PENTAX

ELECTRONIC TOTAL STATION

PCS-1/PCS-2

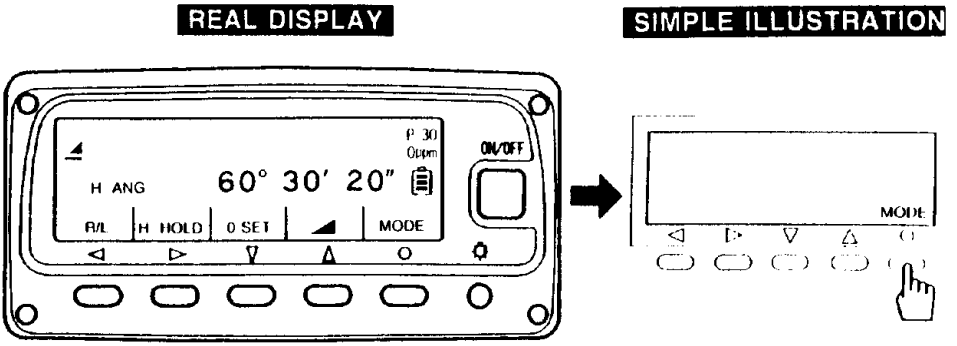
INSTRUCTION MANUAL

ASAHI PRECISION CO., LTD.

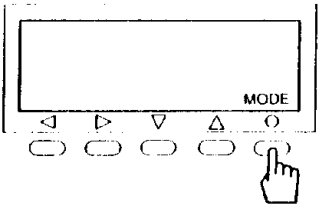
General

Example of displays

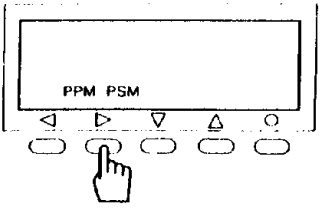
Illustrations of displays in this manual are simplified by omitting unnecessary information thus avoiding complexity.



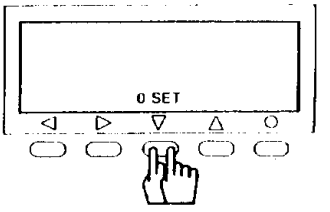
In this manual, illustrated finger-tip shows the key to be operated.



Indicates to push MODE key.



Indicates to push PPM.PSM key.



The illustration showing two finger-tips indicates to push the same key twice. The illustration on the left shows that pushing the key once initiates a beep and that the key should be pushed again while the beep is sounding.

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1 FEATURES

Pentax Electronic Total Station, PCS series, have been designed based on the conception - The Surveying Instrument Which Anybody Can Operate Easily. While simple operation is provided, all necessary functions are incorporated to make the instrument a full-fledged total station.

〈Easy-to-understand display〉

Guide messages on a large and bright LCD display provide you with easier access to each operation.

〈Simple key operation〉

All functions can be performed by operating just 5 keys. Horizontal angles can be measured just by turning the power on and simply sighting the prims makes it possible to obtain the slope distance.

〈Easy operation even at dark site〉

A LCD panel with back-light illumination displays the functions of each key, permitting easier operation even in a dark place.

〈Wide variety of functions〉

In addition to slope reduction, such special measurements as stake-out, REM, RDM and coordinates measurement are provided.

2 PREPARATIONS

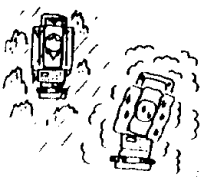
2-1 Precautions

Pentax Total Station are of the highest quality and design. We, therefore, recommend you rea this instruction manual carefully so that you will appreciate the full capabilities of your instr ment and ensure years of trouble-free operation.

〈Solar Survey〉

Avoid aiming the objective lens directly at the su Direct sunlight may cause damage to internal co ponents. When performing a solar survey, attach t sun filter(MU-64) to the objective lens.

〈Storage and environmental conditions〉

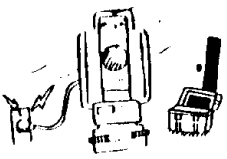


a Avoid storage or usage at extremely high or low temperatures. (Refer to working temperature range) Avoid subjecting it to rapid changes of temperature.

b In poor weather conditions, distance measurement requires more time and an increase in the quantity of prisms.

c Put into the carrying case for storage and place in a dry area not subject to vibration, dust or high moisture.

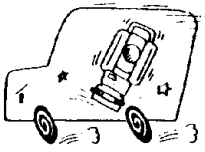
d When storage and usage temperatures are widely different, leave the instrument in the case until it can adjust to the surrounding temperature.

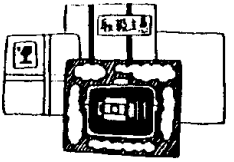


e When not in use for extended periods, recharge the battery and expose the instrument to fresh air once per month.

PREPARATIONS

〈Transportation〉



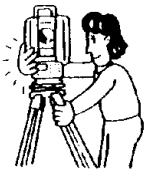


a. Be careful not to subject the instrument to impact or vibration during transportation.

b. Transport in the carrying case. It is recommended that cushioning material be used around the case.

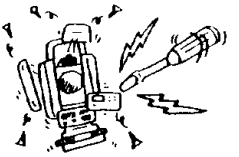
〈Others〉

a. Be sure to secure the instrument with one hand when mounting on or removing from the tripod.



b. Be sure to check the instrument before starting the job.

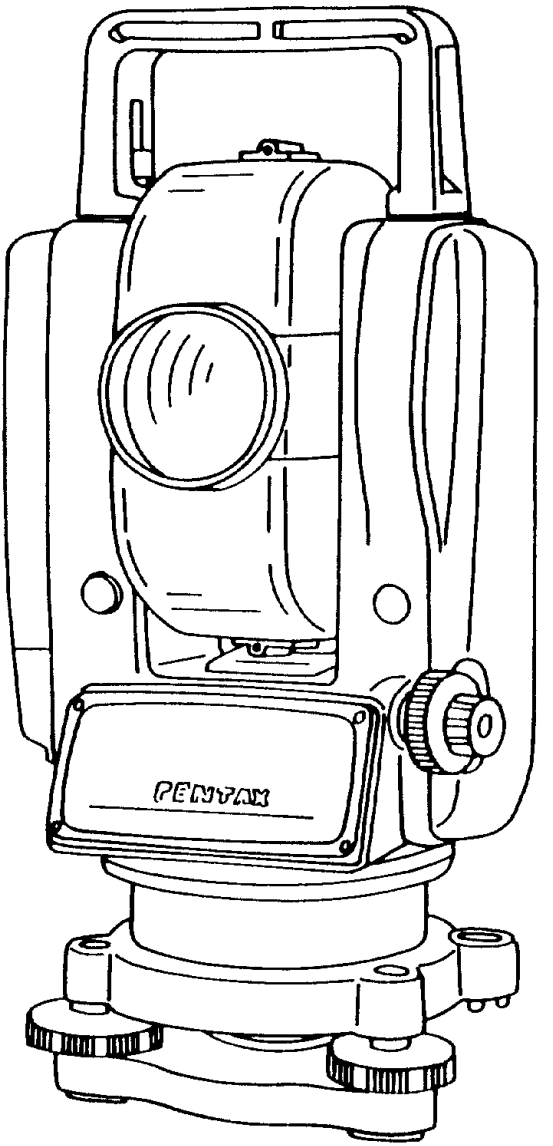
c. Be sure not to try to disassemble the instrument even when a malfunction is found. Contact your local dealer.



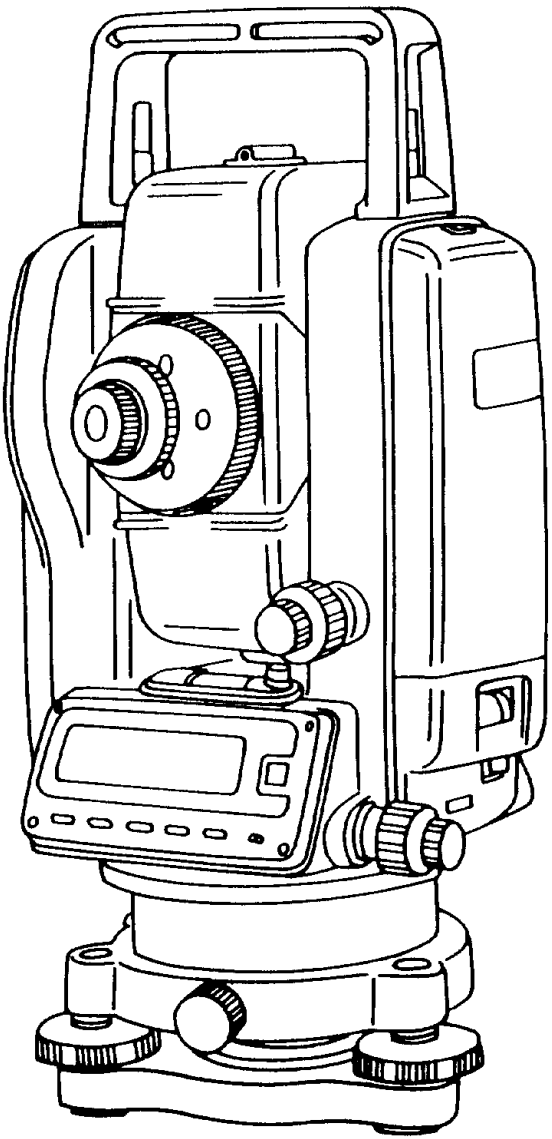
d. To realise full capability of the instrument, adhere to cautions described in each chapter of this manual.

PREPARATIONS

2-2 Nomenclature of parts



PREPARATIONS

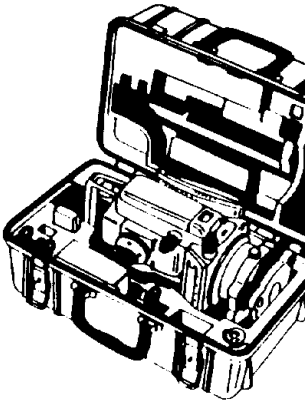


PREPARATIONS

2-3 Unpacking and storing

〈Unpacking〉

1. Gently set down the carrying case so that its cover is upward.
2. Unlatch and open the case while pushing the latch lock(safety device).
3. Take the instrument out of the case.



〈Storing〉

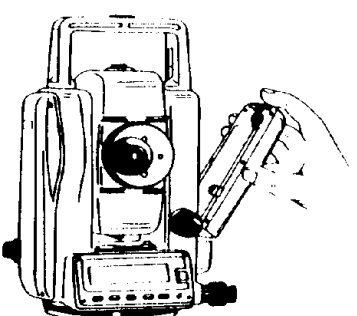
1. Set the telescope close to horizontal, and lightly tighten the telescope clamp screw.
2. Align the yellow dots, and lightly tighten the upper clamp screw.
3. Place the instrument into the case with the yellow dots towards you.
4. Close the case lid and lock the latch.

PREPARATIONS

2-4 Battery insertion and recharging

〈Removing the battery〉

Press the button, on top of the battery, and pull away.



〈Attaching the battery〉

Insert the bottom of the battery into the dimple on the standard cover, and press the top of the battery into the cover until it clicks.

〈Remaining battery capacity〉

When turning the power on, symbol of battery is displayed on the right of LCD display to indicate the status of battery consumption.

 ..... Operation possible.

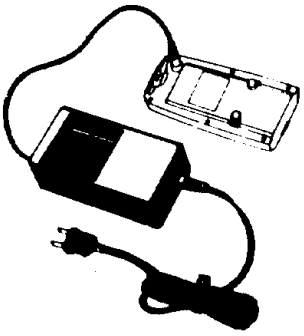
 ..... Get another battery ready.

 ..... Operation is possible, but replacement is recommended.

|BATT CHANGE| ..... Will disappear 5 seconds after it is displayed. Replace or recharge the battery.

〈Recharging〉

1. Insert the battery charger into the wall socket.
2. Remove the on-board battery from the main body, and connect the plug of the charger to the charging connector on the battery.
3. Recharging will be completed in 1.5 hours. (The indicator lamp blinks.) Remove the plug from the charging connector.



〈Note on recharging〉

- The charger has built-in circuitry for protection from over-recharging. However, do not leave the charger plugged into the wall socket after recharging is completed.
- Be sure to recharge the battery at a temperature of 0°C ~ +45°C./+32°F ~ +104°F. Proper recharging may not be possible out of the specified temperature range.
- When the indicator lamp, even after connecting the battery and charger, does not blink, either the battery or the charger may be damaged.

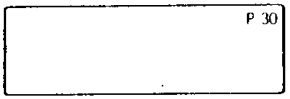
〈Note on storage〉

- Rechargeable battery can be repeatedly recharged 300 ~ 500 times. However, complete discharge of the battery may shorten its' service life.
- In order to get the maximum service life out of the battery, be sure to recharge it once a month.

3 DISPLAY AND KEY PANEL

3-1 Display and symbols

Display and symbols have the following meaning, respectively.

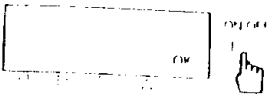
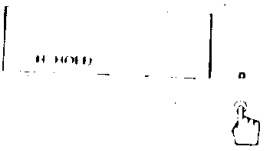
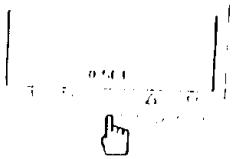
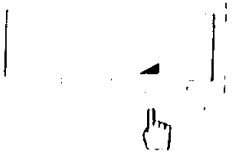
DISPALY · SYMBOL	CONTENTS
	| ⋮ symbol | Indicates distance is being measured.
	|SHOT| Indicates distance is being measured in "SHOT" mode, not in continuous measurement.
	|DOT MATRIX| LCD panel consists of 12 characters in two lines for displaying data or messages.
	|P-30| P-30 is displayed when prism constant offset is set to "-30mm", For "0", P-0 is displayed.
	|0ppm| When the standard atmospheric correction (15°C, 760mmHg/59°F, 29.9inHG) is set or when "NIL" is selected, the message is displayed.
	| ▮ symbol | The symbol indicates the remaining battery capacity. As the capacity goes down, the blank portion increases in 3 phases.
	| ◢ symbol | Appears during distance measurement to indicate respective distance measured. ◢ : Horizontal distance, ◢ Slope distance, ◢| : Difference in height

DISPLAY AND KEY PANEL

3-2 Function of each key

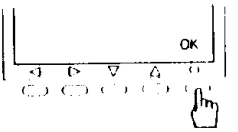
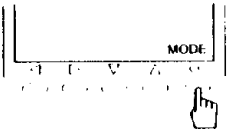
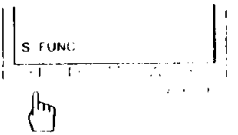
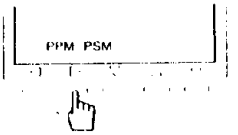
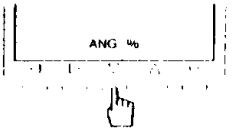
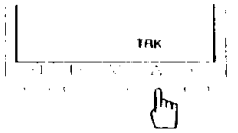
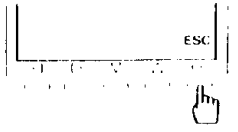
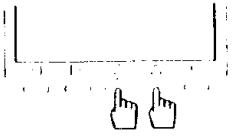
Each key performs multiple functions as described below.

Functions of each key during operation

KEY	FUNCTION
	To turn the power on or off.
	To illuminate the LCD panel and the reticle.
	To select horizontal angle right or left.
	To retain the horizontal angle on the display by pressing twice. (HOLD)
	To set the horizontal angle to 0°0′0″ by pressing twice.
	To select desired distance. Slope distance, horizontal distance and difference in height are displayed in sequence. Also changes to the distance mode from angle mode.

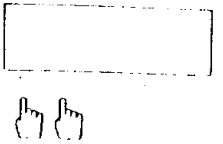
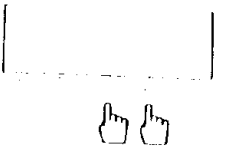
DISPLAY AND KEY PANEL

Functions of each key during operation

KEY	FUNCTION
	Pressing OK completes the entry of numerical value or selection of a mode, and prompts the next sequence.
	Pressing MODE prompts selection of any mode such as special function , correction and so on.
	Pressing S.FUNC prompts selection of any of special functions (shot measurement, stake- out, REM,RDM and coordinates measurement)
	Pressing PPM PSM prompts the change of temperature, atmospheric pressure or prism constant offset.
	Pressing ANG.% prompts the shift from distance mode to angle mode. In angle mode, vertical angle is converted to percentage of grade.
	Pressing TRK prompts the change of distance measurement mode from fine mode to coarse (fast) mode Fine mode: mm/2.5 sec. Fast mode: cm/0.6 sec.
	Pressing ESC returns the instrument to ordinary measurement status.
	Pressing △ or ▽ , in the special function mode, displays each of the special measurement modes in sequence.

DISPLAY AND KEY PANEL

Functions of each key during the entry of numerical values

KEY	FUNCTION
	Pressing ◁ shifts the cursor to the left. Pressing ▷ shifts the cursor to the right.
	Pressing ▽ each time decreases the value by one. Pressing ▽ each time increases the value by one.

4 OPERATING CHART

5. INITIAL SETTINGS

The instrument enables you to select any of various conditions to determine the measurement conditions. This selection is called "INITIAL SETTINGS". Factory settings are those in [ ].

Initial setting A

ITEMS	SELECTIONS
Atmospheric correction	[VALID] / NIL (no correction)
Prism constant offset	[Numeric input] / – 30mm/0mm
Vertical angle mode	[Zenith 0] / Horizontal 0/Compass graduation
Number of shot measurement	[One] / 3/3 and average/5 and average
Refraction coefficient	[0.14] / 0.20/NIL(no corrction)
Unit of distance	[Meter] / Feet
Unit of angle	[360°] / 400G / Mil / Dec
Unit of least angle	[COARSE] / FINE
Preferential mode	[Distance mode] / Angle mode

Initial setting B

ITEMS	SELECTIONS
LCD density	LOW ·· HIGH
Back light brightness	DOWN ·· UP
EDM buzzer	[ON]/OFF
Quadrant buzzer	[ON]/OFF
Auto power off	[10min]/NO

Initial setting C

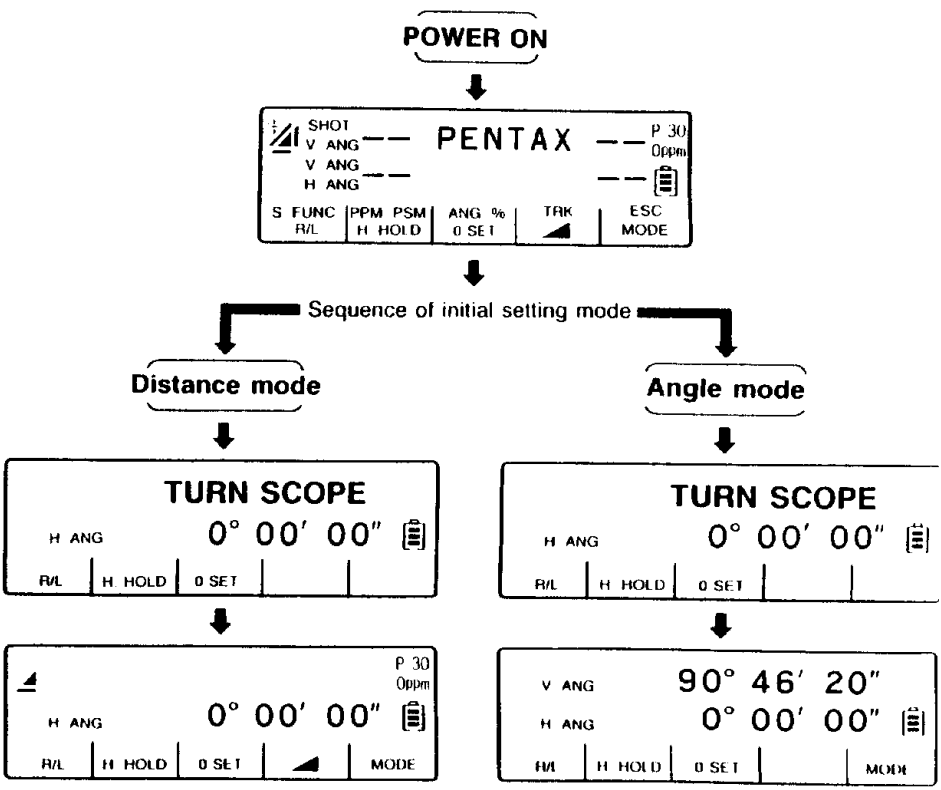
ITEMS	SELECTIONS
Baud rate	[1?] / 24 / 48 / 96
Data bits	[8] / 7
Parity	[NON] / ODD / EVN
Stop bits	[1] / 2

Initial setting A ..... Refer to page 60
Initial setting B ..... Refer to page 68
Initial setting C ..... Refer to page 00

6 ANGLE MODE AND DISTANCE MODE

6-1 Measurement mode when the power is turned ON

The instrument provides two different measurement modes. One is the distance mode which permits measurement of distance as well as angle. The other is angle mode which allows only angle measurement. When the instrument is set to angle mode, power supply to the EDM is automatically cut off to prevent unnecessary battery drainage.



- Distance mode and angle mode can be interchanged during operation.
- Factory setting for initial setting mode is distance mode.

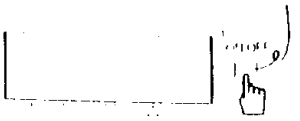
Change of initial setting ..... Refer to page 59
Change to distance mode from angle mode ..... Refer to page 32
Change to angle mode from distance mode ..... Refer to page 31

7 PREPARATION FOR SURVEYING

7-1 Turning the power ON or OFF

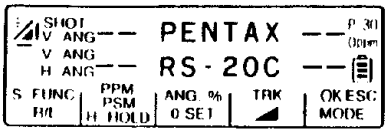
OPERATION

POWER ON

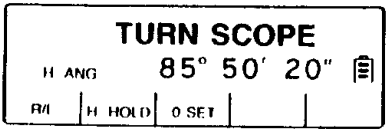


When pressing ON/OFF, all segments on the display light up, and horizontal angle measurement is possible in 2 seconds.
*Press ON/OFF to turn the power off.

DISPLAY



⬇ 2 seconds after



Horizontal angle measurement (right) is possible.

⬇

Proceed to "Indexing vertical 0 point".

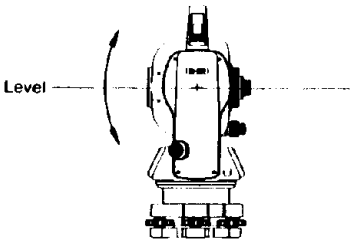
- Index the vertical 0 point when making measurements other than horizontal angles.
- The horizontal angle will be retained in memory even after turning the power off. The value of the horizontal angle will be displayed when the power is turned on again. If the horizontal angle in memory is not necessary, perform "Horizontal angle 0 setting".
- The power is automatically turned off when no operation is performed for 10 minutes due to "Auto power off function".

Change to horizontal angle R/L ..... Refer to page 24
Retention of horizontal angle (HOLD) ..... Refer to page 25
Horizontal angle 0 setting ..... Refer to page 24
Automatic power off function ..... Refer to page 74

PREPARATION FOR SURVEYING

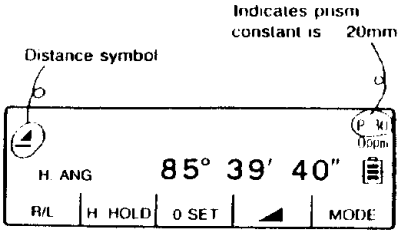
7-2 Indexing vertical 0 point

OPERATION



After turning the power on, turn the telescope upward from the depressed position. Vertical 0 point is indexed when the telescope passes level. Distance symbol (◢) appears, making it possible to measure vertical angle and distances.

DISPLAY



- Horizontal angle measurement is possible without indexing vertical 0 point.
- The horizontal angle, which is displayed when turning the power on, is the value in memory If this horizontal angle is not necessary, perform " Horizontal angle 0 setting".
- Distance measurement may be possible without intentionally indexing vertical 0 point when the telescope passes the 0 point during horizontal angle measurement.

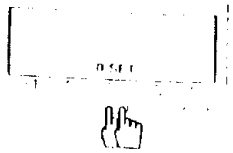
Change to horizontal angle left ..... Refer to page 24
Horizontal angle 0 setting ..... Refer to page 24
Vertical angle measurement ..... Refer to page 22
Distance measurement ..... Refer to page 28

8 ANGLE MEASUREMENT

8-1 Angle measurement (in distance mode)

OPERATION

1 *The operations described hereafter should be performed after indexing vertical 0 point.*

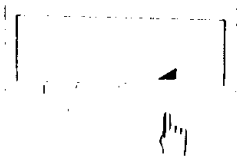


After sighting at the first object, press 0 SET twice to set the horizontal angle to 0.

2

Sight at the second object, and read the horizontal angle.

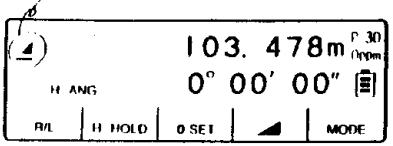
3



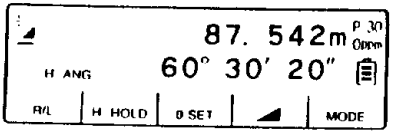
Press ◢ to display slope distance and vertical angle.

DISPLAY

Indicates measurement is in distance mode

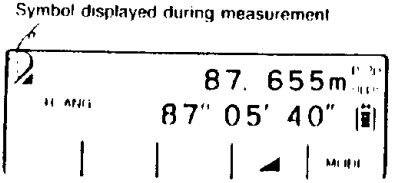


When the object is a prism, distance to a prism is also displayed.



When the object is a prism, distance to a prism is also displayed. (◢ : Horizontal distance)

Symbol displayed during measurement



(◢ Slope distance)

- "Indexing vertical 0 point" is not necessary for horizontal angle measurement only
- 0 SET is not valid for vertical angle.
- Horizontal angle will be retained when the power is turned off.

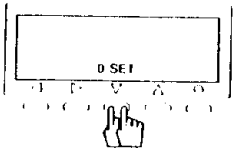
Indexing vertical 0 point ..... Refer to page 21
Horizontal angle 0 setting ..... Refer to page 24

ANGLE MEASUREMENT

8-2 Angle measurement (in angle mode)

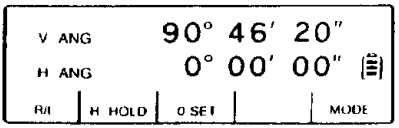
OPERATION

1 *The operations described hereafter should be done after indexing vertical 0 point.*



After sighting at the first object, press 0 SET twice for "Horizontal angle to 0".

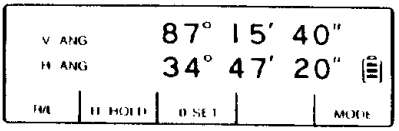
DISPLAY



Setting horizontal angle to 0.

2

Sight at the second object, and read the vertical and horizontal angles.

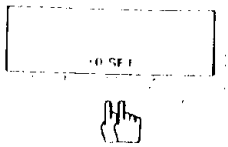


- "Indexing vertical 0 point" is not necessary for horizontal angle measurement only.
- 0 SET is not valid for vertical angle.
- The horizontal angle can be retained when the power is turned off during the measurement.
- Vertical and horizontal angle are simultaneously displayed in "Angle mode" after indexing the vertical 0 point.

Indexing vertical 0 point ..... Refer to page 21
Horizontal angle 0 setting ..... Refer to page 24

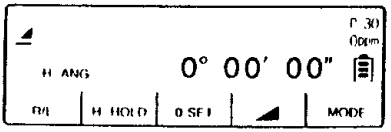
8-3 Horizontal angle 0 setting

OPERATION



Pressing 0 SET twice sets the horizontal angle to 0°00′00″.

DISPLAY



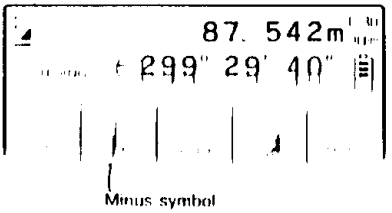
- 0 SET is valid for horizontal angle only.
- Horizontal angle can be set to 0 any time except when it is in "HOLD". If 0 SET is pressed, by mistake, during operation there is no effect unless the key is pressed twice. When the beep stops, operation to the next step is possible.

8-4 Horizontal angle measurement (left)

OPERATION

(−) symbol is displayed preceding the horizontal angle value when R/L is pressed, to show horizontal angle left.

DISPLAY

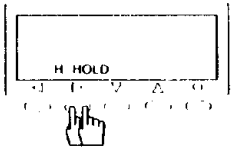


- R/L is not valid for vertical angle.
- Press R/L to change horizontal angle left to right.

ANGLE MEASUREMENT

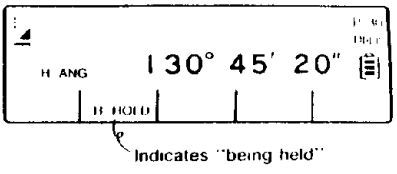
8-5 Horizontal angle retention (H.HOLD)

OPERATION



Press H HOLD twice to retain the measured value of horizontal angle.

DISPLAY



- H.HOLD is not valid for vertical angle or distance.
- Press H.HOLD once to release "HOLD".
- If H.HOLD is pressed, by mistake, during operation there is no effect unless the key is pressed twice. When the beep stops, operation to the next step is possible.

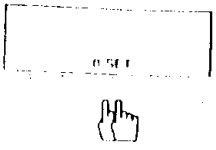
ANGLE MEASUREMENT

8-6 Horizontal angle quadrant setting

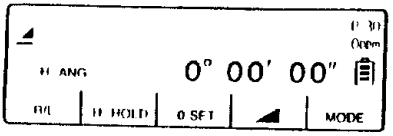
OPERATION

DISPLAY

1

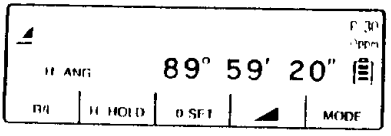


Sight at the first object and then press 0 SET twice to set the horizontal angle to 0.



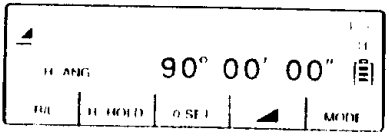
2

Rotate the instrument around the vertical axis and stop it when the beep starts.



3

Use the tangent screw to set the horizontal angle to 90°00′00″ and sight at the new point to be set.



- The beep sounds when the reading passes any of 0°, 90°, 180°, 270°. The beep starts where the angle is ±1′ to respective value, and stops where the angle is within ±20″ from the respective value.
- The beep can be canceled in initial settings.

Selection of quadrant (90°) buzzer ON/OFF ..... Refer to page 73

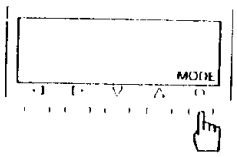
ANGLE MEASUREMENT

8-7 Display of percentage of grade

The vertical angle can be converted to percentage of grade when measurement is in angle mode

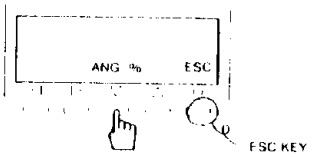
OPERATION

1



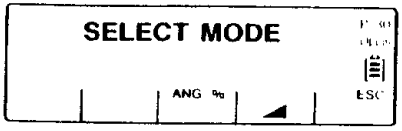
Press MODE to initiate mode selection

2

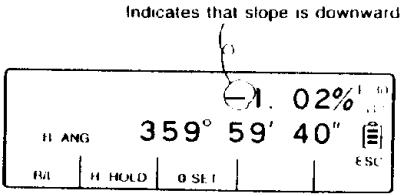


Pressing ANG.% converts the vertical angle to percentage of grade.

DISPLAY



Indicates that slope is downward



- In percentage mode, a horizontal line of sight is translated into 0%, and 45° (+ or − from horizontal) is translated into 100%.
- Press ESC to return to the usual graduation mode.
- In percentage mode, when the elevated or depressed angle of the telescope exceeds 45° (100% in display), error message EXCESS ANG is displayed.
- When the grade returns within ±100%, EXCESS ANG disappears.

Percentage of grade in distance mode ..... Refer to page 30

9 DISTANCE MEASUREMENT

9-1 Fine measurement

OPERATION

1

Set the instrument to distance mode. (Refer to page 33)

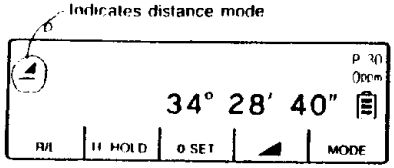
2

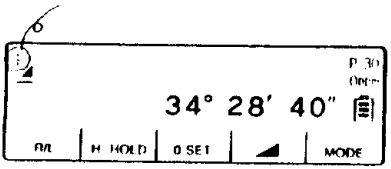
- Sight at a prism.
- The buzzer sounds when the instrument receives reflected beam, and ✻ is displayed. Measurement in a unit of mm automatically starts.

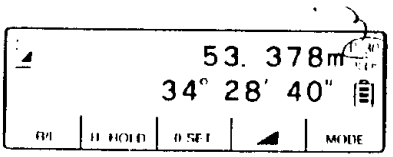
3

The measurement value is quickly displayed and an automatically repeated measurement is performed. (Refer to page 31 for displays of slope distance and difference in height)

DISPLAY







Horizontal distance 53.378 m

- "Indexing vertical 0 point" is required prior to distance measurement.
- Confirm the constant of prism in use. (Refer to page 41 for the alteration of prism constant offset.)
- ◢ is displayed to indicate horizontal distance. Horizontal angle is also displayed.
- Symbols for distance mode are as follows: (◢) Horizontal distance, (◢) Slope distance, (◢) Difference in height

DISTANCE MEASUREMENT

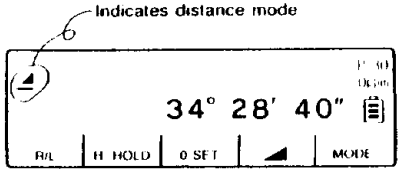
9-2 Coarse(fast) measurement

OPERATION

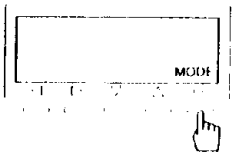
1

Set the instrument to distance mode. (Refer to page 33 to set distance mode.)

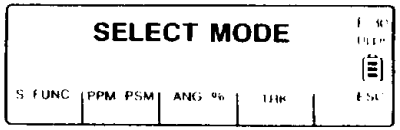
DISPLAY



2

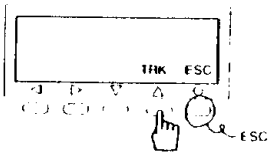


Press MODE to select desired mode.

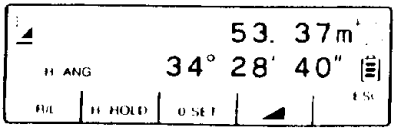


Stand-by for mode selection

3



Press TRK to perform coarse (fast) measurement. Automatically repeated measurement is performed every 0.6 second in a unit of cm.



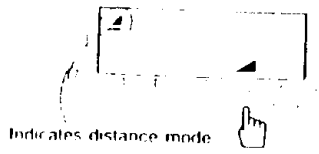
- Slope distance and difference in height measurements are also possible in coarse (fast) measurement mode by pressing (◢) key.
- Press ESC to return to fine measurement.

DISTANCE MEASUREMENT

9-3 Display of slope distance and difference in height

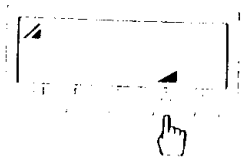
OPERATION

1



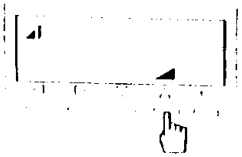
Indicates horizontal distance. Press ◢ to display slope distance when horizontal distance is on display.

2



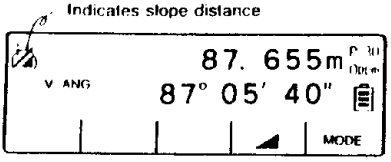
Press ◢ key to display difference in height when slope distance is on display.

3

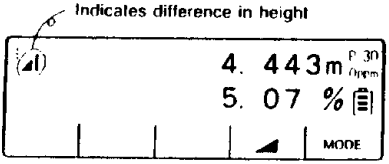


Press ◢ key to display horizontal distance when difference in height is on display.

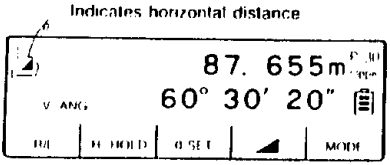
DISPLAY



Slope distance and vertical angle are displayed.



Difference in height and percentage of grade are displayed.

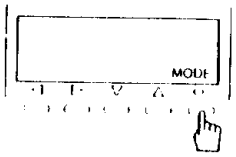
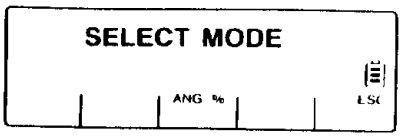
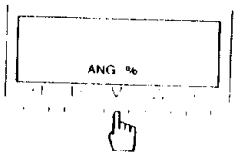
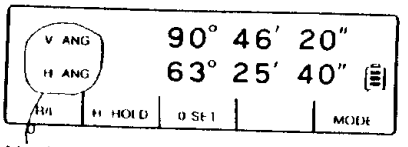


Horizontal distance and horizontal angle are displayed.

- The displays of HORIZONTAL DISTANCE → SLOPE DISTANCE → DIFFERENCE IN HEIGHT → HORIZONTAL DISTANCE appear in order by pressing (◢) key each time.
- The combinations of measurements on display are as follows.
  "HORIZONTAL DISTANCE/HORIZONTAL ANGLE"
  "SLOPE DISTANCE/VERTICAL ANGLE"
  "DIFFERENCE IN HEIGHT/PERCENTAGE OF GRADE"

10 ALTERATION OF MEASUREMENT MODE

10-1 Alteration from distance mode to angle mode

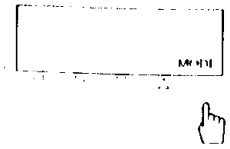
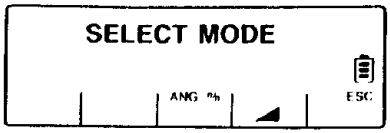
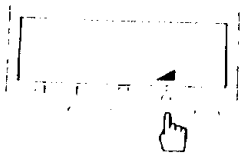
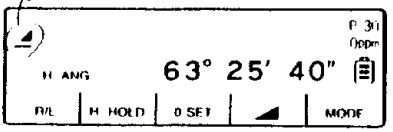
OPERATION	DISPLAY
1 	
Press MODE to select desired mode.	Stand-by for mode selection.
2 	
Press ANG.% to set to angle mode.	Vertical and horizontal angles are simultaneously displayed in angle mode.

- Angle measurement is possible in distance mode. But, distance measurement is not available in angle mode.
- The mode appearing first when the power is turned on is the one set by the initial settings.

Angle measurement ..... Refer to page 22
Distance measurement ..... Refer to page 28
Initial settings ..... Reger to page 59

ALTERATION OF MEASUREMENT MODE

10-2 Alteration from angle mode to distance mode

OPERATION	DISPLAY
1  Press MODE to select desired mode.	 Stand-by for mode selection.
2  Press ◢ to set to distance mode.	Symbol for distance mode 

- Angle measurement is possible in distance mode. But, distance measurement is not available in angle mode.
- The mode appearing first when the power is turned on is the one set by the initial settings.

Angle measurement ..... Refer to page 22
Distance measurement ..... Refer to page 28
Initial settings ..... Refer to page 59

11 MODE SELECTIONS

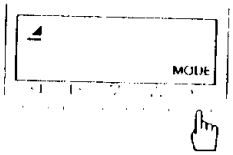
11-1 Mode selection in distance mode

Any of four different modes mentioned below can be selected in distance mode.

1. S.FUNC mode ..... SHOT measurement, Stake-out measurement REM, RDM, Coordinates measurement
2. PPM.PSM mode ..... Change of temperature, atmospheric pressure and prism constant offset
3. ANG.% mode ..... Change to angle mode
4. TRK mode ..... Coarse (fast) distance measurement (in a unit of cm)

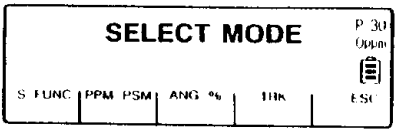
OPERATION

1

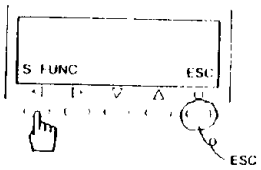


Press MODE to set to the desired mode.

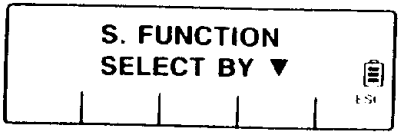
DISPLAY

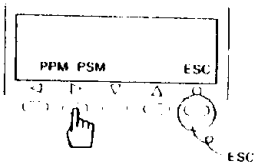


2

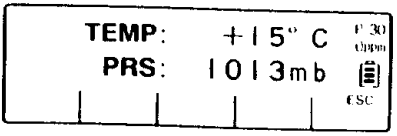


Press S.FUNC to select desired special measurement mode. (Refer to page 44 for selection)





Press PPM.PSM to change temperature, atmospheric pressure and prism constant offset. (Refer to page 37 for change of correction factors.)



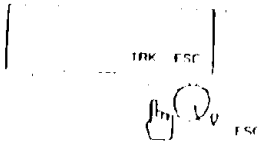
Temperature and atmospheric pressure in memory are displayed.

MODE SELECTIONS

OPERATION

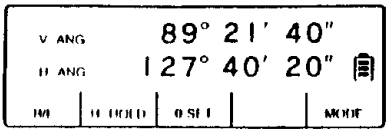
3

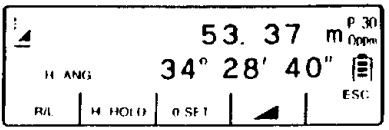
Press ANG % to set to angle mode.
(Refer to page 33 for change to angle mode)



Press TRK to set to coarse (fast) distance measurement mode. Measurement is performed every 0.6 second in a unit of cm. (Refer to page 30 on TRK.)

DISPLAY





● Pressing ESC returns to the previous mode.

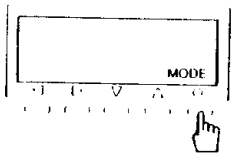
MODE SELECTIONS

11-2 Mode selection in angle mode

Display of percentage of grade and change to distance mode are possible in angle mode.

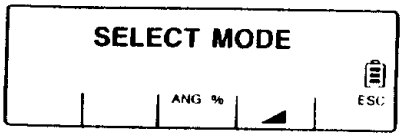
OPERATION

1

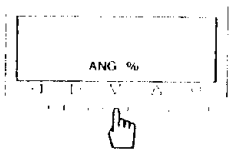


Press MODE to select the desired mode.

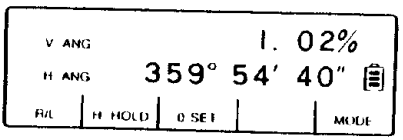
DISPLAY



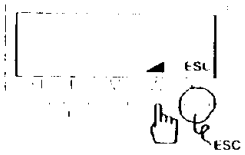
2



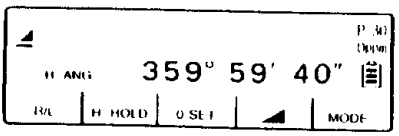
Press ANG.% to display percentage of grade.



3



Press (◢) to set to distance mode.



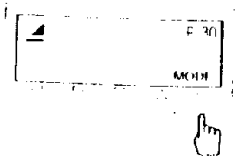
- Pressing ESC returns to the mode previous to SELECT MODE
- The mode to be initiated when the power is turned on again is angle mode.

12 CORRECTION MODES

12-1 Alteration of temperature

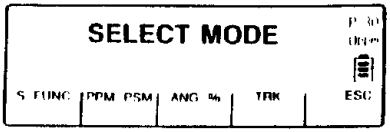
OPERATION

1



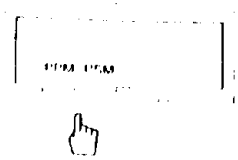
Press MODE to select the desired mode.

DISPLAY

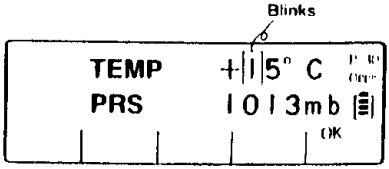


Stand-by for mode selection.

2

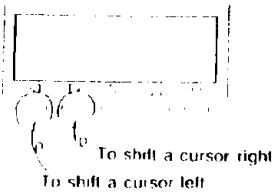


Pressing PPM PSM displays temperature and atmospheric pressure in memory.



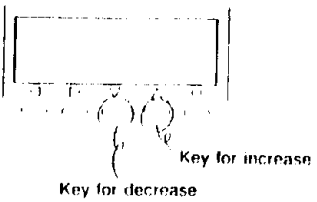
3

- The digit, of a number, covered by a blinking cursor can be changed.
- Press RIGHT SHIFT key to shift the cursor right, and press LEFT SHIFT key to shift the cursor left.



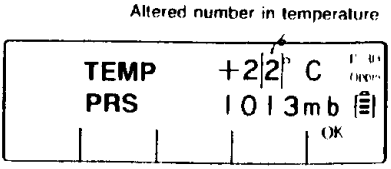
4

- To change the number, use PLUS key for increase and MINUS key for decrease. The number goes up or down by one each time that the key is pressed.

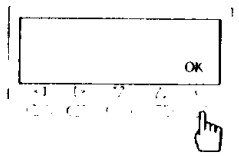
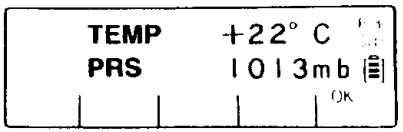


5

- Use SHIFT key to select the digit to be changed and then use the PLUS or MINUS key to increase or decrease the number.



CORRECTION MODES

OPERATION	DISPLAY
6  Press OK to store the new temperature. Blinking cursor moves to the display of atmospheric pressure.	 Stand-by for the alteration of atmospheric pressure.

- When the distance unit is set to "Feet" in initial setting mode A, atmospheric correction in Fahrenheit for temperature is available with the operations described above.
- Correction range of temperature is −30°C ~ +60°C/−22F ~ +140°F.
- If the change of temperature is not necessary,press OK to proceed to the change of atmospheric pressure. If the change of atmospheric pressure is not necessary, either, press OK to return to measurement mode.
- Temperature and atmospheric pressure settings will be retained in memory when the power is turned off.
- 15°C or 59°F is the standard value for the correction of temperature.
- When PPM FIXED is displayed, no atmospheric corrections are accessible as "no correction" (NIL) has been selected in initial settings.

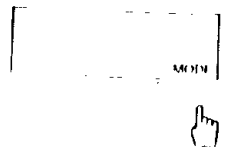
The error of a measurement, when correction of temperature is not done, is −0.1mm at 100m per +1°C or 0.003ft at 300 feet per +2°F.

CORRECTION MODES

12-2 Alteration of atmospheric pressure

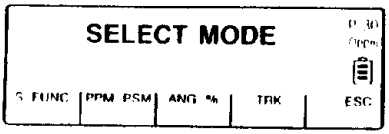
OPERATION

1



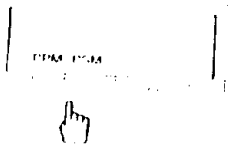
Press MODE to select the desired mode.

DISPLAY

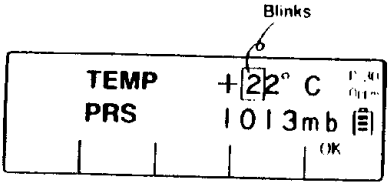


Stand-by for mode selection.

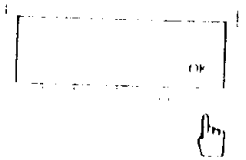
2



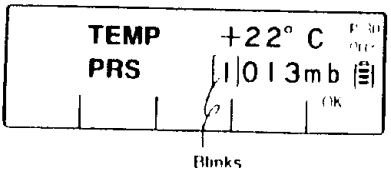
Pressing PPM PSM to display temperature and atmospheric pressure in memory. (The cursor on display of temperature blinks.)



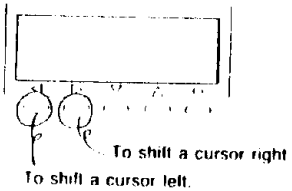
3



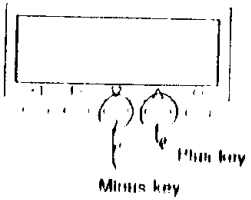
Press OK to move the cursor to atmospheric pressure.



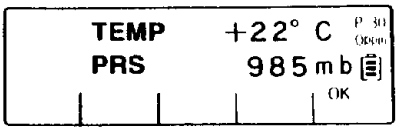
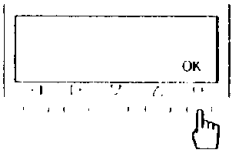
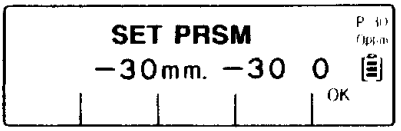
4 · The digit, of the number, covered by a blinking cursor can be changed.
· Press RIGHT SHIFT key to move the cursor right, and press LEFT SHIFT key to move th cursor left.



5 To change the number, use PLUS key to increase and MINUS key to decrease. The number goes up or down by one each time that the key is pressed.



CORRECTION MODES

OPERATION	DISPLAY
6 ○ Use SHIFT key to select the digit to be changed. Use PLUS or MINUS key to change the number.	
7 	
Press OK to terminate the atmospheric pressure change operation.	Stand-by for change of prism constant offset.

- When the distance unit is set to "Feet" in initial setting mode A, atmospheric correction i inHg for pressure is available with the operations descirbied above
- The correction range of atmospheric correction is 420mmHg ~ 840mmHg/17.0inHg ~ 33.0inHg
- If a change of prism constant offset is not necessary, press OK to return to the standard meas urement.
- 760mmHg or 29.9inHg. is the standard value for the correction of atmospheric pressure

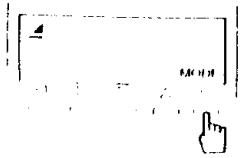
The deviation of measurement is about −0.4mm at 100m per 10mmHg or 0.003 foot at 300 feet per 0.1inHg when no correction is performed.

12-3 Alteration of prism constant

The change of prism constant is possible only when ENTER is set in initial settings. (Refer to page 63)

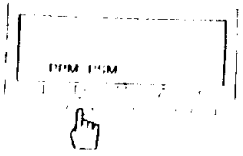
OPERATION

1



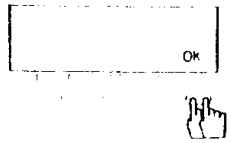
Press MODE to select the desired mode.

2



Press PPM PSM to display temperature and atmospheric pressure.

3

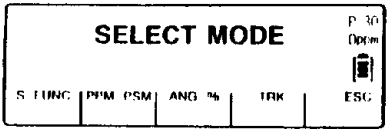


Press OK twice to move to SET PRSM for the change of prism constant.

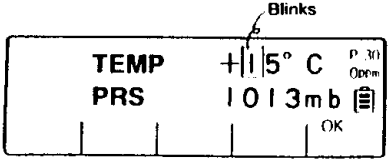
4 The digit, of the number, covered by a blinking cursor can be changed. Press RIGHT SHIFT key to move the cursor right, and press LEFT SHIFT to move the cursor left.

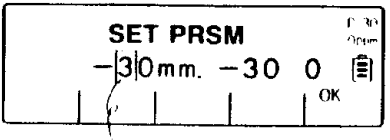
5 To change the number, use PLUS key to increase and MINUS key to decrease. The number goes up or down each time that the key is pressed

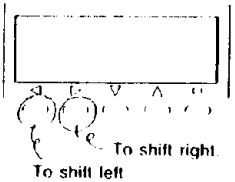
DISPLAY

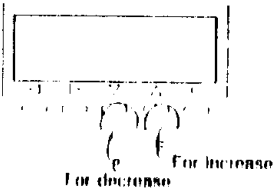


Stand-by for mode selection.

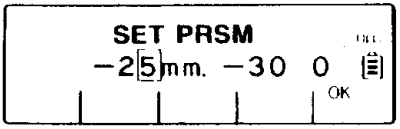
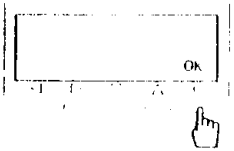
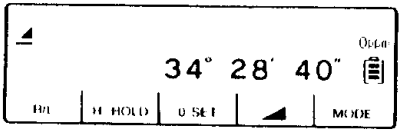








CORRECTION MODES

OPERATION	DISPLAY
6 ○ Use SHIFT key to select the digit to be changed. Use PLUS or MINUS key to change the number.	
7  Press OK to store the prism constant. Display returns to measurement mode.	

- When setting the prism constant to "0" or "−30", bring the cursor to that display, and press OK. The prism constant is selected and stored in memory.
- When selecting "0" or "−30" for prism constant setting, or when entering "0" or "−30" by key, [P-30] or [P-0] is displayed at the right of display, accordingly.
- When entering prism constant other than "−30" or "0", no display for prism constant appears
- Factory setting is "−30".
- The prism constant is retained in memory when the power is turned off.
- PRSM FIXED is displayed when prism constant is fixed in the initial settings. Entry by key is not accessible. Change the initial setting to ENTER.

13 SPECIAL FUNCTIONS

Five different special measurements are available in distance mode with simple key operations.

SHOT MEASUREMENT

Measurements in standard mode are automatically repeated.
The measured value is displayed every several seconds. In shot measurement, number of measuremnts can be selected in the initial settings (single, 3 times, 3 times and average, and 5 times and average). The beam emission stops after the specified number of measurements is performed. This helps save battery power.

STAKE-OUT MEASUREMENT

The difference between a set distance and measured distance can be displayed, by entering the set distance.

REMOTE ELEVATION MEASUREMENT (REM)

REM can be used to quickly measure the height of power transmission line, bridges or other targets on which the reflecting prism can not be located, by placing the prism right under the target.

REMOTE DISTANCE MEASUREMENT (RDM)

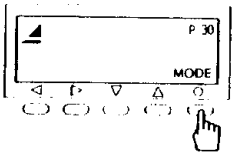
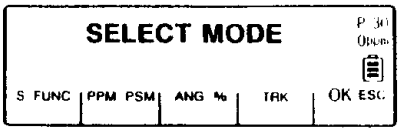
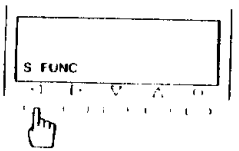
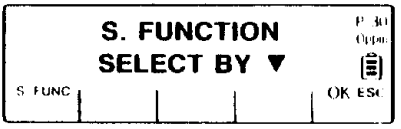
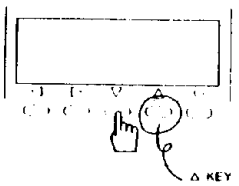
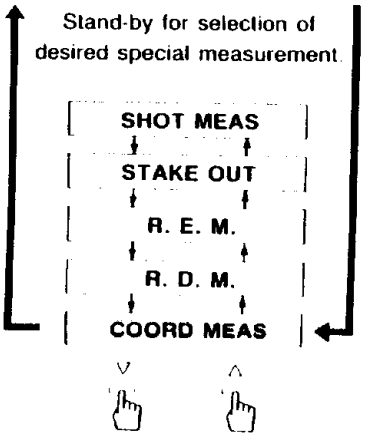
RDM can be used to measure the horizontal and slope distances, difference in height and percentage of grade between two target points.

COORDINATES MEASUREMENT

The coordinates values (N,E,Z) of the target point can be measured and displayed. The known station coordinates can be entered.

SPECIAL FUNCTIONS

13-1 Key operations for special functions

OPERATION	DISPLAY
1  Press MODE to select the desired mode.	 Stand-by for mode selection.
2  Press S.FUNC to select any of special measurement modes.	 Stand-by for selection of desired special measurement.
3  **Press ▽ or △ to select the desired special measurement mode.**	

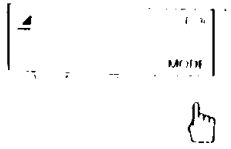
SPECIAL FUNCTIONS

13-2 Shot measurement

When setting to shot measurement mode in the initial settings, specified number of measurements, any of single, 3 times , 3 times and average or 5 times and average, only can be performed, and measurement stops.

OPERATION

1



Press MODE to select the desired mode.

2

Press S.FUNC to select the desired special measurement mode.

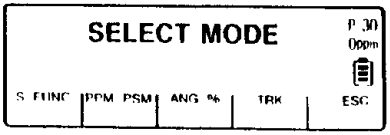
3

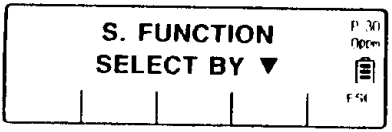
Press ▽ to display SHOT MEAS.

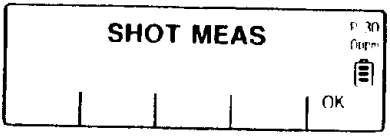
4

Press OK for confirmation.

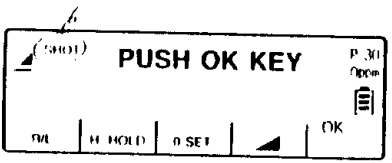
DISPLAY







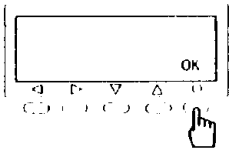
Indicates shot measurement



SPECIAL FUNCTIONS

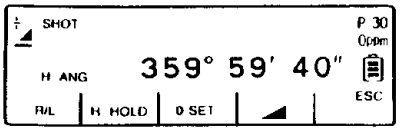
OPERATION

5

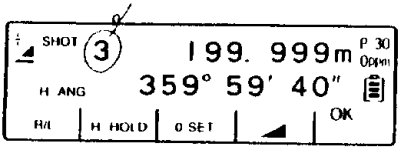


Measurement starts when pressing OK, and stops when specified number of measurement is finished. Press OK for another measurement.

DISPLAY



Number of shot measurement



- Press ESC to exit shot measurement mode. The instrument returns to the the state immediately prior to the operation of shot measurement.
  (If ESC is not displayed, press OK several times to display it.)
- 3A or 5A on the display stands for the measurements of 3 times and average or the measurements of 5 times and average, respectively.

SPECIAL FUNCTIONS

13-3 Stake-out measurement

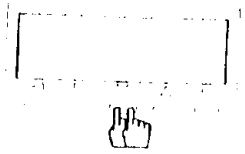
The difference between a set distance and measured distance can be displayed by entering the set distance. The range of distance for entry is 0.85mm ~ 1,999.999m or 0 ft ~ 6561.663ft, and 1999.999m ~ 1,999.999m or ~ 1,999.993ft ~ 1,999.993ft. for difference in height.

OPERATION

1

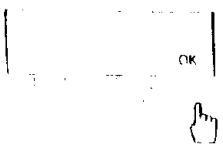
Like the shot measurement on page 45, press MODE to select the desired mode, and press S FUNC to select the desired special measurement mode

2



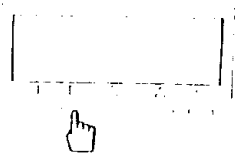
Press ▽ twice to display STAKE OUT.

3



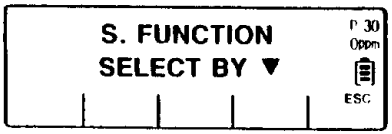
Press OK for entering the set distance.

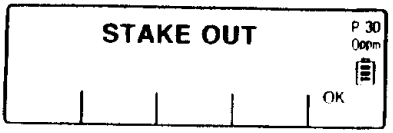
4 EX: Set distance = 123.456m

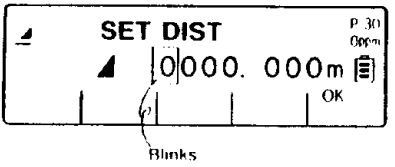


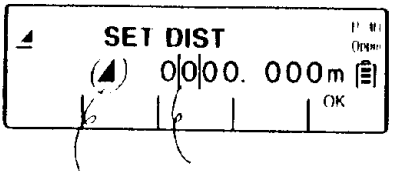
Press (▷) to shift the cursor right.
(Pressing (◁) to shift the cursor left.)

DISPLAY







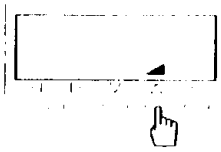


When ( ) is displayed, pressing ▽ changes the distance to be measured in order of slope, difference in height, and horizonta

SPECIAL FUNCTIONS

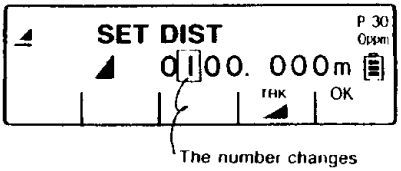
OPERATION

5



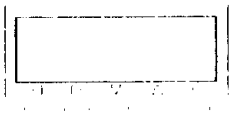
Press △ or ▽ to increase or decrease the number. The number changes by one each time that key is pressed.

DISPLAY

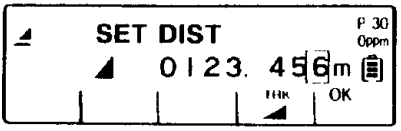


The number changes

6

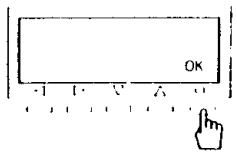


Press (▷) to shift the cursor onto the digit to be changed. Follow the operation as described in 5.

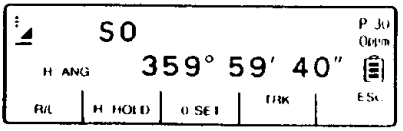


The distance entered is cleared when the power is turned off or when ESC is pressed.

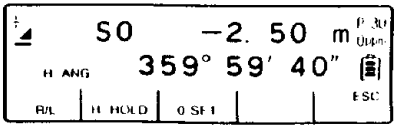
7



Press OK to terminate entering the set distance. Measurement (in cm) starts once the prism is sighted. Move the prism so as to make the difference 0.00m.



several seconds after

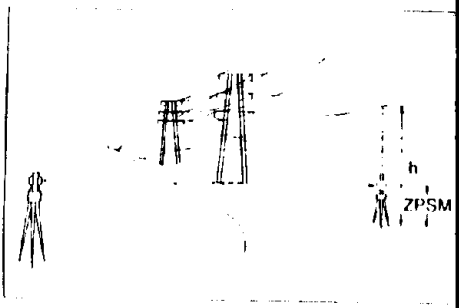


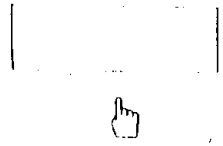
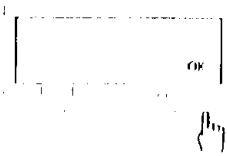
- The measurement value on the display in stake-out mode is the difference between the set distance and the one actually measured. (− symbol indicates that the distance actually measured is shorter than the set distance.
- The initial measurement in stake-out mode is in coarse(fast) measurement. If measurement in fine mode is requested, press TRK. Press it again to set to coarse(fast) mode.
- Press ESC to exit the stake-out mode. (If ESC is not displayed, press OK several times to display it.)

SPECIAL FUNCTIONS

13-4 Remote elevation measurement(REM)

In remote elevation measurement, the height of the target, which is not accesible, can be measured by placing a prism right under the target.



OPERATION	DISPLAY
1 Like the shot measurement described on page 45, press MODE to select the desired mode. Then, press S.FUNC to select the desired special measurement mode.	S. FUNCTION SELECT BY ▼ ESC
2  Press ▽ three times to display R.E.M.	R. E. M. OK
3  Press OK prompts the entry of prism height.	PRSM HEIGHT +0000 000m OK Blinks

SPECIAL FUNCTIONS

OPERATION

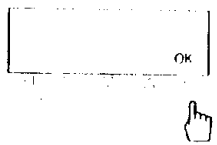
4

- Measure the height of prism placed right under the target, and enter that value into the instrument.
- The operation to enter the prism height is just same as entering the set distance in stake-out.

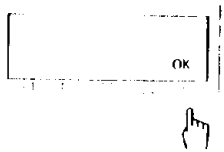
5

Press OK to store the entry of prism height.

6

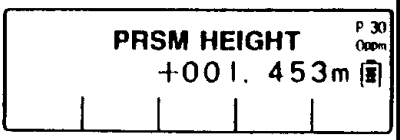


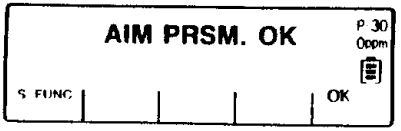
- Following guide message AIM PRSM, aim at the prism.

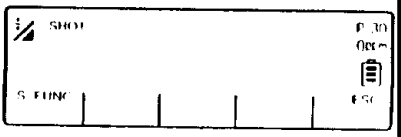


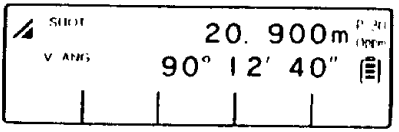
Press OK to start the measurement. The slope distance to the prism and prism height are displayed in succession.

DISPLAY

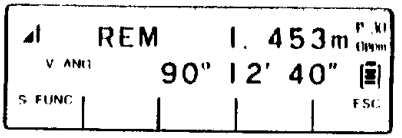






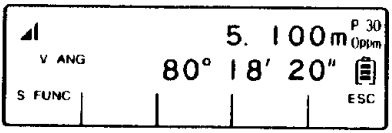


Immediately after displaying slope distance



Display of prism height

SPECIAL FUNCTIONS

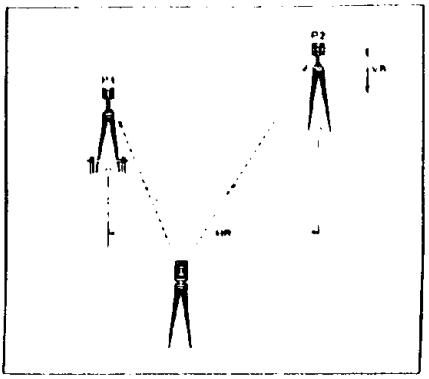
OPERATION	DISPLAY
7 Aim the telescope at the object to obtain the difference in height from the ground to the object.	 Difference in height from the ground

- Remote elevation measurement is performed in "Shot measurement", not in continuous measurement.
- Corrections of atmospheric refraction and earth curvature do not work in REM.
- Pressing S.FUNC during distance measurement returns the display to R. E. M. the remote elevation measurement mode and returns to the previous measurement mode.
- EXCESS ANG indicates that remote elevation measurement is impossible because the vertical angle is too wide or narrow. (If the inclination of the telescope returns within the measurement range, PRSM HEIGHT is displayed.)

SPECIAL FUNCTIONS

13-5 Missing line measurement (RDM)

The RDM mode can be used to measure the difference in height, horizontal distance, slope distance and percentage of grade between two target points.

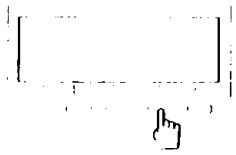


OPERATION

1

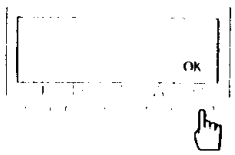
Press MODE to select desired mode. Press S.FUNC to select desired special measurement mode.

2



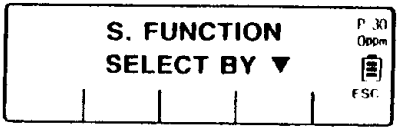
Press ∧ to display R.D.M

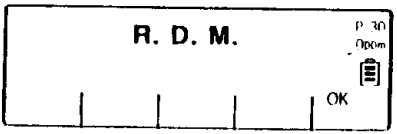
3

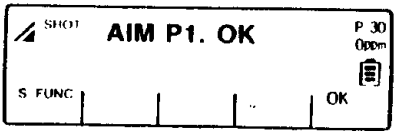


Press OK to start R.D.M measurement

DISPLAY





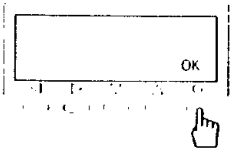


SPECIAL FUNCTIONS

OPERATION

1 Aiming at the first prism

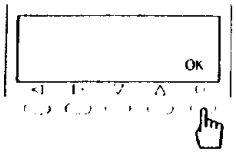
Following the guide message, aim at the first prism (P1).



After aiming at P1, press OK to display the slope distance and vertical angle.

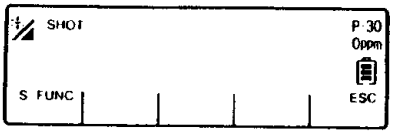
2 Aiming at the second prism

Following the guide message, aim at the second prism (P2).

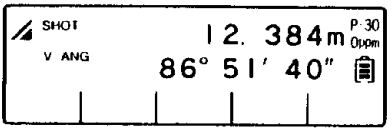


After aiming at P2, press OK to display the slope distance and vertical angle, then difference in height (top line) and horizontal distance (bottom line) between P1 and P2

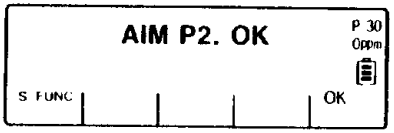
DISPLAY



⬇ Measuring



⬇ Temporary display of slope distance

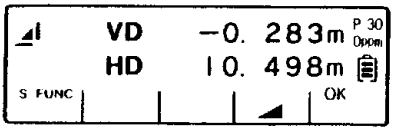


Prompts to aim at the second prism. (P2)

⬇

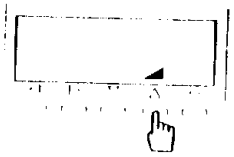
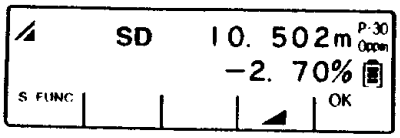
Temporary display of slope distance

⬇



Difference in height (Top line)
Horizontal distance (Bottom line)

SPECIAL FUNCTIONS

OPERATION	DISPLAY
6  Pressing (◢) changes the display to slope distance and %.	 Slope distance (Top line) Percentage of grade, % (Bottom line)

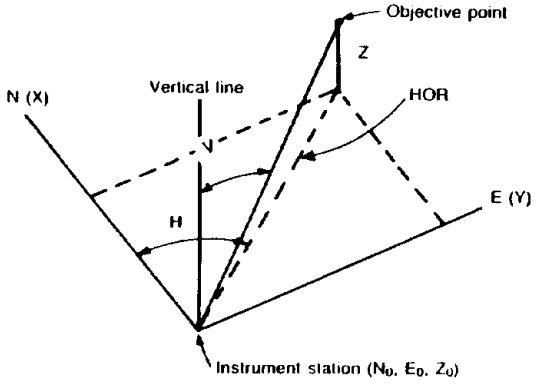
- RDM is performed in "shot measurement", not in continuous measurement.
- Pressing S.FUNC during the measurement returns the display to R. D.M. Reference point (P1) can be changed for further measurement.
- Pressing ESC during the measurement exits RDM mode, and returns to the previous measurement mode.

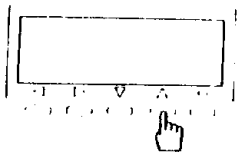
SHOT measurement ..... Refer to page 45

SPECIAL FUNCTIONS

13-6 Coordinates measurement

The coordinate values for any desired objects ca be obtained with reference to the instrument station. If the instrument station coordinates are not (0,0,0), first enter the station coordinates to obtain the objects coordinates in reference to the station.

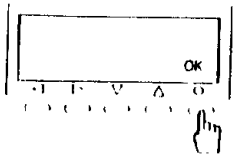


OPERATION	DISPLAY
1 Press MODE to select the desired mode. Press S.FUNC to select the desired special measurement mode.	S. FUNCTION SELECT BY ▼ P 30 0ppm ESC
2  Press △ to display COORD MEAS.	COORD MEAS P 30 0ppm OK

SPECIAL FUNCTIONS

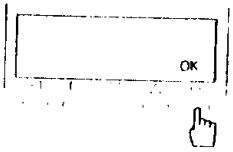
OPERATION

3



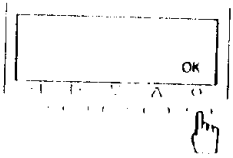
Press OK to start the coordinate measurement. MEAS blinks.

4



When entering the station coodrinates, press (▷) to move the blinking cursor onto STN. If entry of station coordinates is not necessary or they are already in memory, press OK to set backsight angle as described in 9.

5

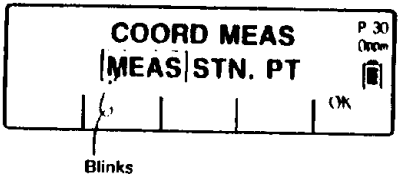


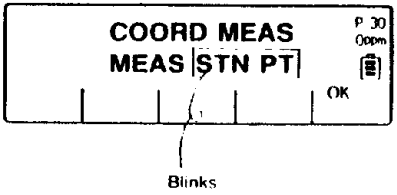
Press OK to enter the station coordinates

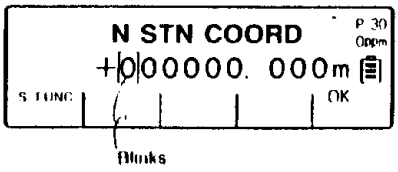
6

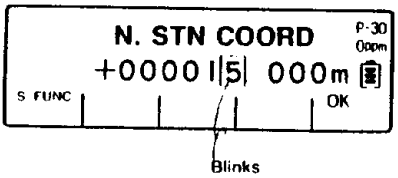
- Enter N coordinate value of the station point. (Refer to Page 27 for entry of numerical value.)

DISPLAY





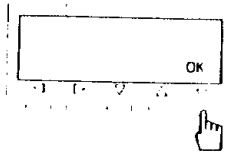




SPECIAL FUNCTIONS

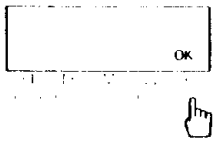
OPERATION

7



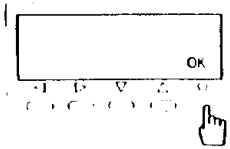
Press OK to complete the entry of N coordinate of the station point and display prompts to enter E coordinate value of the station point. Enter E and Z coordinates of the station point in turn.

8



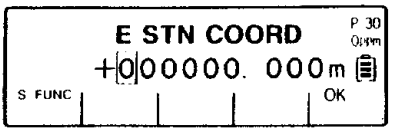
Press OK to complete the entry of the Z coordinate of the station point.

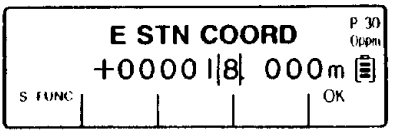
9 **Setting Backsight Point Angle**

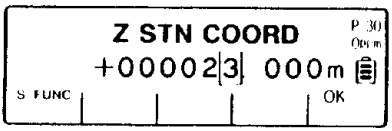


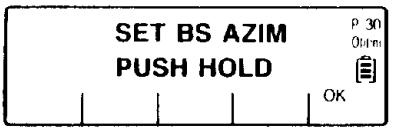
Press OK to prompt to set the backsight point azimuth angle.

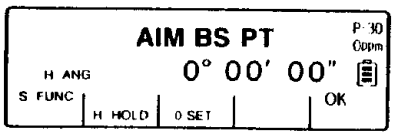
DISPLAY











SPECIAL FUNCTIONS

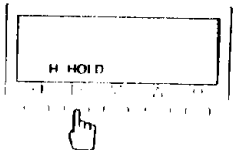
OPERATION

10

Turn the instrument around the vertical axis, and set the desired backsight angle.

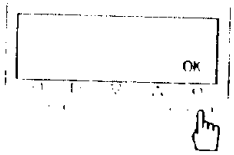
EX: Backsight angle 135°30'20"

11



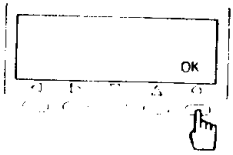
Press H.HOLD twice to retain the backsight angle. The prompt to aim at the backsight point is displayed.

12 Following guide message, aim at the backsight point.



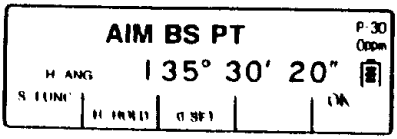
Press OK to cancel angle hold.
Prompt to aim at the foresight point is displayed.

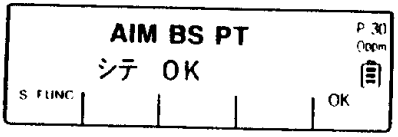
13 **Coordinates Measurement**

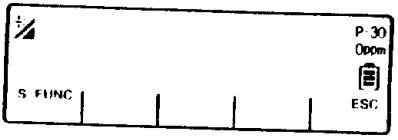


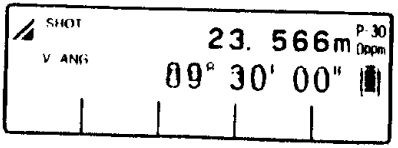
Press OK to display N and E coordinates

DISPLAY







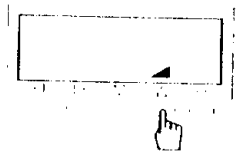


SPECIAL FUNCTIONS

OPERATION

14

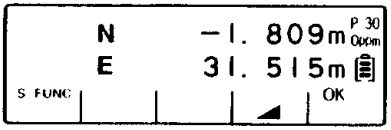
15



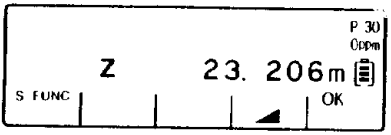
Press (◢) to display Z coordinate.
In order to display N and E coordinates, press (◢) again. For another point, aim at it and press OK. Then, repeat the measurement.

DISPLAY

⬇ 0.5 second after



Display of N and E coordinates



- The station coordinates entered are cleared when the power is turned off.
- Coordinates measurement is performed in shot measurement, but not in continuous measurement.
- Pressing S.FUNC during the measurement restores COORD MEAS, and pressing ESC returns the instrument to the previous measurement mode.
- The ranges of station coordinates entry are:

N and E coordinates	−89999.999m ~ +89999.999m
	−99999.999ft. ~ +99999.999ft.
Z coordinate	−499.999m ~ +3999.999m
	−1640.413ft. ~ +16404.162ft.

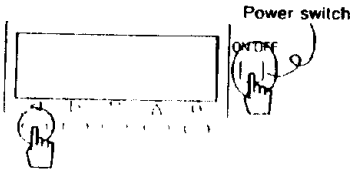
Retention of horizontal angle ..... Refer to page 25
Shot measurement ..... Refer to page 44

14 INITIAL SETTING MODE A

14-1 Selecting initial setting mode A

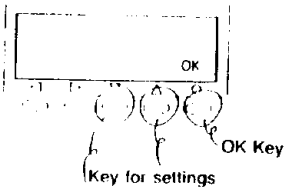
OPERATION

1



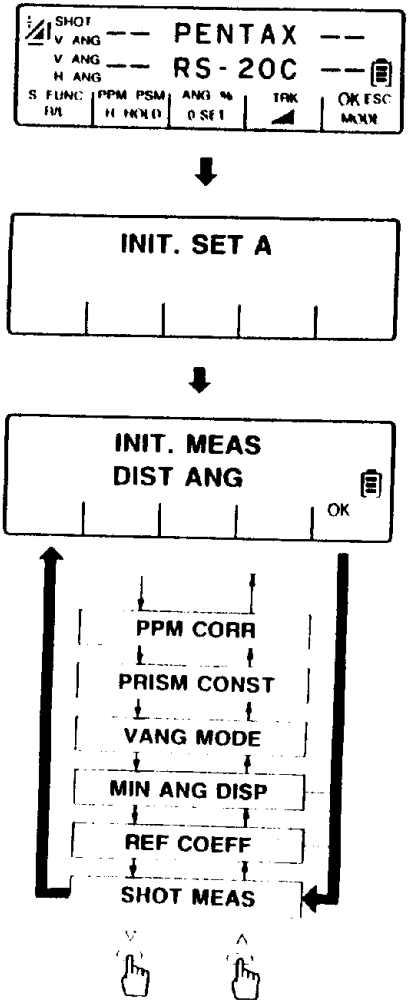
While pressing (◁), press the power switch. INIT. MEAS is displayed immediately after INIT. SET A , which indicates the instrument is in "MODE A", is displayed.
Preferential mode can be selected.

2



Press ▽ or △ to display the item which you want to confirm or change.

DISPLAY



- When terminating the setting of each item, press OK or display another item.
- Pressing OK displays TURN SCOPE, the inital state after turning the power on.
- Keep pressing (◁), after turning the power on, until INIT. SET A is displayed.

INITIAL SETTING MODE A

14-2 Selection of preferential measurement mode

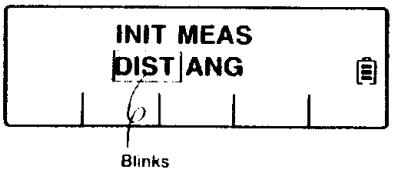
The preferential measurement mode, either of distance mode or angle mode, can be selected. Selection of distance mode allows both distance and angle measurement. But, distance measurement is impossible in angle mode. (Factory setting is distance mode.)

OPERATION

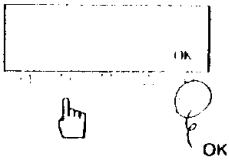
1

As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁).
INIT. MEAS is displayed immediately Blinks after INIT. SET A is displayed.

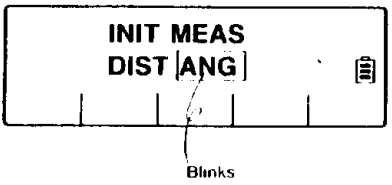
DISPLAY



2



Press (▷) to shift the blinking cursor onto ANG. Selection of angle mode is completed by pressing OK or proceeding to another item. (Press (◁) to shift the cursor to DIST)



The mode which blinks is selected.

- Pressing OK displays TURN SCOPE , the initial state after turning the power on.
- Press △ or ▽ to proceed to return to another item.

INITIAL SETTING MODE A

14-3 Selection of atmospheric correction.

Atmospheric correction can be performed by numerical input of temperature, and atmospheric pressure or these two factors can be fixed to 15°C, 760mmHg or 59°F, 29.9inHg for no atmospheric correction. (Factory setting is 15°C, 760mmHg.)

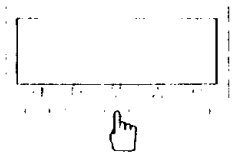
OPERATION

1

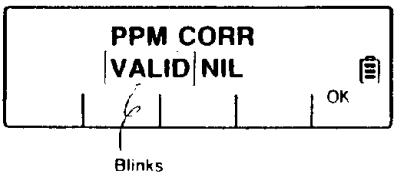
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁). The initial setting Mode A is initiated and INIT. MEAS is displayed.

DISPLAY

2

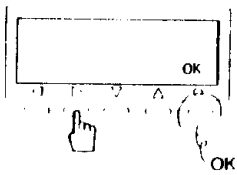


Press ▽ to display PPM CORR.

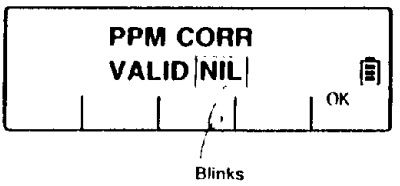


The mode which blinks is selected.

3



Press (▷) or (◁) to shift a cursor onto the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to another item.



- Pressing OK displays TURN SCOPE ,the initial state after the power is turned on.
- When NIL is selected, or when 15°C, 760mmHg (59°F , 29.9inHg) are entered by numerical input 0ppm is displayed.

INITIAL SETTING MODE A

14-4 Setting of prism constant offset

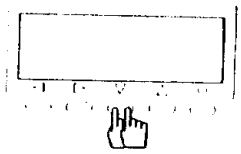
Prism constant offset can be entered by numerical input or it can be fixed at −30mm or 0mm. (Factory setting is −30mm.)

OPERATION

1

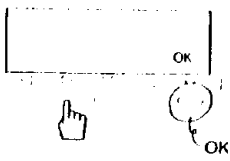
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁) to initiate setting Mode A. INIT. MEAS is displayed.

2



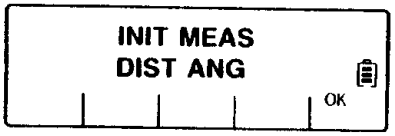
Press ▽ twice to display PRSM CONST.

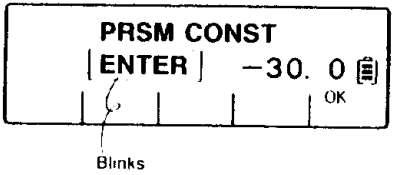
3

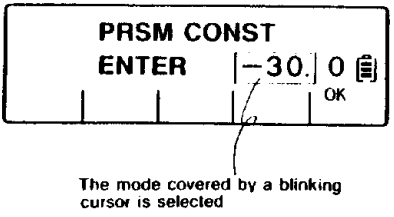


Press (▷) or (◁) to shift the cursor onto the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to another setting.

DISPLAY







- Pressing OK displays TURN SCOPE,the initial state after turning the power on.
- Once [−30] or [0] is selected, numerical input is not available.
- When [−30] or [0] is selected or when "−30" or "0" is entered by numerical input, [P-30] or [P-0] is displayed, respectively.
- Press △ or ▽ to proceed to another item.

INITIAL SETTING MODE A

14-5 Selection of vertical angle mode

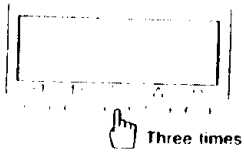
Any vertical angle mode, Zenith 0, Horizontal 0 or compass graduation, can be selected. (Factory setting is Zenith 0).

OPERATION

1

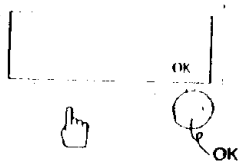
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁).
INIT.MEAS is displayed immediately after INIT. SET A is displayed.

2



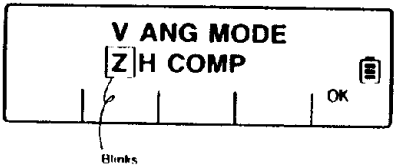
Press ▽ three times to display VANG MODE

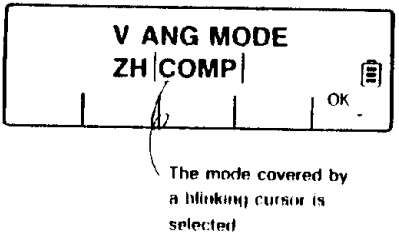
3



Press (▷) or (◁) to shift the cursor onto the desired setting. Press OK to terminate the setting.

DISPLAY





The mode which blinks is selected.

- Press △ or ▽ to proceed to another item.
- Pressing OK displays [DIST] SCOPE, the initial state after the power is turned on.

INITIAL SETTING MODE A

14-6 Selection of least count of angle

The selection of the least count of angle can be done in accordance with the angle unit set in "Initial setting mode A".

	Coarse	Fine
Degree	20″	10″
Grade	50cc	20cc
Mil	0.1	0.05
Decimal	0.005	0.002

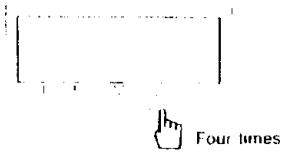
OPERATION

1.

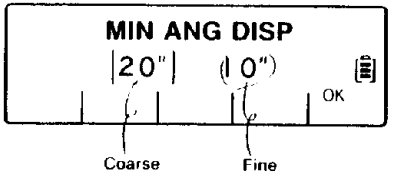
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁). The initial setting Mode A is initiated and INIT. MEAS is displayed.

DISPLAY

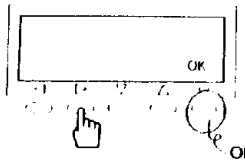
2



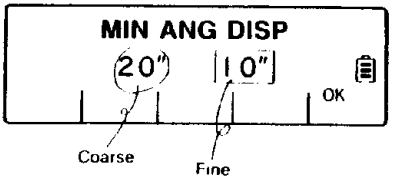
Press ▽ three times to display MIN ANG DISP.



3



Press (▷) or (◁) to shift the cursor onto the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to another item.



Z stands for Zenith 0° and H Horizontal 0°.

- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or ▽ to proceed to another item.

INITIAL SETTING MODE A

14-7 selection of the unit of angle.

Any of the unit of angle, Degree, Grade, Mil or Decimal can be selected.
(Factory setting is in Degree.)

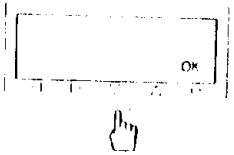
OPERATION

1

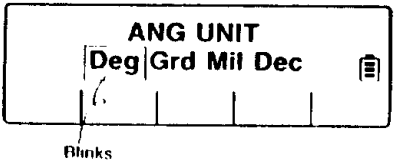
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing ·/ to select setting mode A. INIT MEAS is displayed.

DISPLAY

2

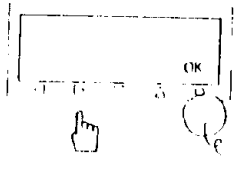


Press required number to display ANG UNIT

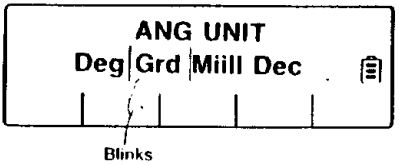


The setting covered by a blinking cursor is in memory.

3



Press ← or → to shift a cursor onto the desired setting. Press OK to terminate the setting. Or, press ↓ or ↑ to proceed to another item.



The setting covered by a blinking cursor is selected

- Pressing OK displays TURN SCOPE, the initial state after turning the power on.
- Press ↓ or ↑ to proceed to another item.

INITIAL SETTING MODE A

14-8 Selection of the unit of distance

The unit of distance, meter or feet, can be selected.
(Factory setting is in meter.)

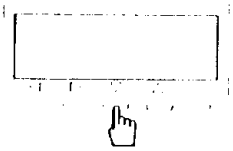
OPERATION

1

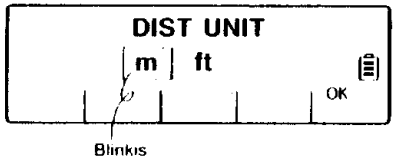
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing to select setting mode A. INIT MEAS is displayed.

DISPLAY

2

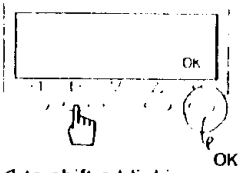


Press ▽ required number to display DIST UNIT.

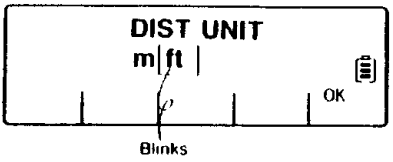


The setting covered by a blinking cursor is in memory.

3



Press ▷ or ◁ to shift a blinking cursor to the desired setting.



The setting covered by a blinking cursor is selected.

- Pressing OK displays TURN SCOPE, the initial state after turning the power on.
- Press △ or ▽ to proceed to another item.

INITIAL SETTING MODE A

14-9 Selection of refraction and earth curvature

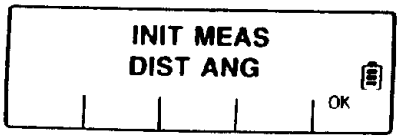
Either 0.14 or 0.20, as atmospheric refraction coefficient, can be selected for atmospheric refractin and earth curvature correction. "No Correction" can be also selected. (Factory setting is 0.14.)

OPERATION

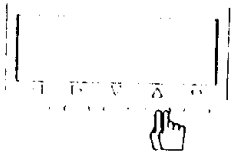
1

As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁). The initial setting Mode A is initiated and INIT. MEAS is displayed.

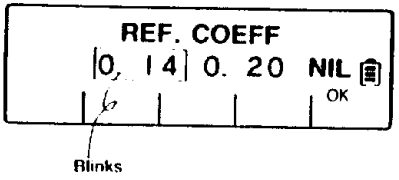
DISPLAY



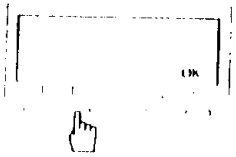
2



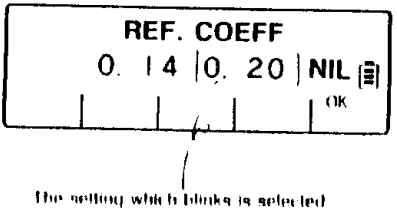
Press ▽ twice to dispaly REF. COEFF.



3



Press (▷) or (▷) to shift the cursor to the desired setting. Press OK to terminate the setting or press ▽ or △ to proceed to another item.



- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- When [NIL] is selected, no correction is available.
- Press △ or ▽ to proceed to another item.

Atmospheric refraction and earth curvature correction Refer to page 90

INITIAL SETTING MODE A

14-10 Selection of shot measurement

Type of shot measurement, single, three times, three times and average or 5 times and average, can be selected. (Factory setting is single.)

*In shot measurement, measurement is performed only by the type selected. The beam emission stops after specified number of measurements is performed.

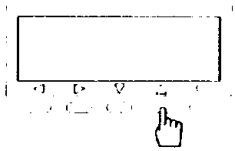
OPERATION

1

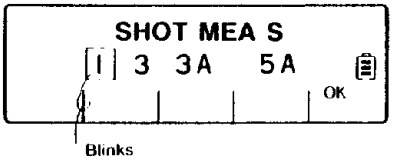
As described in "Selecting initial setting mode A" on page 60, turn the power on while pressing (◁). The initial setting Mode A is initiated and INIT. MEAS is displayed.

DISPLAY

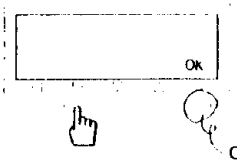
2



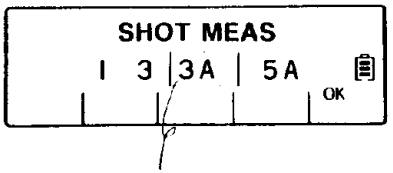
Press ◁. to display SHOT MEAS.



3



Press (◁) or (▷) to shift the cursor to the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to to another item.



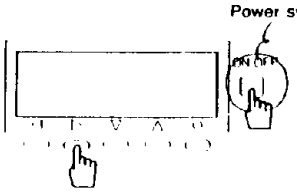
- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or ▽ to proceed to another item.
- The type of measurement is indicated in the display as follows:
  1: Single 3: Three times 3A: 3 times and average 5A: five times and average

15 INITIAL SETTING MODE B

15-1 Selecting initial setting mode B

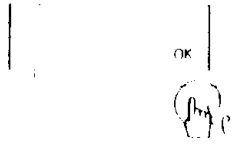
OPERATION

1



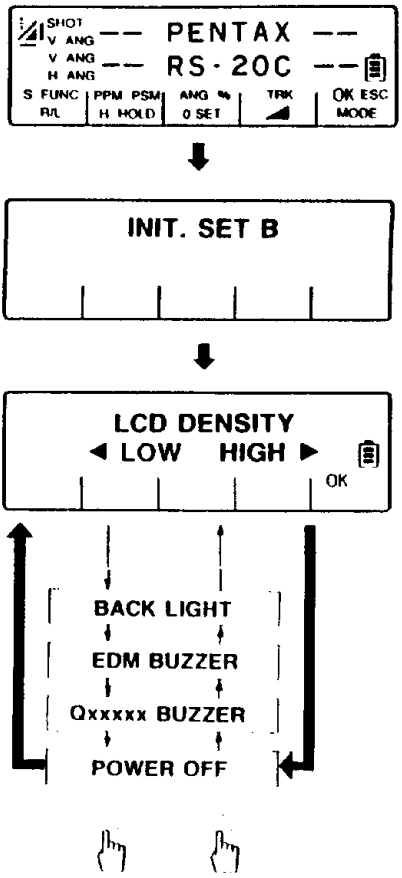
While pressing (▷), turn the power on to select the initial setting mode B. LCD DENSITY is displayed immediately after INIT. SET B is displayed.

2



Press △ or ▽ required number of times to display the desired setting mode.

DISPLAY



● Pressing OK displays TURN SCOPE, the initial state after the power is turned on.

INITIAL SETTING MODE B

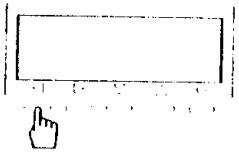
15-2 Adjustment of LCD density

OPERATION

1

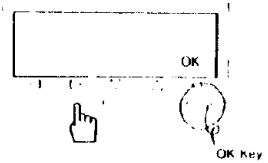
As described in "Selecting initial setting mode B on page 68, turn the power on while pressing (▷). The initial setting Mode B is initiated and LCD DENSITY is displayed.

2



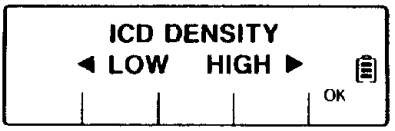
The density becomes lighter each time that (◁) is pressed.

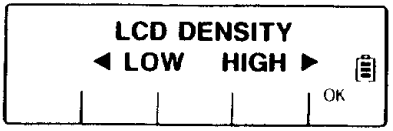
3

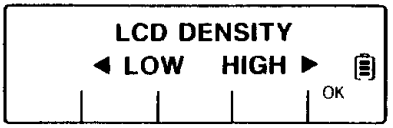


The density becomes darker each time that (▷) is pressed.

DISPLAY





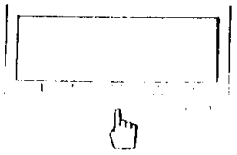
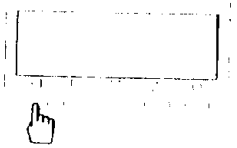
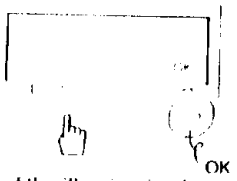


- Proceed to another item or terminate the adjustment when proper density is obtained.
- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press ∧ or ∨ to proceed to another item.

INITIAL SEETING MODE B

15-3 Adjustment of illumination intensity

The intensity of illumination for the reticle and LCD display can be adjusted.

OPERATION	DISPLAY
1 As described in "Selecting initial setting Mode B" on page 68, turn the power on while pressing (▷). The initiate setting Mode D is initiated and LCD DENSITY is displayed.	LCD DENSITY ◀ LOW HIGH ▶ OK
2  Press ▽ to display ILLUMINATION	ILLUMINATION ◀ DOWN UP ▶ OK
3  The intensity of the illumination becomes brighter as (◁) is pressed	ILLUMINATION ◀ DOWN UP ▶ OK
4  OK Key The intensity of the illumination becomes darker as (▷) is pressed.	ILLUMINATION ◀ DOWN UP ▶ OK

- Move to another item or press OK to terminate the adjustment of intensity when the proper intensity is obtained.
- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or ▽ to proceed to another item.
- Individual adjustment of illumination for the reticle and the LCD display is not available.

INITIAL SETTING MODE B

15-4 Selection of audio target aquisition ON/OFF

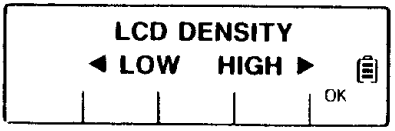
The buzzer which sounds when sighting at a prism can be cancelled. (Factory setting is ON.)

OPERATION

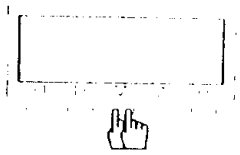
1

As described in "Selecting initial setting mode B" on page 68, turn the power on while pressing (▷). The initial setting mode B is initiated and LCD DENSITY is displayed.

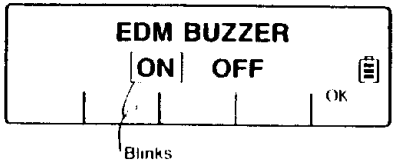
DISPLAY



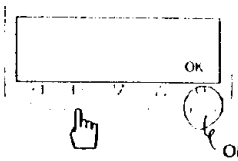
2



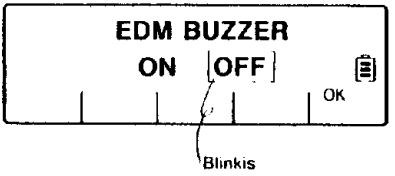
Press ▷ twice to display EDM BUZZER.



3



Press (▷) or (◁) to shif the cursor onto the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to another item.



- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or ▽ to proceed to another item.

INITIAL SETTING MODE B

15-5 Selection of quadrant indicating buzzer ON/OFF

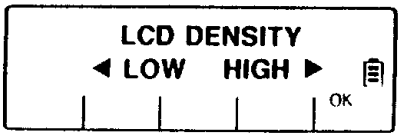
The buzzer for right angle setting can be cancelled. (Factory setting is ON.)

OPERATION

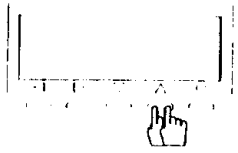
DISPLAY

1

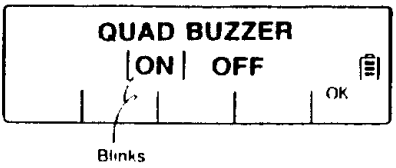
As described in "Selecting initial setting mode B" on page 68, turn the power on while pressing (▷). The initial setting Mode B is initiated and LCD DENSITY is displayed.



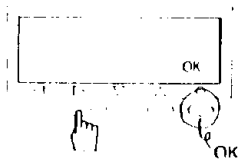
2



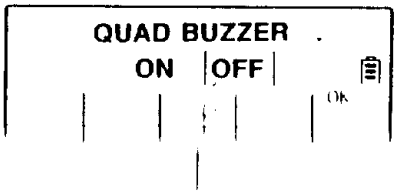
Press △ twice to display QUARD. BUZZER



3



Press (▷) or (◁) to shift the cursor to the [illegible] ting or press [illegible] or [illegible] to proceed to another item.



- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or [illegible] to proceed to another item.

INITIAL SETTING MODE B

15-6 Selection of automatic power off YES/NO

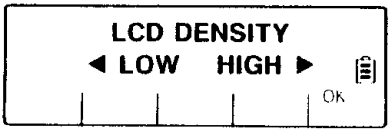
The power is automatically turned off when there is no operation of the instrument for 10 minutes. This function can be cancelled. (Factory setting is YES.)

OPERATION

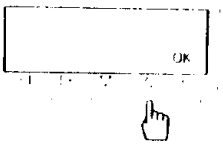
1

As described in "Selecting initial setting mode B" on page 68, turn the power on while pressing (▷). The initial setting Mode B is initiated and LCD DENSITY is displayed.

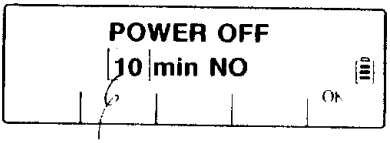
DISPLAY



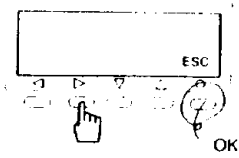
2



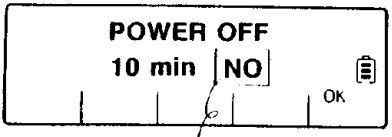
Press △ to display POWER OFF.



3



Press (▷) or (◁) to shift the cursor onto the desired setting. Press OK to terminate the setting or press △ or ▽ to proceed to another item.



The setting covered by a blinking cursor is in memory.

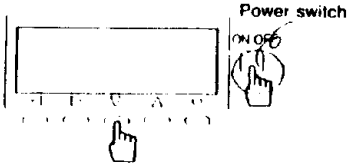
- Pressing OK displays TURN SCOPE, the initial state after the power is turned on.
- Press △ or ▽ to proceed to another item.

16 INITIAL SETTING MODE C

16-1 Selecting initial setting mode C

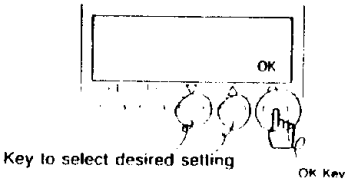
OPERATION

1



While pressing ▽, turn the power on to display INIT SET C.

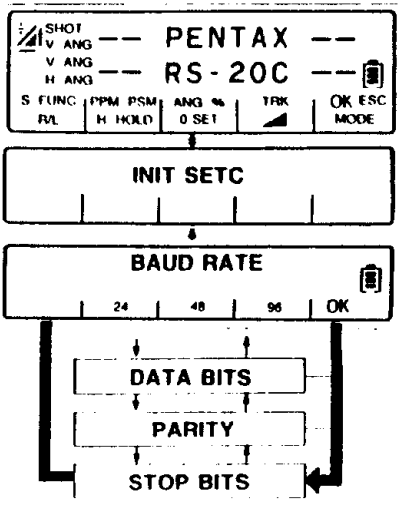
2



Key to select desired setting

Press ▽ or △ required numbers to display the item which you want to confirm or alter.

DISPLAY

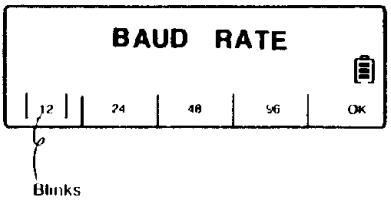
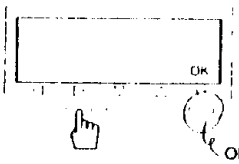
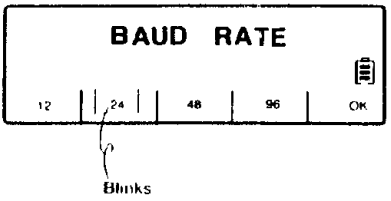


- When terminating the setting of each item, press OK or desplay another item.
- When pressing OK, TURN SCOPE , the initial state after turning the power on, is displayed regardless of item in operation
- Keep pressing ▽ even after turning the power on until INIT SET C is displayed

INITIAL SETTING MODE C

16-2 Selection of data communication parameters

Desired data communication parameters can be selected. Parameters available are: 12, 24, 48 or 96 for Baud rate, 8 or 7 for Data bits, Non, Odd or Even for Parity and 1 or 2 for Stop bits. (Factory settings are: Baud rate = 12, Data bits = 8 Parity = NON, Stop bits = 1)

OPERATION	DISPLAY
1 While pressing ▽, turn the power on. BAUD RATE is displayed immediately after INIT SET C is desplayed.	
2  Press ▷ or ◁ to shift a blinking blinks cursor to the parameter you want to set.	

- When pressing OK, TURN SCOPE, the initial state after turning the power on, is displayed.
- Press △ or ▽ for other parameter item. For each parameter item, use ▷ or ◁ to shift a blinking cursor for setting the desired parameter as described above.

17 PREPERATION OF OBSERVATION

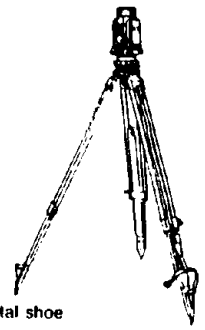
17-1 Centering and leveling of the instrument

〈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 center 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 level as possible, and the plumb bob coincides with the station on the ground.

(3) If the tripod head is mis-leveled by the action of fixing the metal shoes into the ground, correct the level by extending or retracting each leg of the tripod



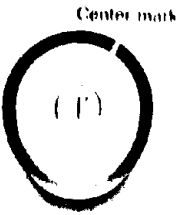
〈Centering and leveling with the optical plummet〉

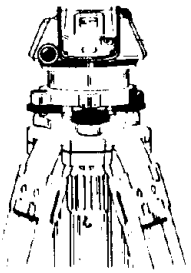
(1) Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.

(2) Rotate the focusing knob of the optical plummet and adjust the focus to the station on the ground.

(3) Loosen the center screw of the tripod. Look though the optical plummet, and shift the instrument base on the tripod head, taking care to avoid rotating the instrument, until the center mark coincides with the station

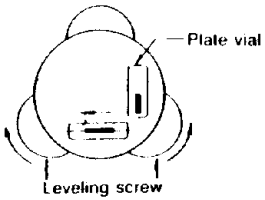
(4) Adjust the tripod legs to position the bubble of [illegible] your foot on the metal shoe, which may disturb the position of the metal shoes)





PREPARATION OF OBSERVATION

〈Leveling with plate vial〉

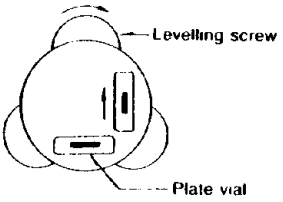


(1) Place a plate vial in parallel with a line joining any two of leveling screws. Adjust the two leveling screws. And position the bubble in the center of the vial. To adjust the screws at the same time, turn them in opposite directions.

(2) Adjust the remaining leveling screw so that the bubble in the other plate vial is positioned in the center.

(3) Be sure that the bubbles of both plate vials stay in the center. If not, repeat (1) and (2).

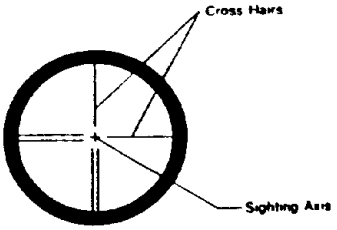
(4) Rotate the instrument 180° around the vertical axis, and check that the bubbles stay centered.



- See arrows in Fig. above for the relation between the direction of leveling screw rotation and the bubble shifting direction.
- If the bubble does not remain centered in (4), "Adjustment of plate vial" is necessary. Refer to page 77.

17-2 Eyepiece adjustment and object sighting

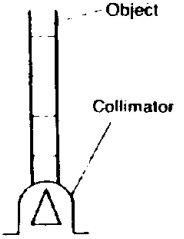
〈Eyepiece adjustment〉



(1) Remove the telescope lens cap.
(2) Point the telescope at a bright object, and rotate the eypiece ring full counterclockwise.
(3) Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticle appears as 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 (☼) to illuminate it. For adjusting intensity of brightness, refer to page 70.

〈Object sighting〉



(1) Point the telescope at the object using the collimator sight.
(2) Look through the telescope eyepiece and finely adjust the focusing knob until the object is perfectly focused. If focusing is correct, the reticle will not move, in relation to the object, even when you move your eye slightly left and right.
(3) Accurately align the reticle with the object, using each tangent screw.

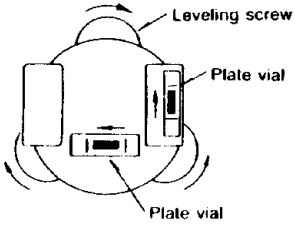
- Turn the focusing knob clockwise to focus on a near object. Turn the knob counterclockwise to focus on a far object.
- In (2), parallax may ruin the relation between the object and reticle, resulting in observation error.
- When aligning to an object using the tangent screw, always align by rotating the screw clockwise. If the screw is turned past the object, turn it back to the original position and then turn the screw clockwise to align the reticle on the object.
- Even when vertical angle measurement is not required, it is recommended that the object be placed close to the center of the reticle.

18 INSPECTION AND ADJUSTMENT

18-1 Plate vial

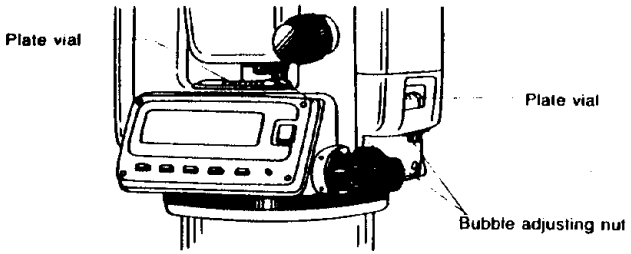
〈Inspection〉

(1) Align the plate vial in parallel with a line joining any two of the leveling screws. Then, adjust the two screws to center the bubble in the vial.
(2) Adjust the remaining leveling screw to center the bubble of the other plate vial.
(3) Repeat (1) and (2) to place the bubbles of both vials in the center.
(4) Loosen the upper clamp screw and rotate the instrument 180° around the vertical axis.
(5) No adjustment is needed if the bubbles stay in the center.



〈Adjustment〉

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



INSPECTION AND ADJUSTMENT

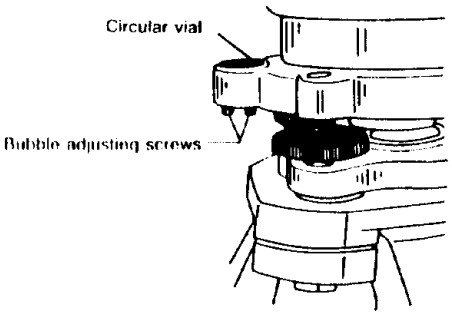
18-2 Circular vial

〈Inspection〉

No adjustment is necessary if the bubble of the circular vial is in the center after inspection and adjustment of plate vials.

〈Adjustment〉

If the bubble of the circular vial is not in the center, bring the bubble to the center by turning the bubble adjusting screws with an adjusting pin.

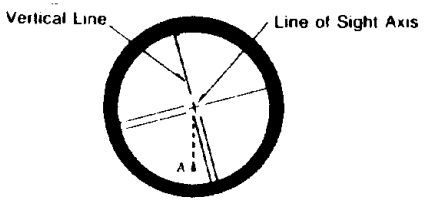


INSPECTION AND ADJUSTMENT

18-3 Inclination of reticle

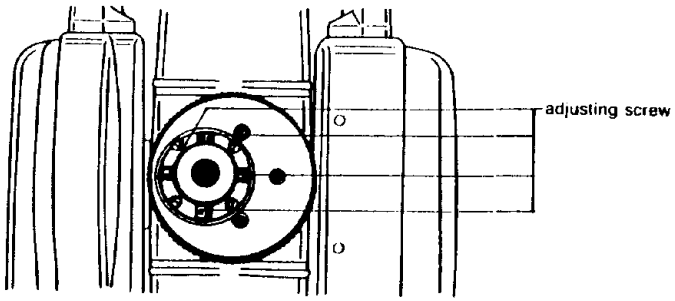
〈Inspection〉

(1) Set an object A on the line of sight through the telescope.
(2) Move point A to the edge of the field of view by adjusting the telescope tangent screw (point A').
(3) No adjustment is necessary if point A moves along the vertical line of the reticle.



〈Adjustment〉

(1) If the point A does not move along the vertical line, first remove the eyepiece cover.
(2) Loosen the four reticle adjusting screws uniformly with an adjusting pin. Rotate the reticle around the sight axis, and align the vertical line of the cross hairs with point A'.
(3) Tighten the reticle adjusting screws uniformly. Repeat the inspection and adjustment and check that the adjustment is correct.



INSPECTION AND ADJUSTMENT

18-4 Perpendicularity of line of sight to horizontal axis

〈Inspection〉

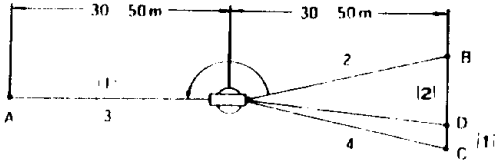
(1) Set an object point A, at a distance of 30 to 50 meters from the instrument, and sight it through the telescope.

(2) Loosen the telescope clamp screw and reverse the telescope around the vertical axis. Mark a point set on the line of sight at about the same distance to the object point A, and call it point B.

(3) Loosen the upper clamp screw, and rotate the instrument around the vertical axis. Sight point A again.

(4) Loosen the telescope clamp screw, and reverse the telescope around the horizontal axis. Mark a point on the line of sight at around the same distance as point B, and call it point C. (The telescope is now in its normal position.)

(5) No adjustment is necessary if points B and C coincide.



〈Adjustment〉

(1) If points B and C do not coincide, set up a point D located 1/4 of the length BC from the point C toward point B.

(2) Turn the two reticle adjusting screws, opposed horizontally. Move the reticle so that point D is set on the line of sight.

(3) Repeat the inspection and check that the adjustment is correct.

INSPECTION AND ADJUSTMENT

18-5 Vertical 0 point error

Be sure to follow inspection procedures mentioned below after making adjustments described in 18-3 and 18-4.

〈INSPECTION〉

(1) Set up the instrument and turn the power on.
(2) Sight the telescope at any reference target A. Obtain vertical angle (γ).
(3) Reverse the telescope and rotate the alidade. Sight again at A and obtain vertical angle ℓ.
(4) If $\gamma + \ell = 360°$, no further adjustment is necessary.

If difference d ($\gamma + \ell - 360°$) is greater than the rated value, adjustment is required. Contact your local dealer.
If the horizontal 0° mode is used, $\gamma + \ell = 180°$ or 540°.

18-6 Optical plummet

〈Inspection〉

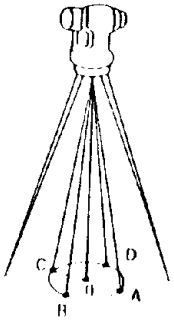
① Set the instrument on the tripod, and place a piece of white paper with a cross drawn on it right under the instrument.

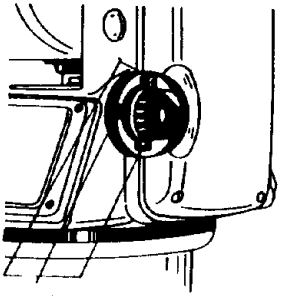
② Look through the optical plummet, and move the paper so that the intersecting point of the cross comes to the center of the field of view.

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.




adjusting screws

〈Adjustment〉

(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 A on the line of sight at a height of about 100 mm on the white paper and mark the point B on the line of sight at a height of about 200 mm on the white paper and call them A (C) and D.

(3) Join the opposite points (A, C and B, D) with a straight line, and set the intersecting point O.

(4) Turn the four optical plummet adjusting screws with a adjusting pin so that the center mark coincides with the intersecting point O.

(5) Repeat from (4), and check that adjustment is correct.

INSPECTION AND ADJUSTMENT

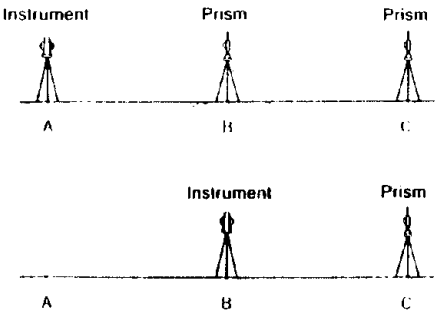
18-7 Offset constant

The offset constant rarely changes. It is recommended, however, that inspection be done once or twice a year.
The inspection of the offset constant can be done on a certified base line. It can also be obtained in a simple way as described below.

〈Inspection〉

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

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



INSPECTION AND ADJUSTMENT

18-8 Beam axis and line of sight

Be sure to check that the beam axis and line of sight are aligned when the adjustments in 18-3 and 18-4 are performed.

〈Inspection〉

(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 measure the distance.
(4) No adjustment is necessary if beam receiving buzzer sounds immediately and measurement value is displayed in a few seconds.

■ If instrument functions is not as described in ④, contact your local dealer.
■ This inspection should be done under good weather conditions.

Cautions on Inspection and adjustments

◇ Make all inspection and adjustments in numerical order.
◇ Be sure not to make inspection and adjustment described in 18-4 prior to those in 18-3. When making adjustments described in 18-3 and 18-4, be sure to make inspection in 18-5 and 18-8 for confirmation.
◇ When adjustment is completed, be sure that adjusting screws completely tightened. When finishing turning adjusting screws, be sure that screws are turned in a direction for tightening.
◇ Repeat inspection after adjustment, and check if the instrument has been adjusted properly.

19 APPENDIX

19-1 Warning and error messages

Messages	Meaning	What to do
BATT. CHANGE	Battery capacity is too low for continued operation.	Replace or recharge battery.
H OVER SPEED **0 set**	The alidade is rotated too quickly.	Press 0 SEt to remeasure.
V OVER SPEED **TURN SCOPE**	The telescope is rotated too quickly.	Turn the telescope to index vertical 0 again.
EXCESS DATA	Numerical values entered exceed the specified range.	Press OK and reenter correct values.
EXCESS RANGE	The measured value exceed the specified angle range.	Perform the measurement within specified range.
EDM ERROR **E - XX**	Some problem found in the distance measurement circuit. Particular number takes the place of [XX].	Turn the power off and turn it on again. If the error message still appears, repair is required. (Inproper operation may cause the message to appear.)
ETH ERROR **E - XX**	Some problem found in the angle measurement circuit. Particular number takes the place of [XX].	
MISC ERROR **E - X**	Some other probelm found. Particular number takes the place of [XX].	

APPENDIX

19-2 Atmospheric corrections

The velocity of the EDM beam, traveling through the atmosphere varies according to the temperature and atmospheric pressure. Corrections of both factors are necessary in order to measure the distance precisely, because distance measurement is based on the velocity of the beam.

The PCS displays the automatically compensated value once the prevailing temperature and atmospheric pressure are entered. The formula of compensation is as follows.

$$K = (279.75207 - \frac{79.55626 \cdot P}{273.14941 + t}) \times 10^{-6}$$

K: Compensation cooefficient

P: Atmospheric pressure (mmHg)

T: Temperature (°C)

APPENDIX

19-3 Atmospheric refraction and earth curvature

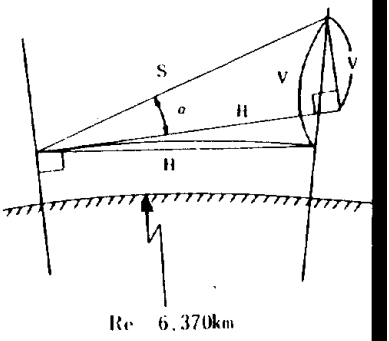
- The effects of atmospheric refraction and earth curvature can be automatically compensated for measurements of horizontal distance and difference in height.
- Compensation for atmospheric refraction and earth curvature is provided according to the following formula.
- When compensation of atmospheric refraction and earth curvature is valid:

  Compensated horizontal distance (H)

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

  Compensated difference in height (V)

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



- The formula when no compensation is made:

  H. Distance $H' = S \cdot \alpha$

  Difference in height $V' = S \cdot \sin\alpha$

S: Slope distance

a: Vertical angle from horizontal

K: Atmospheric refraction coefficient (0.14 or 0.2)

Re: Radius of the earth (6,370kms.)

APPENDIX

19-4 Distance measurement range

Distance measurement range is affected by the surrounding atmospheric conditions. So, the specification refers to two different measurement ranges under different conditions. General classification of atmospheric conditions are described below.

Normal: 15kms visibility with slight haze.
Good: 30kms visibility, overcast, no heat haze and moderate wind

* Cloudy weather is more suitable for distance measurement than fine weather.

20 SPECIFICATIONS

TELESCOPE

Image	Erecting
Magnification	30X
Effective aperture	45mm (EDM 45mm)
Resolving power	3"
Field of view	2.6% (1°30')
Minimum focus	0.85 m

DISTANCE MEASUREMENT SECTION

Measuring range	Normal	(Good)
Mini prism	400m/ (1300ft)	(450m)/ (1500ft)
1 Prism	700m/ (2300ft)	(800m)/ (2600ft)
3 Prism	1000m/ (3300ft)	(1100m)/ (3600ft)

Accuracy	± (5mm + 3ppm) m.s.e.
Minimum count	Fine mode: 1mm TR mode: 1cm
Measuring time	Fine mode: 2.5 sec. TR mode: 0.6 sec.
Measuring system Nomal	Automatically repeated measurement
SHOT	Single, 3, 3/AV, 5/AV.
Maximum slope distance display	1999.999m
Atmospheric correction (On/Off selection)	Temperature: 1°C/1°F per step Pressure: 1 mmHg/0.1inHG per step
Prism constant	selection of 0mm, −30mm, numerical input
Atmospheric refraction and earth curvature	On/Off
Atmospheric refraction coefficient	0.14/0.2
Distance unit	Meter/Feet

(Conversion rate: 1m/3.2808330ft)

Calculation functions	Stake-out Remote elevation (REM) Missing line (RDM) Coordinates measurement

ANGLE MEASUREMENT SECTION

Measuring system	Incremental rotary encoder
Detection method	Horizontal angle: Single Vertical angle: Single
Minimum count	20" (50cc)/10" (20cc) selectable
Accuracy (DIN 18723)	10" : standard deviation
Measuring time	0.3" (continuous measuring)
Diameter of encoder	79mm
Measuring mode	
Horizontal angle	Right, Left, Hold
Vertical angle	Zenith 0°, Horizontal 0°, %, compass

DISPLAY SECTION

Type	LCD two lines w/illumination PCS-1: single PCS-2: Dual
Display combination	V: angle/H: angle %/H: angle H: distance/H: angle S: distance/V: angle Height difference/% N coordinate/E coordinate Z coordinate V: distance/V: angle (REM) Height difference/H: distance (RDM) S: distance/% (RDM)

SENSITIVITY OF VIALS

Plate vial	60"/2mm
Circular vial	8'/2mm

OPTICAL PLUMMET

Image	Erecting
Magnification	3X
Focusing range	0.5m ~ ∞

TYPES OF VERTICAL AXIS AND TRIBRACH

Vertical axis	Single axis
Tribrach Type	Fixing (PCS-1) Detachable (PCS-2)

AUTO POWER OFF FUNCTION

Time Setting	10' (on/off selectable)

SPECIFICATIONS

AMBIENT TEMPERATURE

Temperature range ..... - 20°C ~ + 50°C/
-4°F ~ + 122°F

TRIPOD THREAD

Screw dimension ..... 5/8" × 11

DIMENSIONS AND WEIGHTS

Instrument (w/o battery) W-162/H-338/L-149 4.7Kg

Case W-260/H-250/L-440/ 4.7Kg

ON-BOARD BATTERY (MB01)

Power source ..... Ni-Cd battery
(rechargeable)

Out-put ..... D.C. 7.2V / 1400mAH

Operation time per
charging ..... 3.5 hrs. (angle and
distance measurements)
15 hrs (angle measurement
only)

Weight 0.3Kg

PENTAX

ASAHI PRECISION CO., LTD.
Miyakezaka Bldg., 1-11-1 Nagata-cho,
Chiyoda-ku, Tokyo 100 Japan

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