Electronic Self-leveling Rotary Laser

TRL15x Series

OPERATING MANUAL

Thank you for your choice of the Electronic Self-leveling Rotary Laser TRL15x. This series of production use the high protection with rubber coating.We suggest you read this operating manual carefully before using the instrument. You can keep this manual for the future use. This series of products are aim at different customer requirements and these products were designed for different functional aggregations.

This is a Class 2 or Class 3a laser tool and is manufactured to comply with CFR21, parts 1040.10 and 1040.11 as well as international safety rule IEC285.

This operating manual is an introduction about the electronic self-leveling rotary laser TRL13X and its accessories. It shows the essential operating instructions and the general methods of checking and calibration. It also includes relevant safety information and warning messages. Please read it carefully and comply with all warnings and cautions, in order to ensure the correct usage of this instrument.

⚠ **Warning: Please read the Safety Instructions carefully before use. If ignoring the instructions, you may cause some mistakes, even property loss or personal injury.**

※“Personal injury” includes cuts, burns, electric shocks and some other situations that do not need remedy in hospital or long-term medical observation. “Property loss” includes damage of tools, facilities, building constructions, and failure of measurement data, etc.

CONTENTS

1. Kit Contents

■ The mainframe

■ The accessories

LS6 Detector

(with 6R61 battery)

Target

Receiver holder

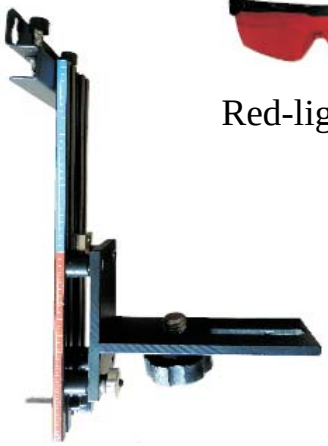
Infrared remote

controller TRC02

(with 2*LR03 battery)

Red-light glasses

12V/2A power adapter



L-shape bracket

Carrying case AX02

2. Safety Instructions

Please pay attention to the warning sign ⚠ and the warning sentences. Warnings indicate that the situation or operation might cause danger to the user, damage the instrument or significant errors during the construction work.

■ WARNING

⚠ Do not stare at the laser beam in operation. Exposure to a laser beam for a long time is hazardous to your eyes.

⚠ Do not dismantle the instrument. Send it to your dealer or an authorized repair shop for service. Dismantle it by yourself will worsen the trouble.

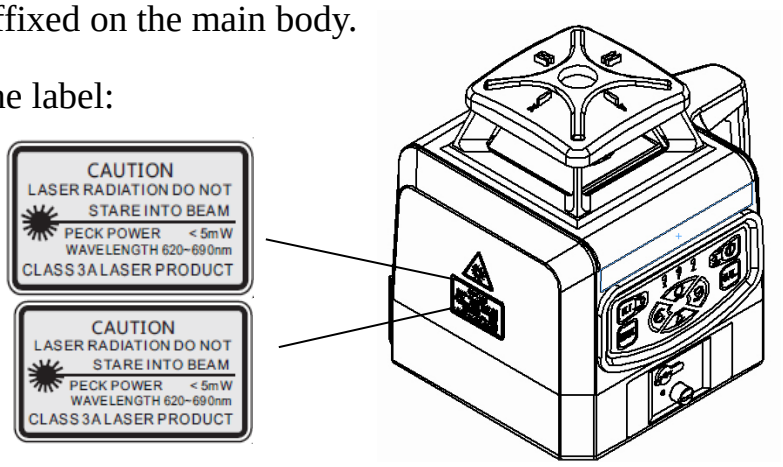
■ NOTICE

The instrument should be transported or carried carefully to avoid impaction or vibration. The instrument should be stored in the carrying case after use.

If the instrument has been stored for a long time without use or it has suffered an impaction or vibration, please check the instrument that whether there is any trouble exists before use. If any trouble exists, please adjust or repair it as soon as possible.

This product conforms to the provisions of **21 CFR 1040.10** and **1040.11**, concerning class Ⅱ and class Ⅲa laser product. The label "**CAUTION: LASER RADIATION, DO NOT STARE INTO BEAM**" is affixed on the main body.

Shape and location of the label:

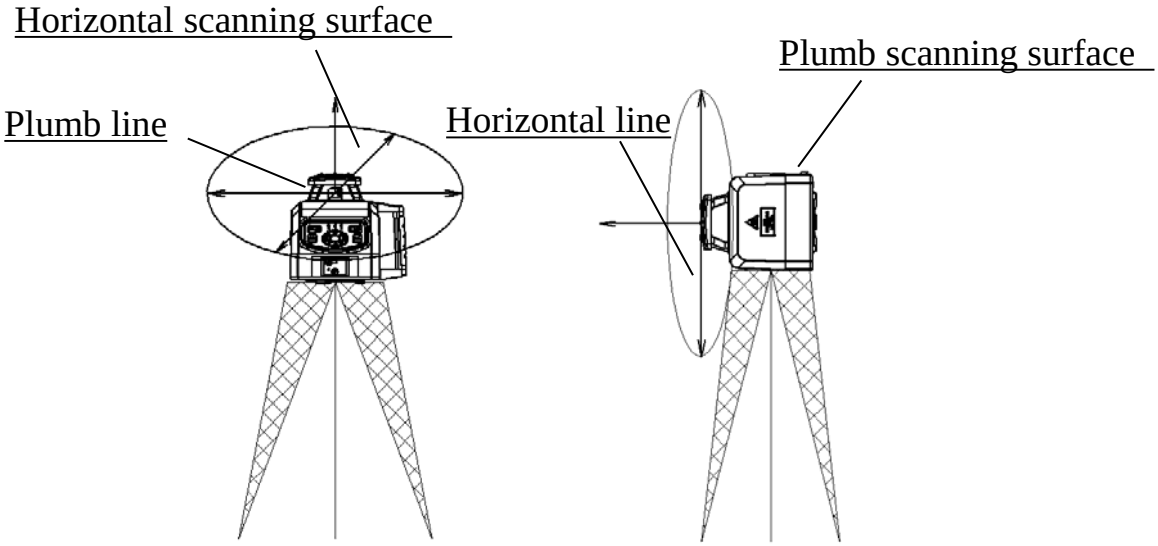


To use this product safely, avoid the operation, maintenance or adjustment which is not described in the operation manual. It may result in danger or unnecessary loss. Please send the instrument to your supplier or the authorized repair shop.

3. Main Functions

■ Self-level / Auto-recognize the working direction

As the picture shown, the instrument can provide two kinds of working directions: when it is set upright, it will emit laser beam to form a horizontal scanning surface and a plumb line; when set horizontally, it will form a plumb scanning surface and a horizontal line. After power on, the instrument will automatically recognize the placement direction as the working direction, and begin to self-level. The laser module will rotate and emit light after auto-leveling.

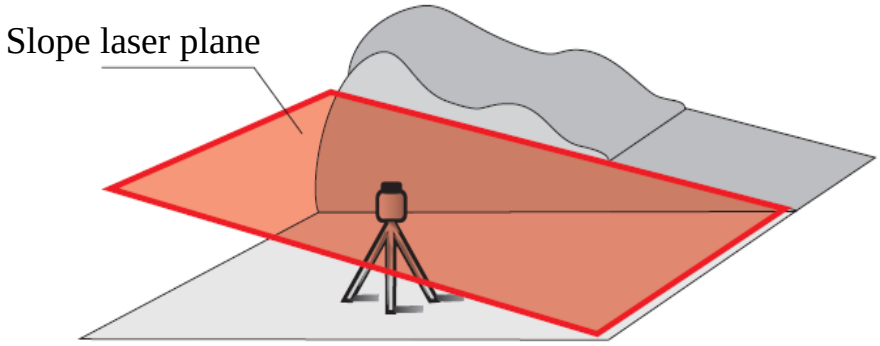


If the instrument is placed improperly or the slope of instrument over the range from -5°to +5°, the instrument will give an audible alarm. More details can be found in "**Error Alarms**".

When the working direction needs to be changed in operation, please turn off the instrument first, then adjust the direction. If the placement direction is changed in operation, the instrument will cause an audible alarm and close down automatically after 5 seconds. Further details can be found in "**Error Alarms**"of this chapter.

■ Slope functions

Some models of the products in the direction of X,Y, can formed the slope of the maximum +10% such as the application example:



The method of settings in details can be found in the ⊿key of **4 panels and indicator.**

■ User Calibration

This product provides the user calibration function and the service with high accuracy. The horizontal accuracy and vertical accuracy can be calibrated by operating the panel. Further details are in "**9. Maintenance**".

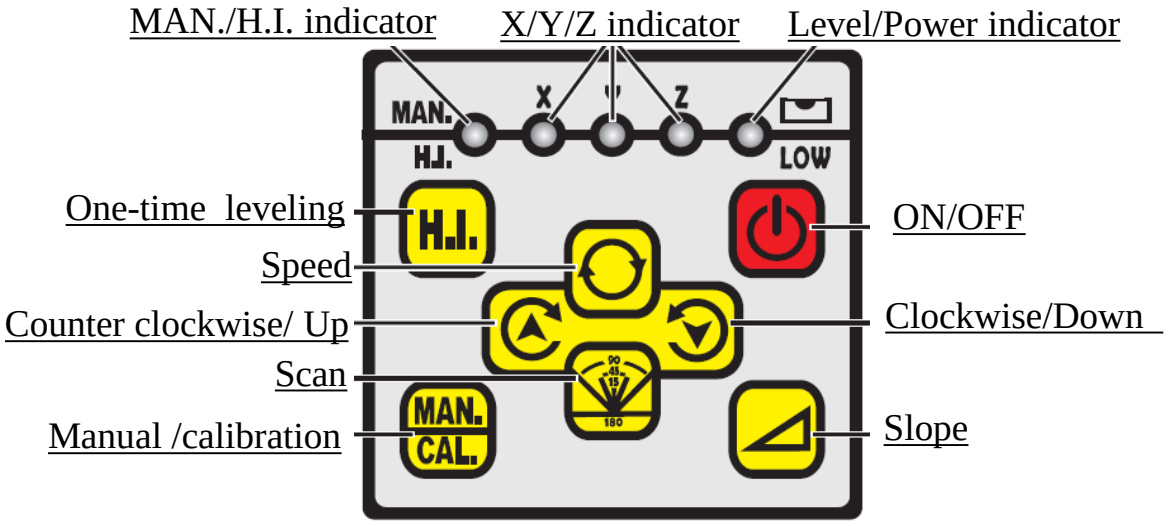
■ Error Alarms

The detailed warning states and solutions are listed below.

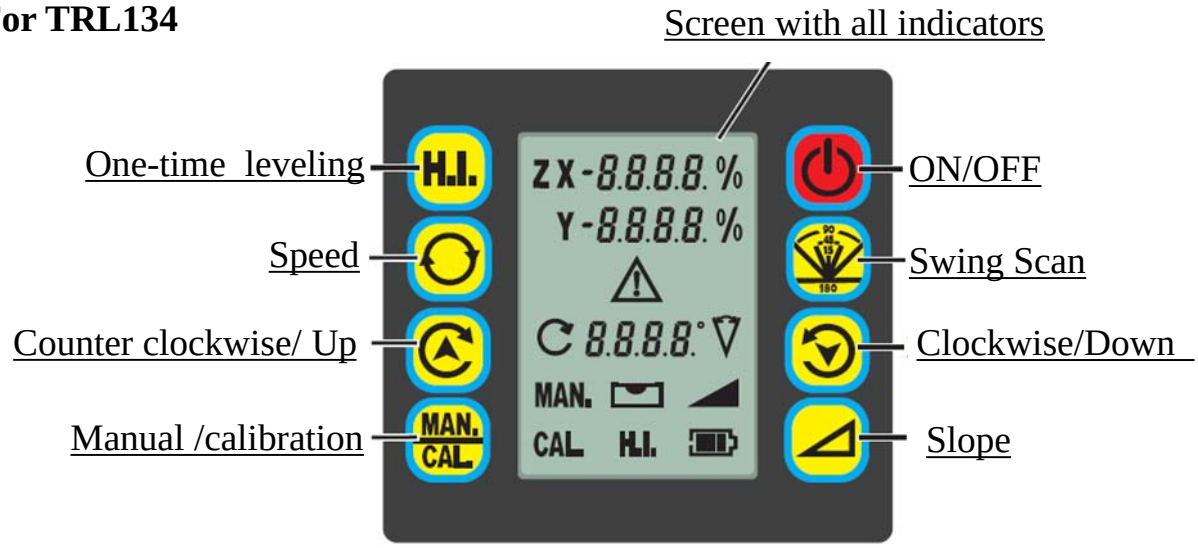
Cause	**State**	**Solution**
X-axis overrun	X indicator blinks or X and⚠flash on the screen with discontinuous beeps	Re-position X direction
Y-axis overrun	Y indicator blinks or Y and⚠flash on the screen with discontinuous beeps	Re-position Y direction
Z-axis overrun	Z indicator blinks or Z and⚠flash on the screen with discontinuous beeps	Re-position Z direction
Working direction changed	Continuous beeps with⚠on the screen, close down after 5 sec.	Re-position in 5 sec or turn it on again
One-time leveling	H.I. and⚠blinks on the screen with continuous beeps	Press the H.I. key to lift the alarm and level again
Low battery	▭and⚠blink on the screen with continuous beeps, power off after 5 sec	Charge or connect an external power

4. Panel and Indicators

■ For TRL131



■ For TRL134



As the picture depicted above, the panel includes 2 kinds. One includes panel and indicators; the other includes panel, indicators and screen.

As shown in the front page, the series of products only has a few button difference in the panel, all the function of keys and their usages are the nearly the same.

Here are the functions of each key and indicator:

■ the power ON/OFF key

After power on, level/power indicator blinks or blinks on the screen means the instrument is during the automatic leveling. After leveling, apparatus rotary head rotating lights, the level/power indicator orchange to a continuous green light.

■ H.I. the one-time leveling key

Press this key to bring automatic leveling into function while MAN/H.I. indicator turns red or H.I. blinks on the screen. In the state of leveling, if the instrument tilts by moving or touching, the laser module will stop spinning and the beeper will alarm discontinuously. H.I. and ⚠ shown on the screen with MAN/H.I. indicator blinks at the same time.

Press this key again to lift the alarm and the instrument can resume the self-level model.

■ **the speed switch key**

The default rotating speed is 600r/min.

Press the key to switch the speed level in 5r/min, 300r/min, 600r/min, 1000r/min.

In addition, hold the key or the key, the spinning speed can be increased or decreased.

■ **Swing scanning key**

The laser module can scan directionally in some range.

Press the key after self-level, and the instrument will enter the fixed-point scanning mode firstly (the degree 0°and shown on the screen). Press the scan key to control the angle of scanning as follows: 15°, 45°, 90°, 180°,0°（fixed-point scanning）. The degree is shown on the screen.

In addition, press shortly or hold the key or the key while the laser spot can spin clockwise or counter-clockwise.

■ MAN./CAL Manual/ Calibration

After self-leveling, press this key of the MAN./H.I firstly, the indicator will turn green or MAN. shown on the screen, then the instrument will enter manual mode and stop self-leveling.

Press MAN./CAL secondly, the instrument will self-level again.

In self-leveling mode, hold it to bring calibration mode.

When the instrument is set upright, press this key until X indicator lights or the X and CAL shown on the screen , the accuracy of X-axis can be calibrated by and . Press this key again, Y indicator lights or the Y and CAL shown on the screen. Then the accuracy of Y-axis can be calibrated.

Similarly, when the instrument is set horizontally, press and hold this key until Z indicator lights or the Z and CAL on the screen, the accuracy of Z-axis can be calibrated by and . See more details in "**9 Maintenance**".

After calibrating the accuracy, press the key shortly to save the data and exit the calibration mode, then the X/Y/Z indicators put out or do not indicate CAL.

Otherwise, this key can work in with to achieve the manually slope functions. Further details can be found in below.

■ Slope key

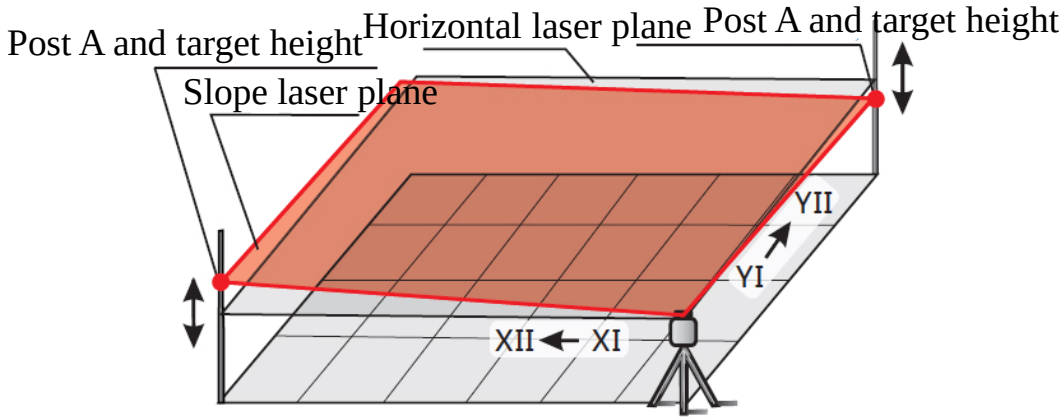
This series of products have the slope function, and realize the manual and automatic slope, the maximum available in X, the formation of +10% Y two direction slopes.

The method of manual setting in slope:

As illustrated in the front page, set the benchmark in the operation area, two benchmark and instrument placement point perpendicular to each other. Rotating apparatus, instruments at the top of the convex XI-XII aiming post A, while YI-YII aiming at post B, placed the instrument. According to the needs of practical operation, confirmed the height of location in post A/B. (Need to set a receiving target in the position of long distance.)

Starting the instrument with the spinning out the light, press MAN. CAL, indicator of MAN/H.I. turns green or MAN. shown on the screen, and then press ◿, then the indicator of X lights. Press ▲ and ▼ continuously, laser plane hit the height of post A would go up or down (distance can be observed by naked eye), until moving to the height of target.

Press again to the triangle button, Y indicator lights or ◢ and Y shown on the screen, press ▲ and ▼ that the laser plane can hit the height of post B and adjust to the target height.



Automatic ramp settings for:

As shown above, set the post in the operation area, two posts and instrument placement point perpendicular. Rotating apparatus, instruments at the top of the convex XI-XII aiming at post A, after YI-YII aim at B placed the instrument (remove it afterwards the placement).

After power on, lightly press the ◿, X indicator lights or ◢ and X shown on the screen. Press ▲ or ▼, the laser surface to YI-YII for shaft clockwise or counterclockwise rotation angle of 0.1% with each press of this key. Long press ▲ or ▼ can increase or decrease X slope value continuously.

※Note: This series of products TRL155 has higher slope accuracy, each press of ▲ and ▼ can change the 0.01% of slope data. The X line on the screen means the slope degree of X- direction.

Similarly, press the ◿ again, Y indicator lights or ◢ and Y shown on the screen, you can press ▲ or ▼ key shortly, to set XI-XII axis rotation angle.

After the completion of installation, press ◿, X and Y lights are lighten or X and Y

shown on the screen. The instrument will adjust automatic to the setting of slope, rotate out of light. If you want to log off the mode of slope， need to restart the machine.

■ /

This key realizes different functions in speed/scan/ calibration modes. Further details can be found in "**Speed/Scan/ CAL.**".

※**Note**: **In the progress of leveling (blink), the keys of speed, scan, , are lose efficacy. The keys will be effective after self-leveling.**

Functions of each indicator are as follows:

■ **MAN./H.I. indicator**

When the indicator displays red, the instrument is in one-time self-leveling mode; when it displays green, the instrument is in manual leveling mode.

■ **X/Y/Z indicators**

In self-leveling mode, if the instrument is placed improperly and exceeds the self-leveling range (±5°), X/Y/Z indicators will blink and there will have an audible alarm discontinuously. More details in "**Error Alarms**" of "**3 Main Functions**".

X/Y/Z indicators are used to indicate the corresponding direction of the calibration in Calibration mode.

■ **Level/Power indicator**

In the process of leveling, this indicator blinks in green. After the instrument leveled, it displays green continuously.

The indicator turns red when the battery is insufficient and the instrument will close after 5 seconds.

■ LCD

The LCD screen is used to indicate the working condition of the instrument. The meanings of these icons as follows:

ZX-8.8.8.8.%	Indicate the state of X or Z direction Shown the slope value in the automatic slope mode. Indicate the calibration value of X or Z direction in the calibration mode
Y-8.8.8.8.%	Indicate the state of Y direction Shown the slope value in the automatic slope mode. Indicate the calibration value of Y direction in the calibration mode.
⚠	Indicate the warning of error
↻ 8.8.8.8.° ▽	The left character indicates the rotating scanning mode. The right character indicates the swing scanning mode. In the scanning mode: indicate the speed of scanning In the swing scanning mode: indicate the angle of swing
MAN.	Indicate the manual leveling mode
▭	Indicate the leveling mode
◢	Indicate the slope mode
CAL.	Indicate the calibration mode
H.I.	Indicate the automatic leveling mode
▮	Indicate the battery

5. Power Supply

■ Lithium-ion battery

✧ The TRL15X has a built-in rechargeable lithium-ion battery pack of 7.4V(4400mAH)

✧ This series of products can provide the customized version of double battery capacity, with a built-in rechargeable lithium-ion battery pack of 7.4V (8800mAH).

✧ The battery should be charged over 10 hours with a standard 12V/2A power adapter before the first use.

✧ Charging temperature range is +10℃to +40℃, indoors. While the battery is charging, the charging indicator displays orange.

✧ In general situation, charging about 6 hours continuously then the indicator turns green indicates that the charging is complete. Unplug the power adapter if charging is complete.

✧ Do not charge over 24 hours, which may result in dangerous situation or battery damage.

✧ The instrument will detect the electricity automatically when it is working. If the battery is nearly exhausted, the power indicator will turn red,  and  blink on the screen with buzzer ringing. It will shut down in 5 seconds. See more details in Error Alarms of chapter **3. Main Functions.**

✧ If it do not use for a long time, please take out the battery and charge it every six months.

✧ Do not put the instrument, lithium-ion battery and power adapter in the place of damp, high temperature or the other poor environments. It should be kept in a dry place with dust prevention in order to avoid damage.

■ External Power

✧ Plug in the 12V/2A power adapter to charge. The instrument and the battery can be charged at the same time.

✧ In addition, power supply can also connect the external power (like storage battery) in 12V DC/2A to the instrument with the external power line.

6. Installation and use

✧ Place the instrument on a platform, on a tripod or bracket. Connect the bracket by the 5/8" screw thread.

※**Note**: **The operator should not be away from the instrument to avoid falling down unless it has been placed and fixed safely,**

✧ Make sure that the voltage of the battery is sufficient before use, or connect an external power. Press the ON/OFF key to bring automatic leveling into function. The laser beam begins to blink.

✧ Self-leveling can be completed in 20 seconds and the laser module rotates and emits.

✧ Referring to the illustration in "**5. Panel and Indicators**", the instrument can switch among one-time leveling, self-leveling, manual-leveling and slope modes.

✧ Check and calibrate the instrument before important or high accuracy work. See details in "**9. Maintenance**".

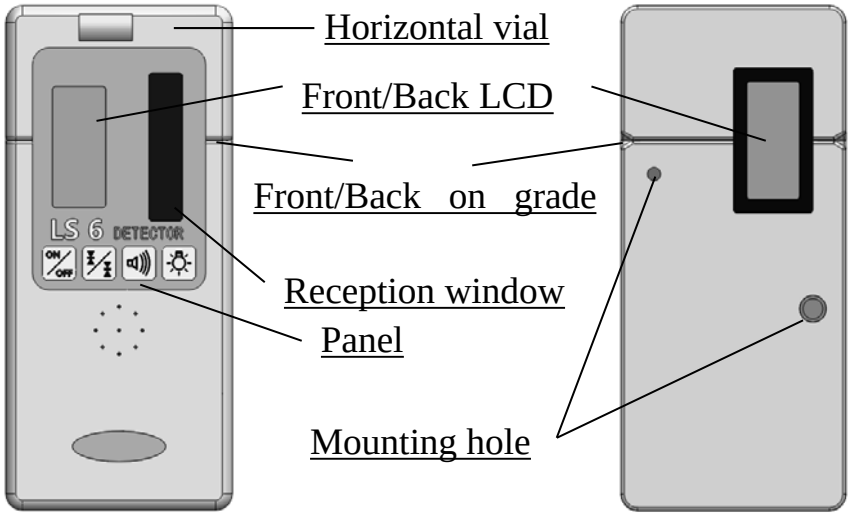
✧ Press the ON/OFF key shortly to turn off the instrument after use.

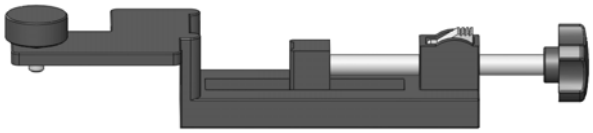
WARNING: Don't expose your eyes to the laser beam (red light source) while the instrument is in operation. Exposure to a laser beam for a long time is hazardous.

8. Accessory: LS6 Detector

The LS6 detector is applied to detect the laser signals that are transmitted by rotary laser, used as an accessory appliance in surveying.

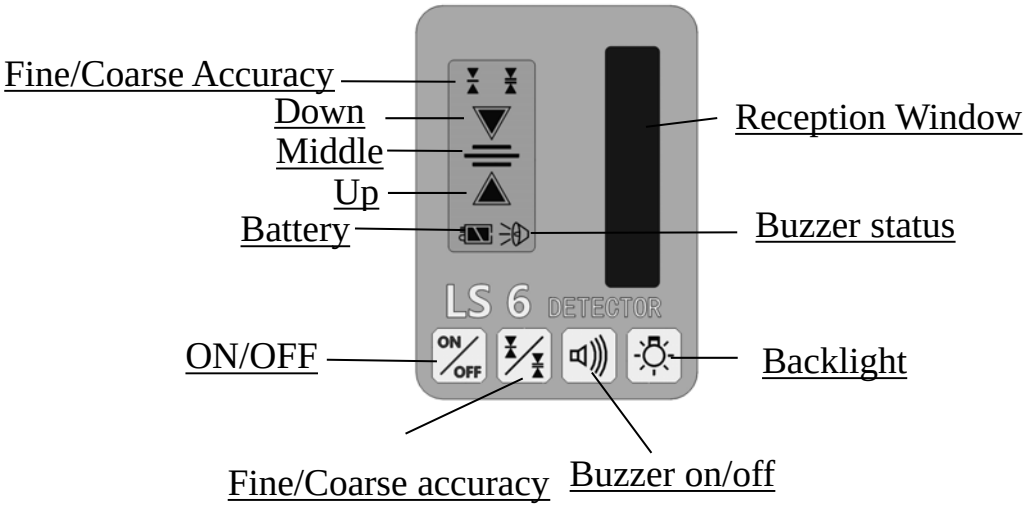
■ Names of all parts





Receiver holder

■ Panel and displays



The LS6 detector includes 4 keys and 2 displays. Here are functions in details:

✧ Power ON/OFF

✧ Fine/Coarse accuracy

Press this button to change the receiving accuracy of the detector.

Press the key to select the detection mode. In initial state, the symbol appears in the upper right corner of the LCD indicate the coarse mode. Press the key to choose the fine mode and the symbol appears in the upper left corner of the LCD.

✧ Buzzer on/off

Press the key to turn on/off buzzer.

When the buzzer is on and the laser beam is higher or lower than the detector, it delivers rapid and short beeps; if the laser beam is nearly in center, it delivers a continuous sound. If the LCD is not able to be observed, you can estimate and measure according to the sound.

✧ Backlight

Press this key to turn on/off the LCD’s backlight.

If the light is dim, turn on the backlight to make the display visible.

✧ Displays

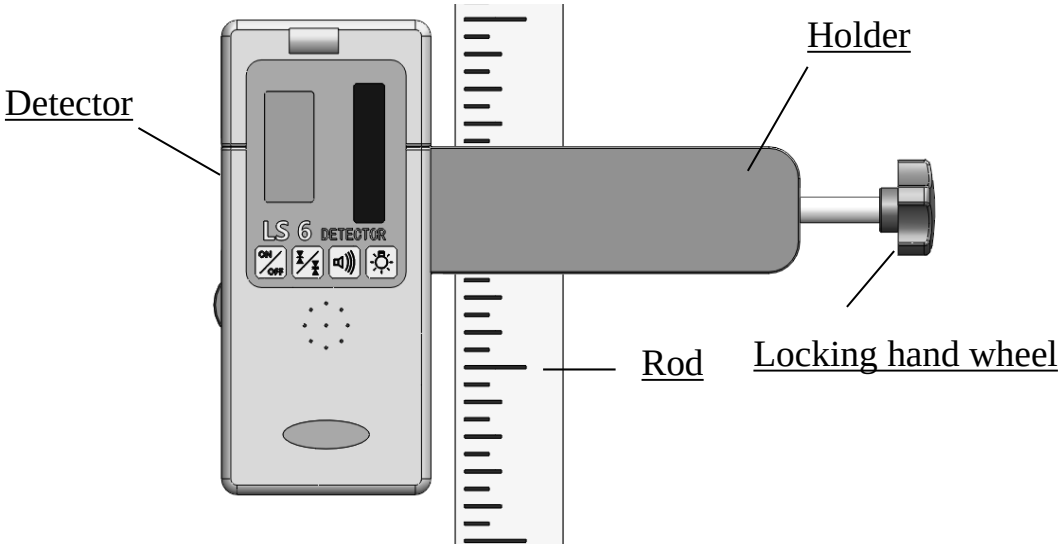
The LS6 detector has front and back LCD displays. They can display the setting state of the detector and the height position of the laser beam at the same time.

Turn on the detector and it displays all the symbols at first. Enter initial state after 1 second, which means it has passed self-test and is ready for use: voltage of battery indicator is in the bottom of left corner; beeper symbol is in the bottom of right corner, on-state; accuracy mode display is on the top. If it is in the coarse mode, appears.

The intermediate of display will display the height position of receiving laser beam.

Turn the capture window towards the laser beam and move the detector up or down according to the information displayed on the LCD screen. When the detector is higher than the laser beam, a down arrow ▼ indicates that you have to put down in order to find the level position. When the detector is lower than the laser beam, an up arrow ▲ indicates that the detector should be raised. When the detector is on-grade in the fine/coarse mode, the symbol — or ＝ appears in the center of the display.

■ Installation and use



✧ As depicted above, connect the detector to the rod clamp through mounting holes on the back of the detector. Then connect the rod clamp to the grade rod by the locking hand wheel.

✧ Put battery into the detector. Press ON/OFF to turn it on.

✧ Have the bubble on the center while detecting.

✧ Press the key with key tone can avoid pressing the wrong.

✧ When detecting, you can adjust the height of the detector according to the sound and the information displayed on the LCD screen and find the laser directly. See more details in **Displays** of **4. Panel and Displays**.

✧ When the symbol — or ＝ appears in the center of the display (continuous beeps if sound is on), mark the spot at the place where the laser beam aligns with the grade rod, or read the

scale value and record the test result.

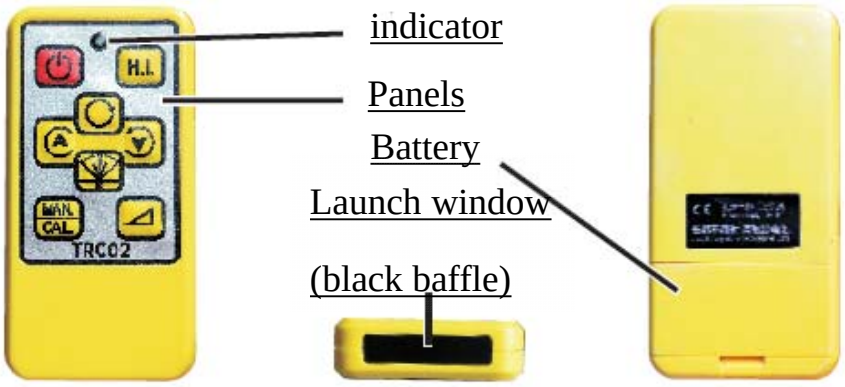
✧ The detector reacts to fluorescent lamps, dimmable lamps and electric waves (inside or outside an airport), avoid these factors during operation. To ensure the accurate results, please block those negative signals at first if the work has to be done under the above environment.

■ Specifications

1. Accuracy: Fine: ±1mm ;
   Coarse: ± 2mm
2. Working Radius: 250m
3. Reception Window: 40mm
4. Power Supply: 9V
5. Hours in Continuous Use: Approx 20 hours
6. Operating temperature: -10℃ - +40℃
7. Dimensions: 150(L)×68(W)×25(H) mm
8. Weight: 0.34 Kg

8.Accessory: Infrared remote controller TRC02 (Not for TRL153)

Infrared remote controller TRC02 can adjust the level's current settings and using state in a long distance (radius 30M within, 360°no block). When use the controller, it should point to remote launch window (black baffle) to the machine.



Front Top Back

Remote controller TRC02 has 8 buttons and 1 indicator. Except the shut down key and standby key, each function of the key and the method of operation are in accordance with the keys of level.

The usage of Indicator and shutdown, standby button operation are present as follows:

■ Indicator

Press any key at the same time, indicator lights means the signal of infrared control was sent successfully. Release the key then the light extinct.

■ Shut down /stand by

Press this key shortly, level saves the current settings and enter the sleep state (to save power). Press this key again shortly, level reentering the work state, and maintain the sleep mode before work settings.

Press the button for 5 seconds, level shutdown.

This button has no function of power on; controller can use only when it is power on.

■ Specification

1.Scope of work:30m

2.Power supply: 3VDC

3.Working temperature:-10℃-+40℃

4.Water proof and dustproof:IP53

5.Size and shape:106(L)X54(W)X16.5(H)mm

6.Weights:0.23kg

9. Maintenance

The TRL13x is a kind of precise instrument. To extend its service life and maintain the accuracy, it is important to calibrate it. Here are a few instructions to check and calibrate the TRL13x. The accuracy of your work is completely your responsibility and you should regularly check your instrument especially prior to important jobs.

■ Routine maintenance

✧ Press the ON/OFF key to turn off the instrument after use.

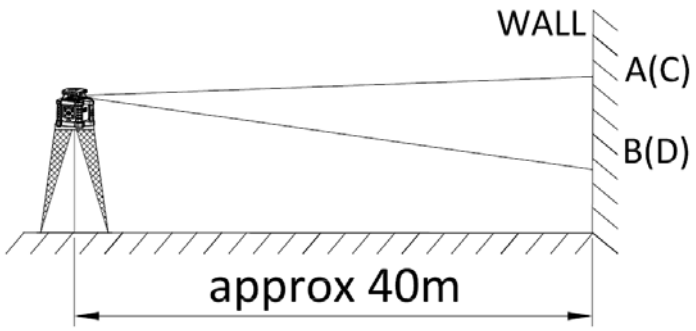
✧ When cleaning the stains on the main body, you need to brush the dust firstly and wipe the water by tissue paper. If the stains are difficult to clean up, you should wipe them with a damp cloth which is soaked in neutral detergent. Do not use gasoline, thinner or the other chemical reagents.

✧ When cleaning the stains on the surface of glass, you need to brush the dust firstly and then wipe them by a silicone cloth or an eyeglass cloth. If there are too many stains on the glass, wipe them with a soft cotton cloth which dipped in cleaning liquid of glasses. Do it discreetly without scratch the glass.

✧ The instrument should be stored in the carrying case after use. Do not put the instrument in the place of wet, dust, vibration conditions.

■ Horizontal direction accuracy checking

✧ As depicted below, place the instrument on a tripod approximately 40m away from a wall.



✧ Adjust the XI direction to face to the wall. After self-leveling, mark the spot where the beam

hits on the wall as A. (as depicted above).

✧ Switch off the power and then turn around the instrument in 180°so that XII direction face to the wall. After self-leveling, mark the spot where the beam hits on the wall as B. (as depicted above).

> **Note**: when turning around the instrument, it should not deviate from the original horizontal surface. (Do not move the tripod)

✧ If the vertical distance between A and B is less than 4mm, the accuracy of X-axis is within tolerance. Calibration is not required. If the distance is more than 4mm, the X-axis needs to be calibrated. (See the below)

✧ The direction of X-axis needs to operate the horizontal tilt error calibration. (See the direction of horizontal tilt error calibration).

✧ Check the Y-axis in the same way.

■ Horizontal direction accuracy calibration

✧ Turn on the instrument. After self-leveling, press MAN. CAL or CAL. shortly，then X indicator lights. The instrument will enter calibration mode and calibrate the X-axis.

✧ As the same way of check, make the XI direction and XⅡ direction face to the wall about 40m away. After self-leveling, mark the spot where the beam hits on the wall as A and B.

✧ Press the and the repeatedly, the instrument levels and adjusts automatically. After self-leveling, observe the position of the laser beam and adjust it moderately until the beam points the center of A and B.

> **Note**: Every four presses on the key or the key, the height of the laser beam changes 1mm in the distance of 40m.

✧ After the X-Axis calibration is completed, press MAN. CAL or CAL. shortly, Y indicator lights and the Y-axis can be calibrated in the same way.

✧ After completing the calibration, press MAN. CAL or CAL. to save the data and exit the calibration mode. The instrument can work continuously which based on the calibration.

✧ To exit from the calibration mode without saving the data, please press ⏻ key.

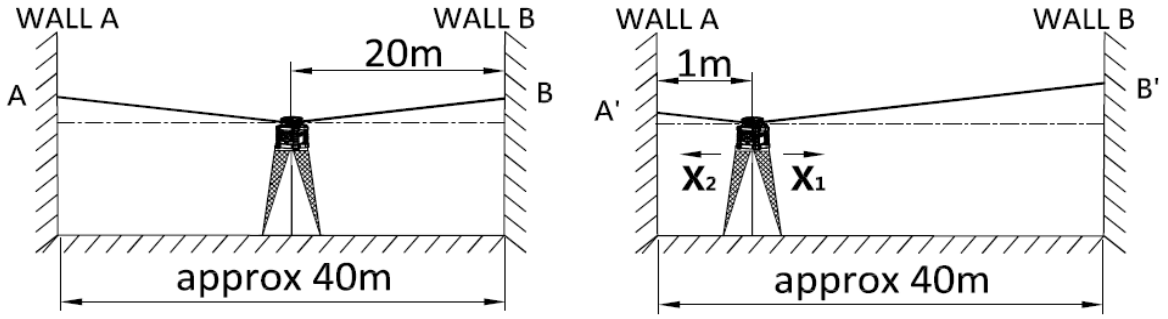
Note: if the distance between two marks exceeds 40mm, please contact your supplier or send it to a specialist at an authorized repair shop.

■ Horizontal cone accuracy checking

After completing the horizontal direction accuracy checking and calibration, the next is horizontal cone error checking. Checking steps are as follows:

✧ Set up the instrument on a tripod about 20m away from a wall (A) and 20m away from another wall (B). As shown in the lower left picture.

✧ After self-leveling, mark the spot where the beam hits on the walls as A and B. As shown in the left picture.



✧ Turn off the instrument. Set it up on the tripod about 1m away from the wall (A). Power on again. After self-leveling, mark the spot where the beam hits on the walls as A' and B' as shown in the right picture.

✧ Compare the distance of two sets of marks (A-A') and (B-B'). If (A-A') - (B-B') is less than 4mm, the position of the laser beam is accurate.

Note: if (A-A') - (B-B') exceeds 4mm, please contact your supplier or send it to a specialist at an authorized repair shop.

■ Vertical direction accuracy checking

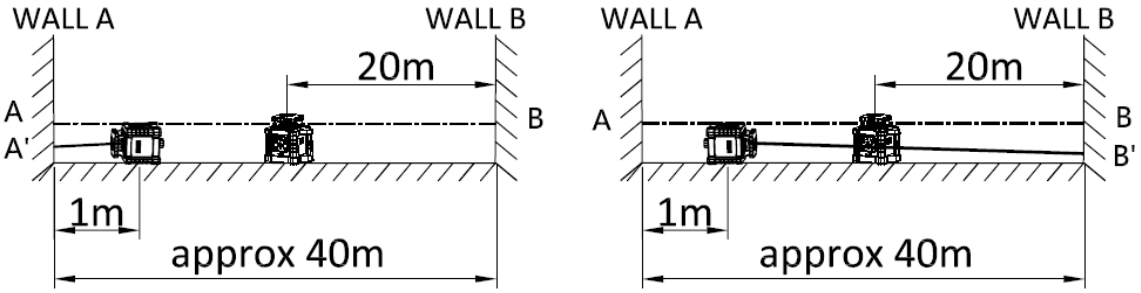
This checking must be done after completing the above checking and calibration. Checking steps are as follows:

✧ Set up the instrument about 20m away from a wall (A) and 20m away from another wall (B). (tripod is not required here), as depicted below.

✧ After self-leveling, mark the spot where the beam hits on the walls as A and B. They are the reference datum as depicted below.

✧ Turn off the instrument. Set it horizontally with the top facing wall (A) and the panel facing upward. Turn on the instrument again. After self-leveling, mark the spot where the beam hits on the wall (A) as A', as shown in the left picture below.

✧ Turn off the instrument and rotate 180° with the top facing to wall (B). Turn on the instrument again. After self-leveling, mark the spot where the beam hits on the wall (B) as B', as shown in the right picture below. (Try to keep the center position immobile when rotating the instrument.)



✧ Compare the distance of two sets of marks (A-A') and (B-B'). If (A-A') - (B-B') is less than 4mm, the position of the laser beam is accurate and calibration is not required. Otherwise, the calibration needs to be done referring to the following point.

■ Vertical direction accuracy calibration

By using the method to measure the distances between two sets of marks on the walls (A-A') and (B-B').

✧ Turn on the instrument, hold MAN. CAL or CAL key until Z indicator illuminates to enter the calibration mode.

✧ Press the key and the key repeatedly, the instrument levels and adjusts. After self-leveling, observe the position of the laser beam and adjust it moderately step by step until (A-A') equals to (B-B').

Note: Every four presses on the key or the key, the height of the laser beam changes 1mm in the distance of 40m.

✧ After completing the calibration, press MAN. CAL or CAL key to save the data and exit the calibration mode. The instrument continues to work based on the calibration.

✧ To exit from the calibration mode without saving the data, just press key.

Note: if the distance between two marks exceeds 40mm, contact your supplier or have it repaired by a specialist at an authorized repair shop.

10. Specifications

1. Horizontal accuracy: ±1mm/10m

2. Vertical accuracy: ±1mm/10m

3.Down point diode accuracy: ±1mm/1.5m

4.Measuring diameter: 300m/600m (using the detector)

5. Self-leveling range: ±5°

6. Slope range: ±10％

Slope accuracy:0.1％(TRL155 is 0.01%)

7. Laser wavelength: 620nm-670nm

8. Laser class: CLASS Ⅱ / CLASS ⅢIa

9. Rotation speed: 5-1000r/min

10. Directional scanning angle: 0°, 15°, 45°, 90°, 180°

11. Power：7.4V(4400mAH) Lithium-ion battery

Or 7.4V (8800mAH) Lithium-ion battery

12. Hours in continuous work: 30 hours / 60 hours (customized version)

13. Battery charging time：6 hours

14. Environmental: IP65 for water and dust resistance

15. Operating temperature: -10℃ - + 40℃

16. Mounting base: 5/8”×11 flat or domed

17. Dimensions: 190(L) ×235(W) ×235(H) mm

18. Weight: 3.5Kg

■ Packing list

1	Rotary laser TRL15x	1
2	12V/2A Power adapter	1
3	L-shaped bracket	1
4	LS6 Detector	1
5	Receiver holder	1
6	Red-light glasses	1
7	Target	1
8	Operating Manual	1
9	Certificate of inspection	1
10	Warranty Card	1
11	Carrying case AX06	1
12	Infrared remote controller TRC02	1

Contact your supplier immediately if there are any missing or damaged parts.