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1. FEATURES

South electronic theodolite has been designed on the concepting of the latest design, high quality, reasonable structure, and smart appearance and easy to operate, While simple operation is provided, all necessary reliable functions are incorporated.

ON-LINE WITH OTHER EDM

On—line with South ND series EDM(electronic distance meter) or other kinds of EDM ,the south Electronic Theodolite can form a total station.

ON-LINE WITH ELECTRONIC REGISTER

On-line with south surveying electronic register, the electronic theodolite forms a total station, and can collect data automatically.

BASY TO OPERATE

There are 6 keys that can perform any one of the functions,The measured angle is displayed on the display panel.

EASY TO OPERATE EVEN AT DARK SITE

The telescope is furnished with illuminationg resource for lightening the cross hair.

2.PREPARATIONS

2-1 Precautions

(1) Avoid aiming the objective lens directly at the sun, When performing a measurement under sunshine, attach the filter to the objective lens.

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

(3) Put into the carrying case for storage and place in a dry area not subject to vibrating, dust or high humidity.

(4) When the storage and usage temperature is widely different, leave the instrument in the case until it is suitable to the surrounding temperature.

(5) When not in use for extended period, recharge the battery once a month.

(6) Transporting in the carrying case, it is recommended that cushioning material be used around the case.

(7) Be sure to secure the instrument with one hand when mounting or removing from the tripod.

(8) When the exposed optical parts need to be cleaned, clean them with degreased cotton or lens-head paper, not other things.

(9) Be sure to clean the plastic parts and organic glass with water-soaked cloth, not chemical reagent.

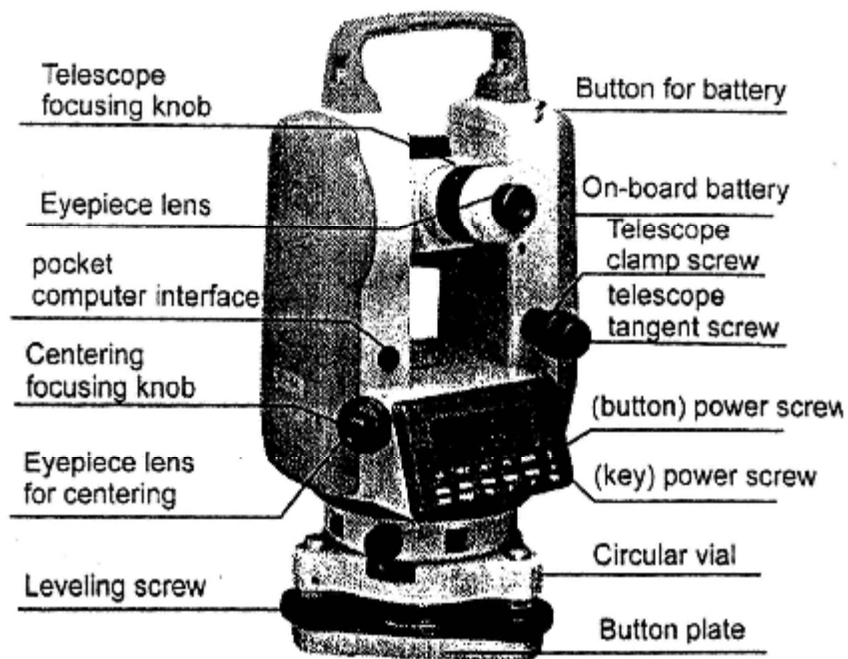
(10) When finished using, clean the instrument surface dust with

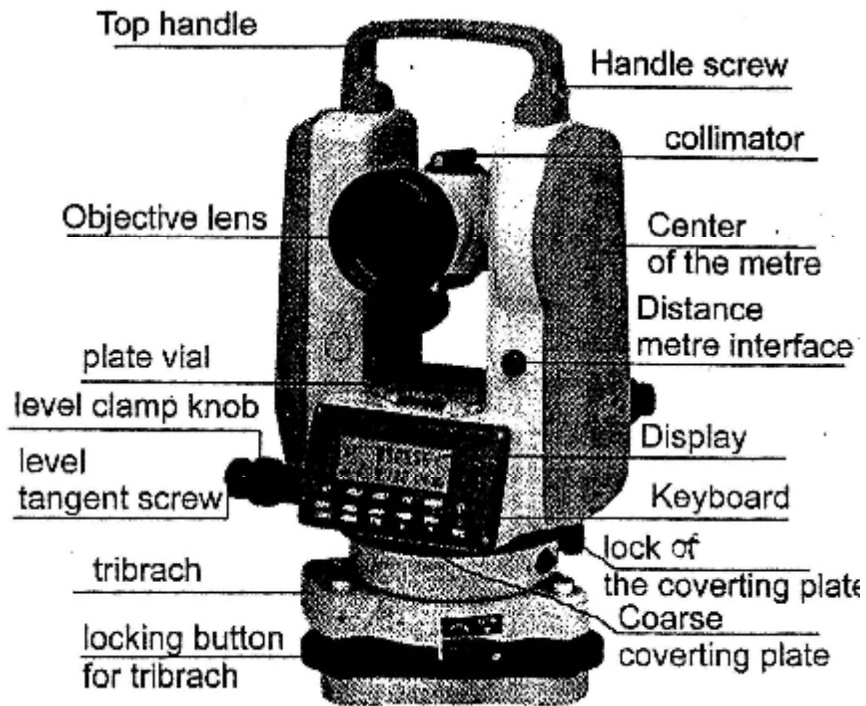
woolen cloth, When wetted, clean it in time.

(11) Before operating, inspect the power, functions and indexes of the instrument, initial setting and correction parameters.

(12) Do not attempt to disassemble the instrument by yourself, even when a malfunction is found, except you are specialist maintenance man.

2-2 Nomenclature of parts





2-3 Unpacking and storing

(1) Unpacking

Gently set down the carrying case and its cover is upward, Unlatch and open the case. Then, take the instrument out of the case.

(2) Storing


Set the telescope close to horizontal, and lightly tighten the telescope clamp screw. Align the white dot, place the instrument into the case with the white dot towards you. Close the case lid and lock the latch.



2-4 Battery insertion and recharging


battery insertion

- (1) Press the top button of the battery box, and take off the battery box.
- (2) Insert the button of the battery box into the slot on the standard cover, and put the top button of the battery into the cover until it clicks.


Battery message

Fully recharged new battery can be used 8 to 10 hours continuously. Right down message “” display consumption message. Each segment indicates about three hour’s consumption energy.

“” and “” indicate that energy is abundant.

“” indicates that the battery can be used only about three hours.

Recharge the battery or prepare a recharged battery.

“” flickers then disappears...from start flickering to turning off the power due to lack of energy, the instrument only can be used about 30 minutes. Stop operating and change the battery as soon as possible.

Battery recharging

Battery should be recharged with the special charger.

Insert the battery charger into the power source with 220V, remove the on-board battery from the main body, and connect the plug of the charger to the charging connector on the battery, The indicating lamp is on that indicates the battery is been recharging and recharge weill be

completed in 12 hours. Then remove the plug from the charging connector.

Notes on taking off the battery box!

- **When you take off the battery box, make sure that the power is turned off, otherwise, the instrument can be damaged.**

Note on recharging!

- **The charger has a built-in circuitry for protection from overcharging. However, do not leave the charger plugged into the power after recharging is completed.**
- **Be sure to recharge the battery at a temperature of 0 °C ~ +45 °C . Recharging may be abnormal beyond the specified temperature range.**
- **When the indicator lamp, even after connecting the battery and charger, does not blink, either the battery or the charger may be damaged.**

Notes on storage!

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

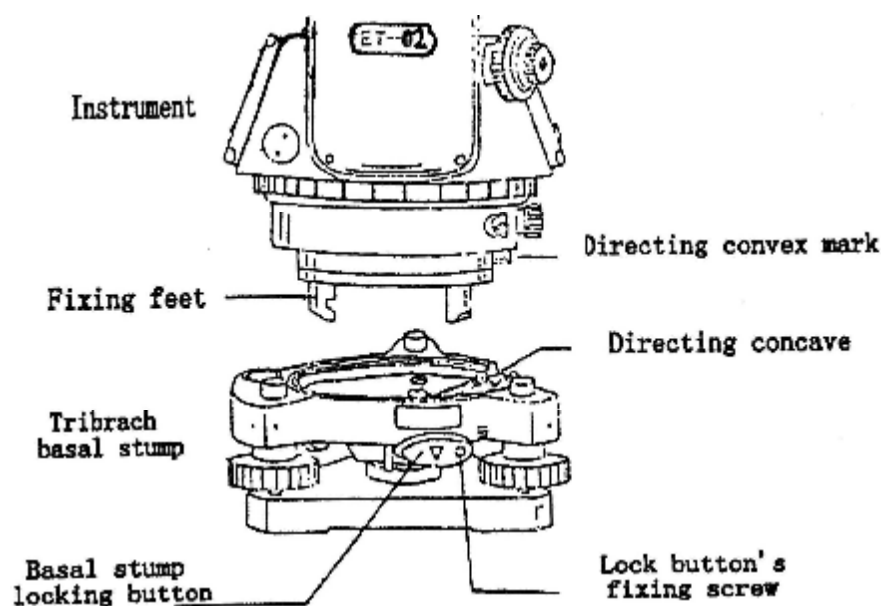
2-5 Mounting and removing of the basal stump

Removing

When necessary, the instrument can be removed from the tribrach basal stump. First, loosen the tribrach locking screw by screw-driver. Then, turn the locking button about 180° in counter clockwise and take off the instrument from the tribrach basal stump.

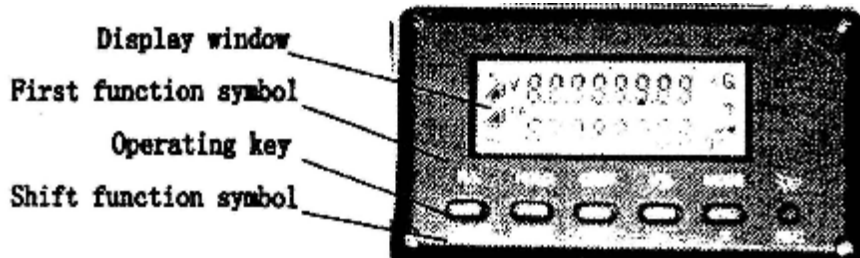
Mounting

Make the three fixing feet into the holes of the basal stump and put the directing convex in accordance with the concave mark.. Turn locking button about 180° clockwise and fix the fixing screw by screw driver.



3.KEY PANEL AND DISPLAY MESSAGES

3-1 Keyboard symbols and functions



The keyboard has double functions. The normal function is for angle measurement. When the key [MODE] is pressed down, the second function (distance measurement) is executed.



R/L Selection key for right or left horizontal angle. Press the key alternately, the direction of the measured angle changes from right to left.

CONS Special function mode key.



HOLD The horizontal angle locking key. Press the key twice, the horizontal angle is locked. Press the key again, then to return to the former status.

MEAS Distance measurement key. Press the key to measure distance precisely and continuously.

◀ Press the key in special mode, the cursor in display board moves to left.



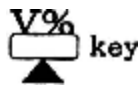
O SET Horizontal angle “0” setting key, Press

this Key twice, the horizontal angle is set to “0”.

TRK Distance tracking measurement key.

Press the Key, the distance will be measured once every second with the precision of 0.01m.

▶ Press the key in special mode, the cursor moves to tight.



V% The shift key between vertical and grade percentage.

In distance measurement mode.

Press the key continuously, slope distance (↗), horizontal distance (↘) And difference in height (↕) will be displayed one after another.

▲ Increasing key, press the key in special mode, the cursor moves up or down or the number increases.



MODE The shift key between angle and distance

measurement.

▼ Decreasing key. Press the key in special mode, the

cursor moves down or up or the number decreases.



Reticule and display board illuminating key. Press

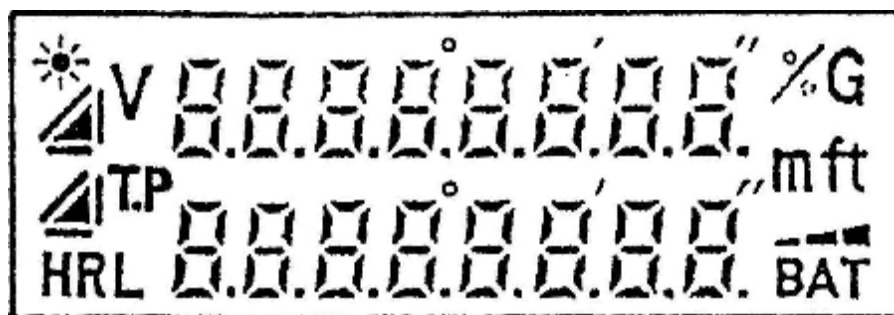
the key to illuminate reticule and display board. Press the key again, the illuminating lamp turns off. (The lamp will be off automatically while no

operation for 10 seconds.)





PWR Power switch. Press the key to turn power on; Press the key and hold it over two seconds to turn power off. (If the button switch is used, the key will be the record function key that orders the register to record.)

3-2 Display Messages

Liquid crystal display board is used. Normal symbols will be displayed as in the following figure:



The two lines in the middle of the lines display angle or distance measurements or a series of character message. Both right and left sides display symbol or character representing content or unit.

- | | | | |
|---|------------------------|---|------------------------|
| V | vertical angle | % | grade percentage |
| H | horizontal angle | G | angle unit(Gon) |
| HR | horizontal angle right | HL | horizontal angle left |
| m | distance unit (meter) | ft | distance unit (foot) |
|  | Slope distance |  | battery energy message |
|  | Height difference |  | Horizontal distance |

4.INITIAL SETTING

The instrument has many functions, In order to be appropriate to different observation, we have to do initial setting before observation.

4-1 Setting items

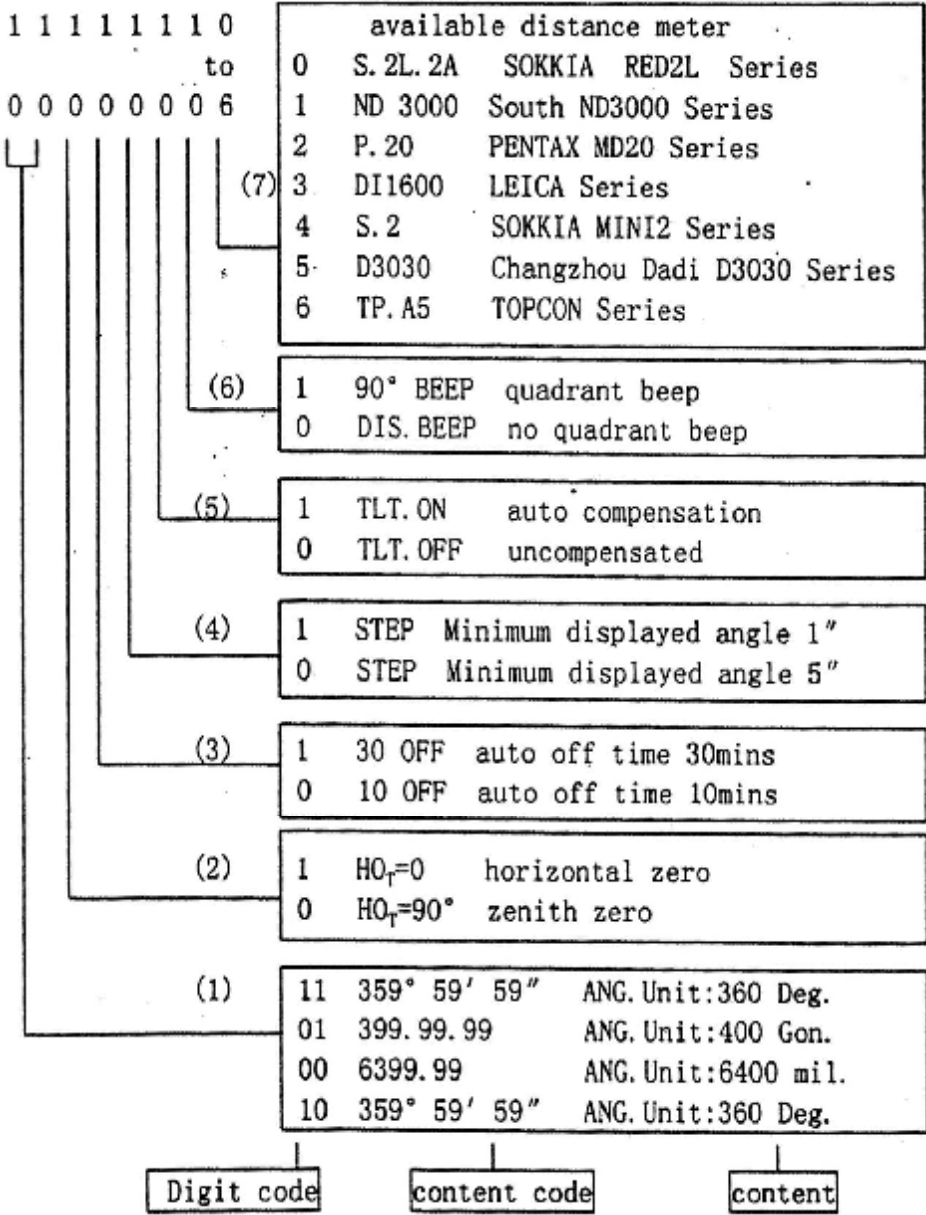
- (1) Unit of angle measurement : 360° ,400gon,6400mil(factory setting: 360°)
- (2) Vertical angle zero point setting: horizontal zero or zenith zero (factory setting:zenith zero)
- (3) Power auto off function:30 min or 10 min.(Factory setting:10 mins)
- (4) Minimum unit of angle displayed: 1 " or 5 " . (factory setting:1")
- (5) Vertical index zero compensation choosing: Auto compensation or uncompensated (factory setting: auto compensation)(No this item for uncompensation instrument)
- (6) Horizontal angle reading passes through 0° , 90° , 180° , 270° , with the beeps or no beeps.(Factory setting:beeps)
- (7) Connection with different kind of EDM. (factory setting South ND3000)

4-2 Setting method

- (1) Press [cons] key to turn power on and hold it until three beeps. The instrument will be into initial setting mode and displayed;

ND 3000 11011111 ----- flickering

The eight figures in second row represent the following initial setting contents.



- (2) Press [MEAS] OR [TRK] key to move the cursor left or right to the figure to be changed.
- (3) Press ▲ or ▼ key to change the figure . The figure represents the string contents that in the form of character codes.
- (4) Repeat 2 and 3 for other initial setting items.
- (5) when all the initial string is finished, press [CONS] key to come back to measurement mode.

When the initial setting is finished, the key [CONS] must be pressed to confirm and save the setting. Otherwise, the setting will be the former setting before.

5. PREPARATION FOR SURVEYING

5-1 Centering and leveling

Setting up the instrument and the tripod

- (1) Adjust the tripod legs to obtain a height suitable for observation when the instrument is set on the tripod.
- (2) Hang a plumb bob on the hook of the tripod, and center over the station on the ground coarsely. At this time, set the tripod and fix the tripod legs firmly into the ground and the plumb bob coincides with the station on the ground.
- (3) Adjust the length of each leg to make the tripod head as level as possible. Fix the lock screws of the tripod legs, then put the instrument on the tripod head and lock with the screws.

Centering and leveling with the optical plummet

- (1) Adjust the three leveling screws, position the bubble in the center of the vial. Look through the optical plummet eyepiece and rotate the eyepiece knob until the reticule can be seen clearly.
- (2) Rotate the focusing knob of the optical plummet until the measurement land mark can be seen clearly.
- (3) Loosen the center screw of the tripod. Look through the optical plummet, and shift the instrument base on the tripod, taking care to avoid rotating the instrument until the center mark coincides with the station.

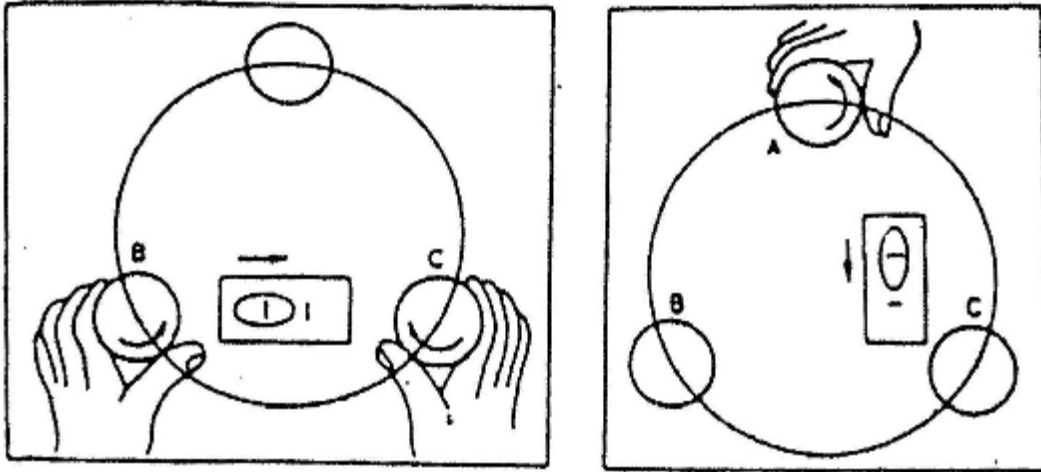
- (4) By adjusting any two leveling screws, position the bubble in the center of the vial.
- (5) Look through the optical plummet, make sure that the land mark coincides with the center of the reticule. If not, repeat the above steps until they are coincidence.
- (6) Make sure that the land mark coincides with the center of the reticule, then, lock the instrument.

Caution!

**Be sure not to touch the tripod legs,
Which may disturb the position of the instrument.**

Leveling with plate vial

- (1) Let the plate vial in parallel with a line joining any two of leveling screws. Adjust the two leveling screws. And position the bubble in the center of the vial by turning the screws in opposite directions at the same time.
- (2) Rotate the plate vial 90° around the vertical axis, make sure that the bubble is in the center by adjusting the third screw.
- (3) Rotate the plate vial 90° , repeat (1) and (2), make sure that the bubble is in the center when plate vial is moved to any directions.
- (4) Rotate the instrument 180° in (1). If the bubble is in the center and always in the center while the plate vial is moved to any directions, the plate vial is set correctly and the instrument is leveled.



- See the arrows in the above fig. For the relation between the directions of leveling screw's rotation and the bubbles shifting direction.
- If the bubble does not remain in center in (4) , “Adjustment of plate vial” is necessary. Refer to (8.1) adjustment method.

5-2. Eyepiece adjustment and object sighting

Eyepiece adjustment

- (1) Remove the telescope lens cap.
- (2) Point the telescope at the sky and rotate the eyepiece ring until the reticule 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 reticule due to poor brightness, press(☀) key to illuminate it.

Object Sighting

- (1) Point the telescope at the object using the collimator.
- (2) Look through the telescope eyepiece and finely adjust the focusing knob until the object is perfectly focused.
- (3) Use the clamp screw, then the tangent screws to point the object exactly. If focusing is correct, the reticule will not move, in relation to the object, even when you move your eye slightly left and right.

● Turn the focusing knob clockwise to focus a near object. Turn the knob counterclockwise to focus a far object.

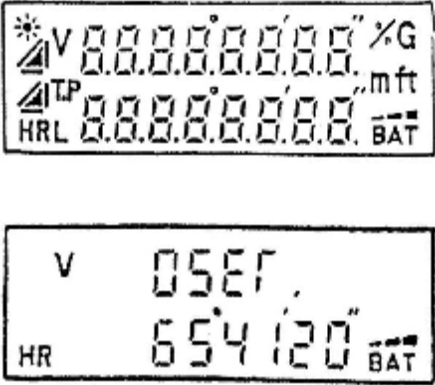
● In (3), parallax may distort the relation between the object and reticule, resulting in the observation error.

● When aligning to an object using the tangent screw, always align by rotating the screw clockwise. If the screw is turned past over the object, turn it back to the original position and sight the object by rotating the screw clockwise again.

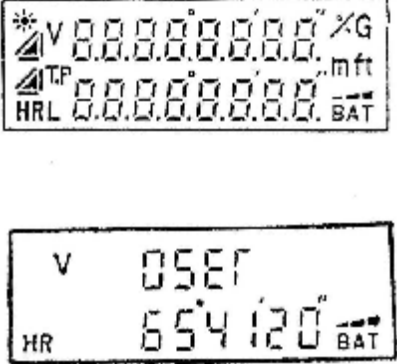
● Even when vertical angle measurement is not required, it is recommended that the object be placed to the center of the reticule as exact as possible.

5-3 Turning power ON or OFF

Handle style power switch

Operation	Display
<p>Put the handle up to ON to turn power on. The display board displays all the mark symbols.</p> <p>Horizontal angle will be displayed in 2 seconds and then horizontal angle measurement can be started.</p> <p>Put the handle down to off to turn power off.</p>	

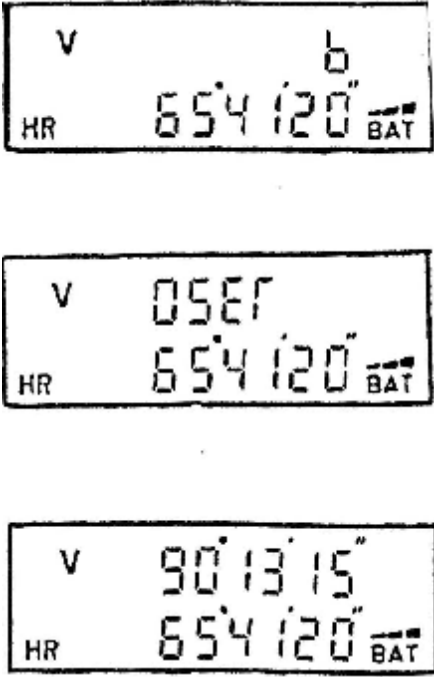
Key style power switch

Operation	Display
<p>Press [PWR] key and hold it until all the symbols are displayed. The power is on.</p> <p>Horizontal angle will be displayed in 2 seconds and then the measurement can be started.</p> <p>Press and hold [PWR] key over 2 seconds to turn power off.</p>	

When the power is turned on, the displayed angle value is the value saved in memory last time. If the displayed angle is no use anymore, the horizontal zero setting can be done.

If no operation is performed for 10 or 30 minutes. The power will be turned off automatically due to “power auto off function” and the horizontal angle will be stored in memory automatically

5-4 Vertical index zero setting

Operation	Display
<p>Turn on the power.</p> <p>Displaying “b” means that the vertical axis is not vertical . When the instrument is leveled exactly, “b” will be disappeared.</p> <p>If the instrument is leveled exactly before turning on the power displaying “v o set” (T is T) means that vertical index is set to zero.</p> <p>Turn the telescope up and down in normal position in leveling direction. Vertical index zero is set when the</p>	

telescope passes level and the vertical angle is displayed. The instrument is now ready for angle measurement.	
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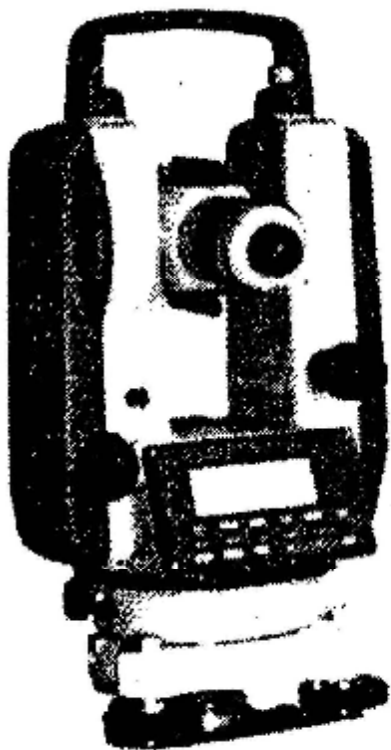
- **If vertical index auto compensation set is used, the vertical index can be compensated. When the vertical index is larger than the designed criterion, “b” will be displayed. Level the instrument precisely until “b” disappears. Then the instrument is ready for measurement.**
- **Setting vertical index zero is not necessary for horizontal angle measurement.**
- **Vertical index zero should be set as the suggestion for vertical angle measurement. The instrument is ready for measurement when a vertical angle value appears.**

6 ANGLE MEASUREMENT

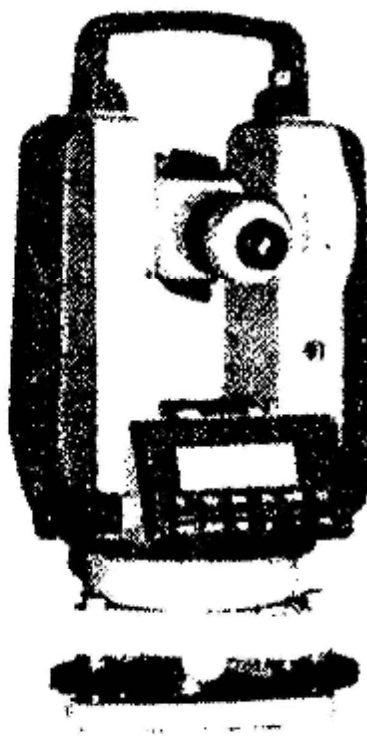
6-1 Normal/reversed position telescope observations

“Normal position telescope” means that the shaft disc is on the left side of the telescope when observers face eyepiece lens(see figure).

“Reversed position telescope” means that the shaft disc is on the right side of the telescope when observers face eyepiece lens. Averaging the value of normal/reversed position can effectively eliminate the instrument systematic errors. So normal and reversed observation are made generally.



Normal position observation



Reversed position observation

6-2 Horizontal angle “0” setting(0 SET)

Sight the telescope at object A. press O SET twice, set the horizontal angle reading as $0^{\circ} 00'00''$.

Object A displaying \rightarrow HR $50^{\circ} 10'20''$ \rightarrow press O SET twice \rightarrow displaying HR $0^{\circ} 00'00''$

●[O SET] key is valid only for horizontal angle.

●Horizontal angle can be set to “0” any time except when [HOLD] key is locked. If [O SET] is pressed by mistake during operation there is no effect unless the key is pressed again.

When the beep stops, the instrument is ready for next step.

6-3 Horizontal and vertical angle measurement (HR.V OR HL.V)

(1) Setting the mode for horizontal right and vertical angle (zenith zero) measurement (HR.V).

Turn the instrument clockwise. Sight at the object A exactly, press O SET twice to set horizontal angle to $0^{\circ} 0'00''$ as the initial zero direction. The steps and displaying contents are as following:

V $93^{\circ} 20'30''$	Press twice	V $93^{\circ} 20'30''$	---Ver. Angle
HR $10^{\circ} 50'40''$	\rightarrow O SET \rightarrow	HR $0^{\circ} 00'00''$	---Hori.angle

Turn the instrument clockwise and sight at object B , Suppose that:

V 91° 05'10" ----Vertical angle (zenith dis.)in B direction.

HR 50° 10'20" -----Horizontal angle right between A and B direction.

(2) press R/L to change horizontal angle from right to left mode (HL.V).

Turn the instrument counterclockwise (HL), sight at the object A exactly, press O SET twice to set horizontal angle to 0° 00'00" as the initial zero direction. The steps san displaying contents are the same as 1 sighting at object A .

Turn the instrument counterclockwise and sight at objects B. The displaying contents are the followings:

V 91° 05'10" ---- Ver.angle (zenith dis.) in B direction

HR 50° 10'20" ----- Hor.angle left between A and B direction.

●R/L key is invalid for vertical angle.

●Press R/L again to change horizontal angle from left mode to right mode (HR.V).

● Other directions can be measured continuously after the observation in B direction.

●In 1 and 2 , only show the steps for normal position observation. Reversed position to follow.

6-4 Horizontal angle lock and release (HOLD)

In the procedure of horizontal angle observation, if you want to retain

the measured value, press [HOLD] twice. Once horizontal angle is locked, "HRL" flickers at down left of the displaying board and the horizontal angle value will not change even if you rotate the instrument when you sight at the needed direction, press [HOLD] again to release lock function. Then the horizontal angle value is the original locked value.

●[HOLD] is invalid for vertical angle or distance.

●If [HOLD] key is pressed by mistake during operation, It does not matter unless the key is pressed again. When the beep stops, next operation step can be continued.

6-5 Horizontal angle setting

The instrument has a horizontal angle setting organization, by which, horizontal angle reading can be set roughly.

- (1) Loosen disc clamp screw.
- (2) Loosen horizontal clamp screw and fix sighting set by hand.
- (3) Turn the rough setting disc, (While, the horizontal reading is changing)until the reading is roughly the required value.
- (4) Tighten disc reading setting clamp screw and horizontal clamp screw.
- (5) Set horizontal angle reading exactly the same as the required readings by the horizontal tangent screw.
- (6) Press [HOLD] key twice to lock the reading.
- (7) Turn the instrument and sight at the target exactly. Then, press

[HOLD] key again to release the lock, so far, the target direction has been set exactly the same as required reading.

● While setting initial azimuth, the horizontal angle setting organization is generally used to preset horizontal angle reading.

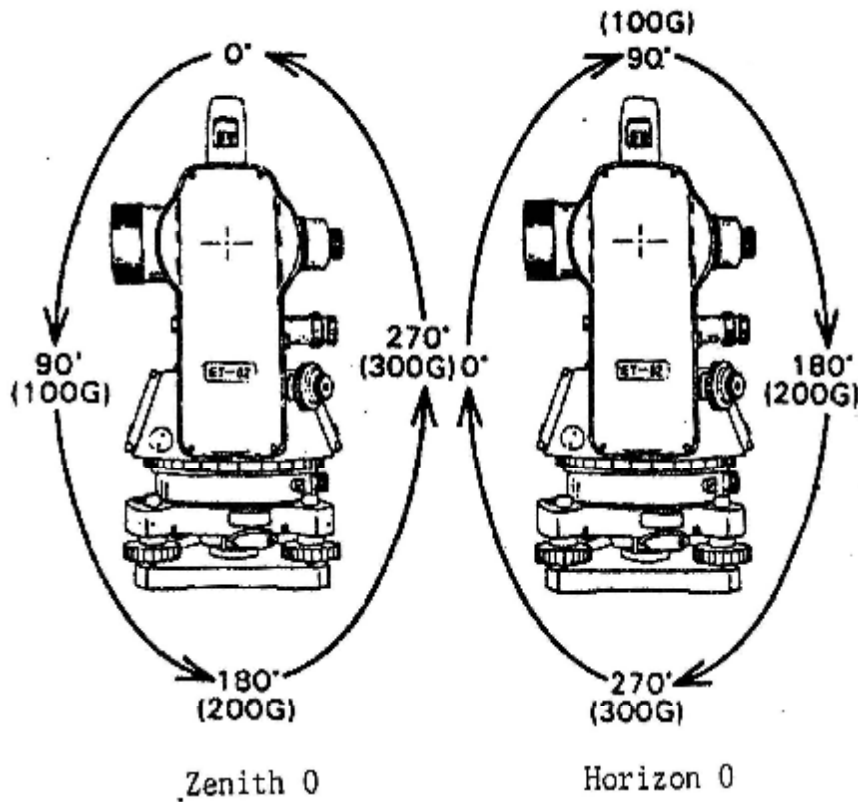
6-6 Horizontal angle quadrant setting

- (1) Sight at the first object and then press [O SET] twice to set the horizontal angle to zero.
- (2) turn the instrument around the vertical axis until the beep starts, displaying $HR89^{\circ} 59'20''$
- (3) Lock the instrument by the clamp screw and set the horizontal angle to $90^{\circ} 00'00''$ by the tangent screw. Then, fix the quadrant target direction by the telescope reticule.

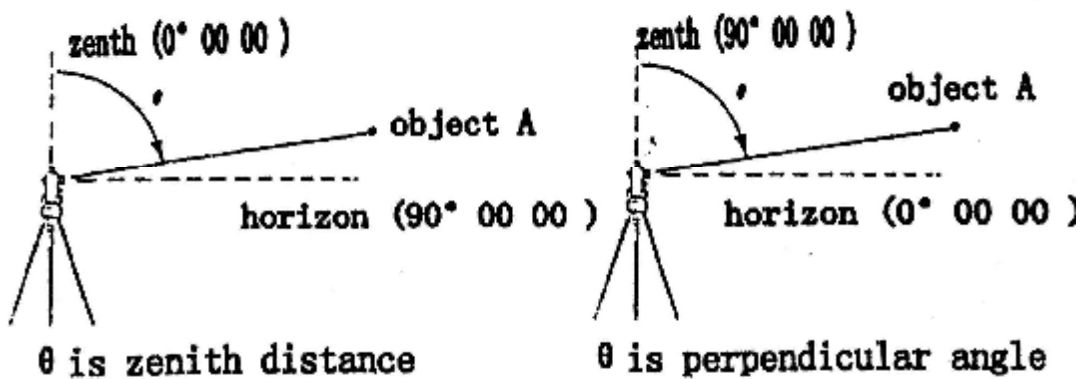
**● The beep beeps when the reading passes any of 0° , 90° , 180° , 270° .The beep starts at $\pm 1'$ range and stops at $\pm 20''$ range to the respective value.
The beep can be canceled when we do initial setting.**

6-7 Vertical angle “0” setting

In initial setting, vertical “0” setting is zenith 0/horizontal 0.(Refer to 4.2 initial stting.)



6-8 Measurement of zenith distance and vertical angle



Zenith distance: If vertical angle is 0° for zenith direction, then, the

vertical angle measured in this way is the zenith distance. (See figure)

$$\text{Zenith distance} = (L + 360^\circ - R) / 2 . \text{ Index difference} = (L + R - 360^\circ) / 2$$

(2) Vertical angle:

If vertical angle is 0° in horizontal direction, then the vertical angle measured in this way is the perpendicular angle. (See figure).

$$\text{Vertical angle} = (L \pm 180^\circ - R) / 2$$

$$\text{Index difference} = (L + R - 180 / 540) / 2$$

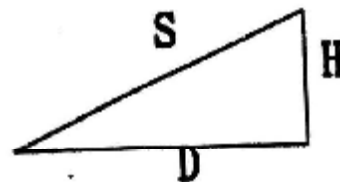
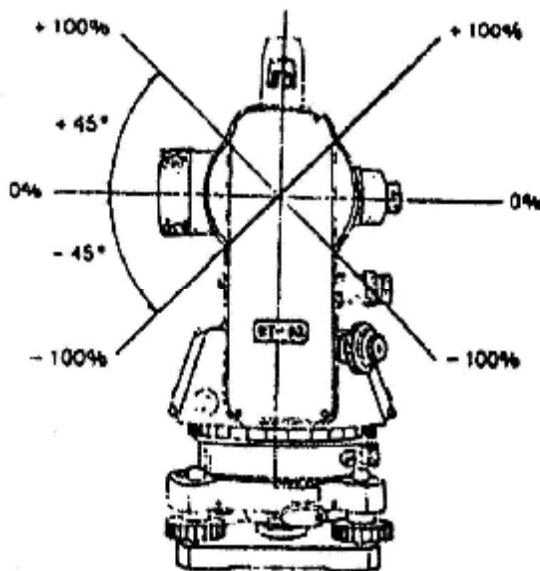
If index difference is larger than $10''$ (I.e, $|I| \geq 10''$),

Adjustment should be made as 8.5 and 8.6 in this manual.

6-9 Grade Percentage

The vertical angle can be converted into grade percentage in angle measurement mode. Press v%, the display panel shows vertical angle or grade percentage alternately.

$$\text{Grade\%} = H / D \times 100\%$$



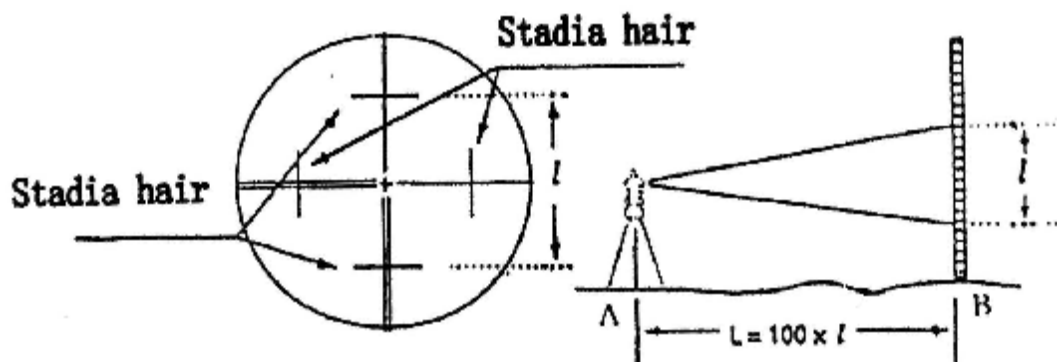
The range of grade percentage is from horizon direction to $\pm 45^\circ$ ($\pm 50G$). otherwise the instrument will not display the grade percentage.

6-10 Stadia Measurement

The distance from the measuring object to the instrument can be obtained by using the stadia hair of the telescope, with the accuracy of $\leq 0.4\%L$.

- (1) Set up the instrument at point A and put the surveying rod on point B.
- (2) Read the intercept (l) of apparent lines from up and down from the reticule on the survey rod.
- (3) The horizontal distance (L) between A and B equals

$$L=100Xl$$



● The precision of this kind of distance measurement is not very high. This method is not used when high precision is required.

7.FORMING A TOTAL STATION ON-LINE WITH EDM

ET—02/05 electronic theodolite has two data interfaces: input/output. Seven kinds of EDM can be connected forms a total station. When ET-02/05 is on—line with EDM and south electronic register, it forms a multi—function total station.

On—line with EDM

- (1) Loosen the two fixed screws of theodolite handle and take down the handle.
- (2) Mount EDM to the connecting post of theodolite and tighten the screws.
- (3) In order to make the two axes in parallel in operation, sight at the target center with the theodolite aiming axis and sight at the reflector center with the EDM aiming axis.
- (4) In normal position, the interface at the inclined downward is the interface connecting EDM. South CE—202 series cable in the following table should be used to connect different kinds of EDM.

(5)

CE ----202	South ND EDM
CE-----202P	Pentax EDM
CE-----202L	Leica EDM
CE-----202S	Sokkia EDM
CE-----202D	Changzhou Land EDM
CE-----202T	Topcon EDM



(5) The type of EDM should be set in initial setting. (See 4 initial setting)

(6) Press CONS key to confirm the initial setting, return to mode of measurement, turn the telescope, vertical index zeroing, and enter into angle measurement mode.

(7) Press MODE key to enter into distance measurement mode.

V	90° 00'00"		press		/▲	0.000m
HR	12° 34'56"	→	MODE	→	HR	12° 34'56"

- (8) Sight at the target center by theodolite reticule and sight at the reflector center by EDM. Then , press the distance measuring key to measure the distance and the measured distance value will be displayed on the panel of the theodolite.

/▲	123.456m
HR	12° 34'56"

- (9) Press V% key to display slope distance (▲), horizontal distance (▲), difference in height (▲) one after another.

Connecting electronic theodolite with south electronic register.

Connect with south electronic register by south CE—201 cable to from a multi ---function total station with automatic data collection.

Notes!

The distance between reflector center and target center should be adjusted as the same as the distance between theodolite transit axis center to EDM transit axis center.

When calculating horizontal distance, height difference, the vertical angle zero direction should be set as the instruction of EDM in initial stting . For south ND series of EDM, vertical angle should be set as zenith distance.

8.INSPECTION AND ADJUSTMENT

8-1.Plate vial

Inspection

(See 5-1 leveling with plate vial.)

Adjustment

- (1) If the bubble of the plate vial moves from the center in (4) of 5-1. Leveling with plate vial, bring it half way back to the center by adjusting the leveling screw which is parallel to the plate vial.
- (2) Correcting the remaining half by adjusting the bubble adjusting screws with the adjusting pin.
- (3) Confirm that the bubble does not move from the center when the instrument is rotated by 180° .
- (4) Turn the instrument around 90° and adjust the third screw to center the bubble in the vial. Repeat inspection and adjustment steps until the bubble remains in center in any directions.

8-2 Circular vial

Inspection

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

Adjustment

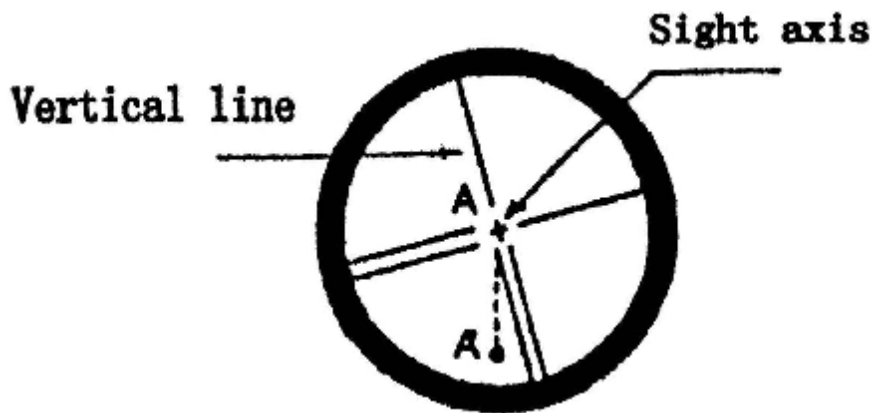
If the bubble of the circular vial is not in the center, bring the bubble to the center by using adjusting pin or adjustable wrench to

adjust the bubble adjusting screw. When adjusting, first loosen the screw on the opposite of the offset side, then , tighten the adjusting screw on the offset side, bring it to the center. After the bubble stays in the center, keep the fastening strenght of the three screws in uniformity.

8-3 Inclination of reticule

Inspection

- (1) Sight at an object A through the telescope and lock the horizontal and vertical clamp screws.
- (2) Move point A to the edge of the field of view by the vertical tangent screw(point A').
- (3) No adjustment is necessary if point A moves along the vertical line of the reticule.



Adjustment

- (1) If the point A does not move along the vertical line , first, remove the eyepiece cover and you can see the four screws.
- (2) Loosen the four reticule adjusting screws uniformly with an adjusting pin. Rotate the reticule around the aiming axis, and align the

vertical line of the reticule with point A'.

- (3) Tighten the reticule adjusting screw uniformly. Repeat the inspection and adjustment to check that if the adjustment is correct.
- (4) Cover the eyepiece cover.

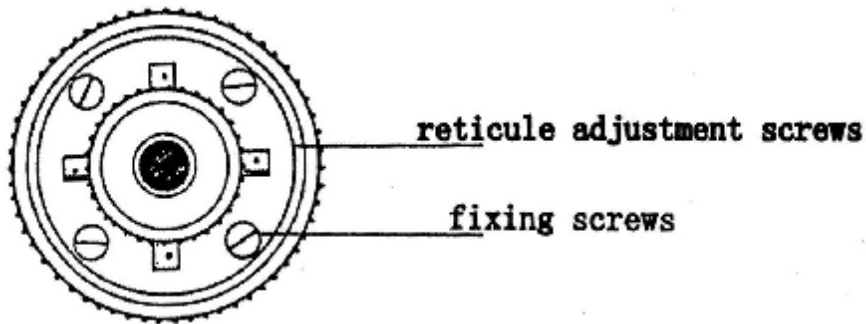
8-4 Perpendicularity of aiming axis to horizontal axis (2C)

Inspection

- (1) Set an object A at a far distance, the same height as the instrument, level and center the instrument and turn on the power.
- (2) Sight at the object A in normal position and read the horizontal angle value. (Suppose that: $L=10^{\circ} 13' 10''$).
- (3) Loosen vertical and horizontal clamp screws, and reverse the telescope. Sight at the object A in reversed position and read the horizontal angle value. (Suppose that : $R=190^{\circ} 13' 40''$)
- (4) $2C=L-(R \pm 180^{\circ}) - 30'' \geq \pm 20''$.
Adjustment is needed.

Adjustment

- (1) Use the tangent screw to adjust the horizontal read to the correct read $R+C=190^{\circ} 13' 25''$.
- (2) Take down the cover of the reticule between eyepiece and focusing screw. Adjust the two adjusting screws by loosening one and tightening the other. Move the reticule to sight at the object A exactly.
- (3) Repeat inspection and adjustment until $|2C| < 20''$.
- (4) Cover the cover of reticule back.



8-5 Vertical index difference compensation

Inspection

Liquid condenser automatic compensation set is used for vertical index zeroing compensation. We can check if the function works well by the following method.

(1) Mount and level the instrument and make the telescope parallel with the line connecting the center of the instrument to any one of the screws. Then, lock the horizontal clamp screw.

(2) Zero the vertical index after turning on the power. Lock the vertical clamp screw and the instrument displays the vertical angle value.

(3) Rotate the above screw in a direction slowly to about 10mm circumference. The displayed value changes and then disappears and rises the message "b". The vertical axis incline more than 3' at this time and exceed the designed compensation range. When you rotate the above screw reversely to the original position, the instrument displays the vertical angle again which means that the vertical index difference compensation function works well. (check its changes at critical position

repeatedly.)

Adjustment

If the compensation function does not work well. Send the instrument back to factory for repairing.

8-6 Vertical index difference (I angle) and vertical index zeroing

After making adjustments as described in 8-3 and 8-5, make the inspection as following:

Inspection

- (1) Set up the instrument and turn the power on . Then , sight at a reference A and obtain the vertical angle (L).
- (2) Reverses the telescope and sight at the object A again and obtain the vertical angle (R)
- (3) If vertical angle is zero at zenith,then, $I=(L+R-360^{\circ})/2$; If vertical angle is zero at horizon, then , $I=(L+R-180^{\circ})/2$ or $(L+R-540^{\circ})/2$.
- (4) If $|i| \geq 10''$, vertical index zeroing should be set again.

Adjustment (Setting up vertical index zeroing)

- (1) After leveling the instrument, press and hold V% key until three beeps. The instrument displays that:

V	O SET
	SET---1

- (2) In normal position, turn the telescope around near the horizontal direction until vertical angle appears. Sight at a clear

and stable object A , which is nearly the same height as the instrument. Press V% key, displaying:

V 90° 20'30"
SET----2

- (3) Reverse the telescope and sight at the object A again. Press V% key to finish vertical index zeroing stting. The instrument returns back to angle measurement mode.
- (4) Repeat the inspection procedure. If $|I| \geq 10''$, check if anything wrong in operation and repeat the adjustment again.
- (5) If the vertical index difference does not meet the standard yet after being adjusted repeatedly, the instrument should be send to factory to be repaired.

<p>● The vertical angle displayed in the procedure of zeroing setting is not compensated and can not be used formally but as a reference value.</p>
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8—7 Optical plummet

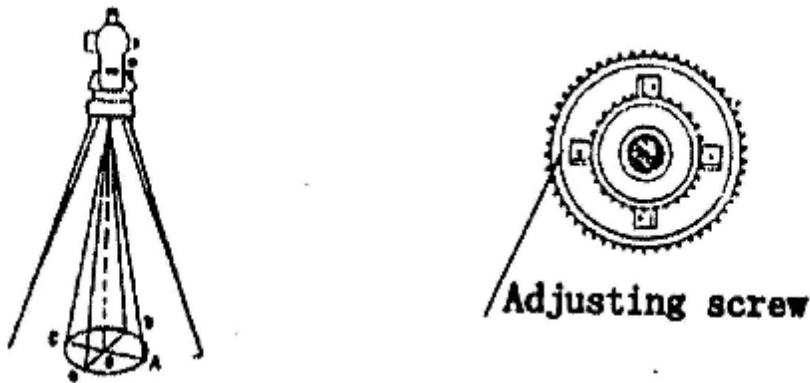
Inspection

- (1) Set the instrument on the tripod, and place a piece of white paper with a cross drawn on it right under the instrument.
- (2) Look through the optical plummet, and move the paper so that the intersecting point of the cross comes to the center of the field of view.

(3). Adjusting 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 and at every 90° observe that if the center mark position coincides with the intersecting point of the cross.

(5) If the center mark always coincides with intersecting point, no adjustment is necessary. Otherwise, the following adjustment is needed.



Adjustment

(1) Take down the protecting cover between the optical plummet eyepiece and focusing knob.

(2) On the white paper with a cross drawn on it, mark the place of the center mark when the instrument moves at every 90° , and mark them A, B, C, D.

(3) Join the diagonals with lines (A, C and B, D), the intersecting point of the two lines is called O.

(4) Adjust the four adjusting screws of the optical plummet by an

adjusting pin, until the center mark coincides with 0 point.

(5) Repeat the above inspecting and adjusting steps and check that if the adjustment is correct.

(6) Cover the protecting cover back.

8-8. Other Adjustment

If the leveling screw looses, adjust it with two adjusting pins on the basal plate. Tighten the screw till they are fit.

9.SPECIFICATIONS

Telescope

Image	-----	Erect image
Magnification	-----	30X
Effective dia. Of objective	-----	45mm
Resolving power	-----	3"
Field of view	-----	1° 30"
Shortest focusing distance	-----	1.4M
Stadia ratio	-----	100
Stadia constant	-----	0
Sight distance precision	-----	≤0.40%L
Tube length	-----	157mm

Angle measurement

Angle measurement mode	-----	photoelectric
	detection by increment	al encoder
Dia of circle (vertical, horizontal)	-----	79mm
Minimum count	-----	1" or 5"
Mode of detection	-----	Horizontal
Angle	:Pual Dual Vertical ang	le: Single
Measurement Unit	-----	360°/ 400gon
	6400mil Available	to choose
Precision	-----ET-02:2"order	ET-05:6"order

Leveling vials

Sensitivity of Plate vial(/2 mm)	-----	30"/2mm
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Sensitivity of circular vial)-----	8'/2mm
Vertical compensatory	
System -----	liquid condenser
Working range -----	± 3"
Precision -----	1"
Optical plummet	
Image -----	Erect image
Magnification -----	3X
Focusing range -----	0.5 ~ ∞
Field of view -----	5°
Display	
Type -----LCD, double line	line segment
Data input/output	
Data interface(2) -----	RS --232C
On-board battery	
Power source - ----- Rechargeable	NI CD Battery
Voltage -----	DC 6V
Operating Time -----	8h
Working environment	
Working Temperature -----	-20° ~ +45°
Dimensions and Weight	
Overall dimensions -----	160X150X330m
Instrument weight -----	5.2kg
The instrument with a plate vial under the battery box has no	

vertical compensator.

10.APPENDIX

Error messages

Display	Meaning and solution
E 01	Something wrong with the horizontal disc. Turn the power off. If happens again, the instrument should be send to factory to be fixed.
E 02	Telescope has been totated too quickly. Turn on the instrument again and set vertical index zeroing.
E 03	The alidade has been rotated too quickly. Press OSET key to clear. If the same thing happens again, the instrument needs to be fixed.
E 04	Something wrong with the vertical disc photoelectric transformer, the instrument needs to be fixed.
E 05	Something wrong with the horizontal disc photoelectric transformer (I), the instrument needs to be fixed.
E 06	Something wrong with the horizontal disc photoelectric transformer (II), the instrument needs to be fixed.
b	Overpass the compensation range. Level the instrument again.

When error messages appear, check the instrument and your operation steps. When you confirm that something is wrong with the instrument , send the instrument to factory to be repaired.

11.ACCESSORIES

Packing case	1
Main body	1
Recharge	1
Plumb bob	1
Adjusting pin	2
Soft brush	1
Awl	1
Wrench	2
Woolen cloth	1
Operation manual	1
Dryer	1
Qualified card	1