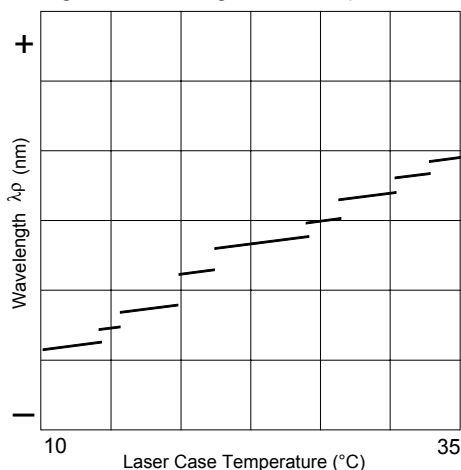


Model "PPM" LASER DIODE OEM SYSTEM INSTRUCTIONS

Introduction

Temperature plays an important role with diode lasers. Wavelength, power, beam amplitude, noise, modal structure, coherence length, and laser lifetime can all be affected by temperature. The Laser Diode OEM Systems that are designed to actively control temperature do so through the incorporation of a built-in Peltier Junction and fan. The Peltier is bi-polar and can therefore be used to heat or cool the laser.

Fig. 1 Wavelength vs. Temperature



The ability to control temperature allows you to manipulate, stabilize, and maintain the total operating and spectral characteristics of the laser. For the full implications of this control and how you can use it, see the appropriate "Application Notes".

As you can see in Fig. 1, the wavelength will change dramatically, as well as the spectral quality of the laser, as the temperature changes. The blank areas between each step indicate areas during the mode change where the system produces unstable lasing and minimal coherence. There are no values or lasers identified in this graph because each laser will have individual and distinct lasing parameters and the position and size of each step will vary with drive current and differ from diode to diode.

Operating Notes

The System can operate in either a constant drive current or a constant optical output power mode. The control circuitry automatically switches modes as necessary so that neither the current nor the power ever exceeds the set values. If the current and power controls have been previously set for the laser diode, then the current and power will ramp up to the set values when power is connected.

Caution: If the power and current controls have not been previously set, then they should be set to zero (12 turns counterclockwise) before connecting power.

The controls for these two modes can either be mechanical or can also be by digital control, if that option was ordered. The optical power of the laser diode OEM system is monitored and adjusted using the signal current feedback from the laser's back facet monitor diode. The system can only operate in one mode at a time. The control that is closest to minimum (counterclockwise) is the mode that is in operation.

You can operate the laser at a constant temperature between 5°C to 30°C¹ or you can vary the temperature anywhere in this range. Protection circuitry in the System will safeguard the laser diode from turn-on and turn-off transients.

Caution: If you are operating the system in the constant current mode, you need to understand the implications of the temperature and laser power correlation. As temperature decreases the laser power increases. Therefore, the laser's current rating decreases. So, the current rating which was set for 25°C is no longer true for the required output power. The laser gets more than the required current. If it goes beyond a certain limit there is a chance for laser burn out. To avoid this outcome when you are operating the laser below 25°C, start with the current setting at its minimum (12 turns counterclockwise), set the temperature, and then increase the current, while monitoring optical power, up to the maximum power output rating of the System.

There are five 12-turn potentiometers built into the system to adjust or change the control parameters. The seven pin connector provides the analog outputs for monitoring the laser diode current, photodiode



current, and laser case temperature. These pins also allow the user to set the low and high temperature point at which the laser shuts off. The pins can either be connected individually to a DVM or they can be connected to an A/D converter. You must remove the plate on the side of the system for access to these controls. See Fig. 2 for identification and location of the controls and the connector pins. The description of the controls is given below.

Fig. 2 Module Controls

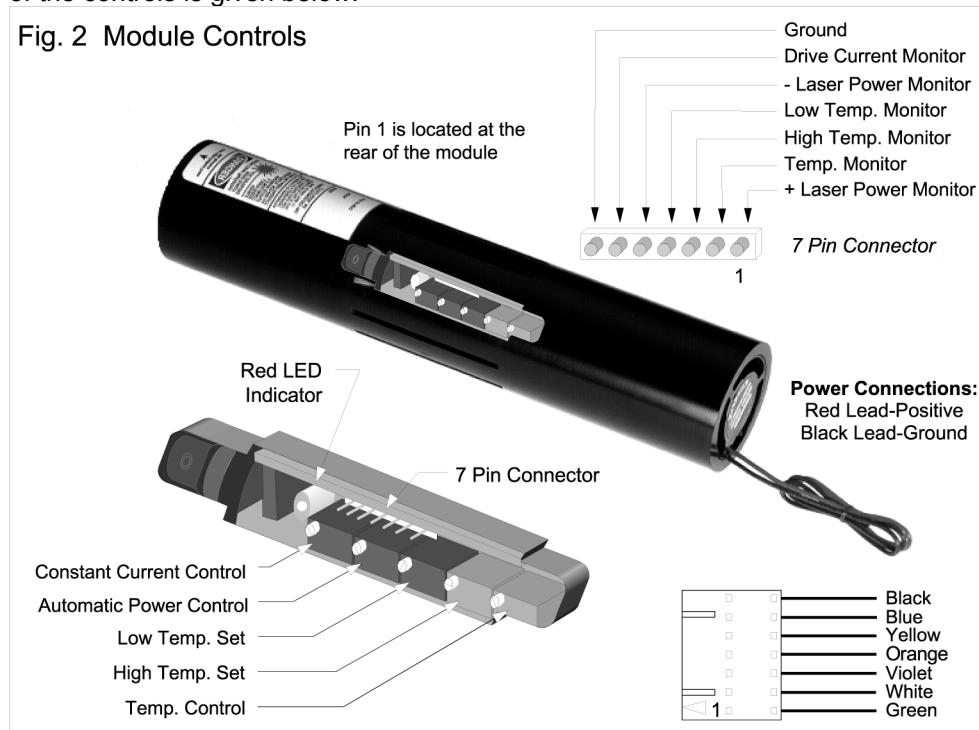


Fig. 2: Behind the cover plate on the side of the system you will find five potentiometers for adjustment of the controls described below. A wired female connector is supplied for use with the 7 Pin Connector to monitor these control adjustments.

NOTE: Not all models will include all of the potentiometers shown above. If module is ordered with digital control options or with beam modulation some potentiometers will not be included.

Operating Procedure/Control Descriptions

Constant Current Mode: Starting with both the power and current controls from zero (counterclockwise, 12 turns), set the power control to maximum (clockwise, 12 turns) and slowly increase the current control until the laser diode current reaches the desired setting. The user can set this current by connecting a voltmeter across the current monitor (blue wire) and the ground (black wire). The voltmeter correlation is 1mV/mA of laser diode current.

Constant Power Mode: Starting with both the power and current controls from zero (counterclockwise, 12 turns), set the current control to maximum (clockwise, 12 turns) and slowly increase the power control until the laser output power reaches the desired setting. The laser power is determined indirectly by measuring the current feedback from the photodiode. Place a voltmeter across Pin 7 Ground, of the 7 Pin Connector (Black wire on the supplied cable) and the Laser Power Monitor (Yellow wire). The voltmeter correlation is 1mV/ μ A of photodiode current. To correlate the photodiode current to the laser power you will need to develop a correlation table for your system utilizing an optical power meter.

Note: The Laser Power Monitor connections can also be used as a “modal monitor”. To do this, use a DVM that blocks the DC. This allows the small AC



variations, or modal noise, to be seen on the low-end AC scale. Large AC variations indicate continuous modal changing or “hopping”. See Fig.1 for a description of this condition.

Low Temperature Set: This control can be adjusted for the desired low temperature setting, below which the laser turns off and the red LED turns on. The desired temperature set value² can be obtained by adjusting the control until the voltage on the low temperature monitor pins (orange and black wires) reaches the appropriate setting identified in Table 1.

High Temperature Set: This control can be adjusted for the desired high temperature setting, above which the laser turns off and the red LED turns on. The desired temperature set value² can be obtained by adjusting the control until the voltage on the high temperature monitor pins (violet and black wires) reaches the appropriate setting identified in Table 1.

Temperature Control: This control can be adjusted to set the desired temperature for operating the laser. Once the temperature is set, the laser case temperature automatically reaches the set value when the power is connected³. This control is normally factory set to run the laser at 25°C. To run the laser below this temperature turn the temperature control counterclockwise, to go above 25°C turn it clockwise. Set the temperature by matching the voltage on the temperature monitor pins (white and black wires) to the appropriate setting identified in Table 1.



Table 1

Laser Case Temperature (°C)	Temperature Monitor (V)
-10	0.383
-9	0.401
-8	0.419
-7	0.438
-6	0.458
-5	0.478
-4	0.499
-3	0.52
-2	0.542
-1	0.564
0	0.586
1	0.61
2	0.633
3	0.657
4	0.682
5	0.707
6	0.732
7	0.758
8	0.783
9	0.81
10	0.836
11	0.863
12	0.89
13	0.917
14	0.945
15	0.972
16	1
17	1.028
18	1.056
19	1.084
20	1.112
21	1.139
22	1.167
23	1.195
24	1.223
25	1.25
26	1.277
27	1.304
28	1.331
29	1.358
30	1.385
31	1.411
32	1.437
33	1.462
34	1.487
35	1.512
36	1.537
37	1.561
38	1.585
39	1.608
40	1.631
41	1.654
42	1.676
43	1.698
44	1.719
45	1.74
46	1.76
47	1.78
48	1.8
49	1.819
50	1.838

Table 1: This table identifies the corresponding laser case temperature for the measured voltage on the temperature monitor pins.

Notes:

1. In order to maintain a laser case temperature of 5°C (cold side), the outside system temperature (hot side) needs to be no more than 30°C. In other words,

$$\Delta T = T_h - T_c = 25^\circ\text{C}$$

where T_h = Hot side temperature
 T_c = Cold side temperature

2. The tolerance of the temperature value is $\pm 0.5^\circ\text{C}$ for each measured voltage in Table 1.
3. Depending on the temperature settings and the ambient temperature, the steady state will be reached in less than five minutes.

