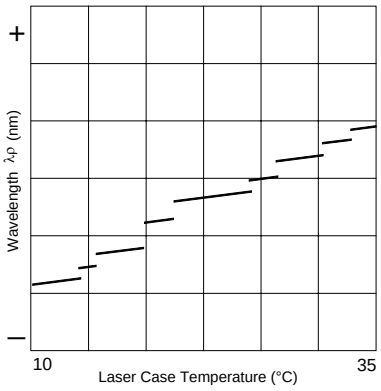
Model "PPMT" LASER DIODE OEM SYSTEM INSTRUCTIONS

Introduction

The PPMT system is designed for external TTL compatible modulation from CW up to 20MHz and to actively control the laser temperature.

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 operates on 12 ±1.8VDC input. In operation, the system provides a constant current to the laser. So, it does not monitor the back-facet photodiode and automatically adjust to maintain a constant optical laser output power as in other systems. The current control has a current limit that prevents the current from exceeding the maximum rating of the laser at 25°C. If the current control has been previously set for the laser diode, then the current will ramp up to the set value when power is connected.

Caution: If the current control has not been previously set, then it should be set to its minimum setting (12 turns counterclockwise) before connecting power.

You can operate the laser at a constant temperature between 5°C to 30°C[1] 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: Since the system drives the laser at a constant current, 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 four 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 and the 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.

TTL Modulation

The modulation signal is transmitted to the system via the single coaxial cable. Since the modulation is TTL, the external pulse generator must toggle between 0VDC and +5VDC. The system can be operated CW (with 0VDC on the data input) or pulsed up to 20MHz.

The system will not operate until driven by a pulse generator, via the coaxial cable, or the termination is shorted (which allows the system to operate CW).

Use of Power Meter

Check the operating range of your power meter before setting the power. Most photodiode based meters will saturate at 2mW (without an external attenuation). Although some digital meters will indicate power greater than 2mW, this reading is usually in error with the meter always giving a reading below the actual power.

Also, because the system is modulated the meter will not give a true reading. For the true laser power you must factor in the pulse width and the pulse frequency.

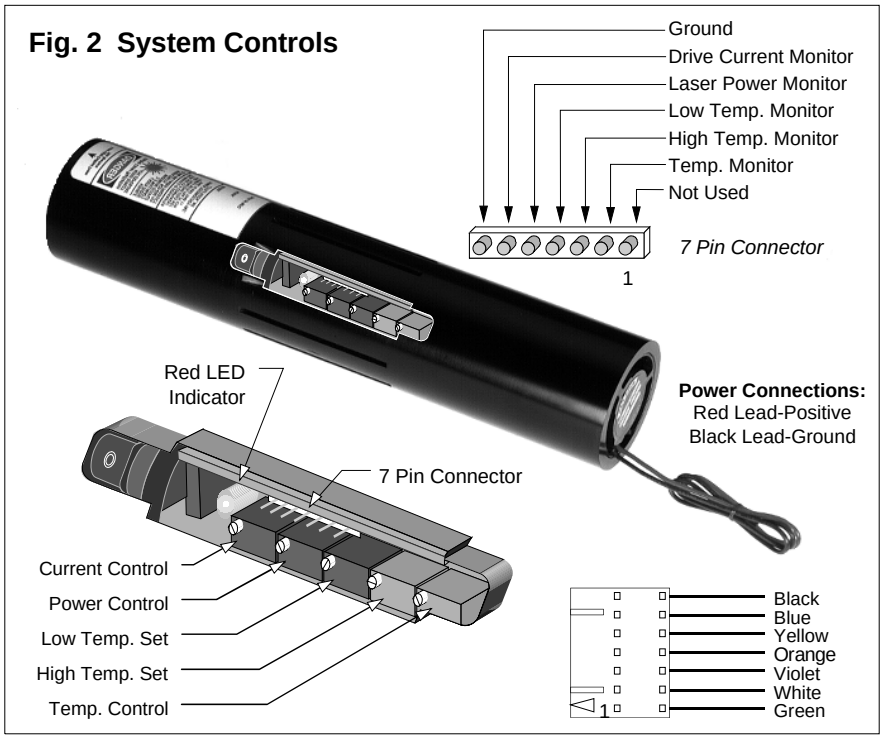


Fig. 2: Behind the cover plate on the side of the system you will find four potentiometers for adjustment of the controls described below. A wired female connector is supplied for use with the 7 Pin Connector to monitor these control adjustments.

Operating Procedure/Control Descriptions

Current Control: Starting with the current control at its minimum setting (12 turns counterclockwise), slowly increase the current control (clockwise) 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 -current monitor (green wire). The voltmeter correlation is 1mV/mA of laser diode current.

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[2] value 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[2] value 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 connected[3]. 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[2] by matching the voltage on the temperature monitor pins (white and black wires) to the appropriate setting identified in Table 1.

Laser Power Monitor: The laser power is determined indirectly by measuring the current feedback from the photodiode. Place a voltmeter across the Gray wire exiting the end of the system and Pin 1 of the 7 Pin Connector (Green wire on the supplied cable). The voltmeter correlation is 1mV/µA 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 *(see Use of Power Meter above)*.
Note: The Laser Power Monitor ("J" Option) 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.

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,

   $\Delta T = T_h - T_c = 25°C$

   where T_h = Hot side temperature
   T_c = Cold side temperature

2. The tolerance of the temperature value is ± 0.5°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.

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