User Instructions

Laser Engraver



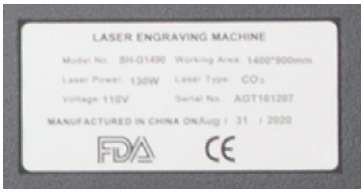
V20200066

Welcome (or welcome back) to the wonderful world of laser cutting and engraving!

This manual contains important information concerning the safe installation, operation, and maintenance of your new laser engraver. Keep it for future reference and provide it—or equivalent training including the specific parameters of this machine and its safe use—to ANYONE who will use this machine. ALL personnel involved in the installation, operation, maintenance, and/or repair of this machine must read and understand this manual, especially its safety instructions (§2).

This machine houses a CLASS 4 LASER and can be extremely dangerous. Please use it safely and responsibly. It is intended for use engraving and cutting signs, stamps, and suchlike. A wide variety of materials—including rubber, acrylic, plywood and medium-density fiberboard, leather and fabric, cardboard, certain metals, and more (see §2 and §4 for details)—can be processed with this laser. The machine should should ONLY be used in designated locations compatible with the safety instructions. Unauthorized modification of the device or use of the system for other purposes or in other areas is against its designated use and waives the manufacturer's liability for any damage to personnel and/or equipment that may result.





It is recommended that you take time now to enter data such as your engraver's serial number and year of manufacture onto the manufacturer's label on the machine so that you always have this information handy if you need to contact customer service or need to ensure that you are purchasing the appropriate spare parts.

CONTENTS

1 General Information ---- 1
- 1.1 Technical Specifications ---- 1
- 1.2 Package List ---- 2
- 1.3 Parts Diagrams ---- 3

2 Safety ---- 4
- 2.1 User Qualification ---- 4
- 2.2 Laser Safety ---- 4
- 2.3 Operational Safety ---- 5

3 Installation ---- 6
- 3.1 Unpacking the Machine ---- 6
- 3.2 Location ---- 7
- 3.3 Filtration System (optional) ---- 7
- 3.4 Built-in Air Pump ---- 7
- 3.5 Computing Requirements ---- 7
- 3.6 Grounding the Machine ---- 7
- 3.7 Connecting the Mains ---- 7
- 3.8 Connecting the Computer ---- 9
- 3.9 Connecting the Exhaust System ---- 9
- 3.10 Connecting the Cooling System ---- 10

4 Operation ---- 11
- 4.1 Control Panel ---- 11
- 4.2 Laser Mirror Calibration ---- 11
- 4.3 Running the Laser ---- 15
- 4.4 Rotary Axis Attachment (optional) ---- 16
- 4.5 Laser Engraving ---- 17

5 Control Interface ---- 19
- 5.1 Keys ---- 20
- 5.2 Main Interface ---- 20
- 5.3 Menu Screen ---- 21
- 5.4 Setting the Laser Speed ---- 21
- 5.5 Setting the Laser Power ---- 22
- 5.6 File Commands ---- 22
- 5.7 Flash Drive Commands ---- 23
- 5.8 Adjusting Engraving Layers ---- 23
- 5.9 Function Menu ---- 24
- 5.10 Adjusting the Z-Axis ---- 24

5.11 Setting an Interface Password ---- 25
5.12 Manual Movement of the Laser Head ---- 25
5.13 Manual Firing of the Laser ---- 26
5.14 Setting Origin Points ---- 26
5.15 Saving Current Parameters and Virtual Keyboard Use ---- 27
5.16 Loading Saved Parameters ---- 27
5.17 Autofocus ---- 27
5.18 Setting the Interface Language ---- 28
5.19 Setting the Machine's IP Address ---- 28
5.20 Diagnostic Tools ---- 28
5.21 Reflecting Images across an Axis ---- 29
5.22 Resetting Axes ---- 29
5.23 Alarm Displays ---- 30

6 Maintenance ---- 31
6.1 Regular Maintenance ---- 31
6.2 Cleaning the Machine ---- 31
6.3 Cleaning the Optical Components ---- 31
6.4 Maintenance of the X and Y Rails ---- 33
6.5 Changing the Water ---- 34
6.6 Parts Replacement ---- 34
6.7 Rewiring the Laser Power Supply ---- 34
6.8 Parts Disposal ---- 35

Contact Information ---- 35

1 General Information
1.1 Technical Specifications

Model	SH-G1490 USBGR14-130W
Color	Blue and grey
Processing/Cutting Area	23.6″ × 39.4″ (90×140 cm)
Workbench	Honeycomb & aluminum knife
Laser Capacity	130W (adjustable from 0–100%, recommended 10–95%)
Laser Type	CO_2 sealed laser tube
Power Supply	110V/60Hz
Maximum Shaped Text	0.08″ × 0.08″ (2×2 mm)
Minimum Shaped Text	0.04″ × 0.04″ (1×1 mm)
Fan	Built-in
Software	RDWorks 8
Display	LCD Digital
Workbench Adjustment	Automatic
Cutting Thickness	0–0.6″ (0–15 mm),varying according to materials and power.
Laser Class	Class 4(H)
Resolution Ratio	≤4500 dpi
Supported Software	CorelDRAW/AutoCAD/EngraveLab/Adobe Illustrator
Dichroic Cutting	256 layers
Assisted Positioning	Red light
Protection	Air-blowing flame retardant, water protection
Buffer Memory	128 MB
System Environment	Windows XP/7/8/10
Graphic Operating Modes	Optimized Raster, Vector, and Combined
Graphic Formats Supported	All formats that can be recognized by CorelDRAW or AutoCAD, including .jpg, .bmp, .ai, .plt, etc.
Data Transmission	USB 2.0 cable, Ethernet cable, USB flash drive
Certifications	CE, FDA, CDRH, ISO9001
Optional Configuration	Regular rotation axis (not included)
Product Dimensions	78.7″ × 60.6″ × 39.4″ (200×154×100 cm)
Net Weight	529 lb. (340 kg)
Package Dimensions	83.5″ × 69.3″ × 45.3″ (212×176×115 cm)
Gross Weight	926 lb. (420 kg)

1.2 Package List

When your shipment arrives, check that the following have been included:

1. Your laser machine, including its optics, a red dot pointer, pass-through door, air pump, exhaust fan, motorized and honeycomb tables, and 1.5″ (38.1 mm) focus lens
2. Any optional components that you selected for your purchase, such as the rotary attachment, auto-focus worktable, water filter or chiller, high-resolution head, or air compressor.
3. The accessories box, which should contain all of the following:

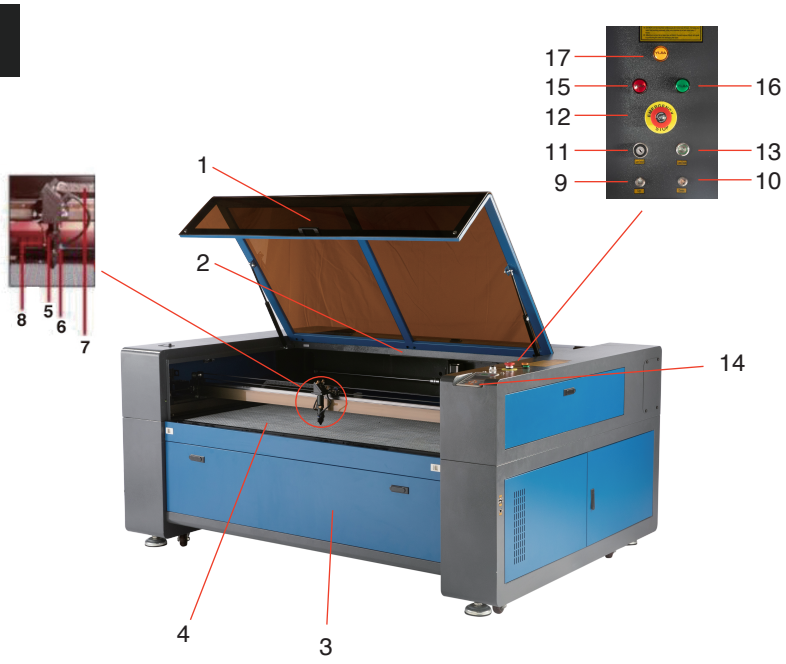


ITEM	QTY
1. Allen Wrenches	1
2. Ground Wire	1
3. Long USB Cable	1
4. Ethernet Cable	1
5. Power Cable	1
6. Tube of Silicone Insulation	1
7. 7 mm Acrylic Focus Tool	1
8. Water Pump	1

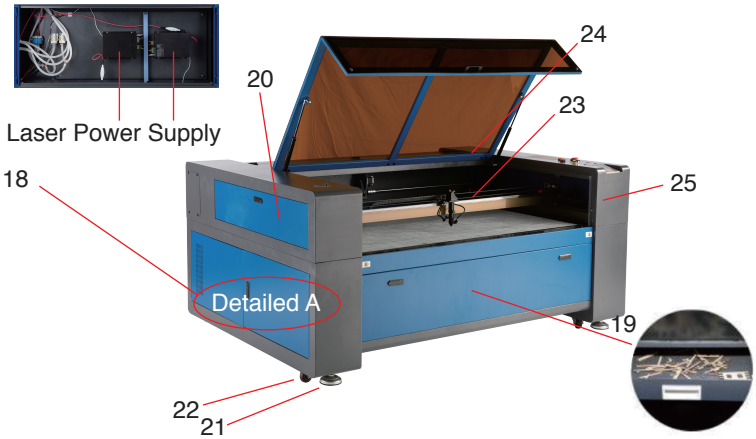
ITEM	QTY
9. Tape for Laser Mirror Adjustment	1
10. Exhaust Pipe	1
11. Hose Clamp	1
12. Water Pipe	1
13. Keys	1
14. Instruction Manual	1
15. 4G USB Flash Drive (software)	1
16. Rotary Axis (optional)	1

1.3 Parts Diagrams

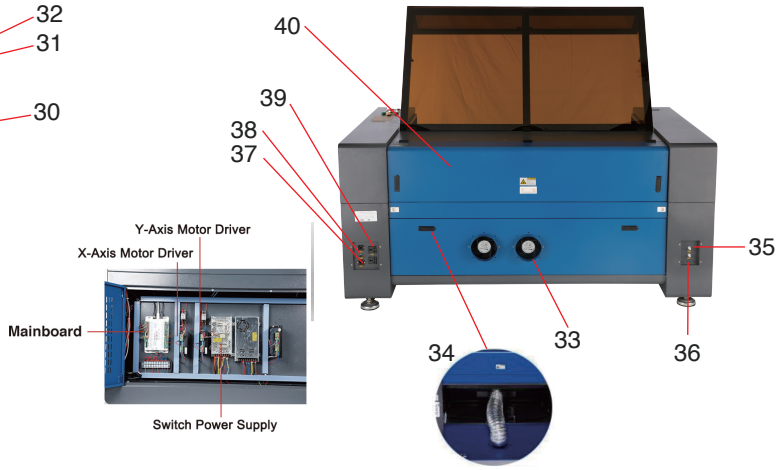
1: Working Area Lid with Acrylic Screen
2: LED Light
3: Drawer Door
4: Honeycomb Working Table (optional)
5: Laser Head
6: Pressurized Air Hose
7: Leading Chain
8: Red Point Locator
9: Up Button for the working table
10: Down Button for the working table
11: Laser Switch
12: Emergency Stop
13: Motherboard Power
14: Control Interface (See §5)
15: Laser Power Indicator Light (Red)
16: Controller Power Indicator Light (Green)
17: Open Cover Indicator Light (Orange)
18: Laser Power Supply



19: Waste Drawer
20: Upper Left Door to second reflective mirror
21: Base Foot
22: Wheels
23: X Limit
24: Information Labels
25: Cover Protection Switch
26: USB Port
27: Port for USB Cable
28: Port for Ethernet Cable
29: Y Limit
30: Lower Right Door to motherboard, X & Y motor drivers, & power supplies
31: Upper Right Door to rotary axis socket
32: Hole for Longer Laser Tubes
33: Exhaust Hose
34: Back Door to electric lift motor & exhaust device
35: Water Inlet
36: Water Outlet







37: Power Socket and Fuses
38: Ground Line Connection
39: Water Pump Power Socket
40: Laser Tube Cover

2 Safety
2.1 User Qualification

All activities involving this laser engraver should be done in accordance with the instructions in this manual.

All personnel involved in installation, set-up, operation, maintenance, and repair of the machine should read and understand this operation manual, particularly this Safety section.

In industrial settings, it is recommended that the user should generate company-internal instructions considering the professional qualifications of the personnel employed for each use, and the receipt of the instruction manual and/or participation in equivalent training should be acknowledged in writing in each case.

The machine must be operated by trained and authorized personnel. Untrained people and minors should never operate this engraver, and none should be left unsupervised around it. The scope of users' competence for the different activities in operating the machine must be clearly defined and observed. This applies in particular to maintenance or repair of the electric equipment, which must be performed by trained experts.

2.2 Laser Safety

This machine is a CLASS 4 LASER, the strongest and most dangerous kind available for public use.



Without careful use, this kind of laser might lead to the following accidents:

1) The laser will easily burn nearby combustible materials.

2) Some working materials may produce radiation or harmful gases during processing.

3) Direct exposure to the laser WILL cause bodily harm.

As such, the area around the engraver must be equipped with fire-fighting equipment and must be kept free of combustible, flammable, or explosive materials at all times. Clean the dust from the work area and waste bins, as it forms a potential fire hazard. Sensitive EMI equipment should also be kept far away from the machine. Do not use the laser at more than 20 mA, as exceeding this current can damage the integrity of the laser tube. **Do not** connect other devices to the laser's fuse, as it requires that connection's full amperage.

The area around the machine should be kept dry. It should be well-ventilated and environmentally controlled to keep the temperature between 41–77°F (5–25°C). Shades are recommended. The area's humidity should not be allowed to exceed 70%. The area should also be free of airborne pollutants, strong electro-magnetic interference, or mechanical shocks.

Processed materials should always be checked beforehand to ensure that they can withstand the heat of a class 4 laser and will not produce any emissions either harmful to people nearby or in violation of local laws and regulations. It is the responsibility of the user to prevent exceeding the national or local limits for workplace concentration of dust, gas, etc. and additional air filtration systems should be employed if the machine's exhaust can not be sufficiently vented from your workspace.

Because even seemingly matte materials may produce harmful reflected beams, care should always be taken to control the beam path and to keep others from observing the machine during use. Be particularly cautious with conductive materials including carbon fiber as their dust can cause short circuits and damage electrical components. Many reflective metals (particularly uncoated aluminum, copper, silver, and gold) cannot be processed with this laser, as their direct reflections of the beam could destroy the working area's protection cover. Similarly, under NO circumstance should polyvinyl chloride (PVC) be processed using this machine.

NEVER operate the machine without having the water pump or chiller running. Always make sure the water tank is full of cool, clean water and the pump is running well before using the machine. For best results, use deionized water. Failing that, use distilled water. Keep the water between 60–85°F (16–29°C). If there is no water or insufficient water or if the water is dirty, the machine should cease operation automatically. If this automatic safety feature does not activate, **DO NOT** use the machine until it has been repaired by a trained professional.

Operators should always be mindful of the laser's potential danger. **NO** part of the machine should be opened during normal operation. All covers should be fully closed before work begins and no cover should be opened until work has stopped.

2.3 Operational Safety

This machine can be highly dangerous to people and property. It should only be used when it is in proper condition, and it is the duty of users to inspect the machine for external damage or defects that may impair its safe operation prior to use. Any such problem should be immediately reported and corrected before use.

Do not use this machine is a careless or irresponsible manner, and do not modify, adjust, or repair it in any way that adversely affects the safety of the machine. In particular, no safety component should be removed or disabled and, if repair or service requires the removal or disabling of any safety component, it **must** be **immediately** replaced and restored to working order following the completion of such repair or service. Only use this machine with identical replacement parts or parts that have been approved by the dealer or manufacturer.

The user must guarantee the cleanliness of and around the machine by following a regular maintenance schedule (see §6) and establishing the necessary instructions and controls. The machine should be easily accessible, with no obstructions.

Users should never leave during operation. They should ensure that no unauthorized person works with the machine. If anything seems to be acting strangely, immediately cut off all power to the machine and contact customer service or a trained professional technician. Similarly, after work is finished, the user should remember to cut off all power to the machine.



DO NOT use the machine for more than eight (8) hours at a time! For optimal continuous use, let the machine cool down for half an hour after every seven (7) hours of use.

Because of its high-voltage and other potentially dangerous components, the machine should only be disassembled or repaired by trained professionals. Only trained personnel should perform the laser mirror calibration (§4.2).

This laser engraver is designed for use with 110V/60Hz electricity. It should never be used with any other form of power supply or used with the power supply is unsteady or unreliable. Always make sure the machine is well-grounded before use.

If you use an air filtration system with this machine, take care that its filters are changed regularly.

The user is obliged to observe these and all other instructions in this manual during use, as well as any applicable local rules or regulations. The Manufacturer shall not be held liable for damage or injury resulting from improper use or failure to follow these safety measures.





Users should also observe the warning & information labels on the machine itself. If these labels are lost or damaged, they should be replaced **immediately** to protect all users.

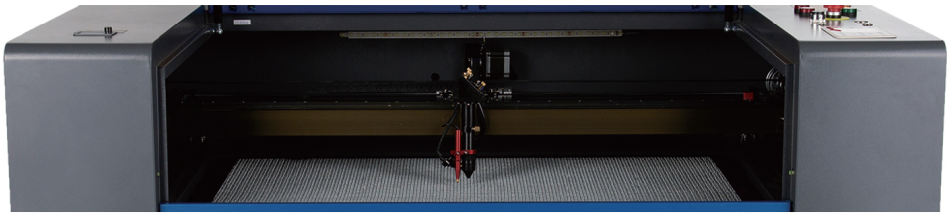
3 Installation
3.1 Unpacking the Machine

You receive your machine packed in a wooden box, which contains the laser machine and additional accessories. The following steps give you an overview of the unpacking and assembly of the laser. Please follow these steps carefully.

1. Put the wooden box on a flat location in a spacious room for unpacking.
2. Remove the machine box and carefully remove the foam material from around the machine.
3. Take out the key and open the door of the laser. Remove the accessories box which contains all the accessory parts required for the installation of the laser machine.
4. Check with the shipping list (§1.2) to see if there is anything missing or damaged during shipping.
5. Remove the sponge from around the laser tube.



6. Remove the nylon cable ties around the honeycomb table and X axis.



7. Start the installation of the various attachments, software, etc. (See below.)
8. Keep the keys. You will require them to secure the machine in the future.
9. Keep the packing box and its screws. You may need it in the case of a return.
10. Dispose all waste according to the applicable waste disposal regulations. (See §6.8.)

3.2 Location

Before you install the laser system, you should select an appropriate location. Follow the guidelines in the Safety section above (§2). In particular:

	Avoid locations where the system is exposed to high temperature, dust or humidity. The temperature should be controlled between 41–77°F (5–25°C) and humidity below 70%. Select a location without higher ambient temperature and avoid the strong exposure of the engraver to the sun. Use blinds, if required.
	Do not connect other devices via the laser fuse, as the laser system requires the full amperage.

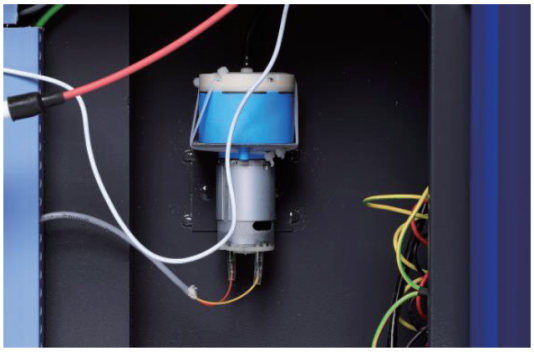
4. Avoid locations where the system is exposed to mechanical shocks.
5. Avoid locations with poor air circulation. Select a location close to ventilation if available.
6. Select a location that is not more than 14′ 9″ (4.5 m) away from your computer as this is the maximum cable length before the onset of disturbing interference.
7. The machine can be rolled into place. Fix it in place by pressing down on the brake pads on the 2 front wheels.
8. Place a working table near the machine (without obstructing access to it) in order to avoid treating the engraver's lid and case as a table during production.

3.3 Filtration System (optional)



To guarantee the right ventilation during the engraving and the cutting, the device is equipped with an exhaust fan. Its vent **must** be placed into open air **outside** the work area or the machine must be equipped with a separate air filtration system (not included). Take care to ensure that the filtration system you choose will be able to handle the materials you plan to work with. **DO NOT** start the machine without an adequate exhaust system.

3.4 Built-in Air Pump



The built-in air pump turns on automatically with the engraver and supplies an air pipe that blows dust and smoke away from the field lens and engraving laser, keeping your optics cleaner and preventing potentially dangerous reflectivity.

3.5 Computing Requirements

The following are the minimum requirements for RDWorks 8. A more powerful computer will generate graphics faster, and the computing and signal transfer times will be reduced. For newer software versions, these requirements may be inadequate.

Windows Vista (with Service Pack 1 or later), XP (with Service Pack 2 or later), 7 (32/64), or 8 (32/64 bit)
Pentium 3 or 4 processor or AMD Athlon XP

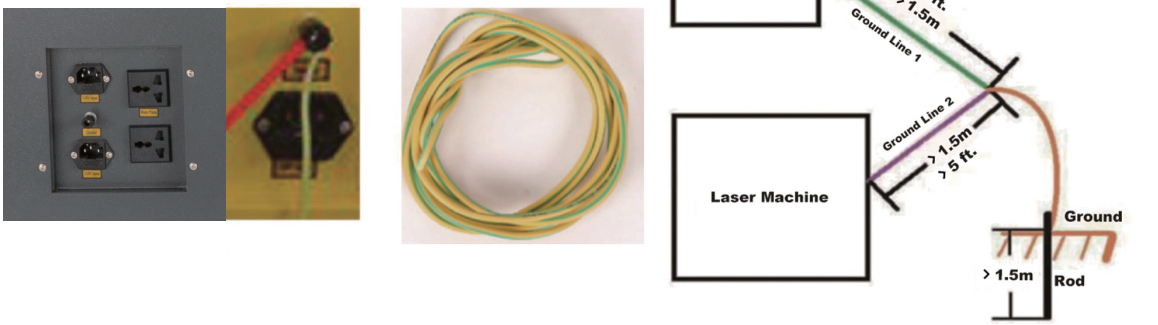
1024 MB of RAM
400 MB of hard disk space
1024×768 or better monitor resolution
1 free USB interface
1 free Ethernet interface
Mouse

Connections

Perform the connections exactly in the order described.
Otherwise electrostatic charging can damage your computer and/or the laser's electronics.

3.6 Grounding the Machine

This CO_2 laser tube is a Class 4 laser. It should only be used after providing electrical grounding. The safe line-to-ground resistance should be less than 5Ω.



The computer & laser should both be grounded with a metal spike driven at least 1′ 8″ (50 cm) deep in the ground.

3.7 Connecting the Mains

Connect one end of the main cable to the connection socket on the rear side of the laser device and the other end to a protected power outlet. This machine can only be used with American-standard 110V/60Hz AC. Refer to the information label beside the connection socket for further details. Under no circumstances should you switch on the device if the voltages do not correspond.

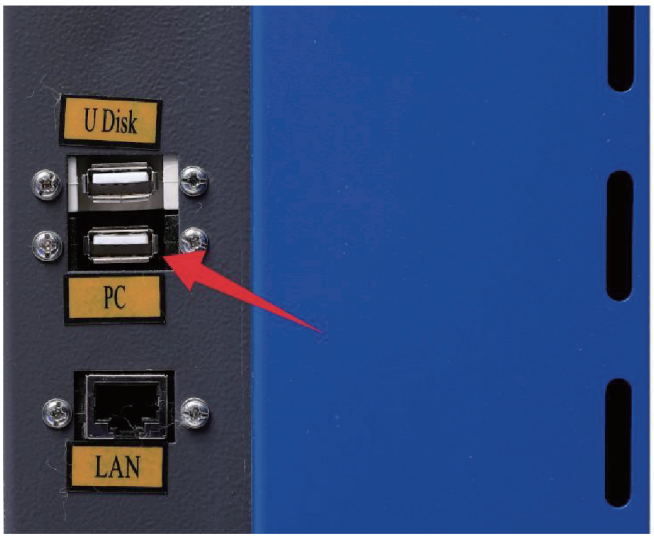
The main fuses are located inside the connection socket and are accessible from the exterior.





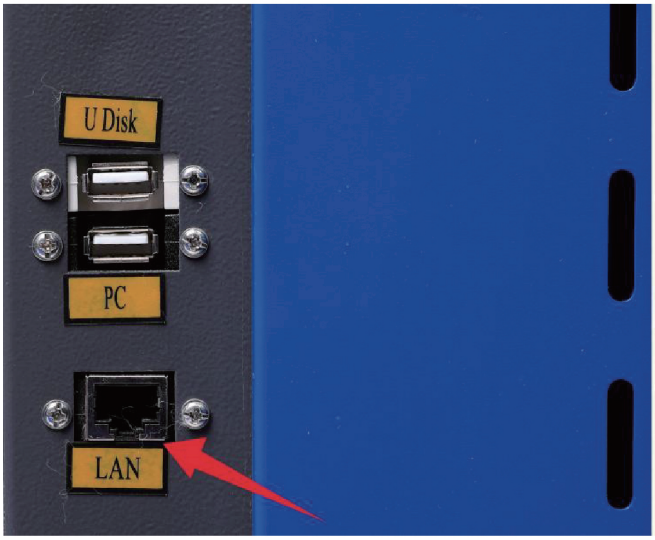
3.8 Connecting the Computer

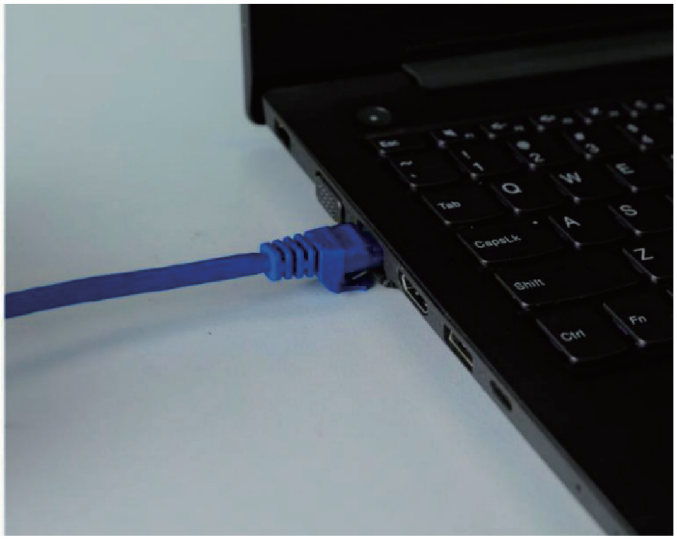
You can connect the computer and the machine by using the USB cable





or connect the computer and the machine by using the Ethernet cable.





3.9 Connecting the Exhaust System

Connect the exhaust fan & its pipe. As mentioned above, the other end should vent outdoors or into a filter system.





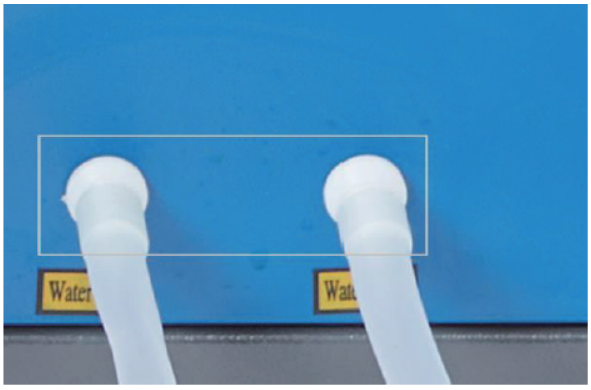
3.10 Connecting the Cooling System

If you have a water chiller, connect the machine to the water chiller directly. If not, connect to the water pump.

To connect the machine to a water chiller,

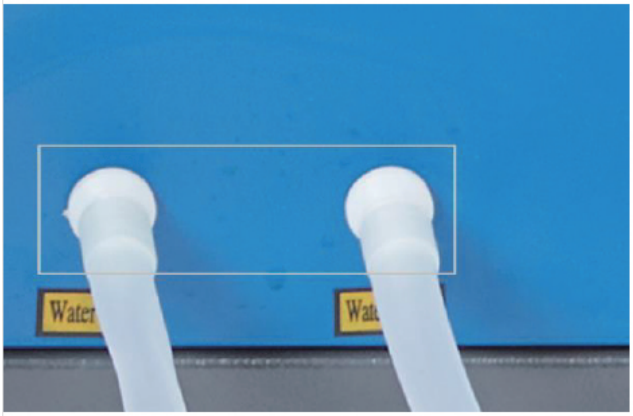
Take out one of the water pipes. Connect to the water chiller's outlet and connect the other end to the machine where it is marked Water IN. Connect the other pipe to the water chiller's inlet and the location marked Water OUT on the machine.

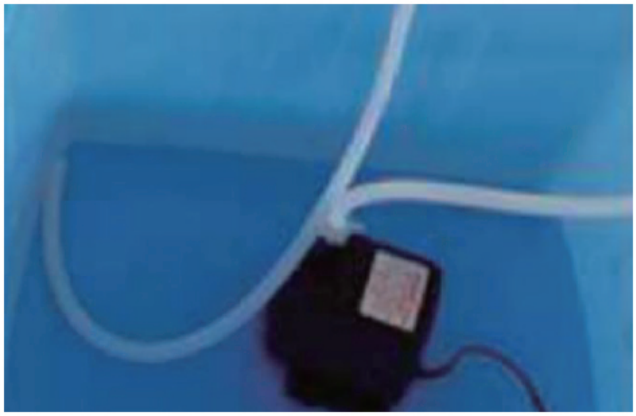




To connect the machine to a water pump,

Take out one of the water pipes. Connect to the water pump's outlet and connect the other end to the machine where it is marked Water IN. Connect the other pipe to the location marked Water OUT on the machine and allow the other end to rest inside the tank holding the water pump. The water pump should be **FULLY** submerged in water as shown. Aim to keep the water temperature in the tank around room temperature (70°F or 20°C).







Plug in the water chiller or the water pump, and turn on the main power. Check that the water chiller or pump work. A green light should come on and water should flow through the pipes. Wait for any bubbles in the line to disappear before using the laser.

Again, do not activate the laser if the water cooling system is not working or if the water is dirty. For best results, use distilled water.

4 Operation
4.1 Control Panel



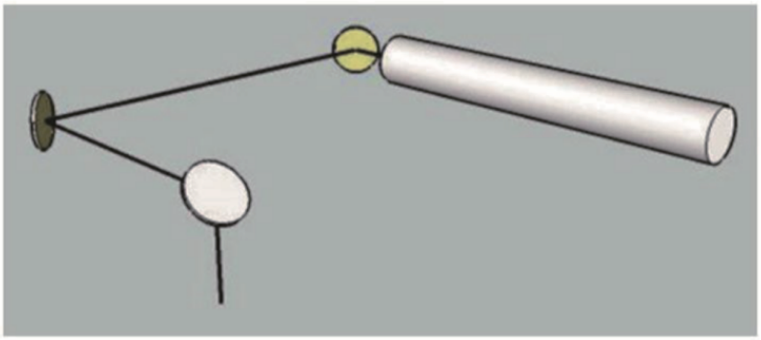
The control panel includes the emergency stop knob and switches the laser power supply on. Before switching on the device, the user must make sure that no objects of any kind are located inside the operating space, which could limit or obstruct the mechanics of the device. The following conditions must be fulfilled for correct start up:

• Unrestricted freedom of motion for the machine's parts
• No materials under the engraving table

When turning on the machine, turn on the emergency stop switch first and then the laser power supply. When the referencing process is completed correctly, there will be an acoustic signal and the device will be ready for operation. The control interface (§5) will display its home screen when the laser is completely reset.

Note: When the main power supply is turned off, all current processing data and unsaved parameter settings are lost.

4.2 Laser Mirror Calibration



4.2.1 Before Use

Having a proper beam alignment is important for the overall efficiency of the machine and quality of its work. This machine went through a complete beam alignment before shipping. However, it is recommended that users to do a quick beam alignment test before use. This double-checks the accuracy of the mirrors and also accustoms the user to the procedures of a beam alignment, which should be checked every month or so. (See §6.1.)

WARNING: Performing a beam alignment can expose the operator to small amounts of radiation if performed carelessly. Please follow these procedures correctly and always take caution when performing a beam alignment.

4.2.2 Components of the Laser Path

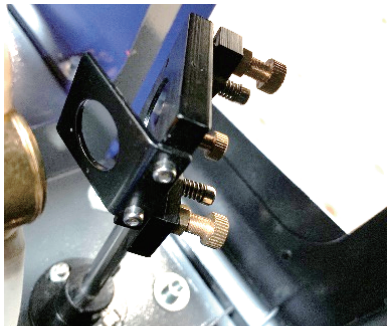
The following are components that make up the laser beam path, starting from the laser tube to the laser head.



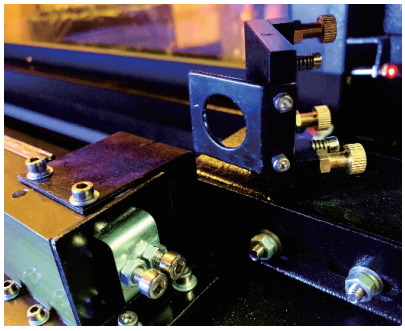
Laser Tube



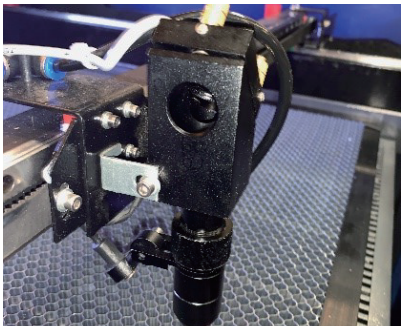
Total Reflection Mirror



Mirror 1



Mirror 2



Mirror 3 & Focus Lens

Beam Alignment Test Instructions

Warning: When performing a beam alignment, the maximum power from the machine MUST be kept at 15%. Any higher percentage will result in the laser igniting the tape.

4.2.3 Performing a beam alignment requires a tape for the laser to mark. Once the provided tape runs out, we recommend masking tape as it is easy to manage and use.

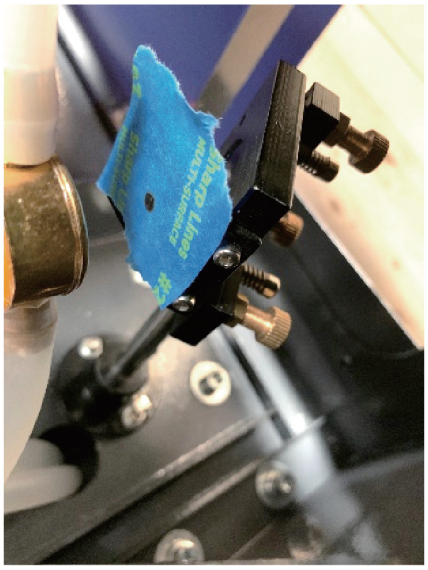
4.2.4 Set the laser power to 15% using the control interface. (See §5.4.)

4.2.5 Laser Tube to Mirror 1

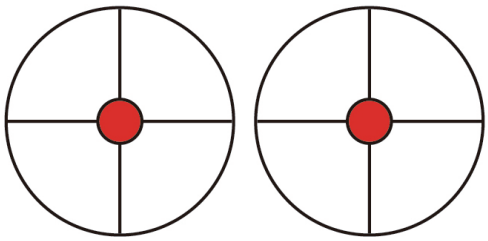
Locate Mirror 1 on the back of the machine next to the Laser Tube. Cut out a piece of tape and place it on Mirror 1's frame. **DO NOT** place the tape directly onto the mirror. Turn on the machine. The green light on the control panel will indicate that the power is on. Insert your key into the Laser Switch Slot and turn it to turn on the laser power. The red light on the control panel will indicate the laser is on.



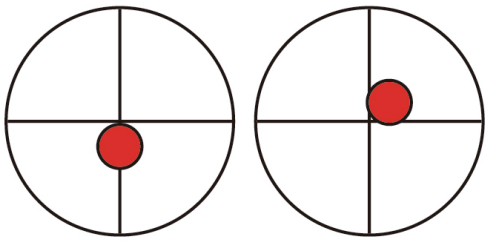




Press PULSE once. You should be able to see a small mark on the tape. If it is not noticeable, press PULSE again.



These marks are OK.



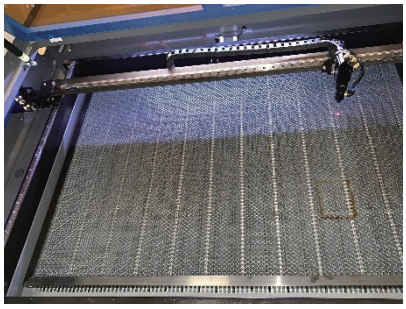
These marks require adjustment.

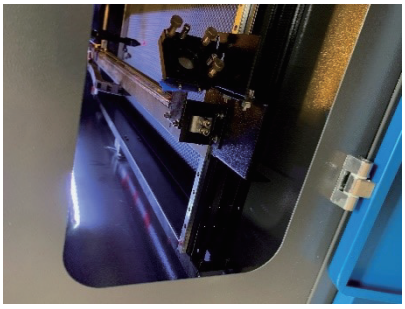
If the laser is not centered on Mirror 1, carefully adjust your laser tube and test again until the beam is well aligned.

Caution: Pressing PULSE activates the laser. Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Take care not to leave your hand or arm in the laser path while pressing the Pulse button.

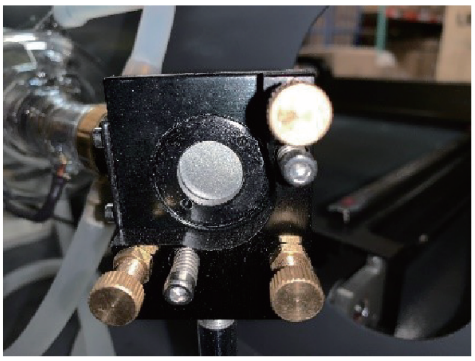
4.2.6 Mirror 1 to Mirror 2 in the Back

After having the laser centered from the Laser Tube to Mirror 1, you will now check to see the alignment between Mirror 1 and Mirror 2. First, you must use the directional arrows on the control panel to send Mirror 2 toward the back of the bed on the Y-Axis.





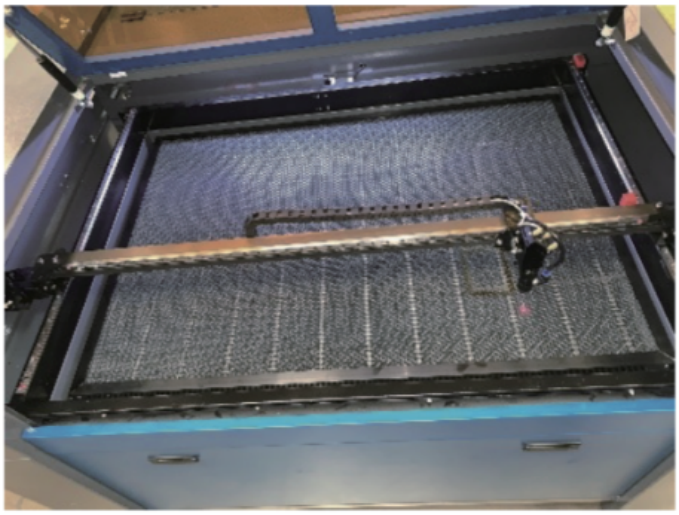
Once set, place a piece of tape on Mirror 2's frame. **DO NOT** place the tape directly onto the mirror. Repeat the steps from 4.2.5. If the laser marks outside the center of Mirror 2, you will need to adjust Mirror 1's set screws accordingly.



Loosen the nut on the screw and then slightly turn the set screw either clockwise or counterclockwise. Each screw adjusts a different position/angle.

4.2.7 Mirror 1 to Mirror 2 in the Front

After Mirror 1 is well aligned with Mirror 2 towards the back of the bed, you will need to check its alignment when Mirror 2 is towards the front of the bed. Using the directional arrows on the control panel, send Mirror 2 towards the front of the bed and repeat the steps as above, using the tape on the mirror's frame. If the laser is not well centered, make small adjustments to the set screws on Mirror 1 as above.



4.2.8 Mirror 2 to Mirror 3

After Mirror 1 is well aligned with Mirror 2 at both positions, you will need to check the alignment between Mirror 2 and Mirror 3. Repeat the steps and adjustments as above, taking care to use the tape on the mirror's frame and not its surface. When the laser is well centered, your laser mirrors are all correctly calibrated and (assuming they are clean) performing at optimum efficiency.

4.3 Running the Laser

When using the machine for the first time,

1. Put the honeycomb workbed on the standard table unless you need to engrave thick material or use the rotary axis.
2. Lower the laser head. The upper part of the head tube must be longer than 1.5″ (38 mm).
3. Reset the Z-axis after turning on the laser machine. Refer to the guidance video to learn how to reset the Z-axis.
4. Don't use the autofocus function if there are no materials on the table.

To successfully engrave your first pattern,

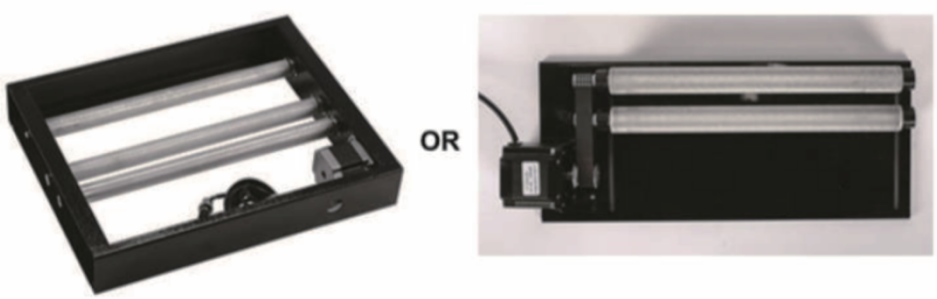
1. Generate a design with the help of your graphics software or choose a picture you want to engrave.
2. Put the object to be engraved onto the honeycomb workbed in the desired position, usually the upper left-hand corner.
3. Use the rulers to determine the dimensions of the object to be engraved.
4. Switch on the main power, the computer, and the laser in order.
5. Position the lens over the material to be engraved with the positioning keys. Focus the lens using the autofocus command (§5.17) or using the acrylic focus tool. To manually focus the lens using this tool, lower the bed to provide enough clearance for the tool between your material and the laser head. Simply place the focus tool on the material and slowly and carefully raise the bed until just before the acrylic tool hits the laser head.
6. Load your design. The size of the graphic does not matter, as the printer driver adjusts it to the workpiece automatically if requested. If you have any questions about how to perform these actions, consult the software manual for further information.
7. Double-click the work in the window. Modify the parameters such as speed, min power, max power, ramp effect, ramp length, interval, etc.
8. When you select Download, you can change the file name. If you don't, the default name is Default and the design will replace the last file.
9. Click Origin and Frame on the display, making sure that the material is in the right location and there is enough space for work.
10. Check that the exhaust fan is working properly and ensure that the ventilation pipe runs out a window or into an air filtration system.
11. Check that the water cooling system is working properly and the water is running into and filling the laser tube. **Do not start your work if the laser tube isn't full of water or if the water has bubbles**, as either may lead to damage to the laser tube due to the high temperature.
12. Press the Start/Pause button in the display to start the engraving process.
13. While the laser is engraving, you can generate your next design.

When your engraving is complete, the laser machine will give out a notification sound and the laser head will go back to its origin. The warning light will return to a green, and you can repeat the process.

4.4 Rotary Axis Attachment (optional)

The rotary axis attachment option in the printer driver is used in combination with a rotary axis attachment to engrave cylindrical objects. To compensate for the different diameters of different objects, the image must be adjusted. This is performed automatically by the engraving driver, by selecting the rotary engraving option and entering the diameter of the object to be engraved.

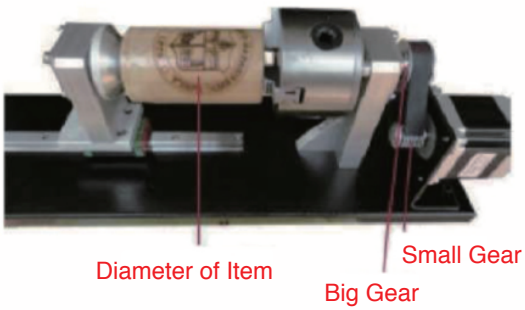
A cylindrical rotary device enables you to work on any cylindrical objects (⌀0.8″–6″)



To install the rotary axis attachment,

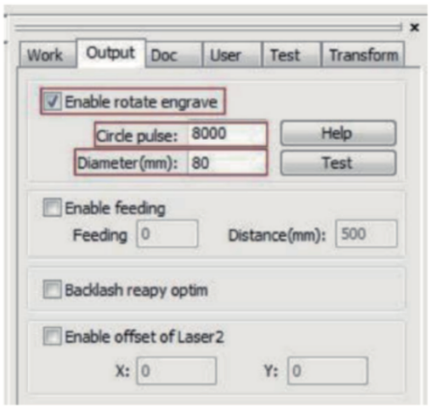
1. Move the working table to the lower position, switch off the laser, and open the top lid.
2. Put the rotary axis attachment onto the working table and connect the rotary axis attachment to the working table. Before you fix the rotary axis attachment, align it so that its sides are parallel to the rulers. The rulers offer a visual aid for placing the graphic.
3. Connect the rotary axis attachment via the control cable with the connector of the motion system. The connector is located on the front right side of the laser. Connect it to this interface. Then, turn on the switch and reset the rotary device by pressing the Reset button on the display. At last, you have finished the device connection.
At last, you have finished the device connection.





To successfully engrave your first pattern,

1. Put the honeycomb workbed on the standard table unless you need to engrave thick material or use the rotary axis.
2. Lower the laser head. The upper part of the head tube must be longer than 1.5″ (38 mm).
3. Reset the Z-axis after turning on the laser machine. Refer to the guidance video to learn how to reset the Z-axis.
4. Don't use the autofocus function if there are no materials on the table.
5. Adjust and fix the slider to make the workpiece fit into the rotary axis attachment.
6. Switch on the laser and wait until the referencing is finished. Position the working head over the object at the position where you want to engrave. Focus on the object with the focus tool or using the autofocus.
7. Generate a graphic with the help of the graphics software. The graphics size must be adjusted until it is less than the dimensions of the workpiece.
8. Select Output, then input the diameter of the object and the circle pulse.



9. Select Download. Click Origin and Frame on the display. Make sure that the material is in the right location and there is enough space for work.
10. Check that the exhaust fan is working properly and ensure that the ventilation pipe runs out a window or into an air filtration system.
11. Check that the water cooling system is working properly and the water is running into and filling the laser tube. **Do not start your work if the laser tube isn't full of water or if the water has bubbles**, as either may lead to damage to the laser tube due to the high temperature.
12. Press the Start/Pause button in the display to start the engraving or cutting process.
13. When you are done using the rotary axis attachment, turn the rotary axis switch off and remove it from the working table. Then, reset the laser machine.

4.5 Laser Engraving

The engraving depth can easily be varied through the laser power or the speed. To increase the engraving depth, reduce the speed or increase the power setting. This way you increase the amount of energy per area. Engraving too deep, however, reduces the quality of the details. With coated materials, the required power depends on the kind and thickness of the coating. With power set too high, the individual lines become too thick and a sharp picture cannot be achieved. The resolution of the graphics should usually be at 500 dpi. The dpi setting (number of laser dots per inch) depends on the material. The lower this setting is, the lower the resolution of the engraved picture will be. This, however, reduces flaming and increases the energy of a pulse, which can improve the overall result (e.g. when engraving some sorts of plastic materials).

4.5.1 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. As most plastic materials have a low melting point, a low pip setting should be selected to reduce the danger of melting.

4.5.2 Acrylic

There are two different types of acrylic: cast and extruded. Cast acrylic becomes white or matte after engraving, and the extruded acrylic remains clear. Use extruded acrylic for engravings that are filled with paint and cast acrylic for normal engravings. Cast acrylic can be best engraved without protection foil. It is better to engrave the entire surface with a low energy setting.

4.5.3 Rubber

The various mixtures and densities of rubber plates cause a slightly varying engraving depth. The settings in the overview table give a good indication. Since engraving a standard rubber material requires a relatively high laser power, the laser power is principally set to 50% or higher and only the speed is varied. Due to their lower density, so-called microporous rubber materials allow a significantly higher engraving speed. Test the rubber first, to find out the correct speed setting. RDWorks 8 uses the engraving function, and you can choose to use its Ramp Effect or common engraving. If you choose Ramp Effect, you will need to set a minimum power lower than the maximum power. It is recommended that you set it to about 15%, and input a value with the Ramp Length that you want. For best result, you may need to test different kinds of power and speed by yourself. Engraving rubber produces a considerable amount of dust and gas. Therefore, a powerful exhaust system and its regular maintenance are very important.

4.5.4 Recommended Parameters

Power and speed are regulated by the control interface (§5). The current in milliamperes is controlled manually. The threshold for the lowest setting is 10%; the laser will not fire at any setting lower than this. It is NOT recommended to use the laser tube at full capacity, especially for extended periods. **The recommended maximum power setting is 95%.**

Power	%	20	30	40	50	65—75	80	90	100
Current	mA	6 mA	10 mA	12 mA	15 mA	18 mA	23 mA	25 mA	30 mA

Description		Cutting Thickness of Acrylic				
		3 mm	5 mm	10 mm	15 mm	20 mm
60W	Power	23 mA	23 mA	23 mA		
	Speed	8 mm/s	3 mm/s	1 mm/s		
80W	Power	23 mA	23 mA	23 mA	23 mA	23 mA
	Speed	12 mm/s	5 mm/s	2 mm/s	1 mm/s	0.7 mm/s
100W	Power	23 mA	23 mA	23 mA	23 mA	23 mA
	Speed	20 mm/s	12 mm/s	4 mm/s	2 mm/s	1 mm/s

Description		Cutting Thickness of MDF		
		3 mm	5 mm	10 mm
60W	Power	23 mA	23 mA	
	Speed	5 mm/s	3 mm/s	
80W	Power	23 mA	23 mA	
	Speed	8 mm/s	4 mm/s	
100W	Power	23 mA	23 mA	23 mA
	Speed	13 mm/s	8 mm/s	2 mm/s

Description		Cutting Thickness of Plywood		
		3 mm	5 mm	10 mm
60W	Power	23 mA	23 mA	
	Speed	12 mm/s	3 mm/s	
80W	Power	23 mA	23 mA	
	Speed	15 mm/s	7 mm/s	
100W	Power	23 mA	23 mA	23 mA
	Speed	20 mm/s	12 mm/s	2 mm/s

Description		Cutting Thickness of Rubber	
		3 mm	5 mm
60W	Power	23 mA	23 mA
	Speed	12 mm/s	4 mm/s
80W	Power	23 mA	23 mA
	Speed	15 mm/s	8 mm/s
100W	Power	28 mA	28 mA
	Speed	30 mm/s	30 mm/s

Description		Cutting Thickness of Leather			
		1 mm	3 mm	5 mm	10 mm
60W	Power	15 mA	20 mA	20 mA	
	Speed	20 mm/s	10 mm/s	6 mm/s	
80W	Power	12 mA	15 mA	18 mA	20 mA
	Speed	50 mm/s	12 mm/s	8 mm/s	2 mm/s
100W	Power	18 mA	18 mA	18 mA	20 mA
	Speed	50 mm/s	28 mm/s	12 mm/s	4 mm/s

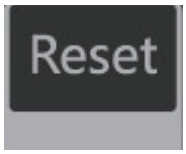
Description		Cutting Thickness of Paper Board				
		0.3 mm	0.5 mm	1 mm	1.5 mm	2 mm
60W	Power	8 mA	10 mA	12 mA	15 mA	15 mA
	Speed	300 mm/s	300 mm/s	200 mm/s	200 mm/s	160 mm/s
80W	Power	8 mA	10 mA	13 mA	18 mA	16 mA
	Speed	400 mm/s	400 mm/s	300 mm/s	300 mm/s	200 mm/s
100W	Power	6 mA	8 mA	12 mA	12 mA	16 mA
	Speed	120 mm/s	120 mm/s	130 mm/s	130 mm/s	100 mm/s

Description		Cutting Thickness of Cloth	
		0.3 mm	0.5 mm
60W	Power	10 mA	12 mA
	Speed	50 mm/s	40 mm/s
80W	Power	8 mA	10 mA
	Speed	70 mm/s	60 mm/s
100W	Power	6 mA	8 mA
	Speed	150 mm/s	140 mm/s

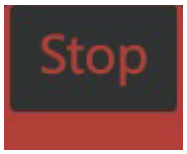
5 Control Interface



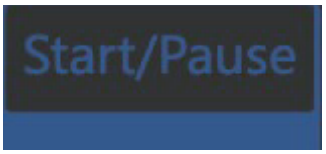
5.1 Keys



Returns the machine to the saved default parameters (See §5.15)



Stops the current job



Starts/pauses the current job



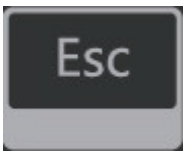
Sets the starting point for the laser head (See §5.14)



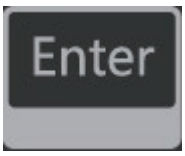
Traces the outline of the current design for sizing



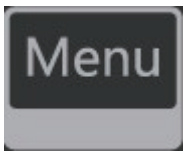
Fires the laser manually (See §5.13)



Stops work or returns to a previous menu



Enters a command or confirms your selection



Opens the main Menu (See §5.3)



Opens the Function menu (See §5.9)



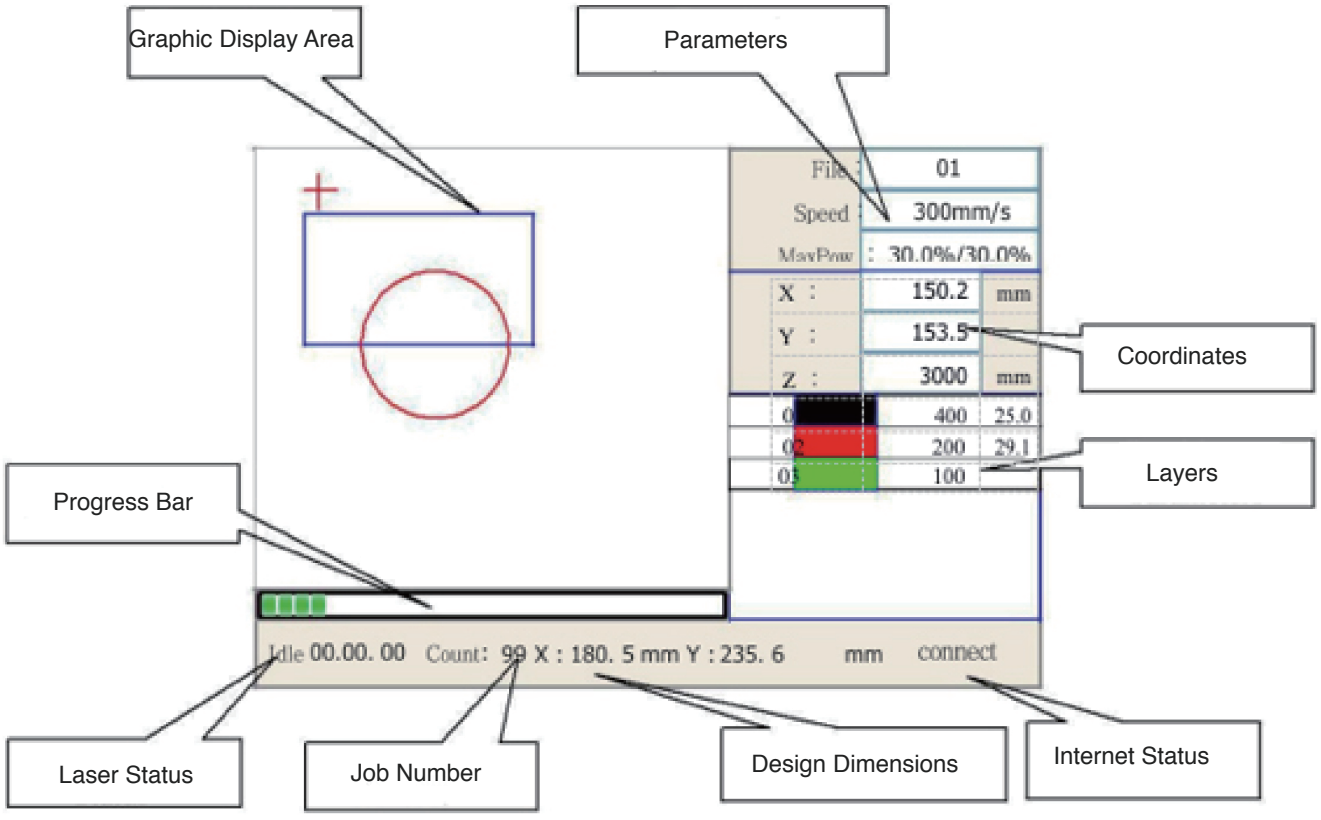
Controls X-axis movement or moves left and right in parameters



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

5.2 Main Interface

When the system is powered on, the screen will show as below:

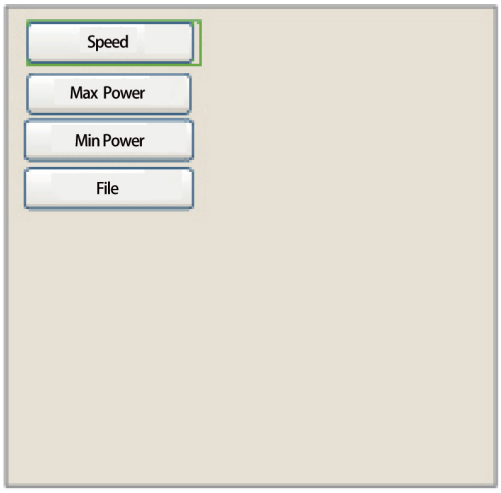


· The Design Display shows the whole file's track and the running track.
· Parameters displays the running file's file number, speed, max power, etc.
· Coordinates displays the current coordinates of the laser head.
· Layers displays the layer parameters of current or previewed files. Parameters from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

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

5.3 Menu Button

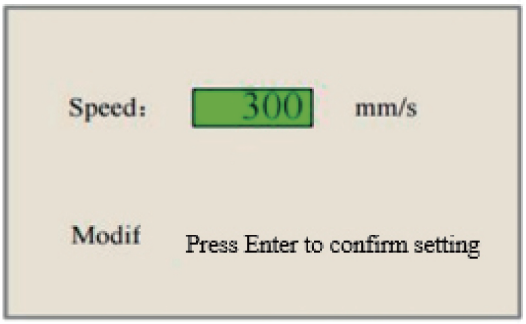
Press Menu on the main interface to enter the Menu interface:



Push the ▲ and ▼ keys to select items, and then press Enter to enter the corresponding sub-menu.

5.4 Setting the Laser Speed

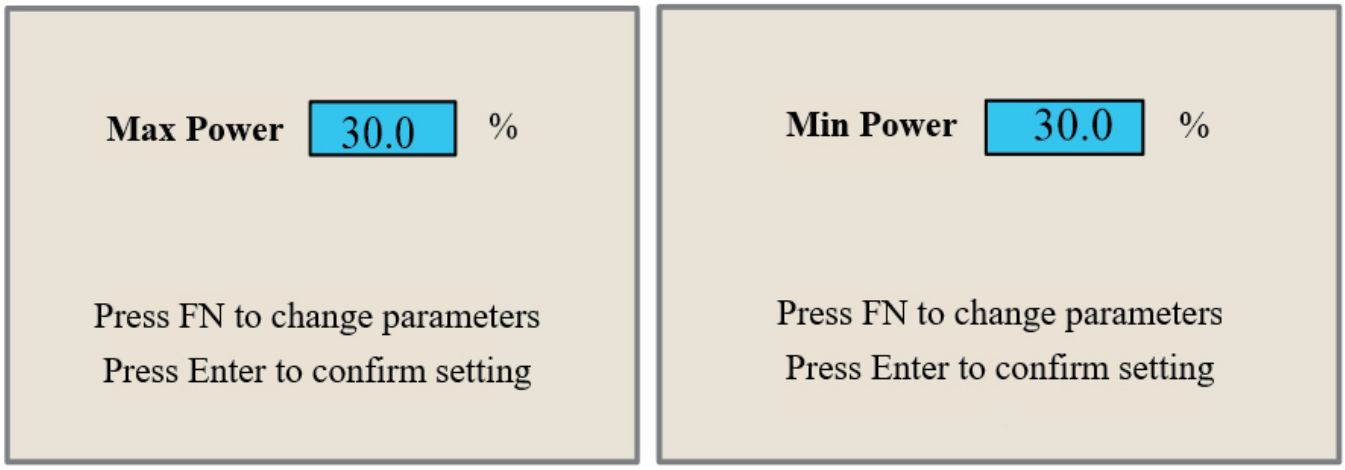
Select "Speed" on the Menu interface, and the following dialogue box will appear:



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

5.5 Setting the Laser Power

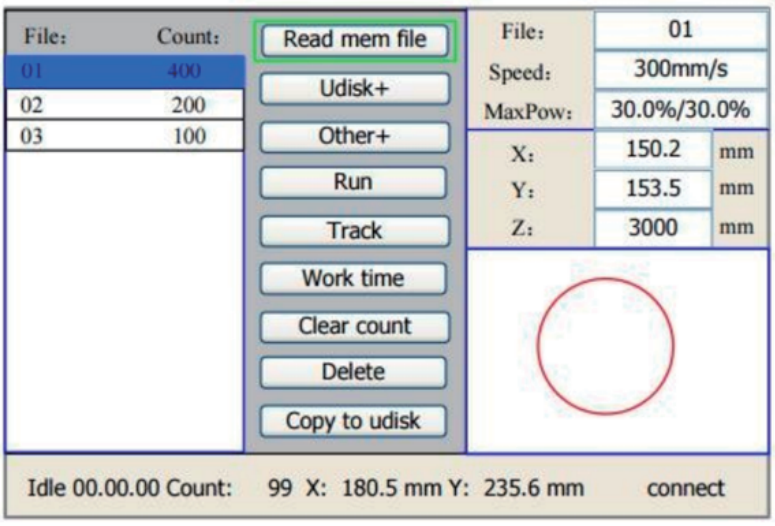
Select "Max Power" or "Min Power" on the Menu interface, and the following dialogue boxes will appear:



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

5.6 File Commands

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



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

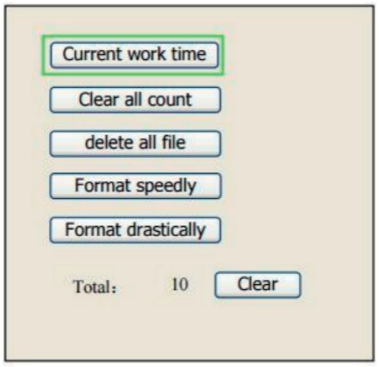
Push the ◀ and ▶ keys, and the light blue cursor can be moved left and right to switch between the file column in the left and the item column in the middle. If the file is being previewed, the preview will be closed when switching to the item column. When the light blue cursor is on the item column,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

The item column includes:

· Read mem file reads the memory file list

· U-disk reads the file list of an inserted USB flash drive

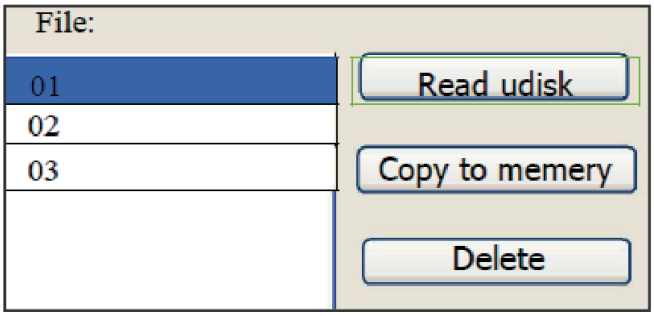
· Other displays other memory files operations
· Run runs the selected file equivalent to pressing Start/Pause.
· Track tracks the selected file
· Work time forecasts the total running time of the selected file, accurate to 1 ms
· Clear count clears the count of the selected file
· Delete deletes the selected file from the memory
· Copy to U-disk copies the selected file to an inserted USB flash drive
Select "Other" and press Enter, and the following dialogue box will pop up:



· Current work time forecasts the running time of the current file
· Clear all count clears the count of every file in the memory
· Delete all files deletes all files from memory
· Format speedily formats memory, after which all files will be deleted
· Format drastically formats memory, after which all files will be deleted
· Total displays the total count of all the files

5.7 Flash Drive Commands

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

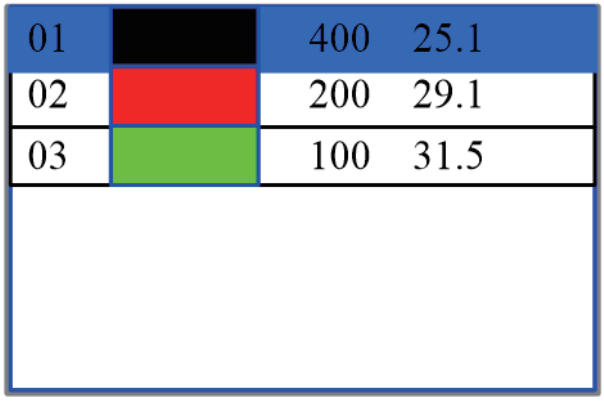


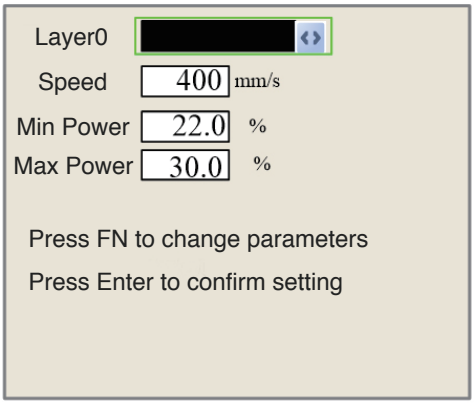
The operation method is the same as that of files in memory. Press Esc to return to the File interface.
· Read U-disk reads the file list of an inserted USB flash drive
· Copy to memory copies the target file to memory.
· Delete deletes the selected file from the USB flash drive

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

5.8 Adjusting Engraving Layers

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

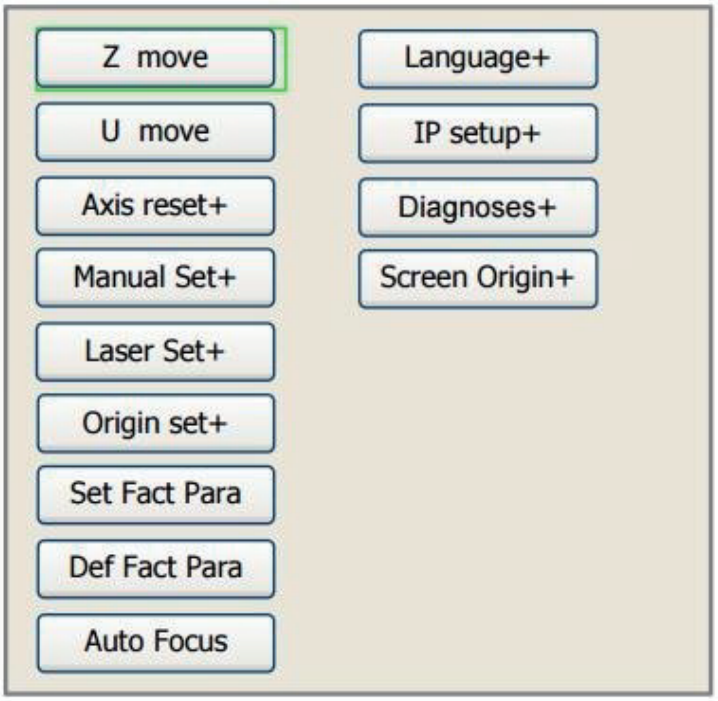




The light blue cursor will be on "Layer" by default. Push the ◀ and ▶ keys to select the intended layer. Press FN to move the light blue block to the intended parameter. Press Enter to save the parameter changes. Otherwise, changes will not be saved. The operation method is the same as that of the max/min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

5.9 Function Menu

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



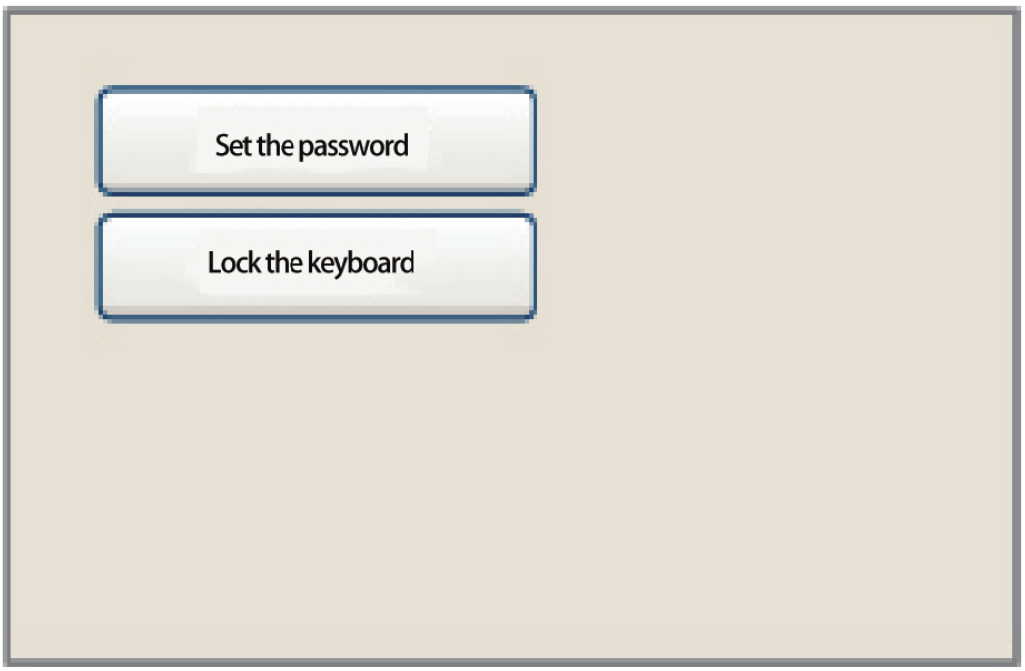
Push the ▲ and ▼ keys to move the light blue cursor to the intended entry, and press Enter to enter the corresponding sub-menu.

5.10 Adjusting the Z Axis

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

5.11 Setting an Interface Password

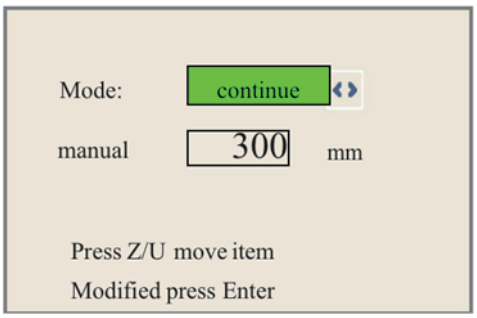
When the light blue cursor is on this item, press Enter, and the following dialogue box will pop up:



Push the ▲ and ▼ keys to select items. When the light blue cursor is on the intended item, press Enter to enter the corresponding interface. See §5.15 for details on the keyboard interface.

5.12 Manual Movement of the Laser Head

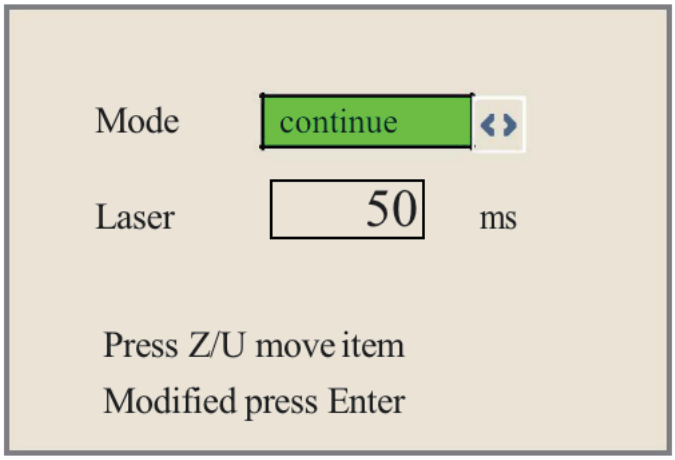
When the light blue cursor is on "Manual Set+", press Enter, and the following dialogue box will pop up:



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

5.13 Manual Firing of the Laser

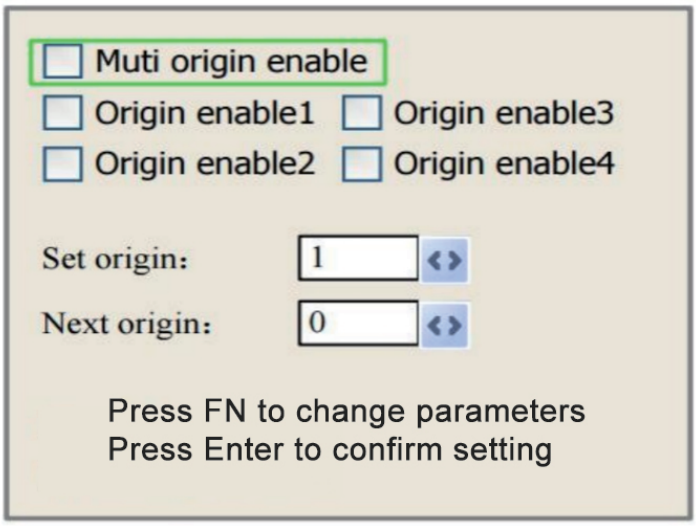
When the light blue cursor is on "Laser Set+", press Enter, and the following dialogue box will pop up:



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

5.14 Setting Origin Points

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



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

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

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

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

The next origin can be chosen from origin 1–4 so as to control the starting point of the next job provided that the origin is enabled. However, it cannot be changed to origin 0. The next origin will always be Origin 0 under single-origin logic.
Origin Enable 1/2/3/4: After multiple-origin logic is enabled, the four origins can also be individually disabled and enabled.

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

5.15 Saving Current Parameters and Virtual Keyboard Use

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



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

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

5.16 Loading Saved Parameters

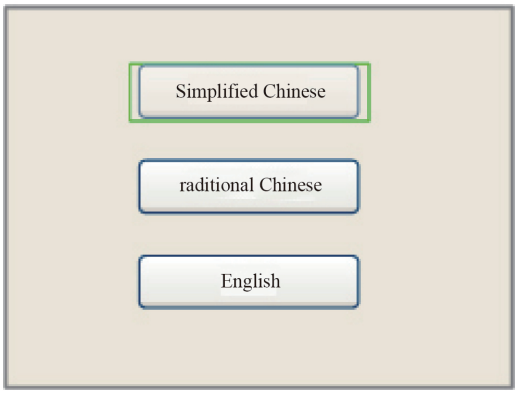
When "Def Fact Para" is selected, the system will replace all current parameters with the default factory parameters. The operation method is the same as setting the factory parameters.

5.17 Autofocus

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

5.18 Setting the Interface Language

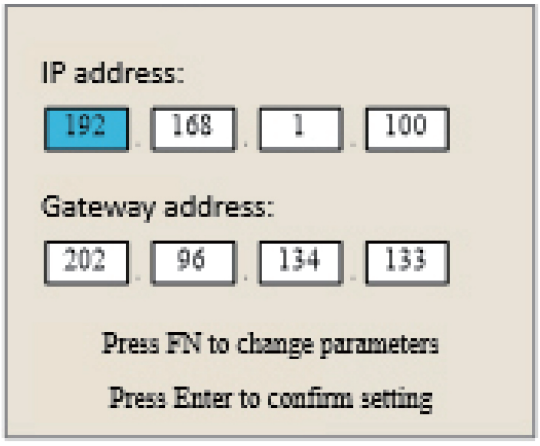
When the light blue cursor is on this item, press Enter, and the following dialogue box will pop up:



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

5.19 Setting the Machine's IP Address

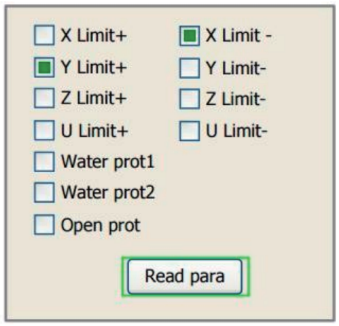
When the light blue cursor is on this item, press Enter, and the following dialogue box will pop up:



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

5.20 Diagnostic Tools

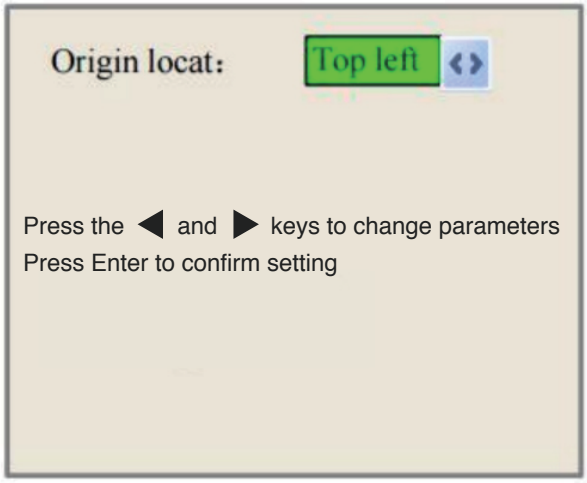
When the light blue cursor is on this item, press Enter, and the following dialogue box will pop up:



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

5.21 Reflecting Images across an Axis

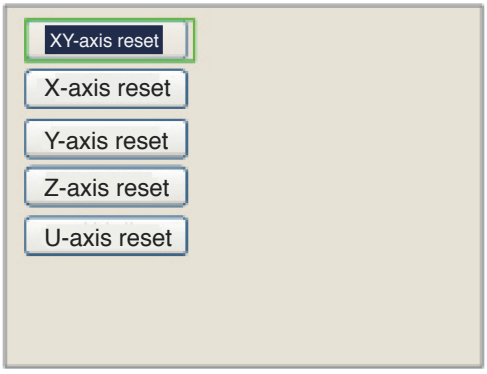
When the light blue cursor is on this item, press Enter, and the following dialogue box will pop up:



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

5.22 Resetting Axes

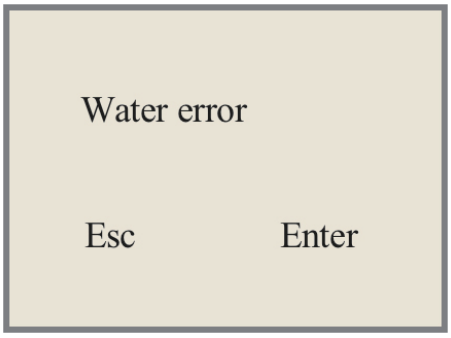
When the green block is on this item, press Enter, and the following dialogue box will pop up:



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

5.23 Alarm Displays

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



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

6 Maintenance
6.1 Regular Maintenance

WARNING

1. Use of procedures other than those specified herein may result in hazardous laser radiation exposure.
2. Before starting cleaning and maintenance work, always switch off the device and unplug the main plug.
3. Always keep the system clean, as flammable parts in the working area or exhaust area constitute the fire hazard.

- The lens and Mirror 3 must be checked daily before use and cleaned if required.
- The working table must be cleaned and the waste bins emptied on a daily basis.
- The exhaust system must be checked every week and cleaned if required.
- Mirror 1 and Mirror 2 must be checked every month and cleaned if required.
- The beam alignment should be checked about every month.
  If you need to readjust the beam path, follow the procedures in §4.2.
- The air blower must be checked every month and cleaned if required.
- The whole laser machine must be cleaned every month.
- Other components (such as the water cooling system) must be checked every month and cleaned if required.

6.2 Cleaning the Machine

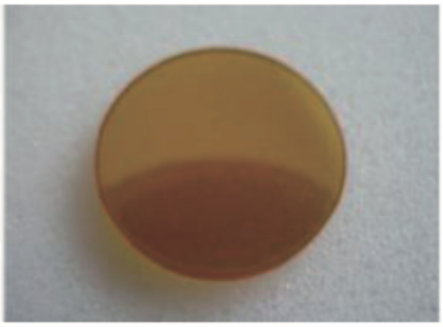
You should check at least once a day whether dust has accumulated in the engraving system. If so, the machine must be cleaned. The cleaning interval strongly depends on the material that is being processed and the operating time of the device. A clean machine guarantees optimal performance and reduces service costs, as well as reducing the risk of fire or injury.

- Make sure that the device is switched off and unplugged before opening the protective cover.
- Move the working table into a position in which it is easier for you to clean the surface with a window cleaning agent and paper towels.
- Thoroughly remove all dirt particles and deposits in the interior of the machine.
- Clean the cover of the laser tube.
- You can clean the viewing window with a cotton cloth. DO NOT use paper towels as they could scratch the acrylic.

6.3 Cleaning the Optical Components

The lens has a durable coating and won't be damaged by correct and careful cleaning. You should inspect the focus lens, the mirrors, and the beam combiner according to your maintenance plan. If you discover a veil of haze or dirt, you must clean them before further use to avoid poor performance and risk of injury.



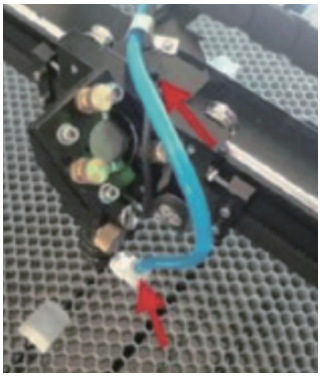


It is recommended that you clean the mirrors and lens before work every day in order to run the machine at maximum efficiency. Mirrors must be cleaned carefully by using lens-cleaning paper or a lens-cleaning cloth to avoid scratching the surface. Do not touch the surface of the mirrors or lens after cleaning.

6.3.1 Cleaning the Focus Lens

1. Move the engraving table to a distance approximately 4'' (10 cm) under the lens holder.
2. Move the working head into the center of the working surface and put a cloth under the lens holder so that the lens is not damaged if it accidentally falls out of its holder.
3. Unscrew the lens holder.
4. Remove the pressurized air hose connection.
5. Remove the extra laser guide connection.
6. Once positioned over a clean lens-cleaning tissue, remove the lens from the lens holder by carefully turning the lens holder and letting the lens and the O-ring drop onto the cleaning cloth.
7. Examine the O-ring and, if necessary, clean it with a cotton bud and a lens-cleaning tissue/cloth.
8. Remove the coarse dust as well as possible by blowing air onto the lens surface.
9. Check the surface and if necessary clean the lens with the lens cleaning liquid and lens tissue/cloth.
10. Hold the lens assembly by its edge with a lens-cleaning tissue and use a drop of lens-cleaning liquid. While holding the lens on an angle, flush both surfaces to wash away grime.
11. Put the lens on a clean lens-cleaning tissue and put some lens-cleaning liquid on one side of the lens. Leave the liquid to take effect for approximately one minute and then gently wipe it away with lens-cleaning tissues soaked with lens-cleaning liquid.
12. Dry this side of the lens with dry lens-cleaning tissues/cloth. Repeat the cleaning process on the other side of the lens. Never use a cleaning tissue twice. Dust accumulated in the cleaning tissue could scratch the lens surface.
13. Examine the lens. If it is still dirty, repeat the cleaning process until the lens is clean.
14. Carefully insert the lens into the lens holder and ensure that the rounded convex side of the lens is facing upwards. Then, put the O-ring on top of the lens.
15. Carefully assemble the lens in reverse order.

Removing the Focus Lens



1. Remove the air hose and laser guide connections.



2. Rotate to the left. The head is divided into two parts.



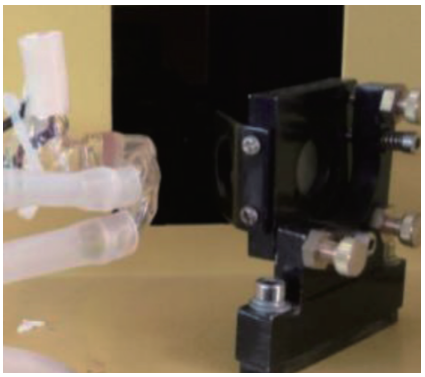
3. Note that the lens is installed with the concave side downward & the convex side upward.



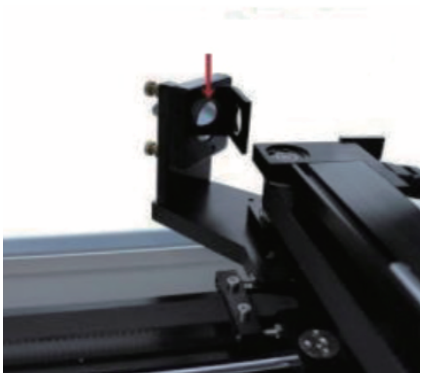
4. Replace the focus lens, being careful not to scratch the lens, and then merge both parts back together.

6.3.2 Cleaning the Mirrors

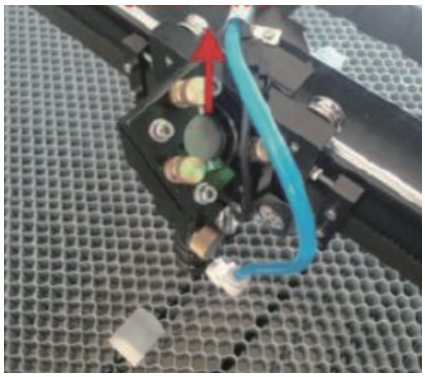
There are three mirrors in the operating area of the laser, which may have to be cleaned if they become dirty. The mirrors can easily accumulate debris, reducing the efficiency of the laser beam. Laser energy absorbed by the mirror may produce heat and damage the mirrors, as well.



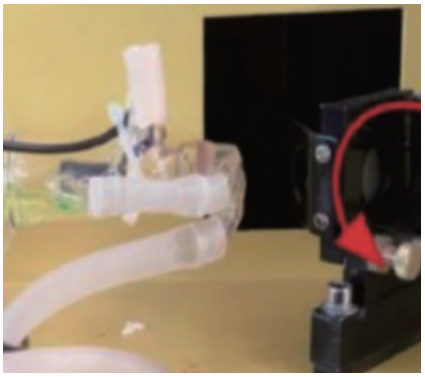
You can clean the 1st mirror directly.

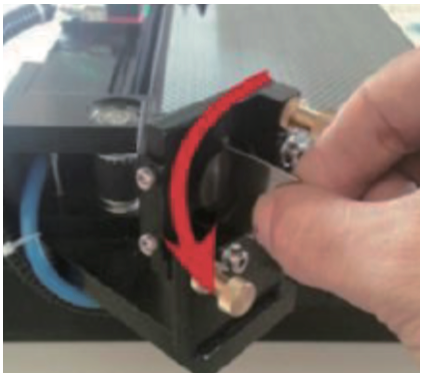


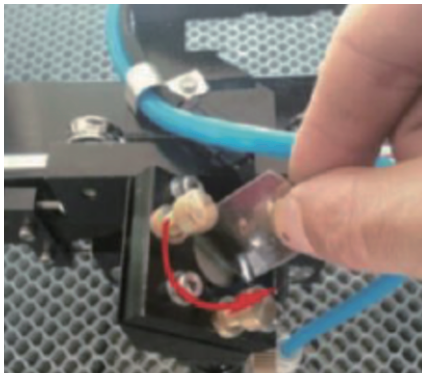
Make sure again that the power of the laser machine is turned off before cleaning the 2nd mirror, which is installed on the left side of X rail. You can clean the 2nd mirror directly.



The 3rd mirror is installed above the focus lens. You can clean the 3rd mirror directly.

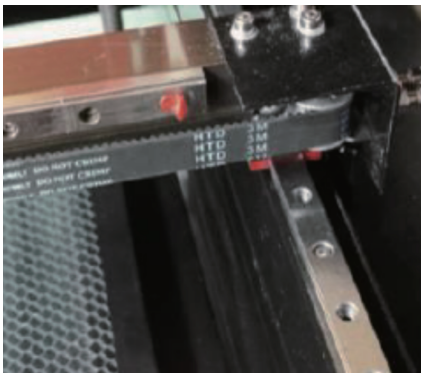


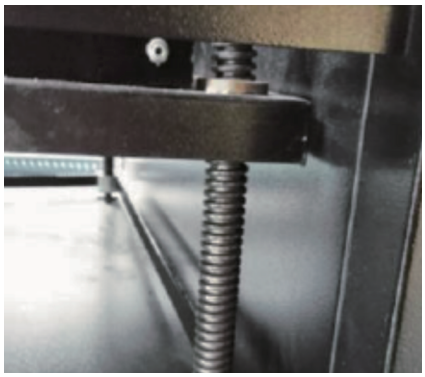




Turn the mirrors counterclockwise to remove them.

6.4 Maintenance of the X & Y Rails





It is recommended that you add white lithium grease to the rails and screws at least every two weeks.

6.5 Changing the Water





It is recommended that you to change the water at least once every month and make sure the laser tube is filled with water before starting the machine. It is advised to add water every 3 days. The quality and temperature of the cooling water affects the life time of the laser tube. You should use pure (distilled) water and must control the temperature below 95 °F (35°C).

6.6 Parts Replacement

If it becomes necessary to replace a consumable part of this machine, take care to use an identical part or contact your vendor or customer service to ensure the replacement part is safe for use with this machine. Using incompatible components is dangerous & waives all liability to the manufacturer for injury or damage it may cause.

6.7 Rewiring the Power Supply

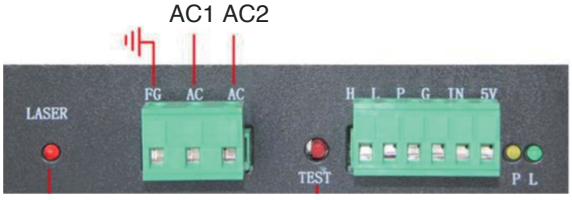


Before adjusting or replacing the laser power supply, turn off and cut ALL power to the machine.

If you replace the laser power supply with an identical model, you will be

able to use the same screw terminal blocks and will only need to rewire the anode and cathode connections. Be extremely careful with the high- voltage anode wire and its connections.

If you use a different laser power supply, you may need to rewire the screw terminal blocks. Refer to the following:



FG: Ground Wire for the Mains & Case
AC1: Neutral Wire to the Mains
AC2: Live Input from the Mains
H: Connection for Active-High Devices (like this machine)
L: Connection for Active-Low Devices
P: Line to the Laser Trigger, Water & Other Systems (such as a door switch)
G: Ground Wire for the Control System, PWM Level Shifters, Potentiometers, etc.
IN: Input Power for PWM Level Shifters or Potentiometers
5V: 5V Connection for Digital Signals

6.8 Disposal



Do **NOT** dispose of this machine or its parts with domestic waste! Electronic devices must be disposed in accordance with state and local regulations concerning electronic waste disposal. If you do not know the proper disposal method for your area, contact your supplier who may take care of the proper disposal of such items.

Contact Us

Thank you for choosing our products. If you have any questions, please don't hesitate to contact us at help@cs-supportpro.com. We'll solve your issue ASAP.