	0.123
2nd	0.123

**BAD    RE\_CALC    RE\_OBS    OK    P1**

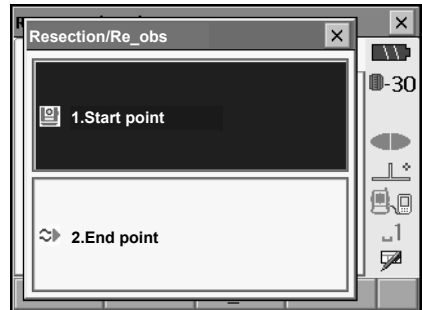
7. If there are problems with the results of a point, align the cursor with that point and press **[BAD]**. "BAD" is displayed to the right of the point. Repeat for all results that include problems.



8. Press **[RE CALC]** to perform calculation again without the point designated in step 8. The result is displayed. If there are no problems with the result, go to step 9. If problems with the result occur again, perform the resection measurement from step 4.
  - Press **[RE OBS]** to measure the point designated in step 8.

If no points are designated in step 8, all the points or only the final point can be observed again.

- Press **[ADD]** when there is a known point that has not been measured or when a new known point is added.



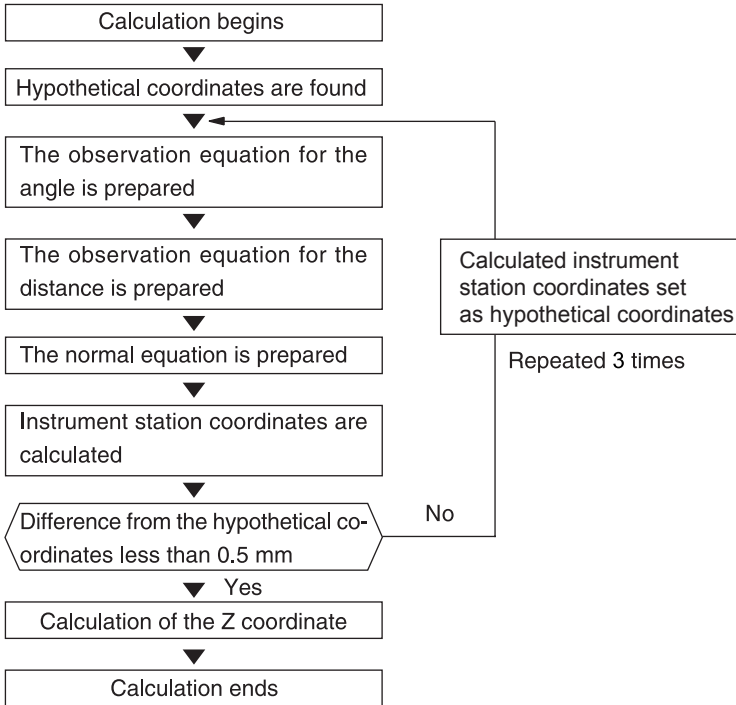
9. Press **[OK]** to finish resection measurement and return to <Resection/Menu>. Only Z (elevation) of the instrument station coordinate is set. N and E values are not overwritten.

## 16. RESECTION MEASUREMENT



### Resection calculation process

The NE coordinates are found using angle and distance observation equations, and the instrument station coordinates are found using the method of least squares. The Z coordinate is found by treating the average value as the instrument station coordinates.





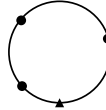
**Precaution when performing resection**

In some cases it is impossible to calculate the coordinates of an unknown point (instrument station) if the unknown point and three or more known points are arranged on the edge of a single circle.

An arrangement such as that shown below is desirable.

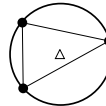


It is sometimes impossible to perform a correct calculation in a case such as the one below.

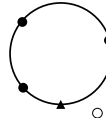


When they are on the edge of a single circle, take one of the following measures.

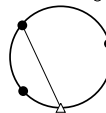
- (1) Move the instrument station as close as possible to the center of the triangle.



- (2) Observe one more known point which is not on the circle.



- (3) Perform a distance measurement on at least one of the three points.



- In some cases it is impossible to calculate the coordinates of the instrument station if the included angle between the known points is too small. It is difficult to imagine that the longer the distance between the instrument station and the known points, the narrower the included angle between the known points. Be careful because the points can easily be aligned on the edge of a single circle.

# 17.SETTING-OUT MEASUREMENT

Setting-out measurement is used to set out the required point.

The difference between the previously input data to the instrument (the setting-out data) and the measured value can be displayed by measuring the horizontal angle, distance or coordinates of the sighted point.

The horizontal angle difference distance difference, and coordinate difference are calculated and displayed using the following formulae.

Horizontal difference

Displayed value (angle) = Horizontal angle of setting-out data - measured horizontal angle

Displayed value (distance) = measured horizontal distance x tan (horizontal angle of setting out data - measured horizontal angle)

Slope distance difference

Displayed value (slope distance) \* = measured slope distance - slope distance setting-out data

\* Horizontal distance or height difference can be input in the above formula.


Coordinate difference

Displayed value (coordinates)\* measured N setting-out coordinates - N coordinates of setting-out data


\* E or Z coordinates can be input in the above formula


Height difference (REM setting out measurement)

Displayed value (height) = measured REM data - REM data of setting out data

- Setting out data can be input in various modes: slope distance, horizontal distance, height difference, coordinates and REM measurement.
- It is possible to allocate softkeys in the Setting-out measurement menu to suit various applications and the ways that different operators handle the instrument.  
 "29.6 Allocating Key Functions"

## 17.1 Using the Guide Light

When the guide light is set to ON, the flashing speed of the light indicates the status of the SETX and can be known when the user is located at a distance from the instrument. Also, the flashing colors relative to the target indicate the direction of the instrument and allow the user to reposition the target.  
 Turning the Guide light ON/OFF: "5.1 Basic Key Operation"

- The pattern of the guide light can be changed.  
 "29.2 Instrument Configuration"



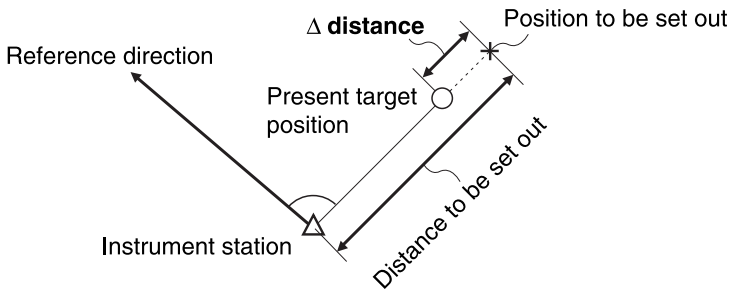
● **Guide light status and meaning**

Indication for positioning target during setting-out measurement

Light status	Meaning
Increased flashing speed	(From position of poleman) Move target toward SETX
Decreased flashing speed	(From position of poleman) Move target away from SETX
Fast flashing	Target is at correct distance
Red	(From position of poleman) Move target left
Green	(From position of poleman) Move target right
Red and Green	Target is at correct horizontal position

**17.2 Distance Setting-out Measurement**

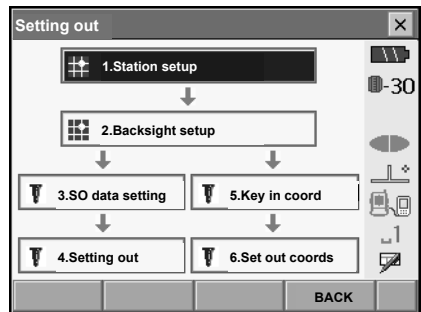
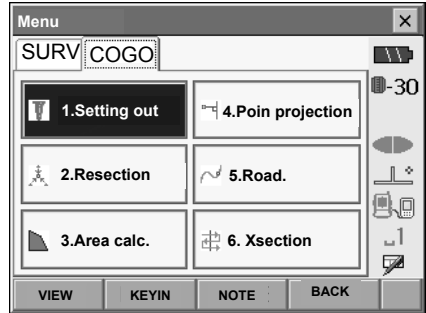
The point is to be found based on the horizontal angle from the reference direction and the distance from the instrument station.



## 17. SETTING-OUT MEASUREMENT

### PROCEDURE

1. Select "Setting out" in the "COGO" tab of <Menu> to display <Setting out>.



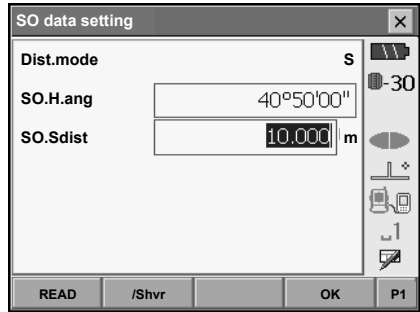
2. Select "Station setup" to display <Station setup>. Enter data for the instrument station and press **[OK]** to move to Bacsight setup.  
☞ "15.1 Entering Instrument Station Data"
  - Press **[READ]** to read in coordinate data registered in Memory mode.  
☞ "15.4 Reading in Registered Coordinate Data from Memory mode"
3. Set the azimuth angle for the backsight station. Press **[OK]** to return to <Setting out>.  
☞ "15.2 Azimuth Angle Setting"

**Reference Direction**



Instrument station

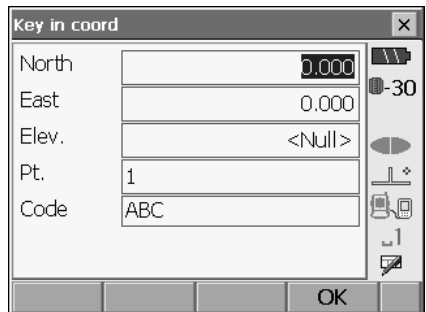
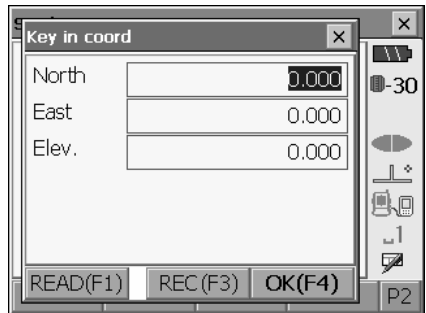
4. Select "SO data setting" In <Setting out> to display <SO data setting>. In the distance mode that conforms to your measurement requirements, enter the included angle between the reference point and the setting-out point in "SO.H.ang", and the distance (slope distance, horizontal distance or height difference) from the instrument station to the position to be set out in "SO.Sdist".



- Each time **[/Shvr]** is pressed, the distance mode changes from "S" (slope distance), "H" (horizontal distance), "V" (height difference), and "Ht." (REM).
- When **[READ]** is pressed, coordinates registered in Memory mode can be recalled and used. The distance selected according to the selected distance input mode is calculated using these coordinate values.

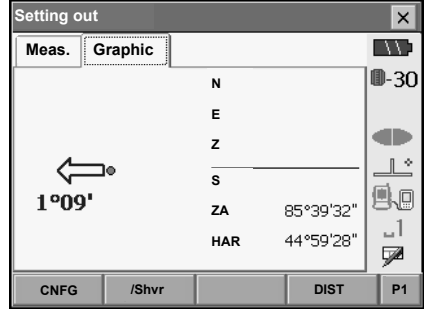
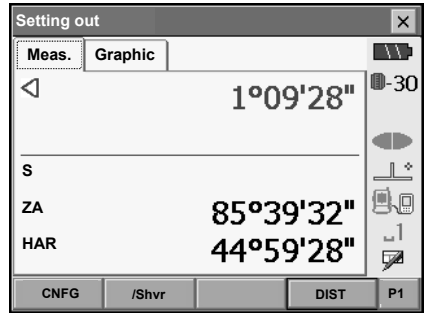
"15.4 Reading in Registered Coordinate Data from Memory mode"

- Press **[COORD]** in the second page and input coordinates in <Key in coord>. The angle and distance from these coordinates to the position to be set out will be calculated.
- When recording known point data in the current JOB, press **[REC]** in <Key in coord>. Enter known point coordinates, point number, and code, then press **[OK]**.



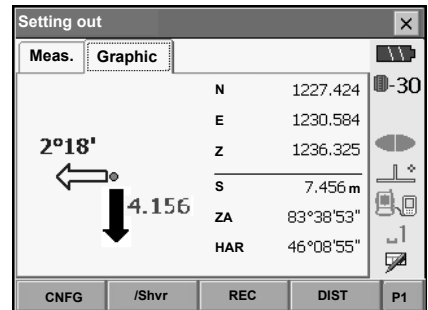
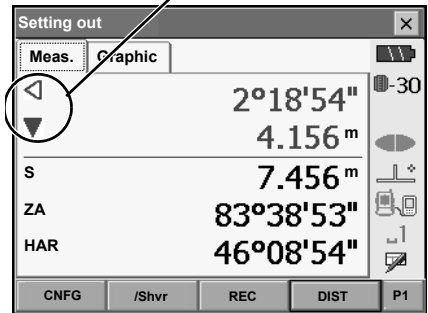
## 17. SETTING-OUT MEASUREMENT

5. Enter values and press **[OK]** to display the screen at right.



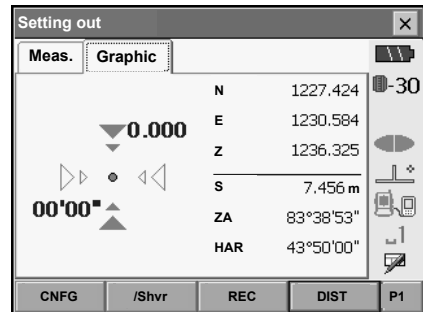
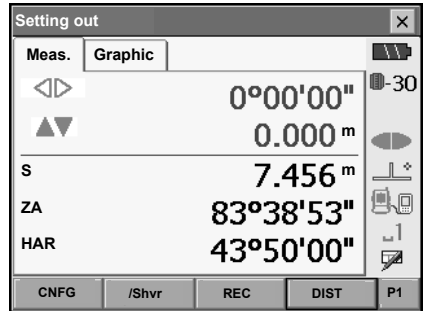
Arrows indicate direction to move

6. Position the target on the line of sight and press **[DIST]** to begin distance measurement. The distance and direction to move the target until the setting out point is located is displayed on the SETX. The sighting point measurement results (currently installed position of the target) are displayed.



- Movement indicator (Red indicates that target position is correct)  
Arrows indicating horizontal direction will point in the opposite direction when viewing the display in Face 2.
  - ◁ : (Viewed from SETX) Move target to the left
  - ▷ : (Viewed from SETX) Move target to the right
  - ◁▷: Target position is correct
  - ▼ : (Viewed from SETX) Move target closer
  - ▲ : (Viewed from SETX) Move target away
  - ▲▼: (Viewed from SETX) Target position is correct
  - ▲ : Move target upward
  - ▼ : Move target downward
  - ▲▼: Target position is correct
- Each time **[/Shvr]** is pressed, the distance input mode changes from "H" (horizontal distance), "V" (height difference), "R" (slope distance), and "S" (slope distance).
  - Press **[CNFG]** to set setting out accuracy. When the position of the target is within this range both arrows will be displayed to indicate that the target position is correct.

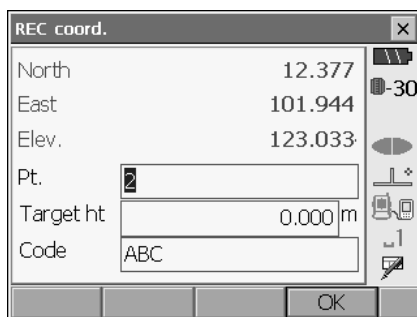
7. Move the target until the distance to the setting-out point reads 0m. When the target is moved within the allowed range, all distance and position arrows are displayed.



## 17. SETTING-OUT MEASUREMENT

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- When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.



The image shows a software dialog box titled "REC coord." with a close button (X) in the top right corner. The dialog contains several input fields and a list of icons on the right side. The fields are:

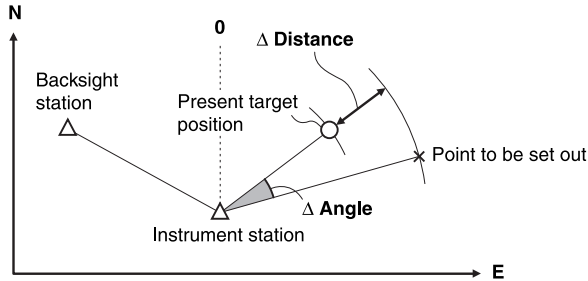
North	12.377
East	101.944
Elev.	123.033
Pt.	<input type="text" value="2"/>
Target ht	<input type="text" value="0.000"/> m
Code	<input type="text" value="ABC"/>

On the right side of the dialog, there is a vertical toolbar with icons for: a printer, a battery level indicator showing -30, a horizontal line with a plus sign, a vertical line with a plus sign, a list icon, and a pencil icon. At the bottom right of the dialog is an "OK" button.

8. Press **{ESC}** to return to <Setting out>. Set the next setting out point to continue setting out measurement.

## 17.3 Coordinates Setting-out Measurement

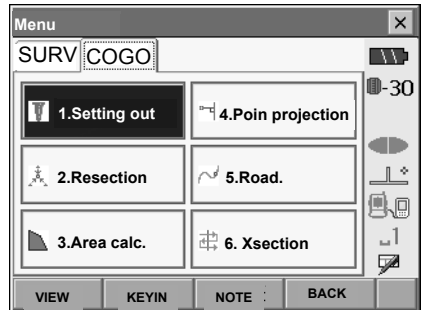
After setting the coordinates for the point to be set out, the SETX calculates the setting-out horizontal angle and horizontal distance. By selecting the horizontal angle and then the horizontal distance setting-out functions, the required coordinate location can be set out.



- Previously recorded setting-out points can be placed in order. Up to 50 points can be recorded.
- To find the Z coordinate, attach the target to a pole etc. with the same target height.

### PROCEDURE

1. Select "Setting out" in the "COGO" tab of <Menu> to display <Setting out>.




2. Select "Station setup" to display <Station setup>. If necessary, enter data for Backsight setup.
  - ☞ "17.2 Distance Setting-out Measurement" steps 2 to 3

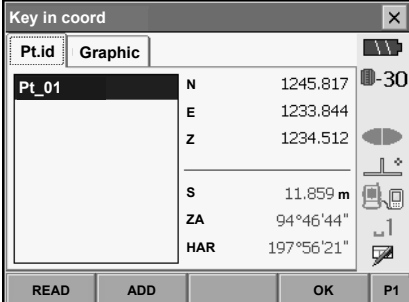
## 17. SETTING-OUT MEASUREMENT

3. Select "Key in coord" in <Setting out>. Record all the setting-out points (includes setting-out points you will measure from now).

Press **[READ]** to display recorded angle data or press **[ADD]** to record new data.

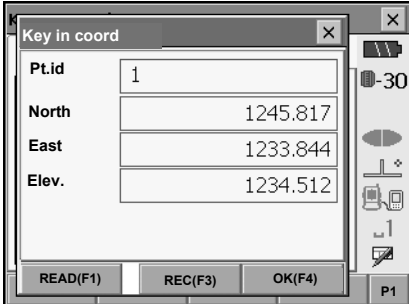
 "15.4 Reading in Registered Coordinate Data from Memory mode"

- Press **[DEL]** in the second page to delete the selected setting out point.
- Press **[DELALL]** in the second page to delete all setting out points.
- When recording known point data in the current JOB, press **[REC]** in <Key in coord>. Enter known point coordinates, point number, and code, then press **[OK]**.



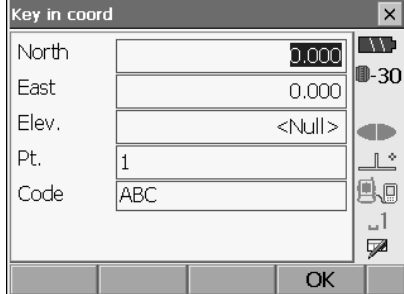
Pt.id	Graphic		
Pt. 01	N	1245.817	
	E	1233.844	
	Z	1234.512	
	S	11.859 m	
	ZA	94°46'44"	
	HAR	197°56'21"	

Buttons: READ, ADD, OK, P1



Pt.id	1
North	1245.817
East	1233.844
Elev.	1234.512

Buttons: READ(F1), REC(F3), OK(F4), P1



North	0.000
East	0.000
Elev.	<Null>
Pt.	1
Code	ABC

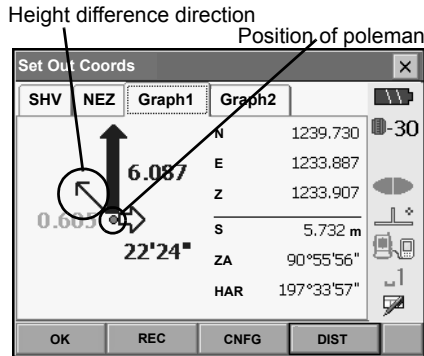
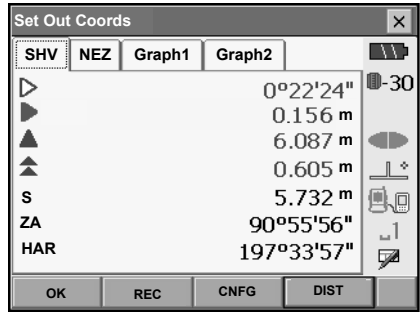
Buttons: OK

4. Select a setting-out point in the first screen of step 3 and press **[OK]** to display <Set out Coords>.



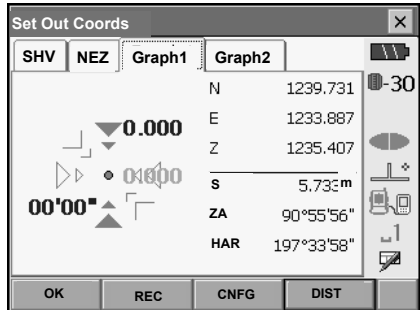
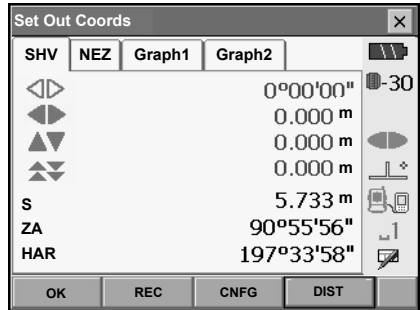
- Position the target on the line of sight and press **[DIST]** to begin distance measurement. The distance and direction to move the target until the setting out point is located is displayed on the SETX. The sighting point measurement results (currently installed position of the target) are displayed.

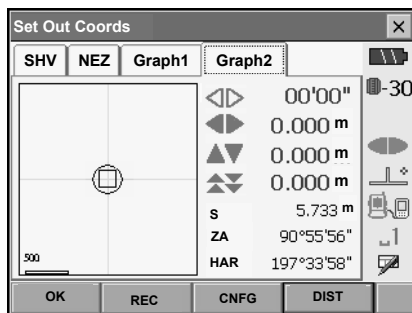
- Switch between the tabs to display different sets of information. The Graph 1 tab shows the current position of the mirror and the direction to the setting out point from this position. The Graph 2 tab shows the position of the setting out point (square) and the current location of the mirror (circle).



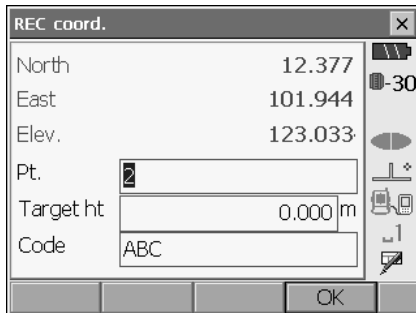
Move the target to find the correct distance (0 is displayed) to the setting out point.

Movement indicators: "17.2 Distance Setting-out Measurement" step 6






- When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.




6. Press **{ESC}** to return to <Key in coord>. Set the next setting out point to continue setting out measurement.

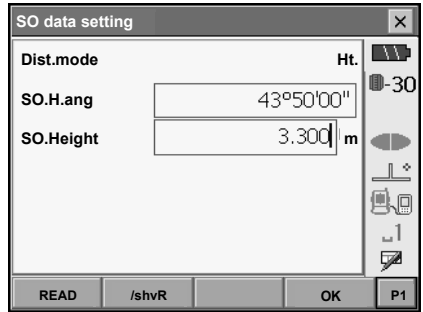
### 17.4 REM Setting-out Measurement

To find a point where a target cannot be directly installed, perform REM setting-out measurement.  
 "13.4 REM Measurement"

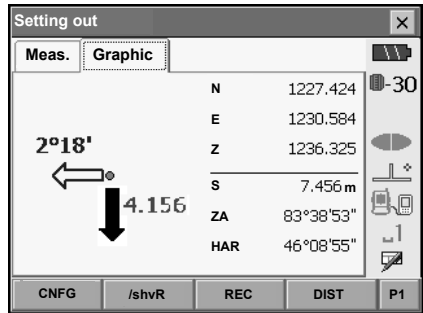
#### PROCEDURE

1. Install a target directly below or directly above the point to be found. Then use a measuring tape etc. to measure the target height (height from the survey point to the target).
2. Select "Station setup" in <Setting out> to display <Station setup>. If necessary, enter data for Backsight setup.  
 "17.2 Distance Setting-out Measurement" steps 2 to 3

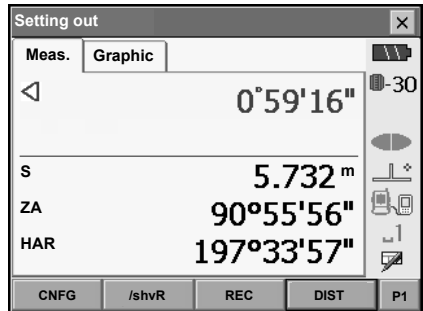
3. Select "SO data setting" In <Setting out> to display <SO data setting>. Press **[/Shvr]** until the distance input mode is "Ht.". Input height from the surveying point to the position to be set out in "SO.Height". If necessary, input the angle to the point to be set out.



4. Enter values and press **[OK]** in step 3 to display the screen at right.



5. Sight the target and press **[DIST]**. Measurement begins and the measurement results are displayed.



## 17. SETTING-OUT MEASUREMENT

6. Press **[REM]** in the second page to start REM measurement.

The distance (height difference) and direction to move the target until the sighting point and setting out point are located is displayed on the SETX.

Press **[STOP]** to stop measuring.

Find the setting-out point by moving the telescope until the distance to the setting-out point reads 0m.

- Movement indicator (Red indicates that target position is correct)

▲▲▲ : Move the telescope near the zenith

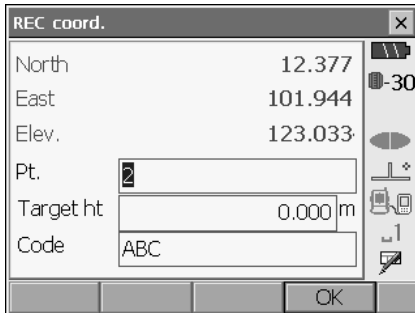
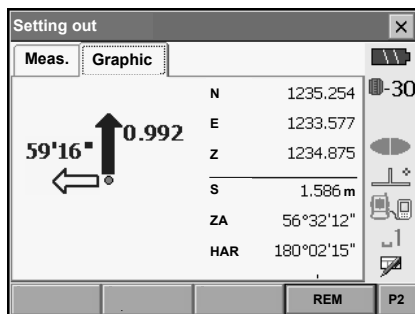
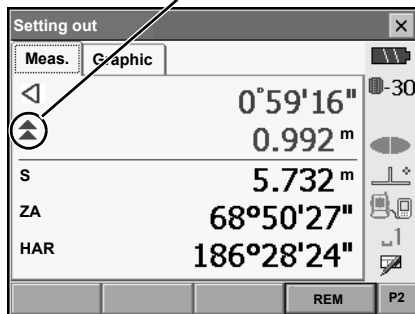
▼▼▼ : Move the telescope near the nadir

▲▼▲ : Telescope direction is correct

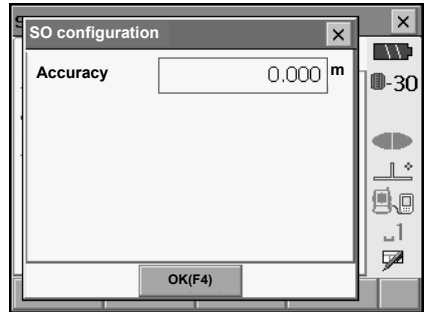
☞ For details of other movement indicators:  
"17.2 Distance Setting-out Measurement"  
step 6

- When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.

Arrows indicate direction to move



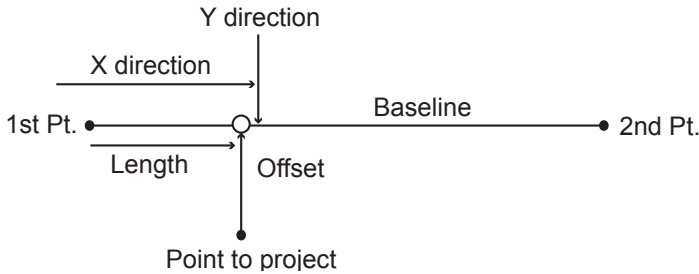
- Press **[CNFG]** to set setting out accuracy. When the position of the target is within this range both arrows will be displayed to indicate that the target position is correct.



7. Press **{ESC}** to return to <SO data setting>.

# 18.POINT PROJECTION

Point projection is used for projecting a point onto the baseline. The point to project can be either measured or input. Displays the distances from the first point and point to project to the position at which a line extending from point to project intersects the baseline at right angles.



## 18.1 Defining Baseline

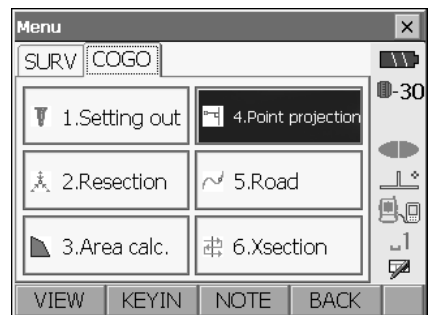
To perform point projection, first, define the baseline. The baseline can be defined by inputting the coordinates of the two points. The scale factor value is the difference between the input coordinates and the observed coordinates.

$$\text{Scale (X, Y)} = \frac{\text{Hdist' (horizontal distance calculated from the measured value)}}{\text{Hdist (horizontal distance calculated from the input coordinates)}}$$

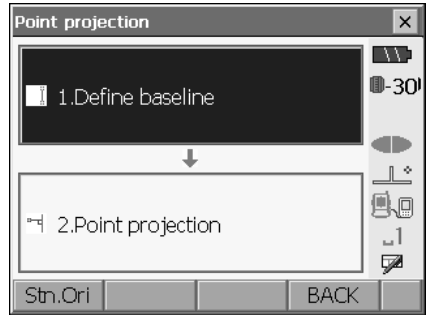
- When not observing first or second points, scale factor is set to "1".

### PROCEDURE

1. Select COGO tab.
2. Select "Point Projection" in the "COGO" tab of <Menu>.



3. Select "Define baseline" in <Point projection>.



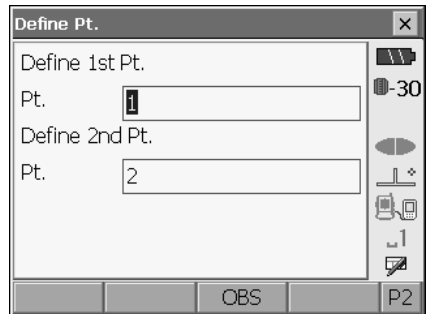
4. Press **[Stn.Ori]** and enter the instrument station data.

"15.1 Entering Instrument Station Data"

5. Select "Define baseline" in <Point projection>.

6. Enter the first point data and the second point data.

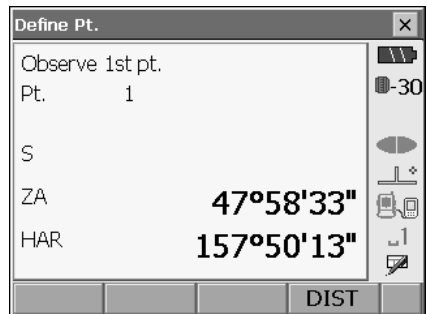
- When **[READ]** on the first page is pressed, registered coordinates can be recalled and used.



7. Sight the first point and press **[OBS]** on the second softkey page of the screen.

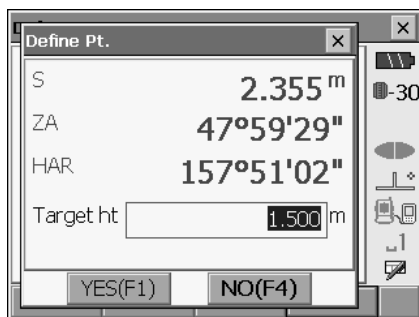
- When not observing the first point and the second point, press **[OK]** and go to step 12.

8. Press **[DIST]** to start measurement.

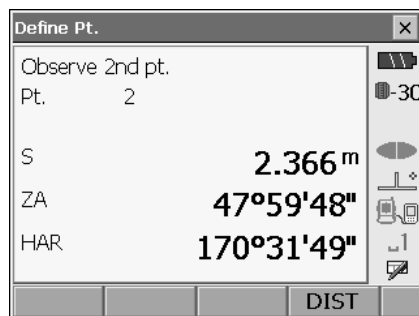


## 18. POINT PROJECTION

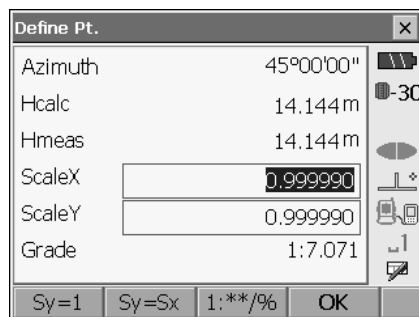
9. Press **[YES]** to use the measurement results of the first point.
- Press **[NO]** to observe the first point again.




10. Sight the second point and press **[DIST]**.
11. Press **[YES]** to use the measurement results of the second point.



The distance between the two measured points, the distance calculated from inputting the coordinates of two points and the scale factors are displayed.




12. Press **[OK]** on the second screen of step 11 to define the baseline. Move to reference point setting.
-  "18.2 Point Projection"
- Press **[Sy=1]** to set scale factor y to "1".
  - Press **[1 : \*\*/%]** to switch the grade display mode between "1 : \*\* = elevation :horizontal distance" and %.

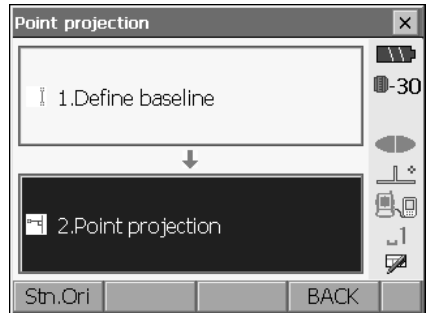


## 18.2 Point Projection

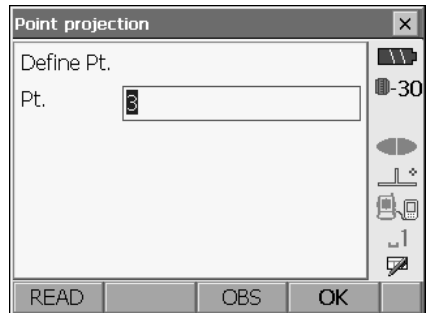
Before performing point projection, the baseline must be defined.

### PROCEDURE

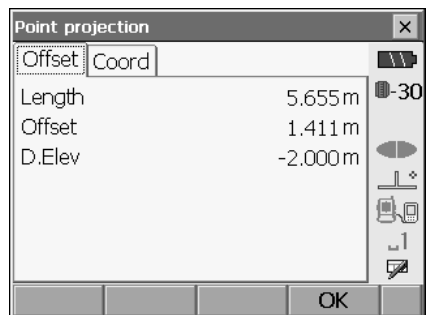
1. Define the baseline.  
 "18.1 Defining Baseline"
2. Select "Point projection" in <Point projection>.



3. Input the point number of reference point.
  - Press **[OBS]** to observe the point to project.



4. Press **[OK]** on the screen of step 3.  
 The following items are calculated and displayed.
  - Length: Distance along the baseline from the first point to the projected point (X direction).
  - Offset: Distance from point to project to the position at which a line extending from point of project intersects the baseline at right angles. (Y direction).
  - D.Elev: Elevation between the baseline and the projected point.



## 18. POINT PROJECTION

On the Coord tab, the coordinate values are displayed.

- **[REC]**: records the coordinate values as known point data.  
☞ Recording method: "24.1 Registering Known Point Data"
- Press **[S-O]** to move to setting-out measurement of the projected point.  
☞ "17. SETTING-OUT MEASUREMENT"

5. Press **[OK]**.

Field	Value
North	4.000
East	4.000
Elev.	4.000
Pt.	[Dropdown]
Target ht	1.500 m
Code	ABC

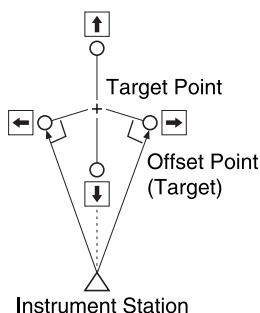
# 19.OFFSET MEASUREMENT

Offset measurements are performed in order to find a point where a target cannot be installed directly or to find the distance and angle to a point which cannot be sighted.

- It is possible to find the distance and angle to a point you wish to measure (target point) by installing the target at a location (offset point) a little distance from the target point and measuring the distance and angle from the survey point to the offset point.
- The target point can be found in the three ways explained in this chapter.
- The instrument station and backsight must be set before the coordinates of an offset point can be found. Station and backsight setup can be performed in the Offset menu.  
☞ Station setup: "15.1 Entering Instrument Station Data", Backsight setup: "15.2 Azimuth Angle Setting".
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

## 19.1 Single-distance Offset Measurement

Finding it by entering the horizontal distance from the target point to the offset point.



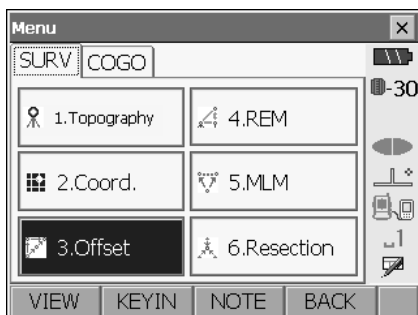
- When the offset point is positioned to the left or right of the target point, make sure the angle formed by lines connecting the offset point to the target point and to the instrument station is almost  $90^\circ$ .
- When the offset point is positioned in front of or behind the target point, install the offset point on a line linking the instrument station with the target point.

### PROCEDURE

1. Set the offset point close to the target point and measure the distance between them, then set up a prism on the offset point.

## 19. OFFSET MEASUREMENT

2. Select "Offset" in the "SURV" tab of <Menu> to display .



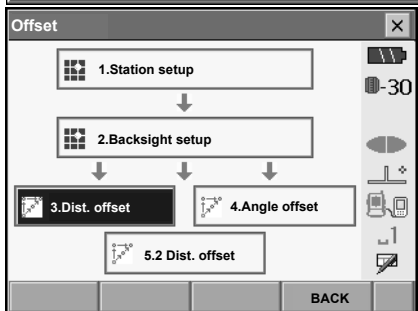
3. Select "Dist. offset".

Input the following items.

- (1) Direction of the offset point.
- (2) Horizontal distance from the target point to the offset point.

- Direction of offset point

- ← : On the left of the target point.
- : On the right of the target point.
- ↓ : Closer than the target point.
- ↑ : Beyond the target point.

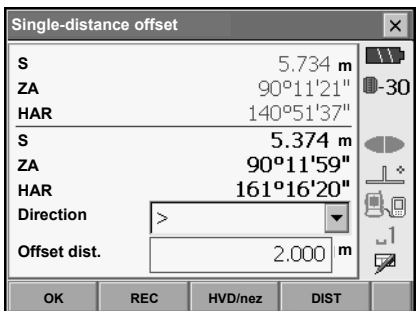
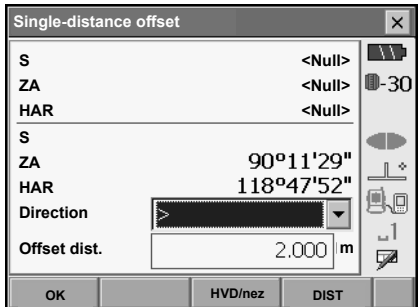


4. Sight the offset point and press **[DIST]** in the screen of step 3 to start measurement.

Press **[STOP]** to stop the measurement.

The measurement results are displayed.

- Press **[HVD/nez]** to switch results for the target point between distance/angle values and coordinate/elevation values.



- When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.

REC measurement	
S	5.290 m
ZA	73°06'25"
HAR	297°57'28"
Pt.	<input type="text" value="2"/>
Target ht	<input type="text" value="0.000 m"/>
Code	<input type="text" value="ABC"/>

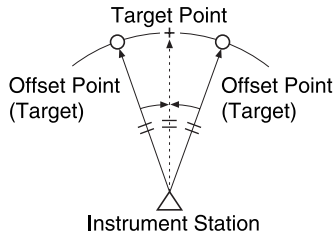
OK

5. Press **[OK]** in the second screen in step 4 to return to <Offset>.

## 19.2 Angle Offset Measurement

Sighting the direction of the target point to find it from the included angle.

Install offset points for the target point on the right and left sides of and as close as possible to the target point and measure the distance to the offset points and the horizontal angle of the target point.

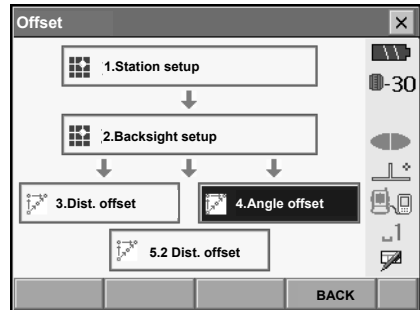


### PROCEDURE

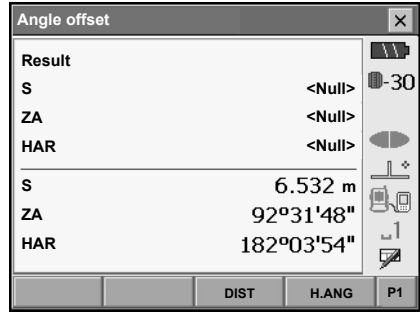
1. Set the offset points close to the target point (making sure the distance from the instrument station to the target point and the height of the offset points and the target point are the same), then use the offset points as the target.

2. Select "Offset" in the "SURV" tab of <Menu> to display <Offset>.

Select "Angle offset".

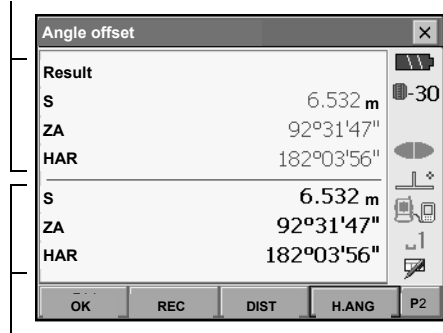


- Sight the offset point and press **[DIST]** to start measurement.  
Press **[STOP]** to stop the measurement.



- Sight the target point and press **[H.ANG]**.
  - Press **[HVD/nez]** on the second page to switch results for the target point between distance/angle values and coordinate/elevation values.
  - When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.

Results for offset point



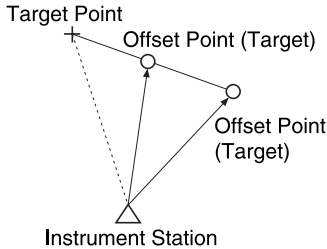
Results for target point

- Press **[OK]** in the screen in step 4 to return to <Offset>.

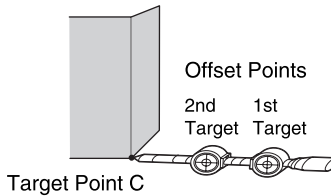
### 19.3 Two-distance Offset Measurement

By measuring the distances between the target point and the two offset points. Install two offset points (1st target and 2nd target) on a straight line from the target point, observe the 1st target and 2nd target, then enter the distance between the 2nd target and the target point to find the target point.

- It is possible to make this measurement easily using the optional equipment: the 2-point target (2RT500-K). When using this 2-point target, be sure to set prism constant to 0.



How to use 2-point target (2RT500-K)



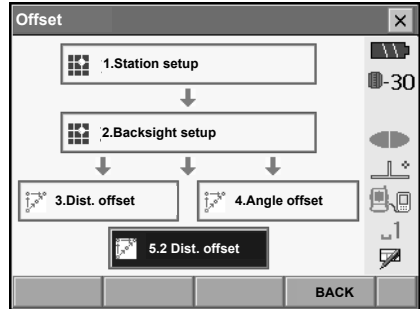
- Install the 2-point target with its tip at the target point.
- Face the targets toward the instrument.
- Measure the distance from the target point to the 2nd target.
- Set the prism constant to 0mm.



**PROCEDURE**

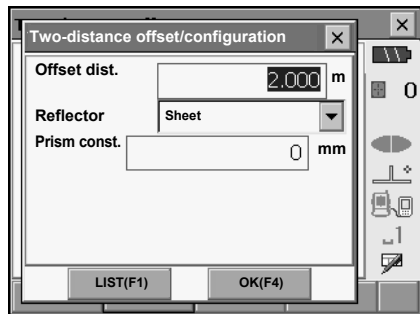
1. Install two offset points (1st target, 2nd target) on a straight line from the target point and use the offset points as the target.
2. Select "Offset" in the "SURV" tab of <Menu> to display <Offset>.

Select "2 Dist. offset".

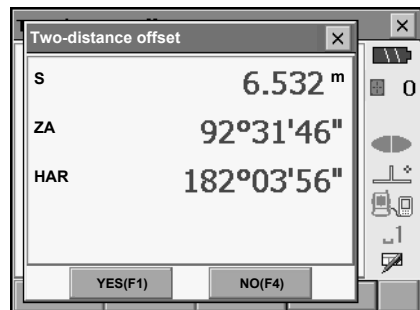


3. Press **[CNFG]** and input the distance from the 2nd target to the target point in "Offset dist.". Set reflector settings and press **[OK]** to confirm.

- Press **[LIST]** to edit the prism constant and aperture in <Reflector setting>.

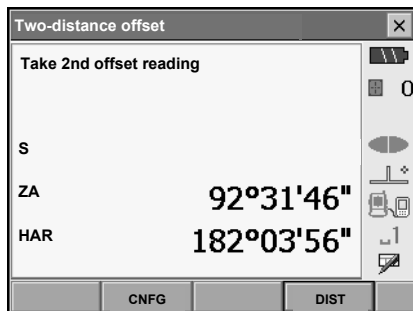


4. Sight the 1st target and press **[DIST]** to start measurement. Press **[STOP]** to stop the measurement. The measurement results are displayed. Press **[YES]** to confirm.



## 19. OFFSET MEASUREMENT

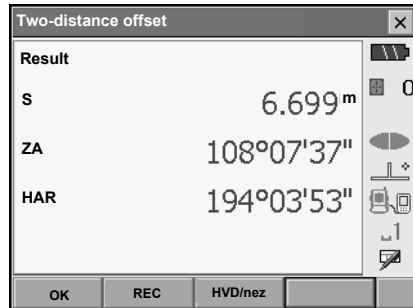
5. Sight the 2nd target and press **[DIST]** to start measurement.  
Press **[STOP]** to stop the measurement. The measurement results are displayed.



6. Press **[YES]** to display results for the target point.

Press **[HVD/nez]** to switch results for the target point between distance/angle values and coordinate/elevation values.

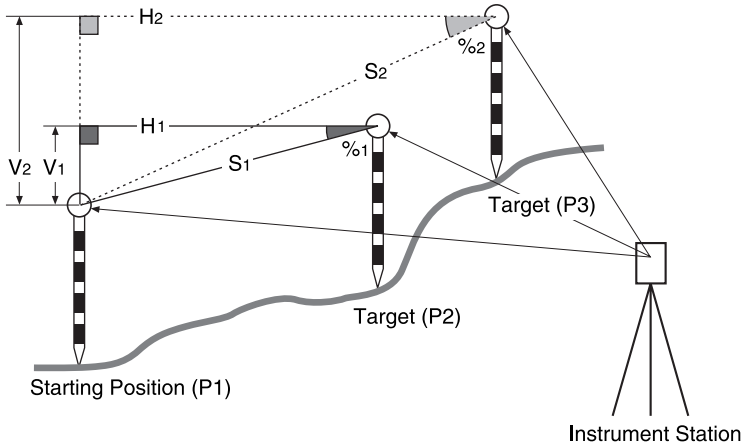
- When recording data in the current JOB, press **[REC]**. Enter point number, target height and code, then press **[OK]**.



# 20.MISSING LINE MEASUREMENT

Missing line measurement is used to measure the slope distance, horizontal distance, and horizontal angle to a target from the target which is the reference (starting point) without moving the instrument.

- It is possible to change the last measured point to the next starting position.
- Measurement results can be displayed as the gradient between two points.

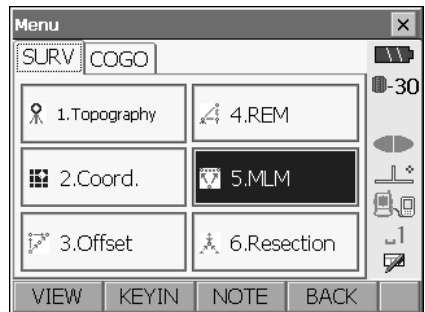


- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"

## 20.1 Measuring the Distance between 2 or more Points

### PROCEDURE

1. Select "MLM" in the "SURV" tab of <Menu>.



## 20. MISSING LINE MEASUREMENT

- Sight the starting position, and press **[DIST]** to start measurement.  
Press **[STOP]** to stop measurement.

### Note

- When measurement data already exists the screen of step 3 is displayed and measurement starts.

Missing line meas.	
Take BS reading	30
S	
ZA	92°44'31"
HAR	183°37'10"
DIST	

Missing line meas.	
ML.Sdist	30
Grade	30
ML.Hdist	
ML.Vdist	
S	
	6.528 m
ZA	92°33'13"
HAR	182°05'18"
DIST    MLM	

- Sight the next target and press **[MLM]** to begin observation. Slope distance, grade, horizontal distance and height difference between multiple points and the starting position can be measured this way.

- Press **[DIST]** to re-observe the starting position. Sight the starting position and press **[DIST]**.
- When **[MOVE]** is pressed, the last target measured becomes the new starting position to perform missing line measurement of the next target.  
☞ "20.2 Changing the Starting Point"

Results for measurement between starting position and second target

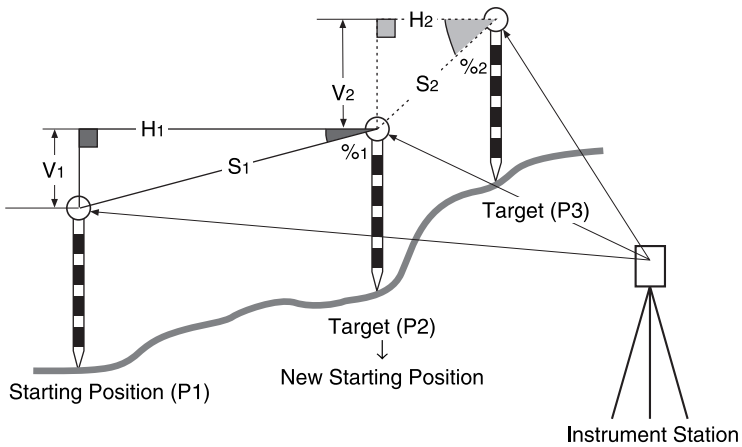
Missing line meas.	
ML.Sdist	13.868 m
Grade	3.750 %
ML.Hdist	13.868 m
ML.Vdist	0.520 m
S	
	8.221 m
ZA	88°55'44"
HAR	297°12'36"
MOVE    DIST    MLM	

Results for current point

- Press **{ESC}** or tap the cross in the top-right corner to end missing line measurement.

## 20.2 Changing the Starting Point

It is possible to change the last measured point to the next starting position.



### PROCEDURE

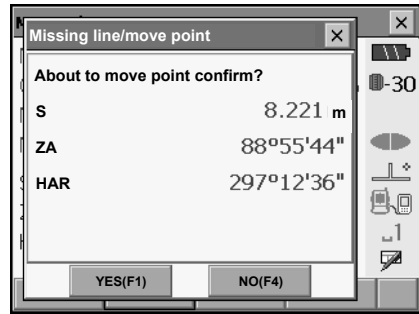
1. Observe the starting position and target following steps 1 to 3 in "20.1 Measuring the Distance between 2 or more Points".
2. After measuring the targets, press **[MOVE]**.

Missing line meas.	
ML.Sdist	13.868 m
Grade	3.750 %
ML.Hdist	13.868 m
ML.Vdist	0.520 m
S	8.221 m
ZA	88°55'44"
HAR	297°12'36"
<span>MOVE</span> <span>DIST</span> <span>MLM</span>	

## 20. MISSING LINE MEASUREMENT

Press **[YES]** in the confirmation message window.

- Press **[NO]** to cancel measurement.



3. The last target measured is changed to the new starting position.
4. Perform missing line measurement following steps 3 to 4 in "20.1 Measuring the Distance between 2 or more Points".

# 21.SURFACE AREA CALCULATION

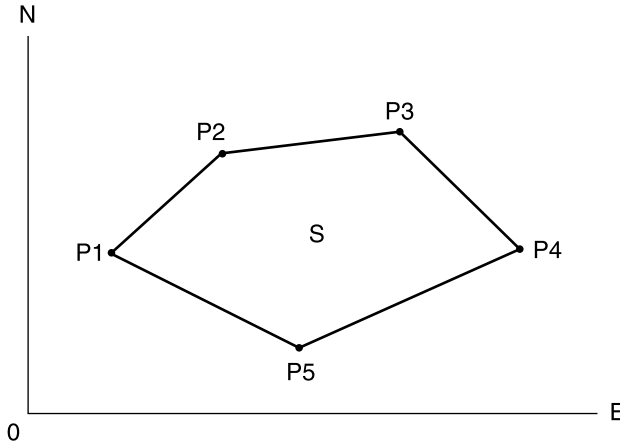
You can calculate the area of land (slope area and horizontal area) enclosed by three or more known points on a line by inputting the coordinates of the points

## Input

Coordinates: P1 (N1, E1, Z1)  
...  
P5 (N5, E5, Z5)

## Output

Surface area: S (horizontal area and slope area)



- Number of specified coordinate points: 3 or more, 30 or less
- Surface area is calculated by observing in order the points on a line enclosing an area or by reading in the previously registered coordinates and using it as known point data.
- It is possible to allocate softkeys in measurement menus to suit various applications and the ways that different operators handle the instrument.  
☞ "29.6 Allocating Key Functions"



- An error will occur if only two points (or less) are entered (or recalled) when specifying an enclosed area.
- Be sure to observe (or recall) points on an enclosed area in a clockwise or counterclockwise direction. For example, the area specified by entering (or recalling) point numbers 1, 2, 3, 4, 5 or 5, 4, 3, 2, 1 implies the same shape. However, if points are not entered in numerical order, the surface area will not be calculated correctly.

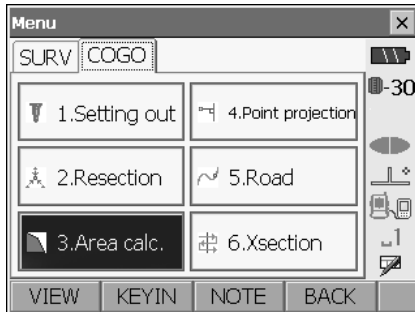


### Slope area

The first three points specified (measured/read-in) are used to create the surface of the slope area. Subsequent points are projected vertically onto this surface and the slope area calculated.

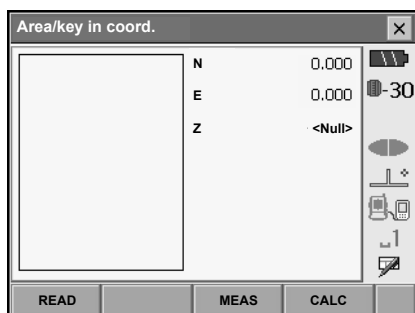
### PROCEDURE Surface area calculation by measuring points

1. Select "Area calc." in the "COGO" tab of <Menu>

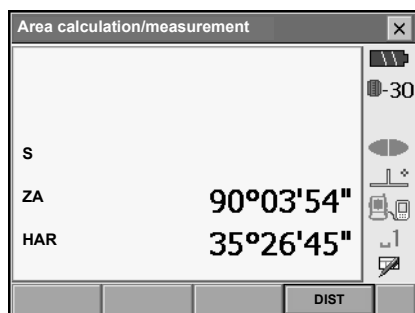


- When **[READ]** is pressed, registered coordinates can be recalled and used in subsequent measurements.

"PROCEDURE Surface area calculation using registered coordinate data"

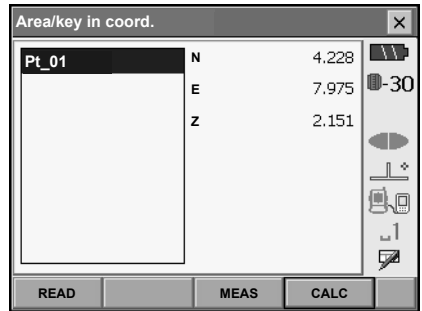
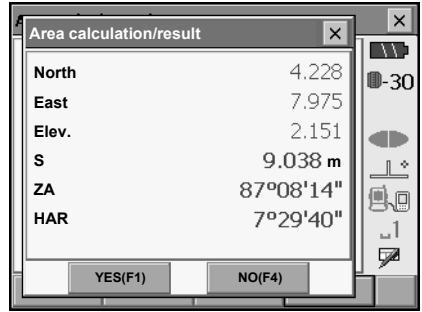


2. Press **[MEAS]** to display <Area calculation/measurement>. Sight the first point on the line enclosing the area, and press **[DIST]**. Measurement begins and the measured values are displayed. Press **[STOP]** to stop measuring.

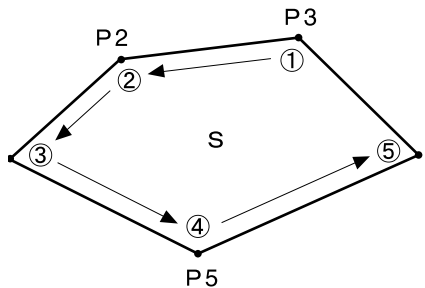




- The measurement results are displayed. Press **[YES]** to confirm. The value of point 1 is set in "Pt\_01".

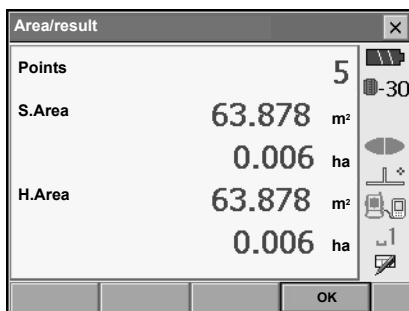
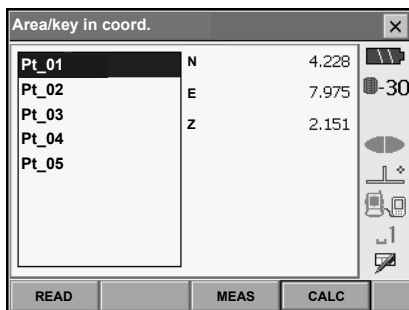


- Repeat steps 2 to 3 until all points have been measured. Points on an enclosed area are observed in a clockwise or counterclockwise direction. For example, the area specified by entering point numbers 1, 2, 3, 4, 5 or 5, 4, 3, 2, 1 implies the same shape.



## 21. SURFACE AREA CALCULATION

5. Press **[CALC]** to display the calculated area.



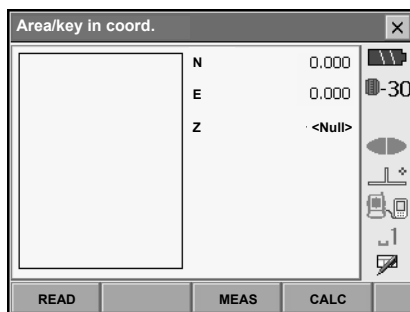
6. Press **[OK]** to return to <Area/key in coord.>. Press **[ESC]** or tap the cross in the top-right corner to quit area calculation.


### PROCEDURE Surface area calculation using registered coordinate data

Coordinate data registered in Memory mode can be recalled and used for area calculations.

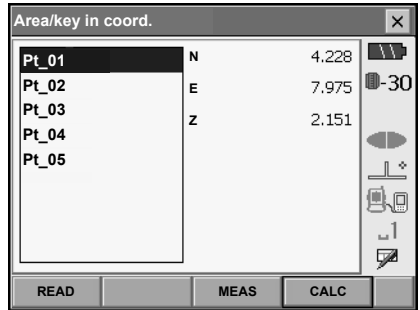
"15.4 Reading in Registered Coordinate Data from Memory mode"

1. Select "Area calc." in the "COGO" tab of <Menu>.
2. Press **[READ]** to read in coordinate data registered in Memory mode.

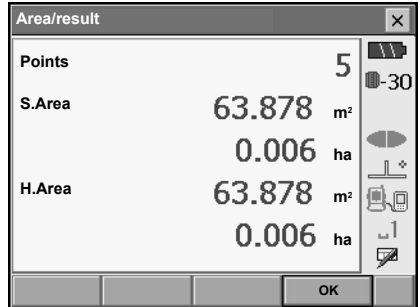


3. Register the first point in the list and press **[OK]**.  
 Reading in coordinate data from Memory mode: "15.4 Reading in Registered Coordinate Data from Memory mode"
4. Read in coordinates of point 2 and onward  
 Repeat steps 2 to 3 until all points have been read in.  
 Points on an enclosed area are read in a clockwise or counterclockwise direction.

After all known points necessary to calculate the surface area have been observed, **[CALC]** is displayed.



5. Press **[CALC]** to display the calculated area.



6. Press **[OK]** to return to <Area/key in coord.>. Press **{ESC}** or tap the cross in the top-right corner to quit area calculation.

# 22.ROUTE SURVEYING

This mode allows a variety of route surveying options widely used in civil engineering measurement. Each menu allows the operator to initiate a string of successive configuration/calculation/record/setting-out operations.

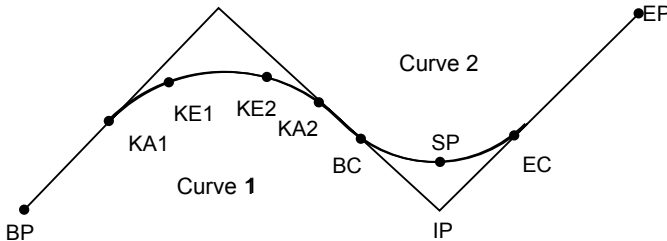
- The orientation of the instrument station and backsight station can be set as necessary.



- The Z-axis coordinate value in all route surveying work is always "Null" ("Null" is not the same as "0").



## Symbols and terms used in Route Surveying



BP Point: route origin

KA Point: clothoid curve origin

BC Point: circular curve origin

IP Point: point of intersection

Offset: reference point stationing chainage

EP Point: route end-point

KE Point: clothoid end-point

EC Point: circular curve end-point

SP Point: circular curve midpoint

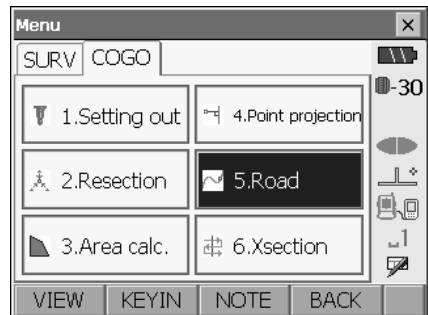
Stationing chainage: target point stationing chainage

## 22.1 Instrument Station Settings

The instrument station to be used as the reference point is recorded, as necessary, prior to starting surveying.

### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.



2. Press [Stn.Ori].

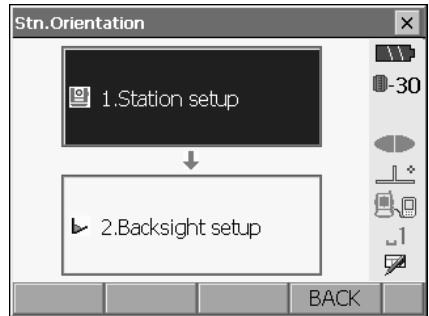
- Press [RESEC] to perform resection measurement. It is possible to set a point found by specifying 2 known points as the instrument station.

☞ "16. RESECTION MEASUREMENT"



3. Select "Station setup" in <Stn. Orientation> and enter instrument station data.

☞ "14.1 Entering Instrument Station Data"



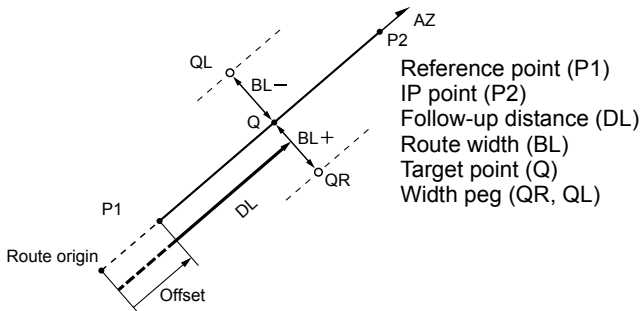
4. Select "Backsight setup" in <Stn. Orientation> and enter backsight station data.

☞ "14.2 Azimuth Angle Setting"

## 22.2 Straight Line Calculation

The coordinates of the center peg and width pegs for a straight line can be found from the coordinates of the reference point and IP point.

It is then possible to proceed with the setting-out of the center peg and width pegs.



## 22. ROUTE SURVEYING

### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.

2. Select "Road Calc1" in <Road>.



3. Select "Straight" in "Element".

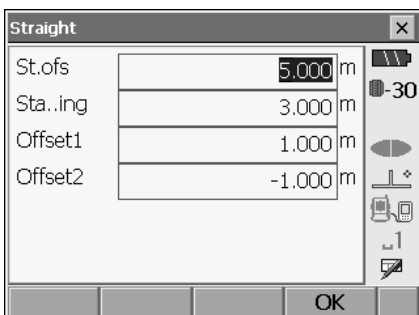
4. Input the point number of reference point.

- Press **[READ]** to read in the already registered coordinate data and set as the coordinates of the reference point.
- If the coordinate of the input point number is not registered, record screen is displayed.  
☞ "15.4 Reading in Registered Coordinate Data from Memory mode"



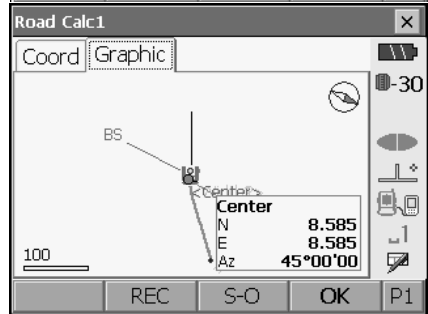
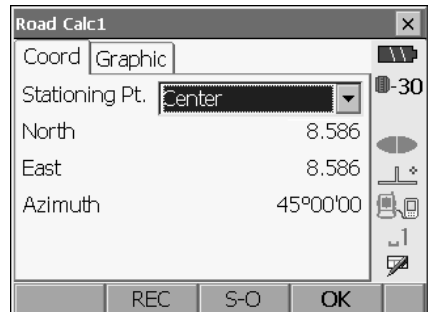
5. Input IP point number or azimuth angle. When inputting point number, select "Coord" in "IP azimuth". When inputting azimuth angle, select "Azimuth" in "IP azimuth". Press **[OK]**.

6. Input the reference point station offset, stationing chainage and offset for width peg.



7. Press **[OK]** in the screen shown in step 6 to calculate the center peg and width peg coordinates and azimuth angle. The coordinates and azimuth angle are then displayed on the screen.  
W

- Select the Graphic tab to display calculation results on a graph.  
☞ "24.3 Reviewing Data"



8. Press **{ESC}** twice to finish Straight Line calculation and return to <Road>.
  - The center peg or width pegs can be stored as a known point in the current job by pressing **[REC]**.  
☞ "24.1 Registering Known Point Data"
  - The center peg or width pegs can be set-out by pressing **[S-O]**.  
☞ 17. SETTING-OUT MEASUREMENT
  - Press **{ESC}** to return to the center peg setting screen.

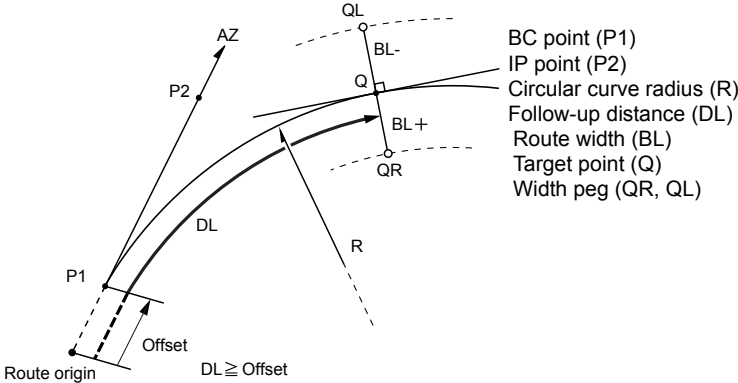
**Note**

- When the azimuth angle is set after the point numbers have been input in step 4, if the coordinates are deleted the azimuth angle is given priority.
- Offset/Stationing chainage input range: 0.000 to 99999.999 (m)
- Route width input range: -999.999 to 999.999 (m)

## 22.3 Circular Curve Calculation

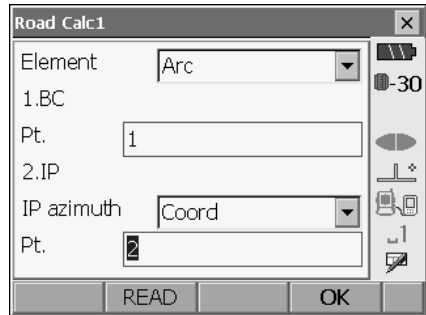
The coordinates of the center peg and width pegs on a circular curve can be found from the coordinates of the BC point and IP point.

It is then possible to proceed with the setting-out of the center peg and width pegs.



### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Road Calc1" in <Road>.
3. Select "Arc" in "Element".



4. Input the point number of BC point.
5. Input IP point number or azimuth angle. When inputting point number, select "Coord" in "IP azimuth". When inputting azimuth angle, select "Azimuth" in "IP azimuth". Press **[OK]**.



6. Select the curve direction, enter curve radius, station offset, and stationing chainage and offset for width peg.

Dircn	Right	
Radius	4.000	m
St.ofs	2.000	m
Sta..ing	3.000	m
Offset1	1.000	m
Offset2	-1.000	m

7. Press **[OK]** in the screen shown in step 6 to calculate the center peg and width peg coordinates and azimuth angle. The coordinates and azimuth angle are then displayed on the screen.

Coord	Graphic	
Stationing Pt.	Center	
North	8.586	
East	8.586	
Azimuth	45°00'00	

8. Press **{ESC}** twice to finish Circular Curve calculation and return to <Road>.

#### Note

- Curve direction: right/left
- Radius input range: 0.000 to 9999.999 (m)

## 22.4 Clothoid Curve

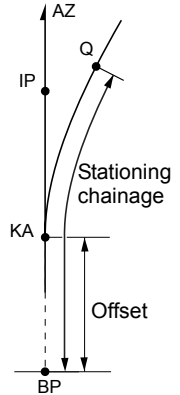
The coordinates of the center peg and width pegs on a clothoid curve can be found from the coordinates of the reference point and curve properties.

It is then possible to proceed with the setting-out of the center peg and width pegs.

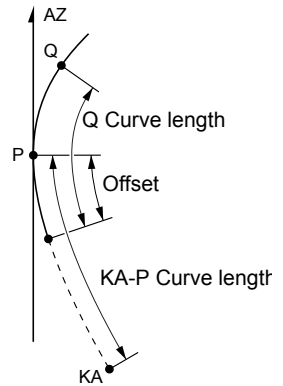
- Select a calculation menu depending on the section of the clothoid curve to be calculated.  
Clothoid curve is calculated by the following formula.

$$A^2 = RL$$

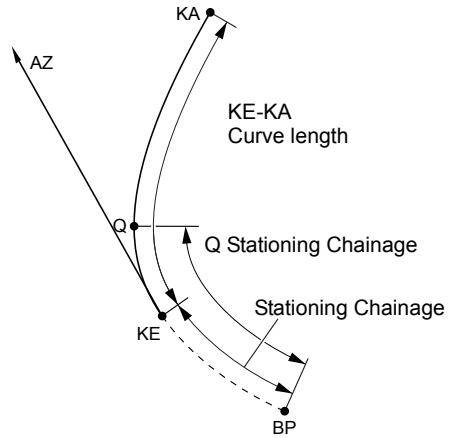
Calculation using KA Point as reference: "KA-KE Calculation 1"



Calculation using arbitrary point between KA1 and KE1 as reference:  
"KA-KE Calculation 2"



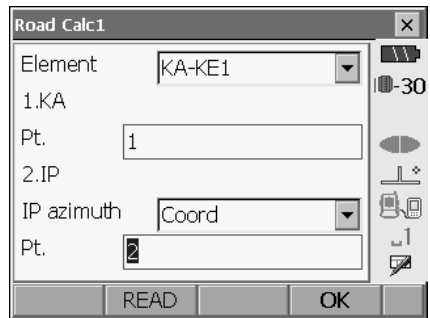
Calculation using KE2 as reference: "KE-KA Calculation"



- If the following conditions are not met, coordinate calculation cannot be performed.
  - "KA-KE Calculation 1":  $0 \leq \text{curve length} \leq 2A$
  - "KA-KE Calculation 2":  $0 \leq \text{KA - reference point curve length} \leq 3A$
  - $0 \leq \text{KA - target point curve length} \leq 2A$
  - "KE-KA Calculation":  $0 \leq \text{KA - KE curve length} \leq 3A$
  - $0 \leq \text{KA - target point curve length} \leq 2A$

**PROCEDURE Calculation using KA Point as reference**

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Road Calc1" in <Road>.
3. Select "KA-KE1" in "Element".



4. Input the point number of KA point.

## 22. ROUTE SURVEYING

- Input IP point number or azimuth angle. When inputting point number, select "Coord" in "IP azimuth". When inputting azimuth angle, select "Azimuth" in "IP azimuth". Press **[OK]**.
- Select the curve direction, enter parameter A, station offset, and stationing chainage and offset for width peg.

Field	Value	Unit
Dircn	Right	
Para A	4.000	m
St.ofs	2.000	m
Sta..ing	3.000	m
Offset1	1.000	m
Offset2	-1.000	m

- Press **[OK]** in the screen shown in step 6 to calculate the center peg and width peg coordinates and azimuth angle. The coordinates and azimuth angle are then displayed on the screen.

Field	Value
Coord	Graphic
Stationing Pt.	Center
North	8.586
East	8.586
Azimuth	45°00'00

- Press **{ESC}** repeatedly to finish Clothoid Curve calculation and return to <Road>.

### Note

- Curve direction: right/left
- Parameter A input range: 0.000 to 9999.999 (m)
- Station offset /Stationing chainage input range:0.000 to 99999.999 (m)

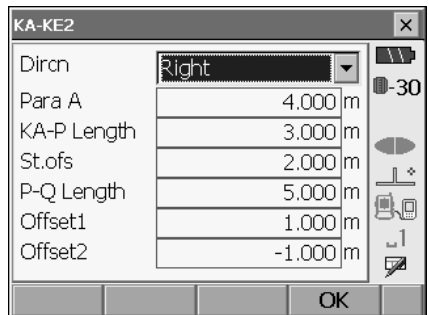
## PROCEDURE Calculation using arbitrary point between KA1 and KE1 as reference

- Select "Road" in the "COGO" tab of <Menu>.
- Select "Road Calc1" in <Road>.

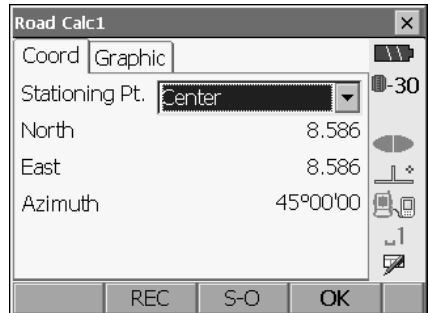
3. Select "KA-KE2" in "Element".



4. Input the point number of P point (reference point).
5. Input the point number of the arbitrary point on the line tangential to the P point or azimuth angle. When inputting point number, select "Coord" in "Direction". When inputting azimuth angle, select "Azimuth" in "Direction". Press **[OK]**.
6. Select the curve direction, enter parameter A, KA-P length (length of curve from KA to P point), station offset, P-Q length (length of curve from P point to target point) and offset for width peg.



7. Press **[OK]** in the screen shown in step 6 to calculate the center peg and width peg coordinates and azimuth angle. The coordinates and azimuth angle are then displayed on the screen.



8. Press **{ESC}** repeatedly to finish Clothoid Curve calculation and return to <Road>.

## 22. ROUTE SURVEYING



- KA-P length input range: 0.000 to 99999.999 (m)
- P-Q length input range: -999.9999 to 999.9999 (m)

### PROCEDURE Calculation using KE2 Point as reference

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Road Calc1" in <Road>.
3. Select "KE-KA" in "Element".

Road Calc1

Element KE-KA

1.KE

Pt. 1

2.Direction Coord

Pt. 2

READ OK

4. Input the point number of KE point (reference point).
5. Input the point number of the arbitrary point on the line tangential to the KE point or azimuth angle. When inputting point number, select "Coord" in "Direction". When inputting azimuth angle, select "Azimuth" in "Direction". Press **[OK]**.
6. Select the curve direction, enter parameter A, KE-KA curve length (length of curve from KE to KA), KE stationing chainage, target point stationing chainage and offset for width peg.

KE-KA

Dircon Right

Para A 4.000 m

KE-KA Length 5.000 m

KE Sta..ing 2.000 m

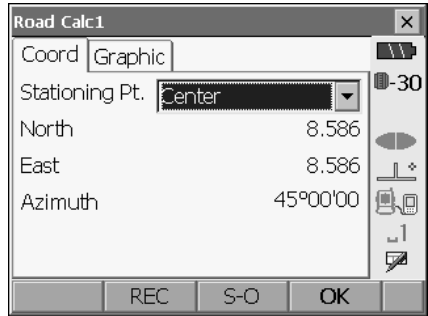
Q Sta..ing 3.000 m

Offset1 1.000 m

Offset2 -1.000 m

OK

- Press **[OK]** in the screen shown in step 6 to calculate the center peg and width peg coordinates and azimuth angle. The coordinates and azimuth angle are then displayed on the screen.



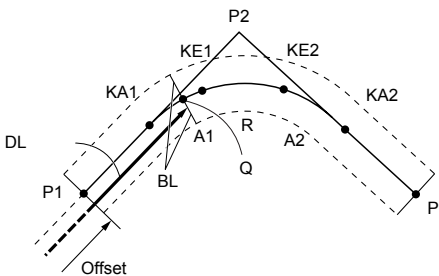
- Press **{ESC}** repeatedly to finish Clothoid Curve calculation and return to <Road>.

**Note**

- KE-KA length (length of curve from KE to KA)/KE stationing chainage/Q stationing chainage (Set out pt sta) input range: 0.0000 to 99999.9999 (m)

## 22.5 3 Point Calculation

The coordinates of a cardinal point, an arbitrary center peg, and width pegs can be found from the coordinates of 3 IP points and curve properties. It is then possible to proceed with the setting-out of the cardinal point, arbitrary center peg, and width pegs

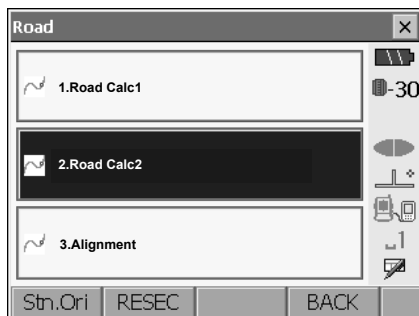


- BP point (P1)
- IP point (P2)
- EP Point (P3)
- Clothoid parameter (A1)
- Clothoid parameter (A2)
- Curve radius (R)
- Route width (BL)
- Arbitrary point follow-up distance (DL)

- When parameter A1, parameter A2 and radius R have all been input a clothoid is created and the KA1, KE1, KE2 and KA2 points can be found.
- When parameter A1 and parameter A2 have been input and radius R is "Null", a clothoid without a transition curve is created and the KA1, KE1, and KA2 points can be found.
- When parameter A1 and parameter A2 are both "Null" and only radius R has been input, a circular curve is created and the BC point and EC point can be found.

### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Road Calc2" in <Road>.

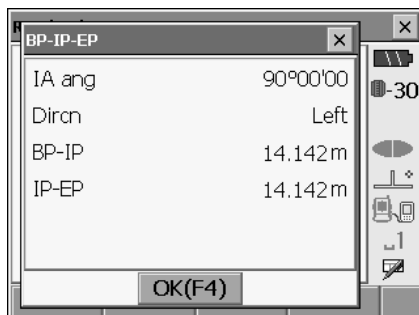


3. Select "BP-IP-EP" in "Element".



4. Input the point number of BP point (reference point), IP point and EP point then press **[OK]**
5. The IA angle (intersection angle), curve direction, BP-IP length, and IP-EP length are calculated from the coordinates of the three input points. The results are then displayed on the screen. Check the data, then press **[OK]**.

- Press **{ESC}** to return to the previous screen to make alterations to this data.





- Input curve properties: parameter A1, parameter A2, curve radius R, and Station offset (offset from stationing chainage).

BP-IP-EP

A1	5.000	m
A2	5.000	m
Radius	4.000	m
St.ofs	2.000	m

OK

- Press **[OK]** in the screen shown in step 6 to calculate the the coordinates and stationing chainage of the KA1 point, KE1 point, KE2 point and KA2 point. The results are then displayed on the screens

Road Calc2

List: Graphic

◆ KA1	KA1	N	142.052
◆ KE1		E	142.052
◆ KE2		Sta.ing	59.471 m
◆ KA2			

REC S-O OK

- Select the Graphic tab to display calculation results on a graph.  
 "24.3 Reviewing Data"

Road Calc2

List: Graphic

KA1

N	145.653
E	145.653
Sta..	64.564m

REC S-O OK P1

- Press **[OK]** in the screen shown in step 7 to move to center peg settings.
- Input stationing chainage and offset for width peg.

Road Calc2

Sta..ing	3.688	m
Offset1	1.000	m
Offset2	-1.000	m

OK

## 22. ROUTE SURVEYING

10. Press **[OK]** in the screen shown in step 9 to calculate the coordinates and stationing chainage of the center peg and width peg. The results are then displayed on the screen

Parameter	Value
North	14.725
East	14.725
Sta.ing	8.688m

11. Press **{ESC}** repeatedly to finish 3 point calculation and return to <Road>.

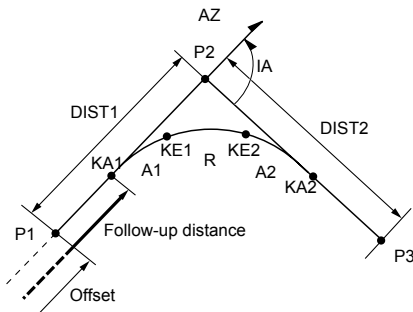
### Note

- In the case of a clothoid with no transition curve, the KA1 Point, KE Point, and KA2 Point can be found in step 7.
- In the case of a circular curve, the BC Point and EC Point can be found in step 7.

## 22.6 Intersection Angle/Azimuth Angle Calculation

The coordinates of a cardinal point, an arbitrary center peg, and width pegs can be found from an intersection angle, curve properties, and either the coordinates of BP point and 1 IP point of intersection or the azimuth angle from the BP Point to the IP point.

It is then possible to proceed with the setting-out of the cardinal point, arbitrary center peg, and width pegs

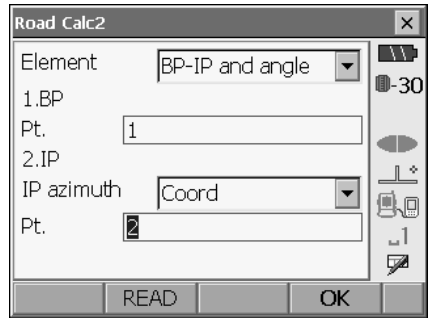


- BP point (P1)
- IP intersection point (P2)
- EP point (P3)
- BP to IP distance (DIST1)
- IP to EP distance (DIST2)
- Clothoid parameter (A1)
- Clothoid parameter (A2)
- Curve radius (R)

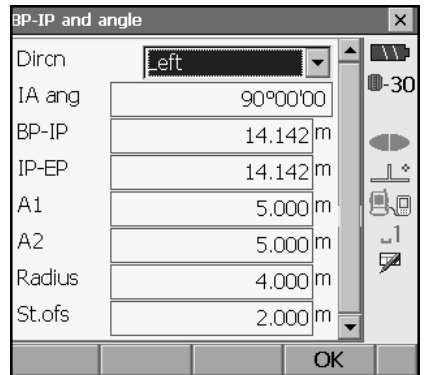
### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Road Calc2" in <Road>.

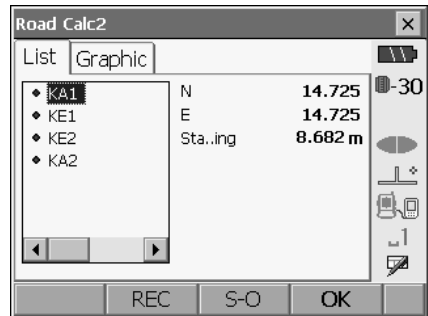
3. Select "BP-IP and angle" in "Element".



4. Input the point number of BP point (reference point).
5. Input the point number of the IP point or azimuth angle. When inputting point number, select "Coord" in "IP azimuth". When inputting azimuth angle, select "Azimuth" in "IP azimuth". Press **[OK]**
6. Input curve properties: curve direction, IA angle (intersection angle), BP-IP (distance between BP Point and IP Point), IP-EP (distance between IP Point and EP Point), parameter A1, parameter A2, curve radius, and station offset (BP Point stationing chainage).



7. Press **[OK]** in the screen shown in step 6 to calculate the coordinates and stationing chainage of the KA1 point, KE1 point, KE2 point, KA2 point. The results are then displayed on the screens



8. Press **[OK]** in the screen shown in step 7 to move to center peg settings.

## 22. ROUTE SURVEYING

9. Input stationing chainage and offset for width peg.

Sta..ing	8.682	m
Offset1	1.000	m
Offset2	-1.000	m

10. Press **[OK]** in the screen shown in step 9 to calculate the coordinates and stationing chainage of the center peg and width peg. The results are then displayed on the screen.

List	Graphic
Stationing Pt.	Center
North	14.725
East	14.725
Sta..ing	8.682m

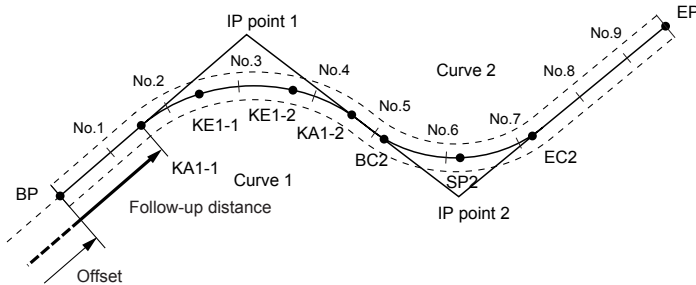
11. Press **{ESC}** repeatedly to finish intersection angle/azimuth angle calculation and return to <Road>.

### Note

- In the case of a clothoid with no transition curve, the KA1 Point, KE Point, and KA2 Point can be found in step 7.
- In the case of a circular curve, the BC Point and EC Point can be found in step 7.
- Intersection angle IA input range:  $0^\circ < IA < 180^\circ$

## 22.7 Route Calculation

Route Calculation is used to find the center pegs and width pegs of a route which contains a series of curves. It is then possible to proceed with setting-out.



- Route Calculation includes the following:  
Curve properties input, curve properties display, automatic calculation of cardinal points, arbitrary point calculation, and inverse width peg calculation.
- In the Route Calculation menu it is possible to set one route per JOB, each route containing a maximum of 16 curves.
- Up to 600 points, including all center pegs and width pegs, can be calculated using automatic calculation of cardinal points.
- Route data is retained even when the power has been cut off. However, the route data will be cleared if the JOB is deleted.  
☞ Deleting a JOB: "25.2 Deleting a JOB"



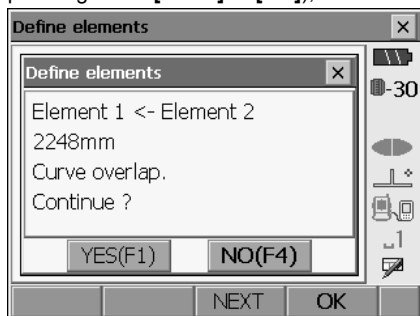
- Curve data is not set when curve properties (parameter A1, parameter A2, radius R) are all set to "Null".
- Route Calculation is used to measure a series of successive curves. If a curve is not connected to the main series of curves, all data from the end of the last connected curve is void. Route surveying is not performed for this section.
- The rounding up of error values in curve calculation may create discrepancies (mm) in coordinates of peg No.

### 22.7.1 Inputting curve properties

- BP Point auto setting (step 10)  
It is possible to preset which point to use as the BP Point of the next curve: the IP Point of the previous curve or the end-point (KA-2 or EC Point) of the previous curve.  
☞ "22.7.5 Setting parameters"

## 22. ROUTE SURVEYING

- If curves overlap when the next curve has been calculated based on input curve properties (by pressing either **[NEXT]** or **[OK]**), the following screen is displayed.



Press **[YES]** to ignore the overlapping and continue calculation.

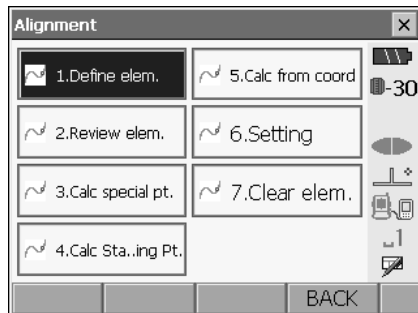
Press **[NO]** to stop calculation and return to the curve properties input screen.

## PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.



3. Select "Define elem." in <Alignment>.



4. Input the desired curve number.

Input the point number of BP point, IP point and EP point then press **[OK]**.

Element num.	Pt.
1.BP	1
2.IP	2
3.EP	3

5. The intersection angle, curve direction, BP-IP length, and IP-EP length are calculated from the coordinates of the three selected points. The results are then displayed in this screen. Check the data, then press **[OK]**.

- Press **{ESC}** to return to the previous screen to make alterations to this data

Element num.	1
IA ang	90°00'00
Dircon	Left
BP-IP	14.142m
IP-EP	14.142m

6. Input curve properties: parameter A1, parameter A2, radius R, and Station offset (offset from stationing chainage).

Element num.	1
A1	5.000 m
A2	5.000 m
Radius	6.000 m
St.ofs	1.000 m

7. Pressing **[NEXT]** in the screen shown in step 7 moves to the next curve number. When "EC/KA2" is set in "22.7.5 Setting parameters", the end-point of the previous curve is displayed as the BP point of the next curve.

The EP Point of the previous curve is displayed as the IP Point coordinates of the next curve.

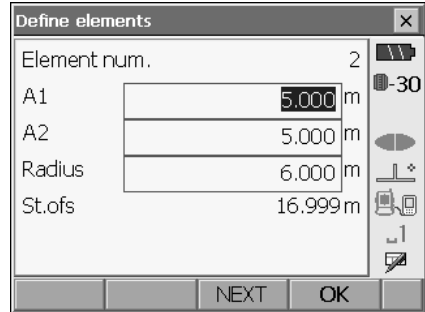
Element num.	Pt.
1.BP	2
2.IP	3
3.EP	4

## 22. ROUTE SURVEYING

---

8. Input the point number of the EP point of the next curve, then press **[OK]**.
9. The intersection angle, curve direction, BP-IP length, and IP-EP curve length are calculated from the coordinates of the BP Point, IP Point and EP Point. The results are then displayed in this screen.  
Check the data, then press **[OK]**.
10. Input curve properties for the next curve:  
parameter A1, parameter A2, and radius R. The offset value is set automatically.

- When "IP" is set in "22.7.5 Setting parameters", offset is not displayed.



11. Repeat steps 7 to 10 for the next curve until the curve properties have been input.
12. Press **[OK]** when all curve properties have been input.

### 22.7.2 Displaying curve properties

---

It is possible to check the curve properties set in "Inputting curve properties". To make alterations, follow the procedure described in "Inputting curve properties".

- The curve property data will be displayed in ascending order of curve number.

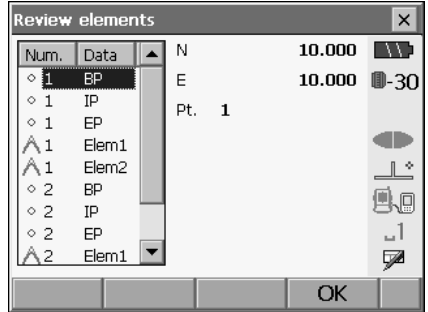
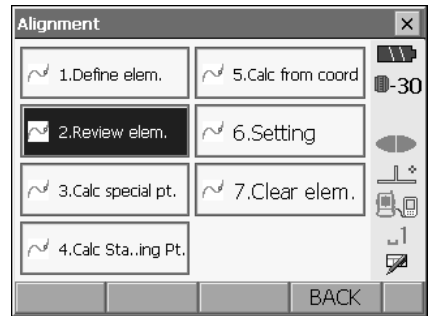
### PROCEDURE

---

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.



3. Select "Review elem." in <Alignment>. Details of the data selected on the left column is displayed on the right.



4. Press [OK] to return to <Alignment>.

### 22.7.3 Automatic calculation of cardinal points

Perform automatic calculation of cardinal points based on the curve properties set in "22.7.1 Inputting curve properties". Center pegs (peg No.) and width pegs set up at intervals can be calculated at once.

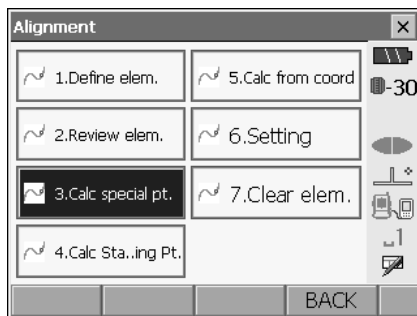
- Up to 600 points, including all center pegs and width pegs, can be calculated using automatic calculation of cardinal points.
- The cardinal point calculated depends on the type of curve involved.  
Clothoid: KA-1 Point, KE-1 Point, KE-2 Point, KA-2 Point  
Clothoid with no transition curve: KA-1 Point, KE Point, KA-2 Point  
Circular curve: BC Point, SP Point, EC Point
- The width pegs can be set up on both sides of the route and the left and right route widths calculated separately.
- A point number is automatically assigned to peg No. that is calculated. The first part of the point number can be preset.
- The coordinates of calculated pegs are automatically stored in the current JOB. When a particular point number already exists in the current job the available options it is possible to select whether or not to overwrite. It is possible to preset which procedure is used in this situation.

### PROCEDURE

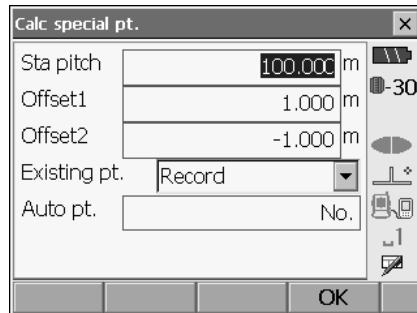
1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.

## 22. ROUTE SURVEYING

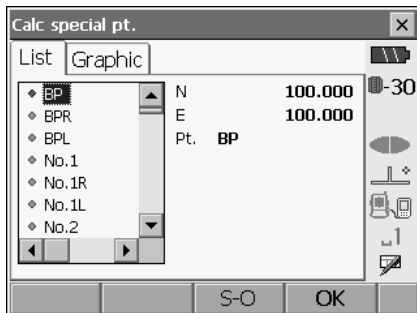
3. Select "Calc special pt." in <Alignment>.



4. Set peg No. pitch (peg interval), Offset 1 (route width), Offset 2, Existing pt. (duplicate point number procedure when point number already exists in current JOB), and Auto pt. (peg No. name).

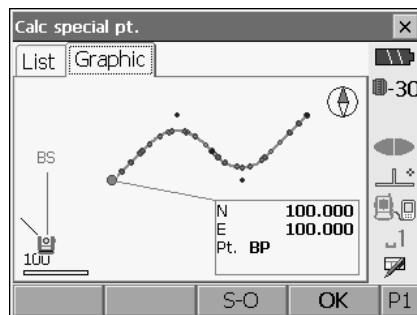


5. Press [OK] in the screen shown in step 4 to calculate the coordinates of the cardinal point, width pegs and peg No. Details of the data selected on the left column is displayed on the right.

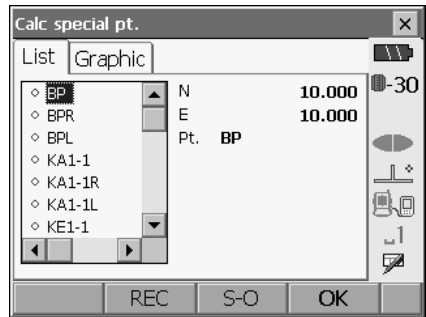


• Select the Graphic tab to display calculation results on a graph.

"24.3 Reviewing Data"



- When "Existing pt." in step 4 has been set to "Skip" a point with a point number which already exists in the current JOB will not be automatically stored. These points are marked with a blue circle. At this stage of the process it is possible to store such a point under a new point number.



- The screen at right is displayed, when the amount of set pegs exceeds 600 points. Press **[YES]** to continue using the initial 600 points. Press **[NO]** to return to the screen of step 4.



- Press **[OK]** to return to <Alignment>.

#### Note

- Sta pitch input range: 0.0000 to 9999.9999 (10.000\*) (m)
- Offset input range: -999.9999 to 999.9999 (Null \*) (m)
- Existing pt. (Duplicate point number procedure): Record (record as separate point with same point number)\* / Skip (no overwrite)
- Auto pt. length: 14 characters ("No."\*)

## 22. ROUTE SURVEYING



### Rules regarding the assigning of point numbers to automatically calculated pegs

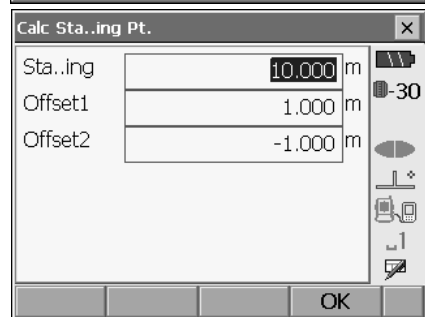
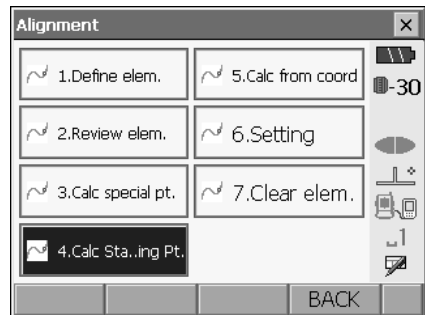
- Clothoid curve cardinal point: the curve number is added at the end e.g. the KA1 Point of curve number 1 is written "KA1-1", and the KA1 Point of curve number 2 is written "KA2-1".
- Circular curve cardinal point: the curve number is added at the end e.g. the BC Point of curve number 1 is written "BC1", and the BC Point of curve number 2 is written "BC2".
- Width peg: "R" or "L" is added at the end of the center peg point number. "R" is added for positive (+) route widths (the route width from the center peg to the RIGHT width peg) and "L" is added for negative (-) route widths (route width from the center peg to the LEFT width peg). When both route widths are input as positive (+) "R" and "R2" are used. When both route widths are input as negative (-) "L" and "L2" are used.
- A blank space at the beginning and end of a point number will be ignored.

### 22.7.4 Arbitrary point calculation

The coordinates of arbitrary points on every calculated curve can be found using arbitrary point calculation.


#### PROCEDURE

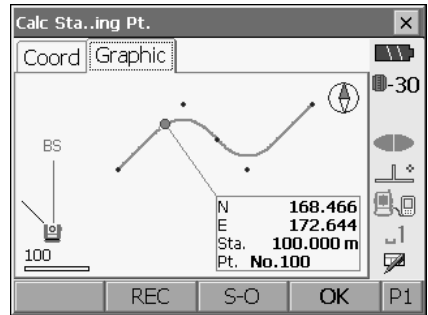
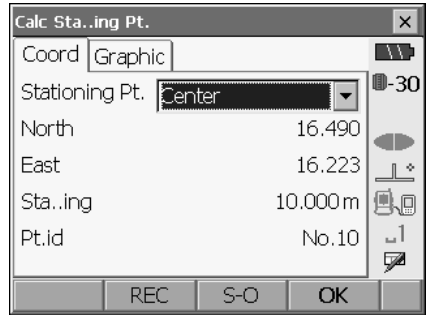
1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.
3. Select "Calc Sta...ing Pt." in <Alignment>.
4. Input the arbitrary point stationing chainage and offset for width peg.



- Press **[OK]** in the screen shown in step 4 to display the coordinates and point number of the arbitrary point.

- The center point can be stored as a known point in the current job by pressing **[REC]**.

- Select the Graphic tab to display calculation results on a graph.  
 "24.3 Reviewing Data"



- Press **{ESC}** to return to <Alignment>.



**Rules regarding the automatic assigning of point numbers to arbitrary points**

- Arbitrary point: The distance to the arbitrary point is given in terms of the closest peg No. from the front of the curve. The distance from the peg No. is added at the end.

**Inverse width peg**

The route widths and coordinates for center pegs on every calculated curve can be found by using inverse width peg calculation.

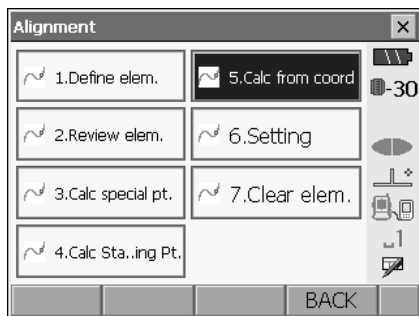
- There are two methods for specifying arbitrary width peg coordinates: key entry and observation.

**PROCEDURE Using key entry to specify arbitrary width pegs**

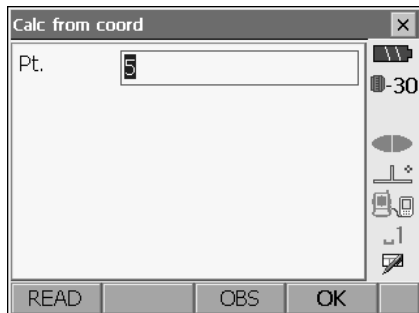
- Select "Road" in the "COGO" tab of <Menu>.
- Select "Alignment" in <Road>.

## 22. ROUTE SURVEYING

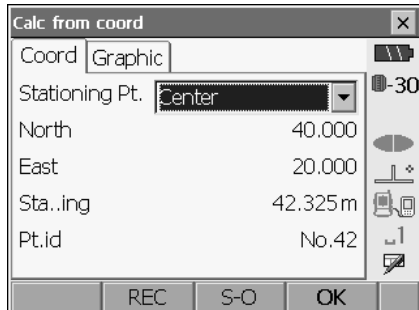
3. Select "Calc from coord" in <Alignment>.




4. Input the point number of the arbitrary width peg.

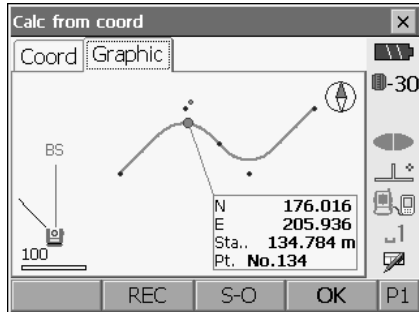


5. Press [OK] in the screen shown in step 4 to display the coordinates and point number of the center peg and width peg.




- Select the Graphic tab to display calculation results on a graph.

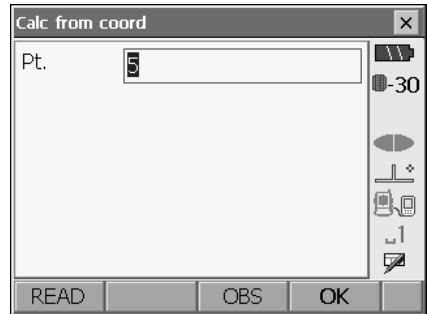
 "24.3 Reviewing Data"



6. The next width peg can then be set by pressing [OK].

## PROCEDURE Using observation to specify arbitrary width pegs

1. Enter the Inverse Width Peg menu in the same manner as shown above.  
 "PROCEDURE Using key entry to specify arbitrary width pegs" steps 1 to 3
2. Sight the width peg and press **[OBS]**.



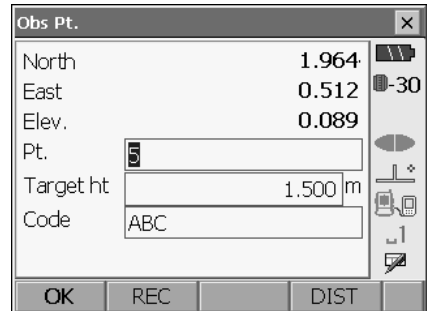
Calc from coord

Pt. 5

READ OBS OK

3. Press **[DIST]** to start measurement. The results are displayed.

•When recording data in the current JOB, press **[REC]**.



Obs Pt.

North 1.964

East 0.512

Elev. 0.089

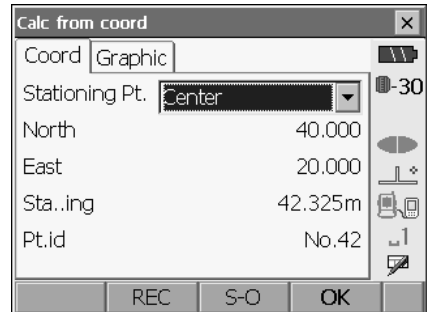
Pt. 5

Target ht 1.500 m

Code ABC

OK REC DIST

4. Press **[OK]** in the screen shown in step 3 to display the coordinates and point number of the center peg and width peg.



Calc from coord

Coord Graphic

Stationing Pt. Center

North 40.000

East 20.000

Sta..ing 42.325m

Pt.id No.42

REC S-O OK

5. The next width peg can then be set by pressing **[OK]**.

### Note

- The rules regarding the assigning of point numbers to width pegs and center pegs are the same as those for when calculating width pegs in automatic calculation of cardinal points.

## 22. ROUTE SURVEYING

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- ☞ "22.7 Automatic calculation of cardinal points" ☞ Rules regarding the assigning of point numbers to automatically calculated pegs"
- The rules regarding the assigning of point numbers to center pegs are the same as those for when calculating arbitrary points.
- ☞ "22.7.4 Arbitrary point calculation" ☞ Rules regarding the automatic assigning of point numbers to arbitrary points"

### 22.7.5 Setting parameters

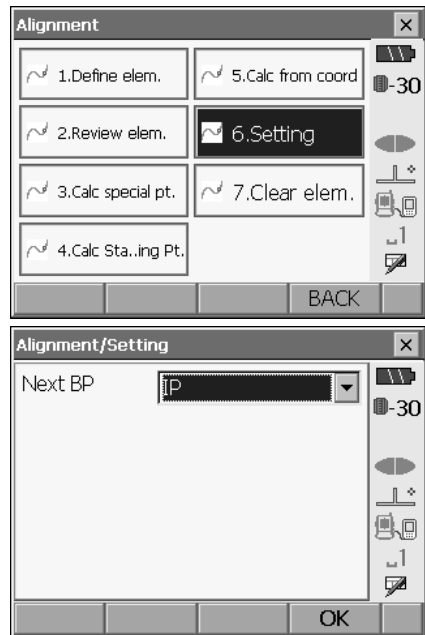
---

When configuring curve properties in "Inputting curve properties", it is possible to preset which point to set as the BP Point of the next curve: the IP Point of the previous curve or the end-point (KA-2 or EC Point) of the previous curve.

### PROCEDURE

---

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.
3. Select "Setting" in <Alignment>.
4. Select the automatic setting method for the BP Point of the next curve.



#### Note

The automatic setting method can be selected from the following:

(\*: Factory setting)

- Next BP: "IP" (IP Point of the previous curve)\*/"EC/KA2" (end-point of the previous curve (KA-2 or EC Point)).

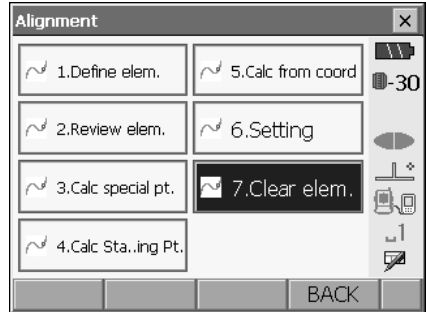


### 22.7.6 Clearing route data

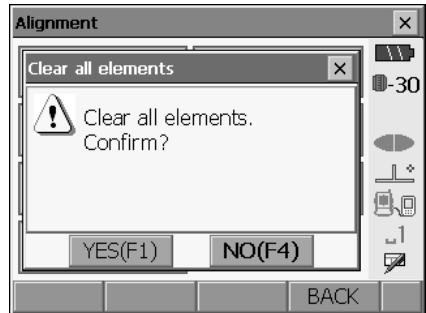
Route data set in "22.7.1 Inputting curve properties" can be cleared.

#### PROCEDURE

1. Select "Road" in the "COGO" tab of <Menu>.
2. Select "Alignment" in <Road>.
3. Select "Clear elem." in <Alignment>.



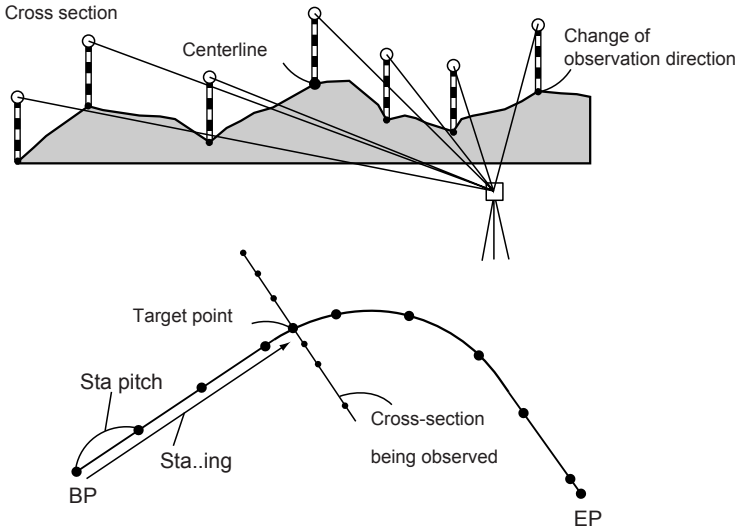
4. Press **[YES]** to clear the route data. <Alignment> is restored.



# 23. CROSS SECTION SURVEY

The purpose of this function is to measure and set out points along a cross-section of a road or linear feature already surveyed using the Route surveying function. Cross-sections can be surveyed in a variety of directions depending on your requirements.

☞ For terminology: "22. ROUTE SURVEYING"

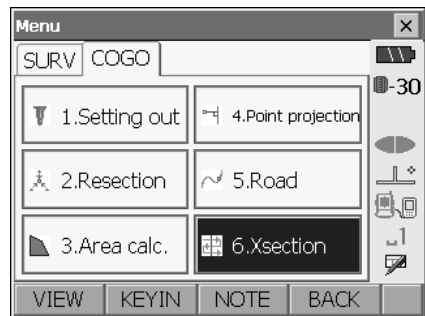


## 23.1 Instrument Station Settings

The instrument station to be used as the reference point is recorded, as necessary, prior to starting surveying.

### PROCEDURE

1. Select "Xsection" in the "COGO" tab of <Menu>

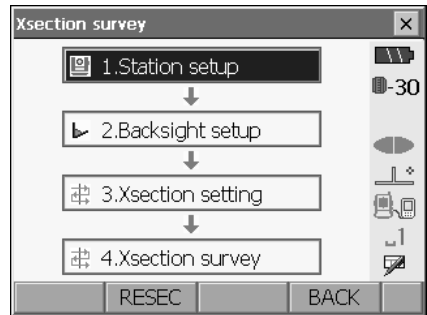


2. Select "Station setup" in <Xsection survey> and enter instrument station data

☞ "14.1 Entering Instrument Station Data"

- Press **[RESEC]** to perform resection measurement. It is possible to set a point found by specifying 2 known points as the instrument station.

☞ "16. RESECTION MEASUREMENT"



3. Select "Backsight setup" in <Xsection survey> and enter backsight station data.

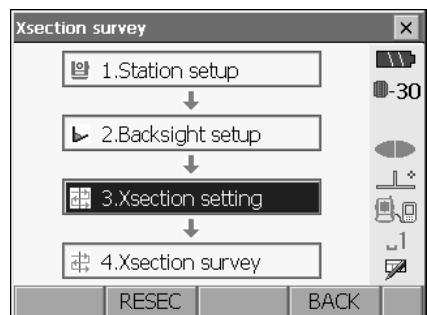
☞ "14.2 Azimuth Angle Setting"

## 23.2 Cross Section Survey

The instrument station to be used as the reference point is recorded, as necessary, prior to starting surveying.

### PROCEDURE

1. Select "Xsection" in the "COGO" tab of <Menu>
2. Select "Xsection setting" in <Xsection survey>



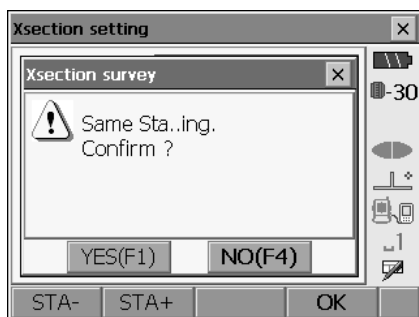
3. Input road name for cross section survey, station pitch, station increment, stationing chainage and select direction. Then press **[OK]**.

- Press **[STA-]** / **[STA+]** to decrease/increase the pitch set in "Sta incr" from/to "Stationing chainage". Stationing chainage is displayed as "xx+xx.xx".



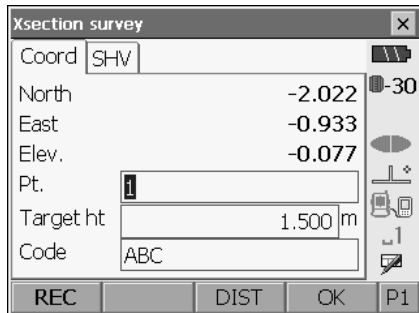
## 23. CROSS SECTION SURVEY

- In the event that stationing chainage was the same as the prior observation, cross-section survey is judged to have finished and a confirmation message window is displayed. Press **[YES]** to proceed to step 4. Press **[NO]** to set station pitch, station increment, and station chainage again.



4. Sight the last point on the cross-section and press **[DIST]**.  
☞ "Direction"

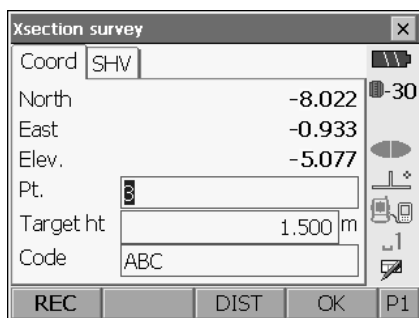
- Press **[OFFSET]** on the second page to perform offset measurement for the last point.
- When observing the center point first, the center point needs to be set.  
☞ Step 7




5. Enter point number, target height, and code, then press **[REC]** to record measurement data.

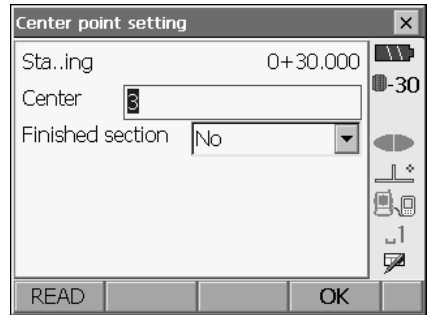
6. Repeat steps 4 to 5 for all points on the cross-section in the set observation direction until the centerline is reached.

7. Observe the center point. Then press **[OK]**.



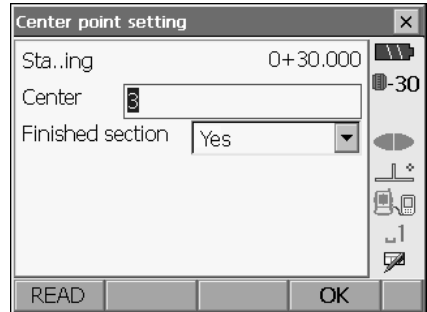
8. Enter center point name. Then press **[OK]**.

- When the center point is set as the instrument station, press **[READ]** to read in already registered coordinate data and set as the coordinates of the instrument station.  
 "15.4 Reading in Registered Coordinate Data from Memory mode"

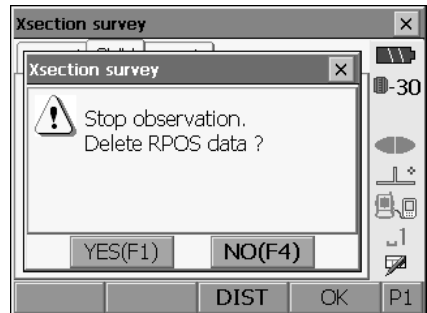


9. Repeat steps 4 to 5 for all points on the cross-section occurring after the centerline.

10. After observing the last changing point, check that "Finished section" is set to "Yes", then press **[OK]**.



- Observation can be cancelled by pressing **{ESC}**. In this event, a confirmation message window is displayed. Press **[YES]** to discard measurement data observed up to that point and exit observation. Press **[NO]** to continue observation.



11. Proceed to observation of the next cross-section.

#### Note

- Road name: up to 16 characters
- Sta incr: 0.000 to 9999.999 (m)
- Sta..ing: -99999.999 to 99999.999 (m)
- Sta pitch: 0.000 to 9999.999 (m)
- Direction: Left->Right\*/Right->Left/Left/Right

## 23. CROSS SECTION SURVEY



### Direction

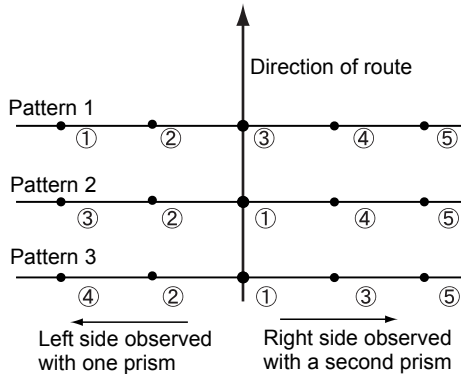
Cross-sections can be measured in the following directions depending on the setting selected in "Direction".

When "Left" or "Left -> Right" selected

Pattern 1: From left-most point to right-most point.

Pattern 2: Center point observed first. Then the point immediately to the left of the center point. Remaining points can then be observed in any order.

Pattern 3: Method using 2 prisms. Center point observed first followed by the point immediately to the left. Subsequent observations can be in whatever order is the most efficient for operation with 2 prisms. In the illustration below the points closest to the center point are observed first, followed by the outermost points (left first, then right).



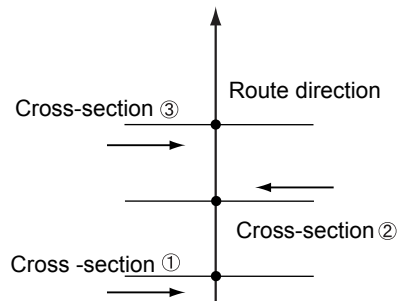
When "Right" or "Right-> Left" selected

Pattern 1: From right-most point to left-most point.

Pattern 2: Center point observed first. Then the point immediately to the right of the center point. Remaining points can then be observed in any order.

Pattern 3: Method using 2 prisms. Center point observed first followed by the point immediately to the right. Subsequent observations can be in whatever order is the most efficient for operation with 2 prisms.


When "Left -> Right" or "Right -> Left" selected, observation of a subsequent cross-section can be switched automatically to the opposite direction upon completion of the previous cross-section observation. This method minimizes the walking distance to the next starting point when measuring multiple cross-sections.





### Cross survey data review

Cross-section data recorded in a JOB is displayed as shown at right. "Offset" represents the distance calculated from the center point coordinates and measurement point coordinates.

 Displaying JOB data: "24.3 Reviewing Data"

View		List Graphic		
1	ROAD	Sta.ing	2+20.000	-30
2		Offset	-1.585 m	
3		Pt. 3		
4		f.h	1.500 m	
5		N	2.033	
6		E	-1.844	
		Z	0.088	
		Code.	ABC	

Line TOP LAST SRCH P1

# 24.REGISTERING/REVIEWING DATA

## 24.1 Registering Known Point Data

It is possible to register coordinate data of the known points in the current JOB using the key entry method.

Registered coordinate data can be used when setting instrument station, backsight station, known point, and setting-out point coordinate data.

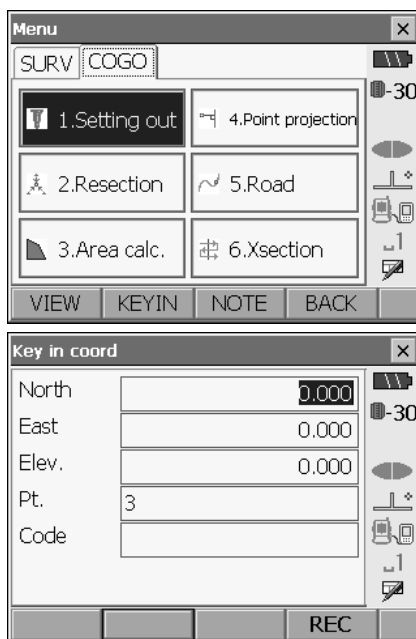
- It is possible to register 2000 items of coordinate data, including the data inside a JOB.



- When "inch" is selected as the distance unit, the value must be input in "feet" or US feet".

### PROCEDURE

1. Press **[KEYIN]** in <Menu>.
2. Input known point coordinates, point number and code. Press **[REC]** to record the data in the current JOB
3. Continue to enter other known point coordinate data for other known points.
4. After all coordinate data has been registered, press **{ESC}** to restore <Menu>.



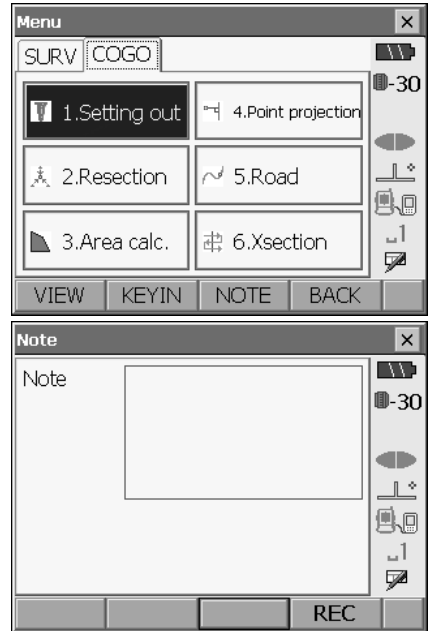


## 24.2 Registering Notes

This procedure explains how to register notes in the currently selected JOB.

### PROCEDURE

1. Press **[NOTE]** in <Menu>.
2. Input the note data, press **[REC]** to record the note in the current JOB. <Menu> is restored.



#### Note

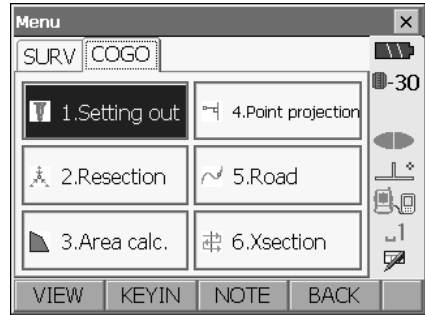
- Maximum note length: 60 characters (alphanumeric)

## 24.3 Reviewing Data

It is possible to display all the data within the current JOB and the coordinate search JOB.

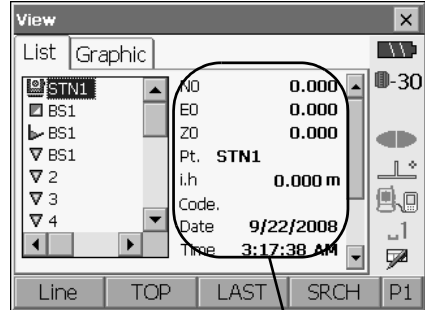
### PROCEDURE

1. Press **[VIEW]** in <Menu>.



2. Select a data in the point number list to display details.  
The list is displayed.

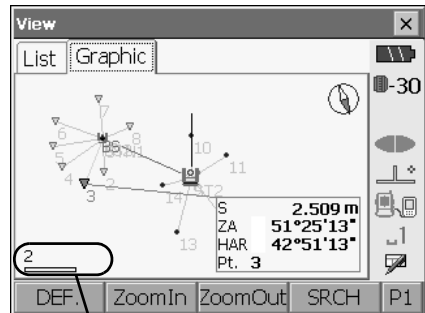
- Press **[Line/Page]** to switch the operation of **{▲}/ {▼}** from page scroll to point scroll.
- Press **[TOP]** to select the first point in the list.
- Press **[LAST]** to select the last point in the list.
- Press **[SRCH]** to search for a point number. Up to 14 characters can be input.
- **[OBS/SAVE]/[RED/SAVE]/[COORD/SAVE]** on the second page are displayed only when observation data is displayed. When the above softkeys are pressed, the observation data is displayed or saved in the converted format.



Details of the selected data

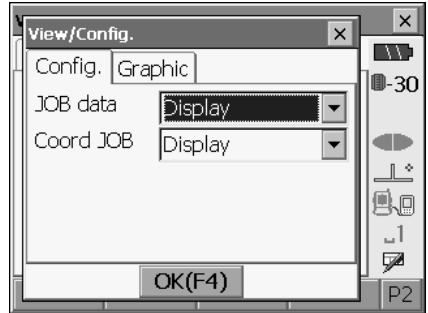
The List and Graphic tabs are linked so that when a particular point is selected in one tab, the same point is automatically selected in the other tab.

- Press **[DEF.]** to return to the default display format.



Scale bar

- Press **[CNFG]** on the second page to change the display setting. Press **[OK]** to confirm the settings.  
Displayed JOB can be selected.



**Settings:**

Orientation of the display can be selected from telescope direction, north or south.

**Center:**

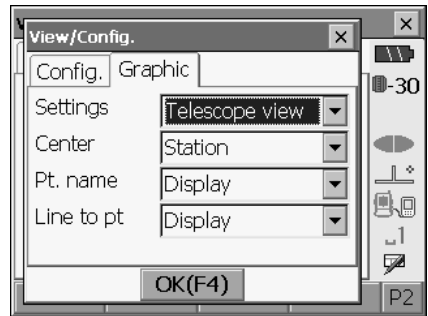
Center point for the display can be selected from instrument station or target point.

**Pt.name:**

Switch point name display on/off.

**Line to pt:**

Switch target line display on/off.



3. Press **{ESC}** to return to <View>.

# 25.SELECTING / DELETING A JOB

## 25.1 Selecting a JOB

Select the current JOB and Coordinate Search JOB.

- A total of 10 JOBS have been prepared, and JOB1 was selected when your SET was shipped from the factory.
- The names of the JOBS has been preset as JOB1 to JOB10; you can change them to any names you wish.
- Scale factor can be set for each JOB.



### Current JOB

Measurement results, instrument station data, known points data, notes and coordinate data are recorded in the current JOB.

Registering known point data: "24.1 Registering Known Point Data"



### Coordinate Search JOB

The registered coordinate data in the selected JOB can be read into coordinate measurement, resection measurement, setting-out measurement, etc.



### Scale correction

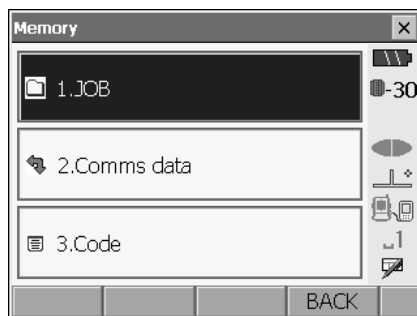
SET calculates horizontal distance and coordinates of a point using measured slope distance. If scale factor has been set, scale correction is carried out during calculation.

Corrected horizontal distance (s) = Horizontal distance (S) × Scale factor (S.F.)

- When scale factor is set to "1.00000000", the horizontal distance is not corrected.

## PROCEDURE JOB selection

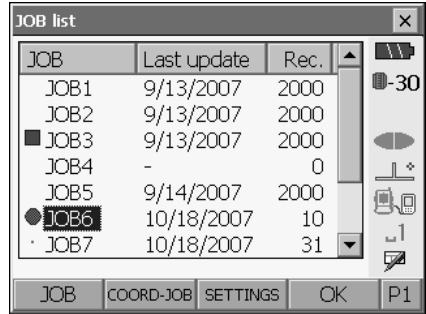
1. Select "JOB" in <Memory>.  
<JOB List> is displayed.



- Align the cursor with the desired current JOB and press **[JOB]** or **{←}**.

Red circle appears to the left of the JOB name.

- The numbers to the right represent the number of data items in each JOB.
- “●” means that the JOB has not been output to an external device yet.

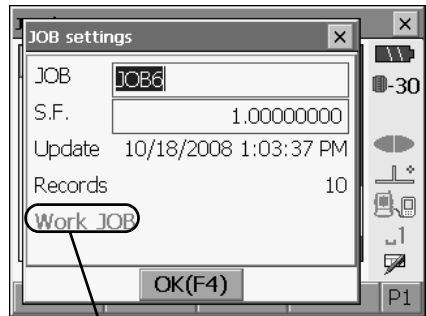


- Align the cursor with the desired coordinate search JOB and press **[COORD-JOB]**.  
Blue square appears to the left of the JOB name.
- Press **[OK]** to return to <Memory>.

### PROCEDURE Inputting a JOB name and scale factor setting

- Select “JOB” in <Memory>.
- Select in advance the JOB whose name you wish to change in <JOB List> and press **[SETTINGS]**.  
☞ “PROCEDURE JOB selection”
- Input the new JOB name and the scale factor for the JOB.  
<JOB list> is restored.

- Scale factor can be set for each JOB.



JOB information is displayed

- Press **[OK]** to return to <Memory>.

**Note**

- Maximum size of JOB name: 12 (alphanumeric)
- Scale factor input range : 0.50000000 to 2.00000000 (\*1.00000000)
- “\*” : Factory setting

## 25.2 Deleting a JOB

It is possible to clear the data within a designated JOB. After the data has been cleared, the JOB name returns to the name allocated when the SET was shipped.



- A JOB that has not been output to an auxiliary device (displayed with \*) cannot be deleted.

### PROCEDURE

---

1. Select "JOB" in <Memory>.
2. Select the JOB to delete in <JOB List> and press **[DEL]**.  
<JOB deletion> is displayed.



3. Press **[YES]**. The data within the selected JOB is deleted and <JOB List> is restored.

# 26.RECEIVING COORDINATE DATA

It is possible to read in coordinate data from a external device, CF card inserted to the SET, or the internal memory of the SET to the current JOB. Such coordinate data can be used when setting instrument station, backsight station, known point, and setting-out point coordinate data.

☞ External devices: "6. USING THE CF CARD SLOT" and "10. CONNECTING TO EXTERNAL DEVICES"

Communication cables: "35. OPTIONAL ACCESSORIES"

Output format and command operations: "Interfacing with the SOKKIA SDR Electronic Field Book" and "Command Explanations" manuals.

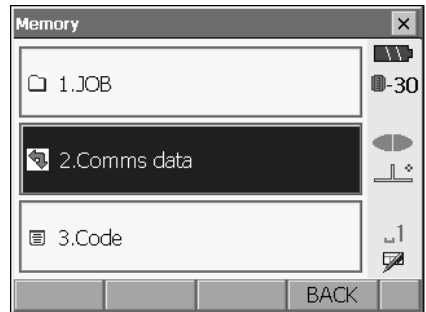
- It is possible to register 2000 items of coordinate data, including the data inside a JOB.
- Coordinate data can be registered by key entry as well.
  - ☞ Key entry: "24. REGISTERING/REVIEWING DATA"
- When entering known point data from an external device, SET does not check the repeated point number.



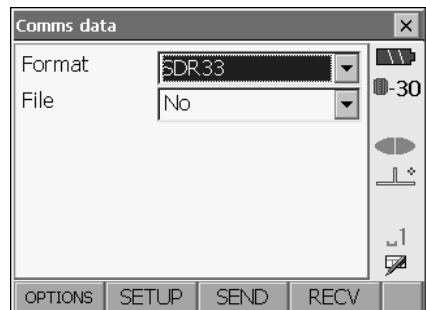
- When "inch" is selected as the distance unit, the value must be input in "feet" or US feet".

## PROCEDURE Receiving known point coordinate data from an external device via RS232C cable

1. Connect SET to the external device.
  - ☞ "10. CONNECTING TO EXTERNAL DEVICES"
2. Select "Comms data" in <Memory>.



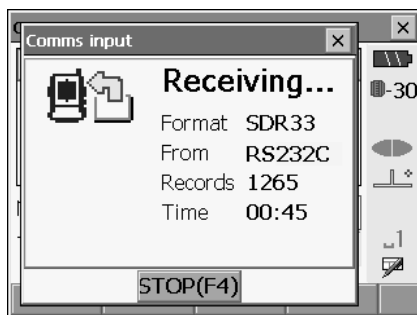
3. Select the input format and select "No" in "File", then press **[RECV]**
  - Press **[SETUP]** to perform communication setup.
    - ☞ "10. CONNECTING TO EXTERNAL DEVICES"



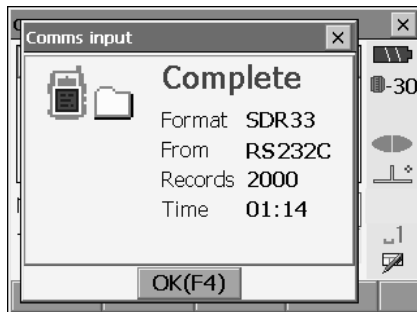
## 26. RECEIVING COORDINATE DATA

The coordinate data receiving starts.

- To stop data reception, press **[STOP]**.

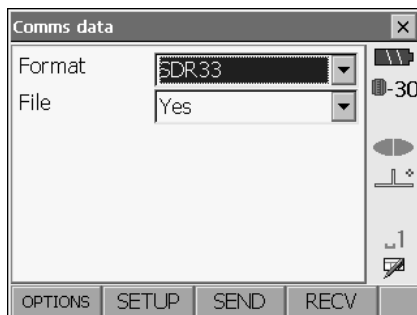


4. Press **[OK]** to return to <Comms data>.



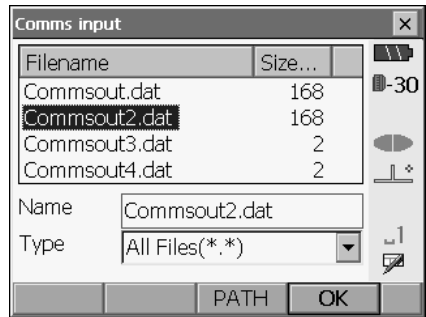
### PROCEDURE Receiving known point coordinate data file via USB port/CF card/internal memory of the SET

1. Connect SET to the USB device or insert a CF card to the CF card slot.  
☞ "6. USING THE CF CARD SLOT"/  
"10. CONNECTING TO EXTERNAL DEVICES"
2. Select "Comms data" in <Memory>.
3. Select the input format and select "Yes" in "File", then press **[RECV]**

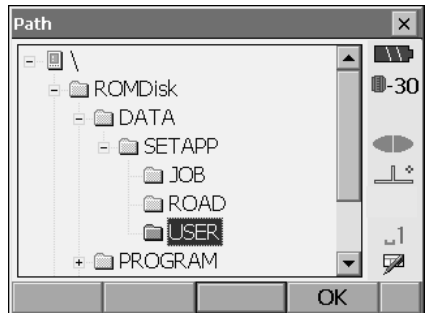




4. Select the file type to display on the list and select the file to read in.

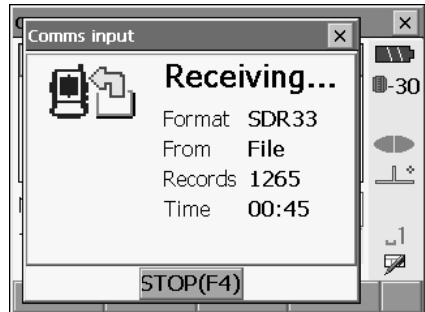


- Press **[PATH]** to specify the filepath.

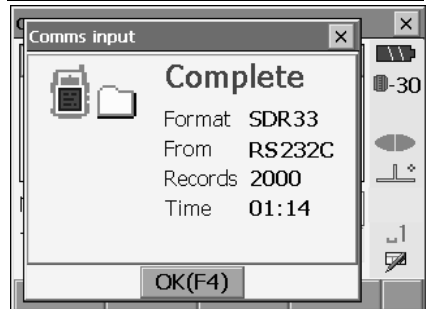


5. Press **[OK]** to start reception.

- To stop reception, press **[STOP]**.



6. Press **[OK]** to return to <Comms Input> in step 4.



# 27.OUTPUTTING JOB DATA

It is possible to output JOB data to a external device, CF card inserted in the SET, or to save in the internal memory of the SET.

☞ External devices: "6. USING THE CF CARD SLOT" and "10. CONNECTING TO EXTERNAL DEVICES"

Communication cables: "35. OPTIONAL ACCESSORIES"

Output format and command operations: "Interfacing with the SOKKIA SDR Electronic Field Book" and "Command Explanations" manuals.

- Measurement results, instrument station data, known point data, notes, and coordinate data in the JOB can be output.



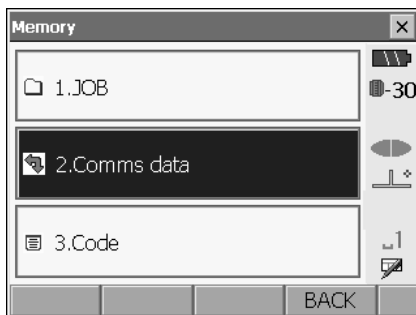
- When "inch" is selected as the distance unit, data is output in "feet" or "US feet" depending on the feet unit selected.

## PROCEDURE Outputting JOB data to external device via RS232C cable

1. Connect SET to the external device.

☞ "10. CONNECTING TO EXTERNAL DEVICES"

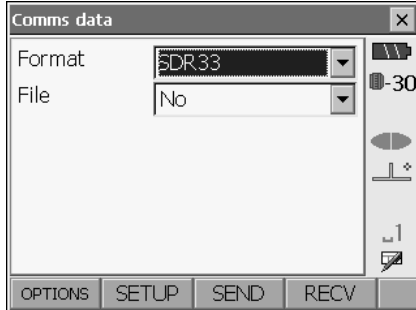
2. Select "Comms data" in <Memory>.



3. Select the output format and select "No" in "File", then press **[SEND]**

- Press **[SETUP]** to perform communication setup.

☞ "10. CONNECTING TO EXTERNAL DEVICES"



- Press **[OPTIONS]** and set post-conversion format for observation data. Items to be configured are as follows.

Current view:

Select "Yes" when outputting data in original record format.

OBS view:

Select "Yes" when outputting converted data (horizontal angle, vertical angle and slope distance).

RED view:

Select "Yes" when outputting converted data (azimuth angle, horizontal distance and vertical distance).

POS view:

Select "Yes" when outputting converted data (coordinate).

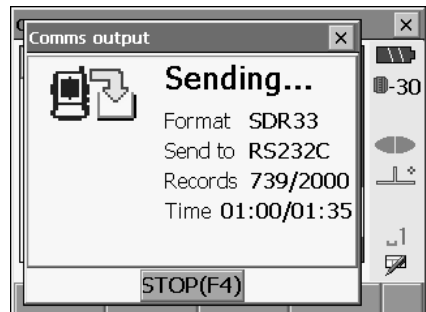
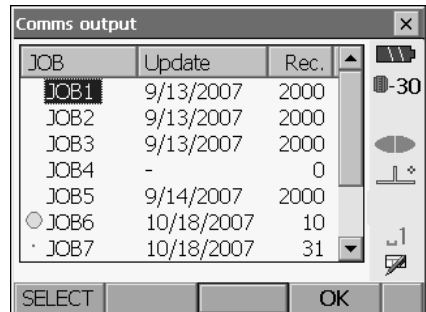
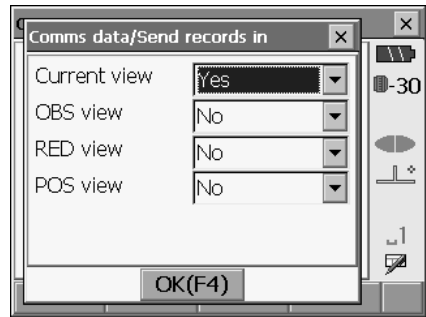
4. Select the JOB to be output by pressing **[SELECT]** or **{←}**.

Green circle appears to the left of the selected JOB. You can select as many JOBS as you want.

- "•" means the JOB has not been output to an external device yet.

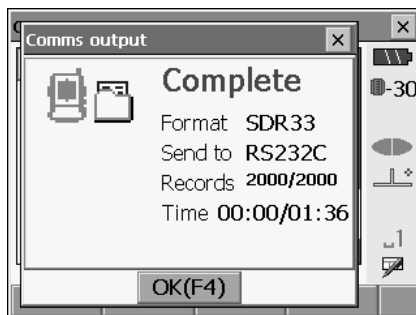
5. Press **[OK]** to start output.

- To stop output, press **[STOP]**.



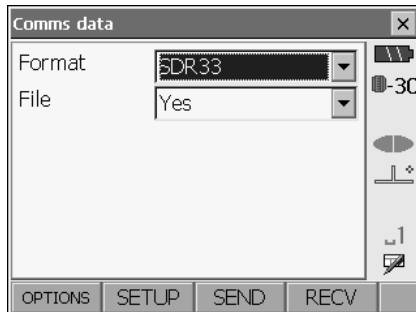
## 27. OUTPUTTING JOB DATA

- Press **[OK]** to return to <Comms output> in step 4.  
It is possible to proceed to output of the next JOB.

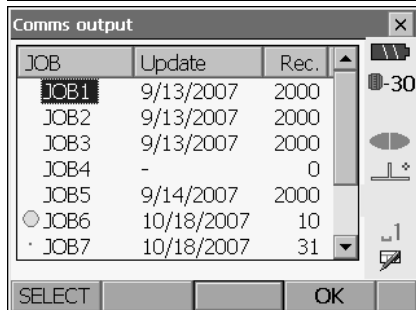


### PROCEDURE Outputting JOB data file to external device via USB port/CF card/internal memory of the SET

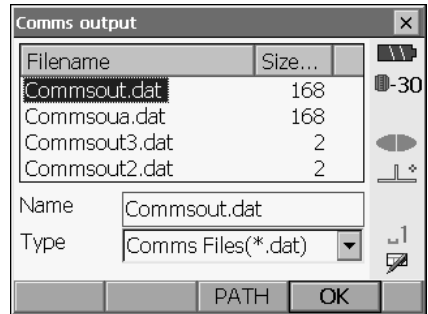
- Connect SET to the USB device or insert a CF card to the CF card slot.  
"6. USING THE CF CARD SLOT"/  
"10. CONNECTING TO EXTERNAL DEVICES"
- Select "Comms data" in <Memory>.
- Select the output format and select "Yes" in "File", then press **[SEND]**



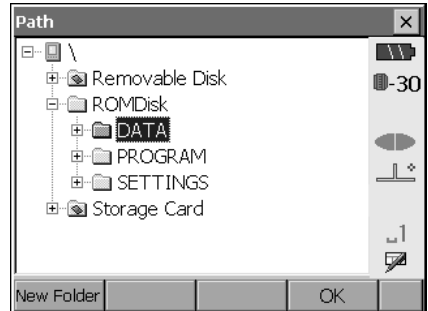
- Select the JOB to be output by pressing **[SELECT]** or **{←}**.  
Green circle appears to the left of the JOB selected. You can select as many JOBS as you want.
  - "•" means the JOB has not been output to an external device yet.



5. Press **[OK]**.
6. Input file name



- Press **[PATH]** to specify the filepath. To create a new folder, press **[New Folder]**



7. Press **[OK]** in the screen of step 6 to start output.

- To stop output, press **[STOP]**.



8. Press **[OK]** to return to <Comms output> in step 4.  
It is possible to proceed to output of the next JOB.

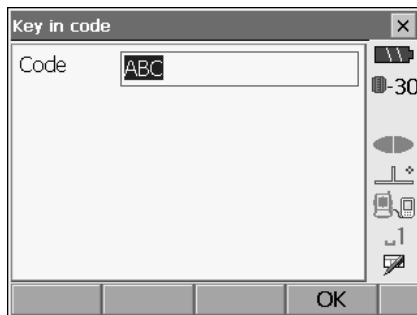
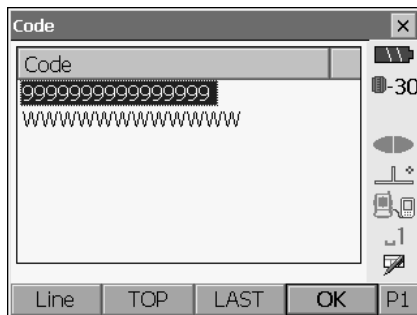
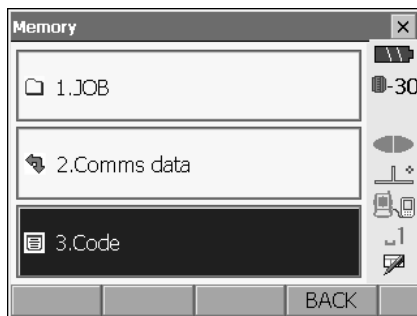


# 28.REGISTERING/DELETING CODE

It is possible to save codes in memory. You can also read in codes registered in memory when recording instrument station data or observation data.

## PROCEDURE Inputting Codes

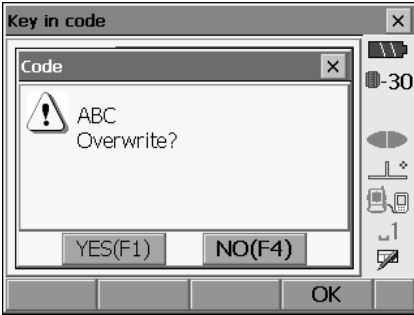
1. Select "Code" in <Memory>.  
Registered codes are displayed.
2. Press **[ADD]** on the second page.
  - Press **[Line]/[Page]** to switch the operation of **{▲}/{▼}** from page scroll to point scroll.
  - Press **[TOP]** to select the first point in the list.
  - Press **[LAST]** to select the last point in the list.
3. Enter the code and press **[OK]**. The code is registered and Code list is restored.



### Note

- Maximum code size: 16 (alphanumeric)
- Maximum number of codes registered: 60

- If the same code is input, the following screen is displayed.

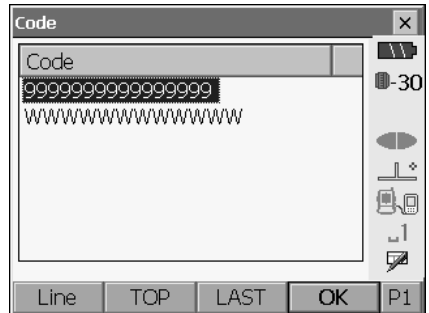


Press **[NO]** to input a new code.

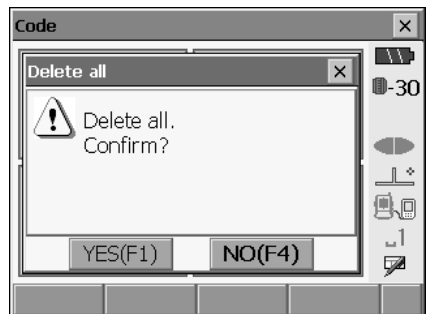
Press **[YES]** to overwrite the present code.

## PROCEDURE Deleting codes

1. Select "Comms data" in <Memory>.  
Registered codes are displayed.
2. Align the cursor with the code to be deleted and  
press **[DEL]** on the second page.  
The selected code is deleted.



- Press **[DELALL]** on the second page then **[YES]** to delete all codes.

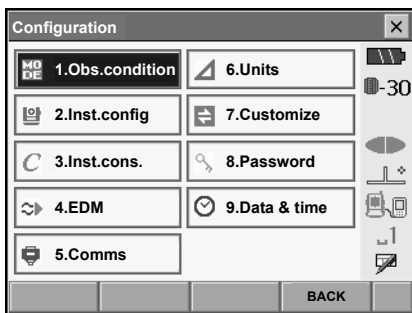


# 29.CHANGING THE SETTINGS

This section explains the contents of parameter settings in Basic mode and how to change these settings.

Each item can be changed to meet your measurement requirements.

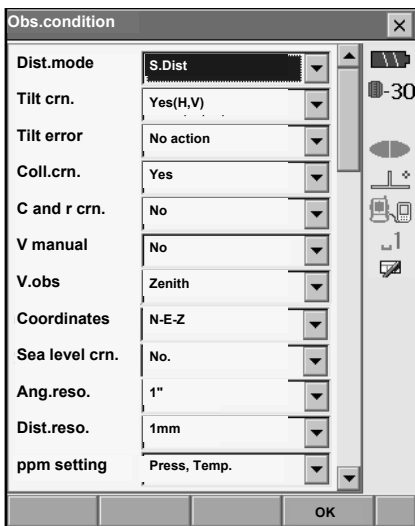
<Configuration> can be accessed by pressing the "CONFIG" icon in <Top>.



The following chapters provide details of items in Configuration mode.

- Communication settings "10. CONNECTING TO EXTERNAL DEVICES"
- Instrument configurations "31.3 Tilt Sensor", "31.5 Reticle"




## 29.1 Observation Conditions



### Items set and options (\*: Factory setting)

- Distance mode: S.Dist (slope distance)\*, H.dist (horizontal distance), V.dist (height difference)
- Tilt crn (tilt correction) : Yes (H,V)\*, Yes (V), No



Tilt error:	No action*/Go to Tilt screen
Coll.crn. (collimation correction) 	No, Yes*
C and r crn.:	No*, K=0.142, K=0.20
V manual:	No*, Yes
V.obs (vertical angle display method) 	Zenith*, Horiz., Horiz ±90°
Coordinates:	N-E-Z*, E-N-Z
Sea level crn. (Sea level correction) 	Yes, No*
Ang.reso. (Angle resolution):	SET1X/SET2X: 0.5", 1"* SET3X/SET5X: 1"*, 5"
Dist.reso. (Distance resolution):	SET1X/SET2X: 0.1mm, 1mm* SET3X/SET5X: 1mm*
ppm setting:	Press, Temp.*, +Humidity

 **Note**

- "Dist.reso." can only be selected for SET1X/SET2X. The screen displayed above is that of SET1X/SET2X.



**Automatic tilt angle compensation mechanism**

The vertical and horizontal angles are automatically compensated for small tilt errors using the 2-axis tilt sensor.

- Read the automatically compensated angles when the display has stabilized.
- The horizontal angle error (vertical axis error) fluctuates according to the vertical axis, so when the instrument is not completely leveled, changing the vertical angle by rotating the telescope will cause the displayed horizontal angle value to change.
- Compensated horizontal angle = Measured horizontal angle + Tilt in angle/tan (Vertical angle)
- When the telescope is directed close to the zenith or nadir angle, tilt compensation is not applied to the horizontal angle.



**Collimation correction**

The SETX has a collimation correction function that automatically corrects horizontal angle errors caused by horizontal axis and leveling axis errors.



**Sea level correction**

The SET calculates horizontal distance using slope distance values. As this horizontal distance does not take height above sea level into consideration, performing spherical correction is recommended when measuring at high altitudes. Spherical distance is calculated as follows.

Spherical distance

$$= \frac{R - H_a}{R} \times d_1$$

Where: R = radius of the spheroid (6372.000m)

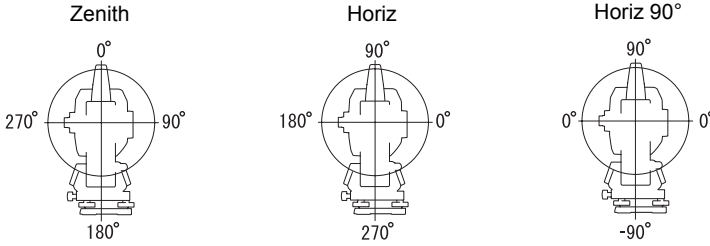
H<sub>a</sub> = averaged elevation of the instrument point and target point

d<sub>1</sub> = horizontal distance

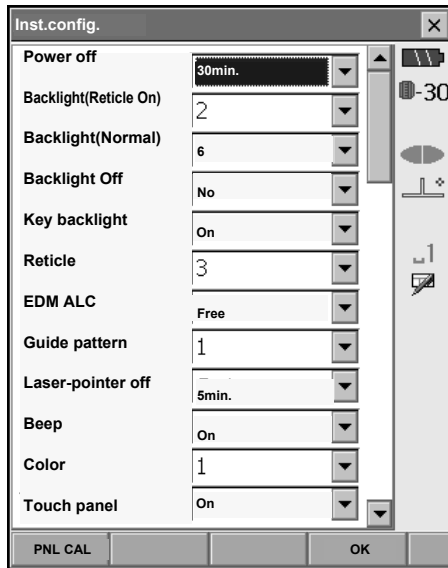
## 29. CHANGING THE SETTINGS



### V mode (vertical angle display method)



## 29.2 Instrument Configuration



### Items set and options (\*: Factory setting)

- Power off : No/5min./10min./15min./30min.\*
- Backlight (Reticle On) : 0 to 8 (2\*) (Brightness level on pressing {})
- Backlight (Normal) : 0 to 8(6\*)
- Backlight Off : No\*/30sec/1min./5min./10min.
- Key backlight : Off/On\*
- Reticle : 0 to 5 level (3\*)
- EDM ALC : Free\*/Hold
- Guide pattern: 1\* (simultaneous)/2 (alternating)
- Laser-pointer off: No/1min./5min.\*/10min./30min.
- Beep: On\*/Off

Color: 1\*/2 (monochrome)  
 Touch panel: On\*/Off

**Note**

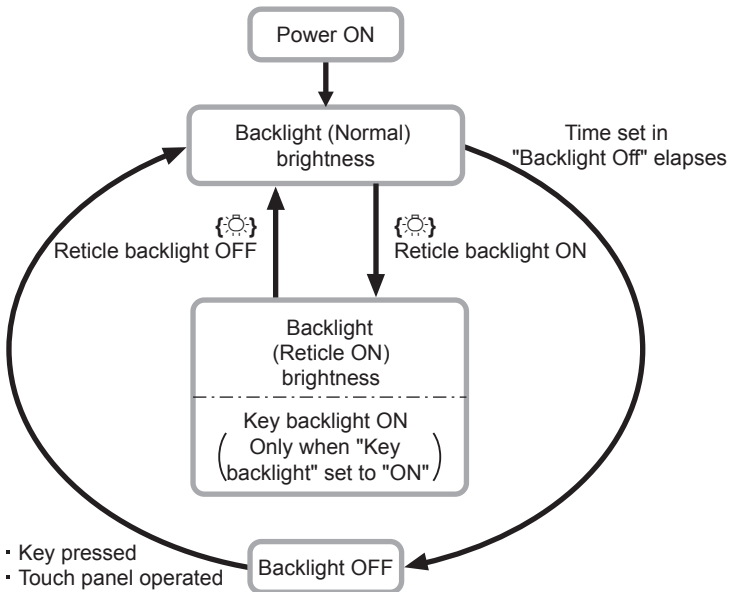
- Press **[PNL CAL]** to display the touch panel calibration screen.
- ☞ "9.1 Configuring the Touch Panel"



**Adjusting backlight brightness/turning the reticle illumination and key backlight ON/OFF**

Pressing switches the brightness level of the backlight in conjunction with the ON/OFF status of the reticle illumination/key backlight.

When the SETX is powered ON the brightness level is set to "Backlight (Normal)". "Backlight (Normal)" was set to a higher brightness level than "Backlight (Reticle ON)" when the SETX was shipped but these values can be modified according to user preferences.



**Power-saving automatic cut-off/Backlight Off**

To save power, power to the SETX is automatically cut off if it is not operated for the set time. The backlight will similarly be turned off if the instrument is not operated for the selected time. However, the backlight will not be turned off when "Backlight" is set to "ON".



**EDM ALC**

Set the light receiving status of the EDM. While carrying out continuous measurement, set this item according to the measurement conditions.

- When EDM ALC is set to "Free," the instrument's ALC will be automatically adjusted if an error occurs as a result of the amount of light received. Set to "Free" when the target is moved during measurement or different targets are used.

## 29. CHANGING THE SETTINGS

- When "Hold" is set, the amount of light received will not be adjusted until continuous measurement is completed.
- If an obstacle intermittently obstructs the light beam during continuous measurement and the "Signal off" error occurs, each time the obstruction occurs it takes some time for the amount of light received to be adjusted and the measurement value displayed. Set to "Hold" when the light beam used for measurement is stable but is frequently obstructed by obstacles such as people, cars, or tree branches etc. preventing measurement from being performed.



- When the distance measurement mode is set to "Tracking" (target is moved during distance measurement) the EDM ALC will be adjusted regardless of the EDM ALC setting.



### Laser-pointer off

To save power, the laser-pointer is automatically turned off after the set time has elapsed.

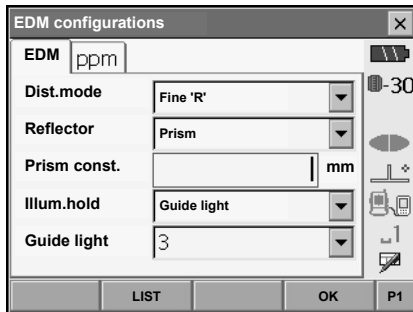


### Key backlight

The key backlight can be set to "ON" or "OFF". When "ON" the keys will be illuminated when "Backlight (Bright)" is active.

## 29.3 EDM Settings

### • EDM tab



### Items set, options, and input range (\*: Factory setting)

Dist. mode (Distance measurement mode): Fine "R"\* , Fine AVG n= 2 (Setting: 2 to 9 times), Fine "S", Rapid "R", Rapid "S", Tracking

Reflector: Prism\*/Sheet/Reflectorless



Prism constant: -99 to 99 mm ("Prism" is selected: -30\*, "Sheet" is selected: 0)

Illum. hold (⏸ function): Laser-pointer\*/Guide light

Guide light (Bright): 1 to 3 (3\*)

- The setting for "Fine AVG" distance measurement mode can be increased/decreased using the [ + ]/[ - ] softkeys.
- Target information can be edited and recorded.  
☞ "PROCEDURE Recording and editing target information"
- "Prism constant" will not be displayed when "Reflectorless" is selected in "Reflector".

- When "prism constant" values are changed and **[OK]** is pressed, these changes are reflected in the status bar target type display. This display will also change to reflect changes in target information settings made using a data collector. In both of the above cases, changes will not be recorded in <Reflector setting>. To remove added target information from the status bar, perform a cold boot.

 Status bar: "5.2 Display Functions", <Reflector setting>: "PROCEDURE Recording and editing target information", Cold boot: "9.2 Resolving Software Issues  Cold boot"

- The Guide light brightness item ("Guide light (Bright)") will be displayed only when "Illum. hold" is set to "Guide light".

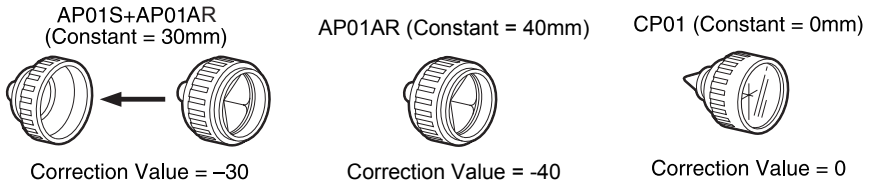


**Prism constant correction**

Reflective prisms each have their prism constant.

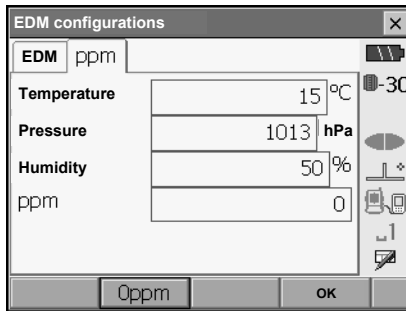
Set the prism constant correction value of the reflective prism you are using. When selecting "Reflectorless" in "Reflector", prism constant correction value is set to "0" automatically.

- The following are samples of the prism constant correction values of SOKKIA reflective prisms.



Prism constants and aperture settings can be set for each prism. The prism constant and aperture values displayed in the EDM tab will change to reflect the reflector type selected in "Reflector".

● **ppm tab**



- [0ppm]**: Atmospheric correction factor returns to 0 and temperature and air pressure are set to the factory settings.
- Atmospheric correction factor is calculated and set using the entered values of the temperature and air pressure. Atmospheric correction factor can also be entered directly.

**Items set, options, and input range (\*: Factory setting)**

Temperature:	-30 to 60°C (15*)
Pressure:	500 to 1400hPa (1013*), 375 to 1050mmHg (760*)
Humidity:	0 to 100% (50*)
ppm (Atmospheric correction factor):	-499 to 499 (0*)

## 29. CHANGING THE SETTINGS

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- The "Humidity" item is displayed only when the "ppm setting" in "Obs. condition" is set to "+Humidity".



### Atmospheric correction factor

The velocity of the light beam used for measurement varies according atmospheric conditions such as temperature and air pressure. Set the atmospheric correction factor when you wish to take this influence into account when measuring.

- The SETX is designed so that the correction factor is 0 ppm at an air pressure of 1013 hPa, a temperature of 15°C, and a humidity of 50%.
- By inputting the temperature, air pressure values and humidity, the atmospheric correction value is calculated using the following formula and set into the memory.

Atmospheric Correction Factor (ppm) =

$$282.324 - \frac{0.294362 \times p}{1 + 0.003661 \times t} + \frac{0.04127 \times e}{1 + 0.003661 \times t}$$

t : Air temperature (°C)

p : Pressure (hPa)

e : Water vapor pressure (hPa)

h : Relative humidity (%)

E : Saturated water vapor pressure

- e (water vapor pressure) can be calculated using the following formula.

$$e = h \times \frac{E}{100} \frac{(7.5 \times t)}{(t + 237.3)}$$
$$E = 6.11 \times 10^{(t + 237.3)}$$

- The SETX measures the distance with a beam of light, but the velocity of this light varies according to the index of refraction of light in the atmosphere. This index of refraction varies according to the temperature and pressure. Near normal temperature and pressure conditions:  
With constant pressure, a temperature change of 1°C: an index change of 1 ppm.

With constant temperature, a pressure change of 3.6 hPa: an index change of 1 ppm.

To perform high accuracy measurements, it is necessary to find the atmospheric correction factor from even more accurate temperature and pressure measurements and perform an atmospheric correction.

It is recommended that extremely precise instruments be used to monitor the air temperature and pressure.

- Enter the average temperature, air pressure and humidity along the measurement beam route in "Temperature", "Pressure" and "Humidity".

Flat terrain :Use the temperature, pressure and humidity at the midpoint of the line.

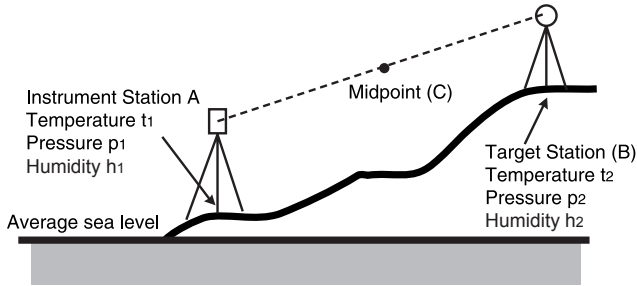
Mountainous terrain:Use the temperature, pressure and humidity at the intermediate point (C).

If it is not possible to measure the temperature, pressure and humidity at the midpoint, take such measurements at the instrument station (A) and the target station (B), then calculate the average value.

Average air temperature : $(t_1 + t_2)/2$

Average air pressure : $(p_1 + p_2)/2$

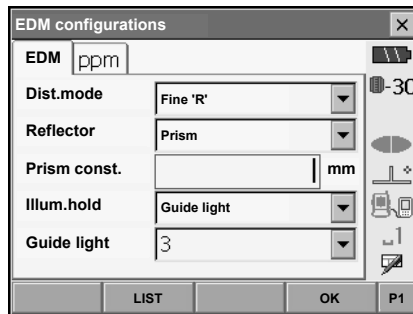
Average humidity : $(h_1 + h_2)/2$



•If the weather correction is not required, set the ppm value to 0.

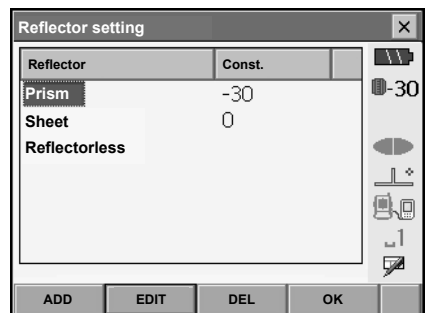
## PROCEDURE Recording and editing target information

The **[LIST]** softkey is displayed when either "Reflector" or "Prism const." is selected in the EDM tab of <EDM configurations>.



1. Press **[LIST]** to display a list of all recorded targets.

- **[ADD]**: Displays <Reflector list>. Select the desired target from this list and press **[OK]** to register in the list in <Reflector setting>. Up to a maximum of 6 targets can be recorded.
- **[DEL]**: Deletes the selected target.



## 29. CHANGING THE SETTINGS

- To edit a target, select the desired target and press **[EDIT]**. <Reflector/edit> is displayed. Select/input relevant information for the target.

Reflector: Prism/Sheet/Reflectorless  
 Const.: -99 to 99 mm

- When selecting "Reflectorless" in "Reflector", prism constant correction values are set to "0" automatically.



- Press **[OK]** in the screen of step 2 to save edited information and return to <Reflector setting>. Press **[OK]** to return to <EDM configurations>.

### 29.4 Allocating User-defined Tabs

It is possible to allocate tabs in Meas mode and Menu mode to suit the measurement conditions. It is possible to operate the SETX efficiently because unique tab allocations can be preset to suit various applications and the ways that different operators handle the instrument.

- The current tab allocations are retained until they are revised again, even when the power is cut off.
- Press **[CLEAR]** in <Customize/Select screen> to return all customized configurations including screen controls, status bar settings, and softkey allocations to their previous settings.
- One screen can contain a maximum of 5 tabs.



- When tab allocations are recorded and registered, the previously recorded tab settings are cleared.

#### ● Tab allocations

The following are tabs allocated when the SETX was shipped and tabs that can be defined by the user.

- Basic measurement

Factory settings	User-definable tabs
SHV	SHV
SHVdist	SHVdist
Graphic	SHV + Coord.

- Setting out

Factory settings	User-definable tabs
Meas.	Meas.
Graphic	

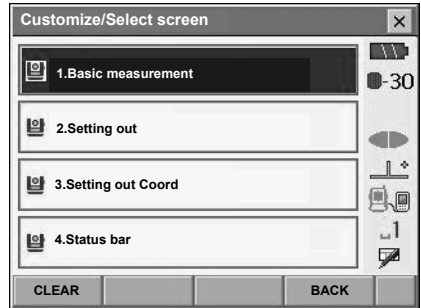


- Setting out Coord.

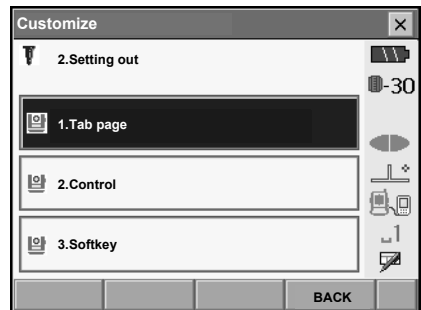
Factory settings	User-definable tabs
SHV	SHV
NEZ	NEZ
Graph1	
Graph2	

## PROCEDURE Allocating tabs

1. Select "Customize" to display <Customize/Select screen>. Select the measurement mode in which you want to allocate a tab.



Select "Tab page".



## 29. CHANGING THE SETTINGS

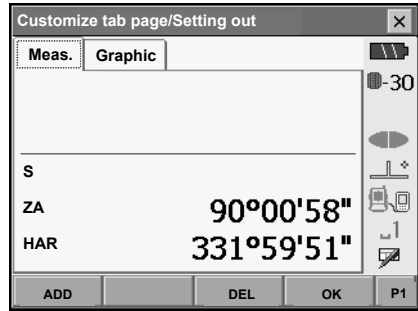
2. Use the softkeys (**[ADD]**, **[DEL]** etc.) in <Customize tab page> to allocate the desired tab page layout.

- Press **[ADD]** to add the selected tab at the right-hand side of the screen.
- Press **[INS]** in the second page to insert the selected tab in front of the current tab.
- Press **[CNFG]** in the second page to replace the current tab with the selected tab.
- Press **[DEL]** to delete the current tab.



- Tabs, once deleted, cannot be retrieved.

Select a tab type from the "Type" drop-down list.



3. Repeat step 2 to perform further tab allocations.
4. Press **[OK]** to finish allocating tabs. The allocated tabs are stored in memory and <Customize> is displayed. The newly allocated tabs appear in the relevant measurement screen.

### 29.5 Customizing Screen Controls

It is possible to customize screen controls in Meas mode to suit the measurement conditions and the different methods employed by different operators.

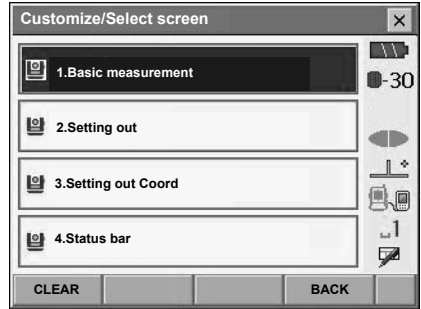
- The current screen control settings are retained until they are revised again, even when the power is cut off.
- Press **[CLEAR]** in <Customize/Select screen> to return all customized configurations including tab pages, status bar settings, and softkey allocations to their previous settings.
- Screen controls cannot be set for the Graphic tab.



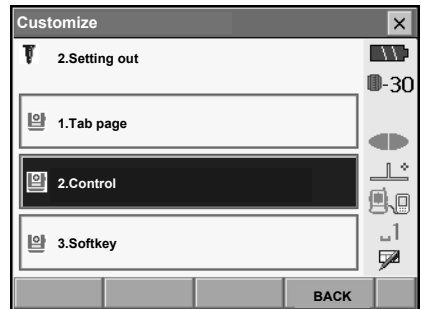
- When screen control settings are recorded and registered, the previously recorded settings are cleared.

## PROCEDURE Customizing screen controls

1. Select "Customize" to display <Customize/Select screen>.  
Select the measurement mode in which you want to customize screen controls.



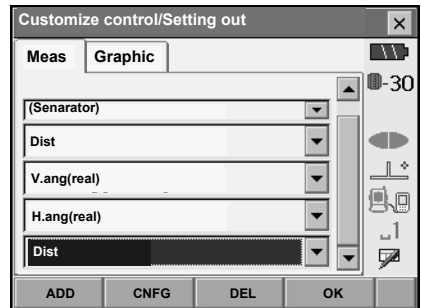
Select "Control".



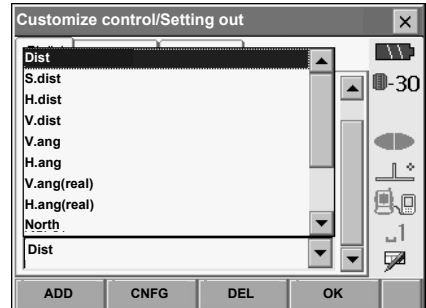
2. Press **[ADD]** to add a control drop-down list.
  - Press **[DEL]** to delete the selected control.



- Controls, once deleted, cannot be retrieved.



3. Select a screen control from the list.



## 29. CHANGING THE SETTINGS

4. Press **[CNFG]** to set the size, thickness, color and spacing of the font.



5. Repeat steps 2 to 4 to customize more screen controls.
6. Press **[OK]** to finish customizing screen controls. The modifications are stored in memory and <Customize> is displayed. The modifications are reflected in the relevant screens.

## 29.6 Allocating Key Functions

It is possible to allocate the softkeys in Meas mode to suit the measurement conditions. It is possible to operate the SETX efficiently because unique softkey allocations can be preset to suit various applications and the ways that different operators handle the instrument.

- The current softkey allocations are retained until they are revised again, even when the SETX is powered OFF.
- Press **[CLEAR]** in <Customize/Select screen> to return all customized configurations including tab pages, status bar settings, and screen controls to their previous settings.



- When softkey allocations are recorded and registered, the previously recorded key settings are cleared.
- Softkeys cannot be allocated to Graphic tabs.
- The following are the screens that can be customized and softkey allocations when the SETX was shipped.
  1. SHV and SHVdist tabs of <Basic measurement>  
Page 1 **[EDM]** **[TILT]** **[0SET]** **[DIST]**  
Page 2 **[MENU]** **[OFFSET]** **[H.ANG]** **[COORD]**  
Page 3 **[MLM]** **[RESEC]** **[REM]** **[S-O]**
  2. Meas. tab of <Setting out>  
Page 1 **[CNFG]** **[SHVR]** **[REC]** **[DIST]**  
Page 2 **[ --- ]** **[ --- ]** **[ --- ]** **[REM]**  
Page 3 **[ --- ]** **[ --- ]** **[ --- ]** **[ --- ]**

## 3. SHV and NEZ tabs of &lt;Set out Coords&gt;

Page 1 [ OK ] [ REC ] [CNFG] [DIST]

Page 2 [ --- ] [ --- ] [ --- ] [ --- ]

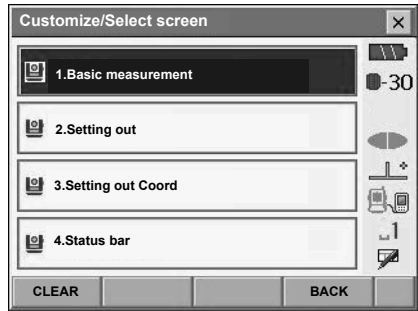
Page 3 [ --- ] [ --- ] [ --- ] [ --- ]

- The following functions can be allocated to the softkeys.

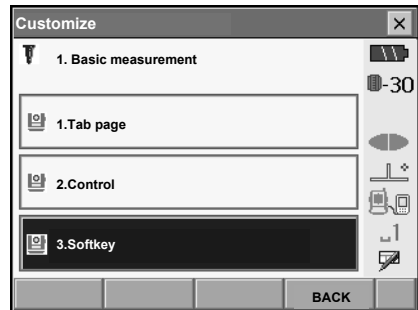
[ --- ]	: No functions set
[DIST]	: Distance and angle measurement
[CNFG]	: Set setting out accuracy (can only be allocated to 2 and 3 above)
[/SHV]	: Switch the "SHV" tab and "SHVdist" tab
[/SHVR]	: Switch distance mode between slope distance (S)/horizontal distance (H)/height difference (V)/REM (R) in setting out screens. The capitalized letter in the softkey indicates the currently selected mode (can only be allocated to 2 above).
[OK]	: Terminate setting out measurement for the selected setting out point and return to <Key in coord>. This setting out point will be removed from the list (can only be allocated to 3 above).
[REC]	: Records measurement results as coordinate values (can only be allocated to 2 and 3 above).
[0SET]	: Set horizontal angle to 0°
[H.ANG]	: Set required horizontal angle
[R/L]	: Select horizontal angle right/left. The capitalized letter in the softkey indicates the currently selected mode.
[ZA / %]	: Switch between zenith angle/slope in %. The capitalized letter in the softkey indicates the currently selected mode.
[HOLD]	: Hold horizontal angle/release horizontal angle
[RCL]	: Display final measurement data
[HV out]	: Output angle measurement results to an external device
[HVD out]	: Output distance and angle measurement results to an external device
[ft/M]	: Switch distance units between meters/feet
[HT]	: Set the instrument station, coordinates and instrument height
[AIM]	: Return signal
[TILT]	: Display tilt angle
[EDM]	: EDM settings
[MENU]	: Display <Menu> (topography measurement, coordinate measurement, setting out measurement, offset measurement, point projection, REM measurement, missing line measurement, resection, area calculation, route surveying, cross section survey)
[TOPO]	: Topography measurement
[COORD]	: Coordinates measurement
[S-O]	: Setting-out measurement
[OFFSET]	: Offset measurement
[A-OFS]	: Angle offset menu
[D-OFS]	: Distance offset menu
[2D-OFS]	: Offset/2D menu
[MLM]	: Missing line measurement
[REM]	: REM measurement
[RESEC]	: Resection measurement
[AREA]	: Surface area measurement

**PROCEDURE Allocating a softkey**

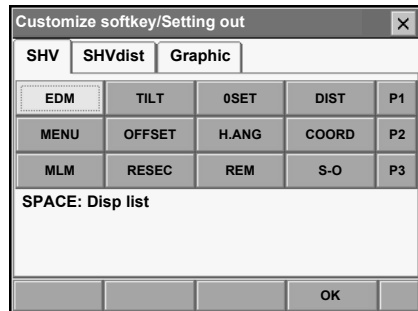
1. Select "Customize" to display <Customize/Select screen>. Select the measurement mode in which you want to allocate a softkey.



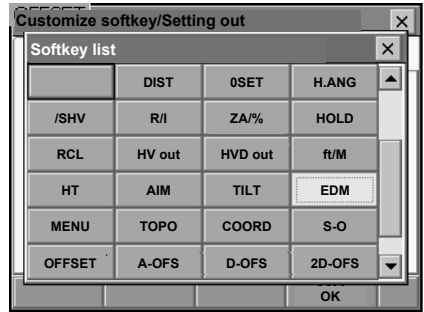
Select "Softkey".



2. Select the desired tab. All softkeys currently allocated to each page of that tab are displayed.



3. Select the softkey whose allocation you want to change. Tapping a softkey, or pressing **{SPACE}** when the cursor is aligned with a softkey, will display **<Softkey list>**.



4. Select the desired softkey from **<Softkey list>** to allocate to the position specified in step 3.
5. Repeat steps 3 to 4 to perform further key allocations.
6. Press **[OK]** to finish allocating keys. The allocated keys are stored in memory and **<Customize>** is displayed. The newly allocated keys appear in the relevant measurement screen.

## 29.7 Changing Status Bar Icons

It is possible to preset icon allocations of the status bar to suit various applications and the ways that different operators handle the instrument.

- The current icon allocations are retained until they are revised again, even when the power is turned off.
- Press **[CLEAR]** in **<Customize/Select screen>** to return all customized configurations including tab pages, screen controls and softkey allocations to their previous settings.



- When icon allocations are recorded and registered, the previously recorded settings are cleared.
- The following icons can be allocated to the status bar:
  - Remaining battery power
  - Target display
  - Guide light/Laser-pointer
  - Tilt
  - Communication status
  - Input mode
  - SIP (Input panel)
  - Touch panel

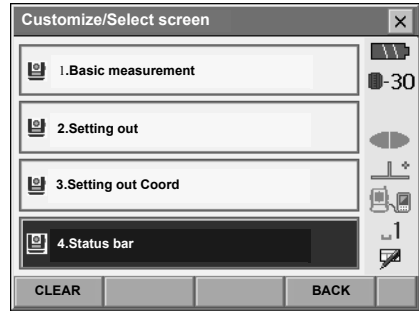
## 29. CHANGING THE SETTINGS

- ppm (atmospheric correction factor)
- No icon

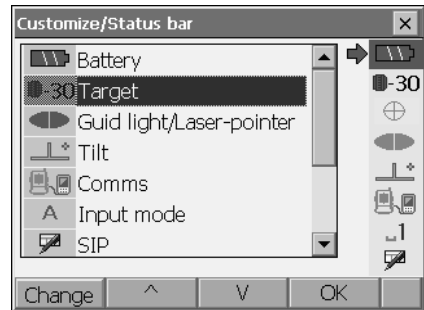
### PROCEDURE Changing icon allocations

1. Select "Customize" to display <Customize/Select screen>.

Select "Status bar".



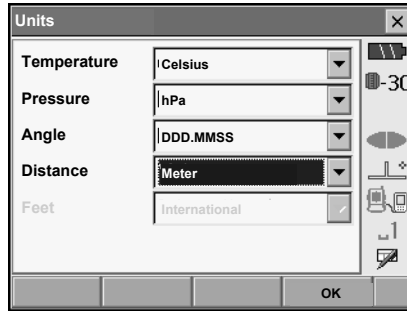
2. Select the icon position (in the status bar) you wish to re-allocate by tapping or using arrow key. A blue arrow will indicate the selected position.



3. Select the new icon for the selected icon position. Select and change by double-tapping. Or Select using {▲}/ {▼} and tap [Change]/{←}.  
4. Repeat steps 2 to 3 to perform further key allocations.
5. Press [OK] to finish allocating icons. The allocated icons are stored in memory and <Customize/Select screen> is displayed. The newly allocated icons appear in the status bar.



## 29.8 Units



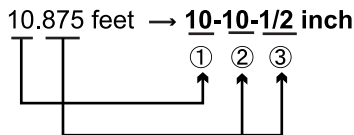
### Items set and options (\*: Factory setting)

Temperature:	Celsius*/Fahrenheit
Pressure:	hPa*/mmHg/InchHg
Angle:	Degree (DDD.MMSS)*/Gon/Mil
Distance:	Meter*/Feet/Inch
Feet (only displayed when "Feet" or "Inch" selected above):	International*/US



### Inch (Fraction of an inch)

"Fraction of an inch" is the unit used in the United States and expressed like the following example.



- ① 10.000 feet
- ② 0.875 feet x 12=10.5 inch
- ③ 0.5 inch=1/2 inch



- Even if "inch" is selected in this setting, all the data including the result of area calculation are output in "feet" and all the distance values must be input in "feet". In addition, when the "inch" display exceeds the range, it is displayed in "feet".

## 29.9 Changing Password

Setting a password allows you to protect important information such as measurement data and e-mail addresses.

No password was set when the SETX was shipped. When setting a password for the first time, leave the "Old password" box blank.

When a password has been set, the password screen will appear when the SETX is powered ON.

Input the password to continue.




### Items set

- |                     |                              |
|---------------------|------------------------------|
| Old password:       | Input current password       |
| New password:       | Input the new password       |
| New password again: | Input the new password again |

- Password can be up to 16 characters in length. Input characters will be displayed as asterisks.
- To deactivate the password function, perform the new password setting procedure but enter a "space" in the "New password" box.

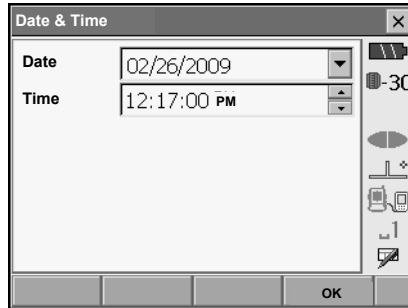
### Note

- An e-mail address is necessary when using the SFX Dial-Up Program.  
 SFX Dial-Up Program Explanations



- The password function will not be canceled when a cold boot is performed.

## 29.10 Date and Time



### Items set

Date:	Manually input date or select from the drop-down calendar by tapping ▼.
Time:	Manually input time or set using [▲]/[▼]. Pressing {SPACE} will increment the selected section by 1.



### Date and Time

The SETX includes a clock/calendar function.

## 29.11 Restoring Default Settings

Perform a cold boot to return all items to factory settings. A cold boot will not erase surveying data in Memory mode. However, if the data in the memory is important, **BE SURE TO TRANSFER IT TO A PERSONAL COMPUTER BEFORE PERFORMING A COLD BOOT.**

To perform a cold boot, while holding {F3}, {F1}, and {BACKSPACE}, press {⏻}. The following message appears.

"All Settings will be cleared. Are you sure?"

Press [YES] to continue. Press {ESC} to cancel.

After [YES] is pressed the instrument powers ON and the screen for configuring the touch panel is displayed. Configure the touch panel to continue.

☞ "9.1 Configuring the Touch Panel"



- The password function will not be canceled.

# 30.WARNING AND ERROR MESSAGES

The following is a list of the error messages displayed by the SETX and the meaning of each message. If the same error message is repeated or if any message not shown below appears, the instrument has malfunctioned. Contact your local dealer.

## **A new folder cannot be made in this folder !!**

A new folder cannot be created in the selected folder. Select a different location.

## **Backsight Z coord is Null !!**

Cannot compute. Backsight Z coord is set to "Null".  
Input the coordinate.

## **Backup battery dead. Clock display may no longer be correct.**

The voltage supplied by the lithium battery either declines or is completely discharged. Ask your local dealer to replace the battery for you.


## **Bad condition**

The air is shimmering a lot, etc., measuring conditions are poor.

The center of the target cannot be sighted.  
Resight the target.

Unsuitable distance measurement conditions when reflectorless measurement is set. When reflectorless measurement is set, distance cannot be measured because the laser beam is striking at least two surfaces at the same time.

Choose a single surface target for distance measurement.

 Precautions for setting prism: "11. FOCUSING AND TARGET SIGHTING"

## **Bad letter !!**

A file name containing special characters such as "\*" and "?" is invalid.

## **Calculation error**

During resection measurement the same point is registered multiple times. Set another known point so that the known point coordinates do not coincide.

Coordinates identical to the known point coordinates observed during resection exist.

During route surveying, requirements for the calculation are not met.

During surface area calculation, conditions necessary for calculations are not met. Check conditions and try again.

An error occurred during calculation.

## **Checksum error !!**

A sending/repetition error has occurred between the total station and external equipment.  
Send/receive the data again.

## **Code error !!**

Cannot read/write code file.

## **Coord not found**

During cross section survey, the dedicated point number cannot be found.

**Data not found !!**

No data found corresponding to input point number.

**Device list is full !!**

No more *Bluetooth* devices can currently be registered. Delete unnecessary devices from the list and try again.

**Disconnect *Bluetooth***

Wireless connection disconnected. Re-connect and try again.

**Error: Read Build Info.**

**Error: Read sysflg**

**Error: Self check**

**Error: Read OS Parameter**

**Error: Write sysflg**

Press **[OK]** to cancel the message. If this error message appears frequently, contact your local dealer.

**File does not exist !!**

No file exists with the input filename.

**Folder already exists !!**

The folder name input already exists.

**Folder creation error !!**

Folder creation failed.

**Incorrect password.**

Input password does not match set password. Input correct password.

**Input device name !!**

*Bluetooth* device name not input. Input device name and complete device registration.

**Input over 3 letters !**

The input password consists of less than 3 characters. Input a password at least 3 characters in length.

**Invalid: Same coords !!**

During route surveying, coordinates have not been defined correctly.

During point projection measurement, baseline has not been defined correctly.

**It is not possible to save in this folder !!**

Data cannot be saved in the selected folder. Select a different save location.

**JOB data is not developed. Or job may have broken.**

Memory mode JOB data lost or cannot be read in. Create JOB data again.

### 30. WARNING AND ERROR MESSAGES

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#### **JOB record full !!**

No more records can be recorded in the current JOB. Record in a different JOB.

#### **Linear !!**

The three input points form a straight line.

#### **Load alignment file error !!**

Cannot load route data.

#### **Need base pt. obs**

During REM measurement, the observation of the target was not completed normally.  
Reset and sight the prism and perform measurement again.

#### **Need element !!**

During route surveying, parameters are all null, or A1 or A2 is null.

#### **Need 1st obs**

During missing line measurement, the observation of the starting position was not completed normally.  
Sight the starting position accurately and press **[DIST]** to perform the measurement again.

#### **New password Diff.**

During new password setting, the passwords input twice are different. Input new password twice correctly.

#### **No data**

When searching for or reading in coordinate data or searching for code data, the search stopped either because the item in question does not exist or the data volume is large.

#### **North/East is null**

Coordinates cannot be read in when either the northing or easting value is set to "Null".

#### **No solution**

The calculation of the instrument station coordinates during resection does not converge.  
Access the results and if necessary, perform the observations again.

#### **Not define baseline !!**

Baseline has not been defined in point projection measurement.

#### **Out of range**

During gradient % display, the display range (less than  $\pm 1000\%$ ) has been exceeded.  
During REM measurement, either the vertical angle has exceeded horizontal  $\pm 89^\circ$  or the measured distance is greater than 9999.999m.  
Install the instrument station far from the target.

The instrument station coordinates calculated during resection are too high.  
Perform the observation again.

During area calculation, results exceeded the display range.

During point projection, scale factor is less than 0.100000 or exceeds 9.999999.

**Please define element !!**

No route defined when calculating route in route surveying.

**Record error !!**

Data cannot be recorded to JOB.

**Receive error !!**

Reception failed.

**Receive format error !!**

Check the received data.

**Save alignment file error !!**

Cannot save route data.

**Send error !!**

Send failed.

**Signal off**

The reflected light is not observed when distance measurement begins. Or, during measurement, the reflected light has weakened or is blocked.

Either sight the target again or, when using a reflective prism, increase the number of reflective prisms.

**Target not found !!**

The prism cannot be found within the Search area range.

Reset and sight the prism and perform measurement again.

**Temp Rnge OUT**

SETX is outside useable temperature range and accurate measurement cannot be performed.

Repeat measurement within the appropriate temperature range.

**Tilt over range !!**

The tilt angle exceeds the tilt angle compensation range of the sensor.

Sight again within  $\pm 1^\circ$ .

**Time out !!**

Measurement is not carried out in the allotted time.

Reset and sight the prism and perform measurement again.

# 31.CHECKS AND ADJUSTMENTS

SETX is a precision instrument that requires fine adjustments. It must be inspected and adjusted before use so that it always performs accurate measurements.


- Always perform checking and adjustment in the proper sequence beginning from "31.1 Plate Level" to "31.7 Additive Distance Constant".
- In addition, the instrument should be inspected with special care after it has been stored a long time, transported, or when it may have been damaged by a strong shock.
- Make sure the instrument is securely set up and stable before performing checks and adjustments.

## 31.1 Plate Level

The bubble tube is made of glass, so it is sensitive to temperature changes or to shock. Check and adjust it as outlined below.

### PROCEDURE Checking and adjusting

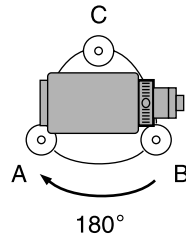
1. Level the instrument and check the position of the bubble of the plate level.

 "8.2 Levelling", steps 3 to 5

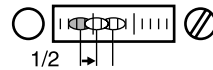
2. Turn the upper part of the SETX through 180° and check the bubble position.

If the bubble is still centered, no adjustment is necessary.

If the bubble is off-center, adjust as follows.

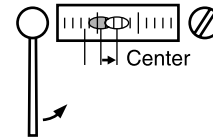


3. Correct half of the bubble displacement using levelling foot screw C.



4. Correct the remaining half of the displacement by using the adjustment pin to rotate the plate level adjustment screw.

When the plate level adjustment screw is turned in the counterclockwise direction, the bubble moves in the same direction.



5. Rotate the top of the instrument and continue adjustments until the bubble remains centered for any position of the upper part.

If the bubble does not move to the center even when the adjustment has been repeated, ask your local dealer to adjust it.




## 31.2 Circular Level

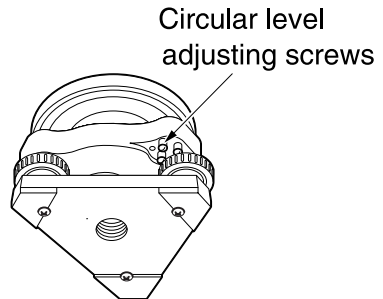
Check and adjust it as outlined below.



- Be careful that the tightening tension is identical for all the adjusting screws.
- Also, do not over-tighten the adjusting screws as this may damage the circular level.

### PROCEDURE Checking and adjusting

1. Perform the plate level inspection and adjustment or carefully use the plate level to level the instrument.  
 "8.2 Levelling", steps 1 to 2
2. Check the position of the bubble of the circular level.  
 If the bubble is not off-center, no adjustment is necessary.  
 If the bubble is off-center, perform the following adjustment.
3. First confirm the off-center direction.  
 Use the adjusting pin to loosen the circular level adjustment screw on the side opposite to the direction the bubble is displaced to move the bubble to the center.
4. Adjust the adjusting screws until the tightening tension of the three screws is the same to align the bubble in the middle of the circle.



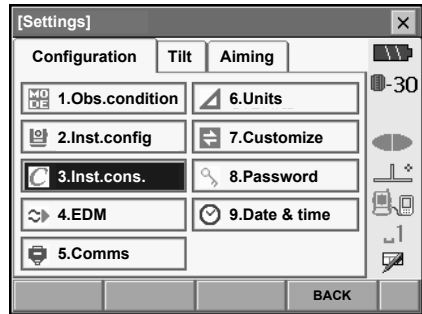
### 31.3 Tilt Sensor

If the tilt angle shown on the display shifts from tilt angle 0° (zero point), the instrument is not correctly levelled. This will adversely affect angle measurement.

Perform the following procedure to cancel the tilt zero point error.

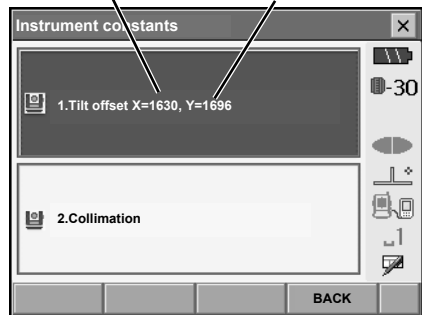
#### PROCEDURE Checking and adjusting

1. Carefully level the SETX. If necessary, repeat the procedures to check and adjust the bubble levels.
2. Select "Inst. cons." in <Settings>

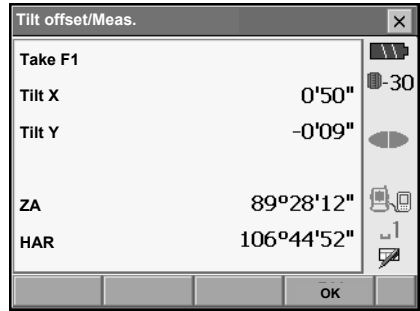


3. Select "Tilt offset". module

correction constant in the X (sighting) direction      correction constant in the Y (horizontal axis) direction

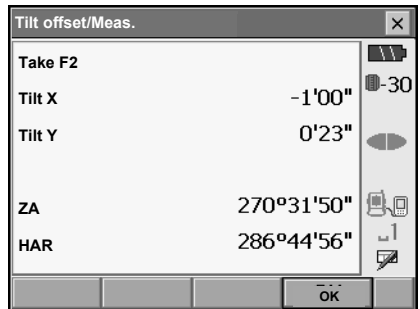


- Level the instrument until the X/Y tilt angles are  $\pm 1'$ . Wait a few seconds for the display to stabilize, then read the current tilt angle in the X (sighting) direction and Y (horizontal axis) direction.



- Press **[OK]** and rotate the top of the instrument and telescope  $180^\circ$  from the current position.
- Wait a few seconds for the screen to stabilize, then read the automatically compensated angles X2 and Y2.
- In this state, calculate the following offset values (tilt zero point error).  
 $X_{\text{offset}} = (X1 + X2) / 2$   
 $Y_{\text{offset}} = (Y1 + Y2) / 2$

If one of the offset values ( $X_{\text{offset}}$ ,  $Y_{\text{offset}}$ ) exceeds  $\pm 10''$ , adjust the value using the following procedure.  
 When the offset value falls within the range  $\pm 10''$ , adjustment is not necessary.  
 Press **{ESC}** to return to <Instrument constants>.



- Press **[OK]** and rotate the top of the instrument and telescope through  $180^\circ$ .

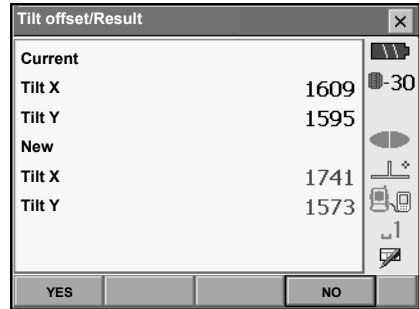
## 31. CHECKS AND ADJUSTMENTS

9. Confirm that the values are in the adjustment range.

If both correction constants are within the range  $1600 \pm 360$  (SET1X:  $6400 \pm 1440$ ), select **[YES]** to renew the correction angle. <Instrument constants> is restored. Continue to step 11.

If the values exceed the adjustment range, select **[NO]** to cancel the adjustment and return to the screen in step 4. Contact your local dealer to perform the adjustment.

Results for target point



Results for offset point

### PROCEDURE Recheck

10. Select "Tilt offset".
11. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X3 and Y3.
12. Press **[OK]** and rotate the top of the instrument and telescope through  $180^\circ$ .
13. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X4 and Y4.
14. In this state, the following offset values (tilt zero point error) are calculated.  
Xoffset =  $(X3+X4)/2$   
Yoffset =  $(Y3+Y4)/2$   
When both offset values fall within the range  $\pm 10''$ , adjustment is completed.  
Press **{ESC}** to return to <Instrument constants>.

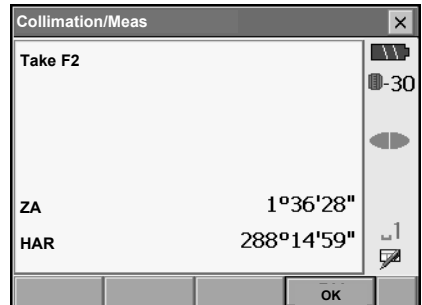
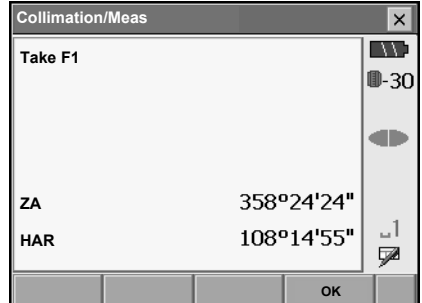
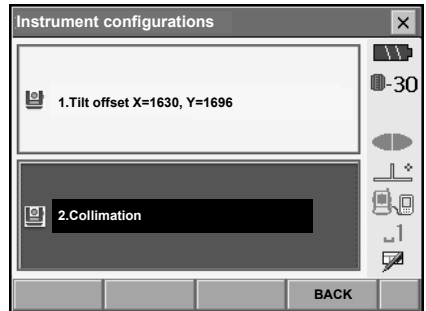
If one of the offset values (Xoffset, Yoffset) exceeds  $\pm 10''$ , repeat the check and adjustment procedures from the beginning. If the difference continues to exceed  $\pm 10''$  after repeating the check 2 or 3 times, have your local dealer perform the adjustment.

## 31.4 Collimation

With this option you can measure collimation error in your instrument so that the SETX can correct subsequent single face observations. To measure the error, make angular observations using both faces.

### PROCEDURE

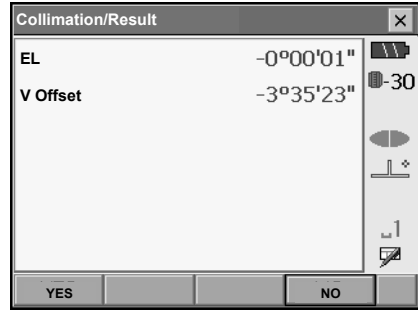
1. Select "Inst. cons." in <Configuration>.
2. Select "Collimation".
3. Sight the reference point in Face 1 and press **[OK]**. Telescope rotates and vertical circle is indexed.
4. Sight the reference point in Face 2 and press **[OK]**.



## 31. CHECKS AND ADJUSTMENTS

5. Press **[YES]** to set the constant.

- Press **[NO]** to discard the data and return to the screen in step 3.



### 31.5 Reticle

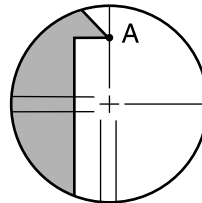
With this option you can check the perpendicularity of the reticle and the horizontal/vertical positions of reticle lines.



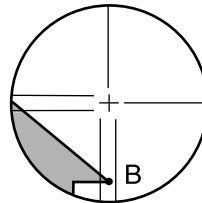
- Check the telescope reticle by sighting the target.

#### PROCEDURE Check 1: Perpendicularity of the reticle to the horizontal axis

1. Carefully level the instrument.
2. Align a clearly visible target (the edge of a roof for example) on point A of the reticle line.



3. Use the fine motion screws to align the target to point B on a vertical line.  
If the target moves parallel to the vertical line, adjustment is unnecessary. If its movement deviates from the vertical line, have our service representative adjust it.



#### PROCEDURE Check 2: Vertical and horizontal reticle line positions

1. Carefully level the instrument.

2. Install a target at a point about 100m in the horizontal direction from the SETX.



3. While the Meas mode screen is displayed and the telescope is in face left, sight the center of the target and read out the horizontal angle A1 and the vertical angle B1.

Example:

Horizontal angle A1 = 18° 34' 00"

Vertical angle B1 = 90° 30' 20"

4. While the telescope is in face right, sight the center of the target and read out the horizontal angle A2 and the vertical angle B2.

Example:

Horizontal angle A2 = 198° 34' 20"

Vertical angle B2 = 269° 30' 00"

5. Do the calculations: A2-A1 and B2+B1  
If A2-A1 is within 180°±20" and B2+B1 is within 360°±20", adjustment is unnecessary.

Example: A2-A1 (Horizontal angle)

= 198° 34' 20" - 18° 34' 00"

= 180° 00' 20"

B2+B1 (Vertical angle)

= 269° 30' 00" + 90° 30' 20"

= 360° 00' 20"

If the difference is large even after repeating the check 2 or 3 times, have our service representative perform the adjustment.

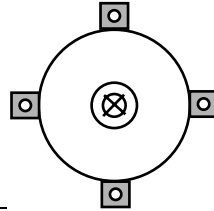
**31.6**    **Optical Plummet**



- Be careful that the tightening tension is identical for all the adjusting screws.
- Also, do not over-tighten the adjusting screws as this may damage the circular level.

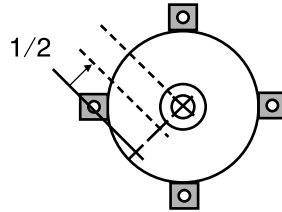
**PROCEDURE Checking**

1. Carefully level the SETX and center a survey point precisely in the reticle of the optical plummet.
2. Turn the upper part through 180° and check the position of the survey point in the reticle. If the surveying point is still centered, no adjustment is necessary. If the surveying point is no longer centered in the optical plummet, perform the following adjustment.



**PROCEDURE Adjustment**

3. Correct half the deviation with the levelling foot screw.



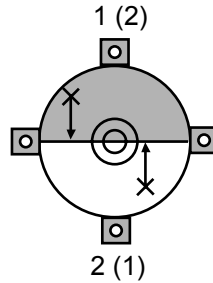
4. Remove the optical plummet reticle cover.



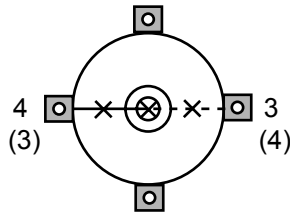
5. Use the 4 adjusting screws of the optical plummet to adjust the remaining half of the deviation as shown below.

When the survey point is on the lower (upper) part of the illustration:

Loosen the upper (lower) adjusting screw slightly, and tighten the upper (lower) adjusting screw the same amount to move the survey point to a point directly under the center of the optical plummet. (It will move to the line in the figure on the right.)



If the survey point is on the solid line (dotted line):  
Loosen the right (left) adjusting screw slightly and, tighten the left (right) adjusting screw by the same amount to move the survey point to a point in the center of the optical plummet.



6. Check to make sure that the survey point remains centered on the reticle even if the upper part of the instrument is rotated.  
If necessary, perform the adjustment again.

7. Replace the optical plummet reticle cover.

### 31.7 Additive Distance Constant

The additive distance constant  $K$  of the SETX is adjusted to 0 before delivery. Although it almost never deviates, use a baseline with a known distance precision to check that the additive distance constant  $K$  is close to 0 several times a year and whenever the values measured by the instrument begin to deviate by a consistent amount. Perform these checks as follows.



- Errors in setting up the instrument and reflective prism or in sighting the target will influence the additive distance constant. Be extremely careful to prevent such errors when performing these procedures.
- Set up so that the instrument height and the target height are identical. If a flat place is not available, use an automatic level to make sure the heights are identical.

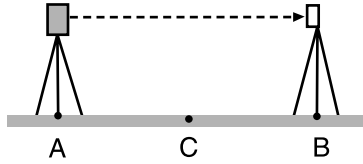
## 31. CHECKS AND ADJUSTMENTS

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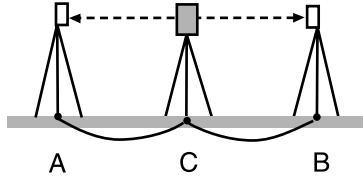
### PROCEDURE Check

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1. Find an area of flat ground where two points 100m apart can be selected.  
Set up the Instrument at point A and the reflective prism at point B. Establish a point C half way between points A and B.



2. Precisely measure the horizontal distance between point A and point B 10 times and calculate the average value.
3. Place the SETX at point C directly between points A and B and set up the reflective prism at point A.



4. Precisely measure the horizontal distances CA and CB 10 times each and calculate the average value for each distance.
5. Calculate the additive distance constant K as follows.  
$$K = AB - (CA + CB)$$
6. Repeat steps 1 to 5 two or three times.  
If the additive distance constant K is within  $\pm 3\text{mm}$  even once, adjustment is unnecessary.  
If it always exceeds this range, have our service representative perform an adjustment.

# 32.POWER SUPPLY SYSTEM

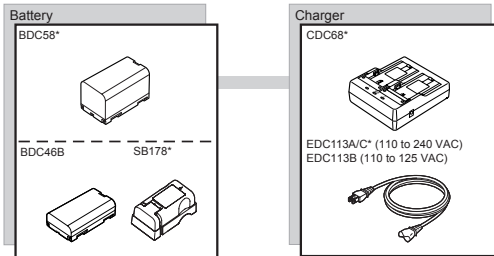
Operate your SETX with the following combinations of power equipment.



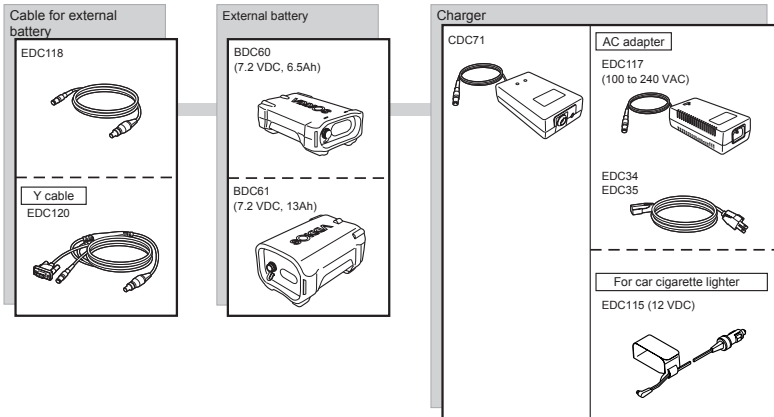
- When using BDC60, BDC61 and EDC117, mount the BDC58 in place to maintain the balance of the instrument.
- Never use any combination other than those indicated below. If you do, the SETX could be damaged.

Those indicated by \* are standard accessories. Others are optional accessories (sold separately).

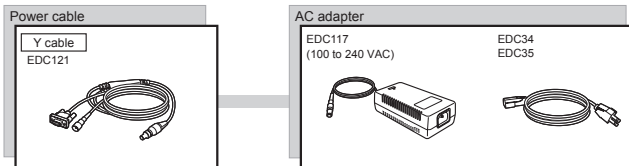
## ● Battery



## ● External battery



## ● AC adapter



- By using the Y cable the SETX can perform RS232C communication (D-sub 9-pin) at the same time as connecting to an external power source.

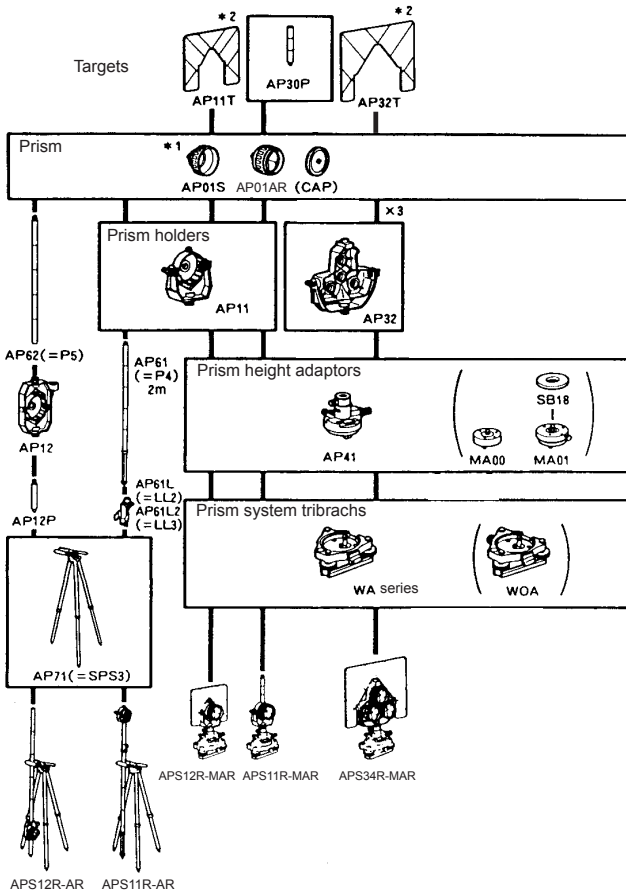
# 33.TARGET SYSTEM

The following are all special accessories (sold separately).

- Because all SOKKIA reflecting prisms and accessories have standardized screws, it is possible to combine these prisms, accessories, etc. according to your objectives.
- Because these targets (\*2) are coated with fluorescent paint, they reflect when there is little light.

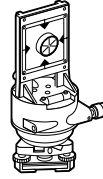


- When using a reflecting prism equipped with a target for distance and angle measurements, be sure to direct the reflective prism correctly and sight the center of the prism target accurately.
- Each reflective prism (\*1) has its own prism constant value. When changing prisms, be sure to change the prism constant correction value.
- To use the triple prism assembly AP32 as a single prism for short distance measurements, mount the single reflective prism AP01AR in the center mounting hole of the prism holder.



- **High-precision reflecting prism (CPS12)**

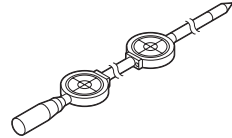
Prism constant: -27



- **2-point target (2RT500-K)**

This target is used for two-distance offset measurement.

Prism constant: 0



- **Instrument height adaptor (AP41)**

This device is used to adjust the height of the target.

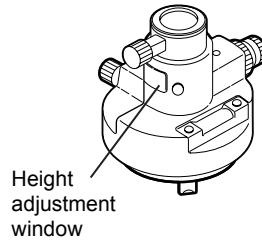
- When used with the SETX, make sure that the instrument height "236" (mm) is displayed in the instrument height adjustment window. For details, see the AP Series operator's manual.

- Adjust the level of the AP41 instrument height adaptor following the checking and adjustment methods of plate level.

 "31.1 Plate Level"

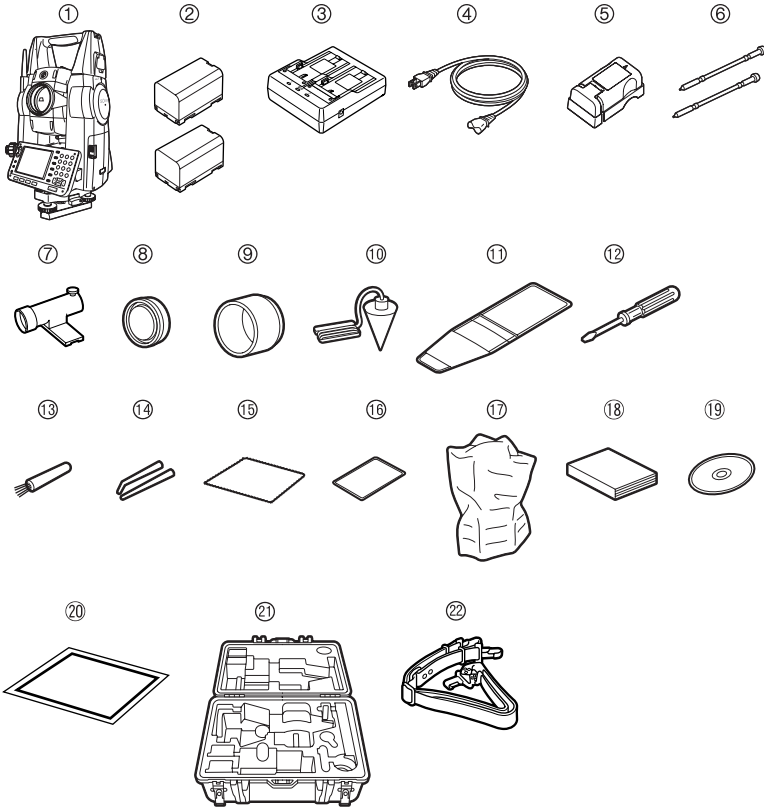
- Adjust the optical plummet of the AP41 instrument height adaptor following the checking and adjustment methods of optical plummet.

 "31.6 Optical Plummet"



# 34.STANDARD EQUIPMENT

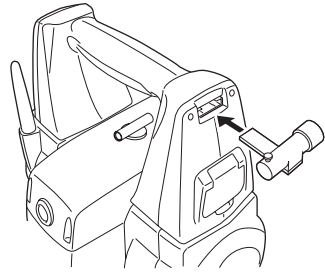
Please verify that all equipment is included.



1	SETX main unit	1	14	Adjusting pin	1
2	Battery (BDC58)	2	15	Cleaning cloth	1
3	Battery charger (CDC68)	1	16	Protective film	1
4	Power cable (EDC113A/113B/113C)	1		(Instrument with optional Face 2 display)	2
5	Battery adapter (SB178)	1	17	Vinyl cover	1
6	Stylus pen	2	18	Operator's manual	1
7	Tubular compass (CP9)	1	19	CD-ROM	1
8	Lens cap	1		(operator's manuals)	1
9	Lens hood	1	20	Laser caution sign-board	1
10	Plumb bob	1	21	Carrying case (SC223)	1
11	Tool pouch	1	22	Carrying strap	1
12	Screwdriver	1			
13	Lens brush	1			

- **Tubular compass (CP9)**

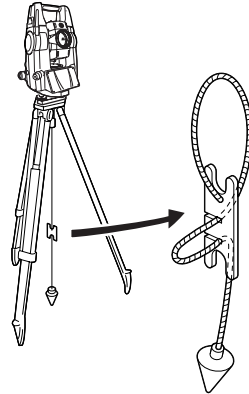
Slide the tubular compass into the tubular compass slot, loosen the clamp screw, then rotate the top part of the instrument until the compass needle bisects the index lines. The telescope's face 1 sighting direction in this position will indicate magnetic north. After use, tighten the clamp and remove the compass from the slot.



- The tubular compass is susceptible to the influence of nearby magnets or metal. Such influence could cause it to fail to accurately indicate magnetic north. Do not use magnetic north as indicated by this compass for base line surveying.

- **Plumb bob**

The plumb bob can be used to set up and center the instrument on days when there is little wind. To use the plumb bob, unwind its cord, pass it through the cord grip piece as shown in the figure to adjust its length, then suspend it from the hook attached to the centering screw.



- **Protective film (PF1)**

PF1 is a protective film for the 3.5 inch (55 x 72.6mm) LCD screen of your surveying instrument. Once applied to the display this film is designed to protect against damage, such as scratching with the stylus pen, during operation. The film will need to be replaced when it becomes scratched or damaged. No residue is left when the protective film is removed.

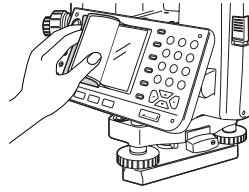
Applying the film

1. Wipe the display clean of any dust or dirt with the wiping cloth for your surveying instrument. Particles on the display create air bubbles under the film preventing the film sticking properly.

## 34. STANDARD EQUIPMENT

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2. Peel off the backing sheet and carefully apply the adhesive side of the film to the display. Make sure no air bubbles are created under the film. In the event that air bubbles enter under the film, peel the film off and start again.



- Make sure the film does not enter the slight clearance gap between the casing and the display. Intrusion of the film into this part of the instrument may cause softkeys to malfunction.

3. When the film has been applied to the display, wipe firmly with the wiping cloth, carefully pushing out any trapped air bubbles.

### ● Handle

The carrying handle can be removed from the instrument.

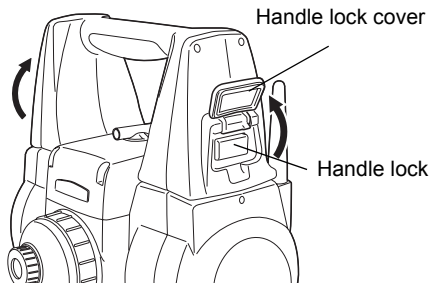


- Users of instruments incorporating the *Bluetooth* module should take extra care when removing the handle to avoid striking the antenna. Otherwise the antenna could be damaged.
- Do not hold the antenna when removing/attaching the handle.

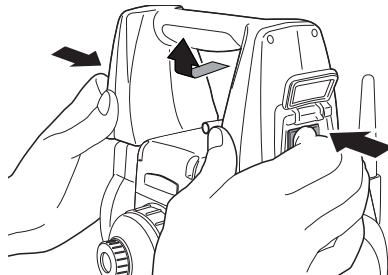
## Removing the handle

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1. Open the handle lock cover.



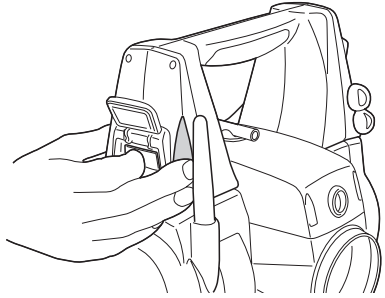
2. Depress the handle locks as shown at right and slide the handle towards you until a click is heard. Lift the handle up to remove.





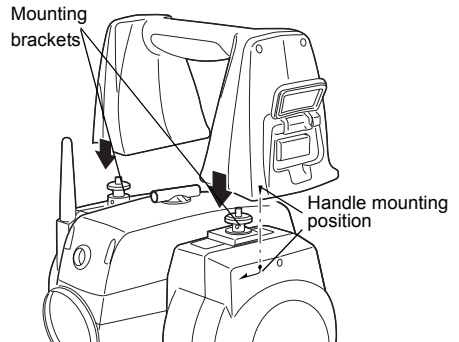


- Make sure that the handle does not fall while being removed. Removing the handle requires a certain amount of force. As a result, always hold as shown at right when removing.

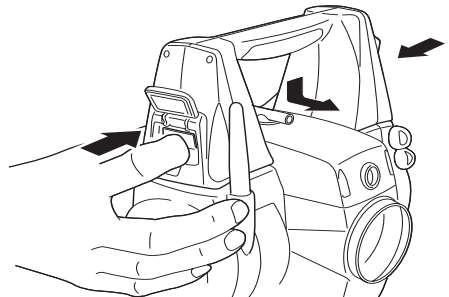


### Attaching the handle

1. Lower the handle onto the mounting brackets while depressing the handle locks.




2. Slide the handle onto the mounting position until a click is heard. Check that the handle locks, once released, return to the original position. Close the handle lock covers.



- Do not use the antenna for leverage when sliding the handle into place (see diagram at right).

# 35.OPTIONAL ACCESSORIES

The following are optional accessories which are sold separately from the SETX.

 Power supply and target optional accessories: "32. POWER SUPPLY SYSTEM", "33. TARGET SYSTEM".


- **Telescope eyepiece lens (EL7)**

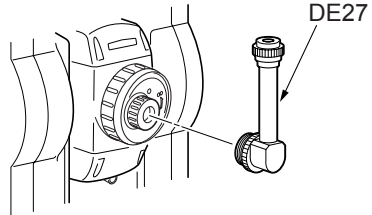
Magnification: 40X  
Field of view: 1° 20'

- **Diagonal eyepiece (DE27)**

The diagonal eyepiece is convenient for observations near the nadir and in narrow spaces.  
Magnification: 30X

After removing the handle from the SETX loosen the attachment screw to remove the telescope eyepiece. Then screw the diagonal lens into place.

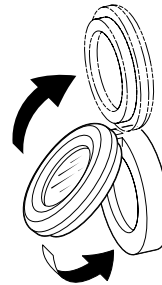
 Handle removal method: "34. STANDARD EQUIPMENT Removing the handle"



- Do not perform vertical rotation of the telescope when using the diagonal eyepiece. The diagonal eyepiece may strike the SETX causing damage.

- **Solar filter (OF3A)**

When sighting targets where glare is present, solar observations for example, attach it to the objective lens of the SETX to protect its interior and the eyes of its operator. The filter part can be flipped up without being removed.



- Do not perform vertical rotation of the telescope when using the solar filter. The solar filter may strike the SETX causing damage.

- **Interface cable**

Connect the SETX to a host computer using the following cables.

Cable	Notes
EDC120 (Y cable)	Pin number and signal level : RS232C compatible
EDC121 (Y cable)	D-Sub connector : 9 pins (female)
DOC129	

### Note

- By using the Y cable the SETX can perform RS232C communication (D-Sub 9-pin) at the same time as connecting to an external power source. DOC25/26/27/1 are necessary when connecting EDC120/121 or DOC129 to DOC128.

# 36.SPECIFICATIONS

Except where stated, the following specifications apply to all SETXs.

## Telescope

Length	173mm
Aperture	45mm (1.8 inch) (EDM: 48mm (1.9 inch))
Magnification	30X
Image	Erect
Resolving power	2.5"
Field of view	1°30' (26m/1,000m)
Minimum focus	1.3m (4.3ft)
Focussing screw	1 speed
Reticle illumination	5 brightness levels

## Angle measurement

Horizontal and Vertical circles type	Rotary absolute encoder scanning
IACS (Independent Angle Calibration System)	SET1X/2X only
Angle units	Degree/Gon/Mil (selectable)
Minimum display	SET1X/2X: 0.5"(0.0001gon/0.002mil)/1" (0.0002gon/0.005mil) (selectable) SET3X/5X: 1" (0.0002gon/0.005mil)/5" (0.0010gon/0.020mil) (selectable)
Accuracy	SET1X: 1" (0.0003gon/0.005mil) SET2X: 2" (0.0006gon/0.010mil) SET3X: 3" (0.001gon/0.015mil) SET5X: 5" (0.0015gon/0.025mil) (ISO 17123-3 : 2001)
Collimation compensation	On/Off (selectable)
Measuring mode	
Horizontal angle	Right/Left (selectable)
Vertical angle	Zenith/Horizontal/Horizontal $\pm 90^\circ/\%$ (selectable)

## Tilt angle compensation

Type	Liquid 2-axis tilt sensor
Minimum display	Same as setting for angle measurement
Range of compensation	$\pm 4'$ ( $\pm 0.0741$ gon)
Automatic compensator	ON (V & H/V)/OFF (selectable)
Compensation constant	Can be changed

## Distance measurement

Measuring method	Coaxial phase-contrast measuring system
Signal source	Red laser diode 690nm Class 3R (IEC60825-1 Ed. 2.0: 2007/FDA CDRH 21CFR Part1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.50, dated July 26, 2001.)) (When the prism or reflective sheet is selected in Config mode as target, the output is equivalent to Class 1)

Measuring range	(Using SOKKIA reflective prism/reflective sheet target during normal atmospheric conditions *1)
Reflective sheet RS90N-K*3	1.3 to 500 m (1,640ft)
Standard prism AP01AR X 1	1.3 to 5,000 m (16,400ft) (to 6,000 m*2) (19,680ft)
Standard prism AP01AR X 3	to 8,000 m (26,247ft) (to 10,000 m*2) (32,808ft)
Mini pole prism OR1PA	1.3 to 500 m (1,640ft)
Compact prism CP01	1.3 to 2,500 m (8,202ft)
Reflectorless (White)*4	0.3 to 500m (1,640ft)
Reflectorless (Gray)*5	0.3 to 250m (820ft)
Minimum display	
Fine measurement	SET1X/2X: 0.0001(0.001ft/ 1/16 inch)/0.001 m (0.01ft/ 1/8 inch) (selectable) SET3X/5X: 0.001 m (0.01ft/ 1/8 inch)
Rapid measurement	0.001 m (0.01ft/ 1/8 inch)
Tracking measurement	0.01 m (0.1ft/ 1/2 inch)
Maximum slope distance display	19,200.0000 m (using prism or reflective sheet target), 800.0000 m (reflectorless measurement)
Distance unit	m/ft/US ft/inch (selectable)
Accuracy	(Under normal atmospheric conditions*1)(ISO 17123-4 : 2001)
(Using prism)	
Fine measurement	SET2X/3X/5X: (2 + 2ppm X D) mm SET1X: (2 + 2ppm X D) mm (distance is less than 4m) (1.5 + 2 ppm X D) mm (however, distance is more than 4m when using CPS12)
Rapid measurement	(5 + 2 ppm X D) mm
(Using reflective sheet target)*3	
Fine measurement:	(3 + 2 ppm X D) mm
Rapid measurement:	(6 + 2 ppm X D) mm
(Reflectorless (White))*4	
Fine measurement	(3 + 2 ppm X D) mm (0.3 to 200m) (5 + 10 ppm X D) mm (200 to 350m) (10 + 10 ppm X D) mm (350 to 500m)
Rapid measurement	(6 + 2 ppm X D) mm (0.3 to 200m) (8 + 10 ppm X D) mm (200 to 350m) (15 + 10 ppm X D) mm (350 to 500m)
(Reflectorless (Gray))*5	
Fine measurement	(3 + 2ppm X D) mm (0.3 to 100m) (5 + 10ppm X D) mm (100 to 170m) (10 + 10ppm X D) mm (170 to 250m)
Rapid measurement:	(6 + 2ppm X D) mm (0.3 to 100m) (8 + 10ppm X D) mm (100 to 170m) (15 + 10ppm X D) mm (170 to 250m)
	(D: measurement distance; Unit: mm)
Measurement mode	Fine measurement (single/repeat/average)/Rapid measurement (single/repeat)/Tracking (selectable)

## 36. SPECIFICATIONS

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Measuring time (fastest time under good atmospheric conditions\*<sup>2</sup>, no compensation, EDM ALC at appropriate setting, slope distance)

Fine measurement	less than 1.5 sec + every 0.9 sec or less
Rapid measurement	less than 1.3 sec + every 0.6 sec or less
Tracking measurement	less than 1.3 sec + every 0.4 sec or less

Atmospheric correction Temperature, pressure, humidity input/ppm input (selectable):

Earth curvature and refraction correction

No/Yes K=0.14/Yes K=0.20 (selectable)

Scale factor setting 0.50000000 to 2.00000000 (in 0.00000001 steps)

Sea level correction No/Yes (selectable)

- \*1: Slight haze, visibility about 20 km, sunny periods, weak scintillation.
- \*2: No haze, visibility about 40 km, overcast, no scintillation.
- \*3: Figures when the laser beam strikes within 30° of the reflective sheet target.
- \*4: Figures when using Kodak Gray Card White side (reflection factor 90%) and brightness level is less than 30000 lx (a little cloudy).
- \*5: Figures when using Kodak Gray Card Gray side (reflection factor 18%) and brightness level is less than 30000 lx (a little cloudy).

### Guide Light

(Slight haze, visibility about 20 km, sunny periods, weak scintillation)

Light source	LED (red 626 nm/green 524 nm) Class 1 (IEC60825-1 Amd. 2: 2001/FDA CDRH 21 CFR Part 1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.50, dated July 26, 2001.))
Distance	1.3 to 150m* <sup>1</sup>
Visible range	Right and Left/Upward and Downward: ± 4° (7m/100m)
Resolving power at center area (width)	4' (about 0.12/100m)
Brightness	3 levels (bright/normal/dim)

### Internal memory

Capacity 750 MB (includes memory for program files)

### External memory

CF card (up to 4 GB, 3.3V type only)  
USB flash memory (up to 4 GB)

### Data transfer

Data input/output	Asynchronous serial, RS232C compatible
USB	USB Ver. 1.1, Host (Type A) and Client (Type miniB)
Card slot	Compact Flash Type II-compatible
SFX Dial-Up function	Yes

### Bluetooth wireless communication (option)

Transmission method	FHSS
Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Frequency band	2.402 to 2.48GHz

<i>Bluetooth</i> profile	SPP, DUN
Power class	Class 1
Usable range	to 200m (usable range may vary with different paired devices) (No obstacles, few vehicles or sources of radio emissions/ interference in the near vicinity of the instrument, no rain)
Authentication	Yes/No (selectable)

**Power Supply**

Power source	Rechargeable Li-ion battery BDC58
Nominal voltage	7.2V
Storage temperature range (long-term)	-20 to 35°C

## Working duration at 20 °C

Distance measurement (Fine distance measurement (single) repeated every 30 sec)	BDC58: about 14 hours BDC46B (optional accessory): about 6.5 hours BDC60 (external battery, optional accessory): about 19 hours BDC61 (external battery, optional accessory): about 38.5 hours
Angle measurement only	BDC58: about 14.5 hours BDC46B (optional accessory): about 7 hours BDC60 (external battery, optional accessory): about 20 hours BDC61 (external battery, optional accessory): about 41 hours

Battery state indicator	4 levels
Auto power-off	5 levels (5/10/15/30 min/Not set) (selectable)
External power source	7.2 to 12V
Required power	10 W (power ON)

**Battery (BDC58)**

Nominal voltage	7.2V
Capacity	4.3Ah
Dimensions	38 (W) x 70 (D) x 40 (H) mm
Weight	about 195g

**Battery (BDC46B)**

Nominal voltage	7.2V
Capacity	2.45Ah
Dimensions	38 (W) x 70 (D) x 20 (H) mm
Weight	about 103g

**Charger (CDC68)**

Input voltage	AC100 to 240V
Charging time per battery (at 25°C)	BDC46B: about 2.5 hours BDC58: about 4 hours (Charging can take longer than the times stated above when temperatures are either especially high or low.)
Charging temperature range	0 to 40°C
Storage temperature range	-20 to 65°C
Size	94 (W) X 102 (D) X 36 (H) mm
Weight	about 170g

## 36. SPECIFICATIONS

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### General

Operating system	Windows CE Ver. 5.0
Display	3.5 inch Transflective TFT QVGA color LCD
Backlight	LED: 9 brightness levels (0 to 8) (selectable)
Touch panel	Resistance-sensitive analog type
Keyboard	32 keys (power, edit, direct, cursor, numeric, soft function, operations, power on, light)
Key backlight	Yes
Trigger key	Yes (right side)
Sensitivity of levels	
Plate level	SET1X: 20"/2 mm SET2X/3X/5X: 30"/2 mm
Circular level	10"/2 mm
Optical plummet	
Image	Erect
Magnification	SET1X: 5.5X SET2X/3X/5X: 3X
Minimum focus	0.3 m
Calendar/clock function	Yes
Laser-pointer function	ON/OFF (selectable)
Laser radiation warning indicator	Yes (lit continuously while laser emitted)
Operating temperature	-20 to 50°C (no condensation)
Storage temperature range	-30 to 70°C (no condensation)
Dust and water resistance	IP65 (IEC 60529:2001)
Instrument height	236 mm from tribrach bottom
Instrument size (with handle)	201 (W) X 202 (D) X 375 (H) mm (display on Face 1 only, excluding protruding sections) 201 (W) X 220 (D) X 375 (H) mm (with optional Face 2 display, excluding protruding sections)
Instrument weight (with BDC58 and handle):	
Display on one side	6.9 kg (15.2 lb)
Display on both sides	7.1 kg (15.5 lb)



# 37. EXPLANATIONS

## 37.1

### Manually Indexing the Vertical Circle by Face Left, Face Right Measurement

The 0 index of the vertical circle of your SETX is almost 100% accurate, but when it is necessary to perform particularly high precision angle measurements, you can eliminate any inaccuracy of the 0 index as follows.

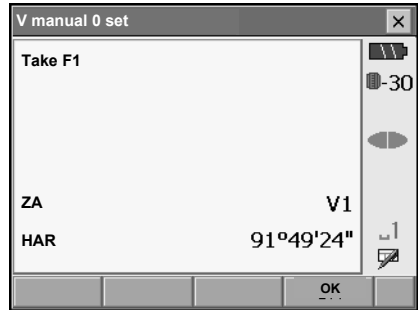


- If the power is cut off, the vertical circle indexing is ineffective. Do it again every time the power is turned on.

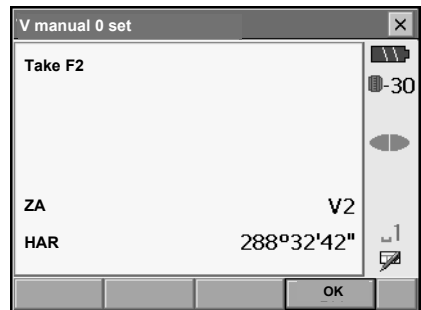
#### PROCEDURE

1. Select "Obs.condition" in <Configuration>. Set "V manual" (vertical circle indexing method) to "Yes".  
☞ "29.1 Observation Conditions"

<V manual 0 set> is displayed.



2. Carefully level the instrument.
3. Accurately sight a clear target with a distance of about 30m in the horizontal direction with the telescope in face left.  
Press **[OK]**. The vertical angle V2 is displayed under "Take F2".
4. Turn the upper part through 180° and clamp it. Then set the telescope in the face right position and accurately sight the same target.  
Press **[OK]**.  
The vertical and horizontal angles are displayed. This concludes the vertical circle indexing procedure.



# 38.REGULATIONS

Users must ensure that their instrument is compliant with the relevant regulations and legal restrictions in place in the country of use.

## For users in the US

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**WARNING:** Changes or modifications to this unit 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 A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment should be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles).

## For users in California

**WARNING:** Handling the cord on this product or cords associated with accessories sold with this product will expose you to lead, a chemical known to the State of California to cause birth defects or other reproductive harm. ***Wash hands after handling.***

## For users in Canada

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This Class A digital apparatus meets all requirements of Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Class A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

This class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme a la norme NMB-003 du Canada.

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 this device.

This equipment complies with IC radiation exposure limits set forth for uncontrolled equipment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles).

## For users in the European Economic Area (EEA)

For a copy of the CE Conformity Declaration for this instrument, contact your local dealer.

### SETX Total Station with WT11

#### Česky [Czech]

Sokkia BV potvrzuje, že výše uvedené zařízení je v souladu se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES.

#### Dansk [Danish]

Undertegnede, Sokkia B.V. erklærer herved, at følgende udstyr det ovennævnte udstyr overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.

#### Deutsch [German]

Sokkia B.V. erklärt, dass die oben genannten Instrumente in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.

#### Eesti [Estonian]

Käesolevaga kinnitab Sokkia B.V., seadme ülal mainitud varustus direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivis tulenevatele teistele asjakohastele sätetele.

#### English

Hereby, Sokkia B.V., declares that the above-mentioned equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

#### Español [Spanish]

Por medio de la presente Sokkia B.V., declara que el equipo arriba mencionado cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.

#### Ελληνική [Greek]

ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ Sokkia B.V., ΔΗΛΩΝΕΙ ΟΤΙ ο προαναφερόμενος εξοπλισμός ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.

#### Français [French]

Par la présente Sokkia B.V., déclare que l'équipement mentionné ci-dessus est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

#### Italiano [Italian]

Con la presente Sokkia B.V., dichiara che questo Il sopra menzionato equipaggiamento è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.

#### Latviski [Latvian]

Ar šo Sokkia B.V., deklarē, ka augstāk minētā iekārta atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.

#### Lietuvių [Lithuanian]

Šiuo Sokkia B.V., deklaruoja, kad šis aukščiau mineta iranga atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.

#### Magyar [Hungarian]

Alulírott, Sokkia B.V. nyilatkozom, hogy a a fent említett eszköz megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.

#### Malti [Maltese]

Hawnhekk, Sokkia B.V., tidjikkara li t-tagħmir imsemmi hawn fuq hu konformi ma-ħtiġijiet essenzjali u provvedimenti rilevanti oħrajn ta' Direttiva 1999/5/KE.

#### Nederlands [Dutch]

Hierbij verklaart Sokkia B.V., dat bovengenoemd toestel in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.

#### Polski [Polish]

Niniejszym Sokkia B.V. oświadcza, że sprzęt wymieniony powyżej jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.

#### Português [Portuguese]

Sokkia B.V. declara que este o equipamento acima mencionado está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

## 38. REGULATIONS

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### Slovensko [Slovenian]

Sokkia B.V. izjavlja, da je ta zgoraj omenjena oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/ES.

### Slovensky [Slovak]

Sokkia BV potvrdzuje, že vyššie uvedené zariadenie je v súlade so základnými požiadavkami a všetky príslušné ustanovenia Smernice 1999/5/ES.

### Suomi [Finnish]

Sokkia B.V. vakuuttaa täten että ylläoleva laite tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.

### Svenska [Swedish]

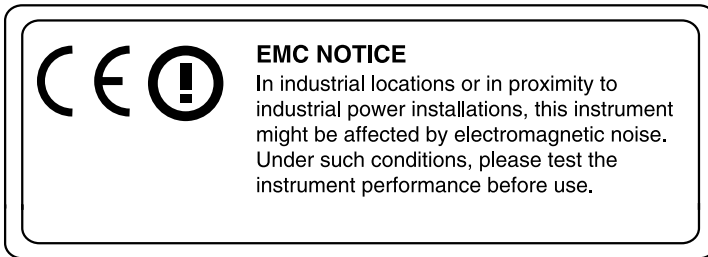
Härmed intygar Sokkia B.V. att den ovan nämnda utrustningen står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

### Íslenska [Icelandic]

Hér með staðfestir Sokkia B.V. að áður nefndur búnaður er í samræmi við grundvallarskilyrði og aðrar viðeigandi kröfur í fyrirmæli Evrópusambandsins 1999/5/EC.

### Norsk [Norwegian]

Sokkia B.V. erklærer herved at utstyret nevnt ovenfor oppfyller de ubetingede krav og andre relevante bestemmelser i Direktiv 1999/5/EC.



## **For users in Mexico**

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Este equipo opera a título secundario, consecuentemente, debe aceptar interferencias perjudiciales incluyendo equipos de la misma clase y puede no causar interferencias a sistemas operando a título primario.

COFETEL + RCPSOWT08-0101

## **For users in Indonesia**

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**06223/POSTEL/2008  
2311**

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**For users in Singapore**

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**Complies with  
IDA Standards  
DB101547**

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**For users in Taiwan**

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低功率電波輻射性電機管理辦法 (930322)

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

---

**For users in the United Arab Emirates**

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Approved by TRA

# 31.INDEX

- A**  
Adjusting backlight brightness/turning the  
reticle illumination and key backlight ON/OFF  
..... 177  
Atmospheric correction factor ..... 180  
Automatic tilt angle compensation mechanism 175
- B**  
*Bluetooth* connections ..... 43  
*Bluetooth* Device Address ..... 46
- C**  
Cold boot ..... 41  
Collimation correction ..... 175  
Coordinate search JOB ..... 162  
Cross Survey data review ..... 157  
Current JOB ..... 162
- D**  
Date and Time ..... 193  
Direction ..... 156
- E**  
EDM ALC ..... 177  
Eliminating parallax ..... 51
- G**  
Guide light ..... 12
- H**  
Horizontal angle settings ..... 65, 72, 80
- I**  
Inch (Fraction of an inch) ..... 191  
Instrument height mark ..... 12
- K**  
Key backlight..... 178
- L**  
Laser-pointer function ..... 12  
Laser-pointer off..... 178  
Laser radiation warning indicator ..... 12
- P**  
Peep sight ..... 12  
Power-saving automatic cut-off/Backlight Off 177  
Precautions when performing resection..... 85  
Prism constant correction ..... 179  
Problems Powering OFF ..... 42
- R**  
Resection calculation process ..... 84  
Resume function ..... 40  
Rules regarding the assigning of point num-  
bers to automatically calculated pegs ... 146  
Rules regarding the automatic assigning of  
point numbers to arbitrary points ..... 147
- S**  
Scale correction ..... 162  
Sea level correction ..... 175  
Slope area ..... 117  
Symbols and terms used in Route Surveying 122
- T**  
Trigger key ..... 12
- V**  
V mode (vertical angle display method). 176



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