HI-TARGET

HTS-420R Total Station

User Service Manual

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Manual Revision

HTS-420R Total Station

Revision Date	Revision No.	Description
Mar. 2019	1	HTS-420R Total Station Service Manual

HTS-420R

Total Station

Contents

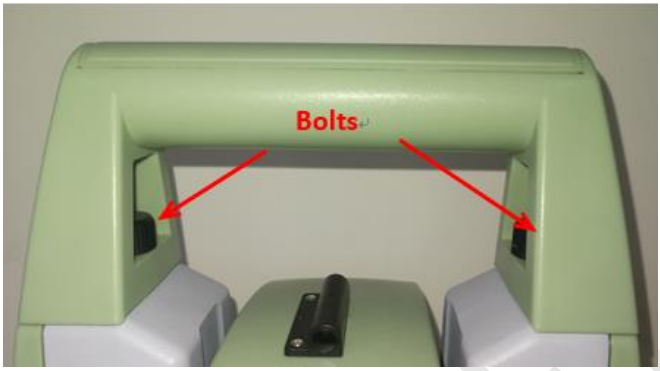
Chapter 1

Disassembly of Main Parts

This Section Describes

- Handle unit
- Display unit (face 2)
- EDM board
- Mainboard
- Electric brush
- EDM module
- Long level vial
- Horizontal tangent screw unit
- Vertical tangent screw unit
- Eyepiece

Handle Unit



1. Unscrew the two bolts with hand then take out the handle unit.

Display Unit (Face 2)

Figure 2-2 display screws

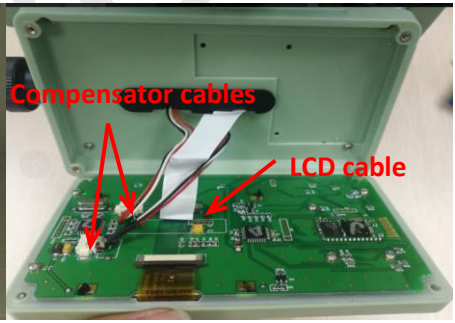


Figure 2-3 display cables

1. Unscrew the 4 screws then open the screen unit and turn it over.
2. Take off both compensator cables and LCD flat cable then take the display unit out.

EDM board

1. Unscrew the 4 screws and remove the top telescope cover. Refer to figure 2-4.
2. Take off all the cables and the 3 screws on the board. Refer to figure 2-5.
3. Turn over the EDM board then unscrew the fixing screw of the optical fiber cable and take the cable out. Refer to figure 2-6.

Figure 2-4 telescope cover screws

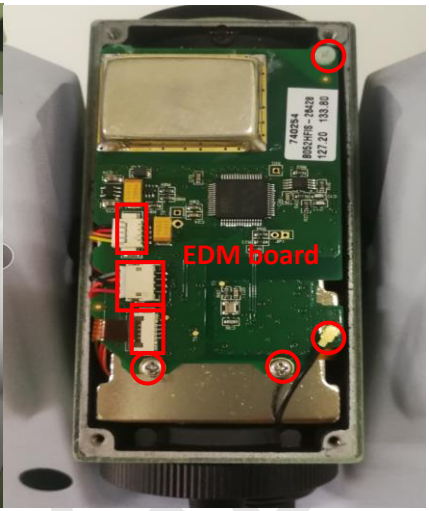


Figure 2-5 EDM board,cables and screws

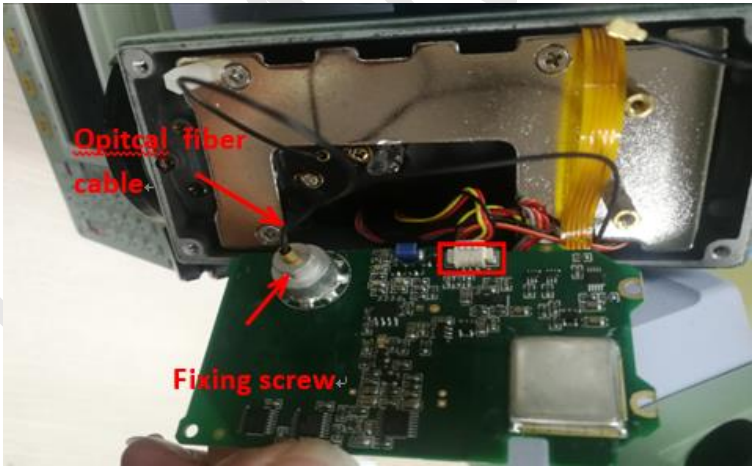


Figure 2-6 optical fiber cable

Mainboard

Figure 2-7 right cover screws

Figure 2-8 main board , cables and screws

1. Unscrew the 6 screws on the right cover and take the cover out.

2. Take off all the cables and unscrew the 4 screws then take the mainboard out.

Electric Brush

Figure 2-9 Mainboard

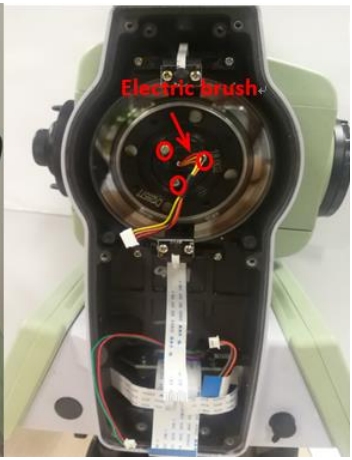


Figure 2-10 electric brush and fixing screws

1. After taking out the mainboard, remove the 3 fixing screws.

2. Take off the connector from the EDM board side then pull the Electric brush out from the mainboard side.

EDM Module

Figure 2-11 telescope cover screws

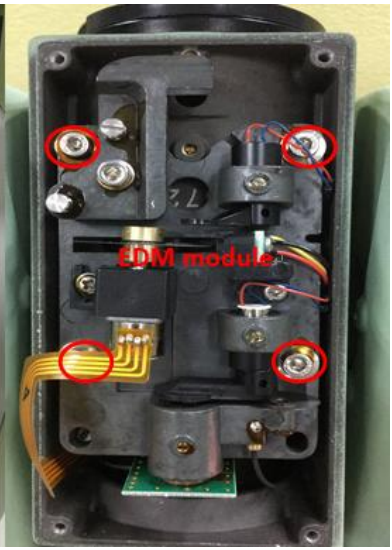


Figure 2-12 EDM module and fixing screws

1. Unscrew the 4 cover screws to take the cover out.

2. Take off all the cables on the EMD board then use the Hex screw driver (3.0mm) to unscrew the 3 fixing screws on the EDM module board and take the whole module unit out.

Long Vial

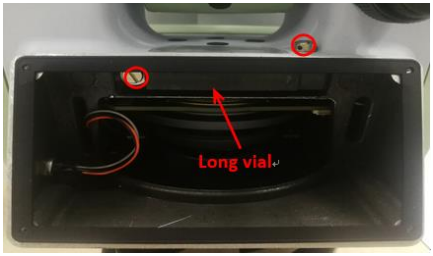


Figure 2-13 long vial and screws

Loosen the 2 screws and take long vial out.

Horizontal Tangent Screw Unit

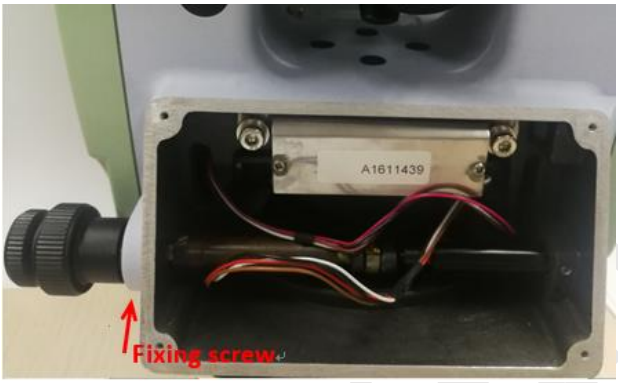


Figure 2-14 fixing screws

Open the display unit (face 2), then unscrew the 2 screws and take the whole tangent screw unit out.

Vertical Tangent Screw Unit

Figure 2-15 fixing screws

After taking out the cover, do the same thing as done for Horizontal tangent screw unit.

Eyepiece

Figure 2-16 eyepiece, protective cover, screws

1. Unscrew and take out the protective cover.
2. Unscrew the 3 screws and take out the eyepiece.

Chapter 2

Common maintenance items

This Section Describes

- List of common maintenance items
- Maintenance operations
- Troubleshooting

List of Common Maintenance Items

1	Long level vial calibration
2	circular level vial calibration
3	Telescope reticle calibration
4	Collimation error calibration(2C calibration)
5	Index error calibration(2I calibration)
6	Compensator mechanical zero position alignment
7	Compensating linearity calibration of compensator
8	Laser plummet alignment
9	EDM laser replacement
10	EDM laser beam alignment
11	filter motor replacement
12	Prism/No Prism mode switch motor
13	light path switch motor replacement

Maintenance Operations

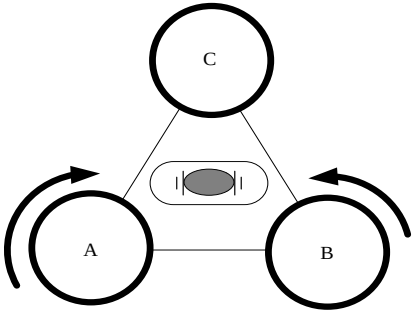
1. Long vial calibration

1) Fix the instrument on a solid and stable platform and set the vial to the position between leveling screw A and B, then continue the steps below.

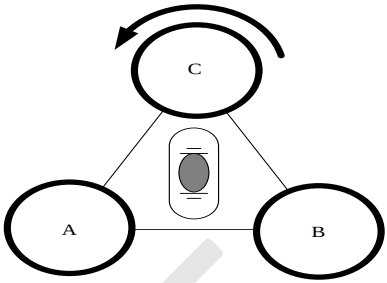
2) Adjust the screw A and B to center the bubble. Turn the instrument horizontally by about 90°and then adjust screw C to center the bubble. Turn the instrument 180°to check if the bubble is still staying in the center. If it is, the vial is aligned, otherwise take the next step.

3) Use the adjusting pin to twist the screw beside the vial to make the bubble move half distance toward the center.

4) Repeat the step 2 and 3 until the bubble is in the center in every direction.



Step 2



Step 3

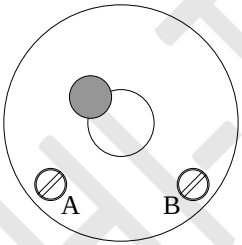
2. Circular vial alignment

1) Fix the instrument on a solid and stable platform. After leveling the instrument, check if the circular level vial is within the center circle. If it isn't, continue the following steps to align it.

2) Loosen or tighten the screw on the opposite side of the bubble to push the bubble to be as close to the center circle as possible.

3) Do the same thing on the other screw.

4) Repeat the steps 1 and 2 until the bubble is within the center circle.



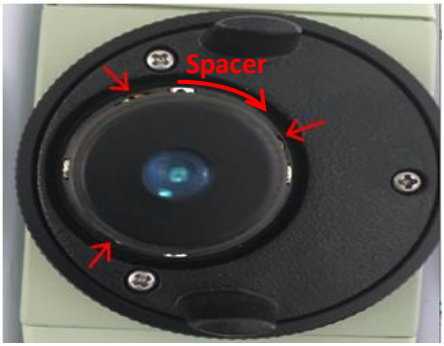
3. Telescope reticle alignment

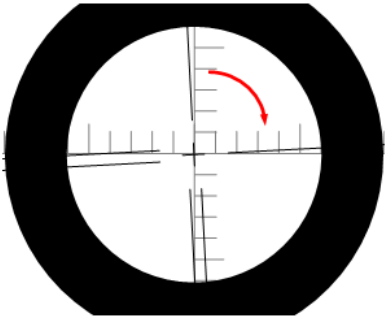
1) Fix the instrument on the solid and stable platform and then level it. Adjust the telescope to connect the top/bottom endpoints of the vertical lines of telescope, target crosshair then check if there is offset between two vertical lines. If there is, continue the following steps to align the reticle.

2) Unscrew and take out the protective cover.

3) Loosen the 3 screws on the spacer slightly and twist the plate to make both crosshairs coincide.

4) Tighten the screws and install the cover.





4. Collimation Error Calibration (2C Calibration)

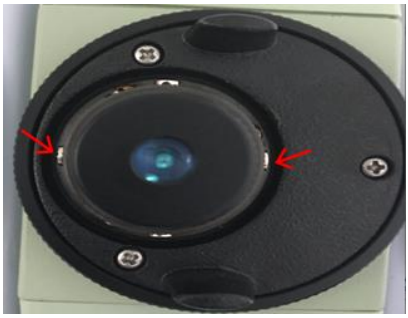
1) Fix the instrument on a solid and stable platform. After leveling it, continue the following steps.

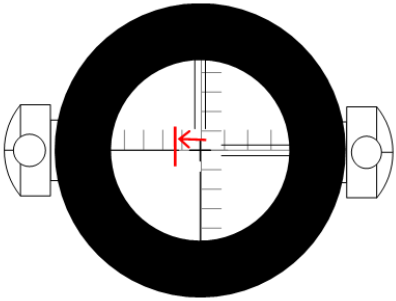
2) Face 1: Aim at target crosshair and make both crosshairs coincide. Set horizontal angle to 00°00’00” (for easier calculation) and turn instrument to the Face 2.

3) Face 2: Do the same thing as done on the Face 1 except setting 0. Note the horizontal angle HR and calculate the 2C: 2C = HR (Face 2) – HR (Face 1) - 180°= HR (Face 2)-00°00’ 00”-180°=HR (Face 2)-180° then check if the 2C is within the qualified range of -16 to 16. If it is not, take the following steps to calibrate the 2C.

4) If 2C<-16, loosen the screw of the right side then tighten the screw on the left side to draw the vertical line of the telescope crosshair toward the left side , in the meantime, observe the movement of the vertical line of the telescope crosshair until the vertical line is in the correct position. E.g. if 2C=179°59’ 10”-180°= -50”, loosen the screw of the right side then tighten the screw of left side to draw the vertical line toward the left side by |-50|”/2=25’’(namely 1.25 grid by 1grid=20’’), as shown in the picture below.

5) If 2C>16, loosen the screw of the left side and tighten the one on the right side. E.g. If 2C=180°00’ 20’’-180°=20”, loosen the screw of the left side then tighten the other one to draw the vertical line toward the right side by 20”/2=10”.(the alignment the is based on face 2)



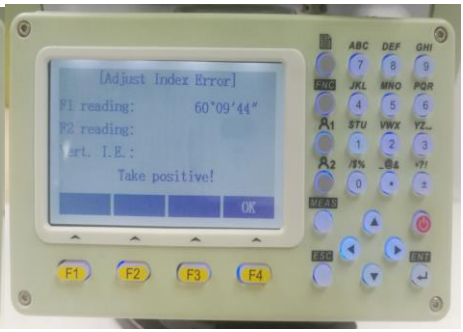


5. Index Error Calibration (2I Calibration)

1) Fix the instrument on a solid and stable platform then level it. In the meantime, make sure the sight line from the eyepiece to the target crosshair is approximately horizontal.

2) Turn the instrument to Face 1, aim at the target crosshair and make both crosshair coincide. Note the HR (Face 1) and turn the instrument to Face 2. Do the same thing as done on Face1 and note HR (Face 2). Calculate the 2I= 360°- HR (Face 2)-HR(Face 1). If the 2I is outside of the qualified range of -16 to 16, take the steps below to calibrate the 2I.

3) Face 1: press the  button to enter the bubble chart interface to turn off the compensator, as shown in the first picture. Choose “Tools”->”Adjust”->”Adjust Index Error”, as shown in the second picture below. Aim at the target crosshair and make both crosshairs coincide then press 【ok】, the screen will display the message “ Take reverse”, then turn the instrument to Face 2.

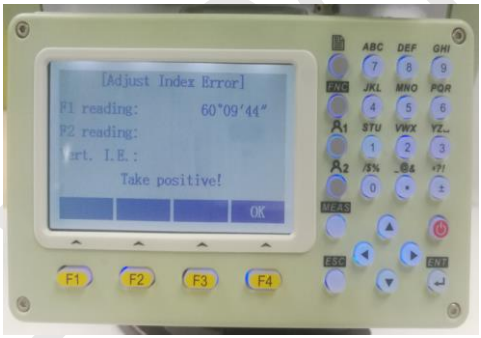


4) Face 2: do the same thing as done on Face 1, and finally press 【Ok】and restart the instrument to save the parameter.

6. Compensator zero position alignment

1) Fix the instrument on a stable and solid platform then level it. Take out the right cover and put in the battery then hang the cover to keep the battery connected.

2) Choose "Tools"->"Adjust"->''Adjust Tilt X". Loosen the right screw according to the offset value (the larger the value is, the looser the screw should be, and sometimes the left screw should also be loosened). Tap the right side of compensator up or down to adjust the value to be as close to 0 as possible. Note the value as A when it gets steady. Turn the instrument horizontally by about 180° and note the value again as B, then calculate the offset =A+B. Check if the sum of A+B is within the qualified range of -30 to 30. If it is not, continue tapping the compensator until the sum of A+B is qualified. Finally, tighten the screw and install the cover. Do the same thing for calibration of Y compensator which is behind the display unit(Face 2).



7. Compensator linearity calibration (calibration by software)

This calibration should be based on qualified compensator zero position, otherwise the calibration may fail. Before linearity calibration, calibrate the Index error first to give this calibration the correct reference data.

X compensator:

1) Place the instrument on a solid and stable platform and set one leveling screw to the target crosshair direction. Fix the instrument and level it, in the meantime, make sure the sight line from the eyepiece to the target crosshair is approximately horizontal, then take the steps below.

2) Turn the instrument to Face 1, choose "Tools"->"Adjust"->''Adjust Tilt X", as shown in the picture below. Aim at the target cross and make both crosshairs coincide, then tighten the clamps. After that, adjust the front leveling screw to tilt the instrument up by 3' (by 1 grid= 20", the horizontal line of the telescope crosshair will go up 9 grids from the target horizontal line in this process).

3) Adjust the tangent screws to make both crosshairs coincide again and then press【Ok】. When the screen display the massage ''F1 down 3'", adjust the leveling screw to tilt the instrument down by 6' from the target horizontal line (the compensator axis is actually tilted down 3' from the horizontal plane).

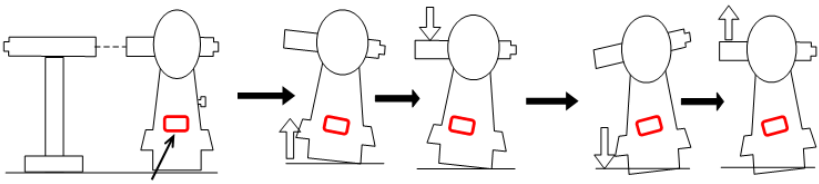
4) Adjust the tangent screw to make both crosshairs coincide again then press 【Ok】. The screen will display message''F2 up 3'".

5) Adjust the leveling screw to Tilt the instrument up 3' (9 grids by 1 grid=20") to level the instrument again and then turn it to Face 2. Do the same thing as done on Face 1. Finally, check if the value of Cok and Coz is respectively within the qualified range of -1< Cok <1 and -30<Coz<30.

6) When both values are qualified, note the electronic bubble offset X(Face 1) and turn 180° to get X(Face 2) then calculate X(Face 1)+X(Face 2). If the result of X (Face 1) + X (Face 2) is within -30 to 30, the calibration is successful, otherwise repeat the calibration.

Y compensator:

Do the same thing as done on X compensator, but every time before pressing 【Ok】, turn the instrument anticlockwise by 90°.



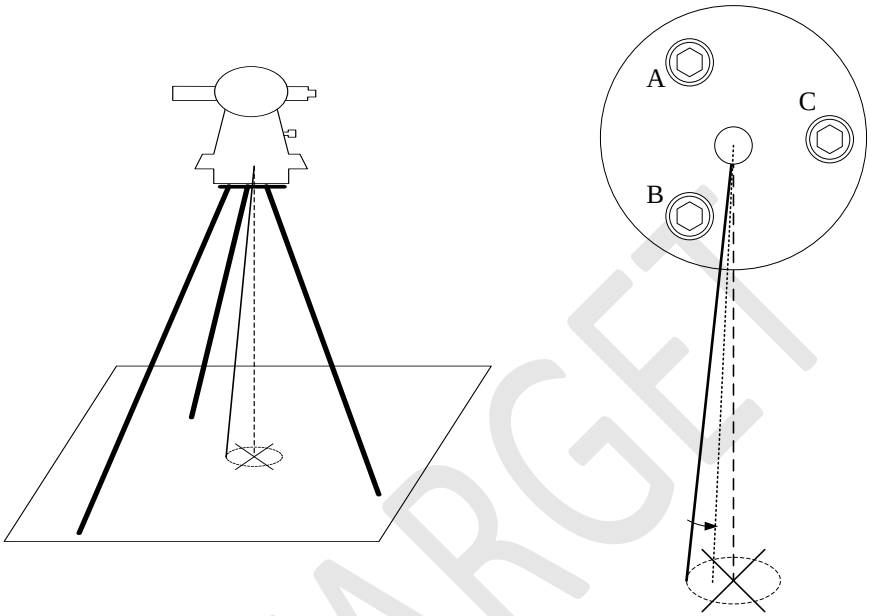
Tilting process of X compensator

8. Laser plummet alignment

1) Remove the plummet cover at the bottom of the pedestal. Set up the tripod and mount the instrument on, and then level it. Turn on the laser and place a paper reticle where the laser spot is. Rotate the instrument and check if the laser spot is drawing circle. If it is, continue the following steps to align the plummet.

2) Place the cross point of the reticle to the center of the laser spot track. Slightly loosen the plummet screw of the laser spot side and tighten the one on the opposite side to push the laser spot as close to the center as possible. Check the offset of the laser spot again, then tighten or loosen the third screw to center the laser spot.

3) Repeat adjusting paper retical and screws until the laser spot is cast right on the center of the cross.



9. EDM laser beam alignment

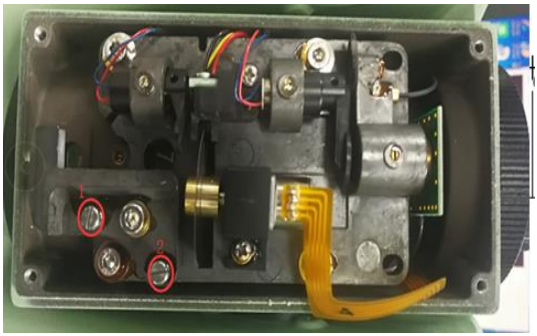
Setup the instrument and set a crosshair over 30 m away from it. Level the instrument and adjust the telescope to make both crosshair coincide. Turn on the EDM laser to check if the laser spot is cast right on the center of target crosshair. If it is not, open the top telescope and continue the following steps to align the laser beam.

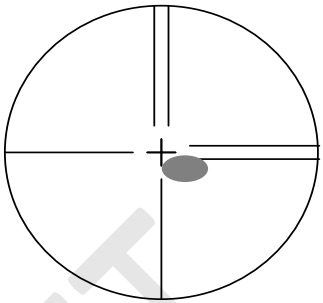
Up - down adjustment:

As shown in the picture below, twist the screw 1 anticlockwise to push the laser spot up, or twist it clockwise to push the laser spot down, until the laser is right on the horizontal line.

Left - right adjustment:

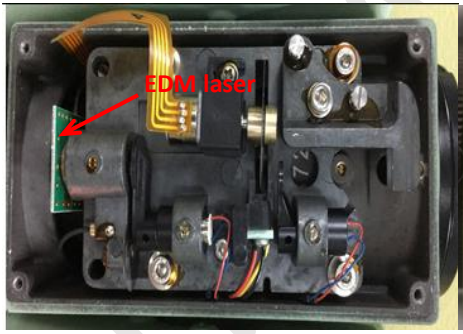
Twist the screw 2 anticlockwise to push the laser spot to the left, or twist it clockwise to push the laser spot to the right, until the laser is spot right in the center.





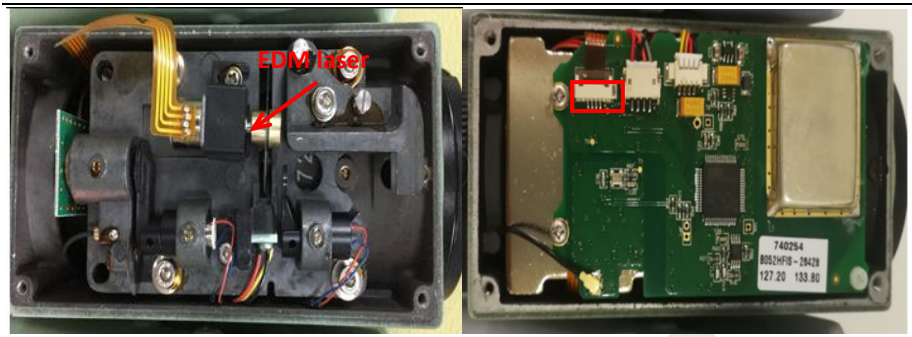
10. EDM Laser Replacement

Remove both top and bottom cover of telescope, and then take off the laser cable from EDM board. Loosen the fixing screws of the laser and take the laser out. Put the brand new laser into the support tube and adjust its front end to be aligned with that of the support tube. Place the laser cable horizontally to the left side then tighten the fixing screws. Finally, connect the laser cable to the EDM board and install the covers.



11. Filter Motor Replacement

Take off the motor cable from the EDM board and unscrew the fixing screw, as shown in the pictures below, then take the motor out. Set the new motor to be in place and tighten the screw (make sure the filter has no contact with the edge of the gap). Finally, connect the motor cable.

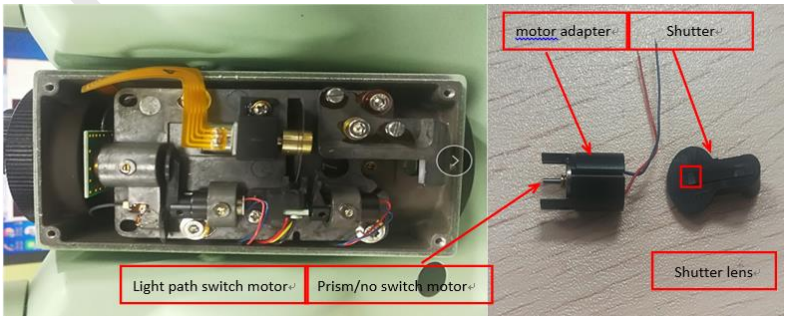


12. Prism/No Prism Switch Motor Replacement

Unscrew the screws and remove the covers of the telescope. Pry the light out with tweezes, as shown in the picture. Put some alcohol on the screws to melt down the glue and loosen them with the screwdriver then pull the motor out. Cut the wires of the motor off and put the heat -shrink-tube on either of them, then connect wires with the ones of the new motor. Solder the junction firmly and heat the heat-shrink-tube to bind the junction tightly. Put the motor in the adapter and install them all together to the motor holder. Turn on the instrument and switch the work mode between No-prism and prism. During the switch, the light shutter will jump up and down correspondingly if the motor is working properly. Turn on the EDM laser and check if the shutter lens is right in the center of the laser spot when the light shutter is down. If it is not, put the adjusting pin into the hole of the motor adapter and twist the adapter up or down to push the lens of the light shutter in the center of the laser spot. Finally, tighten the screw thoroughly.

13. Light Path Switch Motor Replacement

Replace the light path switch motor in the way of Prism/No Prism-mode-switch motor replacement. Start measuring to switch the shutter up and down, then check the shutter to make sure it does not block the laser when it is up, and the edge of shutter head goes into the groove on the base board when it is down.



Chapter 3

Troubleshooting

This Section Describes

- List of common maintenance items
- Maintenance operations
- Troubleshooting

Fault Analysis

Outline of Fault descriptions	Fault detail	Fault location
Fail to turn on	No response when power button is pressed down	1. Power supply failure 2. Program damage 3. power key disconnected 4. Screen disconnected 5. Mainboard failure
Automatic shutdown after startup	After startup, it automatically power off	1. Low battery 2. Parameters missing 3. Shortcircuit in EDM board 4. Mainboard failure
Program crash	When starting up, it hangs at the boot screen	1. Parameters missing
Tilt over	It shows “tilt over ” even the instrument is level	1. Broken compensator 2. Compensator mechanical zero position out of qualified range 3. Incorrect compensator 4. linearity calibration
Blank screen, black screen or buttons don’t work	Normally occurs only on one of both screen unit and the other one is working normally	1. Broken LCD 2. The other LCD disconnected
Fail to communicate with PC	Cannot read any data from PC with USB cable connected to the instrument	1. Broken RS232-USB cable 2. The cable between sockets 3. and mainboard in bad contact 4. Broken mainboard
Angle value hopping	The angle value keep changing by over 1°	If there is CCD waveform detected by software: 1. Stained code circle 2. Stained CCD If no CCD waveform detected by software:

		1. CCD disconnected or broken 2. Broken LED 3. Mainboard failure
Don't measure distance at all	Return no distance value regardless of however long distance it is measuring	1. Broken EDM laser 2. Broken EDM board 3. Laser getting blocked by shutter of the prism/no prism 4. switch motor
Only measure short distance	Return value only when measuring a short distance	1. Filter motor getting stuck 2. Weak laser
Inaccurate slope distance result	Return inaccurate slope distance value when measuring	1. Incorrect Add constant setting 2. Incorrect multi constant setting 3. EDM board malfunction 4. Laser getting blocked by light-path-switch motor
Inaccurate slope distance result but inaccurate horizontal distance result	Return accurate slope value but inaccurate horizontal value when measuring	1. Unqualified Index error 2. Stained code circle 3. Unqualified compensator error 4. Unstable tribrach 5. Hard light interference 6. Unqualified Laser beam offset

Fault Clearance

Take steps in sequence. If one step doesn't solve the problem, take the next one.

1. Fail to turn on

(1) Check if battery has low power. If it does, replace the battery

(2) Check if battery cable is connected well

(3) Replace the screen unit and the cable then check again

(4) Replace the mainboard

2. Automatic shutdown after turning on

(1) Check if battery has low power. If it does, replace the battery

(2) Replace the mainboard if the check if it is faulty

(3) Replace the EDM board to check if it is faulty

3. Program crash

(1) Check if the firmware version is correct. If it is not, upgrade with the correct version

(2) Restore the parameter and check again

(3) Replace the mainboard to confirm if it is a hardware fault

4. Tilt over even when the instrument is level

(1) Check the mechanical zero position.

(2) If the value is within the acceptable range of -30 to 30, Calibrate compensating linearity

(3) If the value is within -200 to -30 or 30 to 200, calibrate the mechanical zero position then calibrate the compensating linearity.

(5)If the value is outside of -200 to 200, replace the compensator then calibrate the the mechanical zero position and compensating linearity.

5. Blank screen, black screen or buttons don't work

(1) Check if the screen cable is connected well

(2) Replace the LCD and check again

6. Fail to communicate with PC

(1) Replace the RS232-USB cable to check if it is faulty

(2) Check if the cable between the socket and mainboard is connected well

(3) Replace the mainboard to check if it is faulty

7. Don't measure distance at all

(1) Check if the laser is emitting light. If it is not, replace the laser and check again

(2) Check if there is any light shutter blocking the laser. If yes, adjust the shutter or replace the motor and check again

(3) Replace the EDM board to check if it is faulty

8. Only measure short distance

(1) Check if the filter motor is working smoothly. If it is not, replace the motor

(2) Replace the laser and test again to find out if the laser is weak

9. Inaccurate slope distance result

(1) Reset the Add constant

(2) Reset the Mul constant

(3) Check if the laser is blocked by light shutter of motors

10. Accurate slope distance result but inaccurate horizontal distance result

(1) Calibrate the Index error correctly

(2) Clean the code disc

(3) Calibrate the compensator

(4) Align the laser beam

(5) Replace the tribrach to check if it is faulty