



# POLAR+ | 55W | CO<sub>2</sub> Desktop Laser Engraver User Manual



Read Carefully Before Use  
Keep for Future Reference



# BEAMING WITH POSSIBILITIES!

Thank you for choosing the OMTECH Polar+ as your new laser engraver!

This CO<sub>2</sub> laser is intended for personal and professional use. When used as instructed, the Polar+ is a Class IV laser system but the active laser is invisible and must be used with great care to avoid serious property damage and severe personal injury. It works by emitting a powerful laser beam from a glass tube filled with carbon dioxide, nitrogen, and insulating gases; reflecting that beam off three mirrors and through a focal lens; and using this focused light to etch designs into 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. With low intensity use, the provided tube has an average lifespan around 10,000 hours before requiring replacement. However, constantly running your laser above 70% of its rated power can significantly shorten its service life.

Read this manual before use, keep it for future reference, contact OMTECH customer service if any point is unclear, and provide it with the machine if it is ever given or sold to another person.



## 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 within 24 hours to resolve your concerns.

### Help Center

[help.omtechlaser.com/hc/en-us](https://help.omtechlaser.com/hc/en-us) | 🔍

[First Time Setup](#) | [Safety](#) | [Maintenance](#) | [Troubleshooting](#) | [FAQ](#) | [Hot Tips](#)



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### @omtechlaser



**Official Website:** [omtechlaser.com](https://omtechlaser.com)

**Technical Support:** [support@omtechlaser.com](mailto:support@omtechlaser.com)

**Support Tel:** (949) 438-4949

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

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# 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 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.

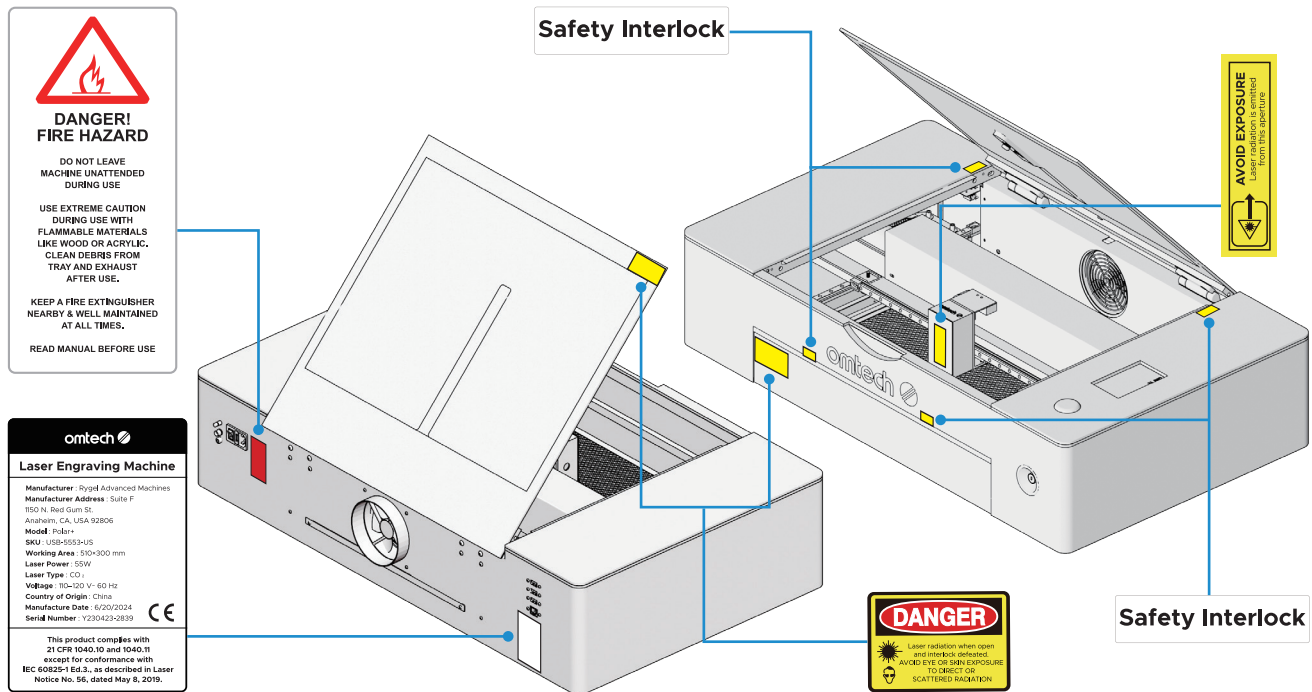


This product contains electrical components that should not be disposed of with regular garbage.

# 1 Safety Information

## 1.3 General Safety Instructions

- Your engraver should come with instruction labels in the following locations.





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

- Use this laser engraving engraver only in accordance with all applicable local and national laws and regulations.
- Use this engraver only in accordance with this instruction manual and the manual for the engraving software included with it. Only allow this engraver to be installed, operated, maintained, repaired, etc. by others who have also read and understood both manuals. Ensure that this manual and the software manual are both included with this engraver if it is ever given or sold to a third party.

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


In the United States, the Polar's wireless network is a certified transmitter module that emits radio signals in compliance with 47 CFR 15 for commercial locations but may require operators to provide additional equipment in residential areas to avoid interfering with emergency and FCC licensed broadcasts. Similarly, the Safe Use of Lasers (Z136) standards published by the American National Standards Institute do not have the force of law, but adherence to its provisions may be required by some companies or local authorities to minimize risk and liability. In particular, it may be necessary in commercial settings to formally designate a laser safety officer, to post warning signs in areas with active lasers, and to document that all operators of laser equipment have been properly trained.

- **DO NOT** operate this engraver with its cooling liquid hotter than 104°F (40°C). If this temperature is ever approached, stop using the laser but allow the exhaust and water-cooling systems to continue running to clear and cool the machine.
- **DO NOT** leave this engraver unattended during operation. Observe the engraver throughout the operation and, if anything seems to be operating strangely, immediately cut off **ALL** power to the machine and contact either our customer service or your dedicated repair service. Similarly, ensure the engraver is **FULLY** turned off (including using the emergency stop switch) after each use. 
- **DO NOT** allow minors, untrained personnel, or personnel suffering from physical or mental impairment that would affect their ability to follow this manual and the software manual to install, operate, maintain, or repair this engraver.
- Any untrained personnel who might be near the engraver while it is in operation **MUST** be informed that it is dangerous and fully instructed on how to avoid injury during its use.
- **ALWAYS** keep a fire extinguisher 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 the extinguisher too close to the flame, as its high pressure can produce blowback. 

## 1.4 Laser Safety Instructions

This machine 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.

When used in accordance with these instructions, it is a Class 1 laser product. But it embeds a Class 4 laser system and some components remain **EXTREMELY** dangerous under improper and/or non-intended use. Used or modified without care, they can cause serious property damage and personal injury including but not limited to the following:

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

As such,

- **DO NOT** modify or disable this engraver'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.

# 1 Safety Information

- **NEVER** leave any part of the engraver open during operation except (when needed) the pass-through doors. Never interfere with the laser beam, do not place any part of your body in any part of the laser path during operation, and never attempt to view the laser directly. When using the pass-through doors or otherwise risking exposure to the laser beam, take measures to protect yourself from potentially reflected laser beams including the use of personal protective equipment such as protective eyewear specially designed to filter the specific wavelength of your engraver's laser with an optical density (OD) of 5 or higher.
- **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. Exercise caution with the red dot positioning light as well, as its direct beam is a Class 2 laser in its own right.
- **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 [§5 Initial Testing](#) on Page 43) before undertaking any other work. Do not continue use if the shutoffs do not occur. Turn off the engraver and contact customer service or your repair service. Never disable these shutoffs.
- **DO NOT** ever under **ANY** circumstances use this laser engraver if the water-cooling system is not working properly. Always activate the water-cooling system and visually confirm that water is flowing through the entire system before turning on the laser tube. Immediately stop use if the water-cooling system malfunctions.
- **DO NOT** use generic antifreeze in your cooling water, as they may leave corrosive residues and solidify inside your hoses and piping, causing malfunctions and even explosions. Use custom laser-safe formulations or use and store your engraver in a climate-controlled area.
- **DO NOT** leave potentially combustible, flammable, explosive, or corrosive materials nearby where they could be exposed to the direct or reflected laser beam.
- **DO NOT** use or leave sensitive EMI equipment nearby. Ensure the area around the laser is free of strong electromagnetic interference during any use.
- **ONLY** use this machine for working the materials described in the Material Safety section of this manual. The laser settings and engraving process must be properly adjusted for specific materials.
- Ensure the area is kept free of other airborne pollutants, as these might pose a similar risk of reflection, combustion, etc.

## 1.5 Electrical Safety Instructions

- **ONLY** use this engraver with a compatible and stable power supply with less than **5%** fluctuation in its voltage.
- **DO NOT** connect other devices to the same circuit, as the laser system may require its full amperage.



- **DO NOT** use standard surge protectors, extension cords, or power strips. Only use additional wiring thick enough to safely handle the full load of the machine. Use only surge protectors rated over 2000 J.
- **ONLY** turn on the power to this engraver 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 grounding port on the engraver. Do not use an ungrounded 3-to-2 prong adapter. The engraver's grounding should be checked regularly for any damage to the line or loose connections.
- The area around this laser engraving engraver should be kept dry, well-ventilated, and environmentally controlled to keep the ambient temperature between **40°F–104°F (5°C–40°C)**. For best results, keep the temperature at **75°F (25°C)** or below. The ambient humidity should remain between **20%–85%**.
- Adjustment, maintenance, and repair of the electrical components of this engraver 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 engraver when it is turned off, disconnected from its power supply, and fully cooled.

## 1.6 Material Safety Instructions

- Users of this laser engraving machine are responsible for confirming that the materials to be processed can withstand the heat of the laser and will not produce any emissions or byproducts either harmful to people nearby or in violation of local or national laws or regulations. In particular, do not use this engraver to process polyvinyl chloride (PVC), Teflon, or other halogen-containing materials under any circumstances.
- Users of this laser engraver are responsible for ensuring that every person present during operation has sufficient PPE to avoid injury from the emissions and byproducts of the materials being processed. In addition to the protective laser eyewear described above, this may require goggles, masks or respirators, gloves, and other protective outer clothing. Always wear hand protection when working with metal to avoid cuts and burns.
- **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 hose malfunctions. Periodically check the air assist intake filter to ensure it stays free of any dust or debris.
- Exercise special caution when working with moderately conductive materials such as carbon steel and stainless steel, as prolonged work can build up residual heat and reflective dust and particles that may damage electrical components, cause short circuits, or produce other effects including reflected laser radiation.

# 1 Safety Information

This machine can be safely used with the following materials:

## Plastics

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

## Other

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

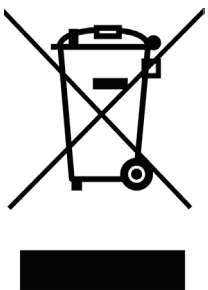
See [§6.4 Instructions for Specific Materials](#) on Page 73 for the recommended parameters for the most commonly engraved materials.

This machine **CAN NOT** be used with the following materials or with any materials that include them:

- Artificial Leather containing Hexavalent Chromium (Cr [VI]), due to its toxic fumes
- Astatine, due to its toxic fumes
- Beryllium Oxide, due to its toxic fumes
- Bromine, due to its toxic fumes
- Chlorine, including Polyvinyl Butyral (PVB) and Polyvinyl Chloride (PVC, Vinyl, Sintra, 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 engraver, seek out its material safety data sheet (MSDS). Pay special attention to information about safety, toxicity, corrosiveness, reflectivity, and reaction(s) to high heat. Alternatively, contact our support department for further guidance.

## 1.7 Disposal Safety 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. This engraver's R-410A refrigerant also requires special handling for reuse or legal disposal. Contact your local authorities or dealer for advice.

# 2 Introduction

## 2.1 General Information

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

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

Your laser engraver works by emitting a powerful laser beam from a glass tube filled with excited carbon dioxide (CO<sub>2</sub>), catalyzing nitrogen (N<sub>2</sub>), and insulating gases, reflecting that beam off three mirrors and through a focus lens, and using this focused light to etch designs into certain substrates. The active laser is invisible to the human eye. This device should never be used while any cover or access panel is open to avoid potentially permanent injury. When its pass-through is used, care should be taken to avoid possible reflective rays.

The laser tube typically travels along the Y axis during engraving. The first mirror is fixed near the left end of the laser tube, the second mirror is fixed nearby, and the third mirror is attached to the laser head that travels along the X axis. The first and second mirrors are located within protective housing but, because dust is generated by the engraving process, the 2nd mirror's window, the 3rd mirror, and the focus lens require frequent cleaning.

With low-intensity use, the provided laser tube has an average lifespan of around 11,000 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.

The cover's viewing window naturally absorbs most reflected beams from the high infrared laser but it is **NOT** otherwise protected against it. Protective eyewear should **ALWAYS** be used by **EVERYONE** present when the laser is active. Such eyewear should be at least OD6 at the laser's main wavelength of 10.6 microns.

The integrated water-cooling system must be used with this engraver to dissipate the heat produced by the laser tube. Similarly, the provided exhaust system must be used in conjunction with an external vent or dedicated air purifier to remove the dust and gases produced by the engraving process and ensure compliance with laws and regulations for workplace and environmental air quality. **NEVER** operate the engraver without both of these systems operating properly.

Note that this device broadcasts signals in the radio spectrum as part of its wireless connectivity. Special shielding or equipment may be necessary to minimize interference with emergency & licensed broadcasting, particularly in residential areas.



## 2.2 Designated Use

The Polar+ 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.

# 2 Introduction

## 2.3 Specifications

Model		Polar+	
Input Power		AC 110 V, 60 Hz	
Power Consumption		600 W	
Rated Power		55 W	
Expected Service Life at <40% / 40–70% / >70% Power		11,000 / 10,000 / 8,000 hr.	
Laser Wavelength		10.6 $\mu\text{m}$ (10,600 nm)	
Laser Tube	Diameter	2.2 in.	55 mm
	Length	35 in.	890 mm
Mirror	Diameter	0.8 in.	20.5 mm
	Thickness	0.12 in.	3 mm
Focus Lens	Diameter	0.6 in.	15.5 mm
	Thickness	0.08 in.	2 mm
	Focal Length	2 in.	50.8 mm
Honeycomb Workbed Dimensions		22.5×13.2×0.9 (in.)	571×336×22 (mm)
Processing Area	Standard (L×W)	20.1×11.8 (in.)	510×300 (mm)
	Trayless (L×W)	13.7×8.2 (in.)	350×210 (mm)
	Rotary 1 (L×D)	L: 0–9.4 (in.) D: 2.4–2.9 (in.)	L: 0–240 (mm) D: 60–75 (mm)
	Rotary 2 (L×D)	L: 0–9.4 (in.) D: 1.2–2.3 (in.)	L: 0–240 (mm) D: 30–60 (mm)
Front/Back Pass-Through Area (L×H)		14.1×0.19 (in.)	360×5 (mm)
Max. Processing Speed		19.6 ips	500 mm/s
Rec. Processing Acceleration	X Axis	196 ips <sup>2</sup>	5000 mm/s <sup>2</sup>
	Y Axis	118 ips <sup>2</sup>	3000 mm/s <sup>2</sup>
Max. Material Thickness	Standard	0.67 in.	17 mm
	Without Workbed	2 in.	51 mm
Max. Resolution		1000 dpi	
Min. Letter Size		0.04×0.04 (in.)	1×1 (mm)
Mainboard		RDC6445G	

Integrated Water Pump	Capacity	1.5 L	
	Flow Rate	540 L/hr.	
Integrated Air Assist	Port Diameter	0.3 in.	8 mm
	Air Flow	13.8 cfm	392 L/min.
Integrated Digital Camera	Max. Resolution	5 MP	
	Field of View	20.1×11.8 (in.)	510×300 (mm)
	Accuracy	±0.04 in.	±1 mm
External Exhaust Fan	Rated Power	60 W	
	Port Diameter	5.9 in.	150 mm
	Air Flow	282/353 (cfm)	480/600 (m <sup>3</sup> /hr.)
Req. Operating Environment	Humidity Range	20–85 (%)	
	Temp. Range	40–104 (°F)	5–40 (°C)
Compatible Operating Software		LightBurn, RDWorks V8	
Supported Image Formats		.ai, .bmp, .dxf, .gif, .hpgl, .jpeg, .pdf, .plt, .png, .rd, .svg, .tiff, .tga	
Dimensions		38.2×22.3×9.2 (in.)	970×565×234 (mm)
Net Weight		104 lb.	47 kg

# 2 Introduction

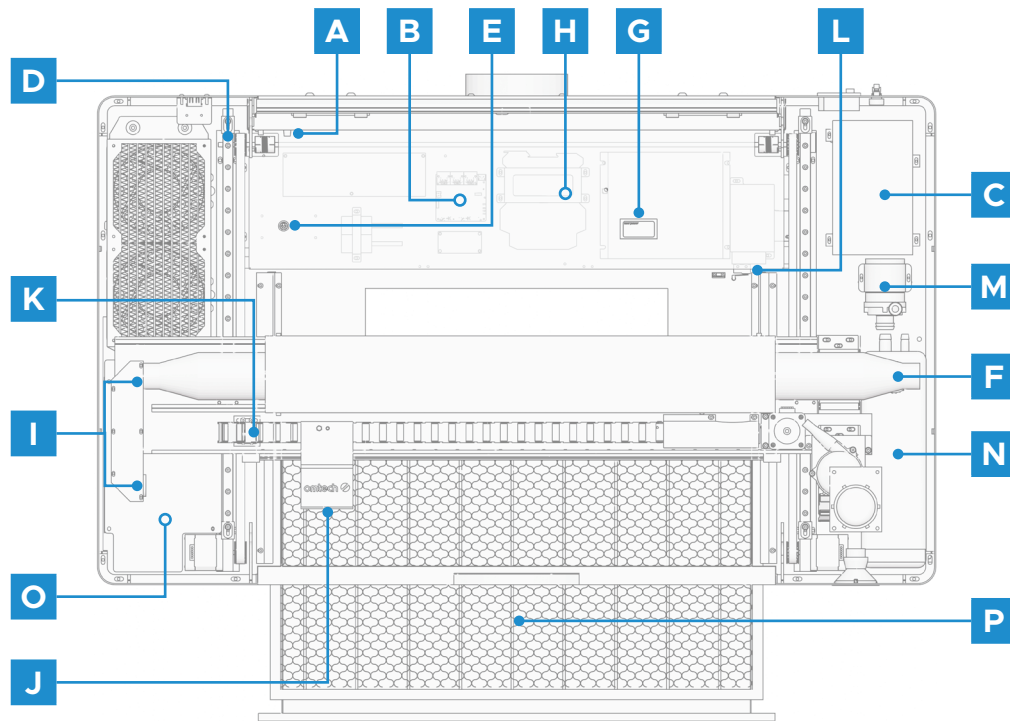
## 2.4 Package List



Item	Name	Qty.		
1	4-wheel Rotary Axes with Its Aviator Connection Cord	2		
2	Rotary Cables	2		
3	60 W Duct Fan	1		
4	Fan Remote Control	1		
5	Adapter Ring	1		
6	Exhaust Pipes Diameter 150 mm, Length 2 m ×1; Diameter 120 mm, Length 3 m ×1	2		
7	Hose Clamps Diameter 150 mm ×1; Diameter 120 mm ×2	3		
8	1.5 m Main Power Cord	1		
9	1.5 m Ethernet Cable	1		
10	1.5 m USB Cables	2		
11	Big Storage Box	a	Cotton Swab ×1	1
		b	Height Ruler ×1	
		c	Focal Ruler ×1	
		d	Laser Keys ×2	
		e	Remote Interlock Connector ×1	
		f	A Set of Hex Wrenches ×1	
		g	A Bag of Target Discs ×1	
		h	A Bag of O-Rings ×1	
		i	Reference Board ×1	
		j	USB Drive With Engraving Software ×1	
		k	Marker ×1	
		l	Air Tube Connector ×1	
		m	Focusing Head ×1	
12	Small Storage box: 4×110V/20A Fuses	1		
13	3 mm Basswood, Cardboard, and Acrylic Blanks	5		
14	Straps	2		

# 3 Components

## 3.1 Top View

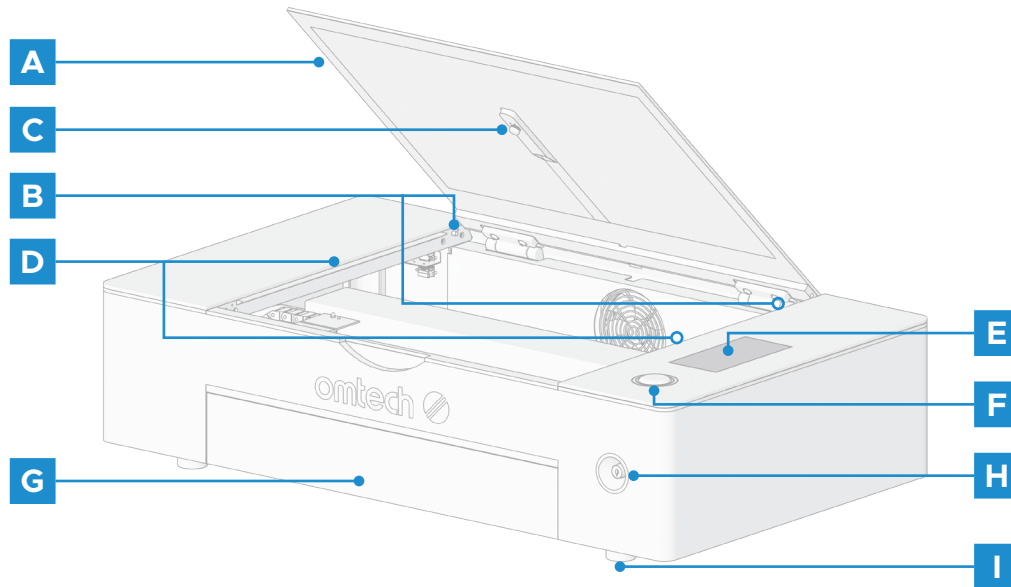


A	<b>Rotary Plug</b>	This small aviation plug connects to the provided rotary axes to provide them with power and command signals.
B	<b>Wifi Card</b>	The 2.4 GHz wireless terminal device located behind the central part of the rear panel provides wifi connectivity for your engraver.
C	<b>Laser Power Supply</b>	This device transforms standard electricity into the extremely high voltage charge necessary for the laser tube.
D	<b>Y-Axis Rail</b>	The Y-axis rail supports the movement of the laser tube and the X-axis rail up and down the workbed.
E	<b>Rotary Switch</b>	This switch directs the mainboard and power supply to provide power and commands to the Y-axis rail ( <b>Standard</b> ) or to a rotary axis ( <b>Rotary</b> ) connected to the rear aviation plug.
F	<b>Laser Tube</b>	This CO <sub>2</sub> -filled glass tube is mounted beside the X-axis rail within a protective housing. They normally move together along the Y-axis rail. The laser's connection to its power supply is extremely high voltage and extremely dangerous.
G	<b>Ammeter</b>	This digital display provides the current of the laser in milliamps (mA).
H	<b>Air Assist</b>	This small air compressor directs pressurized air through a narrow tube to the laser head. To minimize noise, it only activates with the laser.

I	<b>1st &amp; 2nd Mirrors</b>	The protective housing for these fixed mirrors moves with the laser tube and X-axis rail to allow the laser beam to travel along the Y axis.
J	<b>Laser Head</b>	The laser head holds the 3rd mirror, focus lens, and air assist outlet and directs the laser beam down into your materials. Its components are normally protected by a rectangular shell that locks magnetically into place.
K	<b>X-Axis Rail</b>	The X-axis rail supports the movement of the laser head left and right across the workbed. When using either of the rotary axes, this rail should be positioned to connect the matching arrows.
L	<b>Tray Interlock</b>	This switch stops your laser when the debris tray is removed. For pass-through and rotary engraving, close this switch using the nearby bracket.
M	<b>Water Pump</b>	This pump circulates your water or laser-safe coolant through the laser tube to keep it cool and stable.
N	<b>Water Tank</b>	This tank helps keep your laser tube cool and stable. It arrives full of OMTech antifreeze but can also be replaced with distilled water.
O	<b>Mainboard</b>	This circuit board located under the left panel controls the engraving process, responding to commands from your computer's engraving software. It has a total memory of 128 MB, about 95 MB of which is available to store designs.
P	<b>Honeycomb Workbed</b>	The workbed supports your material up to 0.59 inches (15 mm) thick while allowing effective airflow. It can also be removed to fit thicker materials or to use the rotary axes. There are vertical and horizontal inch and cm rulers on opposite sides of the bed.

# 3 Components

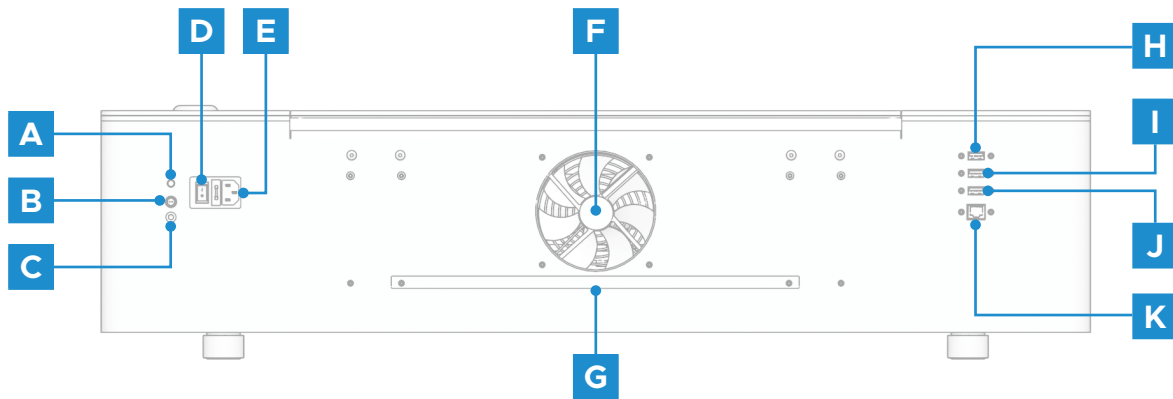
## 3.2 Front View



A	<b>Cover</b>	This acrylic window allows you to monitor the engraving process, absorbing most reflected laser beams. However, always use protective eyewear when observing the active laser and never stare at it for extended periods.	
B	<b>Cover Interlocks</b>	These switches automatically pause work if the cover is opened.	
C	<b>Camera</b>	This fisheye camera helps you position your designs precisely.	
D	<b>LED Light Strips</b>	These integrated lights help keep your workbed easy to see.	
E	<b>Digital Touch screen</b>	This is the main control panel for the laser.	
F	<b>Start Button and Laser Status</b>	This button can be used to pause and restart engraving or to repeat the previously loaded design with its former settings. To start a new design or engrave with adjusted settings, use your software's commands. The ring around the button changes color to indicate your engraver's current status:	
		<b>Status Color</b>	<b>Meaning</b>
		Blue	Active Laser
Green	Ready to Work		
Red	Error or Malfunction		
G	<b>Debris Tray</b>	This tray is easily removable to clean debris after use and to install or remove the honeycomb workbed. It can also be left open to function as the front pass-through.	
H	<b>Laser Key</b>	This lock turns the laser power supply on and off, helping ensure that only approved operators can use your laser.	
I	<b>Legs</b>	These padded legs help avoid any damage to your table or counter.	



### 3.3 Rear View

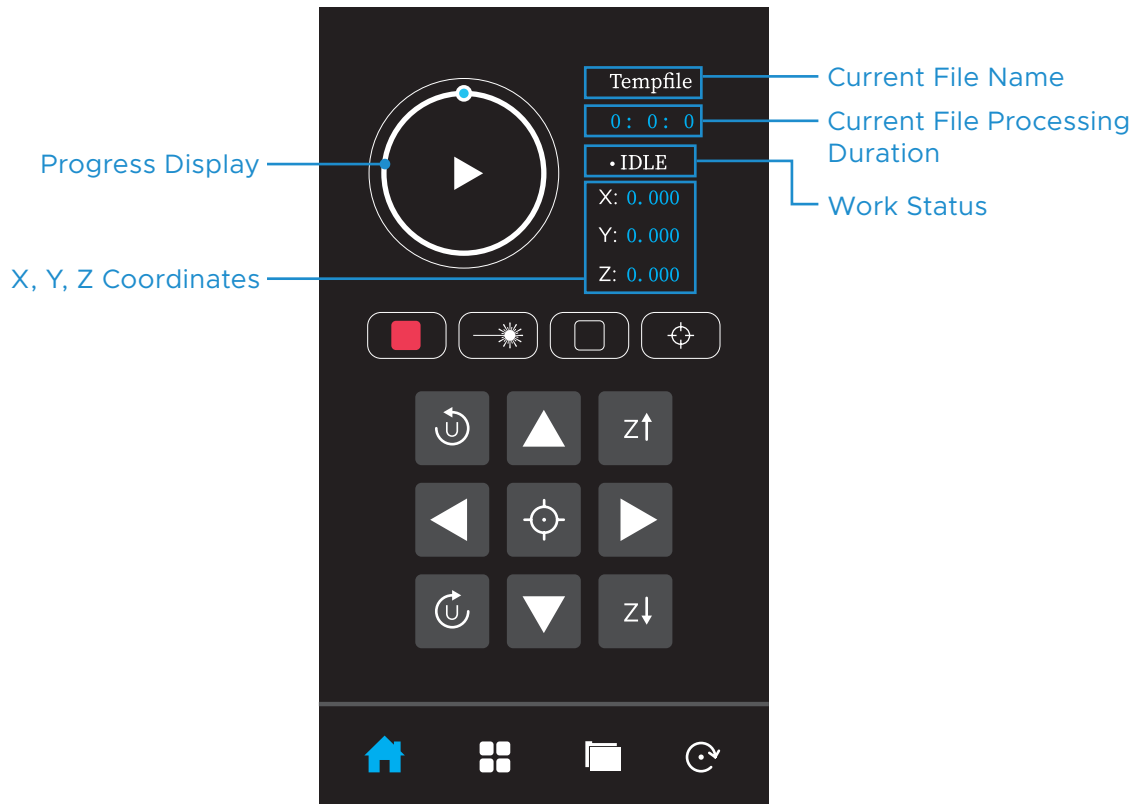


A	<b>Beam Attenuator</b>	This dial provides a master power control for your engraver. It should be turned completely clockwise to enable your software to use the engraver’s full power range.
B	<b>Remote Interlock Connector</b>	This port functions as a second key necessary to activate the laser tube. Insert the provided switch to enable the laser or remove it to completely disable the laser.
C	<b>Grounding Port</b>	This is an optional grounding port. You can either ground this engraver via a firm connection to a 3-prong outlet or via a dedicated grounding cable firmly connected to this grounding port.
D	<b>Power Switch</b>	This switch turns on the engraver’s mainboard, cooling system, LED lighting, and wireless card and places the exhaust fan and air assist into standby mode, ready to activate with the laser. It should always be turned off between sessions.
E	<b>Power Socket</b>	This socket connects to your main power supply and grounds your machine’s electronic components.
F	<b>Exhaust Fan</b>	This fan pulls out gases and airborne debris from the workbed, sending it through your vent to a window or air purifier. To minimize noise, it only activates with the laser.
G	<b>Rear Pass-Through</b>	This door can be unsealed to allow larger pieces of material to be fed into or across the workbed. Additional care must be taken to avoid exposure to the laser beam and its reflections when it is open.
H	<b>External USB</b>	This USB allows you to load and save designs and parameters directly onto the engraver. Only .rd files that are located under the root directory in a FAT32 USB disk are supported.
I	<b>Camera Port</b>	This USB port connects the engraver’s camera to your control computer and engraving software.
J	<b>Computer Port</b>	This USB port connects the engraver’s mainboard to your control computer and engraving software.
K	<b>Ethernet Port</b>	This port allows a fast connection between the engraver’s mainboard and your control computer via the internet.










# 3 Components

## 3.4 Touch Screen

### 3.4.1 Home Interface

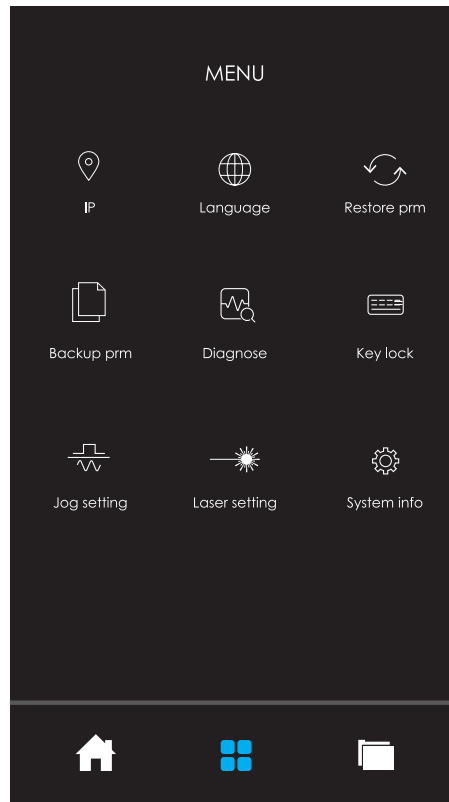






Button	Function	Definition
	<b>Start/Pause</b>	Starts or pauses/restarts work.
	<b>Stop</b>	Stops work.
	<b>Pulse</b>	Fires the laser.
	<b>Frame</b>	Checks out boundaries for the current pattern.
	<b>Autofocus</b>	Autofocuses the leaser.






Button	Function	Definition
	<b>U Axis Coordinate</b>	Moves the U Axis counterclockwise or clockwise.
	<b>Z Axis Coordinate</b>	Moves the Z Axis up or down.
	<b>Y Axis Coordinate</b>	Moves the Y Axis up or down.
	<b>X Axis Coordinate</b>	Moves the X Axis left or right.
	<b>Position</b>	Sets a positioning point.
	<b>Home</b>	Enters the home interface.
	<b>Menu</b>	Enters the menu.
	<b>File</b>	Enters the file interface.
	Reset	Resets the mainboard.

# 3 Components

## 3.4.2 Menu Interface

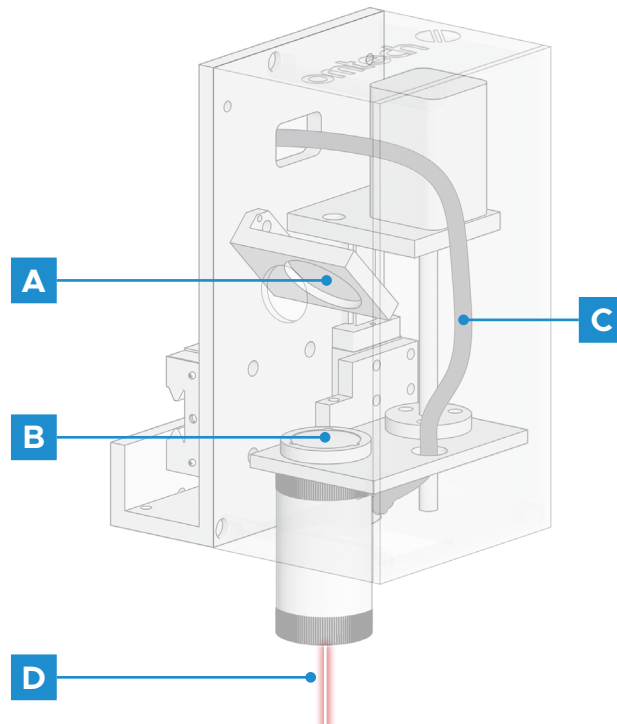


Button	Function	Definition
	<b>IP</b>	<p>Sets the IP.</p> <p>When entering the interface, the current IP address of the board will be read.</p> <p>When touching the dialog box for the IP address, a small keyboard will pop up. Users can modify the host IP address using the keyboard. Once the input is complete, click <b>OK</b>.</p>
	<b>Language</b>	<p>Sets the language.</p> <p>When entering the interface, the gray box represents the currently used language. Select the desired language to switch to, click <b>OK</b>, and the home interface will pop up with the selected language switched.</p>
	<b>Restore PRM</b>	<p>Restores the values of <b>Jog Mode</b>, <b>step length</b>, <b>Pulse Mode</b>, and <b>Laser Time</b>.</p>
	<b>Backup PRM</b>	<p>Backups the values of <b>Jog Mode</b>, <b>step length</b>, <b>Pulse Mode</b>, and <b>Laser Time</b>.</p>

Button	Function	Definition
	<b>Diagnose</b>	Displays the hardware IO port information of the system. Upon entering the interface, the system hardware information is read.
	<b>Key Lock</b>	<p>Locks the home interface.</p> <p>In the locked home interface, parameters such as <b>Current Processing File Name, Processing Progress, Processing Time</b>, etc., will be displayed normally, but only unlocking operations can be performed.</p> <p>Upon successful unlocking, it will jump to the normal home interface. If unlocking fails, it will return to the locked home interface.</p>
	<b>Jog setting</b>	<p>Sets the Jog mode between <b>Jog</b> and <b>Continuous</b>.</p> <ul style="list-style-type: none"> <li>When the Jog mode is set to <b>Jog</b>, each press of the direction key will move the corresponding axis once, with the distance equal to the step length.</li> <li>When the Jog mode is set to <b>Continuous</b>, the <b>step length</b> parameter is not effective. Pressing the direction key will move the axis, and releasing the direction key will stop the axis.</li> </ul>
	<b>Laser setting</b>	<p>Sets the laser mode between <b>Pulse</b> and <b>CW</b> (continuous wave).</p> <ul style="list-style-type: none"> <li>When the laser mode is set to <b>Pulse</b>, each press of the <b>Start</b> key will emit laser once, with the laser duration set by the user as the Laser time value.</li> <li>When the laser mode is set to <b>Continuous</b>, pressing the <b>Start</b> key will keep the laser on, and releasing the <b>Start</b> key will turn off the laser.</li> </ul>
	<b>System info</b>	Shows the system information.

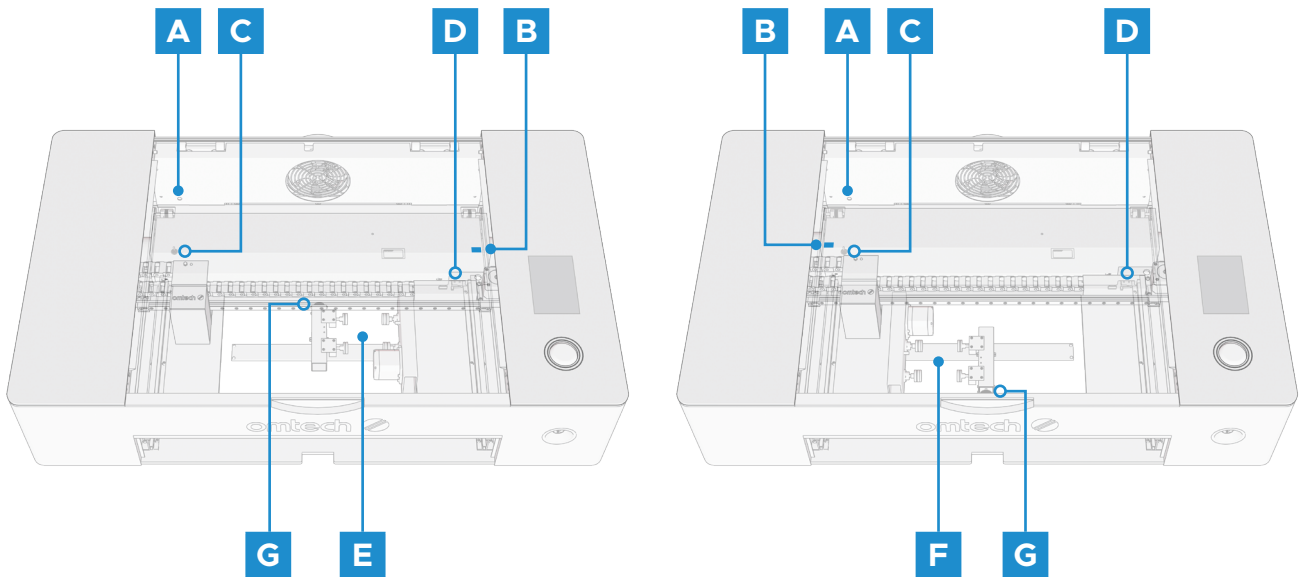
# 3 Components

## 3.5 Laser Head



A	<b>3rd Mirror</b>	This fixed mirror transfers the laser from the 2nd mirror at the end of the X-axis rail downward to the focus lens.
B	<b>Focus Lens</b>	This 15.5 mm lens directs and focuses the laser beam to its point of contact with your material.
C	<b>Air Assist</b>	This tube provides the pressurized air from its compressor to kill sparks and minimize dust and gases.
D	<b>Laser Beam</b>	The engraving laser itself is invisible but highly dangerous. Avoid any direct exposure to your skin or eyes.

### 3.6 Rotary Axes



A	<b>Rotary Aviation Plug</b>	This plug should be covered during normal engraving. When you use the rotary axes, the 4-pin connection will power and direct the rotary motor.
B	<b>Alignment Arrows</b>	These arrows indicate the correct position of the laser and the X-axis rail for use with Rotary Axis 1 (on the right) or Rotary Axis 2 (on the left).
C	<b>Rotary Switches (covered)</b>	These switches redirect power and control from the Y-axis motors to the rotary axis connection and back again.
D	<b>Tray Interlock</b>	<p>This switch must be held closed by the nearby bracket during rotary engraving. Remember to reenale the switch by removing the bracket after your work.</p> <p>This is the only safety feature that should ever be circumvented. You will need to disable this switch—located at the back right side of the main bay near the ammeter—when engraving thick materials or while using the front pass-through or the rotary axes.</p>
E	<b>Rotary Axis 1</b>	This four-wheel rotary axis is installed into the bottom left corner of the open bay as shown. The arrow at the end of the laser tube casing should be aligned with the arrow marked 1 on the right side.
F	<b>Rotary Axis 2</b>	This four-wheel rotary axis is also installed into the bottom left corner of the open bay as shown but the arrow at the end of the laser tube casing should be aligned with the arrow marked 2 on the left side.
G	<b>Height Adjustment Knob</b>	Turn this knob to adjust the height of the right-side wheels when it is necessary to create a level surface while engraving conical objects.

# 4 Installation

## 4.1 Installation Overview

A complete working system consists of the laser engraving machine, its integrated air assist and water pump, its vent and exhaust fan, its control computer, all applicable connection cables, the interlock connector, and the laser key. The engraver can receive designs and commands from the control computer directly from its USB cable or remotely from its wireless network or ethernet cable. It can also store some design files on its circuit board. The designs can be applied to flat surfaces resting on the honeycomb workbed or to round surfaces supported on one of the provided rotary devices. Users can configure other additional accessories (such as a fume extractor) to suit their 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.

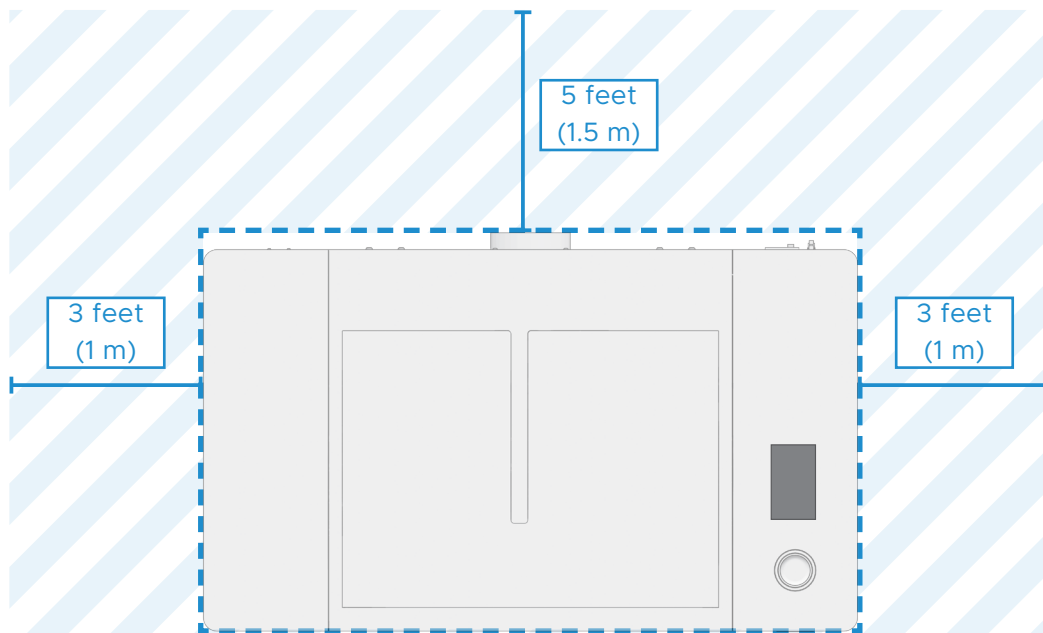
## 4.2 Selecting a Location

Before you install your engraver, select an appropriate location for its use. Be sure that it meets all of the requirements as below:

- Be sure that it meets all of the requirements discussed in [§1 Safety Information](#) on Page 1.
- The location should be stable, level, dry, and climate-controlled to provide an ambient temperature of 40°F–104°F (5°C–40°C) and an ambient humidity between 20%–85%. In particular, the temperature and humidity together should not be close to the dew point. It is also advisable to use a windowless room or to use blinds and/or curtains to avoid exposure to the potential additional heat of direct sunlight.
- The location should be free of dust and other airborne pollutants, and it should be 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; sensitive EMI engravers; and any combustible, flammable, explosive, or corrosive materials.



- The power cord should be plugged into a compatible and stable power source via a grounded 3-prong outlet. No other item should be drawing current from the same circuit. There should be firefighting equipment nearby and the local fire department's phone number should be clearly displayed.
- It is highly recommended to have an extra work table nearby to avoid placing objects on or directly adjacent to the engraver, which could become a fire or laser hazard.
- Provide 5 feet (1.5 m) of clearance behind the engraver for the fan and 3 feet (1 m) of clearance to the right of the engraver for the electronic bay's fans for maximum efficiency.



# 4 Installation

## 4.3 Unpacking

Your engraver should have arrived in a wooden crate with its accessories (including this manual) packaged inside. You should place 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. Open the cover and take out all the parts.

Make sure that you have received all listed accessories in the package list (See [§2.4 Package List](#) on Page 13).

5. 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.

6. Pull out the debris tray and honeycomb bed.



Never attempt to place or remove the honeycomb bed through the main cover. Always remove it along with the debris tray instead.

7. Place the side of the honeycomb with the unit you prefer to use facing up and slide it into place.

The honeycomb bed has inch and metric rulers on opposite sides.

8. Slide the tray back in underneath it.

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.

## 4.4 Checking the 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.



**NEVER** adjust the water level within the tank while it and the laser are connected to power.

1. Open the cover and confirm that the plastic tank to the right of your main bay is full.

The integrated water pump should arrive with about 1.5 L of OMTech coolant already in place. This should not require replacement during the first year of service, but refill it if the tank ever seems below two-thirds full before activation. For instructions, see [§7.3 Refilling the Water Tank](#) on Page 85.

2. Close the cover.
3. Plug in the interlock connector.
4. Confirm the power switch is in the **O** position before setting up the control system.
5. Plug the engraver into a grounded 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.

Confirm that the voltage on the label above the laser's power socket matches your local power supply.



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

6. Press the engraver's main power switch to **I**.
7. Insert and turn the laser key.
8. Confirm that the coolant begins to flow out of its tank, through the laser tube, and back into the tank.  
If it does not work so, turn off the machine and contact our technical support team.
9. Turn the laser key back and unplug the engraver.

# 4 Installation

## 4.5 Installing the Exhaust System

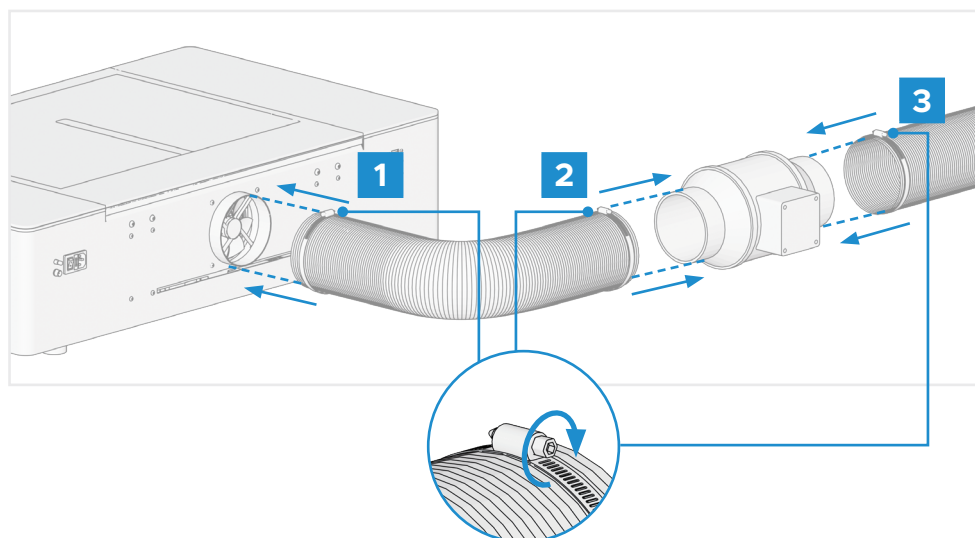


Wear work gloves to avoid cuts.

The provided duct pipes extend to a total length of 16' 4" (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:

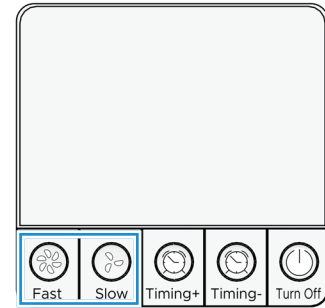
1. Position the duct fan behind your engraver in the correct direction as per the label on it.
2. Slide a  $\text{\O}120$  hose clamp onto one end of the  $\text{\O}120$  mm, 3 m long exhaust hose. Use it to firmly connect the engraver's exhaust port and the hose.
3. Slide the other  $\text{\O}120$  hose clamp onto the other end of the exhaust hose and slide the adapter ring onto the fan, heating it if necessary. Use the clamp to firmly connect the fan inlet and the hose.
4. Slide a  $\text{\O}150$  mm hose clamp onto one end of the  $\text{\O}150$  mm, 2 m long hose. Use it to firmly connect the fan outlet and the hose.
5. 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 hose to a dedicated fume extractor.
6. Seal all seams and connections tightly.
7. Plug the fan into a grounded outlet. Use a circuit different from the one the engraver will be on.



8. Insert two batteries into the fan remote control.
9. Test if the fan works well.

**ALWAYS** keep the fan remote control well, as the duct fan cannot work without it.

- Turn it on by pressing **Fast** or **Slow**.
- Turn it off by pressing **Turn Off**.
- Adjust the running time by pressing **Timing+** or **Timing-**. The fan will automatically turn off after the countdown ends.



**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.

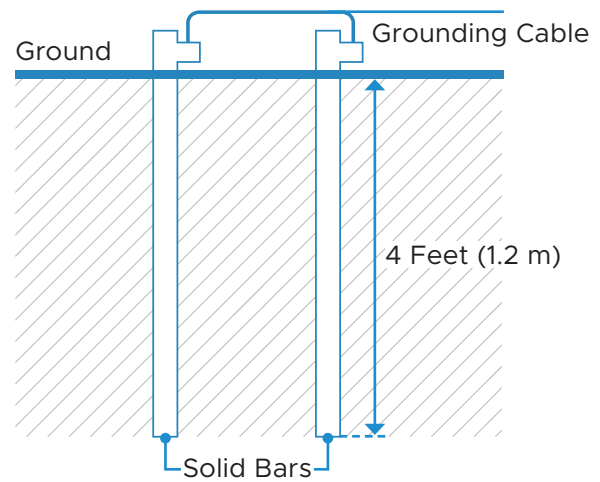
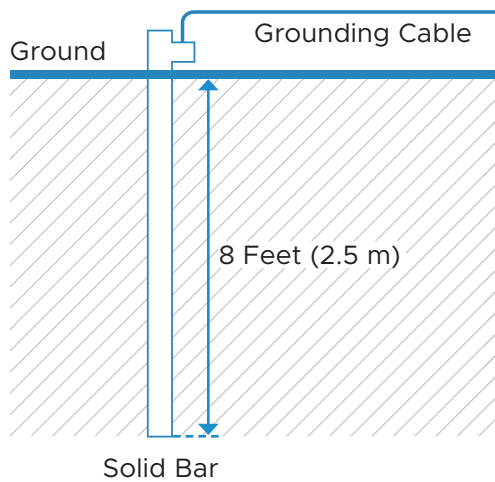
# 4 Installation

## 4.6 Setting up the Control System

1. Turn the beam attenuator fully clockwise.
2. Plug in the interlock connector.
3. Confirm the power switch is in the **O** position before setting up the control system.
4. Confirm that the voltage on the label above the laser's power socket matches your local power supply. And plug the engraver into a grounded 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.

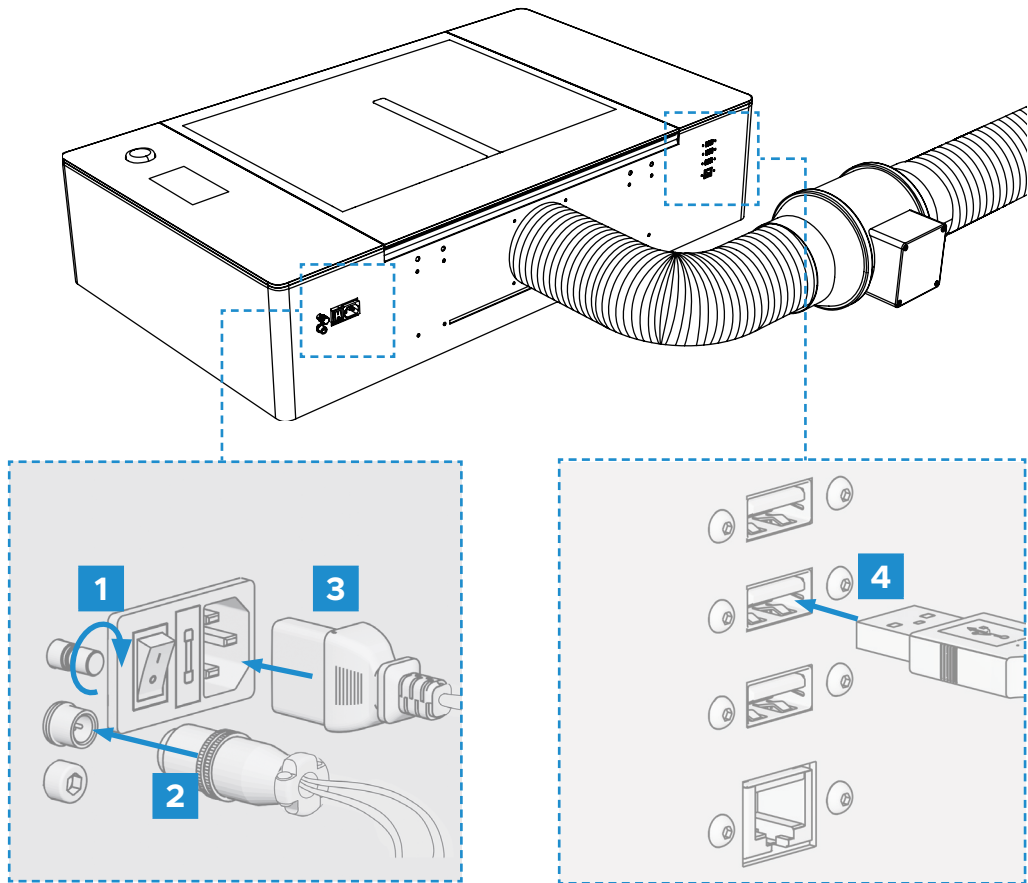
If the outlet is not grounded, use a grounding cable (not included) and connect it as follows:

- a. Fasten the near end of the grounding cable to the grounding 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.



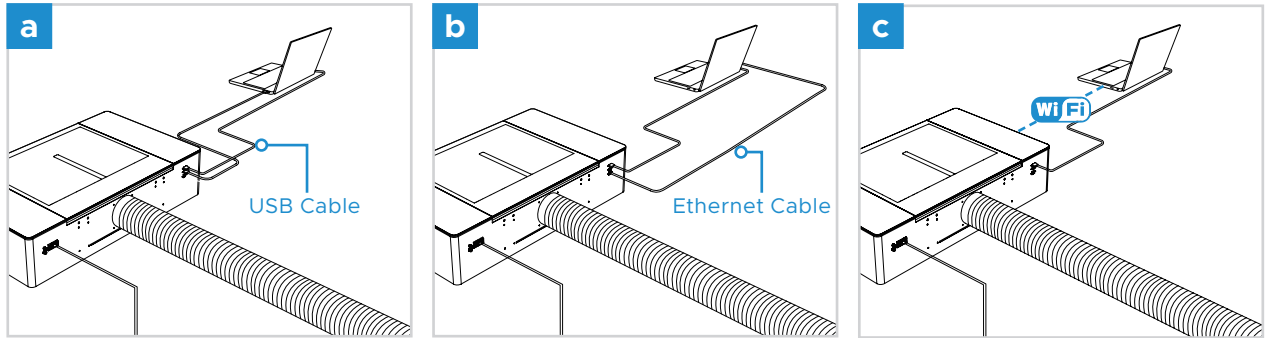
- Fluctuation along the circuit line should be less than 5%. If this is exceeded, the fuse will blow, which is located in the power socket and accessible from the exterior.
- Do not connect this device to standard extension cords or power strips.
- The powerful laser is extremely high voltage and potentially dangerous, so users must securely ground the engraver to avoid the buildup of static electricity.
- Poor grounding **WILL** cause equipment failure and create a serious electrical shock hazard. The manufacturer and/or seller bear(s) no responsibility and assume(s) no liability for any damage, accidents, or injuries caused by bad grounding connections.

5. Connect the camera to your computer by using one USB cable.

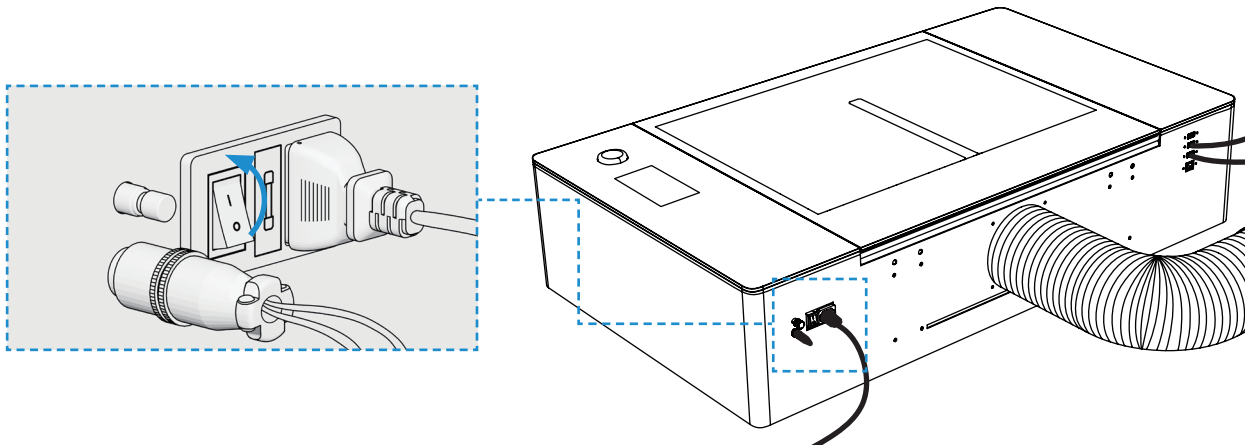


# 4 Installation

6. Connect the engraver to your computer by using any of these 3 ways:
  - a. Connect via the other USB cable.
  - b. Connect via the ethernet cable.
  - c. Connect via wi-fi. For instructions, see [§4.8 Wi-Fi Setup](#) on Page 32.

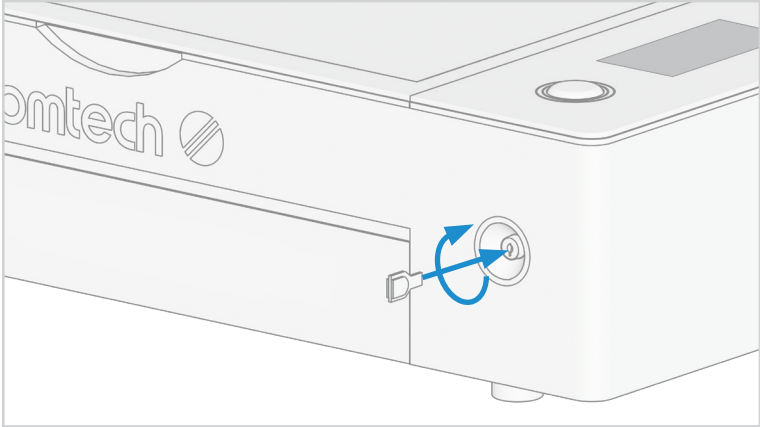


7. Press the power switch to I.





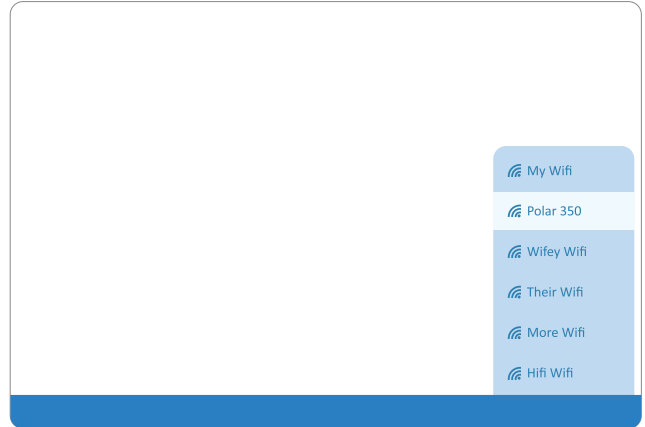
8. Insert and turn the laser key clockwise.



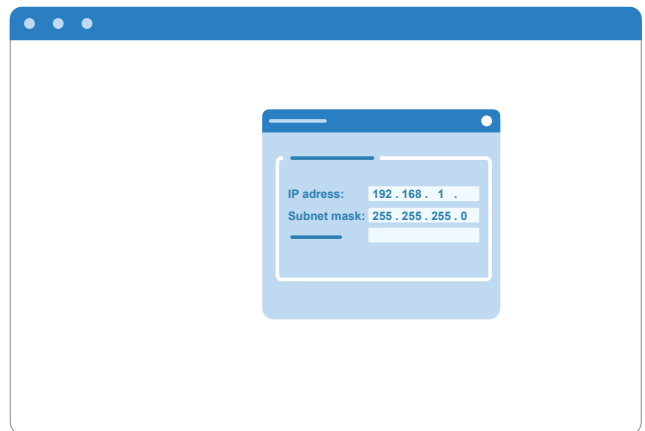
# 4 Installation

## 4.7 Setting up Wi-Fi

1. Check your local wi-fi networks to see if “Polar350” already exists. If so, log into it using the default password 123456abc.



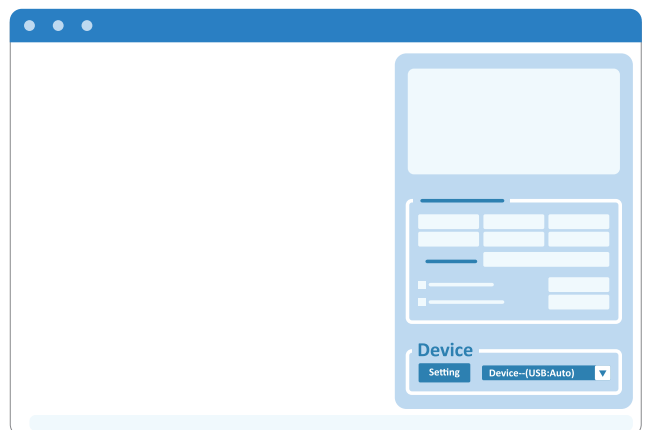
2. Reconfigure your own device's TCP/IP address. The default address of the Polar+'s wireless network is 192.168.1.100. You will need to set your computer's network to use a similar but not identical address.
  - a. Use 192.168.1 for the first three sections and a unique value for the last section. Typically, any value from 2–252 except 47 and 100 should be fine but avoid any values already used by your other networked devices.
  - b. Use the subnet mask 255.255.255.0.



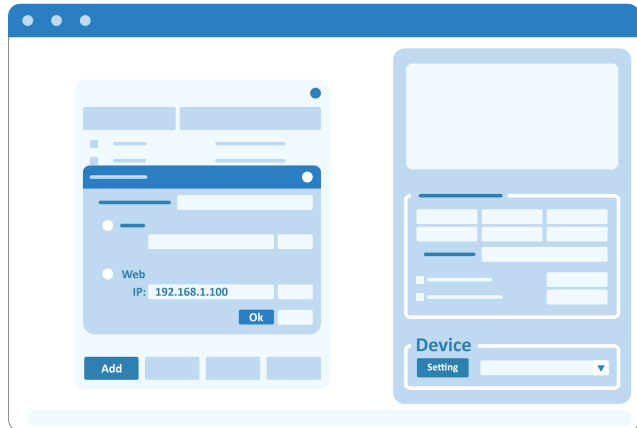
3. Enable wireless control in RDWorks by going to **Device** on the lower right side of the main interface.

If it is not visible, remove the other menus above it until it becomes visible.

For LightBurn and other software setup, contact Customer Service, visit the OMTech website, or see our YouTube channel.

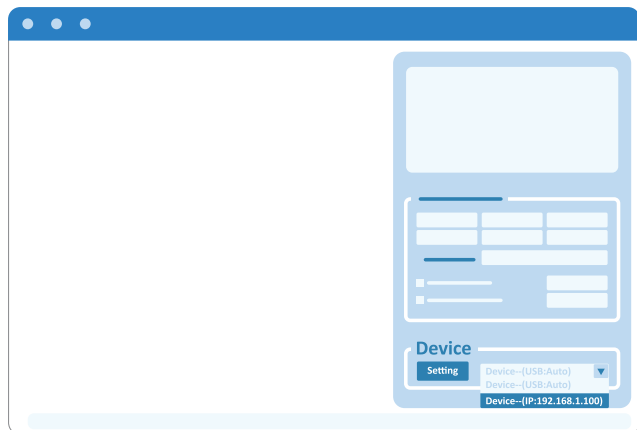


4. Add a device.
  - a. Select **Setting** and then **Add**.
  - b. Toggle the selection to **Web**.
  - c. Enter the IP address 192.168.1.100 if it is not automatically generated.
  - d. Select **OK**.



5. Exit to the main interface, confirming and saving your changes.

You can now use the dropdown menu in the **Device** area to switch between using the cable connection (USB: Auto) and the wireless connection (IP:192.168.1.100).



# 4 Installation

## 4.8 Setting up the Software

1. Transfer the copy of Ruida's RDWorks and its instruction manual from the provided USB to your computer.

You can also download the latest version of RDWorksV8 from Ruida's website at [www.rdacs.com/en](http://www.rdacs.com/en) or from us at [www.omtechlaser.com/pages/software-download](http://www.omtechlaser.com/pages/software-download).

For LightBurn and other software setup, contact Customer Service, visit the OMTech website, or see our YouTube channel.

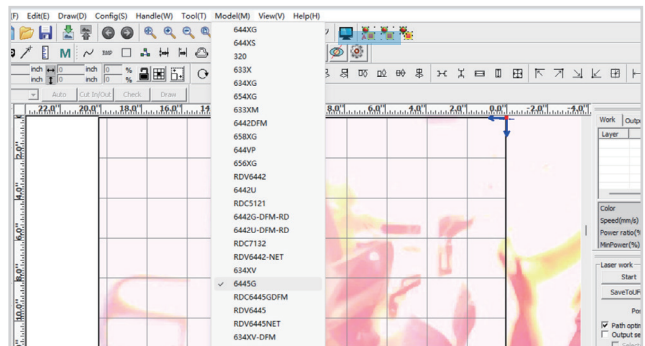


2. Double click the “RDWorksV8Setup 8.01.60-20211201.rar”, and then “RDWorksV8 Setup8.01.60-20211201.exe” to install the software.

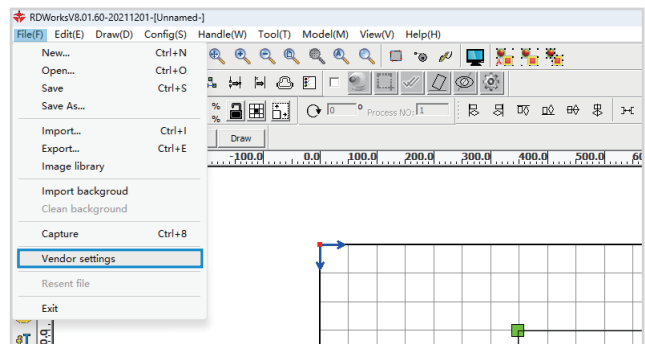


The software version number and release date may differ depending on the engraving machine.

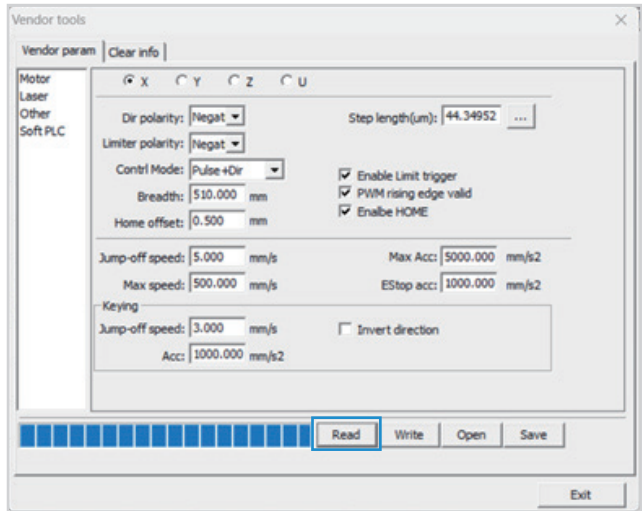
3. Press **ALT+M** (“Model”) and make sure the model is **RDC6445G**.



4. Configure the manufacturer parameters.
  - a. Press **ALT+F** (“File”) and select **Vendor Settings**. Enter the default password “rd8888”.

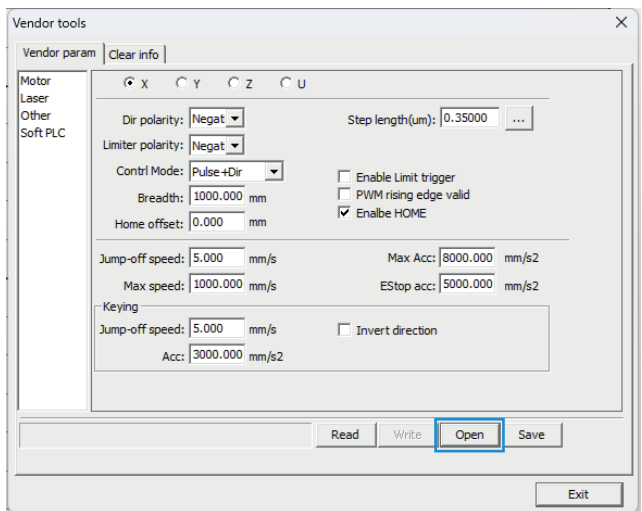


b. Click **Read**.



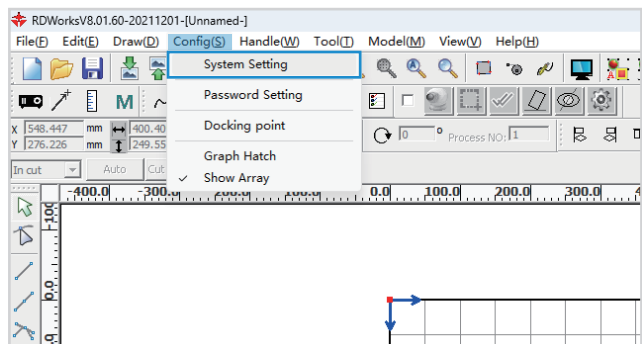
c. Click **Open** and then load the settings file “Manufacturer\_parameters.RDVSet” from the USB.

d. Click **Write** to save the parameters and then click **Exit**.



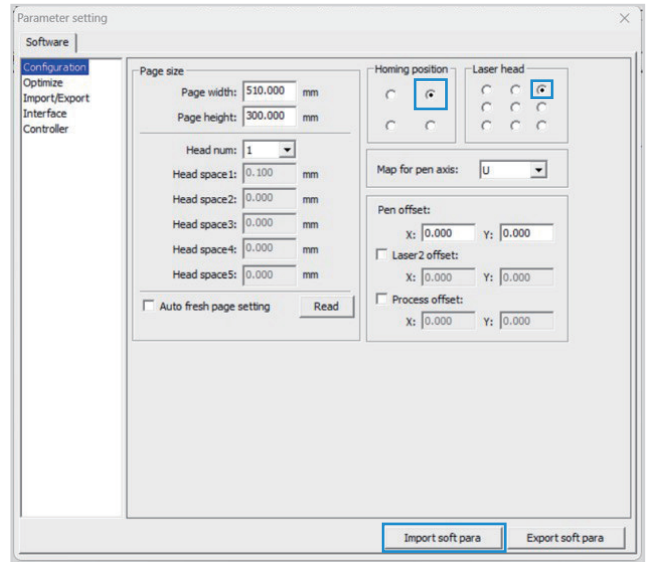
5. Configure the software parameters.

a. Press **ALT+S** (“Config”) and select **System Settings**.



# 4 Installation

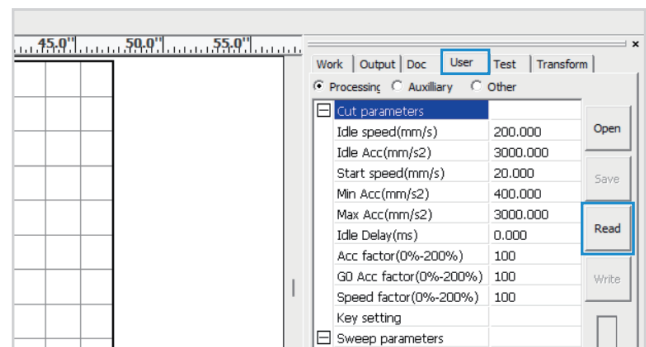
- b. Click **Import Soft Para** and load the file “Software\_parameter.cfg”.



6. Configure the user parameters.

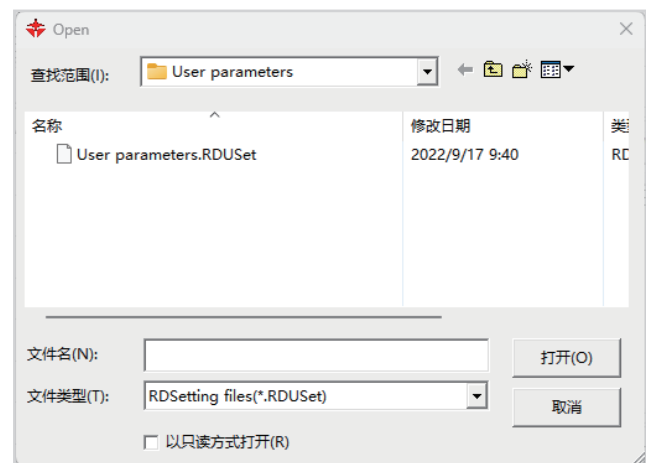
- a. On the **System Work Platform** on the upper right side of the main interface, change the tab from **Work** to **User**.

- b. Click **Read**.



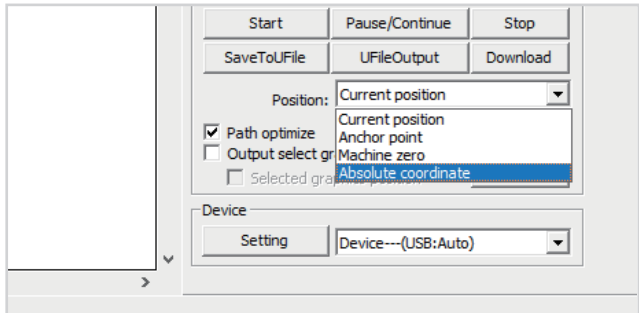
- c. Click **Open** and then load the file “User\_parameters.RDUSet”.

- d. Click **Read** to save the parameters.

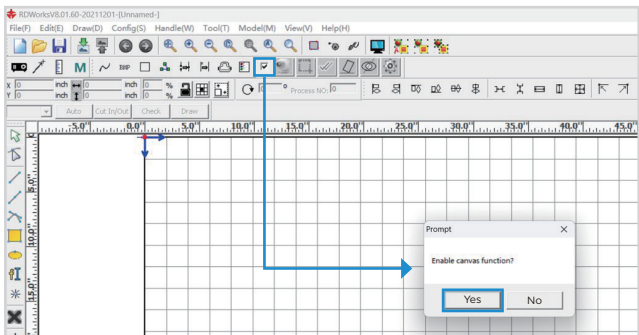


7. Configure the camera.

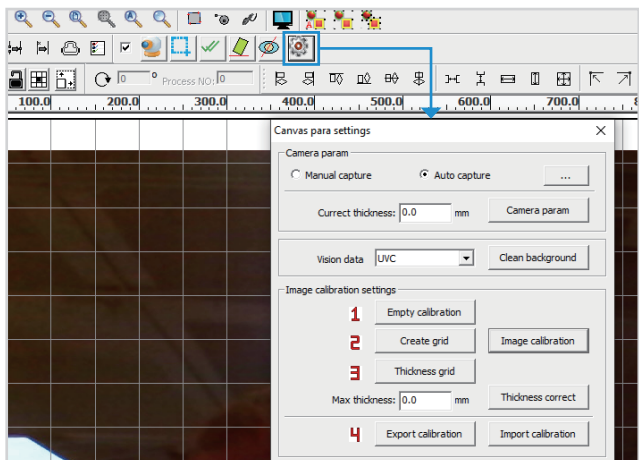
- a. On **Laser Work** at the lower right side of the main interface, change the **Position** value from **Current Position** to **Absolute Coordinates**.



- b. On the **Canvas Tools** toolbar, click the unlabeled check box to enable the canvas function and controls.



- c. Click on the gear icon nearby to open the **Canvas Para Settings** submenu.



# 4 Installation

- d. Click **Import Calibration** and load the file Camera\_calibration\_file.calx.

Canvas para settings

Camera param

Manual capture  Auto capture ...

Current thickness: 0.0 mm Camera param

Vision data: UVC Clean background

Select camera

Image calibration settings

1 Empty calibration

2 Create grid Image calibration

3 Thickness grid

Max thickness: 0.0 mm Thickness correct

4 Export calibration Import calibration

Docking background image

Offset: X: 0.000 mm Y: 0.000 mm

Ratio correct

X: 1.00000 Y: 1.00000

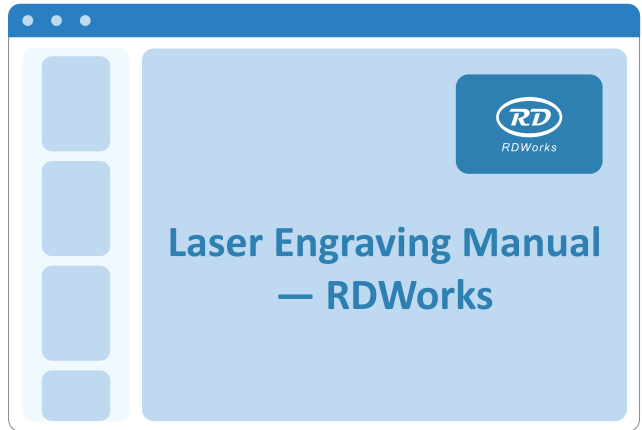
Outer-contour layer: 3 Line width: 1

Inner-contour layer: 2



8. Now the software is correctly configured for your engraver. Turn off your engraver if you are not going to use it.

Familiarize yourself with your software's image design and laser control features before using them to operate the laser.



# 5 Initial Testing



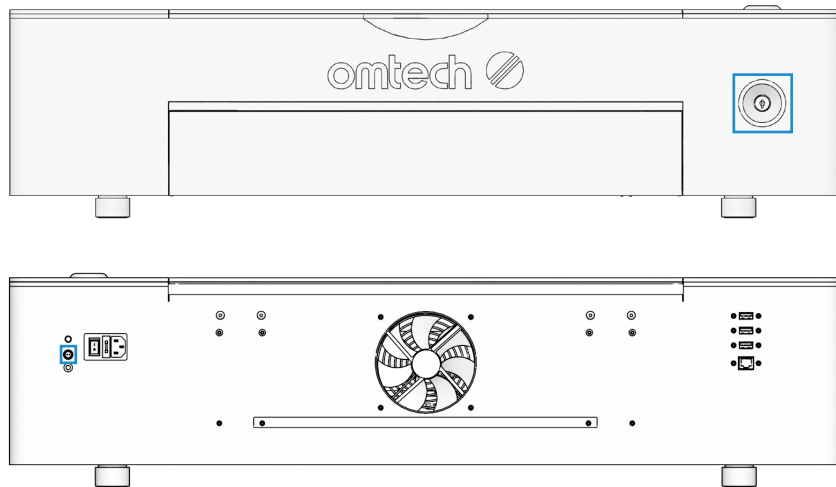
Wear safety glasses during the entire test process!



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.

For your safety and that of passersby, this engraver requires two keys to provide power to the laser tube, the front key (laser power key) and the rear key (remote interlock connector).



Operators should **ALWAYS** remove at least one of these between uses to prevent unauthorized operation of the machine. Only leave them in place if the work area itself is completely secure and inaccessible to any children.

## 5.1 Interlock

Because of the risk of blindness, burns, and other injury from direct exposure to the invisible engraving beam, this device shuts off the laser automatically when parts of its protective housing are opened.



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.

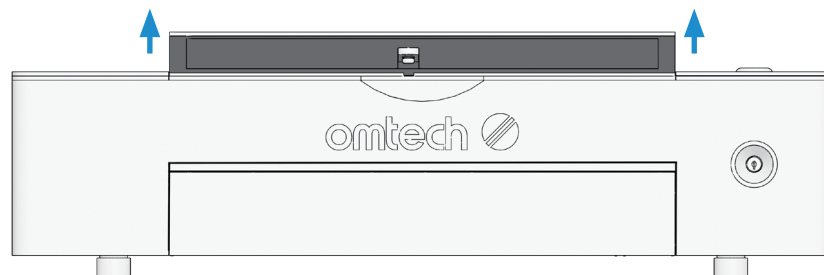
### 5.1.1 Cover Shutoff

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

1. Turn off the engraver.
2. Place a piece of laserable scrap material onto the workbed and then close the cover.
3. Turn on the engraver and duct fan.

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

4. Create or load a simple design into RDWorks.
5. Insert and turn the laser key.
6. Begin engraving by clicking **Start** in the software or pressing the **Start** button on the engraver.
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.



# 5 Initial Testing

8. Check the status of the engraver.

The laser should pause automatically and the Start button should become red.

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.

9. Close the cover and press the **Start** button.

The engraver should restart cutting or engraving.

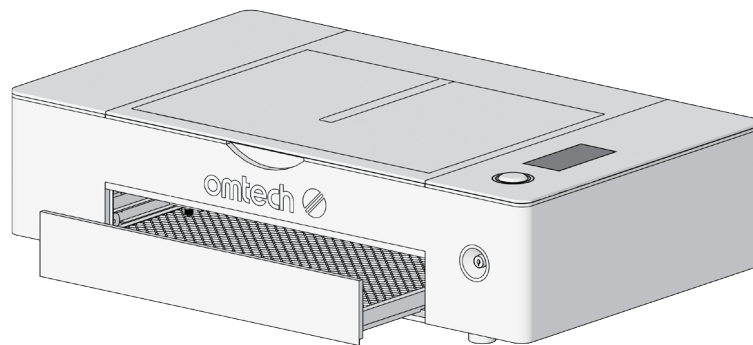
10. Turn off the engraver after the test is done.

## 5.1.2 Tray Shutoff

After ensuring that the cover shutoff works, you should also test that the tray shutoff activates.

1. Perform the same procedure as before but, instead of opening the cover, open the debris tray.

The laser should stop completely. If it continues to engrave the design while the debris tray is open, the automatic shutoff is not working and must be repaired before the engraver can be used.

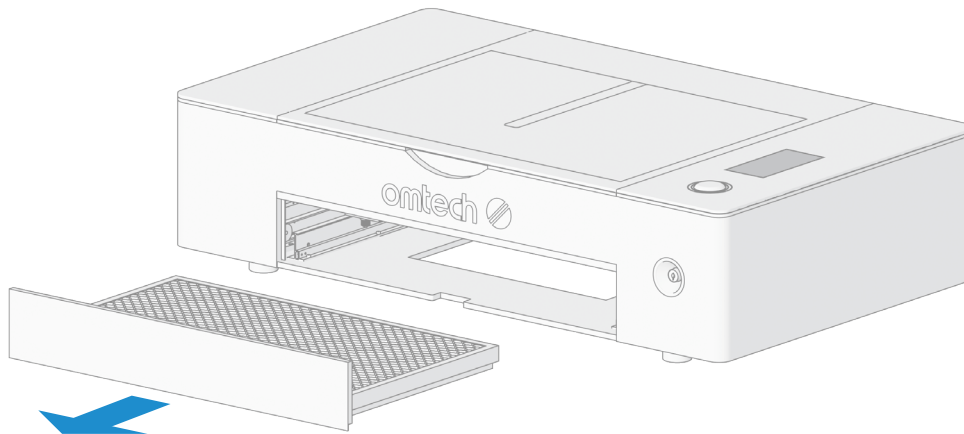


2. Turn off the machine. Contact our technical support team if the tray shutoff is not working.

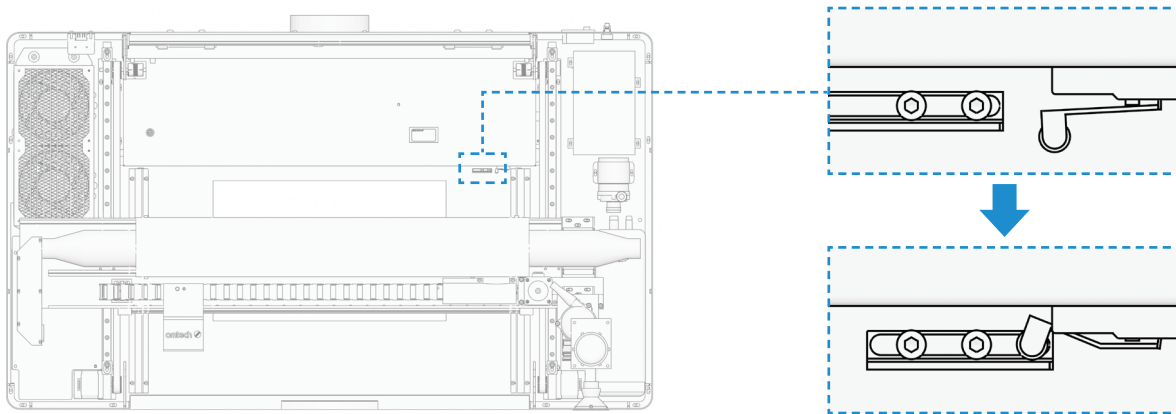
Engraving thick materials, using the front pass-through, or the rotary axes, however, requires this shutoff to be circumvented first. Mind that this the only safety feature that should ever be circumvented.

To do so,

1. Remove the debris tray and the workbed.



2. Move the tray interlock switch into a closed position and hold it there by sliding the nearby metal bracket to the right.



3. Never leave the switch in this position after completing your work. Reenable the switch before leaving the work area.

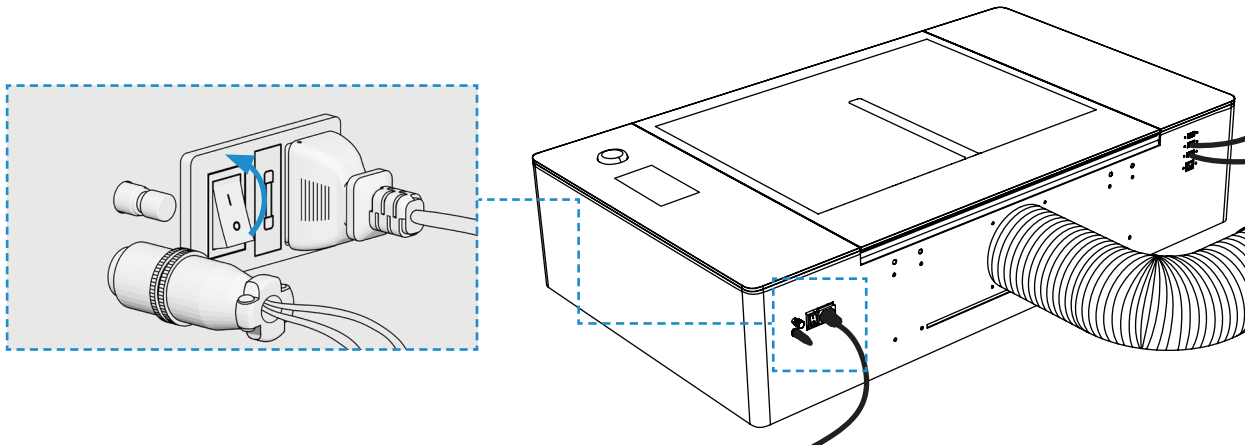
# 5 Initial Testing

## 5.1.3 Interlock Connector Shutoff

After ensuring that the cover and tray interlocks work properly, you should test that the remote interlock connector functions correctly.

1. Perform the same procedure as before but, instead of opening the cover or tray, remove the interlock connector from its socket beside the power switch.

The laser should stop completely. If it continues to engrave the design without the rear key in place, the automatic shutoff is not working and must be repaired before the engraver can be used.



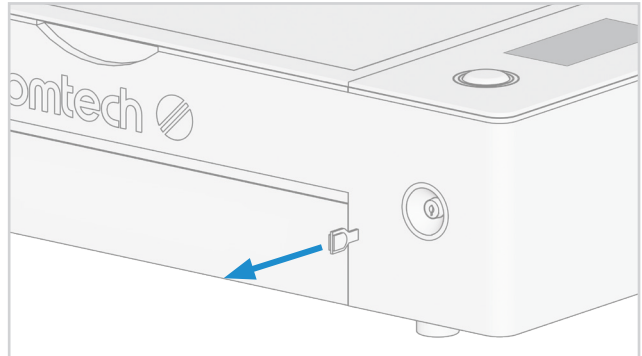
2. Turn off the machine. Contact our technical support team if the rear key shutoff is not working.

## 5.2 Laser Key Shutoff

After ensuring that the interlocks work properly, you should test that the laser key functions correctly.

1. Perform the same procedure as before but, instead of opening the cover or tray, turn and remove the laser key.

The laser should stop completely. If it continues to engrave the design without the key in place, 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.



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

# 5 Initial Testing

## 5.3 Water Shutoff

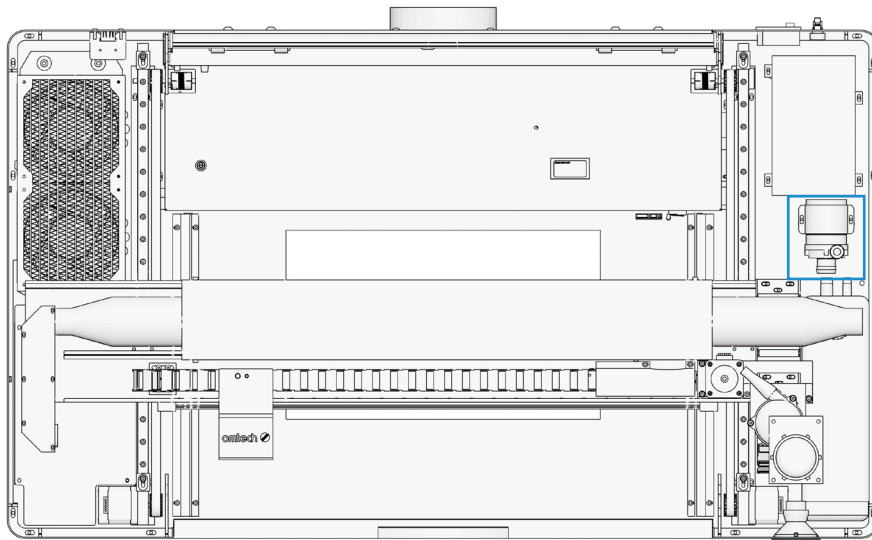
Because of the danger posed by an uncooled laser tube, this engraver also shuts off the laser automatically when its sensors do not detect the correct water flow.

You should test that the water shutoff functions correctly:

1. Perform the same procedure as before but, crimp or tie the water hoses instead, and attempt to fire the laser.

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

2. Choose one of the following options based on your situation:
  - If the laser does 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 does not fire, 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.



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 when it is in operation.



## 5.4 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. Perform the same procedure as before.

Confirm that pressurized air begins to blow from the laser head when the engraver starts engraving. If it does not, Turn off the machine and contact customer service.

2. Turn off the engraver 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.

# 6 Operation



Operate this laser engraver only in accordance with all the instructions provided in this manual.

Failure to follow these instructions can result in property damage and personal injury.

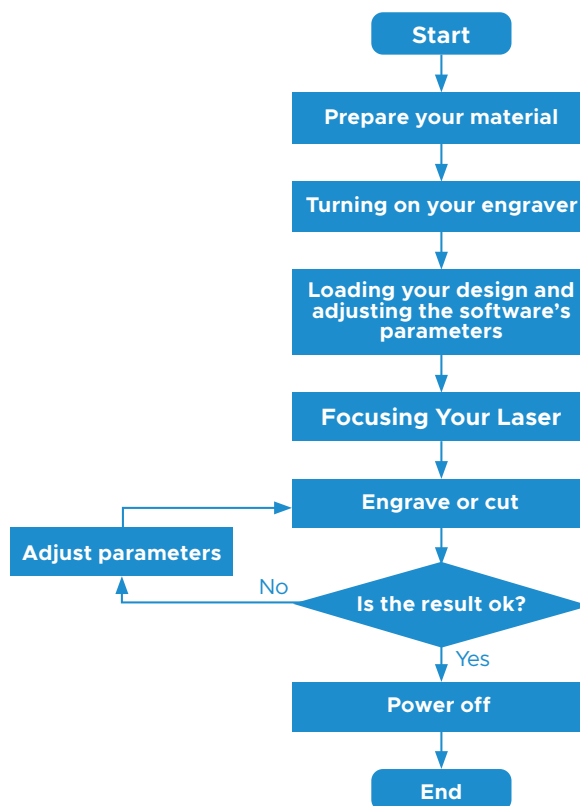


Wear safety glasses during the entire test process!

## 6.1 Operation Overview

This section will address only some of the options and features provided by the operation software. Before beginning to use the machine, make sure that you have read this entire manual (particularly [§Safety Information](#) on Page 1), the separate software manual, and any warnings provided on the machine itself.

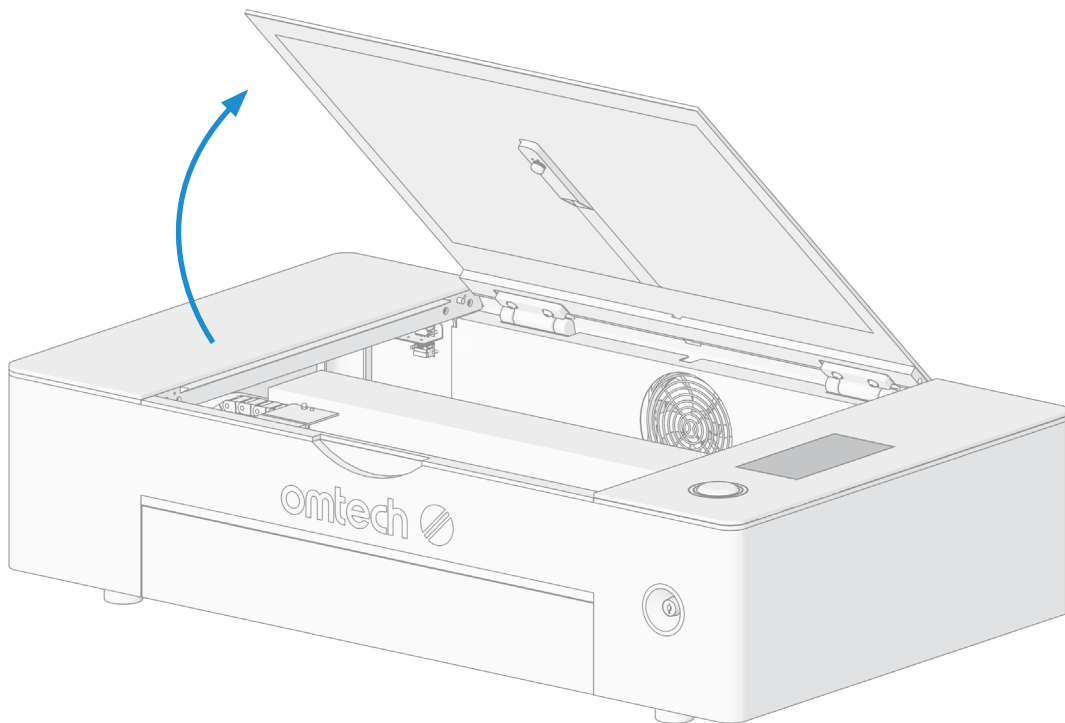
Here are the main operation steps:



## 6.2 General Operation

### 6.2.1 Preparing Your Material

1. Make sure that the engraver is powered off.
2. Open the cover.

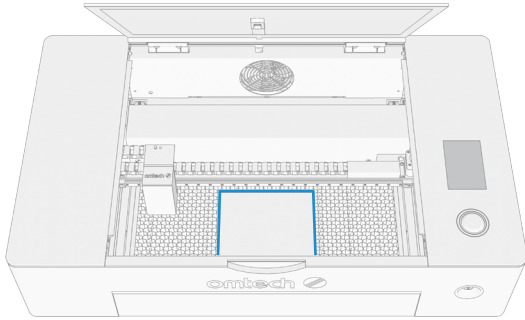
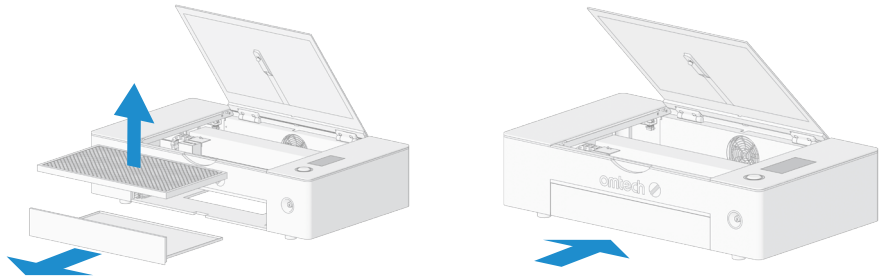
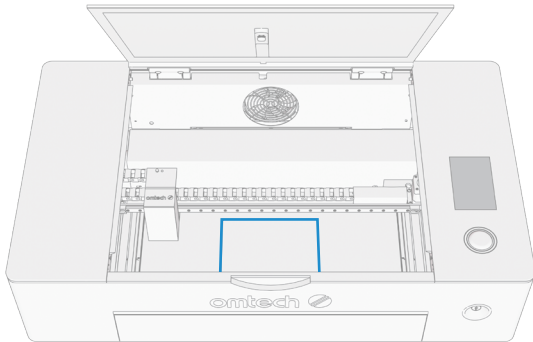


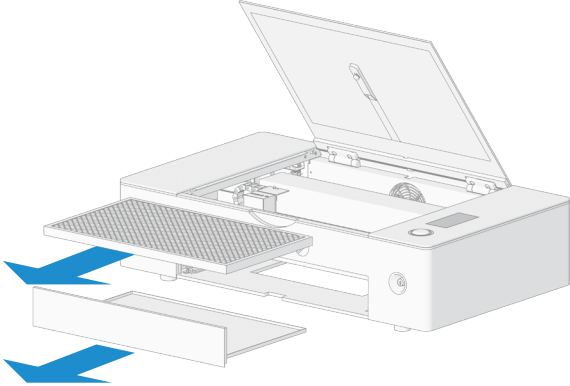
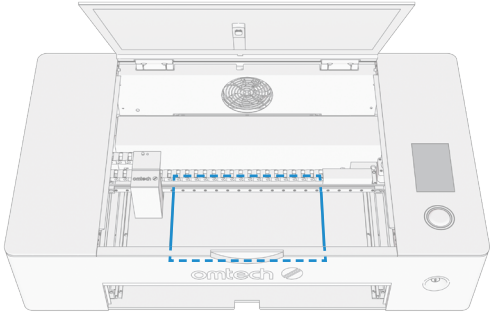

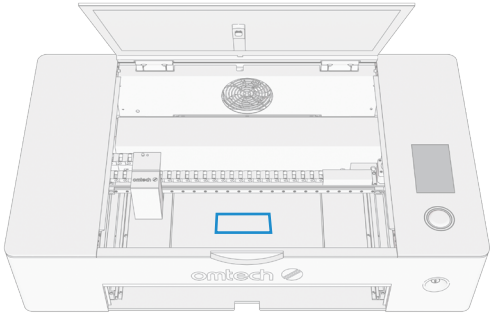
# 6 Operation

3. Confirm the thickness of your material with the provided ruler and place a sample piece into the main bay.

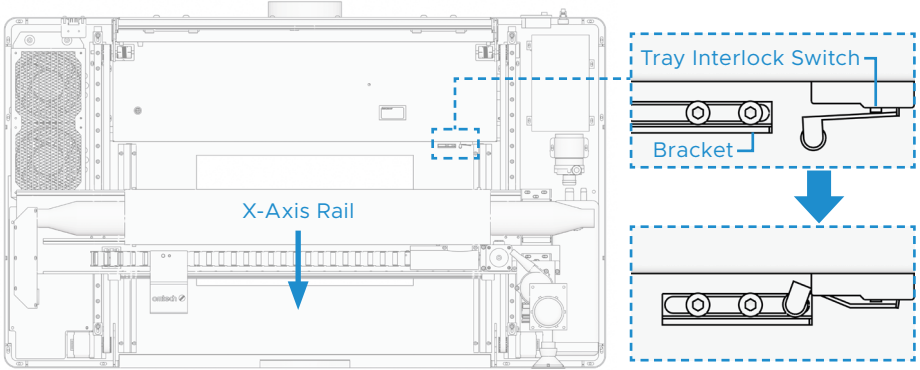

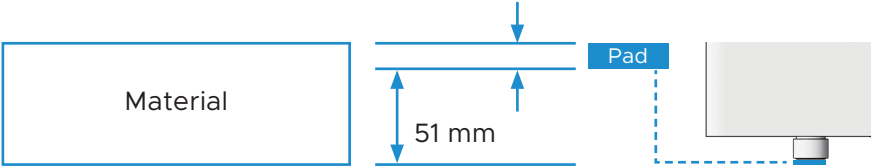
The standard location is in the top right corner of the workbed. This can be changed by moving either your design or the origin position in your software.

### For Pieces No Longer Than 20 inches (510 mm)

Thickness	Instructions
$\leq 17$ mm	<p>Directly put the sample piece on the honeycomb workbed.</p> 
17 mm–51 mm	<ol style="list-style-type: none"><li>1. Open the tray, remove the honeycomb workbed, and then close the tray.</li></ol>  <ol style="list-style-type: none"><li>2. Put the sample piece on the tray.</li></ol> 

Thickness	Instructions
<p>&gt; 51 mm</p>	<p>1. Remove the tray and honeycomb workbed.</p>  <p>2. Cover the exposed area of your table with a non-reflective plank, preferably an MDF that fits the space.</p>  <div data-bbox="526 1223 1435 1455" style="border: 2px solid blue; border-radius: 15px; padding: 10px;">  <p>Warning! Failure to totally cover your table may cause a fire hazard. Using reflective surfaces risks reflecting the laser beam and destroying your engraver.</p> </div> <p>3. Put the sample piece on the plank.</p> 

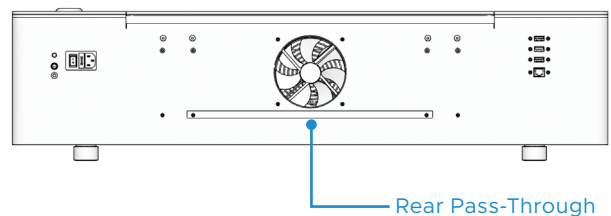
# 6 Operation

Thickness	Instructions
<p>&gt; 51 mm</p>	<ol style="list-style-type: none"> <li>4. Slide the X-axis rail forward to expose the tray interlock switch.</li> <li>5. Move the tray interlock switch into a closed position and hold it there by sliding the nearby metal bracket to the right.</li> </ol>  <p>Never leave the switch in this position after completing your work. Reenable the switch before leaving the work area.</p> <ol style="list-style-type: none"> <li>6. Use 4 identical pads at each corner to elevate the engraver.</li> <li>7. Use another identical pad for elevating the plank that is used to protect the table.</li> </ol> <div style="border: 1px solid blue; border-radius: 15px; padding: 10px; margin: 10px 0;">  <p>Make sure the combined height of the pad and the plank equals however much the material exceeds 51 mm in thickness.</p> </div> 

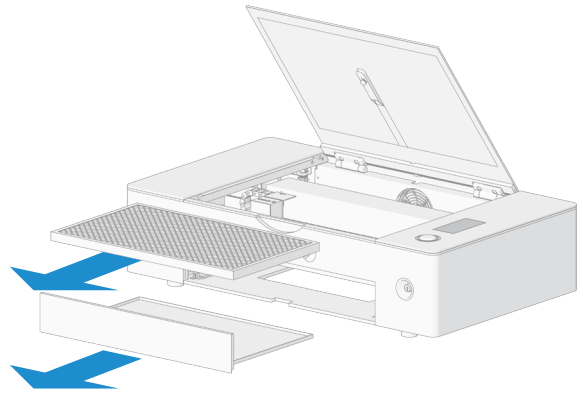
## For Pieces Longer Than 20 Inches (510 mm) and No Thicker Than 51 mm

You should open the tray and rear pass-through door to provide more space.

- a. Open the rear pass-through door.

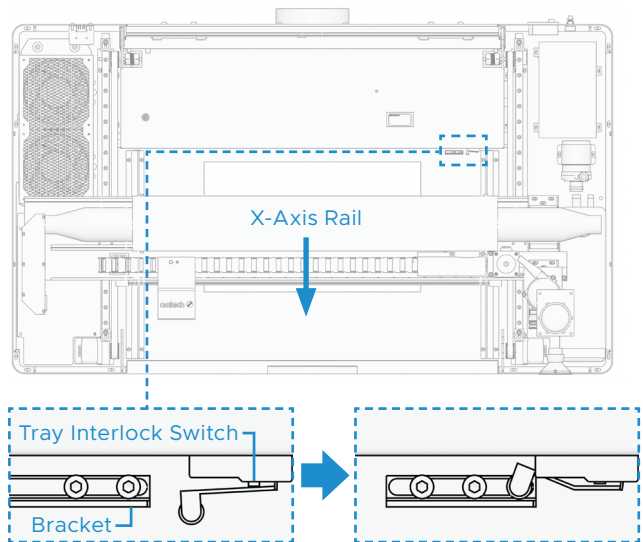


- b. Remove the debris tray and workbed.

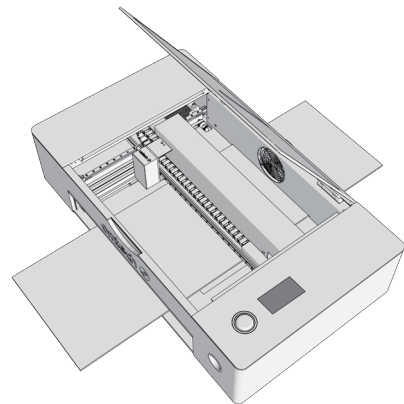


- c. Slide the X-axis rail forward to expose the tray interlock switch.
- d. Move the tray interlock switch into a closed position and hold it there by sliding the nearby metal bracket to the right.

Never leave the switch in this position after completing your work. Reenable the switch before leaving the work area.



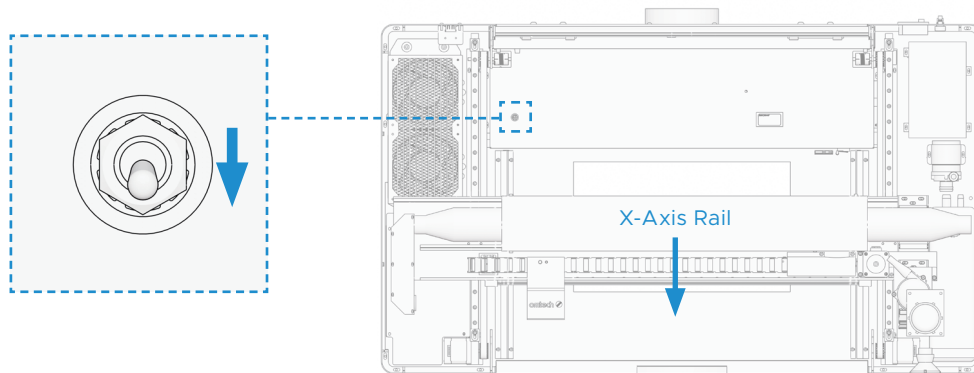
- e. Replace the workbed as needed.
- f. Put your material on the workbed or the tray through the tray and rear pass-through door.



**DO NOT** insert anything through the pass-through doors other than your material. As you work, confirm the ventilation system is removing all dust and fumes. If it cannot, cease use of the pass-through for that material unless sufficient PPE is worn by everyone nearby.

# 6 Operation

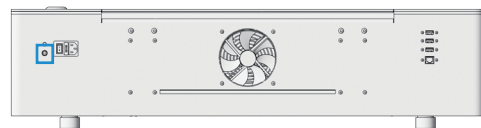
4. Confirm that the rotary switch is flipped down to its standard position and then close the cover.



For round pieces, you will need to use a rotary axis. For instructions, see [§6.3 Instructions for Rotary Operation](#) on Page 65.

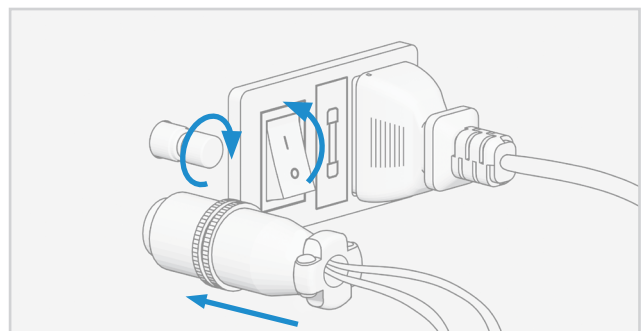
## 6.2.2 Turning on Your Engraver

For your safety and that of passersby, this engraver requires two keys to provide power to the laser tube, the front key (laser power key) and the rear key (remote interlock connector).



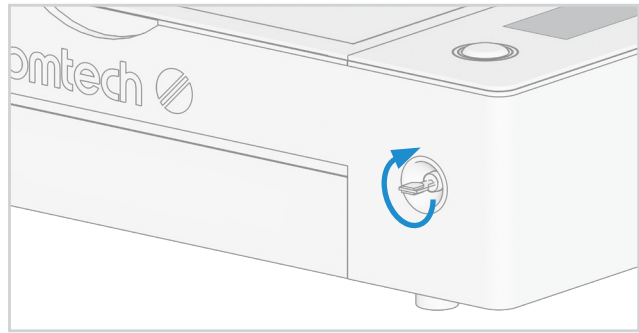
Operators should **ALWAYS** remove at least one of these between uses to prevent unauthorized operation of the machine. Only leave them in place if the work area itself is completely secure and inaccessible to any children.

1. Turn on your duct fan and any fume extractor or other ventilation equipment.
2. Turn the beam attenuator completely clockwise to enable your software to use the engraver's full power range.
3. Insert the interlock connector—if you don't normally leave it in place.





- Turn on your engraver using its rear power switch and the laser key.
- Confirm that the cooling system, air assist, exhaust fan, and internal lights have been activated.



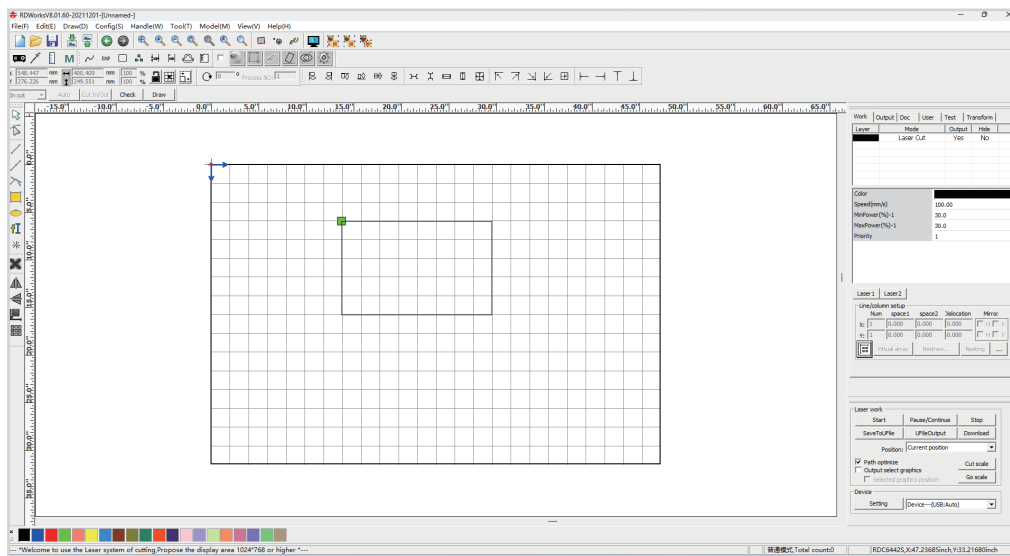
## 6.2.3 Loading Your Design

You can load your design in one of the following 3 ways. Select the option that best fits your needs.

### Via Your Control Computer

- Create the design that you'd like to engrave and save.

You can do this directly in your engraving software or use any other graphics program.

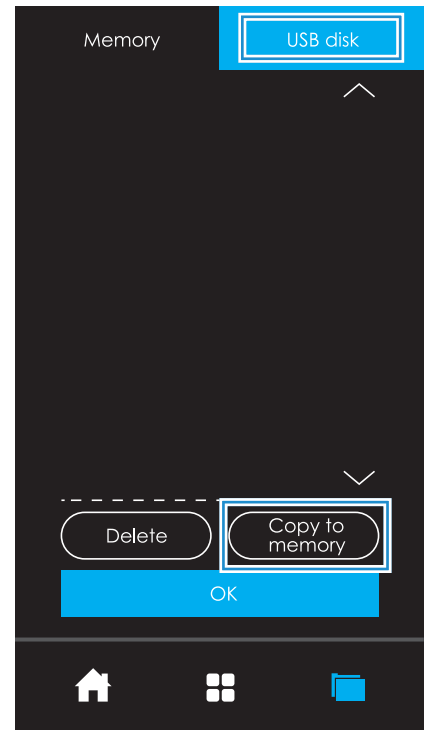


- Confirm that your control computer has a connection to the Polar, either directly through the provided USB cable, Wi-Fi connection or via the internet. For instructions on connection, see [§4.6 Setting up the Control System](#) (Page 31).
- Load your saved design into your engraving software.

# 6 Operation

## Via Your USB Disk

1. Save your design into a .rd file under the root directory in the provided FAT32 USB disk.
2. Insert your USB disk onto the engraver.
3. Click **File** on the touch screen.
4. Set your design file as the current file by choosing it, clicking **Copy to memory**, and then clicking **OK**. The maximum number of files in the memory is 100.



## Via the Memory Folder

1. Click **File** on the touch screen.
2. Set your design file as the current file by choosing it and clicking **OK**.

## 6.2.4 Adjusting the Software's Parameters

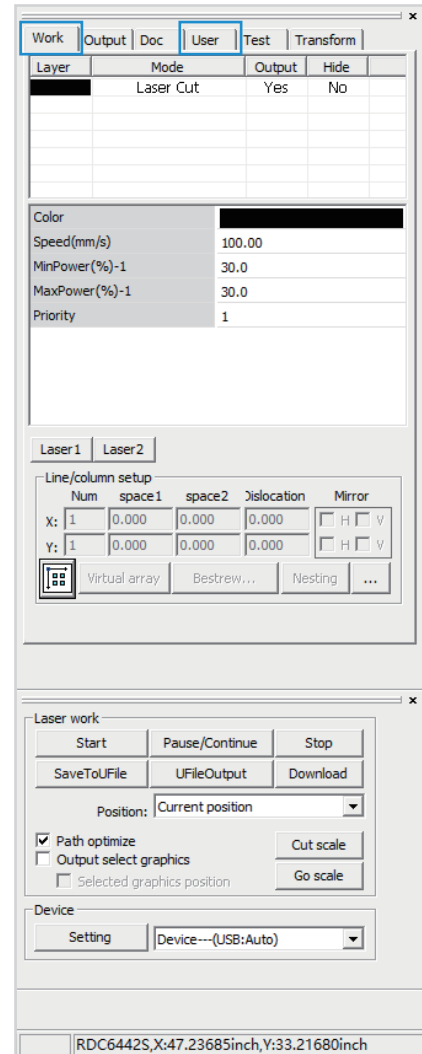
Adjust your software's parameters to suit your project.

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.

It is **NOT** recommended to use the laser at full power. The recommended maximum power setting is 70%, as prolonged use above that amount will shorten your laser's service life. The threshold for the lowest setting is around 10% and the laser may not fire at all when set lower than this.

To improve the laser's engraving or cutting effect without increasing its raw power, increase the amount of energy per unit area by decreasing the speed parameter or increasing the number of loops. Working too intensely, however, increases the risk of fire and reduces image quality, especially with coated materials.


Resolution should usually be set to 500 dots per inch. Lowering 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.

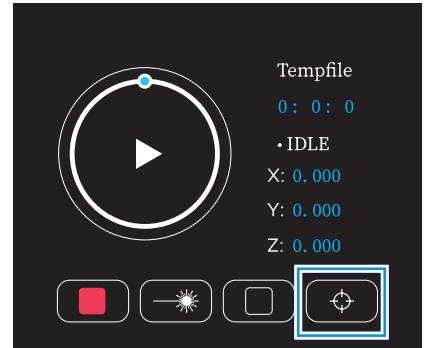


# 6 Operation

## 6.2.5 Autofocusing Your Laser


Autofocusing your laser every time you move the material or use a new material.

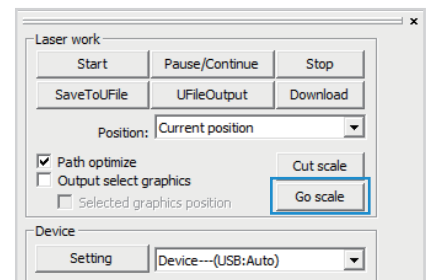
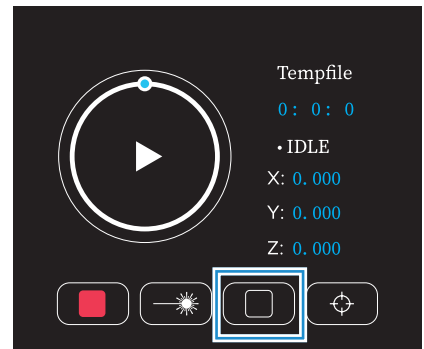
1. Move the laser head over the sample material.
2. Press the autofocusing key  on the touch screen. The laser head should automatically move toward the sample material, then move backward, and finally stop when the correct focal height has been reached.



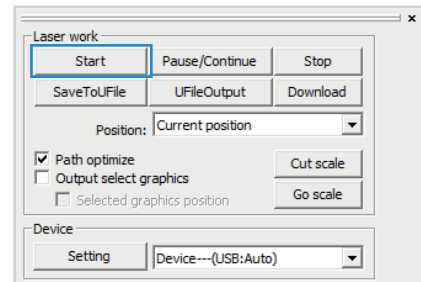
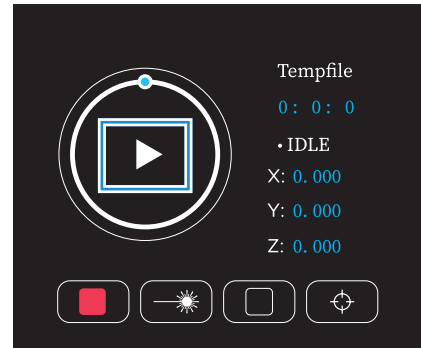
## 6.2.6 Engraving

You can use either the software or the touch screen to operate engraving.

1. Outline the projected area for engraving or cutting on your material by clicking  on the touch screen or **Go scale** on the software. The laser traces the boundary, allowing you to ascertain that the laser path is properly aligned with your material setup.



2. Begin engraving your design by clicking ► on the touch screen or the **Start** button in **Laser Work** on the lower right side of the software's main interface.

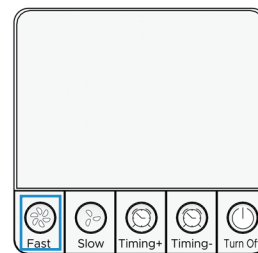


3. Watch for possible issues like sparks or fires using the camera view.

Do not stare continuously at the active laser even through your protective eyewear.

Be prepared to quickly extinguish a fire if necessary.

4. If any dust or fumes begin to build up within the main bay, increase the power of the duct fan by pressing **Fast** on the remote control or pause work periodically by pressing the **Start/Pause** button to allow it to clear the air. You can pause and resume work by pressing the **Start/Pause** button on the right side of the engraver.




## 6 Operation

5. Once the laser has stopped, examine the quality of your first run. You can compare the engraving result of the material with that on the reference board.
6. Adjust the parameters in your software as necessary. You can adjust the values of power and speed based on the reference board.



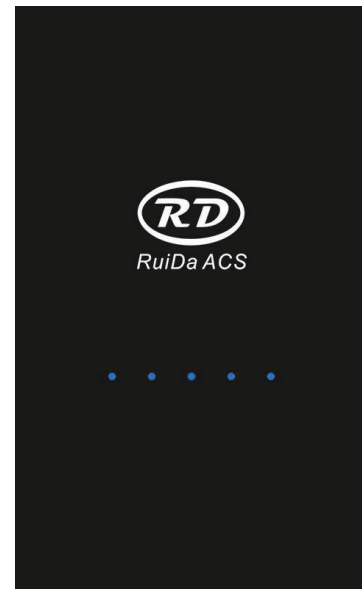
7. Begin your real work in a different location or on a different piece of material. You can also click ► on the touch screen or press the **Start** button to repeat your last loaded design without applying any changes.

The mainboard can be reset by using the reset key if you encounter any problem.

If an error occurs during the reset process preventing successful reset or if you wish to stop the reset, you can click on the  icon in the center of the screen to halt the reset process.



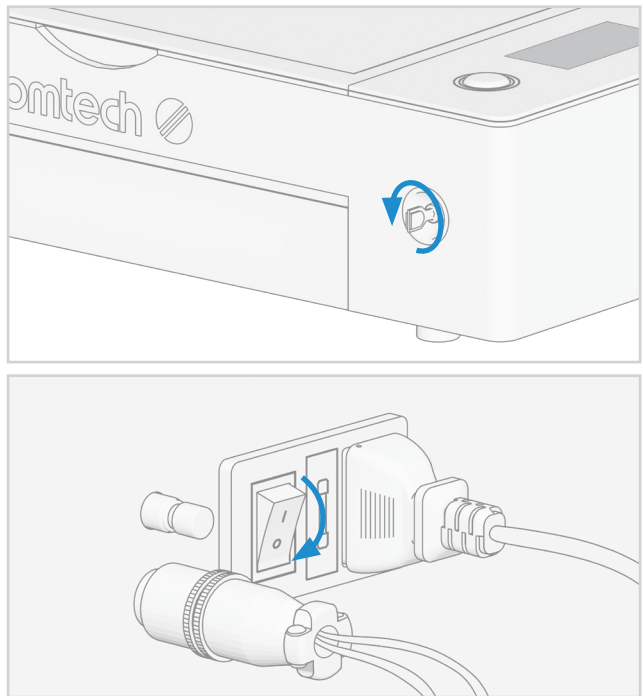
If your engraver stops during repetitive engraving and cutting, the cooling system may have reached 122°F (50°C) and automatically paused work. Resume work by pressing the engraver's **Start** button only after the system has had time to adequately cool. If possible, use lower power settings while reducing speed or increasing the number of times your design is processed.



## 6.2.7 Shutdown

1. When you have finished your project, close your engraving software.
2. Allow the cooling and ventilation systems to continue to run until the air in the main bay is clear and the tube has safely cooled.
3. Turn off the engraver using the laser key and the main power switch and then turn off the external fan.

For best results, fully unplug your engraver or turn off its intermediary surge protector.



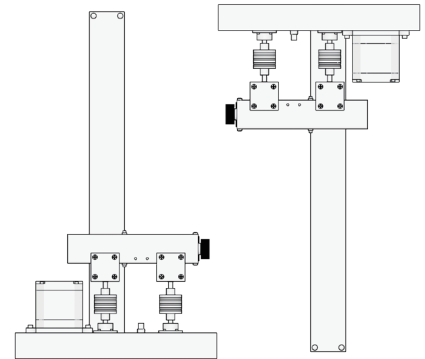
4. Open the cover and remove any dust or debris buildup from the workbed and the various surfaces within the bay.

If the buildup is firm, use a partially damp cloth or similar tools that won't create scratches to remove it. **NEVER** use abrasive papers or steel wools.

# 6 Operation

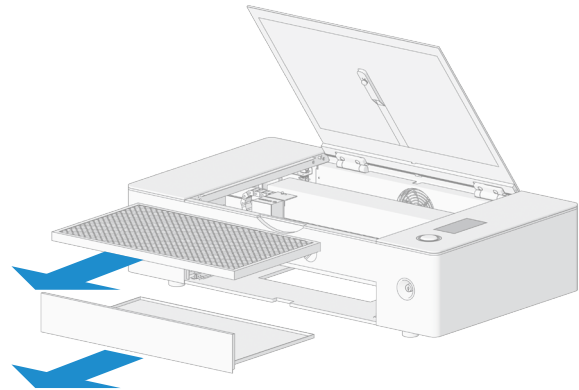
## 6.3 Rotary Operation

The Polar+ comes with two separate 4-wheel rotary axis devices to engrave spherical and cylindrical surfaces. Use Rotary Axis 1 for larger items and use Rotary Axis 2 for smaller ones.

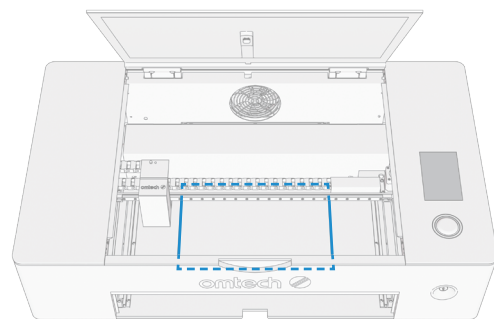


### 6.3.1 Installing Your Rotary Axis

1. Remove the debris tray and the honeycomb workbed. Set them aside where they will not be damaged or fall over.



2. Cover the exposed area of your table with a non-reflective plank, preferably an MDF that fits the space.

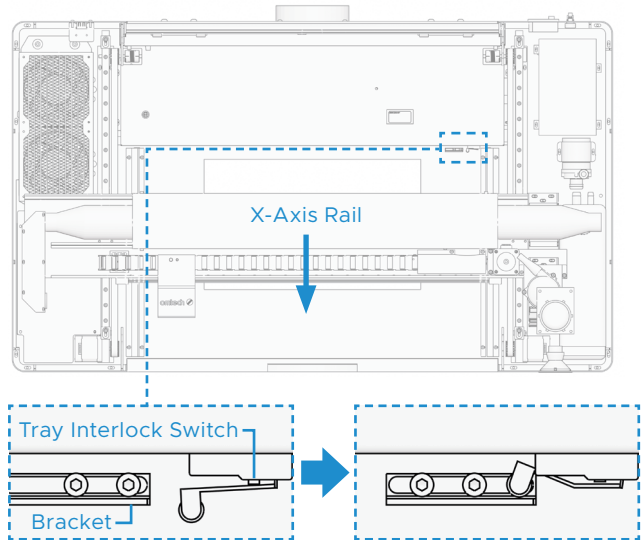


Warning! Failure to place the panel in a position that totally covers your table may cause a fire hazard.

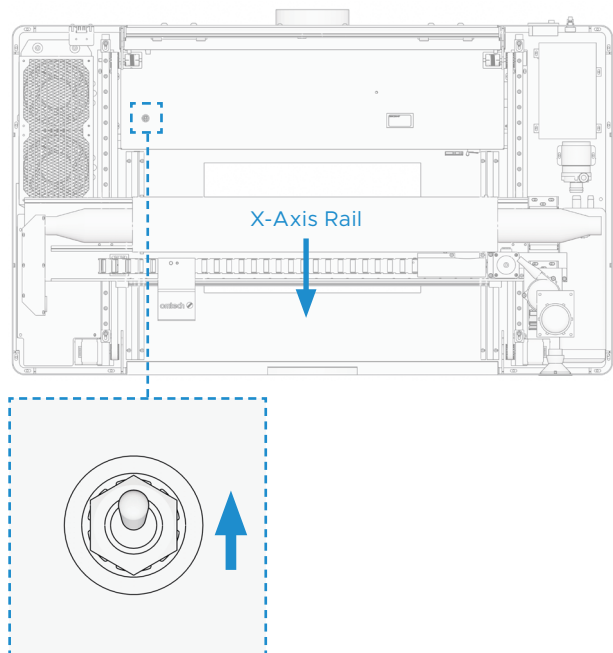


3. Slide the X-axis rail forward to expose the tray interlock switch.
4. Move the tray interlock switch into a closed position and hold it there by sliding the nearby metal bracket to the right.

Never leave the switch in this position after completing your work. Reenable the switch before leaving the work area.



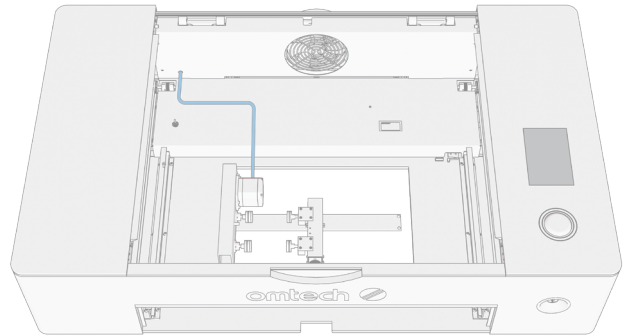
5. Flip the rotary switch up to **Rotary** to deactivate the Y-axis motors and control signals and activate the rotary aviation socket.



# 6 Operation

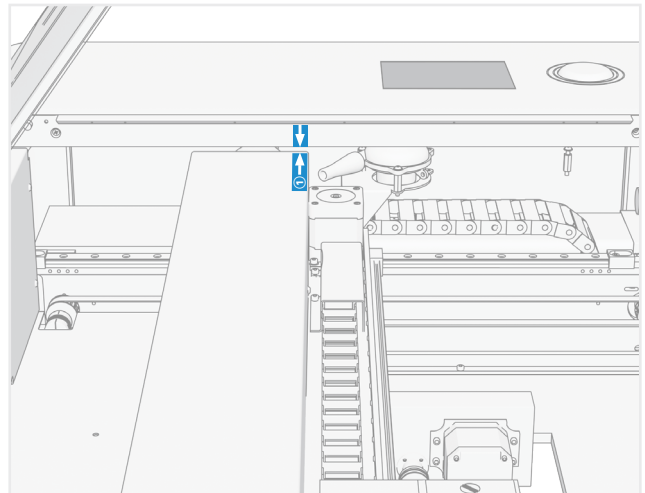
6. Connect the rotary cable.
  - a. Uncover the rotary aviation socket.
  - b. Connect one of the rotary cables to the socket.

You will need to pull back its outer sheath while aligning the 4 holes to their pins.
  - c. Connect the other end of the cable to the motor of the rotary you will be using.

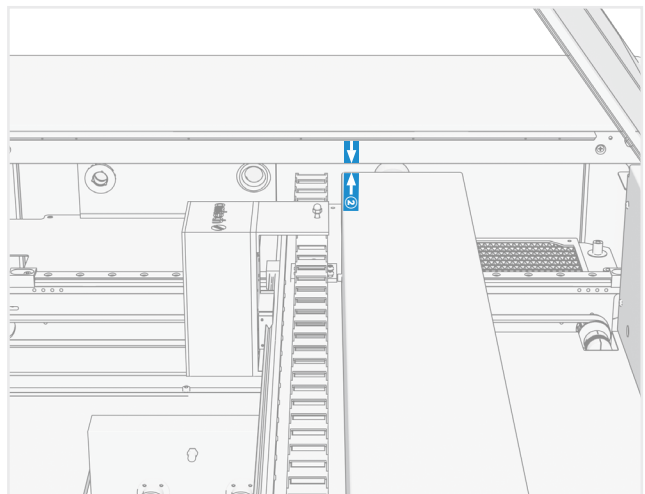


7. Place your rotary axis in the bottom left corner of the open bay so that its number label is in the front left corner and its support frame is flush with the left side of the open bay.
8. Gently move the laser tube and X-axis rail back to align the arrow labels properly.

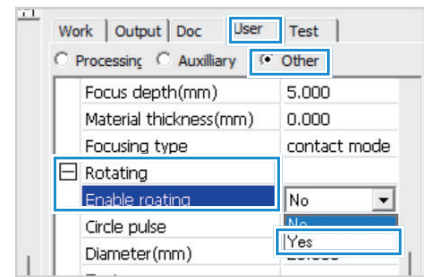
When you are using Rotary Axis 1, align the ① arrow label on the laser tube casing with the arrow label on the **RIGHT** side of the bay.



When you are using Rotary Axis 2, align the ② arrow label on the laser tube casing with the arrow label on the **LEFT** side of the bay.

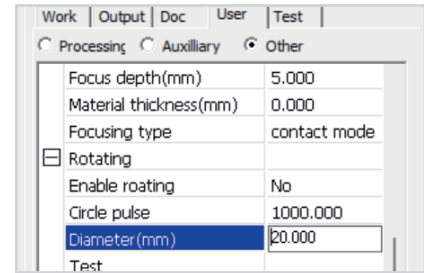


9. Enable the rotary axis function on your RDWorks V8 software by locating the **Enable rotating** function under **User** tab, and choose **Yes**.



10. Measure and fill in the **Diameter** parameter of the object on your RDworks V8 software. To measure **Diameter**, you can use either a ruler or a caliper, but a caliper provides an accurate reading.

For a curved-surface object, take the average value of the diameter of the actual engraving range of the measured object (the average value of the left, middle and right of the engraving range position).



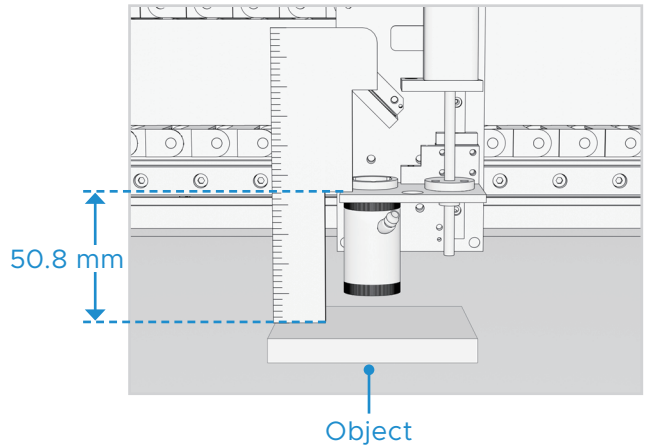
Do not forget to update the parameter of the object every time you change the object.

# 6 Operation

## 6.3.2 Preparing Your Material

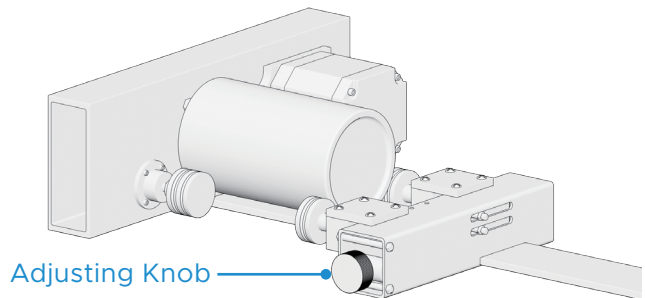


**ONLY** engrave objects that the distance between its surface to the top of the laser mounting board can be 50.8 mm.



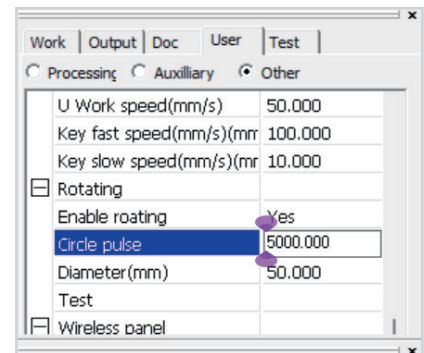
1. Place your object carefully onto the rotary axis.

For a curved-surface object, use the adjusting knob to adjust the supporting bracket to an appropriate height.



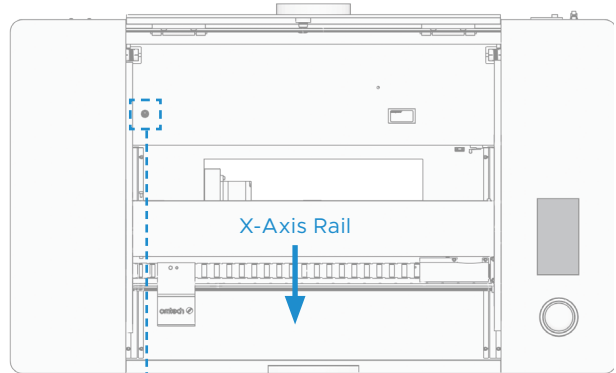
2. Repeat instructions from [5.2.2 Turning on Your Engraver](#) to [5.2.7 Shutdown](#).

Adjust the **circle pulse** parameter as needed during engraving.

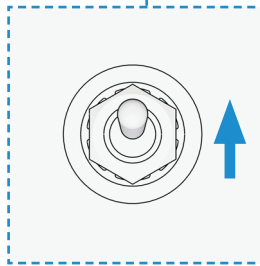


### 6.3.3 Uninstalling Your Rotary Axis

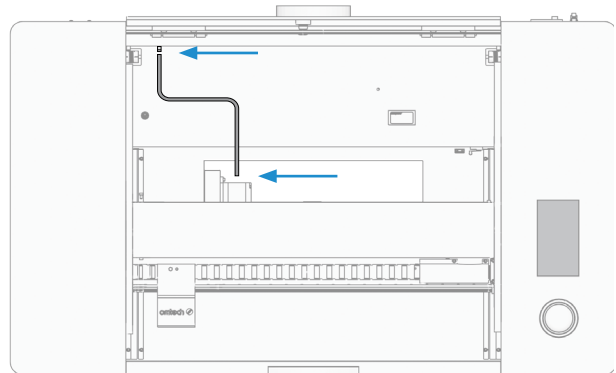
1. Gently move the laser tube and X-axis rail forward.



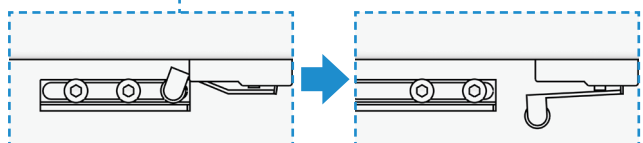
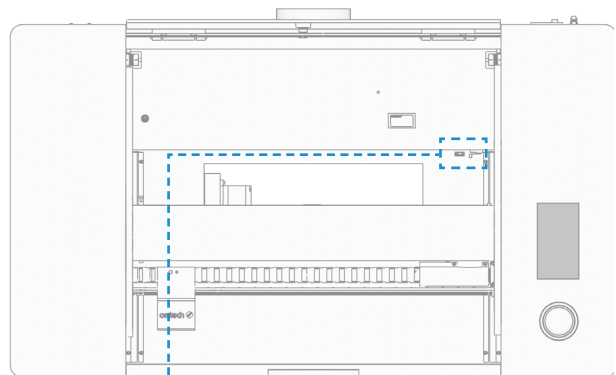
2. Flip the rotary switch up to **Standard** to activate the Y axis motors and control signals.



3. Disconnect the rotary cable from the rotary aviation socket and then cap the socket.

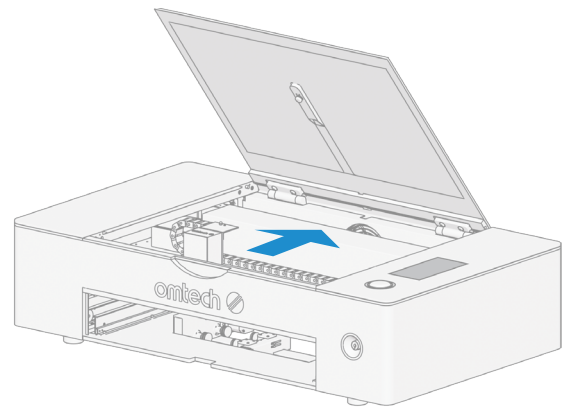


4. Release the tray interlock switch into the open position by sliding the metal bracket to the left.

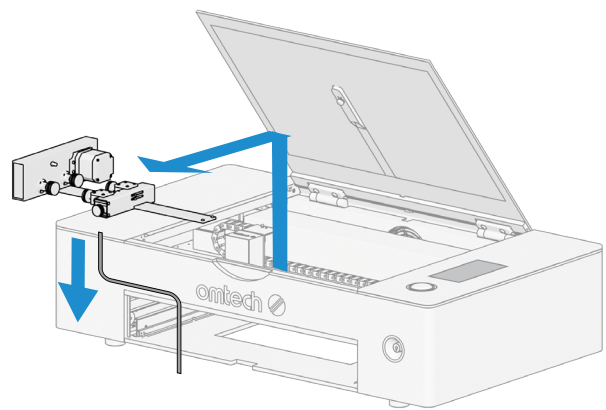


# 6 Operation

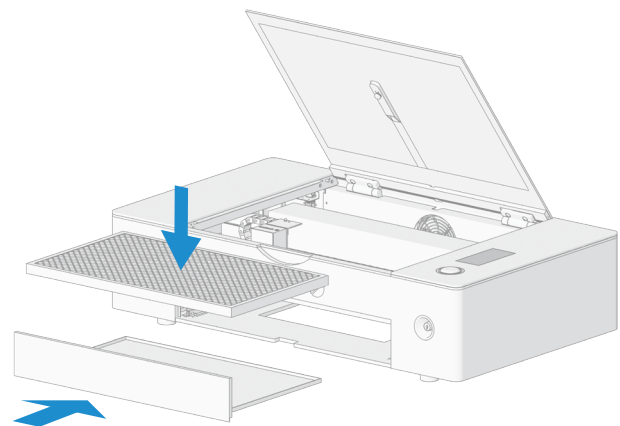
5. Gently move the laser tube and X-axis rail back.



6. Take out your rotary axis.
7. Disconnect the rotary cable from the motor.

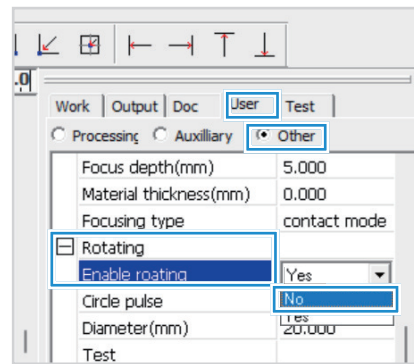


8. Replace the honeycomb workbed and the debris tray.



9. Close the cover.

10. Disable the rotary axis function on your RDWorks V8 software by locating the **Enable rotating** function under **User** tab, and choose **No**.



# 6 Operation

## 6.4 Instructions for Specific Materials

The following instructions are suggestions to help speed safe work with a range of materials. The user should research the specific safety and engraving requirements of their specific material to avoid the risk of fire, hazardous dust, corrosive and poisonous fumes, and other potential problems.

Once the product is known to be safe or appropriate protective equipment has been set up, it can be helpful to engrave a test matrix of small boxes produced at various speed and power settings to discover the ideal settings for your design. Alternatively, start with low power and fast speed settings and rerun your design as many times as needed, using progressively greater laser intensity.

### Average Engraving Settings

Material	Engraving				Cutting				Thickness (mm)	Resolution (dpi)
	Power (W)		Speed (mm/s)		Power (W)		Speed (mm/s)			
Acrylic	25	50%	500	100%	45	90%	35	7%	3	400
Basswood	25	50%	500	100%	45	90%	65	13%	3	400
Canvas	12.5	25%	500	100%	30	60%	350	70%	0.2	300
Cardboard	22.5	45%	500	100%	45	90%	200	40%	2	400
Leather	15	30%	500	100%	45	90%	80	16%	1.5	400
MDF	20	40%	500	100%	45	90%	30	6%	3	300
Rubber	17.5	35%	500	100%	45	90%	25	5%	3	400

### 6.4.1 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 risks 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 a 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.



## 6.4.2 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 markings. 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 afterward.

## 6.4.3 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.

## 6.4.4 Metal

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

## 6.4.5 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 to the possibility of fire, as well as the dust produced in repetitive applications.

## 6.4.6 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.

# 6 Operation

## 6.4.7 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 the 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.

## 6.4.8 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.

## 6.4.9 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.

## 6.4.10 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 softwoods 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 in any setting. Hardwoods 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 can also cause nausea and cardiac problems in high enough amounts.

## 7.1 Maintenance Schedule



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 engraver 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 engraver.

Follow the instructions below when maintaining:

- Clean and cool water or laser-safe coolant must be provided to the system **at all times**.
- Confirm the tank is at least two-thirds full before and **after each use**.
- The workbed must be cleaned and the waste bin emptied **every day**.
- The lenses of the 1st and 2nd mirror housing, the 3rd mirror, the focus lens, and the camera must be checked **every day** and cleaned **if required**.
- The exhaust system must be checked **every week** and cleaned **if required**.
- 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.
- All other components of the laser machine should be checked **every month** and cleaned **where required**.
- Replace your coolant **every three months** for best results. Even if it is visibly clean month after month, drain it, clean the entire system, and replace it **at least once a year**.

In commercial settings, keep a cleaning and maintenance log in a visible location near the engraver. Have operators date and sign the log as cleaning and maintenance are carried out.

# 7 Maintenance

## 7.2 Cleaning



**ALWAYS** allow any fluid used in any cleaning to dry completely before further use of the engraver.

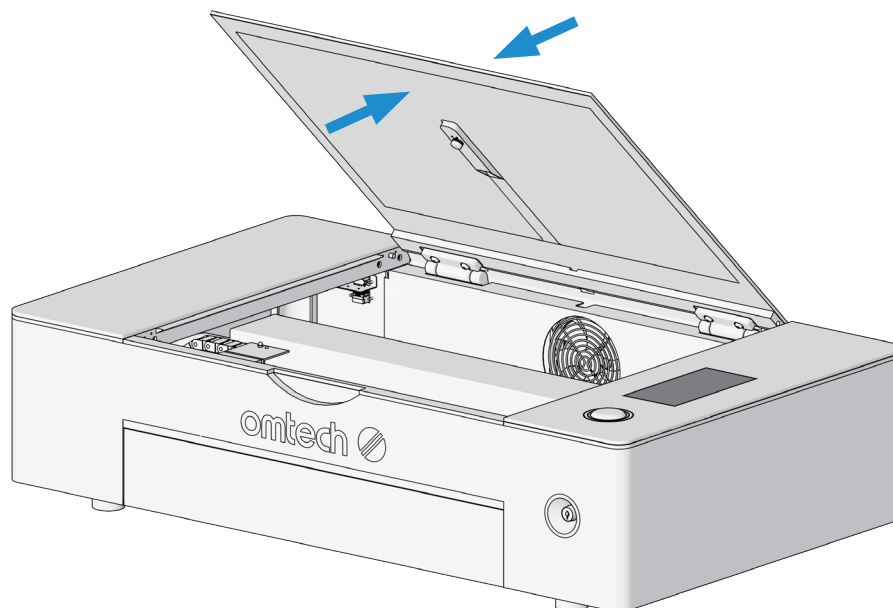
### 7.2.1 Cleaning the Main Bay and Engraver

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

#### Viewing Window

Clean the viewing window with mild cleansers and a lens 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.



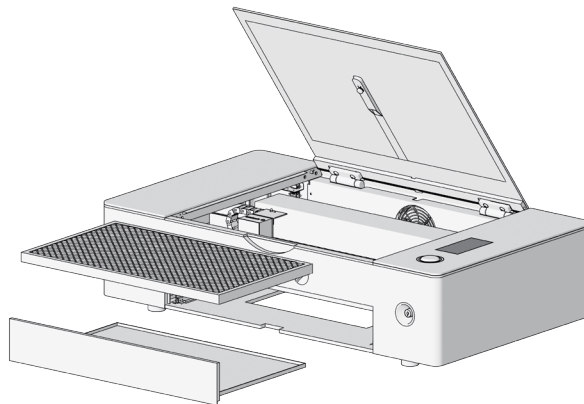
## Interior of the Main Bay



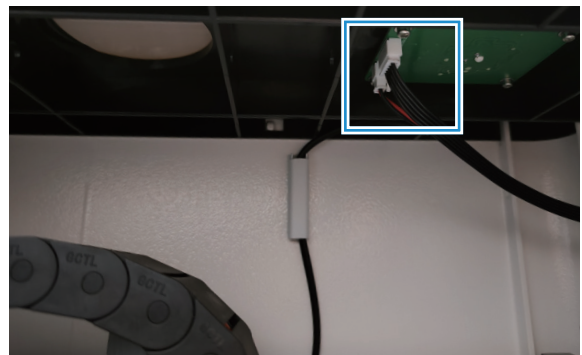
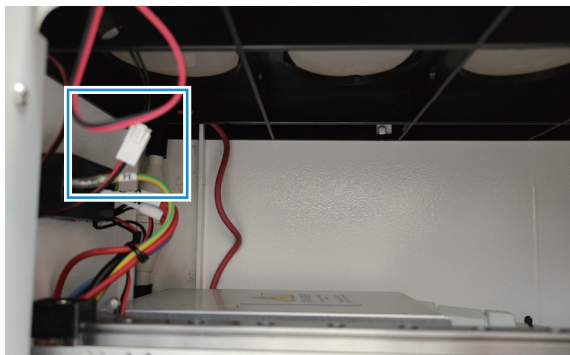
Do not use caustic chemicals or harsh abrasives. Be careful not to allow any electronic component to become wet and let all surfaces dry completely before further use.

Do not leave standing water in the tray.

- Clean the interior of the main bay thoroughly, removing any debris particles or deposits. Paper towels and window cleaner are recommended.



- When it is necessary to clean the right or left sides of the main bay thoroughly, the plastic panels that cover them can be removed for easier access.
  1. Turn off and unplug the engraver.
  2. Open the cover and disconnect all the electronic items on each side.
    - Removing the right panel requires unplugging its LED light as well as the induction switch and key line.

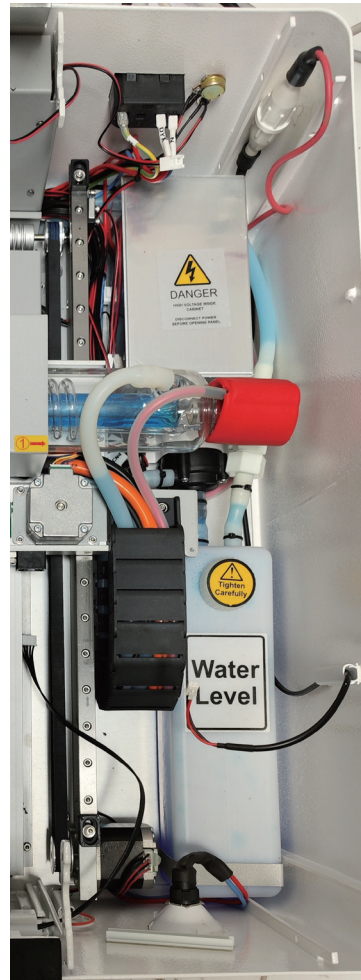


# 7 Maintenance

- Removing the left panel requires unplugging its LED light.



3. Remove the screws and remove the panels.



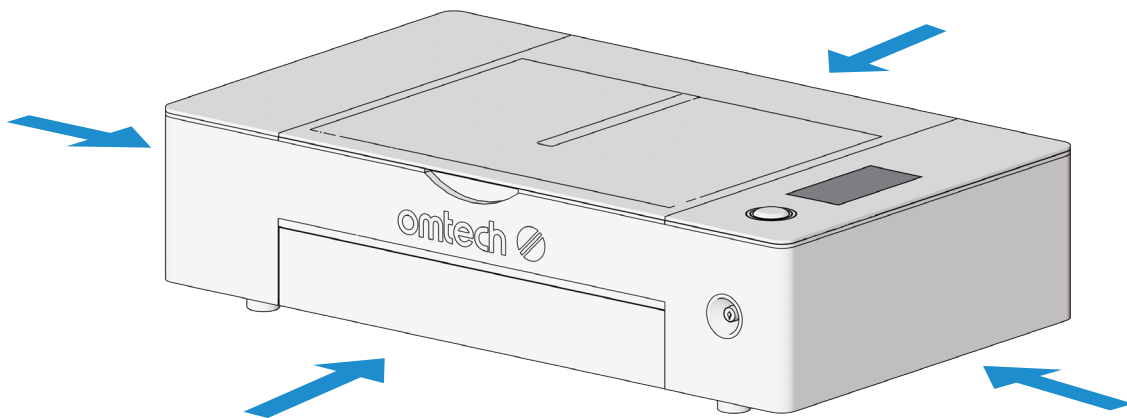
4. Clean the right or left sides of the main bay thoroughly.
5. Replace them using the same screws and then restore the electrical connections.

## Exterior



Do not use caustic chemicals or harsh abrasives. Be careful not to allow any electronic component to become wet and let all surfaces dry completely before further use.

When necessary, clean the engraver's other surfaces with a soft cloth or wipe them using a cloth moderately wetted with mild detergent.



# 7 Maintenance

## 7.2.2 Cleaning the Camera, Mirrors, and Focus Lens

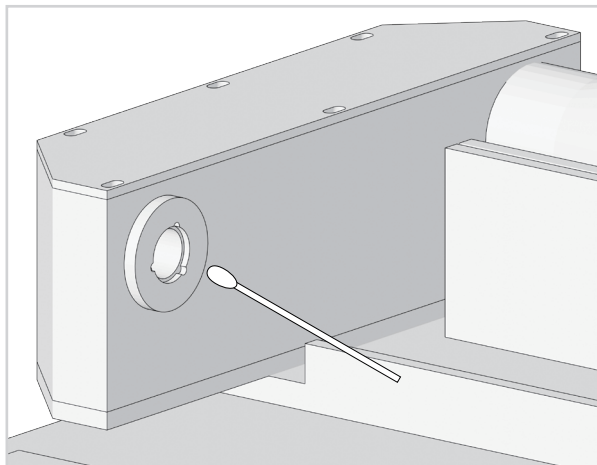


Be careful in all of the following steps not to directly touch the surface of any of these windows, mirrors, or lenses with your finger or any dirty, oily, or abrasive surface. Use lens-safe gloves or cloths only. Avoid pressing hard enough to cause scratches by grinding debris into the lenses.

### Clean the Protective Lenses

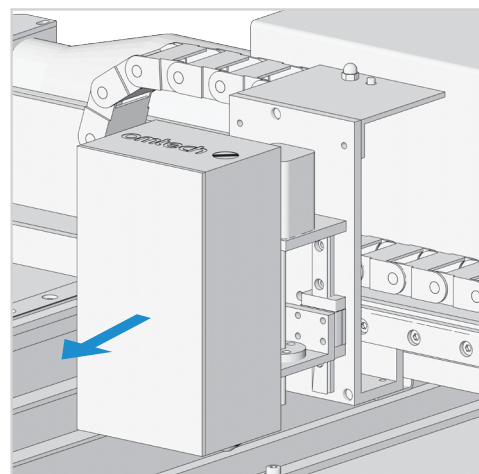
The 1st and 2nd mirrors are permanently aligned within a protective housing and should not require adjustment or cleaning. The 3rd mirror and focus lens are held within the laser head's protective shell.

Clean the lenses of the protective housing's window of the 2nd mirror using a laser-safe microfiber cloth or a cotton swab doused in alcohol or a laser-safe cleaning solution. Clean with gentle circular motions.



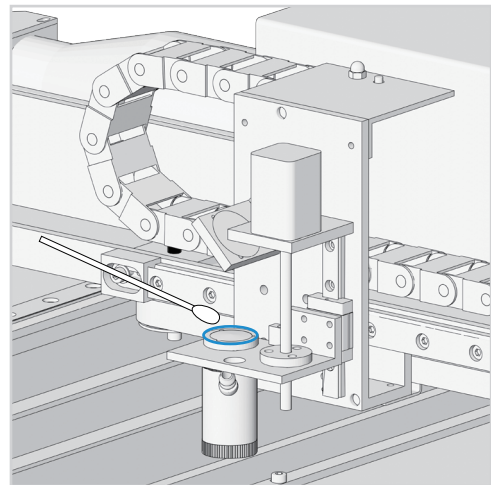
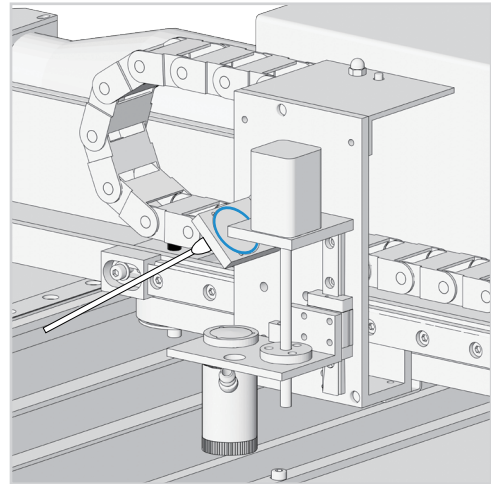
### Clean the Third Mirror

1. To expose the interior of the laser head, gently remove its shell from the magnets that hold it in place.

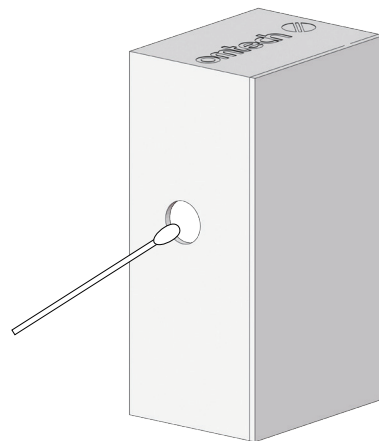




2. Clean the lens of the 3rd mirror and both sides of the focus lens in the same way as the 2nd mirror's protective windows.



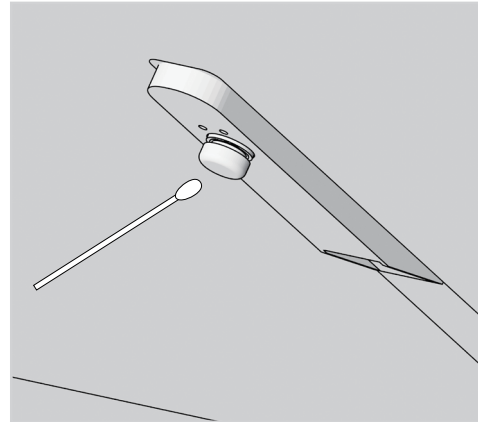
3. Gently remove any other dust or debris from other components inside the laser head and wipe the shell's holes clean as well.
4. Before carefully replacing it, allow the magnets to grab hold and pull it back into place.



# 7 Maintenance

## Clean the camera

Clean the camera lens in the same way. If any permanent spots or debris appear under the camera's glass lens, it cannot be wiped clean and will require replacing the camera itself. Contact customer or technical support for details.

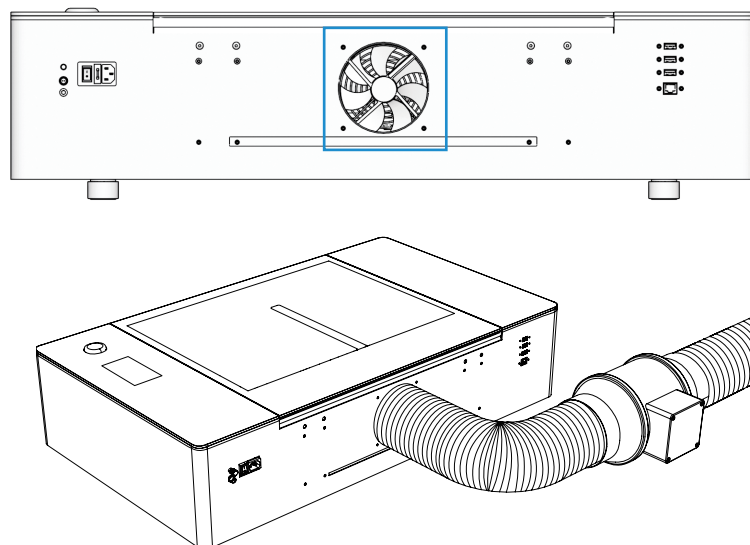


## 7.2.3 Cleaning the Exhaust System

To check and clean the exhaust system at least once a week:

- Check the external fan and surrounding ducts for excessive accumulation of dust and debris.

For best results, use a brush, vacuum, or compressed air to remove large accumulations of dust and debris, and use mild cleansers and soft rags or paper towels to fully clean the fan and its blades at least once a month.



- While you are doing the weekly inspection, check the seams and joints of the ducts for any damage or leaks.

If any are 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.

## 7.2.4 Cleaning the Cooling System



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

Your coolant tank should be shielded from ambient dust created during work. If your coolant ever becomes visibly dirty, discontinue work. The debris in the water will reduce its cooling efficiency, can heat up itself, and can damage the cooling pipes.

1. Remove the right panel following the instructions above.
2. Check the coolant.

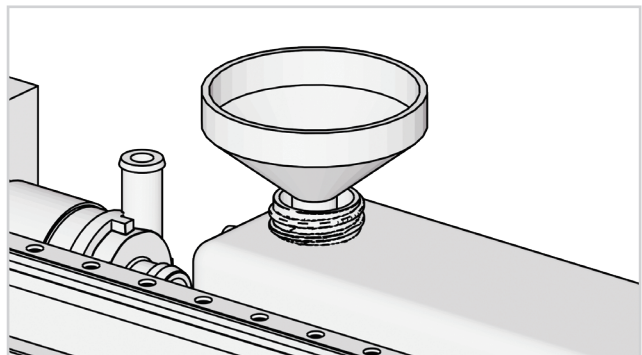
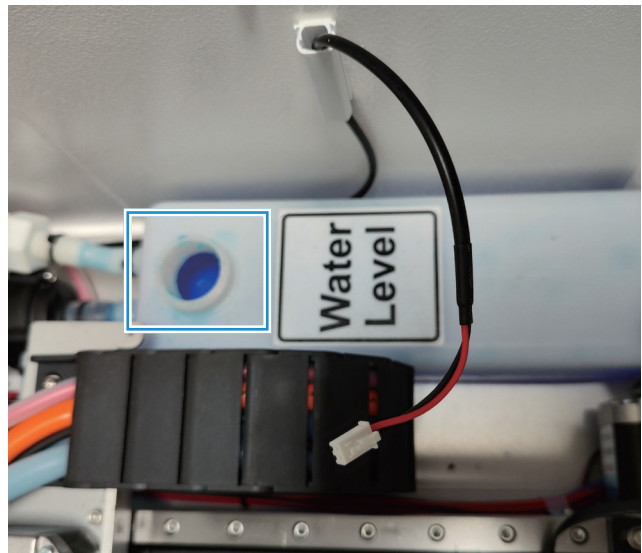
If your coolant remains visibly clean at all times, it is still recommended that you clean the water tank at least once a year as a precaution, replacing the fluid as you do so.

If the coolant is especially polluted, clean it as follows:

- a. Uncap the water tank.
- b. Use a baster or fluid extractor to remove the contaminated coolant.
- c. Use a funnel to refill the tank with clean water and then remove it.
- d. Return the engraver to working order.

See [§6.2.2 Turning On Your Engraver](#) on Page 57. Do not activate the laser use the laser key.

- e. Run the system for a few minutes, turn off the engraver, and then immediately extract the coolant again using a baster or fluid extractor to remove other impurities from the line.
  - f. Use a funnel to refill the tank with clean deionized or distilled water or laser-safe coolant.
  - g. Reseal the tank.
3. Restore the right panel, and resume use.



# 7 Maintenance

## 7.3 Refilling the Water Tank



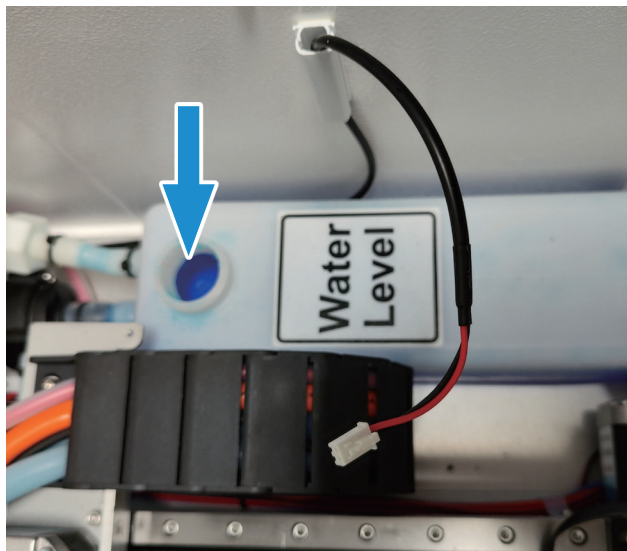
**NEVER** touch or adjust your engraver's water supply while your engraver is still connected to power.



Always fill the chiller with deionized or distilled water or a custom-purpose laser-safe antifreeze. Using tap water for any purpose but rinsing out cleansers (see [§7.2.5 Cleaning the Water Chiller](#) 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.

In addition to the regular cleaning above, check that the tank is at least two-thirds full of coolant or clean water before and after each use.

If the tank ever begins to run low, use a funnel and tube to add more distilled water or laser-safe coolant, or remove the right panel and add the fluid directly with a funnel (see [§7.2.5 Cleaning the Water Chiller](#) above).



## 7.4 Laser Path Alignment

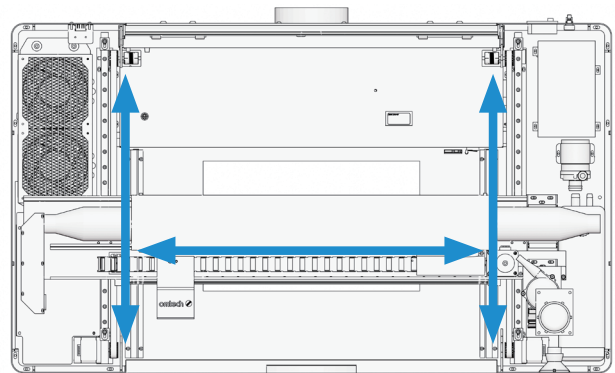
The Polar+ goes through a complete beam alignment before shipping and its design should keep your mirrors locked into their proper positions at all times. If you wish to test the alignment by using the laser to mark pieces of tape along its path to your material, remember to never place the tape directly on any mirrors or lenses, to never use power levels above 15% to mark the tape, and to never disable the cover's interlock switches during your testing.

If you ever find that your mirrors are out of alignment, contact our technical support team to correct the problem.

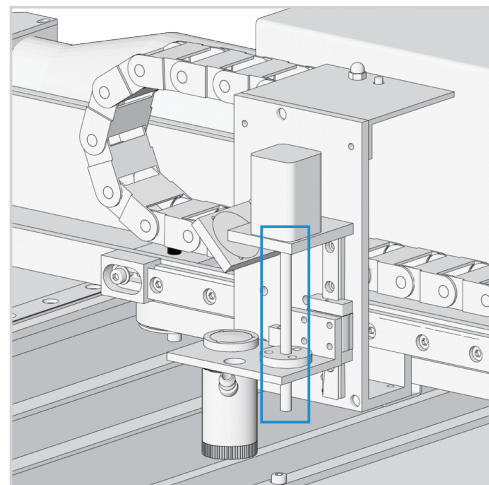
## 7.5 Rail Lubrication

For best results, clean and lubricate the engraver's guide rails every two weeks.

1. Turn off the laser engraver.
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.



4. Do the same to the Z-axis screw.
5. Lubricate both the rails and screws with white lithium grease.
6. Gently move the laser head and X axis to distribute the lubricant evenly along both rails and raise and lower the bed to distribute the lubricant evenly along the screw.



# 7 Maintenance

## 7.6 Parts Replacement



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

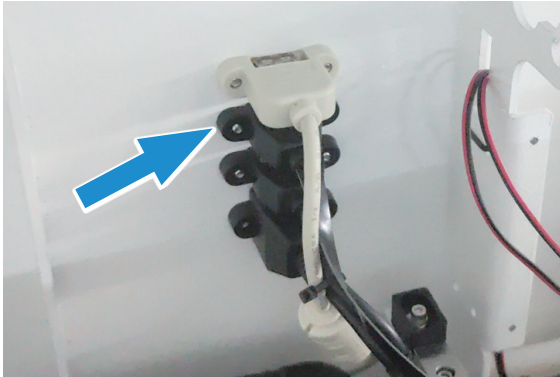
The engraver should not be modified or disassembled by anyone except trained and skilled professionals, but some consumable parts may require replacement after prolonged use. Be sure only to use identical or compatible replacement parts with this engraver. Contact your vendor or our technicians if you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

# 8 Troubleshooting

The common issues and solutions are listed below. For more detailed information on troubleshooting, please visit our official website [omtechlaser.com](http://omtechlaser.com).

## 8.1 Connection

### 8.1.1 The Engraver Can't Find the Device Through Ethernet Cable

Issue	
After powering the device on and connecting it to the computer with an Ethernet cable, the machine's name can't be found in the device list.	
Solution	
Replug the Ethernet Cable	Please check the Ethernet connection cable. Ensure that both ends are properly plugged in.
Try a Different Ethernet Cable	This is to rule out that the cable itself is faulty.
Try with Another Computer	The ethernet port on some computers may not work due to configuration or hardware issues. Try with another computer or docking station that supports Ethernet configuration.
Check the Ethernet Cable Adapter inside the Machine	Take off the left plate of the machine and unplug the inner Ethernet extension cable from the control board.  Connect your Ethernet cable directly to the control board instead.  If it has been connected successfully, it means the extension cable inside the machine is faulty and needs replacement.  

# 8 Troubleshooting

## 8.1.2 The Engraver Can't Find the Device Through Wi-Fi

Issue	
After connecting the machine to the computer via Wi-Fi, the machine's name can't be found in the device list	
Solution	
Affected by VPN Software	Close any VPN on your computer and restart the software to connect again.
Unstable Wi-Fi Connection	Change to another Wi-Fi network in case the signals aren't strong enough.
Special Characters in Wi-Fi Name and Password	Make sure your Wi-Fi name and password consist of only alphanumeric characters. Make sure you enter the correct password.
Unsupported Wi-Fi Frequency Band	Make sure your Wi-Fi is in the 2.4 GHz band, not the 5 GHz band. And try again.
Wi-Fi Is Not Configured	For the first time you connect the engraver to your Wi-Fi, you need to connect it to your computer by USB first and configure the Wi-Fi connection using the software.



### 8.1.3 The Engraver Can't Find Device Through USB

Issue	
After powering the device on and connecting it to the computer with a USB cable, the machine's name can't be found in the device list.	
Solution	
Check the USB Cable Connection	<ol style="list-style-type: none"> <li>1. Check and make sure the connection is secure.</li> <li>2. Replug the USB cable at both ends if necessary.</li> </ol>
Malfunctioning USB Cable or Computer USB Port	<ol style="list-style-type: none"> <li>1. Replace the USB cable, the USB port, and the computer port.</li> <li>2. Turn on the engraver and open the software.</li> <li>3. Check if the driver application of the engraver exists in the following ways.</li> </ol> <p>For Windows:</p> <p>Right-click the start button on your computer.</p> <p>Click <b>Device Manager</b>.</p> <p>Click <b>Network adapters</b> and check if the <b>USB Ethernet/RNDIS Gadget</b> exists.</p> <p>For Mac:</p> <ol style="list-style-type: none"> <li>1. Click <b>System Information</b>.</li> <li>2. Go to <b>Hardware</b> and click <b>USB</b>.</li> <li>3. Check if the <b>RNDIS/Ethernet Gadget</b> exists.</li> </ol>
Check VPN	Exit the VPN software and try again.
Check Ping	<p>The firewall may disable ping.</p> <ol style="list-style-type: none"> <li>1. Click the right button to run the software in <b>Administrator Mode</b>.</li> <li>2. Allow the permission "Default Allow Specific Outbound ICMP" in the firewall software.</li> </ol>
Check SIP	If the MAC system is under SIP protection, the device may be blocked and can't be connected. Disable SIP according to the MAC manual.
Check the Compatibility of the Cable	The engraver does not support a double-end USB-C cable. Connect the engraver using the original USB-A cable or a USB-C to the USB-A docking station instead.

# 8 Troubleshooting

## 8.2 Hardware

### 8.2.1 The Laser Tube Won't Light Up

#### Issue

The laser tube won't light up when trying to process after turning on the engraver.



Do not touch the laser tube when it is illuminating.

#### Solution

##### Adjust the Laser Power Setting

As the laser tube ages, more power will be needed for the same level of laser activation as before.

Try to process by increasing the power to 80%, and observe if the laser tube will light up.

##### Check for Cracks in the Tube

1. Disconnect the power supply of the machine and remove the rear upper cover.
2. Inspect the laser tube for any cracks, both inside and outside. If any cracks have been found, replace the tube.

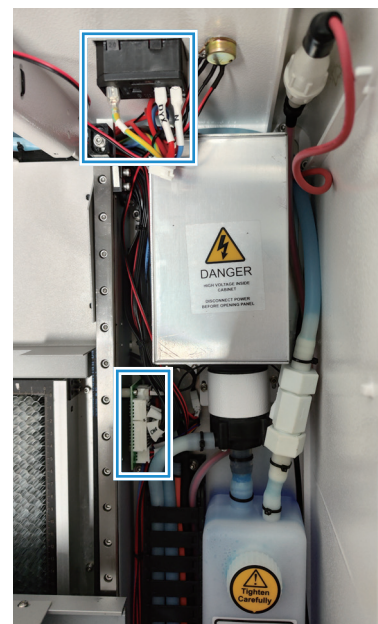
##### Check the Cable and Connection

Disconnect the power supply of the machine and remove the left and right plates.

Inspect the cable as shown in the picture below for any signs of breakage or detachment.

Check if there is any looseness in the cable connection at both ends as shown.

Fix it or replug the cable to ensure a proper connection.



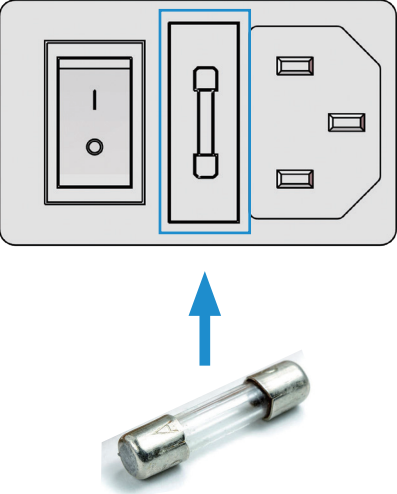
Solution	
Check the Power Supply of the Laser Tube	Have a technician check the power supply of the laser tube or contact our customer service support team for further analysis.
Replace the Laser Tube	If none of the above works, the laser tube may be faulty. Please take a video of the problem, film the troubleshooting steps you have taken, and contact our service team for further assistance.

## 8.2.2 The Engraver Won't Fire Laser

Issue	
The laser tube lights up as usual, but there is no laser coming out from the laser module.	
Solution	
Check the Installation	Have a technician check all the mirrors for any missing, misaligned, or incorrect installation or contact our customer service support team for instructions.
Adjust the Laser Power Setting	<p>The laser requires a certain amount of power to activate—This is called the minimum activation power. As the laser tube ages, however, more power will be needed for the same level of laser activation as before.</p> <p>You can either increase the processing power directly or adjust the device settings to raise the lowest output power so it can reach the minimum power for laser activation.</p> <p>If the processing power is lower than the lowest output power, the latter will be used as the processing power.</p>
Check the Focal Lens	<p>Check if the focal lens is missing and reinstall it.</p> <p>See <a href="#">§7.2.2 Cleaning the Camera, Mirrors, and Focus Lens</a> (Page 81).</p>
Clean the Mirrors and Focal Lens	Check for any residue or stains on the surface of the mirrors and focal lens. For instructions on cleaning, see <a href="#">§7.2.2 Cleaning the Camera, Mirrors, and Focus Lens</a> on Page 81.
Recalibrate the Laser Path	Contact our service to detect if there is any deviation in the optical laser path and calibrate if it is severely deviated.

# 8 Troubleshooting

## 8.2.3 The Engraver Gets Non-Responsive After Power-on

Issue	
After the engraver is powered on by the rear switch, it doesn't give any response. The ammeter display screen, light panel, water pump, motor, etc. won't work at all.	
Solution	
Check the Power Cable	Check if the power cable is properly plugged in on both ends.
Replace the Fuse	<ol style="list-style-type: none"><li>1. Unplug the power cable.</li><li>2. Take off the fuse box next to the switch.</li><li>3. Check the fuse. Replace the fuse if it's blown.</li></ol> 

## 8.3 Processing

### 8.3.1 Poor Smoke Evacuation During Processing

#### Issue

When using the engraver for processing, the smoke generated may fail to disperse properly, resulting in significant accumulation inside the machine or leakage from the machine's seams.

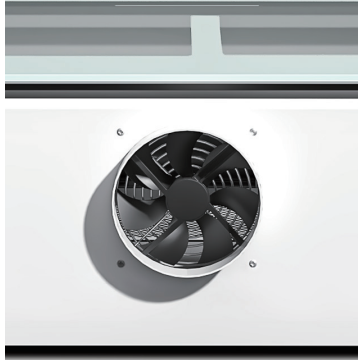
#### Before troubleshooting

Firstly, remove all accessory devices from the engraver (e.g., smoke purifier, extended exhaust pipe, extended exhaust fan, etc.), retaining only the exhaust pipe provided with the machine. Process the material again and evaluate smoke evacuation effectiveness.

- Scenario 1: If smoke evacuation remains poor
- Scenario 2: If smoke evacuation improves

### Scenario 1: If smoke evacuation remains poor

If the smoke evacuation is still poor after removing the accessory devices, the issue may be related to the installation of the smoke exhaust fan.

Check the smoke exhaust pipe	Ensure that the smoke exhaust pipe is not pressed or bent, hindering proper smoke evacuation.
Check the installation of the fan	<p>Remove the smoke exhaust pipe at the rear plate to observe if the fan is installed correctly.</p> <ul style="list-style-type: none"><li>• The correct installation displays the fan blades inward.</li><li>• If not, remove the fan cover and reinstall the fan.</li></ul> 

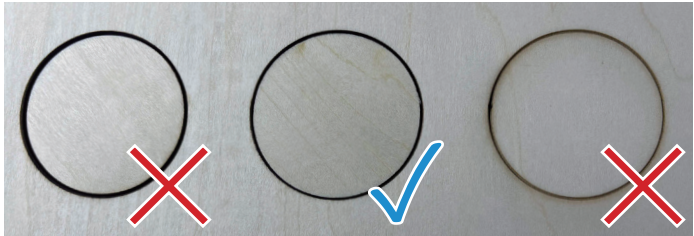
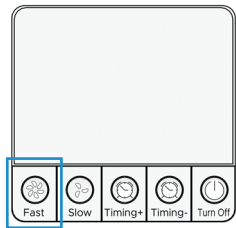
### Scenario 2: If smoke evacuation improves

If the smoke evacuation improves after removing the accessory devices, the issue is related to the used devices.

Check the airflow	For better smoke evacuation, make sure that your extended smoke exhaust fan or purifier has an airflow greater than 200 cfm.
Check the filters	Remove all the filters from the purifier used for the engraver and test the smoke evacuation. If it improves without filters, consider replacements.
Check the extended exhaust pipe	Confirm the smoke exhaust pipe isn't pressed, bent, or excessively lengthy for efficient smoke evacuation.

# 8 Troubleshooting


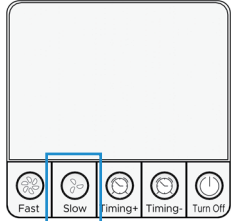
## 8.3.2 Not Cutting Through the Material

Issue	
<p>The engraver won't fully and effectively cut through the material as expected.</p> 	
Solution	
Check the Processing Parameters	<p>For the materials suggested in this manual, you can choose the recommended parameter values for cutting.</p> <p>For those not suggested, you can get the ideal parameter values after several tests.</p>
Check the Material Distance/Thickness Value	<p>Check if the material thickness/distance is out of the standard range of the engraver.</p>
Check the Mirrors and the Focal Lens for Stains	<p>See <a href="#">§7.2.2 Cleaning the Camera, Mirrors, and Focus Lens</a> (Page 81).</p>
Check the Power of the Laser Tube	<p>It is common that the power of the CO<sub>2</sub> laser tube degrades over time.</p> <p>You can try the following methods to improve the performance of the cutting process: increase the power, lower the speed, and increase the processing pass.</p> <p>If the power drops drastically, have a technician replace the laser tube.</p>
Increase the airflow rate	<p>Adjust the airflow of the air duct by pressing <b>Fast</b> on the remote control.</p> 
Check the Focal Lens Installation	<p>When the focal lens is not installed properly, the laser spot will become larger, decreasing cutting performance.</p> <p>Remove the focal lens and install it again. See <a href="#">§7.2.2 Cleaning the Camera, Mirrors, and Focus Lens</a> (Page 81).</p>

Solution	
Use Compatible Material	Some materials are not cuttable with the engraver. For recommended materials, see <a href="#">§1.6 Material Safety Instructions</a> (Page 6).
Calibrate the Laser Path	<p>When the laser path is misaligned, the laser performance may vary significantly in different processing areas.</p> <p>Contact our service to guide you on calibrating the laser path if the solutions above don't work.</p>

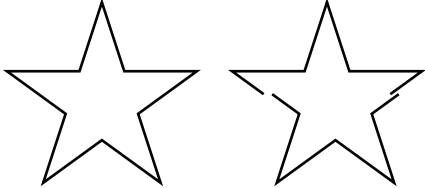
# 8 Troubleshooting

## 8.3.3 Poor Engraving Results

Issue	
<p>When this issue occurs, you may find the engraving performance is not as expected: the pattern appears blurry, and the engraving outcome is excessively darkening or too shallow to be identified.</p> 	
Solution	
Check the Processing Parameters	<p>For materials suggested in this manual, you can choose the recommended parameter values for cutting.</p> <p>For those not suggested, you can get the ideal parameter values after several tests.</p>
Check the Material Distance/Thickness Value	<p>Check if the material thickness/distance is out of the standard range of the engraver.</p>
Set a lower airflow rate	<p>Adjust the airflow of the air duct by pressing <b>Slow</b> on the remote control.</p> 
Check the Focal Lens	<p>When the focal lens is not installed properly, the laser spot will become larger, decreasing engraving performance.</p> <p>See <a href="#">§7.2.2 Cleaning the Camera, Mirrors, and Focus Lens</a> (Page 81).</p>
Check the Material	<p>Some materials can be harder to engrave by laser. To get better results, set a higher processing power or use less dense materials.</p> <p>For recommended settings on materials, see <a href="#">§1.6 Material Safety Instructions</a> (Page 6).</p>
Calibrate the Laser Path	<p>When the laser path is misaligned, the laser performance may vary significantly in different processing areas.</p> <p>Contact our service to guide you on calibrating the laser path if the solutions above don't work.</p>



### 8.3.4 Engraving Image Shifts During Processing

Issue	
<p>The engraved image is deviated or won't close up because of the losing steps in processing.</p>	
	
Solution	
Lower the Speed of the Engraving Process	<p>If the processing speed is too fast, it may cause step loss. Please try again by lowering the speed.</p>
Adjust the Tightness of the Timing Belts	<p>Contact our customer service for instructions on adjusting the tightness of the X-axis and Y-axis timing belts so that the laser module can move smoothly.</p>
Checking the Stability of the Material	<p>If the material is too light, the gas coming out of the air nozzle may nudge the material, causing a deviated image. Use the material clamp or tape to fix the material before processing.</p>
Check the Material Distance/Thickness Value	<p>If the air nozzle hits the material because of the failure of focusing, which leads to the deviation of the image, check if the material thickness or distance is the same as the actual value.</p>







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**Polar+ | 55W | CO<sub>2</sub> Desktop Laser Engraver**  
User Manual

USB-5553-US Rev. 4 Sept. 2024