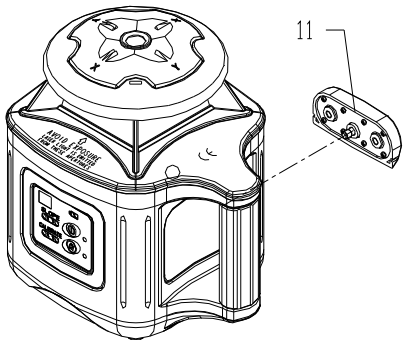
40-6535 Automatic Rotating Laser
Service Manual
Contents

1.0 Introduction

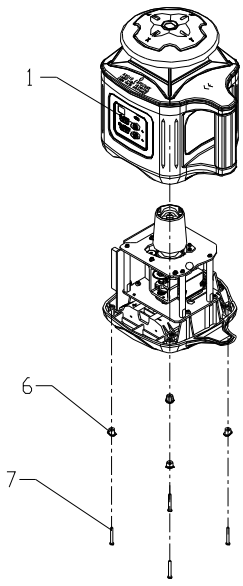
40-6535 rotating laser is a highly accurate instrument. Out side of a few customer adjustments (outlined in the owners manual), all adjustments/service operations are internal to the instrument and to be performed only by authorized service personnel. Authorized personnel should adhere to the guidelines 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

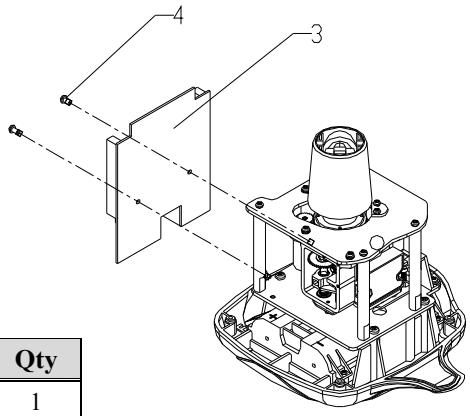
Item	JLT Part #	Description	Qty
1	AP1761	Main housing	1
6	AP1762	Soft top cap plug	4
7	AP1530	M3×25 crosshead plate screws	4
11	AP1763	Battery Cover	1



1. Using a flathead screwdriver or a coin, remove the battery cover (11) from main housing (1),
2. Remove the rechargeable battery pack by carefully disconnecting the wires that plug into the main power board.
3. Using a Philip's screwdriver, remove 4 crosshead plate screws M3×25(7#).
4. Remove 4 top-cap plug (6), and carefully remove the main housing(1).
   - Note that wires will still be connected to various circuit boards that can be damaged.
5. Carefully disconnect the wire connectors that connect to the main housing.
6. Other components to note in the main housing are the keypad assembly and the main power board assembly.

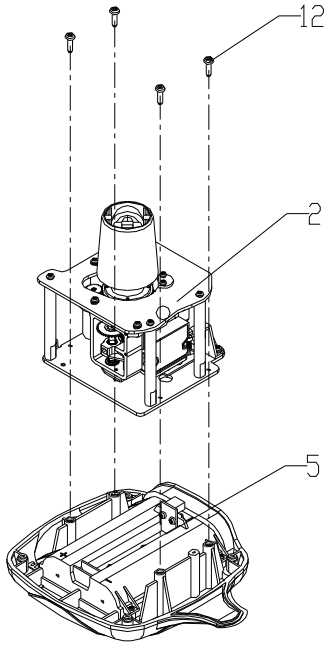


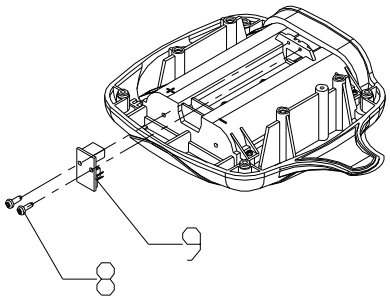
7. Reference figure to the right. Using a cross screwdriver, unscrew the 2 crosshead plate screws M3×6(4#), pull out all the plugs, and disassemble the 1# main circuit board (3#).
8. Reference the figure below. Using a cross screwdriver unscrew the 4 crosshead plate tapping screws M2.9×13 (12#), and disconnect core parts (2#) and base assembly (5#).



Item	JLT Part #	Description	Qty
2	AP1764	Core Module	1
3	AP1765	Main Control Board	1
4	AP1022	M3 x 6 cross plate screws	2
5	AP1766	Base Assembly	1
8	AP1677	ST2.9 x 8 Self Tapping Cross Plate screw	2
9	AP1767	Battery Circuit board	1
12	AP1026	M2.9 x 13 Cross Plate Self taping screws	4

9. Using a cross screwdriver, remove the 2 crosshead plate tapping screws ST2.9×8(8#), then the 3# battery circuit board (9#) could be disassembled.





2.1 Core Module (AP1764)

1. As shown in figure 6, use a cross screwdriver to unscrew the 2 crosshead plate screws M3×6(2-23#), and remove the alarm adjustment module (2-22#).
2. As shown in figure 7, use a cross screwdriver to un screw the 4 crosshead plate screws M3×10(2-29#),and disassemble the X-direction leveling module (2-16#) and Y-direction leveling module (2-21#)
3. Using a cross screwdriver, remove the 4 crosshead plate screws M3×10(2-6#), and disassemble the top support plate (2-5#)
4. Using a cross screwdriver, remove the 2 crosshead plate screws M2.5×8(2-33#), and disassemble the ball axis module (2-32#)
5. Using a cross screwdriver, remove the 4 crosshead plate screws M3×10(2-6#), and disconnect the bottom support plate (2-20#) and the support rod (2-17).
6. As shown in figure 8, use a cross screwdriver to remove the 2 crosshead plate screws M2.5×8(2-38#), disassemble the rotary head (2-2#), and take off the optical wedge module (2-1#)
7. Using a cross screwdriver, remove the 3 crosshead plate screws M2×10(2-3#), and disassemble the prism seat module (2-35#).

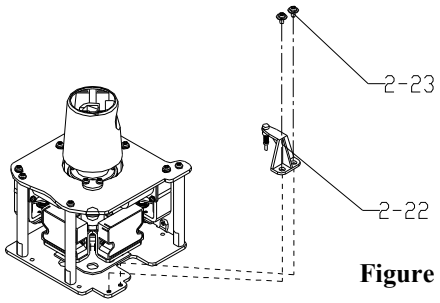


Figure 6

Item	JLT Part #	Description	Qty
2.1	AP1783	Optical Wedge	1
2.2	AP1768	Rotating Head	1
2.3	AP1536	M3 x 10 Cross plate screws	3
2.5	AP1769	Top Support Plate	1
2.6	AP1536	M3 x 10 Cross plate screws	4
2-16	AP1770	X-direction leveling module	1
2-17	AP1771	Support rod	4
2-18	AP1536	M3 x 10 Cross plate screws	3
2-20	AP1772	Bottom Support Plate	1
2-21	AP1773	Y-direction leveling module	1
2-22	AP1774	Alarm adjustment module	1
2-23	AP1022	M3 x 6 Cross plate screws	2
2-29	AP1536	M3 x 10 Cross plate screws	4
2-30	AP1775	Laser/Motor Module	1
2-32	AP1776	Ball axis module	1
2-33	AP1493	M2.5 x 8 Cross plate screw	2
2-35	AP1777	Prism Seat Module	1
2-38	AP1493	M2.5 x 8 Cross plate screw	2

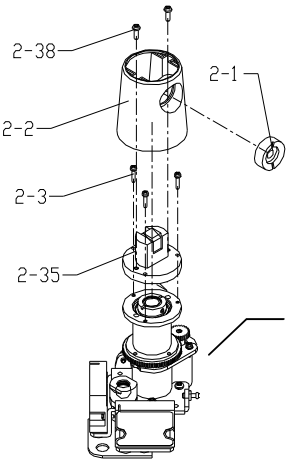


Figure 8

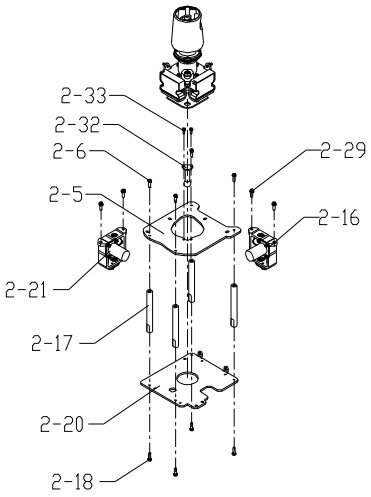
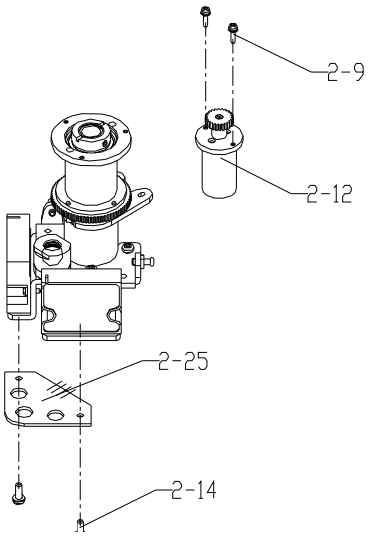


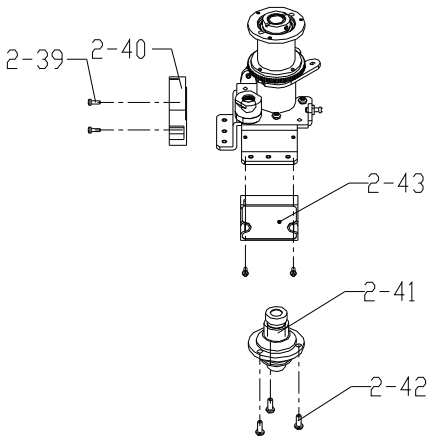
Figure 7

2.2 Laser/Moter Module Disassembly (AP1775)

Item	JLT Part #	Description	Qty
2-9	AP1491	M2 x 8 Cross plate screws	2
2-12	AP1778	Motor Module	1
2-14	AP1022	M3 x 6 Cross plate screws	2
2-25	AP1779	Alarm circuit board module	1
2-39	AP1464	M2 x 6 Cross plate screws	4
2-40	AP1780	X-direction sensor	1
2-41	AP1781	Laser assembly	1
2-42	AP1513	M3 x 8 Cross plate screws	3
2-43	AP1780	Y-direction sensor	1



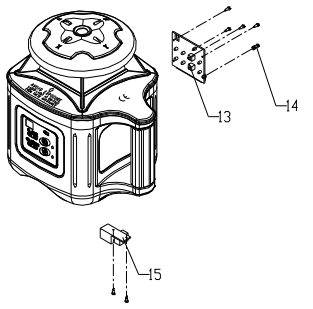
1. Using a cross screwdriver, remove the 2 crosshead plate screws M2×8(2-9#), and disassemble the motor module (2-12#)
2. Using a cross screwdriver, remove the 4 crosshead plate screws M2×6(2-39#), and disassemble the X-direction sensor (2-40#) and Y-direction sensor (2-43#)
3. Using a cross screwdriver, remove the 3 crosshead plate screws M3×8(2-42#), then the indicator parts (2-41#) could be disassembled.



2.3 Main Housing Disassembly (AP1761)

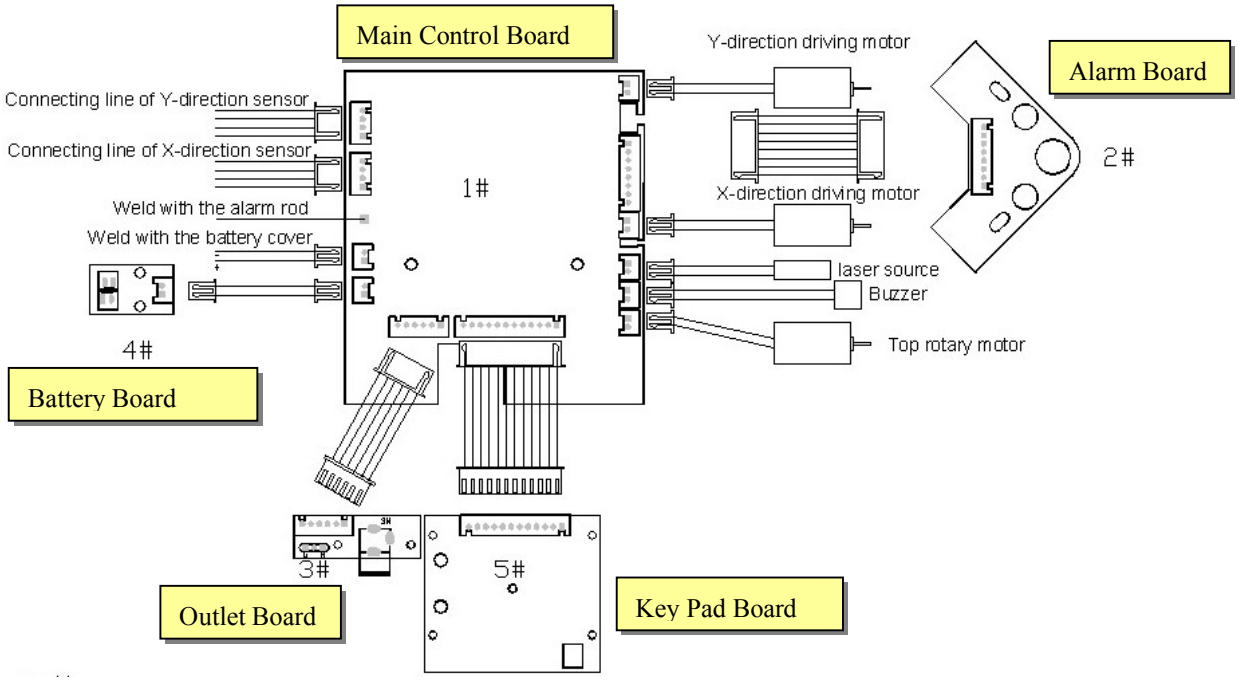
1. As shown in figure 12, using a cross screwdriver to screw off the 2pcs crosshead plate tapping screws ST2.2×6(14#), then the 4# outlet circuit board (15#) could be disassembled.
2. As shown in figure 12, using a cross screwdriver to screw off the 5pcs crosshead plate tapping screws ST2.2×6(14#), then the 5# keypad circuit board (13#) could be disassembled.

Item	JLT Part #	Description	Qty
13	AP1784	Key pad Circuit board	1
14	AP1451	ST2.2 x 6 Self Tapping Cross Plate screw	6
15	AP1782	Outlet Circuit board	1



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 40-6535. Each item discussed is shown below.

4.1 Horizontal Mode Operation

4.1.1 Quantifying Accuracy Error

4.1.2 Characterize the type of error

4.1.2.1 Oblique/Inclination Error

4.1.2.1.1 Fine calibration via Remote control

4.1.2.2 Taper/Cone Error

4.2 Alarm Adjustment

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.

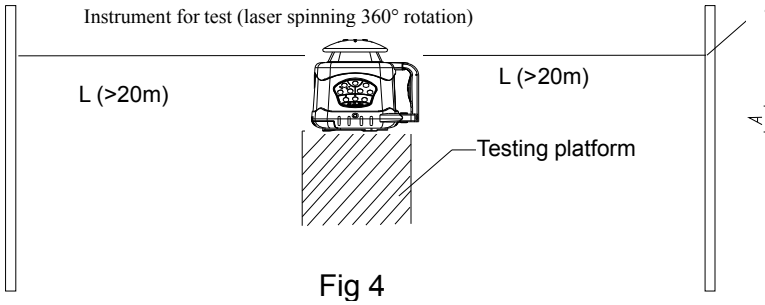
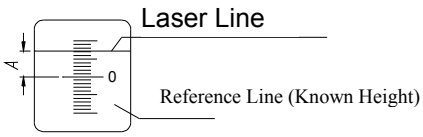


Fig 4

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.

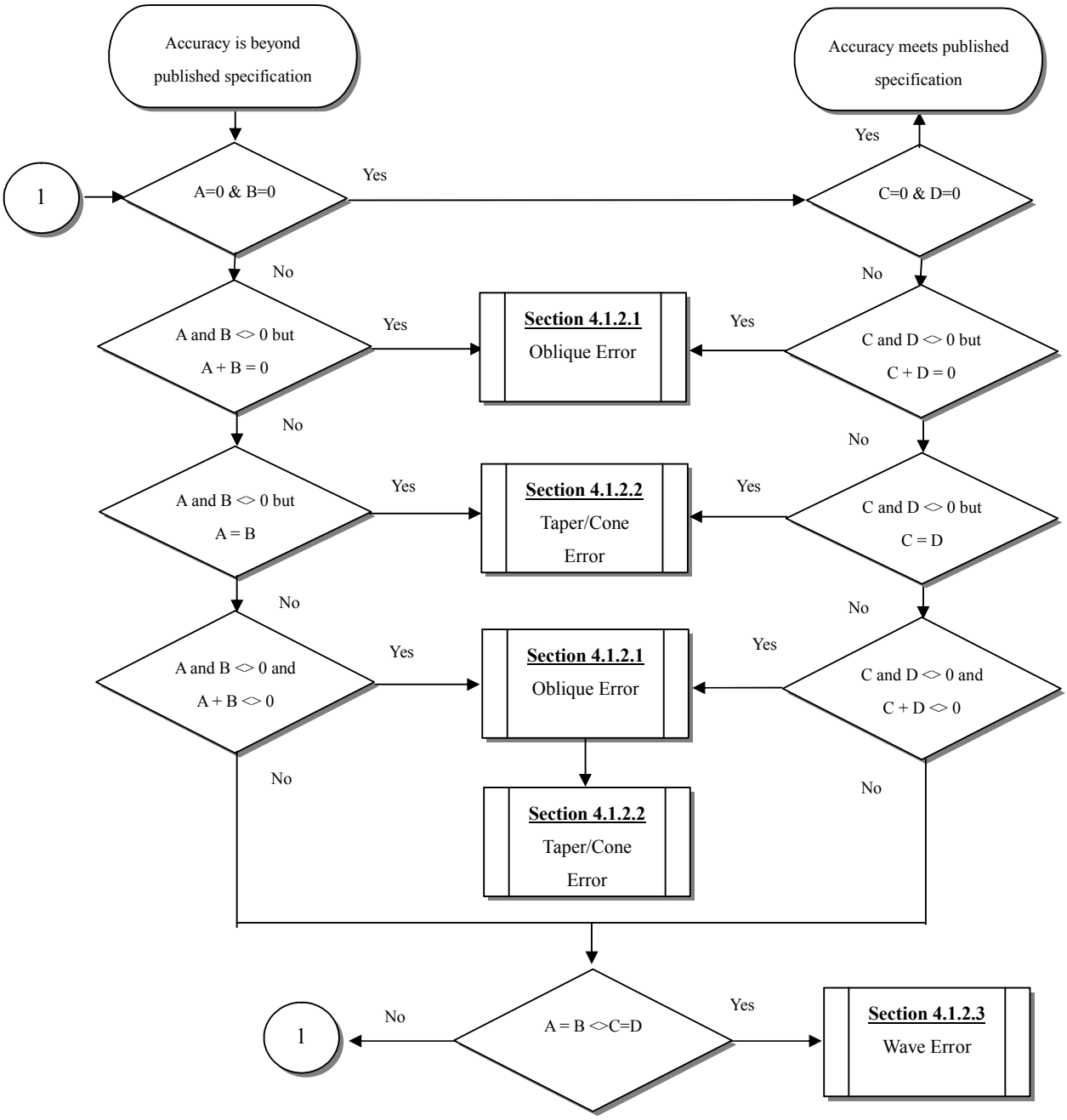


Accuracy (A) = Difference between laser line height and reference line height, divided by the distance that the laser is from the wall (L)

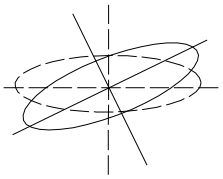
1. Place the instrument for test on the test stand (preconfigured from the illustration above) with handle facing the far target .
2. Power the laser and function in full rotation mode (head rotates 360°)
3. Note the errors in all four quadrants of the instrument as read on the far target (i.e. x axis 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



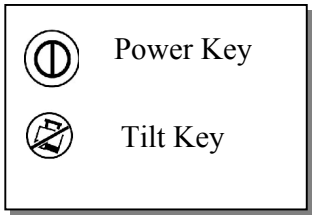
This type of error occurs when leveling compensator does not hang straight (as illustrated to the right), i.e. is not properly balanced. When the laser spins, it actually rotates on a plain that is not level, i.e. perfectly horizontal whose rotating axis is not plumb. So value A on the left target does 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. Use 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 and Y-axis (as indicated via the x and y, Calibrate 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

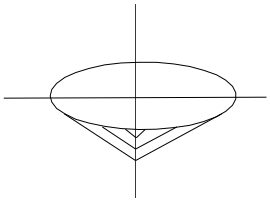
1. Place the unit into calibration mode as discussed above.
2. Position the unit so that the X axis directing to the two targets.
3. Press **"X/Y"** key on the remote control to toggle calibration control to the X-axis
4. Press the "**UP Arrow**" and "**Down Arrow**" keys, respectively to adjust the 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.

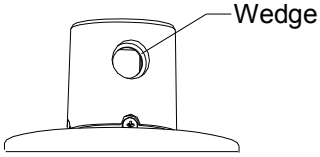


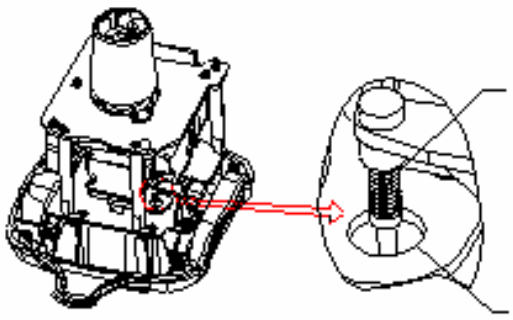
Fig 13

4.2. 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
		Damaged power adapter	Replace power adapter
		Damaged on/off switch	Key pad PCB
		Defective outlet or battery PCB	Replace outlet or battery 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 Main Control PCB
		Damaged laser diode	Send back to factory for maintenance
5	Cannot rotate Low rotating speed	Defective Main Control PCB	Replace Main Control PCB
		Loose/defective motor gear	Service motor gear
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	Unlighted panel LED	Damaged LED	Replace Keypad PCB
8	Lighted charging LED all the time (without adaptor)	Damaged charging socket	Replace Outlet PCB
9	No alarm if titled beyond tolerance	Alarm board is loose	Re-adjust the alarm board
		The connecting line of the alarm board is loose	Re-weld or replace the connecting line
		1# main circuit board is broken	Replace 1# main circuit board
10	No buzzer if titled beyond tolerance.	The beeper is broken	Replace the beeper
		1# main circuit board is broken	Replace1# main circuit board