PENTAX®

Instruction Manual

Electronic Total Station

R-100 SERIES

R-115/R-125/R-135
R-122/R-123
(R-115N/R-125N/R-135N)
(R-122N/R-123N)

ASAHI PRECISION CO., LTD.

Safety Precautions (Must be followed)

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

■ Distinctive Displays

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

⚠ WARNING

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

⚠ CAUTION

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

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

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

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

■ The description concerning only the Reflectorless type, R-115N/R-125N/ R-135N/R-122N/R-123N, is put in ( ).

⚠ WARNING

Do not stare into the laser beam directly as this may result in damage to your eyes. R-100 is a Class II Laser product.

- Never use the telescope to view intense light such as direct sunlight or sunlight reflected through a prism as this may result in loss of sight. Always be sure to attach a special solar filter (MU64) to the objective lens of this product when observing the sun.
- Do not use this product in a coal mine, in a location where there is coal dust, or near flammable material as there is a risk of explosion.
- Do not disassemble, modify or repair this product as there is a risk of fire, electric shock and burn injury. If you think the product requires repair, contact the retail outlet where you purchased it or an authorized repair site.
- Only use the BC03 battery charger intended for this product as the battery charger. Use of another battery charger entails a risk of fire or burn injury from the battery bursting into flames due to possible differences in voltage or polarity.
- Do not use a damaged electric cord plug or loose electric outlet when charging as there is a risk of fire or electric shock.
- Do not charge the battery while covered by clothes or similar item as there is a risk of fire if the clothes ignite.
- Do not use the battery or charger when wet as there is a risk of fire and burn injury due to short-circuit.
- To prevent making short-circuit when removing the battery and charger from the case and storing them, apply electrically resistant tape to the poles of the battery. Storing the battery and charger as-is may result in fire or burn injury due to short-circuit.
- Do not throw the battery into fire or expose it to heat as there is a risk of injury if it explodes.

⚠ CAUTION

- Do not remove the handgrip without good reason. If it does come off, be sure to attach it securely to the instrument with screws. If it is not fastened securely, the instrument may fall when you grasp the handgrip, leading to possible injury.
- Do not short the poles of the battery or charger as there is a risk of injury or fire.
- Do not touch any fluid which may leak from the battery as there is a risk of chemical burn injury or reaction.
- Do not insert or remove the electric plug with wet hands as there is a risk of electric shock.
- Do not use the case to stand on as it is slippery and unstable and may cause you to fall, resulting in possible injury.
- Be sure the tripod itself and the instrument on the tripod are both installed securely as insecure installation may cause the tripod to fall over or the instrument to drop, resulting in possible injury.
- Do not carry the tripod with the metal shoe pointing toward another person as the person may be injured if they strike him or her.

The instrument contains a rechargeable battery and it is rechargeable.
At the end of its useful life, it may be illegal to dispose of the battery.
Check with your local solid waste officials for details for recycling.

Usage Precautions

Surveying instruments are high-precision instruments. In order to assure that the Electronic Total Station R-100 series product which you have purchased will provide long-lasting maximum performance, the precautions in this manual must be followed. Be sure to follow these instructions and use this product properly at all times.

[Solar Observation]

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

[Laser Beam]


Do not stare into laser beam. R-100 is a class-II Laser product.

[Target Constant]

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

[Reflectorless and Reflector sheet]

- The measurement range is determined by the white side of the Kodak Gray Card facing the instrument and by its surrounding brightness.
  There is a possibility that the range may vary when the target does not satisfy the conditions above at survey work.
- Pay attention to followings in case of distance measurement by Reflectorless. In case of resulting in low accuracy, perform the distance measurement by Reflector sheet or Prism. (R-115N/R-125N/R-135N/R-122N/R-123N)

① There is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam when the laser beam comes into the target from diagonal angle.
② There is a possibility that the instrument cannot calculate correctly when receiving reflected laser beam from forth and back directions in case of measuring the target on the road.

③ There is a possibility that synthesized values are calculated and the distance may become longer or shorter than the actual one when the operator measure the target of slope or sphere or rugged shape.
④ There is a possibility that the instrument cannot calculate correctly by collecting the reflected laser beam from a man or a car that comes and goes in front of the target.

- When using Reflector sheet, set the Reflector sheet to have its surface be approx. vertical to the aiming line. If it is positioned not to be approx. right angle, there is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam.

[Battery & Charger]

- Never use any battery charger other than the BC03 battery charger as this may result in damage to the instrument.
- If water should happen to splash on the instrument or the battery, wipe it off immediately and allow it to dry in a dry location. Do not put the instrument in the case until it is completely dry as this may result in damage to the instrument.
- Turn off the power when removing the battery from the instrument as removing the battery while the power is still on may result in damage to the instrument.
- The battery mark displayed on the instrument is only an estimate of remaining battery power and is not completely accurate. Replace the battery quickly when it is about to run down as the time a battery lasts on one charge differs depending on conditions of ambient temperature, and the measurement mode of the instrument.
- Confirm the battery level remaining before operating.

[Auto focus]

The Auto focus mechanism is very precise but will not function under every condition. Focusing depends on brightness, contrast, the shape and size of the target.
In such a case, press the AF button and focus on the target by operating the Power focus key or the AF ring.

[Storage and Operating Environment]

- To prevent making short-circuit when removing the battery and charger from the case and storing them, apply electrically resistant tape to the poles of the battery. Storing the battery and charger as is may result in fire or burn injury due to short-circuit.

- Avoid storing the instrument in places subject to extreme high, low or radically fluctuating temperature. (Ambient temperature range during use: –20° C to +50° C)
- Distance measurements may take longer when atmospheric conditions are poor such as when heat shimmer is present. When storing the instrument, always put it in its case and avoid storage in dusty location or location subject to vibration or extreme heat or humidity.
- Whenever there is a sharp temperature difference between the instrument's storage and usage locations allow the instrument to adjust to the ambient for an hour or more before use. Be sure to protect the instrument from the sun if the location is subject to intense direct sunlight.
- During surveys for which the survey precision or atmospheric measurement method has been defined measure the atmospheric temperature and pressure separately and enter those values rather than using the Automatic Atmospheric Correction function.
- The battery should be charged approximately once per month if the instrument is to be stored for an extended period of time. The instrument should also be removed from its case occasionally and aired out.
- In addition to these precautions, be sure to handle the instrument properly at all times following the descriptions given in the various sections of this manual to assure safe and proper measurements.

[Transporting and Carrying the Instrument]

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

[Checks and Repairs]

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

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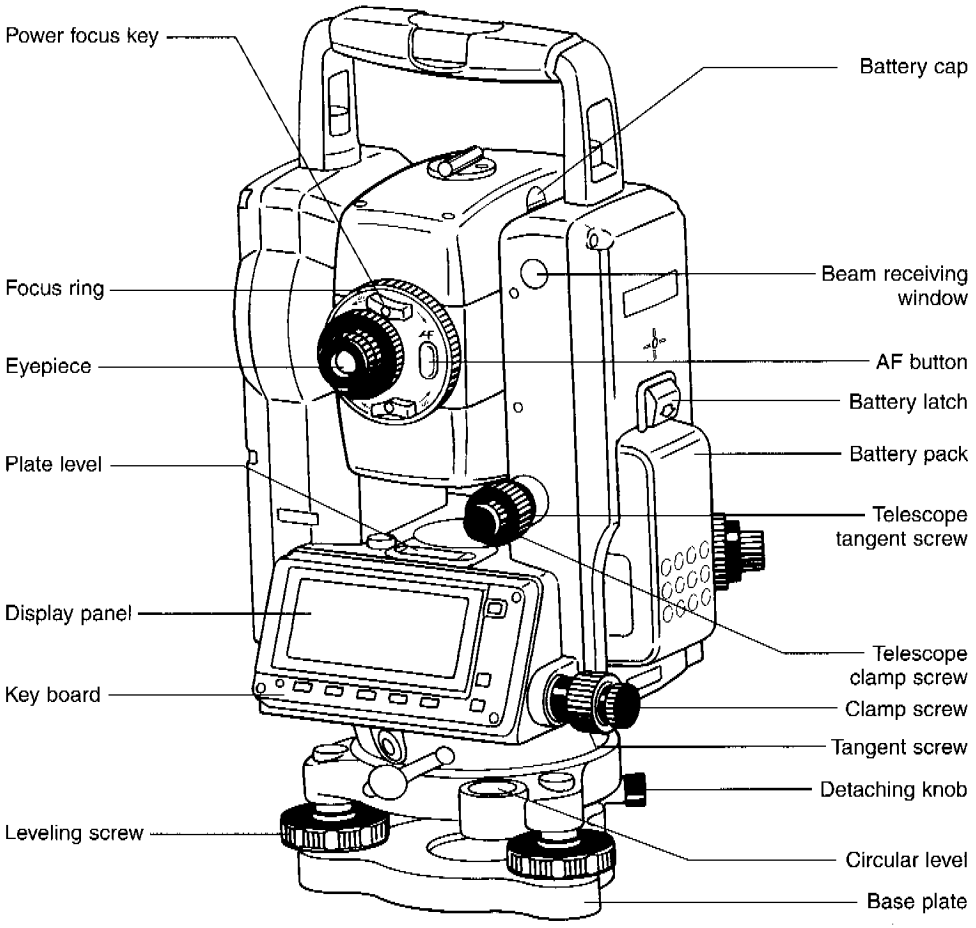
14 APPENDIX

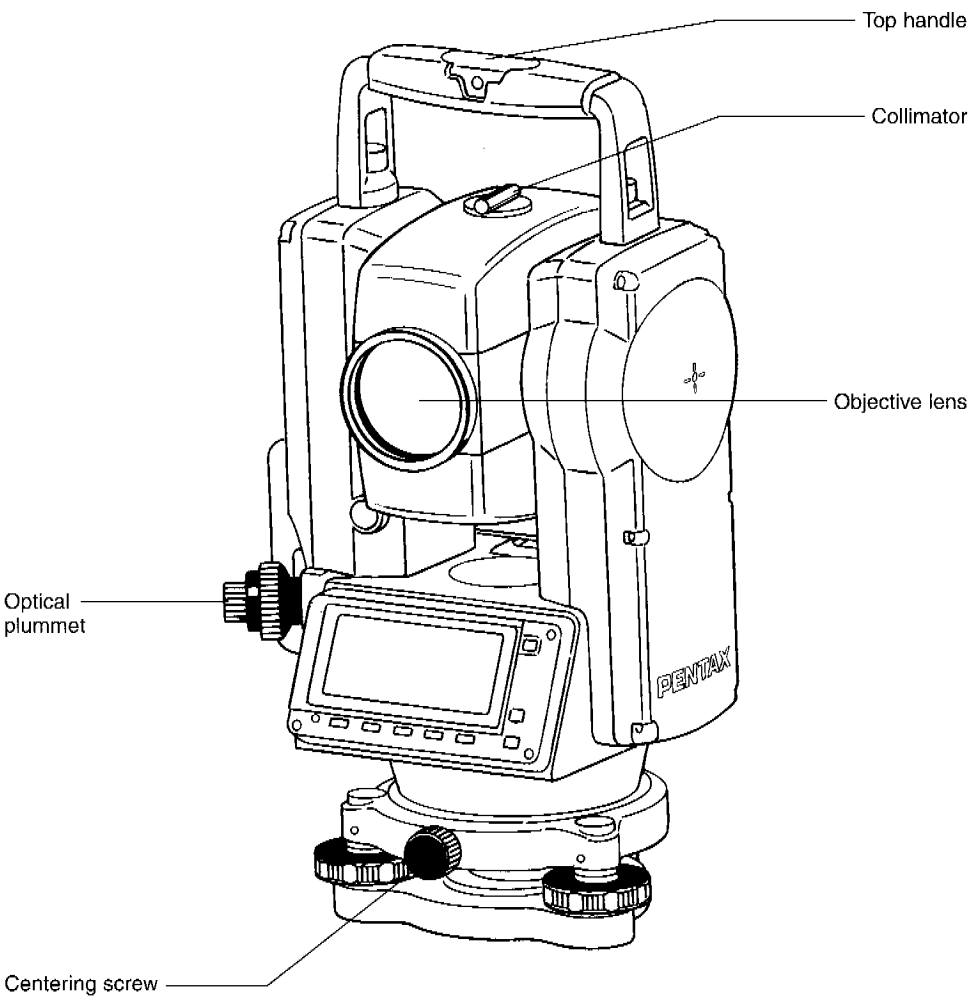
15 NOTICE TO THE USER OF THIS PRODUCT

1 BEFORE USING THE INSTRUMENT

1-1 Names of Parts



R-125(N)/R-122(N)/R-123(N): Detachable type



● Dual display panel is an optional accessory.

R-135 (N): Shift type

1-2 Unpacking and Packing

Unpacking the Instrument from the case

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

Packing the Instrument in the case

① Make sure the telescope is fairly level and lightly tighten the telescope clamp screw.
② Line up the housing marks (round yellow marks on the instrument) and tighten the upper and lower clamp screws.
③ With the housing marks facing upward, set the instrument gently in the case without forcing it.
④ Close the lid to the case and secure the latches.

1-3 Standard equipment

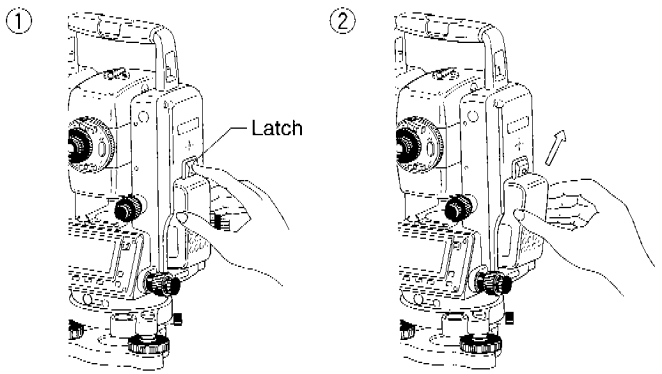
① Instrument
② Carrying case
③ BP02 battery
④ BC03/AC01 charger
⑤ AF battery (CR-123A)
⑥ Plumb bob
⑦ Hexagonal wrench
⑧ Rain cover
⑨ Instruction manual
⑩ CD-R (Special Functions manual)

1-4 Attaching and Charging the Battery

Removing the Battery

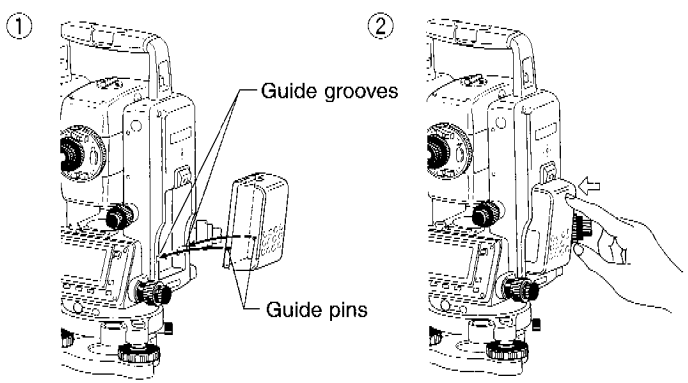
① Pressing down on the latch on the battery pack will cause the top of the battery pack to pop out slightly.
② Lift up the battery pack at an angle and remove it from the instrument.

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



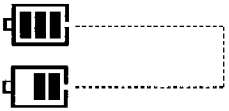
Attaching the Battery

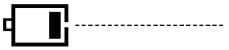
① Align the guide pins on the battery pack with the guide grooves on the instrument and push the battery pack Down into place.
② The battery is attached when you hear the top of the battery pack click into place.

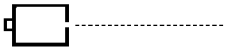


Remaining Battery Charge

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


Plenty of charge left.


Get the spare battery ready.


Replace with the spare battery.

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

Charging the Battery

The "General purpose charging unit BC03/AC01" provided as an accessory should be used to charge the battery.

① Connect the AC01 to charger BC03.
② Insert the AC plug of the AC01 into an AC power outlet.
③ Insert the side of the battery pack. Press on the battery pack until it fits tightly together with the battery charger.

■ Attachment
① Align the battery pack with the guide.

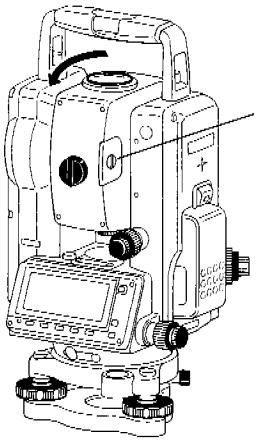
■ Detachment
① Move the battery pack with the guide.

1-5 Attachment of Focus Battery

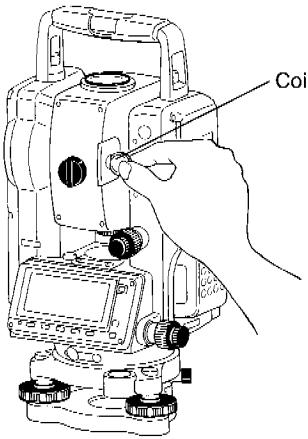
① Turn the telescope upward or downward to remove a battery cap.
② Loosen the screw by means of coin and remove the battery cap.
③ Insert the battery into the battery box according to its (+) and (-) marks and attach the battery cap.

- An alarm beeps when the Auto focus key is pressed in case of battery exhaustion. Replace the battery with the new one.

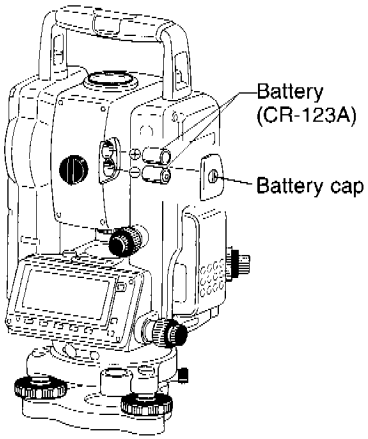
①



②

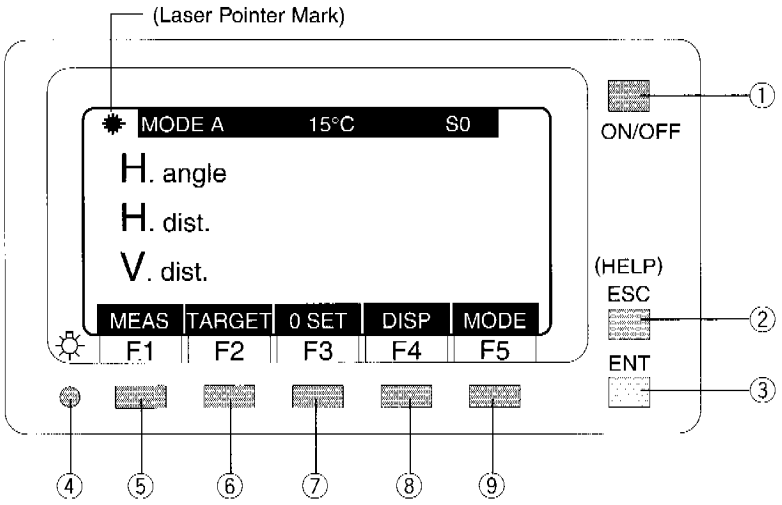


③



2 DISPLAY AND KEYBOARD

2-1 Display and Keyboard



① [POWER] key
② [ESC] key; For [HELP] key, [ILLU] and [ESC] keys are pressed.
③ [ENT] key
④ [ILLU] key; For [HELP] key, [ILLU] and [ESC] keys are pressed.
⑤ F1 key ⑥ F2 key ⑦ F3 key ⑧ F4 key ⑨ F5 key

(● Laser Pointer mark is displayed when the Laser Pointer beam is emitted.)

2-2 Operation Key

Key	Description
[ON/OFF]	ON/OFF of power supply
[ESC]	Returns to previous screen or cancels an operation.
[HELP]	Pressing [ILLU]+[ESC] key causes a help menu to appear in A MODE or B MODE or causes a help message to appear.
[ENT]	Accepts the selected (highlighted) choice or the displayed screen value.
[ILLU]	Turns the illumination of the LCD display and telescope reticle on and off.

2-3 Function Key

Display	F. Key	Description
Mode A		
[MEAS]	F1	Pressing this key one time measures the distance and measurement type can be selected by Initial Setting 2. Pressing this key twice measures the distance and another measurement type can be selected by Initial Setting 2.
[TARGET]	F2	Select whether the target is SHEET/PRISM (/REFRECTORLESS).
[0 SET]	F3	Resets the horizontal angle to 0° 0' 0" by pressing twice.
[DISP]	F4	Switches the display composition in the order "H.angle/H.dist./V.dist.", "H.angle/V.angle/S.dist." and "H.angle/V.angle/H.dist./S.dist./V.dist.".
[MODE]	F5	Switches the screen between MODE A and MODE B.
Mode B		
[S.FUNC]	F1	PowerTopoLite
[ANG SET]	F2	Brings up the angle setting screen for setting angle-related parameters (H.ANGLE/%GRADE, H.ANGLE INPUT and R/L REVERSE).
[HOLD]	F3	Pressing this key twice retains (holds) the horizontal angle shown on the display.
[CORR]	F4	Brings up the screen for changing the Target constant, Temperature, Pressure setting.
[MODE]	F5	Switches the screen between MODE A and MODE B.
Other functions		
[◁]	F1	Moves the cursor to the left.
[▷]	F2	Moves the cursor to the right.
[∧]	F1	Goes back five Items on the screen.
[∨]	F2	Goes forward five items on the screen.
[△]	F3	Moves the cursor up.
[▽]	F4	Moves the cursor down.
[CLEAR]	F5	Clear the figure.
[SELECT]	F5	Open the selection window.

2-4 Display combination of Mode A or B

F. Key	Display of Mode A	Display of Mode B
F1	MEAS	S.FUNC
F2	TARGET	ANG SET
F3	0 SET	HOLD
F4	DISP	CORR
F5	MODE	MODE

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

3 PREPARATION FOR SURVEYING

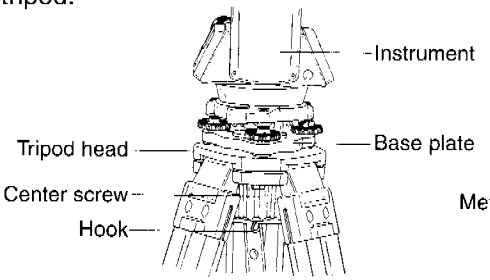
3-1 Centering and Leveling of the Instrument

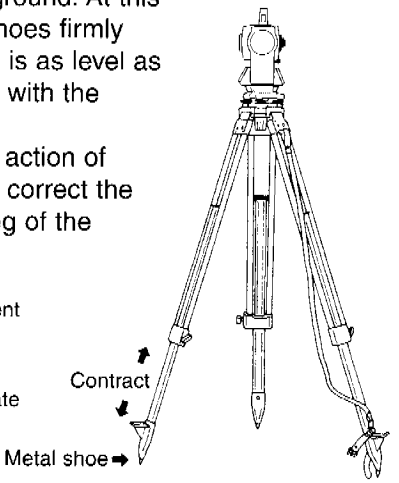
Setting up the instrument and the tripod

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.

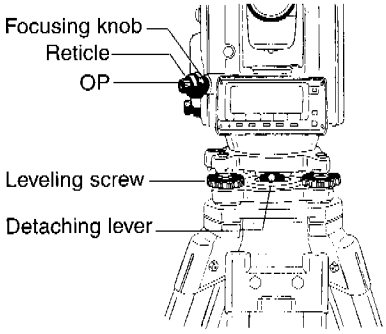
③ If the tripod head is mis-leveled by the action of fixing the metal shoes into the ground, correct the level by extending or retracting each leg of the tripod.

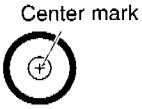




Centering and leveling with the optical plummet [Detachable type: R-125 (N)/R-122 (N)/R-123 (N)]

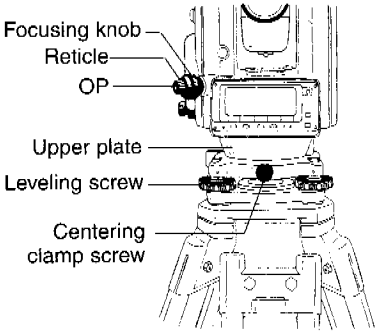
① Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.
② Rotate the focusing knob of the optical plummet and adjust the focus to the station on the ground.
③ Rotate the levelling screws and stay the center mark on the ground mark.
④ Adjust the tripod legs to position the bubble of the circular vial to the center.





[Shift type: R-135 (N)]

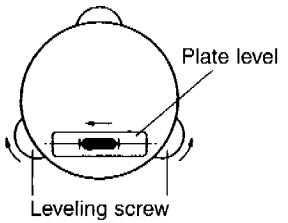
① Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.
② Rotate the focusing knob of the optical plummet and adjust the focus on the ground mark.
③ Loosen the centering clamp screw and push the upper plate by finger and stay the center mark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



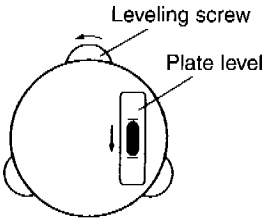
Leveling with Plate level

① Place a Plate level 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 is positioned in the center.
③ Repeat ① and ② by rotating the Plate level through 90 so that the bubble is positioned in the center when the Plate level is moved in any direction.

(A)



(B)

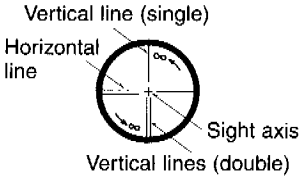


- See arrows in Fig. above for the relation between the direction of leveling screw rotation and the bubble shifting direction.
- If the bubble does not remain centered in ③ "Adjustment of Plate level" is necessary. Refer to page 64.

3-2 Eyepiece Adjustment

Eyepiece adjustment

① Remove the telescope lens cap.
② Point the telescope at a bright object, and rotate the eyepiece ring full counter-clockwise.
③ Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticle appears 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 [ILLU] to illuminate it . For adjusting intensity of brightness, refer to page 31.

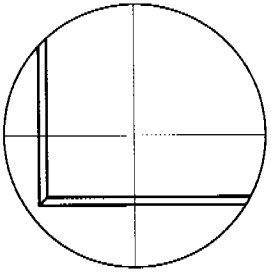
3-3 Target Sighting

[Auto focus]

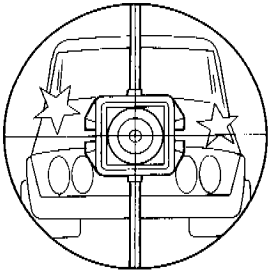
The Auto focus mechanism is very precise but will not function under every condition. There is a slight possibility of focusing failure owing to brightness, contrast, the shape and size of the target.
In such a case, press the AF button and focus on the target by operating the Power focus key or the AF ring.

<Target examples which are hard to focus>

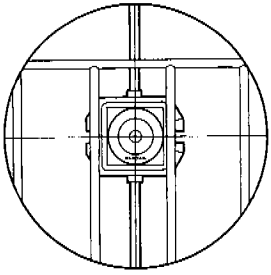
No contrast like a white wall



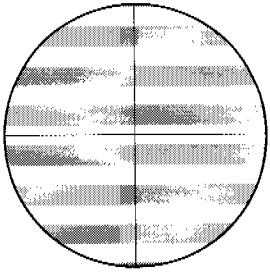
Bright back light



Obstacle in front of a target



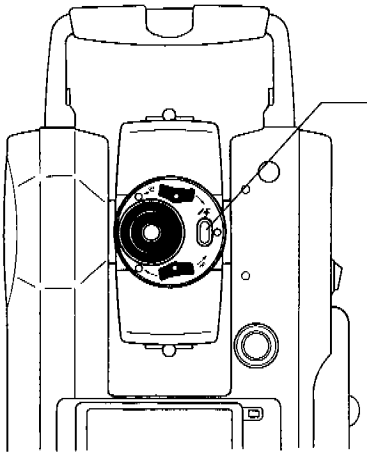
A wall composed of single horizontal lines



[Target sighting by Auto focus]

The Auto focus of R-100 series has following two modes.

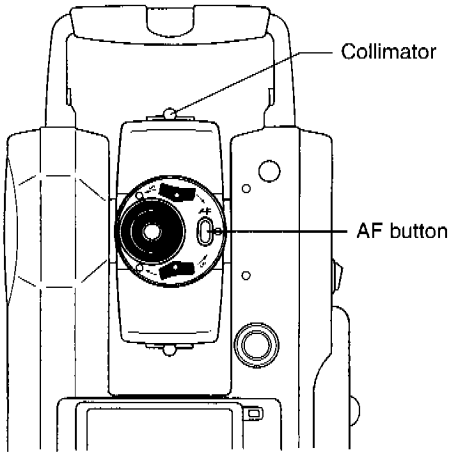
1. Normal mode : Pressing AF button focuses on the target.
2. Continuous mode : Pressing AF buttons for two seconds beeps, and releasing the key enters into the Continuous mode. This mode enables you to perform the Auto focus approx. for one minutes only by sighting the telescope and chasing the target.

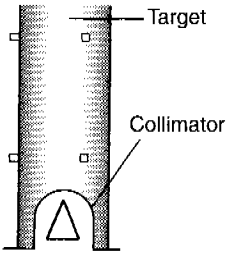


Normal mode : Press the AF button.
Continuous mode : Pressing AF buttons for two seconds beeps and release the key.

[Auto focus :Target sighting by Normal mode]

① Loosen the telescope clamp and horizontal clamp screws.
② Point the telescope at the target using a collimator.
③ Tighten the above two screws.
④ Adjust the eyepiece.
⑤ Look through the telescope and press the AF button. Move your eye vertically and horizontally to see if the target image moves in relation to reticle.
⑥ Stay the reticle accurately on the target using telescope and horizontal tangent screws.



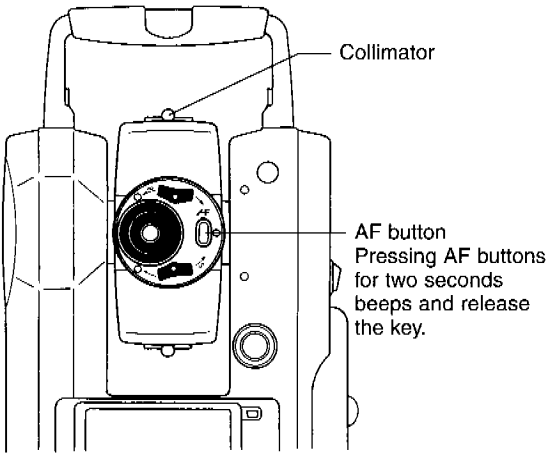


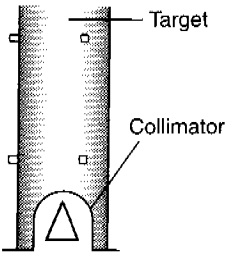
Target sighting

- If the target image does not move, there is no parallax. If it moves, eliminate the parallax.
- Even when vertical angle measurement is not performed, it is recommended that the target should be placed at the reticle center.
- Operating the Power focus key rotates the AF ring, so do not touch it while it is rotating.

[Auto focus :Target sighting by Continuous mode]

① Loosen the telescope clamp and horizontal clamp screws.
② Point the telescope at the target using a collimator.
③ Tighten the above two screws.
④ Adjust the eyepiece.
⑤ Look through the telescope and then press the AF button for two seconds to beep, and release the key to enter into the Continuous mode.
⑥ Stay the reticle accurately on the target using telescope and horizontal tangent screws.
⑦ Point the telescope to the next target as well.



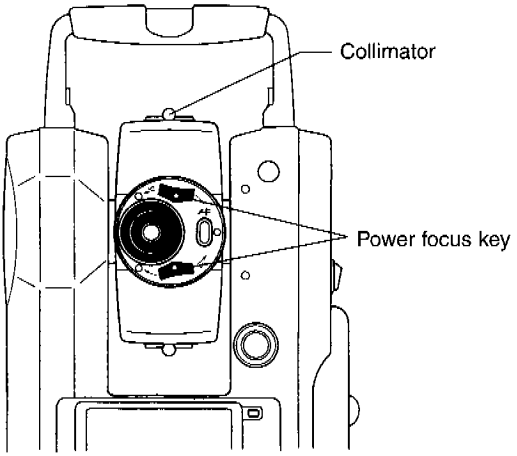


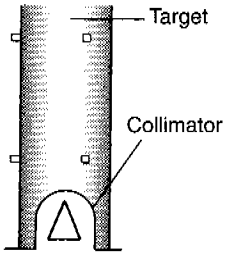
Target sighting

- Keep the target close to the reticle center when chasing it by the Continuous mode.
- Continuous mode automatically ceases after approx. one minute.
- Pressing the AF button or operating the Power focus key releases the continuous mode.
- Operating the Power focus key rotates the AF ring, so do not touch it while it is rotating.

[Auto focus :Target sighting by Power focus mode]

① Loosen the telescope clamp and horizontal clamp screws.
② Point the telescope at the target using a collimator.
③ Tighten the above two screws.
④ Adjust the eyepiece.
⑤ Look through the telescope, and then operate the Power focus key and focus on the target.
⑥ Stay the reticle accurately on the target using telescope and horizontal tangent screws.



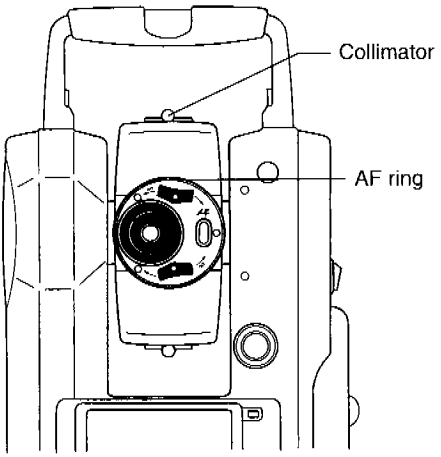


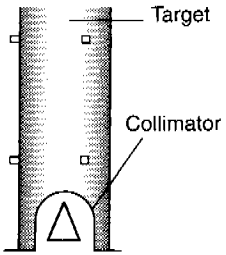
Target sighting

- Tilting the Power focus key "clockwise" makes it possible to focus on closer range and "counterclockwise" makes on further range.
- Tilting angle of the Power focus key makes it possible to perform following three focusing speeds.
  Low speed : When tilted to middle position by approx. 5 degrees
  Middle speed : When tilted fully by approx. 10 degrees
  High speed : When tilted fully by approx. 10 degrees and passed one second
- Operating the Power focus key rotates the AF ring, so do not touch it while it is rotating.

[Target sighting by Manual focus]

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





Target sighting

- The AF ring rotation "clockwise" makes it possible to focus on closer range and "counterclockwise" makes it possible to focus on further range.

3-4 Attachment and Detachment of Tribrach

The tribrach of R-325 is detachable from the instrument if required when replacing the instrument with a target or unit prism for example.

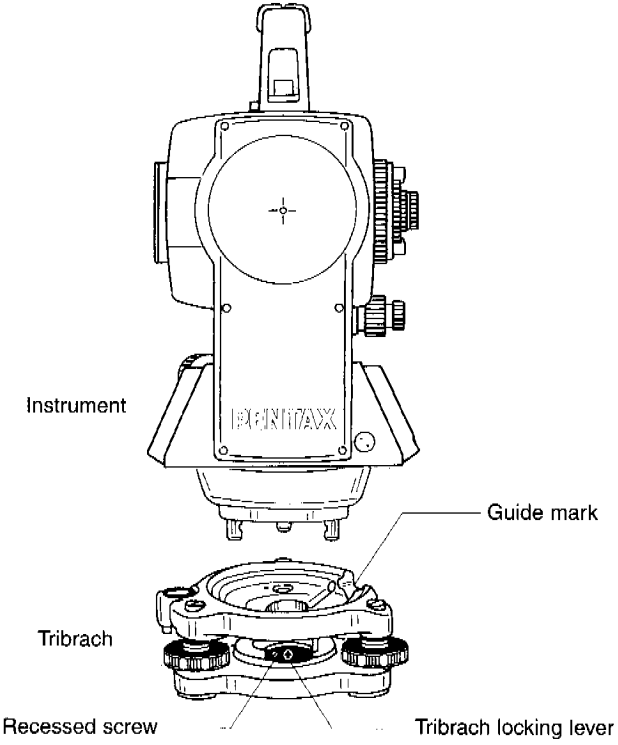
Detachment

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

Attachment

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

The guide and guide mark must be fitted to attach the instrument.
When the tribrach does not need to be attached or detached or instrument is to be transported, tighten the recessed screw with a screwdriver to fix the locking knob.

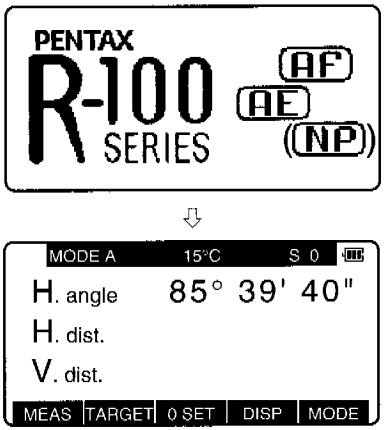


4 TURNING THE POWER ON

4-1 Turning the Power On and Off

Pressing the [POWER] key causes the initial screen.

(The [POWER] key is also used to turn the power off.)
After a few seconds, angle and distance can be measured.

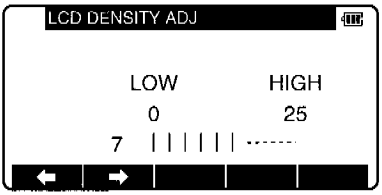


- The Auto Power Off function will automatically turn the power off if no operations are performed for approximately 10 minutes. (Factory default setting)
- The [POWER] key is controlled by software in the instrument while it is working, and this key is valid only when turning off causes no problem.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

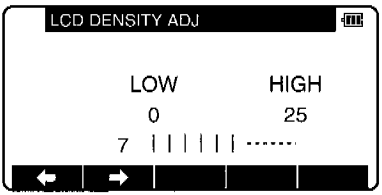
For details on resetting the horizontal angle 0 .....See page 33.
For details on changing the horizontal angle from clockwise to counterclockwise .....See page 37.
For details on measuring the vertical angle .....See page 32.
For details on distance measurement .....See page 38.
For details on the automatic power-off function .....See page 55.

4-2 Adjusting LCD Contrast

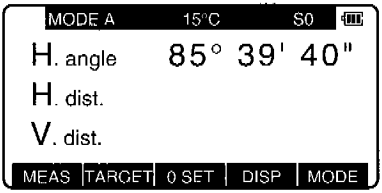
Press [F4] [DISP] while holding down the [ILLU] key to access the screen for adjusting LCD contrast.



Pressing [F1] [⇦] will lighten the contrast,while pressing the [F2] [⇨] will darken the contrast.



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



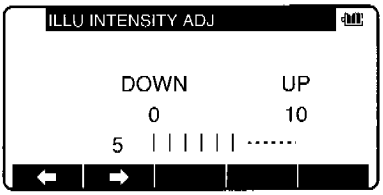
- LCD contrast may be adjusted as necessary at any time.
- The contrast may be adjusted to any one of 25 levels.
- LCD contrast may be unappealing under certain environmental conditions such as high temperature. Adjust the LCD contrast as described above in such situations.

Correction

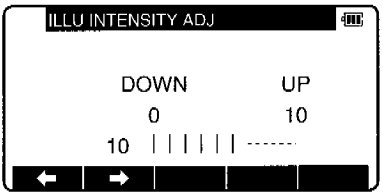
Page 30
Error Correction — Press [F4] [DISP] while...
Correction — Press [F2] while...
Page 31
Error — Press [F5] while...
Correction — Press [F1] while...

4-3 Adjusting Illumination Brightness

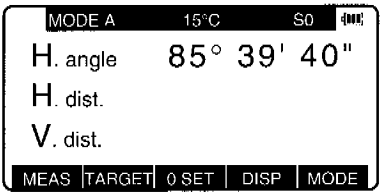
Press [F5] while holding down the [ILLU] key to access the screen for adjusting illumination brightness.



Pressing the [F1] [⇦] will decrease brightness, while pressing the [F2] [⇨] will increase brightness.



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



- Illumination brightness of the LCD screen and telescope reticle may be adjusted as necessary at any time.
- Illumination brightness may be adjusted to any one of 10 levels.

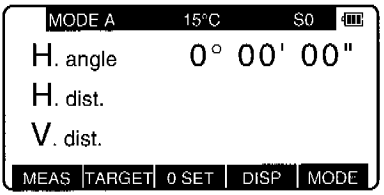
4-4 Switching the Laser Pointer, ON/OFF (R-115N/R-125N/R-135N/R-122N/R-123N)

Press [F5] while holding down the [ILLU] key to switch the laser pointer, ON/OFF. It is switched every time when [F5] is pressed.
" ✸ " is displayed at the upper left of the screen when the laser beam is emitted.

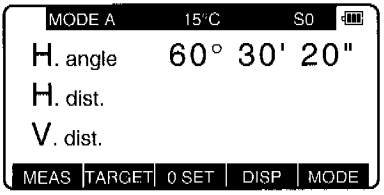
5 ANGLE MEASUREMENT

5-1 Measuring an Angle

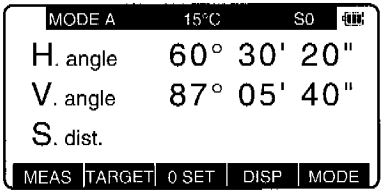
Aim at the first target, then press [F3] [0 SET] twice in succession to reset the horizontal angle to 0.



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



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

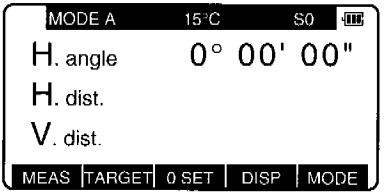


- The [0 SET] key cannot reset the vertical angle to 0.
- Pressing the [MODE] key cycles through the sets of display items: "H.angle/H.dist./V. dist.", "H angle/V.angle/S.dist.", and "H.angle/V. angle/H.dist./S.dist./V.dist.".
- Even though you turn the power off during a survey, the horizontal angle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

For details on resetting the horizontal angle to 0, see page 33.

5-2 Resetting the Horizontal Angle to 0

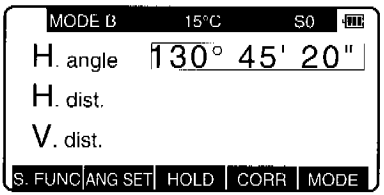
Pressing [F3] [0 SET] twice in succession resets the horizontal angle to 0° 0' 0".



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

5-3 Holding the Horizontal Angle

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

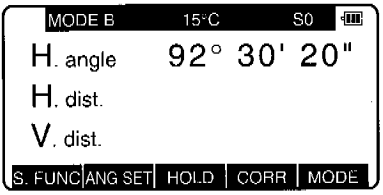


- If you want to hold the horizontal angle when you are in mode A, press [F5] [MODE] first to switch to mode B, then press [F3] [HOLD].
- The [F3] [HOLD] cannot hold the vertical angle or distance.
- To release the horizontal angle from being held, press [F3] [HOLD]once.
- Pressing [F3] [HOLD] accidentally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

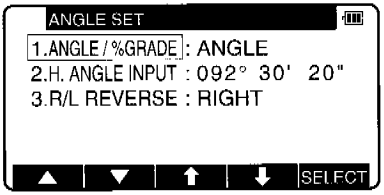
5-4 Inputting an Arbitrary Horizontal Angle

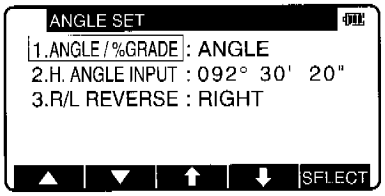
In case of Horizontal angle 123° 45' 20" input

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

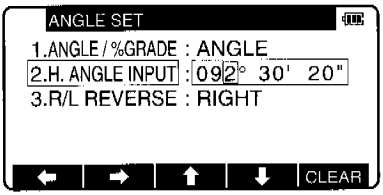


Press [F2] [ANG SET] to display the angle setting screen, then press [F4] [⇩] to move the cursor to "2. H. ANGLE INPUT".

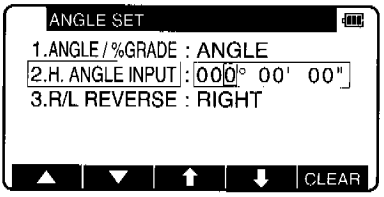




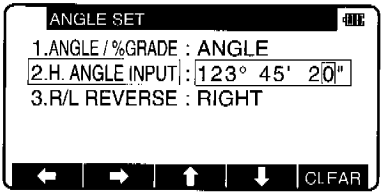
Press [F5] [SELECT] to open the horizontal angle input window.
[F5] [CLEAR] is used to clear the values.



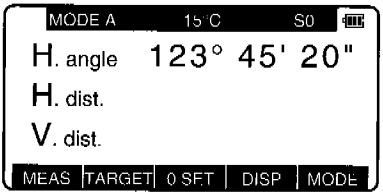
Press [F1] [◁] to move the cursor to the left, then Press [F3] [△] or [F4] [▽] to set the value.
(The [F3] [△] or [F4] [▽] increases or decreases the value, respectively. Pressing [F3] [△] or [F4] [▽] one time increases or decreases the value by one)



Press the [F2] [▷] to move the cursor to the right. Press the [F3] [△] or [F4] [▽] to set the horizontal angle value to 123° 45' 20" in the same way.



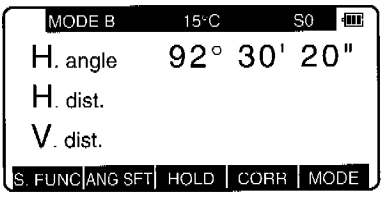
Press the [ENT] key to accept the horizontal angle set to 123° 45' 20" and change the screen to mode A.



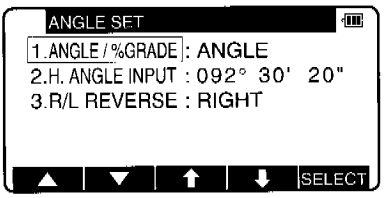
- The instrument can be used with the optional Remote control.

5-5 Displaying the % Slope of the Vertical Angle

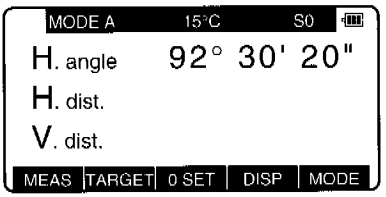
Press [F5] [MODE] to enter mode B.



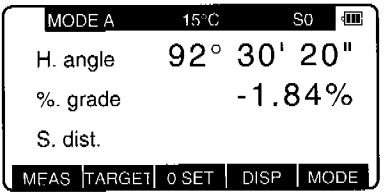
Press [F2] [ANG SET] to display the Angle setting screen.



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



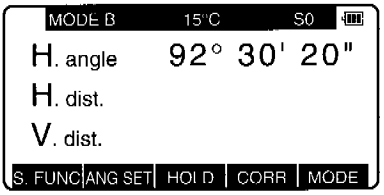
Press [F4] [DISP] to display the slope value in %.



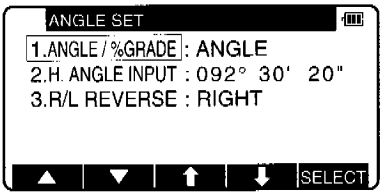
- The 0% represents the horizontal 0, and +100% and -100% represent 45° up and down slopes respectively.
- To return the screen from the slope (%) display to the 360° scale, also take above same steps by entering mode B.
- If the slope (%) exceeds [+/-]1000%, "Out of grade range" is displayed, indicating that the current vertical angle cannot be measured.
- When the telescope returns to a slope within slope [+/-] 1000%, the slope (%) display returns automatically from the "Out of grade range" message to the numeric value.

5-6 Changing the Horizontal Angle from Clockwise to Counterclockwise

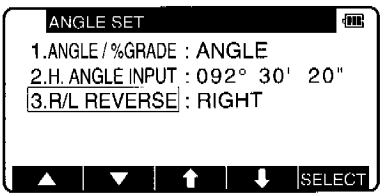
Press [F5] [MODE] to enter mode B.



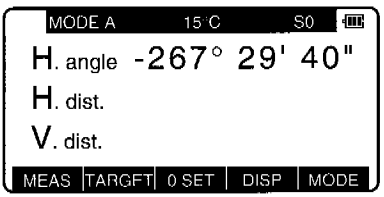
Press [F2] [ANG SET] to display the Angle setting screen.



Press [F4] [⇩] to move the cursor to "3. R/L REVERSE".



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



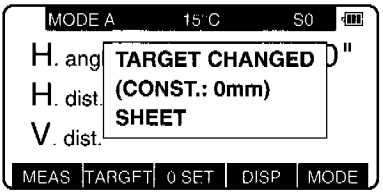
- To return the horizontal angle from counterclockwise to clockwise, also take the above same procedures, press [F5] [SELECT] to select the clockwise angle.
- When the counterclockwise horizontal angle is selected, the order of aiming at the targets becomes the reverse (the right one first, then the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

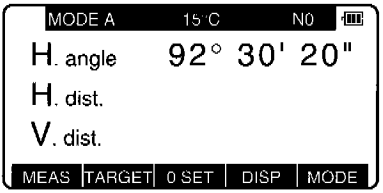
6 DISTANCE MEASUREMENT

6-1 Target Setting

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

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





- The target mode is changed sequentially as follows.
  Reflector sheet, Prism (, Reflectorless) (Factory default setting)
- The target mode after turning the power on can be selected at the Initial Setting 2. (The Factory default setting is Reflector sheet.)
- The target Constant differs according to the selected target mode.
  So, confirm the target mode and its Constant shown at the top screen after changing the target. (Refer to page 42)

1. (Distance measurement by Reflectorless (Non-Prism) mode)

- The measurement range is determined by the white side of the Kodak Gray Card facing the instrument and by its surrounding brightness.
  There is a possibility that the range may vary when the target does not satisfy the conditions above at survey work.
- Pay attention to followings in case of distance measurement by Reflectorless.
  In case of resulting in low accuracy, perform the distance measurement by Reflector sheet or Prism.

① There is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam when the laser beam comes into the target from diagonal angle.
② There is a possibility that the instrument cannot calculate correctly when receiving reflected laser beam from forth and back directions in case of measuring the target on the road.
③ There is a possibility that synthesized values are calculated and the distance may become longer or shorter than the actual one when the operator measures the target of slope or sphere or rugged shape.
④ There is a possibility that the instrument cannot calculate correctly collecting the reflected laser beam from a man or a car that comes and goes in front of the target.

2. Distance measurement by Reflector sheet mode

Position the Reflector sheet whose reflecting surface faces the aiming line to be approx. right angle when the distance is measured by it. If it is positioned not to be approx. right angle, there is a possibility that correct distance measurement may be impossible by dispersion or reduction of laser beam.

3. Applied measurement range by Each target mode

(Reflectorless (Non-Prism) mode): It can measure the distance by Reflector sheet and Prism, but the measurable distance is less than 100m.
Reflector sheet mode: It can measure the distance by Prism mode, but the measurable distance is less than 1km.
Prism mode: It can measure by Reflector sheet as well.
Reflector sheet mode and Prism mode: It is sometimes possible to measure without reflector sheet or prism under special couditions like in the close distance, targeting on a wall surface. However, there is a possibility including some errors in this case, so surely select the Reflectorless mode.

- The target Constant should be correctly selected and confirmed in case that the Reflector sheet is used at the Prism mode and the Prism is used at the Reflector sheet mode.

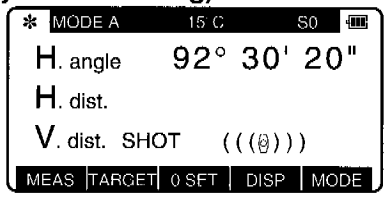
6-2 Distance Measurement

The R-100 series has two distance measurement modes of MEAS and second MEAS. Pressing the [F1][MEAS] one time goes to MEAS and twice goes to second MEAS.
You can freely select and allocate your desired measurement mode MEAS or second MEAS by the Initial Setting 2. The "MEASURE SHOT" is set at MEAS and "TRACK CONT" is set at second MEAS as a Factory default setting.

- MEASURE SHOT means the Distance measurement by the Shot.
  (Minimum distance display is mm.)
- MEASURE CONT means the Distance measurement by the Continuous.
  (Minimum distance display is mm.)
- TRACK SHOT means the Fast distance measurement by the Shot.
  (Minimum distance display is mm or cm.)
- TRACK CONT means the Fast distance measurement by the Continuous.
  (Minimum distance display is mm or cm.)

Confirm the target Constant before beginning the distance measurement.

Example: "MEASURE SHOT" at MEAS (Factory default setting)



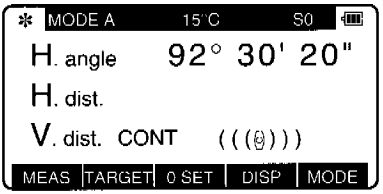
Collimate the telescope at a Target and press the [F1] [MEAS] once to start measuring the distance.
Once distance measurement has been started, the distance measurement mark remains displayed.
Upon reception of a reflected light from the Target, the instrument beeps and displays the ✻ mark to start the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

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

- If the shot number for distance measurement has been set to 2 or more in "Initial Setting 2", the distance is measured for the specified number of times to display the averaged value.
- If the Distance measurement signal in "Initial Setting 2" has been set to "MEAS" the first measurement is started only by aiming at the Target. Press [F1] [MEAS] for each measurement after the first one.
- If the Automatic Distance measurement in "Initial Setting 2" has been set to VALUE, a two-digit number representing the AIM value appears as soon as measurement starts (The AIM value varies depending on the distance and atmospheric conditions.)

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

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



- If the instrument is in mode B, press [F5] [MODE] to switch to mode A and press [F1] [MEAS] twice.
- Pressing [F1] [MEAS] twice after collimating the telescope at the Target starts Continuous distance measurement at fast speed with the "MEAS" text blinking. It remains blinking during the measurement.
  If you press the [F1] [MEAS] again, Distance measurement is completed and the "MEAS" text stops blinking.
- Either "1 mm" or "1 cm" can be selected in "Initial Setting 2" as the Track minimum display unit for fast distance measurement.
- Pressing [F4] [DISP] cycles through the sets of display items: "H.angle/H.dist./V.dist.", "H.angle/V.angle/S.dist.", and "H.angle/V.angle/H.dist./S.dist./V.dist."
- Pressing the [ESC] or [F2] [TARGET] or [F5] [MODE] during fast distance measurement stops it.
- If the shot number for distance measurement has been set to 2 or more in "Initial Setting 2", the distance is measured for the specified number of times to display the averaged value.
- If the Automatic Distance measurement in "Initial Setting 2" has been set to "MEAS" the first measurement is started only by aiming at the Target (Press the [MEAS] key for each measurement after the first one.)
- If the Distance measurement signal in "Initial Setting 2" has been set to VALUE, a two-digit number representing the AIM value appears as soon as measurement starts (The AIM value varies depending on the distance and atmospheric conditions.)

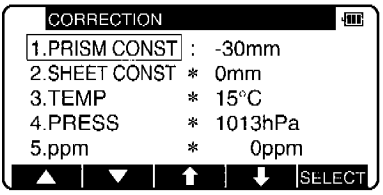
7 CORRECTION MODE

7-1 Changing the Target Constant (Inputting a numeric value)

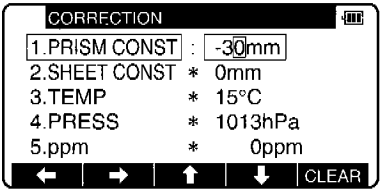
Changing the Target Constant can be performed only when the Reflector sheet and Prism Constant settings are "INPUT" in Initial Setting 1.

Example: Prism Constant - 25mm setting

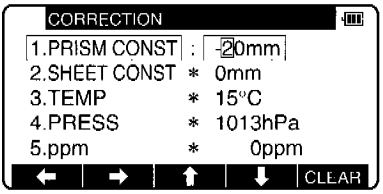
Press [F4] [CORR] in mode B.
(If the instrument is in mode A, press [F5] [MODE] to enter mode B.)
(SHEET CONST : Reflector sheet constant)



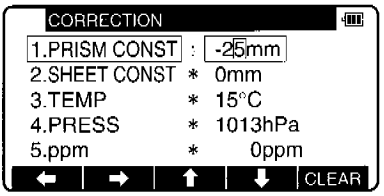
Press the [F5] [SELECT] to enable the Prism Constant to be changed.



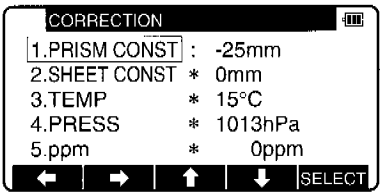
Press [F1] [⇦] to move the cursor to the left and [F3] [⇧] or [F4] [⇩] to set the desired value.
(The [F3] [⇧] or [F4] [⇩] increases or decreases the value, respectively.
Pressing the [F3] [⇧] or [F4] [⇩] one time increases or decreases the value by one.)



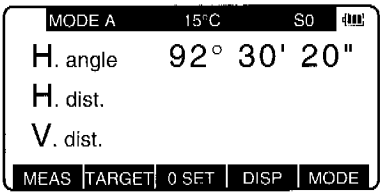
Press [F2] [⇨] to move the cursor to the right.
Press [F3] [⇧] or [F4] [⇩] to set the Prism Constant to -25 mm.



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



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



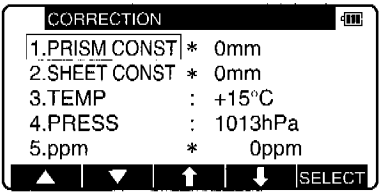
- To set the Reflector sheet constant to "0" select "0" for "Prism Constant" in "Initial Setting 1".
- To set the Prism constant to "0" or "- 30" select "0" or "- 30" for "Prism Constant" in "Initial Setting 1".
- When the "Reflector sheet Constant" has been set to "0" in Initial Setting 1 and "Prism Constant" has been set to "0" or "- 30", "＊" is displayed to the left of "0" or "- 30" on the correction menu screen. When "＊" is on the screen, the Constant cannot be changed (by entering a numeric key).
- To set a mark (+ or -), position the cursor at the desired one and press [F3] [⇧] or [F4] [⇩].
- Once set, the Reflector sheet Constant and Prism Constant remains on the measurement screen as "S 0" or "P 0".
- The factory initial of Reflector sheet Constant and Prism Constant are 0.
- Once set, the each Constant remains in memory even after the power is turned oft.
- The Reflectorless Constant is fixed to "0".

7-2 Changing the Temperature

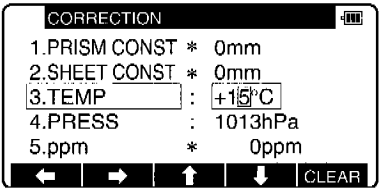
The temperature setting can be changed only when "Atmospheric Correction" has been set to "ATM INPUT" in "Initial Setting 1".

Example: Setting the temperature to +22°C

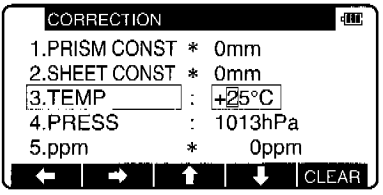
Press [F4] [CORR] in mode B.
(If the instrument is in mode A, press [F5] [MODE] to enter mode B.)



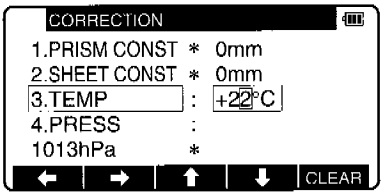
Press [F4] [⇩] to move the cursor to "3.TEMP" and press the [F5] [SELECT] to enable the temperature to be changed.



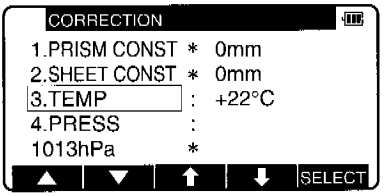
Press [F1] [⇦] to move the cursor to the left and [F3] [⇧] or [F4] [⇩] to set the desired value.
(The [F3] [⇧] or [F4] [⇩] increases or decreases the value, respectively. Pressing the [F3] [⇧] or [F4] [⇩] one time increases or decreases the value by one.)



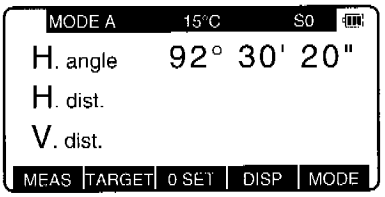
Press [F2] [⇨] to move the cursor to the right.
Press [F3] [⇧] or [F4] [⇩] to set the Temperature to +22°C.



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



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



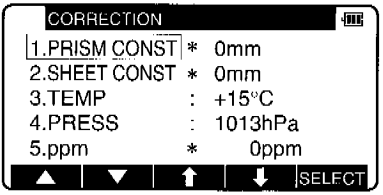
- The valid range of Temperatues input is from -30°C to +60°C.
- When "Atmospheric Correction" in "Initial Setting 1" has been set to "1 . AUTO" or "4. NIL", "＊" is displayed to the left of the temperature value on the correction menu screen. When "＊" is on the screen, the temperature cannot be changed. If "Atmospheric Correction" in "Initial Setting 1" has been set to "3. ppm INPUT", no temperature is displayed on the correction menu screen.
- To set a mark (+ or -), position the cursor at the desired one and press the [F3] [⇧] or [F4] [⇩].
- Once set, the temperature is displayed at the center of the top of the measurement screen.
- The factory initial of temperature is "1. AUTO".
- Once set, the temperature remains in memory even after the power is turned off.
- Temperature correction is based on 15°C.
  If this instrument is used without correcting the temperature, a distance error per 100 m is about -0.1mm per +1°C as a temperature difference from 15°C. A distance error per 100 m is about 0.1 mm per -1°C as a temperature difference from 15°C. (For more accurate values, See page 82.)

7-3 Changing the Atmospheric Pressure

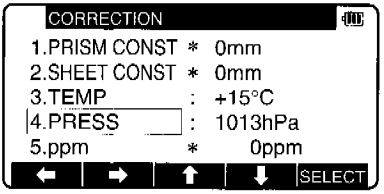
The atmospheric pressure setting can be changed only when "Atmospheric Correction" has been set to "ATM INPUT" in "Initial Setting 1".

Example: Setting the pressure to 900 hPa

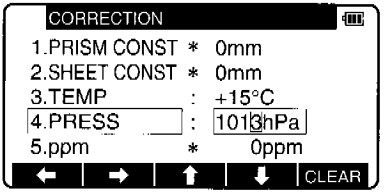
Press [F4] [CORR] in mode B.
(If the instrument is in mode A, press [F5] [MODE] to enter mode B.)



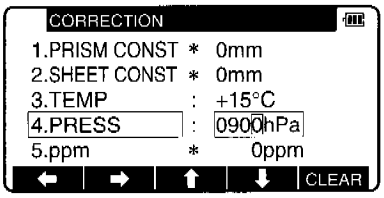
Press [F4] [⇩] to move the cursor to "4.PRESS" and press the [F5] [SELECT] to enable the temperature to be changed.



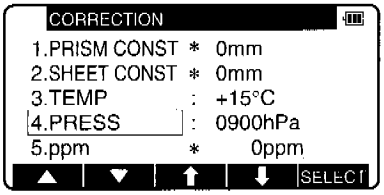
Press [F1] [⇦] to move the cursor to the left and [F3] [⇧] or [F4] [⇩] to set the desired value.
(The [F3] [⇧] or [F4] [⇩] increases or decreases the value, respectively. Pressing the [F3] [⇧] or [F4] [⇩] one time increases or decreases the value by one.)



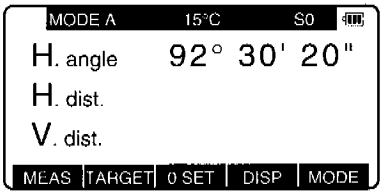
Press [F2] [⇨] to move the cursor to the right.
Press [F3] [⇧] or [F4] [⇩] to set the PRESS to 900 hPa.



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



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



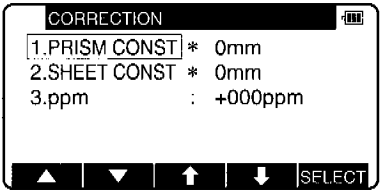
- The valid range of Pressure input is from 600 to 1120 hPa. (420 - 840 mmHg)
- When "Atmospheric Correction" in "Initial Setting 1" has been set to "1. AUTO" or "4. NIL", "＊" is displayed to the left of the pressure value on the correction menu screen. When "＊" is on the screen, the pressure cannot be changed. If "Atmospheric Correction" in "Initial Setting 1" has been set to "3.ppm INPUT", no pressure is displayed on the correction menu screen.
- Once set, the pressure is displayed at the center of the top of the measurement screen.
- The factory initial of pressure is "1. AUTO".
- Once set, the pressure remains in memory even after the power is turned off.
- Pressure correction is based on 1013 hectopascals (hPa).
- If this instrument is used without correcting the pressure, a distance error per 100 m is about - 0.3 mm per -10 hPa as a pressure difference from 1013 hPa. (For more accurate values, see page 82.)

7-4 Changing the ppm Value

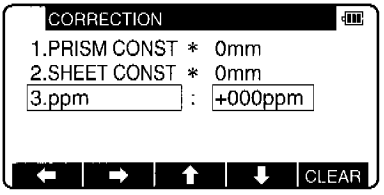
The ppm value can be changed only when "Atmospheric Correction" has been set to "ppm INPUT" in "Initial Setting 1". "TEMP" and "PRESS" are not displayed.

Example: Setting the ppm value to 31 ppm

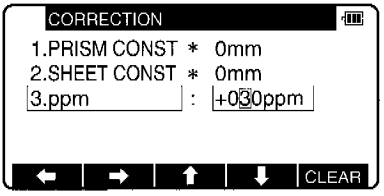
Press [F4] [CORR] in mode B.
(If the instrument is in mode A, press [F5] [MODE] to enter mode B.)



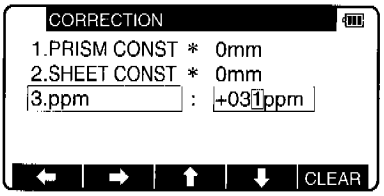
Press [F4] [⇩] to move the cursor to "3. ppm" and press the [F5] [SELECT] to enable the temperature to be changed.



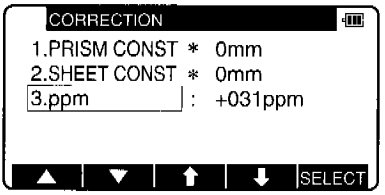
Press [F1] [⇦] to move the cursor to the left and [F3] [⇧] or [F4] [⇩] to set the desired value.
(The [F3] [⇧] or [F4] [⇩] increases or decreases the value, respectively.
Pressing the [F3] [⇧] or [F4] [⇩] one time increases or decreases the value by one.)



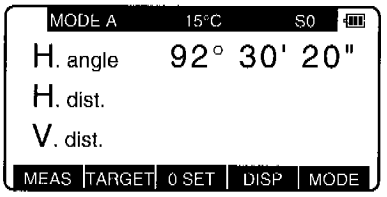
Press [F2] [⇨] to move the cursor to the right.
Press [F3] [⇧] or [F4] [⇩] to set the ppm value to 31 ppm.



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



Pressing the [ESC] key returns the instrument to mode A.



- The valid range of ppm values is from -199 to +199.
- To set a mark (+ or -), position the cursor at the desired one and press the [F3] [⇧] or [F4] [⇩].
- Once set, the ppm value is displayed at the center of the top of the measurement screen.
- The factory initial of ppm value is "1. AUTO".
- Once set, the ppm value remains in memory even after the power is turned off.

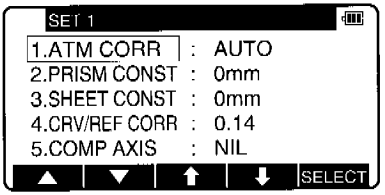
8 INITIAL SETTING

8-1 Overview

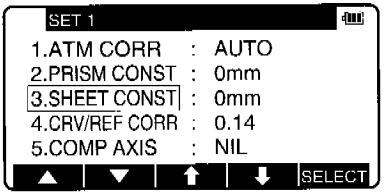
For the R-100 series, you can select and save the desired setting for a variety of prescribed instrument conditions, called Initial Setting.
The Initial Setting is saved in four modes, "Initial Setting 1", "Initial Setting 2", "Initial Setting 4", and "Initial Setting 5", in which you can select and save the instrument conditions described below.
The factor initial for each of these conditions is marked by [ ].
To change Initial Setting, follow the operating procedures for entering each Initial Setting mode on Page 50 and the operating procedures for changing an Initial Setting on Page 52.

8-2 Entering the Mode for Initial Setting 1

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

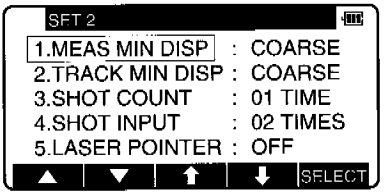


Press [F3] [⇧] or [F4] [⇩] to position the cursor at the item of interest.



8-3 Entering the Mode for Initial Setting 2

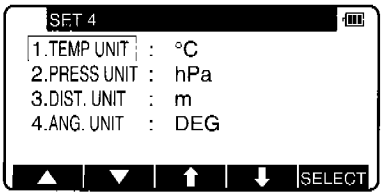
Press the [POWER] key while holding [F2] key down to access the screen for Initial setting 2.



- Select the item of interest in the same way as in the mode for Initial setting 1
- Pressing [F2] [▽] scrolls the screen down five items; pressing [F1] [△] scrolls it up five items.

8-4 Entering the Mode for Initial Setting 4

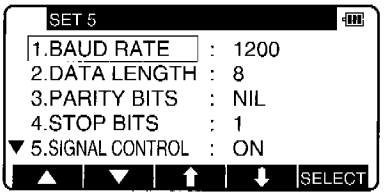
Press the [POWER] key while holding [F4] key down to access the screen for Initial setting 4.



- Select the item of interest in the same way as in the mode for Initial setting 1.

8-5 Entering the Mode for Initial Setting 5

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

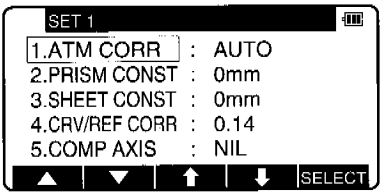


- Select the item of interest in the same way as in the mode for Initial setting 1.
- Pressing [F2] [▽] scrolls the screen down five items; pressing [F1] [△] scrolls it up five items.

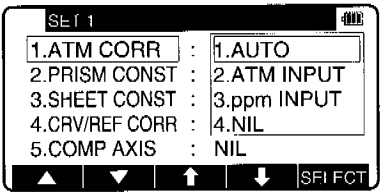
8-6 Example of Changing an Initial Setting Content (Selection of Atmospheric Correction)

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

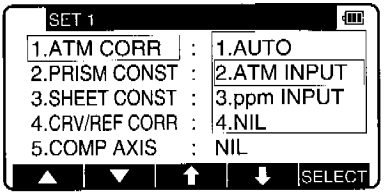
Access the screen for Initial Setting 1 by taking procedures "Entering the Mode for Initial Setting 1" on page 50.



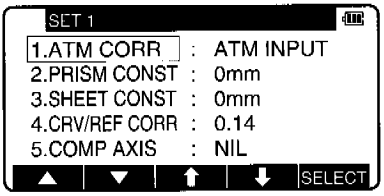
Press [F5] [SELECT] to open the screen for selecting the atmospheric correction.



Press [F3] [⇧] or [F4] [⇩] to position the cursor at the desired item, then press [ENT] key to select that item.
Pressing the [ENT] key settles the change of selected item. Pressing the [ESC] key invalidates the change of selected item.

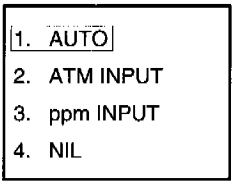


Pressing again the [ESC] key or [ENT] key quits the initial setting screen and usual start screen appears.

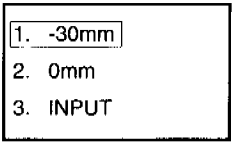


8-7 Initial Setting 1

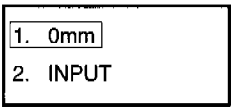
1. Selection of **Atmospheric Correction**
   Select whether Atmospheric Correction is to be performed by using the automatic measurement correction function with a atmospheric sensor, by entering the atmospheric temperature and pressure measured with a thermometer and barometer, by entering ppm value, or by fixing the ppm value to 0 (NIL) not to perform Atmospheric Correction.



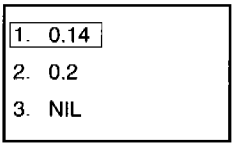
2. Selection of **Prism Constant**
   Select whether the Prism Constant to be input is set to 0 mm, - 30mm or to an arbitrary value to be entered from the keyboard.



3. Selection of **Reflector sheet Constant**
   Select whether the target constant to be input is set to 0 mm, or to an arbitrary value to be entered from the keyboard.



4. Selection for **Refraction & Curvature Corrections**
   Select whether the correction factor to be input for both differences (Refraction, Curvature) is set to 0.14, 0.2, or none (NIL). Selecting "3. NIL" results in no correction of both values.

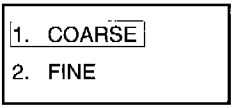


5. Selection of **Tilt Compensation**
   Select whether Tilt Compensation is to be single-axis compensation, dual-axis compensation, or disabled (NIL).

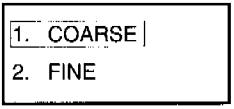
- The factor initial for each instrumet condition is marked by [ ].

8-8 Initial Setting 2

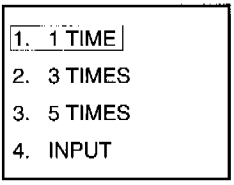
1. Selection of **Distance measurement unit**
   COARSE: 0.001m, FINE: 0.0001m



2. Selection for minimum distance display **during TRACK (Fast) distance measurement**
   Select the minimum distance display unit for TRACK distance measurement: 1 cm or 1 mm.



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

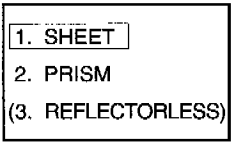


4. Setting the **Shot input**
   Set the shot number for Shot distance measurement using the [F3] [⇧] (to increment the value) or [F4] [⇩] (to decrement the value). Press the [F2] [⇨] and [F1] [↵] to move the cursor.

- The valid range of values for the shot number is from 1 to 99.
- This setting is enabled only when the shot number (Above 3.) has been set to "4. INPUT".

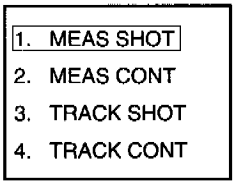
5. Selection of the **Laser Pointer (R-115N/R-125N/ R-135N/R-122N/R-123N)**
   Select whether the laser pointer is used, ON, or not used, OFF. The Laser Pointer mark "✹" is displayed at the upper left of the screen when ON.

6. Selection of **Priority Target**
   Select whether the target is Reflector sheet or Prism (or Reflectorless (Non-Prism)).

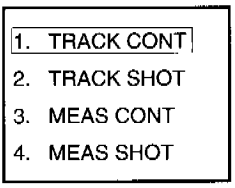


- The target type selected here is the default setting when turned the power on.

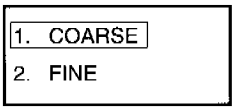
7. Selection of **MEAS** setting
   Select whether the normal distance measurement is MEAS SHOT or MEAS CONT or TRACK SHOT or TRACK CONT.



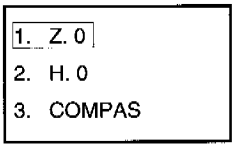
8. Selection of **second MEAS** setting
   Select whether the normal distance measurement is TRACK CONT or TRACK SHOT or MEAS CONT or MEAS SHOT.



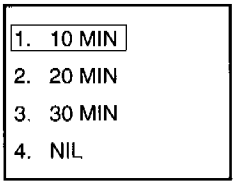
9. Selection of **Minimum angle display**
   Select whether to set the minimum angle display mode to "COARSE (5 seconds)" or "FINE (1 second)".



10. Selection of **Vertical angle mode**
    Select whether the 0 point for vertical angle is set to be "Z.0", "H.0" or "COMPAS".

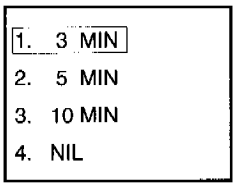


11. Selection for **Automatic power-off function**
    Select the time interval (10, 20, or 30 minutes) for activating the automatic power-off function, or select NIL, disabling the function.



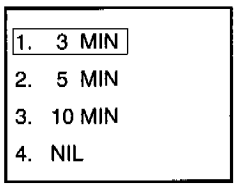
- The automatic power-off function automatically turns the power supply off after the specified period of time (in minutes) when no operation for distance measurement or for key entry has been performed with the angle remaining unchanged.

12. Selection for **Distance measurement automatic power-off function**
    Select the time interval (3, 5, or 10 minutes) for activating the distance measurement automatic power-off function, or select NIL, disabling the function.



- The distance measurement automatic power-off function automatically power-off distance measurement after the specified period of time when no key operation has been performed with the measured value remaining unchanged (over about 0.1 m) during measurement.

13. Selection for **Automatic illumination power-off function**
    Select the time interval (3, 5, or 10 minutes) for activating the automatic illumination power-off function, or select NIL, disabling the function.

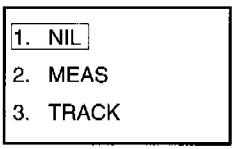


14. Selection for **Distance measurement buzzer**
Select whether to enable or disable the beep when the prism receives a light during distance measurement or during repeated distance measurement.

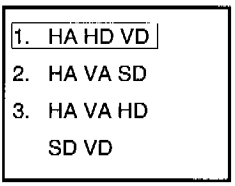
15. Selection for **H. angle 90° buzzer**
Select whether to enable or disable the beep at every 90° during angle measurement.

16. Selection of **Distance measurement signal**
Select whether to display a signal indicator or AIM value to be displayed from when distance measurement is started to when measured data is displayed.

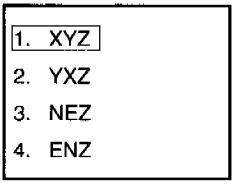
17. Selection of **Automatic distance measurement**
Automatic distance measurement repeats measurement automatically when the telescope has been collimated at the prism. Select whether to disable(NIL) automatic distance measurement, set it as normal distance measurement, or set it as fast distance measurement.



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

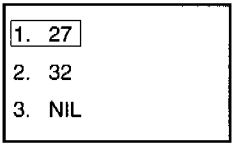


19. Selection of the **Coordinate axis as XYZ, YXZ, NEZ or ENZ**
Select the coordinate axis as XYZ,YXZ,NEZ,ENZ.



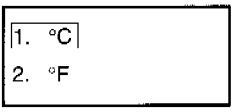
20. Selection of **Remote control**
Select the 27 (for MU75) or 32 (for MU72) or NIL.

- The instrument rejects remote control when "3. NIL" has been selected.

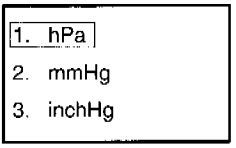


8-9 Initial Setting 4

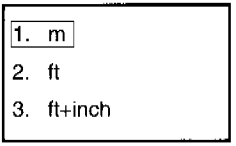
1. Selection of **Temperature unit setting**
   Select °C or °F as the unit for Temperature.



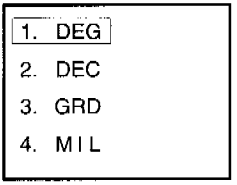
2. Selection of **Pressure unit setting**
   Select hPa (hectopascal) , mmHg, inchHg as the unit for pressure to be input.



3. Selection of **Distance unit setting**
   Select m or ft or ft+inch as the unit for Distance.

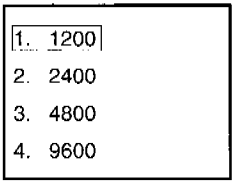


4. Selection of **Angle unit setting**
   Select DEG or DEC or GRD or MIL as the unit for Angle.



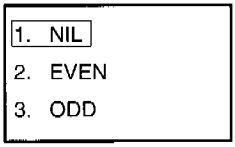
8-10 Initial Setting 5

1. Selection of **Transfer rate (baud rate)**
   Select a baud rate of 1200, 2400, 4800, or 9600.



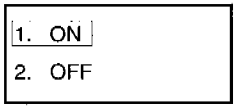
2. Selection of **Data bits**
   Select a data length of 8 bits or 7 bits.

3. Selection of **Parity**
   Select no (NIL) parity bit, even parity, or odd parity.



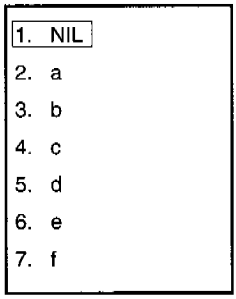
4. Selection of **Stop bit**
   Select the number of stop bits to be used: 1 or 2.

5. Selection of **Control signal**
   Select whether the control signal is effective or not.



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

7. Selection of **Through command**
   Select whether to disable data output without receiving any data request command or enable the "a" to "f" command data output.

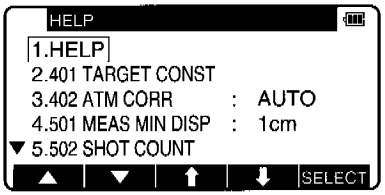


9 ACCESSING THE FUNCTIONS

9-1 Accessing by Help key

You can use the [HELP] key to display specific Initial Setting (such as the Prism Constant and Priority mode).

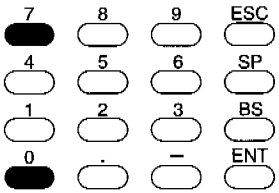
Press the [ILLU]+[ESC] key in mode A or B.

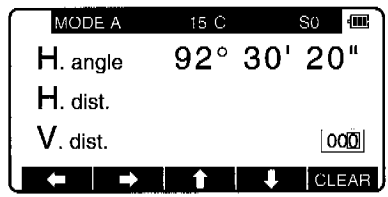


The help menu will then be displayed. Press [F1] [△] [F2] [▽] or [F3] [⇧] [F4] [⇩] to position the cursor to the desired item.

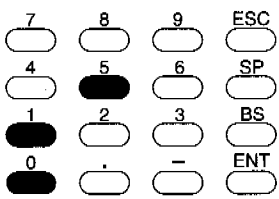
9-2 Accessing by 007

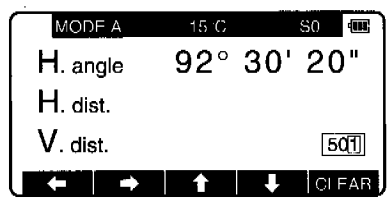
The R-100 allows you to enter a special code of 007 from the supplied Remote controller to display Specific Initial Setting. (such as the Prism Constant and Priority mode)



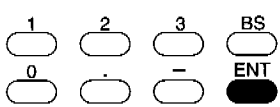


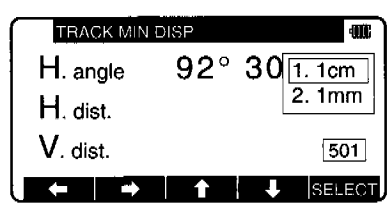
Press the numeric keys [0] [0] [7] on the Remote control in mode A or B. The screen will then change to the command input screen.





Press the numeric keys for the desired command number in the Command No. Table. (For example, press [5] [0] [1] for MEAS MIN DISP & TRACK MIN DISP.)





Press the [ENT] key to access the MEAS MIN DISP & TRACK MIN DISP.

[Command No. list]

Functions	Command No.
TARGET CONST	401
ATM CORR	402
MEAS MIN DISP, TRACK MIN DISP	501
SHOT COUNT, SHOT INPUT	502
CRV/REF CORR	503
MIN UNIT ANG.	504
V. ANG. STYLE	505
DIST. BUZ	508
QUAD BUZ	509
AUTO OFF	510
EDM OFF	511
ILLU. OFF	512
MEAS. SIGNAL	514
PRIORITY SELECT	515
COORD. AXIS	516
COMP AXIS	517
REMOTE	518
(LASER POINTER)	(519)
ATM UNIT, PRESS UNIT	701
DIST. UNIT	702
ANG. UNIT	703
SET UP COM.	801

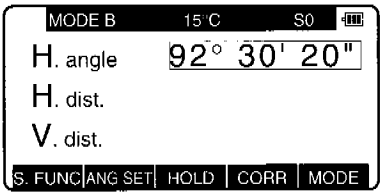
10 REMOTE CONTROL

The keys on the Remote control make it easy to enter numerical values.

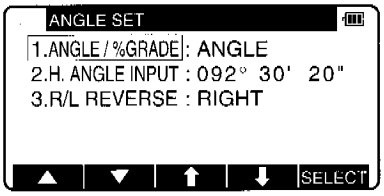
10-1 Using the Remote control to enter values

In case of Horizontal angle 123° 45' 20" input

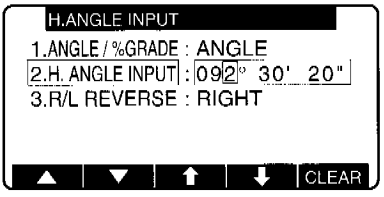
Press [F5] [MODE] to enter mode B.



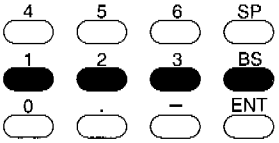
Press [F2] [ANG SET] to access the angle setting screen.

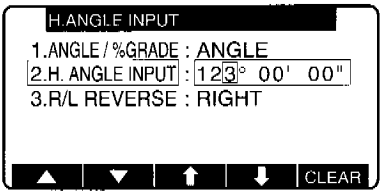


Press [F4] [⇩] to move the cursor to "2. H.ANGLE INPUT", then press the [F5] [SELECT] to open the horizontal angle input window.

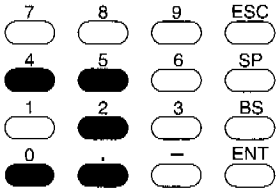


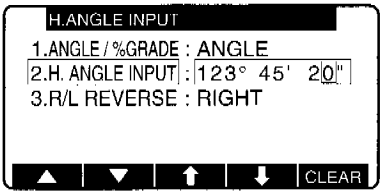
- Remote control is an optional accessory.



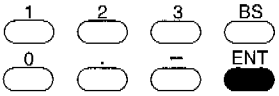


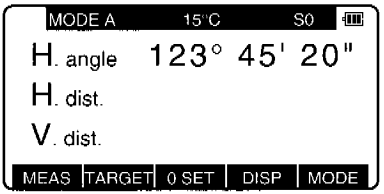
Press the [BS] key on the Remote control to reset the numeric display to 0. Enter [1] [2] [3] using the numeric keys.





Press [.] key and enter [4] [5] [2] [0] using the numeric keys to set the horizontal angle to 123° 45' 20".





Press the [ENT] key to accept the horizontal angle set to 123° 45' 20".
The screen will then change to mode A.

- Use the above operating procedures as a reference for entering values, for example, when using the Remote control to change the Prism Constant or Temperature etc.

11 CHECKS AND ADJUSTMENTS

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

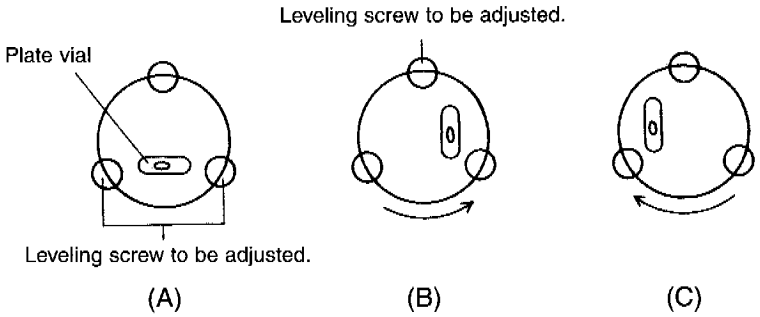
[Cautions on CHECKS AND ADJUSTMENTS]

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

11-1 Plate Level

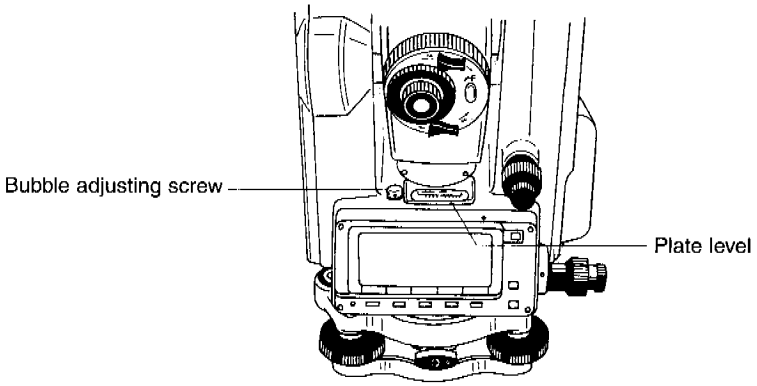
Checks

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



Adjustments

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



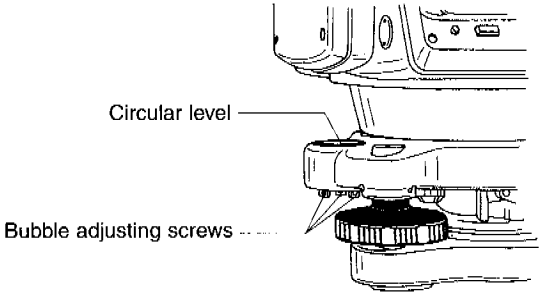
11-2 Circular Level

Checks

No adjustment is necessary if the bubble of the Circular Level is in the center after checks and adjustments of Plate Level.

Adjustments

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

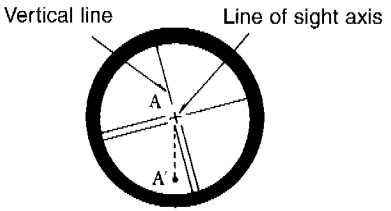


- Tighten the screws equally after the above adjustment.

11-3 Vertical Reticle

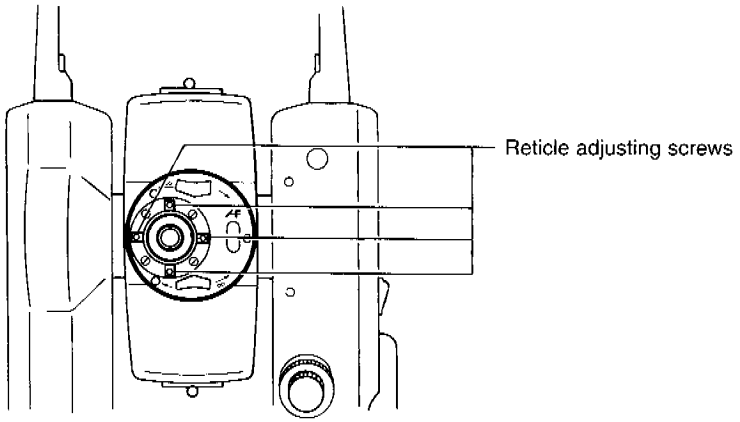
Checks

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



Adjustments

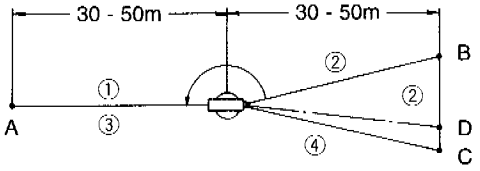
① If Point A is off from the vertical line of the reticle, first remove the eyepiece cover.
② Using the adjusting pin, loosen the four reticle adjustment screws slightly loosening each screw by the same amount, and then rotate the reticle line around the sight axis and align the vertical line of the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



11-4 Perpendicularity of Line of sight to horizontal axis

Checks

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



Adjustments

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

11-5 Vertical 0 point error

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

Checks

① Set up the instrument and turn the power on.
② Sight the telescope at any reference target A at Normale state. Read the vertical angle (γ).
③ Turn the telescope and rotate the alidade. Sight the same target A again at Back state and read the vertical angle R.
④ If γ+R = 360° , no further adjustment is necessary.

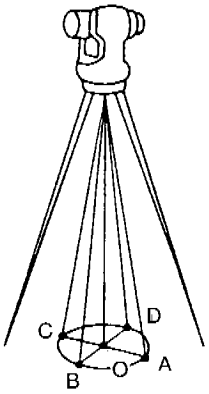
Adjustments

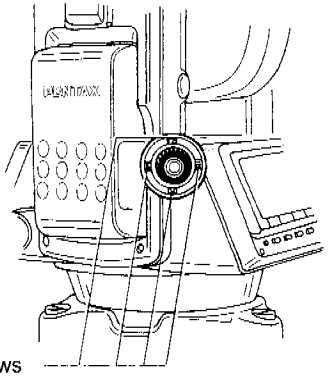
If the deviation d (γ+ R - 360°) is wide, contact your local dealer.

11-6 Optical Plummet

Checks

① Set the instrument on the tripod, and place a piece of white paper with a cross drawn on it right under the instrument.
② Look through the optical plummet, and move the paper so that the intersecting point of the cross comes to the center of the field of view.
③ Adjust the leveling screws so that the center mark of the optical plummet coincides with the intersecting point of the cross.
④ Rotate the instrument around the vertical axis. Look through the optical plummet each 90° of rotation, and observe the center mark position against the intersecting point of the cross.
⑤ If the center mark always coincides with the intersecting point, no adjustment is necessary.





Adjustments

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

11-7 Offset Constant

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

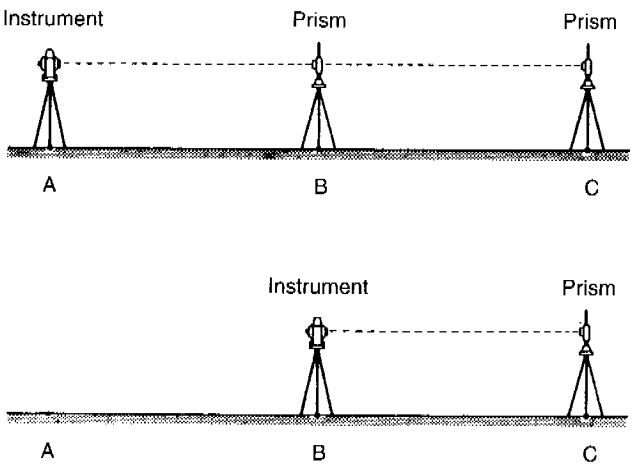
Checks

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

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

Adjustments

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



11-8 Beam axis and Line of sight

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

Checks

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

Adjustments

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

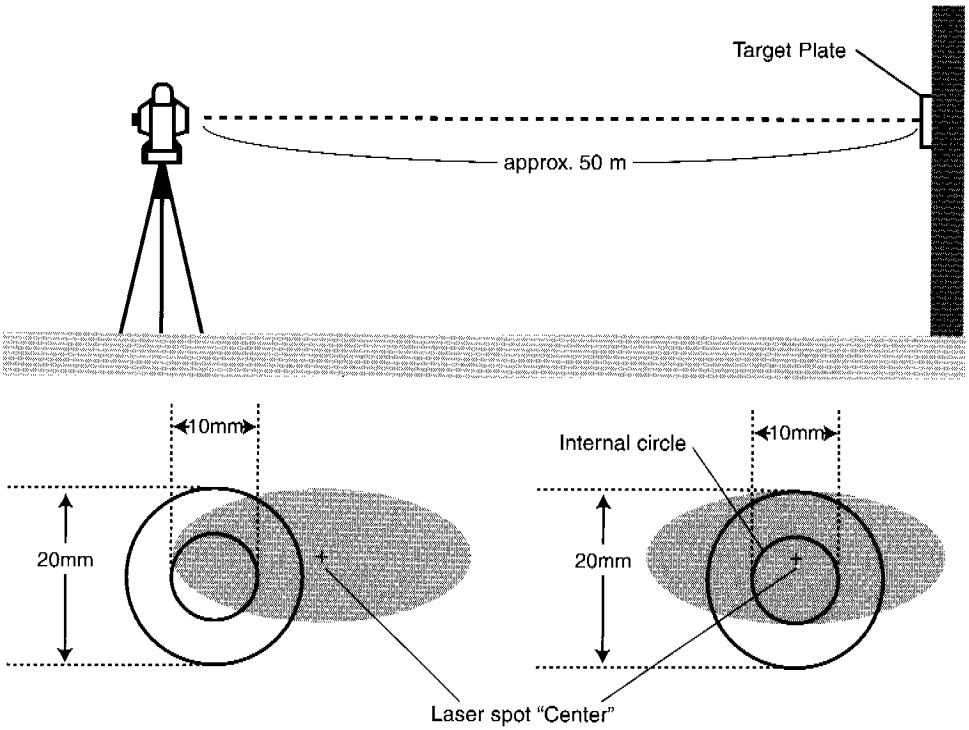
11-9 The EDM beam axis

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

Checks

① Install the instrument on the tripod and level it at the distance of approx. 50 m from the wall.
② Displace the target plate attached to the end of this manual. Place the target plate adjusting its center to the center of telescope cross line and to be about horizontal to the instrument.
③ Turn the power on, and confirm the [TARGET] is set to the Reflecting sheet mode ("S" will be indicated at the top of display, left side of the battery remains sign when it is that.) When it is not, press [F2] [TARGET] and set to Reflecting sheet mode (Reference p38 6.1 Target Setting).
④ Press [F1] [MEAS], then the laser spot appears on the target plate. If the "Center" of the laser spot is within the internal circle (10mm) of the target plate at this moment, the adjustment is unnecessary.

- The laser spot disappears in approx. 20 seconds after pressing [F1][MEAS]. Press [MEAS] again, if it is necessary.



[Example: Adjustment is necessary] [Example: Adjustment is unnecessary]

Adjustments

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

12 SPECIFICATIONS

Telescope

Image	Erect
Magnification	30 x
Effective aperture	45mm (EDM45mm)
Resolving power	3"
Field of view	2.6% (1° 30')
Minimum focus	1.0m

Auto focus (Auto focus, Power focus, Manual focus)

Detection: Phase difference method
Power supply: 3V x 2 lithium battery CR-123A
Operating Number: Auto focus - Approx. 4900 times
Continuous operating time: Approx. 4 hours

Distance measurement

Laser Class : Visible Laser- Class II

Measurement range:		(Normal)	(Good)
	(Reflectorless	1.5m - 50m	(85m))
	Reflector sheet	1.5m - 400m	(450m)
	Mini prism	1.5m - 1000m	(1500m)
	1P	1.5m - 3400m	(4500m)
	3P	200m - 4500m	(5600m)

- Reflector sheet : By PENTAX genuine Reflector sheet (5cm x 5 cm)
- Normal conditions : 20km visibility with slight shimmer
- (Good conditions) : 40km visibility, overcast, no heat no shimmer and moderate wind
- Reflectorless : The measurement range and accuracy are determined by the white side of the Kodak Gray Card.

- The measurement range at TRACK (Fast) mode (10mm/1mm) by Reflectorless mode is over than 5m.
- The measurement range may vary by measurement conditions.

R-115(N)/R-125(N)/R-135(N)

Accuracy:		D: Distance
	Prism	±(5 + 3ppm x D)mm
	Reflectorless, Reflector Sheet	±(5 + 3ppm x D)mm
	At Automatic Atmospheric Correction	±(5 + 10ppm x D)mm
Minimum count:	Normal:	1mm
	Track:	1cm or 1mm
Measuring time:	Normal:	2 sec. (1mm)
	Track:	0.3 sec. (1cm), 1 sec. (1mm)

R-122(N)/R-123(N)

Accuracy:		D: Distance
	Prism	±(3 + 2ppm x D)mm
	Reflectorless	±(5 + 2ppm x D)mm
	Reflector Sheet	±(3 + 2ppm x D)mm
	At Automatic Atmospheric Correction	±(3 + 10ppm x D)mm
Minimum count:	Fine:	0.1mm
	Normal:	1mm
	Track:	1cm or 1mm
Measuring time:	Fine:	3 sec. (0.1mm)
	Normal:	2 sec. (1mm)
	Track:	0.3 sec. (1cm), 1 sec. (1mm)

Measuring system: Automatically repeated or shot
(Shot: 1 , 3, 5 AV or input (1 - 99)
Maximum slope distance display: 9999.999m
Atmospheric Correction: AUTO/ATM INPUT/ppm INPUT/NIL
Temperature input, Pressure input, ppm input (- 99 - + 99ppm)
Prism Constant correction: 0mm, - 30mm, INPUT
Reflector sheet constant: 0mm, INPUT
Refraction and Curvature corrections: 0.14, 0.2, NIL

Special Functions

PowerTopoLite, PCS 330

Angle measurement

Measuring method : Absolute rotary encoder (Horizontal & Vertical)
Detection method : Horizontal angle -----Double
Vertical angle ---------Double
Minimum count : 1" (2cc) / 5" (10cc) selectable
Accuracy (DIN18723) : 5" standard deviation (2":R-122(N), 3":R-123(N))
Measuring time : 0.2"
Diameter of circles : 79mm
Measuring mode
H : R/L, Hold
V : Zenith 0 /Horizontal 0, % , Compass

Display section

Display : Single (Dual: Option)
Dot number : 240 x 96
Character and segment : 20 characters x 8 lines w/back light

Sensitivity of vials

Plate level : R-125(N)/R-122(N)/R-123(N) 30"/2mm,
R-115(N)/R-135(N) 40"/2mm
Circular level : 8'/2mm

Optical plummet

Image : Erect
Magnification : 3 x
Focus range : 0.5m~∞

Vertical axis, Tribrach type

Vertical axis : Single
Tribrach : R-125(N)/R-122(N)/R-123(N) (Detachable)
R-135(N) (Shift)
R-115(N) (Fixed)

Data output

Interface : RS-232C
Baud rate : 1200, 2400, 4800, 9600
Data bits : 8 bit, 7 bit
Parity bits : Nil, Even, Odd
Stop bits : 1, 2

Auto Power off

Setting up time: Nil, 10min, 20min, 30min

Ambient temperature

Working range: -20°C ~ +50°C / -4°F ~122°F

Tripod thread

R-115/125 : 5/8" x 11 (JIS/B)
R-135 : 35mm x 2 (JIS/C)

Dimensions/Weight

Instrument
172(W) x 343(H) x 440(L) mm/5.2kg
Carrying case
268(W) x 442(H) x 465(L) mm/3.9kg

Battery pack BP02

Power source : Ni-MH (Rechargeable)(4300mAh)
Output voltage : DC6V
Operation time : Continuous Approx. 6 hrs (ETH+EDM),12 hrs (ETH)
Weight : Approx. 380g
Charging time : Approx. 2 hrs

Charger BC03

Input voltage : DC16V
Output voltage : DC7.5V/ 9V
Charging time : Approx. 2.5 hrs

AC Adaptor AC01

Input voltage : 100~240V
Output voltage : DC16V
Weight : 280g

Internal Memory

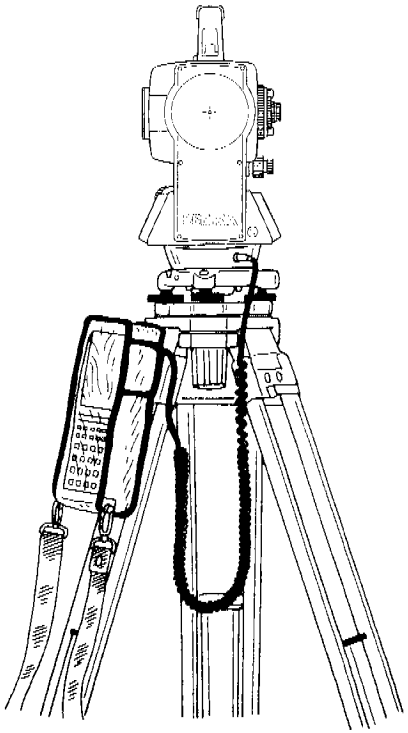
Coordinates data : 7500 points (Measured and input coordinate data)

13 DATA COLLECTOR

The instrument can communicate directly with a computer through the RS232C interface. By use of a data collector you can automate data entry from the collection of survey data to the transfer of the data to a computer. This is useful in saving time and protecting data integrity.

- About connection with data collector and the handling, please refer to an "Instruction manual" of the data collector.

- Connecting a data collector to a computer is different with every system. Please consult your local dealer about them.



14 APPENDIX

14-1 Error Messages

Message	Meaning	What to do
Out of tilt range, Ready ?	Displayed when the instrument is tilted beyond the vertical compensation range (±3') in case 1 axis or 2 axis automatic compensation is selected. This message may be temporarily displayed if the instrument is turned too fast.	Re-level the instrument. Repair is needed if the message is displayed when it is properly leveled.
Excess data	The input data exceeds the allowable range.	Press the [ESC] key and enter the correct data.
Mismatched Target	● The distance is measured by Prism at Reflector sheet mode, and the distance is over than 1000m. ● The distance is measured by Prism or Reflector sheet at Reflectorless mode, and the distance is over than 100m.	Cannot measure
Target is too close.	● The measurement distance is less than 1.5m at Reflector sheet mode. ● The measurement distance is less than 1.5m at Prism mode.	Cannot measure
Unsuitable Condition	● Under too strong sun light. ● Unstable light value owing to shimmer or obstacles. ● Reflector sheet, Target and Prism do not face the instrument. ● Reflector sheet, Target and Prism are not correctly sighted. ● Measurement range is over at Reflectorless mode. ● Sufficient signal does not return by sighting sharp edge etc. at Reflectorless mode.	Cannot measure

Message	Meaning	What to do
ERROR!! EDM ERROR 04 ~ ERROR!! EDM ERROR 06 ERROR!! EDM ERROR 34 ~ ERROR!! EDM ERROR 37 ERROR!! EDM ERROR 50 ~ ERROR!! EDM ERROR 53	Abnormality occurs with EDM (Distance measuring system).	Turn the power off, and then turn on again. Repair is needed when the message appears again.
ERROR!! ETH ERROR 70 ~ ERROR!! ETH ERROR 76	Abnormality occurs with ETH (Angle measuring system).	
ERROR!! MEMORY ERROR 19	Abnormality occurs in the instrument.	

14-2 Atmospheric Correction

The speed at which light travels through the air varies depending on the temperature and atmospheric pressure. The R-100 series is designed to measure distances at the speed of light in order to measure accurately, Atmospheric Correction needs to be used. The instrument is designed to correct for weather conditions automatically if the temperature and pressure are input. Correction is then carried out based on the following formula.

Calculation formula

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

K: Atmospheric Correction Constant
P: Atmospheric pressure (hPa)
t: Temperature(°C)
Distance after Atmospheric Correction D = Ds (1+K)
Ds: Measured distance when no Atmospheric Correction is used.

14-3 hPa and mmHg Conversion Table

Converting from hPa to mmHg

hPa	0	10	20	30	40	50	60	70	80	90
500	375 mmHg	383 mmHg	390 mmHg	398 mmHg	405 mmHg	413 mmHg	420 mmHg	428 mmHg	435 mmHg	443 mmHg
600	450	458	465	473	480	488	495	503	510	518
700	525	533	540	548	555	563	570	578	585	593
800	600	608	615	623	630	638	645	653	660	668
900	675	683	690	698	705	713	720	728	735	743
1000	750	758	765	773	780	788	795	803	810	818
1100	825	833	840	848	855	863	870	878	885	893
1200	900	908	915	923	930	938	945	953	960	968

Converting from mmHg to hPa

mmHg	0	10	20	30	40	50	60	70	80	90
400	533 hPa	547 hPa	560 hPa	573 hPa	587 hPa	600 hPa	613 hPa	627 hPa	640 hPa	653 hPa
500	667	680	693	707	720	733	747	760	773	787
600	800	813	827	840	853	867	880	893	907	920
700	933	947	960	973	987	1000	1013	1027	1040	1053
800	1067	1080	1093	1107	1120	1133	1147	1160	1173	1187
900	1200	1213	1227	1140	1153	1167	1180	1193	1207	1220

14-4 Error when no Atmospheric Correction is made

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

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

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

Unit:mm

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

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

Unit:mm

C° \ mmHg	900	800	760	700	600	500	400
45	2.0	-1.3	-2.6	-4.6	-8.0	-11.3	-14.6
35	3.0	-0.4	-1.8	-3.9	-7.3	-10.8	-14.2
25	4.0	0.5	-0.9	-3.1	-6.6	-10.2	-13.7
15	5.2	1.5	0.0	-2.2	-5.9	-9.6	-13.3
5	6.3	2.5	1.0	-1.3	-5.1	-8.9	-12.7
-5	7.6	3.7	2.1	-0.3	-4.2	-8.2	-12.2
-15	9.0	4.9	3.2	0.8	-3.3	-7.4	-11.5

14-5 Atmospheric Refraction and Earth Curvature Correction

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

Corrected horizontal distance (H)

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

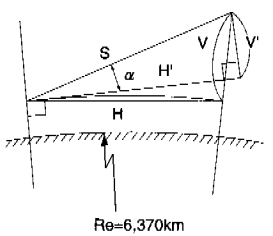
Corrected vertical distance (V)

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

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

Horizontal distance	$H' = S \cdot \cos\alpha$
Vertical distance	$V' = S \cdot \sin\alpha$

S: Slope distance
α: Vertical angle from horizontal
K: Atmospheric refraction coefficient (0.14 or 0.2)
Re: Diameter of earth (6,370 km)



14-6 Distance Range

Generally speaking, the maximum range which can be measured varies considerably depending on the atmospheric conditions. For this reason, the Specifications illustrate the values for both Good and Normal weather conditions. It is extremely difficult to judge when weather conditions are "Good" and when they are "Normal". With this instrument, the conditions noted below are used to differentiate between the two situations, (Good weather conditions for surveying are different from Normal weather conditions, and in surveying situations, cloudy skies are considered more favorable than sunny skies.)

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

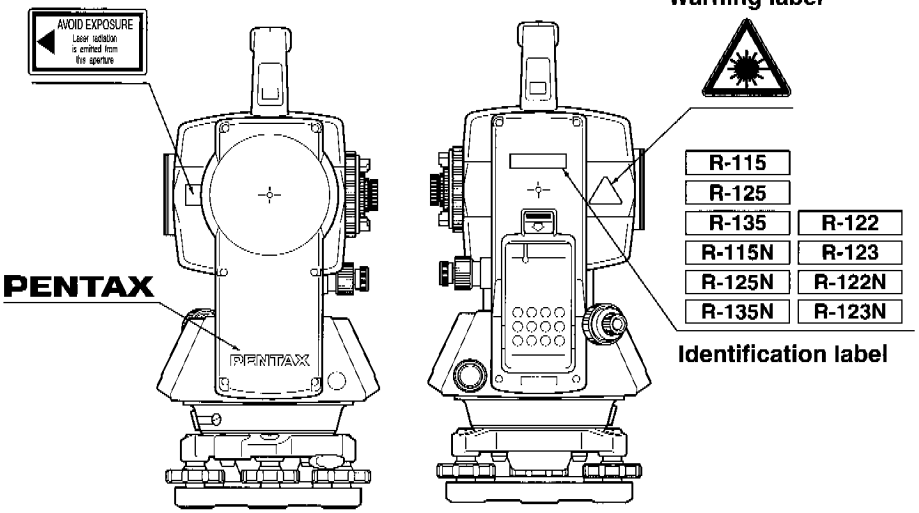
Normal: Visibility of approximately 20 km, with slight shimmer and moderatewind.
Good: Visibility of approximately 40 km, overcast, with no shimmer and moderate wind.

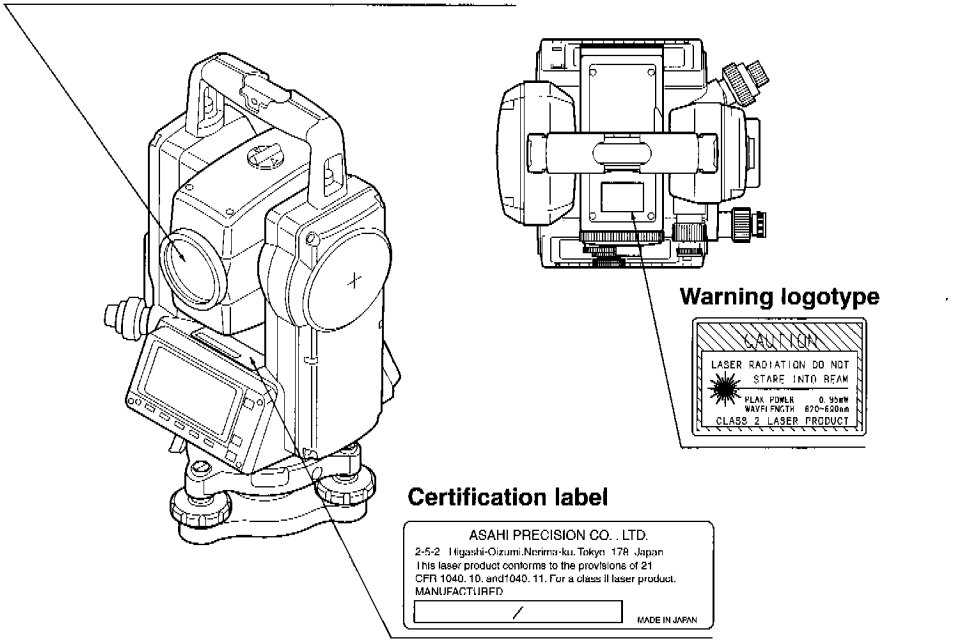
15 NOTICE TO THE USER OF THIS PRODUCT

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

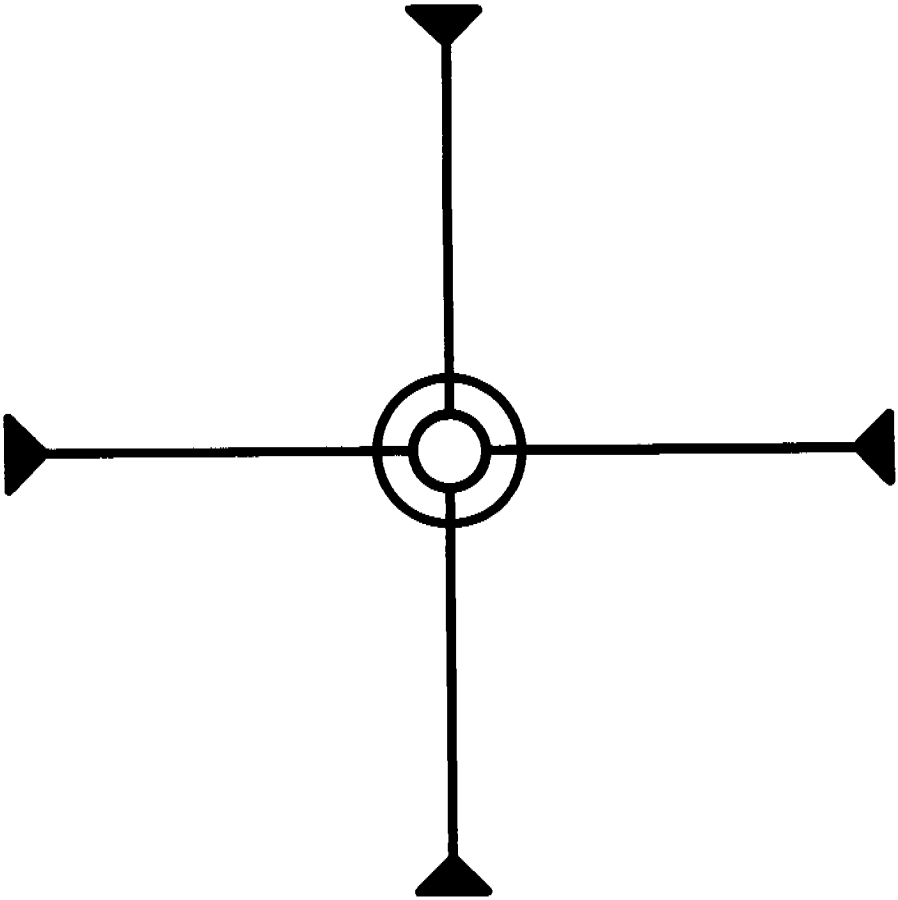

It can be dangerous to look into the beam with optical equipment such as binoculars and telescopes.

1) Specifications of Laser Radiation
   A) The EDM module of the R-100 produces a visible light beam, which is emitted from the telescope objective lens. The R-100 is designed and built to have a laser diode radiating at 620-690 nm.
   B) Radiant power
      The R-100 is designed and built to radiate a maximum average radiant power of 0.95mw. The user may be subject to this radiation as a beam while operation until such time that the instrument is turned off.
2) The following labels are affixed to and must remain attached to this laser product.
   A) Certification label: "This laser product conforms to the provisions of 21 CFR 1040. 10 and 1040.11. For a Class II laser product." Located near the Plate level.
   B) Caution label: "AVOID EXPOSURE Laser radiation is emitted from this aperture."
      Located near the exit aperture.
   C) Warning logotype: "CAUTION LASER RADIATION DO NOT STARE INTO BEAM" Located on the surface of the telescope.
   D) Warning label: Located near the exit aperture.
3) Caution to remain the safety in compliance with the standard
   A) To maintain the safety standard, refrain from any operation, maintenance, or adjustment other than described in this instruction manual.
   B) Operation, maintenance or adjustment other than those specified in this instruction manual may result in hazardous radiation exposure.
   C) Maintenance and repair not covered in this manual must be done by an authorized Pentax dealer.
   D) The Laser beam emission by the Distance measurement can be terminated by pressing [F1][MEAS] key.
   E) The Laser beam emission by the Laser pointer can be terminated by selecting 1. OFF of the Laser pointer selection of the Initial Setting 2.


AVOID EXPOSURE
Laser radiation
is emitted from
this aperture
PENTAX
PENTAX
Warning label
R-115
R-125
R-135
R-122
R-115N
R-123
R-125N
R-122N
R-135N
R-123N
Identification label


Laser beam is transmitted from this aperture.
Warning logotype
CAUTION
LASER RADIATION DO NOT
STARE INTO BEAM
PEAK POWER 0.95mW
WAVELENGTH 670~680nm
CLASS 2 LASER PRODUCT
Certification label
ASAHI PRECISION CO. . LTD.
2-5-2 Higashi-Oizumi,Nerima-ku,Tokyo 178 Japan
This laser product conforms to the provisions of 21
CFR 1040. 10. and1040. 11. For a class II laser product.
MANUFACTURED
MADE IN JAPAN

[TARGET PLATE]



PENTAX®

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CE

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

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

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