

INSTRUCTION MANUAL – SAFETY INTERFACE BOARD

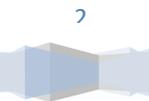


Version: 1.2



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GENERAL

SAFETY INTERFACE OVERVIEW

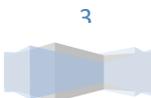
The Safety Interface Board is designed to work with all of the new versions of laser heads with the integrated driver in them. As with the previous generations, the driver is designed to follow the federal guidelines for safety compliance for high power Class 4 laser operation. This includes the use 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.

Power is input and converted into the needed levels for operation. A PWM input is optically isolated and there is an internal PWM feature in case your machine does not have the ability for PWM. 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 power level can be controlled via external PWM signal at the recommended frequency of 1Khz. If external PWM is not available, then there is an internal power level adjustment by switching to internal mode.

The Safety Interface board is cost effective and easily integrated into industrial, research, or enthusiast projects and products. The board can be operated in CW mode or in Input Control Mode to be interfaced to remote electronics. This design uses optical 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.

Specification	
Minimum Operating Voltage	24V
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Current Adjust Modes:	External PWM, Internal Potentiometer
Current Range Accuracy	Within 10% of current limit
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:	3KHz
Connectors:	Screw Terminal and JST PH Connectors



Operating Temperature:	0 to 40 °C
Storage Temperature:	-40 to 70 °C
Dimensions:	4.2" x 3"

SAFETY

- Operate the Safety Interface Board in an explosion free area.
- The Safety Interface 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 heads, 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

- All statements of safety are only applied when the 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.

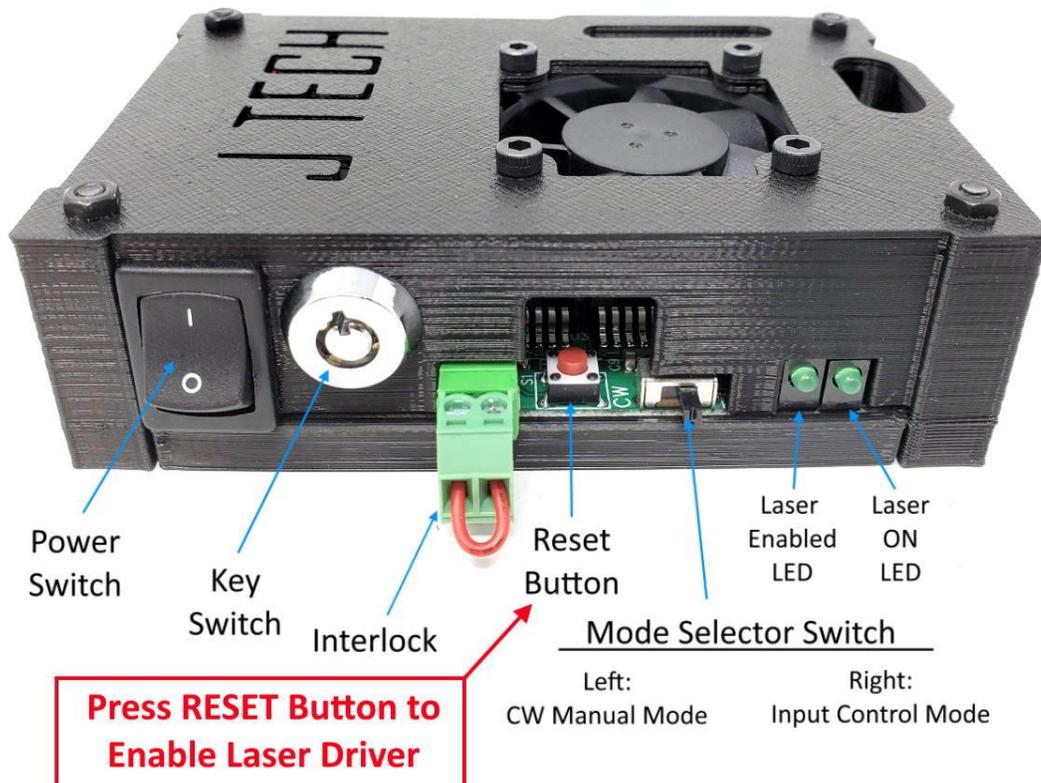
Verify the contents of the package:

- Safety Interface Board
- 2- Key switches
- Power Adapter with connector according to ordering country (Some OEM packages will not have a power adapter).



OPERATION

FRONT OF SAFETY INTERFACE BOARD



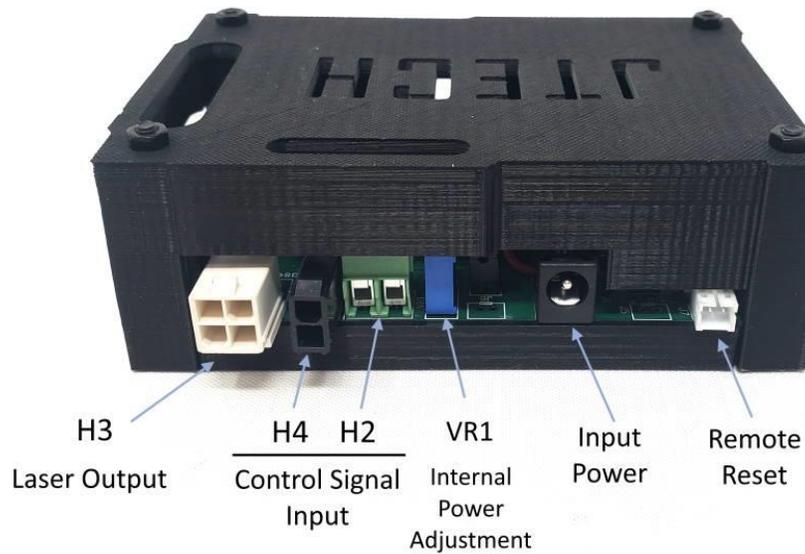
The front contains:

- 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



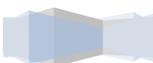
Back View



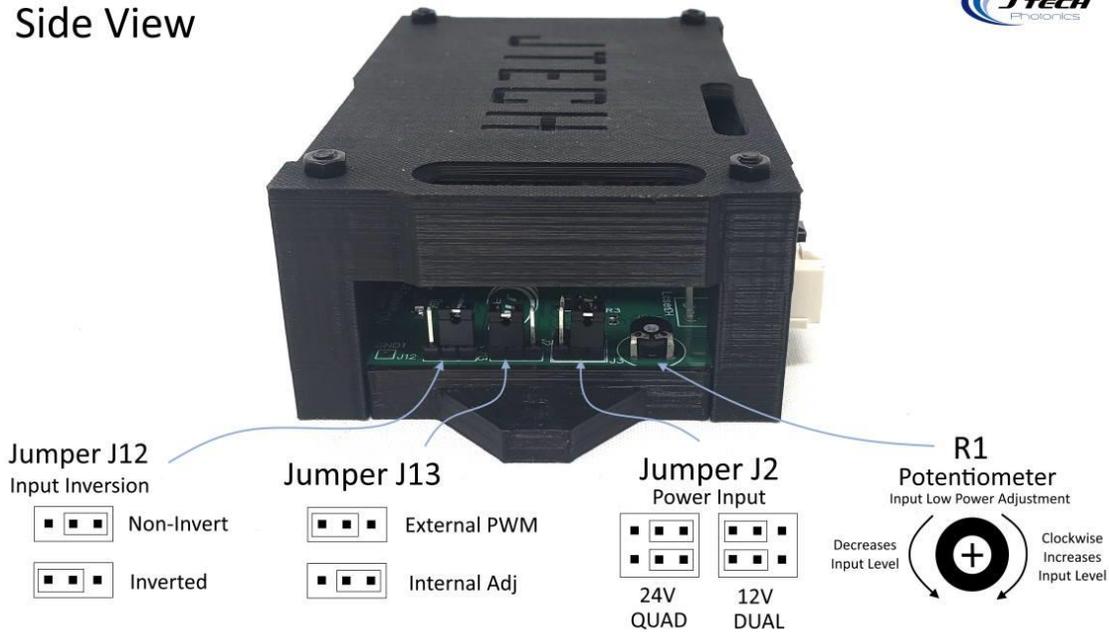
The back contains:

- H3 – Laser Output / Extension Cable Connector
- H4 - Input Control Connector:
- H2 - Input Control Screw Terminal:
- VR1 - Potentiometer for Internal Power Adjustment
- Power Adapter Plug (center pin positive)
- Remote Reset Switch Connector

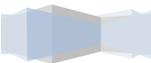
INPUT ADJUSTMENT AND POWER LEVEL



Side View



- Jumper J12 – Input Inversion: This will either invert the input signal or not. Factory setting is non-invert.
- Jumper J13 – Input: External PWM will allow for software control of the laser via PWM signal. Factory setting is external. Internal Adjustment will allow for current level adjustment using the variable potentiometer.
- Jumper J2 – Power Input: Select between 24V and 12V input power. 24V is for Quad Pro. 12V is for Dual Pro lasers.
- R1 Potentiometer – Low power: This will adjust the low power input mode of the laser to allow for machine framing. Clockwise will increase the input and counter clockwise will decrease the input.

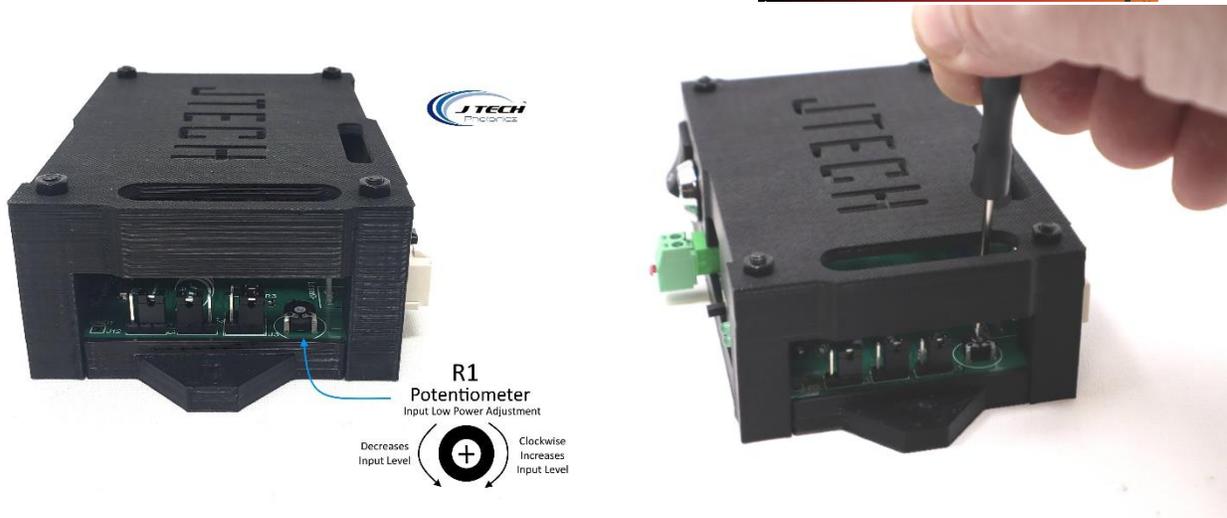
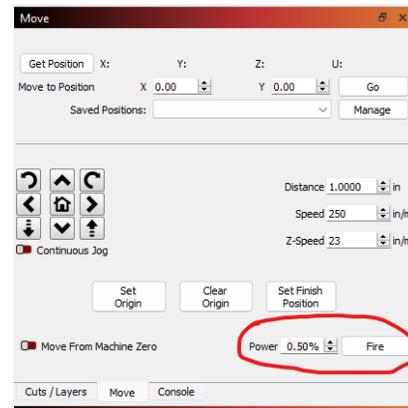


ADJUSTING LOW LEVEL INPUT SIGNAL

Potentiometer R1 is for adjusting the level of the input signal. The high power lasers produce so much power that the low level is still too high for framing the area in which you want to highlight to be able to position the material. In this case, you want to turn the laser down slightly to allow for the input signal to turn the laser just barley on to be able to view where the frame is. In this case, you can adjust the level with potentiometer R1. This is the procedure to do this.

Prepare your laser head to adjust the input power by moving it to an area with a scrap piece of material and put it up high in Z so it is not in focus. In LightBurn, go to the move tab and fire the laser in low power. We recommend setting this low power under 1%.

Put the laser in this low power and press the fire button to fire the laser. Now, adjust the potentiometer R1 to have the laser turn on, but also not be so high that it will burn the material when framing.



The potentiometer is located on the right side of the safety interface board. Adjust the level, but don't turn it down too much as it will cause inconsistencies when cutting if it is too low.

If you still are having issues with framing and burning material, then put the z axis up a known amount of distance so it is out of focus slightly (like 1") and then frame the project. After you have framed it, then you can use the spacer to set your proper distance from the board.

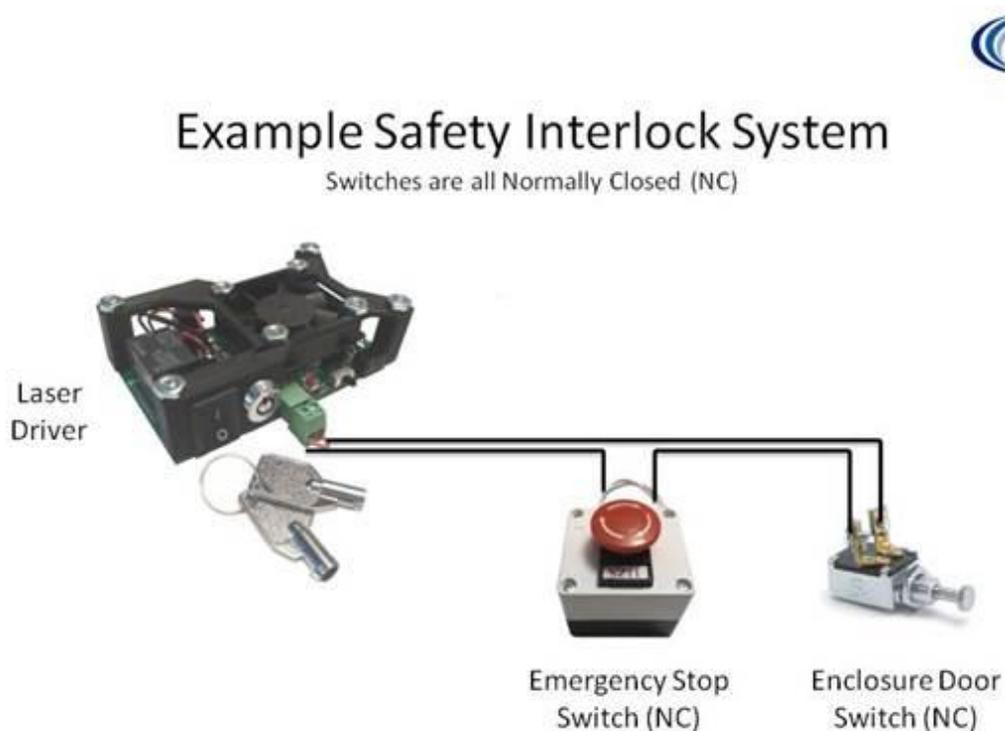


SAFETY INTERLOCKS

The laser driver has an interlock system which is NORMALLY CLOSED and contains a voltage in the cable of 12V or 24V supplied by the safety interface board. This means if any switch along the interlock chain becomes OPEN, then the circuit will open and the laser will disengage the laser.

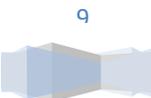
Examples of use of the interlock system include the emergency stop button switch and an enclosure door switch. When integrating the laser driver and laser into an OEM machine, all entrances to the machine (enclosure doors) must have an interlock switch in order to be considered compliant with Class 4 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:



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

If the safety interface board 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 RESETTING 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:

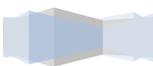
1. Make sure the situation is clear for laser operation and make sure the laser is not being controlled in an ON position.
2. Clear all switches that have been activated back to the Normally Closed position.
3. Make sure the key is to the right.
4. Press the reset switch on the board (or remote reset switch if installed)
5. 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. Make sure the key is to the right.
4. 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.

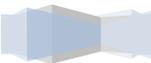


KEY SWITCH

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.



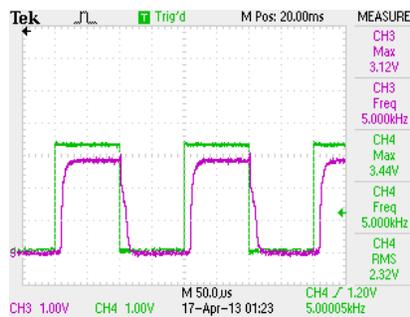
MODE SELECTOR SWITCH

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

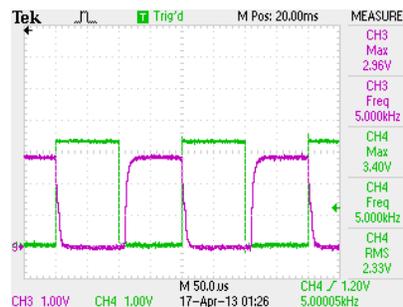
- Input Control Mode: This is when the switch is on the RIGHT. This mode allows for a signal to be connected to connectors H2 or H4 for a signal to turn the laser on and off. Use this input with your controller to turn the laser on and off with G Code commands.
- CW Mode: This is when the switch is on 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. This is useful for troubleshooting that the laser is working properly.

CONTROL SIGNAL AND PERFORMANCE

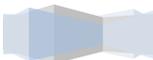
The input connection provides an optically isolated input for control of the laser diode. The connection and the jumper settings were described in the previous sections. The voltage required to turn on the opto-isolator is 2.8 volts. The input can handle up to 24 volts. The input can be cycled with no degradation up to 3KHz. 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 3KHz. Ch 1 control, Ch 3 output.



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

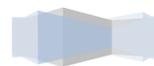


FIRST OPERATION

- **Before operation read the Safety section of this manual.**
- Properly connect the output of the safety interface board to the laser head. Ensure the connections are correct.
- If using input control, connect the input signal to the driver board.
- Plug in the adapter to the AC power.
- Plug in the adapter to the Safety Interface Board.
- Make sure the safety interlocks are correctly assembled or the defeat jumper is on the interlock key.
- Turn the key switch clockwise to the ENABLED right position
- 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.
- Your safety interface board is now ready to produce an output 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

- 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:
 - 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.



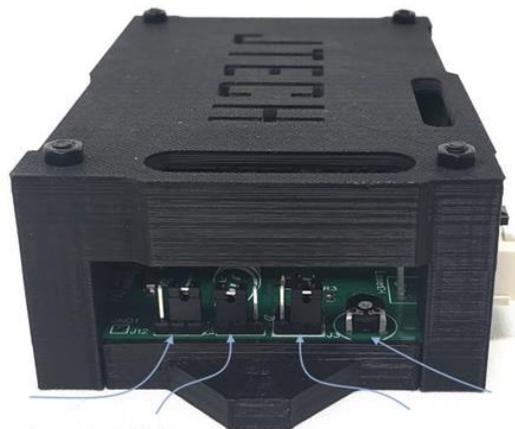
ADJUSTING INTERNAL INPUT

You can use the external PWM to software control the power from this point. If you do not have software control, then you can use jumper J13 to put it into internal mode and use the potentiometer to control the output level.

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

- To **REDUCE** laser power, turn counter clockwise
- To **INCREASE** laser power, turn clockwise

The potentiometer has 21 turns of adjustment and can achieve a resolution of 1% or better. The input will still turn the laser on and off, but it will be regulated by the internal power level adjustment.



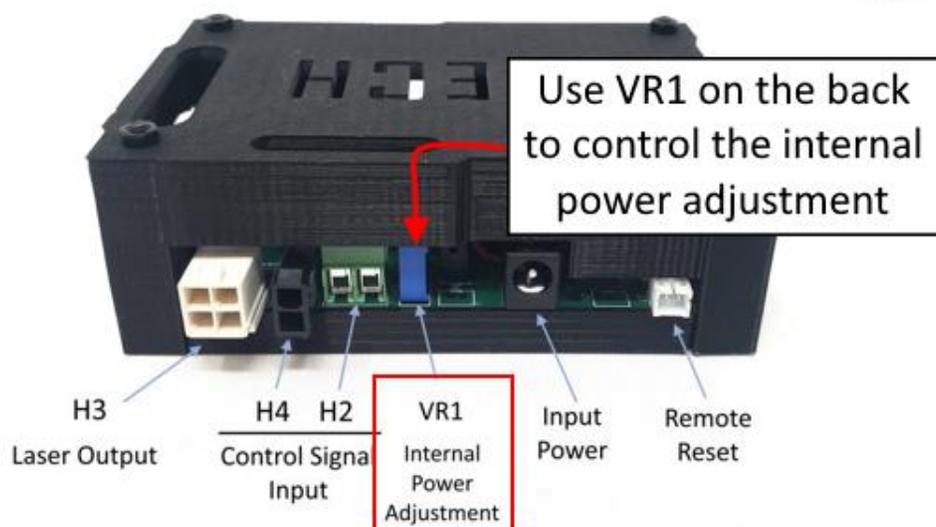
Jumper J13

External PWM

Internal Adj

Switch Jumper J13 to "internal"

Back View



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:

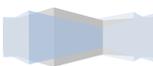
- AC to DC current
- Positive center
- 2.1mm I.D. x 5.5mm O.D
- Female

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 2.8W, 4.2W, 14W lasers. 24V for 24W Quad lasers.



MOUNTING

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

