



# Handheld Laser Welding Equipment User Manual (v3.1)

**Equipment manufacturer:**

**Wuhan Tianxingtong Photoelectric Technology Co., Ltd.**

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## Version record

version num	Updated	Updater	Update Notes
V1.0	2020-10		
V2.0	2021-3		
V2.1	2021-9		Replacement Chiller Instructions
V3.0	2021-1		Handheld three-in-one
V3.1	2022-3		Add revised tip (YB-HJT21)

**Before installing and using this product, please read this user manual carefully.**

**First of all, I would like to express my heartfelt thanks to your company for purchasing our company's TXT-HJ handheld laser welding equipment.**

**This user manual records the operation method, usage and maintenance precautions of the handheld laser welding equipment. In order to ensure the correct use of this equipment, please read the following contents carefully and keep them for reference at any time.**

# Declaration

**Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd.**

**All rights reserved**

- **Reserves the right to modify the products and product-related specification documents in this manual without prior notice**

- **Do not assume any direct, indirect, incidental or consequential loss or liability caused by improper use of this manual or this product.**

- **Owns the patent rights, copyrights and other related intellectual property rights of this product and its software. Unauthorized copying, manufacturing, processing, and use of this product and its related parts are not permitted, directly or indirectly**

- **This product is designed and manufactured for general industrial applications, beyond the expected use and has a significant impact on human life or property is not within the scope of product services**

- **Guarantee: All "Tian Xing Tong Photoelectricity" and "Tian Xing Laser" brand products will receive the perfect service of our company.**

## Foreword

Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. focus on laser technology and application, provides users with complete solutions for laser processing applications, and specializes in the design, manufacture, sales and service of laser processing equipment.

The main product series of Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. include: laser scribing machine, laser cutting machine, laser marking machine, metal laser cutting machine, laser engraving machine, laser welding equipment, laser micro-processing equipment, etc.

Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. has gathered an excellent R&D, production and service technical team. The backbone members have more than 20 years of design and manufacturing service experience in the laser industry, and the elite members have excellent creative potential, constantly surpassing the past and surpassing themselves.

Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. has received strong support from the State Key Laboratory of Laser Technology and the National Engineering Research Center for Laser Processing. With a pragmatic style, a scientific attitude, an innovative spirit and a professional team, it provides customers with satisfactory results. Serve.

Thank you for your trust in Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. and welcome to use our products!

Before using this product, please read and understand this user manual and familiarize yourself with the information we provide you. This manual provides firstly the safety precautions for those who use this product, detailed information on installation, at the same time it introduces the functions and operation methods of each component, describes the routine maintenance necessary to maintain the good state of this product, and lists troubleshooting methods, technical information and supporting documents, etc.

If you have any questions about the product, or have any problems when using this product, please contact us in time, and our technical team will provide you with professional support and advice at any time.

Please contact us:

Wuhan Tian Xing Tong Photoelectricity Technology Co., Ltd. Technology and Service Center: 027-65523998

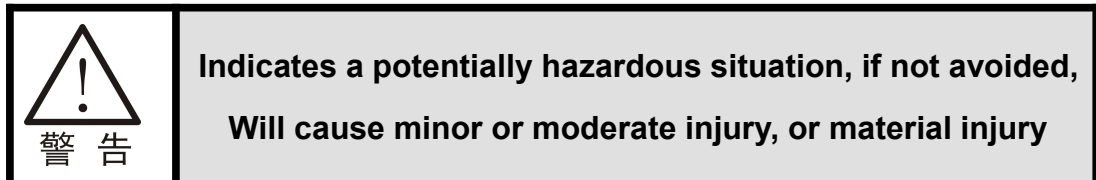
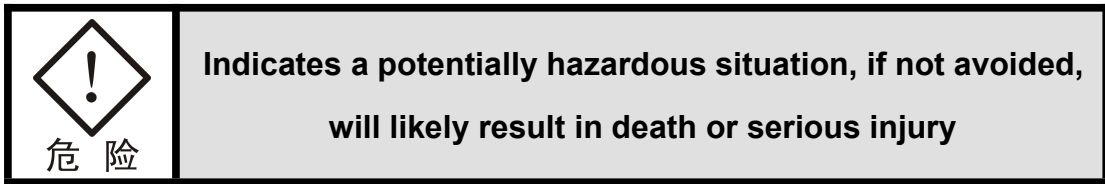
### **Unpacking inspection**

After opening the package, please carefully check whether the product model is consistent with the ordered product; whether the appearance of the equipment is in good condition; and please check whether the products and accessories are complete according to the equipment packing list. If you find that the product model does not match, or is damaged, and the accessories are not complete, please do not use it and contact us in time.

To ensure safe operation and optimum performance of the product, please follow the warnings and precautions below and other information in this manual.

- The DANGER and WARNING symbols below are indicated according to

their degree of accident hazard.



● The following symbols indicate which are prohibited and which must be followed.



Finally, particular attention is drawn to the following related matters:

● Before applying power to the product, please ensure that you fully understand the information contained in this manual regarding the safe operation of the laser and

Important notes on maintenance.

● If not mentioned in this manual, please do not modify or adjust the product or its parts, otherwise it may causes dangerous laser radiation.

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# 1 Safety

## 1.1 Basic Information

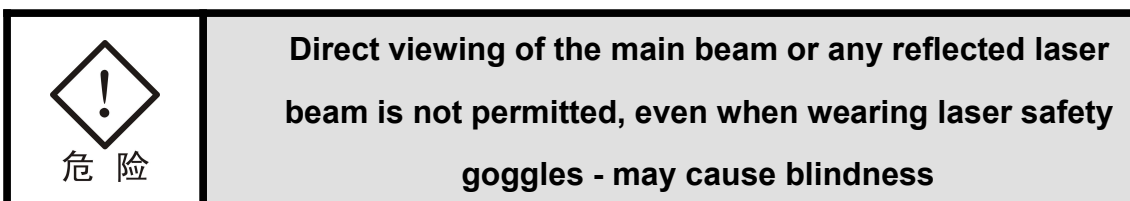
- Only authorized and trained personnel who fully understand the necessary safety procedures should Operate this laser product.
- Please allow access to this laser product only to authorized personnel and keep equipment around the area in which it operates.  
Put appropriate warning signs.
- Please follow the local safety regulations for the relevant equipment.

## 1.2 Optical safety

- This laser product is a four-class laser product, which can output ultra-high Infrared laser radiation exceeding 1000W (1000W ~ 3000W depends on the specific model of the machine). avoid eye

The eyes and skin are exposed to radiation directly or scattered from the laser output.

- Operators should wear appropriate laser safety glasses when the system is working. Matches the wavelength of the laser emitted by the system.

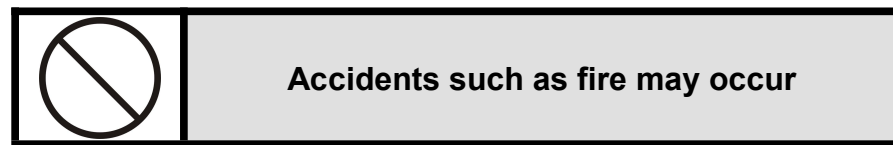




- In the laser radiation area of the working range, it is forbidden for mirror objects to enter to prevent accidental mirror reflection.

Injury to the human eye or the human body.

- It is strongly recommended that users do not point the laser output to the entrance or window of the room when placing the product.
- Avoid flammable and explosive items from entering the direct laser radiation area.



- Unless permitted or authorized by the company, even in a shutdown state, no one is allowed to arbitrarily adjust the complete optical system.

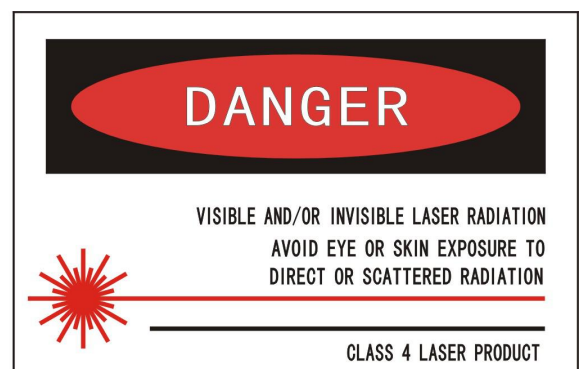
- Safety Signs and Locations



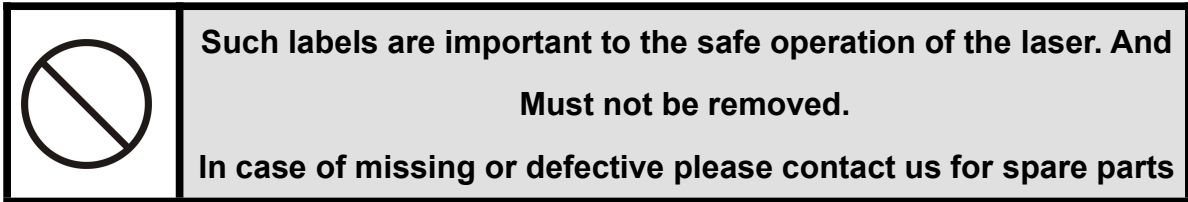
Paste at the laser output head



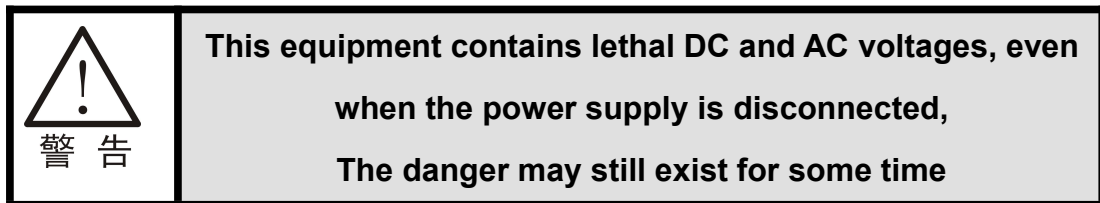
或



Paste on the front of the laser



### 1.3 Electrical safety



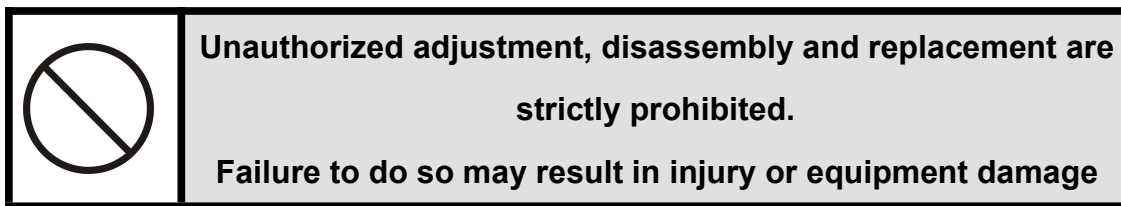
- This product must be used under the specified electrical conditions
- Please connect the power cord correctly and make sure the circuit wiring is correct.
- There is no electrical hazard when the equipment is operating normally. Make sure you are properly grounded and in good condition.
- When the equipment is not in use, the key of the key switch should be removed to prevent unauthorized use.
- When a fault alarm occurs, it should be stopped first and then checked, and the machine can be turned on again until the fault is eliminated.
  - During the operation of the equipment, malfunctions may cause the motion table to operate abnormally, which may cause personnel damage. Injury, at this time must immediately press the emergency stop button or cut off the main power.
- When an abnormal situation occurs, stop working immediately, cut off

the power supply, and then consult our company.

- Replacement of wearing parts must be operated by professional maintenance personnel according to the relevant requirements of this manual.

## 1.4 Mechanical safety

- Please refer to the operating instructions for details.



## 1.5 Equipment related safety standards

The design of this product follows the following national standards:

- GB 18217-2000 - Laser Safety Sign
- GB 18490-2001 - Laser processing machinery safety requirements
- GB 18151-2000 - Laser protection screen
- GB 7247.1-2001 -Radiation Safety, Equipment Classification, Requirements and User

Guide for Laser Products

- GB 4064 -1983 - Guidelines for Safety Design of Electrical Equipment
- GB 10320 -1995 - Electrical Safety of Laser Equipment and Facilities
- GB-T 13740-1992 - Laser radiation divergence angle test method
- GB-T 13741-1992 - Laser radiation beam diameter test method
- GB-T 13863-1992 - Laser radiation power test method
- GB-T 13864-1992 - Laser radiation power stability test method
- GB/T 5226.1-1996 - Industrial Machinery and Electrical Equipment Part 1: General

Specifications

## 2 Overview

### 2.1 Product introduction

The hand-held laser welding equipment consists of optical fiber continuous welding controller, optical fiber hand-held welding head, wire feeder, optical fiber continuous laser and dual temperature and dual control laser chiller. The frequency of the optical fiber handheld head welding galvanometer is 300Hz, and the spot width is 0.2-5mm. The dual protection mirror design can better protect the inner cavity of the tip and improve the service life of the focusing mirror.

The machine adopts the current international popular modular design scheme, the overall gun head is about 0.8KG, and the lightweight design improves the use of the product. The whole machine has the advantages of good continuous working stability, simple and convenient operation and maintenance, etc.

### 2.2 Technical parameters

- Main technical parameters of the equipment:

Items	Parameters
Laser source	fiber-optic laser (QBH)
Laser power	1000~3000W(Option)
Laser wavelength	1064~1080nm
Spot diameter	0.2~5mm

<b>Welding speed</b>	0~120mm/s
<b>Welding penetration depth</b>	0.5~5mm (Depend on power and material)
<b>Weld requirements</b>	≤1mm
<b>Tip weight</b>	0.8Kg@YB-HJT21
<b>cooling method</b>	Intelligent dual temperature water cooling
<b>Gas</b>	Argon or Nitrogen
<b>Power Electricity</b>	AC220V/50Hz/6KW Or AC380V/50HZ

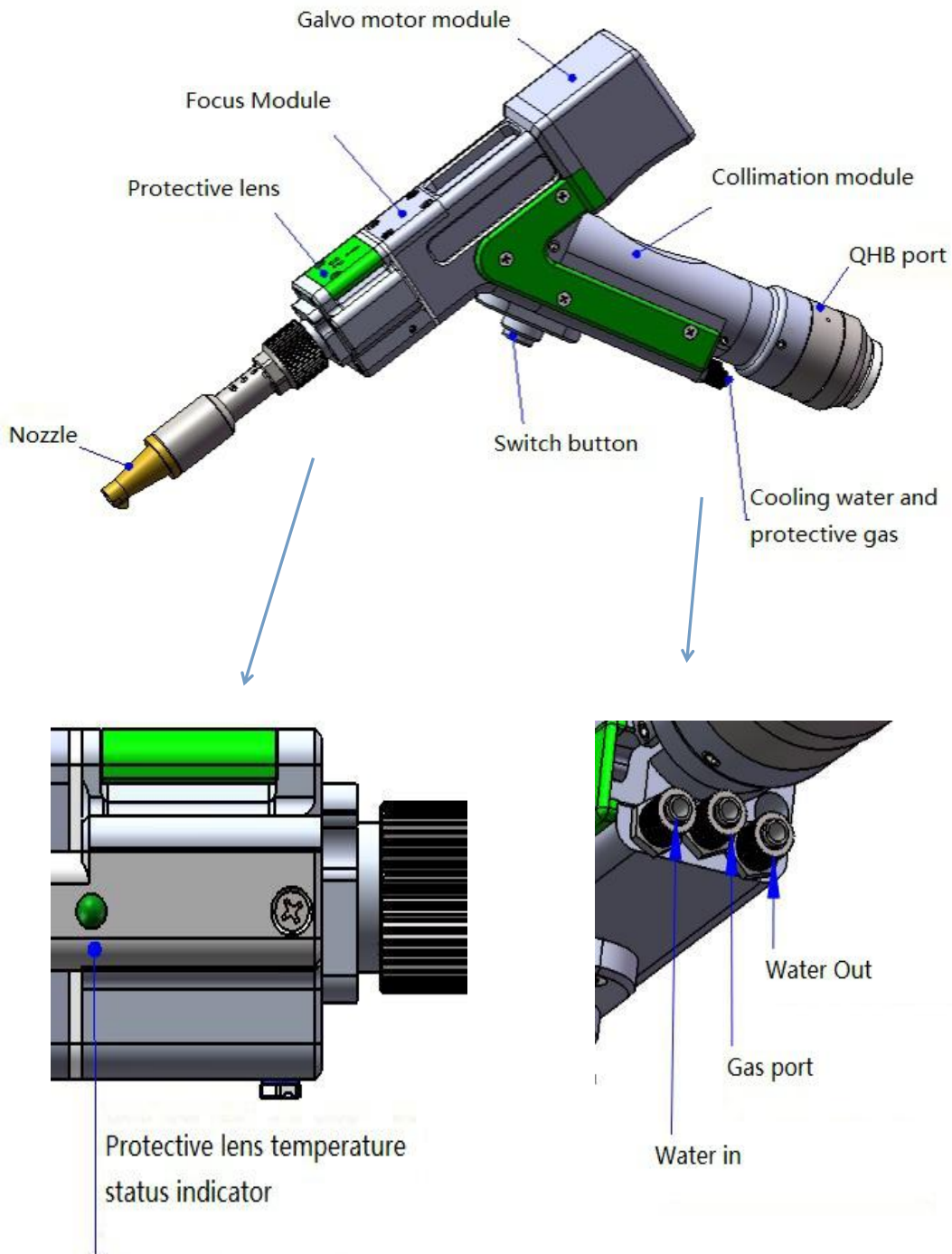
● Device Dimensions:

<b>L×W×H (mm)</b>	600×650×500 (Except brackets)
<b>Weight (KG)</b>	≈200

## 2.3 System structure composition

The handheld laser welding equipment consists of a handheld laser welding gun, a cabinet and a wire feeder.

### 2.3.1 Handheld Laser Welding Gun



### Handheld welding torch (Subject to the actual)

**Memo:** The water pipes are transparent pipes on the left and right respectively. Please see the mark and then pass the water. The air pipe is in the middle of the two water pipes. The default is a black pipe. Some of them will be transparent pipes. It will cause very serious losses, please be careful not to connect wrongly.

### Pay attention: 5 steps to plug and unplug fiber

**Step 1: Check whether the QBH connector and optical fiber plug are dirty, and wipe it clean with alcohol and cotton swab (tissue paper) in time.**



**Memo: When inserting the optical fiber, the laser head needs to be placed horizontally; ensure that the optical fiber is inserted horizontally**

**Step 2: QBH homing "two points and one line"**



**Step 3: Insert the optical fiber plug into place**



**Step 4: Double lock clockwise**



**Step 5: Fiber Protection Jacket, Complete Protection**



**2.3.2 Cabinet**



The equipment cabinet includes the control panel, optical fiber and cable storage area, equipment electrical area, laser and dual temperature and dual control chiller.



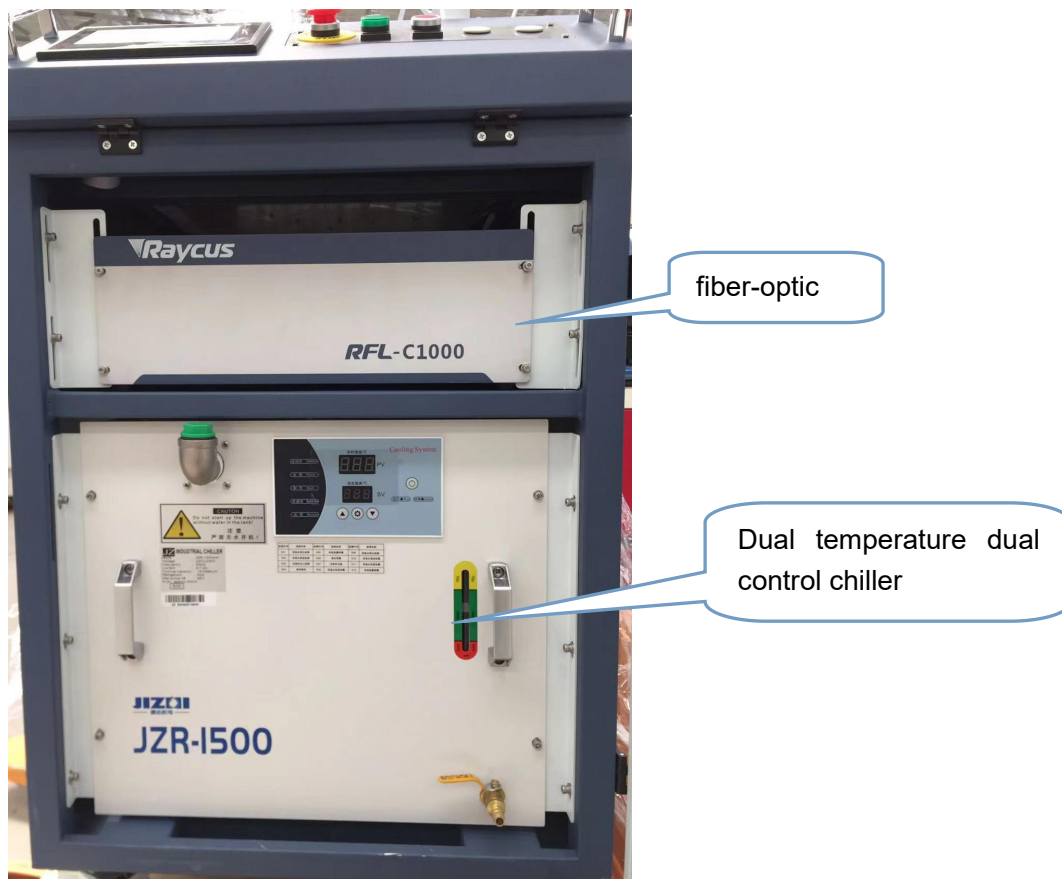
Optical fiber and cable storage area

Note: Fiber bending radius  $\geq$  150mm during use and placement

Where to place the welding torch

Fiber optic support rod installation

panel control area



### 3 Installation

#### 3.1 Unpacking inspection

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#### 3.2 Preparation before installation and commissioning

- Tools: floor mop or forklift over 2 tons, Allen wrench, adjustable wrench, nylon sling, Multimeter, level ruler, cross screwdriver, etc.

Address: 18 South Liu Fang Yuan Road, Sintec Industrial Park, Wuhan Hubei, 430205 PR China  
 Tel: 0086 27 65523998 Mobile/WhatsApp/Wechat:0086-17371095681  
 Web:<http://www.txtlaser.com/> ; E-mail: [sales@txtlaser.com](mailto:sales@txtlaser.com)

- Materials: Several materials to be processed, 1 roll of insulating tape for spare.
- Personnel: Equipment operator: should be able to operate and use computer.

### 3.3 Site and supporting facilities requirements

- The ground is flat, not easy to get dust, far away from vibration sources, and away from strong electromagnetic interference. better to have relative Independent closed room, clean and dust-free with air conditioning. Keep the ambient temperature at 15 ° C to 30 ° C, relative to Humidity <85% (non-condensing).
- Commonly used gases are: argon, nitrogen and other inert gases  
(The gas needs to be filtered, dried and cooled by oil and water before it can be connected to the  $\phi 6$  quick socket at the back of the equipment)

Air pressure requirement  $\geq 0.8\text{MPa}$

## 4 Switching process

### 4.1 Boot process

Before starting the machine, please make sure that the switch on the panel of the device and the switch on the air switch are in the off position.

The dual temperature and dual control chiller must be filled with distilled water. In winter or when the temperature is lower than 10 degrees, special antifreeze for fiber lasers must be added (Clariant is recommended).

**Note: When using this equipment, the whole machine must be grounded, and**

the function of the ground wire must be ensured.

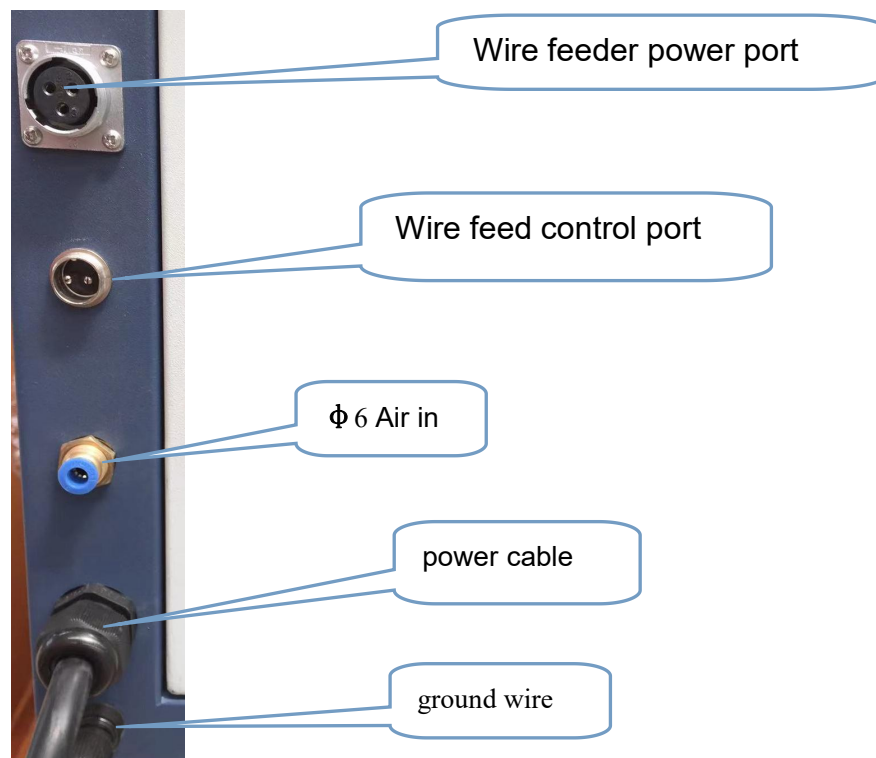
The startup process is as follows:

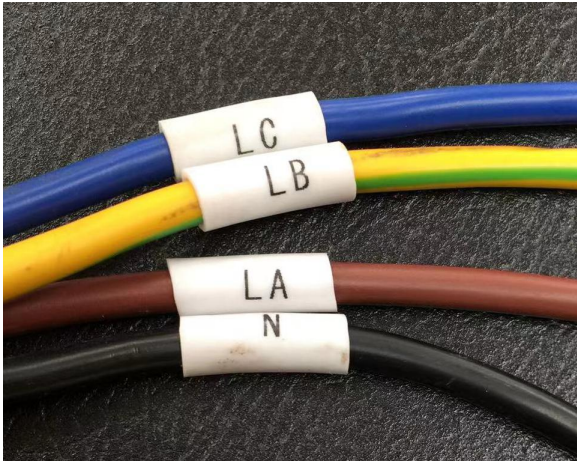
1) Connect the device power supply, the total power supply can be 220V or AC380V.

Make sure that the mains power supply is grounded before connecting.

**The equipment ground wire must be reliably connected to the main power ground wire.**

**The air inlet of the equipment must be connected to a filtered and dried air source.**



**220V connection method:**

LA, LB, LC three wires are all connected to the fire wire L

N is connected to the neutral line N

**Note: 220V connection is recommended for 1000W laser equipment**

**380V connection method:**

**LA line is connected to live line A phase**

LB line to live line B phase

LC wire to live wire C phase

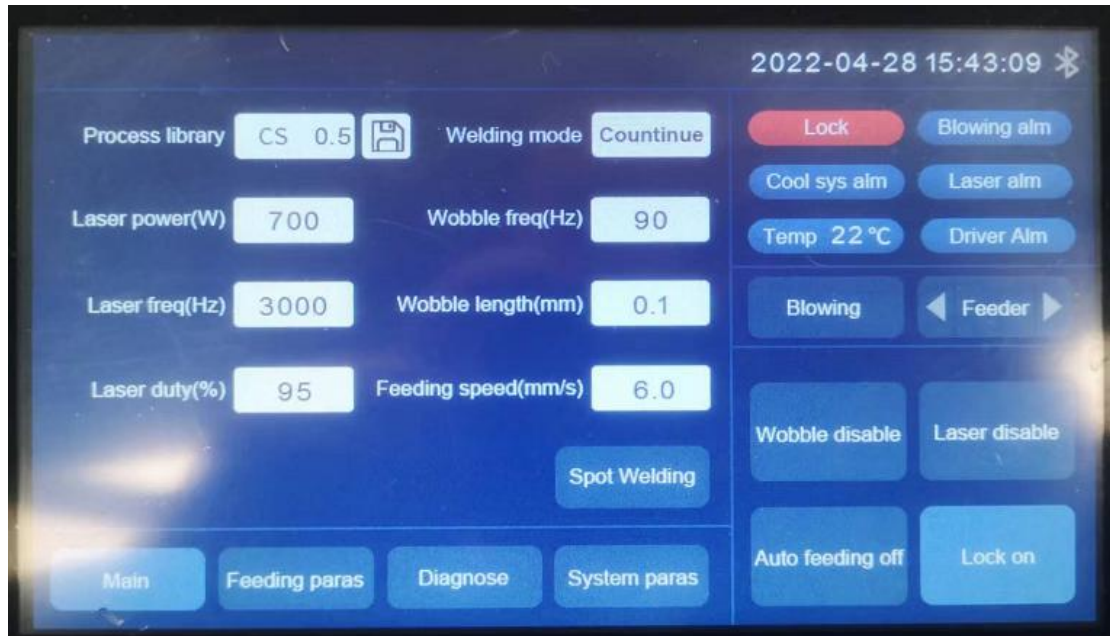
N line to neutral line N

**Note: 380V connection method is recommended for 1500W and above power laser equipment**

2) Turn on the main power control switch on the side of the chassis.



3) After the emergency stop button is released, the device is powered on. The chiller starts to work and the control system starts.



4) Turn on the laser button.



5) The safety clip clamps the workpiece to be processed, and the welding work can be carried out by pressing the switch on the welding gun by hand.

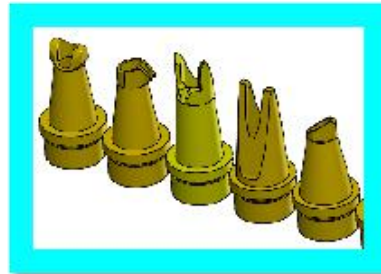
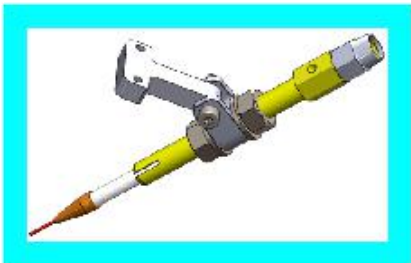
**Safety glasses must be worn**

6) The wire feed switch (wire feed function) is turned on according to the customer's welding processing requirements.

(The wire feeder depends on the actual product delivered)

Press the wire feed switch on the panel, the power supply of the wire feeder is turned on, press the power switch (POWER ON) on the wire feeder and the power indicator (POWER) will light up. Jog wire feed on the wire feeder panel

(WIRE FEED) and jog retraction (WIRE RETRACT) operate as needed.



Wire feed bracket

copper nozzle



Welding wire cap



### Schematic diagram of nozzle welding at different angles



The type and quantity of copper nozzles configured by each device are different, and the actual model shall prevail. Copper nozzles are consumables. The welding wire fixing cap needs to match the hole diameter according to the size of the welding wire.

When using the wire feed function, the wire feed button switch on the touch screen must be turned on.

## 4.2 Shutdown process

When the workpiece is processed or the equipment does not need to be turned on, the shutdown sequence is as follows:

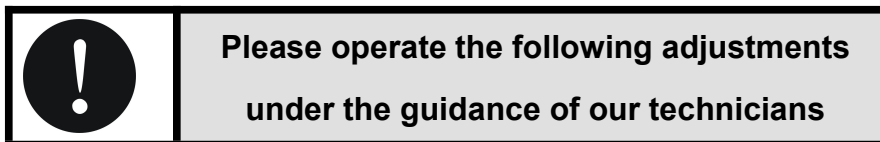
- 1) Put the welding torch head in a safe position.



- 2) Turn off the laser switch on the console.
- 3) Press the emergency stop switch on the console.
- 4) Turn off the main electric control switch on the electric control.

## 5 Solutions to common problems

### 5.1 Main device part



#### Fault phenomenon: welding effect is not good

Cause of issue	Solution
Are you moving too fast?	The gun head moves slower
Whether the laser power and frequency are set well?	Set power, frequency
Protect the lens for contamination	Replace the protective lens
Whether the gun head is damaged	Please contact our after-sales service

#### Fault phenomenon: the welding head does not light up

Cause of issue	Solution
Is the laser turned on?	Turn on the laser switch

Whether the laser is enabled	Turn on the laser enable
Whether the laser is damaged	Please contact our after-sales service

### **Fault phenomenon: intermittent light during welding**

Cause of issue	Solution
Safety protection alligator clip loose	re-clamp
The copper nozzle is loose	Tighten the copper nipple or replace
The rust of the plate leads to the failure of the safety circuit	Rust removal

### **Fault phenomenon: the protective lens is easy to burn**

Cause of issue	Solution
Impure gas	dry filter and cooling
no air pressure	change gas bottle
Broken plug ring	Replace
The red light offset position is too large	Adjust the red light position in the interface
Oil stains on the board	Clear

### **Fault phenomenon: welding torch head overheating**

Cause of issue	Solution
Protective lens burnt	Replace
The gun head waterway is blocked	Check waterways
The chiller setting temperature is too high	Reset

### **Fault phenomenon: touch screen parameters cannot be modified**

Cause of issue	Solution
----------------	----------

Setting value out of range	Reset
Strong electrostatic interference	Restart
Touch screen program garbled	Restart

## 6 Maintenance and care

In order to ensure the normal service life of the equipment, please clean all parts of the equipment regularly once a month.

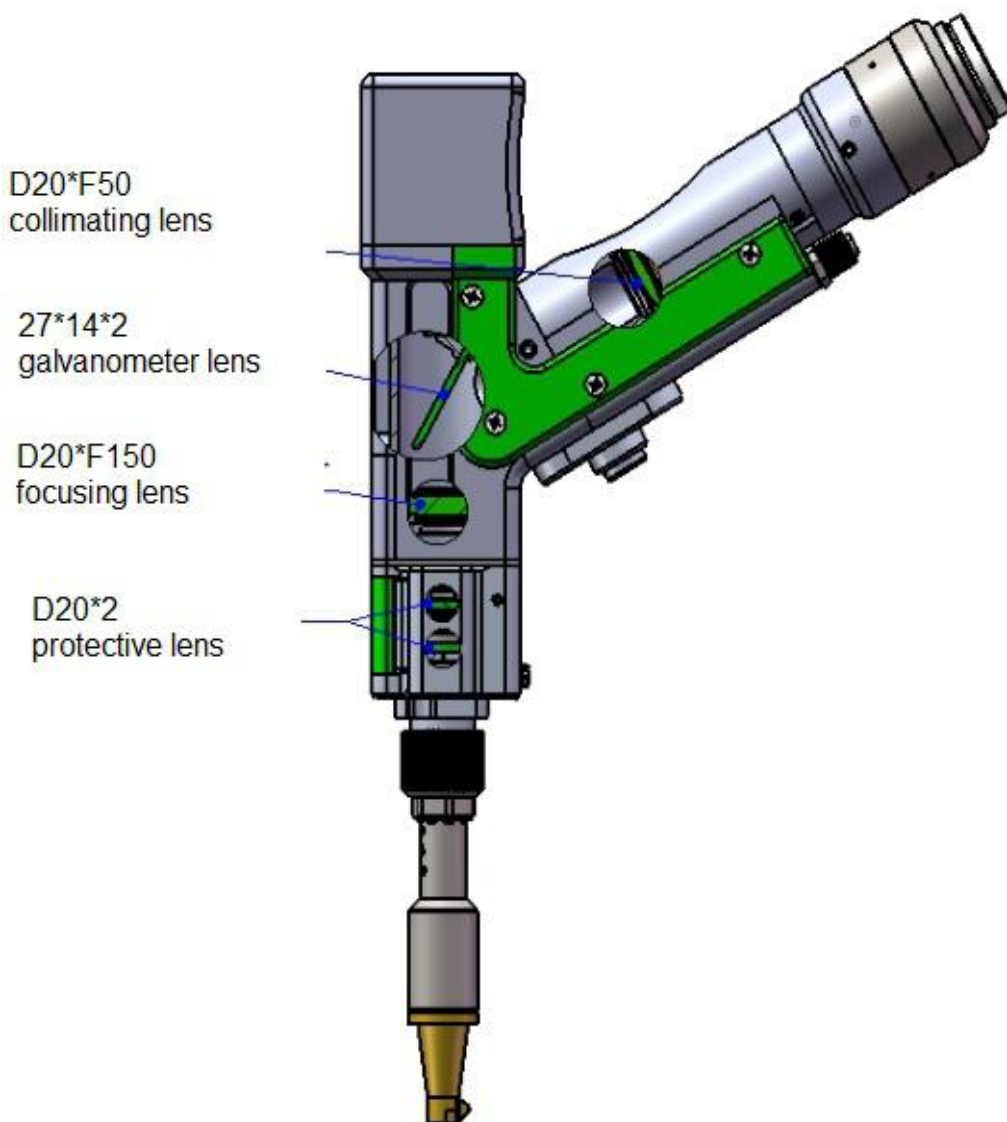
### 6.1 Laser welding gun

After the equipment is used up, the laser welding torch head and protective lens should be kept clean. Use tools such as clean rags and alcohol to clean up dust and impurities on the surface, and place them in a safe area.

Regularly (30 days) clean the protective lenses with alcohol and optical absorbent cotton.

- **Optical lens cleaning operation method and points to pay attention to:**

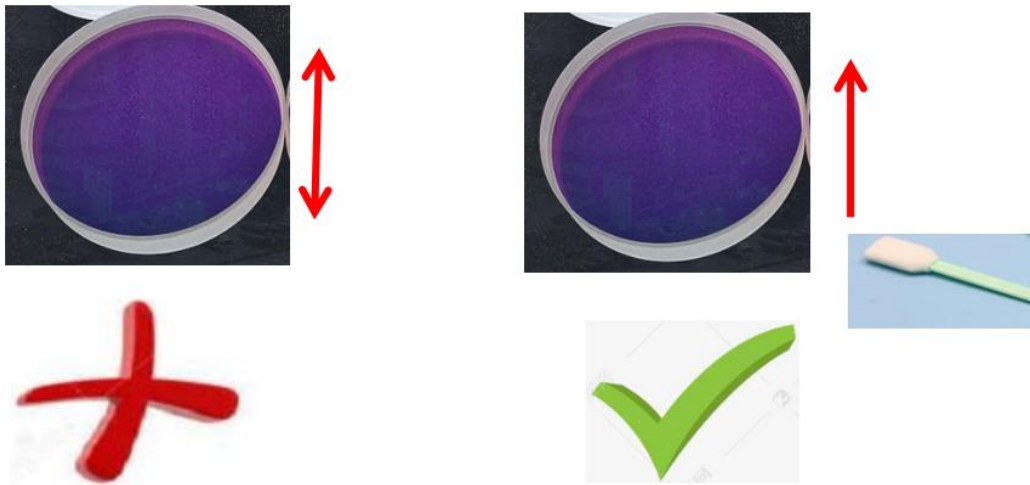
The replacement parts are all assembled in the dust-free workshop. Except for the protective mirror drawer, which can be disassembled, disassembly of other modules is prohibited in principle. If it is necessary to check the collimating lens, focusing lens and vibrating lens, please place the product in a clean environment and remove it.



### Optical lens cleaning

- ※Clean optical lenses, operation methods and points to pay attention to:
- ※Tools: Dust-free gloves or finger cots, dust-free cotton swabs, isopropyl alcohol, filled with dry and pure compressed air.
- ※Spray isopropyl alcohol on the dust-free wiping cotton swab, with the lens facing the eyes, gently pinch the side edge of the lens with the thumb and forefinger of the left hand, and hold the dust-free wiping swab in the right hand, from bottom to top or from left to right, single Gently wipe the front and back sides of the lens in the direction, (do not wipe back and forth to avoid secondary contamination of the lens) and blow the lens surface with filled, dry

and pure compressed air to confirm that there is no foreign matter on the lens surface after cleaning.



### Optical lens disassembly

#### Disassembly of collimating lens

Tools: 2mm Allen wrench, special jig wrench, dust-free cotton swab, alcohol

※The disassembly and assembly process needs to be completed in a clean place, and dust-free hand dust or dust-free finger cots must be worn when disassembling and assembling the lens.

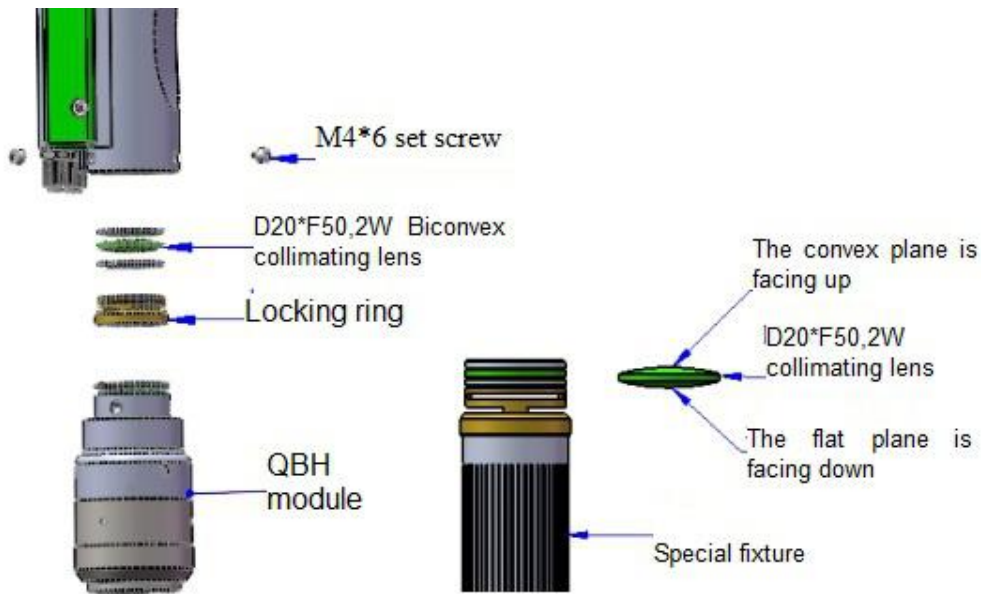
※Disassembly steps:

Step 1: First clean all the dust on the surface of the laser head.

Step 2: Use a 2mm Allen wrench to loosen the 3-M4\*6 machine screw in the picture.

Step 3: Take out the QBH module and seal the port with textured paper to prevent dust from entering the cavity.

Step 4: Use a special disassembly and assembly lens barrel clamp, turn counterclockwise to loosen the locking spring ring, and slowly take out the welding head downwards. And seal the port with textured paper to prevent dust from entering the cavity, and replace the collimating lens. (Pay attention to the placement and thickness of the gasket. This gasket will affect the optical path. After disassembly and assembly, record the thickness of the gasket.)



### Disassembly and assembly of focusing lens

Tools: 2mm Allen wrench, dust-free cotton swab, alcohol, masking tape

※The disassembly and assembly process needs to be completed in a clean place, and dust-free hand dust or dust-free finger cots must be worn when disassembling and assembling the lens.

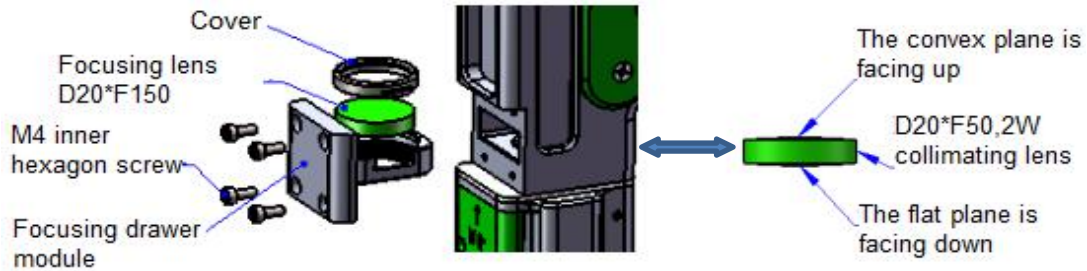
※Disassembly steps:

Step 1: Use a 2mm Allen wrench to loosen the M4 screw.

Step 2: Pull out the focusing module directly in the horizontal direction.

Step 3: Seal the port with masking paper to prevent dust from entering the cavity and being polluted.

Step 4: Gently press the cover down and then rotate it 90°. The two bosses are aligned with the left and right openings. Take out the cover upwards to replace the focusing lens. (Note: the concave and convex direction of the installed lens is facing)



## Disassembly and assembly of protective lens

※The disassembly and assembly process needs to be completed in a clean place, and dust-free hand dust or dust-free finger cots must be worn when disassembling and assembling the lens.

Operation method:

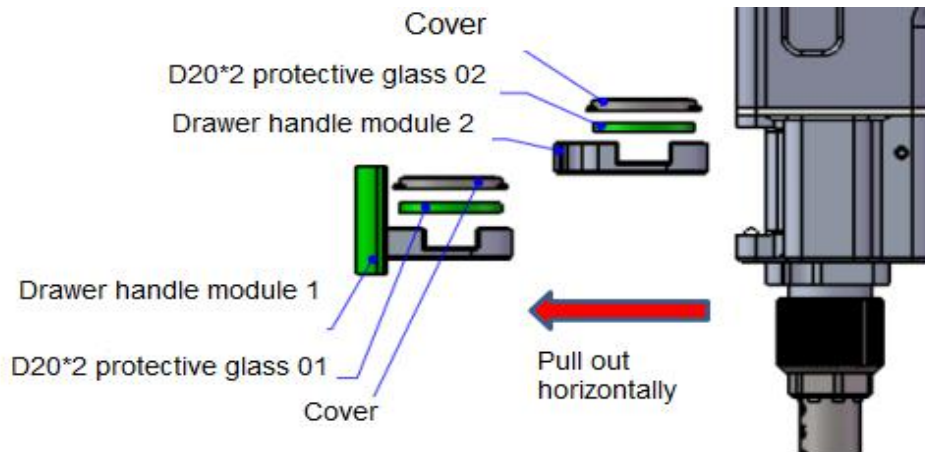
Replacing the protective mirror 01

Step1: hold both sides of the green drawer module 1 handle by hand, and pull out the protective lens horizontally. Pay attention to dust prevention, seal the window exposed on the cavity with textured paper to prevent dust from entering the cavity and be polluted, and then replace the protective lens.

Step 2: Gently press the cover down and rotate it 90°. When the two notches on the two ears are aligned, it will be released. Take out the cover and replace the protective lens.

Replacing the protective mirror 02

Step 1: Take out the green drawer handle module 1, and pull out the handle module 2 horizontally. Pay attention to dust prevention, seal the window exposed on the cavity with textured paper to prevent dust from entering the cavity and be polluted, and then replace the protective lens. Gently press down the cover and rotate it 90°. When the two notches on the two ears are aligned, it will be released. Take out the cover and replace the protective lens.



### ● Precautions for cleaning the tip

1. When cleaning the tip, do not wipe with water or corrosive liquids, and do not blow any part of the tip with an air gun or strong wind.
2. When replacing the protective lens, pay attention to keeping the surrounding environment clean. The fan or air conditioner should be turned off. When the protective lens is pulled out, the gap of the gun body should be sealed with tape in time, and dust is strictly prohibited from entering the gun body.
3. There are many groups of high-power fragile reflective lenses inside the welding torch head, and it is strictly forbidden to bump and drop when using the welding torch head.

### ● Notes on replacing the cleaning protection sheet:

- ★ Do not reuse the lint-free cotton cloth or swab to wipe the protective lens.
- ★ Do not touch the protective lens with your fingers.
- ★ Do not blow directly with the mouth to protect the dirt on the surface of the lens, as this may bring new dirt.
- ★ Do not touch the tip of the cleaning swab with your fingers.
- ★ Don't forget to clean when replacing the mirror drawer.
- ★ When using compressed air, please do not blow the dirt directly from the front, and use the method of blowing from the side to avoid the dirt from sneaking into the surface.
- ★ **In particular, powder-free gloves or finger cots must be worn when cleaning the product. It is now clear that if the damage is caused by, improper handling or the use of incorrect cleaning procedures or chemical use, damage due to such causes is not covered by the warranty.**



## 6.2 Laser

- 1) Note: When using the laser, the grounding wire of the equipment should be grounded reliably.
- 2) There are no built-in parts for use, all repairs should be carried out by qualified laser manufacturer personnel, in order to prevent electric shock, please do not damage the label and open the cover, otherwise any damage to the product will not be covered by warranty.
- 3) The output head of the laser is connected with the optical cable. Please handle the output head carefully when using it to prevent dust or other pollution. Please use special lens paper when cleaning the lens at the output end. When the laser is not installed on the system equipment and does not emit light, please cover the optical isolator protective cover to avoid dust pollution. The bending angle of the optical cable should not be too large, so as not to break and fall off.
- 4) If the laser is not used according to the prescribed method, the protective function it produces will be weakened. Therefore, this product must be used under normal circumstances.
- 5) When the laser is running, it is strictly forbidden to install the output collimator.
- 6) The laser has three fans at the tail plate for heat dissipation, and it must be ensured that there is enough airflow to dissipate heat. Leave at least 10cm of ventilation space before and after the laser.
- 7) Do not look directly at the output head, and make sure to wear the laser safety eye for a long time when operating the machine.
- 8) Power interruption is very harmful to the laser, please provide continuous power.

**The above are the precautions for use safety, please refer to the laser user manual carefully for the specific maintenance details.**

### **6.3 Dual temperature dual control chiller**

Before starting the equipment, be sure to confirm the liquid level display in the chiller, which must be within the permitted range.

Change distilled water regularly (30 days).

Regularly (30 days) use air compressors, brushes, rags and other tools to clean up dust and impurities in the cooling passages of the chiller.

### **6.4 Cabinet**

Regularly (30 days) use air compressors, brushes, rags and other tools to clean up the dust and impurities inside the electric control cabinet.

### **6.5 Operation desk**

Check every switch on the console regularly (30 days) for looseness and malfunction.

Clean the console regularly (30 days).

## **Appendix1: On-site environmental conditions**

### **1. Power Electricity**

The primary side power supply is provided by Party A to the machine workstation, and the voltage stability is plus or minus 10%

Power supply: AC 220V, 50Hz or AC 380V

### **2. Ground requirements**

The ground is required to be a concrete structure, the concrete depth is not less than 200mm, and the ground flatness is 2/1000.

## **Appendix2: Laser Cleaning Safety Operating Procedures**

1. The operator must be familiar with the system structure, electrical, laser optical system and other basic knowledge and use and maintenance methods of the equipment. The operator must pass the assessment before operating.

2. Do it before work:

(1) Check that the liquid level of the chiller should meet the regulations, and the cooling channel should be unobstructed.

(2) Clothing, sleeves, work caps, and protective glasses must be tightened. Scarves, gloves, skirts, sandals, and high-heeled shoes are strictly prohibited.

(3) Check the vicinity of the cleaning range of the machine. If there are obstacles, the obstacles must be cleared.

(4) Check that the emergency stop switch is in the released state, and each button switch is in the off state.

(5) Check whether the protective cover of the gun tip is removed, and ensure that the surface of the protective lens is clean

(6) Before turning on the power, please check carefully that the electric control panel and the control cabinet should be closed firmly, the electrical lines should be well connected, and the grounding should be good.

(7) You should be very familiar with the location of the emergency stop button so that you can press it whenever you need it without looking for it.

(8) Personnel without professional training shall not be allowed to connect the power supply and operate the equipment.

### 3. Do it seriously at work:

(1) Stick to your post, operate meticulously, and do not do anything unrelated to your work. Turn off the power when leaving the device for any reason.

(2) Process according to process regulations. It is not allowed to arbitrarily modify the process parameters, laser power, frequency, width, etc.

(3) During the processing of the equipment, other irrelevant personnel should not enter the working area.

(4) It is not allowed to disassemble the safety protection device on the equipment without authorization, and the equipment without the safety protection device is not allowed to work.

(5) Always remove dust and oil from the equipment and keep it clean.

(6) Pay close attention to the operation of the equipment. If you find abnormal phenomena such as malfunction, vibration, heat, noise, odor, bumps, etc., you should immediately shut down the machine for inspection, and continue to work after troubleshooting.

(7) When an equipment accident occurs, press the emergency stop button immediately, keep the accident scene, and report to the relevant departments

for analysis and processing.

( 8 ) It is strictly forbidden to contact the eyes and skin with the radiation directly emitted or scattered by the laser output.

( 9 ) In the laser radiation area of the working range, it is forbidden to enter mirror objects to prevent damage to human eyes or human body due to accidental mirror reflection. It is strongly recommended that operators should wear appropriate laser protective glasses when the system is working. The laser protective glasses should be issued with the system. match the wavelength of the laser. When placing the product, the laser output port should not point to the entrance or window of the room.

( 10 ) Avoid flammable and explosive items from entering the direct laser radiation area.

( 11 ) It is forbidden for anyone to adjust the optical system arbitrarily.

( 12 ) It is forbidden to change the parameters at will, so as to avoid misoperation, pulling or breaking the fiber.

( 13 ) When the equipment is in normal operation, it is not allowed to enter the working range of the equipment at will.

( 14 ) The operator is not allowed to leave the work post during the work. If he needs to leave, regardless of the length of time, he should stop processing to avoid accidents.

( 15 ) When an emergency occurs during use, press the emergency stop button immediately. When an alarm number appears on the display, the cause of the alarm should be found out first, and corresponding measures should be taken to cancel the alarm before proceeding.

#### 4、Do it carefully after work:

(1) Place the tip of the gun.

(2) Release the emergency stop switch, laser switch, etc. to the non-working position. Cut off the power and air supply.

(3) Remove dust, clean the work site, and clean the equipment carefully. Wipe off the dust on the protective lens and close the tip cap. It is strictly forbidden to use dirty cotton sand with iron filings or oil to wipe the lens. Compressed air cleaning of electrical cabinets is not permitted.

(4) Carefully fill in the equipment problems found in the shift in the shift record book, and do a good job in the shift work.

## Appendix2: Main operation interface description

The operation panel of the handheld laser welding system (referred to as "HMI") adopts a 7-inch configuration TFT touch screen, with a beautiful interface and convenient operation. Laser-related parameters can be set separately, and the input and output IO status, alarm information and motion status can be displayed in real time on the main interface. The main interface of HMI is shown in the figure below.

HMI main interface



**【Bluetooth logo】** : Shows whether this device is connected to the mobile

terminal via Bluetooth.

**【Swing off】** : The galvanometer motor can be turned on or off by swinging this button.

**【Enable security lock】**: Through this button, the safety lock can be activated or turned off. When the safety lock is activated, the laser will stop when the welding head does not touch the welding material during welding.

**【Automatic wire feed off】** : This button can control whether to perform automatic wire feeding during welding. Automatic wire feeding only when light is allowed.

**【Ban light】** : Through this button, the laser can be allowed or prohibited.

**【Alarm status area】** : When the alarm signal is enabled, the protection gas underpressure alarm, cold water flow alarm, laser alarm and temperature alarm status are displayed in real time, and the safety lock status is displayed in real time when the safety lock is enabled; when the alarm signal is not triggered, the corresponding alarm status is Blue; when an alarm occurs, the corresponding alarm icon will flash alternately red and blue.

**【Main】 【Wire feed parameters】 【Diagnosis】 【System parameters】** : Display the parameter category of the parameters on the current page, click the corresponding icon to switch the corresponding parameter page. For example: the icon on the main page turns bright, indicating that the parameters in the current display area are the parameters on the main page; when you need to switch to the wire feeding parameters, click the wire feeding parameter position to switch to the wire feeding parameter page, and the corresponding wire feeding parameter position will become bright.

**【Manual blow】 【Wire Feeder】** : Manual air blow test and wire feeder and wire withdrawal test. For example, press the manual blowing area to keep blowing, release the manual blowing area to turn off the blowing, and press the corresponding small triangular arrows for manual wire feeding and wire drawing.

## 7.2 HMI operation introduction

### 7.2.1 Parameter settings:

Parameter settings include: main page, system parameters, wire feeding parameters, and diagnostic page settings.

**【Main】** : Used to set the related parameters of laser, swing and process library during welding.

Process library: Click the white box area of the process library to select the set process library parameters.

Welding mode: Set welding mode: continuous, pulse mode.

Laser Power: Set the peak power of the laser during welding.

Laser Frequency: Set the frequency of the laser PWM modulation signal.

Duty cycle: Set the duty cycle of the PWM modulation signal, the setting range is 1% to 100%.

Swing frequency: Set the frequency of motor swing.

Swing Length: Set the width of motor swing.

Wire feeding speed: Set the wire feeding speed during welding.

Laser emission time: Laser emission time in spot welding mode.

Spot welding mode: Click to enter the spot welding laser emission mode.

**7.2.2 【System parameters】** : It is used to set the basic parameters of the device, generally configured by the manufacturer, and you need to enter a password before entering the page.

The system entry password is: 666888 six digits.

Pulse On Time: Light output time in pulse mode.

Pulse Off Time: Light off time in pulse mode.

Ramp up time: It is used to set the time for the laser analog voltage to slowly



increase from the initial power to the maximum power when starting.

Slow down time: It is used to set the time for the laser analog voltage to slowly decrease from the maximum power change to the light-off power when the laser is stopped.

Laser on: used to set the starting power of the laser, which is a percentage of the welding power.

Laser progressive time: Control the time it takes for the laser light to slowly rise to the set power.

Off optical power: used to set the off optical power of the laser, which is the percentage of welding power.

Gradual off light time: Control the time it takes for the laser off light power to slowly decrease.

Language: Used to switch the language switch.

Delay of opening gas in advance: When starting the processing, you can set the delay of opening the gas. When the external start button is pressed, the air will be blown out for a period of time, and then the laser will be emitted.

Delayed gas shut-off delay: When stopping processing, delayed gas shut-off can be set. When stopping processing, first stop the laser, after a delay for a period of time, and then stop blowing.

Automatic swing: used to set the galvanometer to automatically swing; when the automatic swing is enabled, when the safety lock is turned on, the galvanometer will swing automatically, and when the safety lock is not turned on, the galvanometer motor will automatically stop swinging after a period of delay.

Device parameter: It is used to switch to the device parameter page, and a password is required.

Authorization: used for authorization management of the motherboard.

Device ID: used to set the Bluetooth ID of the control system. When the user has multiple devices, the number can be freely defined for management.

Center Offset: The setting for the center offset of the red light.

**7.2.3 【Wire feed parameters】** : It is used to set the wire feeding parameters, including the wire feeding parameters, the wire withdrawal parameters, etc.

Wire withdrawal speed: the speed of the motor wire withdrawal after releasing the start switch.

Wire withdrawal time: the time for the motor to withdraw wire.

Feeding speed: the speed of motor feeding.

Wire patching time: the time for motor patching.

Wire feeding delay time: delay wire feeding for a period of time after light is emitted, generally 0.

Continuous wire feeding: It is used to change the wire of the wire feeder. Click once to continuously feed the wire, and click again to stop.

Continuous wire withdrawal: used for wire feeder replacement, click once to continue wire withdrawal, click again to stop.

**【Diagnosis】** : Used to monitor the IO status of the current system.

**7.2.4 【Device parameters】** : Used to set device-related parameters.

Laser rated power: used to set the rated power of the laser.

Maximum deflection angle of the galvanometer: used to set the maximum deflection angle range of the galvanometer.

Maximum laser frequency: Set the maximum frequency of the laser PWM signal. When the PWM frequency set by the welding parameters exceeds the maximum frequency, the PWM frequency will be limited to the maximum frequency.

Maximum swing length: Set the maximum length when swinging. When the length set by the welding parameters exceeds the maximum length, the length will be limited to the maximum length.

Wire feeding step: the step when the motor is feeding wire.

Wire Feed Motor Direction: Set the polarity of the wire feeding direction of the motor.

Galvanometer Correction Coefficient: When the set length is inconsistent with the actual length, and there is a slight difference, it can be corrected by this parameter. When no correction is required, it is generally set to 1.

Lens temperature alarm enable: enable the lens temperature alarm, when the temperature exceeds the limit value, an alarm signal will be generated.

Lens temperature alarm limit: lens temperature limit value.

Laser alarm enable: enable the laser alarm, when the laser generates an alarm, an alarm signal will be generated.

Laser alarm level: laser alarm logic level.

Chiller Alarm Enable: Enable the chiller alarm, when the chiller generates an alarm, an alarm signal will be generated.

Chiller Alarm Level: Chiller alarm logic level.

Undervoltage alarm enable: enable the gas alarm, when the gas underpressure generates an alarm, an alarm signal will be generated.

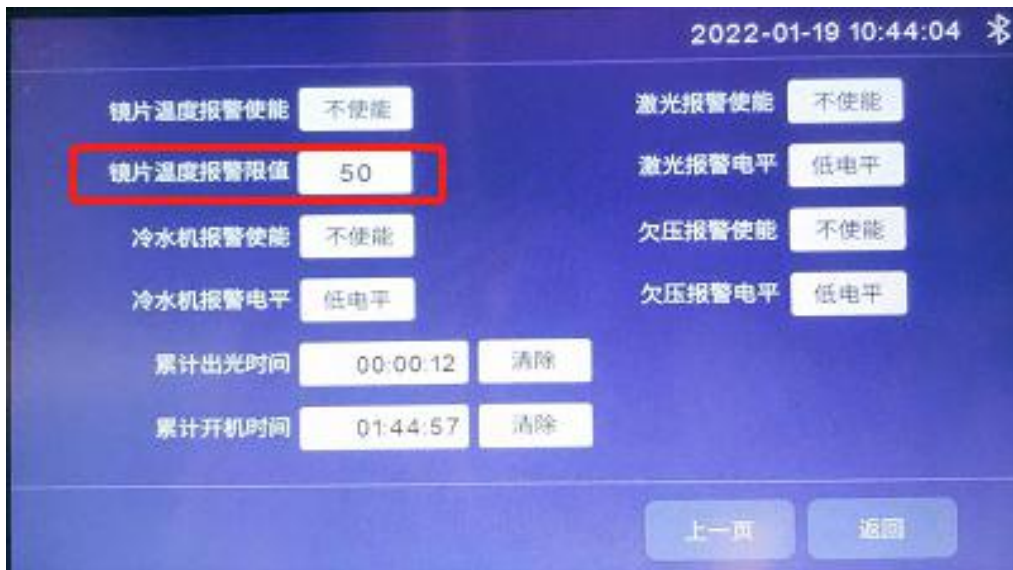
Undervoltage alarm level: Undervoltage alarm logic level.

## 8. Monitoring protection device

### 8.1 Protection lens temperature parameter setting

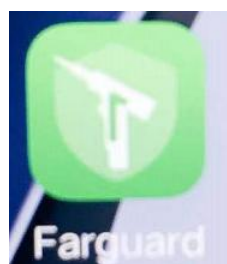
【Home page】→【System parameters】→【Device parameters】→【Enter password 666888】→Next page → Lens temperature alarm limit.

The lens temperature setting value, it is recommended to set it to 50. When the lens temperature exceeds the set value, an alarm will appear on the main page, and the side of the hand-held welding head will display a red light at the same time.



## 8.2 Bluetooth APP monitoring Bluetooth monitoring APP

For the first use, you need to download the Farguard applet, which can be used to contact after-sales customer service. Note: The APP currently only supports Android operating system mobile phones, the following is the applet icon.



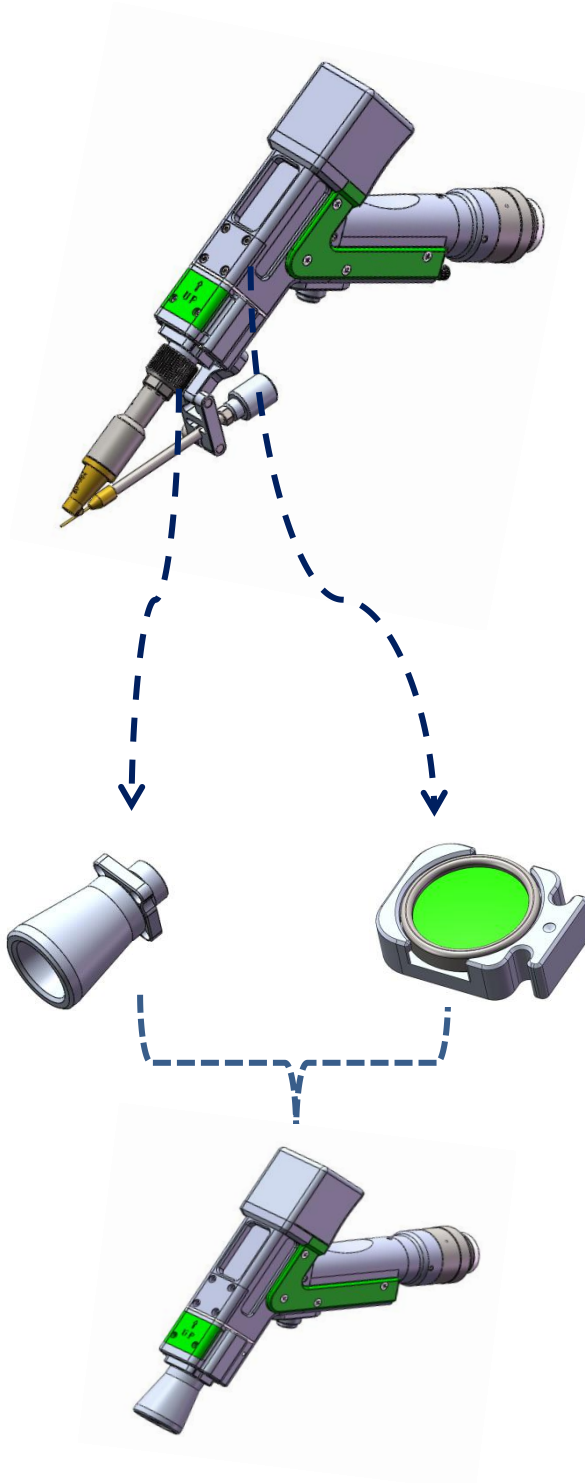
Monitor the main screen, welding system, cleaning system, and choose according to the type of use.

The device status page can view the current usage.



## 9. Cleaning Module Replacement

9.1 The replacement diagram of the structural part is as follow:



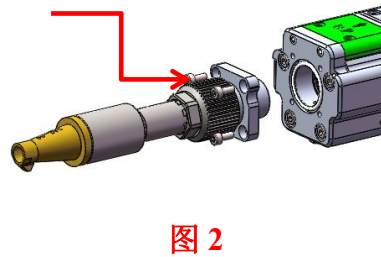
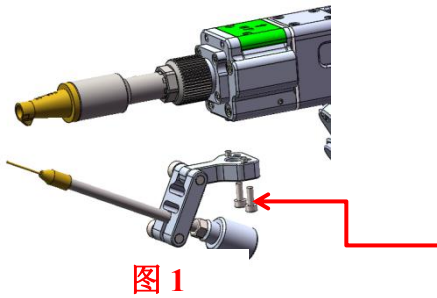
## 9.2 Module replacement

**【Wire feed bracket module】**: Loosen the 2-M3 screw and take out the module

Figure 1

**【Copper nozzle connector】** : Loosen the 4-M2.5 screw and take out the

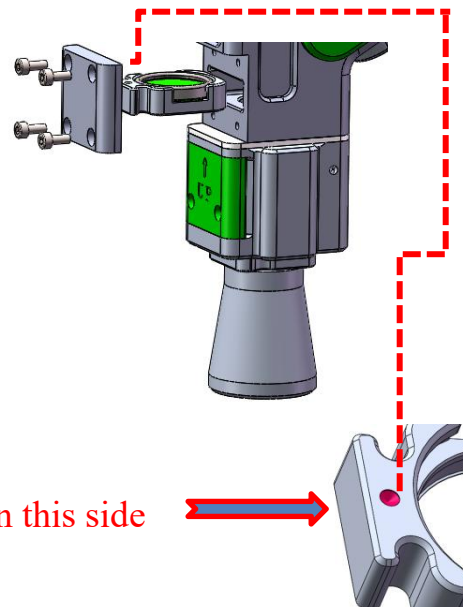
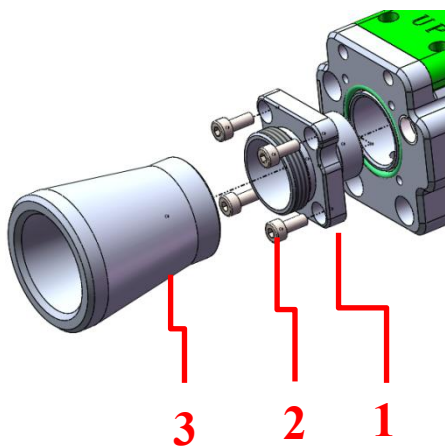
module Figure 2



### 9.3 Assembly and Replacement

【Jacket installation】 : Install in the order of 1, 2, and 3.

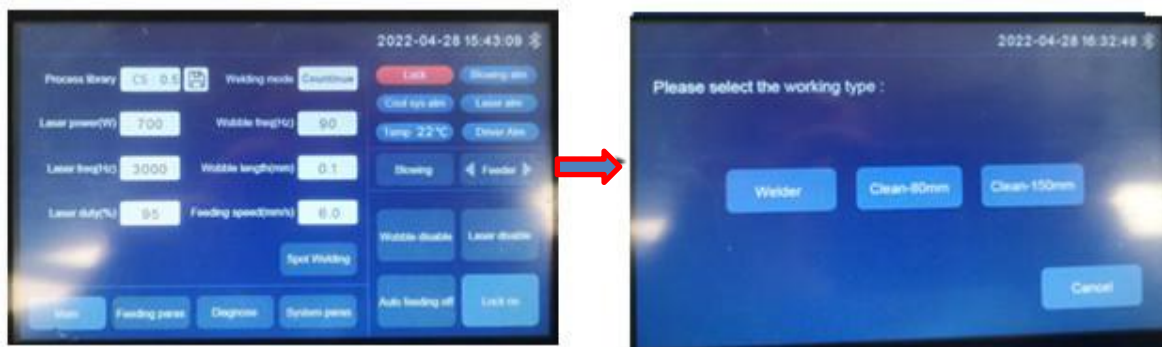
【Focus drawer installation】 : Loosen the 4-M2.5 screw, and directly pull out the focusing module. When replacing and cleaning the focusing module, pay attention to the middle dot on the top. After the replacement, the welding focusing module is well protected against dust and is easy to use and replace.



## 10. Processing module switching

### 10.1 Select processing type

Taking the welding mode to switch to 80mm cleaning mode as an example, on the panel, according to [System Parameters] -> [Authorization] -> [Processing Type], click [Processing Type], and you will be prompted to enter the password 666666, and when the password is entered correctly, it will be Enter the system type selection interface, as shown in the figure:



### 10.2 Module Replacement Tips

After the user selects the processing type, the system will use text and pictures to prompt the tip components that need to be replaced. After the user confirms that the corresponding hardware components and replacement conditions are available, they can click [Confirm], and then the system will prompt that it needs to be powered on again. The user interface powers down the device and replaces the appropriate components.





### 10.3 Switch complete

After the user completes the replacement of hardware components, the device can be powered back on. At this time, it will prompt again whether to confirm the replacement of the corresponding hardware components. After confirming the replacement of the corresponding hardware components according to the prompt, the user clicks **【Confirm】**, and the system processing mode switching is completed.



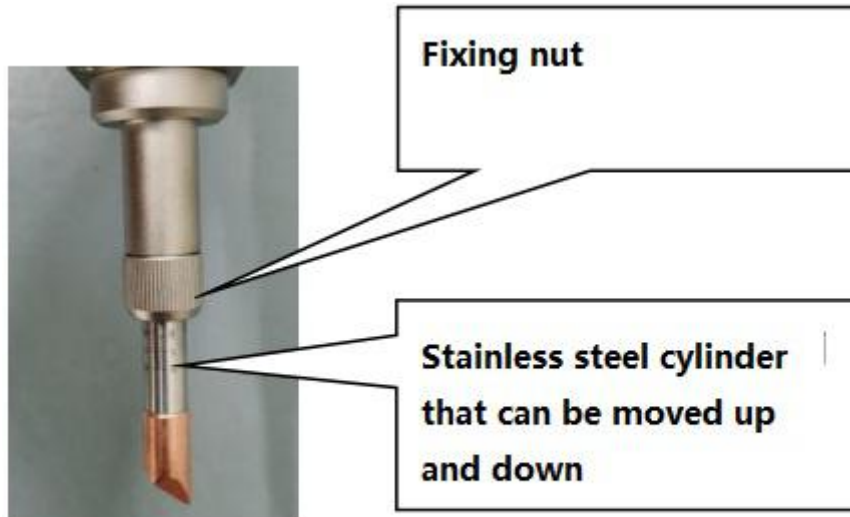
### Welding process parameters of common materials (for reference only)

Material	Thickness	Feeding speed	Scan speed mm/s	Scan width mm	Power (W)	Duty cycle	Pluse Frequency (Hz)	Welding diameter(mm)
SS	1	1	300	2.5	400	100%	1000	1.0
	2	0.9	300	2.5	700	100%	1000	1.2
	3	0.8	300	2.5	900	100%	1000	1.6
CS	1	1	300	2.5	400	100%	1000	1.0
	2	0.9	300	2.5	650	100%	1000	1.2
	3	0.8	300	2.5	900	100%	1000	1.6
Al	2	0.8	300	2.5	700	100%	1000	1.0
	3	0.8	300	2.5	1000	100%	1000	1.2

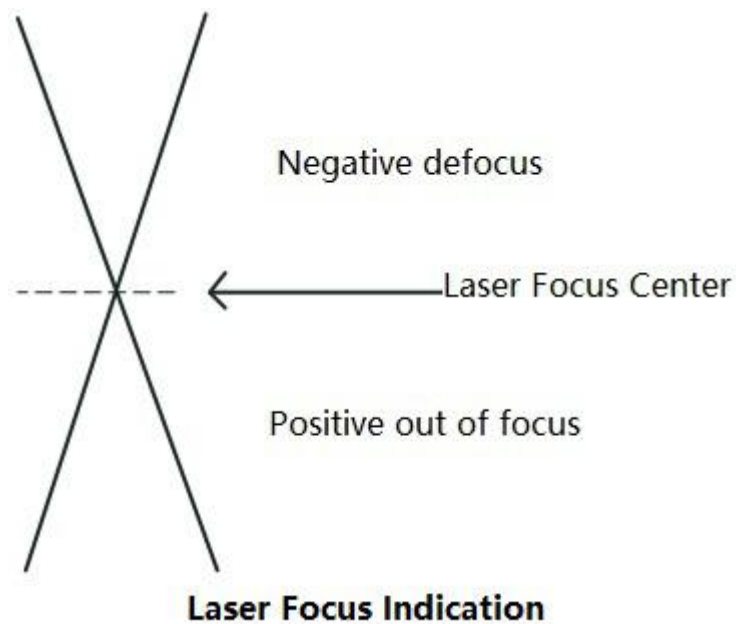
### **Fish scale pattern parameter settings (for reference only)**

1. The frequency setting on the main interface is 8-12Hz;
2. The duty cycle % is set to 70-80;
3. The power is adjusted according to the size of the wire and the sheet;

### **Appendix 4: Focus adjustment and defocus instructions**



**Adjust the focus distance**



The brightness of the laser beam is the strongest, and the marking sound is the loudest. When you hear the crackling sound, that is, the focus is just on the surface of the workpiece, which is zero defocusing.

When the defocus is negative, a larger penetration depth can be obtained,

and the internal power density of the material is higher than that of the surface, which is easy to form stronger melting and vaporization, so that the light energy can be transmitted to the material deeper. Therefore, in practical applications, when the penetration depth is required to be large, negative defocusing is used; when welding thin materials, positive defocusing should be used.

At the front end of the hand-held light-emitting tube, the scale tube can be adjusted according to the user's application requirements, and the positive and negative defocus amounts can be recorded, which is convenient for the user's operation habits.

## **Appendix 4 : Handheld welding related parameters (for reference only)**

### **Melt-depth Parameters**

<b>No</b>	<b>Material</b>	<b>Output power</b>	<b>Max depth(mm)</b>
1	Stainless steel	500	1.5
2	Stainless steel	1000	3
3	Stainless steel	1500	5
4	Carbon steel	500	1.5
5	Carbon steel	1000	3
6	Carbon steel	1500	5
7	Aluminum alloy	500	-
8	Aluminum alloy	1000	2
9	Aluminum alloy	1500	3

### Hand welding without wire feeding (for reference)

<b>Memo:The weld width is 10% of material thickness under the welding head does not feed wire.</b>				
<b>Continuous mode welding</b>				
Material	Thickness (mm)	Laser power(W) Weld firmly/weld deeply	Swing frequency(HZ) Weld firmly/weld deeply	spot size(mm)
Stainless steel	0.5	270/300	150/150	0.7
	1	450/550	140/140	1.5
	1.5	550/570	100/100	2.0
	2	750/900	100/100	2.0
	2.5	900/1050	100/100	2.0
	3	1050/1200	100/100	2.0
	3.5	1200/1350	100/100	2.0
	4	1350/1500	100/100	2.0
	4.5	/	/	
Carbon steel	0.5	270/300	150/150	0.7
	1	450/550	140/140	1.5
	1.5	550/570	100/100	2.0
	2	750/900	100/100	2.0
	2.5	900/1050	100/100	2.0
	3	1050/1200	100/100	2.0
	3.5	1200/1350	100/100	2.0
	4	1350/1500	100/100	2.0
	4.5	/	/	
Aluminium	1	670/750	100/100	2.0
	1.5	750/900	100/100	2.0
	2	900/1100	100/100	2.0
	2.5	1100/1250	100/100	2.0
	3	1350/1500	100/100	2.0
	3.5			
	4			

## **Appendix 5 : Double temperature double control chiller manual**