HW970 Handheld Fiber Laser Welding Head User Manual

Version V2.3

Catalog Index

Abstract

Key points

This manual covers the safe use, basic installation, factory settings, operating instructions, and maintenance services of the HW970 (handheld welding) series products.

Audience

This manual is mainly applicable to the following staff:

- Installation Engineer

- Maintenance Engineer

- Operator

ⓘPlease read this manual carefully and confirm to understand its contents before using this product.

Modify record

The record modification accumulates the description of each document update. The latest version of the document contains updates from all previous document versions.

The company reserves the right to modify the products and product specifications in this manual without prior notice.

Overview

This manual describes the safe use, basic installation, factory settings, operation instructions, and maintenance services of the HW9XX (handheld welding) series

products. There are many specific optical and mechanical custom configurations, and this manual only introduces its main unit components.

Laser welding is a new welding method and handheld laser welding is more widely in used. The handheld laser welding head has the advantages of beautiful appearance, small and light weight, wide use range, simple operation, and fine weld seam, which greatly improves the welding efficiency and quality. Hand-held laser welding solves the existing welding problems such as poor welding of corners, insufficient welding, post-processing of welds, unsightly welds and so on, which makes it the first choice for most metal welding.

Safety Instructions

Please read the following safety precautions and suggestions carefully before operating the laser and handheld laser welding head.

1. **Please observe all safety instructions for laser (including but not limited to descriptions of laser and the related chapters in this document)**

2. **Please ensure that do not look directly at the laser beam at any time or under any circumstances. Do not look at the laser emitter port directly even if wearing laser protective goggles.**

3. **It is forbidden to aim the laser at any human body, animal, vehicle, sky, etc. The operator shall be legally liable for the (direct, indirect and incidental) injury to the object, and the company shall not bear any liability and loss.**

4. **When using laser, wear laser protective goggles of the corresponding wavelength to protect your eyes from the threat of laser.**

5. **At any time, please turn on the power of the controller and other control parts before turning on the power of the laser. Otherwise, it may cause injury by uncontrollable laser beam.**

6. **Any repair or maintenance must be done by professionally trained personnel! Professionals must have received safety training, understand possible hazards and be familiar with safety measures to deal with hazards.**

Product appearance

Figure 1 - Appearance of HW970

Structure composition

As shown in Figure 2, the welding head consists of seven basic units: QBH connector, collimator lens unit, galvo-lens unit, wireless control unit, focus lens unit, protection glass unit and nozzle unit.

喷嘴底管
Nozzle unit

保护镜模块 Protection glass unit

聚焦镜模块 Focus lens unit

无线控制模块
Wireless control unit

振镜模块
Galvo-lens unit
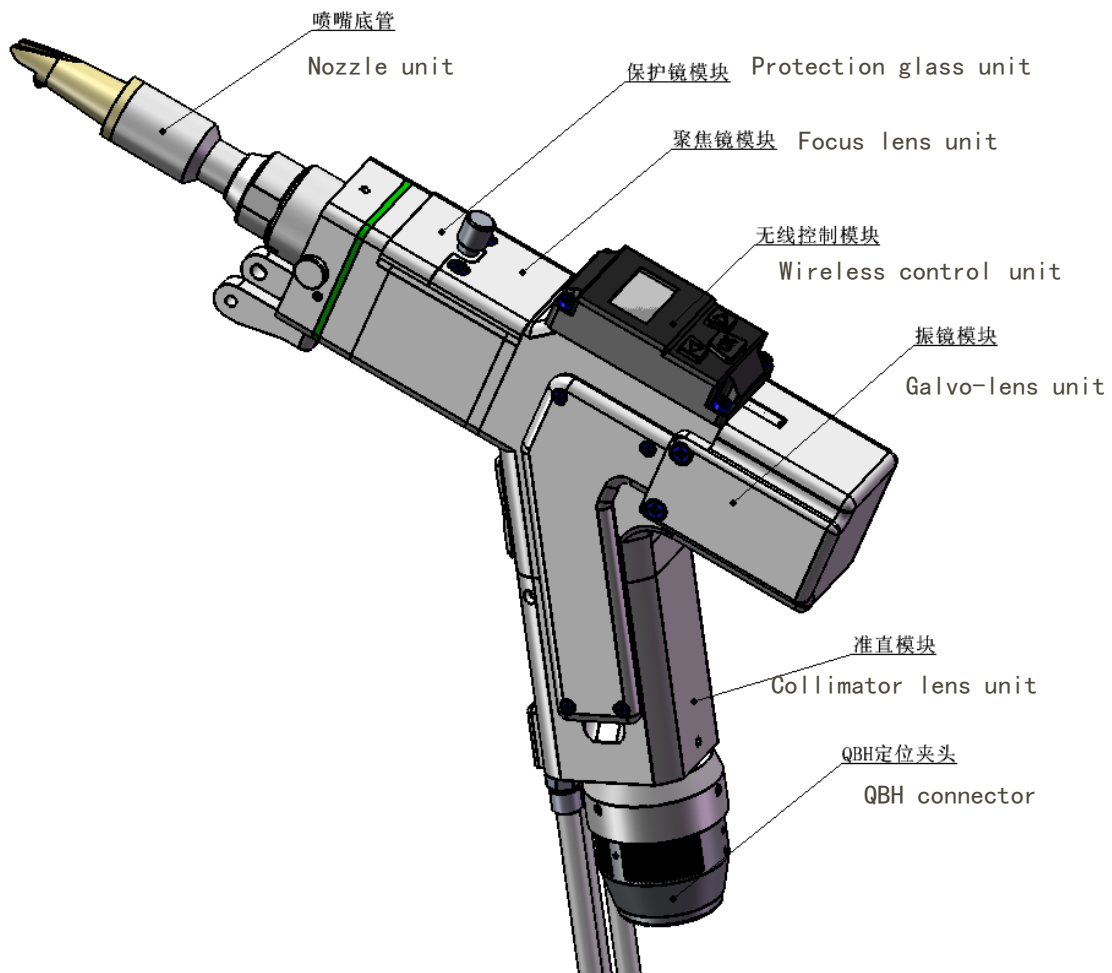
准直模块
Collimator lens unit

QBH定位夹头
QBH connector

Figure 2 - Structure of HW970

- QBH connector: complete the access and lock of the optical fiber connector.

- Collimator unit: complete the fiber collimation function and collimate the incident laser into a parallel beam.

- Galvo-lens unit: Vibrate and reflect the collimated parallel laser at a certain angle to change the direction of the original beam and the shape of the spot.

- Wireless control unit: quickly adjust some high-frequency parameters.

- Focus lens unit: Focus the reflected beam into a convergent beam with high power density.

- Protection glass unit: The protective glass can protect the focusing lens from the damage of returning slag and prolong the service life of the focus lens.

- Nozzle unit: guide the focused beam to the workpiece, and generate high-speed airflow to protect the molten pool from oxidation to achieve high-quality welding results. You can also adjust the focus distance by adjusting the nozzle length.

Product Highlights

- Cool appearance, ergonomic design, comfortable to grip

- Adjustable spot size, high welding firmness, beautiful lines

- Wireless control module, quick adjustment of parameters, one button to complete wire feeding or rewinding

- The light spot can be adjusted to the center position

- Selection of high-quality precision optical components, excellent and stable beam quality

- Compact structure design, high dustproof level

Product configuration

HW970 handheld laser welding head is mainly used for plane processing applications within 2000W, and has very high versatile. Standard configuration model: HW970-Z50-F150.

Configuration parameter

Parameter name	Technical indicators
Maximum applicable laser power	2000W
Optical fiber interface type	QBH
Focus lens specifications	Dia.=20mm，F=150mm
Collimating lens specifications	Dia.=20mm，F=50mm
Maximum clear aperture diameter	16mm
Laser wavelength	1064nm
Welding head weight	≤1000g
Maximum external size of welding head (width)	47mm
Nozzle size	Outer diameter 10mm, tolerance -0.02mm to -0.04mm, length 72.5mm

Configuration list

Product name	Quantity
Handheld laser welding head	1set
Spare copper nozzle	6pcs
Spare protection glass	5pcs

Note: The above table is only for the standard factory configuration

Operation steps

1.Connect the circuit between the laser, the controller and the galvanometer driver. Connect the power cord. For the wiring method, refer to the electrical control section of the user manual.

2. After getting the laser welding head, connect the optical fiber connector firstly, and then connect the air pipe, water pipe and switch circuit. (The detailed installation method of each connector is described later)

3. Turn on the power of the controller and wait for the screen of the laser controller to start up, then turn on the laser switch and the water cooler switch.

4. Set the relevant values on the controller screen (refer to the <User Manual Electric Control Part> to set various parameters)

5. Put on goggles, hold the welding head with the welding head facing the metal welding piece, and observe whether there is red light at the copper nozzle of the welding head. If there is no red light, check whether the laser emits light normally.

* Note: Observe the red light from the side of the welding head, and it is strictly forbidden to look directly at the laser beam with your eyes.

6. Position the welding parts, adjust the angle of the welding head to make the red light shine on the seam to be welded, and the copper nozzle touches the welding parts, and then manually turn the switch on the welding head to start light welding.

*Note: if only part of the red light comes out of the nozzle or the red light cannot be seen at all, do not emit the laser.

Mechanical installation

Cooling water loop installation

The HW970 handheld welding head is equipped with a set of cooling water channels. It should be noted that when the laser power is greater than 500 watts, it is recommended to use water cooling. From Figure 3, you can see the position and number of the water cooling ports, and the table below lists the recommended water flow speeds in detail. The design of the water-cooling interface is a closed loop system. External water supply can be used freely, but the requirements in the list must be met.
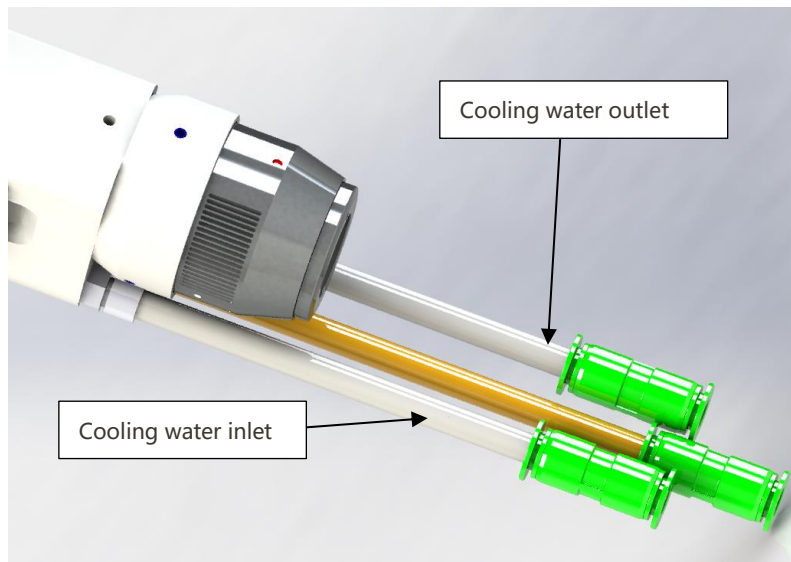

Figure 3 HW970 water cooling interface

Parameter name	Parameter value
Cooling water pipe diameter (outer diameter)	6mm
Minimum flow rate	1.8liters/minute（0.48gpm）
Inlet pressure	170-520kPa (30-60 psi)
Inlet temperature	≥room temperature/＞dew point
Hardness (relative to CaCO3)	＜250mg/liter
pH range	6 to 8
Acceptable impurity particle	Diameter < 200 microns

Pneumatic installation

Impurities in the welding gas such as hydrocarbons and water vapor can damage

the lens. The following table shows the recommended welding gas specifications. The higher the gas purity is, the better the quality of the welding gap is.

Impurities can be filtered out in the gas supply pipeline, but oxygen and water vapor can penetrate into the optical path system through non-metallic materials, which is the source of dust and hydrocarbons. It is recommended to use stainless steel accessories, and a filter that can remove particles as small as 0.01 microns must be used for purification.

It is recommended to use a pressure gauge with a stainless-steel diaphragm. Industrial pressure gauges will inhale air. If a rubber diaphragm is used, hydrocarbons will be generated due to aging and other reasons.

HW970 provides 1 way welding gas connection. The outer diameter of the gas pipe is 6mm. As shown in Figure 4 below.
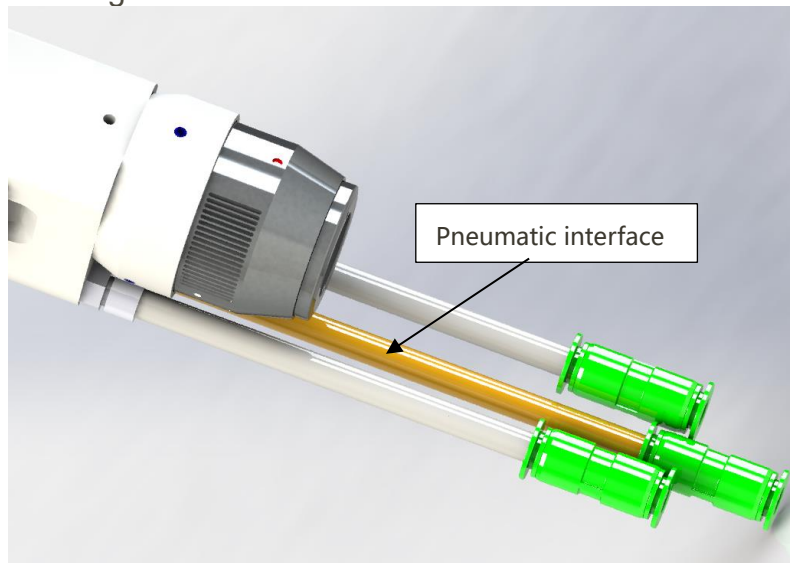

Figure 4 HW970 pneumatic interface

Welding gas	Purity
Nitrogen	99.99%
Argon	99.998%
Helium	99.998%

Optical fiber interface

The HW970 is suitable for most industrial laser generators. It is equipped with a collimator lens assembly.

The connection between the end of the optical fiber and the welding head is called the optical fiber connector. HW970 comes standard with QBH optical fiber connector, as
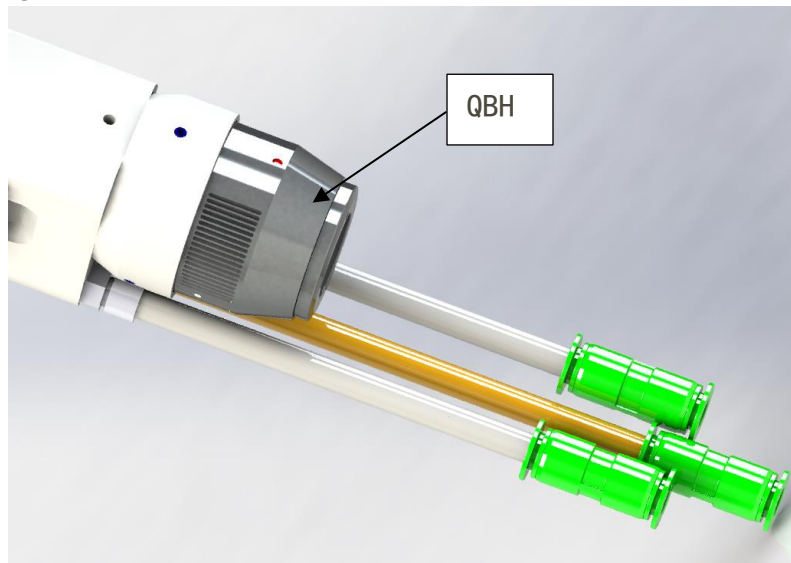
shown in Figure 5 below.

Figure 5 HW970 optical fiber input interface-QBH

Note: The optics must be kept clean, and all dust must be removed before use. If the welding head is to insert the optical fiber vertically, the welding head must be rotated 90 degrees to a horizontal position, and then insert the optical fiber to prevent dust from entering the interface and falling on the surface of the lens. Fix the laser head after inserting the optical fiber.

Fiber rod insertion and locking

First, align the red dots on the end face of the QBH interface with the red dots of the rotating handwheel; then, remove the QBH dust cap, align the red mark of the fiber output end with the QBH red mark, and insert it straight to the bottom; next, rotate the QBH hand wheel clockwise to reach the right position when hearing the sound of "Da", then pull the handwheel upwards and turn it clockwise to the end again. As shown in Figure 6 below.
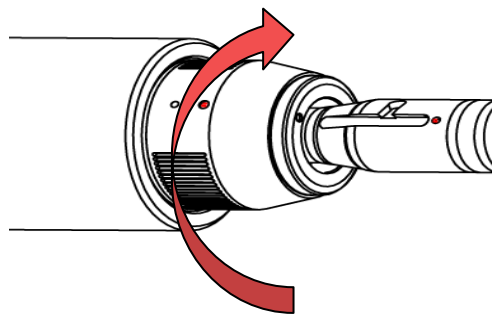

Figure 6 HW970 QBH fiber rod insertion and locking diagram

Focus adjustment

Adjust focus position

The welding head can adjust the focus position. The adjustment method is to rotate the locking ring counterclockwise. After loosening, adjust the copper nozzle extend the length to obtain the required spot energy. After adjusting the position, tighten the locking ring to lock the copper nozzle in the position just adjusted. There is a scale on the copper nozzle, which is convenient and quick to adjust, as shown in Figure 7:
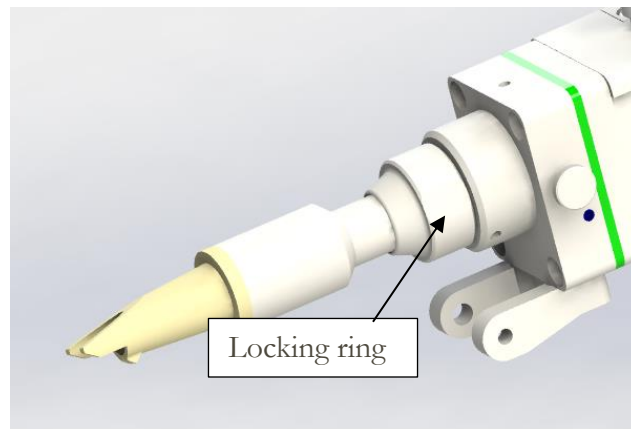

Figure 7 HW970 Focus position adjustment knob

Spot centering adjustment

Adjust the light spot to the horizontal center position of the nozzle.

Adjustment method: power on the HWS5000 welding system controller and then set the "Width" to 0mm on touch screen → click "advanced parameters" → enter the password "2000" → click "ENTER" → set the "optical core offset" parameter. When the "optical core offset" parameter is set to be small, the optical core is shifted to the right; when the "optical core offset" parameter is set to be large, the optical core is shifted to the left; set appropriate parameters so that the optical core is in the center.

Figure 8 Adjusting the optical core offset parameters

Maintenance

Welding head cleaning and maintenance

When the welding head is used, a layer of black ash is attached to the copper nozzle. This is the spark sputtering after the metal is heated, and then attaches to the nozzle. There is also some dust in the air. After use, wipe the nozzle gently with a clean cloth. Then, clean the dust on the welding head; in a relatively clean environment, pull out the drawer and check whether the protective lens is clean. When the welding head is not in use, plug the copper nozzle with tape or a rubber cap to prevent dust from entering the lens. If you unplug the fiber connector, immediately block the hole of the fiber input connector (QBH) with a dust cap to prevent dust from entering the fiber connector.

Clean the lens

There is a lower protection glass at the front of the welding head to protect the focusing lens. When impurities or foreign matters are attached to the protection glass, the lens will be damaged. Therefore, the lens needs to be maintained regularly. It is recommended to check it before start. Please refer to Figure 9 for lens structure.
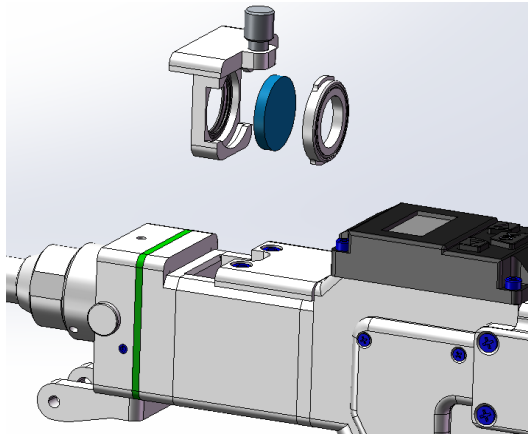
Figure 9 HW970 protection glass module split diagram

■ Lens cleaning tools：

PE gloves or finger cots, polyester cotton swabs, absolute ethanol, rubber air blower (clean compressed air), etc.

■ Lens cleaning method and matters needing attention:

（1）Wear finger cots on the thumb and index finger of the left hand;

（2）Spray ethanol on the polyester cotton swab;

（3）Gently pinch the side edge of the lens with the thumb and index finger of the left hand. (Note that the finger cot cannot touch the surface of the lens to avoid leaving traces);

（4）With the lens facing both eyes, hold the polyester cotton swab in your right hand, gently wipe the lens from bottom to top or from left to right in a single direction (do not wipe back and forth to avoid secondary pollution of the lens), and use rubber air blower (clean compressed air) blows the surface of the lens. Both sides should be cleaned. After cleaning, reconfirm that there are no residues of the following: detergent, floating dust, foreign matter, and impurities.

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Removal and installation of lens

The entire process must be completed in a clean place, and PE gloves or finger cots must be worn when removing and installing the lenses.

■ Disassembly and assembly of the lower protective lens:

Protective lens is a vulnerable part and needs to be replaced after damaged.

（1）As shown in Figure 10, loosen the locking screws, pinch both sides of the drawer-type lens holder and slowly pull out the protective lens drawer;

（2）Rotate the protective lens cover 90° to remove the protective lens cover; take it out from above Lens;

（3）Clean the lens, protective lens drawer and sealing ring. If the sealing ring is damaged, replace it with a new one;

(4) Install the cleaned (or replaced) lens (regardless of the front and back) to the protective lens in the drawer;

(5) Reinstall the protective lens cover;

(6) Reinsert the protective glass holder back into the welding head, and tighten the locking screw.
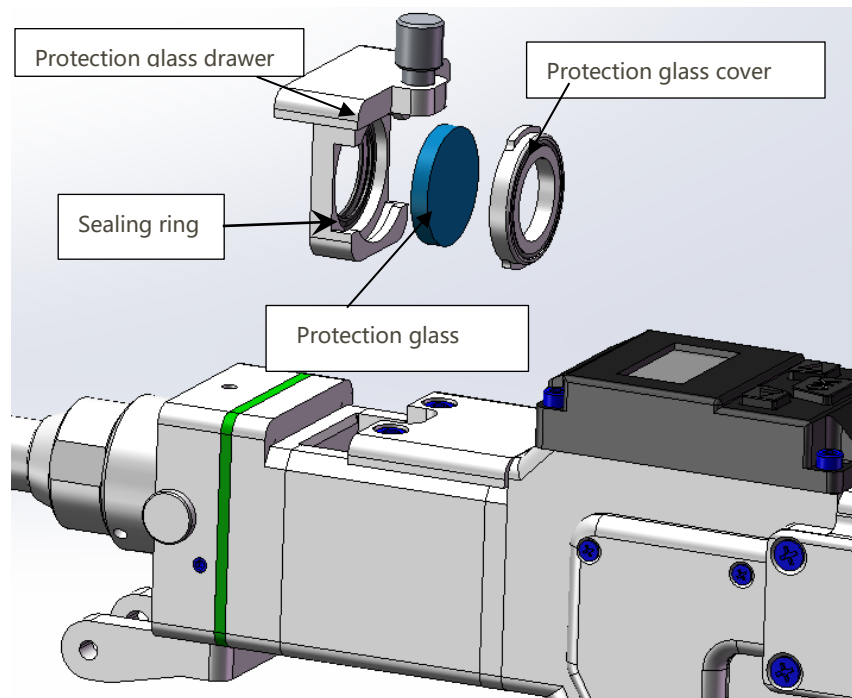
Picture 10 HW970 protection glass split diagram

■ Disassembly and assembly of the upper protective glass and focusing lens:

（1）As shown in Figure 11, loosen two M3X8 Hexagon socket screws, pinch both sides of the drawer-type lens holder and slowly pull out the focusing lens drawer;

（2）Remove focusing lens: use a small cross screw to loosen four M2X5 Phillips screws, remove the focusing lens cover; take out the focusing lens D20-F150

（3）Remove the protective glass: carefully remove the D20.55 sealing ring, and take out the protective glass D20X3.

（4）Install the cleaned (or replaced) lens into the focus lens drawer

（5）Reinstall the focusing lens cover and D20.55 sealing ring.

（6）Reinsert the focusing lens drawer back into the welding head, and tighten the locking screw.
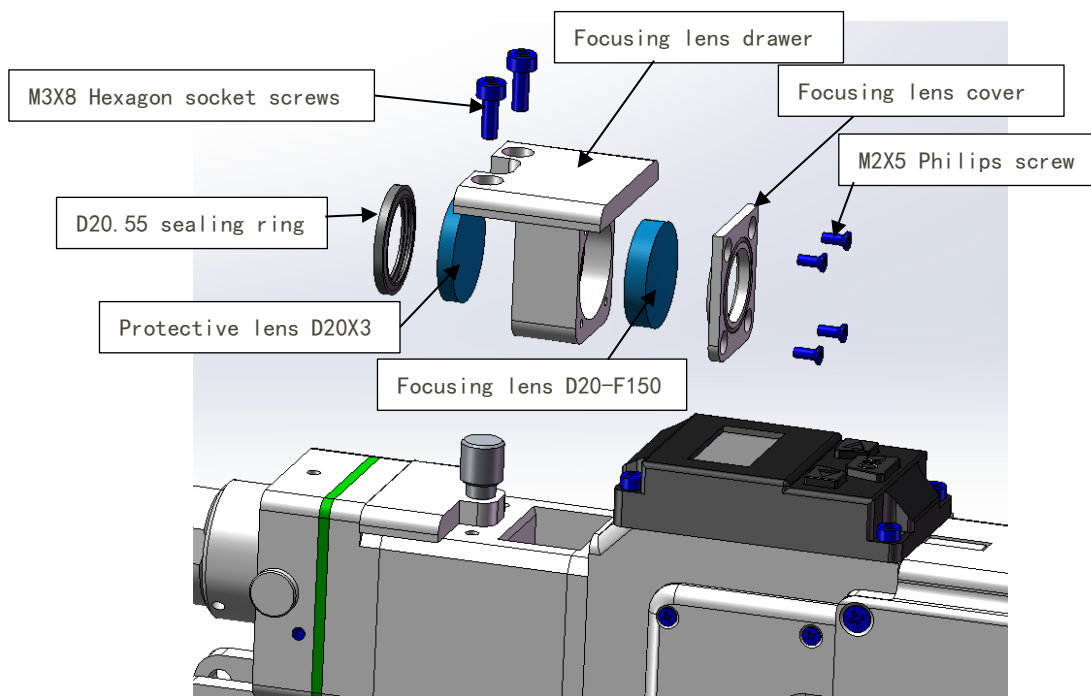

Figure 11   Split diagram of upper protective glass and focusing lens on HW970

Replace the copper nozzle:

In the process of laser welding, the nozzle will touch the welding pieces and rub against the metal parts. Nozzle is consumable accessory and needs to be replaced after a period of use. The nozzle equipped is a combination nozzle, which is composed of a

stainless steel bottom tube and a copper nozzle. The copper nozzle has different styles and can be used in different scenarios. The corresponding copper nozzle is required to use different thickness of welding wire. Refer to Figure 12.

■ Replace nozzle：

(1) Before replacement, the laser enable should be turned off, and the welding head should be facing in front with no one ahead;

(2) Unscrew the copper nozzle counterclockwise;

(3) Replace with a new nozzle.
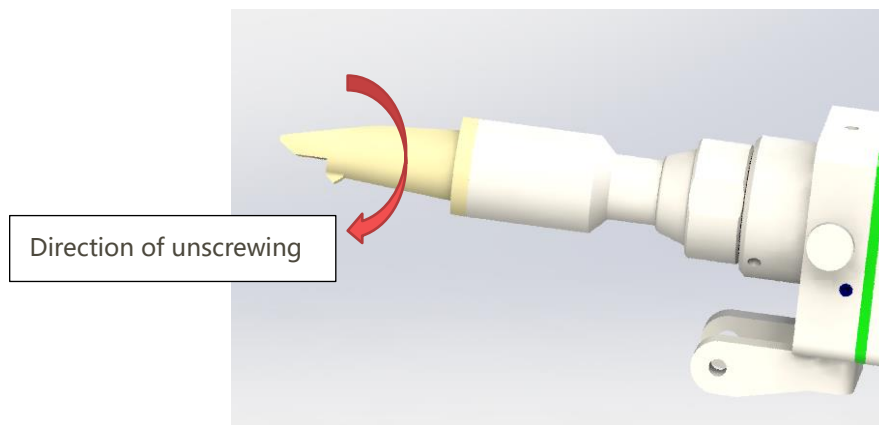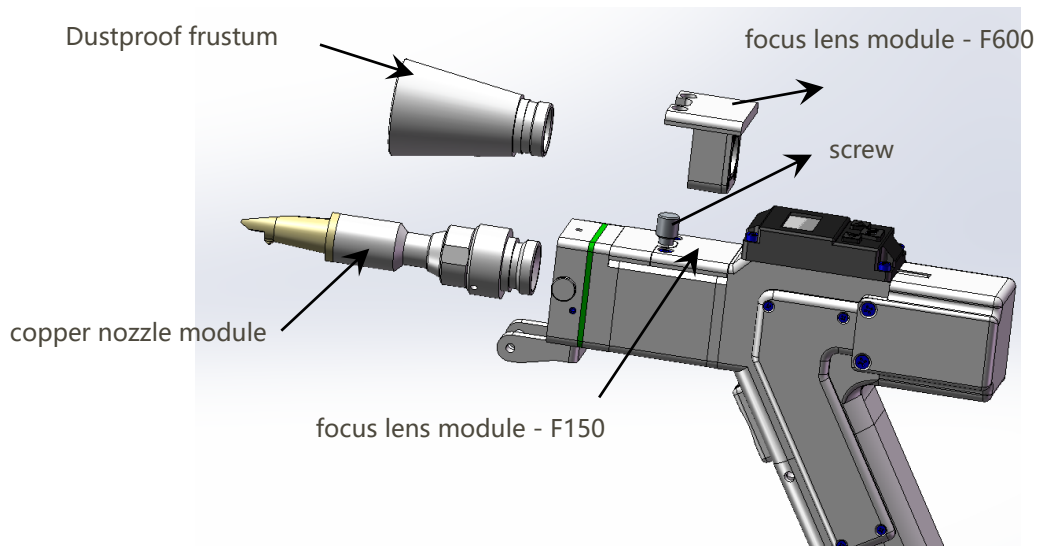
Direction of unscrewing

Fig. 12 diagram of nozzle replacement

Switching to cleaning mode

Replace with cleaning parts

Loosen the screw, then replace the nozzle module with a dustproof light transmission frustum.

Replace the focus lens module (D20-F150) with the focus lens module (D20-F600)

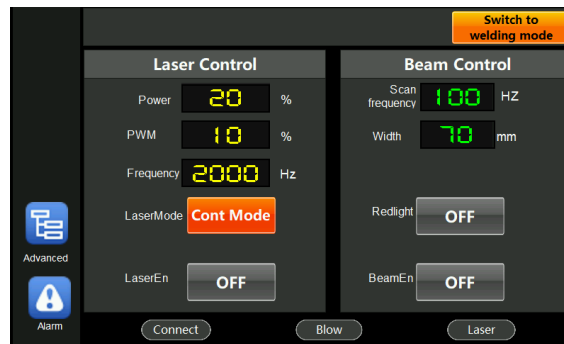## Enable the cleaning mode on the touch screen

Click the red button "Switch to cleaning mode" on the upper right of the welding interface.

Enter the password "5000" in the pop-up window.

Enter the cleaning interface.

After switching to the cleaning mode, the light can be emitted only when the ground wire clamp is clamped on the wire feeding assembly.

Click "switch to welding mode" in the upper right corner of the cleaning interface to switch to the welding interface.

Instructions for welding head wireless control module

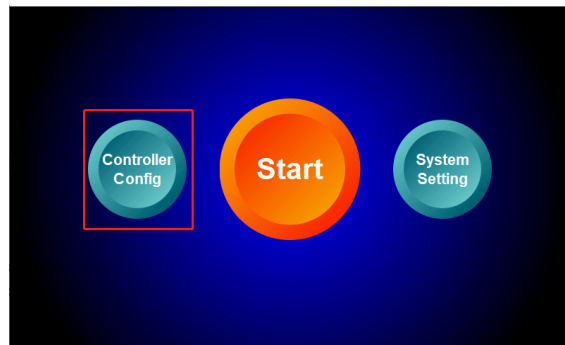Wireless handheld laser welding head and controller wiring
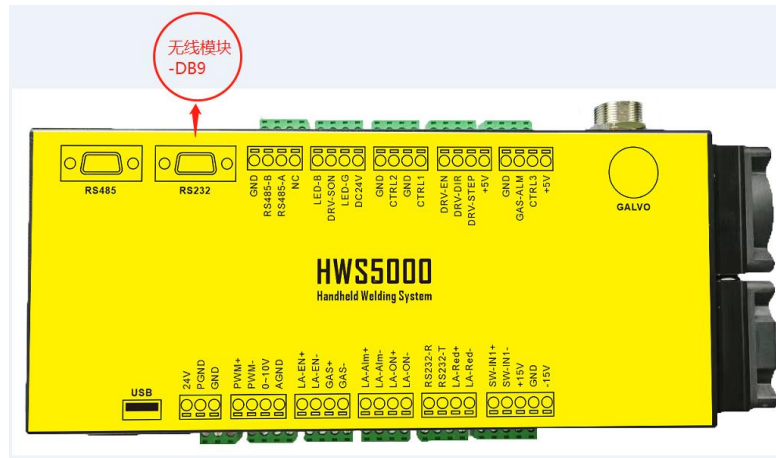
The wireless receiving module is inserted into the DB9 female socket of the HWS2000 controller through the USB

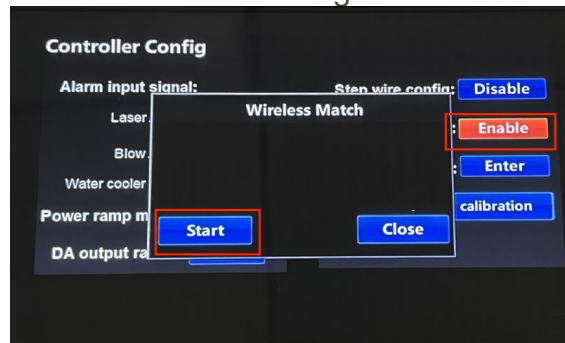Touch screen interface operation

1.   Click the "Home" button

2.   Click the "controller config" button to enter the controller configuration interface:

3.   Check "enable" to turn on the wireless control function of the welding head. The wireless communication address needs to be consistent with the communication address of the wireless controller on the welding head.

Instructions for Handheld Welding Wireless Control unit

Operating Instructions for Wireless Communication Module
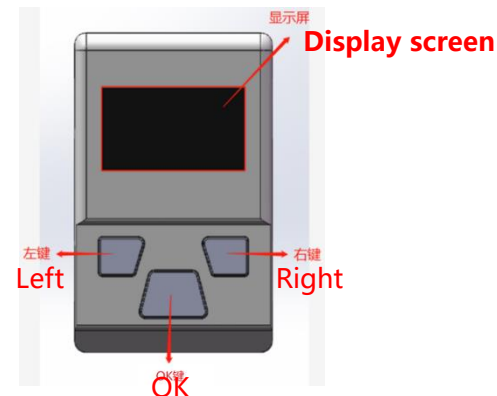
1. Display screen: displays the man-machine interaction interface such as parameter functions.

2. OK key: Short press to enter the parameter editing state, each time you press, the next parameter item is selected, the selected parameter flashes, and the parameter is set by the left or right button; if no key is pressed within 5 seconds or the parameter is not set, return to non-editing Status, the parameter stops flashing; long

press in the non-editing state to trigger the power slow-down function, release it to stop the power slow-down.

3. Left button: Press to decrease parameter value or switch function state in parameter editing state. Long press in the non-editing state to turn on the wire feeding function, release it to stop the wire feeding.

4. Right key: Press to increase the parameter value or switch the function state in the parameter editing state. Long press in the non-editing state to turn on the thread rewinding function, and release it to stop thread rewinding.

Function introduction

1. Communication status: (status: normal\disconnected)

   Shows whether the wireless connection is successful. "Normal" means that the wireless communication is connected, and "disconnected" means that the wireless communication is not connected.

2. Light emitting mode: (status: spot shooting\continuous)

   Corresponding to the touch screen "light mode" parameter. The "continuous" light mode and "spot shot" light mode can be adjusted.

3. Laser power: (range 0%-100%)

   Corresponding to the "peak power" parameter of the touch screen, adjust the maximum power during the stable light emission period.

4. Scanning width: (range 0mm-4mm)

   Corresponding to the "scan width" parameter of the touch screen,Set the beam swing width.

5. Spot enable: (status: on\off)

   Corresponding to the touch screen "spot enable" parameter, turn on/off the swinging spot.

6. Spotting time: (range: 0S-1.0S)

   Set the light emission time in the spot mode corresponding to the "pulse time" parameter in the "advanced parameters" interface of the touch screen.

7. Wire feeding speed: (range: 0%-100%)

Set the running speed of the wire feeder corresponding to the "Wire feeding speed" parameter on the touch screen.

8. Wireless pairing: (Status: On\Off)

Cooperate with "Enter Pairing" in the "Controller Configuration" interface of the touch screen to achieve wireless pairing.

9. Language switching: (Status: Chinese\English\Traditional，etc)

Switch interface language display, support: Simplified Chinese, English, Traditional Chinese, etc.

Attention tips

- The wireless controller needs to avoid shielding or interference.
- The wireless control receiver cannot be plugged in or out with power.

Adjusting the light spot size of the handheld laser welding head

1）**Set "WobbleFreq". The larger the parameter setting, the faster the spot swing frequency.**
2) **Set "WobbleWidth". The larger the parameter setting, the greater the swing amplitude of the spot.**
3) **Turn on the "LightSpot Wobbling". the light spot swings according to the " WobbleFreq" and "WobbleWidth". Turn off the "LightSpot Wobbling" and the spot stops swinging.**

HWS5000 Welding System Controller User Manual

Manual For Welding System Equipment (control part)

Version: V5.0

1. Equipment installation and wiring

1.1 Wiring instructions for touch screen terminals
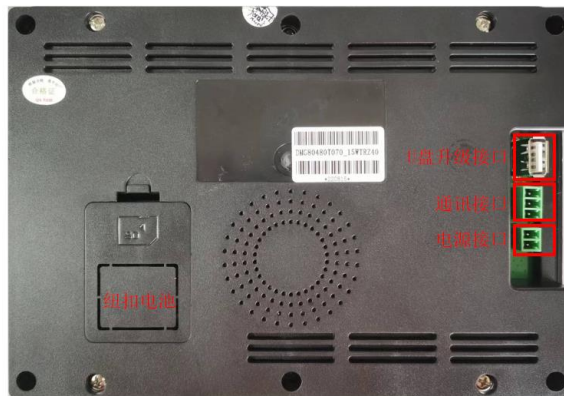
Touch screen wiring terminal

Terminal wiring instructions:

Power terminal: The screen uses 24V DC power supply. The terminals from right to left are: power supply positive, power supply negative, and ground wire.

RS485 communication terminal: This terminal and the controller RS485 communication terminal are connected through the RS485 communication line.

1.2 Controller wiring terminal description

Controller wiring terminal

For detailed description of the controller terminals, please refer to the table below.
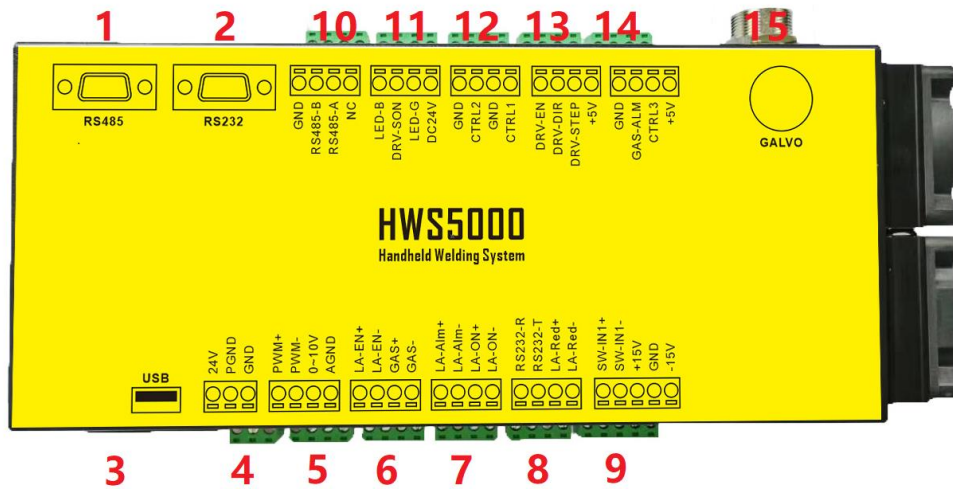
NO.	Port screen printing	Input/Output	Pin	Pin Definition	Terminal description
		Controller terminal description			
1	RS485	IN/OUT	/	RS485	Touch screen communication interface
2	RS232	IN/OUT	/	RS232	RS232 interface (wireless control receiver)
3	/	IN/OUT	/	USB	USB interface (wireless communication/U disk download)
4	POWER	IN	1	24+	Controller DC24V power input
			2	PGND	
			3	GND	
5	CON1	OUT	1	PWM+	DC24V\DC5VPWM output signal (The output amplitude can be configured)
			2	PWM-	

			3	0～10V(0～4V)	0～10V\0～4V analog output signal
			4	AGND	(The output range can be configured)
6	CON2	OUT	1	LA-EN+	DC24V laser enable output signal
			2	LA-EN-	
			3	GAS+	DC24V output connected to solenoid valve to control blowing
			4	GAS-	(Drive current Max 2A)
7	CON3	IN	1	LA-ALM+	Laser alarm input port
			2	LA-ALM-	(DC24V high level valid)
			3	LA-ON+	Connect to the hand gun button switch, turn on the light
			4	LA-ON-	(Short the two points to give out light and breathe out)
8	CON4	IN/OUT	1	RS232-R	Reserved
			2	RS232-T	
		OUT	3	LA-Red+	Red light indicating control signal
			4	LA-Red-	(DC24V high level effective)
9	CON5	OUT	1	SW-IN1+	Reserved
			2	SW-IN1-	
		IN	3	+15V	Controller DC±15V power input
			4	GND	
			5	-15V	
10	CON6	OUT	1	NC	Reserved

			2	RS485-A	Stepping wire feeder communication port
			3	RS485-B	
			4	GND	Reserved
11	CON7	OUT	1	DC24V	DC24V power output
			2	LED-G	Stepping wire feeder green indicator light
			3	DRV-SON	Stepping wire feeder enable
			4	LED-B	Stepping wire feeder blue indicator light
12	CON8	OUT	1	CTRL1	Reserved
			2	GND	
			3	CTRL2	Reserved
			4	GND	
13	CON9	OUT	1	+5V	Reserved
			2	DRV-STEP	
			3	DRV-DIR	
			4	DIR-EN	
14	CON10	IN/OUT	1	+5V	Reserved
			2	CTRL3	Reserved
			3	GAS-Alm	Low air pressure warning input signal
			4	GND	Reserved
15	GALVO	IN/OUT	/	10 pin aviation plug	Connect the welding gun (welding gun control input / output)

In order to improve the safety performance of the product, the hand-held welding head adopts the method of contacting light, that is, the welding head and the welding workpiece must be in contact, and the light can be emitted after pressing the light switch of the hand-held welding head.
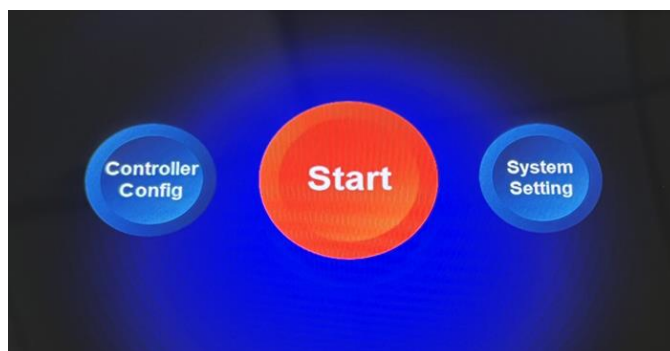
1.3 Controller wiring diagram

HWS5000 galvo-lens handheld welding system wiring diagram
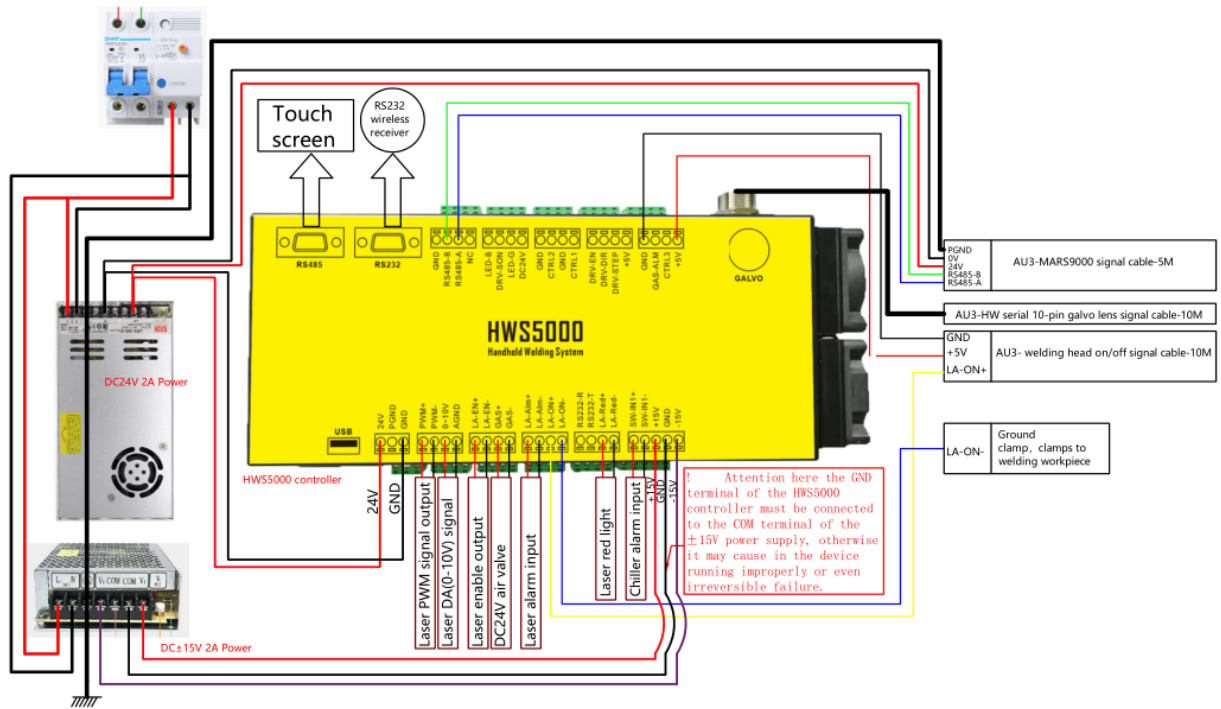
2. The main interface description

2.1 Homepage

After the system is powered on and initialized, the welding work interface is entered by default. Click the "Home" button to enter the home page interface. Under the home page interface, you can enter the system settings, start welding, and controller configuration interfaces.

2.2 System Setting Interface
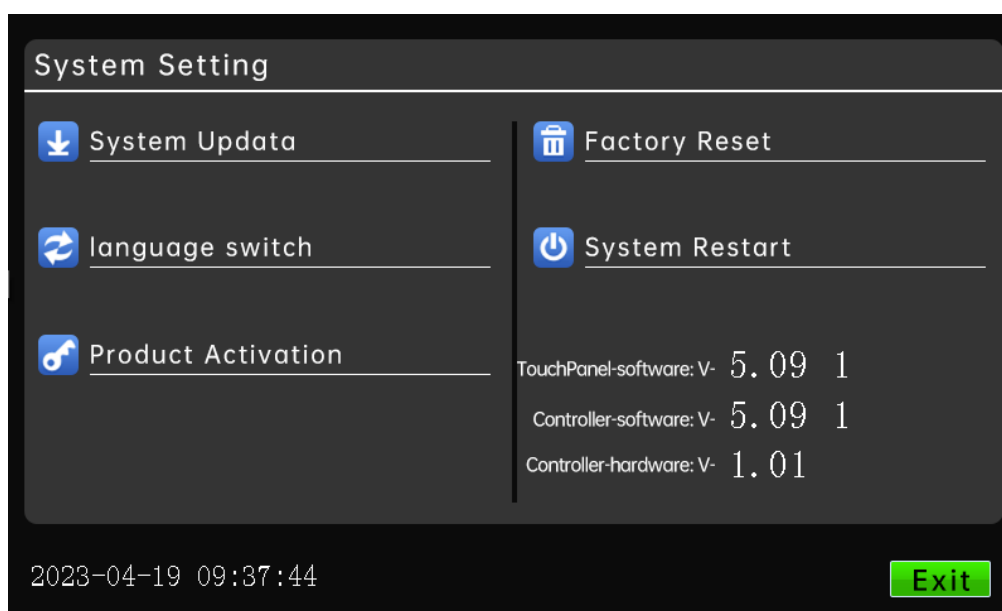
Click the "System Settings" button under the home page interface to enter the system settings interface.

"System Upgrade": Please refer to the program update part for details.

"Language switch": This system supports simplified Chinese, traditional Chinese, English, Japanese, Korean, Turkish, Vietnamese, Slovak, Hungarian, Polish, Russian,

Spanish, Portuguese, Slovenian, Croatian, French, German. After clicking Language Switch, click the required language, and the language will be displayed on all system interfaces.

"Version Information": Display the current system's touch screen version, controller software version, and controller hardware version.

"Product Activation": Query the current device ID and encryption status. The activation code is divided into six segments, each with 4 digits. After entering the correct activation code, click "Activate" to update the encryption time or permanently decrypt.
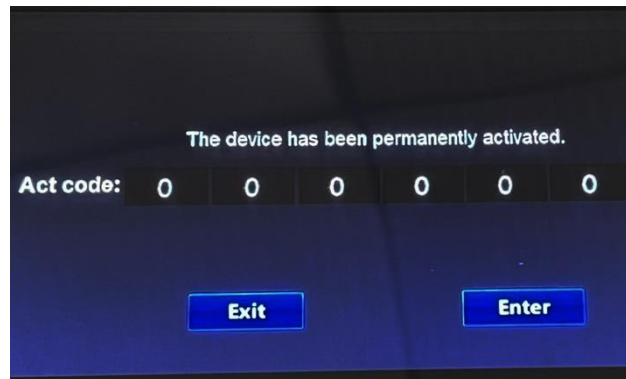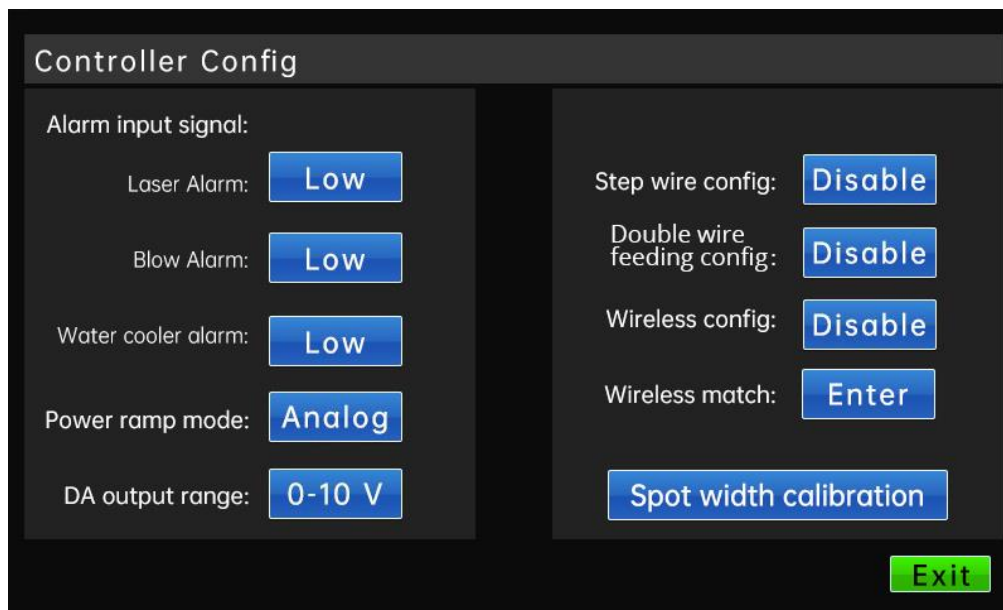

"Restore factory settings": The device is restored to the factory state.

"System restart": Restart the device.

2.3 Controller configuration interface

The password for entering the controller configuration interface is '2000'.

Click the controller configuration button on the homepage and enter the password to enter the control configuration interface. You can configure some functions and parameters of the controller.

Alarm input signal: Configure the corresponding alarm signal as a high-level alarm or a low-level alarm. The system defaults to a low level alarm and supports two IO port input signals, namely, the laser alarm input signal and the air pressure alarm input signal.

Analog output range: You can select the analog voltage output range of the controller, and adapt to different lasers by changing the output range.

Stepping wire feeder configuration: Choose to enable or disable the stepping wire feed (users who use our MARS9000 series wire feeder, please set this option to enabled).

Double wire feeding configuration: Choose to enable or disable the double wire feeding (users who use our MARS5000-D series wire feeder, please set this option to enabled).

Wireless controller configuration: Choose to enable or disable the wireless communication module (users who use our HW970 series handheld laser welding head, please set this option to enabled).

Wireless controller matching: To communicate and match with the wireless control module. This button is available when the wireless controller is configured as "Enable".

2.4 Welding work interface

After the system is powered on, it will enter the welding work interface by default, as shown in the figure below:

The welding work interface is the most commonly used interface for users. Under this interface, users can set parameters, turn on/off enable control, switch working modes, and light emitting methods.

Output power of the welding head = laser power x peak power x PWM duty cycle

Click the "LaserMd" button to switch the light emitting mode.

Continuous light: After turning on the laser enable, when the light-emitting conditions are met, the light can be continuously emitted by pressing the light-emitting switch of the welding head, and the light can be turned off by releasing the light-emitting switch.

Point shot light: When the light is spotted, after the laser enable is turned on, the

light will be emitted only once per press. The light emission time is determined by the spotting time. If you need to spot the light again, you need to release the switch and press the light switch again.

Scaly welding line: after the laser is enabled, the light emitting conditions are met, the light spot swings slowly to achieve the effect of scal pattern.

The enable button has an indication function. The closed and open states are as shown in the figure below:

Turn off enable

Turn on enable

Enable and switch control buttons:

"Red light indicator" button: Turn on/off the red light indicator.

"Spot enable" button: Turn on/off the light spot swing.

"Light emitting mode" button: Set the light emitting mode of "continuous"\"spot shot".

"Laser enable" button: turn on/off the laser enable, only the laser enable is turned on can light be emitted.

"Wire feed switch" button: Turn on/off the wire feed.

"Wire feeding mode" button: can switch between inching wire feeding and automatic wire feeding. When the wire feeding is inching, the wire feeding switch must be pressed continuously before the wire feeder moves, and the wire feeding switch stops when the wire feeding switch is released. During automatic wire feeding, if the wire feeding is turned on, the wire will be fed automatically during the light emitting process, and the wire will stop automatically when the light is stopped.

"Wire feeding direction" button: It can be switched to wire feeding and wire return. In the automatic wire feeding mode, the wire feeding direction is "Wire feeding" and cannot be modified.

Description of welding interface parameters:

"scanning frequency": Set the oscillation frequency of the galvanometer motor of the gun head. The higher the scan frequency is set, the faster the light spot moves. This parameter is limited by the scan width parameter:

Scanning width≤2mm, scanning frequency≤600HZ;

2mm＜scanning width ≤3mm, scanning frequency ≤400HZ;

3mm＜scanning width≤4mm, scanning frequency≤350HZ.

"Scan width": set the beam swing width;

"Blowing before light": Set the delay time of blowing out before light is emitted;

"Blowing after turn off light": set the blowing delay time after turning off the light;

"Peak Power": The maximum power during stable light emission.

"PWM frequency": Adjust the frequency of the PWM pulse signal of the laser.

"PWM Duty Cycle": Adjust the duty cycle (pulse width) of the PWM pulse signal of the laser. The power of the welding head is adjusted by the peak power and the PWM duty cycle.

Welding head output power = laser power * peak power * PWM duty cycle.

"Wire feed speed": Set the running speed of the wire feeder.

"Blow before light emitting": Set the delay time of blowing before light is emitted.

"Blow after light off": Set the delay time for blowing after light off.

Light emitting must meet the following 5 conditions at the same time:

Turn on the laser enable;

The LA-ON-pin of the controller is connected to the metal welding workpiece through a wire (refer to the device wiring chapter);
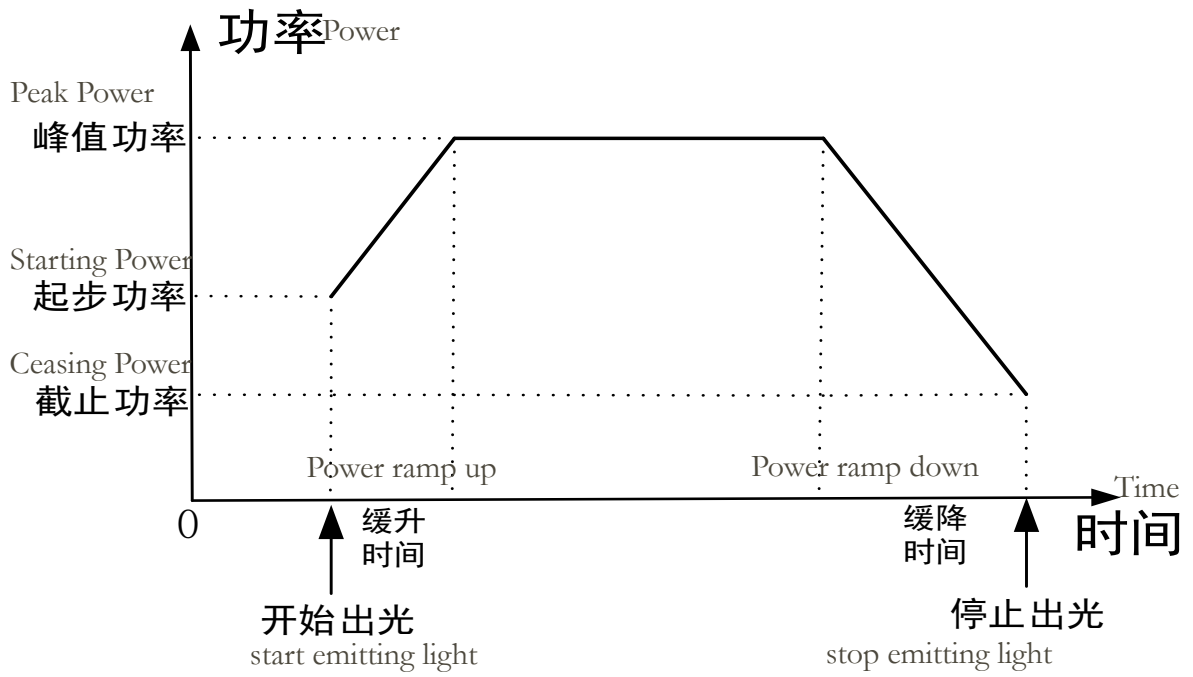
The tip of the gun contacts the metal welding workpiece;

Press the light control switch of the welding gun;

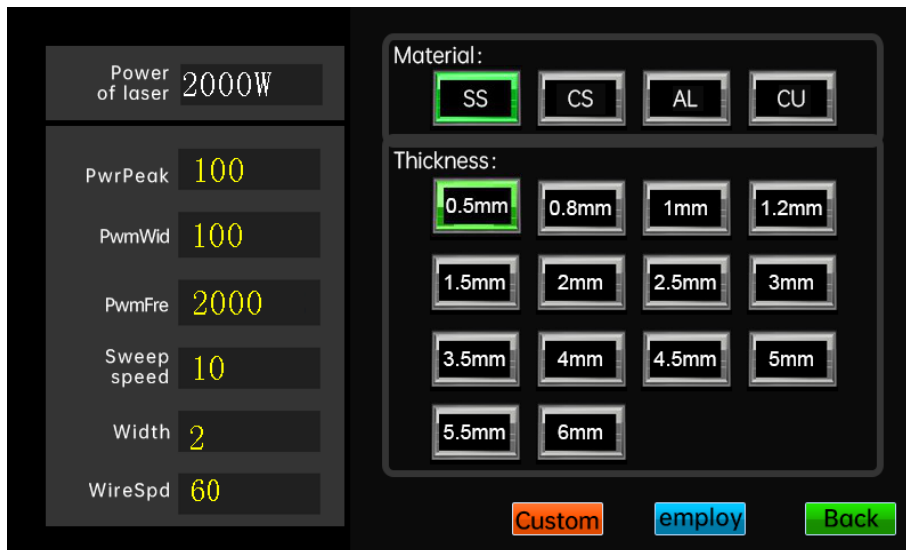**The device currently has no alarms.**

In the case that the laser can work normally, the light cannot be emitted when one of the above 5 conditions is not met.

The process of power change during light emission is shown in the following figure.

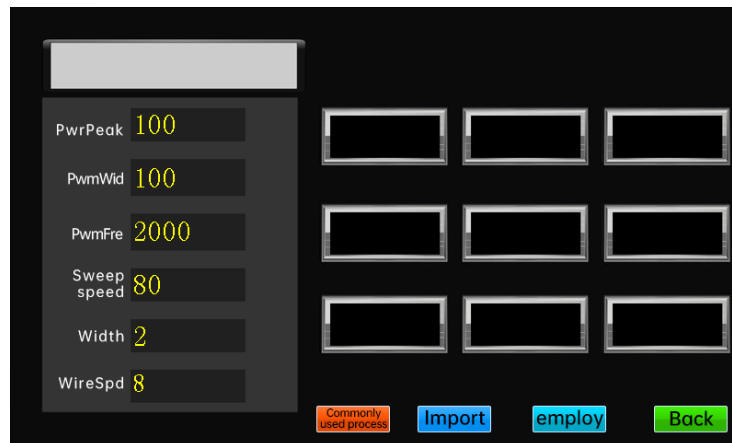Schematic diagram of power changes

2.5 Common process interface

Click the "PARAM" button under the welding interface to enter the process selection interface.

The process interface can store 4 materials, 18 thicknesses, and 6 types of processes. After selecting a group of processes, click "Apply" to directly export the process parameters of this group to the welding work interface. Click "Customize" to enter the custom process interface. The process parameters under the process interface can be permanently saved even in the power failure situation.

## 2.6 Customized process selection interface

Click the "Customize" button under the common process interface to enter the process selection interface.

The customized process interface can store 9 groups and 6 types of processes.

After selecting a certain group of processes, click "Apply" to directly export the process parameters of this group to the welding work interface. Click "Import" to store the parameters of the welding interface into this group of processes. The process parameters in the process interface can be permanently saved even in the power failure situation. Users can input the process name to identify different process parameters.

2.7 Advanced parameter description
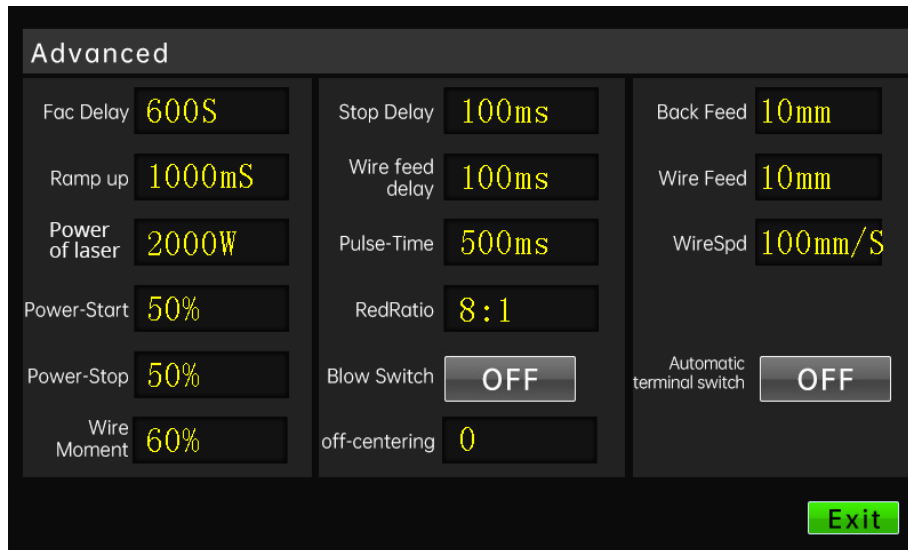
The password for entering advanced parameters is 2000. The explanation and description of the advanced parameters of the handheld welding control system are listed below. Users can set appropriate parameters according to actual needs during use.

1) Fac delay:

When the laser enable is turned on, after stopping the light, the motor stops rotating after this period of delay. The maximum stop delay is 999s.

2) Power ramp up

Set the power ramp-up delay (the time required for the output power to rise from the starting power to the peak power);

3)Laser power

Set the power of the laser.

4) Power ramp down

Set the power slow-down delay (the time it takes for the output power to drop from

the peak power to the cut-off power).

Note: Only the system with optional wireless control module has the power slow down function!

5) Power start:

Show the power when the light starts.

6) Power off:

Show the power when the light is stopped.

7) WireMoment:

If the control system is equipped with a stepping wire feeder, the torque of the stepping wire feeder can be adjusted according to the load of the stepping wire feeder.

8) Stop delay:

After setting the light-off delay time, the light will not be turned off immediately after releasing the off switch of the welding head, but the light will really stop after the light-off delay period. Use the time of the light-off delay to realize that the welding wire is separated from the workpiece after the light is stopped.

Note: The light-off delay time is up to 500ms. When the light-off delay time is set too long, please confirm that the light has been stopped before placing the welding head to prevent laser damage.

9) Pulse-Time:

Set the light emission time in burst mode, the maximum burst time is 1000ms.

10) Blow switch

Open/close solenoid valve

11) Offset

Adjust the lateral offset of the optical core

12) Back Feed:

After the light is stopped, the welding wire will automatically return to a certain length, which is convenient for the next welding. The length of the wire back is determined by the set parameters.

13) Off light wire feeding delay

After the completion of the light off and wire return action, the wire feeder will feed the wire again after this delay.

14) Off light wire feeding

When the light off wire feeding delay is completed, the length of the wire feeded by wire feeder is determined by this parameter to facilitate wire breakage.

15) Off light wire feeding speed

After the light emission ends, the running speed of the back feed and off light wire feed.

16) Automatic wire breakage

With this option on, there is a wire breakage action at the end of each wire feeding and light output. With this option off, there is no wire breakage action at the end of each wire feeding and light output.

3. Equipment alarm and treatment

3.1 Device alarm

If the alarm is not cleared, the red indicatorr light will flash. The red indicator light will only disappear after all alarms are cleared (currently no alarms), as shown in the following figure:

Alarm is not cleared   Alarm cleared

3.2 Solutions to the warning

Once the equipment is alarmed, the user must stop using the handheld laser welding equipment immediately, troubleshoot the fault. Use it only after the fault is resolved. Users can refer to the alarm information in the alarm window to troubleshoot faults. The alarm information and solutions are shown in the following table:

S/N	Alarm information	Solution	Remark

1	Alarm Err-E001: The controller is not connected!	Check whether the RS485 communication line between the touch screen and the controller is properly connected, and check whether the controller is normally powered on and started.	
2	Alarm Err-B001: The air pressure is too low!	Check whether the air pressure is normal.	
3	Alarm Err-L001: Laser failure!	Check whether the laser is working properly.	
4	Alarm Err-W001: Wireless communication failure!	Check whether the green indicator light of the controller flashes normally, if the green indicator light is always on, plug and unplug the wireless receiver again.	This alarm is only for the optional wireless control module.
5	Alarm Err-S001: Wire feeder communication failure!	Check the communication line between the controller and the stepping wire feeder, and plug the communication interface again after power off.	This alarm is only for the optional stepping wire feeder.
6	AlertErr-S002: Stepping wire feeder driver alarm	Check the line connection between the motor and the drive, check whether the power supply voltage is at 24V.	This alarm is only for the optional stepping wire feeder.
7	Alarm Err-S003: Motor shaft lock failure!	After the power is off, check the line connection between the motor interface of the stepping wire feeder and the motor driver, and re-plug and unplug the motor terminal of the driver.	This alarm is only for the optional stepping wire feeder.
8	Alarm Err-C001: Chiller alarm!	Check whether the chiller works normally	
9	Alarm Err-All: There are many faults at present, please	There are many current faults, please troubleshoot them one by one.	

	check detailed fault information!		
10	There is no alarm when the equipment is running normally!	The current device is operating normally.	

4. Program update

## 4.1 Touch screen program update

Note: The U disk uses the USB2.0 interface and has a capacity smaller than 16GB. The format of U disk is FAT32.

Insert the USB drive with updated files into the USB interface on the back of the touch screen, wait for the screen to display the upgrading interface, wait for the program upgrade to complete, and then unplug the USB drive.


4.2 Controller program update

Click on the "Home" → "System Settings" → "System Upgrade" button to enter the controller update interface, as shown in the following figure
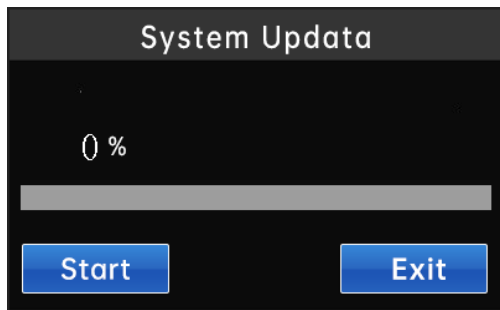
Please follow the steps below to update the controller program:

1. After inserting the U disk with the updateable file into the USB port of the controller, click the "Start Update" button. If an updateable file is detected, the automatic update program will start. If there is no updateable file in the U disk, it will prompt "No updateable file detected";

2. The progress bar indicates the current update progress. After the program update is completed (100%), follow the prompts to remove the U disk and restart the system;

3. If the update fails, you can click the "Start Update Button" again.
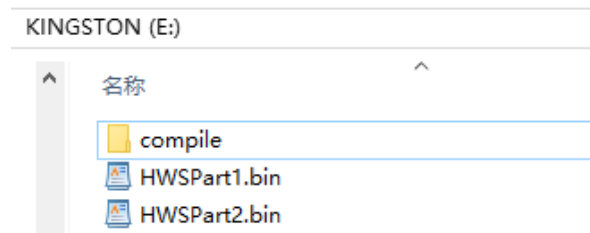
Notice:

1) The update files of the touch screen and the controller should be placed in the root directory of the U disk, as shown in Figure 5-3. Among them, "compile" is the update file of the touch screen, and "HWSPart1.bin" and "HWSPart2.bin" are the update files of the controller. The user must not change these two file names, otherwise the program cannot be updated!

2) It is recommended to use a FAT32 format USB flash drive for updating the program. (After entering the U disk catalog, right-click "Properties" to view the format of the U disk, as shown in the figure below.)