V20241226

omtech

USB 3501 | 50W | CO_2 Cabinet Laser Engraver

User Manual

Read Carefully Before Use
Keep for Future Reference

BEAMING WITH POSSIBILITIES!

Thank you for choosing our laser equipment.

Your CO2 laser engraving machine is intended for personal and professional use. When used under these instructions, it falls under the category of a **CLASS 1** laser product. But it includes a **CLASS 2** laser system and some components remain **EXTREMELY** dangerous under improper and/or non-intended use. 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 comments, suggestions, or questions after reading these manuals, feel free to contact us, and we will address your concerns as soon as possible. Your feedback is invaluable to us in our ongoing efforts to enhance the user experience!

Welcome to the OMTech Community!

For helpful hints and instructional videos, visit our **Help Center** or join our official laser group! If you encounter any issues with your engraver, please feel free to contact us. Our support team will respond **ASAP** to resolve your concerns.

Help Center

help.omtechlaser.com/hc/en-us

First Time Setup | Safety | Maintenance | Troubleshooting | FAQ | Hot Tips

Explore on your smart device

@omtechlaser

Official Website: omtechlaser.com

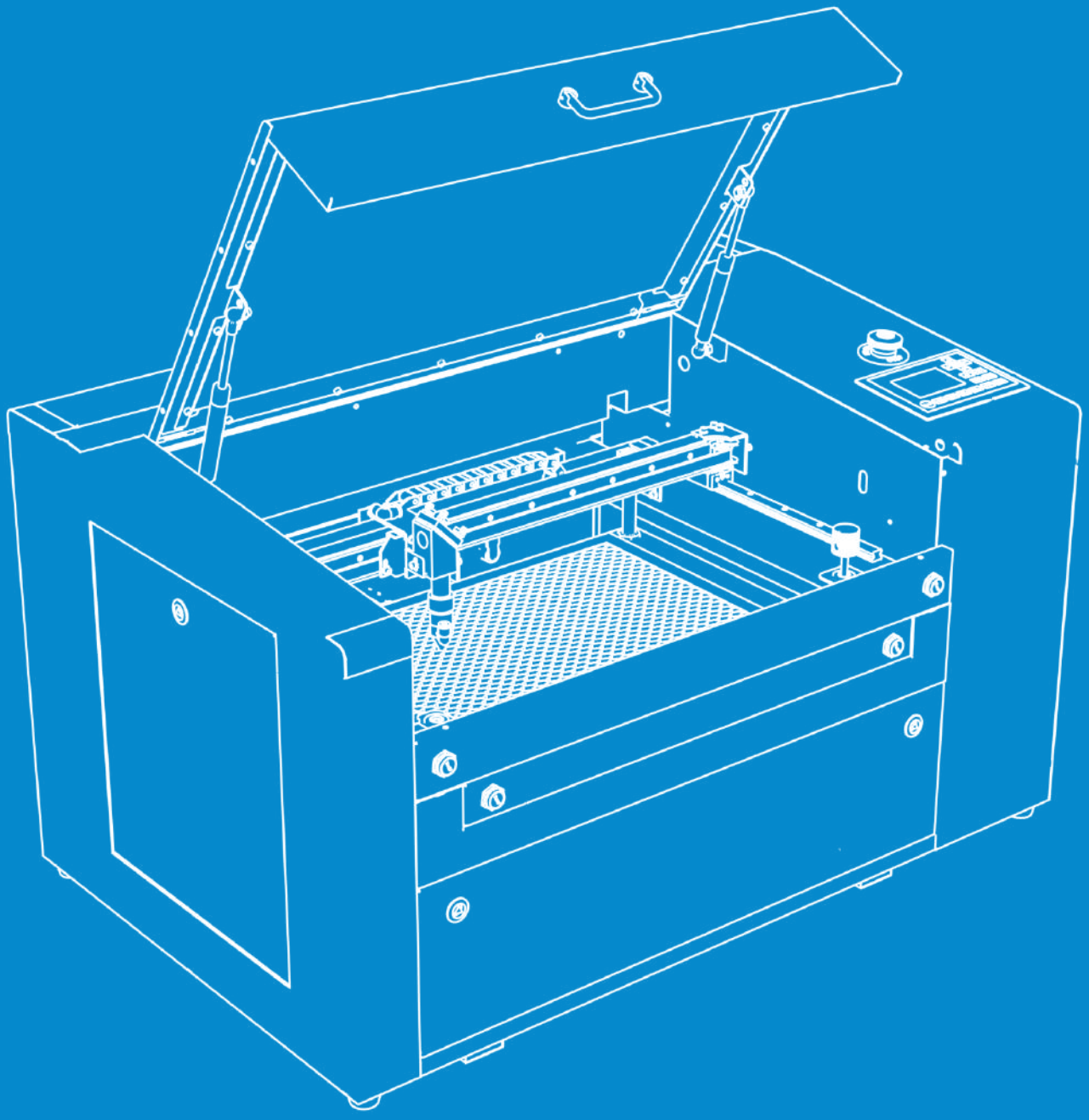
Technical Support: support@omtechlaser.com

Support Tel: +1 (949) 438-4949, Monday – Friday from 9:00 am – 5:00 pm (PT)

Address: Rygel Advanced Machines, 1150 N Red Gum St Ste F, Anaheim, California 92806, USA.

Content

Content



1 Safety Information

1.1 Disclaimer

Read this disclaimer completely and carefully before proceeding with the rest of the manual content.

1. **As-Is**

   This OMTech product is sold 'as is' and without any express or implied warranties, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

2. **Product Modifications**

   Any modifications or alterations to OMTech products void any warranties and may result in damage or injury. OMTech shall not be liable for any damages resulting from such modifications or alterations.

3. **Compliance with Laws**

   Customers shall be liable for ensuring that the use of OMTech products complies with all applicable laws and regulations in their respective jurisdictions. OMTech assumes no responsibility for any violations of laws or regulations resulting from the use of OMTech products.

4. **Correct Use**

   Always use OMTech products only as directed in the accompanying manuals. Failure to follow instructions may result in injury or damage.

   Always ensure the assembly, installation, operation, maintenance, or repair of OMTech products is carried out by a competent person.

   Always make maintenance regularly throughout OMTech products' lifecycles; you have the liability to keep the products operating as intended.

   Always wear appropriate protective gear.

5. **Third-Party Products**

   OMTech shall not be liable for any damages or losses resulting from the use of third-party products in conjunction with OMTech products. Customers shall refer to the third-party's guidelines or/and warranties (if any) for any third-party products used.

6. **Limitation of Liability**

   OMTech shall not be liable for any direct, indirect, punitive, incidental, special, or consequential damages to property or life, whatsoever arising out of or connected with the use or misuse of OMTech products. In no event shall OMTech's liability exceed the value of the products sold.

This disclaimer states the entire obligation of OMTech with respect to OMTech products. If any part of this disclaimer is determined to be void, invalid, unenforceable, or illegal, including but not limited to the warranty disclaimers, liability disclaimers, and liability limitations set forth above, the invalid or unenforceable provision will be deemed superseded by a valid and enforceable provision that most closely matches the intent of the original provision and the remainder of the agreement shall remain in full force and effect.

1.2 Designated Use

This laser engraver is intended for engraving signs and logos on consumer products or applicable substrates. Its 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 non-designated purposes or materials is not permitted.

1.3 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 about the laser beam.

These items address similarly serious concerns about electrical components.

These items address similarly serious concerns about fire hazards.

These items address pinching and crushing hazards.

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

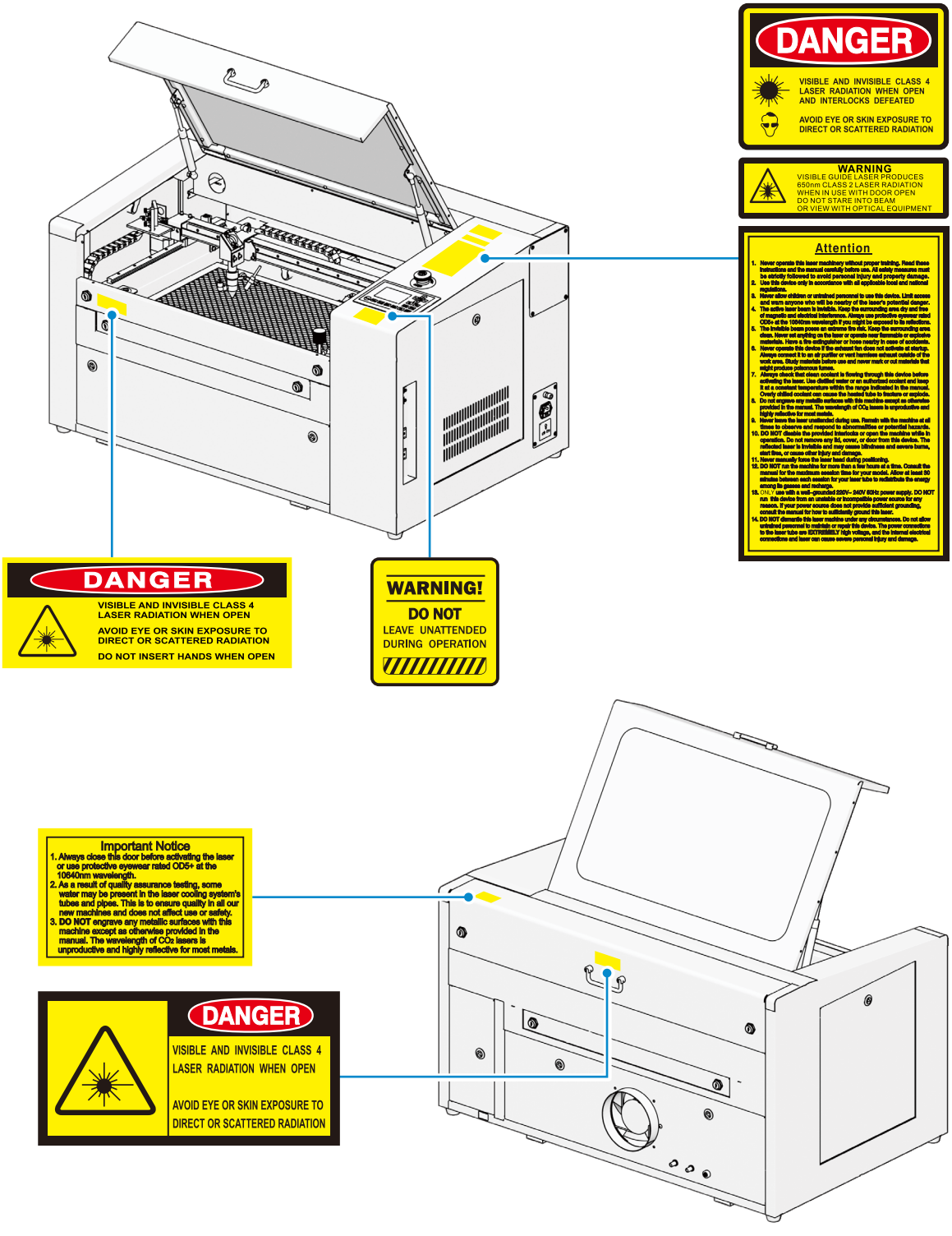
This product is sold in conformity with applicable EU regulations.

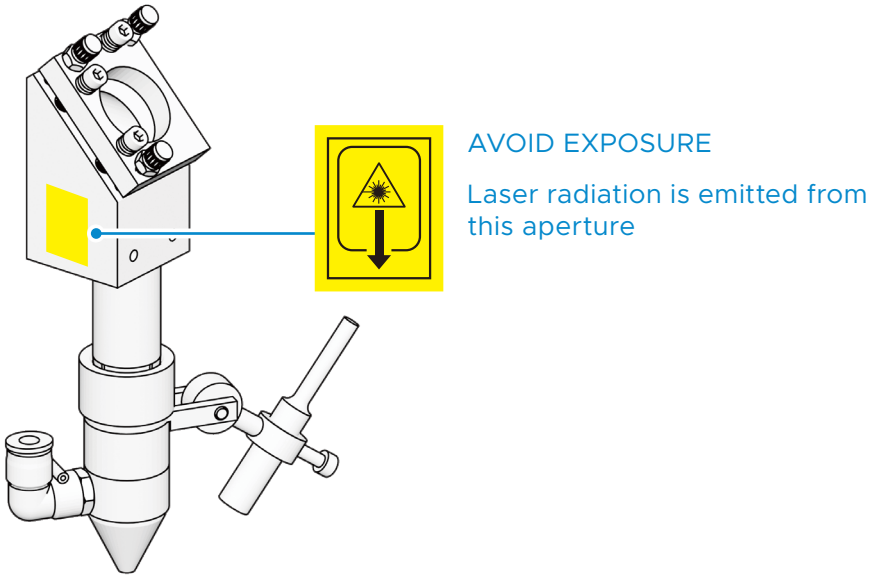
This product contains electrical components that should not be disposed of with regular garbage.

1 Safety Information

1.4 General Safety Instructions

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





For specific details of the nameplate, see the nameplate attached to the machine. If any of these labels is missing, illegible, or becomes damaged, it must be replaced.

- **ALWAYS** follow federal, state, and local laws, codes, and regulations concerning the use of laser marking machinery.
- **ALWAYS** use this machine in accordance with this manual and the manual for the engraving software included with it.

> Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

- **ALL** personnel involved in the installation, operation, and maintenance of this machine **MUST** read and understand this manual and the separate engraving software manual, particularly the 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.

  Ensure that this manual and the separate engraving software manual are both included with this machine if it is ever given or sold to a third party.
- **ALL** personnel involved in the installation, operation, and maintenance of this machine **MUST** be familiar with the field of use, the dangers of the machine, and the characteristics of engraving materials, including its reflectivity, conductivity, potential for creating harmful or combustible fumes and so on.
- **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 separate engraving software manual to install, operate, maintain, or repair this machine.

1 Safety Information

- Any untrained personnel who might be near the machine while it is in operation **MUST** be informed that it is dangerous and be fully instructed on how to avoid injury during its use.
- **ONLY** use this product for its intended purpose, engraving signs and logos on consumer products or applicable substrates. Use of this machine for non-designated purposes or materials is not permitted.
- Limit access to the area where the engraver is in use.
- **ALWAYS** use special protective eyewear when the laser is in use. The active laser is invisible to the human eye and could cause potentially permanent injury.

- **ONLY** touch the components of this product with **ONE HAND** at a time during use to reduce the risk of electric shock.
- It is recommended to use 10%–75% of the rated power to enjoy optimal performance and longevity for most applications.

  Constantly running your laser above 80% of its rated power can significantly **SHORTEN** the service life of this product.

- **DO NOT** operate this machine continuously for more than 3½ hours. Stop for at least 30 minutes between uses.
- **DO NOT** leave this machine unattended during operation.

  Observe the machine throughout the operation. 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.

- **NEVER** use this machine while any cover is open to avoid potentially permanent injury. The active laser is invisible to the human eye.
- **NEVER** operate the engraver without any of the water cooling system and exhaust system operating properly. The water cooling system and exhaust system are both essential to the safe use of this device. 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.
- Ensure the machine is **FULLY** turned off in the correct order after each 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 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 your extinguisher too close to the flame, as its high pressure can produce blowback.

1.5 Laser Safety Instructions

When used as instructed, this machine is a **CLASS 1** laser product safe for users and bystanders. It complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

However, it includes a **CLASS 2** laser system and some components remain **EXTREMELY** dangerous. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure, which 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, please be aware of the following:

- **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.

- **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 under the laser lens during operation. Take measures to protect yourself from potentially reflected laser beams including the use of screens or personal protective equipment (PPE) such as protective eyewear.
- 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+.

- **NEVER** attempt to view the laser directly without protective eyewear. **ALWAYS** wear safety goggles or glasses designed to filter the specific wavelength of your engraver's laser with an optical density (OD) of 5+. As even seemingly matte materials can produce harmful reflected beams, care should be taken to keep anyone without protective eyewear from observing the machine during operation.

  DO NOT stare or allow others to stare continuously at the laser beam during the operation **EVEN WHEN** the cover is closed and/or you are wearing protective eyewear.

  Exercise caution with the red dot positioning light as well, as its direct beam is a **CLASS 2** laser in its own right.

1 Safety Information

- **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.
- **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 confi rm that water is fl owing 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°F–70°F (15°C–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.
- **ONLY** use this machine as described in the **Material Safety** section of this manual. The laser settings and engraving process must be properly adjusted for specific materials.
- **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.
- **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.
- Keep the area free of airborne pollutants, as these might pose a similar risk of reflection, combustion, and so on.
- **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.

1.6 Electrical Safety Instructions

- **ONLY** use this machine with a compatible and stable power supply with less than 5% fluctuation in its voltage.
- **DO NOT** connect other machines 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 protector rated over 2000J.
- **ONLY** turn on the power to this machine 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 back of the control cabinet. Do not use with an ungrounded 3-to-2 prong adapter. The machine's grounding should be checked regularly for any damage to the line or loose connections.

- **ONLY** touch the components of this product with **ONE HAND** at a time during use. The laser is powered by an extremely high voltage connection and placing two hands on the machine at one time during operation has the potential to create a closed circuit with the human body, resulting in electrical shock.
- The area around this laser marking machine should be kept dry, well-ventilated, and environmentally controlled to keep the ambient temperature between 40°F–95°F (5°C– 35°C). For best results, keep the temperature at 75°F (25°C) or below. The ambient humidity should not exceed 70%.
- Adjustment, maintenance, and repair of the electrical components of this machine 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 machine when it is turned off, disconnected from its power supply, and fully cooled.
- **DO NOT** handle the water pump (not included) 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.

1.7 Material Safety Instructions

- Users of this marking machine are responsible for ensuring that every person present during operation has sufficient Personal Protective Equipment (PPE) to avoid any injury from emissions or byproducts of the materials being processed. In addition to the protective laser eyewear discussed above, this may require masks or respirators, gloves, and other protective outer clothing.
- Users must exercise special caution when working with conductive materials as the buildup of their dust and ambient particles may damage electrical components, cause short circuits, or produce other effects including reflected laser radiation.
- Users of this marking machine are responsible for confirming that materials to be processed can withstand the heat of a **CLASS 2** laser and will not produce any emissions or byproducts either harmful to people nearby or in violation of any local or national laws or regulations.
- **DO NOT** ever under any circumstances use this laser engraver if the exhaust system is not working properly. Always ensure that the exhaust fan 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 fan or vent pipe malfunctions. Periodically check the air assist intake filter to ensure it stays free of any dust or debris.

1 Safety Information

This machine **CAN** be safely used with the following materials:

CAN be used
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 **Others** • 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.

For the recommended parameters for the most commonly engraved materials, you can check, see §5.6 Instructions for Specific Materials on Page 50 for reference.

This machine **CANNOT** be used with **THE FOLLOWING MATERIALS OR WITH ANY MATERIALS WHICH INCLUDE THEM**:

CAN NOT be used

- 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). Alternatively, contact our support department for further guidance.

Pay especial attention to information about safety, toxicity, corrosiveness, reflectivity, and reaction(s) to high heat. Never operate the laser on any (such as PVC, teflon, and other halogen- containing substances) that can produce corrosive, hazardous, or even deadly fumes.

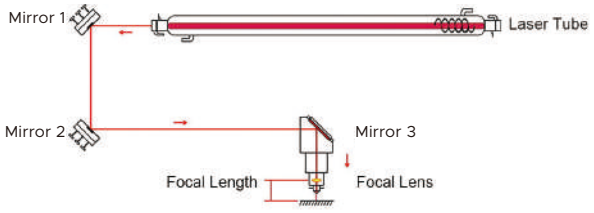
2 Introduction

2.1 General Information

Your laser engraver works by emitting a powerful laser beam from a glass tube filled with excited carbon dioxide (CO_2), catalyzing nitrogen (N_2), and insulating helium (He), reflecting that beam off three mirrors and through a focus lens, and using this focused light to cut and 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.

Laser Path



With low-intensity use, the provided laser tube has an average lifespan around 2,000 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.

2.2 Technical Specifications

Model		USB350I	
Input Power		AC 110 V–120 V, 60 Hz	
Power Consumption		600 W	
Rated Power		50 W	
Expected Service Life at <40% / 40–70% / >70% Power		1000/1500/2000 (hr.)	
Laser Wavelength		10640 nm	
Laser Tube	Diameter	1.97 in.	50 mm
	Length	34.6 in.	880 mm
Mirror	Diameter	0.98 in.	25 mm
	Thickness	0.12 in.	3 mm
Focus Lens	Diameter	0.71 in.	18 mm
	Thickness	0.08 in.	2 mm
	Focal Length	2 in.	50.8 mm
Processing Area		19.7×11.8 (in.)	500×300 (mm)
Front/Back Pass-Through Area (L×H)		24.4×2 (in.)	620×50 (mm)
Aluminum Blades		13	
Honeycomb Laser Bed		1	
Max. Processing Speed		23.6 ips	600 mm/s
Max. Acceleration	X-Axis	315 ips2	8000 mm/s2
	Y-Axis	78.8 ips2	2000 mm/s2
Req. Operating Environment	Humidity Range	70%	
	Temp. Range	40°F–95°F	5°C–35°C
Provided Operating Software		RDWorks	
Compatible Operating Software		CorelLaser, LightBurn	
Supported Image Formats		.ai, .bmp, .dxf, .gif, .hpgl, .jpeg, .pdf, .plt, .png, .rd, .svg, .tiff , .tga	
Graphic Operating Modes		Raster, Vector, Combined	
Certification		CE, FDA	
Dimensions (L×W×H)		40.2×25.6×25.6 (in.)	102×65×65 (cm)
Net Weight		165 lb.	75 kg

2 Introduction

2.3 Package List

A

B

C

D

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O

P

Q

R

S

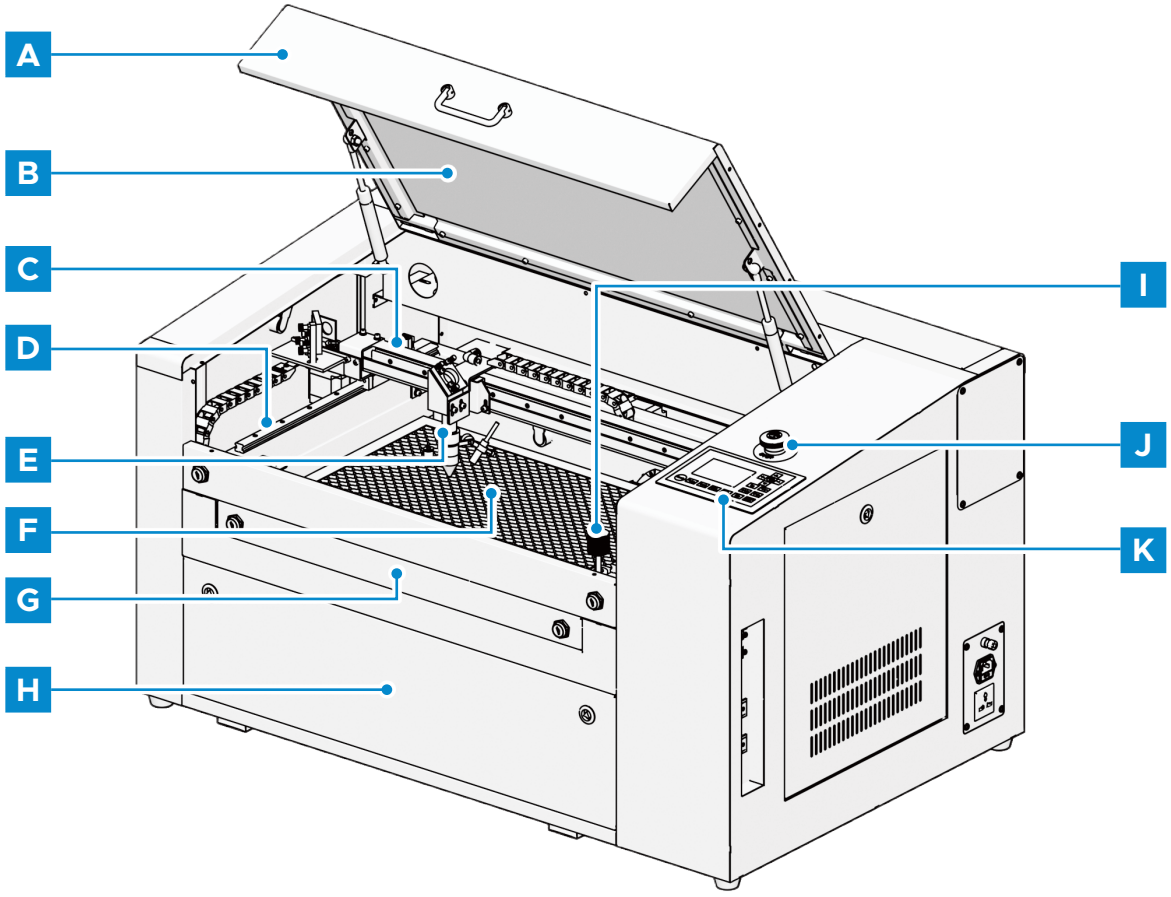
No.	Item	Qty.
A	Power Cord	1
B	USB Flash Drive (Engraving Software Included)	1
C	USB Cable	1
D	Ethernet Cable	1
E	Double-sided Tape	1
F	Set of Hex Wrenches	1
G	User Manual	1
H	Silicone Sealant	1
I	Ceramic Testing Resistor	1
J	Exhaust Pipe (Ø150 mm and 1.5 m Long)	1
K	Pipe Clamp (Ø150 mm)	1
L	Set of Water Pump	1
M	Bundle of Wires	1
N	Water Hoses (Ø12 mm)	2
O	Triangle Keys	2
P	Pass-Through Door Access Keys	2
Q	Focusing Rulers	2
R	Water Hose Clamps (Ø12 mm)	2
S	Bag	1

2 Introduction

2.4 Components

2.4.1 Main Parts

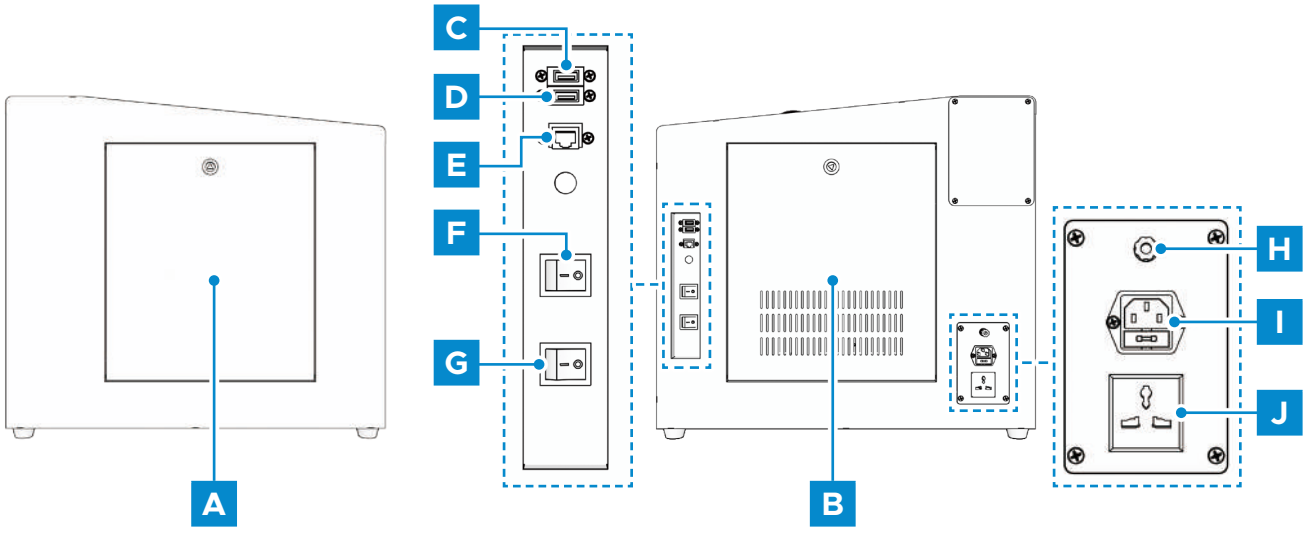
Front



A	**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**	Protects 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	**X-Axis Rail**	Holds the 2nd mirror, supports the movement of the laser head left and right across the workbed.
D	**Y-Axis Rail**	Supports the movement of the X-axis rail up and down across the workbed.
E	**Laser Head**	Holds the 3rd mirror, the focus lens, and the air assist outlet.
F	**Workbed**	Can be adjusted in height to fit thinner and thicker materials, as well as adjusted between the aluminum and honeycomb workbeds.
G	**Pass-Through Door**	Opens 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, and avoid the heavy material falling down to your feet when taking it out.
H	**Front Access Door**	Provides access to the area below the workbed for easy cleanup. The power of this machine will be automatically cut off for safety when opening this door. This is also where the accessories are located when the engraver first arrives.
I	**Workbed Adjustment Knob**	Allows manual raising and lowering of the workbed along the Z-axis.
J	**Control Panel**	Provides hands-on control of the engraving process, including manual movement of the laser head and firing of the laser.
K	**Emergency Stop**	Stops the machine instantly by pressing it down in an event of emergency. Turning it clockwise releases the button. Due to risks of fire and other hazards during engraving, this engraver includes this large and easy-to-reach emergency stop button on the control panel.

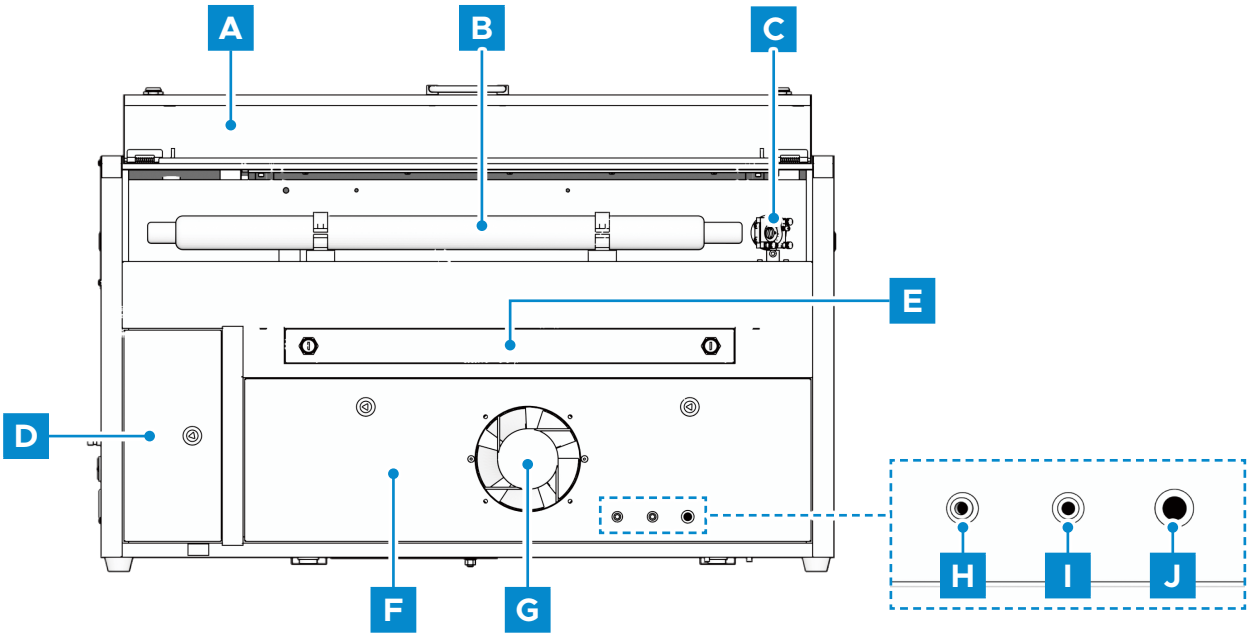
2 Introduction

Left **Right**



A	**Left Access Door**	Provides access to the second mirror, the Z axis rail lifting motor and air pressure sensor for maintenance and repair.
B	**Right Access Door**	Provides access to the mainboard, motor drivers, and control power supply.
C	**USB Drive**	Allows you to load and save designs and parameters directly onto the engraver.
D	**USB Cable**	Connects to your control computer and its engraving software.
E	**Ethernet Cable**	Connects to your control computer and its engraving software.
F	**Main Power Switch**	Controls the main power supply to the machine. For saving energy, the exhaust fan only starts during the working process, and after work is completed, the exhaust fan will automatically shut down after 30 seconds.
G	**Laser Power Switch**	Controls the power supply to your laser tube. Turn it on after the water system and control panel.
H	**Grounding**	Connects to the dedicated grounding cable for safety if applicable.
I	**Main Power Port**	Provides main power supply with the standard 3-prong main power cable.
J	**Water Pump Port**	Provide an additional socket for your water pump if needed. It is recommended, however, to use a separate plug on a different fuse for your water cooling system.

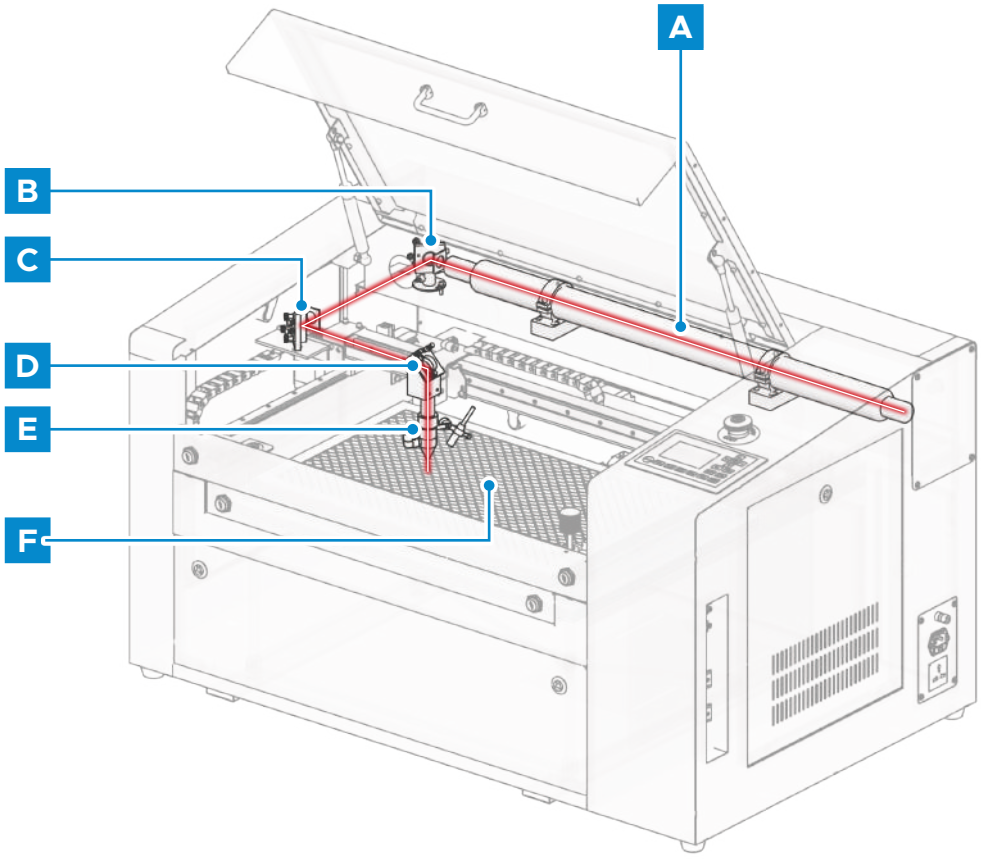
Back



A	**Top Rear Access Door**	Opens to the laser bay, holding the laser tube and its connections.
B	**Laser Tube**	Produces your engraving laser safely with helium, nitrogen, and CO_2 gas and water cooled filled inside. Its connection to the laser power supply is extremely high voltage and extremely dangerous.
C	**1st Mirror**	This adjustable-angle mirror is fixed in place to transfer the engraving laser from the tube to the 2nd mirror.
D	**Lower Left Rear Access Door**	Provides access to the same area as the right access door above.
E	**Rear Pass-Through Door**	Used as the rear equivalent of the front pass-through door and requires similar care during use.
F	**Lower Rear Access Door**	Provides access to the air pump for easier maintenance.
G	**Exhaust Fan**	Pulls out gases and airborne debris from the worktable, sending it through your vent to a window or air purifier.
H	**Water Inlet**	Connects to the outlet of your water pump or chiller to keep your laser tube cool and stable.
I	**Water Outlet**	Connects to the inlet of your water pump or chiller.
J	**Air Assist Intake**	Connects to the air assist pump with a hose of 8 mm diameter to provide its pressurized air. Periodically check its filter to keep it clear of any obstruction.

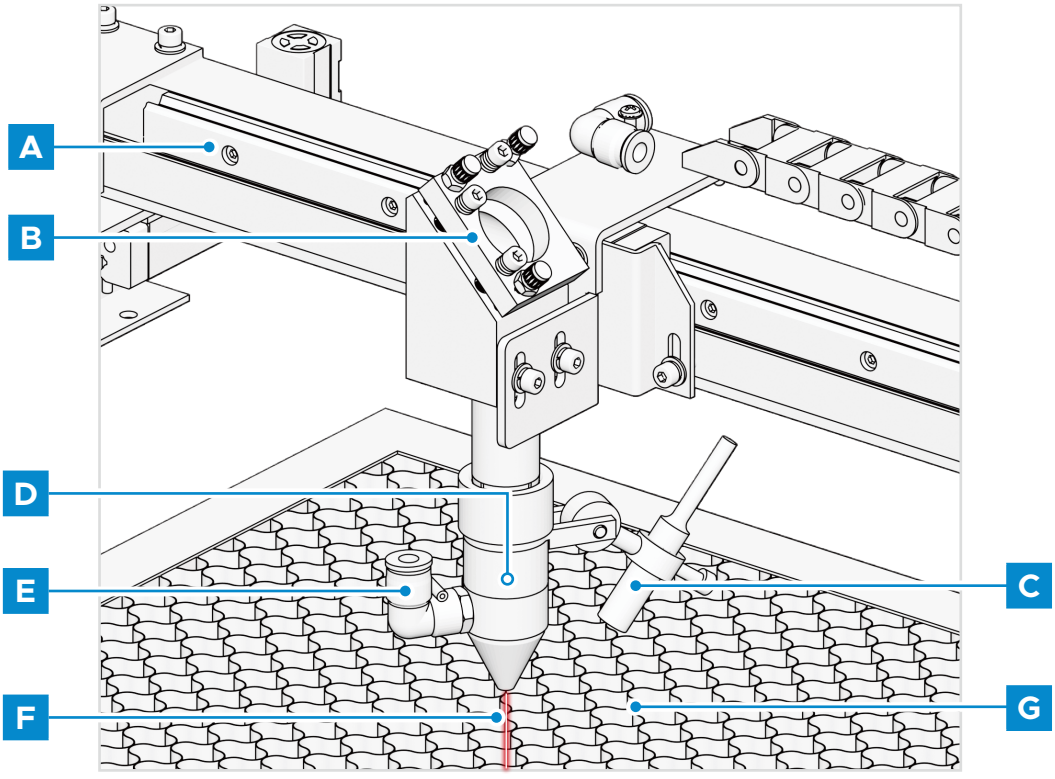
2 Introduction

2.4.2 Laser Path



A	**Laser Tube**	Mounted on brackets and immobile, it produces the laser. Its connection with the laser power supply is extremely high voltage and extremely dangerous.
B	**1st Mirror**	Transfers the invisible engraving laser from the tube to the 2nd mirror.
C	**2nd Mirror**	Moves with the X-axis rail to allow the laser beam to travel along the left Y axis.
D	**3rd Mirror**	Moves with the laser head to allow the laser beam to travel along the X axis.
E	**Focus Lens**	Directs and focuses the laser to the material. For the best effect, it should be at the correct focal length from the upper surface of the material.
F	**Workbed**	Can be adjusted in height to fit thinner and thicker materials, as well as adjusted between the aluminum and honeycomb tables for different projects.

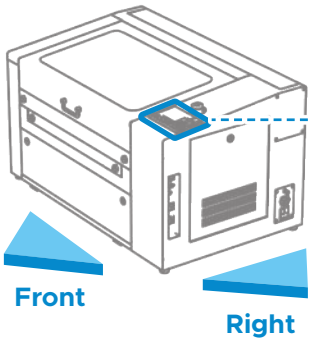
2.4.3 Laser Head



A	**X Axis Rail**	Moves along the Y axis, with its movement controlled by limit switches.
B	**3rd mirror**	Transfers the laser from 2nd mirror to the focus lens. Can adjust its angles.
C	**Red Dot Pointer**	Helps you see the exact position of the invisible engraving laser.
D	**Focus Lens**	With a diameter of 18 mm, directs and focuses the laser beam to its point of contact with the engraving material.
E	**Air Assist**	Blows pressurized air to kill sparks and blow away gas and debris as you engrave.
F	**Laser**	The engraving laser itself is invisible but highly dangerous, thus avoid any direct exposure to your skin or eyes.
G	**Workbed**	Holds the target material, moves the material up and down. You can use the provided focal length ruler to get the correct height for perfect focus for any thickness of material.

2 Introduction

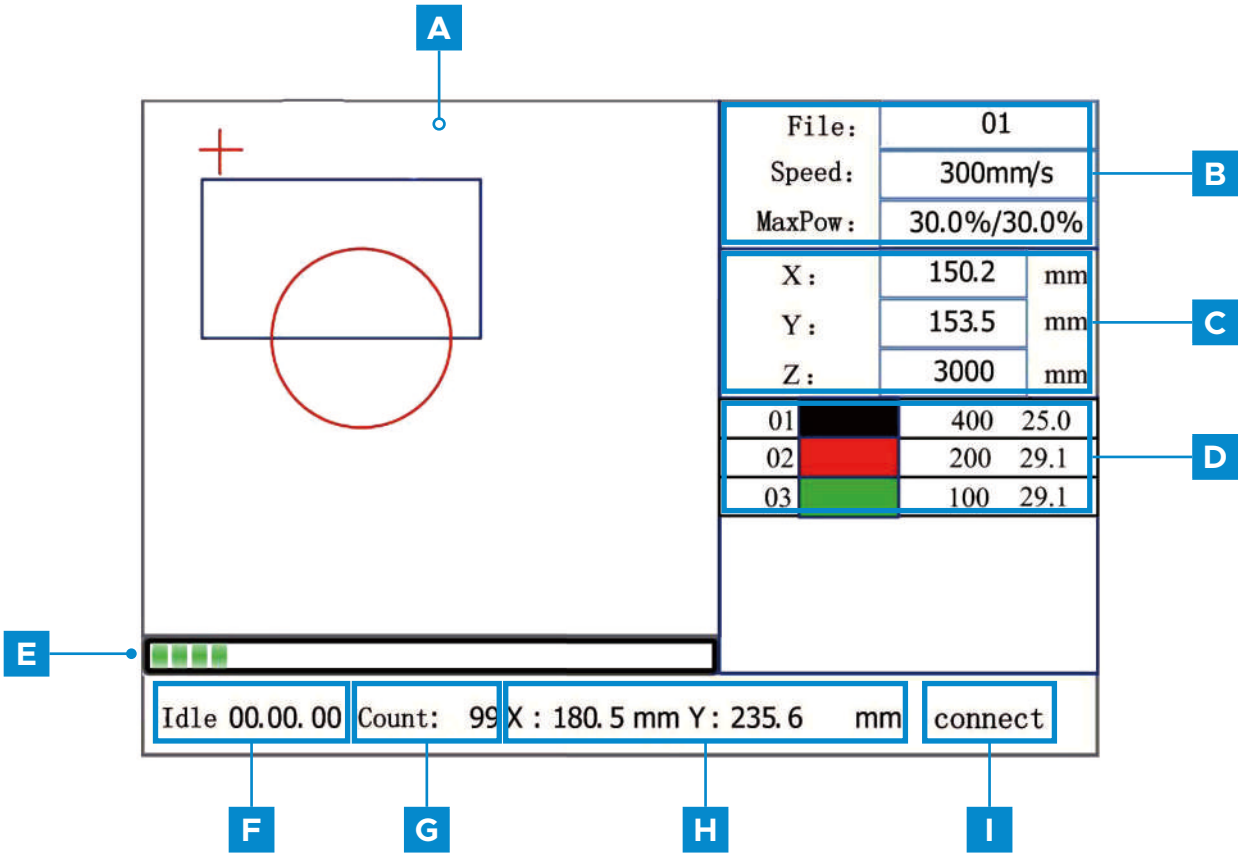
2.4.4 Control Panel



Button	Description
Reset	Returns the machine to the saved default parameters.
Pulse	Manually fires the laser.
Speed	Sets the speed of the current running layer or of the direction keys' movement.
Min-Power	Sets the minimum laser power of the current running layer.
Max-Power	Sets the maximum laser power of the current running layer or sets the power of the laser.
File	Opens the file control menu.
Start-Pause	Starts or pauses the work.
	Moves the laser head along the X axis or the left/right cursor. Moves the laser head along the Z or U axis if **Z Move** or **U Move** in the function menu has been selected.
	Moves the laser head along the Y axis or the up/down cursor.
Z/U	Opens the function menu.
Esc	Stops work or exits from a submenu.
Enter	Enters a command or confirms your selection.
Origin	Sets the starting point for the laser head.
Frame	Traces the outline of the current design for sizing.

2 Introduction

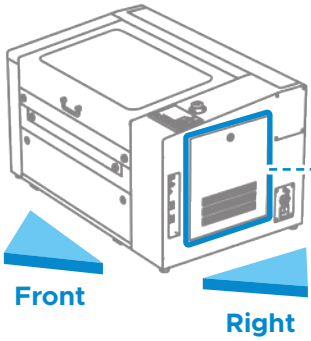
2.4.5 Panel Screen

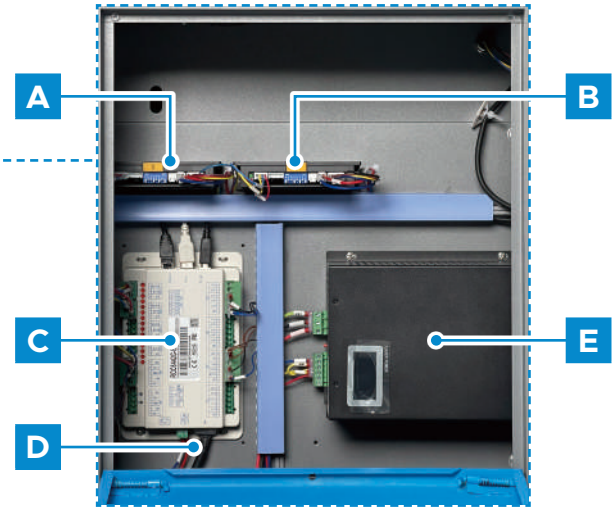


A	**Graphic Display Area**	Traces the processed file image during file preview display and processing.
B	**Parameter Display Area**	Displays the file number, speed, and maximum power of the current processing file.
C	**Coordinate Display Area**	Displays the coordinate values of the current position of the laser head.
D	**Layer Display Area**	Displays the layer parameters of the current processing file or the layer parameters of the preview file. The parameters from left to right are layer, color, layer speed, and layer maximum power.
E	**Progress Bar**	Displays the current processing progress.
F	**System Status**	Displays the current working status of the system, which are idle, paused, completed, or running. The working time is displayed on the right.
G	**Batch Process Number**	Displays the processed quantity of the current processing file.
H	**File Dimensions**	Displays the dimensions of the current file.
I	**Network Status**	Displays the status of the connection to the Internet. When the network connection is successful, **connect** is displayed. Otherwise, **Lan OFF** is displayed. Usually, you do not need an internet connection to use this machine. When the system is running or paused, some buttons on the control panel will not work, for example, Origin and Frame. When the system is idle or the work is finished, all the buttons can be used. For example, you can process the file, set the parameters, preview your file, and so on.

2 Introduction

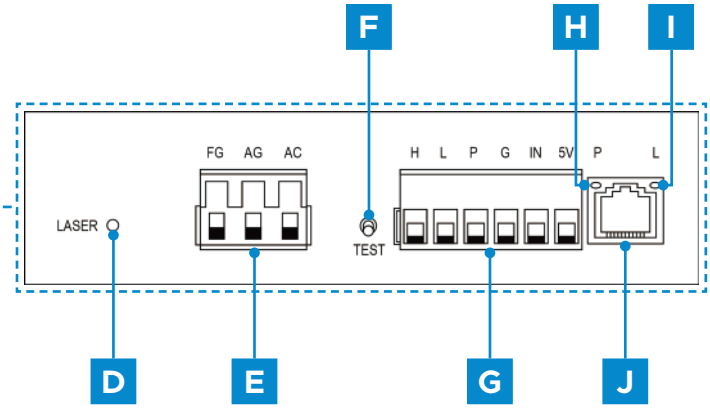
2.4.6 Electronics Bay





A	**X-Axis Driver**	Moves the laser head along the X rail.
B	**Y-Axis Driver**	Moves the X rail along the Y rail.
C	**Mainboard**	Controls the engraving process, responding to commands from your engraving software or the machine's control panel.
D	**Control Power Supply**	Powers the machine's control panel.
E	**Laser Power Supply**	Transforms standard electricity into the extremely high voltage charge necessary for the laser tube.

2.4.7 Laser Power Supply



A	**High-Voltage Wire**	Connects to the laser tube's anode or positive end, providing high-voltage current to power the laser.
B	**Mounting Holes**	Allows simple installation and removal.
C	**Digital Display**	Provides the real-time current value to the laser tube in milliamps.
D	**Laser Indicator Light**	Illuminates when current is being sent to the laser tube.
E	**Main Power Terminal**	Holds the power supply's connection to the engraver's grounding (FG) and to the main power supply (AC).
F	**Test Button**	Tests fire the laser when troubleshooting problems. If the laser fires successfully, the problem will usually be with the control panel or its connections.
G	**Connection Terminal**	This terminal block ensures that the water sensor, interlocks, and so on. H: Connection for active-high devices L: Connection for active-low devices P: Line to the laser trigger, water, and other systems (such as a door switch) G: Ground wire for the control system, PWM level shifters, potentiometers, etc. IN: Input power for PWM level shifters or potentiometers 5V: 5V connection for digital signals
H	**Water Indicator Light**	Illuminates the water cooling system is operating when connected.
I	**Laser Signal Indicator Light**	Illuminates when the laser tube is in operation.
J	**Ethernet Port**	Allows you to connect the laser power supply to an external ammeter while troubleshooting electrical issues. Its indicator lights show its connection to the protection indicator (P) and the active laser (L).

3 Installation

3.1 Installation Overview

A complete working system consists of the laser engraving cabinet, its vent, a water tank (not included) with a pump (included), all applicable connection cables, and the laser and access keys.

The engraver can receive designs and commands from the control computer directly from its USB cable or ethernet cable. 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 needs.

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

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 Selecting a Location

The location should meet all of the following requirements:

- The location meets all of the requirements mentioned in §1 Safety Information on Page 1.
- The location should be stable, level, dry, and climate-controlled to ensure an ambient temperature of 40°F–95°F and an ambient humidity under 70%. In particular, the temperature and humidity together should not be close to the dew point.
- 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 the construction of a dedicated ventilation system.
- The location should be away from children; combustible, flammable, explosive, or corrosive materials; and sensitive EMI machines.
- The main power cable 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.

- The location has fire-fighting equipment nearby and the local fire department's phone number clearly displayed.
- It is recommended to use a windowless room or to use blinds and/or curtains to avoid exposure to the potential additional heat of direct sunlight.
- It is highly recommended to have an extra work table nearby to avoid placing objects on or directly adjacent to the machine, which could become a fire or laser hazard.

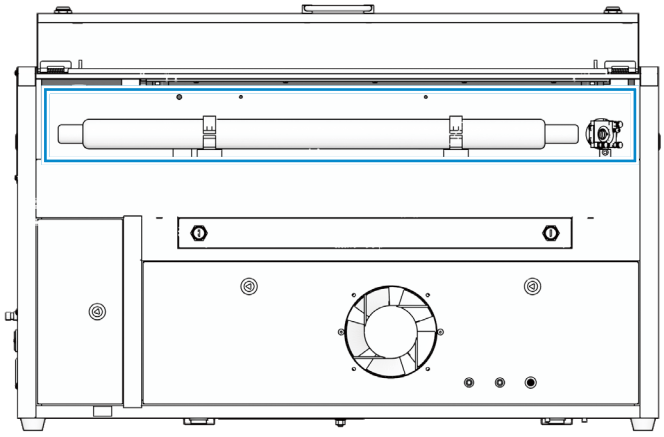
3.3 Unpacking

Your engraver should have arrived in a wooden crate with its accessories (including this manual) packaged inside. You should have placed the crate in a spacious flat area for unpacking, ideally near where you plan to operate the machine permanently. Use at least two people to move and adjust the engraver's position to help keep it level and avoid any sharp or sudden movement.

1. Open the top of the crate, take out the rotary package, and remove the surrounding foam insulation.
2. Carefully remove the other packaging and foam insulation from the sides and set them aside. With at least one other person, use the two straps around the engraver to lift it out of the crate and move it to a sturdy table or countertop.
3. Carefully remove the straps and plastic packaging from around the engraver.
4. Retrieve the access keys from the main bay in the front of the machine.
5. Use them to unlock the front access door below the workbed and take out the accessories pack.

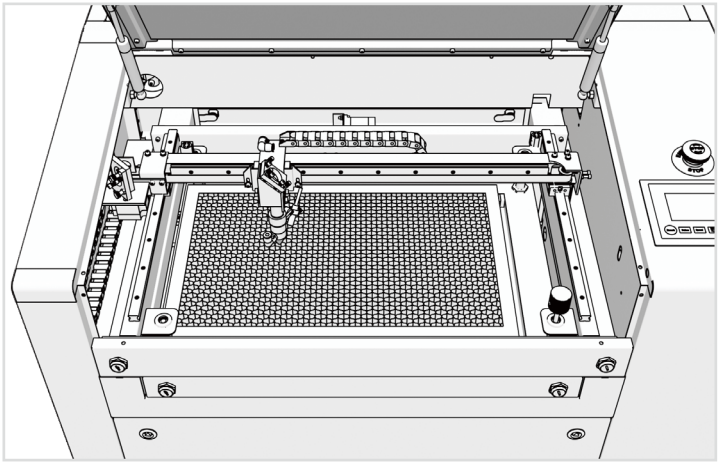
   Make sure that you have received all listed accessories in the package list (See §2.3 Package List on Page 13).
6. Carefully remove any remaining interior packaging and stays—including the strap around the laser head—and set them aside.

   The laser tube is a highly fragile object and should be handled delicately and as little as possible.



3 Installation

7. Inside the main bay, remove the nylon cable ties from the X axis and the honeycomb workbed.



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 Installing the Water Cooling System

- The provided water pump is essential to your engraver's performance and longevity. When this laser works without a properly maintained cooling system, its glass tube **WILL** crack from excess heat.
- Always fill the tank with deionized or distilled water or a custom-purpose laser-safe antifreeze. Using tap water will gradually degrade the quality of your engraver and may even cause dangerous mineral buildup within the cooling system. Never use generic antifreeze for the same reason.

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

As an alternative to manually adjusting the water in your tank, you can also use an industrial water chiller to provide your engraver with temperature-controlled water. We recommend the CW-3000 9L chiller (not included). If using it with this engraver, follow its separate manual and plug it into an outlet on a separate fuse from the engraver itself.

To connect the water pump to the engraver:

1. Fill a dedicated water tank with distilled water at 15°C–21°C. The tank should always hold at least 2 gallons (7.5 L) of water.

   If the temperature drops below 0°C, it is recommended to use laser-safe antifreeze.

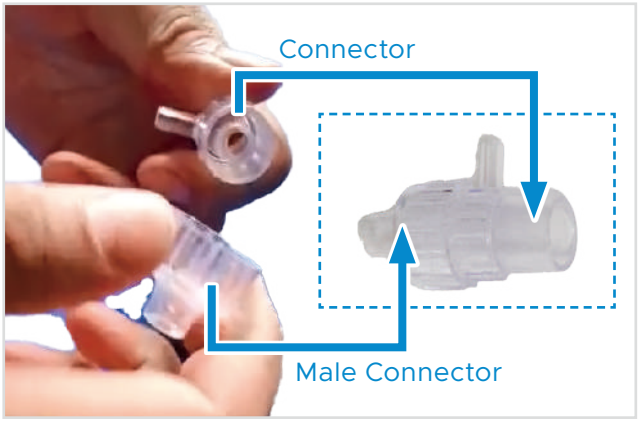
2. Turn the protective cover counterclockwise.

3. Use a flathead screwdriver to pry open the protective cover and remove it.

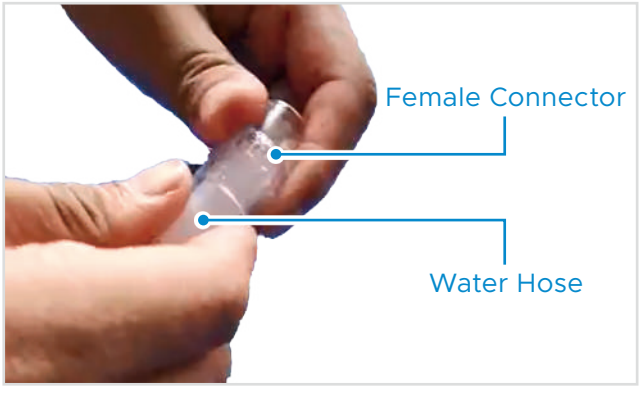
4. Attach the mesh cover to the water pump and turn it clockwise to secure it.

3 Installation

5. Turn and disconnect the female connector and male connector.

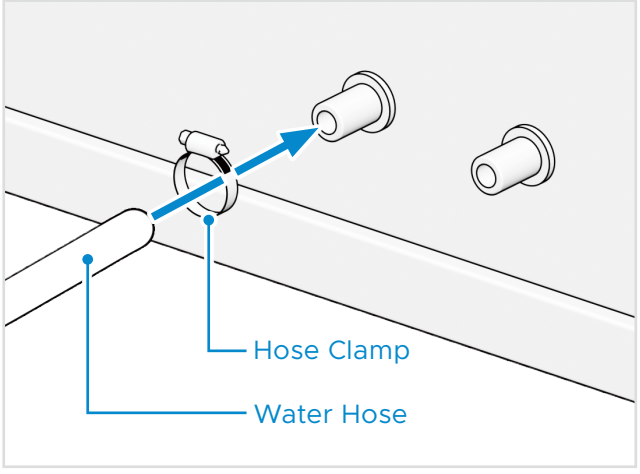


6. Connect the female connector to one end of a water hose.

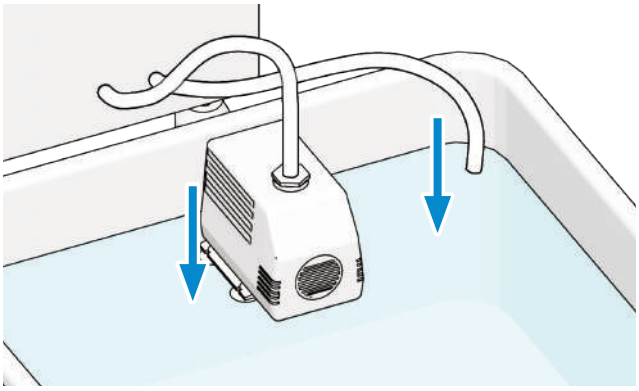


7. Connect the female connector to the water outlet of water pump.

8. Connect the other end of water hose to the water inlet at the back of your engraver and secure it with one hose clamp.



9. Completely submerge the pump in the water tank.
10. Connect one end of the other white hose to the water outlet at the back of your engraver and secure it with the other hose clamp.
11. Put the other end into the tank in such a way that the returning water flows into the tank without splashing or other problems.



12. 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 the dedicated socket located on the back of the engraver.

    Once the plug is plugged in, water should begin to run through your machine and back into your tank. When the water cooling system is in operation, pay attention to the following:

    - **ALWAYS** obtain visual confirmation that the water flows through the laser tube before starting your laser.
    - Larger bubbles will pose a risk of overheating the laser tube. **ENSURE** there are no air bubbles larger than 1 cm. If there are larger bubbles, check the water level in the water tank to fully cover the water pump. You can tilt the engraver on the left side until the bubbles **dissipate**.
    - **NEVER** allow the water in the tank to become too hot to cool the laser. Heat damage can occur quickly and severely shorten the life of the laser tube.

      Periodically check the water's temperature on the built-in digital display on the laser power supply. For best results, keep it between 60°F–70°F (15°C–21°C). If the water begins to come near 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, as this could shatter the heated glass CO_2 **tube as well.**

3 Installation

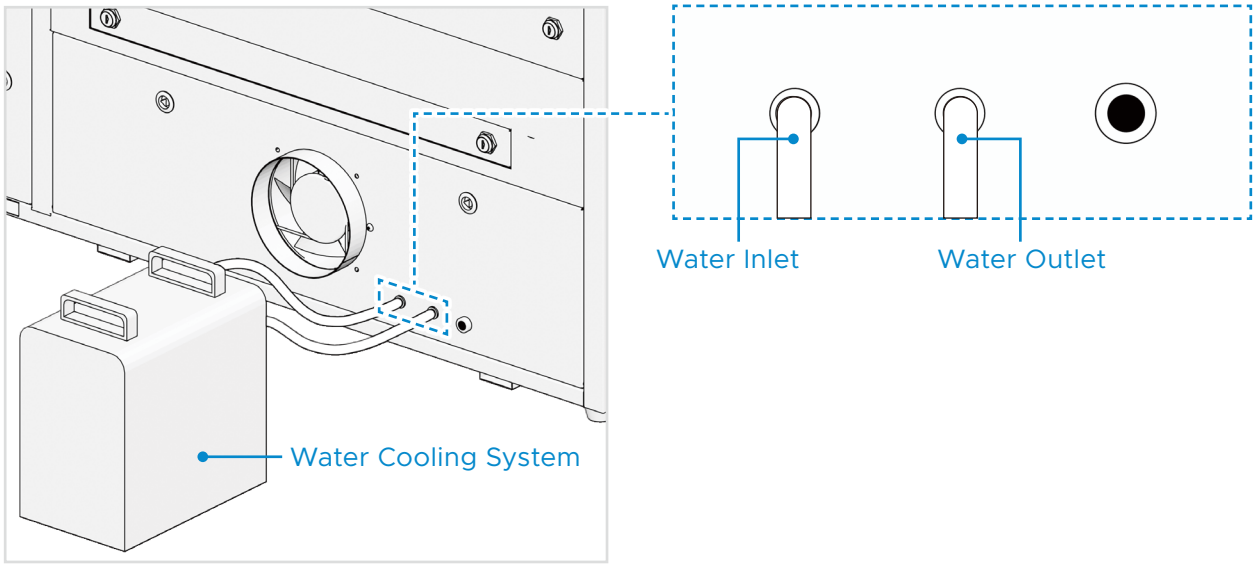
13. Unplug the water pump after confirmation.

    For an engraver with such high power, it is recommended to use an industrial water chiller for better cooling performance, especially when you are using the machine for a long time.

    For instructions on installing the water cooling system, see the manual of your water cooling system. But keep in mind:

    - Connect the water **OUTLET** of your water cooling system to the water **INLET** of the engraver.
    - Connect the water **INLET** of your water cooling system to the water **OUTLET** of the engraver.

> You can use the provided water hose clamps to seal the ports.



3.5 Installing the Exhaust System

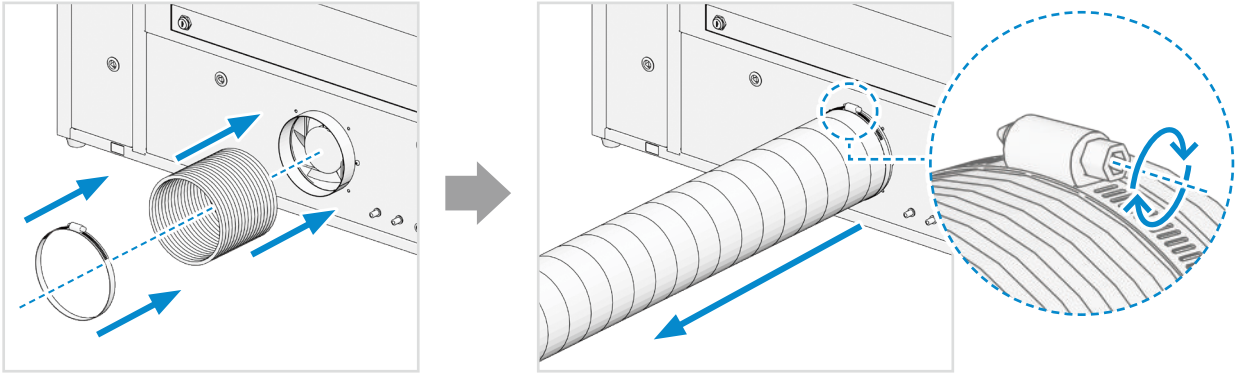
Wear work gloves to avoid cuts.

The provided exhaust pipe extends to a total length of 4.9 ft (1.5 m). Plan out the route that they will take from your engraver's fan to a dedicated purifier or—if your engraving fumes and debris will not be hazardous and meet local and national air safety standards—to any window or exterior vent. Generally speaking, the straighter you can keep the pipes between your engraver and their outlet, the better your system's ventilation will be and the less quickly dust and debris will build up within the pipes over time.

To install the duct fan:

1. Slide the hose clamp onto one end of the exhaust pipe. Use it to firmly connect the engraver's exhaust vent and the pipe.
2. Place the other end of the hose out a door, window, and so on, or—if there will be any harmful byproducts produced as you engrave— connect the pipe to a dedicated fume extractor.
3. Seal all seams and connections tightly.

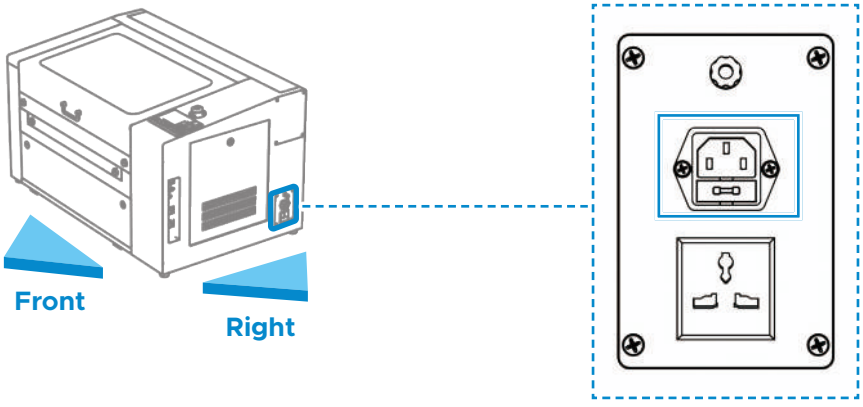
   For all connections made during installation, you can apply the provided silicone sealant to ensure a secure connection afterward.



NEVER operate the laser if the exhaust system is not removing the fumes and dust produced by your materials out of your work area. Always 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 Installation

3.6 Connecting to Power Supply

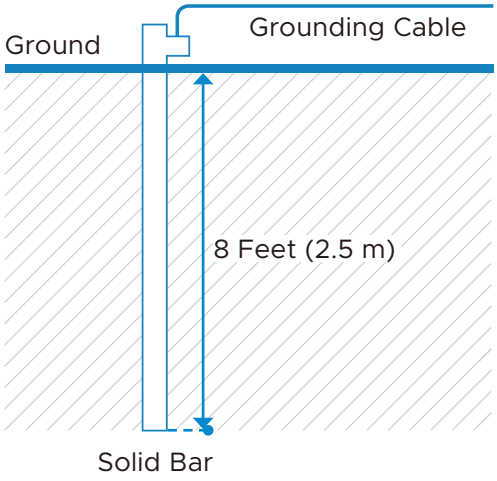


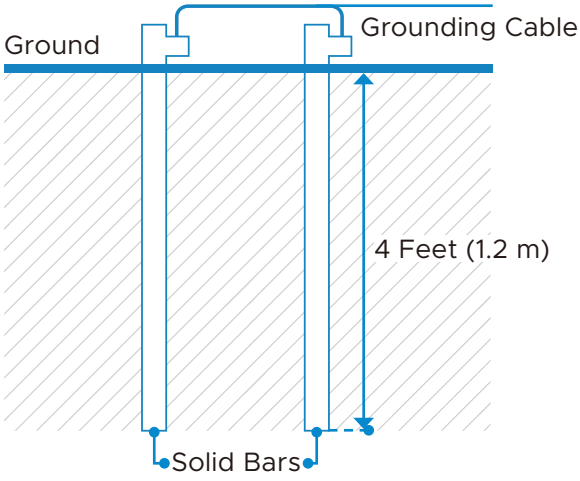
1. Confirm that the labeling beside the power socket at the back of the engraver matches your local power supply and that the power switch is in the **O** position before setting up the control system.
2. Connect one end of the power cable to the power socket.
3. Plug the other end of the power cable into a grounded 3-prong outlet or into a surge protector rated over 2000 J that is itself connected to a grounded outlet. Use a dedicated circuit with no other devices on it.

   If the outlet is not grounded, use the grounding cable and connect it as follows:

   a. Fasten the near end of the grounding cable to the ground port at the back of the engraver.

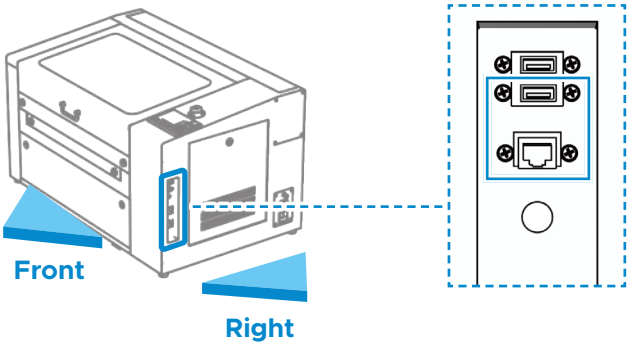
   b. Connect the far end of the cable to a single metal rod driven at least 8 feet (2.5 m) deep or to two separate metal rods driven at least 4 feet (1.2 m) deep into soil located at least 5 feet (1.5 m) from the machine.





- Fluctuation along the circuit line should be less than 5%. If this is exceeded, the fuse will blow, which is located in the power socket and accessible from the exterior.
- Do not connect this device to standard extension cords or power strips.
- The powerful laser is extremely high voltage and potentially dangerous, so users must securely ground the engraver to avoid the buildup of static electricity.
- Poor grounding **WIL**L 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.

3.7 Connecting to Your Control Computer



The control computer can be connected in any of the two ways:

- Via the provided USB cable (via the port **USB Cable to PC**).

  In this way, the control computer is directly connected to the engraver, so 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.

- Via the provided Ethernet cable (via the port **Ethernet Cable**) using the internet.

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.

Familiarize yourself with the software's image design features and laser control settings before using it to operate the laser. For details on the requirements for the control computer, see the software manual.

4 Initial Testing

Wear safety glasses during the entire test process!

Always make sure the path is clear between the laser and its target.

Never allow foreign objects between the laser and the material being engraved. Take care not to leave any part of your body in the laser path when it is in operation.

4.1 Emergency Shutoff

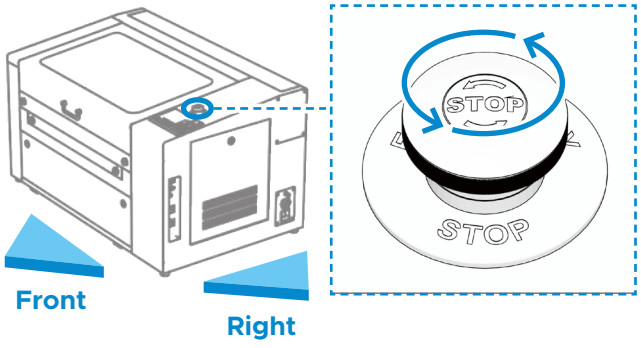
In case of the risk of fire and other hazards during engraving, this engraver includes an easy-to-reach **Emergency Stop** button. Pressing it down stops the laser tube instantly; turning it clockwise unlocks it. When your engraver arrives, its **Emergency Stop** button is initially pressed. It must be unlocked before use.

You should test that it works properly before conducting **ANY** other work with your machine.

1. Turn on the water cooling system.

   Confirm that the cooling system has been activated.

2. Turn the **Emergency Stop** button clockwise to unlock it.



3. Press the power switch to **I** to turn on the engraver.

   Confirm that the air assist and exhaust fan have been activated.

4. Hit the **Emergency Stop** button and observe whether the engraver powers down.

   If the **Emergency Stop** is not working and must be replaced before the engraver can be used, turn off the machine and contact customer service.

5. Turn off the engraver after the test is done.

4.2 Cover Shutoff

Because of the risk of blindness, burns, and other injuries from direct exposure to the invisible engraving beam, this device shuts off the laser automatically when any one of its protective interlocks is triggered.

Always make sure the path is clear between the laser and its target.

Never allow foreign objects between the laser and the material being engraved. Take care not to leave any part of your body in the laser path when it is in operation.

You should test that this engraver also shuts off the laser automatically when the protective cover is raised during operation.

You should test that the cover shutoffs activate properly before conducting any other work on your machine.

1. Turn on the water cooling system.

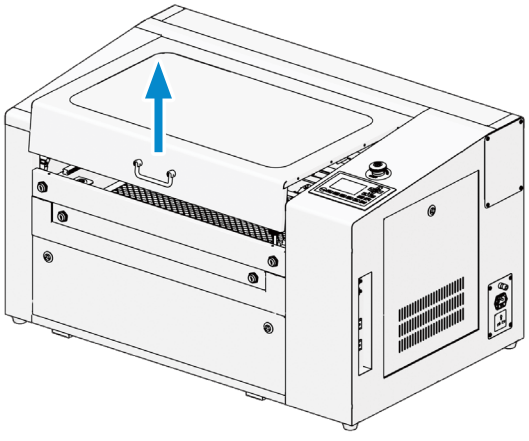
   Confirm that the cooling system has been activated.

2. Turn the **Emergency Stop** button clockwise to unlock it.

   Confirm that the air assist and exhaust fan have been activated.

3. Press the main power switch to **I** to turn on the engraver.
4. Press the laser power switch to **I** to turn on the laser.
5. Place a piece of laserable scrap material onto the workbed and then close the cover.
6. Press **Pulse** to fire the laser.
7. Taking care not to expose yourself to seeing or being hit by any possible reflected laser light, open the cover as little as possible.

   The laser should pause automatically and an error will be displayed on the control panel. If the laser continues to engrave the design while the cover is raised, the automatic shutoffs are not working and must be repaired before the engraver can be used. Turn off the machine and contact our technical support team.



8. Turn off the engraver and press the **Emergency Stop** after the test is done.

4 Initial Testing

4.3 Water Shutoff

Because of the danger posed by an uncooled laser tube, this engraver also shuts off the laser automatically when its sensors do not detect the correct water flow. You should test that the water shutoff functions correctly.

Always make sure the path is clear between the laser and its target.

Never allow foreign objects between the laser and the material being engraved. Take care not to leave any part of your body in the laser path when it is in operation.

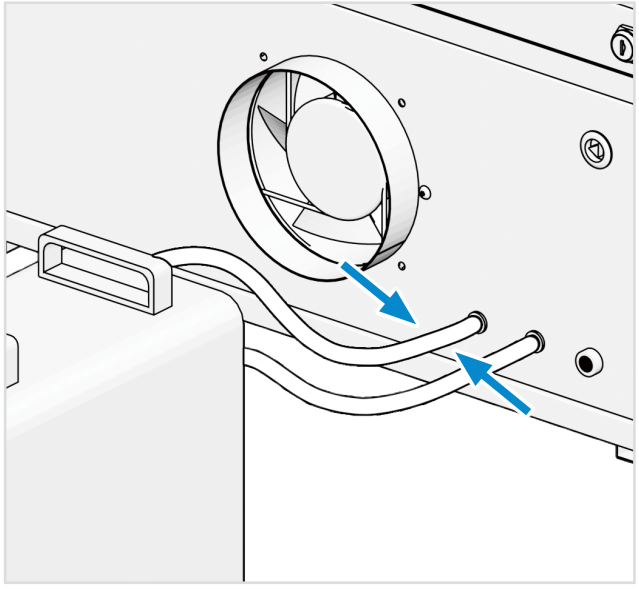
1. Perform the same procedure as before but, crimp or tie the water hoses, or unplug the water pump.

   Be careful not to damage the hoses themselves and to only briefly activate the laser.

   The laser should stop completely and an error will be displayed on the control panel.

   - If the laser continues to fire, the automatic shutoff is not working and must be repaired before the engraver can be used. Turn off the machine and contact our technical support team.
   - If the laser stops completely, the automatic shutoff is working correctly. Release the two hoses and run the water system for a minute or two, checking that no damage or leaks have occurred.

2. Turn off the engraver after the test is done.



4.4 Air Assist

Because of the danger posed by sparks during engraving and the risk of damage to the laser nozzle and focus lenses from fumes and debris, the pressurized air begins to blow from the laser head when the engraver starts engraving.

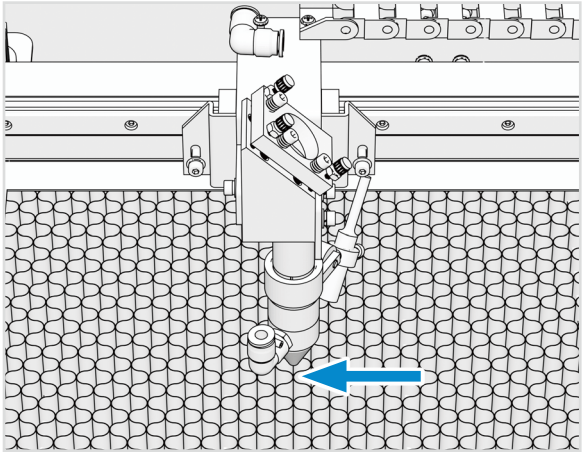
You should test that the pressurized air blows correctly:

1. Make sure that the air assist is in good condition.
   a. Check that the air assist 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** button) before adjusting anything.

   b. Check that its air intake filter is in place, clean, and not obstructed by any nearby objects.
2. Press the power switch to **I** to turn on the engraver.
3. Turn the **Emergency Stop** button clockwise to unlock it.
4. Open the cover.
5. Confirm that the pressurized air begins to blow from the laser head.

   If it does not, turn off the machine and contact customer service.



6. Turn off the engraver and press the **Emergency Stop** button after the test is done.

If any tubing or wiring needs to be adjusted or reconnected, turn off the machine and disconnect it from power before making any such adjustment.

5 Typical Operation Sequence

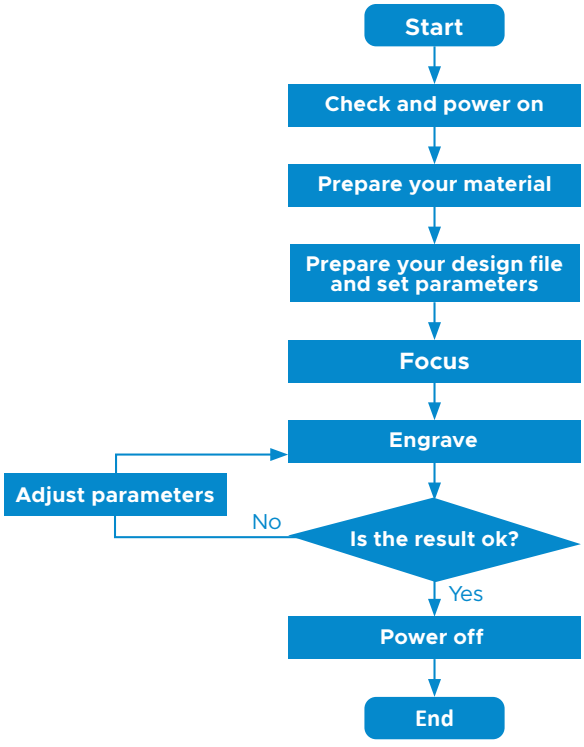
5.1 Operation Overview

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

The engraver is operable either through:

- The built-in control panel
- Your control computer

In typical workflows, designs are created by using graphic files on a control computer, then transferred to the engraver for execution. Here are the main operation steps:



See §5.2.1 Checking on Page 42 and §5.2.2 Powering on on Page 43

See §5.2.3 Preparing Material (Page 44).

See §5.2.4 Preparing the Engraving Pattern (Page 45).

See §5.2.5 Autofocusing (Page 45).

See §5.3 Engraving Proper (Page 46).

See §5.4 Wrapping-up (Page 48).

5.2 Pre-Operation Preparation

5.2.1 Checking

1. Make sure the power supply is ok.
2. Ensure proper ventilation.

   Make sure that any back-up ventilation systems are in place and running smoothly.

NEVER operate the laser if the fan and pipes are not working to purify or remove 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. Adjust the workbed if necessary.

   Honeycomb Bed

   For lightweight materials requiring close support: wood, fabric, leather, thin veneers

   Aluminum Knife Bed

   For heavy or rigid materials that are self-supporting and might damage the honeycomb bed and heat-sensitive materials (for example, acrylic, plastic) needing high airflow to avoid surface damage.

   The honeycomb bed can be removed to expose the aluminum knife bed and provide a little more space for thicker projects.

   The bed can be raised or lowered using the manual adjustment knob to accommodate different thicknesses of various materials.

5 Typical Operation Sequence

5.2.2 Powering on

1. Turn on the water cooling system.

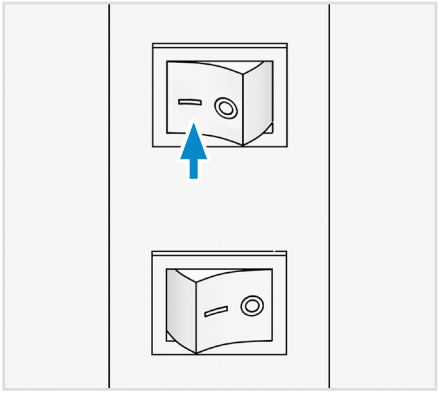
   Visually confirm that the water is flowing through the whole system either by opening the top rear door to look at the laser tube itself or by observing that water is entering the machine and returning to the tank through the outlet tube.

   If the laser tube is examined directly, remember to close its access door before continuing. Add more distilled water if the pump is no longer well covered after filling the engraver's water tubing.

2. (Optional) Turn on your additional ventilation system (such as a dedicated purifier).

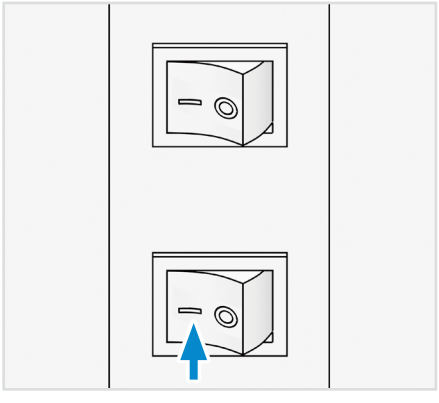
3. Turn the **Emergency Stop** button counterclockwise to unlock it.

4. Press the main power switch to **I** to turn on the engraver.



5. Press the laser power switch to **I** to turn on the laser.

   The laser head should start to move to its origin automatically.



6. Open the engraver's cover, and confirm the air assist is working well, blowing air through the nozzle.
7. Wait until the engraver is in standby mode and ready to use.

5.2.3 Preparing Material

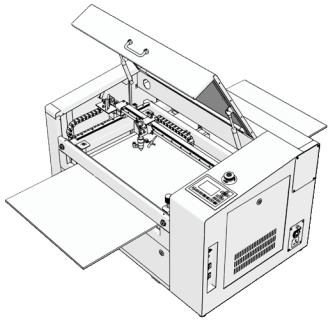
1. Open the engraver's cover.
2. Place a sample piece of your material on the workbed.

   The default location of the laser head's zero position is at the top left corner of the workbed. This can be changed by moving either your design or the engraver's origin position using the control panel or your engraving software.

   For instructions on material safety, see §1.7 Material Safety Instructions on Page 8.

> **DO NOT** insert anything through the pass-through doors other than the material once 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 the byproducts or wear the necessary PPE to ensure the health of users and passersby.

> For heavier pieces of material, be careful to distribute its weight as evenly as possible across reinforced supports. For larger pieces of material, you may open the front and rear pass-through doors.



3. Close the engraver's cover.

> Exercise caution with your hands when closing the cover.

5 Typical Operation Sequence

5.2.4 Preparing the Engraving Pattern

1. Create the design.

   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 §2.2 Technical Specifications on Page 12.

2. Customize your design's contrast and engraving depth by adjusting the parameters in your engraving software or directly through the control panel.

   - 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.

5.2.5 Focusing

1. Open the cover.
2. Use ◀ ▶ ▲ ▼ to move your laser head to the original place.
3. Placing the acrylic focus tool on top of the material.
4. Carefully raise the workbed by using the manual adjustment knob until the laser head barely touch the top of the acrylic tool without applying any pressure.

   Make sure the engraving distance is correct. Again, never attempt to focus the laser either way without some material on the workbed.

5. Place your sample material and laser head to your desired location.
6. Close the cover.

5.3 Engraving Proper

- If there is ever an emergency, hit the **Emergency Stop** button **IMMEDIATELY**.
- **DO NOT** stare continuously at the active laser even while wearing laser glasses but watch during use for possible issues like sparks and be prepared to quickly extinguish a fire if necessary.

1. Tap Origin to define the initial launch position for the laser.

   This action resets the laser head to the designated starting position or origin point, ensuring it aligns with the intended starting location of your design.

2. Tap Frame to outline the projected area for engraving or cutting on your material.

   The laser traces the boundary, allowing you to ascertain that the laser path is properly aligned with your material setup.

3. 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.

4. Once the laser has stopped, press Start-Pause to completely stop work, return to the beginning of the design, and reset the laser head back to its origin.

5. Open the cover and check that the engraved pattern is desired. If not, adjust the parameters as needed. For parameter reference, see §5.6 Instructions for Specific Materials on Page 50.

   Remember to press the reset button after temporarily opening and closing the cover.

6. Remove the sample material and place the actual material for engraving.

7. Press Start-Pause to engrave your design.

5 Typical Operation Sequence

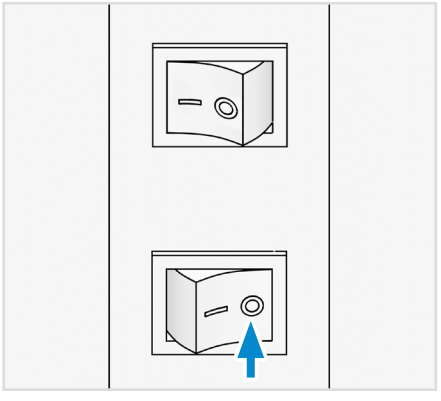
During repetitive engraving and cutting,

- Periodically check your temperature gauge to maintain a water temperature below 100°F (38°C). If this temperature is reached, stop working and allow your device to cool before further use.
- Periodically check that the tank is at least 2 gallons (7.5 L) of water. Fill the tank with deionized or distilled water or a custom-purpose laser-safe antifreeze as needed.
- Monitor the temperature and humidity of the environment. Ensure that the temperature of the cooling water does not fall below the dew point of the surrounding air to prevent condensation. For tips to prevent condensation, see §7.3 Water Cooling System on Page 75.

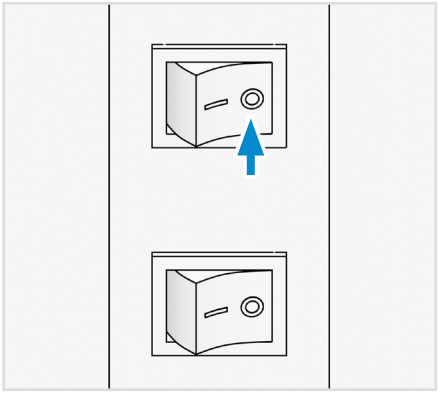
> Condensation can lead to water droplets forming on the machine or the floor, which could damage the electronic components of the engraving machine or create a slip hazard over time.

5.4 Wrapping-up

1. Once you have finished engraving, close your software and then turn off your machine in the following order:
   a. Close your engraving software, and unplug the USB cable or ethernet cable.
   b. Press the laser power switch to **O** to turn off the laser.



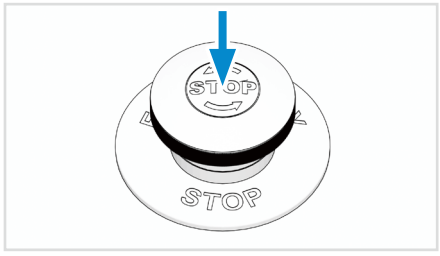
   c. Press the main power switch to **O** to turn off the engraver.



d. Allow time for the ventilation and cooling systems to continue running, cooling the laser and removing any remaining fumes or dust.

e. Turn off the water cooling system.

f. Press the emergency stop button.



g. (Optional) Turn off your additional ventilation system (such as a dedicated purifier).

h. Flip down the circuit breaker that you've prepared for the engraver.

2. Fully clean the workbed and check if the lens or any mirrors require cleaning. Use the bottom left access panel to remove, empty, clean, and replace the debris tray. Store everything neatly away.

3. For best results, lock and disconnect your laser engraver from its power supply between uses.

5.5 Rotary Operation (Optional)

5.5.1 Installing a Rotary Attachment

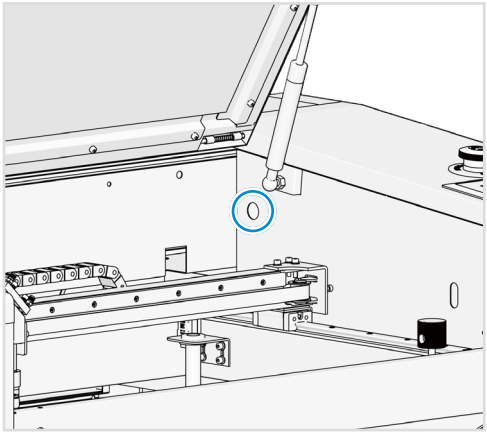
1. If the material is too thick, remove the honeycomb bed, aluminum knife bed and the support bar of the blade.

2. Place your rotary axis in an open area.

3. Put the material and adjust the position using the rotary axis' knobs.

4. Check the height of the workbed is appropriate. If the material is on the workbed, lower the workbed to provide room for the laser head to pass over your axis and material as needed.

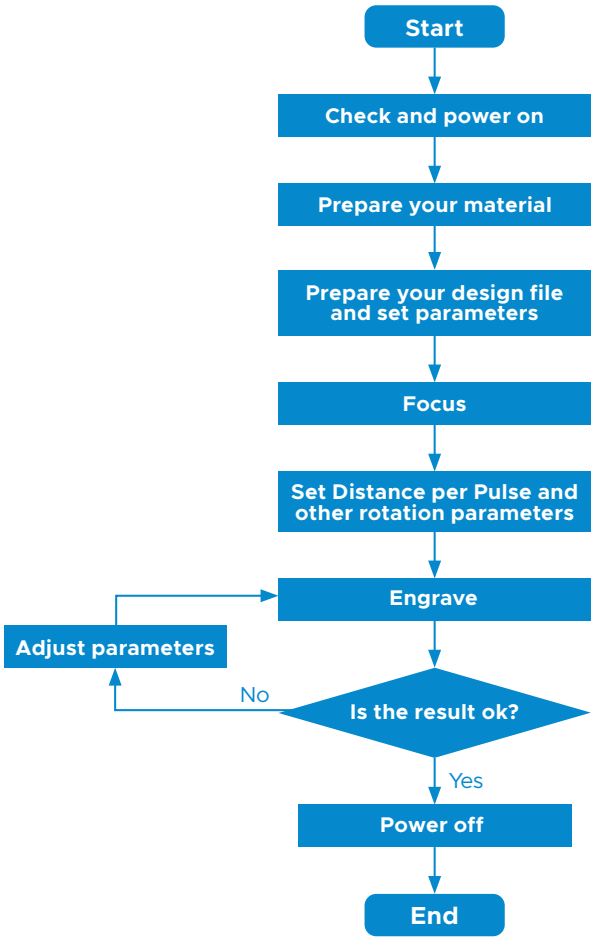
5. Connect the rotary axis cord to the rotary port at the back of the main bay.



5 Typical Operation Sequence

5.5.2 Engraving Procedures with a Rotary Attachment

In typical workflows, designs are created by using graphic files on a control computer, and then transferred to the engraver for execution. Here are the main operation steps:



5.5.3 Engraving Procedures Proper

1. Prepare your engraved material according to the instructions in §5.2. Pre-Operation Preparation on Page 42.
2. Turn on the switch of your rotary attachment. The rotation of the rotary attachment will be controlled by the engraver's Y axis settings.
3. Follow instructions in §5.3 Engraving Proper on Page 46 and §5.4 Wrapping-up on Page 47 for the rest of the engraving process.

5.6 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.

5.6.1 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.

5.6.2 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.

5.6.3 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.

5.6.4 Metal

CO_2 laser engravers should not be used for marking, engraving, or cutting metal. They are best suited for working on coatings applied to a metal base, and care must be taken not to attempt to work on the underlying metal itself. A variety of coatings specialized for CO_2 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.

5 Typical Operation Sequence

5.6.5 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.

5.6.6 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.

5.6.7 Rubber

The various compositions and densities of rubber cause slightly varying engraving depths. 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.

5.6.8 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.

5.6.9 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.

5.6.10 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 engraves 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 their 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.

6 Control Panel Instructions

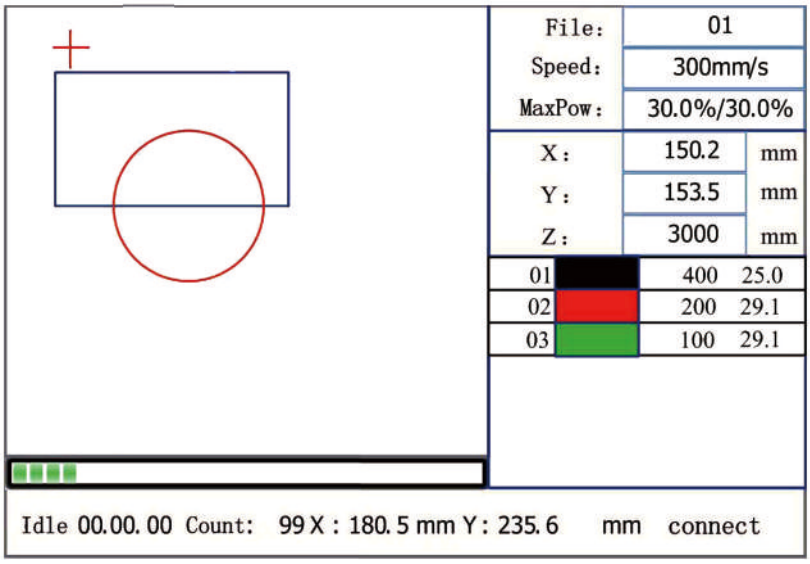
6.1 Overview

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 Z/U and adjusting the parameters under **Manual Set+**. The laser can be set to fire for a fixed period by pressing Z/U and adjusting the parameters under **Laser Set+**. All of the buttons and menus should be labelled in English. If they are not, press Z/U 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 File and then select **Udisk+** and **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.



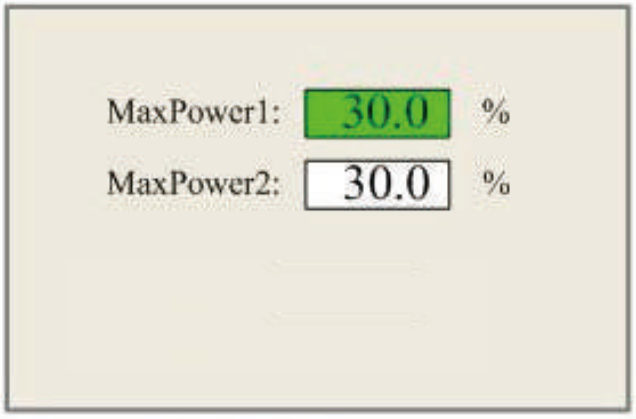
When running a design from the control console, this will be the main display. The design should appear in the top left corner and its name and the current speed and power settings on the top right. The position of the laser head relative to the workbed appears as the X (horizontal) and Y (vertical) coordinates. The Z coordinate shows the elevation of the workbed itself although it can only be automatically adjusted if a motorized lift is installed. 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.

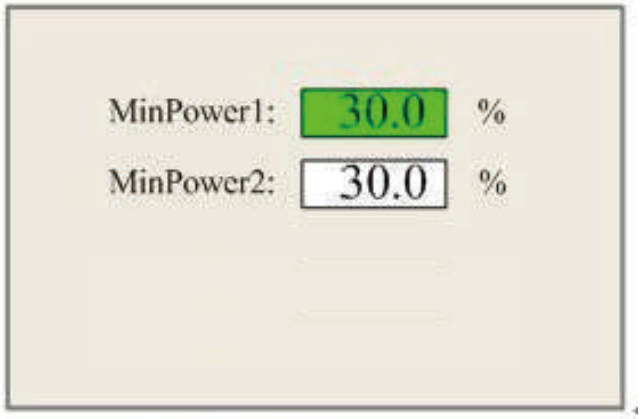
If there is ever an emergency situation such as a fire, do not use the control panel to pause or stop the engraving. Hit the emergency stop button immediately.

6 Control Panel Instructions

6.2 Setting the Laser Power

Select **Max-Power** or **Min-Power** on the main interface, and the following displays will appear.

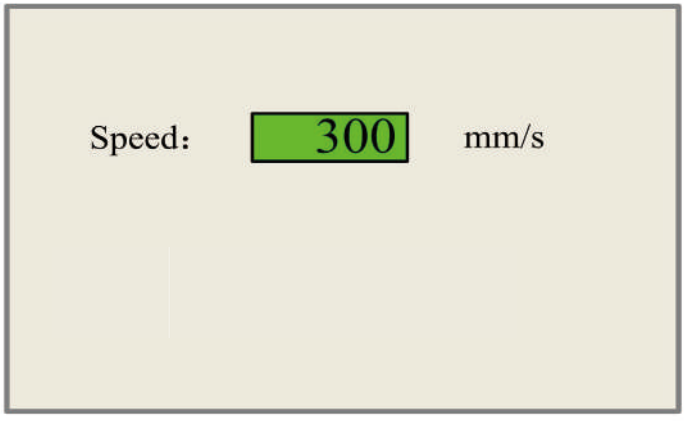




When Z/U is pushed, the green block can move up and down to denote the changing item. Then ▲ or ▼ and ◀ or ▶ can be used to change the value. Press Enter to save the change. Press Esc to invalidate the change and return to the main interface.

6.3 Setting the Laser Speed

Select **SPEED** on the main interface, and the following dialogue box will appear:

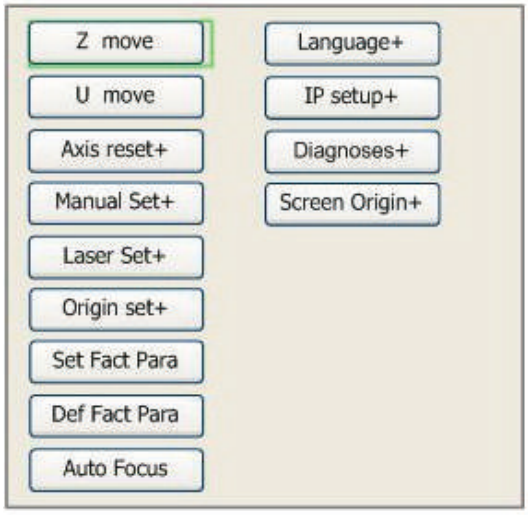


A cursor will appear when pushing ◀ or ▶. Move the cursor to the numeral area and push ▲ or ▼ to change the value. Press Enter to save the change. Press Esc to invalidate the change and return to the main interface.

6.4 Function Menu

6.4.1 Function Interface

Press Z/U on the main interface to enter the Function interface, as shown below:



Push ▲ or ▼ tto select an item, and then push Enter to enter the corresponding submenu.

6.4.2 Adjusting the Z Axis

When **Z Move** is selected, push ← or → to control the movement of the Z axis when a motorized workbed (sold separately) is installed.

6.4.3 Adjusting the U Axis

When **U Move** is selected, push ← or → to control the movement of the U axis. This can be used to control the rotational position of a rotary axis or the linear position of an automatic feed (both sold separately) if either is installed.

6 Control Panel Instructions

6.4.4 Resetting the Axes

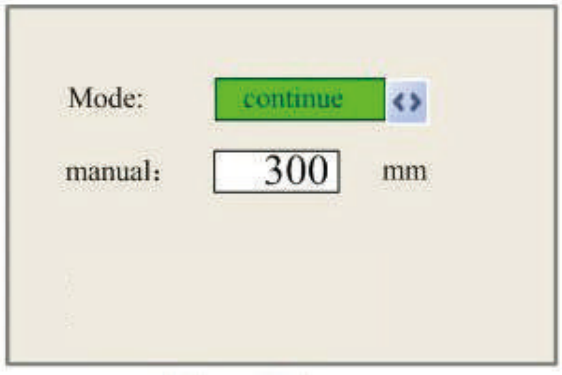
When **Axis Reset+** is selected, push Enter and the display will show:

Push ▲ or ▼ to select an item. Press Enter to start the resetting of the selected axis, and the message “Resetting Is Underway” will show on the screen. Upon completion, the message will automatically disappear and the system will return to the main interface.

6.4.5 Adjusting the Laser Movement Mode

When **Manual Set+** is selected, press Enter and the following will be displayed:

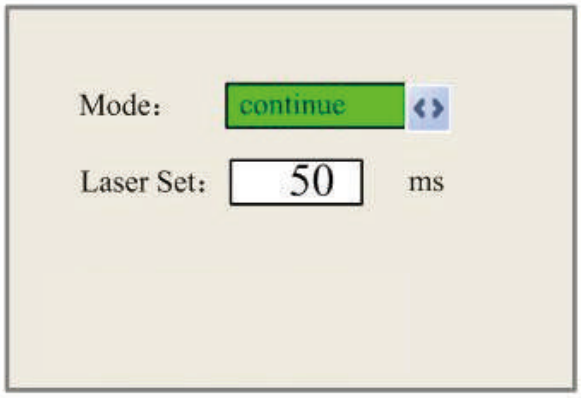
When **Mode** is selected, push ◄ or ► to choose between the two modes **Continue** and **Manual**. Push Z/U to move the cursor. When the cursor is on **Manual**, push ◄ or ► and ▲ or ▼ to change the parameters. If the continuous mode is selected, release this button and the laser stops. If the continuous mode is selected when Pulse is pressed, the laser head will move continuously as long as the direction arrows are held down. If the manual mode is selected, each time the direction arrows are pressed, the laser head will move by precisely the distance shown beside **Manual** in this screen.



6.4.6 Adjusting the Laser Pulse Mode

When **Laser Set+** is selected, press Enter and the display will show:

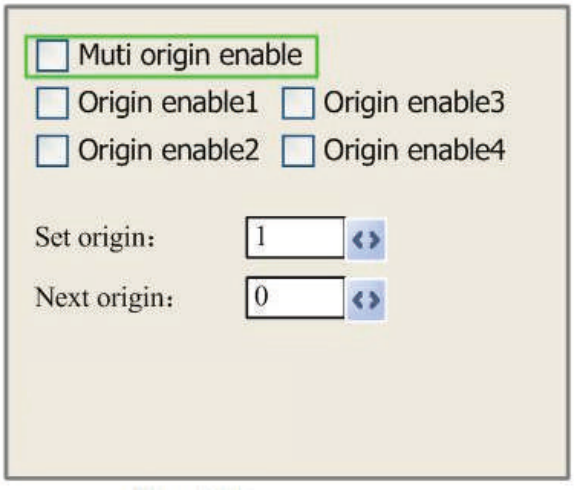
The operation method is the same as the previous setting. When **Continue** is selected, press Pulse to fire the laser, and release the key to finish firing. When **Manual** is selected, pushing Pulse will fire the laser for precisely the period shown beside **Laser Set** in this screen.



6.4.7 Setting the Origin

When **Origin Set+** is selected, press Enter and the display will show:

Press Z/U to select an item. When **Multi Origin Enable** is selected, 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 selecting **Set Origin** or **Next Origin**, push ◀ or ▶ to select the value. When changing the parameters of **Set Origin**, press Enter to validate the change. Parameters will be saved automatically when the interface is closed.



6 Control Panel Instructions

Details of each item are shown below:

Multiple Origins Enable	Yes or No can be selected. If you select No, the system will use single-origin settings. You can press Origin and set the origin. If you select Yes, the system will use the multiple-origin settings and Origin on the keyboard becomes invalid. In this case, the parameter of each origin must be set in the menu as follows.
Set Origin 1/2/3/4	After the multiple-origin setting 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 ones of the origin 1/2/3/4.
Next Origin	Users can choose from 0–4, which represent the origins to be used for the next figure. Origin 0 refers to the origin set by Origin under the single-origin setting. 1–4 represent the origins under the multiple-origin setting. The next origin can be chosen from origin 1–4 so as to control the starting point of the next job. However, it cannot be changed to origin 0.
Origin Enable 1/2/3/4	After the multiple-origin setting is enabled, the four origins can also be individually disabled and enabled.

The system can use multiple different origins. If you select **Take the Original Origin as the Origin**, the work started for each time will use different origins. The rotation order of origin 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.

6.4.8 Setting Default Parameters

When **Set Fact Para** is selected, the following interface will be displayed:

Push ◀ or ▶ and ▲ or ▼ to select a password and press Enter to save it. The current parameters of the machine will be stored as its defaults. They can then be retrieved by using the **Restore Default Parameters** command. It is recommended that you save your machine's actual factory default settings, so they can be easily restored when need be.

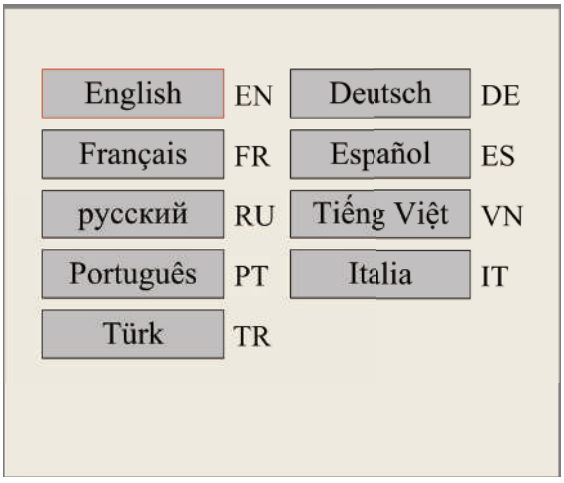
6.4.9 Restoring Default Parameters

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

6.4.10 Setting the Interface Language

When **Language+** is selected, press Enter and the display will show:

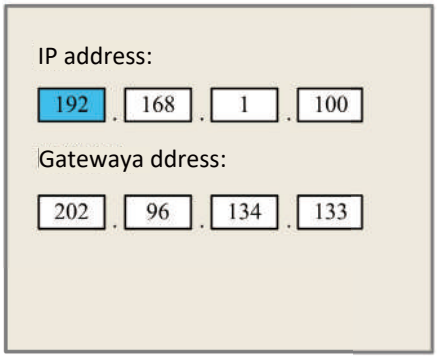
The operation method is the same as those described above. Press Enter when the desired language is selected, and then return to the main interface.



6 Control Panel Instructions

6.4.11 Setting the Machine's IP Address

When **IP Setup+** is selected, press Enter and the display will show:



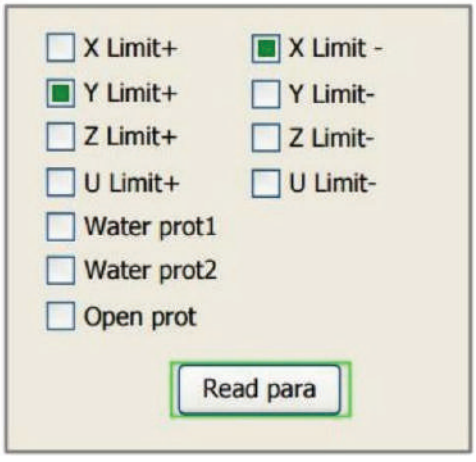
Press Z/U to select an item, and push or ◀ or ▶ and ▲ or ▼ to change the parameters. The default address of the engraver is 192.168.1.100. If this is already in use on your local network, use 192.168.1 for the first three sections and choose a unique value for the last section. Typically, any value from 2–252 except 47 should be OK but avoid values already being used by your other networked devices. Direct connection of the machine to the public internet risks unauthorized use and is not recommended. If you wish to provide it anyway, you will need to register and use a unique public TCP/IP address.

Press Enter to save the changes or Esc to discard changes and return to the previous menu.

6.4.12 Diagnostic Tools

When **Diagnoses** is selected, press Enter and the display will show:

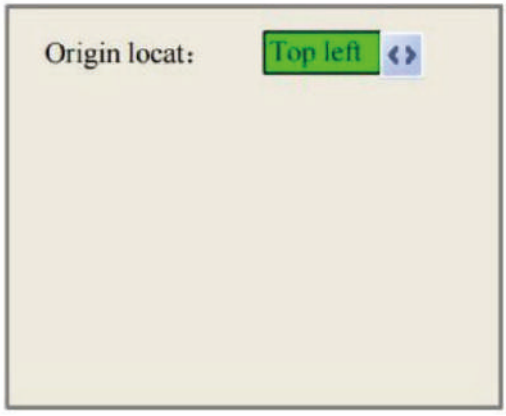
This interface contains input/output information of the system's hardware. Press Read Para. to access hardware information. When the hardware signal is triggered, the small box to the left of the corresponding item will be displayed in green, otherwise it will be gray. Press Esc to return to the previous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



6.4.13 Setting the Screen Reference

When **Screen Origin** is selected, press Enter and the display will show:

This interface sets the relative 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 those described above.

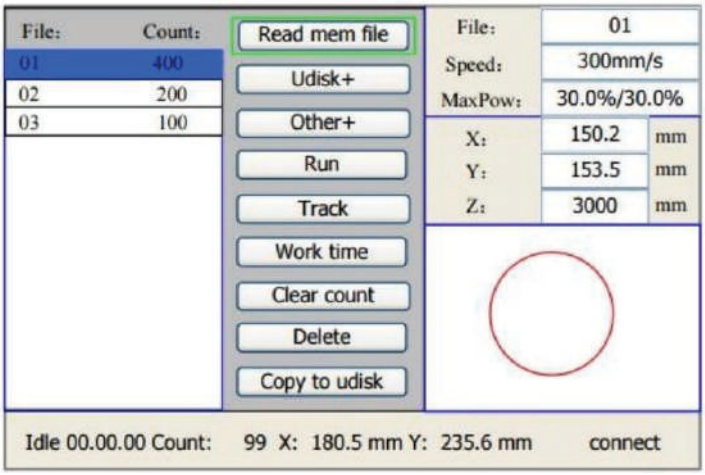


6 Control Panel Instructions

6.5 File Management

6.5.1 File Interface

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



The system will automatically read 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. Different memory files can be selected by using ▲ or ▼. Press Enter to preview the selected file on the main interface. Press to close the preview.

Push ◄ or ► , and the light blue cursor can be moved left and right to switch between file column in the left and 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 ▲ or ▼ to select the item and press Enter to activate the item. Press Esc to return to the main interface.

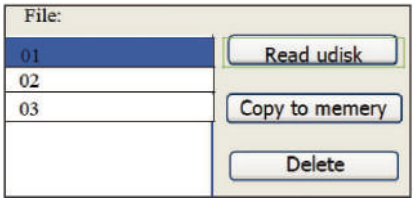
Items in the item column are as follows:

Read Mem File	Reads the list of files in the system's memory.
Udisk+	Reads the file list of an inserted USB drive.
Other+	Other operations involving the files in the system's memory.
Run	Runs the selected file.
Track	Tracks the selected file, and the track mode is optional.
Work Time	Forecasts the running time of the selected file.
Clear Count	Clears the running times of the selected file.
Delete	Deletes the selected file.
Copy to Udisk	Copies the selected file to an inserted USB drive.

6.5.2 Reading USB Files

If **Udisk+** is pressed, the display will show:

Read Udisk	Reads the file list in the inserted USB drive.
Copy to Memory	Copies the target file to the system.
Delete	Deletes the selected file from the USB drive.

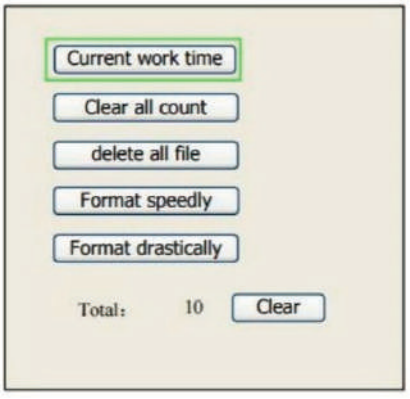


The system supports FAT16 and FAT32 formats, but files can only be identified when placed in the root directory of the flash drive. File names with more than 8 characters will be automatically truncated. File names containing characters other than English letters and numbers cannot be shown by the display. Files copied from the system to the flash drive will be placed in the root directory of the USB drive.

6.5.3 System Memory Management

If **Other+** is pressed, the display will show:

Current Work Time	Previews the running time of the current file.
Clear All Count	Clears the count of every file in the memory.
Delete All Files	Deletes all memory files.
Format Speedily	Deletes all files in memory but allows them to be retrieved by using Restore Factory Parameters (under Menu) if they have previously been backed up.
Format Drastically	Reformats the memory, IRRETRIEVABLY deleting all files in memory.
Total	The total count of all the files.



7 Maintenance

7.1 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 on a daily basis.
- 3rd mirror and the focus lens must be checked every day and cleaned if required.
- The other mirrors, exhaust system, and air assist 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.

7.2 Cleaning

7.2.1 Cleaning the Main Bay and Engraver

Cleaning Frequency: After each use

- Disconnect the engraver from power before cleaning.
- Completely wipe dry the surfaces after cleaning.
- **NEVER** allow water to come into contact with the electronic elements.

*Depending on what you've been engraving, you might need to clean the engraver more or less often. However, we suggest cleaning it after each use for the best results.

Tools Needed:

- Paper towel
- Mild detergent

Viewing Window

Clean 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.

Main Bay Interior

Clean thoroughly with paper towels, removing any debris or deposits.

Debris Tray

1. Turn off and unplug the engraver.
2. Slide out the tray.
3. Empty loose waste, rinse dust and fine debris off, dry, and replace the tray.

Other Surfaces

Dust the other surfaces with a soft cloth or clean them using a mild detergent and then wipe clean before further use.

7 Maintenance

7.2.2 Cleaning the Water System

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

Because distilled water can leach chemicals from your tank and/or hoses and spread these possibly corrosive particles to the laser tube, change your water each week regardless of its level or clarity to maximize your laser's service life.

While changing the water, clean the tank and pump completely to minimize any buildup of residue or chemicals.

1. Turn off the laser engraver and unplug the pump.
2. Open the water tank, remove the pump, and clean both.
3. Disconnect the pump's hose, allowing it to drain, and clean it if needed.
4. Reconnect the hose and replace the pump inside the tank.
5. Add your new water to the tank.
6. Plug the pump in again and allow it to run for 2–3 minutes to restore the water throughout the engraver's cooling system.

Before starting the laser, visually confirm water is running through the laser tube without bubbles and check the water temperature.

7.2.3 Cleaning the Focus Lens

The lens has a durable coating and won't be damaged by correct and careful cleaning. If not clean, your laser will be less efficient and heat buildup on the oil or dust itself can damage the lens.

Cleaning Frequency: After each use

Tools Needed:

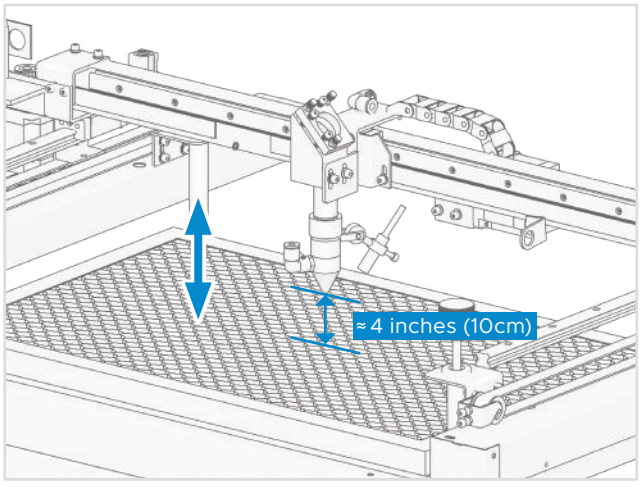
- Lens-cleaning liquid
- Lens tissue or cloth
- The focus lens repair tool (J)

- Disconnect the engraver from power before cleaning.
- Completely wipe dry the surfaces after cleaning.
- **NEVER** allow water to come into contact with the electronic elements.
- Be careful in all of the following steps not to directly touch the lens surface with your hands or any dirty, oily, or abrasive surface. Use lens-safe gloves or cloths only.

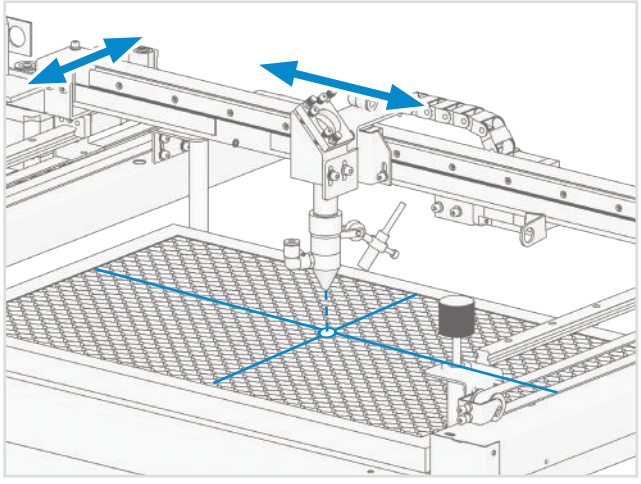
7 Maintenance

Detaching the Focus Lens

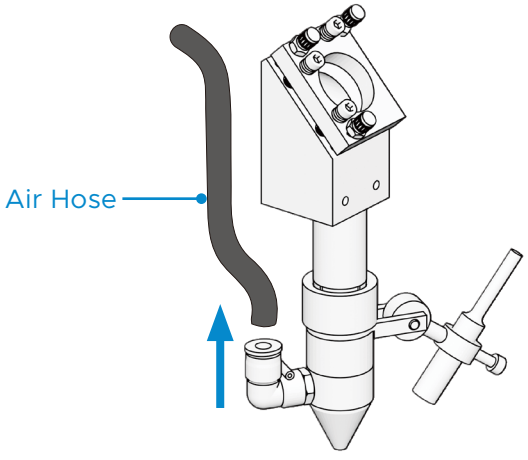
1. Move the engraving table to a distance of approximately 4 inches (10 cm) under the lens holder.



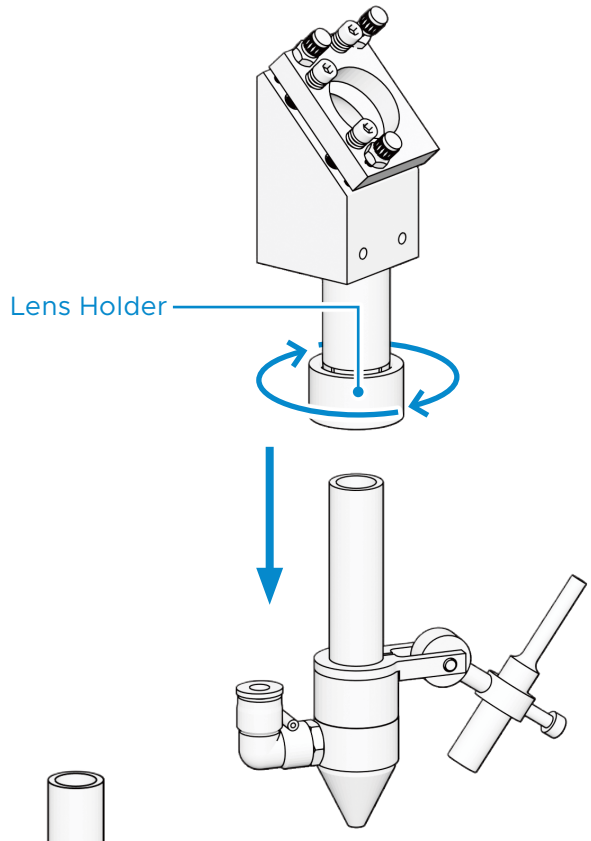
2. Move the laser head into the center of the workbed and put a cloth under the lens holder so that the lens will not be damaged if it accidentally falls from its holder.



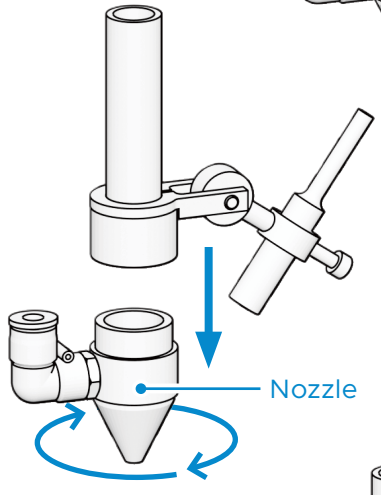
3. Remove the pressurized air hose by pressing down on the sleeve of the air hose connector while pulling the tube upward.



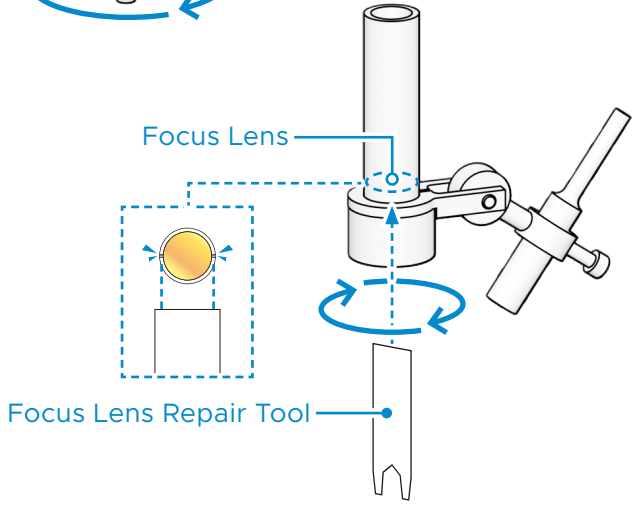
4. Remove the laser guide connections by unscrewing the lens holder counterclockwise.



5. Remove the nozzle by rotating it toward you.



6. Remove the lens from the lens holder by turning the lens holder lock ring counterclockwise with the focus lens repair tool (not inclued) and letting the lens and its O-ring drop onto the cleaning cloth.



7 Maintenance

Cleaning the Focus Lens and Its O-Ring

1. Examine the lens surface, remove coarse dust as well as possible by blowing air onto the lens surface and, if necessary, clean it with the lens cleaning liquid and lens tissue or cloth as below.
   a. Put the lens on a clean lens-cleaning tissue.
   b. Put some lens-cleaning liquid on one side of the lens.
   c. Leave the liquid to take effect for approximately one minute.
   d. Gently wipe the liquid away with lens-cleaning tissues soaked with lens-cleaning liquid.
   e. Dry this side of the lens with dry lens-cleaning tissues/cloth.
2. 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.

3. Examine the O-ring and, if necessary, clean it with a cotton bud and a lens-cleaning tissue or cloth.
4. Examine the O-ring and lens to ensure they are clean. If any dirt remains, repeat the cleaning process until both are thoroughly clean.

Do not touch the surface of the lens after cleaning.

Reattaching the Focus Lens

1. Carefully insert the lens into the lens holder, ensuring that its rounded convex side is facing upwards.
2. Put the O-ring on top of the lens.
3. Carefully reassemble the lens lock ring, the laser guide connection, and the pressurized air hose in reverse order.

7.2.4 Cleaning the Mirrors and Beam Combiner Lens

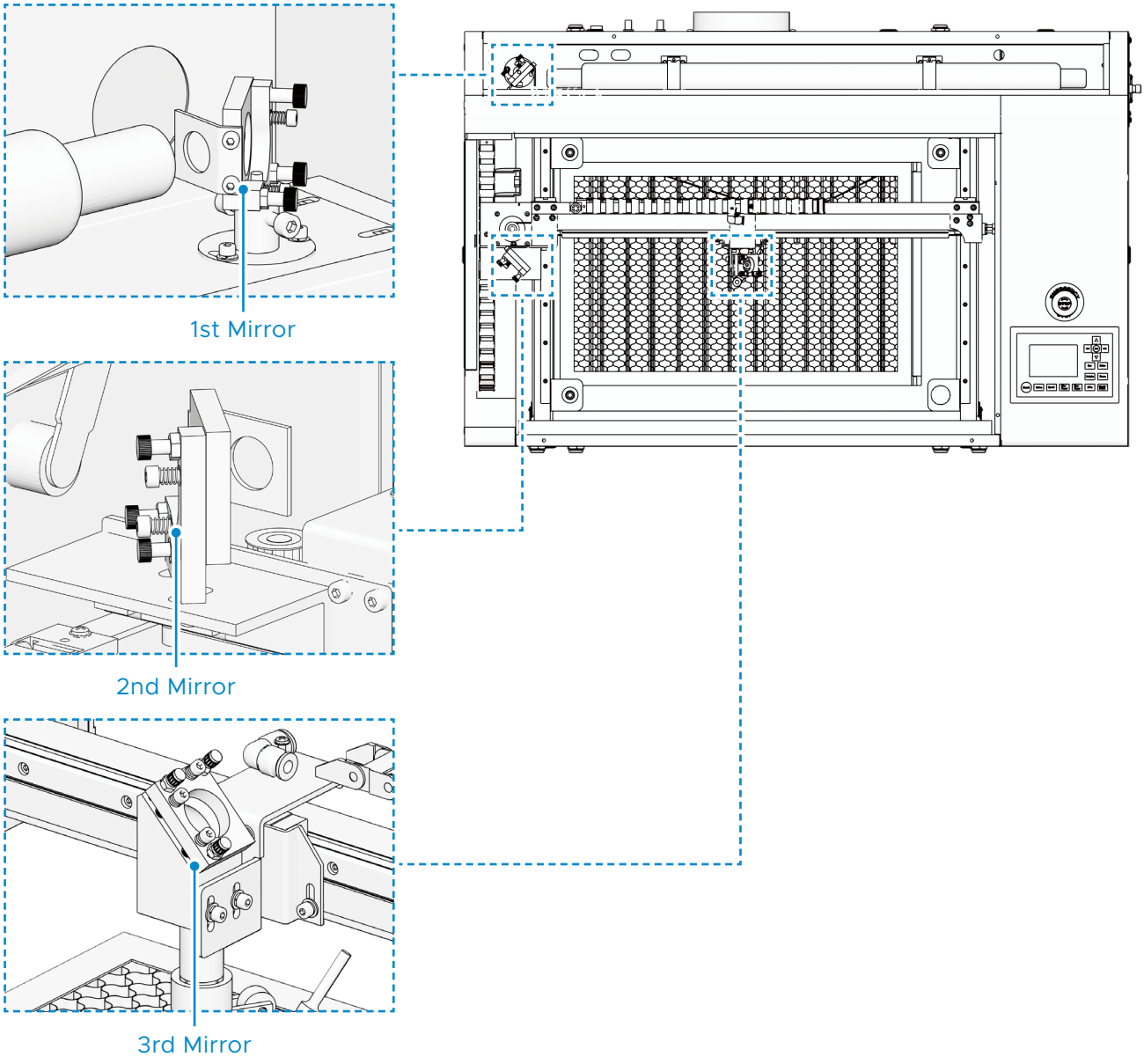
The mirrors should be similarly cleaned if there is any debris or haze on their surface. Otherwise, your laser will be less efficient and could have permanent damage on the mirrors.

Cleaning Frequency: Once a week, after each use

Tools Needed:

- Lens-cleaning liquid
- Lens tissue or cloth

This machine has 3 mirrors and one beam combiner lens used during working, for their locations and cleaning methods, see below:



7 Maintenance

<table>
<tr><th>Mirror Name</th><th>Mirror Location</th><th>Cleaning Method</th></tr>
<tr><td>1st Mirror</td><td>In the back left of the machine beyond the far end of the Y axis</td><td rowspan="4"> 

Avoid press hard enough to grind any debris or cause scratching.
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.
Take care not to touch the surface of any mirror directly.

Clean with lens-cleaning tissue or with cotton wetted with lens-cleaning liquid or isopropyl alcohol in gentle circular motions.

The 3 positioning mirrors can be cleaned in place or removed for cleaning by turning them counterclockwise.

If any mirrors are removed for cleaning, reinstall them by turning them into place clockwise carefully.</td></tr>
<tr><td>Beam Combiner Lens</td><td>The end of the laser tube closest to 1st Mirror</td></tr>
<tr><td>2nd Mirror</td><td>On the Y axis at the left end of the X axis</td></tr>
<tr><td>3rd mirror</td><td>On top of the laser head on the X axis</td></tr>
</table>

7.2.5 Cleaning the Exhaust System

Check and clean the exhaust pipes and fans. The rate of dust accumulation on the exhaust fan and pipe will vary depending on the materials processed and the working environment's air quality.

Cleaning Frequency: Weekly

Tools Needed:

- Dust brush
- Mild cleanser
- Vacuum
- Soft cloth
- Water
- Caulk

- Disconnect the engraver from power before cleaning.
- Allow the fluid used for cleaning to dry completely before reusing.

1. Check the exhaust fan and surrounding pipes for excessive accumulation of dust and debris.
   a. Use a brush, vacuum, or compressed air to remove large accumulation of dust and debris.
   b. Use mild cleansers and soft rags or paper towels to fully clean the fan and its blades.
2. Check the seams and joints of the pipes for any damage or leaks. If any found, immediately repair them. Caulk or special-purpose aluminum foil tape generally works best if available; standard duct tape can deteriorate over time, especially near heated components.

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7.3 Water Cooling System

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

Always fill the water tank with deionized or distilled water or a custom-purpose laser-safe antifreeze. Using tap water for any purpose but rinsing out cleansers (see §7.2.2 Cleaning the Cooling System above) will gradually degrade the quality of your engraver and may even cause dangerous mineral buildup within the cooling system. Never use generic antifreeze for the same reason.

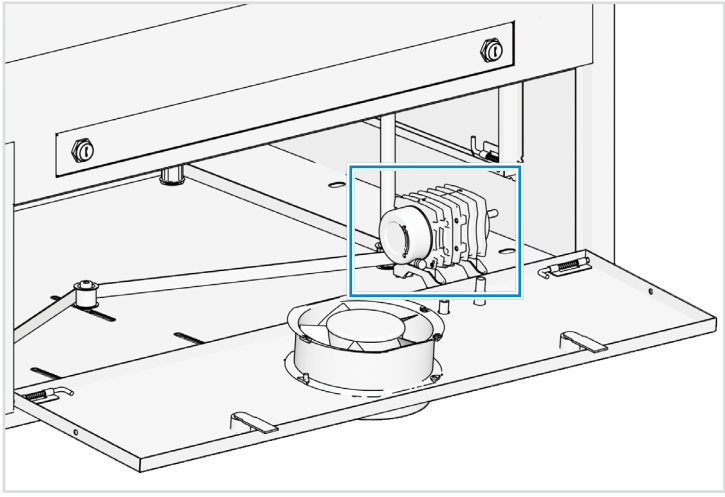
Always make sure the water cooling system is in good conditions by doing the following checks:

- 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 lasersafe coolant to avoid overheating. Check that the tank is at least 2 gallons (7.5 L) of water before and after each use.
- 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
- Ensure that the temperature of the cooling water does not fall below the dew point of the surrounding air to prevent condensation. Here are some tips to prevent condensation:
  - ✧ Use a hygrometer to monitor the temperature and humidity levels in the environment.
  - ✧ If possible, increase the ambient temperature to be lower than the temperature of the cooling water.
  - ✧ Lower the relative humidity of the room, for instance, by using a dehumidifier.
  - ✧ Insulate the cooling water pipes to reduce the likelihood of their surfaces falling below the dew point.
  - ✧ Regularly check the cooling system to ensure it is operating at optimal conditions.

Adjust the above measures appropriately according to your specific environment and equipment requirements.

7.4 Air Assist

Your air assist should arrive preinstalled and correctly wired. Simply check that it is correctly configured and connected every month. 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.

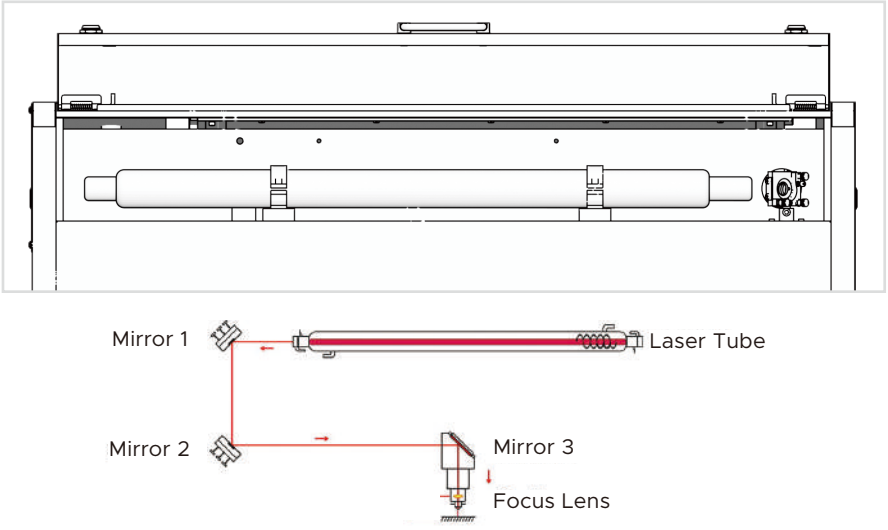


7 Maintenance

7.5 Laser Path Alignment

Having a perfectly aligned laser path is paramount to your engraver's overall performance. Each of the pro-line series went through a complete beam alignment before shipping. Upon first arrival and about once a week during normal operation, however, it is recommended that the alignment be checked. Refer to the diagram below for the basics of the alignment.

This machine went through a complete beam alignment before shipping. However, when the engraver first arrives and about once a week during normal operation, 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. Refer to the diagram below for the basics of the alignment.



The normal alignment procedures are as below:

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.

1. Place a piece of tape at each stage of the laser path. **DO NOT** place the tape directly onto the mirror.
2. Turn on the machine.
3. Set the Max. Power (not Min.) parameter to 15% or lower. Any higher percentage will cause the laser to ignite the testing tape instead of marking it.
4. Press **Pulse** to manually fire the laser and confirm that the stages remain correctly aligned.

   When it is not, use the laser tube's brackets or the setscrews on the back of the misaligned mirror to correct the problem.

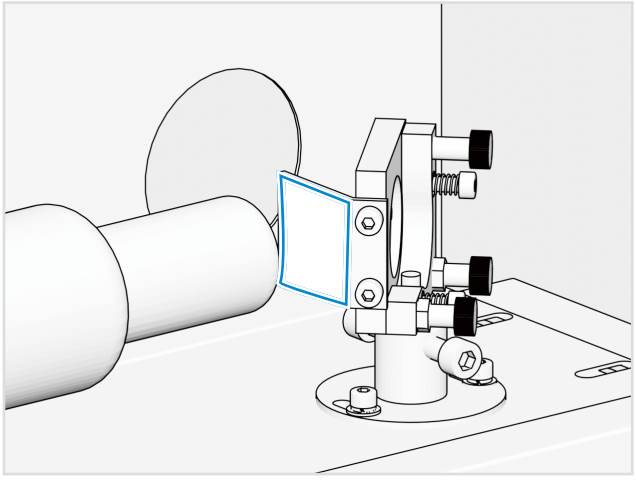
Once the provided tape runs out, we recommend masking tape as it is easy to manage and use.

7.5.1 Laser Tube Alignment

The laser tube is where the laser beam is generated. Once emitted from the tube, the laser hits 1st Mirror first. Follow the steps below to check the laser hits 1st Mirror right in the center.

- Wear safety goggles during the entire aligning process.
- Avoid attaching the tape directly to any of the mirrors.
- Less than 15% of the maximum power (not Min.) should be sufficient to leave a clear mark without setting the testing tape on fire.
- Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Always close the cover before firing the laser. Do not look directly at the active laser through the cover during this procedure.

1. Cut out a piece of masking tape and place it on the mirror's frame. **DO NOT** place the tape directly onto the mirror.
2. Turn on the machine.
3. Set the Max. Power (not Min.) parameter to 15% or lower.



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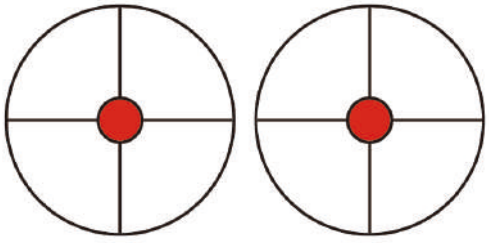
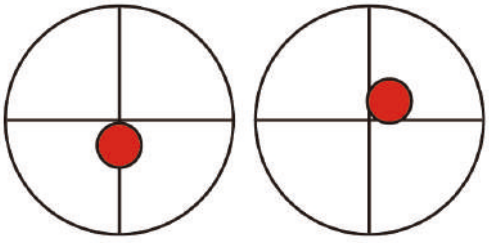
4. Press **Pulse** to manually fire the laser and observe if the laser mark is centered on the tape as below. If so, then the laser tube is aligned with 1st Mirror; if not, continue to step 5.

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.

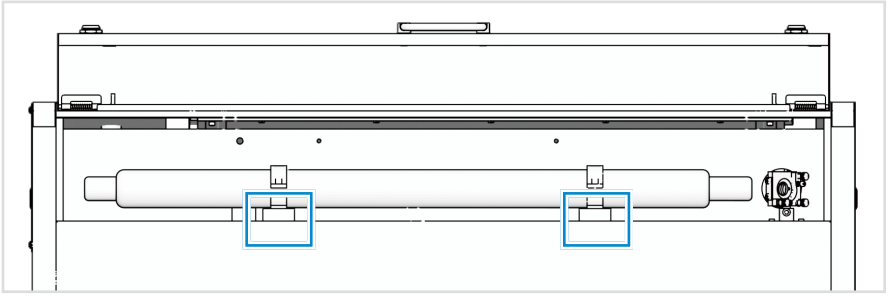


These marks are OK.



These marks require adjustment.

5. Cut the power to your laser.
6. Loosen the screws on its stand and place a shim under the bracket to raise the laser tube. Be careful not to over-loosen the setscrews and not to overtighten them. Only adjust one stand at a time.

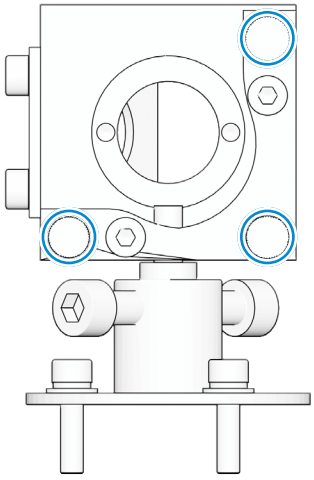


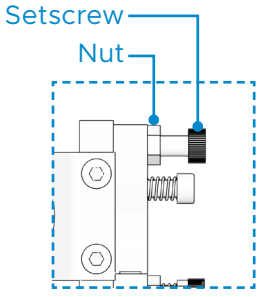
7. Repeat steps 1, 2, 4, 5, and 6 until the burnt hole is at the perfect center of the masking tape.
8. Retighten the setscrews.

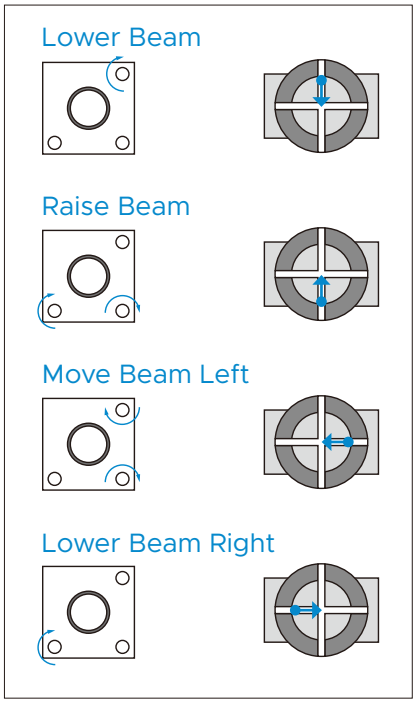
7.5.2 1st Mirror Alignment

After ensuring the laser is well aligned between the laser tube and 1st Mirror, check the alignment between 1st Mirror and 2nd Mirror.

1. Use the direction arrows on the control panel to send 2nd Mirror to the **BACK** of the bed along the Y axis.
2. Place a piece of masking tape on 2nd Mirror's frame. **DO NOT** place the tape directly onto the mirror.
3. Press **Pulse** to manually fire the laser and observe if the burnt hole is at the center of the masking tape on 2nd Mirror. If so, 1st Mirror and 2nd Mirror are aligned; if not, continue to step 4.
4. Adjust 1st Mirror's set setscrews accordingly.
   a. Loosen the nut on the setscrew.
   b. Slightly turn the setscrew 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 ¼ 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.

5. Use the direction arrows on the control panel to send 2nd Mirror to the **FRONT** of the bed along the Y axis.
6. Repeat steps 3 and 4 until the beam is well aligned. Replace the tape when necessary.
7. Retighten the nuts on the setscrews.

7.5.3 2nd Mirror Alignment

- Wear safety goggles during the entire aligning process.
- Avoid attaching the tape directly to the mirror.
- Less than 15% of the maximum power (not Min.) should be sufficient to leave a clear mark without setting the testing tape on fire.
- Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Always close the cover before firing the laser. Do not look directly at the active laser through the cover during this procedure.

After ensuring the laser is well aligned between 1st Mirror and 2nd Mirror, check the alignment between the 2nd Mirror and 3rd mirror.

1. Use the direction arrows on the control panel to send 3rd mirror to the **LEFT** of the bed along the X axis.
2. Place a piece of tape on 3rd mirror's frame. **DO NOT** place the tape directly onto the mirror.
3. Press **Pulse** to manually fire the laser and observe if the burnt hole is at the center of the tape on 3rd mirror. If so, 2nd Mirror and 3rd mirror are aligned; if not, continue to step 4.
4. Adjust 2nd Mirror's set setscrews accordingly as in §7.5.2 1st Mirror Alignment on Page 80.
5. Use the direction arrows on the control panel to send 3rd mirror to the **RIGHT** of the bed along the X axis.
6. Repeat steps 3 and 4 until the beam is well aligned. Replace the tape when necessary.
7. Retighten the nuts on the setscrews.

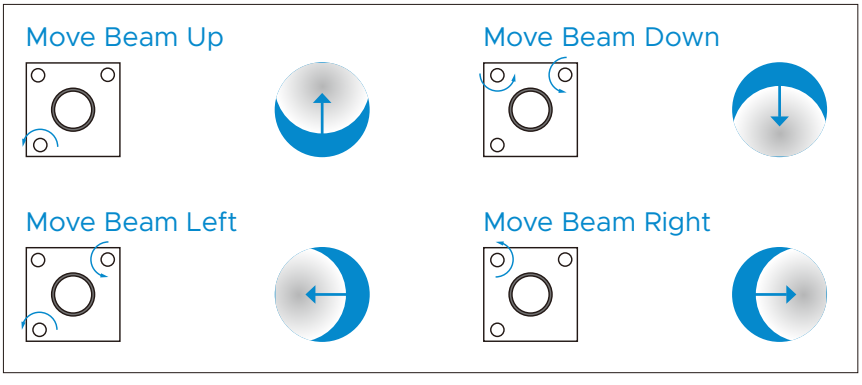
7.5.4 3rd mirror Alignment

- Wear safety goggles during the entire aligning process.
- Avoid attaching the tape directly to the mirror.
- Less than 15% of the maximum power (not Min.) should be sufficient to leave a clear mark without setting the testing tape on fire.
- Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Always close the cover before firing the laser. Do not look directly at the active laser through the cover during this procedure.

After ensuring the laser is well aligned between 2nd Mirror and 3rd mirror, check the alignment between 3rd mirror and the workbed.

1. Unplug the air assist hose from the laser head.
2. Place a piece of masking 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.
3. Lay the tape right under the laser aperture and on top of the laserable scrap.
4. 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.

   If the burnt hole is at the center of the masking tape, 3rd mirror and the workbed are aligned; if not, continue to step 4.
5. Adjust 3rd mirror's setscrews accordingly as in §7.5.2 1st Mirror Alignment on Page 80.



6. Repeat steps 2, 3, and 4 until the hole is at the center of the masking tape.
7. Retighten the nuts on the setscrews.
8. Replug the air assist hose to the laser head.
9. Turn off the machine.

7 Maintenance

7.6 Lubrication

7.6.1 Rail

Lubrication Frequency: Every two weeks

Tools Needed:

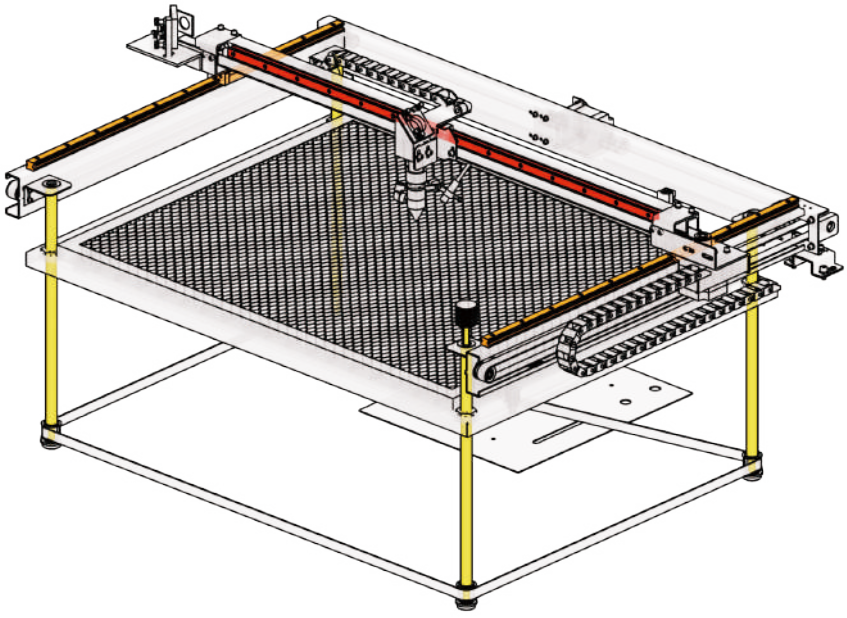
- Cotton cloth
- White lithium grease

1. Disconnect the engraver from power.
2. Gently move the laser head out of the way.
3. 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.
4. Lubricate both the rails and screws with white lithium grease.
5. Gently move the laser head and X axis to coat the lubricant evenly along both rails.
6. Raise and lower the workbed to distribute the lubricant evenly along the screws.

X-Axis Rail

Y-Axis Rails

Z-Axis Screws



7.6.2 Workbed Elevation Bolts

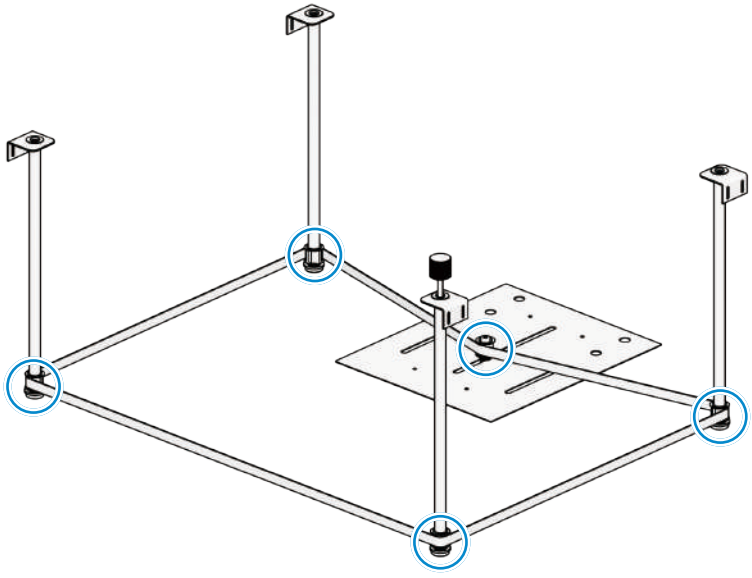
Lubrication Frequency: Every two weeks

Tools Needed:

- Cotton cloth
- White lithium grease

KEEP YOUR HAND CLEAR OF THE MOVING WORKBED WHILE APPLYING GREASE.

1. Disconnect the engraver from power.
2. Open the rear access door to access the ball screws.
3. Clean any contaminated grease off the ball screws using a piece of cloth.
4. Apply some new lithium grease at the middle of the ball screws.
5. Move the workbed along its full stroke of motion along the ball screws to distribute the lubricant evenly along the ball screws.



7 Maintenance

7.7 Parts Replacement

- 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.

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.

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_1: Neutral Wire to the Main Power

AC_2: 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

7.8 Disposal Instructions

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.

Scan for the latest user manual

USB 350I | 50W | CO_2 Cabinet Laser Engraver

User Manual

USB-0503-US Rev. 26 Dec. 2024