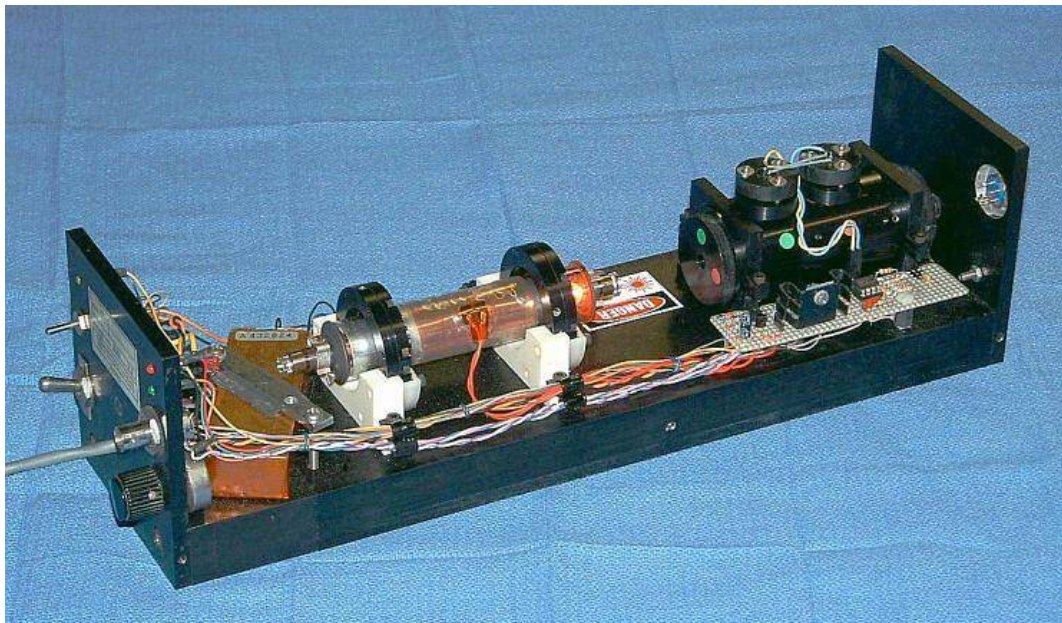




SL-1 Stabilized HeNe Laser Operation Manual

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SL-1 Stabilized HeNe Laser (shown with original ugly cover removed)

WARNING: Do not stare into beam as you may get a neck cramp. ☺

WARNING: High voltage is present on the HeNe laser tube anode. If contacted, the fried flesh will probably smell worse than it feels.

CAUTION: All user serviceable parts are inside.

Optical Specifications

Output Wavelength:	632.81644 nm (according to the Laser FAQ)
Output Power:	>0.4 mW (vertical), >0.2 mW (horizontal)
Beam Dimension:	0.5 mm somewhere near the end of the tube
Far-Field Divergence:	1.70 mR based on theory
Transverse Mode:	TEM00 sort of

Stabilization Characteristics

Frequency Stability (1 μ s to 8 yrs):	TBD
Power Stability (1 μ s to 8 yrs):	TBD
Frequency Offset:	+/-375 MHz (give or take a few dozen MHz)
Temperature Dependence:	Unknown
Time to Lock:	<15 minutes.

General

- **Power input** (gray cable): Wire with clear insulation is +12 VDC (+/-5%), about 1.5 amps max. Black and shield are return. Shield is attached to case. The unit is reverse polarity protected (BIG diode across the input) but your power supply might not like it if hooked up backwards! There is a 2 amp fuse to protect the system. A spare fuse is included taped to the HeNe laser power supply.
- **Weight:** Enough to be painful if you drop it on your foot (which is not covered by the warranty).
- **Size:** Same as Laseangle RB-1 laser head except for controls in rear.
- **Mounting:** Rubber feet have been salvaged from Laseangle controller box, which made shipping the piece of junk across the country well worthwhile.

Controls and connectors (rear panel)



SL-1 Rear Panel Showing Controls, Indicators, (and tail). The user is responsible for labeling.

Main power (large toggle switch, size determined by existing hole).

Laser Operation (small toggle switch. This really should have been called Laser Mode but that might be confusing):

- **Preheat** (down). Tube heater is on at about 2/3rds power.
- **Heater Off** (center).
- **Lock** (up). Feedback loop is closed. Laser will lock if the tube is within locking temperature range.

Tuning Adjust (knob): Approximately +/-45 degree rotation moves the set-point by at least +/-375 MHz. This control normally should be approximately centered.

Tuning input (BNC): Estimated sensitivity is about 75 MHz/V.

Important: Input signal **MUST** either be isolated from the power supply ground or

applied single-ended with reference to about 5.8 V. Thus, for the latter, an input of 5.8 V with respect to power supply ground will result in zero frequency offset.

Normally the BNC should be left unconnected (Its main purpose is to fill the pre-existing hole).

Connector (front panel)

Blue connector. Unassigned and nothing is attached! I assume a more common connector would be added here to monitor some signals like the mode voltage or heater drive. This is left as an exercise for the student or faculty. ☺

Indicators (rear panel)

Heater power: Yellow LED, brightness is proportional to heater voltage.

Mode Display:

Horizontally polarized mode: Red LED.

Vertically polarized mode: Green LED.

Note that the mode LEDs do not actually represent the power in each mode but are more related to the ratio of the mode power since they are a function of the single electrical signal derived from the photodiodes. Thus, if the beam to the photodiodes is blocked, both LEDs will be on at partial brightness.

Initial Inspection

Check for obvious damage. Nothing should rattle. If there is a significant rattle, that's probably bad. ☹ The system was carefully packed and drop-shipped direct to you from the carrier's 737 at cruising altitude (definitely a time saver!). So this should not have happened. It's not our fault if they didn't use a parachute.

Installation

Place the SL-1 on a solid surface. The foam it came packed in is not a solid surface.

Attach the power wires (the tail coming out the back of the laser) to a suitable power supply. If you get it backwards, your power supply will probably be destroyed but the laser won't even know. For this reason, using a car battery as the power source is not recommended since car batteries may fail rather explosively if shorted out making a terrible mess.

Operation

Startup

The following assumes the cover is in place in a physics lab environment where humans can survive. The warmup time may change if this is done with the cover removed and you're outside in typical Florida climate conditions.

1. Turn power on, set the Laser Operation switch to Preheat, and set the Tuning knob to approximately its center position.
 - The laser tube should come on almost immediately with a beam exiting the front of case (remove shutter/plug since the beam doesn't have enough power to drill through it).
 - The yellow Heater LED should be on at near full brightness.
 - The red and green mode LEDs should begin to vary in intensity as the tube warms up. If a polarizer is placed in the output beam, the polarizations corresponding to the vertical (green) and horizontal (red) modes should be evident.

Note: Due to the asymmetry of the beam sampler, the horizontally polarized mode exiting the laser is about half the intensity of the vertical mode. Learn to live with it.

2. After about 10 to 15 minutes, the Laser Operation switch may be flipped to Lock.
 - The easiest test to determine when the system is ready to lock is to time a complete mode cycle (red-green-red). Once a complete cycle takes more than about 30 seconds, the system should lock. With the cover in place, it requires about 12 minutes to be ready in my sub-arctic non-temperature controlled lab (about 62.375 degrees F).
 - After switching to Lock, the mode changes should cease within one mode cycle and the heater LED will then gradually settle down at partial brightness indicating that the feedback loop is regulating. This may take 10 to 20 seconds.
 - If the tube is not warm enough, the heater LED may be off.
 - If the tube is too hot, the heater LED may be on full (even brighter than when in Preheat).

If either of these conditions occurs, the laser will either not be locked at all as indicated by the mode changes continuing, or on the borderline of stability. Take the appropriate action: Let it heat or cool (Laser Operation switch to Preheat or Off) for a couple of minutes as appropriate and then try again.

The desired situation is for the heater LED to be at approximately half brightness when locked. If a thermally tight cover is in place, it will gradually decrease as the ambient temperature inside the enclosure increases. Hopefully, this situation will be remedied prior to meltdown.

3. Once the laser has locked as indicated by the Heater LED being partially on and the Mode LEDs brightness not changing, the Tuning knob can be used to move the set-point around on the neon gain curve. Turn it very slowly as there is some overshoot. Watch the Mode LEDs to see where it is going. If it is turned too far or too fast, the system will lose lock. Centering it should re-acquire lock as long as the tube's temperature is within an acceptable range.

A voltage offset may also be introduced to the Tuning Input subject to the caution note above. This too should vary only very slowly. In keeping with our high standards of quality control, the Tuning Input has not been tested at the factory.

Shutdown

The system may be turned off in any order but recommend switching Laser Operation to “Off” and then killing power.

Notes

1. Have fun. ☺
2. I don't recommend leaving the thing unattended for long periods of time when locked, at least not until you become familiar with any quirks it may have. I don't think anything will melt down but if for some reason it loses lock and decides to turn the heater on full, it could get quite warm inside, maybe.
3. The heatsink does run warm. That's normal. But, do contact technical support if it starts glowing on its own. The only thing that should glow under normal operating conditions is the laser tube.
4. There is a piece of an adjustable power resistor mounted inside to limit current to the tube heater. Its location will be obvious when you remove the cover. The factory default setting is at about 7 ohms. This results in approximately half the maximum possible power to the heater and reduces overall heat production but also increases the time to lock and reduces the operating temperature range. Lowering the resistance to, say, 3 ohms might be desirable but I really have no idea. Failing to adjust this resistor may void the warranty.

Unconditional Conditional Warranty

Standard coverage: This fine system is guaranteed to be free of unspecified defects in materials and workmanship (excluding the ugly cover), and to function as listed in the specifications until 90 photons have come out of the front of the laser or for 90 days from ship date, whichever comes first. Liability is limited to replacement of photon supply or touchup of selected portions of the cover paint job. An optional extended warranty is available which provides for better color matching of the cover paint.

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