

PENTAX

R-400V Series

EFFICIENT ACCURACY AT YOUR FINGERS!

- 400m reflectorless EDM range
- Easy transfer to a PC via USB, SD connection
- Dual axis compensator 3" and 5" models
- Triple axis compensator 2" model
- Adjustable laser plummet



**INCREASED
PRODUCTIVITY
FASTER
TURNAROUND**



80th
PENTAX
SURVEYING
SINCE 1933
TI Asahi Co., Ltd.
anniversary

Model	R-422VN	R-423VN	R-425VN	R-435VN
Telescope	Magnification	30 x		
	Effective aperture	45mm (EDM45mm)		
	Resolving power	3.0"		
	Field of view	2.6 % (1° 30')		
	Minimum focus	1.0 m		
	Focus	Manual		
Distance measurement	Visible laser: Class III a (3R) (Reflectorless) / Class II (2) (Prism, sheet)			
Measurement range (Good conditions) (*3)	Reflectorless (*1)	1.5 ~ 400 m		
	Reflector sheet (*2)	1.5 ~ 600 m (800 m)		
	Mini Prism	1.5 ~ 1,600 m (2,000 m)		
	1 P	1.5 ~ 5,500 m (7,000 m)		
	3 P	1.5 ~ 7,000 m (9,000 m)		
Accuracy	Prism / Reflector sheet	1.5 ~ 10 m: ± (3 + 2 ppm x D) mm / 10 m ~: ± (2 + 2 ppm x D) mm, Quick: ± (3+2ppmxD) mm (*5)		
	Reflectorless	1.5 ~ 300 m: ± (5 + 2 ppm x D) mm / 300 m ~: ± (7 + 10 ppm x D) mm		
	Minimum count	0.1 mm (Fine mode) / 1 mm (Normal mode) / 10mm (Track mode)		
Measuring time (*4)	Repeat meas. Normal (1 mm)	Prism / Reflector sheet 2.0 sec - Reflectorless 2.0 sec		
	Quick (1 mm)	Prism / Reflector sheet 1.2 sec (*5)		
	Track (10 mm)	Prism / Reflector sheet 0.4 sec - Reflectorless 0.4 sec		
	Initial meas. Normal (1 mm)	Prism / Reflector sheet 2.5 sec - Reflectorless 2.4 sec		
	Quick (1 mm)	Prism / Reflector sheet 1.7 sec (*5)		
	Track (10 mm)	Prism / Reflector sheet 2.5 sec - Reflectorless 2.5 sec		
Angle measurement	Measurement method	Absolute rotary encoder		
	Direction method	Vertical / Horizontal angle: 2 sides		Vertical / Horizontal angle: 1 side
	Minimum count	1" / 5" selectable		
	Accuracy (ISO 17123-3)	2"	3"	5"
Compensator	3 Axis		2 Axis	
Target screw	1 speed			
Sensitivity of vials	Plate level	30" / 1 mm		
	Circular level	8' / 2 mm		
Laser Plummet	Visible laser: ± 0.5mm (instrument height: 1.5m) (Optical Plummet is optional)			
Base	Detachable		Shifting	
Dust & water resistance	IP56 (instrument only)			
Ambient temperature	-20°C ~ +50°C / -4°F ~ 122°F (working range)			
Tripod thread	5/8" x 11			35 mm P2
Dimensions / Weight	Dimensions	180 (W) x 342 (H) x 177 (L) mm		
	Weight (incl. battery)	5.7 kg		
	Carrying case	250 (W) x 365 (H) x 425 (L) mm		
Battery pack	Power source	Ni-MH 4300 mAh (rechargeable) DC 6.0 V		
	Operation time	Approx. 7.0 hrs (ETH + EDM) / 15hrs (ETH) with approx. 2.2 hrs of charging time		
	Weight	380 g		
Battery charger and AC adapter	Input Voltage	AC 100 ~ 240 V		
	Output Voltage	DC 7.5 V		
	Weight	280 g		
Data Process	Data recording method	Internal Memory (*7)		
	Coordinates data (*6)	45,000		
	Special function	PowerTopoLite		
	I / F	RS-232C, SD CARD, USB		
Display / keyboard	Display type	Graphic LCD / 20 characters x 8 lines / 240 x 96 pixels		
	Quantity	1 (2nd optional)		
	Keys	22 each (12 numeric / 5 function / 5 special)		
	Display back light	Intensity settings: 10 steps		
Laser Pointer	Yes			
Date clock	Yes			

- *1 The measurement range and accuracy of reflectorless, and time required to measure may vary by the shape, size of surface area and reflection rate of the target and its environment. The measurement range of reflectorless is determined by the white side of the Kodak Gray Card. (KODAK is a trademark of Eastman Kodak Company)
- *2 Reflector sheet: PENTAX genuine Reflector sheet
- *3 The measurement range may vary by conditions of the environment.
Normal conditions: 20km visibility with slight shimmer
Good conditions: 40km visibility, overcast, no heat, no shimmer and moderate wind.
- *4 EDM measuring time is determined in good conditions. It may take longer than usual to measure the distance exceeding 4000m in prism mode and 300m in reflectorless mode. Also the measurement time in reflectorless mode is influenced by the shape, size and surface area and reflection rate of the target and its environment.
- *5 Quick mode, which functions with prism and reflector sheet, is effective only under normal mode (1mm) and up to 500m.
- *6 Number of points to be recorded may vary by usage.
Maximum number of point to be recorded per job site: 3000 points
Maximum number of job file to be recorded: 50 job files
Maximum data points to be sent from PC to the instrument: 3000 points
- *7 Memory Capacity: >128MB

You should be able to use any SD card in your camera.
While Pentax does not guarantee compatibility with any particular manufacturer or model, we have seen consistent compatibility with SD cards from Panasonic (1GB), SanDisk (1 GB), and Toshiba (1GB)

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Your Official Pentax Dealer



The CE marking assures that this product complies with the requirements of the EC directive for safety.



DANGER
 LASER RADIATION - DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENT INTO SUNLIGHT.
 620-690 nm/4.75mW max.
 CLASS IIIa LASER PRODUCT
 Laserclass IIIa, conform FDA 21 CFR Ch. 1 § 1040

CAUTION
 LASER RADIATION - DO NOT STARE INTO BEAM
 620-690 nm/0.95mW max.
 CLASS II LASER PRODUCT
 Laserclass II, conform FDA 21 CFR Ch. 1 § 1040

JSIMA
 Japan Surveying Instruments Manufacturers' Association
 Member symbol of the Japan Surveying Instruments Manufacturers' Association representing the high quality surveying products.

TOTAL STATION

R-400V SERIES

INSTRUCTION MANUAL

BASIC PROCEDURES
FOR R-400V SERIES

R-422VN
R-423VN
R-425VN
R-435VN



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PENTAX

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Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep in a convenient place for easy reference.

Exemption clause

- 1) TI Asahi Co.,Ltd. (TIA) shall not be liable for damage caused by Acts of God, fire, alteration or servicing by unauthorized parties, accident, negligence, misuse, abnormal operating conditions.
- 2) TIA shall not be liable for changes or disappearance of data, loss of company profit or interruption of company operation incurred by the use of this product or malfunction of it.
- 3) TIA shall not be liable for damage caused by usage not explained in the instruction manual.
- 4) TIA shall not be liable for damage to this product caused by other equipment connected to this product.

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PRECAUTIONS REGARDING SAFETY

Safety precautions (Must be followed)

The following items are intended to prevent possible injury to the user or other people and/or damage to the instrument before it occurs. These safety precautions are important to the safe operation of this product and should be observed at all times.

Distinctive displays

The following displays are used to distinguish precautions by the degree of injury or damage that may result if the precaution is ignored.



Items indicated by this sign are precautions which, if ignored, would result in serious injury.



Items indicated by this sign are precautions which if ignored may result in injury or material damage.

- Here “injury” refers to injuries such as cuts, burns or electric shock, of which treatment will not likely require hospitalization or long-term attention.
- “Material damage” refers to damage to facilities, buildings, acquired data, etc.

Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep it in a convenient place for easy reference.

This instrument complies with the protection requirement for residential and commercial areas. If this instrument is used close to industrial areas or transmitters, the equipment can be influenced by electromagnetic fields.

Quick Reference Guide provided in your carrying case contains the following items:

1. Basic Procedures
2. PowerTopoLite Operating Procedures



- ⚠ Do not stare into the laser beam directly as this may result in damage to your eyes.
- ⚠ R-400V is a Class IIIa (3R) Laser product. Do not look into the laser radiation aperture directly as this may result in damage to your eyes.
- ⚠ Never use the telescope to view intense light such as direct sunlight or sunlight reflected through a prism as this may result in loss of sight.
- ⚠ Do not disassemble, modify or repair this product as there is a risk of laser radiation.

⚠ Do not aim the laser beam at a person as it is harmful to the eyes and body. Receive the examination treatment by the doctor when the eyesight or body trouble is doubted by any chance.

- Electro-Magnetic Compatibility (EMC):
This instrument complies with the protection requirement for residential and commercial areas. If this instrument is used close to industrial areas or transmitters, the equipment can be influenced by electromagnetic fields.
- Do not use this product in a coal mine, in a location where there is coal dust, or near flammable material as there is a risk of explosion.
- Do not disassemble, modify or repair this product as there is a risk of fire, electric shock and burn injury. If you think the product requires repair, contact the retail outlet where you purchased it or an authorized repair site.
- Do not charge BP02 Battery with any battery charger other than BC03 as it entails a risk of fire or burn injury from the battery bursting into flames due to possible differences in voltage or polarity.
- Do not use a damaged electric cord plug or loose electric outlet when charging as there is a risk of fire or electric shock.
- Do not charge the battery while covered by clothes or similar items as there is a risk of fire if the clothes ignite.
- Do not use the battery or charger when wet as there is a risk of fire and burn injury due to short-circuit.
- To prevent making short-circuit when removing the battery and charger from the case and storing them, apply electrically resistant tape to the poles of the battery. Storing the battery and charger as it is may result in fire or burn injury due to short-circuit.
- Do not throw the battery into fire or expose it to heat as there is a risk of injury if it explodes.



CAUTION

CAUTION

- ⚠ For your safety, perform the initial and periodical inspection as well as when the instrument is fixed and adjusted.
 - ⚠ When the laser beam enters eyes, an unexpected accident might be caused by blink of eyes.
 - ⚠ Do not place the laser product at a height where its laser beam may hit the eyes of car drivers and pedestrians.
 - ⚠ Do not place the laser product at a place where its laser beam may hit a reflecting object such as a mirror or a glass window. The reflection beam of the laser is also harmful to the human body.
 - ⚠ When not performing measurement, cut off the power supply or shade the objective lens with objective cap to prevent the instrument emitting the laser beam.
 - ⚠ Keep the laser product in a place where persons, who do not have the product knowledge, such as children, can not touch it by mistake.
- Before disposing of the instrument, destroy its power supply mechanism to prevent it from emitting the laser beam.
 - Do not remove the handgrip without good reason. If it does come off, be sure to attach it securely to the instrument with screws. If it is not fastened securely, the instrument may fall when you use the handgrip, leading to possible injury.

- Do not short the poles of the battery or charger as there is a risk of injury or fire.
- Do not touch any fluid which may leak from the battery as there is a risk of chemical burn injury or reaction.
- Do not insert or remove the electric plug with wet hands as there is a risk of electric shock.
- Do not use the case to stand on as it is slippery and unstable and may cause you to fall, resulting in possible injury.
- Make sure the tripod itself and the instrument on the tripod are both installed securely as insecure installation may cause the tripod to fall over or the instrument to drop, resulting in possible injury.
- Do not carry the tripod with the metal shoe pointing toward another person as it may injure him/her.



Ni-MH

- The instrument contains a rechargeable battery and a battery charger.
- It may be illegal to dispose the battery at the end of its useful life.
- Check with your local solid waste officials for details for recycling.

Usage precautions

Surveying instruments are high-precision instruments. In order to assure that the Electronic Total Station R-400V series product which you have purchased will provide long-lasting maximum performance, the precautions in this manual must be followed. Make sure to follow these instructions and use this product properly at all times.

[Solar observation]



WARNING

Never view the sun directly using the telescope as this may result in loss of sight. Never point the objective lens directly at the sun as this may damage internal components. When using the instrument for solar observation, be sure to attach the specially designed solar filter (MU64) to the objective lens.

[Laser beam]

Do not stare into the laser beam. R-400V is a Class IIIa (3R) Laser product.

[EDM axis]

The R-400V series EDM is a red visible laser beam and the beam diameter is very small. The beam is emitted from the objective centre. The EDM axis is designed to coincide with the telescope sight axis (but both axes may deviate slightly because of intense temperature changes and a long time lapse).

[Target constant]

Confirm the Target Constant of the instrument before measurement.

If a different constant is to be used, use the correct constant of the target. The constant is stored in the instrument's memory when turned off.

[Reflectorless and reflector sheet]

- Reflectorless (Non-Prism)

The measurement range and accuracy of the Reflectorless mode are based on the condition that laser beam is emitted perpendicular to the white side of a Kodak Gray Card.

The measurement range may be influenced by the shape of the target and its environment.

There is a possibility that the range may vary when the target does not satisfy the conditions above at survey work.

- There is a possibility that correct distance measurement may not be performed by dispersion or reduction of laser beam when the laser beam comes into the target from a diagonal angle.
- There is a possibility that the instrument may not be able to correctly calculate out the distance when receiving reflected laser beam from forth and back directions in case of measuring the target on the road.
- There is a possibility that synthesized values are calculated and the distance may become longer or shorter than the actual one when the operator measures the target of slope or sphere or rugged shape.
- There is a possibility that the instrument may not be able to correctly calculate out the distance by collecting the reflected laser beam from a man or a car that comes and goes in front of the target.

- There is a possibility that the distance may not be correctly measured when measuring a target in the direction where there is a reflecting object (mirror, stainless board, white wall, etc.) or under too strong sunlight.
- In a situation where high accuracy may not be expected, perform the measurement by Reflector sheet or Prism.
- When using reflector sheet, set the reflector sheet to have its surface to be approx. vertical to the aiming line. If it is positioned not to be approx. right angle, there is a possibility that correct distance measurements may be impossible by dispersion or reduction of laser beam.

In the following environments, the distance may not be possible to be measured; there is a reflecting thing (mirror, stainless board, white wall, etc.) in the direction of the target, and under too strong sunlight

[Battery & charger]

- Do not use any battery or battery charger that is not approved by Pentax as it entails a risk of damaging the instrument.
- If water should happen to splash on the instrument or the battery, wipe it off immediately and allow it to dry in a dry location. Do not put the instrument in the case until it is completely dry as this may result in damage to the instrument.
- Turn off the power when removing the battery from the instrument as removing the battery while the power is still on may result in damage to the instrument.
- The battery mark displayed on the instrument is only an estimation of remaining battery power and is not completely accurate. Replace the battery quickly when it is about to run out of power as the time a battery lasts on one full charge differs depending on conditions of ambient temperature, and the measurement mode of the instrument.
- Confirm the battery level remaining before operating.

[About Clock Battery (lithium)]

- Clock battery is a backup battery used for calendar clock function.
- The battery can last about five years with regular use, but it is possible to be shorter depending on usage.
- When the voltage of the clock battery is low or runs out, the date and time display incorrectly and indication of "Clock-batt. voltage low" will appear.
- Please contact your the dealer which the purchased was mail for any exchange or return of the clock battery.

[LD POINT, laser pointer]

When you make a correct direction using the "LD POINT", aim the laser beam at the wall and mark the centre and then confirm the discrepancy between the reticle centre and the marked point beforehand.

[Storage and operating environment]

- To prevent making short-circuit when removing the battery and charger from the case and storing them, apply electric resistant tape to the poles of the battery. Storing the battery and charger as it may result in fire or burn injury due to short-circuit.
- Avoid storing the instrument in places subject to extreme high, low or radically fluctuating temperature. (Ambient temperature range during use: -20°C to $+50^{\circ}\text{C}$)
- Distance measurements may take longer when atmospheric conditions are poor such as when heat shimmer occurs. When storing the instrument, always put it in its case and avoid storage in dusty location or location subject to vibration or extreme heat or humidity.

- Whenever there is a sharp temperature difference between the instrument's storage and usage environment, allow the instrument to adjust to the environment for an hour or more before using it. Make sure to protect the instrument from the sun if the location is subject to intense direct sunlight.
- The battery should be charged approximately once per month if the instrument is to be stored for an extended period of time. The instrument should also be removed from its case occasionally and aired out.
- In addition to these precautions, be sure to handle the instrument properly at all times following the descriptions given in the various sections of this manual to assure safe and proper measurements.

[Transporting and carrying the instrument]

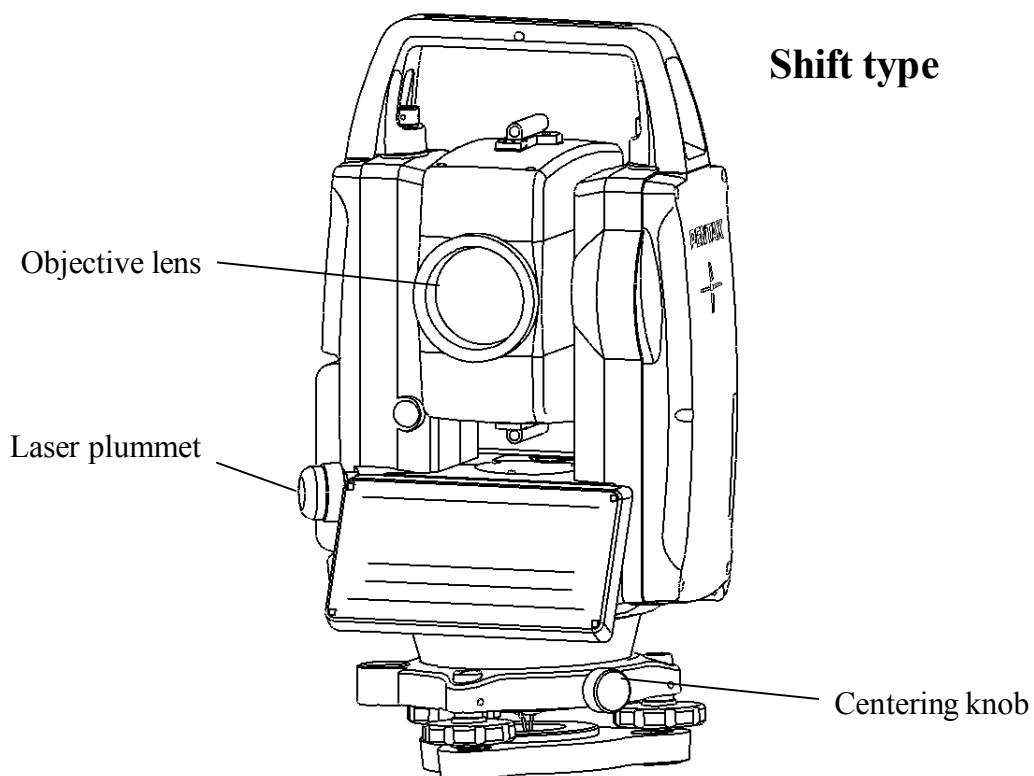
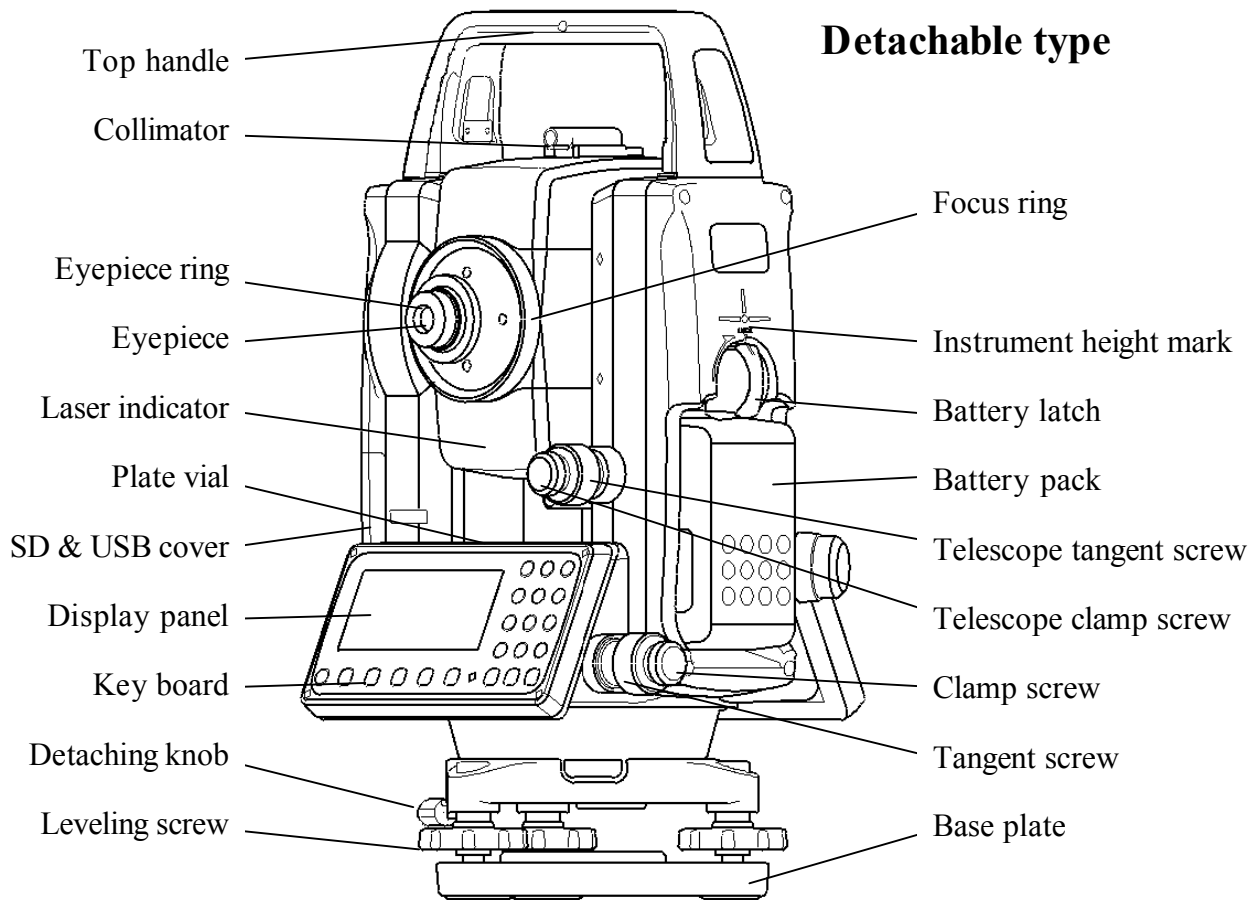
- Be careful to protect this instrument from shock of impact and excessive vibration which may result in damage during transportation and shipment.
- When transporting the instrument, always put it in the case and wrap shock absorbing material around it and be sure it is handled as "FRAGILE".

[Checks and repairs]

- Always check the instrument before beginning work and check that the instrument is maintaining the proper level of precision. Pentax bears absolutely no responsibility for damages due to survey results obtained from surveys conducted without an initial instrument check.
- Never disassemble the instrument, battery or charger, even if you do detect an abnormality, as there is a risk of fire or electric shock due to short-circuit. If you think the product requires repair, contact the retail outlet where you purchased it or an authorized repair site.

1. BASIC OPERATION

1.1 Names of parts



1.2 Standard equipment

- Instrument
- Carrying case
- BP02 battery
- BP03/AC01 charger
- Power supply cord
- Plumb bob
- Plummet hook
- Hexagonal wrench
- Adjusting pin
- Screwdriver
- Rain cover
- Quick Reference Guide
- CD-ROM (Basic operation & Special Functions manual)
- USB cable
- SD card(1GB)

1.3 Unpacking and packing

[Unpacking the Instrument from the case]

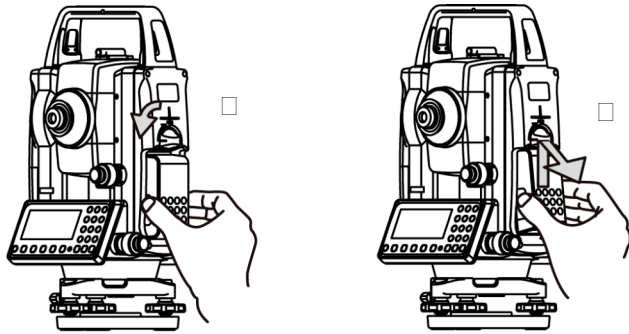
- ① Set the case down gently with the lid facing upwards.
- ② Open the latches while pressing down on the lock (safety mechanism) and open the lid of the case.
- ③ Remove the instrument from the case.

[Packing the instrument in the case]

- ① Make sure the telescope is fairly levelled and lightly tighten the telescope clamp screw.
- ② Line up the housing marks (round yellow marks on the instrument) and tighten the upper and lower clamp screws.
- ③ With the housing marks are facing upwards, set the instrument gently in the case without forcing it. Close the lid to the case and secure the latches.

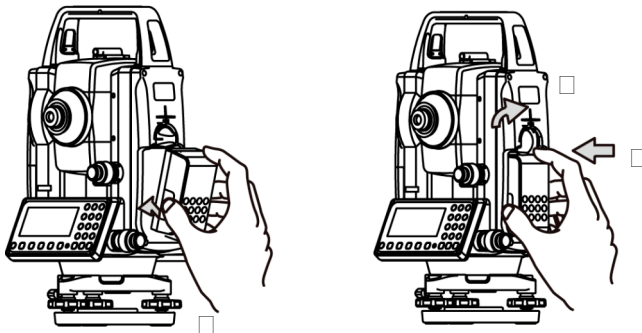
1.4 Removing and attaching the Battery

[Removing the Battery]



- ① Rotate the knob above the battery pack counter clockwise.
- ② Lift up the battery pack and remove it from the instrument.

[Attaching the Battery]

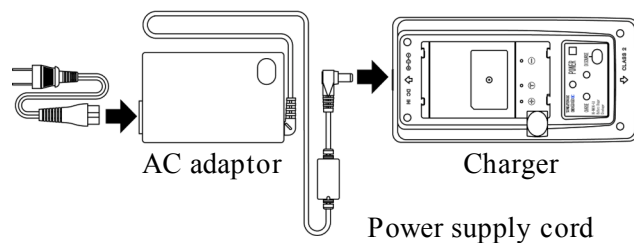


- ① Place the channel on the bottom of the battery pack.
- ② Onto the protrusion of the instrument and push the battery pack down into place.
- ③ Turn the knob clockwise.

1.5 How to charge the Battery

[Charging the battery]

- The battery BP02 is not charged at our factory shipment. It must be charged before use.
- For BP02 charge, use the special BC03 charger.



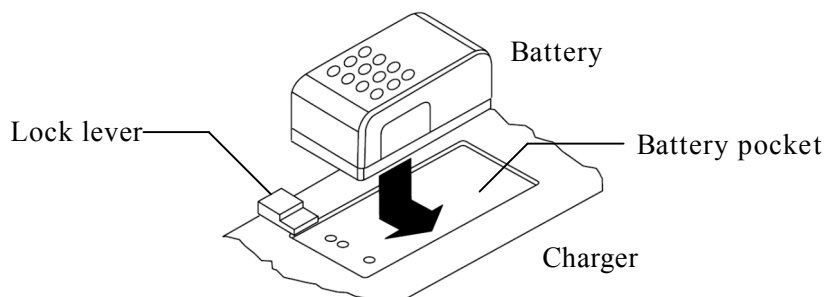
[Connection of code]

- ① Insert the output plug of the power supply code in the jack of the AC adaptor.
- ② Insert the output plug of the AC adaptor in the jack of the charger.

- ③ Insert the power supply plug of the power supply code in the outlet of AC power supply.

[Installation of battery]

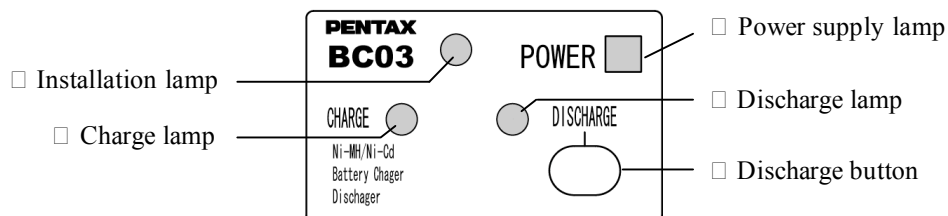
- ① Draw the battery to the lock lever side and put it on the battery pocket. The battery is firmly installed on the battery pocket.
- ② Press down the battery and then slide it to the opposite direction of the lock lever.
- ③ The lock lever goes up, and the battery is fixed.
- ④ Under such a condition, if “Connection of the code” is done, the charge with the battery is begun.



[Detaching the battery]

- ① Press the lock lever and slide the battery to the lock lever direction.
- ② Detach the battery packing from the battery pocket.

[Display panel]



- ① Power supply lamp (red) : Turns on when the power supply is turned on.
- ② Charge lamp (green) : Turns on while charging and turns off when the charge is completed.
- ③ Discharge lamp (yellow) : Turns on when you push the discharge button. Turns off when the discharge is completed.
- ④ Installation lamp (red) : Blinks or turns on when the battery packing is attached normally. Blinks when charge or discharge and turns on when charge is completed. (The charge lamp in the lower does not blink and does not turn on)

- ⑤ Discharge button : Discharge lamp lights when you push this button, and the discharge of battery begins.

[How to charge]

- ① It begins charging automatically when you set the battery packing in the charger which beams the power supply lamp.
- ② Leave just as it is until the charge is completed.
- ③ When the charge is completed, the charge lamp is turned off.
- ④ Detach the battery packing from the charger when the charge is completed.

[Refreshing the battery]

The use time shortens gradually by the phenomenon of “Effect of the memory” when the NiMH battery leaves capacity and repeats the charge. The voltage recovers after refreshing and the use time returns to normal in such a battery. Please refresh one degree every five times of the charge.

[Refreshing]

Set the battery in the charger as well as the case of the charge. Push the electrical discharge button. The electrical discharge lamp lights and the electrical discharge begins. The electrical discharge lamp is turned off when the electrical discharge ends, the charge lamp lights, and the charge starts automatically. Leave just as it is until the charge is completed. When the charge is completed, the charge lamp is turned off. Detach the battery from the charger.

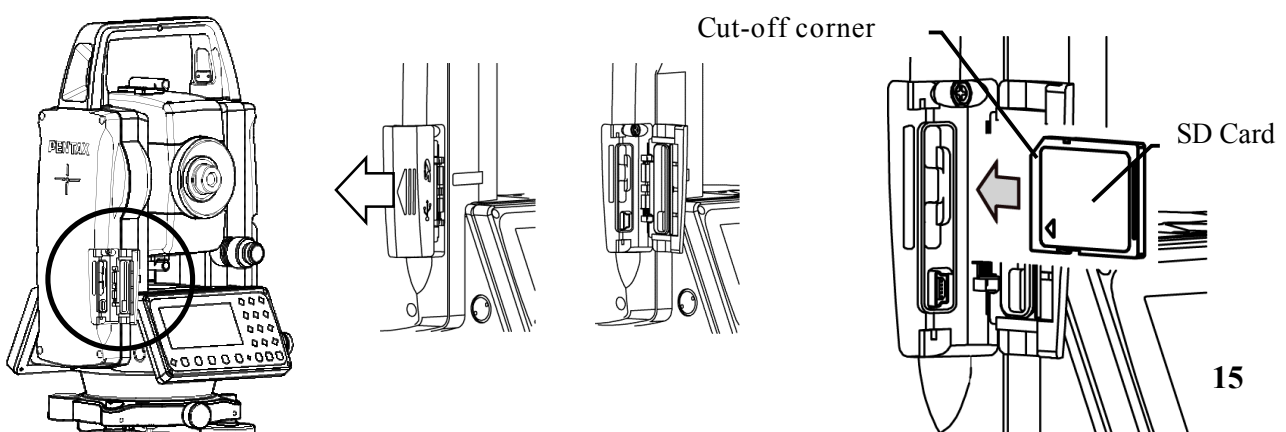
[Time of refreshing and charge]

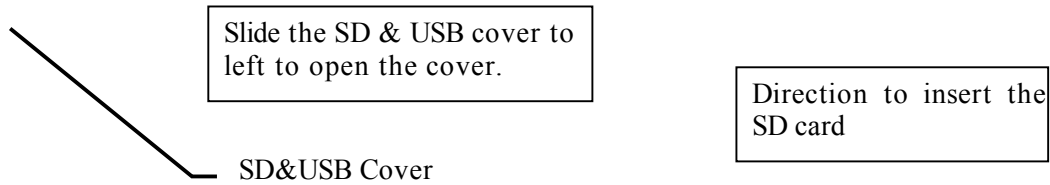
Battery BP02 is discharged from the state of a full charge at about 540 minutes and the charge is completed from the electrical discharge at about 130 minutes. However, the electrical discharge time is proportional to the remainder capacity of the battery. Moreover, the time required for refreshing might be different from the above-mentioned time according to a surrounding temperature and the state of the battery.

1.6 External connections

[Inserting SD card]

- ① Open the SD & USB cover.
- ② Insert the SD card(The side with terminal should face the instrument and the cut-off corner should be up.)
- ③ Insert the SD card to the end. Be sure not to press the card too hard.
- ④ After the SD card is inserted, close the SD & USB cover completely.





[Removing SD card]

- ① Open the SD & USB cover.
- ② Lightly press the SD card slot then release yourself from there.
- ③ The SD card pops up.
- ④ After the SD card is removed, close the SD & USB cover completely.

 **CAUTION**
CAUTION

- Be sure to turn the power off before inserting and removing the SD card.
- Be sure to close/open the SD & USB cover and insert/remove the SD card indoors.

[Suitability of SD card]

- The SD card that can be used with the instrument is 1GB or less.
- SD card and SD logo is registered trademark.
- The SD cards listed in the following table have been tested by us and it has been confirmed that the SD cards can be used with the R-400V series.



This test has been done with only the Pentax R-400V series Total Station, but no other Pentax Total Stations. When using with other Pentax Total Stations, please contact us to confirm if it works properly.

Also it has been confirmed that the models mentioned in the following table can be used with the R-400V series Total Station, but it has not been confirmed whether other brand SD cards, not mentioned here, can be used with the R-400V series Total Station.

Please note that the test has been done by us and it is not meant that each SD card manufacturer guarantees that the SD cards can be used with the Pentax R-400V series.

SD (micro SD) Card

Maker	Model	Capacity
Toshiba	SD-C01GTR	1GB
Toshiba	SD-MD001GA (microSD)	1GB
Panasonic	RP-SDM01GL1A	1GB

Be sure to use the adaptor when using a microSD.

- Regardless of the information here, be aware that all the SDHC cards can't be used with the R-400V Total Stations.
- Test item : The following has been done according to our test standard.
 - ① When data is being sent (with connecting USB), it is necessary to be able to refer to information in the SD card from PC and to operate the file.

- ② When writing / reading text, it is necessary to be able to read/write text file.

[Connecting USB cable]

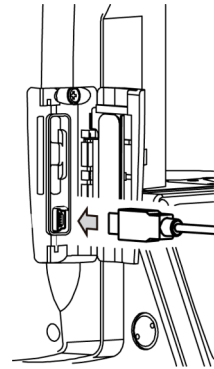
- ① Open the SD & USB cover.
- ② Insert the USB connector into the USB port in the right direction.
- ③ After the USB cable is removed, close the SD & USB cover completely.



CAUTION

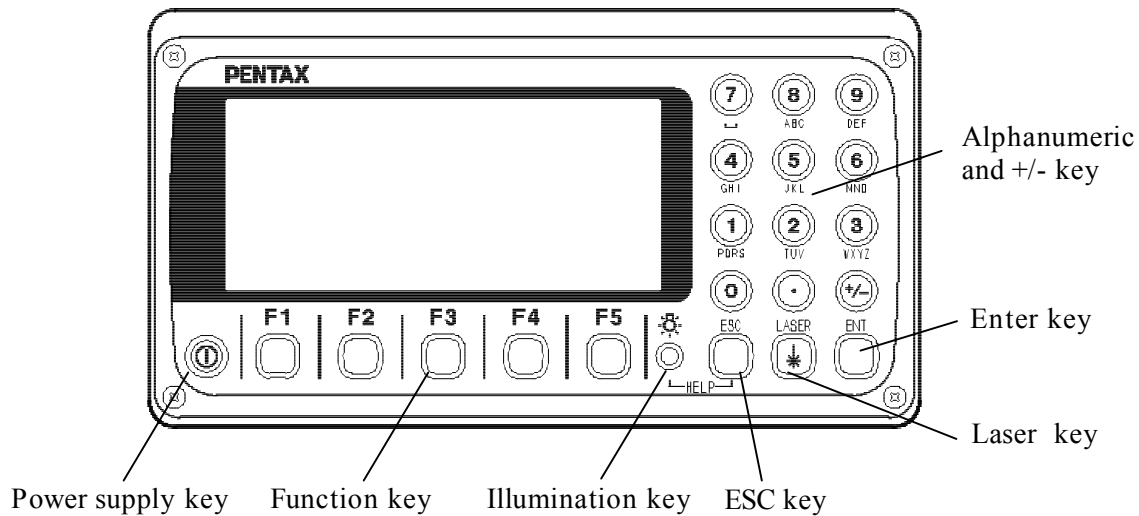
CAUTION

- Be sure to turn the power off before inserting/removing the USB cable.
- Be sure to open/close the SD & USB cover and insert/remove the USB cable indoors.



2. DISPLAY AND KEYBOARD

2.1 Display and keyboard



2.2 Operation keys

Key	Description
[POWER]	ON/OFF of power supply.
[ESC]	Returns to previous screen or cancels an operation.
[ILLU]	Turns the illumination of the LCD display and telescope reticle on and off.
[ENT]	Accepts the selected (highlighted) choice or the displayed screen value.
[LASER]	Displays the laser plummet and the LD point screen when you push the Laser key. (Refer to “2.5 LD POINT, Laser pointer”, “3.2 Laser plummet”).
[Alphanumeric]	At the numerical value screen, the numerical value and the sign “.” displayed are input. The English characters printed right under numeric of each key are input.
[HELP]	Pressing [ILLU]+[ESC] key causes a help menu to appear in MODE A or MODE B or causes a help message to appear.

2.3 Function keys

Display	F. Key	Description
MODE A		
[MEAS]	F1	Pressing this key one time measures the distance in normal mode. Another measurement type can be selected by InitialSetting 2. Pressing this key twice measures the distance in coarse mode. Another measurement type can be selected by initial setting 2.
[TARGET]	F2	Switches the target. REFLECTORLESS / SHEET / PRISM
[0 SET]	F3	Resets the horizontal angle to 0° 0' 0" by pressing twice.
[DISP]	F4	Switches the display composition in the order “H.angle/H.dst./V.dst.”, “H.angle/V.angle/S.dst.” and “H.angle/V.angle/H.dst./S.dst./V.dst.”.
[MODE]	F5	Switches the screen between MODE A and MODE B.
MODE B		
[S.FUNC]	F1	PowerTopoLite Special Functions.
[ANG SET]	F2	Brings up the angle setting screen for setting angle-related parameters. (H.ANGLE /%GRADE, H.ANGLE INPUT and L/R REVERSE)
[HOLD]	F3	Pressing this key twice retains (holds) the horizontal angle shown on the display.
[CORR]	F4	Brings up the screen for changing the target constant, temperature, pressure setting.
[MODE]	F5	Switches the screen between MODE A and MODE B.

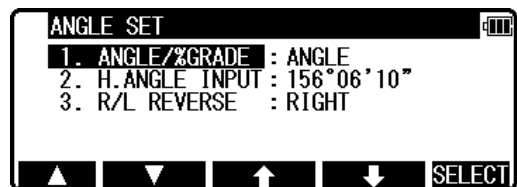
[Other functions]

←	F1	Moves the cursor to the left.
→	F2	Moves the cursor to the right.
↑	F3	Moves the cursor up.
↓	F4	Moves the cursor down.
△	F1	Goes back five items on the screen.
▽	F2	Gose forward five items on the screen.
[RETICLE]	F3	Changing the reticle illumination when pressing illumination key.
[LCD]	F4	Changing the LCD contrast when pressing illumination key.
[ILLU]	F5	Changing the LCD illumination when pressing illumination key.
[CLEAR]	F5	Clear the figure.
[SELECT]	F5	Open the selection window.

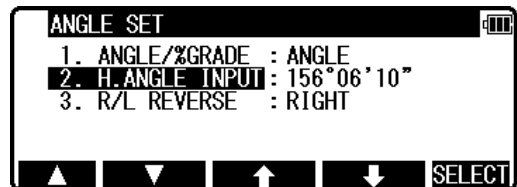
[How to move the menu number]

Example:

The cursor is located at Menu 1.



Press the numeric key 0 and 2 to move to Menu 2 or press [F4] [↓].




2.4 Alphanumeric input

The point name is input by the alphanumeric keys as following.

Key	Letter under key	Letter & figure order to input
[0]		[@][.][_][-][:[/][0]
[1]	PQRS	[P][Q][R][S][p][q][r][s][1]
[2]	TUV	[T][U][V][t][u][v][2]
[3]	WXYZ	[W][X][Y][Z][w][x][y][z][3]
[4]	GHI	[G][H][I][g][h][i][4]
[5]	JKL	[J][K][L][j][k][l][5]
[6]	MNO	[M][N][O][m][n][o][6]
[7]		[][?][!][_][][^][]&[7]
[8]	ABC	[A][B][C][a][b][c][8]
[9]	DEF	[D][E][F][d][e][f][9]
[.]		[.][,][:];[#][()]
[+/-]		[+][-][*][/][%][=][<][>]

2.5 LD POINT, Laser pointer

The Laser pointer function turns the laser beam on continuously to become the aiming point so that visual confirmation is possible.

- ① When the [F2] [RED MARK] key is pressed after pressing the [Laser] key, the Laser pointer function is turned on. The Laser indicator is turned on and the “” mark on the left of the screen blinks while the Laser pointer function is operating.
- ② If the [Laser] key is pressed and the [F2] [RED MARK] key is pressed while the Laser pointer function is operating, the Laser pointer function is turned off.

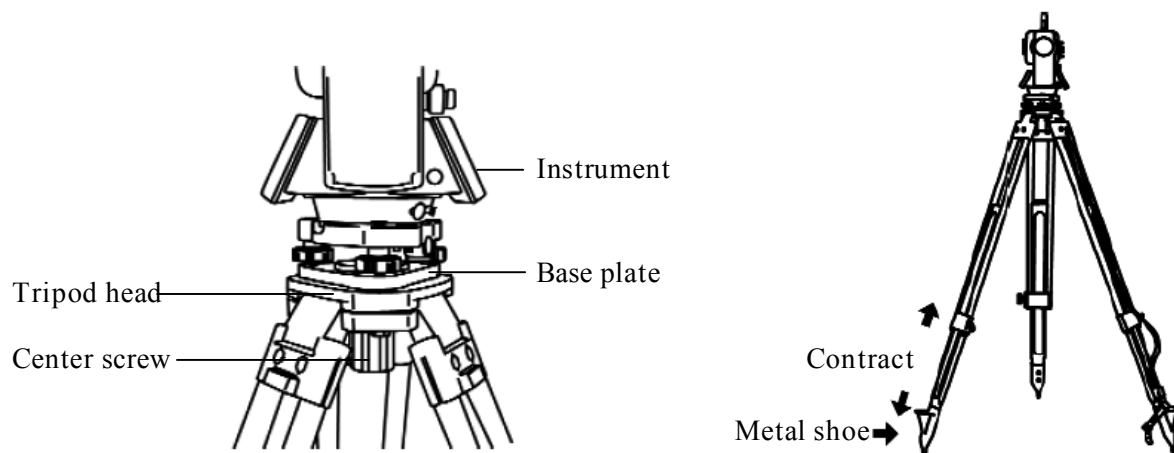
- The beam of the sun is strong and visual confirmation is difficult in daytime when outdoors.
- The laser beam is designed not to be able to observe through the telescope.
- Please visually align the laser beam to the target and mark the centre.
Confirm the alignment (horizontal and vertical) before measuring when performing accurate work like stake out when using the Laser pointer function.
Also refer to “11.9 The EDM beam axis”.
- Please do not look at the laser source of beam directly.

3. PREPARATION FOR SURVEYING

3.1 Centring and Levelling of the Instrument

[Setting up the instrument and the tripod]

- ① Adjust the tripod legs so that a height suitable for observation is obtained when the instrument is set on the tripod.
- ② Hang the plumb bob on the hook of the tripod, and coarse centre over the station on the ground. At this time, set the tripod and fix the metal shoes firmly into the ground so that the tripod head is as levelled as possible.
- ③ If the tripod head is mis-levelled by the action of fixing the metal shoes into the ground, correct the level by extending or retracting each leg of the tripod.



3.2 Laser plummet

[Laser plummet model]

The instrument is equipped with the laser plummet. The laser plummet is not set to be ON at factory shipping. The laser plummet operation of power supply ON can be set by command No.520, LD PLUM. For using Command number, refer to “9.2 Accessing by 007”.

[For the Detaching type laser plummet equipment model]

Turn on the laser plummet function by pushing the [Laser] key and [F4] [PLUM.ADJ] key. Match the position with the leveling screw so that the laser mark coincides with the ground mark.

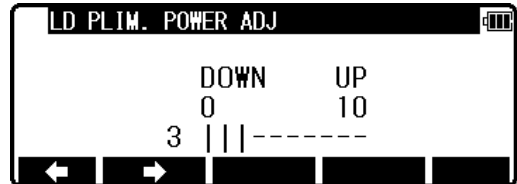
[For the Shift type laser plummet equipment model]

- Turn on the laser plummet function by pushing the [Laser] key and [F4] [PLUM.ADJ] key.
- Match the position by the tripod so that the laser mark coincides with the ground mark.
- The centring knob is loosened, and the upper plate is pushed by the tip of a finger, and a centre mark is matched to the ground mark.
- Tighten the centring knob.
- Loosen the horizontal clamp screw, rotate the instrument by 90°, and confirm the vial of the circular vial is at the centre position.
Correct the vial with the leveling screw when the vial comes off from the centre position.

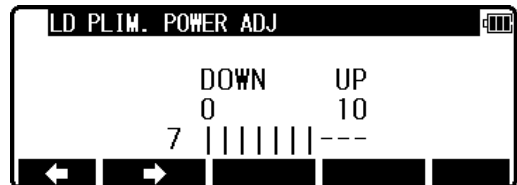
[Brightness adjustment of laser]

Sometimes the state of the surface of the ground mark or a surrounding environmental does not allow observing the laser spot easily. Please adjust the brightness of the laser if necessary.

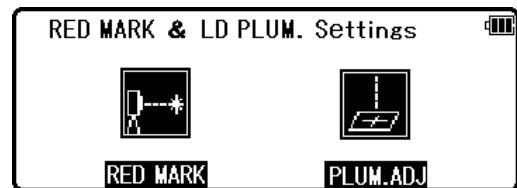
If [Laser] + [F4] [PLUM.ADJ] are pressed in due course., the brightness adjustment screen of the laser plummet device, is displayed.



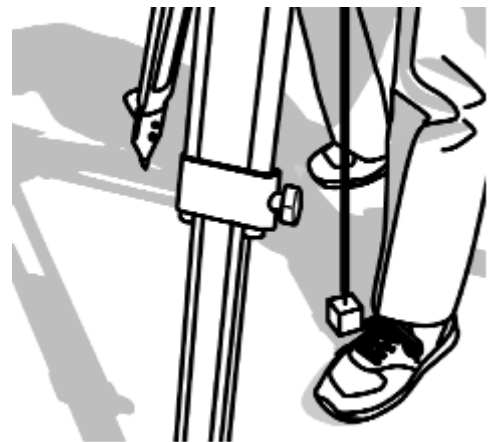
The Laser plummet becomes darker or brighter by pressing [F1] [←] / [F2] [→] key.



The adjustment is completed with the [ENT] key and it returns to RED MARK & LD PLUM. Settings screen.



- The brightness adjustment step of the laser is 10 steps.
- The laser plummet spot can become difficult to see in bright sunlight which makes it difficult to perform the occasional check. In this case, use your foot or the carrying case to make a shadow over the laser position.
- The laser plummet is adjusted to be within $\pm 0.5\text{mm}$ at the instrument height of 1.5m at factory shipping.
- Please double check the amount of the gap (direction of X and Y direction) by laser plummet with the amount of the gap by plumb bomb etc. When working accurately you should put out a perpendicular direction using the laser plummet function.
- Please do not look at the laser source of beam directly.



3.3 Levelling with circular vial

Tripod is adjusted according to the following points by extending or contracting the legs so that the bubble of the Circular vial goes to the centre of the circle.

- Shorten the leg at the side of the bubble or extend the leg opposite of the bubble to position the bubble in the centre of the vial circle.
- All three legs are extended or contracted until the bubble is in the centre.
During this process, the foot is not placed on the tripod leg point and the position of the tripod points do not change.

3.4 Levelling with the plate vial

(A) Align the plate vial in parallel with a line joining any two of the levelling screws.

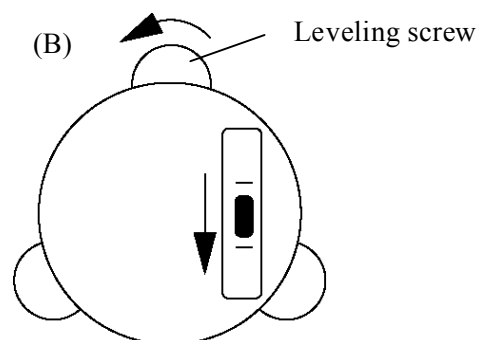
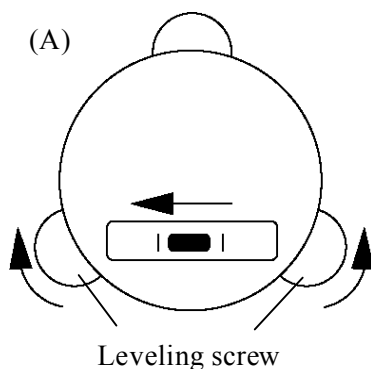
Then, adjust the two screws to centre the bubble in the plate vial.

- Turn two levelling screws in an opposite direction mutually in a way that the bubble moves from the side of the plate vial to the centre.

(B) Rotate the total station 90° .

- Use the remaining screw to centre the bubble in the plate vial.

- Rotate the instrument by 90° and 180° and confirm the position of the bubble in the plate vial. At this time, it is not necessary to adjust it if the bubble of the plate vial is in the vicinity of the centre.

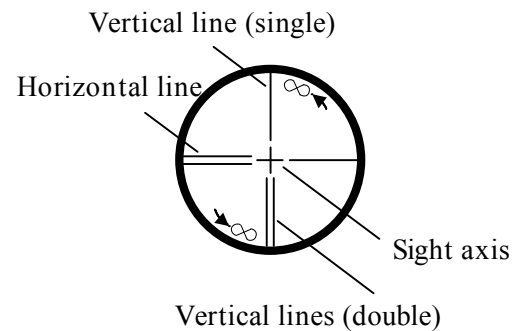


3.5 Eyepiece adjustment

[Eyepiece adjustment]

The eyepiece adjustment is performed before target sighting.

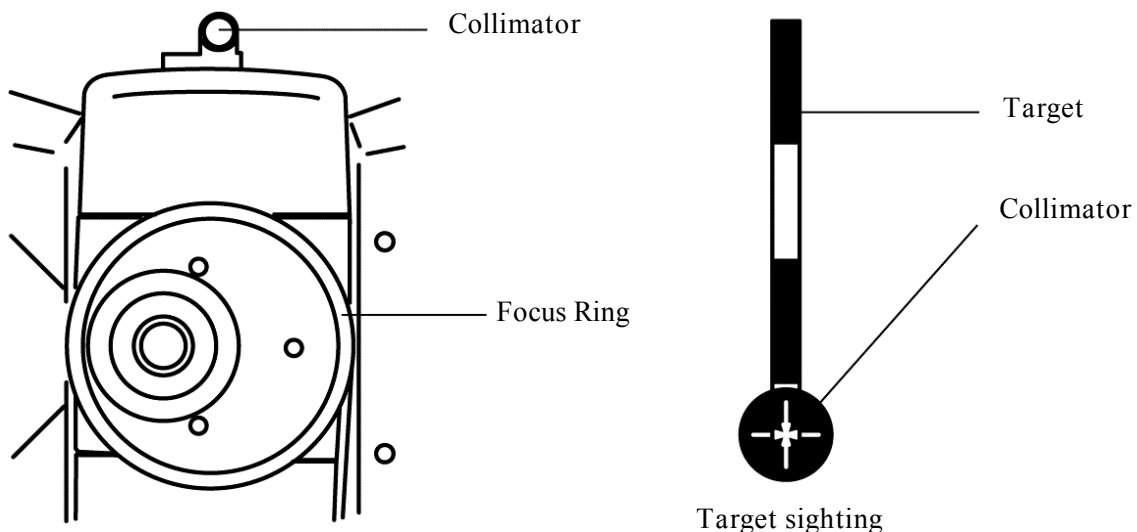
- ① Remove the telescope lens cap.
- ② Point the telescope at a bright object, and rotate the eyepiece ring full counter clockwise.
- ③ Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticle appears at its maximum sharpness.
 - When looking into the eyepiece, avoid an intense look to prevent parallax and eye fatigue.
 - When it is hard to see the reticle due to poor brightness, press [ILLU] + [F3] [RETICLE] to access the RETICLE INTENSITY ADJ. screen. Use the left and right arrow to adjust the reticle intensity.



3.6 Target sighting

[Target sighting by Manual focus]

- ① Loosen the telescope clamp and horizontal clamp screws.
- ② Point the telescope at the target using a collimator.
- ③ Tighten the above two screws.
- ④ Adjust the eyepiece.
- ⑤ Look through the telescope and then rotate the Focus ring and stop it where the target can be clearly seen and the target image does not move in relation to reticle even if your eye is vertically and horizontally moved.
- ⑥ Align the reticle accurately on the target using telescope and horizontal tangent screws.



- The Focus ring rotation “clockwise” makes it possible to focus on closer objects and “counter clockwise” will focus on further objects.

3.7 Attachment and detachment of tribrach

The tribrach of R-422VN, R-423VN, and R-425VN can be detached from the instrument, if required when replacing the instrument with a prism for example.

[Detachment]

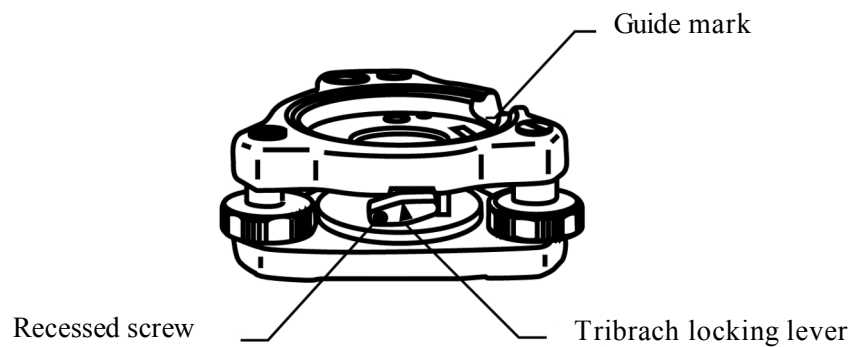
First loosen the recessed screw with a screwdriver, then rotate the locking knob until the arrow points upward, and lift the instrument up.

[Attachment]

Mount the instrument on the tribrach with the guide marks coinciding, and rotate the locking knob until the arrow points downwards.

The guide and guide mark must be fitted to attach the instrument.

When the tribrach does not need to be attached or detached, or the instrument is to be transported, tighten the recessed screw with a screwdriver to fix the locking knob.



4. TURNING THE POWER ON

4.1 Turning the power on and off

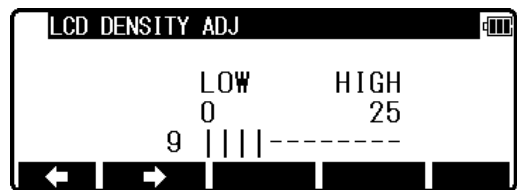
To set power on: ① To shut down: ①

To turn the power supply off, press the I/O key for more than 1 second and then release it. Power turns OFF.

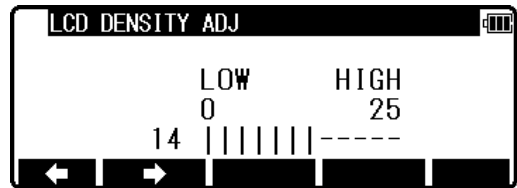
NOTE: The power is automatically turned off after 10 minutes of inactivity (Factory default setting).

4.2 Adjusting LCD contrast

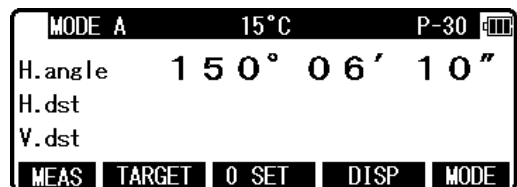
Press [F4] while holding down the Illumination key to access the screen for adjusting LCD contrast.



Pressing the [F1] [↵] will lighten the contrast, while pressing the [F2] [⇒] will darken the contrast.



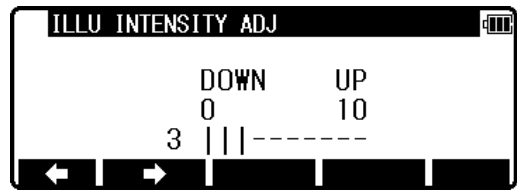
Press [ENT] to exit adjustment mode and return to the previous screen.



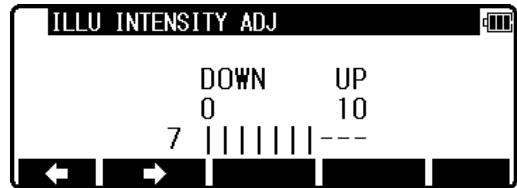
- Pressing the Illumination key views the [F3] [RETICLE], [F4] [LCD] and [F5] [ILLU].
- LCD contrast may be adjusted as necessary at any time.
- The contrast may be adjusted to any one of 25 levels.
- LCD contrast may be unappealing under certain environmental conditions such as high temperature. Adjust the LCD contrast as described above in such situations.

4.3 Adjusting illumination brightness

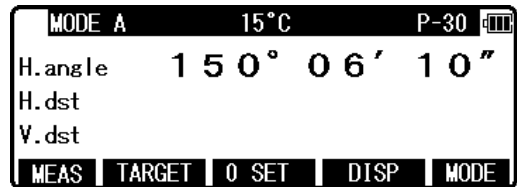
Press [F5] while holding down the Illumination key to access the screen for adjusting illumination brightness.



Pressing the [F1] [←] will decrease brightness, while pressing the [F2] [→] will increase brightness.



Press [ENT] to exit adjustment mode and return to the previous screen.



- Pressing the Illumination key views the [F3] [RETICLE], [F4] [LCD] and [F5] [ILLU].
- Illumination brightness of the LCD screen and telescope reticle may be adjusted as necessary at any time.
- Illumination brightness may be adjusted to any one of 10 levels.

4.4 Adjusting reticle illumination

Press [F3] while holding down the Illumination key to access the screen for adjusting reticle illumination. The procedure to adjust the reticle illumination is the same way as 4.3.

- Pressing the Illumination key views the [F3] [RETICLE], [F4] [LCD] and [F5] [ILLU].

5. ANGLE MEASUREMENT

5.1 Measuring an angle

Aim at the first target, then press [F3] [0 SET] twice in succession to reset the horizontal angle to 0.

MODE A	15°C	P-30	
H. angle	0° 00' 00"		
H. dst			
V. dst			
MEAS	TARGET	0 SET	DISP MODE

Aim at the second target, then read the horizontal angle.

MODE A	15°C	P-30	
H. angle	60° 30' 20"		
H. dst			
V. dst			
MEAS	TARGET	0 SET	DISP MODE

Pressing [F4] [DISP] displays the vertical angle.

MODE A	15°C	P-30	
H. angle	60° 30' 20"		
V. angle	87° 05' 40"		
S. dst			
MEAS	TARGET	0 SET	DISP MODE

- The [F3] [0 SET] key cannot reset the vertical angle to 0.
- Pressing the [F4] [DISP] key cycles through the sets of display items :
“H.angle/H.dst./V.dst.”, “H.angle/V.angle/S.dst.”, and
“H.angle/V.angle/H.dst./S.dst./V.dst.”.
- Even though you turn the power off during a survey, the horizontal angle displayed last time is saved, so that it is restored when the power is turned on next time.
- When the restored horizontal angle is not necessary, reset it to 0.

5.2 Resetting the horizontal angle to 0

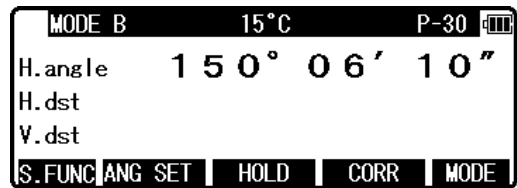
Pressing [F3] [0 SET] twice in succession resets the horizontal angle to 0° 0' 0".

MODE A	15°C	P-30	
H. angle	0° 00' 00"		
H. dst			
V. dst			
MEAS	TARGET	0 SET	DISP MODE

- The [F3] [0 SET] cannot reset the vertical angle to 0.
- Pressing the [F3] [0 SET] accidentally during measurement does not reset the horizontal angle to 0 unless you press it again. Once the buzzer stops sounding, you can go to the next step.
- You can reset the horizontal angle to 0 any time except when it has been held.

5.3 Holding the horizontal angle

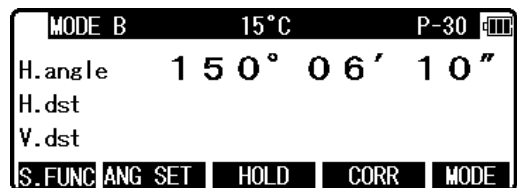
To hold the horizontal angle currently being displayed, press [F3] [HOLD] twice in succession. The horizontal angle value is displayed in reverse video when being held.



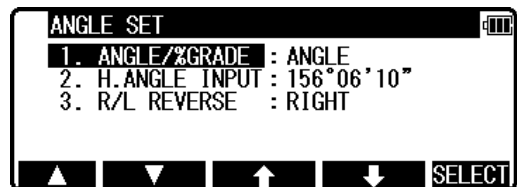
- If you want to hold the horizontal angle when you are in MODE A, press [F5] [MODE] first to switch to MODE B, then press [F3] [HOLD].
- The [F3] [HOLD] cannot hold the vertical angle or distance.
- To release the horizontal angle from being held, press [F3] [HOLD] once.
- Pressing [F3] [HOLD] accidentally during measurement does not hold the horizontal angle unless you press it again. Once the buzzer stops sounding you can go to the next step.

5.4 Inputting an arbitrary horizontal angle

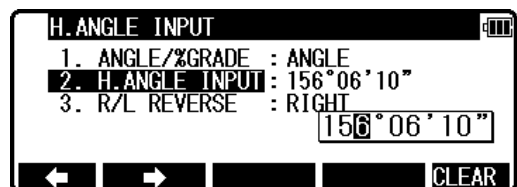
In case of Horizontal angle 123° 45' 20" input. Press [F5] [MODE] to enter MODE B.



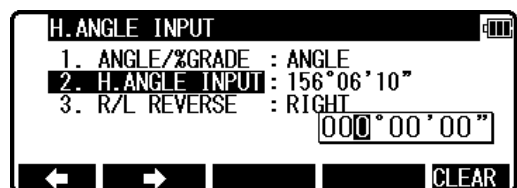
Press [F2] [ANG SET] to display the ANGLE SET screen, then press [F4] [↓] to move the cursor to "2. H.ANGLE INPUT".



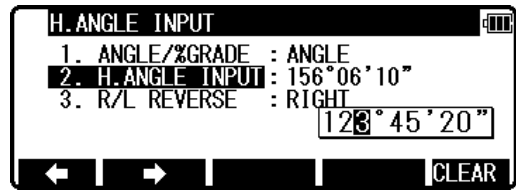
Press [F5] [SELECT] to open the horizontal angle input window.



[F5] [CLEAR] is used to clear the values.

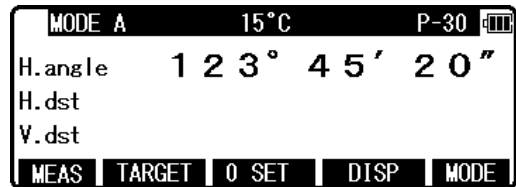


Press the numeric key as 123.4520.



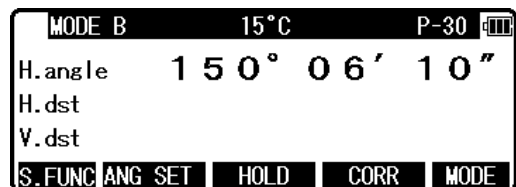
Press the [ENT] key to accept the horizontal angle set to 123° 45' 20" and change the screen to MODE A.

- The former data is called by pressing the [CLEAR] key again.

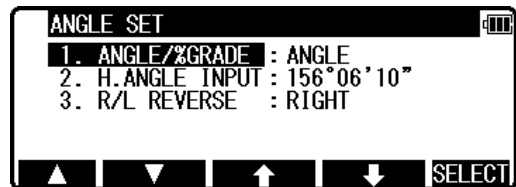


5.5 Displaying the slope % of the vertical angle

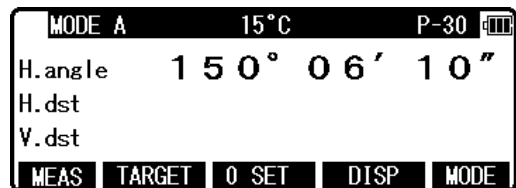
Press [F5] [MODE] to enter MODE B.



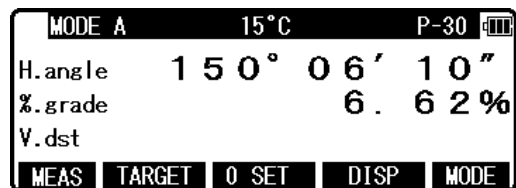
Press [F2] [ANG SET] to display the ANGLE SET screen.



Press the [F5] [SELECT] to change the screen to display the slope % of Vertical angle.



Press [F4] [DISP] to display the slope value in %.

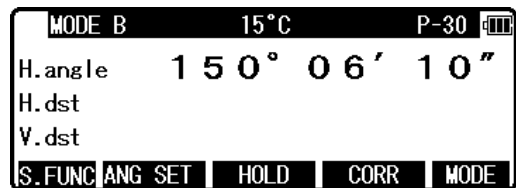


- The 0% represents the horizontal 0, and +100% and -100% represent 45° up and down slopes respectively.

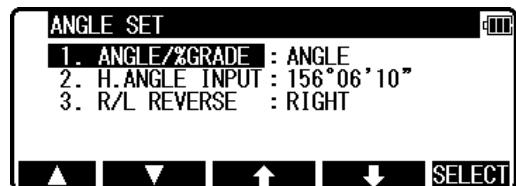
- To return the screen from the slope (%) display to the 360° scale, also take above same steps by entering MODE B.
- If the slope (%) exceeds [+/-] 1000%, “Out of grade range” is displayed, indicating that the current vertical angle cannot be measured.
- When the telescope returns to a slope within slope [+/-] 1000%, the slope (%) display returns automatically from the “Out of grade range” message to the numeric value.

5.6 Changing the horizontal angle from clockwise to counter clockwise

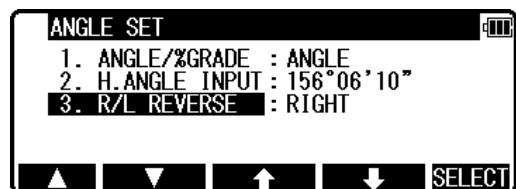
Press [F5] [MODE] to enter MODE B.



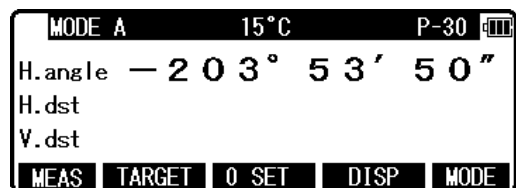
Press [F2] [ANG SET] to display the ANGLE SET screen.



Press [F4] [↓] to move the cursor to “3. R/L REVERSE”.



Press [F5] [SELECT] to add a minus sign (-) to the horizontal angle value as a counter clockwise angle.

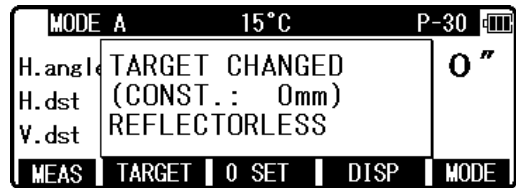


- To return the horizontal angle from counter clockwise to clockwise, also take the above same procedures, press [F5] [SELECT] to select the clockwise angle.
- When the counter clockwise horizontal angle is selected, the order of aiming at the targets becomes the reverse (the right one first, then the left one) of the order for the clockwise angle.

6. DISTANCE MEASUREMENT

6.1 Target setting

The target mode and its Constant of current setting are shown at the left of the battery mark. For example in case of each Constant 0, Reflectorless (Non-Prism); N 0, Prism; P 0



Pressing [F2] [TARGET] changes the target mode.

- The target mode is changed sequentially as follows.
Reflector sheet - Prism - Reflectorless
- The selected target mode is stored in the memory even if the power is turned off.
So, next time you can use the same mode after turning on.
- The target Constant differs according to the selected target mode. So, confirm the target mode and its Constant shown at the top screen after changing the target.

[Distance measurement by reflectorless (Non-Prism) mode]

- The measurement range and accuracy of Reflectorless are based on the condition that laser beam is emitted perpendicular to the white side of the Kodak Gray Card. The measurement range may be influenced by the shape of the target and its environment. There is a possibility that the range may vary when the target does not satisfy the conditions above at survey work.
 - Pay attention to the following in case of distance measurement by Reflectorless.
In case of resulting in low accuracy, perform the distance measurement by Prism.
 - The CODE number 521 [LONG RANGE MES.] shows ON/OFF.
 - The WARNING (Laser Power) screen is displayed when Message ON is selected, and then [F1] [MEAS] key is pressed.
 - Pressing [F1] [MEAS] one time selects “Second MEAS setting” and twice selects “QUIT”.
- ① There is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam when the laser beam comes into the target from diagonal angle.
 - ② There is a possibility that the instrument cannot calculate correctly when receiving reflected laser beam from forth and back directions in case of measuring the target on the road.
 - ③ There is a possibility that synthesized values are calculated and the distance may become longer or shorter than the actual one when the operator measures the target of slope or sphere or rugged shape.
 - ④ There is a possibility that the instrument cannot calculate correctly collecting the reflected laser beam from a man or a car that comes and goes in front of the target.

[Distance measurement by reflector sheet mode]

Position the Reflector sheet whose reflecting surface faces the aiming line to be approx. right angle when the distance is measured by it. If it is positioned not to be approx.

right angle, there is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam.

[Applied measurement range by each target mode]

- When a wrong target mode is selected, a correct distance cannot be measured. Please select a correct target mode and measure.
- It is sometimes possible to measure without prism under special conditions like in the close distance, targeting on a wall surface. However, there is a possibility including some errors in this case, so be sure to select the reflectorless mode.
- The target constant should be correctly selected and confirmed in case that the reflector sheet is used at the prism mode and the prism is used at the reflector sheet mode.

6.2 Distance measurement

The R-400V series has two distance measurement modes of primary MEAS and second MEAS. Pressing the [F1] [MEAS] one time goes to primary MEAS and twice goes to second MEAS.

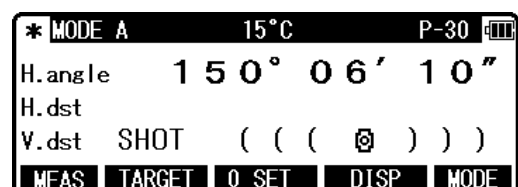
You can freely select and allocate your desired measurement mode in primary MEAS and second MEAS by the initial setting 2. The “MEASURE SHOT” is set at primary MEAS and “TRACK CONT” is set at second MEAS as a factory default setting.

- MEASURE SHOT means the distance measurement by the shot mode.
- MEASURE CONT means the distance measurement by the continuous mode.
- TRACK SHOT means the fast distance measurement by the shot mode.
- TRACK CONT means the fast distance measurement by the continuous mode.

Confirm the target constant before beginning the distance measurement.

Example: “MEASURE SHOT” at primary MEAS (Factory default setting)

Collimate the telescope at a target and press the [F1] [MEAS] once to start measuring the distance. Once distance measurement has been started, the distance measurement mark remains displayed. Upon reception of a reflected light from the target, the instrument beeps and displays the mark to start the shot measurement automatically.

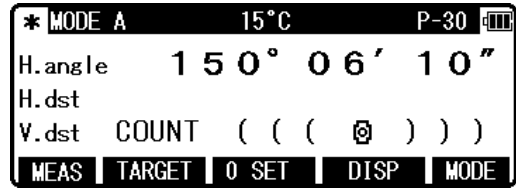


- If the instrument is in MODE B, press the [F5] [MODE] to switch to MODE A and press [F1] [MEAS].
- Pressing the [F1] [MEAS] after collimating the telescope at the prism starts shot distance measurement with the “MEAS” text blinking. Distance measurement is completed and the “MEAS” text stops blinking the moment the distance measured by shot measurement is displayed. During continuous measurement, the “MEAS” text keeps on blinking. Pressing the [F1] [MEAS] again terminates both distance measurement and blinking of the “MEAS” text.
- Pressing [F4] [DISP] cycles through the sets of display items: “H. angle/H. dst./V. dst.”, “H. angle/V. angle/S. dst.”, and “H. angle/V. angle/H. dst./S. dst./V. dst.”
- Pressing the [ESC] or [F2] [TARGET] or [F5] [MODE] during distance measurement stops it.

- If the shot count for distance measurement has been set to 2 or more in “initial setting 2”, the distance is measured for the specified number of times to display the averaged value.

Example: “TRACK CONT” at second MEAS (Factory default setting)

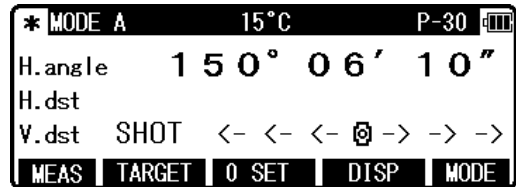
Collimate the telescope at a Target and press [F1] [MEAS] twice to start measuring the distance. Upon reception of a reflected light from the target, the instrument beeps and displays the mark to start the TRACK distance measurement.



- If the instrument is in MODE B, press [F5] [MODE] to switch to MODE A and press [F1] [MEAS] twice.
- Pressing [F1] [MEAS] twice after collimating the telescope at the Target starts Continuous distance measurement at fast speed with the “MEAS” text blinking. It remains blinking during the measurement. If you press the [F1] [MEAS] again, Distance measurement is completed and the “MEAS” text stops blinking.
- Pressing [F4] [DISP] cycles through the sets of display items: “H.angle/H.dst./V.dst.”, “H.angle/V.angle/S.dst.”, and “H.angle/V.angle/H.dst./S.dst./V.dst.”
- Pressing the [ESC] or [F2] [TARGET] or [F5] [MODE] during fast distance measurement stops it.

6.3 Quick mode

The Quick Mode is to shorten the measuring time using prism or reflector sheet.



- The Quick Mode is effective to measure the distance up to 500m using prism or reflector sheet.
- After selecting Quick Mode from the Quick Mode setting screen, the distance measurement is done in Quick Mode.
- If the Quick Mode is selected, the distance measurement mark, "<-<- ->->", instead of "((()))", is displayed

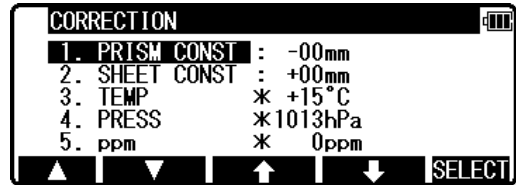
7. CORRECTION MODE

7.1 Changing the target constant

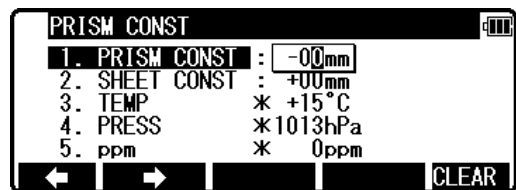
Changing the Target Constant can be performed only when the Reflector sheet and Prism Constant setting are “INPUT” in initial setting 1.

Example: Prism Constant -25mm setting

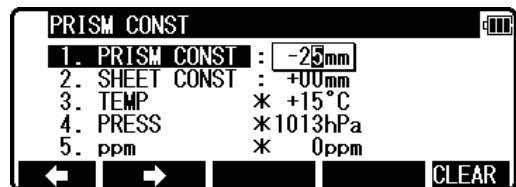
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A,
press [F5] [MODE] to enter MODE B.)



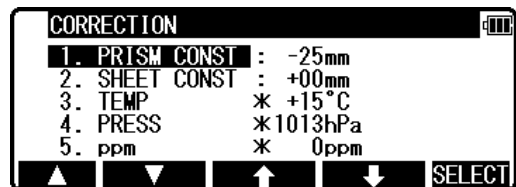
Press the [F5] [SELECT] to enable
the Prism Constant to be changed.



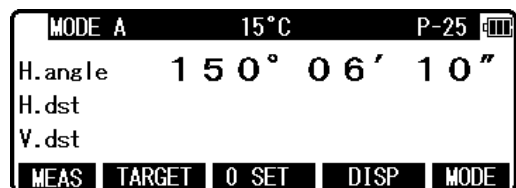
Clear the exiting values by pressing [F5] [CLEAR].
Input -25 by pressing the numeric keys.



Press the [ENT] key to accept the Prism
Constant to -25mm.



Pressing the [ENT] key returns the instrument
to MODE A.



- To set the Reflector sheet constant to “0mm” select “0mm” for “SHEET CONST” in “initial setting 1”.
- To set the Prism constant to “0mm” or “-30mm” select “0mm” for “PRISM CONST” in “initial setting 1”.
- When the “Sheet Constant” has been set to “0mm” in “initial setting 1” and “PRISM CONST” has been set to “0mm” or “-30mm”, “*” is displayed to the left of “0mm” or “30mm” on the correction menu screen. When “*” is on the screen, the Constant cannot be changed (by entering a numeric key).
- Once set, the Reflector sheet Constant and Prism Constant remain on the measurement screen as “S 0” or “P 0”.

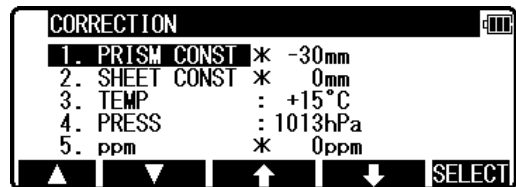
- The factory initial of Reflector sheet Constant and Prism Constant are 0.
- Once set, each Constant remains in memory even after the power is turned off.

7.2 Changing the temperature

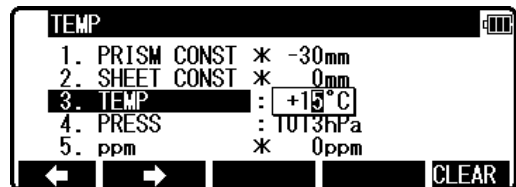
The temperature setting can be changed only when “ATM CORR” has been set to “ATM INPUT” in “initial setting 1”.

Example: Setting the temperature to +22°C

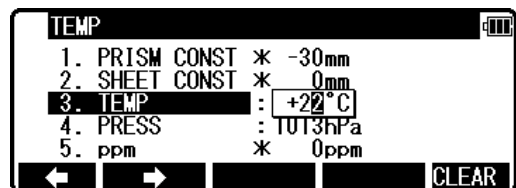
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A,
press [F5] [MODE] to enter MODE B.)



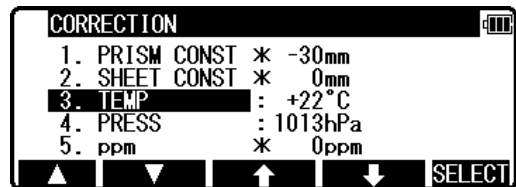
Press [F4] [↵] to move the cursor to “3.TEMP”
and press the [F5] [SELECT] to enable the
temperature to be changed.



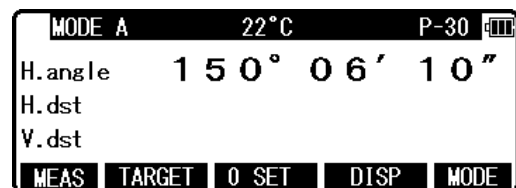
Clear the exiting values by pressing [F5] [CLEAR].
Input 22 by pressing the numeric keys.



Press the [ENT] key to accept the
temperature to +22°C.



Pressing the [ENT] key returns the instrument to
MODE A.



- The valid range of Temperature input is from -30°C to +60°C.
- When “ATM CORR” in “initial setting 1” has been set to “4. NIL”, “*” is displayed to the left of the temperature value on the correction menu screen. When “*” is on the screen, the temperature cannot be changed. If “ATM CORR” in “initial setting 1” has been set to “3. ppm INPUT”, no temperature is displayed on the correction menu screen.
- Once set, the temperature is displayed at the centre of the top of the measurement screen.
- The factory initial of temperature is “+15°C”.
- Once set, the temperature remains in memory even after the power is turned off.

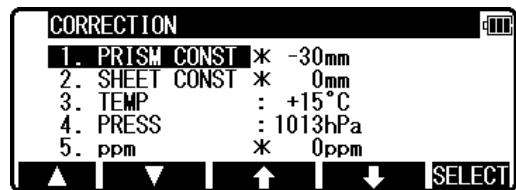
- Temperature correction is based on 15°C.
If this instrument is used without correcting the temperature, a distance error per 100m is about -0.1mm per +1°C as a temperature difference from 15°C.
A distance error per 100m is about 0.1mm per -1°C as a temperature difference from 15°C.
(For more accurate values, See “12.4 Error when no atmospheric correction is made”.)

7.3 Changing the atmospheric pressure

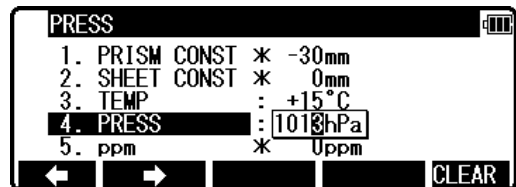
The atmospheric pressure setting can be changed only when “ATM CORR” has been set to “ATM INPUT” in “initial setting 1”.

Example: Setting the pressure to 900hPa

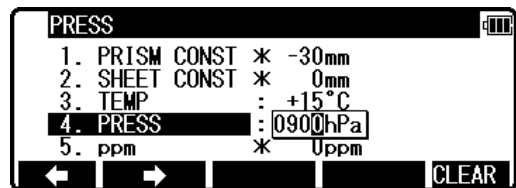
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A,
press [F5] [MODE] to enter MODE B.)



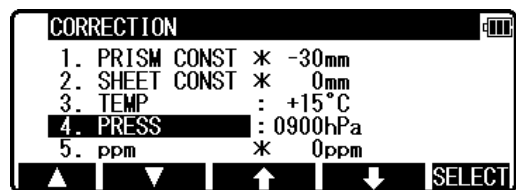
Press [F4] [↵] to move the cursor to “4.PRESS”
and press the [F5] [SELECT] to enable
the temperature to be changed.



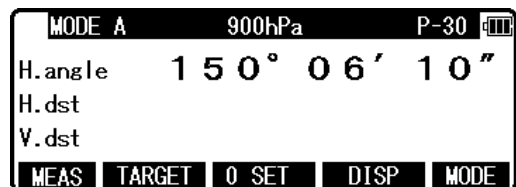
Clear the exiting values by pressing [F5] [CLEAR].
Input 900 by pressing the numeric keys.



Press the [ENT] key to accept the
PRESS to 900hPa.



Pressing the [ENT] key returns
the instrument to MODE A.



- The valid range of Pressure input is from 600 to 1120hPa (420 - 840mmHg) .
- When “Atmospheric Correction” in “initial setting 1” has been set to “3. NIL”, “*” is displayed to the left of the pressure value on the correction menu screen.
When “*” is on the screen, the pressure cannot be changed.
If “ATM CORR” in “initial setting 1” has been set to “2.ppm INPUT”, no pressure is displayed on the correction menu screen.

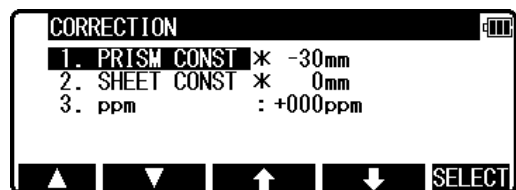
- Once set, the pressure is displayed at the centre of the top of the measurement screen.
- The factory initial of pressure is “1013hPa”.
- Once set, the pressure remains in memory even after the power is turned off.
- Pressure correction is based on 1013 hectopascals (hPa).
- If this instrument is used without correcting the pressure, a distance error per 100m is about -0.3mm per -10hPa as a pressure difference from 1013hPa.
(For more accurate values, see “12.4 Error when no atmospheric correction is made”.)

7.4 Changing the ppm value

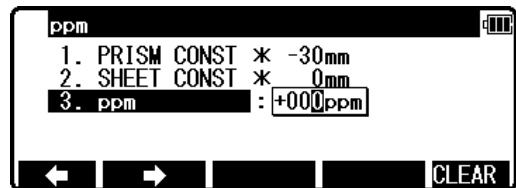
The ppm value can be changed only when “ATM CORR” has been set to “ppm INPUT” in “initial setting 1”. “TEMP” and “PRESS” are not displayed.

Example: Setting the ppm value to 31 ppm.

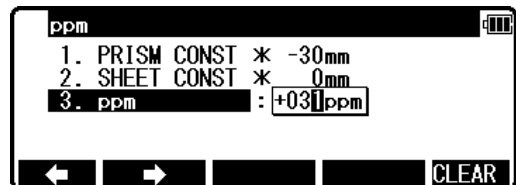
Press [F4] [CORR] in MODE B.



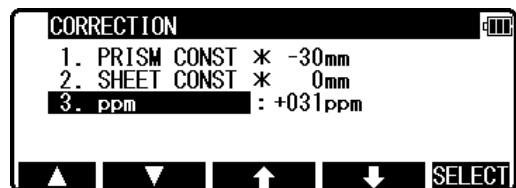
Press [F4] [↓] to move the cursor to “3. ppm” and press the [F5] [SELECT] to enable the temperature to be changed.



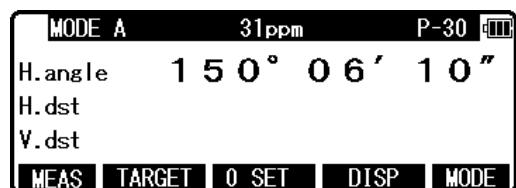
Clear the exiting values by pressing [F5] [CLEAR].
Input 31 by pressing the numeric keys.



Press the [ENT] key to accept the PPM to 31ppm.



Pressing the [ENT] key returns the instrument to MODE A.



- The valid range of ppm values is from -199 to +199.
- Once set, the ppm value is displayed at the centre of the top of the measurement screen.
- The factory initial of ppm value is “0”.
- Once set, the ppm value remains in memory even after the power is turned off.

8. INITIAL SETTING

8.1 Overview

For the R-400V series, you can select and save the desired setting for a variety of prescribed instrument conditions, called initial setting.

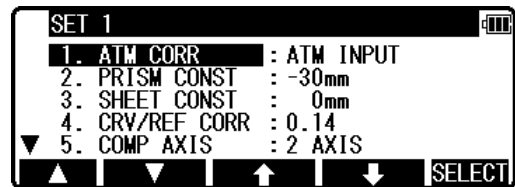
The Initial Setting is saved in five modes, “initial setting 1”, “initial setting 2”, “initial setting 3”, “initial setting 4”, and “initial setting 5” in which you can select and save the instrument conditions described below.

The factory default for each of these conditions is marked by .

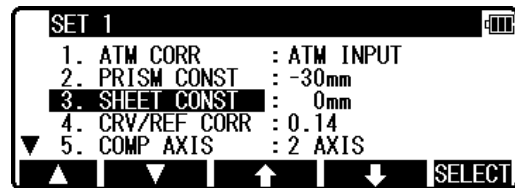
To change initial setting, follow the operating procedures for entering each initial setting mode in “8.2” and the operating procedures for changing an initial setting in “8.2”.

8.2 Entering the mode for initial setting 1

Press the [POWER] key while holding [F1] key down to access the screen for initial setting 1.



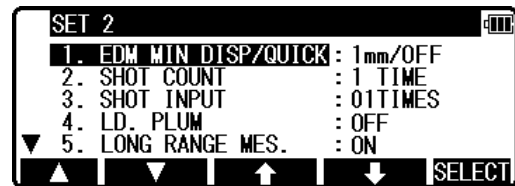
- Pressing [F1] [Δ] scrolls it up five items; pressing [F2] [∇] scrolls the screen down five items.
- Press [F3] [\uparrow] or [F4] [\downarrow] to position the cursor at the item of interest.



8.3 Entering the mode for initial setting 2

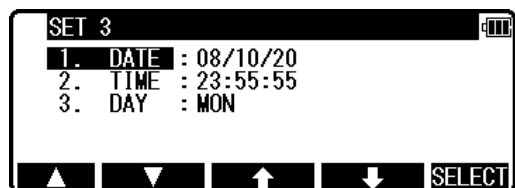
Press the [POWER] key while holding [F2] key down to access the screen for initial setting 2.

- Select the item of interest in the same way as in the mode for initial setting 2.



8.4 Entering the mode for initial setting 3

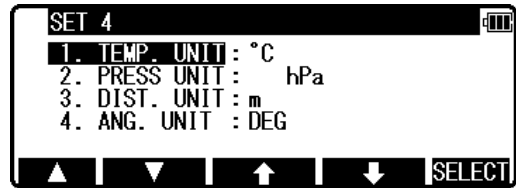
Press the [POWER] key while holding [F3] key down to access the screen for initial setting 3.



8.5 Entering the mode for initial setting 4

Press the [POWER] key while holding [F4] key down to access the screen for initial setting 4.

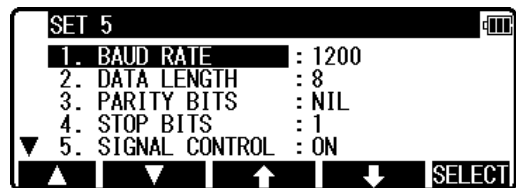
- Select the item of interest in the same way as in the mode for initial setting 4.



8.6 Entering the mode for initial setting 5

Press the [POWER] key while holding [F5] key down to access the screen for initial setting 5.

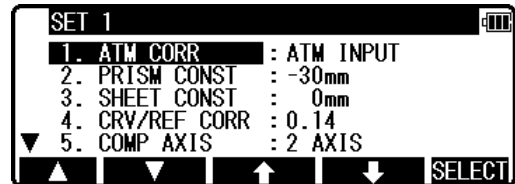
- Select the item of interest in the same way as in the mode for initial setting 5.



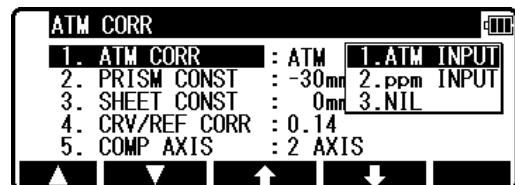
8.7 Example of changing an initial setting content (selection of atmospheric correction)

This section describes the operating procedures for selecting “1.ATM CORR” in initial setting 1 as an example of changing an initial setting content. Use this example as a reference when changing other items because it is also applicable to the operating procedures for changing them.

Access the screen for initial setting 1 by taking procedures “8.2 Enter the mode for initial setting 1”.

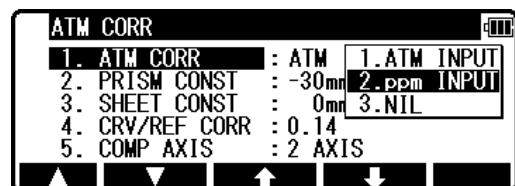


Press [F5] [SELECT] to open the screen for selecting the atmospheric correction.

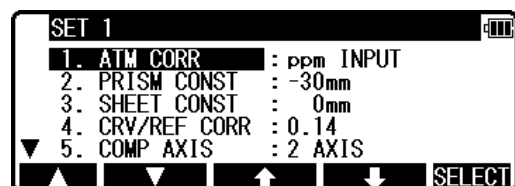


Press [F3] [↑] or [F4] [↵] to position the cursor at the desired item, then press [ENT] key to select that item.

Pressing the [ENT] key selects the change of selected item. Pressing the [ESC] key invalidates the change of selected item.

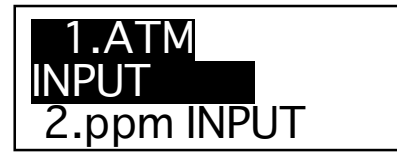


Pressing again the [ESC] key or [ENT] key quits the initial setting screen and usual start screen appears.

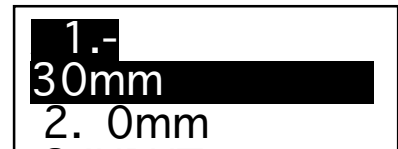


8.8 Initial setting 1

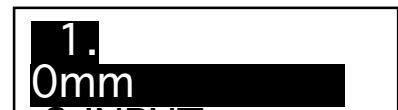
1. Selection of **Atmospheric Correction**: [ATM CORR]
Select whether Atmospheric Correction is to be performed by entering the atmospheric temperature and pressure, by entering ppm value, or by fixing the ppm value to 0 (NIL) not to perform Atmospheric Correction.



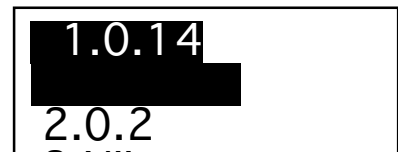
2. Selection of **Prism Constant**: [PRISM CONST.]
Select whether the Prism Constant to be input is set to 0mm, -30mm or to an arbitrary value to be entered from the keyboard.



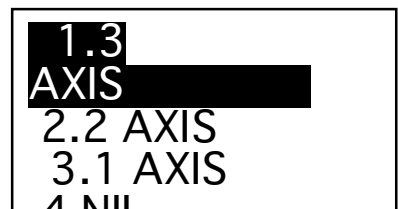
3. Selection for **Reflector sheet Constant**: [SHEET CONST]
Select whether the target constant to be input is set to 0mm, or to an arbitrary value to be entered from the keyboard.



4. Selection for **Refraction & Curvature Corrections**: [CRV/REF CORR]
Select whether the correction factor to be input for both differences (Refraction, Curvature) is set to 0.14, 0.2 or none (NIL). Selecting “3. NIL” results in no correction of both values.



5. Selection of **Tilt Compensation**: [COMP AXIS]
Select whether Tilt Compensation is to be single-axis compensation, dual-axis compensation or disabled (NIL).
R-422VN is selectable up to 3 AXIS.
R-423VN, R-425VN, R-435VN are selectable up to 2 AXIS.
The figure on the right shows that 3 AXIS is selected on R-422VN.



6. Selection of **Atmospheric corrections display**: [ATM CORR DISP]
Select whether to display the atmospheric corrections in the title bar of the measure screens or not.

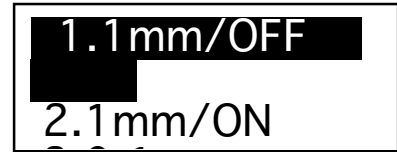


- The factory default for each instrument condition is marked by .

8.9 Initial setting 2

1. Selection of the **Minimum Distance measurement unit and Quick Mode** : [EDM MIN DISP/QUICK]

More fine angle view is necessary, select 0.1mm,
Besides that, select 1mm/OFF.
When using Quick Mode, select 1mm/ON.



2. Selection of the **Shot count**: [SHOT COUNT]
Select whether the shot count for Shot distance measurement is to be 1, 3, 5 or an arbitrary count to be entered.



3. Setting the **Shot input**: [SHOT INPUT]
Set the shot number for Shot distance measurement.



- The valid range of values for the shot number is from 1 to 99.
- This setting is enabled only when the shot number (Above 2.) has been set to “4. INPUT”.

4. Selection of **Laser plummet** : [LD PLUM.]
Laser plumb ON/OFF is selected.



5. Selection of **Long range message**
: [LONG RANGE MES.]
If you need the long range message.



6. Selection of **primary MEAS setting**
: [PRIM. MEAS KEY]
Select whether the primary distance measurement is MEAS SHOT or MEAS CONT or TRACK SHOT or TRACK CONT.



7. Selection of **second MEAS setting** : [SEC. MEAS KEY]
Select whether the second distance measurement is TRACK CONT or TRACK SHOT or MEAS CONT or MEAS SHOT.



8. Selection of **Minimum angle display**: [MIN UNIT ANG.]
Select whether to set the minimum angle display mode to “COARSE (5 seconds)” or “FINE (1 second)”.



9. Selection of **Vertical angle style**: [V.ANG. STYLE]
Select whether the 0 point for vertical angle is set to be “Z.0”, “H.0” or “COMPAS”.

1.Z.0
2.H.0
3.COMPAS

10. Selection of **Automatic power-off function**
: [AUTO OFF]
Select the time interval (10, 20 or 30 minutes) for activating the automatic power-off function, or select NIL, disabling the function.

1.10 MIN
2.20 MIN
3.30 MIN
4.NIL

- The automatic power-off function automatically turns the power supply off after the specified period of time (in minutes) when no operation for distance measurement or for key entry has been performed with the angle remaining unchanged.

11. Selection of **Distance measurement automatic power-off function**: [EDM OFF]
Select the time interval (3, 5, or 10 minutes) for activating the distance measurement automatic power-off function, or select NIL, disabling the function.

1.3 MIN
2.5 MIN
3.10 MIN
4.NIL

12. Selection of **Automatic illumination power-off function**
: [ILLU. OFF]
Select the time interval (3, 5, or 10 minutes) for activating the automatic illumination power-off function, or select NIL, disabling the function.

1.3 MIN
2.5 MIN
3.10 MIN
4.NIL

13. Selection of **Distance measurement buzzer**
: [DIST. BUZ]
Select whether to enable or disable the beep when the prism receives a light during distance measurement or during repeated distance measurement.

1.ON

14. Selection for **H.angle 90° buzzer**: [QUAD. BUZ]
Select whether to enable or disable the beep at every 90° during angle measurement.

1.OFF

15. Selection of **Distance measurement signal**
: [MEAS. SIGNAL]
Select whether to display a signal indicator or AIM value to be displayed from when distance measurement is

1.MARK

started to when measured data is displayed.

16. Selection of **Priority Display**: [PRIORITY DISP.]

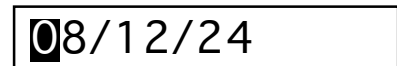
Select the display order of the sets of display items which pressing the [DISP] key cycles through. The set of display items selected here appears first after the power is turned on.



8.10 Initial setting 3

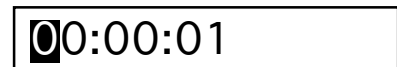
1. Input of date

Set date using [numeric keys].
Year / month / date



2. Input of time

Set time using [numeric keys].
Time : minute : second



3. Selection of week day

Select week day.



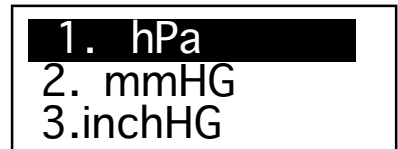
- The date clock is powered by the built-in lithium battery. The lithium battery needs to be replaced in five years. When the message “Li-batt.voltage is low.” is shown on the display screen, have the lithium battery replaced by the dealer from whom the instrument was purchased. The timing of battery replacement varies depending on the frequency of use and the environment where the instrument is stored while not in use.

8.11 Initial setting 4

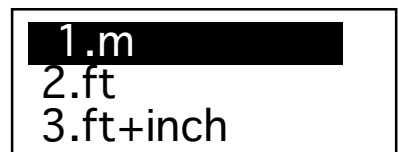
1. Selection of **Temperature unit setting**: [TEMP. UNIT]
Select °C or °F as the unit for Temperature.



2. Selection of **Pressure unit setting**: [PRESS UNIT]
Select hPa (hectopascal), mmHg, inchHg as the unit for pressure to be input.



3. Selection of **Distance unit setting**: [DIST. UNIT]
Select m or ft or ft+inch as the unit for Distance.

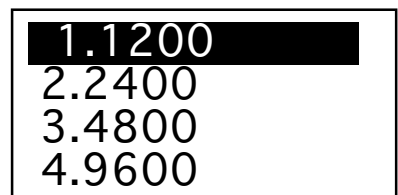


4. Selection of **Angle unit setting**: [ANG. UNIT]
Select DEG or DEC or GRD or MIL as the unit for Angle.



8.12 Initial setting 5

1. Selection of **Transfer rate** (baud rate): [BAUD UNIT]
Select a baud rate of 1200, 2400, 4800 or 9600.



2. Selection of **Data bits**: [DATA LENGTH]
Select a data length of 8 bits.



3. Selection of **Parity**: [PARITY BITS]
Select no (NIL) parity bit, even parity or odd parity.



4. Selection of **Stop bits**: [STOP BITS]
Select the number of stop bits to be used: 1 or 2.



5. Selection of **Control signal**: [SIGNAL CONTROL]
Select whether the control signal is effective or not.

1.ON

6. Selection of **XON/XOFF**: [XON/XOFF]
Select whether to enable or disable XON/XOFF.

1.ON

7. Selection of **Through command**
: [THROUGH COMMAND]
Select whether to disable data output
without receiving any data request command
or enable the “a” to “f” command data output.

1.NIL
2.a
3.b
4.c
5.d
6.e

9. ACCESSING THE FUNCTIONS

9.1 Accessing by help key

You can use the [HELP] key to display specific initial setting (such as the prism constant and priority mode).

Press the [ILLU]+[ESC] key in MODE A or B.

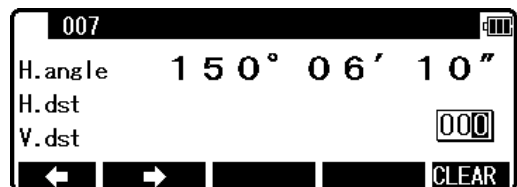


The help menu will then be displayed. Press [F1] [Δ] [F2] [∇] or [F3] [$\hat{\uparrow}$] [F4] [$\hat{\downarrow}$] to position the cursor to the desired item.

9.2 Accessing by 007

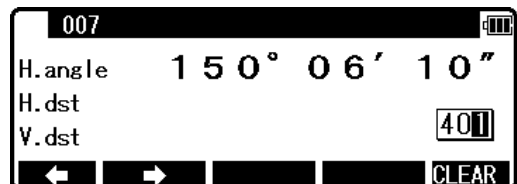
The R-400V allows you to enter a special code of 007 with the alphanumeric keys to display specific initial setting.

Press the numeric keys [0] [0] [7] in MODE A or B. The screen will then change to the command input screen.

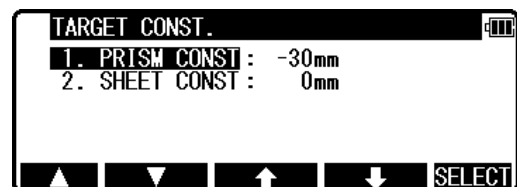


Press the numeric keys for the desired command number in the Command No. Table.

(For example, press [4] [0] [1] for TARGET CONST.)



Press the [ENT] key to access the TARGET CONST.



[Instrument setting items]

007	HELP menu list		Default	Other options
401	TARGET CONST	PRISM CONST	-30mm	0mm, INPUT
		SHEET CONST	0mm	INPUT
402	ATM CORR		ATM INPUT	ppm INPUT, NIL
403	ATM CORR DISP		OFF	ON
501	EDM MIN DISP/QUICK		1mm/OFF	1mm/ON, 0.1mm
502	SHOT COUNT	SHOT COUNT	1TIME	3TIMES, 5TIMES, INPUT
		SHOT INPUT	01TIMES	(input)
503	CRV/REF CORR.		0.14	0.2, NIL
504	MIN UNIT ANG.		FINE	COARSE
505	V.ANG. STYLE		Z.0	H.0, COMPAS
508	DIST. BUZ.		ON	OFF
509	QUAD BUZ.		OFF	ON
510	AUTO OFF		10 MIN	20 MIN, 30 MIN, NIL
511	EDM OFF		3 MIN	5 MIN, 10 MIN, NIL
512	ILL. OFF		3 MIN	5 MIN, 10 MIN, NIL
514	MEAS. SIGNAL		MARK	VALUE
515	PRIORITY SELECT	PRIM. MEAS KEY	MEAS. SHOT	MEAS. CONT, TRACK SHOT, TRACK CONT
		SEC. MEAS KEY	TRACK CONT	TRACK SHOT, MEAS. CONT, MEAS. SHOT
		PRIORITY DISP.	HA/HD/VD	HA/VA/SD, HA/VA/HD/SD/VD
517	COMP AXIS		3 AXIS (R-422VN)	2 AXIS, 1AXIS, NIL
			2 AXIS (R-423VN, R- 425VN, R-435VN)	1 AXIS, NIL
520	LD. PLUM.		OFF	ON
521	LONG RANGE MES.		ON (when target is Ref.less)	OFF
701	ATM UNIT	TEMP. UNIT	<input type="checkbox"/> C	<input type="checkbox"/> F
		PRESS UNIT	hPa	mmHg, inchHg
702	DIST. UNIT		m	ft, ft+inch
703	ANG. UNIT		DEG	DEC, GRD, MIL
801	SETUP COM.	BAUD RATE	1200	2400, 4800, 9600
		DATA LENGTH	8	
		PARITY BITS	NIL	EVEN, ODD
		STOP BITS	1	2
		SIGNAL CONTROL	ON	OFF
		XON / XOFF	ON	OFF
THROUGH COMMAND	NIL	a, b, c, d, e, f		

10. DATA COLLECTOR

The instrument can communicate directly with a computer through the RS-232c interface. By use of a data collector you can automate data entry, from the collection of survey data to the transfer of the data to a computer. This is useful in saving time and protecting data integrity. For instructions about the connection with a data collector and the handling, please refer to the “Instruction manual” of the data collector.

11. CHECKS AND ADJUSTMENTS

- Checks and adjustments should be performed before and during measurement.
- The instrument should be checked after long storage and transportation.
- The checks should be performed in the following order.

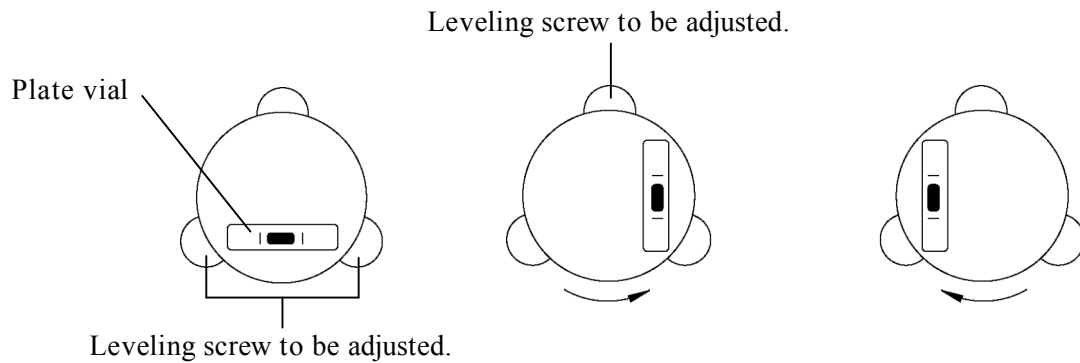
[Cautions on CHECKS AND ADJUSTMENTS]

- When adjustment is completed, be sure that adjusting screws are completely tightened. When finishing turning adjusting screws, be sure that screws are turned in a direction for tightening.
- Repeat check after adjustment, and check if the instrument has been adjusted properly.
- When adjustment is completed, be sure that adjusting screws are completely tightened. When finishing turning adjusting screws, be sure that screws are turned in a direction for tightening.
- Repeat check after adjustment, and check if the instrument has been adjusted properly.

11.1 Plate level

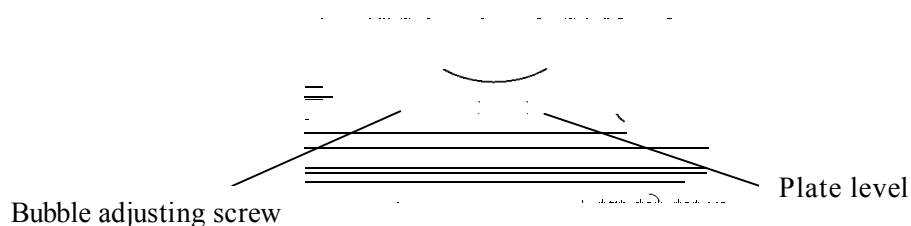
[Checks]

- ① Align the Plate level in parallel with a line joining any two of the leveling screws. Then, adjust the two screws to center the bubble in the vial.
- ② Rotate the instrument 90° and adjust the remaining leveling screw to center the bubble.
- ③ Loosen the upper clamp screw and rotate the instrument 180° around the vertical axis.
- ④ No adjustment is needed if the bubble stays in the center.



[Adjustments]

- ① If the bubble of the plate lever moves from the center, bring it half way back to the center by adjusting the leveling screw(s) which is parallel to the plate level.
- ② Correct the remaining half by adjusting the bubble adjusting nuts with the adjusting pin.
- ③ Confirm that the bubble does not move from the center when the instrument is rotated by 180°.
- ④ When the bubble moves, repeat from (1) once again..



11.2 Circular vial

[Checks]

- ① Adjust by the plate level vial beforehand.
- ② Confirm the position of the bubble of the circular vial.
At this time, it is not necessary to adjust if the bubble is at the centre of the circle.

[Adjustments]

When the bubble of the circular vial comes off from the centre according to check procedure

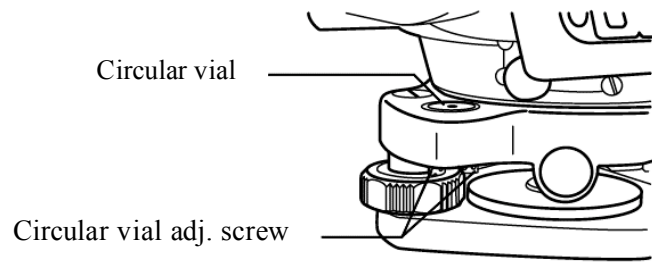
- ②, it is necessary to adjust.

Turn the bubble adjustment screws with the reticle adjustment pin and put the bubble in the centre of the circle.

[Only the detaching type model]

Turn the bubble adjustment screws with the reticle adjustment pin and put the bubble in the centre of the circle.

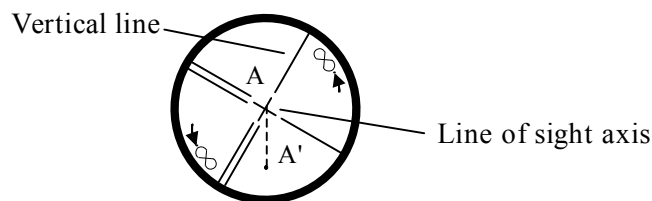
- Tighten the screws equally after the above adjustment.



11.3 Vertical reticle

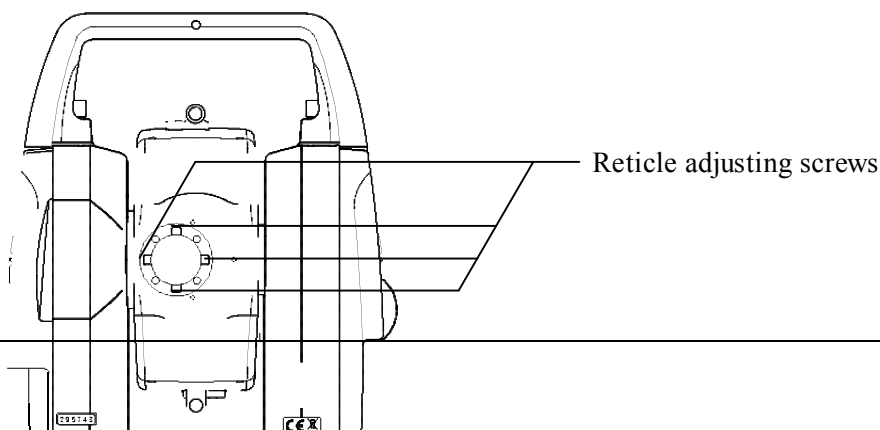
[Checks]

- ① Set the instrument up the tripod and carefully level it.
- ② Sight the target Point A with telescope.
- ③ Using the telescope fine adjustment screws, move Point A to the edge of the field of view by screw (Point A').
- ④ No adjustment is necessary if Point A moves along the vertical line of the reticle.



[Adjustments]

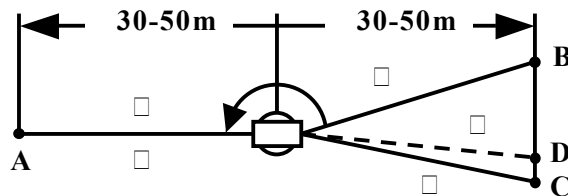
- ① If Point A is off from the vertical line of the reticle, first remove the eyepiece cover.
- ② Using the adjusting pin, loosen the four reticle adjustment screws slightly by the same amount, then rotate the reticle line around the sight axis and align the vertical line of the sight axis with Point A'.
- ③ Tighten the reticle adjustment screws again by the same amount, and repeat the check to make sure the adjustment is correct.



11.4 Perpendicularity of line of sight to horizontal axis

[Checks]

- ① Position a target Point A at a distance 30m - 50m away from the instrument, and sight it with the telescope.
- ② Loosen the telescope lock screw and turn the telescope until a point is sighted at a distance roughly equal to that of Point A. This is Point B.
- ③ With the telescope still reversed, loosen the horizontal lock screw and rotate the instrument around the vertical axis, and sight Point A again.
- ④ Loosen the telescope lock screw and turn the telescope until a point is sighted at a distance equal to that of Point B. This is Point C.
- ⑤ No adjustment is necessary if Point B and C are aligned.



[Adjustments]

- ① If Points B and C are not aligned, mark Point D at $\frac{1}{4}$ the length of the BC, from Point C in the direction of Point B.
- ② Using the adjustment pin, rotate the reticle adjustment screws horizontally opposite each other (see preceding page), and move the reticle to sight Point D.
- ③ Repeat the check and make sure the adjustment is correct.

11.5 Vertical 0 point error

Make sure to follow check procedures mentioned below after making adjustments on reticle and perpendicularity of line of sight to horizontal axis.

[Checks]

- ① Set up the instrument and turn the power on.
- ② Sight the telescope at any reference target A at Normal state. Read the vertical angle (y).
- ③ Turn the telescope and rotate the alidade. Sight the same target A again at Back state and read the vertical angle R.
If $y+R = 360^\circ$, no further adjustment is necessary.

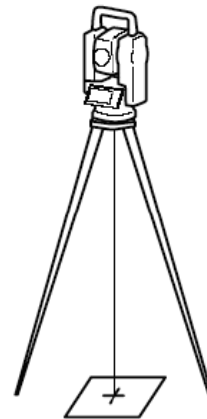
[Adjustments]

If the deviation $d (y+ R - 360^\circ)$ is wide, contact your local dealer.

11.6 Laser plummet

[Checks]

- ① Set the instrument on the tripod, and place a piece of white paper with a cross drawn on it right under the instrument.
- ② Press the [LASER] key and press [F4][PLUM.ADJ] key , and move the paper so that the intersecting point of the cross comes to the centre of the laser mark.
- ③ Rotate the instrument around the vertical axis, and observe the centre mark position against the intersecting point of the cross at each 90° rotation.
- ④ If the laser mark always coincides with the intersecting point, no adjustment is necessary.



[Adjustments]

When a centre part where a cross intersection and the laser mark look the brightest shifts by 0.5mm or more (at the instrument height 1.5m), it is necessary to adjust it. A repair engineer does this adjustment. Please contact the PENTAX dealer.

11.7 Offset constant

The offset constant rarely changes. It is recommended, however, that checks be done once or twice a year.

The check of the offset constant can be done on a certified base line. It can also be obtained in a simple way as described below.

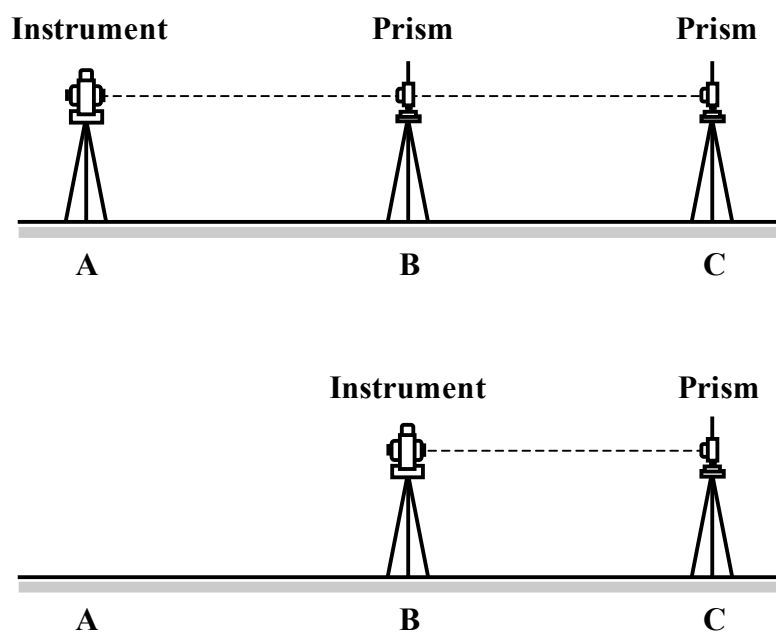
[Checks]

- ① Locate points A, B and C at about 50m intervals on even ground.
- ② Set up the instrument at point A, and measure the distances between AB and AC.
- ③ Set up the instrument at point B, and measure the distance BC.
- ④ Obtain the offset constant (K):

$$K=AC - (AB+BC)$$

[Adjustments]

- Contact your local dealer for adjustment of the offset constant when K is not nearly 0.



11.8 Beam axis and line of sight

Be sure to check that the beam axis and line of sight are aligned when the adjustments on reticle and perpendicularity of line of sight to horizontal axis are made.

[Checks]

- ① Set the prism at a distance greater than 50m.
- ② Accurately sight the centre of the prism through the telescope.
- ③ Turn the power on and press (MEAS) to measure.
- ④ No adjustment is necessary if beam receiving buzzer sounds immediately and measurement value is displayed in a few seconds.

[Adjustments]

- If instrument function is not as described in ④, contact your local dealer.

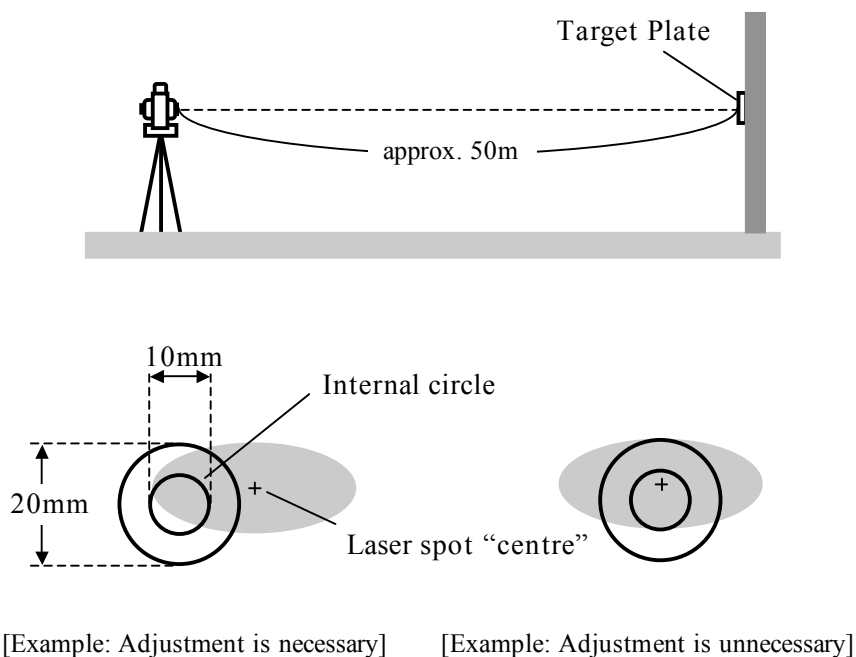
- This check should be done under good weather conditions.

11.9 The EDM beam axis

The distance measurement (EDM) beam axis is adjusted to be aligned to the sighting axis of the telescope, but it can be changed a little in case of rapid temperature change, shock or aging. Check your instrument by following procedures.

[Checks]

- ① Install the instrument on the tripod and level it at the distance of approx. 50m from the wall.
 - ② Displace the target plate attached to the end of this manual. Place the target plate adjusting its centre to the centre of telescope cross line and to be about horizontal to the instrument.
 - ③ Turn the power on, and confirm the [TARGET] is set to the reflector sheet mode (“S” will be indicated at the top of display, left side of the battery remains sign when it is that.) When it is not, press [F2][TARGET] and set to reflector sheet mode (refere to “6.1 Target setting”).
 - ④ Press [F1][MEAS], then the laser spot appears on the target plate. If the “Centre” of the laser spot is within the internal circle (10mm) of the target plate at this moment, the adjustment is unnecessary.
- The laser spot disappears in approx. 20 seconds after pressing [F1][MEAS]. Press [MEAS] again, if it is necessary.



[Adjustments]

At the procedure 4. above, if the “Centre” of laser spot is not within the internal circle (10mm) of the target plate, the adjustment is necessary. Please contact your PENTAX dealer.

12. APPENDIX

12.1 Warning and Error Messages

Warning Message	Meaning	What to do
Out of tilt range	<p>Displayed when the instrument is tilted beyond the vertical compensation range ($\pm 3'$) in case automatic compensation is selected.</p> <p>When it is properly levelled, this message may be temporarily displayed if the instrument is turned too fast.</p>	<p>Re-level the instrument.</p> <p>Repair is needed if the message is displayed when it is properly levelled.</p>
Excess data	The input data exceeds the allowable range.	Press the [ESC] key and enter the correct data.
Out of range □ when being lit□	<p>This message is displayed if a long distance which is far beyond measurable distance of R-400V series is measured with a wrong target mode.</p> <p>Please select a correct target then measure.</p> <p>If a wrong target is selected, a correct distance cannot be measured.</p>	Select the correct target mode.
Out of range (when flashing)	<p>The measurement distance is less than 1.5m in Reflector sheet mode.</p> <p>The measurement distance is less than 5m in Prism mode.</p>	Select a longer point, or use a tape measurer.
Unsuitable Condition	<p>Under too strong sunlight.</p> <p>Unstable light value owing to shimmer or obstacles.</p> <p>Reflector sheet, Target and Prism do not face the instrument.</p> <p>Reflector sheet, Target and Prism are not correctly sighted.</p> <p>Measurement range is over in Reflectorless mode.</p> <p>Sufficient signal does not return by sighting sharp edge etc. at Reflectorless mode.</p>	Change the object that has much better reflectivity or use a prism, or wait until the sun activity has weakened.
Li-batt.voltage is low.	<ul style="list-style-type: none"> • The Date Clock is powered by the built-in lithium battery. • The lithium battery needs to be replaced in five years. 	Have the lithium battery replaced by the dealer from whom the instrument was purchased.

Error Message	Meaning	What to do
EDM ERROR 04 -05, 34-39, 50-53	Distance measurement system problem	Turn the power off, and then turn on again.
ETH ERROR 70-76	Angle measurement system problem	
MEMORY ERROR 19	Memory problem	Repair is needed when the message appears consistently.
ERROR PS DATA of EDM	Problem of the internal EDM parameters	
ERROR P DATA of EDM		
ERROR ETH DATA	Problem of the internal ETH parameters	

12.2 Atmospheric correction

The speed at which light travels through the air varies depending on the temperature and atmospheric pressure. The R-400V series is designed to measure distances at the speed of light. In order to measure accurately, atmospheric correction needs to be used. The instrument is designed to correct for weather conditions automatically if the temperature and pressure are input. Correction is then carried out based on the following formula.

Calculation formula

$$K = \left(276.26713 - \frac{78.565271 \times P}{273.14941 + t} \right) \times 10^{-4}$$

K: Atmospheric Correction Constant

P: Atmospheric pressure (hPa)

t: Temperature(°C)

Distance after Atmospheric Correction D = Ds (1+K)

Ds: Measured distance when no Atmospheric Correction is used.

12.3 hPa and mmHg conversion table

[Converting from hPa to mmHg]

hPa	Unit:mmHg									
	0	10	20	30	40	50	60	70	80	90
500	375	383	390	398	405	413	420	428	435	443
600	450	458	465	473	480	488	495	503	510	518
700	525	533	540	548	555	563	570	578	585	593
800	600	608	615	623	630	638	645	653	660	668
900	675	683	690	698	705	713	720	728	735	743
1000	750	758	765	773	780	788	795	803	810	818
1100	825	833	840	848	855	863	870	878	885	893

1200	900	908	915	923	930	938	945	953	960	968
------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[Converting from mmHg to hPa]

Unit:hPa										
mmHg	0	10	20	30	40	50	60	70	80	90
400	533	547	560	573	587	600	613	627	640	653
500	667	680	693	707	720	733	747	760	773	787
600	800	813	827	840	853	867	880	893	907	920
700	933	947	960	973	987	1000	1013	1027	1040	1053
800	1067	1080	1093	1107	1120	1133	1147	1160	1173	1187
900	1200	1213	1227	1240	1253	1267	1280	1293	1307	1320

12.4 Error when no atmospheric correction is made

When measurement is carried out with no atmospheric correction (with the settings fixed at a temperature of 15°C and an atmospheric pressure of 1013hPa or 760mmHg), the error per 100 meters in temperature and pressure will be shown in the tables below.

- When the actual pressure is 1013hPa (760mmHg) and the temperature is 25°C, conducting the measurement with the temperature left at 15°C will result in the measurement being short by 0.9mm per 100 meters.

[Error table: When hPa (15°C, 1013hPa as standard)]

		Unit:mm							
hPa \ C°	1200	1100	1013	900	800	700	600	500	
45	2.0	-0.5	-2.6	-5.5	-8.0	-10.5	-13.0	-15.5	
35	3.0	0.4	-1.8	-4.7	-7.3	-9.9	-12.5	-15.1	
25	4.0	1.4	-0.9	-4.0	-6.6	-9.3	-12.0	-14.6	
15	5.2	2.4	-0.0	-3.1	-5.9	-8.6	-11.4	-14.2	
5	6.3	3.5	1.0	-2.2	-5.1	-8.0	-10.8	-13.7	
-5	7.6	4.7	2.1	-1.3	-4.2	-7.2	-10.2	-13.1	
-15	9.0	5.9	3.2	-0.2	-3.3	-6.4	-9.5	-12.6	

[Error table: With mmHg (15°C, 760mmHg as standard)]

		Unit:mm						
mmHg \ C°	900	800	760	700	600	500	400	
45	2.0	-1.3	-2.6	-4.6	-8.0	-11.3	-14.6	
35	3.0	-0.4	-1.8	-3.9	-7.3	-10.8	-14.2	
25	4.0	0.5	-0.9	-3.1	-6.6	-10.2	-13.7	
15	5.2	1.5	0.0	-2.2	-5.9	-9.6	-13.3	
5	6.3	2.5	1.0	-1.3	-5.1	-8.9	-12.7	
-5	7.6	3.7	2.1	-0.3	-4.2	-8.2	-12.2	

-15	9.0	4.9	3.2	0.8	-3.3	-7.4	-11.5
-----	-----	-----	-----	-----	------	------	-------

12.5 Atmospheric refraction and earth curvature correction

- Atmospheric refraction and earth curvature correction refers to correcting both the bending of the light beam caused by atmospheric refraction and the effect on the height differential and horizontal distance caused by the earth curvature.
- Correction called “atmospheric refraction and earth curvature correction” is initiated to correct error when the slope distance and vertical angle are caused to determine the horizontal distance and the height differential. With this instrument, the following formula is used to correct these factors.
- Calculation formula when atmospheric refraction and earth curvature correction parameter is set to “ON”:

Corrected horizontal distance (H)

$$H = S \left(\cos \alpha + \sin \alpha \frac{K-2}{2R_e} S \cos \alpha \right)$$

Corrected vertical distance (V)

$$V = S \left(\sin \alpha + \cos \alpha \frac{1-K}{2R_e} S \cos \alpha \right)$$

- Calculation formula when atmospheric refraction and earth curvature correction parameter is set to “OFF”:

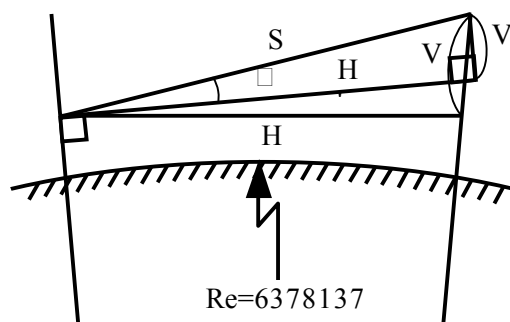
$$\begin{aligned} \text{Horizontal distance } H' &= S \cos \alpha \\ \text{Vertical distance } V' &= S \sin \alpha \end{aligned}$$

S: Slope distance

α : Vertical angle from horizontal

K: Atmospheric refraction coefficient (0.14 or 0.2)

R_e : Diameter of earth (6,370 km)



12.6 Distance range

Generally speaking, the maximum range which can be measured varies considerably depending on the atmospheric conditions. For this reason, the specifications illustrate the values for both good and normal weather conditions.

It is extremely difficult to judge when weather conditions are “Good” and when they are “Normal”. With this instrument, the conditions noted below are used to differentiate between the two situations (good weather conditions for surveying are different from normal weather conditions, and in surveying situations, cloudy skies are considered more favourable than sunny skies).

Weather conditions for measurement ranges are based on the following standard values:

Normal : Visibility of approximately 20 km, with slight shimmer and moderate wind.

Good : Visibility of approximately 40 km, overcast, with no shimmer and moderate wind.

12.7 Specifications

	R-422VN	R-423VN	R-425VN	R-435VN
Telescope				
Magnification	30×			
Effective aperture	45mm (EDM45mm)			
Resolving power	3.0"			
Field of view	1°30' (2.6%)			
Minimum focus	1.0m			
Focus	Manual			
Distance measurement				
Laser class	Visible Laser : Class IIIa (3R) (Reflectorless) / Class II (2) (Prism,sheet)			
Measurement range(Good conditions) ※3				
Reflectorless ※1	1.5~400m			
Reflector sheet ※2	1.5~600m(800m)			
Mini prism	1.5~1,600m(2,000m)			
1P	1.5~5,500m(7,000m)			
3P	1.5~7,000m(9,000m)			
Accuracy				
Prism / Reflector sheet	1.5~10m : ± (3+2ppm×D) mm, 10m~ : ± (2+2ppm×D) mm, Quick : ± (3+2ppm×D) mm ※5			
Reflectorless	1.5~300m : ± (5+2ppm×D) mm 300m~ : ± (7+10ppm×D) mm			
Minimum count	0.1mm(Fine mode), 1mm(Normal mode), 10mm(Track mode)			
Measuring time ※4				
Repeat meas.	Normal(1mm) :	Prism / Ref.sheet 2.0sec. Ref.less 2.0sec.		
	Quick(1mm) :	Prism / Ref.sheet 1.2sec. ※5		
	Track(10mm) :	Prism / Ref.sheet 0.4sec. Ref.less 0.4sec.		
Initial meas.	Normal(1mm) :	Prism / Ref.sheet 2.5sec. Ref.less 2.4sec.		
	Quick(1mm) :	Prism / Ref.sheet 1.7sec. ※5		
	Track(10mm) :	Prism / Ref.sheet 2.5sec. Ref.less 2.5sec.		
Angle measurement				
Measuring method	Absolute rotary encoder			
Detection method	Vertical / Horizontal angle : 2 sides		Vertical / Horizontal angle : 1 sides	
Minimum count	1"/5" selectable			
Accuracy (ISO 17123-3)	2"	3"	5"	
Compensator	3 AXIS	2 AXIS		
Target screw	1 speed			

Sensitivity of vials

Plate vial	30"/1 div.	
Circular level	8'/2mm	
Plummet	Visible laser : ±0.5mm (Instrument height : 1.5m)	
Base	Detachable	Shifting
Dust and Water Protection	IP56 (Instrument only)	
Ambient temperature	-20°C~+50°C/-4°F~122°F (Working range)	
Tripod thread	5/8"x11	M35 P2
Dimensions/Weight		
Dimensions	180(W)×342(H)×177(L)mm	
Weight(incl. Battery)	5.7kg	5.5kg
Carrying case	250(W) x 365(H) x 425(L)mm	
Battery pack BP02		
Power source	Ni-MH 4300mAh (Rechargeable) DC6.0V	
Operation time	Continuous approx.4.5hrs(ETH+EDM), 15hrs(ETH) with approx., 2.2hrs of charging time	
Weight	380 g	
Battery Charger BC03 and AC adapter AC01		
Input voltage(AC01)	AC 100~240V	
Output voltage(BC03)	DC7.5V	
Weight	280g	
Data Process		
Data recording method	Internal Memory	
Coordinates data ※6	45,000	
Special function	PowerTopoLite	
I/F	RS-232C, SD CARD, USB	
Display / keyboard		
Display type	Graphic LCD / 20 characters x 8 lines / 240 x 96 pixels	
Quantity	1 (2nd optional)	
Keys	22 each(12 numeric / 5 function / 5 special)	
Display back light	Intensity settings: 10 steps	
Laser Pointer	Yes	
Date clock	Yes	

NOTE :

- *1 The measurement range and accuracy of reflectorless, and time required to measure may vary by the shape, size of surface area and reflection rate of the target and its environment. The measurement range of reflectorless is determined by the white side of the Kodak Gray Card.
(KODAK is a trademark of Eastman Kodak Company)
- *2 Reflector sheet: PENTAX genuine Reflector sheet
- *3 The measurement range may vary by conditions of the environment.
Normal conditions: 20km visibility with slight shimmer Good conditions: 40km visibility, overcast, no heat, no shimmer and moderate wind.
- *4 EDM measuring time is determined in good conditions. It may takes longer than usual to measure the distance exceeding 4000m in prism mode and 300m in reflectorless mode.
Also the measurement time in reflectorless mode is influenced by the share, size and surface area and reflection rage of the target and its environment.
- *5 Quick mode, which functions with prism and reflector sheet, is effective only under normal mode(1mm) and up to 500m.
- *6 Number of points to be recorded may vary by usage.
Maximum number of point to be recorded per job site : 3000 points
Maximum number of job file to be recorded : 50 job files
Maximum data points to be sent from PC to the instrument: 3000 points

13. NOTICE TO THE USER OF THIS PRODUCT

To assure compliance with the Safety standard 21 CFR, Chapter 1., Subchapter J., the U.S. Bureau of Radiological Health requires the following information to be provided to user.:



It can be dangerous to look into the beam with optical equipment such as binoculars and telescopes.

13.1 Specifications of Laser Radiation




- A) The EDM module of the R-400V produces a visible light beam, which is emitted from the telescope objective lens and the centre hole of the instrument base plate. The R-400V is designed and built to have a laser diode radiating at 620-690nm.
- B) Radiant power
The R-400V is designed and built to radiate a maximum average radiant power of 4.75mW from the telescope. The user may be subject to this radiation as the beam continues operating until such time that the instrument is turned off.

13.2 The following labels are affixed to and must remain attached to this laser product.



WARNING

WARNING

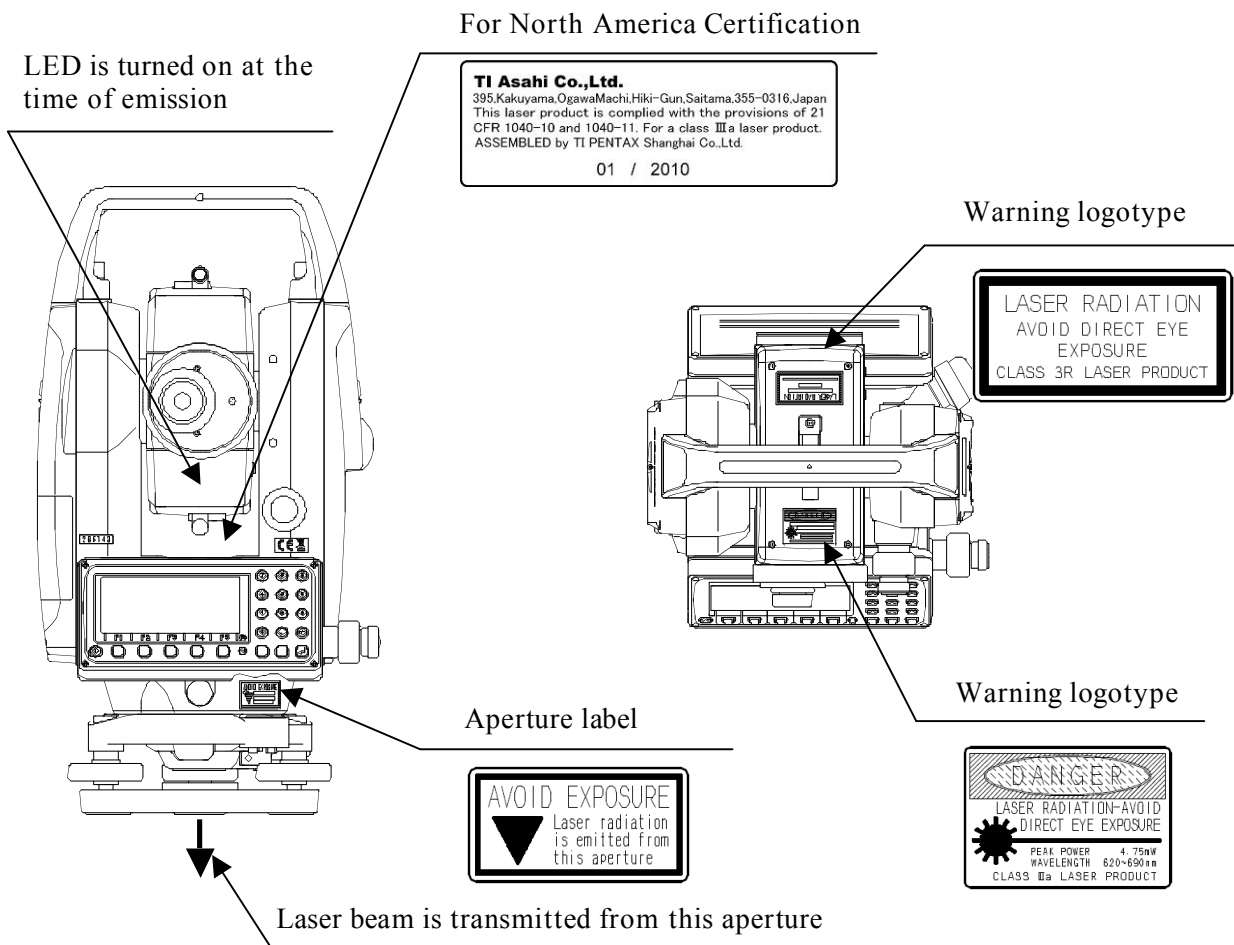
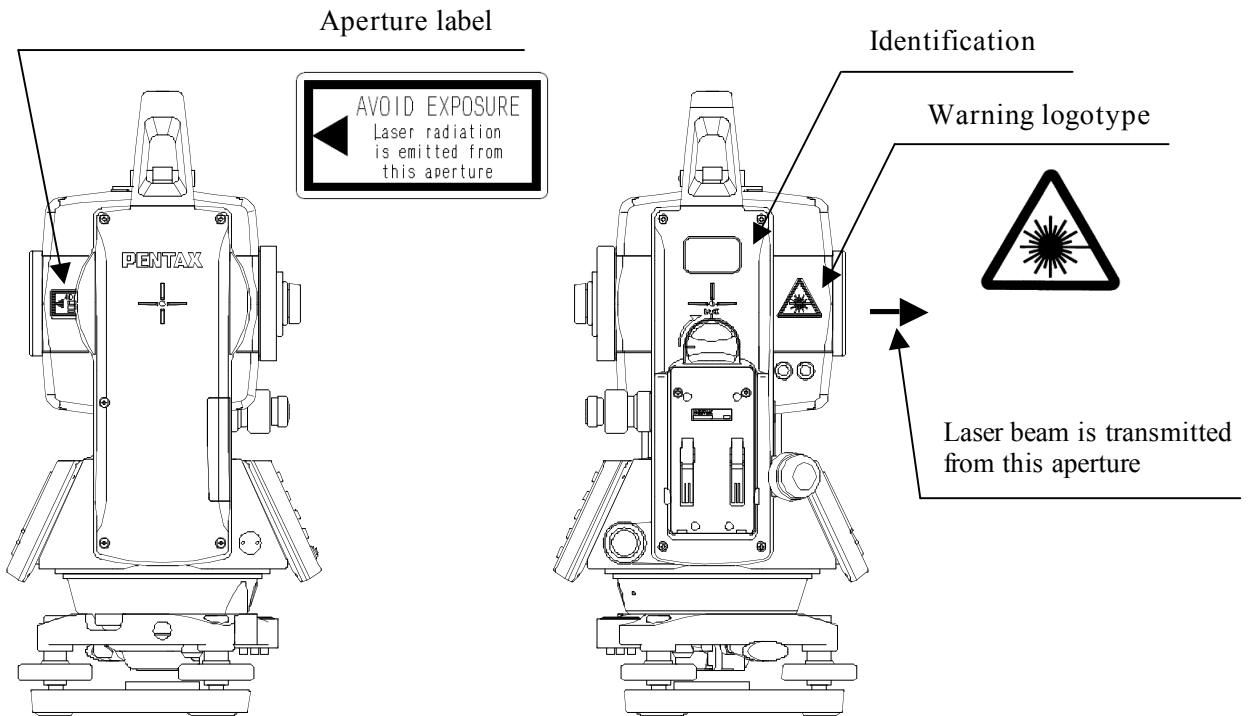
-  Do not stare into the laser beam directly as this may result in damage to your eyes.
-  R-400V is a Class IIIa (3R) Laser product. Do not look into the laser radiation aperture directly as this may result in damage to your eyes.
-  Never use the telescope to view intense light such as direct sunlight or sunlight reflected through a prism as this may result in loss of sight.

- A) The following Certification label is located near the Plate level: “This laser product is complied with the provisions of 21 CFR 1040.10 and 1040.11. For a Class IIIa laser product.”
- B) Caution label is located near the exit aperture: “AVOID EXPOSURE. Laser radiation is emitted from this aperture.”
- C) Warning logotype is located on the surface of the telescope: “CAUTION LASER RADIATION DO NOT STARE INTO BEAM”
- D) Warning label is located near the exit aperture.

13.3 Caution to maintain the safety in compliance with the standard

- A) To maintain the safety standard, refrain from any operation, maintenance, or adjustment other than described in this instruction manual.
- B) Operation, maintenance or adjustment other than those specified in this instruction manual may result in hazardous radiation exposure.
- C) Maintenance and repair not covered in this manual must be done by an authorized Pentax dealer.
- D) The Laser beam emission by the Distance measurement can be terminated by Pressing [ESC] key.
- E) Pressing [Laser] key and [F2] [RED MARK] key can terminate the laser beam emission by the laser pointer.
- F) The laser beam emission by the laser plummet can be terminated by pressing laser key and [F4] [PLUM.ADJ] key.

13.4 Labelling



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Printed in Belgium



JSIMA
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TIA201007

TOTAL STATION **R-400V** SERIES

INSTRUCTION MANUAL

POWERTOPOLITE
FOR R-400V SERIES

R-422VN
R-423VN
R-425VN
R-435VN



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PENTAX

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Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep in a convenient place for easy reference.

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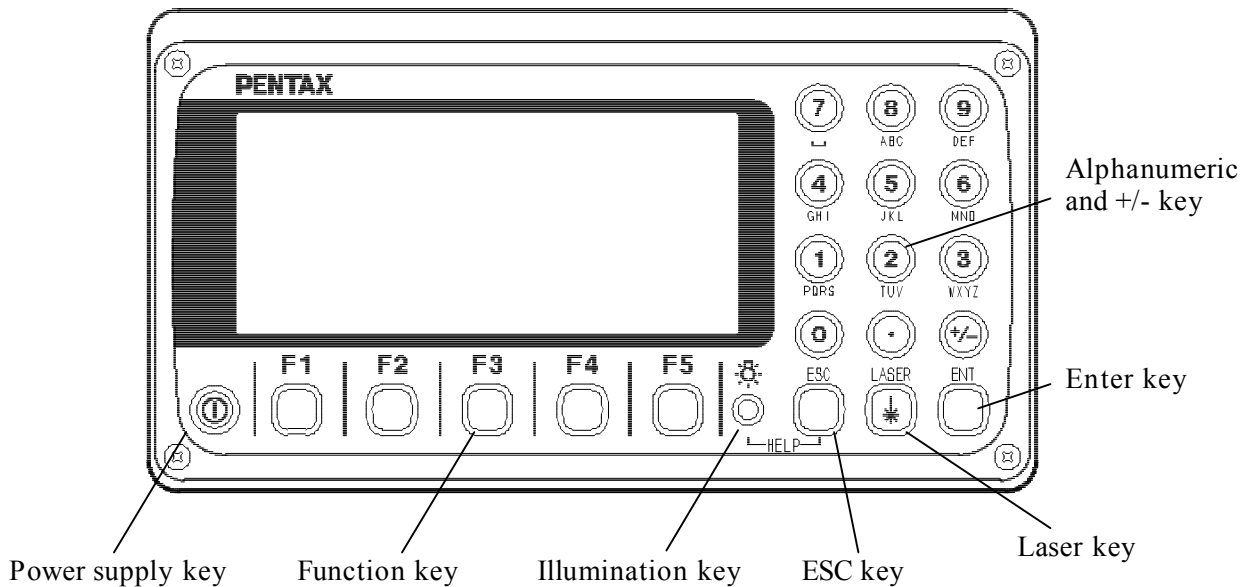
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DISPLAY AND KEYBOARD

- Basic display and keyboard of R-400V series are described below, and the function keys of PowerTopoLite are described in “2. ACCESSING POWERTOPOLITE”.



OPERATION KEY

Key	Description
[POWER]	ON/OFF of power supply.
[ESC]	Returns to previous screen or cancels an operation.
[ILLU]	Turns the illumination of the LCD display and telescope reticle on and off.
[ENT]	Accepts the selected (highlighted) choice or the displayed screen value.
[LASER]	Displays the laser plummet and the LD point screen when you push the Laser key.
[Alphanumeric]	At the numerical value screen, the numerical value and the sign “.” displayed are input. The English characters printed right under numeric of each key are input.
[HELP]	Pressing [ILLU]+[ESC] key causes a help menu to appear in MODE A or MODE B or causes a help message to appear.

FUNCTION KEY

[←]	F1	Moves the cursor to the left.
[→]	F2	Moves the cursor to the right.
[↑]	F3	Moves the cursor up.
[↓]	F4	Moves the cursor down.
[△]	F1	Goes back five items on the screen.
[▽]	F2	Goes forward five items on the screen.
[RETICLE]	F3	Changes the reticle illumination when pressing illumination key.
[LCD]	F4	Changes the LCD contrast when pressing illumination key.
[ILLU]	F5	Changes the LCD illumination when pressing illumination key.
[CLEAR]	F5	Clears the figure.
[SELECT]	F5	Opens the selection window.

- The Function keys of each PowerTopoLite function are described in “2. ACCESSING POWERTOPOLITE” and at each function.

Display combination of MODE A or MODE B

Function	MODE A	MODE B
F1	MEAS	S.FUNC
F2	TARGET	ANG SET
F3	0 SET	HOLD
F4	DISP	CORR
F5	MODE	MODE

- Mode A or Mode B is switched by pressing [F5] [MODE].

ALPHANUMERIC INPUT

The point name etc. is input by the alphanumeric keys as following.

Key	Letter under key	Letter & figure order to input
[0]		[@][.][_][-][:][/][0]
[1]	PQRS	[P][Q][R][S][p][q][r][s][1]
[2]	TUV	[T][U][V][t][u][v][2]
[3]	WXYZ	[W][X][Y][Z][w][x][y][z][3]
[4]	GHI	[G][H][I][g][h][i][4]
[5]	JKL	[J][K][L][j][k][l][5]
[6]	MNO	[M][N][O][m][n][o][6]
[7]		[][?][!][_][□][^][][&][7]
[8]	ABC	[A][B][C][a][b][c][8]
[9]	DEF	[D][E][F][d][e][f][9]
[.]		[.][,][:][;][#][()]
[+/-]		[+][-][*][/][%][=][<][>]

1. INTRODUCTION

1.1 Introduction

Thank you for your first look at PowerTopoLite by reading this manual.

The PowerTopoLite is a user friendly data collection and calculation program for the PENTAX R-400V Series Total Stations.

PowerTopoLite is developed based on PowerTopo, which is known as a versatile on-board software for PENTAX ATS Series Total Stations. The optimum combination of PowerTopoLite and R-400V hardware makes PowerTopoLite an easy and useful fieldwork tool.

The icon based main menu offers you the following possibilities.

- FILE MANAGER
- MEASURE
- VIEW AND EDIT
- FREE STATIONING
- STAKE OUT
- CALCULATIONS
- VIRTUAL PLANE MEASUREMENT
- REMOTE DISTANCE MEASUREMENT
- TRAVERSE
- TRANSFER
- PREFERENCE

1.2 Before using the PowerTopoLite manual

- **Memories in the instrument**

The R-400V series incorporates not only the PowerTopoLite surveying programs as the Special Function but also File Manager and Data Transfer Programs.

The internal memory of the instrument can store a maximum of 45.000 points of data.

- **Relations between the Memory and each Function**

Function	Read from the stored data	Write to the stored data
Measure	SP, BSP	SP, BSP, FP (SD)
Stake Out	SP, BSP, SOP	SP, BSP, SOP, OP
Point to Line	SP, BSP, KP1, KP2	SP, BSP, KP1, KP2, OP
Free Stationing	Each KP	Each KP, SP (CD)
Traverse	SP, BSP	SP, FP (SD)
VPM	SP, BSP, Each KP	SP, BSP, Each KP, CP (CD)

Station point:	SP	Foresight point:	FP	Backsight point:	BSP	Stake Out point:	SOP
Known point:	KP	End point:	EP	Observation point:	OP	Conversion data:	CD
Conversion point:	CP	Crossing point:	CRP	Surveyed data:	SD		

- IH stands for “Instrument Height” and PH stands for “Prism Height”.

- The PowerTopoLite manual mainly describes the R-400V special functions, and the basic operations are described in the (basic) R-400V manual. Therefore, refer to the R-400V basic manual regarding the R-400V general instrument operations.
The PowerTopoLite screens vary with the selections of the “Preference”.
The factory default settings of the Preference are shown there. It is also possible to select “Process type” that takes over the functionality of “PowerTopoLite” or “Structure type” that takes over the functionality of our past product in ”Action Method Selection”.

- The R-400V series instrument has a Job name of “PENTAX” and “COGOPoint” as its default setting. Each data is stored under “PENTAX” unless another new Job name is created. When another Job name is created, each data is stored in the new Job name.

- The input range of the X, Y and Z Coordinate is “-99999999.998” - “99999999.998”.

- The input range of the Instrument and Prism height is “-9999.999” - “9999.999”.

- The PC, PointCodeList, is added to the PN, Coordinates X, Y, Z and IH (PH or IH) and you can input your desired attributes for the point. If you have PointCodeList in the job named “PointCodeList”, you can easily select one of the PointCode from the list or edit one of them after pressing [ENT]. Please note, that Point Code, which is saved in the other job, can not be referred to as a list.

- There are two Coordinates types: Rectangular and Polar.
The RO, VO, DO, TO offset and the remote measurement are possible when you select the Rectangular Coordinates.
The RO, DO offset is possible when you select the Polar Coordinates.

- When you measure in EDM SETTINGS of COARSE TRACKING, the R-400V displays a distance value to two decimal places. However, distance data of polar coordinates are displayed by EDIT function to three decimal places, and sent, to four decimal places. So, “0” or “00” is added to the distance data after the third decimal point in COARSE TRACKING mode.

For example

Displayed value:	123.45
Displayed by EDIT:	123.450
Sent polar data:	123.4500

-
- Rectangular coordinates are displayed, stored, and sent to three decimal places even if in COARSE TRACKING or FINE MEASURE mode.

 - You can change the distance measurement mode during measuring operation by pressing the EDM key at the MEASURE and VPM functions.

 - The same Point Name of the plural polar points can be saved.

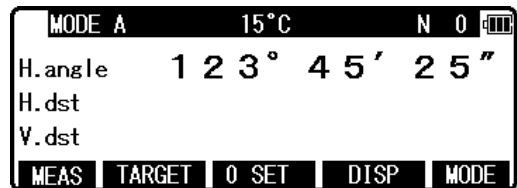
2. ACCESSING POWERTOPOLITE

2.1 How to access PowerTopoLite

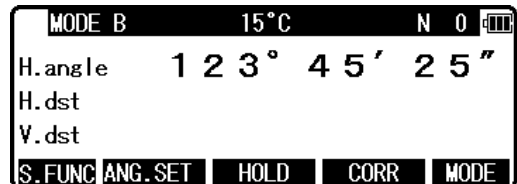
To access the R-400V Special Functions of the PowerTopoLite, perform the following procedures.

Press the [POWER] (ON/OFF) key to view the R-400V start-up screen.

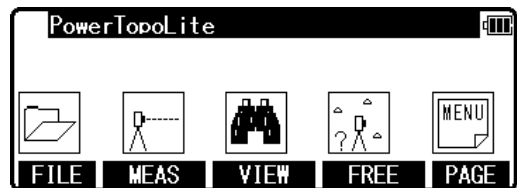
Then, change to MODE A screen.



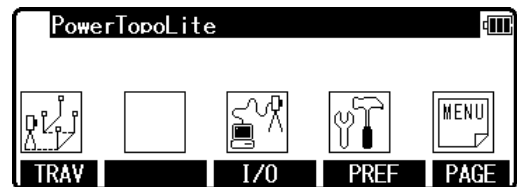
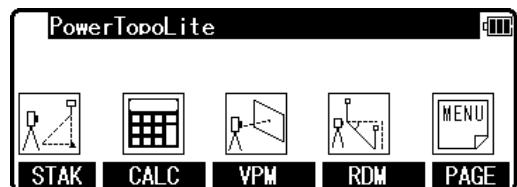
Press the [F5] [MODE] to view MODE B screen.



Press [F1] [S.FUNC] to view Functions of PowerTopoLite screen.



Press [F5] [PAGE] to view another Function combination of PowerTopoLite screen.



2.2 Allocation of each PowerTopoLite Function key

PowerTopoLite functions

KEY	Function	Description
F1	FILE	File Manager
F2	MEAS	Measure
F3	VIEW	View and Edit
F4	FREE	Free stationing

Next four Functions are viewed by pressing [F5][PAGE].

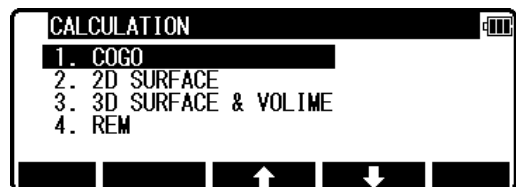
KEY	Function	Description
F1	STAK	Stake Out
F2	CALC	Calculation
F3	VPM	Virtual Plane Measurement
F4	RDM	Remote Distance Measurement

Last three Functions are viewed by pressing [F5][PAGE].

KEY	Function	Description
F1	TRAV	Traverse
F3	I/O	Input and Output
F4	PREF	Preference

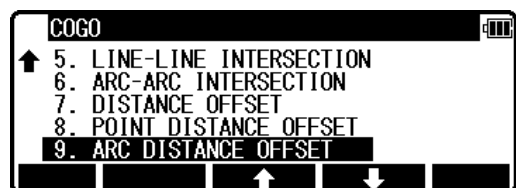
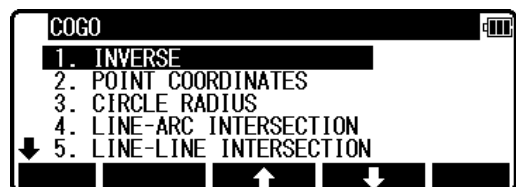
INVERSE, POINT COORDINATES, LINE-LINE INTERSECTION functions

CALCULATION screen is viewed by pressing [F2] [CALC]. The CALCULATION consists of COGO, 2D SURFACE and 3D SURFACE & VOLUME and REM functions.



COGO screen is viewed by selecting 1. COGO and pressing [ENT].

The COGO consists of INVERSE, POINT COORDINATES, CIRCLE RADIUS, LINE-ARC INTERSECTION, LINE-LINE INTERSECTION, ARC-ARC INTERSECTION, DISTANCE OFFSET, POINT DISTANCE OFFSET, ARC DISTANCE OFFSET, and functions.

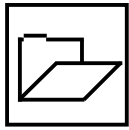


2.3 Typical Function keys of PowerTopoLite

Following function keys are typical of PowerTopoLite and each function key is described for each function in this Manual.

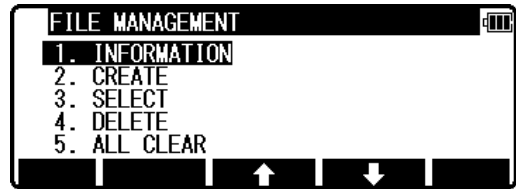
KEY	Description
PAGE	Views another function combination.
SELECT	Selects the Character and moves to next input at PN input etc.
ACCEPT	Enters the displayed values without new Coordinates value input etc.
INPUT	Inputs your desired Horizontal angle.
BSP	Views the BSP SETUP screen to input its Coordinates.
SAVE	Saves input data.
ME/SAVE	Measures and then saves input data.
EDIT	Changes the Point Name or Prism Height.
REMOTE	Views your aiming point Coordinates.
OFFSET	Views the Target Coordinates adding the offset values.
STATION	Returns to the STATION POINT SETUP screen.
H. ANGLE	Returns to the STATION POINT H.ANGLE SETUP screen.
LIST	Views the POINT SELECTION FROM THE LIST screen.
OTHER	Views the JOB LIST SEARCH screen.
ZOOM ALL	Returns to the original size.
ZOOM IN	Magnifies the graphics size.
ZOOM OUT	Reduces the graphics size.
DRAW	Views the GRAPHICAL VIEW screen.
DISP	Views point or point & graphic or point & point name or all.
DELETE	Views the POINT DELETION screen.
FIND PN	Views the PN search screen by inputting the point name.
ADD	Allows you to add more points for free stationing.
CALC	Starts the calculation of free stationing.
NEXT	Views the next known point Coordinates setup screen.
DATA	Views the TARGET POINT screen.
TARGET	Selects the Target type.
EDM	Selects the EDM settings.
ALL	Selects all points of the current job.
ORDER	The order of selected points.

3.FILE MANAGER



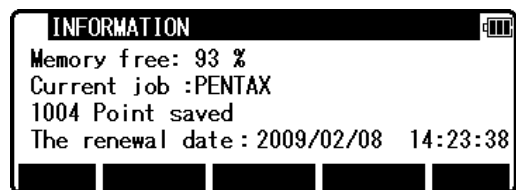
The Data storage memory status, Creating a new Job Name and the Selection and Deletion of a Job Name is executed by this function.

From the PowerTopoLite screen, press [F1] [FILE] to view the FILE MANAGEMENT screen.



3.1 Information of the remaining memory availability

Press [ENT] to view INFORMATION screen.

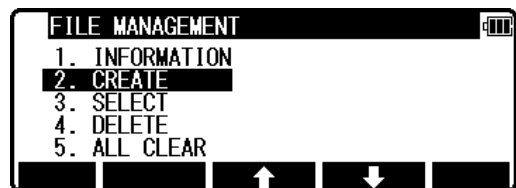


The remaining memory availability and a JOB Name PENTAX are viewed on the screen. The Job name “PENTAX” and “COGOPoint” are a default setting.

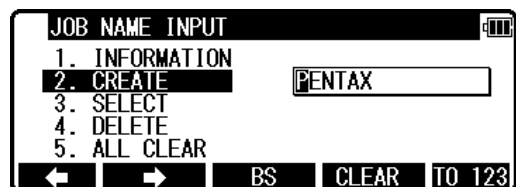
NOTE: Data being used in COGO will be updated in “COGOPoint” file from time to time. For more details, refer to “8.1 COGO”

3.2 Creation of a new Job

Select 2. CREATE by the down arrow key.



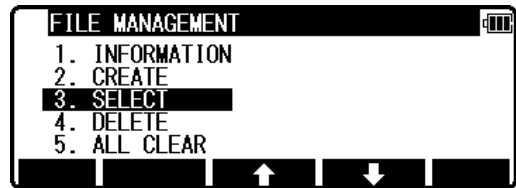
Press [ENT] to view the JOB NAME INPUT screen.



- The Job Name input method can be selected by the “Input method selection” of the “Preference”. This is the “10 KEY SYSTEM” input selection.
- If a new Job is created, the new data is stored in this new Job.

3.3 Selection of a Job Name

Select 3. SELECT by pressing the down arrow key.



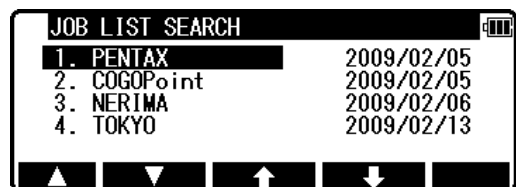
Press [ENT] to view the JOB SELECTION screen.



3.3.1 Selection of a Job

Select 1. JOB LIST SEARCH and press [ENT] to view its screen.

JOB LIST is a list of all stored Jobs.



Select your desired Job Name and press [ENT] to select.

3.3.2 Selection by a Job Name input

Select 2. JOB NAME SEARCH by pressing the down arrow key.

The JOB NAME SEARCH is the search by inputting your desired Job Name.



Press [ENT] to view the JOB NAME INPUT screen.



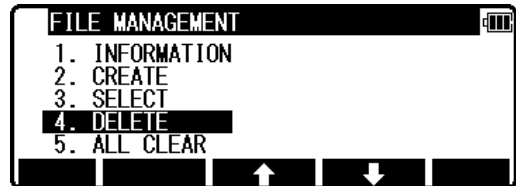
Input your desired JOB NAME and press [ENT] to view the JOB LIST SEARCH screen.



Press [ENT] to select this.

3.4 Deletion of a Job Name

Select 4. DELETE by pressing the down arrow key.



Press [ENT] to view the JOB DELETION screen.



3.4.1 Deletion from a Job List

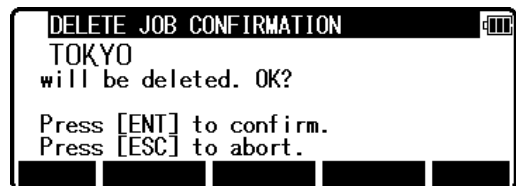
Select 1. JOB LIST SEARCH and Press [ENT] to view its screen.



If TOKYO is selected, deletion confirmation screen is viewed.



Press [ENT] to delete or [ESC] to abort.



3.4.2 Deletion from a Job Name search

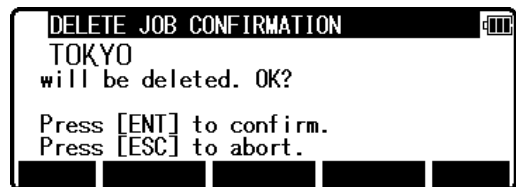
Select 2. JOB NAME SEARCH by pressing the down arrow key.



Press [ENT] to view the JOB NAME INPUT screen.



Input your desired JOB NAME to delete and press [ENT] to view the DELETE JOB CONFIRMATION screen.

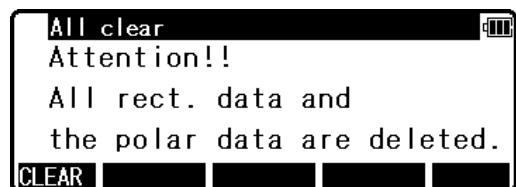


Press [ENT] to delete or [ESC] to abort.

The R-400V series has a Job Name “PENTAX” as its default setting. Therefore, each data is stored in “PENTAX” unless another new Job Name is created. When another Job Name is created, each data is stored in the new Job Name.

3.5 All Clear

Select 5. All Clear by pressing the down arrow key. Press [ENT] to view its screen.

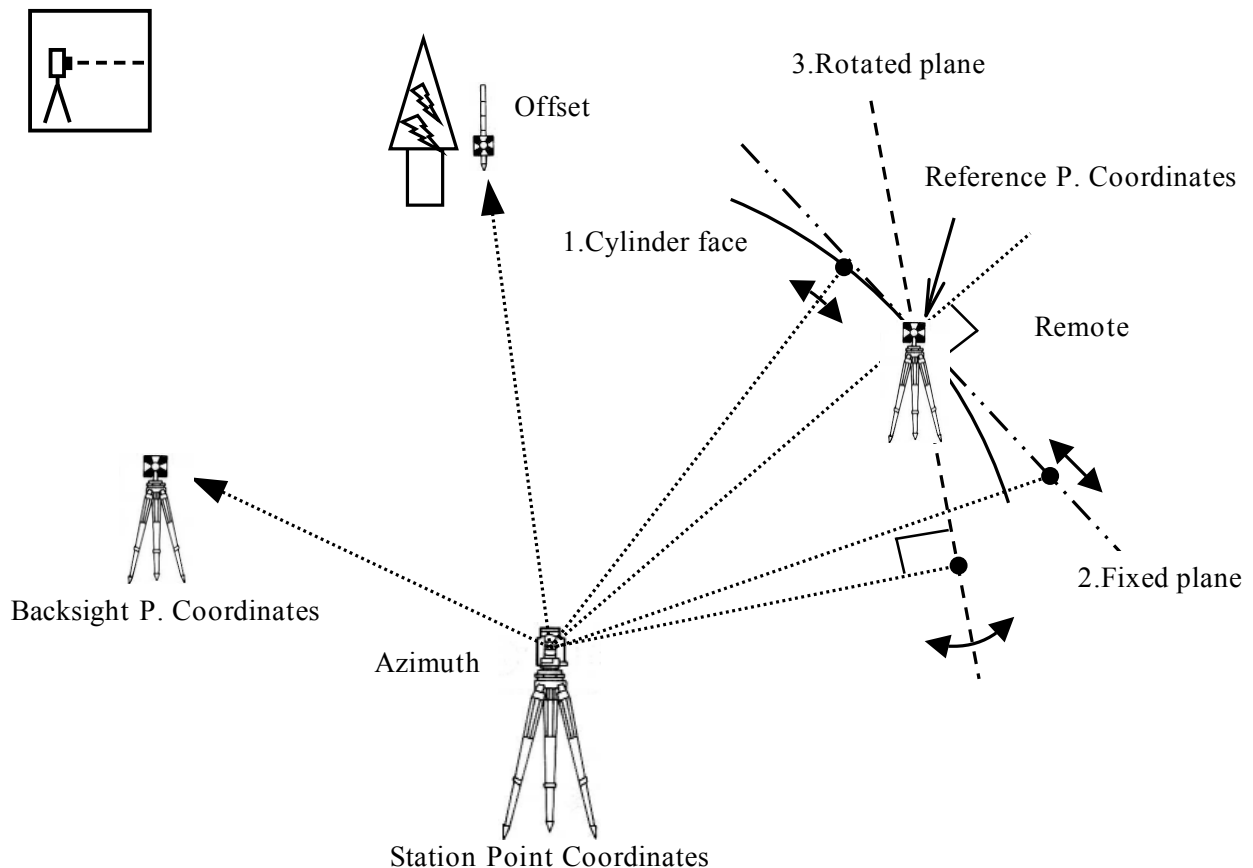


Warning: When [CLEAR] is pushed, all Job Files are deleted.

NOTE: - Creating several new JOB Files and writing-in or rewriting data on the same JOB Files repeatedly may cause the time of writing-in and rewriting of the data to be slower.
- Saving data when the memory capacity is almost full, and then deleting some JOB Files in order to secure open memory capacity, may cause the time of writing-in and rewriting the data to be slower.
- In case the time of writing-in or rewriting the data becomes slower, send the necessary data to PC for backup, then enter ‘All Clear’ in FILE MANAGER.

The above procedure will format the inside memory automatically and improve the time of writing-in and rewriting the data. Beware that all JOB Files will be deleted.

4. MEASURE



An operator can measure the Foresight Point Coordinates from the “Station Point Coordinates and Backsight Coordinates” or the “Station Point Coordinates and Azimuth”, and can store the Point Name and measured Coordinates in the memory. When the Coordinates of the Station Point and Backsight Point are already stored in the memory, the new Coordinates input can be omitted by calling or searching from the Point Name LIST.

The Point Name is within 15 characters and the Coordinates are within 8 in integer and 3 in decimal number. There are two Coordinates types: Rectangular and Polar Coordinates in this [MEASURE].

The Offset at the Target Point Measurement is possible and the Remote Measurement, by aiming at any point, is possible as well when you select the Rectangular Coordinates.

An operator can perform the [MEASURE] function only when the Telescope is at the “Face left position”.

Select the Target type before performing the [MEASURE].

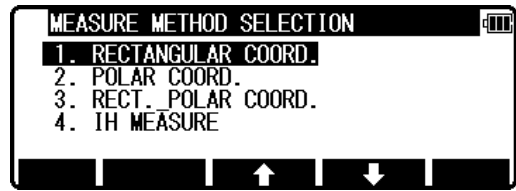
After measuring rectangular coordinates by [MEASURE] function of PowerTopoLite, it is possible to display Angle and Distance by switching the [F3][ANG&DIST] key.

When Remote Mode is selected, Angle and Distance are also calculated according to the Coordinates of the Aiming Point on real time.

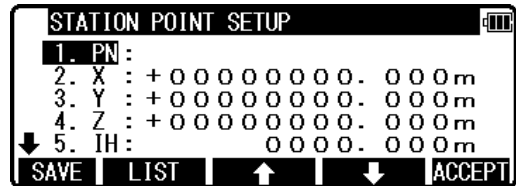
When offset mode is selected, Angle and Distance are also calculated according to the Coordinates where offset value is added.

4.1 Station setup [By Rectangular Coordinates]

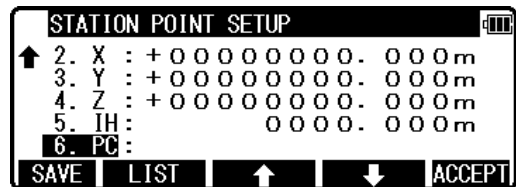
Press [F2] [MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.



Select 1.RECTANGULAR COORD. and press [ENT] to view the STATION POINT SETUP screen.



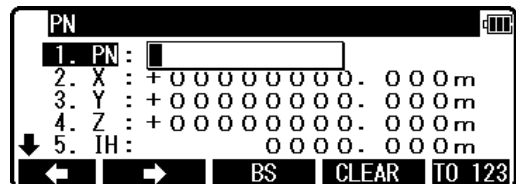
The [↑] / [↓] mark is used to scroll up / down. “6. PC” is viewed by scrolling down.



4.1.1 Point Name input

Select 1. PN to display the PN input screen.

[ENT] is used for both accepting the selected choice and opening the input screen of the Coordinates values, etc.

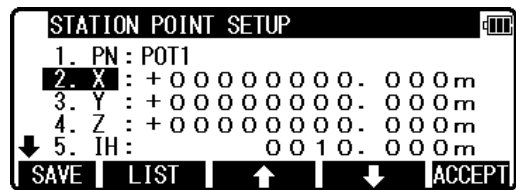


Input your desired point name by pressing keys, and after all Characters are input, press [ENT].

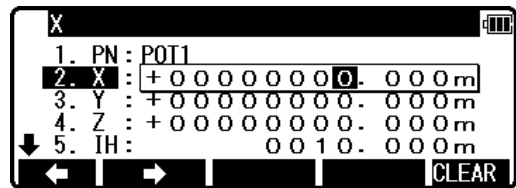
Four character selection methods are available. (Refer to the “13.3 Input method selection”)

4.1.2 Coordinates, X, Y, Z, IH, and PC input

It goes to 2. X coordinate automatically.

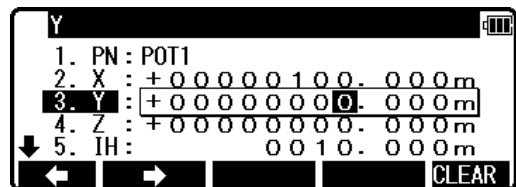


Press [ENT] to view the X coordinate input screen. Input X, Y and Z coordinates, IH and PC as follows. Input your desired X coordinate value by pressing keys.



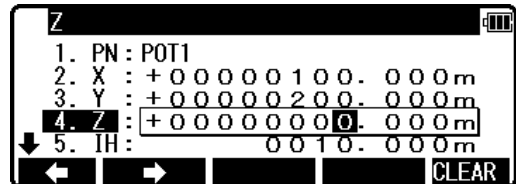
Y coordinate:

Press [ENT] to view the Y coordinate input screen. Input your desired Y coordinate value by pressing keys.



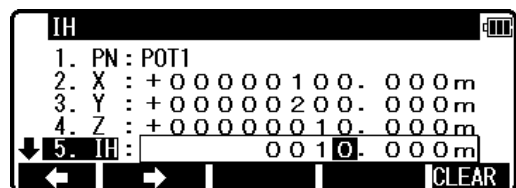
Z coordinate:

Press [ENT] to view the Z coordinate input screen. Input your desired Z coordinate value by pressing keys.



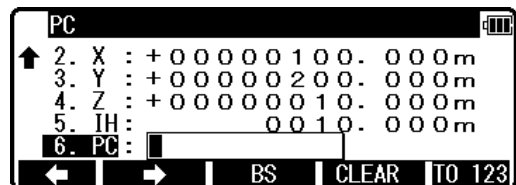
IH value:

Press [ENT] to view the IH screen. Input your desired IH value by pressing keys.



PC, Point Code:

Press [ENT] to view and input the PC screen.

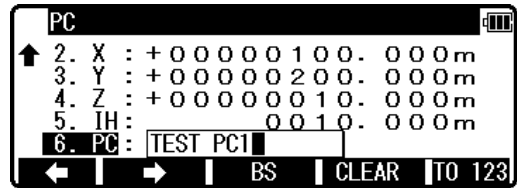


If Point Code exists, you can easily select it from the list.

For using PointCodeList, please refer to “5.4.1 Point Code”.



After pressing [ENT], you can edit Point Code data.



Input your desired PC name by pressing keys, and press [ENT] to view next screen.

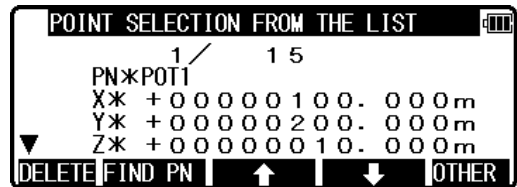
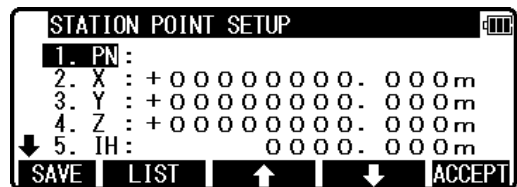
If “PROCESS TYPE” is selected in “Action method selection”, after input/confirm PC data, the input POT1 data will automatically be stored in the memory. Then the panel “STATION POINT H.ANGLE SETUP” will be displayed.

But, if “STRUCTURE TYPE” is selected in “Action method selection”, it is necessary to press [ACCEPT] to proceed to next panel.

4.1.3 Point selection from the list

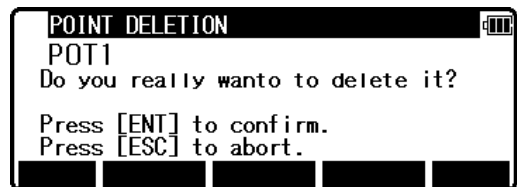
Inputting coordinate information can be done manually and also by calling known points.

Press [F2] [LIST] on STATION POINT SETUP screen to display POINT SELECTION FROM THE LIST screen



- [DELETE] Key
To delete the points being displayed

Press [F1] [DELETE] to display POINT DELETION screen.



Press [ENT] to delete the selected point from job file.
Press [ESC] to return STATION POINT SETUP.

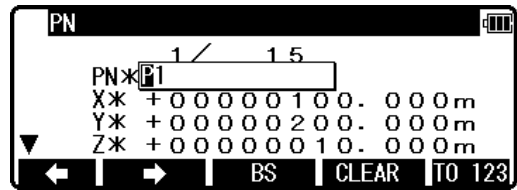
- [OTHER] Key
To select the Job File to be listed



Press [F5] [OTHER] to display JOB LIST SEARCH screen, then select the Job File.

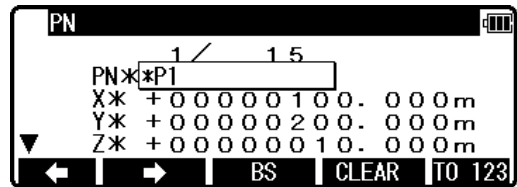
- [FIND PN] Key
To search PN from key word

Press [F2] [FIND PN] to display PN input screen, then input key word.



NOTE: Searching a point by adding “*” to the initial of the key word enables you to list point data with PN including a string after “*”

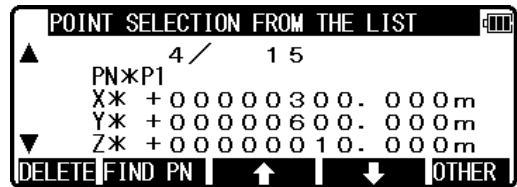
For instance, if you need to search a point including “P1” in PN, input “*P1” in the key word, then press [ENT].



Select the point from the list

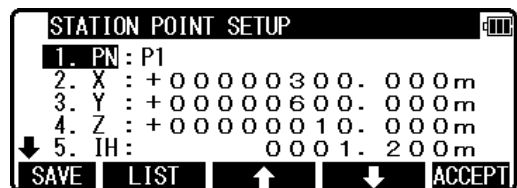


Press [ENT] to display the point that matches the key word.



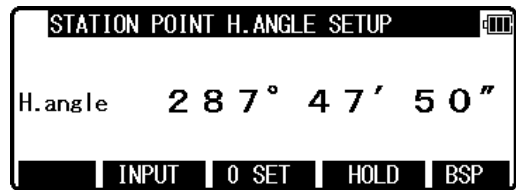
- [↑] / [↓] Key
To switch to the point to be displayed.

When the point you want is displayed, press [ENT] to finalize input.



4.2 Station Orientation

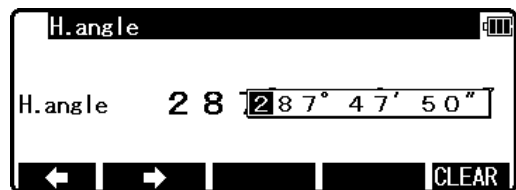
Press the [F5] [ACCEPT] to view the STATION POINT H.ANGLE SETUP screen.



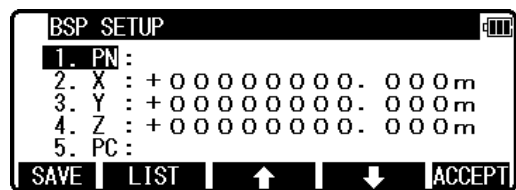
Please note, that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.

Input the H.angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Reference Point Coordinates by pressing [F5] [BSP].

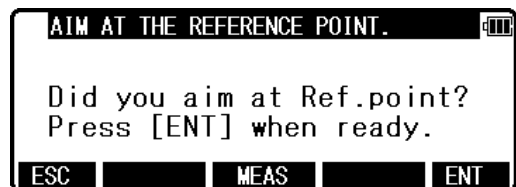
- [INPUT] Key
Enter any horizontal angle.
Press [ENT] to view the BSP SETUP screen.



- [BSP] Key
The Back Sight Point information is obtained.
Press [ENT] to finalize input.



Press [ENT] or [F5] [ACCEPT] to view the AIM AT THE REFERENCE POINT screen.

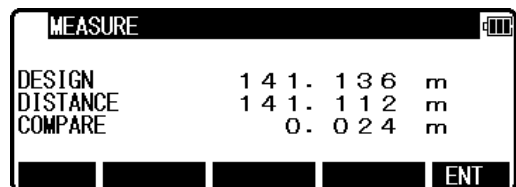


Press [F5] [ENT] to finalize BSP.

Press [F1] [ESC] to redo input.

If you want to make measure to check the point to be aimed, press [F3] [MEAS] to display MEASURE screen.

Press [F3] [MEAS] to make the distance measurement. DESIGN DISPLAY screen appears when the distance measurement is done. Compare design value with measured value.



When “PREFERENCE” of “12. BOTH FACES MEAS” is on, measure the distance at the normal and reverse position.

The measured value to be displayed is the average of measured values measured in normal and reverse position.

4.3 Multiple Orientation

Aim at the reference point , then press [ENT] to enter Multiple Orientation.

```

ADD Ref. Point
ADD Ref. Point ?
NO OK
    
```

Pressing [F1] [NO] of “ADD Ref. Point screen immediately takes you to 4.4 measure screen.
Pressing [F5] [OK] goes to BSP SETUP screen.

```

BSP SETUP
1. PN:
2. X : +000000000. 000m
3. Y : +000000000. 000m
4. Z : +000000000. 000m
5. PC:
SAVE LIST ↑ ↓ ACCEPT
    
```

The same procedure as mentioned in “4.2 Station Orientation” will proceed.
Press [F3] [MEAS] to go to BSP CONFIRM.

```

AIM AT THE REFERENCE POINT.
Did you aim at Ref.point?
Press [ENT] when ready.
ESC MEAS ENT
    
```

Pressing [F5] [ENT] takes you to DESIGN DISPLAY

```

DESIGN DISPLAY
DESIGN      141.136 m
DISTANCE    141.112 m
COMPARE     0.024 m
ESC ENT
    
```

Designed Data: the present angle according to the first orientation.

Calculated Data: the calculated data according to the second orientation.

Average: the average value of designed data and calculated data.

ESC: The present angle doesn't change.

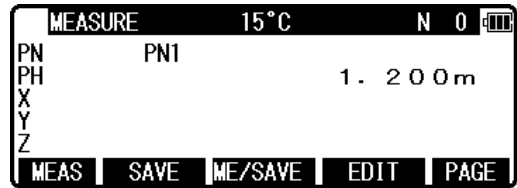
ENT: The present angle is changed to the calculated data.

```

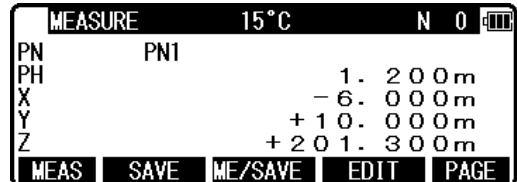
BSP CONFIRM
Designed Data. 287° 47'50"
Calculated Data. 287° 47'30"
Average        287° 47'40"
ESC ENT
    
```

4.4 Function of MEASURE screen

Press [ENT] to display the MEASURE screen



Press [F1] [MEAS] to measure the Distance and display the Coordinates.



Press [F2] [SAVE] to save the measured data.

Press [F3] [ME/SAVE] to measure and save the measured data.

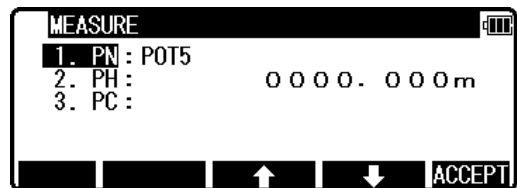
The survey data is not saved if no PN is input.

Press [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

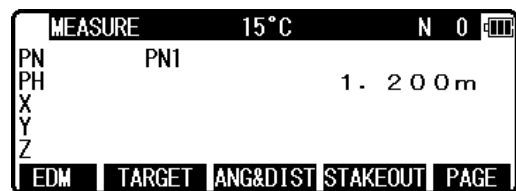
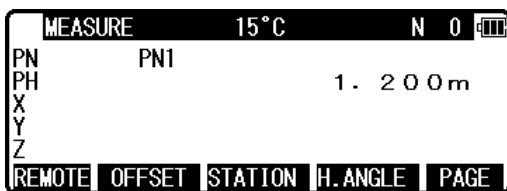
Input your desired Point Name, Prism Height and Point Code.

Press [F5] [ACCEPT] if the current PN, PH and PC are acceptable.

If Point Code exists, you can easily select them from the list or edit one of them after pressing [ENT]. For using Point Code List, please refer to "5.4.1 Point Code".

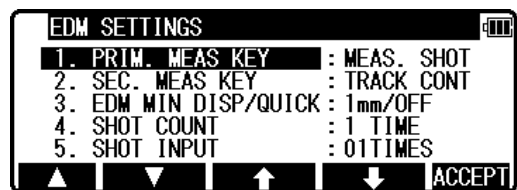


Press [F5] [PAGE] to view another menu.



EDM settings can be selected by pressing [F1] [EDM].

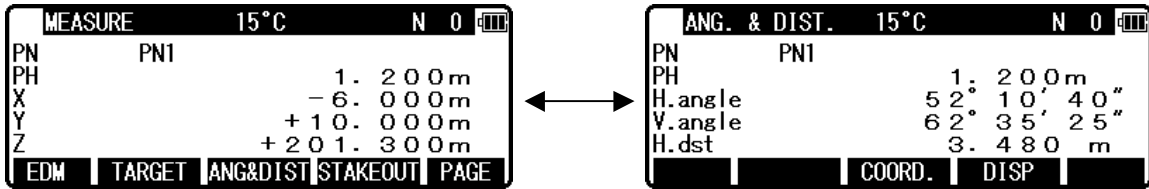
For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).



The target type can be selected by pressing [F2] [TARGET].

Coordinates display and Angle & Distance display

- 1) Press [F5] [PAGE] twice to view [F3] [ANG & DIST].
- 2) Press [F3] [ANG & DIST] to view [F3] [COORD.] and Angle and Distance values.
- 3) Press [F3] [COORD.] to view [F3] [ANG&DIST] and Coordinates.



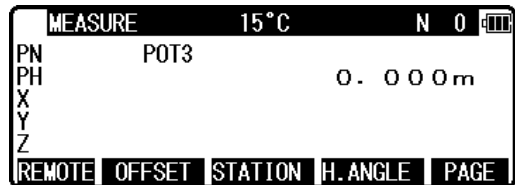
Stake Out can be selected by pressing [F4] [STAKEOUT].

4.5 Remote, Offset, Station, and H. angle function

4.5.1 Remote

Press [F5] [PAGE] to view another MEASURE menu.

Press [F1] [REMOTE] once and then quickly press this key again to measure your desired point Coordinates by moving the telescope.



The displayed Coordinates automatically change according to your aiming point.

The Remote is a function of, so to speak, “Real-time offset”. If a reference point or offset point is measured, the Coordinates of your aiming point are calculated based on the reference plane.

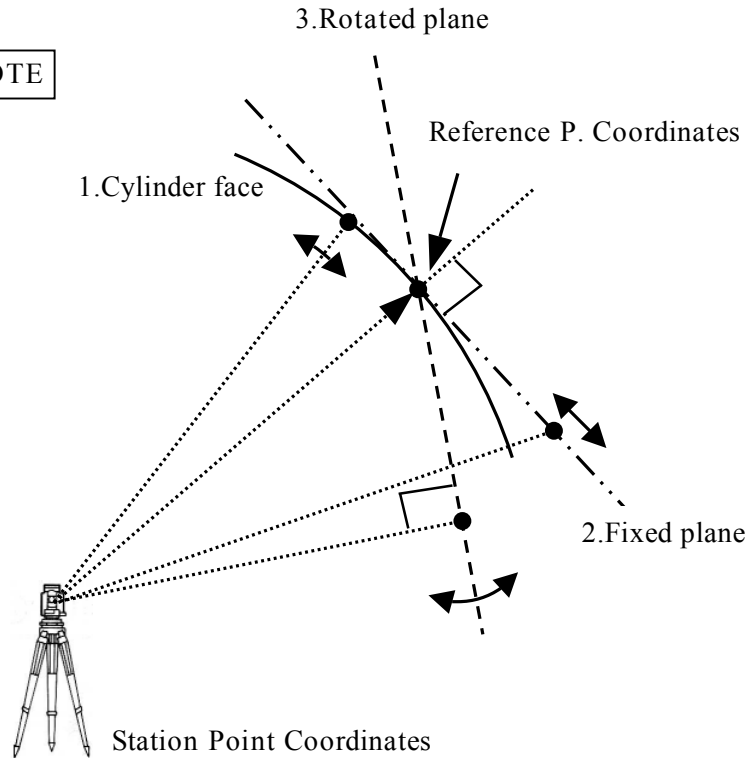
There are three calculation methods: Cylindrical face, Fixed plane and Rotated plane.

They are selected by “13. Preference”. Refer to “13.5 Remote method selection”.

The calculations are performed on the virtual planes.

To quit the Remote measurement, press [F1] [REMOTE] twice again.

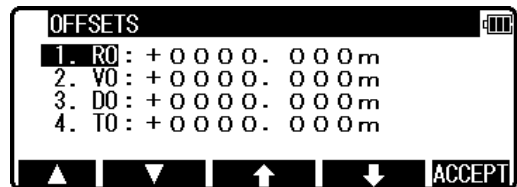
REMOTE



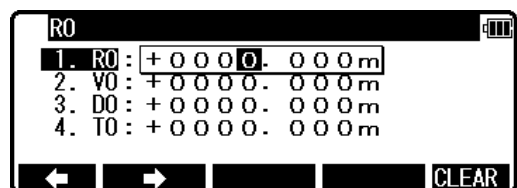
4.5.2 Offset

Press the [F2] [OFFSET] to view the OFFSETS screen.

Offset enables you to work with Offsets. The following offsets are available.



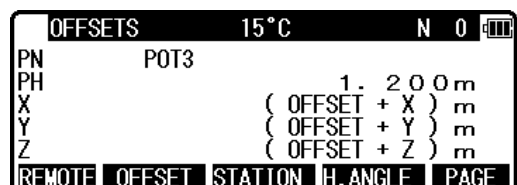
Press [ENT] to view the offset input window. Input the RO offset value by pressing keys. VO, DO and TO values are input in the same manner.



After input "TO" value, press [ENT] to view the MEASURE screen.

(Or press [ESC] then press [ACCEPT].)

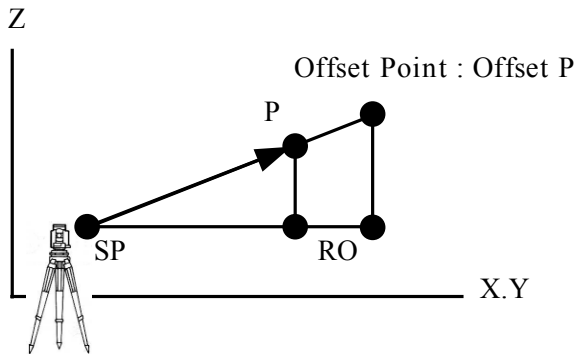
The offset values are added to X, Y and Z values.



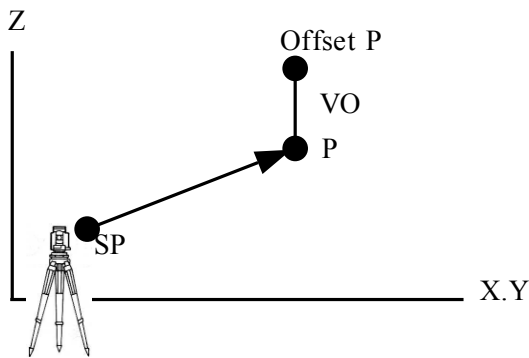
The input value of Offset is cleared when you save the surveying point and step forward to the next surveying point.

RO: Radial Offset

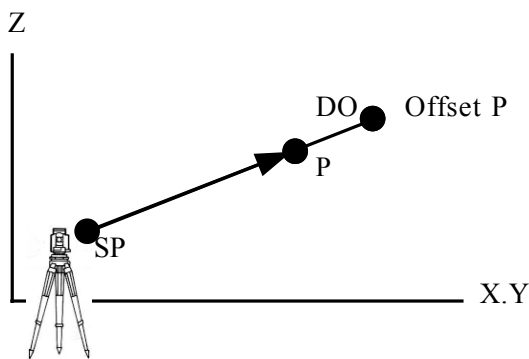
(RO: On the horizontal plane. Offset P: Along the line of measurement, thus along the slope)



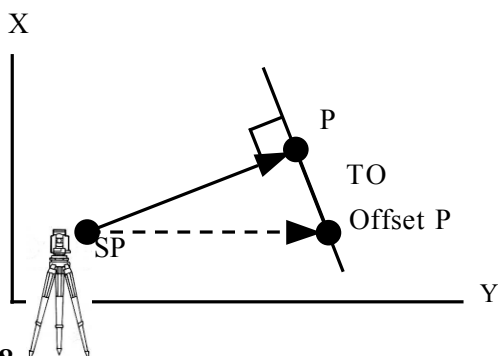
VO: Vertical Offset (Along the third axis)



DO: Distance Offset (Along the line of measurement, thus along the slope)

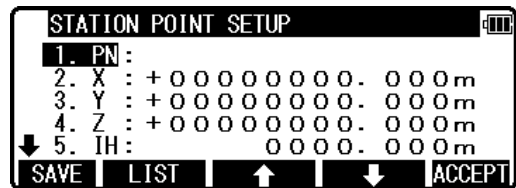


TO: Tangential offset (TO: On the horizontal plane, perpendicular to the horizontal line between Station and Point. Offset P: Along the slope)



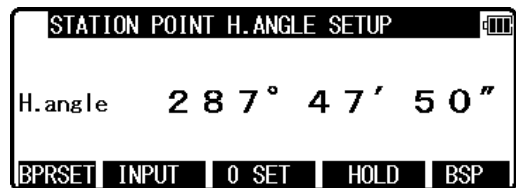
4.5.3 Station

Press [F3] [STATION] to return to STATION POINT SETUP screen.



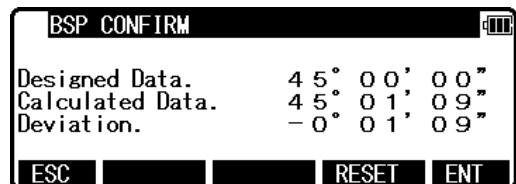
4.5.4 H. angle

Press [F4] [H.ANGLE] to return to STATION POINT H. ANGLE SETUP screen.



Press [ENT] to view the MEASURE screen.

- [BPRSET] key
Deviation of Back Sight Point can be seen.
Press [F1] [BPRSET] key to display BSP CONFIRM screen.



“Designed Data” represents the horizontal angle of the current Back Sight Point.
 “Calculated Data” represents the horizontal angle of the direction that R-400V is facing.
 “Deviation” represents deviation of “Calculated Data”.

If you accidentally move the instrument during the measurement, the amount of error can be checked on this screen.

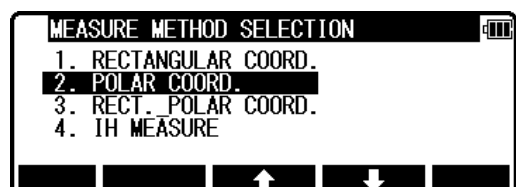
If the instrument is significantly moved, press [F4] [RESET] to reset Back Sight Point at the current position.

If the amount of error is small, press [F5] [ENT] to return to MEASURE screen.

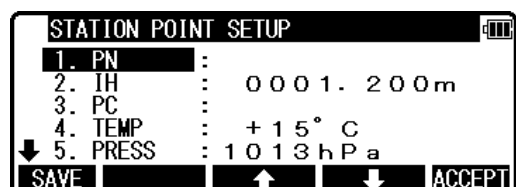
4.6 Station setup [By Polar Coordinates]

The same Point Name of the plural polar points can be saved.

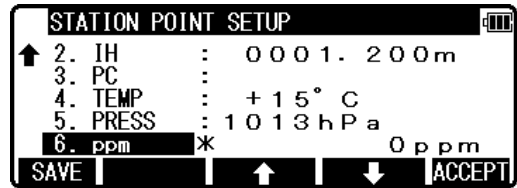
Press [F2] [MEAS] of the PowerTopoLite screen to view the MEASURE METHOD SELECTION screen.



Select 2. POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.



The [↑] / [↓] mark is used to scroll up / down.

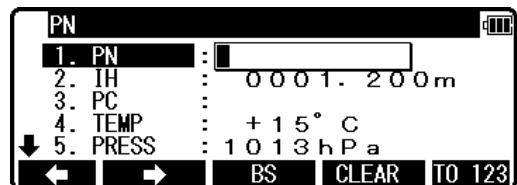


4.6.1 Point Name input

Select 1.PN to display PN input screen.

Input PN value.

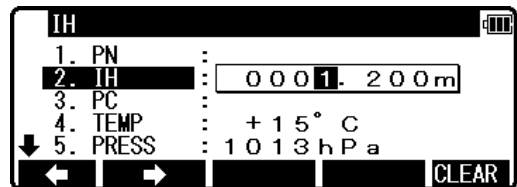
Press [ENT].



4.6.2 IH, TEMP, PRESS, ppm and PC input

Input IH value.

Press [ENT].

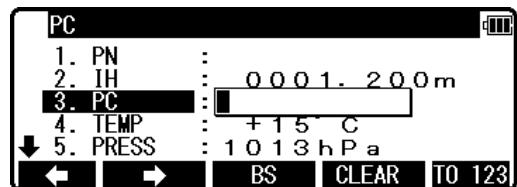


Input the PC.

Press [ENT] to view and input the PC, Point Code, screen.

If Point Code exists, you can easily select it from the list or edit one of them after pressing [ENT].

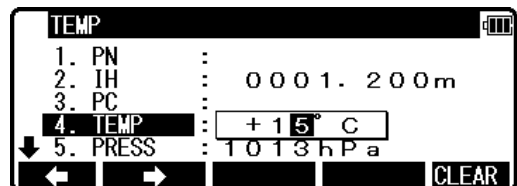
For using Point Code List, please refer to “5.4.1 Point Code”.



Whichever you select PROCESS TYPE or STRUCTURE TYPE, Pressing [SAVE] or [ACCEPT] proceeds to next screen

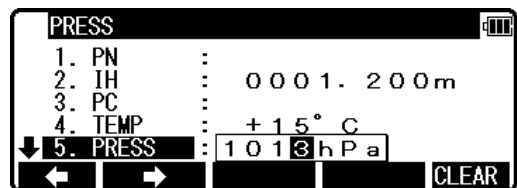
Input the TEMP value.

Press [ENT].

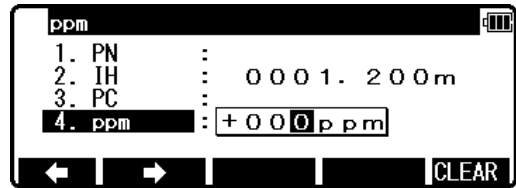


Input the PRESS value.

Press [ENT].



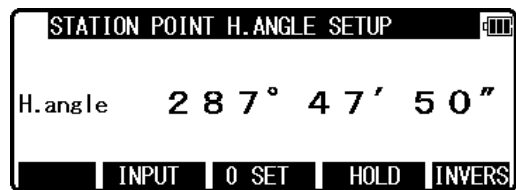
Input ppm value.
Press [ENT].



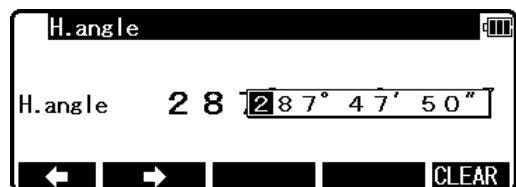
TEMP, PRESS and ppm input depend on the “Initial setting 1”
(ATM INPUT, ppm INPUT, NIL).

4.7 Station Orientation

Press the [F5] [ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.
Input your desired H.angle.



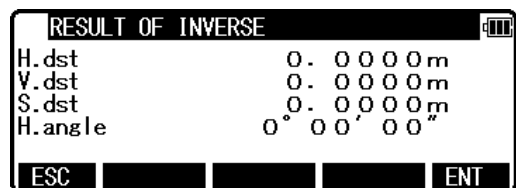
- [INPUT] key
Input your desired H.angle.
Please note, that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.



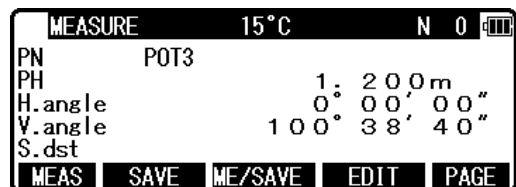
- [INVERS] key
If you want to calculate direction angle, Press [F5][INVERS] to jump to INVERSE function.
Input SP as Station Point, EP as Back Sight Point.



Result angle is set here automatically by pressing [ENT] at RESULT OF INVERSE screen.

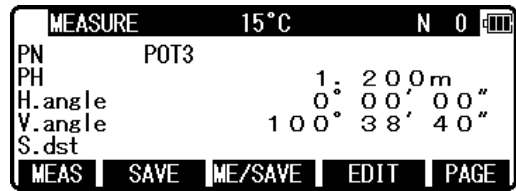


Press [ENT] after aiming back sight point.
Aim at the reference point, then press [ENT] to enter multiple orientation. For more details, refer to “4.3 Multiple Orientation”. After the multiple orientation is completed, the screen moves to MEASURE screen.

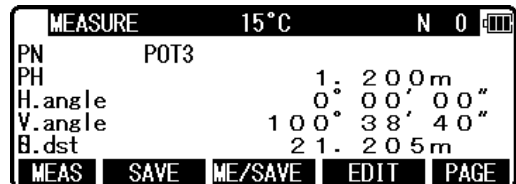


4.8 Function of MEASURE screen

Aim at the reference point and press [ENT] to view the MEASURE screen.



Press the [F1] [MEAS] to measure and display the Distance.



Press [F2] [SAVE] to save the measured data.

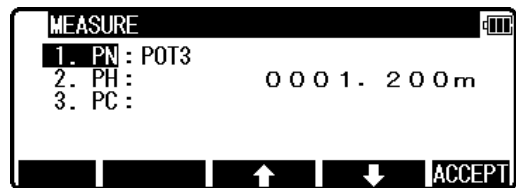
Press [F3] [ME/SAVE] to measure and save the measured data.

No survey data is saved when no PN is input.

Press [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

Press [ENT] to view each input window by pressing up or down arrow key, and input your desired point name or prism height or point code.

Press [F5] [ACCEPT] if the current PN, PH and PC are acceptable.

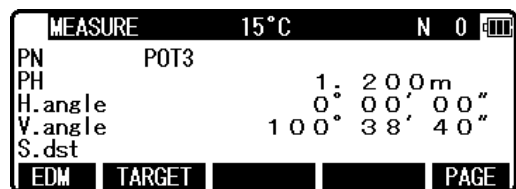
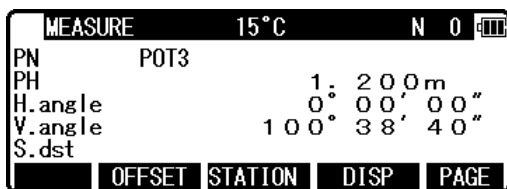


PC, Point Code:

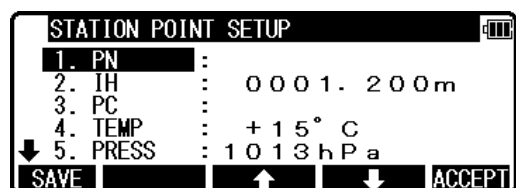
Press [ENT] to view and input the PC, Point Code, screen.

If Point Code exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using PointCodeList, please refer to "5.4.1 Point Code".

Press [F5] [PAGE] to view another menu.

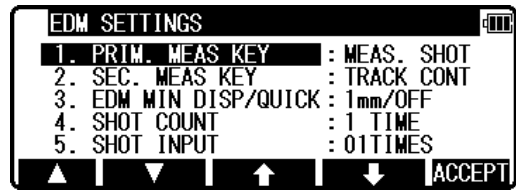


Station point setup can be changed by pressing [F3] [STATION].



EDM settings can be selected by pressing [F1] [EDM].

For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).

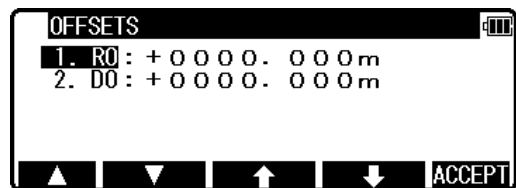


The target type can be selected by pressing [F2] [TARGET].

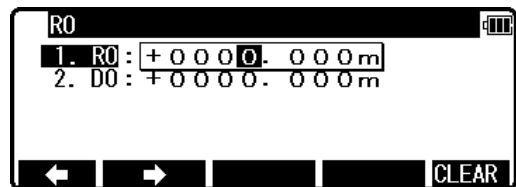
4.9 Offset

Press the [F2] [OFFSET] to view the OFFSET screen.

Offset enables you to work with Offset. The following Offsets are available.

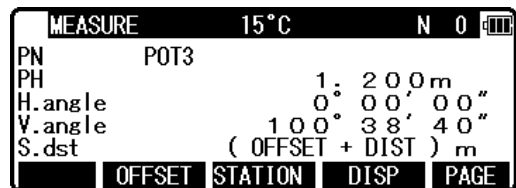


Press [ENT] to view the offset input window. Input the RO offset value by pressing each keys. DO values are input in the same manner.

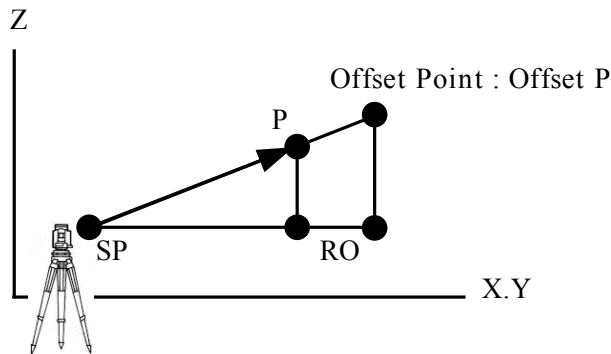


Press [ENT] and then [ACCEPT] to view the MEASURE screen. The S.dst (slope distance) is adjusted by input offset value.

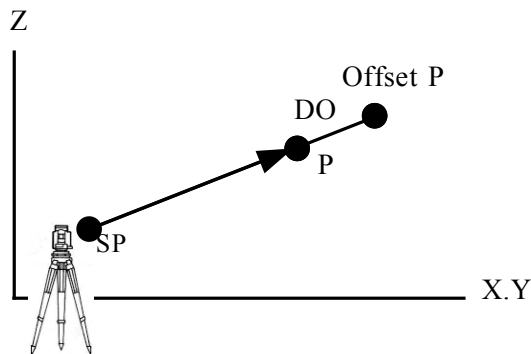
The input value of offset is cleared when you save the surveying point and step forward to the next surveying point.



RO: Radial Offset (RO: On the horizontal plane. Offset P: Along the line of measurement, thus along the slope)



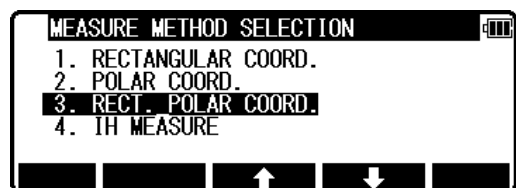
DO: Distance Offset (Along the line of measurement, thus along the slope)



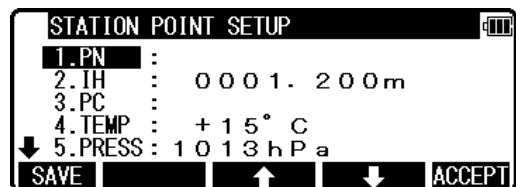
4.10 Station setup [By Rectangular & Polar Coordinates]

Rectangular Data and Polar Data can be stored at the same time in this function.

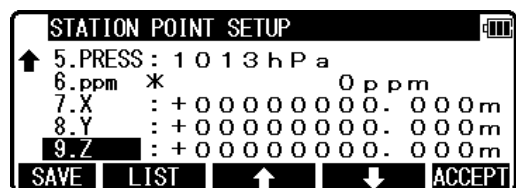
Press [F2] [MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.



Select 3. RECT. POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.



The [↑] / [↓] mark is used to scroll up / down.

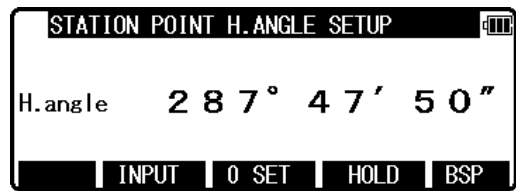


Input the necessary parameters.

For more details on input procedure, refer to “4.1 Station setup [By Rectangular Coordinates]” and “4.5 Station setup [By Polar Coordinates]”

4.11 Station Orientation

Press the [F5] [ACCEPT] to view the STATION POINT H.ANGLE SETUP screen.



Please note, that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.

Input the H.angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Reference Point Coordinates by pressing [F5] [BSP] (Refer to “4.2 Station Orientation”). Aim at the Reference Point, then press [ENT] to enter Multiple Orientation. For more details, refer to “4.3 Multiple Orientation”.

4.12 Function of MEASURE screen

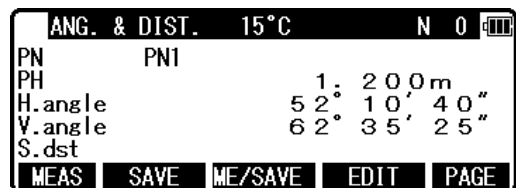
Press [ENT] to display MEASURE screen.

Two screens; “MEASURE” and “ANG. & DIST” are displayed and the screen to be displayed first can be set within “PREFERENCE “ of “11. MEAS. DISPLAY”

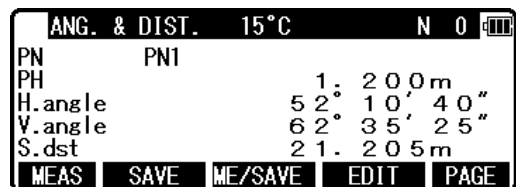
In default, “ANG.& DIST” screen is displayed.

For more details, refer to “13.11 Meas. Display”

Coordinates display and Angle & Distance display. Aim at the Reference Point and press [ENT] to view the MEASURE screen.



Press [F1] [MEAS] to measure the Distance and display the Coordinates.



Press [F2] [SAVE] to save the measured data.

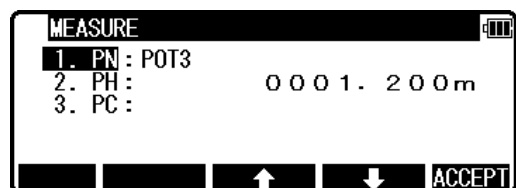
Press [F3] [ME/SAVE] to measure and save the measured data.

No survey data is saved when no PN is input.

Rectangular Data and Polar Data are saved with the same Point Name in the same Job File.

Press [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

Press [ENT] to view each input window by pressing up or down arrow key, and input your desired Point Name or Prism Height or Point Code. Press [F5] [ACCEPT] if the current PN, PH and PC are acceptable.

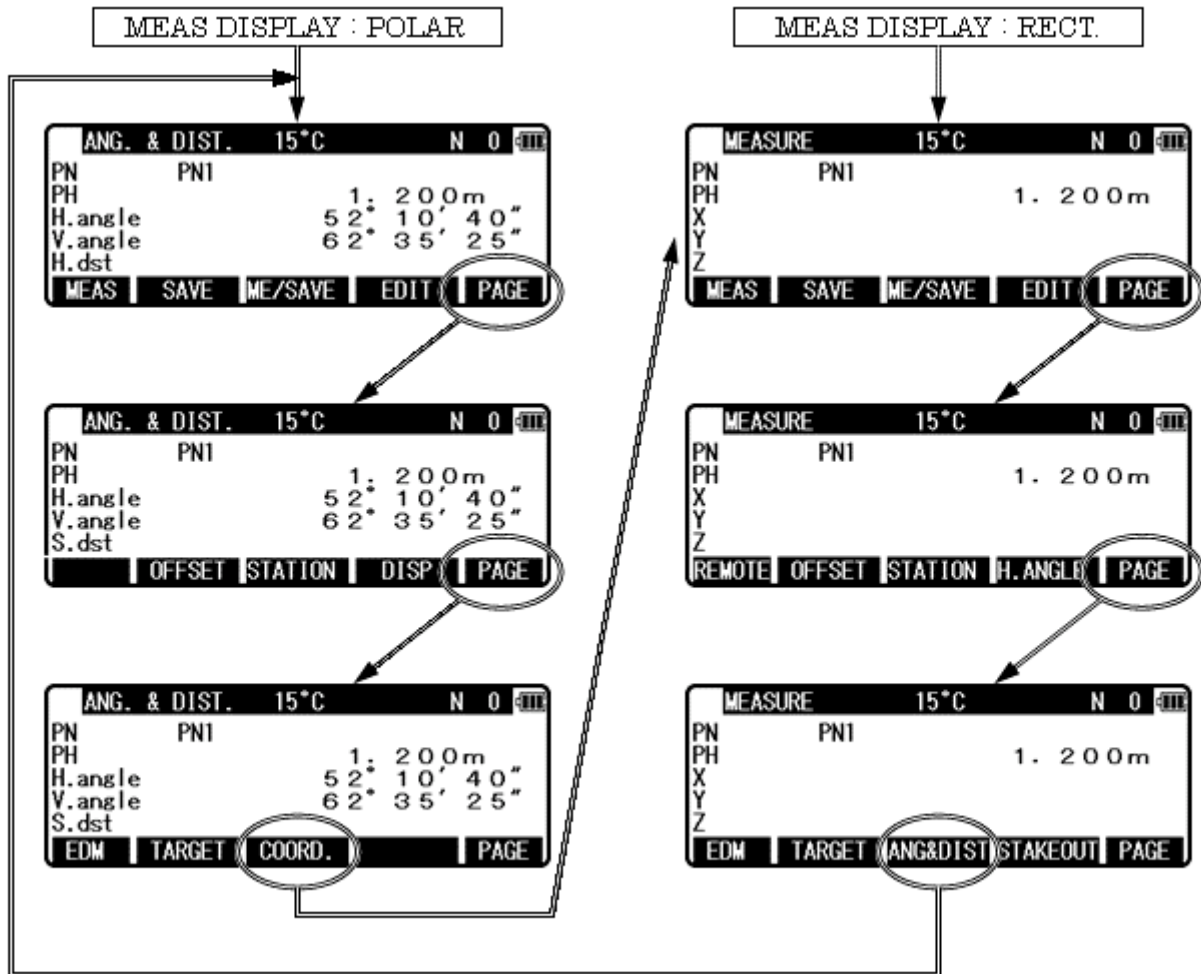


PC, Point Code:

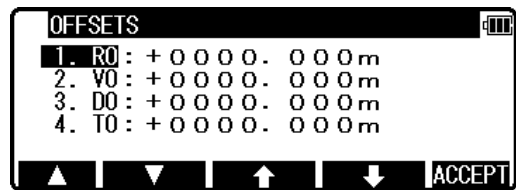
Press [ENT] to view and input the PC, Point code, screen.

If Point Code exists, you can easily select them from the list or edit one of them after pressing [ENT]. For using PointCodeList, please refer to “5.4.1 Point Code”.

Pressing [F5][PAGE] switches the screen as follows;

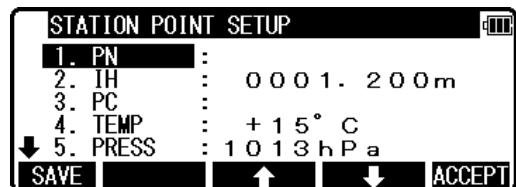


Press [F2] [OFFSET] to display OFFSET screen.
For more details on input procedure, refer to “4.9 Offset”

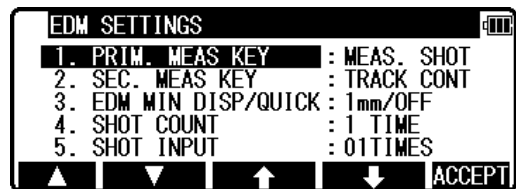


NOTE: When pressing [F2] [OFFSET] on MEASURE screen, besides RO, VO, DO and TO can be input.

Station Point setup can be changed by pressing [F3] [STATION].



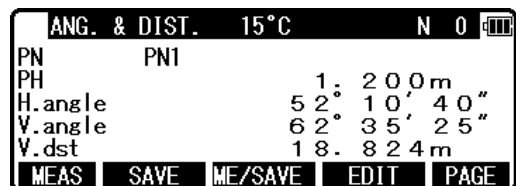
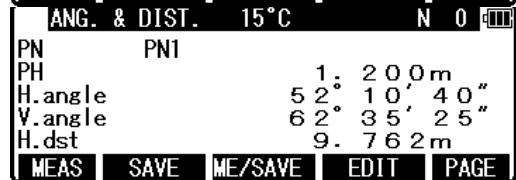
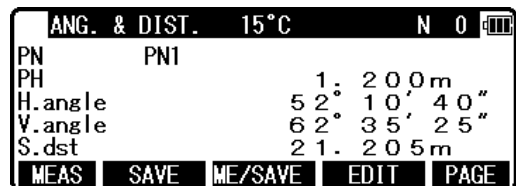
EDM settings can be selected by pressing [F1] [EDM].
For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with PRIM MEAS KEY (MEAS).



The target type can be selected by pressing [F2] [TARGET].
Coordinates display and Angle & Distance display

- 1) Press [F5] [PAGE] twice.
- 2) Press [F3] [ANG & DIST] to view [F3] [COORD.] and Angle and Distance values.
- 3) Press [F3] [COORD.] to view [F3] [ANG&DIST] and Coordinates.

Function of ANG.&DIST screen
Pressing [F4] [DISP] changes the distance data to be displayed.



Function of MEASURE screen:

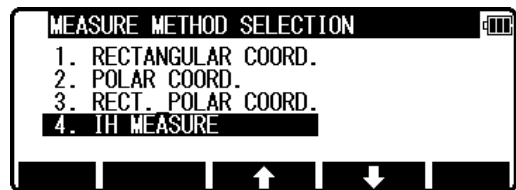
Press [F1] [REMOTE] to carry out Remote measurement (Refer to “4.5.1 Remote”)

Press [F4] [H.ANGLE] to display STATION POINT H. ANGLE SETUP (Refer to “4.2 Station Orientation”)

Stake Out can be selected by pressing [F4][STAKEOUT].

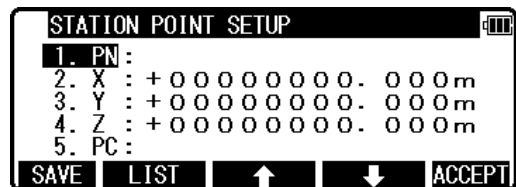
4.13 IH measurement

This function is to measure IH based on known point
The IH value measured here will be set as an initial value of IH to be used on each function



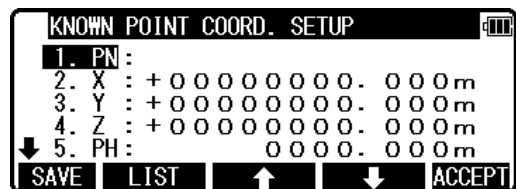
Press [F2] [MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.

Select 4.IH MEASURE and press [ENT] to view the STATION POINT SETUP screen.



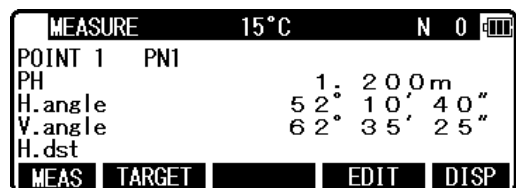
Press [ENT] to open the PN, X, Y, and Z input window and input each.

Then, press [ENT] or [F5] [ACCEPT] to view the KNOWN POINT COORD. SETUP screen.

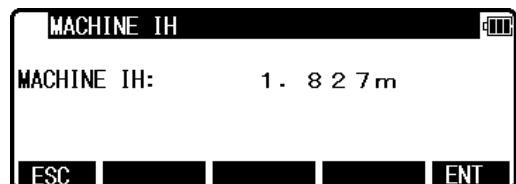


Press [ENT] to open the PN, X, Y, Z and PH input window and input each.

Then, press [ENT] or [F5] [ACCEPT] to view the MEASURE screen.



After pressing [F1] [MEAS] to make the distance measurement, press [ENT] to display MACHINE IH screen.



The value output on this screen is the current IH value. It will be saved as the updated IH value by pressing [ENT]

5. VIEW AND EDIT



Stored data are displayed graphically, and the editing of the stored data is possible by this Function.

The Z Coordinate (the height) of the point is ignored in the graphical display of the point data.

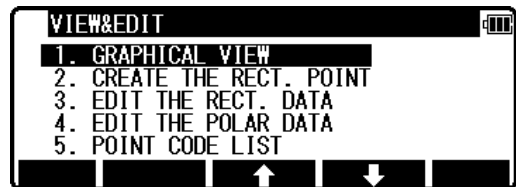
Four menu items are available:

- GRAPHICAL VIEW : Draw recorded points.
- CREATE THE RECT. POINT : Input Rect. Data manually.
- EDIT THE RECT. DATA : Edit recorded Rect. Data.
- EDIT THE POLAR DATA : Edit recorded Polar Data
- POINT CODE LIST : Create and edit PointCodeList

For more details of PointCodeList, refer to “5.4.1 Point Code”.

5.1 Graphical View

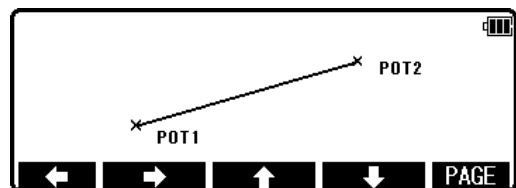
From the PowerTopoLite screen, press [F3] [VIEW] to view its screen.



Press [ENT] to view the GRAPHICAL VIEW screen.

Points, Point Names and their Graphics are displayed.

The Graphic is moved by pressing the arrow keys.



The Graphics are not displayed when points are not stored. Two or more points are needed.

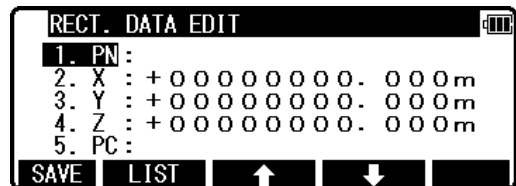
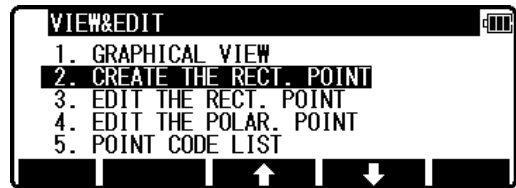
Press the [F5][PAGE] to view another menu.



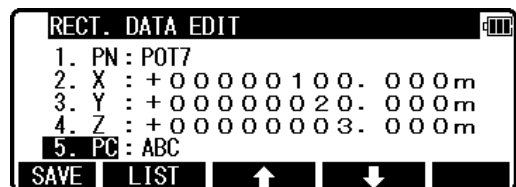
- [DISP]: Each Graphic is displayed as following order by pressing this key.
Full ► Points ► Points + Line ► Points + Points Names
- [ZOOM ALL]: Return to the ordinary Graphics size
- [Zoom IN]: Enlarge the Graphics size.
- [Zoom OUT]: Reduce the Graphics size.

5.2 Create the Rectangular Point

Select 2. CREATE THE RECT. POINT and press [ENT] to view the RECT. DATA EDIT screen.



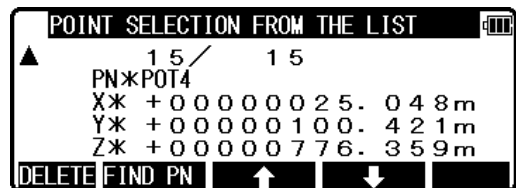
Input the PN, X, Y, Z and PC.
Press [ENT] to save them.



Press [F2] [LIST] to view the saved points.

The first line of the screen shows now displayed point and the total number of points.

Press [F1] [DELETE] to delete your desired point.
Press [F2] [FIND PN] to find your desired point by the PN input.

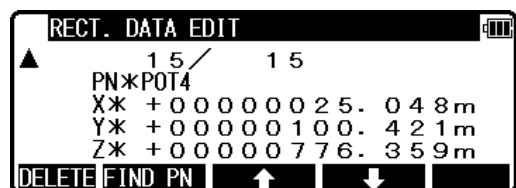
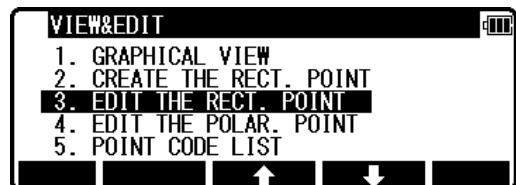


NOTE: For more details on research function, refer to “4.1.2 Coordinates, X, Y, Z, IH and PC input”

5.3 Edit the Data

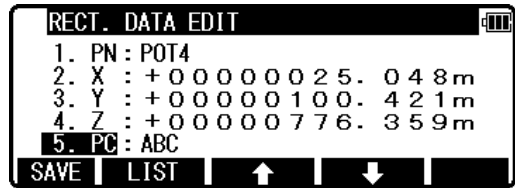
[RECT. DATA]

Select 3.EDIT THE RECT.DATA and press [ENT] to view the RECT.DATA EDIT screen.



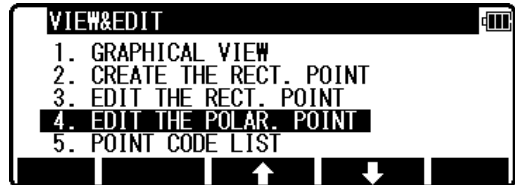
Your desired points are deleted and found as described above.

After selecting desired point with arrow key, press [ENT] to view the RECT. DATA EDIT screen to edit.



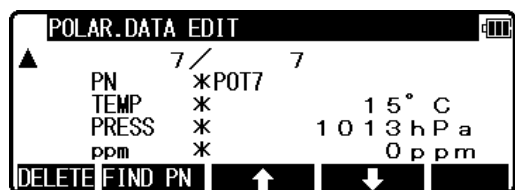
[POLAR DATA]

Select 4. EDIT THE POLAR DATA and press [ENT] to view the POLAR. DATA EDIT screen.



Your desired points are deleted and found as described above.

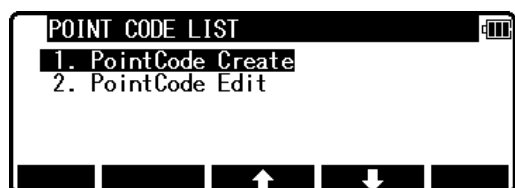
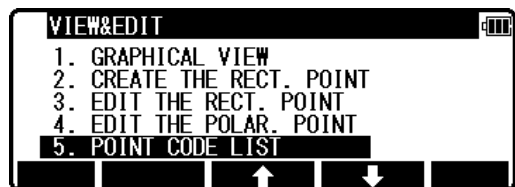
After selecting desired point with arrow key, press [ENT] to view the POLAR DATA EDIT screen to edit.



You can edit data and save it.

5.4 Point Code List

Select 5. POINT CODE LIST and press [ENT] to view the POINT CODE LIST screen.



5.4.1 Point Code

The PC, Point Code can be used for adding your desired attributes to Rect. and Polar data. If Point Codes are stored under the job named "PointCodeList", you can easily select one of the Point Codes from the list or edit one of them after pressing [ENT]. Please note, that Point Codes, which are saved in another job can not be referred to as a list. PointCodeList

Making “PointCodeList”:

PointCodeList can be created by using function of “5.4.1 Point Code List”
Use this function to create, edit and add PointCodeList.

Importing “PointCodeList” file:

PointCodeList can be used after importing it from external devices (ex. PC).
After importing, it is stored in the internal memory of the instrument. To store user defined ”PointCodeList”, please carry out following procedure.

Preparing “PointCodeList” file:

Make a “PointCodeList.csv” file with reference to a sample “PointCodeList.csv” file that is contained in the “R-400V Supplement Disk” for the format.
Please note, that the newly entered PointCode on the instrument is not added to the PointCodeList that is stored in the memory. In this case, edit “PointCodeList.csv” separately.

Contents of “PointCodeList.csv”:

```
1,,PointCodeList,
31,,1,ABC,,
31,,2,DEF,,
31,,3,GHI,,
31,,4,JKL,,
31,,5,MNO,,
31,,6,PQR,,
31,,7,STU,,
31,,8,VW,,
31,,9,XYZ,,
```

Format of the “PointCodeList” file

	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7
Description	Record Type	No.	Name	Description			
Ex. Line 1	1,	,	PointCodeList,	,			
	Job record	Job No. (N/A)	Job Name (Fixed for “PointCodeList”.)				
Ex. Line 2	31,	,	1,	ABC,	,	,	,
	Coord. data record	Point No. (N/A)	Point Name (Should not be duplicated and max. 15 characters.)	Point Code (Max. 15 characters.)			

Import Procedure

Press [F3] [I/O] on PowerTopoLite screen to display TRANSFER MENU.

[In case of using file conversion]

First, set “PointCodeList.csv” in the instrument by means of USB or SD card.

Then, specify ExtCSV to format and carry out file conversion.

More details on file conversion, refer to “12.1.2 Reading from Text File”.

[In case of using COM port]

In case of using COM port, communication setting is necessary.

Press [F3] [COM] to display TRANSFER screen.

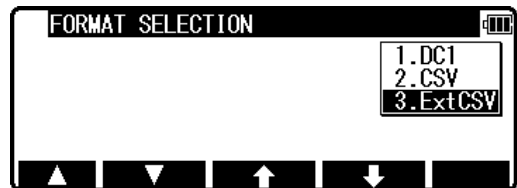
To check the communication setting, select “4. COMMUNICATION SETUP” in the TRANSFER screen and press [ENT] to view COMM.SETTING SELECTION screen.



Then select “1. RECEIVE RECT.DATA” and set “1. BAUD RATE” to “1200”, “6. XON/XOFF” to “OFF” for using “DL-01”, “ON” for using “HYPER TERMINAL”. “7. PROTOCOL” to “OFF” “8. RECORD DELIMITER” to “CR+LF” and press [ACCEPT]. (Cfr. “12.3.3.1 Receiving data setting”)

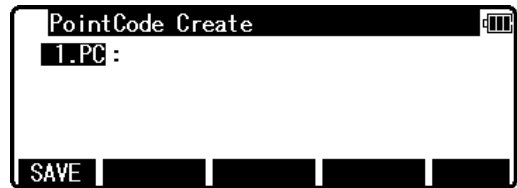
After the communication setting, specify ExtCSV for format, then start transfer.

For more details on the procedure, refer to “12.3.1 Input from the PC”



5.4.2 PointCode Create

Press [ENT] to view the PointCode Create screen.



Press [ENT] to view and input the PC.



After input, press [F1] [SAVE] to save the values.

5.4.3 PointCode Edit

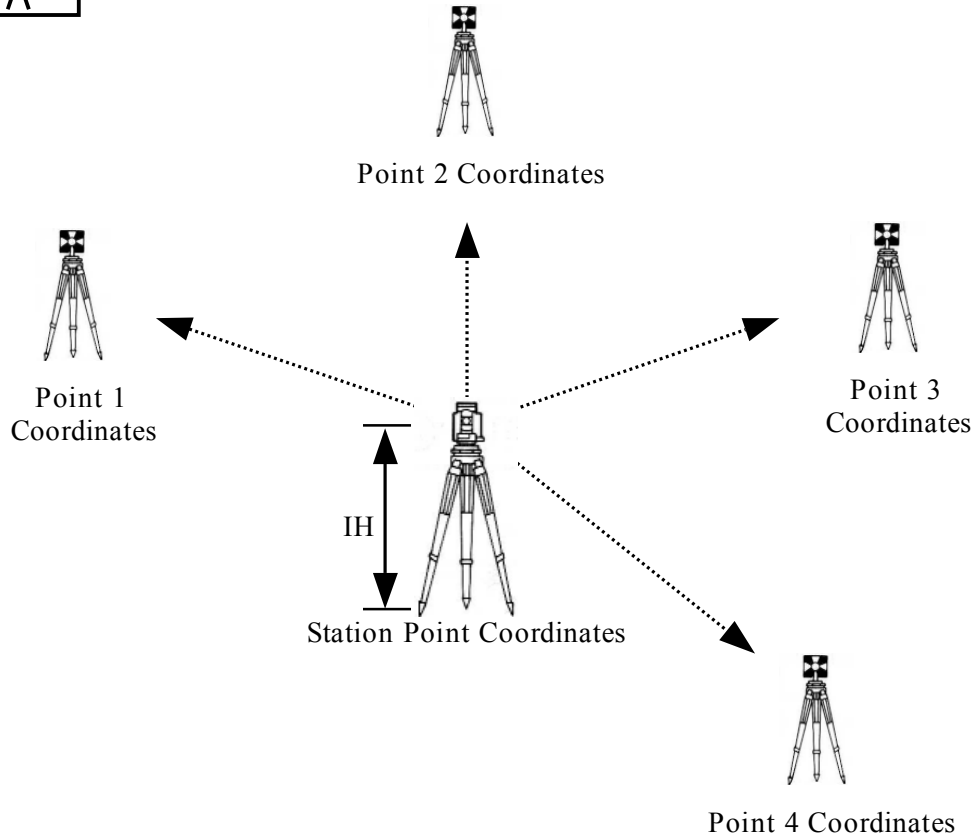
Select 2. PointCode Edit and press [ENT] to view the PointCodeList screen.



Select the PointCode you wish to edit and Press [ENT] to display PC screen , then edit the PointCode.



6. FREE STATIONING



The Station Point Coordinates are calculated from the different known points. To gain the Coordinates, at least two H. angles and one distance or three H. angles are required.

If not so, the error message of “Not enough data to Calculate! 2 angles and 1 distance, 3 angles are required” appears.

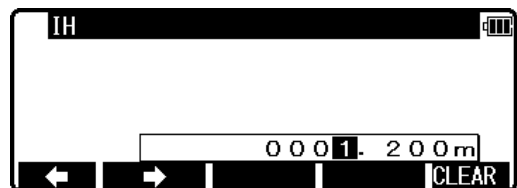
First, input the height of the instrument (IH).

6.1 Stationing by more than 3 known points

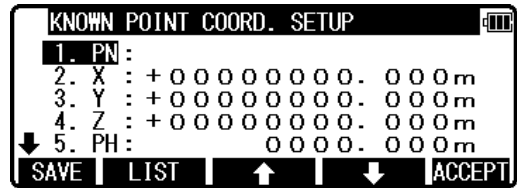
4 known points stationing (For example)

Press [F4] [FREE] of the PowerTopoLite screen to view the IH input screen.

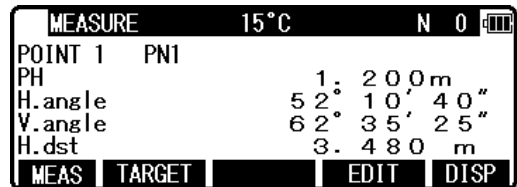
Input the IH value.



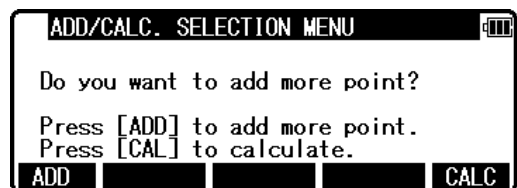
Aim at Point 1.
Press [ENT] to view the KNOWN POINT COORD.SETUP screen.



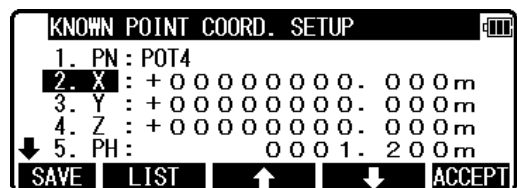
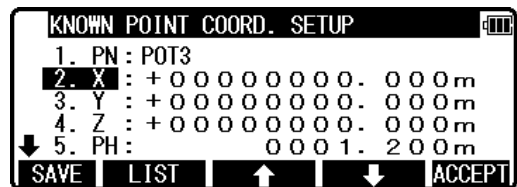
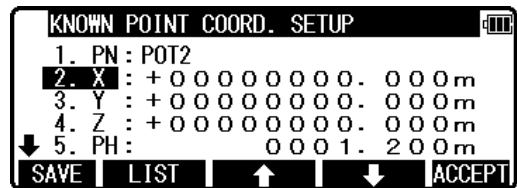
Press [ENT] to open the PN, X, Y, Z and PH input window and input each.
Then, press [ENT] or [F5] [ACCEPT] to view the MEASURE screen.



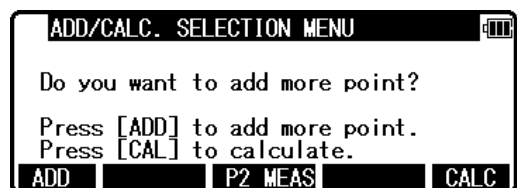
Press [ENT] to view the ADD/CALC. SELECTION MENU screen.
(Measuring is not needed. Just press [ENT].)



Press the [F1] [ADD] to view the KNOWN POINT COORD. SETUP screen.
Aim at Point 2, 3 and 4.
In the same manner, input the values of Point 2, 3 and 4.



[F3] [P2 MEAS] button appears on 3rd point of ADD/CALC.SELECTION MENU screen.



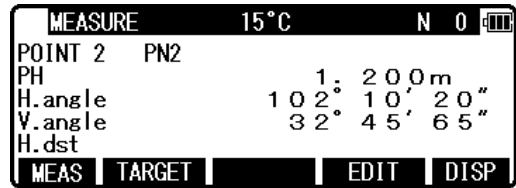
For precise measurement, carry out [F3] [P2 MEAS] to calculate at least two multiplicative.

After pressing [F3] [P2 MEAS], measure the distance of 2nd point.

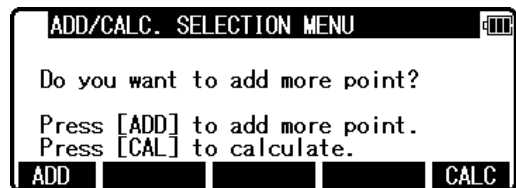
With this function you can obtain the most probable value of the angle of three points: after measuring the distance of 3rd point, measure the 2nd point again.

After the measurement, press [ENT] to go to RESULT COORD. OF STATIONING screen.

The most probable value is calculated based on the station point coordinate.

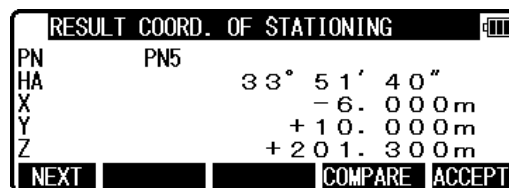


After entering values of PN4, press [ENT] twice to view the MEASURE and ADD/CALC SELECTION MENU.

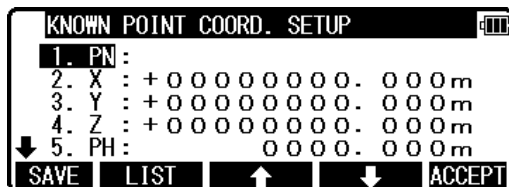


Press the [F5] [CALC] to view the RESULT COORD. OF STATIONING screen.

The Station Coordinates are displayed. Result coordinates of free stationing can be saved for Station setup after pressing [F5] [ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station Point for measuring.

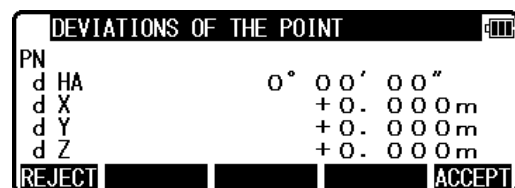


Press [F1] [NEXT] to view KNOWN POINT COORD. SETUP screen.



DEVIATIONS OF THE POINT: Four points or more are needed to view this. Press [ENT] to view the DEVIATIONS OF THE POINT screen. The deviations of X, Y and Z coordinate of each point are displayed. For each point, you can decide if you want to accept or reject the point.

PN: Current Point Number
dX: Deviation on the X value
dY: Deviation on the Y value
dZ: Deviation on the Z value

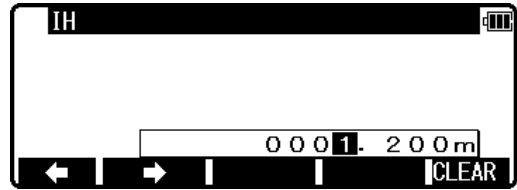


6.2 Stationing by two known points

(One point must be measured at least to gain the Station Coordinates.)

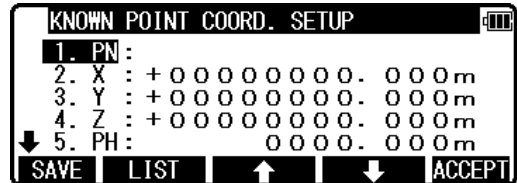
Press [F4] [FREE] of the PowerTopoLite screen to view the IH input screen.

Input the IH value.

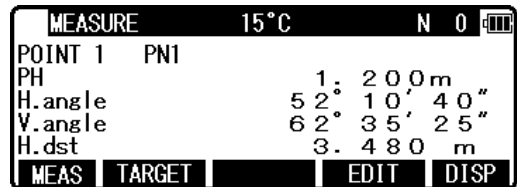


Aim at the Point 1.

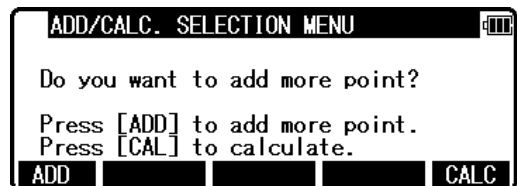
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



Then, press [ENT] to view the MEASURE screen.



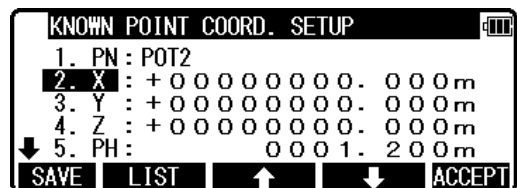
Press [ENT] to view the ADD/CALC. SELECTION MENU screen.



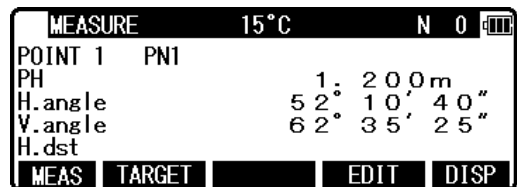
Press [F1] [ADD] to view the KNOWN POINT COORD. SETUP screen.

In the same manner, aim at the Point 2.

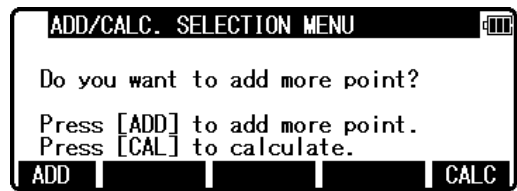
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



Then, press [ENT] or [F5] [ACCEPT] to view the MEASURE screen.

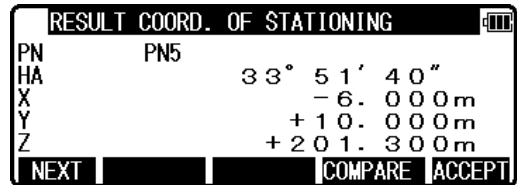


Press the [F1] [MEAS] to measure the distance.
 Press [ENT] to view the ADD/CALC. SELECTION MENU screen.

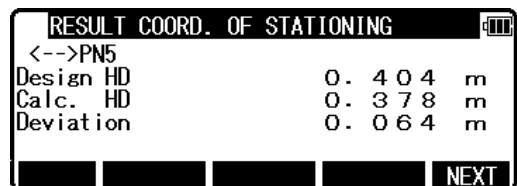


Press [ENT] to view the RESULT COORD. OF STATIONING.

The Station Coordinates are displayed. Result coordinates of free stationing can be saved for Station setup after pressing [F5] [ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station Point for measuring.



Press [F4] [COMPARE] to view the RESULT COORD. OF STATIONING screen.



NOTE:

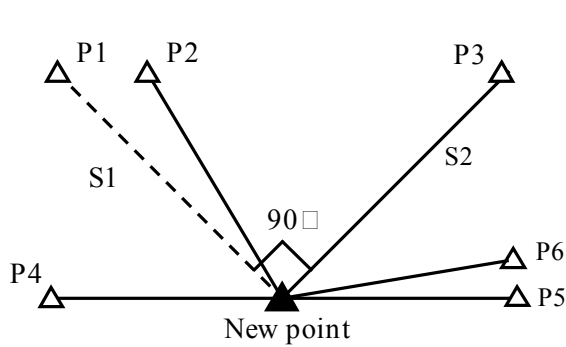


Fig. 1

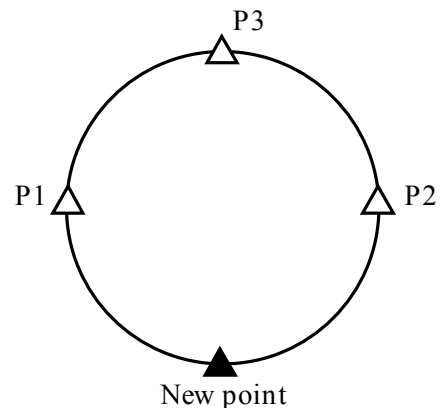


Fig. 2

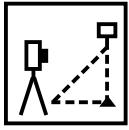
As illustrated in Fig. 1, it is optimal to choose the known points P1 and P3. The instrument should be set up in such a manner so that the angle between P1 and P3 becomes 90° . The distances S1 and S2 should be similar.

The accuracy of a calculation result depends on the following:

- 1) The inner angle between known points is extremely small.
See P1 and P2 on above Fig. 1.
- 2) The inner angle between known points is extremely large.
See P4 and P6 on above Fig. 1.
- 3) The distance from a new point to a known point is extremely short or extremely long.
- 4) A new point (station point) and three or more known points are arranged on the same circumference. See above Fig. 2.

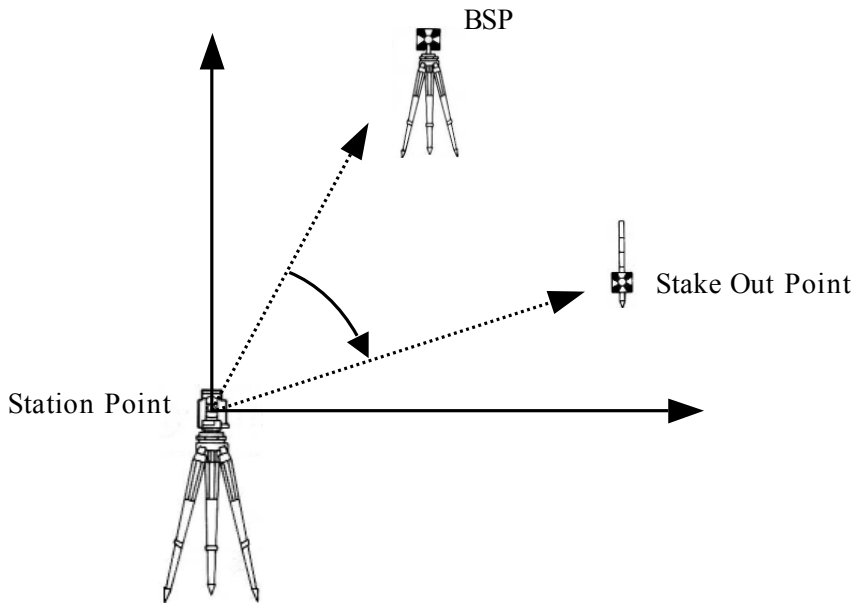
When searching for a new point by free stationing and surveying by installing an instrument in the point, accuracy may not be stabilized compared with the case where an instrument is installed on a known point. In field work which needs a high-precision survey, we cannot recommend this method.

7. STAKE OUT

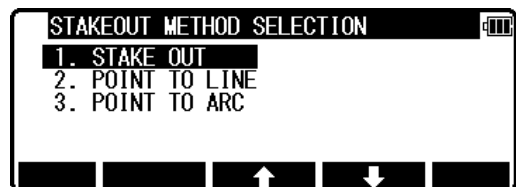


From the known Station Point and Direction Angle, the Coordinates for the Stake Out are obtained.

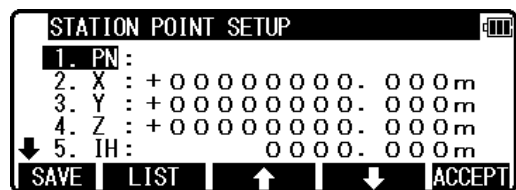
7.1 Stake Out



Press [F1] [STAK] to view the STAKEOUT METHOD SELECTION screen.

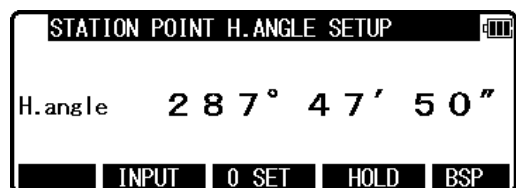


Select 1.STAKE OUT and press [ENT] to view the STATION POINT SETUP screen.



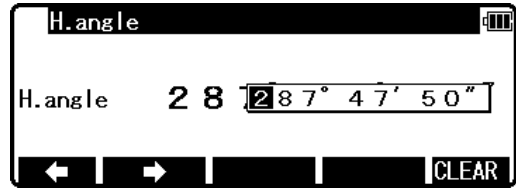
Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1] [SAVE].

Press [ENT] to view STATION POINT H.ANGLE SETUP screen.



Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

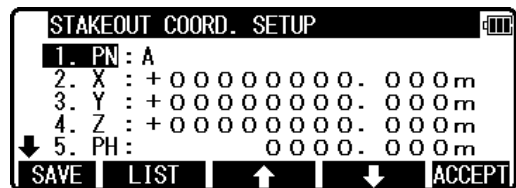
Pressing [F2] [INPUT]
Input any horizontal angle.



Pressing [F5] [BSP]
The information for Back Ssight Point is obtained.
Press [ENT] to finalize the input.
Aim Reference Point, then press [ENT] to enter Multiple Orientation.
For more details, refer to “4.3 Multiple Orientation”.

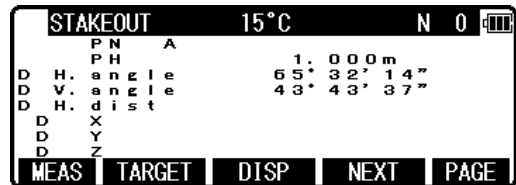


Press [ENT] to enter STAKEOUT COORD.SETUP screen.



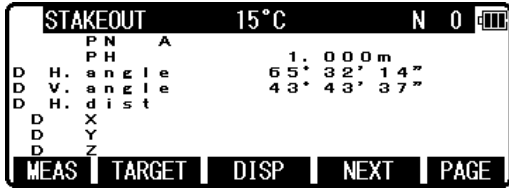
Open the PN, X, Y, Z, PH and PC input window and input each.

Save the data by pressing [F1] [SAVE].
Press [ENT] or [F5] [ACCEPT] to view the STAKEOUT screen.

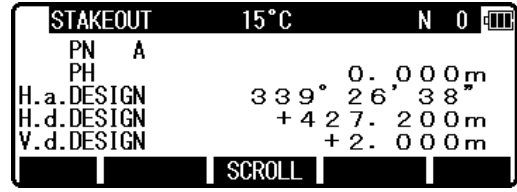


Aim at the Stake Out Point and press the [F1] [MEAS] to begin the Stake Out.
Deviation of each value is displayed.
Form of the screen to display deviation of the Stake Out can be changed by the selections of the “13.6 Compare method selection” in “13.PREFERENCE” setting.

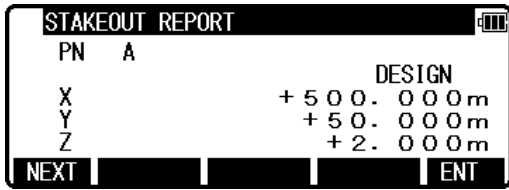
To display all information at once, select "ALL IN ONE INFO."



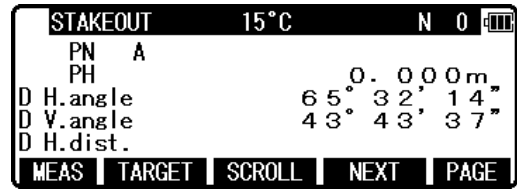
To display information with larger character, select "LARGE CHARACTER".



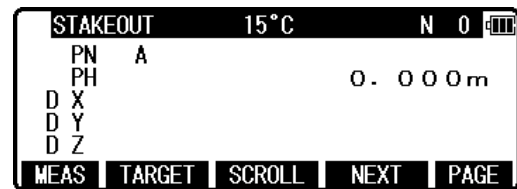
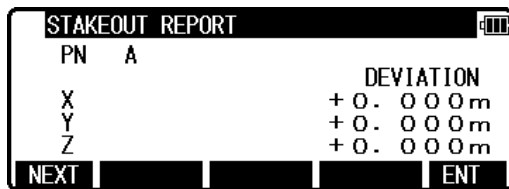
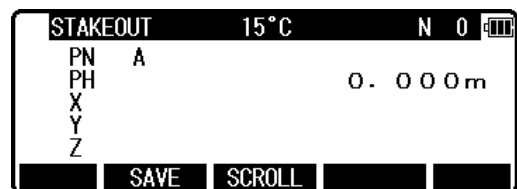
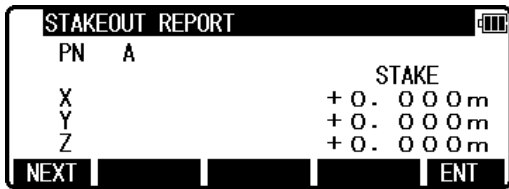
Press [F3] [DISP] to view another screen.



Press [F3] [SCROLL] to view another screen.



Press [F1] [NEXT] to view another screen.



```

STAKEOUT      15°C      N 0
PN A
PH
D H. angle    1. 000m
D V. angle    65° 32' 14"
D H. dist     43° 43' 37"
D X
D Y
D Z
MEAS TARGET DISP NEXT PAGE

```

```

STAKEOUT      15°C      N 0
PN A
PH
D X           0. 000m
D Y
D Z
MEAS TARGET SCROLL NEXT PAGE

```

Press [F5] [PAGE] to view another screen.

```

STAKEOUT      15°C      N 0
PN A
PH
D H. angle    1. 000m
D V. angle    65° 32' 14"
D H. dist     43° 43' 37"
D X
D Y
D Z
RECT.M STATION H.ANGLE DRAW PAGE

```

```

STAKEOUT      15°C      N 0
PN A
PH
D X           0. 000m
D Y
D Z
RECT.M STATION H.ANGLE DRAW PAGE

```

Press [F5] [PAGE] to view another screen.

```

STAKEOUT      15°C      N 0
PN A
PH
D H. angle    1. 000m
D V. angle    65° 32' 14"
D H. dist     43° 43' 37"
D X
D Y
D Z
DEV. PAGE

```

Press [F2] [DEV.] key, dx, dy, dz change to deviation in meter.

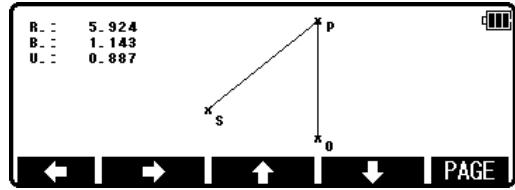
```

STAKEOUT      15°C      N 0
PN A
PH
D H. angle    1. 000m
D V. angle    65° 32' 14"
D H. dist     43° 43' 37"
D B.
D L.
D D.
DEV. PAGE

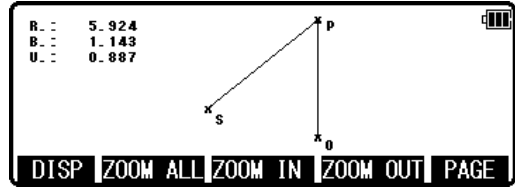
```

Press [F2] [DEV.] key again, return to dx, dy, dz.

If you select “LARGE CHARACTER”, the information is shown with four screens and these screens and the Graphics screen can be switched by [F4] [DRAW].



Press [F5] [PAGE] to view another screen.
Press [F1] [DISP] to change graphic view.

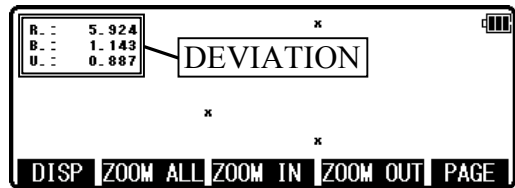


[Point Name]

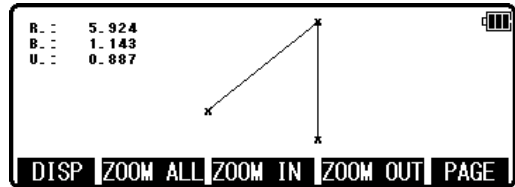
- S Station Point
- P Measurement Point
- O Design Point

[DEVIATION Information]

Display the distance and direction from point P to Point O



- F(Forward) / B(Back) Forward/Backwards
- L(Left) / R(Right) Left/Right
- U(UP) / D(Down) Up/Down



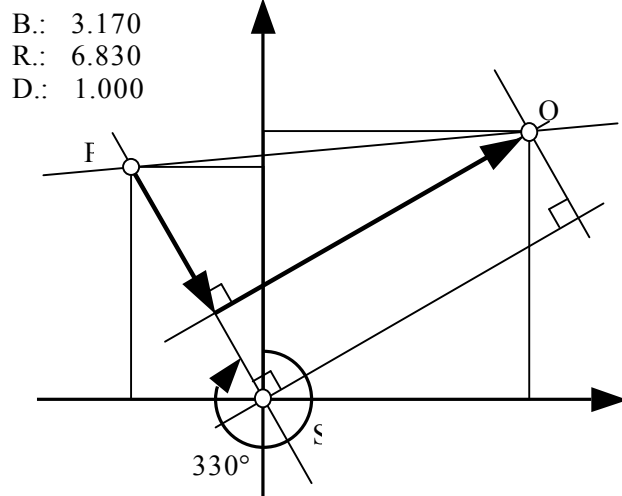
For more details on the operating procedure, refer to “5. VIEW AND EDIT”.



Press [ENT] or [ESC] to return STAKEOUT screen.

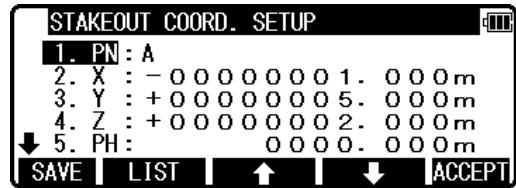
Example :

Station	X	0.000 m
Point	Y	0.000 m
S	Z	0.000 m
Measurement Point	H.angle	330° 00' 00"
	H.dst	5.000 m
	V.dst	1.000 m
Design Point	X	5.000 m
	Y	5.000 m
	O	Z

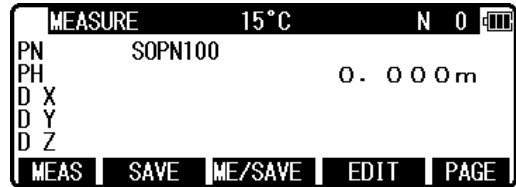


In this case, the operator tells you to move 3.170m forward, 6.830m to the left and 1.000m down against Point P.

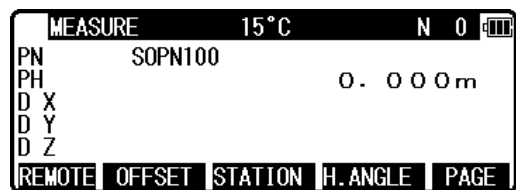
Press the [F4] [NEXT] to carry out staking out for the next point.



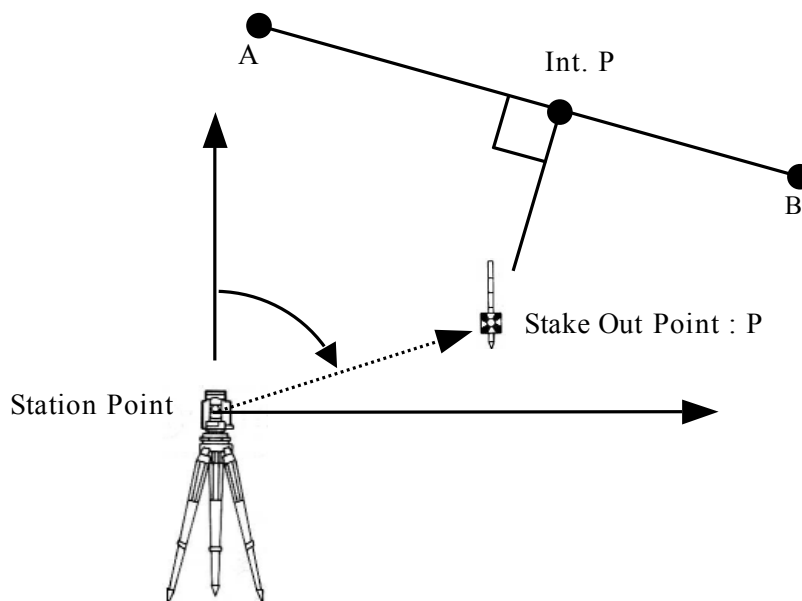
Press the [F1] [RECT.M] to view the MEASURE screen.



Refer to the “4.5 Remote, Offset, Station, and H.angle” function.
Press the [F5] [PAGE] to view the other MEASURE menu.

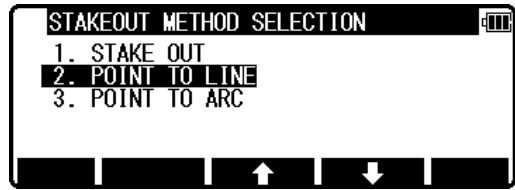


7.2 Point to Line

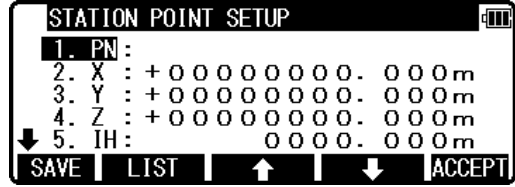


You have to select the point A and B. The distance between the two points A and B has to be at least 1m. The two points A and B define a line and during Stake Out, PTL shows the deviations from the Stake Out Point, P, to the line A-B.
(At above STAKEOUT screen)

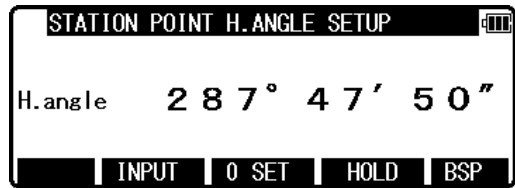
Select 2. POINT TO LINE and press [ENT] to view STATION POINT SETUP screen.



Open the PN, X, Y, Z, IH and PC input window and input each.



Press [ENT] to view the STATION POINT H. ANGLE SETUP screen.

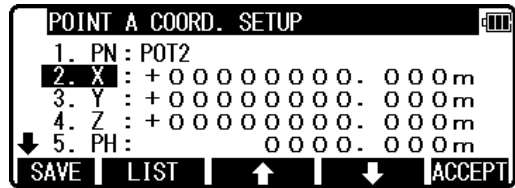


Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

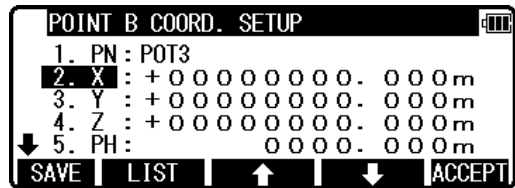
Press [ENT] to enter Multiple Orientation. For more details, refer to “4.3 Multiple Orientation”

Following Multiple Orientation, it takes you to POINT A COORD. SETUP screen.

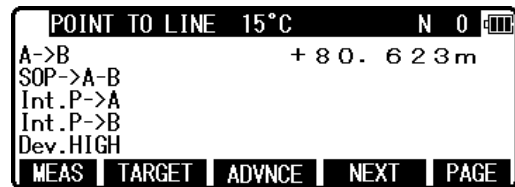
Open the PN, X, Y, Z, PH and PC input window and input each of the Point A and press [ENT].



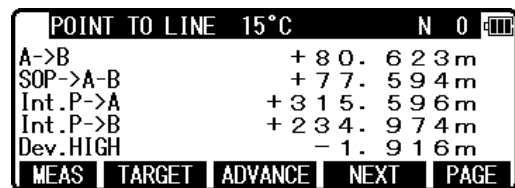
Open the PN, X, Y, Z, PH and PC input window and input each of the Point B.



Press [ENT] to view the POINT TO LINE screen.



Press [F1] [MEAS] to measure. Each distance is displayed.

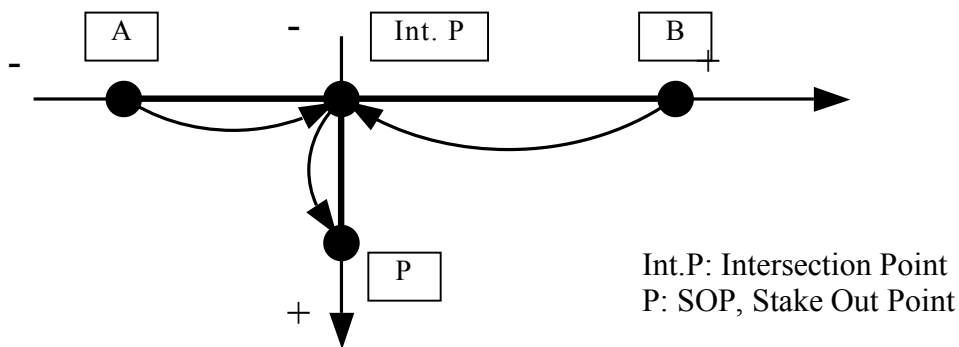


A -> B Distance between Point A and B. This is always positive.

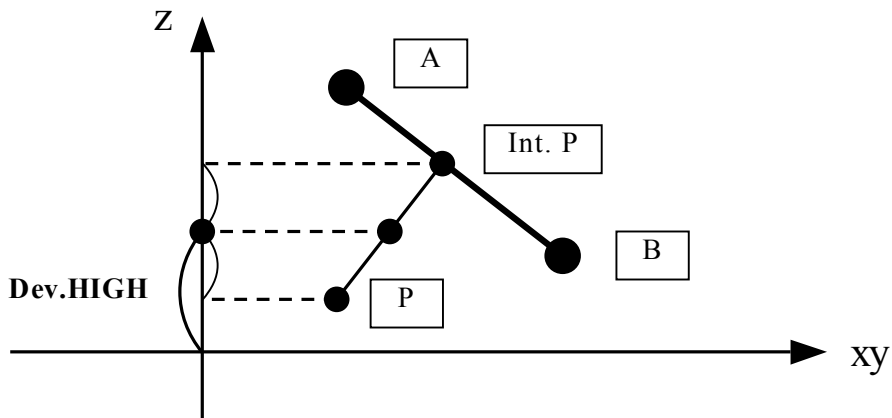
P -> A - B Distance between Int. P and P.
 If P is on the right side of A-B, the value is positive and
 if P is on the left side of A-B, the value is negative.
 In case of the below drawing, P is on the right side for A-B,
 P->A-B is positive.

Int. P -> A Distance between Int. P and A. This is positive or negative.
 If A-Int.P and A-B is are in the same direction, Int.P->A is positive.
 In case of the below drawing, since A-B and A-Int.P are in the same direction,
 Int.P->A is positive.

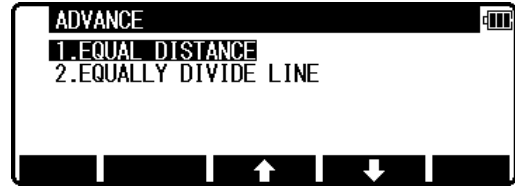
Int. P -> B Distance between Int. P and B. This is positive or negative.
 If B-Int.P and A-B is are in the same direction, Int.P->B is positive.
 In case of the below drawing, A-B is opposite direction to B-Int.P,
 Int.P->B is negative.



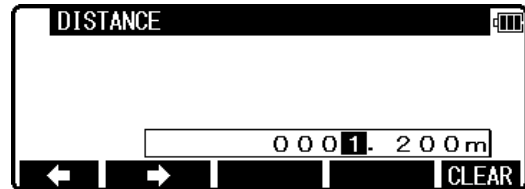
Dev.HIGH Int.P and P is the deviation of the z coordinate.



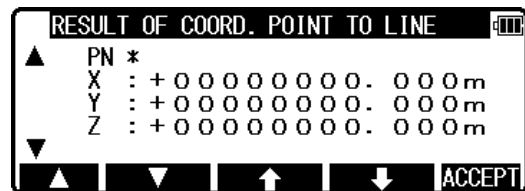
Press [F3] [ADVANCE] to display the ADVANCE screen.



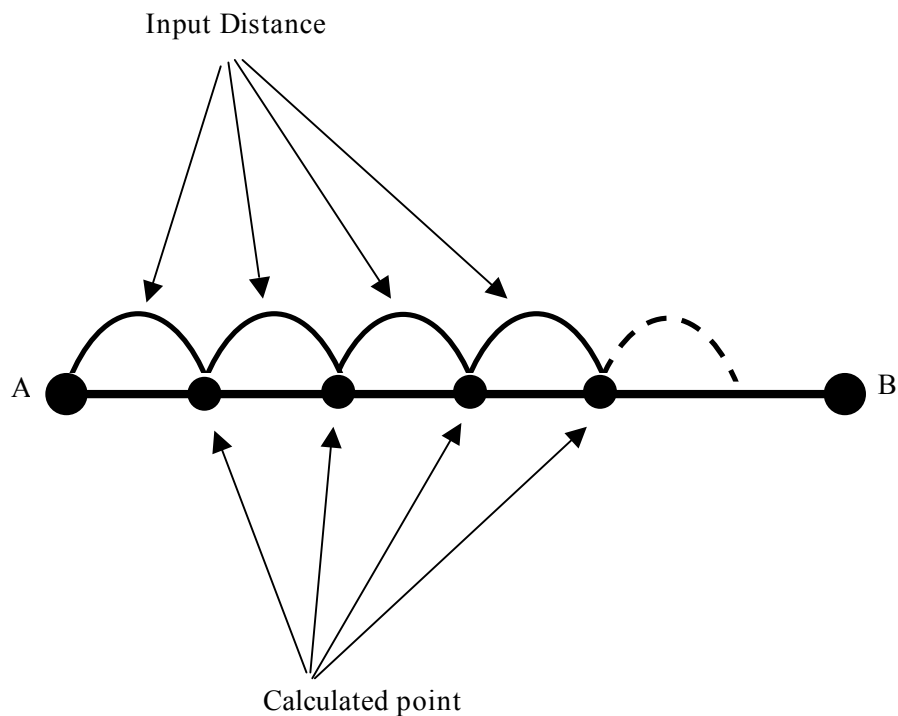
Select [1.EQUAL DISTANCE], enter the following screen.



Input the divided distance.



The divided point's coordinate can be calculated, and displayed. Press the ACCEPT key, the data will be saved, and return to the measure screen. Coordinates will be calculated from A to B in the order of input distance. Refer to the following drawing.



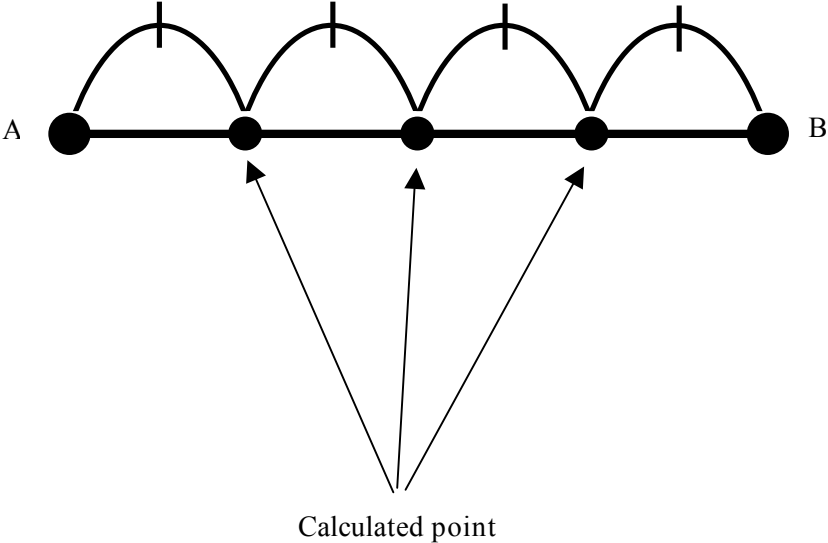
Select [2.EQUALLY DIVIDE LINE], enter the following screen.



Input the divided pieces.

The divided point's coordinate can be calculated, and displayed.
Press the ACCEPT key, the data will be saved, and return to the measure screen.
Coordinates are calculated to be divided by the number you put from A to B
Refer to the following drawing.

Example: Divide into 4 parts averagely

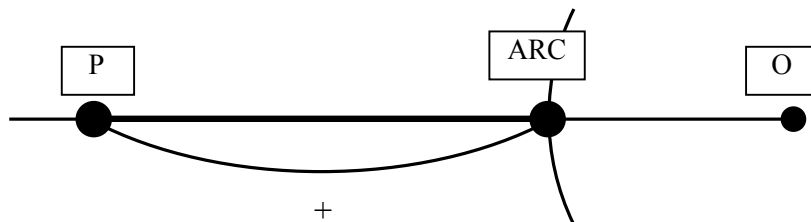


7.3 Point to Arc

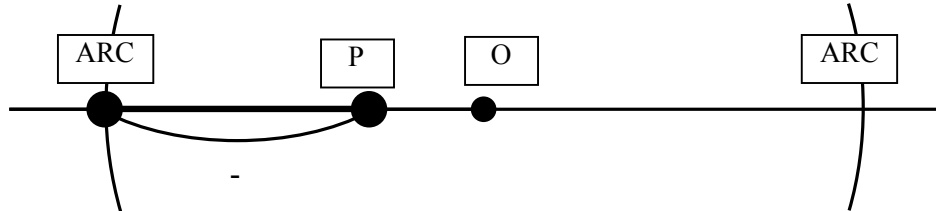
Set Station Point (SP), Target Point (P) and an arbitrary circle, then obtain the distance from point P to the arbitrary circle.

SOP->ARC the distance from Target Point (P) to the circle

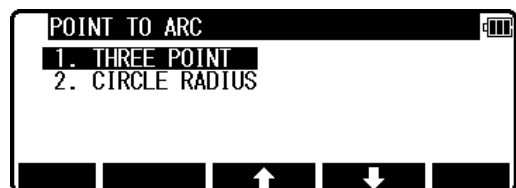
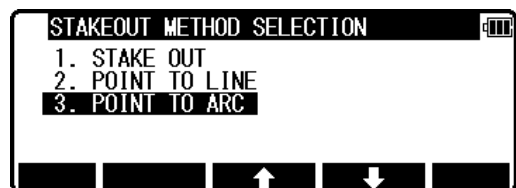
When radius is 0, the figures of the distance between SOP and ARC is shown as a positive (+) figure. When point P is outside the circle, the figures of the distance between SOP and ARC is shown as a positive (+) figure.



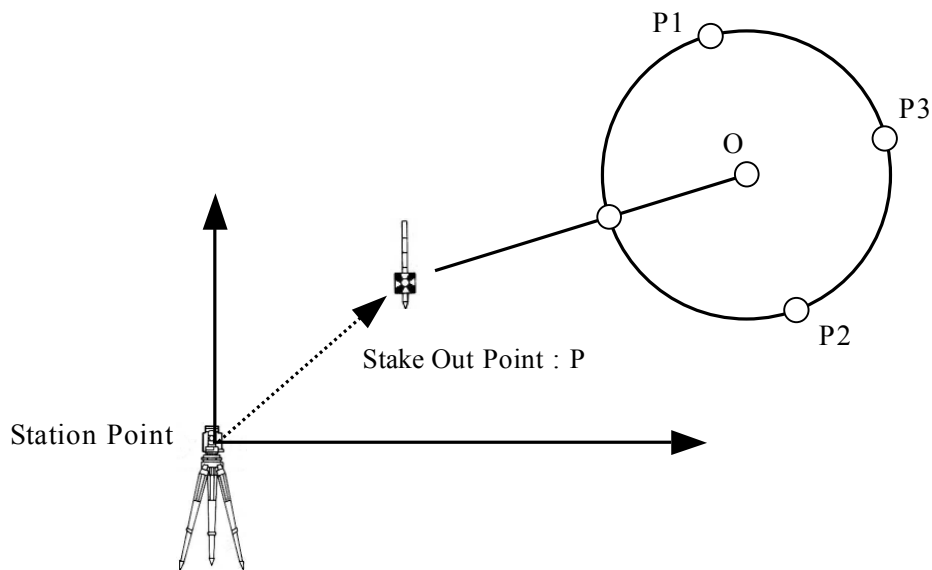
When point P is inside the circle, the figures of the distance between SOP and ARC is shown as a negative (-) figure



Select 3. POINT TO LINE and press [ENT] to view POINT TO ARC screen.

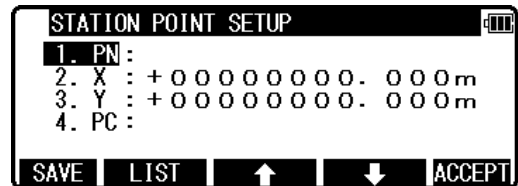


7.3.1 Three point



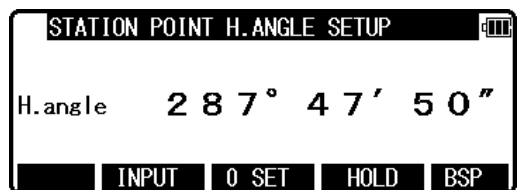
Input three points to make a circle, obtain the distance from the Stake Out Point to the circumference.

Select 1.THREE POINT and press [ENT] to view the STATION POINT SETUP screen.



Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1] [SAVE].

Press [ENT] to view STATION POINT H.ANGLE SETUP screen.



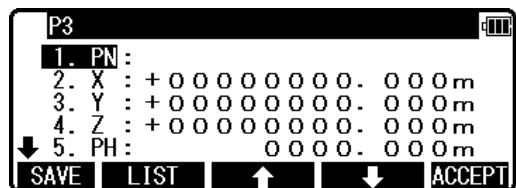
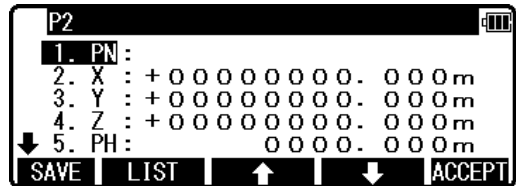
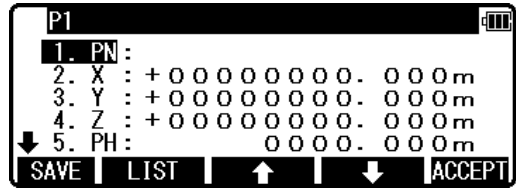
Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

Press [ENT] to enter Multiple Orientation. For more details, refer to “4.3 Multiple Orientation”.

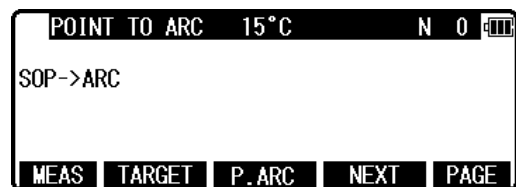
After you finish sighting the reference point, press [ENT] to go to the next screen.

Input three coordinates points on each screen of P1, P2 and P3 to make a circle.

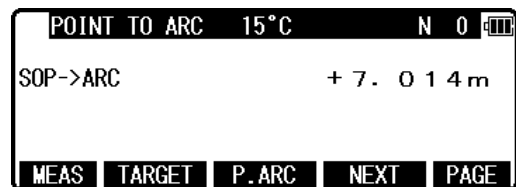
The procedure of inputting the points is the same as that of STATION POINT SETUP .



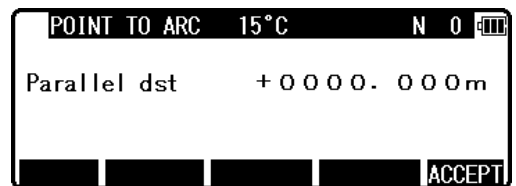
After you are finished with the input, press [F1] [SAVE] or [F5] [ACCEPT] to display the measurement screen.



Sight the target, Press [F1] [MEAS] to measure the distance. From the measurement results, the distance from the target to the circumference is displayed.



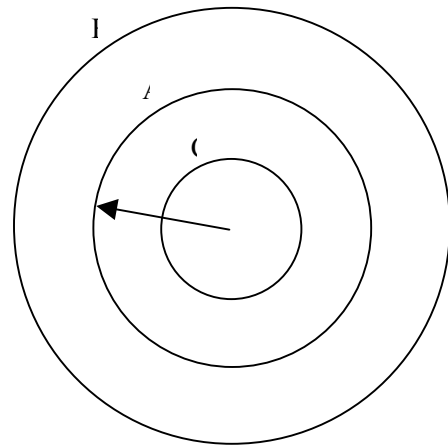
Press [F3] [P.ARC] to enter “Parallel dist” screen.



In circle A, an already-known circle, circle B, and circle C are in a Parallel Arc with circle A.

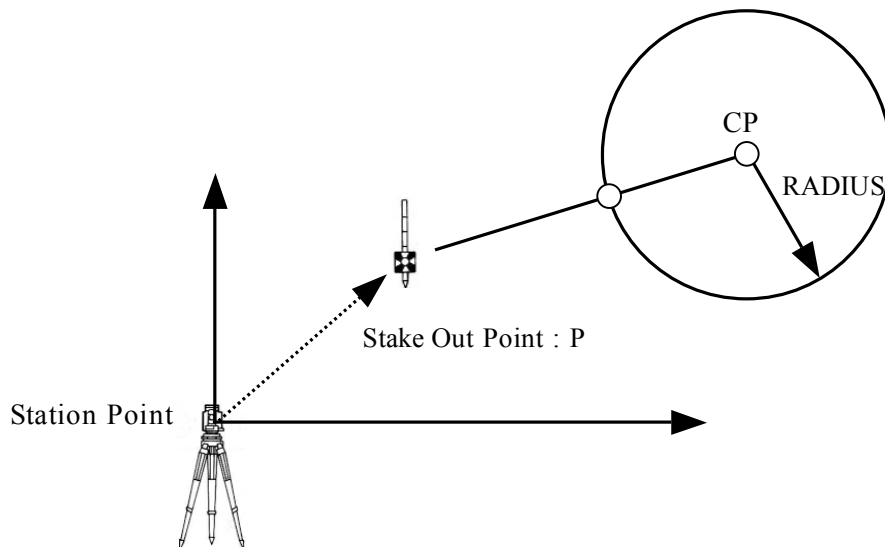
When the input value is "+", Parallel Arc of circle A is circle B.

When the input value is "-", Parallel Arc of circle A is circle C.



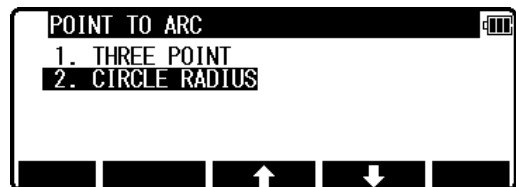
Press [ACCEPT] to return to SOP->ARC screen.

7.3.2 Circle radius

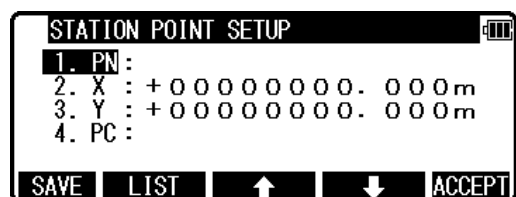


Input center coordinate of the circle and radius to make a circle, then obtain the distance from the Stake Out Point to the circumference.

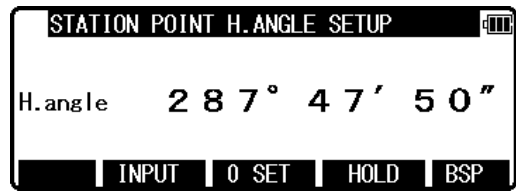
Select 1.THREE POINT and press [ENT] to view the STATION POINT SETUP screen.



Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1] [SAVE].



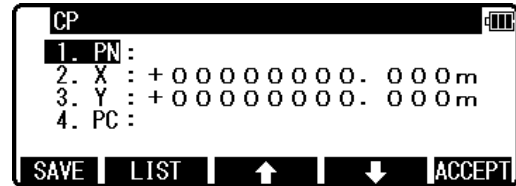
Press [ENT] to view STATION POINT H.ANGLE SETUP screen.



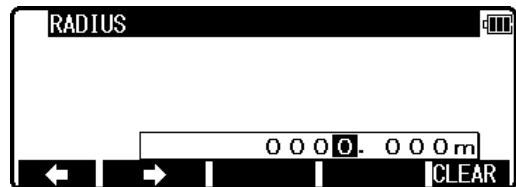
Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

Aim at the reference point, then press [ENT] to enter Multiple Orientation. For more details, refer to “4.3 Multiple Orientation”.

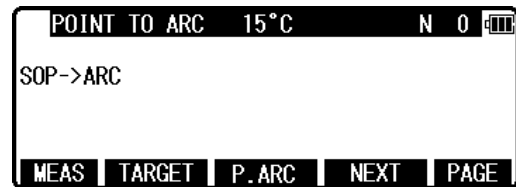
After you finish sighting the reference point, press [ENT] to go to next screen.



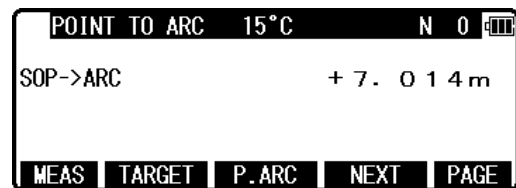
Input coordinates of the center point and radius to make a circle.



After you are finished with input, press [ENT] to display the measurement screen.



Sight the target, Press [F1] [MEAS] to measure the distance. From the measurement results, the distance from the target to the circumference will be displayed. Pressing [F3] [P.ARC] enables you to make the same operation of “7.3.1 Three points”.



8. CALCULATIONS



The following calculations are available:

- COGO
- 2D SURFACE
- 3D SURFACE & VOLUME
- REM

8.1 Cogo

The following COGO functions are available:

- Inverse
- Point Coordinates
- Circle Radius
- Line-Arc intersection
- Line-Line intersection
- Arc-Arc intersection
- Distance offset
- Point distance offset
- Arc distance offset

"COGOPoint" File

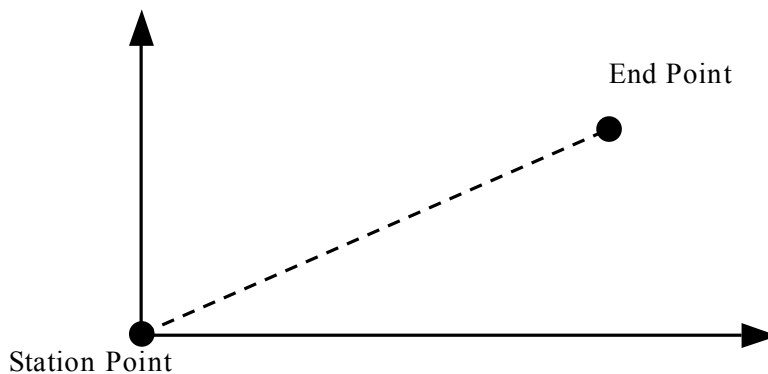
The R-400V series automatically creates "COGOPoint" file. In the file, the following coordinates to be used in COGO function, are recorded.

SP	Station Point
EP	End Point
CO	Coordinates
P1	Point 1
P2	Point 2
P3	Point 3
CP	Center Point
S1	Start point 1
E1	End point 1
S2	Start point 2
E2	End point 2
C1	Center point 1
C2	Center point 2
OP	Observation Point

The values recorded in "COGOPoint" are used as an initial value each time these values are input. These values are updated when the function, which uses these values, is carried out.

For instance, if you carry out Inverse, then carry out Distance offset later, the values of SP and EP which are input at Inverse will be initial values of SE and EP of Distance offset which is carried out later. If you wish to input the initial value in advance, edit it by using "VIEW&EDIT of EDIT THE RECT. DATA. (Refer to "5.3 Edit the Data").

8.1.1 Inverse

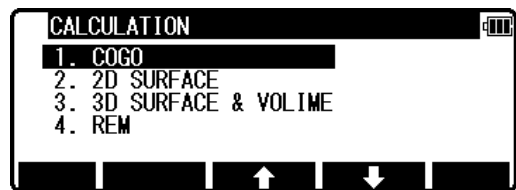


From the given two point Coordinates, the Direction angle and distance are calculated.

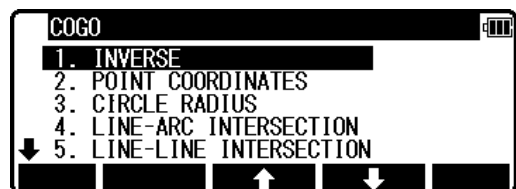
Input: Coordinates of two points

Output: Horizontal distance, Vertical distance between the points and Direction of the line defined by the two points

From the PowerTopoLite screen, press [F2] [CALC] to view CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



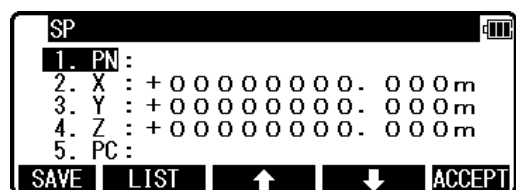
Select the 1. INVERSE and press [ENT] to view INVERSE screen.



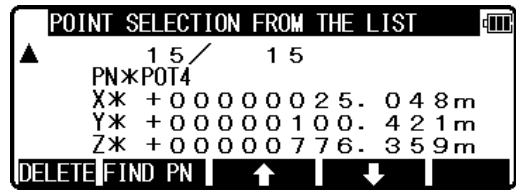
A. Start point input

(Input the PN, Coordinates and PC of the Start point.)

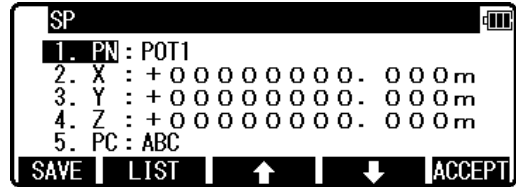
Select 1. SP and press [ENT] to view SP screen.



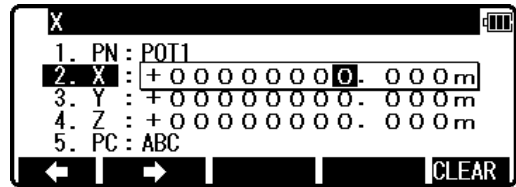
- [LIST] key
All stored points can be displayed as follows by pressing [F2] [LIST].
Press [F2] [LIST] to view POINT SELECTION FROM THE LIST screen.



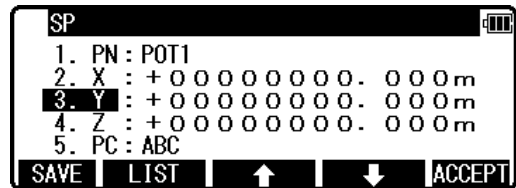
Press [ENT] to open the SP input screen.



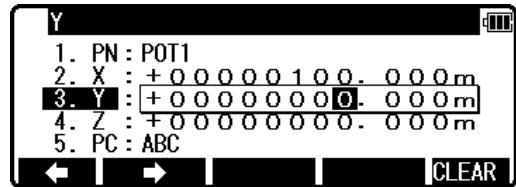
Input your desired Point Name by pressing keys, and press [ENT] to open the X coordinate input screen.



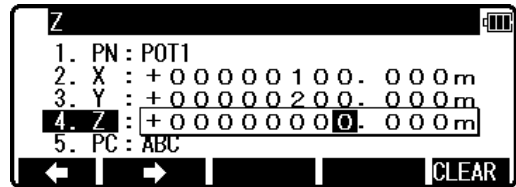
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



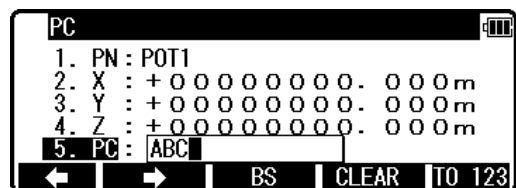
Press [ENT] to open the Y coordinate input screen and input.



Press [ENT] to open the Z coordinate input screen and input.



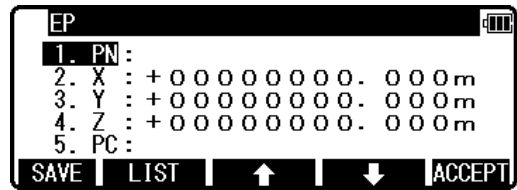
Press [ENT] to open the PC input screen and input.



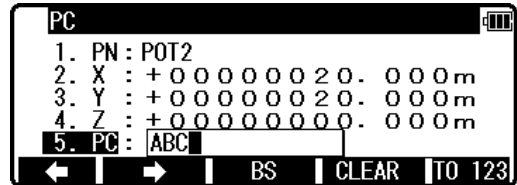
B. End point coordinates input

(Input the PN, Coordinates and PC of the End point.)

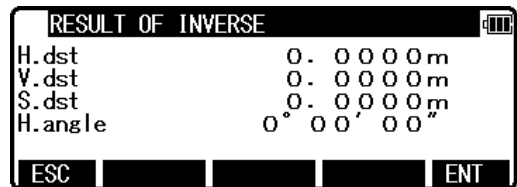
After PC input, EP screen is viewed.



Input the PN, X, Y, Z Coordinates and PC name of the End point.

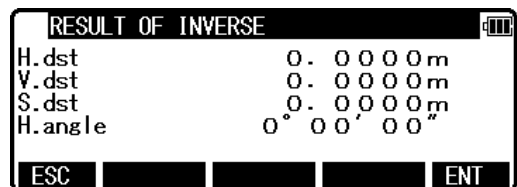
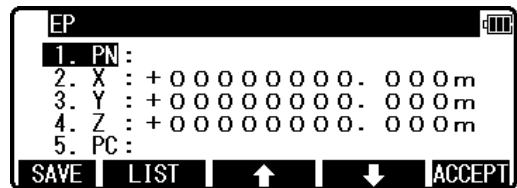


Press [ENT] to view the RESULT OF INVERSE screen.

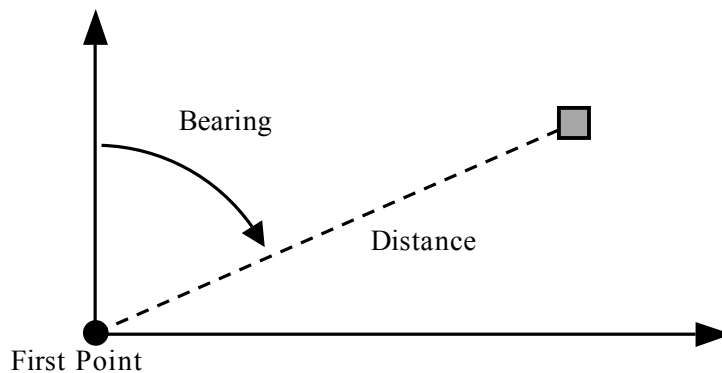


C. Another End point Coordinates input

Input the PN, X, Y, Z Coordinates and PC name of another End point, and another inverse result can be performed.



8.1.2 Point Coordinates



A point Coordinates is calculated from a known point Coordinates and the Distance and Horizontal angle of the Second point.

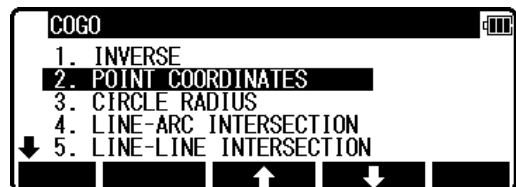
Input: Coordinates of a known point, Distance and Horizontal angle of the Second point

Output: Coordinates of the Second point

From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.

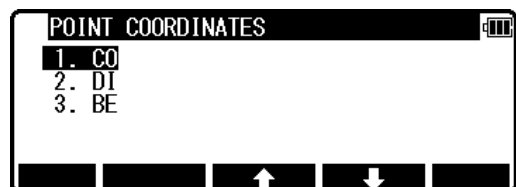


Select 1.COGO and press [ENT] to view the COGO screen.

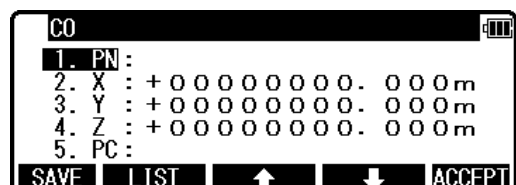


8.1.2.1 Point Coordinates, Distance and H. angle

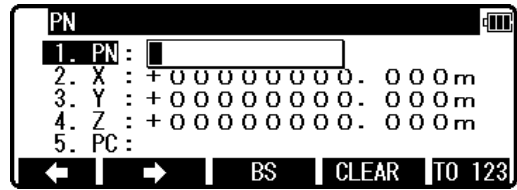
Select the 2. POINT COORDINATES and press [ENT] to view POINT COORINATES screen.



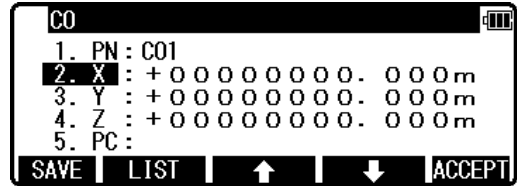
Select 1. CO and press [ENT] to view CO screen.



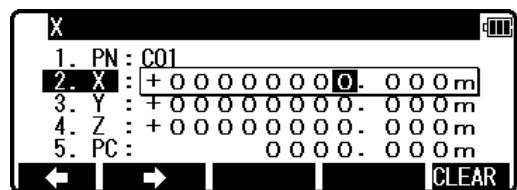
Press [ENT] to open the PN input screen.



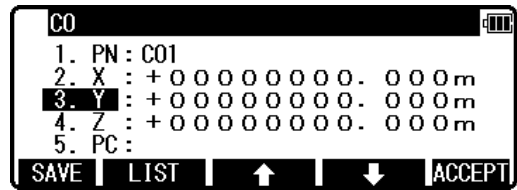
Input your desired Point Name by pressing keys and press [ENT] to view X screen.



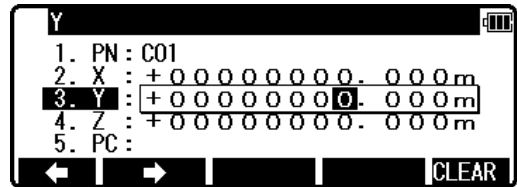
Press [ENT] to open the X coordinate input screen.



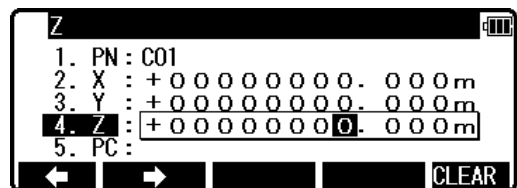
Input your desired value by pressing keys and press [ENT] to go Y coordinate.



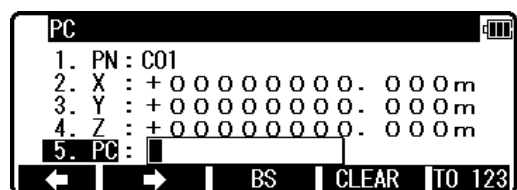
Press [ENT] to open the Y coordinate input screen.



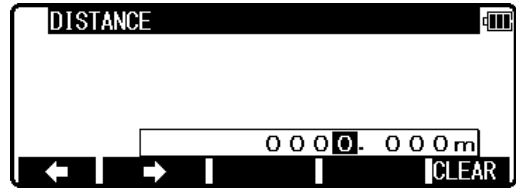
In the same manner, input your desired value by pressing keys and press [ENT] to open the Z coordinate input screen.



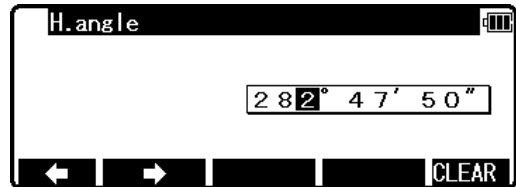
Input your desired value by pressing keys and press [ENT] to open the PC, Point Code, input screen.



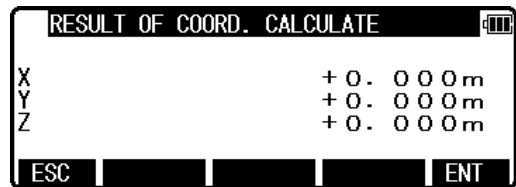
Input your desired PC by pressing keys, and press [ENT] to view DI screen.



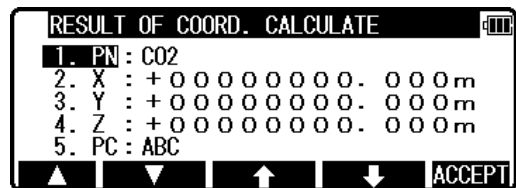
Input your desired value and press [ENT] to open the H. ANGLE input window.



Input your desired value to view the RESULT OF COORD. CALCULATE screen.
The Second point Coordinates are displayed by plus or minus from the known Coordinates.



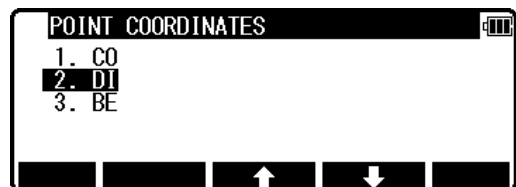
Press [ENT] to view the following screen.



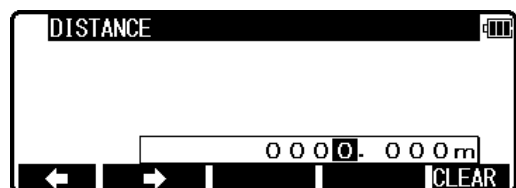
The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

8.1.2.2 Distance and H. angle

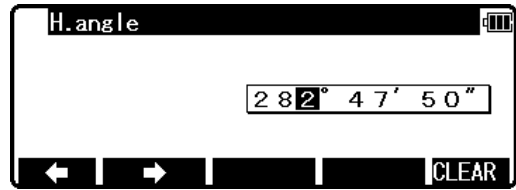
In the same manner, the values of Distance and H. angle are input as follows and the Second point Coordinates are displayed.



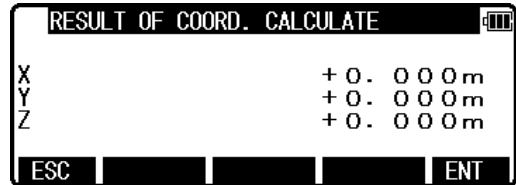
Select 2. DI and press [ENT] to view DI screen.



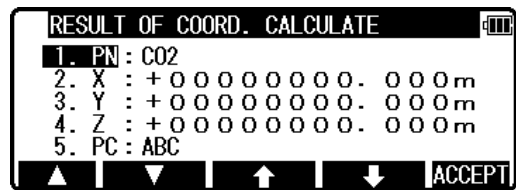
Input your desired value and press [ENT] to open the H. ANGLE input window.



Input your desired value to view the RESULT OF COORD. CALCULATE screen.
The Second point Coordinates are displayed by plus or minus from the known Coordinates.



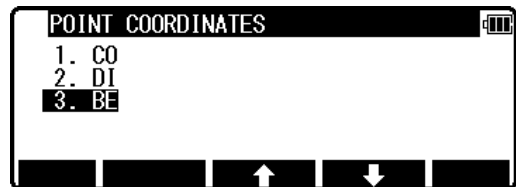
Press [ENT] to view the following screen.



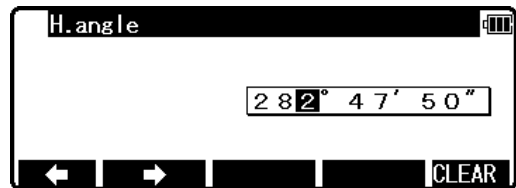
The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

8.1.2.3 H. angle input

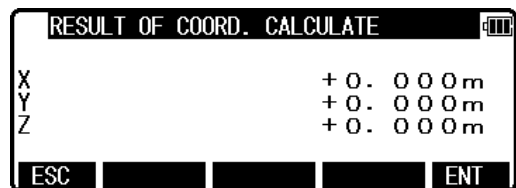
In the same manner, only the value of H. angle is input as follows, and the Second point Coordinates are displayed.



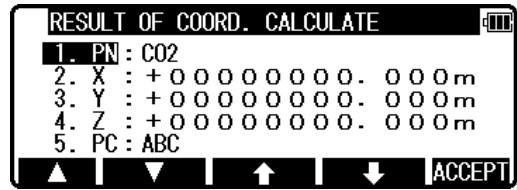
Select 3. BE and press [ENT] to view H. ANGLE screen.
Input H. angle and press [ENT] to view the RESULT OF COORD. CALCULATE screen.



The Second point Coordinates are displayed by plus or minus from the known Coordinates.

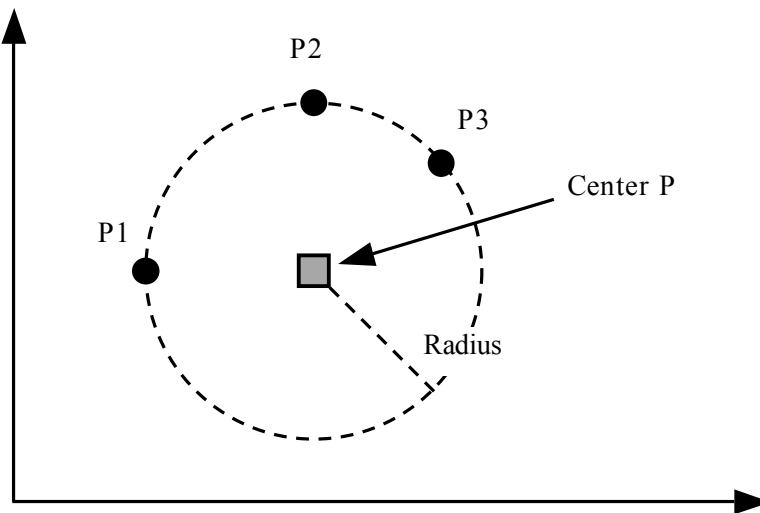


Press [ENT] to view the following screen.



The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

8.1.3 Circle Radius



The Center point and radius of the circle drawn by three points are calculated by this function. You can store calculated Center point.

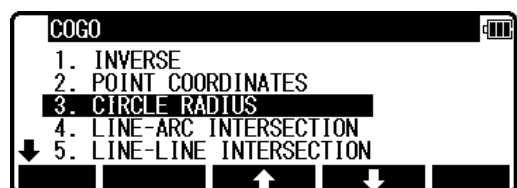
Input: 3 points

Output: Center point of the arc
Radius of the arc

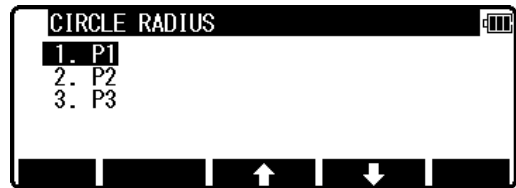
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



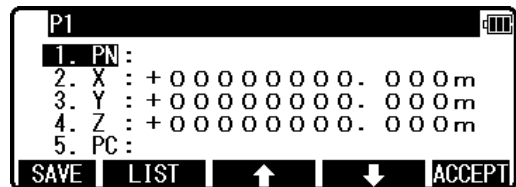
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 3. CIRCLE RADIUS and press [ENT] to view CIRCLE RADIUS screen.

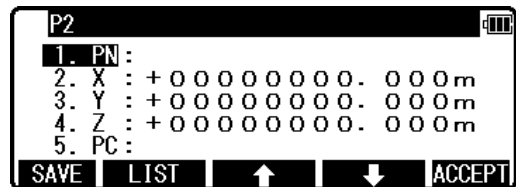


Select 1. P1 and press [ENT] to view P1 screen.

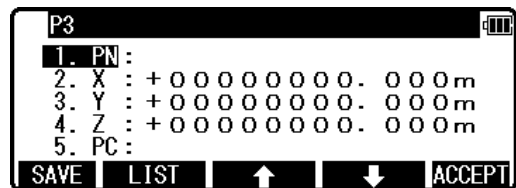


Input PN (Point Name), X, Y, Z, and PC (Point Code) of P1 point or import from the memory of rectangular coordinate as P1 by [F2] [LIST].

If you finish the input of P1 value, press [F5] [ACCEPT]. Then you go to P2 input screen.

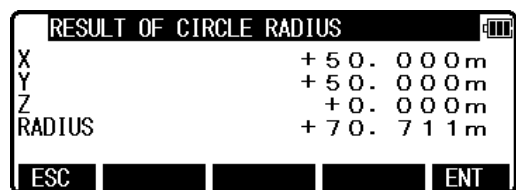


Input P2 data like input of P1. If you finish the input of P2, press [F5] [ACCEPT]. Then you go to P3 input screen.

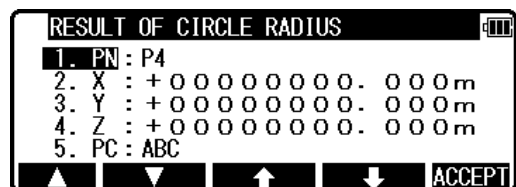


If you finish the input of P3, press [F5] [ACCEPT]. Then you go to RESULT OF CIRCLE RADIUS screen.

You can see the coordinates of Center point of the arc and the radius of the arc.

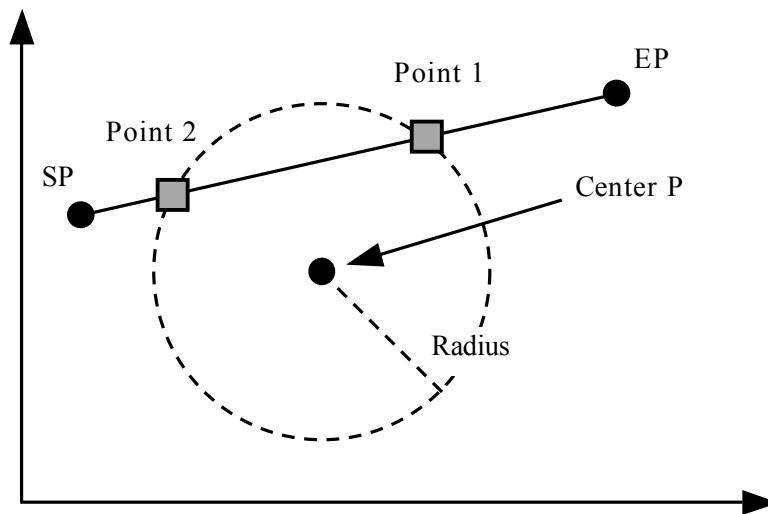


Press [F5] [ENT] to save the coordinates of center point.



The PN, X, Y, Z and PC are viewed and can be edited. If all items are OK, press [F5] [ACCEPT] to save them.

8.1.4 Line-Arc intersection



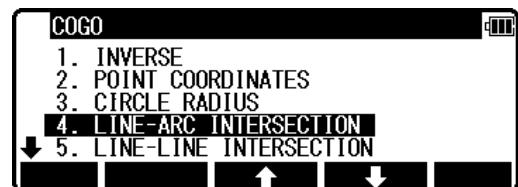
Two intersection points of one line and circle are calculated by this function. The line is drawn by SP and EP. The circle is drawn by center point and radius. You can store two possible intersection points.

Input: Line: Start point and End Point
Arc: Center point and Radius
Output: Two possible intersection points

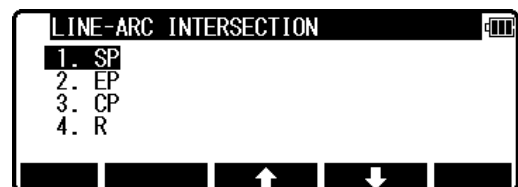
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



Select the 4.LINE-ARC INTERSECTION and press [ENT] to view LINE-ARC INTERSECTION screen.

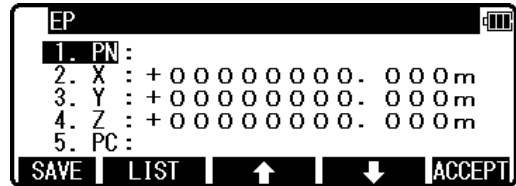


Select 1. SP and press [ENT] to view SP screen.

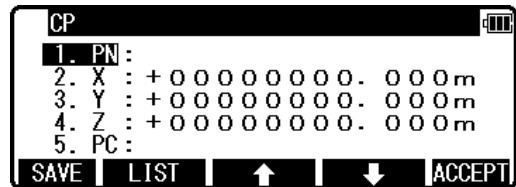


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

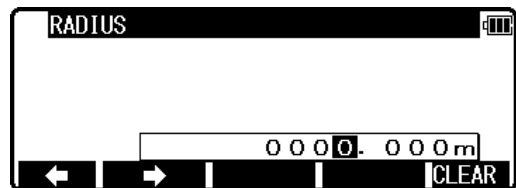
If you finish the input of SP value, press [F5] [ACCEPT]. Then you go to EP input screen.



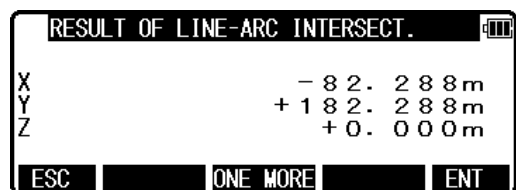
Input EP value like an input of SP. If you finish an input of EP, press [F5] [ACCEPT]. Then you go to CP input screen.



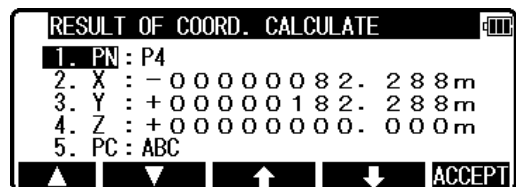
If you finish the input of CP value, press [F5] [ACCEPT]. Then you go to RADIUS input screen.



If you finish the input of RADIUS, press [ENT]. Then you go to RESULT OF LINE-ARC INTERSECTION screen. You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3] [ONE MORE].

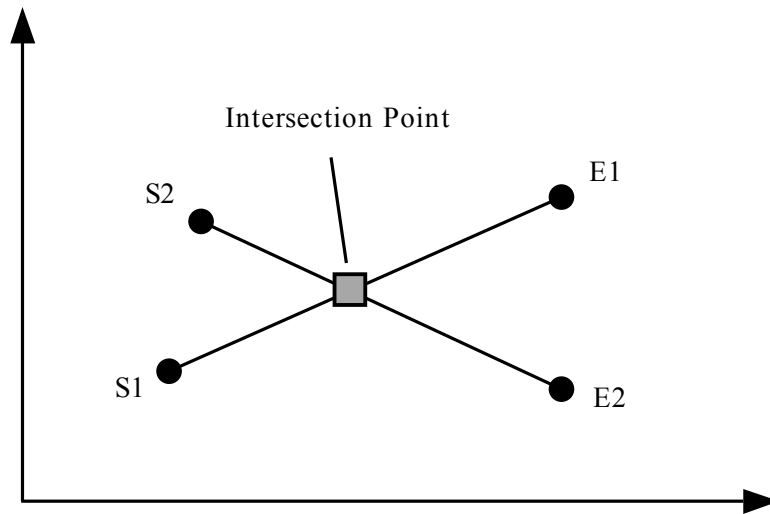


Press [F5] [ENT] to save an intersection point.



The PN, X, Y, Z and PC are viewed and can be edited. If all items are OK, press [F5] [ACCEPT] to save them.

8.1.5 Line-Line intersection



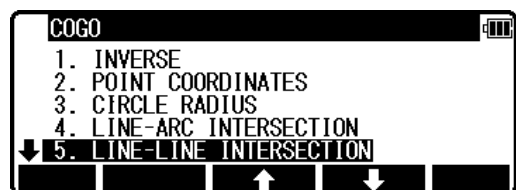
The intersection point of two lines drawn by given four points is calculated by this Function.

Input: First line: Start point and End Point
 Second line: Start point and End Point
 Output: Intersection point between the two lines

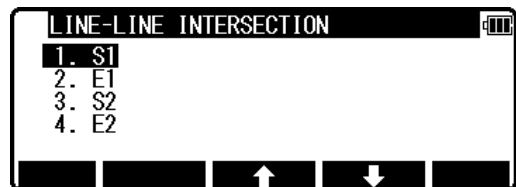
From the PowerTopoLite screen, press the [F2] [CALC] to view the CALCULATION screen.



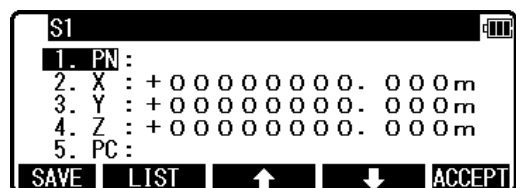
Press 1.COGO to view the COGO screen.



Select the 5. LINE-LINE INTERSECTION and press [ENT] to view its screen

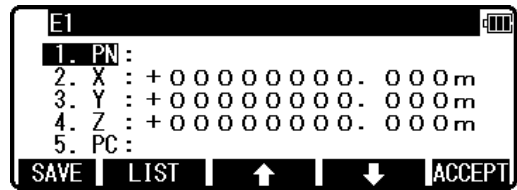


Select 1.S1 and press [ENT] to view S1 screen.

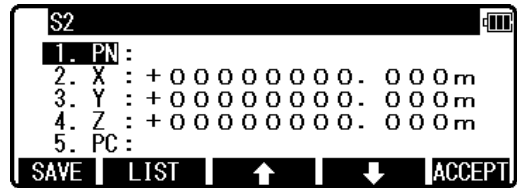


Input PN (Point Name), X, Y, Z, and PC (Point Code) of S1 point or import from the memory of rectangular coordinate as S1 by [F2] [LIST].

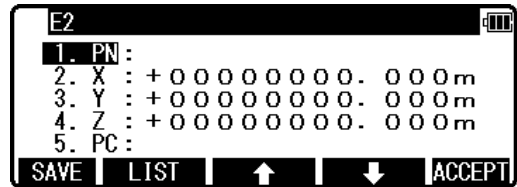
If you finish the input of S1 value, press [F5] [ACCEPT]. Then you go to E1 input screen.



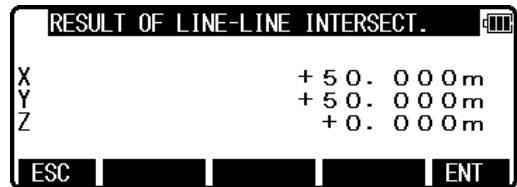
Input E1 value like an input of S1.
If you finish an input of E1, press [F5] [ACCEPT].
Then you go to S2 input screen.



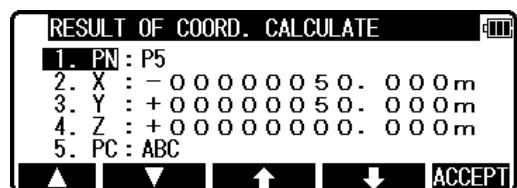
If you finish the input of S2 value, press [F5] [ACCEPT]. Then you go to E2 input screen.



If you finish the input of E2, press [ENT]. Then you go to RESULT OF LINE-LINE INTERSECTION screen to confirm the coordinates of the intersection point.

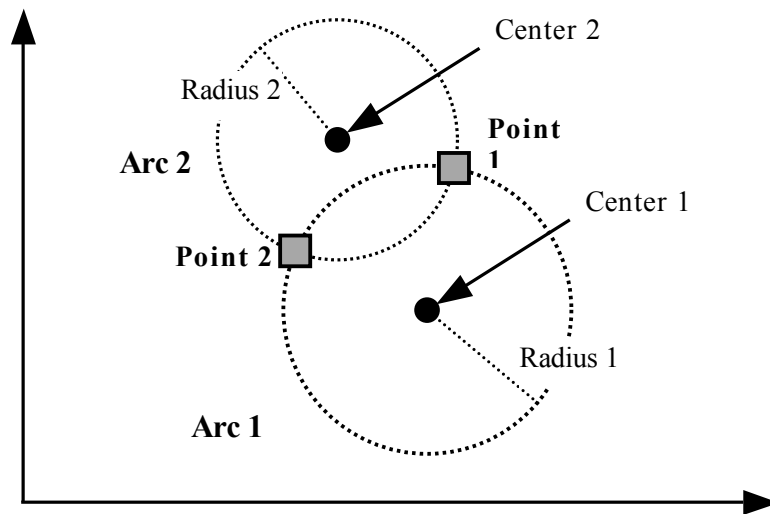


Press [F5] [ACCEPT] to save an intersection point.



The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

8.1.6 Arc-Arc intersection



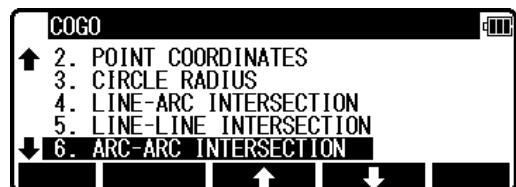
Two intersection points of two arcs drawn by each center point and radius are calculated. You can store two possible intersection points.

Input: Arc 1: Center point and Radius
Arc 2: Center point and Radius
Output: Two possible intersection points

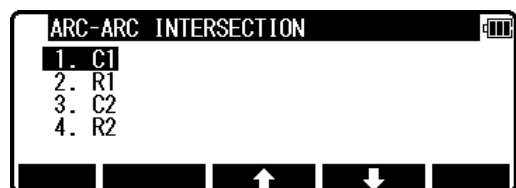
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



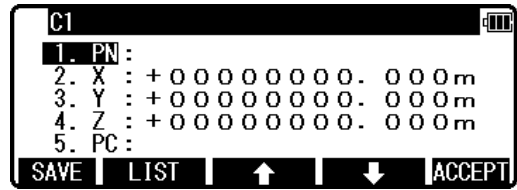
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 6. ARC-ARC INTERSECTION and press [ENT] to view ARC-ARC INTERSECTION screen.

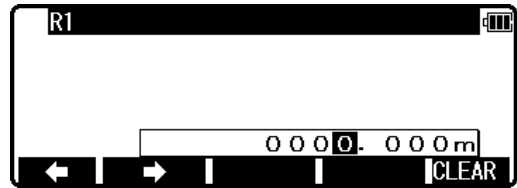


Select 1. C1 and press [ENT] to view C1 screen.

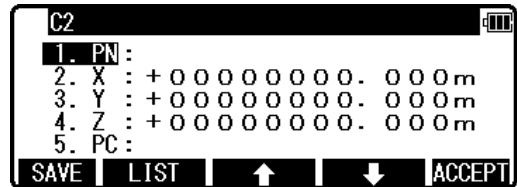


C1 (Center 1) point is Center point of Arc 1.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of C1 point or import from the memory of rectangular coordinate as C1 by [F2] [LIST].

If you finish the input of C1 value, press [F5] [ACCEPT]. Then you go to R1 input screen.

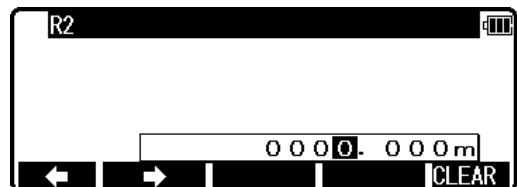


Input the radius of Arc1 as R1 value. If you finish the input of R1, press [F5] [ACCEPT]. Then you go to C2 input screen.



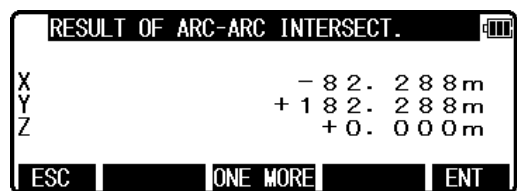
C2 (Center 2) point is Center point of Arc 2.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of C2 point or import from the memory of rectangular coordinate as C2 by [F2] [LIST].

If you finish the input of C2 value, press [F5] [ACCEPT]. Then you go to R2 input screen.

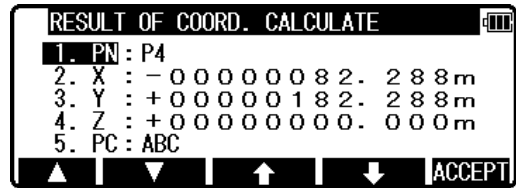


Input the radius of Arc 2 as R2 value. If you finish the input of R2, press [ENT]. Then you go to RESULT OF ARC-ARC INTERSECTION screen.

You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3] [ONE MORE].

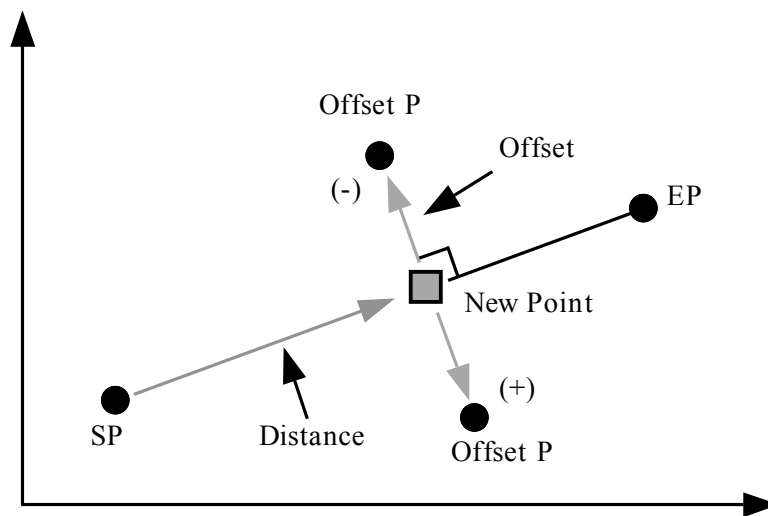


Press [F5] [ENT] to save one of intersection point.



The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

8.1.7 Distance offset



Offset distance of new point to the line and distance of Start point to new point are displayed. Also New Point on the line is calculated by point of start, end, and offset. You can store the New Point.

Input: line: Start Point (SP) and End Point (EP)
Offset Point (OP)

Output: New Point

Offset of New Point from the line

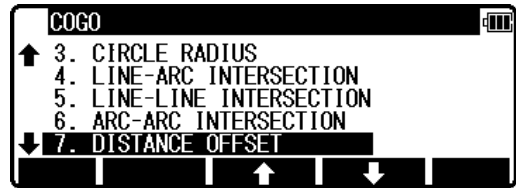
(moving in the direction from Start point to End Point, right is positive, left is negative)

Distance of New Point from Start point

From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



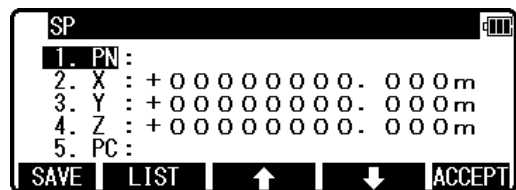
Select 1. COGO and press [ENT] to view the COGO screen.



Select the 7. DISTANCE OFFSET and press [ENT] to view DISTANCE OFFSET screen.

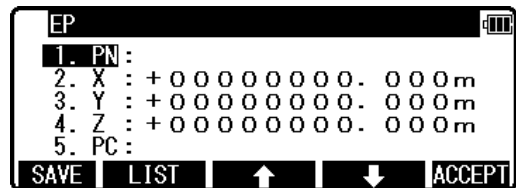


Select 1. SP and press [ENT] to view SP screen.

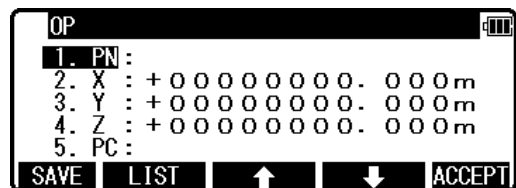


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

If you finish the input of SP value, press [F5] [ACCEPT]. Then you go to EP input screen.

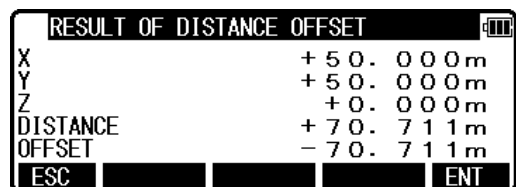


Input EP data like input of SP. If you finish the input of EP, press [F5] [ACCEPT]. Then you go to OP input screen.

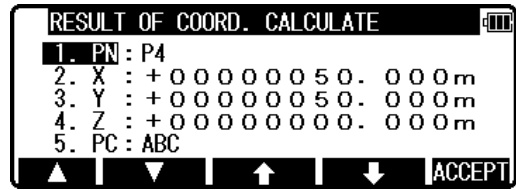


If you finish the input of OP, press [F5] [ACCEPT]. Then you go to RESULT OF DISTANCE OFFSET screen.

You can see the coordinates of New Point on the line, offset distance of New Point to the line and distance of New Point to Start point.

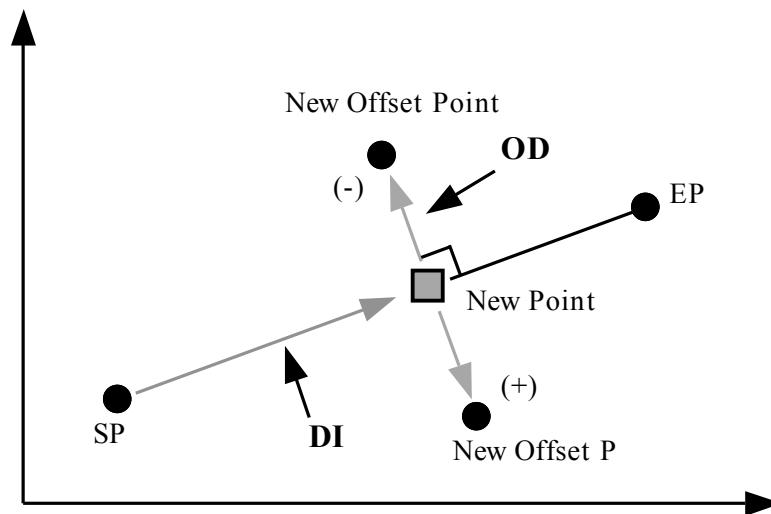


Press [F5] [ENT] to save the coordinates of new point.



The PN, X, Y, Z and PC are viewed and can be edited. If all items are OK, press [F5] [ACCEPT] to save them.

8.1.8 Point distance offset



New offset point is calculated by inputting distance from Start point and Offset from line.

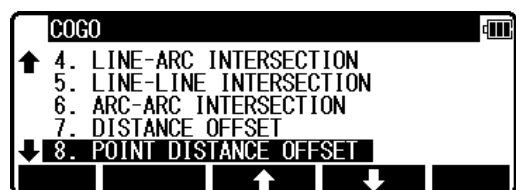
Input: line: Start point and End Point
 Distance from Start point (DI)
 Offset from the line (OD) (moving in the direction from start point to End Point, right is positive, left is negative)

Output: New Point

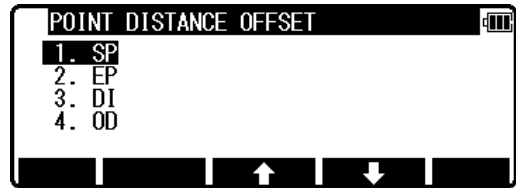
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



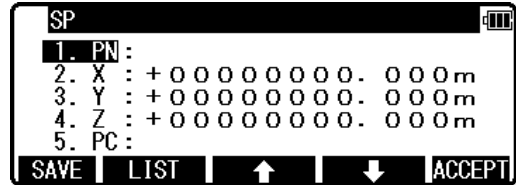
Select 1. COGO and press [ENT] to view the COGO screen.



Select the 8. POINT DISTANCE OFFSET and press [ENT] to view POINT DISTANCE OFFSET screen.

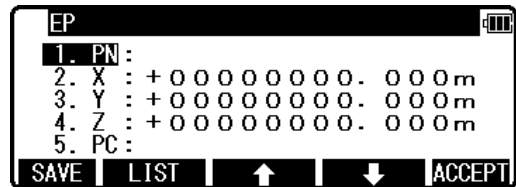


Select 1. SP and press [ENT] to view SP screen.

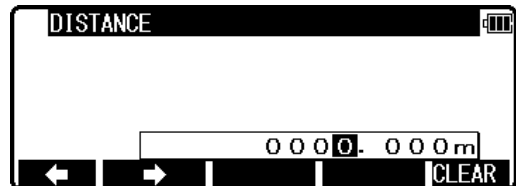


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

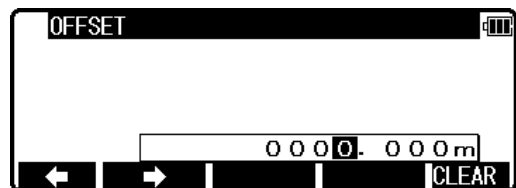
If you finish the input of SP value, press [F5] [ACCEPT]. Then you go to EP input screen.



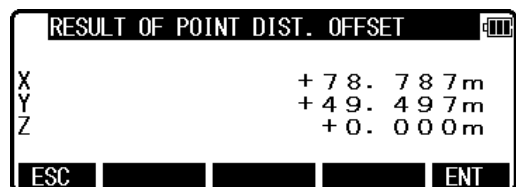
Input EP data like input of SP. If you finish the input of EP, press [F5] [ACCEPT]. Then you go to DISTANCE input screen.



Input DI (Distance from SP to point on the line). If you finish the input of DI, press [F5] [ACCEPT]. Then you go to OFFSET input screen.

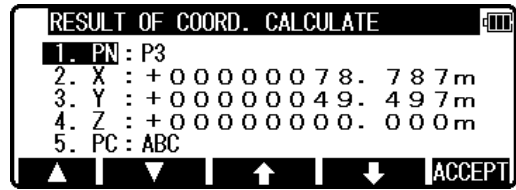


Input OD (Offset distance from the line to offset point). If you finish the input of OD, press [F5] [ACCEPT]. Then you go to RESULT OF POINT DIST.OFFSET screen.



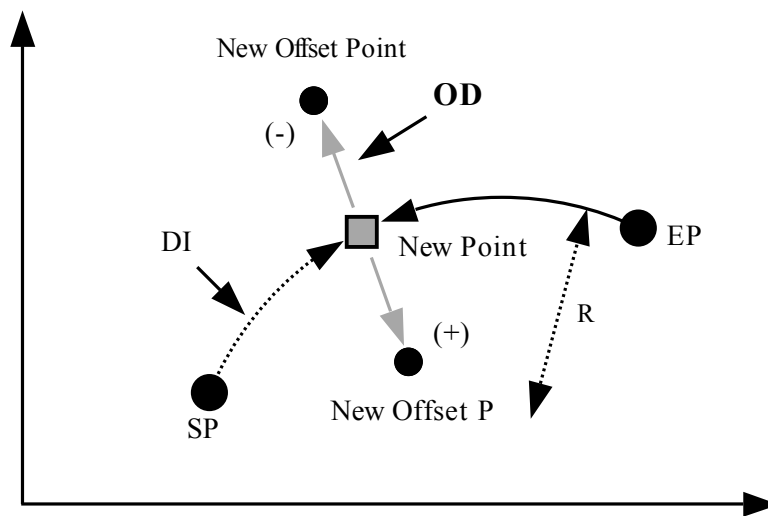
You can see the coordinates of offset point from the line.

Press [F5] [ENT] to save the coordinates of offset point.



The PN, X, Y, Z and PC are viewed and can be edited. If all items are OK, press [F5] [ACCEPT] to save them.

8.1.9 Arc distance offset



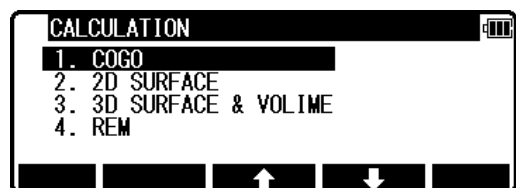
Offset point from the arc is calculated.

Input: arc: Start point, End Point and Radius (R)
 Distance along arc from Start point (DI)
 Offset from the arc (OD) (moving in the direction from Start point to End Point, right is positive, left is negative)

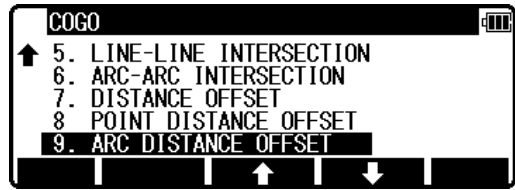
NOTE: From Start point to End Point must be CLOCKWISE. If you calculate by arc of COUNTER CLOCKWISE, change SP for EP and calculate changed DI manually.

Output: new offset point

From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



Select the 9. ARC DISTANCE OFFSET and press [ENT] to view ARC DISTANCE OFFSET screen.

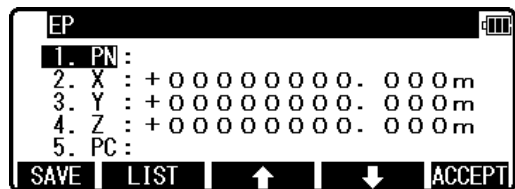


Select 1. SP and press [ENT] to view SP screen.

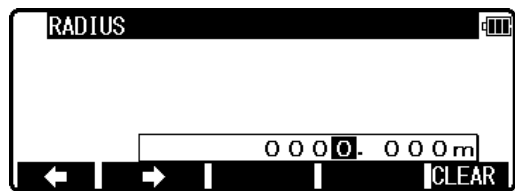


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

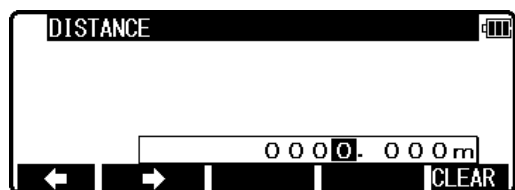
If you finish the input of SP value, press [F5] [ACCEPT]. Then you go to EP input screen.



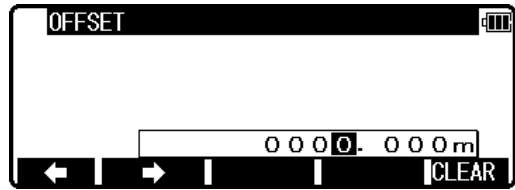
Input EP data like an input of SP.
If you finish input of EP, press [F5] [ACCEPT].
Then you go to RADIUS input screen.



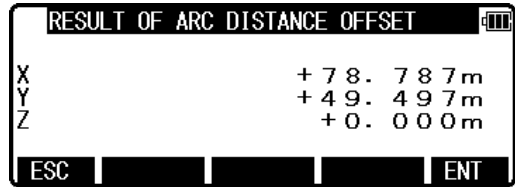
Input RADIUS (Radius of circle).
If you finish the input of RADIUS, press [ENT].
Then you go to DISTANCE input screen.



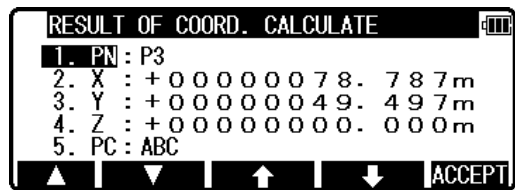
Input DISTANCE (Distance from SP to point on the arc).
 If you finish the input of DISTANCE, press [ENT].
 Then you go to OFFSET input screen.



Input OFFSET (Offset distance from the arc to offset point).
 If you finish the input of OFFSET, press [ENT].
 Then you go to RESULT OF ARC DISTANCE OFFSET screen.
 You can see the coordinates of offset point from the arc.

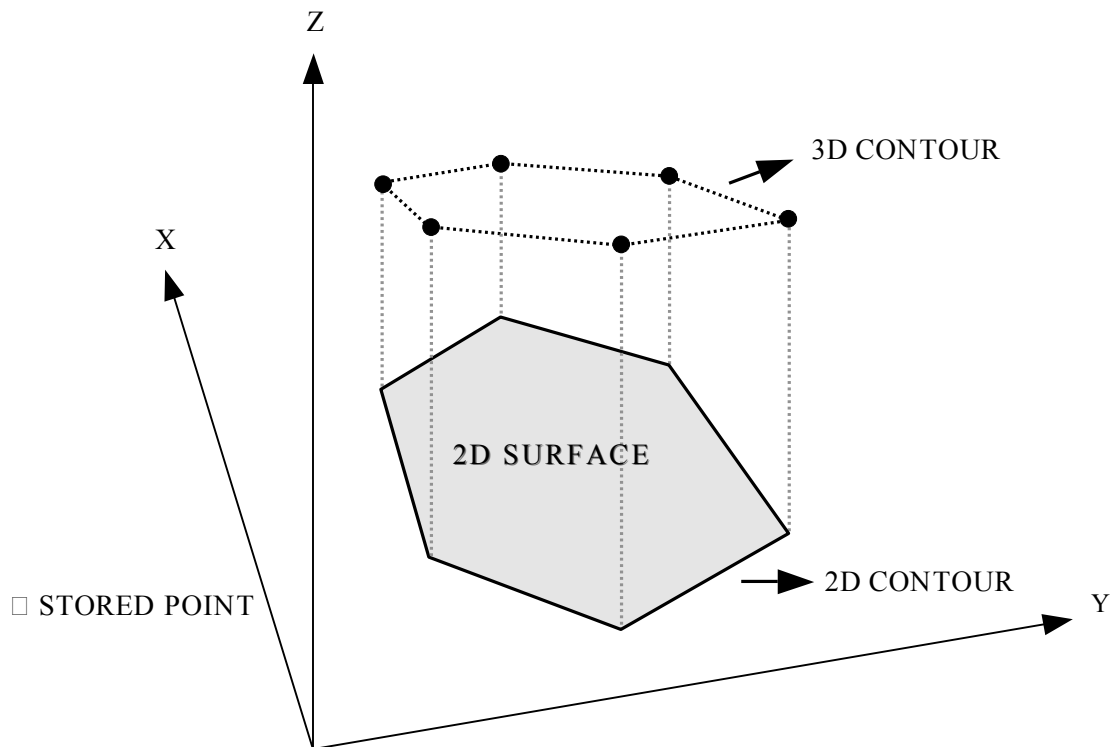


Press [F5] [ENT] to save the coordinates of offset point.



The PN, X, Y, Z and PC are viewed and can be edited.
 If all items are OK, press [F5] [ACCEPT] to save them.

8.2 2D Surface



This function calculates the 2D and 3D contour of a polygon and the 2D surface of the area defined by the polygon.

You define the polygon by selecting points and PowerTopoLite then calculates contour and 2D surface.

NOTE: The polygon is defined by the points you select. Therefore, the order in which you enter the points is important.

If you select points by [ALL] or [FROM] [TO], the polygon is defined according to the order of the memory address. If you select points one by one by [ENT], the polygon is defined according to the order of your selection.

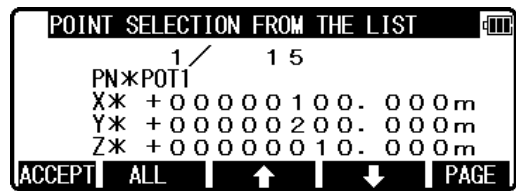
NOTE: You have to select points in such a way that the line segments that define the polygon do not intersect.

NOTE: Selected points should be less than 500 points.

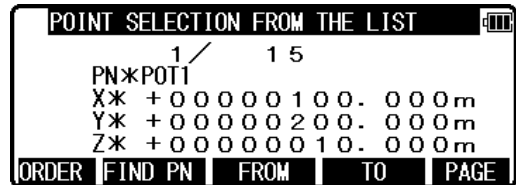
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



Select 2. 2D SURFACE and press [ENT] to view POINT SELECTION FROM THE LIST screen.



If you press [F5] [PAGE], you can see another screen.



You select the order of points, which define the polygon at this screen.

How to select points of polygon

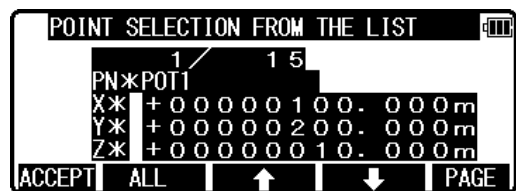
[ENT] key

Move to point selection by [F3] and [F4] arrow keys and press [ENT] to select them one by one, each indication is reversed as follows.

Reverse display shows that it was selected.

If you cancel the selection of the point, press [ENT] again.

You can cancel the selected points one by one after pressing [ALL].



[F2][ALL] key

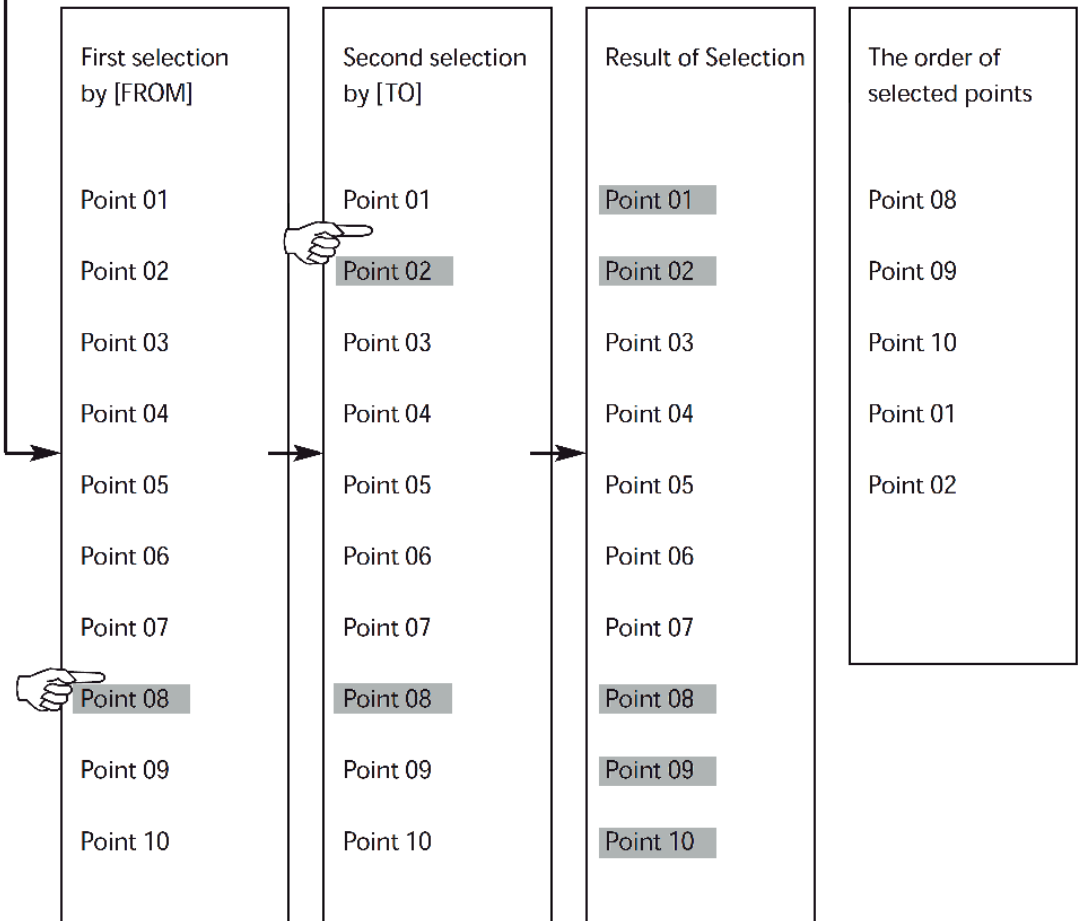
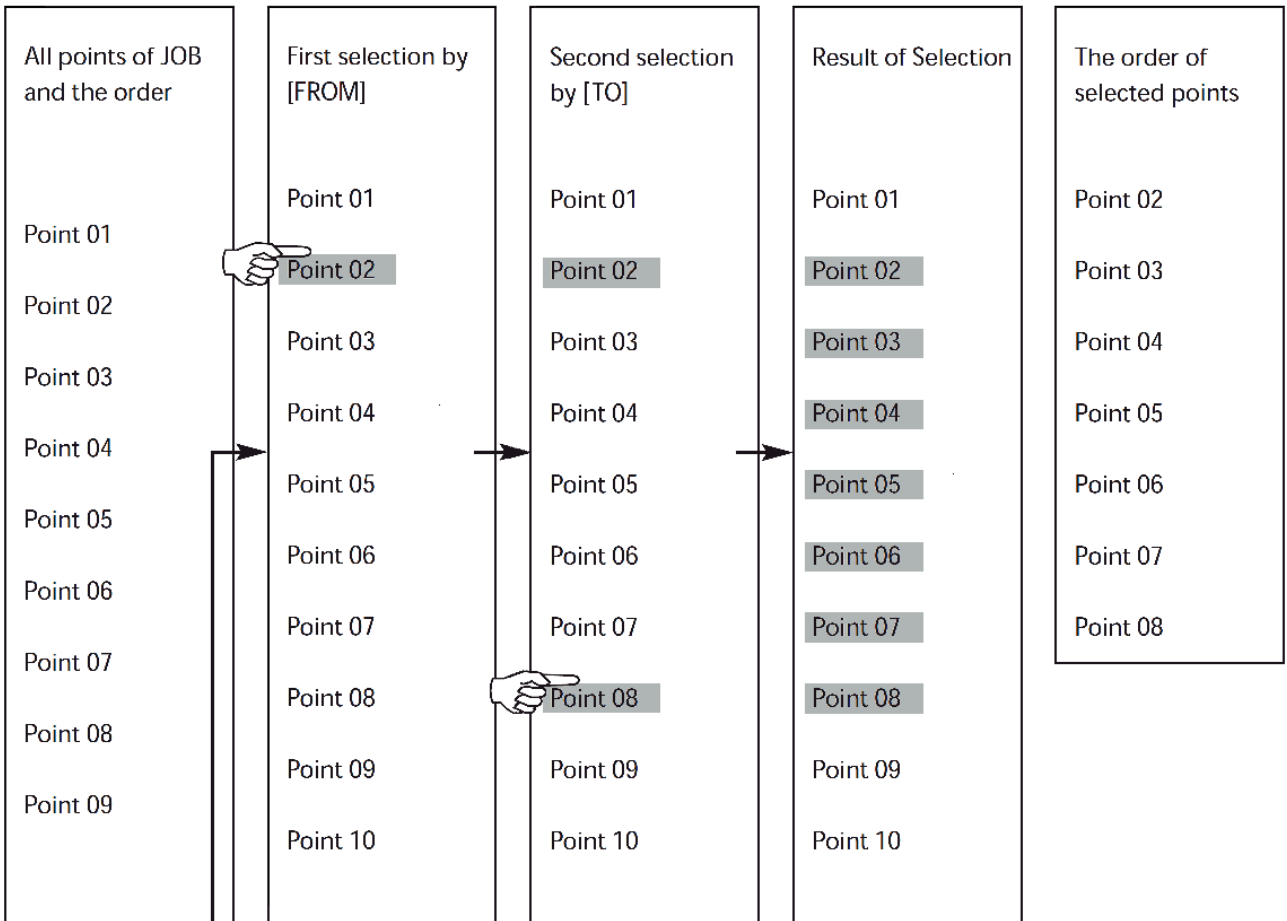
Press [F2] [ALL] to select all stored points of current JOB. The order of points is according to the arrangement of the memory.

If you press [F2] [ALL] again, the selection of all points is canceled. You can cancel the selected points by [ENT] one by one, after pressing [ALL].

If you press [F2] [ALL] after you already selected some points, the selection of all points is reversed.

[F3] [FROM] key and [F4] [TO] key

You can define the range of polygonal points from all points of current JOB by [F3] [FROM] and [F4] [TO] as follows.



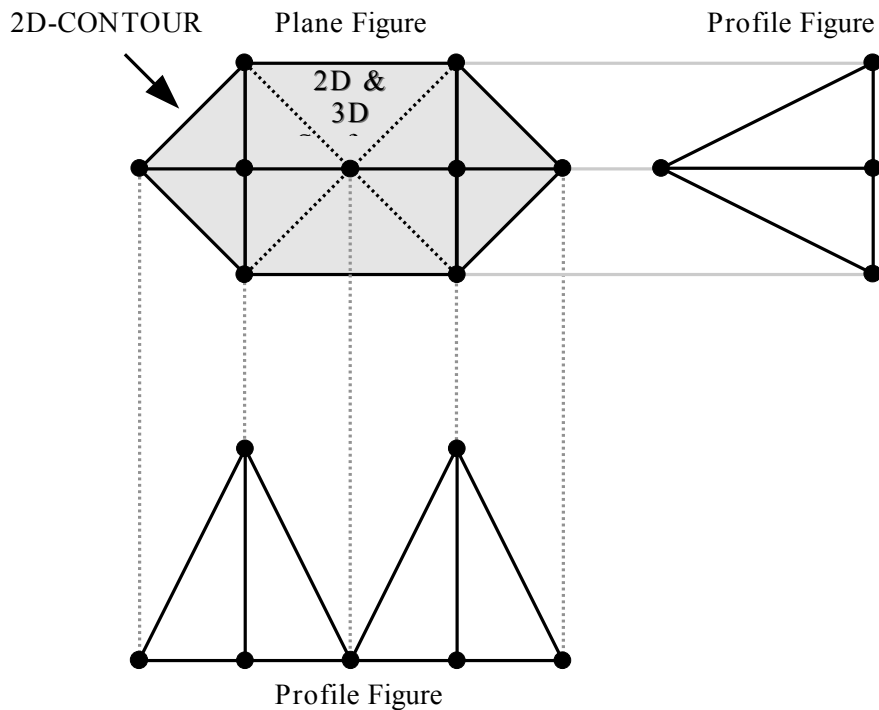
NOTE: [F1] [ORDER] key

Press [F1] [ORDER] to confirm order of selected points after you finished the selection. If you finish point selection of a polygon, press [F1] [ACCEPT] to calculate. The result of calculation is displayed as follows.

RESULT OF 2D SURFACE	
COUNTER	
2D:	947.871m
3D:	1195.084m
2D SURFACE	15000.000m ²
ESC	ENT

Press [ENT] or [ESC] to return to POINT SELECTION FROM THE LIST screen. You change a selection, and you can calculate it again.

8.3 3D Surface and Volume



This function calculates the center, the 2D and 3D surface and positive, negative and total volume.

First, you select the points that are used for the volume calculation. The order in which you select the points is not important. Please refer to 2D SURFACE chapter about selection way. PowerTopoLite generates a mesh (triangulation) of the points automatically and calculates the result based on the mesh.

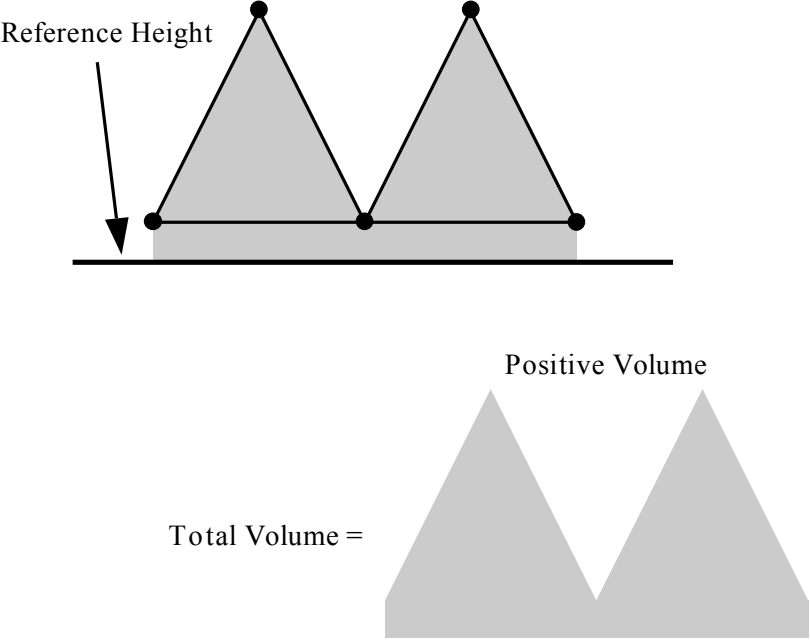
The contour of the points will always be convex. A polygon is generated so that an area may become the biggest. It is like a rope, which is laid around the points, and then tightens.

You have to give the reference height, which is used for volume calculation: the part of the volume that is situated below the reference height is called negative volume and the part above the reference height is called positive volume.

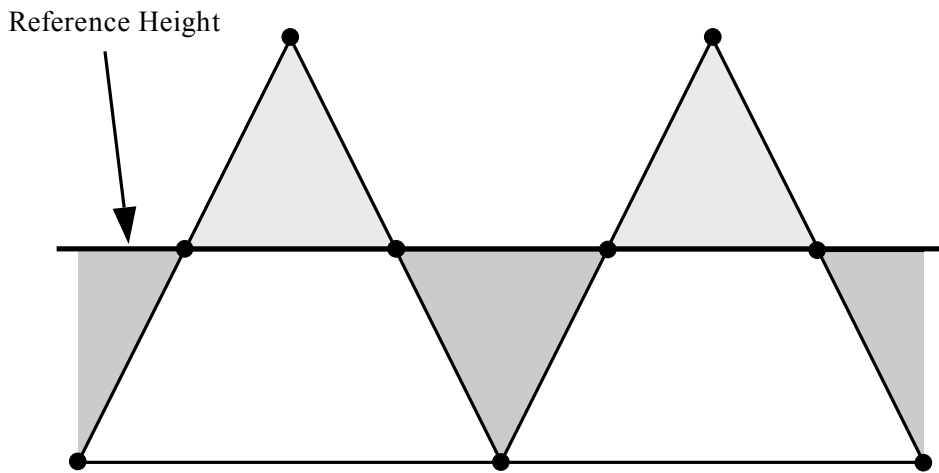
NOTE: Selected points should be less than 350 points.

NOTE: Relations between each volume and reference height are as follows.

In 3D Volume, the case that input reference height is lower than a solid



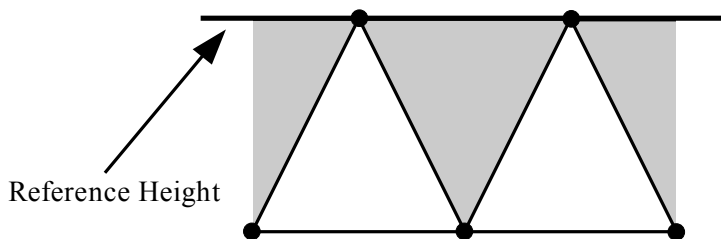
In 3D Volume, the case that input reference height is between a solid



$$\text{Total Volume} = \left(\begin{array}{c} \text{Positive Volume} \\ \text{(Cut)} \end{array} \right) - \left(\begin{array}{c} \text{Negative Volume} \\ \text{(Fill)} \end{array} \right)$$

The diagram shows the calculation of total volume as the difference between positive volume (cut) and negative volume (fill). The positive volume is represented by two upward-pointing triangles, and the negative volume is represented by three downward-pointing triangles, all enclosed in large parentheses with a minus sign between them.

In 3D Volume, the case that input reference height is higher than a solid



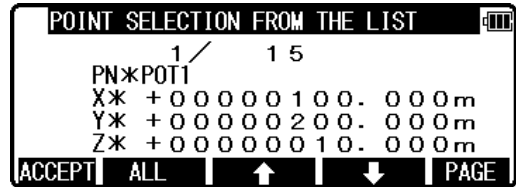
$$\text{Total Volume} = \left(\begin{array}{c} \text{Negative Volume} \\ \text{(Fill)} \end{array} \right)$$

The diagram shows the calculation of total volume as the negative volume (fill). The negative volume is represented by three downward-pointing triangles, all enclosed in large parentheses with a minus sign before them.

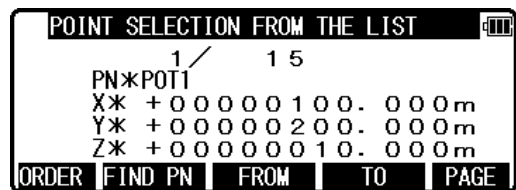
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



Select 3. 3D SURFACE & VOLUME and press [ENT] to view POINT SELECTION FROM THE LIST screen.

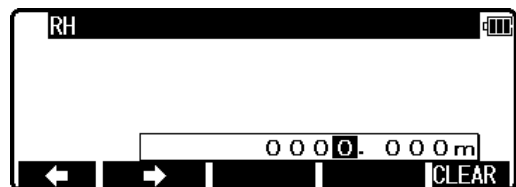


If you press [F5] [PAGE], you can see another screen.



You select points, which compose the polygon in order at this screen.

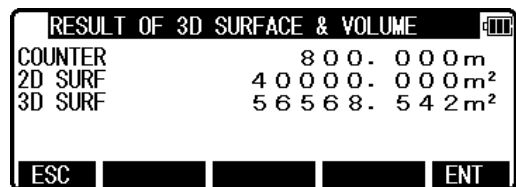
If you finish point selection of a polygon, press [F1] [ACCEPT] to go to RH screen (RH stands for the Reference Height).



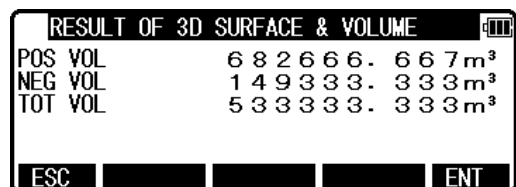
Input Reference Height.

If you finish it, press [ENT] to calculate.

The result of calculation is displayed as follows.



Press [ENT] to go to next screen as follows.



Press [ESC] to return to POINT SELECTION FROM THE LIST screen.

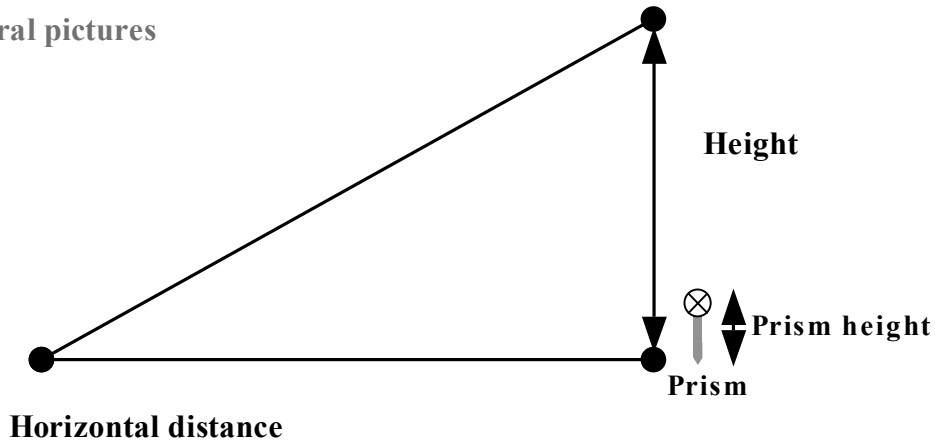
You change a selection, and you can calculate it again.

8.4 REM

8.4.1 General pictures of measurement

With REM measurement, a prism (Reference point) is set approximately directly below the place to be measured, and by measuring the prism, the height to the target object can be measured. This makes it easy to determine the heights of electric power lines, bridge suspension cables, and other large items used in construction.

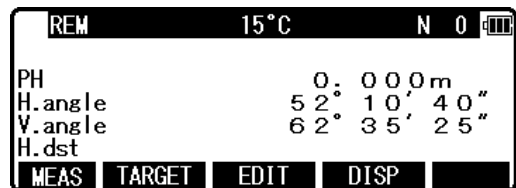
General pictures



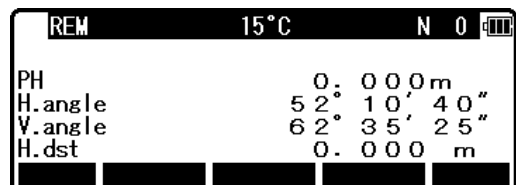
From the PowerTopoLite screen, press [F2] [CALC] to view the CALCULATION screen.



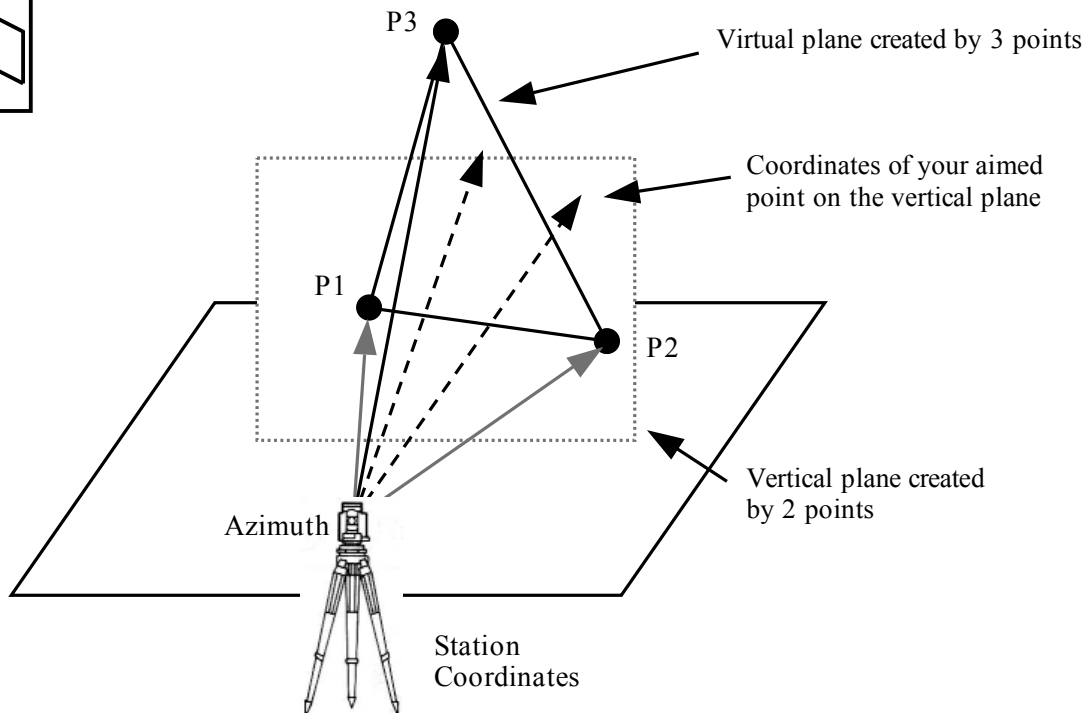
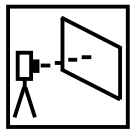
Select 4. REM and press [ENT] to view MEASURE screen.



Please press [ENT] after measuring distance.



9. VPM (Virtual Plane Measurement)



The Virtual plane includes the Vertical plane.

With VPM, the Coordinates on the vertical plane and virtual plane can be obtained by entering the “Station Coordinates and Azimuth” and by measuring point 1, point 2 and point 3. Two points make a vertical plane and three points make a virtual plane. You can measure the Point Coordinates of this virtual plane by aiming at your desired points.

Press the [F3] [VPM] of the PowerTopoLite screen to view the STATION POINT SETUP screen of the VPM function.

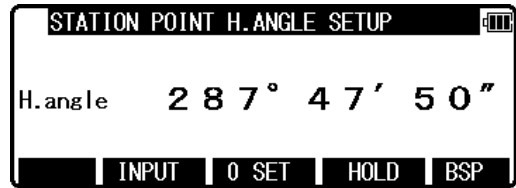
STATION POINT SETUP	
1. PN:	
2. X:	+000000000.000m
3. Y:	+000000000.000m
4. Z:	+000000000.000m
5. IH:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

- [LIST] key
All stored points can be displayed as follows by pressing [F2] [LIST].
Press the [F2] [LIST] to view POINT SELECTION FROM THE LIST screen.
You can enter Coordinates data by applying the List data.

POINT SELECTION FROM THE LIST	
▲	15 / 15
PN*POT4	
X*	+00000025.048m
Y*	+00000100.421m
Z*	+00000776.359m
DELETE FIND PN ↑ ↓	

Press [ENT] to open the input window of PN, X, Y, Z and IH value.

Input each Character or value and press [F5] [ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.

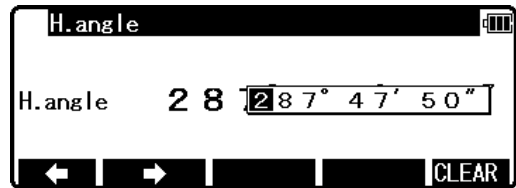


Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

Press [ENT] to open the input window when using [F5] [BSP].

Pressing [F2] [INPUT]

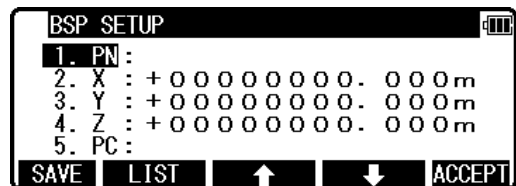
Input any horizontal angle.



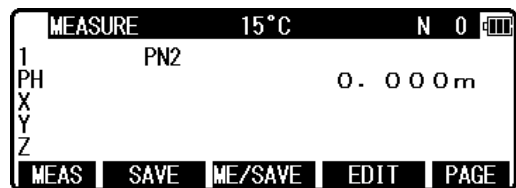
Pressing [F5] [BSP]

The information for Back Sight Point is obtained.

Press [ENT] to finalize the input.

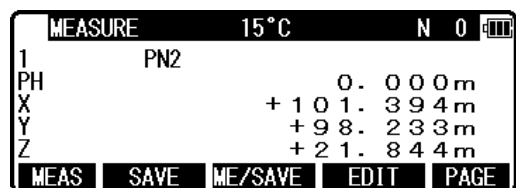


Aim at the reference point, then press [ENT] to enter Multiple Orientation. For more details, refer to "4.3 Multiple Orientation". Following Multiple Orientation, it takes you to MEASURE screen.

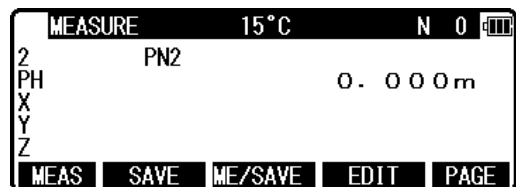


Aim at point 1 and press [F1] [MEAS].

Measured Coordinates are displayed.

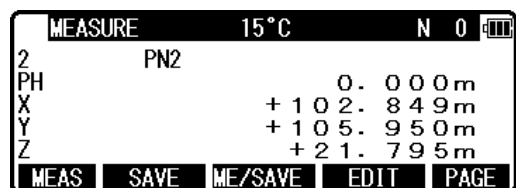


Press [ENT] to view the same MEASURE screen.



In the same manner, aim at point 2 and press [F1] [MEAS].

Measured Coordinates are displayed.



Press [ENT] to view the COORD. ON THE VIRTUAL PLANE screen.
 ON THE VIRTUAL PLANE screen.
 Aim at your desired point and press [ENT].
 The Coordinates which you aim at are displayed.

COORD. ON THE VIRTUAL PLANE	
PN	PN2
PH	0. 000m
X	+ 107. 300m
Y	+ 100. 973m
Z	+ 19. 111m
POINT3	SAVE POINT1 EDIT DISP

Press the [F1] [POINT3] to view the MEASURE screen.

MEASURE 15°C N 0	
3	PN2
PH	0. 000m
X	
Y	
Z	
MEAS	SAVE ME/SAVE EDIT PAGE

Aim at point 3 and press [F1] [MEAS].
 Measured Coordinates are displayed.

MEASURE 15°C N 0	
3	PN2
PH	0. 000m
X	+ 107. 300m
Y	+ 100. 973m
Z	+ 19. 111m
MEAS	SAVE ME/SAVE EDIT PAGE

Press [ENT] to view the COORD. ON THE VIRTUAL PLANE screen.
 Aim at your desired point and press [ENT].
 The Coordinates, which you aim at, are displayed.

COORD. ON THE VIRTUAL PLANE	
PN	PN2
PH	0. 000m
X	+ 107. 300m
Y	+ 100. 973m
Z	+ 19. 111m
POINT3	SAVE POINT1 EDIT DISP

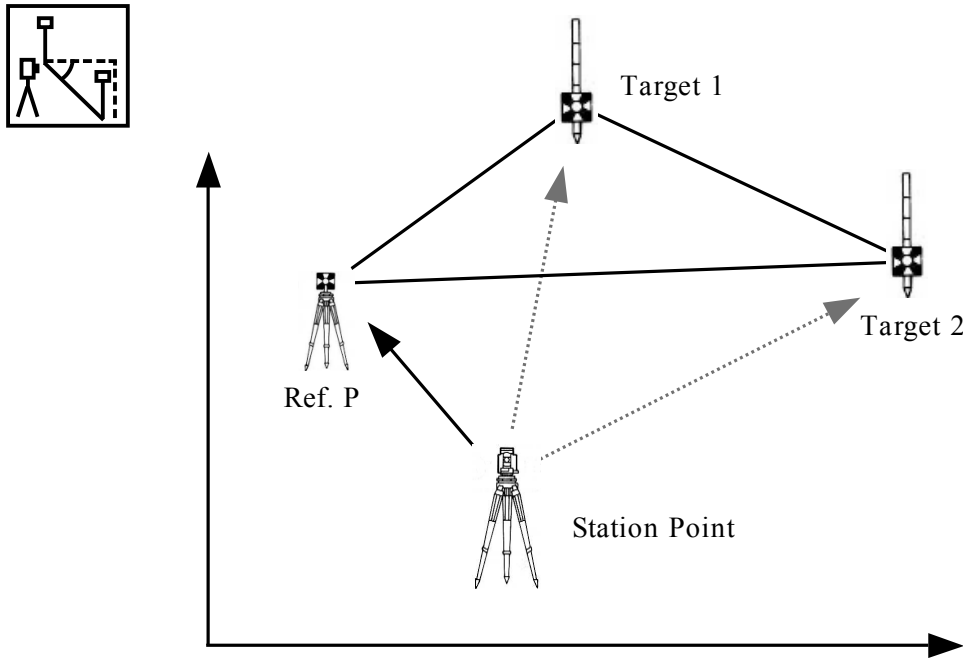
Pressing [F4] [EDIT] can edit the Point Name and Prism Height.

Pressing [F5] [DISP] can switch displayed value from Rectangular data to Polar data.

COORD. ON THE VIRTUAL PLANE	
PN	PN2
PH	0. 000m
H.angle	36° 37' 17"
V.angle	88° 34' 31"
H.dist	2. 536m
POINT3	SAVE POINT1 EDIT DISP

Press [F2] [SAVE] to save the measured data.
 When no PN is input, no survey data is saved.

10. RDM (Remote Distance Measurement)



With RDM, the Horizontal, Vertical and Slope distance and % of Slope between the Reference point and the Target point are measured. The distance between Target 1 and Target 2 are also measured. Any Target point can be changed to the new Reference point.

Press the [F4] [RDM] of the PowerTopoLite screen to view the REF. POINT screen of the RDM function.

REF. POINT		15°C	N 0	☰
PH	0. 000m			
H. angle	52° 10' 40"			
V. angle	62° 35' 25"			
H. dst				
MEAS		TARGET	EDIT	DISP

10.1 PH input

Press [F3] [EDIT] to input the PH, Reference Point Height.

PH		☰
0000. 000m		
←	→	CLEAR

10.2 Reference point - Target distance

Aim at the Reference point and press [F1] [MEAS] to measure the Reference point. It turns to TARGET POINT screen automatically.

TARGET POINT		15°C	N 0	☰
PH	0. 000m			
H. angle	52° 10' 40"			
V. angle	62° 35' 25"			
H. dst				
MEAS		TARGET	EDIT	DISP

Aim at the Target 1 and press [F1] [MEAS] to measure a distance. The distance between Reference point and Target point 1 is displayed.

RESULT OF RDM REF.-TARGET	
H.dst	4. 209m
V.dst	2. 696m
S.dst	4. 998m
%grade	64. 044%
MEAS	DATA DISP

V.dst. and % grade are displayed by minus mark when the Target point height is at a lower position.

Press the [F3] [DATA] to view the TARGET POINT screen.

TARGET POINT 15°C N 0	
PH	0. 000m
H.angle	52° 10' 40"
V.angle	62° 35' 25"
H.dst	3. 251m
MEAS	TARGET EDIT DISP

10.3 Target - Target distance

Aim at the Target 2 and press [F1] [MEAS] to measure a distance. The distance between Reference point and Target point 2 is displayed.

RESULT OF RDM REF.-TARGET	
H.dst	5. 768m
V.dst	2. 642m
S.dst	6. 344m
%grade	45. 801%
MEAS	DATA DISP

Press [F5] [DISP] to display the Target - Target distance.

RESULT OF RDM TARGET-TARGET	
H.dst	2. 536m
V.dst	-0. 054m
S.dst	2. 537m
%grade	-2. 126%
MEAS	DATA DISP

10.4 New Reference point selection

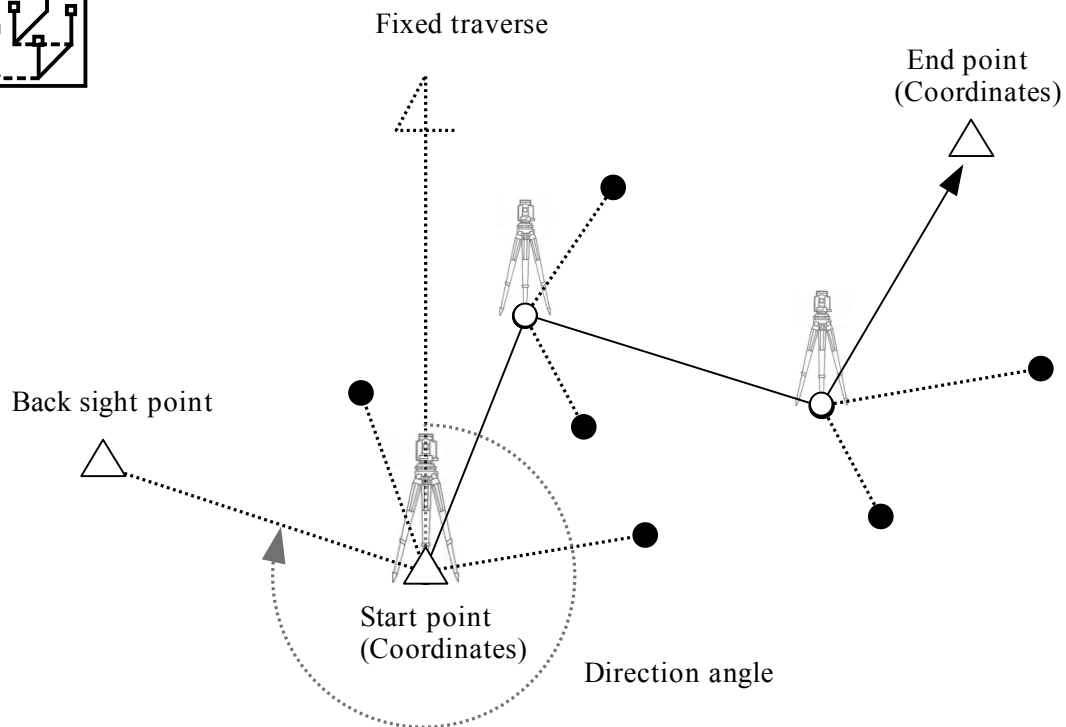
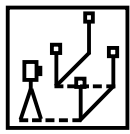
Press [ENT] to view the REF. POINT SELECTION screen. New Ref. point can be selected.

REF. POINT SELECTION	
Use current Target as Ref.?	
Press [ENT] to confirm.	
Press [ESC] to abort.	
ESC	ENT

Press the [F5] [ENT] to view the TARGET POINT screen. Reference point is changed. Input the new PH and repeat the same procedure as the above.

TARGET POINT 15°C N 0	
PH	0. 000m
H.angle	52° 10' 40"
V.angle	62° 35' 25"
H.dst	
MEAS	TARGET EDIT DISP

11. TRAVERSE



- △ Known point
- Corner point
- Sideshot point

This function is for fixed, closed and open traverse calculations.

You can measure not only the corner points but also the sideshot points at the same time. When the traverse is closed, the closing errors of coordinates are calculated and the corner points can be adjusted. In addition, the sideshot points from the corner point based on the adjusted each corner point's coordinates are calculated.

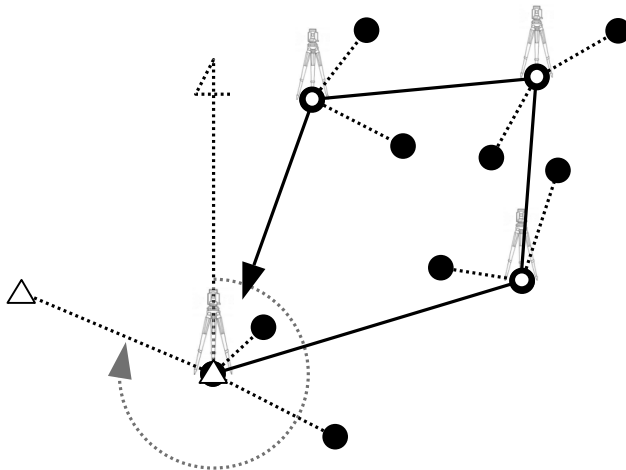
One point of the traverse data uses the memory size of two or three coordinates' data.

Therefore, please check the remaining memory.

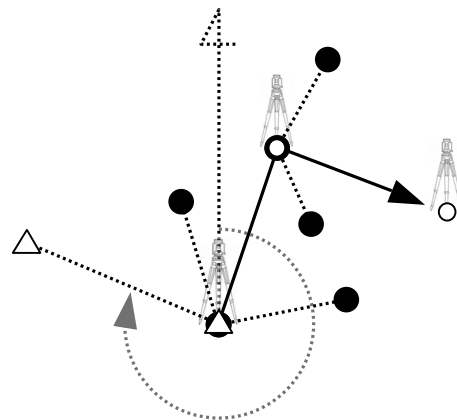
The calculation type is the Compass Rule.

The traverse function can store the polar coordinates data and the rectangular coordinates data. And it can send the polar data by DC1 or AUX format and rectangular data by DC1 or CSV format respectively.

Closed traverse



Open traverse



The following assumptions are made:

The current station is the foresight point of the previous station which you select as a next station. The back sight point of current station is the previous station.

The following limitations are made:

More than one traverse route can't be measured at the same time. Don't store other data while you are measuring the traverse route. When one traverse route is finished, perform the traverse calculation before you store other data. Don't turn the power supply off until the measurement at one start point or at one corner point is completed.

Don't leave the MEASURE screen.

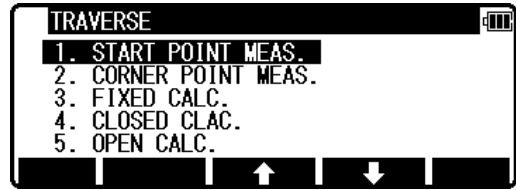
You can't use a duplicate PN in one Job. And you can't overwrite the PN in the traverse. The same traverse route can't be calculated again. Polar coordinates data of back sight and station points can't be seen in the EDIT THE POLAR DATA function. But it is sent properly in SEND POLAR DATA function.

Traverse

From the PowerTopoLite, Press the [F1] [TRAV] of the PowerTopoLite to view the TRAVERSE screen.

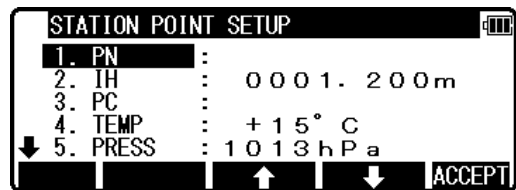
11.1 Start point measuring

Select 1. START POINT first to start new traverse.

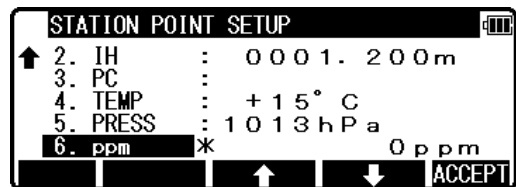


NOTE: More than one traverse route can't be measured at the same time.
Please start the new traverse route after another traverse route is finished.

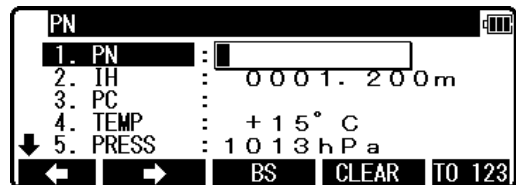
Press [ENT] to view the STATION POINT SETUP screen.



The [↑] / [↓] mark is used to scroll up / down.

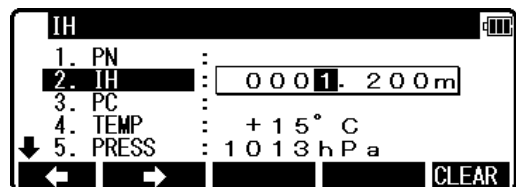


Point name, PN, input.
Press [ENT] to view the PN screen.

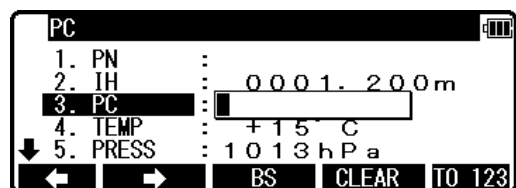


IH, TEMP, PRESS, ppm and PC input.

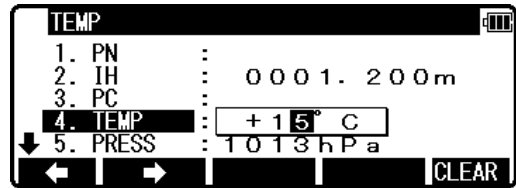
Input IH value.



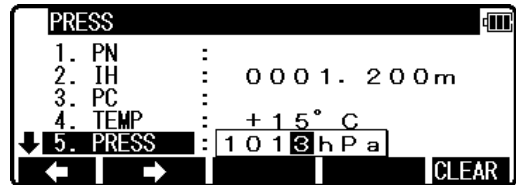
Press [ENT] and input the PC.



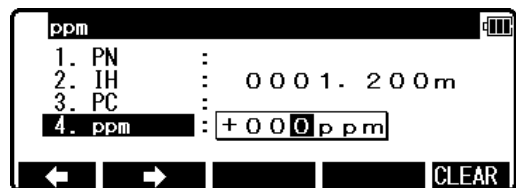
Input the TEMP value.



Press [ENT].
Input the PRESS value.



Press [ENT].
Input the ppm value.

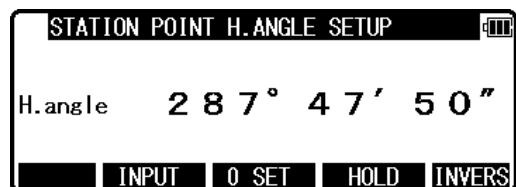


TEMP, PRESS and ppm input depend on the Initial setting 1 (ATM INPUT, ppm INPUT, NIL). And they are alternative.

Press [F5] [ACCEPT] to save the input data.
Then it proceeds to STATION POINT H. ANGLE SETUP screen automatically.

Station Orientation

Input the back sight point's direction angle from the start point.

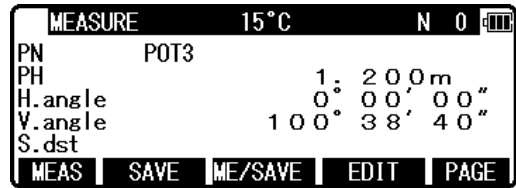


NOTE: The direction angle set at this screen is used in the traverse calculation which will be executed later.

And the rotation of the “H.angle” depends on the rotation setting of “13 .2 Coordinate axis definition”.

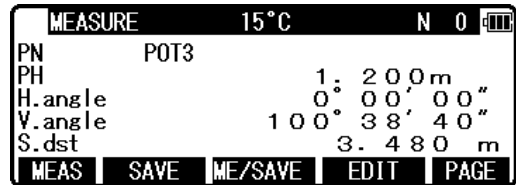
- [INVERS] key
If you want to calculate the direction angle, press [F5] [INVERS] to jump INVERSE function.
Input SP as a start point and EP as a back sight point.
Result angle is set here automatically by pressing the [ENT] at the RESULT OF INVERSE screen. Press [ENT] after aiming at the reference point.

Aim at the reference point and press [ENT] to view the MEASURE screen.



Measuring

Aim at the Target point and press [F1] [MEAS] to measure the distance.



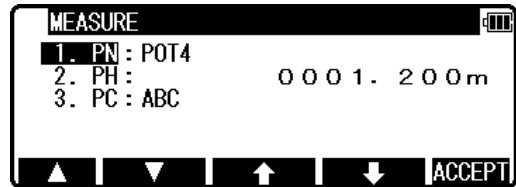
Press [F3] [ME/SAVE] to measure and save the measured data as sideshot point.

Press [F2] [SAVE] to save the measured data as sideshot point.

When no PN is input, no survey data is saved.

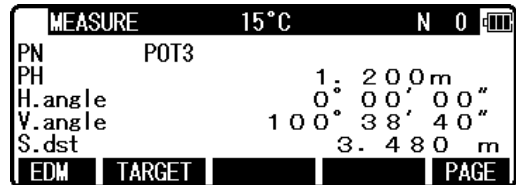
Press the [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

Press [ENT] to view each input window by pressing the up or down arrow key, and input your desired Point Name or Prism Height or Point Code. Press [F5] [ACCEPT], if the current PN, PH and PC are acceptable.



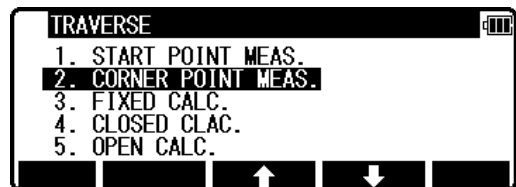
Press the [ENT] to save the measured data as corner point. If [ENT] is pushed more than twice at the one station, the last [ENT] point becomes next corner point.

NOTE: Please use [SAVE] [ME/SAVE] and [ENT] properly by sideshot and corner point. Press [F5] [PAGE] to view another menu.

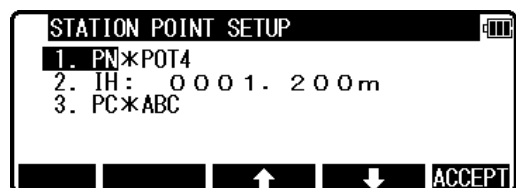


11.2 Corner point measuring

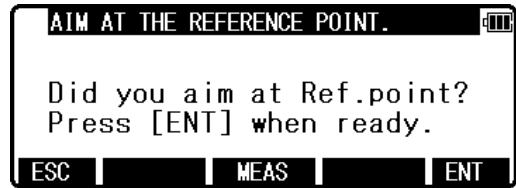
Select 2.CORNER POINT to start measuring at corner point.



And press [ENT] to view the STATION POINT SETUP screen.



Press the [ENT] to view the AIM AT THE REFERENCE POINT screen.

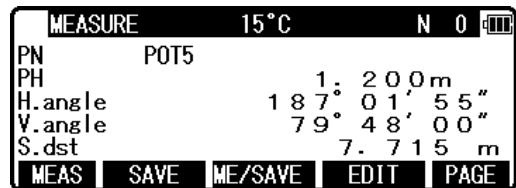


Aim at the previous station, then press [ENT]. The direction angle is set automatically. It proceeds to MEASURE screen automatically.

Press [F3] [MEAS] to confirm the points to be aimed For more details, refer to “4.2 Station Orientation”.

Measuring

Aim at the Target point and press [F1][MEAS] to measure the distance.

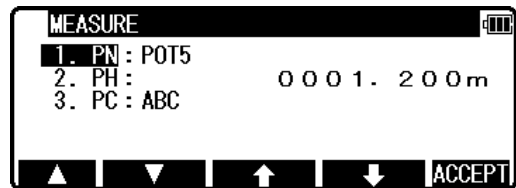


Press [F3] [ME/SAVE] to measure and save the measured data as sideshot point.

Press [F2] [SAVE] to save the measured data as sideshot point.

When no PN is input, no survey data is saved.

Press the [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.



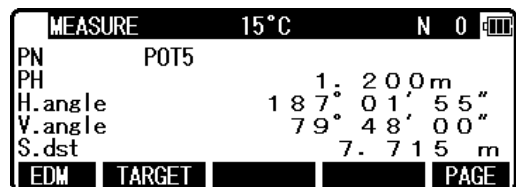
Press [ENT] to view each input window by pressing the up or down arrow key, and input your desired Point Name or Prism Height or Point Code. Press the [F5] [ACCEPT], if the current PN, PH and PC are acceptable.

Press the [ENT] to save the measured data as corner point.

If [ENT] is pushed more than twice at the one station, the last [ENT] point becomes next corner point.

NOTE: Please use [SAVE] [ME/SAVE] and [ENT] properly by sideshot and corner point.

Press [F5] [PAGE] to view another menu.



To finish the traverse measurement

Fixed traverse

Please measure the known point and press [ENT] at the last corner point.

Closed traverse

Please measure the start point and press [ENT] at the last corner point.

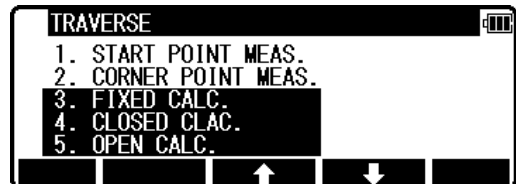
NOTE: Don't use the same point name (PN) for start point when you measure the start point from the last corner point. For example, change "T1" to "T1-1" etc.

Open traverse

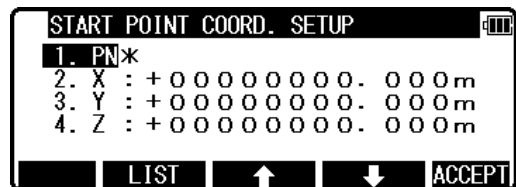
You do not need to measure the corner point by pressing [ENT] for calculation at the last corner point. The closing errors are not calculated.

11.3 Calculation

Select "3.FIXED CALC." or "4. CLOSED CALC." or "5.OPEN CALC." to calculate the traverse route.



Press [ENT] to view the START POINT COORD. SETUP screen.

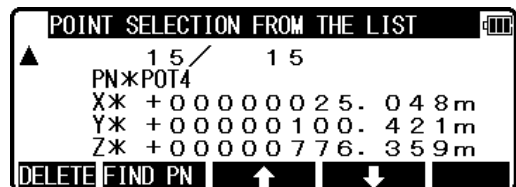


Start point coordinates setup.
(Input the PN, Coordinates and PC of the Start point.)

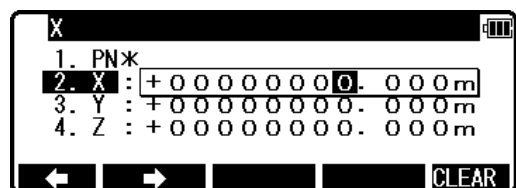
[LIST] key

All the stored points can be displayed as follows by pressing [F2] [LIST].

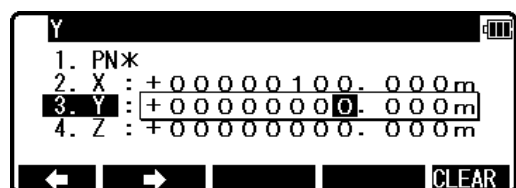
Press [F2] [LIST] to view the POINT SELECTION FROM THE LIST screen.



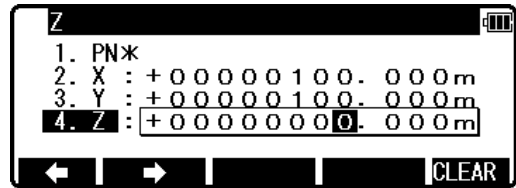
Press [ENT] to open the X coordinate input screen. Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



Press [ENT] to open the Y coordinate input screen and input.

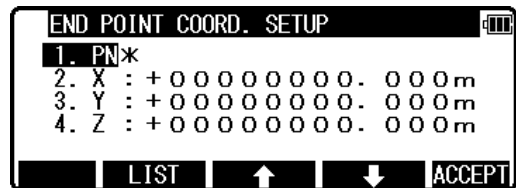


Press [ENT] to open the Z coordinate input screen and input.

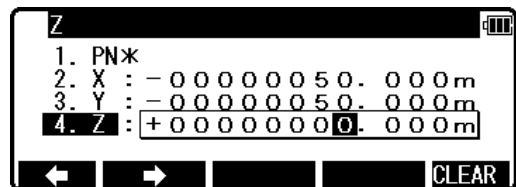


Only in the case of fixed traverse, end point coordinates setup screen is displayed.
(Input the PN, Coordinates and PC of the End point.)

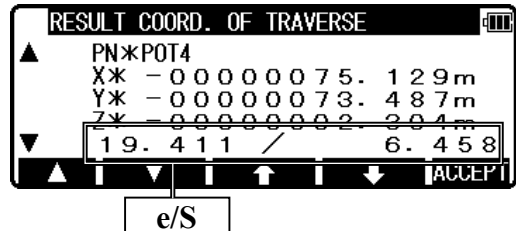
After Z coordinate input, END POINT COORD. SETUP screen is viewed.



Input the PN, X, Y, Z Coordinates and PC name of the End point.



Press [ENT] to view the RESULT COORD. OF TRAVERSE screen.



Display of Calculation Results ※The contents of “e/S” varies by the points to be displayed.

Points being displayed	Contents of “e/S”
Traverse point of Station Point (The point where the instrument is set)	Length between last station P. & current P. / Length between start P. & current P.
Traverse point of not Station Point (The point where the instrument is not set)	Length between last station P. & current P.
Start Point	Closing errors / Total length
End Point	Length between last station P. & current P. / Length between start P. & current P.

※In case of OPEN CALC, Closing errors is not available.

[F1] and [F2] only indicate corner points in order.

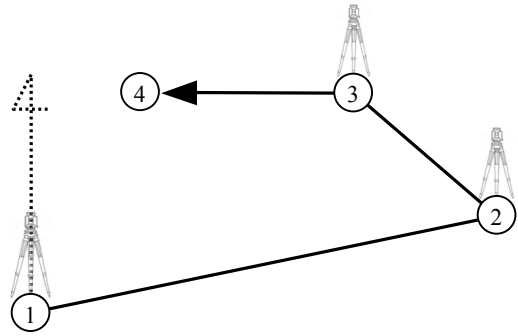
[F3] and [F4] indicate all points in order.

Press [F5] [ACCEPT] to save the all corner, sideshot points, and known points.

FIXED TRAVERSE

Set the instrument in the order of 1, 2, 3 and 4, then make the measurement.

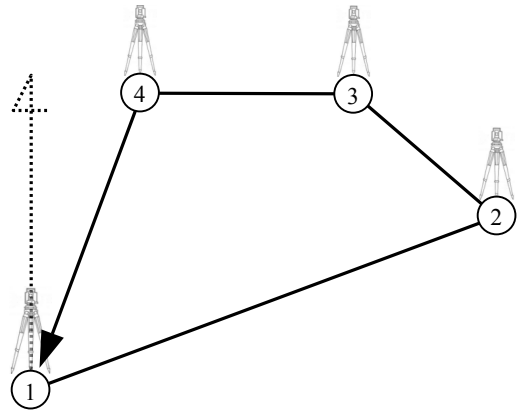
- 1: [Start point]
- 2 and 3: [Traverse points of Station P]
- 4: [End point]



CLOSED TRAVERSE

Set the instrument in the order of 1, 2, 3 and 4, then make the measurement.

- 1: [Start point]
- 2, 3, 4: [Traverse points of Station P.]
- 1, which is measured last, is [End point]



Example:

For point 1

“Closing errors/Total length is the horizontal distance error at point 1 between measured value and theoretical value.

“Total length” is the distance measured in the order of 1-2-3-4-1

For point 3

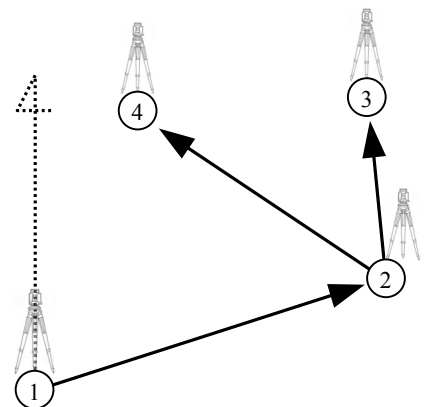
“Length between last station P. & current P.” is the distance between 2 and 3

“Length between start P. & current P.” is the distance measured in the order of 1-2-3

OPEN TRAVERSE

Set the instrument in the order of 1 and 2, then make the measurement.

- 1: [Start point]
- 2: [Traverse point of Station P.]
- 3 and 4: [Traverse points of not Station P.]



Example :

For point 4

“Length between last station P. & current P.” is the distance between 2 and 4.

12. INPUT / OUTPUT



The communication setting and the Input/Output of data are performed by this function.

We recommend you not to press any key until data transfer is completed while transfer operation.

Notice concerning the unit of data to transfer.

Output data (Rect. data & Polar data).

Coordinates and Distance data.

The unit is output by “m” unit even if the distance unit setting of the instrument to send the data is “m”, “ft” and “ft+inch”.

Angle, Temperature and Pressure data.

The data is output according to the unit setting of the Angle, Temperature and Pressure of the instrument to send the data.

Input data (Rect. data).

Coordinates data.

The Coordinates data received is input in the instrument as data of “m” unit.

Then, it is converted according to the distance unit which is set in the instrument, and displayed on the screen.

Data format

1. DC-1

[In case of Text File read / write]

Record No.	:	Site name	:	L/F code						
Record No.	:	P. Name	:	X Coord.	:	Y Coord.	:	Z Coord.	:	L/F code

[In case of Communication with COM]

Record No.	:	Site name	:	BCC	:	L/F code						
Record No.	:	P. Name	:	X Coord.	:	Y Coord.	:	Z Coord.	:	BCC	:	L/F code

[Record No.]

The Record number is a 5-digit serial number.

(the number consists of a 4-digit serial number plus one digit.

The last digit represents the data type. 1: Site name; 2: Survey P.data)

[P. Name] The Survey P. number is handled as text data, if it is input.

[:] “ : ” is used to separate items.

[Coordinate data] X, Y, and Z coordinate data

A 6-digit integer part and a 3-digit fraction part represent coordinate data.

[BCC]

To detect a data transmission error, BCC is calculated per block and attached to the end of data.

[L/F code] use CR/LF

BCC is calculated by the following calculation method

$$BCC = \sum A - (B \times 40H) 20H$$

$\sum A$ = Each character of a block that contains the sum of the ASCII code

$$B = \sum A \div 40H \text{ (truncate decimal places)}$$

2. CSV

P.Name	,	X Coord.	,	Y Coord.	,	Z Coord.	,	P.Code	,	L/F code
--------	---	----------	---	----------	---	----------	---	--------	---	----------

[P. Name]

The P. Name is handled as text data, if it is input.

[Coordinate data]

X, Y, Z Coordinate data.

Represented by a 6-digit integer part and a 3-digit fraction part.

[P. Code]

The P. Code is handled as text data, if it is input.

[L/F code]

use CR/LF.

3. ExtCSV

31	,	No.	,	P. Name	,	P. Code	,	X Coord.	,	Y Coord.	,	Z Coord.	L/F code
----	---	-----	---	---------	---	---------	---	----------	---	----------	---	----------	----------

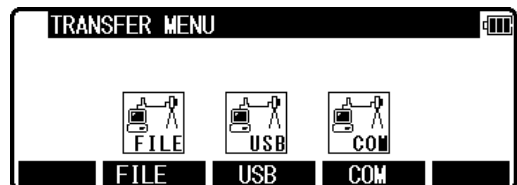
[31] Fixed

NOTE: This format is used when sending PointCodeList. Received files are automatically saved in the "PointCodeList" of Job File.

4. AUX

Format of AUX is used the same as that of DC1.

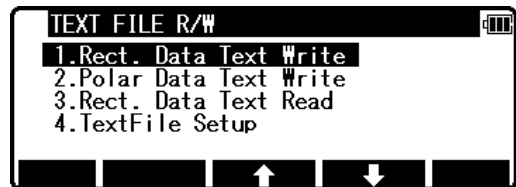
Press the [F3] [I/O] of the PowerTopoLite to view the TRANSFER MENU screen.



12.1 Text File read / write

Text file read/write allows you to input and output format and text data specified recording media. Before taking this procedure, make sure of TextFile Setup (refer to “12.1.3. Text file Setup”).

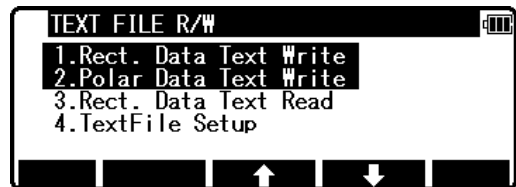
Press the [F2] [FILE] of the TRANSFER MENU screen to view the TEXT FILE R/W screen.



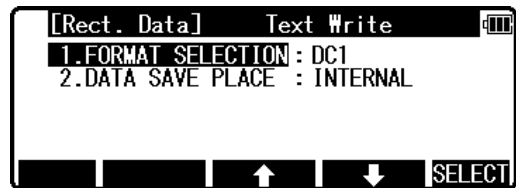
12.1.1 Writing to Text File

This command allows you to transfer the existing measurement point data in the internal memory to specified format per file.

When output Rectangular Data, select 1 and in case of Polar Data, select 2, then press [ENT].



Press [F5] [SELECT] to select format and data save place, then press [ENT].

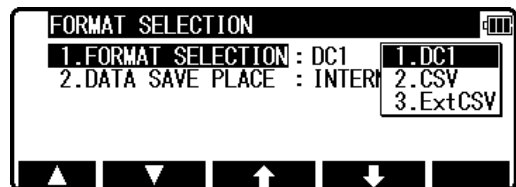


[FORMAT SELECTION]

Rectangular Data

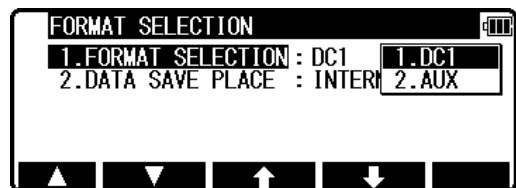
- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)

※ Be careful that extension of CSV and ExtCSV will be the same.



Polar Data

- DC1 (Extension DC1)
- AUX (Extension AUX)



[DATA SAVE PLACE]

INTERNAL

Save data in the memory of the instrument.
Output file can be loaded to PC by connecting a USB (Refer to 12.2 Communication with USB)

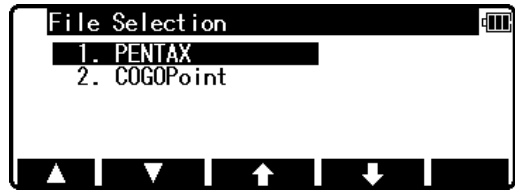
SD CARD

Save data in the SD card.
Output file can be loaded to PC by connecting a USB.

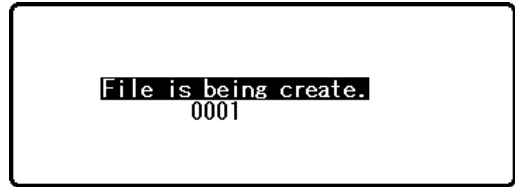


[DATA SAVE PLACE] is set in the SD card, you can use the SD card directly without connection USB.

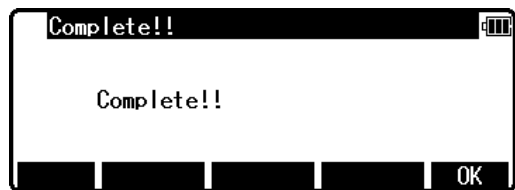
Select the file you desire to output, then press [ENT].



New files are created in the memory of the instrument and SD card, and also transferred data will be recorded in it.



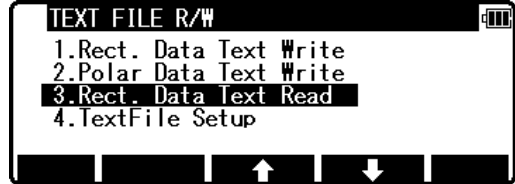
[File Name]
 Rectangular Data [Job Name]_C.[Extension]
 Polar Data [Job Name]_P.[Extension]



NOTE: If free memory space becomes less than 1MB, you can not create the file, and an error message [Space capacity is short] is displayed. Try again after increasing free memory space.

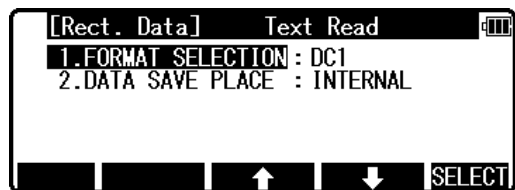
12.1.2 Reading from Text File

This command allows you to transfer the text file containing measurement point data in the internal memory of the instrument or SD card to the data that can be used with the instrument.



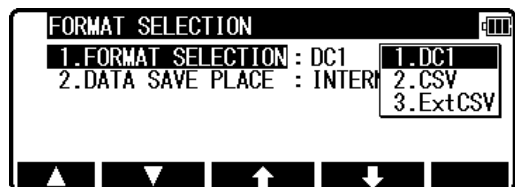
3. Select Rect. Data Text Read, then press [ENT]

Select the format of the file you desire to read and data save place, then press [ENT]



[FORMAT SELECTION]

- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)



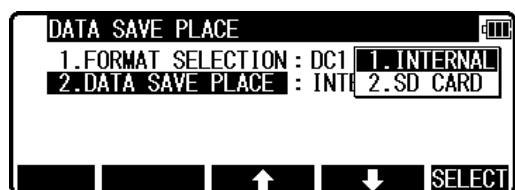
[DATA SAVE PLACE]

INTERNAL

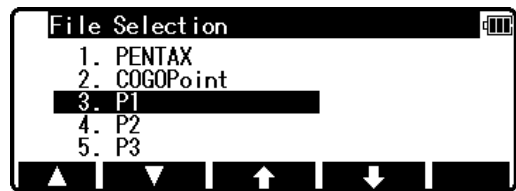
Read the file in the internal memory of the instrument.

SD CARD

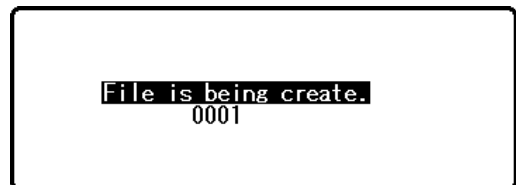
Read the file in the SD



Select the file you desire to read, then press [ENT]



In this case, a new Job File is created in the internal memory of the instrument and the transferred data is recorded in it.



NOTE: File name is limited to a maximum of 12 characters. If the file name is more than 13 characters, it is **not put in the list of the file that can be read.**

NOTE: Error Message

- Duplication of the file name.
If the same file name exists in the instrument, an error message [The file name isn't correct] is displayed. Change the file name and try again.
- Incorrect format.
If the format is incorrect, an error message [Format is not correct] is displayed. Check the format of the coordinate data and try again to read the text file. (For more details on "Format", refer to "12. INPUT/OUTPUT".)
- Maximum number of Job Files stored in the internal memory is exceeded.
The maximum number of Job Files stored in the file is 50. If you try to read a new file while 50 job files already exist, an error message [limited number of files] is displayed. Delete unnecessary job files by pressing [4. DELETE] in [FILE MANAGEMENT]. (For more details, refer to "3.4 Deletion of a Job Name".)
- The remaining capacity of the internal memory becomes less than 1 MB.
You cannot create a file when the remaining capacity is not enough and an error message [Space capacity is short] is displayed. Make sure that the remaining capacity is more than 1MB, then try again to read the text file.

NOTE: Warning

- The number of data exceeds 3,000 points.
The maximum number of points stored in the internal memory per job is 3,000 points. If it reaches 3,000 points during reading the text file, an error message ["3000 point over!"] is displayed. In this case, up to the 3,000th point will be read, but after that no more.

- The number of data exceeds the maximum number of Job Files stored in the internal memory.
If the total number of points in all Job Files exceeds the maximum number of points stored in the internal memory, an error message [WARNING This job file was exceeded] is displayed.
(45.000 points for R-422VN, R-423VN, R-425VN, R-435VN).
In this case, up to the maximum number can be read, but after that no more.

[Suitability of SD card]

- The SD card that can be used with the instrument is 1GB or less.
- SD card and SD logo is a registered trademark.
- The SD cards listed in the following table have been tested by us and it has been confirmed that the SD cards can be used with the R-400V series.



This test has been done with only the Pentax R-400V series Total Station, but no other Pentax Total Stations. When using with other Pentax Total Stations, please contact us to confirm it works properly.

It has also been confirmed that the models mentioned in the following table can be used with the R-400V series Total Station. Other brands or models of SD cards are not confirmed by us. Please note that the test has been done by us and that this does not mean that each SD card manufacturer guarantees that the SD cards can be used with the Pentax R-400V series.

SD (micro SD) Card

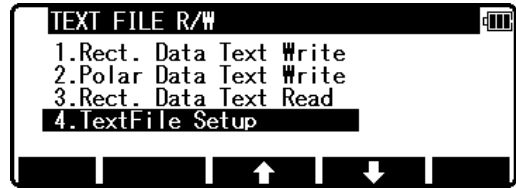
Maker	Model	Capacity
Toshiba	SD-C01GTR	1GB
Toshiba	SD-MD001GA (microSD)	1GB
Panasonic	RP-SDM01GL1A	1GB

Make sure to use the adaptor when using a microSD.

- Regardless of the information mentioned here, take note that not all SDHC cards can be used with the R-400V Total Stations.
- Test item : The following has been done according to our Test Standards.
 - ① When data is being sent (by connecting USB), it is necessary to be able to refer to information on the SD card from PC and to operate the file.
 - ② When writing/reading text, it is necessary to be able to read/write text file.

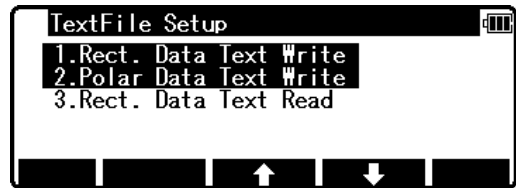
12.1.3 Text File setup

When coordinate data is output/input to and from text file, input parameters.



12.1.3.1 Writing data setting

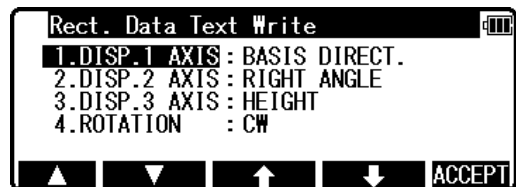
Select the 4. TextFile Setup and press [ENT] to view the TextFile Setup screen.



[1. WRITE RECT. DATA]

Select the 1. Rect. Data Text Write and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] to enter when all selections are finished.

- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cfr. "13.2 Coordinate axis definition")**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the "Coord. Axis" between settings in "Rect. Data Text Write" and settings in "Coordinate axis definition" when same coordinate systems are used.

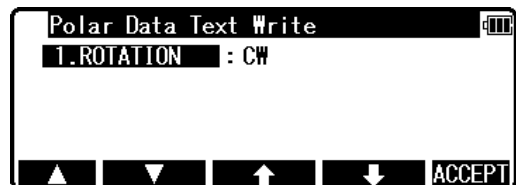
- **Factory default setting of SENDING**

1. DISP.1 AXIS: BASIS DIRECT
2. DISP.2 AXIS: RIGHT ANGLE
3. DISP.3 AXIS: HEIGHT
4. ROTATION: CW

[2. WRITE POLAR DATA]

Select the 2. Polar Data Text Write and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press [ENT].



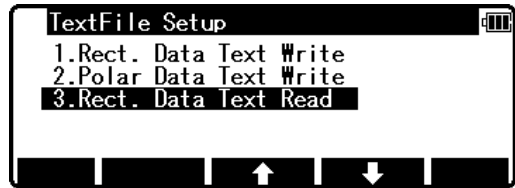
Press [ACCEPT] to enter when all selections are finished.

- **Factory default setting of 3. SEND POLAR DATA**

1. ROTATION: CW

12.1.3.2 Reading data setting

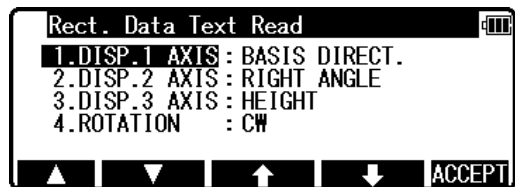
Select the 4. TextFile Setup and press [ENT] to view the TextFile Setup screen.



Select the 3. Rect. Data Text Read and press [ENT] to view the following screen.

Press [ENT] to open the selection window.

Select each setting and press [ENT].



Press [ACCEPT] to enter when all selections are finished.

- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“13.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Rect. Data Text Read” and settings in “Coordinate axis definition” when same coordinate systems are used.

- **Factory default setting of RECEIVING**

1. DISP.1 AXIS:	BASIS DIRECT.
2. DISP.2 AXIS:	RIGHT ANGLE
3. DISP.3 AXIS:	HEIGHT
4. ROTATION:	CW

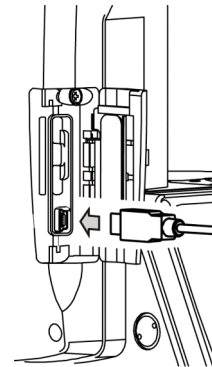
12.2 Communication with USB

By connecting the instrument and PC with USB cable, you can refer to information in the internal memory and SD card. You can use this to transfer the file in the internal memory and SD card to PC or send the file created in the PC to the internal memory or SD card.

Connect the instrument and PC by USB cable as follows;

[Connecting USB cable]

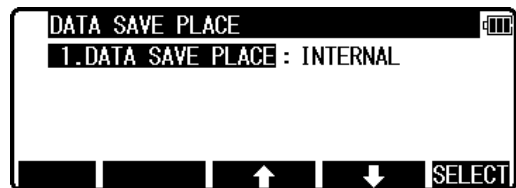
- (1) Open the SD&USB slot cover.
- (2) Insert the USB connector into the USB port in the right direction.
- (3) After the USB cable is removed, close the SD&USB slot cover completely.



CAUTION

- Be sure to open/close the SD&USB slot cover and insert/remove the USB cable indoors.

Press [F3] [USB] of the TRANSFER MENU screen to view the DATA SAVE PLACE screen.



Select data save place, then press [ENT].



[DATA SAVE PLACE]

INTERNAL

Refer to the internal memory of the instrument.

SD CARD

Refer to SD card.

[Button]

UPDATE

Reset USB communication and update the information being displayed on PC.



STOP

Finish USB communication, then return to TRANSFER MENU screen.

NOTE: If the Removable Disk doesn't activate although the USB is connected, click My Computer then double-click Removable disk.

CAUTION

- DAT file in the internal memory is identical with the information in the job file stored in the instrument. For the files with DAT extension, do not copy, paste and delete the file, and do not change the file name.

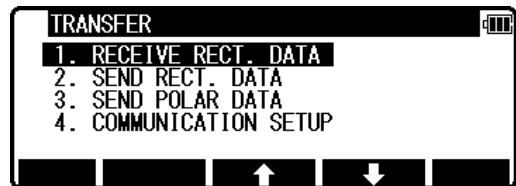
NOTE: DAT file has a hidden file. If you take the following procedure in Windows, DAT file is not displayed.

- Go to Windows Explorer
 - Click Folder Options in Tools
 - Click tab of View
 - In Advanced settings, check [Hidden file and No showing hidden file]
 - Click OK
- When you finish USB communication, make sure to click [Safely Remove Hardware] icon shown in the bottom right of the Desktop. If you don't click this icon, it may cause a loss of data. In case the file, that should be downloaded, is not included, try this procedure again. Before pressing the key to finish, make sure to click [Safely Remove Hardware] icon.

12.3 Communication with COM

This instrument can use the communication by RS-232C.

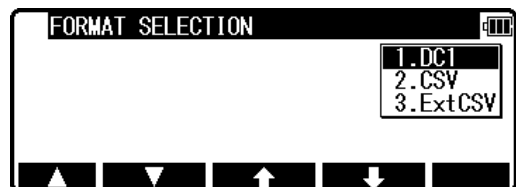
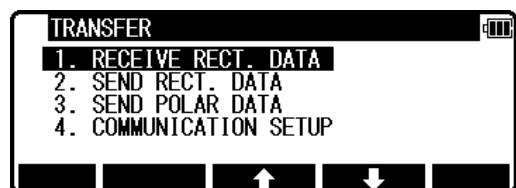
Press the [F4] [COM] of the TRANSFER MENU screen to view the TRANSFER screen.



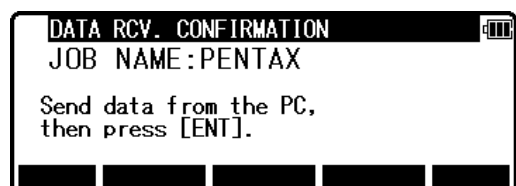
12.3.1 Input from the PC

The Rect. data is sent from the PC and stored in the internal memory of the instrument.

Select the 1. RECEIVE RECT. DATA and press [ENT] to view FORMAT SELECTION screen.



Select the DC1 format and press [ENT] to view DATA RCV. CONFIRMATION screen. (Same procedure is performed for CSV format.)



Set the PC to be ready to send and press [ENT] to receive the data from the PC.

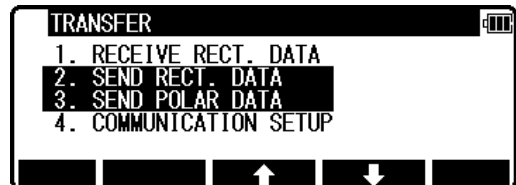


12.3.2 Output to the PC

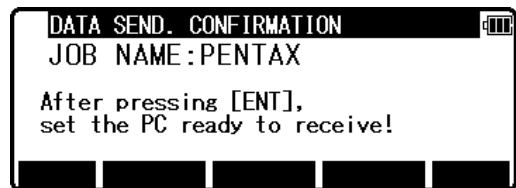
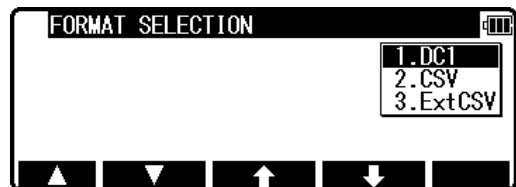
The data stored in the internal memory is sent to the PC.

[RECT. DATA]

Select the 2.SEND RECT.DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.

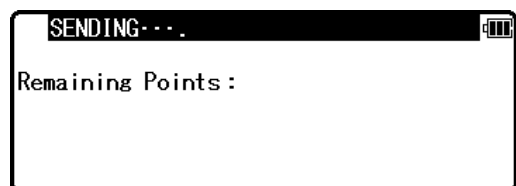


Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed for CSV format.)



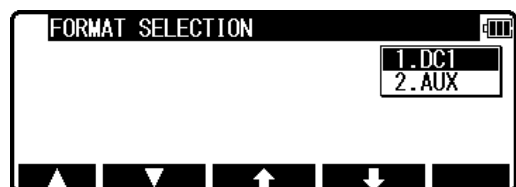
NOTE: When Rect.data DC1 is selected and data is transmitted to PC, the DC1 format PointCode data cannot be transferred.
If CSV or ExtCSV is selected, the PointCode data can be transferred to PC.

Press [ENT], and set the PC to be ready to receive.

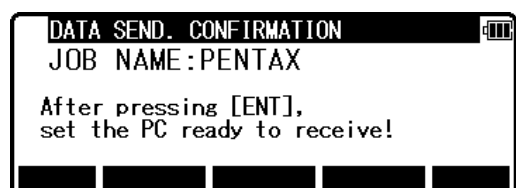


[POLAR DATA]

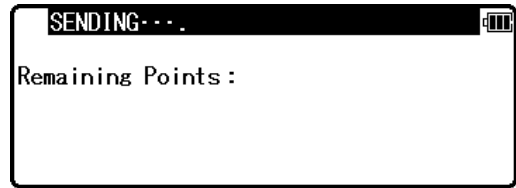
Select the 3. SEND POLAR DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.



Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed for AUX format.)

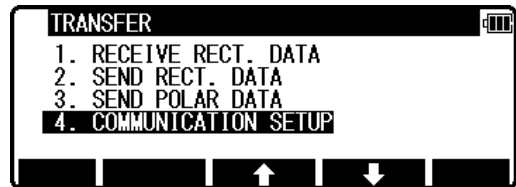


Press [ENT], and set the PC to be ready to receive.



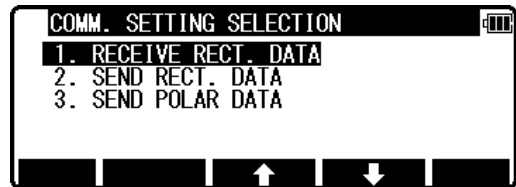
12.3.3 Communication setup

The communication parameter is set when stored data is received or sent between the instrument and the PC etc.



12.3.3.1 Receiving data setting

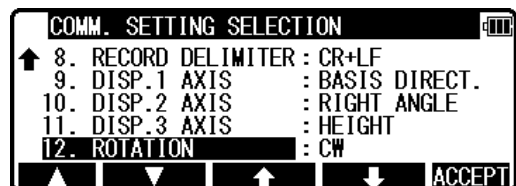
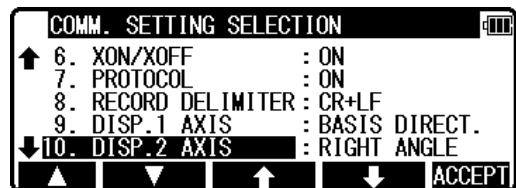
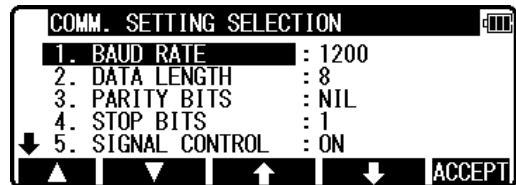
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[1. RECEIVE RECT. DATA]

Select the 1. RECEIVE RECT. DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press [ENT].



Press [ACCEPT] when all selections are made.

- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cfr. “13.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match

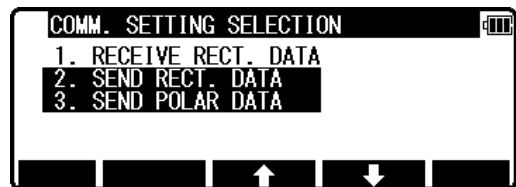
the definition of the “Coord. Axis” between settings in “Communication setup” and settings in “Coordinate axis definition” when same coordinate systems are used.

• **Factory default setting of RECEIVING**

- 1. BAUD RATE: 1200
- 2. DATA LENGTH: 8
- 3. PARITY BITS: NIL
- 4. STOP BITS: 1
- 5. SIGNAL CONTROL: ON
- 6. XON/XOFF: ON
- 7. PROTOCOL: ON
- 8. RECORD DELIMETER: CR
- 9. DISP.1 AXIS: BASIS DIRECT.
- 10. DISP.2 AXIS: RIGHT ANGLE
- 11. DISP.3 AXIS: HEIGHT
- 12. ROTATION: CW

12.3.3.2 Sending data setting

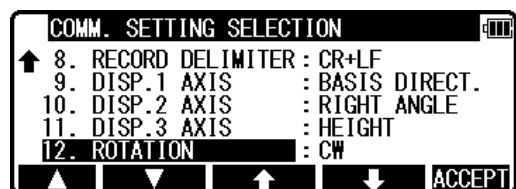
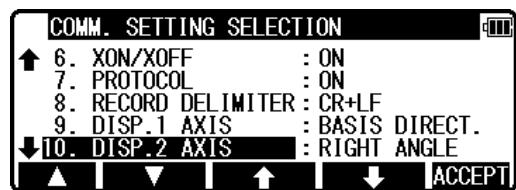
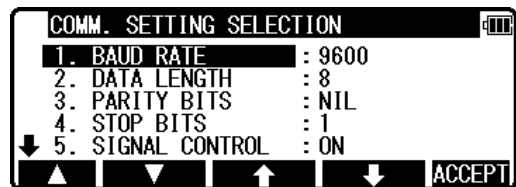
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[2. SEND RECT. DATA]

Select the 2. SEND RECT. DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] when all selections are made.

- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cfr. “13.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Communication setup” and settings in “Coordinate axis definition” when same coordinate systems are used.

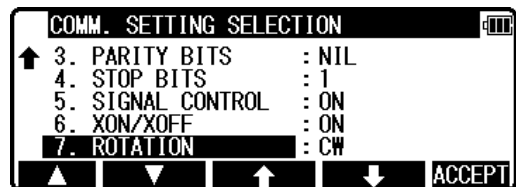
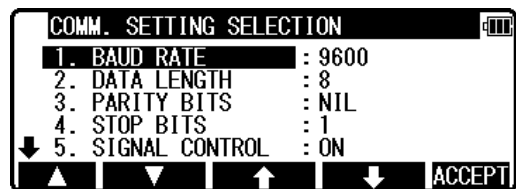
- **Factory default setting of SENDING**

- | | |
|----------------------|--------------|
| 1. BAUD RATE: | 9600 |
| 2. DATA LENGTH: | 8 |
| 3. PARITY BITS: | NIL |
| 4. STOP BITS: | 1 |
| 5. SIGNAL CONTROL: | ON |
| 6. XON/XOFF: | ON |
| 7. PROTOCOL: | ON |
| 8. RECORD DELIMETER: | CR |
| 9. DISP.1 AXIS: | BASIS DIRECT |
| 10. DISP.2 AXIS: | RIGHT ANGLE |
| 11. DISP.3 AXIS: | HEIGHT |
| 12. ROTATION: | CW |

[3. SEND POLAR DATA]

Select the 3. SEND POLAR DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] when all selections are made.

- **Factory default setting of 3. SEND POLAR DATA**

- | | |
|--------------------|------|
| 1. BAUD RATE: | 9600 |
| 2. DATA LENGTH: | 8 |
| 3. PARITY BITS: | NIL |
| 4. STOP BITS: | 1 |
| 5. SIGNAL CONTROL: | ON |
| 6. XON/XOFF: | ON |
| 7. ROTATION: | CW |

12.3.4 About DataLink DL-01 Software

DataLink DL-01 Software allows you to send collected data by R-400V to other devices, to receive coordinates data, and to convert the resulting files into a number of common formats.

a) Recommendation for "PN".

It is recommended that "PN" (Point Name) data should consist of less or equal to 4 (one-byte) numeric characters to convert files with DL-01. Because, it may not be converted properly if alphabetic characters or more than 5 (one-byte) numeric characters are used for the "PN".

b) Notes for the data transferring.

Please be careful about following items for the data transfer with "DL-01".

b-1 Type of data, which can be transferred.

With PTL, "POLAR DATA" can be transferred by "DC1" or "AUX" format. In addition, it is possible for DL-01 to receive/convert "POLAR DATA" with "DC1 (DC-1Z)" format.

b-2 Notes for unit.

If you are requested to select unit when you convert data on DL-01, please select unit according to the settings on R-400V.

b-3 Limitation for each format.

Please, use "CSV" or "DC1 (DC-1Z)" format to transfer data to/from R-400V.

Limitation for the "CSV" format.

With the "CSV" format, "PN" and "PC (Point Code)" data that consists of less or equal to 15 (one-byte) characters can be transferred.

Limitations for the "DC1 (DC-1Z)" format.

With "DC1 (DC-1Z)" format, the length of "PN" data should consist of less or equal to 11 (one-byte) characters. And with the "DC1 (DC-1Z)" format "PC" data cannot be transferred.

b-4 Recommended communication settings on R-400V.

Recommended settings for “COMM SETTING SELECTION” on R-400V special function is as follows.

R-400V → PC(DL-01) to “SEND RECT. DATA”

- 1. BAUD RATE: 1200
- 2. DATA LENGTH: 8
- 3. PARITY BITS: NIL
- 4. STOP BITS: 1
- 5. SIGNAL CONTROL: OFF
- 6. XON/XOFF: OFF
- 7. PROTOCOL: OFF for “CSV” format, ON for “DC1 (DC-1Z)” format
- 8. RECORD DELIMETER: CR
- Subsequent items: As you like.

R-400V → PC(DL-01) to “SEND POLAR DATA”

- 1. BAUD RATE: 1200-9600
- 2. DATA LENGTH: 8
- 3. PARITY BITS: NIL
- 4. STOP BITS: 1
- 5. SIGNAL CONTROL: OFF
- 6. XON/XOFF: OFF
- 7. ROTATION: As you like.

PC(DL-01) → R-400V to “RECEIVE RECT. DATA”

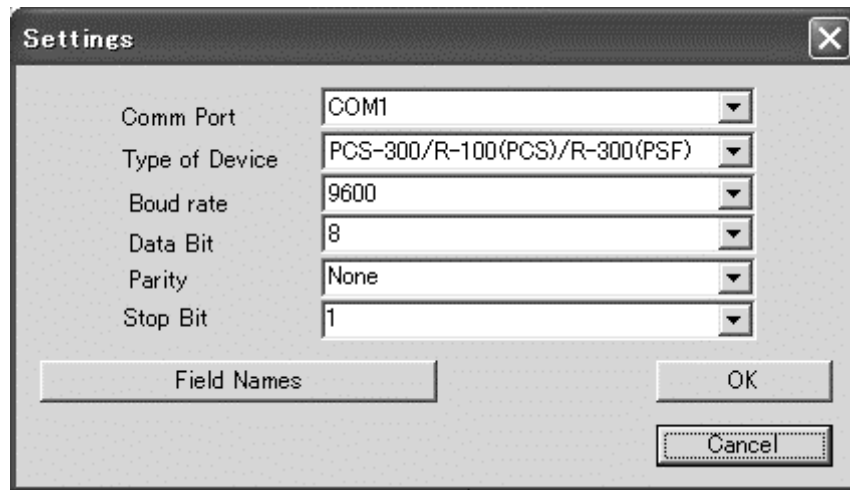
- 1. BAUD RATE: 1200
- 2. DATA LENGTH: 8
- 3. PARITY BITS: NIL
- 4. STOP BITS: 1
- 5. SIGNAL CONTROL: OFF
- 6. XON/XOFF: OFF
- 7. PROTOCOL: OFF for “CSV” format, ON for “DC1 (DC-1Z)” format
- 8. RECORD DELIMETER: CR
- 9. Subsequent items: As you like.

Please note that these settings should be common with DL-01's.

b-5 Recommended communication settings on DL-01.

To configure DL-01 Communication setting, please read “Configuring the software” in the Help topics of DL-01 and select values as follows:

For setting “Type of Device” in the “Settings” panel (Menu—“Edit”--”Settings”), select “R-100(PTL) / R-300(PTL)” for “R-300 PowerTopoLite” and other setting should be as follows.



Please note that these settings should be common with R-400V's. And if the selection of “Type of Device” is not correct it may result in missing some data.

R-400V → PC(DL-01)

Bits per second: 1200 (1200-9600 for sending “POLAR DATA”)
 Databits: 8
 Parity: None
 Stop bits: 1

PC(DL-01) → R-400V

Bits per second: 1200
 Databits: 8
 Parity: None
 Stop bits: 1

c) Note for the Memory capacity.

Data transfer failure from DL-01 to R-400V may cause reduction of memory capacity. If memory capacity becomes less, please back up required data first, and then initialize coordinates data.

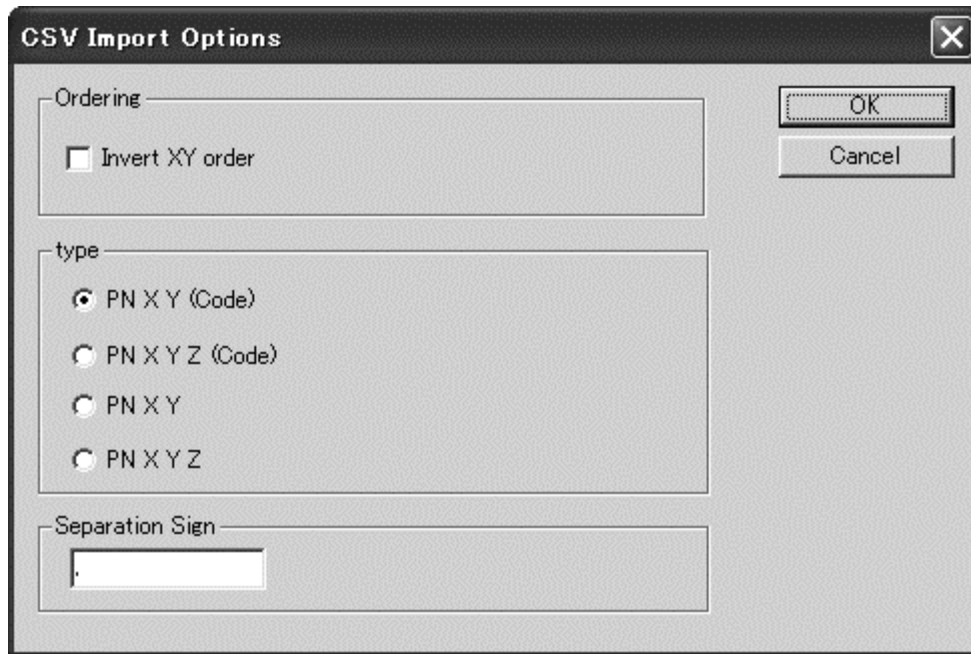
To initialize coordinates data, turn on the instrument while pressing [F2]+[F5]+[ON/OFF], and take your finger off [ON/OFF] again.

After you see the message “COORD. DATA INITIAL”, press [F5]. Then the message “Please wait” is displayed. When it is completed, the panel of MODE A is displayed.

d) Note on converting CSV file.

When you attempt to convert CSV file from R-400V by DL-01, please note that it may not succeed if CSV data type is not correct.

After [CONVERT] button is clicked on DL-01 then “CSV files from PCS/ R-100 (*.*)” is selected for the type of file, “CSV Import Option” will be appear.



In case the CSV data doesn't have “CODE” field, please select “PN XY” or “PN XYZ” from following four types for the “type” of data on the “CSV Import Option” panel.

- PN XY (Code)
- PN XYZ (Code)
- PN XY
- PN XYZ

e) For more information to work with DL-01, please refer to the “help” file after the installation.

13. PREFERENCE

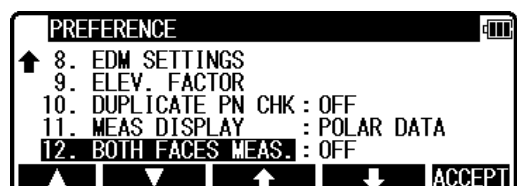
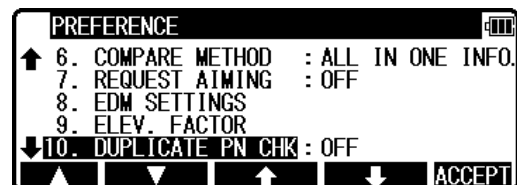
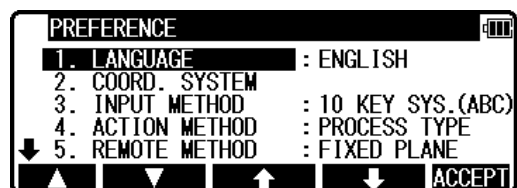


Followings are possible functions and the factory default settings:

A language other than English can be selected.

FUNCTION	DEFAULT SETTINGS
Coordinate system can be selected.	(cfr. 13.2 Coordinate axis definition)
Character input method can be selected.	“10 KEY SYS.(ABC)”
Action input method can be selected.	“PROCESS TYPE”
The offset (remote) method can be selected.	“FIXED PLANE”
Compare method can be selected.	“ALL IN ONE VIEW”
Aiming on/off can be selected.	“OFF”
EDM (electronic distance meter) settings can be selected.	
PRIM. MEAS KEY	“MEAS. SHOT”
SEC. MEAS KEY	“TRACK CONT”
EDM MIN DISP/QUICK	“1mm/OFF”
SHOT COUNT	“1 TIME”
SHOT INPUT	“01 TIME”
Elevation factor can be defined.	
AVE. ELEV.	+0000.0000m
SCALE FACT	1.00000000
Duplicate point name checking	“OFF”
Order of displaying measurement screen	“POLAR DATA”
Foresight and backsight Setting of BSP measurement	“OFF”
Recording format to record polar data	“HA VA SD”

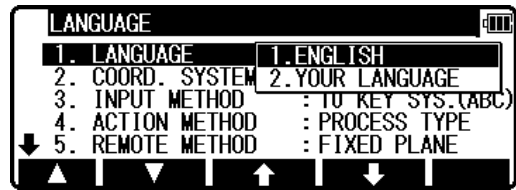
Press [F4] [PREF] of the PowerTopoLite screen to view the PREFERENCE screen.



13.1 Language selection

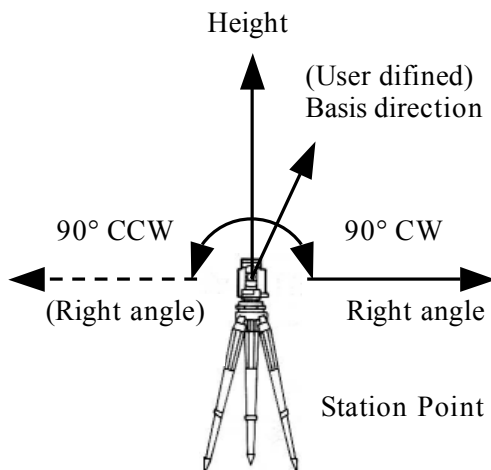
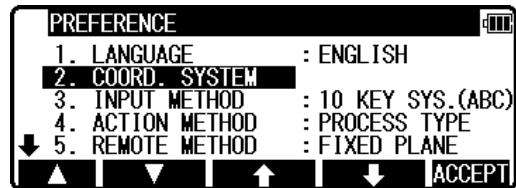
Select 1. LANGUAGE and press [ENT] to view the LANGUAGE selection window.

Press [ENT] to select and press [F5] [ACCEPT] to enter.

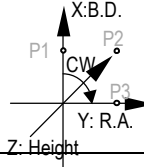
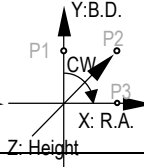
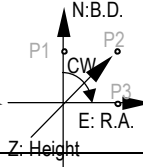
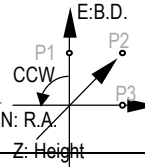


13.2 Coordinate axis definition

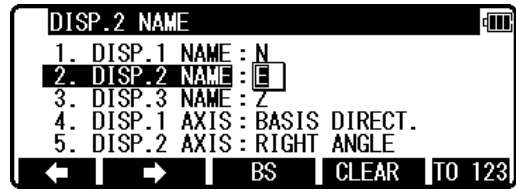
Select 2. COORD.AXIS by pressing the down arrow key, and press [ENT] to view the coordinate system definition window. Press [ENT] to select and press [F5] [ACCEPT] to enter.



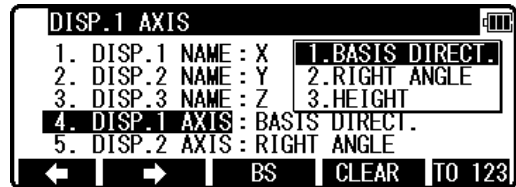
Definition of each selection is as follows.

Item	Description	Selection	Default	ex.1 German XYZ	ex.2	ex.3
1. DISP.1 NAME	Name of the 1st Axis on the screen. (Ex. it is shown 3rd line of the "MEASURE" screen.)	Any name	X	X	N	E
2. DISP.2 NAME	Name of the 2nd Axis on the screen. (Ex. it is shown 4th line of the "MEASURE" screen.)	Any name	Y	Y	E	N
3. DISP.3 NAME	Name of the 3rd Axis on the screen. (Ex. it is shown 5th line of the "MEASURE" screen.)	Any name	Z	Z	Z	Z
4. DISP.1 AXIS	Define the direction of the 1st Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	1. BASIS DIRECTIO N	2. RIGHT ANGLE	1. BASIS DIRECTIO N	1. BASIS DIRECTION
5. DISP.2 AXIS	Define the direction of the 2nd Axis.	1. RIGHT ANGLE 2. HEIGHT 3. BASIS DIRECTION	2. RIGHT ANGLE	1. BASIS DIRECTIO N	2. RIGHT ANGLE	2. RIGHT ANGLE
6. DISP.3 AXIS	Define the direction of the 3rd Axis.	1. HEIGHT 2. BASIS DIRECTION 3. RIGHT ANGLE	3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT
7. ROTATION	Define the rotation from the 1 st Axis to the 2nd Axis..	1. CW 2. CCW	1. CW	1. CW	1. CW	1. CCW
Example of GRAPHICAL VIEW						

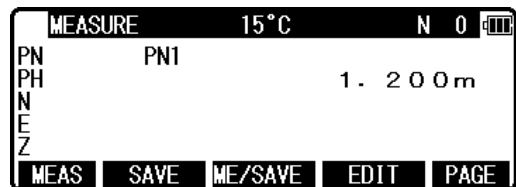
Any name can be defined for all three axes.
For the “DISP.# NAME”, it is possible to define same name. However, please note that the same coordinates’ value will be displayed.



Three types of axes can be selected for each three axes.
For the “DISP.# AXIS”, it is possible to define same type of axis. However, please note that the same coordinates’ value will be displayed.



Definition of this function will be affected to the value of the coordinates.

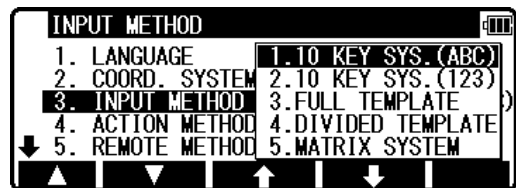


Please note that the up arrow on the screen of the graphical view always shows “BASIS DIRECTION”. In addition, position of points doesn’t change on the “GRAPHICAL VIEW”, but value of coordinates changes according to the setting of “Coordinate axis definition”.



13.3 Input method selection

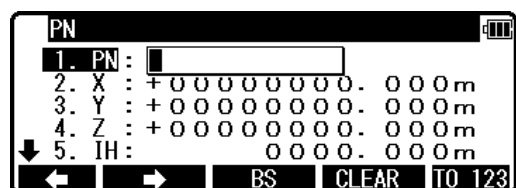
Select 3. INPUT METHOD and press [ENT] to view the Character INPUT METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



Explanation of the 10 Key system (123/ABC), Full template, Divided template and Matrix system.

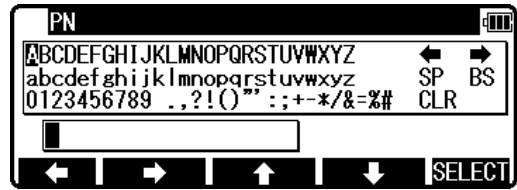
1. 10 KEY SYSTEM (123/ABC)

These are the standard input method using the Alphanumeric and +/- key.

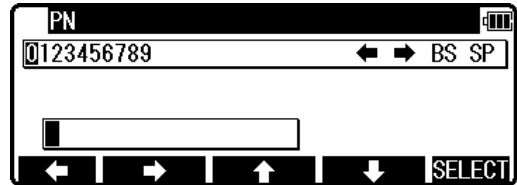


2. Full template

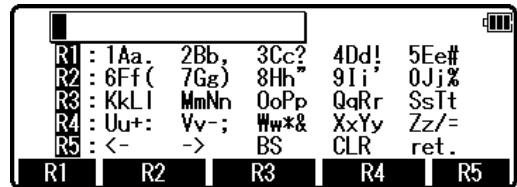
Select each Character by pressing left, right, up and down arrow keys and select each Character by pressing [F5] [SELECT] each time.



3. Divided template

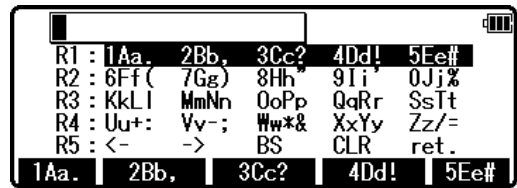


4. MATRIX

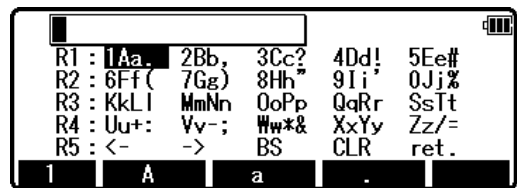


How to input "A" by Matrix.

First press [F1] [R1] to view next screen.



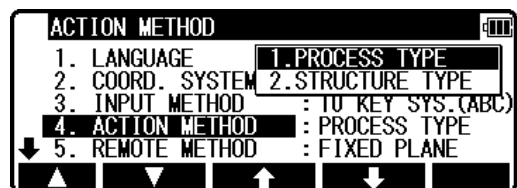
Press [F1] [1Aa] to view next screen.



Press [F2] [A] to select "A".

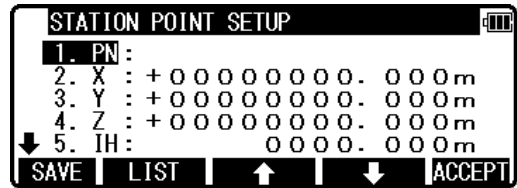
13.4 Action method selection

Select 4.ACTION INPUT METHOD and press [ENT] to view the Character ACTION INPUT METHOD selection window. Press [ENT] to select and press [F5] [ACCEPT].



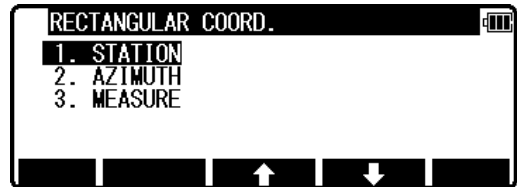
Process type

This input method takes over the functionality of “PowerTopoLite”. When this option is selected, the next screen will be shown after inputting necessary items.



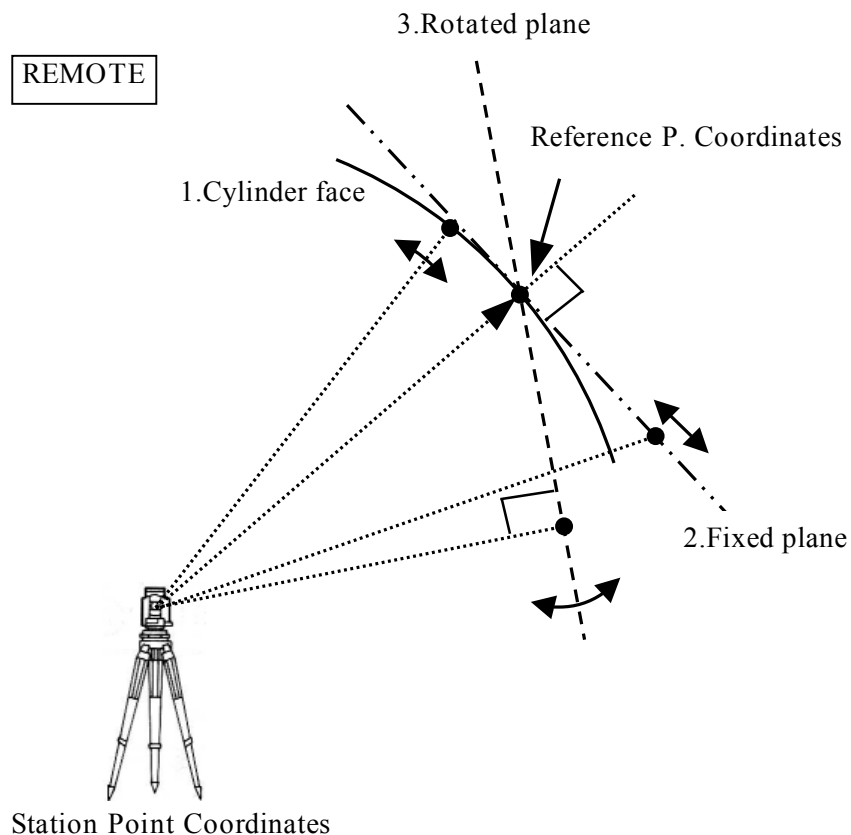
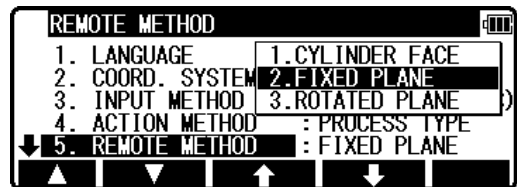
Structure type

This input method takes over the functionality of our past product. When this option is selected, the menu screen will be shown after inputting necessary items.

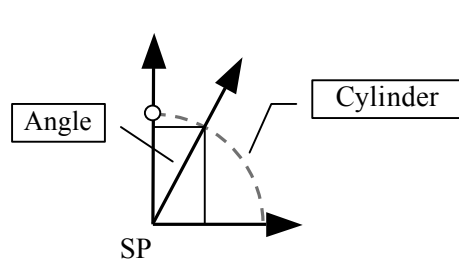


13.5 Remote method selection

Select 5.REMOTE METHOD and press [ENT] to view the REMOTE METHOD selection window. Press [ENT] to select and press [F5] [ACCEPT].

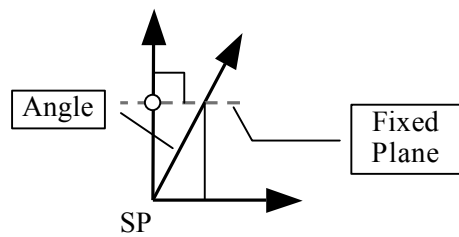


1. Cylinder face



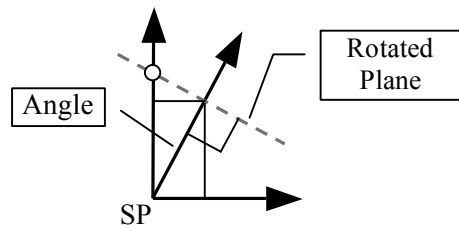
The Remote measurement is performed on the inner surface of the vertical cylinder as shown left.

2. Fixed plane



The Remote measurement is performed on the fixed plane, which is perpendicular to the sight of the reference point as shown left.

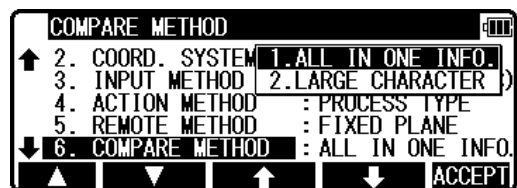
3. Rotated plane



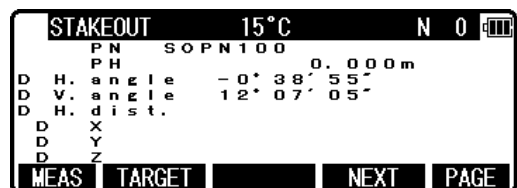
The Remote measurement is performed on the Rotated plane, which is always perpendicular to the present line of sight and induces the reference point as shown left.

13.6 Compare method selection

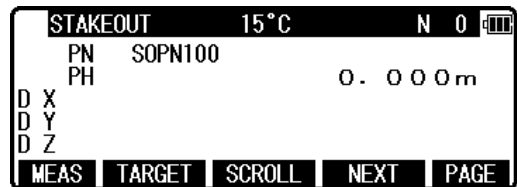
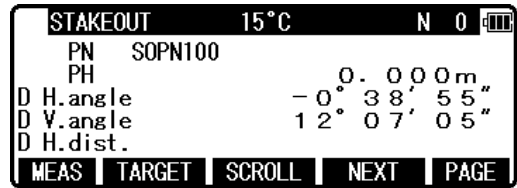
Select 6.COMPARE METHOD SELECTION and press [ENT] to view the COMPARE METHOD selection window. Press [ENT] to select and press [F5] [ACCEPT].



When “ALL IN ONE INFO” is selected, all information will be displayed on the result of Stake Out panel.

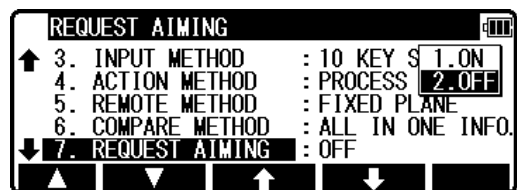


When “LARGE CHARACTER” is selected, result information is shown with two screens and these screens and the Graphics screen can be switched by pressing [SCROLL].

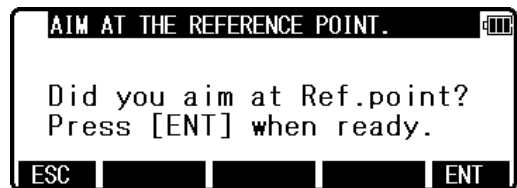


13.7 Request aiming selection

Select 7.REQUEST AIMING and press [ENT] to view the REQUEST AIMING selection window. Press [ENT] to select and press [F5] [ACCEPT].

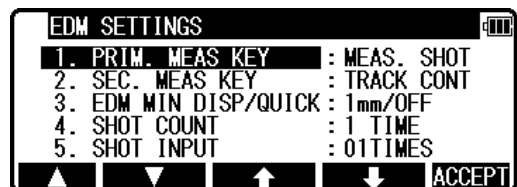
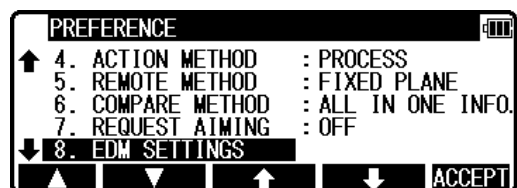


After pressing [ENT] on STATION POINT H.ANGLE SETUP screen, you can choose whether or not the warning message, “Did you aim at Ref. Point?” is displayed.



13.8 EDM settings selection

Select 8.EDM SETTINGS and press [ENT] to view the EDM SETTINGS selection window. Press [ENT] to select and press [F5] [ACCEPT].



1. PRIM.MAES KEY	1. MEAS. SHOT
	2. MEAS. CONT
	3. TRACK SHOT
	4. TRACK CONT
2. SEC.MEAS KEY	1. TRACK CONT
	2. TRACK SHOT
	3. MEAS. CONT
	4. MEAS. SHOT
3. EDM MIN DISP/QUICK	1. 1mm/OFF
	2. 1mm/ON
	3. 0.1mm
4. SHOT COUNT	1. 1 TIME
	2. 3 TIMES
	3. 5 TIMES
	4. INPUT
5. SHOT INPUT	XX TIMES

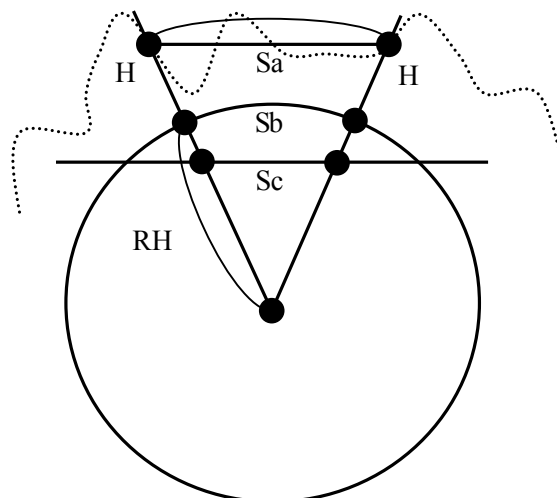
Please refer to the instruction manual of basic function about details of each setting.

13.9 Elevation factor

“Elevation Factor” as used here refers to Average Elevation Correction and Scale Factor carried out as part of the measurement process among the special functions.

It is effective only with MEAS-Rect., FREE, CALC- Traverse, and VPM. These reverse corrections are carried out with STAK (Stake Out, Point To Line). When the instrument is shipped from the factory, the 1.AVE.ELEV. is set to “0” and the 2.SCALE FACT to “1” so that no correction is carried out.

If correction is necessary, input the appropriate values for the AVE.ELEV and SCALE FACT.



Cross section of the earth

Select 9. Elevation factor and press [ENT] to view the ELEVATION FACTOR selection window. Press [ENT] to select and press [F5] [ACCEPT].

```
PREFERENCE
↑ 5. REMOTE METHOD : FIXED PLANE
6. COMPARE METHOD : ALL IN ONE INFO.
7. REQUEST AIMING : OFF
8. EDM SETTINGS
↓ 9. ELEV. FACTOR
▲ | ▼ | ▲ | ▼ | ACCEPT
```

1. Average Elevation

Average (H) = Averaged on-site elevation

Input range: -9999.9998 -- +9999.9998m

```
AVE. ELEV.
1. AVE. ELEV. : +0000.0000m
2. SCALE FACT : 1.00000000
▲ | ▼ | ▲ | ▼ | ACCEPT
```

2. Scale Factor

Scaling = On-site scaling coefficient

Input range: +0.00000001 -- +1.99999998

```
SCALE FACT
1. AVE. ELEV. : +0000.0000m
2. SCALE FACT : 1.00000000
▲ | ▼ | ▲ | ▼ | ACCEPT
```

13.10 Duplicate point check

When for this setting ON is selected, you can check whether a Point Name overlaps another Point Name already input.

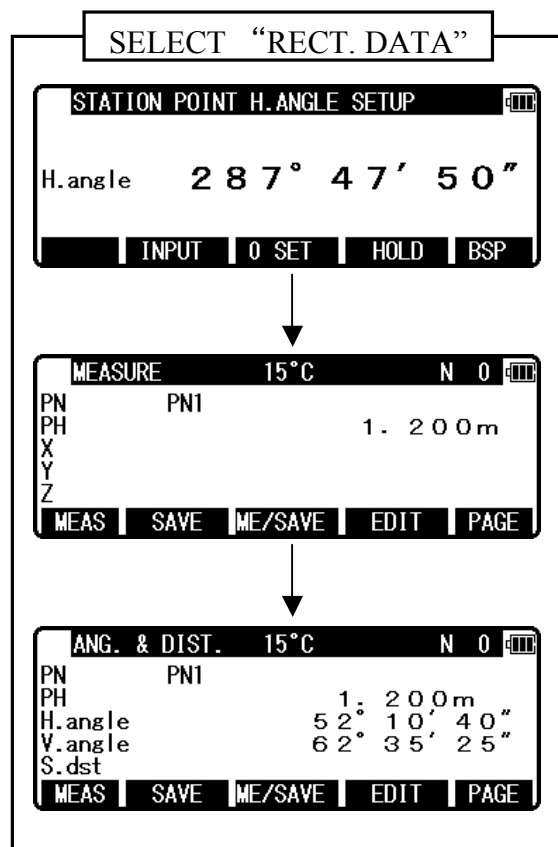
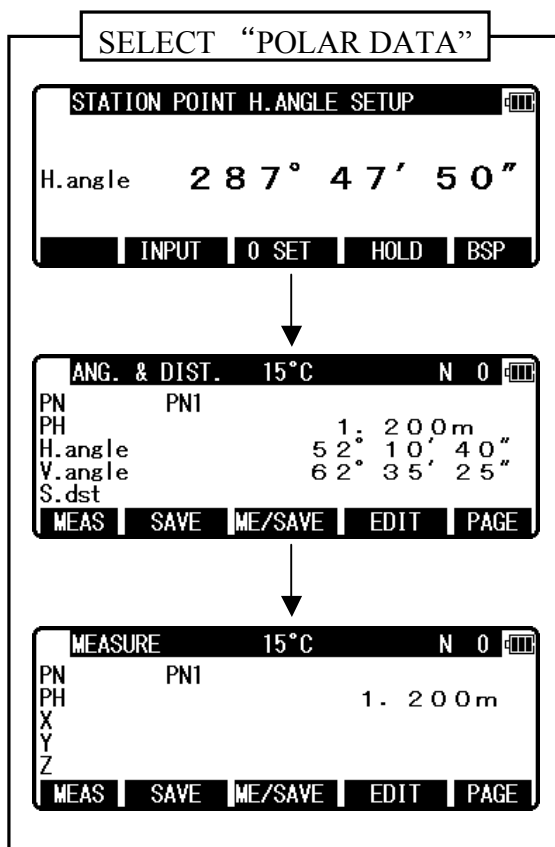
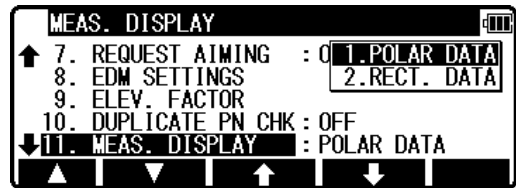
```
DUPLICATE PN CHK
↑ 6. COMPARE METHOD : ALL IN O 1.ON
7. REQUEST AIMING : OFF 2.OFF
8. EDM SETTINGS
9. ELEV. FACTOR
↓ 10. DUPLICATE PN CHK : OFF
▲ | ▼ | ▲ | ▼ | ACCEPT
```

13.11 Meas. display

This setting allows you to set the order of display when a function of “4 MEASUR, RECT_POLAR COORD.RECT” is carried out.

When “POLAR DATA” is selected, STATION POINT H.ANGLE SETUP screen appears next to ANG. & DIST. screen.

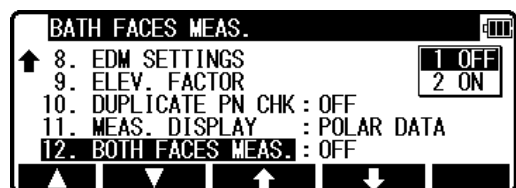
When “RECT. DATA” is selected, MEASURE screen is displayed.



13.12 Both faces meas.

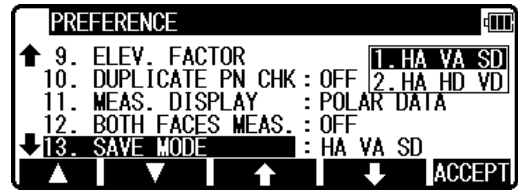
When “ON” is selected and sighting the BSP (Back Sight Point), you are requested to sight at reverse position as well after normal position.

When “OFF” is selected, you can sight only at normal position.

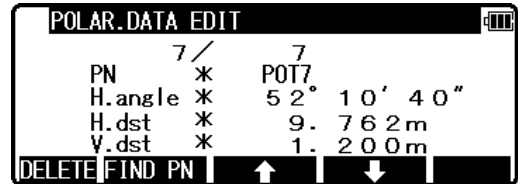


13.13 Save Mode

If you switch to SAVE MODE, you can change the display when Polar data is displayed



When “HA HD VD” are selected at VIEW&EDIT of POLAR DATA of EDIT, the display will be changed as shown in the right figure



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Printed in Belgium



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TIA201008