

MUSE TITAN

USER MANUAL



Full Spectrum

LASER

Table of Contents

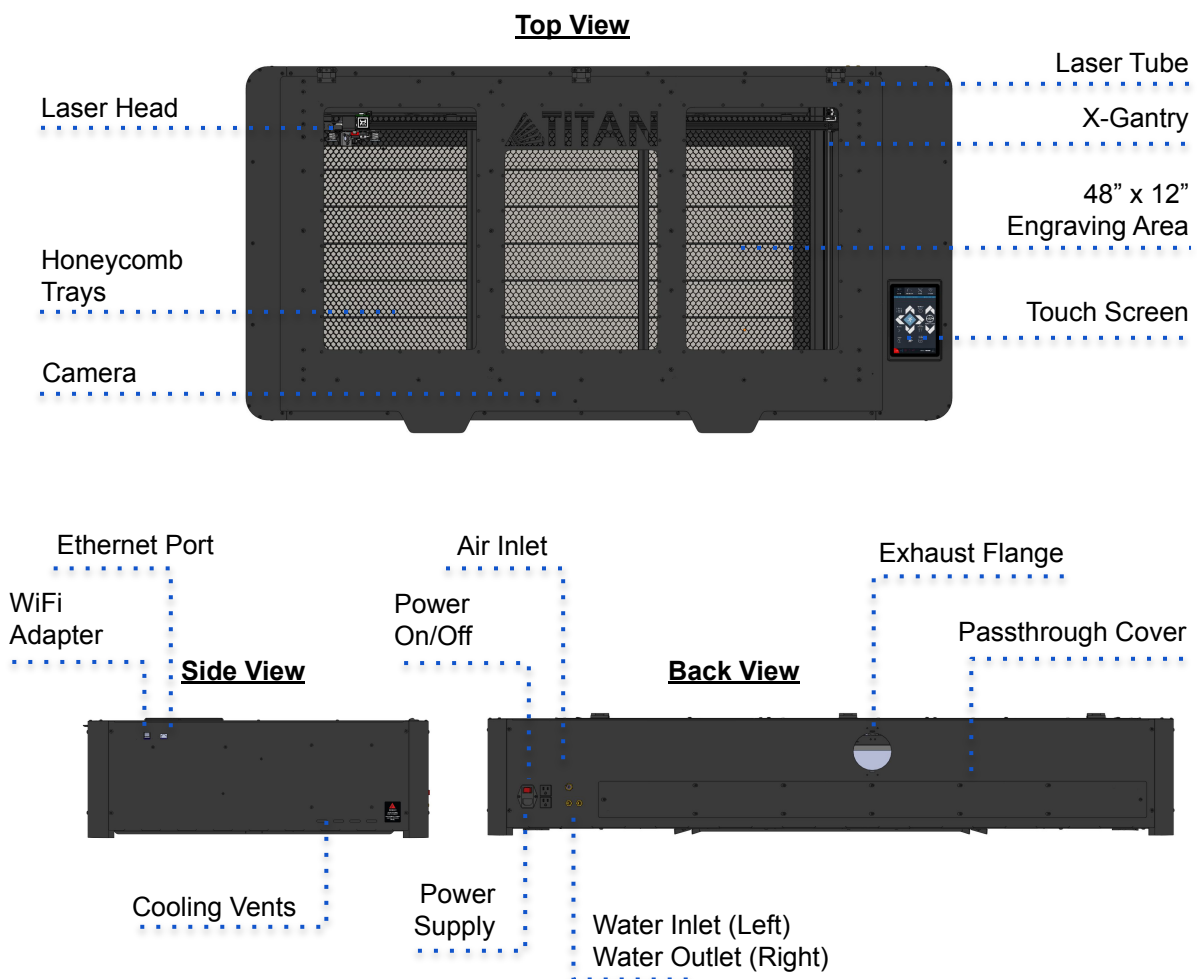
Full Spectrum Laser Muse Titan	2		
Symbols and Definition	3		
Section I. Safety	4		
Setup Precautions	4	Section VII. Operations	36
Safety During Operation	5	General Function	38
Fire Safety	6	Project Workflow	37
Electrical Safety	7		
Materials	8	Section VIII. RetinaEngrave v3.0 Software	40
		Starting on RE3	40
Section II. Unboxing Your Muse Titan	10	Stopping Your Laser	42
Unboxing Steps	10	Camera	43
Checklist	11	Maintaining Camera	44
		Vector Tracing	46
Section III. Installation & Assembly	12	Section IX. Hardware & Maintenance	47
Assembly Stage	12	Replacing the Laser Tube	47
Locate & Remove Zip Ties	13	Belt Installation	49
Connect the Exhaust System	14	Focus Lens and Air Assist Cone	50
Assemble the Water System	16	Replacement Instructions	
Connect the Air Compressor	18	General Maintenance	51
Connect the Electrical Power	19		
Pass-through	20	Free Projects & Extra-Help	52
Section IV. Connectivity	21	Warranty	53
Connect the Ethernet Cable	21		
Connect to Software	22	Customer Support	54
Section V. Tests & Adjustments	23	Join The Full Spectrum Laser Community	56
Alignment Test	23		
Mirror Alignment Procedure	25		
Autofocus Properties	31		
Section VI. Touchscreen Interface	32		
Touchscreen Interface	32		
Safety Override: Lid &	34		
Waterflow Failsafe			
Lock/Unlock Screen Indicators	35		

The Muse Titan By Full Spectrum Laser

Thank you for purchasing your new Muse 3D. Our high quality products will provide years of service simply by following proper usage and upkeep. With proper usage and upkeep your machine will be a key part in any design work.

This user manual will guide you through the safety guidelines and operation of your machine. We recommend that you familiarize yourself with this manual before using your laser engraver. Remember to be safe and have fun!

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



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

Symbols and Definitions

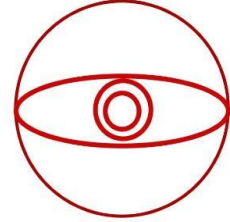
Red icons indicate dangerous situations that could result in serious injury or death.



This symbol indicates a hazardous situation.



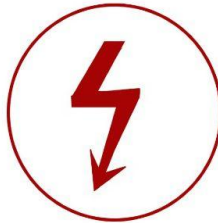
This symbol indicates the risk of fire.



This symbol indicates the risk of potential eye injury.



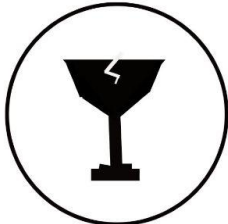
This symbol indicates a respiratory hazard.



This symbol indicates an electrical hazard.



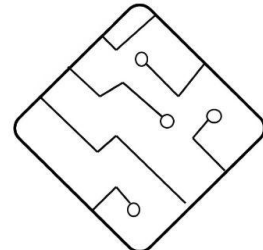
This symbol indicates the risk of getting cut by a sharp object.



This symbol warns of fragile parts.



This symbol calls attention to important details.



This symbol warns of network or software issues.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

Section I. Safety

Setup Precautions

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



WARNING!

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




WARNING

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

Safety During Operation

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


Follow these Safety Guidelines at all times:



WARNING!

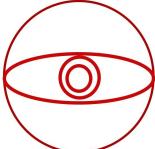
- **Never engrave or cut any material containing PVC or vinyl under any circumstance. These materials (along with other chlorine/ chloride-containing materials) produce a highly toxic, corrosive vapor that is lethal to humans and will destroy your machine.** Your warranty will be void if your machine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

CAUTION!



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

CAUTION!



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

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

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

CAUTION!



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

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

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

Never run a laser with the lid open.

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

Woodshop Dust Fire Safety Considerations

*Guidelines from the U.S. Department of Labor

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

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

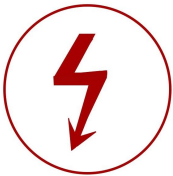
Dust collection is best accomplished at the source, where the equipment is used. For many pieces of equipment, well-designed ducts and vacuum hoods can collect most of the dust generated before it even reaches the operator. Fine dust that manages to escape point-of-source collection can be captured from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

Electrical Safety

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

Note: When performing any replacement procedures, make sure the machine is off for at least an hour.

CAUTION!



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

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

HARMFUL MATERIALS:

WARNING!! TRYING TO CUT THESE ITEMS WILL VOID WARRANTY!!

CUT AT YOUR OWN RISK!

Material	DANGER!	Issues
PVC (Poly Vinyl Chloride)/Vinyl/Pleather/Most Artificial Leather	Emits Chlorine gas fumes	This material can ruin the optics as well as cause the metal of the machine to corrode. The chlorine can also ruin the motor system.
Thick (>1mm) Polycarbonate/Lexan	Catches fire	Often found as flat, sheet material and is even in the window of the laser cutter because <i>polycarbonate strongly absorbs infrared radiation!</i> Polycarbonate cannot be cut with the frequency used in laser engravers. Trying to will creates clouds of soot that float up, ruin the optics and mess up the machine.
ABS plastic	Melts, Emits Cyanide fumes	ABS tends to melt rather than vaporize, which is what is needed for laser cutting. This causes higher fire risks and melted deposits in the workspace. It can also release lethal amounts of hydrogen cyanide.
HDPE/Milk Bottle Plastic	Catches fire and melts	HDPE can melt or catch fire rather than vaporize, leaving deposits and causing risk of fire.
PolyStyrene Foam	Catches fire	This material can ignite quickly and spread flames rapidly.
PolyPropylene Foam	Catches fire	This material can ignite quickly and spread flames rapidly.
Epoxy	Burn or Smoke	Epoxy is a resin made out of carbon. Therefore, a CO2 laser can't cut it. Attempting to do so will result in toxic fumes, such as cyanide.
Fiberglass	Emits fumes	It is made of glass and epoxy. Do not attempt.(Refer to epoxy)
Coated Carbon Fiber	Emits noxious fumes	Cannot be cut and will emit toxic fumes.(Refer epoxy)
Any food	Toxicity	Our machines are not designed to be used with food items as they possess no safe food contact surfaces. There are also risks involved with debris in the workspace polluting any foodstuffs placed in the interior. Do not put food in or around the machine.
Material with Sticky Glue Backing	Coats lens or cracks lens	Items that can normally be cut become uncuttable when the manufacturer adds a layer of peel-off glue on the bottom to attach them to surfaces. The glue will vaporize forming a coating on the lens that will coat, cloud, heat, and potentially crack the lens. It can't be removed without damaging to the lens, requiring a lens replacement. Examples include cork tiles, thin wood laminate, acrylic tiles, and paper stickers. <u>DO NOT CUT MATERIALS THAT HAVE THIS BACKING!</u>

Safe Materials:

Even materials considered safe to use with our machines can have risks. Provided below is a list of safe materials, any cautions, and the maximum thickness the Muse Titan can cut.

Material	Max Thickness	Caution
Many woods	1/4"	Oily or resinous woods may cause fire
Plywood/Composite woods	1/4"	Wood with glue on it may not cut as well.
MDF/Engineered woods	1/4"	May experience a higher amount of charring when cut.
Paper, card stock	thin	Cuts very well and very quickly but at risk of fire.
Cardboard, carton	thicker	Cuts well but may catch fire.
Cork	1/8"	Thin cork can be cut, but quality will depend on the thickness and quality of the cork. Engineered cork has a lot of glue in it, and may not cut as well.
Acrylic/Lucite/Plexiglas/PMMA	1/2"	Cuts extremely well leaving a beautifully polished edge.
Thin Polycarbonate Sheeting (<1mm)	<1mm	Can be cut in very small pieces(0.5mm and less), but tends to discolor badly.
Delrin (POM)	thin	It has a number of strengths available and the higher strengths tend to work better.
Kapton tape (Polyimide)	1/16"	Only use in thin sheets and strips like tape.
Mylar	1/16"	Thin pieces only, thicker mylar has a tendency to warp, bubble, and curl. Gold coated will not cut.
Solid Styrene	1/16"	Can be cut in thin pieces. Releases smoke.
Depron foam	1/4"	Used a lot for hobbies, RC aircraft, architectural models, and toys. 1/4" cuts nicely, with a smooth edge. Cutting requires constant monitoring.
Gator foam		Foam core gets burned and eaten away compared to the top and bottom hard paper shell. Cutting requires constant monitoring.
Cloth/felt/hemp/cotton		Cloth can be cut as long as it's not plastic coated or impregnable
Leather/Suede	1/8"	Only real leather less than 1/8" can be cut. Imitations are made of PVC and can be hazardous.
Magnetic Sheet		Cuts beautifully
Rubber		Fine for cutting as long as there is not chlorine in it. WARNING! CHECK RUBBER TO MAKE SURE THERE IS NO CHLORINE!
Teflon (PTFE)	thin	Cuts OK in thin sheets.
Carbon fiber mats/weave that has not had epoxy applied		Can only be cut at very slow speeds. CANNOT BE COATED!
Coroplast ('corrugated plastic')	1/4"	Difficult because of the vertical strips. Three passes at 80% power, 7% speed, and it will be slightly connected still at the bottom from the vertical strips.

Section II. Unboxing Your Muse Titan

WARNING!!

The Muse Titan is over 150lbs. At least two people are required to lift and unbox the machine. DO NOT TRY TO LIFT ALONE!!

Unboxing Steps

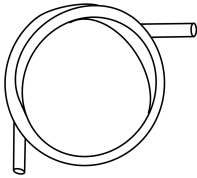
Follow these instructions for best results:

- 1. Prepare Work Space:** You will need an open, level work space to place your laser cutter. A sturdy table with room for the machine(66" x 34" x 12") is recommended. Be sure the table is free of clutter and can support a minimum of 300lbs (the machine itself weighs 176 lbs).
- 2. Place Box:** Due to weight set the box as close to the work area as possible. Open the box carefully by removing the metal tabs on top. The sides of the box can be removed as well for easier access. Remember to use tools only as specified by the manufacturer. Personal protective equipment is recommended.
- 3. Remove Packaging:** Remove the box of honeycombs and the Quick Start Guide. Then carefully remove the top foam pieces securing the machine.
- 4. Removing Your Muse: WARNING!!DO NOT LIFT ALONE!** The machine weighs more than 150 lbs, as a result, lifting straps are provided. You and your lifting partner should standing on both ends and carefully lift the machine out of the box, leaving the bottom foam layer inside.Place on the clean, work area you planned for use.
- 5. Inspect Your Muse Titan:** If you have any questions, contact your sales representative or technical support. Refer to your Muse Titan Quick Start Guide or download the Muse Titan User Manual for assembly instructions.
- 6. Accessory Box:** A separate box should contain the following parts and accessories: a plastic bag with cords and small accessories, a water chiller, an air compressor, and an exhaust fan. Inspect these parts to ensure they are accounted for and intact.

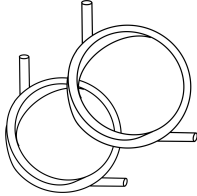
Parts & Accessories Checklist

Checklist

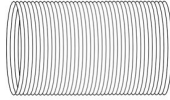
Your laser should come with the following included parts and accessories:



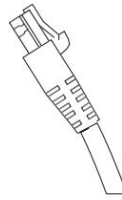
3' Air Line



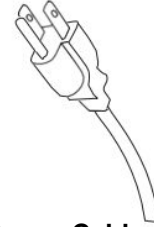
3' Water Line
(QTY:2)



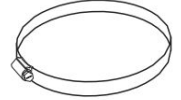
4' Ducting (10')



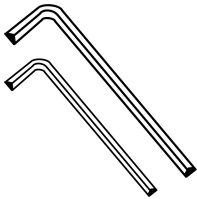
Ethernet Cable



Power Cable



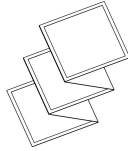
4' Duct
Clamp
(QTY: 2)



2.0mm Hex
Key
2.5mm Hex
Key



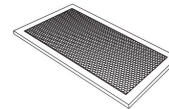
M4X8 Flange
Bolt (QTY: 4)



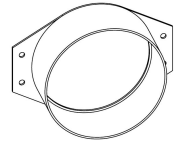
Thermal Paper
(QTY: 3)



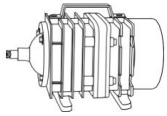
Lens Wipes
(QTY: 2)



Honeycomb
(QTY: 3)



Exhaust
Flange



Air
Compressor



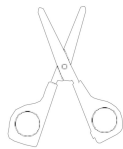
Exhaust Fan

Additional Items

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



3-5 gallons of
distilled



Small Scissors

CAUTION!



- **Never use unapproved ducting in the exhaust system as it is potentially flammable.**

DANGER!



- **Never operate your laser without a working exhaust.** Full Spectrum Laser recommends exhaust systems capable of 500 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

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

Assembly Stages

1. Locate & Remove Zip Ties
2. Connect the Exhaust System
3. Assemble the Water System
4. Assemble the Air Compressor
5. Connect Electrical Power
6. Passthrough

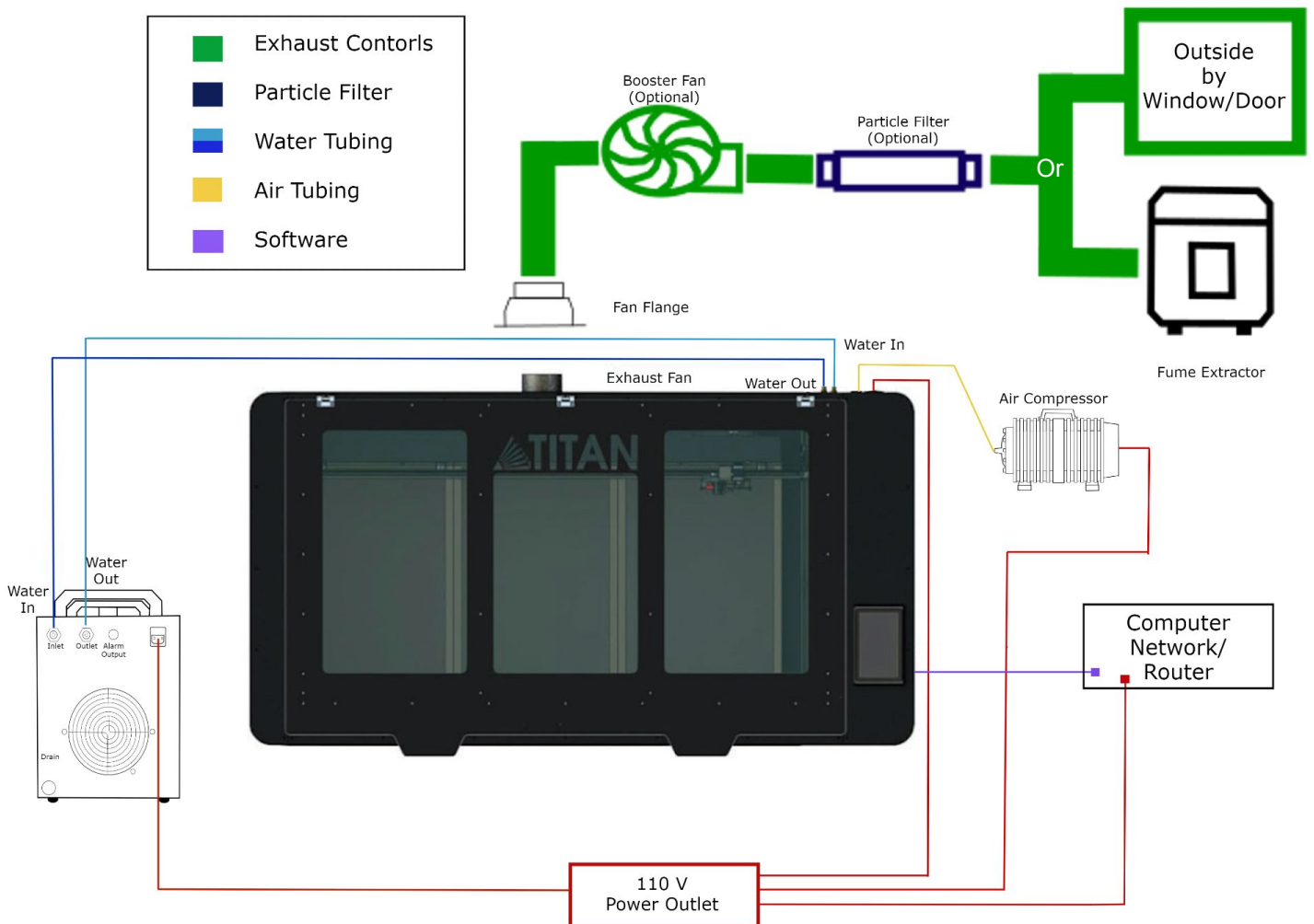


Fig. 1

1. Locating & Removing Zip Ties

Remove Zip Ties

The machine was secured during shipping with zip ties to hold the laser head assembly and the x-gantry. Remove zip ties before operating your laser cutter for the first time.

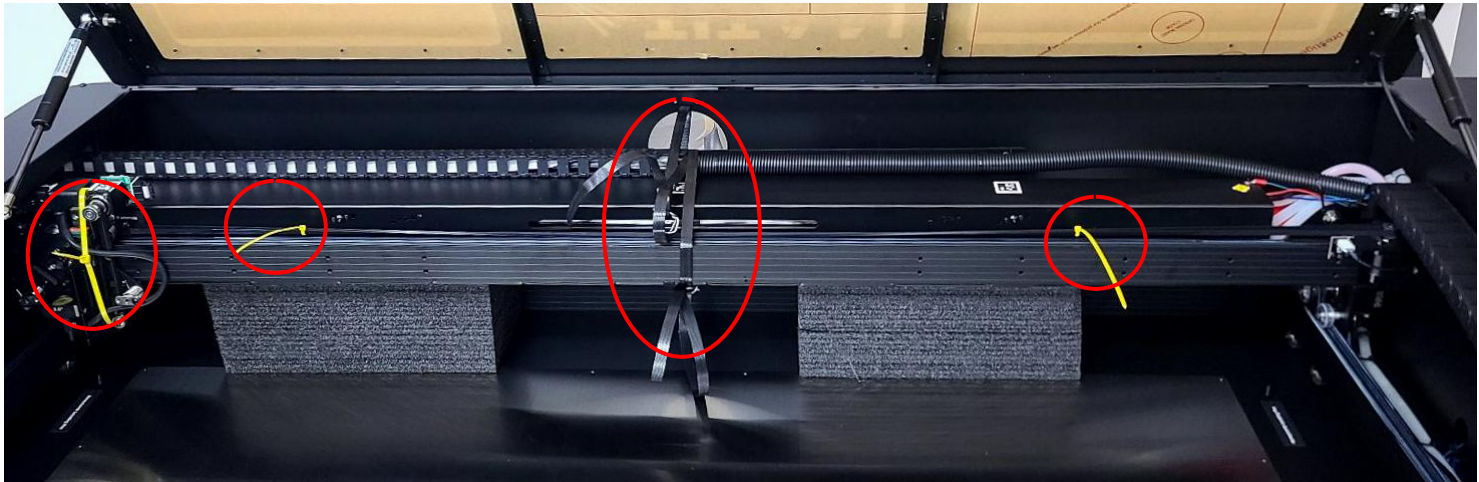


Fig. 2

1. **Locate Zip Ties:** Refer to Picture above.
2. **Cut and Remove Zip Ties:** Using a small pair of scissors or wire snips remove all eight zip ties.

Note: The colors of the zip ties may vary depending on availability. The pictures above refer to the general location of the zip ties. Position may vary depending on movement.

WARNING!! Do not remove any other items found!

2. Connect the Exhaust System

Connecting the Exhaust System

An exhaust fan is required to be connected and on whenever a job is run 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. **Install Exhaust Flange:** Use the provided flange bolts to install the ducting collar on the rear of the machine as shown in Fig. 3.

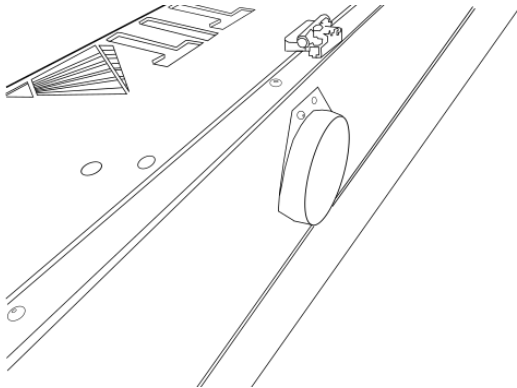


Fig. 3

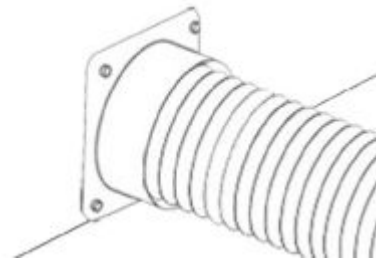


Fig. 4

2. **Position Ducting:** Place your 4" ducting over the Exhaust Port located at the back of the machine and hold. Secure with 4" ducting clamp. (See Fig. 4)

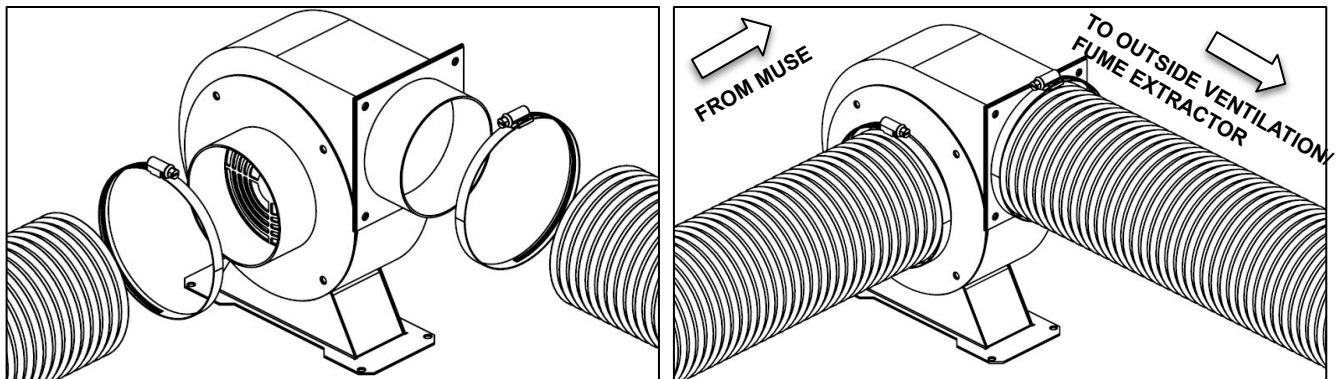


Fig. 5

3. **Attach Exhaust Fan:** Secure the free end of the ducting to the exhaust fan. Repeat the ducting and clamping process in the other side of the exhaust fan and plug in the fan into the bottom power plug marked "exhaust" on the back of your Muse 3D machine. (see Fig. 5).
4. **Ventilate Outside or to Fume Extractor:** Set the open end outside of a window or to a fume extractor. Check your system for leaks and 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.

5. **Connect to Power:** Plug the power cord from the exhaust fan power into the plug marked “exhaust fan” on the back of your Muse Titan.

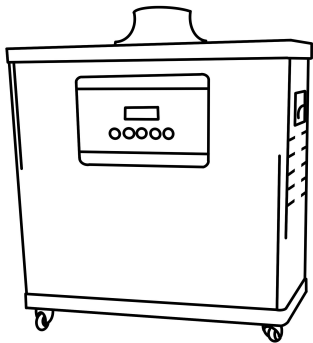
Note: Accessories plugged into the back of your Titan will only turn on when the laser is fired (as intended).

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

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

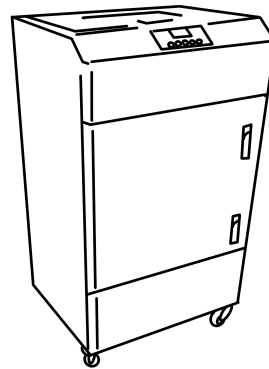
Ask a customer support representative which fume extractor is right for your needs.

Fig. 6



FSL100
Small Fume Extractor

Fig. 7



FSL300
Large Fume Extractor

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

Maintenance guidelines:

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

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

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

From information on how often one should clean or replace filters see the **General Maintenance** section.

3. Setup the Water System

Water System Assembly

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

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

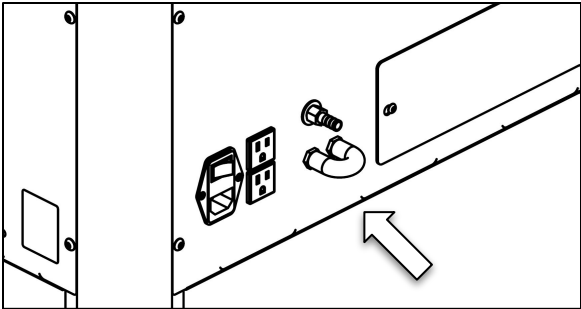


Fig. 8

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

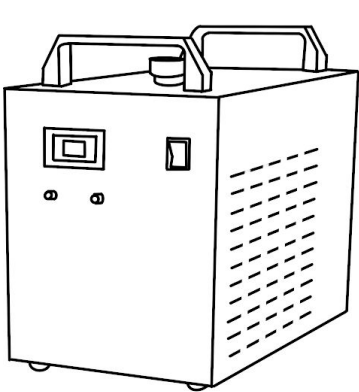


Fig. 9

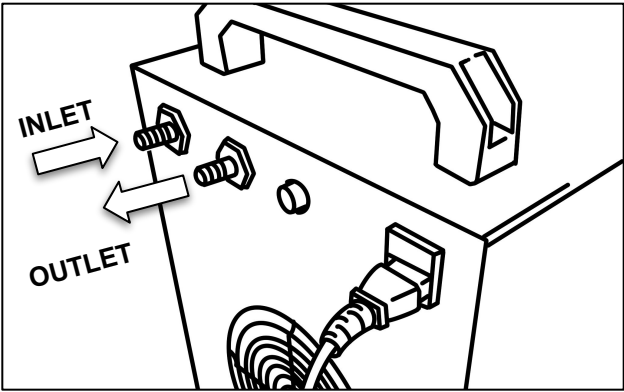


Fig. 10



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

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

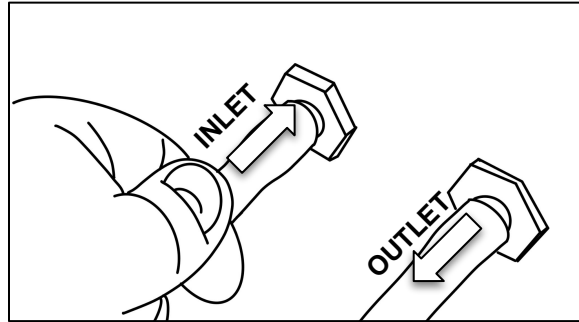


Fig. 11

4. **Preparing the Chiller:** Fill the chiller using 1 gallons of **DISTILLED** water. Make sure to only use distilled water and replace often. If you live in a cold climate you can use a 1:2 Propylene Glycol and Distilled water mix to prevent freezing. Generally Muse Titan systems should not be run in temperatures less than 20°F (-6°C).

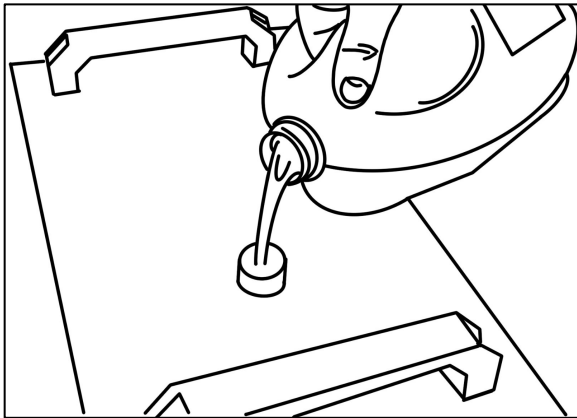


Fig. 12

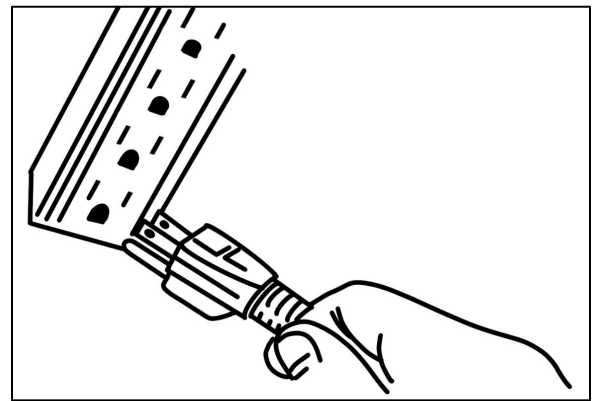


Fig. 13

NOTICE!



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

4. Assemble the Air Compressor

Connect the Air Compressor

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

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

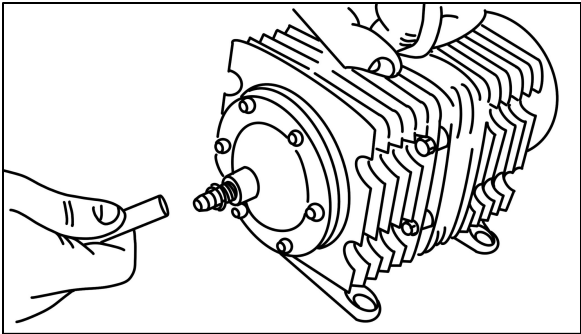


Fig. 14

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

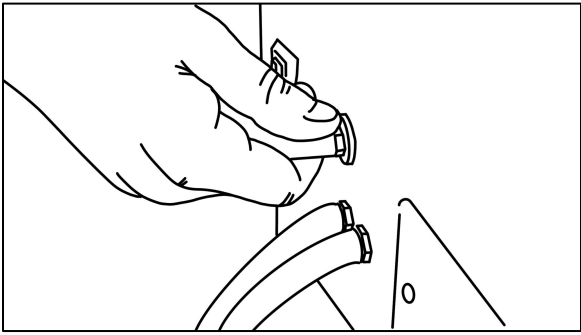


Fig. 15

- 3. **Connect to Power:** Plug the air compressor power cord into the marked “Air Assist” on the back of your Muse Titan.

5. Connecting the Electrical Power

The Muse 3D and its accessories are configured to accept 110VAC at 60Hz. For international purposes we offer an optional single-phase 220VAC converter.

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

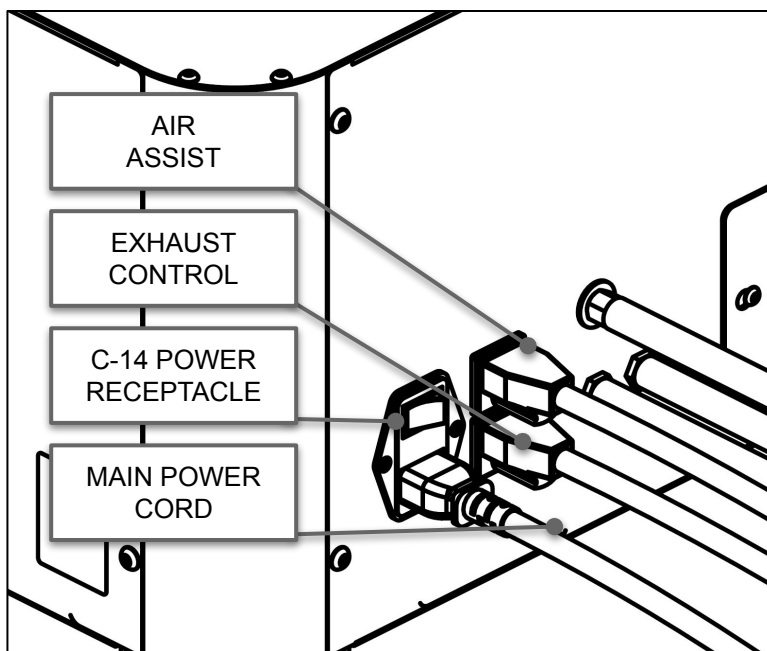


Fig. 16



NOTICE!

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

6. Pass-through

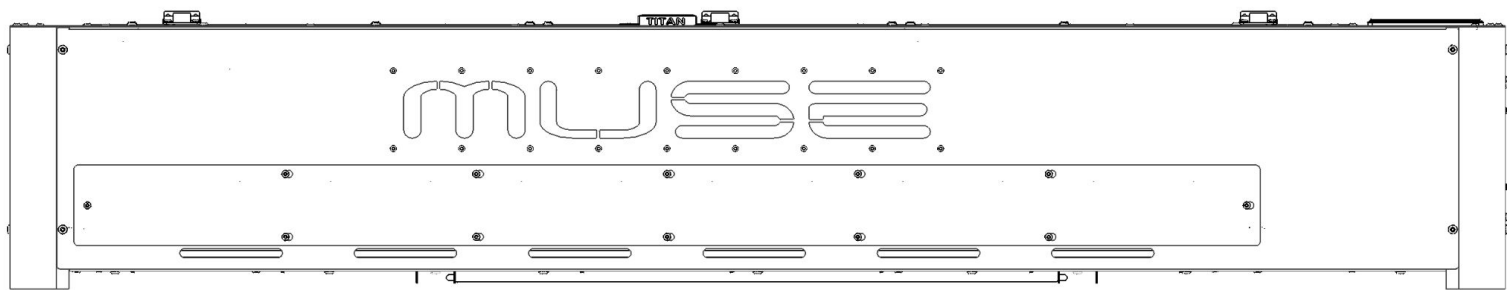


Fig. 17

1. The Muse Titan, along with other Muse models, come with pass-through in the front and back of the machine for projects that may require the use of longer materials, such as signs. All one needs to get the pass-through open is to loosen the screw along the pass-through slot. (see Fig. 18)

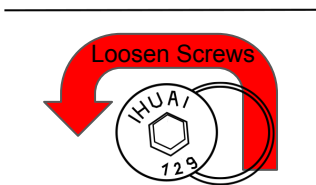


Fig. 18

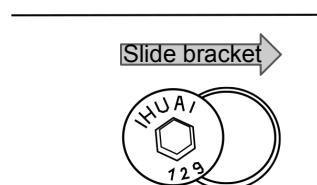


Fig. 19

2. Once the screws are loosened you can push the pass-through bracket to the right to clear the screws (see Fig 19).
3. You can now pull the bracket off the machine and use your pass-through (see Fig. 20).

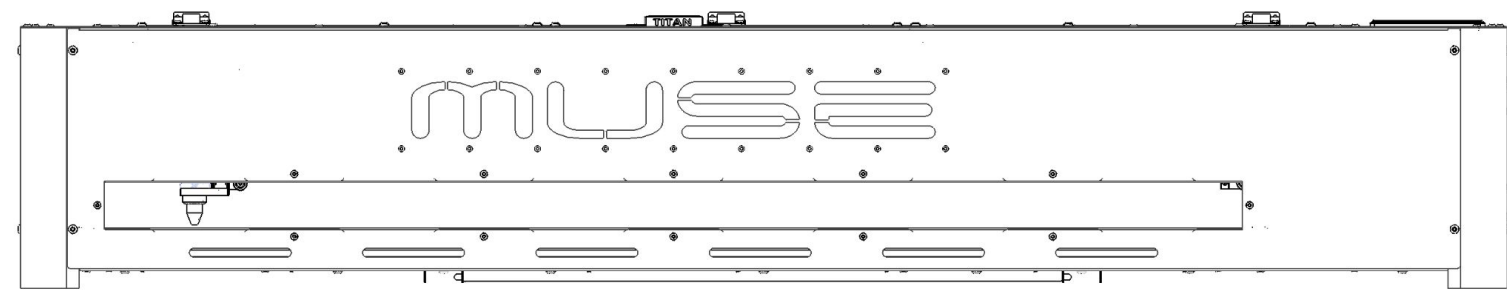


Fig. 20

4. If you decided you want to re-attach the bracket then slid the bracket into the screw cutouts and slide it left. That will hold the bracket in place so that the screws can be re-tightened.

Section IV. Connectivity

Ethernet Connection

The Muse Titan software is browser-based, meaning no download is required. RetinaEngrave v3.0 (RE3) is locally hosted on the machine's internal computer so it will function even without an internet connection. Using any computer, only an internet browser (such as Google Chrome) is needed to access RE3. The easiest method is to connect the Ethernet Cable that came with your Muse 3D.

Connect Via Router (Recommended):

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

1. The Titan comes with an ethernet cable(see Fig. 18).



Fig. 18

2. Connect the cable to the ethernet ports on both devices(see Fig. 19).

Note: Ethernet port looks the same on all devices

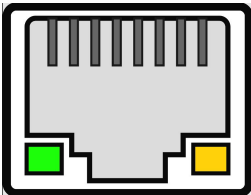


Fig. 19

Connect to Wi-Fi:

1. Your machine should come with a device called a dongle attached to the usb port. This device enables your machine to connect to the wifi. Make sure that it is there and connected.

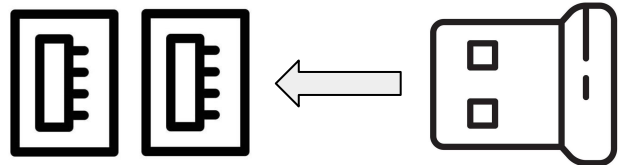


Fig. 20

2. Select the Network button on the top right of the touch screen.

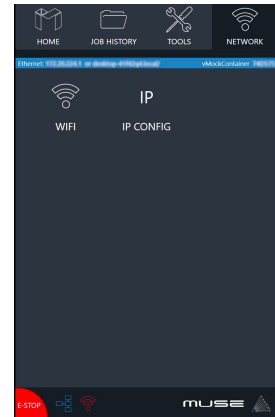


Fig. 21

3. Select wifi and look for your network. Select it and enter password

Connect Directly to Computer:

Connecting the Muse 3D and the computer should only be done if the previous two options are not possible. The Muse can connect to the computer via ethernet cable.

Note: The location of the ethernet port varies on computer models. Some computer may not have an ethernet connection and may need an ethernet adapter.

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. **Turn On Muse Titan: Turning on your 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.
2. **Locate the IP Address in the blue line under the Home icon.** 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.

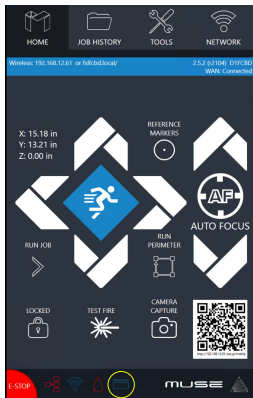


Fig. 26

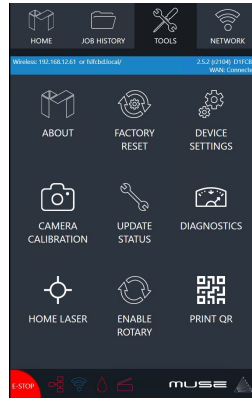


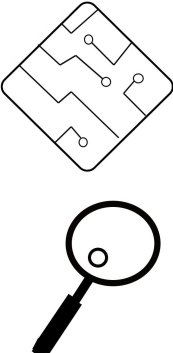
Fig. 27

3. **Type IP Into Browser**(Google Chrome is preferred). This will link you to the RetinaEngrave v3.0 (RE3) 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.

Using QR Code:

Another method is to use the QR code which is visible in the Home and About sections.

1. Take a picture of the QR code with your camera or use a QR code reader.
2. A link will appear that can be selected.



- Occasionally, RetinaEngrave v3.0 will run an update automatically when you first boot up the machine. Updates are quick, however, there may be occasions where updates can take longer. You will know the machine is updating when the interior lights of the Muse Titan turn off. When this happens, **Do not turn off** your machine. Allow the update to complete and the machine lights will turn back on.
- The laser must be powered on when operating the software or when connecting the laser via the Ethernet cable. You will need uninterrupted Network access for this process.

Section V. Tests & Adjustments

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

Alignment Test

Mirror Alignment Procedure

Alignment Test

The laser tube that came pre-installed in your Muse Titan was carefully aligned in our facilities in Nevada. However, it is possible that the mirrors may come out of alignment during shipping. Before running your first job, you will want to check and make sure the mirrors are properly aligned using the following procedure. If your mirror is out of alignment, or if you have installed a new laser tube, you must align the laser. For this alignment test, we will test-fire the laser once in 5 positions across the X-Gantry to make sure the laser is following the right path to the focus head, and ultimately to the cutting material.

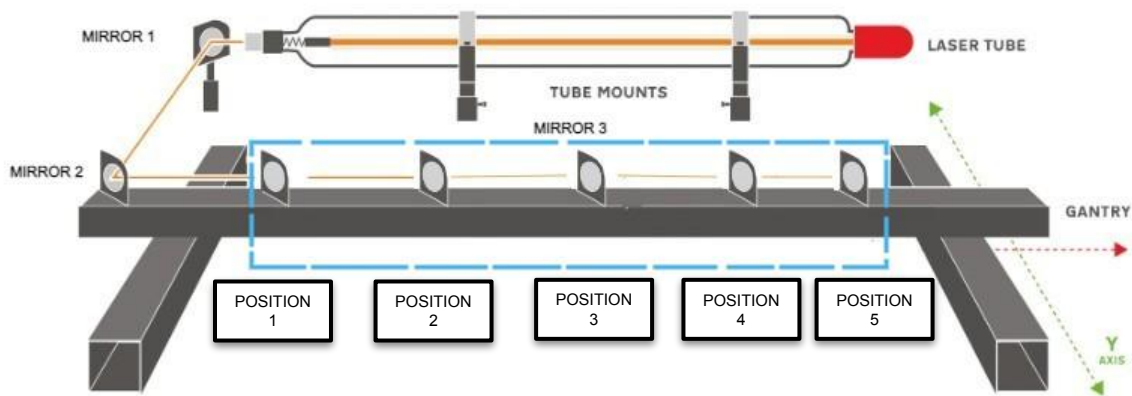


Fig. 28

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 or craft tape and place it over the focus lens under Mirror #3.
3. **Position Laser Head:** Move the laser head into the left side of the workspace (POSITION 1).

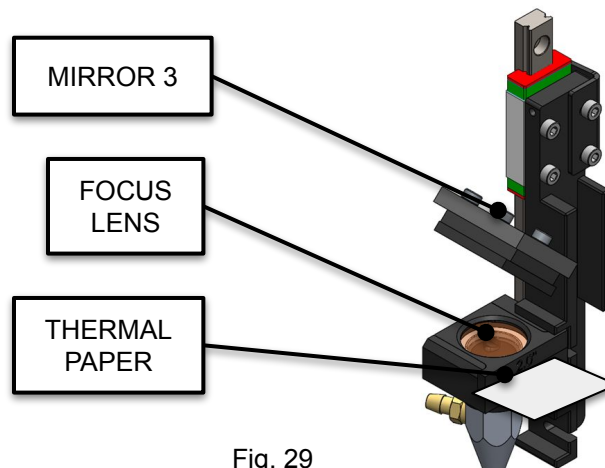


Fig. 29

4. **Close Safety Lid:** Safety measures are in place to ensure laser does not fire with the safety lid open. Regardless, never attempt to fire the laser with the safety lid open.

5. **Test Fire the Laser:** Make sure the water flow is on and then press the Fire Laser Icon Button on the touch screen. A black dot should appear. If it does not appear, press it again. (Refer to picture below.)



Fig. 30

6. **Repeat Test Fire in Other Positions:** Move the laser head to the right about 12". Without removing the thermal tape, fire the laser again. Repeat this step until the laser head reaches the far right.

7. **Check Results:** With the test fires complete, open the lid and remove the thermal tape. The burn marks should overlap each other (see illustration). If they do not overlap perfectly, you will need to align the mirrors.

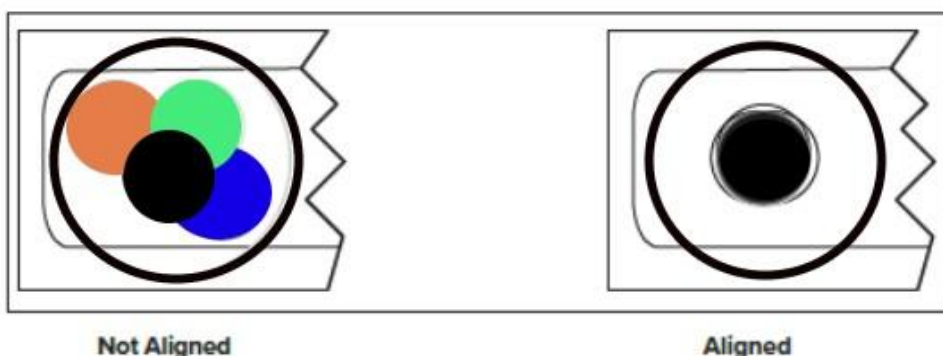


Fig. 31

Note: 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 it gives you immediate feedback on the mirror adjustment. By adjusting it into the first black dot, you are correcting 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.

Please visit our [Youtube](#) channel for more information on alignment

Mirror Alignment Procedure

DO NOT ATTEMPT IF INITIAL TEST WAS ACCEPTABLE!

The goal of the mirror alignment is to align the visible red beam with the invisible CO2 laser beam. The red beam will then serve 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.

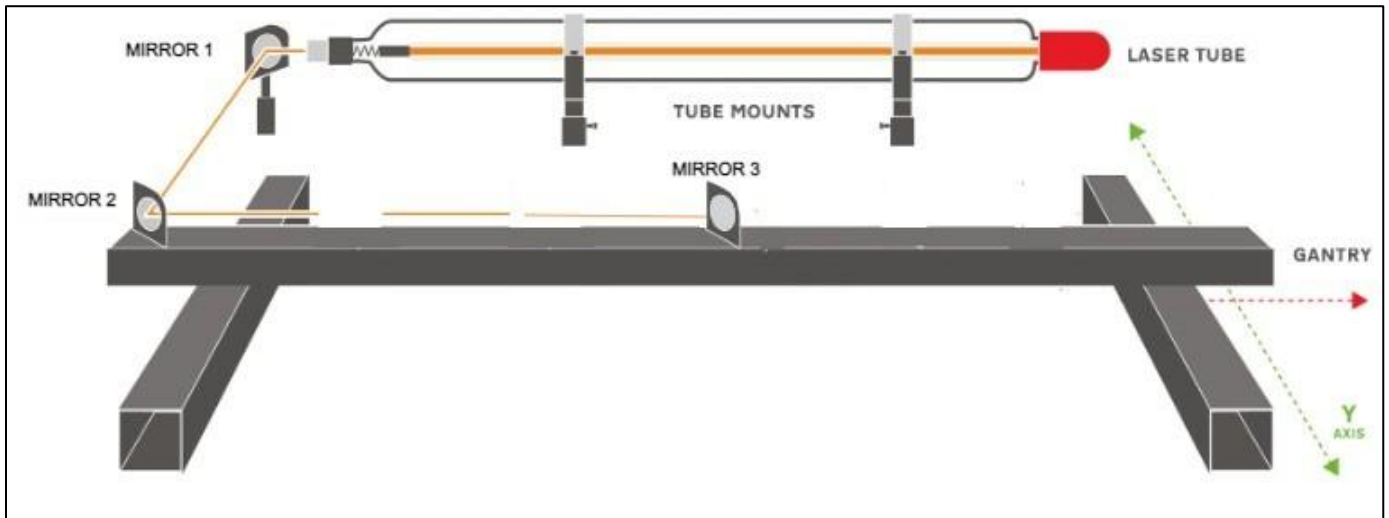


Fig. 29

Assembly Stages

1. Preparation
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



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. Preparation

Make sure to prepare your tools and workspace.

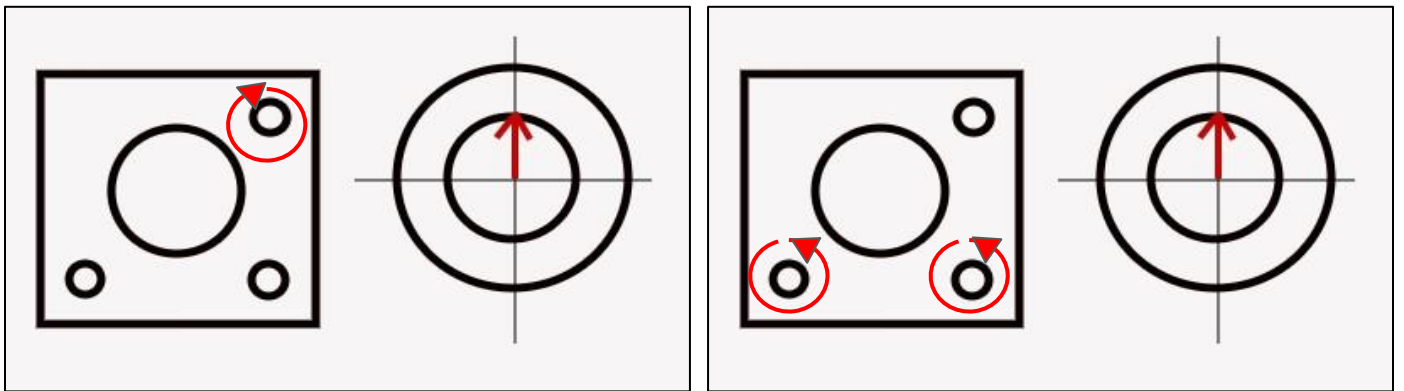
1. **Turn on Laser Cutter:** Allow the machine time to boot up the touch screen operating system.
2. **Unlock Driver Motor:** On the touch screen, press the “Locked” icon to switch to “Unlocked” position. The button will now display the “Unlocked” icon.
3. **Gather Tools:** A 2.5mm hex key and thermal paper are required to perform the mirror alignment procedure.

Orientation Guidelines:

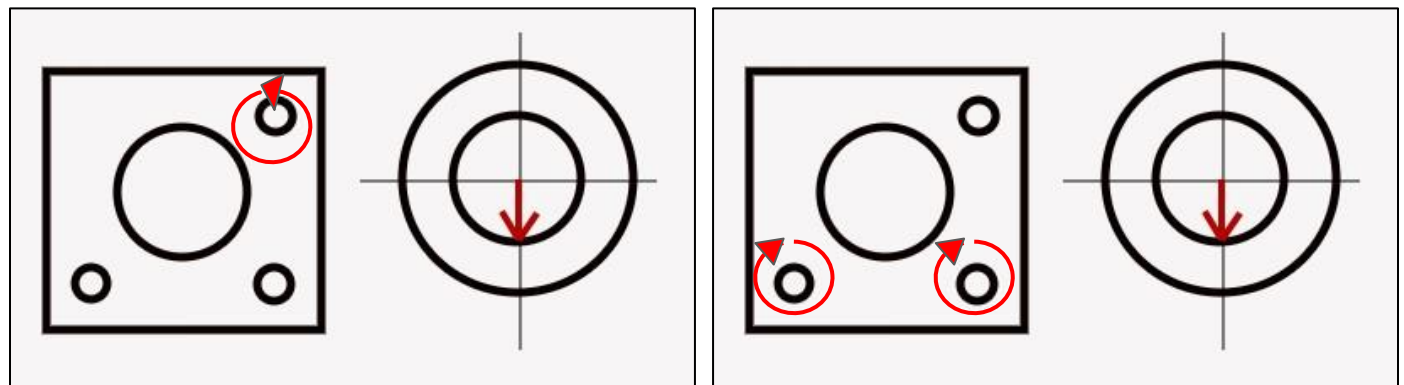
Tightening or loosening any of the three adjustment screws on the mirrors or the red dot diode will move the position in a particular direction depending on the positioning of the other screws. Some experimenting is required to understand the relationship of each screw and how adjusting one affects the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

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

Orienting Up:



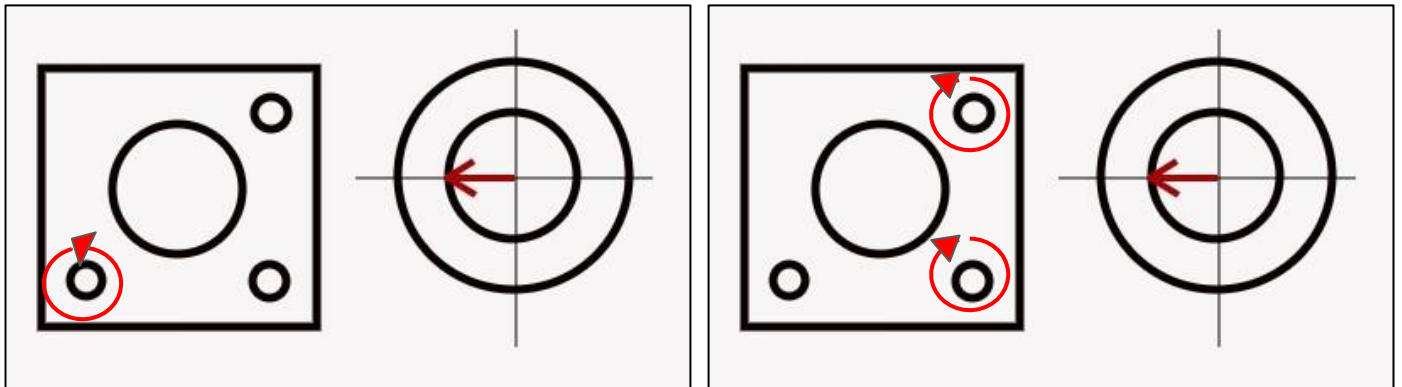
Orienting Down:



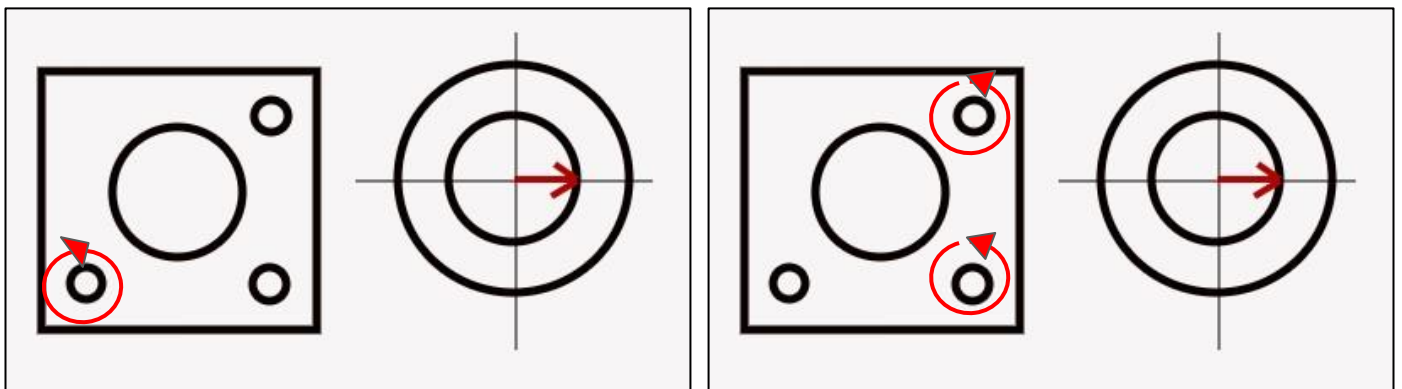
Mirror Alignment Procedure

2. Output to Mirror 1

Orienting Left:



Orienting Right:



Align the output to Mirror #1 making sure song the way that the beam hit each mirror precisely.

1. **Open the Safety Lid.**
2. **Place Thermal Paper:** Take a small piece of thermal paper and place it firmly over **Mirror #1**.
3. **Close Safety Lid:** Machine should unable 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.
5. **Adjust Laser Tube:** If you notice the burn mark is clipping below or above the center you can move the laser tube mounting position up or down (using the 2.5mm hex wrench) on the tube shelf to correct for this.
6. **Adjust Beam Combiner:** If you notice the burn mark is clipping to the left or right of **mirror #1**, adjust beam combiner assembly and sliding the mirror plate forward and backwards.
7. **Adjust Red Diode:** Use your 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.

Mirror Alignment Procedure

3. Mirror 1 to Mirror 2

If any adjustments are made to Laser Tube or Beam Combiner positions, then the alignment between mirrors #1 and #2 must be checked.

1. **Open the Safety Lid.**
2. **Place Thermal Paper:** Take a small piece of thermal paper and place it firmly over **Mirror #2**. Push the laser head all the way to the left closest to the mirror assembly.
3. **Close Safety Lid.**
4. **Test Fire the Laser:** Press the Fire Laser icon to create a burn mark on the thermal paper.
5. **Adjust Red Beam:** Using a 2.5 mm hex key, make adjustments to the three adjustment screws of the **red beam diode**, and position the red dot exactly over the burn mark.

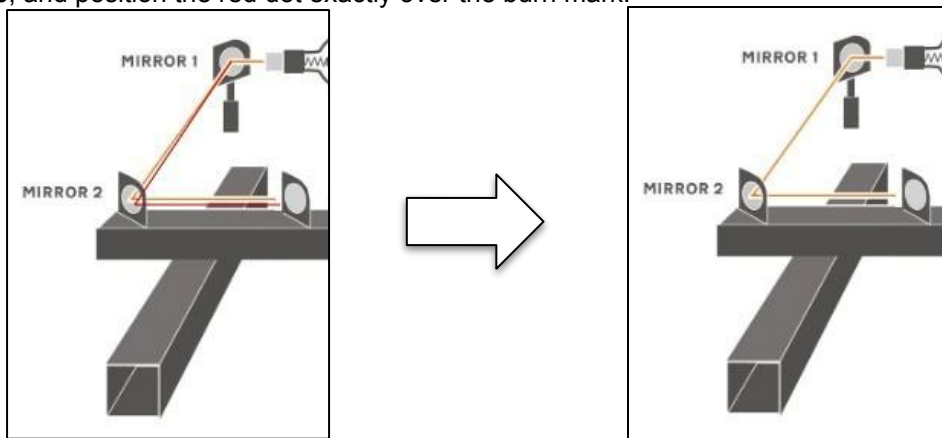


Fig. 33

6. **Adjust Mirror #1:** Next, make micro adjustments to the three adjustment screws of the **Mirror #1**, and position the red dot exactly over the center of **Mirror #2**.

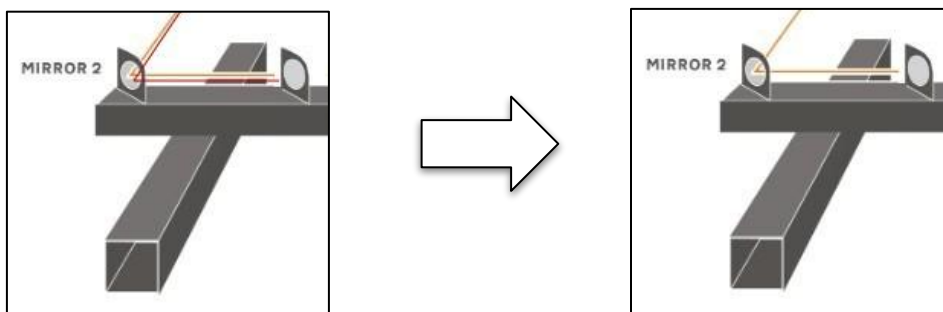


Fig. 34

7. **Mirror #1 and mirror #2** must be checked at both at the nearest possible position and at the furthest possible position to ensure accuracy.

Note: If Mirror #1 and Mirror #2 are aligned in both position this part can be skipped.

Mirror Alignment Procedure

4. Mirror 2 to Mirror 3

Mirror #3 is mounted on the laser head assembly and slides along the X-gantry rail.

1. **Open the Safety Lid.**
2. **Place Thermal Paper:** Take a small piece of thermal paper and place it firmly over Mirror #3. Push the laser head all the way to the left closest to the mirror assembly.
3. **Close Safety Lid.**
4. **Test Fire the Laser:** Press the Fire Laser icon to create a burn mark on the thermal paper.
5. **Position Laser Head:** Open the safety lid to access the interior of the machine. Position the laser head 12" to the right (POSITION 2).
6. **Close Safety Lid.**
7. **Test Fire the Laser:** Press the Fire Laser icon button on the touch screen. You will see a burn mark on the thermal paper.
8. **Check Results:** There should be two observable burn marks on the thermal paper. If the red dot moves away from the test fire, adjust red beam diode to match the second test fire. If the burn marks do not overlap, adjust the three 2.5 mm hex screws on **Mirror #2** (not the red beam diode) to move the second burn mark over the center of **mirror #3**.
9. **Repeat Until Aligned:** Once the burn marks overlap perfectly you can move the laser head to the next position (12" to the right) and repeat steps 6-8. Repeat this process until you are able to fire the laser head at POSITION 1 and POSITION 5 with perfectly overlapping burn marks.

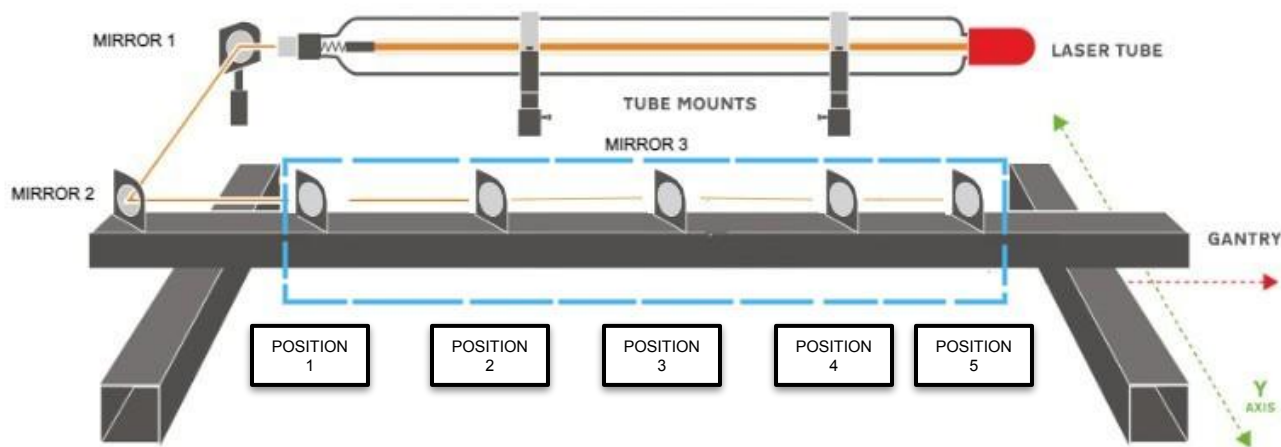


Fig. 35

Mirror Alignment Procedure

5. Mirror 3 to Focus Lens

The focus lens converges the laser beam to a single point. The focus lens does not require manual focusing. It is important to ensure that the path from mirror #3 to the focal point is straight.

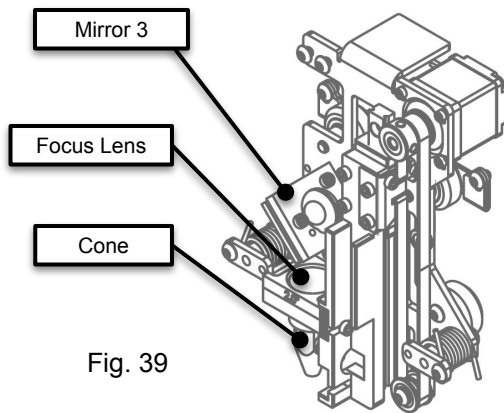


Fig. 39

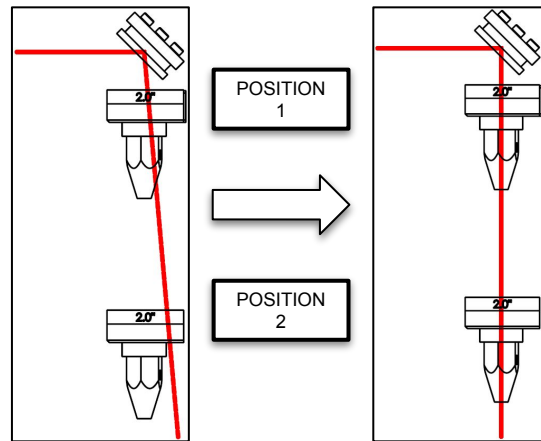


Fig. 40

1. **Open the Safety Lid.**
2. **Place Thermal Paper:** Take a small piece of thermal paper and place it firmly over the **Focus Lens**. Position the lens assembly up closest to the mirror #3 (POSITION 1).
3. **Close Safety Lid.**
4. **Test Fire the Laser:** Press the Fire Laser icon button to make a burn mark on the thermal paper.
5. **Position Laser Head:** Open the safety lid to access the interior of the machine. Position the lens assembly down to the baseplate (POSITION 2).
6. **Close Safety Lid.**
7. **Test Fire the Laser:** Press the Fire Laser icon to see a burn mark on the thermal paper.
8. **Adjust Mirror #3:** Adjust the hex screws on **Mirror #3** to move the second burn mark over the center of the **Focus Lens**.

The default lens for the Muse Titan is 2.0. To install lens, simply slide lens fitting into holder.

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>

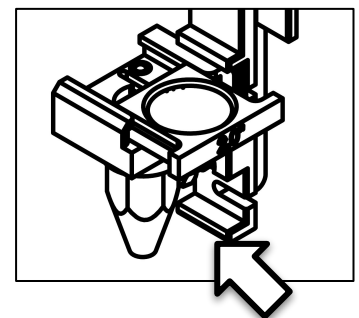


Fig. 41

Autofocus Properties:

Auto focus can be controlled via the touchscreen and will start automatically at the beginning of each job. Focus settings can be customized via the *Autofocus Properties Window*.

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

There are two different Autofocus Types:

Default Contact Autofocus

This setting utilizes distance; the z motor makes physical contact with your material's height.

Manual Height

Use measurement tool to set the distance of the lens manually

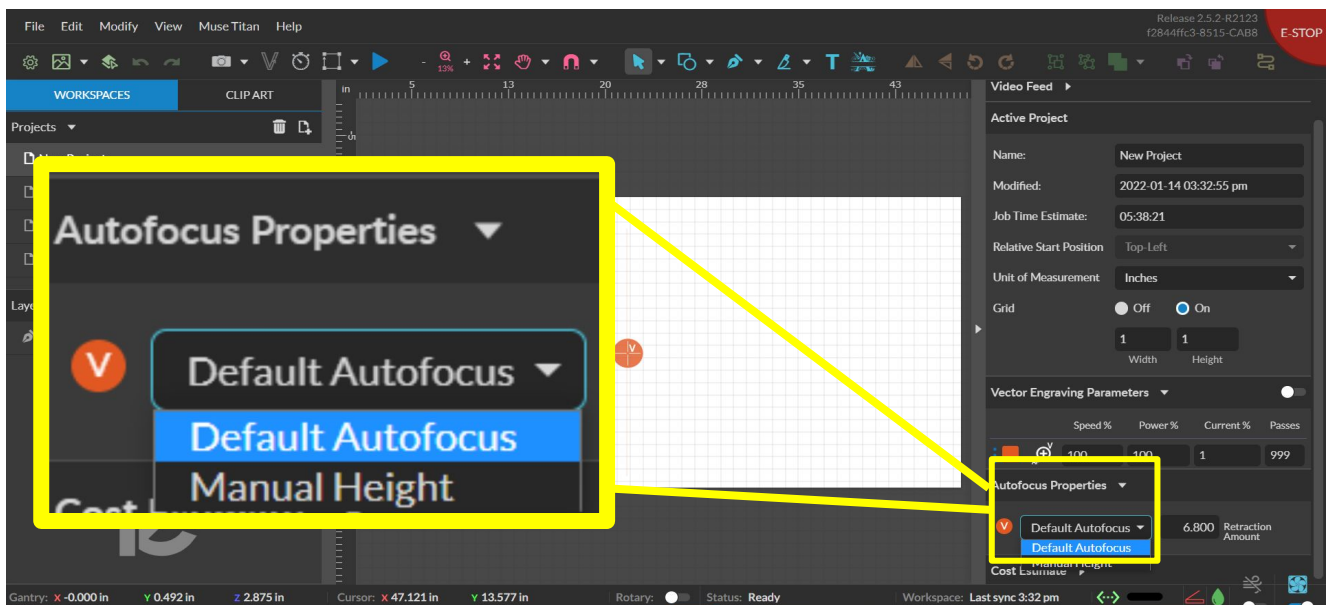


Fig. 42

Section VI. Touchscreen Interface

The touchscreen that comes on your Muse allows you to control the basic functions of your laser without needing a computer. Jobs are accessible through the touchscreen once loaded in from the RE3 interface.

A rotary function comes on your machine, which can be engaged from the touchscreen itself or RE3. Before activation the rotary mode, make sure your optional Rotary attachment is connected properly. Once enabled the screen will change to mention the Z-axis on the jog controls.

Home

The Home screen contains the devices IP address, the QR Code for RE3, the video feed from the camera, and controls for the laser head.

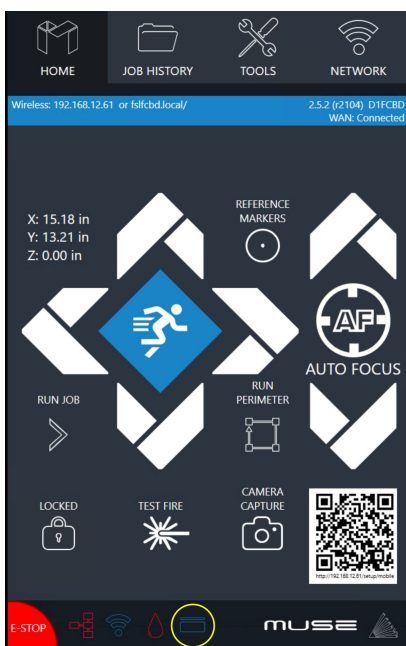


Fig. 43

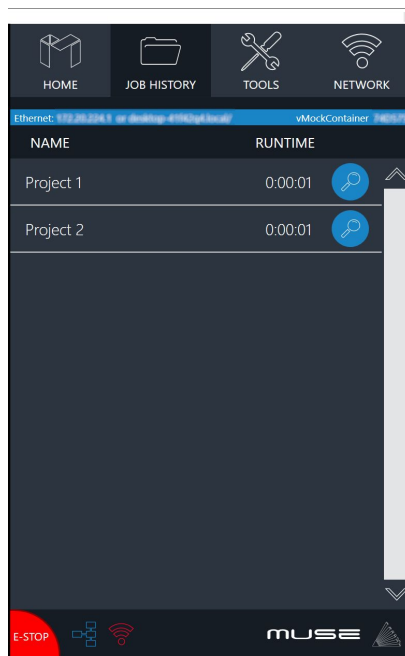


Fig. 44

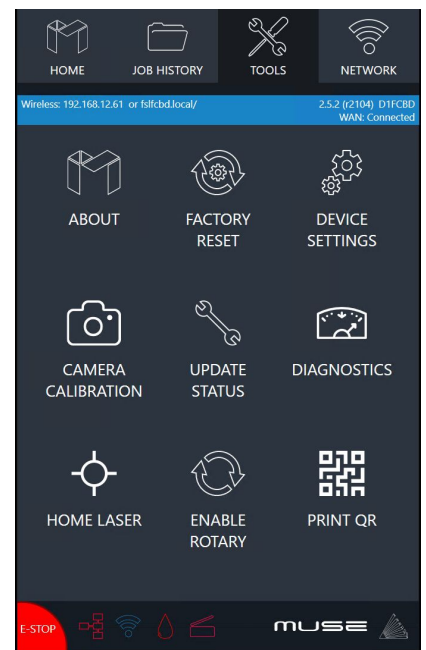


Fig.45

Job History

The Job History icon allows the user to browse previous jobs. Clicking on the File allows the user to view and re-run previous job details. No Wi-Fi connection is needed to run jobs saved here.

Tools

The tools icon allows the user to check and adjust the machine settings. Here the user can enable rotary attachments, home the laser, and get information about the machine.

Tools ⇨ Update Status

The user can use the Update Status icon to check the Network Connection Status, Software updates, and connection history. (See Fig. 45)

Network ⇨ Wi-Fi

Allows the user to connect to the Wi-Fi.

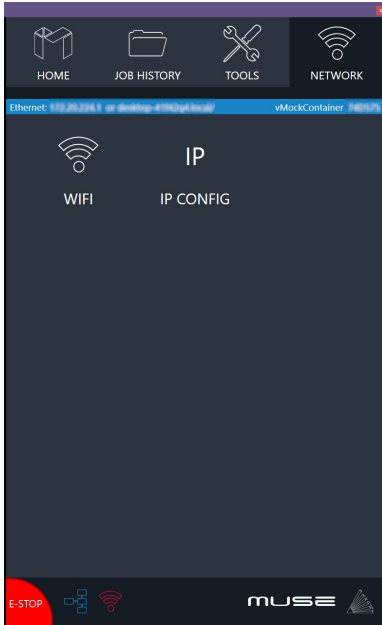


Fig. 46

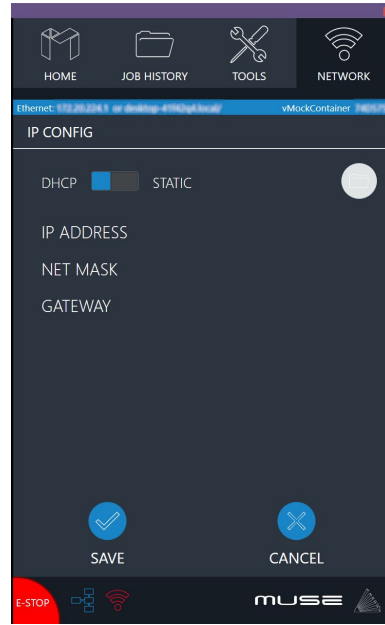


Fig. 47

Network ⇨ IP Configuration

Allows the user to set IP Address and DNS Server manually.

Most of the things mentioned in this section can be done from your phone or other device using the mobile or desktop version of RE3 from the web browser.

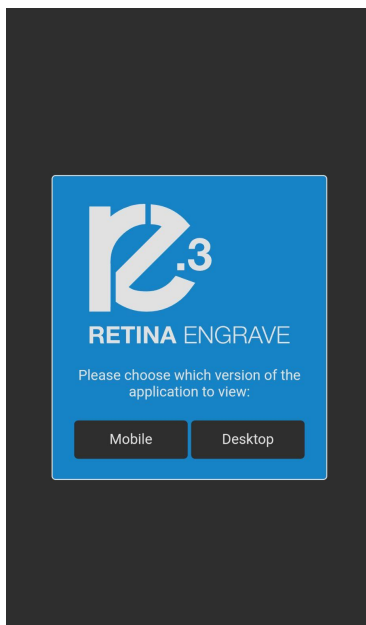


Fig. 48

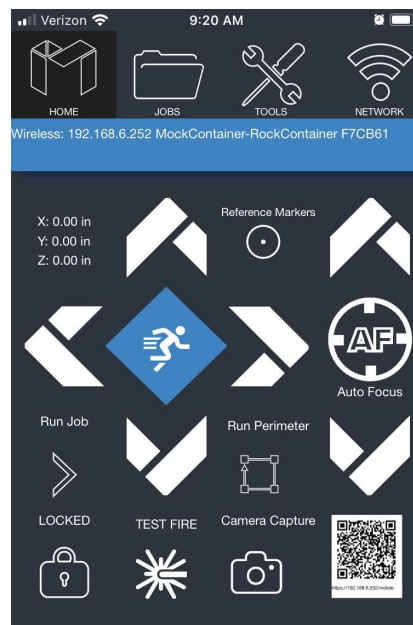


Fig. 49

Safety Override Lid & Waterflow Failsafe

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.

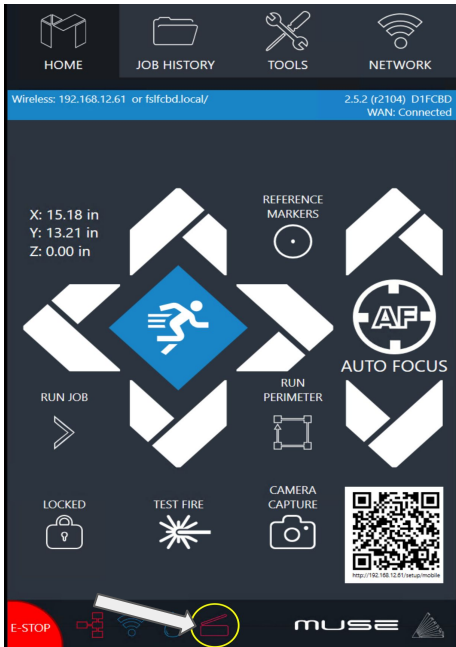


Fig. 50



Fig. 51

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.

Waterflow Failsafe

The following indicator informs us that the water Muse Titan is not flowing.



Fig. 52

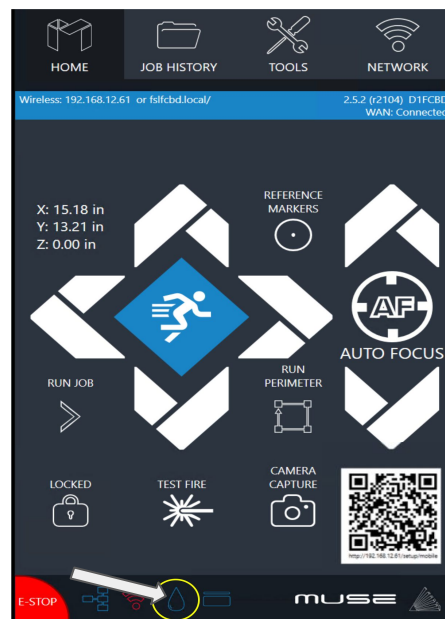


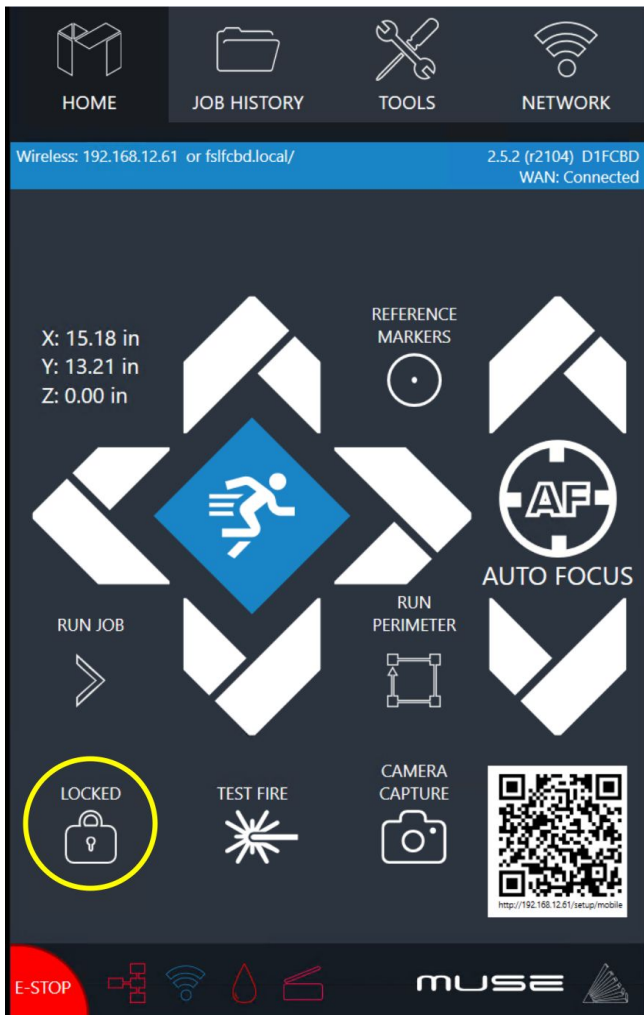
Fig.53

If the water indicator is not flowing through the laser tube, check water tube connections and make sure the tubes and water chiller are assembled correctly. More than likely, the water tubes are reversed or the water sensor is dirty.

Lock / Unlock Indicator

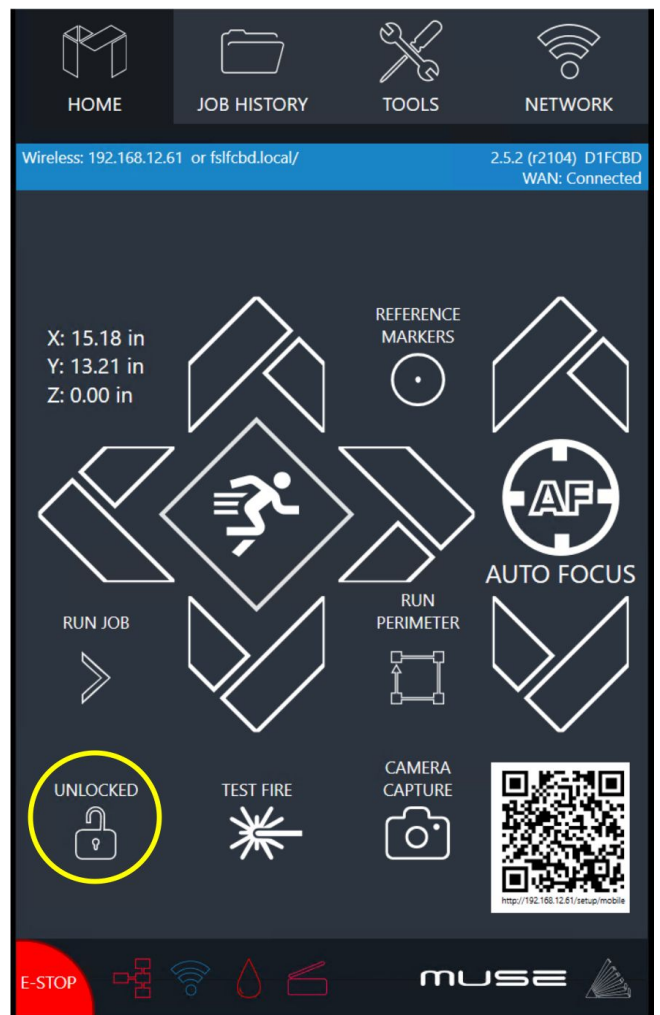
Locked Icon: Indicates the gantry is locked. When locked, the user must move the gantry using JOG controls.

Unlocked Icon: Indicates the gantry is unlocked. When unlocked, the user must manually move the gantry.



Locked

Fig. 54



Unlocked

Fig. 55

Section VII. Operations

This section will guide you through using your Muse Titan. 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, DXF, AI	JPEG, PNG, BMP, TIF
Preferred File Types	
PDF	JPEG
File Composition	
Geometrics Formulas	Pixels

General Functions

Vector Cutting

The most common feature when cutting with a laser engraver or cutter. When vector cutting, the laser follows the “vector lines” embedded 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. RE3 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 that information, the file being printed must be a vector. These images are created using mathematical equations, making them more flexible than rastered images. PDF's, company logos, and branded graphics work great as vector files and are easy to resize without losing resolution.

Engraving

Engraving is the process by which designs are etched into something. Engraving can range from a simple surface mark all the way through deep material removal. It 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, which is controlled by the input image. 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, such as JPEGs and PNGs. Photos found on the Internet and photo prints are raster images, images created using colored pixels. The amount of colored pixels are fixed so they can't be resized without distorting their resolution. Pixels become visibly grainy and the image becomes distorted, that is why it is important that you save raster files at the dimensions needed to eliminate possible resolution issues.

Direct Printing PDF Files

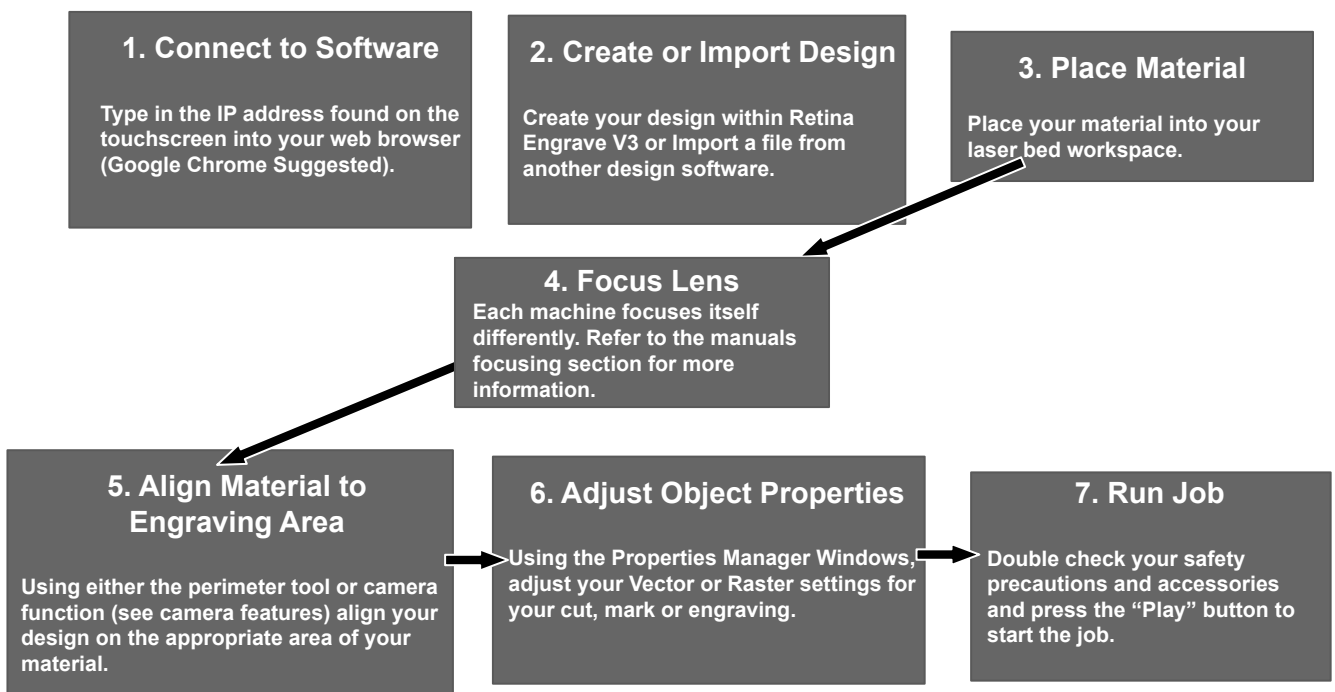
The easiest way to import any file type to RetinaEngrave v3.0 is to “drag ‘n drop” it directly into the workspace window or use the File> Import File. Another method would be to "Print" the PDF file which can send the data directly from your chosen design software into RetinaEngrave 3.0. A PDF file type is the preferred method as this can hold both vector and raster data.

Designing in RetinaEngrave v3.0

RE3 has 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.

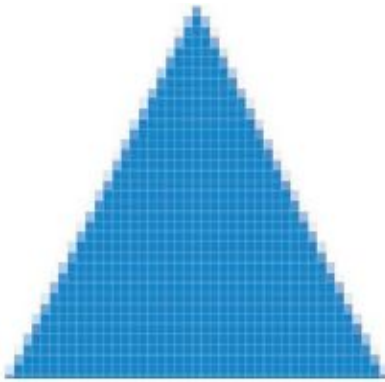
Project Workflow: From Concept to Design

RetinaEngrave v3.0 create a simple, easy to learn set of operations. Your Muse Titan will achieve amazing results using this Project Workflow List. For the “best practice” for any project, follow the step-by-step instructions from start to finish.



1. Create Design

Projects are created in design software and then imported to RetinaEngrave 3.0. A PDF file is mainly used for both raster and vector data due to its ease of conversion. For engraving, a JPEG file is best due to its bitmap files. It is important to know if you intend to do a vector cut or an engraving and choose the most appropriate file type. This will greatly aid the user to design in RE3 without needing outside design software. If the user decides to use a third party software, choose one you are most comfortable with, as most can convert the image to PDF. 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

Note: The size limit for importing is 95mb. The compatible file types for importing are .ai, .bmp, .jpg, .jpeg, .pdf, .png, .re3, .svg, .svgs, .tiff, .tif, and .dxf.

2. Connect to Software RetinaEngrave v3.0

Refer to Section III: Installation & Assembly.

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.

4. Place Material

Place your material into the laser bed workspace. The material can be placed anywhere in the work area. Once the material is placed, close the lid. Your material can range from wood, acrylic, cardboard, fabric, and steel.

Note: It is the user’s responsibility to know the components of material used and its limitations (thickness, chemical residues, etc.). 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. Focusing Your Laser

Your Titan auto-focuses before every job.

6. Align Material to Engraving Area

The material should be aligned to ensure the design is within the workspace and positioned straight. 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 $\frac{1}{2}$ inch of space on the left and right side. Once the material looks aligned, click the “Run Perimeter” button. The laser head will automatically outline the material with the red beam diode, adjust as needed.

Note: Laser will continue to outline the material until manually stopped by re-selecting “Run Perimeter”. Also note that the location of the images will vary depending on the positioning options selected. In absolute position the laser will go wherever you put the image in the workspace, while in relative it will always try to start in the upper left corner.

7. Adjust Object Properties

It is again important to know if you want to engrave, cut, or both. Once the file is imported, 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 the following section.

8. Run Job

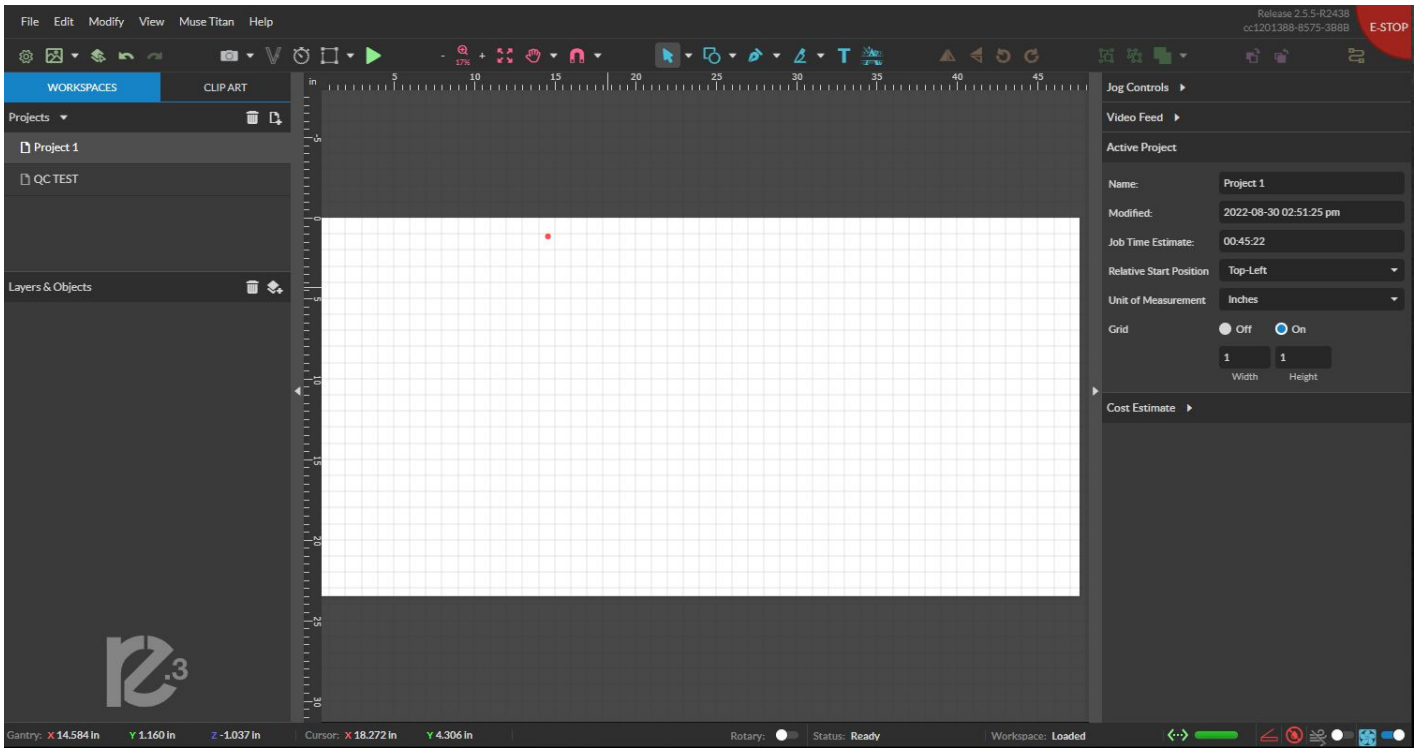
Selecting the “Play” button begins the laser process. Therefore, double check your safety protocol and that your system accessories are connected properly. Be sure to monitor the job while the laser is firing. If a problem occurs during the process, stop the laser.

Section VIII. RetinaEngrave v3.0 Software

Starting with RE3

Our machines are set apart from our competitors with our custom laser engraving software, known as RetinaEngrave v.3 or simply RE3.

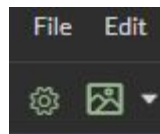
Using your new machine for the first time can seem intimidating but we've worked to make this guide as clear as possible regarding our software. In the previous section we mentioned having an idea of the design and materials for your project. Once you have that prepared you're ready to start using RE3.



RetinaEngrave V.3 will look like this when fully loaded on the browser.

Note: The device must be on and fully booted to access RE3. If the machine is off RE3 will inform you that the device has been disconnected.

1. Select the file you wish to engrave via your editing software or an image saved on your computer.
 - a. It can be placed into RE3 using two methods:
 - It can be “dragged” into your RE3 workspace using your mouse.
 - It can be placed using the photo icon.



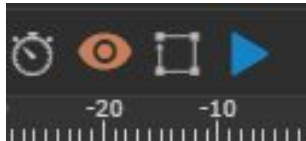
- b. Modify the image in RE3 to be the proper size, laser settings, and file type (raster or vector), as well as any other laser properties that are specific to that engraving
2. Prepare the material you wish to engrave. If the material you are working with is new to you or untested, make sure you have enough material to test with to ensure your settings are correct before marking the final part/design.

3. The laser will automatically focus on to the material when the job starts. Therefore, we recommend taking a picture of the workspace to make sure your material is within the lasers reach.

NOTE: The focus distance number set in the RE3 interface is machine relative. It signifies a distance away relative to home, not a distance away from the part.

4. Align your design with your material

- a. This can be done by using the eye icon or the perimeter icon to preview the area where the laser will engrave.



Note: The Eye icon will procedure a line that will run up and down the work area, while the perimeter icon will form a square image of the work area.

****Using the camera capture option that can help for better alignment of your design. One should still make sure to check the engraving perimeter before running your job.****

- b. Adjust the design or material to ensure your design is engraved in desired area.
- c. Ensure the material has enough weight so as to not move while engraving

Note: A jig, fixture, putty, or tape can be to use to set objects in the same position for repetition.

5. Once the picture is aligned with the material and checked via preview, you are ready to run your job.

- d. Run the laser using the play button.

WARNING!! PUT ON SAFETY GLASSES BEFORE STARTING! LASER CAN CAUSE EYE DAMAGE!

- e. Once the marking is complete, do not move the part until you are sure that it has the desired look, as realigning becomes significantly difficult.
- f. Wipe your material clean of any dust/residue resulting from the engraving process

Congratulations!! You have made your first engraving on RE3. It's an exciting process to engrave material to your liking. Sometimes a little trial and error is needed to see what designs go well in what ways. The following pages will provide more information on how to use RE3 for more detailed and precise engravings.

For a more detailed and in-depth look into RE3, please use the RE3 Guide, which can be found at <https://fslaser.com/resources/> .

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:

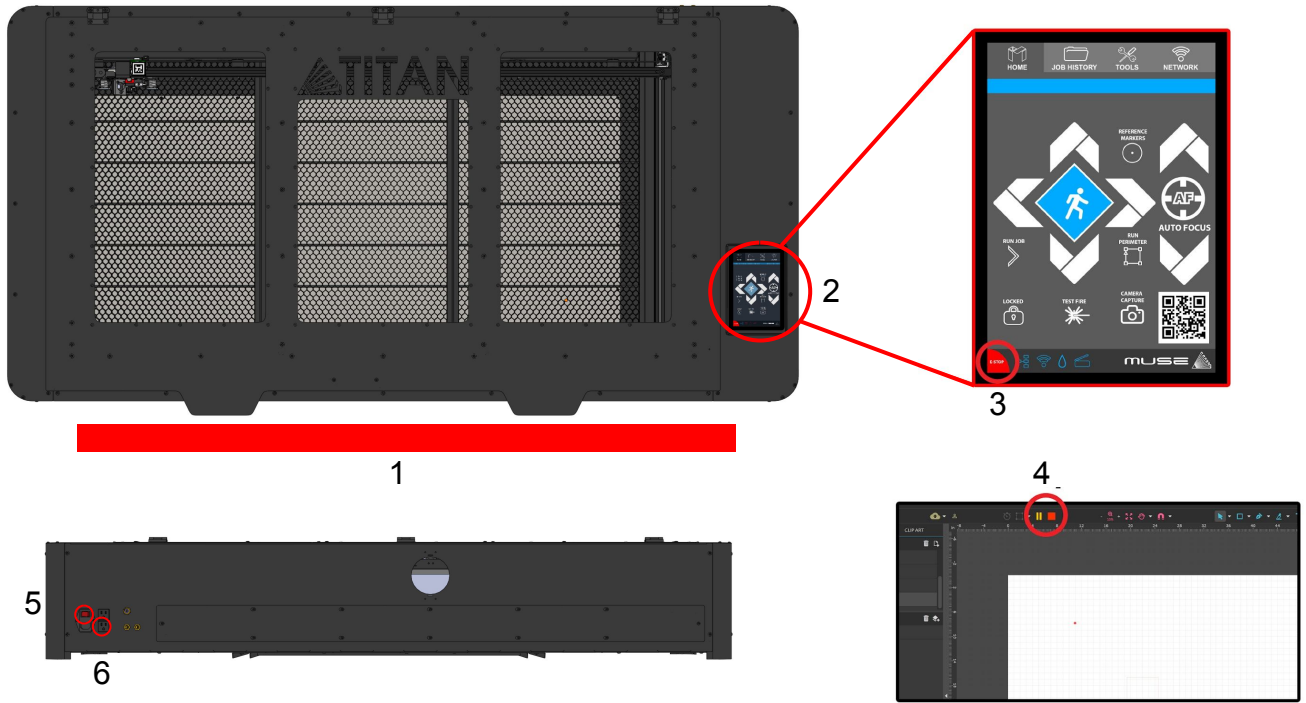


Fig. 56

- 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:** On the top of the Muse Titan there is a button that can pause or stop the laser. Once a job is stopped, starting again will start the project from the beginning.
- 3. E-Stop:** In the lower left corner for the touch screen is an “Emergency” stop button (E-Stop). Pushing this button will instantly cut power to the laser.
Note: The E-Stop is still part of the touch screen and therefore fragile. Do not slam this button!
- 4. Software Pause Button:** If near your computer, the Pause Button (found where the Play button was) can 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:** Flipping the power switch to the off position instantly cuts power from the entire machine.
- 6. Unplug Power:** As a last resort users can unplug the power cord of the Muse Titan from the electrical outlet. This method may cause damage to your cables.



Fig. 57

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. When the lid is open the camera can capture your workspace for easy alignment and when the lid is down the camera will watch your projects as they are cut.

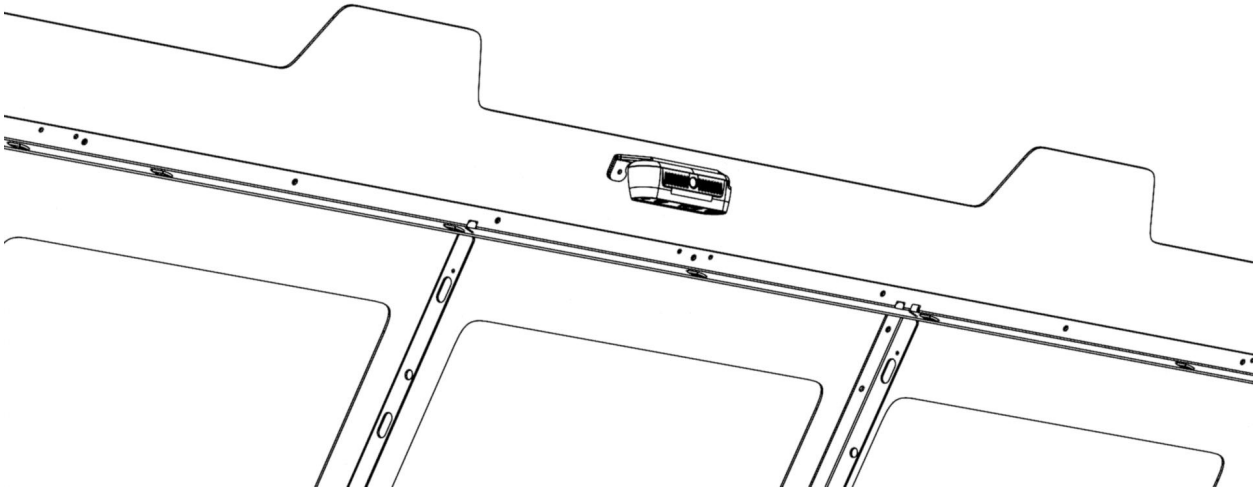


Fig. 58

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). 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 Workflow Section), and adjust settings.
5. Run perimeter to double check your position.
6. You are now ready to run your job.

Maintaining Your Camera

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. It may 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 3 of the camera registration tags are visible.

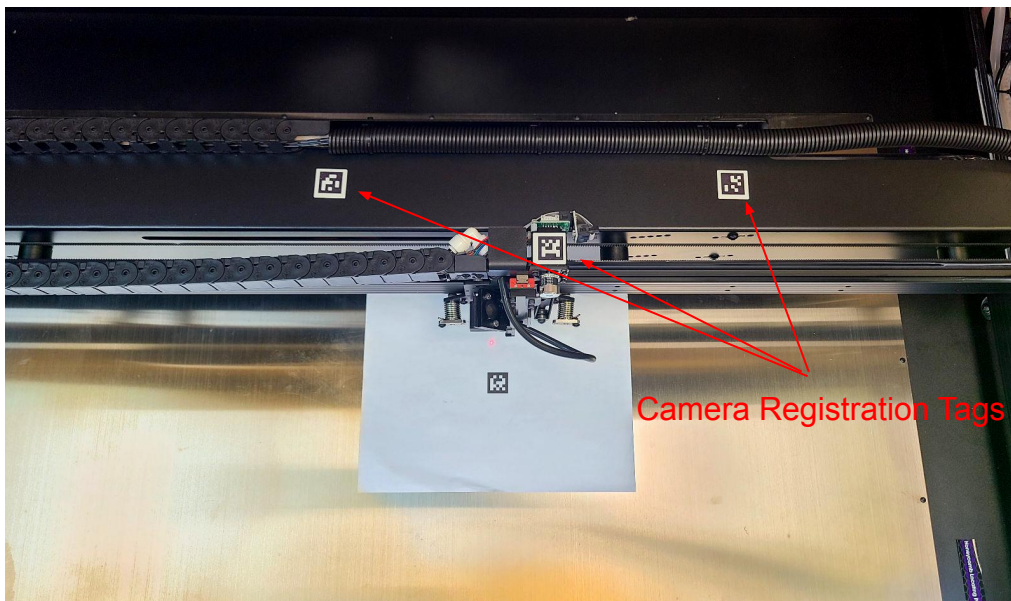
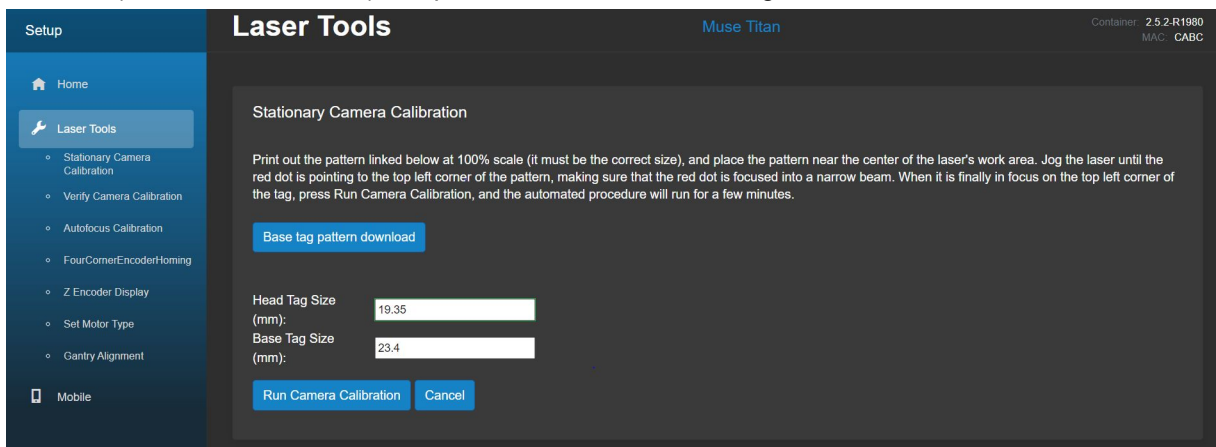


Fig. 59

5. **Redirect:** In your browser bar Copy and Paste “Titan Specific IP”/setup to the end of your IP address so it reads (YOUR IP ADDRESS)/setup/ to look like the below image.



6. Simply Click Laser Tools: In this menu simply scroll down to “Run Camera Calibration”

7. Download: The base tag pattern and print it out on a piece of paper and place it in the middle of the work area (taping it down helps)

8. Position: The laser head to the top left corner of the base tag pattern and autofocus on to it.



Fig. 60

9. Run Camera Calibration: The process will take a few minutes so keep the lid open during the calibration process. 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.

10. Check Accuracy: To check the accuracy of your calibration, place various items into your work area and autofocus onto specific areas such as corners, points, etc.

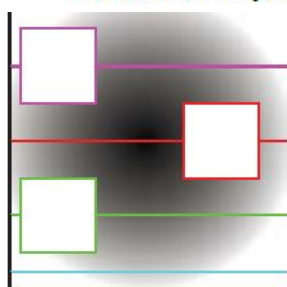
Materials Testing

The Muse Titan is capable of cutting a wide range of materials. Common materials include wood, cardboard, paper, fabric, acrylic, and leather. Muse Titan can also engrave on tile, stone, glass, and other hard surfaces, except metals. If you have any questions whether a material is suitable for a CO2 laser, contact the material manufacturer before use.

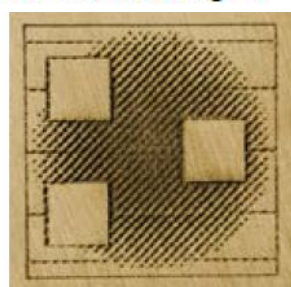


Use suitable materials will a wide range of power, current and speed settings. The settings of a material depends on its properties, such as density and thickness. Settings will also be determined by vector or raster choices, depth of cut and overall desired outcomes. This makes it difficult to provide operators with exact settings for each type of material. Instead, operators should learn to test their material.

Vector Examples from Dark to Light



Sample File



Dithered Example

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

Fig. 61

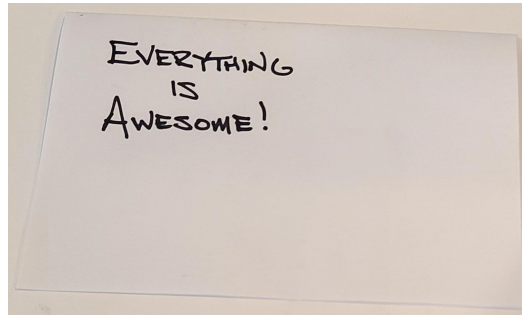
Vector Tracing

Our Muse 3D and Muse Titan come with the Vector Tracing feature. This allows the user to create their own image by hand and upload it into RE3 to save for future works.

1. Prepare the material you want to use. Flat objects work best. We recommend placing masking tape on the surface before marking with a pen or sharpie or making the design on paper for better visibility.

Note: Don't allow the masking tape to overlay on the material when applying more than one strip.

2. Draw your design with thick solid lines to ensure a proper reading. If coloring in an area, ensure it is completely filled in.



3. Capture the workspace.(Use Camera Icon)

Note: Lid must be open on the Titan or closed for the 3D for camera to run.

4. Then, select the "Vectorize" icon and create a box over the item you wish to capture.

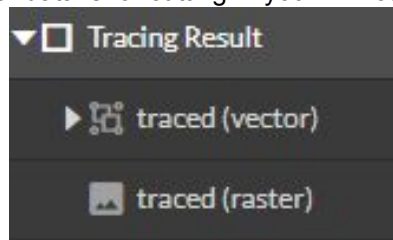


Note: If there is difficulty capturing the area, place a white piece of paper behind your design.

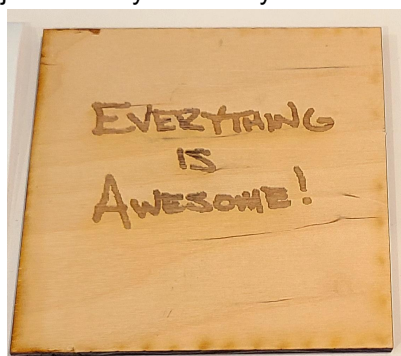
5. RE3 will trace the image.

Note that the image cannot be moved from the captured area. Items you wish to cut or engrave must be placed within the captured area for the job to be done.

6. You will now have Bitmap and Vector data for your object available in the Object Manager box. The Bitmap is for engraving, while the vector data is for cutting. If you will not be using any of the data we recommend deleting it.



7. You are now ready to run your job as many times as you wish.



Section IX. Hardware & Maintenance

With a little care and maintenance, your Muse Titan will 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 and 3mm Hex Wrench

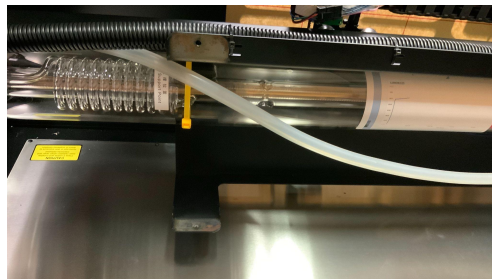
Installation Procedure:

- 1. Power Off Machine:** Power off and unplug your unit. Wait at least 1 hour for capacitors to discharge.
- 2. 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.



Fig. 63

- 3. 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.



- 4. Remove The Four Gantry Mounts:** Use the 3mm Hex key to remove the four M5 bolts that hold the tube in place located on the front side of your gantry behind the belts. Have another person hold the tube while removing the bolts so it does not fall. Remove the tube and set it down on the workspace.



5. **Remove the Connector:** Remove the grounding wire to the aperture using a Philips screwdriver.

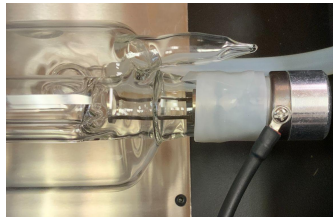


Fig. 64

6. **Disconnect Voltage wires:** Use a screwdriver to remove the blue voltage wire from the uncapped end of the tube. Remove the red cap from the other end and repeat the process.

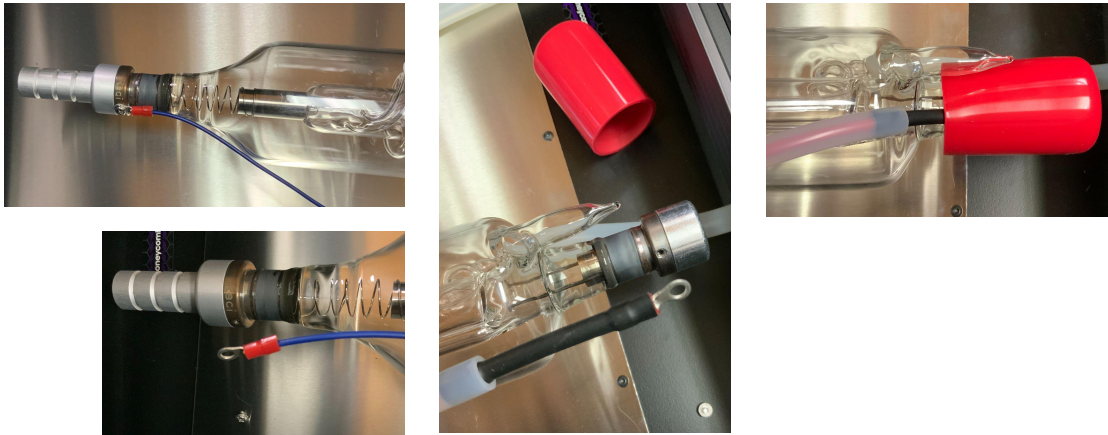


Fig. 65

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

WARNING! INLET AND OUTLET ARE FRAGILE!

WARNING! WATER CAN SPILL! HAVE A CLEANING RAG NEARBY IF NEEDED!

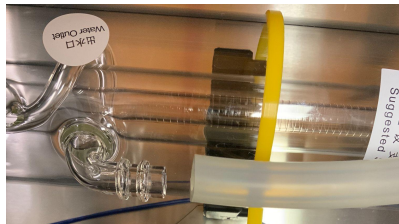


Fig. 66

8. After all items are disconnected, take the provided hex key to remove the screws atop each bracket to release the tube. Be careful when lifting the tube from the enclosure, make sure to angle it and guide it out first from the left side to ensure the right side where the coils are doesn't hit the interior of the chassis.

9. **Tube Disposal:** There are no special disposal instructions for the laser tube as the CO₂ contained inside is not at levels harmful to humans. Carefully break the tube to release the gas before disposing of glass as normal.

10. **Tube Re-mounting:** Simply repeat steps 8-1 in that order to install your new laser tube.

11. Items of Importance:

- Ensure there is silicone tape surrounding high voltage end and red cap is pushed all the way.
- Make sure high voltage wire is secured.
- When remounting tube onto shelf, make sure wires are not getting pinched, as this may damage them and make re-bolting difficult

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.

Required Parts and Tools

- 2.5mm Hex key (included with accessories)

Belt Installation Instructions:

Side Belts:

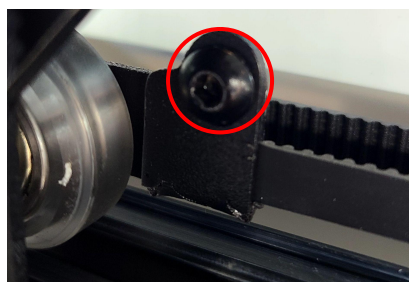
1. **Power Off Machine:** Wait at least 1 hour for capacitors to discharge.
2. **Loosen Retaining Screws:** Remove the M4 retaining screws and washers so that the old belt can be removed and discarded.



3. **Mount The New Belt:** Attach the new belt to the location off the previews on hand tightening one end before going to the other.
4. **Tighten Screws:** Once both ends are in place tighten the screws to secure and retain the belt.

Gantry Belt:

1. **Power Off Machine:** Wait at least 1 hour for capacitors to discharge.
2. **Loosen Retaining Screws:** Remove the M4 retaining screws and washers so that the old belt can be removed and discarded.



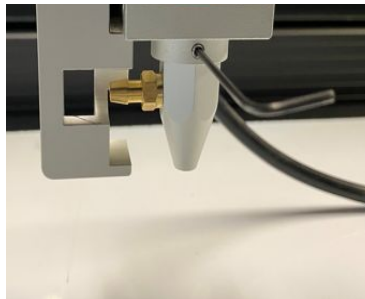
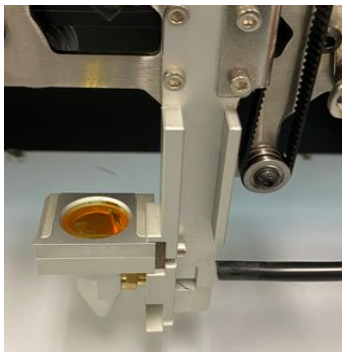
3. **Mount The New Belt:** Run each end of the new belt through the mounting slot.
4. **Tighten Screws:** Once both ends are in place tighten the screws to secure and retain the belt.
5. **Loosen the motor on the mount:** Once the belt has been installed on the rail, loop over the drive and pull motor 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 and Air Assist Cone Replacement Instructions:

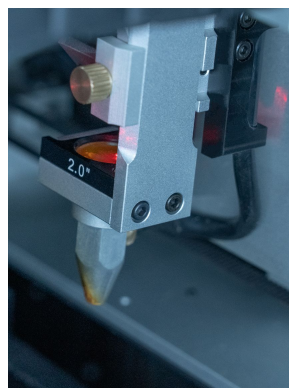
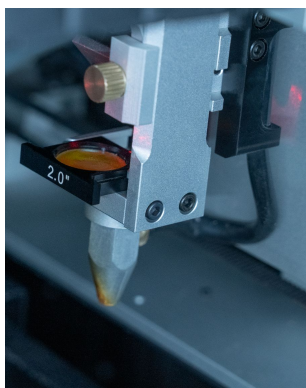
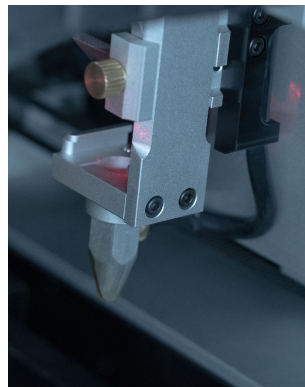
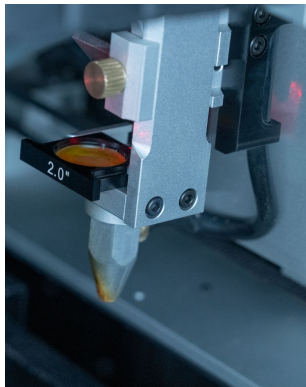
Parts: Air Assist Cone, Assist Fitting, and Focus Lens w/ Case (C)

Note: This is for replacing air assist cones and different sized lenses. If you are replacing a lens that has become damaged or broken you just need to slide the new lens in.

1. Disconnect the air hose by gently pulling it.
2. Using a 1.5 hex wrench (not included), loosen the "set" screw on the cone, but do not remove.
3. Remove the current air assist cone.



4. 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.
5. Slide the current focus lens out of the slot. This does not require tools.
6. Slide the new lens into the slot.



General Maintenance

Before starting a job:

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

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

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

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

Daily:

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

Weekly:

- Wipe down the walls of the machine with a clean rag.
- Use optical-grade lens wipes to clean both sides of the beam combiner, all mirror surfaces, the focus lens, and the tube aperture. Optic surfaces may need to be cleaned more often if cutting materials produce excessive residue (possibly daily).
- Clean fallen debris from the bottom of the machine to reduce fire risk, and provide better exhaust power.
- Clean filters bi-weekly(or sooner depending on use)
- 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).
- 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 may eventually wear and crack. If you find that the belts have become loose over time you can add tension by loosening the motor, adding tension, and re-tightening the bolts.

Free Projects & Extra-Help

We hope that this manual helped make your RE3 experience more enjoyable. We know that sometimes getting started is hard. That's why we offer free projects and other helpful tips and ticks on our website. If you wish to browse the free project list or to get more information just visit us at <https://fslaser.com/laser-101/> .

Below we'll show some samples of plans you can get from our website. We hope that these project will help kickstart your creative adventure.



Warranty

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

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

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

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

Products sold before 8/7/2012, had a 60-day base warranty on all items excluding shipping unless an extended warranty was purchased.

Our lasers have a 30-day full warranty and include a 1-year extended warranty. The 1-year extended warranty excludes shipping and consumable items. All electronic items (control cards, power supplies, motors) and most mechanical items are covered under the extended warranty unless damaged by abuse. Fire damage is not covered under the warranty. Consumables not covered include, but are not limited to, rubber parts (such as tubing, belts, plastic wheels, lenses, mirrors, other optics, and laser tubes).

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

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

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

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

Customer Support

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

Technical Support



M-F 8AM-5PM PST
support@fslaser.com
702-802-3103

Sales



M-F 8AM-5PM PST
sales@fslaser.com
702-802-3101

Manuals



fslaser.com/resources/
User manuals, Quick-Start Guides
and other resources for your laser.

Financing



fslaser.com/financing/
Work with us or our providers to find
the perfect option for any budget.

More Options

Submit a ticket online
fsl3d.zendesk.com/hc/en-us

Videos
youtube.com/user/FullSpectrumLasers

Blog
fslaser.com/blog/

Free Projects
blog.fslaser.com/freelaserprojects

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

Reach out to Us

Headquarters
6216 S Sandhill Rd
Las Vegas, NV 89120

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

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

You can also sign in to check order status

Shipping email: shipping@fslaser.com

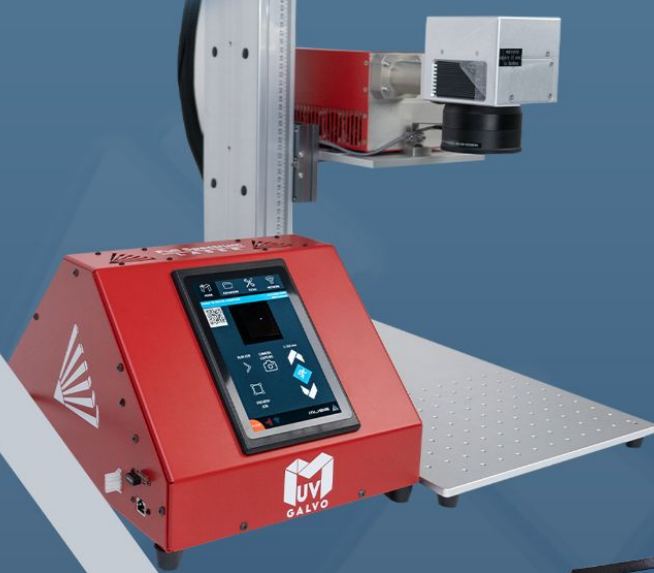
Accounting email: accounting@fslaser.com

READY TO UPGRADE ?

Have you gotten the most out of your desktop laser? have you hit the limits of your output quotas and want to see how the professionals do it? Step up to Professional Grade with P-Series and the Muse Titan by Full Spectrum Laser.

Our P-Series and Muse Titan take your production to the next level. Industrial grade components give you faster movement, better precision and increased laser power. All P-Series and Muse Titans come with our RetinaEngrave software, Motorized Z-stage, AutoFocus, Knife Edge and Honeycomb tables.

Do you have a more specific marking and or engraving application? Something to engrave the smallest of details? Look no further than the Muse Fiber Galvo and the UV Galvo. These machines are designed to capture and engrave extreme details on metal and other special materials.



Full Spectrum
L A S E R

JOIN THE FULL SPECTRUM LASER COMMUNITY

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

- WWW.FACEBOOK.COM/FSLASER

- WWW.INSTAGRAM.COM/FULLSPECTRUMLASER

- WWW.TWITTER.COM/FULLSPECLASER

- WWW.YOUTUBE.COM/FULLSPECTRUMLASERS



Full Spectrum
L A S E R