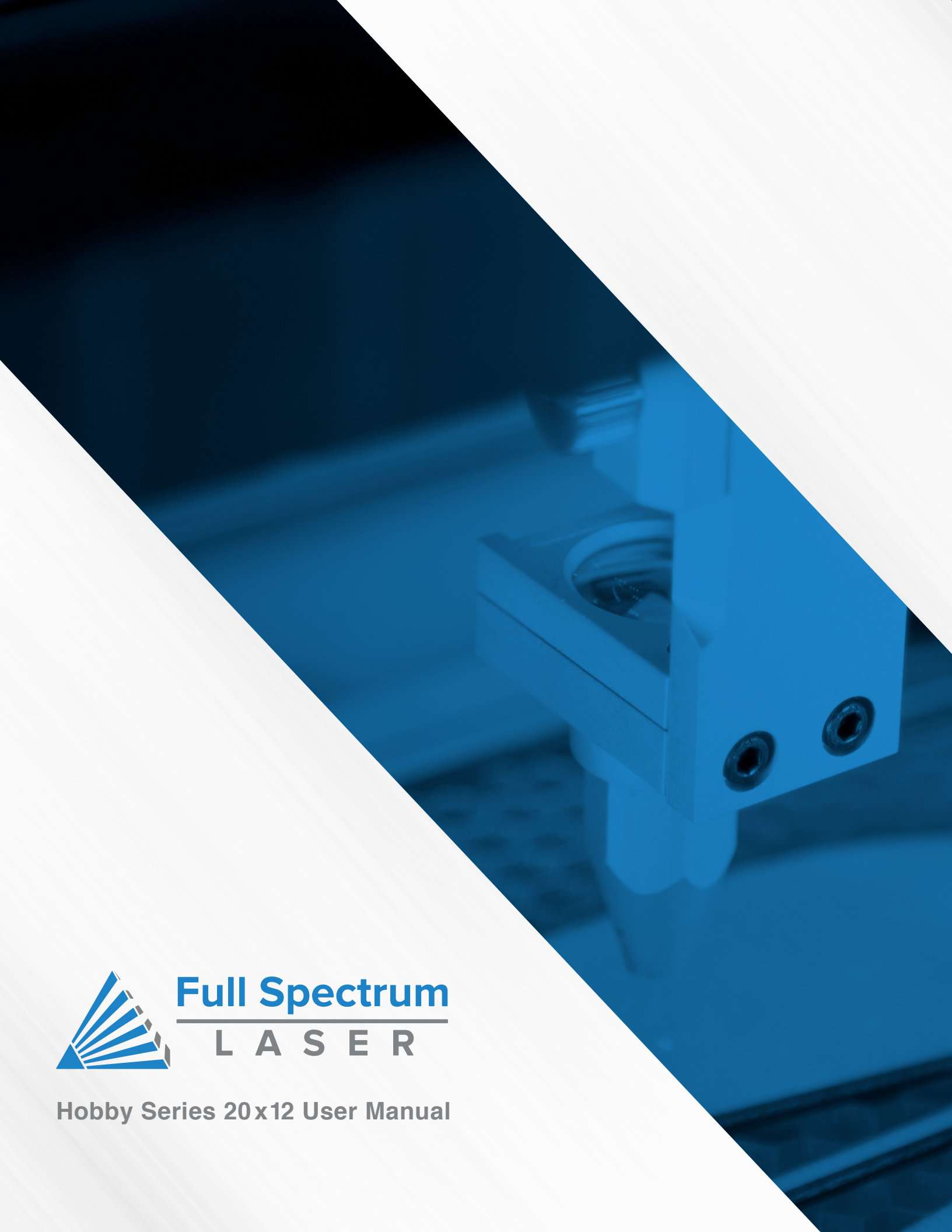


Full Spectrum
LASER

Hobby Series 20x12 User Manual

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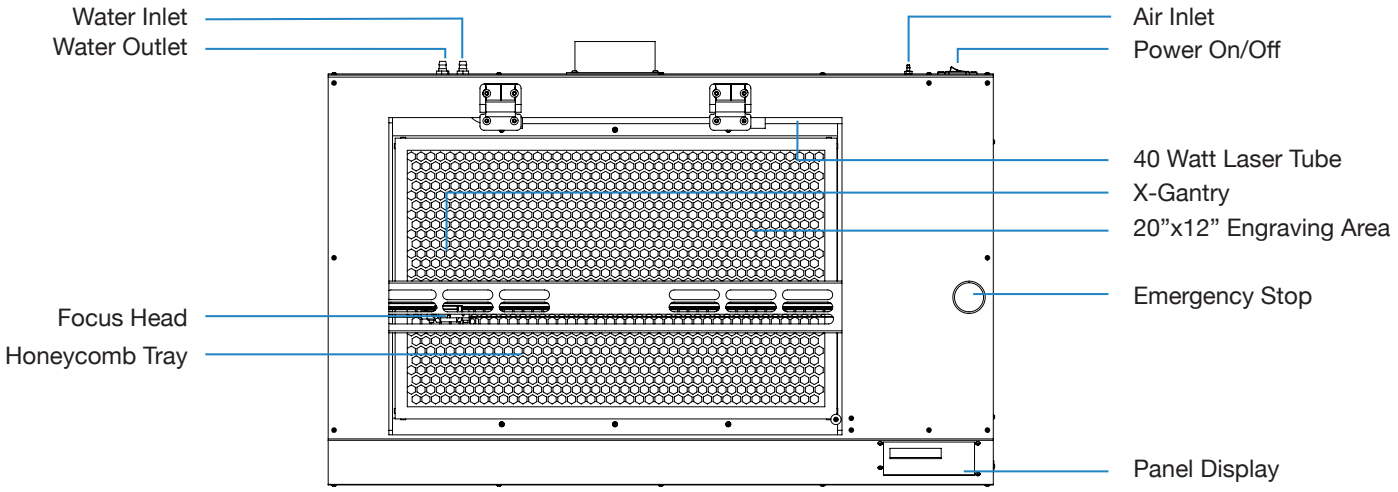
Appendix 70

Hobby Series Laser Cutter User Manual

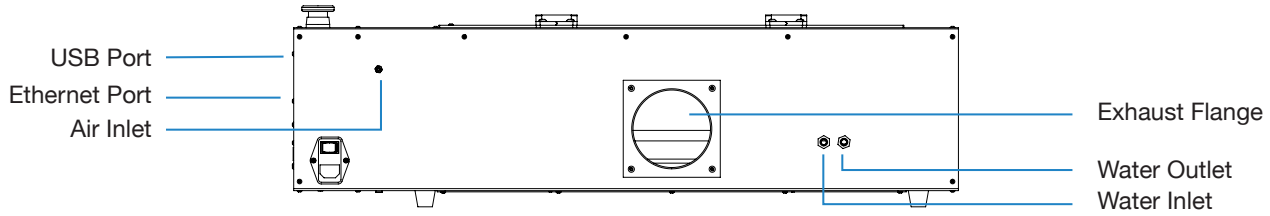
Congratulations on your purchase of a Full Spectrum Laser Hobby Series Laser System. With proper usage and upkeep, your laser cutter should provide years of productive output. This user manual will guide you through the safety guidelines and operation of your machine. It is recommended that you familiarize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

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

Top View



Back View



Compliance Statement The Full Spectrum Laser Hobby Series Laser System is a class 3R laser product, as defined in International Standard IEC 608251. The Full Spectrum Laser Hobby Series complies with 21 CFR 1040.10 and 1040.11, the Federal Performance Standards for LightEmitting Products, except for deviations pursuant to Laser Notice No. 50, dated July 16, 2001. The Center for Devices and Radiological Health of the US FDA issued Laser Notice No. 50 to permit manufacturers to classify and manufacture their products in accordance with the International Standard. 21 CFR 1040 and IEC 608251 require that certification, identification and warning labels be placed on laser products. Reproductions of the labels found on the Full Spectrum Laser Hobby Advanced Laser System follow, with locations specified:

SECTION I. SAFETY FIRST

Familiarize yourself with these icons. They indicate areas that require special attention.



Pro Tips:
Watch for this icon to receive valuable advice in getting the most from your machine.



Shock Icon:
Warns of potential electrical hazards.



Fragile Icon:
Warns of fragile parts or materials, such as glass.



CO2 Gas Icon:
Warns of potential gas leaks and associated hazards.



Level Icon:
Indicates the need for a level surface.



Safe Disposal Icon:
Calls attention to proper disposal of waste materials.



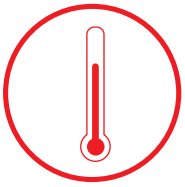
Laceration Icon:
Warns of potential sharp edges that could cause cuts or injury.



Fire Icon:
Warns of potential fire hazards.



Laser Icon:
Warns of potential dangers associated with laser usage.



Temperature Icon:
Warns of potential temperature issues with your machine.



Caution Icon:
Warns of important area of caution not covered by other icons.



Attention Icon:
Calls attention to an important point.

General Safety

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



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.



ALWAYS be aware that the laser tube is made of glass and is therefore extremely fragile and can cause severe lacerations if broken.



ALWAYS be aware that the laser tube is filled with CO2 gas. While carbon dioxide is a class 2.2 gas (nonflammable and nontoxic), 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 build up 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.



NEVER place hands or fingers into moving parts such as cooling fans.



IN CASE OF EMERGENCY power can be instantly cut off by pushing the Emergency Stop (the large red button) located on the top of the machine.

Laser Safety

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 guideline at all times:

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!

NEVER engrave or cut any material containing PVC or vinyl. These materials (along with other chlorine / chloride containing materials) produce a corrosive vapor that is extremely harmful 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).

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 laser with lid open. Always be sure the lid is closed and never tamper with lid safety mechanism.

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, produce compounds that can be harmful if concentrated.

NEVER look into the beam of the Alignment Laser (visible red diode laser).

NEVER aim any laser towards an aircraft or vehicle that is in motion. The bright light can flashblind,cause glare, or distract the pilot or driver.

Laser Safety (Cont.)

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

Fire Safety

Laser cutting and engraving systems can present a significant fire hazard due to the extremely high temperatures generated by the laser beam. While the objective of most cutting and engraving operations is to vaporize material without burning, most materials capable of being cut or engraved are inherently combustible and can ignite. 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.



Pro Tip! *Experience shows that vector cutting with the laser has the most potential to create an open flame. Acrylic in all its different forms has been shown to be especially flammable when vector cutting with a laser.*

ALWAYS keep a properly maintained and inspected 5lb or larger fire extinguisher on hand. Full Spectrum Laser recommends a Halogen fire extinguisher or a multipurpose dry chemical fire extinguisher. Halogen extinguishers are more expensive than a dry chemical, but offer certain advantages should you ever need to use an extinguisher. The Halogen extinguisher discharges a clean, easily removable substance that is not harmful to the mechanics or wiring of the laser system. The dry chemical extinguisher discharges a sticky, corrosive powder that is very difficult to clean up.

BE AWARE that stacking materials (especially organic materials such as paper) can lead to increased risk of flame propagation or work piece ignition.

NEVER operate your machine unattended. There is a significant risk of fire if the machine is set improperly, or if the machine should experience a mechanical or electrical failure while operating.

ALWAYS keep the area around the machine clean and free of clutter, combustible materials, explosives, or volatile solvents such as acetone, alcohol, or gasoline.

ALWAYS use air assist when vector cutting.

BE CAREFUL when vector cutting. Many materials have the potential to burst suddenly into flames – even materials that may be very familiar to the user. Always monitor the machine when it is operating.

Fire Safety (Cont.)

NEVER CUT PVC (polyvinyl chloride) under any circumstances as fumes are highly toxic and potentially lethal.

NEVER store any flammable materials in the inside of the device or in the immediate vicinity of the device. Debris and leftover produced materials within the machine must to be removed to prevent fire hazard.

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.

Woodshop Dust Fire Safety Considerations*

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

Be mindful of large quantities of fuel in the form of wood and wood products, sawdust, and flammable materials such as paints, oil finishes, adhesives, solvents, and liquid propane for internal combustion engines.

Preventing the buildup of dust is one of the key means for controlling fire and explosion hazards. The principal engineering control technology for control of dust is exhaust ventilation. The primary work practice control is good housekeeping.

Dust collection is best accomplished at the source-at the point of operation of the equipment, if feasible. For many pieces of equipment, well-designed ducts and vacuum hoods can collect most of the dust generated before it even reaches the operator.

Very fine dust that manages to escape point-of-source collection can be captured from above by general exhaust points located along the ceiling. These control technologies are effective for most equipment, excepting machines that commonly produce the very finest dust or large quantities of dust.

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

Electrical Safety

The power supply is capable of outputting DC 20,000V at up to 20mA. This power is also provided to the discharge terminals on the laser tube itself. Your laser shipped with silicone terminal covers that prevent access to bare wiring—notify Full Spectrum Laser support and immediately cease operations if these covers ever slip and expose bare wire.

DO NOT open any of the machine's access panels while the unit is plugged in. Opening a panel may expose the operator to the unit's AC input power. The AC input power is potentially lethal and is located on the far right within the cabinet.

NEVER make or break any electrical connections to the system while the unit is turned on.

NEVER access the electronics area with hands or tools unless the unit is disconnected from power for at least one hour.

NEVER replace the installed 10 amp fuse with a fuse of a higher rating. This will void your warranty and the electronics will not be adequately protected from surges or short circuits.

POWER ON/OFF is controlled by the switch at the back of the machine. To power the machine on, press the (-) side down. To turn power off, press the "o" side down.

IN CASE OF A BLOWN FUSE always contact Technical Support before replacing any fuses.

SECTION II. UNBOXING YOUR HOBBY SERIES

When your Hobby Series arrives, it will require careful unboxing and examination of parts. Follow these instructions for best results.

Unboxing Steps

Now that your Hobby Series has arrived, it will require careful unboxing and examination of parts. You will need two able-bodied adults to lift and place the machine.
Follow these instructions for best results:

1. Prepare Work Space: You will need an open, level work space to place your laser cutter. A solid table with adequate room for the machine is recommended (the machine's dimensions are 32" x 20" x 8.25"). Be sure the table is free of clutter and can support a minimum of 100 lbs (the machine weighs 60 lbs on its own).

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

3. Remove Packaging: Gently remove the following from the box: the honeycomb plate, the Quick Start Guide and the top (4) foam pieces securing the machine.

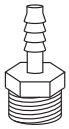
4. Remove Accessories: Nestled inside the machine are the following items: (1) water pump, (1) 2.5mm hex wrench, (1) focus billet, (1) Ethernet cable; (1) power cord, (2) water tubes and thermal paper. Use the checklist below to inspect these parts to insure they are accounted for and intact. Carefully remove any remaining packaging in the machine bed.

5. Place Hobby Series: This will require two adults as the machine weighs approximately 60 lbs. Standing on both ends, grip the machine from the bottom and gently lift the machine out of the box, leaving the bottom foam still inside the box. Place on the clean, flat table you plan on keeping it. Your Hobby Series is now unboxed.

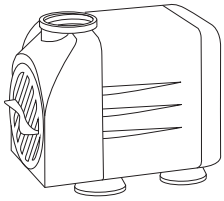
6. Inspect your Hobby Series: If have any questions, contact your sales representative or customer support.

Unpacking List

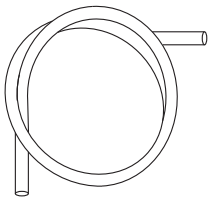
Your laser shipped with the following included parts and accessories:



1. Plastic Fitting



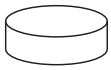
2. Water Pump



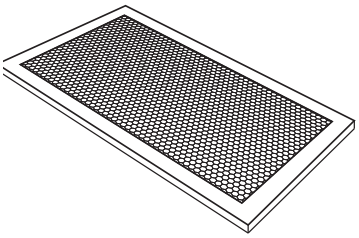
3. Water Tubes



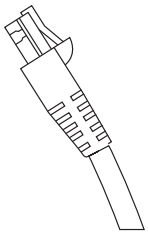
4. 2.5mm Hex Key



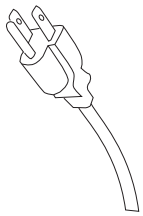
5.Focus Billet



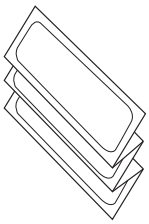
6. Honey Comb



7. Ethernet Cable

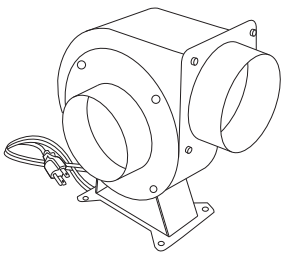


8. Power Cable

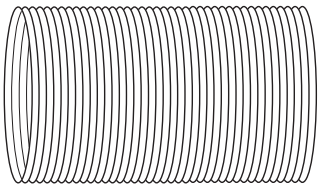


9. Thermal Paper

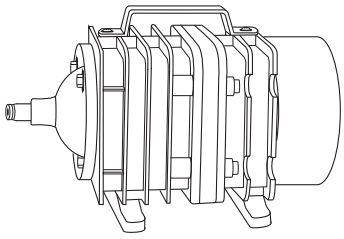
Not Included but Required



10. Exhaust Fan



11. 4” Ducting



12. Air Compressor

Additional Requirements

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

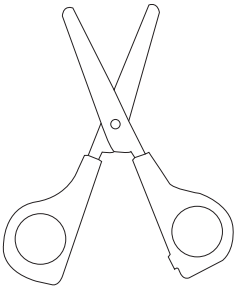
- **3-5 gallons of distilled water**
- **A five gallon bucket**
- **Small Scissors**



Distilled Water



Water Bucket



Small Scissors

CAUTION! *You should never operate your laser without a working exhaust. Full Spectrum Laser recommends exhaust systems capable of 232 CFM. Keep in mind that exhaust systems with high flow rates may require fixtures for thin materials.*

FIRE WARNING! *It is important that either rigid or flexible metal ducting be used in the exhaust system. Any type of "soft" ducting is potentially flammable and should not be used under any circumstance.*

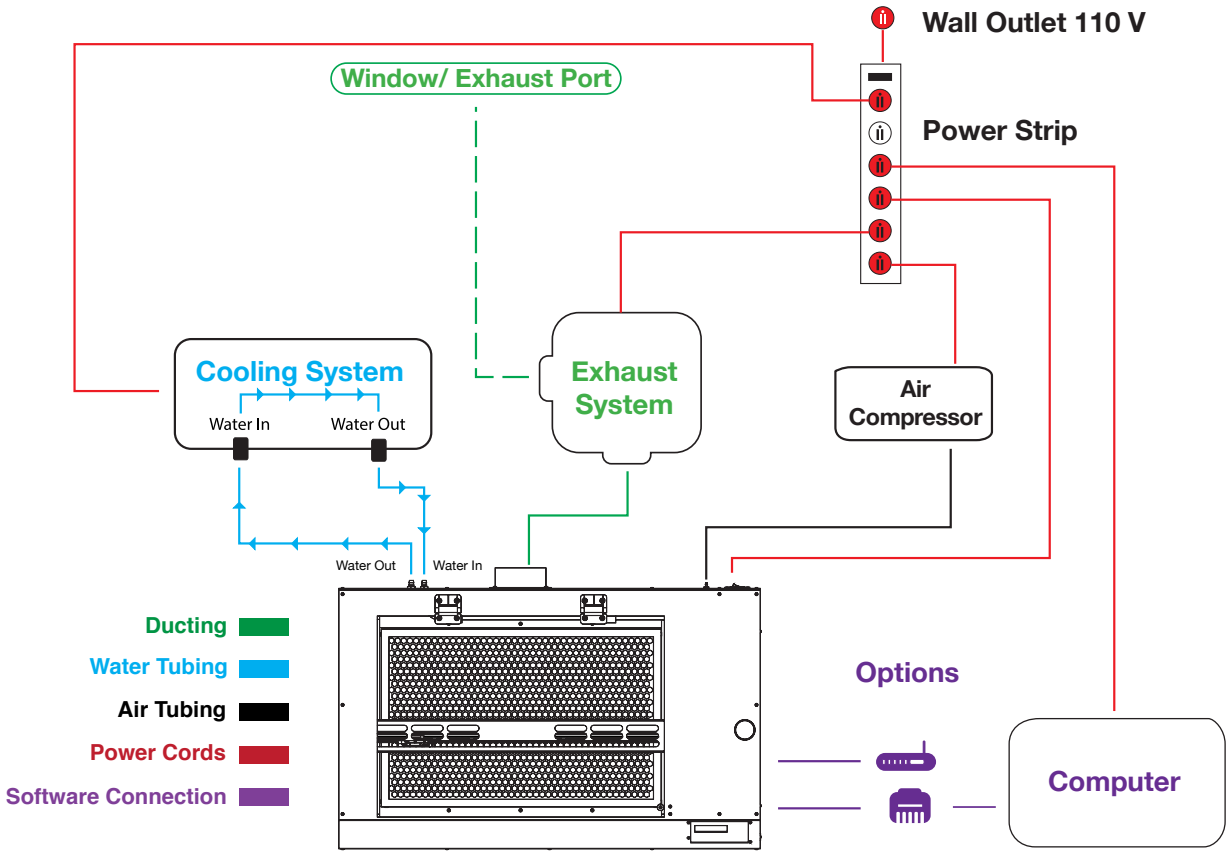
SECTION III. INSTALLATION & ASSEMBLY

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

Assembly Stages:

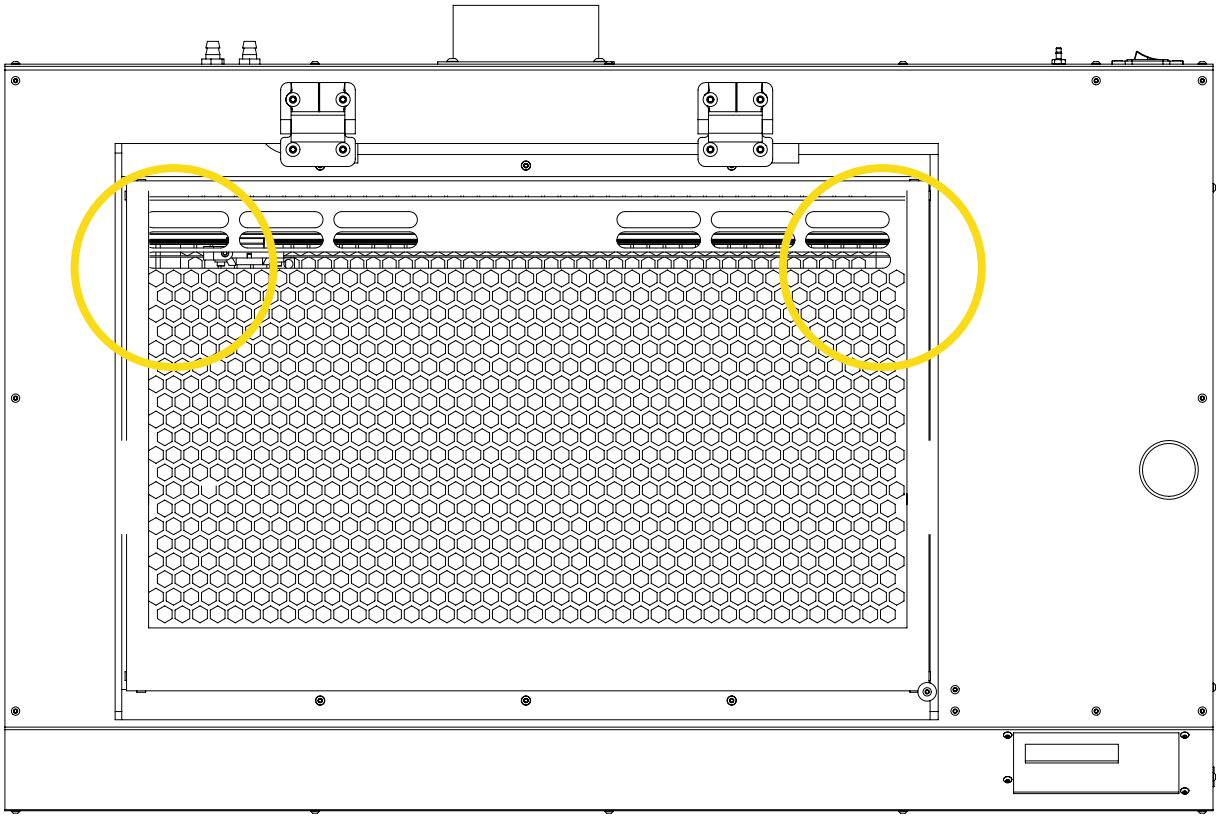
1. **Locate & Remove Zip Ties**
2. **Assemble the Water System**
3. **Assemble the Air Compressor**
4. **Connect the Exhaust System**
5. **Connect Electrical Power**
6. **Connect the Ethernet Cable**
7. **Connect to RetinaEngrave Software**

Figure 3.1



Assembly Stage 1: Locate & Remove Zip Ties

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

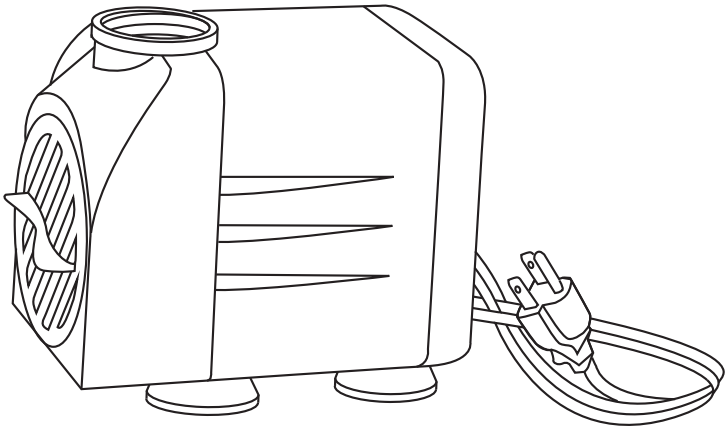


1. Locate Yellow Zip Ties: Yellow zip ties secures the laser head and x-gantry during shipping. Open the lid and identify all yellow zip ties.

2. Cut and Remove Yellow Zip Ties: Using a small pair of scissors (nail cutters work remarkably well), carefully cut and remove ALL yellow zip ties. DO NOT cut any other cord or wire. Be aware that the glass laser tube is extremely fragile. Be careful NOT to damage any part of the machine during this process.

Assembly Stage 2: Assemble the Water System

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





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

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

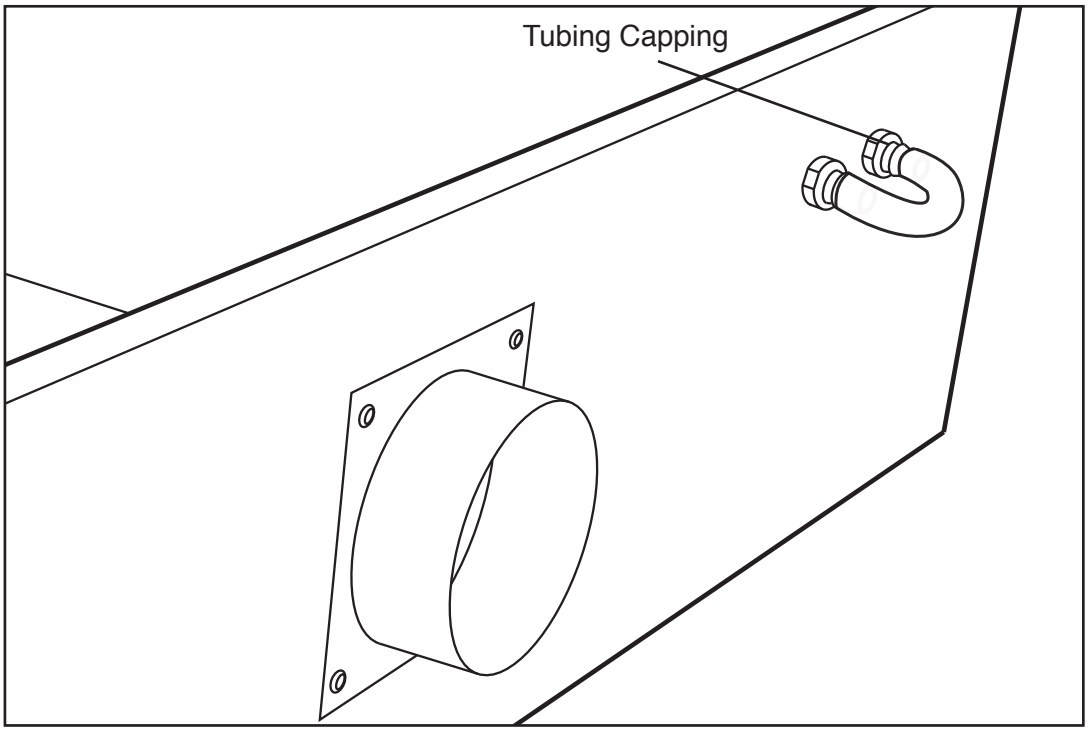


Figure 3.2

2. Attach Water Pump Fitting: Remove the water pump from its packaging. Attach the plastic fitting to the water pump by gently screwing it on.

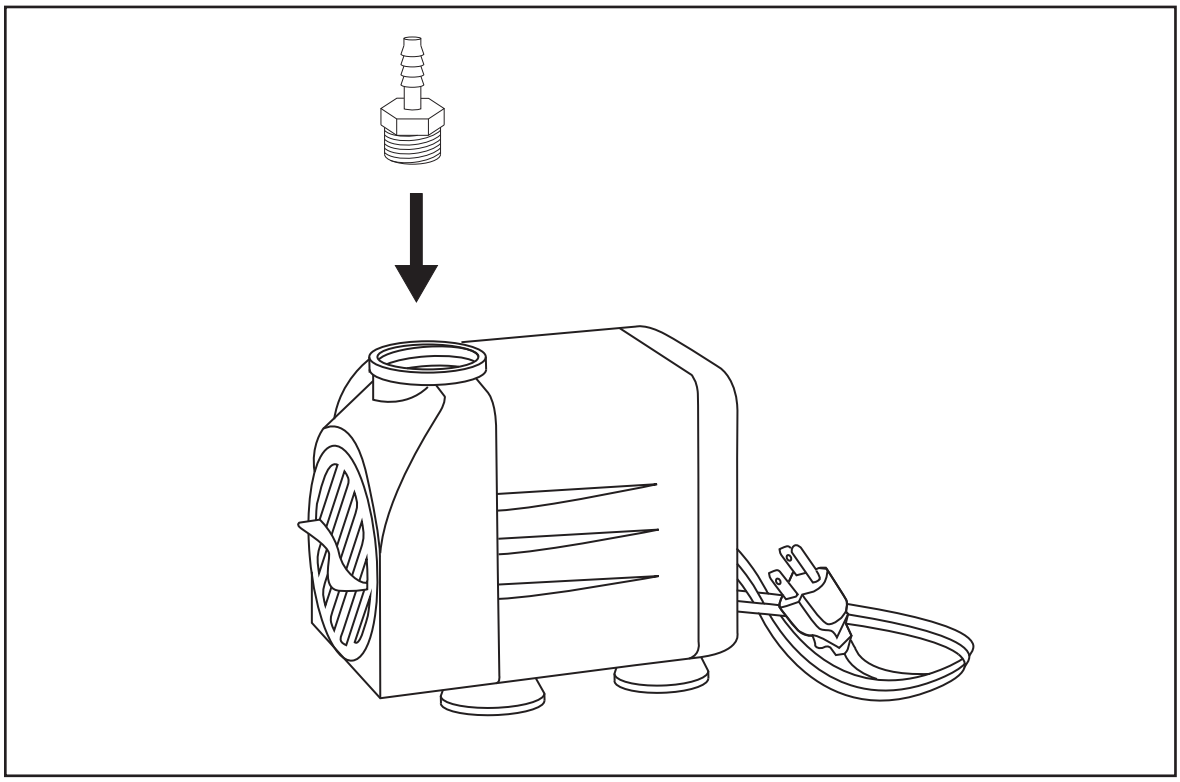


Figure 3.3

3. Prep Water Bucket: Fill a clean 5 gallon bucket (not included) with 3 - 4 gallons of distilled water (not included). ALWAYS use only distilled water and replace often. It is recommended that you choose a bucket with a lid and cut holes to allow the tubes to fit. This will prevent debris falling into your water bucket.

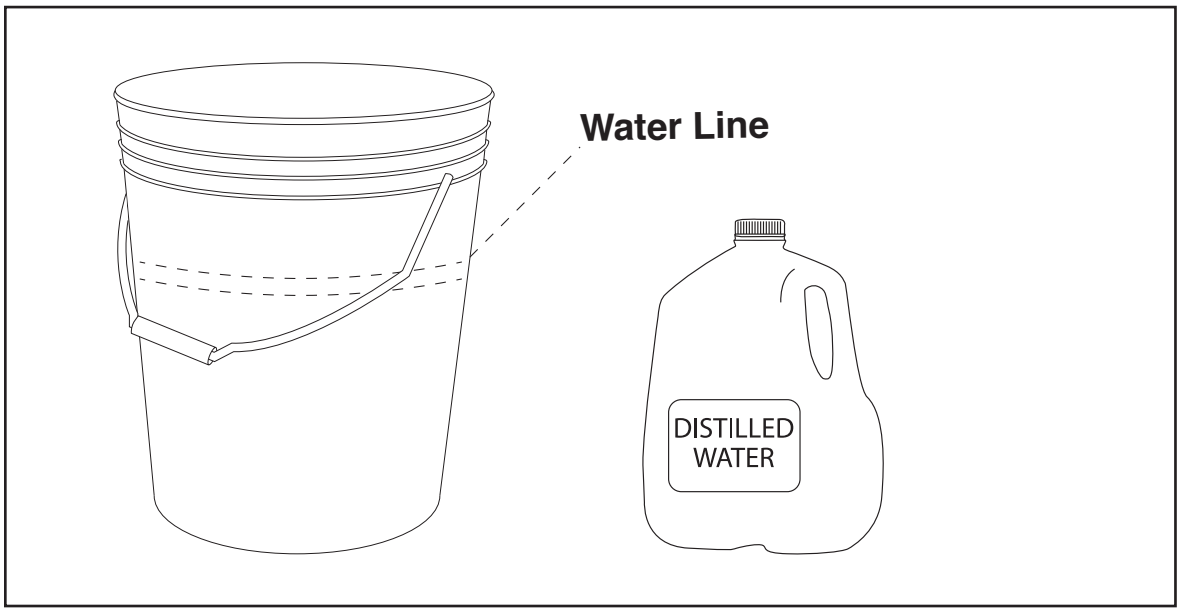


Figure 3.4

4. Attach Inlet Water Tubing: Push one end of one of the two (2) silicone water tubes onto the water pump fitting. Now attach the other end of that tubing to the “water inlet” located at the back of machine. Completely submerge the assembled water pump in the bucket of distilled water.

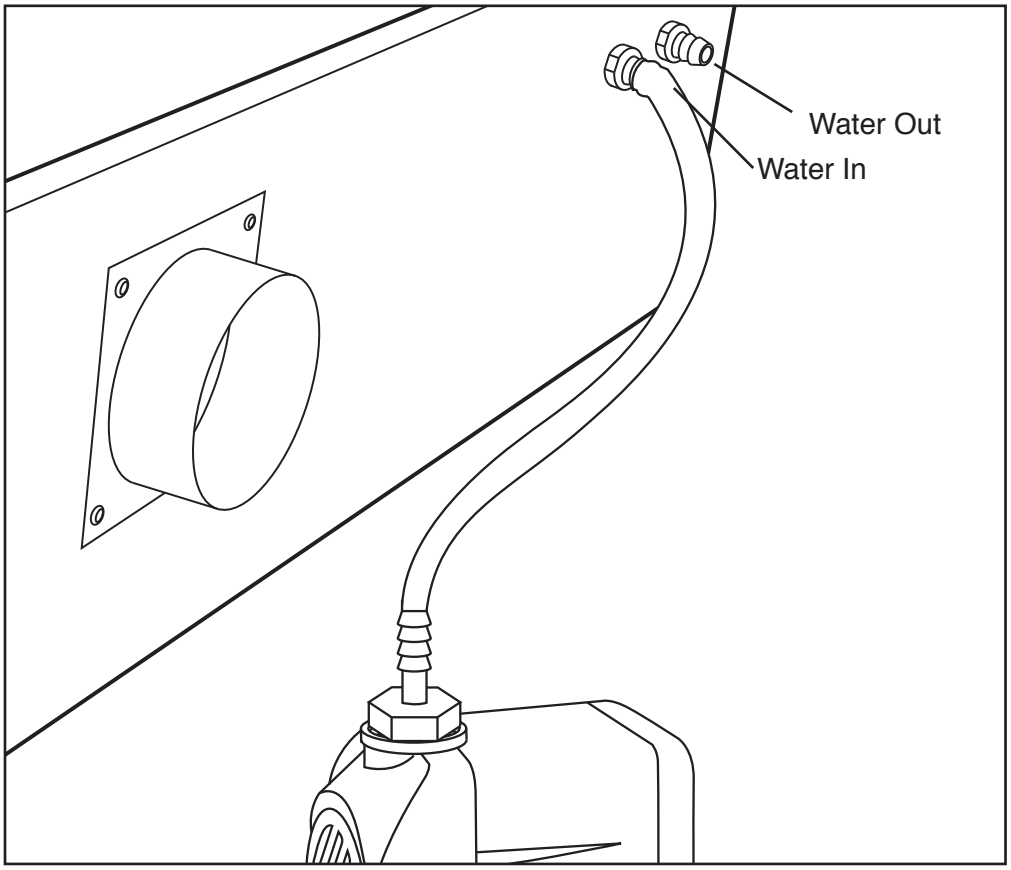


Figure 3.5

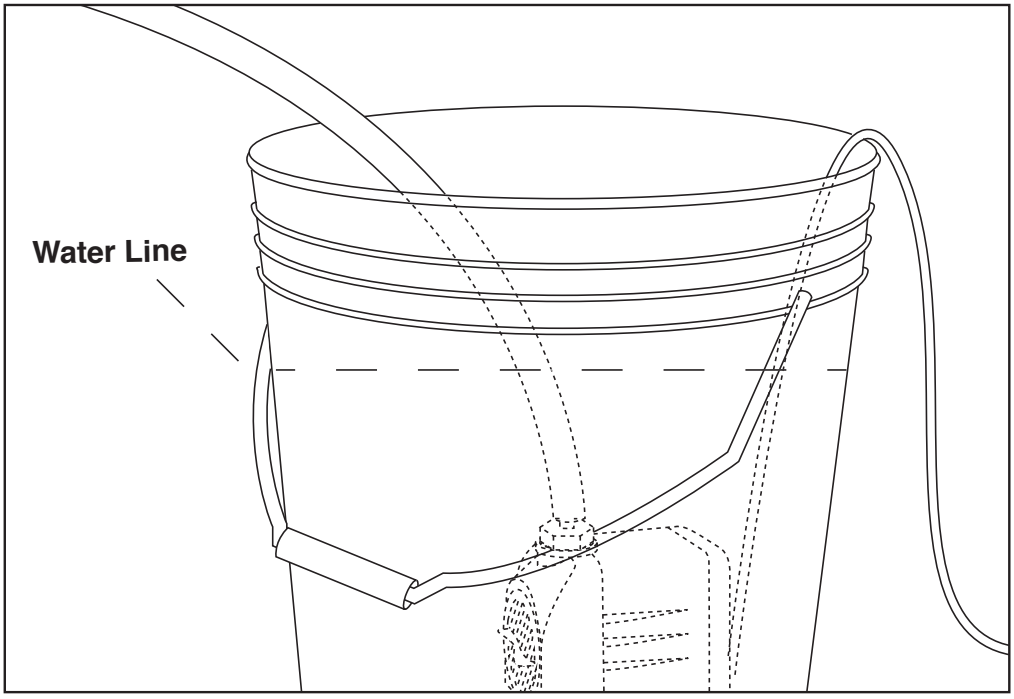


Figure 3.6

5. Attach Outlet Water Tubing: Push one end of the other silicone water tubing onto the "water outlet". Place the other end of the water tubing into bucket of distilled water.

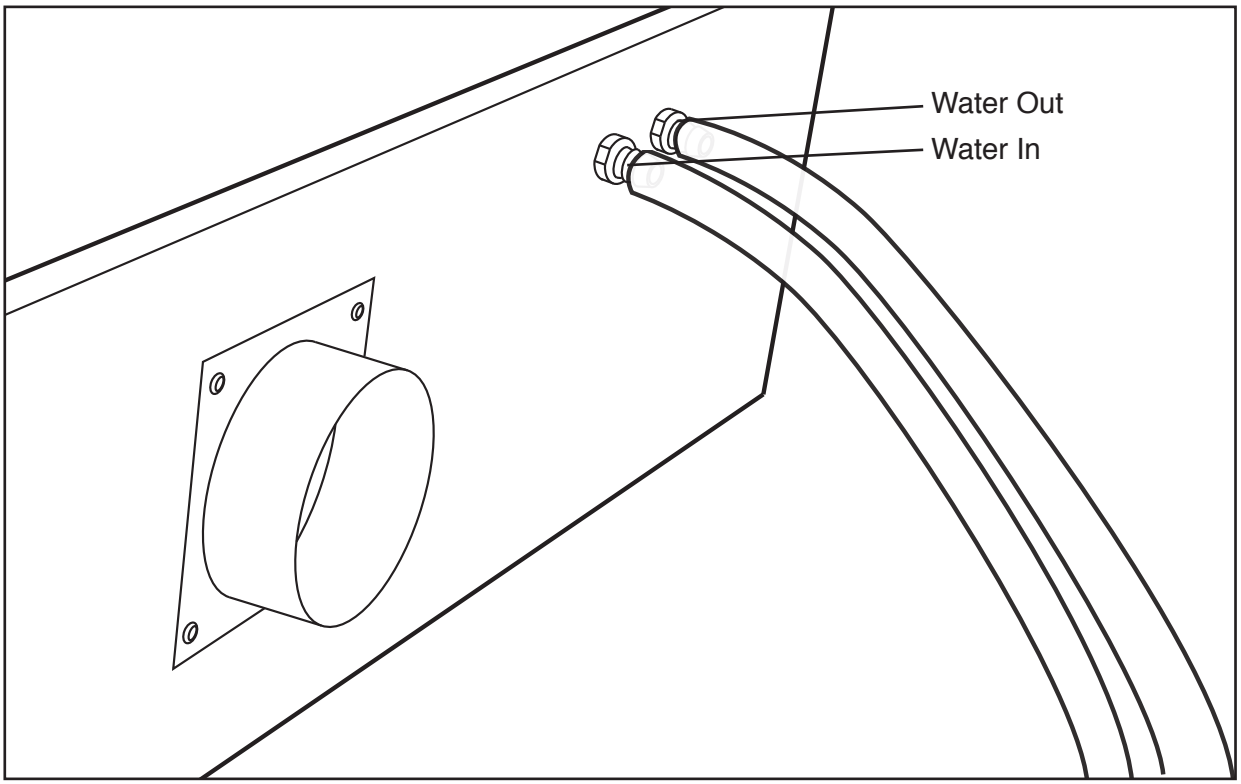


Figure 3.7

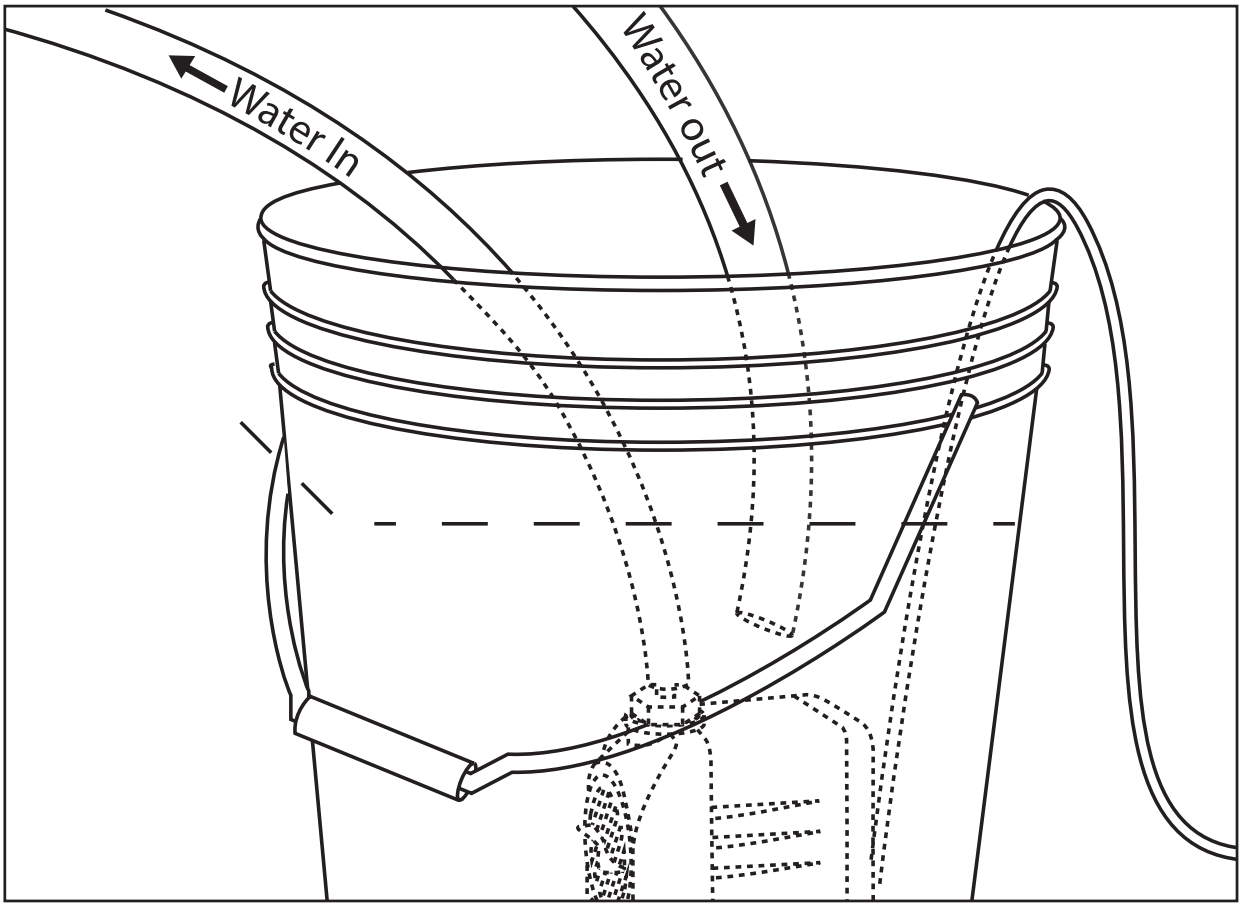


Figure 3.8

Assembly Stage 3: Assemble 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. Attach Push Fitting: Remove the air compressor from its packaging. Gently attach the air hose push fitting to air compressor.

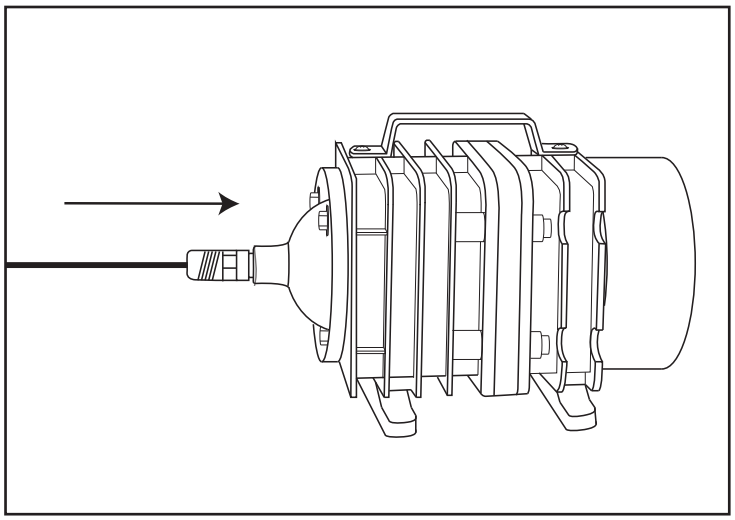


Figure 3.9

2. Attach Air Hose to Air Compressor: Push one end of the black air inlet hose into the air compressor push fitting until it is snug.



PRO TIP! *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 - this ensures that the water pump is always on when the laser is powered.*



CAUTION! *Make sure that there are no air bubbles inside of the water jacket of the laser tube. Air bubbles can create local hot spots in the lasing chamber and reduce the lifetime of your tube. If present, water bubbles typically migrate to the electrodes on either end of the tube. You should visually inspect the laser tube to make sure that bubbles are not present; slightly tilting the laser while powering on the circulation pump is usually sufficient to remove bubbles.*

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

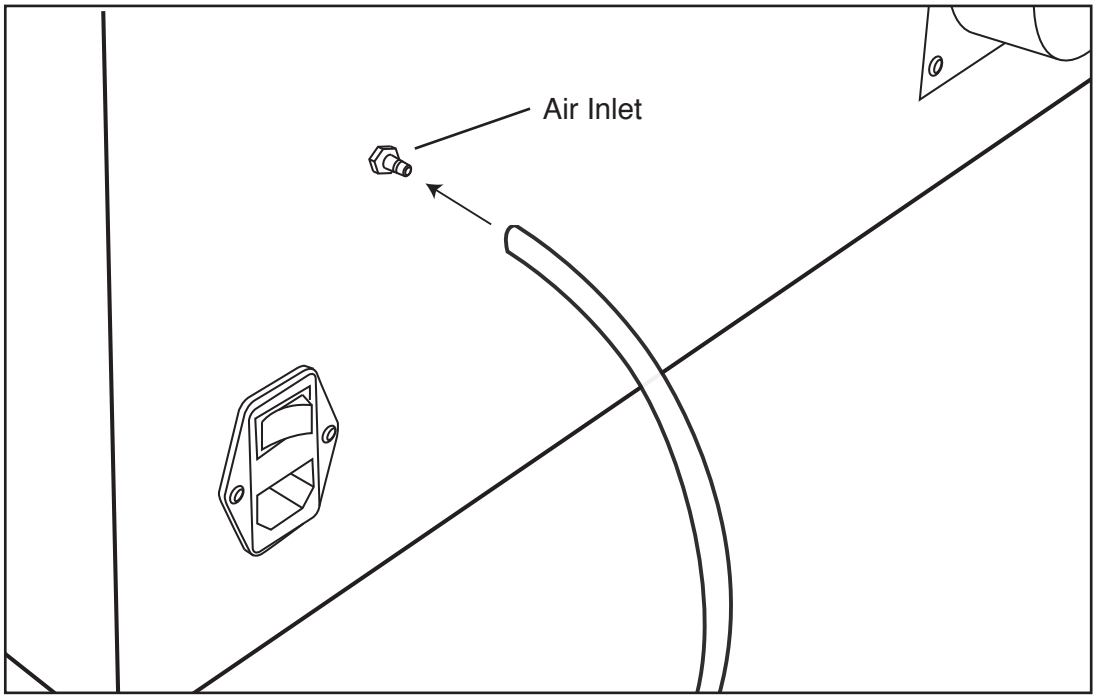


Figure 3.10

4. Connect to Power: Plug the air compressor into a power supply such as an outlet or power strip.

Assembly Stage 4: Connect the Exhaust System

It is required that an exhaust blower (or fume extractor) is connected and operating whenever you run a job on your laser. A properly installed exhaust blower removes smoke and fumes from the case and exhausts them to the outside of the building or a fume extractor. You will also need 4” ducting and two (2) 4” ducting clamps.

1. Position Ducting: Place your 4” ducting over the Exhaust Port located at the back of the machine and hold. Secure with 4” ducting clamp.

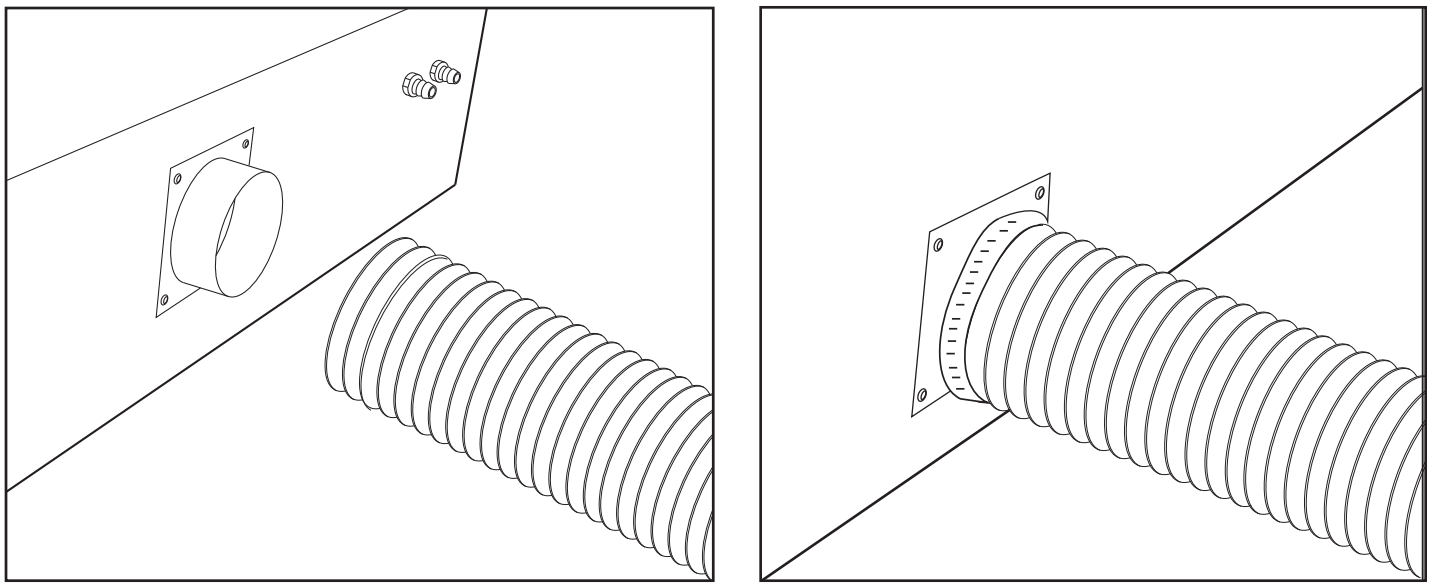
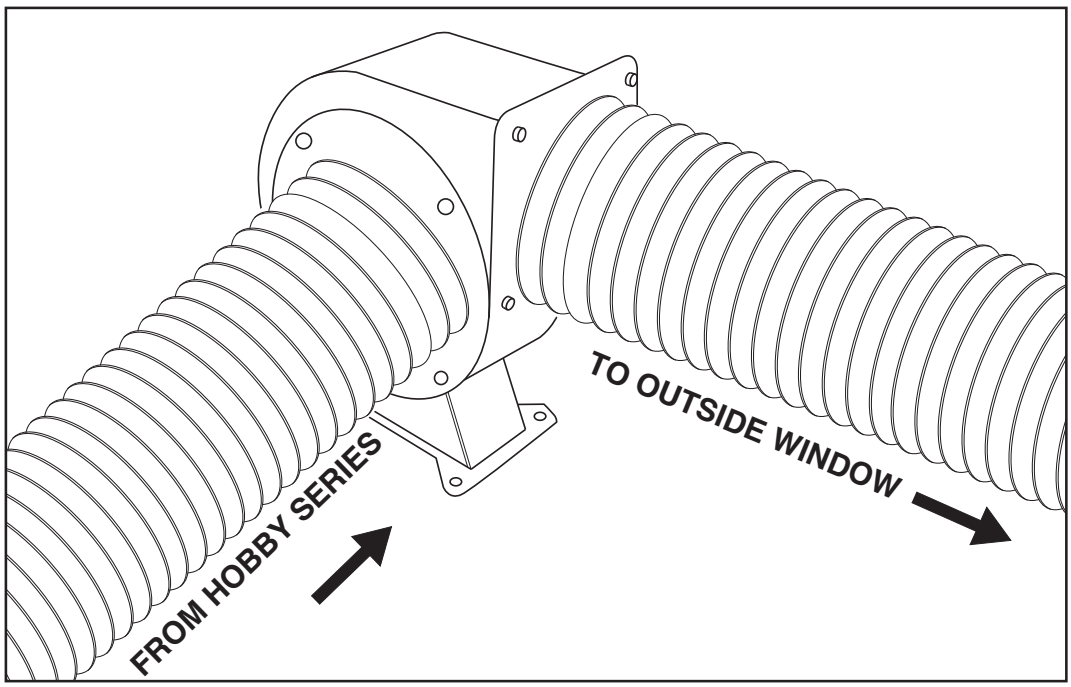


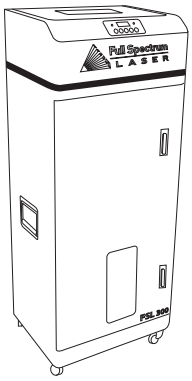
Figure 3.11

2. Attach Exhaust Fan: Secure the other end of the ducting, connected to the machine, to the exhaust fan. Now repeat the ducting and clamping process on the other side of the exhaust fan, creating a sequence of machine to ducting to exhaust fan to second ducting. Now plug in the exhaust fan into the an outlet or power strip.

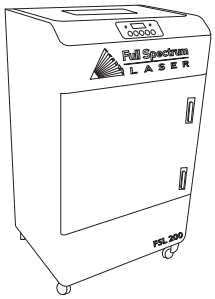


3. Ventilate Outside: Set the open end outside of a window or an installed ventilation outlet. Check your system for leaks—most can be remedied with duct tape. Please be aware that the protective housing is not designed to be airtight; the front grill is designed to allow an exhaust system to draw fresh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

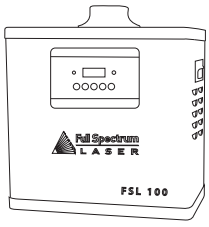
4. Fume Extractor Upgrade (optional): You can also upgrade to a fume extractor. Fume extractors are air purifiers that clean the air through HEPA Filters. Fume extractors do not require outside ventilation. This is a great option for workshops that do not have the option to ventilate outside. Both the extractors and the filters are available on the Full Spectrum Laser website at https://www.fslaser.com/Products/LaserAccessories. Ask a customer support representative which fume extractor is right for your needs.



Large Fume Extractor



Medium Fume Extractor



Small 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.

NEVER use a fume extractor without all filters in place.

Follow these maintenance guidelines:

Pre-Filters

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

HEPA Filters

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

Activated Carbon Filters

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

https://www.fslaser.com/Products/LaserAccessories.

Assembly Stage 5: Connect Electrical Power

Your Hobby Series Laser System, and available accessories, are configured to accept 110VAC at 60Hz. 220VAC units connect to power through an included converter (single-phase 220VAC).

1. Prepare Power Cord: Remove the electrical cord from its packaging.

2. Plug in Power Cord To Laser Cutter: The power cord plugs into a standard power receptacle located on the rear-right side of the machine.

3. Plug in Power Cord to Outlet: Finally, plug the power cord into any proper outlet socket in your workspace.

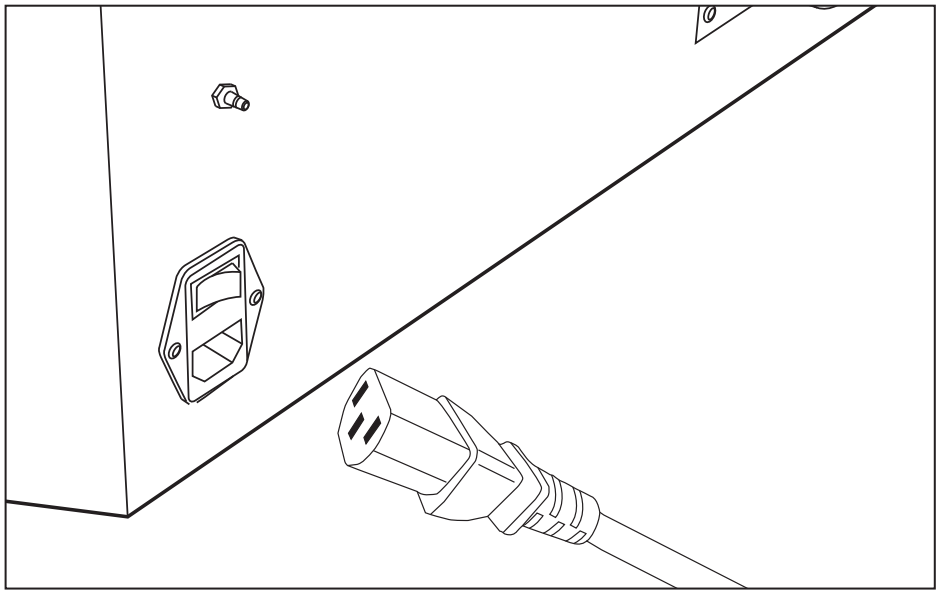


Figure 3.12



EMERGENCY STOP: *The laser's power can be instantly cut off by the large red button (e-stop) located on the top of the case in the far right. This is an open twist to release button. To power the laser down, simply press the button down until it locks. To power the laser up, twist the button clockwise according to the indicating arrows on the surface of the button.*



IN CASE OF A BLOWN FUSE: *The laser system is equipped with a fuse on the power inlet to protect the machine from surges or short circuits. If this fuse ever needs replacement, please contact Full Spectrum Laser technical support.*

Assembly Stage 6: Connect the Ethernet Cable

An Ethernet cable is included with your Hobby Series to enable your machine to connect with your computer to run the software.

1. Identify the Ethernet Cable: Locate and remove the included Ethernet cable from its packaging.

2. Plug Ethernet Cable into Laser Cutter: Plug in the Ethernet cable into the Ethernet slot on the Hobby Series.

3. Plug Ethernet Cable into Computer: Plug the other end of the Ethernet cable into your computer's Ethernet slot.

4. Connect Via Router (Recommended): Router connectivity is more reliable than directly connecting via Ethernet and should be the primary way of connecting. Direct connect from laser to computer should be a secondary choice, if possible. If direct connecting to router is not available (i.e. due to location of router) then we recommend using an Ethernet to Wi-Fi adapter that is connected to the router. If both of those are not possible then direct connection to computer can be utilized via the Ethernet cable.



PRO TIP! *Hobby Series can connect to your computer via either Ethernet or USB (but not both simultaneously). Full Spectrum Laser includes an Ethernet cable in the laser accessories and recommends the use of Ethernet cables as USB is more prone to electrical interference.*



ATTENTION! *Your laser must be connected to your computer in order to download jobs. The laser can store jobs in its onboard memory while powered, however loss of power will cause stored jobs to be lost. If you purchase and install a USB device, you can download jobs to your laser and run them without a computer attached (however you will not be able to alter the job settings from the laser control panel). Because a USB device is not volatile memory, jobs are stored between power cycles.*



PRO TIP! *If your laser is located more than 6ft from your computer, you will need to use the Ethernet connection. Connecting via Ethernet while the power is on requires you to power cycle your machine in order to obtain an IP address.*

Assembly Stage 7: Connect to Software

System Requirements:

- Windows Vista and higher
- Minimum 2GB Ram
- Dual Core Processor

1. Go to Download Page: Turn on your computer or laptop, now connected to your laser cutter via the Ethernet cable, or a router. In your favorite browser (Google Chrome is recommended) go to http://fslaser.com/RetinaEngrave.

2. Download Installer: You will need to download the RetinaEngrave installer first. Click Download for Windows and begin the process, following all on screen instructions.

3. Run Installer: Once the installer is downloaded, click Run. Approve any security warnings – the software will not harm your computer.

4. Run Setup: You will be welcomed by the Setup Wizard. Click Next and follow the instructions.

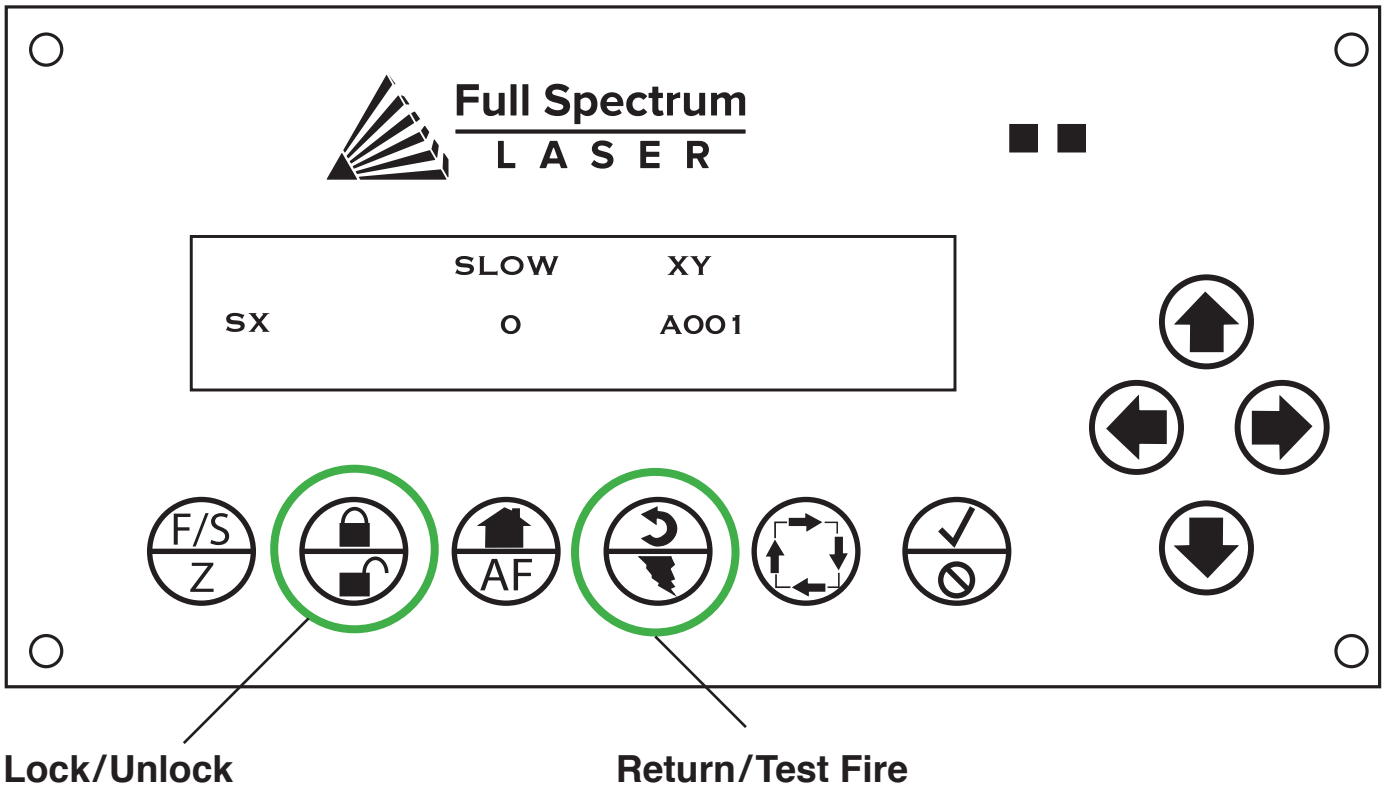
5. Open Software: Once the download process is complete, you are ready to launch the program through your start menu or by clicking the desktop shortcut.



ATTENTION! *Your machine must be powered on when operating the software or when connecting the laser via the Ethernet cable.You will need uninterrupted Internet access for this process.*

SECTION IV. TESTS & ADJUSTMENTS

It is important that your laser is tested and adjusted (if needed) for proper use before you start your first job. The following will be on our list of tests and adjustments:



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

1. Alignment Test

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

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

2. Place Thermal Paper: Take a small piece of thermal paper (approx. 15 mm should be plenty) and place it over the focus lens under Mirror #3.

3. Unlock X-Gantry: Press “unlock” on the touch panel to allow manual movement of the x-gantry bar. It should now move freely with your hands.

4. Position Laser Head: Move the laser head into the upper left corner of the workspace.

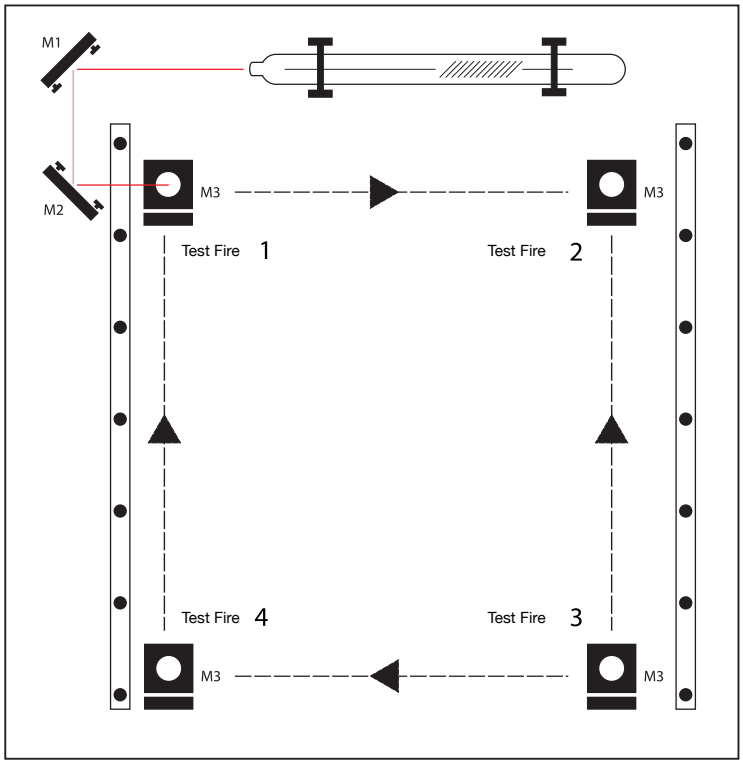


Figure 4.1

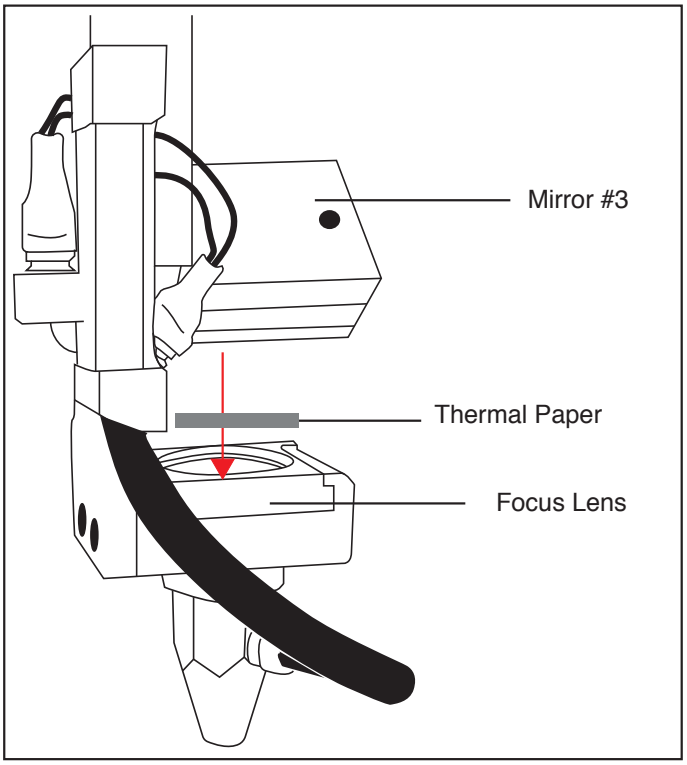


Figure 4.2

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

6. Test Fire the Laser: Press the Fire Laser Icon Button on the touch panel.



ATTENTION! *Find and push this icon on your Hobby Series touch panel to test fire the laser.*

7. Repeat Test Fire in Other Three Corners: Without removing the thermal tape, repeat firing the laser once in each of the other corners of the machine (Upper Right, Lower Right, and Lower Left).

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

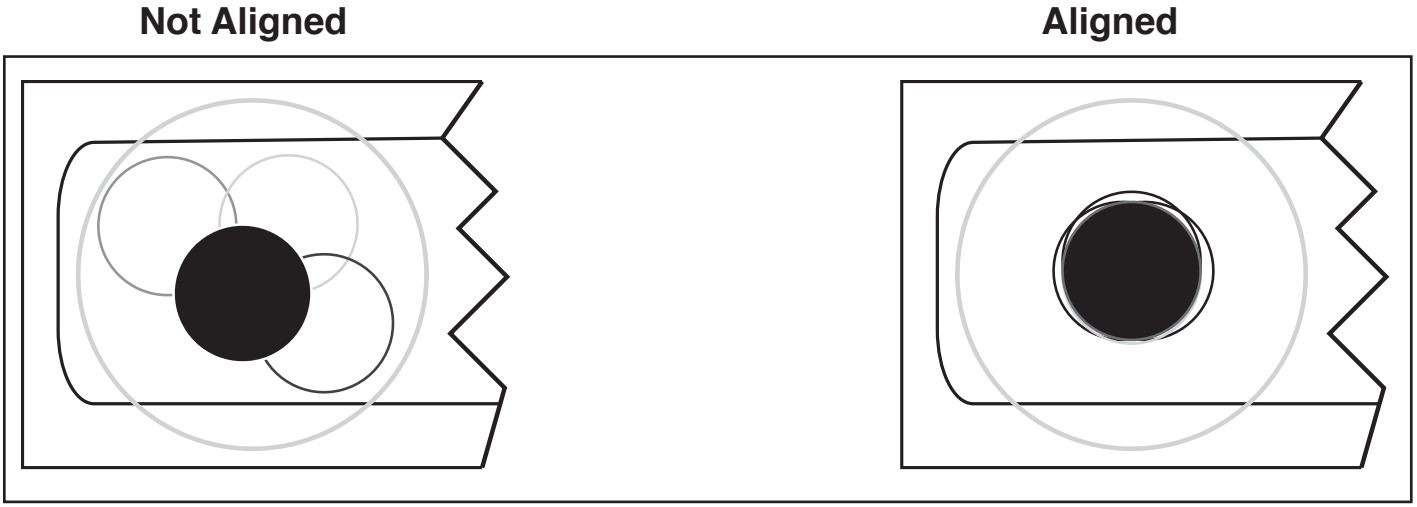
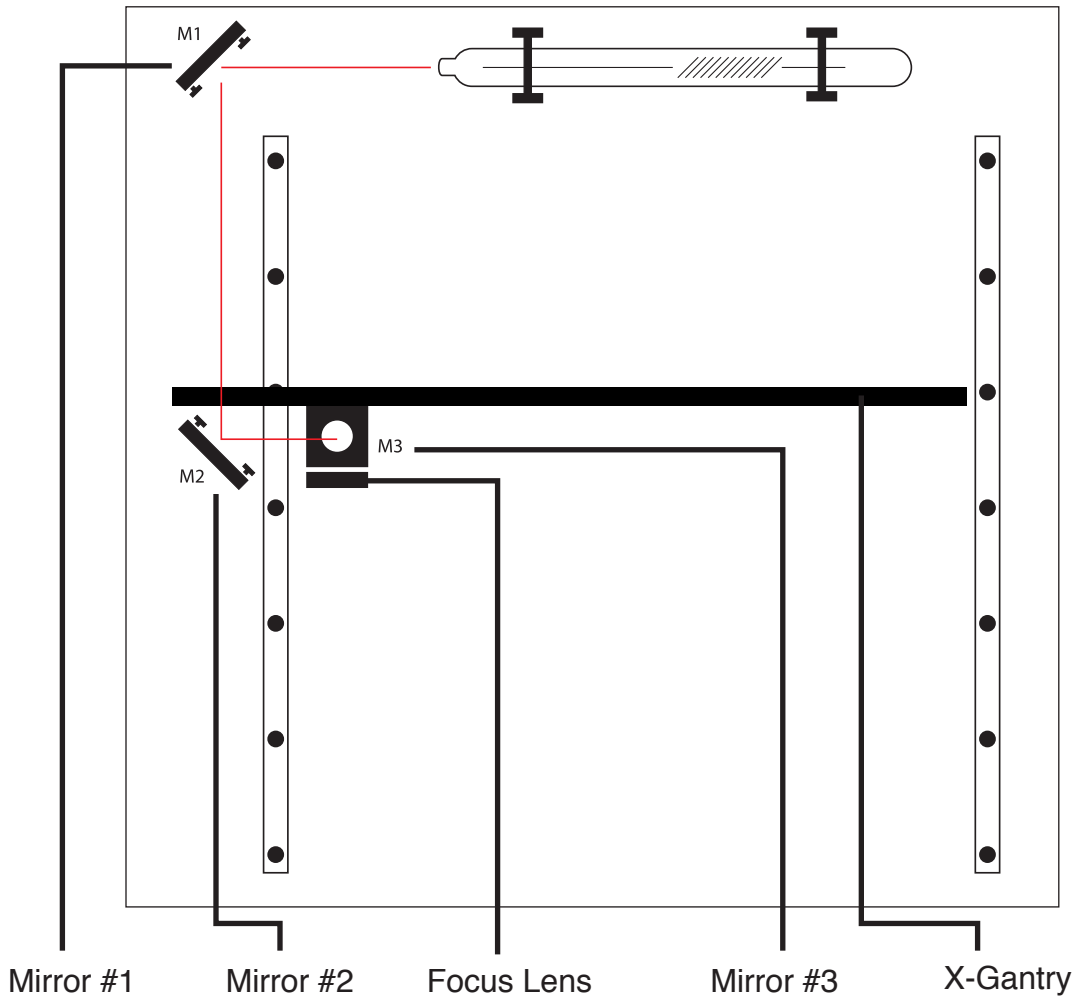


Figure 4.3

2. Mirror Alignment Procedure

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

Figure 4.4



5 Stages:

1. PREP

2. ALIGN LASER OUTPUT TO MIRROR #1

3. ALIGN MIRROR #1 TO MIRROR #2

4. ALIGN MIRROR #2 TO MIRROR #3

5. FOCUS LENS ALIGNMENT

Tools Needed:

Thermal Paper

2.5 mm. Hex Wrench

STAGE 1: PREP

Prepare your tools and workspace.

1. Safety First: Be aware of all safety procedures and precautions before continuing.

2. Power On Laser Cutter: The machine must be powered on to continue this procedure. Turn on the machine by hitting the power switch. Allow the machine time to boot up the touch panel operating system.

3. Unlock Driver Motor: The driver motor needs to be Unlocked to allow manual “jog” control. On the touch panel, press the “Locked” icon to switch to “Unlocked” position. The button will now display the “Unlocked” icon.

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

PRO TIP

PRO TIP! *Note that a 2.5mm hex wrench will perform all of the adjustments a customer may be require to do. If a 2.5mm hex wrench does not fit the screw you want to adjust, it is not meant to be altered by a customer. Call technical support before you adjust or remove any screw not sized for a 2.5mm hex wrench.*

PRO TIP

PRO TIP! *DO NOT over-tighten or over-loosen adjustment screws. Tightening or loosening any of the three adjustment screws on the mirrors or the red dot diode will move the position in a particular direction depending on the positioning of the other screws. Some experimenting is required to understand the relationship of each screw and how adjusting one affects the red dot’s positioning. When adjusting the screws, use the absolute minimum turn of the hex wrench to move the red dot or the mirror into position.*

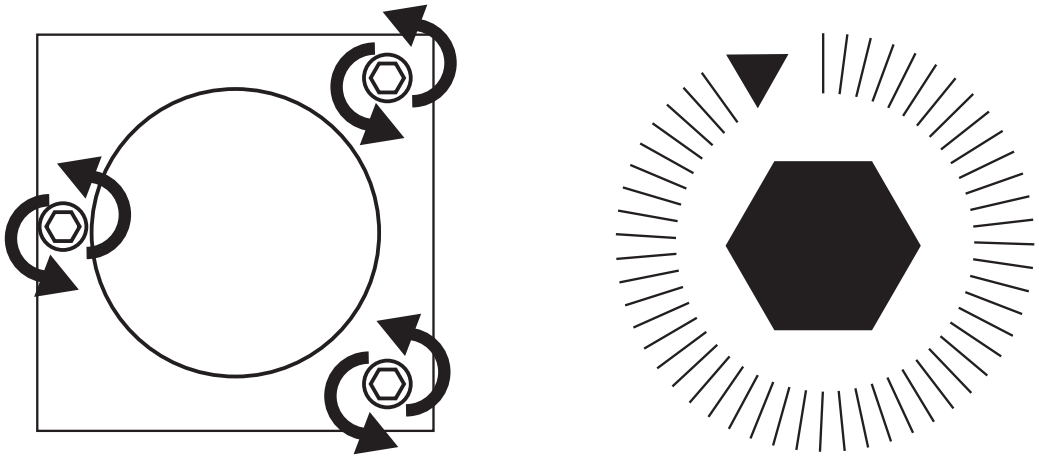


Figure 4.5

STAGE 2: ALIGN LASER OUTPUT TO MIRROR#1

Conceptually, you will be aligning the invisible cutting beam with the visible red beam diode and making sure they hit each mirror precisely. Once again, remember to check your mirror alignment BEFORE starting this procedure as it is likely unnecessary if the laser tube was pre-installed in your Hobby Series.

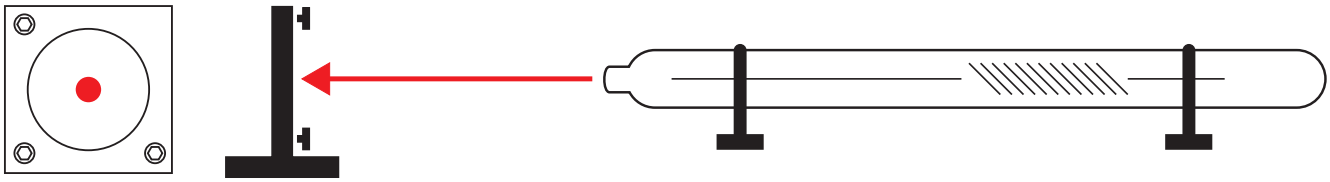


Figure 4.6

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

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

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

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

5. Adjust Red Beam: Using your 2.5m 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.

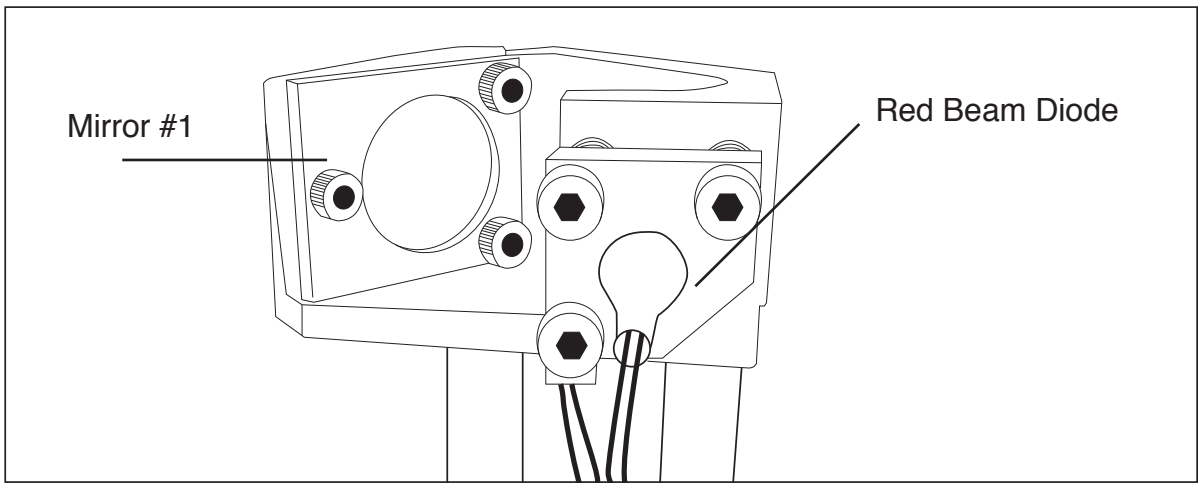


Figure 4.7

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

5. Adjust Red Beam: Using your 2.5m 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.

STAGE 3: ALIGN MIRROR #1 TO MIRROR #2

Because the 2nd mirror moves along with the x-gantry alignment must be checked between mirrors #1 and #2.

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

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

3. Position X-Gantry "Far": Jog or manually position the x-gantry to the lowest position (as shown in Figure 4.8).

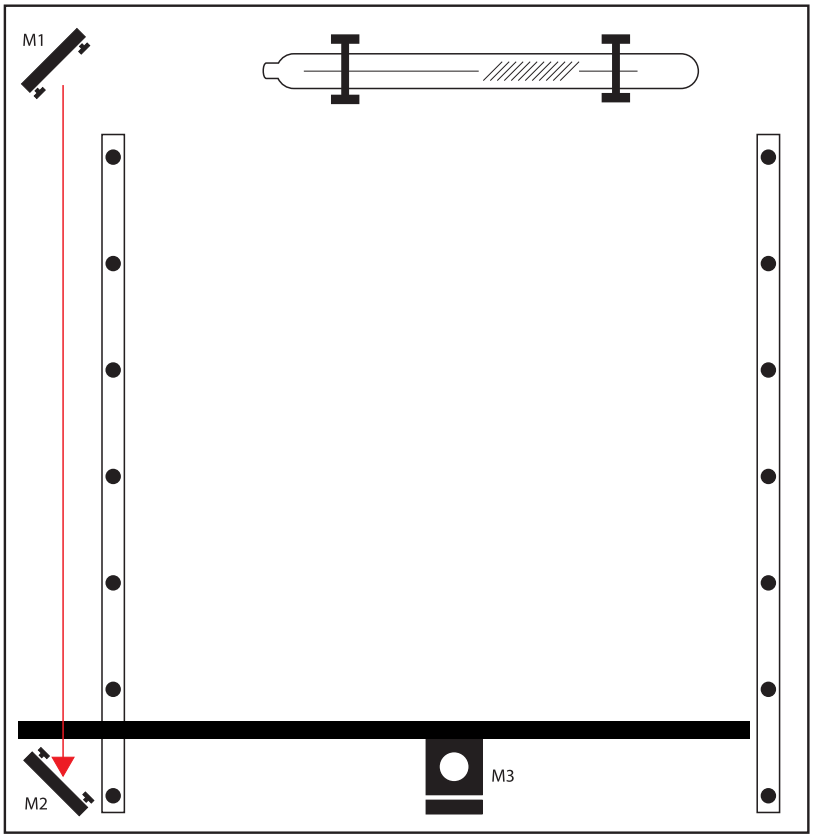


Figure 4.8

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

5. Test Fire the Laser: Press the Fire Laser Icon Button on the touch panel. You will see a burn mark on the thermal paper.

6. Adjust Red Beam. Using your 2.5m 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. Do not worry if this places the red dot away from the center of the mirror, we will adjust to center in the next step.

7. Reposition the X-Gantry to "Close" Position: Now that we have a burn mark on our thermal paper from a "far" firing of the laser, we want to fire the laser from the closest position. Move the x-gantry to the upper most position in the machine and test fire again.

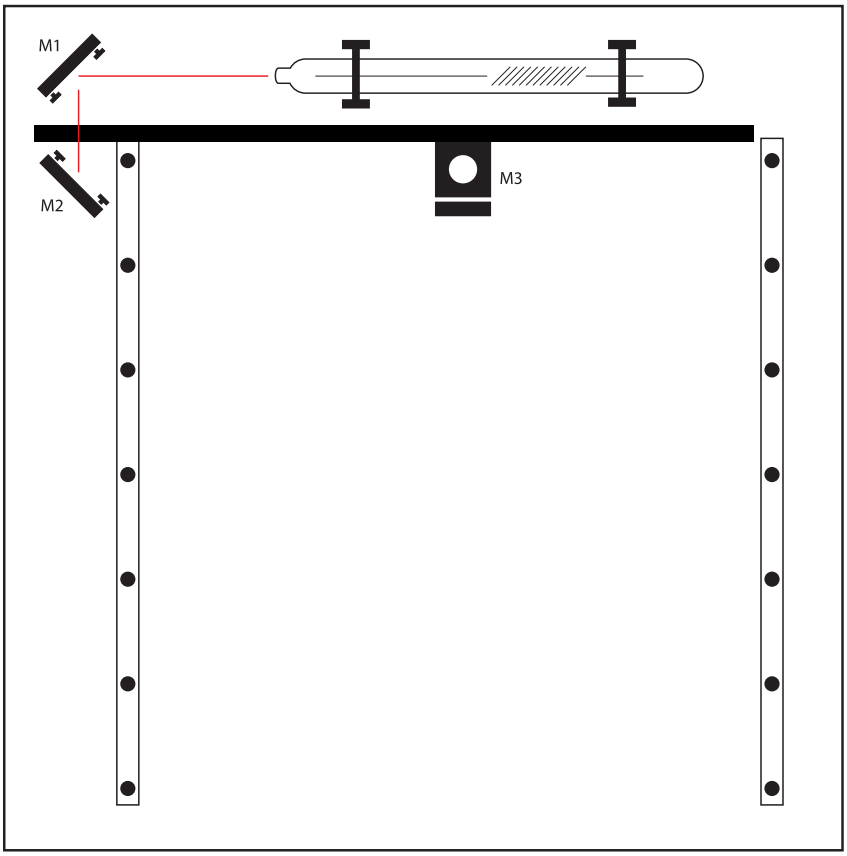


Figure 4.9

8. Re-Position X-Gantry back to "Far": Jog or manually position the x-gantry to the far position where you did the first test fire. (as shown in Figure 4.8).

9. Check Results: There should be two observable burn marks on the thermal paper. If they overlap perfectly you can move on to the next mirror. If they are apart, adjust the three 2.5mm hex screws on Mirror #1 (not the red beam diode) to move the second burn mark over the red beam.

10. Repeat Until Aligned: Check your results by repeating this process until the two burn marks are both center and perfectly overlapping each other. Once aligned, you will repeat this procedure on the next mirror.

STAGE 4: ALIGN MIRROR #2 TO MIRROR #3

The 3rd mirror is mounted on the laser head assembly and slides along the x-gantry rail.

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

2. Place Thermal Paper: Take a small piece of thermal paper (approx. 15mm should be plenty) and place it firmly over Mirror #3.

3. Position the Gantry Bar: Place the gantry bar in the center of the work bed, as shown in the Figure below.

4. Position Laser Head "Far": Jog or manually position the laser head to the far right (as shown in Figure). This is the farthest position of the Mirror #3 from Mirror #2.

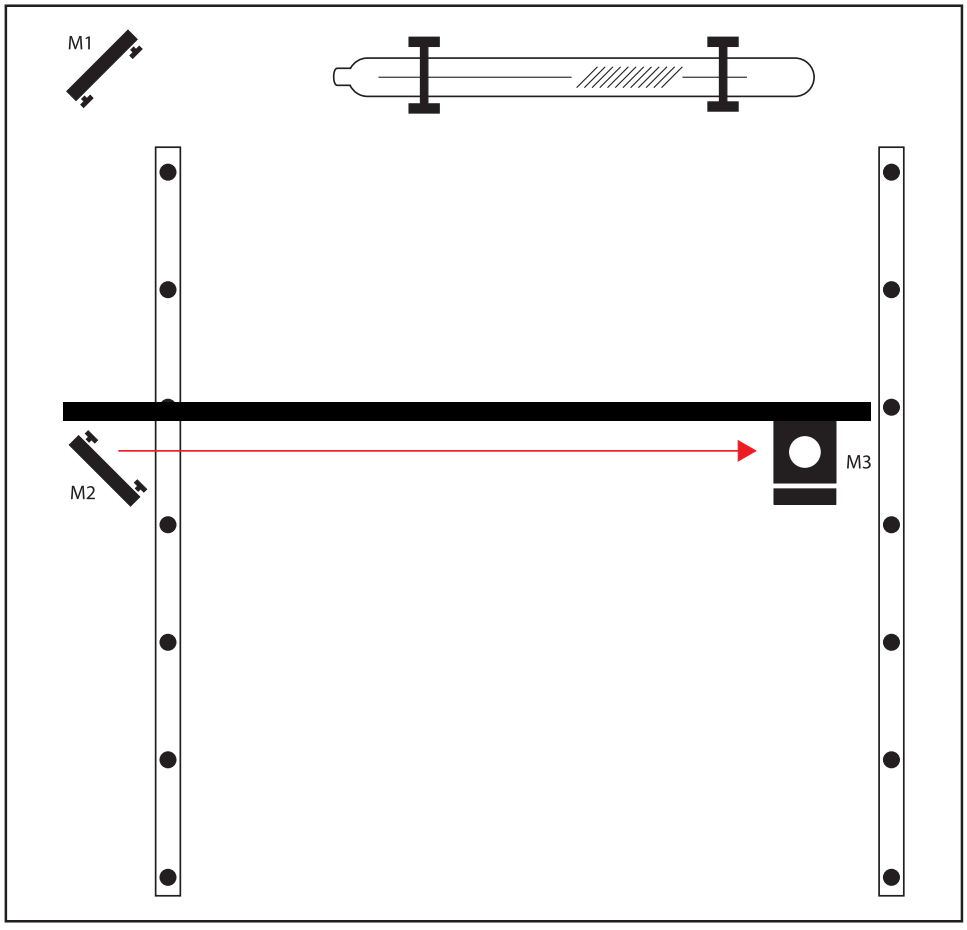


Figure 4.10

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

6. Test Fire the Laser: Press the Fire Laser Icon button on the touch panel. You may need to fire the laser twice to see the burn mark on the thermal paper.

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

8. Reposition the Laser Head to "Close" Position: Now that we have a burn mark on our thermal paper from a "far" firing of the laser, we want to fire the laser from the closest position. Move the laser head to the far left of the machine and test fire again.

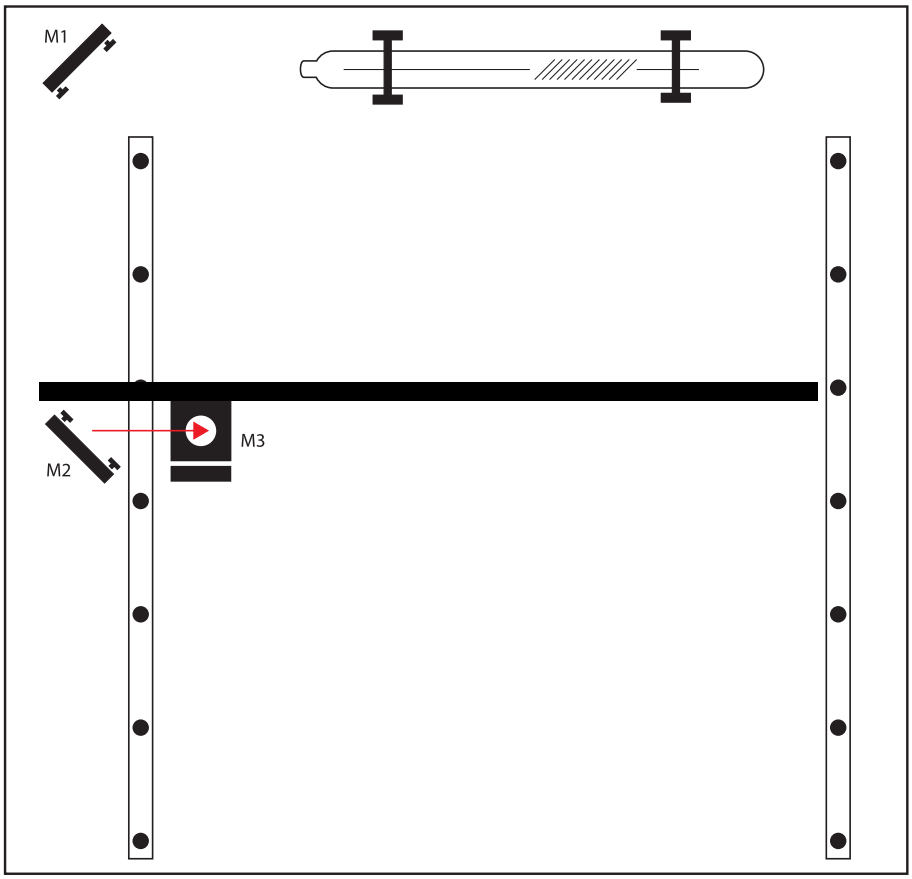


Figure 4.11

9. Re-Position X-Gantry back to "Far": Jog or manually position the laser head to the right position where you did the first test fire (see Figure 4.10).

10. Check Results: There should be two observable burn marks on the thermal paper. If they overlap perfectly you can move on to the next mirror. If they are apart, adjust the three 2.5mm hex screws on Mirror #2 (not the red beam diode) to move the burn mark over the red beam.

11. Repeat Until Aligned: Check your results by repeating this process until the two burn marks are both center and perfectly overlapping each other. Once aligned, you will repeat this procedure on the next mirror.

STAGE 5: FOCUS LENS ALIGNMENT

The focal lens is located at the bottom of the laser head assembly. For proper alignment, the laser beam should always be hitting the center of the focal lens, regardless of the position of the cutting head in the machine.

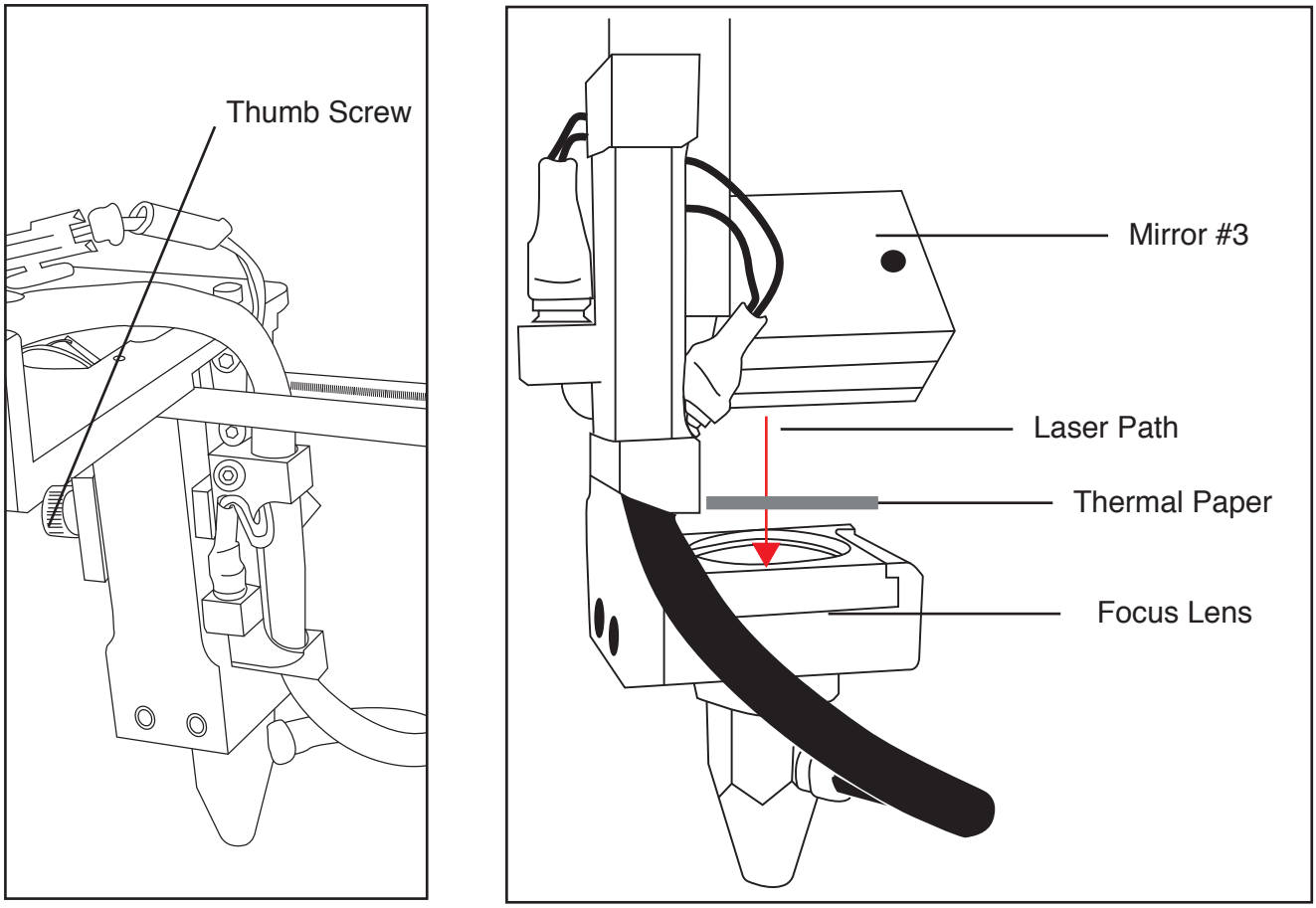


Figure 4.12

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

2. Place Thermal Paper: Put a piece of thermal paper on top of the focus lens. It is best to use a slightly smaller piece of thermal tape to fully see the outline of the lens.

3. Position Focus Lens "Far": Use the thumb screw to loosen and position the focus lens as far down as it will go. Retighten thumbscrew.

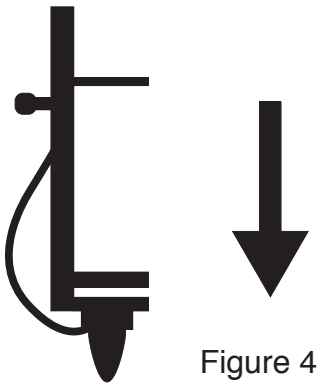


Figure 4.13

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

5. Test Fire the Laser: Press the Fire Laser Icon button on the touch panel. You will see a burn mark on the thermal paper.

6. Adjust Red Beam: Using your 2.5m 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.

7. Reposition the Focus Lens to "Close" Position: Now that we have a burn mark on our thermal paper from a "far" firing of the laser, we want to fire the laser from the closest position. Move the focus lens as far up as it will go. Test fire the laser again, leaving a second burn mark.

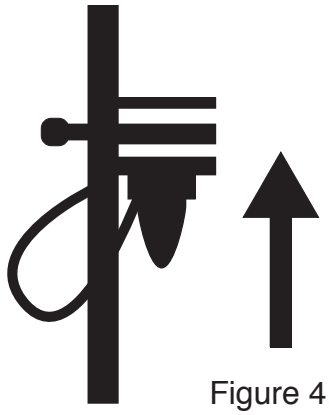


Figure 4.14

8. Re-Position Focus Head back to "Far": Use the thumb screw to loosen and position the focus lens as far down as it will go.

9. Check Results: There should be two observable burn marks on the thermal paper. If they overlap perfectly you can move on to the next mirror. If they are apart, adjust the three 2.5mm hex screws on Mirror #3 (not the red beam diode) to move the burn mark over the red beam.

10. Repeat Alignment Test: To ensure your laser is aligned, repeat the alignment test by test firing the laser in all four corners and checking that all the burn marks perfectly overlap each other.

3. FOCUSING

Focusing the Hobby Series laser cutter is quick and easy. Your laser included a billet sized for the included 2-inch focal length lens.

1. Place Billet: Place the billet on the top of the engraving plane.

2. Release Locking Mechanism: Release the locking mechanism on the focus head until the air assist nozzle rests on top of the billet.

3. Retighten: Retighten the sliding head and remove the billet from the workpiece.

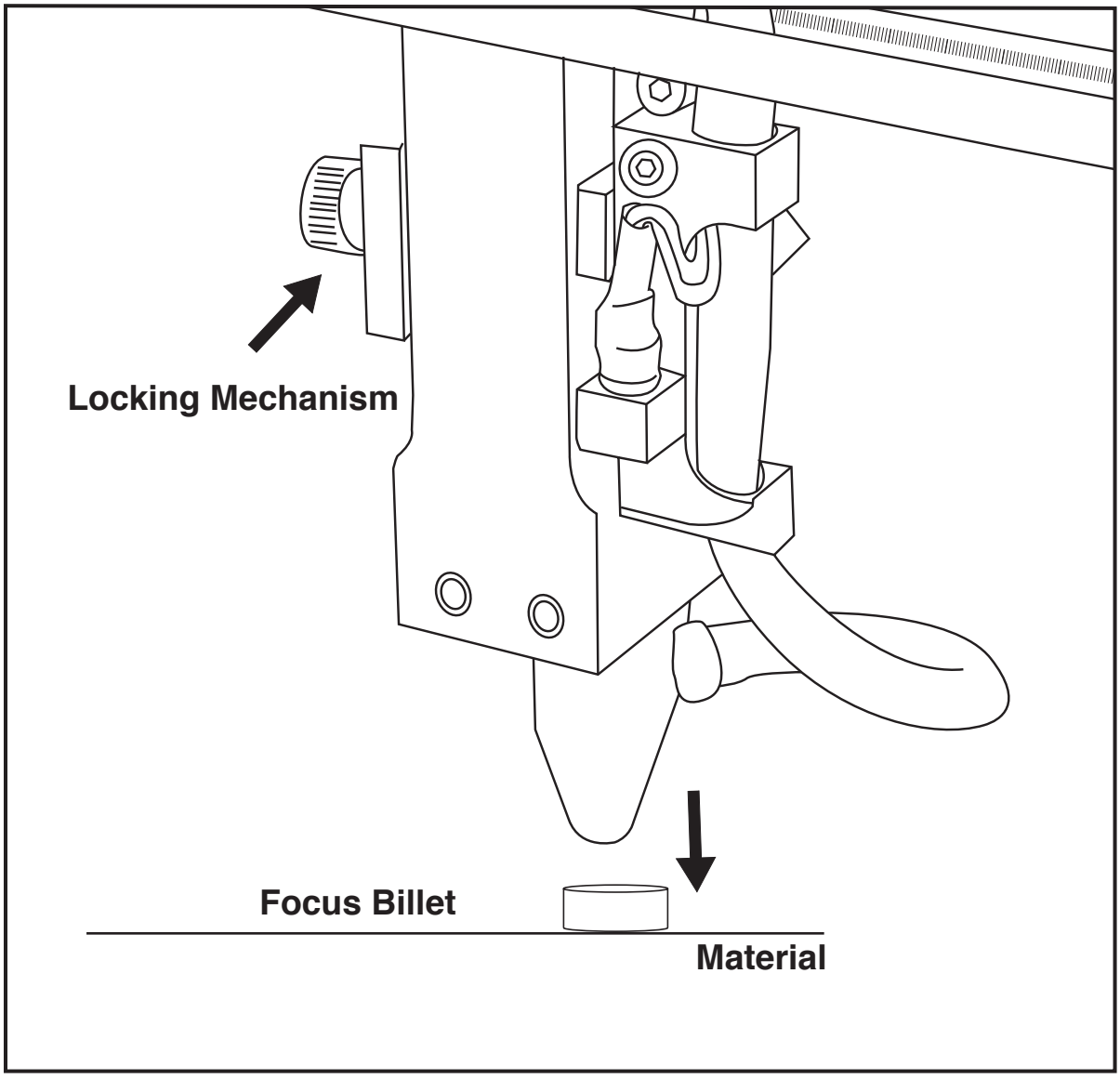


Figure 4.15

SECTION V. TOUCH PANEL INTERFACE

Hobby Series Laser Cutter Touchscreen Interface

The touch panel allows you to control the basic functions of your Hobby Series laser cutter without needing to connect to a computer. This is very convenient during alignment and testing procedures.

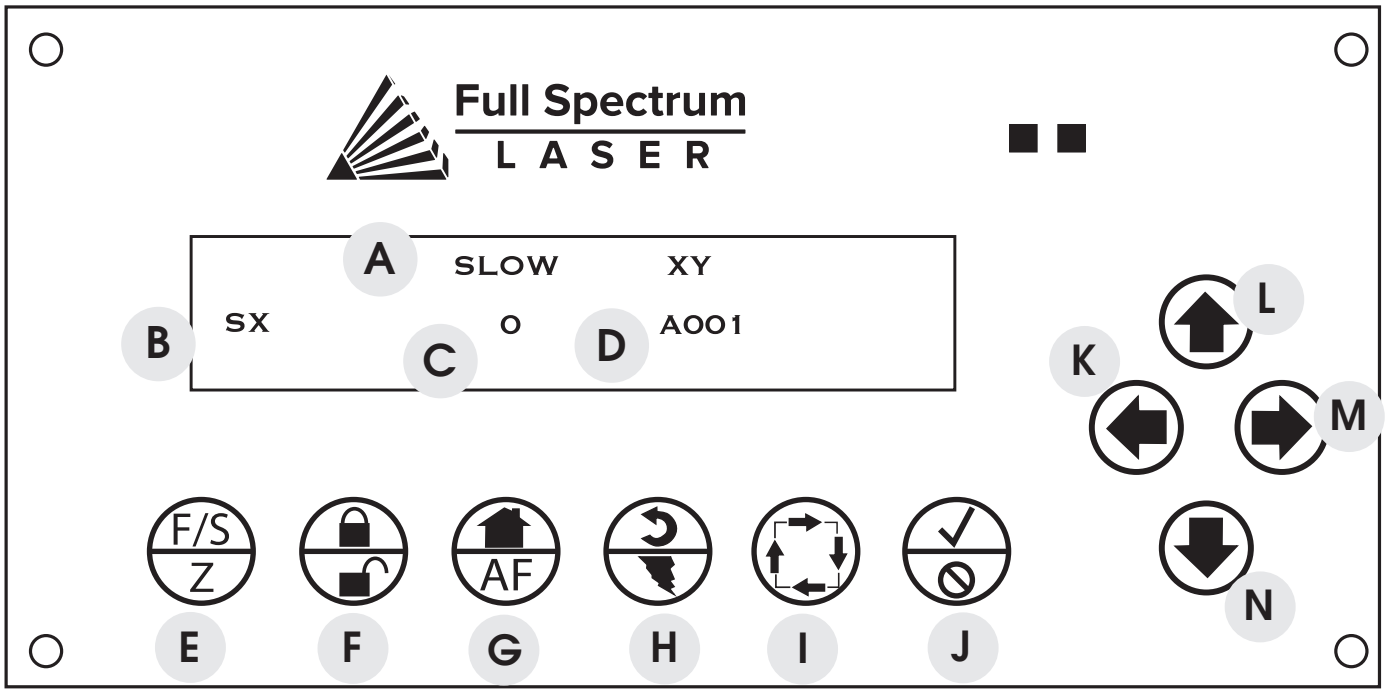


Figure 5.1

A **Selection Field**
Located on the top line, this field gives information on the current operation mode of the laser.

B **Mode Field**
Located on the far left of the lower line, this field tells the operator the current mode.

C **Power Field**
Power Field Displays the laser power. The default setting for all Hobby Series machines is 255.

D **Address Field**
Displays the last 3 digits of the IP address with a character prefix. A prefix of A means that the laser did not find a DHCP server on its network and self-assigned an IP address. The D prefix means the laser found a DHCP server.

Button Functions

Panel function buttons are described below. Typically the icons on the top line are active during Fast XY Jog (Mode 0). The icons on the bottom are typically active during Alignment (Mode 2).

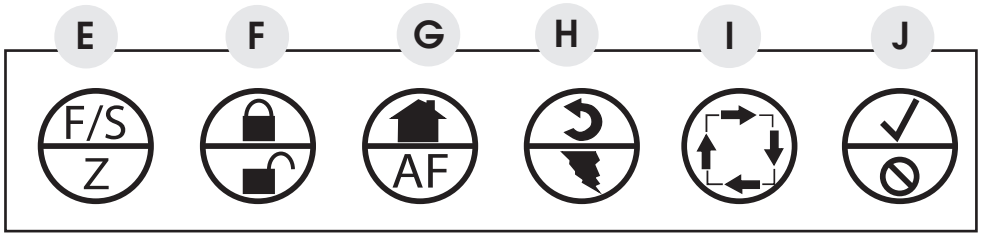


Figure 5.2

E. FS/Z (MODE SELECT)

Toggles between modes:

1. Fast XY Jog	(Mode 0)
2. Slow XY Jog	(Mode 1)
3. Alignment	(Mode 2)
4. USB Jobs	(Mode 3)
5. Job History	(Mode 4)
6. Network	(Mode 5)
7. Software Update	(Mode 6)
8. Support Mode	(Mode 7)
9. Settings	(Mode 8)

F. LOCK/UNLOCK

Locks or unlocks the drive motors

1. Locked

2. Unlocked

G. HOME / AUTOFOCUS

If in Fast XY (Mode 0) or Slow XY (Mode

1. Pressing this button will cause the laser head to seek the home position. When in Fast or Slow Z mode pressing this will autofocus if material is in the work area under the laser head.

H. RETURN/TEST FIRE

1. In Fast XY (Mode 0) or Slow XY (Mode 1) the laser will move to the previously saved job start position.

2. In Alignment (Mode 2) this button fires a short-duration pulse designed to mark thermal paper.

I. RUN PERIMETER

1. In Fast XY (Mode 0) the bounding perimeter of the job will be shown quickly (RetinaEngrave software must be started/ loaded with a job for this function to be active).

2. In Slow XY (Mode 1) the bounding perimeter of the job will be shown slowly.

J. START/CANCEL

In any menu mode (File Select or Factory Reset) this button will select the option displayed in the SELECTION field.

Cancels a move operation (homing, autofocus or a running job).

- In Fast/Slow XY, with the laser UNLOCKED, this fires a higher-power test pulse.

- In Fast XY, pressing this button after the laser homes will rapidly move the head to the upper left corner of the workspace.

- In Slow XY, pressing this button after running a job will allow you to re-run the same job.

Modes

There are nine (9) modes the touch panel can access (modes 0-8). Through these modes, the user can access all of the touch panel functions. Below is a general description for all touch panel modes.

FAST XY JOG (MODE 0) AND SLOW XY JOG (MODE 1). Use the jog buttons to move the laser head. Press the home button to index the laser head.

ALIGNMENT (MODE 2). Use this mode during tube testing and mirror alignment. The test fire button fires a short-duration laser pulse that will mark thermal paper. Use the jog buttons while the motors are locked to jog the head. Unlock the motors to move the head by hand. The test fire function is enabled while the motors are unlocked. The test pulse will not fire with the magnetic safety interlock open.

USB JOBS (MODE 3). Run jobs directly off a USB storage device. Using the touch panel, scroll through the stored jobs and click start to load the job. Click start again to run the job. Note that in order for a job to appear, the name of the job must not have any spaces in the typing.

JOB HISTORY (MODE 4). Review past jobs run on your machine. You may select and re-run any previous job without having to load the job from anywhere else.

NETWORK (MODE 5). Choose a static or a DHCP connection.

SOFTWARE UPDATE (MODE 6). When in this Mode, you will be prompted to check for updates. If there are updates available, the interface will ask you if you want to update. Highlight “Y” and push the check if you want to update the software. You will also be notified of updates when you boot your system. You will need to approve any updates before they run. Note that while the software is updating, you will not be able to run jobs.

SUPPORT MODE (MODE 7). This mode allows a Full Spectrum Laser technical expert access your interface remotely to troubleshoot and fix problems. You will have to manually approve a remote access.

SETTINGS (MODE 8). Use this setting to notify your system you have attached and are using a rotary. When selected, you will be asked, “Rotary: Y/N?” Select yes if you have attached your rotary. (See Appendix A for more information on the optional Rotary Attachment).

Jog Buttons

Four green arrow keys pointing UP (L), DOWN (N), LEFT (K), and RIGHT (M).

1. In Fast or Slow XY (Modes 0 and 1), the buttons move the laser head left/right and front/back.

2. In File Select (Mode 3) the up and down buttons scroll through the loaded jobs.

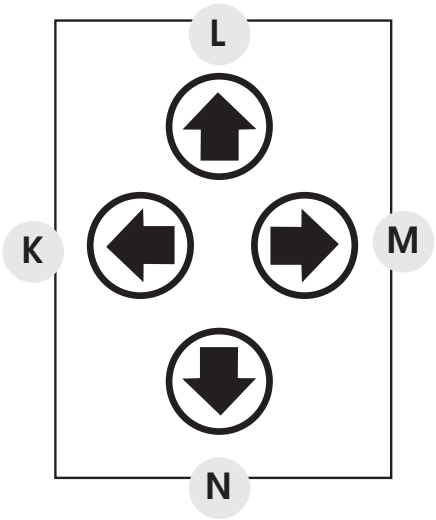


Figure 5.3

PRO TIP

PRO TIP! *During a job only the LOCK/UNLOCK, CANCEL and UP/DOWN JOG buttons function. All other function buttons are disabled.*

LOCK/UNLOCK pauses/resumes the job.CANCEL cancels the job.

UP/DOWN JOG BUTTONS allow you to adjust the job power on the fly. Scale is from 0 (no power) to 255 (full power).

SECTION VI. SOFTWARE

Validating Control Card

RetinaEngrave 3d control cards are preinstalled in all Full Spectrum Laser Hobby Laser models. Your laser's control card is shipped with an 80 hour temporary usage authorization. The 80 hours are only counted while the laser is ON. During the temporary usage period, you must connect your laser to your computer while it is connected to the internet and validate your card. Control card activation is a onetime process.

1. Connect Your Laser to Your Computer: Either directly or over the network. You will need a working Internet connection to continue. Note that activation cannot be done via USB.

2. Turn on Your Laser: Your machine must be ON to continue this process.

3. Start RetinaEngrave: Once the laser has successfully connected to RetinaEngrave a popup will appear informing you that your card is temporarily activated, the amount of hours remaining and will ask you to validate your card.

4. Click "Continue": This will advance you to the validation information screen.

5. Fill Information Fields: Fill in the requested information. This information should match the information you supplied with your initial order. If they do not match, we may contact you for clarification or updated information. Remember spaces with an asterisk (*) require input of valid information. The information requested is the following:

a. Purchase Order Number (Optional): This will be either a three (3) digit number or a nine (9) digit number that was emailed to you from GoogleCheckout at the time you purchased your machine.

b. Contact Person/Company (Required): Enter a first and last name.

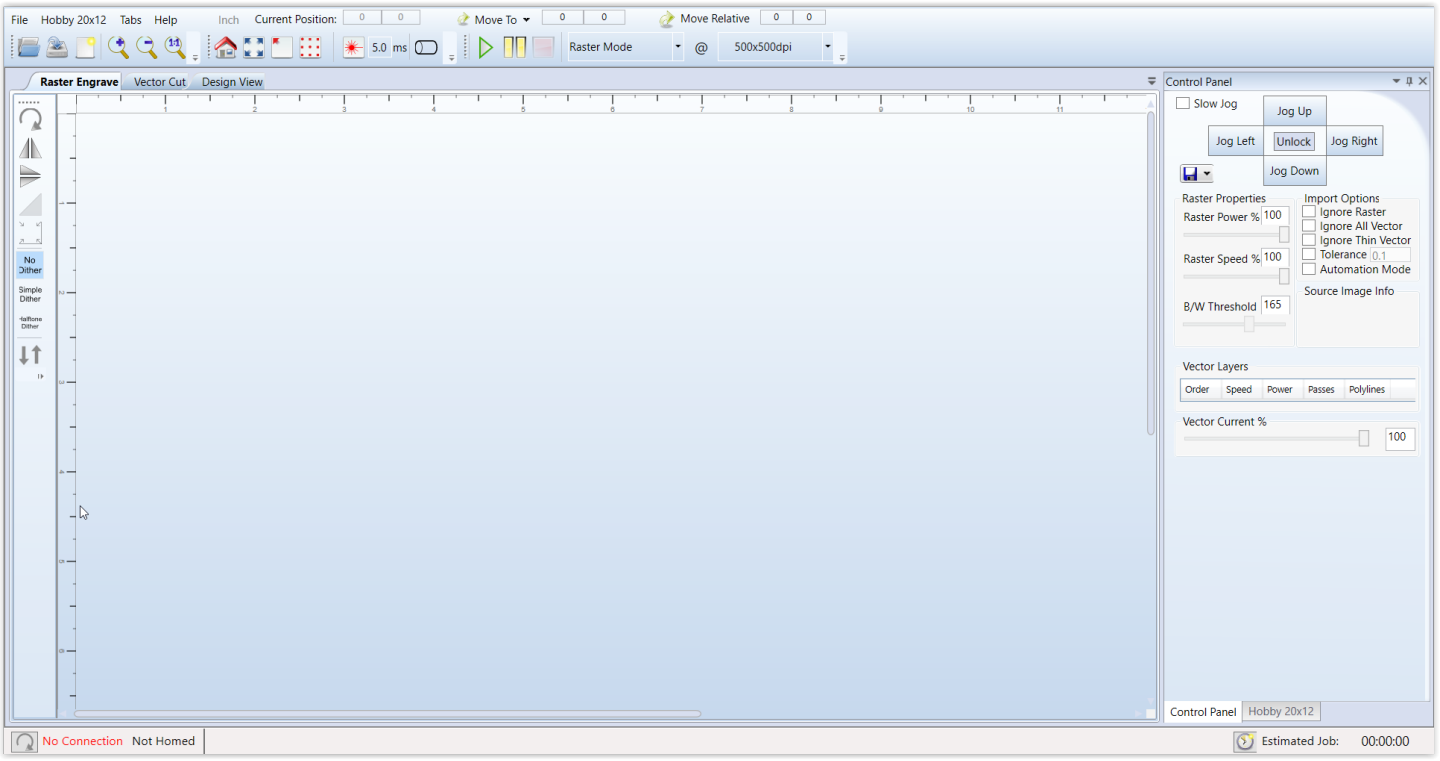
c. Contact Email (Required): Use an active email account that you regularly check.

d. Comments(Optional): Comments can include any information that you want to be added to your customer account file.

6. Click Send: Once all the required fields are filled in (and any optional fields you chose) click "Send". The information will be sent to us for comparison against your order information. Once the information has been received by us, you will see a popup confirmation message. From there we will quickly verify your information and validate your authorization. The next time you launch RetinaEngrave software your control card should be validated and activated under your account.

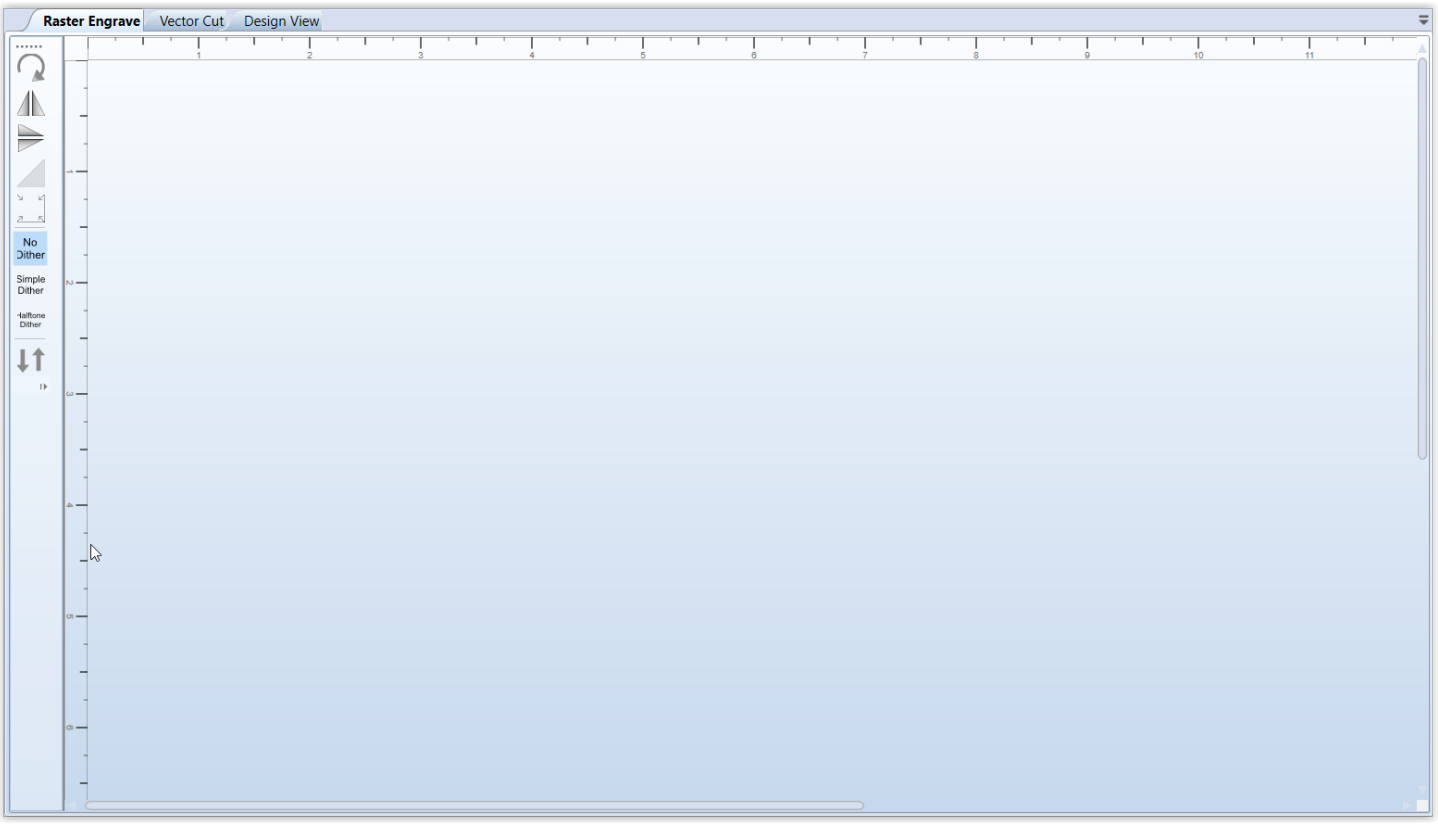
RetinaEngrave Interface

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

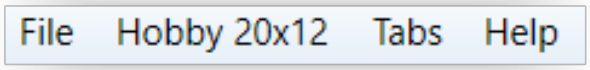


Work Space

The workspace window shows a preview of your current job.



Top Line Menus (Left Side).



File

The File menu allows the user to open up files to engrave. RetinaEngrave supports drag and drop of .xps files for vector cutting and standard image file types (.bmp, .jpg, .png, .tiff) for rasterengraving. Other file types must be printed to the Full Spectrum Engineering Driver or saved as .xps documents. The file menu also allows a user to load or save a project and settings.

File Submenus

- Save Project
- Open Project Settings Only
- Options
- Clear Workspace

The File submenu allows you to save your workspace window setup, set the PC to audibly alert when a job is completed, enable or disable the keyboard shortcuts, load the last saved project on startup or log output for troubleshooting. Note that adjustments made to the designs scale or stroke color while in RE cannot be saved. Designs need to be at the desired scale and stroke color before being brought into RE.

Laser

The Laser menu provides options related to the laser unit configuration and communications. It will allow you to select the type of laser you are connected to, manually reconnect to the laser or manually set the connection IP address.

Laser Submenus:

- Change Laser Profile
- Firmware (Update)
- RetinaEngrave Card Commands
- Configure Static IP Address
- Specify IP Address for Connection
- Save Job as Binary File
- Send Binary to USB
- Save and Send Current Job to USB
- Material and Focus Tests

The Laser submenu allows you to save the current job and settings as a .bin file onto a USB device (when the device is loaded onto the laser).

Tabs

Tabs submenus:

Show 3D Engrave Tab
Show Control Panel

Help

The help menu offers options to inform you about the version of RetinaEngrave you are using, an Activation menu (future functionality), and Troubleshooting and Update fields which will open the FSL website in your default browser.

Help Submenus:

Off line Activation
Software Updates
About

Top Line Menus (Right Side)

INCH/CM

This tabs switches measurements from inches to the metric system.

Current Position

Shows the laser's current absolute position from the origin (home; upper right), it is reset to 0,0 when the laser is homed. The right field is the X coordinate, the left field the Y coordinate.

Move To

The text fields show the saved position read from the controller. The fields are editable, allowing you to move to a manually entered location. Pressing the Move To button will first move the laser head to the home switches for reference then rapidly move to the position in the text boxes. Press the Home button to move the laser head to the origin. The laser will measure the distance it takes to reach the limit switches and enter the X and Y values into the Move To fields. It will then set the Current Position boxes to 0,0.



Move Relative

These fields command a move by the specified amounts along X and Y using the current position as the origin. Combine with the Home button to move to, or between, fixture points.

Line Two Menus (Left)



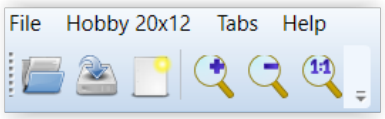
Open File [CTRL+O]
Open compatible file types (.xps, .bmp, .set, .bin).

Save Project [CTRL+S]
Save your current project and settings as a .set file.

Clear Workspace
Clear the workspace of the current job. This feature only exists in prior versions of the software.

Zoom In [+], Zoom Out (-),
1:1 Zoom
The zoom buttons control the workspace view of the Engrave and Cut tabs. The 1:1 Zoom button restores the default zoom level.

Line Two Menus (Middle)



Home [H]
Move the laser head to the origin (upper right of the work area). The laser should be homed after startup or RetinaEngrave will present a bounds alarm when you attempt to run a job. RetinaEngrave has a built-in bounds checker to make sure that your design fits within the workspace.

Perimeter [J]
The perimeter function will run the laser head in a box that bounds the limits of your design.

Perimeter Steps [P]
Each button press steps through one side of the perimeter bounding box.

Laser Head Position

The default job origin is located at the upper left of your design (0,0 in the workspace) and referenced from the current location of the laser head in the work envelope. The Laser Head Positioning button opens a dialog box that allows you to change the default job origin between the center of the job or the upper left (2 radio buttons in top menu division). The lower division of the Laser Head Positioning dialog box contains 9 radio buttons that allow you to preview job perimeter positions (you cannot set them as work origins). Keep in mind that the job origin setting is reset to default when RetinaEngrave is closed.

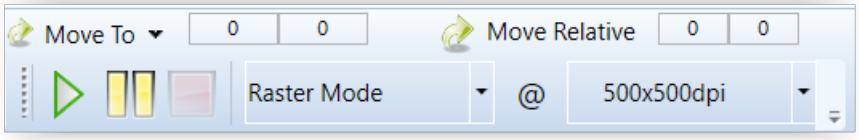
Test Fire [F] And Test Fire Duration Field

Pressing this button causes the tube to fire for the amount of time (in milliseconds) listed in the duration field. Default value is 5.0ms—this works well for marking thermal paper without burning through. Remember to close the lid or the tube will not fire.

Rotary Engrave Tab

The rotary tool, when selected, allows you to enable a rotary attachment, if installed, which allows the proper steps to be sent to the rotary to turn the item properly. See Appendix B: Rotary Attachment Installation for more information on the rotary attachment.

Line Two Menus (Right)



Start Job [G]

Press the Start button to start the job with the current settings. The job origin is, by default, located at the upper left of your design and is indexed from the current location of the laser head. For example, if you are vector cutting a 3 inch square, the laser will fire and move 3 inches to the right, then 3 inches forward (down), then 3 inches left and finally 3 inches up back to the starting position of the laser head. The Start button will be grayed out and not selectable whenever the laser is disconnected.

Pause Space bar

Pressing the space key will pause and un pause the in progress job.

Cancel

Immediately ends the in progress job and returns to the job origin.

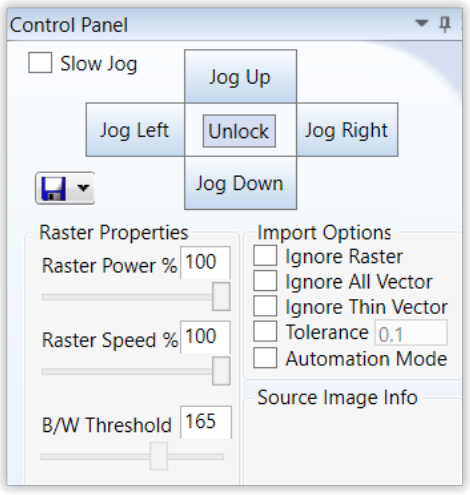
Mode Select Mode

This drop down menu allows you to select between several modes: Raster and Vector modes open their respective tabs, “Raster then Vector” mode will first run the job in the raster tab (black pixels) and then run the job in the vector tab. The Simulate Vector modes create a red dot overlay in the workspace that follows the path of your vector lines at some multiple of the currently selected speed (for example,100% speed at 0.5x runs at equivalent of 50% speed).

Resolution

Drop down menu where you can select the dpi of the current job. Only used in Raster mode.

Control Panel



Jog

“Jogging” allows you to move the laser head using either the buttons or the keyboard arrow keys. Selecting the slow jog check box jogs the motion system at half of normal speed. The Lock/Unlock button allows you to unlock the motors to move the laser head by hand—the motors must be locked in order to run a job or jog.

Raster Properties

The Raster Properties section allows you to set the power and speed of a raster job, as well as the B/W threshold for a grayscale image (see Operations section for more information).

Import Options

Import Options allow you to set conditions under which the print stream from Windows is captured. Ignoring raster data is useful if you are working with large or complex files and only causes RetinaEngrave to only render outlines of filled sections. Ignoring vector data is useful when engraving images. Ignoring thin vectors will ignore small lines within a factor set by the tolerance field.

Vector Layers

The Vector Layers section controls the layer order, speed, power and number of repeats for each layer. As discussed in the General Usage subsection, vector layers are based on one of 7 colors. The Contained Objects First check box determines the order of cutting within a particular layer.



CUSTOMIZING THE INTERFACE

The user interface for RetinaEngrave is built around several tabs relating to functionality (Raster Engrave, Vector Cut, etc). These tabs can be dragged to change their order or location in the program window. You can organize your workspace using the autosize function or leave the tab dialog window floating. The autosize function will snap the dragged tab to a preset location in the program window. The default tab location is reached by dragging to the center of the autosize overlay. Keep in mind that the Start button will always start a job using the data in the active tab. You can organize your workspace using the autosize function or leave the tab dialog window floating. The autosize function will snap the dragged tab to a preset location in the program window. The default tab location is reached by dragging to the center of the autosize overlay. Keep in mind that the Start button will always start a job using the data in the active tab.



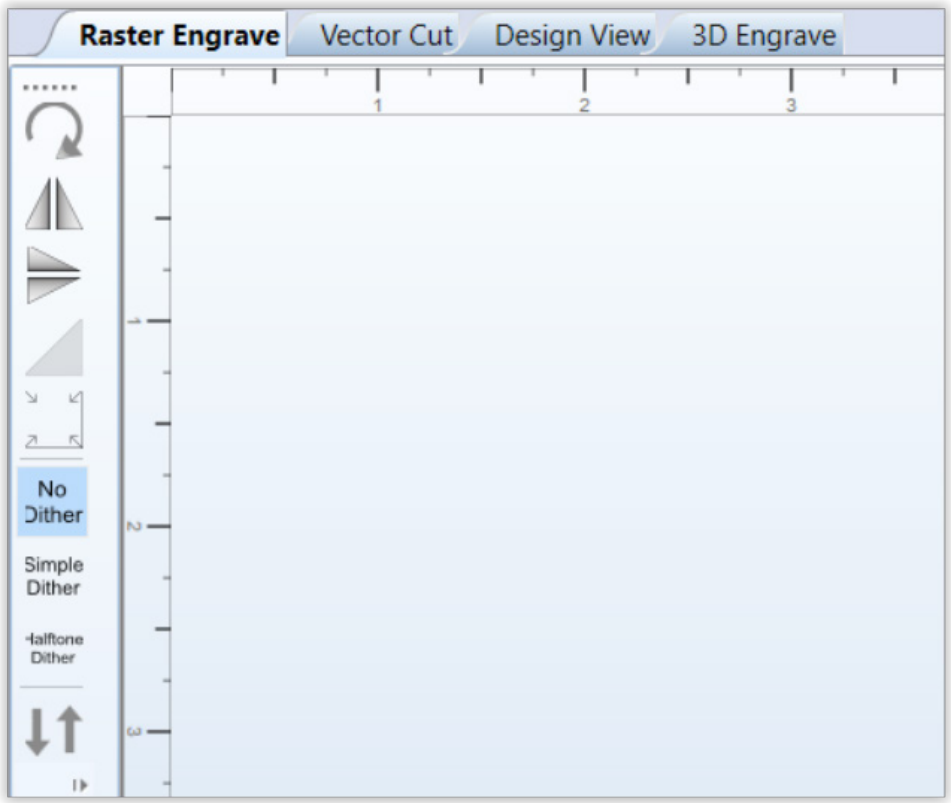
CAUTION! *The "RetinaEngrave Card Commands submenu option should only be accessed under supervision of Full Spectrum Laser support staff.*

SECTION VII. OPERATIONS

Engraving

Your Hobby Laser System has several advanced functions that make it easy to bring your designs from your computer into the real world. Engraving is the process by which complex designs are etched into a work piece or a work piece is marked using an additive coating such as Thermark™. Engraving can range from a simple surface mark all the way through deep material removal. Engraving is differentiated from cutting in that cutting is the process of burning a closed contour completely through a workpiece. The most common type of engraving is known as “RasterEngraving” or “Rastering”, because 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 top to bottom, engraving your image pixel by pixel and line by line. You can also engrave images in vector mode by setting the power such that you score the workpiece without cutting through. Engraving works with both vector and pixel based source files, allowing you to engrave anything from a simple block logo all the way to high resolution photographs. The proceeding sections will introduce you to engraving with RetinaEngrave.

Raster Engrave Tab (Left Button Panel Top To Bottom)



Rotate Image 90 Degrees

Each button press will rotate the image 90 degree clockwise.

Mirror Image Vertically

Mirrors the current image about a vertical centerline.

Mirror Image Horizontally

Mirrors the current image about a vertical centerline.

Invert Image

Reverses the black and white pixels of the image. Useful for engraving on coated materials.

Scale

Scales the image larger or smaller.

No Dither

When No Dither is selected, RetinaEngrave will use the threshold slider value to compute a grayscale cutoff. Any grays below the threshold will be black and any above will be white.

Simple Dither

Dithering a color or grayscale image will produce a pattern of black pixels that approximates the original gradients. Dithering applies a computed dot density of on/off pixels to the image to create a gray-scale effect. The quality of the dithered image preview in the workspace often looks poor—however, the actual output engrave quality will be much higher. Dithered images simulate true grayscale by averaging pixel density to achieve an optical effect closely approximating the original image. Selecting this button has no effect on images that are 1bit or black/white already.

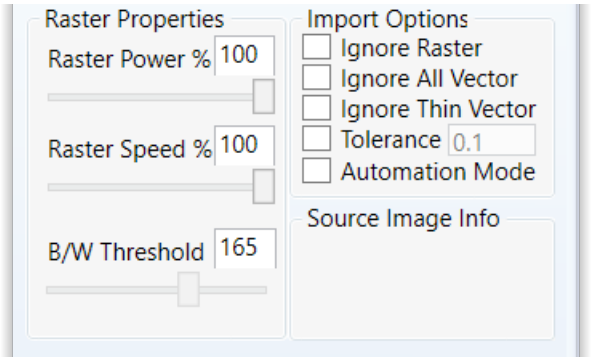
Halftone Dither

Like the Simple Dither button, this button dithers the image in the workspace but uses a different algorithm. Certain images and work materials will often respond better to one algorithm or another.

Reverse Raster

Selecting this feature will allow the job to begin from the bottom of the image and engraver bottom to top instead of top to bottom as standard. This requires the laser head to be jogged down the Y axis in the work area to start the raster job from the bottom left of the image instead of the top left.

Raster Properties (Control Panel)



Raster Power

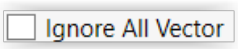
This field and slider allow you to set the firing current as a percentage of the maximum as set in the configuration file. Laser tubes have a minimum activation current; setting this value too low (below 10%) could result in the laser not firing as this is under the minimum activation current. Keep in mind that when setting the power below 10%, the tube may no longer fire as it has reached the minimum activation current.

Raster Speed

Set the engraving speed as a percentage of the maximum. Maximum speed is set in the config.xml file. The raster routine in v4 is optimized so it only rasters non whitespace and minimizes the acceleration distance. If you set the speed % very low such as 1% then the laser head does not need much acceleration distance. Total time to engrave = (acceleration time + raster time). Since acceleration time is also lower the total time is not linearly related to the speed %. However, the energy/heat applied to the material is linear according to the speed %. For deeper engraving use a slower speed.

Black / White Threshold

Adjust this slider to fade in or fade out portions of any image that is not black/white. Your computer graphics card must be fast enough to use the slider in realtime to see the updates. This has no effect on 1bit bitmaps or black and white images. If you have a computer with a slow graphics card, set the threshold using the text box and enter the values manually.



Ignore All Vector

Checking this box will only import raster data and ignore vector data. When processing a print job, RetinaEngrave attempts to sort all the vectors for the fastest cut times. A drawing containing millions of points or vectors will take up a large amount of memory and CPU which can cause a major slowdown in performance. Ignoring the vector data will also allow faster print jobs if only raster is required.

DPI SELECTION



Full Spectrum Laser recommends default settings of 500x500dpi for most applications; text as small as 4pt can be engraved at 500 dpi with excellent readability. Typically, 1000 dpi is only used special cases. The dpi setting also affects the delivered power density, as higher dpi settings correspond to a higher number of pulses per square inch. It is also important to note that due to the focused beam spot size (0.0020.005 inches) there will be pixel overlap at higher dpi settings. This leads to a blending effect in the overlapped areas, which will lead to a darker engrave result on particular materials, such as wood.

The dpi settings affect the print processing resolution. The maximum printing resolution is set in the configuration file and displayed in the control panel in the Source Image Info box. The final resolution is set to the maximum of the configuration file setting and the dpi selected from the dropdown menu. The default setting is 250 dpi. By selecting 1000 dpi before printing, the laser will import at 250 dpi then upscale the image using a bicubic interpolation to 1000 dpi. RetinaEngrave stores the source image in memory and converts it to grayscale before dithering. Due to the large number of pixels in a 1000 dpi image (1 million pixels per square inch) your computer may run out of memory. Computers with less available memory should select 250 dpi before printing because even at an input resolution of 500 dpi the memory requirements can be high.



POSITIONING WHEN RASTER ENGRAVING

When you raster an image, the laser head accelerates to the desired speed over some at the default job origin—if you are using a changed origin, such as a center origin, the laser head will still move to the upper left corner before beginning the job. Because of the acceleration and deceleration distances, some jobs will require a one (1) inch buffer on the left and right sides to avoid crashing the laser head.

Getting Better Raster Results

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 a particular location. This location is controlled by the input image, which can be thought of as a “map” of on and off pixels. The question is how do we give RetinaEngrave the best “map” of these laser dots to accurately represent the original image?

Your source image is processed several times between sending it to the Windows XPS Image Writer (printer) and final laser processing of the workpiece. The first alteration of the source image occurs when the image is sent from the print stream into RetinaEngrave. If the printer DPI is set differently from the software DPI, the source image must be upsampled to the native DPI of the laser; up sampling is necessary to keep the output image dimensions (in inches) the same as the source image dimensions. This process generates new pixels; unfortunately there are mathematical constraints on the sampling process so it is imperfect.

In order to avoid introduction of error through upsampling, the source image must be a 1bit image. 1bit images are an exact “map”; all pixels are either on (black) or off (white). The best results are achieved by creating/converting a source image in a dedicated editing program with DPI settings that match the native DPI of the laser (1000 dpi).

In the case of non 1bit .bmp images (grayscale/color), dimensions are set on import using the page size in the print driver dialog box. Changing the DPI setting results in a different number of pixels in the same space, without changing the dimensions of the image. This procedure results in lower output quality that is not true to the source image. Multibit images that are not evenly divisible by the native laser DPI (250/500/1000) should always be direct printed instead of dragged and dropped, and should be rastered at the same resolution as they were printed. The case study in the following section examines the results of various import methods.

SOURCE TYPE	IMPORT METHOD	BEST PRACTICE
1bit BMP	Drag and Drop, File-Ope	Pixels are divided by laser dpi (1000 for hobby). 1000=1 inch. DPI box changes DIMENSIONS of output by skipping lines. Output is always true to source. It is not recommended to Direct Print 1-bit images
Color/Grayscale BMP	Direct Print	Always Direct Print non 1bit images as they are sampled at a rate proportional to laser output resolution, resulting in better quality output. For best output, Raster at the same DPI as the source image
XPS file containing image	Drag and Drop, File-Open, Direct Print	For best output, Raster at the import DPI

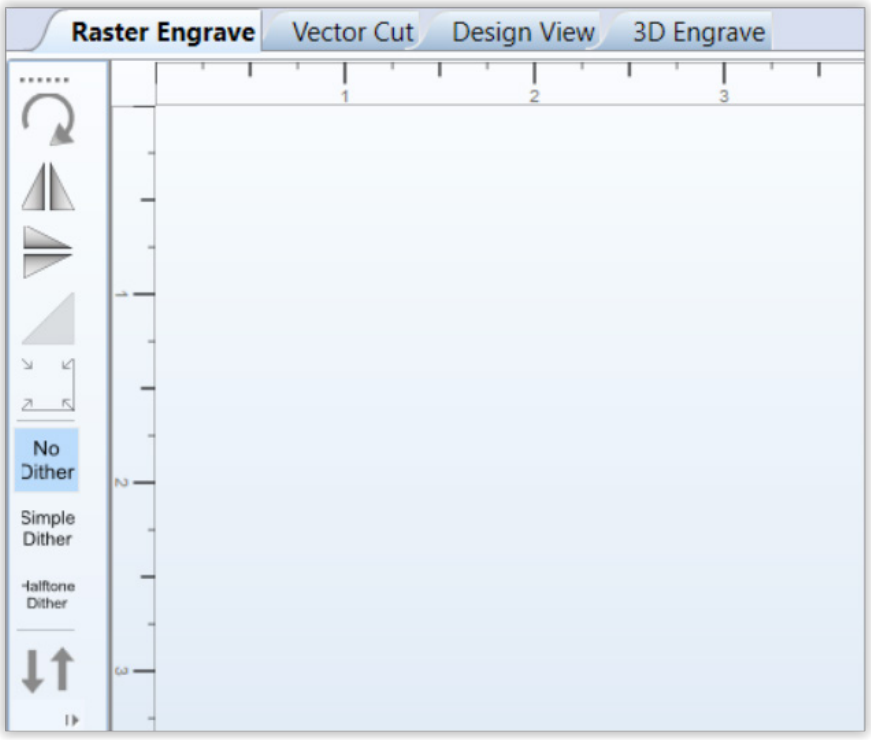
Cutting

In Vector Cut mode, RetinaEngrave receives information from the print stream and interprets it as a series of paths for the laser head to follow. In order for the print stream to have vector information, the file being printed must be a vector file. RetinaEngrave is capable of following complex contour paths created in any vector drawing program, however certain programs and formats are more reliable than others. Full Spectrum Laser carries out unit testing using CorelDraw X7 and recommends that Hobby Laser owners use this program. If you use different design software and run into a problem with the print interface, we recommend printing to the XPS Document Image Writer or saving as a PDF. PDF files save vector information and are the best way to carry artwork from a noncompatible operating system (Mac or Linux) onto your Windows PC. Limited testing has been carried out with CorelDraw X6 and it appears to be a good choice, as well. Other popular packages include Adobe Illustrator, Inkscape and Google's free online vector drawing application. Additionally, most CAD packages are able to output drawings in a vector format for printing; Autodesk 123D is particularly interesting for its cost (free) and builtin 3D slicing capabilities.



PRO TIP! *The Microsoft XPS Document Writer creates images so that they will print exactly as they appear on your screen. Any program that is vector based will have its information embedded as vector paths (CorelDraw, MS Word, CAD programs, etc) and should work with the Vector Cut functionality of RetinaEngrave.*

Vector Cut Tab (Left Button Panel Top To Bottom)



Rotate Vector 90 Degrees

Each button press will rotate the design 90 degree clockwise.

Mirror Vector Vertically

Mirrors the current vector drawing about a vertical centerline.

Mirror Vector Horizontally

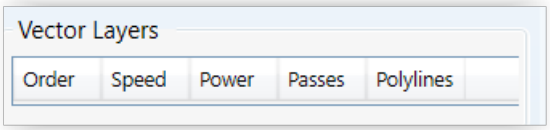
Mirrors the current design about a horizontal centerline.

Resize Vector According To Input Values

This button will bring up a dialog box allowing you to change the size of the vector image in the workspace by setting specific X and Y dimensions. It does not preserve scale.

Horizontal Vector Hatching

This button and corresponding parameter box automatically fill closed contours with a horizontal hatch pattern, with the gap between horizontal scan lines (in inches) determined by the input in the parameter box. This is a useful function for engraving deeply into an object—with the proper settings it will remove material much more quickly than in Engraving mode. Be aware that due to the scan gap being nonzero the bottom surface might not be smooth.



Vector Layers & Current

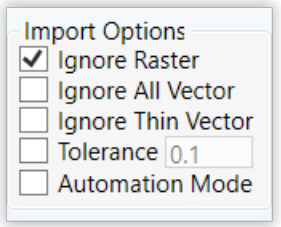
Vector Layers

RetinaEngrave automatically separates vector drawings into layers by color. Each layer can specify different properties. The Reset Layer Properties button will reset the Vector Layers table to the default values. Order. Layers are cut in order from one (1) to seven (7). Speed. Sets the speed of the layer as a percentage of the maximum value. Power %. Sets the PWM frequency. PWM power control is very fine. Setting it to 0.5% will mark but not cut through paper. Passes. Number of repetitions. Polylines. Number of polylines associated with a layer.

Vector Current

Total power is determined by a combination of delivered current and voltage to the laser tube. The current is directly regulated while voltage is controlled by PWM (Pulse Width Modulation). PWM is a technique whereby an average voltage is delivered in a series of pulses per unit time. In Vector mode you can control both the PWM frequency (power) as well as the delivered current (Vector Current %). In Raster mode, the output is pulsed based on the speed and pixel pattern, so only current control is available (Raster Power %).

Vector Import Options



Ignore Vector

Select this option to speed up processing of large vector files on computers with limited memory. Raster data is memory intensive for large drawings at the highest resolutions and is unneeded if only vector cutting is required.

Ignore All Vector

The existing documents in the Vector Cut is not replaced when loading new documents.

Ignore Thin Vector

Disables vectorable content from Raster Tab and non vectorable content from Vector Tab. Vectorable is defined as having linewidth set to hairline. All other objects, including images, are nonvectorable. This option is useful when importing projects with the intention of “Raster then Vector” (Combined Mode).

Tolerance

Override the Con fig File Import Tolerance Setting. This is used to determine the amount of points generated for objects on Vector Import.

Automatic Mode

Start jobs as soon as they are printed using default settings.

Designating Layers

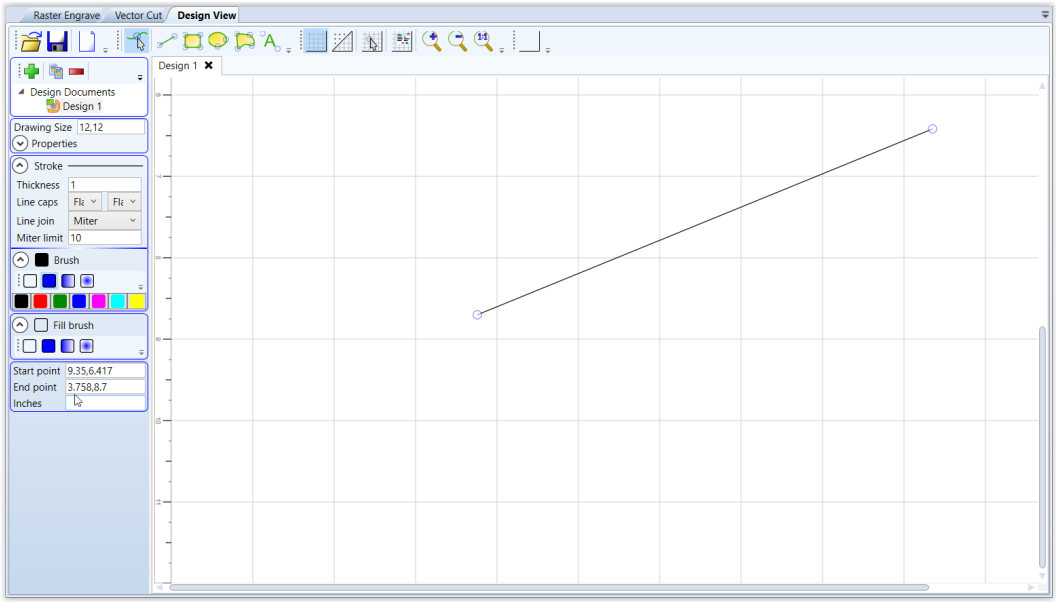
Designating a color to objects/ layers you want to vector cut enables you to take advantage of RetinaEngrave's ability to specify cutting order, cut speed, laser power and number of repeats for each layer. RetinaEngrave supports up to seven standard color layers for maximum program compatibility: Black, Blue, Red, Magenta, Green, Cyan, and Yellow from the RGB color palette.

PRO TIP

PRO TIP! *RetinaEngrave uses a "best guess color round off routine" when a color is not a standard RGB color. Avoid using black whenever possible because black is the default color RetinaEngrave uses whenever it cannot figure out what color it should be. By avoiding black, you will have more control.*

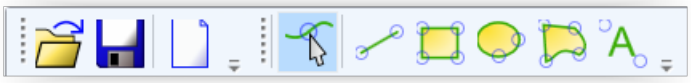
Design Tab

The Design Tab provides basic drawing tools for creating simple designs within RetinaEngrave. The tools allow you to draw open or closed contours, complex paths, shapes and text with a variety of fill options. The Design Tab is project based, with each project having one or more designs. Once you have a design, you select it and render it to one of the mode tabs.



Attention! *The Design Tab is not meant to replace a dedicated drawing/design package—it exists as an internal tool for quick tests and is released "as is". If you are having a problem with the output of the design tab, please use a standard program such as CorelDraw to create your work and report any software issues to support@fslaser.com.*

Design View Top Line Buttons (Left Side)



Open
Open a new project. Opening a new project removes any unsaved data in the document design window.

Save
Save your current project.

New Projects Button
Opens a new project.

Edit Shape
Select shapes or points and edit their information (color, thickness, fill, etc).

New Line
Add a new point to point line. Drag the end handles to change length or use the Shape Properties box (bottom of Shape Properties Panel) to set start and end points.

New Rectangle
Draw a rectangle. Use the handles to change proportions or the properties panel to adjust width and height (units are inches) as well as corner radii. Use the Stroke properties to adjust corner joint type.

New Ellipse
Draw an ellipse. Use the properties panel to change the X and Y radii (units are pixels).

New path
Create a new spline path. Select one of the endpoints to bring up the Shape Properties box and add/remove points and adjust line tangency.

New Text
Place text in the design area.

Design View Top Line Buttons (Left Side)



Toggle Grid
Changes the visibility of the drawing grid in the design area.

Toggle Points
Changes the grid format from lines to points.

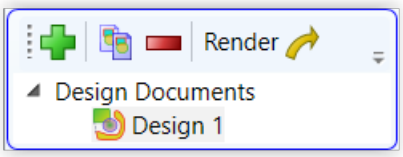
Toggle Snap to Grid
Enable or disable snap functionality with drawing points.

Grid Options
This popup menu controls grid display and parameters. The Grid Width and Snap Grid Width fields can be altered to suit your preferences; units are in inches.

Zoom Buttons
Adjust the zoom level of the design area.

Bounding Options
Print bounding box around work area perimeter.

Properties Panel (Top)



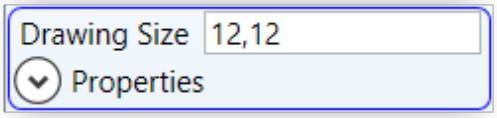
New Drawing
Create a new drawing.

Copy Drawing
Copy current drawing.

Delete Drawing
Delete current drawing.

Render
Output drawing to Vector/Raster tabs.

Design Selection Menus
This dropdown list allows you to select which drawing to make active via a left double click. You can also select the tab of the drawing you would like to work on in the design area.

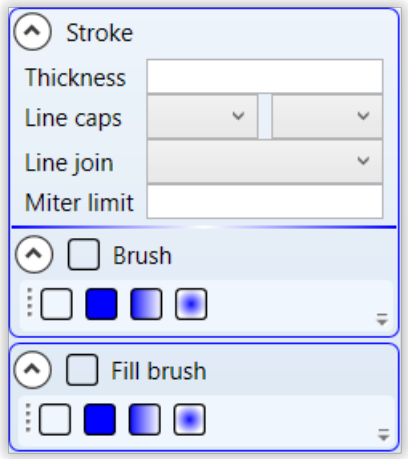


Drawing Properties

Drawing Size
Set the total work area drawing size units in inches.

Design Properties
This dropdown list allows you to select which drawing to make active via a left doubleclick. You can also select the tab of the drawing you would like to work on in the design area.

Shape Properties



Stroke

Control the stroke thickness (pixels), endpoint shape, joint behavior and miter behavior.

Brush

Control the color and fill style of the brush. Allows you to create and specify gradients.

Fill Brush

Specify the properties of a closed shape.

Workspace Tools

Use the drag handles located on the edges of your design to resize the image. The extension lines display the width and height of the bounding box that encloses the image. Dragging the square handle will preserve the designs scale. The small field located on along the height extension line gives the current X and Y workspace coordinates of the mouse. Hovering the mouse over a vector object (polyline) will cause it to highlight. You can right click the mouse to disable that object in the current job and right click again to re enable. Clicking on a poly line will bring up the workspace editor. You can move, scale or disable it; assign it to a layer using the colored buttons; reverse the direction of the path; or close small gaps between the ends of an unclosed polyline (for advanced users).

SECTION VIII. HARDWARE & MAINTENANCE

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

Replacing the Laser Tube

This section provides procedures and a walkthrough to replace the laser tube on your Hobby Series. 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.



FRAGILE GLASS! *Pulling on the tube wires will break your laser tube at the neck. The water connections are very fragile, DO NOT pull or force the connection tubes— gently work the tubes off of the connectors.*



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

REQUIRED PARTS AND TOOLS:

- **45W REPLACEMENT TUBE**
- **2.5MM HEX WRENCH**

Replacing Laser Tube Steps

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

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

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

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

5. Remove Tube Retainer Straps: Using a 2.5mm hex wrench (included with your purchase), remove the four (4) M5 hex nuts from the two (2) tube retainer straps that hold the laser tube in the rubber restraints.

6. Remove Old Laser Tube: Remove the tube from the rubber holders and carefully set it on top of the machine. Be aware the laser tube is still connected to the machine's wiring.
DO NOT pull on the wiring.

7. Remove Universal Laser Pin Connector: Carefully unscrew the universal laser pin connector off the aperture end of the laser tube. Next unclip the connector on the other side of the laser tube. You can now place the old laser tube aside for later disposal.

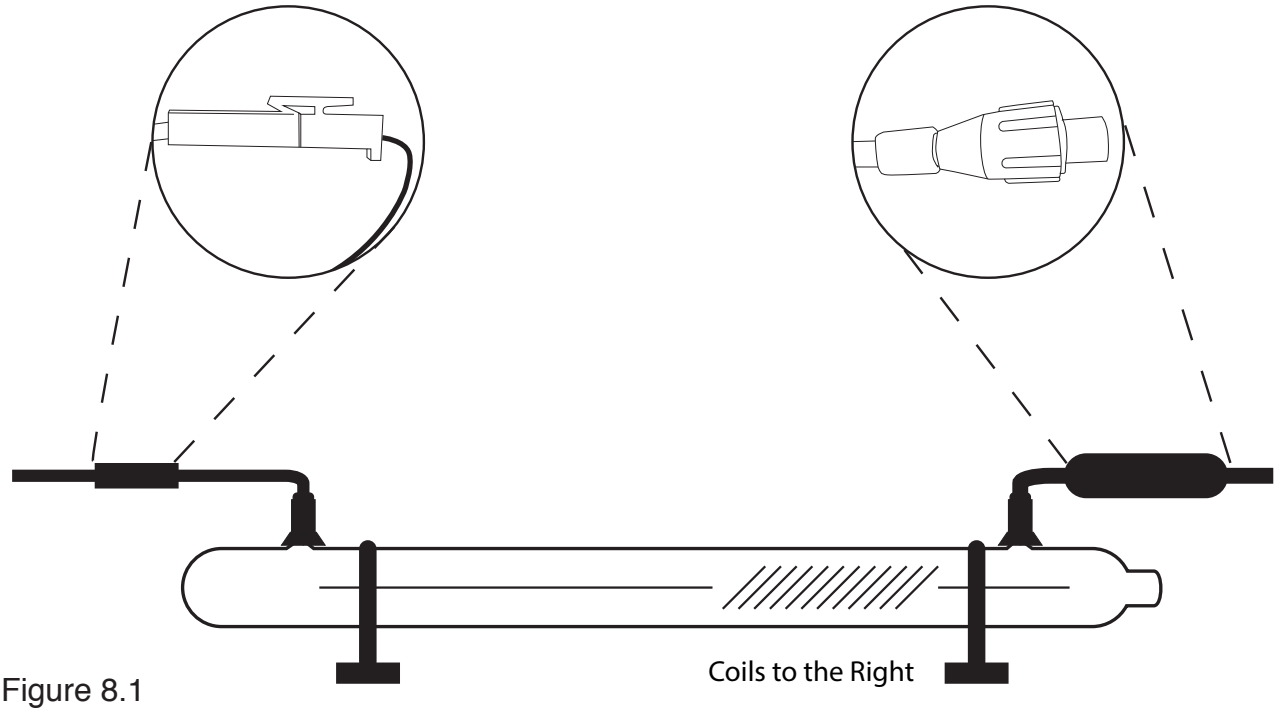


Figure 8.1

8. Reattach Universal Laser Pin Connector: Reverse step 7. Screw the universal laser pin connector onto the aperture end of new laser tube and clip the connector back to the other end of the laser tube.

9. Place New Laser Tube: Place the new tube into the rubber holders in the same orientation as the old tube was in when it was removed (with the glass coils oriented to the RIGHT when facing the machine).

10. Re-Attach Tube Retainer Straps. Gentle place the tube restraining straps back into position over the rubber holders and secure the new laser tube in place.

11. Re-Thread Hex Nuts. CAREFULLY re-thread the M5 hex nuts onto the U-bolt posts and make snug (but not yet tight) with the rear panel.

12. Re-Attach Water Tubes. Carefully re-attach the water tubes to the proper laser connection bulkheads. Make sure that the water tube routing and locations match the original configuration.

We have now switched the old laser tube for the new laser tube.

You will need to retest the mirror alignment and possibly go through the mirror alignment procedure again.

Belt Installation

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



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



WATER WARNING! *You will be disconnecting the water system and working with the laser upside down. Be sure the machine is dry before proceeding with this process.*

REQUIRED PARTS AND TOOLS:

2.5mm Hex Wrench (included with accessories)

1. BELT INSTALLATION STEPS:

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

2. Disconnect Water: Detach the tubes from the rear connectors. Use the small piece of tubing that shipped with your laser to shunt the two water bulkheads together.

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

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

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

6. Loosen the idler pulley mount: Once the belt has been installed on the riser, loop over the drive and idler pulleys.

7. Tension the belt: Pull on the Y idler pulley mount with your hand. Moderate to strong force is recommended. If the motors do not jog, verify that the motors are connected to the control card.

General Maintenance

Before Every Job:

Always be sure your water, air, exhaust, and power systems are properly assembled and operating normally.

Be sure that the machine and workspace are clutter-free.

Be aware of any material warnings and that you are working in a well-ventilated workspace.

Check that your fire extinguisher is up to regulation and is easily accessible.

Always follow all safety protocol.

Weekly

Wipe down the walls 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 cleaned more often if cutting materials produce excessive residue (possibly daily).

Clean fallen debris from the catch tray of the machine. Less excess material will reduce fire risk, and provide for better exhausting.

Always keep rails, motors and moving parts free from excess material as it can obscure movement and cause damage.

Monthly

Check rail lubrication. When the laser arrives, you should be able to visibly see the lubricant on the X and Y rails. These rails will not need to be re-lubricated often, but check monthly to be sure that the rails are properly lubricated and aren't grinding or catching.

Check your fume extractor filters. Depending on your output and the materials being cut, your fume extractor filters may need to be replaced as often as every month (or sooner).

Quarterly

Change water in cooling system. This will keep your tube safe from unwanted debris, mold or evaporation.

A chiller system is enclosed and will stay relatively clean and undisturbed, but it is good practice to check and change the water as needed.

Check for wear on belts. Well lubricated belts should last, however, eventually they may wear and crack and need replacement.

Appendix A: Troubleshooting

As with any machinery, individual user results may vary. In this section we will discuss the most common issues users report and the simple solutions to fix them and get back to work. If you cannot find the solution to your problem in this section, please don't hesitate to contact customer support for personalized discussion of your issue.

PROBLEM: LASER DOES NOT FIRE.

POSSIBLE CAUSE

1. Laser cover is open or magnet wires are disconnected.

2. Water is flowing in the wrong direction or water sensor is not working.

SOLUTIONS

1. Make sure that the cover of your laser is closed during jobs or test fires. Check that the magnet wires are connected to the terminals on the power supply.

2. Be sure that water is flowing from right to left through the laser tube. If confirmed and issue persists contact support.

PROBLEM: ENGRAVED LINES ARE DIFFUSE; CUTTING FAILS EVEN AT HIGH POWER.

POSSIBLE CAUSE

1. Laser is not in focus.

SOLUTIONS

1. Check that your laser is in focus. Rest the included focus billet on top of your work piece. Loosen the lens slide so the output nozzle rests on the focus billet. Retighten the slide.

Appendix B: Rotary Attachment Installation

The Full Spectrum Laser Hobby Advanced Rotary Attachment is an accessory to the Hobby Series Laser System and is not included with the base purchase. You can order the rotary attachment from the Full Spectrum Laser website at http://fslaser.com/Products/LaserAccessories. The rotary attachment is capable of engraving on objects from 0.25in diameter. This Appendix explains the typical install method of the rotary attachment into a Hobby Series Laser System. Once you have unpacked your rotary attachment, you will need to connect it to your laser's RetinaEngrave controller before running any jobs.

Rotary Attachment Installation

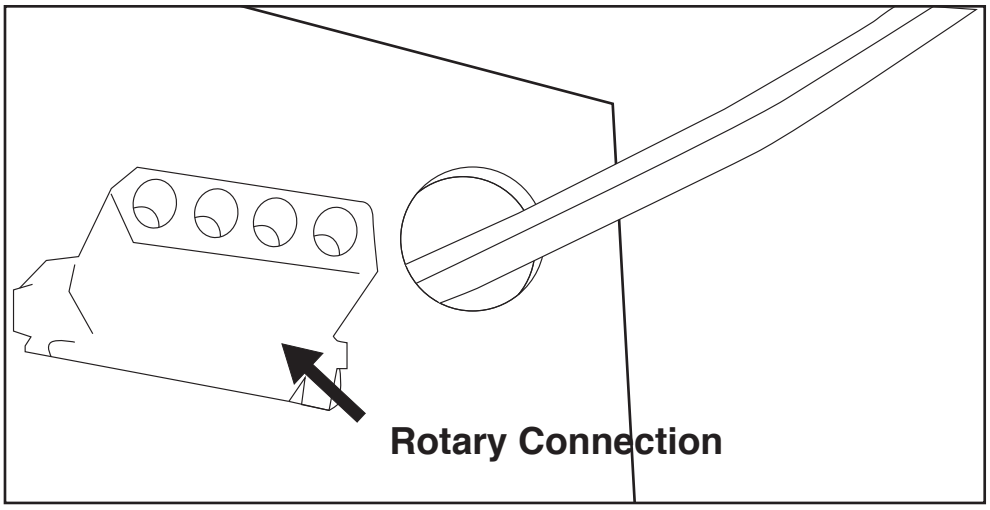
The rotary attachment is a friction-wheel type—objects rest on two driven and two idling wheels and are turned to engrave an image onto the surface of a cylindrical object. The rotary attachment works by translating Y motion along a cylindrical surface.

INSTALLATION STEPS

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

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

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



Rotary Connection

PRO TIP

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

Appendix C: Using the Rotary Attachment

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

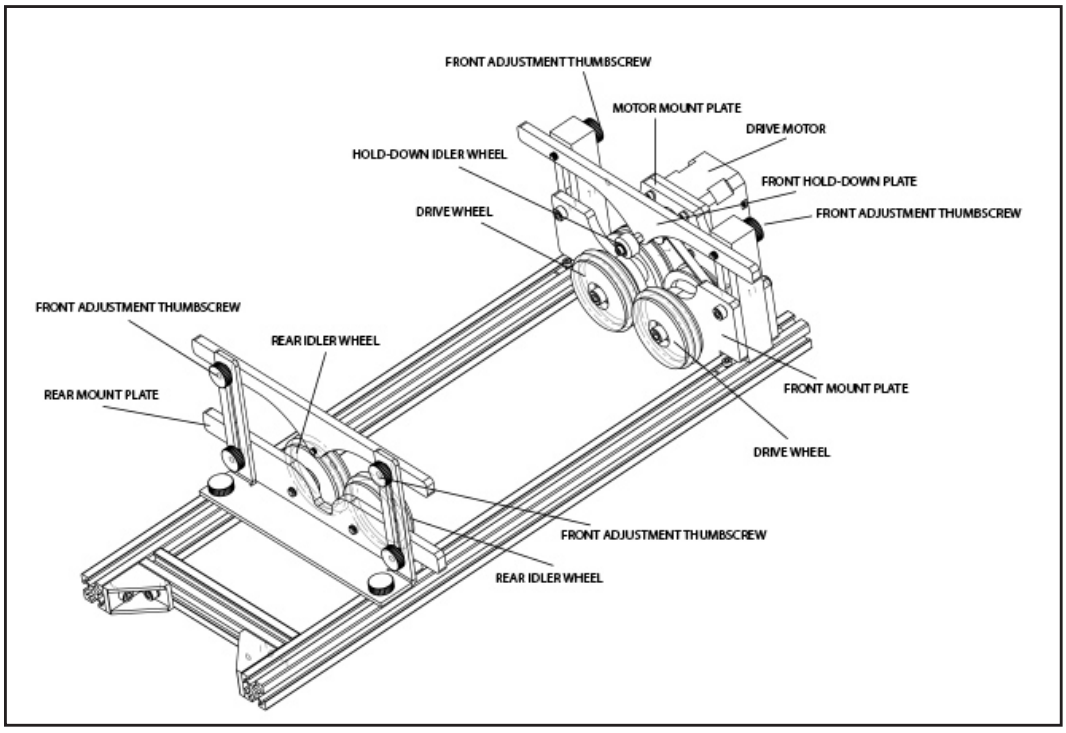
ALIGNING YOUR ROTARY ATTACHMENT

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

1. Starting Position: Focus the laser head onto the rear frame of the rotary attachment on the far left when facing the machine from the front.

2. Slide: With the red dot visible, slowly slide the laser head to the right.

3. Align: Adjust the positioning of the rotary until the red dot tracks back and forth evenly down the center. Note that the rotary is not assembled to the body of the machine but is freestanding. You may need to re-align your rotary each time you use it.



PRO TIP

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

Appendix D: Quick Start Steps

Your Hobby Series is ready to use if you have read the manual to this point and followed all of the foregoing instructions. Please remember to use caution while operating the laser and make sure that all accessories are functioning properly before running any job. The following instructions provide a general workflow for taking an original design and turning it into a laser cut part:

Create your artwork/design in the software program of your choice (e.g. CorelDraw) or use the Design View feature of RetinaEngrave.

1. Turn on the machine and accessories and wait for touch panel to boot.
2. Launch RetinaEngrave on your computer.
3. Place your piece of sample material on the honeycomb.
4. Focus the laser head onto the sample piece.
5. Close the cover. Never fire the laser with the cover open.
6. From CorelDraw, call up the print menu.

Select the “Full Spectrum Engineering” Driver.

If the “Pre-flight check” fails, check that both your document page size and printer page size match the size of the work area, and that no artwork Is outside the boundaries of the page.

1. Once the pre-flight check is clear, continue printing to the software.
2. Your design will be loaded and then rendered by RetinaEngrave under the default raster tab.
3. Once you have set the power levels and layer ordering to your liking, you can run the job.

Appendix E: Warranty Information

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

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

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

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

After 8/7/2012, the Hobby lasers have a 60 day warranty on all items and a free extended limited 1 year warranty which excludes consumable items/shipping included in their price. The limited warranty excludes shipping and consumables and other normal wear and tear items. All electronic items (control cards, power supplies, motors) and most mechanical items are covered under the extended warranty unless damaged by abuse/fires. Consumables not covered include, but are not limited to, rubber parts such as tubing, belts, plastic wheels, lenses, mirrors, other optics, and laser tubes.

Within the first 30 days the original purchaser may transfer the balance of your warranty to anyone else free of charge provided you notify us in writing. Outside of the first 30 days, we will only provide warranty and tech support services to the original purchaser unless a warranty transfer fee is paid as there is a cost involved with initial tech support of new users and accounting fees. If you sell your machine, the warranty remains valid but the buyer must arrange with the original purchaser to request RMAs and send in the machine for repairs unless a warranty transfer fee is paid.

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

Go to http://fslaser.com/service-and-support for most currently warranty postings.

Appendix F: Customer Support

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

PLEASE CONTACT OUR TEAM:

SUPPORT

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

MANUALS

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

SALES

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

SOFTWARE

Install RetinaEngrave software by typing “https://fslaser.com/RetinaEngrave” into your browser and follow instructions.

ORDER ACCESSORIES & UPGRADES

LASER TUBES

40W, 45W Laser Tube

ROTARY ATTACHMENTS

Friction Rotary

FOCUS LENSES

1.5” Lens, 2” Lens, 2.5” Lens, 5” Lens

WATER ASSIST

Water Chiller, Advanced Water Chiller

EXTRACTORS & FILTERS

Large Fume Extractor	Medium Fume Extractor	Small Fume Extractor
Large Filter Replacements	Medium Filter Replacements	Small Filter Replacements

AIR ASSIST

Air Compressor, Exhaust Fan

Appendix G: Workflow Checklist

1. Safety First ensure workspace is free of fire, electrical and other safety hazards.
Be aware of all safety issues when cutting materials with a laser. Always have a fire extinguisher on hand.

2. Power on the laser and all of its components.

3. Ensure that:

- The laser is powered and the boot up cycle begins on the screen.
- The water system is connected properly and water is flowing through the tube.
- The air compressor is powered and exhausting air to the laser head.
- The exhaust system is on and vented into a safe location.

4. Connect to RetinaEngrave Click the RetinaEngrave icon on your computer desktop. Wait for the software to boot. You now have access to the program.

5. Home the laser using the touch panel. Press the long blue button with the House Icon (middle of screen). The laser will automatically home.

6. Import your design and adjust power and speed settings. Double check settings including the number of passes and cut order.

7. Insert material into the laser bed. Use the focus tool to adjust to the top of the material. Focusing should be done each time a new material is introduced.

8. Use the “Perimeter” function to ensure that the file will fit within the cutting area. Adjust accordingly.

9. Run the job file. Do not leave a job running unattended.

Appendix H: Focus Lenses

There are a variety of lenses available for your Hobby Series machine, each specializing in a different cutting thickness or level of engraving detail. The lenses are listed by “inches” which is not an indication of the lenses’ physical size, but rather the focus distance from the material. All Hobby Series machines come standard with a 2.5” lens. See below for the recommended lens for different needs. You can order new or replacement lenses at http://fslaser.com/Products/LaserAccessories.

2.5” Focus Lens

Full Spectrum Laser’s Hobby Series comes standard with a 2.5” lens which is good for cutting up to ¼” of material and engraving detail to around 8pt fonts with a 90w tube. Other lenses are also available that offer different levels of precision, depending on the goals of the project. If you need to ever replace your 2.5” you can order a new one at http://fslaser.com/Product/FocusLens2-5in.

2” Focus Lens

If you are requiring finer engraving and thinner cutting, such as fonts below 8pts, we recommend the 2” lens. The 2” lens has a good combination of fine engraving and thin cutting. A short focus lens has a smaller minimum spot size but spreads out more quickly after reaching the focus making them better for fine detail but not good for thick cutting. A long focus lens keeps the focus longer allowing for straighter edges but does not focus down to as small a minimum spot. To order a 2” lens go to http://fslaser.com/Product/FocusLens2in.

1.5” Focus Lens

If you are requiring extra fine engraving such as fonts below 6pts, we recommend the 1.5” lens. This is a short focus lens has a smaller minimum spot size but spreads out more quickly after reaching the focus making them better for fine detail but not good for thick cutting. To order a 1.5” lens go to http://fslaser.com/Product/FocusLens1-5in.

5” Focus Lens

This optic is appropriate for cutting thick foam. The 5” lens has a large spot size, when focused, which prevents it from being ideal for cutting wood and acrylic. it is also a good lens for engraving into deep bowls, where you need more working space. To order a 5” lens go to http://fslaser.com/Product/FocusLens5in.

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, Twitter, Tumblr, etc.). 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 and 3D printers for FREE. Join our community and see what all the excitement is about.







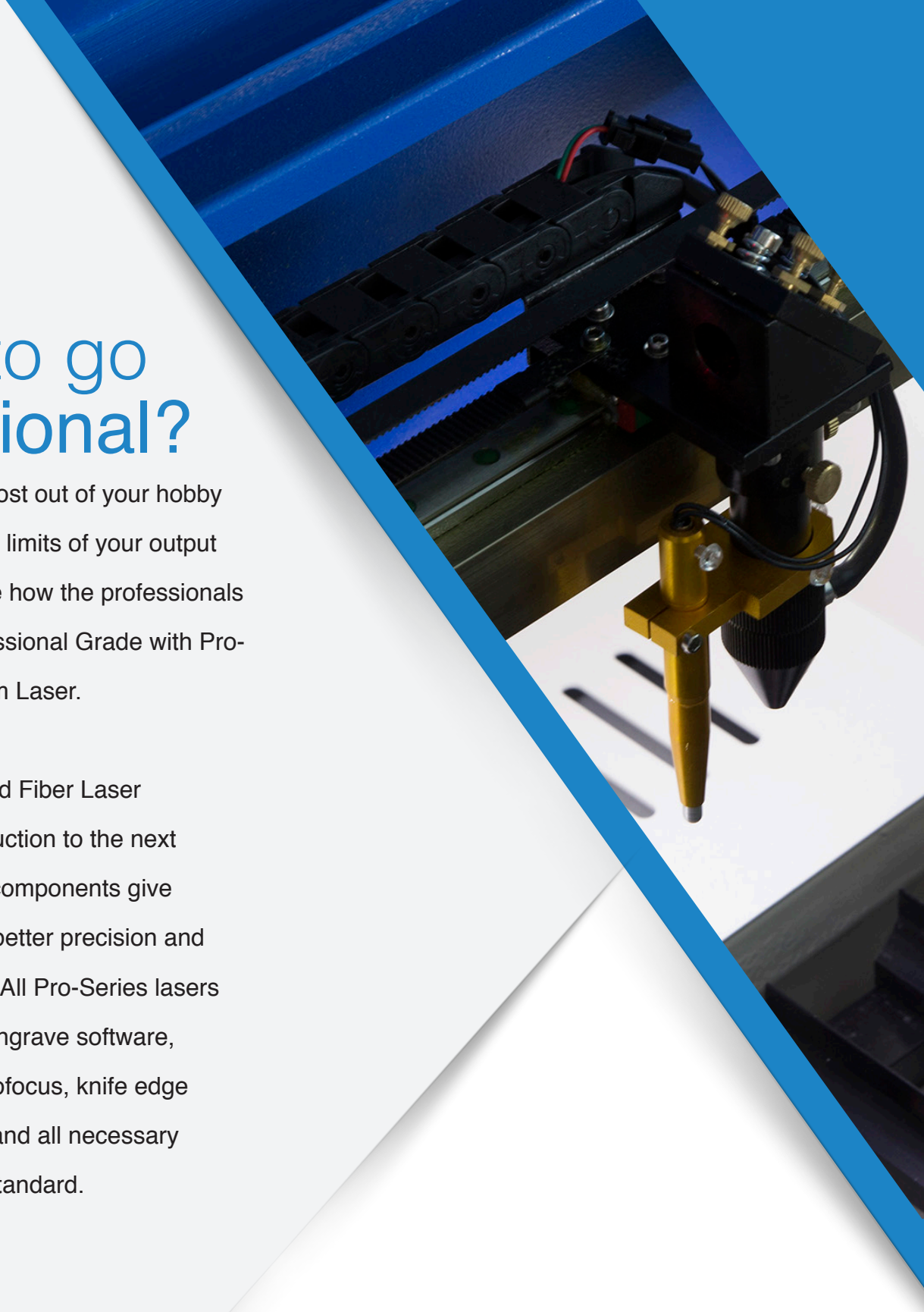
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Ready to go Professional?

Have you gotten the most out of your hobby 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 Pro-Series by Full Spectrum Laser.

Our Pro-Series C02 and Fiber Laser Cutters take your production to the next level. Industrial grade components give you faster movement, better precision and increased laser power. All Pro-Series lasers come with our RetinaEngrave software, motorized z-stage, autofocus, knife edge and honeycomb trays and all necessary accessories included standard.



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