

PENTAX

R-200 Series

EFFICIENT ACCURACY AT YOUR FINGERS!

- 350m reflectorless EDM range
- 2" and 5" models
- Adjustable laser plummet



**INCREASED
PRODUCTIVITY
FASTER
TURNAROUND**



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

Model	R-202NE	R-205NE
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 ~ 350 m
	Reflector sheet (*2)	1.5 ~ 600 m (800 m)
	Mini Prism	1.5 ~ 1,100 m (2,000 m)
	1 P	1.5 ~ 3,000 m (4,000 m)
	3 P	1.5 ~ 4,000 m (5,200 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
	Minimum count	1" / 5" selectable
	Accuracy (ISO 17123-3)	2" / 5"
Compensator	Axis	Single
	Range	±3'
Target screw	1 speed	
Sensitivity of vials	Plate level	30" / 1 mm
	Circular level	8' / 2 mm
Plummet	Laser Plummet	
Base	Detachable	
Dust & water resistance	IP56 (instrument only)	
Ambient temperature	-20°C ~ +50°C / -4°F ~ 122°F (working range)	
Tripod thread	5/8" x 11	
Dimensions / Weight	Dimensions	172 (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, single measurement every 30 sec.), 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
	Coordinates data (*6)	20,000
	Special function	PowerTopoLite
	I / F	RS-232C
Display / keyboard	Display type	Graphic LCD / 20 characters x 8 lines / 240 x 96 pixels
	Quantity	double
	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

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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
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TOTAL STATION

R-200 SERIES

INSTRUCTION MANUAL

BASIC PROCEDURES
FOR R-200 SERIES

R-202NE
R-205NE (POWER)



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PENTAX

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14. Notice to the user of this product

60

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.



- ▲ Do not stare into the laser beam directly as this may result in damage to your eyes.
- ▲ R-200 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

- ▲ 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-200 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-200 is a Class IIIa (3R) Laser product.

[EDM axis]

The R-200 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.

[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.

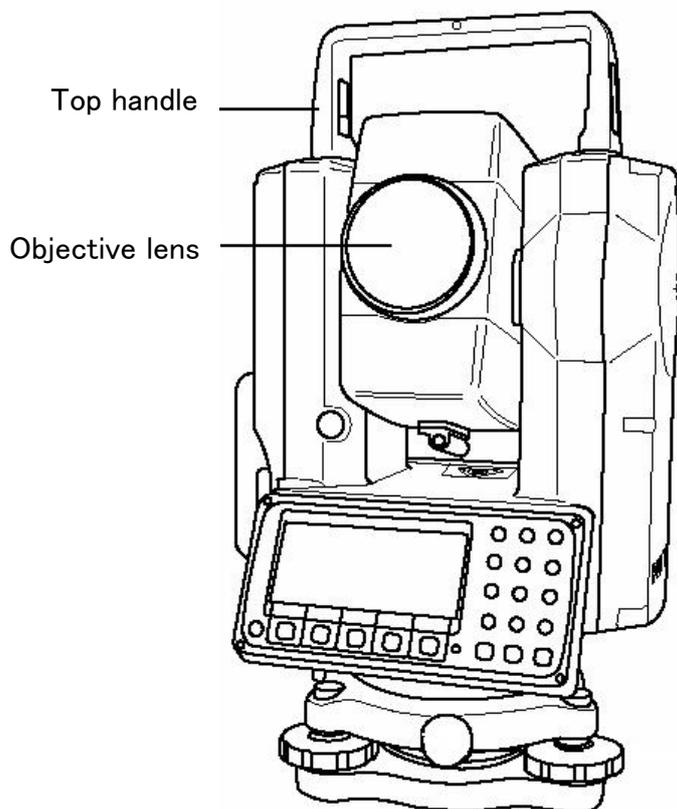
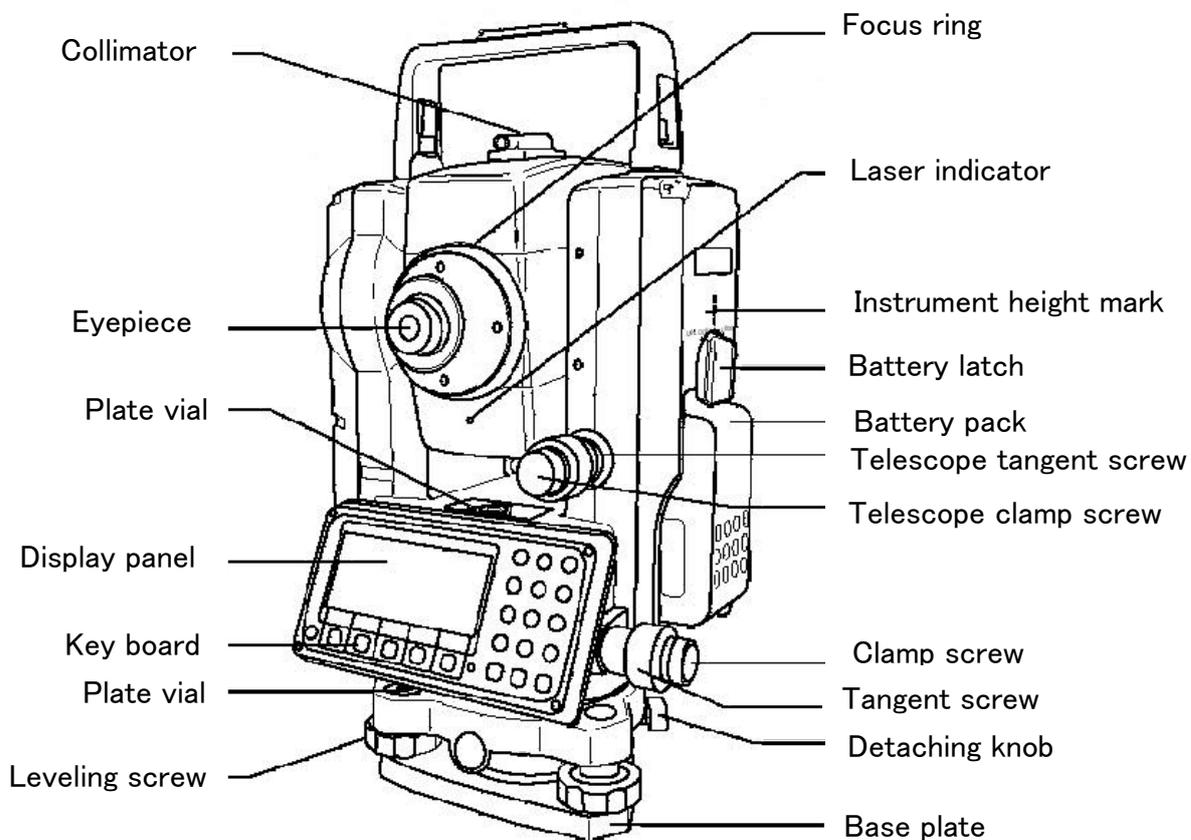
- When transporting the instrument, always put it in the case and wrap shock absorbing material around it and be sure it is handled as “FRAGILE”.

[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 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.

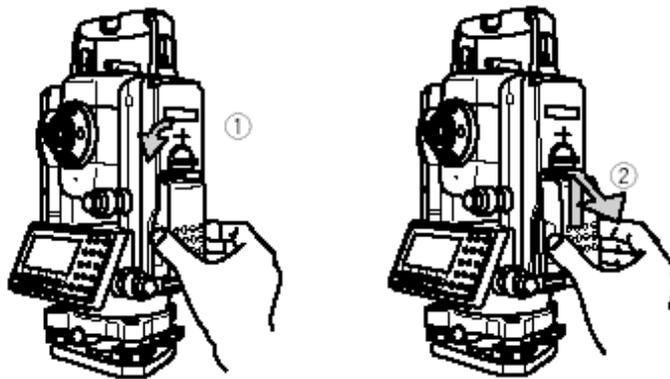
1.3 Standard equipment

- Instrument
- Carrying case
- BP02 battery
- BP03/AC01 charger
- Plumb bob
- Hexagonal wrench
- Rain cover
- CD-ROM (Basic operation & Special Functions manual)

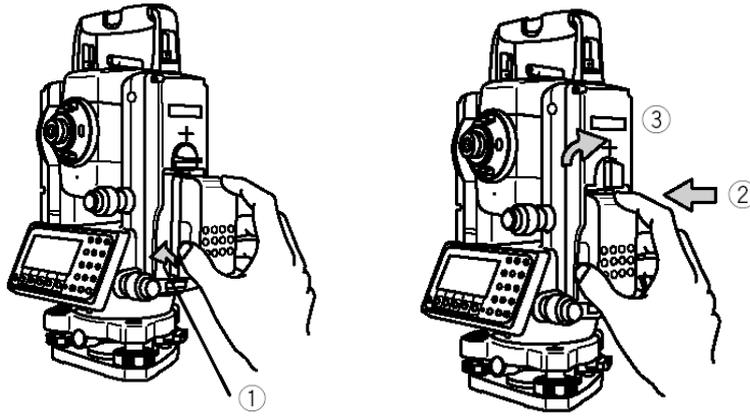
1.4 Removing and attaching the Battery

[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.
- Be absolutely sure to turn the power off when removing the battery as removing the battery while the power is still on may result in damage to the instrument.



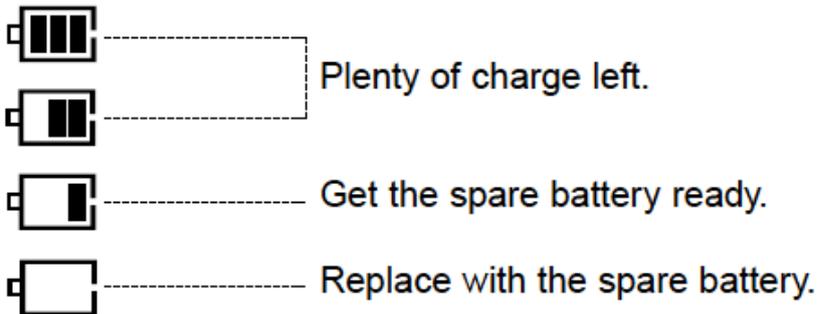
[Attaching the Battery]



- 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.

Remaining Battery Charge

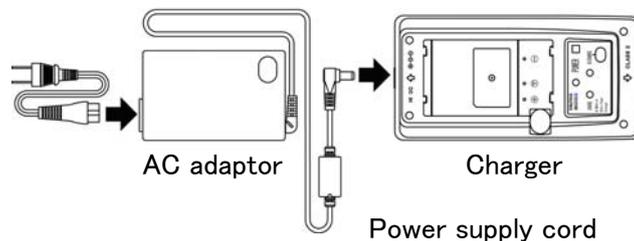
When the instrument's power is turned on, a battery mark “” will be displayed on the right of the display screen. This mark can be used to check the charge status of the battery.



Low battery: Please change. Replace with the spare battery or charge.

[Charging the battery]

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

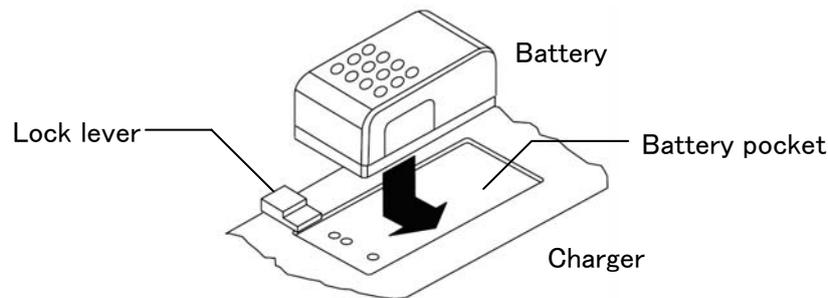


[Connection of code]

- 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]

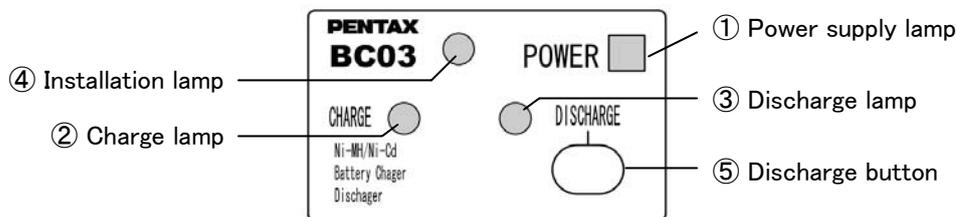
- ① Draw the battery to the lock lever side and put it on the battery pocket. The battery is firmly installed on the battery pocket.
- ② Press down the battery and then slide it to the opposite direction of the lock lever.
- ③ The lock lever goes up, and the battery is fixed.
- ④ Under such a condition,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

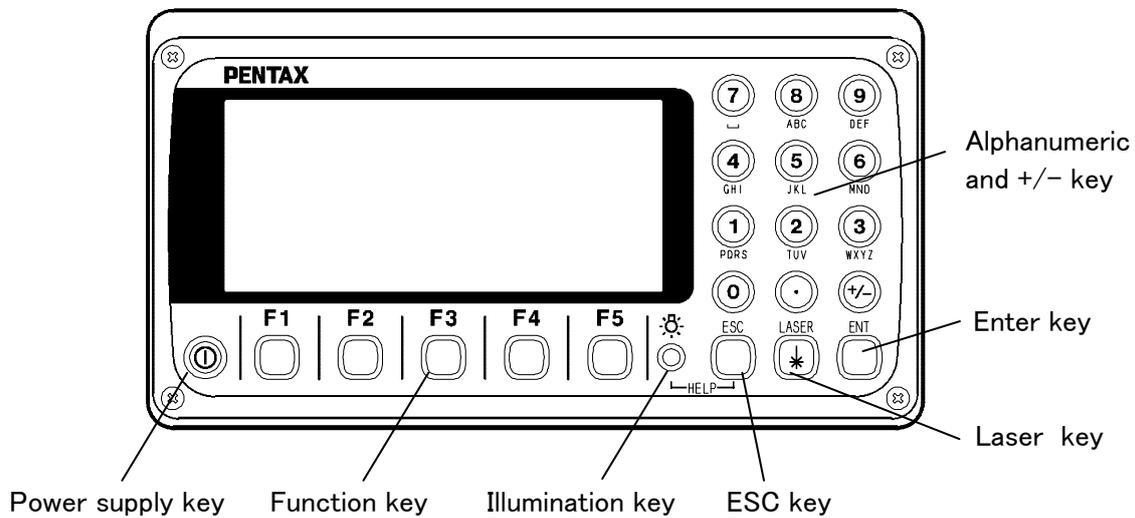
When the charge is completed, the charge lamp is turned off. Detach the battery from the charger.

[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.

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”).
[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
[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.

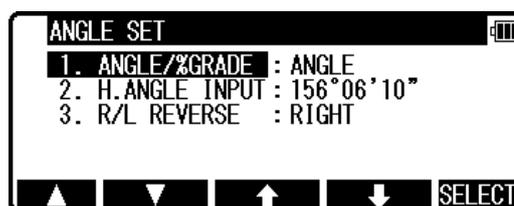
[Other functions]

[←]	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.

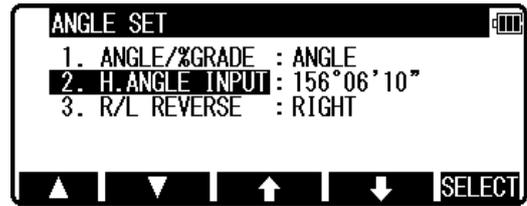
[How to move the menu number]

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.

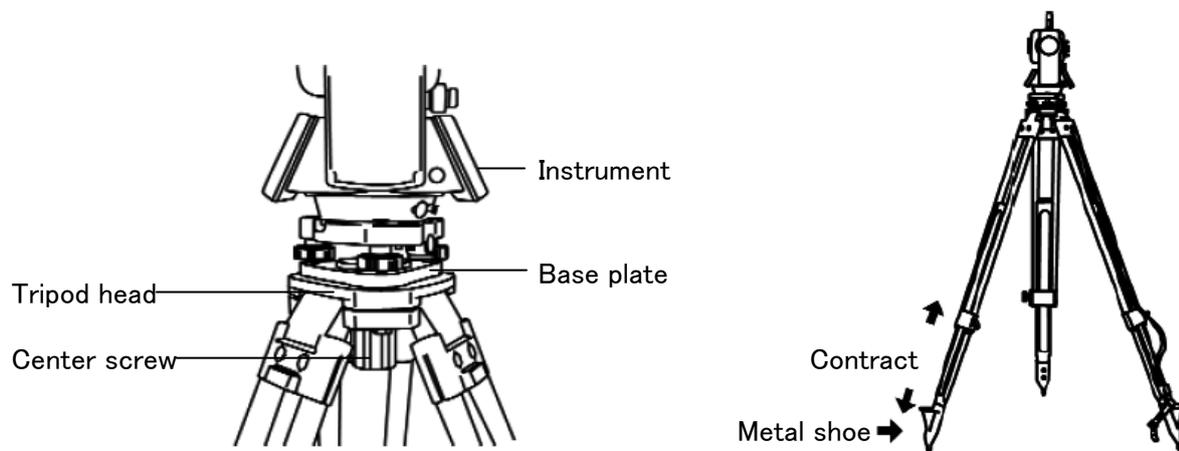
- The beam of the sun is strong and visual confirmation is difficult in daytime when outdoors.
- The laser beam is designed not to be able to observe through the telescope.
- Please visually align the laser beam to the target and mark the centre.
Confirm the alignment (horizontal and vertical) before measuring when performing accurate work like stake out when using the Laser pointer function.
Also refer to “10.9 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.

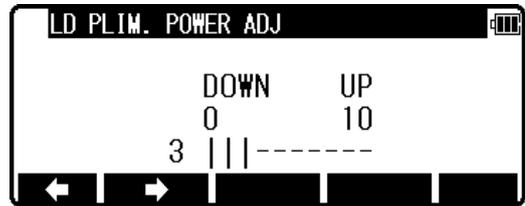
[For the Shift type laser plummet equipment model]

- 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.

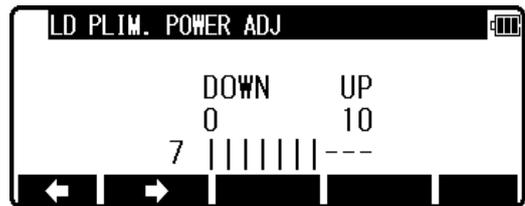
[Brightness adjustment of laser]

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.

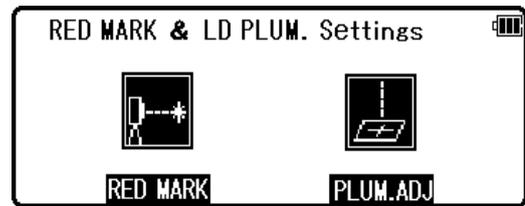
If [Laser] + [F4] [PLUM.ADJ] are pressed in due course., the brightness adjustment screen of the laser plummet device, is displayed.



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 Optical plummet (Option)

[Detachable type]

- ① Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.
- ② Rotate the focusing knob of the optical plummet and adjust the focus to the station on the ground.
- ③ Rotate the levelling screws and align the center mark to the ground mark.

[Shift type]

- ① Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.
- ② Rotate the focusing knob of the optical plummet and adjust the focus on the ground mark.
- ③ Loosen the centering clamp screw and push the upper plate by finger and stay the center mark on the ground mark.
- ④ Tighten the centering clamp screw.
- ⑤ Loosen the horizontal clamp screw and rotate the instrument every 90° and confirm the Circular vial is centered correctly. If the bubble is not centered, it can be properly set using the leveling screws.

3.4 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.

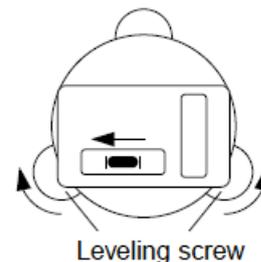
- Shorten the leg at the side of the bubble or extend the leg opposite of the bubble to position the bubble in the centre of the vial circle.
 - All three legs are extended or contracted until the bubble is in the centre.
- During this process, the foot is not placed on the tripod leg point and the position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

3.5 Levelling with the plate vial

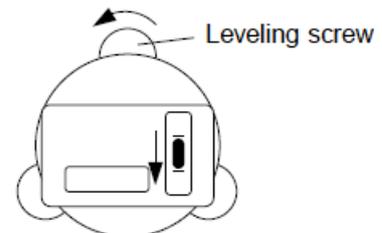
[Leveling]

- ① Rotate instrument horizontally and make two Leveling screws arbitrarily chosen parallel to the display.
- ② Turn on the Electronic vial function by pushing the Laser key.
Put the bubble of the Circular vial in the center of the circle when the display shows "TILT OVER".
- ③ Turn two Leveling screws arbitrarily chosen in an opposite direction mutually and put the vial of the horizontal Electronic vial in the center. (Figure A)
- ④ Put the bubble of the lengthwise Electronic vial in the center by operating the Leveling screw of one remainder. (Figure B)
- ⑤ The procedures are different according to the state of the Automatic inclination correction as following.

(A)



(B)



[When using the Automatic inclination correction by 2 axes]

Please read procedure⑥ because the horizontal angle and the perpendicular angle error by a perpendicular axis are automatically corrected.

[When using the Automatic inclination correction by 1 axis]

The instrument is horizontally rotated by 180° after the bubble of the Electronic vial is adjusted on the center at a Left circle position side and confirm that the bubble of the vial is at the center at the right circle position.

[When using without Automatic inclination correction]

Confirm the bubble is at the center even if the instrument is rotated by each 90° .

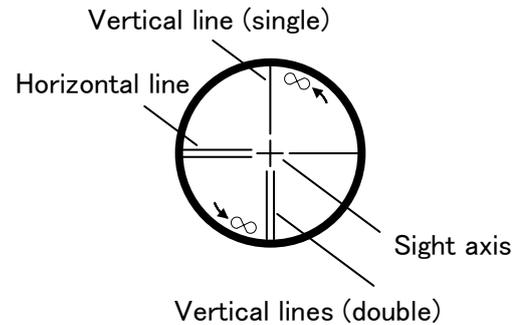
⑥ Confirm whether the plummet is on the ground mark. When you confirm it is not on the mark, loosen the center screw and move the instrument over the ground mark correctly and fix the instrument by a center screw. Repeat from ① to ⑥.

3.6 Eyepiece adjustment

[Eyepiece adjustment]

The eyepiece adjustment is performed before target sighting.

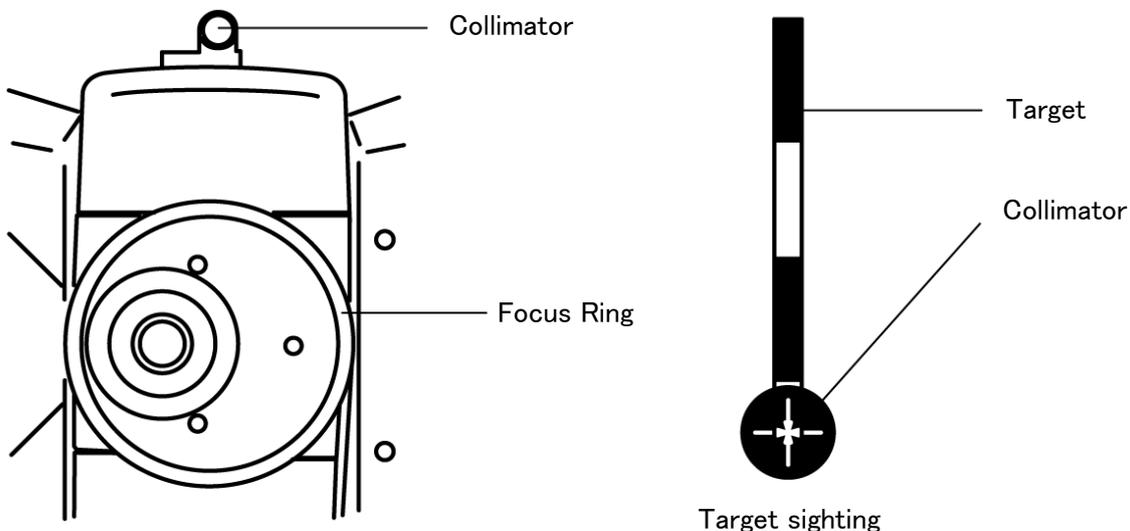
- ① Remove the telescope lens cap.
- ② Point the telescope at a bright object, and rotate the eyepiece ring full counter clockwise.
- ③ Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticle appears at its maximum sharpness.
 - When looking into the eyepiece, avoid an intense 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.



3.7 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.

3.8 Attachment and detachment of tribrach

The tribrach of R-202NE and R-205NE can be detached from the instrument, if required when replacing the instrument with a prism for example.

[Detachment]

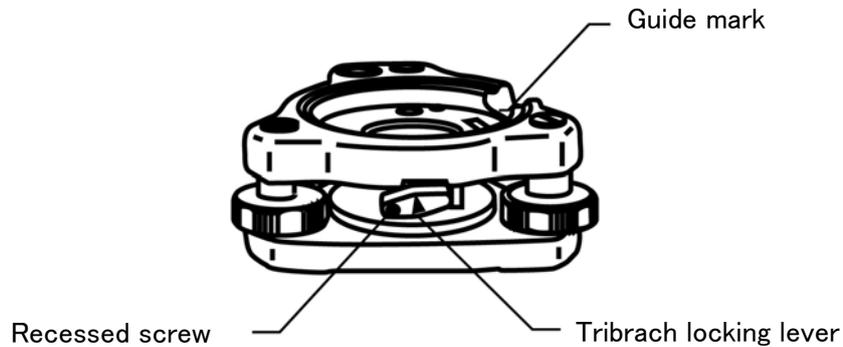
First loosen the recessed screw with a screwdriver, then rotate the locking knob until the arrow points upward, and lift the instrument up.

[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

Pressing the [POWER] key shows the initial screen. (The [POWER] key is also used to turn the power off.) After a few seconds, it turns to Electronic vial screen. Move the vials to center by adjusting the leveling screws. Pressing the [ENT] key views the angle and distance measurement screen.

- The Auto Power Off function will automatically turn the power off if no operations are performed for approximately 10 minutes. (Factory default setting)
- The [POWER] key is controlled by software in the instrument while it is working, and this key is valid only when turning off causes no problem.
- The value displayed when the power was last time turned off will be displayed for the horizontal angle. If this horizontal angle is not needed, please perform horizontal angle 0 SET.

For details on resetting the horizontal angle 0 See "5-2".

For details on changing the horizontal angle from clockwise to counterclockwise See "5-6".

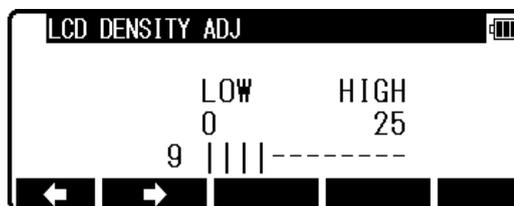
For details on measuring the vertical angle See "5-5".

For details on distance measurement See "6. ".

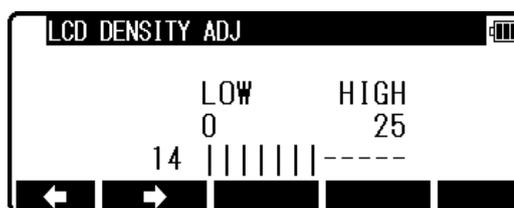
For details on the automatic power-off function... See "8-9".

4.2 Adjusting LCD contrast

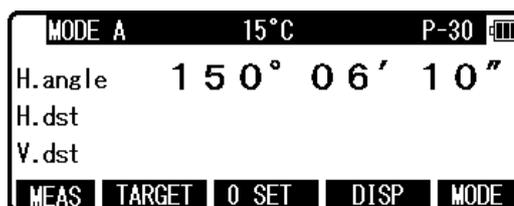
Press [F4] while holding down the Illumination key to access the screen for adjusting LCD contrast.



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.

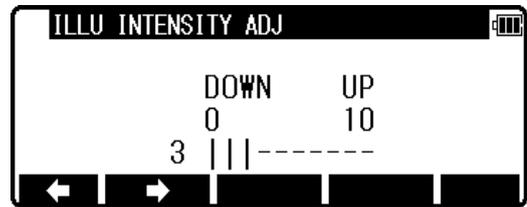


- Pressing the Illumination key views the [F3] [RETICLE], [F4] [LCD] and [F5] [ILLU].
- LCD contrast may be adjusted as necessary at any time.
- The contrast may be adjusted to any one of 25 levels.

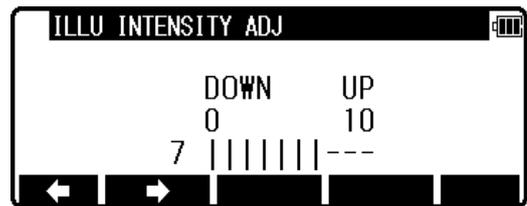
- LCD contrast may be unappealing under certain environmental conditions such as high temperature. Adjust the LCD contrast as described above in such situations.

4.3 Adjusting illumination brightness

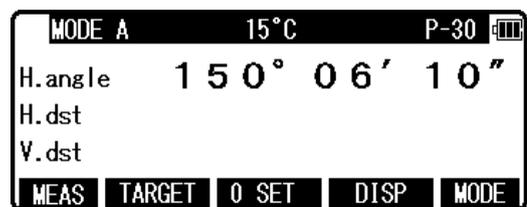
Press [F5] while holding down the Illumination key to access the screen for adjusting illumination brightness.



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

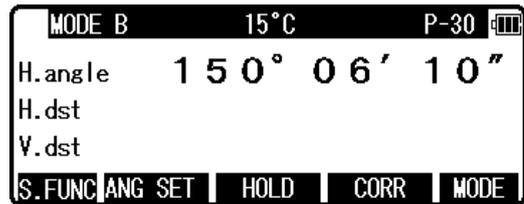
Pressing [F3] [0 SET] twice in succession resets the horizontal angle to 0° 0' 0".

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

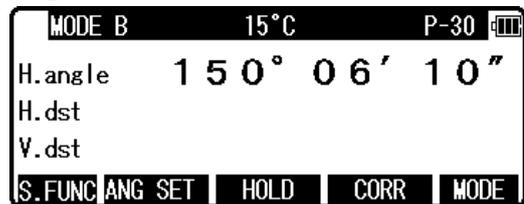
To hold the horizontal angle currently being displayed, press [F3] [HOLD] twice in succession. The horizontal angle value is displayed in reverse video when being held.



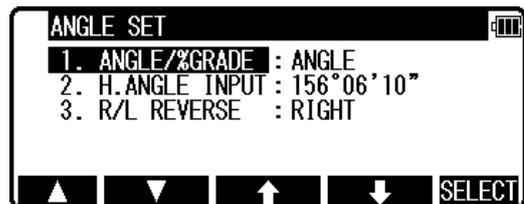
- If you want to hold the horizontal angle when you are in MODE A, press [F5] [MODE] first to switch to MODE B, then press [F3] [HOLD].
- The [F3] [HOLD] cannot hold the vertical angle or distance.
- To release the horizontal angle from being held, press [F3] [HOLD] once.
- Pressing [F3] [HOLD] accidentally 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

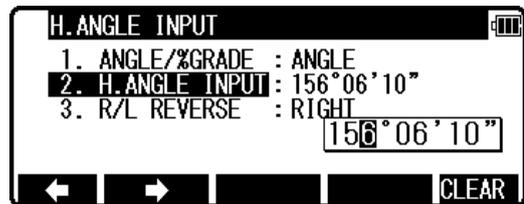
In case of Horizontal angle 123° 45' 20" input.
Press [F5] [MODE] to enter MODE B.



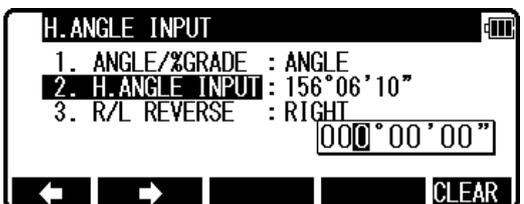
Press [F2] [ANG SET] to display the ANGLE SET screen, then press [F4] [↓] to move the cursor to "2. H.ANGLE INPUT".



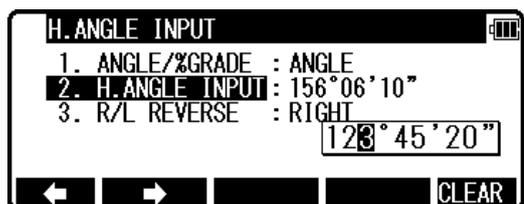
Press [F5] [SELECT] to open the horizontal angle input window.



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

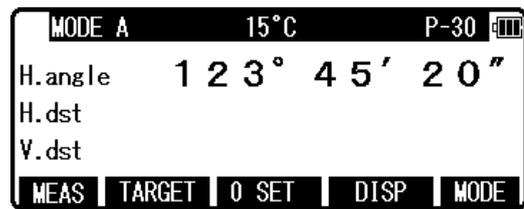


Press the numeric key as 123.4520.



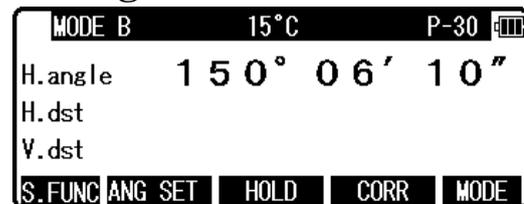
Press the [ENT] key to accept the horizontal angle set to 123° 45' 20" and change the screen to MODE A.

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

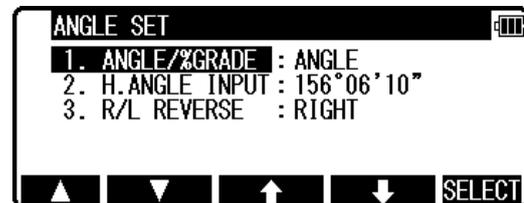


5.5 Displaying the slope % of the vertical angle

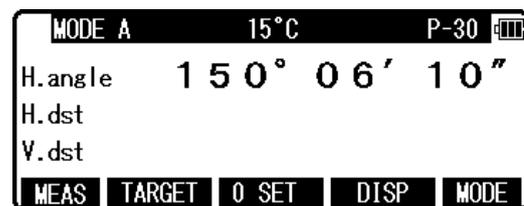
Press [F5] [MODE] to enter MODE B.



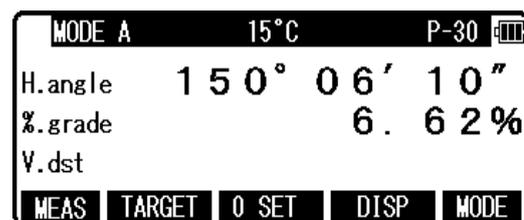
Press [F2] [ANG SET] to display the ANGLE SET screen.



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



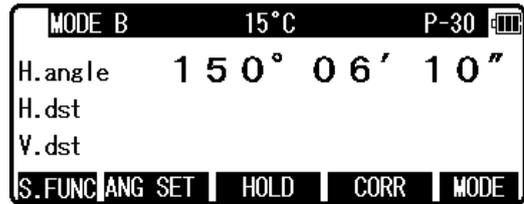
Press [F4] [DISP] to display the slope value in %.



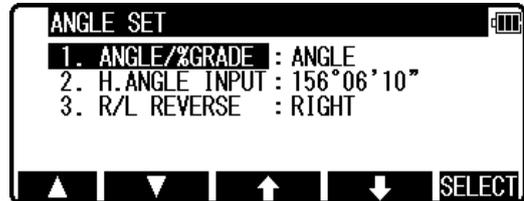
- The 0% represents the horizontal 0, and +100% and -100% represent 45° up and down slopes respectively.
- To return the screen from the slope (%) display to the 360° scale, also take above same steps by entering MODE B.
- If the slope (%) exceeds [+/-] 1000%, “Out of grade range” is displayed, indicating 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

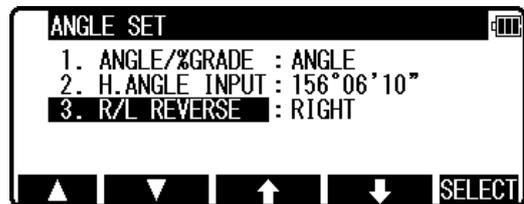
Press [F5] [MODE] to enter MODE B.



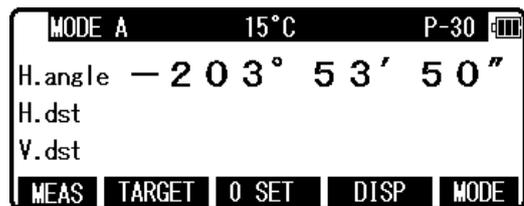
Press [F2] [ANG SET] to display the ANGLE SET screen.



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.

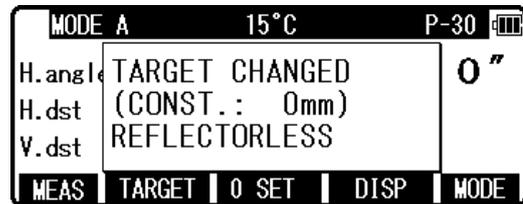


- To return the horizontal angle from counter clockwise to clockwise, also take the above same procedures, press [F5] [SELECT] to select the clockwise angle.
- When the counter clockwise horizontal angle is selected, the order of aiming at the targets becomes the reverse (the right one first, then the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

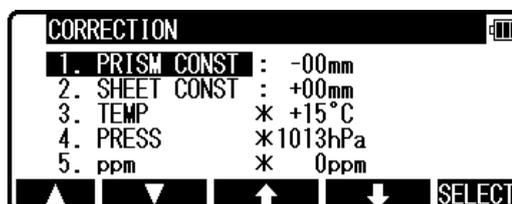
7. CORRECTION MODE

7.1 Changing the target constant

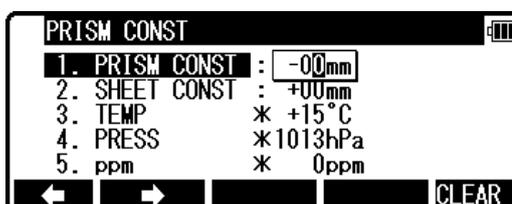
Changing the Target Constant can be performed only when the Reflector sheet and Prism Constant setting are “INPUT” in initial setting 1.

Example: Prism Constant -25mm setting

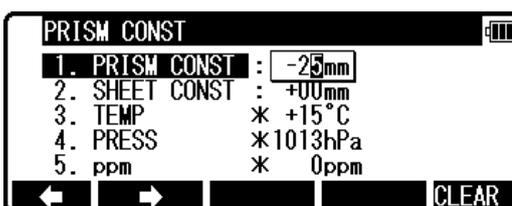
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A,
press [F5] [MODE] to enter MODE B.)



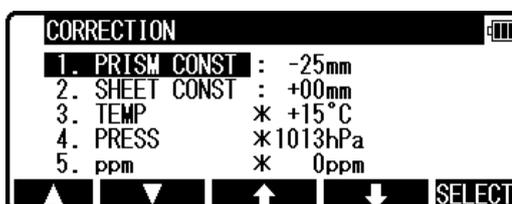
Press the [F5] [SELECT] to enable
the Prism Constant to be changed.



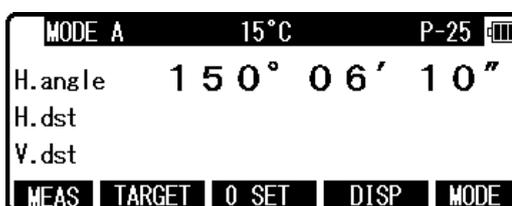
Clear the exiting values by pressing [F5] [CLEAR].
Input -25 by pressing the numeric keys.



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).

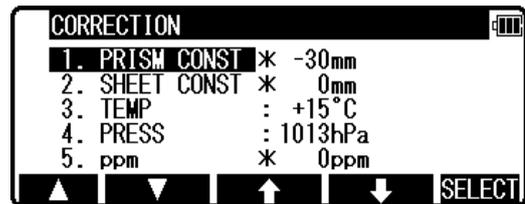
- Once set, the Reflector sheet Constant and Prism Constant remain on the measurement screen as “S 0” or “P 0”.
- The factory initial of Reflector sheet Constant and Prism Constant are 0.
- Once set, each Constant remains in memory even after the power is turned off.

7.2 Changing the temperature

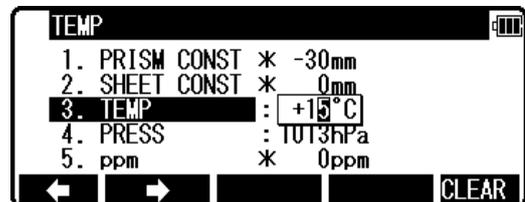
The temperature setting can be changed only when “ATM CORR” has been set to “ATM INPUT” in “initial setting 1”.

Example: Setting the temperature to +22°C

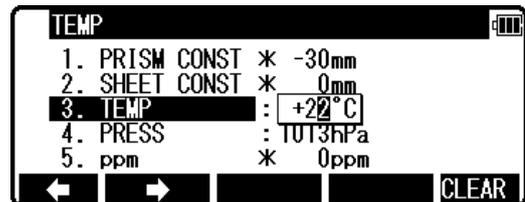
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A, press [F5] [MODE] to enter MODE B.)



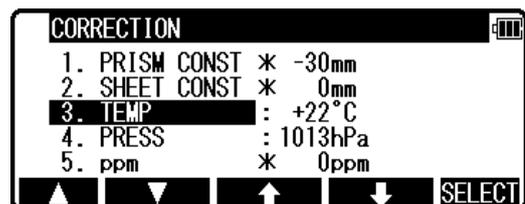
Press [F4] [↵] to move the cursor to “3.TEMP” and press the [F5] [SELECT] to enable the temperature to be changed.



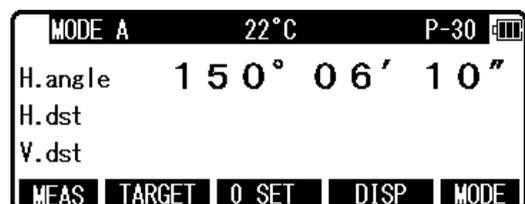
Clear the exiting values by pressing [F5] [CLEAR].
Input 22 by pressing the numeric keys.



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.

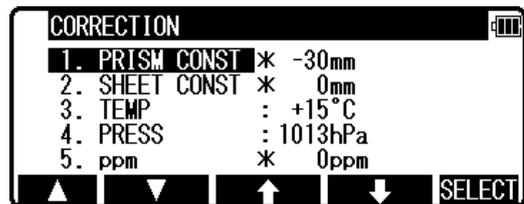
A distance error per 100m is about 0.1mm per -1°C as a temperature difference from 15°C.
(For more accurate values, See “12.4 Error when no atmospheric correction is made”.)

7.3 Changing the atmospheric pressure

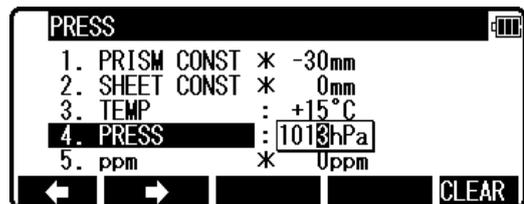
The atmospheric pressure setting can be changed only when “ATM CORR” has been set to “ATM INPUT” in “initial setting 1”.

Example: Setting the pressure to 900hPa

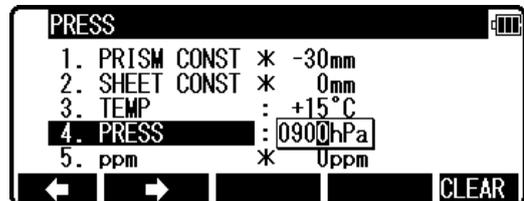
Press [F4] [CORR] in MODE B.
(If the instrument is in MODE A,
press [F5] [MODE] to enter MODE B.)



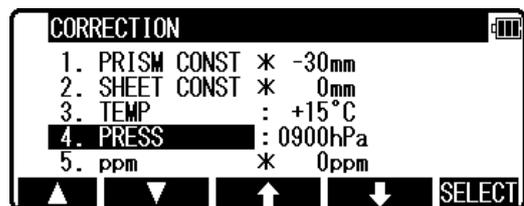
Press [F4] [↓] to move the cursor to “4.PRESS”
and press the [F5] [SELECT] to enable
the temperature to be changed.



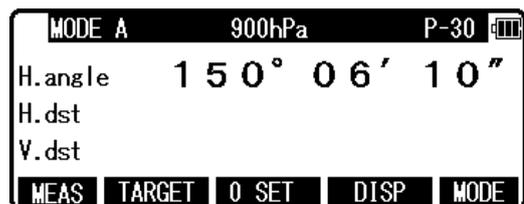
Clear the exiting values by pressing [F5] [CLEAR].
Input 900 by pressing the numeric keys.



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.

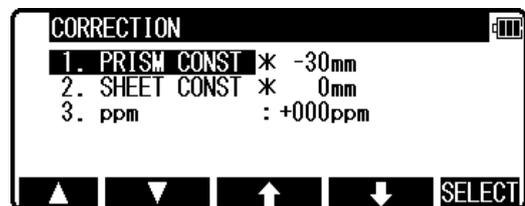
- Once set, the pressure is displayed at the centre of the top of the measurement screen.
- The factory initial of pressure is “1013hPa”.
- Once set, the pressure remains in memory even after the power is turned off.
- Pressure correction is based on 1013 hectopascals (hPa).
- If this instrument is used 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

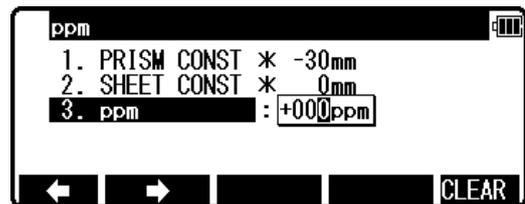
The ppm value can be changed only when “ATM CORR” has been set to “ppm INPUT” in “initial setting 1”. “TEMP” and “PRESS” are not displayed.

Example: Setting the ppm value to 31 ppm.

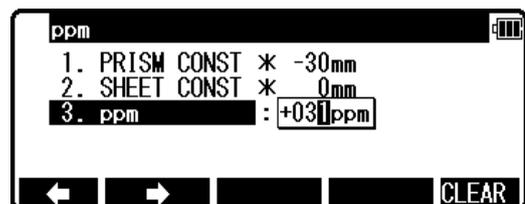
Press [F4] [CORR] in MODE B.



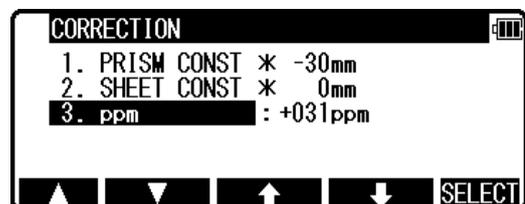
Press [F4] [↓] to move the cursor to “3. ppm” and press the [F5] [SELECT] to enable the temperature to be changed.



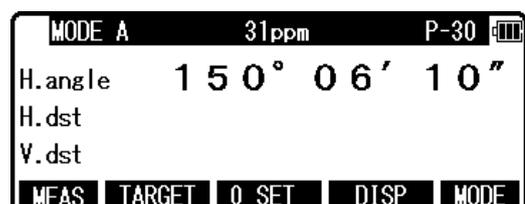
Clear the exiting values by pressing [F5] [CLEAR]. Input 31 by pressing the numeric keys.



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-200 series, you can select and save the desired setting for a variety of prescribed instrument conditions, called initial setting.

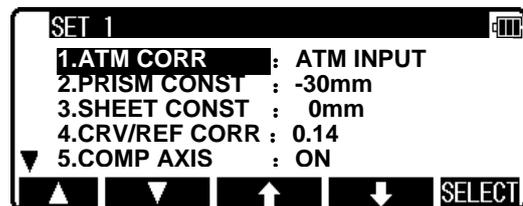
The Initial Setting is saved in four modes, “initial setting 1”, “initial setting 2”, “initial setting 4”, and “initial setting 5” in which you can select and save the instrument conditions described below.

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

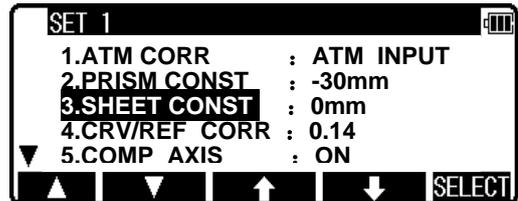
To change initial setting, follow the operating procedures for entering each initial setting mode in “8.2” and the operating procedures for changing an initial setting in “8.2”.

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

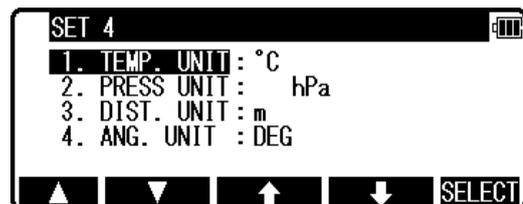
Press the [POWER] key while holding [F2] key down to access the screen for initial setting 2.

- 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 4

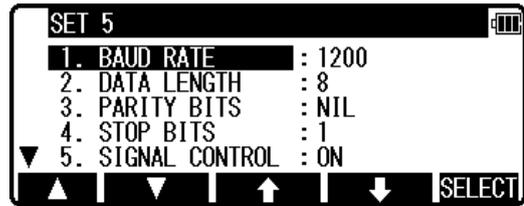
Press the [POWER] key while holding [F4] key down to access the screen for initial setting 4.

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



8.5 Entering the mode for initial setting 5

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

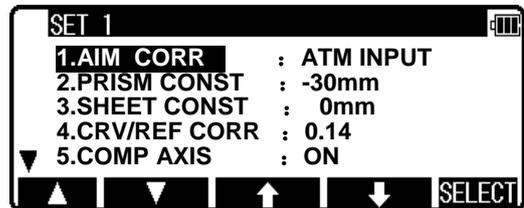


- Select the item of interest in the same way as in the mode for initial setting 5.

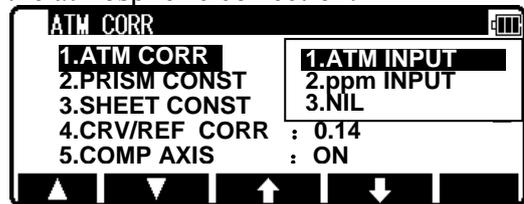
8.6 Example of changing an initial setting content (selection of atmospheric correction)

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”.

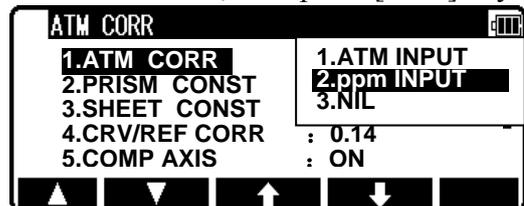


Press [F5] [SELECT] to open the screen for selecting the atmospheric correction.

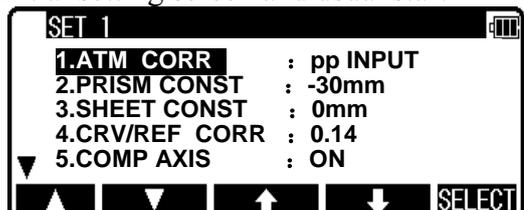


Press [F3] [↑] or [F4] [↓] to position the cursor at the desired item, then press [ENT] key to select that item.

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.



8.7 Initial setting 1

Selection of **Atmospheric Correction**:

By entering ppm value, or by fixing the ppm value to 0 (NIL) not to perform Atmospheric Correction.

- 1. ATM INPUT
- 2. ppm INPUT
- 3. NIL

1. 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.

- 1. -30mm
- 2. 0mm
- 3. INPUT

2. 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.

- 1. 0mm
- 2. INPUT

3. 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.

- 1. 0.14
- 2. 0.2
- 3. NIL

4. Selection of **Tilt Compensation**: [COMP AXIS]

Select whether Tilt Compensation is to be ON/OFF.

- 1. ON
- 2. OFF

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

8.8 Initial setting 2

1. 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.

- 1. 1 TIME
- 2. 3 TIMES
- 3. 5 TIMES
- 4. INPUT

2. Setting the **Shot input**: [SHOT INPUT]

Set the shot number for Shot distance measurement.

01 TIMES

- 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”.

3. Selection of the quick measuring:ON/OFF

1. OFF
2. ON

4. Selection of **Long range message**
: [LONG RANGE MES.]

1. OFF
2. ON

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

1. OFF
2. ON

6. 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)”.

1. COARSE
2. FINE

7. 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

8. 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.

9. 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

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

1. OFF
2. ON

8.9 Initial setting 4

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

1. °C
2. °F

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

1. hPa
2. mmHG
3. inchHG

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

1. m
2. ft
3. ft+inch

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

1. DEG
2. DEC
3. GRD
4. MIL

8.10 Initial setting 5

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

1. 1200
2. 2400
3. 4800
4. 9600

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

1. 8

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

1. NIL
2. EVEN
3. ODD

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

1. 1
2. 2

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

1. ON
2. OFF

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

1. ON
2. OFF

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.

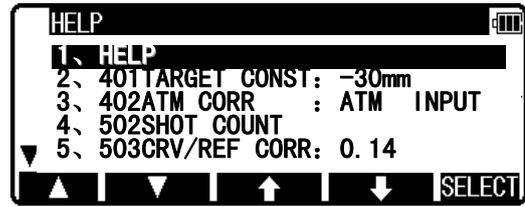
1. NIL
2. a
3. b
4. c
5. d
6. e
7. f

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 atm corr).

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

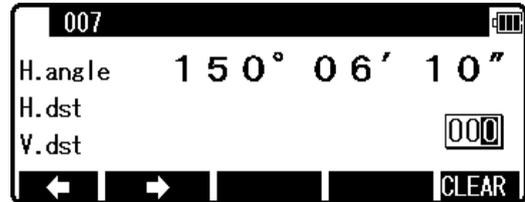


The help menu will then be displayed. Press [F1] [Δ] [F2] [∇] or [F3] [\uparrow] [F4] [\downarrow] to position the cursor to the desired item.

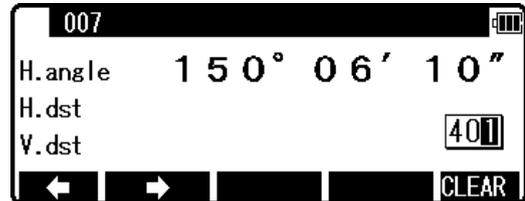
9.2 Accessing by 007

The R-200 allows you to enter a special code of 007 with the alphanumeric keys to display specific initial setting.

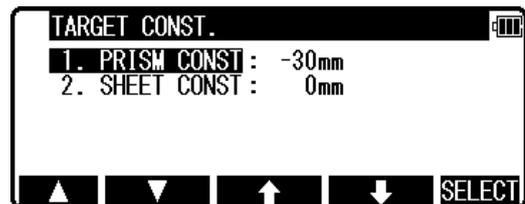
Press the numeric keys [0] [0] [7] in MODE A or B. The screen will then change to the command input screen.



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
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
509	QUAD BUZ.		OFF	ON
510	AUTO OFF		10 MIN	20 MIN, 30 MIN, NIL
511	EDM OFF		ON	OFF
517	COMPENSATOR		OFF	ON
520	LD. PLUM.		OFF	ON
521	LONG RANGE MES.		ON (when target is Ref.less)	OFF
522	QUICK MEASURE		OFF	ON
523	ATM CORR DISP		ON	OFF
701	ATM UNIT	TEMP. UNIT	°C	°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. 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]

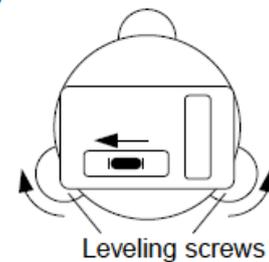
- When adjustment is completed, be sure that adjusting screws are completely tightened. When finishing turning adjusting screws, be sure that screws are turned in a direction for tightening.
- Repeat check after adjustment, and check if the instrument has been adjusted properly.
- When adjustment is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

10.1 Plate level

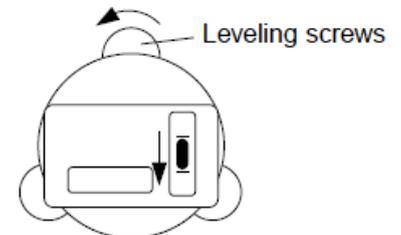
[Checks]

- ① Align the Electronic vial in parallel with a line joining any two of the leveling screws. Then, adjust the two screws to center the bubble in the Electronic vial.
- ② Turn two leveling screws in an opposite direction mutually and have the bubble of the side of the electronic vial to the center.
- ③ Make the bubble of the length of the electronic vial to the center by operating the leveling screw of one remainder.
- ④ Rotate the instrument by 180° and confirm the position of the bubble of the electronic vial. At this time, it is not necessary to adjust it if the bubble of the electronic vial is in the vicinity of the center.

(A)



(B)



- Please check the electronic vial in a steady environment that has no vibration or rapid temperature change.
- When the electronic vial is checked outdoors and on a tripod, avoid sunlight influence by using a sunshade. Please wait for a while until the instrument and tripod are at the same temperature as the surrounding air.
- When the instrument is seen at the position of “Left circle”, movement and the inclination of the instrument become the same on the screen in the electronic vial. Please note that the movement of the bubble becomes opposite direction if it is seen at the position of “Right circle”.

10.2 Circular vial

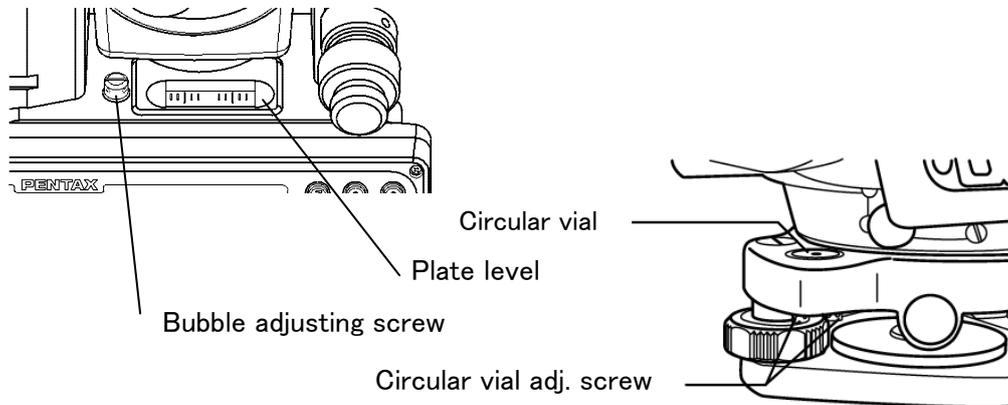
Checks

- ① Adjust by the electronic 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 center of the circle.

Adjustments

When the bubble of the Circular vial comes off from the center according to check procedure ②, it is necessary to adjust.

Turn the bubble adjustment screw with a hex wrench (L type wrench) and put the bubble in the center of the circle.

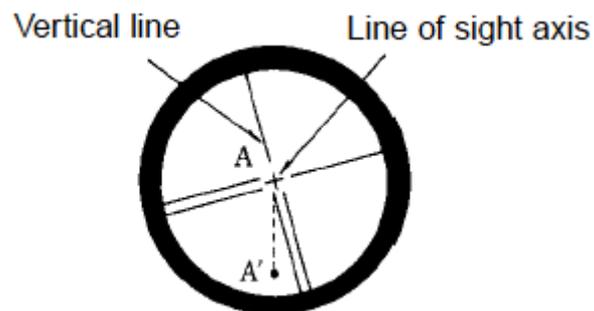


- Tighten the screws equally after the above adjustment.

10.3 Vertical reticle

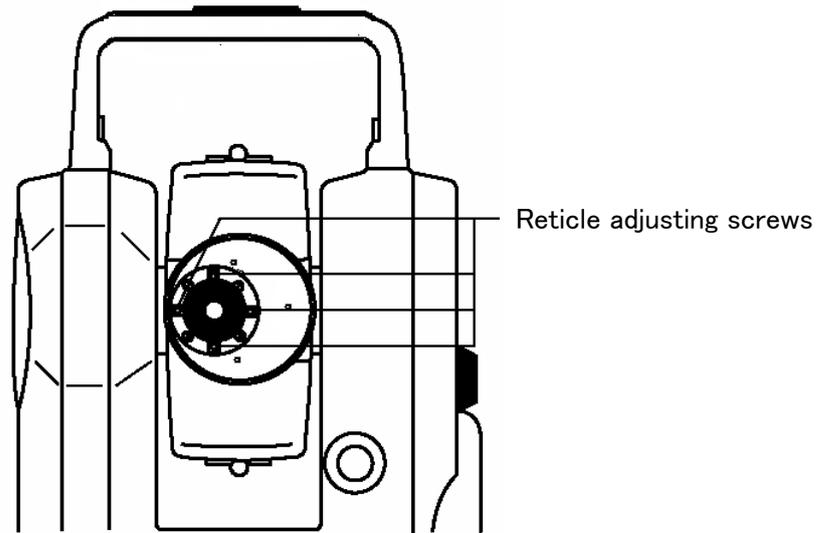
Checks

- 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

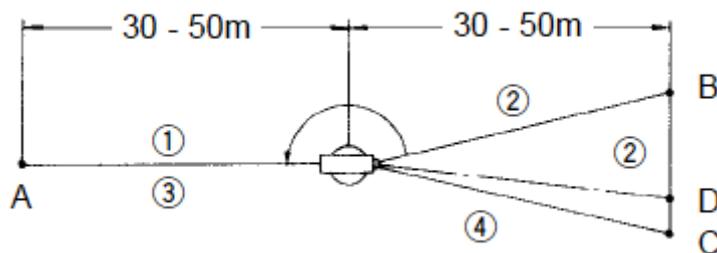
- ① If Point A is off from the vertical line of the reticle, first remove the eyepiece cover.
- ② Using the adjusting pin, loosen the four reticle adjustment screws slightly loosening each screw by the same amount, and then rotate the reticle line around the sight axis and align the vertical line of 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.



10.4 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 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.
 - ① Repeat the check and make sure the adjustment is correct.

10.5 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.

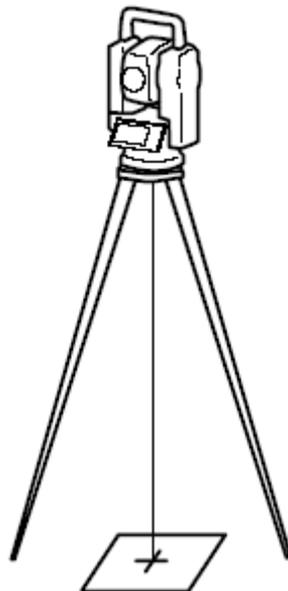
[Adjustments]

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

10.6 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 move the paper so that the intersecting point of the cross comes to the center of the Laser mark.
- ③ Rotate the instrument around the vertical axis, and observe the center 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.



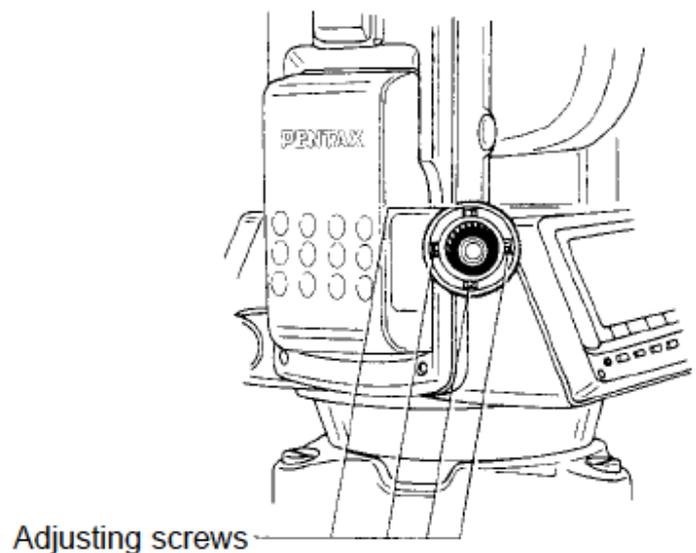
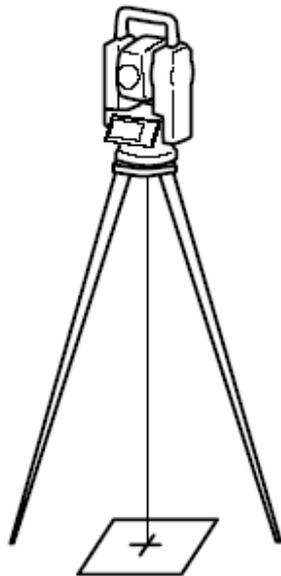
Adjustments

When a center part where a cross intersection and the laser mark look the brightest shifts by 0.8mm 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.

10.7 Optical 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 Look through the optical plummet, and move the paper so that the intersecting point of the cross comes to the center of the field of view.
- ③ Adjust the leveling screws so that the center mark of the optical plummet coincides with the intersecting point of the cross.
- ④ Rotate the instrument around the vertical axis. Look through the optical plummet each 90° of rotation, and observe the center mark position against the intersecting point of the cross.
- ⑤ If the center mark always coincides with the intersecting point, no adjustment is necessary.



Adjustments

- ① If the center mark does not coincide with the intersecting point, rotate the optical plummet focusing knob cover and remove it.
- ② Mark the point set on the line of sight at each step of 90° on the white paper and call them A, B, C and D.
- ③ Join the opposed points (A,C and B,D) with a straight line, and set the intersecting point 0.
- ④ Turn the four optical plummet adjusting screws with an adjusting pin so that the center mark coincides with the intersecting point 0.
- ⑤ Repeat from ④ and check that adjustment is correct.

10.8 Offset Constant

The offset constant rarely changes. It is recommended, however, that check 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.

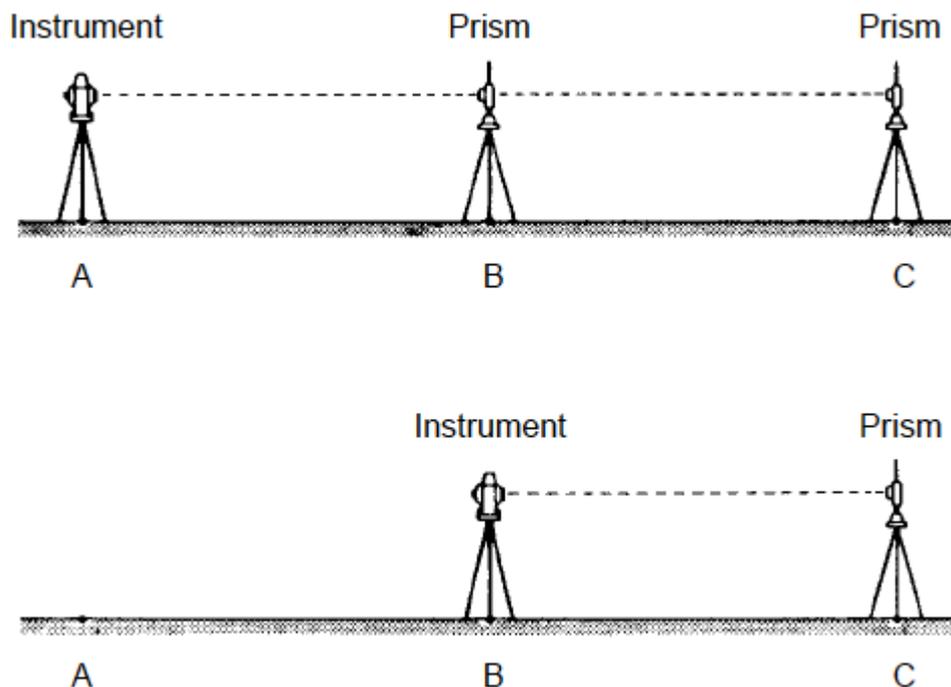
Checks

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 off-set constant when the K is not nearly 0.



10.9 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 50 m.
- ② Accurately sight the center 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

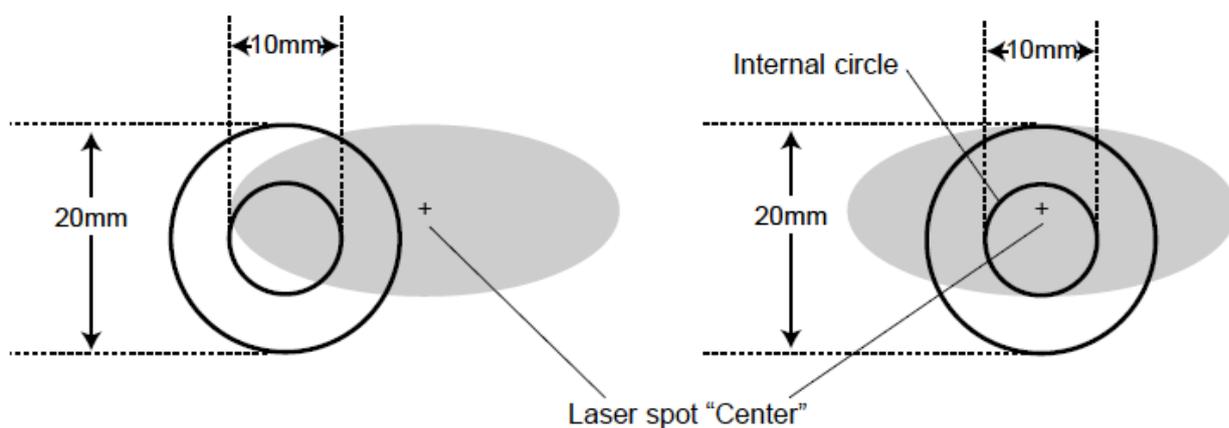
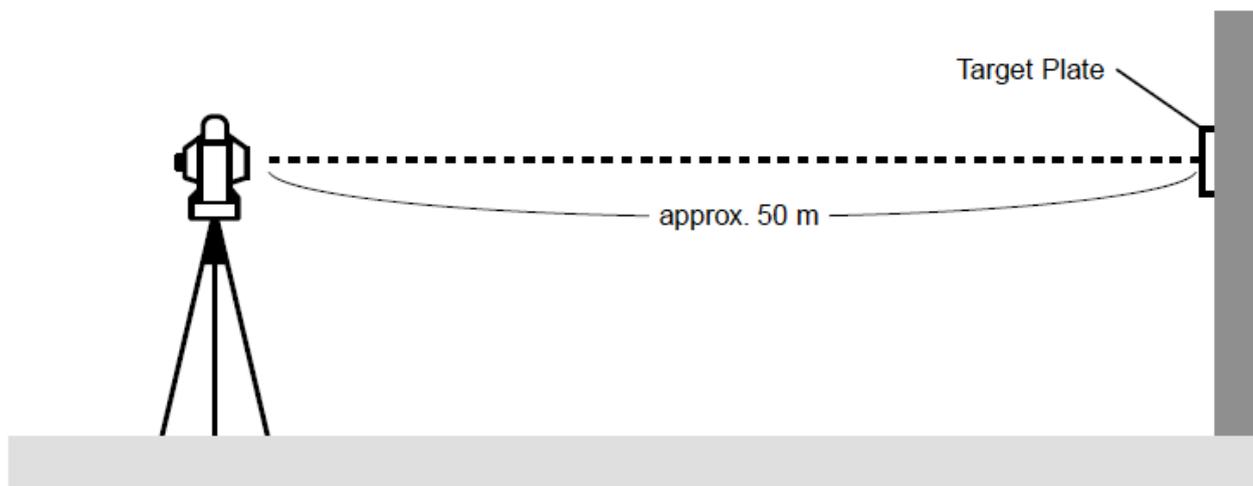
- If instrument function is not as described in ④, contact your local dealer.
- This check should be done under good weather conditions.

10.10 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. 50 m from the wall.
- ② Displace the target plate attached to the end of this manual. Place the target plate adjusting its center to the center 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 Reflecting 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 Reflecting sheet mode (Reference p38 6.1 Target Setting).
- ④ Press [F1] [MEAS], then the laser spot appears on the target plate. If the “Center” 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.



[Example: Adjustment is necessary]

[Example: Adjustment is unnecessary]

Adjustments

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

11. SPECIFICATIONS

	R-202NE	R-205NE
Telescope		
Image	Erect	
Optical aperture	45mm	
EDM aperture	45mm	
Reticle illumination	Intensity settings: 10 steps	
Pointer	Visible laser	
Magnification	30 x	
Resolving power	3"	
Field of view	2.6% (1° 30')	
Minimum focus	1.0m	
Focus	Manual	
Distance measurement		
Laser Class	Visible Laser: Class II (2) / Class IIIa (3R) -Long range mode in Reflectorless	
Measurement range (Good condition)		
Reflectorless	270m	
Mini prism	1.5m - 1100m (40km)	
1P	1.5m - 3000m (20km)	
3P	200m - 4000m (20km)	
Accuracy		
Prism	±(2+2ppm x D)mm	
Reflectorless	±(5+2ppm x D)mm	
Measuring time		
Repeat meas.	Normal :Prism, 2.0sec. (1 mm) Prism, 0.4sec. (1 cm) 1.2 sec. (1 mm) *Quick mode	
Initial meas.	Normal : Prism, 2.4sec. (1mm) Normal :Prism, 2.5sec. (1mm) *Quick mode	
Angle measurement		
Measuring method	Absolute rotary encoder	
Detection	2 sides	
Minimum count	1" / 5"	
Accuracy	2"	5"
Compensator	1 axis	
Sensitivity of vials		
Plate level (electronic)	30"/1div.	
Circular level	8'/2mm	
Plummet	Visible Laser, ±0.8 mm (instrument height 1.5m)	
Base	Detachable	
Water resistant	IP54	
Ambient temperature	-20°C ~ +50°C / -4°F ~122°F (Working range)	
Tripod thread	5/8" x 11	
Dimensions/Weight		
Instrument	172(W) x 343(H) x 177(L) mm	
Weight	Approx.380g	
Weight	280g	
Carrying case	250(W) x 365(H) x 425(L) mm	

Battery pack BP02C	
Power source	Ni-MH (Rechargeable)(4300mAh)
Operation time	Continuous Approx. 5 hrs (ETH+EDM),12 hrs (ETH) with Approx. 2.2 hrs of charging time
Weight	Approx. 380g
Weight	280g
Internal Memory	
Coordinates data	20000 points

Note:

- The measurement range and accuracy of Reflectorless are determined by the white side of the Kodak Gray Card.
- The measurement range may be influenced by the shape of the target and its environment.
- Quick mode, which functions with prism, is effective only under normal mode(1mm) and up to 500m.
- When Quick Mode is on, the EDM accuracy using Prism is $\pm(3+2\text{ppm} \times D)\text{mm}$.
- EDM Measuring time varies according to distance to be measured and conditions of the environment.
- Normal conditions: 20km visibility with slight shimmer.
- Good conditions: 40km visibility, overcast, no heat, no shimmer and moderate wind.
- The measurement time in reflectorless mode is influenced by the shape, size and surface area and reflection range of the target and its environment.
- Maximum number of point to be recorded per job site : 3000 points
Maximum number of job file to be recorded : 50 job files

12. DATA COLLECTOR

The instrument can communicate directly with a computer through the RS232C 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.

- About connection with data collector and the handling, please refer to an “Instruction manual” of the data collector.
- Connecting a data collector to a computer is different with every system. Please contact your local dealer about them.

13. APPENDIX

13.1 Error Messages

Message	Meaning	What to do
Out of tilt range	Displayed when the instrument is tilted beyond the vertical compensation range ($\pm 3'$) in case 1 axis automatic compensation is selected. This message may be temporarily displayed if the instrument is turned too fast.	Re-level the instrument. Repair is needed if the message is displayed when it is properly leveled.
Excess data	The input data exceeds the allowable range.	Press the [ESC] key and enter the correct data.
Mismatched Target	<ul style="list-style-type: none"> ● The distance is measured by Prism at Reflector sheet mode, and the distance is over than 1000m. ● The distance is measured by Prism or Reflector sheet at Reflectorless mode, and the distance is over than 200m. 	Select the correct target mode.
Target is too close.	<ul style="list-style-type: none"> ● The measurement distance is less than 1.5m at Reflector sheet mode. ● The measurement distance is less than 1.5m at Prism mode. 	Select a longer point, or use a tape measure.
Unsuitable Condition	<ul style="list-style-type: none"> ● Under too strong sun light. ● Unstable light value owing to shimmer or obstacles. ● Reflector sheet, Target and Prism do not face the instrument. ● Reflector sheet, Target and Prism are not correctly sighted. ● Measurement range is over at Reflectorless mode. ● Sufficient signal does not return by sighting sharp edge etc. at Reflectorless mode. 	Change the object that has much better reflectivity, or use a reflecting sheet, or wait until the sun activity has weakened.
ERROR!! EDM ERROR 04 -05, 34-39, 50-53	Distance measurement system problem	Turn the power off, and then turn on again. Repair is needed when the message appears consistently.
ERROR!! ETH ERROR 70-76	Angle measurement system problem	
ERROR!! ETH ERROR 19	Memory problem	
ERROR S DATA of EDM	Problem of the internal EDM parameters	
ERROR P DATA of EDM		
ERROR ETH DATA	Problem of the internal ETH parameters	
Li-batt.voltage is low	The Date Clock is powered by the built-in lithium battery. The lithium battery needs to be replaced in five years. The timing of battery replacement varies depending on the frequency of use and the environment of where the instrument is stored while not in use.	Have the lithium battery replaced by the dealer from whom the instrument was purchased.

13.2 Atmospheric Correction

The speed at which light travels through the air varies depending on the temperature and atmospheric pressure. The R-200 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

$$K = \left(276.26713 - \frac{78.565271 \cdot P}{273.14941 + t} \right) \times 10^{-6}$$

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.

13.3 hPa and mmHg Conversion Table

Converting from hPa to mmHg

hPa	0	10	20	30	40	50	60	70	80	90
	mmHg									
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

mmHg	0	10	20	30	40	50	60	70	80	90
	hPa									
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

13.4 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 1013 hPa or 760 mmHg), the Error per 100 meters in temperature and pressure will be shown in the tables below.

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

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

		Unit:mm						
$^{\circ}\text{C}$ hPa	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					
$^{\circ}\text{C}$ mmHg	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

13.5 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)

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

Corrected vertical distance (V)

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

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

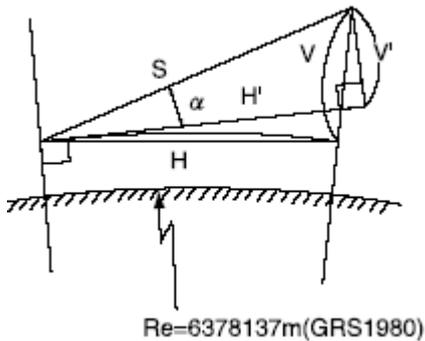
Horizontal distance	$H' = S \cdot \text{Cos}\alpha$
Vertical distance	$V' = S \cdot \text{Sin}\alpha$

S: Slope distance

α : Vertical angle from horizontal

K: Atmospheric refraction coefficient (0.14 or 0.2)

Re: Diameter of earth (6,370 km)



13.6 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 favorable 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.

14 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.

1) Specifications of Laser Radiation

A) The EDM module of the R-200 produces a visible light beam, which is emitted from the telescope objective lens and the center hole of the instrument base plate. The R-200 is designed and built to have a laser diode radiating at 620-690 nm.

B) Radiant power

The R-200 is designed and built to radiate a maximum average radiant power of 4.75mw. (0.95mw for the model without "NE") from the telescope, and 0.95mw from the center hole of the base plate. The user may be subject to this radiation as a beam while operation until such time that the instrument is turned off.

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

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 II laser product."

Or for R-200 models:

"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"

Or for R-200 models:

"DANGER LASER RADIATION AVOID DIRECT EYE EXPOSURE"

D) Warning label is Located near the exit aperture.

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 F1 MEAS key.

E) Pressing Laser key →F2 LD POINT 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.

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PENTAX

TOTAL STATION

R-200 SERIES

INSTRUCTION MANUAL

POWERTOPOLITE
FOR R-200 SERIES

R-202NE
R-205NE (POWER)



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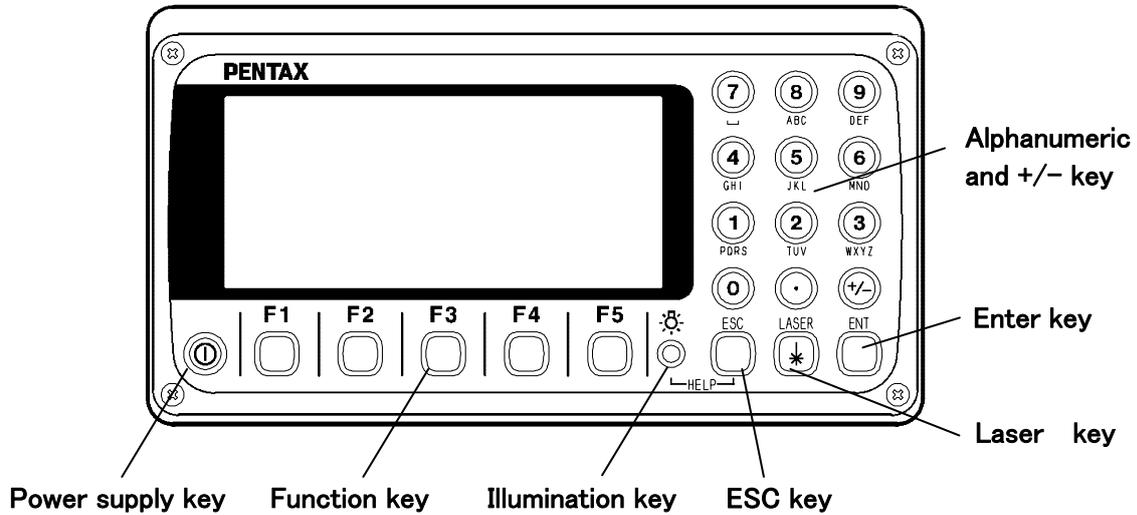
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Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep in a convenient place for easy reference.

Display and Keyboard

- Basic display and keyboard of R-200 series are described below, and the function keys of PowerTopoLite are described at "[2. ACCESSING THE POWERTOPOLITE](#)".



Operation Key

Key	Description
[POWER]	ON/OFF of power supply
[ESC]	Returns to previous screen or cancels an operation.
[Illumination]	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 the LD point screen when you push the laser plummet vial key. (Refer to "2.5 LD point function").
[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] causes a help menu to appear in A MODE or B MODE or causes a help messages to appear.

Function key

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 Initial Setting 2.)
[MEAS]	F1	Pressing this key twice measures the distance in coarse mode(another measurement type can be selected by Initial Setting 2.)
[TARGET]	F2	Select the target type by following order. SHEET / PRISM / REFLECTORLESS (Reflectorless type instrument) SHEET/ PRISM (Prism type instrument)
[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 R/L 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	Toggles the screen between MODE A and MODE B.
Other functions		
[←]	F1	Moves the cursor to the left.
[→]	F2	Moves the cursor to the right.
[▲]	F1	Goes back five Items on the screen
[▼]	F2	Goes forward five items on the screen.
[↑]	F3	Moves the cursor up
[↓]	F4	Moves the cursor down
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

- The Function keys of each PowerTopoLite function are described at "[ACCESSING THE POWERTOPOLITE](#)" and at the 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]
[.]		[.][,][:][;][#][(][)]
[+/-]		[+][-][*][/][%][=][<][>]

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Relations between memories and each function

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1. INTRODUCTION

1.1 Introduction

Thank you for your first looks at PowerTopoLite by reading this manual. The PowerTopoLite is a user friendly data collection and calculation program for the PENTAX total station R-200 series. PowerTopoLite is developed based on PowerTopo, which is known as versatile on-board software for PENTAX ATS total station series. The optimum combination of PowerTopo and R-200 hardware makes PowerTopoLite as 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
- VPM
- RDM
- TRAVERSE
- ROAD DESIGN
- TRANSFER
- PREFERENCE

1.2 Before using the PowerTopoLite manual

- Memories in the instrument

The R-200 series instrument incorporates not only the PowerTopoLite surveying programs as the Special function but also File manager and Data transfer programs. The internal memory in the instrument can store the maximum 20000 point's 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	Stakeout point:	SOP
Known point :	KP	End point :	EP	Observation point:	OP		
Conversion point:	CP	Crossing point:	CRP	Surveyed data:	SD	Conversion data:	CD

- IH and PH
IH stands for "Instrument Height" and PH stands for "Prism Height".

- The PowerTopoLite manual mainly describes the R-200 special functions, and the basic operations are described in the (basic) R-200 manual. And, therefore, refer to the R-200 basic manual regarding the R-200 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 took over functionality of “PowerTopoLite” or “Structure type” that took over functionality of our past product in ”Action Method Selection”.

- The R-200 series instrument has a Job name of “PENTAX” as its default setting. And, therefore, each data is stored in the “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 “-9999.998” – “9999.998”.
- The PC, PointCodeList, is added to the PN, Coordinates X, Y, Z and IH (PH or HI) 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 as a list.
- There are two Coordinates types of Rectangular and Polar. The VO, TO offset and the remote measurement are possible when you select the Rectangular Coordinates.
- When you measure in EDM SETTINGS of COARSE TRACKING, the R-200 displays a distance value to two decimal places. However, distance data of polar coordinates are displayed by EDIT function to three decimal places even, and sent to four decimal place. So, “ 0 “ or “ 00 ” is added to the distance data after the third decimal point in COARSE TRACKING mode.
For example

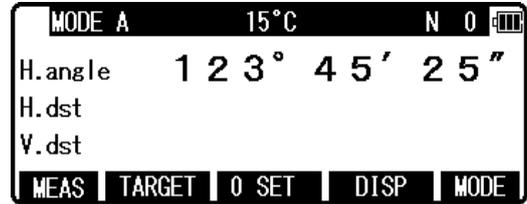
Displayed value:	123.45
Displayed by EDIT:	123.450
Sent polar data:	123.4500
- Rectangular coordinates is displayed, stored, and sent to three decimal place even if in COARSE TRACKING or FINE MEASURE mode.
- You can change the distance measurement mode during measuring operation by pressing the EDM key at the MEASURE and VPM functions.
- The same Point Name of the plural polar points can be saved.

2. ACCESSING POWERTOPOLITE

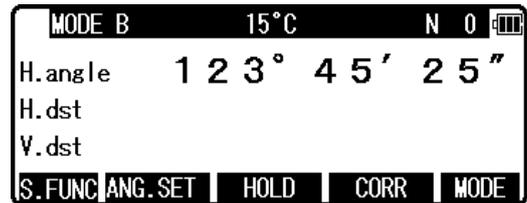
2.1 How to access PowerTopoLite

To access the R-200 Special Functions of the PowerTopoLite, perform the following procedures.

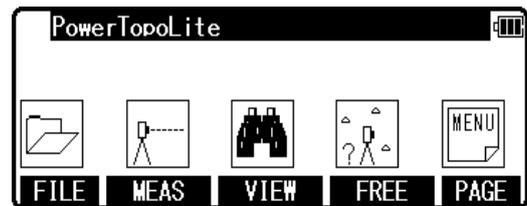
- Press the Power (ON/OFF) key to view the R-200 start-up screen.



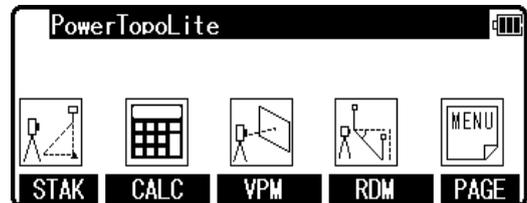
- Press the [F5][MODE] to view Mode B screen.



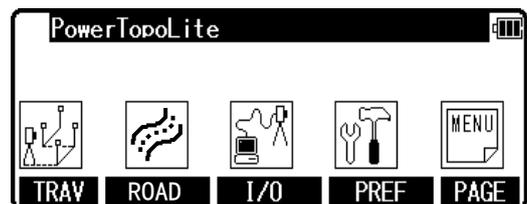
- Press [F1][S.FUNC] to view Functions of PowerTopoLite screen



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



- Press [F1][S.FUNC] to view Functions of Power TopoLite screen



2.2 Allocation of each PowerTopoLite Function key

- FILE, MEAS, VIEW, FREE, STAK, CALC, ROAD, I/O and PREF functions

Function key	Description	
F1	FILE	File manager
F2	MEAS	Measure
F3	VIEW	View and Edit
F4	FREE	Free Stationing

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

Function key	Description	
F1	STAK	Stake out

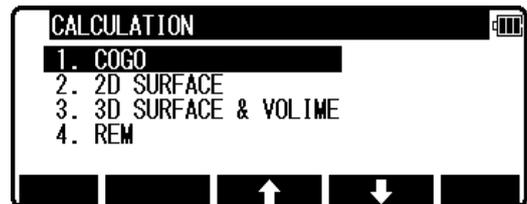
F2	CALC	Calculation
F3	VPM	Virtual Plane Measurement
F4	RDM	Remote Distance Measurement

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

Function key	Description	
F1	TRAV	Stake out
F2	ROAD	ROAD DESIGN
F3	I/O	Input and Output
F4	PREF	Preference

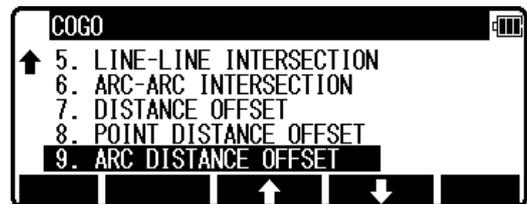
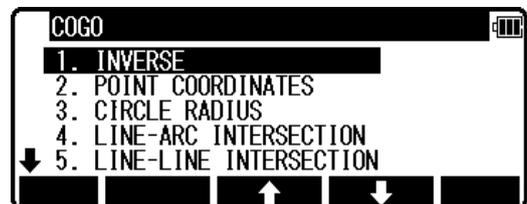
b. INVERSE, POINT COORDINATES, LINE-LINE INTERSECTION functions

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 the [ENT].

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



2.3 Typical Function keys of PowerTopoLite

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

Function key	Description
ENTER	Opens the input screen of Coordinate values etc.
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 inputted data.
ME/SAVE	Measures and then saves inputted 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 STSATION POINT SETUP screen.
H. ANGLE	Returns to the STSATION POINT H.ANGLE SETUP screen.
LIST	Views the POINT SELECTION FROM THE LIST screen.
ZOOM ALL	Returns to original size.
ZOOM IN	Magnifies the graphics size.
ZOOM OUT	Reduces the graphics size.
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.

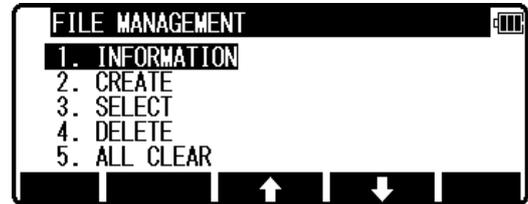
ADD	Allow you to add more points for the free stationing.
CALC	Starts the calculation of the free stationing.
NEXT	Views the next known point Coordinates setup screen.
DATA	Views the TARGET POINT screen.
TARGET	Selects the Target type
EDM	Selects the EDM settings
ALL	Selects all points of current job
ORDER	The order of selected points



3. FILE MANAGER

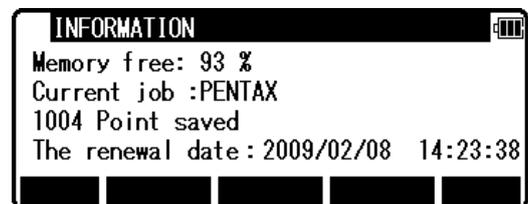
The Data storage memory status, creating a new Job name and the Selection and Deletion of a Job name are executed by this function.

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



3.1 Information of the remaining memory available

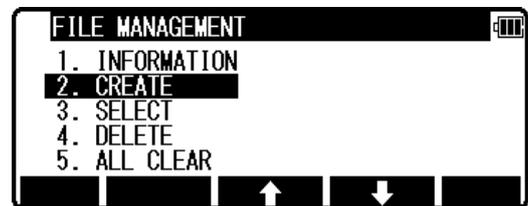
Press [ENT] to view INFORMATION screen.



The remaining memory available and a JOB name PENTAX are viewed on the screen. The Job name "PENTAX" is a default setting.

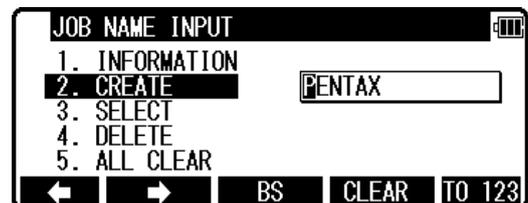
3.2 Creation of a new Job

Select 2. CREATE by down arrow key.



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

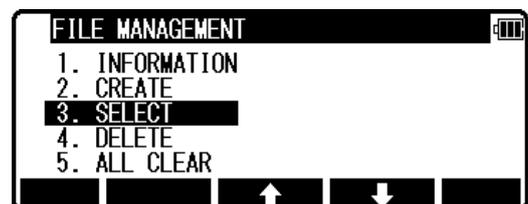
- The Job name input method can be selected by the "[Input method selection](#)" of the "Preference". This is the "10 KEY SYSTEM" input selection.



- If a new Job is created, the new data are stored in this new Job.

3.3 Selection of a Job name

Select 3. SELECT by pressing the down arrow key.



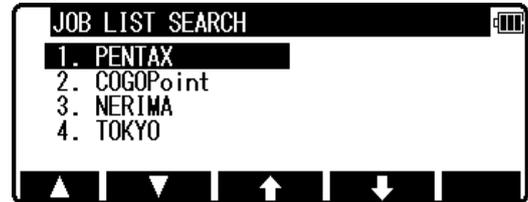
Press [ENT] to view JOB SELECTION screen.



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.



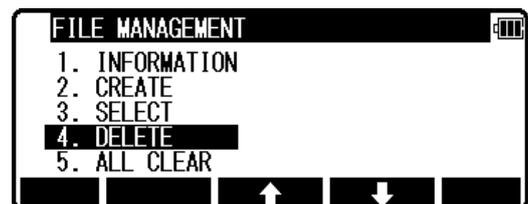
Input your desired JOB NAME and press [ENT] to view the JOB LIST SEARCH screen.



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 JOB DELETION screen.

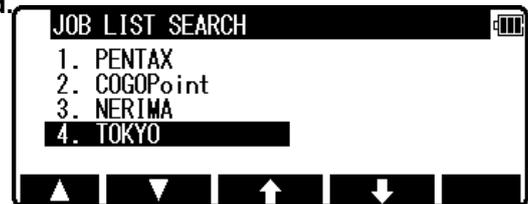


3.4.1 Deletion from a Job list

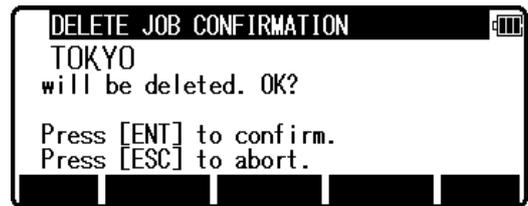
Select 1. JOB LIST SEARCH and Press [ENT] to view its screen.



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

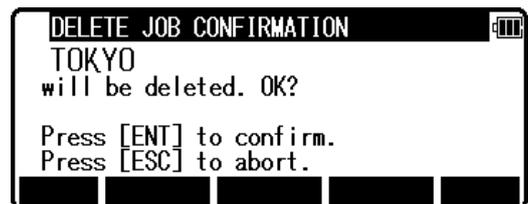
Select 2. JOB NAME SEARCH by pressing the down arrow key.



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



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

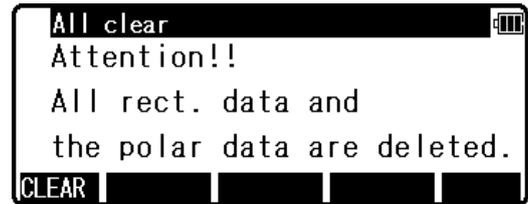


Press [ENT] to delete or [ESC] to abort.

The R-200 series instrument has a Job name of the "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.



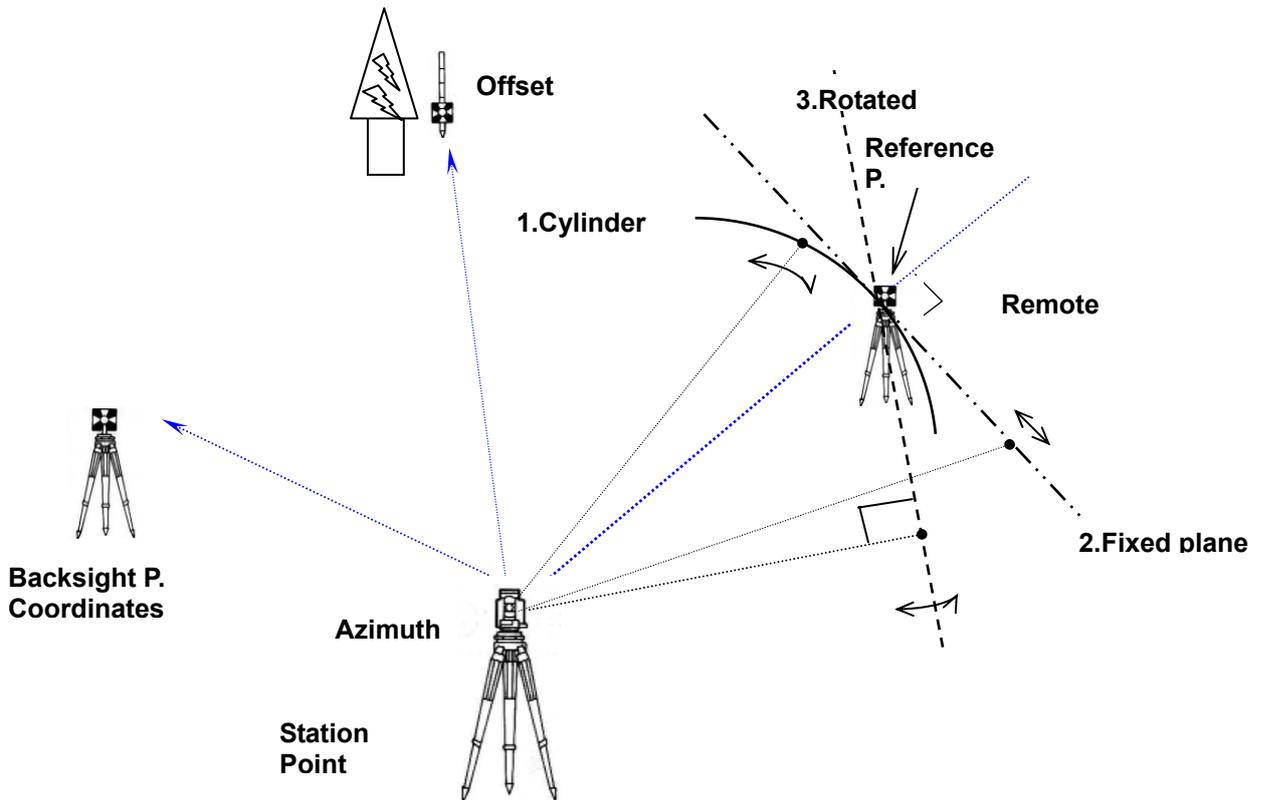
Warning: When [CLEAR] is pushed, all Job Files are deleted.

- 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 of Rectangular and Polar Coordinates in this [MEASURE]. The Offset at the Target point 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].

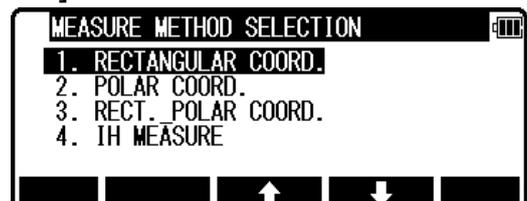
After measuring rectangular coordinates by [MEASURE] function of PowerTopoLite, it is possible to display Angle and Distance by switching the [F3] key.

When Remote mode is selected, Angle and Distance are also calculated according to the coordinates of the aiming point on real time.

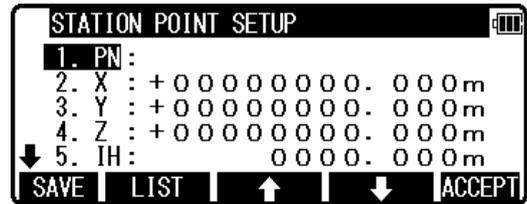
When Offset mode is selected, Angle and Distance are also calculated according to the coordinates where offset value is added.

4.1 Station setup [By Rectangular Coordinates]

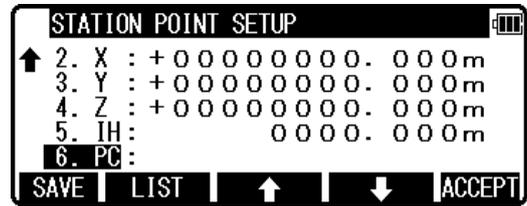
Press [F2][MEAS] of the PowerTopoLite screen to view the MEASURE METHOD SELECTION screen.



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



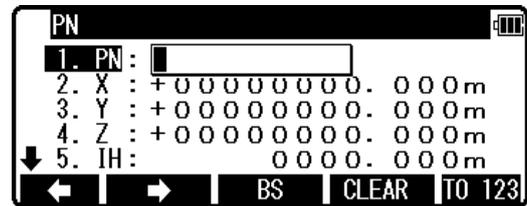
The \uparrow/\downarrow mark is used to scroll up / down. 6. PC is viewed by scrolling down.



4.1.1 Point name, PN, input

Press [ENT] to view the PN screen.

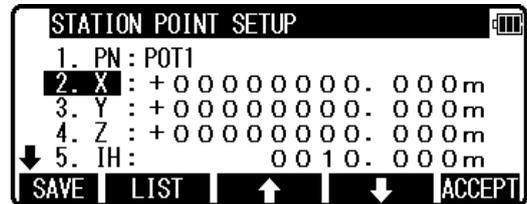
The [ENT] is used for both accepting the selected choice and opening the input screen of the Coordinates values etc..



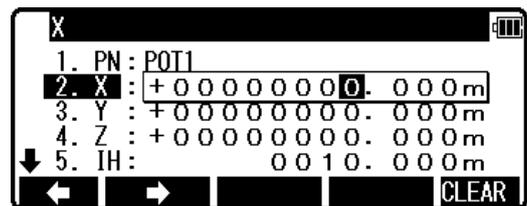
Input your desired point name by pressing keys, and after all Characters are input, press [ENT]. Four character selection methods are available. (Refer to the [“13.3 Input method selection”](#))

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

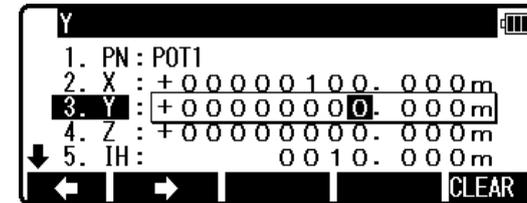
It goes 2. X coordinate automatically.



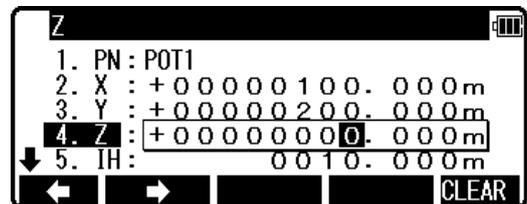
Press [ENT] to view the X coordinate input screen. Input X, Y and Z coordinates, Instrument height and PC as follows. Input your desired X coordinate value by pressing each keys.



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

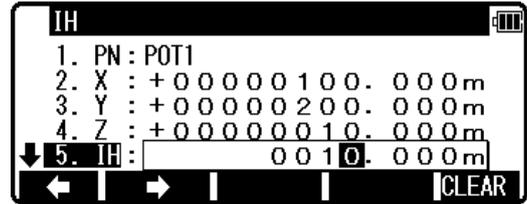


Z coordinate:
Press [ENT] to view the Z coordinate input screen. Input your desired Z coordinate value by pressing each keys.



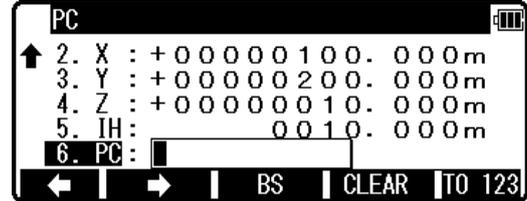
IH value:

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



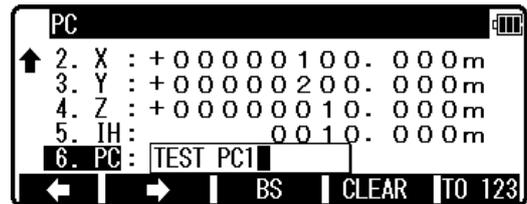
PC, Point Code:

Press [ENT] to view and input the PC, Point code, screen.
If PointCode exists, you can easily select them from the list. Then after pressing [ENT], you can edit Point Code data. For using Point Code List, please refer to “4.4. 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.



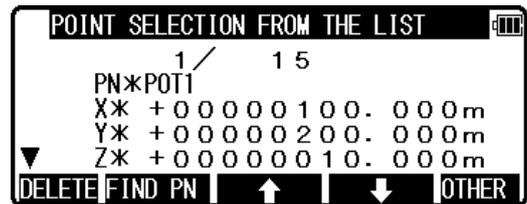
If “PROCESS TYPE” is selected in “[Action method selection](#)”, after input/confirm PC data the inputted POT1 data will automatically be stored in the memory. Then the panel “STATION POINT H.ANGLE SETUP” will be displayed.

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

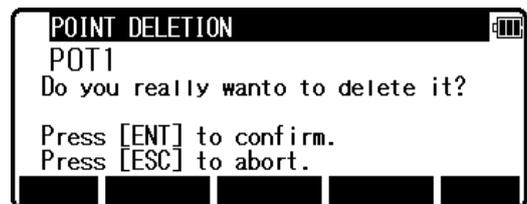
- [LIST] key

All stored points can be displayed, deleted and searched as follows by pressing [F2][LIST].

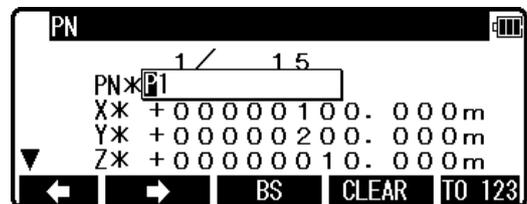
Press the [F2][LIST] to view POINT SELECTION FROM THE LIST screen.



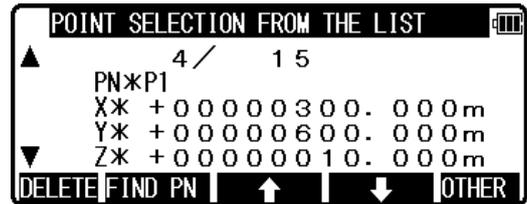
Press [F1][DELETE] to view POINT DELETION screen.



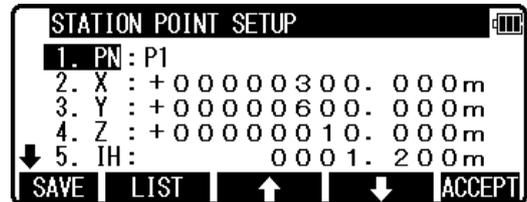
Press [F2][FIND PN] to view PN screen.



[ENT] to view POINT SELECTION FROM the LIST screen.



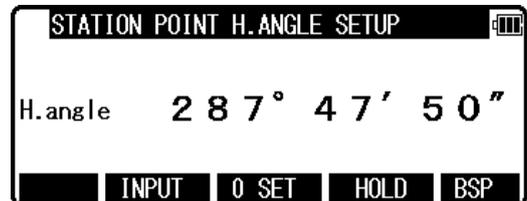
Press [ENT] to view STATION POINT SETUP screen.



4.2 Station Orientation

Press the [F1][ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.

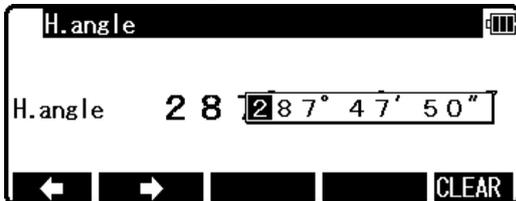
Please, note that the rotation of the “H.angle” depend on the rotation setting of “Coordinate axis definition”.



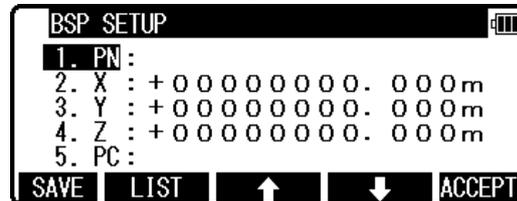
4.2.1 Station orientation

Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Reference point Coordinates by pressing [F1][BSP].

Pressing [F2][INPUT]



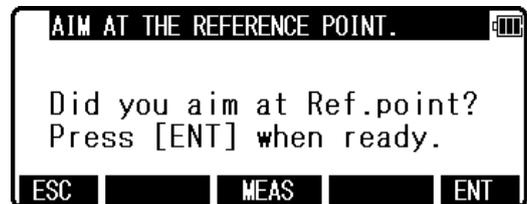
Pressing [F1][BSP]



Press [ENT] to view the input window.

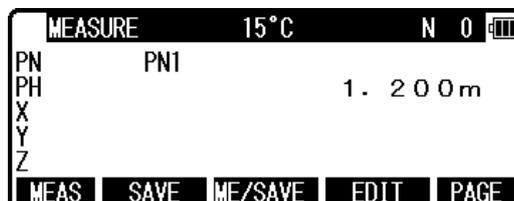
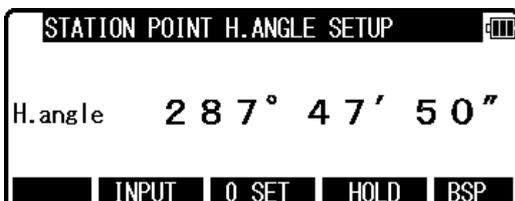
Press [ENT] after entering the Horizontal angle. The AIM AT THE REFERENCE POINT screen is viewed when “1. ON” of “7.REQUEST AIMING” of “Preference” is selected and not viewed when “2. OFF” is selected.

In case of that BSP Coordinates are inputted, this message is always viewed on the screen.



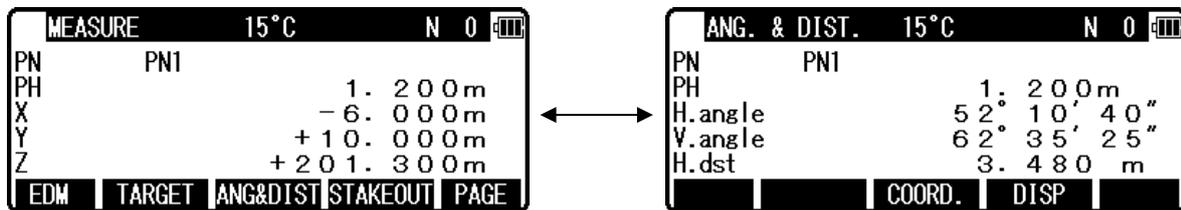
Coordinates display and Angle & Distance display

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



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

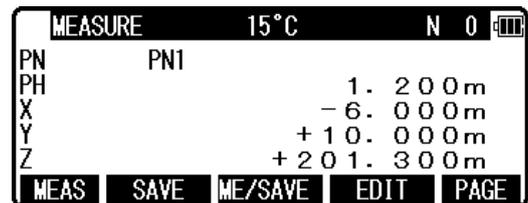
- 1) Press [F5][PAGE] twice to view [F3][ANG & DIST].
- 2) Press [F3][ANG & DIST] to view [F3][COORD.] and Angle and Distance values.
- 3) Press [F3][COORD.] to view [F3][ANG&DIST] and Coordinates.



4.3 Measuring

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

Then, aim at the Target point and press the [F1][MEAS] to measure it.



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

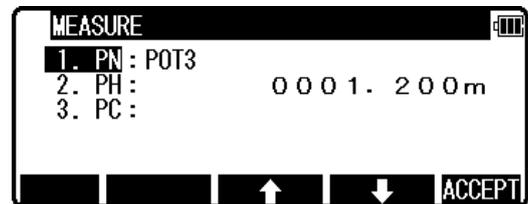
Press [F2][SAVE] to save the measured data.

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 PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using Point Code List, please refer to [“4.4. Point Code”](#).



4.4 Point Code

The PC, PointCodeList 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 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 as a list.

“PointCodeList” can be created by either using [“5.2 Create the Rectangular Point”](#) function or Importing “PointCodeList” file.

Making “PointCodeList”:

Create / select “PointCodeList” job using [“3. FILE MANAGER”](#). Then input point data according to [“5.2 Create the Rectangular Point”](#). Input any value into “PN” field and leave the X, Y, and Z field “0”. And input PointCode data into “PC” field.

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-200 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,	,	2,	DEF,	,	,	,
	Coord. data record	Point No.: (N/A)	Point Name (Shoul not duplicated and Max. 15 Character.)	Point Code (Max. 15 Character.)			

Setting the PROTOCOL:

Press the [F3]/[I/O] of the PowerTopoLite screen to view the TRANSFER screen.

To check the communication setting, select the "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].

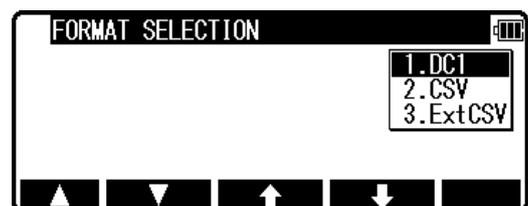
(cf. "[12.3.1 Receiving data setting](#)")



Receive rect. Data:

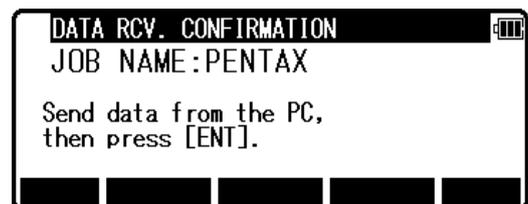
The Rect. data is sent from the PC and stored in the internal memory of the instrument.

Select the 1. RECEIVE RECT. DATA and press [ENT] to view FORMAT SELECTION screen.

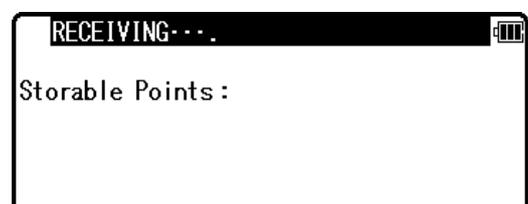


Select the DC1 format and press [ENT] to view DATA RCV. CONFIRMATION screen.

(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.



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

4.5.1 Remote

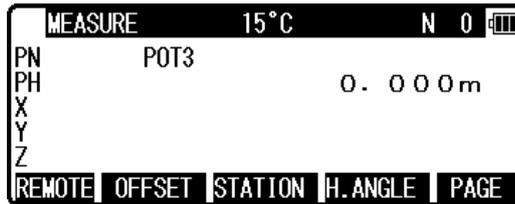
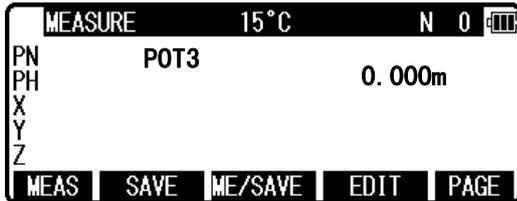
Press [F5][PAGE] to view another MEASURE menu.

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

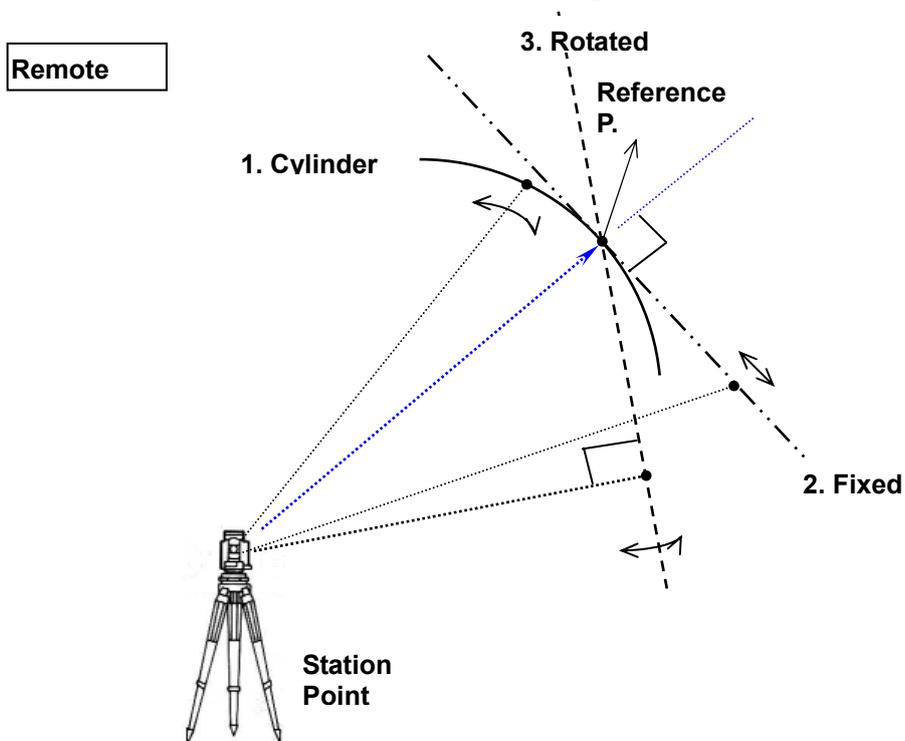
The displayed Coordinates automatically change according to your aiming point.

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.

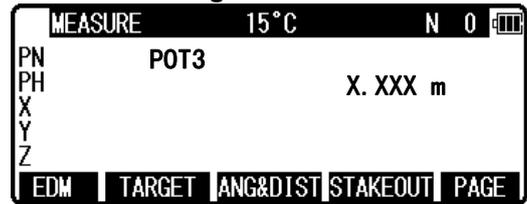
There are three calculation methods of Cylindrical face, Fixed plane and Rotated plane. They are selected by the "Preference". Refer to "Remote method selection". The calculations are performed on the virtual planes.



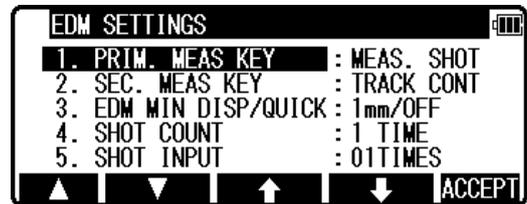
To quit the Remote measurement, press [F1][REMOTE] twice again.



Three type menus can be used by pressing [F5][PAGE]. Another is following menu.
 The target type can be selected by pressing [F2][TARGET].

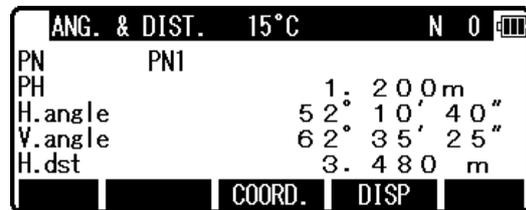
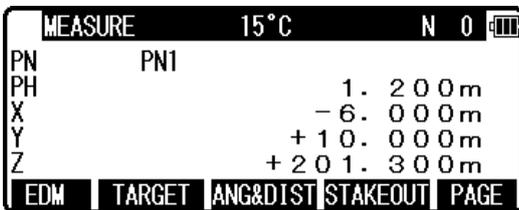


EDM settings can be selected by pressing [F1][EDM].
 For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).



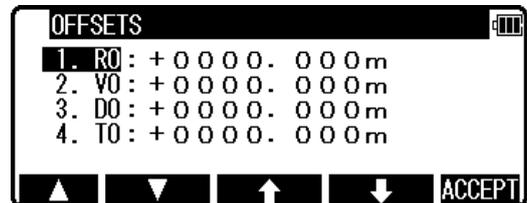
Coordinates display and Angle & Distance display

- 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.

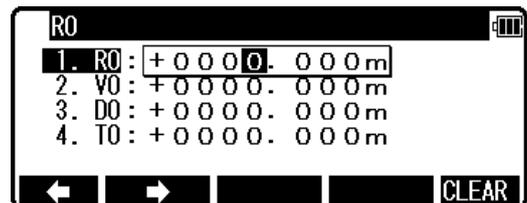


4.5.2 Offset

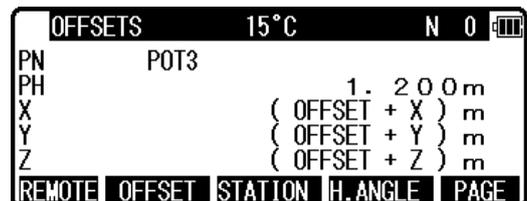
Press the [F2][OFFSET] to view the OFFSETS screen.
 Offset enables you to work with Offsets. The following offsets are available.



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



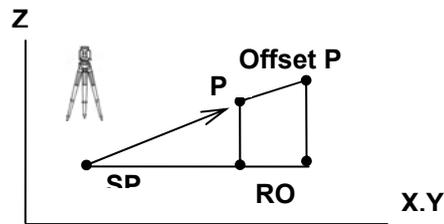
After input "TO" value, press [ENT] to view the MEASURE screen.
 (Or press [ESC] then press [ACCEPT].) The offset values are added to X,Y and Z values.



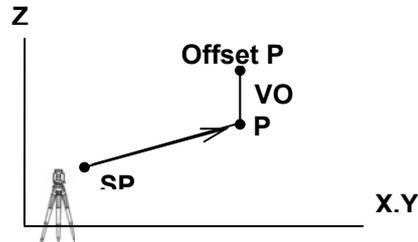
The input value of offset is cleared when you save the surveying point and step forward to the next surveying point.

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

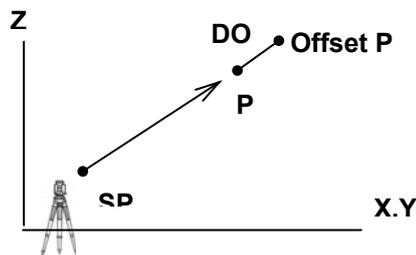
Offset P: Offset Point



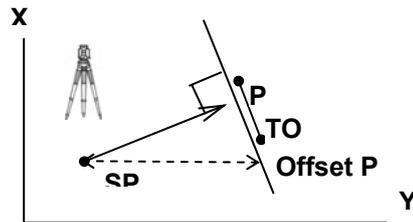
VO: Vertical Offset (Along the third axis)



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)

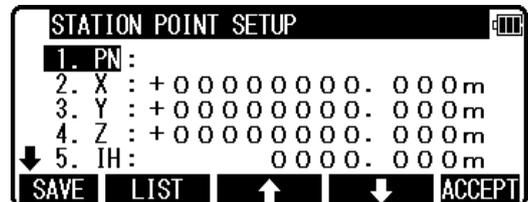


Coordinates display and Angle & Distance display

- 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.

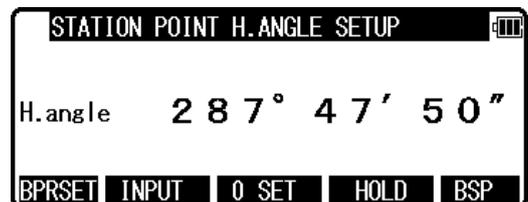
4.5.3 Station

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.

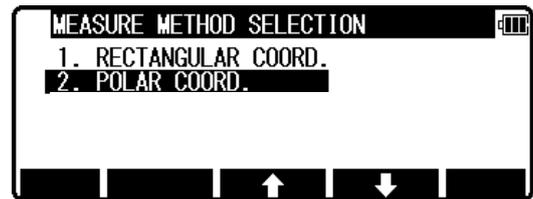


Press [ENT] to view the MEASURE screen.

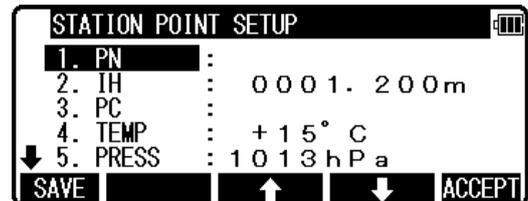
4.6 Station setup [By Polar Coordinates]

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

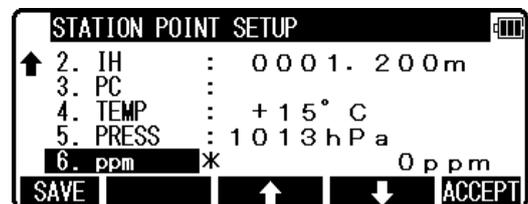
Press [F2][MEAS] of the PowerTopoLite screen to view the MEASURE METHOD SELECTION screen.



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

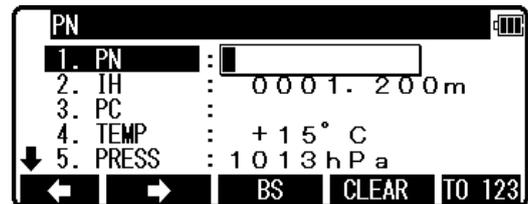


The \uparrow/\downarrow mark is used to scroll up / down. 6. PC is viewed by \downarrow .



4.6.1 Point name, PN, input

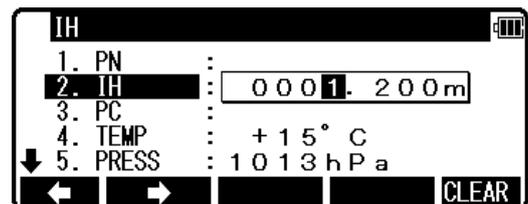
Press [ENT] to view the PN screen.



4.6.2 IH, TEMP, PRESS, ppm and PC input

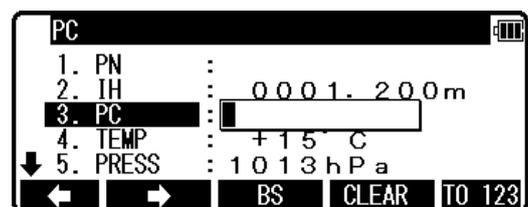
Input IH value.

Press [ENT].



Input the PC.

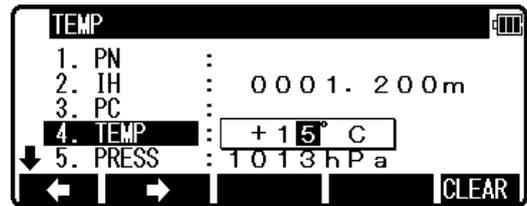
Press [ENT] to view and input the PC, Point code, screen. If PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using Point Code List, please refer to "4.4. Point Code".



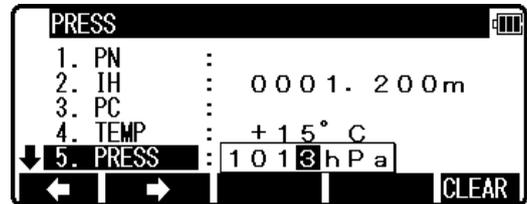
If "PROCESS TYPE" is selected in "[Action method selection](#)", the inputted point data will be stored in the memory with [SAVE]. Then the panel "STATION POINT H.ANGLE SETUP" will be displayed without pressing [ACCEPT].

But, if "STRUCTURE TYPE" is selected in "[Action method selection](#)", it is necessary to press [ACCEPT] to proceed next panel.

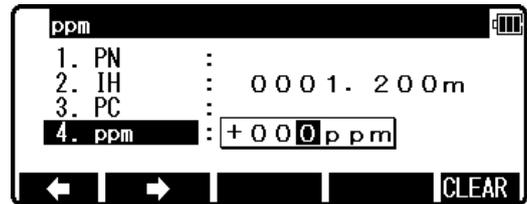
Input the TEMP value.
Press [ENT].



Input the PRESS value.
Press [ENT].



Input ppm value.
Press [ENT].

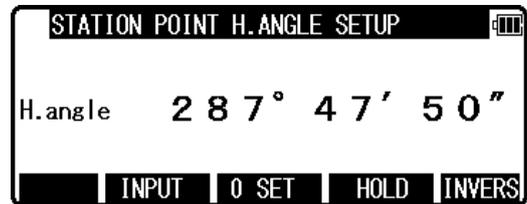


TEMP, PRESS and ppm input depend on the “Initial setting 1” (ATM INPUT, ppm INPUT, NIL).

4.7 Station Orientation

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

Please, note that the rotation of the “H.angle” depend on the rotation setting of [“Coordinate axis definition”](#).

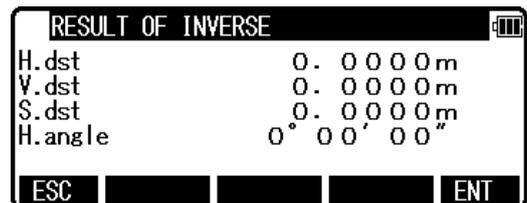


- [INVERS] key

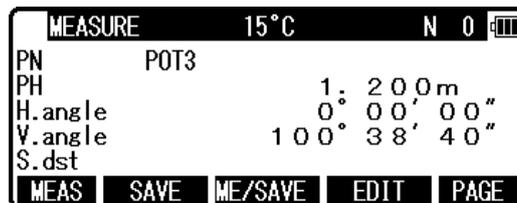
If you want to calculate direction angle, Press [F1][INVERS] to jump to [INVERSE](#) function.
Input SP as station point, EP as back sight point.



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

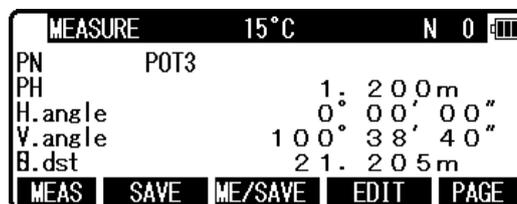


Press [ENT] after aiming back sight point.
Aim at the reference point and press [ENT] to view the MEASURE screen.



4.8 Measuring

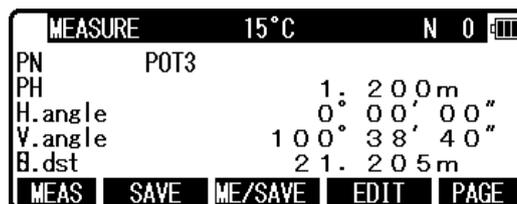
Then, aim at the Target point and press the [F1][MEAS] to measure the distance.



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

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

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.

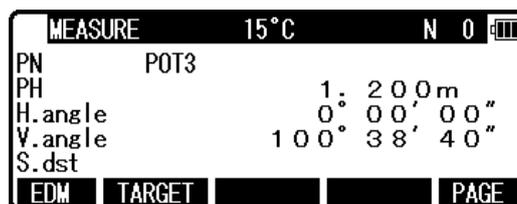


PC, Point Code:

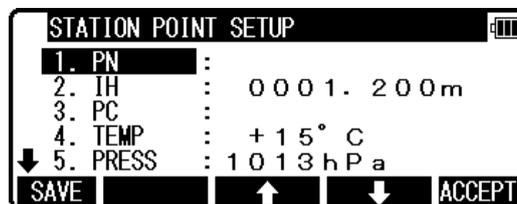
Press [ENT] to view and input the PC, Point code, screen.

If PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using Point Code List, please refer to [“4.4. Point Code”](#).

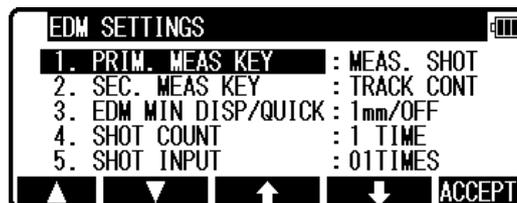
Press [F5][PAGE] to view another menu.



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



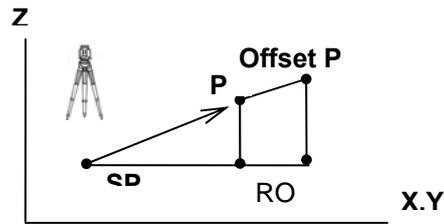
EDM settings can be selected by pressing [F1][EDM]
For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).



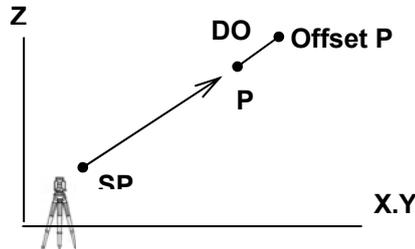
4.9 Offset

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

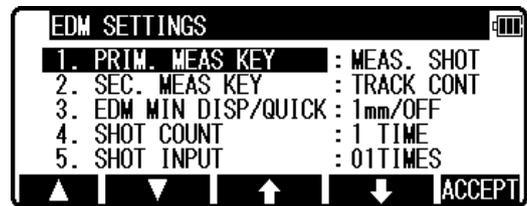
Offset P: Offset Point



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

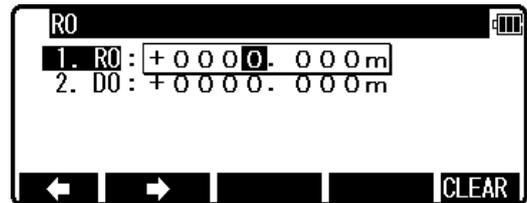


Press the [F4][OFFSET] to view the OFFSET screen. Offset enables you to work with Offset. The following offset are available.

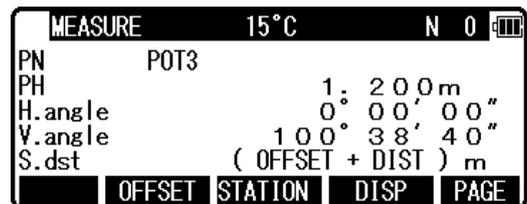


Press [ENT] to view the offset input window. Input the RO offset value by pressing each keys.

DO values are inputted in the same manner.



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



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



5. VIEW AND EDIT

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

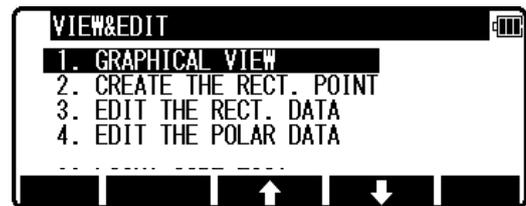
The Z Coordinate (the height) of the point is ignored in the graphical display of the point data.

Four menu items are available:

- GRAPHICAL VIEW
- CREATE THE RECT. POINT
- EDIT THE RECT. DATA
- EDIT THE POLAR DATA

5.1 Graphical View

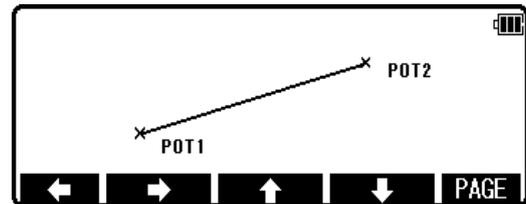
From the PowerTopoLite screen, press [F3][VIEW] to view its screen.



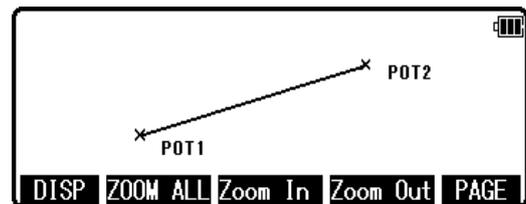
Press [ENT] to view the GRAPHICAL VIEW screen.

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.



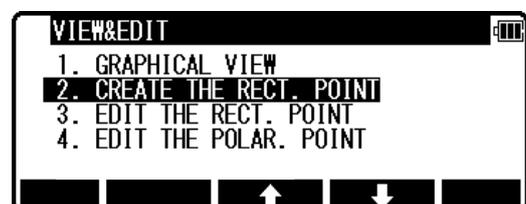
[DISP]: Each Graphic is displayed as following order by pressing this key.
Points → Points + Line → Points + Points names → Full

[ZOOM ALL]: Return to the ordinary Graphics size

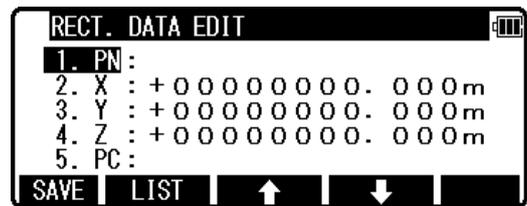
[ZOOM IN]: Enlarge the Graphics size.

[ZOOM OUT]: Reduce the Graphics size.

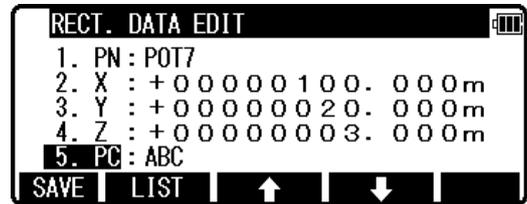
5.2 Create the Rectangular Point



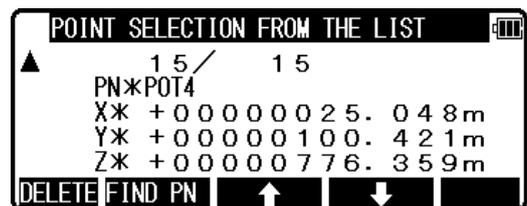
Select 2. CREATE THE RECT. POINT and press [ENT] to view the RECT. DATA EDIT screen.



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

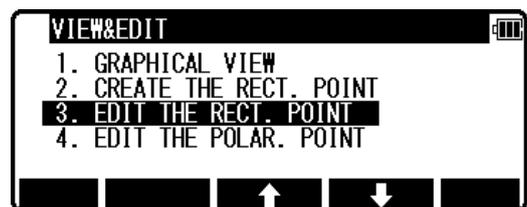


Press [F2][LIST] to view the saved points.

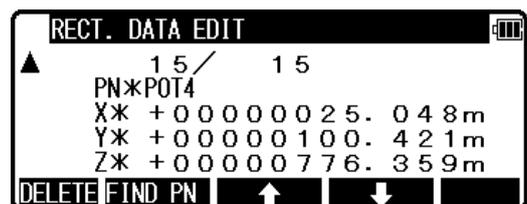


The first line of the screen shows now displayed point and the total number of points.
Press [F1][DELETE] to delete your desired point.
Press [F2][FIND PN] to find your desired point by the PN input.

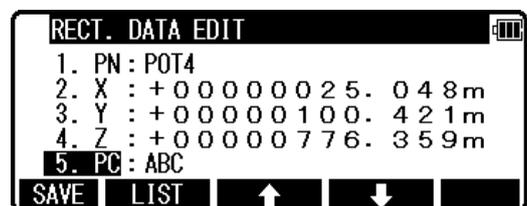
5.3 Edit the Data



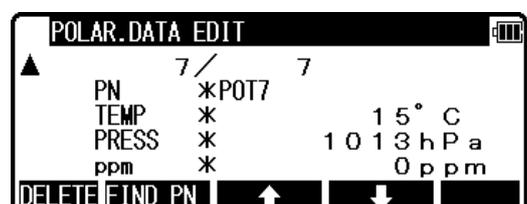
[RECT. DATA]
Select "3. EDIT THE RECT. DATA" and press [ENT] to view the RECT. DATA EDIT screen.



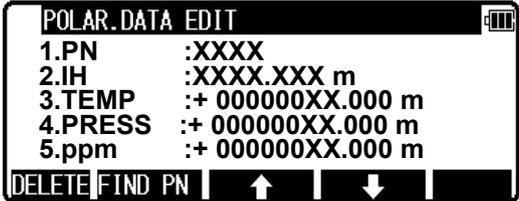
Your desired points are deleted and found as described above.
After selecting desired point with arrow key, press [ENT] to view the RECT. DATA EDIT screen to edit.



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



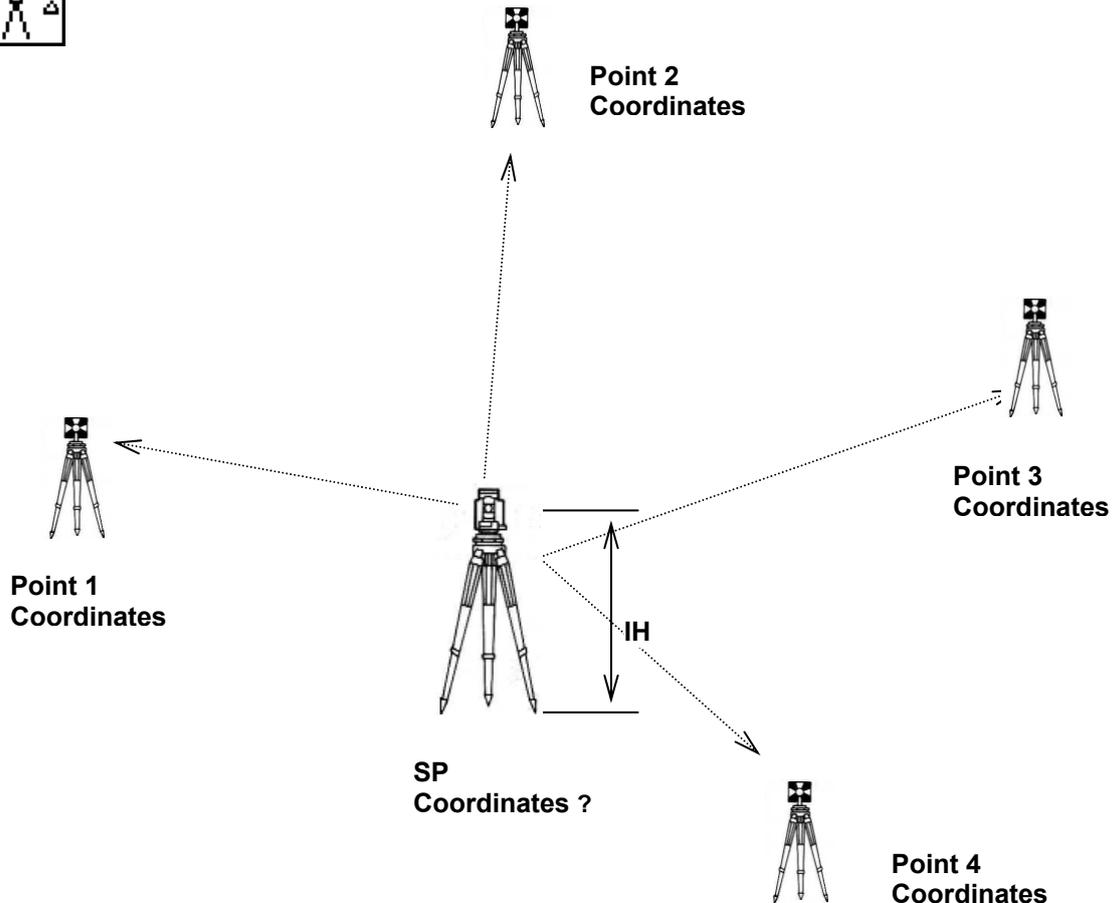
Your desired points are deleted and found as described above.
After selecting desired point with arrow key, press [ENT] to view the RECT. DATA EDIT screen to edit.



You can edit data and save it.



6. FREE STATIONING

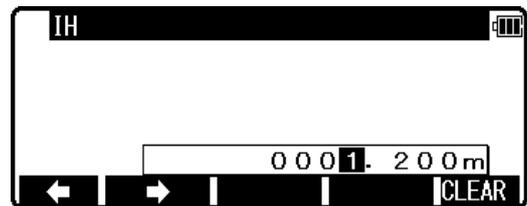


The Station point Coordinates is calculated from the plural known points. To gain the Coordinates, at least two H. angles and one distance or three H. angles are required. If not so, the error message of “Not enough data to Calculate! 2 angles and 1 distance, 3 angles are required” appears. First, input the height of the IH, Instrument height.

6.1 Stationing by more than 3 known points

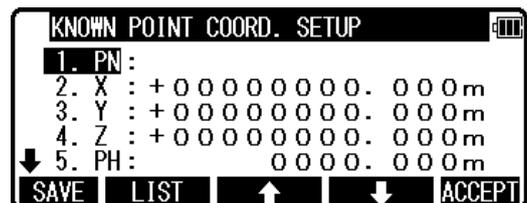
4 known points stationing (For example)

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

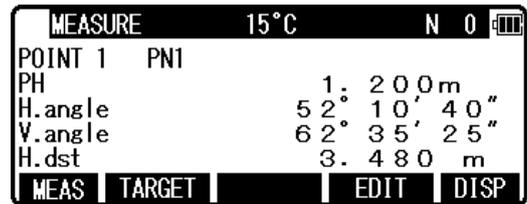


Aim at Point 1.

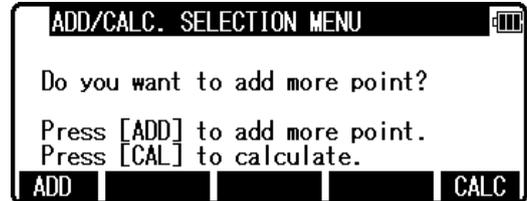
Press [ENT] to view the KNOWN POINT COORD. SETUP screen.



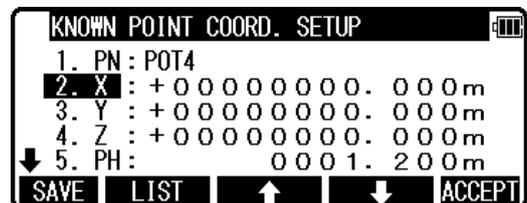
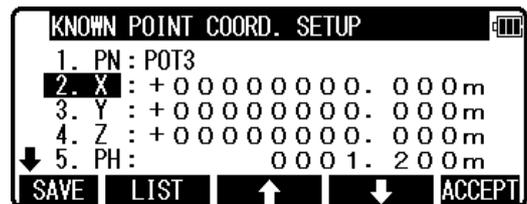
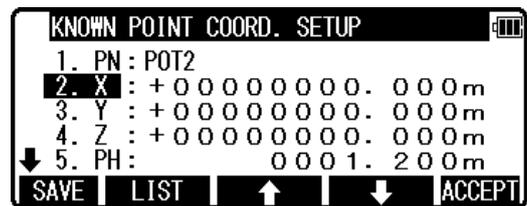
Press [ENT] to open the PN, X, Y, Z, IH and PC input window and input each.
Then, press [ENT] and [ACCEPT] to view the MEASURE screen.



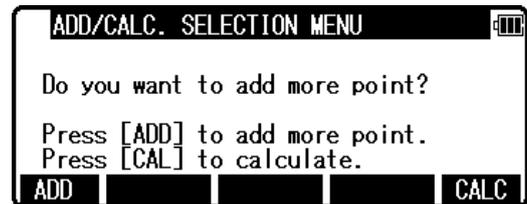
Press [ENT] to view the ADD/CALC. SELECTION MENU screen.
(Measuring is not needed. Just press [ENT].)



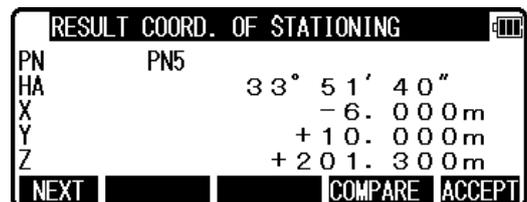
Press the [F1][ADD] to view the KNOWN POINT COORD. SETUP screen.
Aim at Point 2, 3 and 4.
In the same manner, input the values of Point 2,3 and 4.



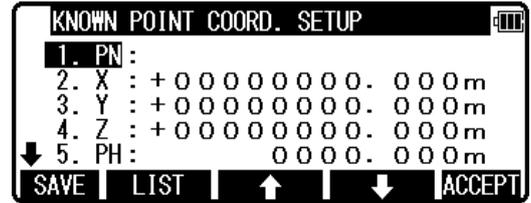
After entering values of PN4, press [ENT] twice to view the MEASURE and ADD/CALC SELECTION MENU.



Press the [F5][CALC] to view the RESULT COORD. OF STATIONING screen.
The Station Coordinates is displayed. Result coordinates of free stationing can be saved for Station setup after pressing [ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station point for measuring.



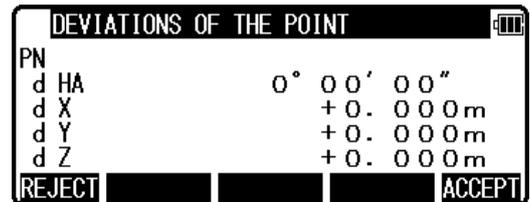
Press [F1][NEXT] to view KNOWN POINT COORD. SETUP screen.



DEVIATIONS OF THE POINT: Four points or more points 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

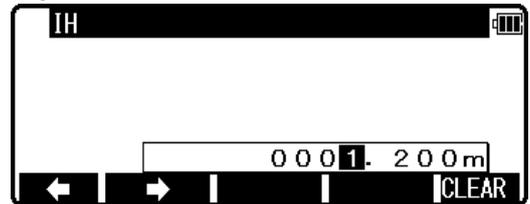


6.2 Stationing by two known points

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

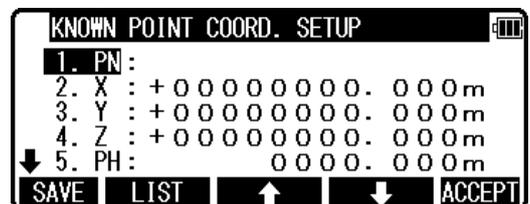
Press [F4][FREE] of the PowerTopoLite screen to view the IH input screen.

Input the IH value.

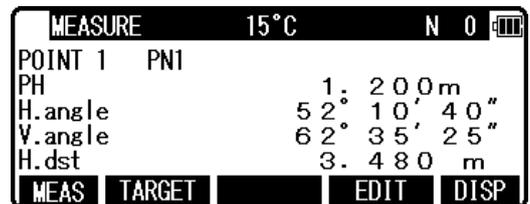


Aim at the Point 1.

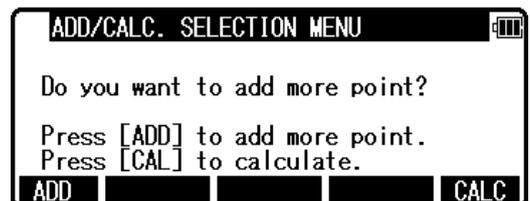
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



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



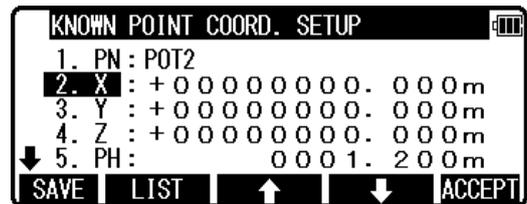
Press [MEAS], and then [ENT] to view the ADD/CALC. SELECTION MENU screen.



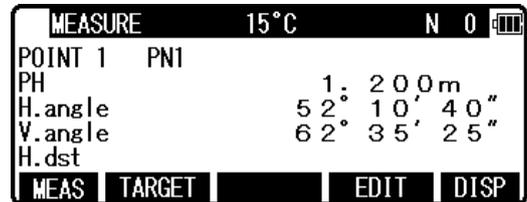
Press [F1][ADD] to view the SET UP THE KNOWN POINT screen.

In the same manner, aim at the Point 2.

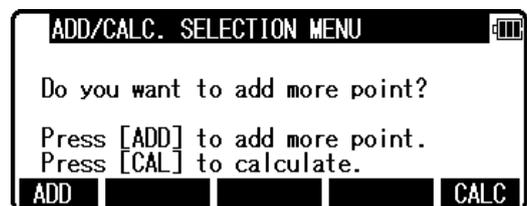
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



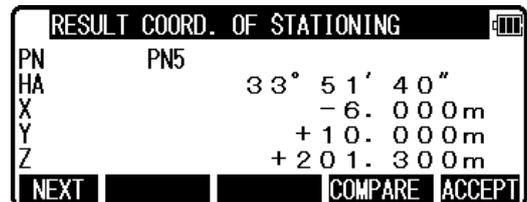
Then, press [ENT] and [ACCEPT] to view the MEASURE screen.



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



Press [CALC] to view the RESULT COORD. OF STATIONING. The Station Coordinates is displayed. Result coordinates of free stationing can be saved for Station setup after pressing [ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station point for measuring.



Note:

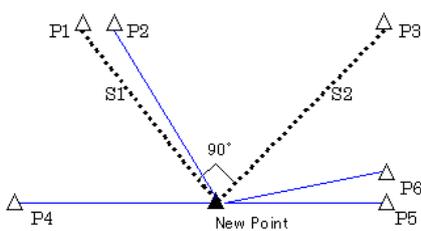


Fig. 1

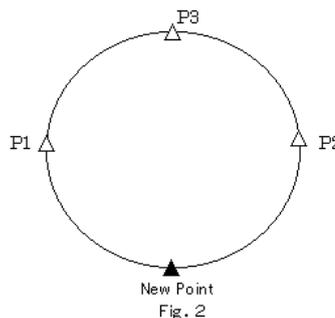


Fig. 2

As illustrated Fig. 1, It is optimal to choose the known points P1 and P3. The angle of two known points should be set up a machine so that it may become 90 degrees. Please install a machine in a position where distance s1 and s2 becomes as same the length as possible.

The accuracy of a calculation result falls as follows,

- 1) When P1 and P2 are chosen for a known point. (The interior angle between known points is extremely small)
- 2) When P4 and P6 are chosen for a known point. (The interior angle between known points is extremely large)
- 3) When P4 and P5 are chosen for a known point. (The interior angle between known points is 180 degrees)
- 4) When the distance from a new point to a known point is extremely short or extremely long.

5) When a new point (station point) and three or more known points are arranged on the same circumference. (Refer to Fig. 2)

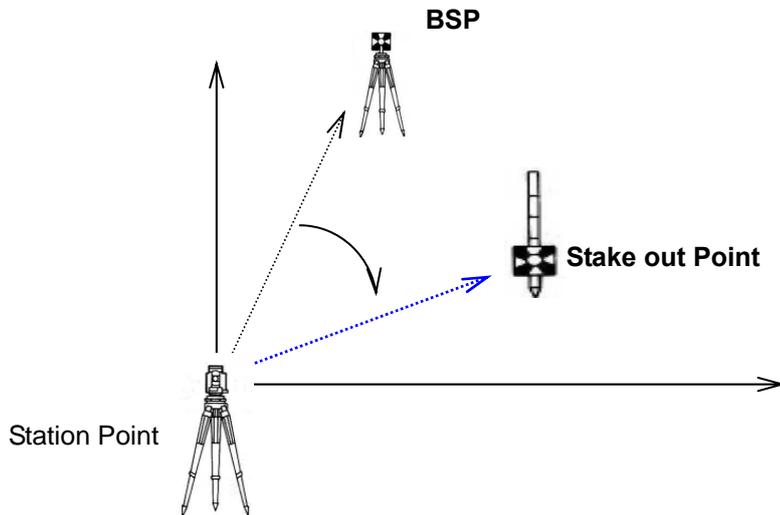
※ When searching for a new point by a FREESTATION and surveying by installing a machine in the point, accuracy may not be stabilized compared with the case where a machine is installed on a known point. In the work which needs a high-precision survey, we cannot recommend you.



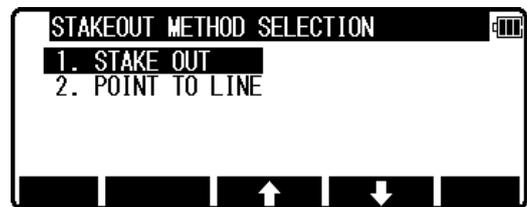
7. STAKE OUT

From the known Station point and Direction angle, the Coordinates for the Stakeout are obtained.

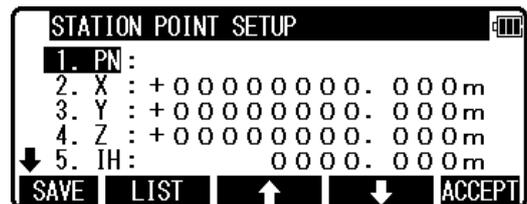
7.1 STAKE OUT



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

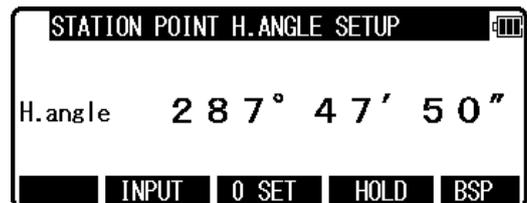


Select 1.STAKE OUT and press [ENT] to view the STATION POINT SETUP screen.



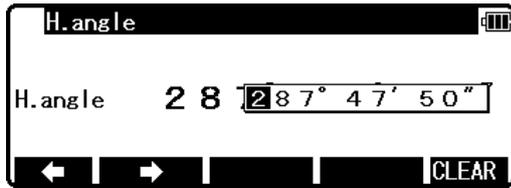
Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1][SAVE].

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

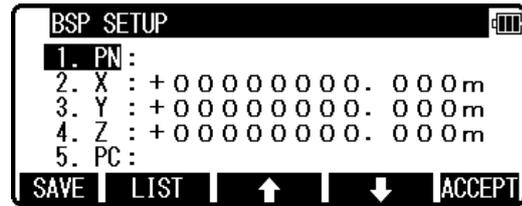


Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F1][BSP].

Pressing [F2][INPUT]

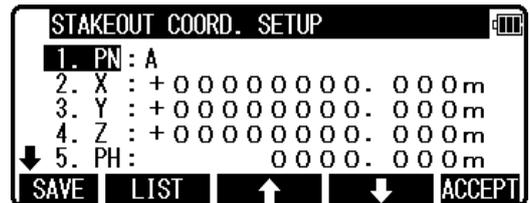


Pressing [F1][BSP]



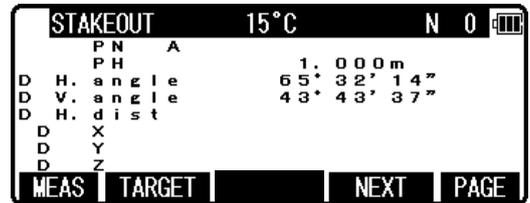
Press [ENT] to view the STAKEOUT COORD. SETUP screen.

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



Save the data by pressing [F1][SAVE].

Press [ENT] or [ACCEPT] to view the STAKEOUT screen.



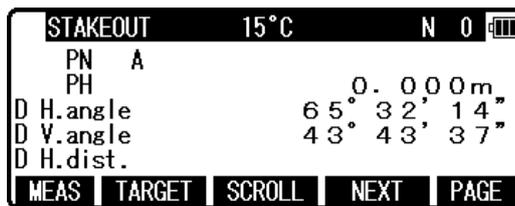
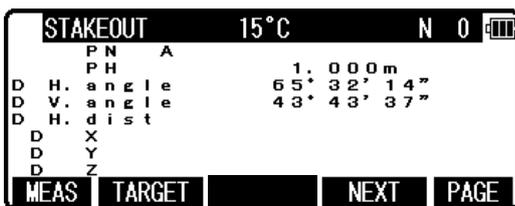
Aim at the Stake out point and press the [F1][MEAS] to begin the Stake Out.

Deviation of each value is displayed.

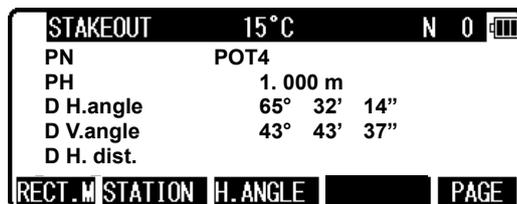
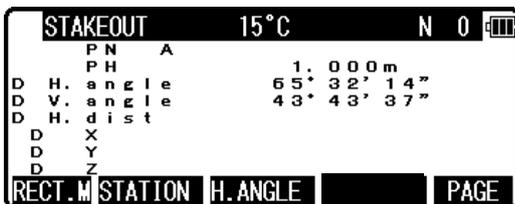
Form of the screen to display deviation of the Stake Out can be changed by the selections of the "Compare method selection" in "PREFERENCE" setting.

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

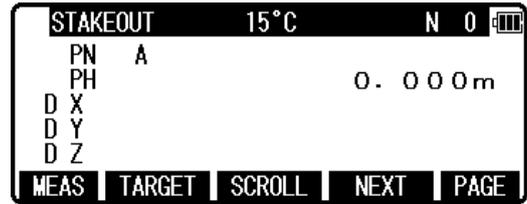
To display information with larger character, select "LARGE CHARACTER".



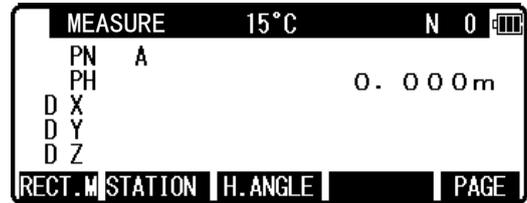
Press [F5][PAGE] to view another screen.



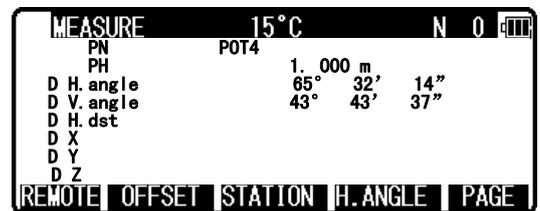
If you select "LARGE CHARACTER", the information is shown with four screens and these screens can be switched by [SCROLL].



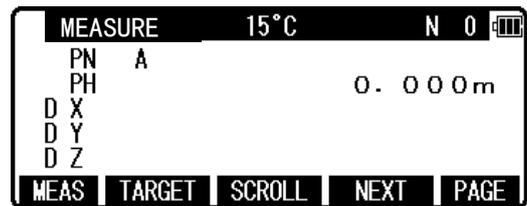
Press the [F4][NEXT] to carry out staking out for the next point.
Press the [F1][RECT.M] to view the MEASURE screen.



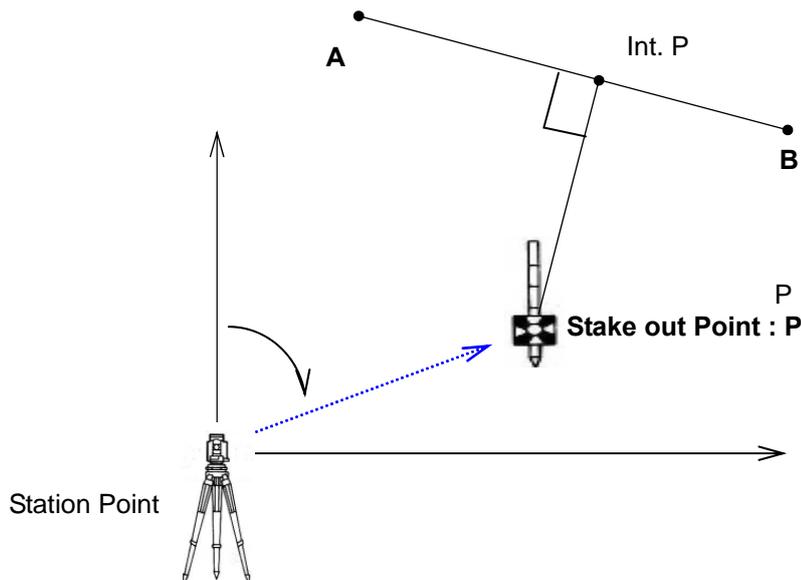
Press the [F5][PAGE] to view the other MEASURE screen.



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

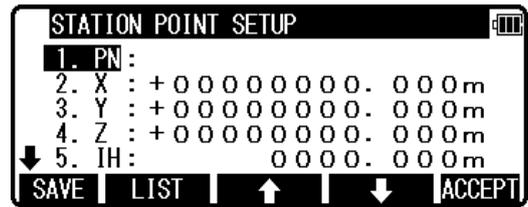


7.2 POINT TO LINE

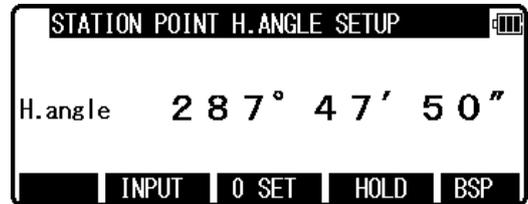


You have to select the point A and B. The distance between the two points A and B has to be at least 1 m. The two points A and B define a line and during Stake out, PTL shows the deviations from the Stake out point, P, to the line A-B. (At above STAKEOUT screen)
Select 2. POINT TO LINE and press [ENT] to view STATION POINT SETUP screen..

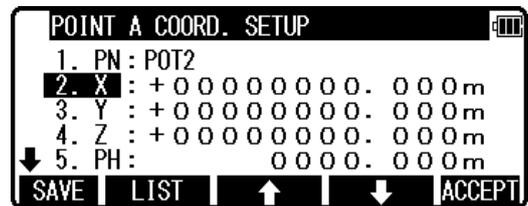
Open the PN, X, Y, Z, IH and PC input window and input each. Press [ENT] to view the STATION POINT H. ANGLE SETUP screen.



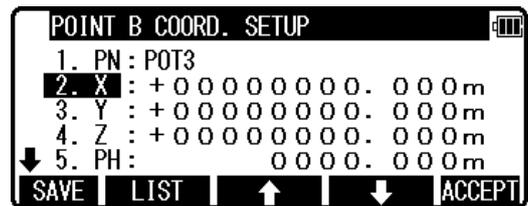
Input the H. angle.



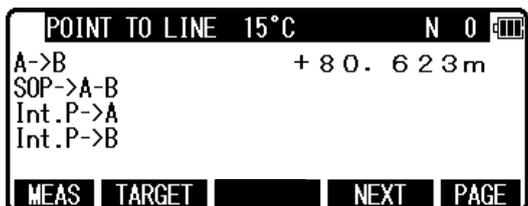
Aim at the reference point and press [ENT] to view POINT A COORD.SETUP screen.



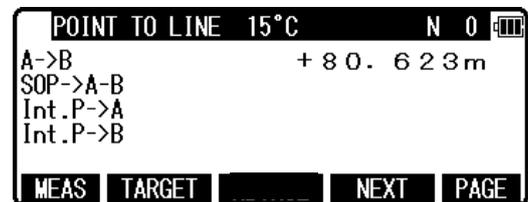
Open the PN, X, Y, Z, PH and PC input window and input each of the Point A and press [ENT].
Open the PN, X, Y, Z, PH and PC input window and input each of the Point B.



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

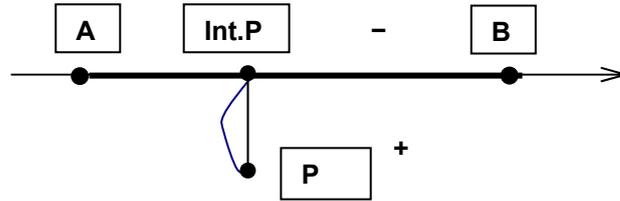


Press [F1][MEAS] to measure.
Each distance is displayed.

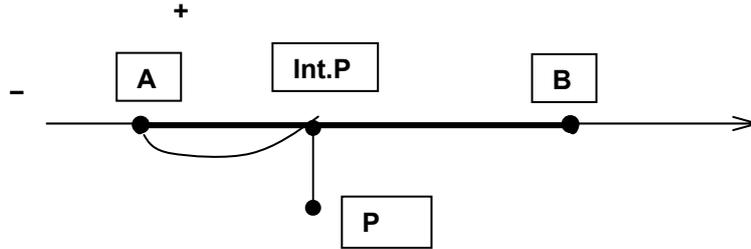


$A \rightarrow B$: Distance between Point A and B. This is always positive.

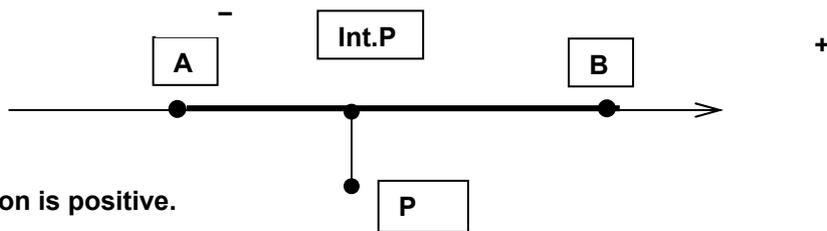
$P \rightarrow A - B$ Distance between Int. P and P, This is positive or negative as shown below.
 Int.P: Intersection point
 P: SOP, Stake Out Point



$Int. P \rightarrow A$ Distance between Int. P and A, This is positive or negative.



$Int. P \rightarrow B$ Distance between Int. P and B, This is positive or negative.



The arrow direction is positive.



8. CALCULATIONS

The following calculations are available:

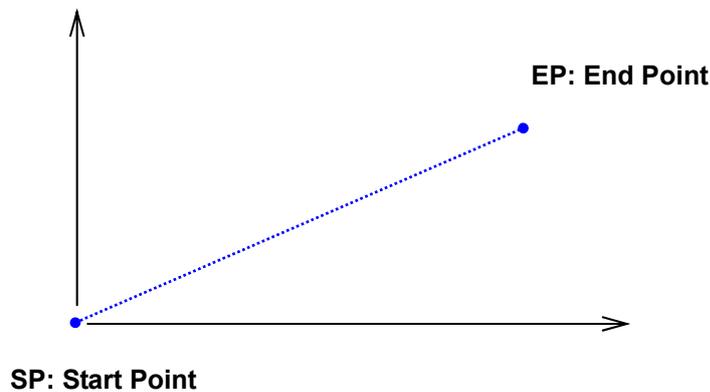
- COGO
- 2D SURFACE
- 3D SURFACE & VOLUME
- REM

8.1 COGO

The following COGO functions are available:

- Inverse
- Points Coordinates
- Circle Radius
- Line-Arc Intersection
- Line-Line Intersection
- Arc-Arc Intersection
- Distance Offset
- Point Distance Offset
- Arc Distance Offset

8.1.1 INVERSE

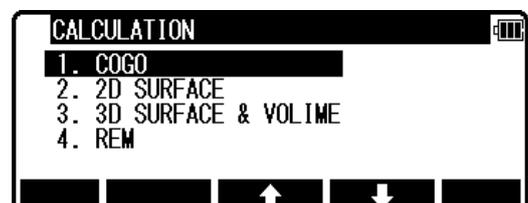


From the given two points Coordinates, the Direction angle and distance are calculated.

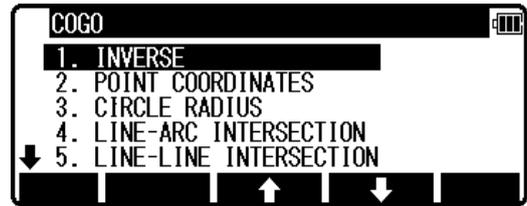
Input: Coordinates of two points

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

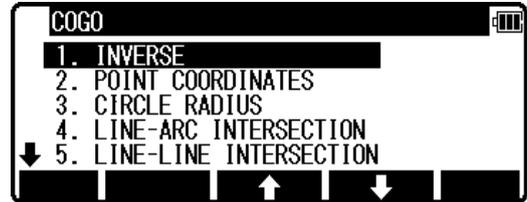
From the PowerTopoLite screen, press [F2][CALC] to view CALCULATION screen.



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

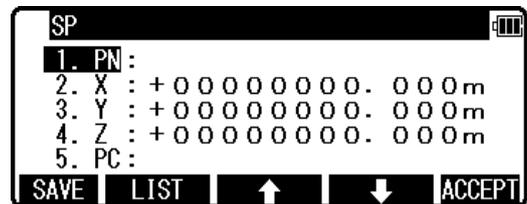


Select the 1. INVERSE and press [ENT] to view INVERSE screen.

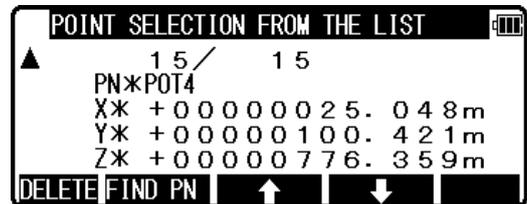


A. Start point input
(Input the PN, Coordinates and PC of the Start point.)

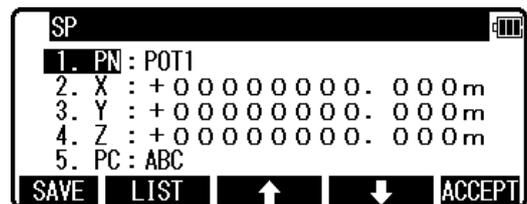
Select 1. SP and press [ENT] to view SP screen.



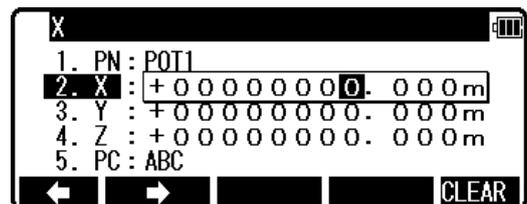
- [LIST] key
All stored points can be displayed as follows by pressing [F2][LIST].
Press [F2][LIST] to view POINT SELECTION FROM THE LIST screen.



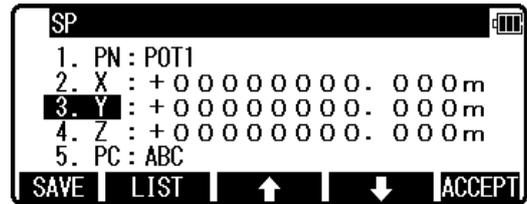
Press [ENT] to open the SP input screen.



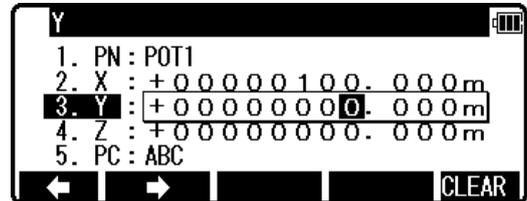
Input your desired point name by pressing each keys, and press [ENT] to view START PT 1 screen.
Press [ENT] to open the X coordinate input screen.



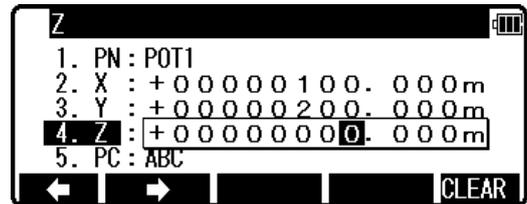
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



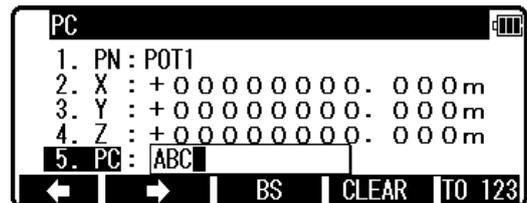
Press [ENT] to open the Y coordinate input screen and input.



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

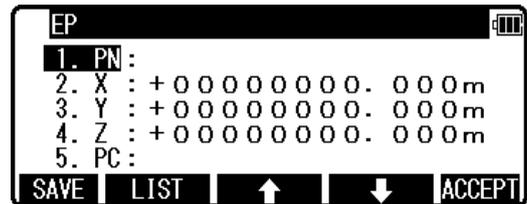


Press [ENT] to open the PC input screen and input.

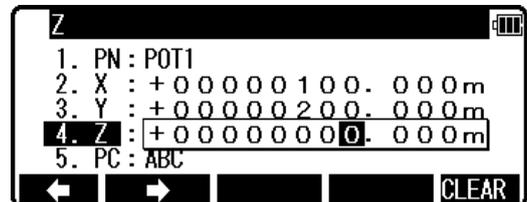


B. End point coordinates input
(Input the PN , Coordinates and PC of the End point.)

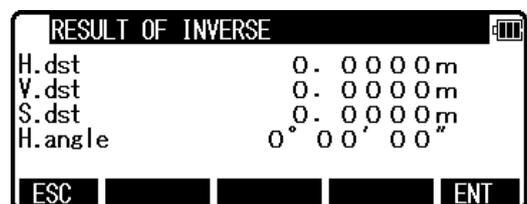
After PC input, EP screen is viewed.



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

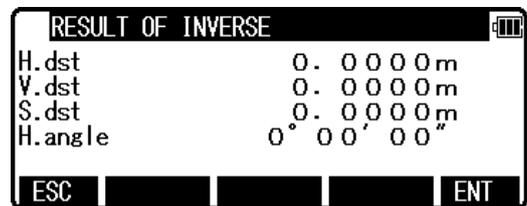
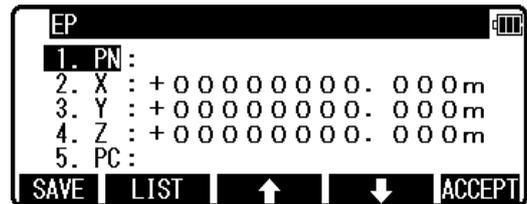
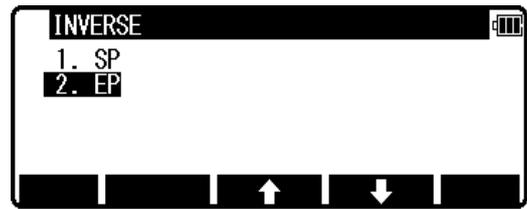


Press [ENT] to view the RESULT OF INVERSE screen.

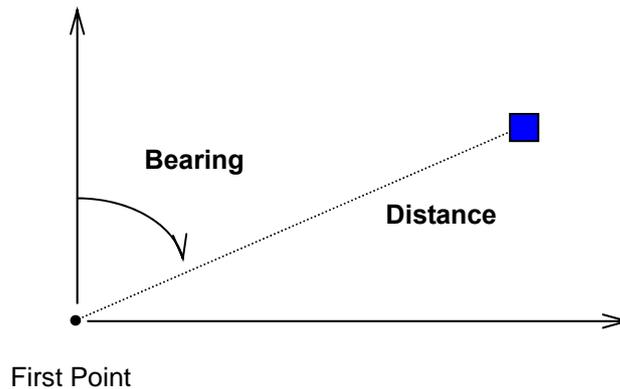


C. Another End point Coordinates input

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



8.1.2 POINTS COORDINATES



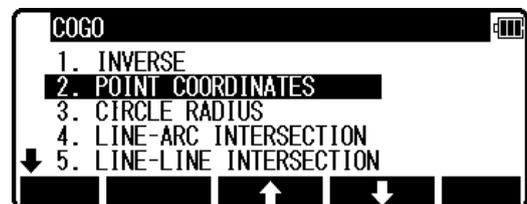
A point Coordinates is calculated from a known point Coordinates and the Distance and Horizontal angle of the second point.

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.

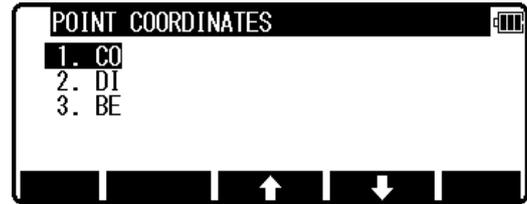


Select 1.COGO and press [ENT] to view the COGO screen.

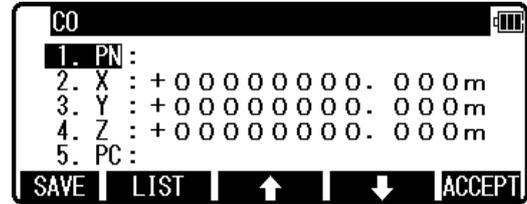


8.1.2.1 Point Coordinates, Distance and H. angle

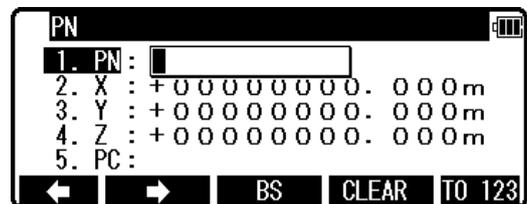
Select the 2. POINT COORDINATES and press [ENT] to view POINT COORINATES screen.



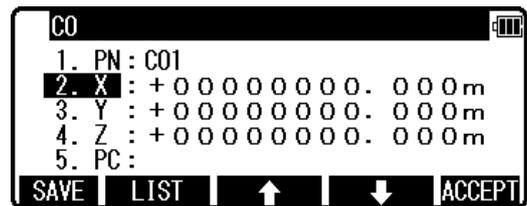
Select 1. CO and press [ENT] to view CO screen.



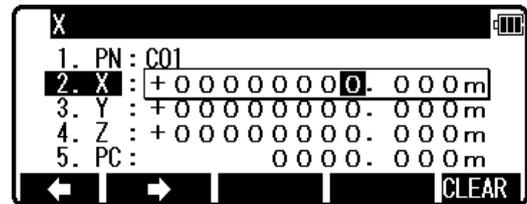
Press [ENT] to open the PN input screen.



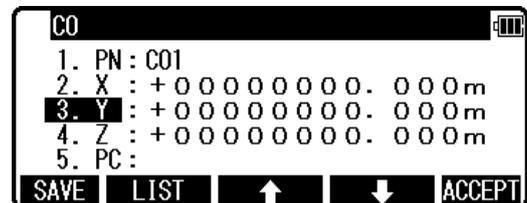
Input your desired point name by pressing keys and press [ENT] to view X screen.



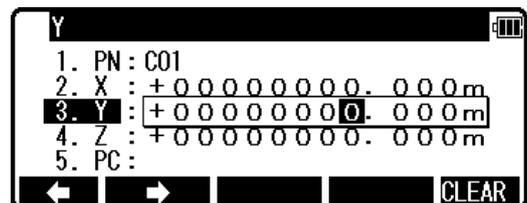
Press [ENT] to open the X coordinate input screen.



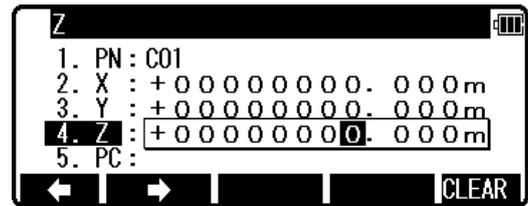
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



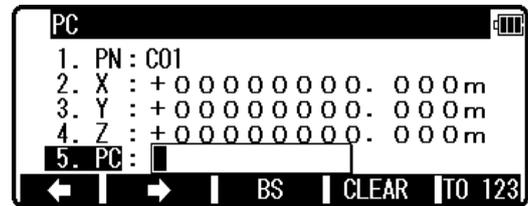
Press [ENT] to open the Y coordinate input screen.



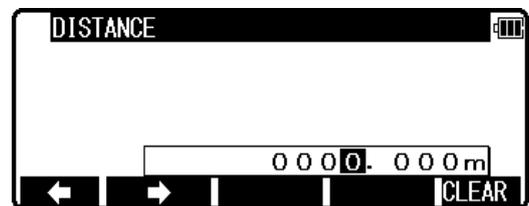
In the same manner, input your desired value by pressing each keys and press [ENT] to open the Z coordinate input screen.



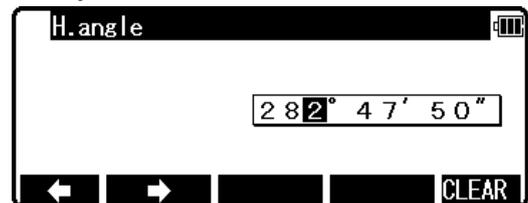
Input your desired value by pressing each keys and press [ENT] to open the PC, Point Code, input screen.



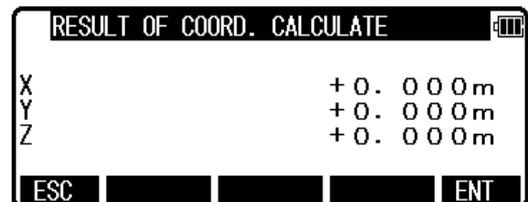
Input your desired PC by pressing each keys, and press [ENT] to view DI screen.



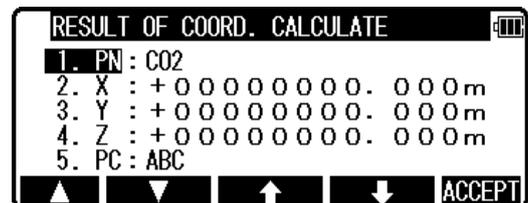
Input your desired value and press [ENT] to open the H. ANGLE input window.



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.



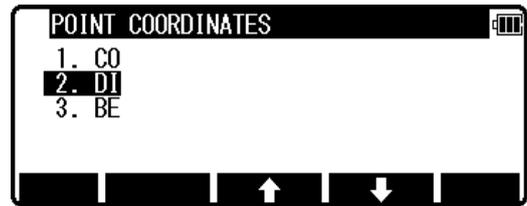
Press [ENT] to view the following screen.



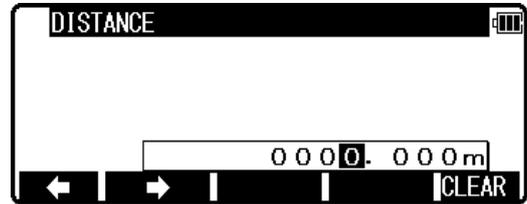
The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

8.1.2.2 Distance and H. angle

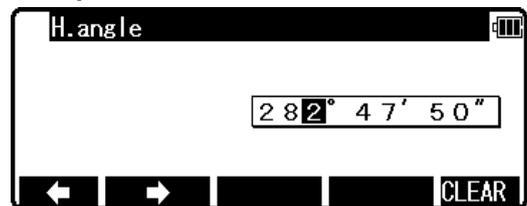
In the same manner, the values of Distance and H. angle are inputted as follows and the second point Coordinates are displayed.



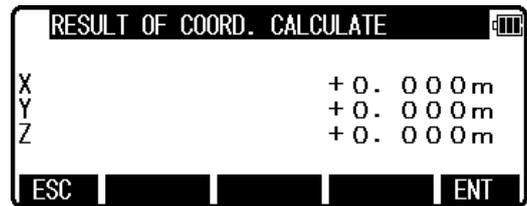
Select 2. DI and press [ENT] to view DI screen.



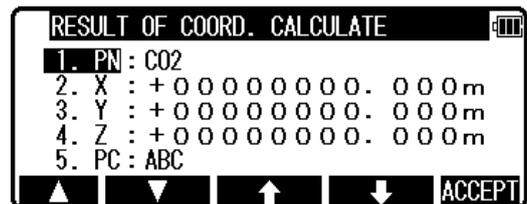
Input your desired value and press [ENT] to open the H. ANGLE input window.



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.



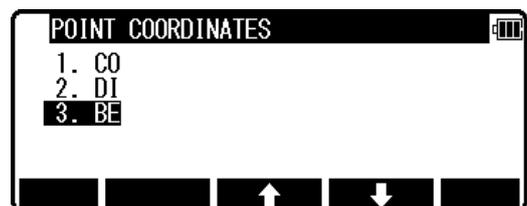
Press [ENT] to view the following screen.



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

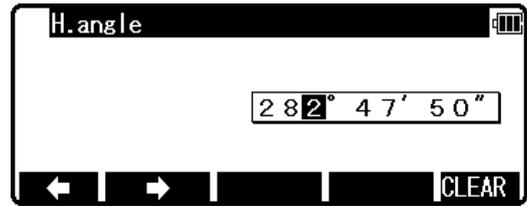
8.1.2.3 H. angle input

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

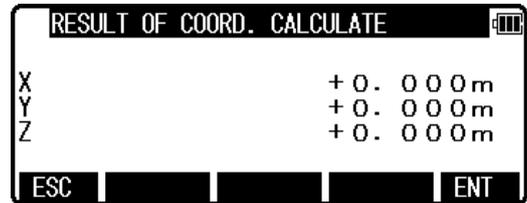


Select 3. BE and press [ENT] to view H. ANGLE screen.

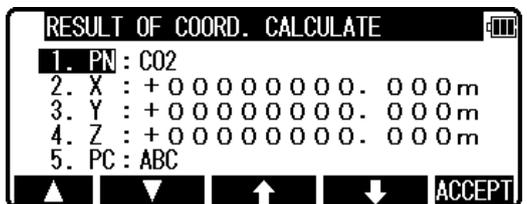
Input H. angle and press [ENT] to view the RESULT OF COORD. CALCULATE screen.



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

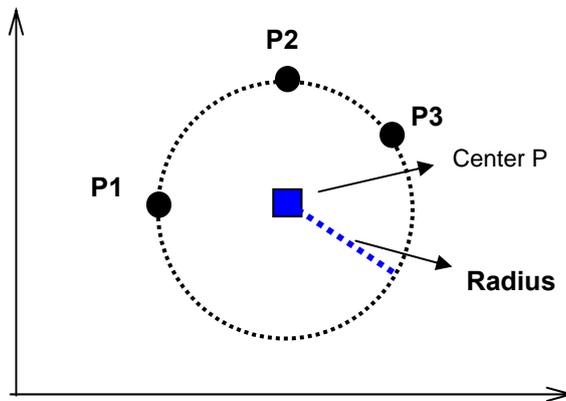


Press [ENT] to view the following screen.



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

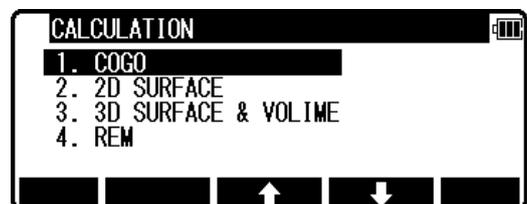


The center point and radius of the circle drawn by three points are calculated by this function. You can store calculated center point.

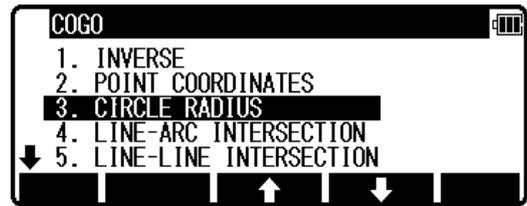
Input: 3 points

Output: Center point of the arc
Radius of the arc

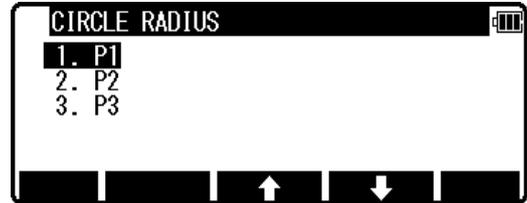
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



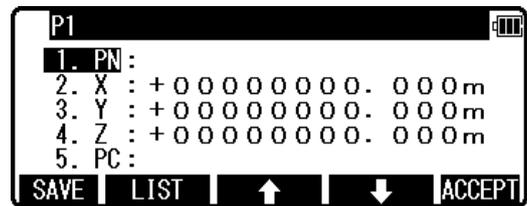
Select 1.COGO and press [ENT] to view the COGO screen.



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

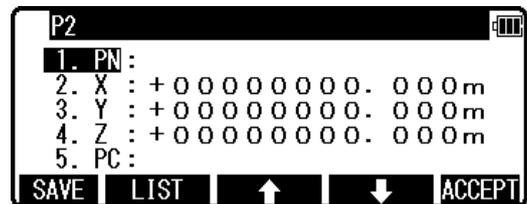


Select 1. P1 and press [ENT] to view P1 screen.

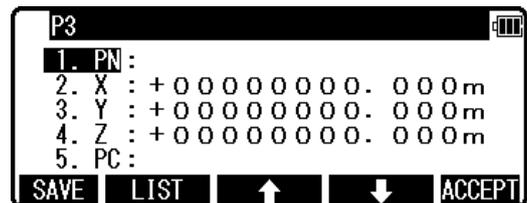


Input PN (Point Name), X, Y, Z, and PC (Point Code) of P1 point or import from the memory of rectangular coordinate as P1 by [F2][LIST].

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

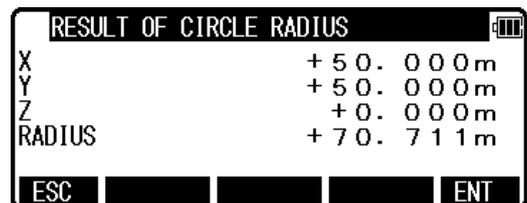


Input P2 data like input of P1. If you finish the input of P2, press [F5][ACCEPT]. Then you go to P3 input screen.

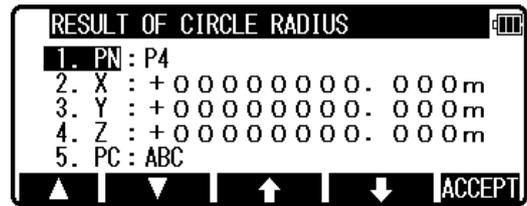


If you finish the input of P3, press [F5][ACCEPT]. Then you go to RESULT OF CIRCLE RADIUS screen.

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

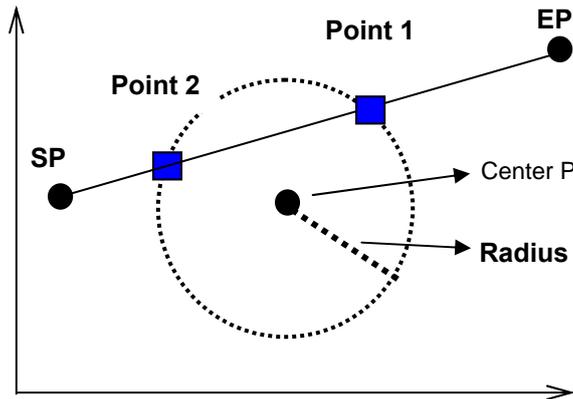


Press [F5][ENT] to save the coordinates of center point.



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

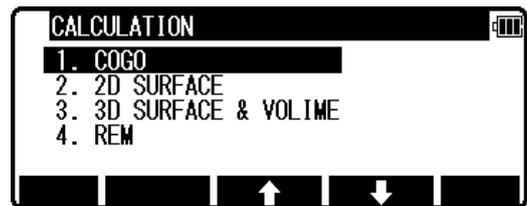


Two intersection points of one line and circle are calculated by this function. The line is drawn by SP and EP. The circle is drawn by center point and radius. You can store two possible intersection points.

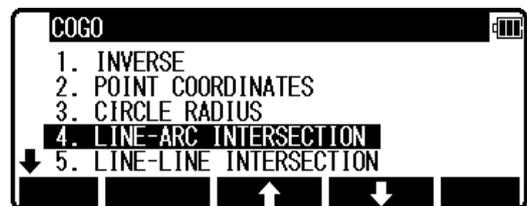
Input: Line: start point and end point
Arc: center point and radius

Output: Two possible intersection points

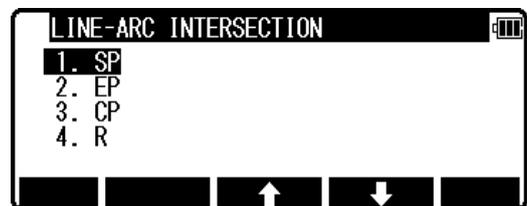
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



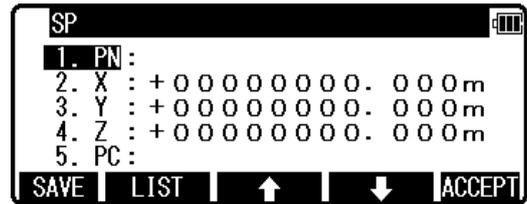
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 3. CIRCLE RADIUS and press [ENT] to view LINE-ARC INTERSECTION screen.

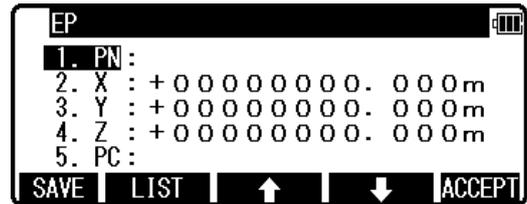


Select 1. SP and press [ENT] to view SP screen.

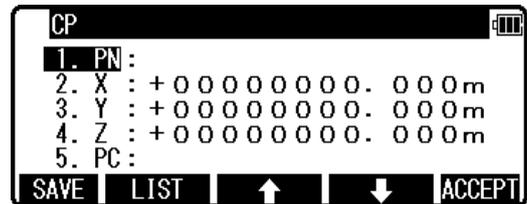


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

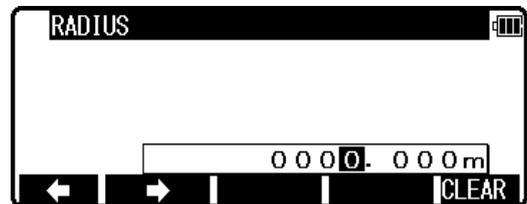
If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.



Input EP value like an input of SP. If you finish an input of P2, press [F5][ACCEPT]. Then you go to CP input screen.

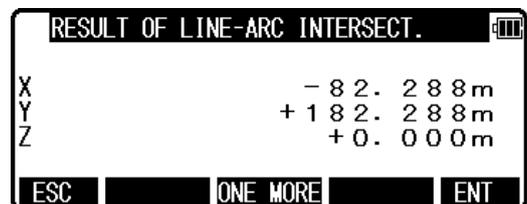


If you finish the input of CP value, press [F5][ACCEPT]. Then you go to RADIUS input screen.

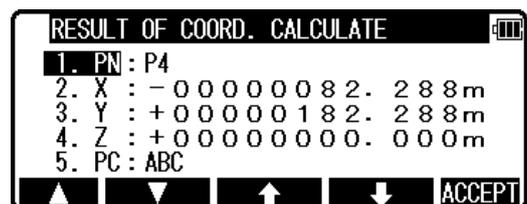


If you finish the input of RADIUS, press [ENT]. Then you go to RESULT OF LINE-ARC INTERSECTION screen.

You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3][ONE MORE].

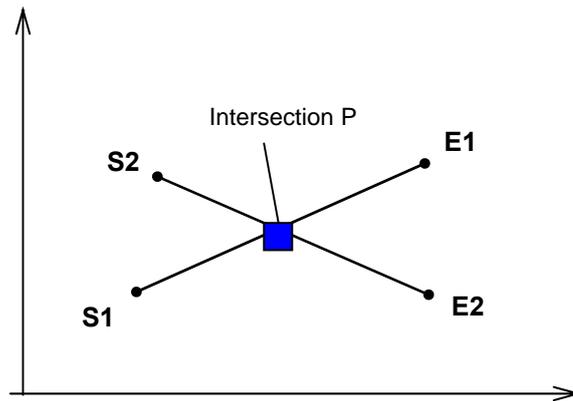


Press [F5][ENT] to save an intersection point.



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

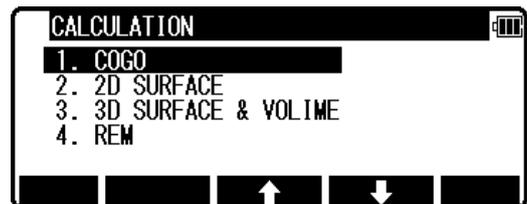


The intersection point of two lines drawn by given two points is calculated by this Function.

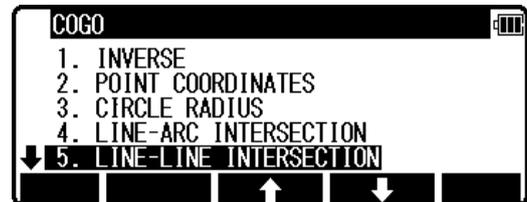
Input: First line : Start point and End point
 Second line: Start point and End point

Output: Intersection point between the two lines

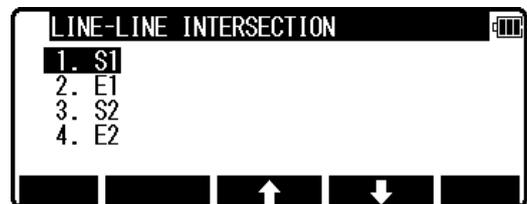
From the PowerTopoLite screen, press the [F2][CALC] to view the CALCULATION screen.



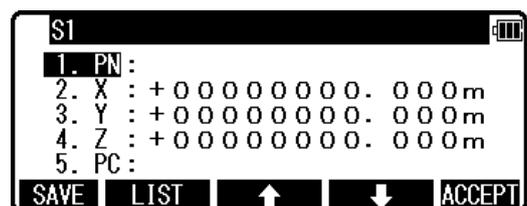
Press 1.COGO to view the COGO screen.



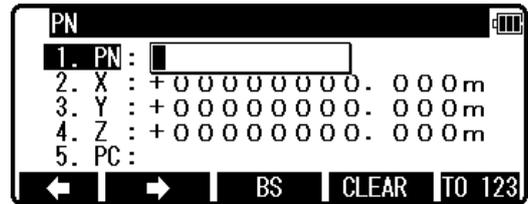
Select 5. LINE-LINE INTERSECTION and press [ENT] to view its screen.



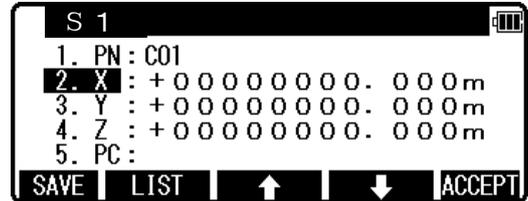
Select 1.S1 and press [ENT] to view its screen.



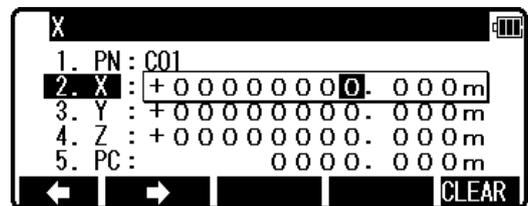
Press [ENT] to open the PN input screen.



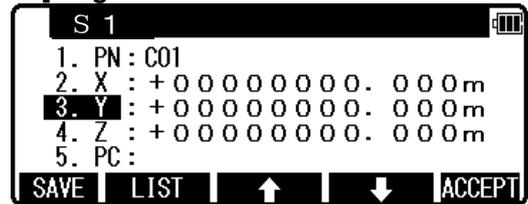
Input your desired point name by pressing each keys, and press [ENT] to view X screen.



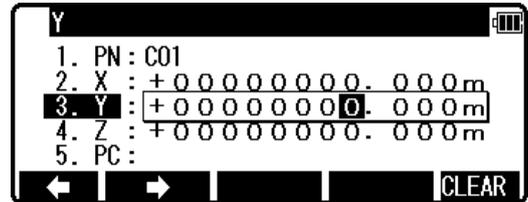
Press [ENT] to open the X coordinate input screen.



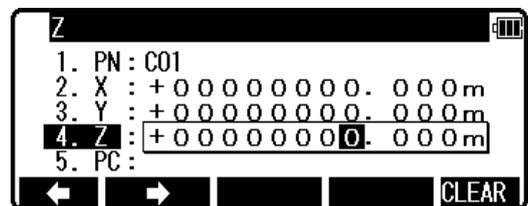
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



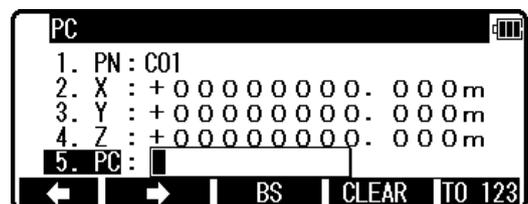
Press [ENT] to open the Y coordinate input screen.



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

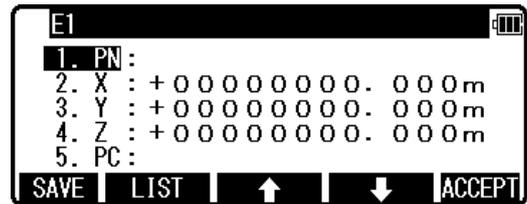


Input your desired value by pressing each keys and press [ENT] to open the PC, Point Code, input screen.

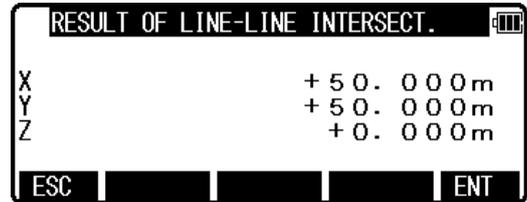


Input your desired PC by pressing each keys, and press [ENT] to view EI screen.

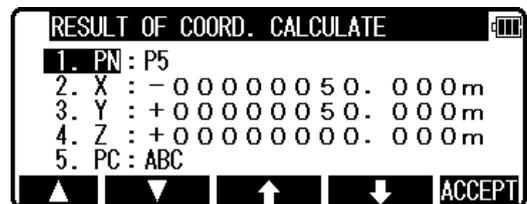
In the same manner, the values of E1, S2 and E2 are all inputted.



The intersection Coordinates are displayed.

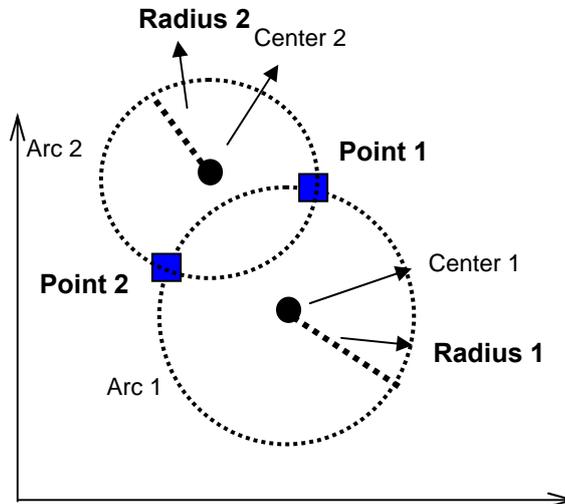


Press [ENT] to view the following screen.



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

8.1.6 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.

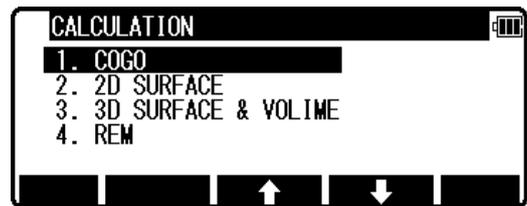
Input: Arc 1: center point and radius
 Arc 2: center point and radius

Output: Two possible intersection points

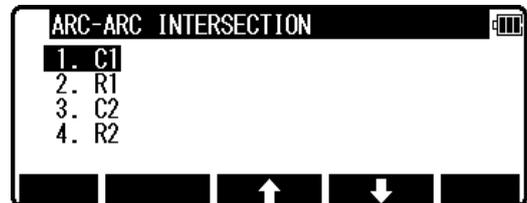
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



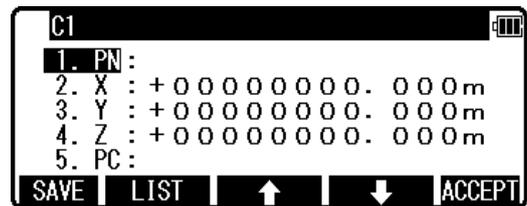
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 6. ARC-ARC INTERSECTION and press [ENT] to view ARC-ARC INTERSECTION screen.

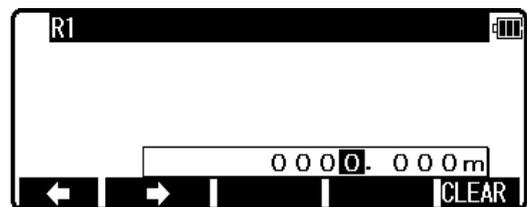


Select 1. C1 and press [ENT] to view C1 screen.

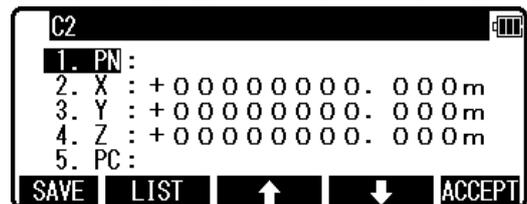


C1 (Center 1) point is center point of Arc 1.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of C1 point or import from the memory of rectangular coordinate as C1 by [F2][LIST].

If you finish the input of C1 value, press [F5][ACCEPT]. Then you go to R1 input screen.

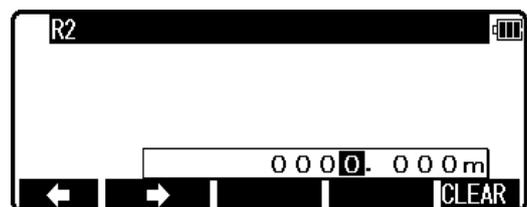


Input the radius of Arc 1 as R1 value. If you finish the input of R1, press [F5][ACCEPT]. Then you go to C2 input screen.

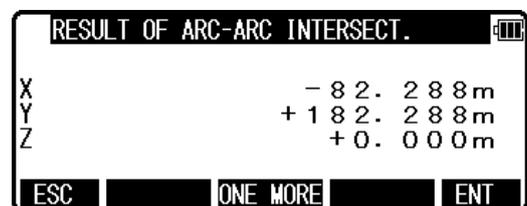


C2 (Center 2) point is center point of Arc 2.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of C2 point or import from the memory of rectangular coordinate as C2 by [F2][LIST].

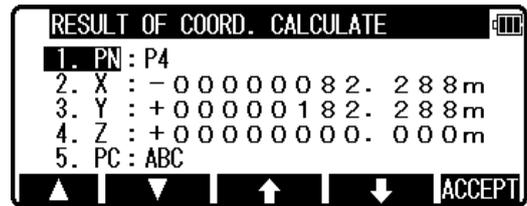
If you finish the input of C2 value, press [F5][ACCEPT].
Then you go to R2 input screen.



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.

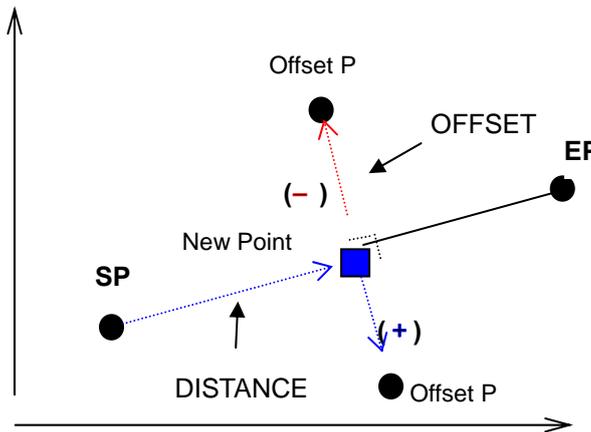


Press [F5][ENT] to save an intersection point.



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

8.1.7 DISTANCE OFFSET

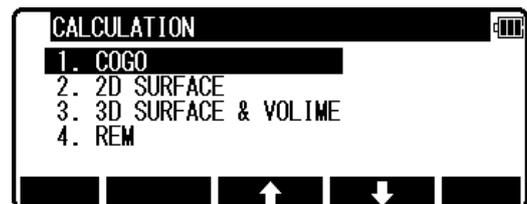


Offset distance of new point to the line and distance of start point to new point are displayed. Also new Point on the line is calculated by point of start, end, and offset. You can store the new point.

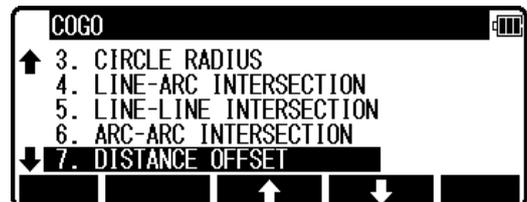
Input: line : start point (SP) and end point (EP)
offset point (OP)

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.



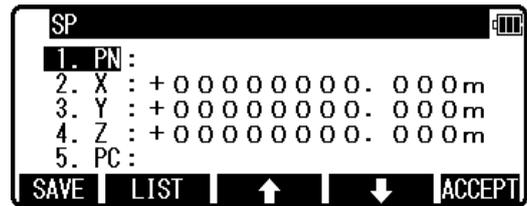
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 7. DISTANCE OFFSET and press [ENT] to view DISTANCE OFFSET screen.

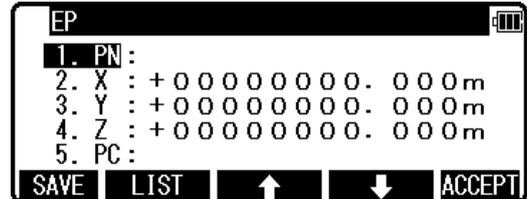


Select 1. SP and press [ENT] to view SP screen.

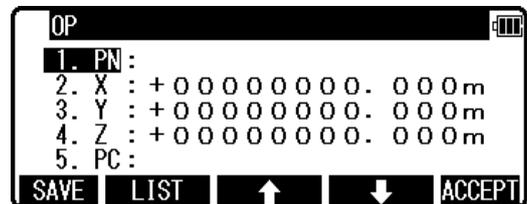


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

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

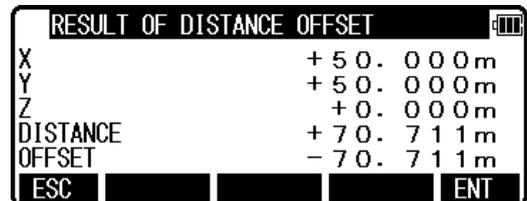


Input EP data like input of SP. If you finish the input of EP, press [F5][ACCEPT]. Then you go to OP input screen.

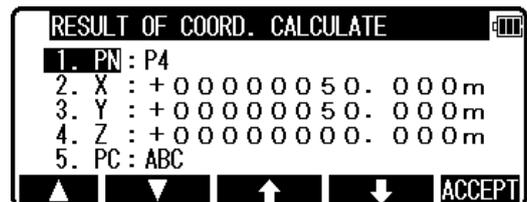


If you finish the input of OP, press [F5][ACCEPT]. Then you go to RESULT OF DISTANCE OFFSET screen.

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.

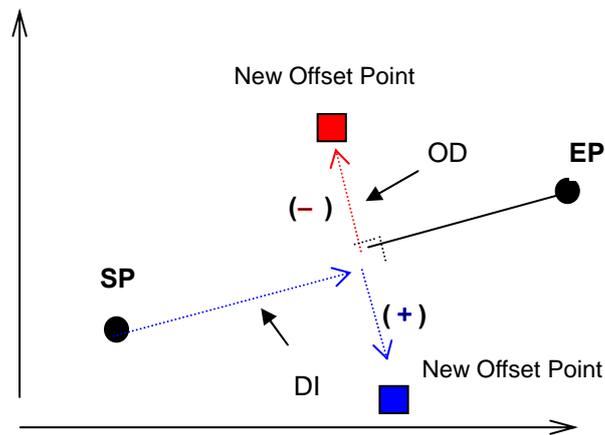


Press [F5][ENT] to save the coordinates of new point.



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

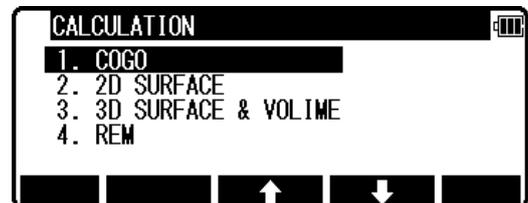


New offset point is calculated by inputting distance from start point and offset from line.

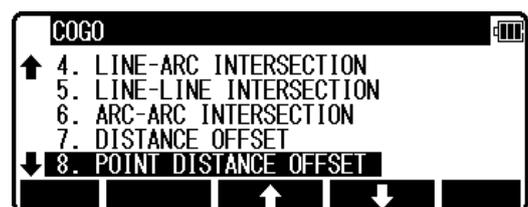
Input: line : start point and end point
distance from start point (DI)
offset from the line (OD) (moving in the direction from start point to end point, right is positive, left is negative)

Output: new point

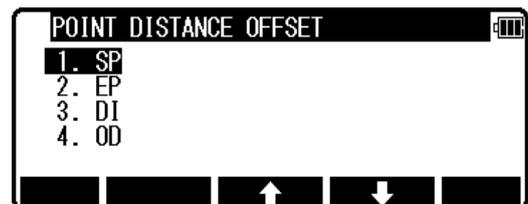
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



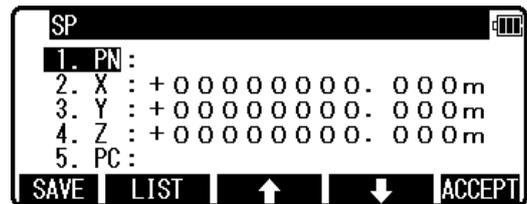
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 8. POINT DISTANCE OFFSET and press [ENT] to view POINT DISTANCE OFFSET screen.

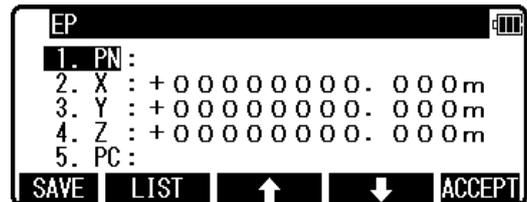


Select 1. SP and press [ENT] to view SP screen.

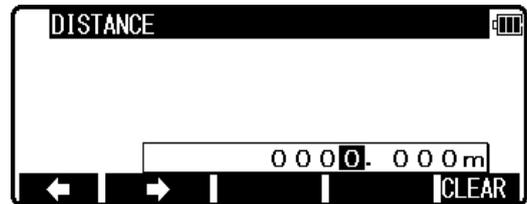


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

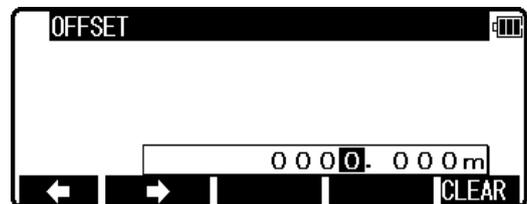
If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.



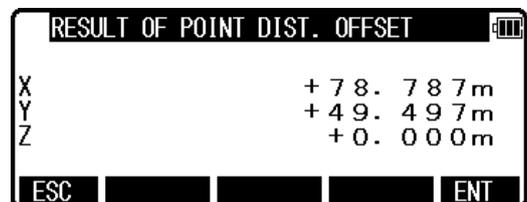
Input EP data like input of SP. If you finish the input of EP, press [F5][ACCEPT]. Then you go to DISTANCE input screen.



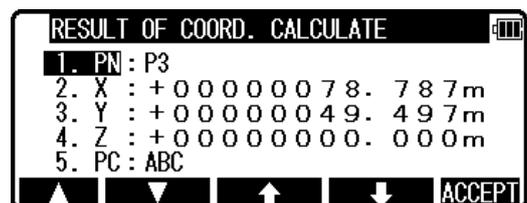
Input DI (Distance from SP to point on the line). If you finish the input of DI, press [F5][ACCEPT]. Then you go to OFFSET input screen.



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 DISTANCE OFFSET screen. You can see the coordinates of offset point from the line.

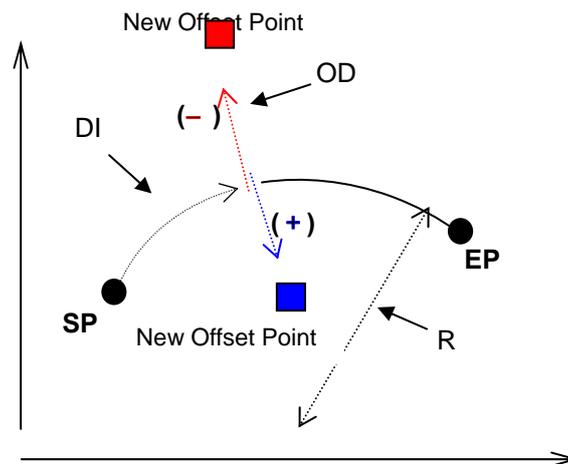


Press [F5][ENT] to save the coordinates of offset point.



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



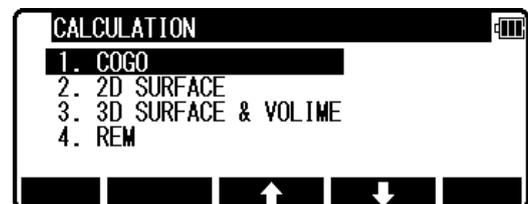
Offset point from the arc is calculated.

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)

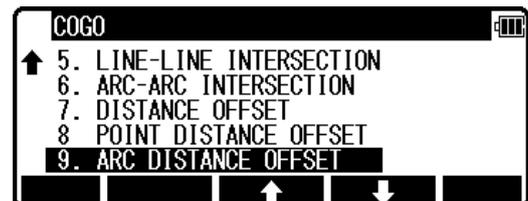
Note: From start point to end point must be **CLOCKWISE**. If you calculate by arc of **COUNTERCLOCKWISE**, change SP for EP and calculate changed DI manually.

Output: new offset point

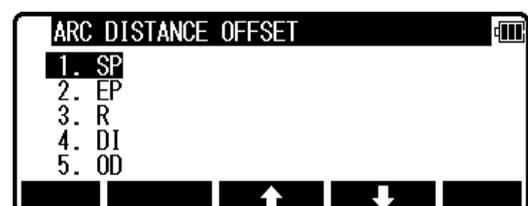
From the PowerTopoLite screen, press [F2][CALC] to view the **CALCULATION** screen.



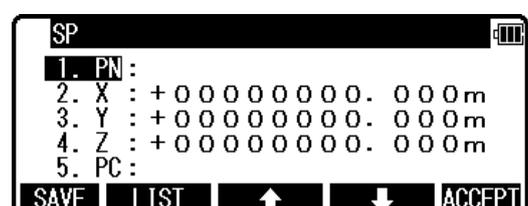
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 9. ARC DISTANCE OFFSET and press [ENT] to view ARC DISTANCE OFFSET screen.

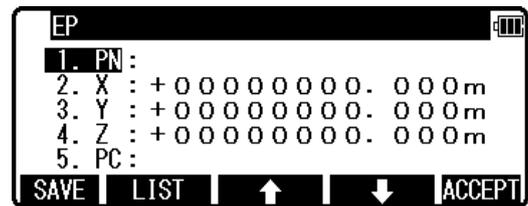


Select 1. SP and press [ENT] to view SP screen.

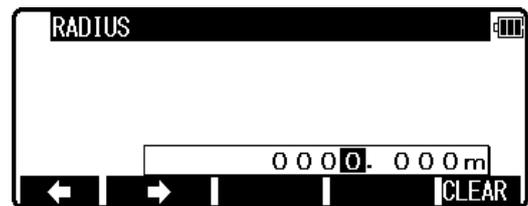


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

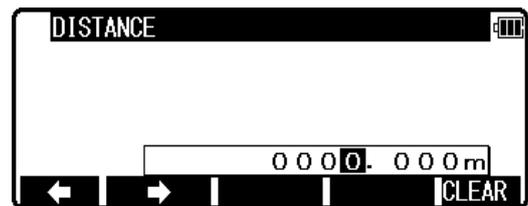
If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.



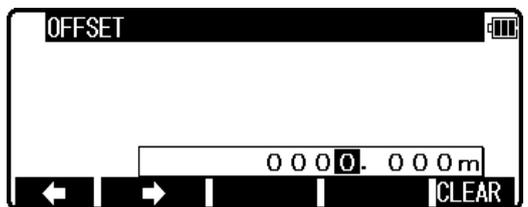
Input EP data like an input of SP. If you finish input of EP, press [F5][ACCEPT]. Then you go to RADIUS input screen.



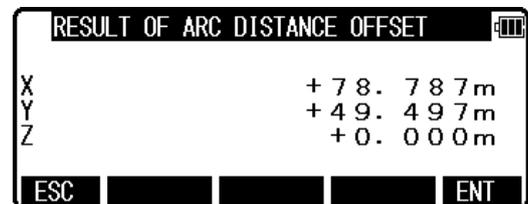
Input RADIUS (Radius of circle). If you finish the input of RADIUS, press [ENT]. Then you go to DISTANCE input screen.



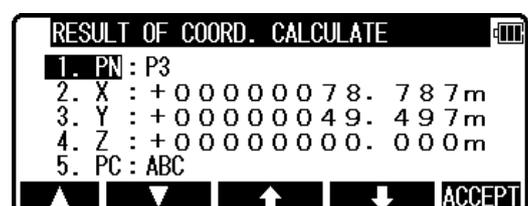
Input DI STANCE (Distance from SP to point on the arc). If you finish the input of DISTANCE, press [ENT]. Then you go to OFFSET input screen.



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.

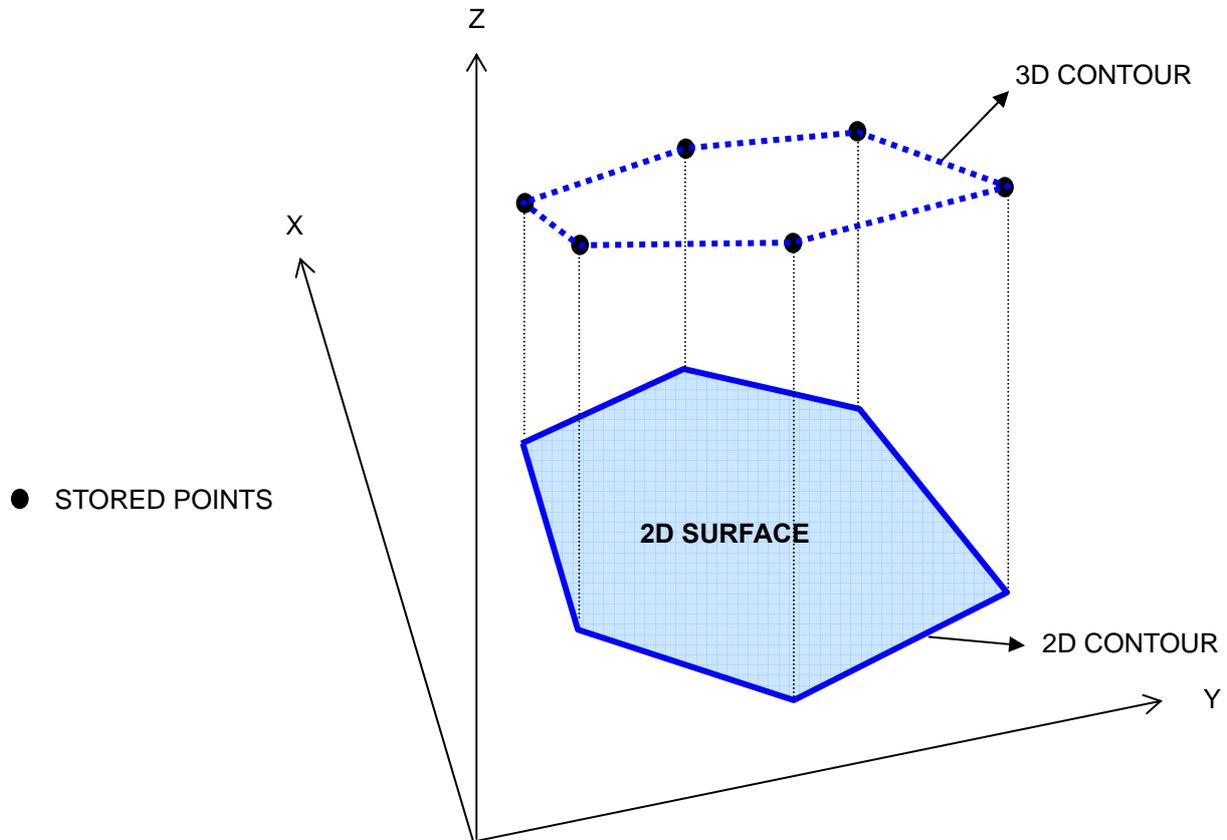


Press [F5][ENT] to save the coordinates of offset point.



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



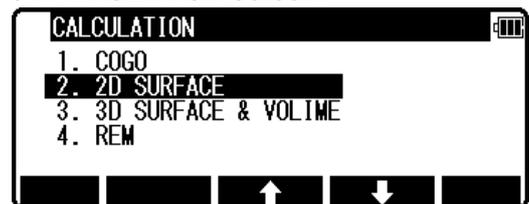
This function calculates the 2D and 3D contour of a polygon and the 2D surface of the area defined by the polygon.
 You define the polygon by selecting points and PowerTopoLite then calculates contour and 2D surface.

Note: The polygon is defined by the point you select. Therefore, the order in which you enter the point 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.

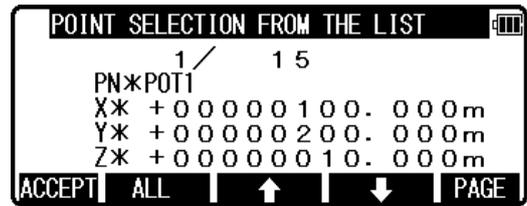
Note: You have to select points in such a way that the line segments that define the polygon do not intersect.

Note: Selected points should be less than 1500 points.

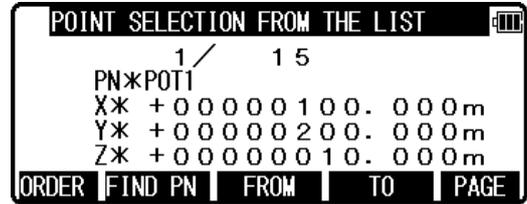
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



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.

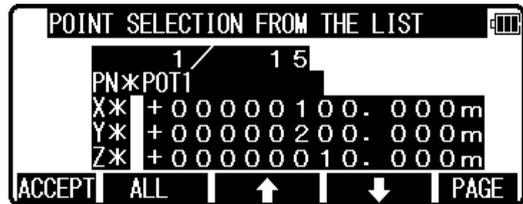


You select points, which defines the polygon in order at this screen.

How to select points of polygon

[ENT] key

Move to selection point by [F3] and [F4] arrow keys and press [ENT] to select it one by one and each indication is reversed as follows. Reverse display shows that it was selected. If you cancel the selection of the point, press [ENT] again. And you can cancel the selection point one by one after pressing [ALL].



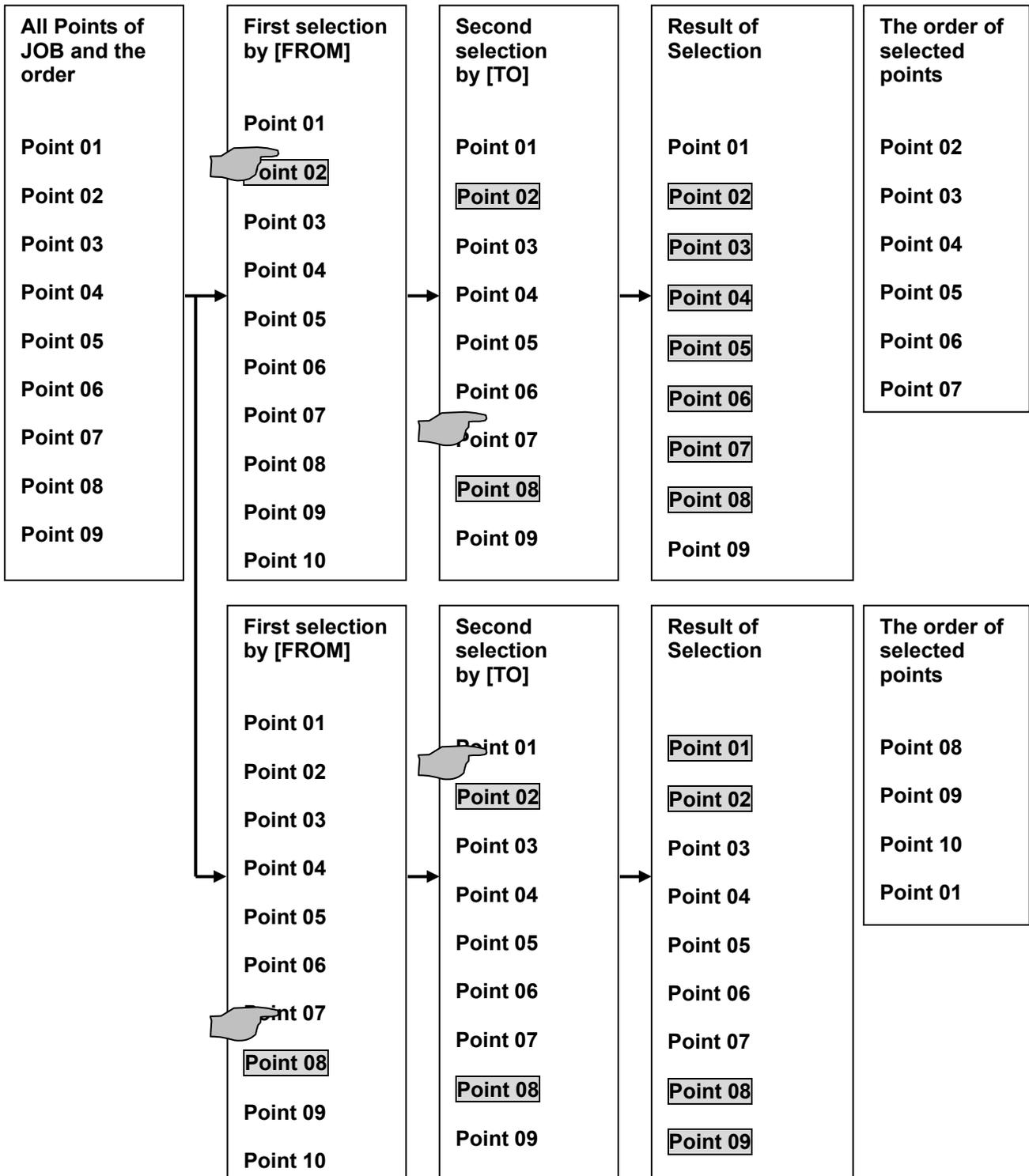
[F2][ALL] key

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 are canceled. You can cancel the selection point by [ENT] one by one after pressing [ALL].

If you press [F2][ALL] after you already selected some points, the selection of each points are 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

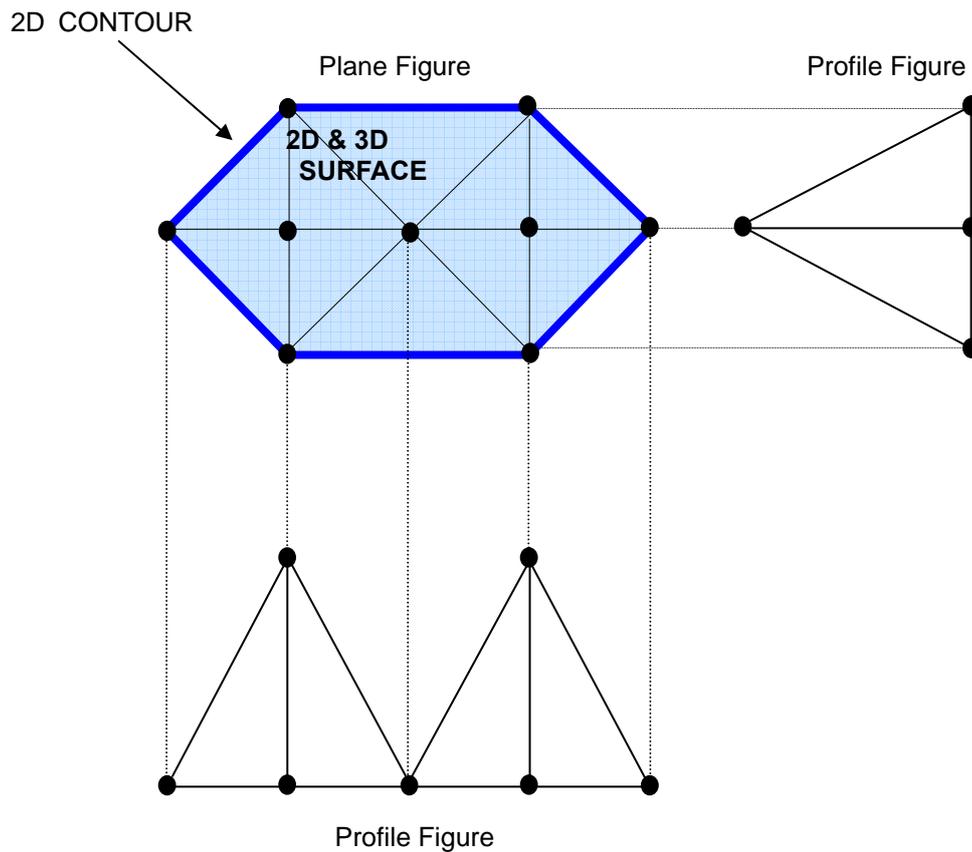
Press [F1][ORDER] to confirm order of selected points after you finished the selection.

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 2D SURFACE chapter about selection way. PowerTopLite generates a mesh (triangulation) of the points automatically and calculates the result based on the mesh.

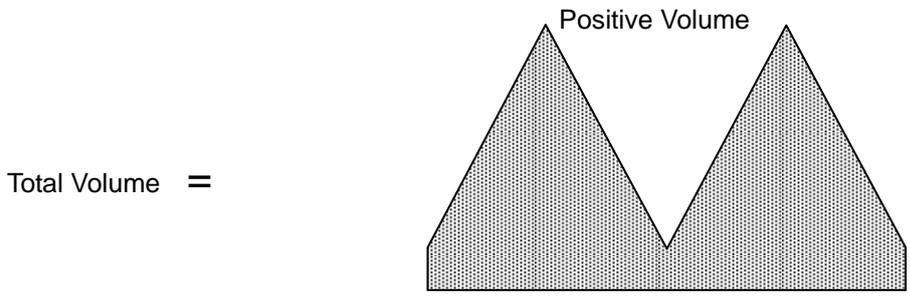
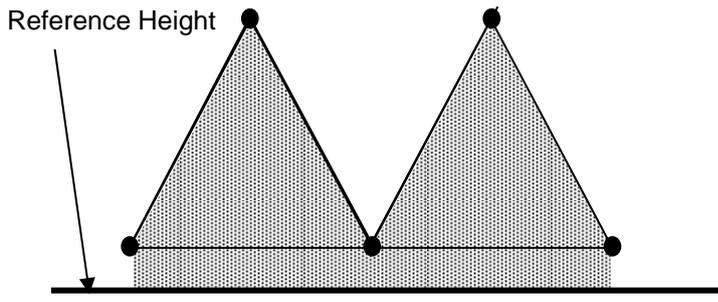
The contour of the points will always be convex. A polygon is generated so that an area may become the biggest. It is like a rope, which is laid around the points, and then tighten.

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.

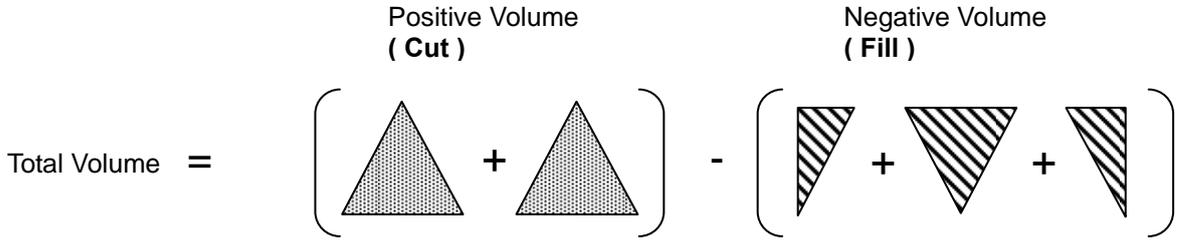
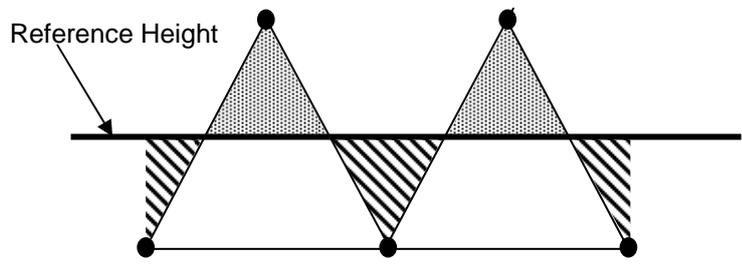
Note: Relations between each volume and reference height are as follows.

Note: Selected points should be less than 350 points.

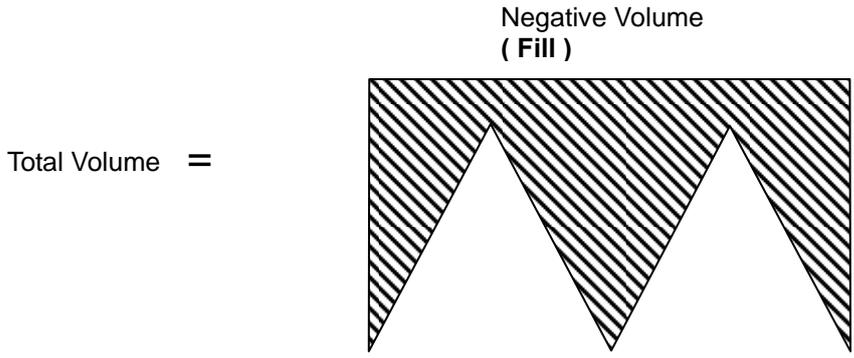
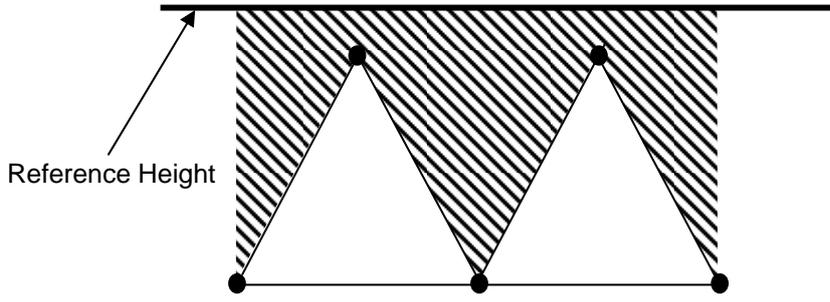
In 3D Volume, the case that inputted reference height is lower than a solid



In 3D Volume, the case that inputted reference height is between a solid



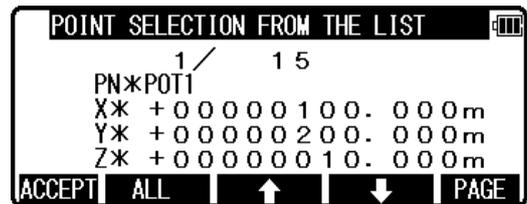
In 3D Volume, the case that inputted reference height is higher than a solid



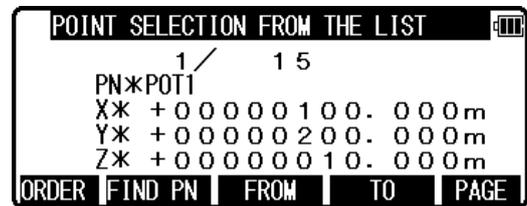
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



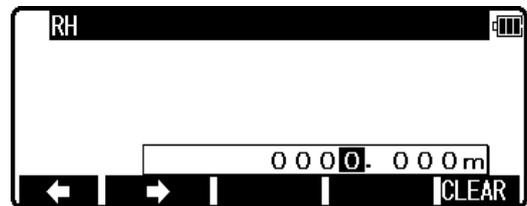
Select 3. 3D SURFACE & VOLUME and press [ENT] to view POINT SELECTION FROM THE LIST screen.



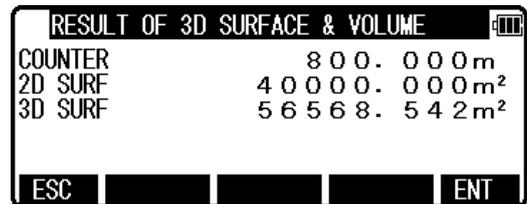
If you press [F5][PAGE], you can see another screen.



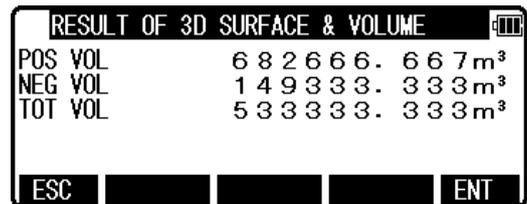
You select points, which composes the polygon in order at this screen. If you finish point selection of a polygon, press [F1][ACCEPT] to go to RH screen. (RH stand for the Reference Height.)



Input reference height. If you finish it, press [ENT] to calculate. The result of calculates is displayed as follows.



Press [ENT] to go to next screen as follows.



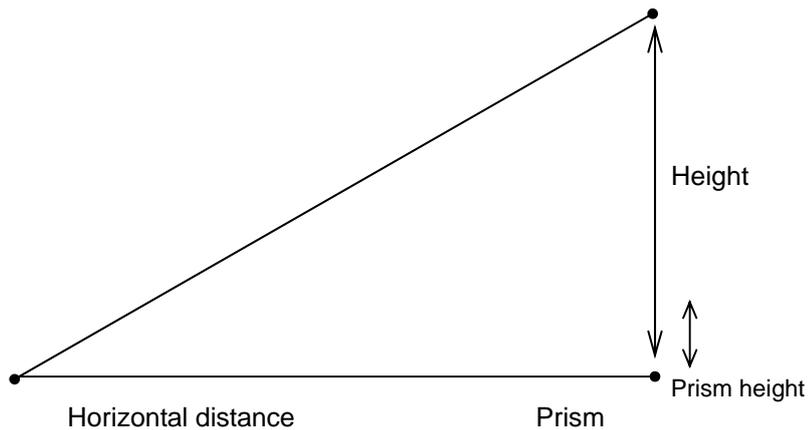
Press [ESC] to return to POINT SELECTION FROM THE LIST screen. You change a selection, and you can calculate it again.

8.4 REM

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.

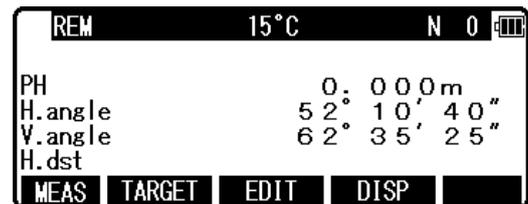
General pictures



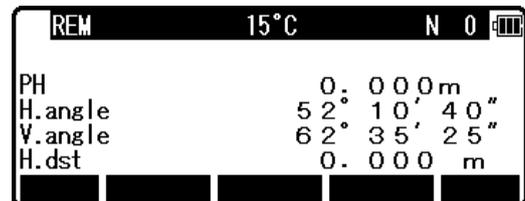
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



Select 4.REM and press [ENT] to view MEASURE screen.



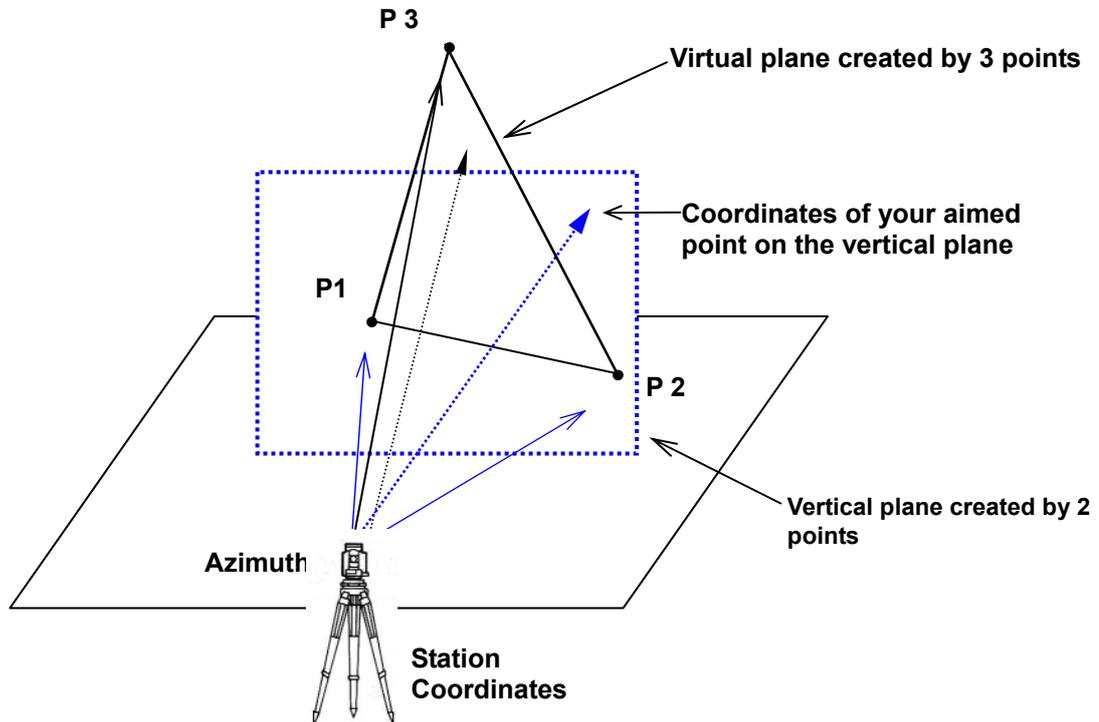
Please press [ENT] after measuring distance.





9 VPM

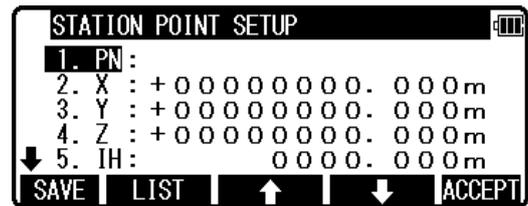
Virtual Plane Measurement



The Virtual plane includes the Vertical plane.

With VPM measurement, 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.

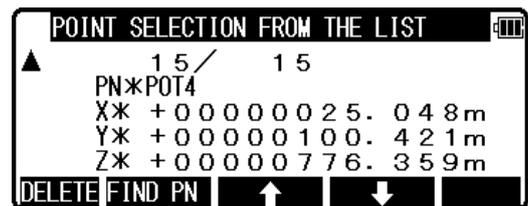
Press the [F3][VPM] of the PowerTopoLite screen to view the STATION POINT SETUP screen of the VPM function.



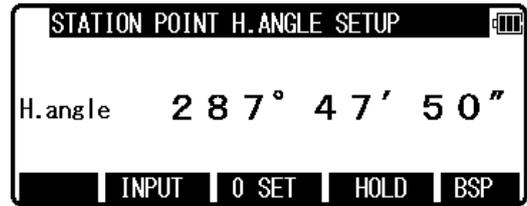
- [LIST] key

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.



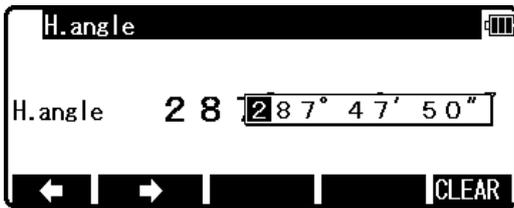
Press [ENT] to open the input window of PN, X, Y, Z and IH value.
 Input each Character or value and press the ENT key to view the STATION POINT H. ANGLE SETUP screen.



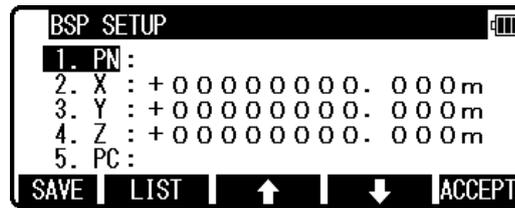
Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

Press [ENT] to open the input window when using [F5][BSP].

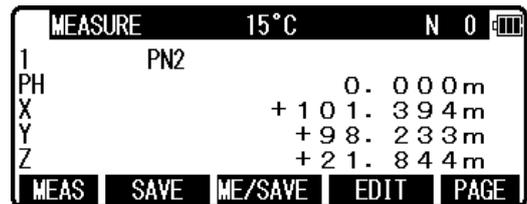
Pressing [F2][INPUT]



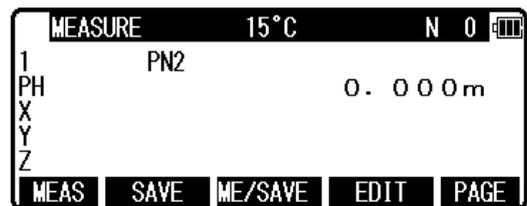
Pressing [F5][BSP]



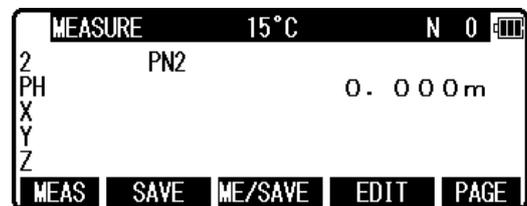
Aim at the reference point, and press [ENT] to view the MEASURE screen.



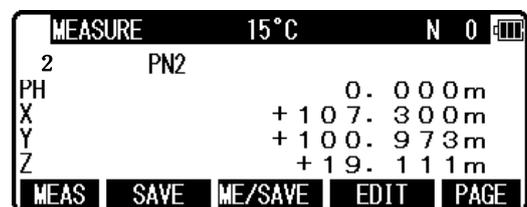
Aim at point 1 and press [F1][MEAS]. Measured Coordinates are displayed.



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.

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

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.

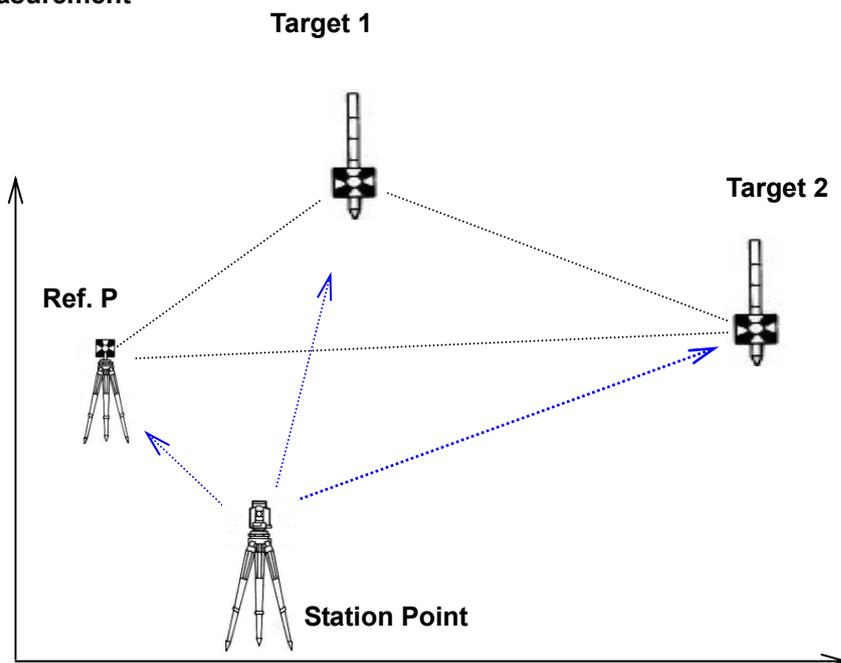
COORD. ON THE VIRTUAL PLANE		
PN	PN2	
PH		0. 000m
X		+107. 300m
Y		+100. 973m
Z		+19. 111m
POINT3	SAVE	POINT1 EDIT

Pressing [F4][EDIT] can edit the point name and prism height.



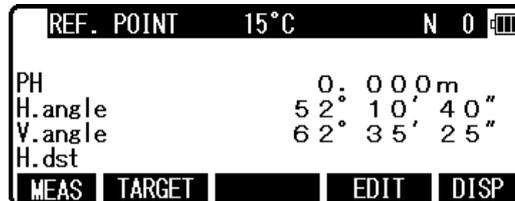
10 RDM

Remote Distance Measurement



With RDM measurement, 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.

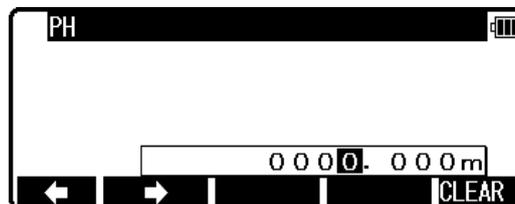
Press the [F4][VPM] of the PowerTopoLite screen to view the REF. POINT screen of the RDM function.



10.1 PH input

Press [F4][DISP] to to change the displayed distance.

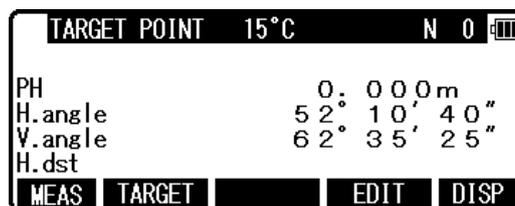
Press [F3][EDIT] to input the PH, Reference point height.



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.



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 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



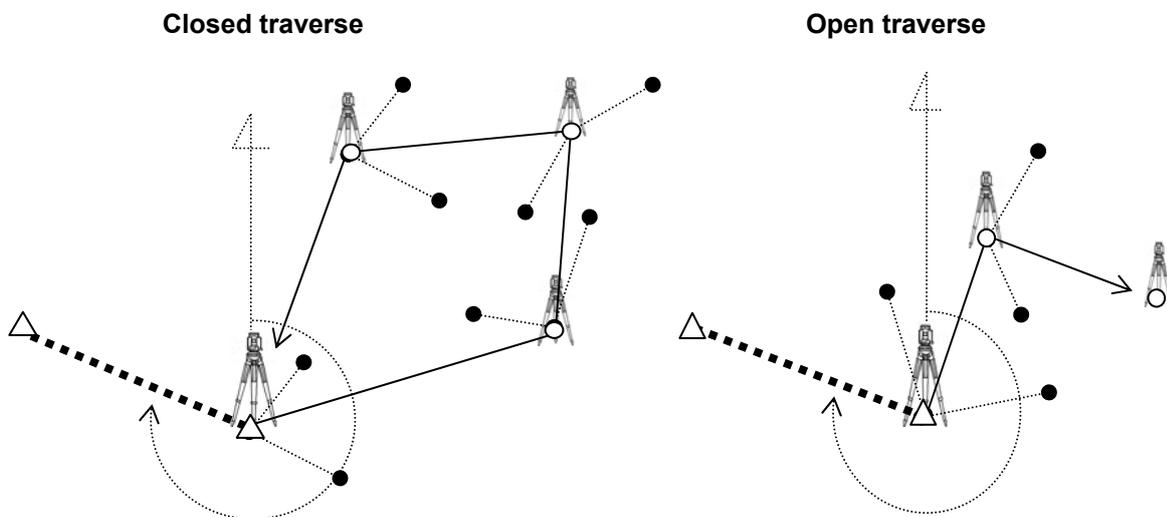
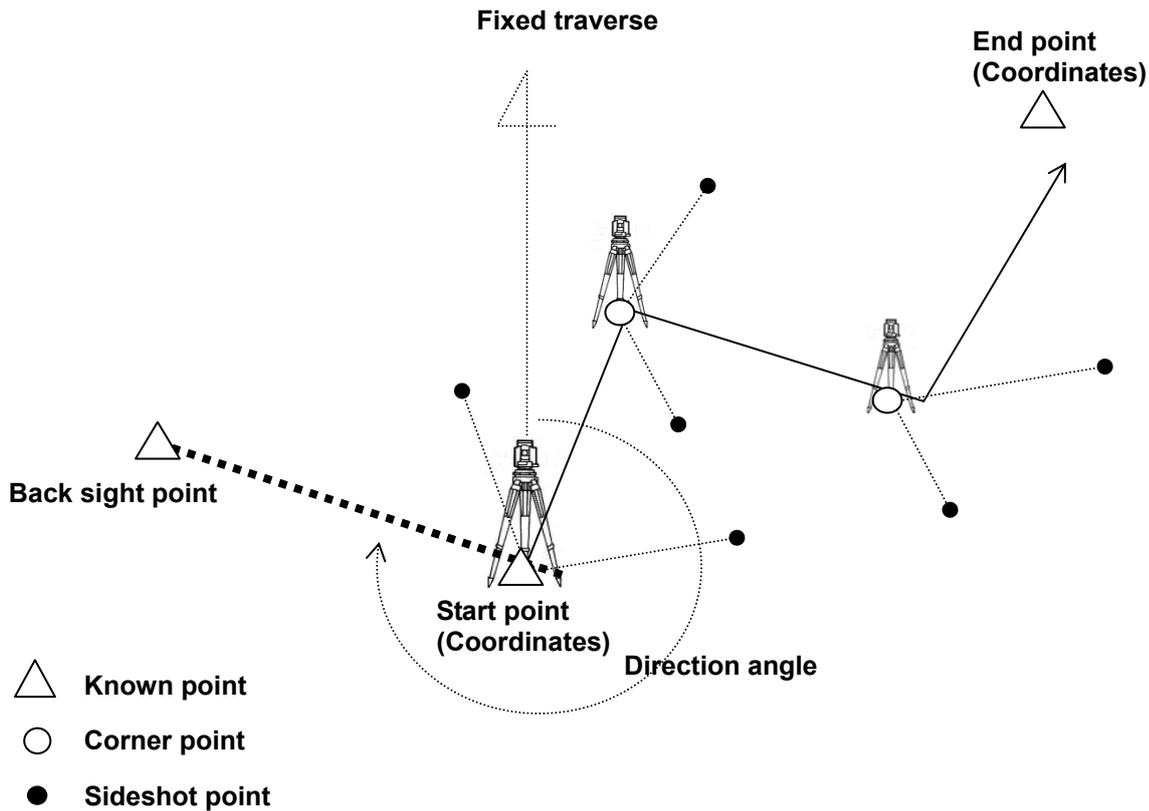
11. Traverse

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 confirm 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.



The following assumptions are made:

The current station is the fore sight 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 escape from 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 screen, Press the [F1][TRAV] of the PowerTopoLite screen to view the TRAVERSE screen.

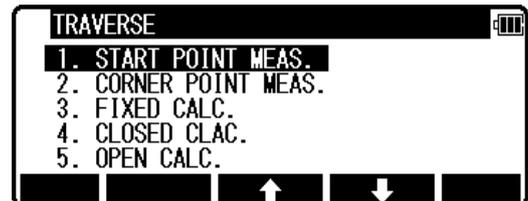
11.1 Start point measuring

Select 1.START POINT first to start new traverse.

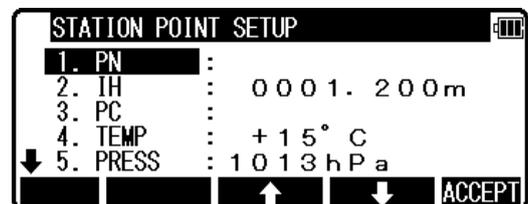
Note

More than one traverse route can't be measured at the same time.

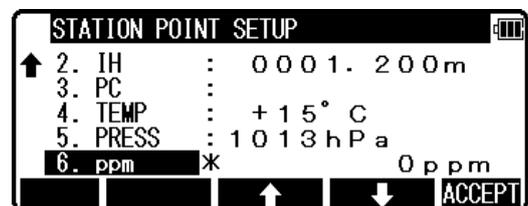
Please start the new traverse route after another traverse route is finished.



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

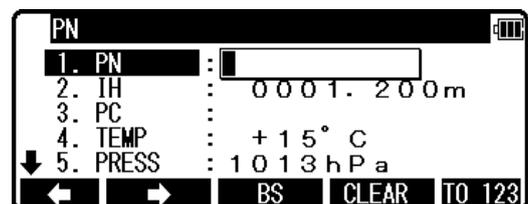


The \uparrow/\downarrow mark is used to scroll up / down. 6. ppm is viewed by .

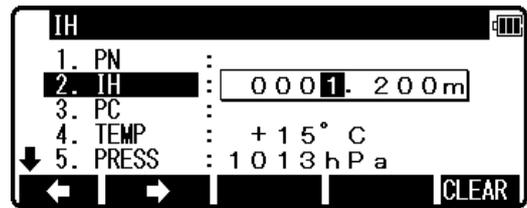


Point name, PN, input

Press [ENT] to view the PN screen.

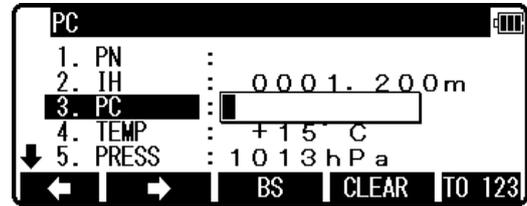


IH, TEMP, PRESS, ppm and PC input
Input IH value.

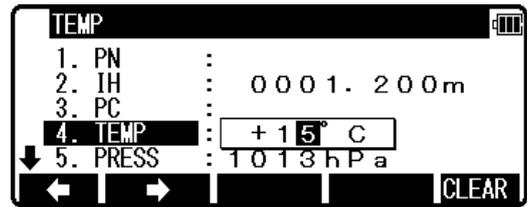


Press [ENT].

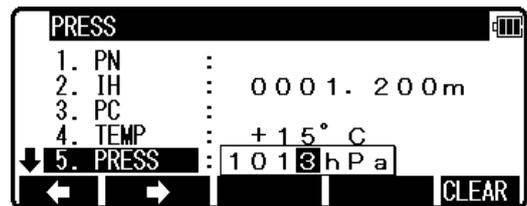
Press [ENT] and input the PC.



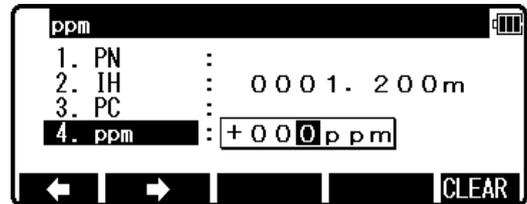
Input the TEMP value.



Press [ENT].
Input the PRESS value.



Press [ENT].
Input the ppm value.

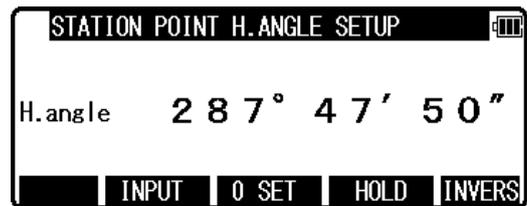


TEMP, PRESS and ppm input depend on the Initial setting 1 (AUTO, ATM INPUT, ppm INPUT, NIL).
And they are alternative.

Press [F5][ACCEPT] to save the inputted 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

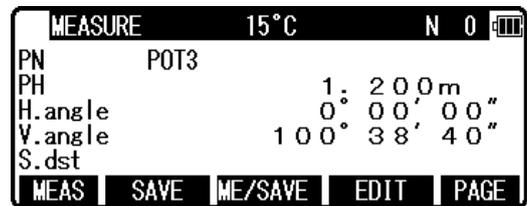
The direction angle set at this screen is used at the traverse calculation which will be executed later.

And the rotation of the "H.angle" depends on the rotation setting of "[134.12 Coordinate axis definition](#)".

- [INVERS] key

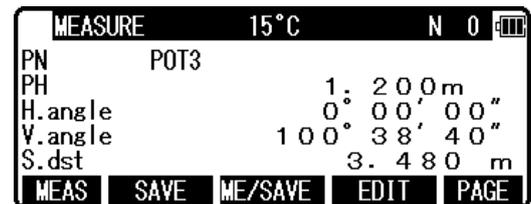
If you want to calculate the direction angle, press [F5][INVERS] to jump INVERSE function.
 Input SP as a start point and EP as a back sight point.
 Result angle is set here automatically by pressing the [ENT] at the RESULT OF INVERSE screen.
 Press [ENT] after aiming at the reference point.

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



Measuring

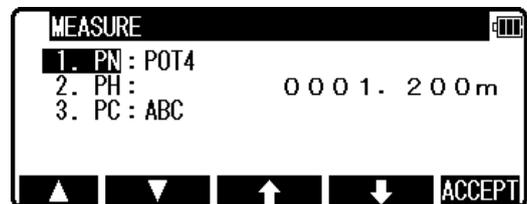
Aim at the Target point and press [F1][MEAS] to measure the distance.



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*.

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



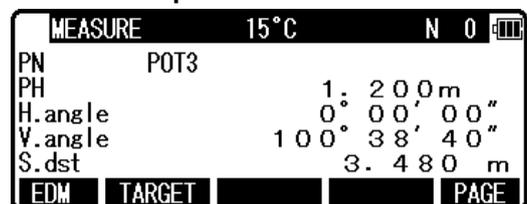
Press the [ENT] to save the measured data as *corner point*

If [ENT] is pushed more than twice at the one station, the last [ENT] point becomes next corner point.

Note

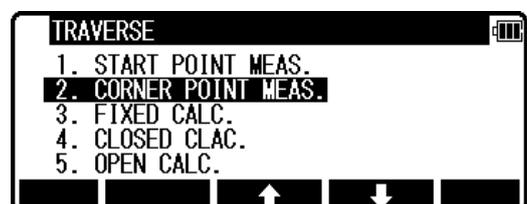
Please use [SAVE] [ME/SAVE] and [ENT] properly by sideshot and corner point.

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

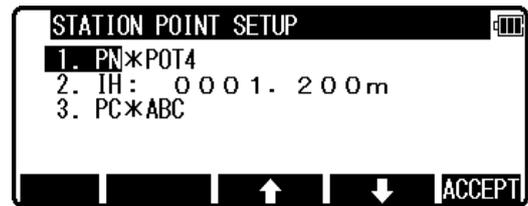


11.2 Corner point measuring

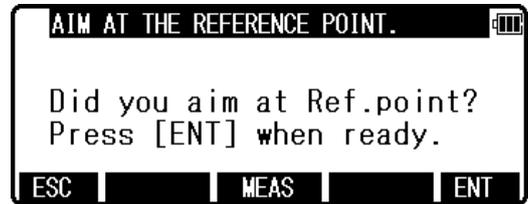
Select 2.CORNER POINT to start measuring at corner point.



And press [ENT] to view the STATION POINT SETUP screen.



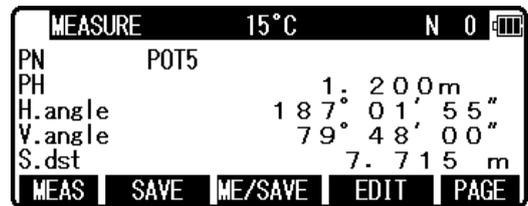
Press the [ENT] to view the AIM AT THE REFERENCE POINT screen.



Aim at the previous station, then press [ENT]. The direction angle is set automatically. It proceeds to MEASURE screen automatically.

Measuring

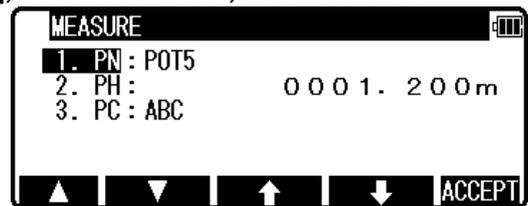
Aim at the Target point and press [F1][MEAS] to measure the distance.



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*.

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



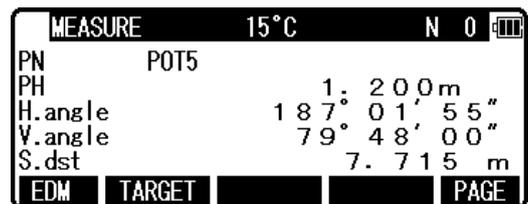
Press the [ENT] to save the measured data as *corner point*

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.

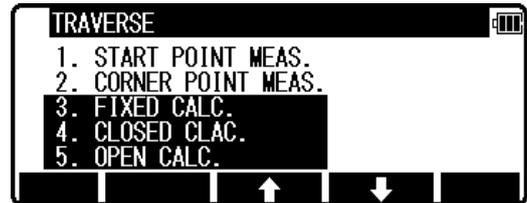
Open traverse

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

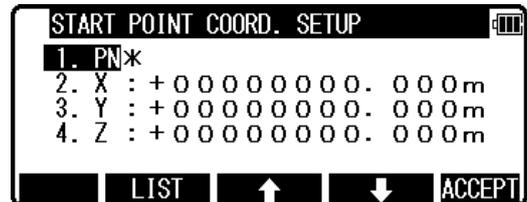
Select "3.FIXED CALC." or "4. CLOSED CALC." or "5.OPEN CALC." to calculate the traverse route.



Press [ENT] to view the START POINT COORD. SETUP screen.

Start point coordinates setup

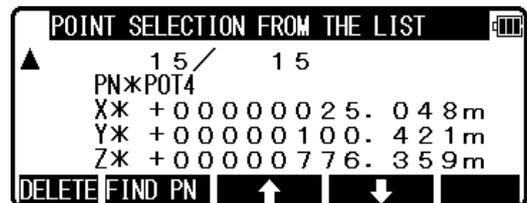
(Input the PN, Coordinates and PC of the Start point.)



- [LIST] key

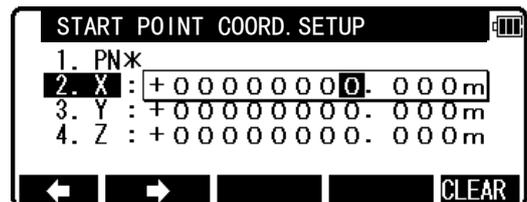
All the stored points can be displayed as follows by pressing [F2][LIST].

Press [F2][LIST] to view the POINT SELECTION FROM THE LIST screen.

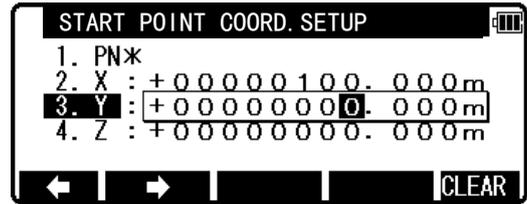


Press [ENT] to open the X coordinate input screen.

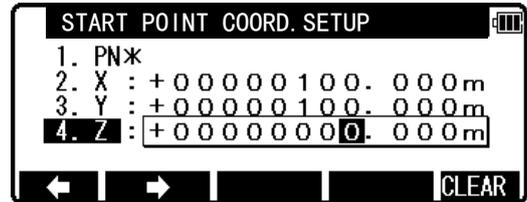
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



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

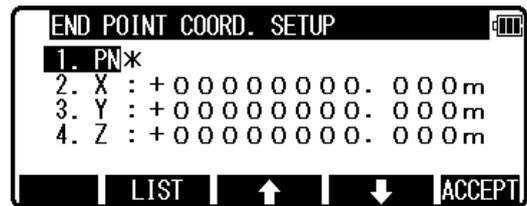


Press [ENT] to open the Z coordinate input screen and input.

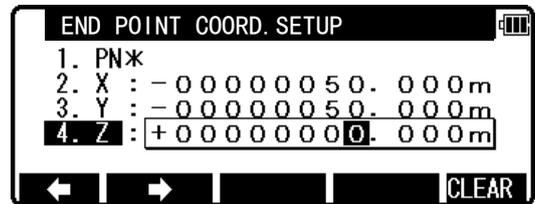


Only in the case of fixed traverse,
End point coordinates setup screen is displayed.
(Input the PN , Coordinates and PC of the End point.)

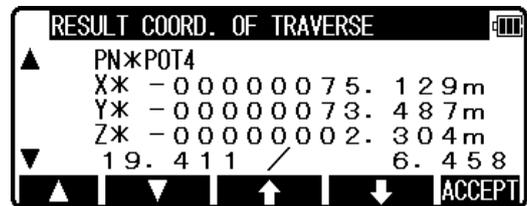
After Z coordinate input, END POINT COORD. SETUP screen is viewed.



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



Press [ENT] to view the RESULT COORD. OF TRAVERSE screen.



“ e / S ” indication means “ closing errors / total length “.
[F1] and [F2]s indicate only corner points in order.
[F3] and [F4]s indicate all points in order.

Press [F5][ACCEPT] to save the all corner, sideshot points, and known points.



12. ROAD DESIGN

You can use this function to calculate basic design clothoid, raised type clothoid, and central peg and width peg of simple curve, and record the coordinates by inputting and specifying each coordinate of BP,IP and EP and the elements of the curve.



WARNING

WARNING

- Road calculation excludes Z coordinate values from the calculation.
- Road calculation allows you to calculate up to 1,000 points in combination with number peg, plus peg and width peg.
- The maximum number of points that can be processed per route is 1,000 points. When making a design for a complex route having many consecutive IP points, you may not be able to obtain your desired smooth linear shape if you calculate with an extreme and rough pitch. Also if there is a mistake of inputting coordinates or elements, it may generate the coordinates quite differently from your desired linear shape. To prevent yourself from these, we recommend you to send the generated coordinates to PC and confirm the linear shape on the monitor or printer screen before using.

[Measurement point name to be selected and specified]

Regarding measurement point name of each coordinate, input alphanumeric character up to three character following the character of BP, IP and EP. When more than three characters following BP, IP and EP or completely different alphanumeric characters by deleting the initial character are input, it automatically generates the point name of an existing value.

This will also happen when you specify a coordinate by researching from the memory.

[Generation of measurement point name]

Numerical part: 3 digits and up to 001 ~ 999.

Integer part of plus peg: up to 01 ~ 99.

Width peg: Left width peg [L] is added at the end of the measurement point name.

Right width peg[R] is added at the end of the measurement point name.

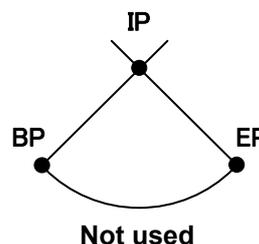
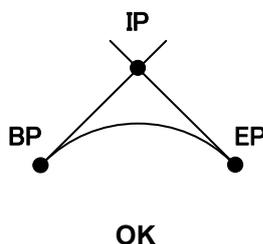
NOTE: measurement point name is not processed for the additional distance.

[Generation of principal peg to be recorded by calculation and measurement point name of

- In case of Simple curve;
BC#, EC#, SP#
([#] of measurement point name of principal peg has actually become IP number.)
- In case of basic design clothoid;
KA#-1, KE#-1, KE#-2, KA#-2, SP#
- In case of raised type clothoid;
KA#-1, KE#-12, KA#-2

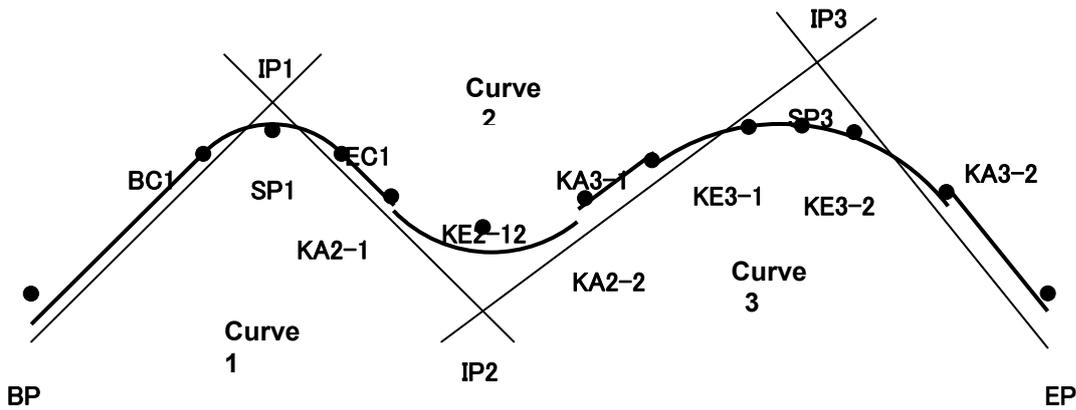
[The curve to be used in road design]

The curve mentioned in the right drawing can not be used, which is called reverse IP or IP curve, although it can be used with basic design clothoid, raised type clothoid and simple curve (see left drawing).



[Terms and curves to be used in Road Calculation]

- | | | | |
|----|-----------------------------|----|------------------------------------|
| BP | Beginning point of route | IP | Intersection point of main tangent |
| EP | End point of route | IA | Intersection point of main contact |
| BC | Beginning of curve | CL | Curve length |
| EC | End of curve | SP | Secant point |
| KA | Beginning of clothoid curve | | |
| KE | End of clothoid curve | | |



12.1 BP, IP, EP input

Press [F2][ROAD] in PowerTopoLite to open BP DATA SETUP.

```

BP DATA SETUP
1. PN: BP
2. X : +000000000.000m
3. Y : +000000000.000m
4. PC:      0000.000m
SAVE | LIST | ↑ | ↓ | ACCEPT
    
```

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

```

IP DATA SETUP
1. PN: IP1
2. X : +000000000.000m
3. Y : +000000000.000m
4. A1:      0000.000m
↓ 5. A2:      0000.000m
SAVE | LIST | ↑ | ↓ | ACCEPT
    
```

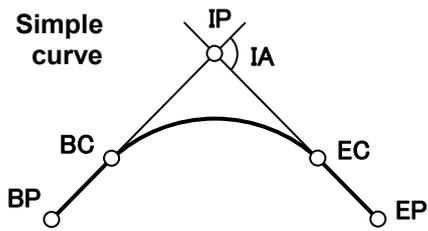
NOTE:

Based on the input parameters in the following table, basic design clothoid, raised type clothoid and simple curve are calculated.

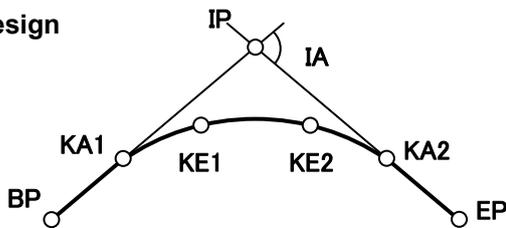
Type	Input items
Basic design clothoid	Radius R Parameter A1, A2
Raised type clothoid	Parameter A1,A2
Simple curve	Radius R

You can input radius R, parameter A1,A2 in the range of 1m or more and less than 10,000m . If you input only parameter A1, or only parameter A2, a message 「clothoid<--->arc cannot cal.」 is displayed. This doesn't support road design composed from clothoid-simple curve or simple

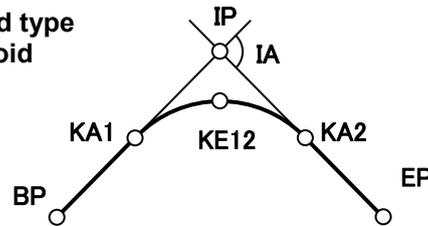
curve-clothoid.



Basic design clothoid

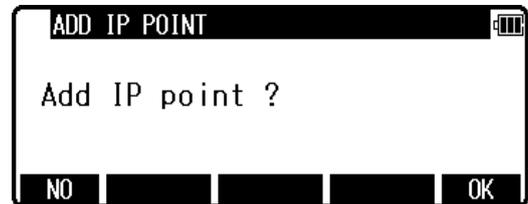


Raised type Clothoid

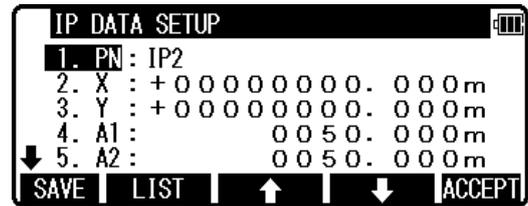


In the same manner, input the values of IP. Then, press [ENT] or [F5][ACCEPT] to view the ADD IP POINT screen.

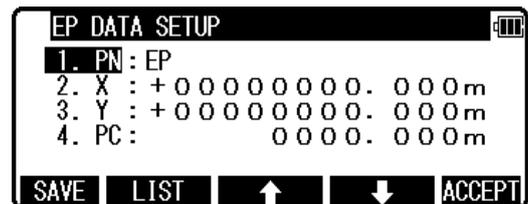
IP can be stored up to 10 points. Press [F5] [OK] to input IP, if not necessary, press [F1][NO] .



In case of OK



In case of No good

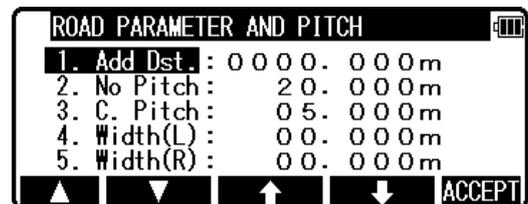


12.2 Road parameter and pitch input

After input of BP, IP and EP is done, input the remaining parameters.

NOTE:

- Initial value of number peg pitch interval : 20m. Initial value of pitch curve section interval: . Input range between number peg pitch and pitch curve section: between 1m or more, and less than 100m.
- Regarding number peg pitch interval and pitch curve interval, if pitch curve section is not 1: integer of number peg pitch (number peg pitch is integer times of pitch curve section), an error message [No.P.isn't multiple of C.P.] is displayed. In this case input again value of number peg pitch and pitch curve section in the range of 1m or more, and less than 100m.
- In case value of pitch curve section is [0], central peg is calculated based on number peg pitch in the pitch curve section.



- If value of number peg pitch and pitch curve section is set for 0, only principal peg is calculated. If interval of number peg is longer than curve length, a message [too large data, cal.stop] is displayed. Input less value of number peg pitch.
- Input range of width is between 0m or more, and less than 100m.
- If you input incorrect value in the input item, a message, [CAN'T CALCULATE THE ROAD] is displayed. Input parameter, BP, IP and EP again.

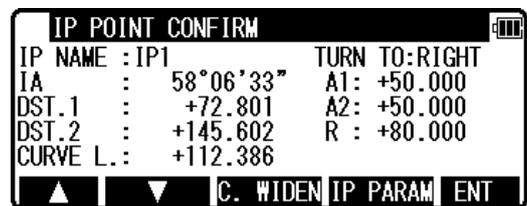
Press [F5] [ACCEPT] after parameter input is done to display IP POINT CONFIRM screen.



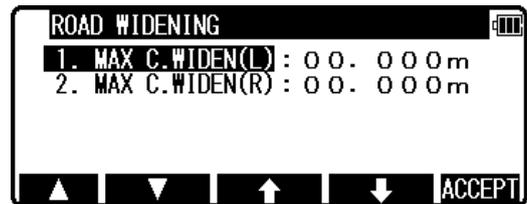
Press [F1][NO] to display calculation results, or press [F5][OK] to go to IP confirmation and widening input screen.

12.3 IP confirm

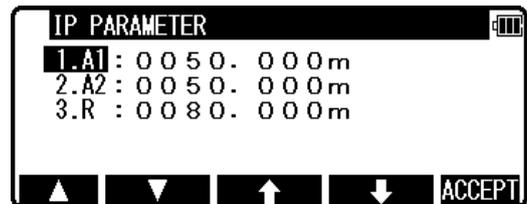
Select IP by pressing [F1][^] / [F2][v] key. Confirm intersection IA, point name, turning direction, distance 1, distance 2 and curve length and other value show in the illustration



Press [F3][C. WIDEN] to display road widening setting screen.



Press [F4][IP PARAM] to display IP PARAMETER screen.



NOTE:

Input range of widening is between 0m or more, and less than 100m. Widening is calculated based on transition curve (Parabola).

In case of simple curve.

Widening is [0] at BC point, the widening will be the maximum at the center of curve and widening of EC point will be [0].

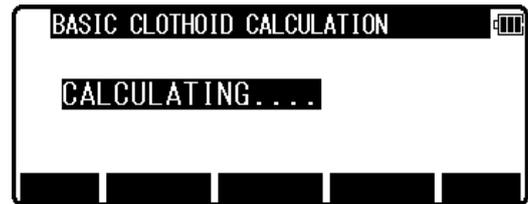
In case of clothoid.

Widening is [0] at KA point, the widening will be the maximum at KE point.

Be aware that there are some limitations as mentioned above when you use it.

NOTE: If you select raised type clothoid, the radius R, which is calculated inside, will be displayed on IP point confirmation screen. When you change the element of raised type clothoid by pressing [F4] [IP PARAM], [0] must be input to [3.R] on the elements setting change screen. If you don't input [0] and press [ENT] with the displayed value, re-calculate as basic design clothoid. Be sure to input [0] when changing the elements.

12.4 Calculation

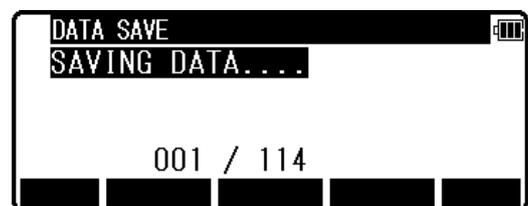


Press [F1] [NO] on 12.2 IP POINT CONFIRM screen or [F5] [ENT] on 12.3 IP POINT CONFIRM to start calculation.

PN	X	Y
BP	+110.000	+120.000
BPR	+108.626	+124.808
BPL	+111.374	+115.192
No001	+114.808	+121.374

The screenshot shows a screen titled "CALCULATION RESULT" with a table of coordinates. At the bottom, there are navigation arrows and a "RECORD" button.

Press [F5][RECORD] to save the calculation results.



NOTE: In case the calculation results don't appear and an error message [CAN'T CALCULATE THE ROAD] is displayed, check input coordinates and parameter again.

- 1) On relation between BP-IPI and BC (or KA), BC (or KA) exists before BP and geometric relationship isn't consistent. Same thing happens to EP.
- 2) In case KE exist before KA.
- 3) When curve section is consecutive, parameter of the curve element is not consistent with the straight section between IP.
- 4) Straight section between IP is not consistent with the curve section.
- 5) Integral part of coordinate of principal peg exceeds 8 digits.

NOTE: If integral part exceeds 8 digits, an error message [TOO LARGEDATA, CAL STOP] is displayed and calculation is stopped.

NOTE: Numerical part of measurement point name of number peg exceeds [999] and becomes more than 1,000, under-3 digit is used as a measurement point name of number peg.

NOTE: In case created coordinates exceed 1,000 before calculation reaches end point, an error message tells you that it is impossible to make calculation until end point, [OVER 1000 POINTS, CAL CAN'T FINISH] is displayed. Select [ESC] and divide route section. Then recalculate, or press [CONT] to continue the calculation, but in this case you have to understand that coordinate calculation is not done completely.

NOTE: Calculated coordinate is stored in the selected job file. If you carry out recording even though the same measurement point name as that of the calculation result exists in the job, the same measurement point name is recorded in the job file.

NOTE: When you want to stop function on the way, press [ESC] several times to return.

NOTE: Since a lot of data is recorded at the same time, it may take some time to complete all the data. Do not remove the battery during recording as it may damage the instrument.

NOTE: IP point is not stored.

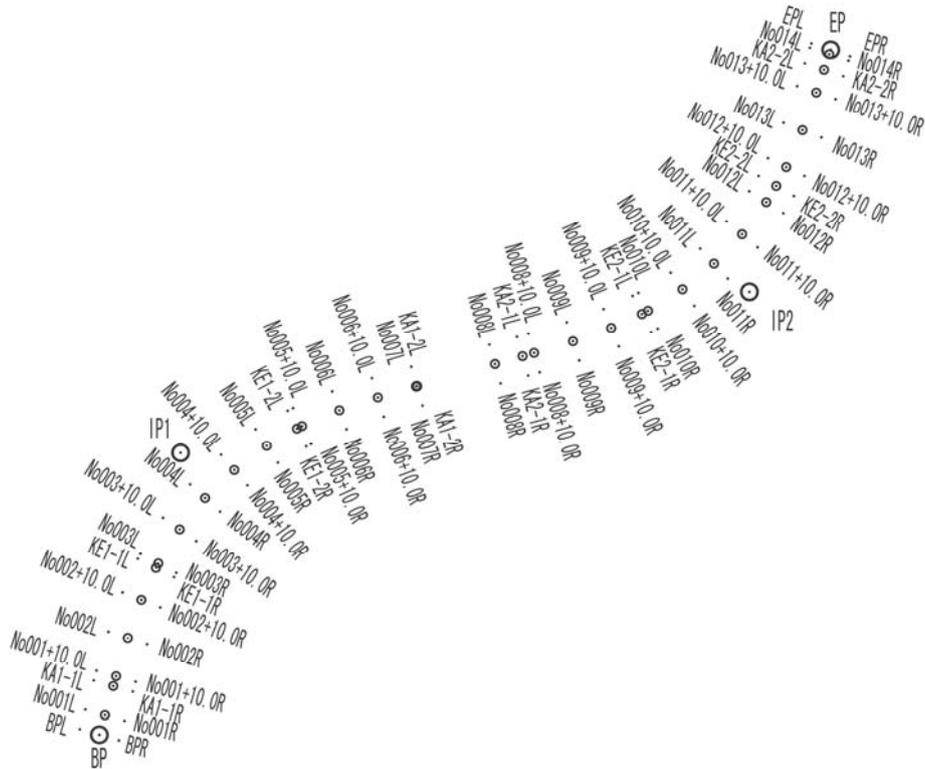
Sample Data

Point Name	X	Y	A1	A2	R
BP	110.000	120.000			
IP1	180.000	140.000	50.000	50.000	80.000
IP2	220.000	280.000	50.000	50.000	80.000
EP	280.000	300.000			

BP Additional distance	15.000
------------------------	--------

Number peg pitch	20.000
Pitch curve section	10.000
Width(Left)	5.000
Width(Right)	5.000

The following plot was made by sending the calculation results to PC after calculating the sample data by the R-200,





13. INPUT / OUTPUT

The communication setting and the Input/Output of data are performed by this Function. There are 4 menu items in the Input/ Output menu. Perform the Communication setup before input from the PC or output from the PC.

We recommend you not to press any keys until data transfer is completed while transfer operation.

Notice concerning the unit of data to transfer

Sending the data (Rec. data & Polar data)

Coordinates and Distance data

The unit is outputted by m unit even if the distance unit setting of the instrument to send the data is m, ft and feetinch.

Angle, Temperature and Pressure data

The data is outputted according to the unit setting of the Angle, Temperature and Pressure of the instrument to send the data.

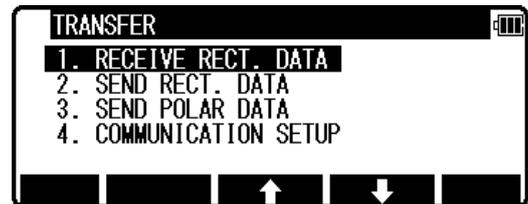
Receiving the data (Rect. data)

Coordinates data

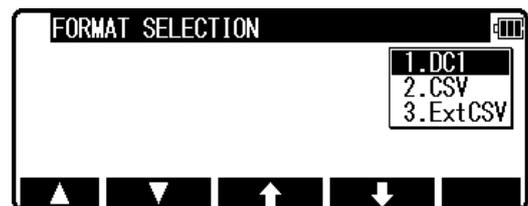
The Coordinates data received is inputted in the instrument as data of “m” unit. And then, it is converted according to the distance unit which is set in the instrument, and displayed on the screen.

13.1 Input from the PC

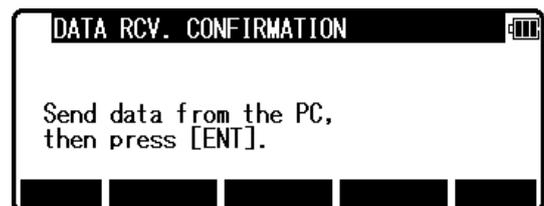
The Rect. data is sent from the PC etc. and stored in the internal memory of the instrument. Press the [F3][I/O] of the PowerTopoLite screen to view the TRANSFER screen.



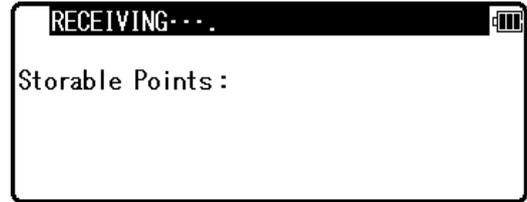
Select the 1. RECEIVE RECT. DATA and press [ENT] to view FORMAT SELECTION screen.



Select the DC1 format and press [ENT] to view DATA RCV. CONFIRMATION screen.
(Same procedure is performed at CSV.)

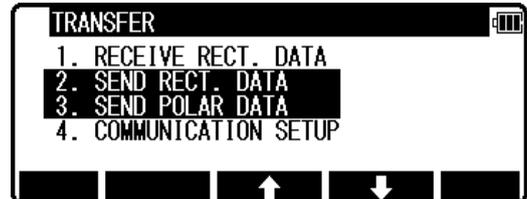


Set the PC to be ready to send and press [ENT] to receive the data from the PC



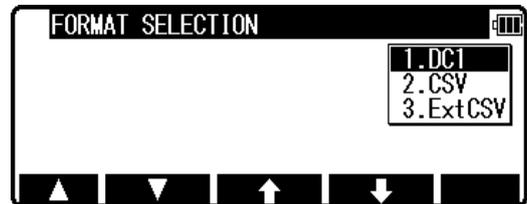
13.2 Output to the PC

The data stored in the internal memory is sent to the PC etc.

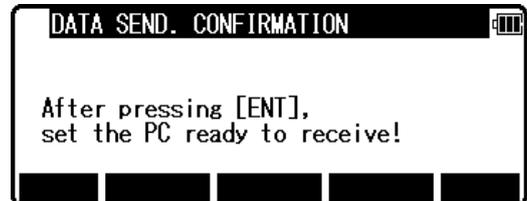


[RECT. DATA]

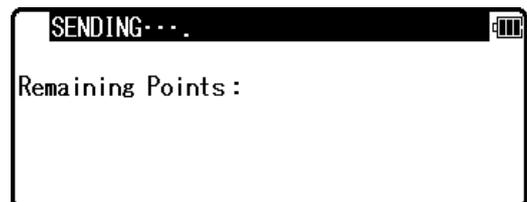
Select the 2. SEND RECT. DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.



Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed at CSV)

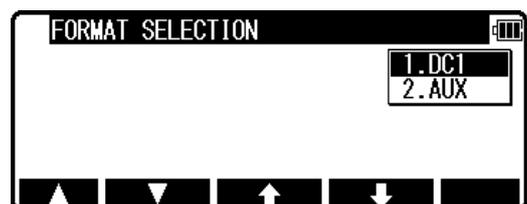


Press [ENT], and set the PC to be ready to receive.



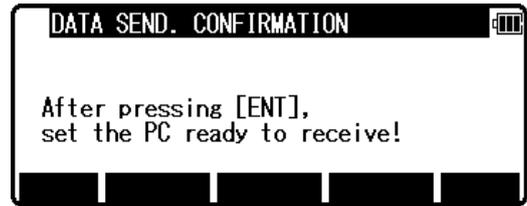
[POLAR DATA]

Select the 3. SEND PLAR DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.

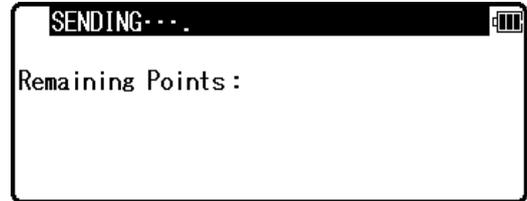


Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.

(Same procedure is performed at AUX)



Press [ENT], and set the PC to be ready to receive.



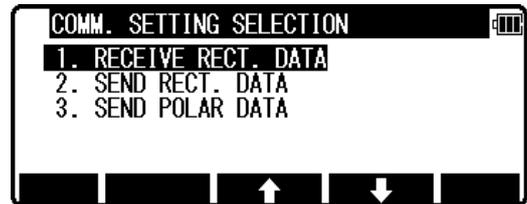
13.3 Communication setup

The communication parameter is set when stored data is received or sent between the instrument and the PC etc.



13.3.1 Receiving data setting

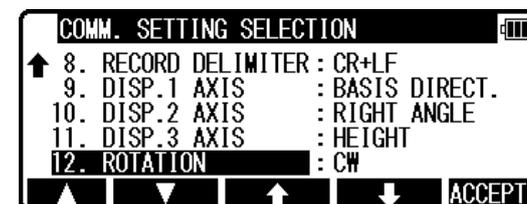
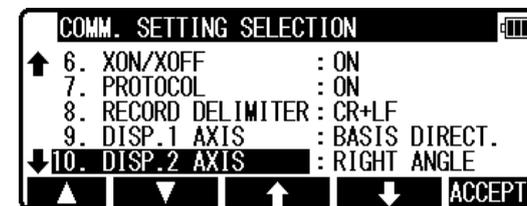
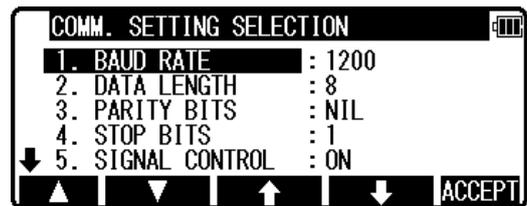
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[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] to enter when all selections are finished.

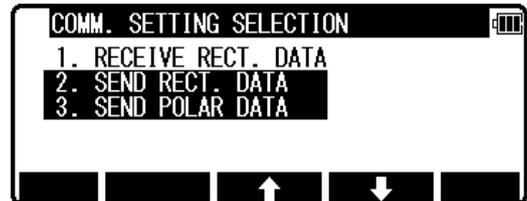
- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT** is selected when data is transferred between the TS and PC. (cf. “[134.21 Coordinate axis definition](#)”)
They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. 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:	121300
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 DELIMITER:	CR+LF
9.DISP.1 AXIS:	BASIS DIRECT
10. DISP.2 AXIS:	RIGHT ANGLE
11. DISP.3 AXIS:	HEIGHT
12. ROTATION:	CW

13.3.2 Sending data setting

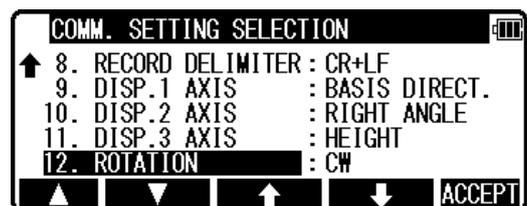
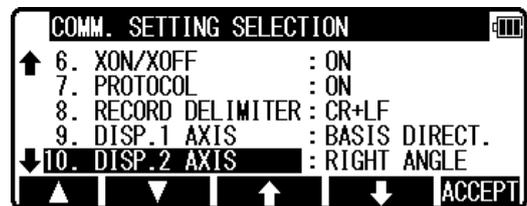
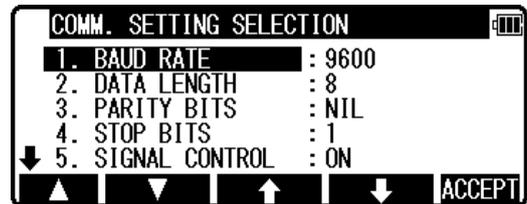
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[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] 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. "[134.21 Coordinate axis definition](#)")

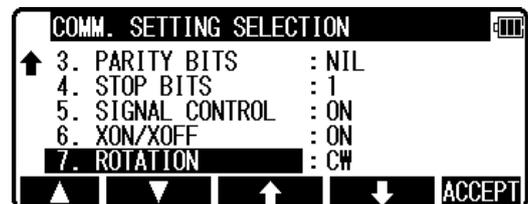
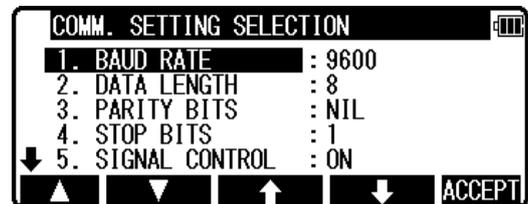
They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the "Coord. Axis" between settings in "[Communication setup](#)" and settings in "[Coordinate axis definition](#)" 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+LF
 - 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] to enter when all selections are finished.

- 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

13.4 About DataLink DL- 01 Software

DataLink DL01 Software allows you to send collected data by R-200 series 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 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-200 series.

b-3 Limitation for each format.

Please, use "CSV" or "DC1(DC-1Z) " format to transfer data to/from R-200 series.

Limitation for the "CSV" format.

With the "CSV" format, "PN" and "PC" (Point Code) data consist 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-200 series.

Recommended settings for "COMM SETTING SELECTION" on R-200 series special function is as follows.

R-200 series ⇒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+LF
Subsequent items: As you like.

R-200 series ⇒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.

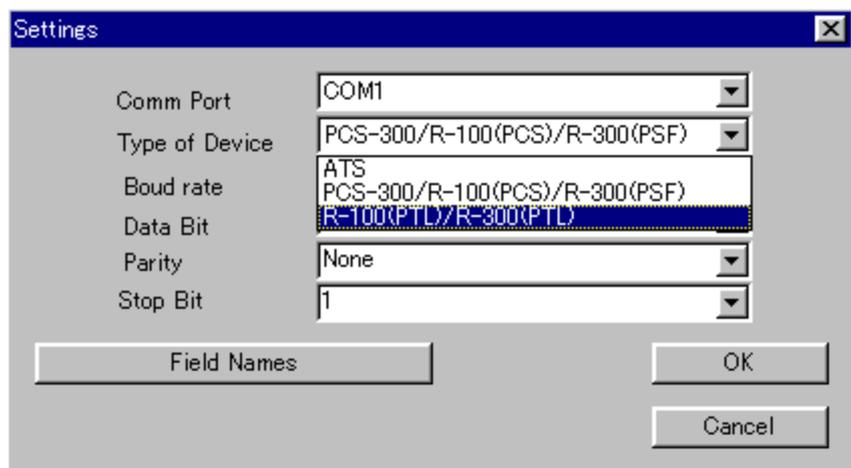
PC(DL-01)⇒ R-200 series to "RECEIVE RECT. DATA"
1.BAUD RATE: 1200
2.DATA LENGTH: 8
3.PARITY BITS: NIL
4.STOP BITS: 1
5.SIGNAL CONTROL: OFF
6.XON/XOFF: OFF
7.PROTOCOL: OFF for "CSV" format, ON for "DC1 (DC-1Z)" format
8.RECORD DELIMETER: CR+LF
9. Subsequent items: As you like.

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)" and other setting should be as follows.



(Please note that these settings should be common with R-200 series. And if the selection of "Type of Device" is not collect it may result in missing some data.)

R-200 series ⇒PC(DL-01)

Bits per second: 1200 (1200-9600 for sending "POLAR DATA")
 Databits: 8
 Parity: None
 Stop bits: 1

PC(DL-01)⇒ R-200 series

Bits per second: 1200
 Databits: 8
 Parity: None
 Stop bits: 1

c) Note for the Memory capacity.

Data transfer failure from DL01 to R-200 series 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]s, and take your finger off from [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 Electronic Vial is displayed.

d) Difference between CSV format on "PentaxSpecialFunction" and "PowerTopoLite".

CSV file format from R-200 series "PentaxSpecialFunction" version is slightly different from "PowerTopoLite" version as follows.

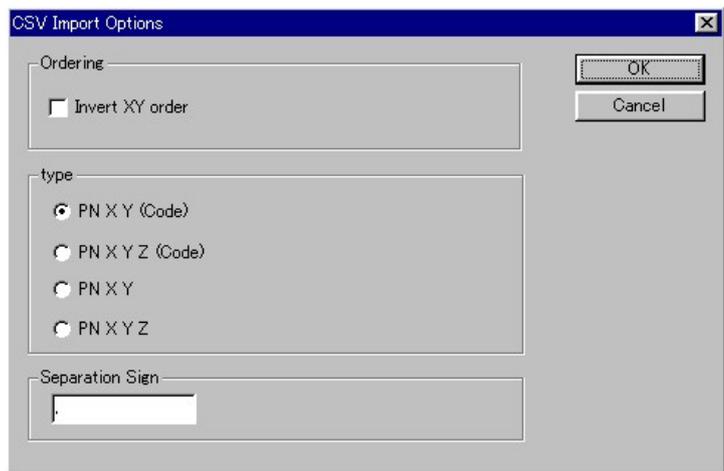
Type of software version	Format
R-200 series "PentaxSpecialFunction" version	PN, X, Y, Z, Code
R-200 series "PowerTopoLite" version	PN, X, Y, Z, Code,

At the end of each line of CSV file output by "PowerTopoLite", there is "," as shown above.

e) Note on converting CSV file.

When you attempt to convert CSV file from R-200 series 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 the case of 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

f) For more information to work with DL-01, please refer to the "help" file after the installation.

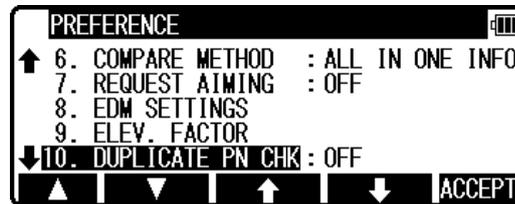
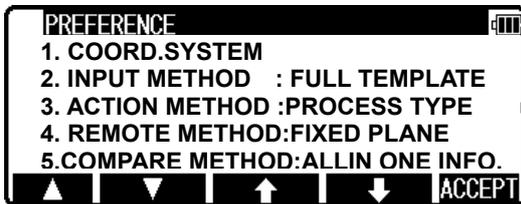


14. PREFERENCE

Followings are possible function and the factory default settings.:

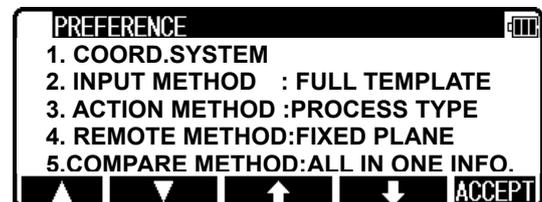
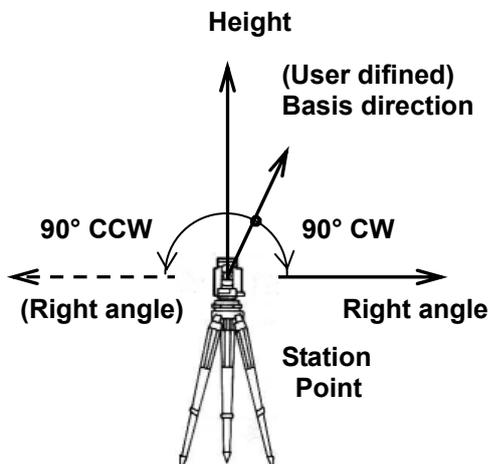
FUNCTION	Default settings
A Language other than the English can be selected.	"English"
Coordinate system can be selected.	(cf. Coordinate axis definition)
Character input method can be selected.	"FULL TEMPLATE"
Action input method can be selected.	"PROCESS TYPE"
The offset (remote) method can be selected.	"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, SEC. MEAS KEY, MEAS. MIN DISP (only R-322EX/NX, R323R-323EX/NX), TRACK MIN DISP, SHOT COUNT, SHOT INPUT.	"MEAS. SHOT" "TRACK CONT" "COARSE" "COARSE" "1 TIME" "01 TIME"
Elevation factor can be defined. AVE.ELEV. SCALE FACT	+0000.0000m 1.00000000
Duplicate point name checking SCALE FACT	"OFF"1.00000000

Press [F4][PREF] of the PowerTopoLite screen to view the PREFERENCE screen.

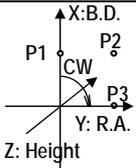
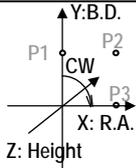
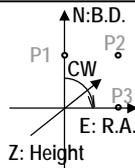
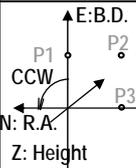


14.1 Coordinate axis definition

Select 21. 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 DIRECTION	2. RIGHT ANGLE	1. BASIS DIRECTION	1. BASIS DIRECTION
5. DISP.2 AXIS	Define the direction of the 2nd Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	2. RIGHT ANGLE	1. BASIS DIRECTION	2. RIGHT ANGLE	2. RIGHT ANGLE
6. DISP.3 AXIS	Define the direction of the 3rd Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT
7. ROTATION	Define the rotation from the 1 Axis to the 2 Axis..	1. CW 2. CCW	1. CW	1. CW	1. CW	1. CCW
Example of GRAPHICAL VIEW						

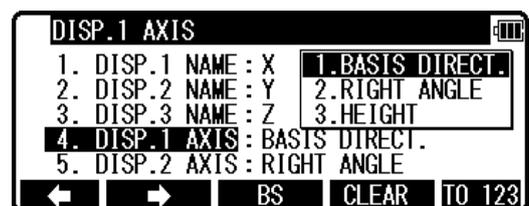
Any name can be defined for each three axis.

For the "DISP.# NAME, it is possible to define same name. However, please note that the same coordinates value will be displayed.

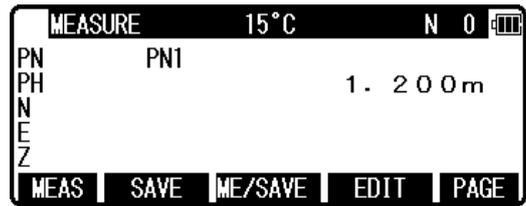


Three type of the axis can be selected for each three axis.

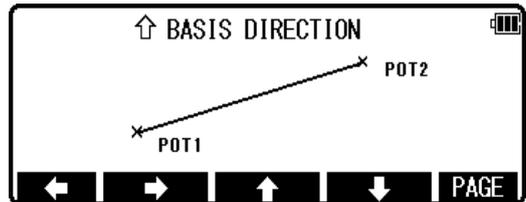
For the "DISP.# AXIS", it is possible to define same type of axis. However, please note that the same coordinates value will be displayed.



Definition of this function will be affected to the value of the coordinates.

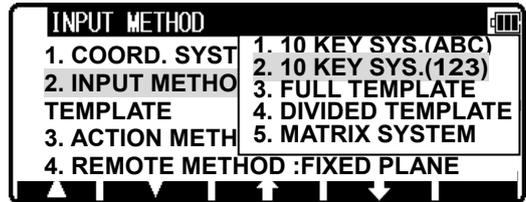


Please, note that the up on the screen of the graphical view always shows “BASIS DIRECTION”. In addition, position of points doesn’t change on the “GRAPHICAL VIEW” but, value of coordinates changes according to the setting of “Coordinate axis definition”.



14.2 Input method selection

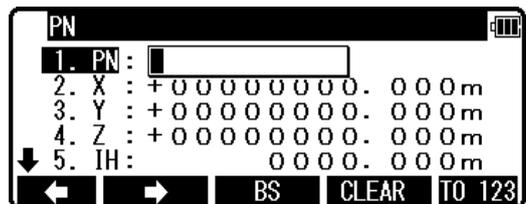
Select 23. INPUT METHOD and press [ENT] to view the Character INPUT METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



Explanation of the 10 Key system(123/ABC), Full template, Divided template and Matrix system.

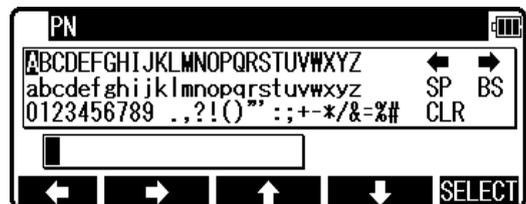
1 . 10 KEY SYSTEM(123/ABC)

These is areis the standard input method using the Alphanumeric and +/- key.

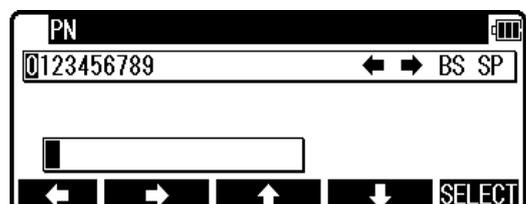


2. Full template

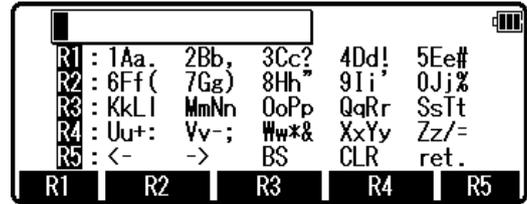
Select each Character by pressing left, right, up and down arrow keys and select each Character by pressing [F5][SELECT] each time.



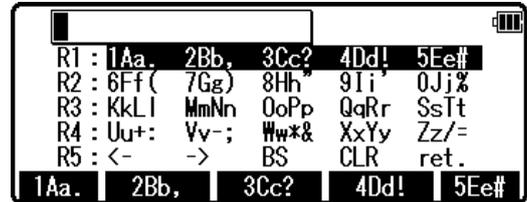
3. Divided template



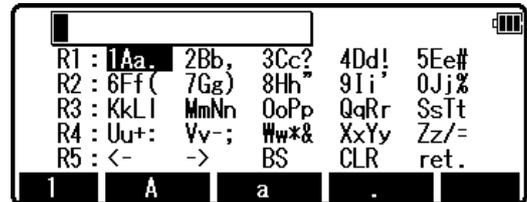
4. MATRIX



How to input "A" by Matrix.
First, Press [F1][R1] to view next screen.



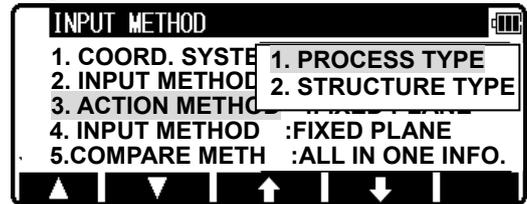
Press [F1][1Aa] to view next screen.



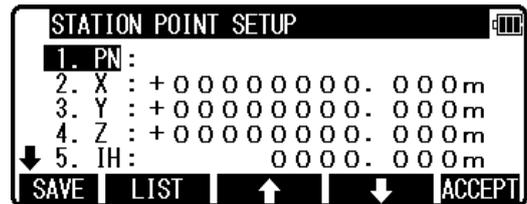
Press [F2][A] to select "A".

14.3 Action method selection

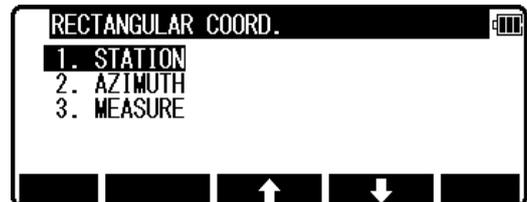
Select 43. ACTION INPUT METHOD and press [ENT] to view the Character ACTION INPUT METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



Process type
This input method took over functionality of "PowerTopoLite". When this option is selected, the next screen will be shown after inputting necessary items.

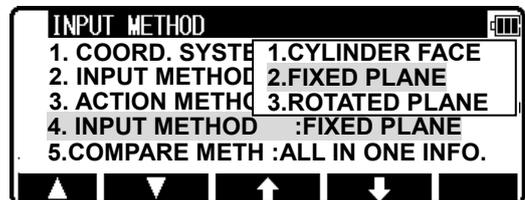


Structure type
This input method took over functionality of "PCS-300". When this option is selected, the menu screen will be shown after inputting necessary items.

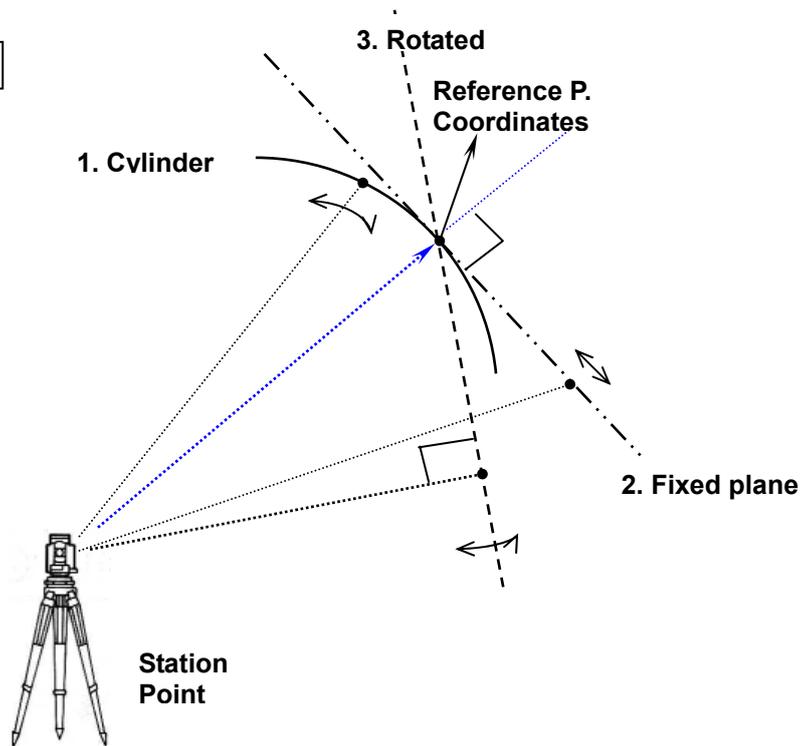


14.4 Remote method selection

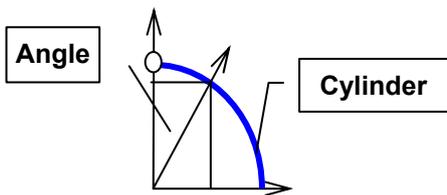
Select 54. REMOTE METHOD and press [ENT] to view the REMOTE METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



Remote

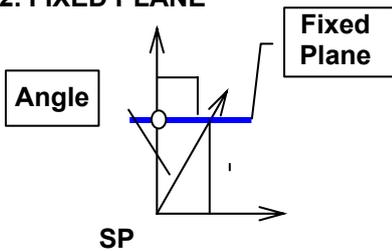


1. CYLINDER FACE



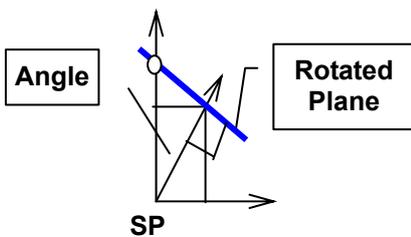
The Remote measurement is performed on the inner surface of the vertical cylinder as shown left.

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.

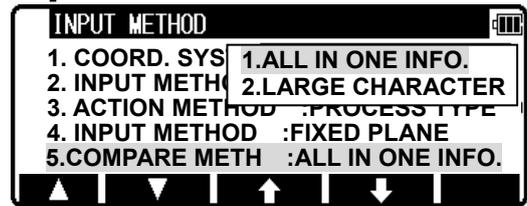
3. ROTATED PLANE



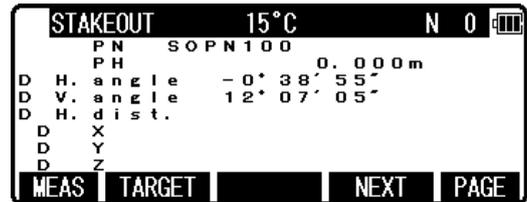
The Remote measurement is performed on the Rotated plane, which is always perpendicular to the present line of sight and induces the reference point as shown left.

14.5 Compare method selection

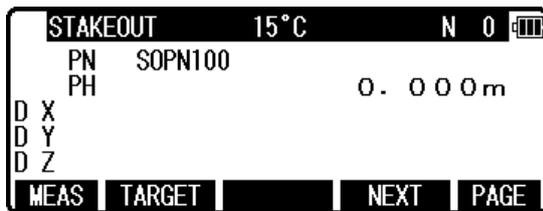
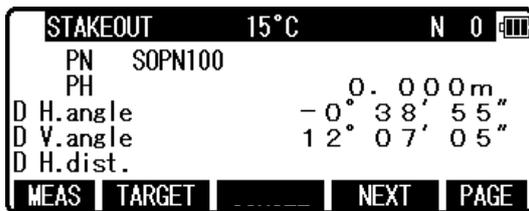
Select 56. COMPARE METHOD SELECTION and press [ENT] to view the COMPARE METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



When “ALL IN ONE INFO” is selected, all information will be displayed on the result of stakeout panel.

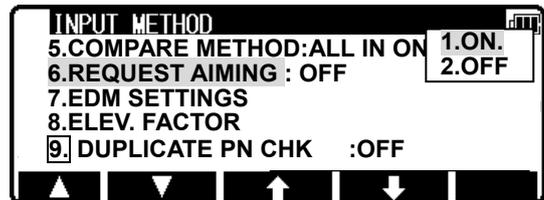


When “LARGE CHARACTOR” is selected, result information is shown with two screens and these screens and the Graphics screen can be switched by [ENT].

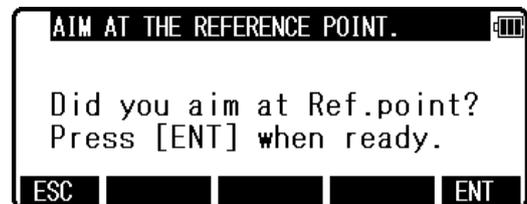


14.6 Request aiming selection

Select 67. REQUEST AIMING and press [ENT] to view the REQUEST AIMING selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.

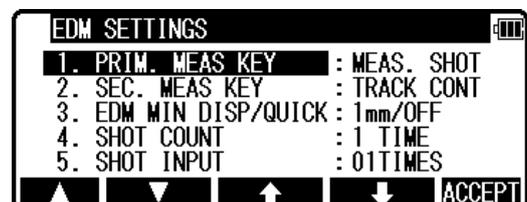


Pressing the [ENT] after entering the Horizontal angle, the AIM AT THE REFERENCE POINT screen is viewed when 1. ON is selected and not viewed when 2. OFF is selected without Coordinates input of BSP.



14.7 EDM settings selection

Select 78. EDM SETTINGS and press [ENT] to view the EDM SETTINGS selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



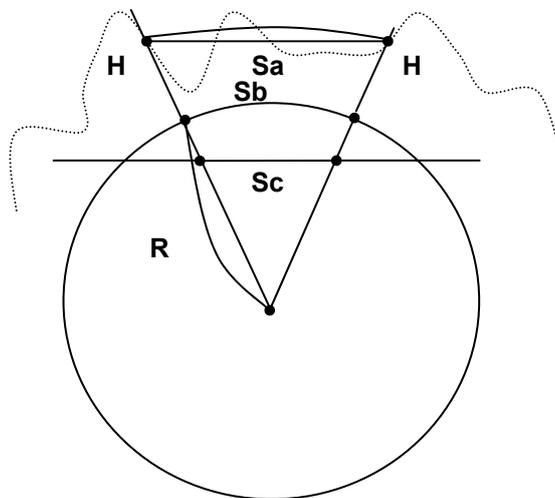
1. PRIM. MEAS KEY	1. MEAS. SHOT
	2. MEAS. CONT
	3. TRACK SHOT
	4. TRACK CONT
2. SEC. MEAS KEY	1. TRACK CONT
	2. TRACK SHOT
	3. MEAS. CONT
	4. MEAS. SHOT
3. MEAS. MIN DISP.	1. COARSE
	2. FINE
4. TRACK. MIN DISP	1. COARSE
	2. FINE
45. SHOT COUNT	1. 1 TIME
	2. 3 TIMES
	3. 5 TIMES
	4. INPUT
56. SHOP INPUT	XX TIME

Please refer to the instruction manual of basic function about details of each setting.

14.9 Elevation Factor

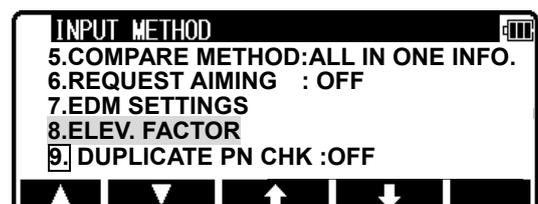
“Elevation Factor” as used here refers to Average Elevation Correction and Scale Factor carried out as part of the measurement process among the special functions.

It is effective only with MEAS-Rect., FREE, CALC- Traverse, and VPM. These reverse corrections are carried out with STAK (Stakeout, 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 98. Elevation factor and press [ENT] to view the ELEVATION FACTOR selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



1. Average Elevation

Average (H) = Averaged on-site elevation

Input range: -9999.9998 --+9999.9998m

ELEV. FACTOR

1. AVE. ELEV. : +0000.0000m

2. SCALE FACT : 1.00000000

▲ ▼ ▲ ▼ ACCEPT

2. Scale Factor

Scaling= On-site scaling coefficient

Input range: +0.0000001 -- +1.99999998

SCALE FACT

1. AVE. ELEV. : +0000.0000m

2. SCALE FACT : 1.00000000

▲ ▼ ▲ ▼ ACCEPT

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