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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.

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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 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. Handheld laser welding solves the existing welding problems such as poor welding of corners, insufficient welding, post-processing of welds, unsightly welds, and so on. It is 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 directly at the laser emitter port even if you wear 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, collimation module, galvanometer module, wireless control module, focusing module, protective mirror module and nozzle module.

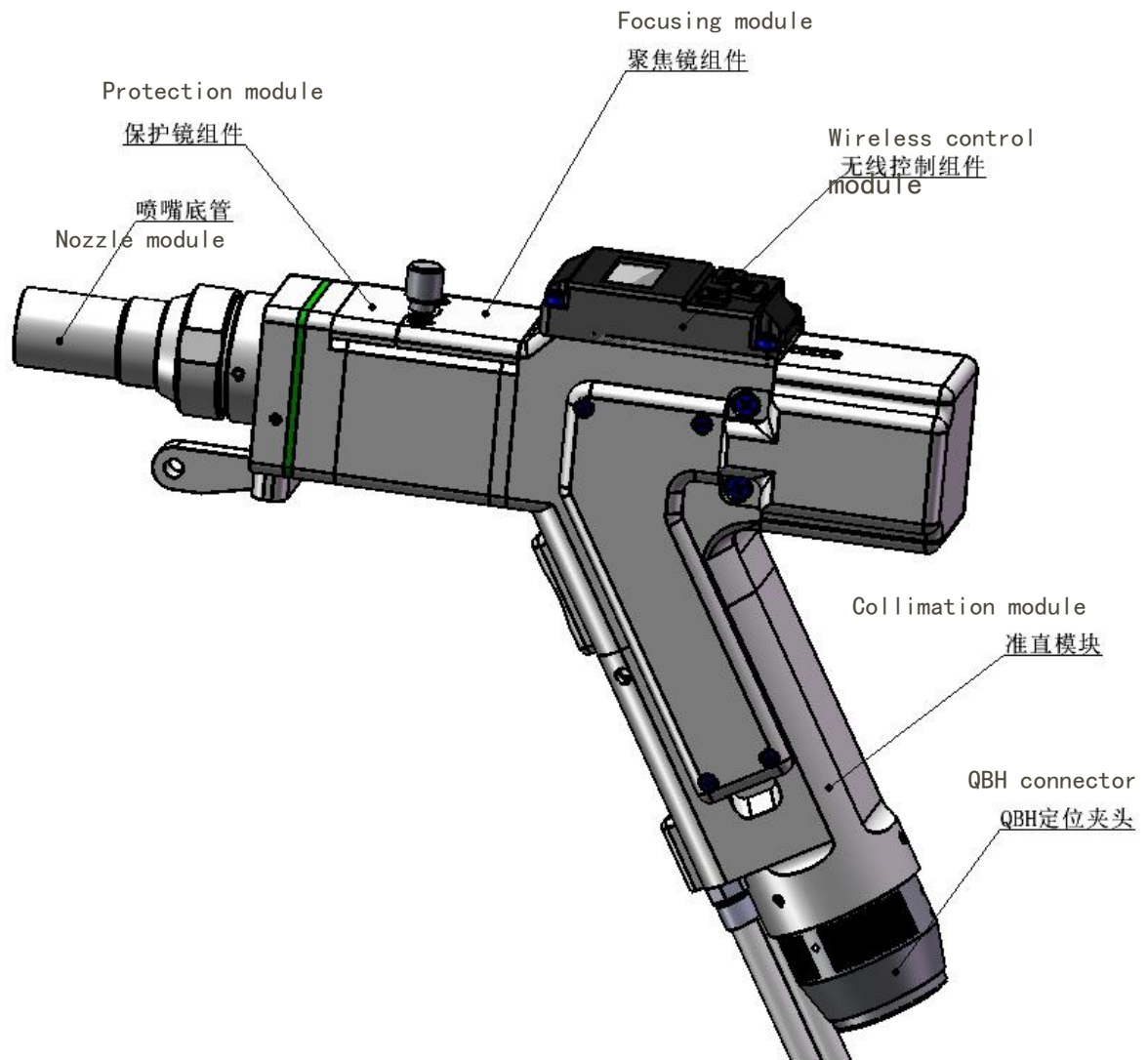


Figure 2 - Structure of HW970

- QBH connector: complete the access and lock of the optical fiber connector.
- Collimation module: complete the fiber collimation function and collimate the incident laser into a parallel beam.
- Galvanometer module: 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 module: quickly adjust some high-frequency parameters.
- Focusing module: Focus the reflected beam into a convergent beam with high power density.
- Protection module: The protective lens can protect the focusing lens from the damage of returning slag and prolong the service life of the focusing lens.
- Nozzle module: 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 grip
- Adjustable spot size, high welding firmness, and beautiful lines
- Wireless control module, quick adjustment of parameters, one key 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 index
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 checklist

Product name	Quantity
Handheld laser welding head	1set
Spare copper nozzle	4pcs
Spare protective lens	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 first, 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

Waterway 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

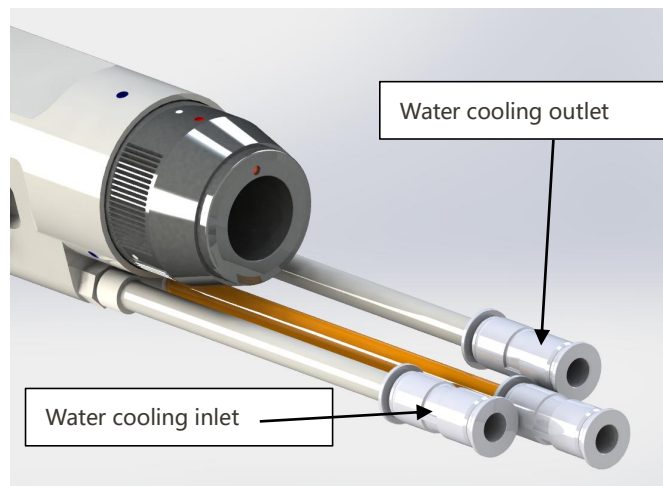


Figure 3 HW970 water cooling interface

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
Passable particle size	Less than 200 microns in diameter

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.

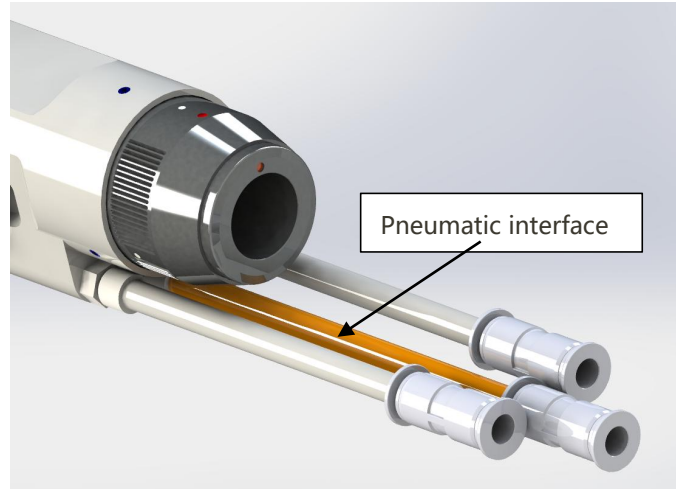


Figure 4 HW970 pneumatic interface

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

Optical fiber interface

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.

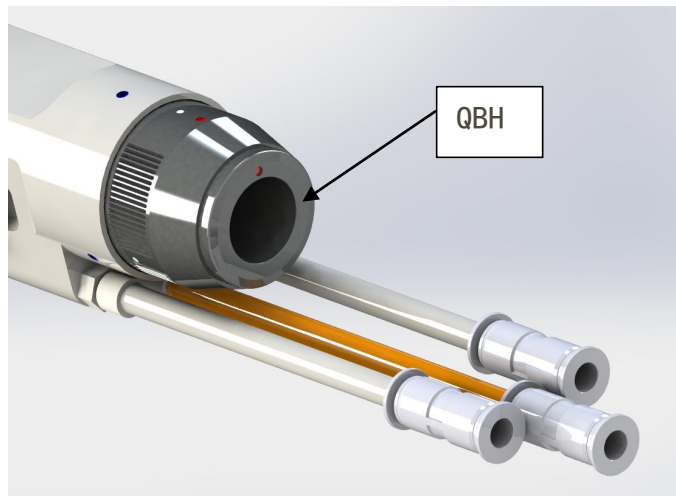


Figure 5 HW970 optical fiber input interface-QBH



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 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.

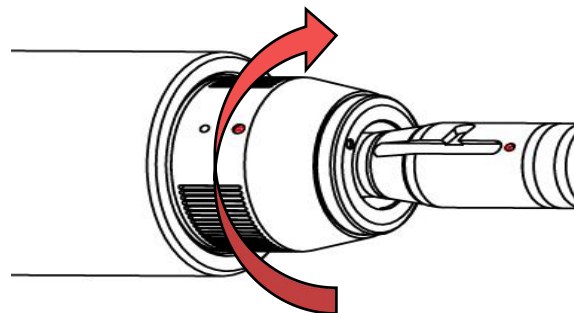


Figure 6 HW970 QBH fiber optic connector insertion and locking diagram

Beam focusing

Adjust the 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:

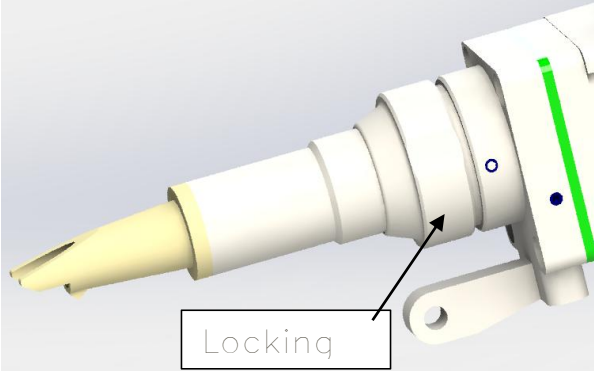


Figure 7 HW970 Focus position adjustment knob

Spot center adjustment

Adjust the light spot to the horizontal center position of the nozzle. Adjustment method: power on the HWS5000 galvanometer handheld welding system, set the "Width" to 0mm on the touch screen → click "advanced parameters" → enter the password "2000" → click "login" → 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

Cleaning and 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 protective lens at the front of the welding head to protect the focusing lens. When impurities or foreign matters are attached to the protective lens, the lens will be damaged. Therefore, the lens needs to be maintained regularly. It is recommended to check it before each use. Please refer to Figure 9 for lens structure.

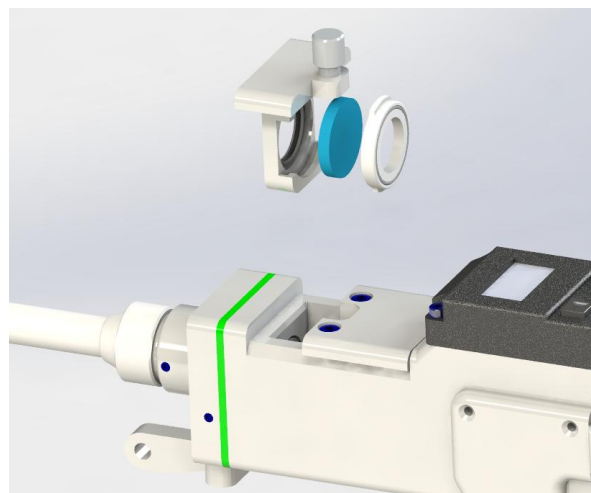


Figure 9 HW970 protective mirror module split diagram

■ Lens cleaning tools:

Dust-proof 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.

Removal and installation of lens

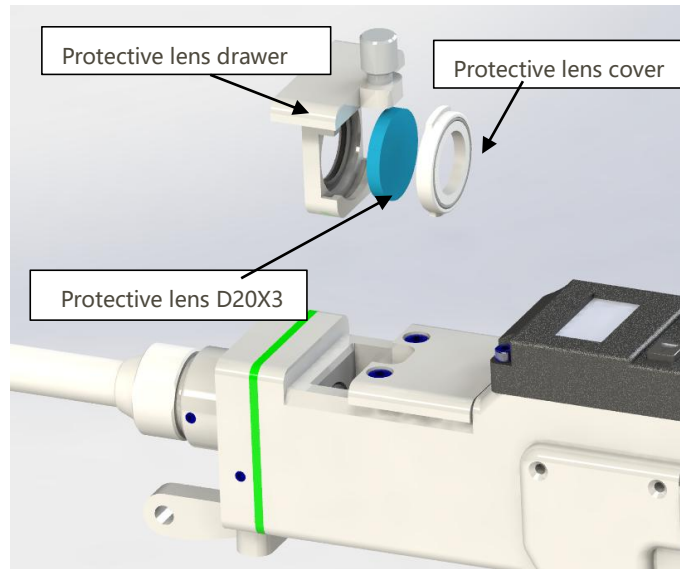
The entire process must be completed in a clean place, and dust-proof gloves or finger cots must be worn when removing and installing the lenses.

■ 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 lens holder back into the welding head, and tighten the locking screw.



Picture 10 HW970 protective lens split diagram

■ Disassembly and assembly of the upper protective lens 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 lens: carefully remove the D20.55 sealing ring, and take out the protective lens 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.

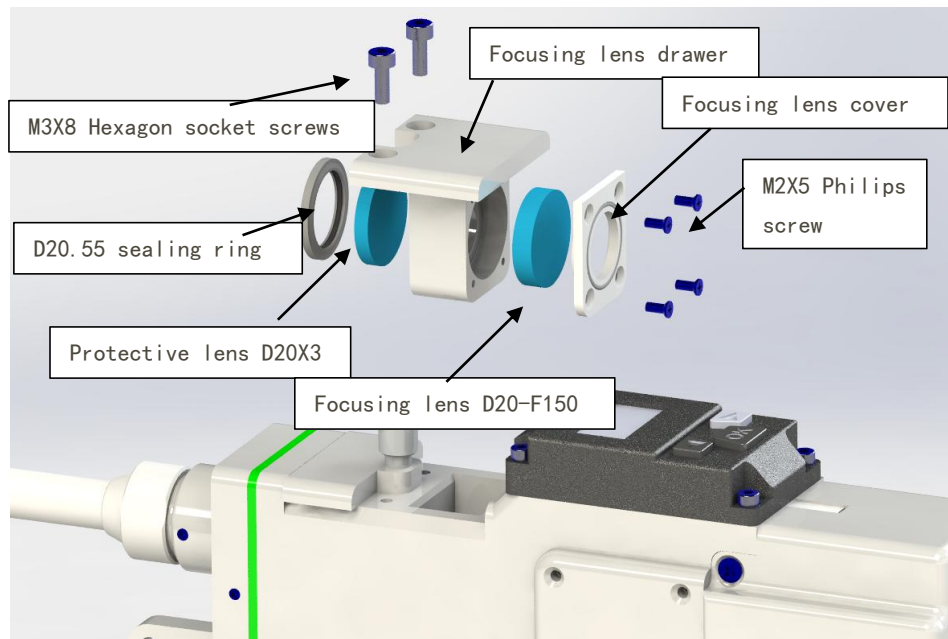


Figure 11 Split diagram of upper protection lens and focusing lens on HW970

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.

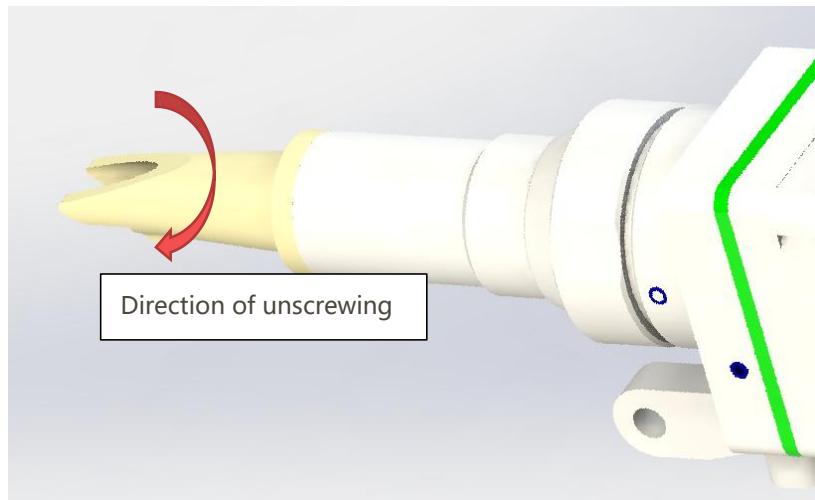


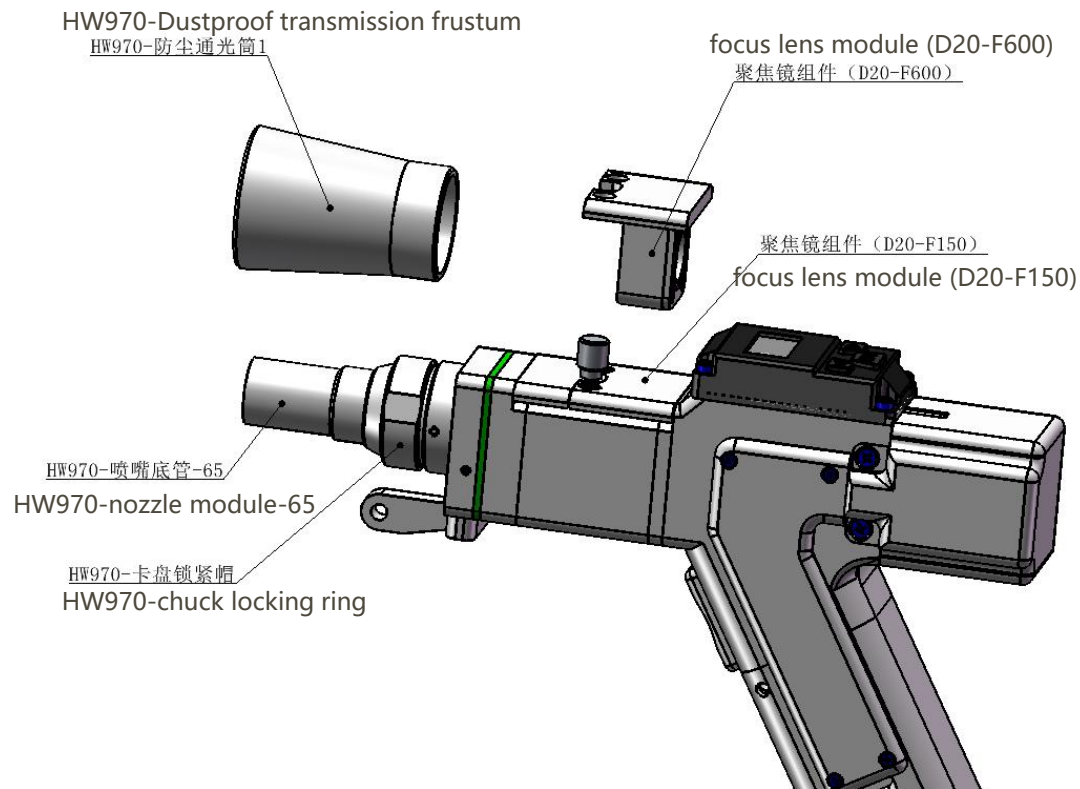
Fig. 12 diagram of nozzle replacement

Switching to cleaning mode

Replace with cleaning parts

Replace the nozzle module and chuck locking ring 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.

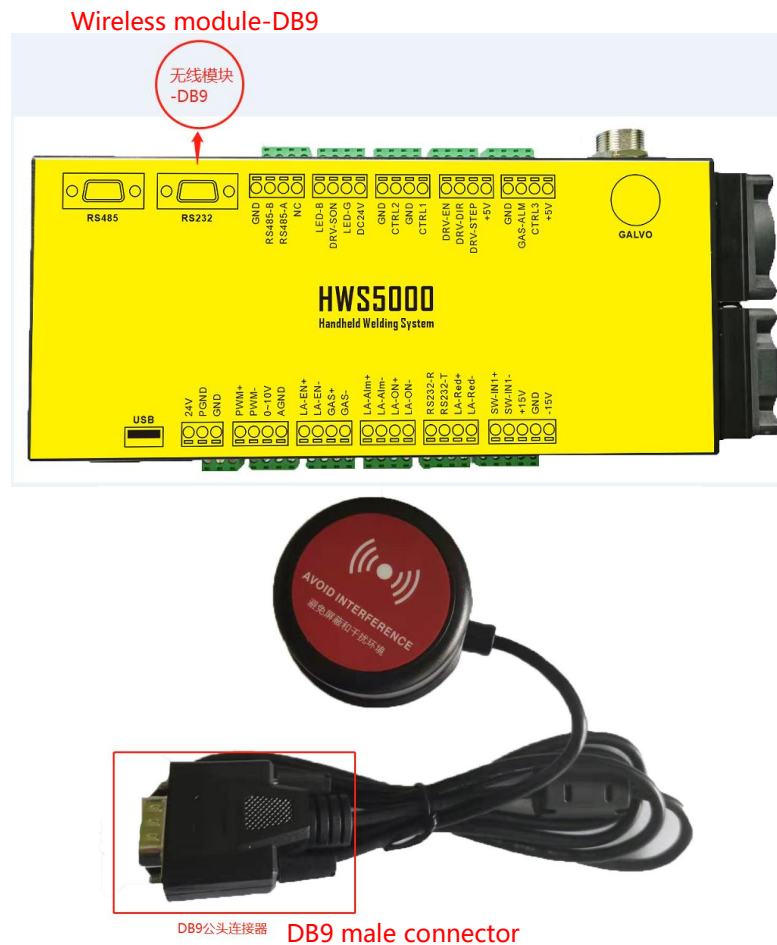


After switching to the cleaning mode, the light can be emitted only when the ground wire clamp is clamped on the wire feeding assembly.

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



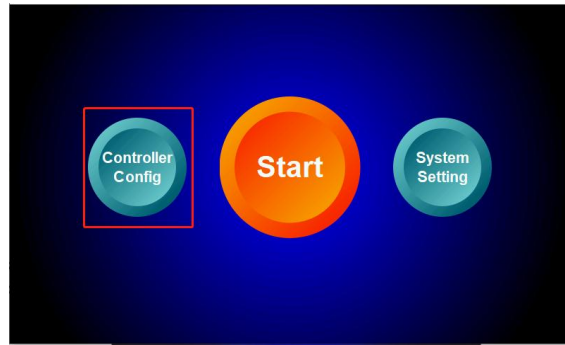
The wireless receiving module is inserted into the DB9 female socket of the controller through USB

Touch screen interface operation

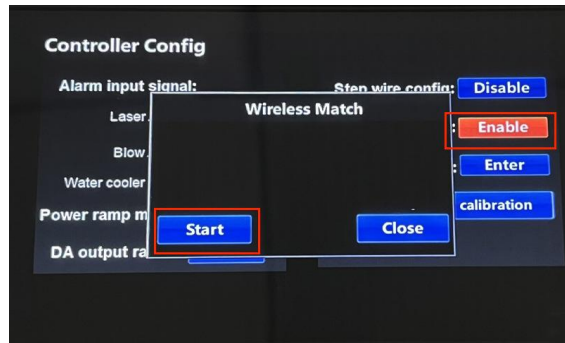
1. Click the "Home" button



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

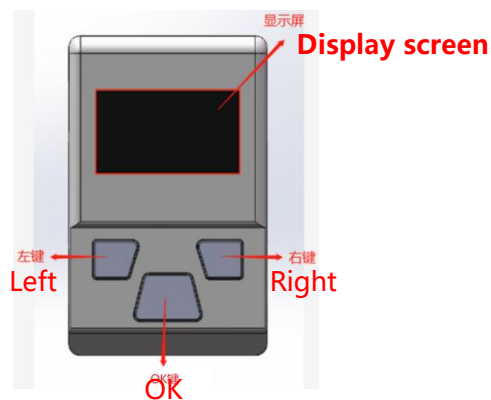


3. Check "enable" to turn on the wireless control function of the welding head. The wireless communication address needs to be consistent with the communication address of the wireless controller on the welding head.



Instructions for Handheld Welding Wireless Control Module

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~~)

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

Matters needing attention

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

Manual for adjusting the spot size of the handheld laser welding head

Set "Sweep speed". The larger the parameter setting, the faster the spot swing frequency.

Set "Width". The larger the parameter setting, the greater the swing amplitude of the spot.

Turn on the "Fadndex". the light spot swings according to the " Sweep speed" and "Width". Turn off the light spot enable and the spot stops swinging.

