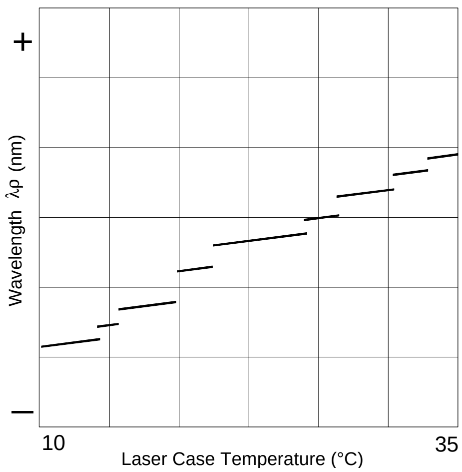
Model "APM" LASER DIODE OEM SYSTEM INSTRUCTIONS

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 APM Laser Diode OEM System is designed to actively control temperature 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. You turn one mode off by setting it to zero (12 turns counterclockwise). The mode control that is closest to maximum (clockwise) is the mode in operation.

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: 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 mimimum (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.

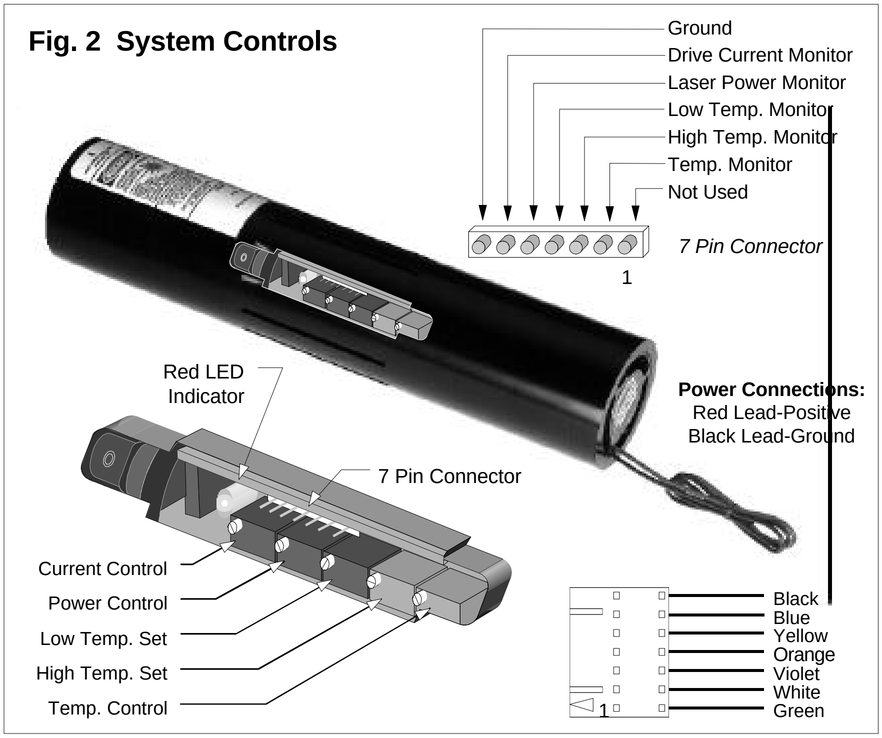


Fig. 2: Behind the cover plate on the side of the system you will find five potentiometers for adjustment of the controls described below. The connector is supplied to monitor these control adjustments.

Operating Procedure/Control Descriptions

Current Control: 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 current monitor has an output of 1 millivolt per milliamp of laser diode current.

Power Control: 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 power monitor does not directly measure the laser diode optical power. Instead it measures the photodiode current, with an output of 1 millivolt per microamp of photodiode current. The user is advised to use an optical power meter to measure the laser diode power to get an accurate reading of the optical output.

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

Fig. 3: This graph demonstrates the non-linearity of the temperature monitor voltage and the laser temperature relationship. For the precise monitor voltage/laser case temperature correlation see Table 1.

Fig. 3 Temperature vs. Monitor Voltage

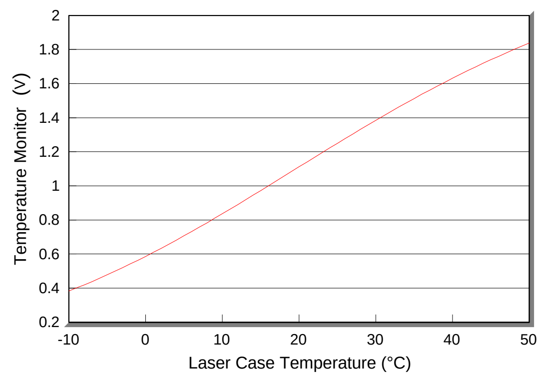


Table 1

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.

otes:

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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