INSTRUCTION MANUAL – 64W SAFETY INTERFACE BOARD

Version: 1

November 20th, 2024

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GENERAL

SAFETY INTERFACE OVERVIEW

The safety interface module 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 safety interface module 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 a 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:	10KHz
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 safety interface module. Also, make sure there is adequate protection around the safety interface module 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 safety interface module or their finished products.
- You Accept this safety interface module 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

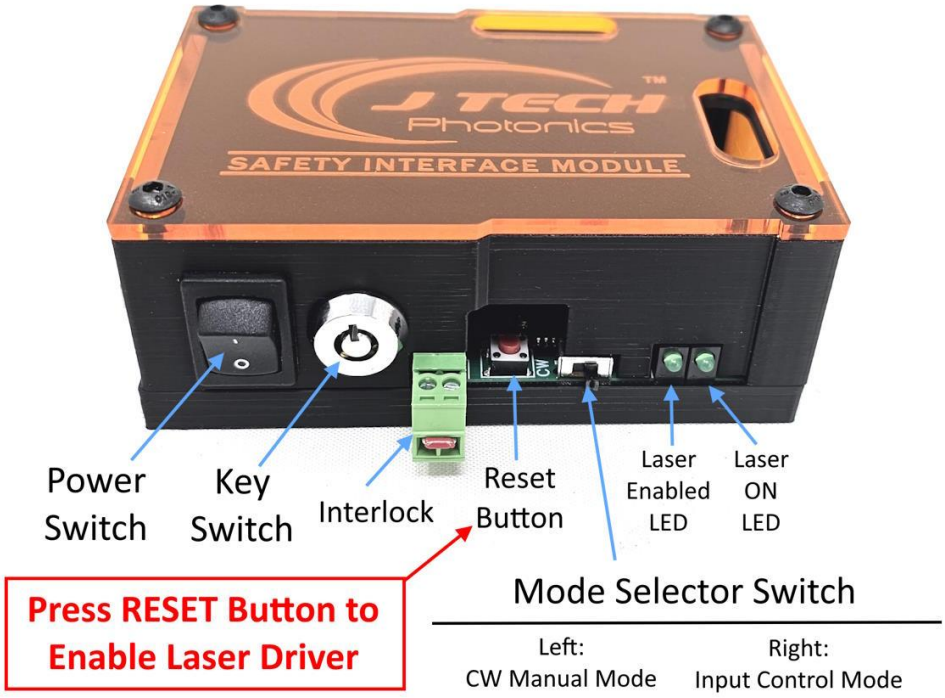
Inspect the shipping container for damage.

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

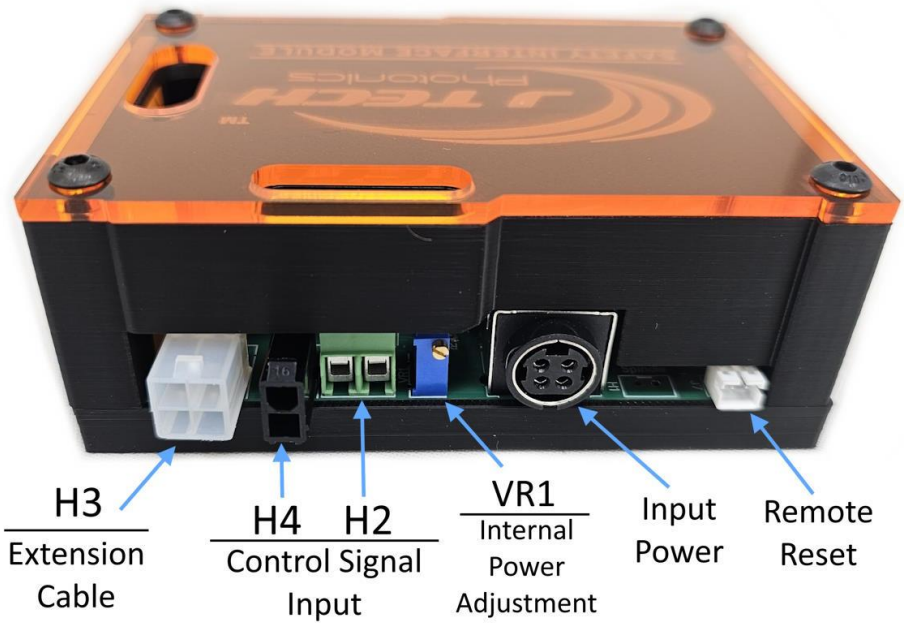
FRONT OF SAFETY INTERFACE BOARD



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 SAFETY INTERFACE MODULE



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

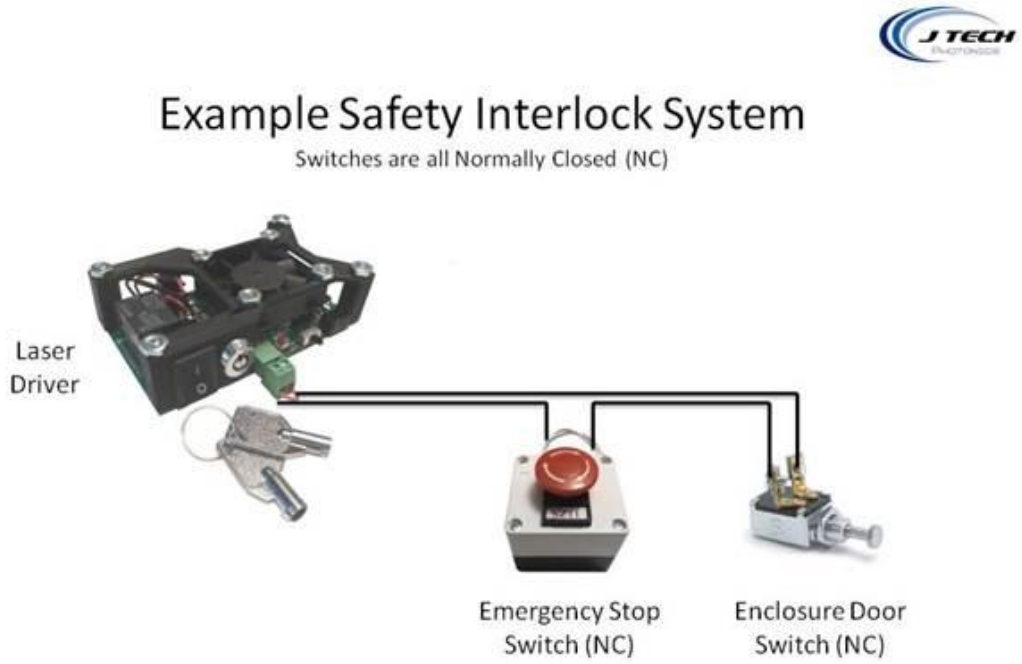
- Jumper J12 – Input Inversion: This will either invert the input signal or not. Factory setting is non-invert.
- Jumper J13 – Input: External PWM will allow for software control of the laser via PWM signal. Factory setting is external.
  Internal Adjustment will allow for current level adjustment using the variable potentiometer.

SAFETY INTERLOCKS

The laser safety interface module 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 safety interface module 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 safety interface module 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 are implemented correctly before use of the laser.

SAFETY FEATURES AND RESETING THE LASER SAFETY INTERFACE MODULE

The safety features of this laser safety interface module 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 safety interface module 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 safety interface module or there is a power outage, then the laser safety interface module 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 safety interface module board on the farthest right connector.

KEY SWTICH

The laser safety interface module 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 safety interface module 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.

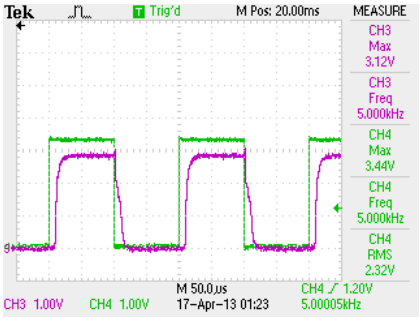
MODE SELECTOR SWITCH

The safety interface module board has a selector switch for the two different modes of the board.

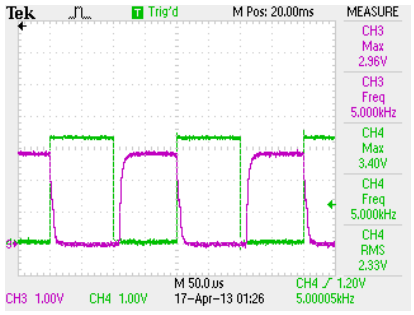
- Input Control Mode: This is when the switch is on the RIGHT. This mode allows for a signal to be connected to connectors H2 or H4 for a signal to turn the laser on and off. Use this input with your controller to turn the laser on and off with G Code commands.
- CW Mode: This is when the switch is on 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 safety interface module 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 safety interface module 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 safety interface module 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 safety interface module output will be enabled.

GENERAL OPERATION

- Make sure it has adequate airflow.
- Keep the safety interface module 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.

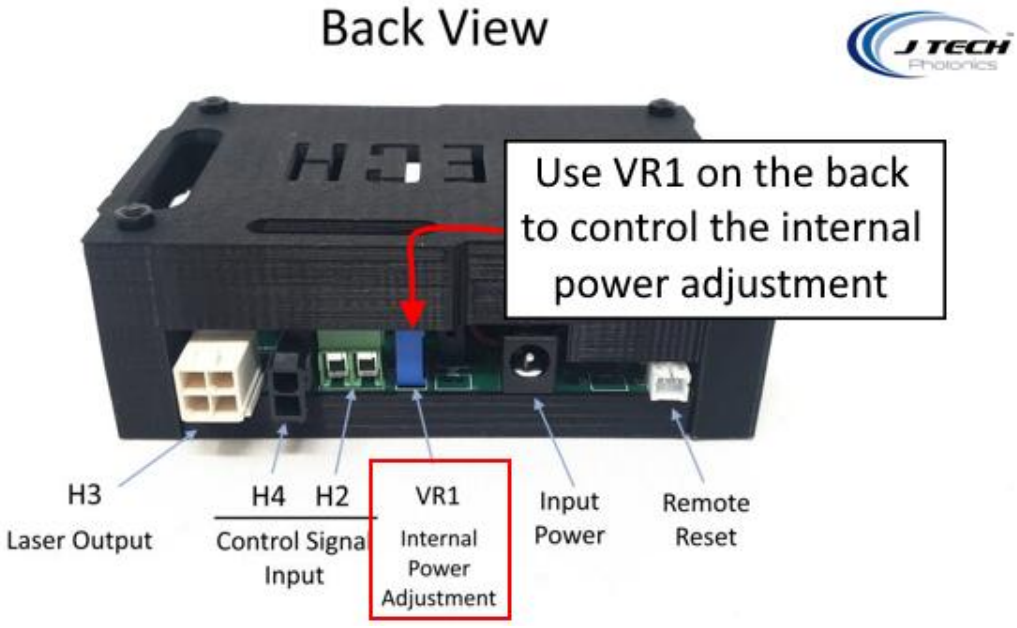
ADJUSTING INTERNAL INPUT

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.



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

MOUNTING

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