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## 2.4 Alphanumeric input

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

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

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## 2.5 LD POINT, laser pointer

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

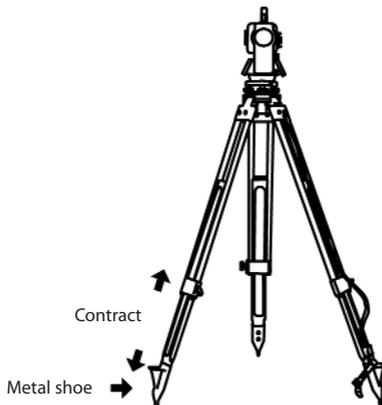
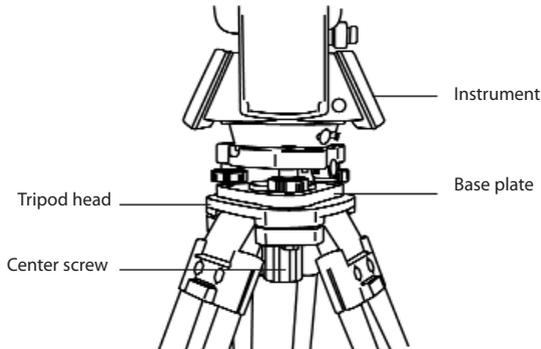
- ① When the [LD POINT] key is pressed after pressing the [Laser] key, the Laser pointer function is turned on. The Laser indicator is turned on and the “\*” mark on the left of the screen blinks while the Laser pointer function is operating.
  - ② If the [Laser] key is pressed and the [LD POINT] key is pressed while the Laser pointer function is operating, the Laser pointer function is turned off.
- The beam of the sun is strong and visual confirmation is difficult in daytime when out doors.
  - The laser beam is designed not to be able to observe through the telescope.
  - Please visually align the laser beam to the target and mark the center. Confirm the alignment (horizontal and vertical ) before measuring when performing accurate work like stake out when using the Laser pointer function. Also refer to 10-10. The EDM beam axis.
  - Please do not look at the laser source of beam directly.

# 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.



## 3.2 Laser plummet

### [Laser plummet model]

The laser plummet is not set to be ON at factory shipping. The laser plummet operation of power supply ON can be set by command No 520, LD PLUM & E VIAL. For using Command number, refer to 9-2. Accessing by 007.

### [For the Detaching type laser plummet equipment model]

Turn on the laser plummet function by pushing the Laser key.

Match the position with the leveling screw so that the laser mark coincides with the ground mark.

### [For the Shift type laser plummet equipment model]

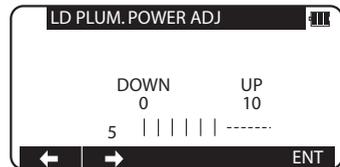
- Turn on the laser plummet function by pushing the Laser key.
- Match the position by the tripod so that the laser mark coincides with the ground mark.
- The centering knob is loosened, and the upper plate is pushed by the tip of a finger, and a center mark is matched to the ground mark.
- Tighten the centering knob.
- Loosen the horizontal clamp screw, and rotate the instrument by 90°, and confirm the vial of the circular vial is at the center at any position.

Correct the vial with the leveling screw when the vial comes off from the center.

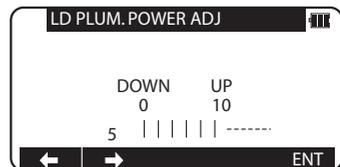
### [Brightness adjustment of laser]

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

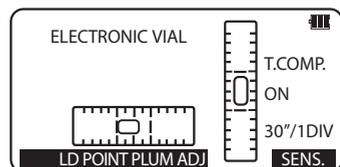
If the Laser key is pressed, the brightness adjustment screen of the laser plummet device, is displayed.



The Laser plummet becomes dark by key and becomes bright by / key



The adjustment is completed with the ENT key and it returns to electronic vial screen.



- The brightness adjustment step of the laser is 10 steps.
- The laser plummet spot can become difficult to see in bright sunlight which makes it difficult to perform the occasional check. In this case, use your foot or the carrying case to make a shadow over the laser position.
- The laser plummet is adjusted to be within  $\pm 0.8\text{mm}$  at the instrument height of 1.5m at factory shipping.
- Please confirm the amount of the gap (direction of X and Y direction) with the laser plummet beforehand compared with plumb bomb etc. when working like accurately putting out a perpendicular direction using the laser plummet function.
- Please do not look at the laser source of beam directly.



### 3.3 Optical plummet (Option)

#### [Detachable type]

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

#### [Shift type]

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

### 3.4 Leveling with circular vial

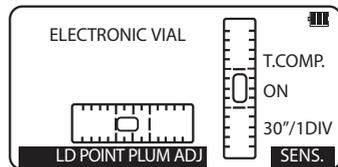
Tripod is adjusted according to the following points by extending or contracting the legs so that the bubble of the Circular vial goes to the center of the circle.

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

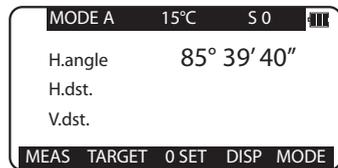
### 3.5 Leveling with electronic vial

#### [Electronic vial screen]

- ① If the Laser key is pushed, it becomes a display screen for the Electronic vial.



- ② It returns to the former screen by the [ESC] key.

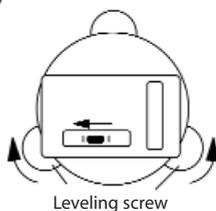


- When R-300X instrument is seen at the position of “Left circle position”, the screen in the electronic vial shows the correct movement direction. Please note that the movement of the electronic vial is in the opposite direction when the observing in “Right circle position”.
- When instrument is within the tilt compensation range, length and sidewise  $\pm 3'$ , “ON” is displayed at the right screen, “OVER” is displayed beyond the limits of range and “NIL” is displayed at no compensation setting.
- With command No “520” or “Initial setting 2”, when the [TILT DISP] is selected as ON, the [F1-TILT] of the vial screen becomes effective. The Vial tilt value is indicated when pushing the [TILT] key. With “TILT DISP.UNIT” of the Initial setting 2, OFF or ON can be selected.

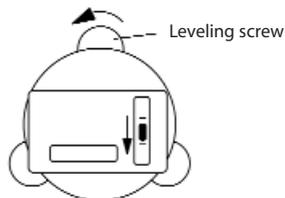
### [Leveling]

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

(A)



(B)



### [When using the Automatic inclination correction by 2 axes]

Please read procedure ⑥ because the horizontal angle and the perpendicular angle error by a perpendicular axis are automatically corrected.

### [When using the Automatic inclination correction by 1 axis]

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

### [When using without Automatic inclination correction]

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

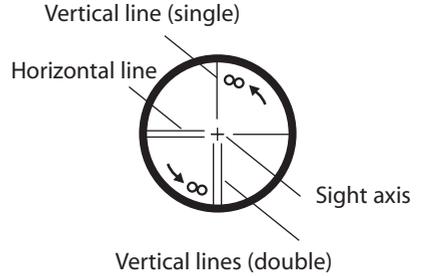
- ⑥ Confirm whether the plummet is on the ground mark. When you confirm it is not on the mark, loosen the center screw and move the instrument over the ground mark correctly and fix the instrument by a center screw. Repeat from ① to ⑥

## 3.6 Eyepiece adjustment

### [Eyepiece adjustment]

The eyepiece adjustment is performed before target sighting.

- ① Remove the telescope lens cap.
  - ② Point the telescope at a bright object, and rotate the eyepiece ring full counter-clockwise.
  - ③ Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticle appears 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 "4-4 Adjusting Reticle Illumination".



## 3.7 Target sighting

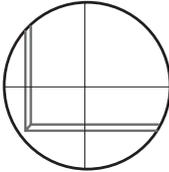
### [Auto focus]

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>

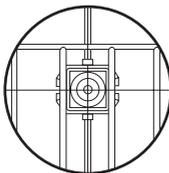
No contrast like a white wall



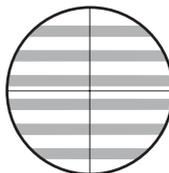
Bright back light



Obstacle in front of a target



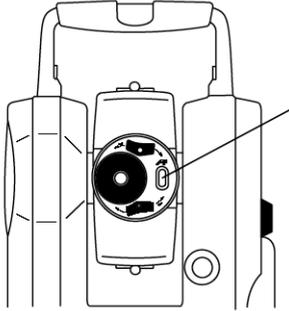
A wall composed of single horizontal lines



### [Target sighting by Auto focus]

The Auto focus of R-300X series has following two modes.

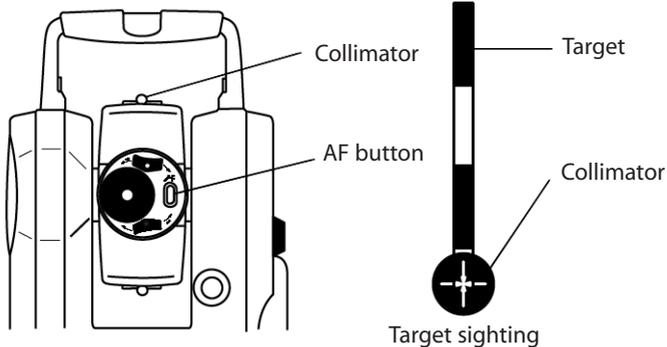
- ① Normal mode: Pressing AF button focuses on the target.
- ② Continuous mode: Pressing AF buttons for two seconds beeps, and releasing the key enters into the Continuous mode. This mode enables you to perform the Auto focus approx. for one minutes only by sighting through the telescope and following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



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

### [Auto focus: Target sighting by Normal mode]

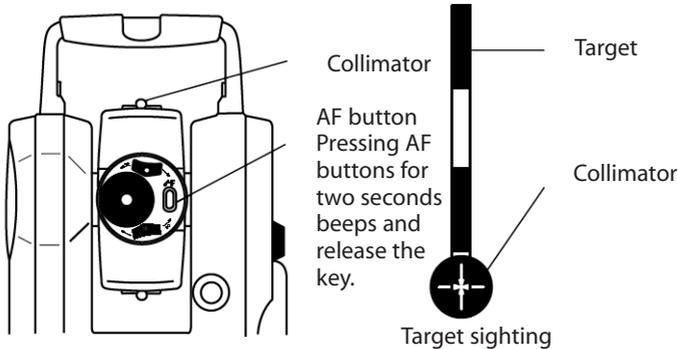
- ① Loosen the telescope clamp and horizontal clamp screws.
- ② Point the telescope at the target using a collimator.
- ③ Tighten the above two screws.
- ④ Adjust the eyepiece.
- ⑤ Look through the telescope and press the AF button. Move your eye vertically and horizontally to see if the target image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



- 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]

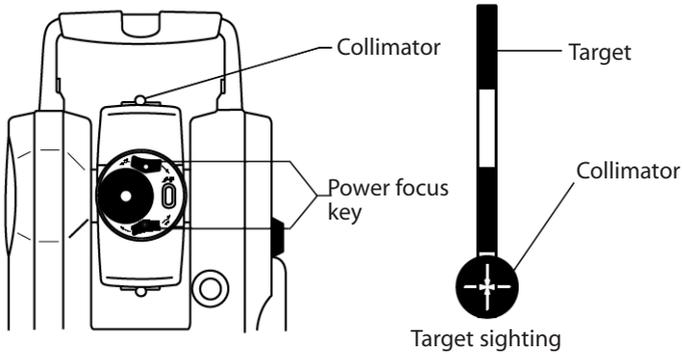
- ① Loosen the telescope clamp and horizontal clamp screws.
- ② Point the telescope at the target using a collimator.
- ③ Tighten the above two screws.
- ④ Adjust the eyepiece.
- ⑤ Look through the telescope and then press the AF button for two seconds to beep, and release the key to enter into the Continuous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



- Keep the target close to the reticle center when following 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]

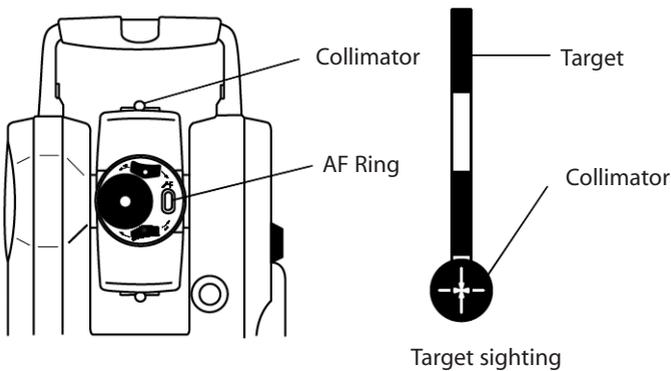
- ① Loosen the telescope clamp and horizontal clamp screws.
- ② Point the telescope at the target using a collimator.
- ③ Tighten the above two screws.
- ④ Adjust the eyepiece.
- ⑤ Look through the telescope, and then operate the Power focus key and focus on the target.
- ⑥ Align the reticle accurately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



- Tilting the Power focus key “clockwise” makes it possible to focus on closer objects and “counterclockwise” will focus on farther objects.
- 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 Align the reticle accurately on the target using telescope and horizontal tangent screws.



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

## 3.8 Attachment and detachment of tribrach

The tribrach of R-322EX, 323EX, 325EX, 322NX, 323NX, 325NX, and 326EX are detachable from the instrument if required when replacing the instrument with a target or unit prism for example.

### [Detachment]

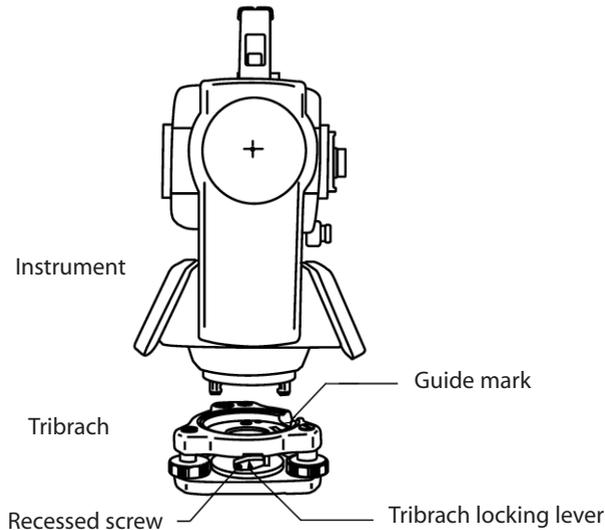
First loosen the recessed screw with a screwdriver, then rotate the locking knob until the arrow points upward, and lift the instrument up.

### [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.

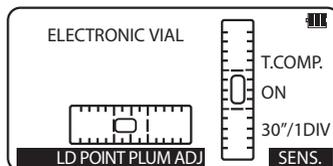


## 4. TURNING THE POWER ON

### 4.1 Turning the power on and off

Pressing the [POWER] key shows the initial screen.

(The [POWER] key is also used to turn the power off.) After a few seconds, it turns to Electronic vial screen. Move the vials to center by adjusting the leveling screws.



Pressing the [ENT] key views the angle and distance measurement screen.



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

For details on resetting the horizontal angle 0 See "5.2"

For details on changing the horizontal angle from clockwise to counterclockwise See "5.6"

For details on measuring the vertical angle See "5.5"

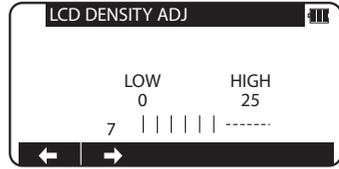
For details on distance measurement See "6 "

For details on the automatic power-off function See "8.9 12"

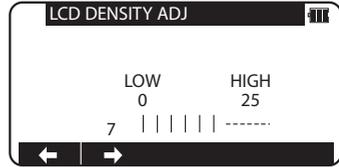
For details on the Electronic vial See "10.1"

## 4.2 Adjusting LCD contrast

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



Pressing [F1] [←] will lighten the contrast, while pressing the [F2] [→] will darken the contrast.



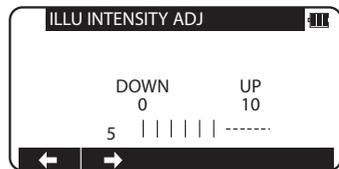
Press [ENT] to exit adjustment mode and return to the previous screen.



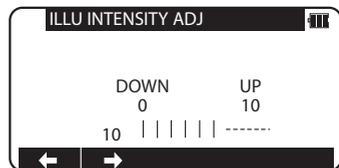
- Pressing the Illumination key views the F3-RETICLE, F4-LCD and F5-ILLU.
- LCD contrast may be adjusted as necessary at any time.
- The contrast may be adjusted to any one of 25 levels.
- LCD contrast may be unappealing under certain environmental conditions such as high temperature. Adjust the LCD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

## 4.3 Adjusting illumination brightness

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



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



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



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

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## 4.4 Adjusting reticle illumination

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

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

# 5. ANGLE MEASUREMENT

## 5.1 Measuring an angle

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

MODE A	15°C	S 0	III
H.angle	0° 00' 00"		
H.dst.			
V.dst.			
MEAS	TARGET	0 SET	DISP MODE

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

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

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

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

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

## 5.2 Resetting the horizontal angle to 0

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

MODE A	15°C	S 0	III
H.angle	0° 00' 00"		
H.dst.			
V.dst.			
MEAS	TARGET	0 SET	DISP MODE

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

## 5.3 Holding the horizontal angle

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



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

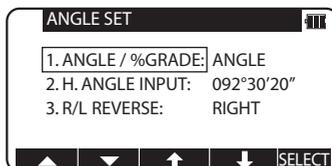
## 5.4 Inputting an arbitrary horizontal angle

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

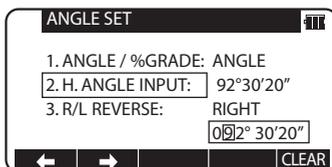
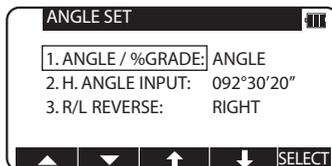
Press [F5] [MODE] to enter mode B.



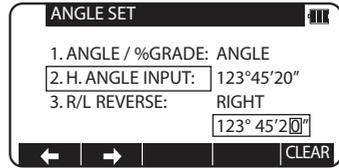
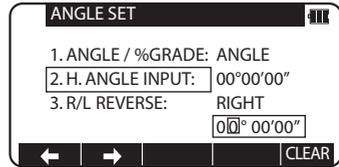
Press [F2] [ANG SET] to display the angle setting screen, then press [F4] [↑] to move the cursor to "2. H. ANGLE INPUT":



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

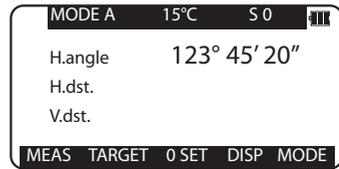


Press the numeric key as 123.4520.



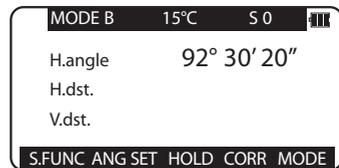
Press the [ENT] key to accept the horizontal angle set to 123° 45' 20" and change the screen to mode A.

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

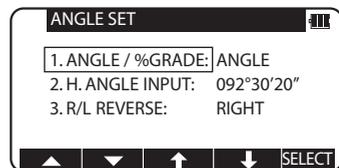


## 5.5 Displaying the % slope of the vertical angle

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



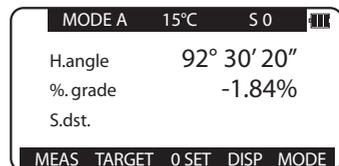
Press [F2] [ANG SET] to display the Angle setting screen.



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



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



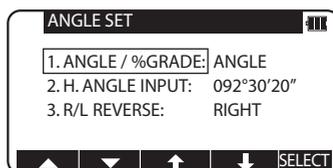
- The 0% represents the horizontal 0, and +100% and -100% represent 45° up and down slopes respectively.
- To return the screen from the slope (%) display to the 360° scale, also take above same steps by entering mode B.
- If the slope (%) exceeds [+/-]1000%, “Out of grade range” is displayed, indicating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

## 5.4 Changing the horizontal angle from clockwise to counterclockwise

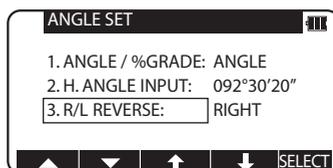
Press [F5] [MODE] to enter mode B.



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.



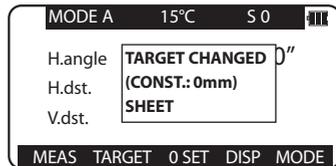
- To return the horizontal angle from counterclockwise to clockwise, also take the above same procedures, press [F5] [SELECT] to select the clockwise angle.
- When the counterclockwise horizontal angle is selected, the order of aiming at the targets becomes the reverse (the right one first, then the 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 (reflectorless models), Reflector sheet - Prism (standard models).
- The selected target mode is stored in the memory even if the power is turned off. So, next time you can use the same mode after turning on.
- The target Constant differs according to the selected target mode. So, confirm the target mode and its Constant shown at the top screen after changing the target.

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

- The measurement range and accuracy of Reflectorless are based on the condition that laser beam is emitted perpendicular to the white side of the Kodak Gray Card. The measurement range may be influenced by the shape of the target and its environment. There is a possibility that the range may vary when the target does not satisfy the conditions above at survey work.
- Pay attention to the following in case of distance measurement by Reflectorless. In case of resulting in low accuracy, perform the distance measurement by Reflector sheet or Prism.
- The Reflectorless "Long Range mode" can be accessed by the 007 CODE number 521 [REF.LESS RANGE]. The measurement range of this mode is 200m and the Laser class is IIIa. This mode can be performed by selecting the "LONG" at 1.REF.LESS RANGE.
- The CODE number 521 [REF.LESS RANGE] shows 1. REF.LESS RANGE (NORMAL/LONG), 2. LONG RANGE MES(ON/OFF) and 3. LONG RANGE SETUP(EACH TIME/PERMANENT).
- The WARNING (Laser Power) screen is displayed when Range LONG and Message ON are selected, and then F1-MEAS key is pressed. F1-MEAS, F3- NORMAL and F5-LONG are viewed.
- Pressing [MEAS] one time selects "Second MEAS setting" and twice selects "QUIT". And then, Normal or Long measurement is selected by pressing F3 or F5.

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

#### **[Distance measurement by reflector sheet mode]**

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

#### **[Applied measurement range by each target mode]**

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