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Wavelength Electronics™

MP SERIES

MPL SERIES

INSTRUCTION MANUAL

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TABLE OF CONTENTS

Features 2
Customer Service / Warranty 2
Optimize Your MPL 3
Quick Start 3
Electrical Specifications 4
Pin Descriptions 5
Operating Instructions 6
MPL Input / Output Cable Diagram 8

FEATURES

The MPL laser diode driver offers many unique features. These include:

- Single supply operation: +12V to +15V
- 250 mA, 500 mA, 2.5 Amps, and 7.5 Amps output currents
- Slow start circuitry
- Output Power Stability < 0.02% typical (24 hours)
- Independent current limit
- Operates all pin configurations of Laser Diodes
- Setpoint and Current Limit are user adjustable
- Low Profile Packaging
- Modulation in Constant Current or Constant Power
- Selectable Photodiode sensitivity

The "MP" series of Laser Diode Drivers and TE Temperature Controllers offers high performance while operating from a single output DC supply. A single 15 pin D-sub connector is used for inputs and outputs, enhancing the reliability of the interface with your laser diode or TE module.

The **MPL** series provides excellent stability during constant current, constant power, or modulated operation of your laser diode. Front panel 12-turn trimpots allow precise control of setpoint and limit current. The independent current limit offers an additional level of protection for your laser diode.

CUSTOMER SERVICE / WARRANTY

If you have any questions or comments, please call our technical staff at (406) 587-4910. Our hours are 8:00 a.m. to 5:00 p.m. MT.

Wavelength warrants this product for 90 days against defects in materials and workmanship when used within published specifications. This warranty extends only to purchaser and not to users of purchaser's products. If Wavelength receives written notice of such defects during the warranty period, we will either repair or replace products which prove to be defective. It is purchaser's responsibility to determine the suitability of the products ordered for it's own use. Wavelength makes no warranty concerning the fitness or suitability of its products for a particular use or purpose; therefore, purchaser should thoroughly test any product and independently conclude its satisfactory performance in purchaser's application. No other warranty exists either expressed or implied, and consequential damages are specifically excluded.

All products returned must be accompanied by a Return Material Authorization (RMA) number obtained from the Customer Service Department. Returned product will not be accepted for credit or replacement without our permission. Transportation charges or postage must be prepaid. All returned products must show invoice number and date and reason for return.

The MPL laser diode drivers can power Class IV laser diodes. Precautions should be taken to avoid exposure to the laser radiation. Do not stare directly into the beam or expose hands or other body parts to the beam. Before powering the laser diode, mount it securely and have beam dumps set up to catch both front and back facet outputs.

In the United States, the Food & Drug Administration is responsible for monitoring laser products. These products must comply with certain requirements in order to be sold to an end user. The MPL series has been registered as an OEM product. It does not comply with regulations. You must incorporate it into your system and that system must comply with federal regulations. Wavelength Electronics has experience with the government requirements. We can help you insure that your device is compliant. Please contact us if you have any questions.

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OPTIMIZE YOUR MPL

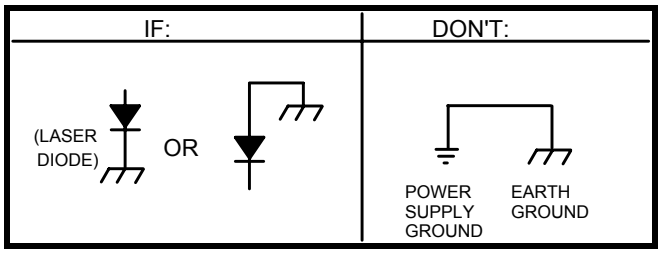
POWER SUPPLY AND NOISE:

The control electronics are designed for low noise operation. The power supply you select will directly affect the noise performance of the driver. We recommend using regulated linear supplies for optimum performance. The following table details power supplies from Power One that properly operate the MPL series. You can contact the California plant at 1-(800) 678-9445:

DRIVER	POWER SUPPLY
MPL-250	HA15-0.9-A
MPL-500	HA15-0.9-A
MPL-2500	HC12-3.4-A
MPL-7500	HE12-10.2-A

GROUNDING:

The following chart details the difference between connecting grounds properly and improperly. **You can connect laser diode anode or cathode to earth ground, but DO NOT CONNECT POWER SUPPLY GROUND TO EARTH GROUND when earth grounding the laser**.



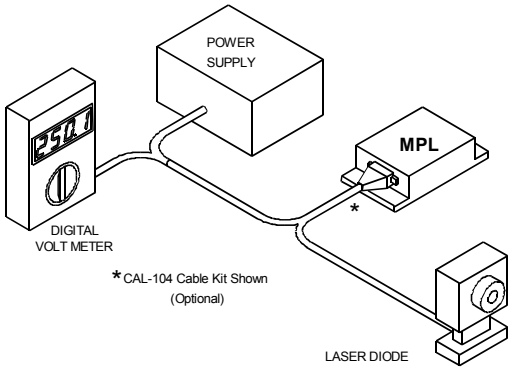
WARNING: If you plan to operate the MPL with an MPT, you may need to use separate power supplies. If the TE cooler or thermistor is connected to the laser diode, you must use two separate power supplies and let each float independent of the other.

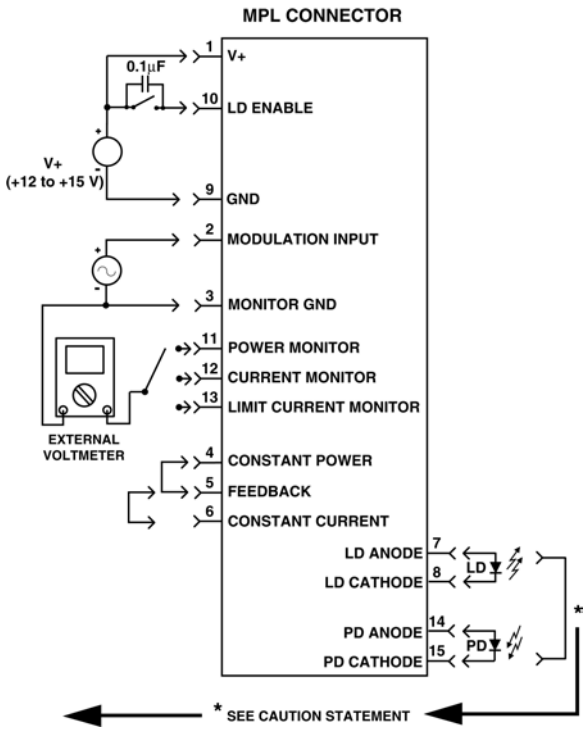
* CAUTION- IF LASER DIODE AND PHOTODIODE ARE ISOLATED:

If you want to maintain isolation, connect a 1 MΩ resistor between the laser diode anode and photodiode cathode. If isolation is not required, simply short the laser diode anode and photodiode cathode. If not connected, the photodiode voltage level can float beyond the input common mode voltage of the transimpedance amplifier, and the driver will not control properly.

QUICK START

The following is a sketch of the components you will need to operate the MPL and a rough connection diagram. Much more detail is included in the PIN DESCRIPTION section, and you should review the entire manual before operating your laser diode with the MPL.





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MPL LASER DIODE DRIVER ELECTRICAL SPECIFICATIONS

Model Number	MPL-250	MPL-500	MPL-2500	MPL-7500
Drive Current Output				
Output Current Range	**0 - 250 mA**	**0 - 500 mA**	**0 - 2.5 Amps**	**0 - 7.5 Amps**
Compliance Voltage ❶	> 6 V	> 6 V	> 6 V	> 6 V
Temperature Coefficient	< 100 ppm / °C	< 100 ppm / °C	< 100 ppm / °C	< 100 ppm / °C
Short Term Stability (1 hr)	< 30 ppm	< 30 ppm	< 30 ppm	< 30 ppm
Long Term Stability (24 hrs.)	< 75 ppm	< 75 ppm	< 75 ppm	< 75 ppm
Noise and Ripple (rms)❷	< 1 µA	< 3 µA	< 10 µA	< 20 µA
Current Limit Range	0 - 250 mA	0 - 500 mA	0 - 2.5 Amps	0 - 7.5 Amps
Photodiode Feedback				
Standard Range	50 - 5000 µA	50 - 5000 µA	50 - 5000 µA	50 - 7500 µA
Optional Range	15 - 500 µA	15 - 500 µA	15 - 500 µA	15 - 750 µA
Max. Forward PD Bias Voltage	0.25 V	0.25 V	0.25 V	0.375 V
Const. Power Output Stability	< 0.02 %	< 0.02 %	< 0.02 %	< 0.02 %
External Modulation				
Input Impedance	100 kΩ	100 kΩ	100 kΩ	100 kΩ
Bandwidth (3 dB) ❸	DC – 1.4 kHz	DC – 1.4 kHz	DC – 1.4 kHz	DC – 1.4 kHz
Depth of Modulation at 100Hz	90%	90%	90%	90%
Transfer Functions (pin 2)				
Constant Current Mode	50 mA / V	100 mA/V	500 mA/V	1000 mA/V
Constant Power Mode (Standard)	1000 µA / V	1000 µA / V	1000 µA / V	1500 µA / V
Constant Power Mode (Optional)	100 µA / V	100 µA / V	100 µA / V	150 µA / V
Power Supply				
Power Up Trip Point ❹	10.5 V	10.5 V	10.5 V	10.5 V
Power Down Trip Point ❹	9.5 V	9.5 V	9.5 V	9.5 V
Maximum Power Dissipation ❺	4 Watts	8 Watts	40 Watts	90 Watts
Setpoint vs. Monitor Accuracy	< 5 %	< 5 %	< 5 %	< 5 %

MPL GENERAL SPECIFICATIONS

Power Requirements ❻
+12 to +15 VDC (+15.5V MAX)

Supply Current
MPL's Maximum LD Output Current plus 200 mA @ V+

Size (H x W x D)
1.0" x 3.5" x 3.5" (2.5 Amps and below)
1.0" x 3.5" x 5.5" (MPL-7500)

Weight
< 0.5 lbs.

Operating Temperature
0 to +50°C (guaranteed)
- 40 to +75°C (typical)

Storage Temperature
- 40 to +85°C

Connector
15 pin D-sub receptacle (cable needs male plug)

Warm-up
1 hour to rated accuracy

Power Indicator
Green LED

❶ Compliance Voltage will vary depending on power supply voltages. A maximum compliance voltage of +10 volts will be obtained with +15 volts input. A maximum compliance voltage of +6 volts will be obtained with +12 volts input.

❷ With modulation input shorted.

❸ Modulation bandwidth in Constant Power mode will depend on photodiode response. Bandwidth specification changed in October 1998. The fourth digit in the Serial Number changed from "B" to "D." The following chart details the bandwidth of the units with "B" in the serial number:

Model Number	MPL-250	MPL-500	MPL-2500	MPL-7500
Bandwidth	DC – 19 kHz	DC – 12 kHz	DC – 9 kHz	DC – 4 kHz

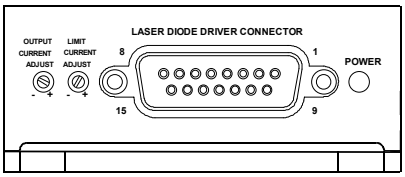
❹ The MPL series has internal control circuitry which turns the output on and off depending on the voltage at V+. When the voltage reaches the power up trip point, the module soft starts the laser diode. When the voltage reaches the power down trip point, the module shunts current around the laser diode, powering it down in a controlled fashion.

❺ See page 6 for power dissipation equations.

❻ If thermistor or TE module are case common with the laser diode, the MPL and MPT power supplies must be isolated from each other.

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PIN DESCRIPTIONS



Pin 1 **V+**
This and pin 9 (GND) provide power to the control electronics and laser diode current source.

Pin 2 **Modulation Input**
Voltage applied to this pin sums with the setting of the Output Current Adjust trimpot (on front panel) in either Constant Current or Constant Power mode. In Constant Current mode, the transfer function depends on the maximum current of the MPL. In Constant Power mode, the transfer function varies with the photodiode range. The modulation input voltage should not exceed V+ (pin 1) or drop below ground potential (pin 9) by more than 0.5V. **IF THE MODULATION INPUT IS NOT USED, SHORT PINS 2 & 3 FOR LOW NOISE OPERATION.**

Pin 3 **Monitor GND (low currents only)**
This pin is the low current ground connection for the monitor outputs (pins 11, 12, and 13) and the modulation input signal (pin 2). Pin 3 is internally connected to pin 9, but if you use pin 9 as monitor ground, you will introduce noise into your measurements.

Pins 4, 5, 6 **Feedback setting**
These pins are used to set the unit to either constant power or constant current mode. Pin 5 is the feedback connection. If Pin 4 is connected to pin 5, the unit operates the laser diode in constant power mode. If pin 6 is shorted to pin 5, the unit operates in constant current mode. If pin 5 is left floating, the output will be disabled. **CAUTION: This connection must be made at the Laser Diode Driver Connector on the mating D-sub connector.**

Pins 7, 8 **LD Anode, LD Cathode**
These pins connect to the laser diode.

Pin 9 **GND (High current return)**
This and pin 1 (V+) provide power to the control electronics and laser diode current source. Pin 3 is internally connected to pin 9. If, however, you use pin 3 for high current ground, you may damage the MPL, and you will cause errors in the feedback and measurement circuits.

Pin 10 **LD Enable**
This pin controls the status of the laser diode current source. If this input floats or is grounded, the laser diode will be disabled. To enable the laser diode, this voltage must be between 3V and V+. This can be as simple as connecting a switch between V+ (pin 1) and pin 10, or can include a complex interlock system. [Always put a 0.1 μF capacitor across switch contacts to minimize contact bounce.] When enabled, the output will be safely ramped to the current setpoint in about 500 msec after a 2 - 3 second delay. When the laser diode current source is disabled, the laser diode is shorted by the mechanical relay, the output setpoint is brought to 0V, the limit current source is reduced to a low standby current, and the residual current is shunted through the control FETs.

Pin 11 **Power Monitor**
This output is used to monitor the current from the photodiode. The transfer function is either 1μA / mV (factory default) or 0.1μA / mV. This transfer function is determined by internal jumpers. See page 7 for Jumper Selection. The impedance of this pin is 1 kΩ.

MPL Connector (15 pin D-sub)	
Pin #	
1	V+
2	Modulation Input
3	Monitor GND
4	Constant Power
5	Feedback
6	Constant Current
7	Laser Diode Anode
8	Laser Diode Cathode
9	GND (High Current Return)
10	LD Enable
11	Power Monitor
12	Current Monitor
13	Limit Current Monitor
14	PD Anode
15	PD Cathode

Pin 12 **Current Monitor**
This output is used to monitor the current through the laser diode. The transfer function varies with the maximum current of the module. The impedance of this pin is 1 kΩ.

Transfer function of pin 12, current monitor			
MPL-250	0.1mA / mV	MPL-2500	1mA / mV
MPL-500	0.1mA / mV	MPL-7500	1mA / mV

Example calculation: MPL-250, operating current is 80mA.

$$V_{PIN12} = \frac{80mA}{0.1mA/mV} = 800mV$$

Pin 13 **Limit Current Monitor**
This output is used in setting the maximum current to the laser diode. The transfer function is the same as the current monitor output of pin 12. See the table and example provided. The impedance of this pin is 1 kΩ.

Pins 14, 15 **PD Anode, PD Cathode**
These pins are wired to the photodiode. **CAUTION: If photodiode pins are isolated from the Laser Diode, you must connect one side of the photodiode to the Laser Diode.** (See page 3, MPL Connection.)

TRIMPOT ADJUSTMENTS

OUTPUT CURRENT ADJUST This 12 turn trimpot adjusts the laser diode forward current in constant current mode and photodiode current in constant power mode.

LIMIT CURRENT ADJUST This 12 turn trimpot is used in setting the maximum current to the laser diode.

There are several internal trimpots used for calibration. These are adjusted only at the factory.

INTERNAL JUMPERS

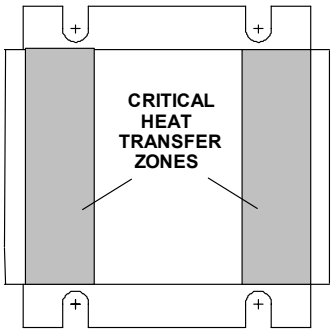
The sensitivity of the photodiode current transimpedance amplifier can be internally jumpered for 1μA / mV or 0.1μA / mV operation. See page 7 for Jumper Selection.

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OPERATING INSTRUCTIONS

1. ESTABLISH THERMAL CONTROL

A heat sink must be properly attached to the MPL in order to remove heat from the module. The following drawing shows where the heat sensitive components are located. Thermally conductive grease should be used between the heatsink and the critical heat transfer zone for optimum performance.



First, calculate the maximum power that will be dissipated by the unit with one of the following equations:

MPL-250, MPL-500: $$P_{UNIT} = \left[V^{+} - V_{LOAD}\right] * I_{LIM} + \left[I_{LIM} - I_{LOAD}\right] * V_{LOAD} + \frac{\left(I_{LIM}\right)^2 + \left(I_{LOAD}\right)^2}{2}$$

ALL OTHERS: $$P_{UNIT} = \left[V^{+} - V_{LOAD}\right] * I_{LIM} + \left[I_{LIM} - I_{LOAD}\right] * V_{LOAD} + \frac{\left(I_{LIM}\right)^2 + \left(I_{LOAD}\right)^2}{10}$$

where P_{UNIT} is the power dissipated in the MPL in Watts, V_{LOAD} is the voltage across the laser diode during operation in volts, I_{LIM} is the limit current for the laser diode in amps, and V^{+} is the voltage at pin 1 on the connector.

Now calculate the allowed rate of temperature increase with:

$$RATE = 70 / P_{UNIT}$$ where Rate is in °C/W.

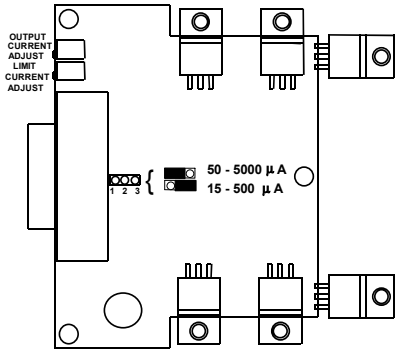
For example, if P_{UNIT} is 60W, RATE is 70/60 or 1.17°C/W. Adding a safety factor, you should select a heatsink with at least a 0.9°C/W rating.

2. WIRE THE 15 PIN CONNECTOR

a) Connect V+ to pin 1 and power supply GND to pin 9.
b) Connect the LD Enable (pin 10) directly to V+ to enable laser on power up OR connect the LD Enable through a switch or interlock system to V+. (When using switches, debounce with a 0.1µF parallel capacitor.)
c) Configure for Constant Current Operation: Short pins 5 and 6 at the connector.
[If you will be operating in Constant Power mode, make this short temporary. It is necessary to have the unit in Constant Current mode to initially set the CURRENT LIMIT.]
d) If you will modulate the laser diode, connect the control voltage to pins 2 and 3. Make sure pin 2 remains positive with respect to pin 3. If the modulation input will not be used, short pin 2 to pin 3.
e) For monitoring purposes, have a DVM available to read pins 11-13. Pin 3 should be connected to the common input of the DVM.

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3. CONFIGURE THE PHOTODIODE SENSITIVITY



The factory set photodiode range is 50µA - 5000µA. As shown in the diagram above, the jumper is internal to the unit and behind the connector. To change the setting to the more sensitive range (15µA - 500µA), move the jumper to the back two pins.

4. SET LIMIT CURRENT

⚠ **CAUTION:** Before connecting a laser diode to the MPL, use a dummy load (such as a low value resistor or ammeter) between pins 7 and 8. When using MPLs with currents greater than 1 Amp, a load resistor may be required to reduce power dissipation in the unit.

Determine the proper Current Limit monitor voltage for your laser diode using the equation on page 5 [transfer function for pins 12 & 13]. Note that maximum current should be well below the damage threshold.

Turn both the Setpoint and Limit Current trimpots fully CCW. You'll hear or feel a small click when these 12 turn trimpots are at the end of adjustment. With the output disabled, connect a DVM to the Limit Current Monitor (pin 13). Turn the Limit Current Trimpot clockwise (CW) until the DVM displays the calculated voltage.

Optional Method: Determine the proper Current Limit monitor voltage for your laser diode using the equation on page 5 [transfer function for pins 12 & 13]. Note that maximum current should be well below the damage threshold. Turn the Limit Current trimpot fully CCW and the Setpoint trimpot completely CW. Connect a DVM to the Current Monitor (pin 12) and a dummy load to the output. Enable the output current and monitor the DVM. Turn the Limit Current trimpot clockwise (CW) until the DVM displays the calculated voltage. Disable the output current and turn the Setpoint Trimpot fully CCW in preparation for setting the output current in the next step.

5. SET OUTPUT CURRENT

Constant Current Mode

Monitor pin 12 (LD Current Monitor) with the DVM. Using the equation on page 5, calculate the voltage reading for the desired laser diode operating current. Turn the OUTPUT CURRENT ADJUST trimpot until the desired operating current is reached. Note that this trimpot has 12 turns of adjustment. Disable the unit and power down. Connect the laser diode to pins 7 and 8 and enable the laser diode current.

Constant Power Mode

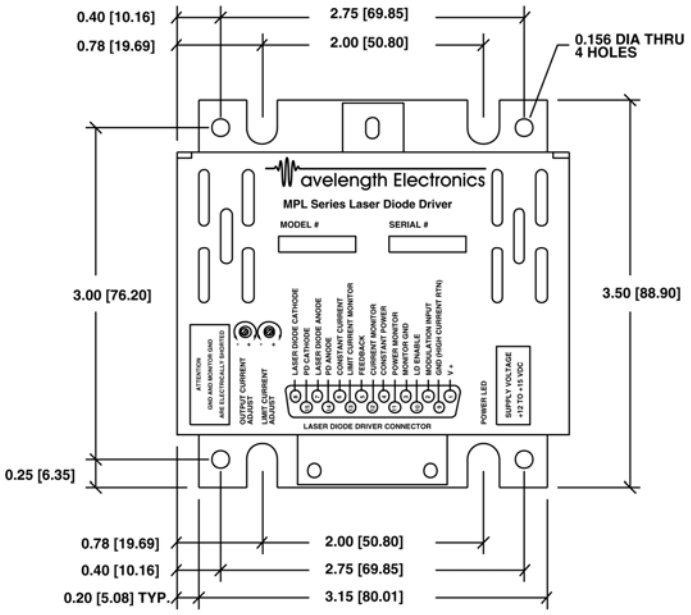
Disable the unit and power down. Connect the laser diode to pins 7 and 8 and photodiode to pins 14 and 15. Configure the unit for Constant Power operation by shorting pins 4 and 5 on the MPL connector. Monitor pin 11 (PD Current Monitor). Using the appropriate transfer function [see table] calculate the voltage reading for the desired photodiode operating current. Turn the OUTPUT CURRENT ADJUST trimpot fully CCW. While monitoring pin 11, power on the unit and enable the laser diode output. Slowly turn the OUTPUT CURRENT ADJUST trimpot CW until the voltage monitored by the DVM is at the calculated level. Note that this trimpot has 12 turns of adjustment.

Range	Photodiode Transfer Function
50 - 5000µA (Standard)	1 µA / mV
15 - 500 µA (Optional)	0.1µA / mV

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MECHANICAL DIMENSIONS

FIGURE A



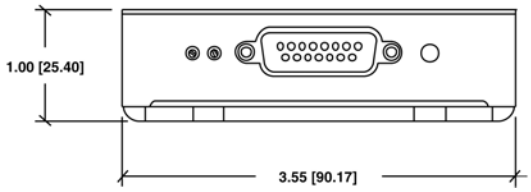
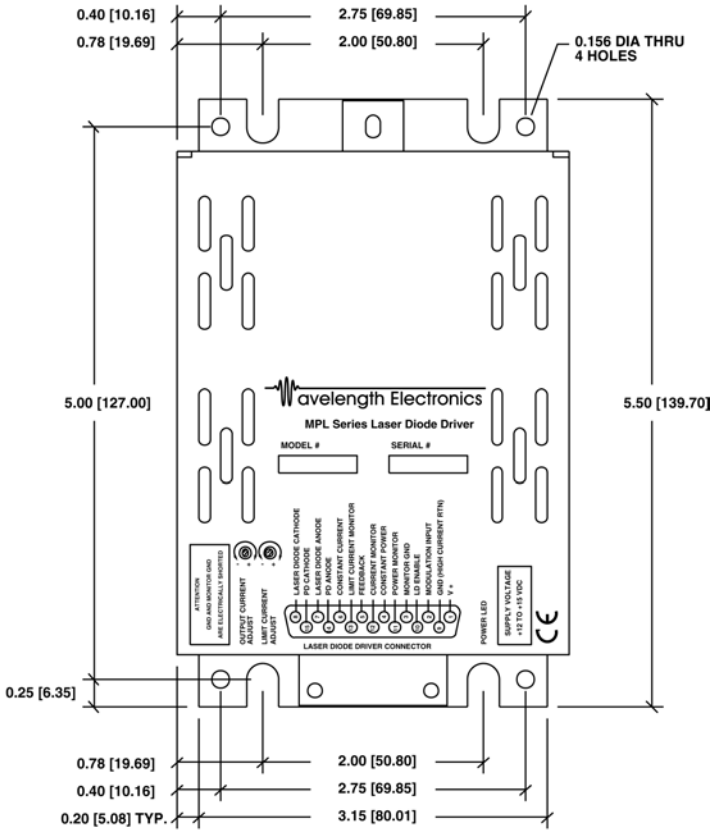


FIGURE B



MPL SERIES SELECTION GUIDE		FIG
MPL-250	250 mA Laser Diode Driver	**A**
MPL-500	500 mA Laser Diode Driver	**A**
MPL-2500	2500 mA Laser Diode Driver	**A**
MPL-7500	7500 mA Laser Diode Driver	**B**

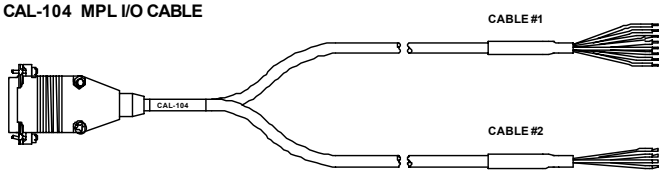
OPTIONAL ACCESSORIES AVAILABLE FOR SYSTEM DEVELOPMENT:

CKL-103
A Connector Kit includes the appropriate 15 pin D-sub connector, hood and hardware.

CAL-104
A Cable Kit includes one meter of cable soldered to a mating connector on one end and unterminated on the other.

Connector Kit	CKL-103
Cable Kit	CAL-104

CAL-104 MPL I/O CABLE



PIN	WIRE COLOR	CABLE #	FUNCTION
1	RED	1	V+
2	ORANGE	1	Modulation Input
3	GREEN	1	Monitor GND
4	———	N/A	Constant Power
5	JMPR		Feedback
6			Constant Current
7	RED	2	Laser Diode Anode
8	BLACK	2	Laser Diode Cathode
9	BLACK	1	GND
10	BLUE	1	LD Enable
11	WHITE	1	Power Monitor
12	BROWN	1	Current Monitor
13	YELLOW	1	Limit Current Monitor
14	GREEN	2	PD Anode
15	WHITE	2	PD Cathode

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