

# USB1410a

## Cabinet Laser Engraver

### User Manual



Read Carefully Before Use  
Keep for Future Reference

# PREFACE

Thank you for choosing our laser equipment.

Your CO<sub>2</sub> laser engraving machine is intended for personal and professional use. When used in accordance with these instructions, it comprises a Class 1 laser system but some components remain **EXTREMELY** dangerous. Never disable the preinstalled safety devices and always use your laser safely and responsibly.

Read this manual carefully before operation. It covers the details of correct installation, adjustment, maintenance, and—most importantly—safe operation of your new laser. It is intended to be used in conjunction with your engraving software manual, as the software typically does not only provide image design but also serves as an alternative interface for the laser settings and machine controls. You and any other users of this device should thoroughly understand **BOTH** manuals before attempting to operate the laser.

Keep both manuals for future reference and provide them to **ANYONE** who will install, operate, maintain, or repair this machine. Both manuals should be included if this device is given or sold to a third party.

If you have any questions after reading these manuals, please contact us and our support department will address your concerns as soon as possible.

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# **1. Introduction**

## **1.1 General Information**

This manual is the designated user guide for the installation, setup, safe operation, and maintenance of your cabinet laser engraver. It is divided into six chapters covering general information, safety instructions, installation steps, operation instructions, maintenance procedures, and contact information.

**ALL** personnel involved in the installation, setup, operation, maintenance, and repair of this machine should read and understand this manual, particularly its safety instructions. Some components are extremely high voltage and/or produce powerful laser radiation. Substandard performance and longevity, property damage, and personal injury may result from not knowing and following these instructions.

Your laser engraver works by emitting a powerful laser beam from a glass tube filled with excited carbon dioxide (CO<sub>2</sub>), reflecting that beam off three mirrors and through a focus lens, and using this focused light to etch designs into certain substrates. The first mirror is fixed near the end of the laser tube, the second mirror travels along the machine's Y axis, and the third mirror is attached to the laser head that travels along the X axis. Because some dust from the engraving process settles on the mirrors, they require frequent cleaning. Because they move during operation, they also require periodic readjustment using their attached positioning screws to maintain the proper laser path. A water cooling system—typically a pump or chiller—must be used with this engraver to dissipate the heat produced by the laser tube. Similarly, an exhaust system—typically either an external vent or a dedicated air purifier—must be used to remove the dust and gases produced by the engraving process.

With low intensity use, the provided laser tube has an average lifespan around 12000 hours before requiring replacement. However, constantly running your laser above 70% of its maximum rated power can significantly shorten its service life. It is recommended to use settings from 10–70% of the maximum rated power to enjoy optimal performance and longevity.

Note that this is a high-voltage device and, as a safety precaution, it is recommended to only touch its components with one hand at a time during use.

Note that the active laser is invisible to the human eye. This device should never be used while any cover is open to avoid potentially permanent injury.

Note also that the water cooling system and exhaust system are both absolutely essential to the safe use of this device. Never operate the engraver without both of these systems operating properly. Water should always be kept clean and around room temperature, and the exhaust system should always comply with all applicable laws and regulations for workplace and environmental air quality.

## 1.2 Symbol Guide

The following symbols are used on this machine's labeling or in this manual:



These items present a risk of serious property damage or personal injury.



These items address similarly serious concerns with regard to the laser beam.



These items address similarly serious concerns with regard to electrical components.



Protective eyewear should be worn by anyone around this machine during operation.



This product is sold in conformity with applicable EU regulations.



This product contains electrical components that should not be disposed of with regular garbage.

## 1.3 Designated Use

This machine is intended for use engraving signs and other consumer products on applicable substrates. This laser can process a wide variety of materials including wood and cork, paper and cardboard, most plastics, glass, cloth and leather, and stone. It can also be used with some specially coated metals. Use of this system for nondesignated purposes or materials is not permitted.

The system must be operated, maintained, and repaired by personnel familiar with the field of use and the dangers of the machine and the material being engraved including its reflectivity, conductivity, potential for creating harmful or combustible fumes, etc.

Laser beams are dangerous. The manufacturer and/or seller bear(s) no responsibility and assume(s) no liability for any improper use of this device or for any damage or injury arising from such use. The operator is obliged to use this cabinet laser engraver only in accordance with its designated use, the other instructions in its manuals, and all applicable local and national laws and regulations.

## 1.4 Technical Specifications

<b>Model</b>		USB1410a	
<b>Laser Tube</b>	<b>Diameter</b>	2.76 in.	70 mm
	<b>Length</b>	69.96 in.	1650 mm
<b>Focus Lens</b>	<b>Diameter</b>	0.79 in.	20 mm
	<b>Thickness</b>	0.08 in.	2 mm
	<b>Focal Length</b>	2.5 in.	63.5 mm
<b>Mirror</b>	<b>Diameter</b>	0.98 in.	25 mm
	<b>Thickness</b>	0.12 in.	3 mm
<b>Input Power</b>		110–120 V~ 60 Hz	
<b>Power Consumption</b>		1500 W	
<b>Rated Power</b>		130 W	
<b>Expected Service Life</b> at <40% / 40–70% / >70% Power		12000/10000/8000 hr.	
<b>Laser Wavelength</b>		10640 nm	
<b>Processing Area</b>		55.1×35.4 in.	1400×900 mm
<b>Front/Back Pass-Through Size</b>		59.1×2 in.	1500×50 mm
<b>Side Pass-Through Size</b>		38.2×0.8 in.	970×20 mm
<b>Workbed Blades</b>		24	
<b>Max. Processing Speed</b>		23.6 ips	600 mm/s
<b>Max. Acceleration</b>	<b>X-Axis</b>	315 ips <sup>2</sup>	8000 mm/s <sup>2</sup>
	<b>Y-Axis</b>	118 ips <sup>2</sup>	3000 mm/s <sup>2</sup>
<b>Min. Engraving Depth</b>		0.0004 in.	0.01 mm
<b>Max. Engraving Depth</b>		0.4 in.	10 mm
<b>Min. Letter Size</b>		0.04×0.04 in.	1×1 mm
<b>Required Operating Environment</b>	<b>Max. Humidity</b>	70%	
	<b>Temp. Range</b>	40–95°F	5–35°C
<b>Provided Operating Software</b>		RDWorks	
<b>Supported Operating Software</b>		CorelLaser, LightBurn	
<b>Supported Image Formats</b>		.ai, .bmp, .dxf, .gif, .hpgl, .jpeg, .pdf, .plt, .png, .rd, .svg, .tiff, .tga	
<b>Graphic Operating Modes</b>		Raster, Vector, Combined	
<b>Certification</b>		CE, FDA	
<b>Net Weight</b>		679 lb.	308 kg

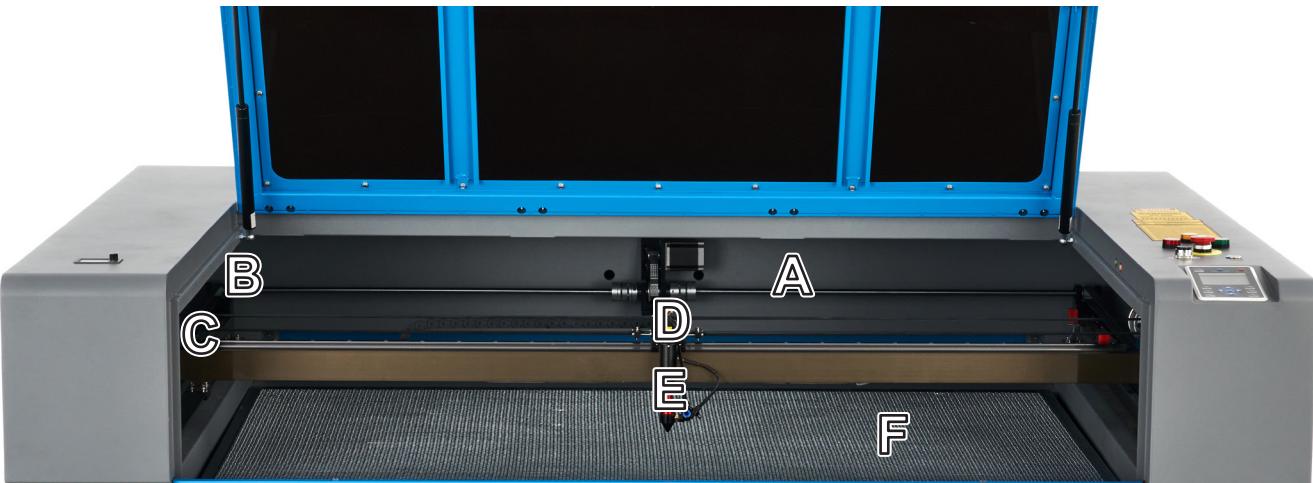
## 1.5 Components



## **Main Parts**

- A. Cover**—The cover provides access to the main bay for placing and retrieving materials, as well as fixing the laser path alignment and other maintenance. Power to the laser is automatically cut when the cover is opened.
- B. Viewing Window**—The polycarbonate window is shielded to protect you and others from the laser and its reflection, allowing monitoring of the engraving process. However, you should never stare continuously at the laser during operation, even through the window.
- C. Y-Axis Rail**—The Y-axis rail supports the movement of the X-axis rail up and down the workbed.
- D. X-Axis Rail**—The X-axis rail holds the 2nd mirror and supports the movement of the laser head left and right across the workbed.
- E. Laser Head**—The laser head holds the 3rd mirror, the focus lens, the red dot guidance, and the air assist outlet.
- F. Workbed**—The workbed can be adjusted in height to fit thinner and thicker materials, as well as adjusted between the aluminum and honeycomb platforms. This is also where the accessories pack is located when the engraver first arrives.
- G. Control Panel**—The control panel offers hands-on control of the engraving process, including manual movement of the laser head and firing of the laser.
- H. Emergency Stop**—This button immediately cuts all power to the laser tube in the event of an emergency.
- I. Pass-Through Doors**—These doors open to allow larger pieces of material to be fed through the workbed. Additional care must be taken to avoid seeing or suffering exposure to the laser beam and its reflection.
- J. Front Access Door**—This door provides access to the waste hopper for easy cleanup after each project.
- K. Caster Wheels**—The front wheels include locks to hold the engraver in place.
- L. Connection Inputs**—This panel includes the machine's ports for its USB, computer, and Ethernet connections.
- M. Right Access Door**—This door provides access to the mainboard, motor drivers, and power supplies.
- N. Warnings**—This notice supplements the Safety Information chapter of this manual. Read it carefully before using the machine.
- O. Power Sockets**—These sockets connect to your main power supply, ground the machine, and provide additional sockets for your water pump and air assist if needed. It is recommended, however, to use a separate plug on a different fuse for these devices.

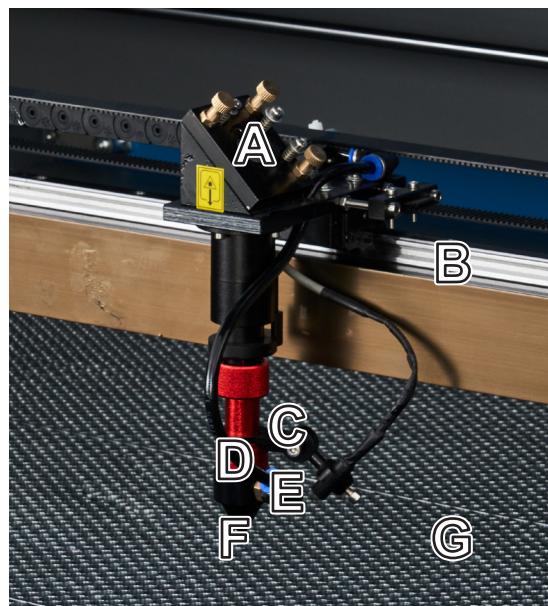
This area also includes the intake that provides the pressurized air for the machine's air assist. Periodically check its filter to keep it clear of any obstruction.
- P. Upper Rear Access Door**—This door opens to the laser bay, holding the laser tube and its connections.
- Q. Exhaust Fans**—These fans pull out gases and airborne debris from the worktable, sending it through your vent to a window or air purifier.
- R. Water Ports**—These ports connect to your water chiller to keep your laser tube cool and stable.



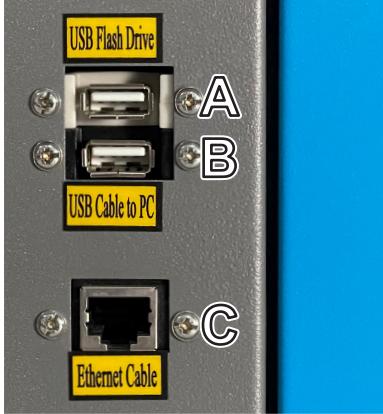
## Laser Path

- A. **Laser Tube**—This CO<sub>2</sub>-filled glass tube is mounted on brackets and immobile. Its connection to the laser power supply is extremely high voltage and extremely dangerous.
- B. **1st Mirror**—This adjustable-angle mirror is fixed in place to transfer the engraving laser from the tube to the 2nd mirror.
- C. **2nd Mirror**—This adjustable-angle mirror moves with the X-axis rail to allow the laser beam to travel along the Y axis.
- D. **3rd Mirror**—This adjustable-angle mirror moves with the laser head to allow the laser beam to travel along the X axis.
- E. **Focus Lens**—This lens directs and focuses the laser to the material.
- F. **Workbed**—The bare workbed can be adjusted in height or fitted with aluminum or honeycomb tables for different projects.

## Laser Head

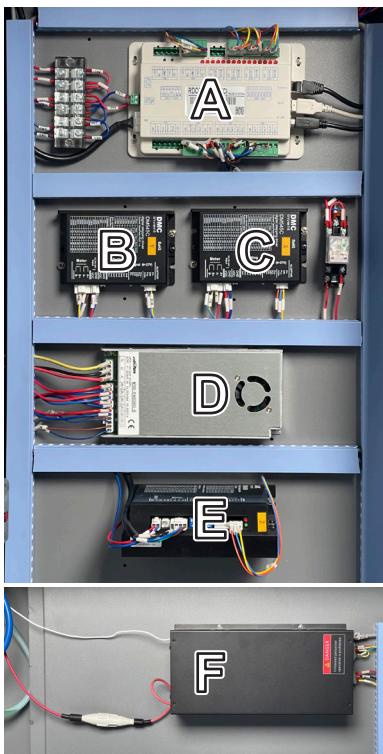


- A. **3rd Mirror**—This adjustable-angle mirror transfers the laser from the 2nd mirror to the focus lens.
- B. **X-Axis Rail**—This rail moves along the Y axis, with its movement controlled by limit switches.
- C. **Red Dot Pointer**—This device helps you see the exact position of the invisible engraving laser.
- D. **Focus Lens**—This 18 mm lens directs and focuses the laser beam to its point of contact with the engraving material.
- E. **Air Assist**—This device blows pressurised air to kill sparks and blow away gas and debris as you engrave.
- F. **Laser**—The engraving laser itself is invisible but highly dangerous. Avoid any direct exposure to your skin or eyes.
- G. **Workbed**—Use the provided acrylic tool to get the perfect focus for any thickness of material.



## Connection Inputs

- A. **USB Port**—This port allows you to load and save designs and parameters directly onto the engraver.
- B. **USB Line Port**—This port connects to your control computer and its engraving software using any of its USB ports.
- C. **Ethernet Port**—This port connects to your control computer and its software either directly or via the internet.



## Right Access Door

- A. **Mainboard**—This circuit board controls the engraving process, responding to commands from your engraving software or the machine's control panel.
- B. **Y-Axis Driver**—This device moves the X rail along the Y rail.
- C. **X-Axis Driver**—This device moves the laser head along the X rail.
- D. **Control Power Supply**—This device powers the machine's control panel.
- E. **Z-Axis Driver**—This device moves the workbed up and down.
- F. **Laser Power Supply**—This device transforms standard electricity into the extremely high voltage charge necessary for the laser tube.



## Laser Power Supply

- A. **High-Voltage Wire**—This line is connected to the laser tube's anode or positive end, providing high-voltage current to power the laser.
- B. **Mounting Holes**—These standard slots allow simple installation and removal.
- C. **Digital Display**—This display provides the real-time current to the laser tube in millamps and notification of any problems with the laser or water systems.
- D. **Water Indicator Light**—When connected, this light shows the water cooling system is operating.
- E. **Laser Signal Indicator Light**—This light shows the laser tube is operating.
- F. **Laser Indicator Light**—This light shows when current is being sent to the laser tube.
- G. **Main Power Terminal**—This terminal block holds the power supply's connection to the engraver's grounding (FG) and to the main power supply (AC).
- H. **Test Button**—This button is used to attempt to test fire the laser when troubleshooting problems. If the laser fires successfully, the problem will usually be with the control panel or its connections.
- I. **Connection Terminal**—This terminal block holds the connections to the high (H) and low level output (L), the water protection switch (P), another ground (G), and two laser signal controls (IN & 5V).
- J. **Ethernet Port**—This port allows you to connect the laser power supply to an external ammeter.

## Control Console

**Reset**

Returns the machine to the saved default parameters (See §4.4.14)

**Esc**

Stops work or returns to a previous menu

**Stop**

Stops the current job

**Enter**

Enters a command or confirms your selection

**Origin**

Sets the starting point for the laser head (See §4.4.13)

**Menu**

Opens the Main menu (See §4.4.2)

**Frame**

Traces the outline of the current design for sizing



Opens the Function menu (See §4.4.8)

**Pulse**

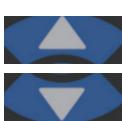
Fires the laser manually (See §4.4.12)



Controls X-axis movement or moves left and right in parameters

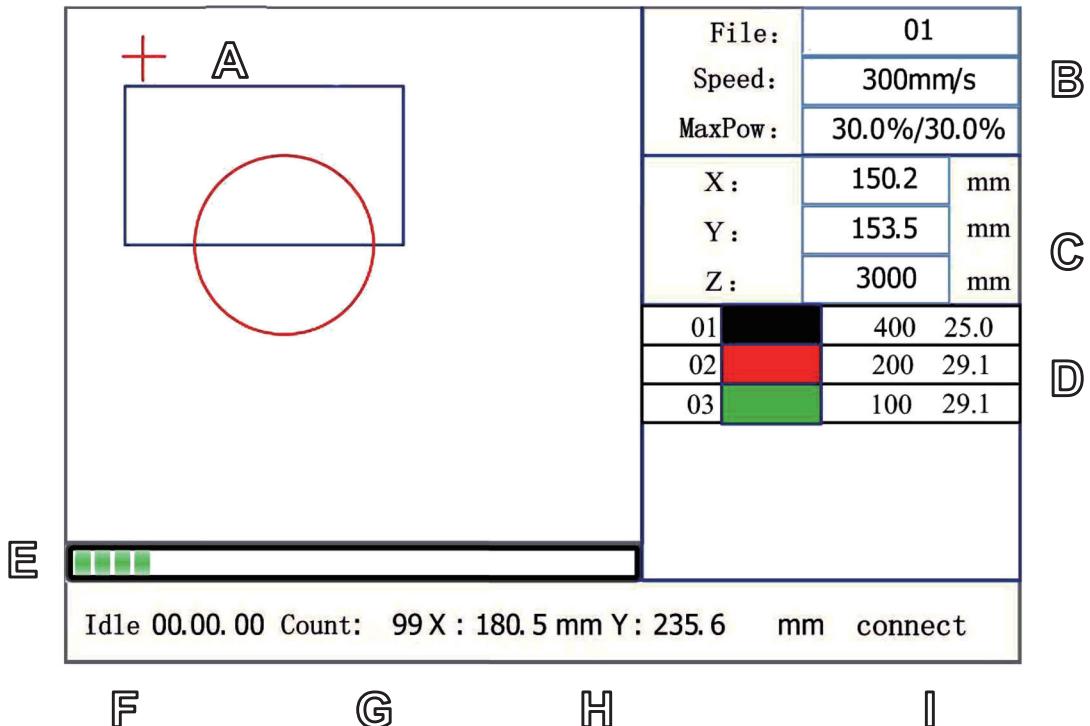
**Start/Pause**

Starts/pauses the current job



Controls Y-axis movement or moves up and down in parameters

## Console Screen



- A. **Design Display:** shows the whole file's track and the running track.
- B. **Parameters:** displays the running file's file number, speed, max power, etc.
- C. **Coordinates:** displays the current coordinates of the laser head.
- D. **Layers:** displays the layer parameters of current or previewed files. Parameters from left to right are layer number, color, speed, and maximum power.
- E. **Laser Status:** displays the current status of the machine: Idle, Running, Paused, or Finished. The processing time is shown on the right side.
- F. **Progress Bar:** displays the progress of the current file.
- G. **Job Number:** shows the count of completed runs of the current file.
- H. **Design Dimensions:** displays the dimension of the current file.
- I. **Internet Status:** displays the status of the machine's internet connection.

When the system is idle or the work is finished, all the buttons can be used. Users can process the file, set the parameters, preview their file, etc. When the work is running or paused, some buttons will not work (e.g., Origin and Frame).

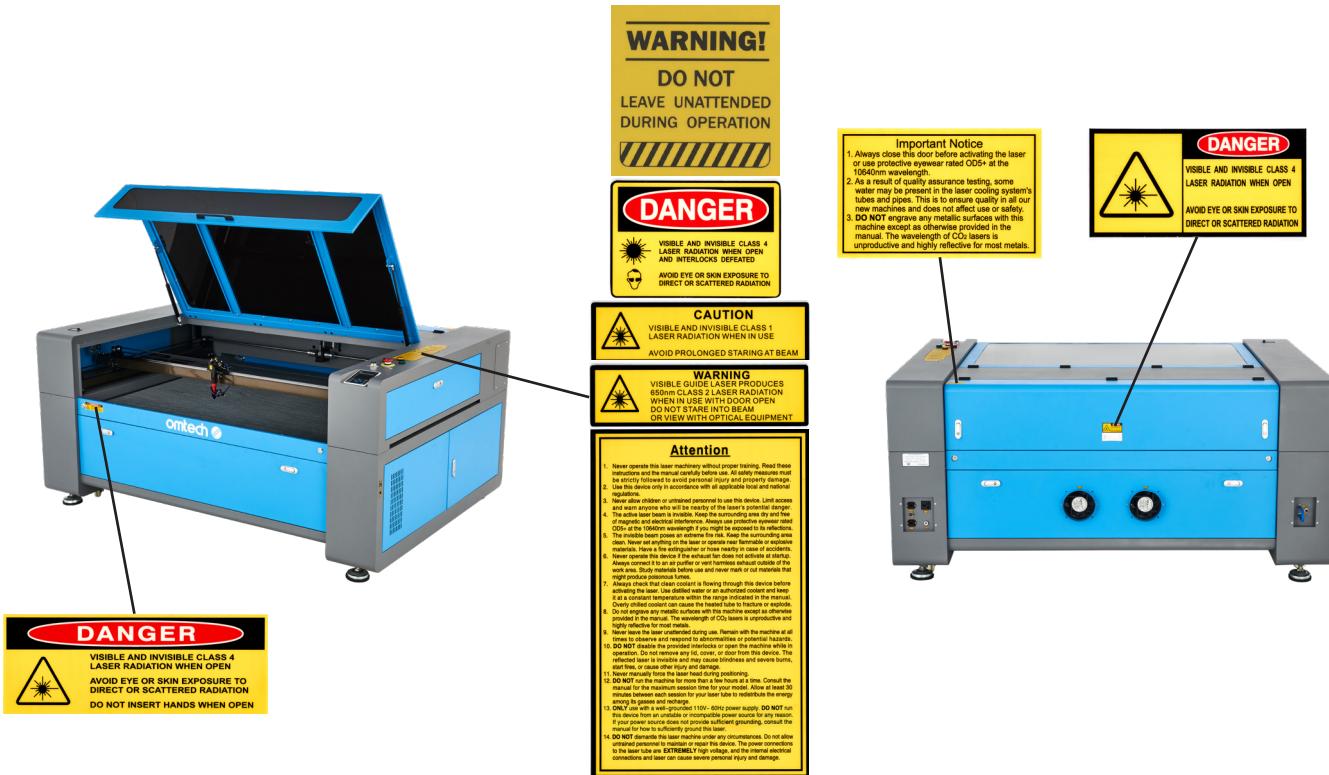
## **2. Safety Information**

## 2.1 Disclaimer

Your engraver may differ somewhat from those shown in this manual due to options, updates, etc. Please contact us if your engraving machine came with an outdated manual or if you have any other questions.

## 2.2 General Safety Instructions

- Your device should come with instruction labels in the following locations:



If any of these labels is missing, illegible, or becomes damaged, it must be replaced.

- Use this laser engraving device only in accordance with all applicable local and national laws and regulations.
  - Use this device only in accordance with this instruction manual and the manual for the engraving software included with it. Only allow this device to be installed, operated, maintained, repaired, etc. by others who have also read and understood both manuals. Ensure that this manual and the software manual are both included with this device if it is ever given or sold to a third party.
  - **DO NOT** operate continuously for more than 5½ hours. Stop for at least 30 minutes between uses.
  - **DO NOT** leave this device unattended during operation. Observe the device throughout operation and, if anything seems to be operating strangely, immediately cut off **ALL** power to the machine and contact either our customer service or your dedicated repair service. Similarly, ensure the device is **FULLY** turned off (including by means of the emergency stop switch) after each use.
  - **DO NOT** allow minors, untrained personnel, or personnel suffering from physical or mental impairment that would affect their ability to follow this manual and the software manual to install, operate, maintain, or repair this device.
  - Any untrained personnel who might be near the device while it is in operation **MUST** be informed that it is dangerous and fully instructed on how to avoid injury during its use.
  - Always keep a fire extinguisher, water hose, or other flame retardant system nearby in case of accidents. Ensure that the local fire department's phone number is clearly displayed nearby. In the case of a fire, cut electrical power before dousing the flame. Familiarize yourself with the correct range for your extinguisher before use. Take care not to use the extinguisher too close to the flame, as its high pressure can produce blowback.



## 2.3 Laser Safety Instructions

When used as instructed, this machine comprises a Class 1 laser system safe for users and bystanders. However the invisible engraving laser, the laser tube, and its electrical connections remain **EXTREMELY** dangerous. Used or modified without care, they can cause serious property damage and personal injury including but not limited to the following:



- The laser will easily burn nearby combustible materials
- Some working materials may produce radiation or harmful gases during processing
- Direct exposure to the laser will cause bodily harm including serious burns and irreparable eye damage

As such,

- **DO NOT** modify or disable this device's provided safety features. Do not modify or disassemble the laser and do not use the laser if it has been modified or disassembled by anyone except trained and skilled professionals. Dangerous radiation exposure and other injury may result from the use of adjusted, modified, or otherwise incompatible equipment.
- **NEVER** leave any part of the cabinet open during operation except (when needed) the pass-through doors. Never interfere with the laser beam, do not place any part of your body in any part of the laser path during operation, and never attempt to view the laser directly. When using the pass-through doors or otherwise risking exposure to the laser beam, take measures to protect yourself from potentially reflected laser beams including the use of personal protective equipment such as protective eyewear specially designed to filter the specific wavelength of your engraver's laser with an optical density (OD) of 5+.
- **DO NOT** stare or allow others to stare continuously at the laser beam during operation even when the cover is closed and/or wearing protective eyewear.
- **ONLY** use this engraver if its automatic shutoffs are working properly. When you first get this engraver and if you subsequently notice any problems, test them (see below) before undertaking any other work. Do not continue use if the shutoffs do not occur. Turn off the device and contact customer service or your repair service. Never disable these shutoffs.
- **DO NOT** ever under **ANY** circumstances use this laser engraver if the water cooling system is not working properly. Always activate the water cooling system and visually confirm that water is flowing through the entire system before turning on the laser tube. If using the provided water pump, ensure that it is placed in a tank full of cool or tepid distilled water. Do not use ice water or water that has become hotter than 100°F (38°C). For best results, keep it between 60–70°F (15–21°C). Replace heated water or add sealed bottles of frozen water to cool it, while never allowing the system to run without water or allowing the water to become colder than 50°F (10°C). Immediately stop use if the water cooling system malfunctions.
- **DO NOT** use generic coolant or antifreeze in your cooling water, as they may leave corrosive residues and solidify inside your hoses and piping, causing malfunctions and even explosions. Use custom laser-safe formulations or use and store your engraver in a climate-controlled area.
- **DO NOT** leave potentially combustible, flammable, explosive, or corrosive materials nearby where they could be exposed to the direct or reflected laser beam.
- **DO NOT** use or leave sensitive EMI equipment nearby. Ensure the area around the laser is free of strong electromagnetic interference during any use.
- **ONLY** use this machine for working the materials described in the Material Safety section of this manual. The laser settings and engraving process must be properly adjusted for specific materials.
- Ensure the area is kept free of other airborne pollutants, as these might pose a similar risk of reflection, combustion, etc.

## 2.4 Electrical Safety Instructions

- **ONLY** use this device with a compatible and stable power supply with less than 5% fluctuation in its voltage.
- **DO NOT** connect other devices to the same fuse, as the laser system will require its full amperage. Do not use with standard extension cords or power strips. Use only surge protectors rated over 2000J.
- **ONLY** turn on the power to this device when it is well grounded, either via a firm connection to a 3-prong outlet or via a dedicated grounding cable firmly connected to the proper slot on the cabinet. Do not use with an ungrounded 3 to 2 prong adapter. The device's grounding should be checked regularly for any damage to the line or loose connections.
- The area around this laser engraving device should be kept dry, well ventilated, and environmentally controlled to keep the ambient temperature between 40–95°F (5–35°C). For best results, keep the temperature at 75°F (25°C) or below. The ambient humidity should not exceed 70%.
- Do not handle the water pump or the water in which it is submerged while the pump is attached to its power supply. Place it in water before connecting it to power and disconnect it from power before removing it.
- Adjustment, maintenance, and repair of the electrical components of this device must be done **ONLY** by trained and skilled professionals to avoid fires and other malfunctions, including potential radiation exposure from damage to the laser components. Because specialized techniques are required for testing the electrical components of this marking system, it is recommended such testing only be done by the manufacturer, seller, or repair service.
- Unless otherwise specified, **ONLY** undertake adjustment, maintenance, and repair of the device when it is turned off, disconnected from its power supply, and fully cooled.



## 2.5 Material Safety Instructions

- Users of this laser engraving machine are responsible for confirming that materials to be processed can withstand the heat of the laser and will not produce any emissions or byproducts either harmful to people nearby or in violation of local or national laws or regulations. In particular, do not use this device to process polyvinyl chloride (PVC), teflon, or other halogen containing materials under any circumstances.
- Users of this laser engraver are responsible for ensuring that every person present during operation has sufficient PPE to avoid the injury from the emissions and byproducts of the materials being processed. In addition to the protective laser eyewear described above, this may require goggles, masks or respirators, gloves, and other protective outer clothing.
- **DO NOT** ever under any circumstances use this laser engraver if the exhaust system is not working properly. Always ensure that the exhaust fans can remove the dust and gas produced by the engraving process in accordance with all applicable local and national laws and regulations. Immediately stop use if the exhaust fans or vent pipes malfunction. Periodically check the air assist intake filter to ensure it stays free of any dust or debris.
- Users must exercise special caution when working with conductive materials as buildup of their dust and ambient particles may damage electrical components, cause short circuits, or produce other effects including reflected laser radiation.

This machine can be safely used with the following materials:

### Plastics

- Acrylonitrile Butadiene Styrene (ABS)
- Nylon (Polyamide, PA, etc.)
- Polyethylene (PE)
- High-Density Polyethylene (HDPE, PEHD, etc.)
- Biaxially-Oriented Polyethylene Terephthalate (BoPET, Mylar, Polyester, etc.)
- Polyethylene Terephthalate Glycol (PETG, PET-G, etc.)
- Polyimide (PI, Kapton, etc.)
- Polymethyl Methacrylate (PMMA, Acrylic, Plexiglass, Lucite, etc.)
- Polyoxymethylene (POM, Acetal, Delrin, etc.)
- Polypropylene (PP, etc.)
- Styrene

### Other

- Cardboard
- Ceramics, including Dishes, Tile, etc.
- Glass
- Leather
- Paper & Paperboard
- Rubber
- Stone, including Marble, Granite, etc.
- Textiles, including Cotton, Suede, Felt, Hemp, etc.
- Wood, including Cork, MDF, Plywood, Balsa, Birch, Cherry, Oak, Poplar, etc.

See §4.3 for the recommended parameters for the most commonly engraved materials.

This machine **CANNOT** be used with the following materials or with any materials which include them:

- Artificial Leather containing Hexavalent Chromium (Cr[VI]), due to its toxic fumes
- Astatine, due to its toxic fumes
- Beryllium Oxide, due to its toxic fumes
- Bromine, due to its toxic fumes
- Chlorine, including Polyvinyl Butyral (PVB) and Polyvinyl Chloride (PVC, Vinyl, Cintra, etc.), due to its toxic fumes
- Fluorine, including Polytetrafluoroethylenes (Teflon, PTFE, etc.), due to its toxic fumes
- Iodine, due to its toxic fumes
- Metals, due to their conductivity and reflectivity
- Phenolic Resins, including various forms of Epoxy, due to their toxic fumes
- Polycarbonate (PC, Lexan, etc.), due to its toxic fumes

For all other materials, if you are unsure about its safety or laserability with this device, seek out its material safety data sheet (MSDS). Pay especial attention to information about safety, toxicity, corrosiveness, reflectivity, and reaction(s) to high heat. Alternatively, contact our support department for further guidance.

## **3. Installation**

### **3.1 Installation Overview**

A complete working system consists of the laser engraving cabinet, its vents, all applicable connection cables, and the laser and access keys. The cabinet can use designs provided by the enclosed engraving software by direct or internet connection with your computer; it can also engrave designs loaded directly from a flash drive. Users can configure other additional accessories (such as an industrial water chiller, fume extractor, or rotary axis) to suit their needs.



Use only the hardware, wiring, and power sources that came with or are compatible with this device. Installing equipment that your device is not designed to work with can lead to poor performance, shortened service time, increased maintenance costs, property damage, and personal injury.

Please note the specific requirements of your system's installation. Every customer must understand these notes before installation to execute a proper setup and achieve safe laser performance. If you have any installation questions or problems, contact our technicians and customer support team.

Any auxiliary equipment must be adjusted to the base machine. Queries may be directed to the dealer or manufacturer of such equipment.

### **3.2 Location Selection**

Prior to assembling your fiber laser marker, select an appropriate location for its use.

Be sure that it meets all of the requirements discussed in the Safety Information above. The location should be stable, level, dry, and climate controlled to ensure an ambient temperature of 40–95°F (5–35°C) and an ambient humidity under 70%. In particular, the temperature and humidity together should not be close to the dew point. It is also advisable to use a windowless room or to use blinds and/or curtains to avoid exposure to the potential additional heat of direct sunlight. The location should be free of dust and other airborne pollutants and well ventilated enough to process any fumes produced by the engraving process in accordance with all applicable laws and regulations. Depending on the materials to be processed, this may require construction of a dedicated ventilation system. It should be away from children; combustible, flammable, explosive, or corrosive materials; and sensitive EMI devices. The power cord should be plugged into a compatible and stable power source via a grounded 3-prong outlet. No other item should be drawing current from the same fuse. There should be firefighting equipment nearby and the local fire department's phone number should be clearly displayed.

It is highly recommended to have an extra work table nearby in order to avoid placing objects on or directly adjacent to the machine, which could become a fire or laser hazard.

### **3.3 Unpacking Your Engraver**

Your engraving machine arrives in a wooden crate with its accessories (including this manual) packaged inside the laser bay. You should have placed the crate in a spacious flat area for unpacking, ideally where you plan to operate the machine permanently. If you have not already done so, finish removing the crate from around your engraver. Once unpacked, the machine can be rolled into place.

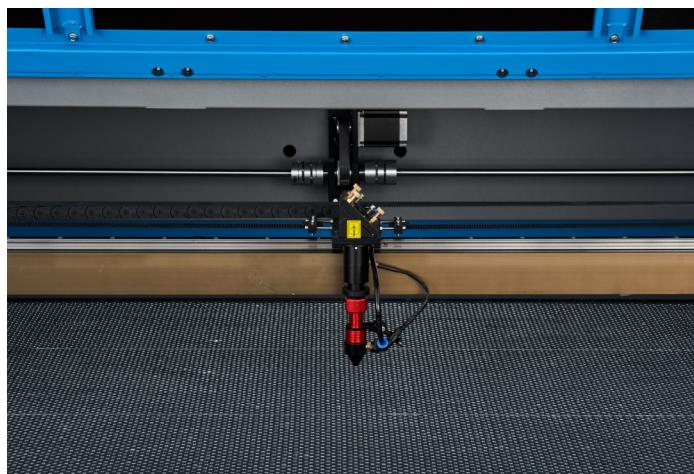
**Step 1.** Fix it in place by pressing down on the brake pads on the 2 front wheels.

**Step 2.** Retrieve the access keys from the main bay in the front of the machine. Use them to unlock the laser bay in the rear and take out the accessories pack. Check that you have received all of the following: a power cord, a ground wire, USB and Ethernet cables, a USB flash drive with engraving software included, an exhaust pipe with a hose clamp, a set of hex wrenches, a tube of silicone sealant, an acrylic focusing tool, a key, and this manual.

**Step 3.** CAREFULLY remove the rest of the foam packaging material from around the laser tube, the viewing window, and the rest of the machine. The laser tube is a highly fragile object and should be handled delicately and as little as possible.



**Step 4.** Inside the main bay, remove the nylon cable ties from the X axis and the honeycomb table.



**Step 5.** You may keep the packaging in case of future return but, if you dispose of it or any accessories, be sure to do so in compliance with applicable waste disposal regulations.

### 3.4 Electrical Grounding

This device employs a powerful laser. As discussed in the Safety Information above, it is extremely high voltage and potentially dangerous, so users must securely ground it to avoid the buildup of static electricity. Using a standard 3-prong outlet will provide sufficient grounding. If you do not have access to a 3-prong outlet, you **MUST** use the grounding cable and ensure its proper connection. The far end of the cable should be securely connected to a single metal rod driven at least 8 feet (2.5 m) deep or to two separate metal rods driven at least 4 feet (1.2 m) deep into soil located at least 5 feet (1.5 m) from the machine.



Poor grounding **WILL** cause equipment failure and create a serious electrical shock hazard. The manufacturer and/or seller bear(s) no responsibility and assume(s) no liability for any damage, accidents, or injuries caused by bad grounding connections.

## 3.5 Water Cooling Installation

 The provided water chiller is essential to your engraver's performance and longevity. When this laser works without a properly maintained cooling system, its glass tube **WILL** explode from excess heat.

 **NEVER** touch or adjust your engraver's water supply while the pump is connected to power.

To install your pump, fill a dedicated tank with at least 2 gallons (7.5 L) of distilled water. Using deionized or tap water will gradually degrade the quality of your engraver and may even cause dangerous mineral buildup in the cooling system. **NEVER** use generic antifreeze for the same reason. Use custom laser-safe formulations or store your engraver in a climate-controlled area.

Connect the two hoses that came with your engraver to the water inlet (marked "Water IN") and water outlet (marked "Water OUT") on the back of your engraver. Attach the other end of the inlet tube directly to your chiller and ensure that all connections are watertight and allow no leaks during use.



Connect the water pump to its power supply. For best results, use a power outlet on a separate fuse from the engraver itself. If no such outlet is available, the pump can also be plugged into a dedicated socket located on the side of the engraving cabinet. Once the pump is plugged in, water should begin to run through your machine and back into your tank. **ALWAYS** obtain visual confirmation that the water is flowing through the laser tube before starting your laser.

**NEVER** allow the water in the tank to become too hot to cool the laser. Install a thermal alarm or periodically check the water's temperature during prolonged use. If the water begins to reach 100°F (38°C), replace it with cooler water. Either replace it in stages or turn off the laser during this process: never allow the laser to operate without a constant flow of cooling water. It is also possible to add sealed bottles of frozen water to your tank to keep the water cool but never allow the water to become ice cold itself, as this could shatter the heated glass CO<sub>2</sub> tube as well.

As an alternative to manually adjusting the water in your tank, you may also use an industrial water chiller to supply temperature-controlled water to your machine. Follow its separate manual and again, for best results, plug it into a separate fuse from the engraver itself. Remember to connect the chiller's outlet port with the engraver's inlet port and to connect the chiller's inlet with the engraver's outlet.

## 3.6 Exhaust System

Install the provided exhaust pipes directly onto the fans. The pipes can be expanded to a full length of about 5 feet (1.5 m).



The other end should be connected to a dedicated purifier or (if the fumes are not hazardous and meet local and national air safety standards) placed out a window. **NEVER** operate the laser if the vents are not purifying or removing the fumes produced by the target material. Research materials before use and never operate the laser on any (such as PVC, teflon, and other halogen-containing substances) that can produce corrosive, hazardous, or even deadly fumes.

## 3.7 Main Power Connection

Confirm that the labeling beside the connection socket on the machine matches your power supply. Connect one end of the main cable to the connection socket and the other end to a grounded outlet. Under **NO** circumstances should you switch on the device if the voltages do not correspond.



Fluctuation along the line should be less than 5%. If this is exceeded, the fuses will blow. They are located in the connection socket and are accessible from the exterior. Similarly, do not connect this device to standard extension cords or power strips. Connect it directly to a grounded outlet or use a surge protector rated over 2000J.

## 3.8 Control Computer

See the software manual for details on the requirements for the control computer. The control computer can be connected using the provided USB cable (via the port marked "USB Cable to PC"), using the provided Ethernet cable (via the port marked "Ethernet Cable"), or using the internet if the engraver has been connected to it using the Ethernet cable. If the control computer is directly connected to the engraver, it should not be placed more than 15 feet (4.5 m) away in order to avoid possible interference to the signal on its line. Familiarize yourself with the software's image design features and laser control settings before using it to operate the laser.

## 3.9 Initial Testing

### Emergency Shutoff

Because of the risk of fire and other hazards during engraving, this engraver includes a large and easy-to-reach emergency stop button near the control panel. Press it down to stop the laser tube instantly.



When your engraver arrives, its e-stop is already pressed and must be pulled up to allow the laser to function. You should test that it works properly before conducting **ANY** other work with your machine. Start the water cooling system, place a piece of laserable scrap material on the workbed, close the cover, and press **PULSE** to fire the laser. Hit the emergency stop button and observe whether the laser stops instantly. If the laser continues to fire, the emergency stop is not working and must be replaced before the engraver can be used. Turn off the machine and contact customer service.

### Cover Shutoff (Interlock)

Because of the risk of blindness, burns, and other injury from direct exposure to the invisible engraving beam, this device also shuts off the laser automatically when the protective cover is raised during operation.



After ensuring that the emergency stop button works, you should also test that the cover shutoff works properly before conducting any other work on your machine. Start the water cooling system, place a piece of laserable scrap material on the workbed, close the cover, and press **PULSE** to fire the laser. Release the button. Taking care not to expose yourself to seeing or being hit by any possible reflected laser light, open the cover as little as possible and attempt to fire the laser again. If the laser fires, the automatic shutoff is not working and must be repaired before the engraver can be used. Turn off the machine and contact customer service.

## **Water Shutoff**

Because of the danger posed by an uncooled laser tube, this engraver also shuts off the laser automatically when the water cooling system malfunctions.

After ensuring that the emergency stop button and cover protection both work, you should also test that the water shutoff works properly before conducting any other work on your machine. Start the water cooling system, place a piece of laserable scrap material on the workbed, close the cover, and press **PULSE** to fire the laser. Release the button. Cut off the flow of water by crimping or tying the two hoses. (Take care not to damage the hoses themselves in this procedure.) Attempt to fire the laser again. If the laser fires, the automatic shutoff is not working and must be repaired before the engraver can be used. Turn off the machine and contact customer service. If the laser does not fire, the automatic shutoff is working fine; simply release the two hoses to begin circulating water again and continue setting up your engraver.

## **Laser Path Calibration**

Although our factory calibrates your entire system during assembly, it is possible for the laser tube, the focus lens, and/or one or more of the mirrors to be jostled out of alignment during shipment. As such, it is recommended that you perform an optical alignment test as part of setting up your machine. See the Maintenance section below for step-by-step guidance.

## **Air Assist**

Your air assist should arrive preinstalled and correctly wired. Simply check that it is correctly configured and connected as shown. If any tubing or wiring needs to be reconnected, shut off all power to the machine (including by pressing the emergency stop) before adjusting anything. Check that its air intake filter is in place, clean, and not obstructed by any nearby objects.



## **3.10 Security**

For your own safety and that of passersby, this engraver can be locked shut using the provided key. It is recommended that you use it to lock the machine between sessions, preventing any unauthorized operation of the machine.

# **4. Operation**

## **4.1 Operation Overview**

 Operate this laser marking machine only in accordance with all the instructions provided in this manual. Failure to follow the proper guidelines detailed here can result in property damage and personal injury.

This section will address only some of the options and features provided by the operation software. Before beginning to use the machine, make sure that you have read this entire manual (particularly the Safety Information above), the separate software manual, and any and all warnings provided on the machine itself.

## **4.2 General Operation Instructions**

**Step 1.** Create your design that you'd like to engrave. You can do this directly in your engraving software or use any other graphics program, saving or converting the file to a format compatible with the engraver. See the full list of acceptable file types in the Technical Specifications section above.

**Step 2.** Check that your water chiller is full of clean and cool but not cold distilled water. Replace the water if it is not clean or cool. Turn it on and check that it is in proper working order. Visually confirm that the water is flowing through the whole system either by opening the top rear door to look at the laser tube itself or by observing that water is entering the machine and returning to the tank through the outlet tube. If the laser tube is examined directly, remember to close its access door before continuing. The water system should be allowed to run, filling the pathway and completely clearing any air and bubbles, before **ANY** use of the laser tubes. Add more distilled water to the chiller's tank if necessary after filling the engraver's water tubing.

**Step 3.** Turn on your fume extractor or ventilation system, if any. (The engraver's own exhaust fans will turn on with the machine.)

**Step 4.** Pull up the emergency stop button and turn on the engraver's control panel using its switch on the side of the cabinet. Load your chosen design directly from a USB flash disk or through your computer's connection with the engraver.

**Step 5.** Open the engraver's cover, check that the air assist is working properly, and adjust the workbed if necessary. The honeycomb bed is recommended for most applications. The bed can be raised or lowered using the control panel or the manual adjustment knob to accommodate different thicknesses of various materials.. Alternatively, the honeycomb bed can be removed to expose the aluminum knife bed and provide a little more space for thicker projects. For heavier substrates, be careful to distribute the weight as evenly as possible across the reinforced aluminum supports.

**Step 6.** Place a sample piece of your material on the workbed. The standard location is in the top left corner of the workbed. This can be changed by moving either your design or the location of the engraver's origin using either the control panel or your engraving software.

To work on larger pieces of material, you may open the front or rear pass-through door or both together.

 **DO NOT** insert anything onto the workbed through the pass-through doors other than the material while the laser is active. Pay special attention to the fumes and dust that may be released through these doors. Be sure that your ventilation system is strong enough to pull in all of byproducts or wear the necessary PPE to ensure the health of users and passersby.

**Step 7.** Focus the laser by placing the acrylic focus tool on top of the material and carefully raising the workbed. The laser head should barely touch the top of the acrylic tool without applying any pressure, ensuring the engraving distance is correct. (Again, never attempt to focus the laser either way without some material on the workbed.) Close the cover.

**Step 8.** Customize your design's contrast and engraving depth by adjusting the parameters in your engraving software or directly through the control panel. If your engraving instructions detail the power setting in milliamperes, use the following conversion chart to find the appropriate power setting:

<b>Power (%)</b>	10	20	30	40	50	60	70	80	90	100
<b>Current (mA)</b>	4	7–8	12–14	18–19	22–23	24–26	28	30–31	32–33	33

The threshold for the lowest setting is 10%. The laser will not fire at any setting lower than this. It is **NOT** recommended to use the laser tube at full capacity, especially for extended periods. The recommended maximum power setting is 70%, as prolonged use above that amount will shorten your laser's service life. To increase engraving depth, increase the amount of energy per unit area by increasing the laser's power or the number of loops or by slowing down the speed parameter. Engraving too deep, however, reduces image quality, especially for coated materials.

When working with new materials, remember that you should always start on the low end of likely settings. If the effect is not yet strong enough, you can always rerun the design loop several times or rerun it with more powerful settings until you create the effect that you want.

Resolution should usually be set to 500 dots per inch. Reducing your image resolution can be helpful in some cases, reducing flaming and increasing the energy of the pulse in a way that improves the quality of the resultant image in some materials such as some plastics.

- Step 9.** Turn on the laser tube by inserting and turning your laser key and by using its separate switch on the side of the cabinet. To reduce the risk of electric shock, once the laser tube is on, try to touch the engraver with only one hand at a time.
  - Step 10.** Press **START/PAUSE** to engrave your design. Again, do not stare continuously at the laser even through the protective polycarbonate window. Watch for possible issues like sparks or fires, however, and be prepared to quickly extinguish a fire if necessary.
  - Step 11.** Once the laser has stopped, examine the quality of your first run and adjust the laser parameters on the control panel or in your software as necessary to create the desired effect.
  - Step 12.** When you have finished engraving, close your engraving software and then turn off your machine in the following order: laser power supply, control panel, any ventilation device, the water cooling system, and the emergency power button. Remove your laser key from the control panel.
- During repetitive engraving and cutting, periodically check your pump's tank to maintain a water temperature below 100°F (38°C). If this temperature is reached, stop work and allow your engraver to cool before further use.
- Step 13.** Fully clean the workbed and empty the waste bin.
  - Step 14.** For best results, lock and disconnect your laser engraver from its power supply between uses. Unplug it or turn off its intermediary surge protector.

## 4.3 Instructions for Specific Materials

The following instructions are suggestions to help speed safe work with a range of materials. The user should research the specific safety and engraving requirements of their specific material to avoid the risk of fire, hazardous dust, corrosive and poisonous fumes, and other potential problems. Once the product is known to be safe or appropriate protective equipment has been set up, it can be helpful to engrave a test matrix of small boxes produced at various speed and power settings to discover the ideal settings for your design. Alternatively, start with low power and fast speed settings and rerun your design as many times as needed, using progressively greater laser intensity.

### Average Engraving Settings

<b>Description</b>		<b>Glass</b>	<b>Leather</b>		<b>Clear Acrylic</b>	<b>Stone &amp; Tile</b>	<b>Wood</b>
			<b>Real</b>	<b>Artifical</b>			
<b>130W</b>	<b>Power</b>	16%	16%	15%	15%	18%	18%
	<b>Speed</b>	275 mm/s	450 mm/s	475 mm/s	375 mm/s	185 mm/s	225 mm/s

## **Ceramics**

When engraving on ceramics, generally use moderate to high power. Using more loops rather than higher power and lower speed can help avoid cracking the material during work. Be mindful of the health risk posed by dust generated from ceramic engraving, especially for repetitive industrial applications. Depending on the material and the amount of work, a fan or even full ventilation system may be required to address the problem. Similarly, operators and others in the work area may need to use breathing PPE such as masks and respirators.

## **Glass**

When engraving glass, generally use high power and low speed. As with ceramics, it can be helpful to run more loops at lower settings to avoid cracks. Care must be taken when engraving fiberglass and carbon fiber to avoid combinations of settings that produce a laser intensity great enough to damage the structural integrity of its component fibers, producing blurry marking. PPE should be worn to avoid exposure of the eyes, nose, mouth, and skin to the dust produced by working with either material, especially for repetitive industrial applications. Clothing worn while working with fiberglass should be washed separately afterwards.

## **Leather**

When engraving leather products, generally use low to moderate power at high speed. Be especially attentive to the possibility of fire, as well as the dust produced in repetitive applications.

**Average Cutting Settings for Artificial Leather**

Description		Thickness of Leather			
		1/16 in.	1/8 in.	1/4 in.	1/2 in.
130W	Power	17%	24%	28%	37%
	Speed	40 mm/s	25 mm/s	9 mm/s	6 mm/s

## **Metal**

CO<sub>2</sub> laser engravers should not be used for marking, engraving, or cutting metal. They are best suited for working coatings applied to a metal base, and care must be taken not to attempt work on the underlying metal itself. A variety of coatings specialized for CO<sub>2</sub> engraving are available, and the user should follow the instructions provided as the parameters vary from product to product and metal to metal. Generally, work on aluminum coatings should be done more quickly at lower power and work on steel coatings can be done more slowly at higher power.

## **Paper and Cardboard**

When engraving various paper products, generally use low to moderate power and fast speed. Test samples from each batch, as only small parameter differences can separate effects that are too light from those that burn through the substrate. As with leather, be especially attentive of the possibility of fire, as well as the dust produced in repetitive applications.

## **Plastics**

Plastics for engraving are available in many different colors and thicknesses and with many different coatings and surfaces. The majority of available plastics can be well engraved and cut with the laser. Plastics with a microporous surface seem to give the best result, because less surface material needs to be removed. When engraving plastics, generally use low power and high speed settings. Marking and engraving with too much power or at too low a speed can concentrate too much energy at the point of contact, causing the plastic to melt. Among other problems, this may produce poor engraving quality, noxious fumes, and even fires. High resolution engraving can cause the same problem, so medium to low resolution designs should be preferred for most plastics.

### Average Cutting Settings for Acrylic

Description		Thickness of Acrylic						
		1/16 in.	1/8 in.	1/4 in.	1/2 in.	3/4 in.	1 in.	1 1/8 in.
130W	Power	17%	25%	30%	37%	42%	55%	58%
	Speed	30 mm/s	15 mm/s	7 mm/s	6 mm/s	5 mm/s	2 mm/s	1 mm/s

## Rubber

The various compositions and densities of rubber cause slightly varying engraving depth. Testing various settings on sample pieces of your specific rubber is highly recommended for best results. When engraving rubber, generally use a consistent high power setting and create your effects by varying the laser's speed. Microporous rubber materials require a significantly higher speed than standard rubber. Engraving any kind of rubber produces a considerable amount of dust and gas. Depending on the amount of work, breathing PPE and/or a full ventilation system may be required to address the problem.

## Stone

When engraving various kinds of stone, generally use moderate power and moderate to fast speed. As with ceramics and glass, be mindful of the dust created (especially for repetitive industrial applications) and take similar measures to ensure the safety of users and others in the work area.

## Textiles

When engraving textiles like cloth and fleece, generally use low power and fast speed. As with leather, be especially attentive to the possibility of fire and dust.

## Wood

As with rubber, there is a huge variety of woods and testing your specific material is essential to get the best results. In general, wood with consistent grain and coloring engravés more evenly. Knotted wood produces uneven effects, while resinous wood produces greater edge contrast. Some soft woods like balsa, cork, and pine engrave well (albeit with low contrast) at low or moderate power settings and high speed. Others like fir suffer from uneven fibers that usually produce a poor effect no matter what you do. Hard woods like cherry and oak engrave well at high power settings and low speed. Manufactured wood products can vary from brand to brand, mostly based on its glue composition and abundance. MDF works well but creates dark edges when cut.

In addition to the risk of fire with any wood product, extra care must be taken with the fumes from the glue used in plywood and other manufactured woods. Some are too dangerous to work with at all, while others require careful ventilation and the use of breathing PPE for repetitive industrial applications. Wood toxicity should also be examined, as the dust from some natural woods including oleander and yew can also cause nausea and cardiac problems in high enough amounts.

### Average Cutting Settings for Baltic Birch

Description		Thickness of Baltic Birch Plywood							
		1/16 in.	1/8 in.	1/4 in.	1/2 in.	3/4 in.	1 in.	1 1/8 in.	1 1/4 in.
130W	Power	18%	25%	27%	32%	37%	42%	47%	55%
	Speed	35 mm/s	16 mm/s	8 mm/s	7 mm/s	6 mm/s	5 mm/s	3 mm/s	2 mm/s

## 4.4 Control Console Instructions

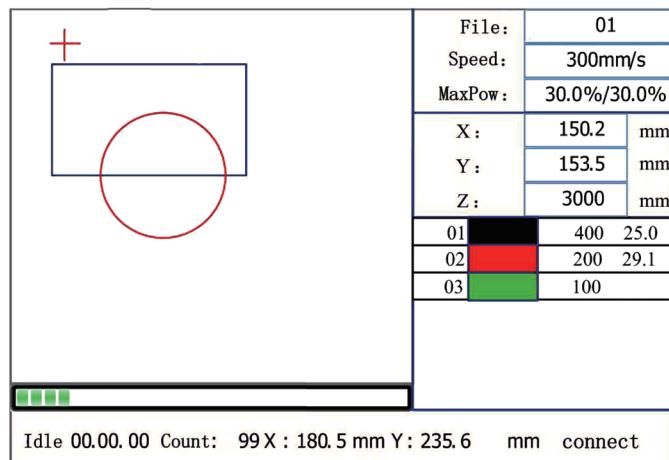
### 4.4.1 Overview

You can control your engraver directly from the built-in control panel, through a direct connection with your computer, or over the internet. For details on operating your engraving software, see its separate manual. The built-in control panel can operate the laser manually or engrave designs loaded onto flash drives and external hard drives connected to the USB port on the right side of the cabinet.



For manual operation, the arrow keys can be used to move the laser head along the X and Y-axis guide rails and the **PULSE** button can be used to fire the laser. The laser head can be set to tab over a set distance each time the arrow buttons are pressed by hitting **FN** and adjusting the parameters under “Manual Set+”. The laser can be set to fire for a fixed period by pressing **FN** and adjusting the parameters under “Laser Set+”. All of the buttons and menus should be labelled in English. If they are not, press **FN** and go to the top button in the right column to change the console's language settings.

To load a design from a FAT16 or FAT32 formatted flash disk or external hard drive, press **MENU**, select “File”, then “Udisk+” and then “Copy to Memory”. Select the design in the File menu and then select “Run”. Various parameters can be adjusted using the console's menus and submenus, including setting multiple origin points to engrave the design on your material four times in a single session.

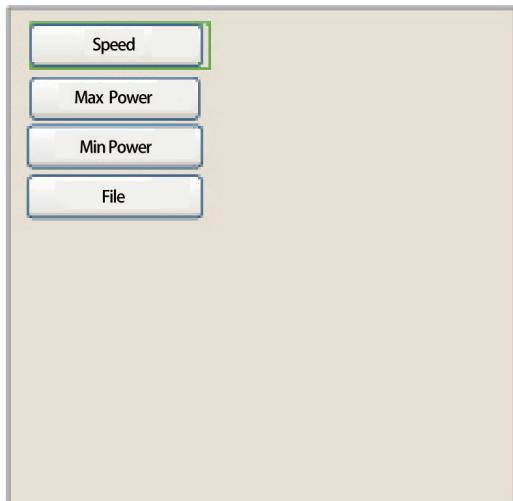


When running a design from the control console, this will be the main display. The design should appear in the top left corner and its name and the current speed and power settings on the top right. The position of the laser head relative to the workbed appears as the X (horizontal) and Y (vertical) coordinates. The Z coordinate shows the elevation of the workbed itself. The U coordinate can be configured to control rotary axes or an automatic feed if either is installed. Below them are the layers with notes about their separate speeds in mm/s and their maximum power as a % of your machine's rated power. The batch count on the lower left keeps track of the number of times the current design has been engraved in a single session. Like the button says, press **START/PAUSE** to start engraving your loaded pattern and to pause engraving when needed.

**!** If there is ever an emergency situation such as a fire, do not use the control panel to pause or stop the engraving. Hit the emergency stop button immediately.

#### **4.4.2 Menu Button**

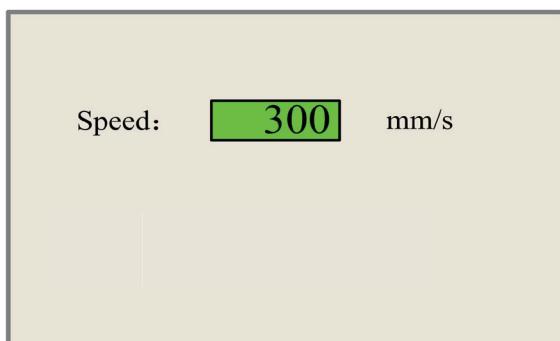
Press **MENU** on the main interface to enter the Menu interface:



Push the **▲** and **▼** keys to select items, and then press **ENTER** to enter the corresponding submenu.

#### **4.4.3 Setting the Laser Speed**

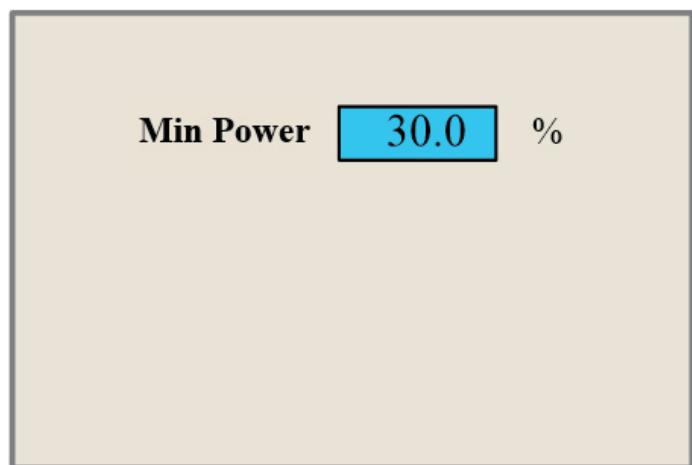
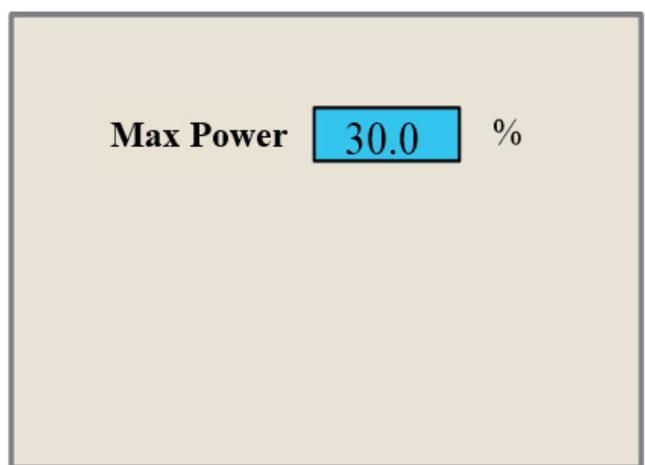
Select "Speed" on the Menu interface, and the following dialogue box will appear:



The cursor will appear when pushing the **◀** and **▶** keys. Move the cursor to the numeral area and push the **▲** and **▼** keys to change the value. Press **ENTER** to save the change. Press **ESC** to invalidate the change and return to the Menu interface.

#### **4.4.4 Setting the Laser Power**

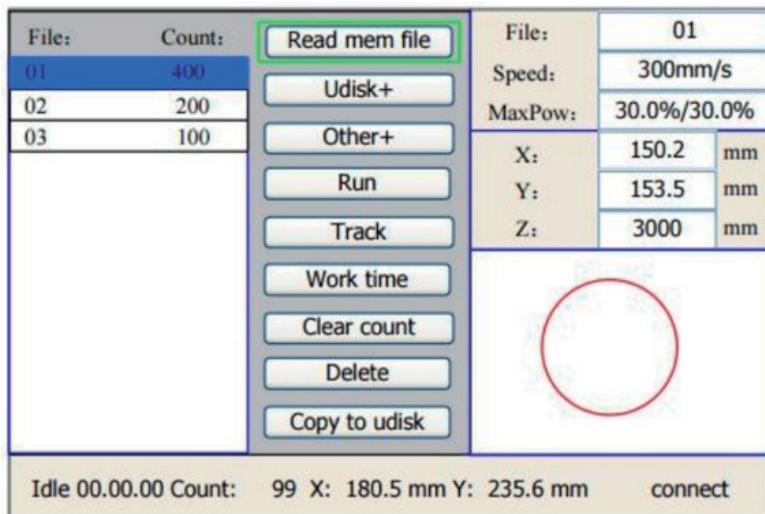
Select "Max Power" or "Min Power" on the Menu interface, and the following dialogue boxes will appear:



Push the **◀** and **▶** and **▲** and **▼** keys to change the parameters. See the "Speed" setting for reference.

## 4.4.5 File Commands

Select "File" on the Menu interface, and the following dialogue box will appear:



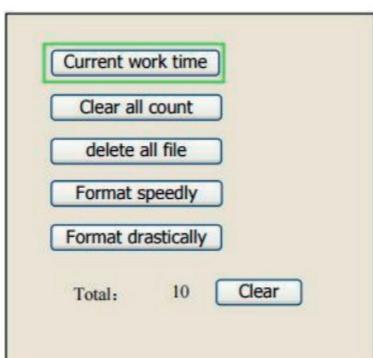
When entering the above interface, the system automatically reads the memory files. The file name and the work times will be listed, and the selected file will be previewed in the upper right corner. When there are several files, use the ▲ and ▼ keys to select one file, and its preview will be shown in the upper right corner of the interface. Press **ENTER** to preview the selected file on the main interface. Press **ESC** to close the preview.

Push the ◀ and ▶ keys, and the light blue cursor can be moved left and right to switch between the file column in the left and the item column in the middle. If the file is being previewed, the preview will be closed when switching to the item column. When the light blue cursor is on the item column, push the ▲ and ▼ keys to select the item and press **ENTER** to activate the item.

Press **ESC** to return to the main interface.

The item column includes:

- Read Mem File reads the memory file list
- U-Disk reads the file list of an inserted USB flash drive
- Other Displays other memory files operations
- Run runs the selected file equivalent to pressing Start/Pause.
- Track tracks the selected file
- Work Time forecasts the total running time of the selected file, accurate to 1 ms
- Clear Count clears the count of the selected file
- Delete deletes the selected file from the memory
- Copy to U-Disk copies the selected file to an inserted USB flash drive

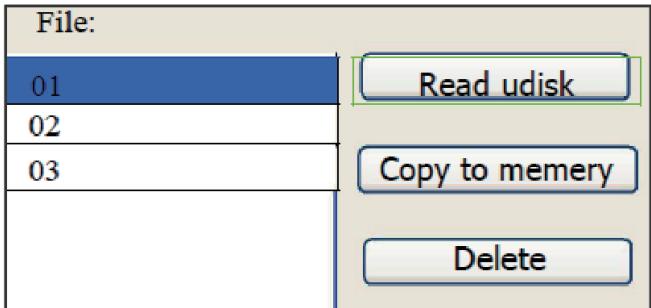


Select "Other" and press **ENTER**, and the following dialogue box will pop up:

- Current Work Time forecasts the running time of the current file
- Clear All Count clears the count of every file in the memory
- Delete All Files deletes all files from memory
- Format Speedily deleted all files from memory and returns to default settings.
- Format Drastically formats memory, after which all files will be deleted
- Total displays the total count of all the files

#### **4.4.6 Flash Drive Commands**

Select "U-disk" on the File interface and press **ENTER**, and the following dialogue box will appear:



The operation method is the same as that of files in memory. Press **ESC** to return to the File interface.

- Read U-disk reads the file list of an inserted USB flash drive
- Copy to memory copies the target file to memory.
- Delete deletes the selected file from the USB flash drive

The system supports file formats such as FAT16 and FAT32, but files can only be identified when placed under the root directory. File names with more than 8 characters will be automatically cut short. File names containing things other than English characters and numbers cannot be shown when copied to the mainboard. Files copied from the mainboard to the flash drive will be placed in its root directory.

#### **4.4.7 Adjusting Engraving Layers**

When the system is idle or the work is finished, press **ENTER** to enter the layer parameter section. Push the **▲** and **▼** keys to select the intended layer. Press **ENTER** to check the selected layer's parameters as shown below:

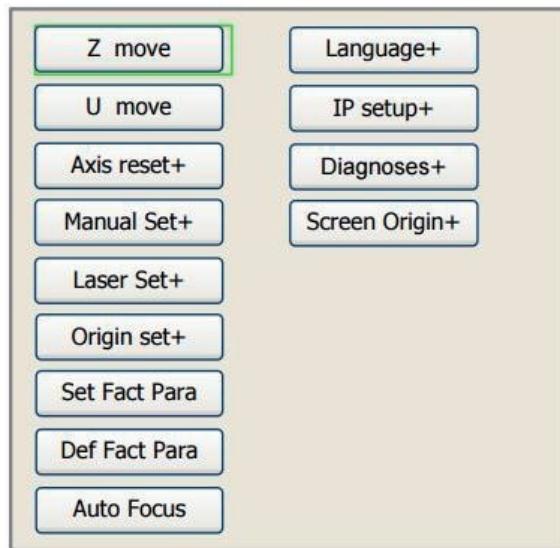
01		400	25.1
02		200	29.1
03		100	31.5

Layer0	<input type="text"/>
Speed	<input type="text"/> mm/s
Min Power	<input type="text"/> %
Max Power	<input type="text"/> %

The light blue cursor will be on "Layer" by default. Push the **◀** and **▶** keys to select the intended layer. Press **FN** to move the light blue block to the intended parameter. Press **ENTER** to save the parameter changes. Otherwise, changes will not be saved. The operation method is the same as that of the max/min power setting.

#### **4.4.8 Function Menu**

Press **FN** on the main interface to enter the following menu:



Push the **▲** and **▼** keys to move the light blue cursor to the intended entry, and press **ENTER** to enter the corresponding submenu.

#### **4.4.9 Adjusting the Z Axis**

When the light blue cursor is on "Z move", push the **◀** and **▶** keys to control the movement of the Z-axis.

#### **4.4.10 Setting an Interface Password**

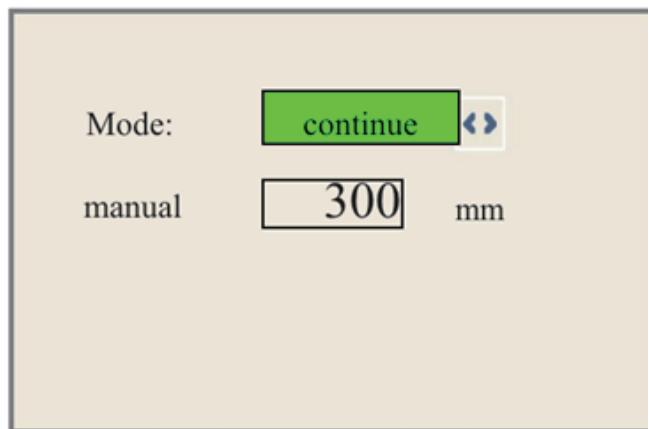
When the light blue cursor is on this item, press **ENTER**, and the following dialogue box will pop up:



Push the **▲** and **▼** keys to select items. When the light blue cursor is on the intended item, press **ENTER** to enter the corresponding interface. See §4.4.14 for details on the keyboard interface.

#### **4.4.11 Manual Movement of the Laser Head**

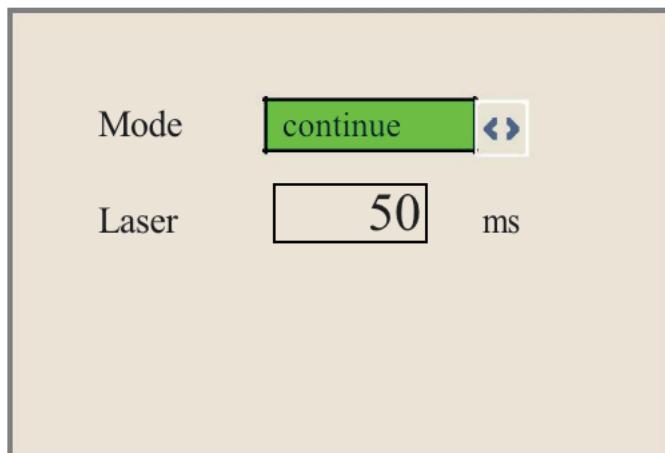
When the light blue cursor is on "Manual Set+", press **ENTER**, and the following dialogue box will pop up:



When the light blue cursor is on "Mode", push the **◀** and **▶** keys to choose between the two modes "Continue" and "Manual". Push **FN** to move the cursor. When the cursor is on the "Manual" item, push the **▲** and **▼** and **◀** and **▶** keys to change the parameters. When the "Continue" mode is selected, the "Manual" item will not be valid. In this case, press down the direction keys to move the corresponding axes, and release the keys to stop the moving. When it is in "Manual" mode, push the direction key and the corresponding axes will move a fixed length as set by the users with each push (unless the scope is overstepped).

#### **4.4.12 Manual Firing of the Laser**

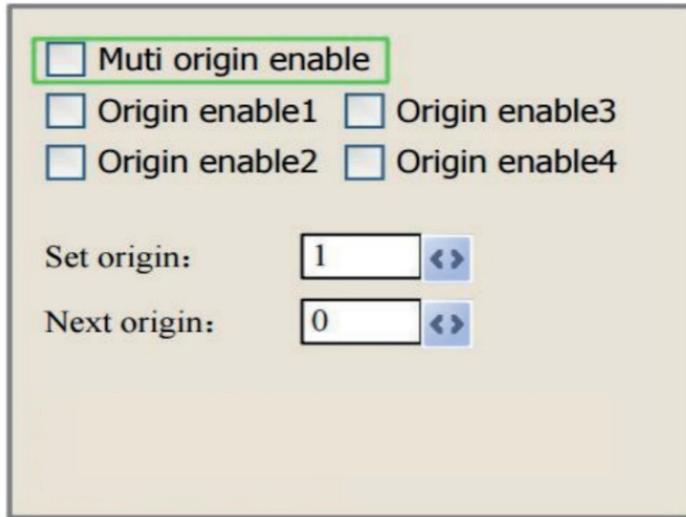
When the light blue cursor is on "Laser Set+", press **ENTER**, and the following dialogue box will pop up:



The operation method is the same as that of the manual set. When "Continue" mode is selected, press down **PULSE** to fire the enabled lasers, and release **PULSE** to finish firing. When "Manual" mode is selected, push **PULSE**, and the laser will fire for a fixed period of time as set by the users with each push.

#### 4.4.13 Setting Origin Points

When the light blue cursor is on "Origin Set+", press **ENTER**, and the following dialogue box will pop up:



Press **FN** to move the light blue cursor to an item and press **ENTER** to enable or disable the item. When enabled, the small box will be red and, when disabled, the small box will be gray. When the light blue cursor is on the "Set origin" item or the "Next origin" item, push the **◀** and **▶** keys to change the value. When changing the parameters of "Set origin", remember to press **ENTER** to validate the change. Parameters will be saved automatically when the interface is closed.

**Multiple Origins Enable:** "Yes" or "No" can be selected. If you select "No", the system will use single-origin logic. If you press Origin and set the origin, only this origin will be used. If you select "Yes", the system will use multiple-origin logic and Origin is disabled. In this case, the parameter of each origin must be set in the menu.

**Set Origin 1/2/3/4:** After multiple-origin logic is enabled, put the cursor on "Set as Origin 1/2/3/4". Press **ENTER** on the keyboard and the system will take the coordinates as the corresponding origin.

**Next Origin:** Users can choose from 0–4, which represent the origin to be used for the next figure. Origin 0 refers to the origin set by Origin under single-origin logic. 1–4 represent the origins under multiple-origin logic.

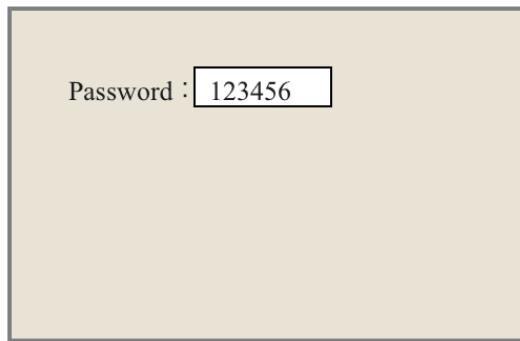
The next origin can be chosen from origin 1–4 so as to control the starting point of the next job provided that the origin is enabled. However, it cannot be changed to origin 0. The next origin will always be Origin 0 under single-origin logic.

**Origin Enable 1/2/3/4:** After multiple-origin logic is enabled, the four origins can also be individually disabled and enabled.

Once multiple-origin logic is selected, if the number of the next origin is 1 and four origins are enabled, when the memory file function is started (via the keyboard or PC) or the processing file is uploaded into the PC and this file selects "Take the Original Origin as the Origin", the work will use different origins each time it starts. The rotation order of origins is 1→2→3→4→1→2...If the processing file is uploaded to the PC and this file selects "Take the Current Origin as the Origin", the system will always use the current origin.

#### **4.4.14 Saving Current Parameters and Virtual Keyboard Use**

When the light blue cursor is on the "Set Fact Para" item, press **ENTER**, and the following dialogue box will pop up:



The password consists of six characters. Push the **▲** and **▼** and **◀** and **▶** keys to select each character, and press **ENTER** to confirm each selection. If the password is wrong, "password error" will pop up and you need to reenter the password. If the password is correct, the system will set all current parameters as factory parameters, and "factory parameters have been successfully set" will appear on the screen.

Before a machine leaves the factory, this function is used to store the preset parameters, which later can be restored by users at any time.

#### **4.4.15 Loading Saved Parameters**

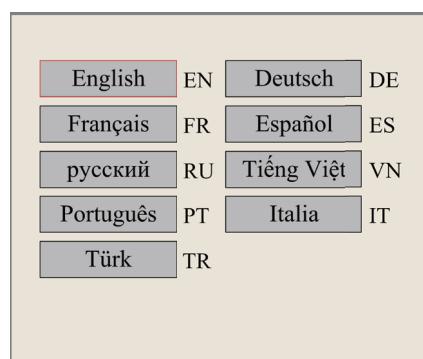
When "Def Fact Para" is selected, the system will replace all current parameters with the default factory parameters. The operation method is the same as setting the factory parameters.

#### **4.4.16 Autofocus**

When the light blue cursor stops on "Auto Focus", press **ENTER** to automatically focus the laser lens.

#### **4.4.17 Setting the Interface Language**

When the light blue cursor is on this item, press **ENTER**, and the following dialogue box will pop up:

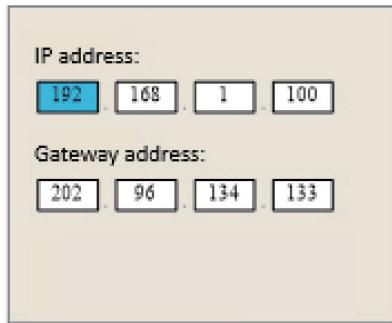


The operation method is the same as described above.

Press **ENTER** when one language is selected, and then return to the main interface.

#### **4.4.18 Setting the Machine's IP Address**

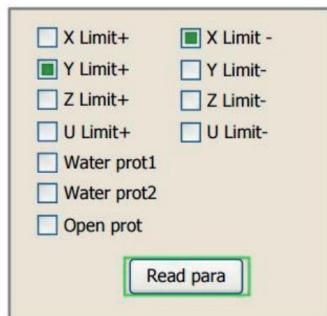
When the light blue cursor is on this item, press **ENTER**, and the following dialogue box will pop up:



Press FN to move the light blue cursor to the intended item, and push the **▲** and **▼** and **◀** and **▶** keys to change the parameters. Press **ENTER** to save the changes or **ESC** to discard changes and return to the previous menu.

#### **4.4.19 Diagnostic Tools**

When the light blue cursor is on this item, press **ENTER**, and the following dialogue box will pop up:



This interface contains input/output information of the system's hardware. Press the "Read Para" button to access hardware information. When the hardware signal is triggered, the small box to the left of the corresponding item will be displayed in green. Otherwise, it will be gray. Press **ESC** to return to the previous menu.

#### **4.4.20 Reflecting Images across an Axis**

When the light blue cursor is on this item, press **ENTER**, and the following dialogue box will pop up:



This interface shows the position of the origin. Different origin positions can generate different reflections of the graph over the X/Y axis. The operation method is the same as described above.

#### **4.4.21 Resetting Axes**

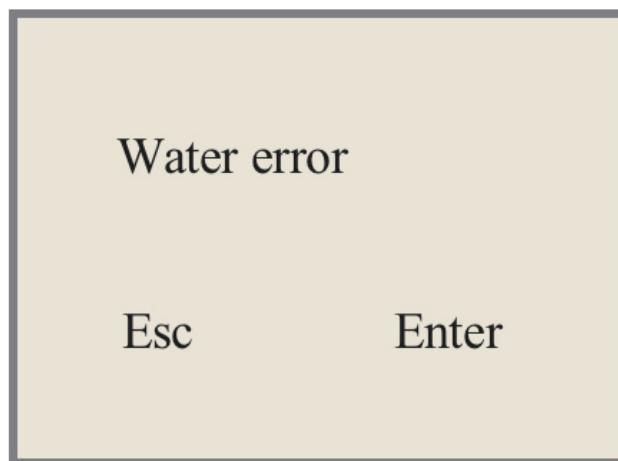
When the green block is on this item, press **ENTER**, and the following dialogue box will pop up:



Push the **▲** and **▼** keys to move the light blue block to the intended item. Press **ENTER** to start the resetting of the selected axis. The message "resetting is underway" will show on the screen. Upon resetting, the message will automatically disappear and the system will return to the main interface.

#### **4.4.22 Alarm Displays**

During the operation of the system or the running of the machine, some alarm information may pop up if there is a water protection error etc. For example, the water protection alarm may pop up as shown below:



Correct the problem displayed and then select either "Enter" or "Esc" to exit.

## 5. Maintenance

### 5.1 Maintenance Overview

The use of procedures other than those specified herein may result in hazardous laser radiation exposure.



Before any cleaning or maintenance work, always switch off the device and disconnect it from its power supply.

Always keep the system clean, as flammable debris in the working and exhaust areas constitutes a fire hazard.

**ONLY** allow trained and skilled professionals to modify or disassemble this device.

- Clean and cool water must be provided to the system at all times.
- The working table must be cleaned and the waste bin emptied on a daily basis.
- The 3rd mirror and the focus lens must be checked every day and cleaned if required.
- The other mirrors, exhaust system, and air intake filter must be checked every week and cleaned if required.
- The beam alignment should be checked weekly.
- The wiring should be checked every week for loose connections, especially the wiring for the laser tube power supply.
- The guide rails should be cleaned and lubricated at least twice a month.
- The air assist must be checked every month and cleaned if required.
- The whole laser machine including the other components such as the water cooling system must be checked every month and cleaned where required.

For video instructions on general maintenance, see our YouTube channel's guide "OMTech Training—Cleaning Your CO<sub>2</sub> Laser Engraver."

### 5.2 Water Cooling System



**NEVER** touch or adjust your engraver's water supply while the pump is still connected to power.

The laser tube requires cool and clean distilled water to avoid overheating. Tepid water at room temperature or a little below is ideal. The laser tube requires at least 2 gallons (7.5 L) of cool and clean distilled water or other laser-safe coolant to avoid overheating. If the temperature of the water ever approaches 100°F (38°C), discontinue work until it has cooled or find a way to reduce its temperature without interrupting the supply of water to the laser tube. The water should never be allowed to become too cold either, which could also cause the glass laser tube to shatter during use. During winter or if ice is used to cool hot water, ensure the temperature never falls below 50°F (10°C). More water should be added every few days to ensure evaporation does not cause the pump to become exposed during use.

### 5.3 Cleaning

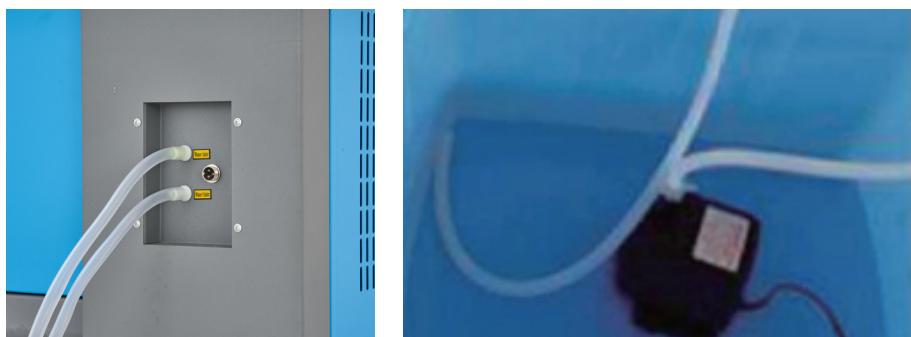
#### 5.3.1 Cleaning the Water System



**NEVER** touch or adjust your engraver's water supply while the pump is still connected to power.

The water tank should be shielded from ambient dust created during work. If the water ever becomes visibly dirty, discontinue work. The debris in the water will reduce its cooling efficiency, can heat up itself, and can damage the cooling pipes. Change the water, place the water outlet tube into a separate bucket, and run the cooling system until all contaminated water has been flushed from the engraver. Clean the water tank itself before refilling it with clean and cool distilled water, replacing the outlet tube, and continuing operation.

If the water remains visibly clean at all times, it is still recommended that you clean the water tank about once a month as a precaution, changing the water as you do so.



If you use an industrial water chiller instead of the provided pump, follow its separate instructions for maintenance but similarly ensure that the water used remains cool, clean, and pure.

### **5.3.2 Cleaning the Main Bay and Engraver**

Check at least once a day whether dust has accumulated in the main engraving bay. If so, it must be removed. The exact cleaning interval and requirements strongly depend on the material being processed and the operating time of the device. A clean machine guarantees optimal performance and reduces service costs, as well as reducing the risk of fire or injury.

Clean the viewing window with mild cleansers and a lens or cotton cloth. **DO NOT** use paper towels as they can scratch the acrylic and reduce the cover's ability to protect you from laser radiation. Clean the interior of the main bay thoroughly, removing any debris particles or deposits. Paper towels and window cleaner are recommended. When necessary, clean the cover of the laser tube after it has been allowed to cool completely. Allow any fluid used in any cleaning to dry completely before further use of the engraver.

### **5.3.3 Cleaning the Focus Lens**

The lens has a durable coating and won't be damaged by correct and careful cleaning. You should check the lens and the 3rd mirror daily and clean them if there is any debris or haze on their surface. Your laser will be less efficient and heat buildup on the oil or dust itself can damage the lens.

1. Move the engraving table to a distance approximately 4" (10 cm) under the lens holder.
2. Move the laser head into the center of the workbed and put a cloth under the lens holder so that the lens will not be damaged if it accidentally falls from its holder.
3. Unscrew the lens holder, rotating to the left.



4. Remove the pressurized air hose and laser guide connections.

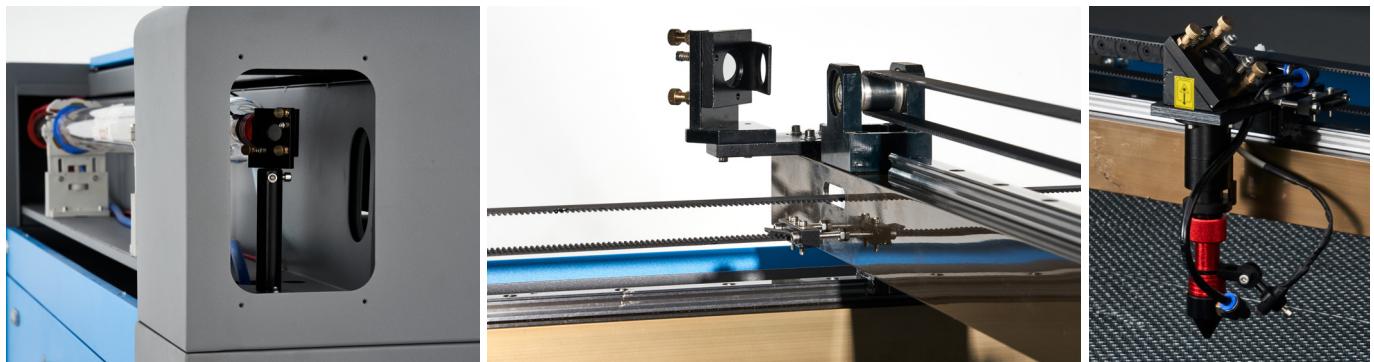


5. Once positioned over your clean lens-cleaning tissue, remove the lens from the lens holder by carefully turning the lens holder and letting the lens and its O-ring drop onto the cleaning cloth.
  6. Examine the O-ring and, if necessary, clean it with a cotton bud and a lens-cleaning tissue or cloth.
  7. Remove coarse dust as well as possible by blowing air onto the lens surface.
  8. Check the surface and, if necessary, clean the lens with the lens cleaning liquid and lens tissue or cloth.
  9. Hold the lens assembly by its edge with a lens-cleaning tissue and use a drop of lens-cleaning liquid. While holding the lens at an angle, flush both surfaces to wash away grime.
  10. Put the lens on a clean lens-cleaning tissue and put some lens-cleaning liquid on one side of the lens. Leave the liquid to take effect for approximately one minute and then gently wipe it away with lens-cleaning tissues soaked with lens-cleaning liquid. Dry this side of the lens with dry lens-cleaning tissues/cloth.
  11. Repeat the same cleaning process on the other side of the lens.
- ⚠️ NEVER** use a cleaning tissue twice. Dust accumulated in the cleaning tissue could scratch the lens surface.
12. Examine the lens. If it is still dirty, repeat the cleaning process above until the lens is clean. Do not touch the surface of the lens after cleaning.
  13. Carefully insert the lens into the lens holder, ensuring that its rounded convex side is facing upwards. Put the O-ring on top of the lens.
  14. Carefully reassemble the lens and laser head attachments in reverse order.



### 5.3.4 Cleaning the Mirrors

The mirrors should be similarly cleaned if there is any debris or haze on their surface to improve performance and avoid permanent damage. The 1st mirror is located in the back left of the machine beyond the far end of the Y axis. The end of the laser tube closest to this mirror is itself a semitransparent mirror that should be checked at the same time. The 2nd mirror is located on the Y axis at the left end of the X axis. The 3rd mirror is located on top of the laser head on the X axis. The most detritus accumulates on the 3rd mirror and it should be checked daily along with the focus lens. The laser tube and the 1st and 2nd mirrors can be checked daily if desired but are usually fine if they are only checked once a week.



The semitransparent mirror at the end of the laser tube should only be cleaned when the engraver is fully disconnected from power and the tube is fully cooled. Clean all four mirrors with lens-cleaning tissue or with cotton wetted with lens-cleaning liquid or isopropyl alcohol. The 3 positioning mirrors can be cleaned in place or removed for cleaning by turning them counterclockwise. Take care not to touch the surface of any mirror directly. Clean with gentle circular motions and avoid pressing hard enough to grind any debris or cause scratching. If any mirrors are removed for cleaning, reinstall them by turning them into place clockwise while again being careful to avoid any scratching.

## 5.4 Laser Path Alignment

Having a proper beam alignment is important for the overall efficiency of the machine and quality of its work. This machine went through a complete beam alignment before shipping. When the engraver first arrives and about once a week during normal operation, however, it is recommended that users confirm that alignment is still at acceptable levels and that the mirrors and focus lens have not shifted due to the movement of the machine.

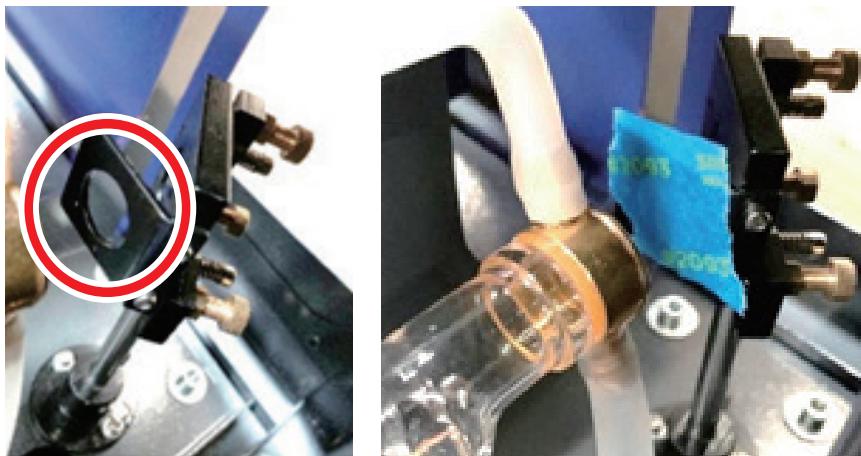


You will need to place a piece of tape at each stage of the laser path, marking it to confirm that that stage remains correctly aligned. When it is not, you will use the laser tube's brackets or the screws on the back of the misaligned mirror to correct the problem. Once the provided tape runs out, we recommend masking tape as it is easy to manage and use.

- ⚠ Performing a beam alignment can expose the operator to small amounts of radiation if performed carelessly.  
Follow these procedures correctly and always take caution when performing a beam alignment.
- ⚠ Perform a beam alignment at low power levels: 15% or less. Any higher percentage will cause the laser to ignite the testing tape instead of marking it. Be sure that you set the Max. Power (not Min.) to 15%.

### 5.4.1 Red Dot Locator Alignment

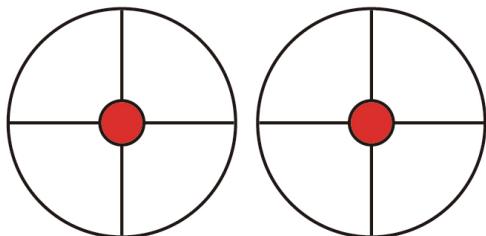
To test the alignment of the laser tube with the 1st mirror, cut out a piece of tape and place it on the mirror's frame.



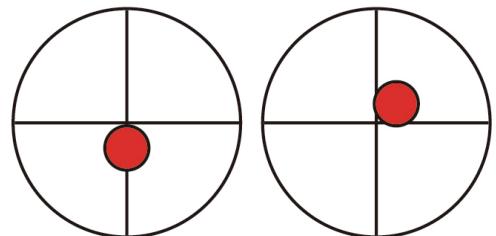
**DO NOT** place the tape directly onto the mirror. Turn on the machine and set the power level to 15% or lower.

Press **PULSE** to manually fire the laser. You should be able to see a small mark on the tape. If it is not noticeable, press **PULSE** again.

 Pressing **PULSE** activates the laser. Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Take care not to leave any part of your body in the laser path while pressing the **PULSE** button.

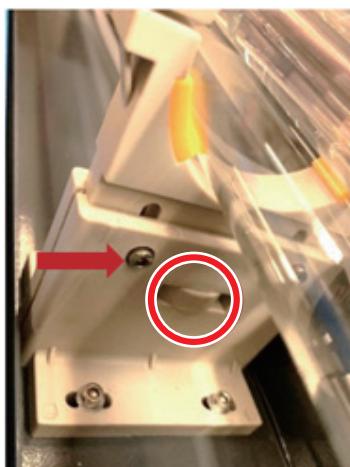
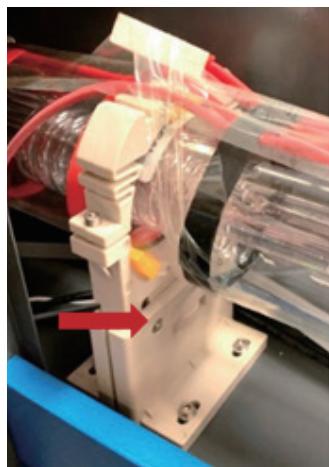


These marks are OK.



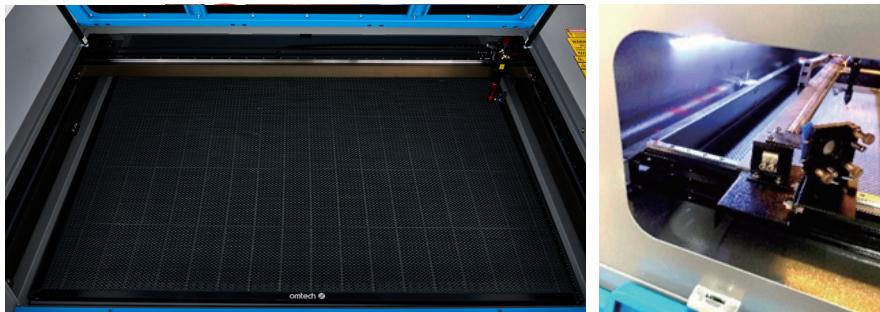
These marks require adjustment.

The laser mark should be near the center of the hole. If the laser is not centered on the 1st mirror, cut the power to your laser and carefully adjust the laser tube in its brackets. This may require loosening the screws on its stand and adjusting its brace wheel. Be careful not to overloosen the screws and not to overtighten them. Only adjust one stand at a time.

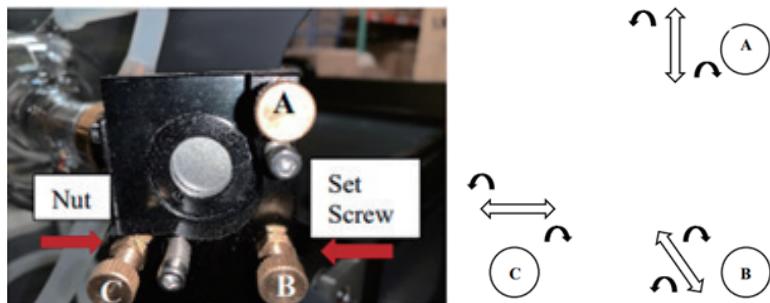


#### **5.4.2 1st Mirror Alignment**

After ensuring the laser is well aligned between the laser tube and 1st mirror, check the alignment between the 1st and 2nd mirrors. First, use the direction arrows on the control panel to send the 2nd mirror to the back of the bed along the Y axis.



Once set, place a piece of tape on the 2nd mirror's frame. **DO NOT** place the tape directly onto the mirror. Repeat the steps from §5.4.1. If the laser is not centered on the 2nd mirror, you will need to adjust the 1st mirror's set bolts accordingly.



To adjust the mirror, loosen the nut on the screw and then slightly turn the screw either clockwise or counterclockwise. Each screw adjusts a different position or angle. Keep track of which screw you are adjusting and the direction of adjustment. Do not turn the screw more than  $\frac{1}{4}$  turn at a time and, especially at first, test the position of the laser after each adjustment so that you learn the effect of each change. Test until the beam is well aligned and then retighten the nuts on the screws once all adjustments are completed.

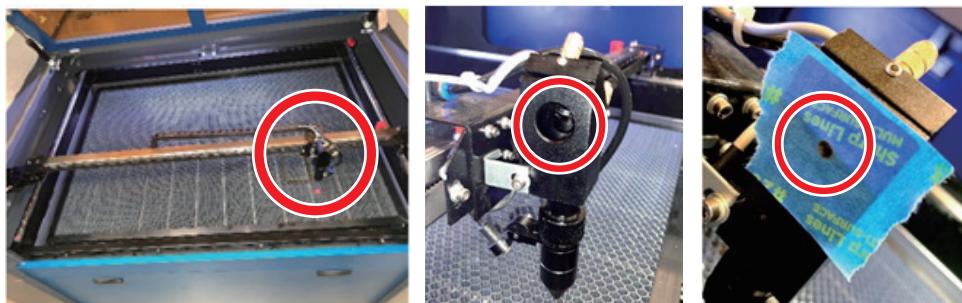
Next, use the direction arrows on the control panel to send the 2nd mirror to the front of the bed along the Y axis.



Once set, place another piece of tape on the 2nd mirror's frame. **DO NOT** place the tape directly onto the mirror. Repeat the steps from §5.4.1 and, if necessary, adjust the set bolts on the 1st mirror. Test again until the beam is well aligned and retighten the nuts on the set screws.

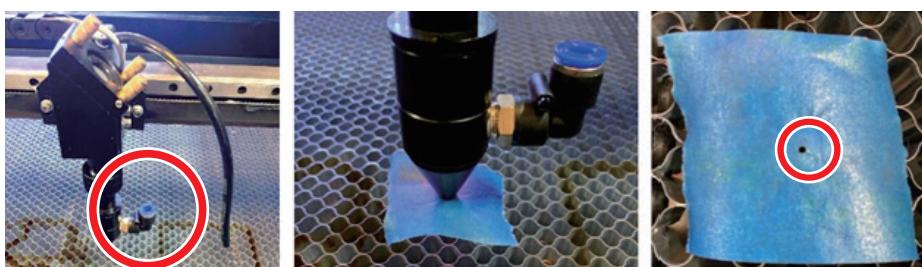
### **5.4.3 2nd Mirror Alignment**

After ensuring the laser is well aligned between the 1st and 2nd mirrors, check the alignment between the 2nd and 3rd mirrors. Repeat the steps and adjustments above, taking care to use the tape on the mirror's frame and not its surface.



### **5.4.4 3rd Mirror Alignment**

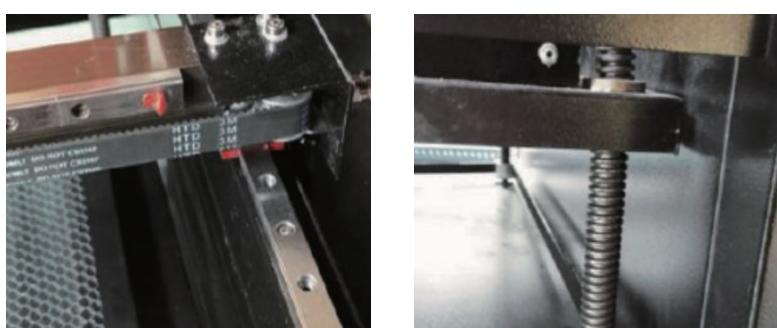
After ensuring the laser is well aligned between the 2nd and 3rd mirrors, check the alignment between the 3rd mirror and the workbed. First, unplug the air assist hose from the laser head. Then, place a piece of tape across the bottom of the laser head and press it onto the nozzle with some force. This will leave a ring mark that can help you check the accuracy. Repeat the steps from §5.4.1. If the laser is not centered through the laser head, adjust the 3rd mirror's set screws accordingly as in §5.4.2. Test again until the beam is well aligned and retighten the nuts on the set screws.



When the laser is well centered along the entire path from the tube to the workbed, your laser mirrors are all correctly calibrated and (assuming they are clean) performing at optimum efficiency.

## **5.5 Lubrication Instructions**

For best results, clean and lubricate the engraver's guide rails every two weeks. Turn off the laser engraver. Gently move the laser head out of the way. Wipe away all dust and debris along the X and Y axis rails with a dry cotton cloth until they are shiny and clean. Do the same to the Z axis screws. Lubricate both the rails and screws with white lithium grease. Gently move the laser head and X axis to distribute the lubricant evenly along both rails and raise and lower the bed to distribute the lubricant evenly along the screws.



## 5.6 Parts Replacement

The engraver should not be modified or disassembled by anyone except trained and skilled professionals, but some consumable parts may require replacement after prolonged use. Be sure only to use identical or compatible replacement parts with this engraver. Contact your vendor or our technicians if you have any questions about fitment. Using incompatible components is highly dangerous and waives all the manufacturer's liability for any damage or injury caused.

 **ALWAYS** completely disconnect the engraver from its power supply before replacing any parts.

Take special care when replacing the laser tube or its power supply, as both have extremely high voltage connections. If you replace the power supply with an identical model, you will be able to use the same screw terminal blocks as a unit. If you change to a different laser power supply, refer to the following diagram:



**FG:** Ground Wire for the Mains and Case

**AC<sub>1</sub>:** Neutral Wire to the Main Power

**AC<sub>2</sub>:** Live Input from the Main Power

**H:** Connection for Active-High Devices

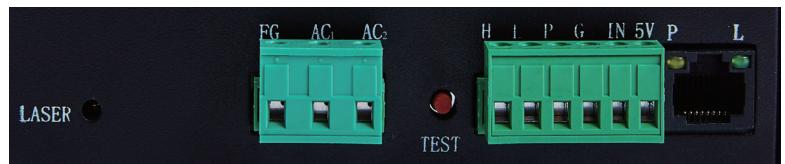
**L:** Connection for Active-Low Devices (like this machine)

**P:** Line to the Trigger, Water, & Other Systems (like the door switch)

**G:** Ground Wire for the Control System, PWM Level Shifters, Potentiometers, &c.

**IN:** Input Power for PWM Level Shifters or Potentiometers

**5V:** 5V Connection for Digital Signals



## 5.7 Disposal



Electrical products should not be disposed of with household products. In the EU and UK, according to the European Directive 2012/19/EU for the disposal of electrical and electronic equipment and its implementation in national laws, used electrical products must be collected separately and disposed of at the collection points provided for this purpose. Locations in Australia, Canada, and the United States may have similar regulations. Contact your local authorities or dealer for disposal and recycling advice.

## Contact Us

Thank you for choosing our laser equipment for your home or shop! For a .pdf copy of the latest version of this manual, use the appropriate app on your smartphone or other device to scan the QR code to the right.

Come join the OMTech community at our official laser group on Facebook or visit the company forums at [omtechlaser.com!](http://omtechlaser.com) Check our YouTube channel for helpful hints and instructional videos. If you encounter any problem regarding your engraver, do not hesitate to contact customer service with your order number at [help@cs-supportpro.com](mailto:help@cs-supportpro.com) or [techsupport@omtechlaser.com](mailto:techsupport@omtechlaser.com). Our teams will respond within 24 hours to make things right. You can also reach us Monday to Friday at (949) 539-0458 between 8 am and 4:30 pm PST.



Thank you and we hope you will choose us again for all your laser needs!

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