

Wattsan 6090/1290/1610 PRO
CO2 Laser Machine Manual



Wattsan

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Dear customer!

Thank you for purchasing our equipment. We hope that this work will delight you for a long time.

The machines are manufactured in accordance with global standards. Each piece of equipment undergoes pre-sale preparation.

First of all, we strongly recommend that this manual be read carefully and completely before using the equipment. Failure to comply with certain points of the Operating Manual may result in injury to personnel and/or damage to equipment!

Follow the instructions in this manual. This will not only make the work easier, but also make the use of the equipment safe and long-term. Please follow these instructions carefully.

This document is intended to provide an overview of the basic technical data and requirements for the use of the Wattsan machine.

If the equipment is transferred to another customer, this document shall be transferred with it.

The manufacturer reserves the right to make changes and improvements to the design that do not impair the declared characteristics of the equipment.

Basic information about the equipment and its technical data:

Equipment name:

Serial Number:

Month and year of issue:

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Information about signs and symbols

In this instruction manual, the following designations, signs and symbols are used to convey particularly important information:

	This indicates a hazardous situation that could result in serious injury or death if the specified instructions are not strictly followed.
	Indicates a potential hazard that could result in minor injury or damage to the product.
	It contains important information about the safe and correct handling of the product.
	This component is energized. In these places, strictly follow the safety rules when working with electricity.
	Caution: Laser beam hazard.

Read the instructions carefully before starting.

Note!

The equipment you directly purchased may differ from the equipment shown in the figures.

	Untrained personnel should not be allowed to work with or install this equipment.
	The equipment complies with safety class 4. The use of this equipment may lead to the following consequences: • Ignition of nearby materials • Materials exposed to laser radiation can become sources of dangerous gases • Laser beams can cause direct harm to humans
 MUST-DO	The location of the equipment must be equipped with fire extinguishing equipment. It is forbidden to store flammable and explosive substances near the device.
 MUST-DO	The user must ensure that the material to be processed is suitable for laser processing to avoid risks to personnel and equipment operation.
 FORBIDDER	The operator must not leave the equipment unattended while it is in operation. The equipment must be turned off at the end of operation. Operation of the equipment without a connected and switched-on compressed air supply system is prohibited.
	The use of highly reflective materials is prohibited to avoid the reflection of the laser beam on a person.
	The equipment must be located in a dry, uncontaminated place. The temperature inside the room should be 10-40 Co. Humidity should be in the range of 5-70% (provided there is no condensation).
	The equipment operates from an alternating power supply of 220V with a frequency of 50 / 60 Hz. It is forbidden to use the equipment without a voltage stabilizer.

Attention!

The seller is not responsible for the improper use of the equipment and if the user fails to take precautions.

Specifications

Model	6090 PRO	1290 PRO	1610 PRO
Dimensions (LxWxH), mm	1550 x 1260 x 960	1850 x 1560 x 960	2250 x 1660 x 960
Working field, mm	600x900	1200x900	1600x1000
Laser power, W	50-150	50-180	50-180
Wavelength, nm	10600		
Focal lens	D20		
Mirror diameter, mm	D25		
Autofocus	Yes		
Lift Table	Automatic		
Lowering depth of the working table, mm	160		
Guides	PMI 15 mm		
Axle Motors	Three-phase close loop		
Cutting speed, mm/s	500		
Engraving speed, mm/s	1000		
Positioning accuracy, mm	0,03		
Control system	Ruida		
Camera (CAM)	Optional		
Software	RDWorks		
Supported formats	PLT, DXF, BMP, JPG, PNG, etc.		
Supported OS	Windows XP/7/8/10/11 (32/64bit)		
Connection Interface	USB / Ethernet / Wi-Fi		
Cooling system	Water (built-in chiller)		
Coolant temperature, °C	20-25		
Ambient temperature range, °C	10~40		
Ambient humidity value, %	<70		
Gas pressure in the system, MPa	<0,8		
Power Supply Configuration	220±10% V AC 、 50 Hz		
Classification of the laser	Class 4		
Classification of the device	Class 1		

Equipment

Name	Quantity
Laser Cutting Machine	1 pc
Built-in chiller	1 pc
Exhaust fan	1 pc
Power Cable	2 pcs
Grounding cable	1 pc
Silicone tube 6x10mm	3 pcs
Built-in air compressor	1 pc
Flexible Air Duct Pipe D150 2m	1 pc
Metal clamp	3 pcs
Allen wrench set	1 pc
Duct tape	1 pc
Sealant	1 pc
Ethernet Cable	1 pc
USB Cable A-B	1 pc
USB-flash drive	1 pc
Machine manual	1 pc

CHAPTER 1. INTRODUCTION

1.1 MAIN PURPOSE AND SCOPE OF THE EQUIPMENT

The WATTSAN CO₂ laser machine is designed for high-precision cutting and engraving of non-metallic materials using laser radiation. This equipment allows you to automate and optimize material processing processes with high quality and accuracy. The machine allows you to perform both serial and small-scale production of products of varying complexity with minimal time and resources.

1.2 MAIN FEATURES OF THE MACHINE

- Automatic focusing system.
- Built-in compressed air system.
- Built-in laser tube cooling system.
- End-to-end worktable for processing long workpieces.
- Additional touch screen.
- Possibility of connecting a rotary device.
- Ruida RDC8445S control system.
- **Wattsan SAS** (SAFETY ASSURANCE SYSTEM) is a comprehensive safety system designed to reduce the risk of fire occurrence and spread during the operation of the machine. It includes an airflow system, structural elements for the protection of the working area and the Wattsan FOX fire detection function.
- **Wattsan FOX** (Fire Overwatch Expert) is a system for detecting and controlling spontaneous combustion in the working area. When signs of fire are detected, the system gives a signal to the operator, allowing you to stop the treatment process in a timely manner and take the necessary measures.

1.3 BASIC OPERATING REQUIREMENTS

- 1) Connected Ground: Ground resistance $<5 \Omega$.
- 2) It is necessary to install a mains voltage stabilizer to stabilize the voltage of the machine.
- 3) Good ventilation is required to prevent the accumulation of dust and combustion products.
- 4) To cool the laser source and laser head, it is necessary to properly configure and control the operation of the chiller. It is specialized equipment that cools and circulates water and requires the use of distilled water only.
- 5) Operation of the equipment is allowed only with a connected compressed air or auxiliary gas supply system.
- 6) To prevent fire, the workplace must be equipped with a suitable fire extinguisher.
- 7) There should be a clear space around the machine of about 1 m on each side.

1.4 IMPACT ON THE ENVIRONMENT AND PEOPLE

The laser machine belongs to class 1 laser equipment, but it is equipped with a class 4 laser source. Its laser beam and reflected light can cause damage to the human body (especially the eyes). The operator and operating personnel should pay attention to eye protection and use special glasses (with radiation protection with a wavelength range of 10600 nm).

Chapter 2. Safety Instructions

2.1 OVERVIEW

Before operating the machine and performing daily maintenance, the operator should read this chapter carefully, learn the safety precautions and requirements of the machine, and follow the appropriate precautions.

2.2 ENSURING THE SAFETY OF WORKING WITH EQUIPMENT

- 1) It is necessary to appoint an industrial safety specialist for the operation of the equipment, determine the scope of his responsibilities, and provide safety training for the machine operator.
- 2) Specify the machine location area, set a warning card for entering and exiting the machine area, specifying: machine power, type of laser source, type of eye protection used, full name of the industrial safety specialist, etc.
- 3) The machine operator must receive special training.

2.3 LASER SAFETY WARNING

	Never point the laser beam at people or animals. High-power laser radiation can cause serious burns or damage to vision. Always keep an eye on the direction of the beam and control its movement.
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2.3.1 EYE AND SKIN PROTECTION

Laser radiation can damage the retina of the eye. The laser can cause cataracts of the eye and skin burns. Therefore, appropriate protective measures are applied when adjusting the laser. This machine is equipped with a CO2 laser source, therefore, when working with the lid open, it is necessary to wear special safety glasses (with radiation protection with a wavelength range of 10600 nm).

A combination of face shields, masks, filters, and/or goggles will provide better protection while the equipment is running. All personnel working near the laser treatment area are advised to wear PPE.

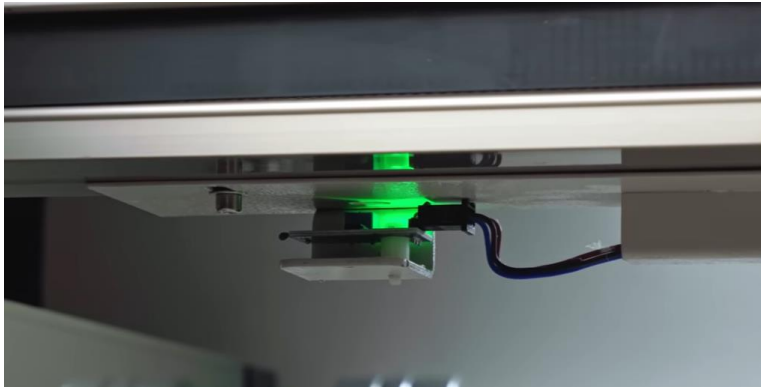
	Parts can be very hot even after the machining process is complete. Take steps to prevent skin damage by wearing protective clothing such as flame-retardant gloves, caps, leather apron, and other flame retardant clothing. Sleeves and collars should be buttoned.
---	--

2.3.2 FIRE PROTECTION

Sparks during operation can easily cause a fire. Therefore, there should be no flammable and explosive objects in the working area of the machine.

To avoid the risk of waste material catching fire, empty the pan under the work area regularly.

The machine is equipped with the "Wattsan FOX" fire detection system.



Principle of operation: sensors located under the gantry, in the event of a fire, send a signal to the system, which stops the operation of the machine and signals an accident using a red indicator light and an audible alarm.

When such a signal occurs. Immediately check the condition of the machine and take the necessary actions to neutralize the threat of fire.

	Fire extinguishers should be nearby and accessible, and staff should be trained in their use.
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2.3.3 SECONDARY RADIATION HAZARDS

During engraving and cutting, both visible and invisible light radiation is generated. The interaction between high-power laser light and the materials being welded can create plasma, which produces UV radiation and "blue light," which can cause conjunctivitis, photochemical damage to the retina, and/or a sunburn-like skin reaction. Even short-term exposure to invisible ultraviolet light during laser operation can cause blurred vision, burning, watery eyes, eye pain, and irritation (a feeling of sand in the eye).

	To avoid the effects of radiation, it is necessary to work with the lid closed.
---	--

2.3.4 SMOKE POISONING HAZARDS

The smoke emitted from the material during laser treatment can consist of very small particles and gases; the smoke and gas are formed from a mixture of fumes of the material being treated, paints, coatings, taking into account chemical reactions and air pollutants. Smoke can negatively affect the lungs, heart, kidneys, and central nervous system.

When the laser interacts with materials such as plastics, metals, and composites, the material can start to evaporate. Often the fumes and mist are not visible, but they are highly toxic and pose a serious health risk.

Handling material in a poorly ventilated confined space is extremely dangerous. Dangerous concentrations of toxic fumes and gases can build up very quickly, causing loss of consciousness or death by suffocation.

	Always work in an area with adequate ventilation. Use a fume extraction system to remove vapors, particles, and hazardous debris from the machine operating area.
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Keep your head away from smoke while working. In confined spaces and other circumstances, a respirator may also be required.

Read and follow the safety guidelines and warning labels for all materials used.

Regular air monitoring should be carried out to determine the levels of hazardous vapors in the area of operation.

2.4 ELECTRICAL SAFETY

- 1) Make sure the installation is properly grounded.
- 2) Make sure the correct AC supply voltage is used before applying power to the unit. Using the wrong voltage may damage the installation.
- 3) Never use the device in a humid or wet environment. Do not touch electrical contacts and switches with wet hands to avoid electric shock.
- 4) Do not open the electrical cabinet or change the machine parameters without consulting the manual. If you need to change something, then these changes must be approved by the equipment supplier. Before modifying, record the original values so that the machine can be restored to its original parameters if necessary.
- 5) Always turn off the device when not in use. Never leave the laser machine running unattended.

	After turning off the power to the machine, you must wait at least 5 minutes, and only then you can touch the electrical circuit of the machine. For a period of time after the power is turned off, there may be a high voltage in the machine's electrical system, which can cause harm to people and equipment.
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2.5 OBLIGATIONS OF THE OPERATOR

- The operator must undergo special training to start working on the machine.
- Follow the instructions for regular maintenance of the appliance to keep it operational and prevent accidents.

	It is forbidden to work on faulty equipment. If a fault is detected, turn off the equipment and unplug it. Inform the specialists. Do not repair the equipment yourself.
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2.6 PROCESSING MATERIALS

- Before processing, the operator must ensure that the material is suitable for processing.
- **It is forbidden to process Teflon, polyvinyl chloride (PVC), getinax (Phenolic paper), fluoroplastic, vinyl, any other fluorine, chlorine, bromine, iodine, astatine-containing materials on the equipment, as the gas emitted during cutting is extremely harmful to human health, and spoils the mechanics and optics of your equipment.**
- It is forbidden to process materials with a high reflectance in the IR spectrum.
- Before handling materials, the operator must check whether harmful substances can be generated during their processing and whether your extraction (filtering) peripheral equipment is suitable for this type of material.
- Work with materials that emit caustic substances (acrylic, plastic, etc.) must be carried out with the lid closed and respiratory protection equipment must be used to avoid poisoning.

	It is the responsibility of the user to take into account national and regional thresholds for dust, mist and gases when selecting filters and exhaust systems.
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Chapter 3. COMPONENT INSPECTION AND INSTALLATION

3.1 EQUIPMENT



Keep the packaging box. You will need it in case of return. Dispose of all waste in accordance with current waste disposal legislation.

- 1) After opening the package, check the complete set (inside the machine frame).
- 2) Check the equipment for damage in transit.



First of all, carefully inspect the laser tube for chips or broken glass, both inside the laser tube and outside. This is the most fragile part in your equipment!

3.2 INSTALLATION

- The machine must be installed on a flat surface without bevels and slopes. It is necessary to leave free space on the sides of the machine of at least 1 m.
- The space around the machine should be freed up for quick and easy access to the panel and other machine components.

3.3 REQUIREMENTS FOR THE PREMISES

1. Ambient temperature

When operating the machine, the ambient temperature should be between +10 °C and +40 °C. When the equipment is switched off, the ambient temperature should not be lower than + 4 °C. If the ambient temperature is above 40 °C, a device that lowers the temperature (e.g. air conditioner) must be installed in the room.

2. Humidity

For the correct operation of the equipment, it is recommended to use it at a relative humidity of <70%. A wet room is not suitable for the operation of the machine, as it corrodes it, which leads to the failure of the electrical and mechanical systems of the machine

	It is forbidden to use the equipment at a relative humidity of more than 70%.
	Do not use the equipment at temperatures below the dew point.

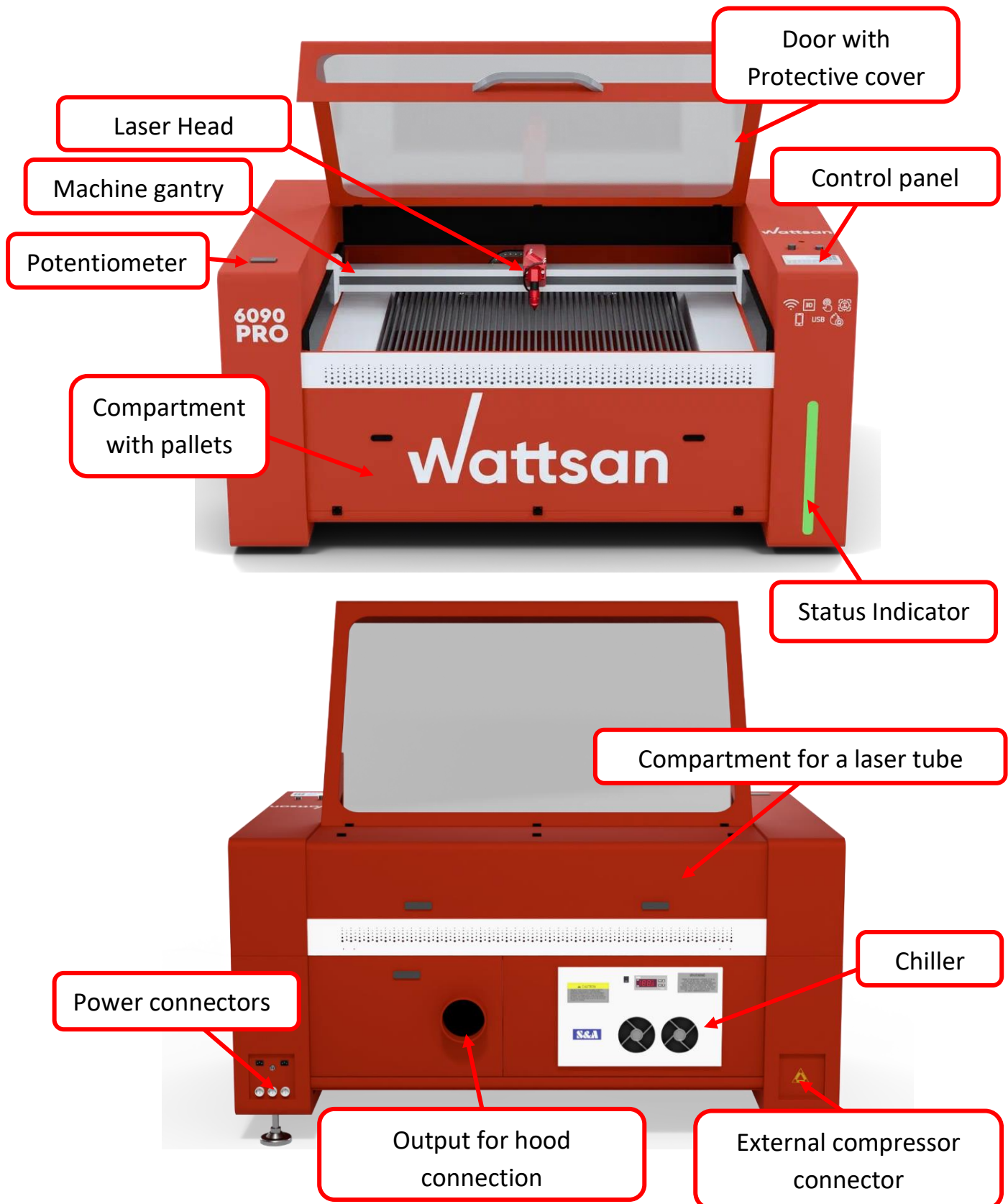
Temperature	Humidity															
	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
16°C				0	2	4	5	7	8	9	10	11	12	13	14	15
18°C			1	3	4	6	8	9	11	12	13	14	15	16	17	18
21°C		1	3	5	7	9	11	12	13	14	16	17	18	18	19	21
27°C	2	5	8	10	12	13	16	17	18	19	21	22	23	24	25	26
29°C	4	7	10	12	14	16	18	19	21	22	23	24	26	27	28	28
32°C	7	10	12	15	17	19	21	22	23	25	26	27	28	29	31	31
35°C	9	12	15	17	19	21	23	24	26	27	29	30	31	32	33	34
38°C	11	14	17	20	22	24	26	27	29	30	31	33	34	35	36	37

3. Cooling of electrical components

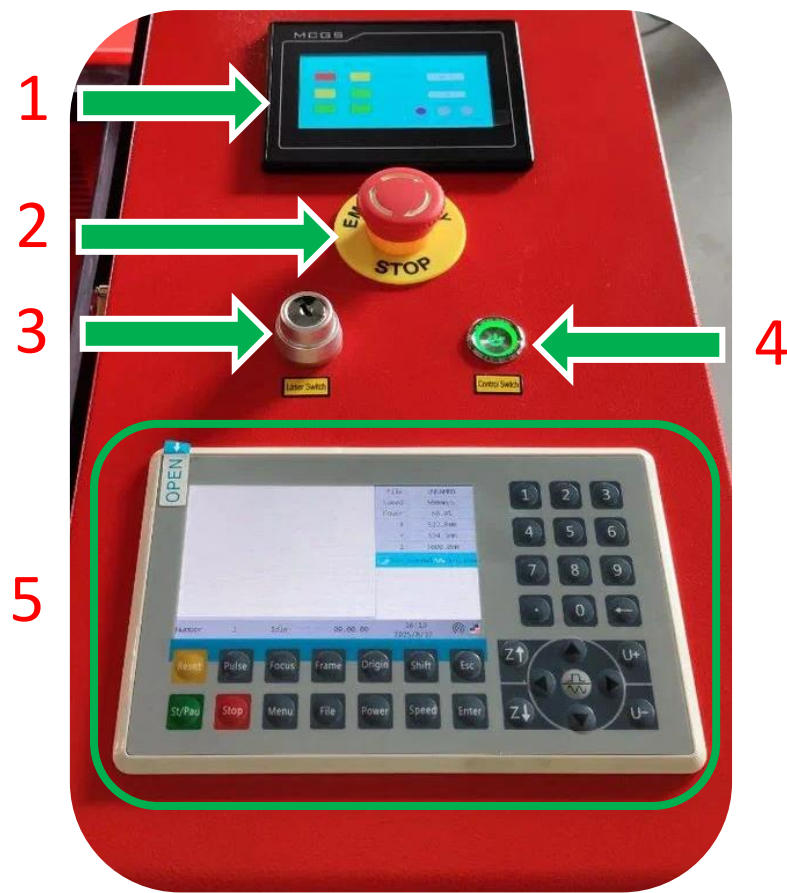
Cooling of the equipment inside the cabinet is carried out by air circulation. Therefore, it is important that the parts inside the cabinet are not contaminated with dust and dirt.

Chapter 4. Equipment design

4.1 APPEARANCE

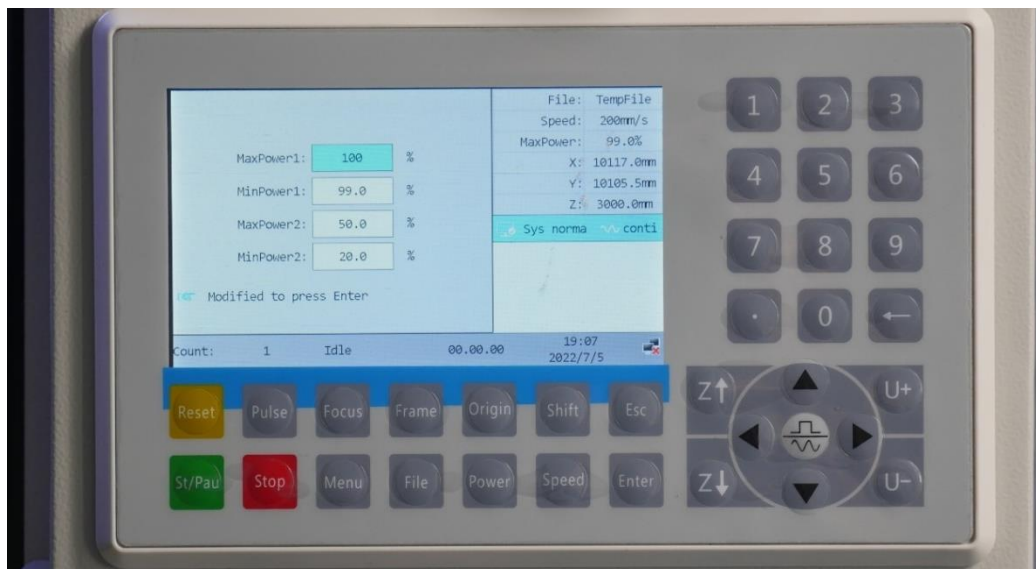


4.2 CONTROL PANEL

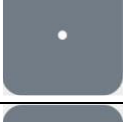


1. Monitoring system screen.
2. Emergency shutdown button.
3. Laser source activation switch.
4. Button to turn on the machine.
5. Controller control panel.

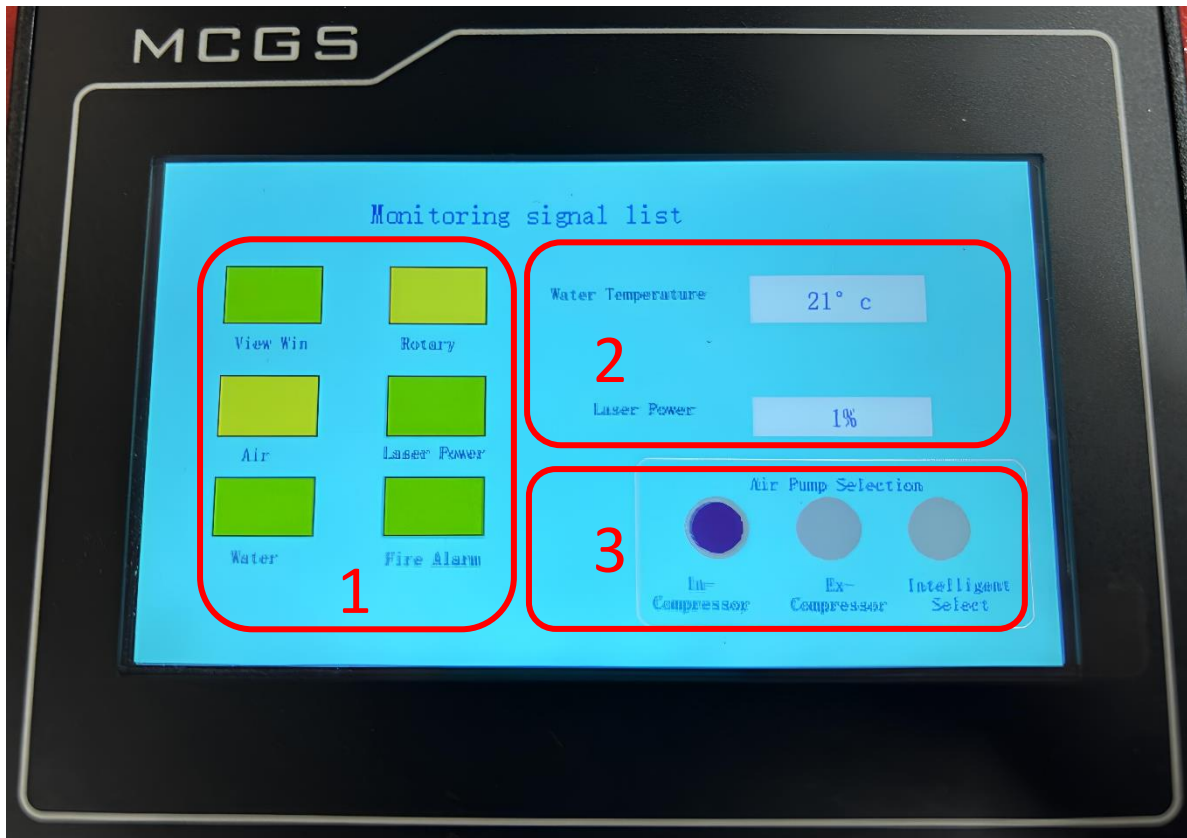
4.2.1 CONTROLLER CONTROL PANEL



1	复位 Reset	Reboot the system. The laser machine is restarted, and the laser heads go to the end sensors.
2	启动/暂停 St/Pau	Start of the selected control program / Pause the execution of the control program.
3	点射 Pulse	Launch of laser radiation in manual mode. Used for testing or alignment.
4	停止 Stop	Stops the execution of the daemon program.
5	寻焦 Focus	Automatic focal length search (if you have a special sensor).
6	菜单 Menu	Access to the controller settings menu.
7	边框 Frame	Traces the processing area of the uploaded file with the laser head.
8	文件 File	Menu for accessing the list of control programs loaded into the controller's memory.
9	定位 Origin	Sets the zero point from which the NC processing will begin.

10		Sets the laser power when the Pulse button is pressed in standby mode, or changes the beam power while the program is running.
11		Access to special features.
12		Sets the speed of the laser head in standby mode or changes the speed of the laser head during the execution of the control program.
13		Exit the menu.
14		Confirmation of choice.
15		Move your head or select menu items.
16		Movement along the Z axis upwards.
17		Move down the Z axis.
18		Movement along the U-axis in a positive direction.
19		Movement along the U-axis in the negative direction.
20		Choosing the method of idle movement of the laser head: "Continuous movement" and "Movement for a given distance".
21		Point (symbol).
22		Delete a character.
23		Numbers (symbol).

4.2.2 MONITORING SYSTEM SCREEN



The screen of the monitoring system has touch control and is divided into 3 main zones:

1. Indication of the status of machine components.
2. Parameter monitoring.
3. Air control.

4.2.2.1 MACHINE COMPONENT STATUS INDICATOR

The monitoring system, with the help of a color indication, notifies the user in what state a particular component is.

-  - Operating normally
-  - On standby
-  - Accident (error)

View Win: Door opening sensor.

Air: Air pressure sensor.

Water: Water flow sensor.

Rotary: Connection of the rotary device.

Laser Power: Power Laser Tube

Fire Alarm: Fire safety sensor.

4.2.2.2 MONITORING OF PARAMETERS

Water Temperature: The temperature of the water in the cooling circuit of the laser tube.

Laser Power: The power level of the laser tube.

4.2.2.3 AIR CONTROL

In this menu, you can switch the source of compressed air supply.

In- Compressor: The air supply will be carried out from the built-in compressor.

Ex-Compressor: The air supply will be from an external compressor.

Intelligent Select: The air supply will be based on the mode of operation (cutting - external compressor; engraving - built-in compressor).

Chapter 5. Installation

5.1 LASER TUBE INSTALLATION



Before installing the laser tube, inspect it for defects.
The tube must be installed carefully to avoid damage.

- Open the compartment for a laser source and unscrew the laser tube mounting screws.

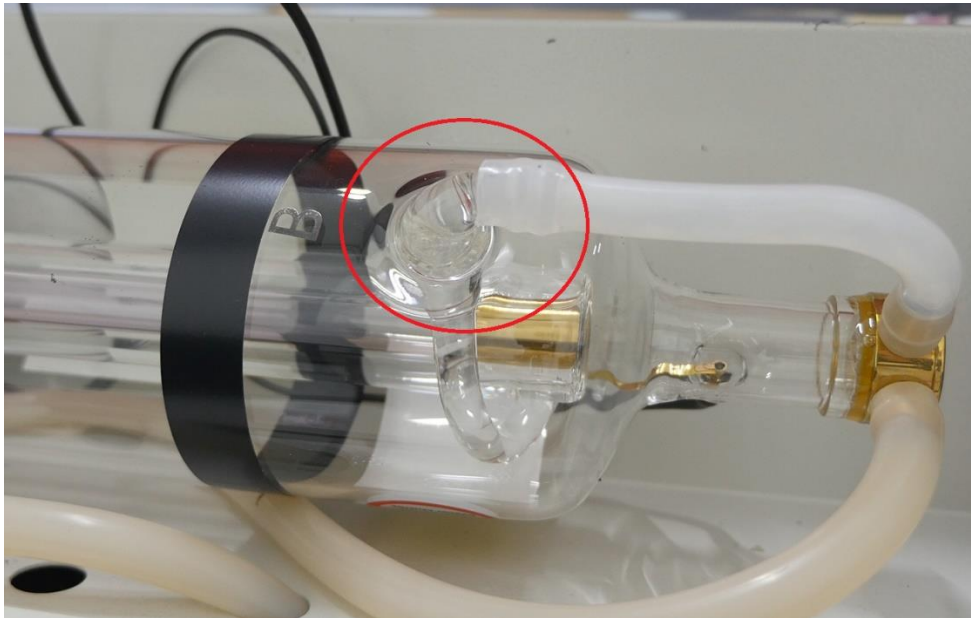


- Install the laser tube in its standard place in the mounts, with the outlet opening facing the first reflective mirror (in the photo on the right)



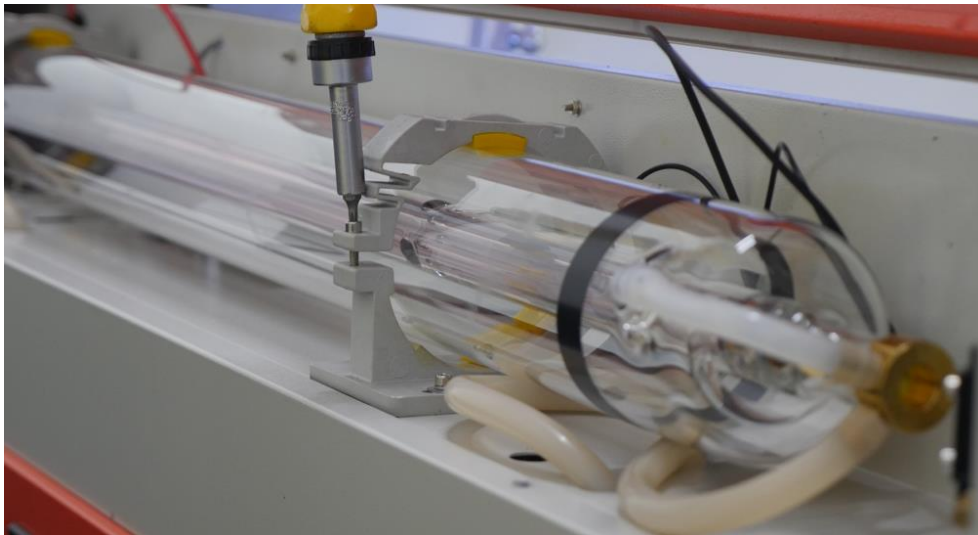
Before installing the laser tube and during its maintenance, check the translucent mirror of the laser tube (in the front part where the laser beam exit) for contamination. Dirt on the mirror will overheat the mirror and disable the tube.

- Rotate the tube around its axis so that the water drain fitting (at the outlet of the laser tube) is facing up. The "This side up" sticker must be on top.



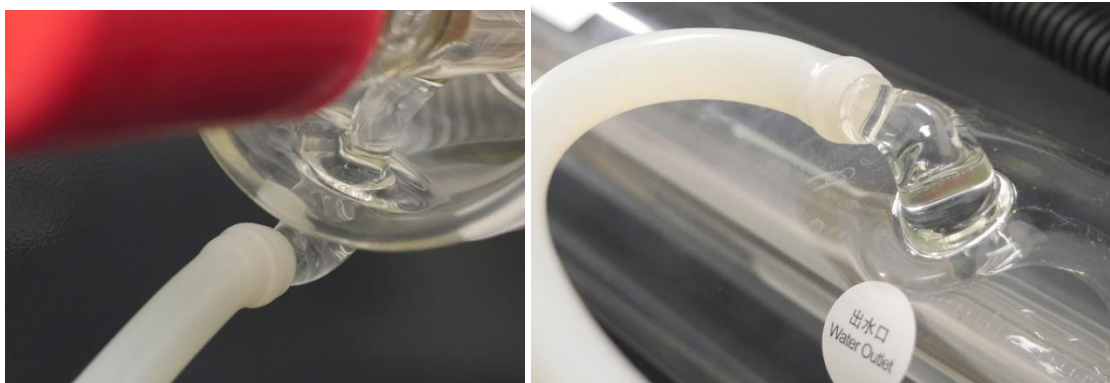
This is necessary in order to remove excess air from the laser tube, otherwise the water will not completely fill the laser tube, which will lead to its overheating and premature failure.

- Without much effort, fix the laser tube in the mounts (mounts on different models may vary):



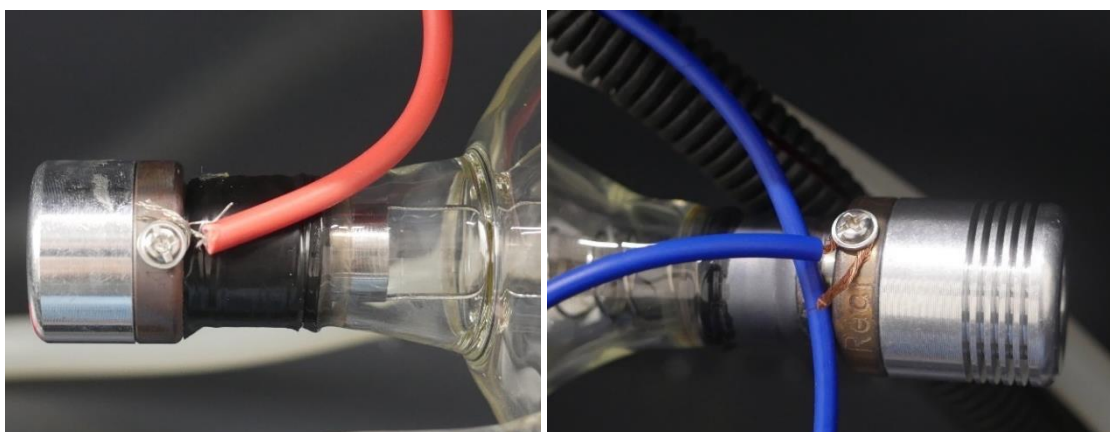
- Connect the tubing to the water supply hoses.

Connect the water supply hose to the back of the laser tube and the water discharge hose to the front. Before starting the equipment, make sure that the water circuit of the laser tube is completely filled with water and does not contain air bubbles that can cause the tube to overheat and fail.



The silicone tubing should not be twisted or pinched for normal water flow and should be tightly connected to prevent water leakage.

Screw the red (high-voltage) wire from the high-voltage unit to the left contact of the tube (from the back of the laser tube) and the black/blue wire from the high-voltage unit to the right (from the side of the laser beam output). The wires must be securely screwed to the laser tube.



The connection of a high-voltage wire must be insulated based on an electric current voltage of 40,000 volts. To properly isolate the contact, you need to:

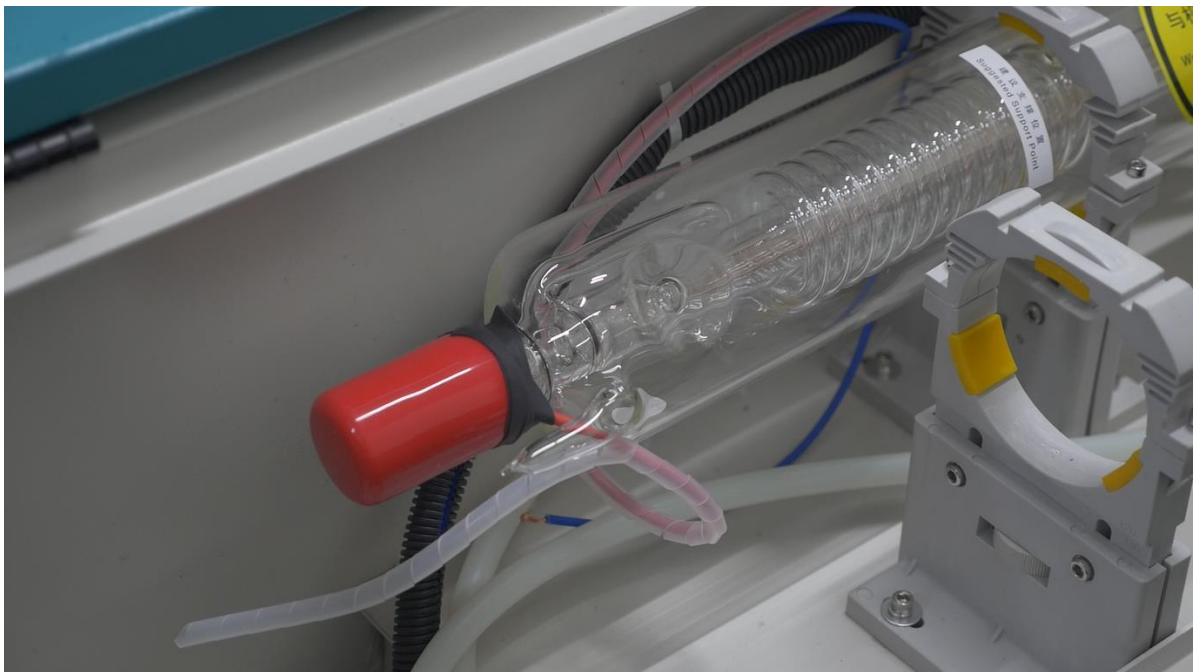
1. Wrap the contact with high-voltage electrical tape.



2. Put a silicone cap on top.



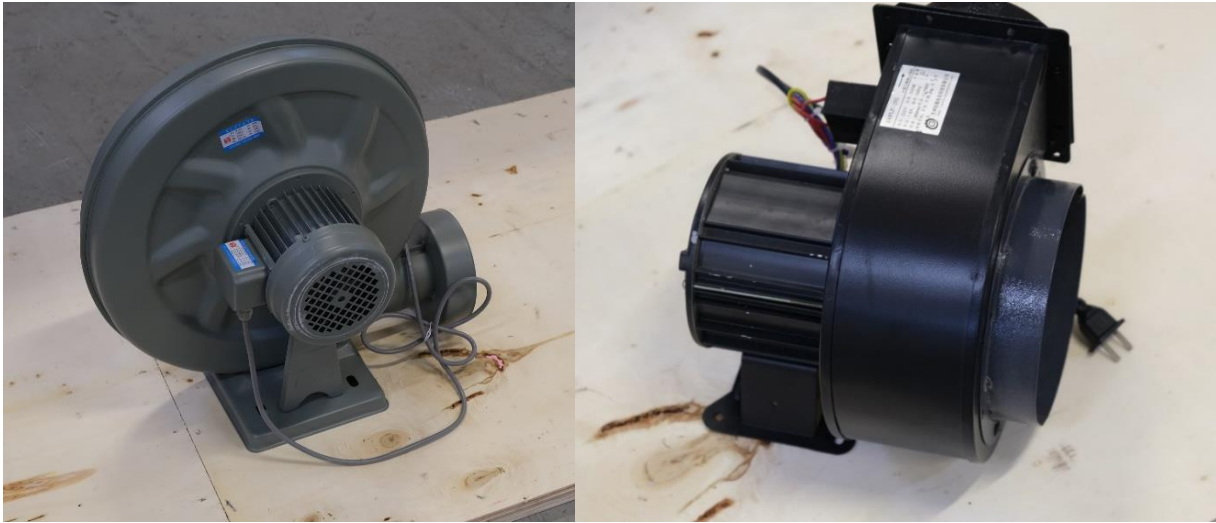
3. Wrap the hood with electrical tape (high-voltage or ordinary).



Clean the laser tube compartment regularly. Do not allow the laser tube to become contaminated, as dust on the electrical contacts may cause electrical breakdown and failure of the laser tube.

5.2 INSTALLATION OF THE EXHAUST SYSTEM.

The machine may come with one of two types of fans:



Connection method:

1. Unpack the exhaust fan. Take 2 corrugated hoses and 3 clamps.



2. At the bottom of the machine (under the machine) there is a mount for a corrugated hose. Climb under the machine, install the No1 corrugated hose and secure it with a metal clamp.



3. Connect the other end of the No1 corrugated hose to the exhaust fan and secure it with a metal clamp.



4. Take the No2 corrugated hose, connect it to the exhaust fan and secure it with a metal clamp.



5. The second end of the No2 corrugated hose must be connected to your ventilation system.



6. If your room does not have a ventilation system to extract industrial smoke, you can pull the other end of the corrugated hose outside through the window or through the door.



7. Connect the fan power cable to the mains.



5.3 GROUND WIRE CONNECTIONS

There is a special ground wire connection point on the laser machine bed. The machine comes with a ground connection wire.



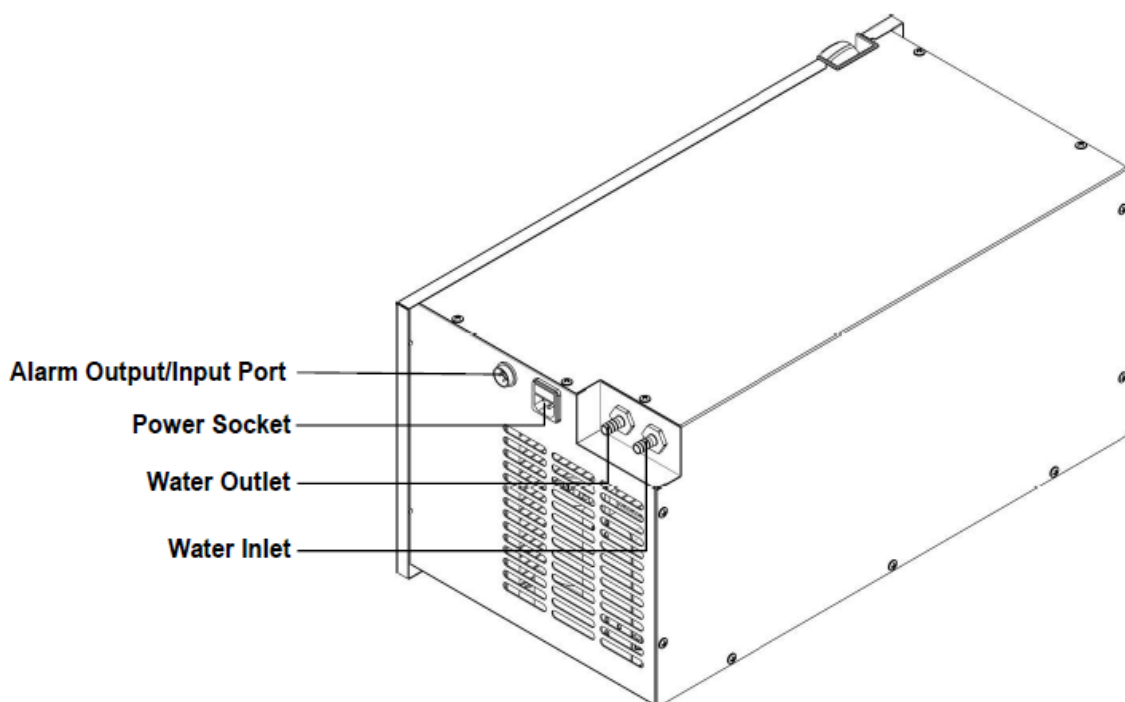
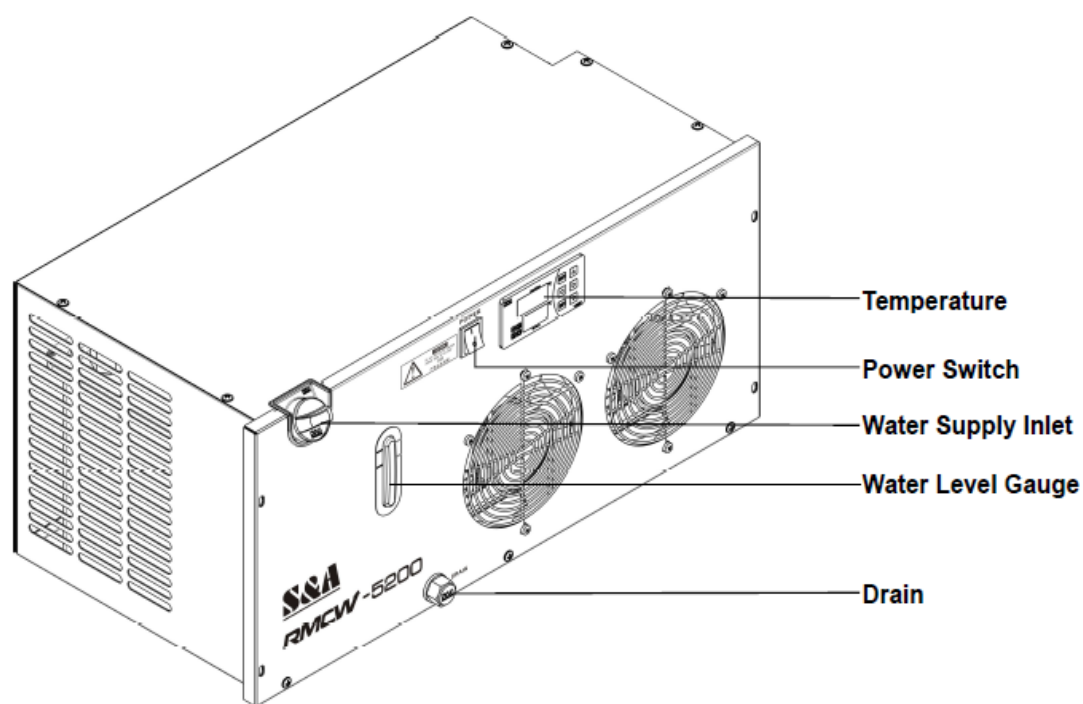
Unscrew the plastic washer, secure the cable to the metal screw, and screw the plastic washer back to secure the ground cable. Check that the wires are tight enough that it will not fall off or dangle.

You need to connect the other end of the wire to the common ground point in your room.

CHAPTER 6. SETUP AND OPERATION

All electrical connections must be connected before power is supplied to the unit. Whenever possible, all connectors should be secured with screws to ensure proper operation. The first start of the machine should be carried out by a specialist and carried out strictly in accordance with the rules set out in this manual. Correct setup is the basis for ensuring the normal operation of the machine.

6.1 PREPARING THE CHILLER



The laser source is water-cooled. Operating at elevated temperatures accelerates the aging of the laser and reduces its efficiency. If the chiller overheats, do not use the appliance and contact our service center for assistance.

	All the necessary information about the chiller, including its setup and error codes, can be obtained by scanning the QR code on the chiller body.
---	--

Chiller Inspection

Clean the chiller's water tank to make sure the water tank is clean and free of contaminants. Next, check the connection of the cooling hoses for breaks.

Make sure that the chiller is filled with refrigerant. Contact the supplier if necessary.

1. Hose connection

Next, check the connection of the hoses for the outlet and inlet of water to the laser head. Make sure that the hoses inside are not dirty and do not have foreign objects (debris and fastener parts), and the hoses are not kinked along the entire routing route.

2. Filling the coolant

	Only distilled water is allowed to be filled into the chiller.
--	--

- 1) Remove the water filler cap.
- 2) Pour distilled water into the tank. Make sure that the water level is in the green zone on the indicator scale.
- 3) Place the lid on the neck.

3. Trial Run

	After starting the chiller and distributing water throughout the system, its level in the chiller tank may drop. Make sure that the water level is in the green area, adding it if necessary.
---	---

Check that the laser tubes are flowing with water. Make sure there are no air bubbles in the water stream.

When the water temperature reaches the set temperature, the chiller will start regulating the temperature automatically.

After the water temperature in the cooling system reaches the required value and air bubbles disappear from the system, you can turn on the laser.

	When working for a long time, always keep an eye on the level of cooling water. The water level should be checked in a timely manner and the hoses should be checked for leaks.
---	---

4. Color/Opacity of Water

The presence of any opacity (e.g. suspension, filamentous, flaky, particles, etc.) indicates water contamination, so it is forbidden to use such water in the cooling system.

	When storing the equipment for a long time, at a temperature below freezing, it is necessary to drain the water from all hoses to avoid rupture.
---	---

6.2 PROCEDURE FOR SWITCHING ON THE EQUIPMENT

1. On the front panel, turn the emergency shutdown button clockwise.
2. Power on the control system.
3. Turn the key to the ON position



After turning on the machine for the first time, it is necessary to check the basic settings of the machine and, if necessary, adjust the machine.

	Before starting the laser source, visually inspect the machine's optics for contamination, including reflective mirrors and focusing lenses. Clean them if necessary.
---	--

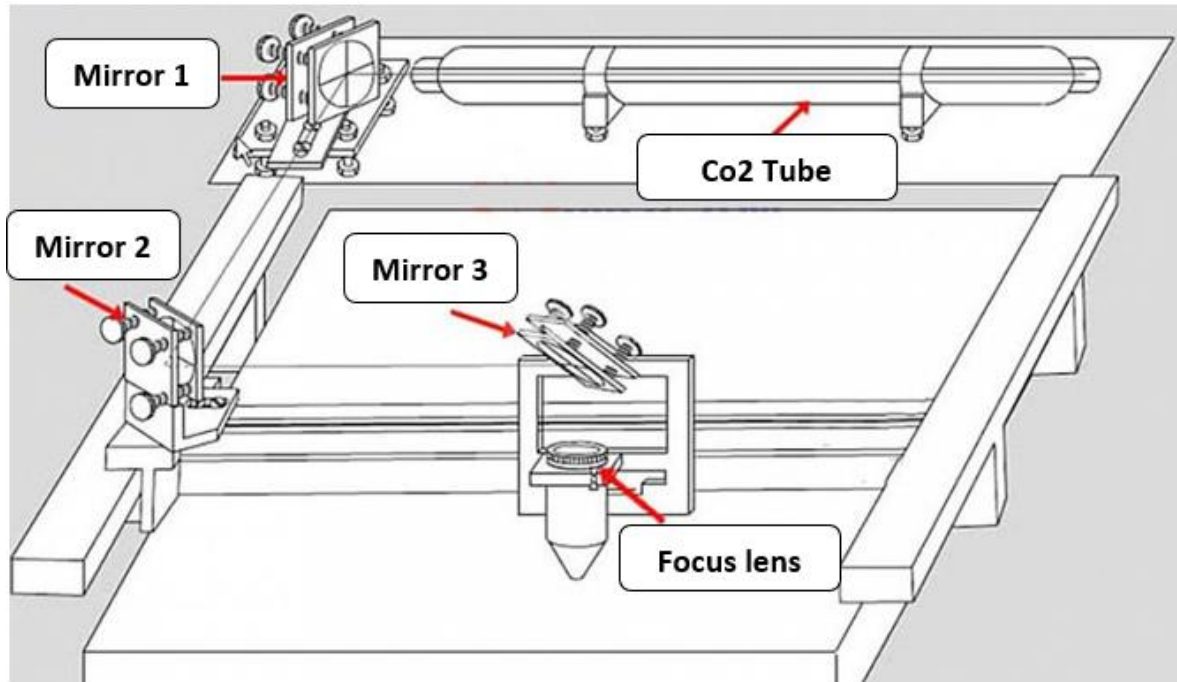
6.3 MACHINE SHUTDOWN PROCEDURE

1. Turn the laser activation key to the OFF position.
2. Turn off the power to the control system.
3. Hold down the emergency stop button.

6.4 ALIGNMENT

Alignment should be carried out at the first start-up of the equipment, as well as checked daily before starting work.

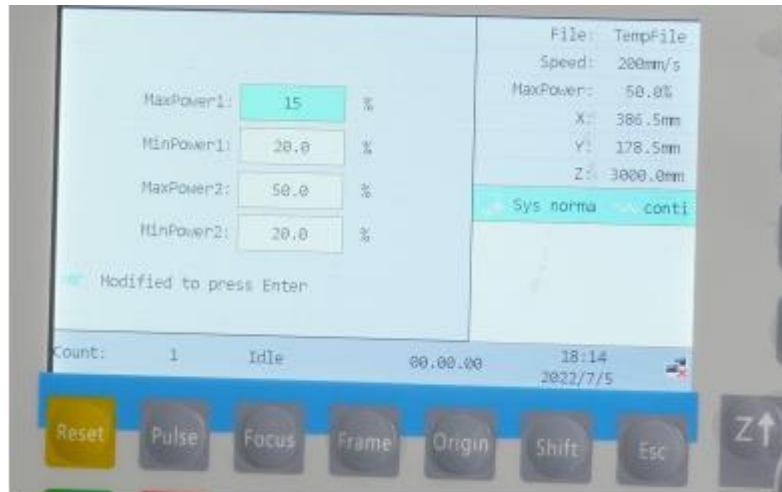
Optical path structure



Before starting alignment, open the rear compartment of the machine with the laser tube.



Set the power to about 15-25%.



The laser tube is installed in its mounts in the lower position. Masking tape (2-4 layers) is applied to the first mirror to make the frame's edges visible. The laser's hit on the first mirror is checked by pressing the "PULSE" button.



If the laser beam doesn't hit the center of the first mirror, the laser tube needs to be adjusted. A convenient wheel and scale are provided on the laser tube mounts for up-and-down adjustment, making it easy to align the rear and front of the tube.



To adjust to the right and left, you need to loosen the bolts of the laser tube fasteners to the machine bed, after which the fasteners can be moved to the right and left.

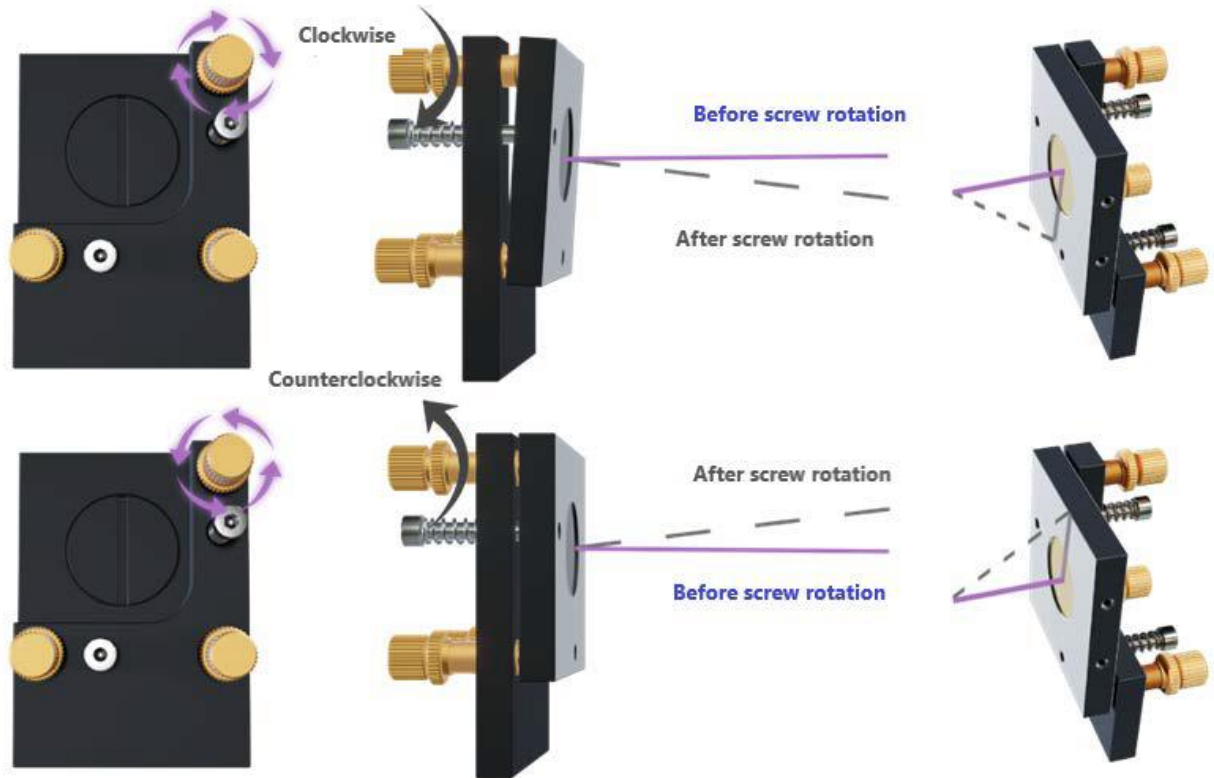


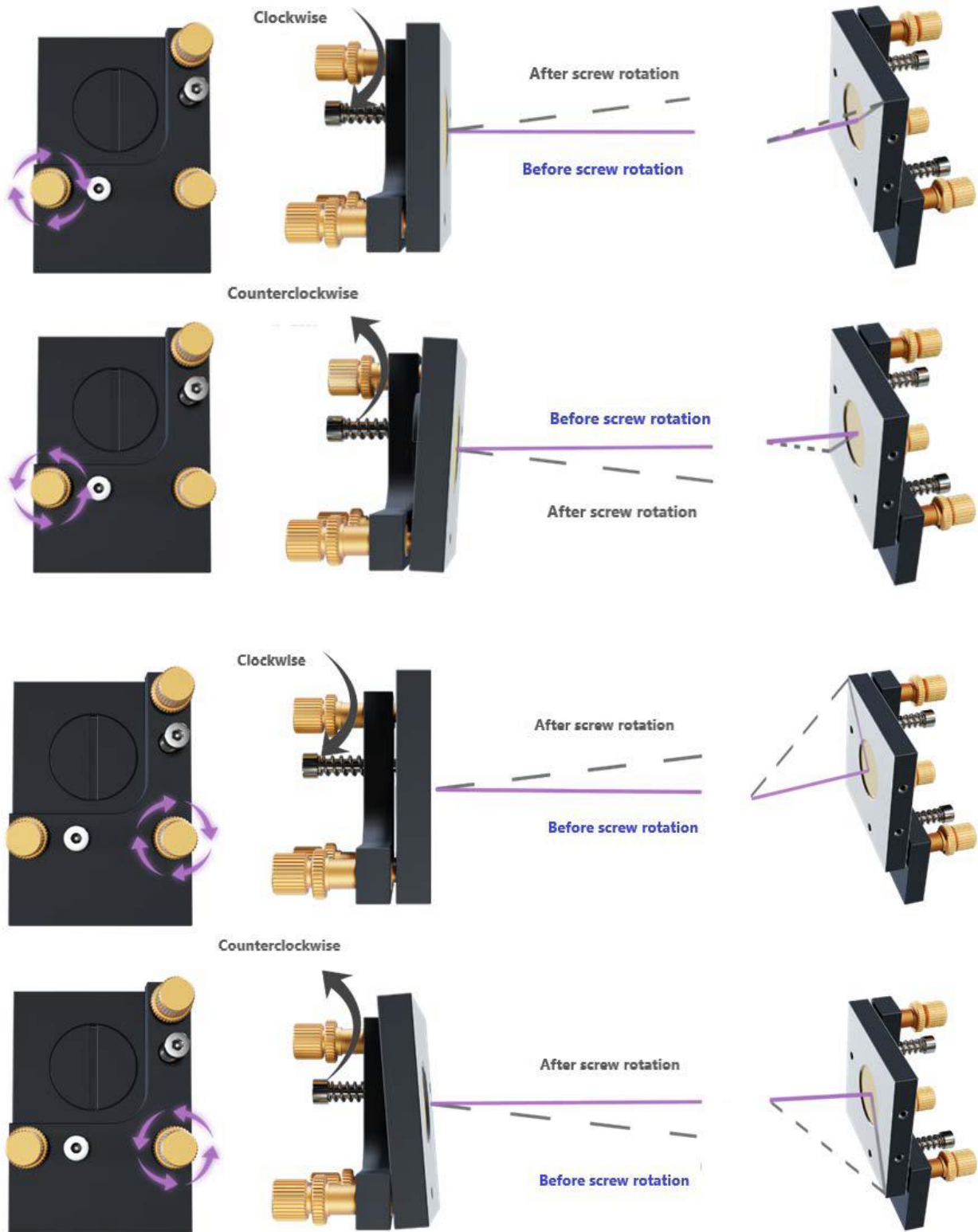
The beam does not have to fall into the very center of the first mirror. The most important thing is to get into the center of the second and third mirrors.

6.4.1 CONFIGURING THE FIRST MIRROR

Each mirror mount has brass screws that adjust the angle of inclination, pushing the frame with the mirror from different sides.

The upper screw adjusts the angle of inclination vertically, and the right and left screws horizontally and diagonally. The larger the field of the machine, the more sensitive the laser is when the screw is turned.





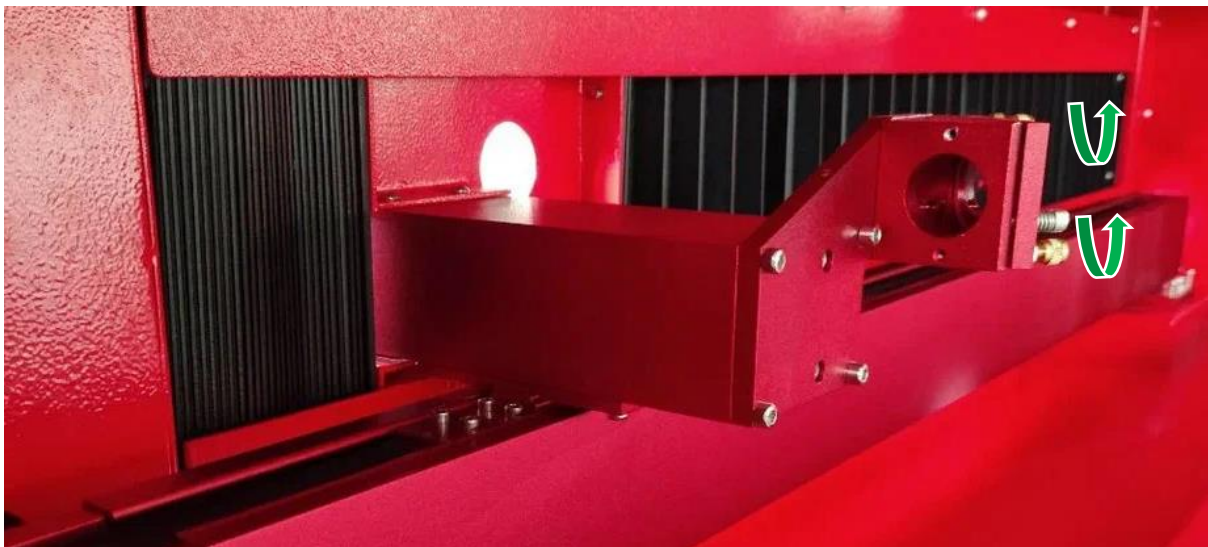
The mirror is adjusted using the screws until the entire beam hits the center of the next mirror.

First, move the portal with the second mirror as close as possible to the first mirror. After aiming the laser beam at the center of the second mirror, move it to the furthest position from the first mirror. Ensure that the laser hits the center of the second mirror's window in both positions. You can then proceed to adjusting the second mirror.



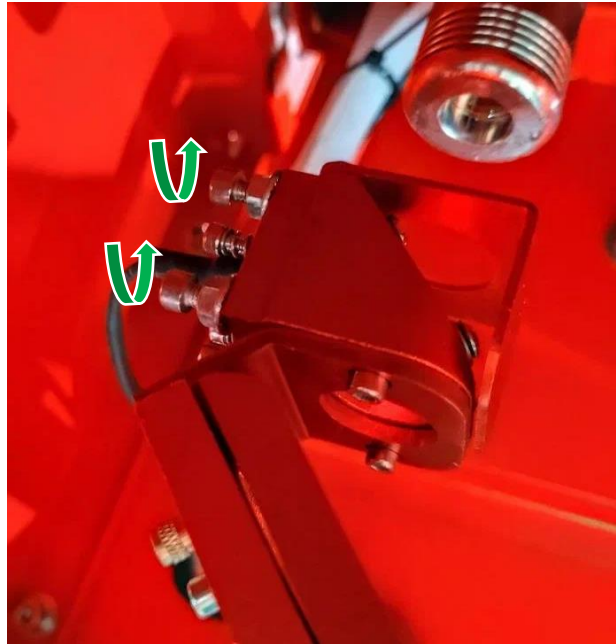
6.4.2 CONFIGURING THE SECOND MIRROR

The first check is carried out at a close distance so that the beam cannot go beyond the boundaries of the frame.



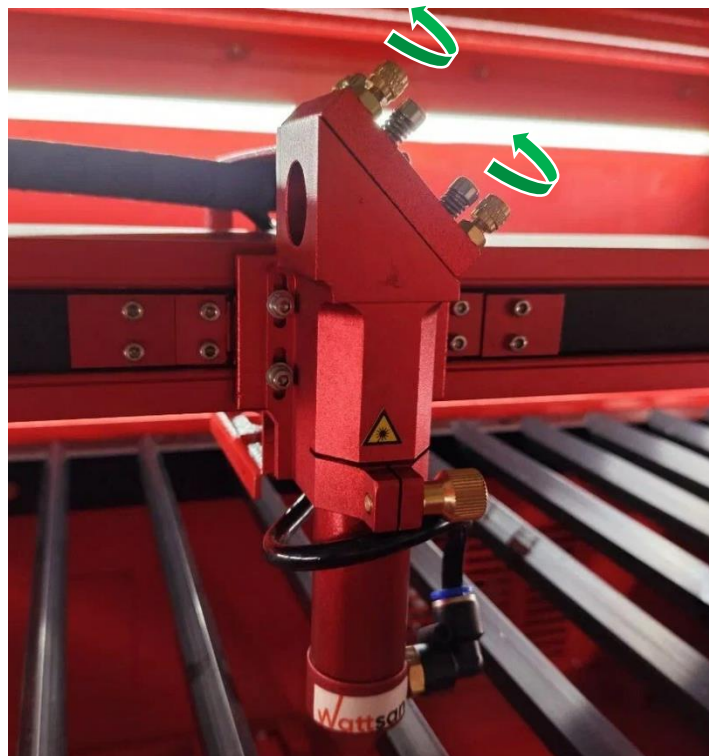
The setup is similar to the previous procedure, but now it's important that the beam hits the center of the mirror window on the laser head. Make sure the laser hits the center of the mirror window on the laser head in all four corners of the working area.

Also, make sure the visible red laser also hits the center of the third mirror and aligns with the beam trace from the laser tube. If necessary, the position of the red beam can be adjusted using the screws near the first mirror.



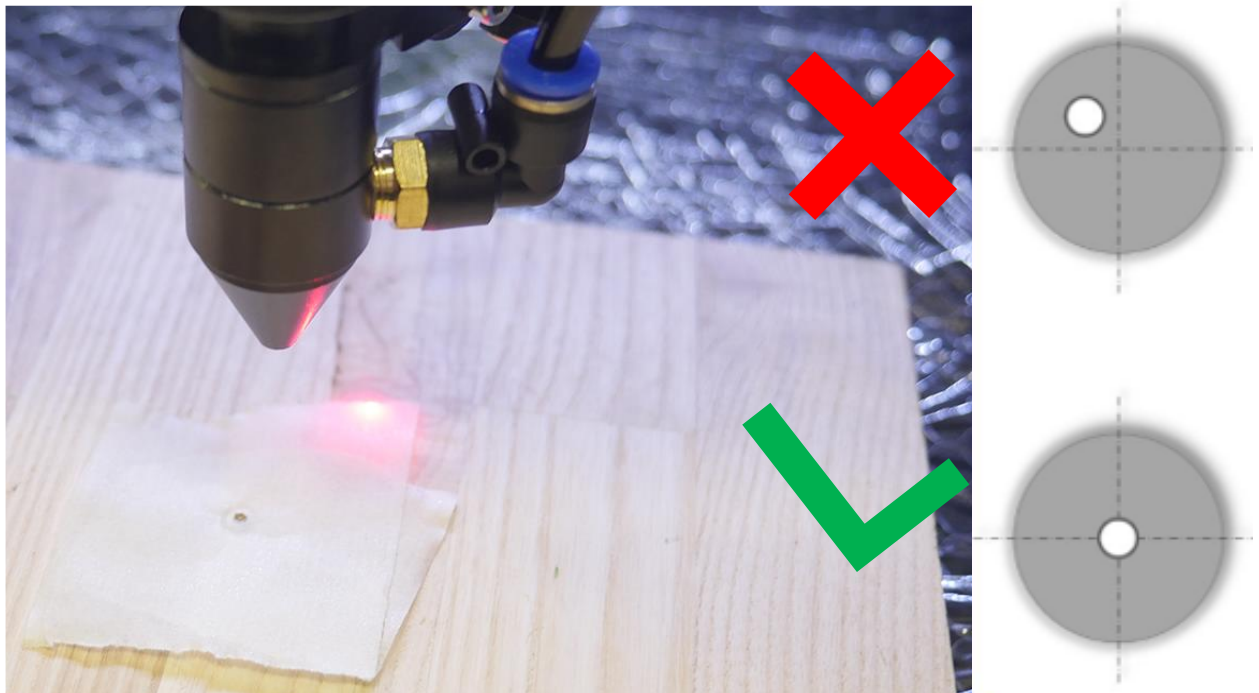
6.4.3 SETTING THE THIRD MIRROR – SETTING THE VERTICALITY OF THE BEAM

The setup should be done in a similar way. It is necessary to make sure that the beam passes through the tube and falls on the material. It is more convenient to do this in an unfocused position of the laser head, so that the shape of the print is better visible.



When the print has become round, a transparent adhesive tape is glued to the nozzle. The minimum power is set, about 10%, Laser is pressed.

A nozzle imprint and a trace of the beam will remain on the tape. The hole should be exactly in the center of the nozzle. The centering is corrected by adjusting the 3rd mirror. The tape is glued again, the alignment is checked. The operation is repeated until the correct position is reached.



After the beam is correctly centered, a small round dot remains on the material.



After alignment, it is necessary to tighten the screws with locknuts! When tightening, the screws must be held by hand so as not to accidentally displace them. After tightening, the alignment accuracy is checked again.

6.4.4 FOCAL LENGTH

The focal length is the distance between the lens in the laser head and its focal point, where the beams converge.

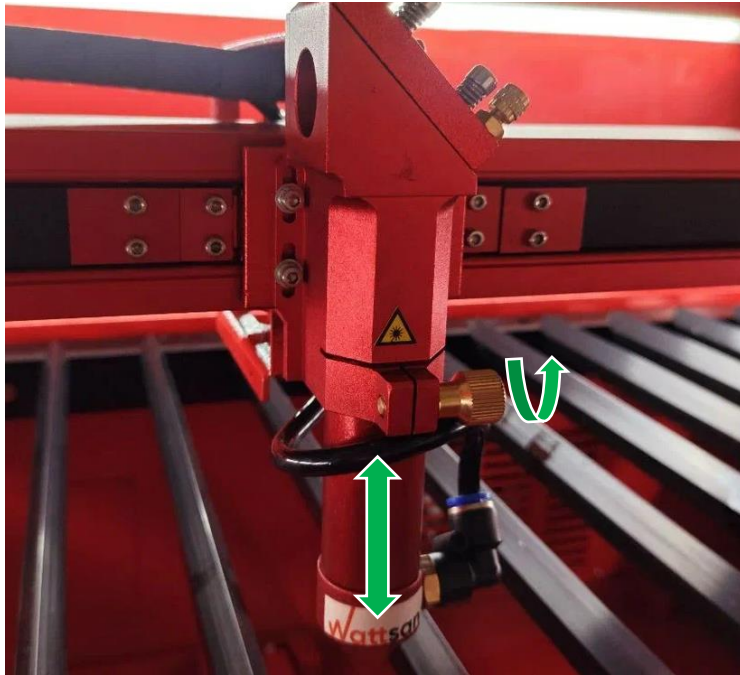
It's important to always maintain the focal length to ensure optimal cutting of your material.

The machine has an autofocus function for finding the focal length. It works as follows:

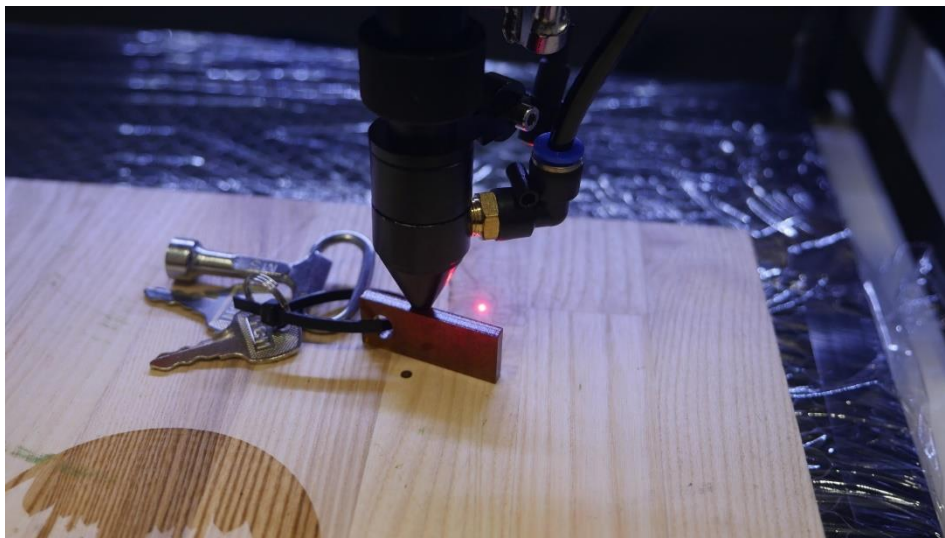
- 1) Lower the machine's worktable slightly by pressing the Z- button on the control panel.
- 2) Place the material on the worktable.
- 3) Press the "Focus" button on the control panel. Confirm the action by pressing "Enter."

The table will begin to rise until the material reaches the autofocus sensors on the sides of the worktable.

Next, adjust the tube in the laser head to the desired height. To do this, loosen the clamping screw that holds the tube with the focal lens.



Place the insert with the wide edge on the material (as shown in the picture). Then, adjust the tube until the nozzle touches the insert. Then, tighten the screw.



6.5 CHECKING THE AIR SUPPLY

The laser head must be supplied with air by an air compressor. This air flow is necessary to prevent material combustion and to prevent contamination of the focusing lens in the laser head.

6.6 PC CONNECTION VIA USB

All control programs for the laser machine, power and speed settings are made on a PC in RdWorks or Lightburn programs.

To connect the machine to a PC:

1. Take the A-B USB cable that comes with the machine.



2. Plug one end of it into the USB socket labeled PC.



3. Connect it to your PC with the second end.



4. Start the machine and PC.

5. After starting the PC, your system should detect a new unknown device.

6. Insert the USB drive that came with your machine into your PC.



7. Find the RdWorksSetup.exe program on it and copy it to your computer.

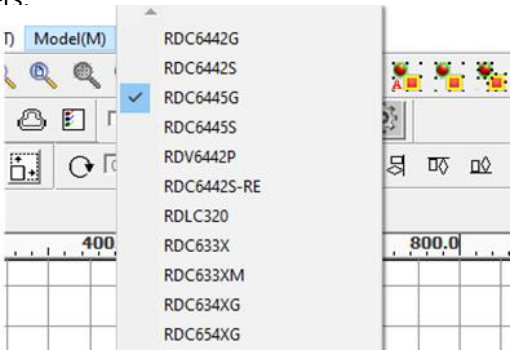


8. Launch this program and follow the installation instructions. In the process, the program will offer both the installation of drivers and the installation of the main RdWorks program.

9. Once installed, the RdWorks shortcut will appear on your desktop. Launch it.

10. Select the correct controller model in the list of controllers:

Controller on the machine	Selection in the RdWorks list
Ruida RDC 8445s	RDC8445S

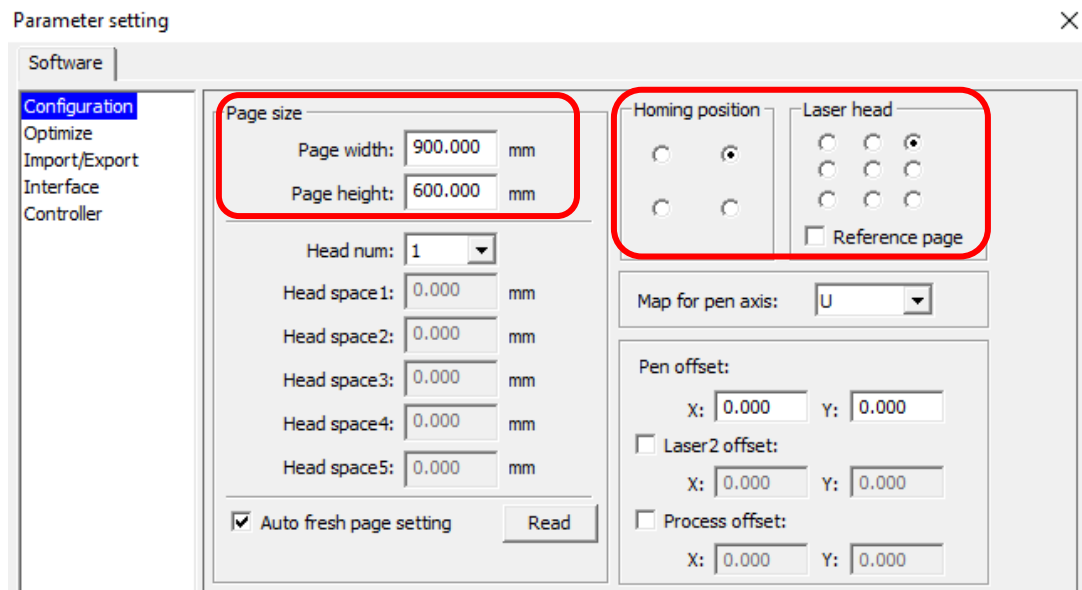


11. Set the working in the program according to the working field of your machine

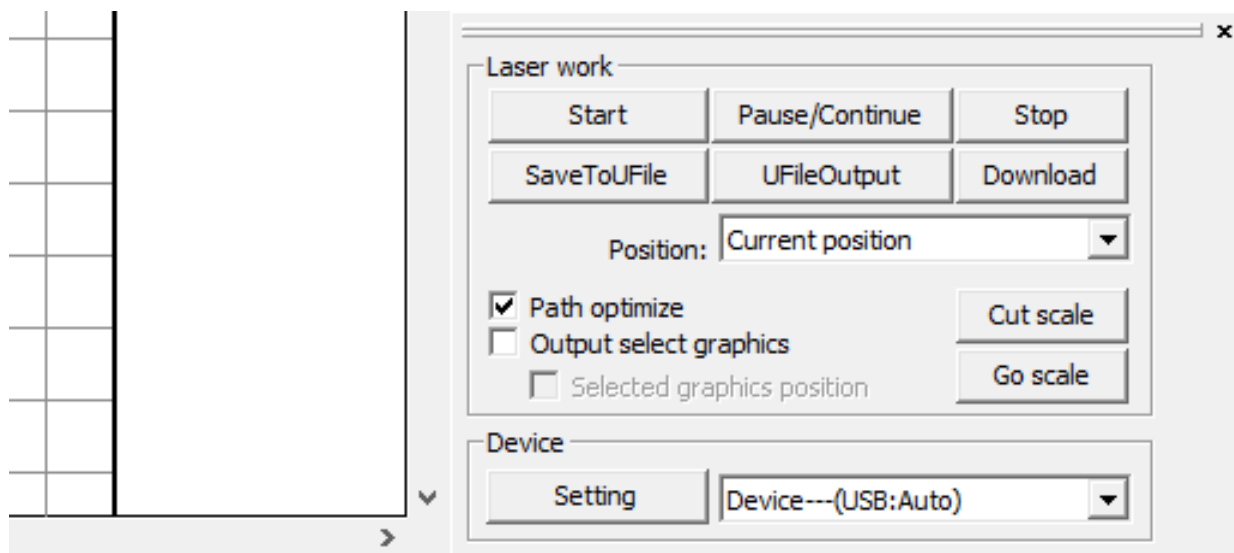
Start the RdWorks program. Go to Config -> System settings. In the Homing position field, set a point in the upper left cell.



If your layout is displayed incorrectly (mirrored) on the machine display when loading the layout into the machine memory, select a different point in the Homing position settings.



In the lower right corner of the program, check that the Device field is set to Device---(USB:Auto).



6.7 CONNECTING VIA ETHERNET

The equipment can be connected to the computer not via a USB connection, but via an Ethernet cable.

Important: Please note that to connect to the machine, you need to choose one of the 2 connection methods - USB or Ethernet.

Take an Ethernet cable, insert one end of it into the ethernet port of your PC.

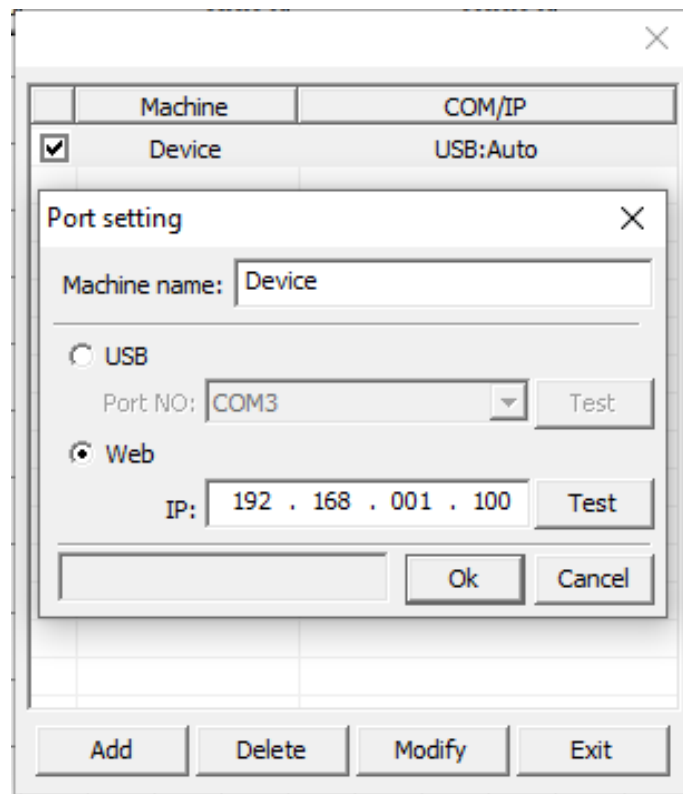


And the other end is in the ethernet port on your machine.

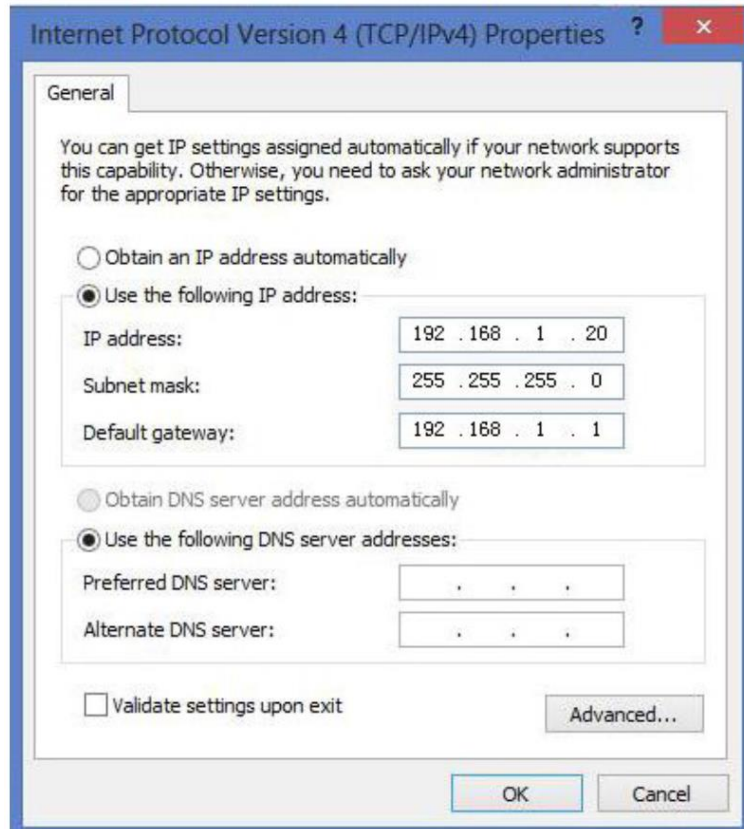


After that, set up in 2 stages:

1. In RdWorks, in the lower right corner, click Settings. In the window that appears, click "Add". Put a dot next to Web. Set the IP address of the controller in the range **192.168.001.100 - 192.168.001.149**.



2. On your PC, go to the Network Connections settings and make the following settings in the Ethernet connection:



Note! set the IP address on the computer between **192.168.001.2 - 192.168.001.049**

Importantly!

1. Minimum PC Requirements:

- Windows XP, 7, 10, 11 (32-bit or 64-bit versions)
- Intel Celeron / Core i3/5/7 or AMD Ryzen 3/5/7/9/
- 2 GB RAM
- 2 GB of hard drive space
- Mouse, tablet, or multi-touch monitor
- Monitor resolution 1280 x 720 at 100% (96 dpi)
- Microsoft Internet Explorer 11 or higher
- USB 2.0 / 3.0

2. The PC must also be grounded.

3. If you do not find a USB drive in your equipment, please contact the supplier.

6.8 CONNECTING VIA WI-FI

The machine controller can be connected to other devices via Wi-Fi in two ways:

1. Create your own Wi-Fi hotspot and connect directly through the created network. (In this case, WEB functions will not be available)
2. Connect to an existing Wi-Fi network.

6.8.1 CREATING A WI-FI HOTSPOT

- To select this function, go to the wireless network settings in the controller menu at the following address: "Menu" -> "Controller+" -> "Net Setting" -> "Wi-Fi settings+".

The screenshot shows a configuration window for Wi-Fi settings. It has a grey background. At the top, 'Mode:' is followed by a blue button labeled 'AP_5G'. Below that, 'Name:' is followed by a white text box containing 'RDC8445S001'. 'Password:' is followed by an empty white text box. 'IP address:' is followed by four white text boxes containing '192', '168', '20', and '1' separated by colons. Below these are two cyan buttons labeled 'Read' and 'Write'. At the bottom left, there is a blue hand icon pointing to the right, followed by the text 'Press <Shift> to open the lowercase letter soft keyboard'.

Mode: Select the wireless network mode (AP_5G/2.4G – create an access point; STA – Connecting to an Existing Wireless Network)

Name: Network Name

Password: Network password

IP address: The IP address of the network

- Select AP_5G or AP_2.4G mode.
- Set a network name and password (or use the default ones)
- If necessary, change the IP address of the network or use the default one
- Click Write.

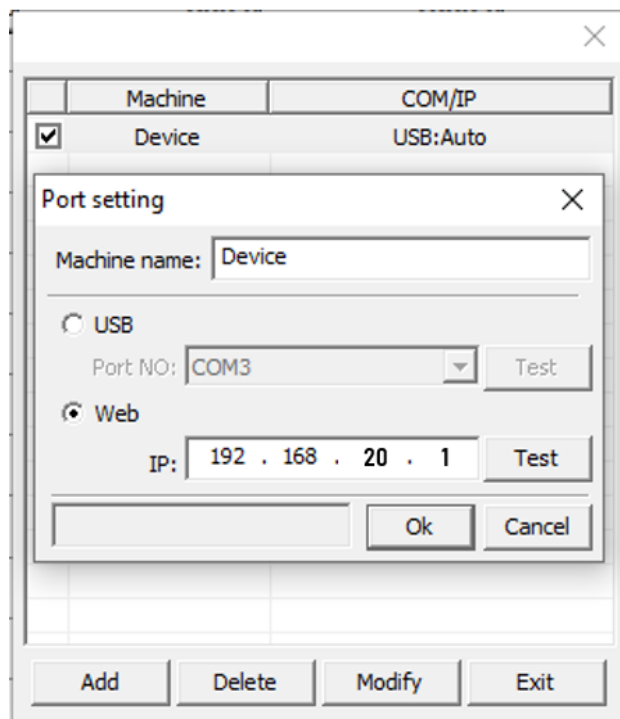
A window should appear with the following content. You can close the window and return to the main screen.

The hotspot has been
successfully opened!

Please <Esc>

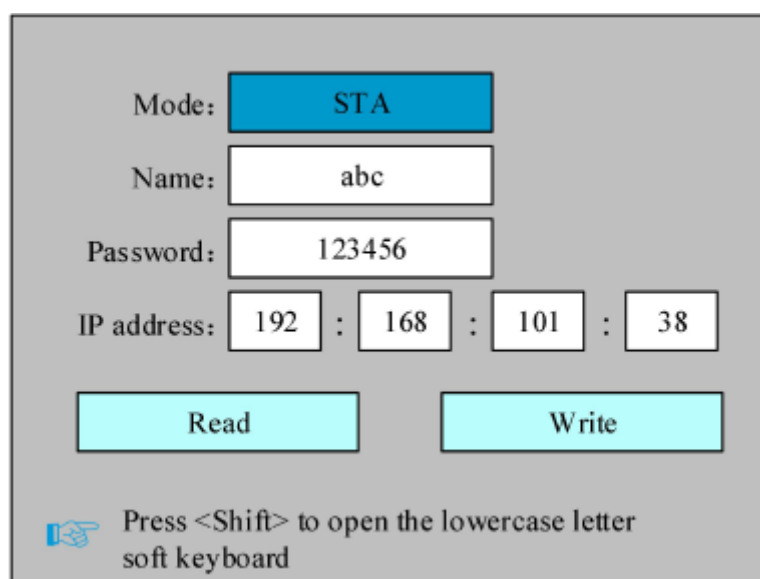
After that, the network with this name should appear in the list of networks on the device you are connecting.

- Connect to the network you created.
- In RdWorks, in the lower right corner, click "Settings" in the Device field. In the window that appears, click "Add". Put a dot next to the Web. Set the IP address of the controller, which was specified on the "Wi-Fi settings+" menu screen 192.168.20.1. Click OK.



6.8.2 CONNECTING TO A WI-FI WIRELESS NETWORK

- To select this function, go to the wireless network settings in the controller menu at the following address: "Menu" -> "Controller+" -> "Net Setting" -> "Wi-Fi settings+".



Mode: Select the wireless network mode (AP_5G/2.4G – create an access point; STA – Connecting to an Existing Wireless Network)

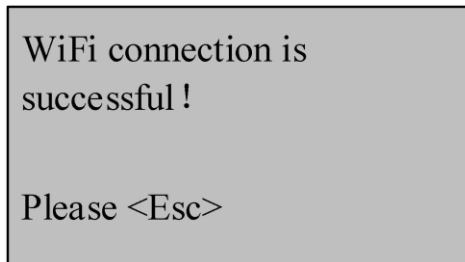
Name: Network Name

Password: Network password

IP address: The IP address of the network

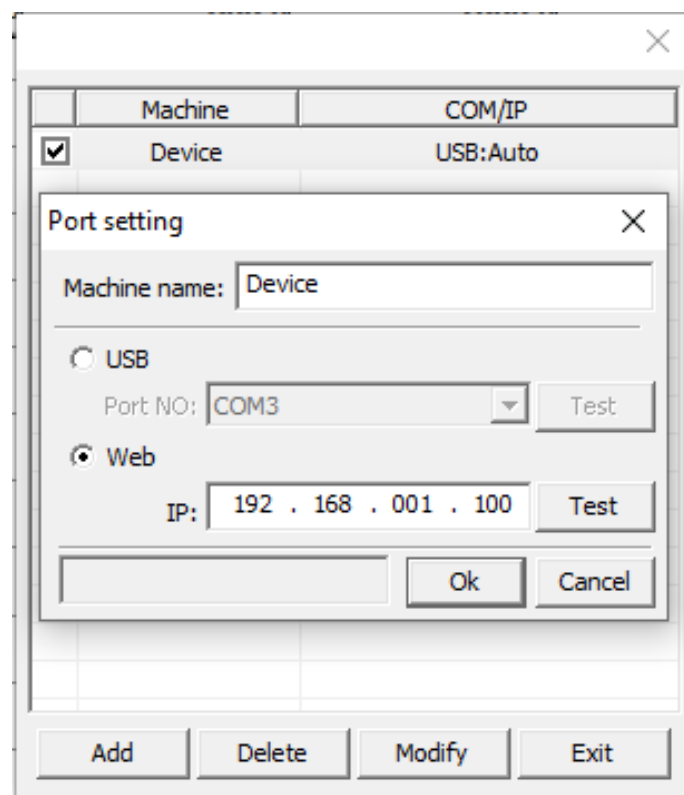
- Select the STA mode.
- Enter the name and password of the existing network
- Click Write.

A window should appear with the following content. At the same time, the assigned IP address will be displayed on the screen, write it down. After that, you can close the window and return to the main screen.



Before the follow-up step, make sure that the device and the machine are connected to the same network.

- In RdWorks, in the lower right corner, click "Settings" in the Device field. In the window that appears, click "Add". Put a dot next to the Web. Set the IP address of the controller that was specified on the "Wi-Fi settings+" menu screen. Click OK.



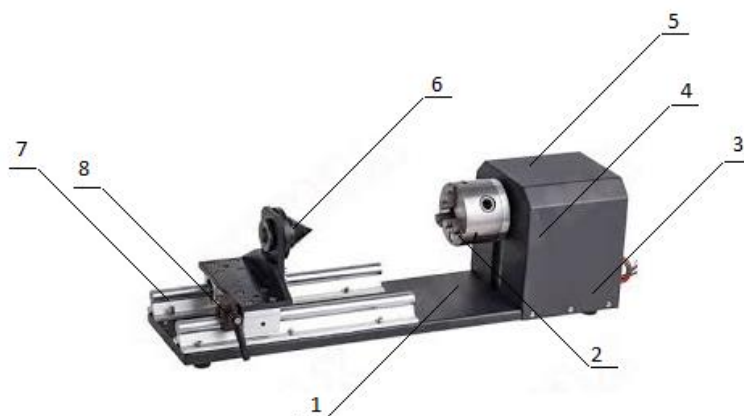
CHAPTER 7. SPECIAL FEATURES

7.1 CONNECTING THE ROTARY AXIS

A rotary device is a special mechanism installed on a laser machine, which is designed to rotate workpieces during processing. The swivel device consists of a cylindrical clamping chuck fixed on the bed, and a stop - a rear centering stop moving on a skid. The rotary axis is driven by a stepper motor.

7.1.1 ARRANGEMENT OF THE SWIVEL MECHANISM:

1. Bed
2. Cylindrical chuck
3. Stepper Motor
4. Reducer
5. Protective Cover
6. Centering Stop
7. Guides
8. Stopper for fixing the back gauge



7.1.2. PRINCIPLE OF OPERATION

The workpiece is placed in a cylindrical clamping chuck and fixed with cams from the back, the workpiece is fixed by a centering stop, the stop itself is fixed with a stopper.

7.1.3. HOW TO CONNECT THE ROTARY DEVICE TO THE MACHINE AND SET IT UP

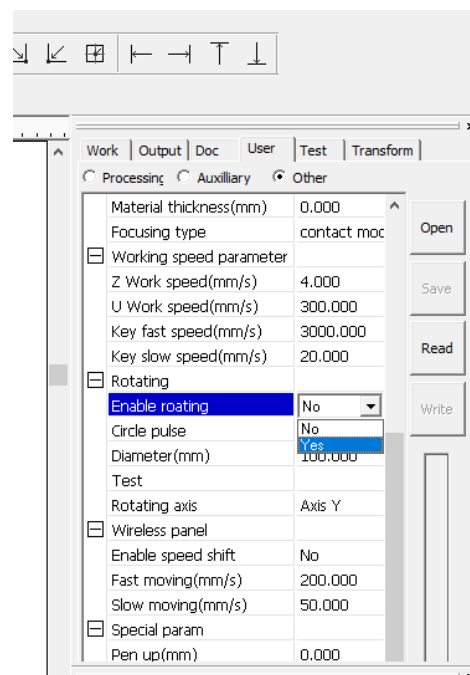
To use the rotary device, connect its cable to the special connector on the machine, located near the right corner of the work area closest to the front. Then, activate the switch to the left of the connector (the indicator on the switch should light green).



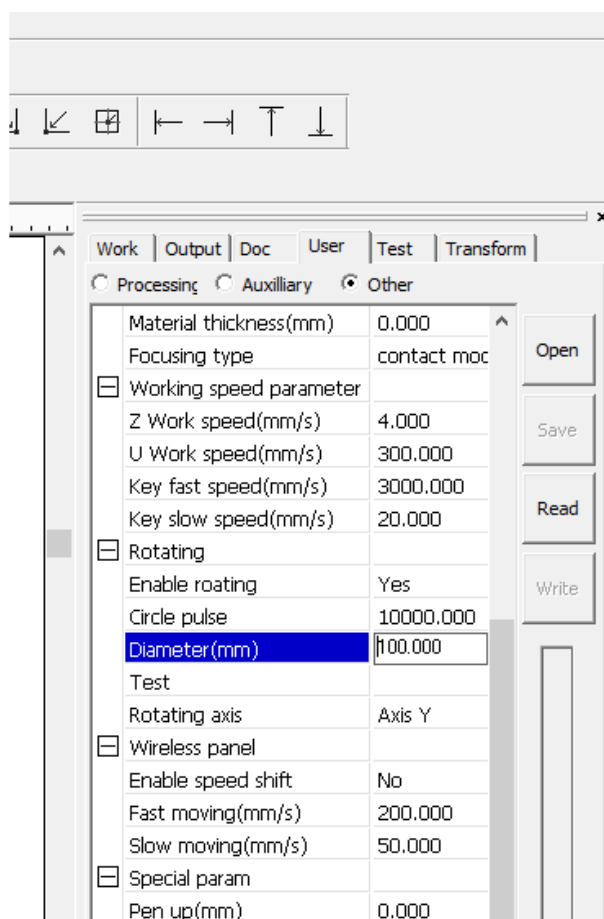
7.1.4. SETTINGS IN RDWORKS

1. Launch RDWorks

2. In the tab, find User Settings -> Other -> Rotating -> Enable rotating. And set it to Yes.

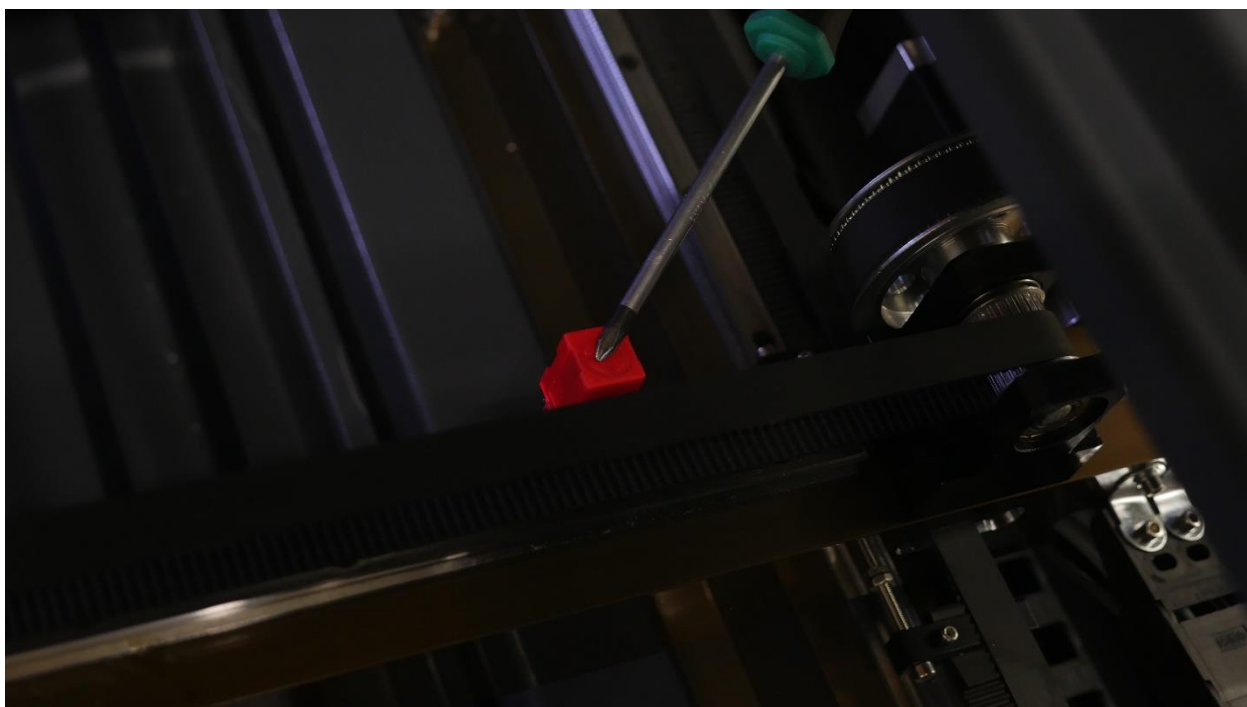


3. In the tab, find User Settings -> Other -> Rotating -> Diameter. And set a value equal to the diameter of your workpiece in mm.



4. Create a square in RdWorks whose side is equal to the diameter of your workpiece.

5. Start the machine and wait for the end sensors to reset the machine. If the machine or rotary device does not stop, close the end inductive probe in the Y axis with any metal object.



6. Run the control program. If everything is correct, then the rotary device will rotate exactly 360 degrees.

7. If not, then you need to choose a gear ratio. It can sometimes be calculated empirically, since the usual error can be 2, 4 or 8 times. Or you can open the casing of your rotary device, where the stepper motor and gearbox are located, and find the gearbox pulleys there. It is necessary to measure the diameter of both gearboxes and find their ratio, it is usually equal to 1:2 or 1:3 or 1:4.

According to these calculations, you need to multiply or divide your Circle pulse value in the RdWorks program by 2 or 3 or 4.

8. Run the control program. If everything is correct, then the rotary device will rotate exactly 360 degrees. If not, go back to previous step.



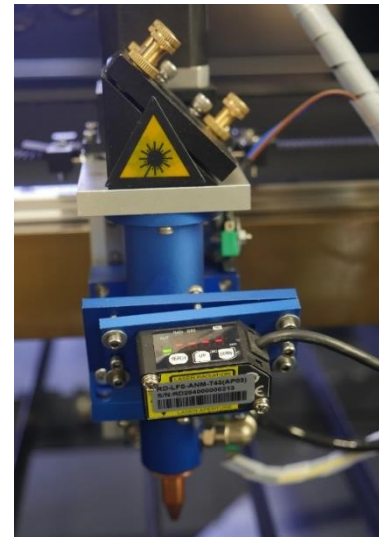
When creating a control program for processing your workpiece, take into account that the dimensions of your drawing in the control program do not exceed the circumference of your workpiece.

7.2 AUTO FOCUS SYSTEM (AFTOFOCUS)

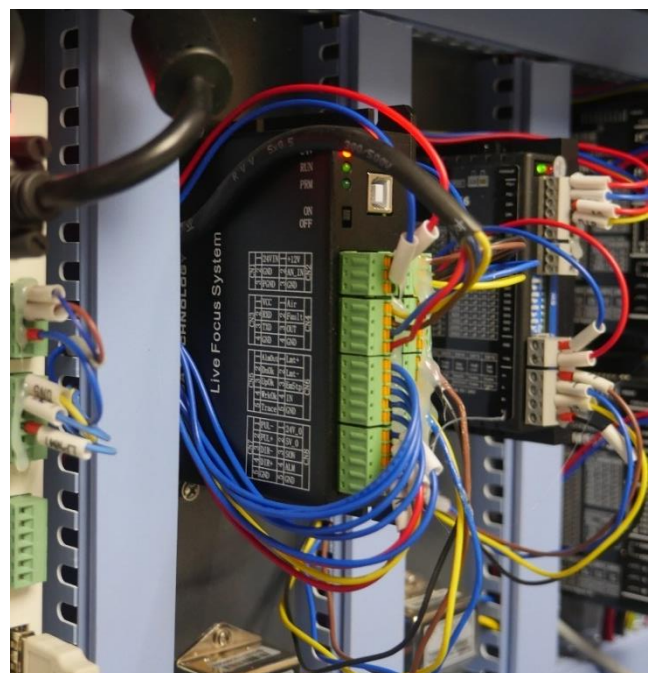
Optionally, a tracking system for non-metallic materials (plywood, wood, plastic, etc.) can be installed on the laser machine, so that the laser head automatically adjusts its focal length to the processed material during the cutting process.

Such a system consists of the following:

1. Laser head with height control sensor.



2. Controller for tracking.



3. Display.

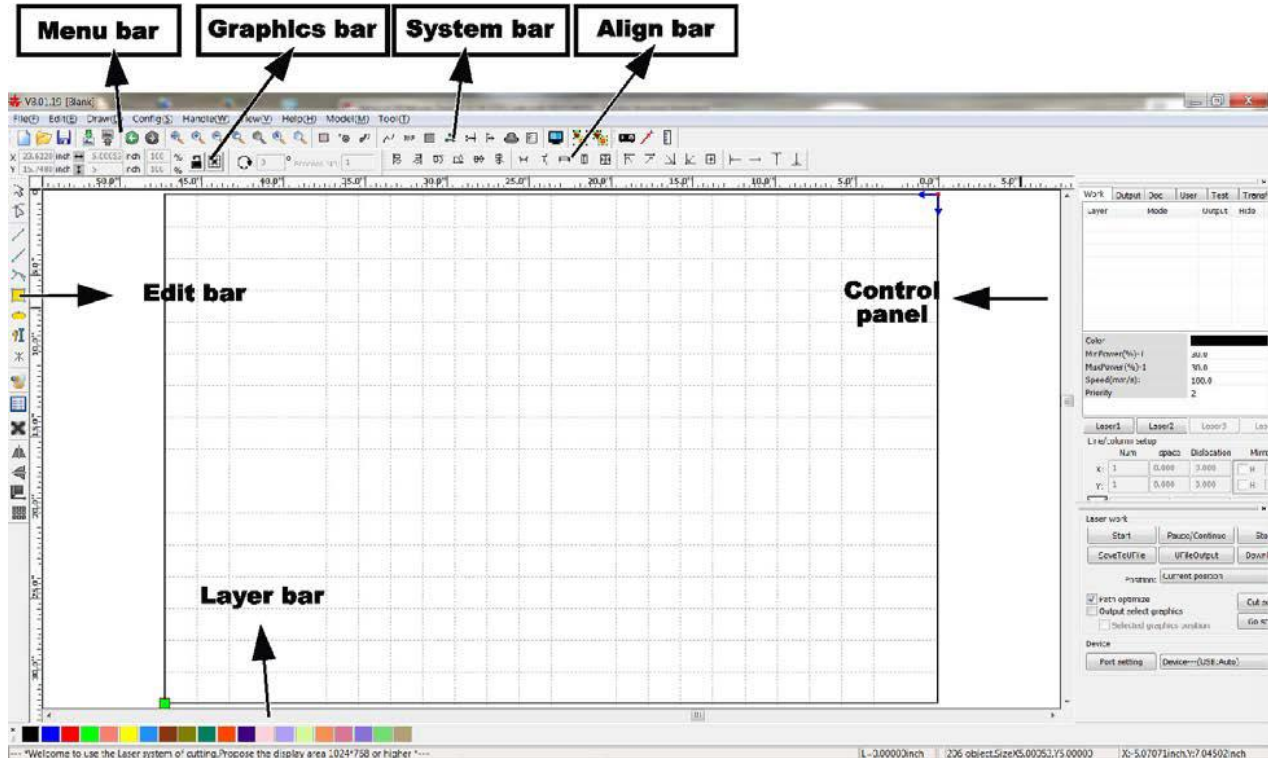


The autofocus system operates independently of the machine's main controller and usually does not require any additional settings. In any case, if any adjustments are needed, please refer to the autofocus system manual.

CHAPTER 8. SOFTWARE DESCRIPTION

8.1 INTRODUCTION TO SOFTWARE FUNCTIONS

Main functions:



- In RdWorks, you can create simple images or text using the Editing Panel. But most often, vector or raster programs (such as CorelDraw, Adobe Illustrator, Photoshop, etc.) are used to create an image, and the resulting files are already imported into RdWorks.
- To import your file into RdWorks, click File -> Import and select the file with the appropriate extension to import.
- To create a control program, only one graphic file is not enough. It is also necessary to configure the parameters for processing this file in the Control Panel.
- Processing parameters.
- In the control panel, you can set unique processing parameters (cutting or engraving) for each color (layer).

Processing parameter – cutting:

1	Layer	Color of the editable layer
2	Is output	If you set No, then this color will not be processed in the current NC
3	Speed	Processing speed, mm/sec
4	Repeat	If you check the box, you can repeat the processing of this layer several times
5	Processing mode	Choosing a Processing Between Cutting and Engraving
6	If blowing	This function is used when an air compressor is connected to the control system in a certain way. If this is not the case, it does not matter whether this function is turned on or off
7	Min power	They can have values from 0 to 100 and determine the power of the laser emitter. The higher the value, the higher the laser energy, the lower the value, the lower the laser energy
8	Max power	
9	Seal	Close open lines. When this value is set, the laser head, after finishing processing the specified vector, will process it again, to the length in mm specified in this parameter.
10	Open delay	Used with the Laser through mode option. This is the time in ms when the machine does not start the movement of the laser head, but turns on the laser beam at the power specified in Through power.
11	Close delay	Used with the Laser through mode option. This is the time in ms when the machine has already finished moving the laser head, but does not turn off the laser beam, but hits it at the power specified in Through power.
12	Laser through mode	Includes a material piercing option, used in metal cutting
13	Through power	Used with the Laser through mode option. This is the power in % when the machine does not start the movement of the laser head, but turns on the laser beam for the time specified in the Open delay.

Processing parameter – engraving:

Layer Parameter

Parameter library

Layer:

Is Output: Yes

Speed(mm/s): 100 ☐ Default

Repeat num: 1 ☐

Processing Mode: Scan

If Blowing: Yes

Min Power(%) Max Power(%)

☒ 1:	30	30	☐ Default
☒ 2:	30	30	
☒ 3:	30	30	
☒ 4:	30	30	
☒ 5:	30	30	
☒ 6:	30	30	

☐ Negative Engrave ☐ Optimized Scan

☐ Output direct ☐ Independent output

☐ Ramp Effect

Ramp Length: 0 mm

Overstriking: Un-process

Scan Mode: X_swing

Interval(mm): 0.1000 mm

☐ Enable blank:

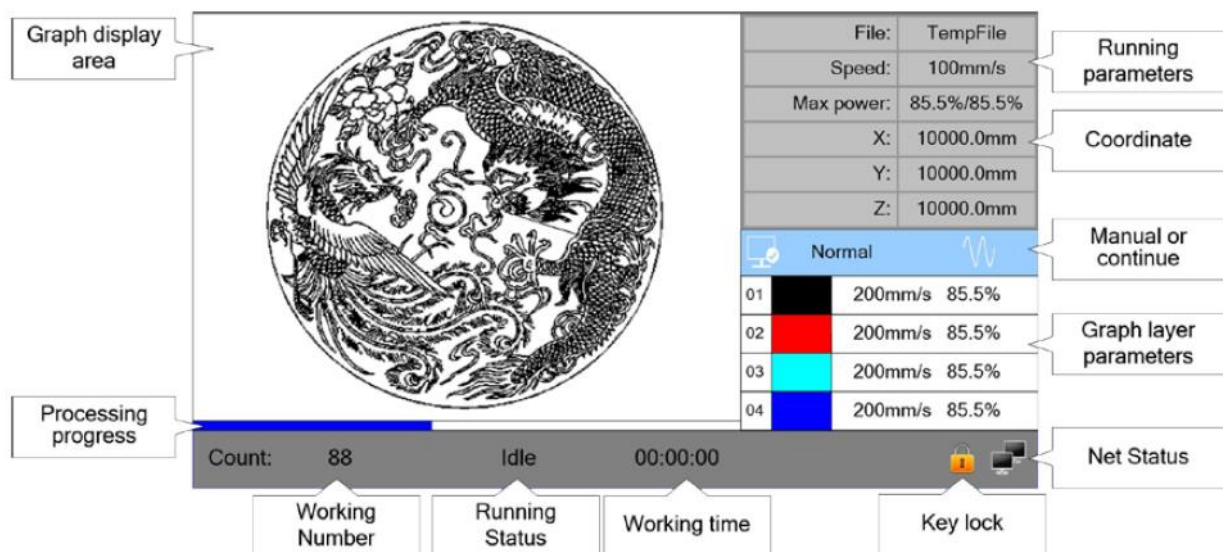
Blank size: 1.0000 mm

☒ Auto synchronize when Modify laser para

1	Layer	Color of the editable layer
2	Is output	If you set No, then this color will not be processed in the current NC
3	Speed	Processing speed, mm/sec
4	Repeat	If you check the box, you can repeat the processing of this layer several times
5	Processing mode	Choosing a Processing Between Cutting and Engraving
6	If blowing	This function is used when an air compressor is connected to the control system in a certain way. If this is not the case, it does not matter whether this function is turned on or off
7	Max power	It can have a value from 0 to 100 and determines the power of the laser emitter. The higher the value, the higher the laser energy, the lower the value, the lower the laser energy
8	Negative engrave	Inverts black pixels to white and white pixels to black. It is used to process dark engravings.
9	Output direct	If you enable this option, the dark colors of the image will be processed with more power, and the light colors of the image will be processed with less power. This option is used for glass and clear acrylic.

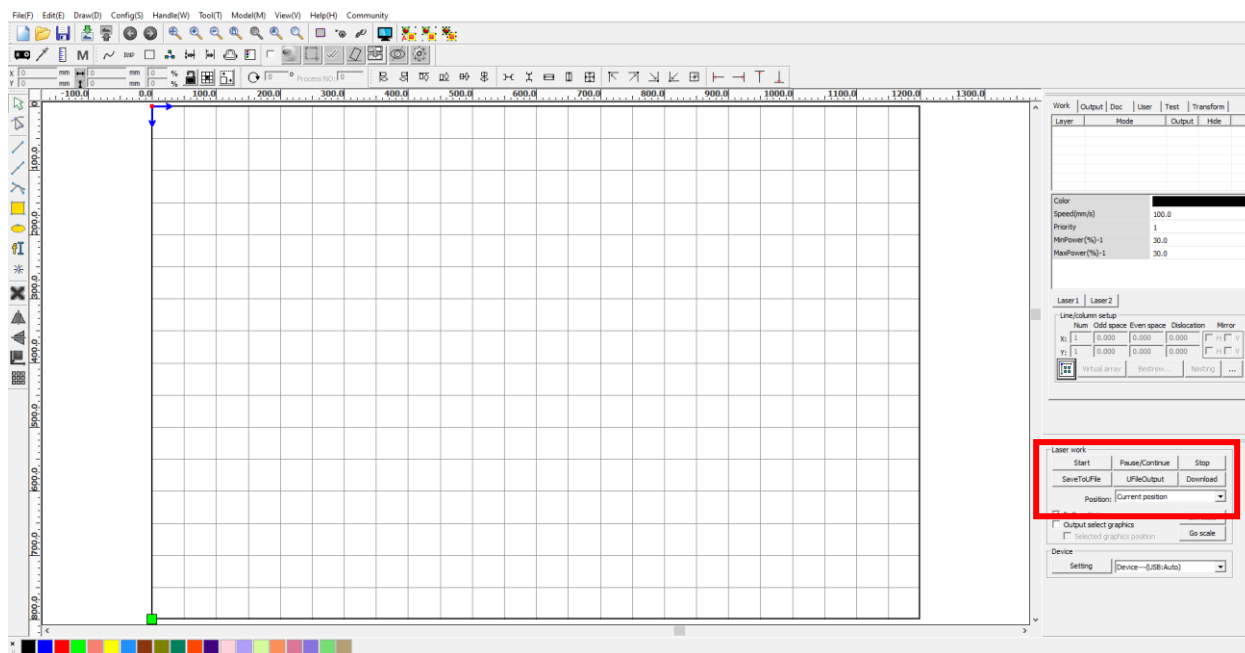
10	Optimized scan	Automatic engraving optimization mode, which can slightly reduce processing time
11	Ramp effect	The slope at the edges of the engraving, the length of this slope is adjusted by this parameter. For this option to work correctly, you need to set the minimum power lower than the maximum
12	Independent output	A mode in which each element will be engraved separately. This function is used to optimize processing, in some situations this function can significantly reduce the processing time, but it can also increase the
13	Overstriking	Engraving Modes Affecting Font Engraving
14	Scan mode	Engraving direction mode, X or Y axis, and unilateralism or swing. The unidirectional mode involves passing the laser from left to right and returning to the beginning of the line, and the bidirectional mode involves laser processing from left to right and right to left on the next line. The unidirectional mode correspondingly significantly increases the processing time, but can give higher quality in some situations, such as when engraving seals
15	Interval	The distance between the engraving lines. This value directly affects the quality and speed of processing. Standard values are 0.08-0.1 mm. The spacing can be set in millimeters or DPI (dots per inch

8.2 DISPLAYING THE MENU ON THE MACHINE CONTROL PANEL SCREEN



8.3 HOW TO RUN THE CONTROL PROGRAM

1. The control program can be run directly from the computer from RdWorks by clicking the Start button in the Laser work window.



2. The control program can be loaded into the controller memory and run from the machine controller display. Click the Download button in the Laser work window, enter the name of your control program under which you want to save it, and click the Ok button.

Then go to the machine display. Click the File button. Select the Read memory files menu item. Press Enter. Select the file you want. Press Enter. And press the Start/Pause button.

3. The control program can be loaded into the controller memory from a removable flash drive and run from the display of the machine controller.

Connect the removable flash drive to your PC. Click the UFileOutput button in the Laser work window. Enter the name of your control program under which you want to save it and click the Ok button.

Insert a removable flash drive into the USB slot on your machine.

Then go to the machine display. Click the File button. Select the Read USB files (Udisk) menu item. Select the file you want. Press Enter. And press the Start/Pause button.

CHAPTER 9. MAINTENANCE

To ensure the normal operation of the machine, it must be regularly maintained.

9.1 PERIPHERAL EQUIPMENT MAINTENANCE

Maintenance period	Maintenance content	Purpose
Once a year	1. Pull through all mechanical connections, including pulleys and gearboxes. 2. Pull through all terminals on the electrical components of the machine.	
Once every 3 months	1. Replace the water in the chiller	To ensure the normal operation of the laser
Once a month	1. Check the table screw guides. Grease if necessary.	
	2. Check the chiller condenser for dirt or dust buildup. If necessary, blow it out.	To ensure the normal operation of the chiller
	4. Checking the condition of the filter in the cooling and air supply systems, and timely replacement.	Good water quality is essential for the normal operation of laser equipment
	5. Check for breaks in the pipelines.	Make sure there are no leaks
	6. Check the tension of the timing belts. Correct tension if necessary.	
Daily	1. Monitor the purity and temperature of the water	To ensure the normal operation of the laser radiation source.
	2. Inspect the mirror and lens for contamination and timely replace/clean in case of contamination.	To ensure the normal operation of the laser head.
	3. Coolant level and temperature control.	For normal cooling of equipment
	4. Inspect the exhaust grate and fan of the machine for contamination and clean in time if dirty.	To ensure the normal operation of the hood.
	5. Checking the alignment condition.	
Perforce	1. Checking the condition of the focusing lens and timely replacement/cleaning in case of contamination.	To ensure the normal operation of the laser head.

9.2 CLEANING AND MAINTAINING THE OPTICAL SYSTEM OF THE MACHINE



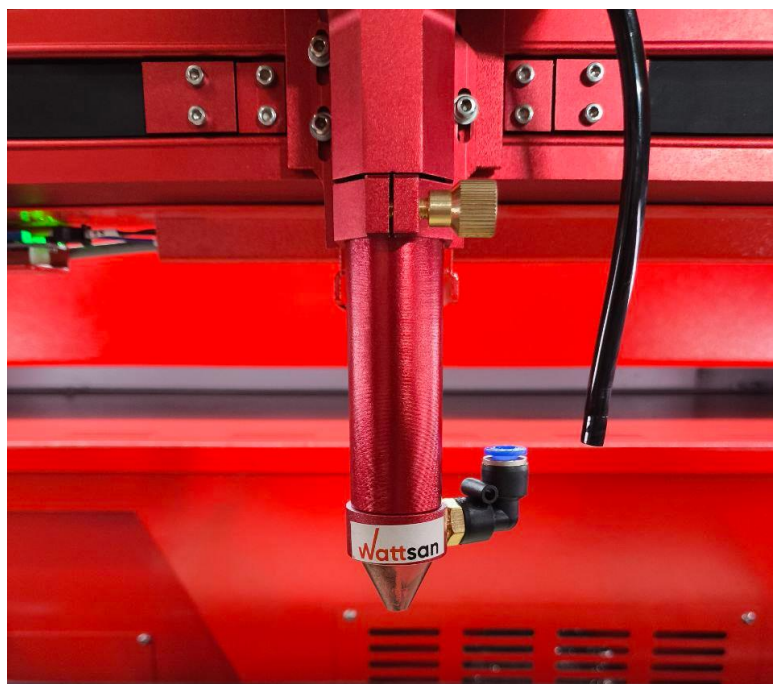
If the optical element is damaged, it must be replaced as soon as possible. It is forbidden to operate the machine with damaged optics.

9.2.1 INSTALLATION AND REPLACEMENT OF THE OPTICAL ELEMENT:

- 1) Before installing the optical element, wear clean clothes, wash your hands with soap and water, and wear clean white thin gloves. During any procedures, try not to touch the surface of the optical element.
- 2) When assembling/disassembling the optical system, do not blow on the optical elements. When installing optical elements, make sure that the installation area is not dusty or dirty.
- 3) When installing/replacing the optical element, do not apply too much pressure to it, as this may cause damage.
- 4) Be extremely careful when removing the optical element from the box in which it is stored. The optical element should be held only by its edges. Avoid dust on the optical element. After installing the optical element, blow it out with clean air from dust and other contaminants. If dirt or dust has accumulated on the optical element, it should be cleaned immediately.

9.2.2 CLEANING THE FOCUSING LENS

1. Unplug the air supply hose



1. Pull out the tube with the nozzle



3. Unscrew the nozzle



4. Unscrew the retaining ring



5. Place the lens on a clean, lint-free cloth



6. Clean the lens

7. Put it all back together

9.2.3 STEPS FOR CLEANING OPTICAL ELEMENTS.

	Work on cleaning and replacing optical elements must be carried out in a clean room!
	Optical elements must not be rinsed with water or detergents.

There are different cleaning methods for different optical elements. If the surface of the optical element is flat and does not have a frame, then you can use special paper for cleaning the optics. If the surface of the optical element is curved or has a frame, and it is not possible to use special cleaning paper to clean it, then clean lint-free sticks should be used.



Cleaning methods:

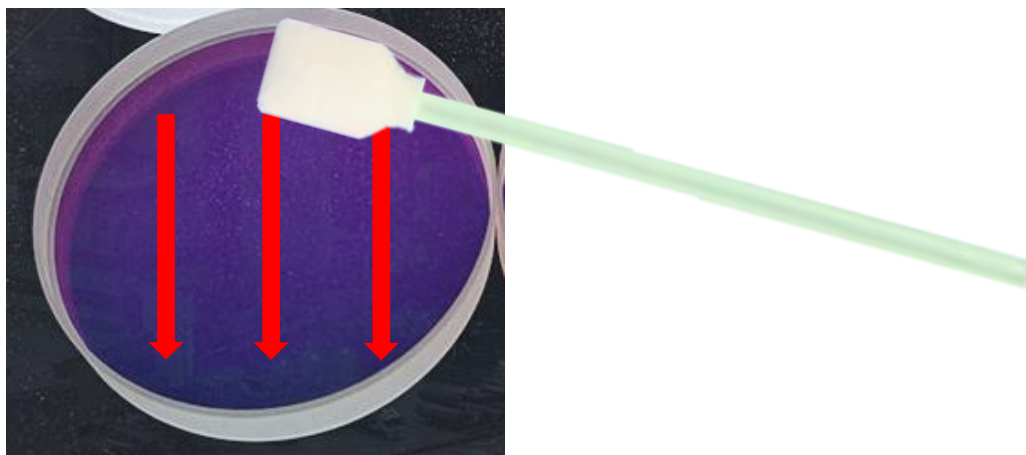
1) Using special paper for cleaning optics.

Use clean air to blow the dust off the surface of the optical element. Use alcohol and special cleaning paper. Position the optical element horizontally on the special cleaning paper. Pour 2~3 drops of high-purity isopropyl alcohol or

acetone onto the optical element and rub slowly, in the direction of the operator, with special cleaning paper on the surface of the optical element until the surface of the optical element is cleaned. Do not press the optical element and try not to scratch it. In no case rub dry on the surface of the optical element, use alcohol or acetone of high purity!

2) Using a special lint-free stick for cleaning optics.

Use clean air to blow the dust off the surface of the optical element. Pour 2~3 drops of isopropyl alcohol or high-purity acetone onto the optical element, or blot a cotton swab. Gently pinch the optical element at the edges. Wipe the surfaces of the optical element with a lint-free stick in one-way motions. **Do not allow backward movements on the surface of the optical element!** Do not use used wipes or lint-free sticks!



9.3 STEPS TO CLEAN OPTICAL ELEMENTS.

Before starting the equipment, it is necessary to clean the optics of the machine: reflective mirrors and focusing lenses.

1. Take a cotton swab (preferably lint-free) or special cloths for cleaning optics and a liquid for cleaning optics (specialized or high-purity acetone or high-purity isopropyl alcohol).



Do not use water, ethanol or methyl alcohol, or other chemicals not listed in this manual for purification.

2. Open the compartment with the laser tube. Pat a cotton swab into the liquid and clean the machine's 1st reflective mirror in a gentle circular motion. Wait for the remaining liquid to evaporate from the surface of the reflective mirror.
3. Move the second mirror located on the machine gantry closer to the front of the machine. Pat a cotton swab into the liquid and clean the machine's 1st reflective mirror in a gentle circular motion. Wait for the remaining liquid to evaporate from the surface of the reflective mirror.
4. The third mirror is located in the laser head. Pat a cotton swab into the liquid and clean the machine's 1st reflective mirror in a gentle circular motion. Wait for the remaining liquid to evaporate from the surface of the reflective mirror.
5. Pull the air supply hose out of the laser head. Unscrew the nozzle of the laser head. Pull out the tube. If possible, clean the focusing lens from 2 sides. If it is not possible to get close to the lens, unscrew the retaining ring, take out the lens and clean it. Try to hold the lens only by its edges.

After cleaning the lens, insert it back into the tube, screw the retaining ring. Insert the tube back into the laser head, screw the nozzle and insert the air supply hose.



Do not allow mechanical damage to the reflective mirrors and the focusing lens. If the reflective mirror or lens is damaged, it must be replaced!

CHAPTER 10. POSSIBLE MALFUNCTIONS AND WAYS TO ELIMINATE THEM

No.	Description of the malfunction	Cause of malfunction	Solution
1	Lack of laser head movement	Check if the device is properly connected to the network	Reconnect the device to the network
		Incorrect control parameters are set on the equipment control panel	Set the control parameters according to the instruction manual
		The emergency button is not pressed	Press the emergency button
2	The laser beam does not turn off	The laser control parameters in the main controller of the machine are set incorrectly	Set the controller parameters according to the instruction manual
		Non-permanent contact on the control unit or main controller	Check the terminals and pull them through
3	Unsystematic laser radiation during operation	Check the water circulation	Clean the water container, water wand and water pump
		Check the stability of the mains voltage	Install the voltage stabilizer
		Faulty water flow sensor or lid closure sensor	Replace the sensors
4	No response when transmitting data to the equipment	Make sure that you have selected the correct connector for uploading data.	Choose the right connector
		Check equipment grounding	Ground the equipment

		Check if the driver for USB is installed	Install the USB driver
5	No laser radiation	Check the alignment	Adjust the trajectory of the laser beam, check the purity of the optical elements
		Check the cooling of the laser tube	Set up your cooling system
		Check the water flow sensor and lid closure sensor	Replace the sensors
6	The PC does not "see" the equipment	Computer or connection problem	Change your computer or USB port
7	Incorrect dimensions of the resulting products	Check the PLT settings in your graphics editor (CorelDraw). PLT resolution must be 1016 units	Change the PLT resolution in CorelDraw for 1016 units
		Check the gear ratios in the controller settings	Recalculate the gear ratios in the controller settings
8	Skipping steps	Check equipment grounding	Ensure that equipment is grounded with a resistance of no more than 5 Ω
		Check the source file for errors, for open curves	Fix the original file
		PC and hardware connection problem	Change the connection port in the PC or use a different PC
9	Controller Display in Chinese	Change the language of the controller display	1. Turn on the machine 2. Wait for the laser head to stop 3. Press Menu on the display. Then press the Down button 4 times. 4. Then Enter 2 times. 5. Select the language you want.

10	Low laser beam power	- Check the cleanliness of the translucent mirror of the laser tube. Check if there are any scratches on the translucent mirror. - Check the amperage of the high voltage unit. - Check the coolant temperature, cleanliness, and water flow pressure. – Check the alignment and cleanliness of the laser machine optics.	During the operation of the laser tube, the environment and smoke from cutting the material can easily contaminate the mirror of the tube. We recommend checking the mirror at least once every two weeks and cleaning it if it gets dirty.
11	High Voltage Breakdown at Laser Tube Contacts	Check that there is no metal near the contact - Check the humidity in the room. Check that no condensation accumulates on the contacts of the laser tube. - Check the high-voltage unit wires for bending and damage	Replace the laser tube
12	Laser tube cracked	- Check the coolant temperature. - Avoid freezing coolant. - Check that the coolant is circulating at the correct pressure and that the cooling hoses are not pinched or twisted.	Replace the laser tube

CHAPTER 11. TRANSPORT, UNLOADING AND STORAGE

11.1 TRANSPORTING THE MACHINE



Before transportation, it is necessary to drain the water from the cooling system, as well as blow out the cooling system.

- 1) A standard stacker or an electric forklift up to 1 ton can be used to load the machine.
- 2) The machine can be transported at a height of at least 100 mm from the ground.

11.2 MACHINE TRANSPORTATION AND DELIVERY FEATURES

- 1) When transporting the machine, it is necessary to avoid rain, moisture, strong inclination, rodents, potholes on the roads. The ambient temperature should be in the range from -10 °C to + 40 °C, relative humidity should not exceed 70%. It is forbidden to store the machine in the open air for a long time.
- 2) Do not put other loads on the machine during transportation.
- 3) The packaging of the machine should protect from moisture and sunlight.

11.3 STORING OPTICAL ELEMENTS

- 1) The storage conditions of optical elements affects their quality.
- 2) The ambient temperature should be between 10°C and 40°C. Do not freeze the optics!
- 3) Optical elements should be stored in a separate box and should not be exposed to vibration, as this can cause damage.

11.4 MACHINE CONSERVATION

If you want to suspend the use of the machine for a long time, then you need to drain the water from the cooling system, cover the machine with an impermeable material.

Storage conditions	
Temperature (°C)	-10 to 40
Humidity (%)	up to 70%

CHAPTER 12. WARRANTY

12.1 DURING THE WARRANTY PERIOD

In case of equipment breakdown during its warranty period due to a defect caused by the manufacturer, repair is carried out by the supplier's company free of charge.

However, consumable parts such as optical parts (focusing lens, laser tube, reflective mirrors, etc.) are not eligible for warranty service.

For free repair or replacement of accessories, the buyer bears the cost of delivering new components from the place of their storage to the buyer's address, and, if necessary, the buyer bears the cost of the specialist's visit to the place of work.

If the equipment failure is caused by a defective part or assembly of the equipment, this part or assembly is repaired or replaced free of charge.

Defective components and parts must be returned to the supplier.

If the malfunction is not caused by the quality of parts or components of the equipment, the buyer will have to pay the cost of repair as well.

Warranty service is also not subject to malfunctions due to improper use of equipment, non-compliance with maintenance rules, operating conditions, as well as warnings specified in manuals and on warning plates that have arisen during the warranty period.

It is also a prerequisite that your equipment and peripheral devices are grounded and operated through a voltage stabilizer.

12.2 SPECIAL WARRANTY FOR LASER TUBES

1. Do not exceed the recommended maximum current value of the high voltage unit when using the laser tube, as it may shorten the service life of the laser tube.
2. If the laser tube is turned on without circulating cooling water, it will fail within a few minutes. In this case, the laser tube is not covered by the warranty.
3. If the laser tube needs to be sent to the supplier for diagnosis and repair, be sure to pack it in its original packaging. Coolant must be completely removed from the laser tube before packaging.

How to properly send a claim for a malfunction of the handset:

1. If there is no laser beam inside the laser tube:
 - Provide photos or videos of the laser tube model and serial number.
 - Provide photos or videos of the laser tube output end.
 - Provide photos or videos of the high voltage end of the laser tube.
 - Provide photos or videos of the output connector
2. If there is a laser beam inside the laser tube but it does not come out of the laser tube:
 - Provide a video that includes: the model and serial number of the laser tube, as well as the working current readings of the laser tube. During operation, slowly record video from the end of the output to

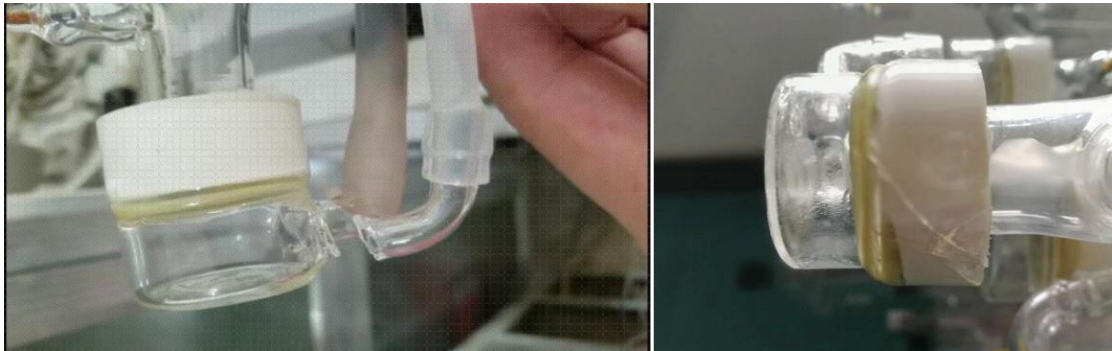
the end of the high voltage and stay on the label for 2 seconds.

3. If the laser power is too low:

- Provide a video that includes: the model and serial number of the laser tube, as well as the reading of the operating current of the laser tube. During operation, slowly record video from the end of the output to the end of the high voltage and stay on the label for 2 seconds.
- Provide a video showing the shape of the laser beam spot on the first mirror.

12.3 NON-WARRANTY SITUATIONS

1. The laser tube warranty has expired.
2. Damage to the electrode or water-cooling system due to the fault of the user. For example: Damage to the electrodes or water-cooling system caused by the user. The picture below shows damage to the glass connector of the water-cooling system.



3. Crack of the negative electrode. This usually happens when the contact is installed or soldered.



4. Poor cooling may cause cracks in the laser tube glass. Similar phenomena are associated with poor water cooling. The pictures below show breakdowns caused by poor water cooling.



5. The product label is damaged, stained, hidden, or the two serial numbers do not match.
6. Damage due to transportation.
7. The product is damaged due to shipping or packaging when returned to the supplier under warranty.
8. Power reduction due to long-term continuous operation with maximum current.
9. Reduced power or broken contacts due to improper installation of the laser tube.
10. Power loss due to contamination of the output translucent mirror.
11. The laser tube has failed due to a large amount of dirt or dust on it.
12. The color of the anode contact has undergone changes.