

# Master Class CO2 Flatbed USER MANUAL



**Full Spectrum**  

---

**L A S E R**

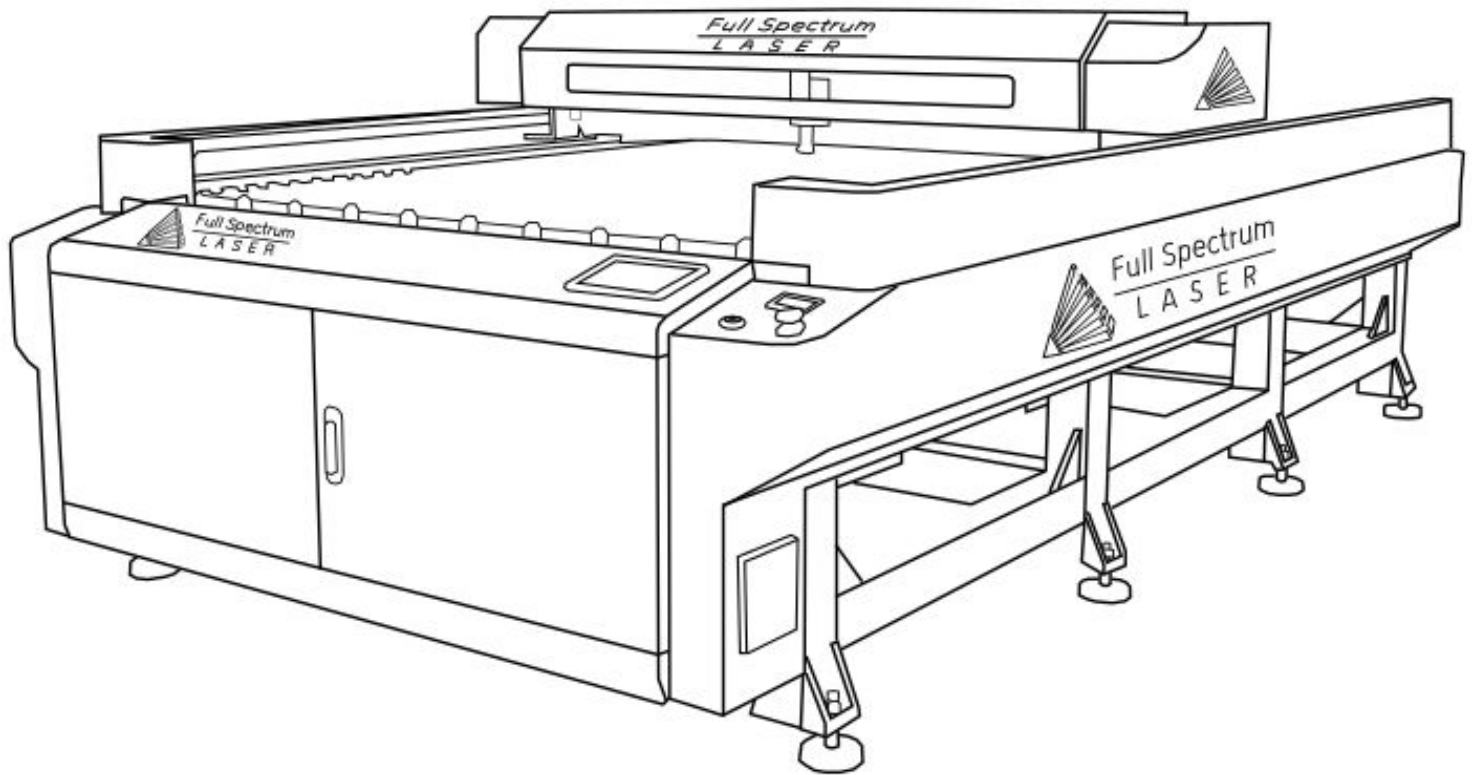
# Table of Contents

<b>Master Class CO2 Flatbed</b>	<b>2</b>
<b>Symbols and Definition</b>	<b>3</b>
<b>Section I. Safety</b>	<b>4</b>
Setup Precautions	4
Safety During Operation	5
Fire Safety	6
Electrical Safety	7
Materials	7
<b>Section II. Unboxing Your Muse Titan</b>	<b>8</b>
Unboxing Steps	8
Checklist	9
<b>Section III. Installation &amp; Assembly</b>	<b>10</b>
Assembly Stage	10
Connect the Electrical Power	10
Power On Machine	11
Laser Tube Installation	12
Connect the Exhaust System	13
Assemble the Water System	15
Connect the Air Compressor	17
MetalCut Installation	18
<b>Section IV. Tests &amp; Adjustments</b>	<b>19</b>
Laser Test	19
Mirror Alignment Procedure	20
Focusing	22
<b>Section V. Control Panel</b>	<b>23</b>
<b>Section VI. MetalCut</b>	<b>25</b>
<b>General Maintenance</b>	<b>29</b>
<b>Warranty</b>	<b>30</b>
<b>Customer Support</b>	<b>31</b>
<b>Join The Full Spectrum Laser Community</b>	<b>32</b>

# The Master Class CO2 Flatbed By Full Spectrum Laser

Thank you for purchasing your new Master Class CO2 Flatbed. Our high quality products will provide years of service simply by following proper usage and upkeep. This user manual will guide you through the safety guidelines and operation of your machine. We recommend that you familiarize yourself with this manual before using your laser engraver. Remember to be safe and have fun!

For more information and product selection, please visit [www.fslaser.com](http://www.fslaser.com)



Compliance Statement: The Full Spectrum Laser Master Class Series is a Class 4 laser product, as defined in International Standard IEC 608251. The Full Spectrum Muse Titan complies with 21 CFR 1040.10 and 1040.11, the Federal Performance Standards for Light Emitting Products, except for deviations pursuant to Laser Notice No. 50, dated July 16, 2001. The Center for Devices and Radiological Health of the US FDA issued Laser Notice No. 50 to permit manufacturers to classify and manufacture their products in accordance with the International Standard. 21 CFR 1040 and IEC 608251 require that certification, identification, and warning labels be placed on laser products.

# Symbols and Definitions

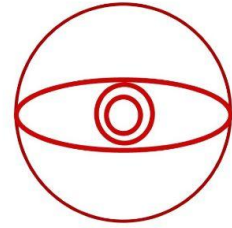
Red icons indicate dangerous situations that could result in serious injury or death.



This symbol indicates a hazardous situation.



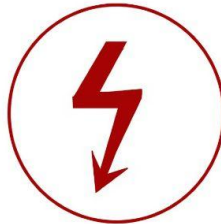
This symbol indicates the risk of fire.



This symbol indicates the risk of potential eye injury.



This symbol indicates a respiratory hazard.



This symbol indicates an electrical hazard.



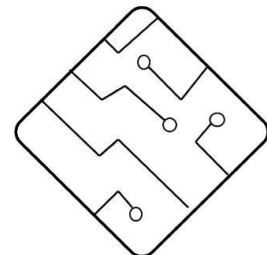
This symbol indicates the risk of getting cut by a sharp object.



This symbol warns of fragile parts.



This symbol calls attention to important details.



This symbol warns of network or software issues.

 **DANGER**

**Danger:** Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

**Warning:** Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

**Caution:** Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.

# Section I. Safety

## Setup Precautions

Follow all safety protocols and procedures before operating any machinery. It is the responsibility of the operator to ensure all safety precautions are correctly followed, and the machine is properly assembled and in working order.



**WARNING!**

- **Always inspect the laser cutter for damage or breakage before each use. Do not operate machinery that is damaged or defective in any way.**
- **Always have a clean, level, and open work space to unbox and place your laser cutter.**
- **The laser tube is filled with CO2 gas. While carbon dioxide is a class 2.2 gas (nonflammable and nontoxic), the release of this gas from the laser tube will render your laser inoperable.**
- **Never modify, disassemble, or in any way alter the construction of the laser and never start up a system that has been modified or disassembled.**
- **Never leave the laser system unattended during operation.**
- **Keep your laser system clean.** A buildup of cutting and engraving residue and debris is dangerous and can create a fire hazard. Keep your laser system clean and free of debris. Regularly remove the cutting grid to clean any small pieces that have gotten stuck or fallen through.
- **Do not disassemble the machine or remove any of its protective covers.**
- **Always have on hand a first-aid kit designed for the initial treatment of burns and smoke inhalation.** Be sure to store this kit in an area that is outside risk areas.
- **Never operate the machine with any of the panels removed.** Be aware that removal of any portion of the cabinet will expose the laser system and greatly increase the risk of injury and/or fire. Personal injury and fire risks are especially pronounced if the machine is operated with the bottom panel removed. Remember that the CO2 laser beam is invisible.




**WARNING!**

- **Never place hands or fingers into moving parts such as cooling fans.**
- **The laser tube is made of glass and is therefore extremely fragile and can cause severe lacerations if broken.**

## Safety During Operation


The output of the CO2 engraving laser is fully contained in a Class 1 enclosure during normal operation. The laser cabinet has a safety interlock switch that deactivates the laser if the door is opened during operation, and no special precautions are necessary to operate the high power laser safely. However, the output beam of the Alignment Laser (visible red diode laser) is accessible to the operator during normal operation, giving the total system an overall rating of Class 3R. Class 3R lasers have minimal safety concerns when used properly and handled with care.

Follow these Safety Guidelines at all times:



**WARNING!**

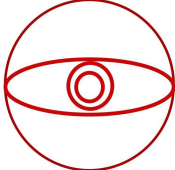
- **Never engrave or cut any material containing PVC or vinyl under any circumstance. These materials (along with other chlorine/ chloride-containing materials) produce a highly toxic, corrosive vapor that is lethal to humans and will destroy your machine.** Your warranty will be void if your machine is damaged by corrosion from engraving or cutting PVC or vinyl.
- **Never engrave or cut any unknown material.** The vaporization/melting of many materials, including but not limited to PVC and polycarbonates, can give off hazardous fumes. Please refer to the MSDS sheet from the material manufacturer to determine the response of any work material to extreme heat (burning/fire hazard).
- **Never operate the machine without a properly operating ventilation system.** Most materials produce an irritating smoke when engraved. Some materials, including but not limited to: paint, varnish, composition board, and plastics, toxic compounds.



**WARNING!**

- **Always use the air assist, especially while vector cutting.** Vector cutting movements are relatively slow and apply an extremely large amount of heat to the workplace. This buildup of heat can create a significant fire risk.
- **Never run a laser with the lid open.** Always be sure the lid is closed and never tamper with the lid safety mechanism.

**CAUTION!**



- **Never look into the beam of the Alignment Laser (visible red diode laser).**
- **Never aim any laser towards an aircraft or vehicle that is in motion.** The bright light can flash, blind, cause glare or distract the pilot or driver.

**Laser cutting and engraving systems can present a significant fire hazard due to the extremely high temperatures generated by the laser beam.** While the objective of most cutting and engraving operations is to vaporize material without burning, most materials capable of being cut or engraved are inherently combustible and can ignite. Usually this is a small flame of burning material issuing from the cut zone which self-extinguishes due to the air assist or depowering of the beam. However, it is possible for the flame to propagate and set fire to the machine and its surroundings.

**Always keep a properly maintained and inspected 5lbs. or larger fire extinguisher on hand.** Full Spectrum Laser recommends a Halogen or multipurpose dry chemical fire extinguisher. Halogen extinguishers are more expensive than a dry chemical, but offer certain advantages should you ever need to use an extinguisher. The Halogen extinguisher are expensive but easy clean, while the dry chemical extinguisher discharges a sticky, corrosive powder that is very difficult to clean up.



**WARNING!**

**Warning! Stacking materials can lead to increased risk of flame propagation or work piece ignition.** Always keep the area around the machine clean and free of clutter. **Never store any flammable materials in or near the device.**

**Never operate your machine unattended.** There is a significant risk of fire if set improperly, or if a mechanical or electrical failure occurs while operating.

**Always use the air assist, especially while vector cutting.** The process is relatively slow and applies a large amount of heat to the workplace. **Vector cutting with the laser has the most potential to create an open flame**

**Never run a laser with the lid open.**

**WARNING!! Never cut PVC (polyvinyl chloride) under any circumstances!!**  
**Never store any flammable materials in or near the device. Debris and left over produced materials within the machine must be removed to prevent a fire.**

## Woodshop Dust Fire Safety Considerations

\*Guidelines from the U.S. Department of Labor

Before using materials, the user must verify whether harmful fumes will be generated and whether the filter equipment of the exhaust system is suitable for the harmful materials. We emphasize that it is the responsibility of the user to consider the national and regional threshold values for dust, fogs, and gases when selecting the filters and the exhaust system. (Values for maximum workplace concentration must not be exceeded.)

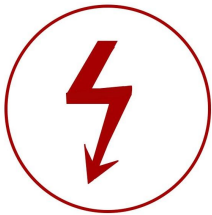
Be mindful of large quantities of flammable materials in the form of wood, sawdust, paints, oil finishes, adhesives, solvents, and liquid propane for internal combustion engines. Preventing the buildup of dust is one of the key means for controlling fire and explosion hazards. The primary ways for controlling dust are proper ventilation and good housekeeping.

Dust collection is best accomplished at the source, where the equipment is use. For many pieces of equipment, well-designed ducts and vacuum hoods can collect most of the dust generated before it even reaches the operator. Fine dust that manages to escape point-of-source collection can be captured from above by general exhaust points located along the ceiling. These control procedures are effective for most equipment, except for machines that commonly produce very finest dust or large quantities.

# Electrical Safety

The power supply is capable of releasing a current up to 20mA. This power is sent to the discharge terminals on the laser tube itself. In order to prevent access to bare wiring your laser shipped with silicone terminal covers. Please notify Full Spectrum Laser support and immediately cease operations if the covers ever slip and expose bare wire.

**CAUTION!**



- **Do not open any of the machine’s access panels while the unit is plugged in.** Opening a panel may expose the operator to the unit’s power box, which is potentially lethal.
- **Never make or break any electrical connections to the system while the unit is turned on.**
- **Never access any electrical areas with hands or tools unless the unit is disconnected from the power for at least one hour.**
- **Never replace the installed 20 amp fuse with one of a higher rating.** This will void your warranty and the electronics will not be adequately protected from surges or short circuits.
- **POWER ON/OFF is controlled by the switch at the back of the machine.** The machine is on when the (-) side is pressed and off when the “o” side is.
- **In case of a blown fuse always contact Technical Support before replacing anything.**

The standard for laser safety is the American Standard for the Safe Use of Lasers, Z136.12000. Developed by the American National Standards Institute (ANSI) it is the basis for many federal regulations and Occupational Safety and Health Administration (OSHA) guidelines for laser and laser system manufacturers. It contains detailed information concerning the proper installation and use of laser systems. While the ANSI standard is not a law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be mandatory under local regulations. It is the operator's responsibility to ensure that the installation and operation of the Full Spectrum Desktop Laser System are performed following applicable laws. Copies of ANSI Standard Z136.12000 are available from:  
LASER INSTITUTE OF AMERICA 12424 RESEARCH PARKWAY, SUITE 125 ORLANDO, FL 32826 (407) 3801553.

# Materials

CO2(150W)	Max Thickness
Acrylic	20mm (25/64")
Soft Wood	15mm (19/32")
Plywood	12mm (1/2")
Leather	6mm (1/4")
Rubber	6mm (1/4")



# Section II. Crate Removal

**WARNING!!** The MC CO2 Flatbed models are over 2000lbs. A forklift is need to move this machine. DO NOT ATTEMPT TO LIFT!!

## Removing the CO2 Flatbed from Crate

Follow these instructions for best results:

1. **Prepare Work Space:** You will need an open, level work space to place your laser cutter. A well-ventilated open room with at least 135" x 74" x 44" free is recommended. Be sure there is always a fire extinguisher nearby in case of emergencies.
2. **Open Crate.** Use  $\frac{3}{8}$ " socket or flat blade screwdriver to remove multiple 3" screws. A cordless impact gun is recommended to decrease breakdown time. Remove the top panel, the top support bars, the left and right sides, and lastly the front and back sides. Note this will require help for best results.
3. **Remove Plastic Wrap and Foam.** Remove the plastic wrap and foam from around the machine.
4. **Remove Machine from Crate.** Remove machine from the crate bottom. With the laser unit now sitting on the base of the crate, gently lift the machine off of the crate with a forklift.
5. **Install Thread Posts for Feet.** Pass the threaded posts through each mount frame for the machine feet and secure them with the provided hex nuts so the rounded portion of the thread posts are facing down.
6. **Place Machine on Feet.** Position provided feet for machine under each thread post and slowly lower machine onto the feet so that the groove on top of the feet house the rounded portion of the thread posts.
7. **Ensure Machine is Level.** Before completely lowering the machine, ensure that once the machine is lowered it is level. If out of level, adjust height of threaded posts as needed until machine is level. Lower machine onto feet.
8. **Uncrate the accessories.** Remove the individual accessories from the crate and compare them to the parts list (see page 9).
9. **Inspect the machine.** With the unit and accessory box now out in the work area be sure to give the interior and exterior of the unit a thorough visual inspection for any defects or breakage. If you find any defects or breakage, contact your sales representative immediately. Have pictures of the damage ready to share. Your machine is now uncrated.

**CAUTION!**

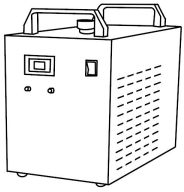


**WARNING!! FRAGILE!** Be careful when removing the foam packaging and accessories. Never pull or force the packaging loose. Be aware that the water inlet and outlet nodes protrude from the tube and are extremely fragile when unboxing your laser tube

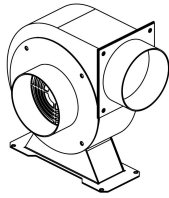
# Parts & Accessories Checklist

## Checklist

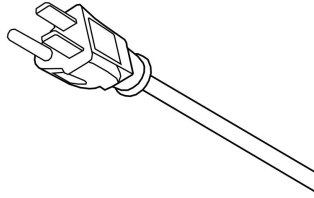
Your laser should come with the following included parts and accessories:



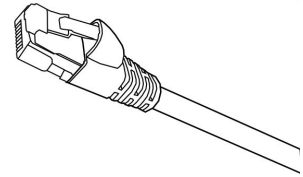
Water Chiller



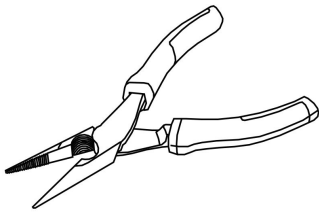
Exhaust Fan



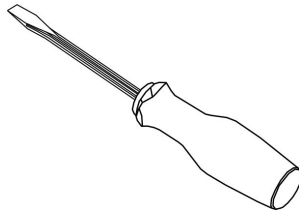
Power Cable



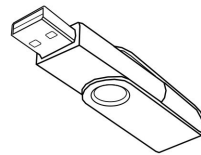
Ethernet Cable



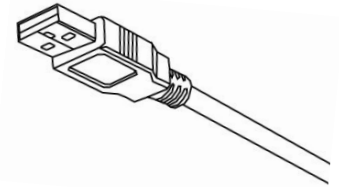
Needle Nose Pliers



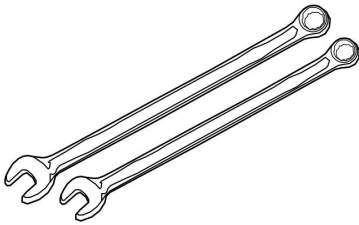
Flathead Screwdriver



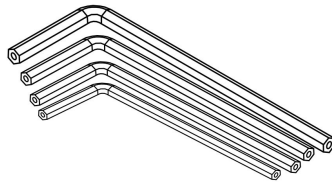
Flashdrive with Software



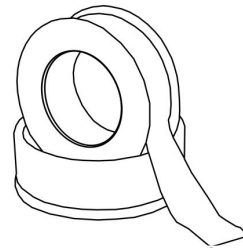
USB Cable



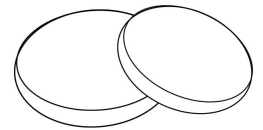
5.5 & 7mm Wrench



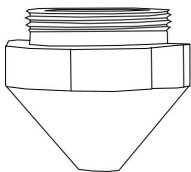
2, 2.5, 3 and 5mm Hex Keys



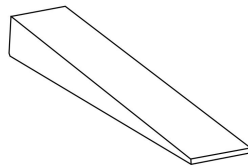
Thread Tape



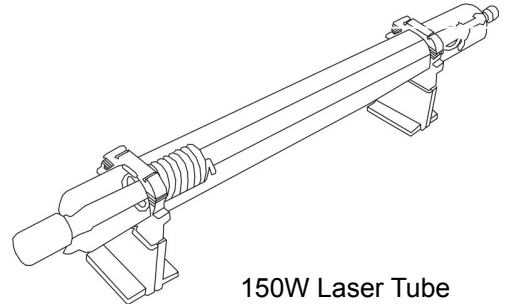
2.5" & 4" Focus Lens



Air Assist Nozzles



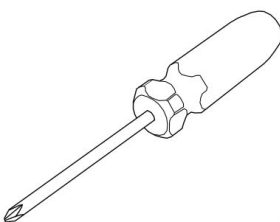
Focusing Wedge



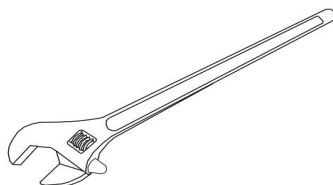
150W Laser Tube

## Additional Items

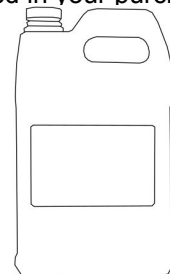
You will also need the following tools and accessories (not included in your purchase):



Philips Screwdriver



Crescent Wrench



Distilled Water

# Section III. Installation & Assembly

This assembly is a simple process that should take less than half an hour to complete.

## Assembly Stages

1. Connect Electrical Power
2. Power on Machine
3. Laser Tube Installation
4. Connect the Exhaust System
5. Water System Assembly
6. Air Compressor Assembly
7. MetalCut Software Installation

### 1. Connecting the Electrical Power

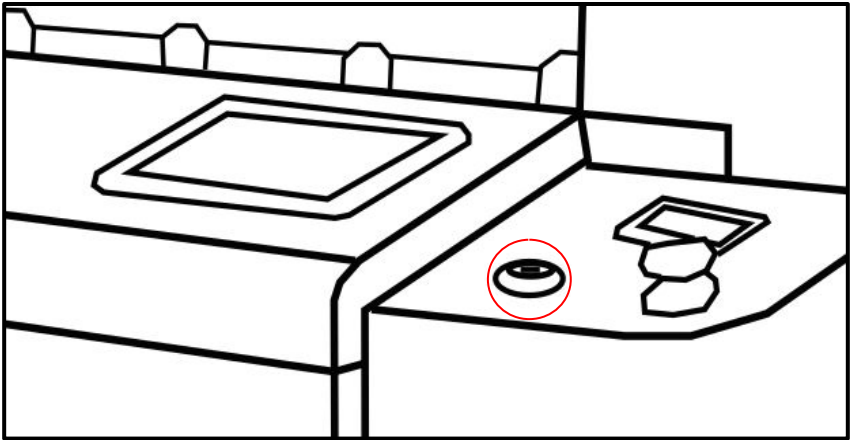
The Master Class Laser System and its accessories are configured to accept 110VAC at 60Hz. 220VAC units connect to power through an included converter (single-phase 220VAC).

1. **Prepare Power Cord:** Remove the electrical cord from its packaging.
2. **Plug in Power Cord To Laser Cutter:** The power cord plugs into the C14 slot located on the back of the machine. Ensure the red power switch is turned on.
3. **Plug in Power Cord to Outlet:** Plug the power cord into any proper outlet socket in your workspace.

#### NOTICE

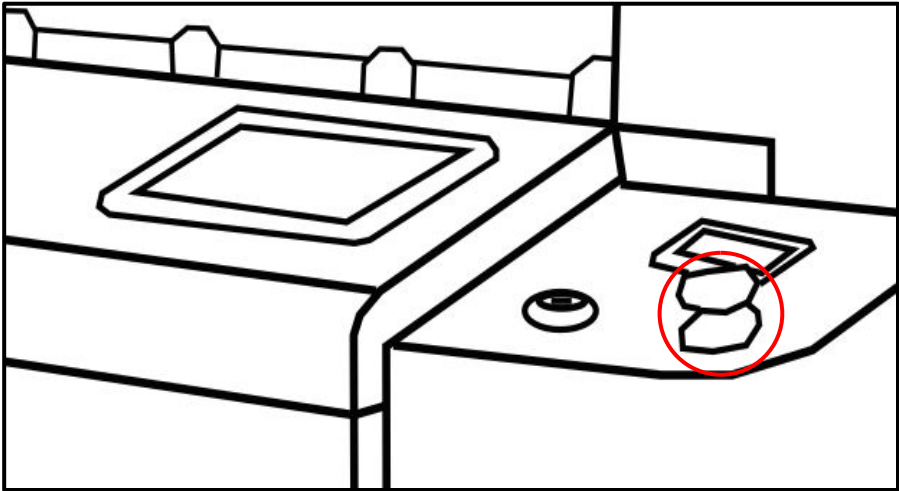
- **Please be aware that the accessories will increase circuit load**  
The most significant power draw usually comes from the blower/exhaust system. Consult the manufacturer's information and manual for the operating parameters of your exhaust system.
- **The power inlet is equipped with a fuse to protect the machine from surges or short circuits in case of emergencies. If this fuse ever needs replacement, please contact Full Spectrum Laser technical support.**

## 2. Power On Machine



The control panels for the CO2 Flatbed are located on the right-hand side. The CO2 Flatbed comes with 2 ignition keys. As a safety feature the laser will not start without the keys in the appropriate position on the safety switch.

1. Insert the ignition key into the ignition switch (see above).
2. Turn the ignition switch into the on position.



3. With the key in the ignition the laser is started using the emergency stop button.

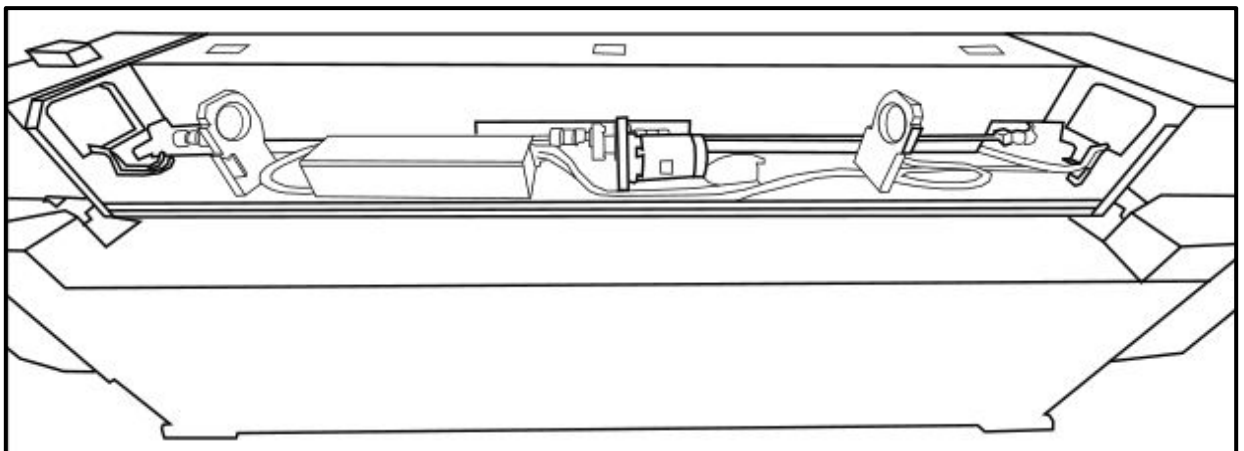
**Note: This is the item users are most likely to press without meaning to. Always make sure that the power button is in the correct position.**

# 3. Laser Tube Installation

The Laser installation process required several steps being precisely followed. Read the following steps properly before attempting tube installation.

Laser Tube Installation:

- 1. Position X Gantry For Tube Installation.**  
Power on the laser. Use the arrow keys on the user interface and move the X gantry to the back of the laser. This will allow access to the Laser Tube Access Panel.
- 2. Remove Laser Tube Access Panel.**  
Use a 3mm hex key and remove the screws securing the tube's access panel to the X gantry and remove the panel.



- 3. Open the Laser Mount and Position Laser Tube.** Open the mount using a 3mm hex key. Position the tube so the water exit nozzle on the aperture end of the laser tube is pointed up at "12 O'clock".
- 4. Install Water Tubes.** Install the water inlet and exit tubes on both ends of the laser.
- 5. Secure Laser onto Mount.** Attach mounting straps over the laser tube and mount with supplied screws
- 6. Install Laser Tube Access Panel.** Use the 3mm hex key and secure the laser tube access panel back onto the X gantry of the machine.
- 7. Connect Laser to Machine.**  
Open left and right X gantry compartment doors to gain better access to both ends of laser tube. Remove the red cap from the positive end of the laser tube and attach the red high voltage wire to the tube with the included phillips screwdriver. Connect the black grounding wire to the laser tube near laser tube aperture.

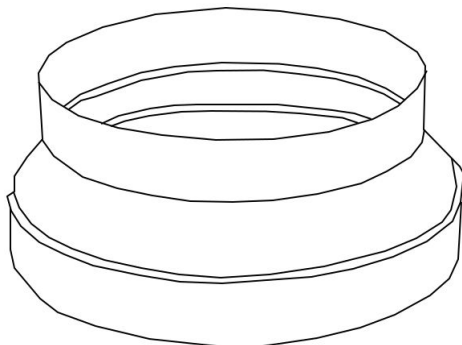
**NOTE: GROUND WIRE MUST NOT INHIBIT LASER TUBE APERTURE. THE RED CAP MUST BE REINSTALLED OVER THE HV END OF THE LASER TUBE TO PREVENT DAMAGE FROM OCCURRING.**

## 4. Connect the Exhaust System

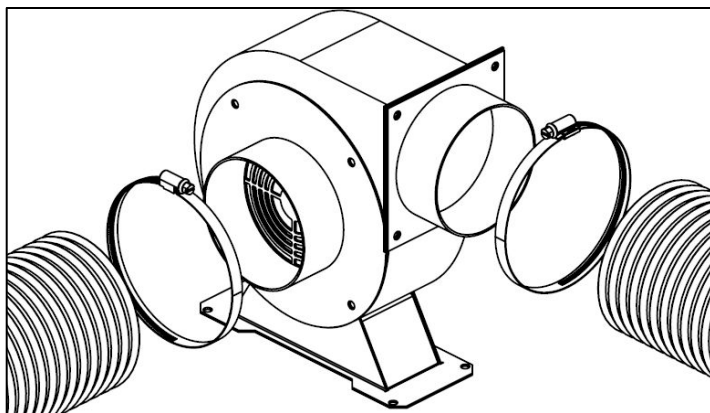
### Connecting the Exhaust System

The CO2 Flatbed require two exhaust fans to be connected and on whenever a job is run on your laser. The properly installed exhaust fans removes smoke and fumes from the work area and exhausts them to the outside of the building or a fume extractor.

1. **Position the Fans.** The fans should be placed next to provided exhaust ducts on left side of the laser engraver, found directly under the machine.
2. **Attach 8" to 6" Reducer Flanges.** Using the provided hardware and a 3mm hex key, secure the 8"-6" reducer flange to the intake ports on both of the exhaust fans.



3. **Attach 6" Flanges to Exhaust Fans.** Using the provided hardware and a crescent wrench, attach the provided 6" flange to the outlet port on both exhaust fans.
4. **Secure Ducting.** Use the supplied ducting and hose clamps to connect the 8" ducting from the exhaust ports on the machine to the inlet reducer ports on both of the exhaust fans and the 6" ducting to the 6" flanges on both exhaust fans.



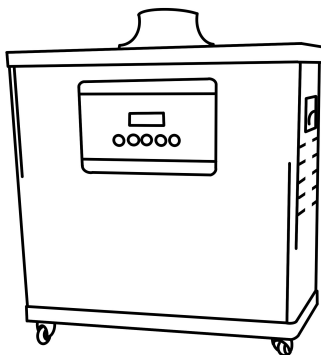
5. **Ventilate Outside.** Check your system for leaks. Be aware that the protective housing is not designed to be airtight; the front grill is designed to allow an exhaust system to draw fresh air through the work area. Run 6" ducting out a door, window, or attach to ventilation ports in machine environment.
6. **Connect to Power.** Connect the power cables for the exhaust fans to and available power circuit separate from the circuit the machine is being powered by

7. **Fume Extractor Upgrade (optional):** Fume extractors are air purifiers that clean the air through HEPA Filters. Fume extractors do not require outside ventilation. This is a great choice for workshops that do not have the option to ventilate outside.

Both extractors and the filters are available on the Full Spectrum Laser website at <http://fslaser.com/laser-accessories/>

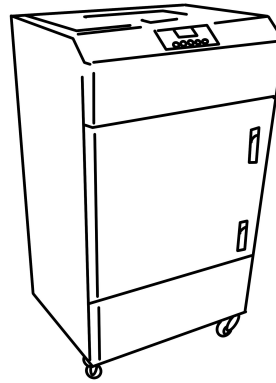
Ask a sales representative which fume extractor is right for your needs.

Fig. 6



**FSL100**  
Small Fume Extractor

Fig. 7



**FSL300**  
Large Fume Extractor

Fume Extractor filters require routine cleaning and replacement, dependent on use and materials cut. Generally, fume extractor suction will diminish and odors will be detected as filters clog.

## NOTICE

Never use a fume extractor without all filters in place.

### Maintenance guidelines:

**Pre-Filters:** Clean often using a shop vacuum. Check weekly, especially if cutting a lot of wood. When about 70% of accumulated debris remains after cleaning, replace.

**HEPA Filters:** Clean immediately when suction seems reduced, using the shop vacuum. When cleaning does not return optimal suction power, it is time to replace it.

**Activated Carbon Filters:** Clean when odors are detected or suction is reduced. Shake to remove excess dust and debris before proceeding with the shop vacuum. When cleaning no longer eliminates detectable odors, replace Activated Carbon Filters.

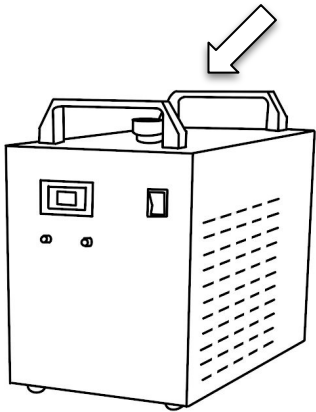
# 5. Setup the Water System

## Water System Assembly

Master Class CO2 Flatbeds have a water-cooled continuous beam CO2 laser tube. The tube requires a flow of room temperature water to regulate the temperature of the laser tube. Your purchase includes a water chiller for cooling the laser tube.

1. **Remove Water Cap:** Remove the short silicone tubing, capping the water inlet and outlet on the back of the machine.

Fig. 8



2. **Attach Water Chiller:** Remove the chiller from its packaging. Push one of the two (2) silicone tubes onto the inlet and the other into the outlet of the water chiller.

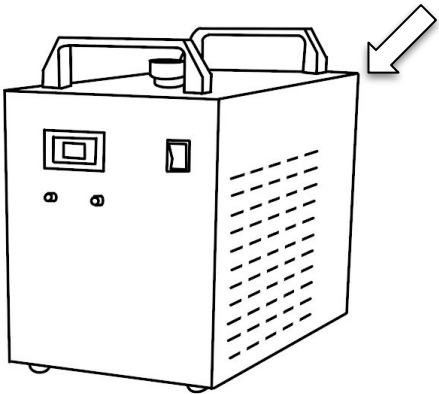


Fig. 9

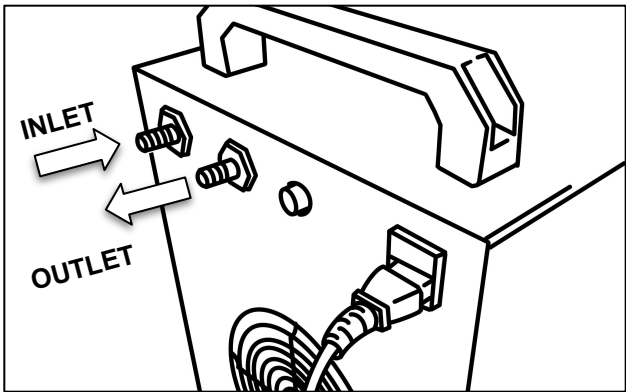


Fig. 10

### WARNING

**Never Fire the Laser without a correctly connected and powered water chiller.** Firing the laser without turning the pump on or with no water in the system will severely degrade or destroy your laser tube and void your warranty



3. **Attach Water Tubing to Titan:** Connect the two (2) silicone tube from the chiller to the contrasting **INLET** and **OUTLET** of the CO2 Flatbed (**Remember: In to Out, Out to In**). Your laser will not fire if this is installed backwards thanks to the water flow sensor.

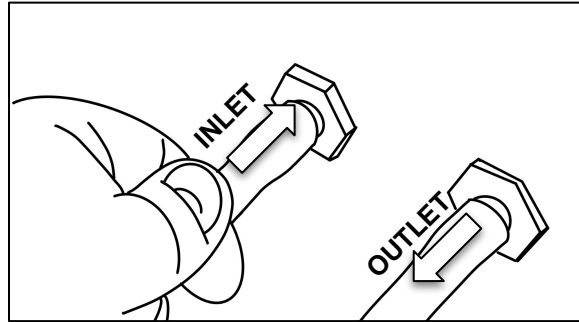


Fig. 11

4. **Preparing the Chiller:** Fill the chiller using between 3 and 5 gallons of **DISTILLED** water. Make sure to only use distilled water and replace often. If you live in a cold climate use a 20% propylene glycol/distilled water mix to prevent freezing. Do not operate the laser at temperatures below 20°F (-9.4°C).

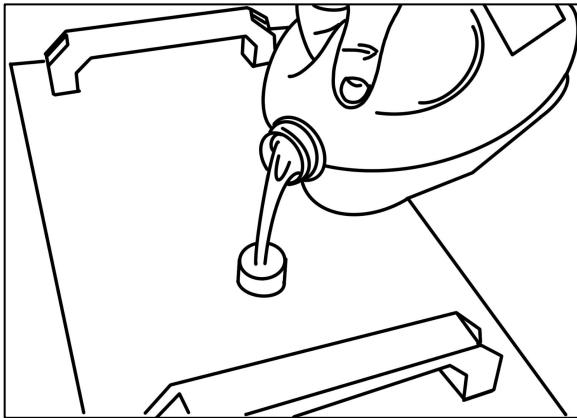


Fig. 12

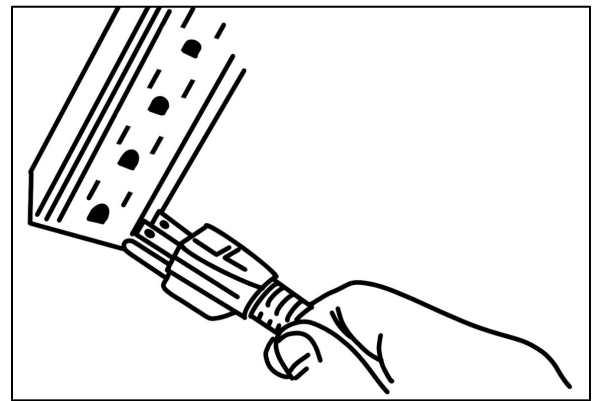


Fig. 13

## NOTICE



- We recommend that you attach the laser and water pump to a power strip and use that to control the main power to the unit, ensuring that the water pump is always on when the laser is powered.
- **Make sure that there are no air bubbles inside of the water jacket of the laser tube as it can reduce the lifetime of your tube.** If present, water bubbles typically migrate to the electrodes on either end of the tube. Visually inspect the laser tube to make sure that bubbles are not present. If bubbles persists completely drain the tube of water then turn the chiller back on and check once more.

## 6. Assemble the Air Compressor

### Connect the Air Compressor

Air is used as a pressurized gas to assist in cutting and engraving operations. This pressurized air is critical to safe and efficient cutting operations as it not only helps cut through material more quickly, but also helps prevent the formation of flames.

1. **Tubeing:** Remove the air compressor from its packaging and attach the silicone tube on the air compressor.

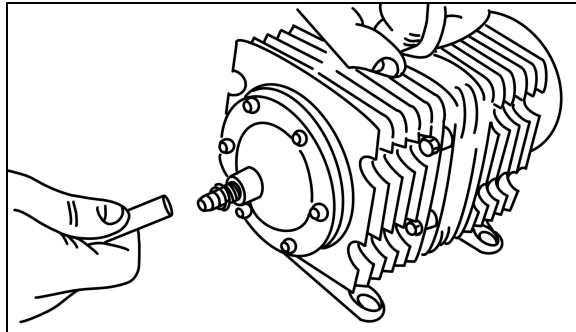


Fig. 14

2. **Attach Air Hose to Laser Cutter:** Insert the other end of the hose into the “air inlet” nozzle in the back of the laser cutter through the barbed air connect.

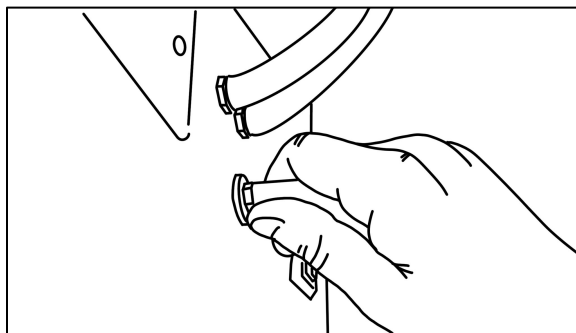
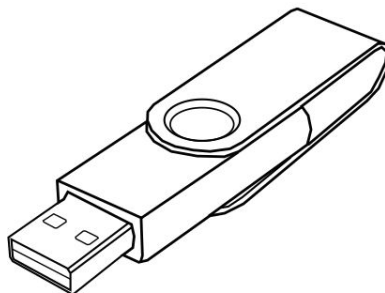


Fig. 15

3. **Connect to Power:** Plug the air compressor power cord into the marked “Air Assist” on the back of your Muse Titan. Note that accessories plugged into the back of your Muse Titan will only turn on when the laser is fired (as intended).

## 7. MetalCut Installation

The CO2 Flatbed uses the MetalCut software. It comes included on a USB drive that can be found in the accessories box included with the machine.



**Note: Flash Drive may be different from picture above.**

- 1. Ensure Machine is Powered On.** To properly download and install the necessary drivers the laser must be powered on.
- 2. Plug Provided Flash Drive into Computer.** With the computer that you intend to use to operate the laser engraver, plug the USB flash drive into an available USB port.
- 3. Plug Provided USB Cord into Computer.** Remove the provided USB cord from the toolbox and plug one end of the cord into the “PC” USB port labeled on the right side of the machine and plug the other end of the USB cord into an available USB port on the computer.
- 4. Install MetalCut software and Drivers.** Open the File Explorer on your computer and locate the USB flash drive. Open the drive and select the MetalCut Folder. With the folder opened, double click on the MetalCutSetupV1.33.12.exe file to run the installation wizard. When the “Welcome to Use” window appears, change the Language from Simple Chinese to English and then select Install and then Install USB Driver.
- 5. Open MetalCut Software.** With the software and USB drivers installed, open the MetalCut software now present on the computer desktop.

# Section IV. Tests & Adjustments

Before you start your first job, it is important that your laser is tested in case it needs to be adjusted. Follow the following steps to test and adjust your laser:

## 1. Laser test

## 2. Mirror Alignment Procedure

# 1. Laser Test

The laser tube needs to be installed manually in our CO2 Flatbed laser. Therefore, before running your first job you will need to check and make sure the mirrors are properly aligned using the following procedure. If your mirror is out of alignment, or if you have installed a new laser tube, you must align the laser.

This simple test will demonstrate a properly functioning CO2 laser tube.

1. **Power Up.** Turn on the machine by turning the ignition key to the on position and then flip the on/off switch up to the on position. Give the machine time to boot up.
2. **Turn on Water Chiller.** Turn on the water chiller and allow it to pump water through the laser tube. If there are any air bubbles inside the laser tube, squeeze the water inlet pipe and release to break the bubbles free.

**Note: The tube access panel needs to be removed to check for air bubbles.**

3. **Position Laser Head in Center of Work Area.** Proceed to position the laser head into the center of the work area using the user interface with no material underneath it.
4. **Set Pulse Output Parameters.** On the machine interface select Max Power and ensure Tube 1 is set to 98% and select OK. Then select the Min Power button and ensure tube 1 is set to 98%. From there ensure that the mA knob on the right side of the machine is turned all the way to the right for full power output.
5. **Fire Laser to Confirm Output Power.** Press and hold the "Pulse" button on the touch panel and then refer to the mA gauge on the right side of the machine. Holding the pulse button down and referring to the mA gauge you should see a mA output in between 28 - 32mA. That means the machine is firing at full power.

# Mirror Alignment Procedure

Once the laser tube is installed, before running your first job, you will want to check and make sure the mirrors are properly aligned using this simple test. Once the mirror alignment is confirmed, you are ready to use your laser cutter. If your mirrors are out of alignment, you must align the laser using the procedure provided.

<h2>Tools Required</h2> <p><b>Thermal Paper</b></p> <p><b>2.5mm Hex Wrench</b></p>
--

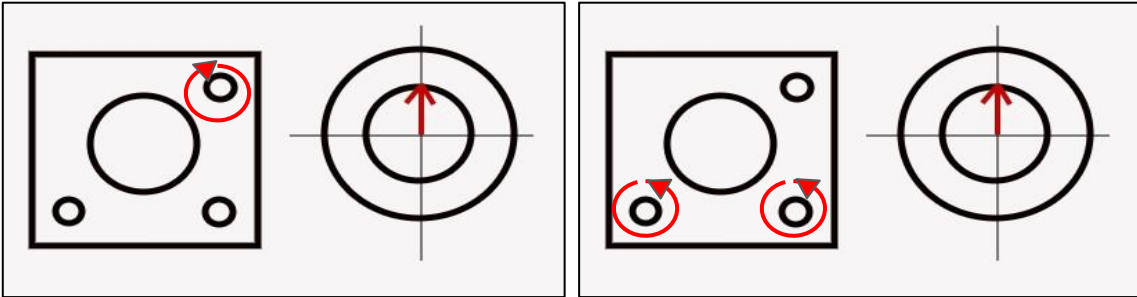
1. **Place Thermal Tape.** Place a piece of thermal tape over mirror 5 located at the laser head and lightly press the edges of the thermal paper with your finger so you can clearly see the outline of the mirror port.
2. **Position Laser Head to the Left.** Jog the laser head all the way to the left.
3. **Adjust Laser Power Output.** Since the pulse button on the machine interface fires for as long as you press it, it will be difficult to perform a proper test fire without first dropping down the power output. Locate and select the Min Power button on the user interface and specify 2% and then select the Max Power button on the user interface and set to 2%. From there turn the mA knob on the right side of the machine fully to the left.
4. **Test Fire.** Press the "Pulse" button on the control panel interface quickly noting the beep from the user interface.
5. **Confirm Burn Mark.** Check the thermal paper and confirm the test fire is present on the thermal paper. If not present, slowly turn the mA knob up to the right and take a test fire in between each adjustment until you see a faint mark on the thermal paper. Several test fires can be taken to darken the mark on the thermal paper. Main goal is to ensure the test fires are not so strong that the thermal paper catches fire.
6. **Confirm Test Fire Location.** Once the laser is set to the proper output power, refer to the location of the test fire onto the thermal paper. The test fire needs to be as close to center as possible. If centered, move on to the next stages of mirror alignment. If not centered, open the right side tube cabinet compartment to gain access to the back of mirrors 1 and 2. Loosen the lock nut screws on the back of mirror 2 and adjust the mirror alignment screws taking test fires in between each adjustment so that the test fires at the laser head become centered at mirror 5 on the thermal paper. Once centered lock down the lock nuts. Place a new piece of thermal paper onto mirror 5 and take a single test fire to mark the thermal paper

### Orientation Guidelines:

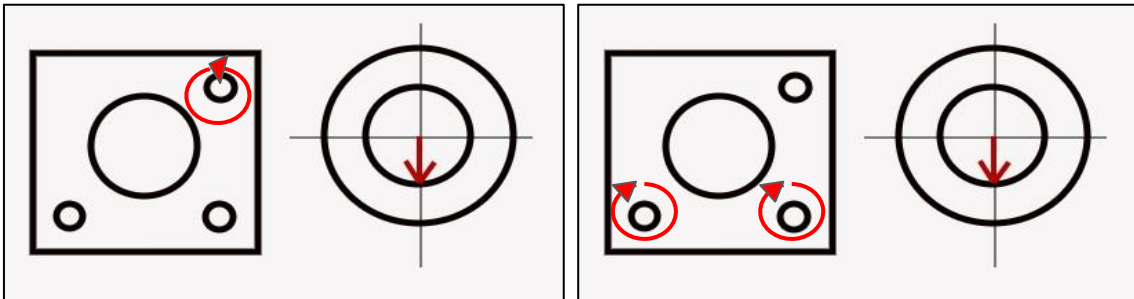
Tightening or loosening any of the three adjustment screws on the mirrors or the red dot diode will move the position in a particular direction depending on the positioning of the other screws. Some experimenting is required to understand the relationship of each screw and how adjusting one affects the red dot's positioning. When adjusting the screws, use the absolute minimum turn of the hex wrench to move the red dot or the mirror into position.

Below are some pictures that will help you better understand how to align your mirror.

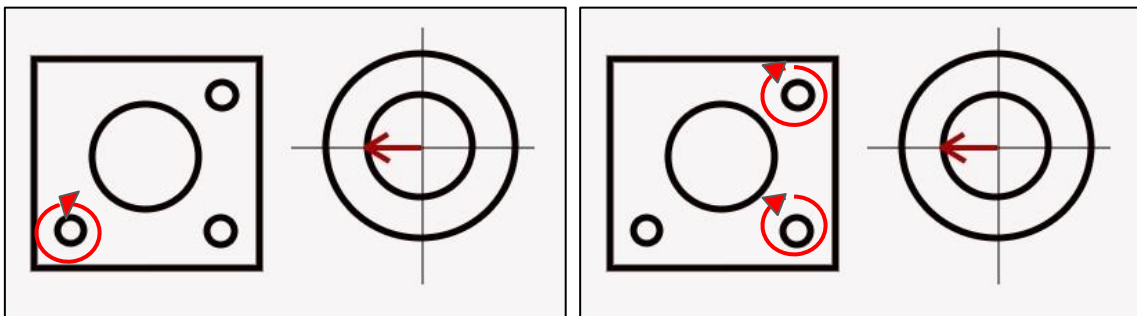
#### Orienting Up:



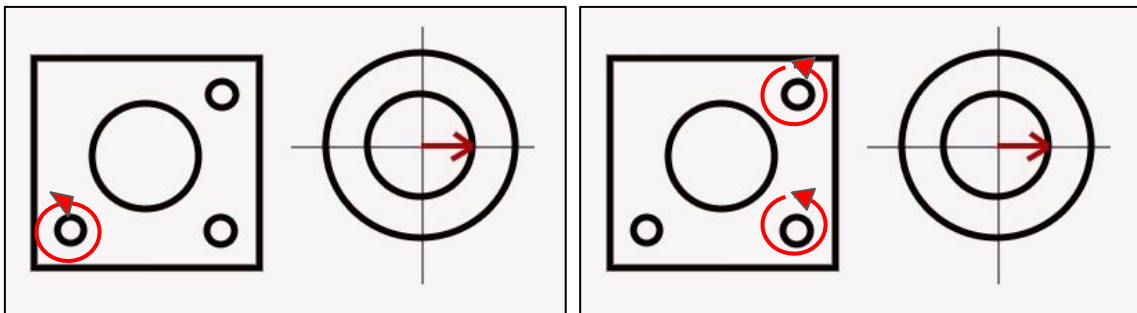
#### Orienting Down:



#### Orienting Left:



#### Orienting Right:



**Note:** This guideline is a general one and may not be the same for all lasers. Orientations of screws and screw slot may vary on availability and can impact orientation.

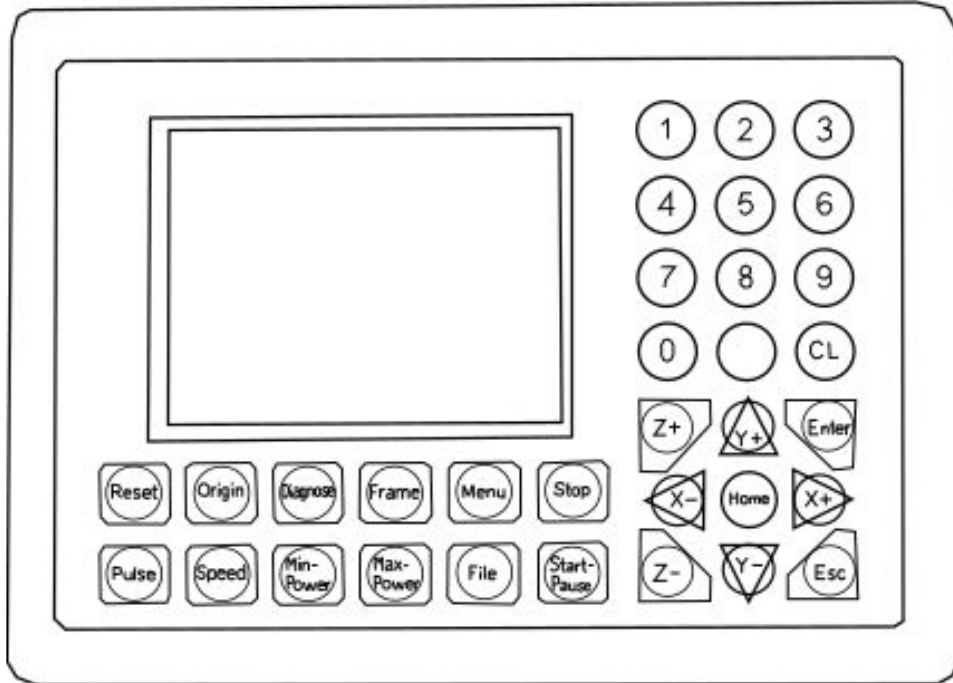
After the first test fire is on the center of the paper. Proceed with these instructions.

1. **Position Laser Head Right.** Now jog the laser head all the way to the right.
2. **Test Fire.** Press the “Pulse” button on the control panel interface, again.
3. **Check Results.** Refer to the thermal paper and confirm if the second test fire is on top of the first test fire. If second test fire is on top of or within 1-2mm center to center of the first test fire, move on to final stages of mirror alignment. If the second test fire is outside of 1-2mm of the first test fire, open the left side mirror access compartment to gain access to the back of mirrors 3 and 4. Loosen the lock nuts on the back of mirror 4 and adjust the mirror alignment screws, taking a test fire after each adjustment, until the test fires are hitting on top of the first test fire taken with the laser head positioned all the way to the left.
4. **Confirm Alignment Results.** Once both test fires are hitting on top of one another, replace the thermal paper with a fresh piece of thermal paper and retake the far left test fire and then the far right test fire. Confirm both test fires are concentric by adjusting the screws on the back of mirror 4 until the second test fire is on top of the first test fire.
5. **Mirror 5 to Focus Lens Alignment.** The final stage of mirror alignment is to ensure that the laser test fire is hitting within the air cone port perimeter at the bottom of the laser head. To confirm this, use the machine interface and select Z- to lower the laser head all the way down. Be sure there are no items/material present to inhibit the travel of the laser head. Place a piece of thermal paper directly onto the air cone port under the laser head and use your finger to outline the small perimeter of the air cone port into the thermal paper. Take a single test fire and refer to the thermal paper. If the test fire dot is hitting within the air cone perimeter without contacting the sides of the air cone frame, mirror alignment is now complete. If the test fire is hugging the edge of the air cone port, loosen the lock nuts for the alignment screws located at the top of the laser head on the back of mirror 5. Proceed to adjust the alignment screws on the back of mirror 5 until you can take a test fire and the dot be within the perimeter of the air cone port.
6. **Complete Mirror Alignment.** Once the test fire is firing within the air cone port, tighten the lock nuts down for the alignment screws on the back of mirror 5. This completes the mirror alignment process. Be sure to tighten all lock nuts that were loosened to correct mirror alignment to ensure mirror alignment holds during operation.

## Focusing

In the accessories kit included with the machine is a focus wedge and a focus ruler. The wedge is 4mm thick and is used in conjunction with the 4” (100mm) focal lens installed in the upper slot for cutting organic materials. Focus the laser by jogging the Z axis down until the focus wedge marked prior to shipping is snug between the material and the nozzle. This will focus the laser to the surface of the material. When cutting steel make sure the 2.5” (63.5mm) lens is installed in the lower slot and the machine is set to “Metal” on the right side switch. With the steel under the cutting head press the “FOCUS” button on the machine’s side panel. The laser head will jog down until it touches the steel and then return to a start position. This calibrates the autofocus and allows the machine to auto focus when cutting steel.

# Section V. Control Panel



The Co2 Flatbed comes with a Control Panel for use without a computer.

Bottom Row:

**Reset** - Restarts the laser (Machine will re-home and return to origin)

**Origin** - Sets the starting position for a job file

**Diagnose** - Displays any current errors

**Frame** - Will jog around the perimeter of the selected job file

**Menu** - Loads machine settings menu

**Stop** - Stops and resets a job file

**Pulse** - Fires the laser

**Speed** - Sets the maximum jog speed

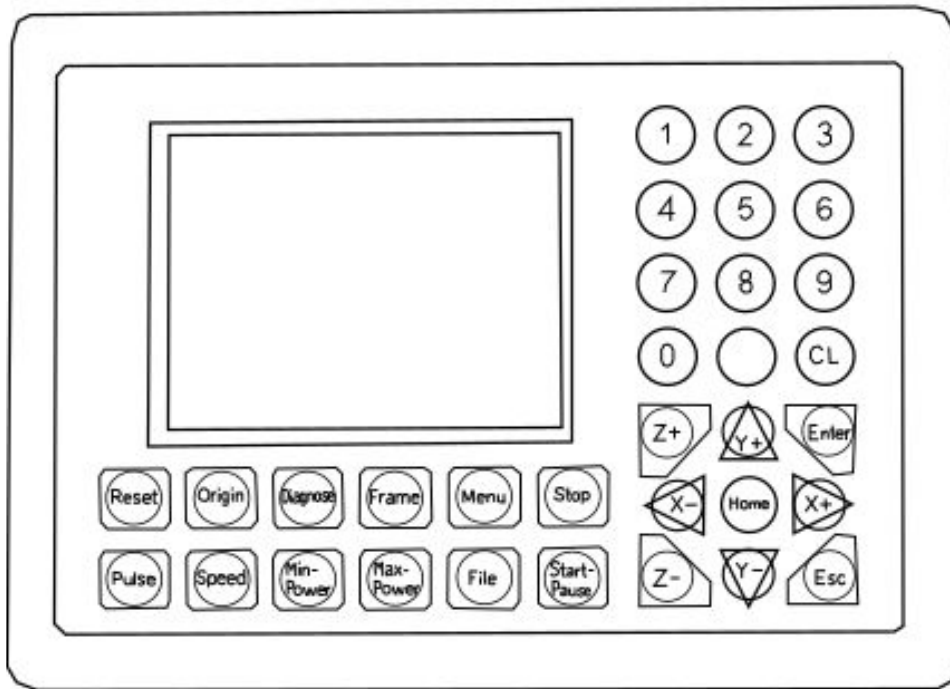
**Min-Power** - Sets the minimum power the laser will fire when using pulse button

**Max-Power** - Sets the maximum power the laser will fire when using the pulse button.

**File** - Brings up menu for selecting job files from memory/USB

**Start-Pause** - Starts/pauses a job file





Right Column:

**0-9** - Used to input your desired settings

**Clear** -Clear the input numbers

**Z+/Z-** - Raises and lowers the cutting head (While machine is in Acrylic Mode)

**Y+/Y-** - Moves the gantry backwards and forwards

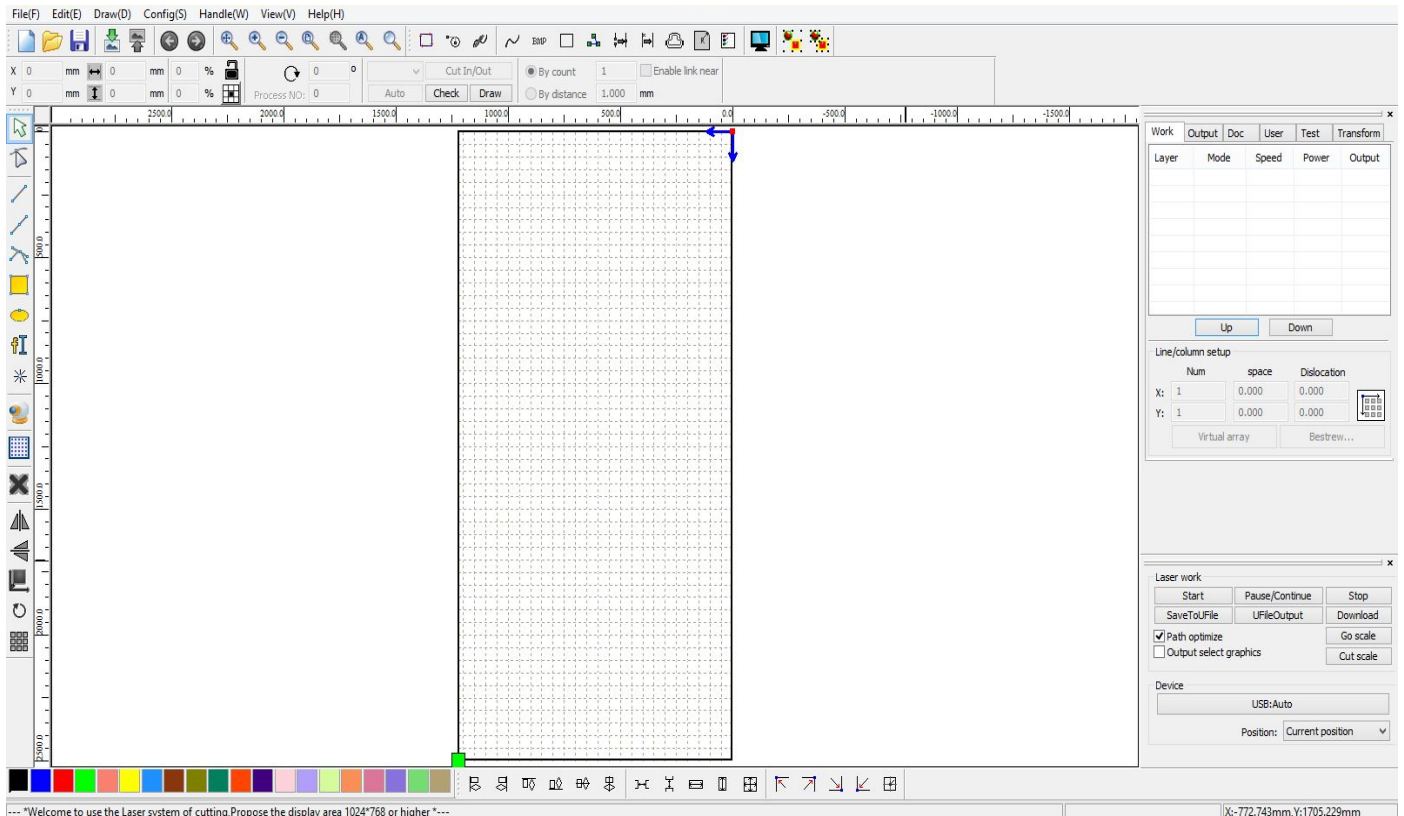
**X+/X-** - Moves the laser head right and left

**Home** - Origins a specific axis

**CL** - clears selection

# Section VI. MetalCut

If you have not yet done so, then install MetalCut. The software should look like the window below when correctly installed.



File(F) Edit(E) Draw(D) Config(S) Handle(W) View(V) Help(H)

## Menu Bar:

**File(F)** - Opens and saves new project files

**Edit(E)** - Has features such as cut, copy, delete, clone, rotate, etc.

**Draw(D)** - Used to draw simple features such as lines, circles, squares, text, etc.

**Config(S)** - Can adjust file import settings and machine settings

**Handle(W)** - Can edit imported vector files for optimized output

**View(V)** - Select which icon bars are visible

**Help(H)** - Can change language setting



## Main Toolbar:

**New** - Creates a new workspace

**Open** - Opens .rld files

**Save** - Saves your workspace as a RLD file

**Import** - Imports compatible files into the workspace

**Export** - Exports your workspace as AI or PLT file

**Undo** - Cancels the last operation

**Redo** - Cancels the last undo

**Move** - Allows you to scroll by clicking and dragging the mouse

**Zoom Out** - Zooms out of the workspace

**Zoom In** - Zooms in to the workspace

**Show Page** - Zooms to fit the workspace

**Show Data** - Zooms to fit a selected graphic

**View All** - Zooms to fit all graphics

**Show Select** - Zooms to the selected graphic

**Show Path** - Displays the cutting path for the job

**Edit Cut In Property** - Edit's lead in/out function

**Edit Cut Property** - Used to change order of operations for cutting

**Curve Smooth** - Smooths jagged curves

**Bitmap Handle** - Edits bitmap properties for raster engraving

**Curve Auto Close** - Draws lines between gaps of a set distance in a vector

**Cut Optimize** - Can edit the order which graphics are cut

**Combine Curve** - Joins two selected, separate curves

**Delete Overlap** - Can delete overlapping sections of line

**Offset Polygon** - Creates an outline or inline of a selected vector

**Fillet** - Radius corners

**Data Check** - Searches for possible issues in vector file drawing

**Preview** - Simulates cutting the job file

**Group** - Groups selected graphics together

**Un-Group** - Ungroups selected graphics

### Side Bar:



**Select** - allows user to select objects in work area.

**Edit Node** - allows user to edit specific nodes within object.

**Line** - create a single line

**Polygon** - create a multipoint line

**Curve Edit** - allows user to edit curves within object.

**Rectangle** - create rectangle

**Ellipse** - create ellipse

**Text** - create text box/ variable text.

**Point Creation** - create single point in work area

**Camera** - capture image

**LGP Design** - create light guide plate design

**Delete** - deletes selected object

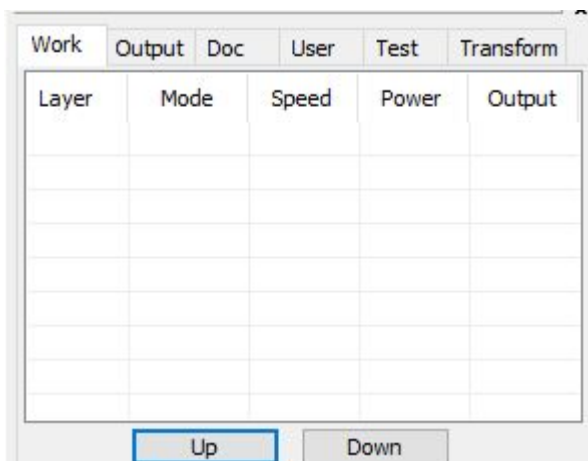
**Horizontal Mirror** - mirror selected object horizontally

**Vertical Mirror** - mirror selected object vertically

**Center Data** - send selected object to center of work area

**Rotate** - rotate selected object

**Array** - create array for an object



### System Window:

Displays the system information using various tabs.

**Work** - Work settings

**Output**- Output settings and line spacing

**Doc.** - Document settings

**User** - User Interface

**Test** - Can perform test runs here

**Transform**- section for object transformation

## Object Properties & Transformation:

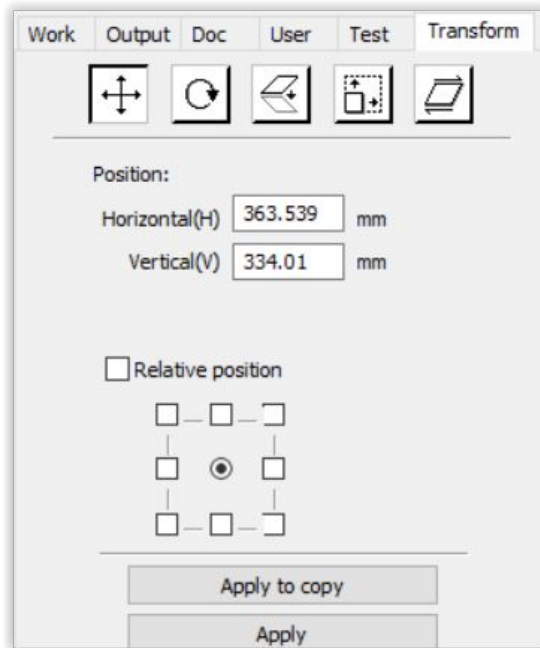


### Object Properties:

Object Properties toolbar is used to change the basic properties of graphs, including graph location, size, scaling, and processing number.

### Object Transformation:

In order to perform object transformation, open the transformation window.



The 5 boxes at the top of the transformation windows are:

- Object Positioning** - Enables you to move the object
- Object Rotation** -Rotates the object the number of degrees selected.
- Mirror** -Flips the object vertically and horizontally in different angles
- Scaling** -Increase or decrease the size of the object
- Skew** -Flips the object horizontally

## Before starting a job:

Make sure the lens and optics are clean and cleared of debris using a microfiber cloth or lens wipes.

**Note: these are the only recommended options for cleaning lenses as any other option can cause micro scratches in your optics.**

Check your gantry rails for any debris. If any particles are present, wipe it clean with a rag. If you find that a piece of debris fell into your gantry rails, then we suggest removing the belt to remove the debris as it can interfere with your lasers output. Double check that no material is near your belts, laser head, or any moving components as the laser will move to the front right side of your laser upon boot up.

**Always** check the MSDS properties of the material you are planning on cutting / engraving and **never cut any material containing PVC.**

## Daily:

- Check that your water, air, air exhaust, and power systems are properly assembled and operating normally.
- Keep you machine and workspace clutter-free.
- Read all material warnings and make sure you are working in a well-ventilated workspace.
- Keep your fire extinguisher up to regulation and easily accessible.
- Always follow all safety protocols.

## Weekly:

- Wipe down the walls of the machine with a clean rag.
- Use optical-grade lens wipes to clean both sides of the beam combiner, all mirror surfaces, the focus lens, and the tube aperture. Optic surfaces may need to be cleaned more often if cutting materials produce excessive residue (possibly daily).
- Clean fallen debris from the debris tray and from of the machine to reduce fire risk, and provide better exhaust power.
- Keep rails, motors and moving parts free from excess material as it can obscure movement and cause damage.
- Lubricate the wheel track and belts with a light layer of synthetic oil or grease on top for proper movement.

**Note: Depending on usage lubrication may be required every few days.**

## Monthly:

- Check your fume extractor filters. Depending on your output and the materials being cut, your fume extractor filters may need to be replaced as often as every month (or sooner).
- Change water in the cooling system. This will keep your tube safe from unwanted debris, mold or evaporation. If you live in an area that gets cold it is recommended to add laser antifreeze to your system to keep your tube from breaking.
- Check for wear on belts. Belts should last, however, eventually they may wear and crack. If you find that the belts have become loose over time you can add tension by loosening the motor, adding tension, and re-tightening the bolts.

# Warranty

**Full Spectrum Laser will replace or repair any defective parts free of charge within the first 30 days. Ground shipping is free with overnight shipping available at extra charge.**

Full Spectrum Laser will replace or repair any defective part within the warranty period free of charge but shipping charges are the responsibility of the customer. Warranty includes parts and labor only. Shipping of defective and replacement components is excluded.

The customer may arrange their own shipping. Parts can be dropped off at our warehouse free of charge.

All defective parts must be returned to Full Spectrum Laser for evaluation before replacements are issued, unless otherwise authorized. The warranty is valid for normal use only and excludes uses not stated in manual. Parts damaged by fires are considered user error if the machine is left unattended. Always stand next to the machine with a fire extinguisher and be ready to turn it off in case of an emergency. Never operate the machine unattended.

Our lasers have a 60-day full warranty and include a 1-year extended warranty. The 1-year extended warranty excludes shipping and consumable items. All electronic items (control cards, power supplies, motors) and most mechanical items are covered under the extended warranty unless damaged by abuse/fires. Consumables not covered include, but are not limited to, rubber parts (such as tubing, belts, plastic wheels, lenses, mirrors, other optics, and laser tubes).

The original purchaser may transfer the balance of the warranty to anyone free of charge provided we are notified in writing within 30 days. After 30 days, we will only provide warranty and tech support services to the original purchaser unless a warranty transfer fee.

Warranty will remain valid if product is sold. However, the buyer must request RMAs and repairs from the original purchaser unless a warranty transfer fee is paid.

**NOTE: Full Spectrum Laser DOES NOT offer warranties or customer support for 3rd Party parts, including replacement laser tubes, as it may not be compatible with Full Spectrum Laser machines and can cause damage to your laser system.**

Visit <https://laser101.fslaser.com/support> for most current warranty postings.

# Customer Support

If you have any questions about your machine don't hesitate to contact us. We have a large number of resources available to make your first laser experience user-friendly.

## Technical Support



**M-F 8AM-5PM PST**  
[support@fslaser.com](mailto:support@fslaser.com)  
**702-802-3103**

## Sales



**M-F 8AM-5PM PST**  
[sales@fslaser.com](mailto:sales@fslaser.com)  
**702-802-3101**

### Manuals



[fslaser.com/resources/](https://fslaser.com/resources/)  
User manuals, Quick-Start Guides  
and other resources for your laser.

### Financing



[fslaser.com/financing/](https://fslaser.com/financing/)  
Work with us or our providers to find  
the perfect option for any budget.

## More Options

Submit a ticket online  
[fsl3d.zendesk.com/hc/en-us](https://fsl3d.zendesk.com/hc/en-us)

Videos  
[youtube.com/user/FullSpectrumLasers](https://youtube.com/user/FullSpectrumLasers)

Blog  
[fslaser.com/blog/](https://fslaser.com/blog/)

Free Projects  
[blog.fslaser.com/freelaserprojects](https://blog.fslaser.com/freelaserprojects)

Retina Engrave 3.0  
<https://fslaser.com/software/>

## Reach out to Us

**Headquarters**  
6216 S Sandhill Rd  
Las Vegas, NV 89120

PHONE: (702) 802-3100  
FAX: (702) 987-0150

**Order Status | Shipping | Accounting**  
M-F 8AM-5PM PST

You can also sign in to check order status

Shipping email: [shipping@fslaser.com](mailto:shipping@fslaser.com)

Accounting email: [accounting@fslaser.com](mailto:accounting@fslaser.com)



# JOIN THE FULL SPECTRUM LASER COMMUNITY

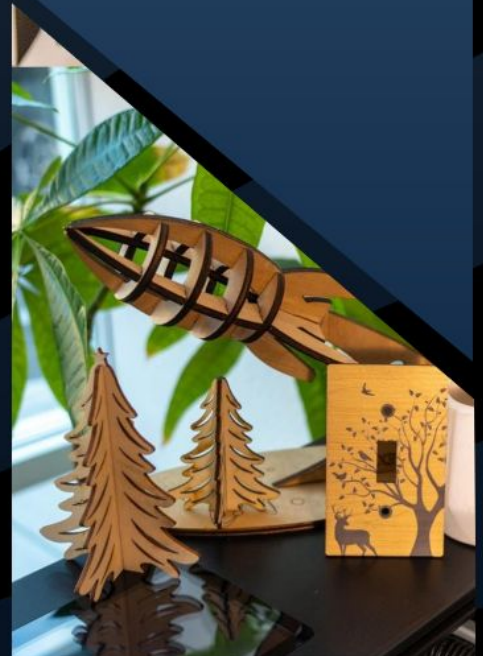
FULL SPECTRUM LASER INVITES YOU TO JOIN OUR COMMUNITY OF HOBBY MAKERS AND PROFESSIONAL MANUFACTURERS THROUGH OUR SOCIAL MEDIA CHANNELS (FACEBOOK, INSTAGRAM, TWITTER, YOUTUBE) WE ALWAYS HAVE SOMETHING POSITIVE TO SAY ABOUT HOBBY MAKER CULTURE OR THE INDUSTRY WE WORK IN. YOU CAN FOLLOW US AS WE CROSS THE COUNTRY GOING TO CONVENTIONS AND MAKER EVENTS OR JUST CHECK OUT ALL THE AWESOME STUFF WE MAKE. BEST OF ALL, WE OFFER ALL THOSE DESIGNS FOR ALL THOSE PROJECTS WE MAKE WITH OUR LASER CUTTERS FOR FREE. JOIN OUR COMMUNITY AND SEE WHAT ALL THE EXCITEMENT IS ABOUT

- [WWW.FACEBOOK.COM/FSLASER](http://WWW.FACEBOOK.COM/FSLASER)

- [WWW.INSTAGRAM.COM/FULLSPECTRUMLASER](http://WWW.INSTAGRAM.COM/FULLSPECTRUMLASER)

- [WWW.TWITTER.COM/FULLSPECLASER](http://WWW.TWITTER.COM/FULLSPECLASER)

- [WWW.YOUTUBE.COM/FULLSPECTRUMLASERS](http://WWW.YOUTUBE.COM/FULLSPECTRUMLASERS)



Full Spectrum  
LASER