Voltage Drop Across High Current Laser Interconnect Cable

LD CONTROL TECH NOTE

This technical note compares the voltage drop across the standard and high current laser interconnect cables available from ILX Lightwave for use with laser diode current sources.

INTRODUCTION

For a large percentage of laser diodes, the drive current and compliance voltage required for operation is on the order of tens to a few hundreds of milliamps at a compliance of typically 2 - 4 Volts. In these situations, cabling is not necessarily a critical component of the system. Shielded cables and twisted pairs within the cables may still be required or desired for improved noise immunity but voltage drop and power loss within the cable may not be a concern. Most laser drivers have sufficient overhead to overcome cable voltage drops and power these typical diodes.

This is not necessarily true with laser diodes that require several amperes or when several diodes are connected together in series. In the first case, the large current creates an increased voltage drop due to Ohm's Law and the small, but no longer negligible, cable resistance. In the second case, even though the current has remained constant, the increased number of diodes in series requires a larger voltage across the group in order to operate them. In certain circumstances, there may be just enough voltage drop within the cable to keep the operational voltage required for each device from being reached. Cable resistance can be minimized by using cabling with a larger number of conductors and conductors of a larger size and by reducing the overall cable length. Wire and cable spec sheets typically call out a resistance per unit length and choice should be based on the lowest resistance possible while maintaining cable flexibility. A 10 gauge solid conductor wire would definitely minimize the voltage drop caused by a current of 5 Amps but would be too stiff for practical use.

All ILX laser current source and TEC interconnect cables are braid shielded, with twisted pair conductors to improve noise immunity and are highly flexible. In addition, these cables are designed with connectors (gender and size) to prevent improper connections between the instrument and the device-mounting fixture. Also, cables designed for currents larger than can be safely applied to standard ILX laser mounts are left unterminated to allow the user to configure the cable for their specific application.

MEASUREMENT SETUP

Standard (CC-306S) and high current (CC-306H) laser cables were connected to ILX Lightwave LDC-3916338 and LDC-3926339 current sources which are capable of providing up to 3A and 6A respectively. Because the high current CC-306H cable has a special high current connector specific to the 3926339 module, 6A measurements were only performed on that cable. With both cables, the output end was soldered directly to the test load. Current was sourced to the load, and the voltage drop across the cable (excluding connector) was measured using a benchtop multimeter.

RESULTS

Table 1 compares the voltage drop measured across a standard unterminated cable (CC-306S) and a high current cable (CC-306H) under different current setpoints. The voltage drop across the high current cable is roughly half the voltage drop across the standard laser current cable. This reduced voltage drop is due to the larger gauge wire used inside the cable. There will be a voltage drop associated with the connector pins as well. This was not measured but will be small due to the large gauge and short length of the pins.

			Voltage Drop		
Model	Notes	Length	1.5A	3A	6A
CC-306S	Standard Laser Cable, unterminated	6 ft.	176 mV	353 mV	N/A
CC-306H	High Current Cable, unterminated	6 ft.	69 mV	137 mV	275 mV

Table 1: Laser Interconnect Cables

In general, whenever currents of several amperes or cable runs of several feet are required, choose cabling with as large a gauge as possible. This will minimize voltage drops across the cable and allow power delivered to the device-under-test to be maximized.