Pro Shot L5 Service Manual

• Confidential

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Contents

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Tools & Training

Following this explanation is a list of special tools necessary to perform the procedures detailed in this manual. Where special tools made by Laser Reference are listed, equivalent substitutes may be used. The recommended repair times for each procedure are, however, based on the use of the Laser Reference special tools. The recommended repair times assume factory training or equivalent experience. Recommended repair times are listed in hours and/or decimal fractions.

The Laser Reference factory, and Laser Reference distributors, will train technicians from qualified and approved dealer service centers based on mutually acceptable advance scheduled appointments. There will be no charge for training time, but each trainee must provide his or her own transportation and living expenses.

During the term of the warranty on Laser Reference products (see warranty statement for details) Laser Reference will reimburse an approved service center for ***approved*** warranty repairs based on the repair times listed in this manual. The dollar rate of reimbursement per hour will be set by Laser Reference. Repairs may be sent directly to the distributor or to the factory for repair if the dealer is not equipped or trained to perform these operations.

Dealers who wish to become service centers must apply for approval. Please contact your distributor, or Laser Reference for further information.

Special tool list (L5):

Description:	Part No.
Laser Power Meter	50-1200
Calibration Range	
L5 Remote Power Supply, Core	

Other tools and supplies needed:

Description:
Loctite 290 or equivalent
Nyogel 773A or equivalent
Grounded soldering iron
Oscilloscope
Static-free work station

Theory of Operation

The L5 is a pendulum compensated rotary laser transmitter, which produces a level plane of light by sweeping a collimated laser beam 360 degrees. The beam is produced by a laser diode and then is collimated by passing through a lens.

The laser diode and lens are mounted inside the body of a pendulum, which is suspended at the top by a series of 3 gimbal plates. These plates have flexible elements connecting them together which are arranged to provide a nearly deflection free vertical hang throughout the travel of the pendulum. As long as the pendulum hangs vertically, the beam will also be vertical. At the bottom of the pendulum, there is a lightweight aluminum cup mounted. This cup is allowed to swing within the confines of another cup, providing travel limiting for the pendulum as well as air damping to stabilize the pendulum and settle it after vibrations. The pendulum is physically travel limited by the outer cup and also has an electronic circuit which uses capacitance changes to detect when the inner cup is in close proximity to the outer cup. The circuit can then shut off the beam before the free travel of the pendulum is stopped by contact with the outer cup.

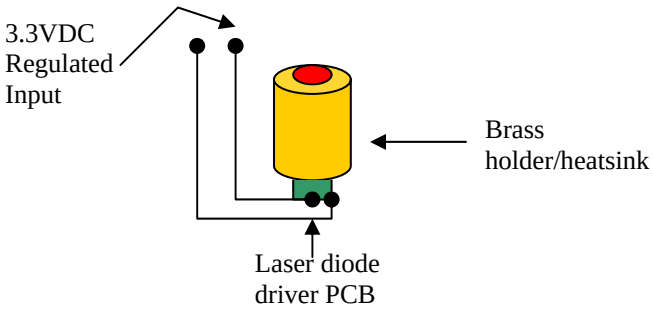
Mounted transversely through the pendulum are two headless screws. Turning these screws changes the center of gravity of the pendulum and sets the position of the pendulum so that it can be adjusted to give a truly vertical beam.

The vertical beam leaves the pendulum and is reflected into the horizontal plane by a penta prism. The penta-prism is driven by a motor to produce a sweeping beam which rotates through 360 degrees The penta prism is a special optic which has the property of allowing a certain amount of wobble in the rotating platform which holds it, without deflecting the beam. This creates a flat plane of light, regardless of bearing wear or free play. The pendulum compensator is centered in its travel by use of a circular level vial, which allows the operator to adjust the tiltable base assembly until the pendulum is centered in its travel. Using this system, the operator can have confidence that the reference plane he is using is truly level and the laser will turn off if it is disturbed beyond its ability to correct.

Optical Path Diagram 1

Laser Diode

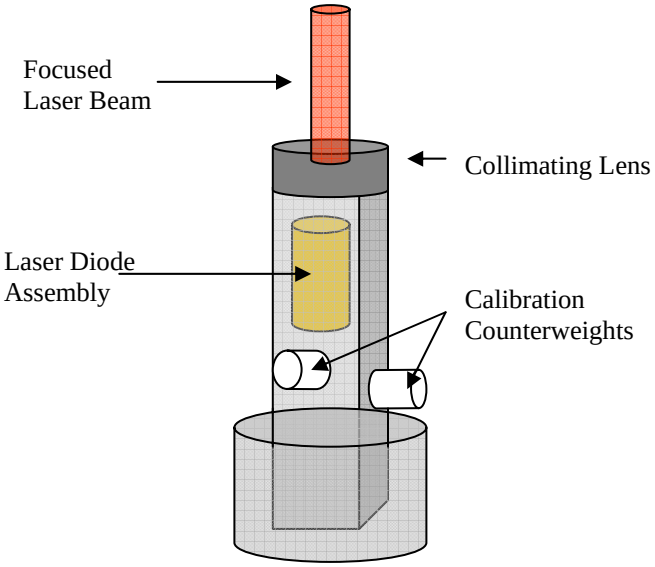
- 4.5 Milliwatts @ 635 Nanometers
- Static-sensitive
- Position within the pendulum determines beam focus



Optical Path Diagram 2

Pendulum Module

- Focused and rolled
- Angle of the hanging pendulum determines the accuracy of the laser plane
- Calibration is adjusted by threading in or threading out the counterweights for both axes

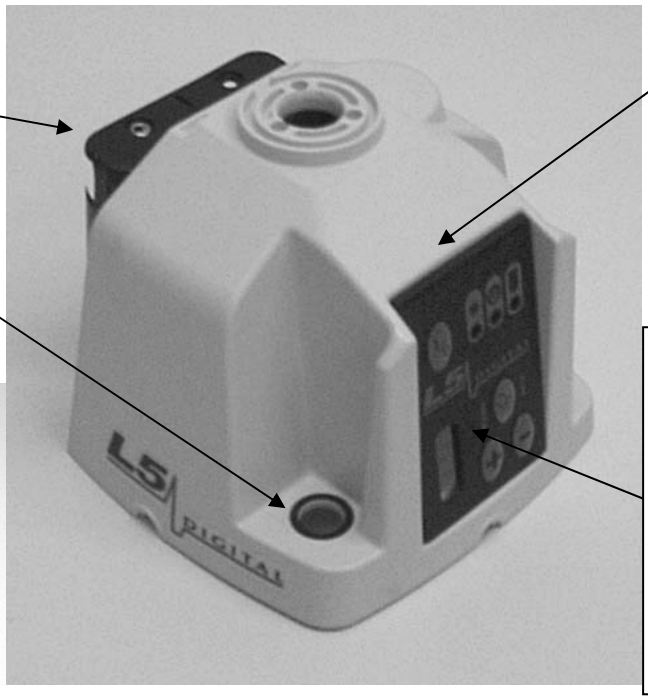


Part Identification L5 Assembled

Part Identification L5 Old Style Housing Assembly (Outer View)

080-5500 Battery Holder, incl. Wiring Harness & Charging Jack

Vial Window 060-3333

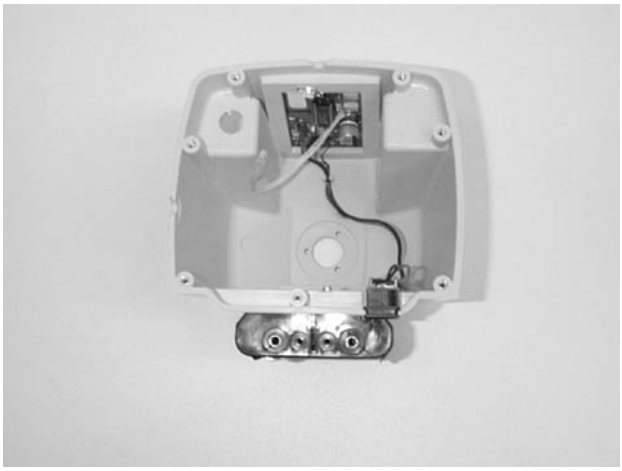


Control Panel Keypad (rubber label) 080-3550

Control Panel-PCB Assembly 800-0200 (Includes PCB, Control Panel Keypad, Adhesive Layer 080-3560, clear window 080-3500). Located under Keypad

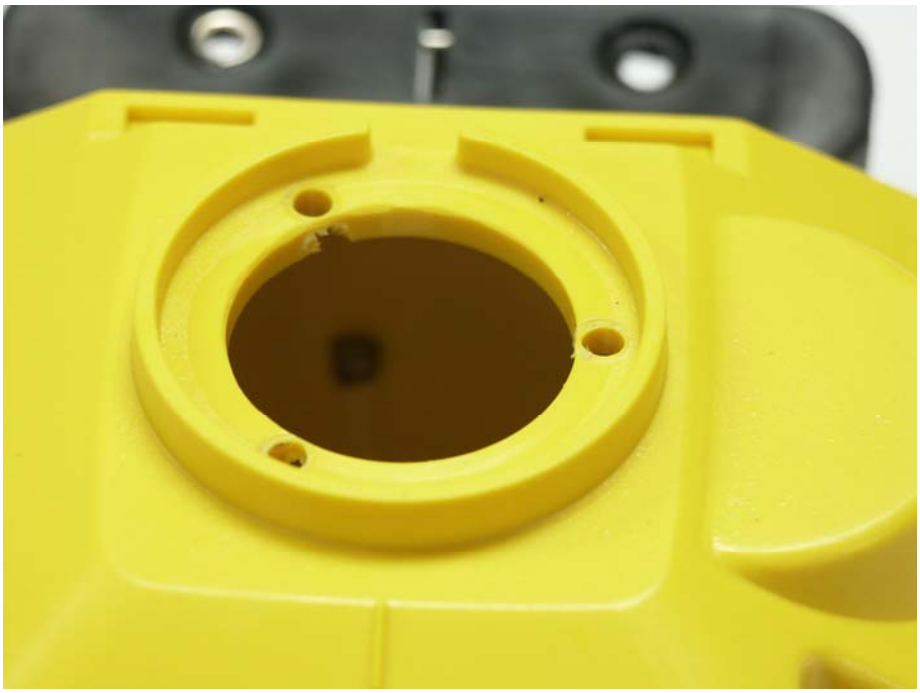
080-6025 Battery Door

L5 Housing Assembly
Includes all items shown <u>except Control Panel PCB.</u>
080-0850



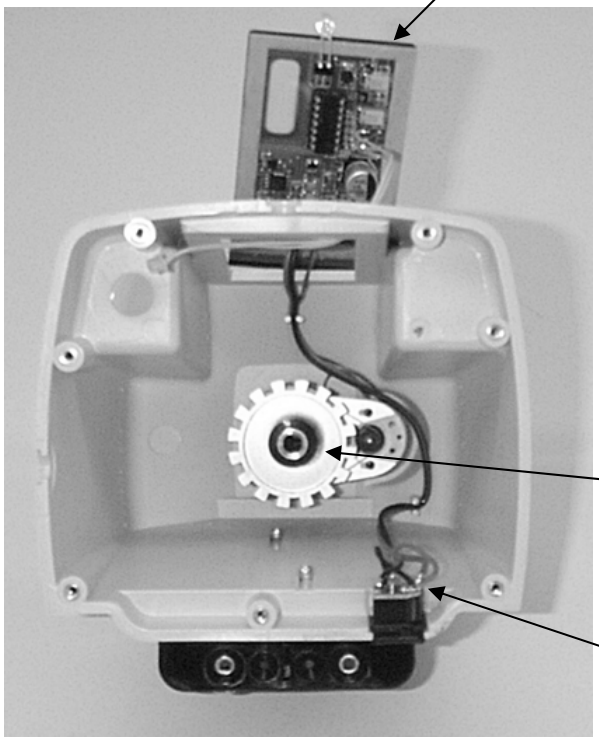
L5 Housing Assembly Inside View 800-0300 (Control Panel PCB not included)

New Style Housing



New style housing with new style bearing shell

Part Identification Housing Interior Old Style



Adhesive Layer
080-3560

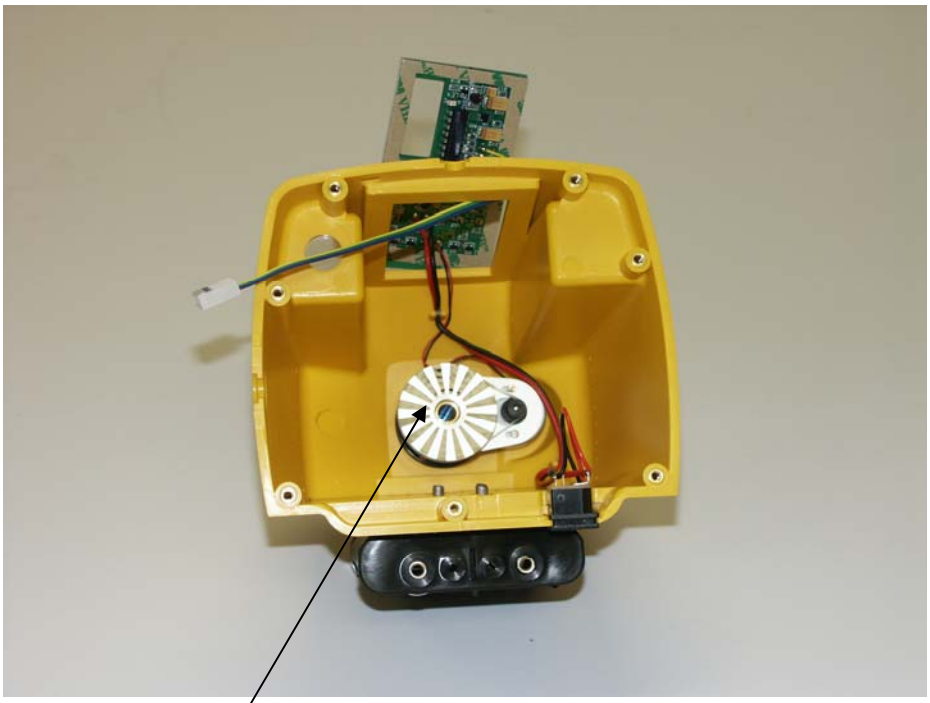
Old style Driven Pulley
080-2710

Changeover from old style pulley to new style occurred at serial number X015450.

080-5500 Battery Holder, incl. Wiring Harness & Charging Jack

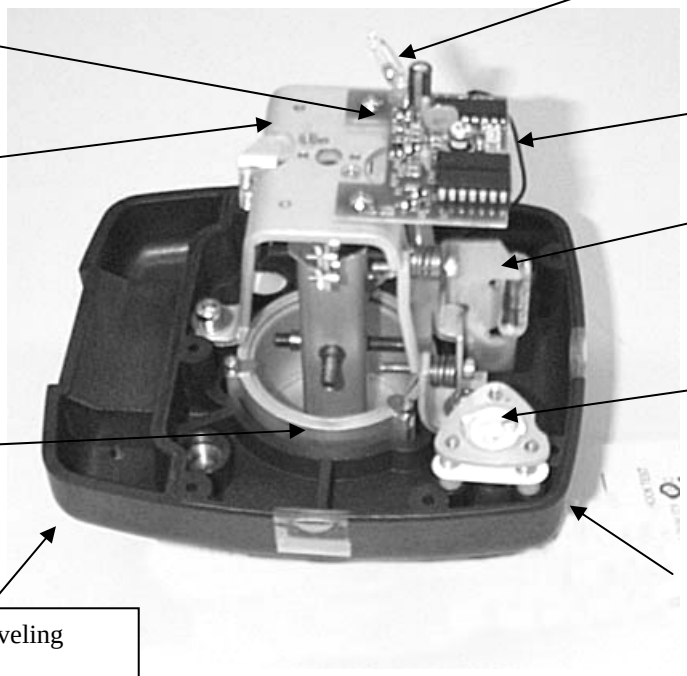
Internal Housing New Style

Changeover from old style pulley to new style occurred at serial number X015450.



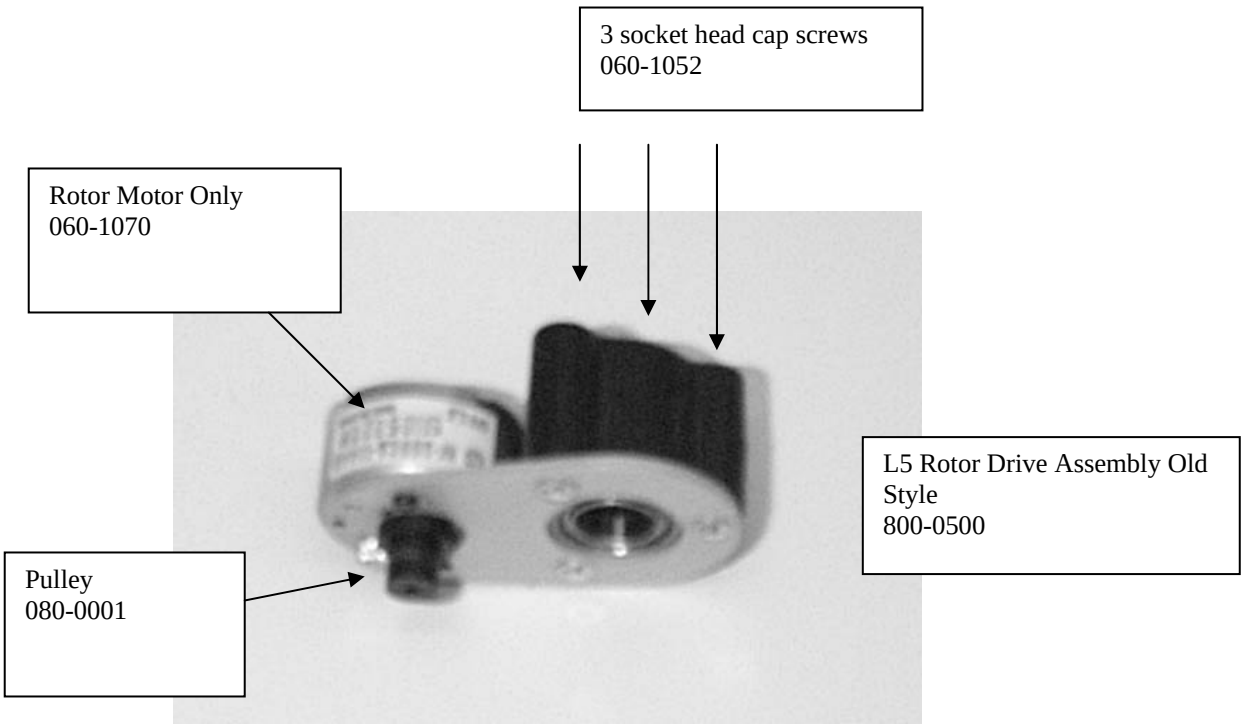
Note new style pulley and label. Alternating silver and black bands of the label are read optically to control scanning beam range and operation.

Part Identification L5 Internals

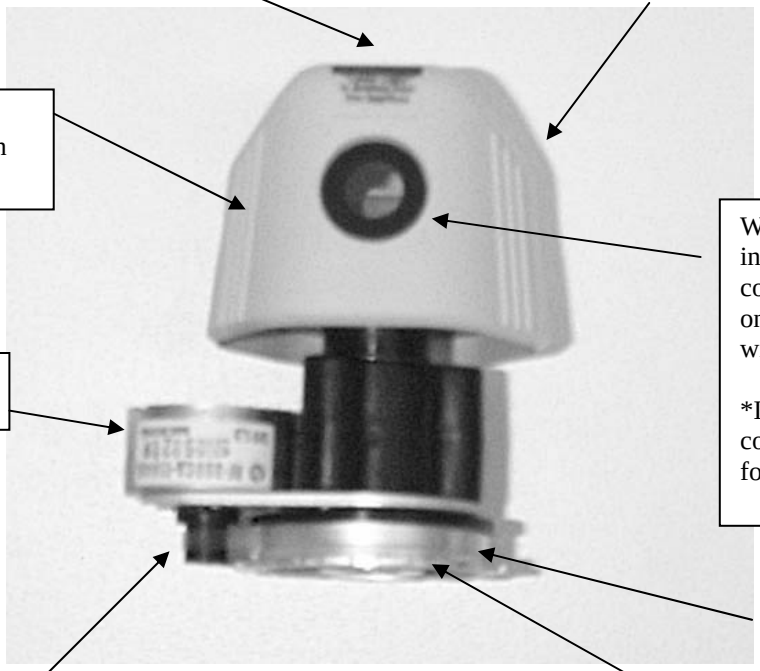


L5 Internals
080-0500

Part Identification Rotor Drive Assembly



Part Identification Rotor Drive System



Window, Glass, Output, Inspected 080-3331 for plumb spot

Rotor Assembly, incl cap, penta, shaft, label 080-0210

Rotor Cap with Windows & Caution Label 051-2400

Window, Glass Output, inspected, 080-3331, (also covers plumb beam output on top of rotor.) Glued in with clear RTV

*If plastic window is used, contact service department for repair procedure.

Motor Only 060-1070

Rotor Drive Belt 060-1047

Rotor Drive Pulley
This part is pressed on to the motor shaft. It is not available separately and will come installed on a motor.

Driven Pulley 080-2700

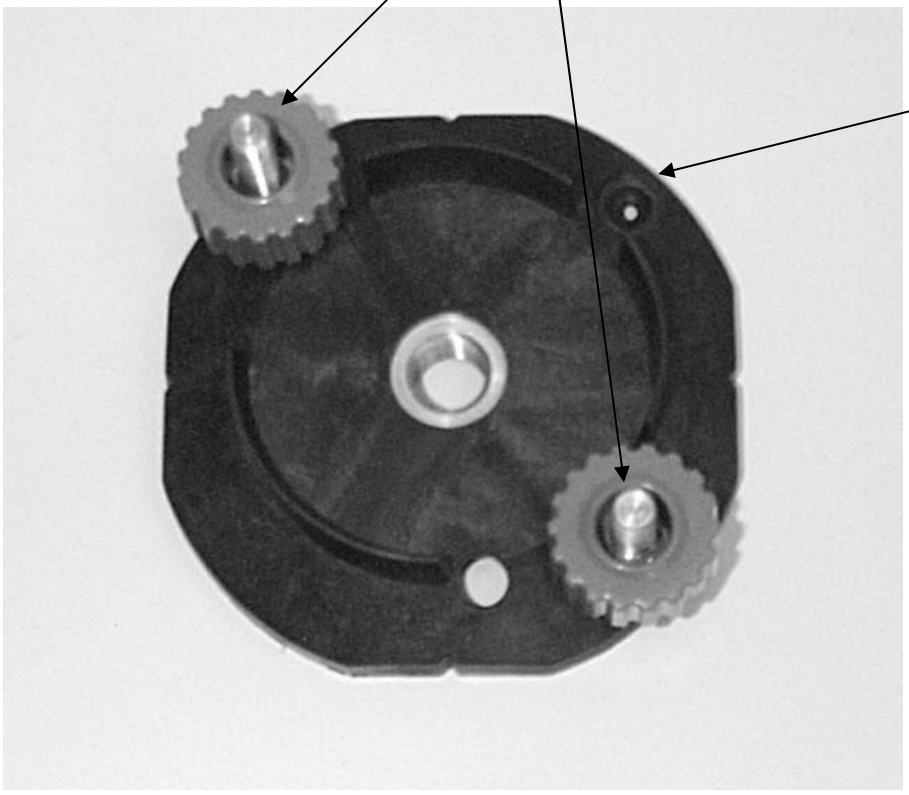
Flange Plate 080-2710

Customer must specify between old and new rotor assembly when ordering this part.

New Style Rotor, Note Rotor Shaft has a snap ring and is made of brass.

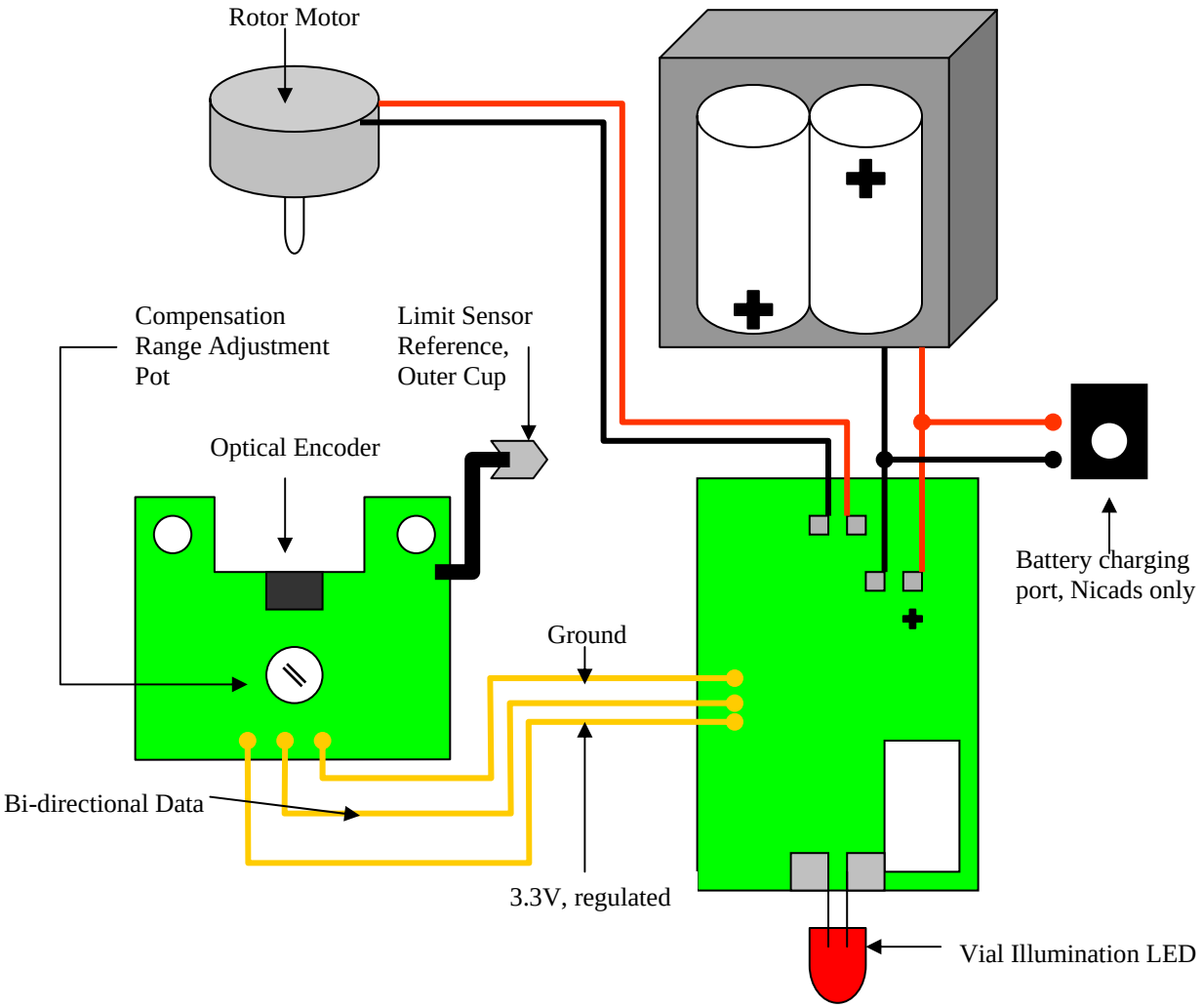
New L5 Rotor Assembly part number 080-0210. Rotor assembly includes rotor cap, windows, penta prism, and rotor shaft. Pulley is not included.

Part Identification Leveling Base Assembly



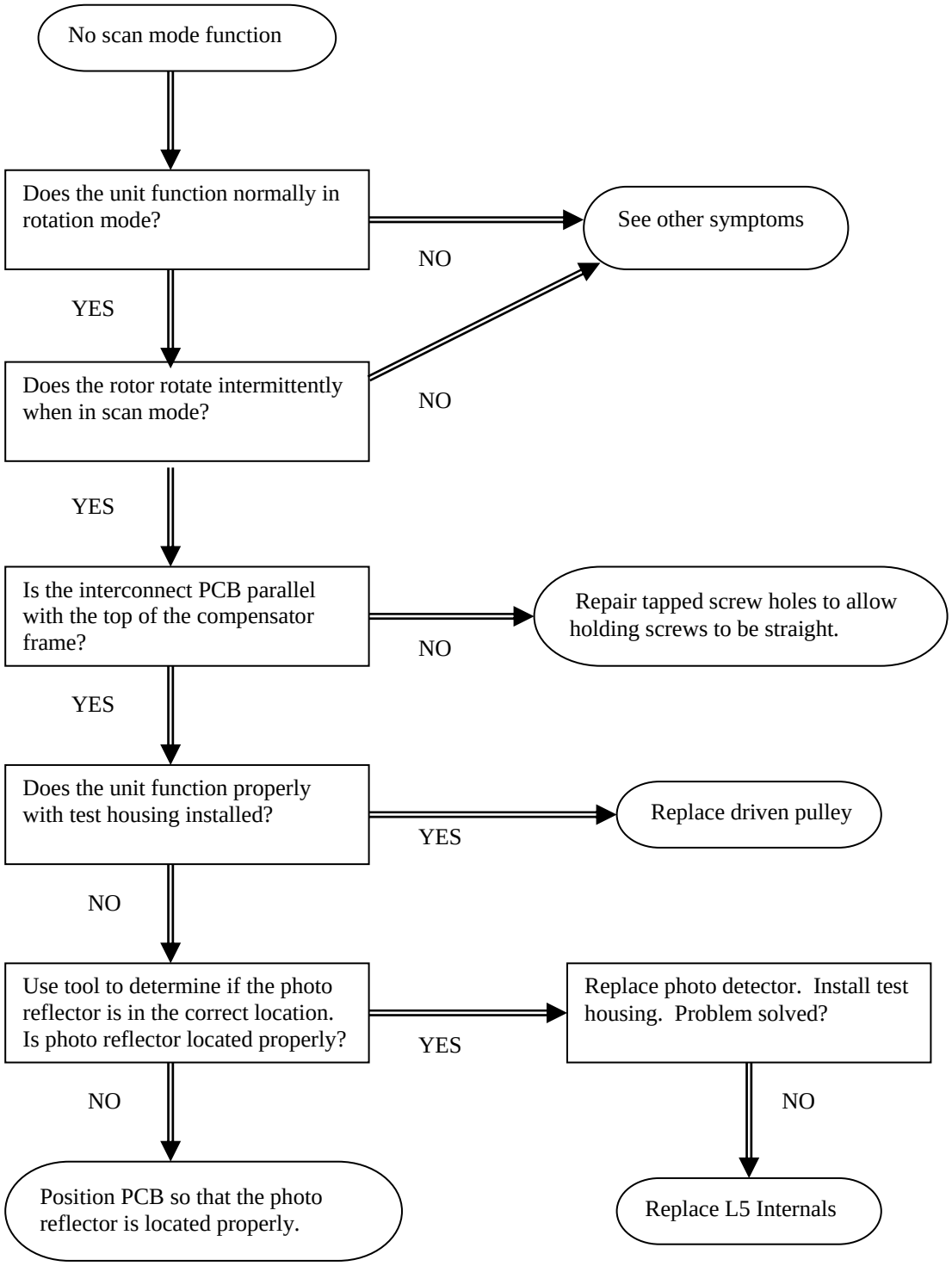
Leveling Base Assembly
Wi Base Pan 080-0777

L5 Wiring Diagram



Troubleshooting Guide

No Scan Mode Function



Known Issues

Power Switch

Symptoms: Laser powers on as soon as batteries are inserted, cannot be turned off. In some instances, the laser will not power on, even with good batteries. The dome switches were being damaged by our vendor who was stuffing the PCB, and could fail in the field even after our in house inspections. We have since begun to install the switches ourselves in order to avoid damaging the switches. There will be a redesign of the PCB so that we can utilize a different switch. If you run into this problem, replace the PCB and return the defective item to us with a warranty claim form.

Connector from Housing to Interface PC Board

Symptoms: Penta Mirror rotates but there is no beam, malfunction of speed control, scan mode, and compensator limits. If either of the two outside wires lose contact, the laser will rotate, but there will be no beam. If the middle wire loses contact, speed control, scan mode, and compensator limits will malfunction. Check the connector for continuity and replace if necessary.

Rotation Slows

Symptom: Laser rotation slows without anyone touching speed controls. The LED used to illuminate the level vials was pulling voltage to the PCB down to the point where noise in the circuit would result in a slow down. The first part of the solution was to wire a resistor in line with the LED to reduce the amount of voltage pull down occurring. This has been integrated into the latest PCB’s. There is also new software designed to prevent the unwanted slowing from occurring.

Repair Procedures

Replace Leveling Base .25 hrs.

1. Remove exiting leveling base assembly.
   a) Remove the screw and 0-ring at the pivot point.
   b) Unscrew both leveling screws from the base pan.
   c) Remove any excess grease or brass shaving.
2. Install new leveling base assembly
   a) Apply a small amount of grease to the threads of the leveling screws and thread them into the base pan. *Orient the base assembly so the ball of the base pan seats in the socket of the base.
   b) Replace the screw and o-ring at the pivot point. *Do Not Over tighten!

Replace Rotor Output Window .25 hrs.

1. Because the output window is actually part of the optical path that corrects cone error, observe the following procedure for its replacement.
2. Set the laser up on a stable tripod approximately 50 feet away from a target surface, level the unit, and turn it on.
3. Stop the rotation and point the beam at the target surface. Mark the beam center.
4. Remove the old window. With the window removed, the beam will probably be a bit above or below the mark. Take a new window and rotate it in the beam path just in front of the rotor output hole until the beam hits the mark on the target. The amount of wedge that a window provides can vary, so you may have to try different windows.
5. Taking care not to rotate the new window, press it into its place in the rotor head. Check to make sure that the beam is still centered upon the mark on the target.

Replace Rotor Drive Assembly .25 hrs.

1. Remove the rotor drive assembly.
   a) Remove housing from base pan. (See replace housing assembly procedure for details.)
   b) Reach into the housing, with a gloved hand, and hold the driven pulley while rotating the rotor assembly counter clockwise.
   c) Lift the rotor from the housing and collect the driven pulley components.
   d) Using a 3/32” hex driver, remove the 3 socket head cap screws that attach the rotor drive assembly to the inside of the housing.
   e) Desolder the motor leads from the control panel PCB.
2. Replace rotor drive assembly
   a) Install the new rotor drive assembly in the correct orientation. *Note: be sure not to overtighten the 3 socket head cap screws, use fingertips on a hex driver.
   b) Install rotor assembly
   c) Slide the shaft of the rotor through the bearings and motor plate.
   d) Place the spacer disk on the shaft with the step toward the motor plate.
   e) Thread the driven pulley onto the rotor shaft and tighten with a gloved hand.
   f) Install the rotor drive belt and adjust tension. (See rotor drive belt tension adjustment procedure.)
3. Attach housing to base pan.

Rotor Drive Belt Tension and Adjustment .25 hrs.

1. Set rotor to fastest speed.
2. Set belt to loosest setting by loosening the motor holding screws and sliding the motor toward the driven pulley.
3. When belt tension is properly set, if the rotor is held and stopped when the laser is set to full speed, the motor pulley should slow but continue to turn. It is very important to set belt tension properly. If the belt is too tight, scan mode may not function properly and current draw will be very high leading to short battery life.

Replace the Internals Assembly .75 hrs.

1. Remove the housing using a 3/32" hex driver to remove the 7 socket head cap screws that attach the housing assembly to the base pan. * Carefully lift the housing assembly from the base pan and detach the 3 wire harness from the interconnect PCB.
2. Remove the base assembly from the faulty internals and install it on the new internals (see replace leveling base procedure for details).
3. Inspect new internals assembly for loose particles and cleanliness.
4. Replace the housing assembly using a 3/32" hex driver to install the 7 socket head screws. * Tighten the screws in an alternating pattern to ensure an even seat of the housing and pan.
5. *Note that the bullseye vial may need to be adjusted slightly. (See check and adjust bullseye vial procedure.)

Check and Adjust Bullseye Vial Procedure .25 hrs.

*Note the laser beam should be on when the bubble within the bullseye vial is centered. If the beam is off and the out of level indicator is flashing, the bullseye vial must be adjusted.

1. Use both leveling screws to determine how far, and which direction, the bullseye vial is off.
    a) Watch the bubble move across the vial while observing when the beam turns on. Stop when the beam appears.
2. Adjust the bullseye vial.
    a) Using the 3 bullseye vial adjustment screws, adjust the vial until the bubble appears centered within the vial.
3. Check and adjust the limits and range of the compensator.
    a) Use both leveling screws to determine where the beam turns off on both sides of both axes.

*Note: the beam should turn off when the bubble appears to straddle the ring of the vial. Small adjustments of the bullseye vial screws may be required to center the bubble within the compensator's range.

Replace Control Panel PCB Assembly (800-0200) .25 hrs.

1. Remove the housing from the base pan.
    a) Using a 3/32" hex driver, remove the 7 socket head cap screws that attach the housing to the pan.
    b) Carefully lift the housing from the base pan and detach the 3 wire harness from the interconnect PCB.
2. Remove the control panel PCB.
    a) Use a straight blade X-Acto knife to carefully pry the control panel away from the housing.
    *Note: The circuit board is adhered to the housing with a thin layer of adhesive.
    b) De-solder the wires coming from the battery holder and rotor motor.
3. Prepare the housing surface for new adhesive by cleaning the housing with alcohol.
4. Solder the wires from the battery holder and rotor motor to the new control panel PCB assembly.
5. Install the new control panel PCB assembly.
    a) Remove the adhesive layer backing tape and carefully place the control panel against the housing.
    b) Firmly press the perimeter of the control panel against the housing to ensure a complete seal and a secure installation.
6. Replace Housing.
    a) Inset the 3 wire harness connector into the interconnect PCB with the correct orientation.
    b) Carefully lower the housing onto the base pan.
    c) Using a 3/32" hex driver, install and secure the 7 socket head cap screws that hold the housing against the base pan. *Note: tighten the screws in a crisscross pattern.

Adjusting the L5 vertical vial .25 hrs.

1. Turn the laser on its side into its vertical mode.
2. Hang a plumb line that can be used as a reference. The plumb line must be positioned so that it lines up with the path of the rotating beam.
3. Using the two leveling screws, adjust the laser so that the rotating beam travels in line with the plumb line. Note the position of the vertical vial bubble. If it is not centered, note how far out of center it is, and the direction it needs to move to be centered.

4. Remove the front calibration plug. Insert allen calibration tool and adjust bubble to center. **Note, older models required removal of housing to enable vertical vial adjustment. Housing can be modified by drilling a hole and insertion of a calibration plug. Check with factory for hole dimensions and placement.**
5. Replace the calibration plug.

Laser Diode Replacement 1 hr.

Procedure for replacing the pendulum frame on the Proshot l5

1. Remove the laser housing and set aside. (7 screws)
2. Secure the base plate to a tripod or other secure mounting platform.
3. Loosen the three screws holding the cup retainer tabs and rotate the tabs out of the way.
4. Remove the three 10-32 screws holding the pendulum frame to the base pan and lift out the frame and pendulum.
5. Place the new pendulum assembly into position and loosly install the 10-32 screws and washers. Rotate the retainer tabs into place and tighten the screws.
6. Level the unit using the leveling screws so the circular bubble is centered.
7. Plug the housing to the cable so the unit can power up. Do not install the housing, prop the housing close by.
8. Push the power button to turn on the unit.
9. Making sure the bubble is still centered, move the frame until the inner cup is visually centered inside the outer cup. Tighten the 3 10-32 screws.
10. Check the unit's operating range. The beam and rotation should shut off when the bubble is the same distance out of center front and back, right and left. If the range is out of balance with respect to the bubble, loosen the screws again and re-adjust the frame until a rough balance is achieved.
11. Adjust the operation range so that the beam shuts off when the bubble is approx. 1/3 out of the circle using the potentiometer on the board on top of the frame. Turning the pot left makes the range smaller, right larger. Be careful that the beam shuts off before the inner cup contacts the outer cup.
12. Install the housing using the 7 4-40 screws. Make sure the o-ring is in position.
13. Rough calibrate the unit in both axes.
14. Fine adjust the bubble by minutely turning the 3 phillips head screws under the base, directly below the bubble. This adjustment is for small fine tuning and must not be used for gross adjustment, or the squaring of the penta mirror will be lost, resulting in plane errors.
15. Finish calibrating the laser and check that the unit compensates correctly at the limits of the bubble range. (less than 20 second error at the limits).
16. Calibrate the vertical vial; mount the unit horizontally. Remove the plug at the lower left corner of the control panel. Adjust the leveling screws so the plumb spot beam is level. Reach into the calibration port and adjust the vial so the bubble is centered.
17. Re-install the calibration plugs and test the unit for proper operation.

Squaring Procedure

1 Remove the laser main housing.
2 Mount the laser to a stand securely.
3 Level the gasket surface of the base pan in both axes using a torpedo level as a reference.
4 Reach through the 3 holes under the base pan provided for adjustment of the circular bubble and set it for level. do not disturb the leveling screws.
5 Plug in the housing and check the leveling range of the compensator. If the range is out of center compared to the circular bubble by more than ½ of the bubble's travel, the frame must be moved to re-center it.
6 Center the bubble using the laser leveling knobs. Visually inspect for inner cup centering inside the outer cup. Loosen the 3 screws holding the frame down to the base pan and slide the frame to a position where the inner cup is centered. Tighten the 3 screws and recheck the compensation range.

7 Re-install the housing and check the compensation range compared to the bubble travel. If the bubble is out of center but within the circle when the range is centered, adjust the bubble to match the compensator range. The bubble can be brought to center with the adjustment screws without causing unacceptable squaring errors.

Notes: