Read Through This Entire User & Safety Manual Before Using The Sienci Labs 7W LaserBeam System

7W LaserBeam Product Description

The Sienci Labs 7W LaserBeam System is a plug and play add-on for the Sienci Labs LongMill Benchtop CNC. It gives the CNC laser engraving and cutting capabilities.

The 7W LaserBeam attachment system consists of a laser diode, focusing lens, heatsinks, cooling fan and a 5A constant current driver. It allows you to engrave and cut laser safe material with accuracy and quality when paired with a CNC machine. This component is a Class 4 laser emitting device.

7W 445nm Laser Diode Assembly

First, the 7W 445nm multi-mode laser diode is pressed into a copper heatsink. Then this is assembled into an aluminum heatsink with a set screw on the bottom of the heatsinks. Located at the front of the assembly is an adjustable glass focusing lens with an aluminum lens focus ring for users to easily adjust the focus. Providing the diode with a constant 4A will give approximately 7W of optical output power. The diode assembly includes a laser cooling fan on the rear end to cool the entire assembly and improve the heat dissipation capabilities. We recommend customers keep their laser diode component assembly at 50 degrees Celsius and below.

Max Forward Current	5A
Recommended Max Forward Current	4A
Threshold Current	150mA - 350mA
Forward Voltage	3.7V - 5.2V
Optical Output Power	7.5W
Wavelength	445nm
Package	TO - 5 (9mm)
Estimated Lifespan	1000 hours - 10,000 hours
Storage Temperature	-40°C – 85°C
Operating Temperature	0°C – 60°C

Focused Spot Size	0.065mm x 0.130mm
Beam Divergence Parallel	10° (5° - 25°)
Beam Divergence Perpendicular	46° (35° - 52°)

Table 1: 7W 445nm laser diode specifications

Output Conditions

The laser diode output will vary based on temperature and diode lifecycle. As the diode degrades over time, it will require more current. For longevity, we recommend keeping the maximum current at 4.5A. Additionally, for any jobs longer than 15 minutes and utilizing the maximum set power (cutting at 100% power), we recommend you keep the current at 4A or under.

Normal Operating Conditions

Operating the laser diode with normal operating conditions of 4A will produce an optical output of 7W. Although it is possible to increase this output by adding additional current, it will decrease the lifespan of the laser diode.

Laser Safety

User Safety

The 7W LaserBeam and any other laser device can cause harm to you or others. Ensure that you follow these safety guidelines

1. **Never let the laser run unattended**

   Ensure that you have a fire suppression system such as a fire extinguisher nearby in case of a fire. Never leave your laser unattended. Ensure that your laser is turned off when not in use.

2. **Ensure proper ventilation**

   Use the laser in a well-ventilated environment. Fumes and particulates from cutting or engraving can be harmful. We recommend having a fume extraction system or having an open door or window to provide ventilation.

3. **Wear Eye Protection**

   Wear compatible laser safety goggles or glasses. Not wearing appropriate eye protection may cause permanent eye damage. The 7W LaserBeam comes with appropriate OD 7+ safety glasses. Ensure that the user and any personnel in the same room are wearing them before the laser is in use.

4. **Static & Surges**

   Be aware that static electricity and power surges will degrade the performance of the laser diode. Take necessary steps to avoid this.

5. **Cut and Engrave only laser safe materials**

Never cut materials that can generate toxic fumes or are dangerous to cut/engrave, such as

- PVC
- ABS
- Vinyl
- Fiberglass

Caution - use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Safety Sticker 1 Text

LASER RADIATION
AVOID EYE OR SKIN EXPOSURE
TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER
MAXIMUM OUTPUT: 7.5W
EMITTED WAVELENGTH: 445NM
IEC 6085-1:2014
Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3 and IEC 60601-2-22 Ed. 3.1, as described in Laser Notice No. 56, dated May 8, 2019

Figure 1.1: Safety sticker 1

Safety Sticker 2 Text

AVOID EXPOSURE
LASER RADIATION IS
EMITTED FROM THIS APERTURE

Figure 1.2: Safety sticker 2

Product Label Text:

Sienci Labs
Desktop CNC Milling
372 King St N Unit 2,
Waterloo, ON
N2J 2Z3 Canada
Unit Name: 7W-LBV1
Input Rating: 100-240V, 50/60Hz, 2.0A
Manufactured: Month - Year

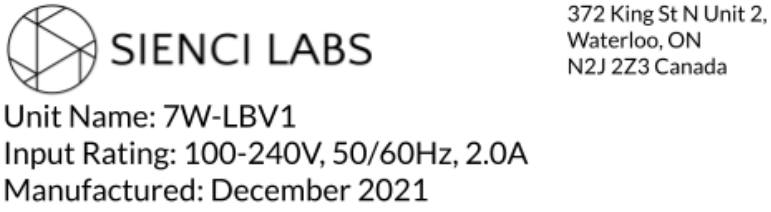

Figure 1.3: Product Label

Figure 2: Laser diode assembly with safety stickers

Figure 3: Laser diode assembly with product label

Laser Diode Assembly Components

- 1x Copper diode heatsink
- 1x Aluminum heatsink
- 1x Set screw - m3x12mm
- 1x Acrylic router plate mount or 1x steel router plate mount
- Safety warning stickers
- 1x Laser cooling fan

Additional Components

- 1x G2 lens
- 1x 7mm Lens spring
- 1x Lens focus ring
- Extension cables

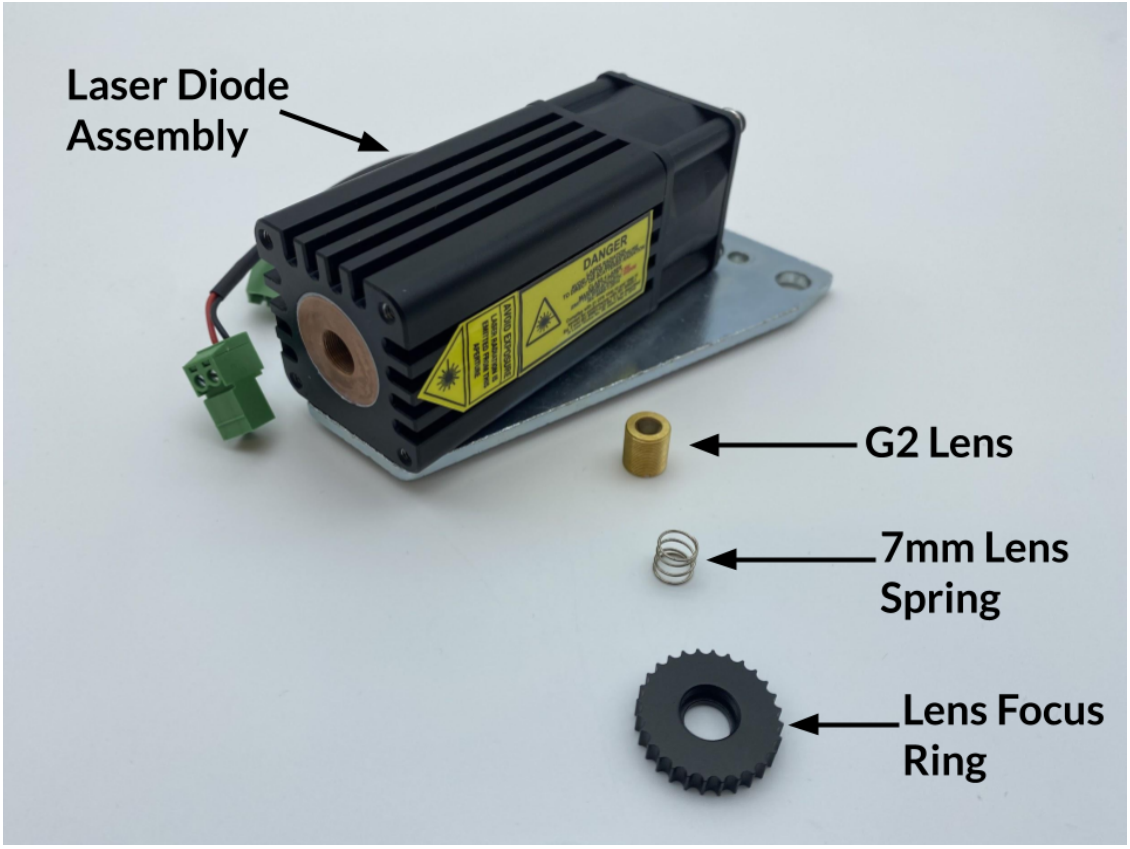

Figure 4: Laser diode assembly with lens focus ring, 7mm lens spring and G2 lens

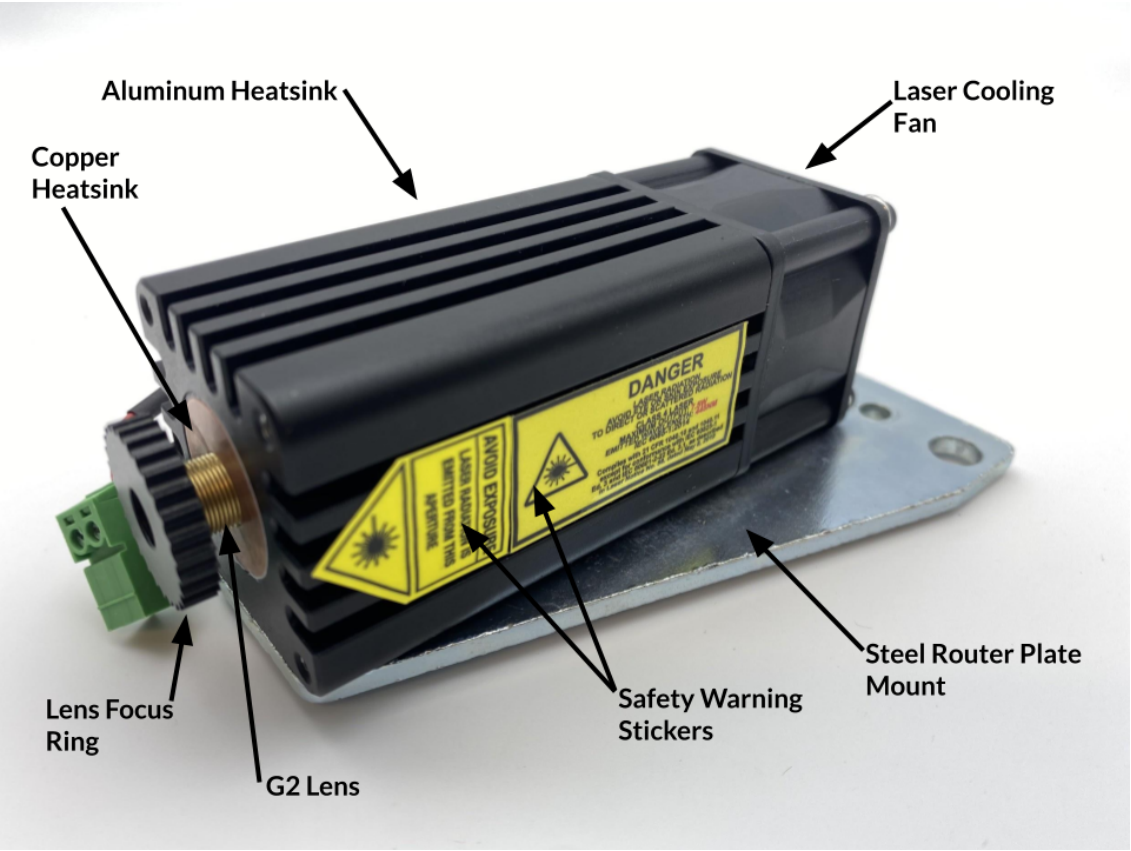

Figure 5: Laser diode assembly mounted with lens focus ring, 7mm lens spring and G2 lens

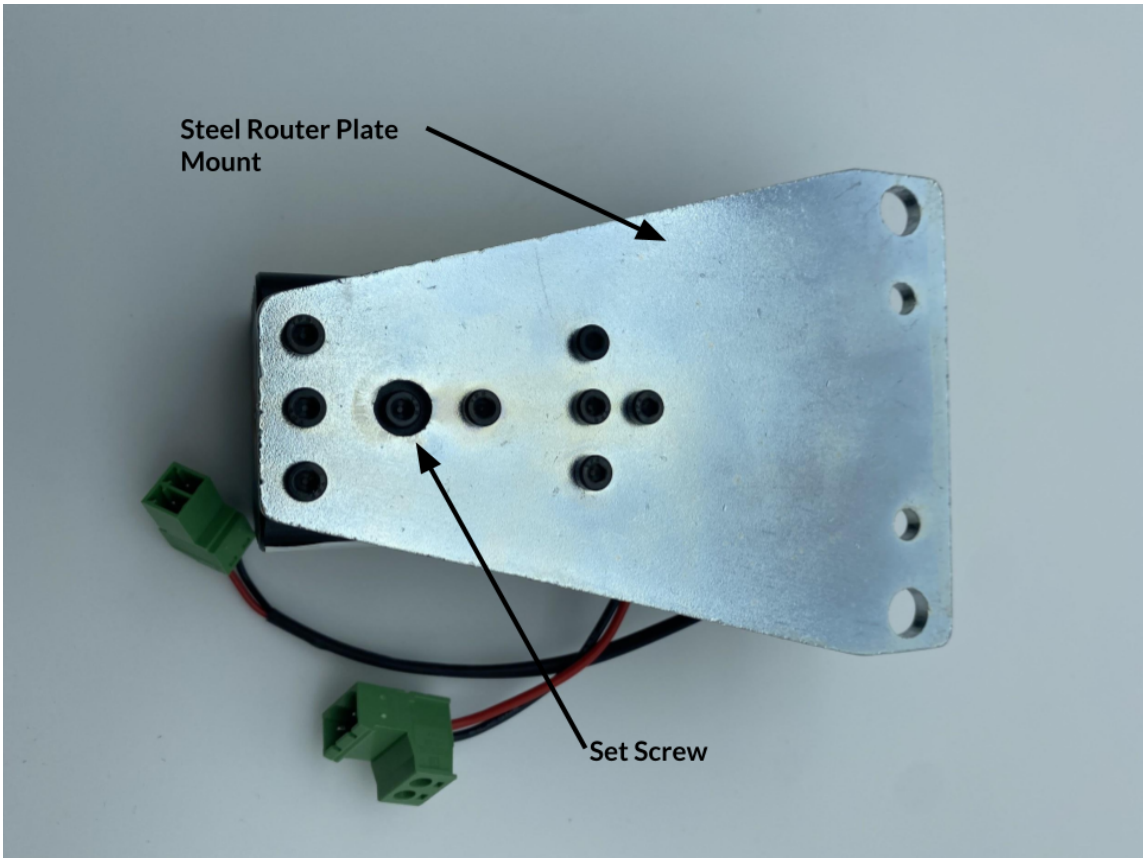

Figure 6: Rear view of laser diode assembly

Laser Diode Assembly Extension Cables

1. Laser Diode Extension Cable: 2.5m - 18AWG
    a. WJ15EDGK-5.08-2 pin male terminal connector
    b. Labelled with blue tags

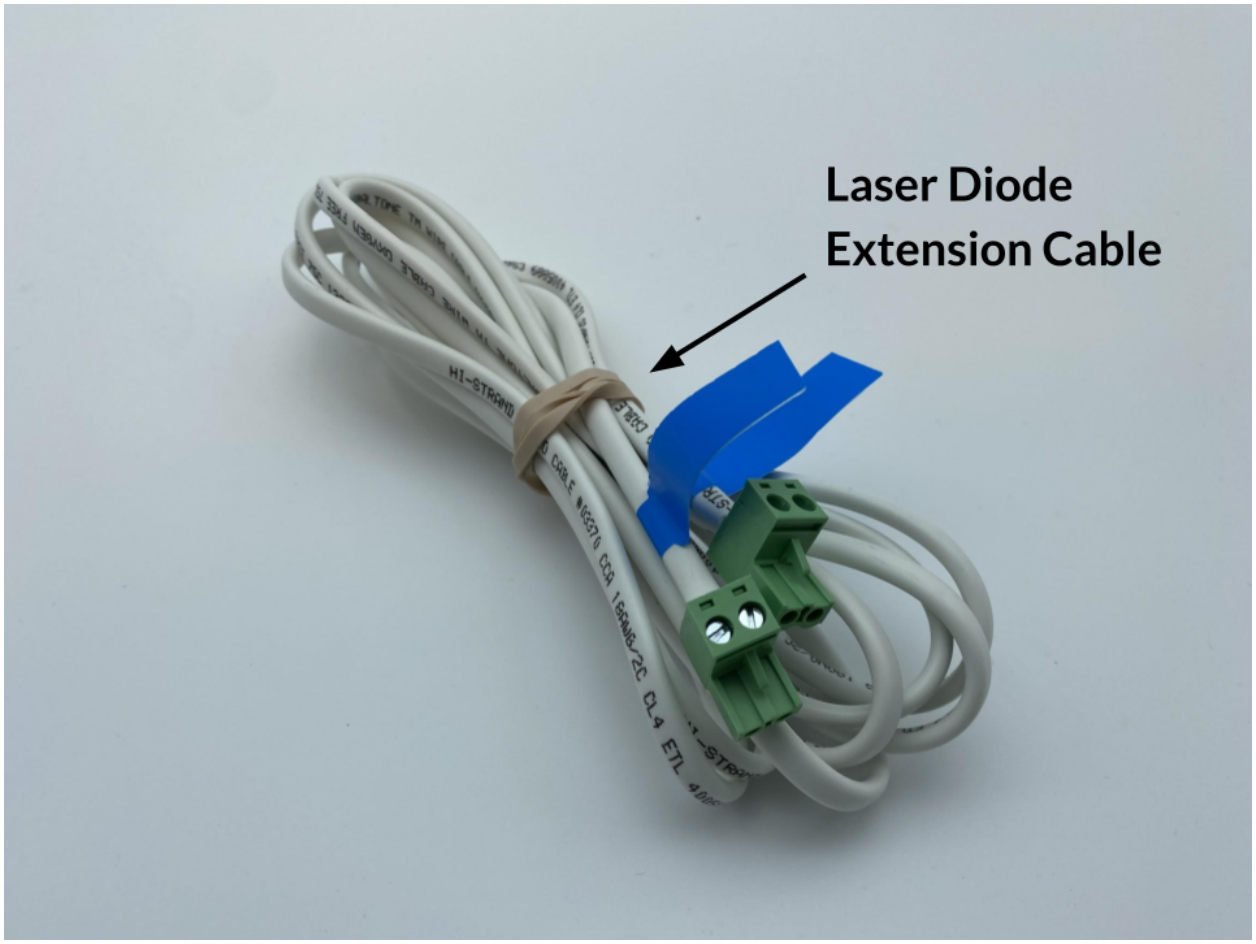

Figure 7: Laser diode extension cable

2. Laser Cooling Fan Extension Cable: 2.5m - 22AWG
    a. WJ15EDGK-3.81-2 pin male terminal connector
    b. Labelled with red tags

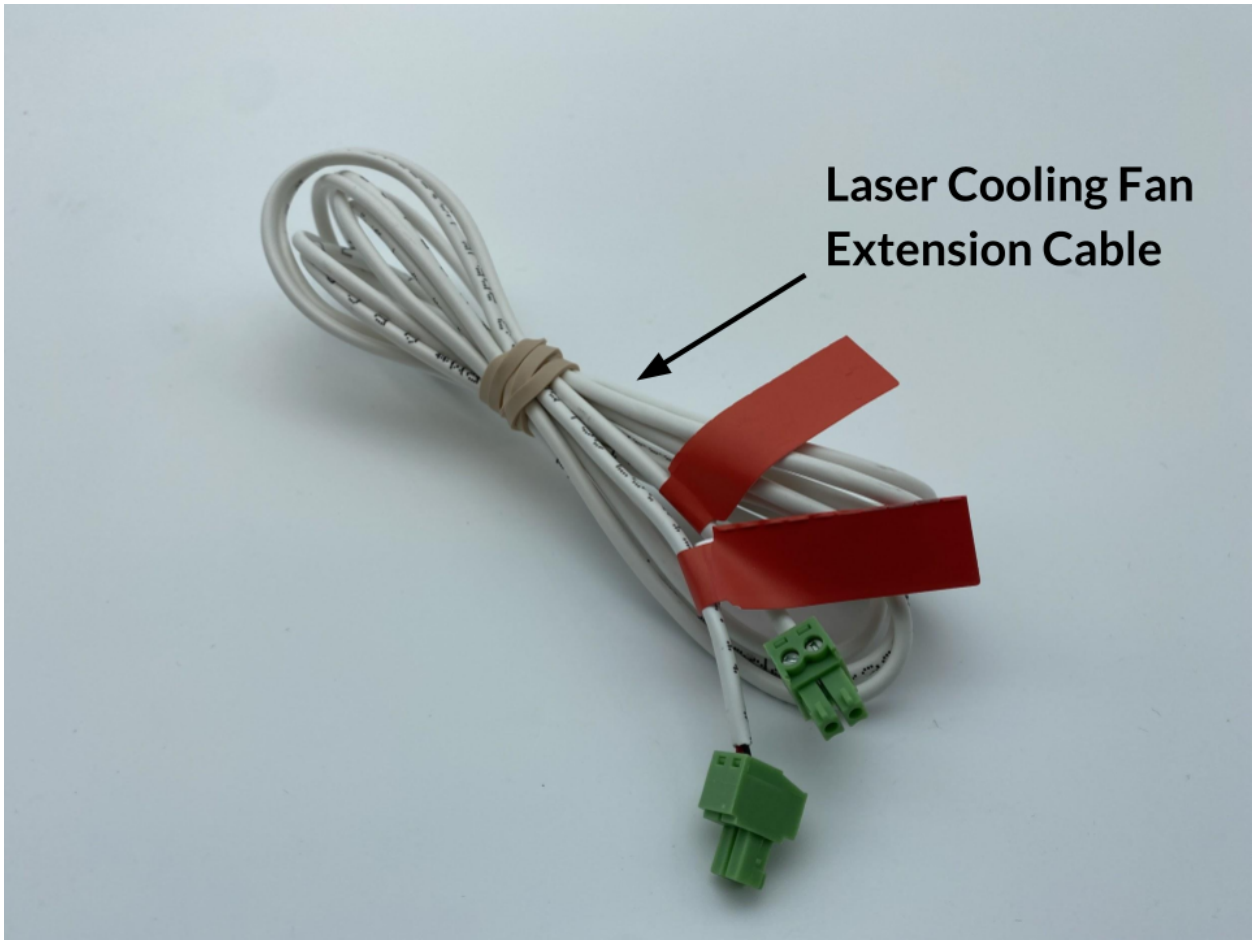

Figure 8: Laser cooling fan extension cable

3. 12V Accessory Extension Cable: 2.5m - 22AWG
    a. WJ15EDGK-3.81-2 pin male terminal connector
    b. Labelled with yellow tags

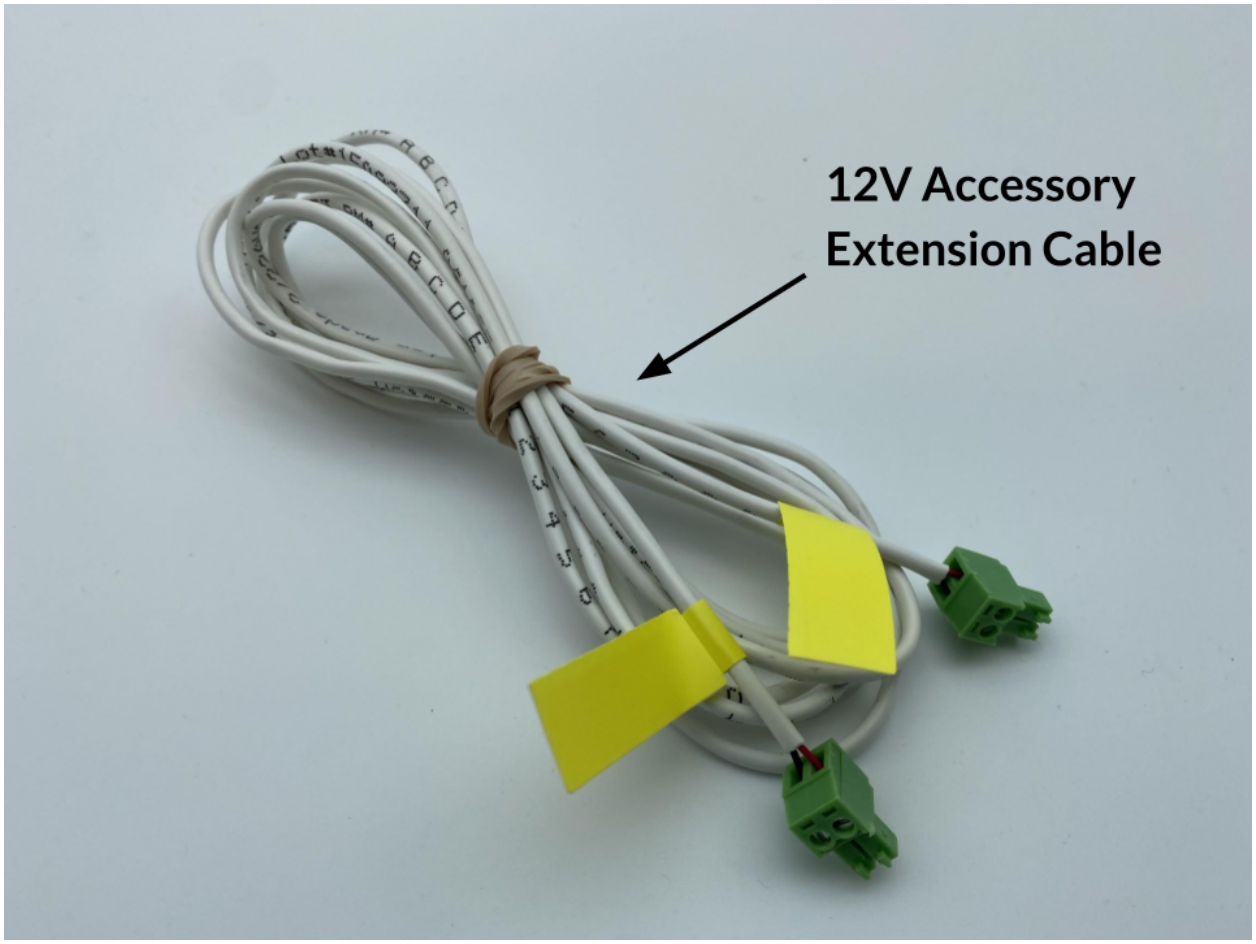

Figure 9: 12V Accessory extension cable

4. PWM Driver Signal Cable: 0.6m - 22AWG
    a. WJ15EDGK-3.81-2 pin male terminal connector
    b. Labelled with purple tags

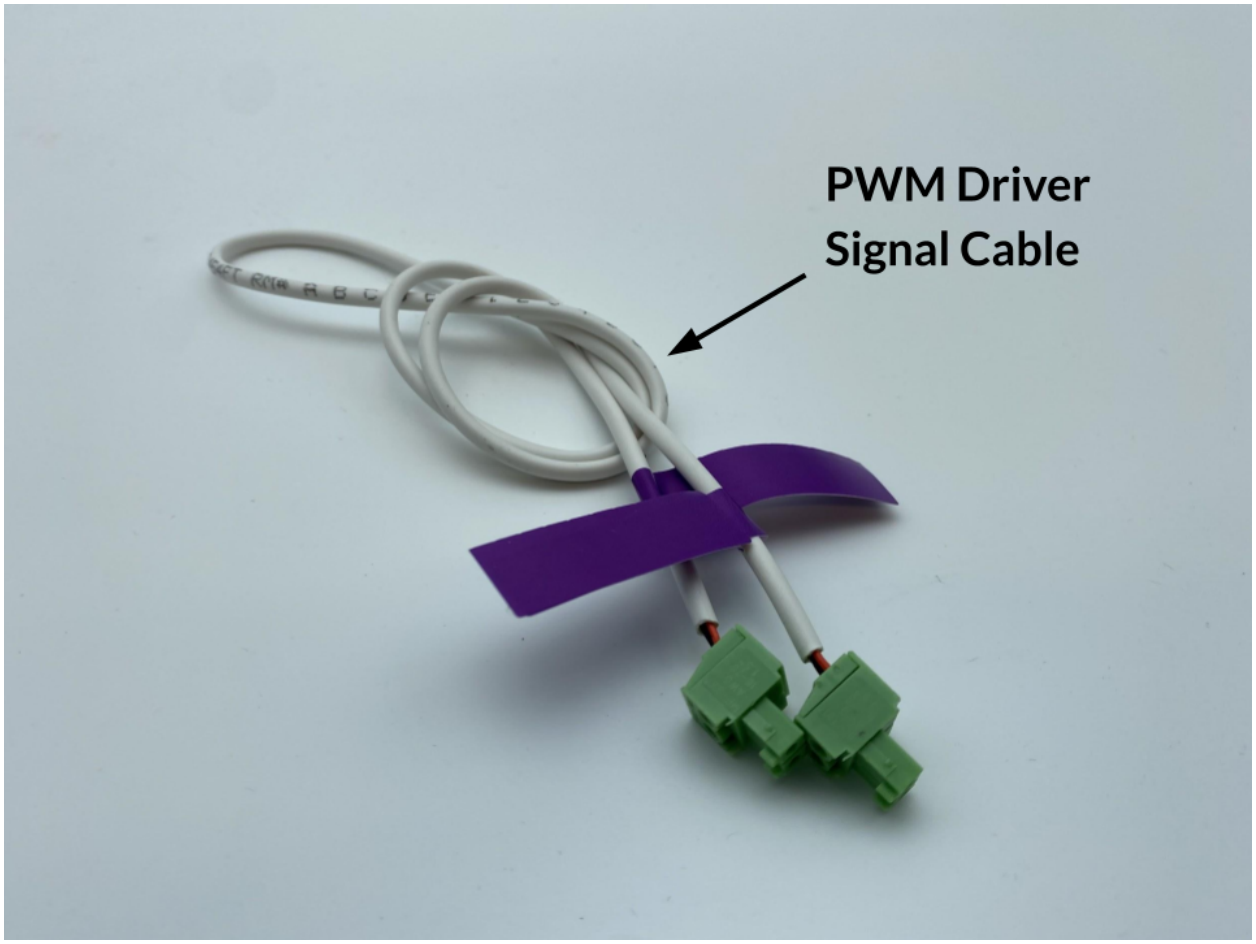

Figure 10: PWM driver signal cable

Laser Diode Assembly Input Connections

The 7W Laser assembly includes 2 input female terminal connectors.

1. 7W 445nm Laser Diode Input: WJ15EDGK-5.08-2 pin female terminal connector

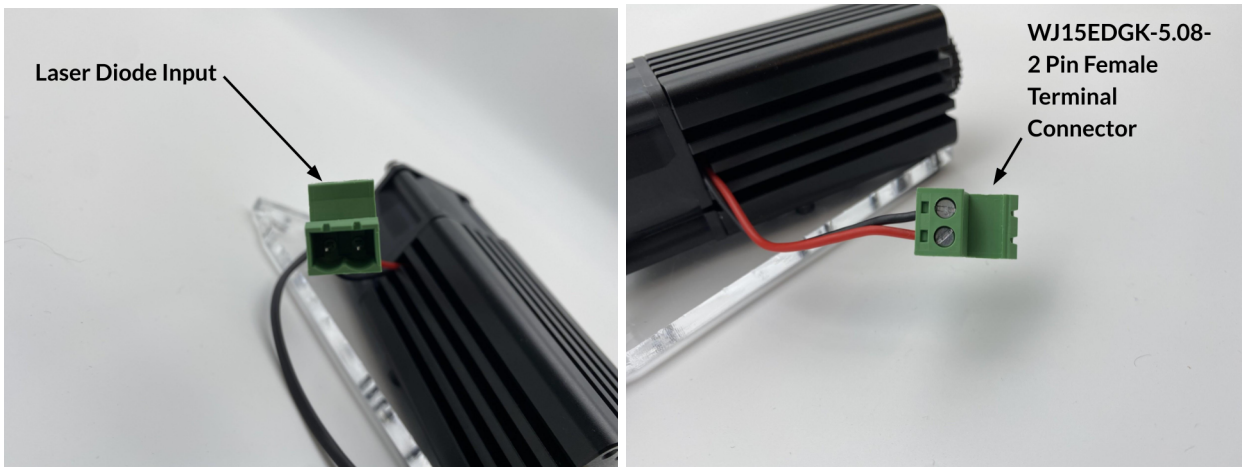

Figure 11: Female terminal connector for laser diode input

2. Laser Cooling Fan Input: WJ15EDGK-3.81-2 pin female terminal connector

Figure 12: Female terminal connector for laser cooling fan input

Laser Safety Glasses

The 7W LaserBeam comes with appropriate OD 7+ safety glasses to protect the user while operating this product. Ensure that the user and any other personnel in the same room are wearing safety glasses before the laser is in use. Along with the safety glasses, a carrying case and cleaning cloth are included.

Protection Range	200-500 nm
Optical Density within Protection Range	OD 7+
Transmittance	30%

Table 2: Laser safety glasses specifications

Figure 13: Laser safety glasses, case and cleaning cloth

Cleaning & Maintenance

When operating the 7W LaserBeam you will create smoke and other particulates that will get into the lens, lens focus ring, aluminum heatsink and laser assembly cooling fan which can affect performance. We recommend that you clean the lens with rubbing alcohol and a non-abrasive cloth such as a lens cleaning cloth, cotton swab or microfiber cloth. We recommend cleaning the remaining components with rubbing alcohol and microfiber cloth. Cleaning on a regular basis will ensure peak performance and longevity of the 7W LaserBeam diode assembly.

5A Constant Current LaserBeam Driver Assembly

The 5A constant current LaserBeam driver was designed to provide a maximum of 5A of constant current to the 7W LaserBeam diode assembly. Our driver has been designed in compliance with Class 4 requirements; it includes a key switch, remote interlock, power fault protections, power reset button and emission LED, keeping users safe and meeting all necessary requirements. Made to be plug and play with the Sienci

Labs LongMill Benchtop CNC, it can receive the PWM signal and operate as a laser attachment.

Current Output Range	0-5 A
Current Limit Dip Switch Settings	1A, 2A, 3A, 4A, 5A
Compliance Voltage	6V
Input Power	12V 8A
Laser Diode Protection	Current Limit
Minimum “on” Control Signal Voltage	3V
Maximum “on” Control Signal Voltage	12V
Maximum Control Signal Frequency	30Khz
Connector Type	Pluggable Terminal Block
Operating Temperature	0 - 40 C
Storage Temperature	-40 -70 C

Table 3: 5A Constant Current Laser Driver Specifications

Laser Driver Functionality

Power switch: Turns the driver ON/OFF
Power input: 12V Power supply input
PWM sIgnal input: 3V - 12V PWM signal input
Maximum current DIP switch: Set maximum current between 0A-5A
Laser diode output: Provide constant current to laser diode assembly
Fan output 1: 12V output to power the driver cooling fan
Fan output 2: 12V output to power the diode assembly cooling fan
Fan output 3: 12V output to power the air assist fan or other 12V accessories
Power reset button: Reset to allow the driver to turn ON
Interlock: Add a switch or E-Stop to allow more control over when driver can be turned on
Key switch: Allow for only authorized users with a key to operate laser driver

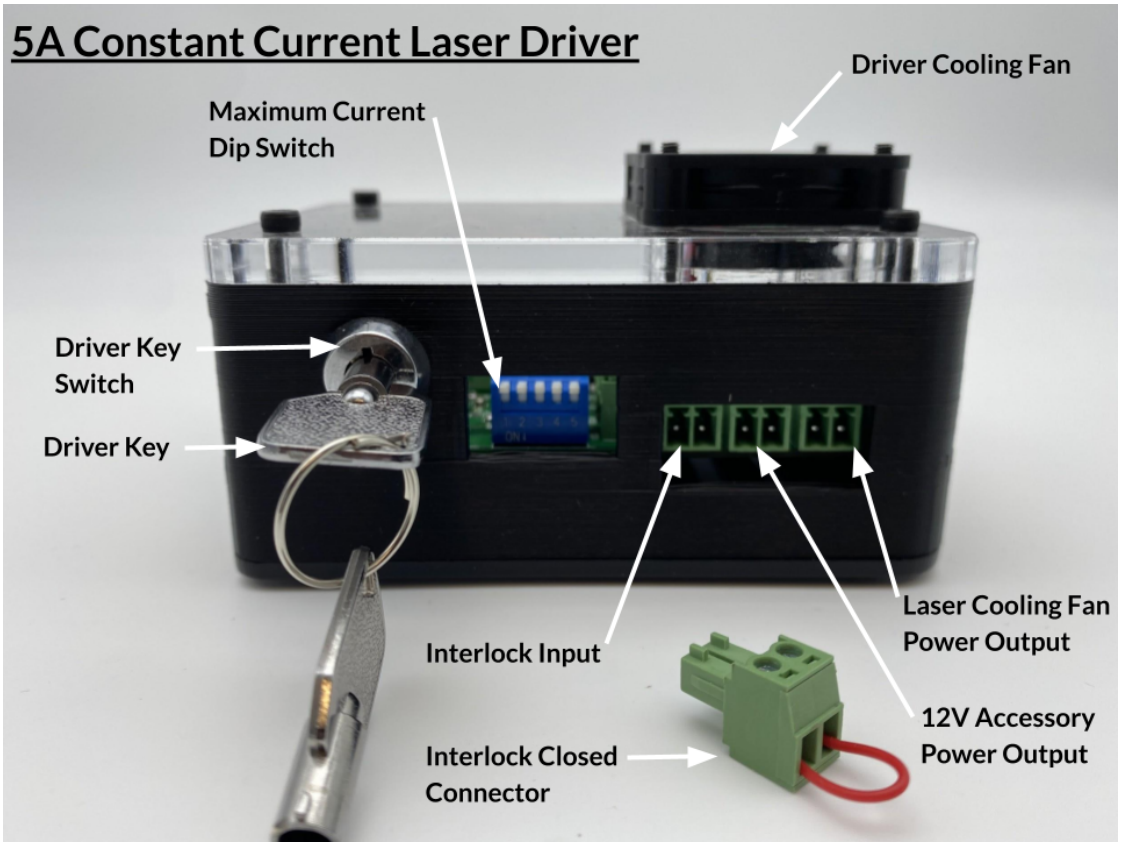

Figure 14: Front view of 5A constant current laser driver assembly

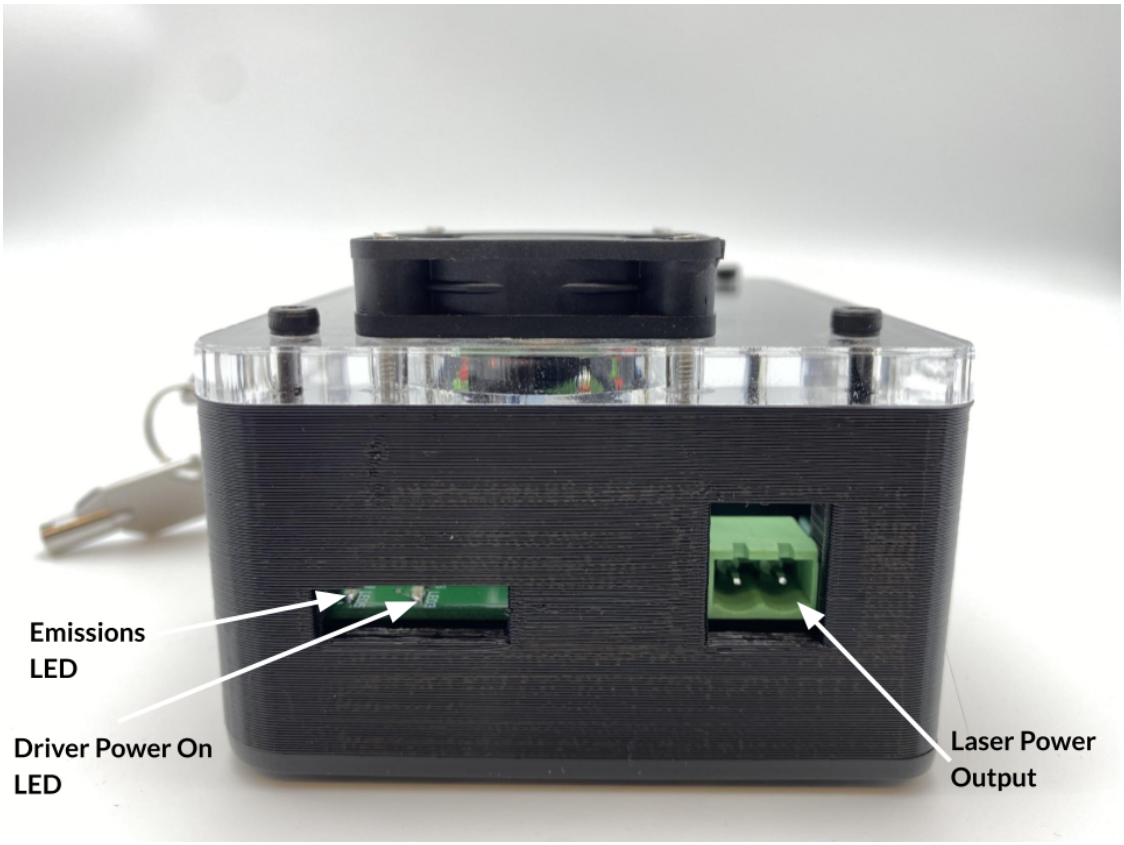

Figure 15: Right side view of 5A constant current laser driver assembly

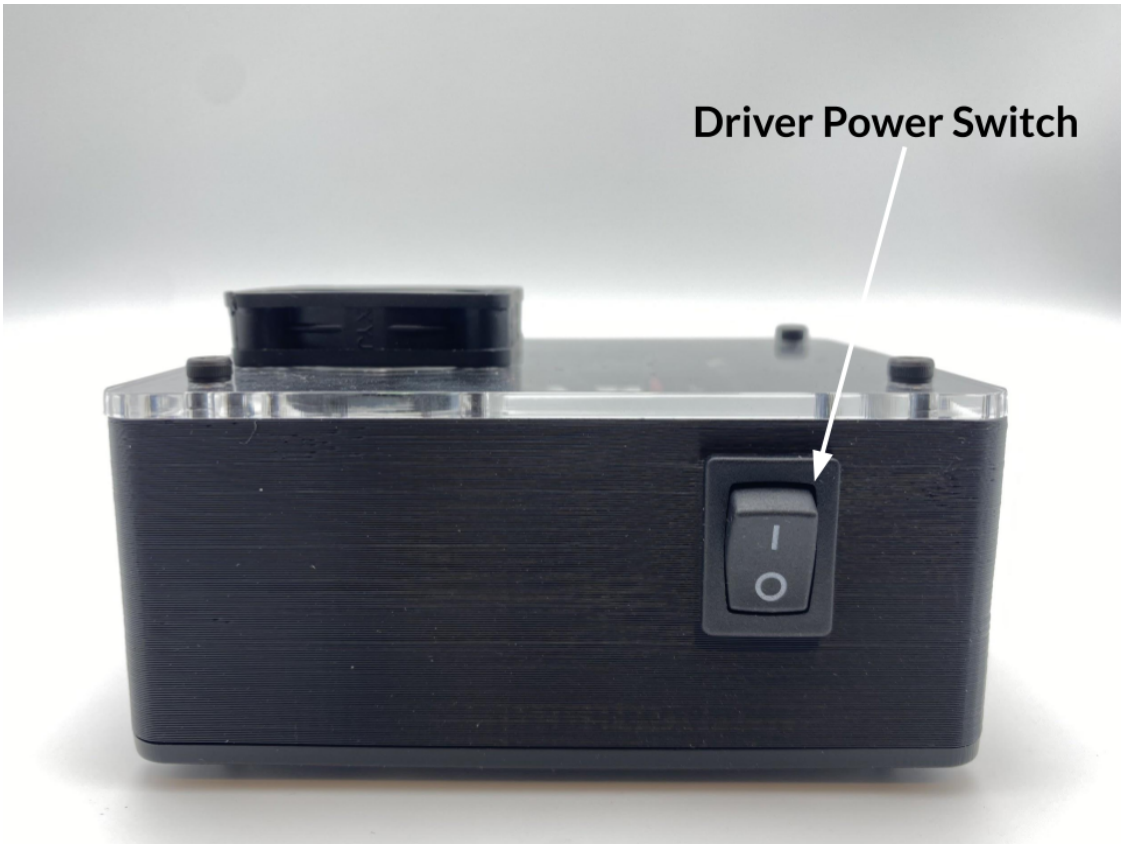

Figure 16: Back view of 5A constant current laser driver assembly

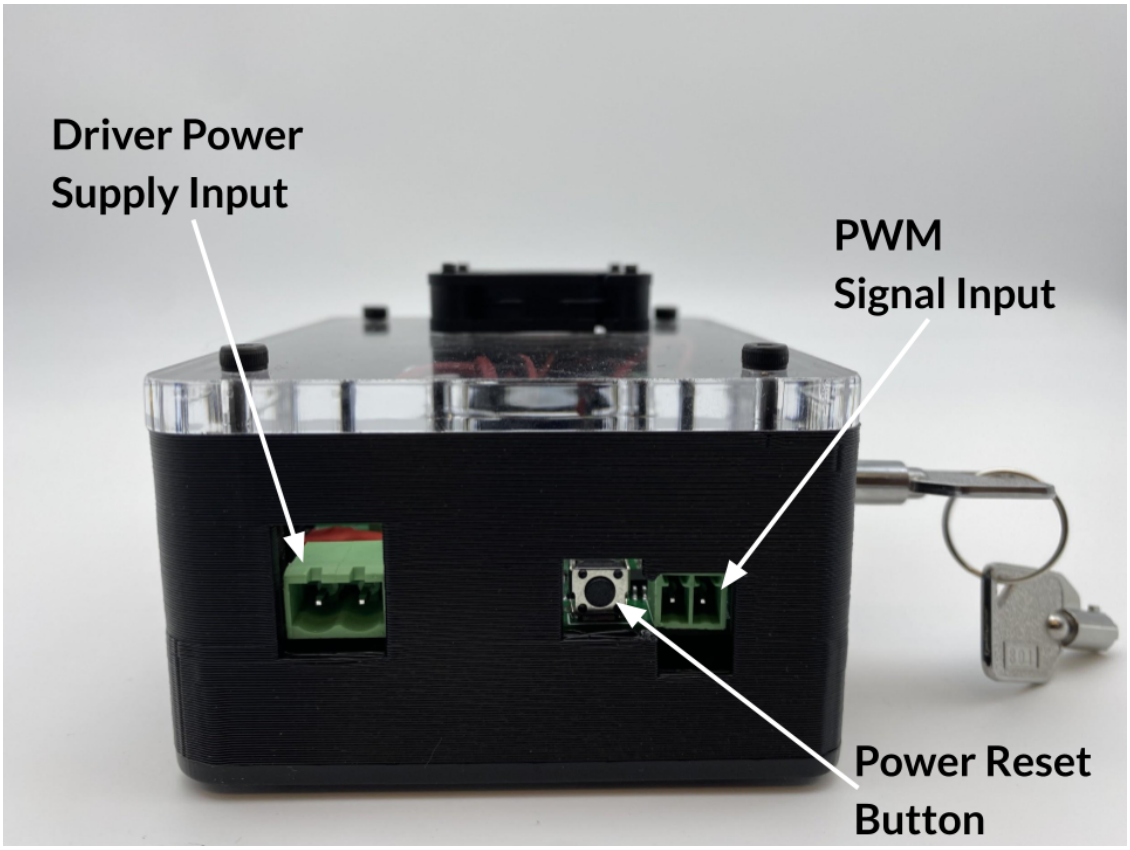

Figure 17: Left side view of 5A constant current laser driver assembly

Laser Driver Safety & Compliance

Integrated Driver Safety Features

Key switch: The key needs to be inserted into the key switch and turned 90 degrees clockwise to the ON position to enable the laser driver (along with the remote interlock enabled and power reset pushed) If the key is turned to the OFF position the driver will turn off immediately and will not turn on.

Remote interlock: The interlock connection needs to be closed to enable the laser driver (along with the key switch enabled and power reset pushed). This allows for additional switches to be added to the laser driver. An E-stop or other system can be implemented to shut the laser driver down in the case of an emergency. If the remote interlock connection is open, the driver will turn off immediately and will not turn on until the connection is closed.

Power fault protection: If the driver ever loses power the laser will turn off. In case of a power outage, you can have peace of mind knowing that the laser is off whenever power returns.

Power reset button: If the driver is turned off in any way other than the main power switch, the power reset button needs to be pushed in order to turn the driver on again.

Emission indicator: This LED located on the LaserBeam driver will notify you if the laser output is on. This becomes useful if operating outside the visible light spectrum

7W Laser Assembly & 5A Driver Operation:

Confirm Parts

Every stock 7W LaserBeam product package will include the following, please confirm that you have received all parts and check for any damage that may have occurred during shipping. Please contact us via www.sienci.com if you have received any damaged parts:

- ☐ 1x 7W Laser diode assembly
- ☐ 1x G2 lens
- ☐ 1x 7mm Lens spring
- ☐ 1x Lens focus ring
- ☐ 1x Laser diode extension cable (2.5m), with WJ15EDGK-5.08-2 pin male connectors
- ☐ 1x Laser cooling fan extension cable (2.5m), with WJ15EDGK-3.81-2 pin male connectors
- ☐ 1x 12V Accessory extension cable (2.5m) with WJ15EDGK-3.81-2 pin male connectors
- ☐ 1x PWM signal cable (0.6m) with WJ15EDGK-3.81-2 pin male connectors
- ☐ 1x 5A Constant current laser driver
- ☐ 1x Driver key
- ☐ 1x Interlock closed connector
- ☐ 1x Laser safety glasses
- ☐ 1x 12V 8A Power supply w/ AC cable

Figure 18: 7W LaserBeam product package

Cabling

1. Take your laser diode extension cable, laser assembly fan extension cable and 12V accessory extension cable. Use the colored labels affixed to ensure you have the correct cables.

a. Laser diode extension cable (2.5m) → blue tags
b. Laser cooling fan extension cable (2.5m) → red tags
c. 12V accessory extension cable (2.5m) → yellow tags
d. PWM signal extension cable (0.6m) → purple tags

2. Safely route your cables through the LongMill Benchtop CNC drag chain to avoid them interfering with the use of your laser diode assembly.
3. Follow the next section to ensure proper cable connections are made.

Connections

1. 7W Laser Diode Assembly → 5A Constant Current Driver
    a. This is how your Laser Diode will receive power from your driver.
    b. Use the laser diode extension cable - blue tags.
    c. Confirm that the red and black wires match on both the male and female side of the connector before firmly pressing the male connector from the extension cable into the female connector from the laser diode assembly.

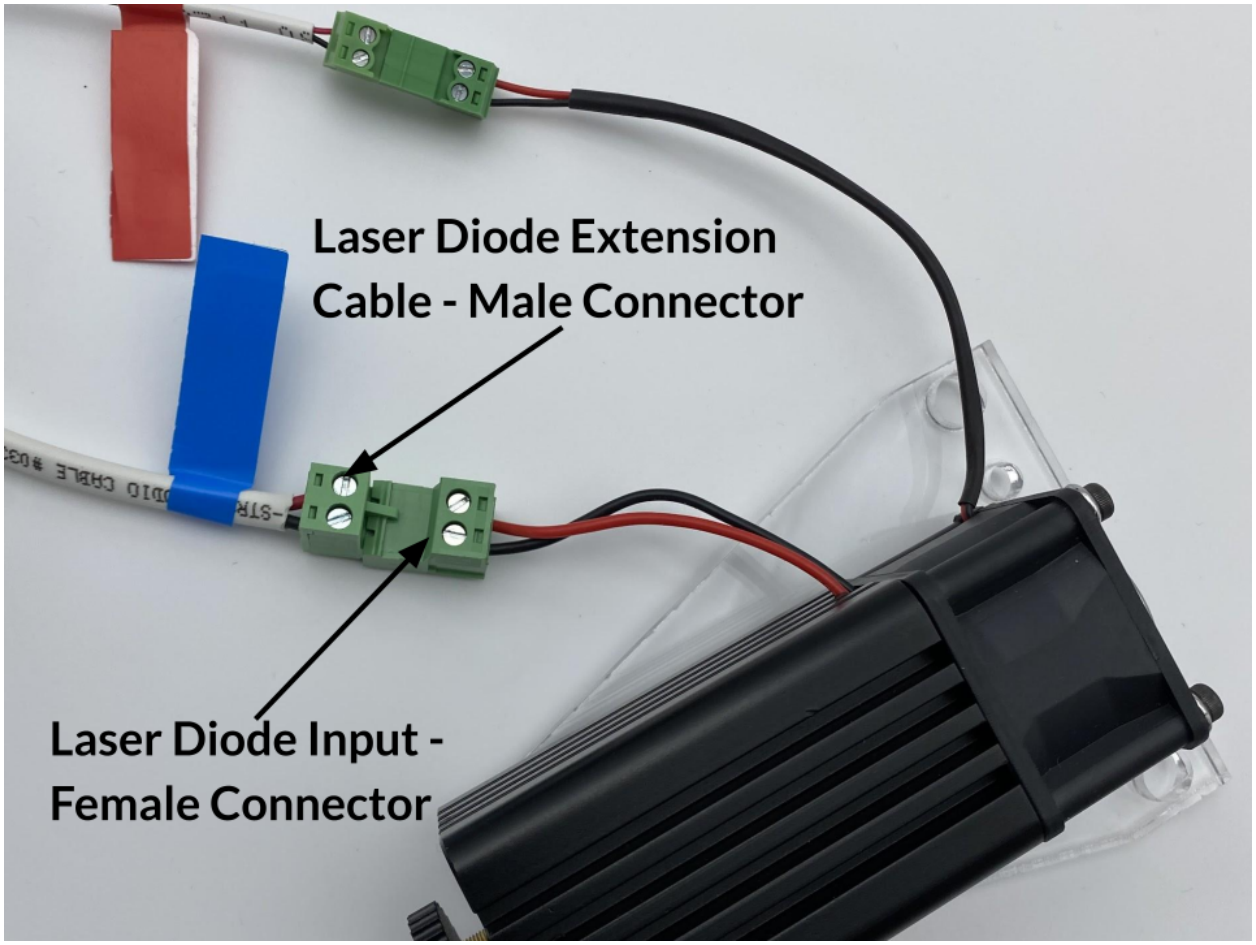

Figure 19: Connecting laser diode to extension cable

    d. Plug the male connector from the other end of the extension cable into the driver laser power output female connector, which is labeled in the above sections of this manual and below.

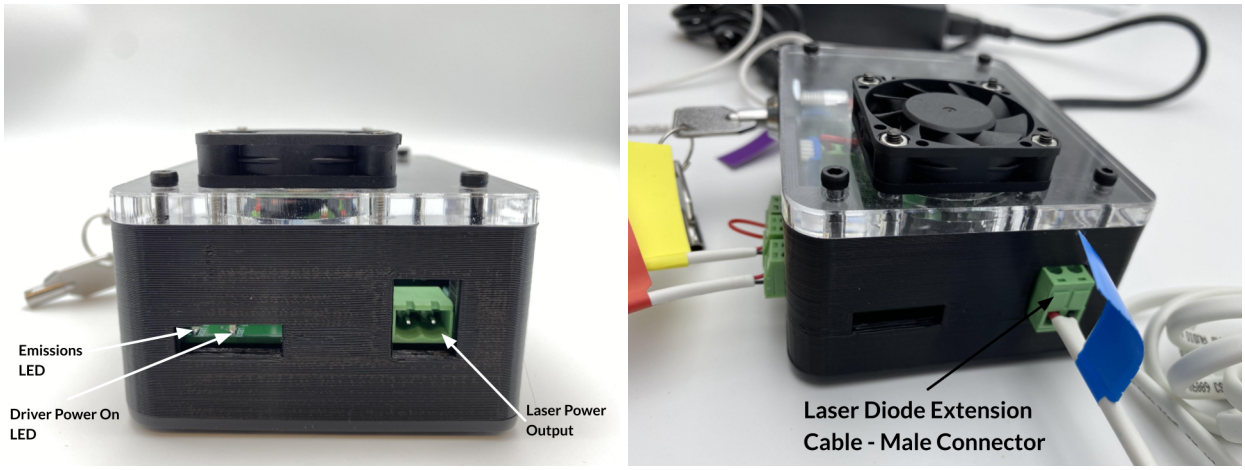

Figure 20: Connecting laser diode to driver

2. Laser Cooling Fan → 5A Constant Current Driver
    a. This is how your laser cooling fan will receive power from your driver.
    b. Use the laser cooling fan extension cable - red tags.
    c. Confirm that the red and black wires match on both the male and female side of the connector before firmly pressing the male connector from the extension cable into the female connector from the laser cooling fan.

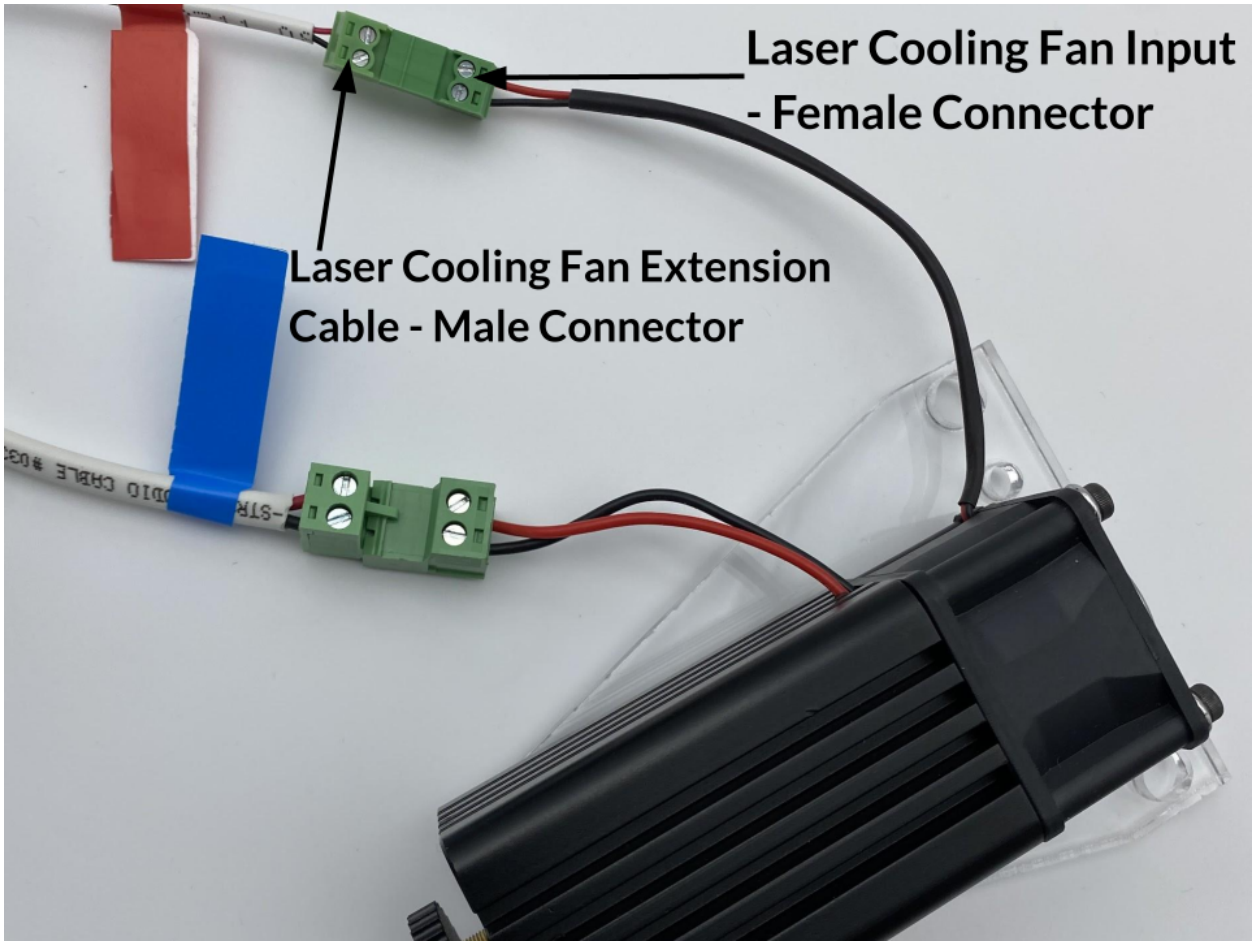

Figure 21: Connecting laser cooling fan to extension cable

d. Plug the male connector from the other end of the extension cable into the driver laser cooling fan power output female connector, which is labeled in the above sections of this manual and below.

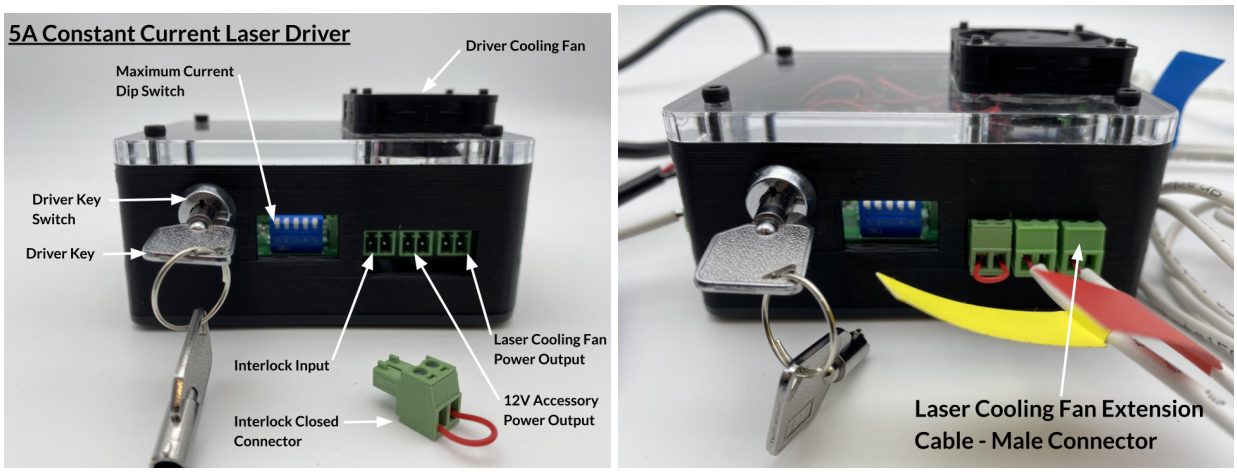

Figure 22: Connecting laser cooling fan to driver

3. 12V Accessory → 5A Constant Current Driver
    a. The use of a 12V accessory is not needed to fully operate your 7W LaserBeam System. We do provide you the option to include a 12V air assist fan assembly as an accessory. This is how the 12V accessory will receive power from your driver.
    b. Use the 12V accessory extension cable - yellow tags.
    c. Confirm that the red and black wires match on both the male and female side of the connector before firmly pressing the male connector from the extension cable into the female connector from your 12V laser accessory.

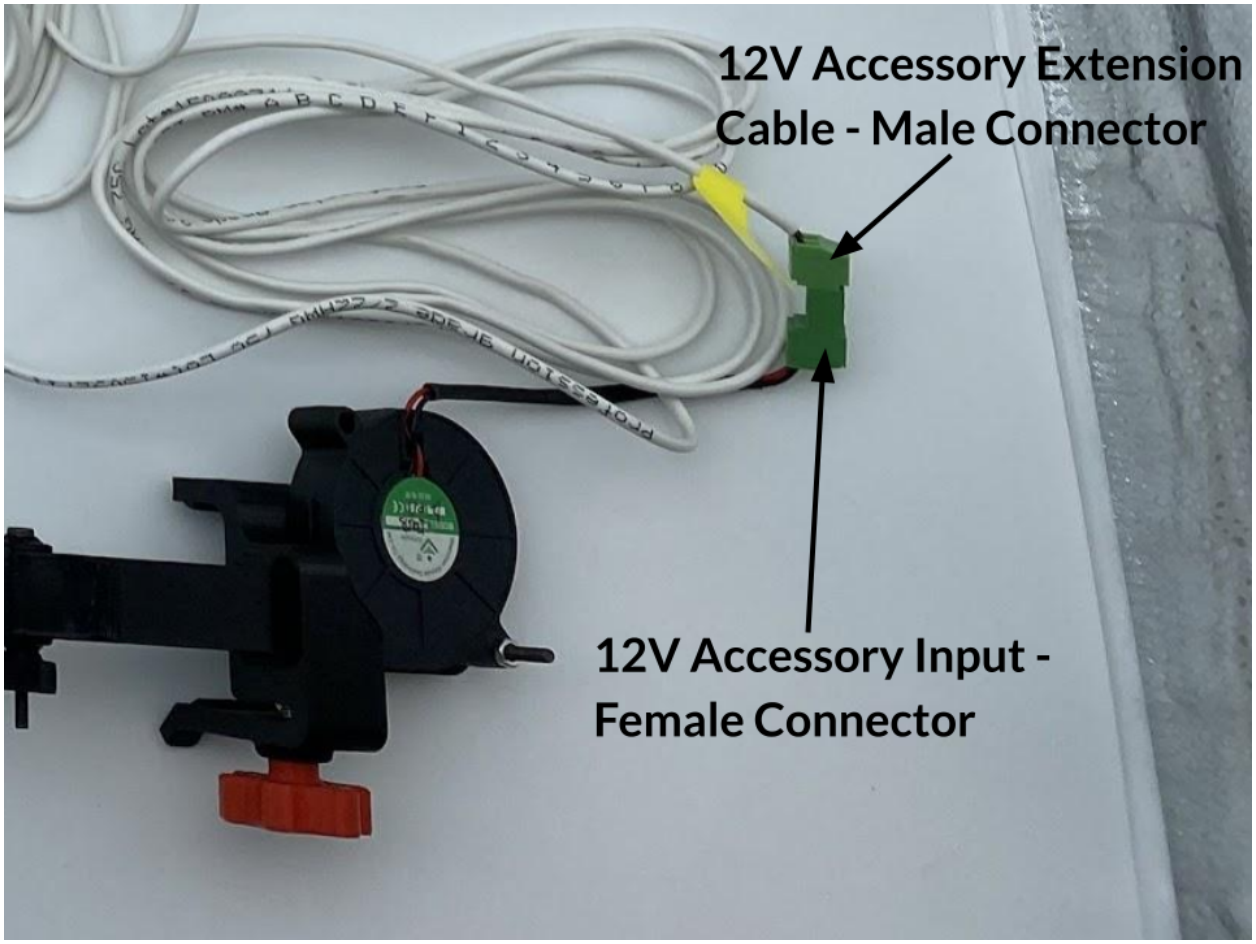

Figure 23: Connecting 12V accessory input to extension cable

d. Plug the male connector from the other end of the extension cable into the driver 12V accessory power output female connector, which is labeled in the above sections of this manual and below

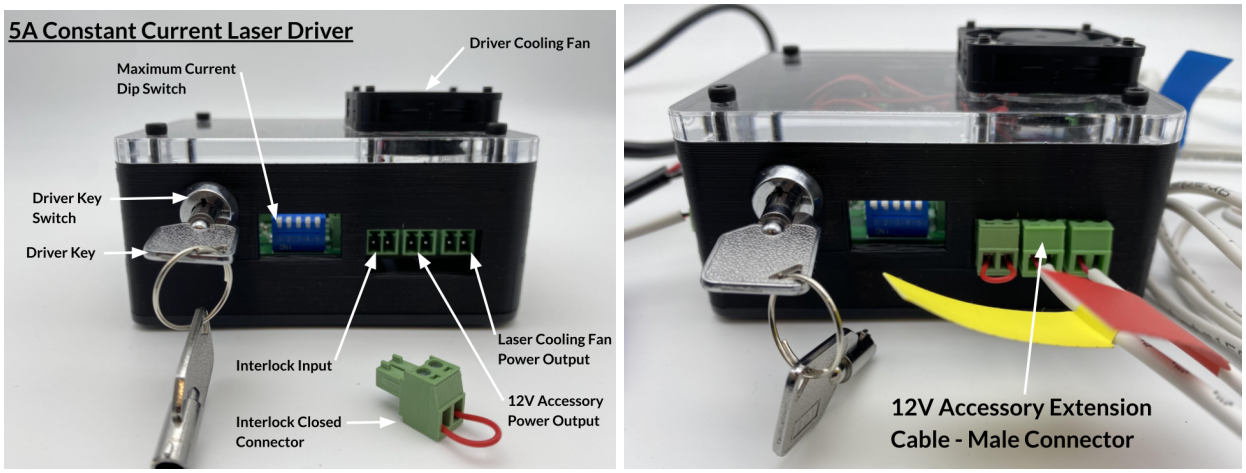

Figure 24: Connecting 12V accessory input to driver

4. PWM Signal on 5A Constant Current Driver → LongMill Benchtop CNC Controller PWM Output
    a. This is how you control your laser and laser driver assembly with a 5V PWM signal that is sent from the LongMill Benchtop CNC controller and received by the laser driver.
    b. The driver uses this PWM signal to control when the laser is ON and OFF and at intensity and frequency when the driver is in PWM Mode.
    c. Use the PWM signal cable - purple tags.
    d. Confirm that the red wire aligns with the SpinPWM label on your LongMill Benchtop CNC Controller and the black wire aligns with the GND label before firmly pressing the male connector from the cable into the female connector on your LongMill Benchtop CNC controller.

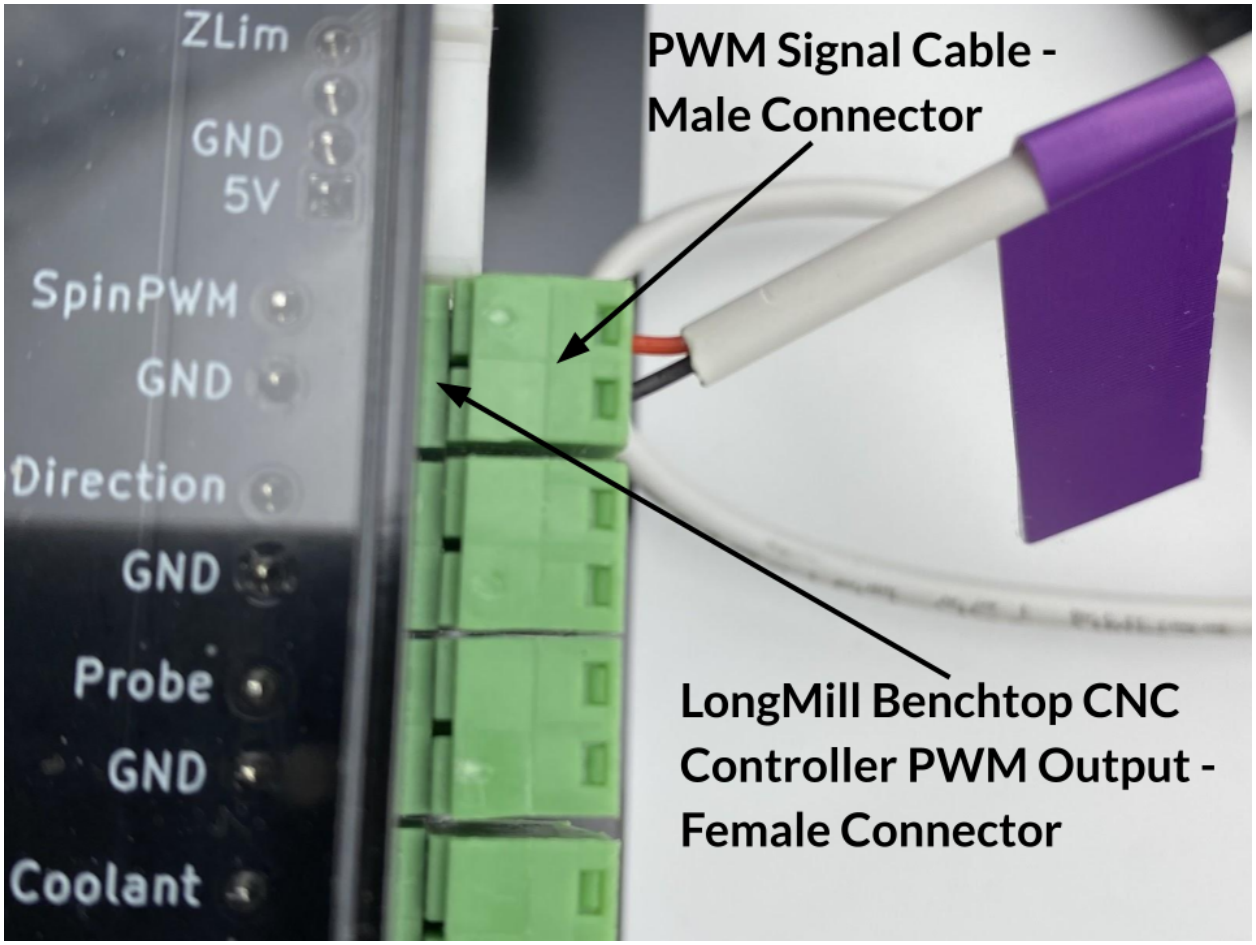

Figure 25: Connecting PWM signal input to LongMill controller

    e. Plug the male connector from the other end of the cable into the drivers PWM signal Input female connector, which is labeled in the above sections of this manual and below.

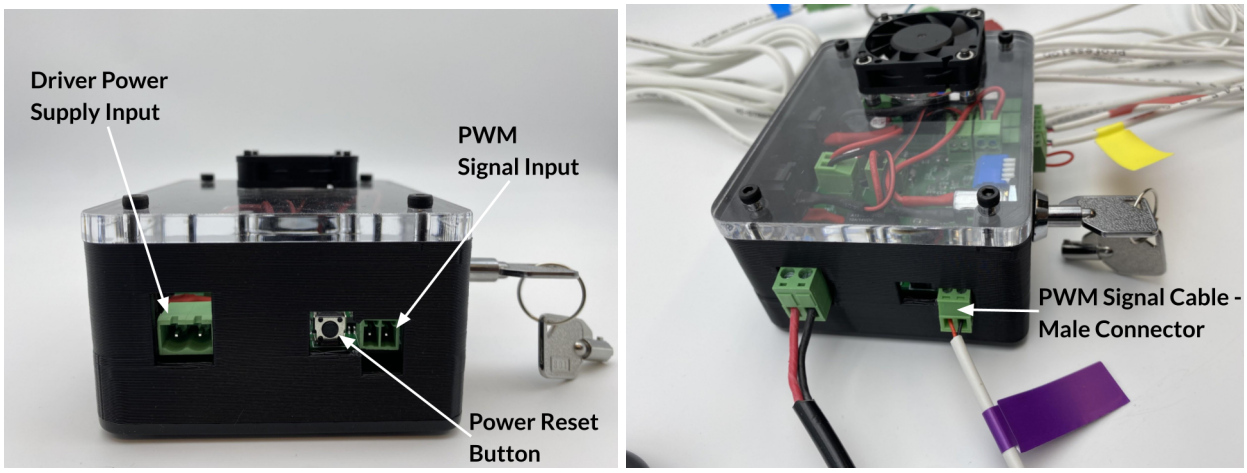

Figure 26: Connecting PWM signal input to driver

Driver

1. Key Switch
    a. Insert your driver key into the key switch.

Figure 27: Driver key into key switch

b. Push and turn 90 degrees clockwise to enable the laser driver key switch.

Figure 28: Enabled key switch

2. Interlock
    a. Insert the closed interlock male connector into the interlock input female connector located on the driver, which in the above sections of this manual and below.

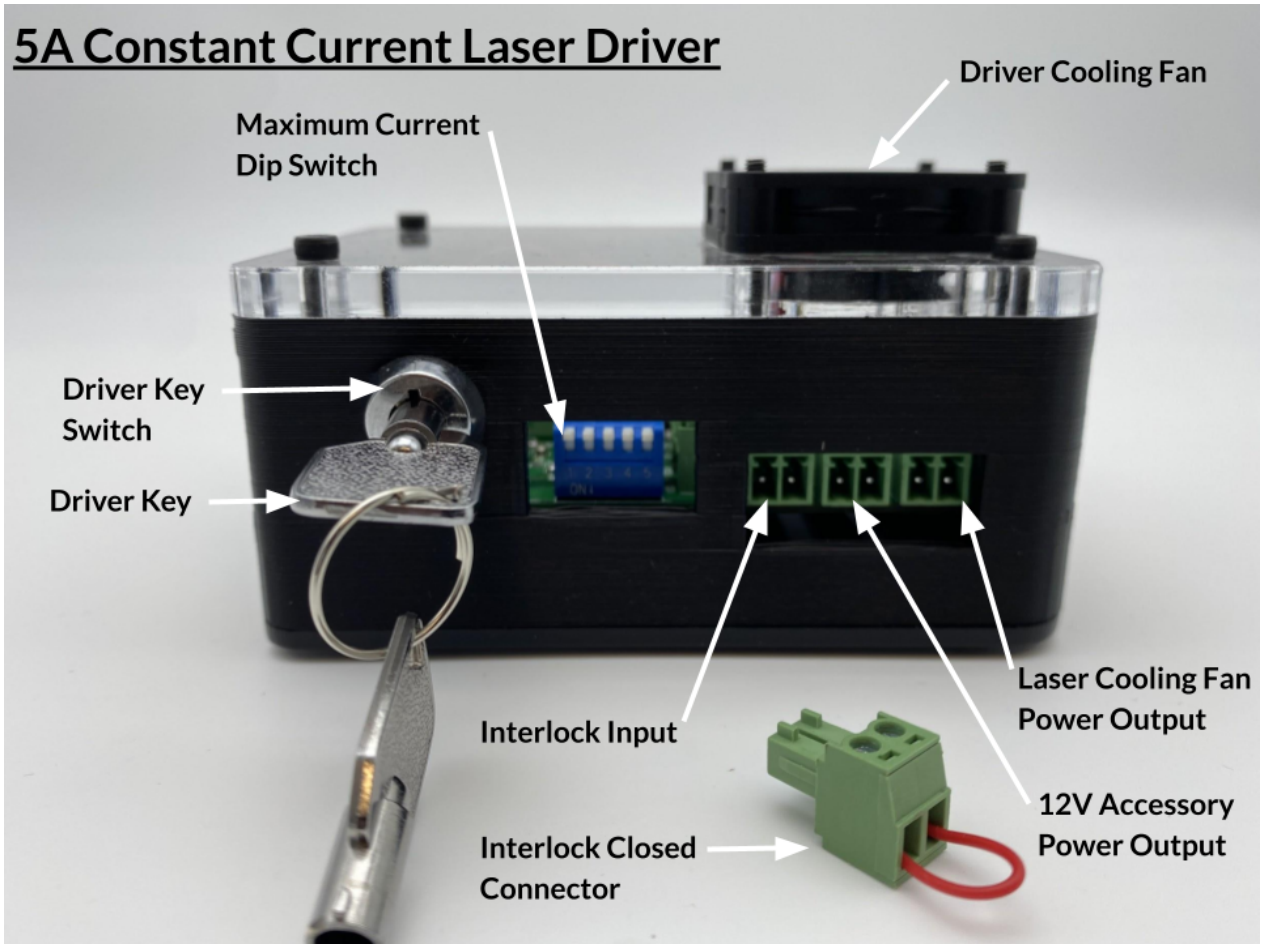

Figure 14: Front view of 5A constant current laser driver assembly

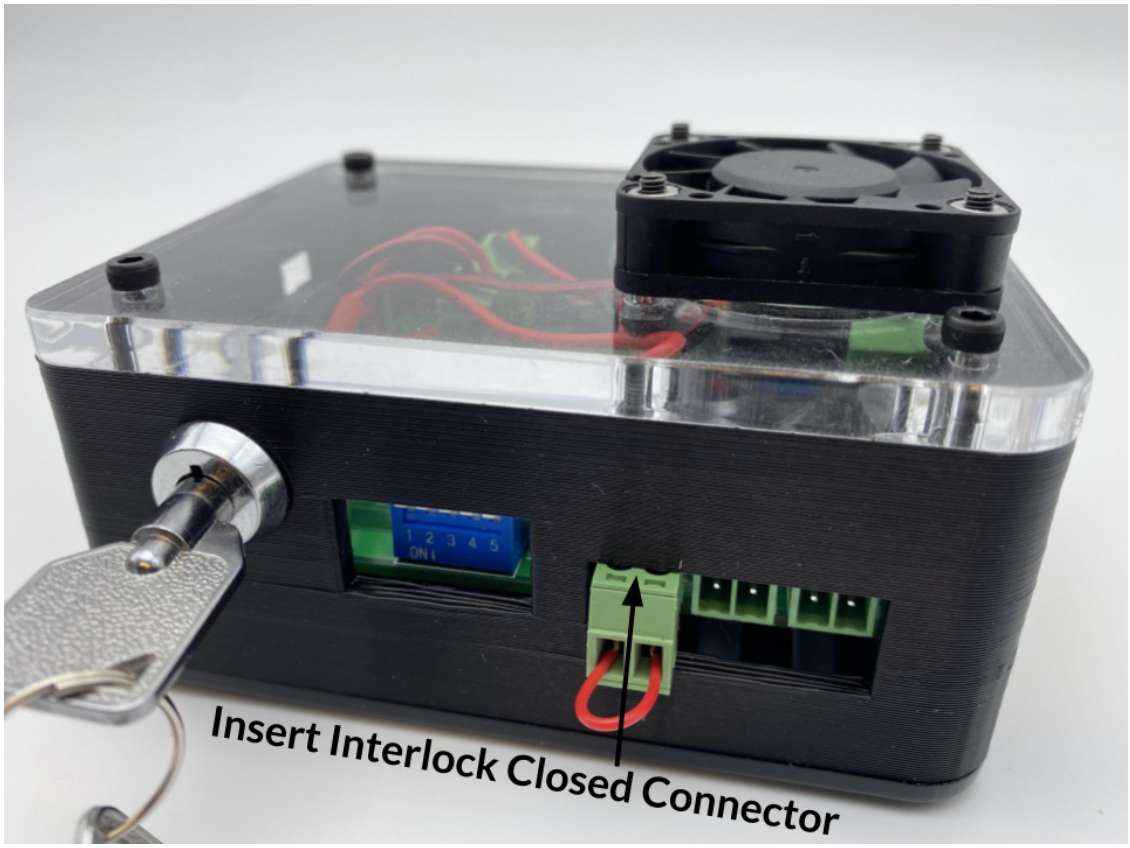

Figure 29: Interlock closed connector inserted

b. If you have an additional switch you would like to incorporate into your driver use the closed interlock male connector to connect your switch into the interlock input located on the driver.

3. Power Supply
    a. This power supply is for indoor use only.

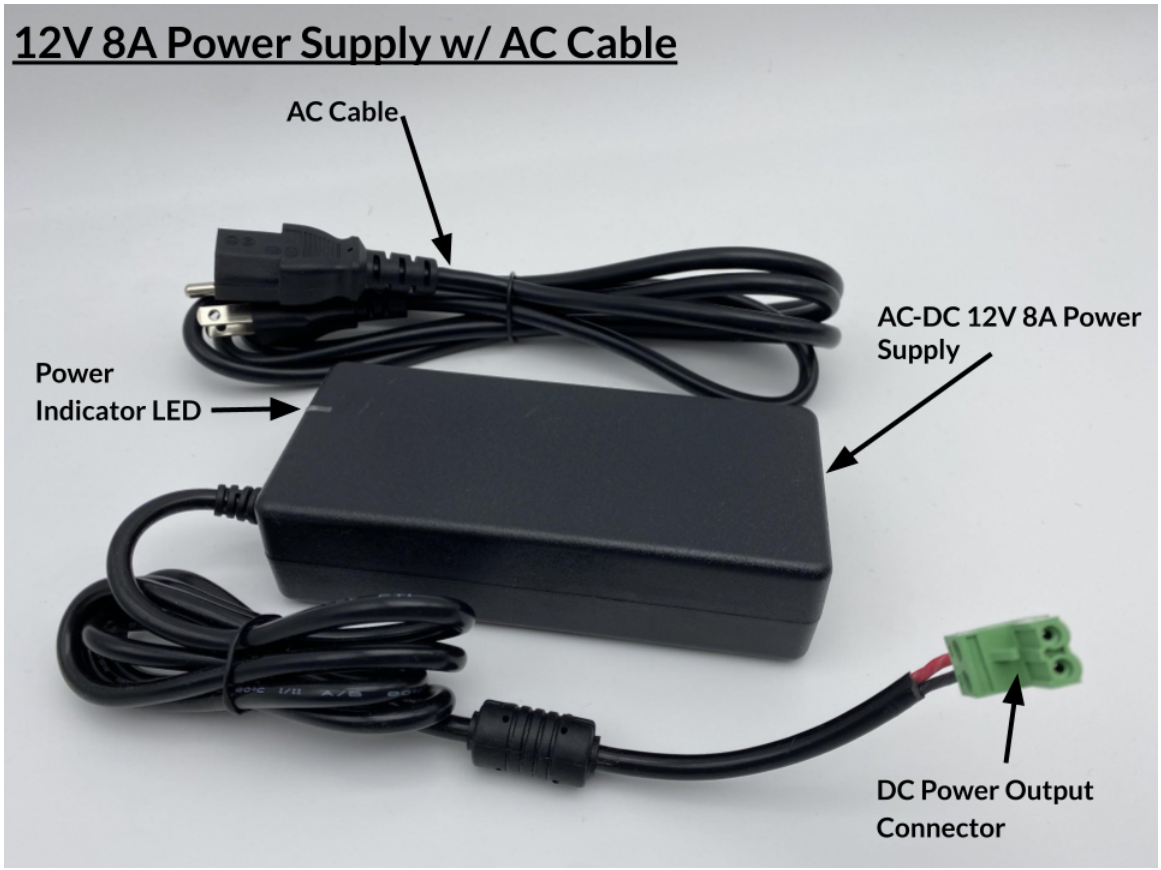

Figure 30: 12V 8A Power Supply w/AC Cable

b. Locate the 12V 8A Power supply and insert the female AC cable plug into the power supply, be aware of the orientation of the AC cable.

Figure 31: AC cable plugged into power supply

c. Ensure that you plug the other end of the AC Cable into an AC power outlet that supplies 100-240VAC.

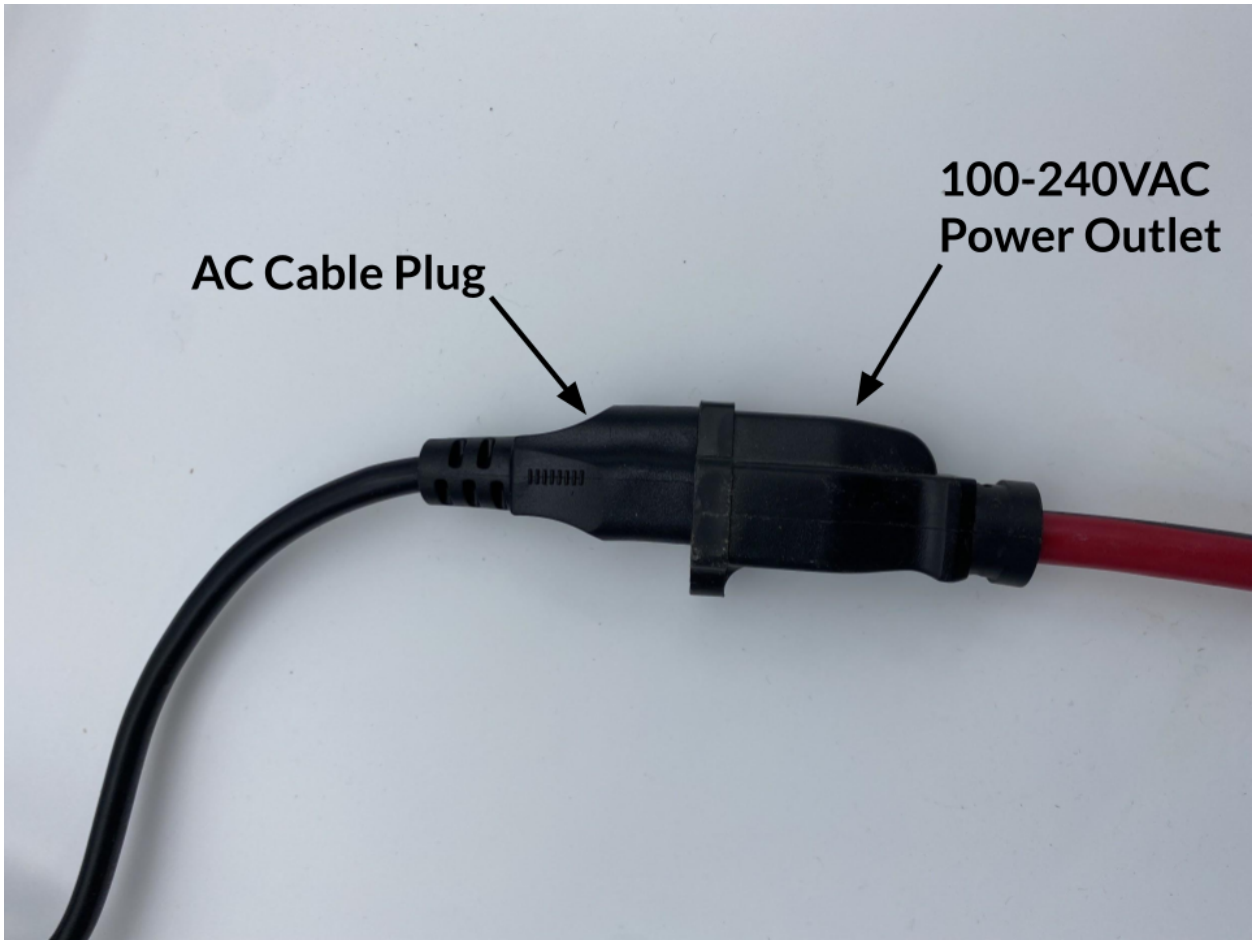

Figure 32: Power supply plugged into 100-240VAC outlet

d. Plug the green male connector from the power supply into the driver power input, which is labeled in the above sections of this manual and below.

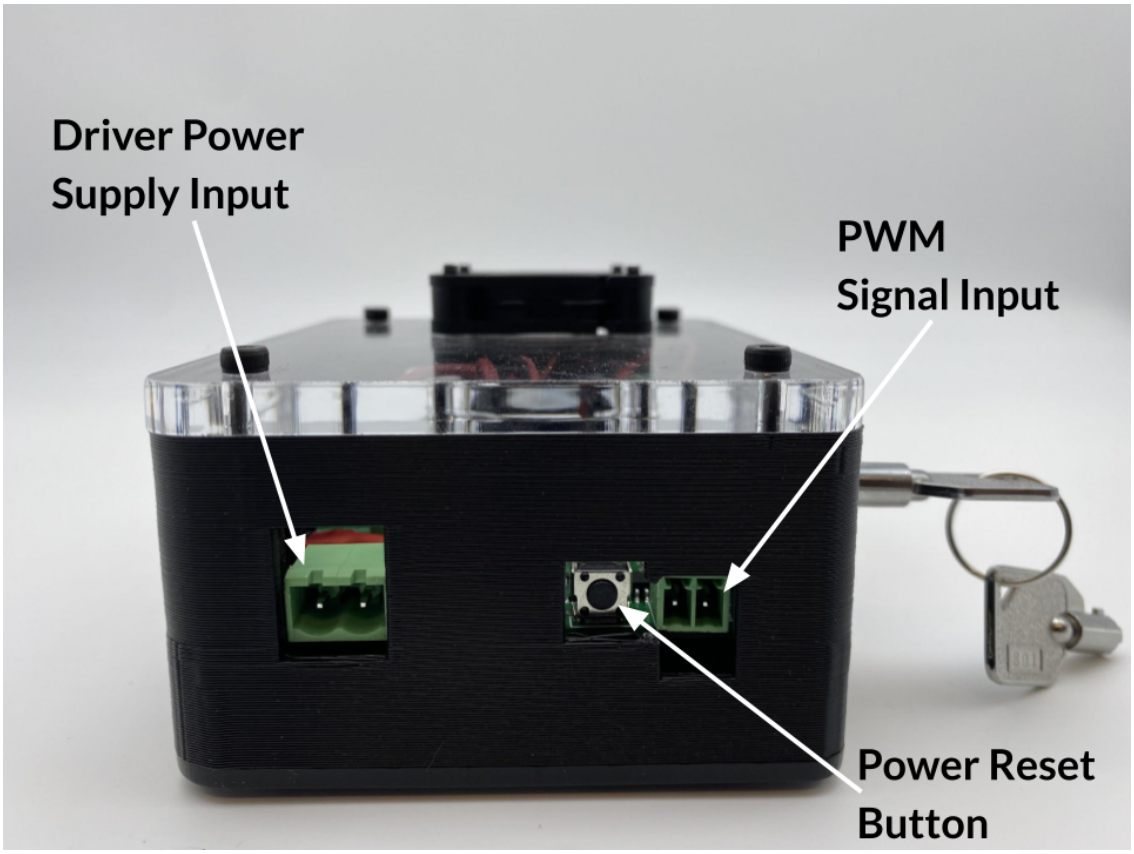

Figure 17: Left side view of 5A constant current laser driver assembly

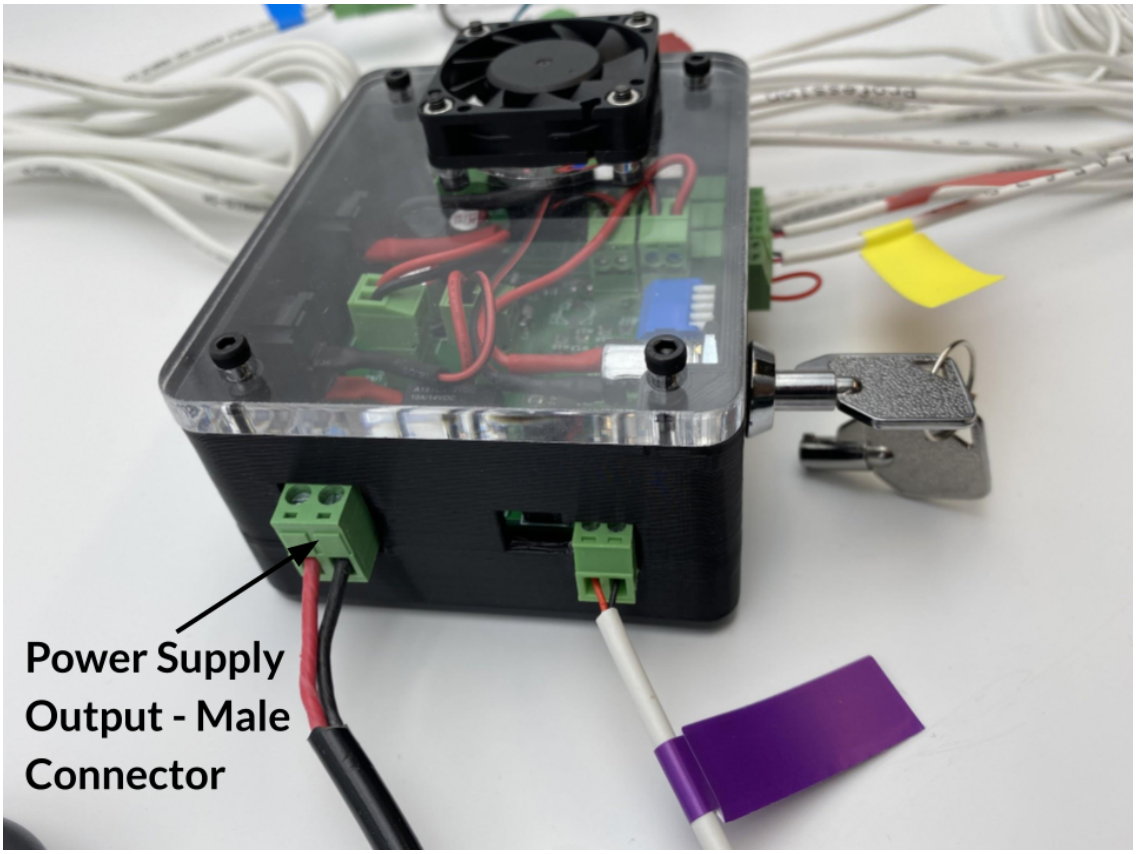

Figure 33: Connecting power supply into driver

e. When you plug the power supply into an appropriate power outlet, confirm that you see a green LED located on the power supply turn on, which signals that your power supply is receiving power.

Figure 34: Green light indication on power supply

4. Maximum Current Setting
    a. Before you turn on your laser driver, ensure that all switches located on the maximum current dipswitch are set to the OFF position to avoid any accidents.
    b. After you have turned on your laser driver, you must set your maximum current before accessing laser driver function.
    c. Locate the maximum current setting DIP switch.

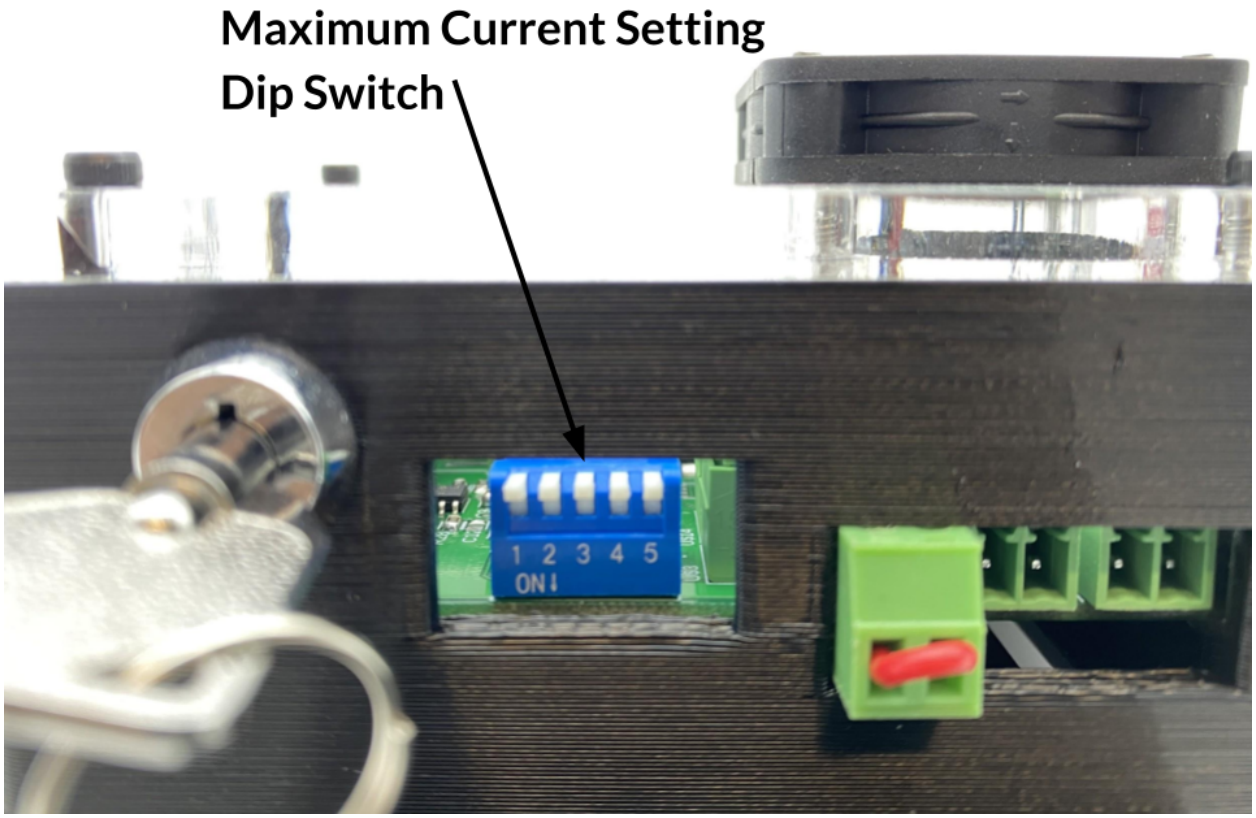

Figure 35: Maximum current setting DIP switch, OFF position

d. Ensure that the switch for the current setting you require is in the down (ON) position completely in order to enable the selected maximum current limit.

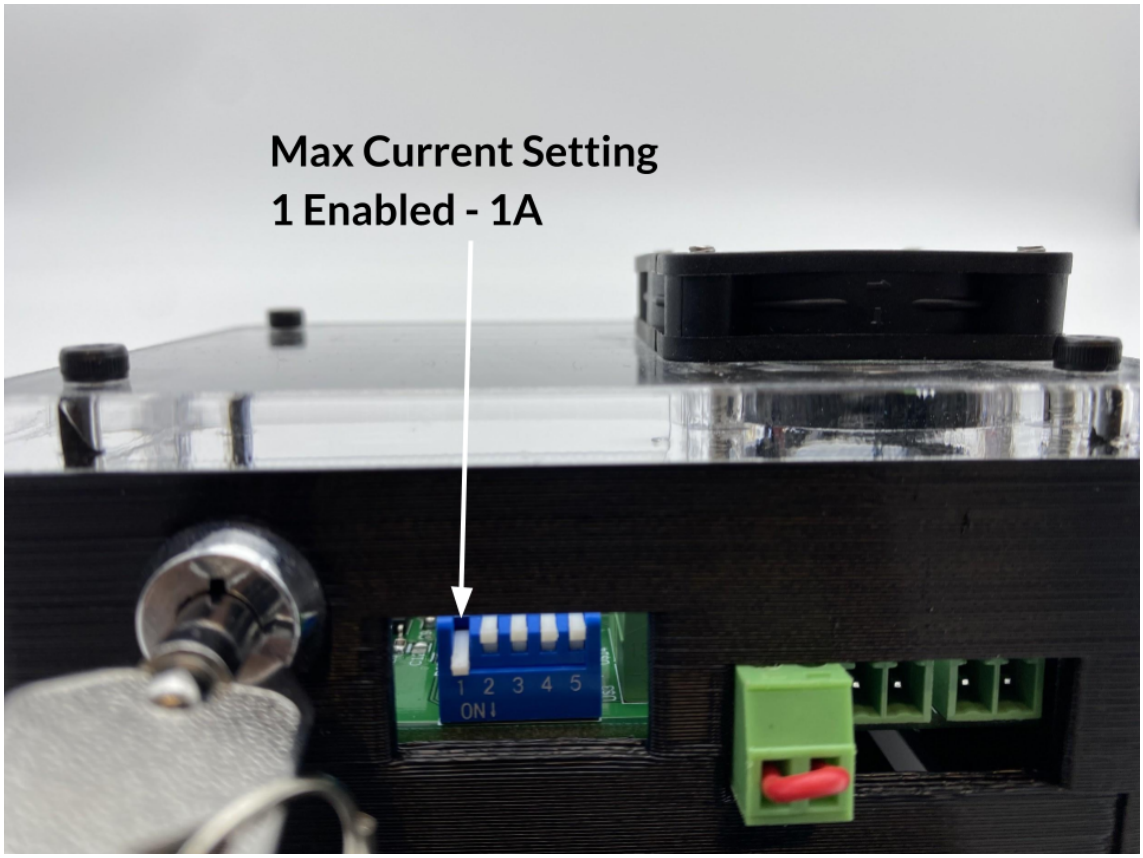

Figure 36: Maximum current setting DIP switch, 1A enabled (ON)

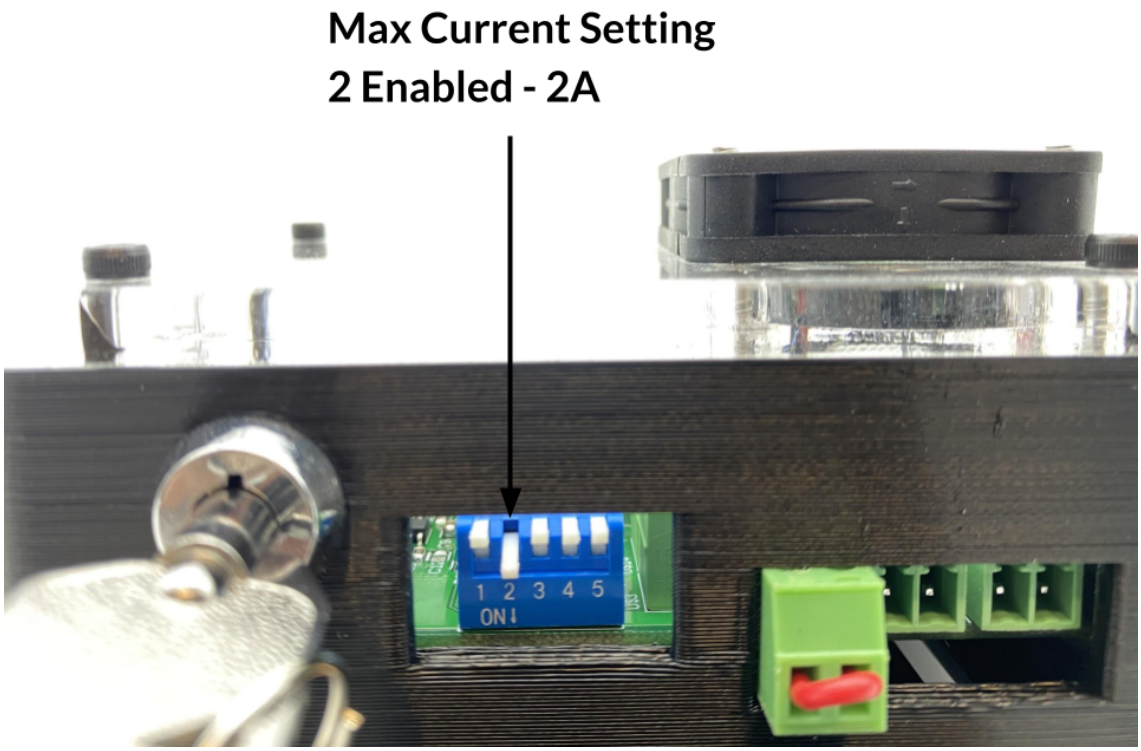

Figure 37: Maximum current setting DIP switch, 2A enabled (ON)

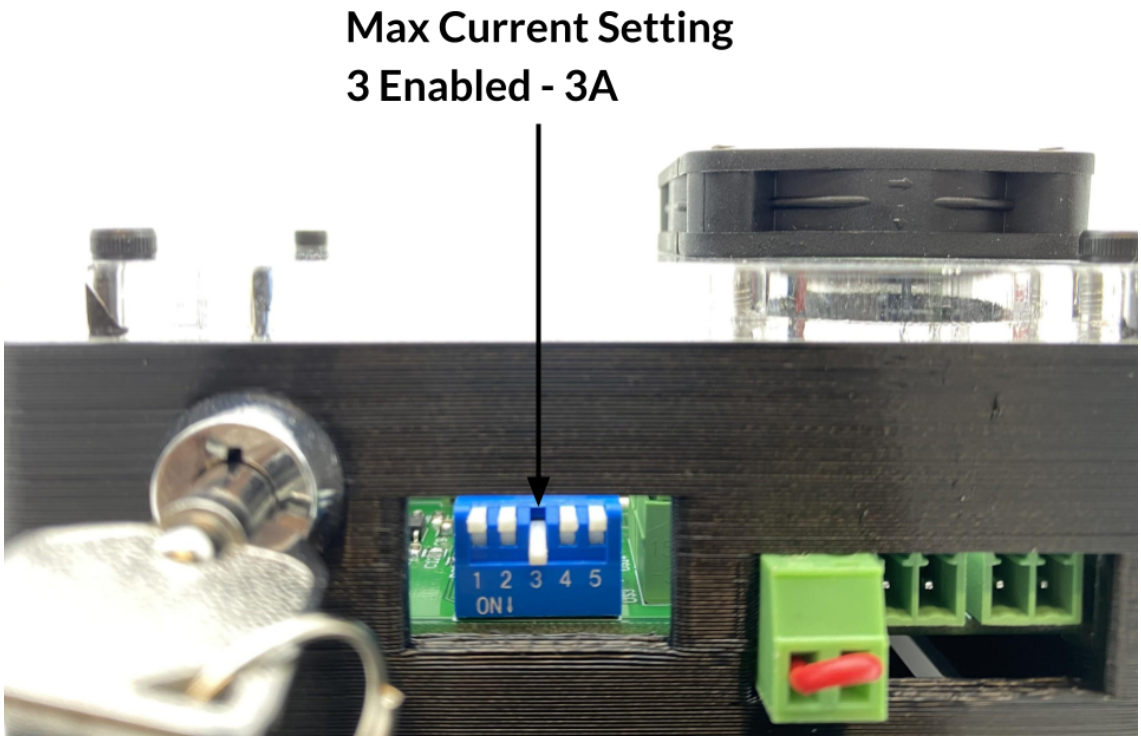

Figure 38: Maximum current setting DIP switch, 3A enabled (ON)

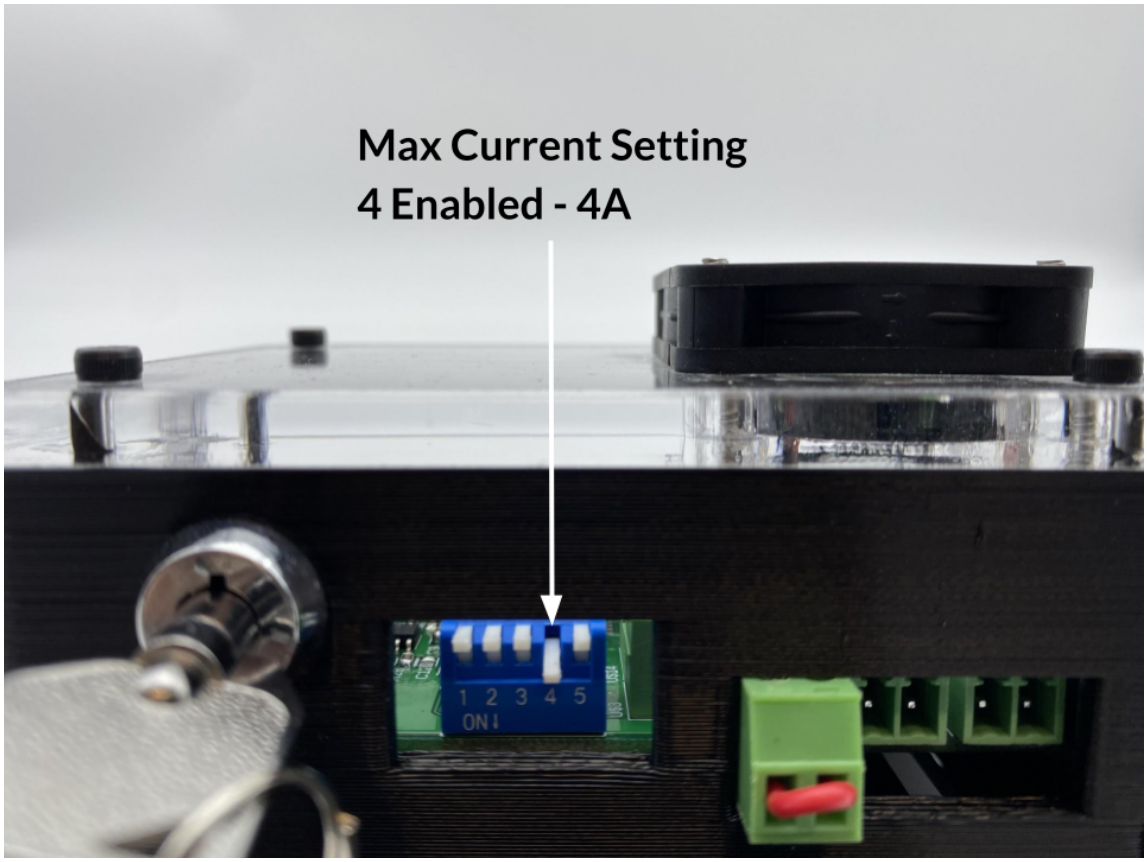

Figure 39: Maximum current setting DIP switch,4A enabled (ON)

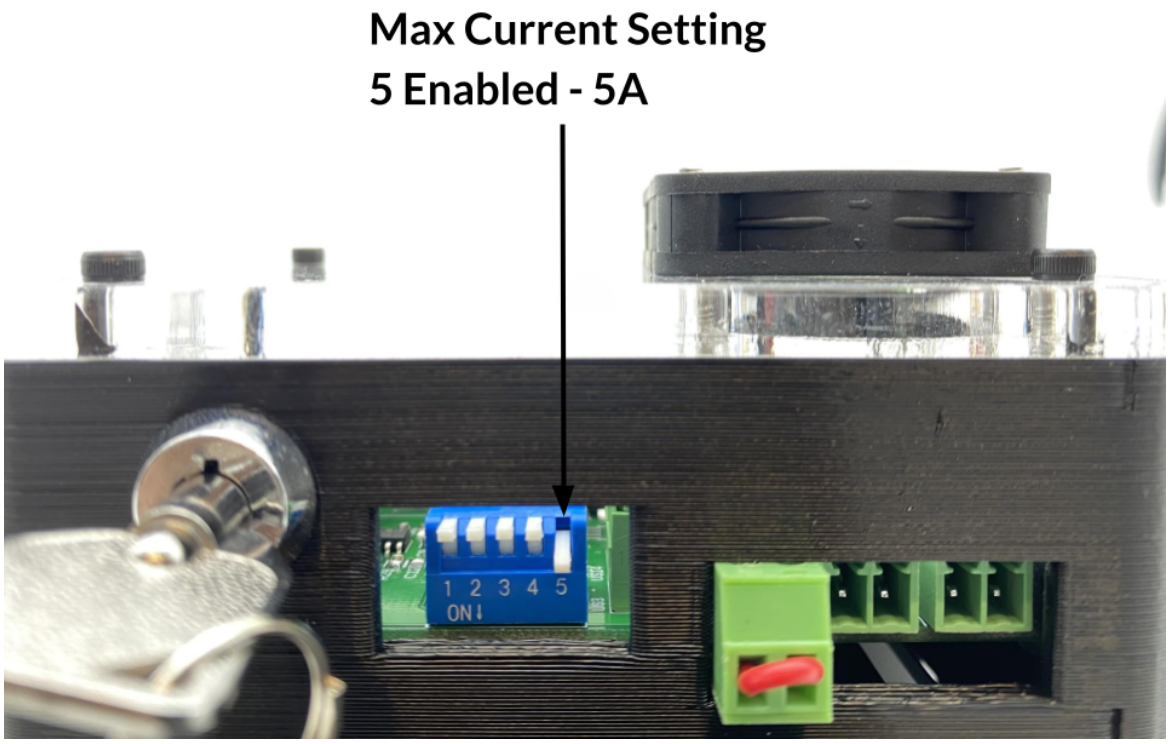

***Figure** 40: Maximum current setting DIP switch, 5A enabled (ON)*

e. There are 5 switches each with a number listed; please refer below for each settings current level:
   i. 1=1A max current limit
   ii. 2=2A max current limit
   iii. 3=3A max current limit
   iv. 4=4A max current limit
   v. 5=5A max current limit
f. This DIP switch will limit your max setting according to the levels listed above.
g. Ensure that you only have one switch enabled (in the down position) at one time.

5. Power Reset Button
   a. The power reset button will need to be pressed if the driver was turned off in any way other than through the driver power switch.

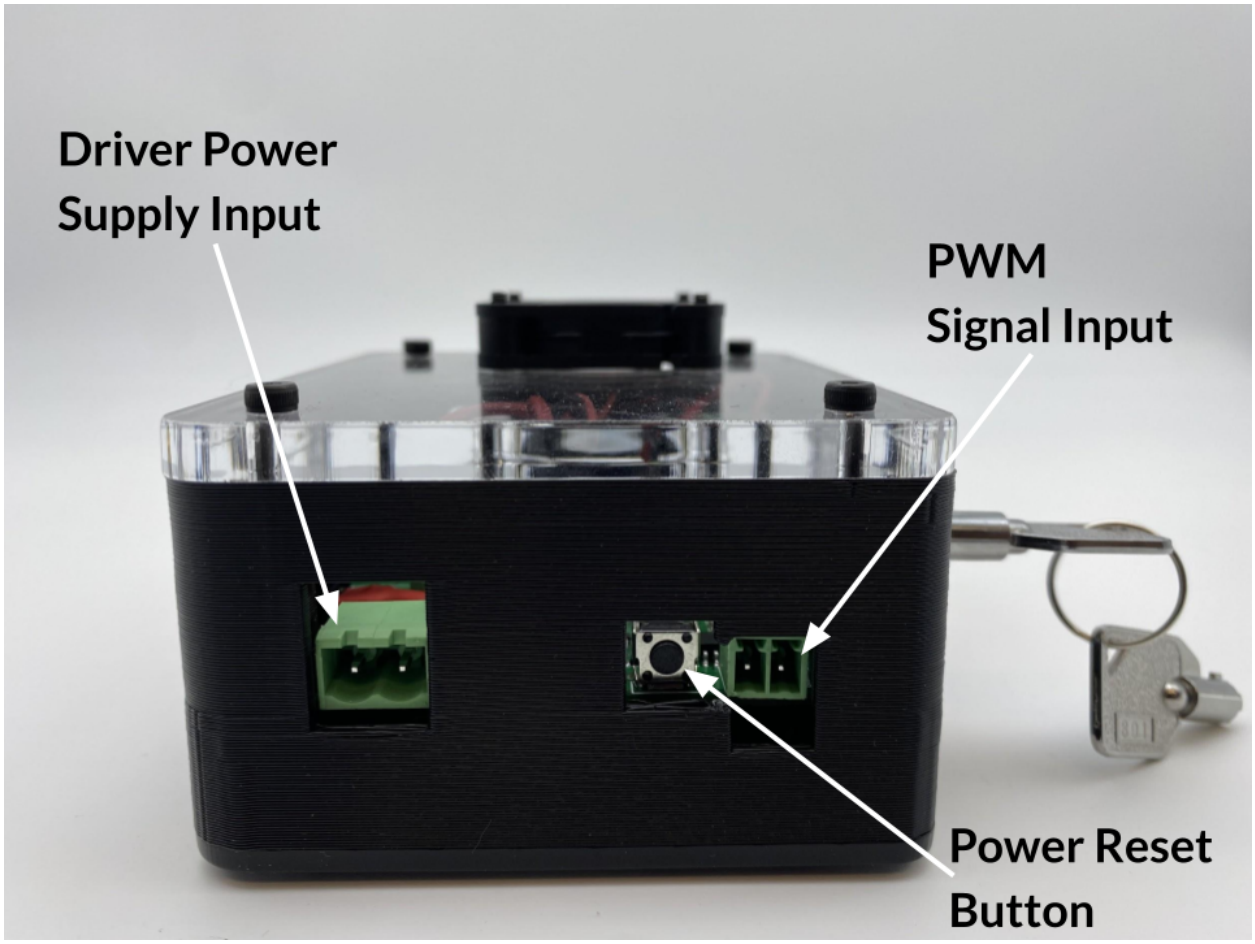

Figure 17: Left side view of 5A constant current laser driver assembly

b. You will need to press the power reset button to allow your driver to turn on if:
    i. If the interlock is opened
    ii. If the key is not in the enabled position in the key switch
    iii. If you remove the power supply
    iv. If your power source is cut
    v. Or any combination of the above situations
c. If this happens, make sure your key is in the ON position, interlock is in closed position, LED on the power supply is turned on and power supply connector is pressed fully into your driver, turn your driver off via the main power switch. Press your reset button and turn your main power switch back on.
d. If your driver is enabled, pushing the power reset button will do nothing.

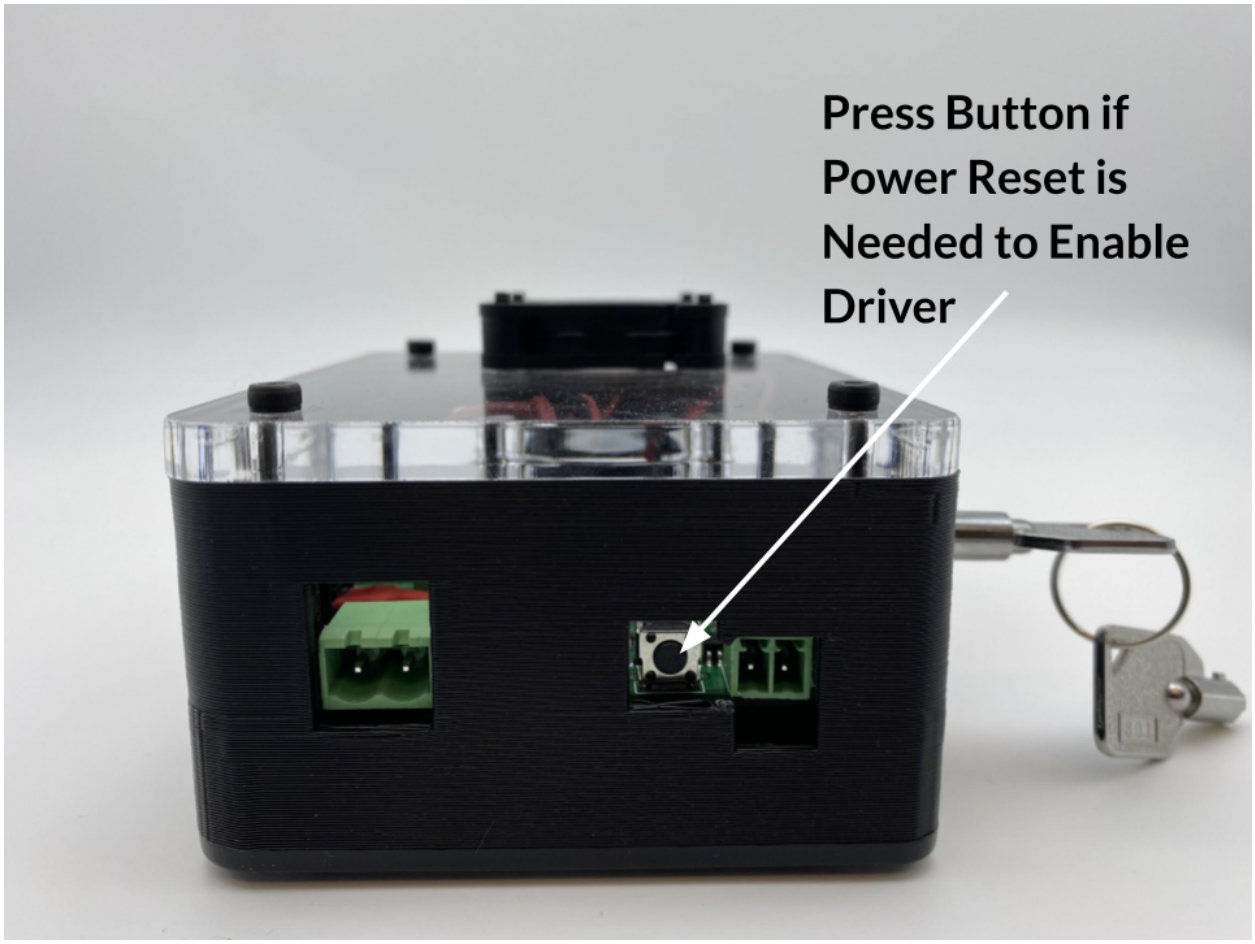

Figure 43: Press the Power reset button

6. Driver Power Switch
    a. This power switch is how you turn your driver on and off.

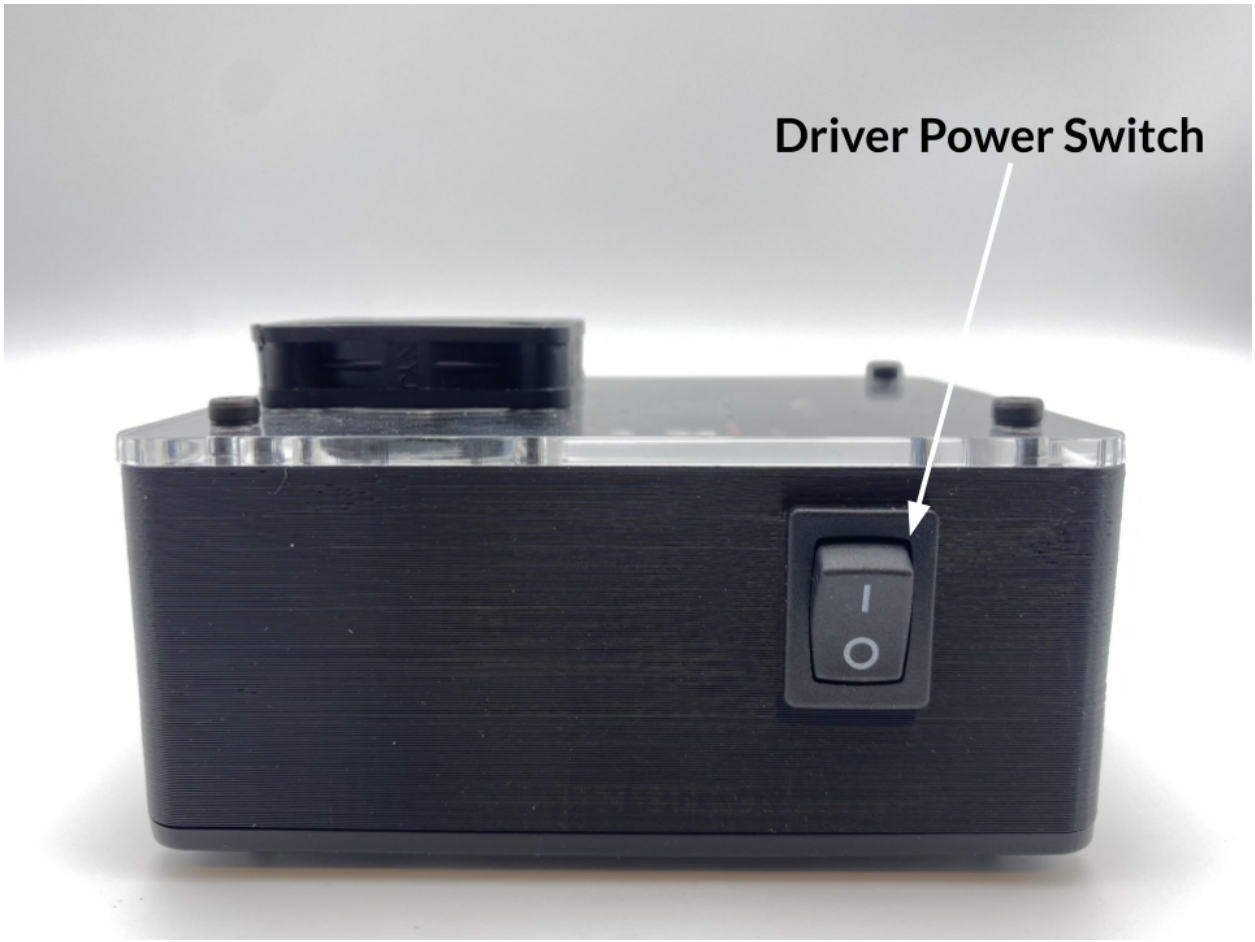

Figure 16: Back view of 5A constant current laser driver assembly

b. Position (o) = Driver OFF/disabled position

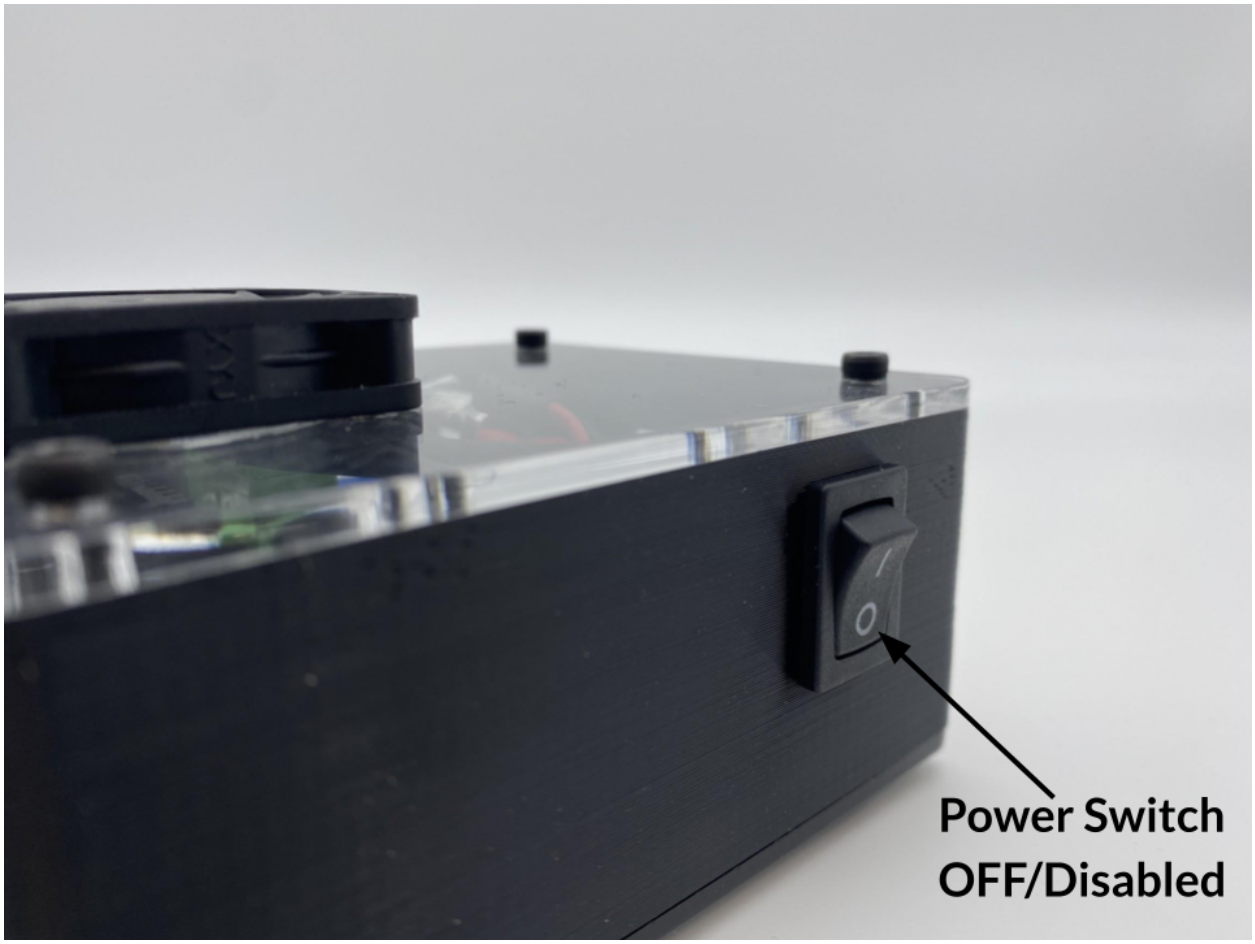

Figure 44: Driver power switch OFF

c. Position (I) Driver ON/enabled position

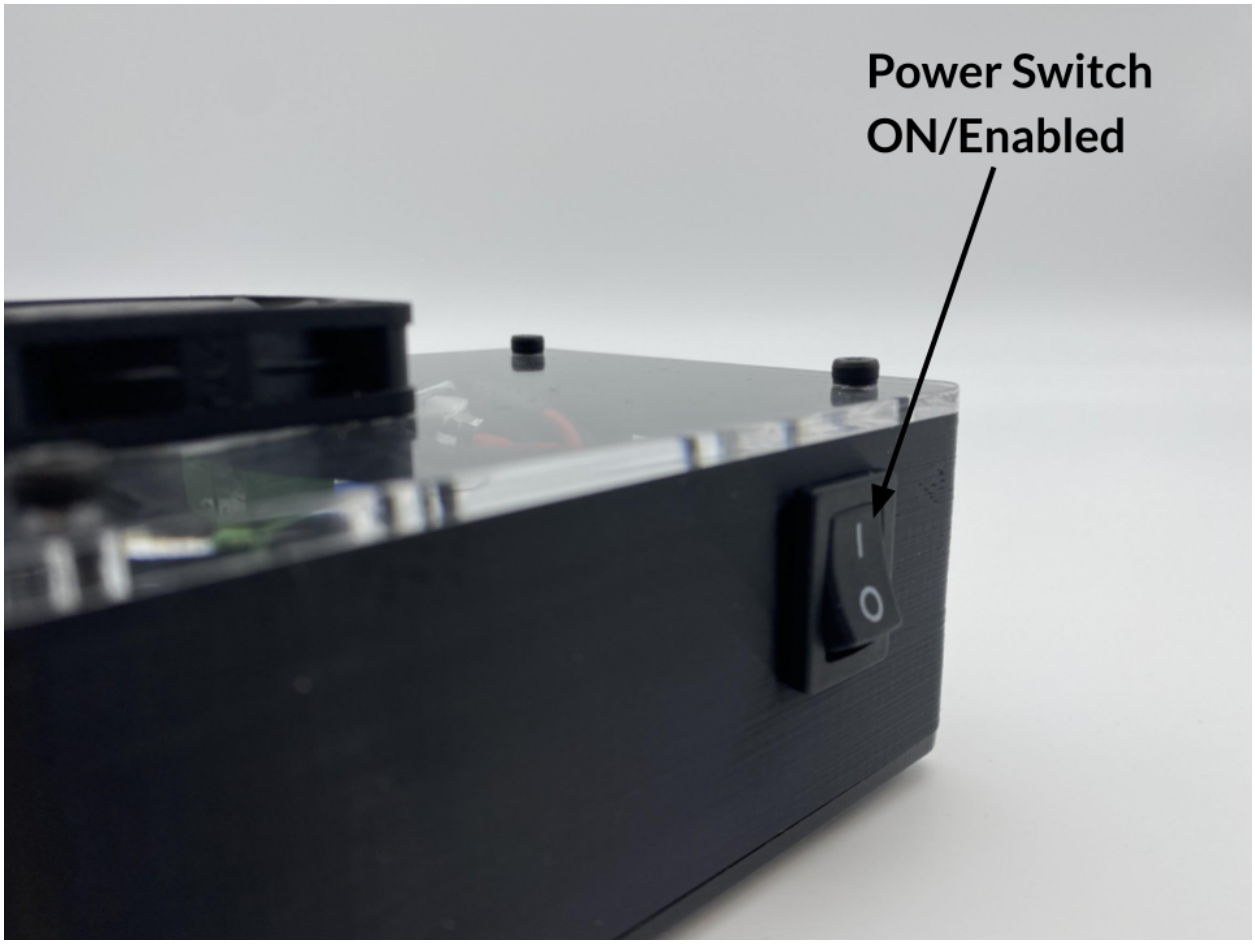

Figure 45: Driver power switch ON

d. You can confirm your driver is on when your driver power LED is ON, located on the driver.

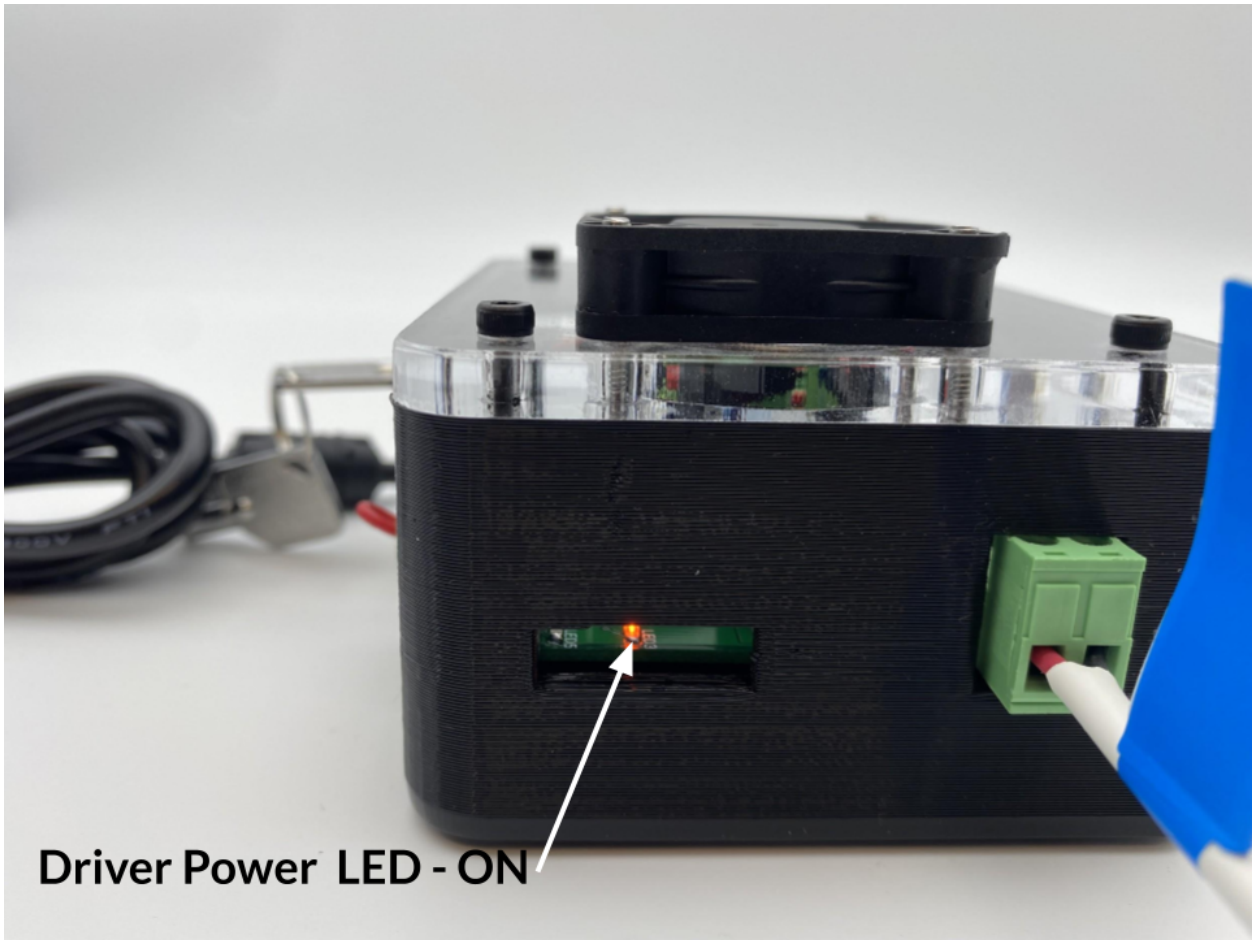

Figure 46: Driver power LED ON

e. Your power switch will only turn your driver on if:
    i. Your interlock is closed
    ii. Your key is inserted and turned to the ON position
    iii. Your power supply is receiving the proper AC power source
    iv. Your power supply is connected to your driver
    v. Your reset button has not been triggered or you have pressed the reset button after it has been triggered

7. LED indicators
    a. LED 1 will indicate when your driver has been turned on.

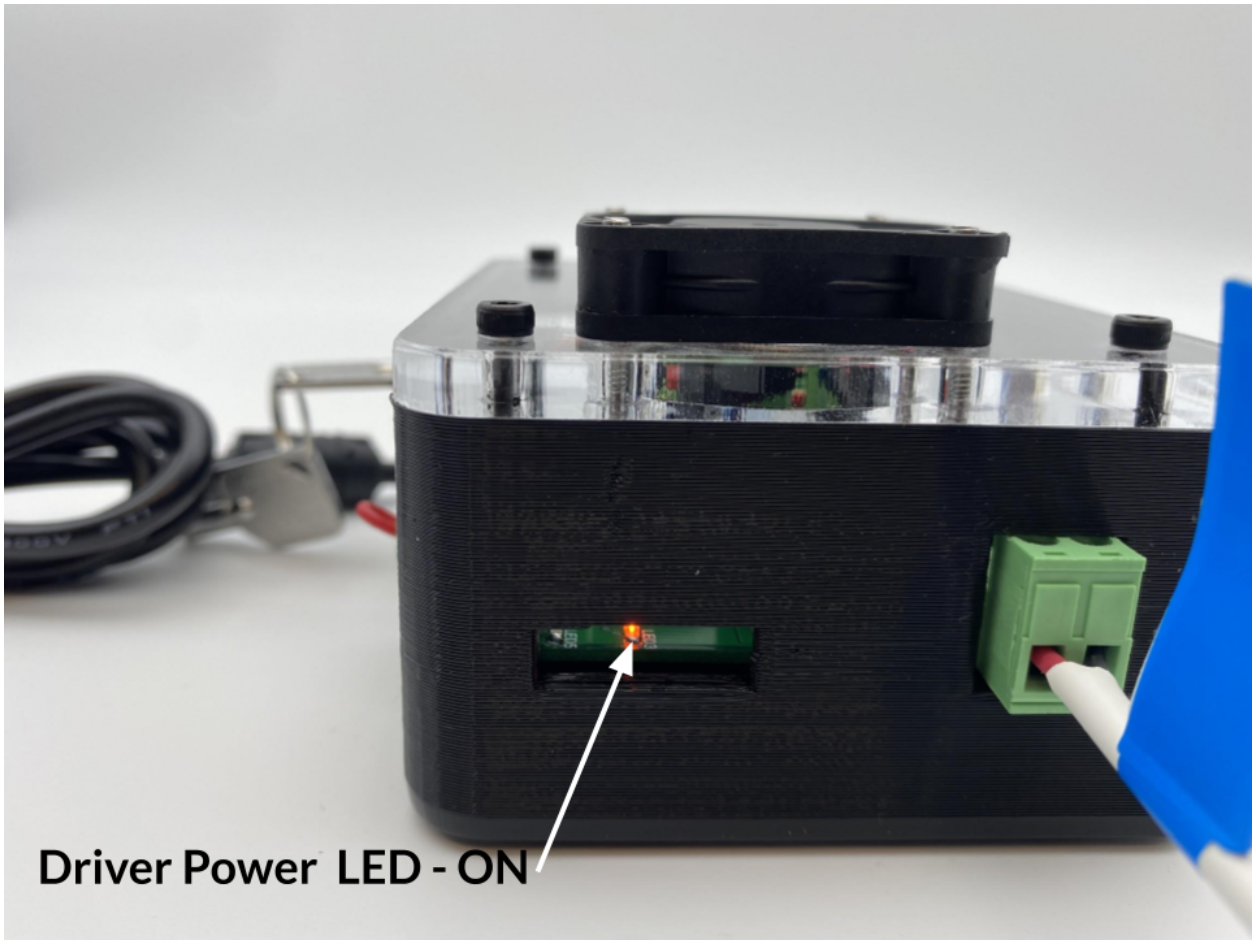

Figure 46: Driver power LED ON

b. LED 2 is an emissions LED that will indicate when your laser output is enabled and when your driver has turned your laser on
    i. Because the laser can be turned on at different intensities and off at different frequencies, this LED will mimic the signal that your laser is receiving relative to the LEDs max intensity.

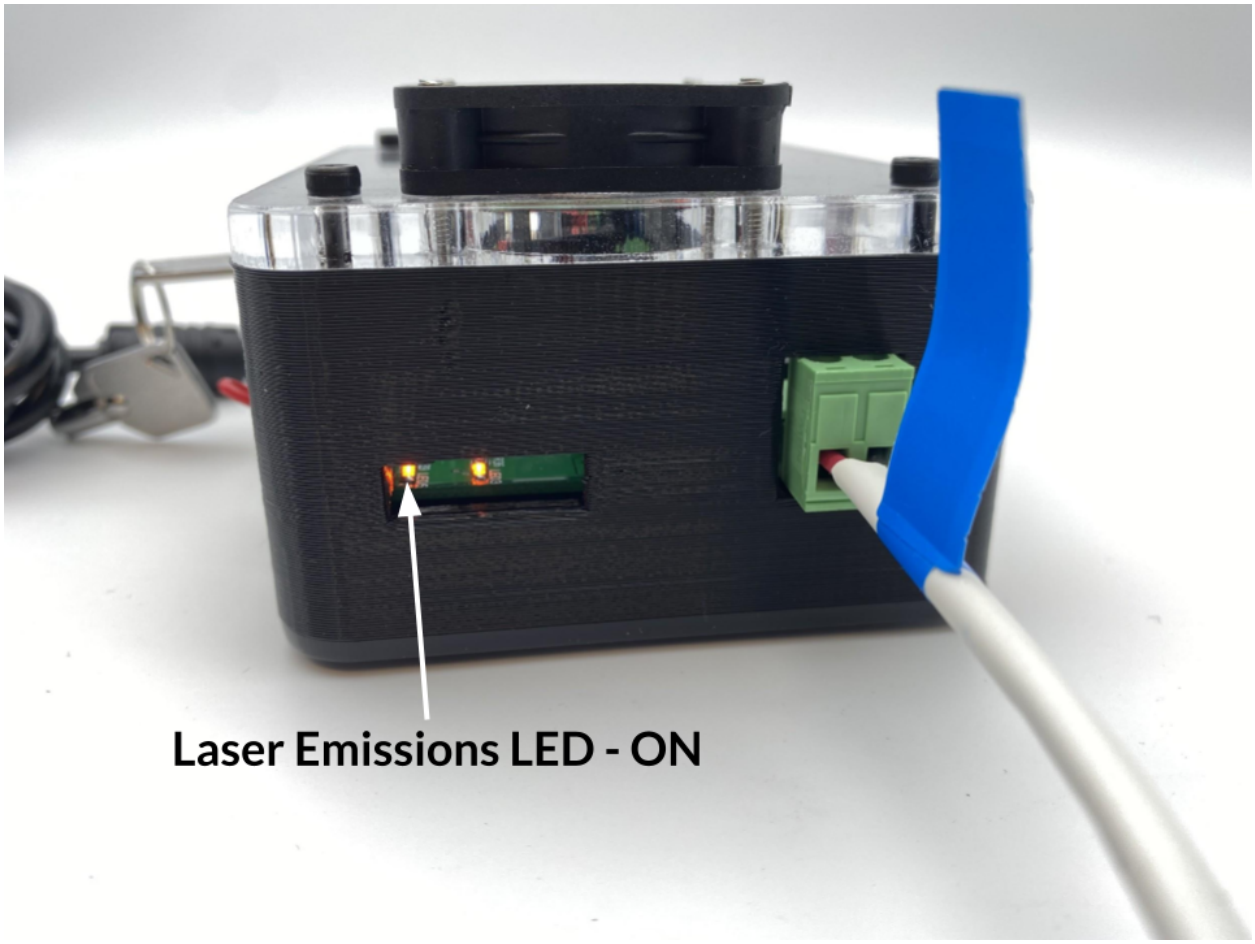

Figure 47: Laser emissions LED ON

Turning Laser ON Checklist

- ☐ Before operating the 7W LaserBeam System you must read through all sections of this User and Safety Manual.
- ☐ Ensure that your 12V 8A power supply is working correctly and the LED is on when the AC cable is connected to the power supply and an outlet that supplies 100-240VAC.
- ☐ Ensure that your laser diode and laser cooling fan are properly connected to the driver.
- ☐ Ensure that you and all personnel in the room are wearing the appropriate laser safety glasses before use.
- ☐ If using the PWM signal from your Longmill Benchtop CNC, ensure that your signal wires are connected in the proper orientation.
- ☐ If using the PWM signal from your Longmill Benchtop CNC, mount your laser diode assembly to your Longmill router mount.
- ☐ Only direct your Laser assembly towards laser safe materials.
- ☐ Insert your driver key into the laser driver, lightly push and turn your key 90 degrees once in the driver key Switch to enable.

- ☐ Ensure that the interlock is closed with the interlock closed connector, or your own interlock switch.
- ☐ Ensure that your maximum current setting DIP Switch is disabled.
- ☐ Press the power reset button.
- ☐ Turn the driver power switch to the ON position.
- ☐ Confirm that your driver is on via the driver power LED.
- ☐ Set your maximum current setting via the maximum current setting DIP switch.
- ☐ Send your PWM signal from your Longmill Benchtop CNC controller and confirm your Laser emissions LED turns on and off with your laser diode assembly.

Compliance

The LaserBeam was designed to comply with as many regulatory bodies without contradicting each other. The LaserBeam meets or exceeds the need requirement for a class IV laser to be operated and sold in North America and Internationally.

1. International Electrotechnical Commission Regulation 60825-1
2. Food and Drug Administration Center for 21 CFR 1000 - 1050
3. Canada's Radiant Protection Bureau Radiation Emitting Devices Act (RED Act)

Disclaimer

Caution:

- *The 7W LaserBeam is dangerous, it is not a toy.*
- *Laser radiation is dangerous even when handled indirectly*
- *Always use proper safety glasses for the range of 430 - 470nm for 7W*
- *Never point a laser module at anyone or anything not meant for laser use*
- *Do not touch the beam, it may cause burns or other injuries.*
- *Do not stare at the beam or the beam spot while the material is being cut.*
- *Laser radiation - Avoid eye or skin exposure to direct or scattered radiation.*
- *This is a Class 4 laser product.*
- *You, the customer, are legally responsible for any and all liabilities of this laser assembly*

Please note that lasers are very dangerous. Sienci Labs is not responsible for injury or damage caused by the use or installation of this laser product.