

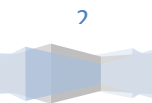
INSTRUCTION MANUAL – HIGH CURRENT DRIVER BOARD 5 AMP



Version: 1.0

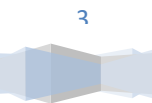
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GENERAL

OVERVIEW

This is the fifth generation of the popular High Current Laser Diode Driver series. We designed this new generation to follow the federal guidelines for safety compliance for high power Class 4 laser operation. This includes the use of a key enable switch, safety interlock system, power off reset, and laser LED indicators. All of these features make for a safer laser operation and will comply with federal laws regulating such operations.

At the heart of the product are laser trimmed parallel regulators to give constant current without the large temperature dissipation of other regulators. Couple this with inherent safety features like soft starting, current isolation, reverse protection, ESD protection, and thermal shutdown control and you have all you need in a small package.

The high power laser diode driver is cost effective and easily integrated into industrial, research, or enthusiast projects and products. The driver can be operated in CW mode or in Input Control Mode to be interfaced to remote electronics. This design uses digital isolators for super fast response and input range while protecting the laser from deadly ground loops. The board has screw terminal connections as well as Molex mini-fit Jr. connectors for easy connections to external equipment for control and the laser diode output. Specifications

Specification	
Minimum Operating Voltage	8.2V
Maximum Operating Voltage	1,2,3,4,5 Amps
Compliance Voltage w/12V adapter:	8 volts
Current Resolution:	0.1%
Current Adjustment:	Analog Trim Pot
Current Range Accuracy	Always greater than limit, no more than 15%
Laser Diode Protection:	Soft Start, Reverse Voltage, Current Limit, Thermal Shutdown
Integrated Safety Features	Laser Enable Key Switch, Integrated Laser Interlock, Power off Reset, LED Indicators
AC Adapter Input Voltage:	100 - 240 VAC
Control Signal Digital Isolation Voltage:	4500 Vrms
Minimum Control Signal "Turn On" Voltage:	2.8 Volts
Control Signal Maximum Voltage:	24 Volts
Control Signal Maximum Current:	50 ma
Control Signal Maximum Frequency:	5KHz
Connectors:	Screw Terminal and JST PH Connectors
Operating Temperature:	0 to 40 °C
Storage Temperature:	-40 to 70 °C
Dimensions:	3.25" x 2.25"



SAFETY

- Operate the High Current Driver Board in an explosion free area.
- The Driver Board may reach high temperatures under operation. Make sure there is adequate airflow to the Driver Board. Also, make sure there is adequate protection around the Driver Board and that it is not in contact with other materials.
- When connected to laser diode components, the output of the laser can be up to several watts of power. Always use proper safety eyewear and laser safety protection when connecting to laser components in your final system. When operated incorrectly the laser component can cause severe damage to eyes and health.

DISCLAIMER

- The High Current Driver board is designed as an OEM product to be integrated into a final solution.
- All statements of safety are only applied when the driver board is used in its intended purpose.
- You are legally responsible for any injury to anybody resulting from the use of or assembly of the driver board or their finished products.
- You Accept this driver board as a COMPONENT for integration in a system of YOUR OWN design and will be legally responsible from any and all LIABILITIES.

GETTING STARTED

UNPACKING

Inspect the shipping container for damage.

Verify the contents of the package:

1 - High Current Driver Board.

2- Key switches

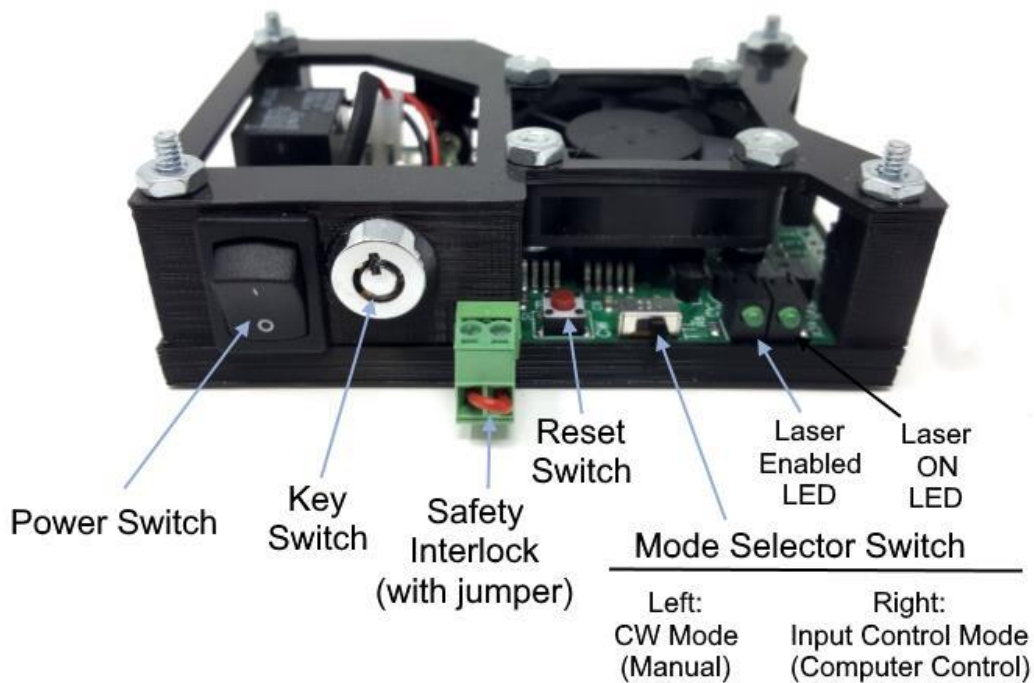
1- Power Adapter with connector according to ordering country or OEM cable.



OPERATION

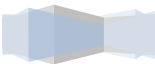
FRONT OF DRIVER BOARD

Front View



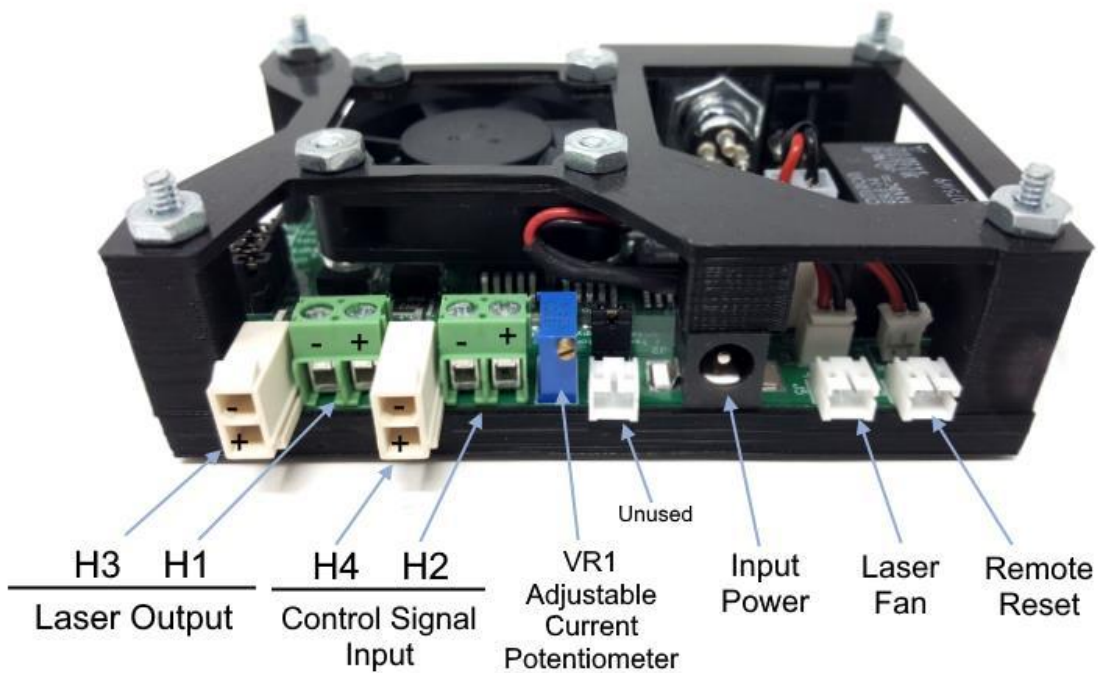
The front contains:

- Power / Enable Switch: Down = OFF, Up = ON
- Laser Enable Key Switch: Key Up = OFF, Key to Right = Enabled
- Safety Interlock: Screw Terminals for "Normally Closed" interlock switches. (shown defeated)
- Reset Switch: Press momentarily to reset interlock and power faults
- Mode Selector Switch: Left = CW Mode, Right = Input Control Mode
- LED Indicators: Left = Laser Enabled, Right = Laser Emission ON



BACK OF DRIVER BOARD

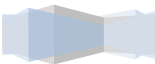
Back View



The back contains:

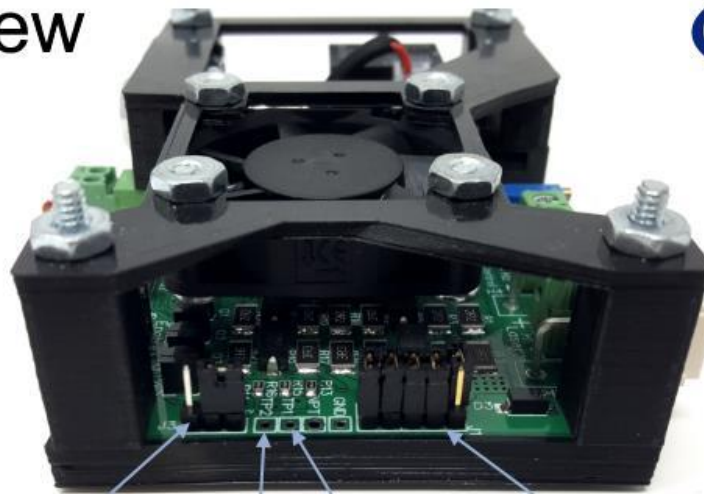
- H3 - Laser / LED Output Connector:
- H1 - Laser / LED Output Screw Terminal:
- H4 - Input Control Connector:
- H2 - Input Control Screw Terminal:
- VR1 - Potentiometer for Analog Current Level
- Power Adapter Plug (center pin positive)
- Laser Fan Connector
- Remote Reset Switch Connector

Top = Negative Output, Bottom = Positive Output
 Left = Negative Output, Right = Positive Output
 Top = Negative Input, Bottom = Positive Input
 Left = Negative Input, Right = Positive Input



CURRENT LIMIT SETTINGS AND TEST POINTS

Side View



Jumper J3		TP2	TP1	Jumper J1	
Non-Inv	Inv	Voltage	Voltage	Setting	Current Limit
Input Control	Input Control	at Laser	at Regulator	1	1A
Signal Logic	Signal Logic	divided by	divided by	1&2	2A
HIGH will	LOW will	3.61	3.61	1&2&3	3A
turn ON Laser	turn ON laser			1&2&3&4	4A
				1&2&3&4&5	5A

- Jumper J1 Current Limit Selector: This will limit the output current of the driver to the selected level. The maximum level is based on the driver version that was purchased.

Current Limit (Amps)	Jumper Position On
1	1
2	1,2
3	1,2,3
4	1,2,3,4
5	1,2,3,4,5



- **Test Points:** These signals provide a connection point to be able to monitor current with a computer or microcontroller. See section "Monitoring Current with Microcontroller" for more details.

INPUT SIGNAL CONFIGURATION

- **J3 - Control Signal Jumper:** This will either invert or not invert the incoming control signal. When interfacing with equipment that is not under the users control, it is sometimes needed to invert the incoming logic.

Outer Two Jumpers On = Non-Inverting Input

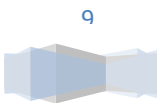
Inner Two Jumpers On = Inverting Input

SAFETY INTERLOCKS

The laser driver has an interlock system which is NORMALLY CLOSED and contains a voltage in the cable of 12V supplied by the laser driver board. This means if any switch along the interlock chain becomes OPEN, then the circuit will open and the laser will disengage the laser.

Examples of use of the interlock system include the emergency stop button switch and an enclosure door switch. When integrating the laser driver and laser into an OEM machine, all entrances to the machine (enclosure doors) must have an interlock switch in order to be considered compliant with Class 4 laser rules. Multiple switches can be added along the chain when integrating the laser driver into OEM machines as long as they are wired in series.

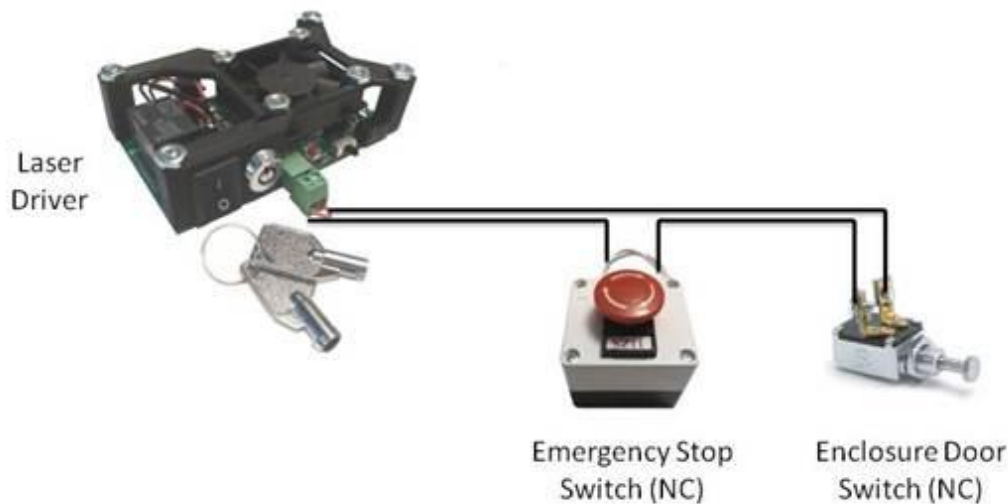
Here is an example of an interlock system:





Example Safety Interlock System

Switches are all Normally Closed (NC)



In the example above the switches are connected in series so if ANY of the switches are opened, the interlock will engage.

If the laser driver was purchased in a kit including the emergency stop button, it will be wired to the interlock key. If not, then the key will be shipped with a jumper, defeating the interlock system. It is up to the consumer to make sure the interlocks implemented correctly before use of the laser.

SAFETY FEATURES AND RESETING THE LASER DRIVER

The safety features of this laser driver include both a safety interlock and a power monitor to watch for power outages. If either of these features is activated, they will disable the laser and the user **MUST** reset the laser driver to continue operation of the laser. Here are the situations for each of these safety features and how to reset the feature:

Safety Interlock: If the interlock is tripped, either by an emergency stop switch being activated or by an enclosure door switch opening you must:

1. Make sure the situation is clear for laser operation and make sure the laser is not being controlled in an ON position.



2. Clear all switches that have been activated back to the Normally Closed position.
3. Press the reset switch on the board (or remote reset switch if installed)
4. The laser is then ready for use again.

Power Outage Monitor: If the power adapter is either unattached from the laser driver or there is a power outage, then the laser driver will disable the laser. This is in case there is a power outage situation in which the laser was left ON and to prevent unknowing persons being injured when the power comes back on and not realizing the laser was left ON.

1. Make sure the situation is clear for laser operation and make sure the laser is not being controlled in an ON position.
2. Plug back in the power adapter (if it was removed from the board).
3. Press the reset switch on the board (or remote reset switch if installed)

REMOTE RESET SWITCH

The remote reset switch option allows for placement of another reset switch to a more convenient location, like the front of the machine for example. The switch can be mounted on a panel and attached tight with the provided locking nut. Attach the connector to the back of the driver board on the farthest right connector.



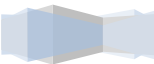
KEY SWITCH

The laser driver includes a key switch to enable or disable the laser. This is a requirement for Class 4 laser operation. The key is only removable in the "unlocked" position with the key facing up. The key can then be stored in a safe place to prevent unwanted use of the laser by children or others who are not authorized to use the equipment.

When the key is turned clockwise to the right, the laser will be enabled. The key cannot be removed when the laser is enabled. The laser driver can be turned off with the power switch while the key is still in the Enabled position.

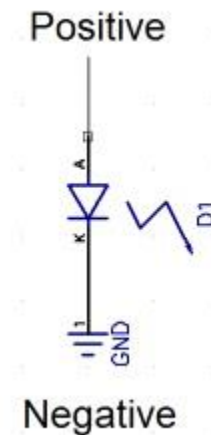
The key can sometimes be a bit difficult to turn so be gentle with it as it might break away the plastic housing if forced.





OUTPUT CONNECTION

A typical connection for a laser diode or LED will be:

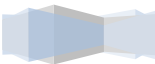


If you purchased the laser driver in a kit with a laser, it will have a molex mini fit connector that will attach to connector "H3".

MODE SELECTOR SWITCH

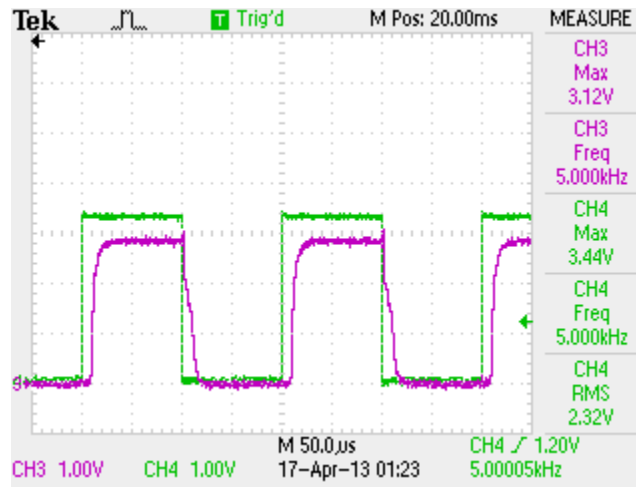
The driver board has a selector switch for the two different modes of the board.

- **Input Control Mode:** This is when the switch is on the RIGHT. This mode allows for a signal to be connected to connectors H2 or H4 for a signal to turn the laser on and off. Use this input with your controller to turn the laser on and off with G Code commands.
- **CW Mode:** This is when the switch is on the LEFT. This mode stands for "Constant Wave", which means that the laser will turn on and stay on until the switch is turned back to the right or the power on the board is turned off.

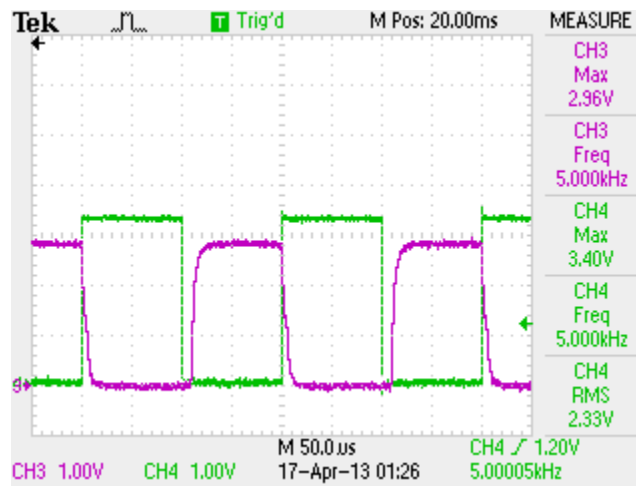


CONTROL SIGNAL AND PERFORMANCE

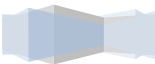
The input connection provides an optically isolated input for control of the laser diode. The connection and the jumper settings were described in the previous sections. The voltage required to turn on the opto-isolator is 2.8 volts. The input can handle up to 36 volts. The input can be cycled with no degradation up to 5KHz. It will work with 3.3V, 5.0V and 12V, 24V logic boards from various manufacturers like National Instruments.



Typical Control Signal with "non inverting" set running at 5KHz. Ch 1 control, Ch 3 output.



Typical Control Signal with "inverting" set running at 5KHz. Ch 1 control, Ch 3 output.



FIRST OPERATION

- **Before operation read the Safety section of this manual.**
- Properly connect the output of the driver to the laser or LED to be driven. Ensure the connections are correct.
- If using input control, connect the input signal to the driver board.
- Make sure the jumpers are correctly set for current limit and input control to the desired settings.
- Plug in the adapter to the AC power.
- Plug in the adapter to the Driver Board.
- Make sure the safety interlocks are correctly assembled or the defeat jumper is on the interlock key.
- Press the RESET button on the driver board. You should hear an audible "click" which is the safety relay connecting. If you do not hear a click, check your interlock circuit and make sure the driver has power.
- Push the power switch to the ON position.
- Turn the key switch clockwise to the ENABLED position
- Your driver is now ready to produce current for your laser. If in CW mode, the "enabled" and "laser on" LEDs will light up and the output will be enabled. If in input control mode and the input signal is not enabled, the "enabled" LED will only light up. When the input control signal gets enabled, the "laser on" LED will light up and the driver output will be enabled.

GENERAL OPERATION

- Laser Diodes and LEDs are meant to be driven within their specifications. Degradation of the diode will occur when diodes are overdriven beyond their specifications.
- Keeping laser diodes on for a long continuous time will degrade the diode if thermal issues are not addressed.
- The high current driver board will reach high temperatures if the board is continuously driving high current for long durations. Make sure it has adequate airflow.
- Keep the driver board in a well ventilated area.
- Using the Mode Selector Switch as an ON/OFF switch for the laser:
 - Make sure Jumper J3 is on "non inverting".
 - When there is no input control, you can keep the power switch on and use the Mode Selector Switch to control the output of the laser.



CURRENT RANGES AND ADJUSTING CURRENT

There are two sets of adjustment for controlling the current output. There are the current limit jumpers and the potentiometer. The current limit jumpers are J1 and have the "1 2 3 4 5" on them will set the MAX current the board can provide with the potentiometer set to FULL (all the way turned clockwise). The numbers are in 1amp increments:

- 1 – 1amp limit
- 1&2 - 2amp limit
- 1&2&3 - 3 amp limit
- 1&2&3&4 - 4 amp limit
- 1&2&3&4&5 -5 amp limit

Having all five jumpers on gives a maximum of 5 amps possible. Having three jumpers on gives a maximum of 3 amps. We recommend keeping it below the maximum current for your laser diode if you don't want the possibility of overdriving the laser which will probably kill it quickly.

Set the jumper on J1 to the appropriate range you desire to drive the diode. For example, a 2Amp range will have the jumper 1 and 2 on. This will give an output current of greater than 2 Amps within 10% (with the potentiometer VR1 completely turned counter-clockwise.)

To get a specific current, adjust the potentiometer VR1 with a small flat head screwdriver.

- To **REDUCE** current, turn counter clockwise
- To **INCREASE** current, turn clockwise

To get exactly 2 Amp of current, adjust the potentiometer VR1 counter counter-clockwise to decrease the current to the diode and clockwise to increase the current to the diode.

The potentiometer has 21 turns of adjustment and can achieve a resolution of 1% or better.

CHECKING THE OUTPUT CURRENT ON A METER

We recommend using a current meter to check the output of the driver board before hooking up the laser to verify the output is within the limits of operation of the diode laser. This is a very useful tool when adjusting the current to a specific value with the potentiometer.





Klein Tools Digital Multi-meter

HOME Depot Model # MM1000 Internet # 202521270 Store SKU # 362878

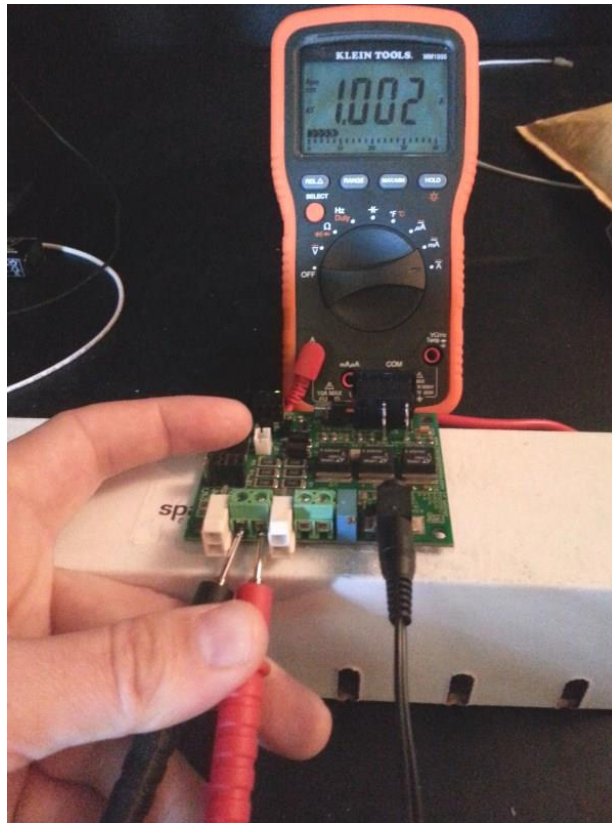


Alternatively, you can use a clamp style meter to check the current on the output wire to the laser. This method is normally not as accurate as the multi meter but can provide a view of the current as the laser is in operation.

Depending on your laser efficiency you can estimate the output power of the diode. Many lasers are 1:1 for current to Watts. For a laser with a high output G2 lens, the ratio is 1:3.

To check the current of the board with a multi-meter, simply connect the test leads of the multi meter to the output connector from the laser driver. Always check the current **WITHOUT** the laser connected! Because you are connecting your meter test leads to the output connector they may make spurious connections causing power spikes and will be sent to the laser diode directly bypassing the safety protection features of the laser driver board. You can adjust the current here using the potentiometer. This is shown in the following picture:





Checking output current with Multi-meter. Laser Diode is **UNPLUGGED** for this procedure.

COMPLIANCE VOLTAGE AND POWER ADAPTERS

Depending on the compliance voltage of the laser diode, it is preferable to choose the correct power adapter to meet the needs of the laser while minimizing excess voltage dissipated as heat across the regulators.

There are several AC/DC wall adapters in the accessories section of www.jtechphotonics.com to choose from, or you can purchase your own. The requirements are:

- AC to DC current
- Positive center
- 2.1mm I.D. x 5.5mm O.D
- Female

OEM POWER SUPPLY SELECTION

If you purchased the OEM version of the laser driver, you can either purchase your own adapter or connect it to your own power supply. For integration into other systems, it is advisable to use the system power supply as long as it is in the range of the laser diode you are driving.

It is necessary to choose a power supply that will have enough voltage to run the laser diode at maximum current as well as be not more than a few volts over the compliance of the laser diode. Any additional voltage above the compliance voltage of the laser diode will be dissipated as heat. Excessive additional voltage can lead to overheating of the laser driver. To figure out how much voltage is needed for a minimum, take the compliance voltage of the laser diode and add the voltage drop from the laser driver.

We recommend a 12V supply for all 445nm blue diodes.

MOUNTING

The following drawing is provided for mounting. Units are in inches.

