Manual of Handheld Fiber Laser Welding Machine

Shanghai FLAMA Welding Equipment Manufacture Co., Ltd.

1. Foreword

1.1 Acknowledgement

Thank you for using the handheld fiber laser welding machine manufactured by Shanghai FLAMA Welding Equipment Manufacture Co., Ltd. Please read the Manual as well as contents marked with "Danger", "Warning" and "Caution" therein carefully before using the product for the very first time, in order to use it safely and correctly.
[Danger] means the failure to follow the correct operation may immediately result in serious personal injury or even endanger lives.
[Warning] means the failure to follow the correct operation may result in serious personal injury or even endanger lives.
[Caution] means the failure to follow the correct operation may lead to serious personal injury or equipment damage.

1.2 Company Profile

Founded in 2008, Shanghai FLAMA Welding Equipment Manufacture Co., Ltd. is a high-tech enterprise that integrates R&D, production, sales and services of welding equipment.

Located at Zhoupu Intelligent Industry Park, Pudong New Area, Shanghai, the Company has established its subsidiary Shanghai Zongrong Electric Appliance Co., Ltd. and modern plants and offices sized 25,000m^2 and employed over 300 employees.
The Company's Flama welding machines have passed National CCC electrician safety compulsory authentication, EU CE authentication and CSA authentication, etc. We have exported our products worldwide and established strategic cooperation relationship with partners all over the world, such as USA, Indonesia, Turkey, Brazil, Russia and Portugal.

With focus on offering key technical supports, targeted and personalized system integration solutions for Industry 4.0 and future factory, the Company helps enterprises realize intelligent manufacturing, improves work efficiency through intelligent manufacturing and makes manufacturing intelligent.

1.3 Corporate Culture

- **The Vision**

We endeavor to take the lead in China's welding manufacturing industry, produce branded welding machines with advanced techniques and professional services, and provide customers with high-quality services that integrate technology, sales and services.

- **The Mission**

Adhering to the service tenet of "user orientation, harmony, provision of safe, economic, comfortable and high-quality" welding cutting, the Company wins trust from global users.

- **Company Slogan**

High casting and welding quality

2. Overview

2.1 Model Introduction

HLW-F1500
HLW-F2000
HLW-F3000

HLW-YT800
HLW-A1500
HLW-A2000

Water-cooled Series

Air-cooled Series

- The handheld laser welding machine (the Equipment) developed by the Company features small size, compact structure and easy relocation.
- With such characteristics as easy handling, fast welding, smooth and stylish welds, the Equipment applies to nonferrous welding in sheet metal processing industry, to replace the traditional argon arc welding and YAG welding.
- With both spot welding and continuous welding supported, the Equipment applies to processing of small-batch and multi-type products; high-speed welding of long welds.

2.2 Scope of Application

The Equipment widely applies to the industries such as advertisement, chassis cabinet, decorative lighting, metal furniture and external metal processing.

2.3 Model Characteristics

- Easy operation and handling.

- The continuous welding mode can ensure smooth welds without fish scale, and eye-pleasing welding without crater, to reduce follow-up polishing processes.
- Small heat affect zone of welding, good welding quality and small workpiece deformation.

Comparison between handheld laser welding and argon arc welding		
	Laser welding	Argon arc welding
Welding spot/weld joint	Eye-pleasing and free of crater	Crater, deformation, grinding required
Workpiece deformation	None	Frequent
Consumables	Protective gas, protective lens (welding wire)	Welding wire, tungsten needle, protective gas
Operation	Easy to learn	High difficulty, skilled worker required
Efficiency	High	Low

2.4 Machine Parameters

2.4.1 Parameters of HLW-FXXXX Water-cooled Laser Welding Machine

S/N	Item	Parameters
1	Laser generator	GW 1500W
		GW 2000W
		GW 3000W
2	Optical fiber length	10m
3	Laser welding head	Single-axis wobbling welding head
4	Cooling water tank	Special use for laser
5	OS	Button + knob

Model	HLW-F1500	HLW-F2000	HLW-3000
Laser type	Optical fiber laser device	Optical fiber laser device	Optical fiber laser device
Laser wavelength	1075±10 nm	1075±10 nm	1075±10 nm
Peak power	1500 W	2000 W	3000 W
Working mode	Continuous/pulse/customized pulse mode	Continuous/pulse/customized pulse mode	Continuous/pulse/customized pulse mode
Output beam quality	BPP≤1.5 50 μm optical output	BPP≤1.5 50 μm optical output	BPP≤1.5 50 μm optical output
Cooling method	Water cooling	Water cooling	Water cooling
Core diameter/optical fiber length	50 μm/10 m	50 μm/10 m	50 μm/10 m
Shielding gas	Argon/nitrogen	Argon/nitrogen	Argon/nitrogen
Power supply	220 V±10% 50/60 Hz AC	380 V±10% 50/60 Hz AC	380 V±10% 50/60 Hz AC
Total power	5.9 KW	7.5 KW	10.0 KW
Coolant pressure	5-6 bar	5-6 bar	5-6 bar
Outline of main engine	L750*W600*H1000	L750*W600*H1000	L960*W600*H1000
Total weight	118 kg	136 kg	152 kg

Ambient temperature	5-45°C	5-45°C	5-45°C
Welding thickness	0.8-4.0 mm	0.8-6.0 mm	0.8-8.0 mm
Applicable materials	Carbon steel/stainless steel/galvanized plate/aluminum plate	Carbon steel/stainless steel/galvanized plate/aluminum plate	Carbon steel/stainless steel/galvanized plate/aluminum plate
Welding joint	≤ 0.5 mm	≤ 0.5 mm	≤ 0.5 mm

2.4.2 Parameters of HLW-AXXXX Air-cooled Laser Welding Machine

Model	HLW-YT800	HLW-A1500	HLW-A2000
Laser type	Optical fiber laser device	Optical fiber laser device	Optical fiber laser device
Laser wavelength	1070±10 nm	1070±10 nm	1070±10 nm
Peak power	800 W	1500 W	2000 W
Working mode	Continuous/tempering	Continuous/tempering	Continuous/tempering
Operating temperature	10-45°C	10-45°C	10-45°C
Cooling method	Forced air cooling	Forced air cooling	Forced air cooling
Core diameter/optical fiber length	20 μm/5 m	25 μm/10 m	25 μm/10 m
Shielding gas	Argon/nitrogen	Argon/nitrogen	Argon/nitrogen
Power supply	220 V±10% 50/60 Hz AC	220 V±10% 50/60 Hz AC	220 V±10% 50/60 Hz AC
Total power	3.0 KW	4.5 KW	5.5 KW
Total weight	38kg	48kg	56kg
Outline of main engine	L680*W360*H680	L680*W360*H680	L770*W360*H680

Appearance of air-cooled main engine

3. Safety Instructions and Preventive Measures

Please read the safety precautions carefully, in order to operate the Equipment correctly and safely, for it belong to Class 4 laser product that can generate diffuse reflection, lead to personal injury or fire hazard as per China national standard GB7247.1-2001(EN60825-1:2014+A11:2021).

The Equipment conforms to the standards set forth in *Electrical Safety of Laser Equipment and Installations* (GB 10320—1995(EN60204-1:2018)). Beyond that, it conforms to EN IEC 61000-6-2:2019 and EN IEC 61000-6-4:2019 standards, and users should read the contents in the safety section carefully before use

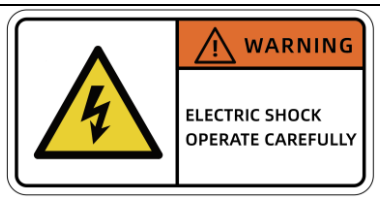
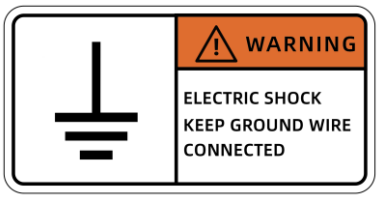
3.1 Safety Precautions

⚠ WARNING	
	**Please wear safety goggles.** Please wear safety goggles before using the Equipment. Direct laser radiation may still lead to blindness even if protective goggles are worn.
	**Direct laser radiation to skin is prohibited.** Direct laser radiation may lead to major burning of skin.
	**Do not touch the workpiece amid welding or instantly after welding is done.** The workpiece can be hot in the conditions above.
	**Use the specified cable only** Unauthorized cable or poor connection may lead to fire hazards.
	**Do not damage the optical fiber, power cable and connection wires.** Do not step on, stretch nor twist the optical fable, power cable and connection wires. Otherwise, it may lead to optical fiber damage, short circuit or fire hazard. Please contact us when repairing is required.
	**For any fault, please power off and stop using the Equipment immediately.** For any burning, abnormal sound, overheat or smoke, please power off the Equipment immediately; otherwise, electric shock or fire hazard may occur. Please contact us in the cases above.

	**Grounding** If not grounded, electric shock may occur in case of a fault.

	**Use protective device** Laser is harmful to human body. Some protective devices (such as materials which can absorb laser and have resistance to heat and radiation) can be used for preventing laser scattering.
	**Personnel carrying cardiac pacemaker should not approach the welding machine** Unless otherwise permitted by doctor, the personnel carrying cardiac pacemaker should not approach the welding machine at working status, or have activity around the welding machine.
	**Do not spray water on the welding machine** Otherwise, the welding machine may have short circuit or fire.
	**Put the welding machine horizontally and safely** Personal injury or machine damage may occur when welding machine falls down.
	**Do not put container that has water on the welding machine** Electric shock or fire may occur when water is splashed on the welding machine
	**Keep away from inflammables** The inflammables can be ignited by spatters.
	**Do not have laser irradiation to inflammables** Avoid laser irradiation to inflammables to avoid a fire hazard
	**Do not cover the welding machine with carpet or cloth** It is forbidden to cover carpet on the welding machine while using it (to avoid fire hazard).
	**Do not use the welding machine for other purposes other than metal welding** Otherwise, electric shock or fire hazard may occur.
	**Wear protective devices** Make sure to wear protective articles such as goggles, protective gloves, long-sleeved jacket and leather apron while implementing welding; otherwise, the spatters may lead to injury of eyes and skin.
	**Arrange fire extinguisher near the welding machine** Place the fire extinguisher near the welding machine just in case.
	**Regular maintenance** The welding machine should undergo regular maintenance to prevent potential hazards.

3.2 Warning Identification

S/N	Warning identification	Description of warning identification
1		Laser output window, do not stare at nor touch the laser beam, to avoid direct laser or radiation
2		High-voltage power supply, be aware of electric shock!
3		Equipment must be grounded reliably!
4		Be aware of finger jam
5		Please read through the Manual before use, and follow it while operating the Equipment!

6		Make sure to wear safety goggles before operating the Equipment!
7		Opened by professional technicians only!
8		Emergency stop mark!

3.3 Safety management warning

1) Do not stare at nor touch the laser beam (whether safety goggle is worn or not). Keep eyes and skin away from the Equipment's output laser or diffuse laser; otherwise, blindness or burning may occur!

2) The Equipment is prohibited to be dismantled, repaired or altered by the non-professional personnel; otherwise, the users shall bear liabilities for the consequences such as electric shock and fire hazards. Provide education on safety knowledge to field operators and guide the production process. Do not perform other operations other than maintenance specified in the Manual.

3) Please use the specified power wires and cables; otherwise, the power wires and cables with insufficient capacity or improper wiring may lead to fire hazards or electric shock.

4) The power supply must be provided with the third-party grounding; otherwise, we do not bear liabilities for the possible electric shock due to a fault or electric leakage.

5) Personnel carrying cardiac pacemaker should keep away from the Equipment; otherwise, the Equipment may generate magnetic field and affect the normal functioning of cardiac pacemaker.

6） Never use the Equipment for occasions other than metal processing.

7） Places with direct laser or indirect radiation should be clearly distinguished with other areas with a baffle, pasted with safety warning to prevent access of irrelevant personnel. The laser output port should not directly face human body or combustibles when power is on.

3.4 Notice of laser safety and operation safety

Designed with sealed laser path, the Equipment can prevent leakage of laser radiation effectively. The Equipment's operation precautions are as follows:

1) Do not supplement any part or object in the Equipment while it is running normally. Do not run the welding system while cover is opened.

2) Do not touch the spare parts unrelated to maintenance during maintenance and laser output, but use heat-resistant laser absorbers and diffusers to prevent laser leakage.

3) Make sure to wear safety goggles and gloves during laser processing. Do not point the laser gun at human body and eyes when the Equipment is powered on. Please wear gloves when touching the workpiece at the completion of processing, for the workpiece is still hot.

4) It is forbidden to use the Equipment along with high-pressure arc welding equipment.

3.5 Electrical Safety

1) Do not damage the power wire and cable. Do not step on, twist or pull the cable. Any cable damage may lead to electric shock, short circuit and fire hazard.

2) For any scorched flavor, abnormal sound, overheat or smoke, please power off the Equipment and contact us immediately; otherwise, electric shock and fire hazard may occur.

3) Avoid foreign matters in the Equipment, especially metal or conductive materials, to prevent short circuit or fault.

4) Do not use the Equipment in humid places; otherwise, the electrical parts may have electric shock or short circuit when meeting water.

5) Please power off the Equipment when it is idled.

3.6 Material Safety Notice

1) Wipe off the external dirt of system with dry cloth or slightly wet cloth. Where necessary, wipe it off with diluted neutral detergent or alcohol. Do not use special solvent or gasoline; otherwise, structure deformation or surface discoloration may occur.

2) Do not place container that has liquid onto the case. Sprayed water may damage the insulation and corrosive liquid may corrode the Equipment.

3.7 Fire Safety

1) Do not stack inflammables, explosives and sundries around the Equipment. The splashed sparks during welding may lead to fire hazards when meeting consumables.

2) Do not put inflammables and explosives on optical path or the irradiation range of laser beam. Fire hazard or explosion may occur when laser beam is irradiated on the inflammables and explosives.

3) Do not cover the Equipment with textile such as carpet and cloth during operation, to avoid a fire hazard due to overheat.

4) For any fire or explosion of the Equipment, be sure to cut off all power supplies and put out fire with carbon dioxide or dry powder extinguisher; or use dry sands to put out the fire.

3.8 Operation Precautions

1) Assign relevant specialists.

The relevant specialists must have the relevant knowledge and experience of laser and the Equipment. The specialist should guide the operators to use the Equipment and teach them with relevant safety knowledge.

2) Establish special laser welding area.

The relevant responsible personnel should establish the special laser welding area (separated from other working areas with devices such as fence); meanwhile, set up "staff only" marks at the welding area.

3) Install the Equipment horizontally and firmly and avoid tilting.

4) The HLW-FXXXX series water-cooled laser welding machine should be used in places with ambient temperature of 5°C-45°C, humidity not above 85%; the ambient temperature should have no major fluctuation. HLW-AXXXX series air-cooled laser welding machine applies to the ambient temperature of 10°C-45°C. It is forbidden to use the Equipment in the places with:

- dust and oil dirt.
- corrosion.
- humidity.
- vibration.
- electromagnetic interference.
- high concentration of oxide of carbon, nitrogen and sulphur in air

Note: HLW-AXXXX air-cooled series laser welding machine does not apply to places with much dust.

5) When ambient temperature decreases under 0°C in winter, the water tank of HLW-FXXXX water-cooled laser welding machine can be damaged due to freezing. Therefore, the ambient temperature of water chiller should not be lower than 0°C in winter. Please drain the water in water tank when ambient temperature is reduced under 0°C.

6) Water vapor may be formed on module or lens due to dramatic change of ambient temperature, which may affect the Equipment's functioning. Therefore, dramatic change of ambient temperature should be avoided as far as possible. When water vapor is formed, please preheat the Equipment after startup.

7) Wipe off the dirt or water on the Equipment's case will dry or wet cloth. When failing to remove the dirt with cloth, clean the Equipment with neutral detergent or alcohol, instead of gasoline or paint thinner.

8) It is forbidden to put screws or coins inside or outside the Equipment, to avoid damages due to short circuit.

9) Please operate the button or knob gently. Do not operate them by force.

10) Press the button and switch once each time, instead of operating them continuously. Repeated switch on/off may affect the Equipment's service life.

11) Make sure to pull main switch to “off” position before connection of optical fiber, maintenance and debugging.

12) Take notice that the Equipment’s minimum welding thickness is 0.45mm. Due to the principle of laser welding, the crater may have small pores when being observed under microscope, but they will not affect the welding quality. However, it is not suggested to weld the large-diameter airtight parts.

13) The Equipment applies to welding of carbon steel, stainless steel, galvanized plate and aluminum; however, it does not apply to welding of copper due to its high reflection.

14) Do not bend the optical fiber below its min. bending radius. For details of the min. bending radius of optical fiber, please refer to the table below:

Model	Minimum bending radius
HLW-FXXX	R 200 mm
HLW-AXXX	R 150 mm

4. Equipment Installation

4.1 Installation Environment of Handheld Laser Machine

Safe Distance:

The Equipment's rear side should be 1.5m away from wall (for air exhaust and cooling of fan); the distance between nitrogen cylinder and the Equipment should not exceed 10m.

Power Source:

Specification 1: Single-phase, 220VAC/50Hz/60Hz, the capacity varies along with laser device type and capacity.

Specification 2: Three-phase, 380VAC/50Hz/60Hz, the capacity varies along with laser device type and capacity.

Quality: Three-phase unbalance<2.5%, line voltage fluctuation <5%. Single-phase 220V±5%.

Stabilized power supply is suggested: The stabilized power supply can ensure the stability of the Equipment's input voltage, to ensure good functioning of the Equipment and laser device.

The high-power electrical appliance should not pass through the stabilized power supply, to avoid disturbing the power output of laser device due to power change.

Grounding:

The Equipment should be provided with grounding protection, with grounding resistance not above 4Ω.

Environment Requirements:

The Equipment's ambient environment should be well-ventilated, free from dust, corrosion and water leakage. As the Equipment's core, the laser device, water chiller and control unit should not be disturbed by electromagnetic wave, such as arc welding and discharge processing machine, to avoid affecting the normal functioning of the Equipment and laser device.

Installation Foundation Table:

The Equipment should be installed on cement ground horizontally and firmly, with ground flatness of ±10mm, instead of being tilted.

Unloading:

The Equipment should be unloaded with 1t forklift. Make sure the Equipment is placed vertically upwards, with tilting angle not above ±10° to ensure smooth unloading, for the Equipment contains precise instruments.

Coolant:

Distilled water/deionized water/purified water, instead of mineral water or tap water, should be used as the cooling circulating water of HLW-FXXXX water-cooled laser welding machine. Adjust the temperature of water chiller according to the ambient temperature. The recommended set temperature of water chiller is 23°C – 26°C for GW laser device

Laser device condensation, which should be prevented, does not fall under the warranty scope.

The operating ambient temperature of HLW-FXXXX water-cooled laser welding machine should be above 5°C, for its coolant is water. When heating is not provided in workshop in winter, or workshop ambient temperature may be lower than 5°C.. Anti-freezing measures can minimize the damage to the Equipment accessories. Damage of laser device due to freezing is excluded from warranty.

Fire prevention:

The processing location should be at least 1 dry powder fire extinguisher and reserved with firefighting access to prevent the occurrence of fire hazards.

4.2 Construction Method of Reference Grounding

Purpose: The grounding resistance is not above 4Ω

- **Recommended method**

Purchase 3 grounding pins (specification: Copper-clad steel grounding pins; diameter: 20mm; length: 2m, copper layer thickness: 0.5). Insert 3 grounding pines vertically into the ground, keep a spacing over 5m between two pins, reserve the connection part above the ground only; connect the 3 grounding pins with 6mm 2 electric wire to form a grounding grid. Connect the grounding pin, which is at equipment side, to the Equipment through 6mm 2 electric wire.

1. The exposed part of entire grounding grid should be connected reliably; the grounding wire should have correct specification, intact painting, complete and eye-catching marks.

2. The quantity and position of connecting plate for temporary grounding wire should conform to the design requirements.

3. Test records: Measure the grounding resistance with a grounding resistance meter and it should not exceed 4Ω.

4.3 Standard Requirements of Gas Use

Argon or nitrogen can be used as the Equipment's protective gas, with purity ≥99.99% and flow≥15L/min.

1) Argon gas meter, as shown in Fig. 1; 2) Small steel cylinder of nitrogen, as shown in Fig. 2;

3) Dewar flask, as shown in Fig. 3; 4) Gas pipe connection method, as shown in Fig. 4;

Paint the yellow fonts, paste the safety warning mark and use it in strict accordance with the operation regulations of special gas. (Suggested layout is as follows)

(Fig. 1)

(Fig. 2)

(Fig. 3)

(Fig. 4)

5. Transport, Loading and Storage

5.1 Precautions of Transport/handling/storage

Please follow the rules below while handling the Equipment:

1) Pack the Equipment if necessary.

2) The handling workers should wear helmet, safety shoes and leather gloves.

3) The tools such as crane and forklift can be used.

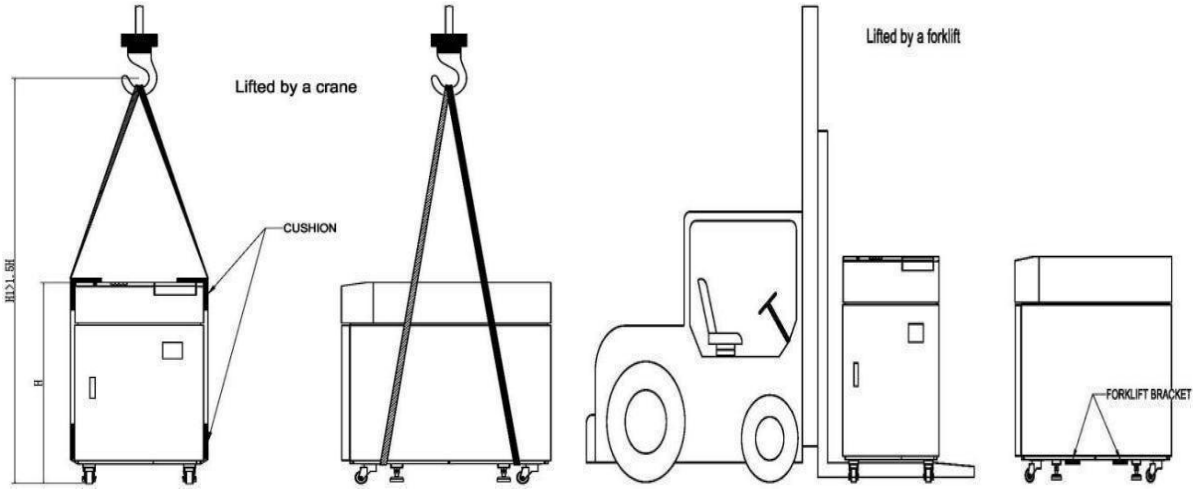
4) Make sure steel wire rope is bound inside the Equipment's casters (as shown in picture below).

5) Make sure forklift is inserted into the Equipment's casters (as shown in picture below).

6) Do not suspend other loads on the Equipment's front door while uplifting it.

7) The Equipment can be hoisted by authorized personnel only. No standing is allowed under the Equipment during hoisting.

8) Make sure to store the Equipment in a dry and waterproof place when it is not installed or used immediately after delivery.



5.2 Guidance of Assembly/disassembly

5.2.1 Precautions for Disassembly and Assembly

1，For any obvious sign of external damage on the package, check if the Equipment has damage and inform the forwarding agent immediately. Take out the Equipment from package box with caution, to make sure optical fiber has no crack or damage.

2，Upon receiving the Equipment, inspect all items by the packing list in system files. For any item missing or obvious damage of the Equipment, please contact us immediately. For any obvious or suspected damage of the Equipment, do not try to install nor operate it under any condition.

3.As a precision instrument, the Equipment is suggested to be unpacked as follows:

a: Put the Equipment horizontally onto the flat ground according to the mark of package box;

b. Unpack the Equipment step by step according to marks on top cover; remove the top foam baffle after unpacking;

c: Please take out the laser device with caution, for it is fitted with optical fiber cable of gun head; make sure the bending radius of optical fiber armor is >180mm;

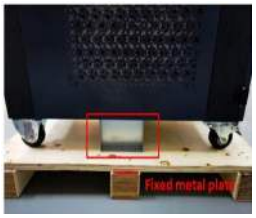
d: Inspect the accessories by the packing list;

e: Keep all articles properly after unpacking for further use in transport or storage.

Unpacking of HLW-FXXXX water-cooled laser welding machine

Remove wooden case Remove carton →

Remove Fastener →



Validation Accessory →

Unpacking of HLW-AXXXX air-cooled lase welding machine

Open packaging carton →

Take out laser welding machine →

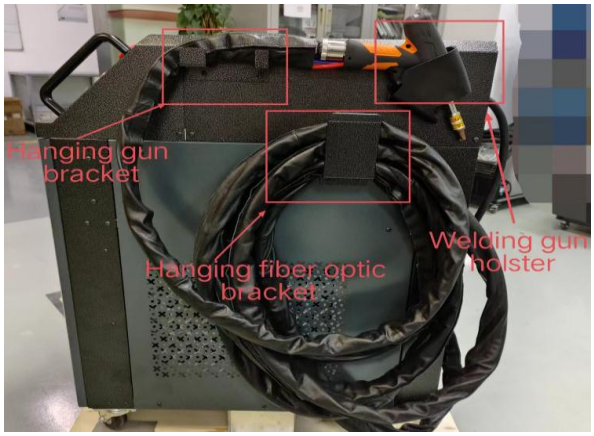
6. Operation Guidance of Handheld Welding Machine

6.1 Operation Guidance

6.1.1 Precautions

- Please select proper power supply by referring to Section 4.1 Introduction and nameplate contents of Chapter 4.
- Check if the Equipment's ambient working environment conforms to the requirements according to Chapter 4 and safety warning information at the top of the Equipment.
- Please wear sound insulation earplugs and specific laser goggles prior to laser welding.

6.1.2 Accessory Installation

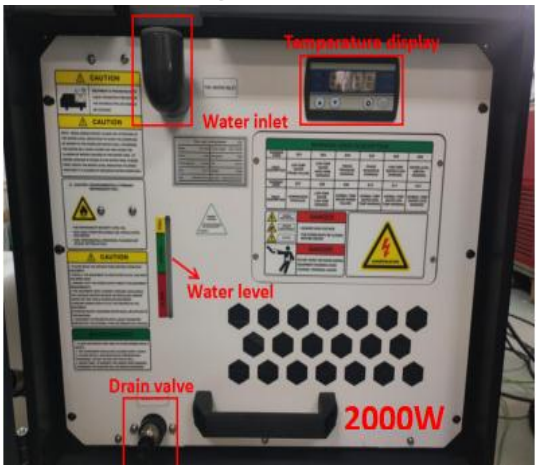


As shown in picture above, the “Hanging gun bracket” , “welding gun holster”, and “Hanging fiber optic bracket” are fixed in the reserved installation holes through attached screws and need to be fastened (If they are fixed, just skip this step).

6.1.3 Gas Connection

The Equipment is provided with inert gas (nitrogen/argon) as protective gas of welding; the protective gas should have purity of 99.99% and gas flow of ≥15L/min. For details of gas specification, please refer to Section 4.3 of the Manual.

6.1.4 Water Injection of Water Tank (applies to water cooling series)

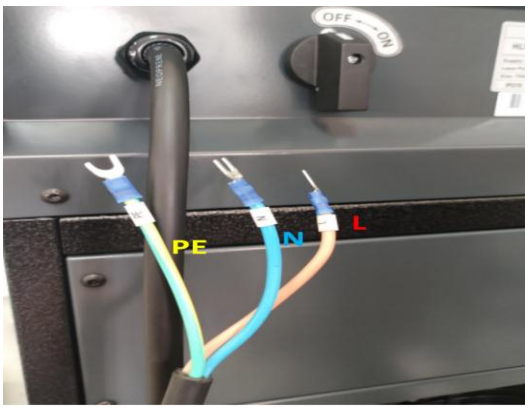


The water level indication, temperature display, water inlet and drain valve are as shown in picture (1000/1500W water tank has minor difference with 2000W water tank, but water injection quantity is consistent); inject around 4L purified water from the water inlet (anti-freezing solution should be added when air temperature is below 0°C, see Section 4.1 and 7 of manual for details), until the water level reaches the standard green area. The water level will drop suddenly when running the Equipment for the first time, and water needs to be supplemented to the standard green area. In addition to sudden water level drop of water tank in the first operation, water should also be supplemented to the standard green area when water level reaches the red water shortage area during operation. The water can be drained properly through drain valve when water level reaches the yellow overflow area.

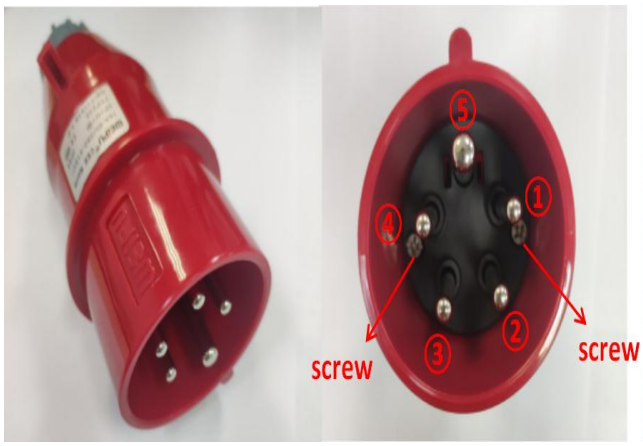
6.1.5 Power Connection

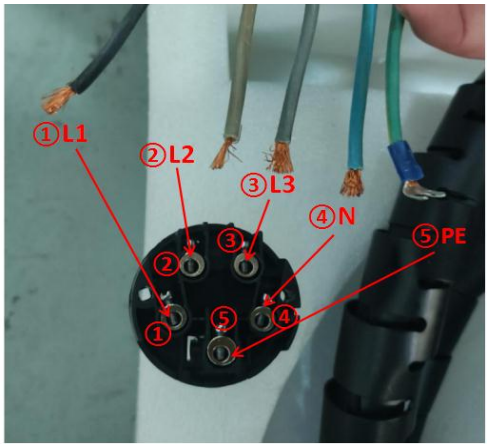
Single-phase 220V power supply (select the power supply according to equipment nameplate)

The live line and zero line of power wire are as shown in mark number. Note: The ground wire must be connected.



Three-phase 380V power supply (select the power supply according to equipment nameplate)





As shown in picture above, remove the screws of power plug and then connect the wire; make sure the 3-phase 5-wire wiring sequence is correct and all circuits have good contacts and no short circuit. Note: The ground wire must be connected.

6.1.6 Connection of Wire Feeder

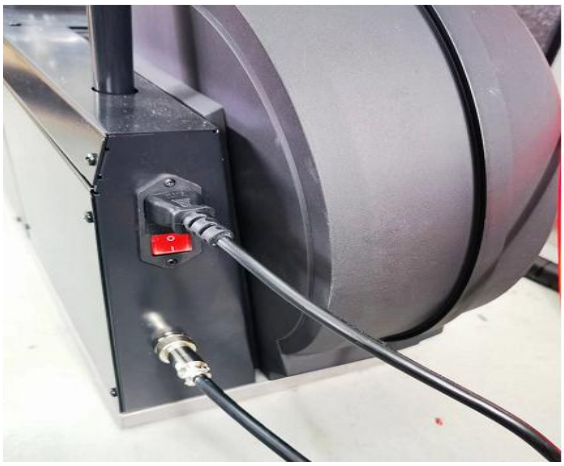
a: Installation of wire feeder

Caster installation

The movable casters are installed near the front panel;

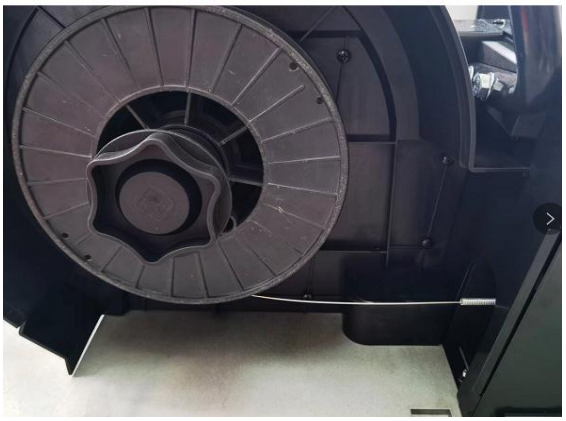
fixed casters are installed at the rear position.

Insert the attached power wire into the 3-pin type socket.



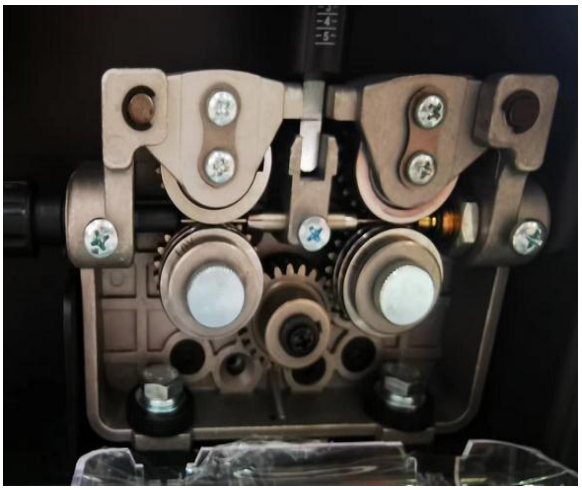
Insert 485 communication wire into the interface and fasten it

Loosen the opening, align the scroll jack with the convex plate



Pay attention to the wire feed direction, cross the wire into the wire feed pipe

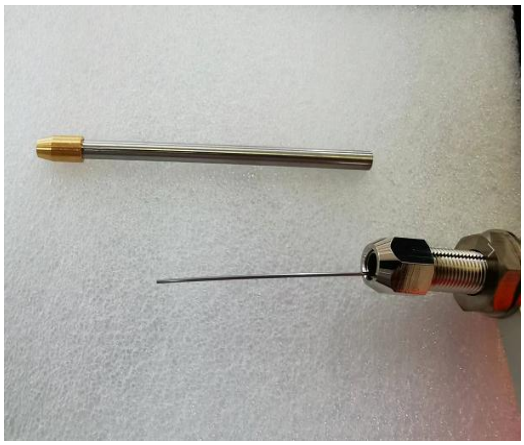
Arrange the wire feed wheel of corresponding wire diameter



Press the wire feed wheel with pressing handle, then loosen it properly

When welding wire is passed, insert the welding wire into the wire feeding hose

Push the knurled nut and insert it into the quick plug wire feeding hose

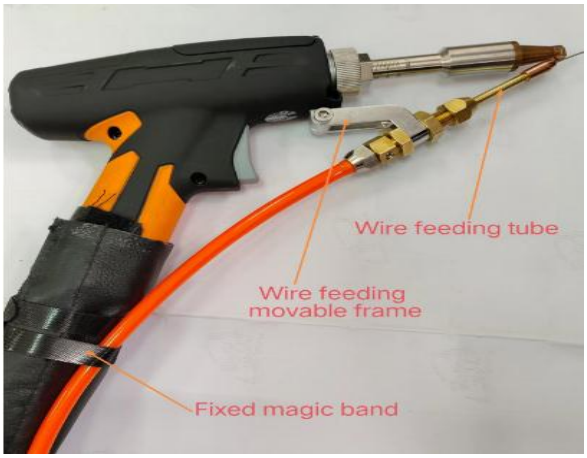


When welding wire leaves the hose component, insert it into the wire feeding hose and choose proper wire feeding nozzle

b: Connection between wire feed frame and handheld welding gun head

Lock the wire feed frame with screws

Adjust the position of “Fixing screws for the movable frame”.



Determine the welding focus, adjust the “wire feed movable frame” to the middle position, then adjust the length of “wire feeding tube” until the wire feed nozzle is close to the welding copper nozzle.

Wire feed nozzle 0.8-1.6mm

Welding copper nozzle

Select proper wire feed nozzle and welding copper nozzle by referring to 6.4.1

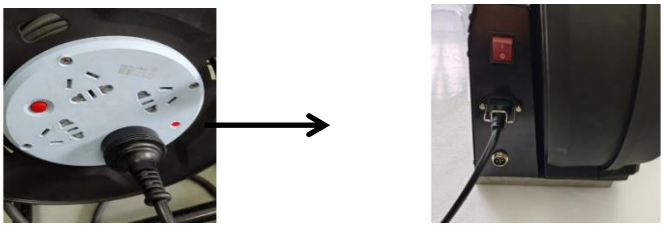
c: Communication connection between wire feeder and the Equipment

Connection of communication wire

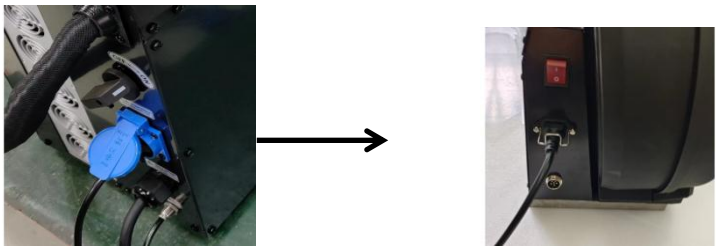
Establish communication between the Equipment and wire feeder through 6-core aviation plug

d: Connection of wire feeder power wire

1）The wire feeder is provided with 220V power supply. The external power supply can be connected directly through power wire.

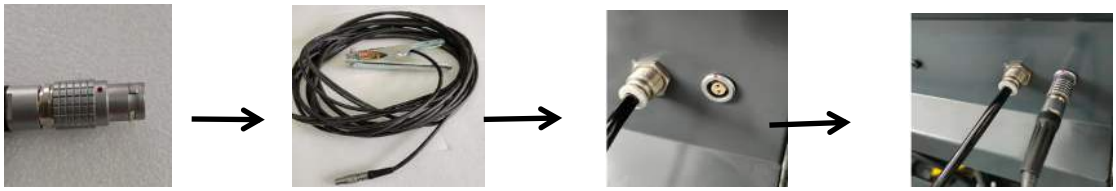


2）The wire feeder can also be powered by the Equipment's 220V socket through power wire



6.1.7 Connection of Ground Clamp

a: For LEMO connector grounding clamp: Align the red mark of plug and socket and insert them; hold the anti-slip outer ring of groove and pull it out.



b: 2-core aviation grounding clamp: Align the plug and socket with the pin, insert them and fasten the nuts.

6.1.8 Power On/Off

- Make sure all electrical connections (including protective gas and grounding wire) are completed before use. Make sure to fasten and fix all connectors with screws.
- Do not stare at the laser output port; instead, wear the safety goggles and sound insulation earplugs while operating the laser device.
- Please power off the laser device completely prior to wiring.

a: Steps of startup:

（1）Power on

（2）Turn on the knob switch

（3）Release the emergency stop switch (by rotating it anticlockwise)

（4）Turn on system switch

（5）Turn on the water-cooling switch (as the water level will drop suddenly after the first startup, please supplement water to the green area) – Observe the water level and temperature display of water tank (laser output is not allowed until temperature reaches 23~28°C)

（6）Press the gas check button to conduct gas detection. Adjust the flow of protective gas to be ≥15L/min

Water level indication

① Emergency stop switch
② System switch
③ Water-cooling switch

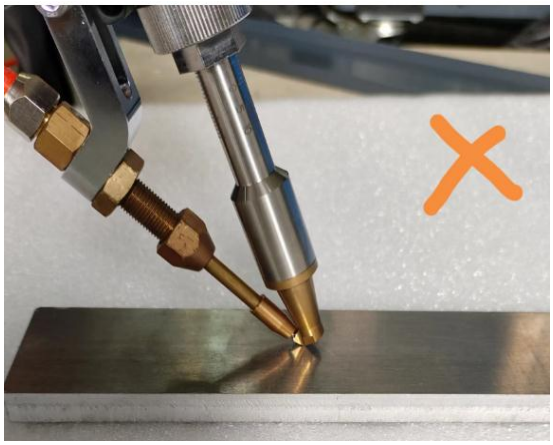
Gas check

（7）Enter system interface and adjust the relevant parameters (such as laser power, wire feeding speed, swing frequency, gas blow/stop delay and laser output mode)

（8）Clamp the alligator clip on the to-be-welded workpiece (or welding table with good conduction)

（9）Keep gun head copper nozzle in contact with workpiece, the safety ground lock of main engine interface shows green light, and the Equipment is ready for laser output. In this status, press the gun handle switch to output laser; (Note: Laser output will stop immediately when copper nozzle leaves the workpiece, and it is not affected by the parameter of delayed laser output)

Note: Keep an inclined angle of around 45° between the welding gun and to-be-welded surface of workpiece, avoid laser reflection to protect the welding gun.



b: Steps of shutdown:

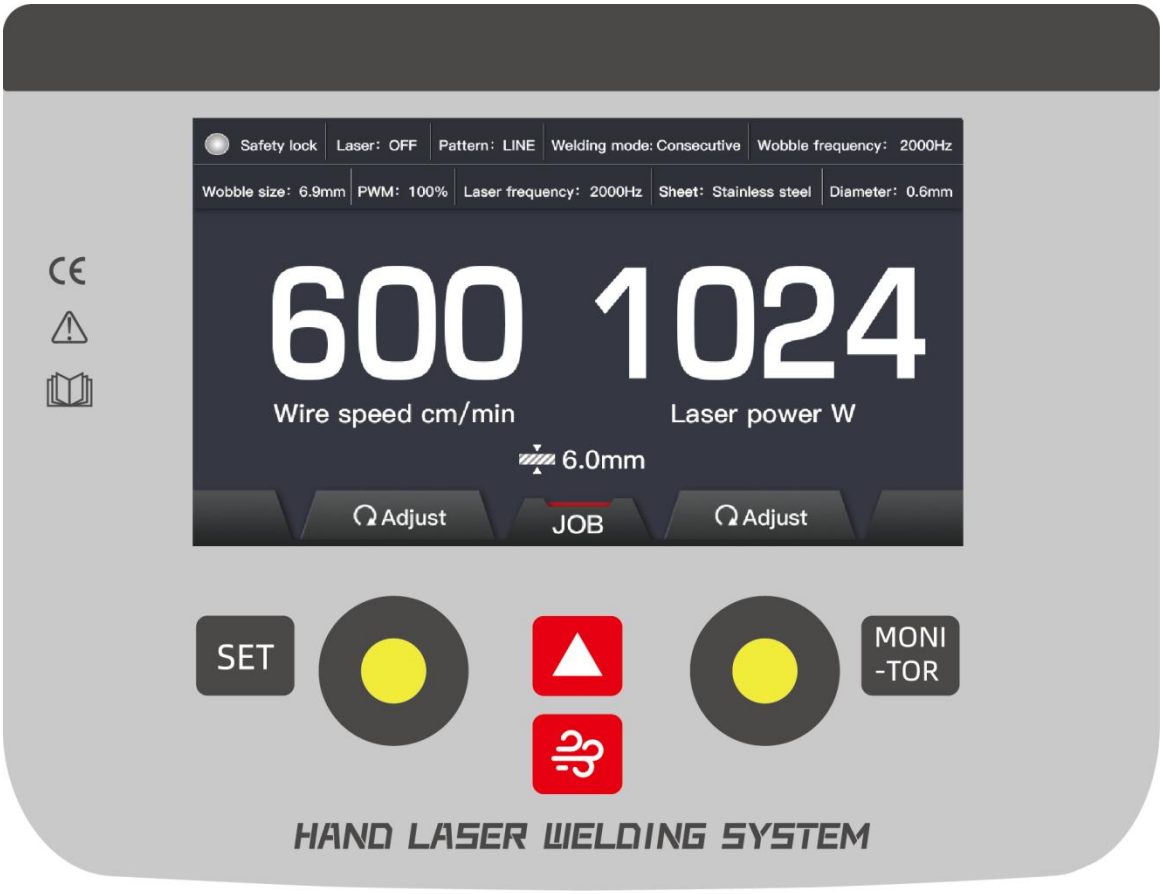
（1）Turn off water-cooling switch　　(2) Turn off control switch

(3) Turn off equipment power supply　　(4) Turn off gas valve switch

Arrange the cable, put the welding gun in the frame, clean the equipment surface and workplace.

6.2 Synchronization Operating System

6.2.1 Main Interface



1，Enter the interface to view the present process parameters and warning information.

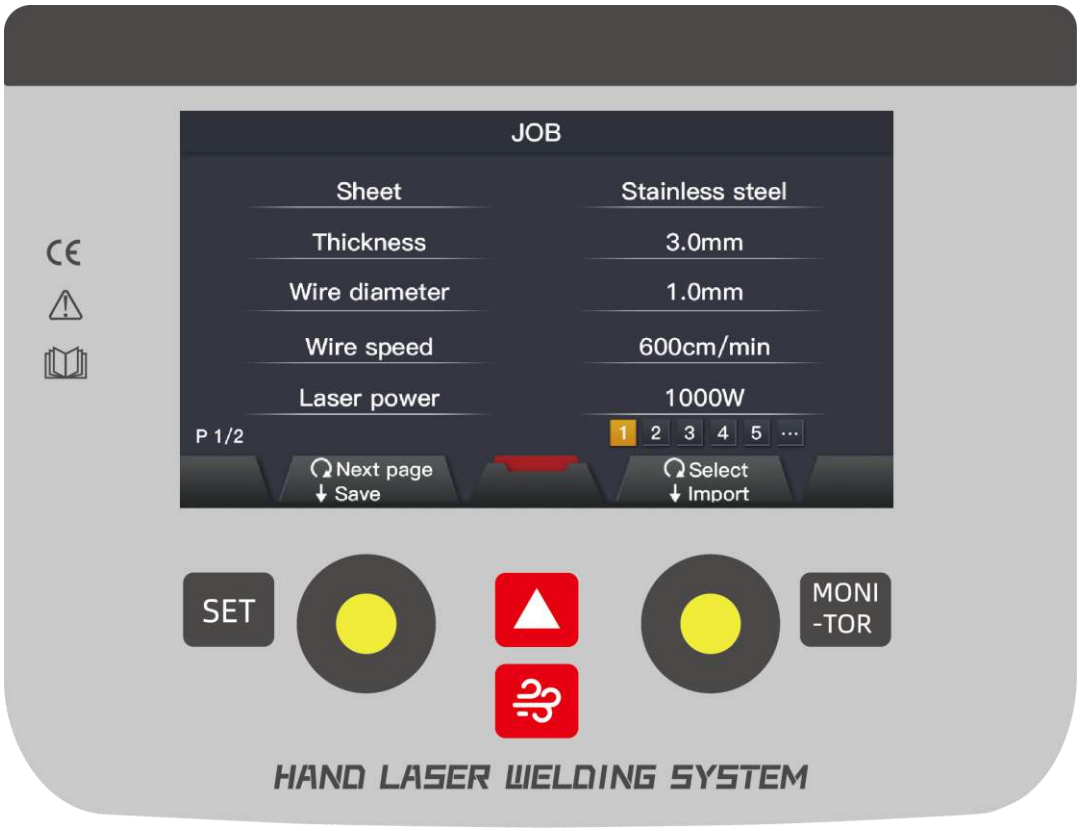
2，SET button: Press it in homepage to enter the setting page; MONITOR button: Press it to enter monitoring page;

3，Left encoder knob: Press it in the main interface to adjust the wire feed speed; right encoder knob: Press it in homepage to adjust the Equipment’s power.

4.  Function button: Press it in homepage to enter process parameter selection interface and choose the process parameters.

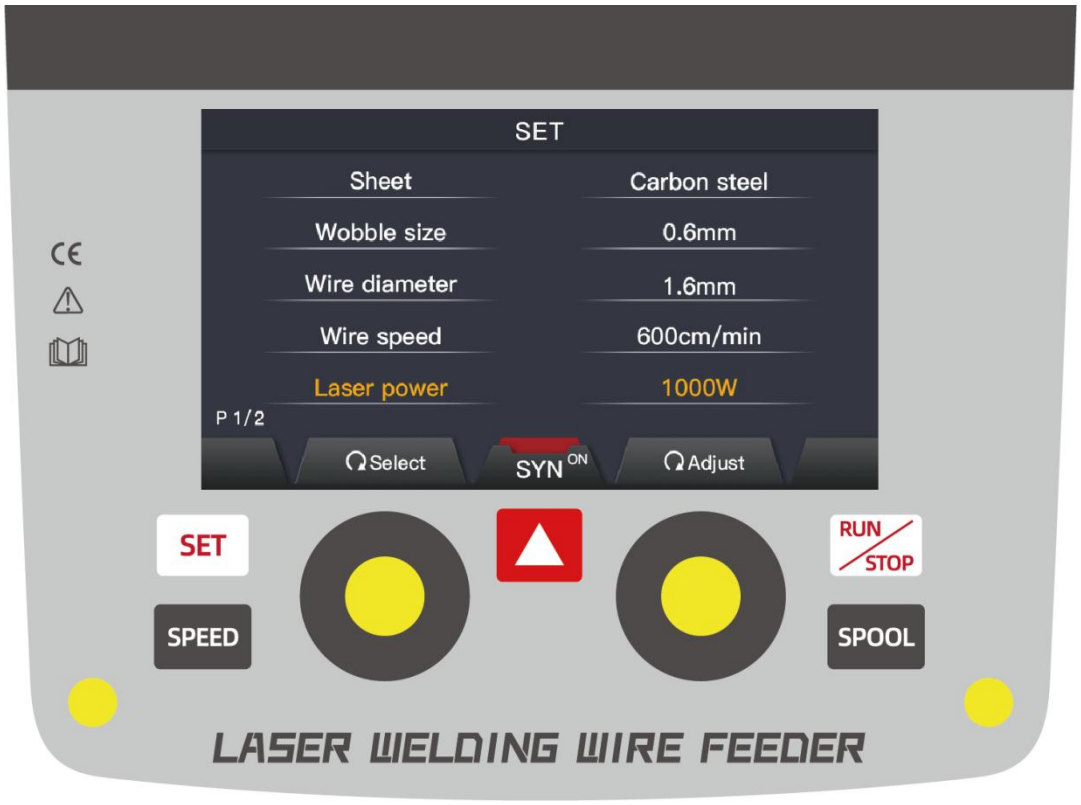
5.  Gas check button: Press it in homepage to carry out gas discharge test; release this button to stop gas discharging.

6.2.2 Process Interface



1. This interface shows the detailed contents of current process parameters;
2. SET button: This button is invalid in process interface. MONITOR button: Press it to enter monitoring page;
3. Left encoder knob: Rotate this button in process interface to adjust the parameter page, press this button to store the current parameter into the corresponding process groups;
4. Right encoder knob: Rotate this button in process interface to adjust the process group, press this button to import the current parameter of the process group;
5.  Press this button in process interface to return to the main interface;
6.  Gas check button: Press it in process interface to carry out gas discharge test; release this button to stop gas discharging.

6.2.3 Setting Interface



1. SET button: Press this button in setting interface to return to homepage. MONITOR button: Press it to enter monitoring page;

2. Left encoder knob: Rotate it in setting interface to select parameters; press this button to enter help page;

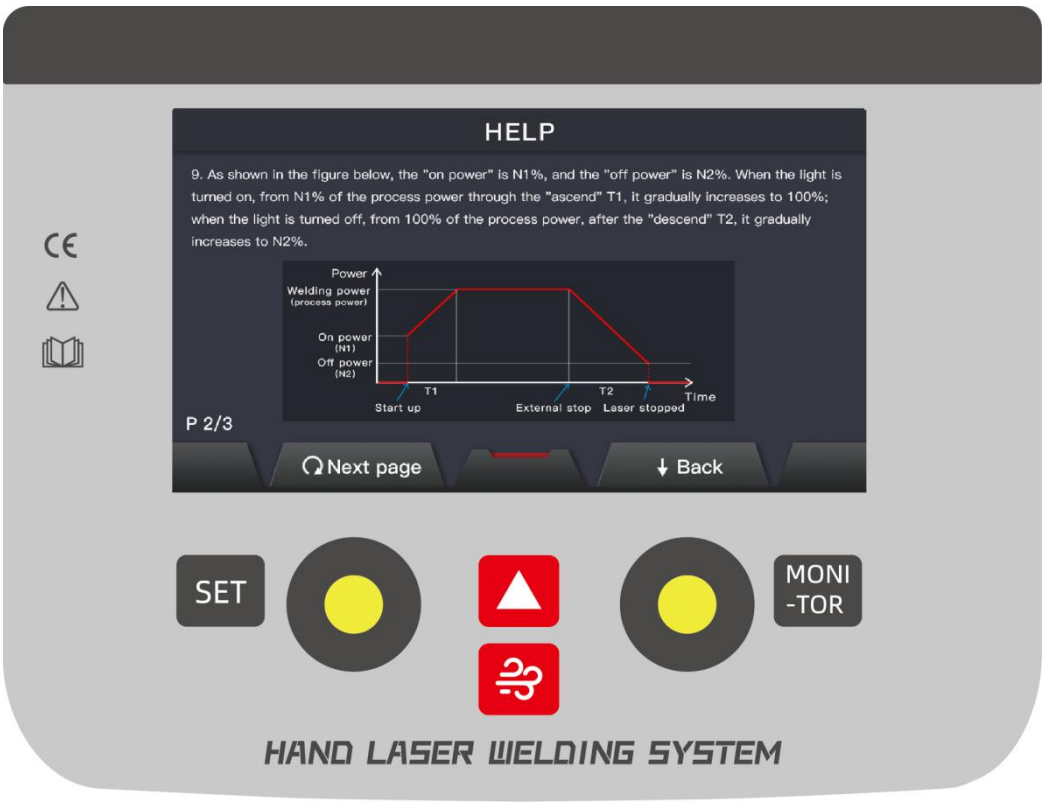
4. Right encoder knob: Rotate it in setting interface to adjust the current parameter;

5.  Press this button in setting interface to enable synchronization mode switch;

6.  Gas check button: Press it in the main interface to carry out gas discharge test; release this button to stop gas discharging.

6.2.4 Help Interface


HELP
1. The user selects whether to use the unified function according to the actual situation. After use, the user selects the corresponding workpiece thickness, workpiece material, and the diameter of the welding wire used (in some cases, the selection range of the diameter will be limited according to the thickness of the plate). The recommended wire feeding speed and welding power automatically appear (it is allowed to be adjusted within a certain range)
2. The wobble frequency is 1~200HZ, 50~100HZ is recommended.
3. The wobble size is 0~5mm.
4. Laser power must be less than or equal to the max power on the parameter page.
5. PWM: 0~100%.
6. Laser frequency range: 5~9999hz, 5~2000hz is recommended.
7. "Gas in advance" range: 0~10.0s, 0.5~1.0s recommended.
8. "Gas delay" range: 0~10.0s, 1.0~2.0s recommended.
P 1/3
Next page
Back
SET
MONI
-TOR
HAND LASER WELDING SYSTEM


HELP
9. As shown in the figure below, the "on power" is N1%, and the "off power" is N2%. When the light is turned on, from N1% of the process power through the "ascend" T1, it gradually increases to 100%; when the light is turned off, from 100% of the process power, after the "descend" T2, it gradually increases to N2%.
Power
Welding power
(process power)
On power
(N1)
Off power
(N2)
T1
T2
Time
Start up
External stop
Laser stopped
P 2/3
Next page
Back
SET
MONI
-TOR
HAND LASER WELDING SYSTEM

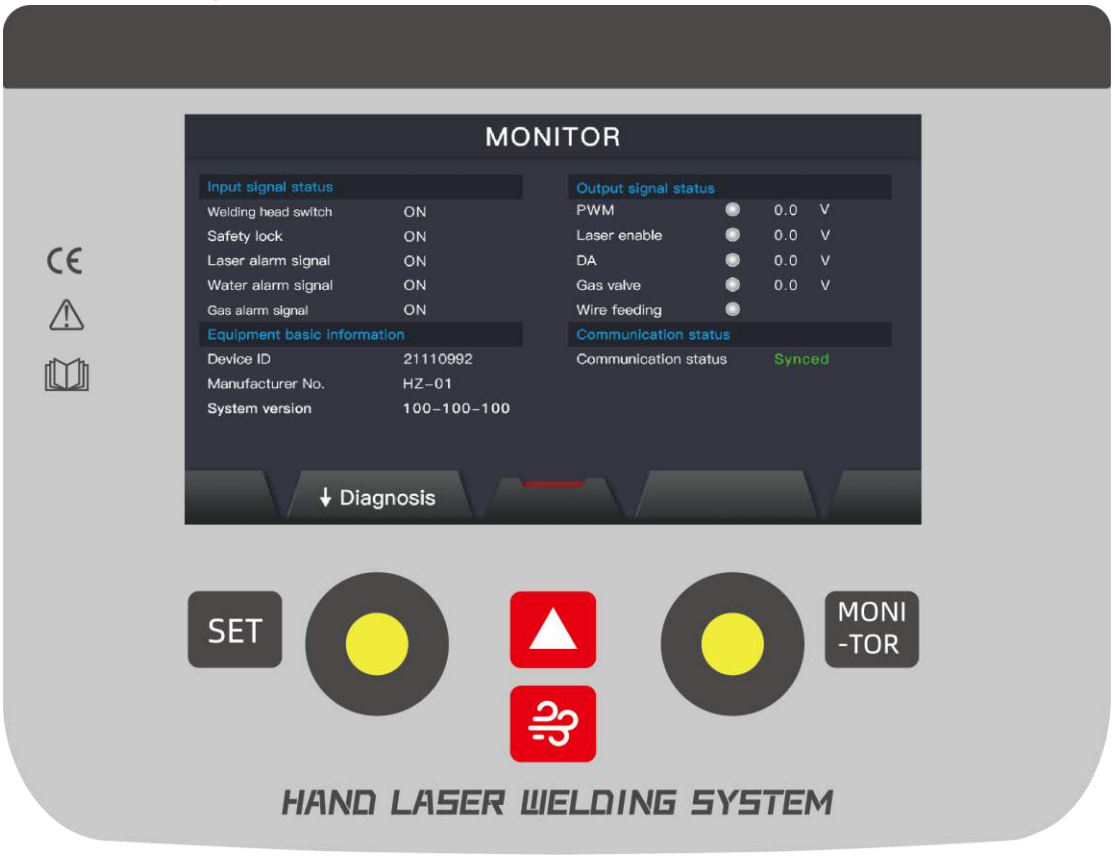
1. SET button: This button is invalid in help interface. MONITOR button: Press it to enter monitoring page;

2. Left encoder knob: Rotate it in help interface to adjust the help page; right encoder knob: Press it in help interface to return to homepage;

5.  This button is invalid in help interface;

6.  Gas check button: Press it to carry out gas discharge test; release this button to stop gas discharging.

6.2.5 Monitoring Interface



1. SET button: This button is invalid in help interface. MONITOR button: Press it to enter monitoring page;

2. Left encoder knob: Press this button in monitoring interface to enter diagnosis mode, then press this button again to quit the diagnosis mode; right encoder knob: Rotate this button in diagnosis mode to adjust the diagnosis parameters;

3.  Press the button in the monitoring interface to pop up the initialization option, press the encoder to confirm, and press the right encoder to return;

4.  Gas check button: Press it in the main interface to carry out gas discharge test; release this button to stop gas discharging.

6.3 Parameter Description

6.3.1 Homepage Parameter Description

Homepage parameter description:

（1） Safety lock: It indicates whether the Equipment’s workpiece is connected and ready for laser output and if so, the green indicator will be on;

（2） Laser: It indicates whether laser device is enabled; it will be ON when enabled, or OFF when disabled;

（3） Pattern: It indicates the current red light mode of the Equipment;

（4） Welding mode: It indicates the Equipment's current welding mode;

（5） Wobble frequency: It indicates the current scan frequency of the Equipment's galvanometer;

（6） Wobble size: It indicates the current scan width of the Equipment's galvanometer;

（7） PWM: It indicates the current laser output duty cycle of the Equipment;

（8） Laser frequency: It indicates the current laser output frequency of the Equipment's laser device;

（9） Sheet: It indicates the workpiece welding material of the Equipment's current process;

（10）Diameter: It indicates the welding wire diameter of the Equipment's current process;

（11） Wire speed: It indicates the current wire feed speed of the Equipment's wire feeder; adjusted through the left knob;

（12） JOB: It indicates process option;

（13） Laser power: It indicates the current laser output power of the Equipment; adjusted through the right knob;

6.3.2 Setting Page Parameter Description

Setting page 1

Parameter description of setting page 1:

（1） Sheet: Select sheet according to the material of to-be-welded welding materials, including stainless steel, carbon steel, galvanized plate and aluminum plate;

（2） Thickness: Select plate thickness according to the to-be-welded welding plate; plate thickness includes 0.6, 0.8, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0mm;

（3） Wire diameter: Select the wire diameter according to the welding wire diameter, including 0.6, 0.8, 1.0, 1.2, 1.6mm;

（4）Wire speed: Set the auto wire feed speed of the Equipment's wire feeder; range of wire feed speed: 25-600cm/min;

（5）Laser Power: Set the output optical power of the Equipment, ranging from 5 to the upper limit power;

（6）Select/help: Operate the left knob to select parameters; press it to enter the help page;

（7）SYN: Synchronization mode;

（8）Adjust: Operate the right knob to adjust the current parameter value.

Setting page 2

（1） Wobble frequency: It indicates the scan frequency of red light; adjust this parameter to change the swing speed of galvanometer; the adjustment frequency of red light scanning and swing ranges from 1 to 200Hz;

（2） Wobble size: It indicates the scan width of red light; adjust this parameter to change the segment amplitude of red light scanning; the adjustment range of scan width is from 0 to 5.00mm;

（3） Laser center offset: It indicates the left/right offset distance of red light from the center; which aligns with welding wire center during wire feeding;

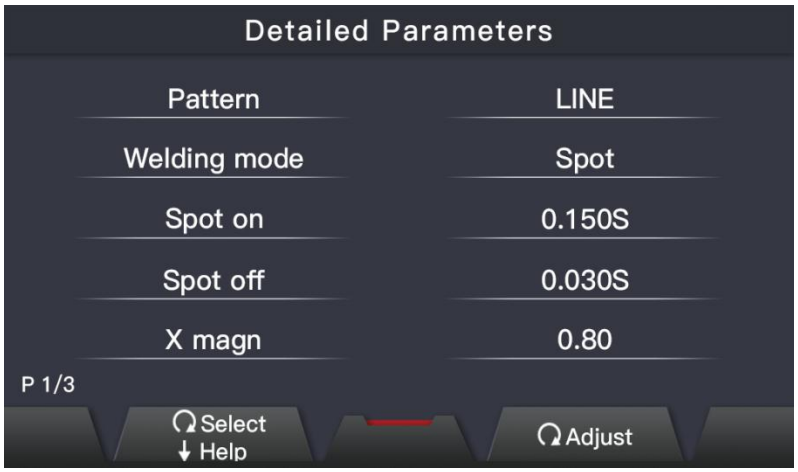
（4） Language: Set the current language;

（5） Laser: It represents enable switch of laser device: ON for turn on; OFF for turn off;

（6） Select/Help: Operate the left knob to select items; press it to enter the help page;

（7） Adjust: Operate the right knob to adjust the parameters of current item.

Advanced setting 1



Press and hold the right encoder for 3S on the setting page to enter the advanced setting page.

Parameter description of advanced setting page 1:

（1）Pattern: It indicates the red light mode; point or segment is optional

（2）Welding mode: It indicates welding mode of laser device; continuous welding or fish scale spot welding is optional

（3）Spot on: Set the duration of fish scale spot welding; the adjustment parameter is continuous laser output period of fish scale welding per week; adjustment ranges from 0.010S to 1.000S;

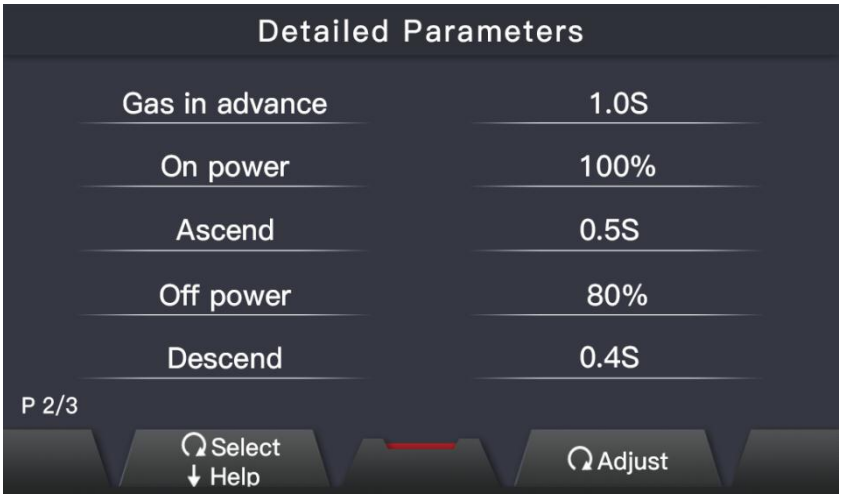
（4）Spot off: Set the interval of fish scale spot weld; the adjustment parameter is continuous laser off period of fish scale welding per week; adjustment ranges from 0.010S to 1.000S;

（5）X magn: It indicates the amplification coefficient of red light X axis; adjust the parameter to calibrate the red light scan width; adjustment ranges from 0.25 to 4.00;

（6）Select/Help: Operate the left knob to select items; press it to enter the help page;

（7）Adjust: Operate the right knob to adjust the parameters of current item.

Advanced setting 2



Parameter description of advanced setting page 2:

（1）Gas in advance: Set the front gas feed of laser device; the adjustment parameter is lead time and adjustment range is 0-10S;

（2）ON power: The starting power when laser device starts laser output and increases gradually; adjustment parameter is percentage of current output power; adjustment range: 0-150%;

（3）Ascend: The increase period from start of laser output of laser device to the set laser output power; adjust parameter to change the increase rate of laser output power; adjustment range: 0-5S;

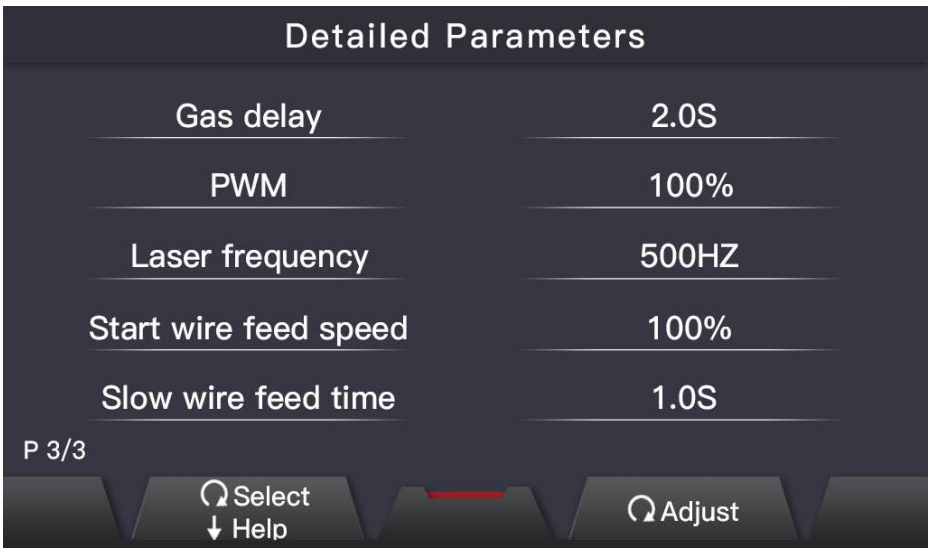
（4）Off power: The stop power of slow decrease when laser device stops laser output; the adjustment parameter is the percentage of current output power; adjustment range: 0-100%;

（5）Descend: The decrease period from stop of laser output of laser device to the set laser off power; adjust parameter to change the decrease rate of laser off power; adjustment range: 0-5S;

（6）Select/Help: Operate the left knob to select items; press it to enter the help page;

（7） Adjust: Operate the right knob to adjust the parameters of current item.

Advanced setting 3



Parameter description of advanced setting page 3:

（1）Gas delay: Set the rear gas feed of laser device; the adjustment parameter is delay time and adjustment range is 0-10S;

（2）PWM: Duty cycle of laser device output; adjustment range: 0-100%;

（3）Laser frequency: The output laser frequency of laser device; adjustment range: 5-9999Hz;

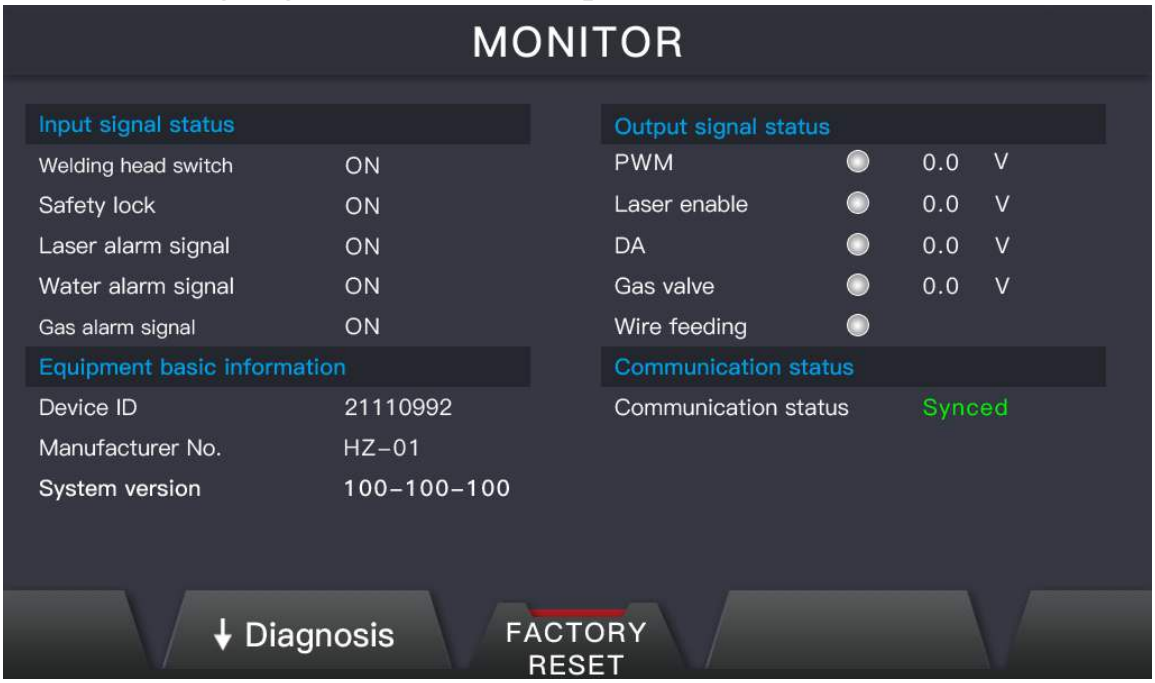
（4）Start wire feed speed: Initial wire feed speed of the wire feeder, which is adjusted according to the set wire feed speed percentage, adjustment range: 0-100%;

（5）Slow wire feed time: The period from the initial wire feed speed to the set wire feed speed;

（6）Select/Help: Operate the left knob to select items; press it to enter the help page;

（7）Adjust: Operate the right knob to adjust the parameters of current item.

6.3.3 Monitoring Page Parameter Description:



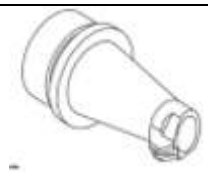
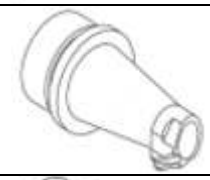
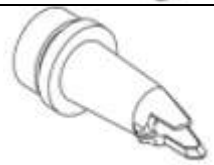
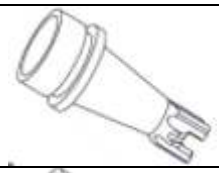
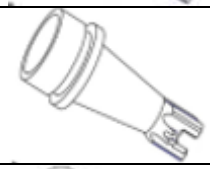
（1）Monitor the overall state of the main engine;

（2）Diagnosis: Press the left encoder to separately control the output status signal for testing whether the specific output signal is normal;

（3）FACTORY RESET: Press  to enter the initialization option;

6.4 Process Description

6.4.1 Type Selection and Focus Confirmation of Copper Nozzle/Weld Wire

Model	Name	Drawing	Inner angle	Outer angle	Tailored welding	Wire diameter (mm）
AS-12.	Welding copper nozzle		●	●	●	0.8/1.0/1.2
BS-16	Welding copper nozzle		●	●	●	1.2/1.6
CS-12	Outer angle copper nozzle		/	●	/	0.8/1.0/1.2 (Outer angle not at 90°)
ES-12.	Outer angle copper nozzle		/	●	/	0.8/1.0/1.2 (Outer angle at 90°)
FS-16.	Outer angle copper nozzle		/	●	/	1.6
C	Outer angle copper nozzle		/	●	/	No wire adding
AS-20D	Nozzle washing		/	/	/	Weld cleaning range of 5mm
Cutting nozzle			/	/	/	Single layer thickness of 1.5mm

Classification and distinguishing of copper nozzle:

Whether to feed wire, welding wire size and welding angle are as shown in the figure above; for example, the AS-12 copper nozzle should be used for welding 1.0 wire of internal angle wire feed welding

Selection of welding wire:

The welding wire (gas protection solid-core welding wire) should be selected depending on the welding plate

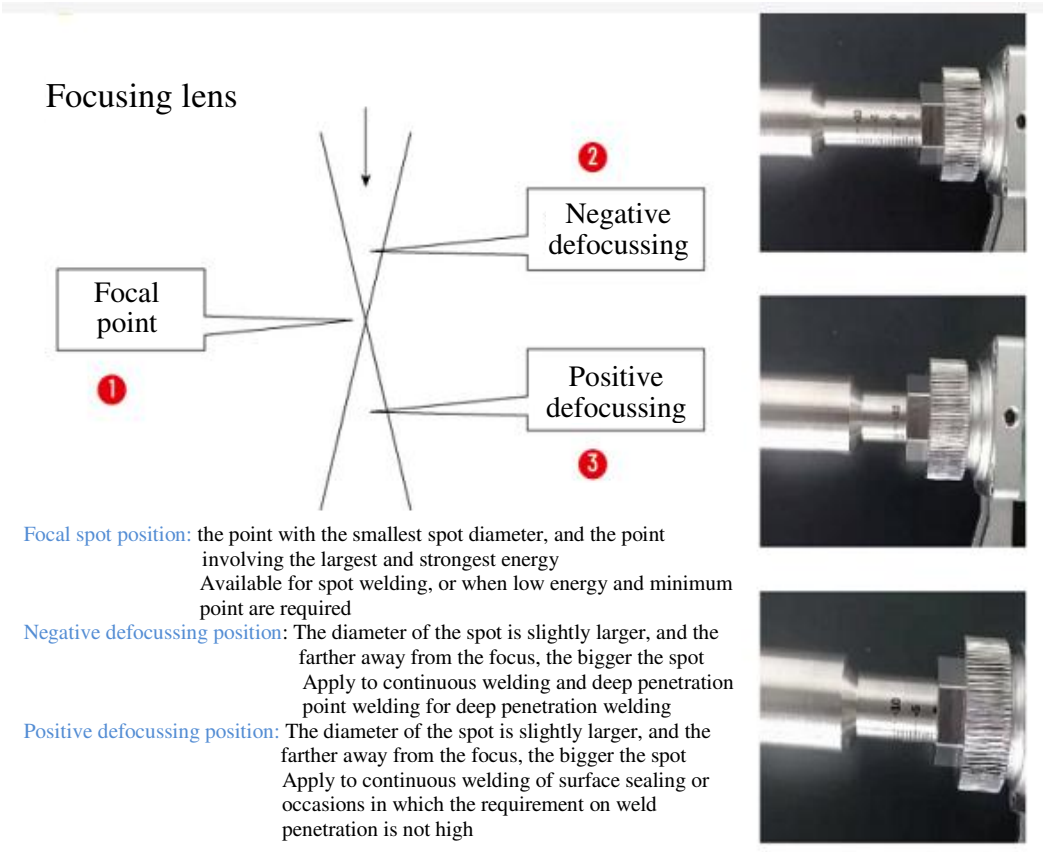
Stainless steel = Stainless steel welding wire, such as ER304

Carbon steel/galvanized plate = Carbon steel wire, such as ER70S-6

Aluminum = Aluminum wire, such as ER5356 (as for aluminum welding wire, it is recommended to use alloy aluminum above 5 series to reduce blockage due to high hardness)

Focus description:

Generally, 0 focus welding is adopted



Focal spot position: the point with the smallest spot diameter, and the point involving the largest and strongest energy
Available for spot welding, or when low energy and minimum point are required

Negative defocussing position: The diameter of the spot is slightly larger, and the farther away from the focus, the bigger the spot
Apply to continuous welding and deep penetration point welding for deep penetration welding

Positive defocussing position: The diameter of the spot is slightly larger, and the farther away from the focus, the bigger the spot
Apply to continuous welding of surface sealing or occasions in which the requirement on weld penetration is not high

Perform welding by following principles as follows:

a: Wire feed speed will decrease along with the increase of plate thickness, welding wire thickness and power

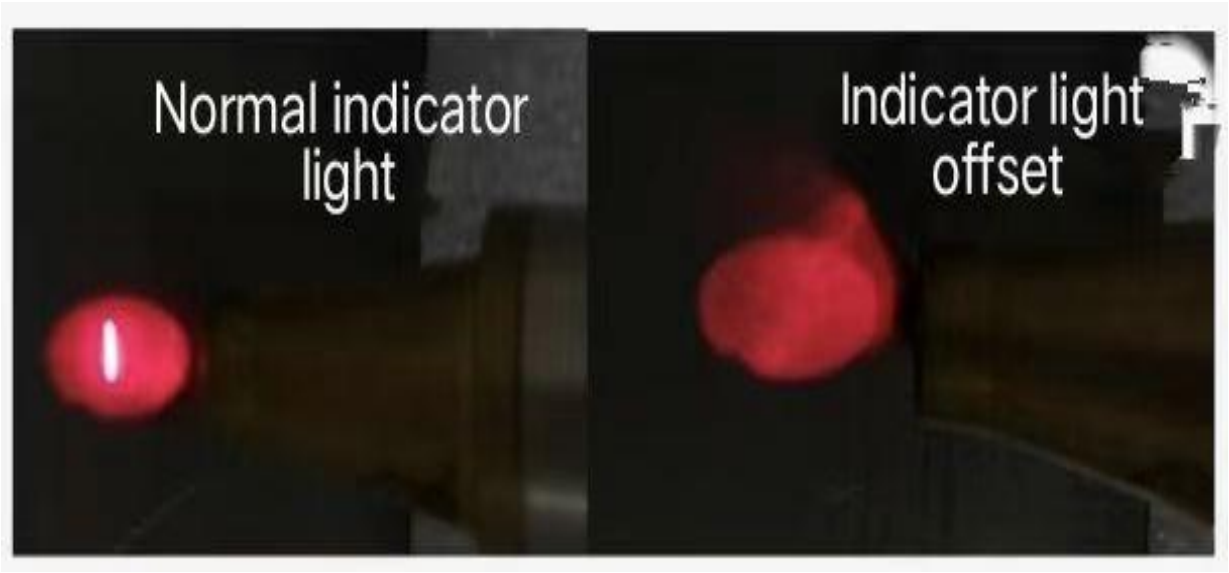
b. The lower the power, the lower oxidation degree of the welding surface, and the shallower the weld penetration; the higher the power, the higher the oxidation degree of the welding surface, the deeper the weld penetration;

c. The plate thickness should be higher than welding wire diameter. The welding wire may affect the fullness degree of weld joint

d. The scan width will decrease along with the reduction of welding wire width

e. Aluminum welding. While welding high reflection materials, make sure to open the molten pool at high power, to avoid personal injury due to reflection power; the wire feed pipe should be replaced with specific graphite wire feed pipe.

6.4.2 Red Light Adjustment



Red light offset

Cause analysis:

1. The swing motor has abnormal operation and red light has offset slowly due to external interference; do not share the same power supply box with the device that has major impact on power grid, such as argon arc welding machine; the power supply of welding head must be grounded effectively; meanwhile, the isolated transformer and magnetic ring can be used for eliminating the interference.

2. Red light offset occurs when replacing QBH, lens or other parts; the red light can become inconsistent when replacing some parts and it can be corrected through software setting or mechanical adjustment

3. Signal wire has disconnection or poor contact. Generally, this may occur when light offset fails to be adjusted and motor has abnormal sound during normal processing

Solution:

Software setting (treatment of Cause 1/2)

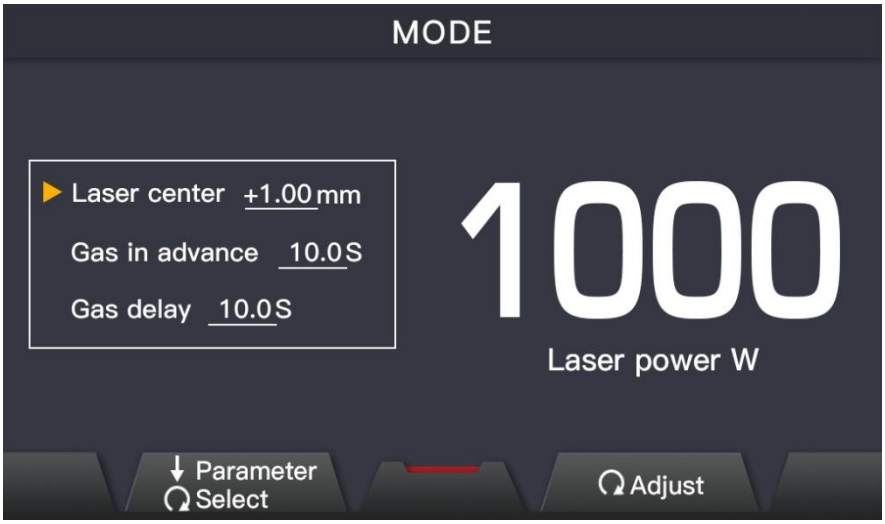
Do fine adjustment through laser center offset in setting interface: {1. Setting – 2. Change laser center offset, with the maximum adjustable value of +3/-3}。 This solution applies to left/right fine adjustment

6.5 Setting of Welding Head Cutting Functions

Copper nozzle Use of cutting copper nozzle (copper nozzle above 1.5 is recommended)

Mode selection Press and hold the set button for 3s to enter mode selection, select cutting mode and then press “Confirm”

Press "Confirm" to enter cutting page



Center point of red light

Correct the red light position through the “laser center” parameter, make sure the red light comes out from copper nozzle completely; otherwise, it may lead to burning of copper nozzle, or even damage of gun head or laser device in severer case

Workpiece cutting

Focus requirements: Negative focus may have less adhering slags relatively

Valve requirements (**oxygen or argon pressure reduction valve is used)**

Gas requirements: For any requirement for cutting side, it is recommended to use protective gas (above 6kg) such as nitrogen or argon, and the cutting side will be white relatively.

For any requirement for cutting thickness, please use oxygen or air for cutting and the cutting side will be black relatively

The manual cutting speed should be kept uniform

6.6 Setting of Spot Welding Functions

Switch to spot weld mode in setting interface, to realize the fish scale weld effects by setting the period of continuous and intermittent laser output

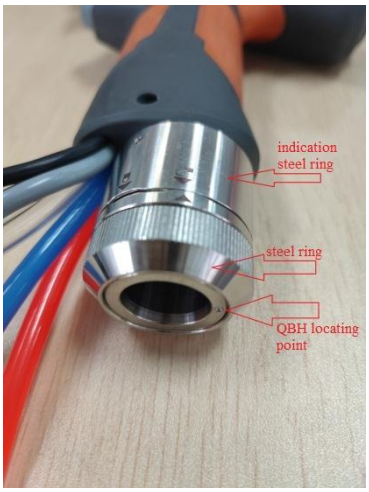
Reference value: Duration (laser output period): 100-150ms

Intermittent period (laser off period): 10-30ms

6.7 Setting of Weld Cleaning Functions

Weld cleaning functions: It mainly applies to cleaning of surface oxidation of weld after completion of welding; replace the front-end copper nozzle of welding gun with Type AS-20D copper nozzle during cleaning; set the scan width above the weld cleaning and set the power as 150W-300W in general; the cleaning is consistent with welding steps, but the welding gun should be pulled manually to complete cleaning of weld;

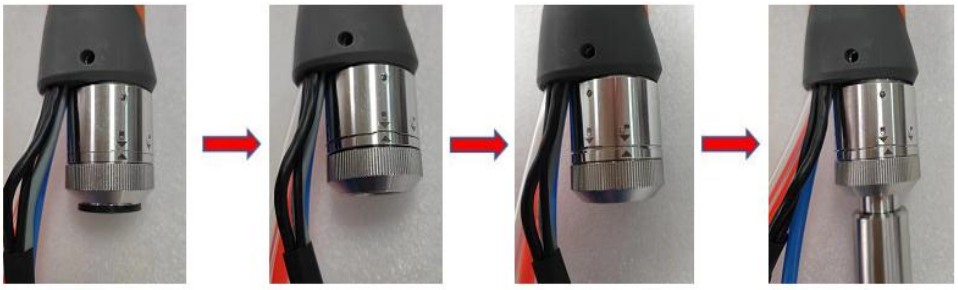
6.8 Use of QBH Connector



The structure of the Equipment's QBH connector is as shown in picture above

Plugging/unplugging of QBH

Operation guidance of QBH connector: Rotate it anticlockwise to loosen the steel jacket and move it to "Unlock" position, place the welding head horizontally, then align the red mark of optical fiber output end horizontally to QBH locating point, then insert it vertically to the bottom. After optical fiber head is inserted, adjust the indication steel ring to "Lock" position, then rotate it clockwise to fasten the steel ring

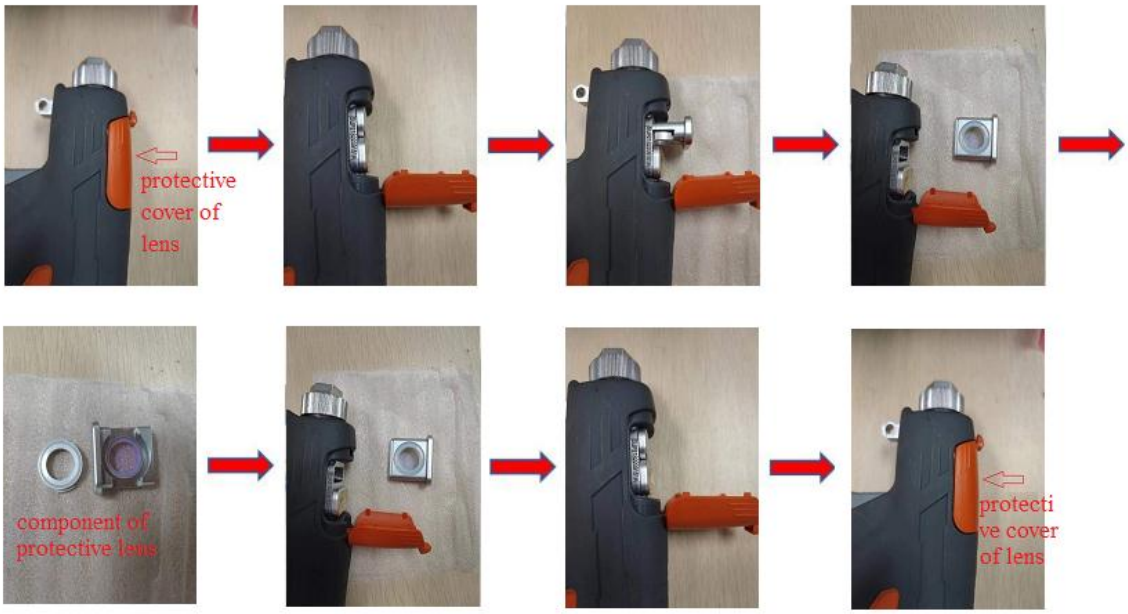


6.9 Disassembly of Protective Lens

6.9.1 Disassembly of Outer Protective Lens

Note: It should be disassembled in dust-proof places

1. Open the protective cover of lens
2. Take out the component of protective lens
3. Rotate the lens latch to remove it
4. Remove the to-be-placed protective lens with new ones
5. Reinstall the lens latch and rotate it by 90°
6. Install the entire component of protective lens into the gun
7. Close the lens protective cover to complete replacement



6.9.2 Maintenance & Inspection

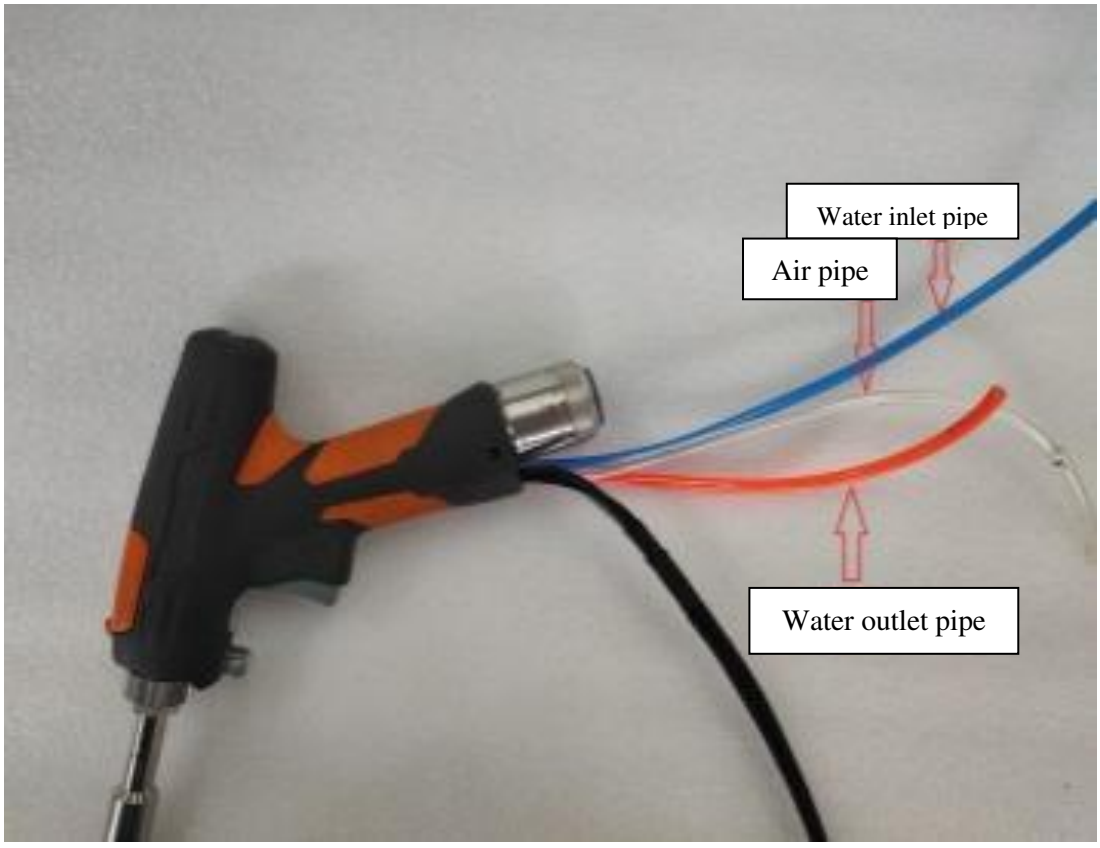
1. Check if the Equipment's gas supply is normal through the gas detection switch before the first use each day; check if outer protective lens is polluted and if so, replace it.

2， Check if QBH connectors are loose before the first use each day; make sure it is locked and fixed prior to operation.

3. Check if the copper nozzle is blocked and the copper nozzle has normal conduction with ground lock before the first use each day; replace the welding slag when it is blocked and fail to remove the welding slag. For any poor conduction, check if the workpiece is clamped safely by clip and the cable is disconnected.

4. Check if water circuit has water penetration before the first use each day; if so, replace the connector in time.

5. Avoid wrong connection when feeding water and gas; connect the middle to auxiliary gas; connect both sides to cold water, one for water inlet and the other for water; the diameter of gas and water pipe should be φ6mm. For air-cooled laser welding machine, the water feed pipe is regarded as gas feed pipe, connect the water outlet pipe to the original gas pipe to complete gas pipe connection.



7. Maintenance

7.1 Maintenance of HLW-FXXXX Series Cooling System

7.1.1 Coolant Replacement

Cooling water may be replaced when one of the following situations occurs:

1） The service time is up to 60 days;

2） Transport and handling;

3） The Equipment remains unused for a long time.

Note: In case of 2) and 3), the cooling water in the chiller should be fully discharged in advance, otherwise we will not be responsible for any fault occurs to the chiller!

Method to replace the cooling water in the chiller:

One water container;

Open the plug on the chiller drain outlet to drain the water in the chiller, and then plug the plug tightly; remove the top cover of the chiller tank, inject proper amount of purified water/deionized water into it and close the top cover.

7.1.2 Laser Anti-freeze Warning:

When the ambient temperature is lower than 0° in cold winter, the liquid water will coagulate into solid immediately and its volume will increase during coagulation; therefore, it will “crack” the pipes, connectors and elements in water cooling system.

The water cooling system includes water chiller, laser device and output head. Part freezing of water cooling system is excluded from warranty scope. Maintenance of laser device is the key in freezing prevention of laser device. The anti-freezing protection measures and hazards of winter are informed to you; please read them carefully to avoid unnecessary damages.

When power outage will never occur locally and electricity cost is not considered, do not turn off the water chiller at night, keep the coolant at circulating status and its temperature not below the freezing point;

Make sure to use the anti-freezing solution when power outage occurs regularly locally and it is not possible to drain coolant each day. Generally, the basic solution of anti-freezing solution consists of alcohol and water. It should have high boiling point and flash point, high specific heat and conduction capability, low viscosity at low temperature, less bubbling, no corrosion of metal parts and rubber hose. When selecting or preparing antifreeze, its freezing point should be 5℃ lower than the lowest temperature under the operational environment.

7.1.3 Selection of Antifreeze

Add professional and branded antifreeze into the chiller, such as AntifrogenN antifreeze produced by Clariant, in strict accordance with the operating instructions of the antifreeze supplier.

The frigid climate will cause irreparable damage to the water cooling system, please be sure to strictly follow the above operations, pay attention and do a good job of prevention and and protection, to prevent unnecessary economic losses.

If "Clariant Antifreeze" is used as the coolant, the following dilution proportion table is for reference only (the proportion data provided by the antifreeze supplier shall prevail).

Dilution Proportion Table of Relationsihip between Concentration and Frost Resistance				
S/N	**Ratio of concentration to volume (Antifrogen N: deionized water)**	**Anti-freezing temperature (°C)**	**Remarks**	**Notes**
1	**20**	**-8**	**Minimum Concentration**	
2	**21**	**-9**		
3	**22**	**-10**		
4	**23**	**-10**		
5	**24**	**-11**		
6	**25**	**-12**		
7	**26**	**-13**		
8	**27**	**-13**		
9	**28**	**-14**		
10	**29**	**-15**		
11	**30**	**-16**		
12	**31**	**-16**		
13	**32**	**-17**		
14	**33**	**-18**		
15	**34**	**-19**		
16	**35**	**-20**		
17	**36**	**-21**		
18	**37**	**-21**		
19	**38**	**-22**		
20	**39**	**-23**		

21	**40**	**-24**		
22	**41**	**-25**		
23	**42**	**-26**		
24	**43**	**-28**		
25	**44**	**-29**		
26	**45**	**-30**		
27	**46**	**-31**		
28	**47**	**-33**		
29	**48**	**-34**		
30	**49**	**-35**		
31	**50**	**-37**		
32	**51**	**-38**		
33	**52**	**-40**		
34	**53**	**-42**		
35	**54**	**-43**		
36	**55**	**-45**		
37	**56**	**-47**		
38	**57**	**-48**		
39	**58**	**-50**		
40	**59**	**-52**		
41	**60**	**-53**		

7.1.4 Chiller Setting of HLW-FXXXX Water-cooled Laser Welding Machine

Parameter category	S/N	Parameters	Unit	Setting Range	Step	Default Value
User parameters	1	Cold water set temperature	℃	-20.0~50.0	0.1	25.0
	2	Cold water set return difference	℃	0.1~8.0	0.1	1.0
	3	Warm water set temperature	℃	5.0~60.0	0.1	28.0
	4	Warm water set return difference	℃	0.1~8.0	0.1	0.1
	5	Following temperature difference of warm water	℃	-20.0~20.0	0.1	0

7.2 Maintenance of QBH and Optical Fiber Head

Note: Carry out cleaning in clean and dust-free environment.

1) All laser circuit devices mounted in laser head should be provided with dedusting carefully!
2) The lens components must be replaced at a clean place!
3) The components must be assembled or replaced at a clean place!
4) Please prepare the new components before removing the old lens components!
5) Please purchase lens components from us when there are no standby components!
6) When standby components are not available, it is recommended to seal the opening immediately with non-stick protective film when lens is removed!
7) Reduce the exposure of laser head path to air, to prevent the dust and dirt!
8) When safety or protection devices are removed, they must be reinstalled prior to running or debugging of the Equipment; check and confirm that the Equipment function properly.

Maintenance of QBH and optical fiber splice

1) Wrap the position where QBH and optical fiber splice is connected, to prevent dust from entering the clearance and increasing the maintenance difficulty;

2) The cooling water pipe of optical fiber splice should be well connected to avoid water leakage. For any accidental water inflow of QBH, please stop using it immediately and return it to us for treatment.

7.3 Equipment Cleaning

The Equipment should undergo daily maintenance to ensure normal functioning. The Equipment should be given careful maintenance as a precision instrument. Firstly, clean the environment to keep ground dry and clear prior to operation; then, clean the Equipment, including the case outer surface, observation system and worktable, until it is clean and free from foreign matters. The protective lens should be kept clean.

7.4 Fault Analysis & Troubleshooting

Note: For any unknown faults or emergency accident, please power off the Equipment and stop using it immediately, and call us for help!

1) When laser output fails, please check the safety line and switch of gun head to see if connection is normal; whether laser device reports error and has normal startup; cooling system reports error and has normal startup.

2) In case laser energy is low, check if protective lens is damaged, laser value is too low and laser focus has offset.

3) Inspect the cylinder air pressure when there's no air blowing.

7.5 Service and Maintenance Statement

7.5.1 Maintenance Instructions

Note: To safeguard your rights and interests, please contact us or our local sales representative quickly and claim for product maintenance service when a fault is found and, after being authorized by us, pack the product under repairing and send it to us.

1）For any damage of product received, make sure to reserve the certificate document to claim for rights from the forwarding agent.

2）Do not send any product to us until it is communicated and confirmed in advance.

3）The customer should pay for product maintenance when product warranty expires.

4）We reserve the right to change the design and structure of the product without prior notice.

7.5.2 Service Statement

1) For any problem about safety, setting, operation or maintenance of our laser products, please read the Manual carefully and follow the operation guidance.

2) Once confirmed by our Customer Service Department, the problems you reported will be tracked by a specific technical service team. If failing to solve your problem after communicating with the technical service team, please send the product to us for in-depth analysis.

8 Maintenance Statement

8.1 Omnibus Clause

We offer warranty services for products which have defects due to materials or production process within the warranty period, and ensure the product conforms to the quality and specification requirements in the following document under the condition of normal use.

We offer maintenance and replacement services for products which have defects due to material and production process within the warranty period. Such products still enjoy the warranty based on the residual warranty period.

8.2 Warranty Limitation

(1) The Equipment, parts or equipment is beyond the warranty scope in case of the following situations:

(2) The Equipment is tempered, dismantled or altered by other personnel other than our personnel;

(3) The Equipment is damaged due to improper use, negligence or accident;

(4) The Equipment is used beyond its product specification or technical requirements;

(5) The Equipment is damaged due to a fault of user software or interface;

(6) The Equipment is not maintained properly or is used under other abnormal operation conditions which are excluded in the Manual;

The accessories and optical fiber connectors do not fall under the warranty scope;Customers should be clear about the information above and follow the Manual; otherwise, the product faults will be excluded from the warranty scope.

Attention:

For equipment within the warranty scope, customers must report the fault within 1 month upon discovery.

Neither third-party organization nor individual is authorized by us to maintain or replace our products.