

Scotle YAG Water-cooled Jewelry Laser Welding Machine Manual



Shenzhen Scotle Technology Group Limited

No.14, 2F, Building Y1, Bantian Street Creative Park, Longgang District,
Shenzhen, Guangdong, 518129 China

www.scotle.com

Chapter 1 Preface

1.1 Welcome

Thank you for purchasing our company's laser mold welding machine. If it is your first time to use this type of product, please be sure to read this instruction manual carefully before installation and use. Please carefully read the contents marked **[Danger]**, **[Warning]**, and **[Caution]** in this instruction manual to ensure that you and those around you safety and correct use of equipment.

[Danger]: It means that if you do not follow the correct operation, it may immediately cause serious personal injury or even endanger life.

[Warning]: Failure to follow correct operations may result in serious personal injury or even life-threatening consequences.

[Caution]: Refers to failure to follow correct operations, which may result in personal injury or damage to the equipment.

1.2 Company Profile

Our company is a high-tech enterprise that specializes in R&D and manufacturing of laser mold welding machines, laser marking machines, fully automatic laser welding machines, fiber laser welding machines and other equipment. The company has professional R&D, production and sales teams, as well as other types of Brand laser equipment technology, through continuous innovation and improvement, has now become an excellent manufacturer in the laser industry.

The company's equipment is spread all over the country. We adhere to the principle of "win the market with quality and build the brand with integrity", seek reputation with quality, survive with reputation, benefit with management, and develop with benefit, and are further committed to product development and quality improvement. , improve the service system and other work to provide our customers with more complete and better services.

1.3 Services

The company has specially set up a marketing management center with more than 100 offices across the country to provide customers with comprehensive pre-sales, in-sales and after-sales support and services. Wherever our products are available, there is our quality service!

1. Free technical consultation, software upgrade and other services;
2. Customer service response time is within 24 hours;
3. Provide maintenance services for life.

Chapter 2 Product Overview

2.1 Overview

Laser welding is a new type of welding method and one of the important aspects of the application of laser material processing technology. Laser welding is mainly aimed at the welding of thin-walled materials and precision parts. The welding process is of the heat conduction type, that is, the laser radiation heats the surface of the workpiece, and the surface heat Through heat conduction and internal diffusion, the workpiece is melted to form a specific molten pool by controlling parameters such as the width, energy, peak power and repetition frequency of the laser pulse. It can realize spot welding, butt welding, stack welding, seal welding, etc., with high aspect ratio, small weld width, small heat-affected zone, small deformation, fast welding speed, smooth and beautiful welding, no treatment required after welding or just Simple processing, high weld quality, no pores, precise control, small focused light spot, high positioning accuracy, easy to realize automation.

2.2 Main technical features

- Adopts imported ceramic focusing cavity, with high reflectivity, strong energy and long service life;
- Equipped with a special chiller, which can meet long-term, high-power welding;
- Fast speed, high efficiency, large depth, small deformation, small heat-affected area, high welding quality, pollution-free solder joints, high efficiency and environmental protection;
- Cross cursor indication, and the use of high-speed liquid crystal light valve to automatically block light, and the protective gas output synchronously with the laser to ensure the beauty of the solder joints.No oxidation or discoloration.
- No noise during processing and no pollution to the environment;

2.3 Application industries and scope

Widely used in welding, hole filling, spot welding holes, inlaid parts and Welding of claw feet.

2.4 Product model and technical parameters

| | | |
|---|--|------|
| Device model | YME-200W-VI type | |
| Maximum laser power | 200W | |
| Laser wavelength | 1064nm | |
| condenser cavity reflector | Imported ceramic focusing cavity | |
| laser frequency | 1-30Hz | |
| Pulse Width | 0.1- 10Ms | |
| Spot adjustment range | 0.3-2mm | |
| Aiming and positioning | Microscope and camera system | |
| rated power | 5KW | |
| electricity demand | 220V \pm 5V 50Hz 40A | |
| Overall dimensions/net weight L \times W \times H | Host: 580 \times 350 \times 1170mm | 60kg |

2.5 Requirements of working environment

- 1) Ambient temperature: 5 $^{\circ}$ C~35 $^{\circ}$ C, air conditioning is required;
- 2) Humidity requirements: 40%~80%, no condensation, a dehumidifier should be installed;
- 3) Grid fluctuation: <5%. In areas where the power supply grid voltage fluctuates by more than 5%, automatic voltage stabilizing and current stabilizing devices should be installed. The power grid grounding wire should comply with national standards;
- 4) Foundation amplitude: <50um, vibration acceleration: <0.05g. Avoid large stamping machines and other machine tools nearby;
- 5) Air pressure requirements: 86kpa~106kpa;
- 6) There should be no strong electromagnetic signal interference near the equipment installation location, and avoid radio transmitting stations (or relay stations) around;
- 7) The equipment working space must be smoke-free and dust-free, and avoid being placed in environments with heavy dust such as metal polishing and grinding;
- 8) In some environments, electrostatic shielding measures such as installing anti-static floors and grounding equipment shells should be taken;
- 9) When the ambient temperature drops below 0 $^{\circ}$ C, the circulating cooling water in the equipment will freeze, and the equipment may be damaged; when the equipment is out of service, the internal circulating cooling water must be drained, and when used, ensure that there is no ice inside the

equipment. ;

10) In situations where the temperature changes rapidly, condensation will form on the end face of the YAG crystal and the optical lens, resulting in stains and fog spots. Be sure to prevent rapid changes in ambient temperature. If this is unavoidable, make sure there is no condensation before using the device.

2.6 Overall machine structure and working principle

The laser welding machine consists of laser power supply, optical system, cooling system and three-dimensional workbench. It produces a pulsed laser, and the welding process is achieved by applying high-energy pulsed laser. The laser power supply first lights the pulse xenon lamp for pre-ignition. Under the control of the microcontroller, the xenon lamp is pulse-discharged by the laser power supply to form a light wave with a certain frequency and a certain pulse width. This light wave radiates to the Nd³⁺:YAG laser through the ceramic reflection cavity. On the crystal, the Nd³⁺:YAG laser crystal is excited to emit light, and then resonates through the laser cavity to emit a pulse laser with a wavelength of 1064nm. The pulse laser is transmitted, expanded, and focused before hitting the object to be welded; what is needed during welding The frequency, pulse width, etc. of the pulsed laser are controlled by a microcontroller. The power and energy of the pulsed laser can be adjusted and controlled by different settings of the laser frequency and pulse width.

Chapter 3 Machine Installation Matters

3.1 Machine connection method

Machine rear panel



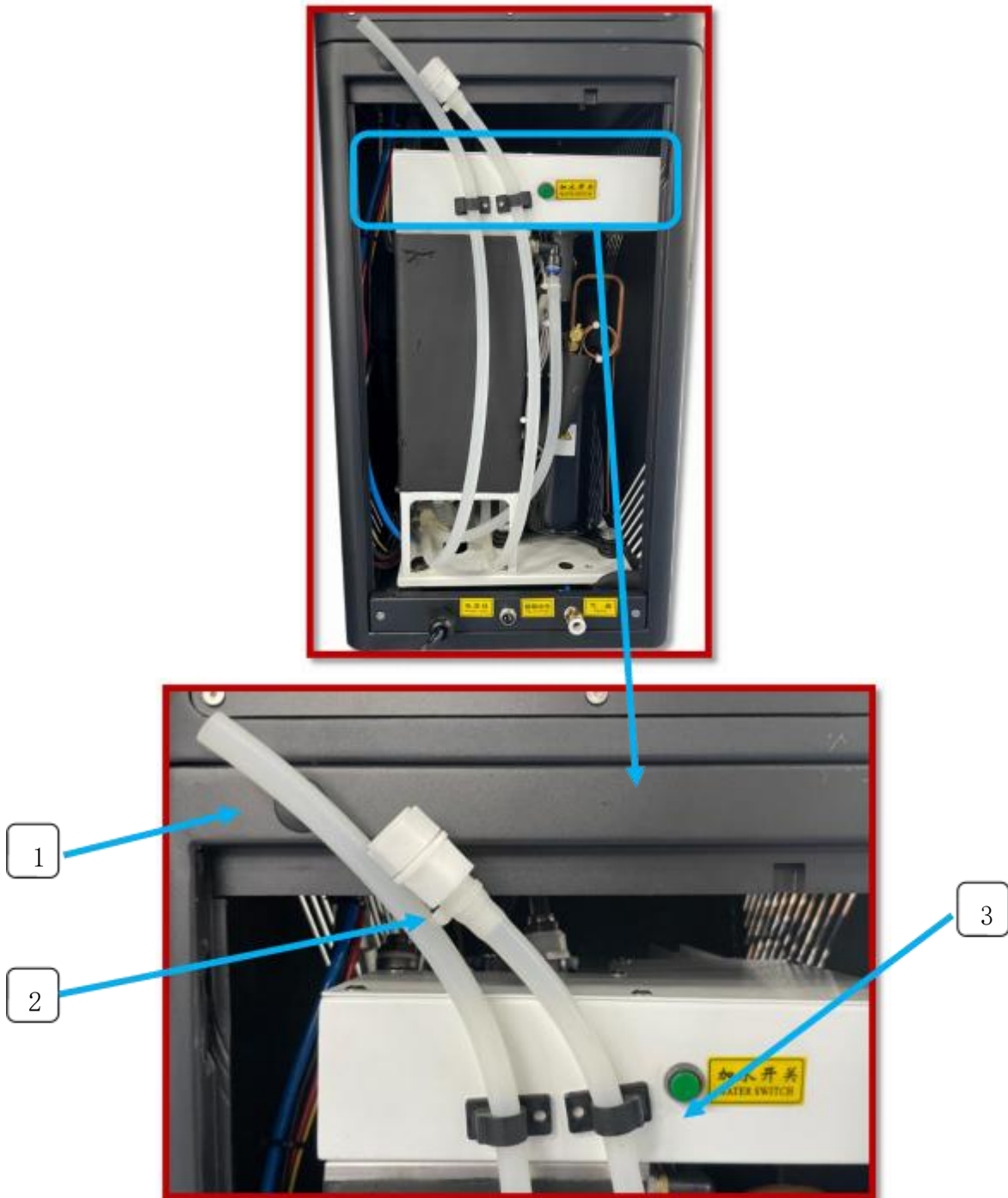
1--Power cord: The working power supply of the whole machine, connected to 220V/50Hz

2--Pedal light: connect the pedal cable, step on the pedal: trigger the laser.

3--Gas valve: connect to protective gas (argon or nitrogen)

(Customers must prepare other corresponding configurations before purchasing equipment: argon gas bottle, argon gas meter)

Open the back cover of the machine



1. Water adding pipe: Cooling water is sucked in from this pipe;
2. Water outlet pipe: When replacing the cooling water, unscrew the plastic cover and the cooling water will flow out from this pipe;
3. Water adding switch: Press and hold this button to start adding water, and it will stop automatically when it is full;

3.2 Environmental requirements for machine installation

| | |
|--------------------|---|
| Temperature | 5 °C ~ 35 °C |
| Humidity | 40%-80% |
| Electricity demand | 220V50Hz/40A |
| Grid fluctuations | < ± 5% |
| Grid ground | Comply with national standard requirements for computer rooms |
| Cooling water | Deionized water or pure distilled water and keep it clean |

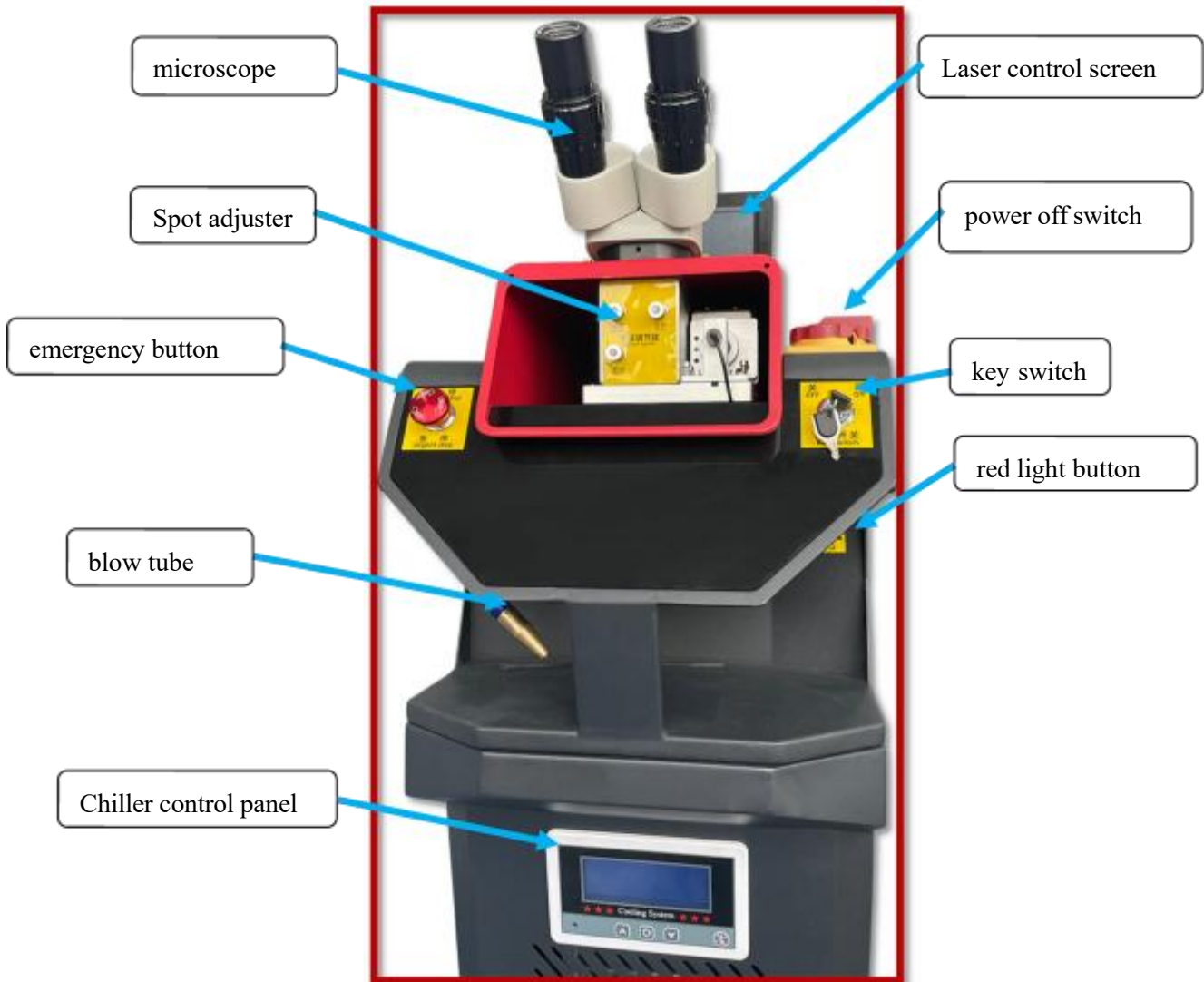
During the installation process, please note the following:

- 1) Please designate a person with sufficient knowledge and experience in lasers and laser devices as the equipment administrator.
- 2) This equipment must be installed in a fixed, horizontal, non-inclined location. Inclination or toppling of the device will cause malfunction.
- 3) The installation and adjustment of this system are completed by our company's professionals.
- 4) Please be careful when operating switches and buttons with your hands. Operating them carelessly or using objects such as screwdrivers and pen tips may cause equipment failure or damage.
- 5) Please be careful to operate switches, buttons, etc. one by one in order to avoid equipment failure caused by switching multiple switches at the same time.
- 6) The outer panel and cover are connected to the main body of the equipment with ground wires. After removing the outer panel and cover, be sure to reconnect the ground wire if you restore it to the original position. During installation, do not sandwich the ground wire between the outer panel and the main body of the device to prevent it from affecting the optical path.

Chapter 4 Equipment Operating Instructions

4.1 Host panel button description

Schematic diagram of the front of the host



1—Laser control screen: control laser status, parameter settings, system control, status indication menu;

2—Microscope: one of the observation windows during welding, and the CCD function of the control panel can also be used;



3-Spot adjuster: adjust the spot position;

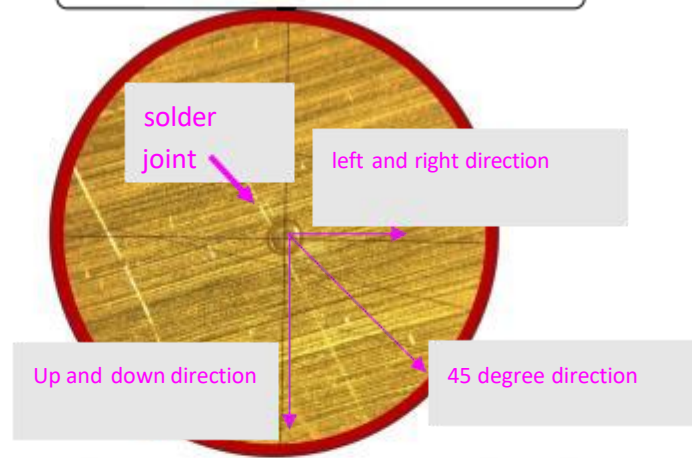
Left and right: adjust the laser spot to move left and right.

Front and back: adjust the laser spot to move up and down.

Fine adjustment: adjust the laser spot to move slightly at a 45-degree angle.



Movement diagram under microscope



4--Emergency stop: In an emergency, press this button to disconnect the main power supply of the machine, and turn the button to the right to return to normal;

5--Key switch: turn on/off the touch display power;



6--Blow tube: Protective gas blow tube;

7--Red light button: Turn on or off the red light indication function;



8—Cooler control screen: displays the operating status of the water machine;

9—Power-off switch: turn on/off the power of the whole machine;



4.2 Power-on and shutdown steps

Power on

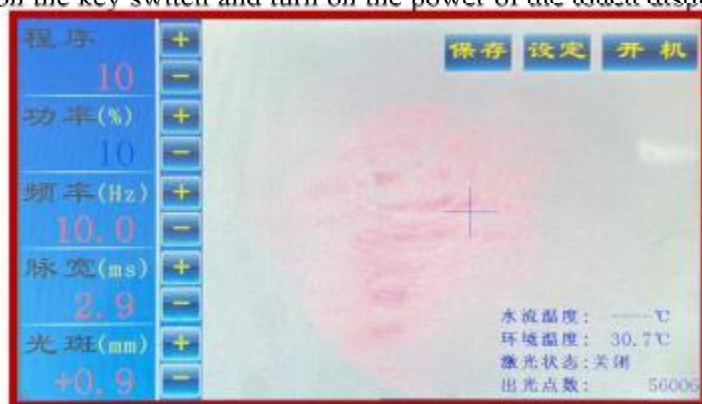
- ① After ensuring that the host is powered on, close the power leakage switch and you can hear the sound of water flow and the sound of the water pump running at the same time;
- ② Turn on the host key switch and the laser control screen lights up;
- ③ Click the power-on button on the control panel, and you should hear the closing sound of the AC contactor after a while;
- ④ Open the air valve and adjust the air flow;
- ⑤ Adjust to appropriate welding parameters
- ⑥ Start welding.

Shut down

- (1) Click the shutdown button on the control screen and wait for the shutdown prompt dialog box;
- (2) Click the "Yes" button;
- (3) Turn the key switch on the main panel left to turn off the laser control panel.
- (4) Close the gas cylinder valve.
- (5) Turn off the power leakage switch.

4.3 Laser control screen description

Turn on the key switch and turn on the power of the touch display screen



Program: Save the parameters set in the current interface as a whole as a program, and set a digital number to facilitate the user's storage, classification, and call at any time.

Power: Indicates the discharge current of the lamp (xenon lamp that provides light energy for laser excitation). The higher the working current, the greater the laser output energy. The power adjustment range here is 1%-100%.

Frequency: Displays the pulse frequency of the power supply per second (the number of times the laser emits light per second), in Hz. The higher the frequency, the more pulses are sent out per second. The frequency should be set according to the product process and the operator's proficiency.

Generally, welding sharp corners , The frequency is lower, but can be higher when flat surfaces and worktables are moved at high speed for automatic welding.

Pulse width: Displays the pulse width of each laser point working in ms. At the same operating current, the wider the pulse width, the longer the laser output time, the greater the total output energy, so the solder joints are larger.

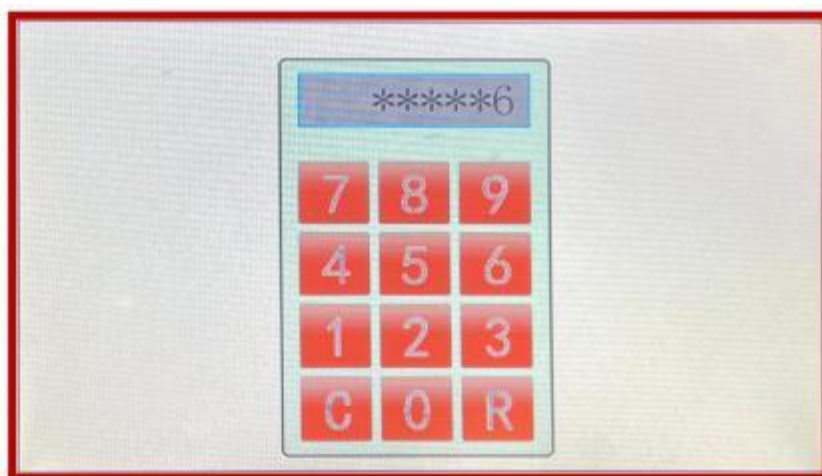
Spot: The " + , -" symbols before the spot display number indicate the positive and negative defocus of the spot; adjust the distance of the focus (i.e. adjust the size of the spot, the smaller the spot, the stronger the penetration)

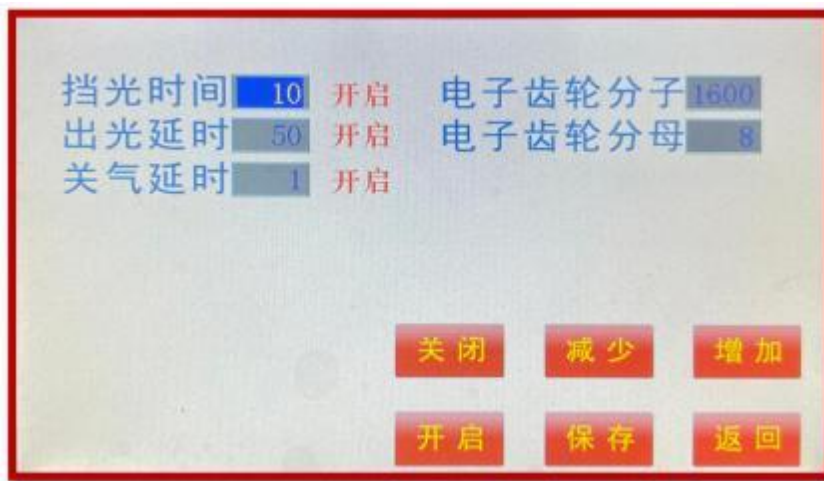
Save: Save the above modified parameters and store them in the program of the current number.

Setting: Set several other parameters of the machine. Click the setting button to pop up the password page. After entering the password, enter the electronic gear and other parameter interfaces.

Power on: turn on or off the laser power

Click "Settings", enter the password "16263646", and click "R"





Light blocking time: time to turn on the light blocking function in advance (unit: ms)

Light emission delay: the delay time of laser emission at the beginning (unit: ms)

Gas closing delay: the time to delay closing the gas valve at the end (unit: ms)

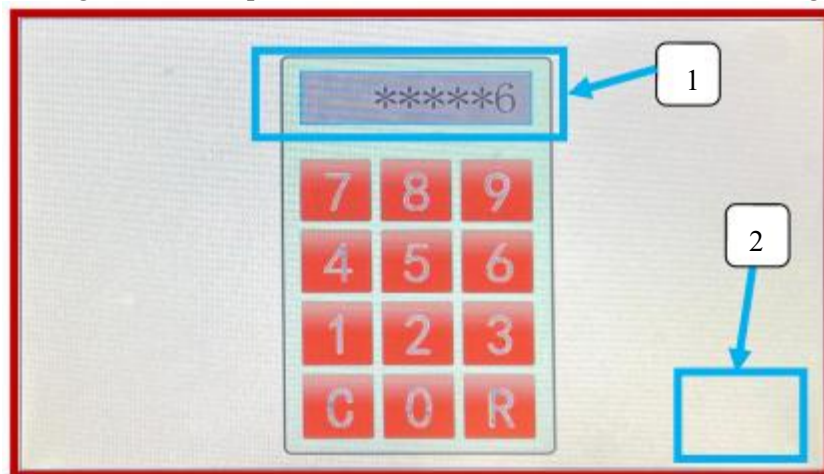
On/Off: Control the functions of the above three items on and off.

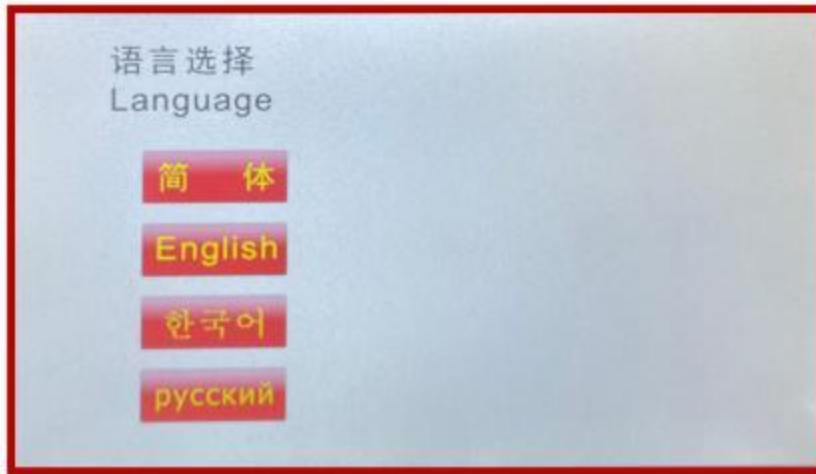
Electronic gear: According to the numerator/denominator = the number of pulses emitted in a single step of 0.1mm spot value (the specific spot change in a single step is related to the driver subdivision and beam expansion screw pitch) generally does not need to be adjusted, and the appropriate parameters have been set at the factory. .

Decrease/Increase: Modify the size of parameter values everywhere. Select the parameter to be modified, and then click the decrease or increase button, the value will change by 1/time.

Save/Return: After setting the parameters, click Save to save the current interface parameters, click Return to return to the previous parameter interface.

Click "Settings", enter the password "666666", and click on the lower right corner





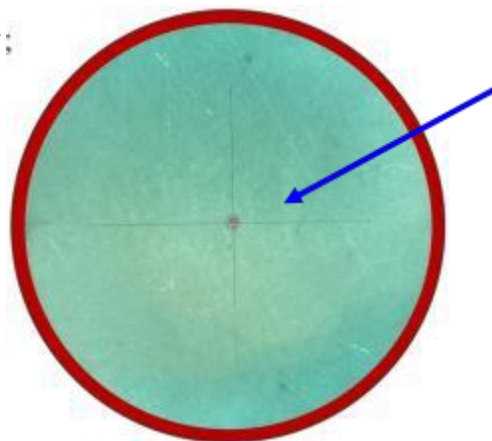
Language selection interface: a total of 4 languages "Chinese", "English", "Korean" and "Russian"

4.4 Crosshair correction of observation window

There are two observation windows for this welding machine, namely microscope and CCD display.

The cross-center correction method of the observation window:

1. Adjust the field of view to the clearest state under the microscope, and use the "spot adjuster" (refer to 4.1-3 instructions) to align the solder joint with the crosshair of the microscope, as shown in the figure below;



The center point of the solder spot coincides with the crosshair of the microscope

2. After the microscope crosshair is calibrated, do not move the test piece and directly calibrate the CCD crosshair. The method is as shown in the figure below:



As shown in the picture above: to move the position of the CCD crosshair, you need to click on the areas marked by the 4 purple dotted boxes in the picture to move the crosshair;

Area 1: After clicking, the crosshair moves upward;

Area 2: After clicking, the crosshair moves to the left;

Area 3: After clicking, the crosshair moves downward;

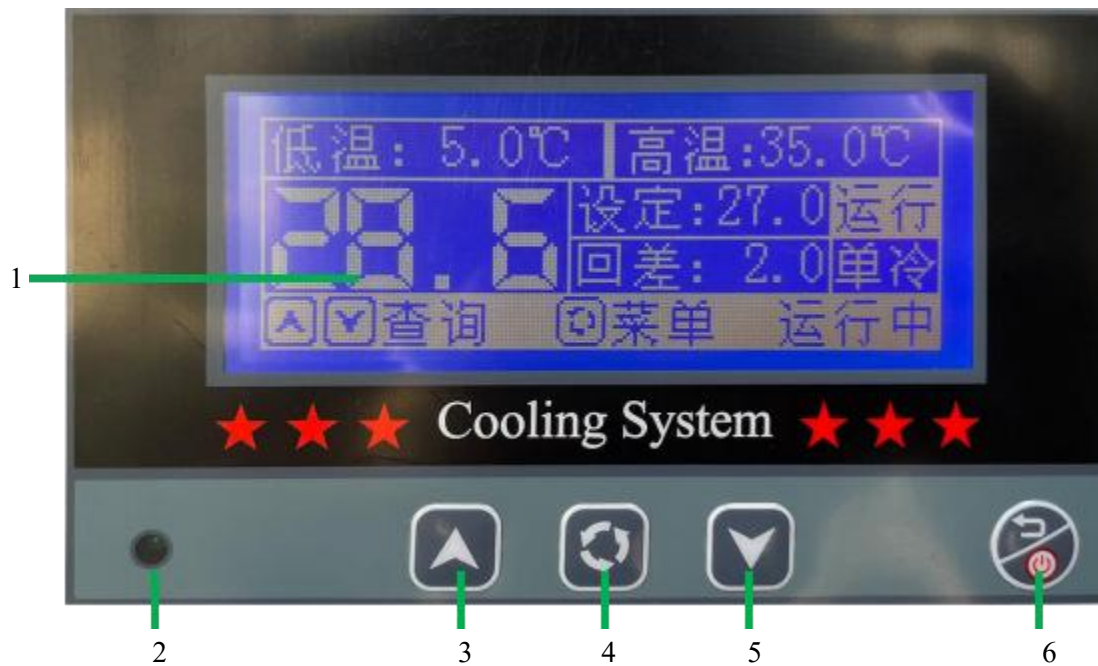
Area 4: After clicking, the crosshair moves to the right;

Finally, move the crosshair of the CCD to the position shown in the figure below, and the center point coincides with the center point of the solder spot, as shown in the figure below.



Chapter 5 Chiller Description and Maintenance

5.1 Display version operating instructions



1-LCD display

2-Status indicator light

3-Up/+ key

4-Menu/Confirm key

5-Down/-Key

6-Return/On/Off key

5.2 Parameter setting table

After pressing the "Menu" key in the main interface, you will enter the main menu interface. Press the "Up" and "Down" keys to select the submenu, and press the "Switch" key to return to the previous menu. After entering the root menu, press the "up" and "down" keys to adjust the parameter value, and press the "menu" key to save the parameters. If no button is pressed for 10 seconds during the setting process, it will automatically return to the main interface.

| Parameter category | NO | Parameter name | Unit | Set range | Step by step | Default value |
|--------------------|----|-------------------------------|------|-----------|--------------|---------------|
| User parameters | 1 | Set temperature | °C | 2.0~50.0 | 0.1 | 25.0 |
| | 2 | Single cold return difference | °C | 1.0~8.0 | 0.1 | 1.0 |
| | 3 | Constant | °C | 0.1~8.0 | 0.1 | 0.5 |

| | | | | | | |
|--|-------------------------------------|--------------------------------------|---|------------|--------------|---|
| | | temperature return difference | | | | |
| | 4 | Follow the temperature difference | °C | -20.0~20.0 | 0.1 | 0 |
| Administrator parameters (password 359) | 5 | Incoming call start and stop methods | 0-power on the machine memory | | | power on the machine memory |
| | | | 1-power on machine standby power on turn on the machine | | | |
| | | | 2-power on the machine memory | | | |
| | 6 | Media alarm limit | °C | 20.0~60.0 | 0.1 | 35 |
| | 7 | Media alarm lower limit | °C | -10.0~20.0 | 0.1 | 5.0 |
| | 8 | Traffic protection lower limit | L/Min | 0~50.0 | 0.1 | 2.0 |
| | 9 | Flow switch enable | 0 - disabled | | | 1 |
| | | | 1-Enable | | | |
| | 10 | Level switch type | 0-Normally open | | | Normally open |
| | | | 1-Normally closed | | | |
| | 11 | Alarm output type | 0-Normally open | | | Normally closed type |
| | | | 1-Normally closed | | | |
| | 12 | Traffic detection delay | Second | 1-300 | 1 | 10 |
| | 13 | Press frequency start delay | Second | 10-300 | 1 | 30 |
| | 14 | Pump start and stop methods | 0-The pump starts and stops with the compressor | | | The pump always runs when it is turned on |
| | | | 0-The pump always runs when it is turned on. | | | |
| | 15 | Mode selection | 0-Temperature fixed mode | | | Temperature fixed mode |
| | | | 1-Environment following mode | | | |
| 16 | Environment follows the upper limit | °C | 25.0~60.0 | 0.1 | 32.0 | |
| 17 | environment following lower limit | °C | 0.0~30.0 | 0.1 | 20.0 | |
| 18 | 003 function output | mixing valve | | | mixing valve | |
| | | Four-way valve | | | | |



| | | | | |
|--|----|-----------------|-----------------------|--------|
| | 19 | Model selection | 0-Single cooling type | Single |
|--|----|-----------------|-----------------------|--------|

| | | | | | | |
|---|----|------------------------------|--------------------------------|----------|-----|--------------|
| | | | 1-Constant temperature type | | | cooling type |
| | 20 | Standby antifreeze enable | 0 - disabled 1-Enable | | | Disable |
| | 21 | Dust blowing interval | Hour | 0-5000 | 1 | 400 |
| PID parameters | 22 | PID enable | 0 - disabled 1-Enable | | | Disable |
| | 23 | PID output cycle | Second | 1.0~20.0 | 0.1 | 10.0 |
| | 24 | PID integration period | Second | 1~50 | 1 | 10 |
| | 25 | PID-KP | | 0~100 | 1 | 10 |
| | 26 | PID-KI | | 0~100 | 1 | 1 |
| | 27 | PID-KD | | 0~100 | 1 | 2 |
| Sensor parameters (password 168) | 28 | Temperature sensor selection | 5K 10K | | | 5K |
| | 29 | Flow sensor selection | 0-switch type 1-Analog type | | | switch type |
| | 30 | Flow sensor coefficient | | 0.1~50.0 | 0.1 | 1.4 |
| System parameters | 31 | Backlight delay | Second | 0~600 | 1 | 60 |
| | 32 | language selection | Chinese English | | | Chinese |
| | 33 | Date of manufacture | 2014-01-01~3000-12-31 | | | 2017-10-02 |
| | 34 | Authorization time | | | | 0 |

5.3 Simple faults and solutions

Fault 1:



Approach

Dust blowing, filters on both sides, internal condenser;
Use an air gun, blow it clean, and filter on both sides;
The net air gun can also be rinsed with water.

Fault 2



Approach

1. Check whether there is air in the internal water pipe. Open the water outlet and wait 5 seconds to insert the water pipe back in and restart;
2. Whether the water in the water pipe flows (flowing - check whether the temperature control water flow port is loose, re-insert it, or replace the water flow switch; not flowing - check whether the water pipe is bent or blocked, or the water pipe is blocked);
3. Cleaning of filter element;
4. Whether the water pipe is large enough;

Fault 3



Approach

The chiller does not stop and continues to add water into the chiller. The alarm will be automatically **cleared** when the water is full.

Troubleshooting list of causes and solutions:

Approach

The chiller does not stop and continues to add water into the chiller. The alarm will be automatically cleared when the water is full.

| Fault/phenomenon | Possible Causes | Approach |
|------------------------------|------------------------------------|---|
| Cold water upper limit alarm | The filter and condenser are dirty | Blow with a powerful air gun to clean the condenser |
| | The filter element is dirty | Filter element inspection, cleaning or replacement |
| | High voltage switch is broken | Replace high voltage switch |
| | Missing refrigerant | Add refrigerant |
| | Low voltage switch is broken | Replace low voltage switch |

| | | |
|-------------------------|--|--|
| | The heat load exceeds the standard | Reduce heat load or switch to a model with greater cooling capacity |
| | Abnormal power supply voltage | Voltage 220 or frequency power line more than 2.5 square meters |
| | Thermostat power output | The thermostat outputs control power to the compressor |
| | Improper setting of press overload current | Reset the press overload protection value |
| | Parameter setting error | Adjust the parameter table accordingly |
| | Power supply lacks phase | Check whether the power supply is missing a phase and swap the phases. |
| | The fan does not rotate | Replace capacitor, fan motor, loose circuit |
| | Compressor does not start | Replace capacitors, motors, loose circuits |
| | voltage | The power supply is matched to 220V power cord 4 or 6 square meters |
| | Is the water pipe of the welding gun blocked? Is there a discount? | Air gun blows through the water channel of the laser head lens |
| Cold water flow failure | Abnormal power supply voltage | Voltage 220 or frequency power line 2.5 square meters |
| | Is there air in the cold water pipe? | Open the water pipe outlet for 8 seconds, plug it back in, and restart |
| | Is there a discount on cold water pipes? | Air gun blows through the water channel of the laser head lens |
| | Is the water cooler bucket filled with water? | Add water to the water inlet |
| | Water pump, water flow starts | Replace the water pump or start the water flow |

| | | |
|------------------------------|--|--|
| No power | The power cord is not connected properly | Check whether the power supply and wiring are correct |
| | Internal fuse blown | Replace the main control board fuse inside the machine |
| Low temperature alarm | Turn on when the temperature is lower than or equal to 5 degrees | Wait for the temperature to rise and operate normally |
| | Temperature sensor is bad | Replace temperature sensor |
| Sensor failure | Temperature sensor connector is loose | Re-plug the sensor interface |
| | Temperature sensor is bad | Replace temperature sensor |
| Liquid level alarm | Low water level in the water tank. | Need to add water |
| | Insufficient water in the water tank. | |
| | Liquid level switch is broken | Replace level switch |
| No display/discolored screen | Loose wiring, loose casing | Cable lock |

Troubleshooting list of causes and solutions:

Warning: Maintenance should be carried out by maintenance personnel. When the power is turned on, dangerous voltages may exist in some parts. Be extra careful when measuring electricity while it is live.

5.4 Chiller maintenance

Before each unit is started, check that the filter of the water machine is ventilated. The filter will filter out dust and fluff in the air. Please be sure to blow the condenser when the machine is used for a long time.

Check the water level in the water tank before starting the unit, replenish the water level in time, and change the water quality regularly. The water must be changed every 30 days to prevent the water quality from deteriorating. Due to the difference in temperature between the north and the south of the region, if the weather in the north is lower than 4 to 5 degrees or lower, please add Only ethanol (industrial alcohol) is allowed as external liquid. The ratio of water to alcohol is 4:1. It is recommended not to shut down the machine at night to avoid freezing of water channels, causing damage to the machine or cracking of components. When the temperature rises, the water must be drained and renewed. When using water, the water tank drain outlet should be opened when not used for a long time, drain the water, and check the power supply voltage regularly to

avoid damage caused by galvanic switches.

5.5 Chiller safety precautions

Before installing power for the first time, carefully check whether the wiring and voltage are correct.

Personnel is responsible for installing the unit. Improper installation may lead to leakage, water leakage or fire. If you need to dismantle and reinstall the unit, please contact professionals.

Through the switching system of the controller, do not turn on or off the unit by pulling out the power plug. Excessive current may burn the plug and open the circuit, causing personal danger.

Make sure the power connection is firm and the wire insulation is intact. Loose wires and damaged wires may cause electric shock, short circuit or fire.

Do not put your fingers or foreign objects held by sticks into the air outlet of the unit, otherwise it may damage the unit or cause personal injury.

Maintain ventilation during operation of the unit

Do not allow people to stand or place objects on the unit

Do not operate the unit with wet hands, otherwise you may get an electric shock

Grounding wire, the unit should have good grounding. The grounding wire must not be connected to gas pipes, water pipes, or telephone lines. Poor grounding can easily lead to electric shock accidents.

Install a leakage protection device. Failure to install a leakage protection device may result in electric shock.

If you find any abnormality (such as the smell of fire or burning), please cut off the power immediately and contact your dealer to find solutions.

Chapter 6 Safety Instructions and Precautions

6.1 Safety warning signs and instructions

Please read the safety labels on this equipment carefully and use this equipment correctly to avoid accidents and malfunctions.



Laser radiation warning signs

Avoid direct exposure to laser light or radiation



Laser products

Avoid direct exposure to laser light or radiation



Beware of electric shock warning signs

Pay attention to safety to prevent electric shock



Hazard warning signs



Hazard warning signs



Hazard warning signs

6.2 Warnings for safety management.

- 1) Do not look at or come into contact with the laser beam (whether using protective glasses or not). Do not let your eyes and skin come into contact with the laser output from the device or the diffusely reflected laser, otherwise it may cause blindness or burns.
- 2) Non-professionals are prohibited from dismantling, repairing, or modifying this equipment by themselves. Please be responsible for any consequences such as electric shock or fire caused by the above reasons. Provide safety knowledge education to actual operators on site and direct the production process. Do not perform maintenance operations other than those specified in the manual.
- 3) Please use the designated wires and cables. If you use wires and cables with insufficient capacity or incorrect connection methods, it may cause fire or electric shock.
- 4) The power supply equipment must be grounded by a third party, otherwise it may cause electric

shock in the event of failure or leakage.

- 5) Persons using pacemakers should not approach this device. The welding machine will produce a magnetic field during operation, which will affect the normal operation of the pacemaker.
- 6) It is prohibited to use the equipment in situations other than metal processing. If there are other processing requirements, please choose other special equipment.
- 7) In areas where direct or indirect laser radiation may exist, set up baffles to clearly distinguish it from other areas, put labels on the area to provide safety warnings, and stipulate that irrelevant personnel are not allowed to enter.

6.3 Laser Safety Notice

The laser welding machine adopts a closed laser optical path design, which can effectively prevent the leakage of laser radiation. Laser welding in operation

Please note the following when operating the machine:

- 1) During normal operation of the laser, no parts or items are allowed inside the welding machine. This welding system must not be used with the sealing cover open.
- 2) When maintaining and maintaining the laser output, do not touch parts unrelated to maintenance, and use high-temperature-resistant light absorbers and diffusers as baffles to prevent laser leakage.
- 3) During laser processing or after processing is terminated, the workpiece is still at high temperature. Please do not touch the workpiece immediately.

6.4 Electrical safety

- 1) Do not damage the power cords and cables. Do not step on, twist or pull the cable. Damage to the cable may cause electric shock, short circuit, or fire.
- 2) If there is a burning smell, abnormal sound, abnormal heating, smoke or other abnormal phenomena, please turn off the power to stop operation, and contact the company immediately, otherwise there is a risk of electric shock, fire, etc.
- 3) Foreign objects, especially metal or conductive objects, should be avoided inside the device to prevent short circuit or malfunction.
- 4) Please do not use this device in a humid environment. Contact with water in the electrical parts may cause electric shock or short circuit.
- 5) When replacing the xenon laser lamp, be sure to cut off the power supply of the welding machine.
- 6) Do not connect the power to the device when it is not in use.

6.5 Fire safety

- 1) It is prohibited to pile up flammable and explosive materials and debris around the machine. Sparks may splash out during welding, and a fire may occur if combustible materials are encountered.
- 2) Do not place flammable and explosive materials on the light path or where the laser beam may be illuminated. If the laser beam irradiates flammable and explosive materials, it may cause a fire or explosion.
- 3) Do not cover the device with blankets, cloths and other textiles during use to prevent the device from heating up and causing a fire.
- 4) Once the machine catches fire or explodes, be sure to cut off all power supplies and use carbon dioxide or dry powder fire extinguishers to extinguish the fire; or use dry sand to extinguish the flames.

Chapter 7 Maintenance, Maintenance and Troubleshooting

In order to ensure the normal use of the laser welding machine, routine maintenance of the equipment should be carried out. Laser welding machines are precision equipment and require maintenance

Be extra attentive.

7.1 Summary

Routine maintenance and upkeep can make the machine work more efficiently and extend the service life of the machine. If any parts need to be replaced, please consult the company's local office first, and have professionals perform the relevant operations in accordance with the instructions in the operation manual. Otherwise, our company will not be held responsible if machine failure results in related accidents and losses.

7.2 Cleaning of equipment

Before and after each work, clean the environment first to make the ground dry and clean. Then clean the equipment, including the outer surface of the chassis, observation system, work surface, etc., should be free of debris and clean. Protective lenses need to be kept clean.

7.3 Maintenance of cooling system

Replace cooling water

1 Replacement conditions: The cooling water must be replaced under the following circumstances:

After 1 month of use

Use again after long period of non-use

Transportation and Handling

2 steps:

Step 1: Open the back cover of the machine, unscrew the plastic cover of the drain pipe, drain the water in the chiller, and then unscrew the

Tight plastic cover

Step 2: Put the water pumping pipe into the cooling water, press and hold the water pumping button, and it will automatically stop when the water is filled.

Step 3: Cover the back cover of the machine.

7.4 Replacement of consumables

Protective lens installation steps

Unscrew the focusing lens counterclockwise, unscrew the focusing lens protective cover and take out the protective lens that needs to be replaced. Place the new protective lens on top of the sealing ring, tighten the protective cap, and reinstall the focusing lens clockwise to its original position.

Note: Protective lenses should be cleaned every day with alcohol and cotton balls.

Foot switch installation steps

Pull out the foot switch that needs to be replaced, align the aviation plug (slot) of the foot switch connecting cable and insert it tightly.

7.5 Maintenance items

| Maintenance every six months | | | | |
|------------------------------|------------------------------------|---|---------------------------------------|------------|
| Num ber | project | method | Target | Rem ark |
| 1 | Cleaning the end face of laser rod | Remove the laser rod and wipe it with long-fiber absorbent cotton dipped in more than 99.5% pure alcohol. | The end face is clean and transparent | |
| 2 | Cleaning ceramic reflectors | Use long-fiber absorbent cotton dipped in more than 99.5% pure alcohol to scrub | clean, no dirt | |
| 3 | Power dust | Remove the laser power supply and blow away | Dust removal to eliminate | |

| | | | | |
|---|-----------------------------|--|--|--|
| | removal | the dust with dry compressed air. Check whether the screws are tightened and whether the connectors are loose. 2. Add engine oil to the fan rotor. | hidden dangers of poor contact | |
| 4 | Check water pump | During the operation of the whole machine, check whether the water pump heat exceeds 80 ° C and whether there is any noise during operation. | Determine whether the water pump is overloaded | |
| 5 | Equipment body dust removal | Disassemble the shell of the device body and use dry compressed air to blow away the dust and clean the interior. | Dust removal | |
| 6 | Clean heat exchanger | Clean scale with 35% dilute hydrochloric acid | Clean scale | |

7.6 Failure analysis and troubleshooting methods

| fault condition | cause of issue | cause of issue |
|---|---|--|
| No response when booting | 1. The power grid is out of power | Consult the power supply company |
| | 2. There is a problem with the power switch | Replace the power switch |
| The water machine works and does not respond when turned on. | 1. Turn off the emergency stop switch | Turn clockwise to stop |
| | 2. Phase loss in the power grid | Consult the power supply company |
| | 3. The power cord is disconnected | Connect the power cord |
| | 4. Poor contact of power switch | Connect the power switch |
| There is no laser display when turning on the computer | Poor laser contact or damage | Improve contact or replace laser light |
| A few seconds after turning on the machine, the light goes out and "Water Pressure" is displayed in the lower right corner of the | 1. The chiller is turned off | Turn on the water machine switch |
| | 2. The chiller is short of water | Add water to the water machine |

| | | |
|--|---|---|
| display. | | |
| No response when pedaling | Foot switch is broken | Replace the foot switch |
| You can also shoot laser without pedaling | Foot switch is broken | Replace the foot switch |
| Lights turn on and off | Oxidation of bulb pins leads to poor contact | Replace the bulb or replace the lamp holder |
| The welded object cannot be seen clearly | The microscope eyepiece may be contaminated with the large objective lens | Wipe with wipes soaked in absolute alcohol |
| | The work lighting is not bright enough or damaged | Replace work lights |
| | Water condensation occurs on the end face of the laser crystal | Increase the water tank set temperature value, which is lower than the indoor temperature |
| Laser spot energy varies from time to time | Refrigeration system lacks refrigerant | Professional refrigeration engineer adds refrigerant |
| Water tank cooling effect is poor | Laser optical path position | Adjust laser light path |
| Increasing the value still fails to melt the welding wire. | Laser lamp aging | Replace laser light |
| | Solenoid valve or solenoid valve circuit failure | Replace the solenoid valve or troubleshoot the circuit fault |

If the above steps still cannot eliminate the fault, please do not disassemble it without authorization to prevent the accident from expanding. Please contact our company in time.

Chapter 8 Transportation, Shipping and Storage

8.1 Transportation precautions

When transporting equipment, please pay attention to the following matters to avoid accidents:

- 1) During hoisting and transportation, it is prohibited to deflect or invert the machine.
- 2) Hoisting and transportation may affect the laser optical path and need to be re-debugged before use.
- 3) When the machine is not used for a long time, all external electrical connections of the machine should be disconnected and the optical components should be kept clean.
- 4) During long-distance transportation, they must not be installed in open cabins and vehicles, and must be stored in open warehouses. They are not allowed to be shipped together with flammable, explosive, and corrosive items, and they are not allowed to withstand rain, snow or other liquids. and mechanical damage.
- 5) During transportation, it is necessary to use forklifts, cranes, straps, etc. that can carry at least 600Kg.
- 6) For safety reasons, staff must wear helmets, gloves, and safety shoes.
- 7) During transportation, the foot cups need to be completely stowed.

8.2 Storage precautions

The following should be noted when storing equipment:

- 1) The equipment should be stored in the original packaging box. The ambient temperature of the warehouse where the equipment is stored is: 0°C~40°C, and the relative humidity is 45%~80%;
- 2) The equipment is not allowed to be stored together with various harmful gases, flammable, explosive items and corrosive items;
- 3) The storage location should be free from strong mechanical vibration, impact and strong magnetic field;
- 4) The packaging box should be placed at least 20cm off the ground. If there are no other regulations, the storage period should not exceed three months.