

**INSTRUCTION MANUAL**

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**FOIF**

**Electronic Theodolite**

**DT400**



**Suzhou FOIF Co., Ltd.**

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## **Foreword**

Thanks for purchasing the DT400 series Electronic Theodolites. In order to use the instrument well, please read the instruction manual carefully and keep it cautiously for consulting in the future.

## **Product confirmation:**

Please fill the model and the serial number of your instrument in corresponding blank. Feedback to local distributor or our sales department.

**Mode:** \_\_\_\_\_

**Serial number:** \_\_\_\_\_

**User:** \_\_\_\_\_

### Warning!

- Please read the instruction manual carefully before use it.
- Avoid insulating the instrument, and don't collimate the sun directly for protecting eyes at instrument.
- When using it please insure the connection between tripod and instrument is firm; if it's raining you can hood it with rainproof cover.
- Please loose the clamp system when the instrument is in the case, and keep the case dry.
- When transporting, keep the instrument in the case and try your best to lighten librations.
- After working in wet or raining condition, please wipe water on surface and keep it in air, when is dry completely, you can put it in the case.
- Don't clean the instrument surface with alcohol, aether or other irritant chemical things, and the equipped paper to clean the optical parts.
- If you do not use the instrument for a long time, you should take the battery pack down and take out the batteries.
- If you do not use the instrument for a long time, take the instrument out of the case and keep it in the dry condition.

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### 1.Applications

DT400 series Electronic Theodolite applied absolute encoders system for digital angle measurement, don't need to rotate telescope to start angle measurement. It can achieve measurement, calculating, display and memory etc. By means of computer technology it can display measuring results of horizontal and vertical angle at the same time. Furthermore, vertical angle can switch to zenith angle or grade and so on.

DT400 series Electronic Theodolite can be used in third, fourth-order triangulation control surveying, railway, highway, bridge, water conservancy and mine etc engineering surveying as well as building, installing of large equipment. It is also applied to cadastral surveying, topographic surveying and other engineering surveying.

DT400 series Electronic Theodolite applied wide LCD display and saving power design, with 4 AA alkaline batteries, it can work 40 hours continuously. With absolute encoders, angle can be saved when power off, that is to say, if power off, when you turn on again and aim the same target, the current angle do not change.

## 2. Introduction

### 2.1 Instrument encasement

Please refer to the following figure to encase. See also packing list.

1. Instrument(1 each)

2. Instruction manual(1 each)

3. Charger(1 each)

4. Rechargeable battery pack(1 each)

5. AA battery pack(1 each)

6. Tool kit (1 each)

7. Rain cover(1 each)

8. Silica gel(1 each)

Warning! Please loose the clamp system when the instrument in the case.

NOTE: According to dealer's demands, the encasement list will change.



Fig. 1

2

### 2.2 Nomenclature

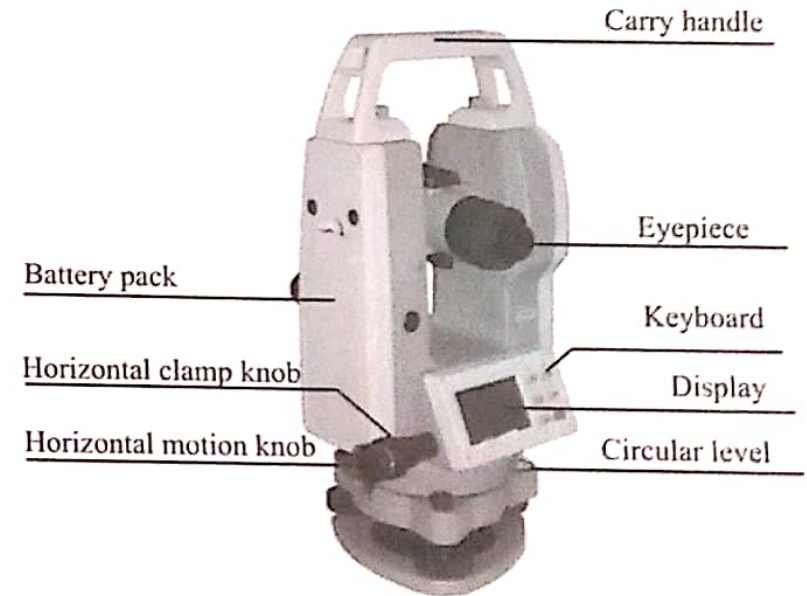


Fig. 2  
3

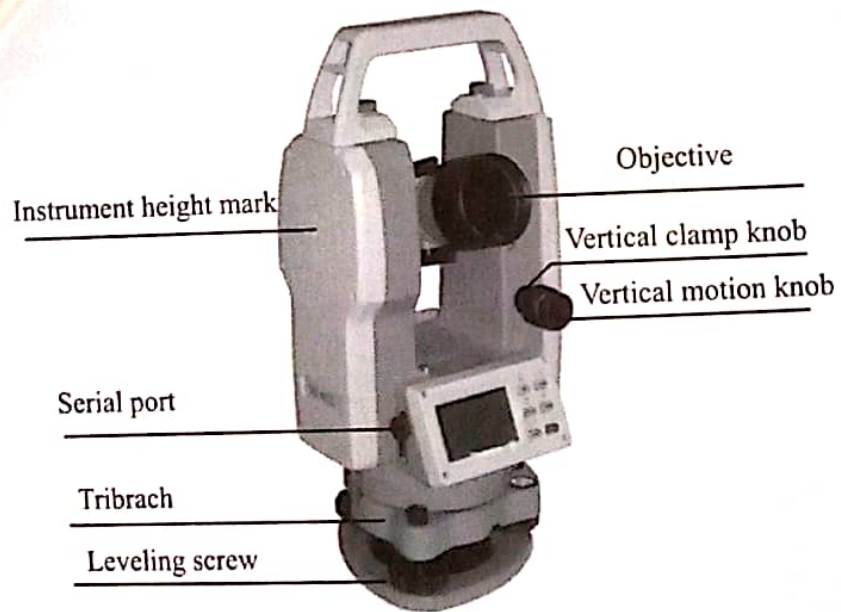


Fig. 3

### 2.3 Display

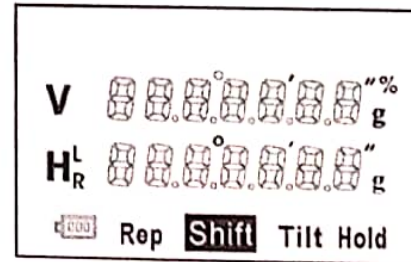


Fig.4

| Display | Description                  | Display        | Description                 |
|---------|------------------------------|----------------|-----------------------------|
|         | Battery indicator            |                |                             |
| Rep     | Repeat angle measurement     | Tilt           | Tilt sensor work mode       |
| Shift   | The second function key mode | Hold           | Horizontal angle is holding |
| %       | Percent grade                | H <sup>L</sup> | Horizontal angle left       |
| V       | Zenith angle                 | H <sub>R</sub> | Horizontal angle right      |
| g       | Unit display GON             | ° ' "          | Unit display DEG            |

## 2.4 Operation keys

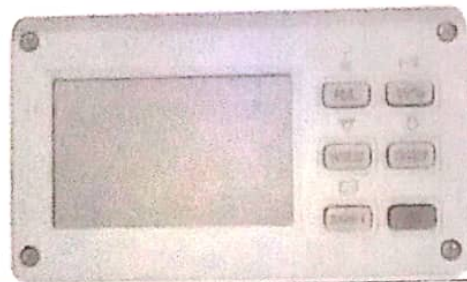


Fig.5

| Key   | First Function                            | Second Function                              |
|-------|---|--|
|       | Power on or off                           |  |
| SHIFT | Active the second function of keys        | Send data to other equipment through RS-232C |
| HOLD  | Holding measured horizontal angle         | Enter repeat angle measurement mode          |
| 0SET  | Set horizontal angle to 0° 00' 00"        | LCD and reticle lamp on/off                  |
| V/%   | Select the zenith angle or grade angle    | Turn on/off telescope laser pointer(LP400)   |
| R/L   | Select the right or left horizontal angle | Turn on/off laser plummet                    |

## 3. Battery

### 3.1 Mounting the battery

Insert the battery by aligning the battery guide with the guide hole in the instrument, press the top of the battery until you hear a click.

### 3.2 Removing the battery

Push the lock lever downward and pull out the battery.

### 3.3 Battery indicator display

A battery figure is displayed at lower-left corner of LCD panel. That the black is more means the battery power is full. If the black shows little or approaches the bottom, it means the battery needs to be replaced or recharged.

Please find the operation time on Specifications (P40-41).

Please use the alkaline battery with famous brand, otherwise it will do harm to the battery pack.



Fig. 6



Fig. 7



### 3.4 Recharge

#### (1) Recharge

Plug the charger on 100~240VAC(50/60Hz) alternating power supply, the red lamp becomes flash.

Insert the fan-out of charger into the battery jack, red lamp become lighting. It shows recharging. The output voltage is DC6V and the charger mode no. is FDJ7.

When recharge is complete, the red lamp flashes again, it shows recharge complete. Normally, it will take about 3.5 hours.

**Caution: For indoor use only!**

#### NOTE

1. The new battery (or not be used for a long time) needs to be recharged and discharged for several times to reach the good performance.

2. It is better to prolong charge 1-2 hours after green lamp lighting to reach the best performance.

3. Lamp situation: red lamp lighting--charging;

Green lamp lighting--charge complete;

Red lamp flash--waiting, not connecting or battery defective.

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Fig. 8

4. If the red lamp flash when plug the charger, please shut off the power and wait a minute to connect again.

### 3.5 Replace the AA alkaline batteries

Open the cover of the AA battery pack, take out the old batteries and put new 4 pcs AA alkaline batteries as illustration shows in the direction of + and -, and then close the cover.

#### Note:

1. Replace all 4 batteries to new ones at the same time. Don't mix the old batteries to the new ones.

2. If the instrument don't use for a long time, please taking the batteries out.

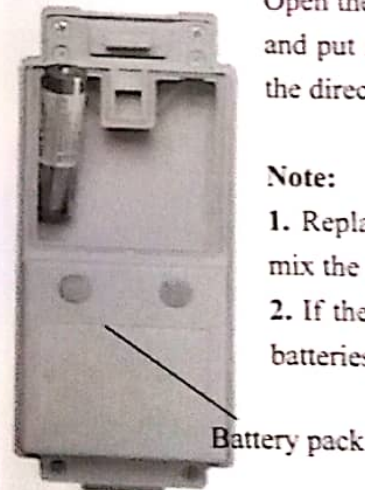


Fig.9

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## 4. Surveying preparation

### 4.1 Setting up the instrument

#### (1) Setting up the tripod

Adjust the tripod legs so that a height suitable for surveying is gained. Tighten the lock screw.

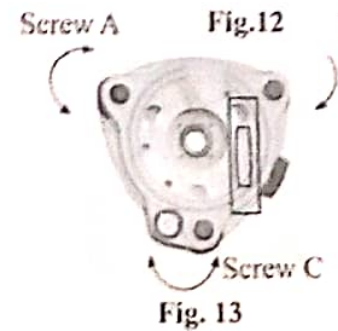
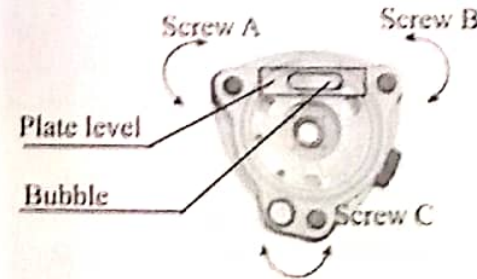
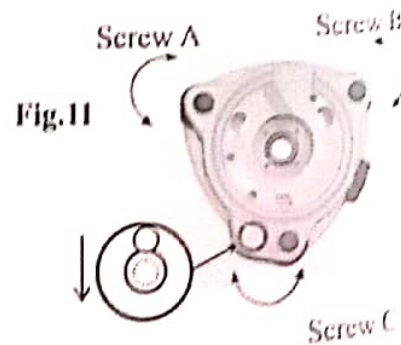
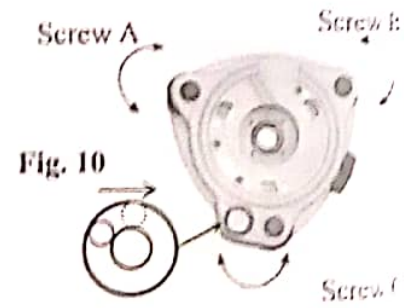
#### (2) Setting up instrument on the tripod

Put the instrument on the head and attach it to the base plate by the center screw.

### 4.2 Leveling the instrument

#### (1) Leveling with the bubble

By adjusting leveling screws A and B, position the bubble in the center of vial (Fig. 10).



Adjust the leveling screw C, position the bubble in the center of circle (Fig. 11).

#### (2) Leveling precisely by the Plate level.

Loosen horizontal clamp screw, place the plate level in parallel with a line joining leveling screws A and B. Adjust the leveling screws A and B, position the bubble in the center of the plate level (Fig. 11). Loosen horizontal clamp screw, rotate the Plate level through  $90^\circ$  around the vertical axis. Adjust leveling screw C, position the bubble in the center of plate level (Fig. 12).

Repeat above steps until the bubble remains in the center of plate level to any position.

### 4.3 Centering

#### 4.3.1 Centering with laser plummet

- (1) Power on, press [SHIFT] key firstly to active key's second function, press [R/L] key to turn on laser plummet. You will see the laser spot on the ground.
- (2) Loosen the center screw of the tripod, and move the base plate on the tripod head until the laser spot coincides with the ground mark point. Tighten the center screw.
- (3) Repeat leveling and (2) steps until the instrument keeps leveling and the laser spot coincides with the mark point when rotating alidade of instrument to any direction.
- (4) After centering, press [R/L] key to turn off laser plummet to save power.

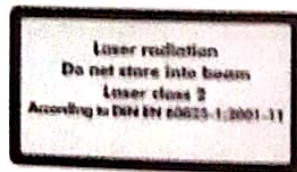


Fig.14

NOTE: Do not stare into beam

#### 4.3.2 Centering with the optical plummet(Factory optional)

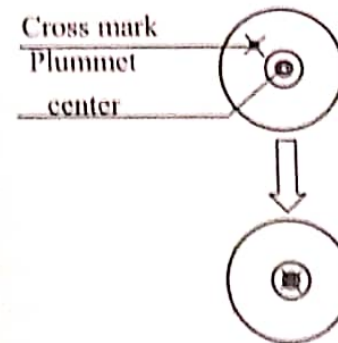


Fig.15

Rotate the focusing knob of the optical plummet and adjust the focus to the ground mark point. Then loosen the center screw of the tripod. Look through the optical plummet, and move the base plate on the tripod head until the center mark coincides with the ground mark point. Tighten the center screw. Ascertain that the bubble stays positioned in the center when rotating the Plate level in steps of  $90^\circ$  (100g). If the bubble is not positioned in the center, adjust the level screws.

Repeat above steps. Ascertain that the center of reticle plate coincides with the mark point when rotating alidade of instrument.

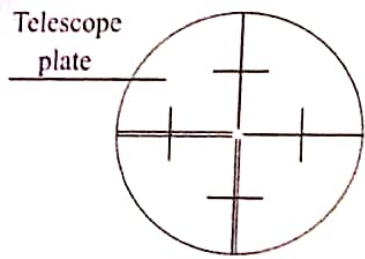


Fig. 16

#### 4.4 Focusing and Sighting

##### (1) Reticle Cross Hairs

Point telescope to sky or a uniformly light surface, turn eyepiece until cross hairs are sharp and black. The dioptic scale now indicates the correct setting for the observer's eye.

##### (2) Target Image Focusing


Slacken horizontal and vertical clamps. Point telescope to target by means of optical sight. Tighten clamps. Look through telescope eyepiece and turn focusing ring until target is seen. Set

cross hairs close to target by turning horizontal and vertical tangent screw. Complete focusing by turning ring until target image is sharp and free from parallax, i.e. there should be no apparent movement between cross hairs and target as observer moves his eye slightly. If there is parallax remove, adjusting the focusing slightly. Arrows on the ring indicate the direction to infinity.

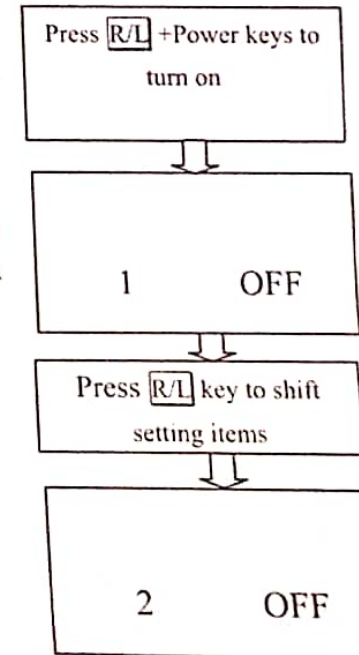
#### 5. Setting mode

Before starting first work with this instrument, you must set these parameters, but in future use, if your demand isn't changed, it is unnecessary to set again.

##### 5.1 Enter into the setting mode

Keep pressing R/L key on, and press the  key to turn on the power until SET is display, release [R/L] key firstly, then release [Power], after one buzzer is heard and setting screen is displayed.

Press [R/L] key to shift between different setting items.



### 5.2 Items of the setting mode

| Setting Items | Options | Descriptions  |
|---------------|---------|---|
| 1             | ON      | Set the vertical angle as 0° at horizontal position   |
|               | OFF *   | Set the vertical angle as 90° at horizontal position  |
| 2             | ON *    | Auto power off without any operation after 20 minutes |
|               | OFF     | Not auto power off                                    |
| 3             | 1" *    | Set the min angle reading as 1" (0.2mgon)             |
|               | 5"      | Set the min angle reading as 5" (1mgon)               |
|               | 10"     | Set the min angle reading as 10" (2mgon)              |
| 4             | 1*      | Set the angle unit as Degree                          |
|               | 2       | Set the angle unit as GON                             |
|               | 3       | Set the angle unit as MIL                             |
| 5             | 1*      | Turn on compensator                                   |
|               | 2       | Turn off compensator                                  |
| 6             | ON*     | Press [0SET] key twice to set HA as 0                 |
|               | OFF*    | Press [0SET] key once to set HA as 0                  |

The option with mark \* means default factory setting

### 5.3 How to set the selecting mode

[Example] Power auto-off

| Operating procedure   | Operation           | Display                              |
|---|---------------------|--------------------------------------|
| 1. Press [R/L] + Power keys to turn on, release them until below screen display | [R/L]<br>+<br>Power | 1 OFF                                |
| 2. Press [R/L] key until and make the digit No. 3 blinking                      | [R/L]               | 3 OFF                                |
| 3. Press [V/%] key to switch the option as "ON"                                 | [V/%]               | 3 ON                                 |
| 4. Press [SHIFT] key to save the setting and angle, go to measurement mode      | [SHIFT]             | Vz: 075° 52' 37"<br>Hz: 175° 12' 03" |

## 6. Instrument operation

### 6.1 Power on

Hold pressing the Power key until all the segments on LCD display, release power key, the instrument enters into measurement mode.

### 6.2 Power off

Keep pressing the Power key until the instrument display "OFF", release the key, the instrument will be turned off.

### 6.3 Turn on display back light

Press [SHIFT] once, keyboard will be on the second function mode, press [OSET] key once, display back light will turn on.

### 6.4 Turn off display back light

If display back sight is on, press [OSET] key once on the keyboard second function mode, back sight will be turned off.

|                |              |
|----------------|--------------|
| V              | 075° 52' 37" |
| H <sub>R</sub> | 175° 12' 03" |

Press [R/L] key

|                |              |
|----------------|--------------|
| V              | 075°52'37"   |
| H <sup>L</sup> | 184° 47' 57" |

Flow chart for horizontal R/L  
angle shift

|                |              |
|----------------|--------------|
| V              | 075° 52' 37" |
| H <sub>R</sub> | 175° 12' 03" |

|                |              |
|----------------|--------------|
| V              | 075°52'37"   |
| H <sub>R</sub> | 000° 00' 00" |

Flow chart for horizontal  
angle 0 set

### 6.5 Switching horizontal angle right/left ([R/L])

After instrument switch, the horizontal angle display is "H<sub>R</sub> xxx° xx' xx\"", it shows horizontal angle will increase by turning the instrument clockwise ("H<sub>R</sub>" mode)

Press the [R/L] key and release it, horizontal angle display changes to "H<sup>L</sup> xxx° xx' xx\"", it shows horizontal angle will increase by turning the instrument counterclockwise. ("H<sup>L</sup>" mode)

### 6.6 Set the horizontal angle to 0 ([OSET])

Press the [OSET] key, then release it, horizontal angle will flash, press OSET key again, horizontal angle value will change to 000° 00' 00"

In setting mode, if the sixth item is OFF, press [OSET] once to set HA as 0 directly.

|                |              |
|----------------|--------------|
| V              | 058° 52' 20" |
| H <sub>R</sub> | 175° 12' 00" |

|                |              |
|----------------|--------------|
| V              | 0.6039 %     |
| H <sub>R</sub> | 175° 12' 00" |

Flow chart for  
Vertical angle mode  
0°



180°  
Zenith mode



Grade mode

## 6.7 Switching vertical angle zenith/grade (V/%)

### (1) Zenith mode (V)

After instrument is switched on and initialized, vertical angle measurement mode enters the Zenith mode automatically. The angle value range is 0° ---360°. For example, the first line shows "V 058° 52' 20" ".

### (2) Grade mode (V%)

Press the [V/%) key and release it under the Zenith mode (Vz), vertical angle measurement mode will enter grade mode (V%) and it displays "V 0.6039%" in the first line. The range of grade is -100% ~ +100%, corresponding angle range is -45° ~ +45°, horizontal direction is 0.0000. If it is over the range, LCD displays "error".

In the state of grade mode, press the [V/%) key and release it again, then return to the Zenith mode.

|                |              |
|----------------|--------------|
| V              | 075° 52' 37" |
| H <sub>R</sub> | 175° 12' 03" |

Press **HOLD** key

|                  |              |
|------------------|--------------|
| Vz:              | 075° 52' 37" |
| H <sub>R</sub> : | 175° 12' 03" |

Hold

Press **HOLD** key

|                  |              |
|------------------|--------------|
| Vz:              | 075° 52' 37" |
| H <sub>R</sub> : | 175° 12' 03" |

Flow chart for hold H-angle

## 6.8 Holding the horizontal angle value and set to arbitrary value (HOLD)

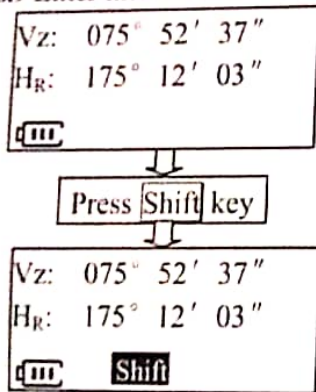
### (1) Holding the horizontal angle value

Press the **HOLD** key and release it, the LCD displays "Hold" at the last line, at this status the horizontal angle reading retains unchanged when you rotate the alidade. Press **HOLD** key once again, instrument returns to original status. The horizontal angle will change when instrument is turned.

### (2) Set horizontal angle to arbitrary value

Turning the horizontal tangent screw until it displays a value that you need, press the **HOLD** key, the angle value is held and "Hold" message is displayed. Turning the instrument and sighting the target, press the **HOLD** key and release it again, the hold function releases, you can go on the next measurement.

### 6.9 Enter into the second function key mode



Flow chart for shift key function mode

All keys have two functions, the first function is marked on the key, and the second function is marked above the key. At normal mode, the first function is active, and at shift mode, the second function is active.

Press the SHIFT key and release it, the buzzer will ring, and the LCD displays "Shift" at the last line, the instrument enters into second function key mode. Press the SHIFT key again, the instrument enters into the normal mode (first function key mode).

## 7. Angle measurement

### 7.1 Horizontal angle measurement

- (1) Switch on. ( ① )
- (2) Check battery indicator.
- (3) Check LCD illumination is ON or OFF.
- (4) Select direction of angle measurement ( $H_R$  or  $H^L$ ).
- (5) Set unit of angle ( $360^\circ$  or  $400\text{gon}$ ).
- (6) Set horizontal angle to  $0^\circ$  or set to arbitrary value. (OSET or HOLD)
- (7) Aim target.
- (8) Read the displayed value.
- (9) Go on next measurement item.
- (10) Complete measurement and turn off. ( ① )

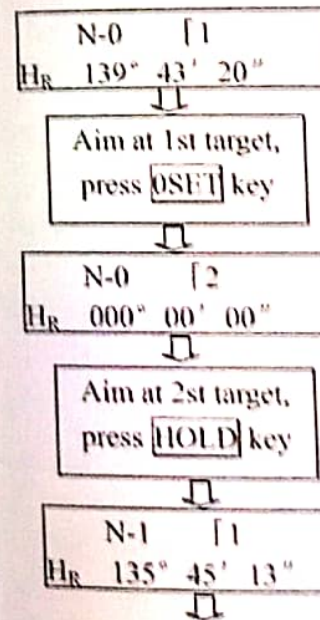


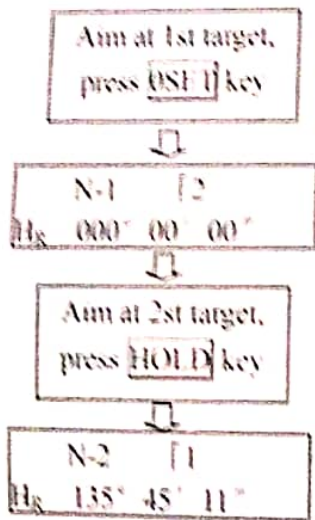
## 7.2 Vertical angle measurement

- (1) Switch on. ( ① )
  - (2) Check battery indicator.
  - (3) Check LCD illumination is ON or OFF.
  - (4) Set unit of angle ( $360^\circ$  or  $400\text{gon}$ ).
  - (5) Select vertical angle measurement mode (zenith V, grade %).
  - (6) Aim target.
  - (7) Read the displayed value.
  - (8) Go on next measurement item.
  - (9) Complete measurement and turn off. ( ① )
- Note: Both of horizontal and vertical angle can be measured at the same time.

## 7.3 Angle repeat measurement

- (1) Press [SHIFT] key to enter keyboard second function mode, press [HOLD] key to angle horizontal angle repeat measurement program.
- (2) Aim at the first target accurately with tangent screw.
- (3) Press [0SET] key to set HA as 0
- (4) Aim at the second target accurately with tangent screw.
- (5) Press [HOLD] key.





- (6) Aim at the first target accurately with tangent screw again.
- (7) Press [OSET] key to set HA as 0
- (8) Aim at the second target accurately with tangent screw.
- (9) Press [HOLD] key, average horizontal angle between target 1 and target 2 will be show.
- (10) Repeat above steps to get more precise horizontal angle.

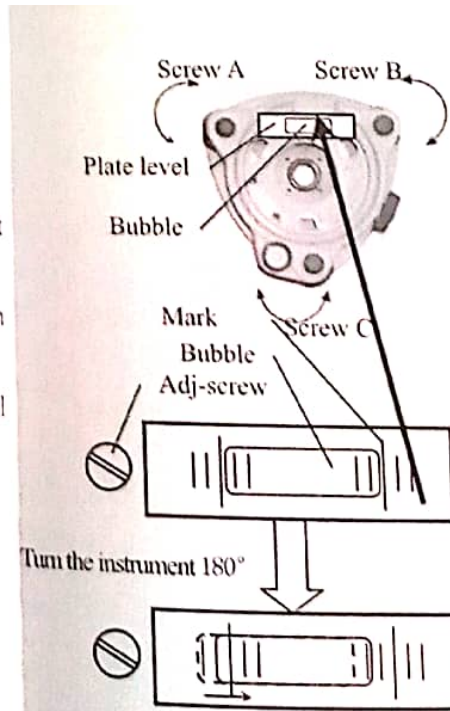


Fig. 18

## 8. Check and adjustment

### 8.1 Check/adjust the plate level

#### Check

- (1) Set-up the instrument on stable equipment (such as tripod or adjustment platform) and fix it.
- (2) Leveling the instrument, place the plate level parallel to a line of two leveling screws. Adjust the leveling screws, position the bubble in the center of the plate level.
- (3) Rotate the instrument through 180° (200g), confirm if the bubble is in the center. No adjustment is necessary if the bubble of the plate level is in the center. If the bubble moves, then proceed with the following adjustment.

### Adjustment

- (1) Set-up the instrument on stable equipment and fix it.
- (2) Leveling the instrument.
- (3) Rotate instrument, place the plate level parallel to a line of two leveling screws. Adjust the leveling screws, position the bubble in the center of the plate level.
- (4) Rotate the instrument  $180^\circ$  (200g), bring the bubble half way back to the center by adjusting the bubble adjustment screw with the adjusting pin.
- (5) Repeat the procedures of (3) and (4) until the bubble always in the center by rotating the instrument.

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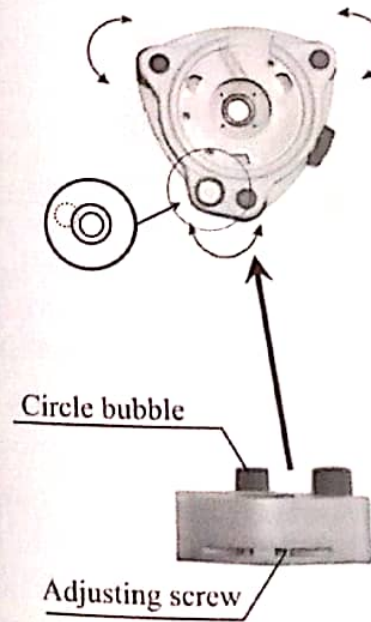


Fig. 19

### 8.2 Check/adjust the circular level

- (1) Set-up the instrument on stable equipment and fix it.
- (2) Leveling the instrument accurately by plate level; Confirm if the bubble of circular level is in the center. No adjustment is necessary if the bubble of the plate level is in the center. If the bubble moves, proceed with the following adjustment.

#### Adjustment

- (1) Set-up the instrument on stable equip
  - (2) Leveling the instrument accurately by the plate level.
  - (3) Shift the bubble to the center by adjusting the bubble adjusting 2 screws with the adjusting pin.
- NOTE: When adjusting two adjustment screws with the adjusting pin, don't press too strong.

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### 8.3 Optical sight

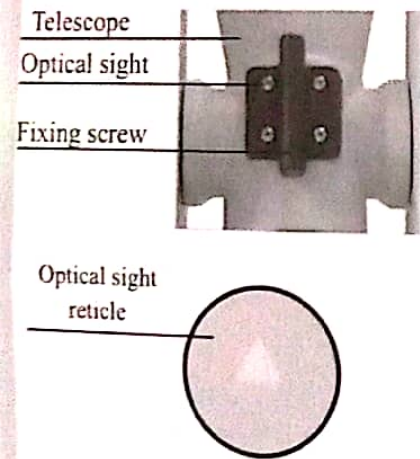


Fig. 20

adjusting the optical sight to correct position, then tighten these four fixing screws.

#### Check

- (1) Set-up the instrument on tripod and fix it.
- (2) Place a cross-hair target 50m from instrument.
- (3) Aim at the cross hair on the target through telescope.
- (4) Confirm if optical sight aims at the cross hair. No adjustment is necessary if the optical sight aims at the cross hair. If the cross hair moves, proceed with the following adjustment.

#### Adjustment

- (1) Set-up the instrument on tripod and fix it.
- (2) Place a cross-hair target 50m from instrument.
- (3) Aim at the cross hair on the target through telescope.
- (4) Loosen four fixing screws of the optical sight,

### 8.4 Laser plummet

#### Check

- (1) Set the instrument on stable device and fix it.
- (2) Set a cross mark on the ground under the instrument.
- (3) Turn the laser switch on and focus it accurately.
- (4) Turn the three leveling screws until the instrument keeps leveling and the laser spot coincides with the cross mark on the ground.
- (5) Rotate the instrument  $180^\circ$  (200g) around and check the laser spot and cross mark, if they coincide, adjustment is not required. Otherwise, adjust it.

#### Adjustment

1. Setting up the instrument on the checking tool or tripod which is 1.5m apart from ground.
2. Turn on laser plummet, turn tribrach

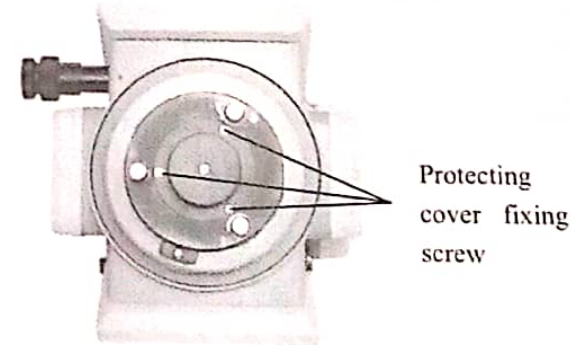


Fig. 21

foot screws until laser spot coincide with cross mark. If you use tripod, make a cross mark on the laser spot directly.

3. Rotate instrument  $180^\circ$  around, if the laser spot is over 2mm apart from cross mark, remove the protecting cover firstly, adjust two screws with 1.5mm hexagon wrench to move laser spot to the cross mark, correct only one-half of the displacement in this manner.

Adjusting details see attached figure.

4. Repeat steps 2 and 3 until laser spot coincides with cross mark always when rotate instrument.

Note: there are three screws amounted around laser plummet part, only two screws are used for laser accuracy adjustment.

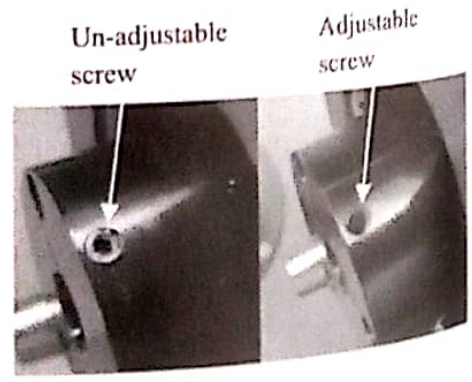


Fig. 22  
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### 8.5 Optical Plummet(Factory optional)

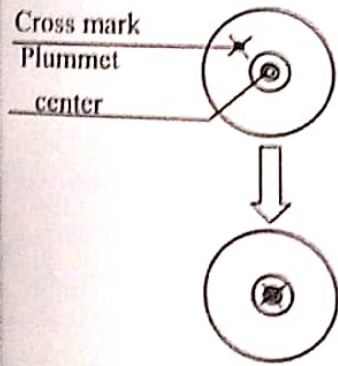


Fig. 23

#### Check

- (1)Set-up the instrument on tripod and fix it.
- (2)Place a cross-mark under the instrument directly.
- (3)Rotate the leveling screws, make the intersection of cross hairs superposed to the Point.
- (4)Rotate the instrument  $180^\circ$ (200g), confirm if intersection of cross hairs is superposed to the Point. No adjustment is necessary if the intersection of cross hairs is superposed to the point. If not, proceed with the following adjustment.

#### Adjustment

- (1)Set-up the instrument on tripod and fix it.
- (2)Place a cross-mark under the instrument directly.
- (3)Rotate leveling screws, make the intersection of cross hairs superposed to the point.
- (4)Rotate the instrument  $180^\circ$ (200g), remove the eyepiece shield, bring the point half way back to the intersection of cross hairs by adjusting the adjusting pin.
- (5)Repeat procedure (3) (4) until the intersection of cross hairs is superposed to the point by rotating the instrument.

### 8.6 Vertical Hairs of telescope's reticle

Check

- (1) Set-up the instrument on tripod and level it accurately.
- (2) Place a point mark A 50m from instrument.
- (3) Aim at the point mark A, turn the vertical tangent screw. If point A moves along the vertical hairs, no adjustment will be necessary. If point A moves deviation from the vertical hairs, proceed with the following adjustment.

Adjustment

- (1) Set-up the instrument and place a point mark A 50m from instrument.
- (2) Remove the eyepiece shield of telescope, turn the vertical tangent screw, loosen four adjusting screws slightly. Then turn the eyepiece assembly until the point A coincides with the vertical hairs. Tighten the four adjusting screws.
- (3) Repeat check procedure (3), adjustment procedure (2) until the deviation is not existent.

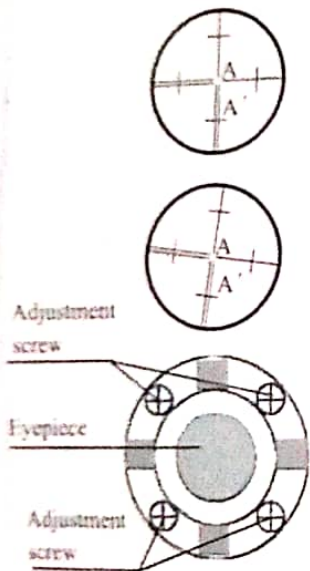


Fig. 24

### 8.7 Horizontal collimation error C

Check

- (1) Set-up the instrument and level it accurately.
- (2) Aim at the cross-hairs of collimator or the obvious target at a distance. Get the face left angle reading  $H(l)$  and the face right angle reading  $H(r)$ .
- (3) Calculating the horizontal collimation error  $C$  according to  $C = (H(l) - H(r) \pm 180^\circ) / 2$ . If  $C < 10''$ , no adjustment will be necessary. If  $C > 10''$ , proceed with the following adjustment.

Adjustment

- (1) Rotate the instrument in face right position, turning horizontal tangent screw until  $H(r') = H(r) + C$ .
- (2) Loosen the shield of telescope's reticle, adjusting two screws at left and at right until the vertical hairs of telescope's reticle coincides with the cross-hairs of collimator or target.
- (3) Repeat the check and adjustment procedure until it is up to standard value.

For example:

Face left angle

$$H(l) = 000^\circ 00' 00''$$

Face right angle

$$H(r) = 180^\circ 00' 30''$$

Horizontal collimation error  $C$  is:

$$C = (H(l) - H(r) \pm 180^\circ) / 2 = -15''$$

If  $C$  is out of tolerance, need to adjust

Adjustment

screw

Eyepiece

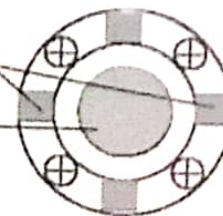


Fig. 25

### 8.8 Check and adjustment of the vertical index error i

Check

- (1) Set-up the instrument on tripod or platform and level it accurately.
- (2) Aim at the cross-hairs of collimator or the target which is  $\pm 10^\circ$  not apart away from horizontal line. Then read the face left angle reading  $V_l$  and the face right angle reading  $V_r$ .

(3) Calculating the vertical index error  $i$  according to  $i = (V_l + V_r - 360^\circ) / 2$

(4) If  $i < 15''$ , no adjustment will be necessary.

If  $i > 15''$ , proceed with the following adjustment.

Press Power + [V/°] keys

SET F1  
H<sub>R</sub> 091° 51' 37"

At telescope face left aim at the collimator, press [R/K] key

Adjustment

- (1) Set-up the instrument on tripod or adjustment platform and level it accurately.
- (2) Keep pressing power key, and press [V/°] key to enter index error adjusting screen. "SET F1" will display
- (3) Rotate the telescope to aim the cross-hairs of collimator which is  $\pm 10^\circ$  not apart away from horizontal line, press [R/L] key to confirm. "SET F2" will display.

SET F2  
H<sub>R</sub> 271° 51' 32"

At telescope face right aim at the collimator, press [R/K] key

SET  
H<sub>R</sub> 271° 51' 32"

press [R/K] key to save the new value

V<sub>Z</sub>: 075° 52' 37"  
H<sub>R</sub>: 175° 12' 03"

Flow chart for adjusting error I

(4) Turn the instrument around  $180^\circ$ , and aim the same target.

(5) SET will display, press [R/L] key to save new value for vertical index error, the adjustment finish and enter into measurement mode automatically.

**NOTE:**

1. After the adjustment of vertical index I, please check it again.
2. At index error adjusting screen, press [SHIFT] key to enter measurement mode directly, new error is not saved.

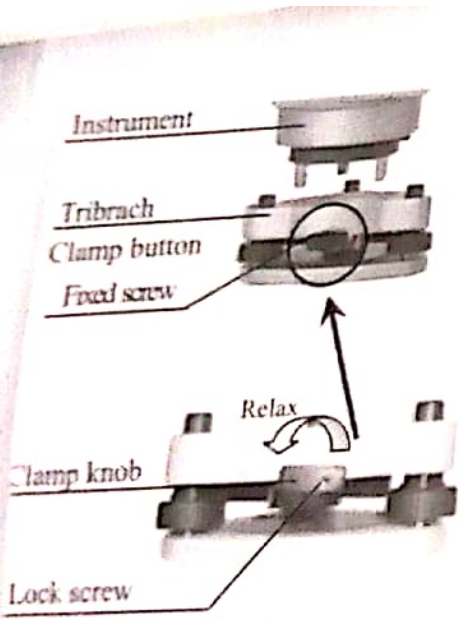


Fig. 26

### 9. Assembling and disassembling for three-jaw tribrach

#### Disassembling

- (1) Tighten the fixed screw.
- (2) Rotate the clamp knob 180°(200g) anticlockwise.
- (3) One hand hold up the tribrach, another hand hold the carry handle of the instrument and lift out the instrument from the tribrach.

#### Assembling

- (1) Confirm the tribrach clamp knob is loosened.
- (2) Put the instrument into the tribrach lightly, let the communication port against in the indentation of the tribrach.
- (3) Rotate the clamp knob of tribrach through 180°(200g) clockwise.
- (4) Tighten the fixed screw. (Note: don't remove the fixed screw from the tribrach.)
- (5) Confirm the instrument and the tribrach

connected stably.

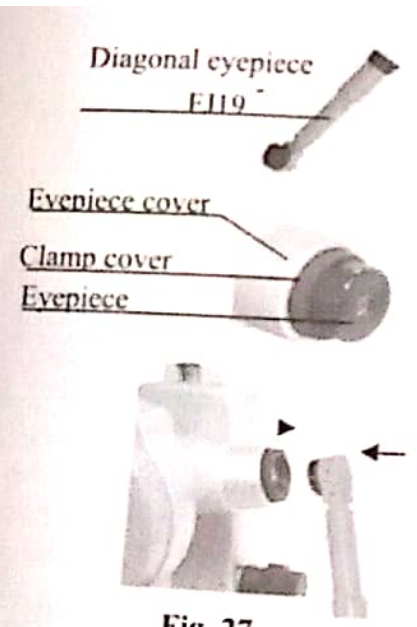


Fig. 27

### 10. Optional Accessories

The telescope diagonal eyepiece can be applied to the instrument in order to observe the larger elevation and zenith.

#### Assembling

- (1) Loosen the eyepiece clamp cover anticlockwise, then take out the eyepiece.
- (2) Put the diagonal eyepiece into correspond eyepiece site, tighten the eyepiece clamp cover clockwise.



## 11. Specifications

\*: No stadia hairs D: Without compensator L: Laser plummet, standard

| Model                        | DT402/DT402L    | DT405/DT405L    | DT405D/DT405DL  |
|------------------------------|-----------------|-----------------|-----------------|
| <b>Angle measurement</b>     |                 |                 |                 |
| Measuring method             | absolute coding | absolute coding | absolute coding |
| Minimum reading              | 1" /5" /10"     | 1" /5" /10"     | 1" /5" /10"     |
| Accuracy                     | 2"              | 5"              | 5"              |
| Automatic compensation range | ±3'             | ±3'             | /               |
| <b>Telescope</b>             |                 |                 |                 |
| Objective lens               | 45mm            | 45mm            | 45mm            |
| Magnification                | 30 <sup>x</sup> | 30 <sup>x</sup> | 30 <sup>x</sup> |
| Image                        | Erect           | Erect           | Erect           |
| Field of view                | 1° 30'          | 1° 30'          | 1° 30'          |
| Minimum focus                | 1m              | 1m              | 1m              |
| <b>Display</b>               |                 |                 |                 |
| Display panel                | Double sides    | Double sides    | Double sides    |
| <b>Illumination</b>          |                 |                 |                 |
| Reticle                      | Yes             | Yes             | Yes             |
| Display panel                | Yes             | Yes             | Yes             |

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| Model                     | DT402/DT402L                     | DT405/DT405L | DT405D/DT405DL |
|---------------------------|----------------------------------|--------------|----------------|
| <b>Level sensitivity</b>  |                                  |              |                |
| Plate level               | 30" /mm                          |              |                |
| Circular level            | 8" /mm                           |              |                |
| <b>Power supply</b>       | 6V Ni-MH recharge battery        |              |                |
| <b>Operation time</b>     | About 15 hours with backlight on |              |                |
| <b>Laser plummet</b>      |                                  |              |                |
| Accuracy                  | ±1.0mm /1.5m                     |              |                |
| Laser class               | Class 2 /IEC60825-1              |              |                |
| Laser wave                | 635nm                            |              |                |
| <b>Other</b>              |                                  |              |                |
| Serial interface          | RS-232C                          | RS-232C      | /              |
| Instrument size           | 153*175*340mm                    |              |                |
| Instrument weight         | 4.3kg                            |              |                |
| Operation temperature     | -20~-50°C                        |              |                |
| Water and dust production | IP54                             |              |                |

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**NOTE:**

These designs, figures and specifications are subject to change without notice.

We shall not be held liable for damages resulting from errors in this instruction manual.