

**INSTRUCTION MANUAL
EASY STATION**

**ES-62
ES-65**

HOW TO READ THIS MANUAL

Thank you for selecting the ES-62/65.

- Please read this Operator's manual carefully, before using this product.
- ES 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 "Communication manual" and ask your local dealer.
- The specifications and general appearance of the instrument are subject to change without prior notice and without obligation by TOPCON CORPORATION and may differ from those appearing in this manual.
- The content of this manual is subject to change without notice.
- Some of the diagrams shown in this manual may be simplified for easier understanding.
- Always keep this manual in a convenient location and read it when necessary.
- This manual is protected by copyright and all rights are reserved by TOPCON CORPORATION.
- Except as permitted by Copyright law, this manual may not be copied, and no part of this manual may be reproduced in any form or by any means.
- This manual may not be modified, adapted or otherwise used for the production of derivative works.

Symbols

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.

Notes regarding manual style

- Except where stated, "ES" means ES-62/65.
- Screens and illustrations appearing in this manual are of ES-62.
- Learn basic key operations in "BASIC OPERATION" before you read each measurement procedure.
- For selecting options and inputting figures, see "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" (*Note*).
- *Bluetooth*[®] is a registered trademark of Bluetooth SIG, Inc.
- KODAK is a registered trademark of Eastman Kodak Company.
- All other company and product names featured in this manual are trademarks or registered trademarks of each respective organization.



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.




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 instruction manual.

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








Definition of Indication

 WARNING	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.
 CAUTION	Ignoring this indication and making an operation error could possibly result in minor 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 solar filter (optional accessory) for sun observation.
 "21. SPECIAL ACCESSORIES"
-  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.
-  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 locking screws. 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

Warning






-  Do not place articles such as clothing on the battery charger while charging batteries. Sparks could be induced, leading to fire.
-  Do not use batteries other than those designated. An explosion could occur, or abnormal heat generated, leading to fire.
-  Do not use voltage other than the specified power supply voltage. Fire or electrical shock could result.
-  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 or charger 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

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



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 they may be adversely affected by the electromagnetic waves produced resulting in malfunction and injury.

PRECAUTIONS

Before starting work or operation, be sure to check that the instrument is functioning correctly with normal performance.

Charging Battery

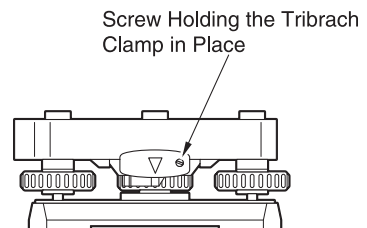
- Be sure to charge the battery within the charging temperature range.
Charging temperature range: 0 to 40°C
- Use only the specified battery or the battery charger. Failures caused by using other batteries or battery chargers are out of warranty including the main unit.

Warranty policy for Battery

- Battery is an expendable item. The decline in retained capacity depending on the repeated charging/discharging cycle is out of warranty.

Tribrach Clamp

- 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 tribrachs. Before using the instrument the first time, loosen this screw with a precision screwdriver. And before transporting it, tighten the locking screw to fasten the tribrach clamp in place so that it will not shift on the tribrachs.



Precautions concerning water and dust resistance

ES conforms to IP66 specifications for waterproofing and dust resistance when the battery cover and external interface hatch are closed and connector caps are attached correctly.

- Be sure to close the battery cover and external interface hatch, and correctly attach the connector caps to protect the ES from moisture and dust particles.
- Make sure that moisture or dust particles do not come in contact with the inside of the battery cover, terminal or connectors. Contact with these parts may cause damage to the instrument.
- 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.
- Do not press the speaker hole using something with a pointed tip. Doing so will damage an internal waterproof sheet, resulting in a degraded waterproof property.
- If there is a crack or deformation in the rubber packing for the battery cover or external interface hatch, stop using and replace the packing.
- To retain the waterproof property, it is recommended that you replace the rubber packing once every two years. To replace the packing, contact your local dealer.

The Lithium Battery

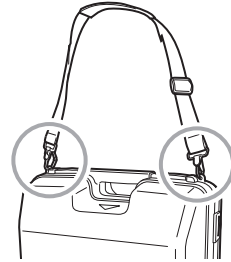
- This instrument contains lithium battery. It lasts for approximately 5 years of normal use and storage (Temperature = 20°C, humidity = about 50%), but its lifetime may be shorter depending on circumstances. To replace the lithium battery, contact your local dealer.

Vertical and horizontal clamps

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

Carrying case

- When using the carrying strap, be sure to attach the both hooks to the attachment holes on the carrying case.



Backing up data

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

Other precautions

- Close the external interface hatch before starting measurement. Otherwise, ambient light entering the USB port may adversely affect measurement results.
- If the ES is moved from a warm place to an extremely cold place, internal parts may contract and make the keys difficult to operate. This is caused by cold air trapped inside the hermetically sealed casing. If the keys do not depress, open the battery cover to resume normal functionality. To prevent the keys from becoming stiff, remove the connector caps before moving the ES to a cold place.
- Never place the ES directly on the ground. Sand or dust may cause damage to the screw holes or the centering screw on the base plate.
- Do not aim the telescope directly at the sun. Also, attach the lens cap to the telescope when not in use. Use the Solar filter to avoid causing internal damage to the instrument when observing the sun.
☞ “21. SPECIAL ACCESSORIES”
- Protect the ES from heavy shocks or vibration.
- Never carry the ES on the tripod to another site.
- Turn the power off before removing the battery.
- When placing the ES in its case, first remove its battery and place it in the case in accordance with the layout plan.
- 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

- 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 unit 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 unit.
- Store the ES 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.
☞ “18. CHECKS AND ADJUSTMENTS”
- When removing the ES from the carrying case, never pull it out by force. The empty carrying case should be closed to protect it from moisture.
- Check the ES for proper adjustment periodically to maintain the instrument accuracy.

Bluetooth Wireless Technology

- *Bluetooth* function may not be built in depending on telecommunications regulations of the country or the area where the instrument is purchased. Contact your local dealer for the details.
- 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. ㊦ “25. REGULATIONS”
- TOPCON CORPORATION 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 ES 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 ES 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 ES 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.
- Do not use the ES 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 ES in proximity to televisions and radios.
 - Televisions and radios use a different frequency band to *Bluetooth* communications. However, even if the ES is used within proximity to the above equipment with no adverse effects with regard to *Bluetooth* communication, moving a *Bluetooth* compatible device (including the ES) 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.
- Reduced range due to atmospheric conditions
 - The radio waves used by the ES 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.



- TOPCON CORPORATION cannot guarantee full compatibility with all *Bluetooth* products on the market.

Exporting this product (Relating EAR)

This product is equipped with the parts/units, and contains software/technology, which are subject to the EAR (Export Administration Regulations). Depending on countries you wish to export or bring the product to, a US export license may be required. In such a case, it is your responsibility to obtain the license. The countries requiring the license as of May 2013 are shown below. Please consult the Export Administration Regulations as they are subject to change.

North Korea
Iran
Syria
Sudan
Cuba

URL for the EAR of the US: <http://www.bis.doc.gov/policiesandregulations/ear/index.htm>

Exporting this product (Relating telecommunications regulations)

Wireless communication module is incorporated in the instrument. Use of this technology must be compliant with telecommunications regulations of the country where the instrument is being used.

Even exporting the wireless communication module may require conformity with the regulations.

Contact your local dealer in advance.

Exceptions from Responsibility

- 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.
- 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 instruction manual.
- The manufacturer, or its representatives, assumes no responsibility for damage caused by incorrect operation, or action resulting from connecting to other products.

LASER SAFETY INFORMATION

ES is classified as the following class of Laser Product according to IEC Standard Publication 60825-1 Ed.3.0: 2014 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 June 24, 2007.)

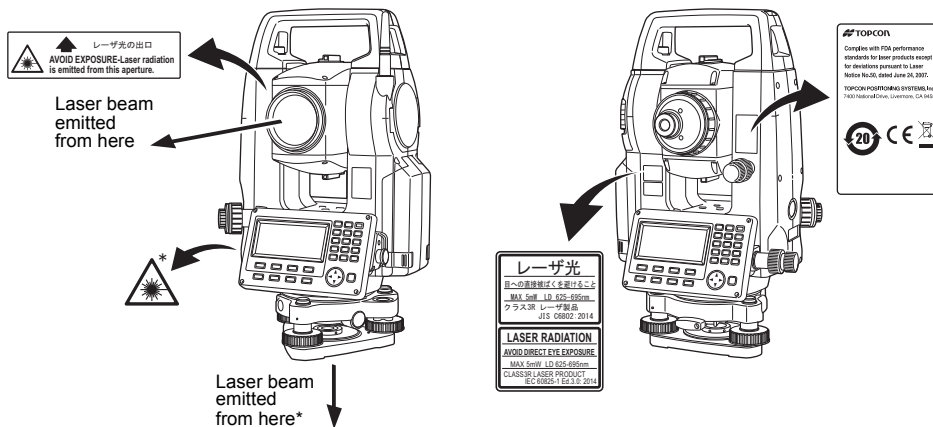
Device		Laser class
EDM device in objective lens	Light beam used for measurement (When reflectorless measurement is selected in Config mode)	Class 3R
	Light beam used for measurement (When prism or reflective sheet is selected as target in Config mode)	Class 1
	Laser-pointer	Class 3R
Laser plummet (option)		Class 2



- EDM device is classified as Class 3R Laser Product when reflectorless measurement is selected. When the prism or reflective sheet is selected in Config mode 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 product.



*: only for instruments with laser plummet (option)


- Never intentionally point the laser beam at another person. The laser beam is injurious to the eyes and skin. If an eye injury is caused by exposure to the laser beam, seek immediate medical attention from a licensed ophthalmologist.
- Do not look directly into the laser beam. Doing so could cause permanent eye damage.
- Do not stare at the laser beam. Doing so could cause permanent eye damage.
- Never look at the laser beam through a telescope, binoculars or other optical instruments. Doing so could cause permanent eye damage.
- Sight targets so that laser beam does not stray from them.

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.
- 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.
- After using the Laser-pointer function, be sure to turn OFF the emission of the laser beam.
- 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 laser is used should be posted with a standard laser warning sign.

Symbol mark while the laser is emitting

The following symbol mark will appear at the right side of the second line.

TILT SENSOR: [XY-ON]	
X: -0°00'25"	
Y: 0°00'20"	
X-ON XY-ON OFF ---	

Symbol mark

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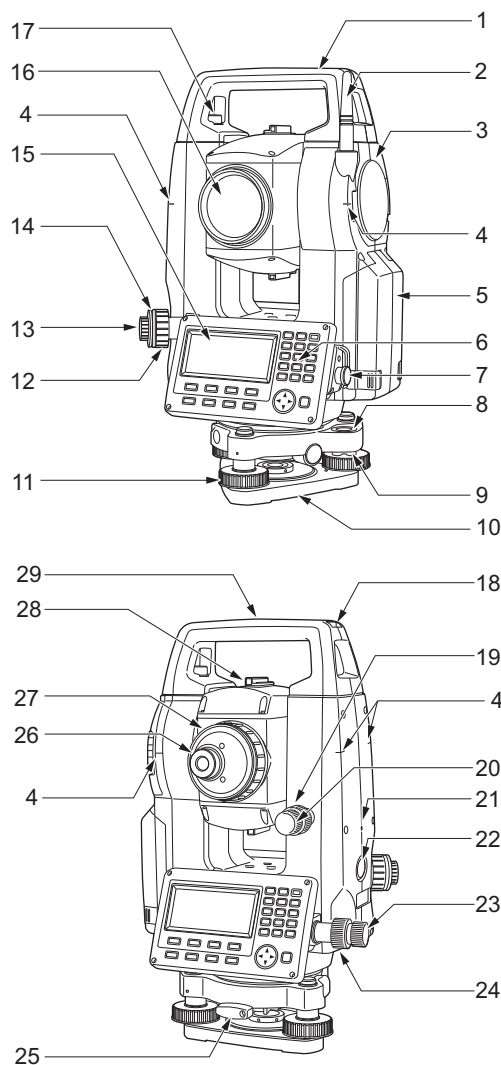
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Target for Laser plummet adjustment	APPENDIX-1

1 NOMENCLATURE AND FUNCTIONS

1.1 Nomenclature



- 1 Handle
- 2 Bluetooth antenna
- 3 External interface hatch (USB port)
- 4 Instrument height mark
- 5 Battery cover
- 6 Operation panel
- 7 Serial connector
- 8 Circular level
- 9 Circular level adjusting screws
- 10 Base plate
- 11 Levelling foot screw
- 12 Optical plummet focussing ring
- 13 Optical plummet eyepiece
- 14 Optical plummet reticle cover (12-14: Not included on instruments with laser plummet (option))
- 15 Display unit
- 16 Objective lens (Includes Laser-pointer function)
- 17 Handle locking screw
- 18 Tubular compass slot
- 19 Vertical clamp
- 20 Vertical fine motion screw
- 21 Speaker
- 22 Trigger key
- 23 Horizontal fine motion screw
- 24 Horizontal clamp
- 25 Tribach clamp
- 26 Telescope eyepiece screw
- 27 Telescope focussing ring
- 28 Sighting collimator
- 29 Instrument center mark

- **Sighting collimator**

Use sighting collimator to aim the ES in the direction of the measurement point. Turn the instrument until the triangle in the sighting collimator is aligned with the target.

- **Instrument height mark**

The height of the ES is as follows:

- 192.5mm (from tribrach mounting surface to this mark)
- 236mm (from tribrach dish (TR-103) to this mark)

"Instrument height" is input when setting instrument station data and is the height from the measuring point (where ES is mounted) to this mark.

- **Trigger Key**

Press the trigger key when the ES is in the observation screen or when **[MEAS]** is indicated on the display unit. You can start/stop measurement.

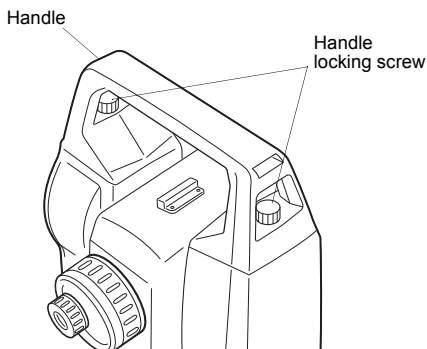
In the screen displaying **[AUTO]**, press trigger key to perform automatic operation from distance measurement to recording.

- **Laser-pointer Function**

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

- **Handle**

The handle can be removed from the instrument. To remove it, loosen the handle locking screw.




1.2 Display

- **Display**

The display uses a graphic LCD which has 4 lines and 20 characters per line. In general, the upper three lines display measured data, and the bottom line displays the soft key function which changes with the measuring mode.

- **Contrast and Illumination**

The contrast and illumination of display window are adjusted.  See Chapter 6 "SPECIAL MODE (Menu Mode)" or section 1.5 "Star key mode".

- **Example**

```
V : 90°10'20"
HR: 120°30'40"
OSET HOLD HSET P1↓
```

Angle measurement mode

V-angle : 90°10'20"
H-angle : 120°30'40"

Feet unit

```
HR: 120°30'40"
HD* 123.45 f
VD: 12.34 f
MEAS MODE NP/P P1↓
```

Horizontal-angle : 120°30'40"
Horizontal distance : 123.45ft
Relative elevation : 12.34ft

```
HR: 120°30'40"
HD* 65.432 m
VD: 12.345 m
MEAS MODE NP/P P1↓
```

Distance measurement mode

Horizontal-angle : 120°30'40"
Horizontal distance : 65.432m
Relative elevation : 12.345m

Feet and inch unit

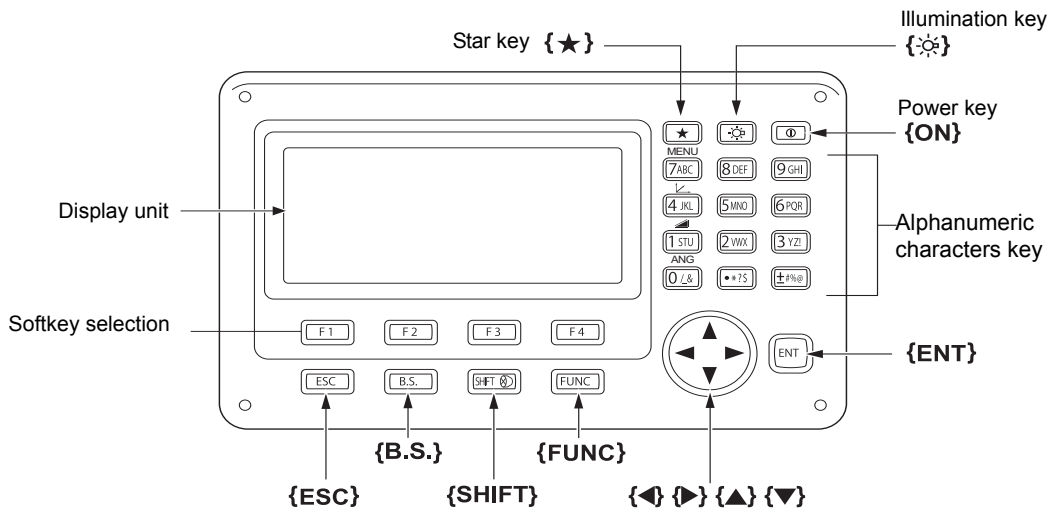
```
HR: 120°30'40"
HD* 123.04.6 f
VD: 12.03.4 f
MEAS MODE NP/P P1↓
```

Horizontal-angle : 120°30'40"
Horizontal distance : 123ft4in6/8in
Relative elevation : 12ft3in4/8in

● Display marks

Display	Contents	Display	Contents
V	V-angle	*	EDM working
HR	H-angle right	m	Meter unit
HL	H-angle left	f	Feet unit / Feet and inch unit
HD	Horizontal distance	N P	non-prism mode
VD	Relative elevation		Sheet mode
SD	Slope distance		Laser emitting mark
N	N coordinate		<i>Bluetooth</i> is under communication. (This symbol mark of the <i>Bluetooth</i> will be displayed above the battery mark when the pulse total station is in the state which can be communicated by <i>Bluetooth</i> .)
E	E coordinate		
Z	Z coordinate		

1.3 Operating Key



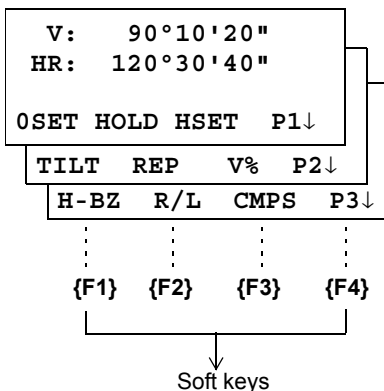
Keys	Name of Key	Function
{★}	Star key	Switches to Star key mode This mode is used for each presetting or displaying as follows. 1 Contrast of the display, 2 Reticle illumination, 3 Laser pointer, 4 Tilt correction, 5 Set audio mode, 6 Laser Plummet • Press {★} during Star key mode to go to the Tilt Screen. ☞ For levelling procedure: see Section 2.5.2 "Levelling".
{↙}	Coordinate meas.key	Switches to coordinate measurement mode
{▀}	Distance meas.key	Switches to distance measurement mode
{ANG}	Angle meas.key	Switches to angle measurement mode

Keys	Name of Key	Function
{MENU}	Menu key	Switches to menu mode Starts measurement applications and performs various settings
{☀}	Illumination key	Lights up the display unit and key Switches the screen/key backlight and Reticle illumination ON/OFF
{SHIFT ⇧}	Shift / Target key	Switches between target types (prism mode/sheet mode/non-prism mode)
{FUNC}	Function key	Not in use
{0} – {9} / {.} / {±}	Alphanumeric characters key	Input letters/figures ☞ For entering alphanumeric characters, see Section 2.4 “How to Enter Alphanumeric Characters”.
{ESC}	Escape key	<ul style="list-style-type: none"> ● Returns to the measurement mode or previous layer mode from the mode set ● Switches to data collection mode or layout mode directly from the normal measurement mode ● It is also possible to use as Record key in normal measurement mode. ☞ For selecting function of Escape key, see Chapter 17 “SELECTING MODE” .
{ENT}	Enter key	Selects/accepts input word/value
{⏻}	Power key	Turns ON/OFF of power source (Power OFF: Press and hold: About 1 second)
{F1} – {F4}	Soft key (Function key)	Respond to the message displayed.

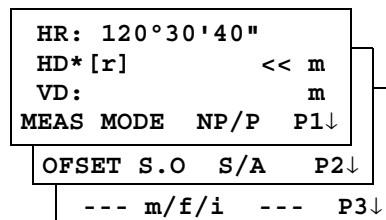
1.4 Function Key (Soft Key)

The Soft Key message is displayed at the bottom line of display. The functions are according to the displayed message.

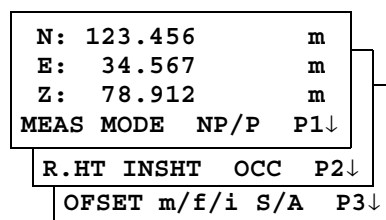
Angle measurement mode



Distance measurement mode



Coordinates measurement mode



Angle measurement

Page	Soft key	Display mark	Function
1	{F1}	0SET	Angle of Horizontal is set to 0°00'00"
	{F2}	HOLD	Hold the horizontal angle.
	{F3}	HSET	Sets a required horizontal angle by entering numerals.
	{F4}	P1↓	The function of soft keys is shown on next page (P2).
2	{F1}	TILT	Setting Tilt Correction If ON, the display shows tilt correction value.
	{F2}	REP	Repetition angle measurement mode
	{F3}	V%	Vertical angle percent grade(%) mode
	{F4}	P2↓	The function of soft keys is shown on next page (P3).
3	{F1}	H-BZ	Sets the buzzer sound for every horizontal angle 90°.
	{F2}	R/L	Switches R/L rotation of horizontal angle.
	{F3}	CMPS	Switches the COMPASS ON/OFF of vertical angle.
	{F4}	P3↓	The function of soft keys is shown on next page (P1).

Distance measurement mode

1	{F1}	MEAS	Start measuring
	{F2}	MODE	Sets a measuring mode, Fine/Coarse/Tracking.
	{F3}	NP/P	Switches non-prism mode, prism mode or sheet mode.
	{F4}	P1↓	The function of soft keys is shown on next page (P2).
2	{F1}	OFSET	Select Off-set measurement mode.
	{F2}	S.O	Select stake out measurement mode.
	{F3}	S/A	Select set audio mode.
	{F4}	P2↓	The function of soft keys is shown on next page (P3).
3	{F2}	m/f/i	Switches meter, feet or feet and inch unit.
	{F4}	P3↓	The function of soft keys is shown on next page (P1).

Coordinate measurement mode

1	{F1}	MEAS	Start measuring.
	{F2}	MODE	Sets a measuring mode, Fine/Coarse/Tracking.
	{F3}	NP/P	Switches non-prism mode, prism mode or sheet mode.
	{F4}	P1↓	The function of soft keys is shown on next page (P2).
2	{F1}	R.HT	Sets a prism height by input values.
	{F2}	INSHT	Sets an instrument height by input values.
	{F3}	OCC	Sets an instrument coordinate point by input values.
	{F4}	P2↓	The function of soft keys is shown on next page (P3).
3	{F1}	OFSET	Select Off-set measurement mode.
	{F2}	m/f/i	Switches meter, feet or feet and inch unit.
	{F3}	S/A	Select set audio mode.
	{F4}	P3↓	The function of soft keys is shown on next page (P1).

1.5 Star key mode

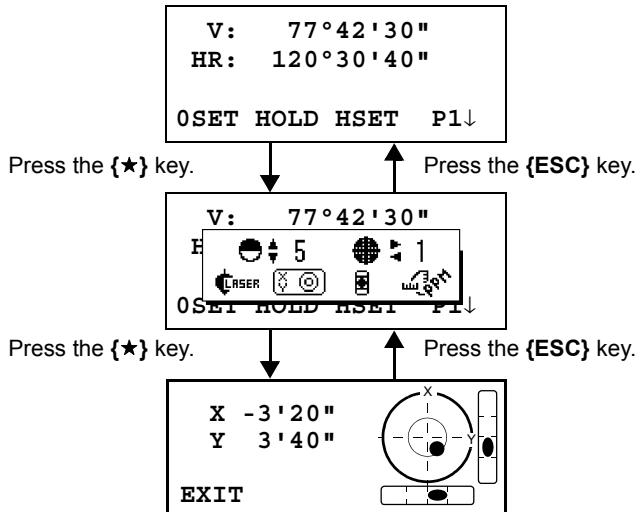
Press the {★} key to view the instrument options.

The following instrument options can be selected from the {★}:

1. Adjustment the contrast of the display (0 to 15 steps) {▲} or {▼}
2. Adjustment the reticle illumination (1 to 5 steps) {◀} or {▶}
3. Turn the Laser pointer option ON/OFF
4. Setting Tilt Correction
5. S/A (set audio) mode
6. Adjustment the contrast of the laser plummet (1 to 5 steps) {▲} or {▼}
7. Turn the Laser plummet option ON/OFF



- Star key mode does not function when the same function as the function assigned to the star key mode is performed from the main routine.
- Press {★} during Star key mode to go to the Tilt Screen.
 For levelling procedure: see Section 2.5.2 "Levelling".



key	Display mark	Function
{F1}		Turn the Laser plummet option ON/OFF
{F2}		Setting Tilt Correction If ON, the display shows tilt correction value.
{F3}		Turn the Laser pointer option ON / OFF [/]
{F4}		The light acceptance quantity level for the EDM (SIGNAL), the atmospheric correction value (PPM) and correction value of prism constant (PSM / NPM / SHT) are displayed.*1)
{▲} or {▼}		Adjust the contrast of the display (0 to 15 steps)
{◀} or {▶}		Adjust the Reticle Illumination (1 to 5 steps) ON/OFF of the reticle illumination is linked with ON/OFF of the backlight.
{▲} or {▼}		Adjust the laser plummet brightness (1 to 5 steps) (displayed only when the laser plummet is ON)

- **Adjustment the contrast (0 to 15) of the display**

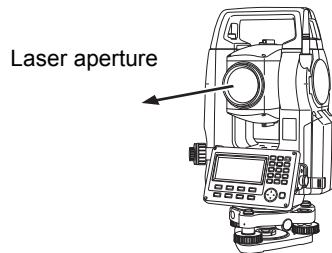
This enable you to adjust the contrast of the display.
Press the up or down arrow keys to adjust the contrast.

- **Adjustment the reticle illumination (1 to 5)**

This enable you to adjust the reticle illumination.
Press the right or left arrow keys to adjust the reticle illumination.
The switch of reticle illumination will be interlocked with the switch of display backlight.

- **Lighting and Extinguishing of Laser Pointer**

Whenever the {F3} key is pressed, the laser pointer will light up or be extinguished, in that order.
The laser pointer assists with collimation by radiating visible laser light from the objective lens to the target.



- The laser pointer indicates the approximate collimation position of the telescope. It does not indicate the exact collimation position.
- You cannot see the laser pointer when looking through the telescope. Therefore, please look directly, with the naked eye, at the point indicated by the laser pointer.
- The distance to which the laser pointer can be used will vary with climatic conditions and with the eyesight of the user.
- When the laser pointer is used, the operating time of internal power source will become short.

- **Tilt correction**

The tilt setting mode performed here will not be memorized after powering OFF. To set TILT correction in the initialized setting (it is memorized after powering OFF), see Section 6.4.3 "Vertical and Horizontal Angle Tilt correction (Tilt ON/OFF)".

- **Set audio mode**

The light acceptance quantity level (Signal level) is displayed in this mode.
When reflected light from the prism is received, a buzzer sounds. This function is good for easy collimation when the target is difficult to find.
Press the {F4} key to view the set audio screen.
☞ To stop the buzzer, refer to Chapter 17 "SELECTING MODE".
Also, it is possible to display the signal level in Distance Measuring Mode.

The temperature, pressure, PPM, PSM and NPM can be viewed in set audio mode.

☞ Refer to Chapter 10 "SET AUDIO MODE", Chapter 11 "SETTING THE PRISM CONSTANT VALUE" and Chapter 12 "SETTING ATMOSPHERIC CORRECTION", for further instructions.

1.6 Serial signal RS-232C connector


The serial signal connector is used for connecting the ES with a computer or TOPCON Data Collector, which enables the computer to receive measured data from the ES or to send preset data of horizontal angle, etc. to it.

The following data will be output at each mode.

Mode	Output
Angle mode (V, HR or HL) (V in percent)	V, HR (or HL)
Horizontal distance mode (HR, HD, VD)	V, HR, HD, VD
Slope distance mode (V, HR, SD)	V, HR, SD, HD
Coordinate mode	N, E, Z, HR (or V, HR, SD, N, E, Z)

Note

- The display and the output at the coarse mode are the same as the contents above.
- Output at the tracking mode is displayed as distance data only.

 The details necessary for the connection with the ES are obtained from the ES-60 series Interface Manual which is optionally available. Please refer to the manual.

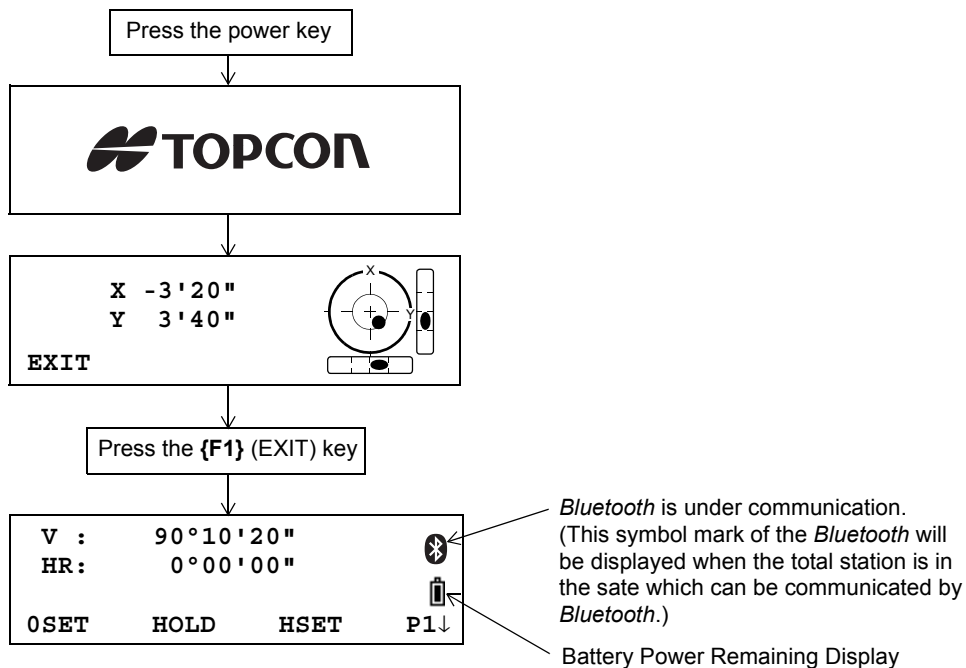
1.7 Bluetooth communication (Only for built-in *Bluetooth* model)

By built-in *Bluetooth*, it can communicate with *Bluetooth* instruments by wireless, without connecting a serial signal connector.

2 PREPARATION FOR MEASUREMENT

2.1 Power Switch Key ON

- 1 Confirm the instrument is leveled.
- 2 Press the power key.



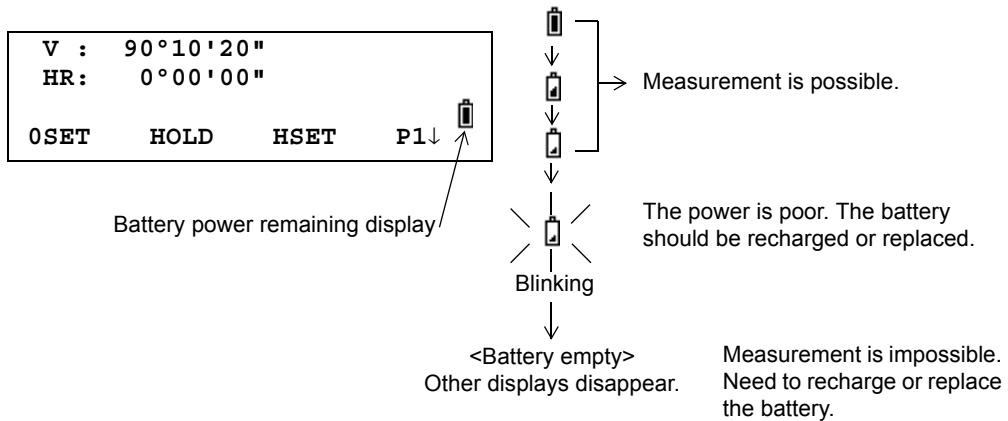
- Confirm the battery power remaining display. Replace with charged battery or charge when battery level is low or indicates "Battery empty". See Section 2.2 "Battery Power Remaining Display".
- **Contrast adjustment**
You can confirm prism constant value (PSM), non-prism constant value (NPM), sheet constant value (SHT), atmospheric correction value (PPM) and you can also adjust the contrast of the display when the instrument is turned on.
 To display this screen, see Chapter 17 "SELECTING MODE".

CONTRAST ADJUSTMENT			
PSM:	0.0	PPM	0.0
NPM:	0.0	SHT:	0.0
↓	↑	- - -	ENTER

This enables you to adjust the brightness by pressing the **{F1}** (↓) or **{F2}** (↑) key. To memorize the setting value after powering off, press **{F4}** (ENTER) key.

2.2 Battery Power Remaining Display

Battery power remaining display indicates the power condition.

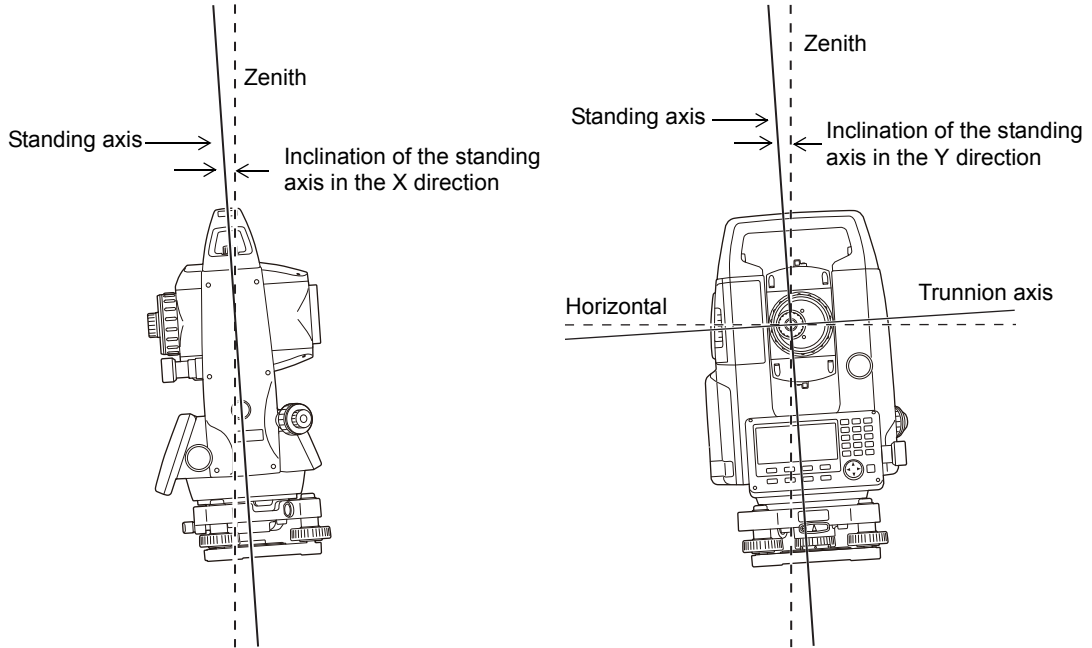


- The battery operating time will vary depending on the environmental conditions such as ambient temperature, charging time, the number of times of charging and discharging etc. It is recommended for safety to charge the battery beforehand or to prepare spare full charged batteries.
- For general usage of the battery, see Chapter 14 "POWER SOURCE AND CHARGING".
- The battery power remaining display shows the power level regarding to the measurement mode now operating.
The safety condition indicated by the battery power remaining display in the angle measurement mode does not necessarily assure the battery's ability to be used in the distance measurement mode.
It may happen that the mode change from the angle mode to the distance mode will stop the operation because of insufficient battery power for the distance mode which consumes more power than angle mode.

2.3 Vertical and Horizontal Angle Tilt Correction

When the tilt sensors are activated, automatic correction of vertical and horizontal angle for mislevelment is displayed.

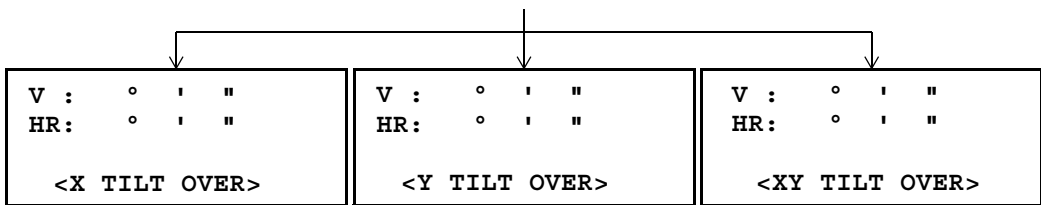
To ensure a precise angle measurement, tilt sensors must be turned on. The display can also be used to fine level the instrument. If the (TILT OVER) display appears the instrument is out of automatic compensation range and must be leveled manually.



Note

- ES compensates both the vertical angle and the horizontal angle readings due to inclination of the standing axis in the X and Y directions.

When the instrument is out of compensation. (TILT OVER)



Standing Axis in the X direction
out of range

Standing Axis in the Y direction
out of range

Standing Axis in the X and Y
directions out of range

- The display of Vertical or Horizontal angle is unstable when instrument is on an unstable stage or a windy day. You can turn off the auto tilt correction function of V/H angle in this case.
- To set auto tilt correction from the moment that power is on, See Section 6.4.3 "Vertical and Horizontal Angle Tilt correction (Tilt ON/OFF)".

- **Setting Tilt Correction by Soft Key**

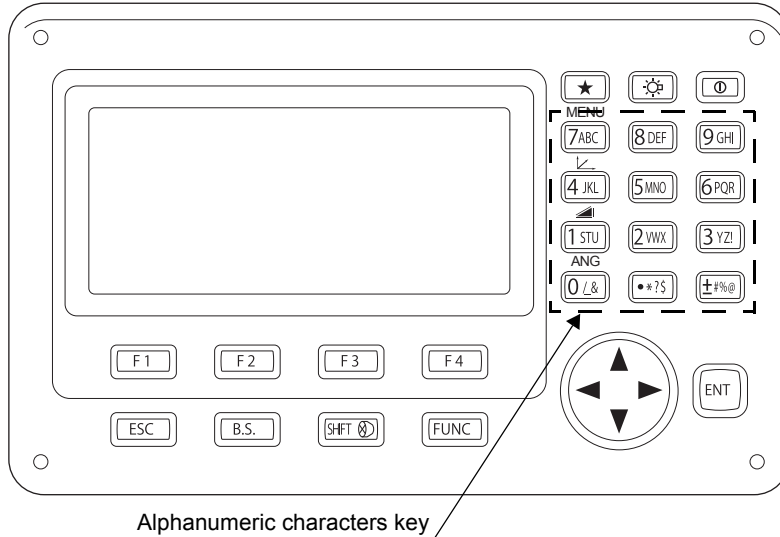
To enable you to select tilt ON/OFF function. setting is not memorized after power is OFF.

[Example] Setting X,Y Tilt OFF

Operating procedure	Option	Display
1 Press {F4} key to get the function page 2.	{F4}	<pre>V : 90°10'20" HR: 120°30'40" OSET HOLD HSET P1↓ TILT REP V% P2↓</pre>
2 Press {F1} (TILT) key. In case ON is already selected, the display shows tilt correction value.	{F1}	<pre>TILT SENSOR: [XY-ON] X: -0°00'25" Y: 0°00'20" X-ON XY-ON OFF ---</pre>
3 Press {F3} (OFF) key.	{F3}	<pre>TILT SENSOR: [OFF] X-ON XY-ON OFF ---</pre>
4 Press {ESC} key.	{ESC}	<pre>V : 90°10'20" HR: 120°30'40" OSET HOLD HSET P1↓</pre>
<ul style="list-style-type: none"> ● The setting mode performed here will not be memorized after powering OFF. To set TILT correction in the initialized setting (it is memorized after powering OFF), See Section 6.4.3 "Vertical and Horizontal Angle Tilt correction (Tilt ON/OFF)". 		

2.4 How to Enter Alphanumeric Characters

This enables you to enter alphanumeric characters such as the instrument height, prism height, occupied point, backsight point etc.



Keys	Name of Key	Function
{0} – {9}	Number key	During numeric input, input number of the key. During alphabetic input, input the characters displayed above the key in the order they are listed.
{.} / {±}	Decimal point key/ Plus-minus sign key	Input a decimal point/plus or minus sign during numeric input. During alphabetic input, input the characters displayed above the key in the order they are listed.
{◀} / {▶}	Cursor key	Right and left cursor/Select other option.
{▲} / {▼}	Cursor key	Up and down cursor.
{ESC}	Escape key	Cancel the input data.
{B.S.}	Backspace key	Delete a character on the left.
{ENT}	Enter key	Select/accept input word/value.

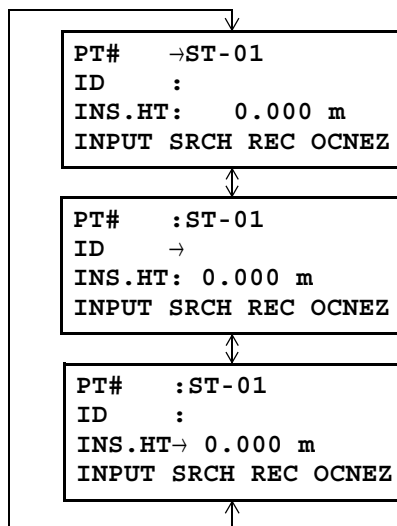
● **How to select a item**

[Example setting] Occupied point in the data collection mode.

The arrow indicates a item to enter.

The arrow line moves up or down when the {▼} key or {▲} key is pressed.

{▼}
or
{▲}



● **How to enter characters**

[Example setting] TOPCON-1

- 1 Move the arrow to enter a item using the {▼} or {▲} key.

```
PT#   →
ID    :
INS.HT: 0.000 m
INPUT SRCH REC OCNEZ
```

- 2 Press the {F1} (INPUT) key. The arrow changes to the equal (=). The instrument switches to numerical input mode.

```
PT#   =
ID    :
INS.HT: 0.000 m
[ALP] [SPC] [CLR] [ENT]
```

- 3 Press the {F1} ([ALP]) key. The instrument switches to alphabetical input mode.

```
PT#   =
ID    :
INS.HT: 0.000 m
[NUM] [SPC] [CLR] [ENT]
```

- 4 Enter letters of the alphabet by pressing the alphanumeric characters key. Example: {1} (STU) key is pressed twice.

```
PT#   =T
ID    :
INS.HT: 0.000 m
[NUM] [SPC] [CLR] [ENT]
```

- 5 Enter other letters of the alphabet in the same way.

```
PT#   =TOPCON
ID    :
INS.HT: 0.000 m
[NUM] [SPC] [CLR] [ENT]
```

- 6** Press the **{F1}** (NUM) key, again.
The instrument switches back to numerical input mode.

```
PT#    =TOPCON
ID     :
INS.HT: 0.000 m
[ALP] [SPC] [CLR] [ENT]
```

- 7** Enter numbers by pressing the alphanumeric characters key.

Example: **{ - }, {1}** key is pressed.

```
PT#    =TOPCON-1
ID     :
INS.HT: 0.000 m
[ALP] [SPC] [CLR] [ENT]
```

- 8** Press **{F4}** (ENT) key.
The arrow moves to next item.

Select next character in the same manner.

Note

- To correct a character, move the cursor to correct character by pressing **{◀}** or **{▶}** key and enter again.

2.5 Setting Instrument Up for Measurement

Mount the instrument to the tripod. Level and center the instrument precisely to insure the best performance. Use tripods with a tripod screw of 5/8 in. diameter and 11 threads per inch, such as the Type E TOPCON wide- frame wooden tripod.

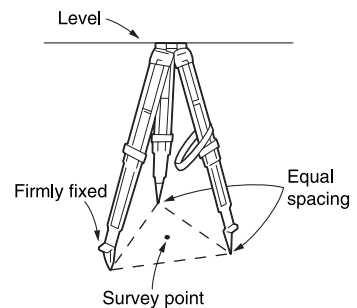


- Mount the battery in the instrument before performing this operation because the instrument will tilt slightly if the battery is mounted after levelling.

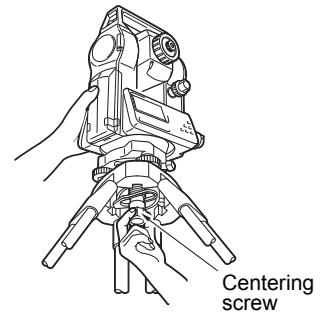
2.5.1 Centering

● PROCEDURE: Centering with the optical plummet eyepiece

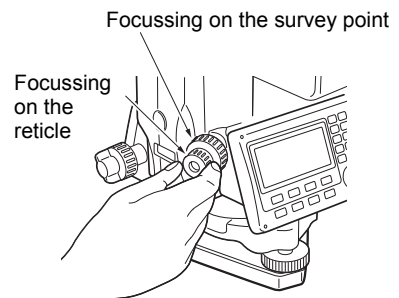
- 1 Make sure the legs are spaced at equal intervals and the head is approximately level.
Set the tripod so that the head is positioned over the survey point.
Make sure the tripod shoes are firmly fixed in the ground.



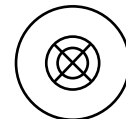
- 2 Place the instrument on the tripod head.
Supporting it with one hand, tighten the centering screw on the bottom of the unit to make sure it is secured to the tripod.



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



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



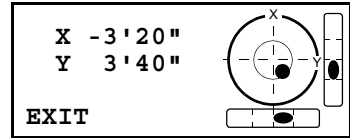
- 5 Continue to the levelling procedure.
☞ See Section 2.5.2 "Levelling".

● **PROCEDURE: Centering with the laser plummet (Option)**

1 Set up the tripod and affix the instrument on the tripod head.
 [F] "PROCEDURE: Centering with the optical plummet eyepiece" steps 1 and 2

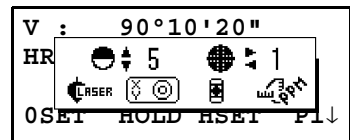
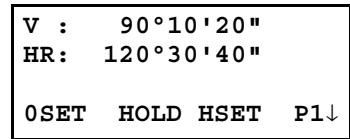
2 Press {ON} to power on
 [F] See Section 2.1 "Power Switch Key ON".

• The circular level is displayed on the screen.

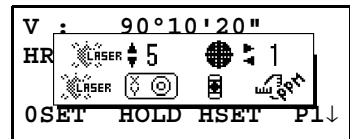


3 Press {F1} to display observation screen.

4 Press {★} to display star key menu, and then press {F1}.
 The laser plummet beam will be emitted from the bottom of the instrument.



5 Use {▲} / {▼} to adjust the brightness of the laser.



6 Adjust the levelling foot screws to align the laser beam with the center the survey point.

7 Press {F1} to turn the laser plummet off.


8 Continue to the levelling procedure.
 [F] See Section 2.5.2 "Levelling".

Note

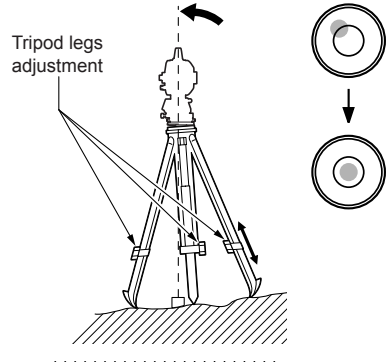
- Visibility of the laser spot may be affected when operating in direct sunlight. In this event, provide shade for the survey point.


2.5.2 Levelling

● **PROCEDURE**


- 1 Perform the centering procedure.
 See Section 2.5.1 "Centering".
- 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.

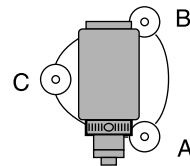
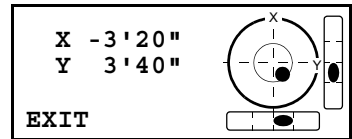
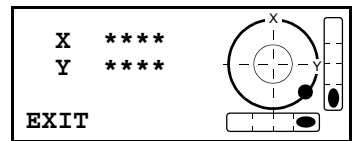
Turn the levelling foot screws while checking the circular level until the bubble is centered in the center circle.



- 3 Press **{ON}** to power on.
 See Section 2.1 "Power Switch Key ON".
- The circular level is displayed on the screen.
 - "●" indicates bubble in circular level. The range of the inside circle is $\pm 4'$ and the range of the outside circle is $\pm 6'$. Tilt angle values X and Y are also displayed on the screen.
 - "●" is not displayed when the tilt of the instrument exceeds the detection range of the tilt sensor. Level the instrument while checking the air bubbles in the circular level until "●" is displayed on the screen.

 **Note**

- When executing the measurement program, if measurement starts with the instrument tilted, the circular level is displayed on the screen.
- 4 Center "●" in the circular level
 steps 1 to 2
 - If the bubble is centered, move to step 9.
 - 5 Turn the instrument until the telescope is parallel to a line between levelling foot screws A and B, then tighten the horizontal clamp.



- 6 Set the tilt angle to 0° using foot screws A and B for the X direction and levelling screw C for the Y direction.

- 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.
- When the instrument was centered using the laser plummet, emit the plummet beam again to check position over the survey point.
☞ See "PROCEDURE: Centering with the laser plummet (Option)"
- 8 Confirm that the bubble is positioned at the center of the circular level on the screen.
If not, repeat the procedure starting from step 6.
- 9 When levelling is completed, press **{OK}** changes to the observation screen.

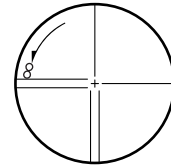
2.6 FOCUSING AND TARGET SIGHTING



- 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 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 Loosen the vertical and horizontal clamps, then use the sighting collimator to bring the target into the field of view. Tighten both clamps.
- 3 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 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.

3 ANGLE MEASUREMENT

3.1 Measuring Horizontal Angle Right and Vertical Angle

Make sure the mode is in Angle measurement.

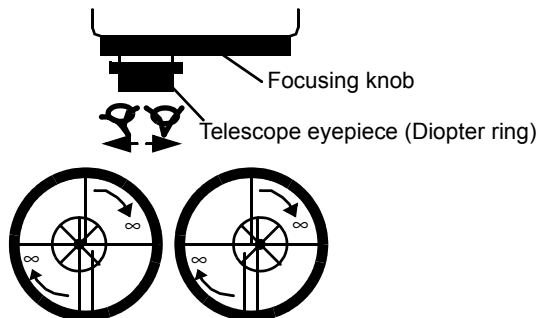
Operating procedure	Operation	Display
1 Collimate the 1st target (A).	Collimate A	V : 90°10'20" HR: 120°30'40" 0SET HOLD HSET P1↓
2 Set horizontal angle of target A at 0° 00' 00". Press the {F1} (0 set) key and press the {F3} (YES) key.	{F1}	H ANGLE 0 SET > OK? --- --- [YES] [NO]
	{F3}	V : 90°10'20" HR: 0°00'00" 0SET HOLD HSET P1↓
3 Collimate the 2nd target (B). The required V/H angle to target B will be displayed.	Collimate B	V : 98°36'20" HR: 160°40'20" 0SET HOLD HSET P1↓



● How to Collimate

- 1 Point the telescope toward the light. Turn the diopter ring and adjust the diopter so that the cross hairs are clearly observed.
(Turn the diopter ring toward you first and then backward to focus.)
- 2 Aim the target at the peak of the triangle mark of the sighting collimator. Allow a certain space between the sighting collimator and yourself for collimating.
- 3 Focus the target with the focusing knob.

* If parallax is created between the cross hairs and the target when viewing vertically or horizontally while looking into the telescope, focusing is incorrect or diopter adjustment is poor. This adversely affects precision in measurement or survey. Eliminate the parallax by carefully focusing and using diopter adjustment.



3.2 Switching Horizontal Angle Right/Left

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
1 Press the {F4} (↓) key twice to get the function on page 3.	{F4} twice	<div style="border: 1px solid black; padding: 2px;"> V : 90°10'20" HR: 120°30'40" 0SET HOLD HSET P1↓ TILT REP V% P2↓ H-BZ R/L CMPS P3↓ </div>
2 Press the {F2} (R/L) key. The mode Horizontal angle Right (HR) switches to (HL) mode.	{F2}	<div style="border: 1px solid black; padding: 2px;"> V : 90°10'20" HL: 239°29'20" H-BZ R/L CMPS P3↓ </div>
3 Measure as HL mode.		
<ul style="list-style-type: none"> Every time pressing the {F2} (R/L) key, HR/HL mode switches. 		

3.3 Measuring from the Required Horizontal Angle

3.3.1 Setting by Holding the Angle

Make sure the mode is angle measurement.

Operating procedure	Operation	Display
1 Set the required horizontal angle, using Horizontal tangent screw	Display angle	<div style="border: 1px solid black; padding: 2px;"> V : 90°10'20" HR: 130°40'20" 0SET HOLD HSET P1↓ </div>
2 Press the {F2} (HOLD) key.	{F2}	<div style="border: 1px solid black; padding: 2px;"> H ANGLE HOLD HR: 130°40'20" >SET ? --- --- [YES] [NO] </div>
3 Collimate the target.	Collimate	
4 Press the {F3} (YES) key to finish holding the horizontal angle.*1) The display turns back to normal angle measurement mode.	{F3}	<div style="border: 1px solid black; padding: 2px;"> V : 90°10'20" HR: 130°40'20" 0SET HOLD HSET P1↓ </div>
<p>*1) To return to the previous mode, press the {F4} (NO) key.</p>		

3.3.2 Setting a Horizontal Angle from the Keys

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
1 Collimate the target.	Collimate	V : 90°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓
2 Press the {F3} (HSET) key.	{F3}	H ANGLE SET HR= --- --- [CLR] [ENT]
3 Input the required horizontal angle by using keys. *1) For example:70°40'20" When completed, normal measuring from the required Horizontal angle is possible.	70.4020 {F4}	V : 90°10'20" HR: 70°40'20" 0SET HOLD HSET P1↓
*1) To enter Alphanumeric characters, see Section 2.4 "How to Enter Alphanumeric Characters".		

3.4 Vertical Angle Percent Grade(%) Mode

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
1 Press the {F4} (↓) key to get the function on page 2.	{F4}	V : 90°10'20" HR: 70°40'20" 0SET HOLD HSET P1↓ TILT REP V% P2↓
2 Press the {F3} (V%) key. *1)	{F3}	V : -0.30 % HR: 170°30'20" TILT REP V% P2↓
*1) Every time pressing the {F3} (V%) key, the display mode switches. ● When the measurement is carried out over ±45° (±100%) from the horizontal, the display shows <OVER>.		

3.5 Repetition Angle Measurement



- Repetition angle measurement can be done by horizontal angle right measurement mode.

Make sure the mode is Horizontal Angle Right measurement.


Operating procedure	Operation	Display
1 Press the {F4} (↓) key to get the function on page 2.	{F4}	<pre>V : 90°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓ TILT REP V% P2↓</pre>
2 Press the {F2} (REP)key.	{F2}	<pre>REPETITION ANGLE >OK? --- --- [YES] [NO]</pre>
3 Press the {F3} (YES) key.	{F3}	<pre>REP-ANGLE COUNT [0] Ht: 0°00'00" Hm: 0SET V/H REL HOLD</pre>
4 Collimate the target A and press the {F1} (0SET) key.	Collimate A {F1}	<pre>REPETITION ANGLE INITIALIZE >OK? --- --- [YES] [NO]</pre>
5 Press the {F3} (YES) key.	{F3}	<pre>REP-ANGLE COUNT [0] Ht: 0°00'00" Hm: 0SET V/H REL HOLD</pre>
6 Collimate the target B using the horizontal clamp and tangent screw. Press the {F4} (HOLD) key.	Collimate B {F4}	<pre>REP-ANGLE COUNT [1] Ht: 45°10'00" Hm: 45°10'00" 0SET V/H REL HOLD</pre>
7 Recollimate target A using the horizontal clamp and tangent screw, and press the {F3} (REL)key.	Collimate A {F3}	<pre>REP-ANGLE COUNT [1] Ht: 45°10'00" Hm: 45°10'00" 0SET V/H REL HOLD</pre>
8 Recollimate target B using the horizontal clamp and tangent screw, and press the {F4} (HOLD) key.	Collimate B {F4}	<pre>REP-ANGLE COUNT [2] Ht: 90°20'00" Hm: 45°10'00" 0SET V/H REL HOLD</pre>
9 Repeat 7 to 8 to measure the desired number of repetitions.		<pre>REP-ANGLE COUNT [4] Ht: 180°40'00" Hm: 45°10'00" 0SET V/H REL HOLD</pre>

[Example] 4 measurement

<p>10 To return to the normal angle mode, press the {F2} (V/H) key or {ESC} key.</p>	<p>{ESC} or {F2}</p>	<pre> REPETITION ANGLE Exit >OK? --- --- [YES] [NO] </pre>
<p>11 Press the {F3} (YES) key.</p>	<p>{F3}</p>	<pre> V : 90°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓ </pre>
<ul style="list-style-type: none"> • Horizontal angle can be accumulated up to (3600°00'00" – minimum reading) (horizontal angle right). In case of 5 second reading, horizontal angle can be accumulated up to +3599°59'55". • Error will be displayed when the results differ from first measurement by more than ±30". 		

3.6 Buzzer Sounding for Horizontal Angle 90° Increments

When the horizontal angle falls in the range of less than $\pm 1^\circ$ of 0° , 90° , 180° or 270° , the buzzer sounds. Buzzer stops only when the horizontal angle is adjusted to $0^\circ00'00''$, $90^\circ00'00''$, $180^\circ00'00''$ or $270^\circ00'00''$.

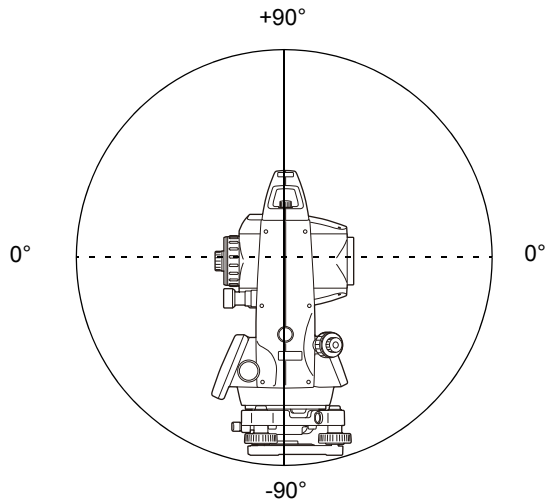
This setting is not memorized after powering off.  Refer to 17 "SELECTING MODE" to set the initial setting (memorized after powering off).

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
<p>1 Press the {F4} (↓) key twice to get the function on page 3.</p>	<p>{F4} twice</p>	<pre> V : 90°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓ H-BZ R/L CMPS P3↓ </pre>
<p>2 Press the {F1} (H-BZ) key. The data previously set is shown.</p>	<p>{F1}</p>	<pre> H-ANGLE BUZZER [OFF] [ON] [OFF] --- ENTER </pre>
<p>3 Press the {F1} (ON) key or {F2} (OFF) key to select the buzzer ON/OFF.</p>	<p>{F1} or {F2}</p>	<pre> H-ANGLE BUZZER [ON] [ON] [OFF] --- ENTER </pre>
<p>4 Press the {F4} (ENTER) key.</p>	<p>{F4}</p>	<pre> V : 90°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓ </pre>

3.7 Compasses (vertical angle)

Vertical angle is displayed as shown below.



Operating procedure	Operation	Display
1 Press the {F4} (↓) key twice to get the function on page 3. 2 Press the {F3} (CMPS) key. *1)	{F4} twice {F3}	V : 98°10'20" HR: 170°30'20" 0SET HOLD HSET P1↓ H-BZ R/L CMPS P3↓
		V : - 8°10'20" HR: 170°30'20" H-BZ R/L CMPS P3↓
*1) Every time pressing the {F3} (CMPS) key, the display mode switches.		

4 DISTANCE MEASUREMENT

⚠ 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. ES 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 obstructs the light beam used for measurement or an object is positioned with a high reflective factor (metal or white surface) behind 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.


● Target type (Prism mode / Non-prism Mode / Sheet mode)

Measurement mode can be selected depending on the object to measure; prism mode, non-prism mode (objects other than prism), and sheet mode.

- Regardless of whether the laser pointer is used, measurement is possible with both the non-prism mode, sheet mode and the prism mode. That is, when the ES is used in the open air, in an urban area, etc., the laser pointer can be stopped and distance measurement then conducted, making it possible to prevent the laser light from hitting a third party.
- For measurement with a prism, be sure to measure with the prism mode. If you measure with the non-prism mode and sheet mode accuracy cannot be guaranteed.
- Non-prism mode enable all distance measurements such Distance measurement, Coordinate measurement, Offset measurement and Layout.
- To switch over Prism mode to Non-prism mode or sheet mode, press the **[NP/P]** soft key in each measurement display.

When selecting non-prism or sheet mode, the icon on the right side of the screen indicates the currently selected mode.

Non-prism mode: []

Sheet mode: []

Changing mode shall be done before measurement.

Example Distance measurement mode

```

HR: 120°30'40"
HD* 65.432 mNP
VD: 12.345 m
MEAS MODE NP/P P1↓
  
```


Non-prism
mode
indicator

Coordinate measurement mode


```

N: 120.456 m
E: 34.567 mNP
Z: 12.345 m
MEAS MODE NP/P P1↓
  
```


To change the mode, press the **[NP/P]** soft key in each measurement.

- It is possible to set Non-prism mode for distance measurement during the power on time.  Refer to 16.SELECTING MODE to set the option.
- If happened collimating the near distance prism in Non-prism mode, measurement will not be done because of too much light.

4.1 Setting of the Atmospheric Correction

When setting the atmospheric correction, obtain the correction value by measuring the temperature and pressure.  Refer to Section 12.2 "Setting of Atmospheric Correction Value".

4.2 Setting of the Correction for Prism Constant








Topcon's prism constant value is 0. Set correction for prism at 0. If the prism is of another manufacture, the appropriate constant shall be set beforehand.  Refer to Chapter 11 "SETTING THE PRISM CONSTANT VALUE". The setting value is kept in the memory even after power is off.



- Confirm that Non-prism correction value is set at zero before measurement target such as a wall in Non-prism mode or sheet mode.

4.3 Distance Measurement (Continuous Measurement)

Make sure the mode displays angle measurement.





Operating procedure	Operation	Display
1 Collimate the center of prism.	Collimate P	<pre>V : 90°10'20" HR: 120°30'40" 0SET HOLD HSET P1↓</pre>
2 Press the  key. Distance measurement starts. *1),2)		<pre>HR: 120°30'40" HD* [r] << m VD: m MEAS MODE NP/P P1↓</pre>
The measured distances are shown. *3)~*5)		↓
		<pre>HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓</pre>
<ul style="list-style-type: none"> • Pressing the  key again, the display changes to horizontal (HR) and vertical (V) angle and slope distance(SD). *6) 		<pre>V : 90°10'20" HR: 120°30'40" SD* 131.678 m MEAS MODE NP/P P1↓</pre>
<p>*1) When EDM is working, the "*" mark appears in the display.</p> <p>*2)  To change mode from Fine to Coarse or Tracking, refer to section 4.5 "Fine Mode/Tracking Mode/Coarse Mode".  To set the distance measurement on when the instrument is powered on, refer to Chapter 17 "SELECTING MODE".</p> <p>*3) The distance unit indicator "m" (for meter), "f" (for feet or feet inch) appears and disappears alternatively with buzzer sounds at every renewal of distance data.</p> <p>*4) Measurement may repeat automatically in the instrument if the result is affected by shimmer etc.</p> <p>*5) To return to the normal measuring angle mode from a distance measuring mode, press the {ANG} key.</p> <p>*6) It is possible to choose the display order (HR, HD, VD) or (V, HR, SD) for initial measuring distance mode.  Refer to Chapter 17 "SELECTING MODE".</p>		

4.4 Distance Measurement (N-time Measurement/Single Measurement)

When the number of times measurement is preset, the ES measures the distance the set number of times. The average distance will be displayed.


When presetting the number of times as 1, it does not display the average distance, because of single measurement. Single measurement is set at the factory.

Make sure the mode displays angle measurement.

Operating procedure	Operation	Display
1 Collimate the center of prism.		V : 90°10'20" HR: 120°30'40" 0SET HOLD HSET P1↓
2 Press the  key. Continuous measuring starts.*1)		HR: 120°30'40" HD* [r] << m VD: m MEAS MODE NP/P P1↓
3 Press {F1} (MEAS) key while continuous measuring is exceeding. *2) The average value is displayed and "" mark disappears.	{F1}	HR: 120°30'40" HD* [n] << m VD: m MEAS MODE NP/P P1↓
<ul style="list-style-type: none"> While EDM is working, press {F1} (MEAS) key again, the mode will be changed to continuous measuring mode. 		↓
		HR: 120°30'40" HD: 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓
<p>*1) It is possible to set the measurement mode for N-times measurement mode or continuous measurement mode when the power is turned on.  Refer to Chapter 17 "SELECTING MODE".</p> <p>*2)  For setting the number of times (N-times) in the measurement, refer to Chapter 17 "SELECTING MODE".</p>		

- **Choose meter /feet / feet+inch unit by soft key**

It is possible to change the unit for distance measurement mode by soft key.

This setting is not memorized after power off.  Refer to 17 "SELECTING MODE" to set at the initial setting (memorized after power off).


Operating procedure	Operation	Display
1 Press the {F4} (P1↓) key twice to get the function on page 3.	{F4}	HR: 120°30'40" HD* 2.000 m VD: 3.000 m MEAS MODE NP/P P1↓ OFSET S.O S/A P2↓ --- m/f/i --- P3↓
2 Press the {F2} (m/f/i) key, the display unit will be changed.	{F2}	HR: 120°30'40" HD* 6.560 f VD: 9.845 f --- m/f/i --- P3↓
<ul style="list-style-type: none"> Every time pressing the {F2} (m/f/i) key, the unit mode switches. 		

4.6 Stake Out (S.O)

The difference between the measured distance and the input stake out distance is displayed.

Measured distance — Stake out distance = Displayed value

In stake out operation, you can select either horizontal distance (HD), relative elevation (VD) and slope distance (SD)

Operating procedure	Operation	Display
1 Press the {F4} (↓) key in the distance measuring mode to get the function on page 2.	{F4}	<pre>HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ ----- OFSET S.O S/A P2↓</pre>
2 Press the {F2} (S.O) key. The data previously set is shown.	{F2}	<pre>STAKE OUT HD : 0.000 m HD VD SD ---</pre>
3 Select the measuring mode by pressing the {F1} to {F3} key. Example: Horizontal distance	{F1}	<pre>STAKE OUT HD = 0.000 m --- --- [CLR] [ENT]</pre>
4 Enter the distance for stake out. *1)	Enter data {F4}	<pre>STAKE OUT HD : 100.000 m INPUT --- --- ENTER</pre>
5 Collimate the target (Prism). Measuring starts. The difference between the measured distance and the stake out distance is displayed.	Collimate P	<pre>HR: 120°30'40" dHD* [r] << m VD: m MEAS MODE NP/P P1↓</pre> <p style="text-align: center;">↓</p> <pre>HR: 120°30'40" dHD* 23.456 m VD: 5.678 m MEAS MODE NP/P P1↓</pre>
6 Move the target until the difference becomes 0m.		
<p>*1)  Refer to section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> To return to normal distance measurement mode, stake out distance to "0" or turn the power off. 		

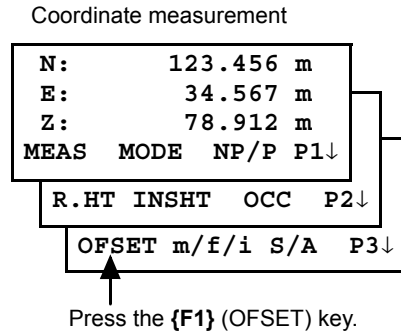
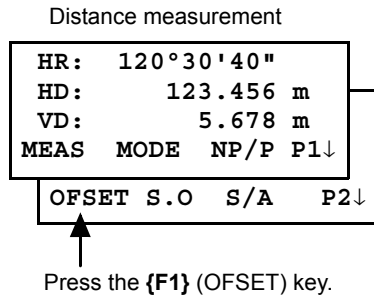
4.7 Offset Measurement

There are four offset measurement modes in the Offset Measurement.

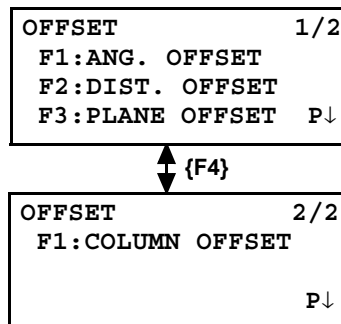
- Angle offset
- Distance offset
- Plane offset
- Column offset

To show the offset measurement menu, press the **[OFFSET]** soft key from distance or coordinate measurement mode.

Example:



Offset Measurement Menu

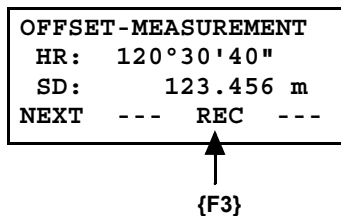


● Outputting the Measurement Data

The results of offset measurement can be output to external device.

Setting the function of the **{ESC}** key to (REC), the **{F3}** soft key which assigned (REC) will appear in measured result display.

☞ Refer to Chapter 17 "SELECTING MODE" to set this option.



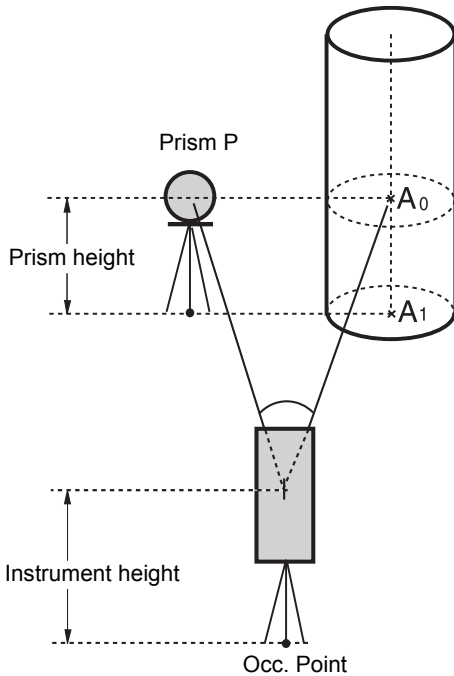
● Distance measurement mode of the offset measurement

Offset measurement will be done by N-time fine measurement mode.

☞ For setting measuring times refer to Chapter 17 "SELECTING MODE".

4.7.1 Angle Offset

This mode is useful when it is difficult to set up the prism directly, for example at the center of a tree. Place the prism at the same horizontal distance from the instrument as that of point A₀ to measure. To measure the coordinates of the center position, operate the offset measurement after setting the instrument height/prism height.



When measuring coordinates of ground point A₁: Set the instrument height/prism height.

When measuring coordinates of point A₀: Set the instrument height only. (Set the prism height to 0).






When sighting to A₀, you can select one of two ways. One is to fix vertical angle to the prism position even updown the telescope position, and the other is to gear vertical angle to the updown of telescope movement. In case following the vertical angle to the movement of telescope, SD(Slope Distance) and VD(Vertical Distance) will be changed according to the movement of telescope.

To set this option, refer to Chapter 17 "SELECTING MODE".

Note

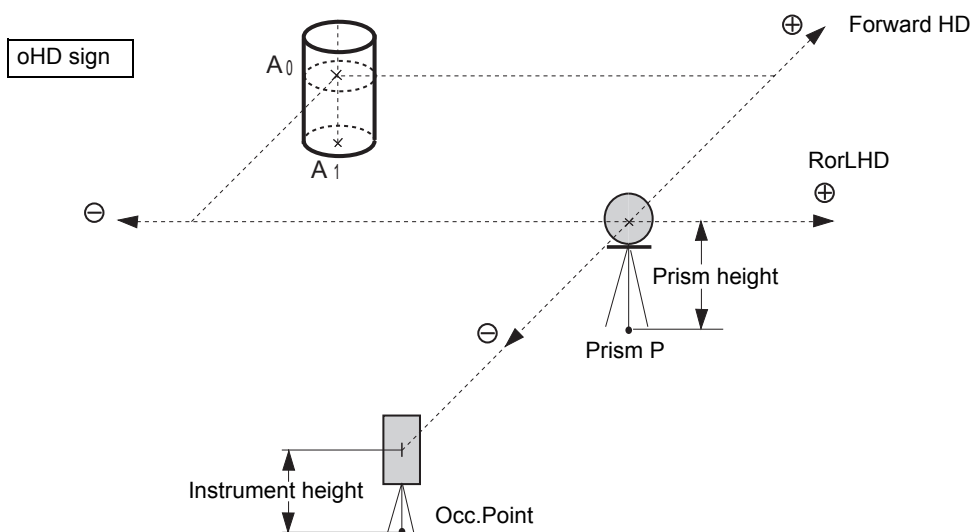
- Set the instrument height/prism height before proceeding to the offset measurement mode.
- When setting the coordinate value for the occupied station, refer to Section 5.1 "Setting Coordinate Values of Occupied Point".

Operating procedure	Operation	Display
1 Press the {F4} (P1↓) key from distance measuring mode to get the function on page 2.	{F4}	<pre> HR: 120°30'40" HD: 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ </pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre> OFFSET 1/2 F1:ANG.OFFSET F2:DIST.OFFSET F3:PLANE OFFSET P1↓ </pre>
3 Press the {F1} (ANG. OFFSET) key.	{F1}	<pre> OFFSET-MEASUREMENT HR: 120°30'40" HD: m MEAS --- NP/P --- </pre>
4 Collimate prism P, and press the {F1} (MEAS) key.	Collimate P {F1}	<pre> OFFSET-MEASUREMENT HR: 110°20'30" HD* [n] << m >Measuring... </pre>

The horizontal distance from the instrument to the prism will be measured.	Collimate A ₀	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 110°20'30"</td></tr> <tr><td>HD: 56.789 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 110°20'30"	HD: 56.789 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 110°20'30"						
HD: 56.789 m						
NEXT --- --- ---						
5 Collimate point A ₀ using the horizontal motion clamp and horizontal tangent screw.	Collimate A ₀	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 113°30'50"</td></tr> <tr><td>HD: 56.789 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 113°30'50"	HD: 56.789 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 113°30'50"						
HD: 56.789 m						
NEXT --- --- ---						
6 Show the relative elevation of point A ₀ .	{  }	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 113°20'30"</td></tr> <tr><td>VD: 3.456 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 113°20'30"	VD: 3.456 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 113°20'30"						
VD: 3.456 m						
NEXT --- --- ---						
7 Show the slope distance of point A ₀ .	{  }	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 113°20'30"</td></tr> <tr><td>SD: 56.894 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 113°20'30"	SD: 56.894 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 113°20'30"						
SD: 56.894 m						
NEXT --- --- ---						
<ul style="list-style-type: none"> Each time pressing the {} key, horizontal distance, relative elevation and slope distance are shown in sequence. 	{  }	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 113°20'30"</td></tr> <tr><td>N: -12.345 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 113°20'30"	N: -12.345 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 113°20'30"						
N: -12.345 m						
NEXT --- --- ---						
8 Show N coordinate of point A ₀ or A ₁ .	{  }	<table border="1"> <tr><td>OFFSET-MEASUREMENT</td></tr> <tr><td>HR: 113°20'30"</td></tr> <tr><td>N: -12.345 m</td></tr> <tr><td>NEXT --- --- ---</td></tr> </table>	OFFSET-MEASUREMENT	HR: 113°20'30"	N: -12.345 m	NEXT --- --- ---
OFFSET-MEASUREMENT						
HR: 113°20'30"						
N: -12.345 m						
NEXT --- --- ---						
<ul style="list-style-type: none"> To return to procedure 4, press the {F1} (NEXT) key. To return to the previous mode, press the {ESC} key. Press the {F3} (NP/P) key after the step 3 to change target type. 						

4.7.2 Distance Offset Measurement

The measurement of a place apart from a prism is possible by inputting offset horizontal distance of front and back / right and left.




When measuring coordinates of ground point A_1 :
When measuring coordinates of point A_0 :

Set the instrument height / prism height.
Set the instrument height only.
(Set the prism height to 0).

Operating procedure	Operation	Display
1 Press the {F4} (P1↓) key from distance measuring mode to get the function on page 2.	{F4}	<pre> HR: 120°30'40" HD: 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ </pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre> OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓ </pre>
3 Press the {F2} (DIST. OFFSET) key.	{F2}	<pre> DISTANCE OFFSET INPUT RorL HD oHD= m --- --- [CLR] [ENT] </pre>
4 Enter Right and Left direction offset value, and press the {F4} (ENTER) key.	Enter HD {F4}	<pre> DISTANCE OFFSET INPUT FORWARD HD oHD= m --- --- [CLR] [ENT] </pre>
5 Enter Forward direction offset value, and press the {F4} (ENTER) key.	Enter HD {F4}	<pre> DISTANCE OFFSET HR: 80°30'40" HD: m MEAS --- NP/P --- </pre>
6 Collimate prism P, and press the {F1} (MEAS) key. Measuring will start.	Collimate P1 {F1}	<pre> DISTANCE OFFSET HR: 80°30'40" HD* [n] << m >Measuring... </pre>

After measuring, the result added offset value will be shown.

- 7** Show the relative elevation of point P0.
- Each time pressing the {} key, horizontal distance, relative elevation and slope distance are shown in sequence.

- Show coordinate of point P0.

{}

DISTANCE OFFSET	
HR:	80°30'40"
HD*	10.000 m
NEXT	--- --- ---

DISTANCE OFFSET	
HR:	80°30'40"
VD:	11.789 m
NEXT	--- --- ---

DISTANCE OFFSET	
HR:	80°30'40"
SD:	11.789 m
NEXT	--- --- ---

{}

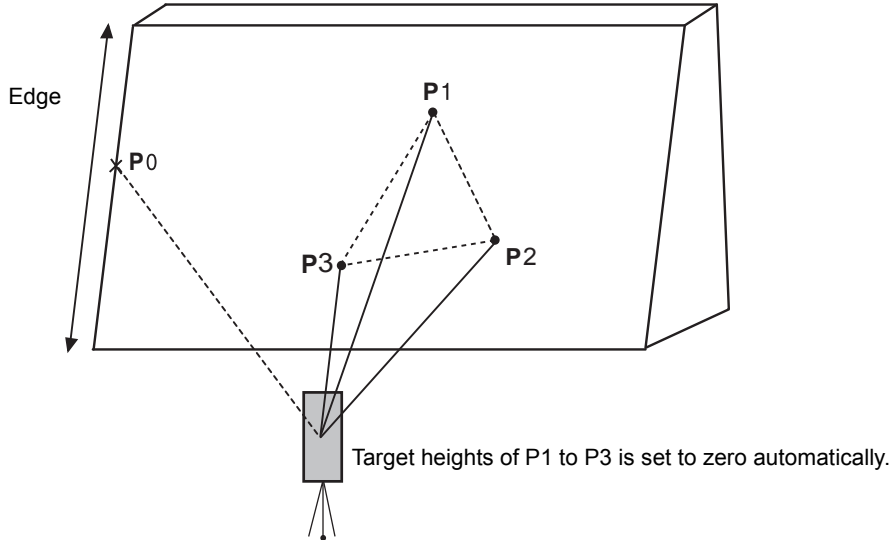
N :	12.345 m
E :	23.345 m
Z :	1.345 m
NEXT	--- --- ---

- To return to procedure **4**, press {**F1**} (NEXT) key.
- To return to the previous mode, press {**ESC**} key.
- Press the {**F3**} (NP/P) key after the step 3 to change target type.

4.7.3 Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.

Three random prism points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane. Collimate the measuring target point (P0) then the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



☞ When setting the coordinate value for the occupied station, refer to Section 5.1 “Setting Coordinate Values of Occupied Point”.

Example: Non-prism measurement

Operating procedure	Operation	Display
1 Press the {F4} (P1↓) key from distance measuring mode to get the function on page 2.	{F4}	<pre> HR: 120°30'40" HD: 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ </pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre> OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓ </pre>
3 Press the {F3} (PLANE OFFSET) key.	{F3}	<pre> PLANE N001#: SD: m MEAS --- NP/P --- </pre>
4 Press the {F3} (NP/P) key to change to the non-prism mode.	{F3}	<pre> PLANE N001#: N P SD: m MEAS --- NP/P --- </pre>
5 Collimate first point P1, and press the {F1} (MEAS) key. N-time measuring will start. After measuring, the display will show the second point measurement.	Collimate P1 {F1}	<pre> PLANE N001#: N P SD* [n] << m >Measuring... </pre> <p style="text-align: center;">↓</p>

- 6** Measure the second and third points in the same way.

Collimate
P2
{F1}

```

PLANE
N002#: N
          P
SD: m
MEAS --- NP/P ---
  
```

Collimate
P3
{F1}

```

PLANE
N003#: N
          P
SD: m
MEAS --- NP/P ---
  
```

The instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane. *1), 2)

```


HR: 80°30'40"
HD: 54.321 m N
          P
VD: 10.000 m
EXIT
  
```



- 7** Collimate the edge (P0) of the plane. *3), 4)

Collimate
P0

```

HR: 75°30'40"
HD: 54.600 m N
          P
VD: -0.487 m
EXIT
  
```

- 8** To show the slope distance (SD), press the {} key.

- Each time pressing the {} key, horizontal distance, relative elevation and slope distance are shown in sequence.
- To show coordinate of point P0, press the {} key.

- 9** To escape the measuring, press the {F1} (EXIT) key. The display returns to the previous mode.

```

V : 90°30'40"
HR: 75°30'40" N
          P
SD: 56.602 m
EXIT
  
```

*1) In case the calculation of plane was not successful by the measured three points, error displays. Start measuring over again from the first point.

*2) Data display is the mode beforehand of offset measurement mode.

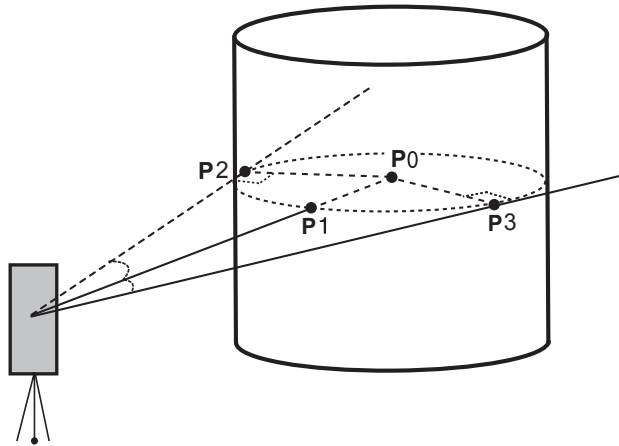
*3) Error will be displayed when collimated to the direction which does not cross with the determined plane.

*4) The point height of the target point P0 is set to zero automatically.

4.7.4 Column Offset Measurement

If it is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measured circumscription points (P2) and (P3).

The direction angle of the center of the column is 1/2 of total direction angle of circumscription points (P2) and (P3).



☞ When setting the coordinate value for the occupied station, refer to Section 5.1 "Setting Coordinate Values of Occupied Point".

Example: Non-prism measurement



Operating procedure	Operation	Display
1 Press the {F4} (P1↓) key from distance measuring mode to get the function on page 2.	{F4}	<pre> HR: 120°30'40" HD: 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ </pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre> OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓ </pre>
3 Press the {F4} (P↓) key.	{F4}	<pre> OFFSET 2/2 F1:COLUMN OFFSET P↓ </pre>
4 Press the {F1} (COLUMN OFFSET) key.	{F1}	<pre> COLUMN OFFSET Center HD: m MEAS --- NP/P --- </pre>
5 Press the {F3} (NP/P) key to change to the non-prism mode.	{F3}	<pre> COLUMN OFFSET Center N P HD: m MEAS --- NP/P --- </pre>


6 Collimate the center of the column (P1) and press the **{F1}** (MEAS) key.
N-time measuring will start.
After the measurement, angle measuring display of the left side (P2) will be shown.

7 Collimate the left side of the column (P2) and press the **{F4}** (SET) key.
After the measurement, angle measuring display of the right side (P3) will be shown.

8 Collimate the right side of the column (P3) and press the **{F4}** (SET) key.

The distance between the instrument and center of the column (P0) will be calculated.

9 To show the relative elevation (VD), press the **{}** key.
Each time pressing the **{}** key, horizontal distance, relative elevation and slope distance are shown in sequence.

- To show coordinate of point P0, press the **{}** key.

10 To escape the measuring, press the **{ESC}** key.
The display returns to the previous mode.

Collimate
P1
{F1}

```

COLUMN OFFSET
Center                N P
HD* [n]              << m
>Measuring...
  
```

Collimate
P2
{F4}

```

COLUMN OFFSET
Left                  N P
HR: 120°30'40"
--- --- --- SET
  
```

Collimate
P3
{F4}

```

COLUMN OFFSET
Right                 N P
HR: 180°30'40"
--- --- --- SET
  
```

```

COLUMN OFFSET
HR: 150°30'40"      N P
HD: 43.321 m
NEXT --- --- ---
  
```

{}

```

COLUMN OFFSET
HR: 150°30'40"      N P
VD: 2.321 m
NEXT --- --- ---
  
```

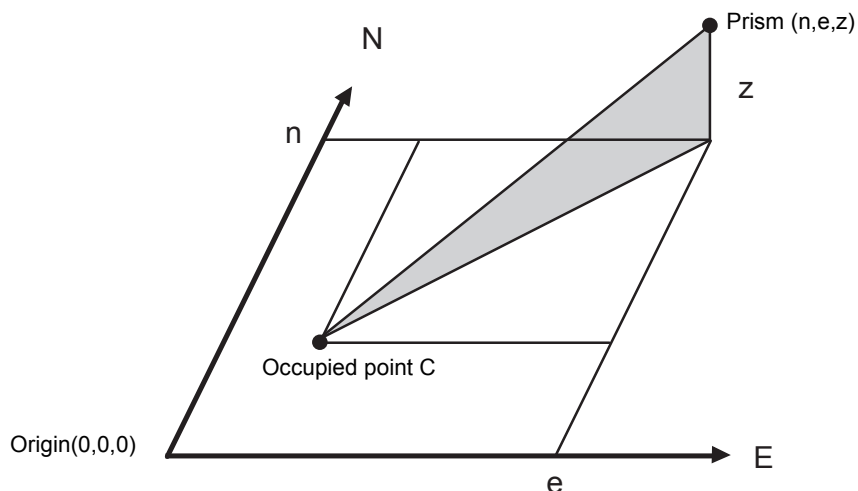
5 COORDINATE MEASUREMENT

5.1 Setting Coordinate Values of Occupied Point

Set the coordinates of the instrument (occupied point) according to coordinate origin, and the instrument automatically converts and displays the unknown point (prism point) coordinates following the origin.

It is possible to retain the coordinates of the occupied point after turning the power off.

☞ Refer to Chapter 17 "SELECTING MODE".



Operating procedure	Operation	Display
1 Press the {F4} (↓) key from the coordinate measurement mode to get the function on page 2.	{F4}	<pre> N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ R.HT INSHT OCC P2↓ </pre>
2 Press the {F3} (OCC) key.	{F3}	<pre> N= 0.000 m E= 0.000 m Z= 0.000 m --- --- [CLR] [ENT] </pre>
3 Enter N coordinate value. *1)	Enter data {F4}	<pre> N: -72.000 m E= 0.000 m Z: 0.000 m --- --- [CLR] [ENT] </pre>
4 Enter E and Z coordinate values in the same manner. After entering the values, the display returns coordinate measuring display.		<pre> N: 51.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ </pre>
<p>*1) ☞ Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> ● Input range $-99999999.9990 \leq N,E,Z \leq 99999999.9990$ m $-99999999.999 \leq N,E,Z \leq 99999999.999$ ft. $-99999999.11.7 \leq N,E,Z \leq 99999999.11.7$ ft.+inch 		

5.2 Setting Height of the Instrument

It is possible to retain the height of instrument after turning the power off.

☞ Refer to Chapter 17 “SELECTING MODE”.

Operating procedure	Operation	Display
1 Press the {F4} (↓) key from the coordinate measurement mode to get the function on page 2.	{F4}	<pre> N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ R.HT INSHT OCC P2↓ </pre>
2 Press the {F2} (INSHT) key. The current value is displayed.	{F2}	<pre> INSTRUMENT HEIGHT INPUT INS.HT=0.000 m --- --- [CLR] [ENT] </pre>
3 Enter the instrument height. *1)	Enter Inst.HT {F4}	<pre> N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ </pre>
<p>*1) ☞ Refer to Section 2.4 “How to Enter Alphanumeric Characters”.</p> <ul style="list-style-type: none"> Input range $-999.9999 \leq$ Instrument height ≤ 999.9999 m $-999.999 \leq$ Instrument height ≤ 999.999 ft. $-999.11.7 \leq$ Instrument height $\leq 999.11.7$ ft.+inch 		

5.3 Setting Height of Target (Prism Height)

This mode can be used to obtain Z coordinate values. It is possible to retain the height of target after turning the power off. ☞ Refer to Chapter 17 “SELECTING MODE”.

Operating procedure	Operation	Display
1 Press the {F4} (↓) key from the coordinate measurement mode to get the function on page 2.	{F4}	<pre> N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ R.HT INSHT OCC P2↓ </pre>
2 Press the {F1} (R.HT) key. The current value is displayed.	{F1}	<pre> REFLECTOR HEIGHT INPUT R.HT =0.000 m --- --- [CLR] [ENT] </pre>
3 Enter the prism height. *1)	Enter R. HT {F4}	<pre> N: 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓ </pre>
<p>*1) ☞ Refer to Section 2.4 “How to Enter Alphanumeric Characters”.</p> <ul style="list-style-type: none"> Input range $-999.9999 \leq$ Prism height ≤ 999.9999 m $-999.999 \leq$ Prism height ≤ 999.999 ft. $-999.11.7 \leq$ Prism height $\leq 999.11.7$ ft.+inch 		

5.4 Execution of Coordinate Measuring

Measure the coordinates by entering the instrument height and prism height, coordinates of unknown point will be measured directly.

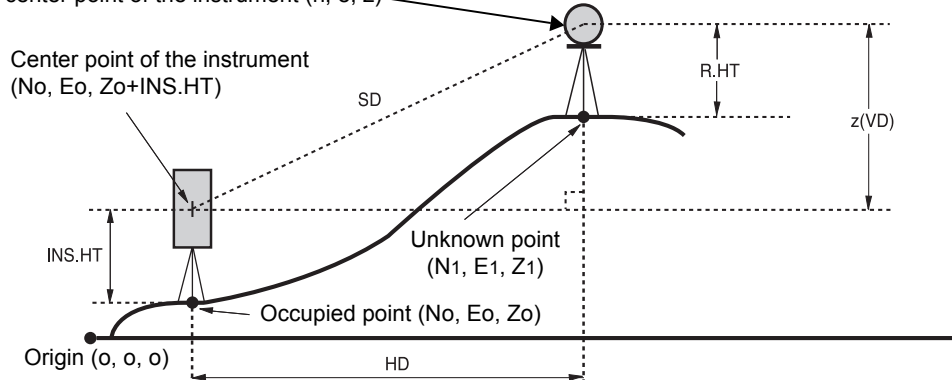
☞ When setting coordinate values of occupied point, see Section 5.1 “Setting Coordinate Values of Occupied Point”

☞ When setting the instrument height and prism height, see Section 5.2 “Setting Height of the Instrument” and 5.3 “Setting Height of Target (Prism Height)”.

The coordinates of the unknown point are calculated as shown below and displayed:

Coordinates of occupied point : (N_0, E_0, Z_0)
 Instrument height : INS.HT
 Prism height : R.HT
 Vertical distance (Relative elevation) : z (VD)
 Coordinates of the center of the prism,
 originated from the center point of the instrument : (n, e, z)
 Coordinates of unknown point : (N_1, E_1, Z_1)
 $N_1 = N_0 + n$
 $E_1 = E_0 + e$
 $Z_1 = Z_0 + \text{INS.HT} + z - \text{R.HT}$

Coordinates of the center of the prism, originated from the center point of the instrument (n, e, z)



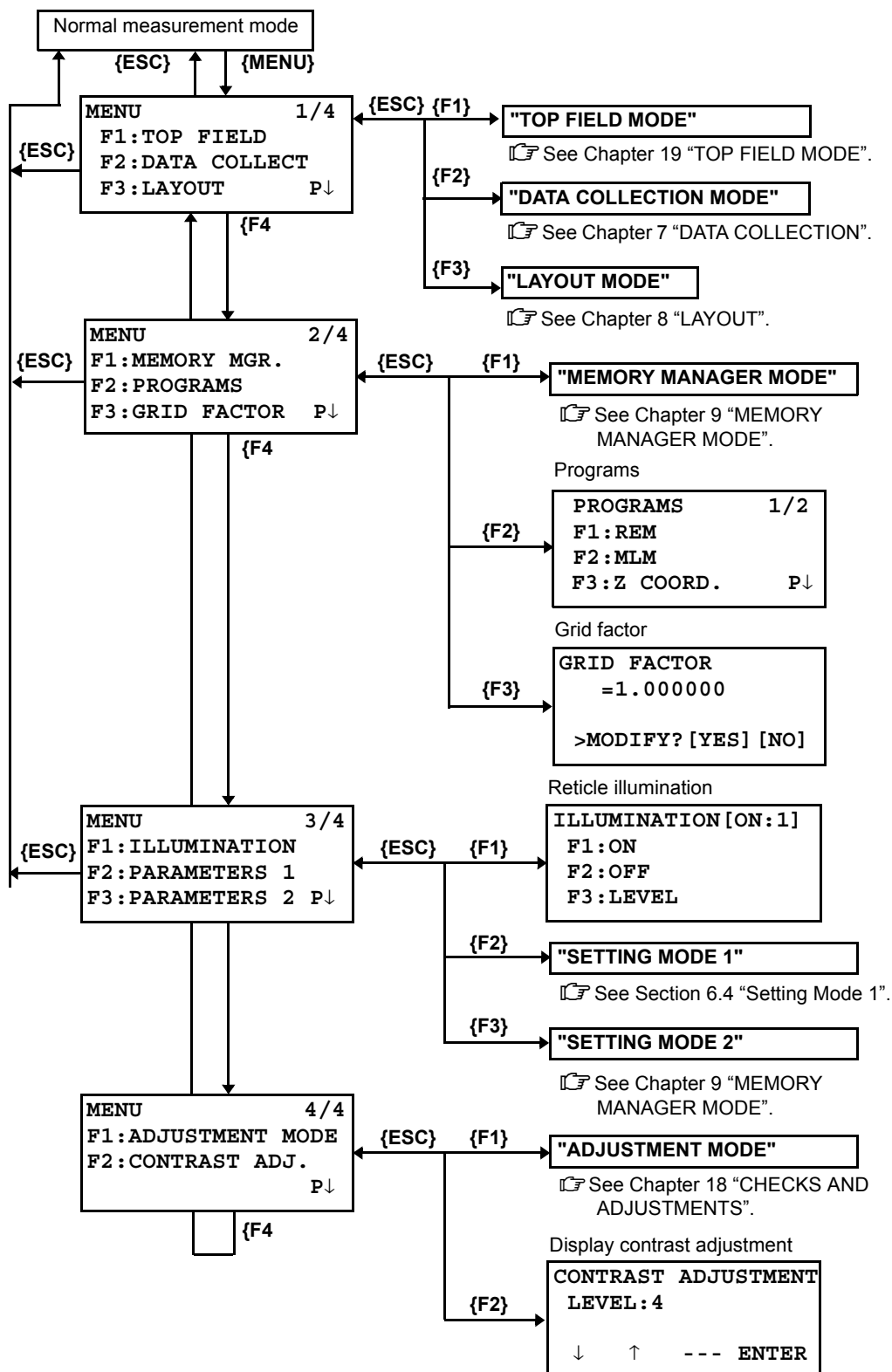
Operating procedure	Operation	Display
1 Set the direction angle of known point A. *1)	Set direction angle	V : 90°10'20" HR: 120°30'40"
2 Collimate target prism.	Collimate P	0SET HOLD HSET P1↓
3 Press the $\{\downarrow\}$ key. Measuring starts.	$\{\downarrow\}$	N* [r] << m E: m Z: m MEAS MODE NP/P P1↓
The result will be shown.		↓ N* 123.456 m E: 34.567 m Z: 78.912 m MEAS MODE NP/P P1↓

*1) ☞ Refer to Section 3.3 “Measuring from the Required Horizontal Angle”.

- In case the coordinate of instrument point is not entered, (0,0,0) will be used as the default for the instrument point.
The instrument height will be calculated as 0 when the instrument height is not entered.
- The prism height will be calculated as 0 when the prism height is not set.

6 SPECIAL MODE (Menu Mode)

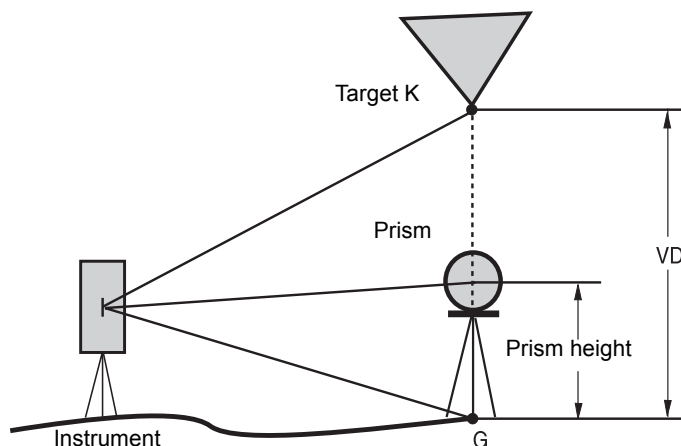
By pressing the **{MENU}** key, the instrument will be in MENU mode.
In this mode, special measuring, setting and adjustment are possible.



6.1 Application Measurement (PROGRAMS)


6.1.1 Remote Elevation measurement (REM)

To obtain elevation of the point at which setting the target prism is not possible, place the prism at any point on the vertical line from the target then carry out REM procedure as follows.



- 1) With prism height (h) input (Example:h=1.5m)

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F1} (REM) key.	{F1}	REM F1:INPUT R.HT F2:NO R.HT
4 Press the {F1} key.	{F1}	REM-1 <STEP-1> R.HT = 0.000 m --- [CLR] [ENT]
5 Enter prism height. *1)	Enter R.HT {F4}	REM-1 <STEP-2> HD: m MEAS --- NP/P ---
6 Collimate prism.	Collimate P	
7 Press the {F1} (MEAS) key. Measuring starts.	{F1}	REM-1 <STEP-2> HD* [n] << m >Measuring...

Horizontal distance (HD) between the instrument and prism will be shown.	Collimate K	<pre>REM-1 <STEP-2> HD* 123.456 m >Measuring...</pre>
8 Collimate target K. Vertical distance (VD) will be shown. *2),3)		<pre>REM-1 VD: 1.500 m --- R.HT HD ---</pre>
		<pre>REM-1 VD: 10.456 m --- R.HT HD ---</pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <p>*2) To return to procedure 5, press the {F2} (R.HT) key. To return to procedure 6, press the {F3} (HD) key.</p> <p>*3) To return to PROGRAMS Menu, press the {ESC} key.</p>		

2) Without prism height input

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	<pre>MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓</pre>
2 Press the {F2} key.	{F2}	<pre>PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓</pre>
3 Press the {F1} (REM) key.	{F1}	<pre>REM F1:INPUT R.HT F2:NO R.HT</pre>
4 Press the {F2} key.	{F2}	<pre>REM-2 <STEP-1> HD: m MEAS --- NP/P ---</pre>
5 Collimate prism.	Collimate P	
6 Press the {F1} (MEAS) key. Measuring starts.		{F1}
Horizontal distance (HD) between the instrument and prism will be shown.		<pre>REM-2 <STEP-1> HD* 123.456 m >Measuring...</pre>

The prism position will be decided.		<pre> REM-2 <STEP-2> V : 60°45'50" --- --- --- SET </pre>
7 Collimate ground point G.	Collimate G	<pre> REM-2 <STEP-2> V : 123°45'50" --- --- --- SET </pre>
8 Press the {F4} (SET) key. The position of point G will be decided. *1)	{F4}	<pre> REM-2 VD: 0.000 m --- V HD --- </pre>
9 Collimate target K. Vertical distance (VD) will be shown. *2)	Collimate K	<pre> REM-2 VD: 10.456 m --- V HD --- </pre>
<p>*1) To return to procedure 5, press the {F3} (HD) key. To return to procedure 7, press the {F2} (V) key. *2) To return to PROGRAMS Menu, press the {ESC} key.</p>		

6.1.2 Missing Line Measurement (MLM)

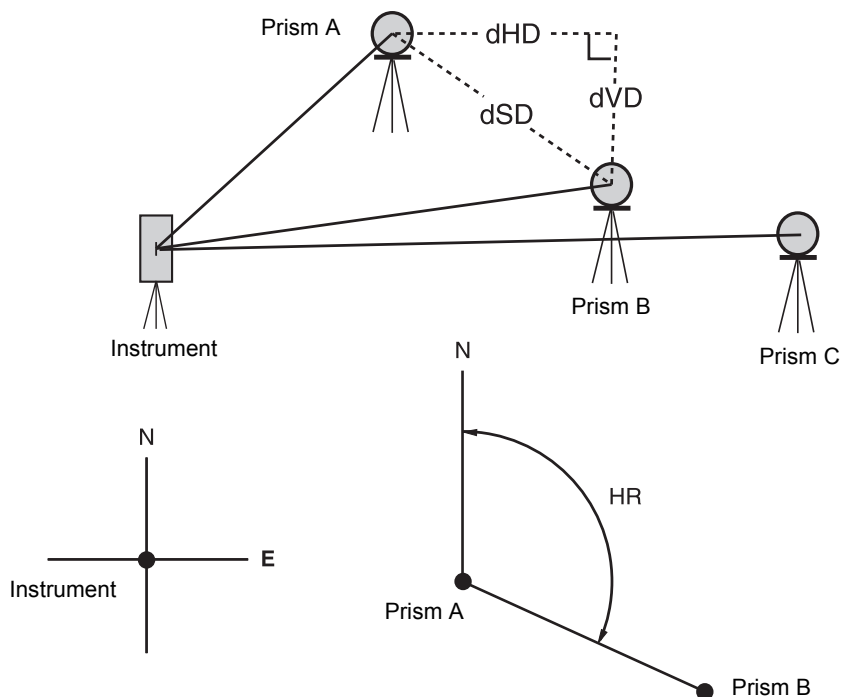
Measurement for horizontal distance (dHD), slope distance (dSD), elevation (dVD) and horizontal bearing (HR) between two target prisms.

It is possible to enter the coordinate value directly or calculate from coordinate data file.

MLM mode has two modes.

1: MLM-1 (A-B, A-C) :Measurement is A-B, A-C, A-D,.....

2: MLM-2 (A-B, B-C) :Measurement is A-B, B-C, C-D,.....



- It is necessary to set the direction angle of the instrument.

[Example] MLM-1 (A-B, A-C)

- Procedure of MLM-2 (A-B, B-C) mode is completely same as MLM-1 mode

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F2} (MLM) key.	{F2}	MLM F1:USE FILE F2:DON'T USE
4 Press the {F1} or {F2} key to select using coordinate file. [Example:F2 : DON'T USE]	{F2}	GRID FACTOR F1:USE G.F. F2:DON'T USE

- 5** Press the **{F1}** or **{F2}** key to select using GRID FACTOR.
[Example:F2 : DON'T USE]


- 6** Press the **{F1}** key.

- 7** Collimate prism A, and press the **{F1}** (MEAS) key. Horizontal distance (HD) between the instrument and prism A will be shown.

The prism position will be decided.

- 8** Collimate prism B and press the **{F1}** (MEAS) key. Horizontal distance (HD) between the instrument and prism B will be shown.

The horizontal distance (dHD) and relative elevation (dVD) between prism A and B.

- 9** To show slope distance (dSD), press **{** key.

- 10** To measure the distance between points A and C, press the **{F3}** (HD). *1)

- 11** Collimate point C (Prism C) and press the **{F1}** (MEAS) key. Horizontal distance (HD) between the instrument and prism C will be shown.

{F2}

```
MLM
F1:MLM-1 (A-B, A-C)
F2:MLM-2 (A-B, B-C)
```

{F1}

```
MLM-1 (A-B, A-C)
<STEP-1>
HD:                m
MEAS  R.HT  NEZ  NP/P
```

Collimate A
{F1}

```
MLM-1 (A-B, A-C)
<STEP-1>
HD* [n]            << m
MEAS  R.HT  NEZ  NP/P
```

↓

```
MLM-1 (A-B, A-C)
<STEP-1>
HD* 123.456 m
MEAS  R.HT  NEZ  NP/P
```

```
MLM-1 (A-B, A-C)
<STEP-2>
HD:                m
MEAS  R.HT  NEZ  NP/P
```

Collimate B
{F1}

```
MLM-1 (A-B, A-C)
<STEP-2>
HD* [n]            << m
MEAS  R.HT  NEZ  NP/P
```

↓

```
MLM-1 (A-B, A-C)
<STEP-2>
HD* 345.678 m
MEAS  R.HT  NEZ  NP/P
```

```
MLM-1 (A-B, A-C)
dHD : 123.456 m
dVD : 12.345 m
---  ---  HD  ---
```

{

```
MLM-1 (A-B, A-C)
dSD : 124.072 m
HR  : 12°34'40"
---  ---  HD  ---
```

{F3}

```
MLM-1 (A-B, A-C)
<STEP-2>
HD:                m
MEAS  R.HT  NEZ  NP/P
```

Collimate
prism C
{F1}

The horizontal distance (dHD) and relative elevation (dVD) between prism A and C.

```
MLM-1 (A-B, A-C)
dHD : 234.567 m
dVD : 23.456 m
--- --- HD ---
```

12 To measure the distance between points A and D, repeat procedure 12 to 14. *1)

*1) To return to previous mode, press the **{ESC}** key.

● How to use coordinate data

It is possible to input coordinate value directly or calculate from coordinate data file

Operating procedure	Operation	Display
<p>To use coordinate data file, select "USE FILE" in step 4.</p> <p>After procedure 6.</p> <p>1 Press the {F3} (NEZ) key. Direct key input display will be shown.</p> <p>2 Press the {F3} (PT#) key to use coordinate data file. Point number input display will be shown. Pressing the {F3} (HD) key, the display will return to procedure 6.</p> <p>After selecting coordinate input mode by pressing the {F3} (NEZ or PT# or HD) key, press the {F1} (INPUT) key and enter the data.</p>	<p>{F3}</p> <p>{F3}</p>	<pre>MLM-1 (A-B, A-C) <STEP-1> HD: m MEAS R.HT NEZ NP/P N> 0.000 m E: 0.000 m Z: 0.000 m INPUT --- PT# ENTER</pre> <pre>MLM-1 (A-B, A-C) PT#: _____ INPUT LIST HD ENTER</pre>

6.1.3 Setting Z Coordinate of Occupied Point


Occupied point coordinate data and known point actual measuring data are utilized, z coordinate of occupied point is calculated and reset again.

Known point data and coordinate data can use the coordinate data file.

1) Setting occupied coordinate

[Example setting] Using coordinate data file.

Operating procedure	Operation	Display
1 After pressing {MENU} key, press {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F3} (Z COORD.) key.	{F3}	Z COORD.SETTING F1:USE FILE F2:DON'T USE
4 Press the {F1} (USE FILE) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
5 Press the {F1} (INPUT) key and enter the File Name.	{F1} Enter FN {F4}	Z COORD.SETTING F1:OCC.PT INPUT F2:REF.MEAS
6 Press the {F1} key.	{F1}	OCC.PT PT#: _____ INPUT LIST NEZ ENTER
7 Press the {F1} (INPUT) key and enter the Point number. Instrument height setting display will be shown.	{F1} Enter PT# {F4}	INSTRUMENT HEIGHT INPUT INS.HT=0.000 m --- --- [CLR] [ENT]
8 Enter the height. The display returns to Z coordinate menu.	Enter HT {F4}	Z COORD.SETTING F1:OCC.PT INPUT F2:REF.MEAS

 For more information about data file, see Chapter 9 "MEMORY MANAGER MODE".

2) Z Coordinate Calculation from Known Point Measuring Data

[Example setting] Using coordinate data file

Operating procedure	Operation	Display
1 After pressing {MENU} key, press {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F3} (Z COORD.) key.	{F3}	Z COORD.SETTING F1:USE FILE F2:DON'T USE
4 Press the {F1} (USE FILE) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
5 Press the {F1} (INPUT) key and enter the File Name.	{F1} Enter FN {F4}	Z COORD.SETTING F1:OCC.PT INPUT F2:REF.MEAS
6 Press the {F2} key.	{F2}	NOO1# PT#: _____ INPUT LIST NEZ ENTER
7 Press the {F1} (INPUT) key and enter the Point Number in coordinate data file.	{F1} Enter PT# {F4}	N: 4.356 m E: 16.283 m Z: 1.553 m >OK ? [YES] [NO]
8 Press the {F3} (YES) key and enter the Point Number in coordinate data file.	{F3}	REFLECTOR HEIGHT INPUT R.HT =0.000 m --- --- [CLR] [ENT]
9 Enter the height.	Enter R. HT {F4}	REFLECTOR HEIGHT INPUT R.HT : 0.000 m MEAS --- NP/P ---
10 Collimate a prism on the point and press the {F1} (MEAS) key. Measuring starts. *1)	Collimate P {F1}	HR: 120°30'40" HD* [n] << m VD: m >Measuring...



<p>11 Press the {F4} (CALC) key.*2) Z : Z coordinate dZ: Standard deviation</p>	{F4}	<pre>HR: 120°30'40" HD: 12.345 m VD: 23.456 m NEXT --- --- CALC</pre>
<p>12 Press the {F4} (SET) key. *3) Z coordinate of the occupied point will be set. Basksight point measuring screen will be shown.</p>		{F4}
<p>13 Press the {F3} (YES) key. Horizontal angle will be set. The display returns to Programs 1/2 menu.</p>	{F3}	
		<pre>PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓</pre>
<p>*1) Measurement is Fine N-times measurement mode. *2) To measure other points, press the {F1} (NEXT) key. *3) Pressing the {F3} key, the display will be changed alternately.</p>		

6.1.4 Area Calculation

This mode calculate the area of a closed figure.
There are two area calculation methods as follows.

- 1) Area Calculation from Coordinate data file
- 2) Area Calculation from Measured data



- Area is not calculated correctly if enclosed lines cross each other.
- It is impossible to calculate what a mix of coordinate file data and measured data.
- If the coordinate data file does not exist, the area calculation from measured data is done automatically.
- The numbers of points used to calculate are not limited.

1) Area Calculation from Coordinate Data File

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2/4.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F4} (P↓) key to get the PROGRAMS menu on page 2/2.	{F4}	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
4 Press the {F1} (AREA) key.	{F1}	AREA F1:FILE DATA F2:MEASUREMENT
5 Press the {F1} (FILE DATA) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
6 Press the {F1} (INPUT) key and enter the File Name. Initial display will be shown.	{F1} Enter FN {F4}	AREA 0000 m.sq NEXT# :DATA-01 PT# LIST UNIT NEXT
7 Press the {F4} (NEXT) key. *1),2) The top of the file data (DATA-01) will be set and the second point number will be shown.	{F4}	AREA 0001 m.sq NEXT# :DATA-02 PT# LIST UNIT NEXT
8 Repeat pressing the {F4} (NEXT) key to set required number of points.	{F4}	⋮

When 3 or more points are set, the area surrounded by the points is calculated and the result will be shown.

```

AREA                0021
                   123.456 m.sq
NEXT# :DATA-22
PT#  LIST  UNIT NEXT
    
```

*1) To set specify point, press the {F1} (PT#) key.

*2) To show the list of the coordinate data in the file, press the {F2} (LIST) key.

2) Area Calculation from Measured Data

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2/4.	{MENU} {F4}	<pre> MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓ </pre>
2 Press the {F2} key.	{F2}	<pre> PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓ </pre>
3 Press the {F4} (P↓) key to get the PROGRAMS menu on page 2/2.	{F4}	<pre> PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓ </pre>
4 Press the {F1} (AREA) key.	{F1}	<pre> AREA F1:FILE DATA F2:MEASUREMENT </pre>
5 Press the {F2} (MEASUREMENT) key.	{F2}	<pre> AREA F1:USE G.F. F2:DON'T USE </pre>
6 Press the {F1} or {F2} key to select using GRID FACTOR. [Example:F2 : DON'T USE]	{F2}	<pre> AREA 0000 m.sq MEAS --- UNIT NP/P </pre>
7 Collimate a prism and press the {F1} (MEAS) key. Measuring starts. *1)	Collimate P {F1}	<pre> N* [n] <<< m E: m Z: m >Measuring... </pre> <p style="text-align: center;">↓</p> <pre> AREA 0001 m.sq MEAS --- UNIT NP/P </pre>
8 Collimate next point and press the {F1} (MEAS) key.	Collimate {F1}	<p>⋮</p>

When 3 or more points are measured, the area surrounded by the points is calculated and the result will be shown.

```

AREA          0003
      234.567 m.sq
MEAS --- UNIT NP/P
  
```

*1) Measurement is Fine N-times measurement mode.

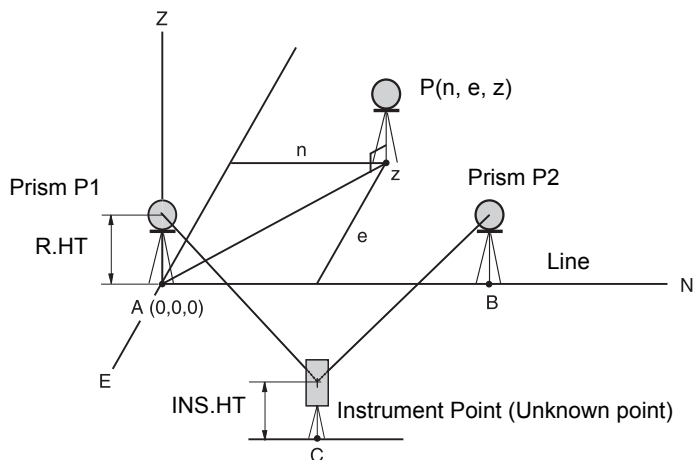
● To change the display unit

It is possible to change the displayed area unit.

Operating procedure	Operation	Display
1 Press the {F3} (UNIT) key.	{F3}	<pre> AREA 0003 100.000 m.sq MEAS --- UNIT NP/P </pre>
		<pre> AREA 0003 100.000 m.sq m.sq ha ft.sq acre </pre>
2 Select a unit by pressing the {F1} to {F4} key. Example: {F2} (ha) key.	{F2}	<pre> AREA 0003 0.010 ha MEAS --- UNIT NP/P </pre>
● m.sq: square meter ha: hectare ft.sq: square feet acre: acre.		

6.1.5 Point to Line Measurement

This mode is used to obtain the coordinate data with the origin point A(0,0,0) and the line AB as N axis. Place the 2 prisms at the points A and B on the line, and place the instrument at unknown point C. After measuring the 2 prisms, the coordinate data and the direction angle of the instrument will be calculated and restored.




Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2/4.	{MENU} {F4}	MENU 2/4 F1:MEMORY MGR. F2:PROGRAMS F3:GRID FACTOR P↓
2 Press the {F2} key.	{F2}	PROGRAMS 1/2 F1:REM F2:MLM F3:Z COORD. P↓
3 Press the {F4} (P↓) key to get the PROGRAMS menu on page 2/2.	{F4}	PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓
4 Press the {F2} key.	{F2}	INSTRUMENT HEIGHT INPUT INS.HT=0.000 m --- [CLR] [ENT]
5 Enter instrument height.	Enter INS.HT {F4}	REFLECTOR HEIGHT INPUT R.HT =0.000 m --- [CLR] [ENT]
6 Enter reflector A(P1) height.	Enter R.HT {F4}	POINT TO LINE MEAS.P1 HD: m MEAS --- NP/P ---

<p>7 Collimate prism P1 (Origin) and press {F1} (MEAS) key. Measuring starts. *1)</p> <p>Input display of reflector B(P2) height will be shown.</p>	<p>Collimate P1 {F1}</p>	<pre>POINT TO LINE MEAS.P1 HD* [n] << m >Measuring...</pre> <p style="text-align: center;">↓</p> <pre>REFLECTOR HEIGHT INPUT R.HT= 0.000 m --- --- [CLR] [ENT]</pre>
<p>8 Enter reflector B(P2) height.</p>	<p>Enter R. HT {F4}</p>	<pre>POINT TO LINE MEAS.P2 HD: m MEAS --- NP/P ---</pre>
<p>9 Collimate prism B (P2) (Origin) and press the {F1} (MEAS) key. Measuring starts. *1)</p> <p>The coordinate data and the direction angle of the instrument are calculated and restored. The result (The distance between A and B) will be displayed. dHD: Horizontal distance dVD: Vertical distance dSD: Slope distance *2),3)</p>	<p>Collimate P2 {F1}</p>	<pre>POINT TO LINE MEAS.P2 HD* [n] << m >Measuring...</pre> <p style="text-align: center;">↓</p> <pre>DIST. (P1-P2) 1/2 dHD: 10.000 m dVD: 0.000 m NEZ S.CO --- P↓</pre>
<p>10 Press {F1} (NEZ) key to measure other points.</p>	<p>{F1}</p>	<pre>N: 0.000 m E: 0.000 m Z: 0.000 m MEAS R.HT NP/P --- >Measuring...</pre>
<p>11 Collimate a prism and press {F1} (MEAS) key. Coordinate measurement starts. *4) The result will be shown. *5)</p>	<p>Collimate P {F1}</p>	<pre>N: 3.456 m E: 5.432 m Z: 0.000 m MEAS R.HT NP/P --- >Measuring...</pre> <p style="text-align: center;">↓</p> <pre>N: 3.456 m E: 5.432 m Z: 0.000 m MEAS R.HT NP/P ---</pre>
<p>*1) Measurement is Fine N-times measurement mode. *2) To show dSD, press {F4} (P↓) key. *3) To show the new occupied data, press {F2} (S.CO) key. *4) Measurement is Fine N-times measurement mode. *5) To return to previous mode, press the {ESC} key.</p>		

6.2 Setting the GRID FACTOR

GRID FACTOR can reset in this menu mode.

 For more information, refer to Section 8.1.1 "Setting the GRID FACTOR".

Grid Factor can be applied to the following application programs.

It is also possible to cancel the Grid factor function by selecting "DON'T USE" in "SELECTING MODE". At this time the setting and selecting screens for Grid Factor will be omitted.

- **Data collection mode**

When the NEZ automatic calculation (NEZ AUTO. CALC) is ON, Grid factor will be applied to the coordinate data (Including PTL data) recorded into a coordinate data file when the RAW data is measured and recorded. (In this case, Grid Factor is not applied to the RAW data recorded into the measured data file.)

PTL (Point To Line measurement)

When executing PTL measurement mode, the NEZ Auto Calculation will be turned on compulsorily and Grid factor will be applied to the coordinate data.

- **Layout / ROAD**

Execution Layout (Including PTL measurement mode) / ROAD

1. When displaying the difference (dHD) between grid horizontal distance to a layout point (HDg) on the projection plane and measured ground horizontal distance to a prism point (HD), Grid factor will be applied to grid distance (HDg) in order to reverse-convert grid distance to ground distance.
2. After completion of a layout point, the displayed coordinate data will be applied to grid factor in order to compare with surveying data and calculated data on the projection plane.

(NEW POINT-Side Shot)

In side shot method, a new point coordinate data will be applied to grid factor and the new point coordinate data will be recorded into a coordinate data file.

(NEW POINT - Resection)

In resection method, when a new point calculated coordinate data is displayed or recorded, the new point coordinate data will be applied to grid factor and the coordinate data will be recorded into a coordinate data file.

- **MLM (Missing Line Measurement)**

When selecting grid factor "USE G.F.", measured data will be applied to grid factor. At this time, horizontal distance (dHD) and slope distance (dSD) will be on the projection plane.


- **AREA (Area calculation / Measured method)**

When selecting grid factor "USE G.F.", measured data will be applied to grid factor. At this time, the calculated area will be on the projection plane.



- Calculation of Z coordinate is not influenced even if it is applied to grid factor.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key to get the menu on page 2.	{MENU} {F4}	MENU 2/4 F1: MEMORY MGR. F2: PROGRAMS F3: GRID FACTOR P↓
2 Press the {F3} (GRID FACTOR) key.	{F3}	GRID FACTOR =0.998843 >MODIFY? [YES] [NO]

<p>3 Press the {F3} (YES) key.</p> <p>4 Enter Elevation. *1) Press the {F4} (ENT) key.</p> <p>5 Enter Scale Factor in the same way.</p> <p>Grid Factor is displayed for 1 to 2 second and display returns to menu.</p>	<p>{F3}</p> <p>Enter ELEV. {F4}</p> <p>Enter Scale {F4}</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>GRID FACTOR ELEV.=1000 m SCALE:0.999000 --- --- [CLR] [ENT]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>GRID FACTOR ELEV.:2000 m SCALE=1.001000 --- --- [CLR] [ENT]</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>GRID FACTOR =1.000686</p> </div>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> ● Input Range:Elevation : -9,999 to 9,999 meter (-32,805 to 3,2805 ft, ft+in) Scale Factor: 0.990000 to 1.010000 		

6.3 Setting Illumination of Display and Cross Hairs

Setting ON/OFF/LEVEL (1 to 5) for illumination of display (LCD) and reticle.

Setting LEVEL (1 to 5) is only for reticle.

[Example setting] LEVEL:2 and turn on the illumination.

Operating procedure	Operation	Display
<p>1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.</p>	<p>{MENU} {F4} {F4}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓</p> </div>
<p>2 Press the {F1} key. The data previously set is shown.</p>	<p>{F1}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>ILLUMINATION [OFF:1] F1: ON F2: OFF F3: LEVEL</p> </div>
<p>3 Press the {F3} (LEVEL) key.</p>	<p>{F3}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>ILLUMINATION [OFF:1] [LEVEL MODE]</p> <p>↓ ↑ --- ENTER</p> </div>
<p>4 Press the {F2} (↑) key, and then press the {F4} (ENTER) key.</p>	<p>{F2} {F4}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>ILLUMINATION [OFF:2] F1: ON F2: OFF F3: LEVEL</p> </div>
<p>5 Press the {F1} (ON) key.</p>	<p>{F1}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>ILLUMINATION [ON:2] F1: ON F2: OFF F3: LEVEL</p> </div>
<ul style="list-style-type: none"> ● To return to previous mode, press the {ESC} key. 		

6.4 Setting Mode 1

In this mode, the following settings are possible.

1. Setting Minimum Reading
2. Auto Power off
3. Vertical and Horizontal Angle Tilt Correction (Tilt ON/OFF)
4. Systematic Error of Instrument Correction (ES-62/65)
5. Setting for RS-232C communication
6. Selecting Communication Port (Only for built-in *Bluetooth* model)
7. Confirming the *Bluetooth* Device Address and Setting the PIN code (Only for built-in *Bluetooth* model)



- This setting is memorized after power off.

6.4.1 Setting Minimum Reading

Select minimum display unit for angle measurement, coarse distance measurement mode.

To select minimum display for fine measurement mode, see Chapter 17 "SELECTING MODE" .

Models	Angle Unit			Coarse mode Distance unit
	Degree	GON	MIL	
ES-62/65	5" / 1"	1mgon / 0.2mgon	0.1mil / 0.01mil	Prism mode, Non-Prism mode 10mm (0.02ft)/1mm(0.005ft)

[Example] Minimum angle: 5", Coarse: 1mm

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	MENU 3 / 4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1 / 2 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
3 Press the {F1} key.	{F1}	MINIMUM READING F1: ANGLE F2: COARSE
4 Press the {F1} key.	{F1}	MINIMUM ANGLE [F1: 1"] F2: 5" ENTER
5 Press the {F2} (5") key and press the {F4} (ENTER) key.	{F2} {F4}	MINIMUM READING F1: ANGLE F2: COARSE
6 Press the {F2} key.	{F2}	COARSE READING F1: 1 mm [F2: 10 mm] ENTER

7 Press the {F1} key and press the {F4} (ENTER) key.	{F1} {F4}	<table border="1"> <tr> <td> MINIMUM READING F1: ANGLE F2: COARSE </td> </tr> </table>	MINIMUM READING F1: ANGLE F2: COARSE
MINIMUM READING F1: ANGLE F2: COARSE			
<ul style="list-style-type: none"> To return to previous mode, press the {ESC} key. 			

6.4.2 Auto Power Off

If no key operation is given or no process of measurement is performed for more than 30 minutes (No change exceeding 30" has occurred during horizontal angle or vertical angle measurement.), the power turns off automatically.

Operating procedure	Operation	Display	
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	<table border="1"> <tr> <td> MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓ </td> </tr> </table>	MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓			
2 Press the {F2} key.	{F2}	<table border="1"> <tr> <td> PARAMETERS 1 1/2 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓ </td> </tr> </table>	PARAMETERS 1 1/2 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
PARAMETERS 1 1/2 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓			
3 Press the {F2} key. The data previously set is shown.	{F2}	<table border="1"> <tr> <td> AUTO POWER OFF [OFF] F1: ON F2: OFF <p style="text-align: right;">ENTER</p> </td> </tr> </table>	AUTO POWER OFF [OFF] F1: ON F2: OFF <p style="text-align: right;">ENTER</p>
AUTO POWER OFF [OFF] F1: ON F2: OFF <p style="text-align: right;">ENTER</p>			
4 Press the {F1} (ON) key or {F2} (OFF) key, and press the {F4} (ENTER) key.	{F1} or {F2} {F4}		

6.4.3 Vertical and Horizontal Angle Tilt correction (Tilt ON/OFF)

In case the instrument is used in an unstable situation, constant indexing of vertical and horizontal angle may be impossible. In this case, the function of tilt correction can be stopped by selecting TILT OFF. It has been set to X,Y (V/H) TILT ON at the factory.



- This setting is memorized after power off.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1/3 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
3 Press the {F3} key. The data previously set is shown. If already ON, the display shows tilt correction value.	{F3}	TILT SENSOR: [XY-ON] X: 0°02'10" Y: 0°03'00" X-ON XY-ON OFF ENTER
4 Press the {F1} (X-ON) key or {F2} (XY-ON) or {F3} (OFF) key, and press the {F4} (ENTER) key.	{F1} ~ {F3} {F4}	

6.4.4 Systematic Error of Instrument Correction

Setting ON/OFF for error correction of collimation and horizontal axis for angle measurement.



- Perform this item after complete Section 18.3 "Adjustment of Compensation Systematic Error of Instrument".

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 2.	{MENU} {F4} {F4}	MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1/3 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
3 Press the {F4} key.	{F4}	PARAMETERS 1 2/3 F1: ERROR CORRECTION F2: RS-232C F3: SELECT COM P↓

<p>4 Press the {F1} key. The data previously set is shown.</p>	{F1}	<table border="1"><tr><td>ERROR CORR.</td><td>[OFF]</td></tr><tr><td>F1:ON</td><td></td></tr><tr><td>F2:OFF</td><td></td></tr><tr><td></td><td>ENTER</td></tr></table>	ERROR CORR.	[OFF]	F1:ON		F2:OFF			ENTER
ERROR CORR.	[OFF]									
F1:ON										
F2:OFF										
	ENTER									
<p>5 Press the {F1} (ON) key or {F2} (OFF) key, and press the {F4} (ENTER) key.</p>	{F1} or {F2} {F4}									

6.4.5 Setting RS-232C communication with external device

you can set the parameters for RS-232C communication with external device from parameters setting menu.

The following parameters can be set.

Item	Selecting items
Baud rate	1200, 2400, 4800, 9600, 19200, 38400
Character bit/Parity	7/Even, 7/Odd, 8/None
Stop bit	1, 2
ACK mode	Standard, Omitted
CR,LF	ON, OFF
REC type	REC-A, REC-B
Factory setting	Baud rate: 1200 baud rate, Character bit/Parity:7/Even, CRLF:OFF, REC type: REC-A, ACK:Standard

ACK mode, CRLF and REC type are interlocked with the same items in the selecting mode.

☞ Refer to 17 "SELECTING MODE"

Sample setting

STOP BITS: 2

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 2.	{MENU} {F4} {F4}	MENU 3/4 F1:ILLUMINATION F2:PARAMETERS 1 F3:PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1/3 F1:MINIMUM READING F2:AUTO POWER OFF F3:TILT P↓
3 Press the {F4} key.	{F4}	PARAMETERS 1 2/3 F1:ERROR CORRECTION F2:RS-232C F3:SELECT COM P↓
4 Press the {F1} key. The data previously set is shown.	{F1}	RS-232C 1/3 F1:BAUD RATE F2:CHAR./PARITY F3:STOP BITS P↓
5 Press the {F3} key to select STOP BITS. The data previously set is marked.	{F3}	STOP BITS [F1:1] F2:2 ENTER
6 Press the {F2} (2) key to select stop bit 2, and press the {F4} (ENTER) key.	{F2} {F4}	

6.4.6 Selecting Communication Port

You can change the communication port to *BLUETOOTH* port (option).

Sample setting

Bluetooth

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1/3 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
3 Press the {F4} key.	{F4}	PARAMETERS 1 2/3 F1: ERROR CORRECTION F2: RS-232C F3: SELECT COM P↓
4 Press the {F3} key.	{F3}	SELECT COM F1: BLUETOOTH [F2: RS-232C] ENTER
5 Press the {F1} (<i>BLUETOOTH</i>) key to select the communication port and press the {F4} (ENTER) key. The display will return to the previous menu.	{F1} {F4}	SELECT COM [F1: BLUETOOTH] F2: RS-232C ENTER

6.4.7 Confirming the *Bluetooth* Device Address and Setting the PIN code (Only for built-in *Bluetooth* model)

You can confirm the *Bluetooth* address and set the PIN code

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	MENU 3/4 F1: ILLUMINATION F2: PARAMETERS 1 F3: PARAMETERS 2 P↓
2 Press the {F2} key.	{F2}	PARAMETERS 1 1/3 F1: MINIMUM READING F2: AUTO POWER OFF F3: TILT P↓
3 Press the {F4} key.	{F4}	PARAMETERS 1 2/3 F1: ERROR CORRECTION F2: RS-232C F3: SELECT COM P↓
4 Press the {F4} key.	{F4}	PARAMETERS 1 3/3 F1: BLUETOOTH P↓
5 Press the {F1} key. The <i>Bluetooth</i> device address and PIN code will display.	{F1}	BLUETOOTH ADDR. : 0000E14F49B4 PIN CODE : 1234 INPUT NONE --- ENTER
6 To change the PIN code, press the {F1} (INPUT) key.	{F1}	BLUETOOTH ADDR. : 0000E14F49B4 PIN CODE = 2233
7 Enter a new PIN code and press the {F4} (ENTER) key.	Enter PIN code {F4}	--- --- [CLR] [ENT]



- To communicate between the ES and *Bluetooth*-enabled instrument, it is necessary to make the PIN codes of both instruments identical.
If two PIN codes don't coincide, the two instrument cannot communicate each other.
- For setting the PIN code of *Bluetooth*-enabled instrument, see the instrument's instruction manual.
- If you do not use the PIN code, choose "NONE." (The factory default setting is "NONE.")

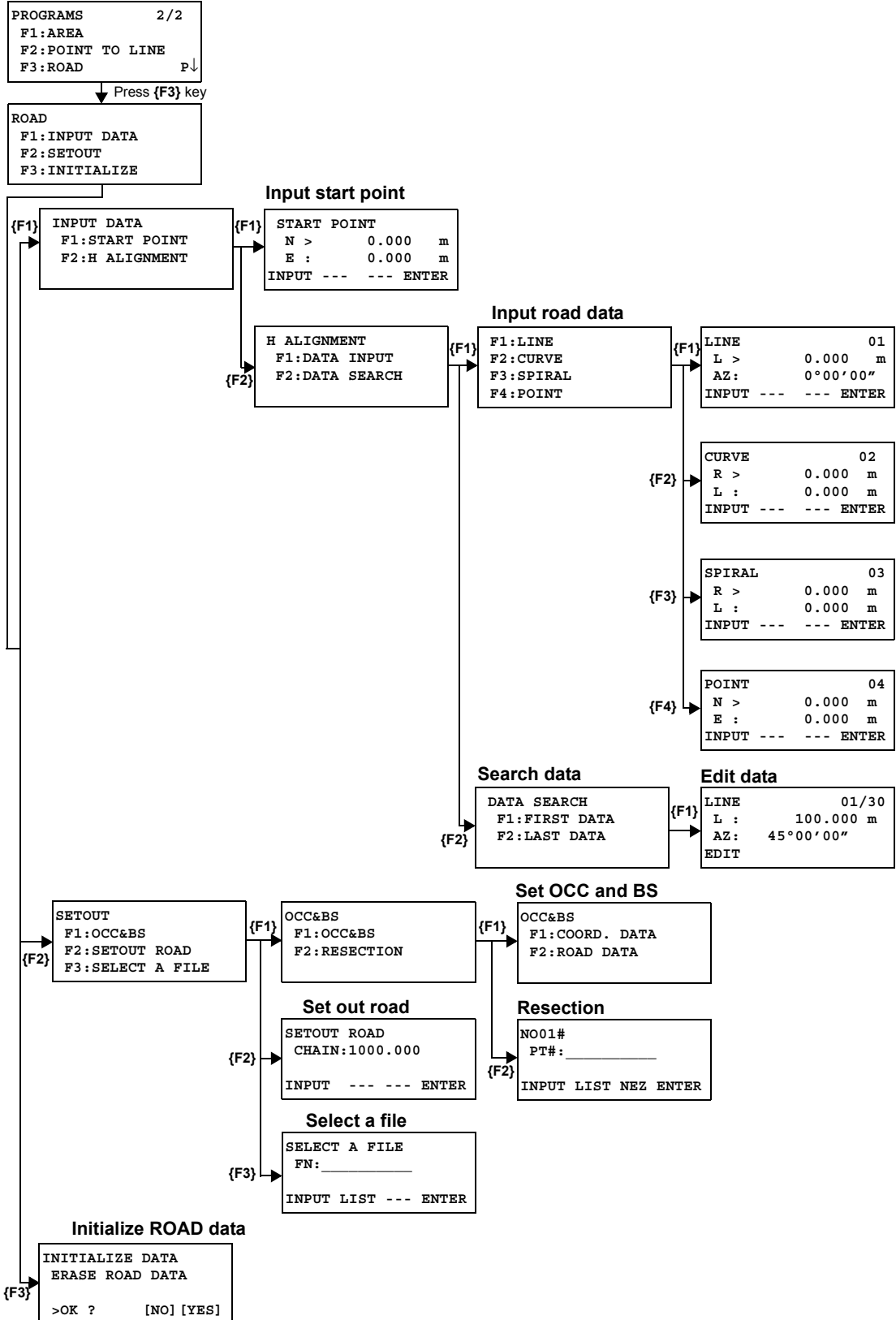
6.5 Setting Contrast of Display

Setting level for contrast of display (LCD)

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key three times to get the menu on page 3.	{MENU} {F4} {F4} {F4}	<div style="border: 1px solid black; padding: 5px;"> MENU 4 / 4 F1: ADJUSTMENT MODE F2: CONTRAST ADJ. P↓ </div>
2 Press the {F2} key.	{F2}	<div style="border: 1px solid black; padding: 5px;"> CONTRAST ADJUSTMENT LEVEL: 4 ↓ ↑ --- ENTER </div>
3 Press the {F1} (↓) key or {F2} (↑) key, and press the {F4} (ENTER) key.	{F1} or {F2} {F4}	

6.6 ROAD

● Road menu operation



6.6.1 Input Start Point

To input the start point, carry out the following operating procedure.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓), {F2}, {F4} key to get the programs menu on page 2/2.	{MENU} {F4} {F2} {F4}	<pre> PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓ </pre>
2 Press the {F3}, {F1}, {F1} key. (Refer to "Input start point" on page 6-26.)	{F3} {F1} {F1}	<pre> START POINT N = 0.000 m E : 0.000 m --- --- [CLR] [ENT] </pre>
3 Input coord N, E. 4 Press the {ENT} key.	Input coord {ENT}	<pre> START POINT CHAIN = 0.000 m INTERVAL:100.000 m --- --- [CLR] [ENT] </pre>
5 Input value data CHAIN, INTERVAL. 6 Press the {ENT} key.	Input data {ENT}	<pre> <SET!> </pre>
<pre> INPUT DATA F1:START POINT F2:H ALIGNMENT </pre>		
<ul style="list-style-type: none"> For [ROAD], in addition to the "Start Point" and "Road Data" input files, other files necessary for the calculations are created. Consequently, if the free area of the memory reaches 10% or less, a "MEMORY POOR" warning message is displayed. (In this case, the instrument can still be operated.) CHAIN and INTERVAL input range $-50,000\text{m} \leq \text{CHAIN} \leq 500,000\text{m}$ $0\text{m} < \text{INTERVAL} \leq 5,000\text{m}$ 		

6.6.2 Input Road Data

[ROAD] is made up of four types of components: LINE, CURVE, SPIRAL and POINT.
To input the required components, carry out the following operating procedure.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓), {F2} , {F4} key to get the programs menu on page 2/2.	{MENU} {F4} {F2} {F4}	<pre>PROGRAMS 2/2 F1: AREA F2: POINT TO LINE F3: ROAD P↓</pre>
2 Press the {F3} , {F1} , {F2} , {F1} key. (☞ Refer to "Input road data" on page 6-26.)	{F3} {F1} {F2} {F1}	<pre>F1: LINE F2: CURVE F3: SPIRAL F4: POINT</pre>
<ul style="list-style-type: none"> The amount of input data varies depending on the type of data, up to a maximum of 30. (In the case of POINT input only, the maximum is 9 points including end point.) An error may occur when entering a combination of POINT and other components if the amount of data entered exceeds the maximum amount allowed for internal calculations. If this happens, please reduce the amount of input data. 		

- Input LINE data

Operating procedure	Operation	Display
1 To input LINE data, press the {F1} key. *1)	{F1}	<pre>F1: LINE F2: CURVE F3: SPIRAL F4: POINT</pre>
2 Input LENGTH.	Input LENGTH	<pre>LINE 01 L = 0.000 m AZ: 0°00'00" --- --- [CLR] [ENT]</pre>
3 Press the {ENT} key.	{ENT}	<pre>LINE 01 L : 100.000 m AZ= 0°00'00" --- --- [CLR] [ENT]</pre>
4 Input AZIMUTH.	Input AZIMUTH	:
5 Press the {ENT} key.	{ENT}	:
		<pre><SET! ></pre>
*1) The number at the top right of the screen shows the amount of data currently entered.		

- Input CURVE data

Operating procedure	Operation	Display
<p>1 To input CURVE data, press the {F2} key. *1)</p> <p>2 Input RADIUS.</p> <p>3 Press the {ENT} key.</p> <p>4 Input LENGTH.</p> <p>5 Press the {ENT} key.</p> <p>6 Select TURN (direction of turn): RIGHT or LEFT.</p> <p>7 Press the {ENT} key.</p>	<p>{F2}</p> <p>Input RADIUS {ENT}</p> <p>Input LENGTH {ENT}</p> <p>Select {F1} (LEFT) or {F2} (RIGHT) {ENT}</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>F1: LINE F2: CURVE F3: SPIRAL F4: POINT</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>CURVE 02 R = 0.000 m L : 0.000 m --- [CLR] [ENT]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>CURVE 02 R : 100.000 m L = 0.000 m --- [CLR] [ENT]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center;">⋮</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>CURVE 02 TURN > RIGHT LEFT RIGHT --- ENTER</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 5px;"> <p><SET!></p> </div>
<p>*1) CURVE cannot be input as the first data.</p>		

- Input SPIRAL data

Operating procedure	Operation	Display
<p>1 To input SPIRAL data, press the {F3} key. *1)</p> <p>2 Input RADIUS.</p> <p>3 Press the {ENT} key.</p> <p>4 Input LENGTH.</p> <p>5 Press the {ENT} key.</p> <p>6 Select TURN (direction of turn): RIGHT or LEFT.</p> <p>7 Press the {ENT} key.</p> <p>8 Select DIR (direction): IN (entrance) or OUT (exit).</p> <p>9 Press the {ENT} key.</p>	<p>{F3}</p> <p>Input RADIUS {ENT}</p> <p>Input LENGTH {ENT}</p> <p>Select {F1} (LEFT) or {F2} (RIGHT) {ENT}</p> <p>Select {F1} (IN) or {F2} (OUT) {ENT}</p>	<pre> F1:LINE F2:CURVE F3:SPIRAL F4:POINT </pre> <pre> SPIRAL 03 R = 0.000 m L : 0.000 m --- [CLR] [ENT] </pre> <pre> SPIRAL 03 R : 100.000 m L = 0.000 m --- [CLR] [ENT] </pre> <p style="text-align: center;">⋮</p> <pre> SPIRAL 03 TURN > RIGHT DIR : IN LEFT RIGHT --- ENTER </pre> <pre> SPIRAL 03 TURN : LEFT DIR > IN IN OUT --- ENTER </pre> <pre> <SET!> </pre>
<p>*1) SPIRAL cannot be input as the first data.</p>		

6.6.5 Set OCC and BS

To set the Occupied Point and Backsight Point, carry out the following operating procedure.

Operating procedure	Operation	Display
<p>1 After pressing the {MENU} key, press the {F4} (P↓), {F2}, {F4} key to get the programs menu on page 2/2.</p>	<p>{MENU} {F4} {F2} {F4}</p>	<pre>PROGRAMS 2/2 F1: AREA F2: POINT TO LINE F3: ROAD P↓</pre>
<p>2 Press the {F3}, {F2}, {F1} key. (☞ Refer to "Set OCC and BS" on page 6-26.)</p>	<p>{F3} {F2} {F1}</p>	<pre>OCC&BS F1: OCC&BS F2: RESECTION</pre>
<p>3 Press the {F1} key. *1)</p>	<p>{F1}</p>	<pre>OCC&BS F1: COORD. DATA F2: ROAD DATA</pre>
<p>4 To input OCC. PT, press the {F1} (COORD. DATA) or {F2} (ROAD DATA) key.</p> <p>COORD. DATA: Choose the data from Coord Data and set the Occupied Point.</p> <p>ROAD DATA: Create the data from Road Data and set the Occupied Point.</p> <p>(Example: ROAD DATA)</p>	<p>{F2}</p>	<pre>OCC. PT CHAIN= --- --- [CLR] [ENT]</pre>
<p>5 Input OCC. PT, press the {ENT} key.</p>	<p>Input OCC. PT {ENT}</p>	<pre>CHAIN: 1000.000 >CENTER LEFT RIGHT --- ENTER</pre>
<p>6 Press the {ENT} key.</p> <p>LEFT or RIGHT: Use the offset point. CENTER: Use the center point.</p> <p>(Example: CENTER)</p>	<p>{ENT}</p>	<pre>CHAIN: 1000.000 N : 0.000 m E : 0.000 m >OK ? [YES] [NO]</pre>
<p>7 Press the {F3} (YES) key.</p>	<p>{F3}</p>	<pre>BACKSIGHT CHAIN= --- --- [CLR] [ENT]</pre>
<p>8 Input the backsight.</p>	<p>Input Backsight</p>	
<p>9 Press the {ENT} key.</p>	<p>{ENT}</p>	<pre>CHAIN: 0.000 >CENTER LEFT RIGHT --- ENTER</pre>

6.6.6 Setout Road

To setout the road, carry out the following operating procedure.

Operating procedure	Operation	Display
<p>1 After pressing the {MENU} key, press the {F4} (P↓), {F2}, {F4} key to get the programs menu on page 2/2.</p>	<p>{MENU} {F4} {F2} {F4}</p>	<pre>PROGRAMS 2/2 F1:AREA F2:POINT TO LINE F3:ROAD P↓</pre>
<p>2 Press the {F3}, {F2}, {F2} key. (Refer to "Set out road" on page 6-26.)</p>	<p>{F3} {F2} {F2}</p>	<pre>SETOUT ROAD CHAIN= --- --- [CLR] [ENT]</pre>
<p>3 Input data.</p>	<p>Input data</p>	<pre>SETOUT ROAD CHAIN=1200 --- --- [CLR] [ENT]</pre>
<p>4 Press the {ENT} key.</p>	<p>{ENT}</p>	<pre>CHAIN:1200 > CENTER LEFT RIGHT --- ENTER</pre>
<p>5 Select offset. (Example: RIGHT) Press the {F2} key. *1)</p>	<p>{F2}</p>	<pre>CHAIN:1200 : RIGHT = m --- --- [CLR] [ENT]</pre>
<p>6 Input the offset value.</p>	<p>Input offset value</p>	
<p>7 Press the {ENT} key. The setout point coordinates are displayed.</p>	<p>{ENT}</p>	<pre>CHAIN:1200 N : 0.000 m E : 0.000 m >OK ? [YES] [NO]</pre>
<p>8 Press the {F3} (YES) key. The distance to the setout point and the backsight are displayed. HR: Calculated horizontal angle of the layout point HD: Calculated horizontal distance from the instrument to the layout point</p>	<p>{F3}</p>	<pre>CALCULATED HR= 60°00'00" HD= 100.000 m ANGLE DIST --- ---</pre>
<p>9 Press the {F1} (ANG) key. CHAIN: Layout point HR: Measured (Actual) horizontal angle. dHR: Horizontal angle to be turned to the layout point = Actual horizontal angle - Calculated horizontal angle. Correct direction when dHR = 0°00'00"</p>	<p>{F1}</p>	<pre>CHAIN:1200 HR: 60°00'00" dHR: 0°00'00" DIST --- NEZ ---</pre>
<p>10 Press the {F1} (DIST) key. HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance - Calculated horizontal distance.</p>	<p>{F1}</p>	<pre>HD* 100.000 m dHD: 0.000 m MODE NEZ NP/P NEXT</pre>

11 Press the {F3} (NEZ) key. The coordinate data is shown.	{F3}	<pre> N * 70.000 m E : 50.000 m MODE ANG NP/P NEXT </pre>
12 Press the {F4} (NEXT) key to set next layout point.	{F4}	
*1) If not selecting offset, press the {ENT} key.		

6.6.7 Select a File

To set the coordinates to be used for the Occupied Point and Backsight Point, carry out the following operating procedure.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓), {F2} , {F4} key to get the programs menu on page 2/2.	{MENU} {F4} {F2} {F4}	<pre> PROGRAMS 2 / 2 F1 : AREA F2 : POINT TO LINE F3 : ROAD P↓ </pre>
2 Press the {F3} , {F2} key. (☞ Refer to "Select a file" on page 6-26.)	{F3} {F2}	<pre> SETOUT F1 : OCC&BS F2 : SETOUT ROAD F3 : SELECT A FILE </pre>
3 Press the {F3} key.	{F3}	<pre> SELECT A FILE FN : _____ INPUT LIST --- ENTER </pre>
4 Enter the name of the file being used (or select it from the list).	Select a file	
5 Press the {ENT} key.	{ENT}	

6.6.8 Initialize ROAD data

To initialize the data, carry out the following operating procedure.

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓), {F2} , {F4} key to get the programs menu on page 2/2.	{MENU} {F4} {F2} {F4}	<pre> PROGRAMS 2 / 2 F1 : AREA F2 : POINT TO LINE F3 : ROAD P↓ </pre>
2 Press the {F3} , {F3} key. (☞ Refer to "Initialize ROAD data" on page 6-26.)	{F3} {F3}	<pre> INITIALIZE DATA ERASE ROAD DATA >OK ? [NO] [YES] </pre>
3 When the {F4} (YES) key is pressed, all ROAD DATA with the exception of the coordinate data file is erased. Press the {F4} key.	{F4}	

7 DATA COLLECTION

The ES is able to store the measured data into the internal memory.

The internal memory is shared by the measured data files and the coordinate data files.

- **Measured data**


The collected data is memorized into a files.

- **The number of measurement points**

(In case not using the internal memory in layout mode)

MAX. 10,000 points

Because the internal memory covers both data collection mode and layout mode, the number of measurement points will be decreased when the layout mode is used.

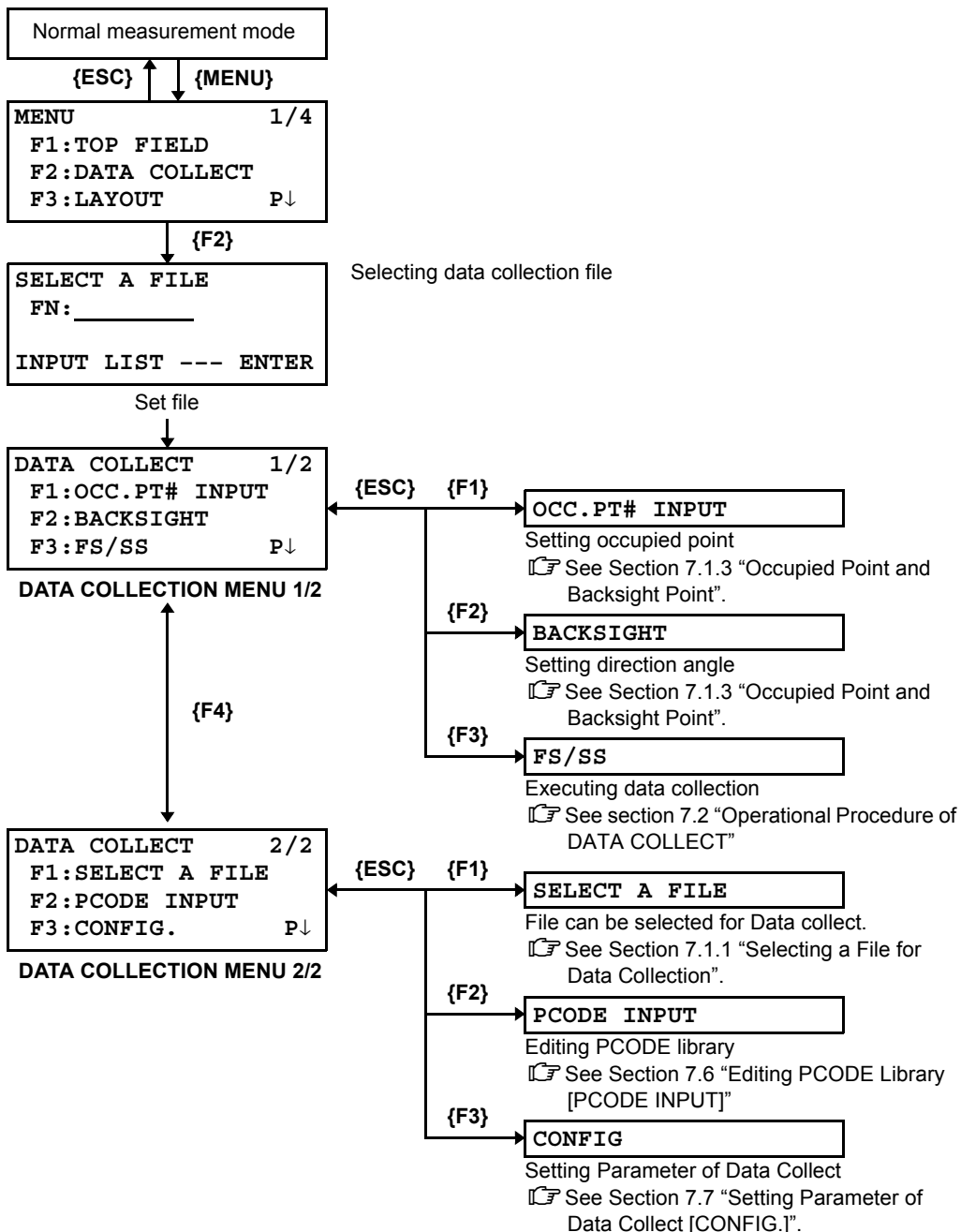
 For the internal memory, refer to Chapter 9 “MEMORY MANAGER MODE”.



- When turning off the power, ensure that you are in the main menu screen or main angle measurement mode.
This ensures completion of the memory access process and avoids possible damage to the stored data.
- It is recommended for safety to charge the battery beforehand and prepare fully charged spare batteries.

● Data collect menu operation

By pressing the {MENU} key, the instrument will be in MENU 1/3 mode.
 Press the {F2} (DATA COLLECT) key, the menu of data collect 1/2 will be shown.



7.1 Preparation

7.1.1 Selecting a File for Data Collection

A file used by data collection mode must be selected at first.

Select a file before beginning data collection mode because selection screen of a file is displayed. And a selection from data collection menu is possible in the mode.

Operating procedure	Operation	Display
<p>1 Press {F2} (DATA COLLECT) key from menu 1/3.</p> <p>2 Press {F2} (LIST) key to display the list of file. *1)</p> <p>3 Scroll file list by pressing {▼} or {▲} key and select a file to use. *2),3)</p> <p>4 Press {F4} (ENTER) key. The file will be set and data collect 1/2 menu will be shown.</p>	{F2}	<pre> MENU 1/3 F1:TOP FIELD F2:DATA COLLECT F3:LAYOUT P↓ </pre>
		<pre> SELECT A FILE FN: _____ INPUT LIST --- ENTER </pre>
	{F2}	<pre> AMIDATA /M0123 →*HILDATA /M0345 TOPDATA /M0789 --- SRCH --- ENTER </pre>
		{▼} or {▲}
{F4}	{F4}	<pre> DATA COLLECT 1/2 F1:OCC.PT# INPUT F2:BACKSIGHT F3:FS/SS P↓ </pre>
		<pre> DATA COLLECT 2/2 F1:SELECT A FILE F2:PCODE INPUT F3:CONFIG. P↓ </pre>
<p>*1) If you want to make a new file or input file name directly, press {F1} (INPUT) key and enter a file name.</p> <p>*2) When a file has been selected already, "*" mark is indicated on left of current file name.</p> <p>*3) Data in a file shown with arrow can be searched by pressing {F2} (SRCH) key.</p>		
<p>Note</p> <ul style="list-style-type: none"> It is possible to select a file from DATA COLLECT 2/2 menu in the same way. 		<pre> DATA COLLECT 2/2 F1:SELECT A FILE F2:PCODE INPUT F3:CONFIG. P↓ </pre>

7.1.2 Selecting a Coordinate File for Data Collection

When coordinate data in a coordinate data file are used for occupied point or backsight point, select a coordinate file from the data collect menu 2/2 beforehand.

Operating procedure	Operation	Display
<p>1 Press the {F1} (SELECT A FILE) key from DATA COLLECT menu 2/2.</p>	<p>{F1}</p>	<pre>DATA COLLECT 2/2 F1:SELECT A FILE F2:PCODE INPUT F3:CONFIG. P↓</pre>
<p>2 Press the {F2} (COORD.DATA) key.</p>		<p>{F2}</p>
<p>3 Select a coordinate file in the same manner as Section 7.1.1 "Selecting a File for Data Collection".</p>		<pre>SELECT A FILE FN: _____ INPUT LIST --- ENTER</pre>

7.1.3 Occupied Point and Backsight Point

The occupied point and direction angle in the data collect mode are linked with the occupied point and direction angle in normal coordinate measurement.


It is possible to set or change the occupied point and direction angle from the data collect mode.

Occupied point can be set by two setting methods as follow.

- Setting from the coordinate data stored in the internal memory.
- Direct key input.

The following three setting methods for backsight point can be selected.


- Setting from the coordinate data stored in the internal memory.
- Direct key input of coordinate data.
- Direct key input of setting angle.

 See 9.4 “Coordinate Data Direct Key Input” and 9.7.2 “Loading Data” for how to store coordinate into the internal memory.

● **Example for setting the occupied point:**

In case of setting occupied point from the coordinate data stored in the internal memory.

Operating procedure	Operation	Display
1 Press the {F1} (OCC.PT# INPUT) key from the data collect menu 1/2. The previous data is shown.	{F1}	PT# →PT-01 ID : INS.HT: 0.000 m INPUT SRCH REC OCNEZ
2 Press the {F4} (OCNEZ) key.	{F4}	OCC.PT PT#:PT-01 INPUT LIST NEZ ENTER
3 Press the {F1} (INPUT) key and enter PT#.*1) Press the {F4} (ENT) key.	{F1} Enter PT# {F4}	N: 0.000m E: 0.000m Z: 0.000m >OK? [YES] [NO]
4 Press the {F3} (YES) key.	{F3}	PT# →PT-11 ID : INS.HT: 0.000 m INPUT SRCH REC OCNEZ
5 Enter ID, INS.HT in the same way. *2),3)	Enter ID, INS.HT	PT# :PT-11 ID : INS.HT→ 1.335 m INPUT SRCH REC OCNEZ >REC ? [YES] [NO]
6 Press {F3} (REC) key.	{F3}	
7 Press {F3} (YES) key. The display returns to the data collect menu 1/2.	{F3}	DATA COLLECT 1/2 F1:OCC.PT# INPUT F2:BACKSIGHT F3:FS/SS P↓

*1)  Refer to Section 2.4 “How to Enter Alphanumeric Characters”.

*2) ID can be input by inputting a register number linked with PCODE Library.

To show the list of PCODE library, press the **{F2}** (SRCH) key.



*3) Press the **{F3}** (REC) key when you do not input the INS.HT.

Note

- The data recorded in data collect is PT#, ID and INS.HT.
- If point is not found in internal memory "PT# DOES NOT EXIST" is displayed.




● **Example for setting the direction angle:**

The following is to memorize the data of the backsight after setting the backsight point from point number.

Operating procedure	Operation	Display
<p>1 Press the {F2} (BACKSIGHT) key from the data collect menu 1/2. The previous data is shown.</p>	{F2}	<pre>BS# → PCODE : R.HT : 0.000 m INPUT 0SET MEAS BS</pre>
<p>2 Press the {F4} (BS) key. *1)</p>	{F4}	<pre>BACKSIGHT PT# : INPUT LIST NE/AZ ENT</pre>
<p>3 Press the {F1} (INPUT) key and enter PT#. *2)</p>	{F1} Enter PT#	<pre>N: 0.000m E: 0.000m Z: 0.000m >OK? [YES] [NO]</pre>
<p>4 Press the {F3} (YES) key. Enter PCODE,R.HT in the same way. *3),4)</p>	{F3}	<pre>BS# →PT-22 PCODE : R.HT : 0.000 m INPUT 0SET MEAS BS</pre>
<p>5 Press the {F3} (MEAS) key.</p>	{F3}	<pre>BS# →PT-22 PCODE : R.HT : 0.000 m *VH SD NEZ NP/P</pre>
<p>6 Collimate back sight point. Select one of the measuring mode and press the soft key. EXAMPLE: {F2} (Slope Distance) key. Horizontal circle is set to calculated direction angle. Measuring starts. Measuring result is memorized and the display returns to the data collect menu 1/2.</p>	Collimate BS {F2}	<pre>V : 90°00'00" HR: 0°00'00" SD*[n] <<< m > Measuring...</pre> <p style="text-align: center;">↓</p> <pre>DATA COLLECT 1/2 F1:OCC.PT# INPUT F2:BACKSIGHT F3:FS/SS P↓</pre>
<p>*1) Pressing each time the {F3} key, the input method changes as Coordinate value, Angle, Coordinate point name alternatively.</p> <p>*2)  Refer to Chapter 2.4 "How to Enter Alphanumeric Characters".</p> <p>*3) PCODE can be input by inputting a register number linked with PCODE Library. To show the list of PCODE library, press the {F2} (SRCH) key.</p> <p>*4) Data collect sequence can be set to [MEAS→EDIT].  Refer to Section 7.7 "Setting Parameter of Data Collect [CONFIG]".</p> <p>Note</p> <ul style="list-style-type: none"> If point is not found in internal memory " PT# DOES NOT EXIST" is displayed. 		

7.2 Operational Procedure of DATA COLLECT


Operating procedure	Operation	Display
		DATA COLLECT 1/2 F1:OCC.PT# INPUT F2:BACKSIGHT F3:FS/SS P↓
1 Press the {F3} (FS/SS) key from the data collect menu 1/2. The previous data is shown.	{F3}	PT# → PCODE : R.HT : 0.000 m INPUT SRCH MEAS ALL
2 Press the {F1} (INPUT) key and enter PT#. Press the {F4} (ENT) key. *1)	{F1} Enter PT# {F4}	PT# =PT-01 PCODE : R.HT : 0.000 m [ALP] [SPC] [CLR] [ENT]
		PT# :PT-01 PCODE → R.HT : 0.000 m INPUT SRCH MEAS ALL
3 Enter PCODE, R.HT in the same way. *2),3)	{F1} Enter PCODE {F4}	PT# →PT-01 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL
4 Press the {F3} (MEAS) key.	{F1} EnterR.HT {F4}	VH *SD NEZ P1↓
5 Collimate the target point.	{F3}	
6 Press one of the {F1} to {F3} key. *4) Example: {F2} (SD) key. Measuring starts. The measuring data is memorized and the display changes to the next point. *5) PT# is automatically incremented.	Collimate {F2}	V : 90°10'20" HR: 120°30'40" SD*[n] < m > Measuring... < complete > ↓ PT# →PT-02 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL
7 Enter the next point data and collimate the next point.	Collimate	
8 Press {F4} (ALL) key. Measuring starts in the same measuring mode of the previous point. Data is recorded.	{F4}	V : 90°10'20" HR: 120°30'40" SD*[n] < m > Measuring... < complete > ↓ PT# →PT-03 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL
Continue the measuring in the same way. To finish the mode, press {ESC} key.		

- *1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".
- *2) PCODE can be input by inputting a register number linked with PCODE Library.
To show the list of PCODE library, press the {F2} (SRCH) key.
- *3) Data collect sequence can be set to [MEAS→EDIT].  See to Section 7.7 "Setting Parameter of Data Collect [CONFIG]".
- *4) The mark "*" indicates the previous measuring mode.
- *5) You can confirm the measured data as follows.  Refer to Section 7.7 "Setting Parameter of Data Collect [CONFIG]".

```
V : 90°10'20"
HR: 120°30'40"
SD: 98.765 m
> OK ? [YES] [NO]
```

7.2.1 Searching the recorded data

While executing the DATA COLLECT mode, you can search the recorded data.

Operating procedure	Operation	Display
<p>1 While executing the DATA COLLECT mode, press {F2} (SRCH) key. *1)</p> <p>The using file name will appear on the top of the right side of the display.</p> <p>2 Select one of three search methods by pressing {F1} to {F3} key. *2)</p>	<p>{F2}</p> <p>{F1} to {F3}</p>	<pre>PT# →PT-02 PCODE : R.HT : 1.200 m INPUT SRCH MEAS ALL</pre> <pre>SEARCH [TOPCON] F1:FIRST DATA F2:LAST DATA F3:PT# DATA</pre>
<p>*1) It is possible to see the PCODE list when the arrow is located beside PCODE or ID. *2) The operation is same as the "SEARCH" in the MEMORY MANAGER mode.  For more information, refer to Section 9.2 "Searching Data".</p>		

7.2.2 Entering PCODE / ID using PCODE Library

While executing the DATA COLLECT mode, you can enter PCODE /ID from PCODE Library.

Operating procedure	Operation	Display
<p>1 Move the arrow to the PCODE or ID in the DATA COLLECT mode, press the {F1} (INPUT) key.</p> <p>2 Enter a register number linked with PCODE library and press the {F4} (ENT) key. (Example) Register number, 32 = TOPCON</p>	<p>{F1}</p> <p>Enter No {F4}</p>	<pre>PT# :PT-02 PCODE → R.HT : 1.200 m INPUT SRCH MEAS ALL</pre> <pre>PT# :PT-02 PCODE =32 R.HT : 1.200 m [ALP] [SPC] [CLR] [ENT]</pre> <pre>PT# :PT-02 PCODE :TOPCON R.HT → 1.200 m INPUT SRCH MEAS ALL</pre>

7.2.3 Entering PCODE / ID from the list of PCODE

You can also enter PCODE / ID from the list of PCODE.

Operating procedure	Operation	Display
<p>1 Move the arrow to the PCODE or ID in the DATA COLLECT mode, press the {F2} (SRCH) key.</p> <p>2 By pressing the following keys, the register number will increase or decrease. {▲} or {▼}: Increasing or Decreasing one by one {▶} or {◀}: By ten Increasing or Decreasing. *1)</p> <p>3 Press the {F4} (ENTER) key.</p>	<p>{F2}</p> <p>{▲} or {▼} {▶} or {◀}</p> <p>{F4}</p>	<pre>PT# :PT-02 PCODE → R.HT : 1.200 m INPUT SRCH MEAS ALL</pre> <pre>→001:PCODE01 002:PCODE02 EDIT --- CLR ENTER</pre> <pre> 031:PCODE31 →032:TOPCON 033:HILTOP EDIT --- CLR ENTER</pre> <pre>PT# :PT-02 PCODE :TOPCON R.HT → 1.200 m INPUT SRCH MEAS ALL</pre>
<p>*1) To edit the PCODE library, press the {F1} (EDIT) key. To delete the PCODE registered with shown an arrow, press the {F3} (CLR) key.</p> <p>Note</p> <ul style="list-style-type: none"> PCODE can be edited in DATA COLLECT menu 2/2 or MEMORY MANAGER menu 2/3. 		

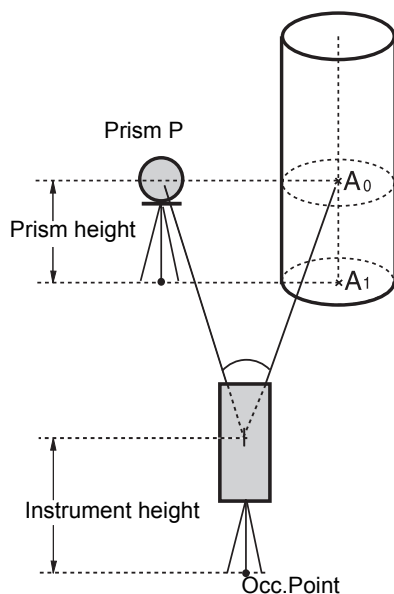
7.3 Data Collect Offset Measurement mode

This mode is useful when it is difficult to set up the prism directly, for example at the center of a tree. Data Collect. Offset Measurement has two measuring methods.

- Angle offset measurement
- Distance offset measurement
- Plane offset measurement
- Column offset measurement

7.3.1 Angle Offset Measurement


Place the prism at the same horizontal distance from the instrument as that of point A0 to measure.








When measuring coordinates of ground point A1: Set the instrument height / prism height.

When measuring coordinates of point A0: Set the instrument height only. (Set the prism height to 0).

When sighting to A₀, you can select one of two ways. One is to fix vertical angle to the prism position even up down the telescope position, and the other is to gear vertical angle to the up down of telescope movement. In case following the vertical angle to the movement of telescope, SD (Slope Distance) and VD (Vertical Distance) will be changed according to the movement of telescope.

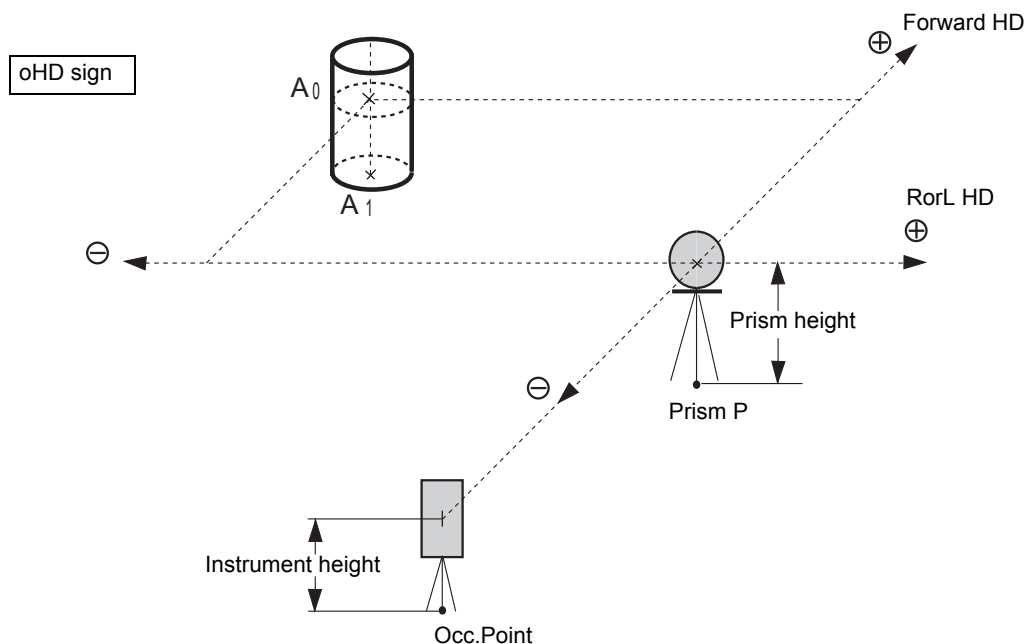
 To set this option, refer to Chapter 17 "SELECTING MODE".

Operating procedure	Operation	Display
1 Press the {F3} (MEAS) key and press the {F4} key to get to the next soft key page.	{F3} {F4}	<pre>PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL</pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre>PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m VH *SD NEZ P1↓ OFFSET PTL NP/P P2↓</pre>
3 Press the {F1} (ANG.OFFSET) key.	{F1}	<pre>OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓</pre>
4 Collimate the prism.	Collimate P	<pre>OFFSET-MEASUREMENT HR: 120°30'40" HD: m MEAS --- NP/P ---</pre>

<p>5 Press the {F1} (MEAS) key. Continuous measuring starts.</p>	{F1}	<pre> OFFSET-MEASUREMENT HR: 120°30'40" HD* [n] < m >measuring ... </pre>
<p>6 Collimate point A0 using the horizontal motion clamp and horizontal tangent screw.</p>	Collimate A0	<pre> OFFSET-MEASUREMENT HR: 120°30'40" SD* 12.345 m >OK? [YES] [NO] </pre>
<p>7 Show the horizontal distance of point A0.</p>		<pre> OFFSET-MEASUREMENT HR: 123°30'40" SD: 12.345 m >OK? [YES] [NO] </pre>
<p>8 Show the relative elevation of point A0.</p> <ul style="list-style-type: none"> Each time pressing  key, horizontal distance, relative elevation and slope distance are shown in sequence. 		<pre> OFFSET-MEASUREMENT HR: 123°30'40" HD: 6.543 m >OK? [YES] [NO] </pre>
<p>9 Show N coordinate of point A0 or A1.</p> <ul style="list-style-type: none"> Each time pressing  key, N,E and Z coordinate are shown in sequence. 		<pre> OFFSET-MEASUREMENT HR: 123°30'40" VD: 0.843 m >OK? [YES] [NO] </pre>
<p>10 Press the {F3} (YES) key.</p>	{F3}	<pre> OFFSET-MEASUREMENT HR: 123°30'40" N : -12.345 m >OK? [YES] [NO] </pre>
<p>The data is recorded and the next measuring point is displayed.</p>		<pre> PT# →PT-12 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL </pre>

7.3.2 Distance Offset Measurement

The measurement of a place apart from a prism is possible by inputting offset horizontal distance of front and back / right and left.



When measuring coordinates of ground point A₁: Set the instrument height / prism height.

When measuring coordinates of point A₀: Set the instrument height only.
(Set the prism height to 0).

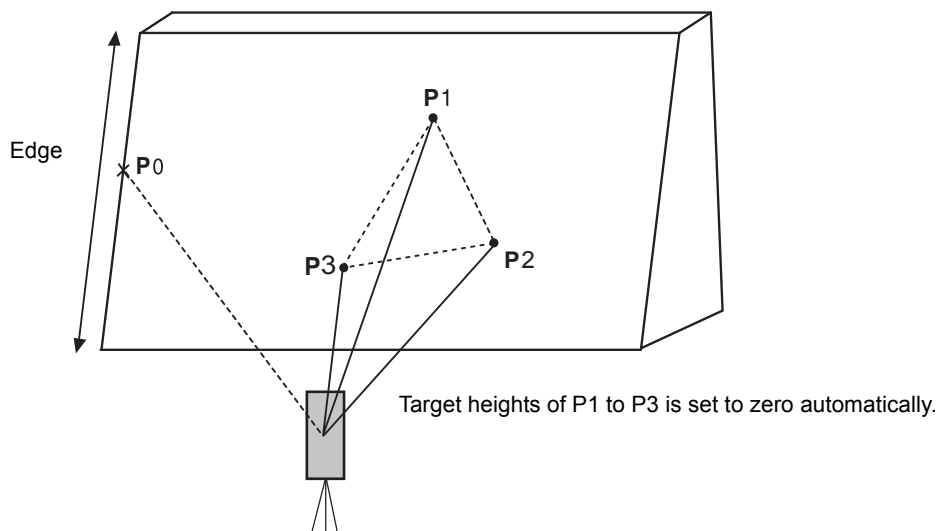
Operating procedure	Operation	Display
1 Press the {F3} (MEAS) key and press the {F4} key to get to the next soft key page.	{F3} {F4}	PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL
		PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m VH *SD NEZ P1↓ OFFSET PTL NP/P P2↓
2 Press the {F1} (OFFSET) key.	{F1}	OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓
3 Press the {F2} (DIST.OFFSET) key.	{F2}	DISTANCE OFFSET INPUT RorL HD oHD=0.000 m --- --- [CLR] [ENT]
4 Enter Right and Left direction offset value.*1)	Enter HD {F4}	DISTANCE OFFSET INPUT FORWARD HD oHD=0.000 m --- --- [CLR] [ENT]

<p>5 Enter Forward direction offset value. *1)</p> <p>6 Collimate the prism.</p> <p>7 Press the {F2} or {F3} key. Example:{F3} (NEZ) key Measuring starts.</p> <p>The data is recorded and the next measuring point is displayed.</p>	<p>Enter HD {F4}</p> <p>Collimate P {F3}</p>	<pre> PT# :PT-11 PCODE : TOPCON R.HT : 1.200 m --- *SD NEZ NP/P </pre> <pre> N*[n] <<< m E : m Z : m >measuring ... >Calculating... </pre> <p style="text-align: center;">↓</p> <pre> PT# →PT-12 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL </pre>
<p>*1) To skip entering, press the {F3} (SKP) key.</p>		

7.3.3 Plane Offset Measurement




Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.

Three random points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane. Collimate the measuring point (P0) then the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



Operating procedure	Operation	Display
1 Press the {F3} (MEAS) key and press the {F4} key to get to the next soft key page.	{F3} {F4}	PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL
		PT# →PT-11 PCODE :TOPCON R.HT : 1.200 m VH *SD NEZ P1↓ OFFSET PTL NP/P P2↓
2 Press the {F1} (OFFSET) key.	{F1}	OFFSET 1/2 F1:ANG. OFFSET F2:DIST. OFFSET F3:PLANE OFFSET P↓
3 Press the {F3} (PLANE OFFSET) key.	{F3}	PLANE N001#: SD: m MEAS --- NP/P ---
4 Collimate prism P1, and press the {F1} (MEAS) key. Measuring will start. After measuring, the display will show the second point measurement.	Collimate P1 {F1}	PLANE N001#: SD* [n] << m >Measuring...

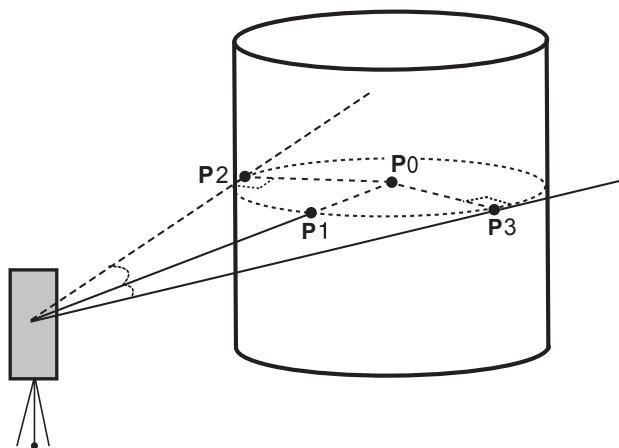


<p>5 Measure the second and third points in the same way. *1)</p>	<p>Collimate P2 {F1}</p>	<pre>PLANE N002#: SD: m MEAS --- NP/P ---</pre>
<p>The display changes to PT# input in the plane offset measurement. Input point number if necessary.</p>	<p>Collimate P3 {F1}</p>	<pre>PLANE N003#: SD: m MEAS --- NP/P ---</pre>
<p>6 Press the {F4} (MEAS) key. The instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane. *2)</p>	<p>{F4}</p>	<pre>PLANE PT# →PT-11 PCODE :TOPCON INPUT SRCH --- MEAS</pre>
<p>7 Collimate the edge (P0) of the plane. *3), 4)</p>	<p>Collimate P0</p>	<pre>HR: 80°30'40" HD: 54.321 m VD: 10.000 m >OK? [YES] [NO]</pre>
<p>8 To show the slope distance (SD), press the {} key.</p> <ul style="list-style-type: none"> Each time pressing the {} key, horizontal distance, relative elevation and slope distance are shown in sequence. To show coordinate value of point P0, press the {} key. 	<p>Collimate P0</p>	<pre>HR: 75°30'40" HD: 54.600 m VD: -0.487 m >OK? [YES] [NO]</pre>
<p>9 Press the {F3} (YES) key. Next offset point number will be displayed.</p>	<p>{F3}</p>	<pre>V : 90°30'40" HR: 75°30'40" SD: 54.602 m >OK? [YES] [NO]</pre>
<p>10 To escape the measuring, press the {ESC} key. The display returns to the next point number in data collect mode.</p>	<p>{ESC}</p>	<pre>PLANE PT# →PT-12 PCODE :TOPCON INPUT SRCH --- MEAS</pre>
<pre>PT# →PT-12 PCODE :TOPCON R.HT : 1.200 m INPUT SRCH MEAS ALL</pre>		
<p>*1) In case the calculation of plane was not successful by the measured three points, error displays. Start measuring over again from the first point. *2) Data display is the mode beforehand of offset measurement mode. *3) Error will be displayed when collimated to the direction which does not cross with the determined plane. *4) The reflector height of the target point P0 is set to zero automatically</p>		

7.3.4 Column Offset Measurement





If it is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measured circumscription points (P2) and (P3).

The direction angle of the center of the column is 1/2 of total direction angle of circumscription points (P2) and (P3).




Example: Non-prism measurement

Operating procedure	Operation	Display
1 Press the {F3} (MEAS) key and press the {F4} key to get to the next soft key page.	{F3} {F4}	<pre>PT# →PT-11 PCODE :TOPCON N R.HT : 1.200 m INPUT SRCH MEAS ALL</pre>
2 Press the {F1} (OFFSET) key.	{F1}	<pre>PT# →PT-11 PCODE :TOPCON N R.HT : 1.200 m VH *SD NEZ P1↓ OFFSET PTL NP/P P2↓</pre>
3 Press the {F4} (P1↓) key.	{F4}	<pre>OFFSET 1/2 F1:ANG. OFFSET N F2:DIST. OFFSET P F3:PLANE OFFSET P↓</pre>
4 Press the {F1} (COLUMN OFFSET) key.	{F1}	<pre>OFFSET 2/2 F1:COLUMN OFFSET N P↓</pre>
5 Collimate the center of the column (P1) and press the {F1} (MEAS) key. Measuring will start. After the measurement, angle measuring display of the left side (P2) will be shown.	Collimate P1 {F1}	<pre>COLUMN OFFSET Center N HD: m MEAS --- NP/P ---</pre> <pre>COLUMN OFFSET Center N HD* [n] << m >Measuring...</pre> <p style="text-align: center;">↓</p>

<p>6 Collimate the left side of the column (P2) and press the {F4} (SET) key. After the measurement, angle measuring display of the right side (P3) will be shown.</p>	<p>Collimate P2 {F4}</p>	<pre> COLUMN OFFSET Left N P HR: 120°30'40" --- --- --- SET </pre>
<p>7 Collimate the right side of the column (P3) and press the {F4} (SET) key.</p>	<p>Collimate P3 {F4}</p>	<pre> COLUMN OFFSET Right N P HR: 180°30'40" --- --- --- SET </pre>
<p>The distance between the instrument and center of the column (P0) will be calculated.</p>		<pre> COLUMN OFFSET HR: 150°30'40" N P HD: 43.321 m >OK? [YES] [NO] </pre>
<p>To show the relative elevation (VD), press the { key.</p>	<p>{</p>	<pre> COLUMN OFFSET HR: 150°30'40" N P VD: 2.321 m >OK? [YES] [NO] </pre>
<p>Each time pressing the { key, horizontal distance, relative elevation and slope distance are shown in sequence.</p>		
<p>To show coordinate of point P0, press the { key.</p>		
<p>8 Press the {F3} (YES) key. The display returns to the next point number in data collect mode.</p>	<p>{F3}</p>	<pre> PT# →PT-12 PCODE :TOPCON N P R.HT : 1.200 m INPUT SRCH MEAS ALL </pre>

7.4 NEZ Auto Calculation

As measured data is collected, coordinates are calculated and stored for traverse or topo collection. Automatic making out function of coordinate data sets up in CONFIG of data collect.

 Refer to Section 7.7 "Setting Parameter of Data Collect [CONFIG]."

As a default, coordinate data calculated will be saved in a file of the same name as the measurement data file.

When the coordinate data file of the same name as the measurement data file does not exist, it will be generated automatically.

It is possible to change a file for saving coordinate data in the DATA COLLECT Menu 2/2 (F1:SELECT A FILE).

To calculate a coordinate data, it is necessary to add a point number in Data Collect execution.

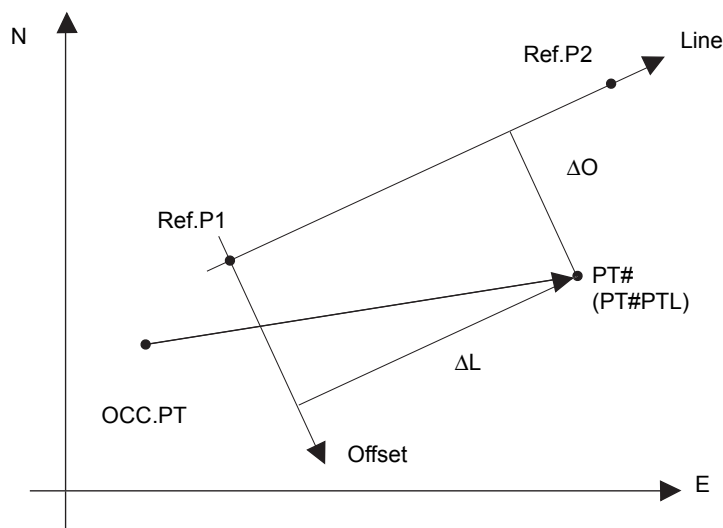
When a coordinate data of the same point number exist already, it can be replaced with the new data by confirming display.

Note

- Coordinates will be calculated using the grid factor.
 To set the grid factor, see Section 6.2 "Setting the GRID FACTOR".

7.5 Point to Line Measurement

In this mode, a offsetting point from a certain determined line can be measured.



7.5.1 To change to the point to line measurement

Operating procedure	Operation	Display
<p>1 Press the {F3} (MEAS) key and press the {F4} key to get to the next soft key page.</p> <p>2 Press the {F2} (PTL) key.</p> <p>3 Press the {F1} (ON) key and press the {F4} (ENTER) key. The input screen of a reference point 1 will appear.</p> <p>4 Enter the point 1 data and press the {F4} (Enter). The input screen of a reference point 2 will appear.</p> <p>5 Enter the point 2 data and press the {F4} (Enter). The screen will return to data collect measurement. If the PTL measurement mode is available, 'PTL' will appear next to PT#.</p>	<p>{F3} {F4}</p>	<pre>PT# →PT-01 PCODE :TOPCON R.HT : 1.500 m INPUT SRCH MEAS ALL</pre>
		<pre>PT# →PT-01 PCODE :TOPCON R.HT : 1.500 m VH *SD NEZ P1↓ OFSET PTL NP/P P2↓</pre>
	<p>{F2}</p>	<pre>POINT TO LINE MODE [F1:ON] F2:OFF ENTER</pre>
		<p>{F4}</p> <pre>REF. POINT 1 PT#: _____ INPUT LIST --- ENTER</pre>
	<p>{F4}</p>	<p>Input data {F4}</p> <pre>REF. POINT 2 PT#: _____ INPUT LIST --- ENTER</pre>
<p>{F4}</p>	<p>Input data {F4}</p> <pre>PT#PTL→PT-01 PCODE :TOPCON R.HT : 1.500 m INPUT SRCH MEAS ALL</pre>	

7.5.2 Executing a point to line measurement


Operating procedure	Operation	Display
<p>Conduct data measurement according to the same procedure as with ordinary FS/SS (ALL can also be selected). However, when you conduct observation in the angle mode, PTL data will not be displayed (only the raw data will be recorded, upon which the operation will end).</p> <p>1 Press the {F3} (MEAS) key.</p> <p>2 Press the {F2} (SD) key. If the PTL mode is on, then, after the coordinate data is calculated, the PTL data will be displayed regardless of the coordinate check setting, etc.</p> <p>3 PTL measurement data will display. Confirm the data and press {F3} (YES) key. The recorded data are measured data and coordinate data generated at the same time as a PTL data.</p>	<p>{F3}</p> <p>{F2}</p> <p>{F3}</p>	<pre>PT#PTL→PT-01 PCODE :TOPCON R.HT : 1.500 m INPUT SRCH MEAS ALL</pre> <pre>PT#PTL→PT-01 PCODE :TOPCON R.HT : 1.500 m VH *SD NEZ P1↓</pre> <pre>V : 90°10'20" HR: 120°30'40" SD* < m > Measuring...</pre> <pre>L: 44.789 m O: 33.456 m E: 2.321 m >REC? [YES] [NO]</pre> <pre>PT#PTL→PT-02 PCODE :TOPCON R.HT : 1.500 m INPUT SRCH MEAS ALL</pre>
<ul style="list-style-type: none"> In the PTL measurement mode, NEZ Auto Calculation will be turned on compulsorily and the coordinate data will be stored into a coordinate file. 		

7.6 Editing PCODE Library [PCODE INPUT]

PCODE data can be entered into PCODE Library in this mode.

A PCODE is liked with a number of 1 to 50.

PCODE can be also edited in MEMORY MANAGER menu 2/3 in the same way.

Operating procedure	Operation	Display
<p>1 Press the {F2} (PCODE INPUT) key from Data Collect menu 2/2.</p> <p>2 By pressing the following keys, the list will increase or decrease. {▲} or {▼}: Increasing or Decreasing one by one. {▶} or {◀}: By ten Increasing or Decreasing.</p> <p>3 Press the {F1} (EDIT) key.</p> <p>4 Enter PCODE and press the {F4} (ENT) key. *1)</p>	{F2}	<pre>DATA COLLECT 2/2 F1:SELECT A FILE F2:PCODE INPUT F3:CONFIG. P↓</pre>
		<pre>→ 001:TOPCON 002:TOKYO EDIT --- CLR ---</pre>
	{▲} or {▼} {▶} or {◀}	<pre>011:URAH → 012:AMIDAT 013:HILLTO EDIT --- CLR ---</pre>
		{F1}
Enter PCODE {F4}	<pre>011:URAH → 012:AMISUN 013:HILLTO EDIT --- CLR ---</pre>	
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		

7.7 Setting Parameter of Data Collect [CONFIG.]

In this mode, the following settings of data collect mode are possible.

● Setting Items

Menu	Selecting Item	Contents
F1:DIST MODE	FINE / CRS(1) / CRS(10)	Select Fine /Coarse(1) /Coarse(10) mode in distance measurement mode. The unit to be displayed is as follows. Fine mode: 1mm (0.2mm) Coarse (1) mode: 1mm Coarse (10) mode: 10mm
F2:HD/SD	HD/SD	Select the distance measurement mode Horizontal Distance or Slope distance.
F3:MEAS. SEQ.	N-TIMES / SINGLE / REPEAT	Select to set measurement mode for distance measurement.
F1:DATA CONFIRM	YES/NO	It is possible to confirm the result of measuring data before the data is recorded.
F2:COLLECT SEQ.	[EDIT→MEAS] / [MEAS→EDIT]	Select the procedure of data collection. [EDIT→MEAS]: Measurement is carried out after entering other data. [MEAS→EDIT]: Measurement is carried out before entering other data.
F3:NEZ AUTO. CALC	ON/OFF	It is possible to calculate coordinate value of data collected and store it into coordinate data file in every data collection.

● How to Set Items

Example Setting: DATA CONFIRM: YES

Operating procedure	Operation	Display
<p>1 Press the {F3} (CONFIG.) key from the data collect menu 2/2. The CONFIG menu 1/2 is shown.</p> <p>2 Press the {F4} (P↓) key to display the CONFIG menu 2/2.</p> <p>3 Press the {F1} (DATA CONFIRM) key. [] indicates the current setting.</p> <p>4 Press the {F1} (YES) key.</p> <p>5 Press the {F4} (ENTER) key.</p>	<p>{F3}</p> <p>{F4}</p> <p>{F1}</p> <p>{F1}</p> <p>{F4}</p>	<pre>DATA COLLECT 2/2 F1:SELECT A FILE F2:PCODE INPUT F3:CONFIG. P↓</pre>
		<pre>CONFIG. 1/2 F1:DIST MODE F2:HD/SD F3:MEAS. SEQ. P↓</pre>
		<pre>CONFIG. 2/2 F1:DATA CONFIRM F2:COLLECT SEQ. F3:NEZ AUTO.CALC P↓</pre>
		<pre>DATA CONFIRM F1: YES [F2:NO] ENTER</pre>
		<pre>DATA CONFIRM [F1: YES] F2:NO ENTER</pre>


8 LAYOUT

LAYOUT mode has two functions which are setting of layout points and setting new points using coordinate data in the internal memory.

Also, if the coordinate data is not stored in the internal memory, this can be input from keyboard. The coordinate data is loaded from PC to the internal memory via RS-232C.

- **The coordinate data**

The coordinate data is memorized into a file.

 For the internal memory, refer to Chapter 9 "MEMORY MANAGER MODE".

The ES is able to store the coordinate data into the internal memory.

The internal memory is shared by the measured data and the coordinate data for layout.

Maximum 30 files can be generated.

- **The number of coordinate data**

(In case not using the internal memory in the data collect mode)

MAX. 10,000 points

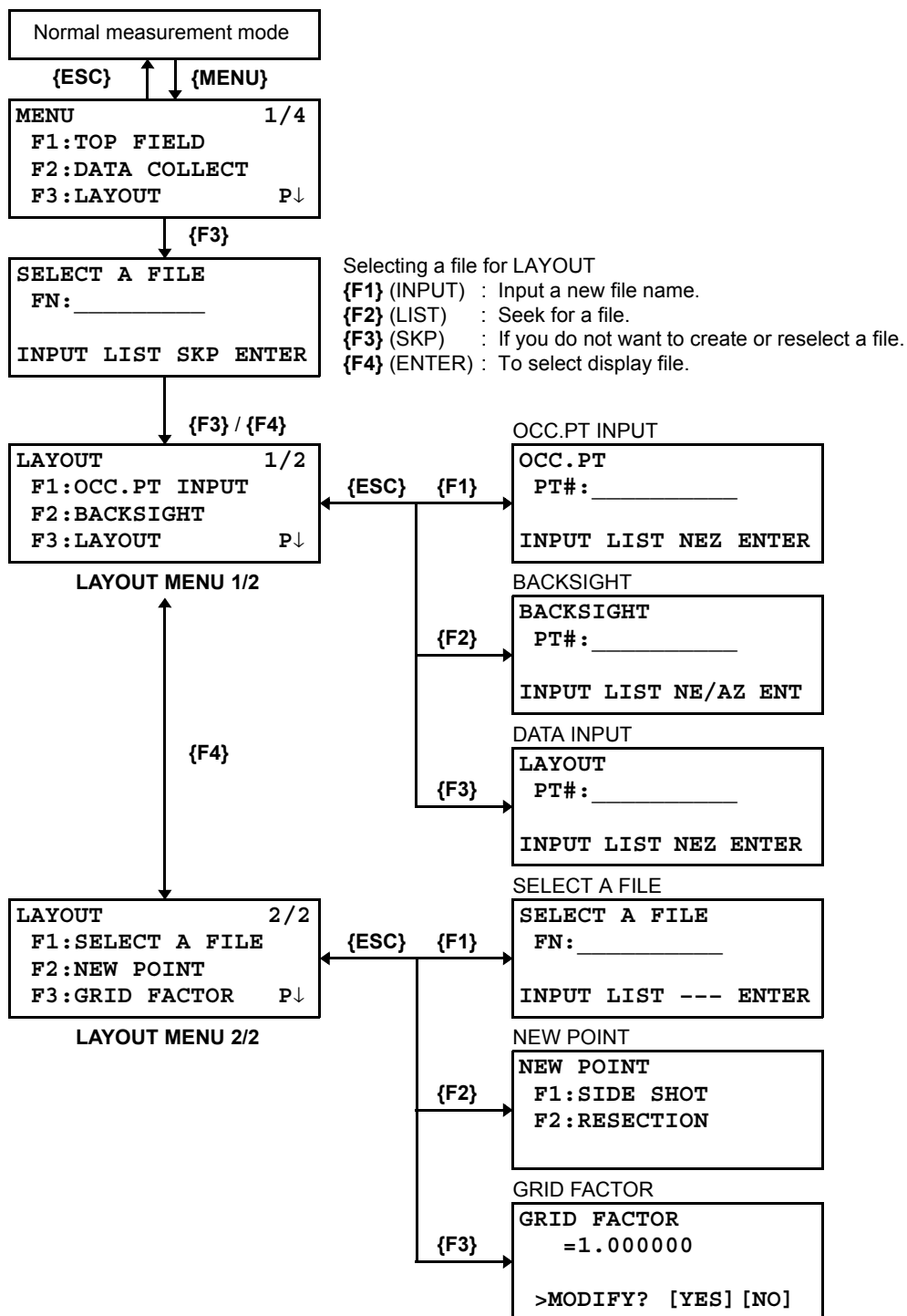
Because the internal memory covers both data collection mode and layout mode, the number of coordinate data will be decreased when the data collection mode is used.

 **Note**

- When turning off the power, ensure that you are in the main menu screen or main angle measurement mode.
This ensures completion of the memory access process and avoids possible damage to the stored data.
- It is recommended for safety to charge the battery beforehand and prepare fully charged spare batteries.
- When recording new point data, remember to consider the amount of internal memory available.

● **Layout menu operation**

By pressing the {MENU} key, the instrument will be in MENU 1/4 mode.
Press the {F3} (LAYOUT) key, the menu of layout 1/2 will be shown.



8.1 Preparation

8.1.1 Setting the GRID FACTOR

- **Calculation Formula**

- 1) Elevation Factor

$$\text{Elevation Factor} = \frac{R}{R + \text{ELEV.}}$$

R : The average radius of the earth
 ELEV. : The elevation above mean sea level

- 2) Scale Factor

Scale Factor : Scale Factor at the surveying station

- 3) Grid Factor

Grid Factor = *Elevation Factor* × *Scale Factor*

- **Distance Calculation**

- 1) Grid Distance



$$\text{HDg} = \text{HD} \times \text{Grid Factor}$$

HDg : Grid distance
 HD : Ground distance

- 2) Ground Distance

$$\text{HD} = \frac{\text{HDg}}{\text{Grid Factor}}$$

- **How to Set Grid Factor**

Operating procedure	Operation	Display
<ol style="list-style-type: none"> 1 Press the {F3} (GRID FACTOR) key from the Layout menu 2/2. 2 Press the {F3} (YES) key. 3 Enter Elevation. *1) Press the {F4} (ENT) key. 4 Enter Scale Factor in the same way. <p>Grid Factor is displayed for 1 to 2 second and display returns to Layout menu 2/2.</p>	<p>{F3}</p> <p>{F3}</p> <p>Enter ELEV. {F4}</p> <p>Enter Scale {F4}</p>	<pre>LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓</pre>
		<pre>GRID FACTOR =0.998843 >MODIFY? [YES] [NO]</pre>
		<pre>GRID FACTOR ELEV.=1000 m SCALE:0.999000 --- --- [CLR] [ENT]</pre>
		<pre>GRID FACTOR ELEV.:2000 m SCALE=1.001000 --- --- [CLR] [ENT]</pre>
		<pre>GRID FACTOR =1.000686</pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters". Input Range: Elevation : -9,999 to 9,999 meter (-32,805 to 3,2805 ft, ft+in) Scale Factor : 0.990000 to 1.010000  See section 8.1.1 "Setting the GRID FACTOR" for more information.</p>		

8.1.2 Selecting Coordinate Data File

You can execute a Layout from selected coordinate data file, also you can record New point measured data into the selected coordinate data file.

- The only coordinate data file existing can be selected and you can not make a new file in this mode. For more information about File, refer to Chapter 9 "MEMORY MANAGER MODE".
- When LAYOUT MODE is begun, a file can be selected in the same way.


Operating procedure	Operation	Display
<p>1 Press the {F1} (SELECT A FILE) key from the Layout menu 2/2.</p> <p>2 Press the {F2} (LIST) key to display the list of coordinate data file.*1)</p> <p>3 Scroll file list by pressing the {▲} or {▼} key and select a file to use. *2),3)</p> <p>4 Press the {F4} (ENTER) key. The file will be set.</p>	{F1}	<pre>LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓</pre>
		<pre>SELECT A FILE FN: INPUT LIST --- ENTER</pre>
	{F2}	<pre>COORDDATA /C0123 →*TOKBDATA /C0345 TOPCDATA /C0789 --- SRCH --- ENTER</pre>
		<pre>*TOKBDATA /C0345 → TOPCDATA /C0789 SATIDATA /C0456 --- SRCH --- ENTER</pre>
{▲} or {▼}		
{F4}		<pre>LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓</pre>
<p>*1) If you want to input file name directly, press the {F1} (INPUT) key and enter a file name.</p> <p>*2) When a file has been selected already, "*" mark is indicated on left of current file name. For the file discrimination mark (*, @, &), refer to Section 9.3 "File Maintenance".</p> <p>*3) Data in a file shown with arrow can be searched by pressing the {F2} (SRCH) key.</p>		

8.1.3 Setting Occupied Point



Occupied point can be set by two setting methods as follow.

- 1) Setting from the coordinate data stored in the internal memory.
- 2) Direct key input of coordinate data.

- Example setting: Setting the occupied point from the internal coordinate data file

Operating procedure	Operation	Display
1 Press the {F1} (OCC.PT INPUT) key from the Layout menu 1/2.	{F1}	OCC.PT PT#: _____ INPUT LIST NEZ ENTER
2 Press the {F1} (INPUT) key and enter PT#. *1) Press the {F4} (ENT) key.	{F1} Enter PT# {F4}	OCC.PT PT#=PT-01 [ALP] [SPC] [CLR] [ENT]
3 Enter INS.HT in the same way.	Enter INS.HT {F4}	INSTRUMENT HEIGHT INPUT INS.HT= 0.000 m --- --- [CLR] [ENT]
The display returns to layout menu 1/2.		LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		

- Example setting: Setting Instrument point coordinates directly

Operating procedure	Operation	Display
1 Press the {F1} (OCC.PT INPUT) key from the Layout menu 1/2.	{F1}	OCC.PT PT#: _____ INPUT LIST NEZ ENTER
2 Press the {F3} (NEZ) key.	{F3}	N→ 0.000 m E: 0.000 m Z: 0.000 m INPUT --- PT# ENTER
3 Press the {F1} (INPUT) key and enter coordinate value. press the {F4} (ENT) key. *1)	{F1} Enter coord. {F4}	COORD.DATA INPUT PT#: INPUT --- --- ENTER
4 Press the {F1} (INPUT) key and enter PT#. Press the {F4} (ENT) key. *2)	{F1} Enter PT# {F4}	INSTRUMENT HEIGHT INPUT INS.HT=0.000 m --- --- [CLR] [ENT]
5 Enter Instrument Height in the same way. The display returns to layout menu 1/2.	Enter INS.HT {F4}	LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		
*2) It is possible to record the coordinate value.  Refer to Chapter 17 "SELECTING MODE".		


8.1.4 Setting Backsight Point

The following three setting methods for Backsight point can be selected.

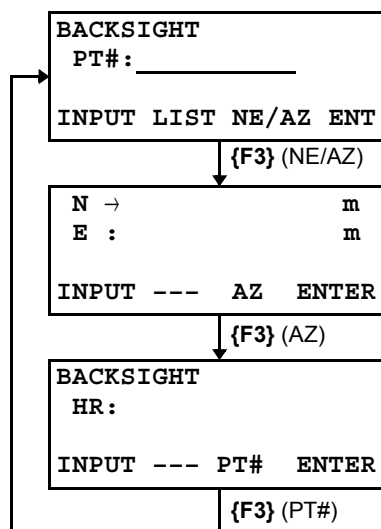
- 1) Setting from the coordinate data file stored in the internal memory.
- 2) Direct key input of coordinate data.
- 3) Direct key input of setting angle.

- Example setting: Setting the backsight point from the internal coordinate data file



Operating procedure	Operation	Display
1 Press the {F2} (BACKSIGHT) key from the Layout menu 1/2.	{F2}	<div style="border: 1px solid black; padding: 5px;"> BACKSIGHT PT#: _____ INPUT LIST NE/AZ ENT </div>
2 Press the {F1} (INPUT) key. Enter PT#, press the {F4} (ENT) key. *1)	{F1} Enter PT# {F4}	<div style="border: 1px solid black; padding: 5px;"> BACKSIGHT PT#=BK-01 [ALP] [SPC] [CLR] [ENT] </div> <div style="border: 1px solid black; padding: 5px;"> BACKSIGHT H(B) = 0°00'00" >Sight ? [YES] [NO] </div>
3 Sight the backsight point and press the {F3} (YES) key. The display returns to the layout menu 1/2.	Sight BK {F3}	

*1)  Refer to Section 2.6 "How to enter alphanumeric characters".

- With each pressing of **{F3}** key, method of inputting backsight is changed.



- Example setting: Setting the backsight point coordinates directly

Operating procedure	Operation	Display
1 Press the {F2} (BACKSIGHT) key from the Layout menu 1/2. The previous data is shown.	{F2}	<pre> BACKSIGHT PT#: _____ INPUT LIST NE/AZ ENT </pre>
2 Press the {F3} (NE/AZ) key.	{F3}	<pre> N→ m E: m INPUT --- AZ ENTER </pre>
3 Press the {F1} (INPUT) key and enter coordinate value. Press the {F4} (ENT) key. *1), 2)	{F1} Enter coord. {F4}	<pre> BACKSIGHT H(B) = 0°00'00" >Sight ? [YES] [NO] </pre>
4 Sight the backsight point.	Sight BK	
5 Press the {F3} (YES) key. The display returns to the layout menu 1/2.	{F3}	<pre> LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓ </pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <p>*2) It is possible to record the coordinate value.  Refer to Chapter 17 "SELECTING MODE".</p>		

8.2 Executing a Layout

The following methods can be selected for executing a Layout:

- 1) Recalling points from internal memory by point number.
- 2) Direct key input of coordinate values.

Example setting: Recalling point from internal memory.

Operating procedure	Operation	Display
		<pre>LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓</pre>
1 Press the {F3} (LAYOUT) key from the layout menu 1/2.	{F3}	<pre>LAYOUT PT#: INPUT LIST NEZ ENTER</pre>
2 Press the {F1} (INPUT) key, and enter PT#. *1) Press the {F4} (ENT) key. *2)	{F1} Enter PT# {F4}	<pre>REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]</pre>
3 Enter reflector height in the same way. When the layout point is set, the instrument will start layout calculation. HR: Calculated horizontal angle of the layout point HD: Calculated horizontal distance from the instrument to the layout point	Enter R.HT {F4}	<pre>CALCULATED HR= 90°10'20" HD= 123.456 m ANGLE DIST --- ---</pre>
4 Collimate the prism, and press the {F1} (ANGLE) key. PT#: Layout point HR: Measured (Actual) horizontal angle. dHR: Horizontal angle to be turned to the layout point = Actual horizontal angle - Calculated horizontal angle. Correct direction when dHR = 0°00'00"	Collimate P {F1}	<pre>PT#: LP-100 HR: 6°20'40" dHR: 23°40'20" DIST --- NEZ ---</pre>
5 Press the {F1} (DIST) key. HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance – Calculated horizontal distance. dZ: Vertical distance to be turned to the layout point = Actual vertical distance – Calculated vertical distance.	{F1}	<pre>HD* [t] < m dHD: m dZ: m MODE NEZ NP/P NEXT</pre> <p style="text-align: center;">↓</p> <pre>HD* 110.12 m dHD: -13.34 m dZ: -0.05 m MODE NEZ NP/P NEXT</pre>
6 Press the {F1} (MODE) key. The fine mode measuring starts.	{F1}	<pre>HD* [r] < m dHD: m dZ: m MODE NEZ NP/P NEXT</pre> <p style="text-align: center;">↓</p> <pre>HD* 120.129 m dHD: -3.327 m dZ: -0.046 m MODE NEZ NP/P NEXT</pre>

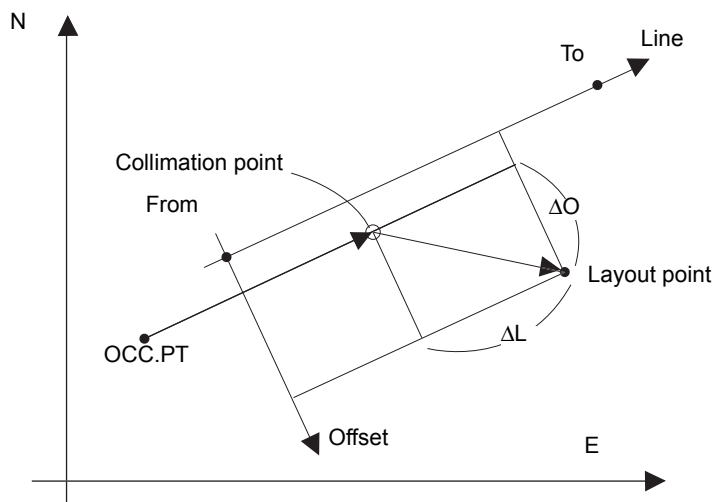
8.2.1 Layout of Coordinates of Point to Line

The coordinate data of point to line can be used during execution of layout.

When a point name including PTL coordinates (including 'From' and 'To' data) is specified, the mode will change to PTL mode automatically.

There are two ways to enter the PTL coordinate data, Direct key input and Data transfer.

☞ Refer to 9.4.2 "PTL (Point to Line) data input" and 9.7 "Data Communications".



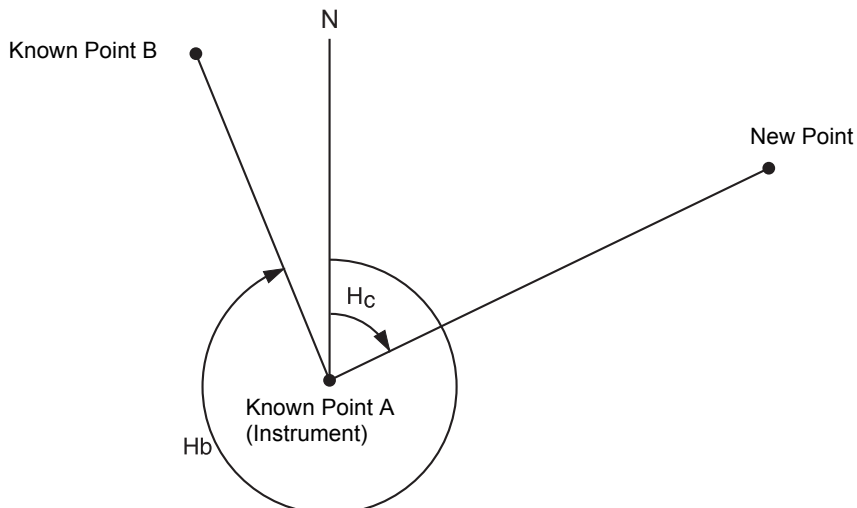
Operating procedure	Operation	Display
<p>1 Press the {F1} (INPUT) key, and enter PT#. Press the {F4} (ENT) key.</p>	<p>{F1} Enter PT# {F4}</p>	<pre>LAYOUT PT#: PT-21 INPUT LIST NEZ ENTER</pre>
<p>2 Enter reflector height in the same way.</p> <p>When the layout point is set, the instrument will start layout calculation. The {F3} (PTL) key will be assigned.</p>	<p>Enter R.HT {F4}</p>	<pre>REFLECTOR HEIGHT INPUT R.HT = 1.500 m --- --- [CLR] [ENT]</pre>
<p>3 Collimate the prism, and press the {F1} (ANGLE) key.</p>	<p>Collimate P {F1}</p>	<pre>CALCULATED HR= 45°10'20" HD= 1.500 m ANGLE DIST PTL ---</pre>
<p>4 Press the {F1} (DIST) key.</p> <p>HD: Measuring (Actual) horizontal distance dHD: Horizontal distance to be turned to the layout point = Actual horizontal distance – Calculated horizontal distance. dZ: Vertical distance to be turned to the layout point = Actual vertical distance – Calculated vertical distance.</p>	<p>{F1}</p>	<pre>PT#: LP-100 HR: 45°00'00" dHR: 0°00'00" DIST --- PTL --- HD* 143.84 m dHD: -13.34 m dZ: -0.05 m MODE PTL NP/P NEXT</pre>
<p>5 Press the {F2} (PTL) key.</p> <p>The difference between Collimation point and Layout point distance on the coordinate system of the line determined will be displayed.</p>	<p>{F2}</p>	<pre>dL: 0.005 m dO: 0.327 m dE: 0.046 m MODE ANGLE NP/P NEXT</pre>

8.3 Setting a New Point

New point is required for example when a layout point cannot be sighted from existing control points.

8.3.1 Side Shot Method

Set up the instrument at a known point, and measure the coordinate of the new points by the side shot method



Operating procedure	Operation	Display
<p>1 Press the {F4} (↓) key from the layout menu 1/2 to get the layout menu 2/2.</p> <p>2 Press the {F2} (NEW POINT).</p> <p>3 Press the {F1} (SIDE SHOT) key.</p> <p>4 Press the {F2} (LIST) key to display the list of coordinate data file. *1)</p> <p>5 Scroll file list by pressing {▲} or {▼} key and select a file to use. *2),3)</p>	{F4}	LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓
		LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓
	{F2}	NEW POINT F1:SIDE SHOT F2:RESECTION
	{F1}	SELECT A FILE FN: _____ INPUT LIST ----ENTER
	{F2}	COORDDATA /C0123 →*TOKBDATA /C0345 TOPCDATA /C0789 --- SRCH --- ENTER
{▲} or {▼}	*TOKBDATA /C0345 → TOPCDATA /C0789 SATIDATA /C0456 --- SRCH --- ENTER	

<p>6 Press the {F4} (ENTER) key. The file will be set.</p>	{F4}	<pre>SIDE SHOT PT#: INPUT SRCH --- ENTER</pre>
<p>7 Press the {F1} (INPUT) key, and enter the new point name. *4) Press the {F4} (ENT) key.</p>	<p>{F1} Enter PT# {F4}</p>	<pre>REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]</pre>
<p>8 Enter reflector height in the same way.</p>	<p>Enter R.HT {F4}</p>	<pre>REFLECTOR HEIGHT INPUT R.HT : 1.235 m MEAS --- NP/P ---</pre>
<p>9 Collimate the new point, and press the {F1} (MEAS) key. Distance measuring starts.</p>	<p>Collimate {F1}</p>	<pre>HR: 123°40'20" HD*[n] < m VD: m > Measuring... < complete ></pre>
<p>10 Press the {F3} (YES) key.*5) The name and coordinate value are stored into COORD.DATA. The input menu for next new point is displayed. PT# is automatically incremented.</p>	{F3}	<pre>N : 1234.567 m E : 123.456 m Z : 1.234 m >REC ? [YES] [NO]</pre> <p style="text-align: center;">↓</p> <pre>SIDE SHOT PT#:NP-101 INPUT SRCH --- ENTER</pre>
<p>*1) If you want to input file name directly, press the {F1} (INPUT) key and enter a file name. *2) When a file has been selected already, "*" mark is indicated on left of current file name. ☞ For the file discrimination mark (*, @, &), refer to Chapter 9.3 "File Maintenance". *3) Data in a file shown with arrow can be searched by pressing {F2} (SRCH) key. *4) ☞ Refer to Section 2.4 "How to Enter Alphanumeric Characters". *5) An error will be displayed when the internal memory is full.</p>		

8.3.2 Resection Method

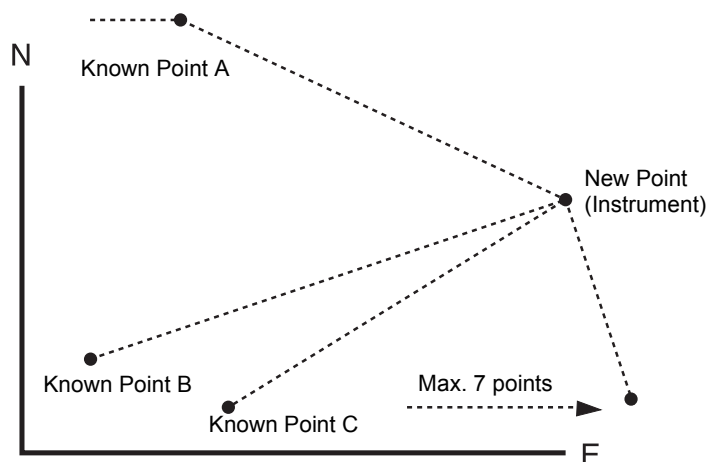
Set up the instrument at a new point, and calculate the coordinate of the new point using the coordinate data of maximum seven known points and the measurements made to these points.

By following observation, resection is possible.

- Resection by distance measurement: 2 or more points must be measured
- Resection by angle measurement only: 3 or more points must be measured

An occupied point coordinate value will be calculated by the method of least squares.

(In case that 3 known points are measured by angle measurement only, the value would not be calculated by the method of least squares.)



Operating procedure	Operation	Display
1 Press the {F4} (↓) key from the layout menu 1/2 to get the layout menu 2/2.	{F4}	<pre>LAYOUT 1/2 F1:OCC.PT INPUT F2:BACKSIGHT F3:LAYOUT P↓</pre>
2 Press the {F2} (NEW POINT).	{F2}	<pre>LAYOUT 2/2 F1:SELECT A FILE F2:NEW POINT F3:GRID FACTOR P↓</pre>
3 Press the {F2} (RESECTION) key.	{F2}	<pre>NEW POINT F1:SIDE SHOT F2:RESECTION</pre>
4 Press the {F1} (INPUT) key, and enter the new point name. *1), 2) Press the {F4} (ENT) key.	{F1} Enter PT# {F4}	<pre>NEW POINT PT#: _____ INPUT SRCH SKP ENTER</pre>
		<pre>INSTRUMENT HEIGHT INPUT INS.HT = 0.000 m --- --- [CLR] [ENT]</pre>

5 Enter instrument height in the same way.

6 Enter the known point A number. *3)

7 Enter reflector height.

8 Collimate the known point A, and press the **{F1}** (ANG) or **{F2}** (DIST) key.
Example: **{F2}** (DIST)
Distance measuring starts.

Known point B entering display will be shown.

9 Same as procedure **6** to **8** proceed to the known point B.

When two points have been measured by the **{F2}** (DIST) key, the RESIDUAL ERROR will be calculated. *4)

10 Select GRID FACTOR for calculation of RESIDUAL ERROR by pressing **{F1}** or **{F2}** key. *5)
Example: **{F1}**

11 Press the **{F1}** (NEXT) key to measure other points.
Maximum seven points can be measured.

12 Same as procedure **6** to **8** proceed to the known point C.

Enter
INS.HT
{F4}

{F1}
Enter PT#
{F4}

Enter R.HT
{F4}

Collimate A
{F2}

{F1}

{F1}

```
NO01#
PT#: _____
INPUT LIST NEZ ENTER
```

```
REFLECTOR HEIGHT
INPUT
R.HT = 0.000 m
--- --- [CLR] [ENT]
```

```
REFLECTOR HEIGHT
INPUT
R.HT : 1.235 m
ANG DIST NP/P ---
```

```
HR: 123°40'20"
HD*[n] < m
VD: m
> Measuring...
< complete >
```

↓

```
NO02#
PT#: _____
INPUT LIST NEZ ENTER
```

↓

```
SELECT GRID FACTOR
F1:USE LAST DATA
F2:CALC MEAS.DATA
```

```
RESIDUAL ERROR
dHD= 0.015 m
dZ = 0.005 m
NEXT --- G.F. CALC
```


```
NO03#
PT#: _____
INPUT LIST NEZ ENTER
```

⋮

```
HR: 123°40'20"
HD*[n] < m
VD: m
> Measuring...
< complete >
```

↓

```
HR: 123°40'20"
HD: 123.456 m
VD: 1.234 m
NEXT --- --- CALC
```

<p>13 Press the {F4} (CALC) key. *6) Standard Deviation will be shown. Unit: (sec.) or (mGON) or (mMIL)</p>	<p>{F4}</p>	<table border="1"> <tr> <td colspan="2">Standard Deviation</td> </tr> <tr> <td>=</td> <td>1.23 sec.</td> </tr> <tr> <td>---</td> <td>↓</td> </tr> <tr> <td>---</td> <td>NEZ</td> </tr> </table>	Standard Deviation		=	1.23 sec.	---	↓	---	NEZ		
Standard Deviation												
=	1.23 sec.											
---	↓											
---	NEZ											
<p>14 Press the {F2} (↓) key. Standard Deviations of each coordinate will be shown. Unit: (mm) or (inch) The display will be changed alternately by pressing {F2} (↓) or (↑) key.</p>	<p>{F2}</p>	<table border="1"> <tr> <td>SD (n) :</td> <td>1.23 mm</td> </tr> <tr> <td>SD (e) :</td> <td>1.23 mm</td> </tr> <tr> <td>SD (z) :</td> <td>1.23 mm</td> </tr> <tr> <td>---</td> <td>↑</td> </tr> <tr> <td>---</td> <td>NEZ</td> </tr> </table>	SD (n) :	1.23 mm	SD (e) :	1.23 mm	SD (z) :	1.23 mm	---	↑	---	NEZ
SD (n) :	1.23 mm											
SD (e) :	1.23 mm											
SD (z) :	1.23 mm											
---	↑											
---	NEZ											
<p>15 Press the {F4} (NEZ) key. Coordinate data of the new point will be shown.</p>	<p>{F4}</p>	<table border="1"> <tr> <td>N :</td> <td>65.432 m</td> </tr> <tr> <td>E :</td> <td>876.543 m</td> </tr> <tr> <td>Z :</td> <td>1.234 m</td> </tr> <tr> <td>>REC ?</td> <td>[YES] [NO]</td> </tr> </table>	N :	65.432 m	E :	876.543 m	Z :	1.234 m	>REC ?	[YES] [NO]		
N :	65.432 m											
E :	876.543 m											
Z :	1.234 m											
>REC ?	[YES] [NO]											
<p>16 Press the {F3} (YES) key. *7) The new point data will be stored into the coordinate data file and the value of occupied coordinate data will change to that of the calculated NEW POINT. The display returns to new point menu.</p>	<p>{F3}</p>	<table border="1"> <tr> <td colspan="2">NEW POINT</td> </tr> <tr> <td>F1 :</td> <td>SIDE SHOT</td> </tr> <tr> <td>F2 :</td> <td>RESECTION</td> </tr> </table>	NEW POINT		F1 :	SIDE SHOT	F2 :	RESECTION				
NEW POINT												
F1 :	SIDE SHOT											
F2 :	RESECTION											
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <p>*2) When there is no need to memorize the new point data, press the {F3} (SKP) key.</p> <p>*3) To enter the known point coordinate data by direct key inputting, press the {F3} (NEZ) key.</p> <p>*4) RESIDUAL ERROR; dHD (Horizontal distance between two known points) = Measured value – Calculated value dZ = (Z coordinate of the new point calculated from known point A) – (Z coordinate of the new point calculated from known point B)</p> <p>*5) [F1:USE LAST DATA]; RESIDUAL ERROR is calculated with GRID FACTOR already set. [F2:CALC MEAS.DATA]; RESIDUAL ERROR is calculated without GRID FACTOR already set. In this case, new GRID FACTOR is calculated from measured data and reset." • To see the GRID FACTOR value, press the {F3} (G.F.) key.</p> <p>*6) In case that the all points are measured by angle measurement only, the following display will be shown. You can select Z coordinate calculation.</p>												
<table border="1"> <tr> <td colspan="2">CALC. Z COORD.</td> </tr> <tr> <td>F1 :</td> <td>YES</td> </tr> <tr> <td>F2 :</td> <td>NO</td> </tr> </table>			CALC. Z COORD.		F1 :	YES	F2 :	NO				
CALC. Z COORD.												
F1 :	YES											
F2 :	NO											
<p>F1(YES): :N,E,Z coordinates will be calculated with measured angle data. F2(NO): :N and E coordinates will be calculated with measured horizontal angle data. Z coordinate would not be calculated. (Z coordinate value =0.000m)</p>												
<p>When the distance measurement is done even one point, Z coordinate will be calculated as a mean value of relative distance (vertical distance data).</p>												
<p>*7) The display shows ">SET ?" when {F3} (SKP) key pressed in step 4. In this case, the new point data is not stored into the coordinate data file, only the value of occupied coordinate data changes to that of the calculated NEW POINT.</p>												

● Viewing PT# LIST

You can see the PT# List and enter the data from the List, also you can see coordinate data of a point.
[Example: Executing Layout Mode]

Operating procedure	Operation	Display
<p>1 While executing the LAYOUT mode, press the {F2} (LIST) key. The arrow(→) indicates selected data.</p> <p>2 By pressing the following keys, the list will increase or decrease. {▲} or {▼}: Increasing or Decreasing one by one. {▶} or {◀}: By ten Increasing or Decreasing.</p> <p>3 To show the coordinate of the selected data, press the {F1} (VIEW) key. It is still possible to scroll the PT# data by pressing {▲} or {▼} key.</p> <p>4 Press the {ESC} key. The display returns to the List.</p> <p>5 Press the {F4} (ENTER) key. The selected point number is set as PT#.</p>	<p>{F2}</p> <p>{▲} or {▼} {▶} or {◀}</p> <p>{F1}</p> <p>{ESC}</p> <p>{F4}</p>	<pre>LAYOUT PT#: _____ INPUT LIST NEZ ENTER</pre>
		<pre>[TOPCON] →DATA-01 DATA-02 VIEW SRCH --- ENTER</pre>
		<pre>DATA-49 →DATA-50 DATA-51 VIEW SRCH --- ENTER</pre>
		<pre>PT# DATA-50 N] 100.234 m E] 12.345 m Z] 1.678 m</pre>
		<pre>DATA-49 →DATA-50 DATA-51 VIEW SRCH --- ENTER</pre>
<pre>REFLECTOR HEIGHT INPUT R.HT = 0.000 m --- --- [CLR] [ENT]</pre>		
<p>● The operation of {F2} (SRCH) is same as the "SEARCH" in the MEMORY MANAGER MODE. ☞ For more information, refer to Chapter 9 "MEMORY MANAGER MODE".</p>		

9 MEMORY MANAGER MODE

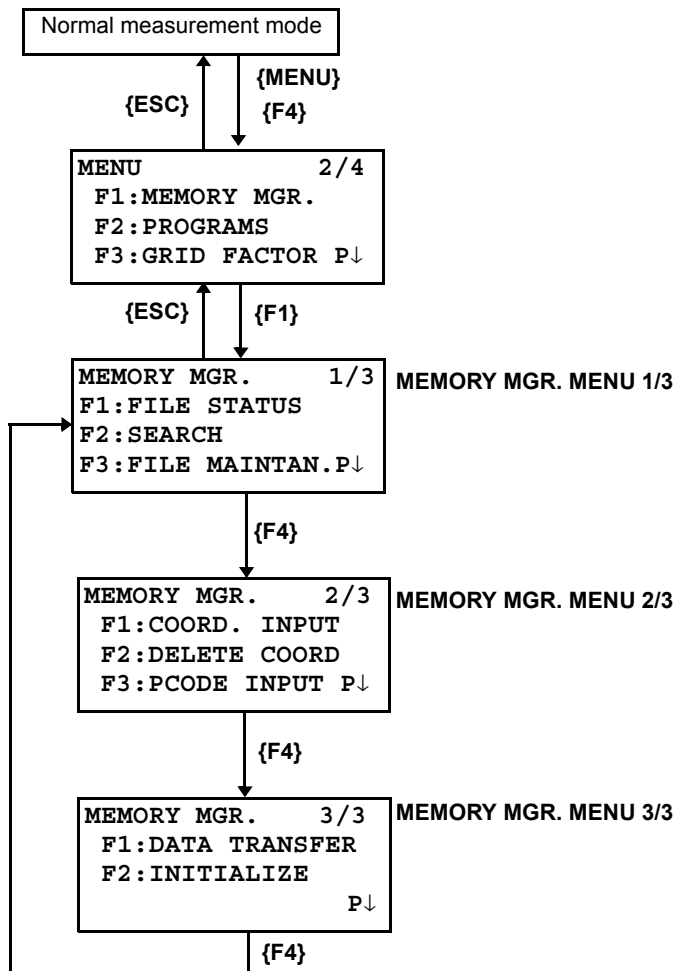
The following items for internal memory are available in this mode.

- 1) FILE STATUS : Checking the number of stored data / Remaining internal memory capacity.
- 2) SEARCH : Searching the recorded data.
- 3) FILE MAINTAN. : Deleting files / Editing file name
- 4) COORD. INPUT : Inputting coordinate data into Coord. data file.
- 5) DELETE COORD. : Deleting coordinate data from Coord. data file.
- 6) PCODE INPUT : Inputting PCODE DATA into PCODE Library
- 7) DATA TRANSFER : Sending measured data or coordinate data or PCODE Library data / Uploading coordinate data or PCODE Library data / Setting communication parameters
- 8) INITIALIZE : Initializing internal memory.

● Memory manager menu operation

By pressing the **{MENU}** key, the instrument will be in MENU 2/4 mode.

Press the **{F1}** (MEMORY MGR.) key, the menu of MEMORY MGR. 1/3 will be shown.



9.1 Display Internal Memory Status

This mode is used to check the internal memory status.

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F1} (FILE STATUS) key. The total number of stored measured data files and coordinate I files are shown.	{F1}	<pre> FILE STATUS 1/2 MEAS. FILE : 3 COORD. FILE: 6 [.....] P↓ </pre> <p style="text-align: center;">↑ Remaining memory capacity</p>
3 Press the {F4} (P↓) key. The total number of stored measured data and coordinate data in all files are shown.*1)	{F4}	<pre> DATA STATUS 2/2 MEAS. DATA :0100 COORD. DATA:0050 [.....] P↓ </pre>
<p>*1) Each coordinate file has one extra data for working area.</p> <p>Note</p> <ul style="list-style-type: none"> The FILE/DATA STATUS display will change alternately by pressing {F4} (P↓) key. To return to MEMORY MGR. menu press the {ESC} key. 		

9.2 Searching Data

This mode is used to search the recorded file data in the DATA COLLECT or LAYOUT mode. The following 3 search methods in each type of files can be selected.

- 1: First data search
- 2: Last data search
- 3: Point number search (MEAS.DATA, COORD.DATA)
Number search (PCODE LIB.)

MEAS. DATA : Measured data in the data collect mode.

COORD. DATA : Coordinate data for layout, control points and new point data measured in the layout mode.

PCODE LIB. : The data which was registered with a number from 1 to 50 in Point code library.

Point name (PT#, BS#), ID, PCODE and Height data (INS.HT, R.HT) can be corrected in the searching mode.

Measured value can not be corrected.

9.2.1 Measured Data Searching

Example: Point number searching

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
2 Press the {F2} (SEARCH) key.	{F2}	SEARCH F1:MEAS. DATA F2:COORD. DATA F3:PCODE LIB.
3 Press the {F1} (MEAS. DATA) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
4 Press the {F1} (INPUT) key and enter File Name. Press the {F4} (ENT) key. *1),2)	{F1} Enter FN {F4}	MEAS. DATA SEARCH F1:FIRST DATA F2:LAST DATA F3:PT# DATA
5 Press the {F3} (PT# DATA) key.	{F3}	PT# DATA SEARCH PT# = _____ [ALP] [SPC] [CLR] [ENT]
6 Enter PT#. Press the {F4} (ENT) key. *1)	Enter PT# {F4}	PT# TOP-104 1/2 V] 98°36'20" HR] 160°40'20" TILT] 0°00'00" ↓

<p>7 Press the {F4} (↓) key to scroll data for selected point.</p>	<p>{F4}</p>	<pre>PT# TOP-104 2/2 PCODE R.HT 1.200 m EDIT ↓</pre>
<p>*1) Refer to Section 2.6 "How to enter alphanumeric characters". *2) To show the file list, press the {F2} (LIST) key.</p> <p>Note</p> <ul style="list-style-type: none"> • "↓" represents data shown on the display is the stored data. • Press the {▲} or {▼} key to scroll to next or previous point. • To search MEAS. DATA of the same point number, press {◀} or {▶} key. 		

● **To edit the data in searching mode**


Point name (PT#, BS#), ID, PCODE and Height data (INS.HT, R.HT) can be corrected in the searching mode.
 Measured value can not be corrected.

Operating procedure	Operation	Display
<p>1 Press the {F1} (EDIT) key from last page of displayed data.</p>	<p>{F1}</p>	<pre>PT# TOP-104 2/2 PCODE R.HT 1.000 m EDIT ↓</pre>
<p>2 Select the item to correct by pressing {▲} or {▼} key.</p>	<p>{▲} or {▼}</p>	<pre>PT# →TOP-104 PCODE : R.HT : 1.000 m INPUT ---- ENTER</pre>
<p>3 Press the {F1} (INPUT) key and enter data. *1) Press the {F4} (ENT) key.</p>	<p>{F1} Enter Data</p>	<pre>PT# :TOP-104 PCODE : R.HT → 1.000 m INPUT ---- ENTER</pre>
<p>4 Press the {F4} (ENTER) key.</p>	<p>{F4} {F4}</p>	<pre>PT# →TOP-104 PCODE : R.HT : 1.200 m >SAVE? [YES] [NO]</pre>
<p>5 Press the {F3} (YES) key.</p>	<p>{F3}</p>	<pre>PT# TOP-104 2/2 PCODE R.HT 1.200 m EDIT</pre>
<p>*1) Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <p>Note</p> <ul style="list-style-type: none"> • When editing, ID and PCODE are not linked with PCODE LIBRARY. • Even though the height data (INS.HT, R.HT) are corrected, the measured value can not be corrected. 		

9.2.2 Coordinate Data Searching

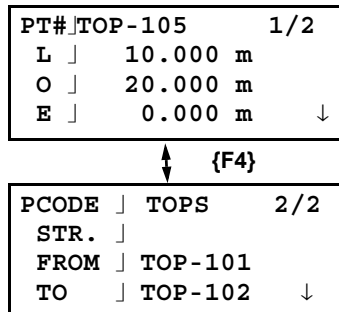
Example searching: Point number searching

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F2} (SEARCH) key.	{F2}	<pre> SEARCH F1:MEAS. DATA F2:COORD. DATA F3:PCODE LIB. </pre>
3 Press the {F2} (COORD. DATA) key.	{F2}	<pre> SELECT A FILE FN: _____ INPUT LIST --- ENTER </pre>
4 Press the {F1} (INPUT) key and enter File Name. Press the {F4} (ENT) key. *1)	{F1} Enter FN {F4}	<pre> COORD. DATA SEARCH F1:FIRST DATA F2:LAST DATA F3:PT# DATA </pre>
5 Press the {F3} (PT# DATA) key.	{F3}	<pre> PT# DATA SEARCH PT#= _____ [ALP] [SPC] [CLR] [ENT] </pre>
6 Enter PT#. Press the {F4} (ENT) key. *1)	Enter PT# {F4}	<pre> PT# TOP-104 1/2 N 100.234 m E 12.345 m Z 1.678 m ↓ </pre>
7 Press the {F4} (↓) key to get the next page.	{F4}	<pre> PCODE TOPS 2/2 STR. ↓ </pre>

*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".


Note

- "J" represents data shown on the display is the stored data.
- Press the {▲} or {▼} key to scroll to next or previous point.
- To search COORD. DATA of the same point number, press the {◀} or {▶} key.
- PTL data will be shown below.




9.2.3 PCODE LIBRARY Searching

Example searching: Number searching

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F2} (SEARCH) key.	{F2}	<pre> SEARCH F1:MEAS. DATA F2:COORD. DATA F3:PCODE LIB. </pre>
3 Press the {F3} (PCODE LIB.) key.	{F3}	<pre> PCODE DATA SEARCH F1:FIRST DATA F2:LAST DATA F3:No. SEARCH </pre>
4 Press the {F3} (No. SEARCH) key.	{F3}	<pre> PCODE No. SEARCH No. = --- --- [CLR] [ENT] </pre>
5 Enter number. Press the {F4} (ENT) key. *1) The number and linked data will be shown. *2)	Enter PT# {F4}	<pre> 011:NAKADAI →012:HILLTOP 013:ITABASH EDIT --- CLR --- </pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> Press the {▲} or {▼} key to scroll to next or PCODE data. <p>*2) To correct the PCODE data, press the {F1} (EDIT) key. To delete the PCODE data, press the {F3} (CLR) key.</p>		

9.3.1 Rename a File

An existing file in internal memory can be renamed.

Operating procedure	Operation	Display
1 Press the {F3} (FILE MAINTAN.) key from the Memory manager menu 1/3.	{F3}	→MEASD1 /M0123 COORD1 /C0056 REN SRCH DEL ---
2 Select a file by pressing {▲} or {▼} key.	{▲} or {▼}	MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 REN SRCH DEL ---
3 Press the {F1} (REN) key.	{F1}	MEASD1 /M0123 =COORD1 /C0056 COORD1 /C0098 [ALP] [SPC] [CLR] [ENT]
4 Enter new file name. Press the {F4} (ENT) key. *1)	Enter FN {F4}	MEASD1 /M0123 →COORD5 /C0056 COORD1 /C0098 REN SRCH DEL ---
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters". Existing file name can not be available. To return to the FILE MAINTAN. Menu, press the {ESC} key.		

9.3.2 Searching Data in a File

An existing file in internal memory can be searched.

Operating procedure	Operation	Display
1 Press the {F3} (FILE MAINTAN.) key from the Memory manager menu 1/3.	{F3}	→MEASD1 /M0123 COORD1 /C0056 REN SRCH DEL ---
2 Select a file to search by pressing {▲} or {▼} key.	{▲} or {▼}	MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 REN SRCH DEL ---
3 Press the {F2} (SRCH) key.	{F2}	SEARCH [COORD1] F1:FIRST DATA F2:LAST DATA F3:PT# DATA
4 Select searching method by pressing the {F1} to {F3} key. *1)	{F1} to {F3}	
*1) Because procedures from next are same as procedures of Section 9.2 "Searching Data", refer to Section 9.2 "Searching Data" To return to the FILE MAINTAN. Menu, press the {ESC} key.		

9.3.3 Deleting a File

This mode erases a file from internal memory. Only one file can be erased at a time.


Operating procedure	Operation	Display
1 Press the {F3} (FILE MAINTAN.) key from the Memory manager menu 1/3.	{F3}	<pre> →MEASD1 /M0123 COORD1 /C0056 REN SRCH DEL --- </pre>
2 Select a file to delete by pressing {▲} or {▼} key.	{▲} or {▼}	<pre> MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 REN SRCH DEL --- </pre>
3 Press the {F3} (DEL) key.	{F3}	<pre> MEASD1 /M0123 →COORD1 /C0056 COORD2 /C0098 >DELETE? [NO] [YES] </pre>
4 Confirm the deleting, and press the {F4} (YES) key.	{F4}	<pre> MEASD1 /M0123 →COORD2 /C0098 COORD3 /C0321 REN SRCH DEL --- </pre>
<ul style="list-style-type: none"> ● To return to the FILE MAINTAN. Menu, press the {ESC} key. 		

9.4 Coordinate Data Direct Key Input

9.4.1 Coordinate data input


Coordinate data for the layout point or control point can be input directly from the keyboard. This data can be stored into a file in the internal memory.

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
2 Press the {F4} (P↓) key.	{F4}	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
3 Press the {F1} (COORD. INPUT) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
4 Press the {F1} (INPUT) key and enter File Name you want to input. Press the {F4} (ENT) key. *1)	{F1} Enter FN {F4}	COORD. DATA INPUT F1:NEZ F2:PTL
5 Select the kind of coordinates. NEZ: Coordinate data PTL: The coordinate data for point to line	{F1}	COORD. DATA INPUT PT#: _____ INPUT LIST --- ENTER
6 Press the {F1} (INPUT) key and enter PT#. Press the {F4} (ENT) key. *1)	{F1} Enter PT# {F4}	N= 100.234 m E: 12.345 m Z: 1.678 m --- --- [CLR] [ENT]
7 Enter data. Press the {F4} (ENT) key. *1)	Enter data {F4}	COORD. DATA INPUT PCODE: _____ INPUT LIST --- ENTER
8 Enter PCODE and press the {F4} (ENTER). Next input display is shown, point number (PT#) is automatically incremented.	{F1} Enter PCODE {F4}	COORD. DATA INPUT PT#: TOPCON-102 INPUT --- --- ENTER

*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".


9.4.2 PTL (Point to Line) data input

PTL Coordinate data for the layout point or control point can be input directly from the keyboard. This data can be stored into a file in the internal memory.

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓
2 Press the {F4} (P↓) key.	{F4}	MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓
3 Press the {F1} (COORD. INPUT) key.	{F1}	SELECT A FILE FN: _____ INPUT LIST --- ENTER
4 Press the {F1} (INPUT) key and enter File Name you want to input. Press the {F4} (ENT) key. *1)	{F1} Enter FN {F4}	COORD. DATA INPUT F1:NEZ F2:PTL
5 Select the kind of coordinates. NEZ: Coordinate data PTL: The coordinate data for point to line	{F2}	COORD. DATA INPUT PT#: _____ INPUT LIST --- ENTER
6 Press the {F1} (INPUT) key and enter PT#. Press the {F4} (ENT) key. *1)	{F1} Enter PT# {F4}	L= m O: m E: m --- --- [CLR] [ENT]
7 Enter data. Press the {F4} (ENT) key. *1) L: Line O: Offset E: Elevation Enter PCODE, FROM and TO data and press the {F4} (ENTER). *2) Next input display is shown, point number (PT#) is automatically incremented.	Enter data {F4} {F1} Enter PCODE {F4}	PCODE→ _____ FROM: _____ TO : _____ INPUT LIST --- ENTER COORD. DATA INPUT PT#: TOPCON-102 INPUT --- --- ENTER
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		
*2) When the inputted point name data as FROM or TO, does not exist in the same file, an error will be displayed.		

9.5 Delete a Coordinate Data from a File

Coordinate data in a file can be erased.


Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F4} (P↓) key.	{F4}	<pre> MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓ </pre>
3 Press the {F2} (DELETE COORD.) key.	{F2}	<pre> SELECT A FILE FN: _____ INPUT LIST --- ENTER </pre>
4 Press the {F1} (INPUT) key and enter File Name. Press the {F4} (ENT) key. *1)	{F1} Enter FN {F4}	<pre> DELETE COORD. PT#: _____ INPUT LIST --- ENTER </pre>
5 Press the {F1} (INPUT) key and enter PT#. Press the {F4} (ENT) key. *1)	{F1} Enter PT# {F4}	<pre> N: 100.234 m E: 12.345 m Z: 1.678 m >DELETE? [YES] [NO] </pre>
6 Confirm the data and press the {F3} (YES) key. Deleting starts. The display will return to the previous display.	{F3}	
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		
<p>Note</p> <ul style="list-style-type: none"> Even if an individual coordinate data is deleted, the internal memory usage does not change. Delete the file including coordinate data to decrease the memory usage. 		

9.6 Editing PCODE Library

PCODE data can be entered into PCODE Library in this mode.

A PCODE is linked with a number of 1 to 50

PCODE can be also edited in DATA COLLECT menu 2/3 in the same way.

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN. P↓ </pre>
2 Press the {F4} (P↓) key.	{F4}	<pre> MEMORY MGR. 2/3 F1:COORD. INPUT F2:DELETE COORD. F3:PCODE INPUT P↓ </pre>
3 Press the {F3} (PCODE INPUT) key.	{F3}	<pre> →001:TOPCON 002:TOKYO EDIT --- CLR --- </pre>
4 By pressing the following keys, the list will increase or decrease. {▲} or {▼} : Increasing or Decreasing one by one. {▶} or {◀} : By ten Increasing or Decreasing.	{▲} or {▼} {▶} or {◀}	<pre> 011:URAH → 012:AMIDAT 013:HILLTO EDIT --- CLR --- </pre>
5 Press the {F1} (EDIT) key.	{F1}	<pre> 011:URAH → 012=<u>A</u>MIDAT 013:HILLTO [ALP] [SPC] [CLR] [ENT] </pre>
6 Enter PCODE and press the {F4} (ENT) key. *1)	Enter PCODE {F4}	<pre> 011:URAH → 012:AMISUN 013:HILLTO EDIT --- CLR --- </pre>
*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".		

9.7 Data Communications

You can send a data file stored in the internal memory to a computer directly. Also, you can directly load a coordinate data file and PCODE Library data to the internal memory from the computer.

9.7.1 Sending Data

Example: Sending a Measured data file


Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F4} (P↓) key twice.	{F4} {F4}	<pre> MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INITIALIZE P↓ </pre>
3 Press the {F1} (DATA TRANSFER) key.	{F1}	<pre> SELECT COM [F1:BLUETOOTH] F2:RS-232C F3:USB ENTER </pre>
4 Press the {F2} (RS-232C) key.*1)	{F2}	
5 Press the {F4} (ENTER) key.	{F4}	<pre> DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT </pre>
6 Select data format. GTS format: The conventional data SSS format: Including PCODE data, 'From' and 'To' data for Point to Line.	{F1}	<pre> DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS </pre>
7 Press the {F1} (SEND DATA) key.	{F1}	<pre> SEND DATA F1:MEAS. DATA F2:COORD. DATA F3:PCODE DATA </pre>
8 Select the type of data to send by pressing {F1} - {F3} key. Example: {F1} (MEAS. DATA)	{F1}	<pre> SELECT A FILE FN: _____ INPUT LIST --- ENTER </pre>
9 Press the {F1} (INPUT) key and enter File Name you want to send. Press the {F4} (ENT) key. *2),3),4)	{F1} Enter FN {F4}	<pre> SEND MEAS. DATA >OK ? --- --- [YES] [NO] </pre>

10 Press the **{F3}** (YES) key.*5)
The sending starts.
The display will return to menu.

{F3}

```
SEND MEAS. DATA
< Sending Data!>
      STOP
```

*1) Only for built-in *Bluetooth* model

*2)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".

*3) To scroll the data, press the **{▲}** or **{▼}** key.

*4) To show the file list, press the **{F2}** (LIST) key.


*5) To cancel the sending, press the **{F4}** (STOP) key.

9.7.2 Loading Data

Coordinate data files and PCODE Library data can be loaded from PC.

Example: Loading a coordinate data file (from PC)

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F4} (P↓) key twice.	{F4} {F4}	<pre> MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INITIALIZE P↓ </pre>
3 Press the {F1} (DATA TRANSFER) key.	{F1}	<pre> SELECT COM [F1:BLUETOOTH] F2:RS-232C F3:USB ENTER </pre>
4 Press the {F2} (RS-232C) key.	{F2}	
5 Press the {F4} (ENTER) key.	{F4}	<pre> DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT </pre>
6 Press the {F1} (GTS FORMAT) key.	{F1}	<pre> DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS </pre>
7 Press the {F2} (LOAD DATA) key.	{F2}	<pre> LOAD DATA F1:COORD. DATA F2:PCODE DATA </pre>
8 Select the type of data to load by pressing {F1} or {F2} key. Example: {F1} (COORD. DATA)	{F1}	<pre> COORD. FILE NAME FN=_____ [ALP] [SPC] [CLR] [ENT] </pre>
9 Enter New File Name you want to receive. Press the {F4} (ENT) key. *1)	Enter FN {F4}	<pre> LOAD COORD. DATA >OK ? --- --- [YES] [NO] </pre>
10 Press the {F3} (YES) key.*2) The loading starts. The display will return to menu.	{F3}	<pre> LOAD COORD. DATA < Loading Data!> STOP </pre>

*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".
*2) To cancel the loading, press the **{F4}** (STOP) key.

9.7.3 Setting Parameter of Data Communications

● Items of the Parameter

Item	Selecting Item	Contents
F1: Protocol	[ACK/NAK], [ONE WAY]	Setting Protocol [ACK/NAK] or [ONE WAY] communication
F2: Baud rate	1200, 2400, 4800, 9600, 19200, 38400	Setting transfer speed 1200/2400/4800/9600/19200/38400 baud
F3: Char. / Parity	[7/EVEN], [7/ODD], [8/NON]	Setting data length and parity. [7bit, even], [7bit, odd], [8bit, none]
F1: Stop Bits	1, 2	Setting Stop 1 bit or 2bits

● Example Setting Baud rate: 19200 baud

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	<pre> MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN P↓ </pre>
2 Press the {F4} (P↓) key twice.	{F4} {F4}	<pre> MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INITIALIZE P↓ </pre>
3 Press the {F1} (DATA TRANSFER) key.	{F1}	<pre> SELECT COM [F1:BLUETOOTH] F2:RS-232C F3:USB ENTER </pre>
4 Press the {F2} (RS-232C) key. *1)	{F2}	
5 Press the {F4} (ENTER) key.	{F4}	<pre> DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT </pre>
6 Press the {F1} (GTS FORMAT) key.	{F1}	<pre> DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS </pre>
7 Press the {F3} (COMM. PARAMETERS) key.	{F3}	<pre> COMM. PARAMETERS 1/2 F1:PROTOCOL F2:BAUD RATE F3:CHAR./PARITY P↓ </pre>
8 Press the {F2} (BAUD RATE) key. [] indicates present setting.	{F2}	<pre> BAUD RATE [1200] 2400 4800 9600 19200 38400 ENTER </pre>
9 Select the items by pressing {▲} or {▼} , {◀} and {▶} keys. *2)	{▶} {▼}	<pre> BAUD RATE 1200 2400 4800 9600 [19200] 38400 ENTER </pre>

10 Press the {F4} (ENTER) key.	{F4}	<table border="1"> <tr> <td>COMM. PARAMETERS 1/2</td> </tr> <tr> <td>F1: PROTOCOL</td> </tr> <tr> <td>F2: BAUD RATE</td> </tr> <tr> <td>F3: CHAR. / PARITY P↓</td> </tr> </table>	COMM. PARAMETERS 1/2	F1: PROTOCOL	F2: BAUD RATE	F3: CHAR. / PARITY P↓
COMM. PARAMETERS 1/2						
F1: PROTOCOL						
F2: BAUD RATE						
F3: CHAR. / PARITY P↓						
<p>*1) Only for built-in <i>Bluetooth</i> model *2) To cancel setting, press the {ESC} key.</p>						

9.7.4 Confirming the parameters for *Bluetooth* communication (Only for built-in *Bluetooth* model)

The communication parameters for the *Bluetooth* are fixed as follows. You can only confirm the parameters in Memory manager mode.

- **Fixed parameters for *Bluetooth* communication**

Item	Fixed parameters
Baud rate	38400 baud (Maximum effective speed)
Char. / Parity	8bit, none
Stop Bits	Stop 1 bit

9.8 Initialization

This mode is used to initialize the internal memory.
Following data can be initialized.

FILE DATA : All files of measuring data and coordinate data
PCODE DATA : PCODE LIST
ALL DATA : FILE DATA and PCODE DATA



- The following data are not initialized even if initialization is executed.
: Coordinates of the instrument, Instrument height and Reflector height.

Example Initialization: ALL DATA (FILE data and PCODE data)

Operating procedure	Operation	Display
1 Press the {F3} (MEMORY MGR.) key from the menu 1/3.	{F3}	MEMORY MGR. 1/3 F1:FILE STATUS F2:SEARCH F3:FILE MAINTAN. P↓
2 Press the {F4} (P↓) key twice.	{F4} {F4}	MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INITIALIZE P↓
3 Press the {F2} (INITIALIZE) key.	{F2}	INITIALIZE F1:FILE AREA F2:PCODE LIST F3:ALL DATA
4 Select the data to initialize by pressing one of the {F1} to {F3} key. Example: {F3} (ALL DATA)	{F3}	INITIALIZE DATA ERASE ALL DATA ! >OK ? [NO] [YES]
5 Confirm the erase data, press the {F4} (YES) key. Initializing will start. The display returns to menu.	{F4}	INITIALIZE DATA <Initializing!> ↓ MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INITIALIZE P↓

10 SET AUDIO MODE

The light acceptance quantity level for the EDM (SIGNAL), the atmospheric correction value (PPM), and prism constant correction value of each target are displayed in this mode.

When reflected light from the prism is received a buzzer sounds. This function is good for easy collimation when the target is difficult to find.


Operating procedure	Operation	Display
<p>1 Press the {F4} key to get the soft key page 2 in the distance measurement mode or page 3 in the coordinate measurement.</p>	{F4}	<pre> HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ </pre>
<p>2 Press the {F3} (S/A) key to change to set audio mode.</p> <p>The display indicates correction value of prism constant (PSM), non-prism constant (NPM), sheet constant (SHT), atmospheric correction (PPM) and reflection light level (SIGNAL).</p>	{F3}	<pre> PSM:0.0 PPM 0.0 NPM:0.0 SHT: 0.0 SIGNAL: [] PRISM PPM T-P --- </pre>
<ul style="list-style-type: none"> ● When receiving reflected light, buzzer sounds. It is possible to stop the sound, see Chapter 17 "SELECTING MODE". ● The {F1} to {F3} keys are used for setting atmospheric correction and prism constant. ● To return to normal measuring mode, press the {ESC} key. 		

11 SETTING THE PRISM CONSTANT VALUE

The prism constant value of Topcon is set to zero. When using prisms other than Topcon's, it is necessary to set the prism constant correction value of that specific prism. Once you set the correction value for prism constant, it is retained after power is OFF.



- Confirm the non-prism constant value is set at 0 when measuring target such as walls in Non-prism mode.

Operating procedure	Operation	Display
<p>1 Press the {F4} key to get the soft key page 2 in the distance measurement mode or page 3 in the coordinate measurement.</p> <p>2 Press the {F3} (S/A).</p> <p>3 Press the {F1} (PRISM) key.</p> <p>4 Input prism constant correction value. Press {F4} (ENT) to move to the next item. PRISM: Prism Constant Correction Value N_PSM: Non-prism Constant Correction Value SHEET: Sheet Constant Correction Value</p> <p>When all the values are set, previous screen is restored.</p>	<p>{F4}</p> <p>{F3}</p> <p>{F1}</p> <p>Enter value {F4}</p>	<pre> HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓ ----- PSM:0.0 PPM 0.0 NPM:0.0 SHT: 0.0 SIGNAL: [] PRISM PPM T-P --- PRISM =0.0 mm N_PSM : 0.0 mm SHEET : 0.0 mm --- --- [CLR] [ENT] PRISM : 14.0 mm N_PSM =0.0 mm SHEET : 0.0 mm --- --- [CLR] [ENT] PSM:14.0 PPM 0.0 NPM:0.0 SHT: 0.0 SIGNAL: [] PRISM PPM T-P --- </pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> ● Input range: -99.9mm to 99.9mm,0.1mm step. 		

12 SETTING ATMOSPHERIC CORRECTION

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 ES 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%.

The values are kept in the memory even after power is OFF.

12.1 Calculation of Atmospheric Correction

By inputting the temperature and air pressure values, the atmospheric correction value is calculated using the following formula and set into the memory. (humidity is regarded as 50%)

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.

$$e = h \times \frac{E}{100} = 6.11 \times 10^{\frac{(7.5 \times t)}{(t + 237.3)}}$$

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.

- Determine the temperature and pressure as follows.

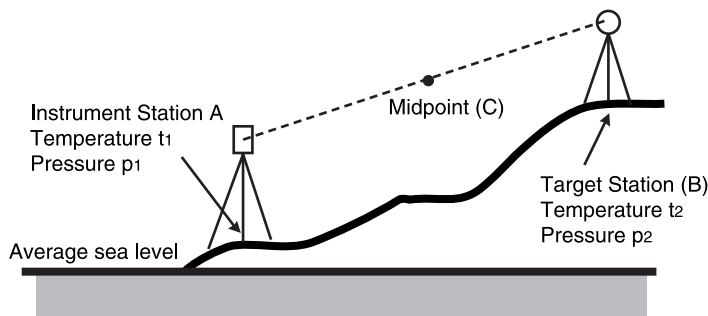
Flat terrain : Use the temperature and pressure at the midpoint of the line.

Mountainous terrain : Use the temperature and pressure at the intermediate point (C).

If it is not possible to measure the temperature and pressure at the midpoint, take the temperature and pressure 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 : $(p_1 + p_2)/2$




- If the weather correction is not required, set the ppm value to 0.

12.2 Setting of Atmospheric Correction Value

● How to Set Temperature and Pressure Value Directly

Measure the temperature and air pressure surrounding the instrument beforehand.


Example: Temperature: 26°C, Pressure:1017 hPa

Operating procedure	Operation	Display
<p>1 Press the {F4} key to get the soft key page 2 in the distance measurement mode or page 3 in the coordinate measurement.</p>	{F4}	<pre>HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓</pre>
<p>2 Press the {F3} (S/A) key to set Set Audio Mode from distance or coordinate measurement mode.</p>	{F3}	<pre>PSM:0.0 PPM 0.0 NPM:0.0 SHT: 0.0 SIGNAL: [] PRISM PPM T-P ---</pre>
<p>3 Press the {F3} (T-P) key.</p>	{F3}	<pre>TEMP. & PRES. SET TEMP. =15.0 °C PRES. : 1013.2 hPa --- --- [CLR] [ENT]</pre>
<p>4 Input Temperature value and Pressure value.*1) Mode returns to Set Audio mode.</p>	Enter Temp. Enter Pres.	<pre>TEMP. & PRES. SET TEMP. : 26.0 °C PRES. : 1017.0 hPa INPUT --- --- ENTER</pre>
<p>*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".</p> <ul style="list-style-type: none"> ● Range: Temp. -30 to 60°C (0.1°C step) or -22 to 140°F (0.1°F step) Pres. 560 to 1066.0hPa (0.1hPa step), 420 to 800mmHg (0.1mmHg step) or 16.5 to 31.5inHg (0.1inHg step) 		

● **How to Set the Atmospheric Correction Value Directly**

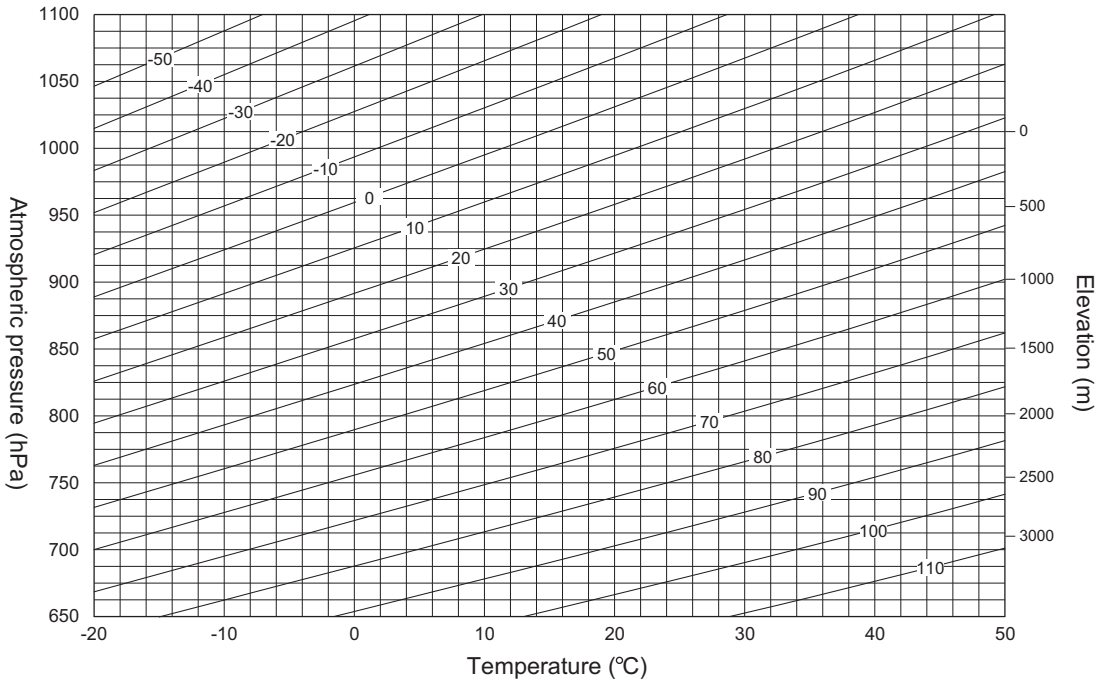
Measure the temperature and air pressure to find atmospheric correction value (PPM) from the chart or correction formula.

Operating procedure	Operation	Display
<p>1 Press the {F4} key to get the soft key page 2 in the distance measurement mode or page 3 in the coordinate measurement.</p>	{F4}	<pre>HR: 120°30'40" HD* 123.456 m VD: 5.678 m MEAS MODE NP/P P1↓ OFFSET S.O S/A P2↓</pre>
<p>2 Press the {F3} (S/A) key to set Set Audio Mode from distance or coordinate measurement mode.</p>	{F3}	<pre>PSM:0.0 PPM 0.0 NPM:0.0 SIGNAL: [] PRISM PPM T-P ---</pre>
<p>3 Press the {F2} (PPM) key. Current setting value is displayed.</p>	{F2}	<pre>PPM SET PPM = 0.0 ppm --- --- [CLR] [ENT]</pre>
<p>4 Enter atmospheric correction value. *1) Mode returns to Set Audio mode.</p>	Enter Data {F4}	

*1)  Refer to Section 2.4 "How to Enter Alphanumeric Characters".

- Input range: -999.9ppm to 999.9ppm, 0.1ppm step

● **Atmospheric Correction Chart (For your reference)**



13 CORRECTION FOR REFRACTION AND EARTH CURVATURE

The instrument measures distance, taking into account correction for refraction and earth curvature.

13.1 Distance Calculation Formula

Distance Calculation Formula; with correction for refraction and earth curvature taken into account. Follow the Formula below for converting horizontal and vertical distances.

Horizontal distance $D = AC(\alpha)$

Vertical distance $Z = BC(\alpha)$

$D = L\{\cos\alpha - (2\theta - \gamma) \sin\alpha\}$

$Z = L\{\sin\alpha + (\theta - \gamma) \cos\alpha\}$

$\theta = L \cdot \cos\alpha / 2R$: Earth curvature correcting item

$g = K \cdot L \cos\alpha / 2R$: Atmospheric refraction correcting item

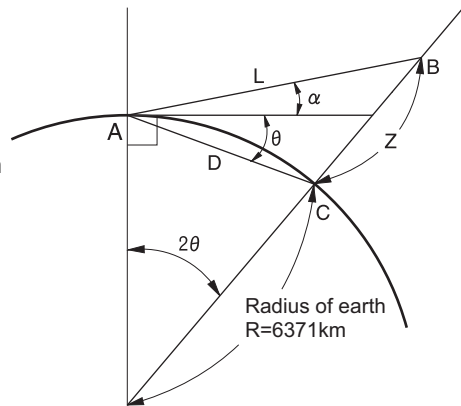
$K = 0.14$ or 0.20 : Coefficient of refraction

$R = 6371\text{km}$: Radius of earth

a : Altitude angle

L : Slope distance

- ☞ Changing "K (Coefficient of refraction)" value : see Chapter 17 "SELECTING MODE" .



14 POWER SOURCE AND CHARGING

14.1 Battery Charging

Be sure to charge the battery fully before using it for the first time or after not using it for long periods.



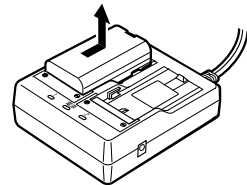
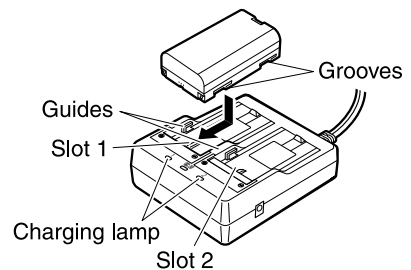
- The charger will become rather hot during use. This is normal.
- Do not use to charge batteries other than those specified.
- The charger is for indoor use only. Do not use outdoors.
- Batteries cannot be charged, even when the charging lamp is flashing, when the temperature is outside the charging temperature range.
- Do not charge the battery just after charging is completed. Battery performance may decline.
- Remove batteries from the charger before putting into storage.
- When not in use, disconnect the power cable plug from the wall outlet.
- Store the battery in a dry room where the temperature is within the following ranges. For long-term storage, the battery should be charged at least once every six months.

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

- Batteries 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.

● 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. When charging starts, the lamp starts blinking.
- 3 Charging takes approximately 2.5 hours (BDC46C: 25°C).
The lamp lights when charging is finished.
- 4 Remove the battery and unplug the charger.



Note

- 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: BDC46C: about 2.5 hours (at 25°C)
BDC70 (optional accessory): about 5.5 hours (at 25°C)
(Charging can take longer than the times stated above when temperatures are either especially high or low).

14.2 Installing/Removing the Battery

Mount the charged battery.

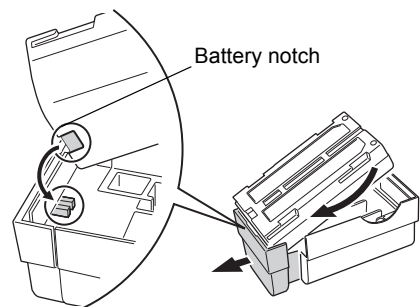


- Use the provided battery BDC46C/BDC70 (optional accessory) for this instrument.
- The Battery BDC46C should be inserted to the battery adapter SB178 before mounting it to the instrument. If the adaptor is exposed to heavy shocks, the battery may come off the adaptor.
- When removing the battery, turn the power off.
- When installing/removing the battery, make sure that moisture or dust particles do not come in contact with the inside of the instrument.
- Waterproofing property for this instrument is not secured unless the battery cover and external interface hatch are closed, and the connector caps are correctly attached. Do not use it with these open or loose, under the condition where water or other liquid spills over the instrument.

● Using the Battery adapter

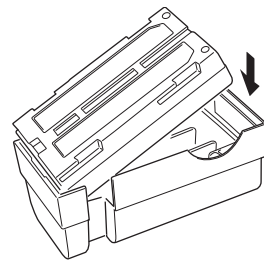
Insert the BDC46C into the battery adapter.

- 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.



- Do not attach the battery adaptor in the wrong direction. The battery cover could be damaged when inserting the battery and closing the battery cover.

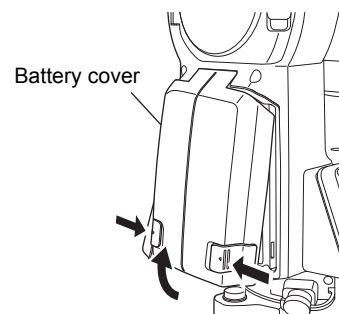
- 2 Slot the top end of the battery into the battery adapter. The extendable portion of the battery adapter will automatically retract and hold the battery in place.



- To remove, grip both sides of the battery towards the terminals-end and pull out.
- It is possible to charge the BDC46C without removing from the battery adapter.

● Mounting the battery

- 1 Remove the cover while pressing the buttons on both sides of the battery cover.

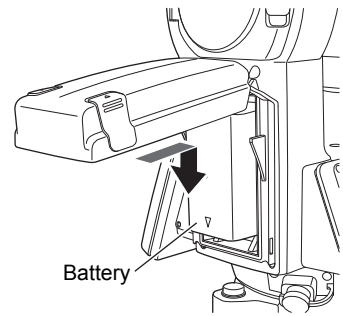


2 Insert the battery with the arrow shown on it downward while pressing toward the instrument.



- Inserting the battery aslant may damage the instrument or the battery terminal.

3 Close the cover. Listen for the click to ensure that the cover is properly closed.



15 USING USB FLASH DRIVE

It is possible to read in/output data from/to a USB flash drive.

- When using a USB flash drive, data is stored in the root directory. You cannot read/write data from/to subdirectories.
- When using the ES, an MS-DOS-compatible text file can be input/output.
- You can neither save a file under the same name as a read-only file, nor change/delete the name of a read-only file. (However, this varies depending on the model or software you are using.)
- For "Communication Manual" that describes details on the communication formats used for inputting/outputting data to/from a USB flash drive, please consult with your local dealer.
- When using the ES, you can use a USB flash drive with the capacity of up to 8GB.

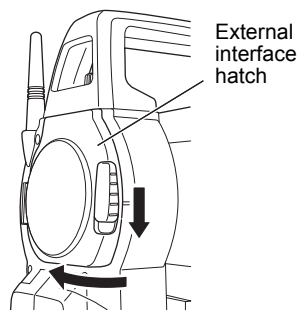
15.1 Inserting the USB flash drive



- Do not remove the USB flash drive during data read/write. Doing so will cause data stored in the USB flash drive or the ES to be lost.
- Do not remove the battery or turn off the power during data read/write. Doing so will cause data stored in the USB flash drive or the ES to be lost.
- Waterproofing property for this instrument is not secured unless the battery cover and external interface hatch are closed, and the connector caps are correctly attached. Do not use it with these open or loose, under the condition where water or other liquid spills over the instrument.

● PROCEDURE

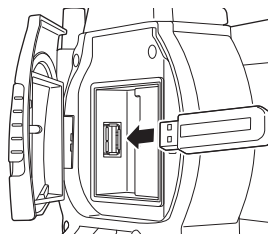
- 1 Slide the catch on the external interface hatch cover down to open.



- 2 Insert the USB flash drive in the respective slot.



- When using a USB memory with 4 metal terminals on the surface, insert it with the terminal facing backwards to avoid damaging the USB port.



- 3 Close the cover.
Listen for the click to ensure that the cover is properly closed.

16 DETACH/ATTACH OF TRIBRACH

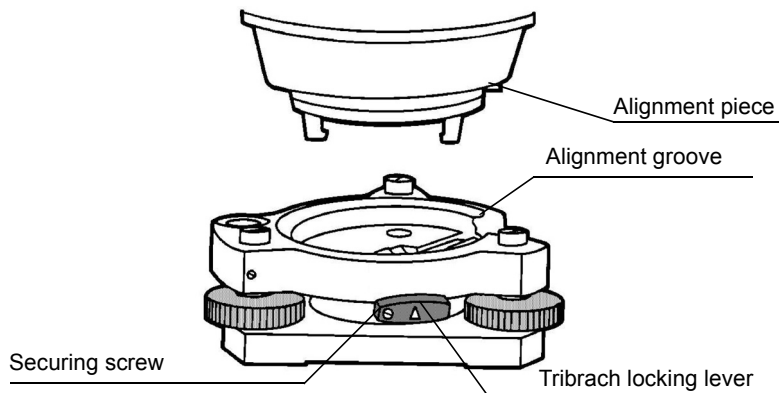
The instrument is easily detached or attached to the tribrach, with a tribrach locking lever loosened or tightened for this purpose.

● Detachment

- 1 Loosen the tribrach locking lever, by revolving it 180° or 200gon in the counterclockwise direction (which will point the triangle mark upwards).
- 2 Grip the carrying handle firmly with one hand while holding the tribrach with the other. Then lift the instrument straight upwards and off.

● Attachment

- 1 Hold the instrument by the carrying handle, with one hand, and carefully lower it on top of the tribrach while, at the same time, coinciding the alignment piece with the tribrach alignment groove on the instrument and tribrach respectively.
- 2 When fully seated, revolve the tribrach locking lever 180° or 200gon clockwise (which will point the triangle mark downwards again).
- 3 Confirm that the upper instrument section is securely attached.



● Locking the Tribrach Locking Lever

The tribrach locking lever can be locked, to prevent it be accidentally removed, especially if the upper instrument section is not being detached very often. Simply tighten the securing screw on the locking lever with the accessory screwdriver, found in the case.

17 SELECTING MODE

17.1 Items of the Selecting Mode

The following modes are available.

Menu	Items	Selecting item	Display
1: UNIT SET	TEMP. & PRES.	°C / °F hPa / mmHg / inHg	Select the unit of temperature for atmospheric correction. Select the unit of air pressure for atmospheric correction.
	ANGLE	DEG(360°) / GON(400G) / MIL(6400M)	Choose degree, gon or mil unit for measuring angle.
	DISTANCE	m / ft / ft + in	Choose measuring unit for distance meter, feet or feet and inch
	FEET	US SURVEY / INTERNATIONAL	Select the meter / feet conversion factor. US SURVEY feet 1m = 3.28083333333333 ft. INTERNATIONAL feet 1m = 3.280839895013123 ft.
2: MODE SET	POWER ON MODE	ANGLE MEAS./ DISTANCE MEAS.	Select to set the measurement mode for angle or distance when the power is turned on.
	FINE/CRS/ TRK	FINE / COARSE / TRACK	Select Fine /Coarse / Tracking mode in distance measurement mode, when the power is turned on.
	HD&VD/SD	HD&VD /SD	Specify which is displayed first, horizontal and vertical distance or slope distance, when the power is turned on.
	V ANGLE ZO/H0	ZENITH 0 / HORIZONTAL 0	Choose the vertical angle reading from zenith or from level.
	N-TIMES / REPEAT	N-TIMES /REPEAT	Select the measurement mode for distance when the power is turned on.
	TIMES OF MEAS.	0~99	Set N (number of times) for times of distance measurement. When setting number of times as 1 or 0, it is single measurement.
	NEZ / ENZ	NEZ / ENZ	Select a coordinate displaying order either NEZ or ENZ.
	HA MEMORY	ON / OFF	Horizontal angle set can be retained after the power is turned off.
	ESC KEY MODE	DATA COLLECT / LAYOUT / REC /OFF	You can select a function of the {ESC} key. DATA COLLECT / LAYOUT: It is possible to enter data input mode (in DATA COLLECT) or Layout Menu from normal measuring mode directly. REC: While executing normal or offset measuring, the measuring data can be output. OFF: Returns to normal function.
	COORD. CHECK	ON / OFF	Select coordinate displaying ON or OFF when setting a point.
FINE READING	0.2mm/1mm	Select 1mm or 0.2mm for the minimum reading unit in the distance mode (FINE mode). * This mode is for switching output format unit when using communication commands. Regardless of this setting, minimum reading unit of slope distance is always set to "1 mm" and calculated.	

	OFFSET V ANG	FREE / HOLD	Select Vertical angle setting in the Angle Offset measurement mode. FREE: Vertical angle varies by the angle of the telescope. HOLD: Vertical angle is fixed even if the angle of the telescope changes.
	NON-PSM / PRISM	NON-PRISM / PRISM / SHEET	Select the distance measurement mode when the power is turned ON.
3: OTHERS SET	H-ANGLE BUZZER	ON / OFF	Specify whether the buzzer sounds or not for every horizontal angle 90°.
	S/A BUZZER	ON / OFF	Specify whether the buzzer sounds or not in the set audio mode.
	W-CORRECTION	OFF / 0.14 / 0.20	Set correction for refraction and earth curvature, coefficient of refraction as; K=0.14, K=0.20 or no correction.
	NEZ MEMORY	ON / OFF	It is possible to retain the coordinate of instrument point, the instrument height and prism height after power off.
	REC TYPE	REC-A / REC-B	Select REC-A or REC-B for data output. REC-A : The measurement is made again and this new data is output. REC-B : The data being displayed is output.
	CR,LF	ON / OFF	It is possible to output the data with carriage return and line feed.
	NEZ REC FORM	STANDARD / with RAW / STANDARD -12Dig / with RAW - 12Dig	Select to record coordinates in standard or with raw data.
	MANUAL NEZ REC	ON/ OFF	In the layout mode or data collect mode, it is possible to record coordinates entered directly from the keyboard.
	ACK MODE	STANDARD / OMITTED	Set the procedure of the communication with external device. STANDARD:Normal procedure OMITTED: Even though the [ACK] is omitted from the external device, the data is not sent again.
	GRID FACTOR	USE G.F. / DON'T USE	Select using GRID FACTOR in calculation of measurement data.
	CUT & FILL	STANDARD / CUT&FILL	In the layout mode, CUT & FILL can be displayed instead of dZ.
	CONTRAST MENU	ON / OFF	When the instrument is turned ON, it is possible to display the screen which you can adjust contrast of the display and confirm the prism constant (PSM), non-prism constant (NPM), sheet constant (SHT) and atmospheric correction value (PPM).
	PASSWORD *1	ON / OFF	When the instrument is turned ON, the screen to request the password will appear. *2

*1 Applicable only to the instruments with security function

*2 If you forget a password, the instrument needs repair to cancel the password. Please contact Topcon or your local Topcon dealer.

17.2 How to Set Selecting Mode

<Example>: Setting unit in hPa, °F, NEZ MEMORY:ON

Operating procedure	Operation	Display
1 After pressing the {MENU} key, press the {F4} (P↓) key twice to get the menu on page 3.	{MENU} {F4} {F4}	MENU 3/4 F1:ILLUMINATION F2:PARAMETERS 1 F3:PARAMETERS 2 P↓
2 Press the {F3} key.	{F3}	PARAMETERS 2 F1:UNIT SET F2:MODE SET F3:OTHERS SET
3 Press {F1} (UNIT SET) key.	{F1}	UNIT SET 1/2 F1:TEMP. & PRES. F2:ANGLE F3:DISTANCE P↓
4 Press {F1} (TEMP. & PRES.) key.	{F1}	TEMP. & PRES. UNIT TEMP. : °C PRES. : mmHg °C °F --- ENTER
5 Press {F2} (°F) key, and press {F4} (ENTER) key.	{F2} {F4}	TEMP. & PRES. UNIT TEMP. : °F PRES. : mmHg hPa mmHg inHg ENTER
6 Press {F1} (hPa) key, and press {F4} (ENTER) key. Returns to unit set menu.	{F1} {F4}	UNIT SET 1/2 F1:TEMP. & PRES. F2:ANGLE F3:DISTANCE
7 Press {ESC} key. Returns to PARAMETERS 2 menu.	{ESC}	PARAMETERS 2 F1:UNIT SET F2:MODE SET F3:OTHERS SET
8 Press {F3} (OTHERS SET) key.	{F3}	OTHERS SET 1/5 F1:H-ANGLE BUZZER F2:S/A BUZZER F3:W-CORRECTION P↓
9 Press {F4} (P↓) key, to get the function in page 2.	{F4}	OTHERS SET 2/5 F1:NEZ MEMORY F2:REC TYPE F3:CR, LF P↓

10 Press {F1} key.	{F1}	<table border="1"> <tr> <td>NEZ MEMORY</td> <td>[OFF]</td> </tr> <tr> <td>[ON] [OFF] ---</td> <td>ENTER</td> </tr> </table>	NEZ MEMORY	[OFF]	[ON] [OFF] ---	ENTER				
NEZ MEMORY	[OFF]									
[ON] [OFF] ---	ENTER									
11 Press {F1} (ON) key, and press {F4} (ENTER) key. Returns to OTHERS SET menu.	{F1} {F4}	<table border="1"> <tr> <td>OTHERS SET</td> <td>2/5</td> </tr> <tr> <td>F1:NEZ MEMORY</td> <td></td> </tr> <tr> <td>F2:REC TYPE</td> <td></td> </tr> <tr> <td>F3:CR,LF</td> <td>P↓</td> </tr> </table>	OTHERS SET	2/5	F1:NEZ MEMORY		F2:REC TYPE		F3:CR,LF	P↓
OTHERS SET	2/5									
F1:NEZ MEMORY										
F2:REC TYPE										
F3:CR,LF	P↓									

18 CHECKS AND ADJUSTMENTS

A ES 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 Section 18.1 “Circular Level” to 18.7 “Checking and Adjusting of Laser Plummet”.
- 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.

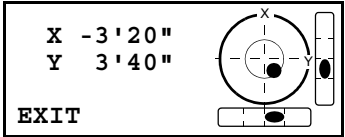
18.1 Circular Level

● PROCEDURE: Checking and adjusting

- 1 Level while checking the display.
☞ see Section 2.5.2 “Levelling”.



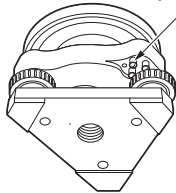
- If the tilt sensor is misaligned, the circular level is not adjusted correctly.



- 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 hexagonal wrench (2.5mm) 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.

Circular level adjusting screws



- 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.



- 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.

18.2 Adjustment of Vertical Angle 0 Datum

If when measuring the vertical angle of target A at telescope position normal (direct) and reverse settings, the amount of normal and reverse measurements combined is other than 360° (ZENITH-0), half of the difference from 360° is the error amount from corrected 0 setting. Carry out adjustment. As adjustment for vertical angle 0 setting is the criteria for determining instrument coordinate origin, use special care for adjustment.

Operating procedure	Operation	Display
1 Level the instrument properly with the plate level.		
2 While pressing the {F1} key, turn power switch ON.	{F1} + Power ON	<div style="border: 1px solid black; padding: 5px;"> ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:V0 AXIS P↓ </div>
3 Press the {F1} key.	{F1}	<div style="border: 1px solid black; padding: 5px;"> V0 ADJUSTMENT <STEP-1> FRONT V: 90°00'00" ENTER </div>
4 Collimate target A from the telescope properly in normal setting.	Collimate A (Normal)	
5 Press the {F4} (ENTER) key.	{F4}	
6 Collimate target A in reverse telescope setting.	Collimate A (Reverse)	<div style="border: 1px solid black; padding: 5px;"> V0 ADJUSTMENT <STEP-2> REVERSE V: 270°00'00" ENTER </div>
7 Press the {F4} (ENTER) key. Measured value is set and carry out normal angle measurement.	{F4}	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <SET!> </div>
		<div style="border: 1px solid black; padding: 5px;"> ↓ V : 270°00'00" HR: 120°30'40" 0SET HOLD HSET P1↓ </div>
8 Check that the total amount of normal and reverse angular travel is 360° collimating the target A by normal and reverse positions.		

18.3 Adjustment of Compensation Systematic Error of Instrument

- 1 Vertical axis error
- 2 Collimation axis error
- 3 Vertical angle 0 datum error

Correction constants for the above errors are calculated and stored in the instrument by the following procedure, and then measurement values are corrected using the stored constants. This adjustment has a direct effect on determining the coordinate origin. Carry out the adjustment very carefully.

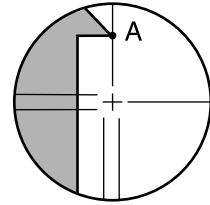
Operating procedure	Operation	Display
1 Level the instrument properly with the plate level.	{F1} + Power ON	ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:V0 AXIS P↓
2 While pressing the {F1} key, turn power switch ON.		
3 Press the {F2} key.	{F2}	AV0 AXIS F1:MEASUREMENT F2:CONSTANT LIST
4 Press the {F1} key.	{F1}	V0/AXIS ADJUSTMENTS ↓ (A) COLLIMATION ↓
5 Collimate target A. (FACE (1)).	Collimate A (Normal)	FRONT FACE1 /0 V: 89°55'50" LEVEL ±0 SET
6 Press the {F4} (SET) key. *1 The sample display shows that the measurement is made 5 times in FACE 1.	{F4}	
7 Turn the telescope in reverse telescope setting (FACE (2)).	Turn telescope	REVERSE FACE2 /5 V: 270°04'20" LEVEL ±0 SET
8 Collimate target A.	Collimate A (Reverse)	↓
9 Press the {F4} (SET) key. Repeat the procedures in step 8 and 9 so that the count of measured times matches to the one in FACE (1). *2)	{F4}	
10 Press the {F4} (SET) key. Repeat the procedures in step 13 and 14 so that the count of measured times matches to the one in FACE(2). Then the display returns to main menu.	{F4}	COMPLETE

<ul style="list-style-type: none"> To show the constant list of systematic error of instrument <p>1 Press the {F3} key from Adjustment Mode menu 1/2.</p> <p>2 Press the {F2} key. Correction values are displayed.</p>	<p>{F3}</p> <p>{F2}</p>	<div style="border: 1px solid black; padding: 5px;"> <p>ADJUSTMENT MODE F1:V ANGLE 0 POINT F2:V0 AXIS P↓</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>V0 AXIS F1:MEASUREMENT F2:CONSTANT LIST</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>VCo: 1°57'12" HCo: -0°00'20" HAx: -0°00'20" EXIT</p> </div>
<p>3 Press the {F1} key. The display returns to previous menu.</p>	<p>{F1}</p>	
<p>*1) It is able to get the average value from 1 to 10 measurements. To get the average, repeat the procedures in steps 5, 6 or 10, 11. The measured times is counted in the second line of display.</p> <p>*2) The compensation values of 1) Error of vertical axis (X,Y tilt sensor offset), 2) Collimation error, and 3) Error of vertical angle Odatum will be set and memorized internally.</p>		

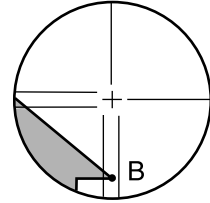
18.4 Reticle

● 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 telescope fine motion screw 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.



● Check 2: Vertical and horizontal reticle line positions



- Perform check in weak sunlight and no scintillation.
- "Tilt crn" should be set to "Yes (H,V)" and "coll.crn" to "Yes" in <Obs. condition> while performing checks.

- 1) Carefully level the instrument.
- 2) Install a target at a point about 100m in the horizontal direction from the instrument.
- 3) While the observation screen is displayed and the telescope is in Face 1, sight the center of the target correctly 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 2, sight the center of the target correctly 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 $180^\circ \pm 20''$ and B2(B1 is within $360^\circ \pm 40''$,
 adjustment is unnecessary.

Example:

$$\begin{aligned} \text{A2-A1 (Horizontal angle)} &= 198^\circ 34' 20'' - 18^\circ 34' 00'' \\ &= 180^\circ 00' 20'' \end{aligned}$$

$$\begin{aligned} \text{B2-B1 (Vertical angle)} &= 269^\circ 30' 00'' + 90^\circ 30' 20'' \\ &= 360^\circ 00' 20'' \end{aligned}$$

If the difference is large even after repeating the check 2 or 3 times, make sure that checking and adjusting of Section 18.2 "Adjustment of Vertical Angle 0 Datum" and "Adjustment of Compensation Systematic Error of Instrument" are completed.
 If the results remain the same, have our service representative perform the adjustment.

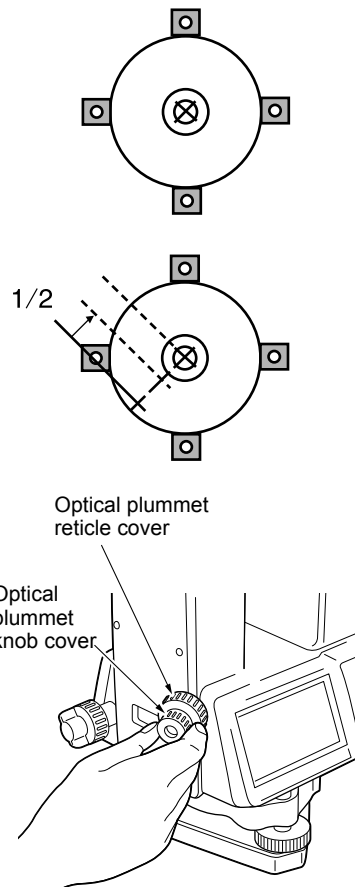
18.5 Optical Plummet

● Checking

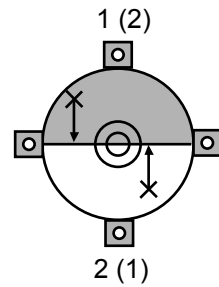
- 1) Carefully level the ES and exactly center a survey point in the reticle of the optical plummet.
- 2) Turn the upper part 180° and check the position of the survey point in the reticle.
 If the surveying point is still centered, no adjustment is necessary.
 If the surveying point is not still centered in the optical plummet, adjust as follows:

● Adjusting

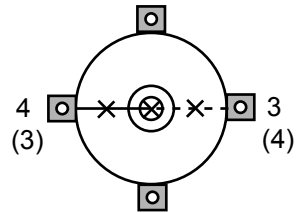
- 3) Correct half the deviation with the levelling foot screw.
- 4) Firmly hold down the top portion of the instrument, and remove the optical plummet knob cover, then remove the optical plummet reticle cover on the inside. Replace the optical plummet knob cover. Use the 4 adjusting screws of the optical plummet to adjust the remaining half of the deviation as show below.



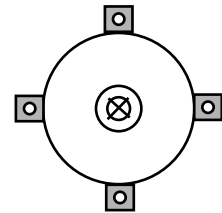
- 5) When the survey point is on the lower (upper) part of the illustration:
 1. Loosen the upper (lower) screw slightly.
 2. Tighten the lower (upper) screw by the same amount.



- 6) If the survey point is on the solid line (dotted line):
 3. Loosen the right (left) screw slightly.
 4. Tighten the left (right) screw by the same amount.



- 7) Check the adjustment by rotating the upper part of the instrument. The survey point should remain centered in the reticle. If necessary, repeat the adjustment.



- 8) Remove the optical plummet knob cover, and install the optical plummet reticle cover on the inside.
 Replace the optical plummet knob cover.



- Do not over-tighten the 4 adjusting screws as this may cause the reticle to go out of adjustment.

18.6 Additive Distance Constant

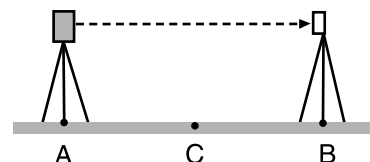
The additive distance constant K of the ES is adjusted to 0 before delivery. Although it almost never deviates, use a baseline with a known distance precision to check that the additive distance constant K is close to 0 several times a year and whenever the values measured by the instrument begin to 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.

● Checking

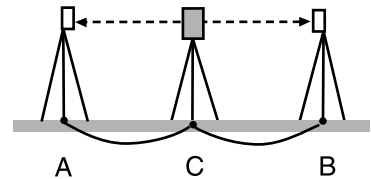
- 1) Find an area of flat ground where two points 100m apart can be selected.
 Set up the Instrument at point A and the reflective prism at point B. Establish a point C half way between points A and B.



- 2) Precisely measure the horizontal distance between point A and point B 10 times and calculate the average value.

- 3) Place the ES 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.

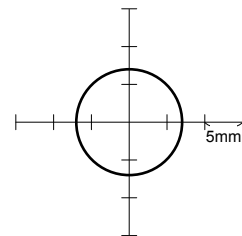


18.7 Checking and Adjusting of Laser Plummet

Checks and adjustments are performed using an adjustment target (cut out and use targets printed at the back of this manual). As this target is made of paper great care must be taken to prevent it getting wet.

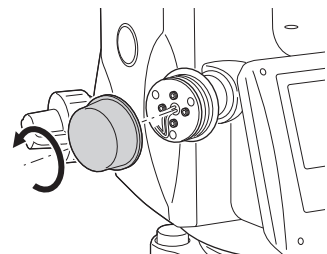
● Checking

- 1) Level the instrument and emit the laser plummet beam.
 see Section 2.5.2 "Levelling".
- 2) Rotate the upper part horizontally and place a target so that it is aligned with the center of the circle created by the rotating laser plummet beam.
 - Laser beam remains centered on the center of the target – No adjustment necessary
 - Laser beam strays from the center of the target – Adjustment necessary.
 - Laser beam draws a circle outside the target circle – Contact your local dealer.

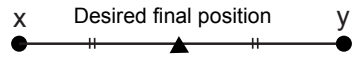


● Adjusting

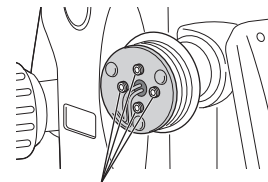
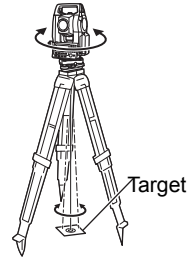
- 1) Turn the laser plummet adjustment cap anticlockwise and remove.
- 2) Emit the laser plummet beam.
- 3) Note the current position (x) of the laser beam.



- 4) Turn the upper part of the instrument horizontally through 180° and note the new position (y) of the laser beam. Adjustment will bring the laser beam to a point midway along a line drawn between these two positions.
- 5) Check the position of the desired final position. Place a target so that its center is aligned with the desired final position. The remaining deviation will be adjusted using the 4 fine adjustment screws.



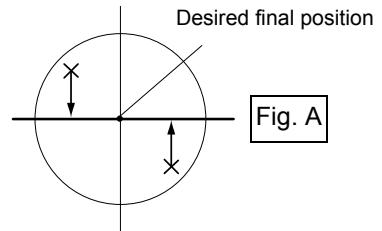
- Be extremely careful to adjust all the fine adjustment screws by the same amount so that none will be over-tightened.
- Turn screws clockwise to tighten.



Fine adjustment screws

- 6) When the laser beam is on the upper (lower) part of Fig. A the up/down adjustment is made as follows:

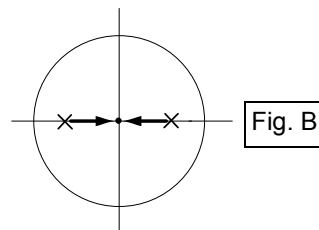
- a. Insert the provided hexagon key wrench into both the upper and lower screws.



- b. Slightly loosen the upper (lower) screw and tighten the lower (upper) screw. Make sure that the tightening tension for both screws is identical. Continue to adjust until the laser beam is on the horizontal line of the target.

- 7) When the laser beam is in the right (left) part of Fig. B the left (right) adjustment is made as follows:

- a. Insert a hexagon key wrench into both the left and right screws.
- b. Slightly loosen the right (left) screw and tighten the left (right) screw. Make sure that the tightening tension for both screws is identical. Continue to adjust until the laser beam is aligned with the target center.

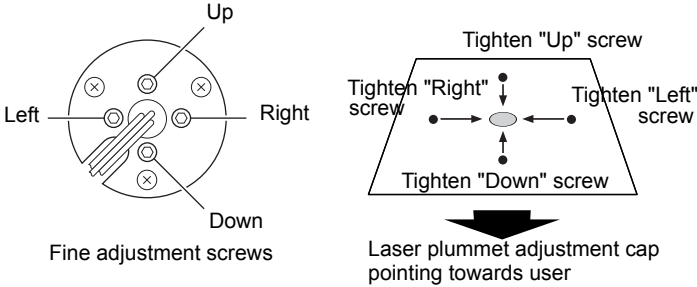


- 8) Turn the upper part of the instrument horizontally and check that the laser beam is now aligned with the target center.

- 9) Re-attach the laser plummet adjustment cap.

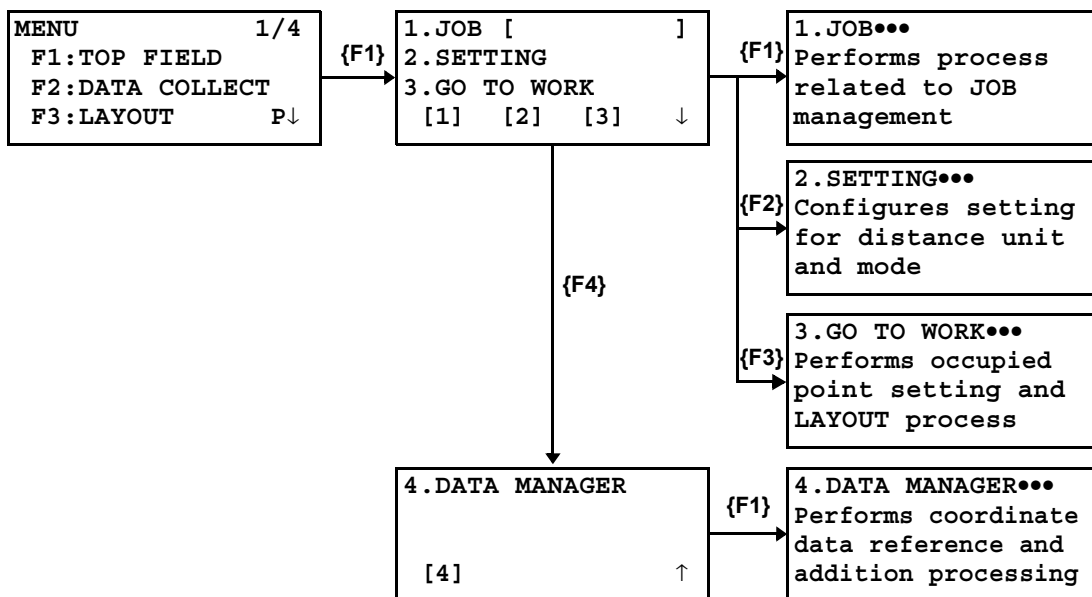
Note

- Tightening each of the fine adjustment screws moves the laser plummet beam in the directions shown below.



19 TOP FIELD MODE

19.1 MAIN MENU (Major Functions)



19.2 JOB



- When a job is created, a measurement/coordinates data file with the same job name will be created in the internal memory. If there is another file with the same name, the existing data file will be used for the job.

19.2.1 To Create New Job

Operating procedure	Operation	Display
1 Select {F1} (TOP FIELD) from the menu.	{MENU} {F1}	1.JOB [] 2.SETTING 3.GO TO WORK [1] [2] [3] ↓
2 Select {F1} (JOB).	{F1}	1.OPEN JOB FILE 2.CREATE NEW JOB 3.NO JOB FILE [1] [2] [3] ↓
3 Select {F2} (CREATE NEW JOB).	{F2}	ENTER JOB FILE [_] ALP CLR
4 Enter job name. ● 10 letters maximum	Enter job name	ENTER JOB FILE [JOB1_] ALP CLR
5 Press {ENT} key to create a new job. ● If there is another job with the same name, the existing job will be selected. ● A maximum of 15 job files can be registered.	{ENT}	1.JOB [JOB1] 2.SETTING 3.GO TO WORK [1] [2] [3] ↓

19.2.2 To Select Existing Job

Operating procedure	Operation	Display
1 Select {F1} (TOP FIELD) from the menu.	{MENU} {F1}	1. JOB [] 2. SETTING 3. GO TO WORK [1] [2] [3] ↓
2 Select {F1} (JOB).	{F1}	1. OPEN JOB FILE 2. CREATE NEW JOB 3. NO JOB FILE [1] [2] [3] ↓
3 Select {F1} (OPEN JOB FILE).	{F1}	SELECT JOB FILE [_] ↑ ↓ ALP CLR
4 Select an existing job name with {F1} or {F2} (Arrow) key, or enter a job name.	{F1} or {F2} Enter job name	SELECT JOB FILE [JOB1_] ↑ ↓ ALP CLR
5 Press {ENT} key to select job.	{ENT}	1. JOB [JOB1] 2. SETTING 3. GO TO WORK [1] [2] [3] ↓
<ul style="list-style-type: none"> When the job is selected, the job name will be displayed at the top right of TOP FIELD of the main menu. <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <pre> 1. JOB [JOB1] 2. SETTING 3. GO TO WORK [1] [2] [3] ↓ </pre> </div>		

19.2.3 To Delete Job

Operating procedure	Operation	Display
1 Select {F1} (TOP FIELD) from the menu.	{MENU} {F1}	1. JOB [] 2. SETTING 3. GO TO WORK [1] [2] [3] ↓
2 Select {F1} (JOB). 3 Select {F4} (↓) to move to the second page of the JOB menu.	{F1}, {F4}	4. DELETE JOB FILE [4] ↓
4 Select {F1} (DELETE JOB FILE).	{F1}	SELECT JOB TO DEL [_] ↑ ↓ ALP CLR

5 Select an existing job name with {F1} or {F2} (Arrow) key, or enter a job name.	Enter/ Select job name	<pre> SELECT JOB TO DEL [JOB1_] ↑ ↓ ALP CLR </pre>
6 Press {ENT} key.	{ENT}	<pre> SELECT JOB TO DEL [JOB1_] >OK ? [YES] [NO] </pre>
7 Pressing {F3} (YES) key will delete the job file.	{F3}	<pre> 4 .DELETE JOB FILE [4] ↓ </pre>

19.2.4 When Job is not to be Used

Job selection can be canceled if the job is not to be used and coordinate data is not to be recorded.

Operating procedure	Operation	Display
1 Select {F1} (TOP FIELD) from the menu.	{MENU} {F1}	<pre> 1 .JOB [JOB1] 2 .SETTING 3 .GO TO WORK [1] [2] [3] ↓ </pre>
2 Select {F1} (JOB).	{F1}	<pre> 1 .OPEN JOB FILE 2 .CREATE NEW JOB 3 .NO JOB FILE [1] [2] [3] ↓ </pre>
3 Job selection will be cancelled when {F3} (NO JOB FILE) is selected.	{F3}	<pre> <SET! > </pre>

19.3 SETTING

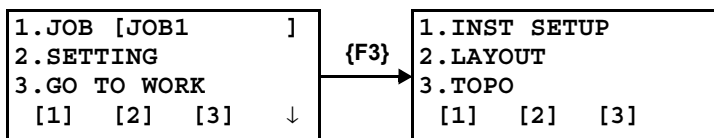
Operating procedure	Operation	Display
1 Select {F1} (TOP FIELD) from the menu.	{MENU} {F1}	<pre> 1 .JOB [] 2 .SETTING 3 .GO TO WORK [1] [2] [3] ↓ </pre>
2 Select {F2} (SETTING).	{F2}	<pre> DIST UNITS :FT-10 COORDINATES :XYZ EDM MODE :FINE OK EDIT </pre>
3 To change the setting, select {F2} (EDIT). ● To not change the setting, select {F1} (OK).	{F2}	<pre> 1 .US FEET-10THE 2 .US FEET-INCHES 3 .METERS [1] [2] [3] </pre>

<p>4 Select {F1} to {F3} to set the unit of distance.</p> <p>{F1} (US FEET-10THE): Display in feet {F2} (US FEET-INCHES): Display in feet and inches {F3} (METERS): Display in meters</p>	<p>Select {F1} ~ {F3}</p>	<pre>1. N, E, Z 2. E, N, Z 3. X, Y, Z [1] [2] [3]</pre>
<p>5 Select {F1} to {F3} to set the display sequence of coordinates.</p> <p>{F1} (N,E,Z): Display N, E, Z {F2} (E,N,Z): Display E, N, Z {F3} (X,Y,Z): Display X, Y, Z</p>	<p>Select {F1} ~ {F3}</p>	<pre>1. FINE 2. CRS - 1mm 3. CRS - 10mm [1] [2] [3]</pre>
<p>6 Select {F1} ~ {F3} to set the distance measurement mode.</p> <p>{F1} (FINE): FINE mode {F2} (CRS-1mm): COARSE mode (Rounding in the unit of 1mm) {F3} (CRS-10mm): COARSE mode (Rounding in the unit of 10mm)</p>	<p>Select {F1} ~ {F3}</p>	<pre>DIST UNITS : METERS COORDINATES : NEZ EDM MODE : CRS - 10 OK EDIT</pre>
<p>7 Press {F1} (OK) to set.</p>	<p>{F1}</p>	<pre>1. JOB [] 2. SETTING 3. GO TO WORK [1] [2] [3] ↓</pre>

19.4 GO TO WORK

The following operations are performed with GO TO WORK.

- 1) Setting of occupied point and backsight ●●●●●INST SETUP
- 2) Layout ●●●●●LAYOUT
- 3) Ordinary measuring and coordinate saving ●●●●●TOPO



19.4.1 To Set Occupied Point and Backsight

To set occupied point

- **Selecting from existing coordinate data**

Operating procedure	Operation	Display
<p>1 Select {F1} (INST SETUP).</p>	<p>{F1}</p>	<pre>1. INST SETUP 2. LAYOUT 3. TOPO [1] [2] [3]</pre> <pre>1. SELECT INST PT 2. CREATE INST PT 3. MEAS KNWN PTS [1] [2] [3]</pre>

<p>2 Select {F1} (SELECT INST PT).</p>	{F1}	<pre> ENTER INST PT PT#: [] ↑ ↓ ALP CLR </pre>
<p>3 Select an existing coordinate point with {F1} or {F2} (Arrow) key, or directly enter a coordinate point.</p>	Enter/ Select PT#	<pre> ENTER INST PT PT#: [OCC-PT] ↑ ↓ ALP CLR </pre>
<p>4 Set with {ENT} key.</p>	{ENT}	<pre> ENTER INST HT INST HT =0.000_ m CLR </pre>
<p>5 Enter an instrument height.</p>	Enter instrument height	<pre> ENTER INST HT INST HT =1.500_ m CLR </pre>
<p>6 Set with {ENT} key. <ul style="list-style-type: none"> Then, the procedure will move onto backsight setting. </p>	{ENT}	<pre> 1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3] </pre>

● **Setting by entering the coordinate data of a occupied point directly**

Operating procedure	Operation	Display
<p>1 Select {F1} (INST SETUP).</p>	{F1}	<pre> 1.INST SETUP 2.LAYOUT 3.TOPO [1] [2] [3] </pre>
<p>2 Select {F2} (CREATE INST PT).</p>	{F2}	<pre> ENTER NEW POINT: PT#: [_] DESC: [_] ALP CLR </pre>
<p>3 Enter the coordinate point of a occupied point and its description.</p>	Enter PT#, Enter DESC	<pre> ENTER NEW POINT: PT#: [OCC] DESC: [POINT_] ALP CLR </pre>
<p>4 Set with {ENT} key.</p>	{ENT}	<pre> N [] E [] Z [] ALP CLR </pre>

5	Enter occupied point coordinates (N, E, Z).	Enter occupied point coordinate	<pre>N [0.000] E [0.000] Z [0.000] ALP CLR</pre>
6	Set with {ENT} key.	{ENT}	<pre>ENTER INST HT INST HT =0.000_ m CLR</pre>
7	Enter an instrument height.	Enter instrument height	<pre>ENTER INST HT INST HT =1.500_ m CLR</pre>
8	Set with {ENT} key.	{ENT}	<pre>1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3]</pre>
<ul style="list-style-type: none"> Then, the procedure will move onto backsight setting. 			

● Seeking an occupied point from existing coordinate data

Operating procedure	Operation	Display	
1	Select {F1} (INST SETUP).	<pre>1.INST SETUP 2.LAYOUT 3.TOPO [1] [2] [3]</pre>	
2	Select {F3} (MEAS KNWN PTS).	<pre>1.SELECT INST PT 2.CREATE INST PT 3.MEAS KNWN PTS [1] [2] [3]</pre>	
3	Enter an instrument height.	Enter instrument height	<pre>ENTER INST HT INST HT =0.000_ m CLR</pre>
4	Set with {ENT} key.	{ENT}	<pre>ENTER INST HT INST HT =1.500_ m CLR</pre>
4	Set with {ENT} key.	{ENT}	<pre>ENTER # REF PTS # REF PTS: = CLR</pre>
5	Enter point number to collimate.	Enter collimate point number	<pre>ENTER # REF PTS # REF PTS: = 2 CLR</pre>
<ul style="list-style-type: none"> Collimate point number: 2 to 7 points 			
6	Set with {ENT}.	{ENT}	<pre>ENTER TARGET HT HT OF ROD =0.000_ m CLR</pre>

7 Enter a reflector height.

Enter reflector height

```

ENTER TARGET HT
HT OF ROD
      =1.500_   m
                        CLR
    
```

8 Set with {ENT} key.

{ENT}

```

ENTER TARGET PT# 1/2
PT#:  [ _      ]
      ↑   ↓   ALP CLR
    
```

9 Select the coordinate point of a collimate point with {F1} or {F2} (Arrow) key, or enter the coordinate point directly. *1)

Enter/ Select PT#

```

ENTER TARGET PT# 1/2
PT#:  [PT-01_  ]
      ↑   ↓   ALP CLR
    
```

10 Set with {ENT} key.

{ENT}

```

MEAS POINT          1/2
PT#:  [PT-01      ]
HD:           m
MSR  CHK   HR
    
```

11 Collimate prism and press {F1} (MSR) key. Begin measurement.

{F1}

```

MEAS POINT          1/2
PT#:  [PT-01      ]
HD*           <<< m
>Measuring...
    
```

12 When the prism measurement is completed, perform measurement for the next collimate point.

- Follow the same procedure.

```

ENTER TARGET PT# 2/2
PT#:  [PT-01_  ]
      ↑   ↓   ALP CLR
    
```



```

MEAS POINT          2/2
PT#:  [PT-01      ]
HD*           <<< m
>Measuring...
    
```

After the prism is measured the set number of times, the occupied point coordinates will be calculated and the standard deviation will be displayed.

```

dN:    0000.00 mm
dE:    0000.00 mm
dZ:    0000.00 mm
OK                      NO
    
```

13 Press {F1} (OK).

The screen for inputting the coordinate point of an occupied point and its description will be displayed.

{F1}

```

ENTER NEW POINT:
PT#:  [ _      ]
DESC: [ _      ]
                        ALP CLR
    
```

14 Enter the coordinate point of an occupied point and its description.

Enter PT#,
Enter
DESC

```

ENTER NEW POINT:
PT#:  [OCC      ]
DESC: [POINT_  ]
                        ALP CLR
    
```

<p>15 Set with {ENT} key.</p>	<p>{ENT}</p>	<pre>POINT X SET! ORIENTATION SET! OK NEZ</pre>
<p>16 When you press {F1} (OK), an occupied point and backsight will be set and the procedure will be completed.</p> <ul style="list-style-type: none"> The backsight is set up based on the previously collimated prism position. Therefore, always press {OK} under the condition in which the previous prism backsight collimated. 	<p>{F1}</p>	<pre>1. INST SETUP 2. LAYOUT 3. TOPO [1] [2] [3]</pre>

● **Checking collimate point coordinates during prism collimation**

Operating procedure	Operation	Display
<p>1 To check the collimate point coordinates during prism collimation, select {F2} (CHK) key.</p>	<p>{F2}</p>	<pre>MEAS POINT 1/2 PT#: [PT-01] MSR CHK HR ↓ N [10.000] E [20.000] Z [0.000] ENTER</pre>

● **Checking prism height during prism collimation**

Operating procedure	Operation	Display
<p>1 To check the prism height during prism collimation, select {F3} (HR) key.</p>	<p>{F3}</p>	<pre>MEAS POINT 1/2 PT#: [PT-01] MSR CHK HR ↓ ENTER TARGET HT HT OF ROD =1.500_ m CLR</pre>

● **Checking occupied point coordinates during occupied point/backsight setting**

Operating procedure	Operation	Display
<p>1 To check the occupied point coordinates during occupied point/backsight setting, select {F2} (NEZ) key.</p>	<p>{F2}</p>	<pre>POINT X SET! ORIENTATION SET! OK NEZ ↓ N [0.000] E [0.000] Z [0.000] ENTER</pre>

To set backsight

After completing the occupied point setting, the display for backsight setting will be displayed.

● **Setting from existing coordinate data**

Operating procedure	Operation	Display
<ul style="list-style-type: none"> When the occupied point setting is completed, this menu screen will be displayed. 		<pre>1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3]</pre>
<p>1 Select {F1} (SELECT BS PT).</p>	{F1}	<pre>ENTER BS POINT PT#: [] ↑ ↓ ALP CLR</pre>
<p>2 Select an existing coordinate point with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.</p>	Enter/ Select PT#	<pre>ENTER BS POINT PT#: [BS-PT_] ↑ ↓ ALP CLR</pre>
<p>3 Set with {ENT} key.</p>	{ENT}	<pre>ENTER BS HEIGHT BS HT =0.000_ m CLR</pre>
<p>4 Enter a reflector height.</p>	Enter reflector height	<pre>ENTER BS HEIGHT BS HT =1.500_ m CLR</pre>
<p>5 Set with {ENT} key.</p>	{ENT}	<pre>SIGHT BS TARGET 1.MEAS ANG+DIST 2.MEAS ANG ONLY</pre>
<p>6 Measure collimate point to set up backsight. To measuring distance, and to seek deviation with missing line distance calculated from coordinate data, select {F1} (MEAS ANG + DIST); and to set up only the angle, select {F2} (MEAS ANG ONLY).</p>		<pre>BS DIST CHECK dDIST = m MSR OK</pre>
<ul style="list-style-type: none"> For example, select {F1} 		
<p>7 Select {F1} (MSR). The distance to collimate point will be measured and the difference to the distance sought from coordinate data will be displayed.</p>	{F1}	<pre>BS DIST CHECK dDIST = 0.000 m MSR OK</pre>
<p>8 Pressing {F4} (OK) will complete the backsight setting.</p>	{F4}	<pre>1.INST SETUP 2.LAYOUT 3.TOPO [1] [2] [3]</pre>

● **Setting by entering the coordinate data of a collimate point directly**

Operating procedure	Operation	Display
<ul style="list-style-type: none"> After the occupied point setting is completed, this menu will be displayed. 		<pre>1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3]</pre>
1 Select {F2} (CREATE BS PT).	{F2}	<pre>1.INPUT PT 2.MEAS PT [1] [2]</pre>
2 Select {F1} (INPUT PT).	{F1}	<pre>ENTER NEW POINT: PT#: [_] DESC: [_] ALP CLR</pre>
3 Enter the coordinate point of a collimate point and its description.	Enter PT #, Enter DESC	<pre>ENTER NEW POINT: PT#: [BS] DESC: [POINT_] ALP CLR</pre>
4 Set with {ENT} key.	{ENT}	<pre>N [] E [] Z [] ALP CLR</pre>
5 Enter collimate point coordinates (N, E, Z).	Enter collimate point coordinate	<pre>N [10.000] E [10.000] Z [0.000] ALP CLR</pre>
6 Set with {ENT} key.	{ENT}	<pre>ENTER BS HEIGHT BS HT =0.000_ m CLR</pre>
7 Enter a reflector height.	Enter reflector height	<pre>ENTER BS HEIGHT BS HT =1.500_ m CLR</pre>
8 Set with {ENT} key.	{ENT}	<pre>SIGHT BS TARGET 1.MEAS ANG+DIST 2.MEAS ANG ONLY</pre>
9 From here to the backsight setting, follow the same procedure to set backsight from existing coordinate data.		<p>↓</p>

● Using an existing horizontal angle and saving the coordinate data of the collimate point

Operating procedure	Operation	Display
<ul style="list-style-type: none"> After the occupied point setting is completed, this menu will be displayed. 		1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3]
1 Select {F2} (CREATE BS PT).	{F2}	1.INPUT PT 2.MEAS PT [1] [2]
2 Select {F2} (MEAS PT).	{F2}	ENTER NEW POINT: PT#: [_] DESC: [_] ALP CLR
3 Enter the coordinate point of a collimate point and its description to record.	Enter PT #, Enter DESC	ENTER NEW POINT: PT#: [BS] DESC: [POINT_] ALP CLR
4 Set with {ENT} key.	{ENT}	ENTER BS HEIGHT BS HT =0.000_ m CLR
5 Enter a reflector height.	Enter reflector height	ENTER BS HEIGHT BS HT =1.500_ m CLR
6 Set with {ENT} key.	{ENT}	SIGHT BS TARGET HD: m MSR
7 Collimate the reflector and press {F1} (MSR) key to begin measurement.	{F1}	SIGHT BS TARGET HD* <<< m >Measuring...
8 After measuring the reflector, record the coordinate data to complete the setting.		1.INST SETUP 2.LAYOUT 3.TOPO [1] [2] [3]

● Setting by entering backsight directly

Operating procedure	Operation	Display
<ul style="list-style-type: none"> After the occupied point setting is completed, this menu will be displayed. 		1.SELECT BS PT 2.CREATE BS PT 3.BS DIRECTION [1] [2] [3]

<p>1 Select {F3} (BS DIRECTION).</p>	<p>{F3}</p>	<pre>ENTER BS ANGLE BS AN[_] DDD.MMSS 0SET CLR</pre>
<p>2 Enter a backsight directly. Pressing {F1} (0SET) will enter 0.</p>	<p>Enter backsight</p>	<pre>ENTER BS ANGLE BS AN[0.0000_] DDD.MMSS 0SET CLR</pre>
<p>3 Set with {ENT} key.</p>	<p>{ENT}</p>	<pre>SIGHT BS TARGET >OK ? [YES] [NO]</pre>
<p>4 Collimate the reflector and press {F3} (YES). Set backsight to end.</p>	<p>{F3}</p>	<pre>1.INST SETUP 2.LAYOUT 3.TOPO [1] [2] [3]</pre>

19.4.2 To Layout

Operating procedure	Operation	Display
		<pre> 1. INST SETUP 2. LAYOUT 3. TOPO [1] [2] [3] </pre>
1 Select {F2} (LAYOUT).	{F2}	<pre> ENTER TARGET HT HT OF ROD =0.000_ m CLR </pre>
2 Enter a reflector height.	Enter reflector height	<pre> ENTER TARGET HT HT OF ROD =1.500_ m CLR </pre>
3 Set with {ENT} key.	{ENT}	<pre> ENTER LAYOUT POINT# PT#: [_] DESC: [_] ↑ ↓ ALP CLR </pre>
4 Select a coordinate point to layout with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.	Enter/ Select PT#	<pre> ENTER LAYOUT POINT# PT#: [P01_] DESC: [_] ↑ ↓ ALP CLR </pre>
5 Set with {ENT} key. The data displayed will be Line 1: Horizontal angle to layout point (Difference) Line 2: Cross directional distance to layout point (Difference) Line 3: Vertical distance to layout point (Difference)	{ENT}	<pre> dHA: 45°00'00" IN : m CUT: m MSR R/L REC NEXT </pre>
6 Pressing {F1} (MSR) will perform distance measurement and it will also display the distance difference. ● Data is updated each time (MSR) is performed.	{F1}	<pre> dHA: 45°00'00" IN : 2.500 m CUT: 0.010 m MSR R/L REC NEXT </pre>
7 Pressing {F2} (R/L) key will display distance difference in the horizontal direction, instead of the difference in the horizontal angle. Line 1: Horizontal distance to layout point (Difference) Line 2: Cross directional distance to layout point (Difference) Line 3: Vertical distance to layout point (Difference)	{F2}	<pre> R : 1.250 m IN : 2.500 m CUT: 0.010 m MSR NEZ REC NEXT </pre>

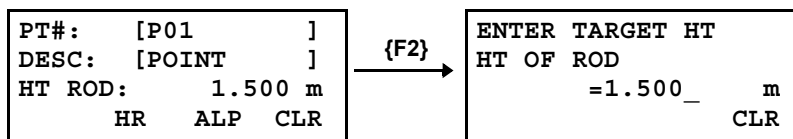
<p>8 Pressing {F2} (NEZ) key will display coordinate data. Line 1: N coordinate (E coordinate) Line 2: E coordinate (N coordinate) Line 3: Z coordinate</p>	<p>{F2}</p>	<pre>N : 1.250 m E : 2.500 m Z : 0.010 m MSR dHA REC NEXT</pre>
<ul style="list-style-type: none"> Pressing {F2} (dHA) will return to the angle difference display. <p>9 Press {F3} (REC) key to record the data and move to layout for the next point, and press {F4} (NEXT) key to move to layout for the next point without saving the data. The number in the coordinate point will automatically be incremented.</p>		<p>{F3} or {F4}</p>

19.4.3 To Conduct Ordinary Measurement and to Record Coordinates

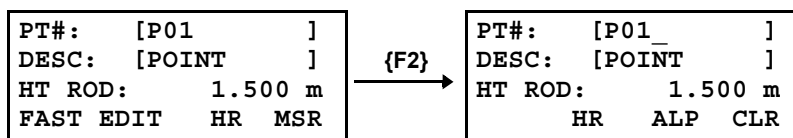
Operating procedure	Operation	Display
1 Select {F3} (TOPO).	{F3}	<pre>1. INST SETUP 2. LAYOUT 3. TOPO [1] [2] [3]</pre>
2 Enter the coordinate point and its description to record. * 1)		Enter PT#, Enter DESC
3 Set with {ENT} key. * 2)	{ENT}	
4 To record the coordinate data without checking measured data, select {F1} (FAST) key.	{F1}	<pre>PT#: [P01] DESC: [POINT] HT ROD: 1.500 m >Measuring...</pre>
5 The measured coordinate data will be recorded, and the number in the coordinate point will automatically be incremented.	Save data	<pre>PT#: [P02] DESC: [POINT] HT ROD: 1.500 m FAST EDIT HR MSR</pre>
6 To record the coordinate data while checking measured data, select {F4} (MSR) key.	{F4}	<pre>VA: 90°00'00" HA: 120°00'00" HD: m MSR SD NEZ REC</pre>
7 Measure with {F1} (MSR) key.	{F1}	<pre>VA: 60°00'00" HA: 120°00'00" HD: 10.000 m MSR SD NEZ REC</pre>

<p>8 Pressing {F2} (SD) key will switch the distance display to the SD display.</p>	{F2}	<table border="1"> <tr><td>VA:</td><td>60°00'00"</td></tr> <tr><td>HA:</td><td>120°00'00"</td></tr> <tr><td>HD:</td><td>11.547 m</td></tr> <tr><td>MSR</td><td>HD</td><td>NEZ</td><td>REC</td></tr> </table>	VA:	60°00'00"	HA:	120°00'00"	HD:	11.547 m	MSR	HD	NEZ	REC	
VA:	60°00'00"												
HA:	120°00'00"												
HD:	11.547 m												
MSR	HD	NEZ	REC										
<p>9 Pressing {F3} (NEZ) key will switch to the coordinate display.</p>	{F3}	<table border="1"> <tr><td>N :</td><td>-5.000 m</td></tr> <tr><td>E :</td><td>8.660 m</td></tr> <tr><td>Z :</td><td>5.774 m</td></tr> <tr><td>MSR</td><td>HD</td><td>NEZ</td><td>REC</td></tr> </table>	N :	-5.000 m	E :	8.660 m	Z :	5.774 m	MSR	HD	NEZ	REC	
N :	-5.000 m												
E :	8.660 m												
Z :	5.774 m												
MSR	HD	NEZ	REC										
<p>10 Pressing {F3} (A/D) key will switch to the previously measured angle/measured distance display.</p>	{F3}	<table border="1"> <tr><td>VA:</td><td>60°00'00"</td></tr> <tr><td>HA:</td><td>120°00'00"</td></tr> <tr><td>HD:</td><td>11.547 m</td></tr> <tr><td>MSR</td><td>HD</td><td>NEZ</td><td>REC</td></tr> </table>	VA:	60°00'00"	HA:	120°00'00"	HD:	11.547 m	MSR	HD	NEZ	REC	
VA:	60°00'00"												
HA:	120°00'00"												
HD:	11.547 m												
MSR	HD	NEZ	REC										
<p>11 Pressing {F4} (REC) key will record the data.</p>	{F4}	<table border="1"> <tr><td>PT#:</td><td>[P02</td><td>]</td></tr> <tr><td>DESC:</td><td>[POINT</td><td>]</td></tr> <tr><td>HT ROD:</td><td>1.500 m</td></tr> <tr><td>FAST EDIT</td><td>HR</td><td>MSR</td></tr> </table>	PT#:	[P02]	DESC:	[POINT]	HT ROD:	1.500 m	FAST EDIT	HR	MSR
PT#:	[P02]											
DESC:	[POINT]											
HT ROD:	1.500 m												
FAST EDIT	HR	MSR											
<ul style="list-style-type: none"> Data to be recorded are recalculated from the currently displayed angle and horizontal distance (angle offset function). <p>To record the coordinate data of the collimate point, record (REC) them without moving the angle after measurement (MSR).</p>													

*1) To change the reflector height, select **{F2}** (HR) key to switch to the screen for reflector height input.



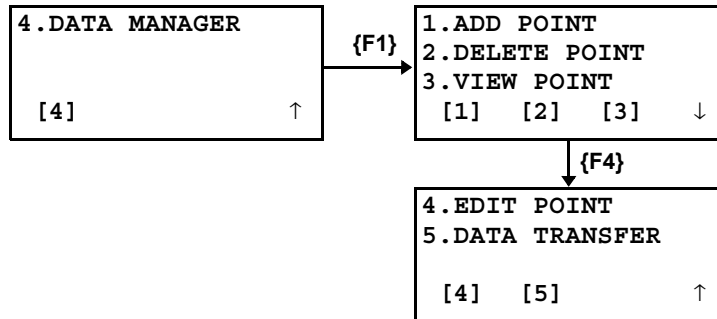
*2) To edit a coordinate point and its description, select **{F2}** (EDIT) key to return to the editing mode.



19.5 DATA MANAGER

The following operations can be performed with DATA MANAGER.

- | | |
|---------------------------------|--------------------|
| 1) Adding coordinate data |ADD POINT |
| 2) Deleting coordinate data |DELETE POINT |
| 3) Viewing coordinate data |VIEW POINT |
| 4) Editing coordinate data |EDIT POINT |
| 5) Transferring coordinate data |DATA TRANSFER |



19.5.1 To Add Coordinate Data To Add Coordinate Data

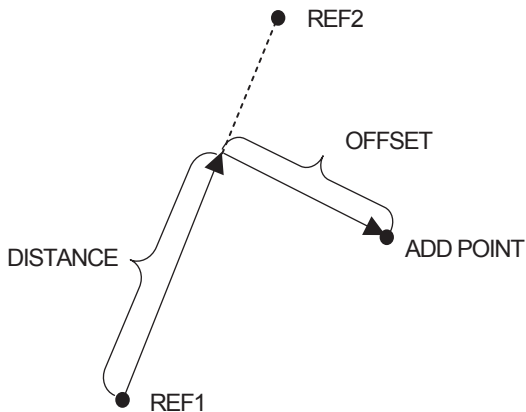
Operating procedure	Operation	Display
Select {F1} (ADD POINT). Coordinates can be added through the following procedure: 1. COORDINATES 2. REFLINE 3. TAPE	{F1}	1 . ADD POINT 2 . DELETE POINT 3 . VIEW POINT [1] [2] [3] ↓
		1 . COORDINATES 2 . REFLINE 3 . TAPE [1] [2] [3]

● Entering coordinates directly (COORDINATES)

Operating procedure	Operation	Display
1 Select {F1} (COORDINATES). 2 Enter a coordinate point and its description. 3 Set with {ENT} key.	{F1}	1 . COORDINATES 2 . REFLINE 3 . TAPE [1] [2] [3]
		ENTER NEW POINT: PT#: [_] DESC: [_] ALP CLR
	Enter PT#, Enter DESC	{ENT}
		N [_] E [_] Z [_] CLR

<p>4 Enter N/E/Z coordinates.</p>	<p>Enter NEZ Coordinate Data</p>	<table border="1"> <tr><td>N</td><td>[0.000</td><td>]</td></tr> <tr><td>E</td><td>[0.000</td><td>]</td></tr> <tr><td>Z</td><td>[0.000_</td><td>]</td></tr> <tr><td colspan="3" style="text-align: right;">CLR</td></tr> </table>	N	[0.000]	E	[0.000]	Z	[0.000_]	CLR			
N	[0.000]													
E	[0.000]													
Z	[0.000_]													
CLR															
<p>5 Set with {ENT} key. The coordinate point and the job name will be displayed and the procedure will be completed.</p>	<p>{ENT}</p>	<table border="1"> <tr><td>PT#:</td><td>[P01</td><td>]</td></tr> <tr><td colspan="3" style="text-align: center;">STORED!</td></tr> <tr><td>JOB</td><td>[JOB1</td><td>]</td></tr> </table> <p style="text-align: center;">↓</p> <table border="1"> <tr><td>1. COORDINATES</td></tr> <tr><td>2. REFLINE</td></tr> <tr><td>3. TAPE</td></tr> <tr><td>[1] [2] [3]</td></tr> </table>	PT#:	[P01]	STORED!			JOB	[JOB1]	1. COORDINATES	2. REFLINE	3. TAPE	[1] [2] [3]
PT#:	[P01]													
STORED!															
JOB	[JOB1]													
1. COORDINATES															
2. REFLINE															
3. TAPE															
[1] [2] [3]															

● REFLINE



Operating procedure	Operation	Display								
<p>1 Select {F2} (REFLINE).</p>	<p>{F2}</p>	<table border="1"> <tr><td>1. COORDINATES</td></tr> <tr><td>2. REFLINE</td></tr> <tr><td>3. TAPE</td></tr> <tr><td>[1] [2] [3]</td></tr> </table> <table border="1"> <tr><td>ENTER REF1</td></tr> <tr><td>PT#: [_]</td></tr> <tr><td>DESC:</td></tr> <tr><td>↑ ↓ ALP CLR</td></tr> </table>	1. COORDINATES	2. REFLINE	3. TAPE	[1] [2] [3]	ENTER REF1	PT#: [_]	DESC:	↑ ↓ ALP CLR
1. COORDINATES										
2. REFLINE										
3. TAPE										
[1] [2] [3]										
ENTER REF1										
PT#: [_]										
DESC:										
↑ ↓ ALP CLR										
<p>2 To acquire coordinate data for reference "REF1," select an existing coordinate point with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.</p>	<p>Enter/ Select PT#</p>	<table border="1"> <tr><td>ENTER REF1</td></tr> <tr><td>PT#: [P01_]</td></tr> <tr><td>DESC:</td></tr> <tr><td>↑ ↓ ALP CLR</td></tr> </table>	ENTER REF1	PT#: [P01_]	DESC:	↑ ↓ ALP CLR				
ENTER REF1										
PT#: [P01_]										
DESC:										
↑ ↓ ALP CLR										
<p>3 Set with {ENT} key.</p>	<p>{ENT}</p>	<table border="1"> <tr><td>ENTER REF2</td></tr> <tr><td>PT#: [_]</td></tr> <tr><td>DESC:</td></tr> <tr><td>↑ ↓ ALP CLR</td></tr> </table>	ENTER REF2	PT#: [_]	DESC:	↑ ↓ ALP CLR				
ENTER REF2										
PT#: [_]										
DESC:										
↑ ↓ ALP CLR										

4 Acquire coordinate data for Reference "REF2" in the same manner.

Enter/
Select PT#

```

ENTER REF2
PT#:  [P02_  ]
DESC:
      ↑   ↓   ALP CLR
    
```

{ENT}

```

ENTER DISTANCE

=  _          m
                CLR
    
```

5 Enter the distance (DISTANCE) from reference "REF1" to the direction of "REF2".

Enter
DISTANCE

```

ENTER DISTANCE

= 10.000_    m
                CLR
    
```

6 Set with {ENT} key.

{ENT}

```

ENTER OFFSET

L =  _          m
LEFT RIGHT    CLR
    
```

7 Enter the horizontal direction distance (OFFSET). To select directions, press {F1} (LEFT) to move to the left and {F2} (RIGHT) to the right.

Enter
OFFSET,
{F1} or
{F2}

```

ENTER OFFSET

R = 5.000_    m
LEFT RIGHT    CLR
    
```

8 Set with {ENT} key. The conditions for calculating coordinate data will be displayed.

{ENT}

```

REF1 [P01  ]
REF2 [P02  ]

OK  EDIT   ↓
    
```

9 {F4} (↑/↓) will allow the switching of the "REF1/REF2" display and "DISTANCE/OFFSET" display.

{F4}

```

DIS:      10.000 m
R :       5.000 m

OK  EDIT   ↑
    
```

10 Press {F1} (OK) to calculate coordinate data. After the coordinate data is calculated, the procedure will move onto coordinate point/description entries.

{F1}

```

ENTER NEW POINT:
PT#:  [_     ]
DESC:  [_     ]
                ALP CLR
    
```

- The procedures below will be the same as the ones for entering coordinates directly (COORDINATE).

Enter PT#,
Enter
description

```

ENTER NEW POINT:
PT#:  [P03  ]
DESC:  [POINT_ ]
                ALP CLR
    
```

{ENT}

```

N [      10.000 ]
E [       5.000 ]
Z [       0.000 ]
                ENTER
    
```

- The calculated value will be displayed for the coordinate data. Set with **{ENT}** key.

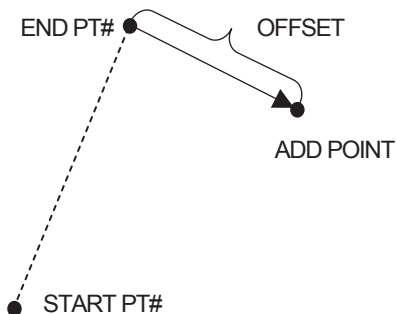
{ENT}

PT#:	[P03]
	STORED!	
JOB	[JOB 1]

↓

1. COORDINATES
2. REFLINE
3. TAPE
[1] [2] [3]

● **TAPE**



Operating procedure	Operation	Display				
1 Select {F3} (TAPE).	{F3}	<table border="1"> <tr> <td>1. COORDINATES</td> </tr> <tr> <td>2. REFLINE</td> </tr> <tr> <td>3. TAPE</td> </tr> <tr> <td>[1] [2] [3]</td> </tr> </table>	1. COORDINATES	2. REFLINE	3. TAPE	[1] [2] [3]
1. COORDINATES						
2. REFLINE						
3. TAPE						
[1] [2] [3]						
2 In order to acquire coordinate data for reference "START" point, select an existing coordinate point with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.	Enter/ Select PT#	<table border="1"> <tr> <td>ENTER START PT#</td> </tr> <tr> <td>PT#: [_]</td> </tr> <tr> <td>DESC:</td> </tr> <tr> <td>↑ ↓ ALP CLR</td> </tr> </table>	ENTER START PT#	PT#: [_]	DESC:	↑ ↓ ALP CLR
ENTER START PT#						
PT#: [_]						
DESC:						
↑ ↓ ALP CLR						
3 Set with {ENT} key.	{ENT}	<table border="1"> <tr> <td>ENTER START PT#</td> </tr> <tr> <td>PT#: [P01_]</td> </tr> <tr> <td>DESC:</td> </tr> <tr> <td>↑ ↓ ALP CLR</td> </tr> </table>	ENTER START PT#	PT#: [P01_]	DESC:	↑ ↓ ALP CLR
ENTER START PT#						
PT#: [P01_]						
DESC:						
↑ ↓ ALP CLR						
4 In order to acquire coordinate data for reference "END" point, select an existing coordinate point with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.	Enter/ Select PT#	<table border="1"> <tr> <td>ENTER END PT#</td> </tr> <tr> <td>PT#: [_]</td> </tr> <tr> <td>DESC:</td> </tr> <tr> <td>↑ ↓ ALP CLR</td> </tr> </table>	ENTER END PT#	PT#: [_]	DESC:	↑ ↓ ALP CLR
ENTER END PT#						
PT#: [_]						
DESC:						
↑ ↓ ALP CLR						
5 Set with {ENT} key.	{ENT}	<table border="1"> <tr> <td>ENTER END PT#</td> </tr> <tr> <td>PT#: [P02_]</td> </tr> <tr> <td>DESC:</td> </tr> <tr> <td>↑ ↓ ALP CLR</td> </tr> </table>	ENTER END PT#	PT#: [P02_]	DESC:	↑ ↓ ALP CLR
ENTER END PT#						
PT#: [P02_]						
DESC:						
↑ ↓ ALP CLR						
	{ENT}	<table border="1"> <tr> <td>ENTER FROM END PT#</td> </tr> <tr> <td>L = _ m</td> </tr> <tr> <td>LEFT RIGHT CLR</td> </tr> </table>	ENTER FROM END PT#	L = _ m	LEFT RIGHT CLR	
ENTER FROM END PT#						
L = _ m						
LEFT RIGHT CLR						

- 6** Enter the horizontal distance (OFFSET) from "END" point.
To select directions, press **{F1}** (LEFT) to move to the left and **{F2}** (RIGHT) to the right.
- 7** Set with **{ENT}** key.
The conditions for calculating coordinate data will be displayed.
- 8** Press **{F1}** (OK) to calculate coordinate data.
After the coordinate data is calculated, the procedure will move onto coordinate point/description entries.
- The procedures below will be the same as the ones for entering coordinates directly (COORDINATE).
 - The calculated value will be displayed for the coordinate data. Set with **{ENT}** key.

Enter OFFSET, **{F1}** or **{F2}**

{ENT}

{F1}

Enter PT#, Enter DESC

{ENT}

{ENT}

ENTER FROM END PT#	
R = 5.000	m
LEFT	RIGHT CLR
START [P01]	
END [P02]	
R :	5.000 m
OK	EDIT ↓
ENTER NEW POINT:	
PT#:	[_]
DESC:	[_]
	ALP CLR
↓	
ENTER NEW POINT:	
PT#:	[P03]
DESC:	[POINT _]
	ALP CLR
↓	
N [10.000]
E [5.000]
Z [0.000]
	ENTER
↓	
PT#:	[P03]
	STORED!
JOB	[JOB1]
↓	
1. COORDINATES	
2. REFLINE	
3. TAPE	
[1]	[2] [3]

19.5.2 To Delete Coordinate Data

Operating procedure	Operation	Display
1 Select {F2} (DELETE POINT).	{F2}	1. ADD POINT 2. DELETE POINT 3. VIEW POINT [1] [2] [3] ↓
		1. DESIGN PT 2. MEASUREMENT PT [1] [2]
2 Select the type of data to delete. {F1} (DESIGN PT) Coordinate data entered directly and recorded for addition of coordinates {F2} (MEASUREMENT PT) Coordinate data observed and recorded through layout, TOPO, etc.	{F1} or {F2}	ENTER PT TO DEL PT#: [_] DESC: [_] ↑ ↓ ALP CLR

<p>3 Select a coordinate point to delete with {F1} or {F2} (Arrow) key, or enter a coordinate point directly.</p>	<p>Enter/ Select PT#</p>	<pre>ENTER PT TO DEL PT#: [P01_] DESC: [] ↑ ↓ ALP CLR</pre>
<p>4 Set with {ENT} key.</p>	<p>{ENT}</p>	<pre>ENTER PT TO DEL PT#: [P01] DESC: [] >OK ? [YES] [NO]</pre>
<p>5 When deleting data, there will be a verification procedure. Selecting {F3} (YES) here will delete the coordinate data selected.</p>	<p>{F3}</p>	<pre>POINT DELETED!</pre> <p style="text-align: center;">↓</p> <pre>1.DESIGN PT 2.MEASUREMENT PT</pre> <p>[1] [2]</p>

19.5.3 To View Coordinate Data

Operating procedure	Operation	Display
<p>1 Select {F3} (VIEW POINT).</p>	<p>{F3}</p>	<pre>1.ADD POINT 2.DELETE POINT 3.VIEW POINT [1] [2] [3] ↓</pre> <pre>1.DESIGN PT 2.MEASUREMENT PT</pre> <p>[1] [2]</p>
<p>2 Select type of data to view. {F1} (DESIGN PT) Coordinate data entered directly and recorded for addition of coordinates {F2} (MEASUREMENT PT) Coordinate data observed and recorded through layout, TOPO, etc.</p>	<p>{F1} or {F2}</p>	<pre>DESIGN PT PT#: [P01] DESC: [POINT] ↑ ↓ NEZ</pre>
<p>3 Select a coordinate point to view with {F1} or {F2} (Arrow) key.</p>	<p>Enter/ Select PT#</p>	<pre>DESIGN PT PT#: [P99] DESC: [POINT] ↑ ↓ NEZ</pre>
<p>4 To check the coordinate data, press {F4} (NEZ).</p>	<p>{F4}</p>	<pre>N [0.000] E [0.000] Z [0.000] ↑ ↓ PT#</pre>
<p>5 Pressing {F4} (PT#) will return to the coordinate point display.</p>	<p>{F4}</p>	<pre>DESIGN PT PT#: [P99] DESC: [POINT] ↑ ↓ NEZ</pre>

19.5.4 To Edit Coordinate Data

Operating procedure	Operation	Display
<ul style="list-style-type: none"> Only entered coordinate data (design data) can be edited. 		<pre> 4 .EDIT POINT 5 .DATA TRANSFER [4] [5] ↑ </pre>
<ol style="list-style-type: none"> Select {F1} (EDIT POINT). 	{F1}	<pre> DESIGN PT PT#: [P01] DESC: [POINT] ↑ ↓ EDIT NEZ </pre>
<ol style="list-style-type: none"> Select a coordinate point to edit with {F1} or {F2} (Arrow) key. 	{F1} or {F2}	<pre> DESIGN PT PT#: [P99] DESC: [POINT] ↑ ↓ EDIT NEZ </pre>
<ol style="list-style-type: none"> Switch to the editing mode by pressing {F3} (Edit) key. 	{F3}	<pre> DESIGN PT PT#: [P99_] DESC: [POINT] ALP CLR </pre>
<ol style="list-style-type: none"> After editing the coordinate point and its description, set with {ENT} key. 	Edit data {ENT}	<pre> DESIGN PT PT#: [PT-99] DESC: [POINT] ↑ ↓ EDIT NEZ </pre>
<ul style="list-style-type: none"> Coordinate data can be edited with the editing mode in the same manner. 		<pre> N [0.000] E [0.000] Z [0.000] ↑ ↓ EDIT PT# </pre> <p style="text-align: center;">↓</p> <pre> N [0.000_] E [0.000] Z [0.000] CLR </pre>

19.5.5 To Transfer Coordinate Data

Operating procedure	Operation	Display
1 Select {F2} (DATA TRANSFER). Data transfer corresponds to the following two types of transmission formats: F1: GTS FORMAT F2: SSS FORMAT	{F2}	4.EDIT POINT 5.DATA TRANSFER [4] [5] ↑
		DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT

● Setting Transmission Protocol

Operating procedure	Operation	Display
<ul style="list-style-type: none"> Always check transmission protocol before performing data transfer. 		DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT
1 Select the transmission format to use.	{F1} or {F2}	DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS
2 Select {F3} (COMM. PARAMETERS)	{F3}	COMM. PARAMETERS F1:BAUD RATE F2:CHAR./PARITY F3:STOP BITS

Set items for transmission protocol are as follows according to the format.

● GTS FORMAT

Item	Selecting Item	Contents
Protocol	[ACK/NAK], [ONE WAY]	Setting Protocol [ACK/NAK] or [ONE WAY] communication
Baud rate	1200, 2400, 4800, 9600, 19200, 38400	Setting transfer speed 1200/2400/4800/9600/19200/38400 baud
Char. / Parity	[7/EVEN], [7/ODD], [8/NON]	Setting data length and parity. [7bit, even], [7bit, odd], [8bit,none]
Stop Bits	1, 2	Setting Stop 1 bit or 2bits

● SSS FORMAT

Item	Selecting Item	Contents
Baud rate	1200, 2400, 4800, 9600, 19200, 38400	Setting transfer speed 1200/2400/4800/9600/19200/38400 baud
Char. / Parity	[7/EVEN], [7/ODD], [8/NON]	Setting data length and parity. [7bit, even], [7bit, odd], [8bit,none]
Stop Bits	1, 2	Setting Stop 1 bit or 2bits

● Receiving coordinate data

Operating procedure	Operation	Display
<p>1 Select the transmission format used for receiving data.</p> <p>F1: GTS FORMAT F2: SSS FORMAT</p> <p>2 Select {F2} (LOAD DATA).</p> <p>3 Press {F3} (YES) to begin the coordinate data receiving process.</p>	<p>{F1} or {F2}</p> <p>{F2}</p> <p>{F3}</p>	<p>DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT</p>
		<p>DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS</p>
		<p>LOAD COORD. DATA</p> <p>>OK ? --- --- [YES] [NO]</p>
		<p>LOAD COORD. DATA * < Loading Data ! > STOP</p>

● Sending coordinate data

Operating procedure	Operation	Display
<p>1 Select the transmission format used for receiving data.</p> <p>F1: GTS FORMAT F2: SSS FORMAT</p> <p>2 Select {F1} (SEND DATA).</p> <p>3 Press {F3} (YES) to begin the coordinate data sending process.</p>	<p>{F1} or {F2}</p> <p>{F1}</p> <p>{F3}</p>	<p>DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT</p>
		<p>DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS</p>
		<p>SEND COORD. DATA</p> <p>>OK ? --- --- [YES] [NO]</p>
		<p>SEND COORD. DATA * < Sending Data ! > STOP</p>

20 PRECAUTIONS

- 1) For transportation, hold by the handle or yoke of the instrument. Never hold by the lens barrel as it can affect the fixing bracket inside and reduce the accuracy of the instrument.
- 2) Never expose the instrument without a filter to direct sunlight. It may damage the components inside the instrument.
- 3) Never leave the instrument unprotected in high temperature. The temperature inside instrument may easily reach up to 70°C or above and will reduce the service life.
- 4) The instrument should be stored in the room temperature range of minus 30°C to plus 60°C.
- 5) When a high degree of precision is required for measurement, provide shade against direct sunlight for the instrument and tripod.
- 6) Any sudden change of temperature to the instrument or prism may result in a reduction of measuring distance range, i.e. when taking the instrument out from a heated vehicle.
- 7) When opening the carrying case and taking out the instrument, place the case horizontally, then open the case.
- 8) When returning the instrument to its case, be sure to match the white positioning marks provided with the case and fit it correctly into the concave shape inside the case.
- 9) For transportation, provide dampening or a cushion appropriately to avoid sudden shock or vibration.
- 10) For cleaning the instrument after use, remove dust using a cleaning brush, then wipe off with a cloth.
- 11) Wipe off moisture completely if the instrument gets wet during survey work. Store the instrument in a dry room where the temperature remains fairly constant.
- 12) For cleaning the lens surface, use a cleaning brush to remove the dust, then use a clean lintless cotton cloth. Moisten it with alcohol (or mixture with ether) to wipe gently in a rotational motion from the center out.
- 13) Even if any abnormality occurs, never attempt to disassemble or lubricate the instrument yourself. Always consult with TOPCON or your dealer.
- 14) To remove the dust on the case, never use thinner or benzine. Use a clean cloth moistened with neutral detergent.
- 15) Check each part of the tripod after extended use. Parts (screws or clamps) may work themselves free.

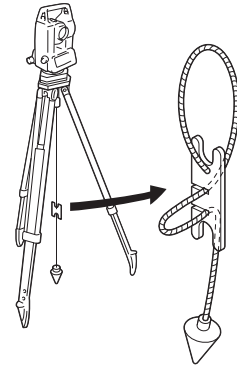
21 SPECIAL ACCESSORIES

The following are optional accessories which are sold separately from the ES.

☞ Target and power supply optional accessories: see Section 22 "BATTERY SYSTEM". and 23 "PRISM SYSTEM".

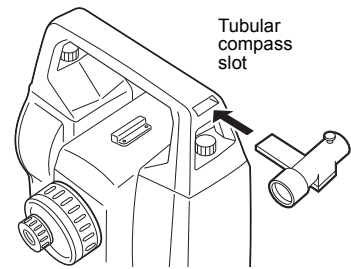
- **Plumb bob**

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.



- **Tubular compass (CP7)**

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.

- **Telescope eyepiece lens (EL7)**

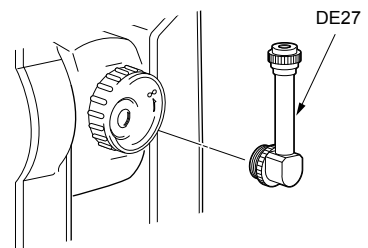
Magnification: 40X
Field of view : 1° 20'

- **Diagonal eyepiece (DE27)**

The diagonal eyepiece is convenient for observations near the nadir and in narrow spaces.
Magnification: 30X

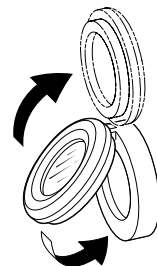
After removing the handle from the ES, loosen the attachment screw to remove the telescope eyepiece. Then screw the diagonal lens into place.

☞ Handle removal method: see Section 1.1 "Nomenclature".



- **Solar filter (OF3A)**

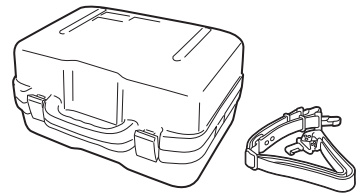
When sighting targets where glare is present, solar observations for example, attach it to the objective lens of the ES to protect its interior and the eyes of the operator. The filter part can be flipped up without being removed.



- **Carrying case (SC249T) & Carrying strap**

This is a carrying case and strap set.

Attach the strap to the carrying case to shoulder the case.



- **Interface cable**

Connect between the ES and the host computer for data output.

Cable	Notes
DOC210	Pin Numbers and signal levels: RS-232C compatible D-sub connector: 9pins (female)

Note

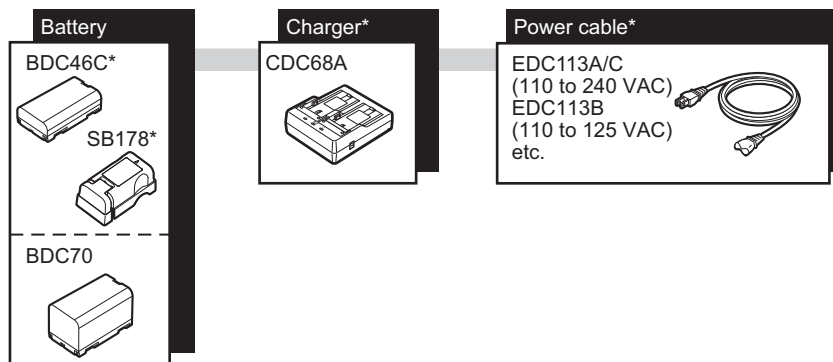
- By using the Y cable the ES can perform RS232C communication (D-sub 9-pin) at the same time as connecting to an external power source.

22 BATTERY SYSTEM

Operate your ES with the following combinations of power equipment.



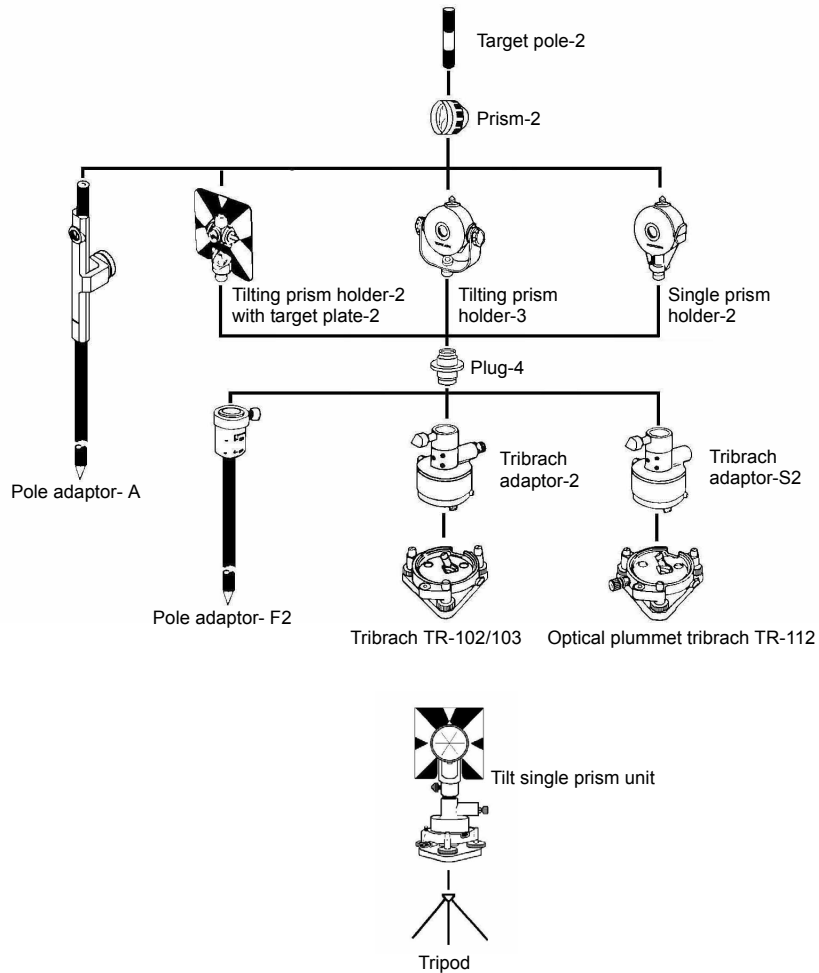
- Be sure to carefully read the operating manuals for the battery and charger before operating.
- Never use any combination other than those indicated below. If you do, the ES could be damaged.
- Those indicated by * are standard accessories.



- Dedicated power cables differ according to the country or the area where the instrument is used. Contact your local dealer for the details.

23 PRISM SYSTEM

Arrangement according to your needs is possible.



- Plug-4 is necessary for the tribrach adaptor-2, tribrach adaptor-S2 and pole adaptor-F2 to coincide with the height of this series.
Use the above prisms after setting them at the same height as the instruments. To adjust the height of prism set, change the position of fixing screws.
- During a traverse observation, it is recommended to use the same type (tribrach-TR-102/103/112) of tribrach for the target.

24 ERROR DISPLAYS

The following is a list of the error messages displayed by the instrument and the meaning of each message.



- There is a possibility that an unexpected error occasionally occurs when using an old battery. In such a case, exchange it for a new battery, and please check the operation of the instrument.
- If error still persist after attempting to clear them, contact your local dealer.




Error code	Description	Countermeasures
3 points required	When area calculating, there are less than 3 points coordinate data in selected file.	Confirm the file data and calculate again.
BadCondition	The air is shimmering a lot, etc., measuring conditions are poor. The center of the target cannot be sighted. 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.	Perform measurement again when measuring condition becomes better. Resight the target. Choose a single surface target for distance measurement.
CALC ERROR	Calculation is impossible from the data input.	Confirm the input data.
DELETE ERROR	When deleting coordinate data, it can not be done successful.	Confirm the data and delete again.
SIGNAL OFF	Measuring conditions are poor, and there is not enough reflective light for measuring distances.	Resight the target. When using reflective prisms, effectiveness will be improved by increasing the number of prisms used.
E020's, E031, E033	EDM error	Repair is required.
E35	Displayed when REM measurement carried out to the range from zenith or nadir $\pm 6^\circ$.	Operate in the range out of $\pm 6^\circ$ from the zenith or nadir.
E72	Displayed when Vertical angle -position is adjusted in wrong position.	Repair is required.
E73	The instrument was not leveled when Vertical angle 0-position is adjusted.	Level the instrument then carry the adjustment work.
E80's	Mainly at the time data transmission between ES and external instrument.	Confirm operation procedure is correct or the connection cables are correct.
E097	EDM device error	Repair is required.
E123, E124	Tilt error	Contact your local dealer.
E198	Angle measurement error	Contact your local dealer.
E201	EDM distance measurement time out error	If the same error message is repeated, repair is required.
E205	Communication with EDM is poor	If the same error message is repeated, repair is required.
FILE EXISTS	The same file name exists.	Use another file name.

FULL FILES	When making a file, 30 files already exist.	If necessary, send or delete files.
FAILED INITIALIZE	Initializing can not be done successful.	Confirm initializing data and try to initialize again.
LIMIT OVER	Limit of input data exceeded.	Input again.
MEMORY ERROR	Any abnormality occurs with internal memory.	Initialize the internal memory.
MEMORY POOR	Shortage of capacity of the internal memory.	Download data from internal memory to PC.
NO DATA	The data is not found in the search mode	Confirm the data and search again.
NO FILE	There is no file in internal memory.	If necessary, make files.
FILE NOT SELECTED	When using a file, no file is selected.	Confirm the file and select a file.
P1-P2 distance too short	When in point to line measurement, the horizontal distance between first point and second point is within 1m.	The horizontal distance between first point and second point must be more than 1m.
CIRCULAR ERROR	Known points and occupied point are on the same circle at the resection mode.	Take the different point.
PT# EXIST	Same new point name is already memorized in the memory.	Confirm the new point name and input again.
PT# DOES NOT EXIST	When you enter incorrect name or PT# does not exist in the internal memory.	Enter the correct name or enter point in the internal memory.
RANGE ERROR	When setting a new point, calculation is impossible from the measured data.	Measure again.
READ ONLY FILE	Read-only file on the USB flash drive cannot be changed and file contents cannot be deleted or edited.	Remove the read -only attribute of the file on your PC etc.
Temp RangeOUT	ES is outside useable temperature range and accurate measurement cannot be performed.	Repeat measurement within the appropriate temperature range. If the ES is used under direct sunlight, use an umbrella to protect it against the heat of the sun.
Tilt Over	Instrument tilts over more than 3 minutes.	Level the instrument properly.
USB ERROR	An error has occurred in loading or saving data to USB flash drive.	Check if the USB flash drive is formatted to FAT32. Insert the USB flash drive correctly. If the error still occurs, use another USB flash drive.
V ANGLE ERROR H ANGLE ERROR VH ANGLE ERROR	Abnormality in angle measuring system.	If this error code continues to display, repair is required.

25 REGULATIONS

Region/ Country	Directives/ Regulations	Labels/Declarations
U.S.A.	FCC-Class A	<p>FCC Compliance</p> <p>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.</p> <p>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.</p> <p>Means of conformity This device complies with part 15 of the FCC Rules, Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p> <p>This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.</p> <p>This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.</p>
California, U.S.A.	Proposition 65	<div style="border: 1px solid black; padding: 5px;"> <p>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. <i>Wash hands after handling.</i></p> </div>
California, U.S.A.	Perchlorate Material (CR Lithium Battery)	<div style="border: 1px solid black; padding: 5px;"> <p>This product contains a CR Lithium Battery which contains Perchlorate Material-special handling may apply. See http://www.dtsc.ca.gov/hazardouswaste/perchlorate/ Note ; This is applicable to California, U.S.A. only</p> </div>

Region/ Country	Directives/ Regulations	Labels/Declarations
California and NY, U.S.A.	Recycling Batteries	<p style="text-align: center;"><u>DON'T THROW AWAY RECHARGEABLE BATTERIES, RECYCLE THEM.</u></p> <p style="text-align: center;"><u>Topcon Positioning Systems Inc., United States Return Process for Used Rechargeable Nickel Metal Hydride, Nickel Cadmium, Small Sealed Lead Acid, and Lithium Ion, Batteries</u></p> <p>In the United States Topcon Positioning Systems Inc., has established a process by which Topcon customers may return used rechargeable Nickel Metal Hydride(Ni-MH), Nickel Cadmium(Ni-Cd), Small Sealed Lead Acid(Pb), and Lithium Ion(Li-ion) batteries to Topcon for proper recycling and disposal. Only Topcon batteries will be accepted in this process.</p> <p>Proper shipping requires that batteries or battery packs must be intact and show no signs of leaking. The metal terminals on the individual batteries must be covered with tape to prevent short circuiting and heat buildup or batteries can be placed in individual plastic bag. Battery packs should not be disassembled prior to return.</p> <p>Topcon customers are responsible for complying with all federal, state, and local regulations pertaining to packing, labeling, and shipping of batteries. Packages must include a completed return address, be prepaid by the shipper, and travel by surface mode. <u>Under no circumstance should used/recyclable batteries be shipped by air.</u></p> <p>Failure to comply with the above requirements will result in the rejection of the package at the shipper's expense.</p> <p>Please remit packages to: Topcon Positioning Systems, Inc. C/O Battery Return Dept. 150 7400 National Dr. Livermore, CA 94551</p> <p style="text-align: center;"><u>DON'T THROW AWAY RECHARGEABLE BATTERIES, RECYCLE THEM.</u></p>
Canada	ICES-Class A	<p>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.</p> <p>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.</p> <p>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.</p> <p>This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets the RSS-102 of the IC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.</p>

Region/ Country	Directives/ Regulations	Labels/Declarations
EU	EMC-Class B R&TTE-Class 1	<p>EMC NOTICE In industrial locations or in proximity to industrial power installations, this instrument might be affected by electromagnetic noise. Under such conditions, please test the instrument performance before use.</p> <p>This product complies with the electromagnetic environmental testing of industrial locations.</p> <p>Model: ES series</p> <p>Manufacturer Name: TOPCON CORPORATION Address: 75-1, Hasunuma-cho, Itabashi-ku, Tokyo, 174-8580 JAPAN</p> <p>Europe Representative and Importer Name: Topcon Europe Positioning B.V. Address: Essebaan 11, 2908 LJ Capelle a/d IJssel, The Netherlands</p> 
EU	WEEE Directive	 <p>WEEE Directive This symbol is applicable to EU members states only.</p> <p>Following information is only for EU-member states: The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.</p>
EU	EU Battery Directive	 <p>EU Battery Directive This symbol is applicable to EU members states only.</p> <p>Battery users must not dispose of batteries as unsorted general waste, but treat properly. If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows: Hg: mercury(0.0005%), Cd: cadmium(0.002%), Pb: lead(0.004%)</p> <p>These ingredients may be seriously hazardous to human and the global environment.</p> <p>This product contains a coin cell. You cannot replace batteries by yourself. When you need to replace and/or dispose batteries, contact your local dealer.</p>

26 SPECIFICATIONS

Except where stated, the following specifications apply to all models of ES Series.

Telescope

Length:	171mm
Aperture:	45mm (EDM:48mm)
Magnification:	30X
Image:	Erect
Resolving power:	2.5"
Field of view:	1°30'
Minimum focus:	1.3m
Focussing screw:	1 speed
Reticle illumination:	5 brightness levels

Angle measurement

Horizontal and Vertical circles type:	Rotary absolute encoder
Detecting	
ES-62:	2 sides
ES-65:	1 side
Angle units:	Degree/Gon/Mil (selectable)
Minimum display:	1" (0.0002gon/0.01mil)/5" (0.0010gon/0.1mil) (selectable)
Accuracy:	
ES-62:	2" (0.0006gon/0.010mil)
ES-65:	5" (0.0015gon/0.025mil)
(ISO 17123-3: 2001)	
Measuring time:	0.5 sec or less
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:	1"
Range of compensation:	$\pm 6'$ (± 0.1111 gon)
Automatic compensator:	ON (V & H/V)/OFF (selectable)
Compensation constant:	Can be changed

Distance Measurement

Measuring method:	Coaxial phase shift measuring system
Signal source:	Red laser diode 690nm Class 3R (IEC60825-1 Ed. 3.0: 2014/ 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 June 24, 2007.)) (When the prism or reflective sheet is selected in Config mode as target, the output is equivalent to Class 1). (Using the following reflective prism/reflective sheet target during normal atmospheric conditions.*1)
Measuring range:	Reflective sheet RS90N-K*3: 1.3 to 500m (1,640ft) 1.3 to 300m (980ft)*2 Reflective sheet RS50N-K*3: 1.3 to 300m (980ft) 1.3 to 180m (590ft)*2 Reflective sheet RS10N-K*3: 1.3 to 100m (320ft) 1.3 to 60m (190ft)*2 Prism-2 X 1: 1.3 to 4,000m (13,120ft)*6 Prism-5: 1.3 to 500m (1,640ft)

	Reflectorless (White) ^{*4} :	0.3 to 350m (1,140ft) 0.3 to 200m (650ft) ^{*7}
	Reflectorless (Gray) ^{*5} :	0.3 to 220m (720ft) 0.3 to 100m (320ft) ^{*7}
Minimum display:		
Fine/Rapid measurement:		0.001m (0.005ft / 1/8inch)
Tracking measurement:		0.01m (0.02ft / 1inch)
Maximum slope		Prism/ reflective sheet: 7,680m (25,190ft)
distance display:		Reflectorless: 350m (1,140ft)
Distance unit:		m/ft/inch (selectable)
Accuracy:		
(Using prism)		Fine measurement:(2 + 2 ppm X D) mm Rapid measurement:(5 + 2 ppm X D) mm
(Using reflective sheet target) ^{*3}		Fine measurement:(3 + 2 ppm X D) mm Rapid measurement:(5 + 2 ppm X D) mm
(Reflectorless (White)) ^{*4}		Fine measurement: (3 + 2ppm X D) mm (0.3 to 200m) (5 + 10ppm X D) mm (over 200 to 350m) Rapid measurement: (6 + 2ppm X D) mm (0.3 to 200m) (8 + 10ppm X D) mm (over 200 to 350m)
(Reflectorless (Gray)) ^{*5}		Fine measurement (3 + 2ppm X D) mm (0.3 to 100m) (5 + 10ppm X D) mm (over 100 to 170m) (10 + 10ppm X D) mm (over 170 to 220m) Rapid measurement: (6 + 2ppm X D) mm (0.3 to 100m) (8 + 10ppm X D) mm (over 100 to 170m) (15 + 10ppm X D) mm (over 170 to 220m)
Measurement mode:		Fine measurement (single/repeat/average)/Rapid measurement (single/repeat)/Tracking (selectable)
Measuring time:		
Fine measurement:		1.7 sec + every 0.9 sec.
Rapid measurement		1.4 sec + every 0.7 sec.
Tracking measurement:		1.4 sec + every 0.3 sec.
Atmospheric correction:		
Temperature input range:		-30 to 60°C (in 0.1°C step)/ -22 to 140°F (in 0.1°F step)
Pressure input range:		560 to 1,066 hPa (in 0.1 hPa step) 420 to 800 mmHg (in 0.1mmHg step) 16.5 to 31.5 inchHg (in 0.1inchHg step)
ppm input range:		-999.9 to 999.9 ppm (in 0.1 ppm step)
Prism constant correction:		-99.9 to 99.9 mm (in 0.1 mm step) 0 mm fixed for reflectorless measurement
Earth curvature and refraction correction:		No/Yes K=0.14/Yes K=0.20 (selectable)
Scale factor setting:		0.5 to 2.0
Sea level correction:		No/Yes (selectable)

*1: Slight haze, visibility about 20 km, sunny periods, weak scintillation.

*2: Measurement at 50 to 60°C (122 to 140°F)

*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).

- *4,*5: When performing reflectorless measurement, the possible measurement range and precision will change depending on the target reflection factor, weather conditions and location conditions.
 *6: Face the prism toward the instrument during the measurement with the distance at 10 m or less.
 *7: At the time of the tracking measurement.

Internal memory

Capacity 10,000 measurement points

External memory

USB flash memory (up to 8 GB)

Data transfer

Data input/output Asynchronous serial, RS232C compatible
 USB USB Revision 2.0 (FS), Host (Type A), Only a USB flash drive is compatible.

Bluetooth wireless technology (Option)*8

Transmission method: FHSS
 Modulation: GFSK (Gaussian-filtered frequency shift keying)
 Frequency band: 2.402 to 2.48GHz
 Bluetooth profile: SPP, DUN
 Power class: Class 1
 Usable range: about 10m (No obstacles, few vehicles or sources of radio emissions/interference in the near vicinity of the instrument, no rain)
 Authentication: Yes/No (selectable)

- *8: *Bluetooth* function may not be built in depending on telecommunications regulations of the country or the area where the instrument is purchased. Contact your local dealer for the details.

Power Supply

Power source: Rechargeable Li-ion battery BDC46C
 Working duration at 20 °C:
 Distance and angle measurement (Fine single measurement = every 30 sec.):
 BDC46C: about 15 hours
 BDC70 (optional accessory): about 36 hours
 Battery state indicator: 4 levels
 Auto power-off: 2 levels (30 min/Not set) (selectable)
 Charging time at 25 °C (using CDC68A):
 BDC46C: about 2.5 hours
 BDC70 (optional accessory): about 5.5hours

Battery (BDC46C)

Nominal voltage 7.2V
 Capacity 2430mAh
 Dimensions 38 (W) x 70 (D) x 20 (H) mm
 Weight about 103g

Battery (BDC70: optional accessory)

Nominal voltage 7.2V
 Capacity 5240mAh
 Dimensions 40 (W) x 70 (D) x 40 (H) mm
 Weight about 197g

Charger (CDC68A)

Input voltage: AC100 to 240V
 Charging time per battery (at 25°C):
 BDC46C: about 2.5 hours
 BDC70 (optional accessory): about 5.5 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

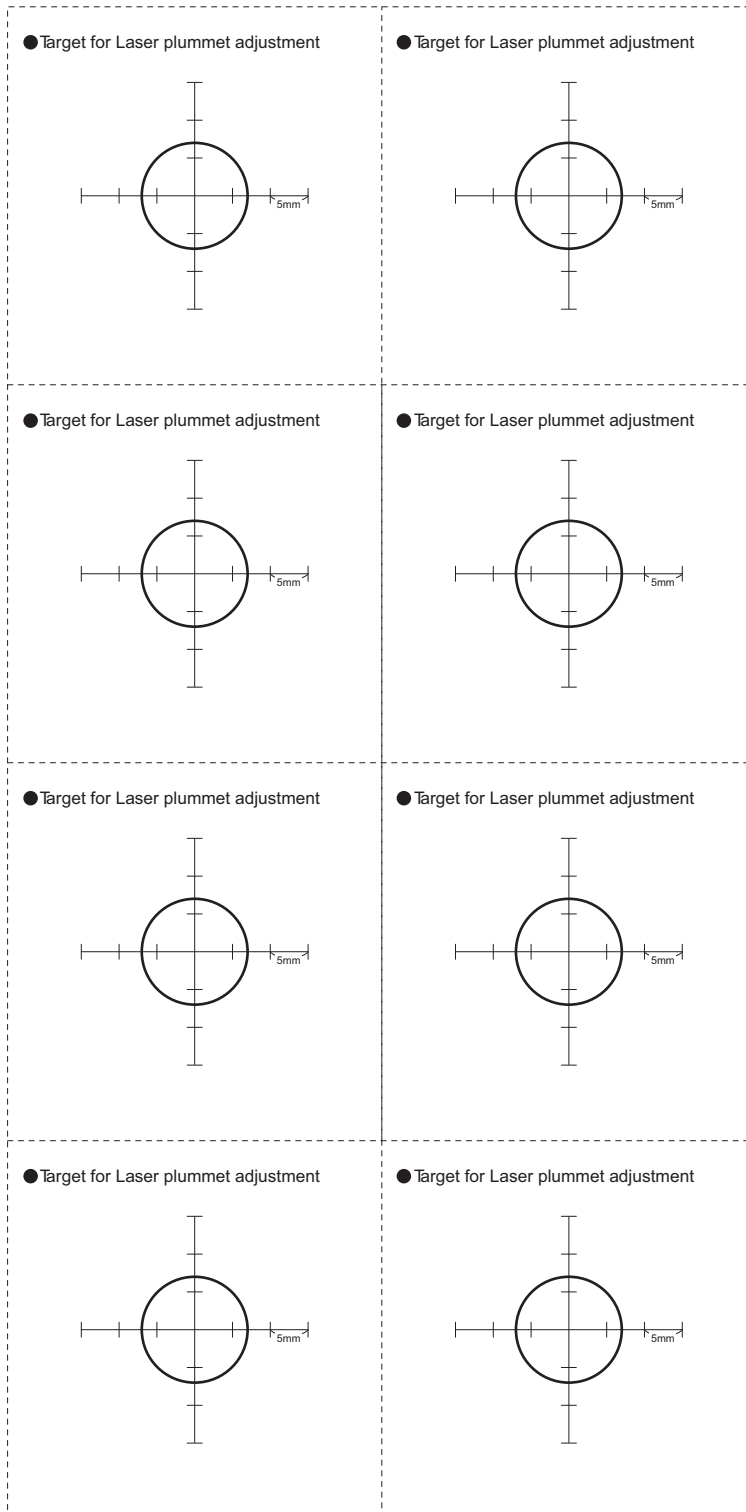
General

Display unit:	LCD graphic display, 192 dots X 80 dots
ES-62:	1 LCD graphic display on each face with illuminator
ES-65:	1 LCD graphic display with illuminator
Operation panel (keyboard):	25 keys (soft function, operations, power on, light) with illuminator
Laser-pointer function:	Provided On/Off (selectable)
Internal memory:	1MB (about 10,000 points)
Sensitivity of levels:	
Circular level:	10 ¹ / ₂ mm
Electronic Circular levels:	
Graphic display range	6' (inner circle)
Digital display range	±6' 30"
Optical plummet:	
Image:	Erect
Magnification:	3X
Minimum focus:	0.3 m
Laser plummet (option):	
Signal source:	Red laser diode 635 ±10nm (Class 2 IEC60825-1 Ed. 3.0:2014/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 June 24, 2007.))
Beam accuracy:	1mm or less (when tripod head height is 1.3m).
Spot diameter:	ø3mm or less
Brightness control:	5 levels
Auto power-off	Provided (power cut off after 5 minutes)
Operating temperature (no condensation):	-20 to 60 °C (-4 to 140 °F) * ⁹
Storage temperature range (no condensation):	-30 to 70 °C (-22 to 158 °F)
Dust and water resistance:	IP66 (IEC 60529: 2001)
Instrument height:	192.5 mm from tribrach mounting surface 236mm +5/-3mm from tribrach bottom
Size (with handle):	
ES-62:	191 (W) X 181 (D) X 348 (H) mm
ES-65:	191 (W) X 174 (D) X 348 (H) mm
Weight (with handle and battery):	5.4kg (11.9lb)

*⁹: No direct sunlight for using high temperatures of 50 to 60 °C (122 to 140 °F).

APPENDIX

1 Target for Laser plummet adjustment



TOPCON CORPORATION (Manufacturer)

75-1 Hasunuma-cho, Itabashi-ku, Tokyo 174-8580, Japan <http://www.topcon.co.jp>

Please see the attached address list or the following website for contact addresses.

GLOBAL GATEWAY <http://global.topcon.com/>
