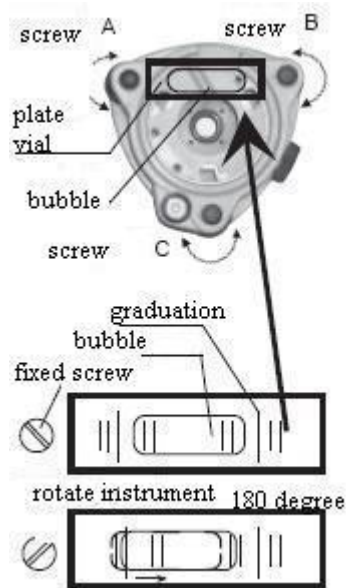


SERVICE MANUAL
(DE /DE-L SERIES)

1. Check & Adjustment of Plate Vial

Check

① Rotate the instrument horizontally by loosening the Horizontal Clamp Screw and place the plate vial parallel with the line connecting leveling screw A and B, and then bring the bubble to the center of the plate vial by turning the leveling screws A and B. (shown as below)

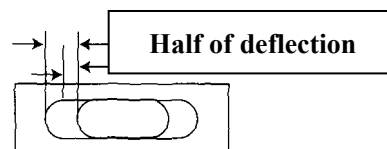


② Rotate the instrument 180° (200g) around its vertical axis. Observe the bubble of plate vial. Follow the steps below to adjust it if the bubble is not in the center.

Adjustment

① If the bubble of the plate vial moves from the center, bring it half way back to the center by adjusting the leveling screw, which is parallel to the plate vial. Correct the remaining half by adjusting the screw of plate vial with adjusting pin.

② Confirm whether the bubble does is in the center by rotating the instrument 180° . If not, repeat step ①.



③ Turn the instrument 180° (200g) and adjust the third screw to center the bubble in the vial.

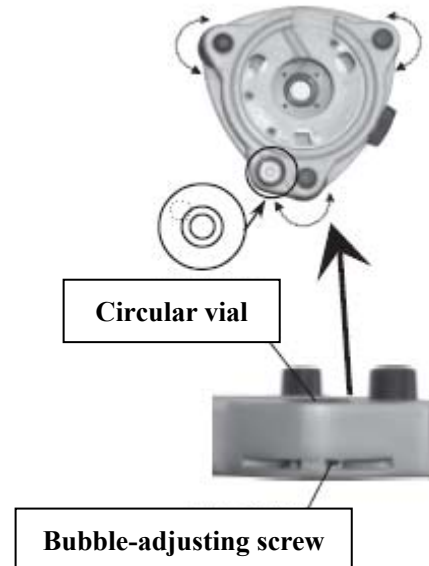
2. Check & Adjustment of Circular Vial

Check

No adjustment is necessary if the bubble of the circular vial is in the center after inspection and adjustment of the plate vial. (shown at right)

Adjustment

If the bubble of the circular vial is not in the center, bring the bubble to the center by using the adjusting pin to adjust two bubble-adjusting screws.



3. Check & Adjustment of Optical Plummet

Check

① Set the instrument on the tripod and place a piece of white paper with two perpendicular lines, then intersect drawn on it directly under the instrument. Adjust the leveling screws so that the center mark of the optical plummet coincides with the intersection point of the cross on the paper.

② Rotate the instrument around the vertical axis 180° (200g) observe whether the center mark position coincides with the intersection point of the cross. If the center mark always coincides with intersection point, no adjustment is necessary. Otherwise, the following adjustment is necessary.



Adjustment

① Take off protective cover of the optical plummet, you may see 4 adjusting screws. Adjust 4 adjusting screw.

② Move woodscrew to make the center of optical plummet coincides with ground point.

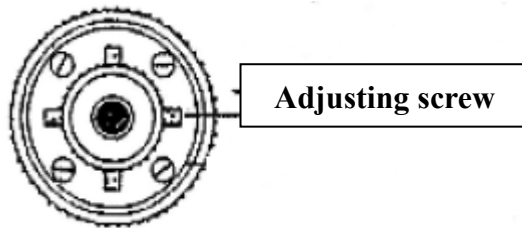
③ Rotate the instrument around the vertical axis 180° (200g) observe whether the center mark position coincides with the intersection point of the cross. If the center mark always coincides with intersection point, no adjustment is necessary. Otherwise, repeat steps above mentioned.

4. Check & Adjustment of Perpendicularity of line of sight to Horizontal Axis

(2c)

Check

- ① Set target A which should be the same height as the instrument, level the machine and then turn on.
- ② Aim at target A when turn left and read the Horizontal angle(L)(for example: $L=10^{\circ}13'10''$).
- ③ Loose the Vertical and Horizontal Clamp Screw ,move the telescope. Then aim at target A(remember to lock the Vertical and Horizontal Clamp Screw before aiming) and get the Horizontal angle(R)(for example: $R=190^{\circ}13'40''$).
- ④ $2C=L - (R\pm 180^{\circ}) = - 30''\geq\pm 20''$, it should be adjusted.



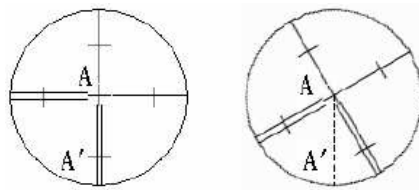
Adjustment

- ① Move the Horizontal Tangent Screw to make the reading as R-C($R-C=190^{\circ}13'40'' - 15''=190^{\circ}13'25''$).
- ② Take away the cover between the telescope eyepiece and focusing knob, adjust the two adjusting screws(left and right) to make reticle coincides with cross line of collimator or one target away.
- ③ Repeat check and adjustment until $|2C|<20''$.
- ④ Put the cover back .

5. Check & Adjustment of Inclination of Reticle

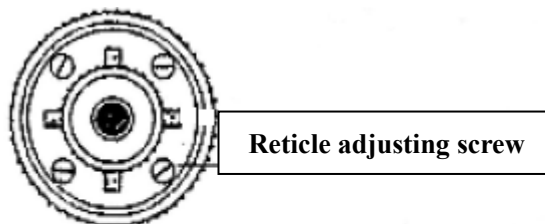
Check

- ① Set the instrument on a tripod and level it.
- ② Aim at target A with telescope (One point, 50m away) .
- ③ Observe point A moves along the vertical line of the reticle or not by moving telescope up and down. If so, no adjustment is necessary. If not so, then need to adjust the reticle.



Adjustment

- ① Remove the eyepiece cover to expose the four reticle adjusting screws.
- ② Loosen the four reticle adjusting screws uniformly with an adjusting pin. Rotate the reticle around the sight line and align the vertical line of the reticle with point A. Tighten the reticle adjusting screws.
- ③ Repeat the inspection and adjustment to see if the adjustment is correct.



Notice: Please check the perpendicularity of line of sight to horizontal axis (c) and the index after the adjustment.

6. Check & Adjustment of Vertical Index Difference (i angle)

(Inspect the item after finishing the inspection and adjustment of section 4 and 5.)

Check

① Set the instrument on a tripod and level it.

② Sight object A in left position and read the Vertical angle value VI. Rotate the telescope. Sight object B in right position and read the Vertical angle value VR.

③ Calculating, $i = (VI + VR - 360^\circ) / 2$

④ If $i \leq 10''$, no adjustment is necessary; If $i > 10''$, please adjust it.

Adjustment

(Please adjust through the software if the differences between the index is too big.)

Operation Procedure	Operation	Display
① Keep to press [F1] to power on until right screen occurs. Loose [F1]	[F1]+ [POWER]	V 0 S. E. T. S. E. T. - 3 0 1
② Rotate telescope and make vertical angle passing 0. Enter into the mode of V ANGLE 0 SET		V 90° 00' 00" S T E P - 1
③ Aim at target (left position). Press [F4] (0 SET)	Aim at target [F4]	V 270° 00' 00" S T E P - 2
④ Aim at target (right position). Press [F4] (0 SET) . Power on automatically.	Aim at target [F4]	
⑤ Finish adjustment Repeat, if not within standard.		

7.Adjustment of Simulator signal

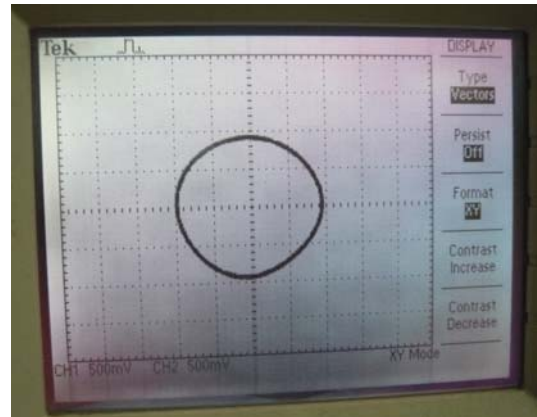
Check

①Set the oscilloscope(shown at right)

CH1 : 500mV

CH2 : 500mV

Center point (X: -2.50V, Y: -2.50V)



②Connect the two probes of the oscilloscope to HJCOS and HJSIN (HYCOS to HYSIN,VJCOS to VJSIN). Its ground wire connects with the theodolite's.

③Turn on,rotate the instrument.Compare the simulator signal with the shown picture :

(a)Unified center

(b)Amplitude:2V (Max change:0.4V)

(c)There won't be any heavy break during the rotating.



Horizontal axis Proximate



Vertical axis

Adjustment

①Potentiometer distribution(look at the following picture)

Left I : Move the signal right-left

Right I : Move the signal up-down

Left II : Adjust the shape of the signal

Right II : Adjust the size of the signal

②Adjust the potentiometer according with the real shape to make the signal meet requirement.



Potentiometer of Vertical axis



Potentiometer of Horizontal axis Proximate



Potentiometer of Horizontal axis Remote

8.Adjustment of Simulator signal at null position

①Set the oscilloscope(shown at right)

CH1 : 500mV (message source)

Frequency: 10ms

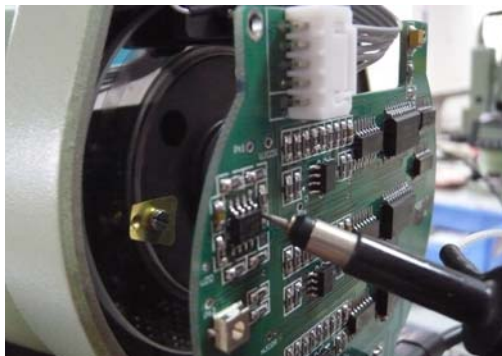
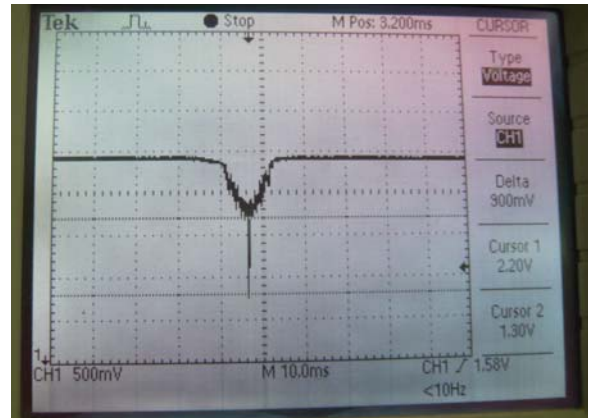
②Connect the probe CH1 (look at the picture below)

Its ground wire connects with the theodolite's.

③Turn on,rotate the instrument.Compare the simulator signal with the shown picture (Pay attention to the position of the cursor)

Increment > 400 mV

④Measure the voltage to earth(A) at REF, adjust the potentiometer to make $A = (\text{cursor 1} + \text{cursor 2}) / 2$



9. Check & Adjustment of the laser confocal and coaxial

※This step was done after finishing the inspection and adjustment of Inclination of Reticle and discrepancy between twice collimation errors(C).

Check

- ①Adjust eyepiece to make the reticle cross line can be clearly seen.
- ②Aim at the front(2m and over) receiving board as a target through the telescope and it should be fixed,then keep focusing until the lines on the receiving board is clearly visible.
- ③Move the tangent and clamp screw to make the reticle center locked on a fixed point of the target board.
- ④Open the up laser,check the laser point on the target,it shows the laser tube is broken when the laser point become duck obviously.The adjustment can be done after changing the laser tube.
- ⑤If you see a faint outer ring is a circle of the diffraction rings while the center point is a bright facula.Check the size of the facula.,confocal adjustment should be done when it can't be seen clearly or more than 2mm/10m.
- ⑥Observe whether the laser spot center and the locking point of the reticle coincides, if the angle that was made of the spot center and lens center connected with the collimation axis is more than 5",then you should do the coaxial adjustment.

Change the laser tube

- ①Using a Phillips screwdriver to remove the 4-solid screw on the adjust frame of the laser tube.
- ②Take away the three screws on the cover of the laser tube by slotted screwdriver.
- ③Separate the entire tube from the telescope and you will see as Picture 1.
- ④Peel the insulation cloth on the board,and move away the whole tube.
- ⑤Change the new tube and take care of the position of the connection.
- ⑥Screw on the tube cover and adjusted frame in turn.



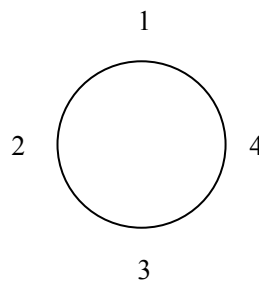
Picture 1

Adjustment

- ① Put a target in front of the theodolite (more than 1.5m).
- ② Adjust eyepiece to make the reticle cross wire can be clearly seen.
- ③ Aim at the target, keep focusing until the lines on the target is clearly visible.
- ④ Turn on the laser, you will see the red spot on the reticle.
- ⑤ Open up the tube cover and you will find 4-screw and the abutment screw (see picture 2).
- ⑥ Release the abutment screw, move the tube socket up and down to make the laser spot smallest.
- ⑦ Fix the abutment screw and finish the adjustment of confocal.
- ⑧ Check the position shift of the spot and the center of the cross line, adjust the 4 screws to make them coincide (Adjust screw 1 and 3 when up and down, adjust screw 2 and 4 while left and right).



Picture 2



Up, tighten screw 1, relax screw 3

Down, tighten screw 3, relax screw 1

Left, tighten screw 4, relax screw 2

Right, tighten screw 2, relax screw 4

10.Adjustment of laser plummet

Check

- ①Place the instrument on the tripod(about 1.5m high) and fixed well.
- ②Turn on the down laser,check the brightness of the laser point.It shows the laser tube burns out when the point becomes duck obviously.Change the laser tube first and then do the adjustment.
- ③Rotate the instrument around the horizontal axis 180° (200g),check the laser point circumvolute or not.If it circumvolutes,but the semidiameter is less than 1mm,there is no need to adjust,or the adjustment should be done.

Change the laser tube

- ①Power off,take away the battery, then release the 5 solid screws on the left side cover and move the side cover away.
- ②Remove the 2 hexagon screws within the drawtube by the hexagonal wrench.
- ③Peel the insulation cloth on the board,unsolder the red green blue wires.
- ④Pull out the laser drawtube.
- ⑤Release the 4 adjusting screws within the needle and take out the laser tube.
- ⑥Replace the new laser tube and fit on the 4 screws,then let the wire pass through the hole and wear a heat-shrinkable tubing to protect it.
- ⑦Inserted the drawtube into the main body and solder the three-color wires,take care of the position of the wire.
- ⑧Turn the laser on,rotate laser drawtube to make the laser shooted out from the center of the horizontal axis.
- ⑨Rotate the instrument,check the laser point whether it rotates or not,spin the tube slightly at the same time,and screw on the two hexagonal screws while the radial value of the laser point is minimum.
- ⑩Adjust the laser plummet to make it in the center position.

Adjustment

- ① Remove the cover of the plummet, you will see four adjusting screws (see picture 3).
- ② Turn the laser on, adjust three leveling screws to make the laser point coincide with the reference point on the ground..
- ③ Rotate the instrument around the horizontal axis 180° (200g) , check the deviation between the two point.
- ④ Release the 4 adjusting screws within the needle:
If up and down deviation, adjust the up and down screws, relax the down one while tighten the up, the laser point will move up, or it will move down.
If left and right deviation, adjust the left and right screws, relax the left one while tighten the right, the laser point will move left, or it will move right.
- ⑤ Actually the offset won't be very heavy, only need to do little adjustment.



Picture 3

Notice: As the laser device used is a turn-point optical path, and the structure is very special, we can't promise that the down laser would be stationary when the instrument at any height. The above checking and adjustment should be taken under the special conditions (just like the tripod is too high or too short).