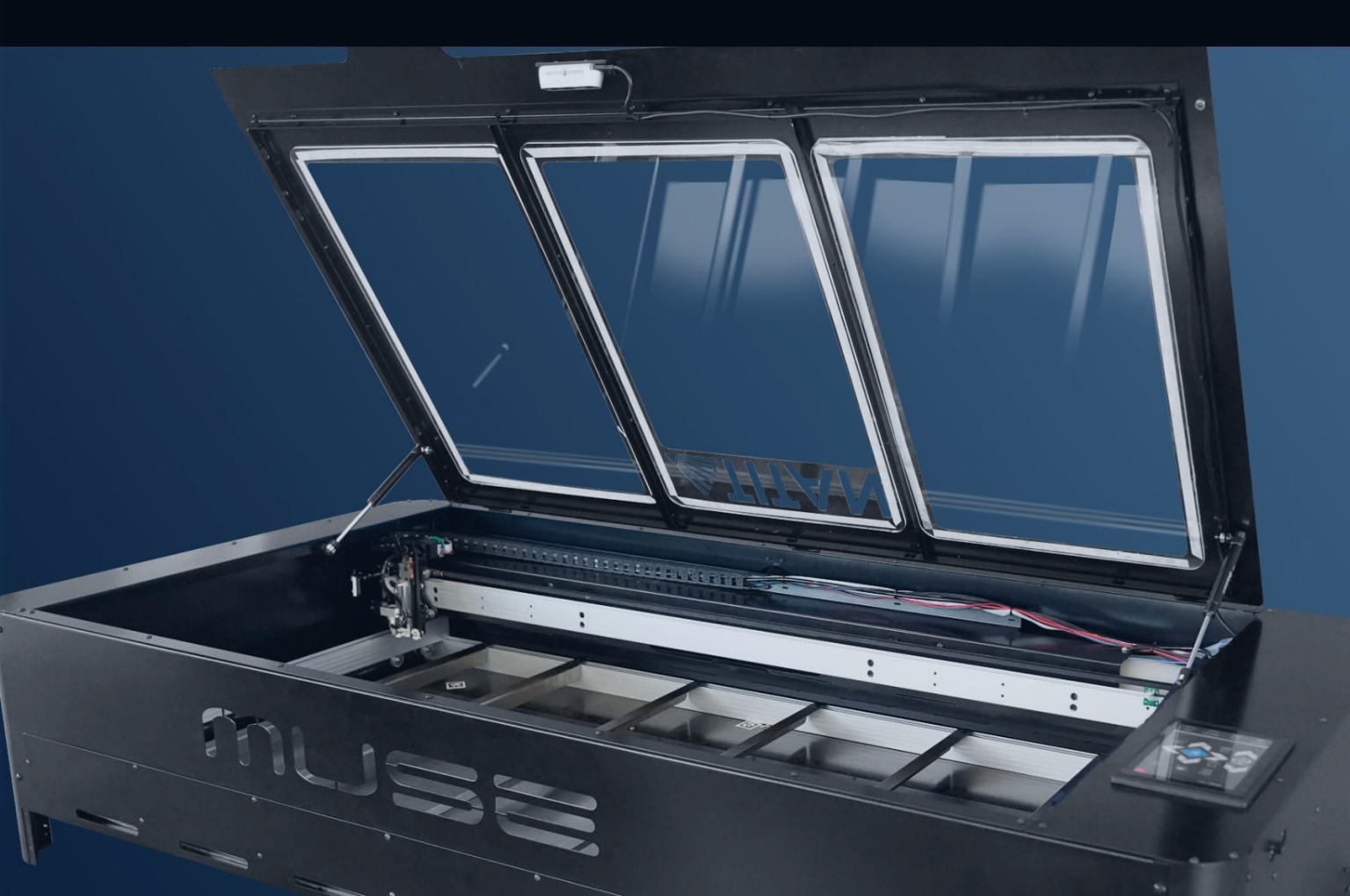
muse
TITAN



MUSE TITAN

Operations Manua

version 1.

Full Spectrum
LASER

Table of Contents

Full Spectrum Laser Muse Titan

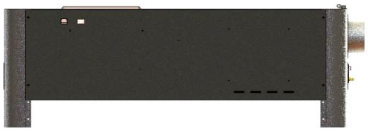
Congratulations on your purchase of a Full Spectrum Laser Muse Titan. With proper usage and upkeep, your laser cutter should provide years of productive output. This user manual will guide you through the safety guidelines and operation of your machine. It is recommended that you familiarize yourself with this manual before using your laser cutter.

For more information and product selection, please visit www.fslaser.com

Top View

Back View

Side View



Compliance Statement: The Full Spectrum Laser Muse Titan is a class 3R 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. Reproductions of the labels found on the Full Spectrum Desktop Advanced Laser System follow, with locations specified.

Symbols and Definitions

Red Icons Indicate dangerous situations that could result in death or serious injury.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided,could result in minor or moderate injury.

Indicates a hazardous situation.

Indicates a risk of fire.

Warns of potential risk to eye-safety.

Indicates a respiratory hazard.

Indicates an electrical hazard.

Warns sharp edges that could cause injury via laceration.

Black Icons Indicate practices not related to personal injury.

NOTICE

Calls attention to important information.

CAUTION

Calls attention to information regarding security of device.

Warns of fragile parts or materials.

Calls attention to important details.

Indicates issues regarding software or network.

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.

CAUTION 	**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:

<table>
<tr><td rowspan="3"> 
</td><td>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.</td></tr>
<tr><td>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).</td></tr>
<tr><td>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.</td></tr>
</table>

<table>
<tr><td rowspan="2"> 
</td><td>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.</td></tr>
<tr><td>Never run a laser with the lid open. Always be sure the lid is closed and never tamper with the lid safety mechanism.</td></tr>
</table>

<table>
<tr><td rowspan="2"> 
</td><td>Never look into the beam of the Alignment Laser (visible red diode laser).</td></tr>
<tr><td>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.</td></tr>
</table>

Fire Safety

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. Typically, 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.

<table>
<tr>
<td rowspan="12"> 
</td>
<td>Always keep a properly maintained and inspected 5lbs. or larger fire extinguisher on hand. Full Spectrum Laser recommends a Halogen fire extinguisher or a 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 discharges a clean, easily removable substance that is not harmful to the mechanics or wiring of the laser system. The dry chemical extinguisher discharges a sticky, corrosive powder that is very difficult to clean up.</td>
</tr>
<tr>
<td>Stacking materials (especially organic materials such as paper) can lead to increased risk of flame propagation or work piece ignition.</td>
</tr>
<tr>
<td>Never operate your machine unattended. There is a significant risk of fire if the machine is set improperly, or if the machine should experience a mechanical or electrical failure while operating.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Never run a laser with the lid open. Always be sure the lid is closed and never tamper with lid safety mechanism.</td>
</tr>
<tr>
<td>Always keep the area around the machine clean and free of clutter, combustible materials, explosives, or volatile solvents such as acetone, alcohol, or gasoline.</td>
</tr>
<tr>
<td>Always use air assist when vector cutting.</td>
</tr>
<tr>
<td>Be cautious when vector cutting. Many materials have the potential to burst suddenly into flames – even materials that may be very familiar to the user. Always monitor the machine when it is operating</td>
</tr>
<tr>
<td>Vector cutting with the laser has the most potential to create an open flame. Acrylic in all its different forms is especially flammable when vector cutting with a laser.</td>
</tr>
<tr>
<td>Never cut PVC (polyvinyl chloride) under any circumstances: fumes are highly toxic and potentially lethal.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</table>

Woodshop Dust Fire Safety Considerations

Before processing 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.

(The values for the maximum workplace concentration must not be exceeded.)

Be mindful of large quantities of fuel in the form of wood and wood products, sawdust, and flammable materials such as 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 principal engineering control technology for control of dust is exhaust ventilation. The primary work practice control is good housekeeping.

Dust collection is best accomplished at the source-at the point of operation of the equipment, if feasible. 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 technologies are effective for most equipment, except for machines that commonly produce the very finest dust or large quantities of dust.

*These guidelines come from the U.S. Department of Labor

Electrical Safety

The power supply is capable of outputting DC 20,000V at up to 20mA. This power is also provided to the discharge terminals on the laser tube itself. Your laser shipped with silicone terminal covers that prevent access to bare wiring—notify Full Spectrum Laser support and immediately cease operations if these 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 AC input power. The AC input power is potentially lethal and is located on the far right within the cabinet.
	Never make or break any electrical connections to the system while the unit is turned on.
	Never access the electronics area with hands or tools unless the unit is disconnected from power for at least one hour.
	Never replace the installed 10 amp fuse with a fuse 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. To power the machine on, press the (-) side down. To turn power off, press the "o" side down.
	In case of a blown fuse always contact Technical Support before replacing any fuses.

The standard reference for laser safety is the American Standard for the Safe Use of Lasers, Z136.12000, developed by the American National Standards Institute (ANSI). This reference is the basis for many of the federal regulations for laser and laser system manufacturers and the Occupational Safety and Health Administration (OSHA) laser safety guidelines. It contains detailed information concerning proper installation and use of laser systems. While the ANSI standard itself does not have the force of law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be compulsory under local workplace regulations when operating laser systems above Class I. 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.

Section II. Unboxing Your Muse Titan

Unboxing Steps

Your Muse will require careful unboxing and examination of parts. You will need two able-bodied adults to lift and place the machine at the desired workstation.

Follow these instructions for best results:

1. **Prepare Work Space:** You will need an open, level workspace to place your laser cutter. A solid table that can compensate for the size and weight of your machine.

2. **Place Box:** Set the box on a flat space near where you will place the machine. Open the box carefully from the top. If you use a cutting tool to open the box, be careful not to allow the cutting edge to cut past the cardboard box. Always use all tools with caution and only as specified by the manufacturer.

3. **Remove Packaging:** Gently remove the Titan from the box with a friend.

4. **Remove Accessories:** Inside the interior of the machine there is foam and zip ties holding your gantry together (these must be cut prior to booting up your machine). Remember your major accessories are in separate boxes and also need to be removed and installed.

5. **Place Muse Titan:** For your safety, please always carry and lift your Muse with at least two adult people.

6. **Inspect your Muse Titan:** If you have any questions, contact your sales representative or customer support. Refer to your Muse Titan Quick Start Guide or download the Muse Titan User Manual for assembly instructions.

	Fragile Parts! Be gentle in removing the foam packaging and accessories. Never pull or force the packaging loose from the laser cutter. Be particularly aware that the water inlet and outlet nodes protrude from the tube and are extremely fragile when unboxing your laser tube.

NOTICE	Note that if you purchased a chiller with your Muse Titan, you will be directed to Appendix A: chiller for unpacking instructions.

Unpacking List

Your laser shipped with the following included major components and their associated accessories:

Major components

Muse Titan, Air compressor, Exhaust fan, Chiller

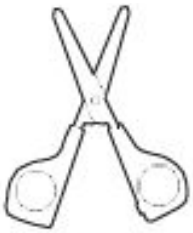
Minor components

Minor components will consist of all the wiring, tubing, and ducting to set up your laser.

Additional Required Items

In addition, you will need the following tools and accessories (not included with your machine purchase):

3-5 gallons of distilled water



(1) Small Scissors

CAUTION 	**Never use unapproved ducting in the exhaust system. Unapproved ducting is potentially flammable and should not be used under any circumstance.**

DANGER 	**Never operate your laser without a working exhaust.** Full Spectrum Laser recommends exhaust systems capable of 232 CFM. Keep in mind that exhaust systems with high flow rates may require a particle filter for materials with significant particulates such as wood.

Section III. Installation & Assembly

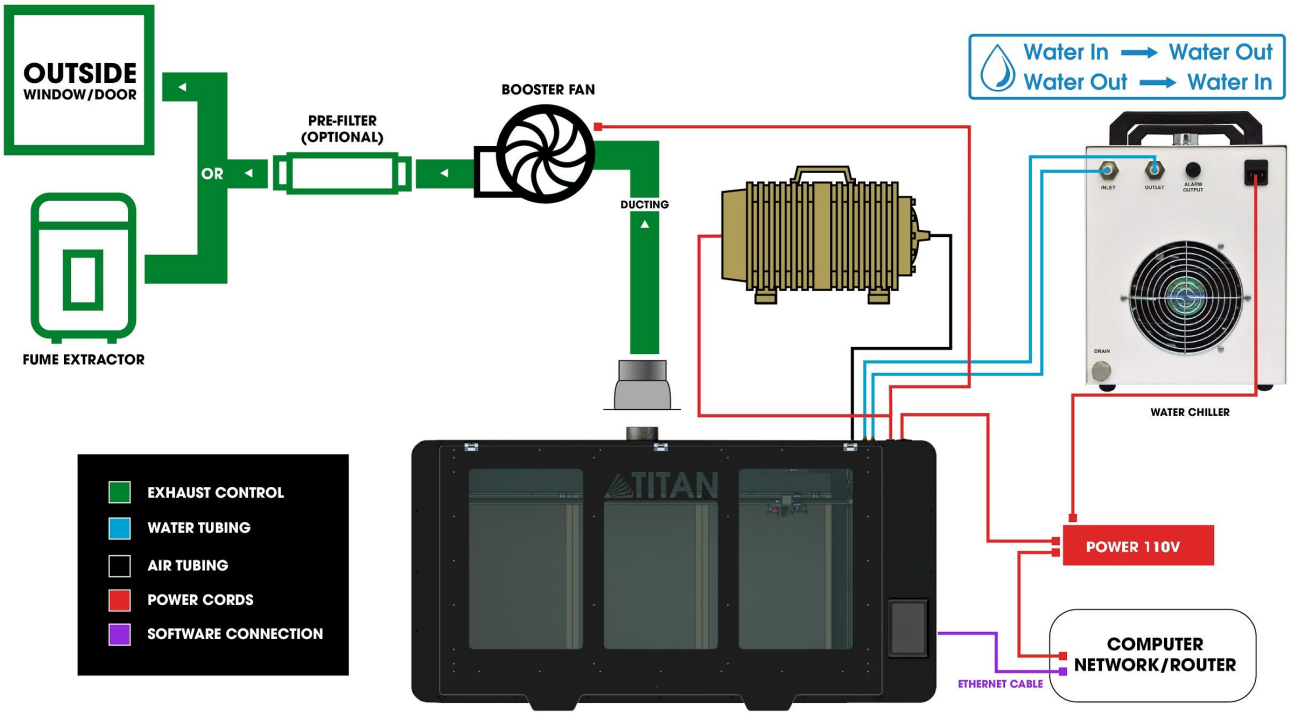
With your laser cutter unboxed and placed in its permanent work space we can now prepare it for use. This is a simple process that should take less than half an hour to complete.

Assembly Stage 1: Remove Zip Ties

To secure the machine during shipping, zip ties are used to hold the laser head assembly and the x-gantry. These zip ties must be removed before operating your laser cutter for the first time.

1. **Locate Zip Ties:** Zip ties secure the laser head and x-gantry during shipping. Open the lid and identify all zip ties.
2. **Cut and Remove Zip Ties**: Using a small pair of scissors, carefully cut and remove all zip ties.

NOTICE	Do not cut any other cord or wire. Be aware that the glass laser tube is extremely fragile. Be careful NOT to damage any part of the machine during this process.



Assembly Stage 2: Connect the Exhaust System

It is required that an exhaust fan is connected and operating whenever you run a job on your laser. A properly installed exhaust fan removes smoke and fumes from the case and exhausts them to the outside of the building or a fume extractor.

1. **Position Ducting:** Place your 6” ducting over the Exhaust Port located at the back of the machine and hold. Secure with 6” ducting clamp.

2. **Attach Exhaust Fan:** Secure the other end of the ducting, connected to the machine, to the exhaust fan. Now repeat the ducting and clamping process on the other side of the exhaust fan(if applicable).

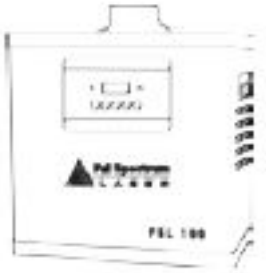
3. **Attach Exhaust Fan:** Set the open end outside of a window or an installed ventilation outlet. Check your system for leaks - most can be remedied with duct tape. Please be aware that the protective housing is not designed to be airtight; the front grill is designed to allow an exhaust system to draw fresh air through the work area.

4. **Connect to Power:** Plug the exhaust fan power cord into the lower power plug marked “exhaust fan” 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 to save power).

5. **Fume Extractor Upgrade (optional):** You can also upgrade to a fume extractor. Fume extractors are air purifiers that clean the air through HEPA Filter. Fume extractors do not require outside ventilation. This is a great choice for workshops that do not have the option to ventilate outside

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

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



Small Fume Extractor

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. Use a shop vacuum to clean as debris builds. Check weekly, especially if cutting a lot of wood. When accumulated debris remains over 70% after cleaning, replace Pre-Filter.

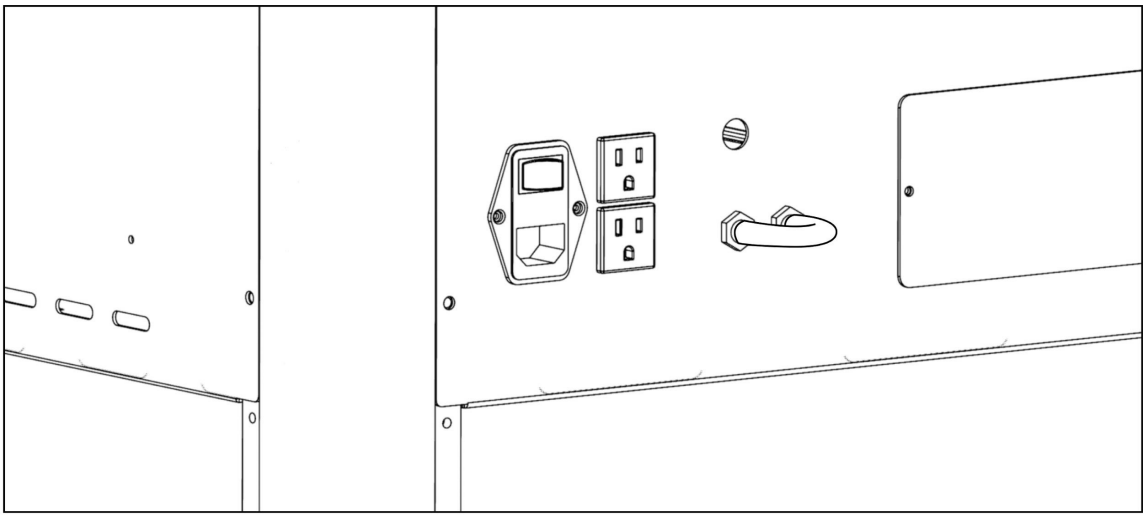
HEPA Filters: Clean immediately when suction is reduced. Use a shop vacuum to clean accumulated dust. When cleaning does not return optimal suction power, replace HEPA Filter.

Activated Carbon Filters: Clean when odors are detected or suction is reduced. Gently shake excess dust and debris from the carbon filter and follow with a shop vacuum. When cleaning no longer eliminates detectable odors, replace Activated Carbon Filters

Assembly Stage 3: Assemble the Water System

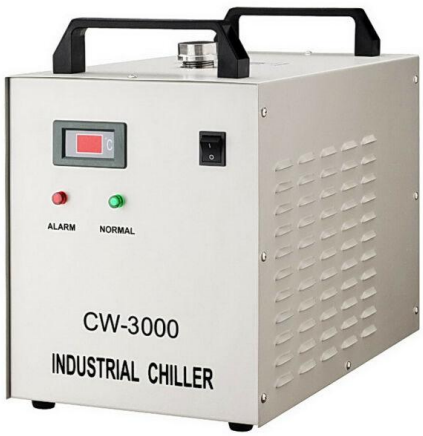
Muse Titan uses a water-cooled continuous beam CO2 laser tube. The tube requires a flow of room temperature water to regulate the temperature of the laser tube. Your purchase includes a water chiller for cooling the laser tube.

1. **Remove Capping On Water Inlet / Outlet:** Remove the short silicone tubing, capping the water inlet and outlet on the back of the machine.



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

2. **Attach Water Chiller:** Remove the chiller from its packaging. Attach the provided silicone tubing to the chiller.



3. **Attach Water Tubing to Titan:** Push the silicone tube that is coming from the **OUTLET** of the chiller to the **INLET** of the Muse Titan. Then Push on the silicone tubing from the **INLET** of the Chiller to the **OUTLET** of the Muse Tian. Important to remember **In** to **out**, **out** to **in**; Your laser will not fire if this is installed backwards.

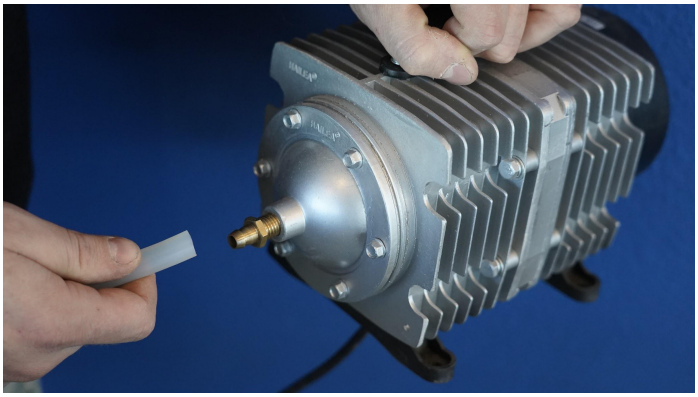
4. **Fill the chiller:** Now that everything is connected properly you will want to fill the chiller with DISTILLED water only. If you live in a cold climate you will want to add antifreeze (dowfrost) to the system to keep your tube from breaking.

NOTICE	We recommend that you attach the laser and chiller to a power strip and use that to control the main power to the unit - this ensures 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. Air bubbles can create local hot spots in the lasing chamber and reduce the lifetime of your tube. If present, water bubbles typically migrate to the electrodes on either end of the tube. You should visually inspect the laser tube to make sure that bubbles are not present; slightly tilting the laser while powering on the circulation pump is usually sufficient to remove bubbles.

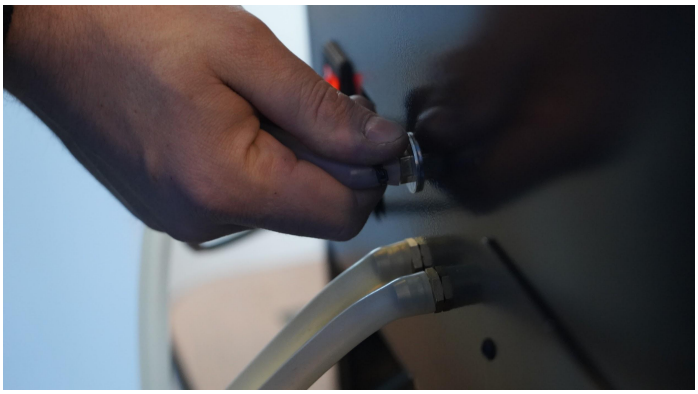
Assembly Stage 4: Connect the Air Compressor

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

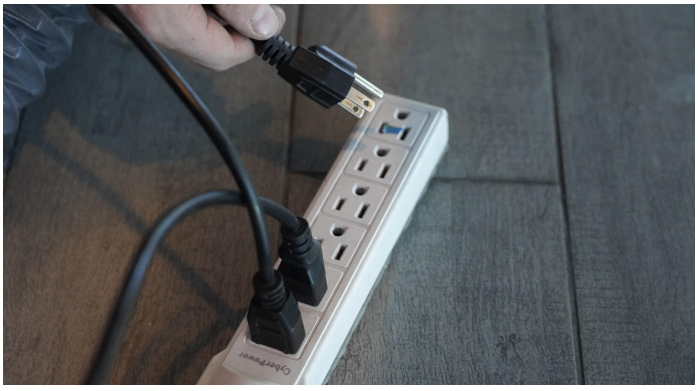
1. **Add tubing:** Remove the air compressor from its packaging. Gently attach the silicone tube on the air compressor.



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



3. **Connect to Power:** Plug the air compressor into a separate power strip not associated with the Muse



Assembly Stage 5: Connect Electrical Power

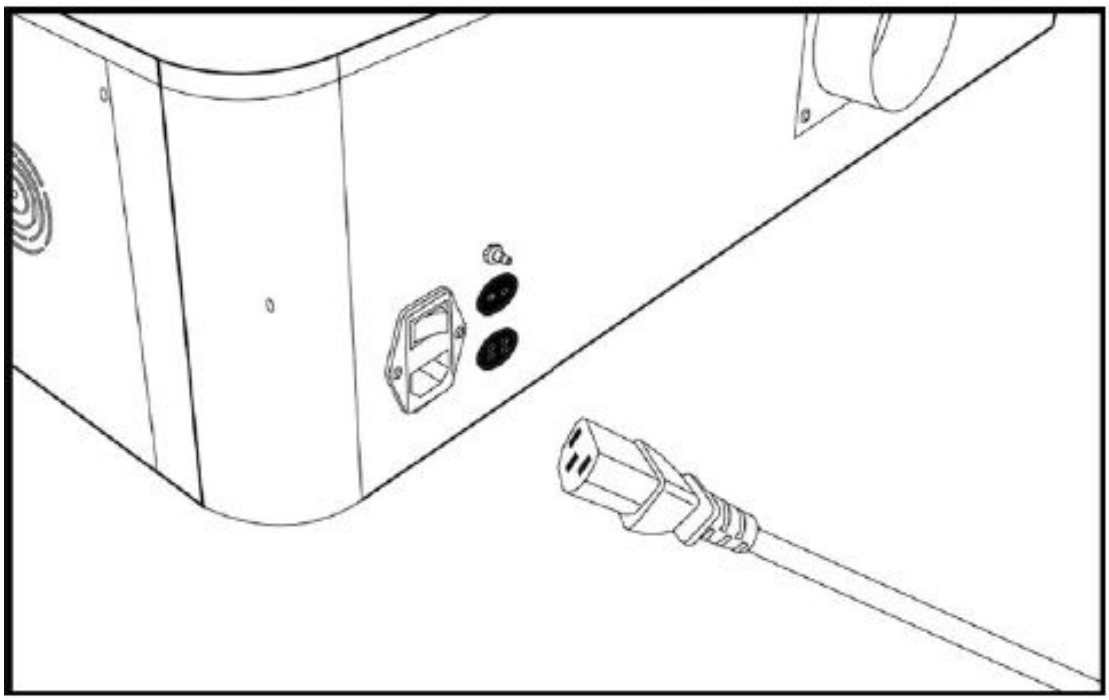
The Muse Laser System, and available accessories, are configured to accept 110VAC at 60Hz.

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 a “C14” power receptacle located on the right side of the machine.

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 the 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.
	In case of a blown fuse, the laser system is equipped with a fuse on the power inlet to protect the machine from surges or short circuits. If this fuse ever needs replacement, please contact Full Spectrum Laser technical support.

Assembly Stage 6: Connect to the Machine

The Muse Titan utilizes RetinaEngrave v3.0, browser-based software that doesn't require any downloads. Only two items are required to access RetinaEngrave v3.0: a computer with access to an internet browser (Google Chrome recommended) and a connection between the Muse Titan and the internet or said computer.

Watch this video to learn more: https://www.youtube.com/watch?v=zYR90f6jXq0&t=1s

Connect Via Router (Recommended):

Connecting to the Muse Titan via the router is the most reliable way to establish a link to RE3.

1. Locate and remove the included Ethernet cable from its packaging.
2. Plug the Ethernet cable into the Ethernet slot on the Muse Titan.
3. Plug the other end of the Ethernet cable into your router's Ethernet slot.

Connect to Wi-Fi

Connecting to the Muse Titan via Wi-Fi is the secondary way to establish a link to RE3.

1. Tap Network on the Muse Titan Screen.
2. Click Wi-Fi and the machine will automatically search for networks.
3. Select the preferred connection from the list and enter the proper password in order to connect to Wi-Fi. The machine will now have an internet connection and is ready to connect to RetinaEngrave v3.0.

Connect Directly to Computer

A direct connection between the Muse Titan and the computer should only be done if the previous two options are not possible.

1. Locate and remove the included Ethernet cable from its packaging.
2. Plug the Ethernet cable into the Ethernet slot on the Muse Titan.
3. Plug the other end of the Ethernet cable into your computer's Ethernet slot.

	Muse Titan can connect to your computer via Ethernet. Full Spectrum includes an Ethernet cable in the laser accessories.
	Your laser must be connected to your computer in order to download jobs. The laser can store jobs in the software.
	If your laser is located more than 6ft from your computer, you will need to use the Ethernet connection. Connecting via Ethernet while the power is on requires you to power cycle your machine in order to obtain an IP address.

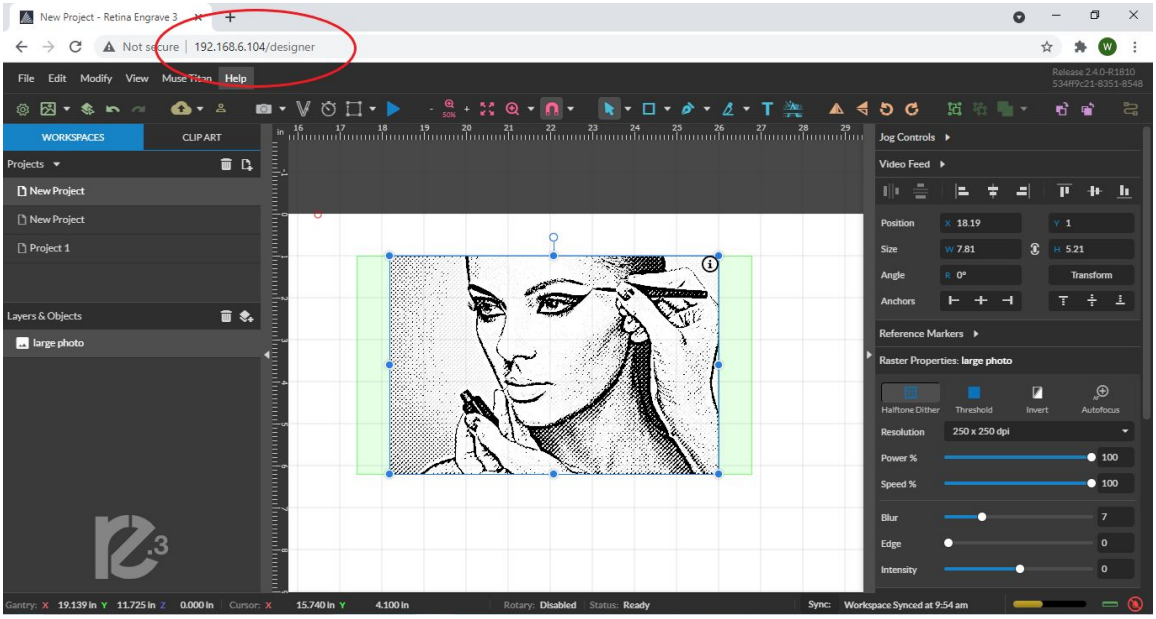
Assembly Stage 7: Connect to the Software

RetinaEngrave v3.0 is a combination of a print driver and control software that communicates with, downloads jobs to, and controls the laser system. There is no download required for RetinaEngrave v3.0. With a local connection (achievable with Wi-Fi or the included Ethernet cable) your Muse Titan will link with the software's IP address.

1. **Turning on Muse Titan will automatically boot up your Muse Touch Screen interface.** Allow 30 seconds or so for the machine and touch screen to boot up. Upon boot up you with have to hit the yellow Agree button.

2. **Locate the IP Address at the top of the Home screen.** Alternatively, you can find the IP Address of the machine by tapping Tools -> About. The address will be listed there. This IP Address is of the network you connected the machine to. Wireless and Wired connections will have different IP Addresses. In addition you can scan the QR code to get the IP address as well.

3. **Type IP Into Browser:** On the Network Screen, you will see a “Wired IP” number. Using your computer, type this IP number into your favorite browser (Google Chrome is recommended). This will link you to the RetinaEngrave v3.0 interface. You now have full access to the software. There is no need to install or download anything. You must, however, keep a local connection, either through Wi-Fi or the Ethernet cable.



	Occasionally, RetinaEngrave v3.0 software will run an update. This is an automatic process that can happen when you first boot up the machine. Typically, updates are quick, however, there may be some occasions where updates can take longer. Allow the update time to complete before running the Muse Titan.
	The machine must be powered on when operating the software or when connecting the machine via the Ethernet cable. You will need uninterrupted Internet access for this process.

Section IV. Tests & Adjustments

Before you start your first job, it is important that your laser is aligned; Luckily you have the Titan which is the easiest laser to align.

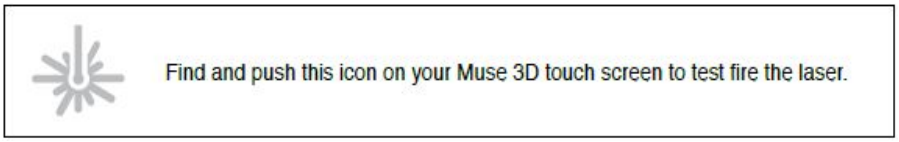
1. Alignment Test **2. Mirror Alignment Procedure**

1. Alignment Test

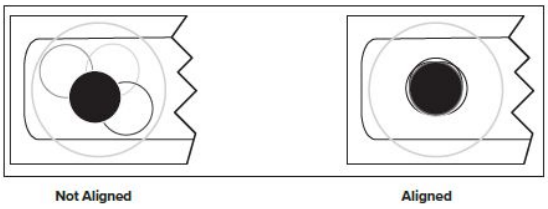
The laser tube that came pre-installed in your Muse Titan was carefully aligned in our facilities in Nevada. When you first turn on your machine, the mirror alignment should be perfect. It is possible, however, that sometimes the mirror may come out of alignment during shipping. Before running your first job, you will want to check and make sure the mirror is properly aligned using this simple test. Once the mirror alignment is confirmed, you are ready to use your laser cutter. If your mirror is out of alignment, or if you have installed a new laser tube, you must align the laser using the procedure provided. For this alignment test, we will test-fire the laser once in each corner of the machine to make sure the laser is following the right path to the focus head, and ultimately to the cutting material.

1. **Open the Safety Lid:** You will need to access the interior of the machine.

2. **Place Thermal Paper**: Take a small piece of thermal paper (approx. 15 mm should be plenty) and place it over the focus lens under Mirror #3.
3. **Position Laser Head:** Move the laser head into the upper left corner of the workspace.
4. **Close Safety Lid:** Safety measures should make it impossible to fire the laser with the safety lid open. Regardless, never attempt to fire the laser with the safety lid open.
5. **Test Fire the Laser:** Press the Fire Laser Icon Button on the touch screen.



6. **Repeat Test Fire in Other Three Corners:** Without removing the thermal tape, repeat firing the laser once in each of the other corners of the machine (Upper Right, Lower Right, and Lower Left).
7. **Check Results:** With the fourth corner test fire complete, open the lid and remove the thermal tape. The four burn marks should overlap each other perfectly (see illustration). If they do not overlap perfectly, you will need to align the mirrors.

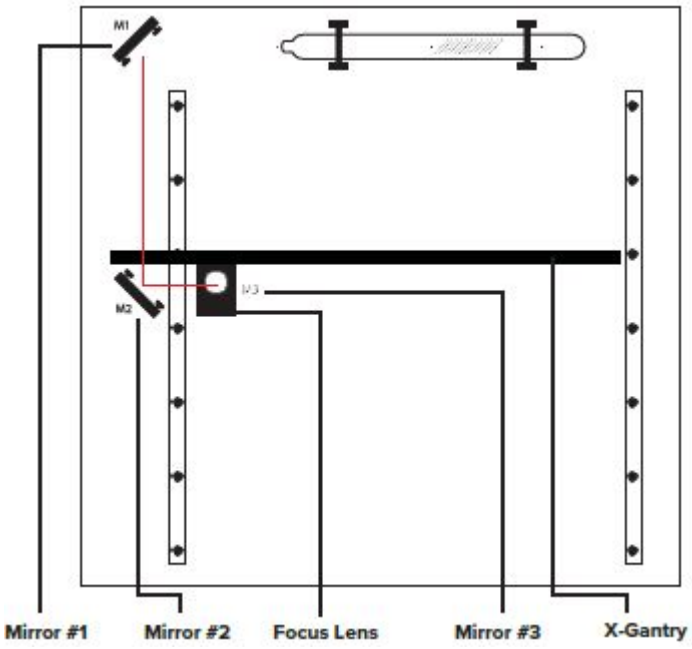


NOTICE	When the laser is not aligned, you will have two black dots from the test fires in the top and bottom positions. The red laser pointer is aligned with the invisible laser pointer so gives you immediate feedback on the mirror adjustment. By adjusting it into the middle of the two black dots, you are splitting the error difference. Typically, after 1 or 2 iterations, the black dots will be exactly on top and this axis is aligned. The goal is to have the two black dots overlap exactly.

2. Mirror Alignment Procedure

(Please note that if your initial test looked good, do not attempt this step)

The mirror alignment procedure goal is to first align the visible red beam with the invisible CO2 laser beam then use the red beam as the primary indicator for mirror alignment. The idea is that when the laser is not aligned, you will have two black dots from the test fires in the top and bottom positions. The red laser pointer is aligned with the invisible laser pointer to give you immediate feedback on the mirror, the black dots will be exactly on top and this axis is aligned. The goal is to have the two black dots overlap exactly. It is not necessary that the dots be in the center of the mirror but they should be somewhere on the mirror.



Process

1. **Prep**
2. **Align Laser Output to Mirror 1**
3. **Align Mirror #1 to Mirror #2**
4. **Align Mirror #2 to Mirror #3**
5. **Focus Lens Alignment**

Tools Required

- **Thermal Paper**
- **2.5mm Hex Wrench**

Stage 1: Prep

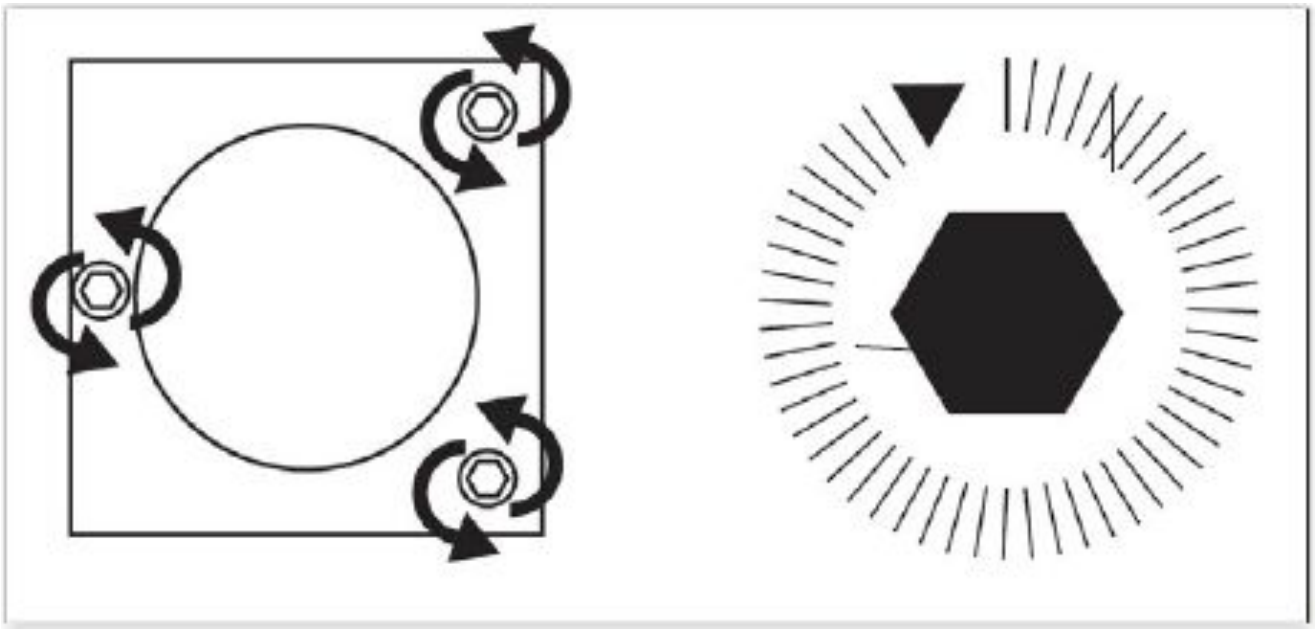
Prepare your tools and workspace.

CAUTION	Before starting any project, be sure you are aware of all safety issues. Be sure you read and understand all safety warnings presented in Section I.

1. **Power on Laser Cutter:** Turn on the machine by hitting the power switch. Allow the machine time to boot up the touch screen operating system.

2. **Unlock Driver Motor:** On the touch screen, press the “Locked” icon to switch to “Unlocked” position. The button will now display the “Unlocked” icon.

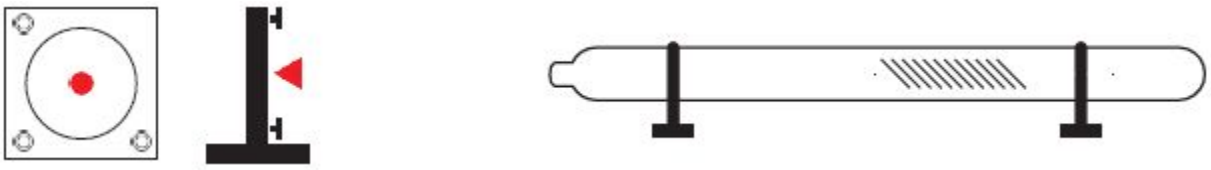
3. **Gather Tools:** A 2.5mm hex wrench and a supply of thermal paper are required to perform the mirror alignment procedure (if required).



NOTICE	**Do not over-tighten or over-loosen adjustment screws.** 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.

Stage 2: Mirror #3

Align the invisible cutting beam with the visible red beam diode and make sure they hit each mirror precisely. Remember to check your mirror alignment before starting this procedure; it is probably unnecessary if the laser tube was pre-installed in your Muse Titan.



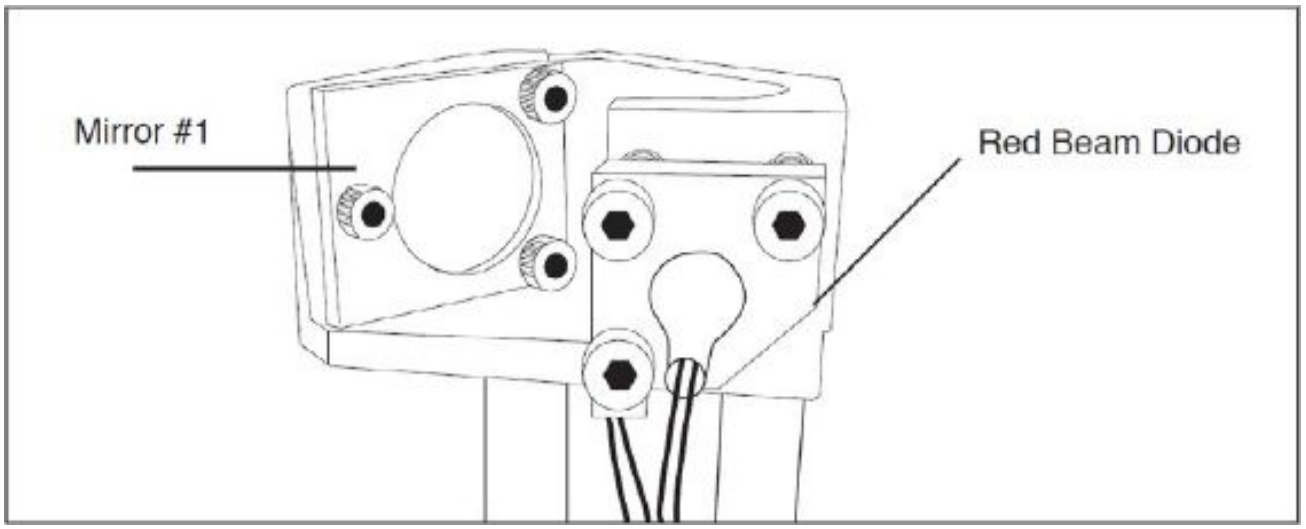
1. **Open the Safety Lid:** You will need to access the interior of the machine.

2. **Place Thermal Paper:** Take a small piece of thermal paper (approx. 15mm should be plenty) and place it firmly over Mirror #1.

3. **Close Safety Lid:** Safety measures should make it impossible to fire the laser with the safety lid open. Regardless, never attempt to fire the laser with the safety lid open.

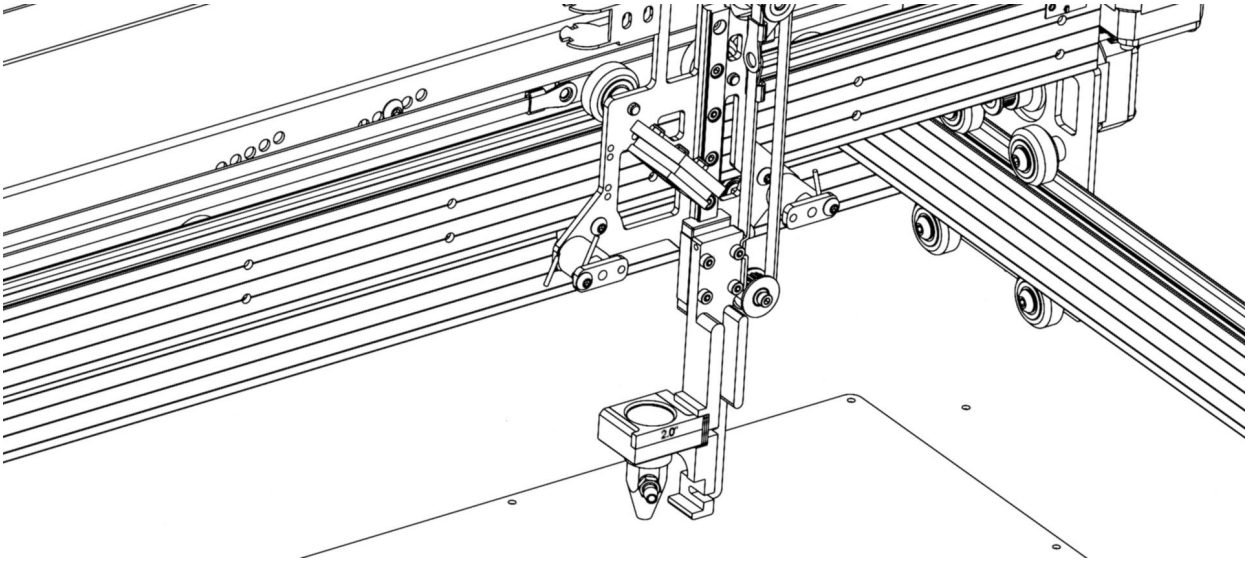
4. **Test Fire the Laser:** Press the Fire Laser icon Button on the touch screen. You will see a burn mark on the thermal paper. It should hit the mirror in the middle.

5. **Adjust Red Beam:** Using your 2.5mm hex wrench, make micro-adjustments to the three-adjustment screws of the red beam diode, and position the red dot exactly over the burn mark.

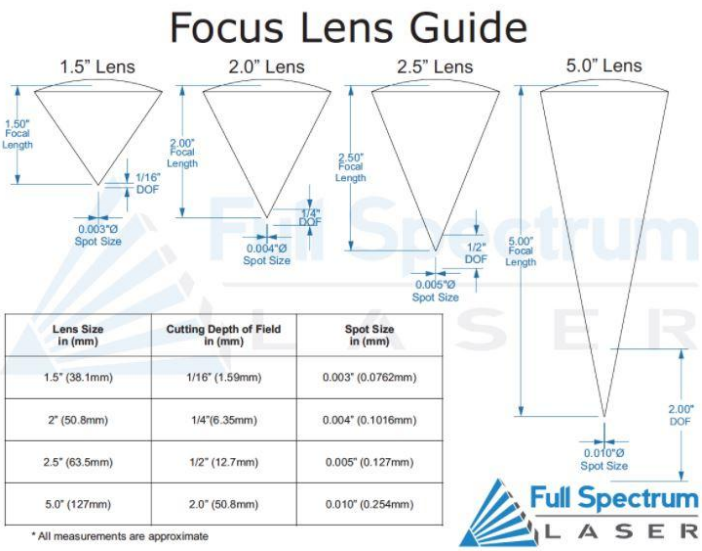


Focus Lens

The focal lens does not require manual focusing; it physically detects surface distance via the autofocus.
The focal lens is located towards the bottom of the laser head assembly.
The focal lens is considered a consumable; cleaning and maintaining the lens is essential for long use.
Always use the special optic cloth or wipes to clean your lens.



The default lens for the Muse Titan is 2.0



Lens Size in (mm)	Cutting Depth of Field in (mm)	Spot Size in (mm)
1.5" (38.1mm)	1/16" (1.59mm)	0.003" (0.0762mm)
2" (50.8mm)	1/4"(6.35mm)	0.004" (0.1016mm)
2.5" (63.5mm)	1/2" (12.7mm)	0.005" (0.127mm)
5.0" (127mm)	2.0" (50.8mm)	0.010" (0.254mm)

* All measurements are approximate

The following lenses are compatible with Muse Titan: **1.5, 2.0, 2.5, and 5.0**

To learn more about lenses please visit:
http://blog.fslaser.com/experts/a-clear-look-at-focus-lenses-for-laser-cutter

Autofocus Properties

Auto focus can be run via the touchscreen or will function automatically at the beginning of each job.

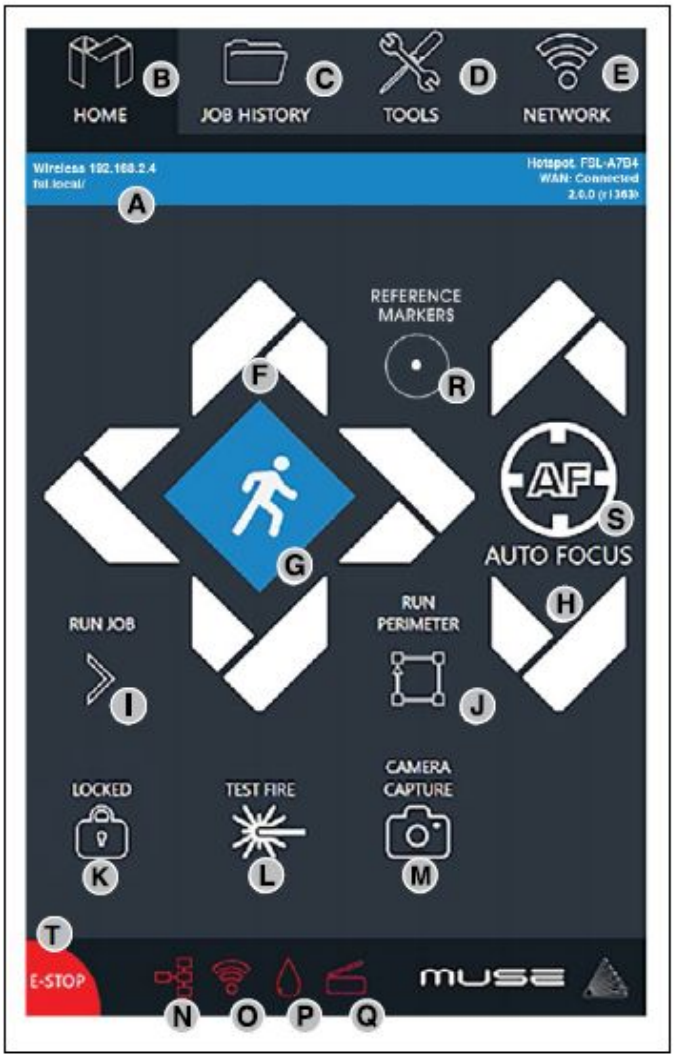
The auto focus will also retract to get out of the way of anything in your workspace when doing a camera capture of your work area.

Standard Function: When running a laser job proper Autofocus function should go to the center of your design, lower the laser cone until it makes contact with your material, then lift up to a given proper focal measurement.

Faulty: If your autofocus receives a false positive and stops short your laser will be out of focus when running a job. If this occurs you will need to double check that the laser head belt and mechanical components are clean and clear of debris. If this continues to happen you will need to contact support via: **support@fslaser.com**

Section V. Touch Screen Interface

Muse's touch panel allows you to control the basic functions of your laser without needing to connect to a computer. This is very convenient during alignment and testing procedures. To run jobs, you will need to access the RetinaEngrave v3.0 software (see Installations and Assembly Section).



A **IP Address**
Muse's IP Address. Type this into address bar of web browser

B **Home**
Returns to the main Home Screen from any sub-screen

C **Job History**
Accesses Job History sub-screen

D **Tools**
Accesses About Muse, Update Status, Factory Reset, Device Settings, Camera Calibration, and Home Laser

E **Network**
WIFI settings, Static IP settings

F **Directional Jog**
Jog gantry left, right, up, or down

G **Jog Speed**
Switch from Slow jog to fast jog

H **Adjust Autofocus**
Manually adjust focus height

I **Run Job**
Start current job in workspace

J **Run Perimeter**
Laser automatically JOGs the extent of the current project

K **Locked / Unlocked**
Lock or unlock the gantry for auto or manual homing

L **Test Fire**
Test fire the laser. Used for mirror alignment and testing,

M **Camera Capture**
Captures the laser bed.

N **Wired Connection**
Indicates connection status from the machine to wired network.

O **WIFI Connection**
Indicates connection status from the machine to wired network.

P **Water Indicator**
Indicates water system is running properly

Q **Lid Open / Close**
Indicates lid is opened or closed

R **Reference Marker**
Used only in absolute mode, this is a way to align objects without the camera

S **Auto Focus**
Automatically focuses laser to material

T **E-Stop**
Instantly stop any action. Opening the lid will also stop the laser firing, but not from moving

Safety Override Lid Failsafe

As a safety feature, the lid has a magnetic failsafe that disconnects the laser when the lid is open. this will be indicated by your touch screen display like so.

Be sure your lid is closed when you try to fire the laser. If the lid is closed and the laser still does not fire, check that the lid magnet is touching the proper base magnet and that wires are connected.

Safety Override Waterflow Failsafe

The laser will not fire unless water is flowing through the laser tube. The following indicator informs Muse Titan operators if water is not flowing.

If your touch screen indicates water is not flowing through the laser tube, check your water tube connections and make sure your tubes and water chiller are assembled correctly. More than likely, you have the water tubes reversed.

Job History Screen

Search: Opens History Options.
Delete: Delete Project from History.
Run Perimeter: Laser automatically JOGS the extent of the current project's border.
Start: Run selected Project.

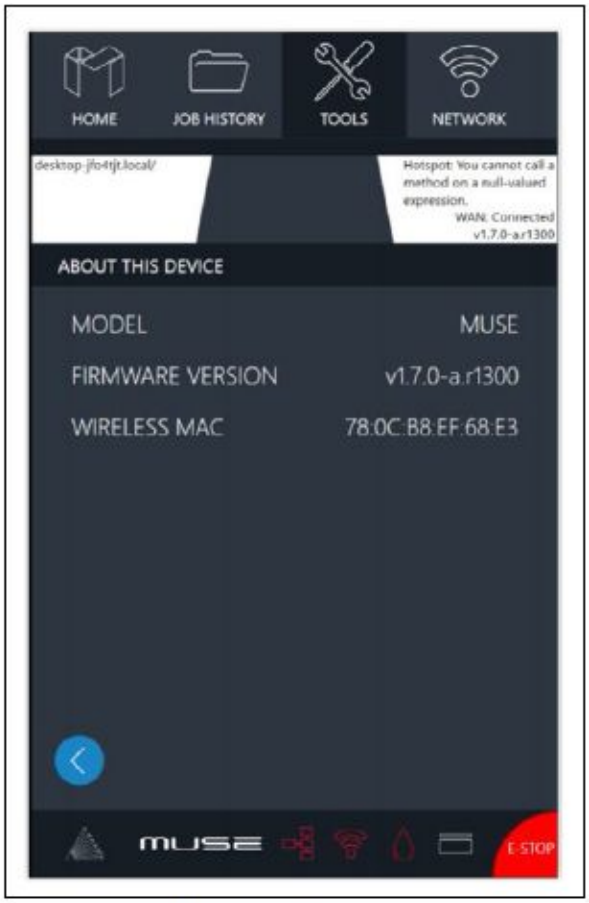
Main Tools Screen

Search: Opens History Options.
Delete: Delete Project from History.
Run Perimeter: Laser automatically JOGS the extent of the current project's border.
Start: Run selected Project.

About Sub-Screen

Model: Indicates Laser Model.
Firmware Version: Current Version of Touchscreen
Wireless MAC: MAC wireless Information.

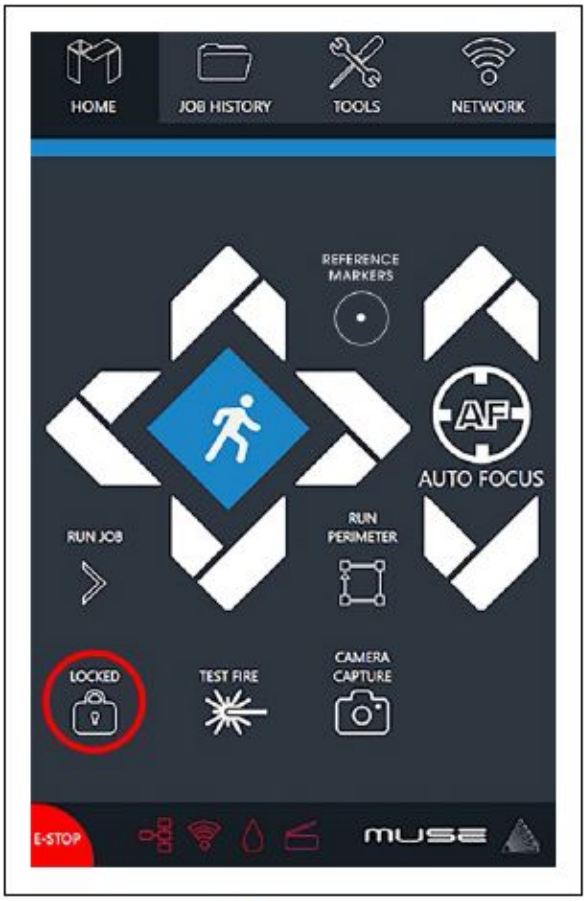
Main Tools Screen



About **Sub-Screen**

Lock / Unlock Indicator

Locked Icon: Indicates the gantry is locked. When locked, the user must move the gantry using JOG controls.
Unlocked Icon: Indicates the gantry is unlocked. When unlocked, the user must manually move the gantry.

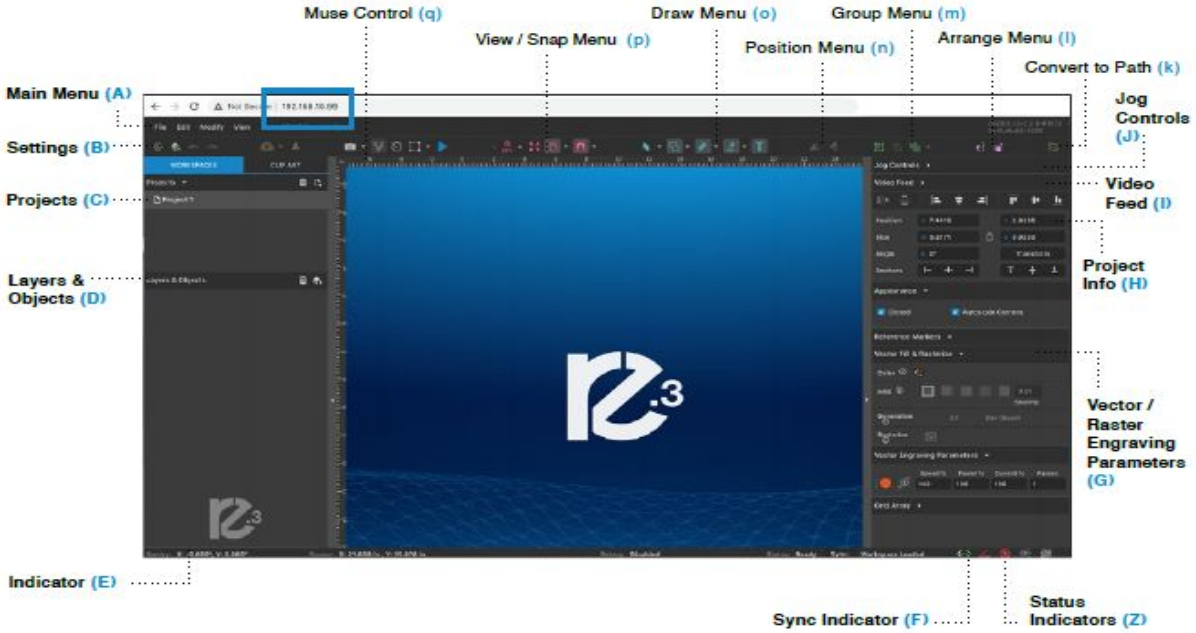


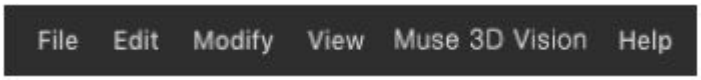
Locked

Unlocked

Section VI. RetinaEngrave v3.0 Software

In this section, you will be introduced to the major interface features of RetinaEngrave v3.0.





Main Menu (A)

FILE

→ **New Project (Alt+N):** Start a new project.
→ **New From Clipboard (Shift+Ctrl+Alt+N):** Start a new project from the clipboard.
→ **Load Project from File (Ctrl+O):** Load a project from a saved file.
→ **Place/Import:** Import and place a file.
→ **Import fonts:** Add fonts from outside sources.
→ **Export Project to File (Shift+Ctrl+E):** Export the project to a file.
→ **Submit Support Ticket:** Auto send a support request ticket.

EDIT

→ **Undo Delete Layer or Item (Ctrl+Z):** Reverse previous project command.
→ **Redo (Shift+Ctrl+Z):** Reverse your last undo.
→ **Cut (Ctrl+X):** Item is removed and added to the clipboard.
→ **Copy (Ctrl+C):** Copy some portion of an object or item.
→ **Paste (Ctrl+V):** Paste a copied or cut portion of an object or item.
→ **Delete (Del):** Delete selected object or item.
→ **Paste In Place (Shift+Ctrl+V):** Paste a copied object or item in the same location.
→ **Paste Inside Selection:** Paste a copied object or item inside the selected area.
→ **Paste Style (F4):** Paste and match style.
→ **Duplicate (Ctrl+D):** Create a copy of a selected object.
→ **Clone (Shift+Ctrl+D):** Create an exact copy or 'clone' of an object.
→ **Select All (Ctrl+A):** Select all items on the work screen.
→ **Deselect All (Shift+Ctrl+D):** All items in the work screen are deselected.
→ **Invert Selection (Ctrl+I):** Items previously selected are now unselected and items unselected are selected.
→ **Select by Font Type:** Select item by font type.
→ **Settings:** Displays settings menu.
→ **Materials:** Allows the user to select material from the list.
→ **Activate user profiles**: Users can open their profiles.

MODIFY

ARRANGE

→ **Send to Front (Shift+Ctrl+Up):** Send an object to the front layer.
→ **Bring Forward (Ctrl+Up):** Send an object one layer forward.
→ **Send Backward (Ctrl+Down):** Send an object one layer backward.
→ **Send to Back (Shift+Ctrl+Down):** Send an object to the back layer.

ALIGN

→ **Align Left:** Align object to the left.
→ **Align Center:** Align object to center.
→ **Align Right:** Align object to right.
→ **Align Top:** Align object to top.
→ **Align Middle:** Align object to middle.
→ **Align Bottom:** Align object to bottom.
→ **Same Width:** All selected objects convert to the same width.
→ **Same Height:** All selected objects convert to the same height.
→ **Distribute Horizontally:** Evenly arrange selected objects horizontally.
→ **Distribute Vertically:** Evenly arrange selected objects vertically.
→ **Snap to Full Units:** Snap to grid as full units.
→ **Snap to Half Units:** Snap to grid as half units.

TRANSFORM

→ **Rotate 45° Left:** Rotate selected object left 45°.
→ **Rotate 90° Left:** Rotate selected object left 90°.
→ **Rotate 180° Left:** Rotate selected object left 180°.
→ **Rotate 45° Right:** Rotate selected object right 45°.
→ **Rotate 90° Right:** Rotate selected object right 90°.
→ **Rotate 180° Right:** Rotate selected object right 180°.
→ **Flip Vertical:** Reverse selected object's orientation along vertical axis.
→ **Flip Horizontal:** Reverse selected object's orientation along horizontal axis.

GROUP SELECTION (Ctrl+G): Select a group of objects.
MERGE SELECTION (Ctrl+M): Merge a selected group of objects.
SPLIT SELECTION (Shift+Ctrl+M): Split up a compound shape or object.

CREATE COMPOUND SHAPE:

→ **Union:** Combine layers into a single compound layer.
→ **Intersection:** Combine overlapping layers into a single compound layer.
→ **Subtract:** Remove and combine non-overlapping layers into a single compound layer.
→ **Difference:** Combine non-overlapping layers into a single compound layer.
→ **Create Nested Compound:** Combine compound shapes into a single compound shape.

PATH

→ **Join Paths (Ctrl+J):** Combine 2 or more selected paths into one compound path.
→ **Split Paths (Shift+Ctrl+J):** Split a compound path into its original separate paths.
→ **Convert to Path (Shift+Ctrl+P):** Convert a non-path to a layer path.
→ **Convert to Raw Path:** Convert a path or non-path layer to a new path.
→ **Convert to Outline:** Create an outline path of a specified size around an object.
→ **Expand/Shrink:** Scale an object up or down by a specified amount.
→ **Vectorize Border:** Create a vector path of the border of an object.
→ **Rasterize:** Convert object to raster
→ **Vectorize Image:** Create vector paths of each separate element in an image.
→ **Attach Text to Path:** Attach and conform text to a path.
→ **Detach Text from Path:** Detach text that is attached to a path.
→ **Simplify Path (Ctrl+Alt+S):** Simplify (and smooth) a path to varying degrees of tolerance.
→ **Connect Path Lines:** Connect together the ends of 2 or more paths.
→ **Break Curve:** Break apart a path at a specified node.
→ **Reverse Order:** Reverse the order of nodes in a path.
→ **Pack Objects:** Packs multiple vectors and/or images into a set area.
→ **Generate Barcode:** Generates a barcode based on given details.

VIEW

→ **Original View (Ctrl+0):** Return the workspace to the original view state before zooming or panning.
→ **Fit Selection:** Fit the current selection to the viewable page area.
→ **Fit Layer:** Fit the currently selected layer to the viewable page area.
→ ***Fit All (****Alt+Ctrl+0):* Fit all layers, whether or not selected, to the viewable page area.

Magnification Increase or decrease magnification.

→ *Zoom In (Ctrl++):* Enlarges workspace screen detail and size.
→ *Zoom Out (Ctrl+-):* Reduces workspace screen detail and size.

Outline View: Set to outline view mode.

CANVAS

→ **Show Rulers:** Toggle rulers on and off.
→ **Show Guide Lines (Ctrl+,):** Toggle guidelines on and off.
→ **Show Grid (Ctrl+Alt+G):** Toggle grid on and off.

SNAP TO

→ **Use Snapping (Shift+F10):** Enable or disable the snapping feature.
→ **Use Snap Zones:** Enable or disable the snap zone feature.
→ **Snap to Grid:** Enable or disable the Snap to Grid feature.
→ **Snap to Guide Lines:** Enable or disable the Snap to Guide Lines feature.
→ **Snap to Full Pixels:** Enable or disable the Snap to Full Pixels feature.
→ **Snap to Anchor Points:** Enable or disable the Snap to Anchor Points feature.
→ **Snap to Shapes:** Enable or disable the Snap to Shapes feature.
→ **Snap to Pages:** Enable or disable the Snap to Pages feature.

Toggle fullscreen: Causes the window to occupy the entire screen.
Video Feed : Allows user to access video feed

MUSE TITAN

CAMERA

→ **Capture Workspace:** Initiates camera functions.
→ **Clear Last Workspace Capture:** Remove last camera image.

Trace Background: Used with camera functions to apply vectors to selected area of image.
Estimate Job Time: Give approximate time for the job to complete.
Run Job: Run your project. When running, “Play” button is replaced with “Pause” and “Cancel”.

DIAGNOSTICS

→ **Manual Power Test:** Manual test of power supply.
→ **Power Supply Test:** Runs the testing for the power supply.

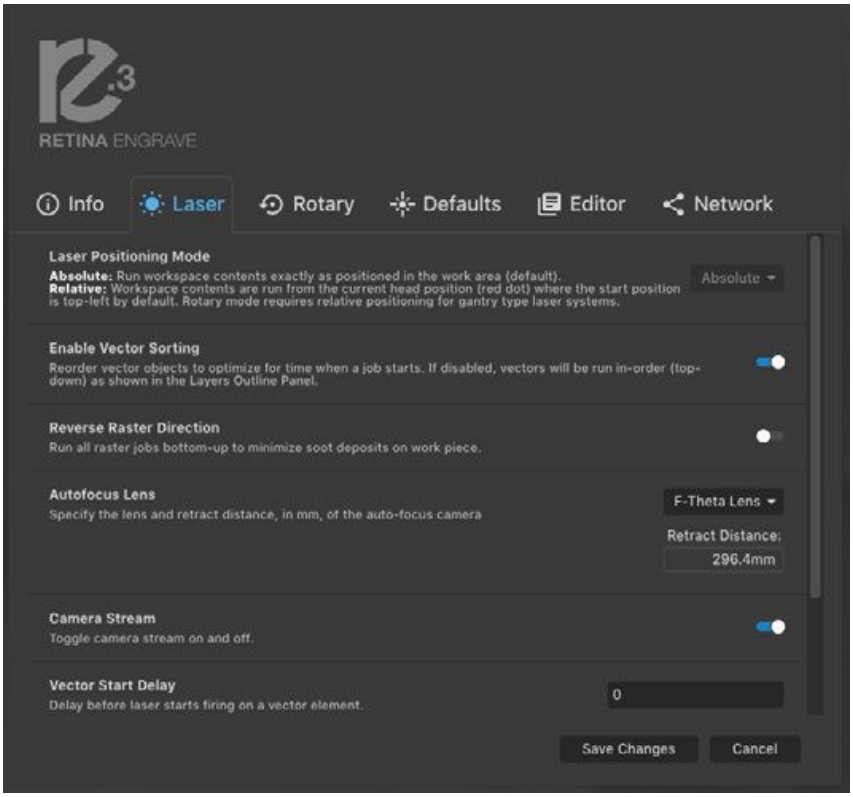
HELP

USER GUIDE

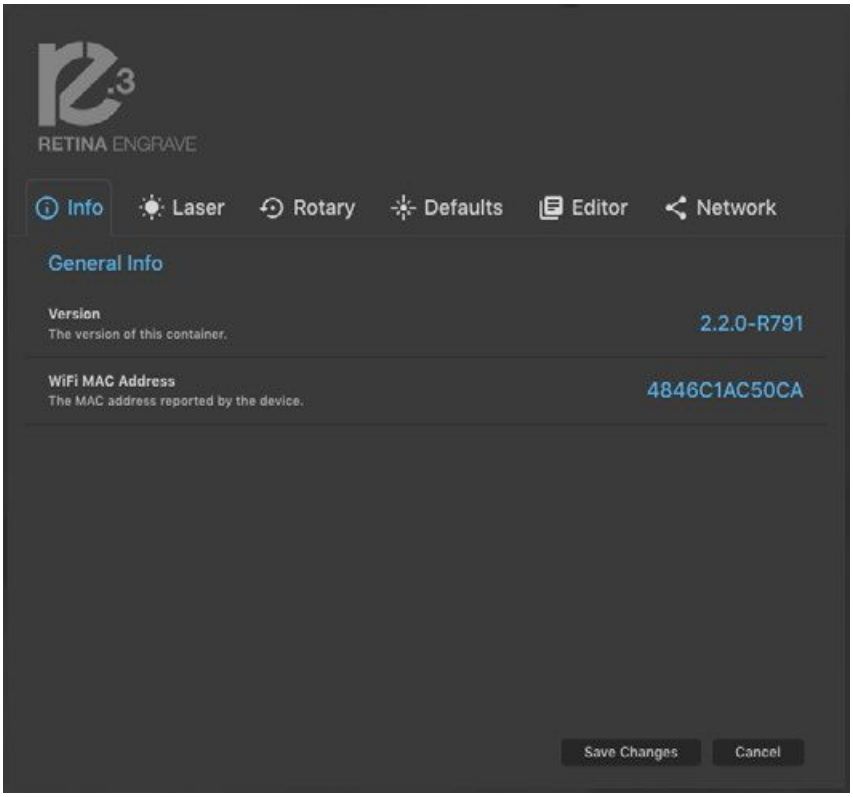
SUPPORT
Contact Us
Submit Support Ticket

TUTORIALS
Importing PDF
Vector Colors

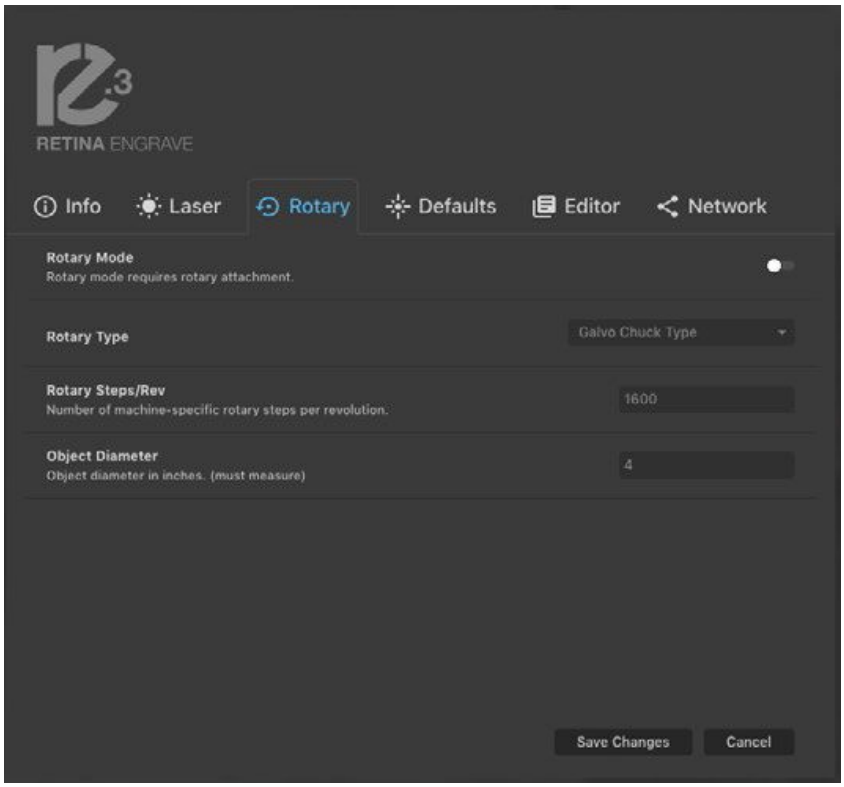
Settings (A)



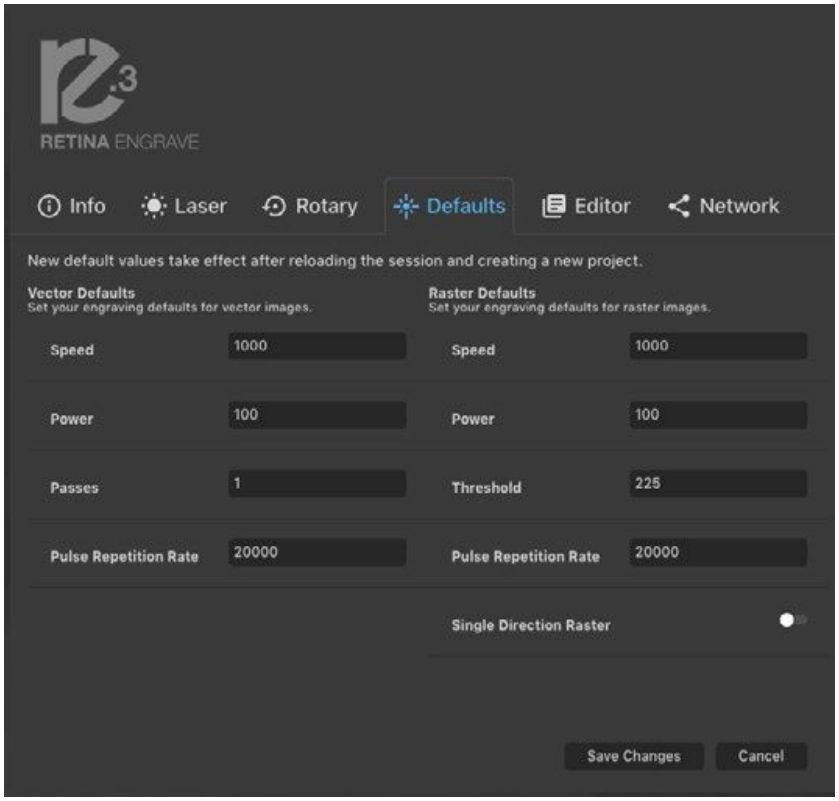
Info: Information regarding your machine.



Laser: Information regarding device options

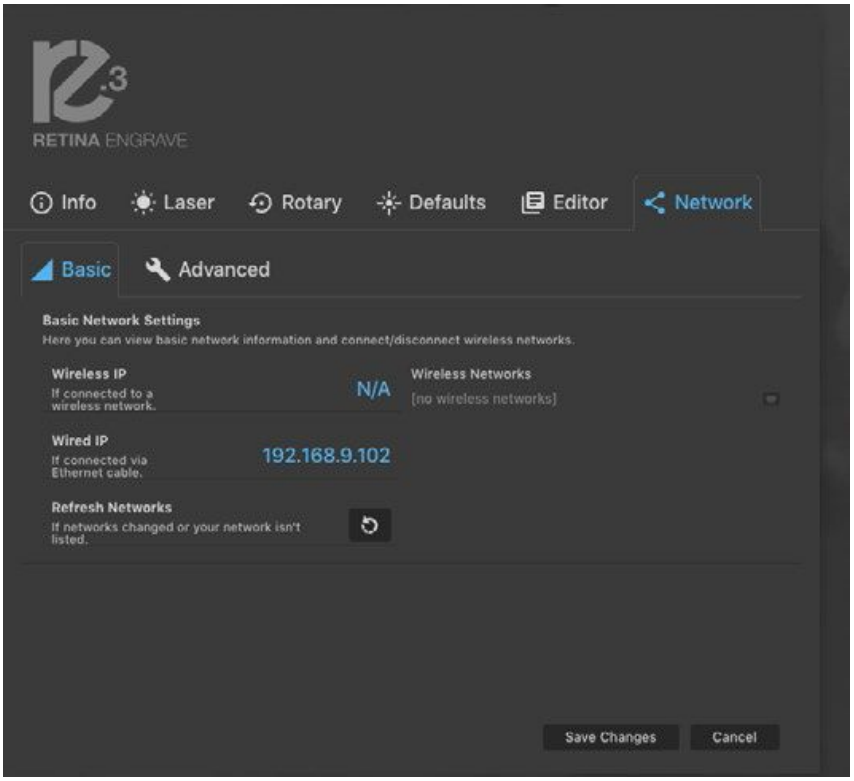


Rotary: Shows information on rotary.



Defaults: Set image defaults with dither options.

Editor: Editing menu for RE3.



Network: Network settings for RE3.

Settings (B)

Save: Save project.
Undo: Reverse your last action.
Redo: Reverse your last undo.

Muse Control (q)

Capture Workspace: Takes images of workspace
Clear Last Workspace Capture: Clears previous workspace image.
Estimate Job Time: Amount of time the job will take.
Preview Contour of All Objects: Shows laser tracing of job.
Show Bounding Perimeter of all Objects: Shows the space the job will occupy.
Run Job: Start Engraving

View Snap Controls (p)

View options or position items on a workspace grid.
Zoom (-/+): Enlarges/Reduces workspace screen detail and size.
Fit All: Fits entire captured image on screen.
View

- **Pan (H): Manually pan project window using mouse.**
- **Zoom (Z): Zoom project window using mouse.**

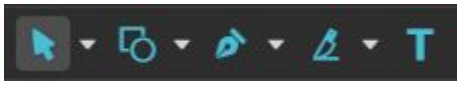
Snap

- **Use Snapping (Shift+F10):** Enable or disable the snapping feature.
- **Use Snap Zones:** Enable or disable the snap zone feature.
- **Snap to Grid:** Enable or disable the Snap to Grid feature.
- **Snap to Guide Lines:** Enable or disable the Snap to Guide Lines feature.
- **Snap to Full Pixels:** Enable or disable the Snap to Full Pixels feature.
- **Snap to Anchor Points:** Enable or disable the Snap to Anchor Points feature.
- **Snap to Shapes:** Enable or disable the Snap to Shapes feature.
- **Snap to Pages:** Enable or disable the Snap to Pages feature.

Show Grid: Toggle grid on and off.
Show Guidelines: Toggle guidelines on and off.

Convert to Path (k)

Convert objects to paths.



Draw Menu (o)

Select (Pointer):

Pointer (V): Initiates mouse pointer.
Subselect (D): Initiates “subselect” mouse pointer.
Lasso (O): Initiates “lasso” mouse pointer.
Layer (M): Initiates “layer” mouse pointer.

Shape

Line (L): Create a line with the drawing tool.
Rectangle(R): Create a rectangle with the drawing tool.
Ellipse (E): Create an ellipse with the drawing tool.

Polygon: Create a polygon with the drawing tool.
Triangle: Create a triangle with the drawing tool.
Star: Create a star with the drawing tool.

Path

Pen (P): Initiates “pen” mouse pointer for creating custom paths.
Bezigon (B): Initiates “bezigon” mouse pointer for creating custom path points.
Freehand: Initiates “freehand” mouse pointer for creating freehand paths.

Knife(K): Initiates “knife” for cutting out objects

Freehand Shaping: Initiates “freehand” mouse pointer for creating paths.

Text: Create an object made of text.

Position Menu (n)

Flip Horizontally: Flip object along horizontal axis.
Flip Vertically: Flip object along vertical axis.

Group Menu (m)

Group: Group objects

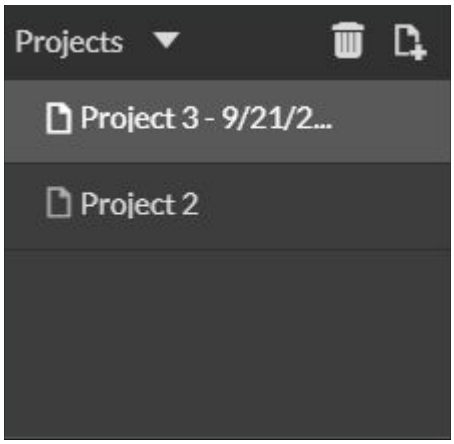
Merge

Union: Combine layers into a single compound layer.
Difference: Combine non-overlapping layers into a single compound layer.
Intersection: Combine overlapping layers into a single compound layer.
Subtract: Remove and combine non-overlapping layers into a single compound layer.

Split: Split up a compound shape or object.

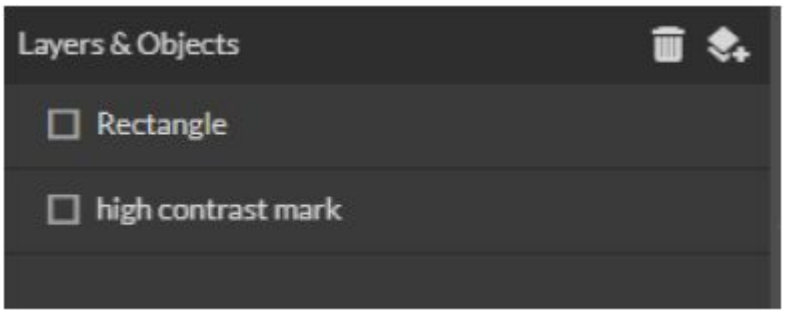
Arrange Menu (l)

Bring Forward: Send an object one layer forward.
Send Backward: Send an object one layer backward.



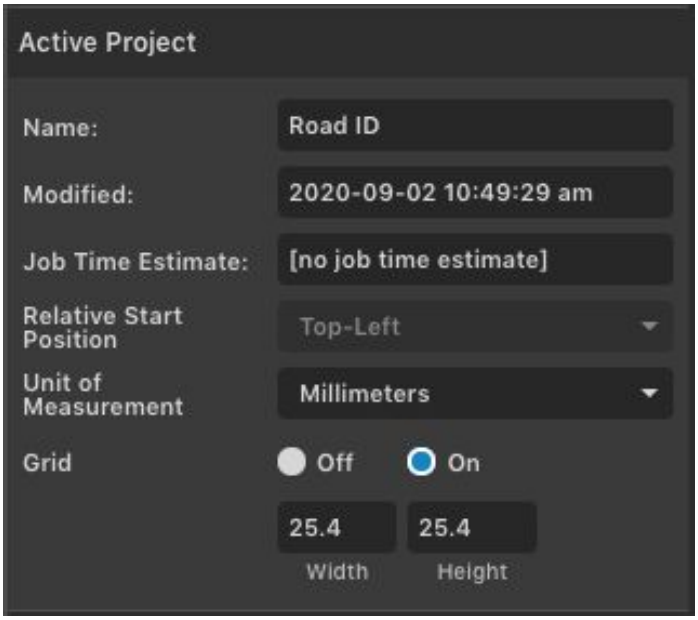
Projects Menu (C)

Displays information about projects.
Reduce Window: Reduce or expand projects window.
Delete: Delete selected project.
Create New Project: Begin a new project.
Project Name: Displays project's name.
Toggle Lock: Lock or unlock project in current order.
Toggle Visibility: Turn visibility of project on or off.



Layers & Objects Menu (D)

Displays information on layers.
Delete: Delete selected layer.
New Layer: Add a new layer.
Layer Name: Displays name of project.
Toggle Lock: Lock or unlock layer in current order.
Toggle Visibility: Turn visibility of layer on or off.
Toggle Outline: Turn displayed outline of layer on or off.



Project Info (H)

This window displays information regarding the active project.
Active Project Name: Displays name of active project.
Modified: Displays last date project was modified.
Job Time Estimate: Displays estimated time until job is complete.
Unit: Choose unit of measurement from the following

- **Pixels:** Sets unit of measurement to pixels.
- **Centimeters:** Sets unit of measurement to centimeters.
- **Millimeters:** Sets unit of measurement to millimeters.
- **Inches:** Sets unit of measurement to inches.
- **Picas:** Sets unit of measurement to picas.
- **Points:** Sets unit of measurement to points.

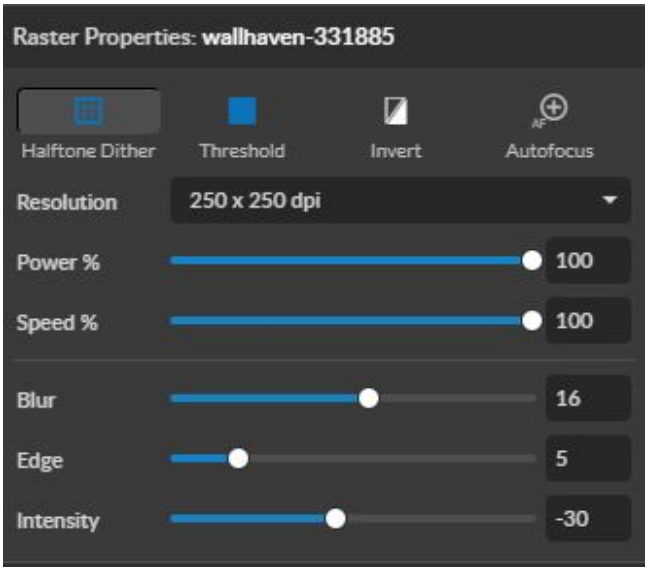
Grid: Toggles grid on/off/isometric.

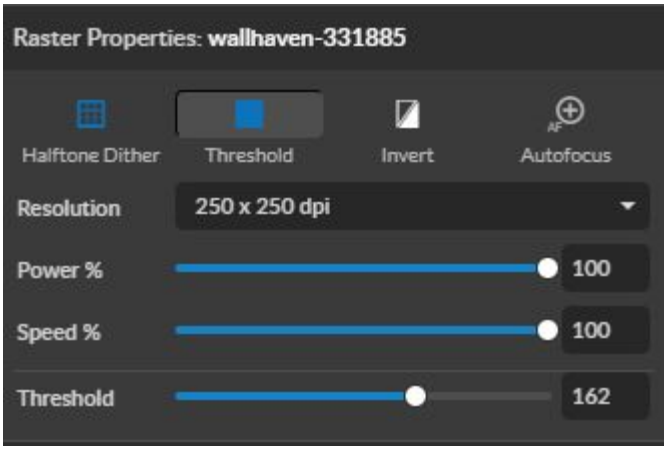
- **On:** When “on” grid displays in workspace.
- **Off:** When “off” grid does not display in workspace.

Width: Displays width of item according to chosen unit of measurement.
Height: Displays height of item according to chosen unit of measurement.

Vector Engraving & Parameters (G)

Window appears when the vector file is detected and is used to input vector settings.
Hide Window: Click to hide vector engraving parameters window.
Show All Parameters: Toggle to show or hide all parameters.
Change Position: Drag with mouse to reorder any color.
Color Indicator: Separates vector cuts with color indicators.
Speed: Input speed settings.
Power: Input power settings.
Current: Input current settings.
Passes: Input the number of passes for the laser.



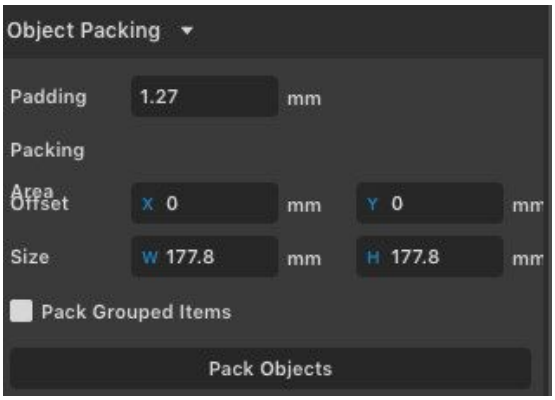


Raster Properties Window (G)

Halftone Dither: Apply Halftone Dither.

- **Blur:** Adjust blur filter radius from 0 to 30.
- **Edge:** Adjust edge enhancement threshold from 0 to 30.
- **Intensity:** Adjust intensity from -255 to 255.

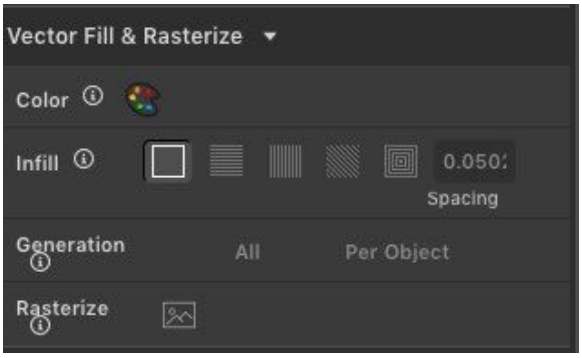
Threshold: Apply Threshold; adjust from 0 to 255.
Invert: Reverse Black and White elements.
Resolution: Set resolution (250, 500, 1000 dpi).
Power%: Select power percentage from 1 to 100.
Speed%: Select speed from 1 to 100.
Autofocus: Allows the user to autofocus to the selected point.



Object Packing (Appears when an object is selected)

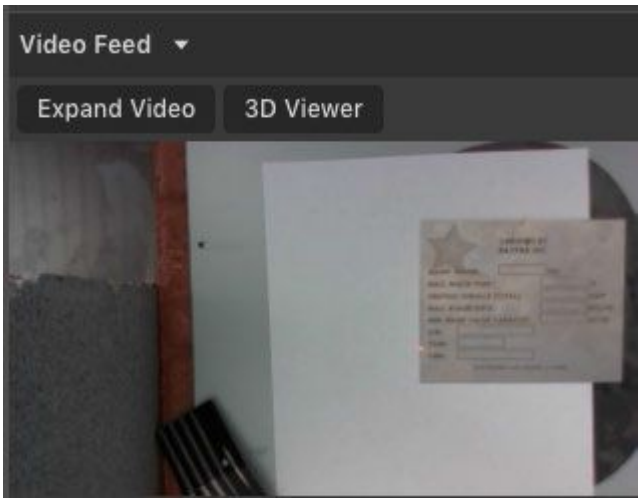
Allows the user to arrange multiple designs relative to the top-left corner with customized spacing.
Padding: Spacing between objects.
Packing Area

- **Offset:** Offsets the packing area of the objects.
- **Size:** Determine the size of the packing space.



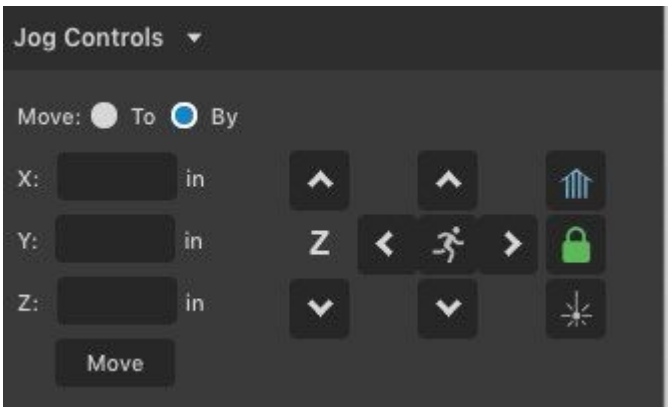
Vector Fill & Rasterize (G)

Use this Window to set an infill for shapes and designs.
Color: Set the color of the layer.
Infill: Set the pattern of your fill.
Spacing: Spacing between infill lines.
Generation: Generates raster lines based on all objects or for each object.
Rasterize: Clicking icon opens raster menu.



Video Feed (I)

Watch the screen to view real-time display.



Jog Controls (J)

This tool is for moving the laser head along the X, Y, and Z-axis.
Home: Moves the laser head to the home position.
Locked: Allows the position of the laser head to be locked (stops movement) or unlocked (allows movement).
Test Fire: Fires the laser when the button is pressed.

Indicators (Bottom Row) (E)

Position Indicator: Displays current position of the laser on the grid.

Time Remaining Indicator: Displays the time remaining to complete the current job.

Status Indicator: Displays whether laser is ready to initiate a job or is currently executing a job.

Sync Indicator: Notifies you of the last workspace update operation results. “Press Sync” to sync immediately. The workspace will update automatically, periodically.

Machine Indicators: Displays information on connected devices.
Device Connection Available: Indicates connection to machine is successful.
Lid Status: Indicates whether the lid is open or closed.
Water Status: Indicates whether the water flow is on or off.
Air Assist Status: Shows whether the air assist is on or off.
Exhaust Fan Status: Shows whether the Exhaust Fan is on or off.

Engraving / Rastering

Engraving, also called Rastering, is the process of creating a surface image on material without cutting through the material entirely.

Setting Engraving Properties

Clicking an object (design image) in the workspace will allow you to access that object properties tab. The Raster Properties will automatically open. For vector objects (basic shapes), it will open up the Vector Fill & Rasterize tab. Select the icon next to Rasterize to open the Raster Properties.

Setting Resolution

The resolution of your engravings can be controlled by the DPI (Dots Per Inch). DPI options include 250, 500, and 1000. The more dots per inch, the higher precision, and quality of your images, while a lower DPI will process and engrave faster. Speed and power should be compensated for different DPI settings. The software's default resolution is set to 250 DPI.

Setting Passes

The passes setting dictates the number of times the selected shape is engraved. The passes range from 1 to 999. Increasing the number of passes will increase the amount of times the shape is rastered.

Setting Raster Power

Power will determine how much power the laser delivers. As with speed, power will vary depending on the wattage of the laser tube and the material itself.

Setting Raster Speed

Speed settings determine how quickly the laser head will move. For faster engravings, 100% is ideal. Lowering the speed will allow you to create deeper engravings, as it allows the laser beam to be in contact with the material for a longer period of time.

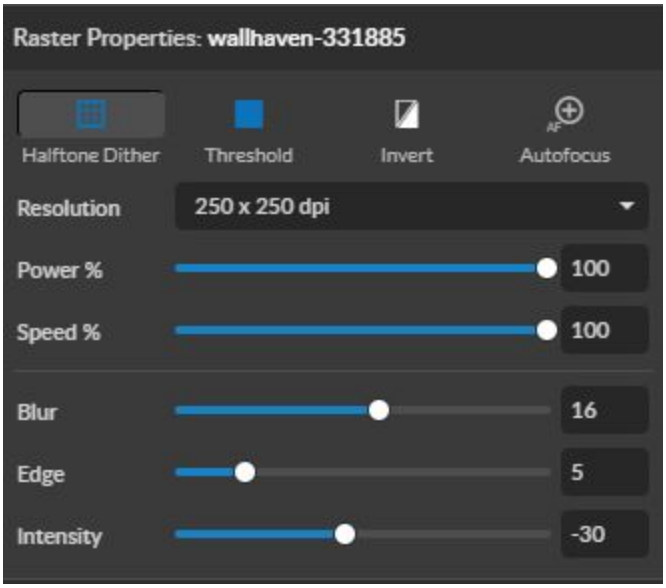
Applying B/W Threshold

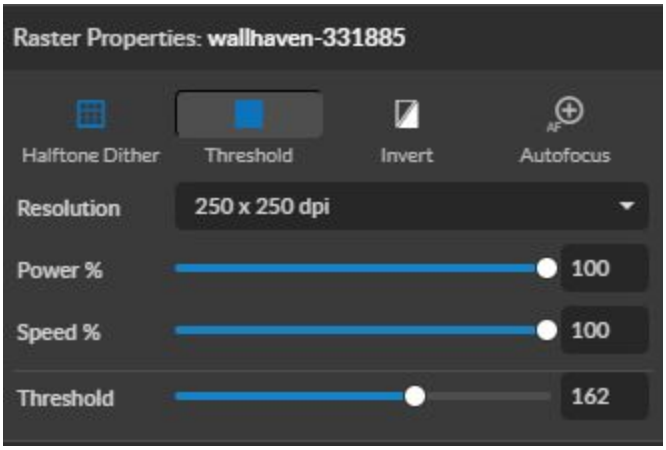
At this moment, the image is still displayed at the threshold. The black and white raster feature is great for tracing logos, text, or simple high contrast images that only appear in a single color. You can adjust the threshold of what's considered black, and what's considered white by selecting your image and clicking "Threshold". This will bring up a B/W Threshold slide bar, from which you can adjust B/W threshold to your liking.

Halftone Dither

For images that have shadows and depth, it's ideal to use Halftone Dithering. Halftone Dithering creates a series of dots similar to newsprint. This effectively creates a grayscale that is ideal for photorealistic engravings. To Halftone Dither an object, click the Halftone Dither button.

(Refer to images on the next page)

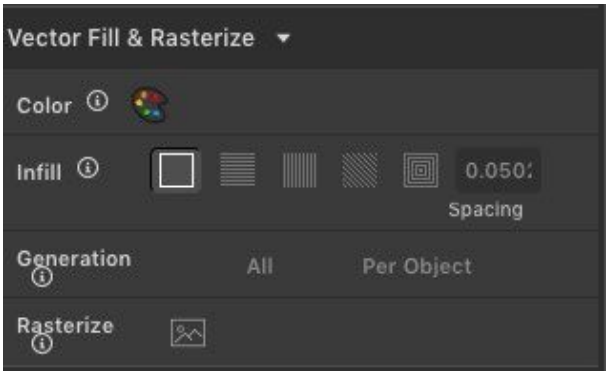




Engraving/Rastering Power Settings

Setting Vector Properties

When a PDF file is imported into RetinaEngrave v3.0, the program automatically detects it as both a vector file and a raster file. When a vector object (basic shapes) is selected the Vector Fill & Rasterize property tab will open on the right side. For vector engravings, this tab will allow you to set the infill for the object.



Infill

This section fills in the selected object. The way the fill will appear is based on which option is selected. You can enter the spacing between each infill line.

Generation

This feature decides how the infill is generated. *Per Object* generates the infill pattern for each drawing object at a time. "*All"* generates the infill pattern based on the location of all of the objects. Using *All* is usually preferred since it leads to all of the lines of the infill being even across all the patterns whereas *Per Object* would cause the infill lines of each object to not match up.

Vector Color

Tags allow you to create separate vector layers and keep track of them with a unique color. Each color will match an object in the workscreen. You can set the order of operations by clicking on the "three dots" and then dragging the layer up or down. Objects are then processed from top to bottom.

Setting Vector Power

Power will determine how much power the laser delivers. As with speed, power will vary depending on the wattage of the laser tube and the material itself. You will need to experiment with material testing to find the right power for your vector cuts.

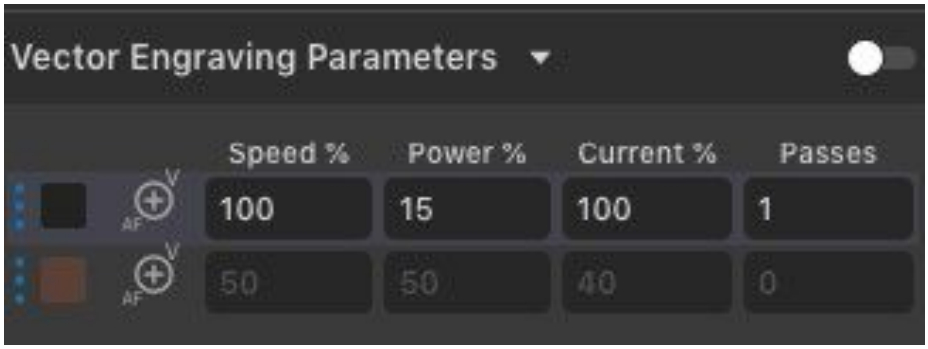
Setting Vector Speed

Speed settings determine how quickly the object will be engraved. Lowering speed allows you to create deeper engravings, as it allows the laser beam to be in contact with the material for a longer period of time.

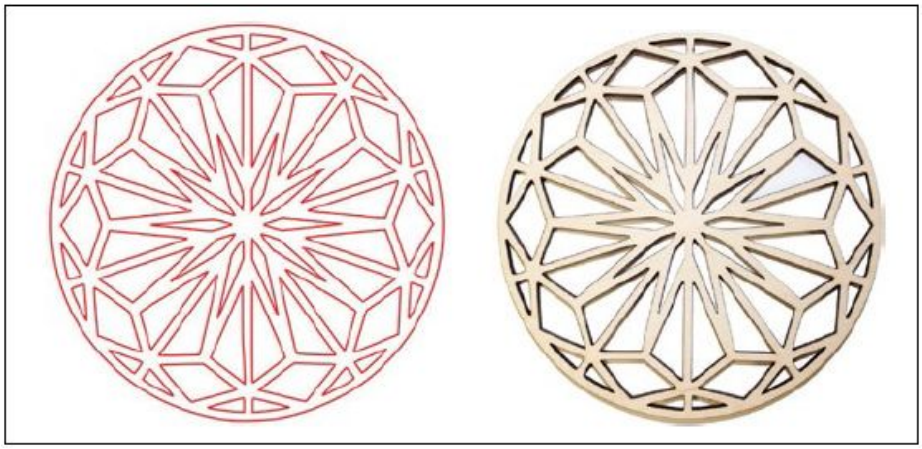
Passes
This allows the operator to assign how many times the laser will complete a full cycle. Adding passes creates deeper cuts. Setting passes to “0” will disable the respective color layer.

Setting Vector Current
Vector current is a control unique to vector files. As always, settings will vary with your tube wattage and type of material. It’s best to test on an inconspicuous part of your material before creating your final piece. Once optimal results are discovered for speed, power, and current, through material testing, record the settings for each in a materials log.

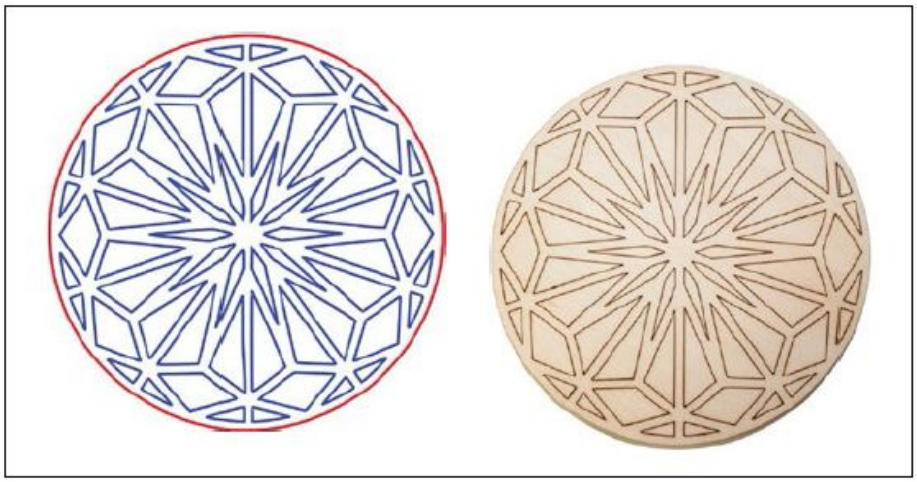
Show All Parameters
This toggle switch displays or hides all possible vector tags as a series of color options. Often when performing both vector cuts and raster engraving, it is a good idea to change the color of the vector cut to something other than black. This will avoid the laser detecting the vector cut as part of the raster. We can outline (as opposed to fill) parts of the pattern for a second design option. Engravings can be combined with vector cuts to create a variety of outcomes. A simple example is to engrave an image, and then cut the image out with a vector outline.



Basic Vector Cutting Example

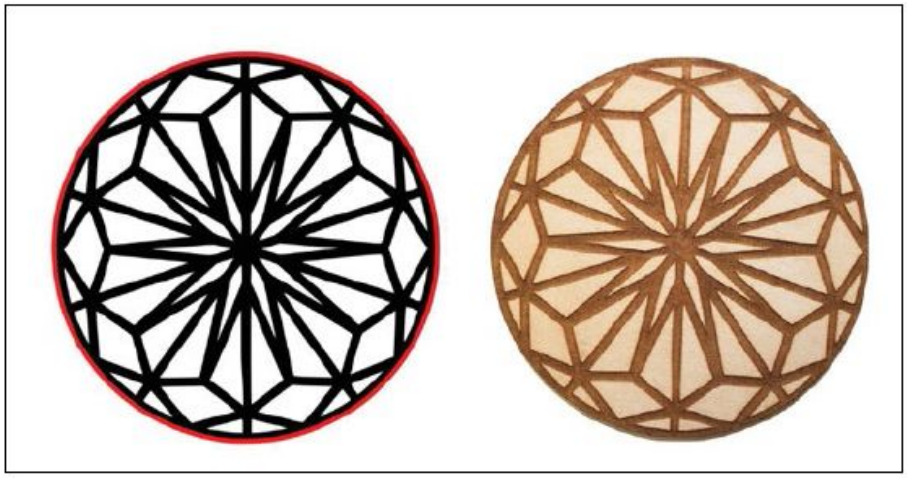


Vector Mark Example



We can outline (as opposed to fill) parts of the pattern for a second design option. Again, we will instruct the laser using our vector properties In this design, the blue lines will not be cut through on our material, but instead will be marked, as the red outline still cuts.

Combining Vector and Raster



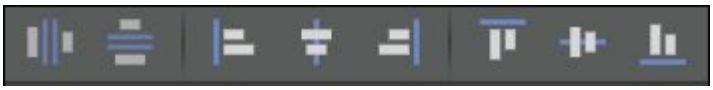
Engravings can be combined with vector cuts to create a variety of outcomes. A simple example is to engrave an image, and then cut the image out with a vector outline. In this case the laser will raster in the black fill and cut the red line.

Adding Text 

Click the “T” icon and then click anywhere in the view window. You can now write your text. To customize your text, click on the text object you created and a new window will appear with options to adjust the positioning, size and font of your text.

Text Positioning

Text position can be quickly adjusted by clicking on one of the following options:



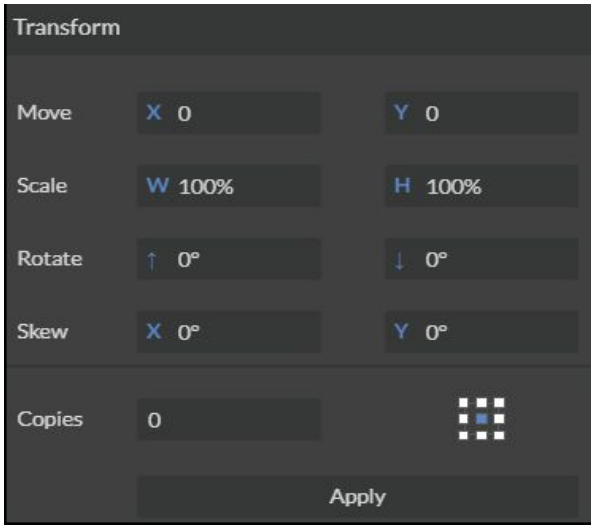
Distribute Horizontally: Evenly arrange selected text horizontally.
Distribute Vertically: Evenly arrange selected text vertically.
Align Left: Align text to the left.
Align Center: Align text to center.
Align Right: Align text to right.
Align Top: Align text to top.
Align Middle: Align text to middle.
Align Bottom: Align text to bottom

Text Positioning Coordinates

This window displays the coordinates and other specs of the selected text. Coordinates can be changed manually by entering the desired specifics directly into the software.
Position: Displays position of text in X/Y coordinates in the workspace. Click box to directly input X/Y coordinates.
Size: Displays size of text according to width and height. Click box to directly input desired width and height of text.
Angle: Displays angle of text as a degree. Click the box to directly input the angle degree of text.
Transform: Clicking the transform button brings up the Transform Window options.
Anchors: Allows the user to snap the layer to anchors.

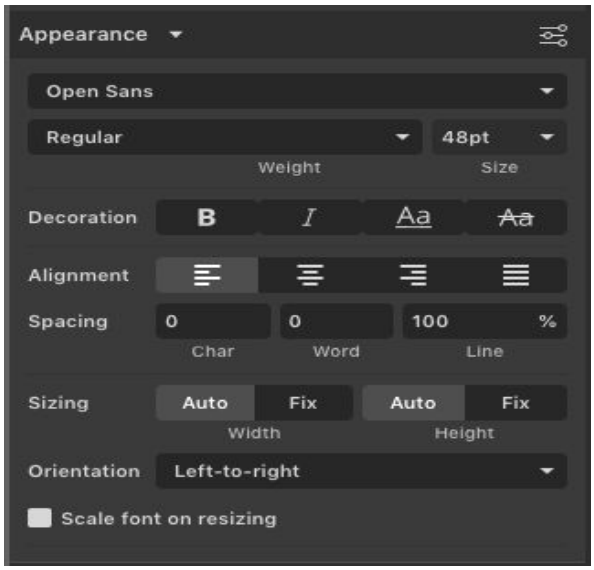
Text Transform Options

Transform options allow the operator to alter the shape and skew of text.
Move: Set X/Y coordinates.
Scale: Manipulate the scale of text, separately, in width and height.
Rotate: Rotate text a set number of degrees, up or down.
Skew: Skew the angle of text by a set number of degrees on the X and Y axis.
Copies: Create duplicates of the selected text.
Apply: Click to apply all transform changes.



Text Appearance

Select Font: Choose or change selected text font.
Weight: Choose bold and italic options for selected text.
Font Size: Choose font size for selected text.
Alignment: Align or justify selected text left, right, or center.
Spacing: Set spacing for characters, word blocks, and lines.
Sizing: Lock all sizing options (Fixed) or allow custom alterations (Auto). When set to auto, click on text and use the mouse to manipulate corner nods to change size.



Text Path Options

Attach Text to Path: This function allows the user to attach text to a shape and contour the text to that shape. As an example, a user creates an ellipse design and a text element separately. With the mouse, drag a square over both. By clicking Attach Text to Path, the text is merged with the ellipse and the text conforms to the contour of the shape. The user can then drag the text element to the desired position, using the mouse.

Detach Text from Path: This function reverses the Attach Text to Path option. Select the object and text with the mouse by dragging a square to highlight both. Then, click Detach Text from Path. The shape and the text will now be separated.

Convert to Path (Shift+Ctrl+P): Convert a non-path to a layer path. If a layer is composed of elements that are treated like paths, internally, or the layer is a Text object, the existing paths that make up the object are simply extracted from the object as they are already defined. The result is a compound path containing all of the separate paths. Any transform information from the original layer is not retained in the individual paths. For all other types of layers a new path is created, preserving any transforms. The user creates a text layer then converts to a path. Because the text was composed of more than one distinct element a compound path is created. The compound path can then be split into separate paths for each distinct element in the text.

Convert to Raw Path: Convert a path or non-path layer to a new path. This is similar to Convert to Path with some important differences. With Convert to Raw Path new path objects are always created regardless of the type of the original layer and transforms are preserved. The user creates a text layer, attaches it to an ellipse path so that it follows the curvature of the ellipse, then converts the text to a raw path. The text retains its curvature because the transforms of the separate text paths are preserved.

The easiest way to create an object is to select a shape from the tools menu. For example, you want to make a circle. Select the circle tool, then click and drag to create a circular shape. By holding shift while dragging, you can constrain the proportions so that the circle is perfectly round. Design view has hundreds of shapes that can be selected and manipulated to endless choices. Click the “Square” icon to access the shape library.

Creating Shapes 

Click the Square Icon and then click and hold anywhere in the view window. By moving the mouse, you can expand and manipulate the square you want to create. By clicking the drop-down arrow next to the Square Icon, you can choose other base shapes and expand them just like with a square. The basic shape library includes line, rectangle, ellipse, polygon, triangle, and star. You can modify any shape by clicking on it and then adjusting the interface data appearing on the right side of the screen. Each shape will have slightly different options as follows:

Line (L)

Creates Lines

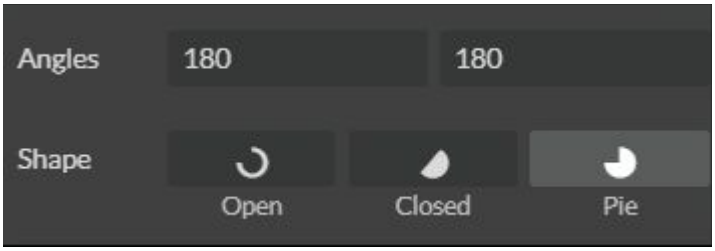
Rectangle (R)

Round: Create rounded corners.
Round2: Create inverted rounded corners.
Bevel: Create beveled corners.
Inset: Create inset corners.
Fancy: Create fancy corners
Autoscale Corners: Toggle autoscale corners on and off.
Uniform Corners: Click to ensure all corners have the same parameters.

Ellipse (E)

Angles: Input custom angles.
Shape:

- **Open:** Click for open ellipse.
- **Closed:** Click for closed ellipse.
- **Pie:** Click for pie shaped ellipse.

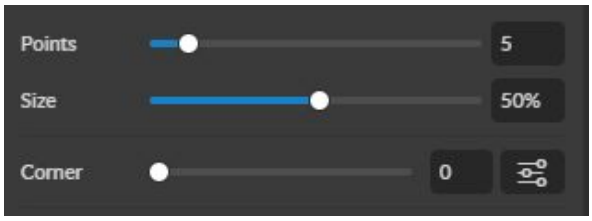


Triangle & Polygon

Points: Slide bar to create polygons with multiple points (3 to 25).
Corner: Slide bar to curve corners.

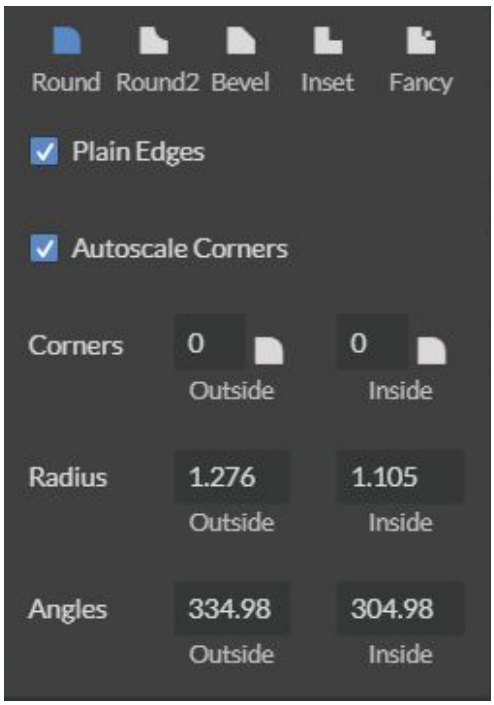
Star

Points: Slide bar to create polygons with multiple points (3 to 25).
Size: The size of the inside of the star.
Corner: Slide bar to curve corners.



Advanced Settings

Round: Create rounded corners.
Round2: Create inverted rounded corners.
Bevel: Create inset corners.
Inset: Create inset corners.
Fancy: Create fancy corners
Autoscale Corners: Toggle autoscale corners on and off.
Uniform Corners: Click to ensure all corners have the same parameters.
Plain Edges: Toggle plain edges on and off.
Corners: Input outside and inside corner curvature.
Radius: Input outside and inside corner radius.
Angles: Input outside and inside corner angles.



Creating, Manipulating Compound Shapes & Objects

Compound Shapes & Objects Operators can combine and modify shapes and objects to create unique compound shapes and objects with these functions (see also Modify):

Split Selection (Shift+Ctrl+G): Split up a previously created compound shape or object that has been Unioned with other shapes. Select the compound shape and choose Split Selection. The different objects are split back up into individual layers that can be moved independently.

Create Compound Shape->Union: Combine multiple layers into a single compound layer. Union will create a compound shape containing all of the selected layers, retaining their relative positions. Union together several different objects and create a compound shape so they can all be moved and manipulated as one. To reverse, select the compound shape and choose Split Selection. The different objects are split back up into individual layers so you can move one of them independently.

Create Compound Shape->Intersection: Combine overlapping layers into a single compound layer. Intersection will create a compound shape containing the areas where the selected layers overlap. Intersect together part of an ellipse and part of a rectangle to create a new compound shape with curved and straight lines.

Create Compound Shape->Subtract: Remove and combine non-overlapping layers into a single compound layer. Subtract will create a compound shape containing only the areas of the last selected layer where the other selected layers do not overlap. For example, users can create an ellipse and subtract a rectangular area so the ellipse can be placed over another layer and not obstruct part of it. Or use to make a design that is made up of standard shapes by subtracting certain areas

Create Compound Shape->Difference: Combine non-overlapping layers into a single compound layer. Difference is the opposite of Intersection. It will create a compound shape containing only the areas where the layers do not overlap. For example, the user can create a large circle ellipse, then create a smaller circle ellipse. Place the smaller circle ellipse over the large circle ellipse and center it. Select both layers and choose Difference. A hole is created in the large circle ellipse and a donut design is formed.

Create Nested Compound: Combine compound shapes into a single compound shape. All of the selected compound shapes will be nested within the compound shape that was selected last. For example, if a user has created compound shapes and created the layout with the desired spacing but would like to move them all while retaining the existing layout, creating a nested compound shape that includes them all works best.

Convert to Outline: Create an outline path of a specified size around an object. If the original object is not continuous, such as a line, an outline is created around the line and the original line is replaced. If the original object is continuous, such as a rectangle, an outline is created around the rectangle and the original rectangle is preserved, resulting in a compound path with two rectangles. The user creates a curved line then converts it to an outline of size 10. The result is a continuous curved polygon that looks like a wet noodle.

Expand/Shrink: Scale an object up or down by a specified amount. The user creates an object and wants to grow it a few pixels but trying to scale it with a selection box is too difficult. The user can expand the object by specifying the exact amount.

Creating & Converting Vector Paths

A vector path indicates the line the laser moves along while cutting. For a simple line, the path is a clear route from Point A to Point B. More complicated paths, and shapes, can be created using the following options in the Modify drop-down window:

Vectorize Border: Use to create a vector path of the border of an object. For example, the user creates an object, such as a rectangle, and wants to have a vector path of just the border of the triangle.

Vectorize Image: Use to create vector paths of each separate element in an image. For example, the user first imports an image. User then wants certain parts of the image to be vectors so they can be cut. User vectorizes the image and then moves some of the resulting vectors out of the image object. The vectors can then be edited.

Join Paths (Ctrl+J): Combine 2 or more selected paths into one compound path. The result is a single layer titled ‘Compound Path’. It does not connect them into one continuous path but rather a single object with breaks between the individual paths that were joined. The user joins together multiple path objects so that they can be transformed more easily and change their properties as a single object.

Split Paths (Shift+Ctrl+J): Split a compound path into its original separate paths. The result is a path layer for each separate path in the Compound path. Simplify Path (Ctrl+Alt+S) Simplify (and smooth) a path to varying degrees of tolerance. The user creates a freehand line or compound curve but the resulting curve has some sharp turns and jagged edges. Next, select the path and simplify it with a tolerance (start with 20%). The resulting path has fewer vertices and smoother turns.

Connect Path Lines: Connect the ends of 2 or more paths. The user vectorizes an image containing text. Due to the low quality of the image some of the text characters have breaks in their paths, so the user selects the lonely paths and uses the “Connect Paths Lines” feature to connect the paths.

Break Curve: Break apart a path at a specified node. The user creates a path but would like to separate it and add space at certain vertices to add another artistic element in between. Or maybe to specify different engraving parameters for different parts of the path. To do so, the user selects a node and chooses “Break Curve”. The path is separated into two separate paths.

Reverse Order: Reverse the order of nodes in a path. When the user creates several paths and uses the “Connect Paths Lines” feature, they are connected but not at the desired ends. This is because the paths are connected from the last node of one path to the first node of the next. Undo the previous action and choose “Reverse”.

Mouse Controls

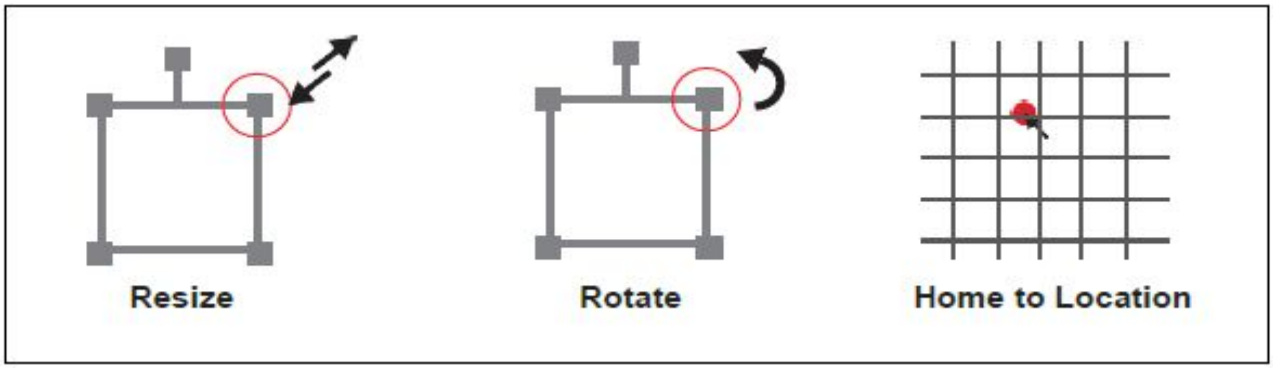
1. **Drag ‘n Drop:** Click and hold a design file and then drag it into the workspace. You will be invited to “Drop anywhere!”. Once uploaded, click and hold the left mouse button and drag the mouse to move the object in the workspace.

2. **Resize / Rotate:** Clicking on the object with your mouse will highlight the adjusters for size and orientation. Use the mouse to manipulate the object’s size by expanding or constricting the square adjusters or turning the rotation node to rotate the object.

3. **Left Click to Rotate:** Hold the Alt button on your keyboard, then left click and hold your mouse over the rotation node. By moving the mouse, you can rotate the object from the opposing node.

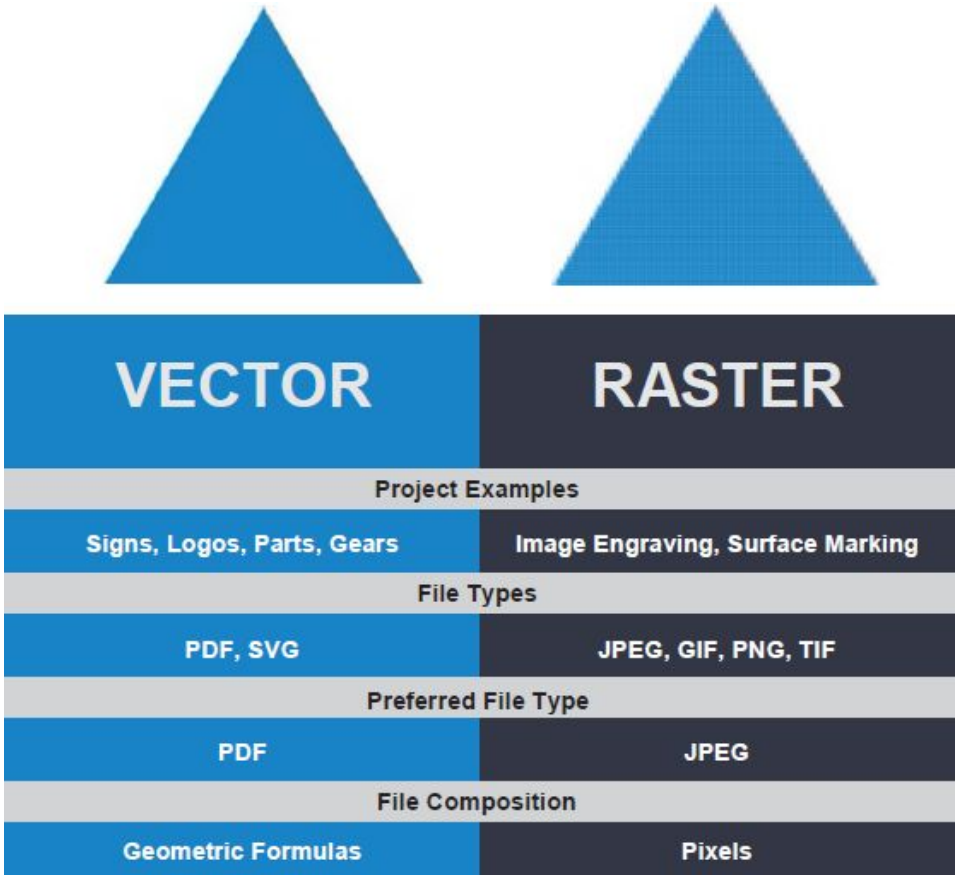
4. **Left Click to Resize:** Hold the Alt button on your keyboard, then left click and hold your mouse over one of the four corner “resizing” nodes. By moving the mouse, you can resize the object from the center rather than the corner.

5. **Home to Location:** Instantly home the laser to any location in the work bed by simultaneously holding the Ctrl key and left-clicking the mouse.



Section VII. Operations

This section will guide you through using your Muse Titan laser cutter. To get started, it is important to understand the meanings of “Vector Cutting” and “Raster Engraving” and their associated file types.



VECTOR	RASTER
Project Examples	
Signs, Logos, Parts, Gears	Image Engraving, Surface Marking
File Types	
PDF, SVG	JPEG, GIF, PNG, TIF
Preferred File Type	
PDF	JPEG
File Composition	
Geometric Formulas	Pixels

General Functions

Vector Cutting

The most common feature of a laser cutter. Vector cutting with a laser means “to cut a line or shape”. When vector cutting, the laser follows the “vector lines” embedding in the vector image to cut out the design. The laser starts at a designated location and follows the vector lines until the shape is cut out. This process is highly accurate and requires no resolution adjustments because of the properties of a vector image.

Vector Images

In Vector Cut mode, the software receives information from the print stream and interprets it as a series of paths for the laser head to follow. For the print stream to have vector information, the file being printed must be a vector image. Vector images are more flexible than raster images. These images are created using mathematical equations rather than pixel blocks. PDF’s work great as vector files and are easy to resize without losing resolution. Company logos and branded graphics are usually vector images.

Engraving

Engraving is the process by which complex designs are etched into a workpiece. Engraving can range from a simple surface mark all the way through deep material removal. Engraving is differentiated from cutting in that cutting is the process of burning a closed contour completely through a workpiece. Engraving is also known as “Raster Engraving” or “Rastering”. For engraving, a laser has two states: on and off. Every black pixel or “laser dot” is the result of the laser turning on and firing at that location. This location is controlled by the input image, which can be thought of as a “map” of on and off pixels. The laser fires individual pulses corresponding to pixels in an image. When the laser is operating in raster mode the head moves rapidly from left to right and slowly from top to bottom, engraving your image pixel by pixel and line by line.

Images and Engraving

Engravable images use multiple colored pixels to form an image. JPEGs and PNGs are common engraving image types. Most of the photos found on the Internet and photo prints are raster images. Raster images are created using a fixed number of colored pixels, so they can’t be dramatically resized without distorting their resolution. When sized to fit a space they weren’t designed to, the pixels become visibly grainy and the image becomes distorted. When this happens, altered photos may appear pixelated or low resolution compared to the original source. Because of this, it is important that you save raster files at precisely the dimensions needed to eliminate possible resolution issues.

PDF Files

Engraving works with both vector and pixel-based source files, allowing you to engrave anything from a simple block logo all the way to high-resolution photographs. A PDF file type is generally treated as a vector file, however, RetinaEngrave v3.0 can read PDF files as either a vector or an engraving file when you import the image. This allows operator great freedom in converting any image file to a PDF.

Direct Printing PDF Files

The easiest way to import any file type to RetinaEngrave v3.0 is to “drag ‘n drop” it directly into the workspace window. If there are ever any problems importing files in this manner , direct printing a converted PDF file is the next method to try. Most design software have a simple method for converting files to PDF and then directly printing them to the RetinaEngrave v3.0 software.

Designing in RetinaEngrave v3.0

RetinaEngrave v3.0 includes a robust set of design tools, allowing users to design in the software without needing outside design software. Third party design software, however, is still an option for RetinaEngrave v3.0 users. Just about any design software will work (You can choose the software you are most comfortable with, as long as you can convert files to PDF (which most can). You can also “direct print” to the software. Each operating system does this in a slightly different way, so check the instructions for your particular program.

If you use third party design software and run into a problem with the print interface, we recommend printing to the XPS Document Image Writer or saving as a PDF. PDF files save vector information and are the best way to carry artwork from a non-compatible operating system (Mac or Linux) onto your Windows PC.
Compatible design packages include: CorelDraw, Adobe Illustrator, Inkscape, and Google’s free online vector drawing application. Additionally, most CAD packages are able to output drawings in a vector format for printing; Autodesk 123D is particularly interesting for its cost (free) and built- in 3D slicing capabilities.

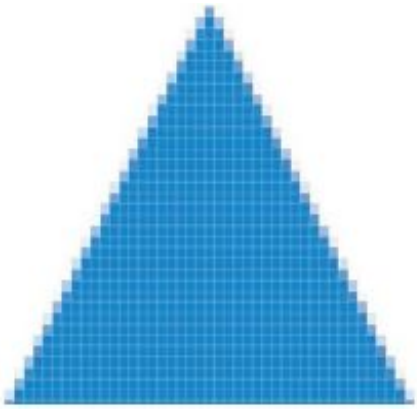
From Concept to Design

The RetinaEngrave v3.0 software works with your Muse Titan to create a simple and intuitive set of operations that is easy to learn and use. With experience, you will find your Muse Titan achieving amazing results following this procedure. Use this Project Workflow List for the “best practice” sequence for any project and follow the step-by-step instructions from start to finish.

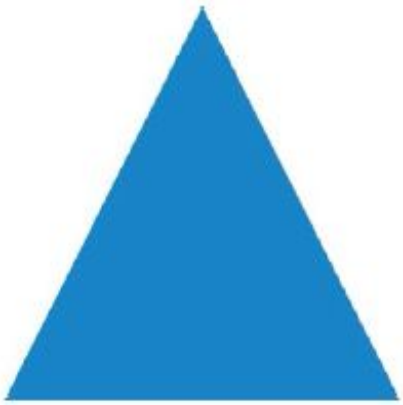
CAUTION	Before starting any project, be sure you are aware of all safety issues. Be sure you read and understand all safety warnings presented in Section I.

1. Create Design

Typically, projects are created in design software and then imported to RetinaEngrave 3.0. Generally, a PDF file is optimal for most vector cuts, as PDF files are easy to convert to and most design software has “convert to PDF” as a standard feature. For rastering (engraving), a JPEG file is best as these are bitmap files perfect for pixel-based images. It is important to know, at this stage, if you intend to do a vector cut or an engraving and choose the most appropriate file type (PDF or JPEG). This will greatly aid the software users to design in the software without needing outside design software. Third party design software, choose the software you are most comfortable with, as long as you can convert files to PDF (which most can). You can also “direct print” to the software. Each operating system does this in a slightly different way, so check the instructions for your particular computer.



Raster Image (bitmap)
Pixel based image.
Examples: JPEG, PNG



Vector Image (bitmap)
Vector File Geometric based image.
Example: SVG, AI, PDF

2. Connect to Software RetinaEngrave v3.0

Follow the instructions presented in Section III: Installation & Assembly. As a recap, you will turn on your computer and your Muse Titan laser cutter and wait for both to finish their boot cycle. Then, using the Muse Titan touch screen, touch the “Settings” button and then touch “Network”. Copy the IP address on the touch screen into your computer’s browser and the program will appear, ready to use. For best results, we recommend using Google Chrome as this is the most compatible with RetinaEngrave v3.0 technology.

3. Import Design

Import your designs by selecting the “Open File” icon, or by dragging and dropping your file into the workspace. This software detects a wide variety of file types, however, for vector cuts PDF files work best and are simple to convert on most design software. For raster engraving, the JPEG file format is widely used and can easily be taken from a cell phone photo or an image found online. It is important to know what files work best with vector or raster images. A raster image is a pixel-based image (bitmap) and works well as a JPEG file. When you import a JPEG file, the software will automatically detect it as a raster file and will set up the project accordingly by presenting raster options in the properties tab menu.

4. Place Material

At this stage you will place your material into the laser bed workspace. The material can be placed anywhere within the work bed; however, we recommend placing material close to center. Once the material is placed, close the lid. Your material is what you will be cutting or engraving. Typical materials include wood, acrylic, cardboard, fabric, etc. Note that is the user's responsibility to know the components of any material used and the limitations of utilizing that material (thickness, chemical residues, etc.) with a 45W laser tube. Always check with the material manufacturer, or MSDSonline.com, if there are any questions to its usage. We recommend using a Materials Log to keep track of the different materials you use.

5. Focus Laser to Material

Alignment of the material ensures the design to be cut is contained within the material in the workspace. This process also makes sure the design is aligned to the material so the cut is positioned straight. Typically, this can be done with a simple vision check while "jogging the perimeter". By using the directional arrows on the touchscreen or the arrow keys on your computer, move the laser dot to the top left corner of your material. When placing an engraving image, leave at least ½" inch of space on the left and right side. When creating engravings, you must compensate for the left and right overshooting of the laser head. Once the material looks aligned, click the "Jog Perimeter" button. The laser head will automatically outline the material with the red beam diode. You can then adjust the material as needed. Note the laser head will continue to outline the material until stopped manually by clicking the "Run Perimeter" button a second time. See Positioning below for more options.

6. Adjust Object Properties

It is again important to know if you intend to raster, vector cut, or both. Once the file is imported, and the image is clicked with your mouse, you will have access to the Properties Tab. Click this tab and select the parameters for your cuts and/or engravings. For details on setting these parameters, see below.

7. Run Job

Clicking the "Start Job/Play" button begins the laser cutting process. Before doing so, double check your safety protocol and that your system accessories are connected properly. Be sure to monitor the job while the laser is firing. If there is a problem, stop the laser using one of the methods mentioned below.

Positioning the Laser Head (Jog)

Operators will want to become accustomed to moving the laser head, in order to position the laser. This can be done in one of two methods: manual and jog control. Manually moving the laser head requires that the laser head be in the “Unlocked” position. To unlock the laser head, push the “Lock” icon, on the touch screen, so that the icon has an open lock icon. The laser head can now be freely moved to any position in the workspace by hand.

Jogging is when the operator uses the touch screen “jog” buttons, or Ctrl + Left Mouse Button within the web application workspace, to move the laser head. To use the jog feature, the laser head must be in the “Locked” position. To lock the laser head, push the “Lock” icon so that the icon has a closed lock icon.

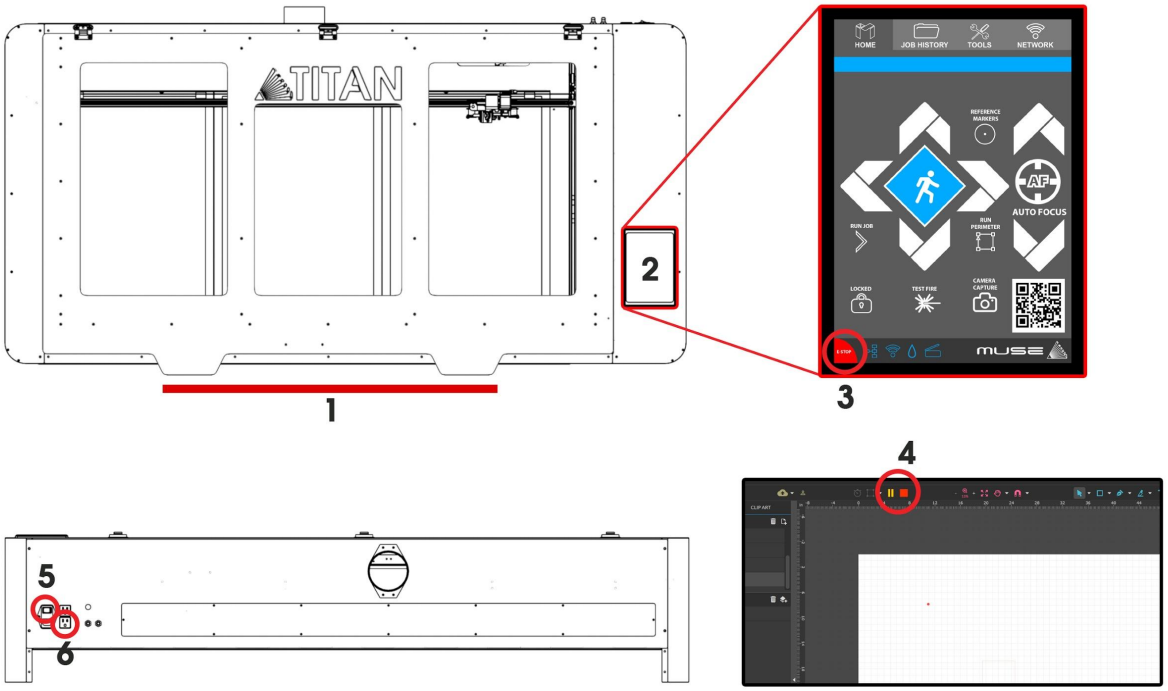
Positioning Material

Relative positioning is relative to the laser head. The red dot from the laser will be considered the top left corner of an image. This makes positioning easier without the use of the Muse Titan camera system. Absolute positioning is the default mode and will directly translate the object’s location on the computer workspace to the respective location on the laser bed. Absolute positioning is ideal when using the camera system.

You can switch from Relative Positioning to Absolute Positioning by going to Settings, within the Edit drop-down options. Click Settings > Laser. Next, choose Absolute Positioning or Relative Positioning on the slide bar across from Laser Positioning. Click Save Changes when you are done.

Stopping the Laser

Once a project has begun, the laser will continue until the project is complete. If for any reason an operator needs to stop the laser immediately, choose one of these options:



1. **Open the Lid:** The large workbed access lid is installed with a device that automatically (and instantly) cuts off the laser if it is opened even slightly. This should be your first method of stopping the laser during an emergency. This is a safety feature of Muse Titan and under no circumstances should this safe lid auto-shutoff device be tampered with or removed. Doing so will void your machine's warranty. If the machine ever fails to shut off the laser when the safety lid is open, immediately unplug the machine and contact customer service.

2. **Touch Screen Pause Button:** Top of Machine Pause Button. On the top of Muse Titan machines there is a button that can pause or stop the laser. Press once to pause the job. Press and hold to stop the job. Once a job is stopped, starting again will start the project from the beginning.

3. **E-Stop:** On the touch screen, in the lower left corner, is an "Emergency" stop button (E-Stop). Pushing this button will instantly cut power to the laser. Be aware this is still part of the touch screen and is fragile. Do not slam this button.

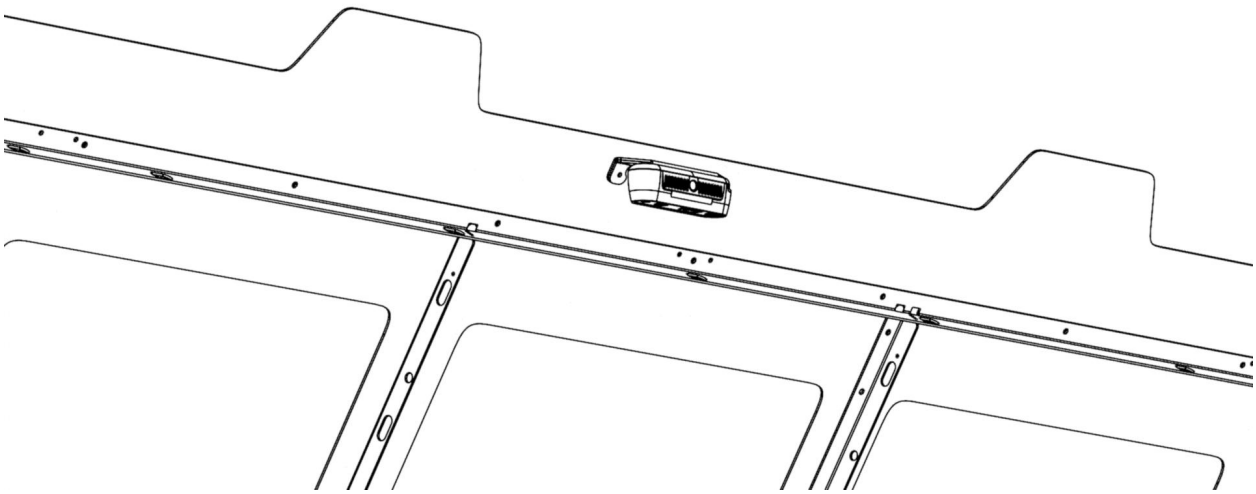
4. **Software Pause Button:** In the software, on your computer, you can click the Pause Button (converted Play button when the laser is running a job) to halt the laser. This may take a second to process,so it is not recommended as a method of stopping the laser in an emergency.

5. **Power Switch:** At the back of the machine is the power on/off switch. Flipping this switch to the off position instantly cuts power from the laser head (and the entire machine). Using this option will completely cut power from the laser, the touch screen and all other Muse Titan systems.

6. **Unplug Power:** You can also simply unplug the power cord of the main Muse Titan unit. This should be a last resort method for emergencies as the other methods are quicker to access and prevent pulling on cords and connections.

Camera

Inside your Muse Titan you will find a Intel RealSense 3D camera. This camera uses multiple cameras simultaneously to create a 3D map of your workspace to get the most accurate data for your laser projects. Saving time and money on materials with the 3D camera system is a major benefit. Also the 3D camera allows you to do cool things like our trace feature in RE3. To learn more take a look at our software section.



You will notice that the 3D camera is mounted to the lid of your Muse Titan. Not only can the camera capture your material in the workspace but also when the lid is down the camera will watch your projects as they cut.

Camera: Capture Workspace

Use the Intel Realsense 3D camera to capture your workspace to align your designs.

1. Place material in the laser bed.

2. Lift the Lid of the laser in it’s upper position.

3. Initiate Camera - Press the Camera Icon on your RE3 software, or on the LCD touch screen (for touch screen controls, see user manual) - Note that you 1) use the camera button, 2) position the head, and 3) press the camera button again (this initiates sequence with no indication on software). Follow the steps on the screen.

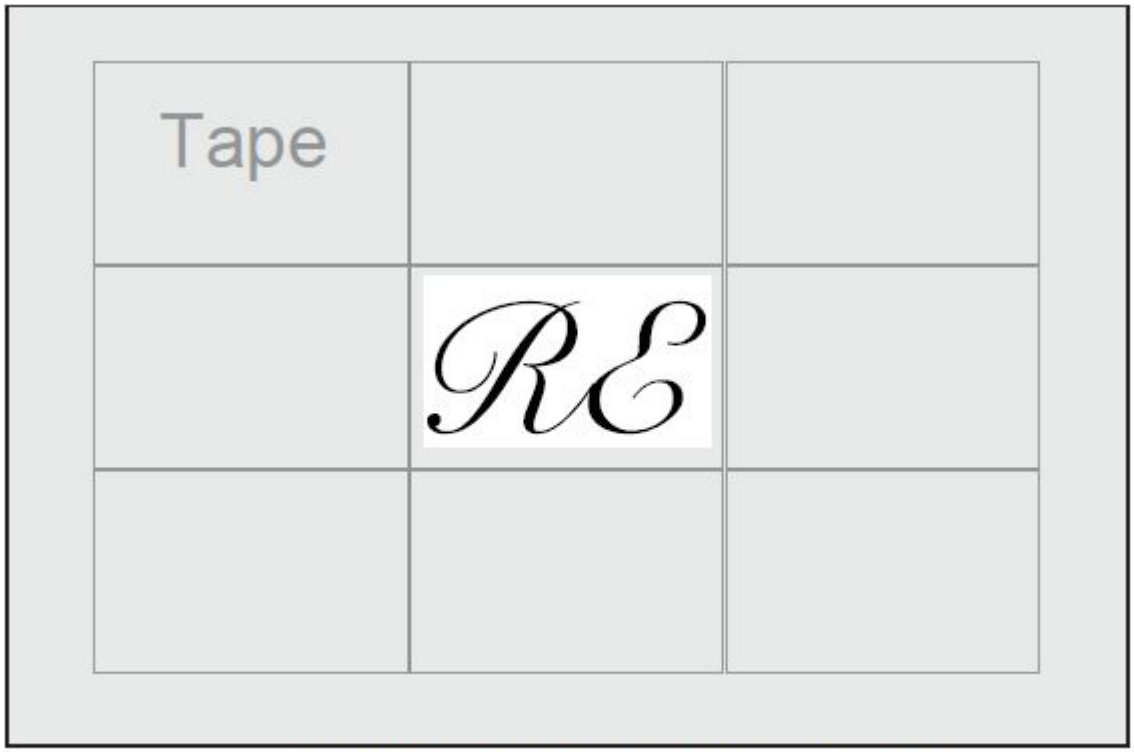
4. After 1 photo is taken, your workspace should now represent your laser bed. Position your design as needed (for help importing, see the Work-Flow Section), and adjust settings.

5. You are now ready to run your job. To double check a position on your workspace, CTRL-Click anywhere on the work space to position the laser head there.

6. Run perimeter to double check your position.

Camera: Vector Trace

Use the onboard camera to capture your workspace to align your design.



MASKING TAPE OVER WORK AREA

1. Choose and prepare your material. Flat objects work best, and we suggest you place masking tape (paper tape) on the surface before marking with a pen (sharpie). Don't allow the masking tape to overlay on the material when applying more than one strip.

2. Using a thick black marker or pen, draw on your material. Thick solid lines will be read the best. If coloring in a space, ensure the space is completely filled in.

3. Capture the workspace as shown in steps 3 & 4 in the "Capture Workspace" instructions.

4. Click on the "Vectorize" icon in the top menu bar (show with label). This will bring up a sub-menu. Using your mouse, select the section you want to vectorize and press ok. You can repeat this step as many times as you like. Place a white piece of paper behind your self-drawn design to help aid if having trouble capturing the area you want to vectorize.

5. You now have Bitmap and Vector data for your object available. They should appear in the Object Manager box. Delete data not needed. If just engraving, delete vector data, if just cutting or marking, delete bitmap data.

6. You are now ready to run your job.

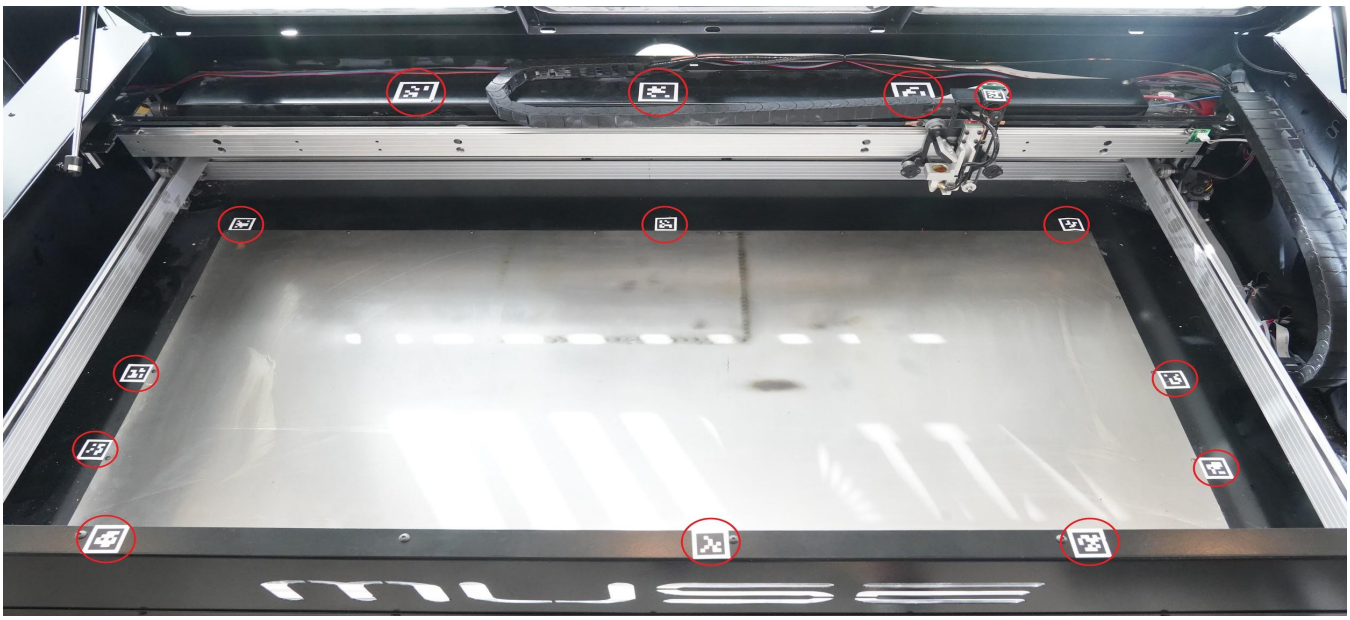
Maintaining Your Camera

Follow these simple tips to keep your camera clean and functioning at peak performance: Just like with mirrors, you will need to clean the camera lens periodically. Use lens wipes to gently clean the camera lens as needed. Just like with mirror alignment, it may occasionally be necessary to correct the camera offset if the camera is bumped or jostled. Follow the “Correcting Offset Camera Calibration” instructions below.

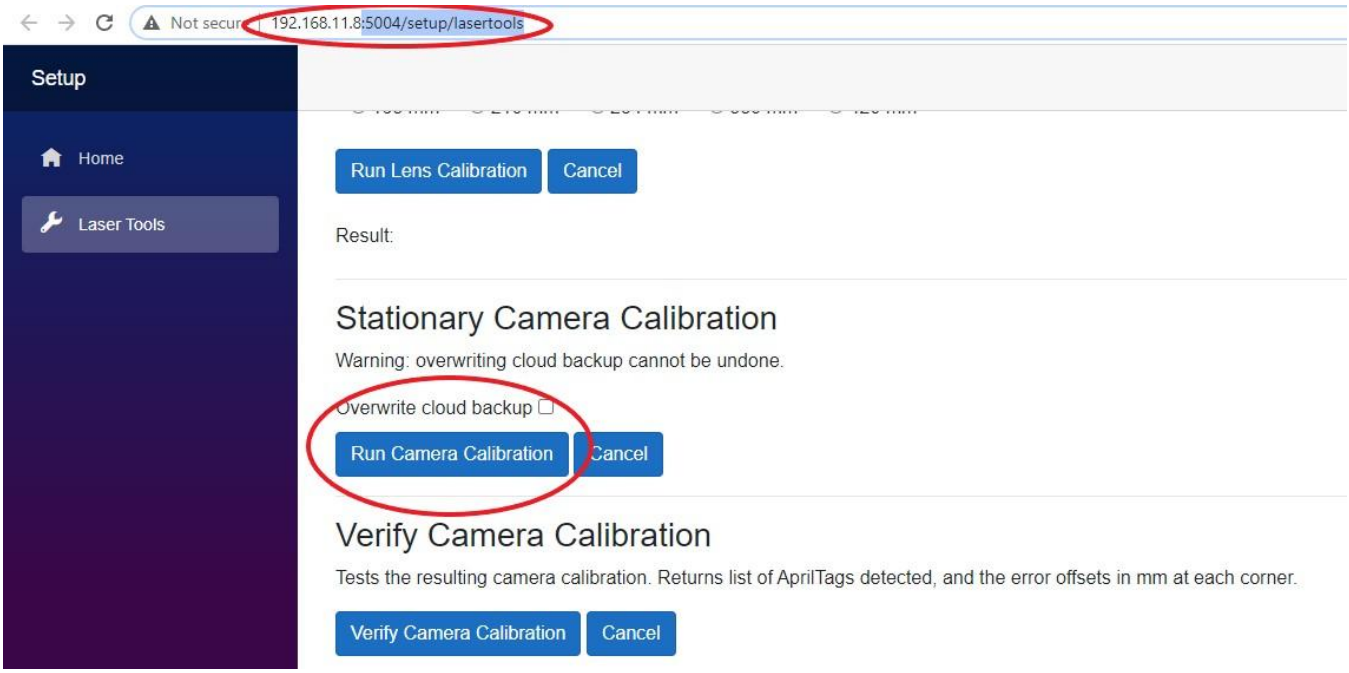
3D Camera Calibration

Muse Titan can detect the height and position of the material using the camera feature. It is possible, however, that the height and positional accuracy of the calibration can be jarred out of alignment. To check calibration, follow these instructions:

1. **Power on Machine:** Power on your Muse unit and verify all the connections.
2. **Connect :** Connect to the software via IP address.
3. **Lid:** Lift the lid to the full and upright position.
4. **April tags:** Make sure all the camera registration tags are visible.



5. **Redirect:** In your browser bar Copy and Paste :5004/setup/laser tools to the end of your IP address so it read (YOUR IP ADDRESS):5004/setup/laser tools to look like the below image.



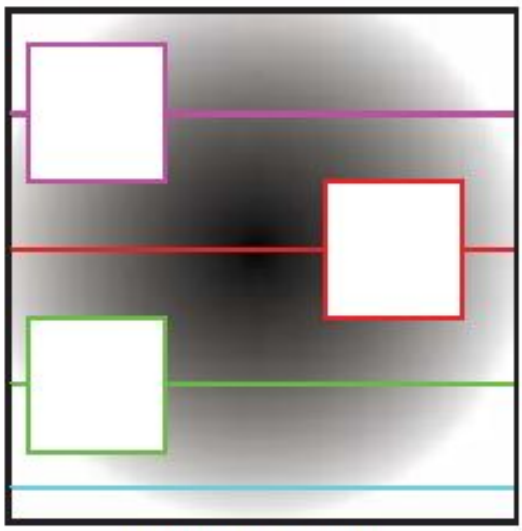
6. **Simply Click:** In this menu simply scroll down to “Run Camera Calibration” and click it. The rest of this process is automated.

7. **Close The Lid**: Once the automated process is complete you can simply close the lid and prepare your project. You will notice that the camera is active on the touchscreen when a laser job is in progress.

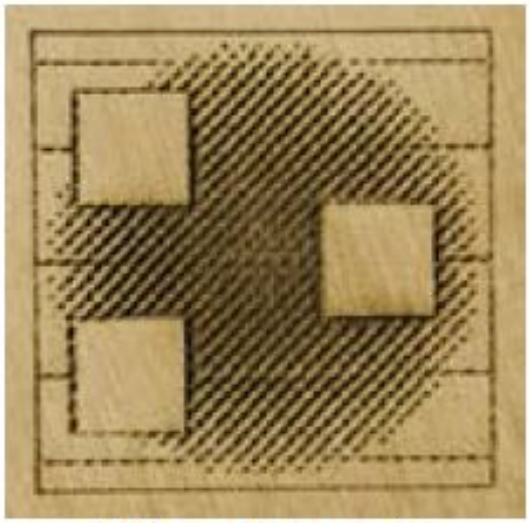
NOTICE	The lid must be open while the camera is being used to capture a workspace. Once the lid is closed you can watch your job and keep an eye out for any possible issues.

Materials Testing

Muse Titan is capable of cutting a wide range of materials. Common materials include wood, cardboard, paper, fabric, acrylic, leather, and many more. Muse Titan can also engrave on tile, stone, glass, and other hard surfaces. Muse Titan is not designed to cut metal of any type. If you have any questions whether a material is suitable for a CO2 laser, contact the material manufacturer before use.



Sample File



Dithered Example

Vector Examples from Dark to Light

Using suitable materials will still have wide variance in power, current and speed settings depending on the properties of that material, such as density and thickness. For example, wood can be soft (pine) or hard (oak), depending on the source. Settings will also be determined by vector or raster choices, depth of the cut and overall desired outcomes. This makes it difficult to provide operators with exact settings for each type of material. Instead of giving inaccurate data, operators should become accustomed to material testing.

Full Spectrum Laser provides a free materials test template with suggested starting points in power and speed settings. From there, you can experiment with your own materials testing. Once the perfect settings are determined, we recommend recording those results in a Materials Log. To access the material test templates, complete material testing instructions and a free materials log, go to http://laser101.fslaser.com/materialtest

Section VIII. Hardware & Maintenance

With a little care and maintenance, you Muse Titan Laser Cutter will remain clean and continue to run at top efficiency for years to come. Be aware of all safety and maintenance issues with your machine by following all the safety instructions in this manual.

Replacing the Laser Tube

This section provides procedures and a walkthrough to replace the laser tube on your Muse Titan. Although it should last for hundreds of projects, the laser tube is considered a consumable and will eventually need to be replaced. Please carefully read all instructions before beginning the replacement procedure as there are several critical steps which must be properly followed to avoid breaking the laser tube. The included pictures show how to properly connect wires to the tube's electrodes and secure the connections.

Required Parts and Tools

- 75W/90W/100W Replacement Tube
- 2.5 mm Hex Wrench

	The capacitors in the power supply retain power even after turning the laser off. To ensure your safety, turn off the laser, remove the power cord and wait at least 1 hour before accessing the power supply.

	The Laser Tube Glass is fragile. Pulling on the tube wires will break your laser tube at the neck. The water connections are very fragile. Do not pull or force the connection tubes— gently work the tubes off of the connectors

Installing the CO2 Laser Tube

CAUTION 	If replacing the tube, unplug the machine and let rest for one hour for capacitors to discharge to avoid electrocution.
	Handle CO2 tube with care, glass is fragile and can cause lacerations if mishandled.

CO2 Laser Tube Replacement

1. **Power Off Machine:** Power off and unplug your unit. Wait at least 1 hour for capacitors to discharge.

2. **Disconnect Water:** Detach the water tubes from their connectors on the laser tube and drain the water into a bucket.

3. **Remove Water Tubes (Step One):** Remove the two (2) water tubes from the bulkheads on the back of the machine and carefully drain any water into a bucket. Use the small piece of tubing that shipped with your laser to shunt the two water bulkheads in the back of the machine together.

4. **Remove Water Tubes (Step Two):** Gently remove the water tubes from the laser glass bulkhead. Be careful not to let any excess water in the tubes spill onto the machine's components.

5. **Remove Metal Gantry Strap:** Using a 2.5mm hex wrench (included with your purchase),remove the Two (2) M4 bolts From the metal strap that wraps around the tube.

6. **Fold Down Gantry Tube Strap:** Carefully push the metal gantry strap panel downwards to gain access to the tube. * Note * - This panel is made to bend so don't be afraid to bend it out of the way; But do not bend too much as the hinge will fail if continued to be folded open multiple times.

7. **Remove Universal Laser Pin Connector:** Carefully unscrew the universal laser pin connector off the aperture end of the laser tube. Next unclip the connector on the other side of the laser tube.

8. **Remove The Four Gantry Mounts:** The last step in your laser tube removal will be the four bolts located on the front side of your gantry behind the belts. .

9. **Tube Disposal:** The old tube can simply be disposed of via a trash can. It is important to know nothing about the old tube is dangerous itself besides the glass.

10. Simply reverse these steps to install your new laser tube.

NOTICE	Now that you have switched the old laser tube for the new laser tube. You will need to retest the mirror alignment and possibly go through the mirror alignment procedure again.

Belt Installation

The belts on your laser system are a consumable item and will eventually stretch beyond a usable length or break. You can contact Full Spectrum Laser support for replacements.

	The capacitors in the power supply retain power even after turning the laser off. To ensure your safety, turn off the laser, remove the power cord and wait at least 1 hour before accessing the power supply.
	You will be disconnecting the water system and working with the laser upside down. Be sure the machine is dry before proceeding with this process..

Required Parts and Tools

- 2.5mm Hex key (included with accessories)

Belt Installation Instructions

1. **Power Off Machine:** Power off and unplug your unit. Wait at least 1 hour for capacitors to discharge.

2. **Loosen Retaining Screws:** Loosen or remove the M3 retaining screws and washers so that the old belt can be removed and discarded.

3. **Mount Belt:** Run each end of the new belt through the mounting slot with the teeth on the inside of the closed loop. The ends of the belt should protrude by approximately 3 teeth (6mm) through the slot. Make sure that the belt forms a flat, closed loop.

4. **Tighten Retaining Screws:** Tighten the M3 retaining screws to secure and retain the belt.Starting the thread with your fingers can speed the process up.

5. **Loosen the motor on the mount:** Once the belt has been installed on the rail, loop over the drive and pull motor to tighten the belt then re-tighten the bolts.

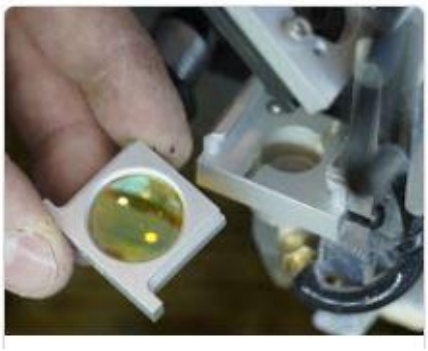
6. **Tension the belt:** Pull on the motor on the mount with your hand. Moderate to strong force is recommended, then re-tighten the bolts. If the motors do not jog, verify that the motors are connected to the control card.

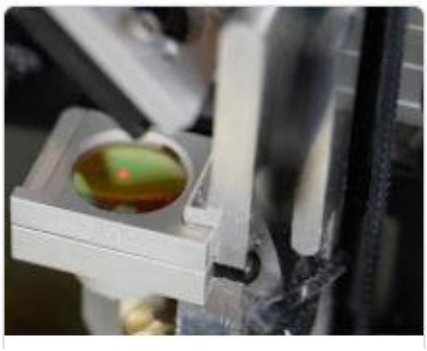
Focus Lens Replacement Instructions

Parts: Air Assist Cone (A) - Fitting O-Ring (B) - Air Assist Fitting (C) -Focus Lens w/ Case (E)

(These instructions are for replacing different sized lenses; If you are simply replacing a lens that has become damaged or broken you will simply slide the new lens in where the old one was)

1. **Disconnect the air hose by gently pulling it.**
2. **Using a 1.5 hex wrench (not included), loosen the "set" screw, but do not remove.**
3. **Remove the current air assist cone.**
4. **Place the fitting O-ring on the air assist fitting and attach to a new air assist cone.**
5. **Place the new air assist cone under the focus lens and into the slot.** Tighten "set" screw with a 1.5hex wrench. Reattach air hose.
6. **Slide the current focus lens out of the slot.** This does not require tools.
7. **Slide the new lens into the slot.**





See "Appendix B" for information regarding different types of lens FSL supplies

NOTICE	The Focus Lens will need, at minimum, weekly cleaning, depending on usage and types of materials used. Only use optical grade lens wipes and gently wipe the surface of the lens clean. Save the case the lens came for storage when switching to a different lens. With any lens, always use the correct focus billet and air assist cone.

General Maintenance

Maintenance on the Muse Titan is extremely important to maintain optimal output. Please follow the directions below to keep a clean machine for best results.

Before starting a job:

Make sure the lens and optics are all clean and clear of debris; Microfiber cloth or lens wipes are the only recommended options for cleaning lenses as any other option can cause micro scratches in your optics. We suggest Zeiss lens wipes.

Check your gantry rails for any debris. If any particles are present from cutting material you can simply wipe them clean with a rag. If you find that a piece of debris fell into your gantry rails then it is suggested to remove your belt to remove the debris as it can cause wobbles in 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.
Never cut any material containing PVC.

Daily

- Always be sure your water, air, exhaust, and power systems are properly assembled and operating normally.
- Be sure that the machine and workspace are clutter-free.
- Be aware of any material warnings and that you are working in a well-ventilated workspace.
- Check that your fire extinguisher is up to regulation and is 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 bottom of the machine. Less excess material will reduce fire risk, and provide for better exhausting.
- Always keep rails, motors and moving parts free from excess material as it can obscure movement and cause damage.

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). Quarterly
- 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 and need replacement. If you find that the belts have become loose over time you can add tension by loosening the motor, adding tension, and retightening the bolts.

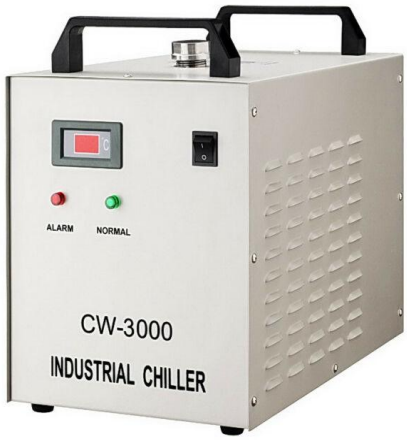
Appendix A. Chiller

Unboxing

Carefully remove the items from the box as directed.

1. **Remove From Package:** You will see the chiller and all needed accessories.

2. **Remove Right Packaging Box:** Remove the chiller and check that all the following parts are included: silicone tubing (2) and AC Power Cable (1).



Typically the Muse Titan is shipped with a CW3000. If you live in a hot climate it is suggested to get the CW5000. If you live in a cold climate we suggest adding Dowfrost to your chiller to prevent tube breakage.

Parts Checklist

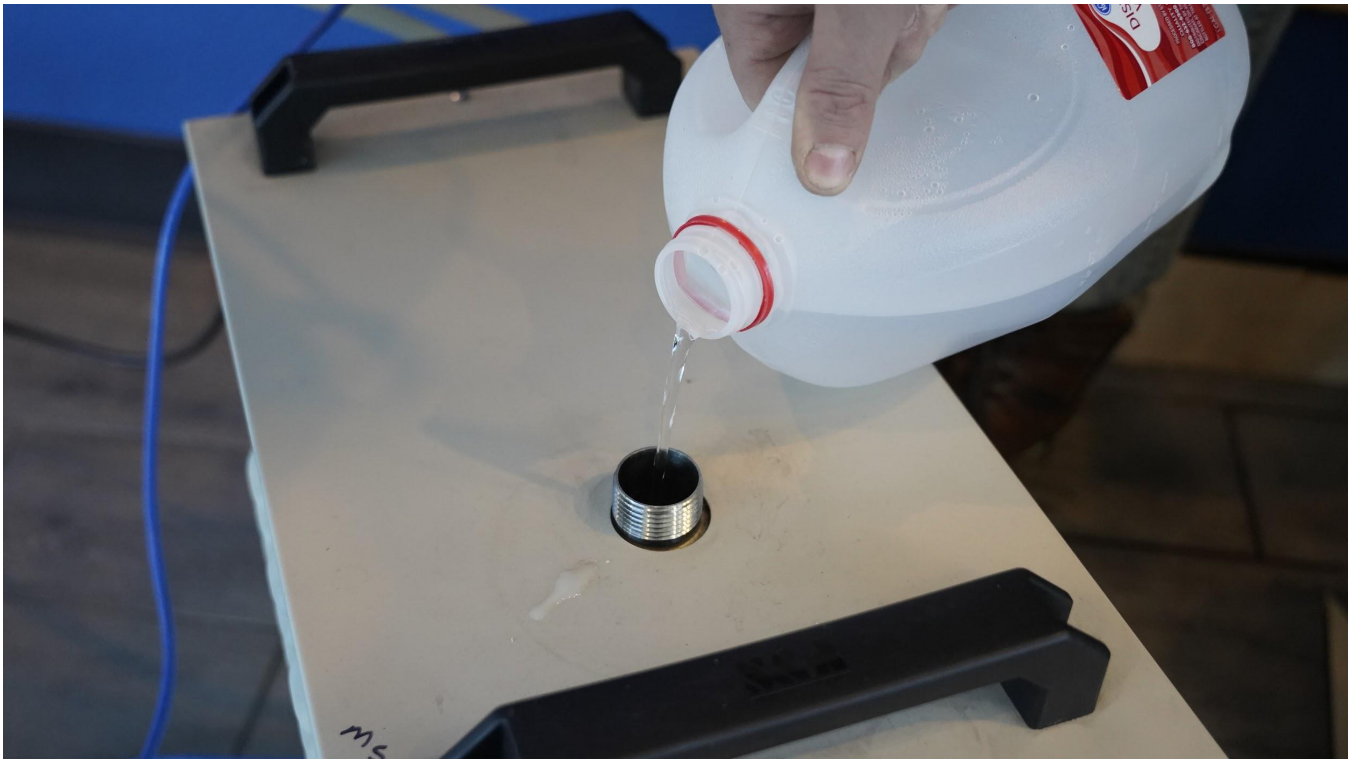
Chiller Unit (1)	
Silicone tubing (2)	
Power Cord (1)	
Signal Port (1) (not needed for Titan)	

Chiller Installation Steps

1. **Safety First:** Before starting this procedure, turn off your Muse Titan and unplug it from all power sources. We recommend to wait at least 20 minutes to ensure no residual electricity remains.

2. **SIlicone tubing (Chiller):** Connect both silicone tubes provided to your chiller.

3. **Silicone tubing (Muse Titan):** Connect the silicone tube going from the inlet of the chiller to the outlet of the laser and vice versa.



4. **Water:** Now that your lines are connected you can fill your chiller with distilled water. (only distilled water!)

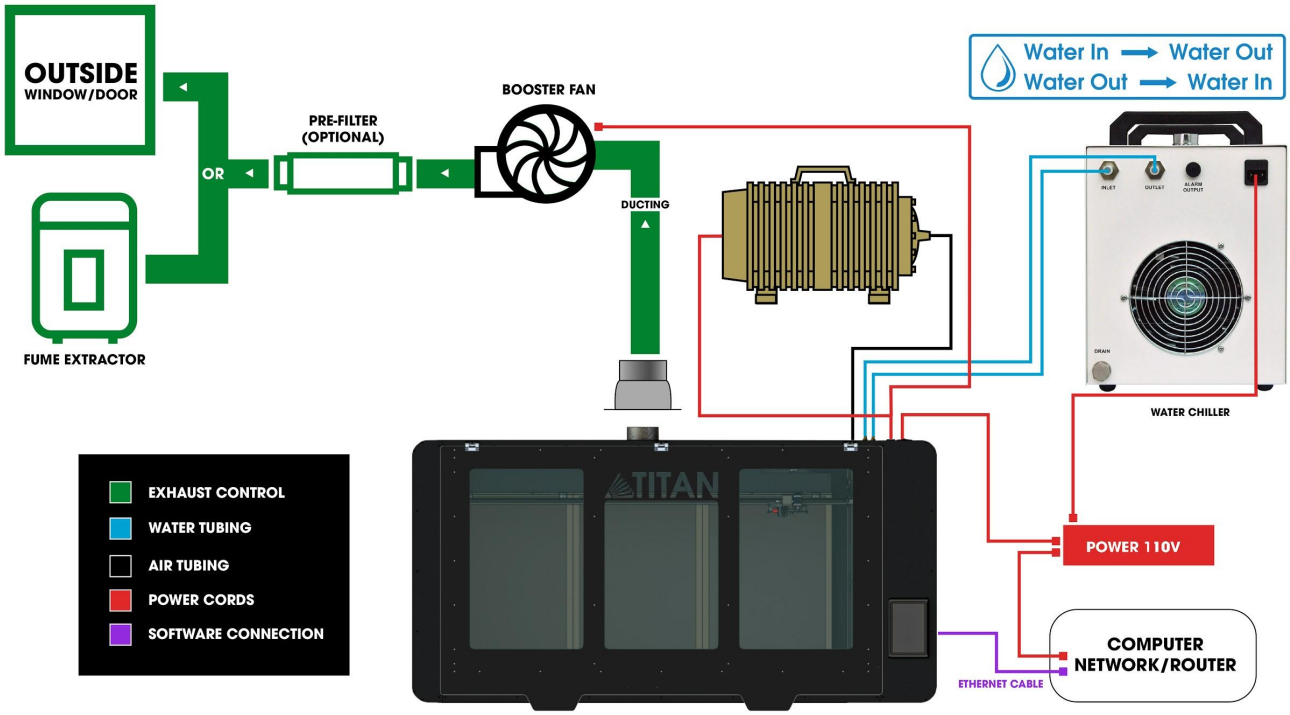
5. **Power:** Now you can connect the power cord to your chiller.

NOTICE	Make sure that the In tube of the chiller is going to the output on the laser itself and vice-versa. If installed incorrectly the laser will not fire.

Using Your Chiller

1. **Add Distilled Water:** Unscrew water cap. Fill the tank with distilled water (approx. 2.1 gallons). Put cap back on and tighten.

2. **Power On chiller:** Water will continuously run through the tube when powered on.

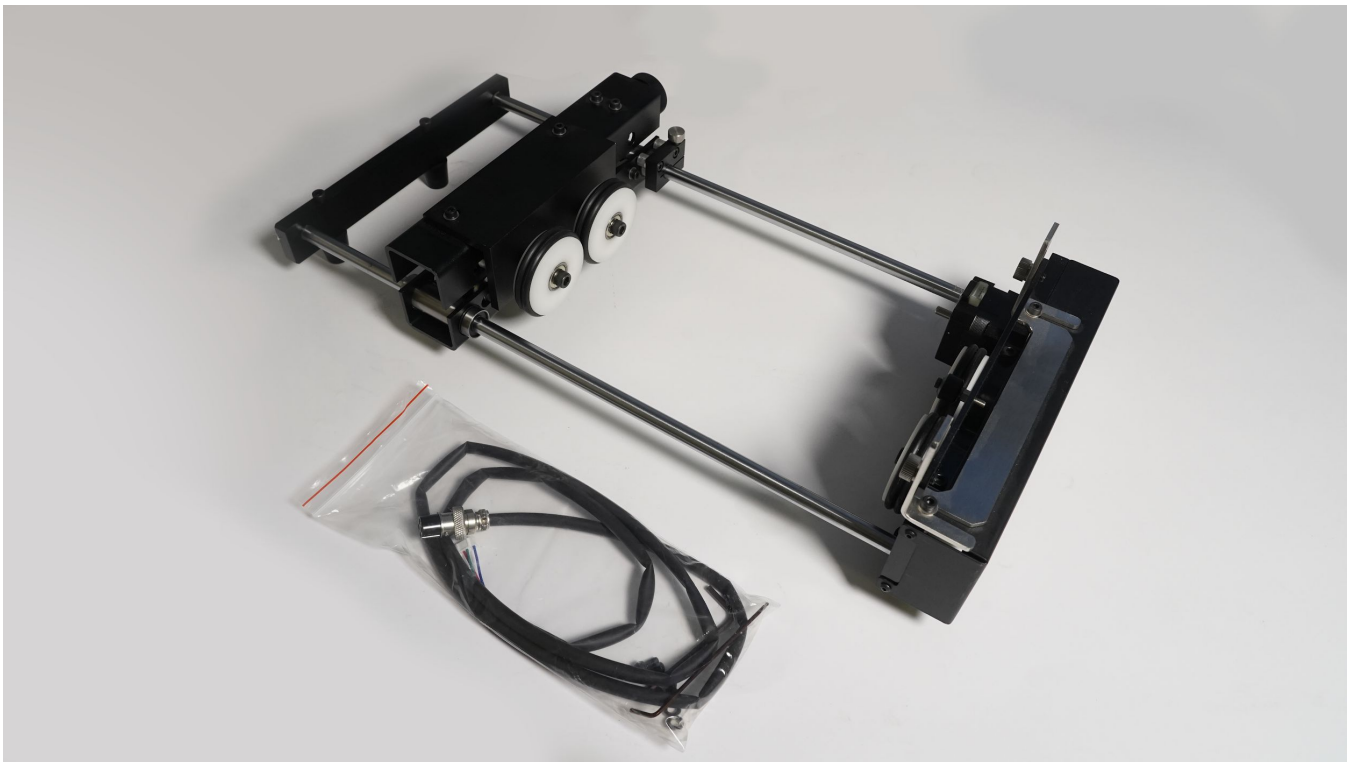


Appendix B. Rotary Attachment

The Full Spectrum Laser Hobby Advanced Rotary Attachment is an accessory to the Muse Titan and is not included with the base purchase. The rotary attachment is capable of engraving on objects from 0.25in diameter. You can order the rotary attachment from the Full Spectrum Laser website at: https://fslaser.com/laser-accessories/

The rotary attachment is a friction-wheel type - objects rest on two driven and two idling wheels and are turned to engrave an image onto the surface of a cylindrical object. The rotary attachment works by translating Y motion along a cylindrical surface.

Rotary Attachment Installation Steps

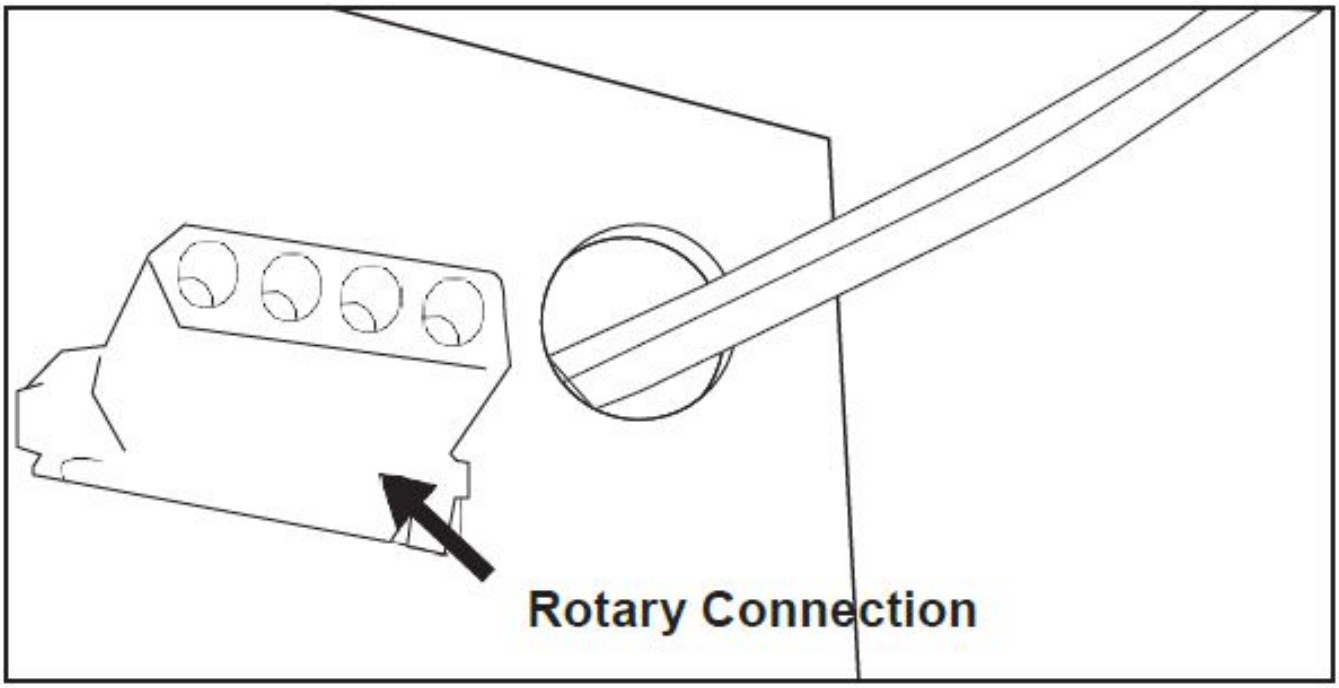


1. **Power Off Machine:** Power off and unplug your unit. Wait at least 1 hour for capacitors to discharge.

2. **Position Rotary:** Place the rotary attachment into your laser's work area.

3. **Connect Rotary:** Find the rotary connector inside the machine under the LCD display. Connect the rotary attachment motor keeping the same orientation as in the diagram below.

4. **Switch to Rotary Mode in Software:** The final step is to inform the software you are using the rotary. To do this, Click the Edit button, then click Settings. This will bring up the Settings menus. Click make the bar blue. Next, below Rotary Mode, there is a bar for Laser Positioning. The rotary requires this to Relative Positioning. Finally, click Save Changes at the bottom of the screen. The rotary is now ready for use.



NOTICE	Once you have connected your rotary attachment, you can activate your laser and move the rotary attachment and laser head into a position to engrave on your workpiece. The red dot should be in the same vertical (X-Z) plane as the center axis of the workpiece.

The rotary attachment is designed to be used within the laser case, however its maximum engraving diameter can be increased by modifying your laser system's bottom panel. Please be aware that any system modifications must be performed by an authorized technician and in accordance with all applicable state and federal laws.

Aligning Your Rotary Attachment

The best way to align your rotary attachment with the laser head is to build a jig that uses the frame as a reference. This is a very quick process.

1. **Starting Position:** Focus the laser head onto the rear frame of the rotary attachment on the far left when facing the machine from the front.
2. **Slide:** With the red dot visible, slowly slide the laser head to the right.
3. **Align:** Adjust the positioning of the rotary until the red dot tracks back and forth evenly down the center. Note that the rotary is not assembled to the body of the machine but is free standing. You may need to re-align your rotary each time you use it.

NOTICE	Rotary engraving is best performed along the topmost area of the project. It is crucial that the rotary be level. Use a small carpenter's level to be sure your rotary is flat within the interior of the laser cutter.

If you want to watch a video on how to assemble you rotary please watch this video:

https://www.youtube.com/watch?v=SiqkkhF-BgA

Appendix C. Focus Lenses

There are a variety of lenses available for your Muse Titan, each specializing in a different cutting thickness or level of engraving detail. The lenses are listed by “inches” v which is not an indication of the lenses’ physical size, but rather the focus distance from the material. See below for the recommended lens for different needs. You can order new or replacement lenses at https://fslaser.com/laser-accessories/

2.5” Focus Lens
Full Spectrum Laser’s Pro-Series comes standard with a 2.5” lens which is good for cutting up to 1/2 of material and engraving detail to around 8pt fonts with a 90w tube, yet can be beneficial for desktop lasers if you want to cut up to half inch material. (please note that cutting dense ½ inch material will take multiple passes with a 40-45 watt system.

2” Focus Lens (default Muse Titan lens)
If you are requiring finer engraving and thinner cutting, such as fonts below 8pts, we recommend the 2” lens. The 2” lens has a good combination of fine engraving and thin cutting. A short focus lens has a smaller minimum spot size but spreads out more quickly after reaching the focus making them better for fine detail but not good for thick cutting. A long focus lens keeps the focus longer allowing for straighter edges but does not focus down to as small a minimum spot.

1.5” Focus Lens
If you are requiring extra fine engraving such as fonts below 6pts, we recommend the 1.5” lens. This is a short focus lens that has a smaller minimum spot size but spreads out more quickly after reaching the focus making them better for fine detail but not good for thick cutting.

5” Focus Lens
This optic is appropriate for cutting thick foam. The 5” lens has a large spot size, when focused, which prevents it from being ideal for cutting wood and acrylic. It is also a good lens for engraving into deep bowls, where you need more working space.

If you want to watch a video on lenses please watch this video:

https://www.youtube.com/watch?v=oie4lQPaJNc

Appendix D. Warranty

Within the first 30 days, Full Spectrum Laser will replace or repair any defective parts free of charge and pay for ground shipping of parts. Overnight shipping is available at extra charge.

Outside the first 30 days, 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. The warranty includes parts and labor only. Shipping of defective and replacement components is excluded by the warranty. The customer may arrange their own shipping or drop parts off to exchange parts at our warehouse free of charge. Typically, Full Spectrum Laser has most replacement parts on hand for immediate shipment of under warranty parts.

All defective parts must be returned to Full Spectrum Laser postage paid for evaluation before replacements are issued unless otherwise authorized. The warranty is valid for normal use only and excludes Acts of God, user error and use outside of normal parameters. Parts damaged by fires are considered user error if the machine is left unattended. Just like operating a household gas stove, always stand next to the machine with a fire extinguisher and be ready to turn it off in case of a fire and never operate the machine unattended.

Prior to 8/7/2012, the extended warranty was charged separately and the Desktop Lasers had a 60-day base warranty on all items excluding shipping unless an extended warranty was purchased.

After 8/7/2012, the desktop lasers have a 60-day warranty on all items and a free extended limited 1- year warranty which excludes consumable items/shipping included in their price. The limited warranty excludes shipping and consumables and other normal wear and tear 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. Within the first 30 days the original purchaser may transfer the balance of your warranty to anyone else free of charge provided you notify us in writing. Outside of the first 30 days, we will only provide warranty and tech support services to the original purchaser unless a warranty transfer fee is paid as there is a cost involved with initial tech support of new users and accounting fees. If you sell your machine, the warranty remains valid but the buyer must arrange with the original purchaser to request RMAs and send in the machine for repairs unless a warranty transfer fee is paid.

Please Note: Full Spectrum Laser DOES NOT offer warranties or customer support for 3rd Party replacement parts, including replacement laser tubes. Use of such parts 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.

Appendix E. Customer Support

Full Spectrum Laser provides the best customer support in the industry. Contact us if you have any questions or issues with your Muse Titan Laser Cutter. We can also offer convenient purchasing of accessory upgrades and replacement of consumable items. Refer to this sheet for all your customer support and reordering needs.

PLEASE CONTACT OUR TEAM:

SUPPORT

M-F 8am to 5pm (PMT)
support@fslaser.com
702.802.3103

MANUALS

For a PDF of the user manual, warranty & video tutorials:
fslaser.com/support

SALES

M-F 8am to 5pm (PMT)
sales@fslaser.com
702.802.3101

SOFTWARE

Access RetinaEngrave v3.0 by typing IP address displayed on the touch screen into your browser

ORDER ACCESSORIES & UPGRADES

LASER TUBES

45W Laser Tube

ROTARY ATTACHMENTS

Friction Rotary

FOCUS LENSES

1.5" Lens, 2" Lens, 2.5" Lens, 5" Lens

WATER ASSIST

Water Chiller, Advanced Water Chiller

EXTRACTORS & FILTERS

Large Fume Extractor
Large Filter Replacements

Small Fume Extractor
Small Filter Replacements

AIR ASSIST

Air Compressor, Exhaust Fan, Large Exhaust Fan

COOLBOX

Combines water assist, air assist & exhaust into one system

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 love being part of the hobby maker culture and the industry we work in. You can follow us to see what is new at FSL, and learn about the latest updates, projects, and more. Best of all, we offer countless FREE projects for you to make on your new laser. Join our community and see what all the excitement is about.