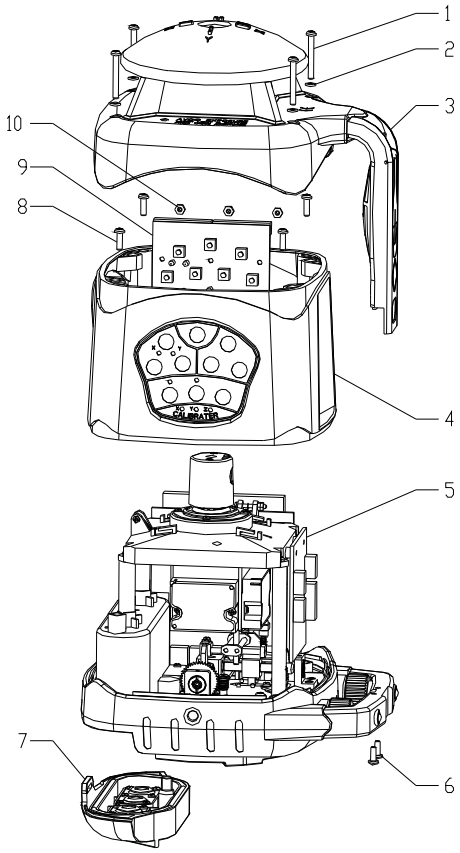
40-6522 Automatic Rotating Laser
Service Manual
Contents

1.0 Introduction

40-6522 rotating laser is a highly accurate instrument. Out side of a few customer adjustments (outlined in the owners manual), all adjustments/service operations are internal to the instrument and to be performed only by authorized service personnel. Authorized personnel should adhere to the guidelines described within this service manual for all repairs and/or service work. This manual is written with the assumption that a unit is disassembled or assembled from start to finish. In reality, only component parts or modules would be replaced during a repair. Given this, procedures discussed in this manual should be adjusted according to the repair being made.

2.0 Overall Unit Disassembly

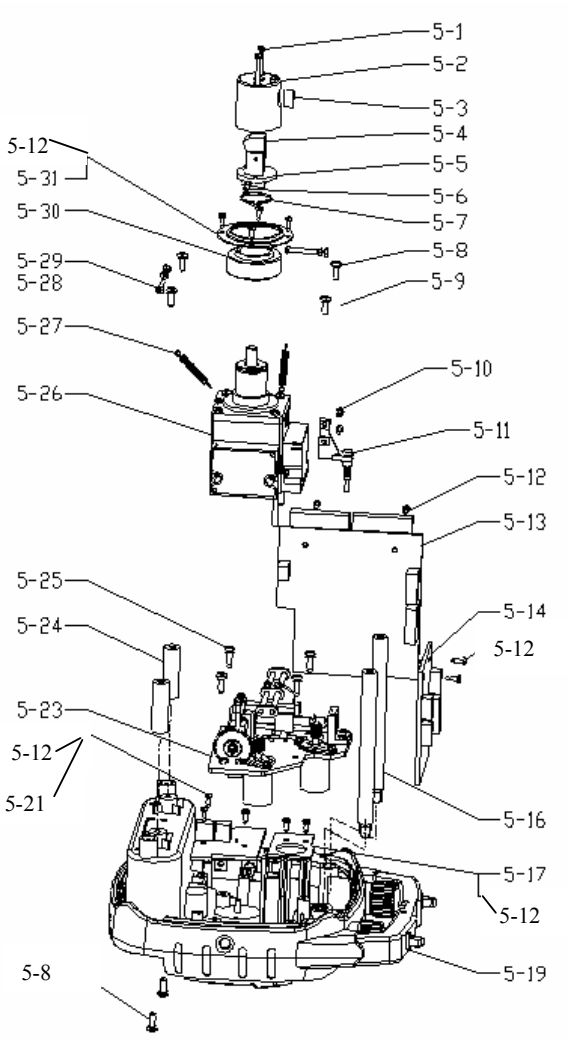
Item	JLT Part #	Description	Qty
1	AP1530	Cross Plate Screw (M3x25)	4
2	AP1531	Nylon Washer (Gasket Seal)	4
3	AP1532	Top Cover Module	1
4	AP1533	Shell Module	1
5	AP1534	Body Module	1
6	AP1513	Cross Plate Screw (M3x8)	2
7	AP1535	Battery Cover Module	1
8	AP1536	Cross Plate Screw (M3x10)	4
9	AP1537	#4 Key Pad PCB	1
10	AP1538	Hexagon Nut (M2.5)	5



1. Using a Phillips screw driver, remove 4 bolts (1) from top cover module (3) and 2 bolts (6) from the bottom of the handle.
2. Gently pull on top cover module to break seal of the Top Cover Module (3).
3. Using a Phillips screw driver, remove 4 bolts (8) from shell module (4).
4. Gently pull on Shell module (5) to break seal, and disconnect the wire connectors connecting to Keypad PCB (9) Take off the Shell Module (4) with slightly strength upside.
5. Using a needle nose pliers, remove the 5 hexagon nuts (10) retaining the Key pad PCB (1)
6. Remove key pad PCB from Shell module (4).

2.1 Body Module Disassembly (AP1534)

Item	JLT Part #	Description	Qty
5.1	AP1539	Cross Plate Bolt (M2x20)	2
5.2	AP1540	Rotating Head	1
5.3	AP1541	Optical Wedge Module	1
5.4	AP1542	Prism	1
5.5	AP1543	Prism Seat	1
5.6	AP1544	Inner Hex Fastening Screw (M3x6)	1
5.7	AP1545	C-ring	1
5.8	AP1513	Cross Plate Screw(M3x8)	6
5.9	AP1546	Core module Mounting Plate	1
5.10	AP1022	Cross Plate Screw (M3x6)	2
5.11	AP1547	Alarm Adjustment Module	1
5.12	AP1548	Cross Plate Tap Bolt (ST2.2x6.5)	13
5.13	AP1549	#2 Main Control Board	1
5.14	AP1550	#5 Signal Board	1
5.16	AP1551	Long Brace	2
5.17	AP1552	#3 Alarm PC Board	1
5.19	AP1553	Base Module	1
5.21	AP1554	#1 Power Supply Board	1
5.23	AP1556	Leveling Module	1
5.24	AP1557	Short Brace	2
5.25	AP1558	Cross Plate Self Tap Screw (ST2.5x9.5)	4
5.26	AP1559	Core Module	1
5.27	AP1560	Tension Spring	2
5.28	AP1561	Cross Plate Bolt (M2x14)	2
5.29	AP1562	Hexagon Nut (M2)	4
5.30	AP1563	Ball Bearing	1
5.31	AP1564	Press Board	1



2.1.1 Removal of rotating head/prism assembly

1. Remove rotating head (5.2) by unscrewing the two cross plated screws (5-1).
2. Remove prism (5-4) from core module (5-26) by loosening Inner hex fastening bolt (5-6).

2.1.2 Removal of Core Module Assembly

1. Remove four cross plate screws (5-8) from core module mounting plate (5-9).
2. Remove two screws (5-12) that join the Main control board (5-13) to the core module mounting plate (5-9).
3. Remove the two screws (5-12) that join the Signal board (5-14) to the core mounting plate (5-9).
4. Disconnect all wires from the core module to the various circuit boards and remove core module assembly (with mounting plate still connected) from the body module
5. Remove Core module (5-26) from mounting plate (5-9) by first disconnecting X and Y axis tension springs (5-27). One spring is used for each axis.
6. Using a spanner wrench, remove c-ring (5-7) from ball bearing (5-30).
7. Slide Core module mounting plate (5-9) off of core module (5-26)

2.1.3 Removal of Main Control Board

1. Disconnect all wire connectors leading to the Main control board (5-13)

2.1.4 Removal of Power Supply Board

1. Disconnect all wire connectors leading to the Power Supply board (5-21)
2. Remove three cross plate screws (5-25) that join the Power Supply board (5-21) to the Base Module (5-19)
3. Gently rock the power supply board (5-21) back and forth to release the power adapter plug and detector sensor from the base module (5-19). Once released, gently remove the power supply module (5-21)from the base module (5-19).

2.1.5 Removal of Alarm Board

1. Disconnect all wire connectors leading to the Alarm board (5-17)
2. Remove two cross plate screws (5-12) that join the Alarm board (5-17) to the Base Module (5-19).
3. Gently remove the Alarm board (5-17) from the Base Module (5-19)

2.1.6 Removal of Leveling Module

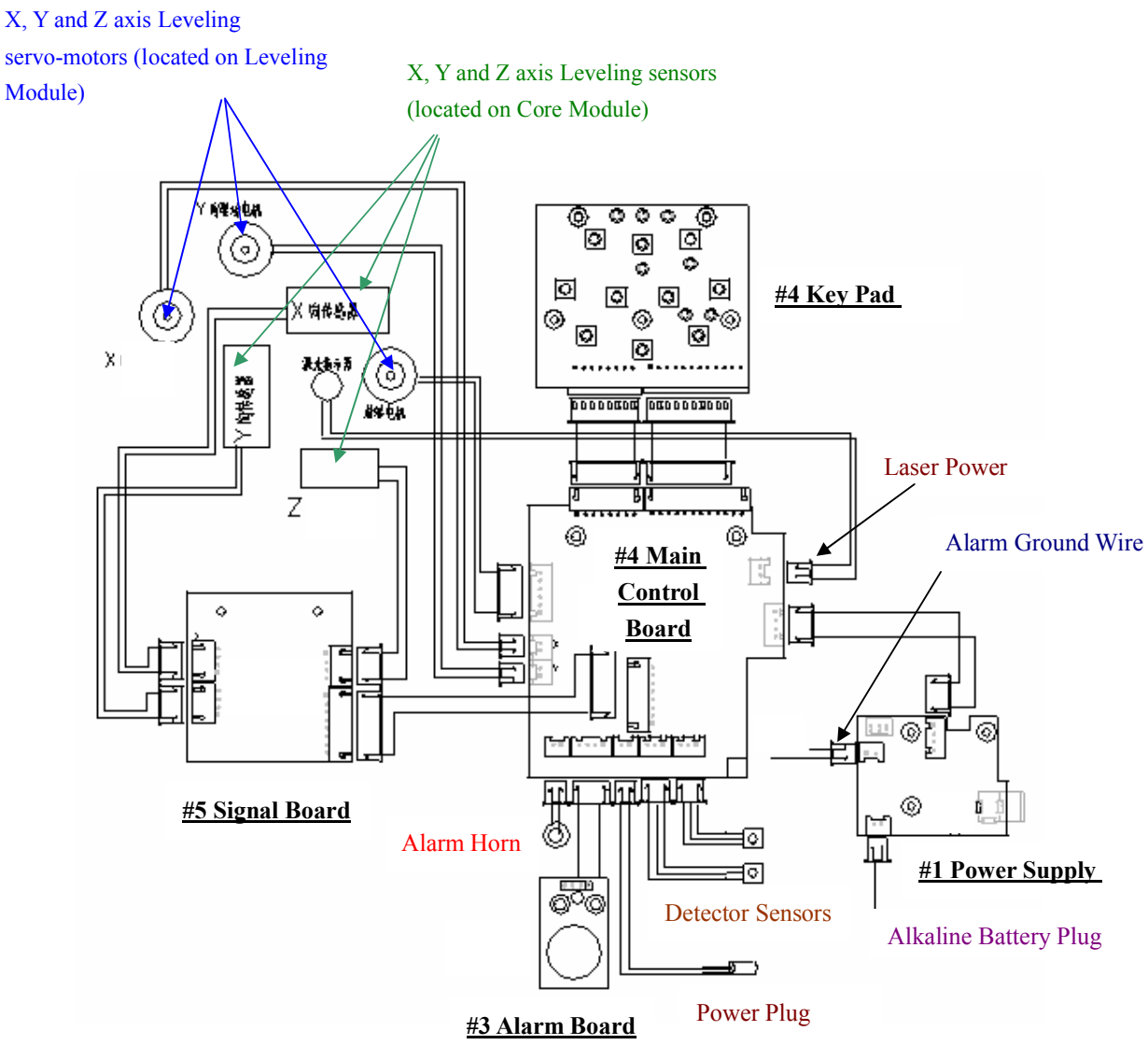
1. Disconnect all wire connectors leading to the Leveling Module (5-23)
2. Remove four cross plate screws (5-25) that join the Leveling Module (5-23) to the Base Module (5-19).
3. Gently remove the Leveling Module (5-23) from the Base Module (5-19)

2.1.7 Removal of Alarming horn

Due to the method used to attach the alarming horn to the base module (5-19), it is not possible to remove it without damage to the base. The only repairs that can be done relate to the wires and wire connector, as appropriate.

3.0 Schematic Diagram

The schematic diagram shows function blocks and general wire connections. It does not detail operation of each functional block.



4.0 Calibration

Calibration is a process that is used to correct for accuracy and/or functional errors above and beyond those stated in published specifications. While Manual-leveling, Self-leveling, and Automatic-leveling (motor driven) devices have different mechanisms that require calibration, there are similarities with optics that is consistent regardless of the leveling mechanism. This section of the service manual discusses calibrations specific to the 40-6522. Each item discussed is shown below.

4.1. Horizontal Mode Operation

In this mode of operation, the instrument is self-leveling, where by a major factor of accuracy is how well the leveling compensator is balanced. Different types of errors require different methods of calibration. These errors are easily characterized by placing the instrument on a flat surface following the guidelines below, and running the instrument with the rotating head continuously rotating 360°.

4.1.1. Quantifying Accuracy Error

Establish the set up shown in the following drawing.

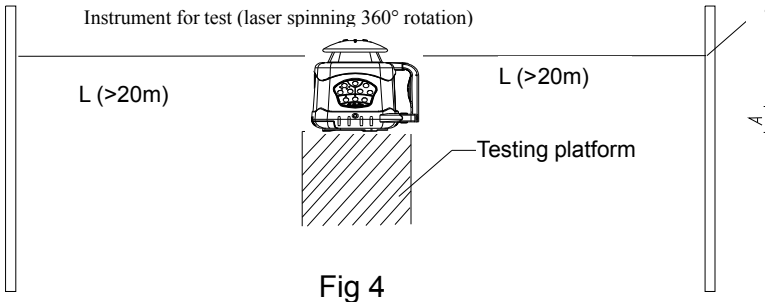
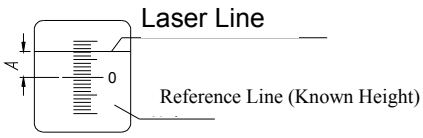


Fig 4

Near Target placed within 0.3m (12") of instrument. Note that "0" of the target corresponds to the height of laser line at the aperature of the instrument.

Far Target placed on wall at least 10m (33ft) from Test Stand, where "0" corresponds to them same height as "0" on the target next to the aperature of the instrument.

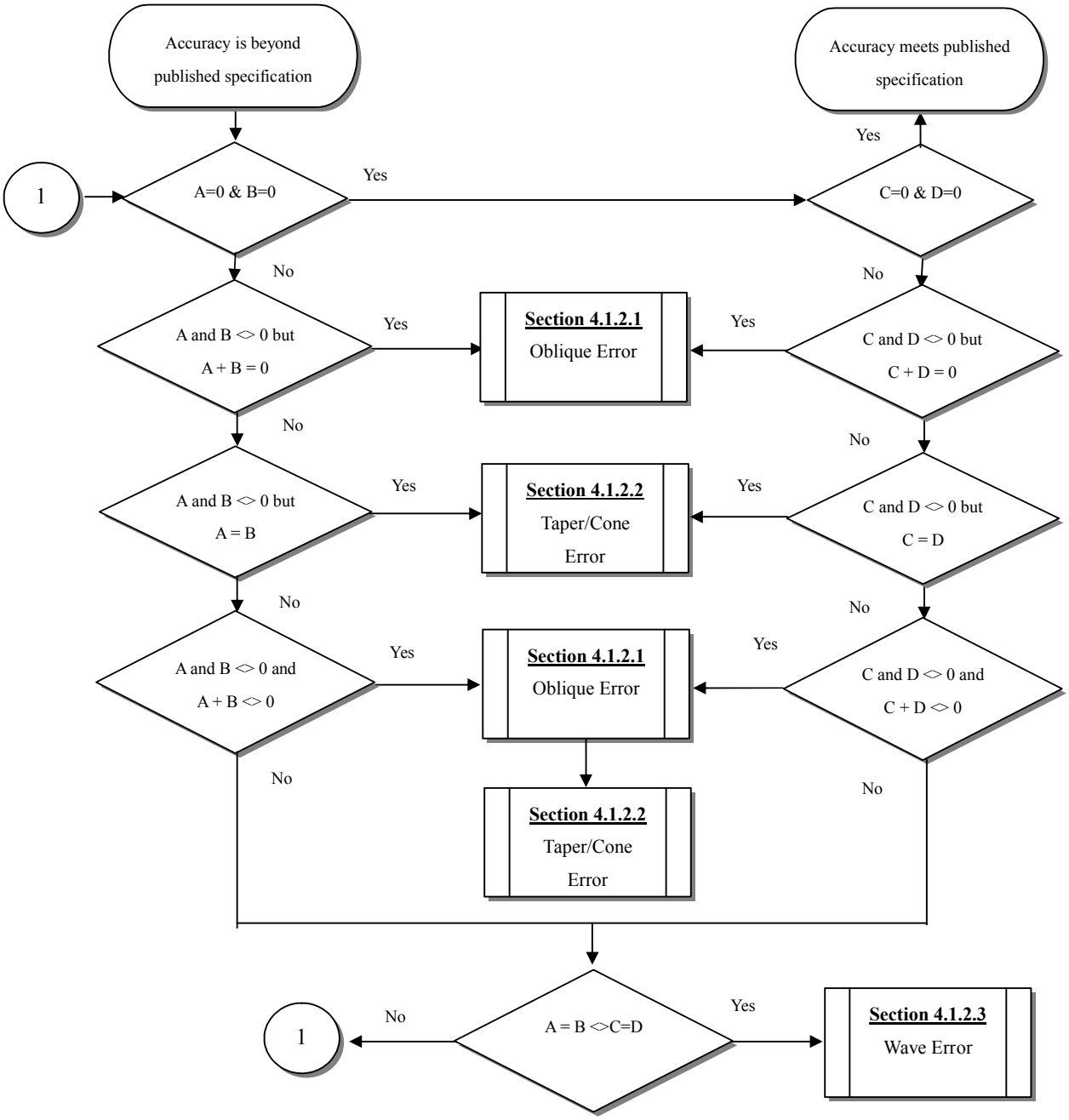


Accuracy (A) = Difference between laser line height and reference line height, divided by the distance that the laser is from the wall (L)

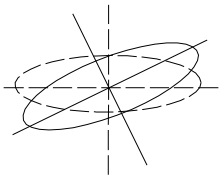
1. Place the instrument for test on the test stand (preconfigured from the illustration above) with handle facing the far target .
2. Power the laser and function in full rotation mode (head rotates 360°)
3. Note the errors in all four quadrants of the instrument as read on the far target (i.e. x axis A = 0° and B = 180°, y axis C = 90° and 270°)
   - You should end up with 4 numbers
     A (0°) = _____
     B (180°) = _____
     C (90°) = _____
     D (270°) = _____
4. Since all of the errors are referenced against "0" on the far target, essentially the largest number from the data collected (A – D) / the distance should be equal to or less than the published specification for the product. If not, characterize the error and determine method of calibration as defined by section 4.1.2 of this document.

4.1.2. Characterize the type of error

Use the following rules to determine what type of accuracy error the instrument for test has, and reference the stated section to adjust for it. Note that the unit my have a combination of different types of errors to adjust for, in which case, multiple calibration must be performed.



4.1.2.1 Oblique/Inclination error



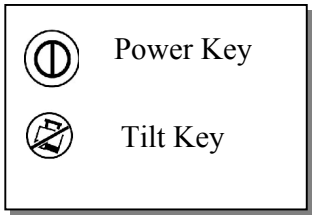
This type of error occurs when leveling compensator does not hang straight (as illustrated to the right), i.e. is not properly balanced. When the laser spins, it actually rotates on a plain that is not level, i.e. perfectly horizontal whose rotating axis is not plumb. So value A on the left target does not has the same sign as that on the right target, like, $A_{0°}$=+2, $A_{180°}$= -2. A number of factors can cause this situation to exist.

- Normal use – Depending upon how careful the user is with the instrument, finely tuned adjustments can be altered by very large changes in temperature, vibrations (due to handling and transportation)
- Shock – The instrument was dropped and components of the leveling system have either been damaged or came out of alignment. If defective components are present, they will need to be repaired or replaced prior to the calibration procedures defined below being initiated.

Depending upon the magnitude of the error (±5mm or 0.2”), only fine adjustments need to be made. Larger errors (>5mm or 0.2”) require coarse adjustment to get close, the fine adjustment to bring the unit within specification.

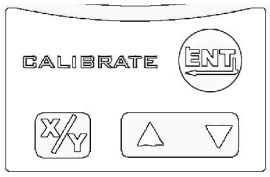
Note: Only fine adjustments are discussed in this document. Coarse adjustments are integral to the core module and are factory adjusted. Units that have defective core modules, or core modules that need coarse calibration should be replaced by the service technician and the defective part sent back to the factory for repair/recalibration.

4.1.2.1.1. Fine Calibration via Remote Control



1. Access calibration mode by simultaneously pressing the “**Power**” key and the “**Tilt**” key.
2. While continuing to hold the “**Tilt**” key, release the “**Power**” key.
   - When releasing the “**Power**” key, all red LED’s on the unit’s keypad display with light up. After about 10 seconds, all LED’s, except the power LED will go off.
3. Release the “**Tilt**” key.
   - Note that the rotating head of the laser is not rotating but the laser is flashing. The unit is now in calibration mode and all other operations will be performed with the unit’s remote control.

4. Open the lower cover of the remote control to access the operation panel for the calibration.



   - Multiple presses of the **"X/Y"** key toggles calibration control between the X-axis, Y-axis, and Z-axis (as indicated via the x, y, and z Calibrater LED's located on the instruments keypad. See below

Status Indicator

   - Once the desired axis has been selected, the "**UP Arrow**" and "**Down Arrow**" keys are used to adjust the position of the laser plane.

X-axis Calibration

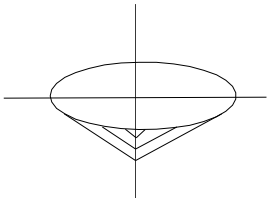
1. Place the unit into calibration mode as discussed above. 
2. Position the unit so that the X axis directing to the two targets.
3. Press **"X/Y"** key on the remote control to toggle calibration control to the X-axis
4. Press the "**UP Arrow**" and "**Down Arrow**" keys, respectively to adjust the laser height to coincide with the zero position of the target
5. Press the "**Enter**" key on the remote control to accept the calibration value, noting that the status indicator goes "off"
6. After calibration is completed, make sure to power off the unit and then power on again to activate the calibration.

Y-axis Calibration

1. Place the unit into calibration mode as discussed above. 
2. Position the unit so that the Y axis directing to the two targets.
3. Press **"X/Y"** key on the remote control to toggle calibration control to the X-axis
4. Press the "**UP Arrow**" and "**Down Arrow**" keys, respectively to adjust the laser height to coincide with the zero position of the target
5. Press the "**Enter**" key on the remote control to accept the calibration value, noting that the status indicator goes "off"
6. After calibration is completed, make sure to power off the unit and then power on again to activate the calibration.

Once calibration is complete re-verify accuracy as directed in sections 4.1.1 and 4.1.2, and repeat as necessary.

4.1.2.2 Taper/Cone error



Taper error results when the prism base module does not reflect the laser light exactly 90° (i.e. non-perpendicularity between the rotating line and the rotating axis). The end result is a laser rotating surface that is not a plane, but a tapered one as shown in the figure to the right. The value A in the left target shares the same symbol as the one in the right target during the check, that is, $A_{0°}$=+2 and $A_{180°}$= +2. The error is removed by adjusting the optical wedge of the laser output window to make the rotating laser beam and rotating axis plumb beam. The details are listed as follows:

a. Remove the top cover as discussed in section 1 of this document
b. Screw the wedge out of its base with special spanner as shown in the figure to the right.
c. Adjust the laser to the zero position of the target.

Note: Only one direction (X or Y) is necessary for the adjustment.

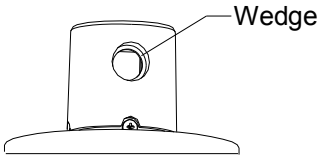
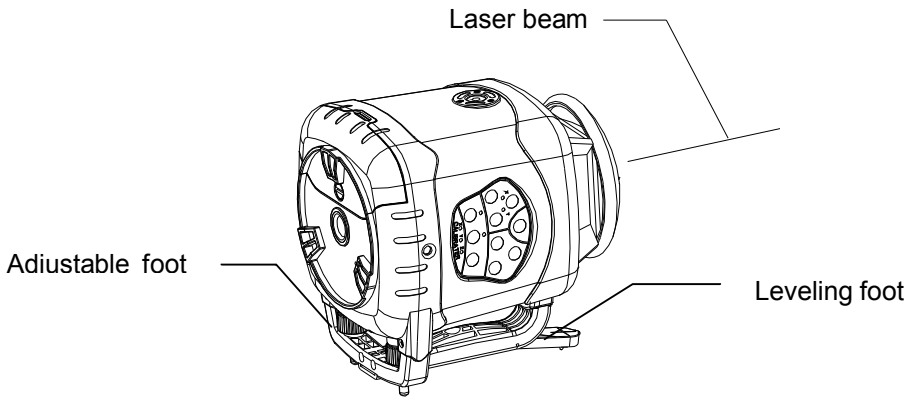


Fig 13

4.2 Vertical Mode Operation

In this mode of operation, rotating laser surface is a plumb plane, and meanwhile the laser line projected from the top is in horizontal situation. To check whether the plane is plumb, we just need to check whether the beam is horizontal. This is done by doing the following:

a) Put the unit in horizontal mode. Power on the unit and have it self-leveled.
b) Check whether the laser beam is horizontal by using auto level.
c) If the horizontal accuracy exceeds the range, it needs the calibration.



Z-axis Calibration

1. Place the unit into calibration mode as discussed above.
2. Position the unit so that the Z axis directing to the two targets.
3. Press **"X/Y"** key on the remote control to toggle calibration control to the X-axis
4. Press the "**UP Arrow**" and "**Down Arrow**" keys, respectively to adjust the laser height to coincide with the zero position of the target
5. Press the "**Enter**" key on the remote control to accept the calibration value, noting that the status indicator goes "off"
6. After calibration is completed, make sure to power off the unit and then power on again to activate the calibration.

4.3. Vial Calibration for Z axis

Setup the unit in horizontal mode as shown above. Center the bubble of the vial on the housing by adjusting the height of two adjustable feet and then power on the unit allowing it to self-level. Observe whether the laser beam around fixing foot coincide with the scale on the supporting board. If there is great deviation, it needs following calibrations.

a.) Using the adjustment screws on the two adjustable feet, center the laser beam on the cross hare scale located on the leveling foot.

Note: Keep the two adjustable feet at the same height and observe the coincidence only after the unit is self-leveled.

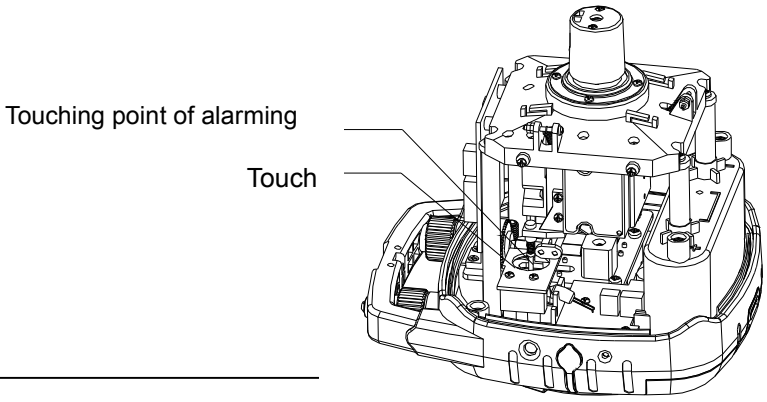
b.) Center the bubble in the bulls eye vial by adjusting the three screws around the vial.

4.4. Calibration for sound alarming range

If the alarm range is obviously biased, one side exceeds 4.5 degree and other side is much less than 4.5 degree, it needs the calibration.

Calibration method is as following:

a) Remove the top cover and the shell module
b) Put the unit on the leveling platform, turn on the unit to have it self-leveled and turn it off then.
c) Adjust the touching staff to the circle center of the touching ring on the alarming part.
d) Assemble the housing and the top cover on.



5.0. Troubleshooting Guide

No.	Symptom	Cause	Repair method
1	Cannot power on	Low battery	Replace batteries or charge NiMH battery-pack
		Broken 12-pin lead	Replace 12-pin lead
		Damaged on/off switch	Replace 4# PCB
		Defective 2# PCB	Replace 2# PCB
2	Cannot power off	Defective 2# PCB	Replace 2# PCB
3	No response of remote control	Low battery for remote control	Replace remote control battery
		Damaged receiving tube	Replace receiving tube
4	No Laser	Damaged laser driving	Replace 1# PCB
		Damaged laser diode	Send back to factory for maintenance
5	Cannot rotate Low rotating speed	Defective 2# PCB	Replace 2# PCB
		Loosen motor gear	Re-glue motor gear by adhesive
6	Cannot self-leveled after powered on	Too big or too small clearance between worm wheel and worm	Adjust clearance between worm wheel and worm
		Loosen adjustment part	Replace adjustment part
		Out-of-range without alarm	Wipe alarm staff and alarm ring by alcohol
		Damaged motor driving	Replace 1# PCB
7	Cannot self-leveled but alarm	Memorizer error	1．Turn on the unit 2．Press keys of ⏻ and ▭ at the same time 3．Loose key ⏻ but keep pressing key ▭ until power indicator LED turn off. 4．Turn on the unit again to take precision calibration
8	Unlighted panel LED	Damaged LED	Replace 4# PCB
9	Lighted charging LED all the time (without adaptor)	Damaged charging socket	Replace 1# PCB