# laser Plummet
# manual

# Foreword

Dear user:

Thank you for purchasing and using ou laser Plummet.

Th Laser Plummet is a precision instrument that uses the principle of optical collimation to measure plumb lines. In order to let you master all the functions and performance of this instrument so that it can be used freely in the operation and avoid malfunction, we recommend that you read this user manual carefully before using the instrument.

▲ This instrument is a class II laser product, pay attention to laser protection. Do not look directly at the laser beam or illuminate others when the laser is turned on. Although there is color filter protection, you need to turn down the brightness and do not watch for a long time.

# Contents

1. The instrument characteristics
2 .The basic parameters of the instrument
3 . **The Nomenclature of parts**
4 . How to use
5 . Battery replacement
6 . Instrument inspection and correction
7 . Instrument maintenance and precautions
8 . Instrument common errors and troubleshooting methods

# 1. The instrument characteristics

## 1.1. The characteristics of the instrument

According to the optical collimation principle, the instrument uses a semiconductor laser to generate a visible laser beam that coincides with the telescope's collimation axis, which can be directly observed by the human eye.

The instrument adopts an integrated fuselage and its performance is stable and reliable.

The instrument uses a semiconductor laser, which has the advantages of small size, light weight, vibration resistance and long life. The laser has characteristics such as high brightness and good monochromaticity. The laser optical axis of the instrument laser system is strictly concentric, co-focusing, and coaxial with the telescope's visual axis. Therefore, when the telescope sights the target, a visible red spot can be generated at the target.

The lower-point laser spot does not need to be adjusted, which improves the measurement accuracy.

The instrument is equipped with a square laser target, which is more convenient for users.

The instrument comes with a filter that can be viewed by the human eye when the laser is turned on.

The instrument is equipped with a dial to make measurement and calibration more accurate.

The instrument uses two No. 5 alkaline batteries, and two new batteries can be used continuously for 8 to 10 hours.

## 1.2. The main purpose of the instrument

The instrument is used to measure small horizontal deviations from the plumb line, point transfer of the plumb line, measurement of the vertical contour of the object, and vertical transmission of the azimuth.

The instrument is widely used in high-rise building construction, high towers, chimneys, elevators, construction and installation of large-scale mechanical equipment, engineering supervision and deformation observation.

## 2. The basic parameters of the instrument

**2.1. The standard deviation of the vertical measurement:** 1/45000

**2.2. Plate level :** 20″/2mm

**2.3. Telescope:**

| | |
|---|---|
| Effective aperture | 30mm |
| magnification | 25 times |
| Field of view | 1°30' |
| Shortest line of sight | 1m |
| Imaging | Just like |

**2.4. Laser point device**

| | |
|---|---|
| wavelength | 650nm |
| Optical power | 1mW |
| Point accuracy | 1mm |
| Spot diameter | 2mm |

**2.5. Vertical laser**

| | |
|---|---|
| wavelength | 635mm |
| Laser level | level 2 |

**2.6. Power: 3V**

**2.7. Vertical laser effective range**

| | |
|---|---|
| daytime | ≥120m |
| nighttime | ≥300m |

**2.8. Vertical laser spot size**

| | |
|---|---|
| Spot diameter at 40m | ≤2 mm |
| Spot diameter at 100m | ≤5mm |

**2.9. Alignment axis and vertical axis coaxial error:** ≤ 5”

**2.10. Coaxial error between laser optical axis and collimation axis :** ≤5”

**2.11. The laser optical axis is the same as the collimation axis:** ≤1 diopter

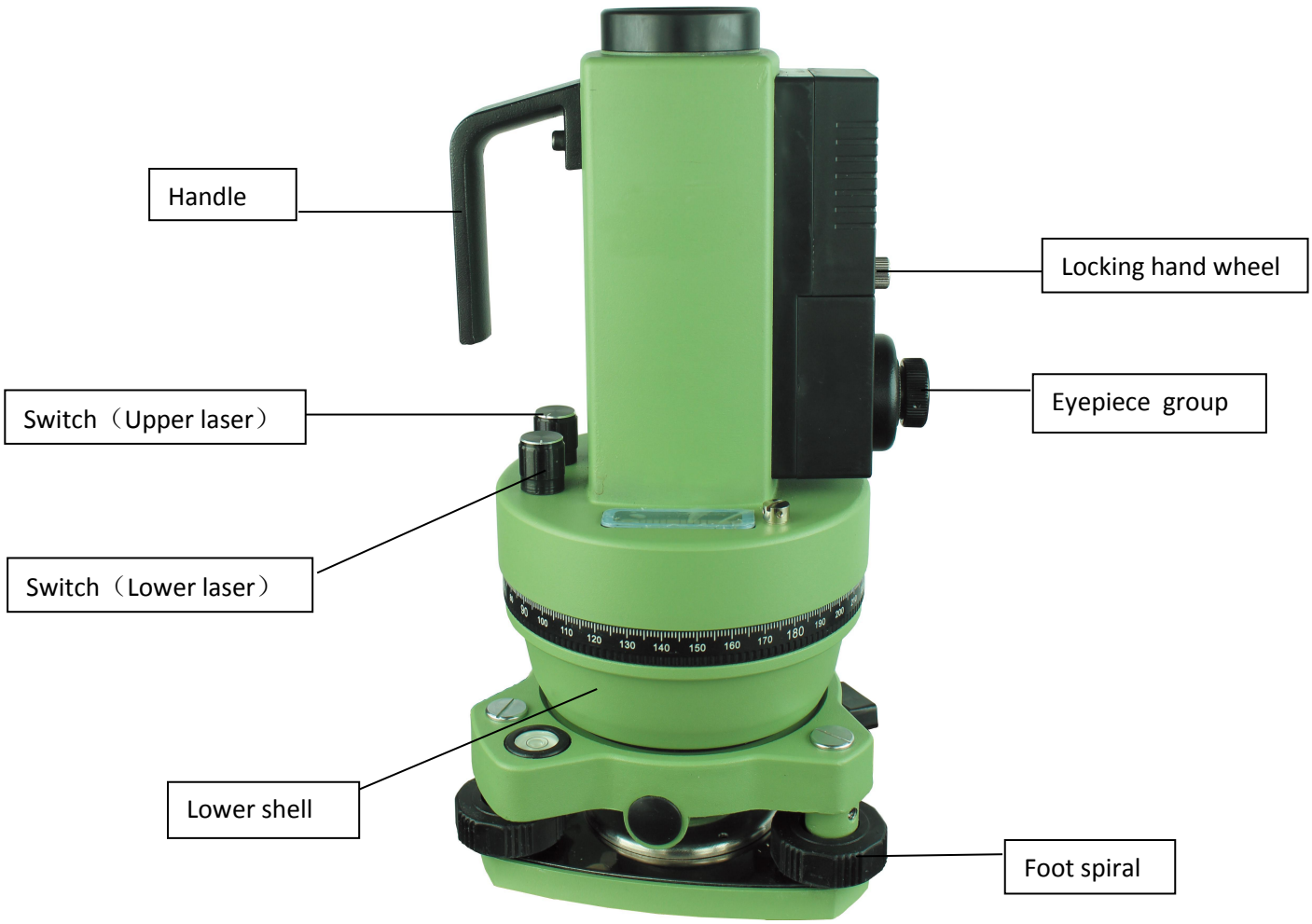
**2.12. Dial:** full 360°, minimum reading 1°

**2.13. Instrument operating temperature range:** -20 ° C ~ +50 ° C

**2.14. Instrument weight:** 2.9kg

**2.15. Instrument volume:** 130x140x250mm3

## 3. The Nomenclature of parts


Handle
Locking hand wheel
Switch（Upper laser）
Eyepiece group
Switch（Lower laser）
Lower shell
Foot spiral


Objective cover
Battery compartment cover
Focusing hand wheel
Plate level
Calibration screw
Dial
Circular level
Pedestal

# 4.How to use

### 4.1. Placement and leveling of the instrument

1. Select the appropriate height to support the tripod, so that the measuring station is located directly below the center hole of the tripod, and the centering screw is firmly connected with the tripod.

2. Use a tripod to level the instrument and place it firmly on the ground. Rotate the foot screw ABC to center the bubble (see Figure 1), while rotating A, B, the handwheel blisters move to the right. Rotate the C handwheel and the blisters move down.

3. Long leveling instrument accurately leveling the instrument, using the rotation of the foot screw B, C, so that the bubbles of the long blisters parallel to the B, C line are centered (see Figure 2).

Rotate the instrument 90°, then turn the foot screw A to center the bubble. Repeat the above steps for every 90° rotation of the instrument and check that the bubbles at all of these points are properly centered.

4. Centering. Turn on the lower point laser switch, adjust the tripod to center the round bubble bubble; accurately level the instrument until the instrument rotates to any position, the maximum deviation of the bubble does not exceed 1/4 grid.

Turn the instrument sighting part 180° to check the alignment. If there is any deviation, loosen the center screw.

Rotate and translate the entire instrument on the head until the laser point is accurately centered with the station.

Turn the sighting part to confirm that the instrument rotates to any position, and the long level bubble is centered. If there is any deviation, repeat the above steps to confirm that the centering and leveling are completed, the laser can be turned off to save power.

### 4.2. Sighting

Place a grid laser target at the target, rotate the telescope eyepiece to make the reticle crosshair clear, turn the focus handwheel to make the laser target clear on the reticle; accurate measurement needs to eliminate parallax, that is, when the observer slightly moves the line of sight There should be no significant offset between the crosshairs and the target. Otherwise, continue the above steps until there is no parallax.

### 4.3. Upright

1. Optical alignment

After the instrument is calibrated and leveled, the coaxial axis and the vertical axis have a coaxial error of ≤5″, which can be used as a vertical line. One observation can ensure the accuracy of the vertical alignment. As the accuracy of the vertical accuracy, the instrument sighting unit should be rotated by 180°. The second observation is obtained by the telescope, and the number (midpoint) is taken as the measured value.

2. Laser alignment

When the vertical laser switch is turned on, a laser beam is emitted from the telescope objective lens and focused on the laser target. The reading at the center of the laser spot is the observed value. It is also recommended that the user improve the accuracy of the vertical reading by rotating the sighting section.

### 4.4. Measuring the contour of the object in the vertical direction

Place the instrument on a tripod near the object to be measured, and accurately level the long blisters.

1.Optical method

a. Rotate the telescope eyepiece to the crosshair that clearly sees the reticle.

b. One end of the laser target is pressed against the object to be tested, and the focus wheel is rotated to make the laser target clearly imaged on the crosshair of the reticle. At this time, the eye

moves up, down, left, and right, and the laser target is no relative displacement between the image and the crosshair. After the focus is adjusted, the reading of the laser target is read and recorded by the telescope.
c. Move the laser targets upward at a certain vertical interval and measure them separately according to (b), so that the actual contour of the measured object in the vertical direction can be measured.

2. Laser method

a. Rotate the telescope eyepiece to the crosshair that clearly sees the reticle.
b. Hold one end of the laser target against the object to be tested, rotate the focusing hand wheel to minimize the laser spot on the laser target, and directly read and record the reading at the center of the laser spot on the laser target.
c. Move the laser target upwards at a certain vertical interval and measure separately according to the method of b, so that the actual contour of the measured object in the vertical direction can be measured.

**4.5. Vertical transmission of azimuth (vertical direction)**

In engineering or mine surveys,
The reference edge of the known azimuth is transmitted to the underground tunnel
Or mine, the laser can be used to complete the orientation
Vertical transfer (vertical direction).
As shown in Figure 3, the line AB is a known
Azimuth side, this position can be taken by laser alignment
Passed underground.

1. Place the laser target on the end point A of the known orientation edge AB .

2. Set up a tripod under the laser target and place the instrument. Rotate the instrument foot screw to center the long level bubble and rotate the telescopic eyepiece to clearly see the crosshair of the reticle.

3. Rotate the focusing handwheel to see the laser target and shift the instrument so that the center of the laser target coincides with the center of the crosshair of the reticle. At this time, the bubble of the long level of the instrument should be centered, otherwise it should be further leveled and centered. Operation until the long level bubble is centered and the center of the laser target coincides with the center of the crosshair of the reticle.

4. Determine the subsurface point C plummet with a laser instrument.

5. In the other end of the line B AB laser target placed according to the above method may determine another subsurface point D. The CD edge is the reference orientation equal to the AB side azimuth.

# 5.Battery replacement

The instrument uses two alkaline batteries, and two new alkaline batteries can be used continuously for 8 to 10 hours. When the laser brightness drops significantly, the battery should be replaced.

Loosen the battery lock handwheel, pull out the battery cover in the direction of the objective lens, remove the battery from the battery case and replace it with a new one. Pay attention to the positive and negative terminals of the battery, then cover the battery cover and tighten the battery lock handwheel.

# 6 . Instrument inspection and correction

The instrument is strictly calibrated at the factory, but after the instrument has been transported and used for a period of time, the instrument should be inspected and calibrated. In order to prevent the latter correction from damaging the previous calibration, the instrument inspection and calibration should be performed in the following order.

**6.1．Inspection and correction of long level**

Place the instrument on a tripod or calibration table so that the long level is parallel to the spiral connection of any two legs. Rotate the two foot spirals in the opposite direction to center the long level bubble, rotate the instrument sight 90 °, rotate the third Spiral of the foot, centering the bubble of the long level, and then rotating 180 ° according to the above procedure, until the blisters do not shift with the rotation of the instrument. At this time, if the bubble is more than half a square away from the center position, correction is needed. Use the foot screw and the long level to correct the half of the deviation of the air bubbles. Repeat the above steps for inspection and calibration until the instrument is turned to any position to ensure that the long level bubble is centered.

**6.2．Inspection and correction of circular level**

When the long level is centered, check if the circular level is centered. If it is not centered, adjust the calibration screw of the circular level to center the bubble.

**6.3．Inspection and correction of the coincidence of the telescope's collimation axis with the vertical axis**

1. Inspection

Place a squared paper with a crosshair at the top of the instrument 40m (the higher the height, the more accurate the inspection and correction), so that the instrument accurately aligns the crosshair of the checkered paper, the instrument rotates 180 °, if the crosshair of the checkered paper If the offset of the crosshairs with the telescope exceeds 1 mm (ie, the ratio of the deviation value to the distance is greater than 1 mm/40 m ), correction is required.

2. Correction

Open the reticle cover and use the four adjustment screws, left, right, up, and down, to correct half of the deviation.

According to the above steps, the inspection and correction are repeated until the instrument is turned to any position. The image of the crosshair of the checkered paper is not more than 1mm away from the crosshair of the telescope reticle . After the calibration is completed, the cover is cleaned.

**6.4．Inspection and correction of laser pointers**

1. Inspection

Turn on the laser pointer switch to align the laser spot to a clear ground point. Rotate the instrument 180 ° around the vertical axis to observe the laser point. If the ground point is still at the laser point, no calibration is required. Otherwise, follow the steps below to correct it.

2. Correction

a．Remove the lower case, place the instrument on the tooling (optional), place it on a tripod, draw a crosshair on the white paper and place it on the floor directly below the instrument.

b．Turn on the laser pointer switch, illuminate the laser pointer, rotate the instrument so that the two threaded holes on the back of the vertical axis face themselves, record the drop point A on the white paper , and turn the instrument in turn. 90 °, record the drop point BCD separately .

Connecting the intersection point of the diagonal AC and BD, provided with two straight lines straight lines O.

Figure:

Two threaded holes (1) Turn the instrument when point A is on its own, placement at the point A is assumed at this time, the n-tight top wire their two following holes to (orabove 180 °)

is Make the drop point coincide with the connecting line of the BD (if at point C , correct the top wire of the upper surface of itself or 180 ° corresponding thereto).

( 2 ) When the landing point coincides with the BD connecting line, if it is on the OB , the lower top wire (or the upper top wire in the right two holes) in the left two holes is made to make the falling point reach the O point. (If the drop point is on the OD , the lower top wire in the upper or right side of the two holes in the left side).

( 3 ) Install the upper and lower shells.

**6.5 . Inspection and correction of the laser optical axis and the telescope's collimation axis**

1. Inspection

a . Place the instrument horizontally, place a grid of cross-cut paper at 50m from the instrument , turn on the laser switch, and fine-tune the handwheel to minimize the laser spot.

b . Rotate the telescope eyepiece to clearly see the reticle crosshair. Since the laser optical axis is the same as the telescope's collimation axis, you should be able to see the checkered paper crosshairs. The eye is made up, down, left and right relative to the eyepiece. Moving, the image of the checkered paper and the crosshair should have no relative displacement, that is, no parallax. If the parallax is greater than 1 diopter (approximately 20 ° eyepiece rotation angle), it should be corrected.

2. Correction

Rotate the telescopic eyepiece to the crosshair that clearly sees the reticle, rotate the focusing handwheel, and make the squared paper clearly imaged on the reticle. At this time, the eye moves up, down, left, and right, and the squared paper There is no relative displacement between the image and the crosshair, ie no parallax. Turn on the laser switch, illuminate the laser, unscrew the reticle cover, unscrew the locking handwheel on the battery cover, remove the eyepiece cover, increase or decrease the coke adjustment pad, and make the laser spot on the graph paper The smallest. Repeat the test and calibration until it meets the requirements. Finally, tighten the set screws.

**6.6 . Inspection and correction of the coaxiality of the laser optical axis and the telescope's collimation axis**

1. Inspection

Place the instrument horizontally, place a squared paper with a crosshair at 40m from the instrument , and rotate the telescopic eyepiece to the crosshair that clearly sees the reticle. Rotate the focus wheel to see the checkered paper, move the checkered paper, make the center of the crosshair on the graph paper coincide with the center of the crosshair of the reticle, press the laser switch, then the center of the laser spot on the checkered paper should be Offset with the center of the crosshair of the checkered paper

The deviation is not more than 1mm , otherwise it should be corrected.

2. Correction

Adjust the front, rear, left and right four coaxial adjustment screws so that the center of the laser spot is exactly coincident with the center of the crosshair of the graph paper. Finally, install the battery compartment cover, cover the reticle cover, install the battery cover and screw the locking handwheel on the battery cover.

It should be noted that due to the user's conditions, the inspection and correction of items 3 , 4 , 5 and 6 above is preferably carried out by the conditional repair department or manufacturer.

## 7. Instrument maintenance and precautions

7.1 . The ambient temperature of the instrument is -20 °C ~ +50 °C. Do not use the instrument when the temperature exceeds this temperature. The instrument should be carefully checked before use.

7.2 . The instrument should avoid strong impact and vibration. When handling it for short distances, it should be handled gently. When transporting or transporting for long distances, the instrument should be installed in the instrument box.

7.3 . The surface of the instrument lens should be kept clean. If there is dirt, use lens paper or a mixture of alcohol and ether to wipe it clean.

7.4 . When turning on the laser, do not point your eyes straight at the laser objective to avoid damaging your eyes.

7.5 . The semiconductor laser tube used in the instrument, do not remove the laser tube without authorization.

7.6 . The instrument uses an alkaline battery. When the brightness of the laser is significantly dimmed, the battery should be replaced. When replacing the battery, pay attention to the positive and negative terminals of the battery. Remove the battery when you are not using the instrument for a long time to prevent the battery from leaking and damaging the battery case.

7.7 . When the instrument is damaged, it should be repaired by the manufacturer or a qualified repair department. Do not disassemble it by yourself.

## 8 .Instrument common errors and troubleshooting methods

| Description | the reason | Method of exclusion |
|---|---|---|
| 1, the laser tube is not bright enough | a. The battery is not enough | a. Replace the battery |
| | b. Laser tube or other device damage | b. Find a factory to repair |
| 2, the laser spot is large | a. Focus is not allowed | a. refocusing |
| | b. The laser optical axis is different from the collimation axis | b. According to Article 5 of 5 Line inspection |
| 3, long level bubble no Method adjusted to center | The long horizontal axis is not perpendicular to the vertical axis | According to Article 6 Check out |
| 4, the laser when the instrument rotates Light shift (circle) | The laser optical axis is different from the collimation axis | According to Article 6-6 Check out |