TECH NOTE

Minimum Temperature Control Range of the LDM-4984T

OVERVIEW

The LDM-4984T is designed to accommodate a 14-pin butterfly laser diode module. The laser diode package is mounted on a temperature controlled plate and secured by Zero-Insertion Force (ZIF) fasteners and clamps. The LDM-4984T 14-Pin Butterfly Laser Diode Mount with Case Temperature Control includes a thermoelectric cooler (TEC) case temperature controller with an operating range of -5^{0}C to 50^{0}C.

This technical note describes the process of finding the minimum stable temperature for the LDM-4984T for a given heat load.

TEST SETUP

A Caddock Electronics MP930 2.00 Ω power resistor was used as the heat load. The MP930 was mounted to the cooling plate of a standard LDM-4984T Butterfly Laser Diode Mount. Measurements were made with the LDM-4984T not bolted to any surface and with the LDM-4984T bolted to an optical table. A LDT-5980 High Power Precision Temperature Controller was used to control TEC current and monitor temperature. A LDX-3232 High Compliance Precision Laser Diode Driver was used to provide current to the MP930.

TEST PROCEDURE

The TEC current was set to 5 A (84% of maximum rating of the LDM-4984T TEC current) and the temperature was allowed to reach steady state at heat loads of 0 W, 2 W, 4 W, and 6 W for both test setups and for heat loads of 8 W and 10 W for the optical table setup. The steady state temperature was recorded for each of these heat loads. The results are displayed in figure 1. Red squares show values for the unbolted mount and blue diamonds show values for the bolted mount.

The heat load was determined by using the equation for power (P) in Watts based on current (I) in Amps and resistance (R) in Ohms: $P = I^2R$.

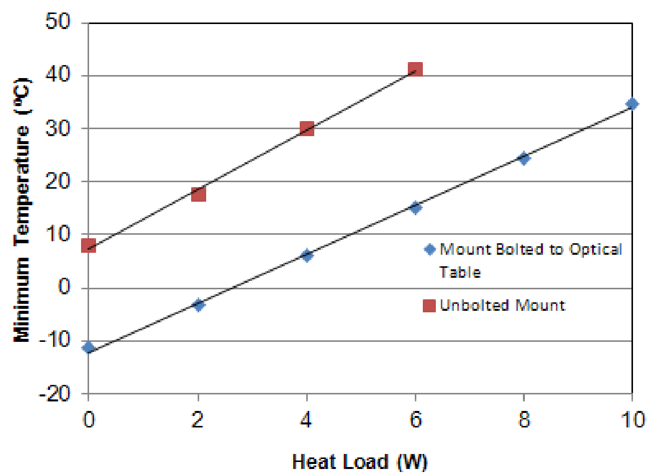

FIGURE 1: Minimum Stable Temperature Versus Applied Heat Load

RESULTS

The relationship between the applied heat load and the minimum stable case temperature is defined by an equation derived from the best fit trend-line calculated from the above graphs. This line has the equation $T_m = 5.5857 \times P + 7.464$ for the unbolted mount and $T_m = 4.6202 \times P - 12.163$ for the bolted mount, where P is the heat load applied in Watts and T_m is the minimum stable case temperature achievable when that heat load is applied.

Using the above equations, we see that a thermal load of 5 W can be controlled to a minimum case temperature of approximately 11^{0}C if the mount is bolted to an optical table or to a minimum case temperature of approximately 35^{0}C if the mount is not bolted to an optical table.

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Through the data acquired in this experiment it was determined that the -5^{0}C specified minimum case temperature of the LDM-4984T is typically attainable with a heat load of 1.5 W when the mount is bolted to an optical table. This value specifies heat load for typical behavior, and this number may vary for different experimental setups or environmental conditions.

CONCLUSION

The LDM-4984T mount in this experiment achieved a case temperature control range of -5^{0}C to 50^{0}C at a maximum heat load of 1.5 W when bolted to an optical table. At higher heat loads, or when the mount is not bolted to an optical table, the minimum achievable stable temperature can be calculated from the equations above.

It is important to note that when a laser diode is being operated, the heat load created is caused by the waste heat produced by the laser diode and the internal TEC of the laser package, if one is present. This value can be much higher than the output power of the laser, and it is this value that must be used in the above equations in order to obtain a meaningful estimate of minimum stable case temperature.