



Handheld welding manual for Hanrao series

Hanray Intelligent Laser Technology (Shanghai) Co., LTD

catalogue

I. Product Introduction 3	4
1.1 Product Overview 3	4
1.2 Product Features 3	4
1.3 Technical parameters 4	5
1.4 Auxiliary media 4	5
1.5 Operation Instructions 4	5
1.6 Configuration information and delivery list 5	6
II. Notes 7	8
2.1 Safety Notes 7	8
Handheld laser welding gun and system control introduction 9	10
3.1 Installation and debugging 9	10
3.1.1 Operating environment and parameters 9	10
3.1.2 Pay attention to information 11	12
3.2 Installation and Connection 11	12
3.2.1 Controller interface definition 11	12
3.2.2 Controller wiring block diagram 14	15
3.2.3 Optical fiber input interface 14	15
3.2.4 Protective gas and water cooling machine interface 14	15
3.2.5 Connection interface between welding torch and control box 15	16
3.3 Control Panel Operation Guide 15	16
3.3.1 Welding Mode 15	16
3.3.2 Cutting Mode 21	22
3.3.3 Cleaning Mode 21	22
3.3.4 Signal status and equipment function diagnosis 24	25
3.4 Maintenance and replacement of related lenses 25	26
3.5 Common exception handling 25	26
3.5.1 Laser/water cooler pressure alarm 25	26
3.5.2 Screen does not light up/click does not respond 25	26
3.5.3 No light 26	27
3.5.4 Sudden stop of light output during processing 26	27
3.6 Laser head maintenance 26	27
3.7 Handgun fault analysis 26	27
IV. Introduction to water cooling machine 28	29
4.1 Product Overview 28	29
4.2 Equipment installation conditions and requirements 29	30
4.3 Layout of inlet and outlet water pipes 30	31
4.4 Start up and operation 30	31
4.5 Electrical connection 30	31
4.6 Water filling and exhaust 31	32
4.6.1 Watering 31	32
4.6.2 Exhaust 31	32
4.7 Pre-test inspection 31	32
4.8 Operation status and parameter adjustment 31	32
1. Introduction to the temperature controller panel 31	32
2. The working status indicator light of the thermostat 31	32
3. Operation of the thermostat panel 32	33
4. User parameter setting (only F0~F7 parameters can be set) 32	33
5. Restore factory Settings 32	33
4.9 Parameter Settings Table 32	33

4.10 Alarm and output ports 32	33
1. Alarm output port and wiring diagram 33	34
2. Alarm cause and working status table 33	34
4.11 Maintenance 33	34
4.12 Simple troubleshooting 33	34
4.13, specification description 34	35
V. Introduction to lasers 35	36
5.1 Safety Notes 35	36
5.1.1 Laser safety level 35	36
5.1.2 Safety protection measures 35	36
5.1.3 Other safety precautions 35	36
5.2 Product Description 35	36
5.2.1 Product Technical Specification Table 35	36
5.2.2 Laser Panel Description 37	38
5.3 Definition of laser control interface 37	38
5.3.1 Control interface definition 37	38
5.3.2 Power supply requirements and wiring definition 39	40
5.4 Operation Instructions 39	40
5.4.1 Usage Notes 39	40
5.4.2 Cooling system requirements 39	40
5.4.3 Turn on and off the laser 40	41
5.4.4 Installation and use of the host computer 41	42
5.4.5 Installation and use of Bluetooth APP 41	42
5.5 Common faults and solutions of laser 43	44
VI. Warranty and Repair 44	45
VII. Welding process parameters 45	46

I. Product Introduction

1.1 Product Overview



A handheld laser welding machine utilizes a high-energy fiber laser through its Quick-Connect (QBH) or Remote Direct (RD) interface to deliver laser energy to a handheld welding torch. The system focuses and converges the laser beam onto the workpiece surface, instantly melting specific areas to create sufficient penetration depth for secure fusion. Comprising a laser source, cooling system, handheld welding head, control system, and visual touchscreen interface, this equipment replaces traditional methods like TIG welding, arc welding, and gas shielded arc welding. With its intuitive operation, stable welding temperature, minimal consumables usage, broad applicability, and exceptional flexibility, it has become essential in industries including sheet metal processing, automotive manufacturing, jewelry production, advertising, kitchenware, furniture, and metal tool manufacturing.

1.2 Product features

Handheld laser welding machine is based on the combination of traditional welding field application and laser principle, continuous practice, so as to develop a more light and practical laser welding equipment. The characteristics are as follows:

1. Original design, novel scheme and multiple patent protection to create soulful Chinese products.
2. Light appearance, simple and beautiful appearance, full of industrial feel.
3. Built-in sensors monitor the status of the lens, and set up multiple safety alarms to avoid problems in advance.
4. Master ergonomics, light structure, beautiful shape, strong comfort, comfortable grip on the palm of the hand without fatigue.
5. Built-in water and air circuit design to better cool the optical system.
6. Optimize the optical scheme, the galvanometer swing spot can be adjusted, and the welding effect is more powerful.
7. Modular design and simple maintenance.
8. Simple operation, zero-based and easy to operate.

9. Weldable stainless steel, carbon steel, aluminum alloy, copper, etc.
10. Flexible configuration, can be combined with robots, rotating shaft and other equipment to achieve automatic welding
11. Wide application, sheet metal processing, building materials, home furnishing, automobile, etc

1.3 Technical parameters

Technical parameters of 1500w/2000w handheld gun configuration			
interface type	alignment CF/mm	focus FF/mm	power bracket
QBH/RD	CF60	Welding FF150/cleaning FF400/800	≤2000W
Wobble mode	The scope of the swing is wide	laser wave length	Protective lenses
One-word swing	Welding 0-6mm/cleaning 0-120mm	1060-1080	D18X2mm
cooling-down method	protective gas	pressure	weight /KG
Built-in water cooling/fan cooling	Nitrogen/argon/inert gas	Below 0.8Mpa	≈0.7

Technical parameters of 3000w handheld gun configuration			
interface type	alignment CF/mm	focus FF/mm	power bracket
QBH/RD	CF60	Welding FF200/cleaning FF400/800	≤3000W
Wobble mode	The scope of the swing is wide	laser wave length	Protective lenses
One-word swing	Welding 0-8mm/cleaning 0-120mm	1060-1080	D18X2mm
cooling-down method	protective gas	pressure	weight /KG
Built-in water cooling/fan cooling	Nitrogen/argon/inert gas	Below 0.8Mpa	≈0.75

1.4 Auxiliary media

To prevent oxidation at welding joints and ensure optimal protection, the shielding gas must possess chemical properties that prevent harmful reactions with the workpiece. The gas quality must comply with ISO 8573-1:2010 Class 2.4.3 standards, free from impurities, dust, moisture, or oil particles. Higher purity of the shielding gas extends the lifespan of protective lenses and improves welding performance.

1.5 Operation instructions

Please read this manual carefully before using this machine. The company will not be responsible for improper use or violation of the manual.

Before powering on the welding machine, please check whether the external circuit is connected correctly, whether the power supply voltage meets the product requirements, and whether the cabinet is reliably grounded; ensure that QBH is reliably connected to the laser head and the protective gas is open.

Unfold the laser fiber and pull it to the welding place. Roll the remaining fiber into the fiber placement place of the cabinet. Straighten the fiber without twisting during the moving process to avoid breaking it during dragging.

After the welding machine is powered on, check whether the water level, temperature and flow rate of cooling water meet the light output requirements.

When operating the machine, the staff should wear laser protective glasses with corresponding wavelength and protection level. The wavelength of this laser is $1060\sim1080\pm10\text{nm}$.

Please refer to [III. Introduction to Handheld Laser Welding Gun and System Control] for the use and operation of the welding gun.

After welding is completed or when the operator leaves, please coil the optical fiber back to the optical fiber placement place of the cabinet, put the welding gun on the gun frame of the cabinet, remove the welding nozzle at the welding nozzle and put on the blocking cap shipped with the random delivery to prevent dust from entering and polluting the lens, cut off the power supply and turn off the protective gas.

1.6 Configuration information and delivery list

Configuration information table			
Java runtime environment Java			
Parameter content	PW series		
service voltage	AC 220V/380V;50/60Hz		
operating ambient temperature	5℃~40℃		
Working environment humidity	≤80%		
Equipment configuration list			
Laser handheld welding head	Welding gun/cleaning gun (optional)		
Continuous fiber laser	Caplin/Tottenham Hotspur/Rico/Chuangxin/other; 1500W/2000W/3000W (customer optional)		
Handheld welding special cabinet	1500W/2000W/3000W (standard version)		
Horizontal water cooler	1500W/2000W/3000W (standard version)		
Wire feeder	Single feeder (standard); double feeder (optional)		
Mechanical parameters			
Specifications/parameters	1500W	2000W	3000W
Overall size (length, width and height)	1080*580*780	1080*580*780	1100*580*900
Overall weight	102Kg	111Kg	145Kg
Overall power consumption	8.5Kw	11Kw	16.5Kw
mode of operation	Handheld/automated		
Laser part			
Laser power (optional)	1500W/2000W/3000W/other (optional)		
Power stability	Better than 5%		
Power adjustment range (W)	200W-maximum output power of the laser		
repeat frequency rate (Hz)	200-20000 (adjustable)		
laser wave length	1064-1080		
Armored cable length	9-meter standard (customizable)		
Chiller section			
cooling-down method	Water cooling		
Chiller configuration	1.5 pieces / 2.0 pieces / 3.0 pieces		

Handheld laser welding machine	Light beam continuous laser	Chiller: 1
		
One bullet in the head	Laser dedicated wire feeder: 1	Double feeding machine (optional)
		
Protective lenses: 5	Wire feeder: 1 set	Laser protective glasses: 1 pair
		

AS12	BS16	CS12	C	ES12	FS16	AS20
						
Internal corner welding wire 0.8mm/1.0mm/1.2mm	Internal corner weld wire 1.6mm	Wire feeding for angled welding 0.8mm/1.0mm/1.2mm	Used for general flat corner welding without wire feeding.	Wire feeding for angled welding 0.8mm/1.0mm/1.2mm	The corner weld is used for feeding 1.6mm wire	Internal corner weld wire 2.0mm
M8D1.5	AS16D	AS20D	AS25D	BS20	Single feed nozzle	Double feed nozzle

						
Used for cutting	Internal corner weld with 1.6mm wire feed	Internal corner weld with 2.0mm wire feed	Internal corner weld with 2.5mm wire feed	Internal corner weld with 2.0mm (8mm weld)	Single feed wire copper nozzle	Double feed wire copper mouth 1.6/2.0mm

II. Notes

2.1 Safety precautions



Before using this product, please carefully read this manual and confirm your full understanding of its functions and contents. Ensure proper installation and debugging procedures are followed during operation. Our company shall not be held liable for any direct, indirect, incidental, or consequential losses arising from improper use of this manual or the product. The following sections outline correct usage guidelines to ensure operator safety, prevent personal injuries, and protect property integrity. Please review these instructions thoroughly!



Any installation, commissioning, operation and maintenance personnel need to learn professional knowledge, which shall be trained by personnel who have received professional training, safety training, understanding of possible dangers and familiar with the safety measures to deal with the dangers. In addition to the safety regulations stipulated by laws and regulations, the safety regulations specified by the manufacturer must also be observed.



Before operating the equipment, you must wear special laser protective glasses. The machine may generate four levels of laser during operation. Avoid direct or scattered exposure of eyes or skin to laser. Even if you wear protective glasses, direct exposure of eyes to laser can still cause blindness in both eyes. Never point the laser at the body at any time, otherwise it will cause casualties!



During machine maintenance and laser head consumable replacement repairs, the power must be turned off immediately! Avoid direct exposure of eyes or skin to laser beams or their scattered radiation! Never look directly at the laser beam. When welding high-reflection materials, ensure no personnel stand in the direction of the laser head's light emission. The reflected light can cause severe laser-induced injury and pose serious health risks.



Danger-Ultra-high voltage During equipment maintenance and repair, the power supply must be turned off and prevented from being opened during this period. Check whether the power supply system of welding equipment is good and the grounding is good. Otherwise, operators may feel tingling when using handheld welding gun, and the welding system may be damaged.



During the operation of the equipment, do not put your hand or other parts of your body in the forward direction of the moving shaft or under the laser head. The protective ground wire must be connected to the workpiece to be welded, rather than directly connected to the welding head. Otherwise, the protective function of the handheld welding head will be invalid, which may cause accidents and harm the surrounding people.



Do not place water containers on the equipment. Water or liquids spilled on the welding machine may cause electric shock or fire. Avoid splashing water or liquids onto handheld torches, as this could lead to short circuits and fires in the nozzle or welding device. Never use laser welding torches or cleaning tools on flammable or explosive materials.



Before welding, ensure the protective gas is properly activated and maintain welding pressure within 0.1-0.3Mpa range. Failure to activate the gas shield can severely damage the welding torch's optical components, while excessive gas pressure may cause molten droplets to splash. Never weld perpendicular to the workpiece, as this orientation allows molten material to enter the torch's interior and burn out the optical lens.

After the termination of laser welding or laser cleaning, the processed workpiece is in a high temperature state. Please do not touch the workpiece to prevent scalding.



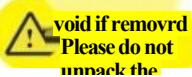
Keep the PE of the power line reliably grounded. You may be electrocuted in case of abnormality.



Please check the water temperature of the chiller regularly to ensure that the welding gun and laser have a good cooling effect. The low temperature of the chiller is $26^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and the normal temperature is set to $28^{\circ}\text{C} \pm 2^{\circ}\text{C}$. QBH/RD head does not condense.



The laser output optical cable must be placed in a natural state and twisted is prohibited. The output optical cable should keep the bending radius of the fiber more than 200mm, otherwise the responsible core will be broken.



Do not tear off the anti-tampering label on the head and controller housing to avoid loss of warranty rights.



It is forbidden to modify the laser welding gun by oneself, the above behavior may cause short circuit of the welding gun, and any behavior other than that specified in the manual is prohibited.



Machines in motion are dangerous! Users are responsible for effectively handling the error points and safety protection mechanisms in the machines. The company is not obligated or responsible for any direct, indirect or consequential losses caused

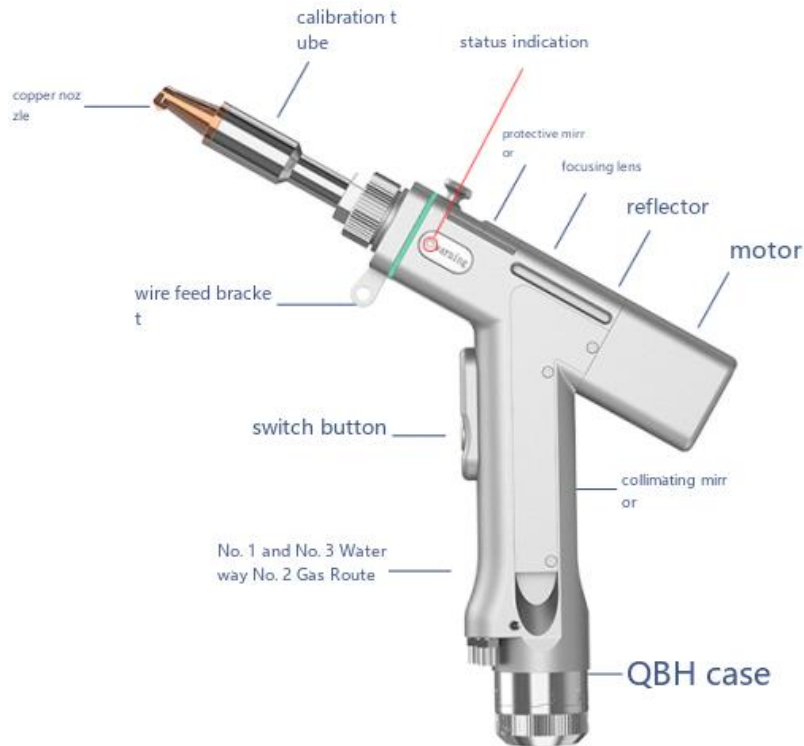
Handheld laser welding gun and system control introduction

3.1 Installation and debugging

3.1.1 Operating environment and parameters



service voltage (V)	220V±10% AC 50/60Hz
Place environment	Flat, vibration and impact free
Working environment temperature (°C)	10 ~ 40
Working environment humidity (%)	< 70
cooling-down method	hydrocooling
Applicable wavelength	1064nm(±10nm)
Applicable power	≤2000W
alignment	D16*4.5/F60
focus	D20*4.5/F150
reflex	30x14xT2
Protective mirror specifications	D18*T2
Maximum support air pressure	15Bar
Focus vertical adjustment range	±10mm
Scan width-welding	(Standard) 0~6mm (Customization) 0~8mm
Scan width-cleaning	F150-0~30mm
	F400-0~60mm
	F800-0~120mm
weight	0.7kg



service voltage (V)	220V±10% AC 50/60Hz
Place environment	Flat, vibration and impact free
Working environment temperature (°C)	10 ~ 40
Working environment humidity (%)	< 70
cooling-down method	hydrocooling
Applicable wavelength	1064nm(±10nm)
Applicable power	≤3000W
alignment	D16*4.5/F60
focus	D20*4.5/F200
reflex	30x14xT2
Protective mirror specifications	D18*T2
Maximum support air pressure	15Bar
Focus vertical adjustment range	±10mm
Scan width-welding	(Standard) 0~8mm
Scan width-cleaning	F150-0~30mm
	F400-0~60mm
	F800-0~120mm
weight	0.75kg

3.1.2 Pay attention to information

1. Ensure reliable grounding before power supply.
2. The laser output head is connected to the handheld laser head through QBH. Please check the laser output head carefully during use to prevent dust or other pollution. Clean the laser output head with special lens paper.
3. If the equipment is not used according to the method specified in this manual, it may be in abnormal working condition and cause damage.
4. When replacing the protective mirror, please ensure that proper protection is in place.
5. Please note: When using for the first time, the red light cannot come out from the copper mouth. Do not emit light.

3.2 Installation and connection

3.2.1 Controller interface definition

As shown in Table 2.1, the interface definition of handheld laser head controller is as follows:

Table 2. 1 SUP21T controller interface definition

plug		definition	Signal type	Explain in detail
source	1	-15V	import	Connect V2 to the ± 15V switching power supply to provide -15V power supply voltage
	2	GND	Reference	Connect to ± 15V and open any COM of the power supply
	3	+15V	import	Connect V1 to the ± 15V switching power supply to provide +15V power supply voltage
	4	GND	Reference	Connect to the -V of the 24V switching power supply
	5	+24V	import	Connect to the +V of the 24V switching power supply
LCD	1	G	Reference	Power ground
	2	R	transmitting terminal	Data direction: controller → LCD screen
	3	T	receiving terminal	Data direction: LCD screen → controller
	4	V	output	Provide 24V power supply for LCD screen
Signal interface 1	1	GND	Reference	Signal ground
	2	Pressure alarm signal	import	The alarm signal polarity can be set on the setting page. If not used, set it as low level alarm
	3	GND	Reference	Signal ground
	4	Water cooling machine alarm signal	import	The alarm signal polarity can be set on the setting page. If not used, set it as low level alarm
	5	Safety anchor reference point	Isolation	Connect the metal clip and connect with the processed part. In the cleaning mode, the system does not make a judgment, and this foot

				is suspended
	6	Safety door	import	Seven-core wire-blue wire (marked with safety lock on top) -the system does not make judgment in cleaning mode, and this foot is suspended
	7	Welding head light switch 1	import	Seven-core wire-black wire (marked with optical switch 1 on top)
	8	Welding head light switch 2	import	Seven-core wire-brown wire (marked with optical switch 2 above)
Signal interface 2	1	Measuring temperature 1	import	Seven-core wire-yellow wire (top temperature measurement 1) Connect the same seven-core wire-green wire (marked GND on top) to GND to form a circuit
	2	Measuring temperature 2	import	Seven-core wire-red wire (marked temperature 2) Connect the same seven-core wire-white wire (marked GND on top) to GND to form a circuit
	3	Protective valve-	Reference	Signal ground (reference ground for 2/4 feet)
	4	Protective valve +	output	Valve open: output 24V; Valve closure: no output.
	5	wire feed -	output	Wire feeding machine two-core wire-brown (marked with wire feeding above)
	6	wire feed +	output	Wire feeding machine two-core wire-blue wire (marked with wire feeding +)
Signal interface 3	1	Abnormal laser signal	import	Laser alarm signal
	2	The laser is enabled by light emission	output	Enabling signal for laser
	3	24V output	output	24V output, which outputs 24V voltage directly after power-on.
	4	GND	Reference	Reference (foot 1/2/3/5)
	5	0~10V analog quantity	output	Analog DA+ for laser reception
	6	Radio frequency-(PWM-)	output	Laser pulse width modulation signal-
	7	Radio frequency +(PWM+)	output	Laser pulse width modulation signal +

1. Power supply end of the controller

The power supply end uses the 5P interface and is powered by the random 24V switching power supply and $\pm 15V$ switching power supply.

Please note that the positive and negative poles of the 15V switch power supply are distinguished. V1 is connected to +15V, and V2 is connected to -15V. Any COM on the 15V switch power supply is connected to the 2nd foot GND!

Please note that the switching power supply must be grounded!

2. The LCD screen of the controller

The LCD screen wiring is randomly attached and can be directly connected. See Table 2.1 for the specific definition.

3. Controller signal interface 1

Signal interface 1 uses 8P interface as the input signal interface, and the detailed interface definition is shown in Table 2.2:

Table 2.2 Signal Interface 1 function description

Signal interface 1		
Pin number	Signal definition	function declaration
1	GND	Pressure alarm signal input port, if needed to enable (need to connect), Please set the "air pressure alarm level" on the display screen setting page to be consistent with the actual air valve alarm level.
2	Pressure alarm signal	
3	GND	Water tank alarm signal input port, if needed to enable (need to connect), Please set the "water cooling alarm level" on the display screen setting page to be consistent with the actual water cooling alarm level.
4	Water tank alarm signal	
5	Safety anchor reference point	Connect the metal clip and connect with the processed part -in the cleaning mode, the system does not make a judgment, and this foot is suspended
6	Safety door	Seven-core wire-blue wire (marked with safety lock on top) -the system does not make a judgment in cleaning mode, and this foot is suspended
7	Welding head light switch 1	Seven-core wire-black wire (marked with optical switch 1 on top)
8	Welding head light switch 2	Seven-core wire-brown wire (marked with optical switch 2 above)
Note: Please note that the subsequent output ports will have normal output signals only when there is no alarm and the safe lock and switch signals are green.		

4. Controller signal interface 2

Signal interface 2 uses 6P interface, the detailed function definition is shown in Table 2.3:

Table 2.3 Signal interface 2 function description

Signal interface 2		
Pin number	Signal definition	function declaration
1	Measuring temperature 1	Calibration mirror temperature measurement requires a circuit with GND
2	Measuring temperature 2	To measure temperature with a protective mirror, form a circuit with GND
3	Protective valve-	Valve on: protection valve + output 24V; Valve closure: protective valve + no output.
4	Protective valve +	
5	wire feed -	The signal of wire feeding switch is connected according to the wire label.
6	wire feed +	

5. Controller signal interface 3

Signal interface 3 uses 7P interface, the detailed function definition is shown in Table 2.4:

Table 2.4 Signal interface 3 function description

Signal interface 3		
Pin number	Signal definition	function declaration
1	Abnormal laser signal	To enable it (connect the wire), please set the display page The laser alarm level is consistent with the actual laser alarm level.
2	The laser is enabled by light emission	Enable +, connect the laser enable +.
3	24V output	24V output, which outputs 24V voltage directly after power-on.
4	GND	For the common land (reference ground at 1/2/3/5)
5	analog quantity +	Analog output (default 0~10V analog voltage).
6	Radio frequency- (PWM-)	PWM- modulating signal
7	Radio frequency + (PWM+)	PWM+ modulating signal

3.2.2 Controller wiring diagram

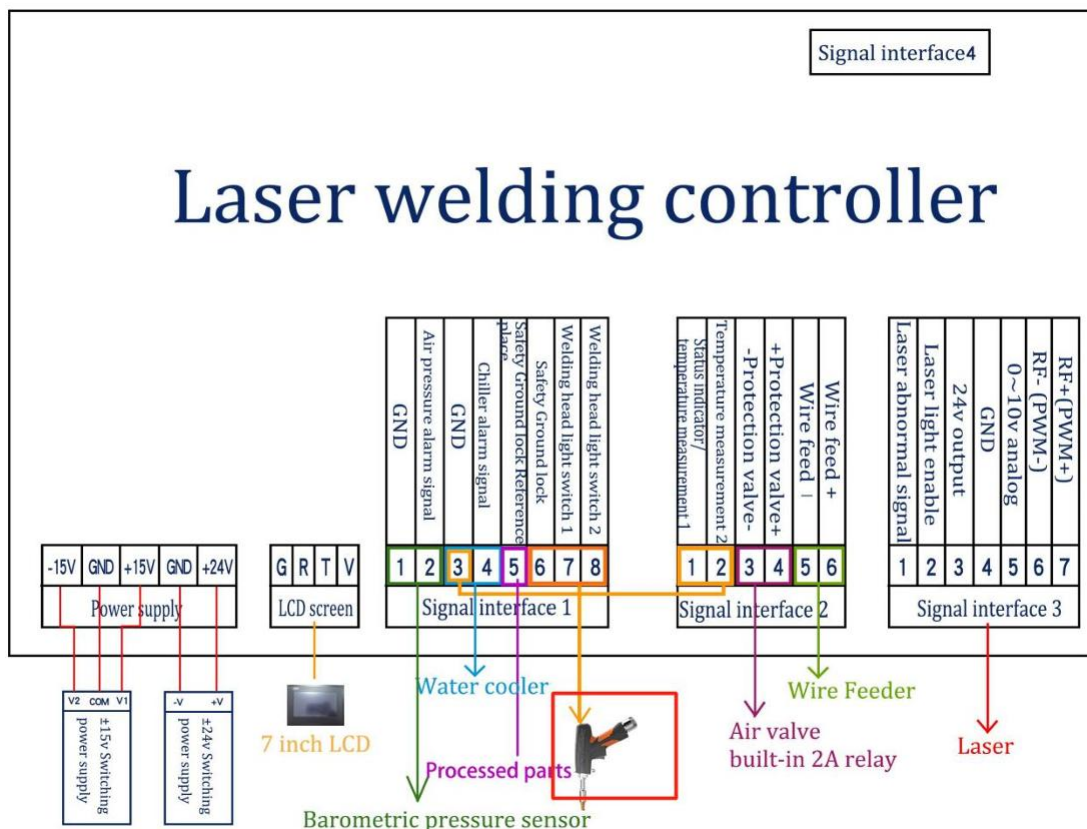


Figure 2.1 Controller wiring diagram

Note: the ground wire of the switching power supply must be effectively grounded!

Note: ±15V, the COM terminal of the switching power supply and the +24V switching power supply-V (0V) terminal should be connected to GND. The switching power supply shell must be connected to the ground, otherwise there may be abnormal light out.

3.2.3 Optical fiber input interface

SUP welding connectors are compatible with most industrial laser systems. Common fiber optic connectors include IPG, Riko, Chongxin, Feibo, Spurs, Jepet, and Kaplin models. Maintain optical components in clean conditions and remove all dust before use. When inserting fibers, ensure the welding torch head is horizontally positioned to prevent dust from entering through the interface.

3.2.4 Protective gas and water cooling machine interface

The water pipe and air pipe interface can be installed with a hose with an outer diameter of 6mm and an inner diameter of 4mm. The inlet and outlet pipes of the water circuit (regardless of the direction)

The cooling system consists of the water circuit part of the welding head and the water circuit part of the fiber optic head, which are connected in series as shown in the figure below:

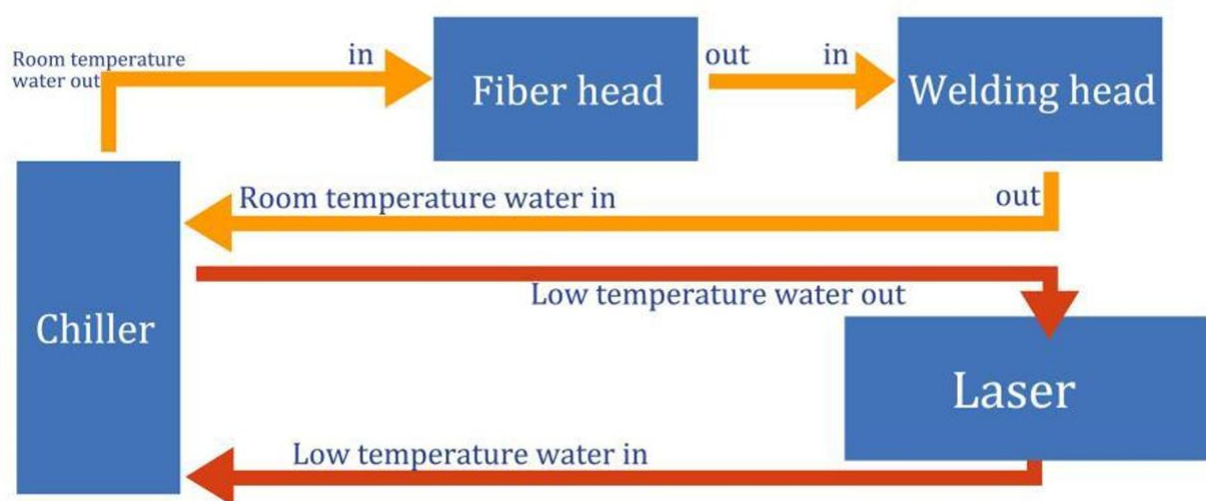


Figure 2.2 Schematic diagram of water circuit for welded joint and fiber optic head

3.2.5 Connection interface between welding torch and control box

The handheld welding head is connected to the control box via a set of "multi-function system connectors". The handheld welding head features an aviation plug female connector, while the control box uses an aviation plug male connector. The seven-core cable controls light output and temperature monitoring in the gun body, whereas the two-core and five-core cables serve as control lines for the galvanometer motor.

3.3 Control Panel Operation Guide

The SUP-21T handheld welding head control panel version number is V5.8-81-701. You can view the system version on the monitoring page, and the last three digits represent the control panel version.

Supported languages:

simplified Chinese	English	Korean	Russian
traditional Chinese	Japanese	Dervin	French
Italian	Spanish	Portuguese	Turkish
Greek	Czech	Slovak	Polish
Thai	Vietnamese	Romanian	

3.3.1 Welding mode

1. Control panel page

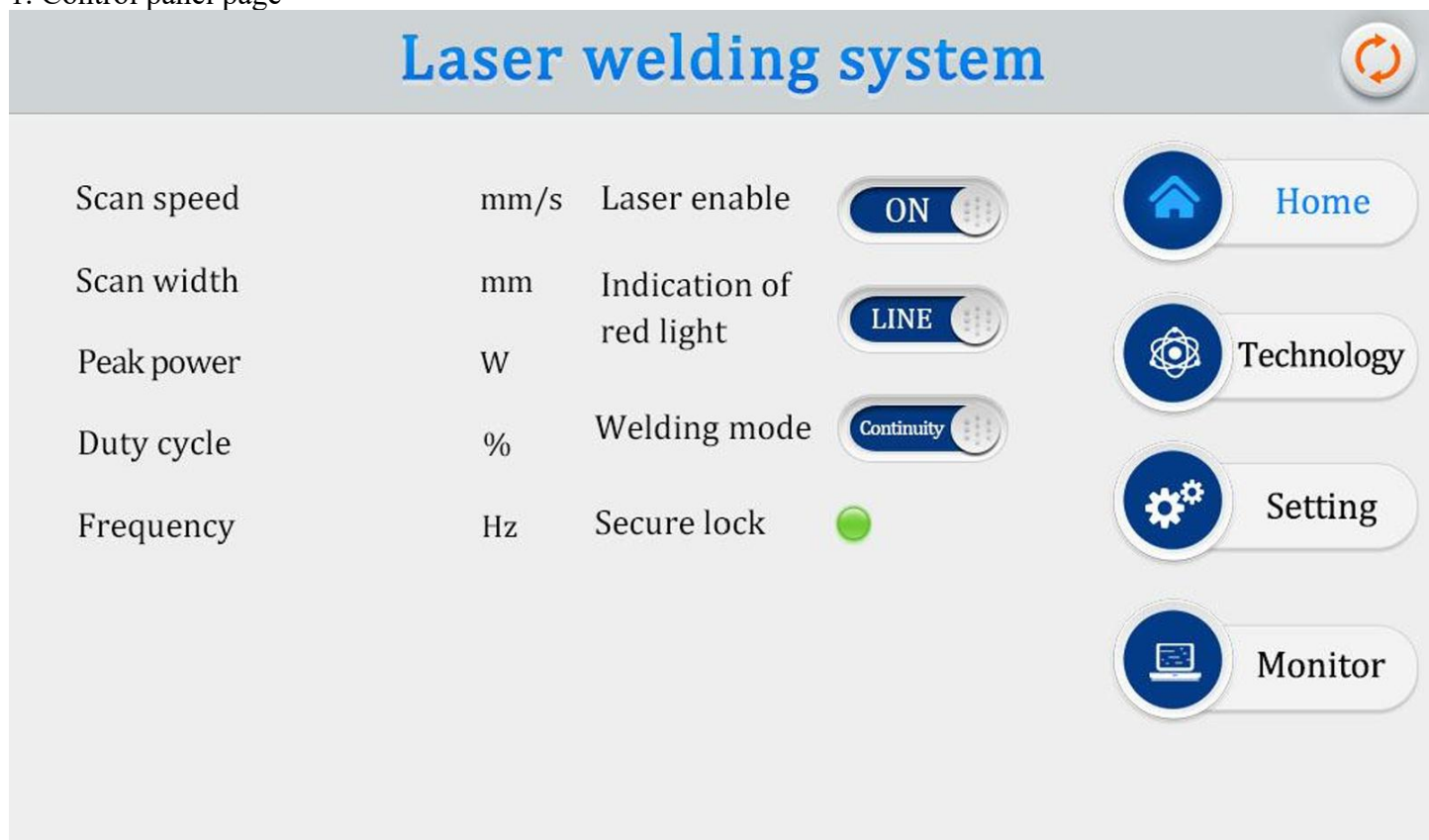


Figure 3.1-1 Control panel home page

(1). This interface can see the current process parameters (this page cannot modify the process) and real-time alarm information.

(2). In startup mode, the default enable is set to ON, with the indicator red light showing LINE mode and continuous welding mode. When disabled, no enable signal is sent to the laser, which can be used to test the gas discharge function. Turning off the red light indicator stops motor oscillation, displaying a single red dot at this stage for center position adjustment. Welding modes include continuous and spot welding. When selecting spot welding, the type must be configured in the settings page.

(3). The safety lock is divided into gray and green. When the metal clip is clamped on the workpiece and the gun body copper nozzle contacts the workpiece, the 5th and 6th pins of signal interface 1 are connected, and the safety lock indicator light shows green. At this time, pressing the trigger can realize the light.

(4) Click the upper right corner to switch cleaning mode.

2. Laser welding process

At present, the process page provides 10 process items for users to save parameters. The following introduces the definition and range of process parameters:

Laser welding system

Technology

Help

Process library: monofilament (0~6mm)

Material	thickness mm
carbon steel	
stainless steel	
aluminium	
other	

Scan speed mm/s

Scan width mm

Peak power W

Duty cycle %

Frequency Hz

Silk feeder

Feeding speed cm/min

Weld wire diameter mm

Spot welding type **Interval**

Spot welding duration ms

Spot welding interval ms

Import Return

Figure 3.1-2 Control panel process page

(1). The process interface contains the debugging process parameters. Click the box (red) to modify. After modification, click OK and then save it in the quick process. When using it, click import (modify-save-import).

(2). The scanning speed ranges from 2 to 6000 mm/s, with a scanning width of 0.6 mm. The scanning speed is limited by the scanning width, following the rule: $10 \leq \text{scanning speed} / (\text{scanning width} \times 2) \leq 1000$. Exceeding this limit will automatically reset to the maximum value. When the scanning width is set to 0, no scanning occurs (i.e., point light source). (Most commonly used scanning speed: 300 mm/s, width 2.5-4 mm).

(3). The peak power shall be less than or equal to the laser power on the parameter page (if the laser power is 1000W, this value shall not be higher than 1000).

(4) The duty cycle range is 0~100 (default 100, usually not needed to change).

(5). The recommended pulse frequency range is 5-5000Hz (default 2000, usually no change is needed).

(6). Click the HELP button in the upper right corner to get more explanations of relevant parameters.

(7). After modifying the parameters, you can check whether the import is successful on the home page.

(8) Reference process: You can refer to the process in the small program.

matters need attention :

(1). Some lasers cannot emit light with less than 10% power. When the peak power of the process page is less than 10% of the maximum power of the laser on the setting page, all output signals are normal, but no light may be emitted.

(2). The default duty cycle is set to 100%, which generally requires no adjustment. In such cases, the pulse frequency has no effect. If required, adjust it according to actual needs. Example: With peak power of 300W, duty cycle of 50%, and pulse frequency of 1000Hz, the light emission cycle is 1mS,0.5mS. When emitting light at 300W, there's a 0.5mS gap between emissions, repeating this pattern. The normal phenomenon is the air at the welding area producing explosive noises and abnormal sounds. Actual conditions should be verified against laser parameters.

(3) Click the Help button in the upper right corner of the screen to get more explanations of relevant parameters.

(4) More reference processes can be viewed in the process of WeChat Mini Program.

3. Control panel Settings

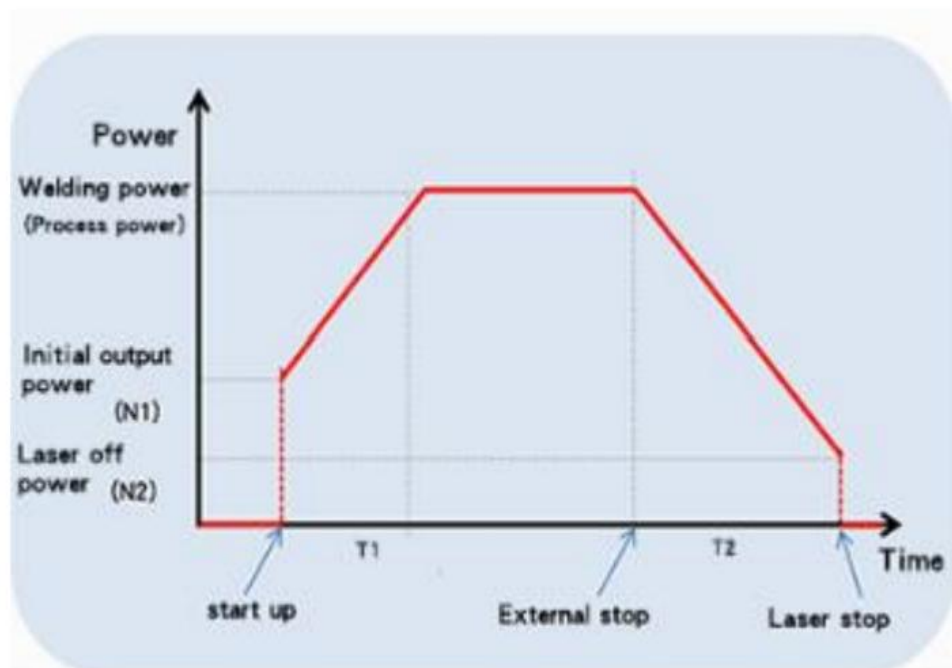
Figure 3.1-3 Control panel Settings page

Click "Settings" on the home page, and enter the password 123456 in the password input page of the pop-up window to enter the Settings page.

(1). Laser power is the power of the laser used. Please fill in correctly.

(2). Switch gas delay is 200ms by default, ranging from 0ms to 3000ms.

(3) During the opening of the light, the process power is gradually increased to 100%; during the closing of the light, the process power is gradually increased to N2 (as shown in the figure below):



graph 3.1-4

The preset optical power of the switch is generally 20%, and the gradual time of the switch is 200ms;

(4) Wire delay compensation refers to the wire advance time relative to the light output signal, which can be used with the retract function. It is not set by default;

(5). The maximum value of the three temperature alarm valves is 70°C. When this value is set to 0, the temperature is not detected, and the buzzer will alarm when the measured temperature is greater than the set value;

(6). The scanning correction coefficient = target line width/measurement line width, ranging from 0.01 to 4. It is usually set to 1;

(7). Laser center offset-3~3mm, reduce to the left and increase to the right, applied to adjust the red light center of the axis;

(8) The alarm level signal of air pressure/cooling machine/laser is set as low by default. When using this alarm signal, the alarm level here should be set to the same as that of external equipment;

(9). Spot welding duration is the light output time in each cycle of spot welding mode, and spot welding interval time is the light stop time in each cycle of spot welding mode;

(10). Click the Help button in the upper right corner to get more explanations of relevant parameters.

4. Signal status monitoring

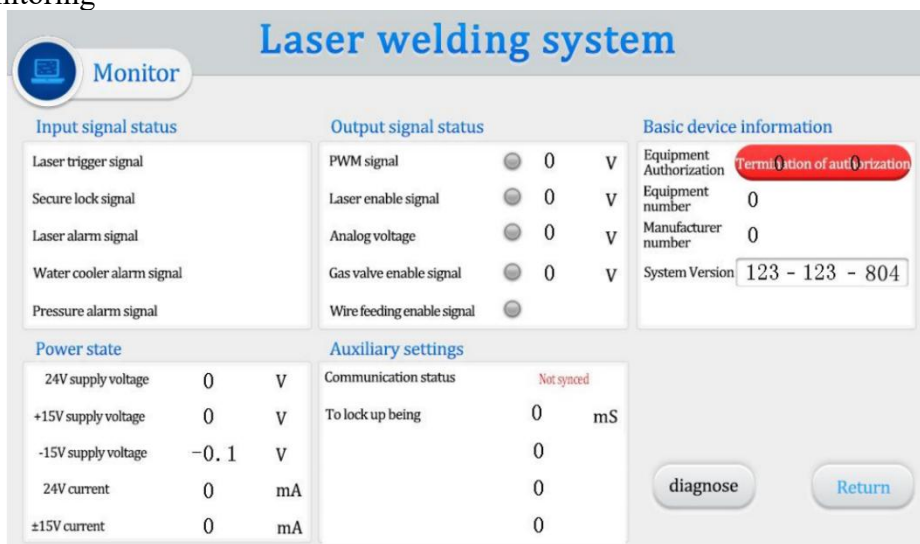


Figure 3.1-5 Monitoring page

This page shows the status of each signal and the device information.

(1) Input signal status

Laser trigger signal: When the user controls the signal interface 1, pins 7 and 8 are connected, the state changes from gray to green.

Safety ground lock signal: normally short circuit, this state changes from gray to green.

Laser/hydraulic/cyber alarm signal: monitors the real-time level status of these interface inputs.

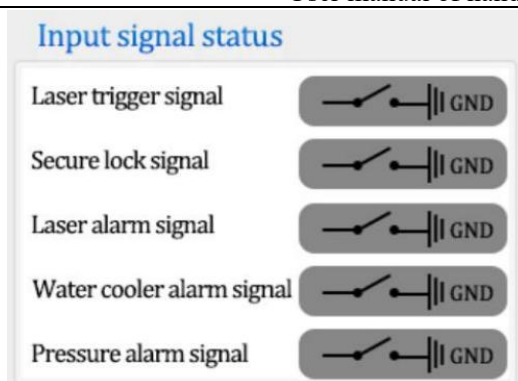


Figure 3.1-6 Monitoring page-input signal status bar

(2) Output signal status

When the signal is output, the signal in this area changes immediately and can be visualized. The monitoring signal is a real-time circuit signal that fluctuates within a certain range and has an error of less than 0.3V with the final output signal.

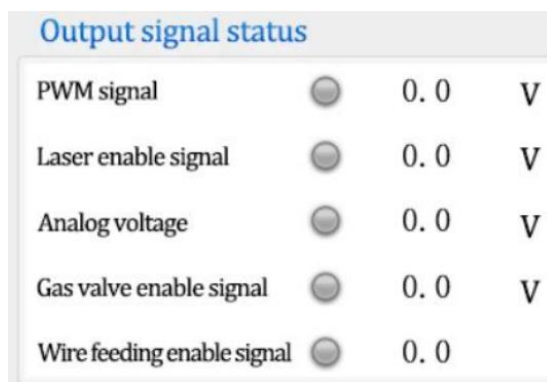


Figure 3.1-7 Monitoring page-Output signal status bar

(3) Basic information of the equipment

Device authorization: Click to encrypt the use time of the device. When the device is used for more than the set time, the authorization will be terminated. The factory default is long-term valid. If you need to encrypt or decrypt, please contact us for inquiry.

System version: three sets of numbers, the first group is the hardware version, the second group is the single chip program version, the third group is the touch screen version.

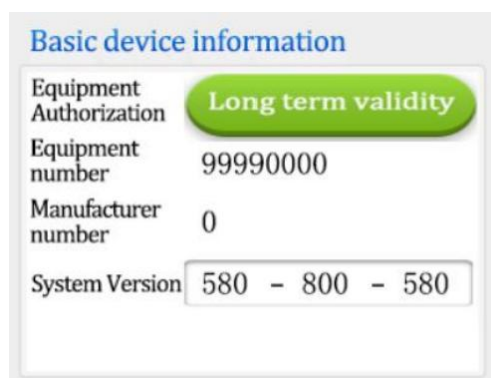


Figure 3.1-8 Monitoring page-Set the basic information bar

(4) Power status

It displays the real-time power supply voltage and current of the device. Due to the algorithm update, data accuracy continues to be indicated, and there will be some differences in the current status of different versions, which is a normal phenomenon. The main purpose is to help after-sales service troubleshoot power supply faults through the power supply voltage.

Power state		
24V supply voltage	23.7	V
+15V supply voltage	14.9	V
-15V supply voltage	-14.9	V
24V current	72	mA
±15V current	13	mA

Figure 3.1-9 Monitoring page-Power status bar

(5) Communication status

"Communication status" indicates the communication between the touch screen and the motherboard. If the synchronization is not synchronous, check the screen connection cable.

The "Safety Ground Lock Anti-Shake" feature addresses contact failures in safety ground locks, operating within a 0-300ms range. To configure parameters, click the "Device Authorization Box" on the password page (as shown in Figure 3.1.10). The password "fffffaa300" contains two fixed components: "fffffaa" denotes the anti-shake parameter (unchangeable) and "300" indicates the duration (300ms). This mechanism ensures continuous light output when trigger signals are normal and safety ground lock signals remain open for <300ms. The feature is typically set to 0 to resolve unstable conductivity in materials with poor surface properties (e.g., corrosion) during welding processes.

Laser welding system

License

f f f f f f a a 3 0 0

Import

C	D	E	F	←	ESC
6	7	8	9	A	B
0	1	2	3	4	5

Figure 3.1-10 Monitoring page-Auxiliary status bar-Anti-shake password for the ground lock

The three real-time temperature parameters—"Motor Driver Temperature," "Protection Mirror Temperature," and "Collimator Mirror Temperature"—are measured to monitor equipment performance. The Motor Driver Temperature directly affects motor oscillation performance. Poor heat dissipation in the equipment's environment may cause abnormal temperature spikes in this parameter, which can reduce laser scanning speed and ultimately compromise weld quality. The Mirror Temperature provides operational status feedback, helping to determine whether the mirror has been damaged.

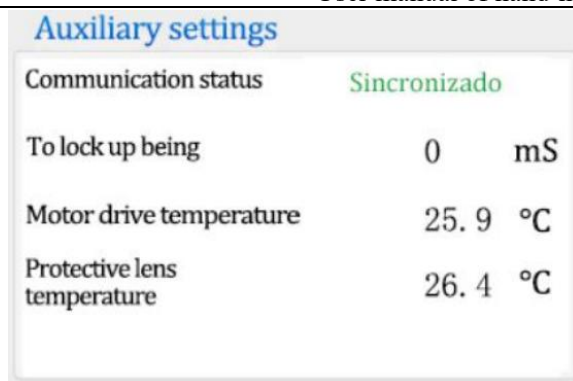


Figure 3.1-11 Monitoring page-Auxiliary status bar

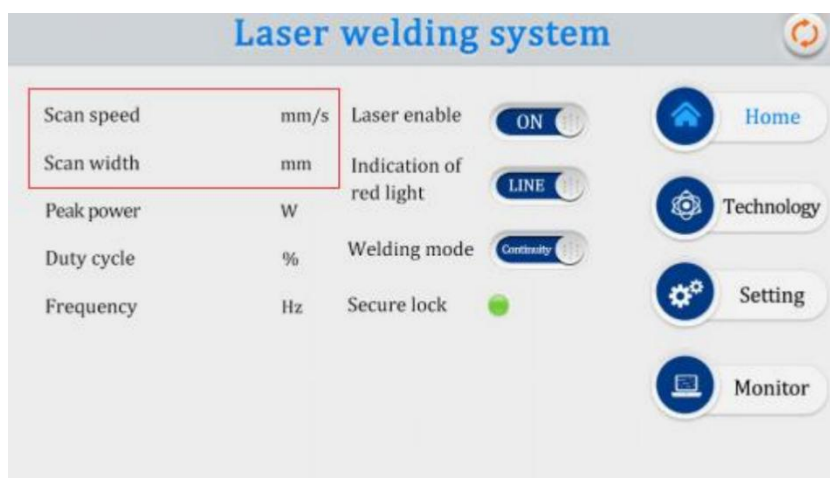
(6) Diagnosis

Click the "Diagnosis" button in the detection interface to access the diagnostic screen. This function verifies whether each signal port has actual outputs, typically requiring consistent output values with detected readings. When discrepancies occur (e.g., when the laser fails to emit light), performing individual port switches in conjunction with laser monitoring software or multimeter measurements can accurately determine if signal transmission is functioning properly.



Figure 3.1-12 Diagnostic page

3.3.2 Cutting mode

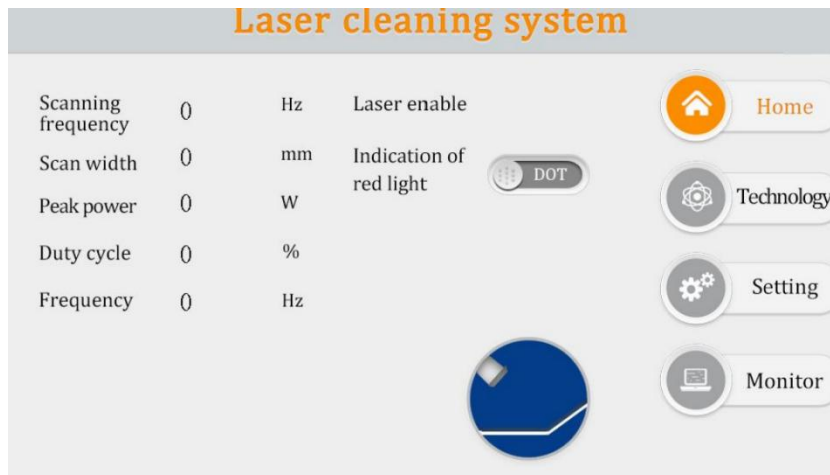


graph 3.2-1

Indicate the red light to switch to "dot", replace the copper nozzle for cutting, and carry out the cutting operation. The control logic of cutting is the same as that of welding. It is necessary to press the trigger and safely lock the conduction at the same time.

3.3.3 Cleaning mode

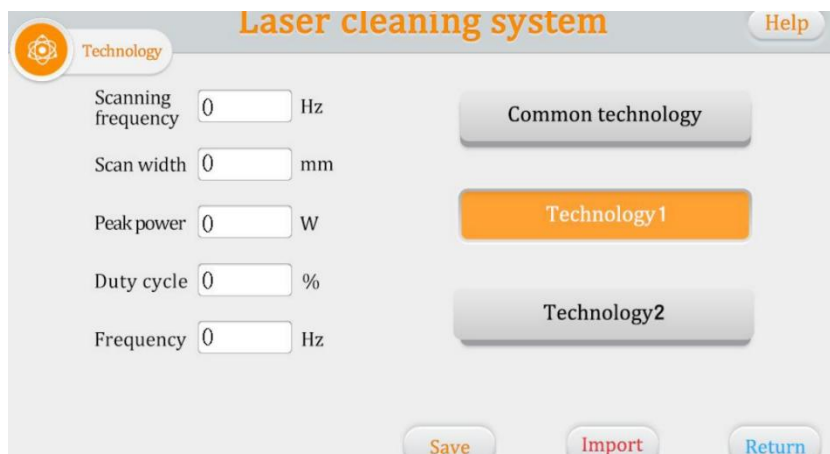
1. This interface can see the current process parameters (this page can not modify the process) and real-time alarm information.



graph 3.3-1

2. When enabled in startup mode, the default indicator red light stays on. When disabled, no enable signal is sent to the laser, which can be used to test the gas discharge function. When the red light is turned off, the motor stops oscillating. At this point, the red light becomes a single dot, which is used to adjust the center position.

3. Click the upper right corner to switch the cleaning mode.



graph 3.3-2

(1). The process interface contains the debugging process parameters. Click the box (red) to modify. After modification, click OK and then save it in the quick process. When using it, click import (modify-save-import).

(2). The scanning frequency range is 10-100HZ, and the scanning width range is 0~30mm. (When focusing lens F400, the maximum width is 60mm. When focusing lens F150, the maximum width is 30mm).

(3). The peak power shall be less than or equal to the laser power on the parameter page. (If the laser power is 1000W, this value shall not be higher than 1000).

(4) The duty cycle range is 0~100 (default 100, usually not needed to change).

(5). The recommended pulse frequency range is 5-5000Hz (default 2000, usually no change is needed).

(6). Click the "Help" button in the upper right corner to get more explanations of relevant parameters.

(7). After modifying the parameters, you can check whether the import is successful on the home page.

(8) Reference process: You can refer to the process in the small program.

4. Parameter setting in cleaning mode.

The screenshot shows the 'Laser cleaning system' parameter setting interface. It includes a 'Setting' tab and a 'Help' button. The interface is divided into several sections for parameter input:

- Gunhead model:** SUP21/23T
- focal length:** 150 mm
- Width:** 30 mm
- Laser power:** 0 W
- Laser starting power:** 0 %
- Open gas delay:** 0 ms
- Laser on progressive time:** 0 ms
- Off gas delay:** 0 ms
- Laser off power:** 0 %
- Scan correction:** 0
- Laser off progressive time:** 0 ms
- Laser center offset:** 0 mm
- Motor drive temperature threshold:** 0 °C
- Protective mirror temperature threshold:** 0 °C
- Collimator temperature threshold:** 0 °C
- Language:** 中文
- Trigger setting:** Click on
- Laser alarm level:** Low
- Chiller alarm level:** Low
- Pressure alarm level:** Low
- Buttons:** Save, Return

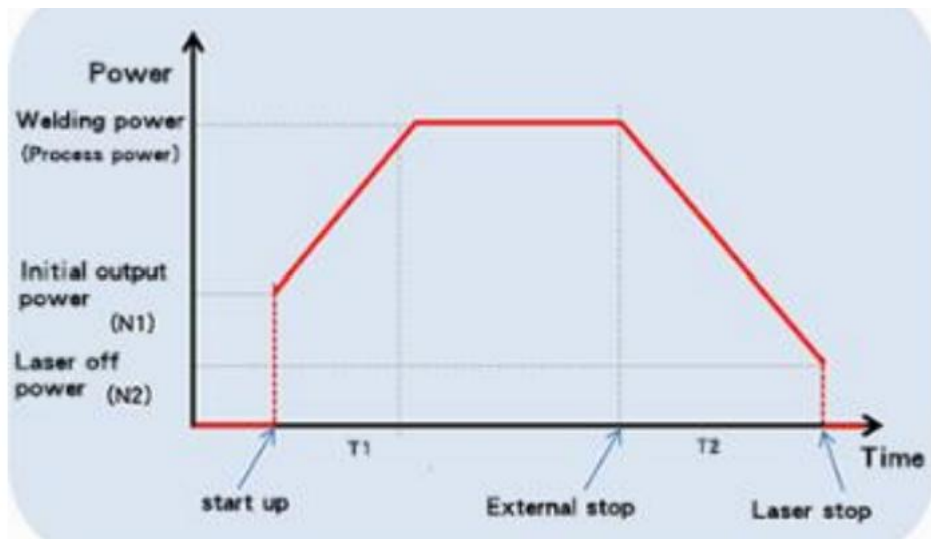
graph 3.3-3

Password 123456

(1). Laser power is the power of the laser used. Please fill in correctly.

(2). Switch gas delay is 200ms by default, and the range is 200ms-3000ms.

(3) During the opening of the light, the process power is gradually increased from N1% to 100%; during the closing of the light, the process power is gradually increased from 100% to N2% (as shown in the figure below).



graph 3.3-4

The higher the process power is, the lower the recommended opening power should be. The opening power should not exceed 50%, and too high opening power will greatly reduce the service life of the lens.

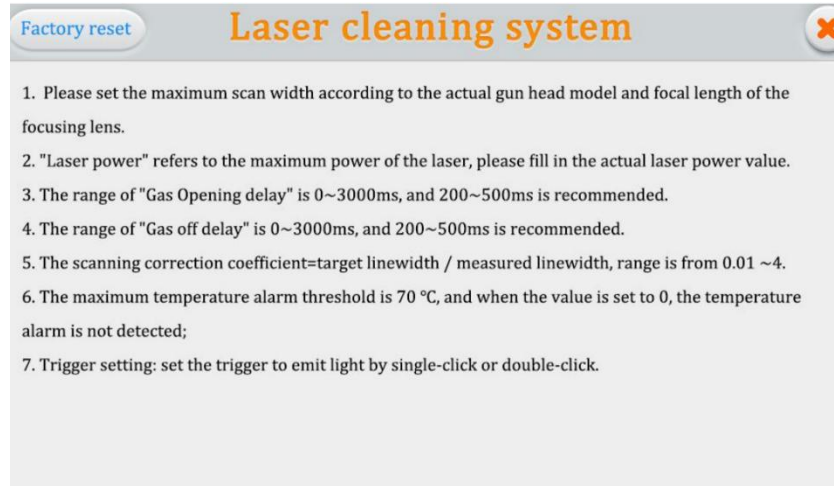
(4) The maximum temperature alarm threshold is 65°C. When this value is set to 0, the temperature alarm is not detected.

(5). The range of scanning correction coefficient is 0.01~4, and the target line width/measurement line width coefficient is 1.25 by default.

(6). Laser center offset-75~75mm, reduce to the left and increase to the right, which is used to adjust the red light center.

(7). The alarm level signal of air pressure/cooling machine/laser is set as low by default. When this alarm signal is used, if an external air pressure alarm is installed, it will be changed to high level effective; otherwise, abnormal alarm will occur. The same is true for other alarm signals.

(8) Click the "Chinese" button to switch to other languages in the language selection bar. The standard version currently supports four languages: Simplified Chinese, English, Korean and Russian. If you need other language versions, please contact us.



graph 3.3-5

(9). Click "Help" in the upper right corner to enter the help page of the Settings page. Long press "Restore factory Settings" to restore the Settings parameters to the factory state. Long press "Save as factory Settings" to modify the factory parameters.

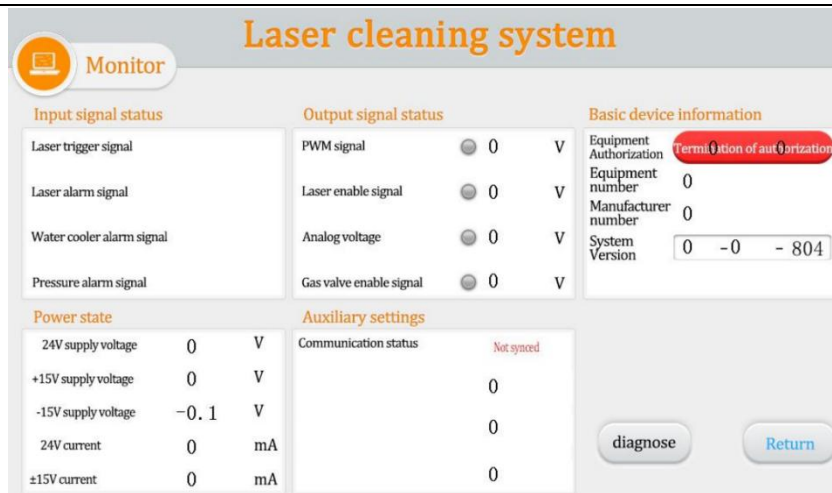


graph 3.3-6

(10). Click "Gun model" to focus more on the selection of maximum scanning width.

3.3.4 Signal status and equipment function diagnosis

1. This page shows the status of each signal and device information



graph 3.4-1

Laser trigger signal: When the trigger is pulled, this state changes from gray to green

Laser/cold water/air pressure alarm signal: monitor the set high and low levels

The output signal is shown in the middle of the page. When the signal is output, it is green on a gray display

Device authorization: You can authorize the use time of the device. When the device is used for more than the set time, the authorization will be terminated

System version: three sets of numbers, the first group is the hardware version, the second group is the single chip program version, the third group is the touch screen version



graph 3.4-2

Click the "Diagnosis" button to enter the diagnosis page. The laser on this page will not emit light, and the "PWM", "laser enable", "valve enable", and "analog quantity" can be independently output through the "switch control". Compare the test value with the theoretical value to determine whether the control box functions properly.

3.4 Maintenance and replacement methods of related lenses

1. Before operation, clean and dry your hands, then wipe them again with cotton dipped in alcohol.
2. Open the protective lens in a relatively dust-free place, focus the lens chamber cover, pull out the lens bracket, do a good job of protection (cover with rice paper), check the protective lens, if there are obvious burn spots on the surface of the lens, replace it directly.
3. Then check the white storage seal ring below the lens. (If there is any scratch or deformation of the storage seal ring, it can not be used and must be replaced immediately).

4. Wipe the bin opening and the inner side of the bin cover with a cotton ball dipped in alcohol, insert the protective mirror bracket into the protective mirror bin quickly, and lock the screw.

3.5 Common exception handling

3.5.1 Laser/hydraulic pressure alarm

1. If the alarm signal is not used and the above alarm occurs, please change the alarm level on the screen Settings page.
2. If the alarm signal is used and the above alarm occurs, check whether the alarm or high/low level of the alarm signal of the corresponding equipment is set incorrectly.

3.5.2 Screen does not light up/click does not respond

1. If the screen is not bright, ensure that the controller is powered on, check whether the four-core wire between the controller and the screen is correctly connected, and whether the voltage of the first and fourth pins is normal.
2. If the click is not working properly during normal use, check whether the temperature of the whole machine is too high.
3. Click "Can not input". Check whether the four-core wire between the controller and the screen is correctly connected, and whether the second and third pins are normal. See 2.1.2 controller display terminal for details.
4. If the new equipment does not respond to click, it may be because the system version is not matched. You can refresh the program with SD card. Please inquire about the specific version from us.

3.5.3 No light

1. Check whether there is an alarm prompt on the home page and whether laser enable is ON;
2. Check whether the trigger signal and safety lock signal on the monitoring page are green during welding;
3. Check whether PWM, laser enable and analog output on the monitoring page are normal during welding.

If the above status is normal, check whether there is an abnormal alarm for the laser.

Example: the gas is sent but no light is emitted, which is due to laser fault or laser wiring error. If neither gas is sent nor wire is sent, it may be due to the absence of input signal. See 2.1.3 controller signal interface 1 for details.

3.5.4 Sudden stop of light output during processing

Check the safety lock and other alarms on the monitoring interface.

3.6 Laser head maintenance

1. Check whether the protective lens is clean before working every day. If there are foreign objects on the lens, clean and wipe it with special sterile cotton swabs dipped in industrial alcohol in time until there is no trace of foreign objects, and then put it into use.
2. During the inspection of protective lens, if coating damage or lens bad spots are found on the protective lens, replace the protective lens immediately, otherwise it will affect the welding effect, and greatly increase the chance of burning other optical lenses of the welding gun.
3. It is necessary to connect welding protective gas (nitrogen or argon, etc.) during the welding process. The blowing gas can reduce the chance of dust entering the gun body and prolong the life of optical lenses. For

the best welding effect, it is recommended that the pressure of protective gas should be within 0.12-0.3Mpa range.

4. Ensure that the purity of welding protective gas is above 99%, and there is no water, gas or oil pollution. It is best to install an oil and water filter at the welding equipment position to ensure clean and dry gas.

5. Ensure that the deviation between the cooling water temperature of the welding head and room temperature does not exceed 2°C during the welding process, otherwise it may cause fogging of the optical lens, affecting the laser transmittance, and in serious cases, it may lead to excessive absorption of laser energy and burnout of the lens.

6. Do not point the nozzle vertically at the weld during welding, so as to reduce the chance of optical lens being contaminated by welding spatter.

7. During the rest period after the use of the welding gun, please seal the nozzle with clean adhesive tape to avoid dust from the workshop into the gun body.

8. Before pulling out the laser QBH head from the welding gun, please place the QBH horizontally before plugging and pulling it out to avoid dust falling into the welding gun. If the fiber optic QBH/ or RD head is pulled out and not used for a while, please seal the QBH joint of the welding gun with adhesive tape to prevent dust from entering the gun body.

9. Keep the operating environment clean and dust-free during the installation of QBH joint or other optical lenses.

3.7 Handgun fault analysis

1. Sudden weakening of welding energy

Foreign matter or damage to the optical lens affects the transmission of the laser. The reason for protecting the lens can be cleaned or replaced on site.

The protective gas contains impurities such as water and air, which are contaminated on the protective lens during the blowing process. Clean the protective lens and replace the protective gas at the same time. Other reasons are recommended to return to the factory for maintenance.

2. The energy attenuation of the laser itself. Return to the factory for repair of the laser.

3. The welding effect is not smooth

The reason for the uneven welding effect is that the protective gas pressure is too high, which blows away the molten welding fluid directly. The recommended pressure is 0.15-0.3Mpa.

The welding texture is very obvious, and the laser spot path can be clearly seen. The reason is that the welding point and the laser focus position are not aligned. It is recommended to use appropriate offset welding in the welding process, and the compensation can be made by adjusting the nozzle position or the scale plate position to obtain the most ideal welding effect.

4. The light spot does not swing

Reason 1: The safety protection line is not connected. Enter the status monitoring and check whether the safety protection is open

Reason 2: The graphics are selected incorrectly or the motor frequency is zero. Select the graphics and motor frequency again

Reason 3: The vibration mirror is not communicating, the line contact is poor or not connected. Enter the status monitoring to check the communication status of the vibration mirror, check the line, eliminate the line fault, reconnect the system terminal, and measure whether the path is open with a multimeter. If not, it is a line fault.

Reason 4: The galvanometer motor is damaged and needs to be repaired in the factory (Tips: In the process of using the welding gun, it is necessary to handle it gently to avoid damaging the internal optical components and motor).

5. Yellowing of stainless steel and aluminum plate welding

If the protective gas pressure is too low, adjust it appropriately. If the laser frequency is too low, the single-point energy will be high, resulting in overburning and yellowing. It is recommended to use continuous mode welding for stainless steel. If the hand movement speed is too low during welding, it will cause overburning and yellowing of the material.

6. Burn through at the starting and ending points of welding

Since the starting and ending points, the hand movement process has a acceleration and deceleration process, and the laser will continue to heat the position during this process, resulting in perforation. Appropriate slow rise and slow fall times can be set to improve this problem.

7. No light

- (1) The wiring of the welding system is wrong
- (2). The light gate of the welding system display screen is not open
- (3) The welding system detects alarm, communication and other faults
- (4) The welding system does not provide the signal to enable DA/PWM
- (5) The protection signal and switch are not connected
- (6). The welding control system program is wrong
- (7). The laser is not normally turned on
- (8) Abnormal water temperature and pressure alarm lock the laser
- (9) The laser wiring is wrong, resulting in abnormal signal communication.

8. No protective gas

For example, the gas in the bottle may have been used up, the gas valve is not open, the air blowing solenoid valve is not working, the switch button is not working, and the welding system logic control program is not set to blow output command.

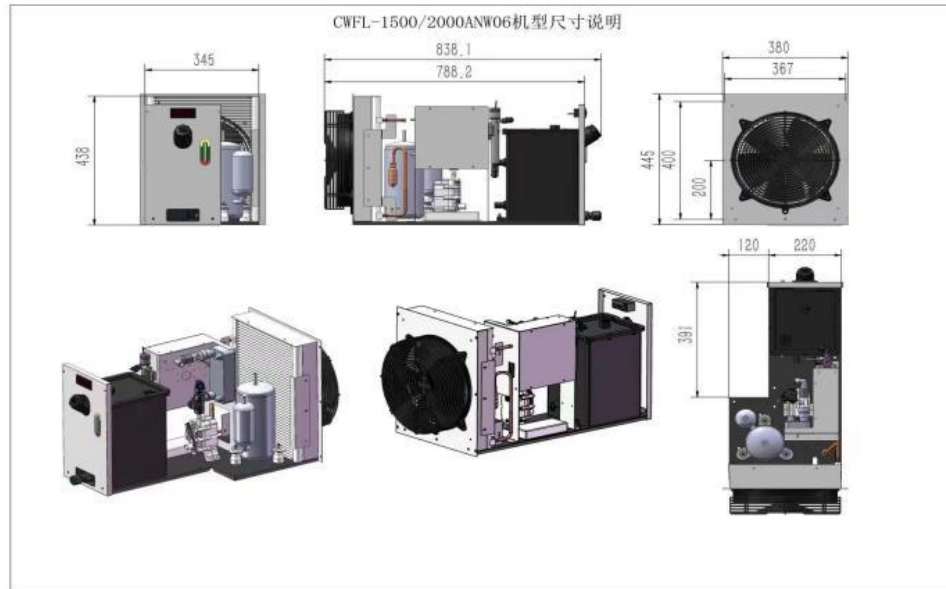
9. The gun body is hot

If the optical lens is burned, stop welding immediately. If the protective lens position is hot, you can check the lens by yourself and replace it. The protective gas contains water, which is contaminated with the protective lens and causes laser scattering, resulting in hot gun body.

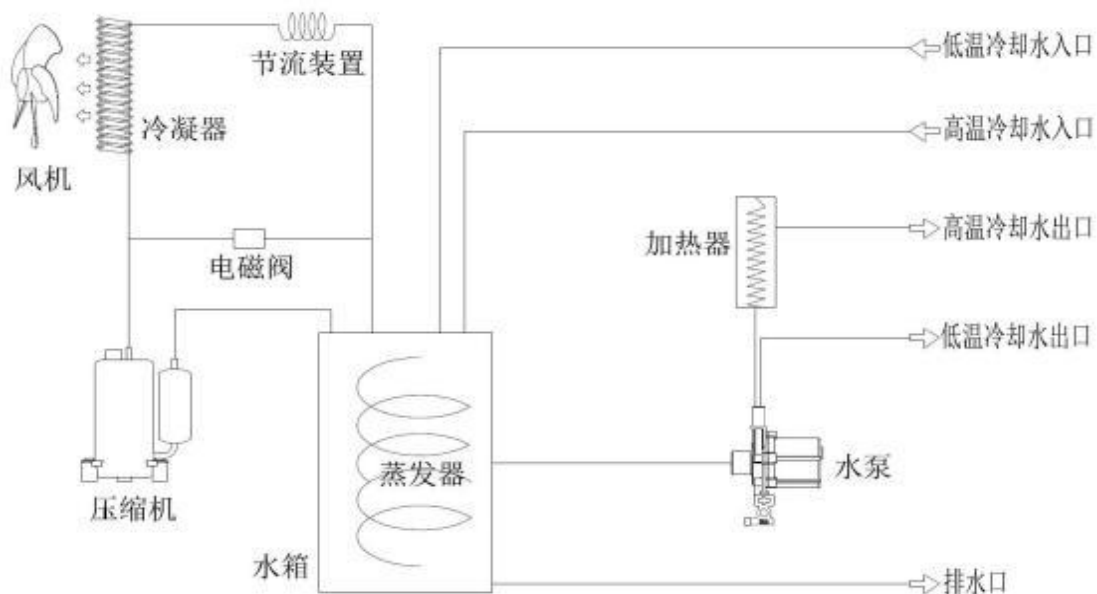
When the welding torch's water-cooling temperature becomes too low, fogging occurs on the optical lens. This causes excessive absorption of laser energy, leading to overheating of the torch body. The welding must be immediately stopped and the water temperature of the chiller should be adjusted upward. It's recommended to inspect and maintain the welding torch lens to ensure it's free from contamination or damage before resuming operation.

IV. Introduction of water cooling machine

4.1 Product Overview



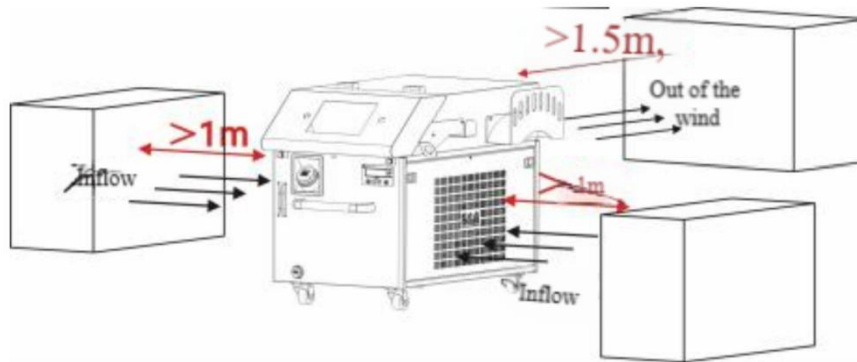
This product is designed and manufactured as an industrial cooling equipment for laser cutting, laser welding, laser marking, laser engraving and other laser processing equipment, which can provide a temperature stable cooling medium for the above application scenarios.



A chiller system consists of components including a compressor, condenser, throttling device (expansion valve or capillary tube), evaporator, and water pump. Its working principle involves the refrigeration system cooling water, which is then pumped by the water pump to equipment requiring cooling. The cooled water absorbs heat, warms up, and returns to the chiller for reheating before being recirculated back to the equipment. In the refrigeration process, the refrigerant in the evaporator coils absorbs heat from the return water and vaporizes into steam. The compressor continuously extracts this vaporized liquid from the evaporator, compresses it, and directs the high-temperature, high-pressure vapor to the condenser where it releases heat through air or fan cooling. The condensed liquid then passes through the throttling device to reduce pressure before re-entering the evaporator, where it vaporizes again to absorb heat from water. This continuous cycle allows users to monitor operation via temperature controls or by observing water temperature readings.

4.2 Equipment installation conditions and requirements

1. It must be installed horizontally and not tilted.
2. When operating the machine, ensure the casters are locked to prevent slippage during operation. The brake mechanism is typically installed on the wheel hub or surface. When applying foot or hand pressure, the wheel should remain stationary during operation, but should be able to turn – this indicates proper braking.
3. The air outlet above the chiller should be more than 1.5m away from the obstacle, and the air inlet on the side should be more than 1M away from the obstacle (see the figure below).



4. It shall not be installed in corrosive, combustible gas, dust, oil mist, conductive dust, high temperature and humidity, strong magnetic field, direct sunlight and other harsh environments.

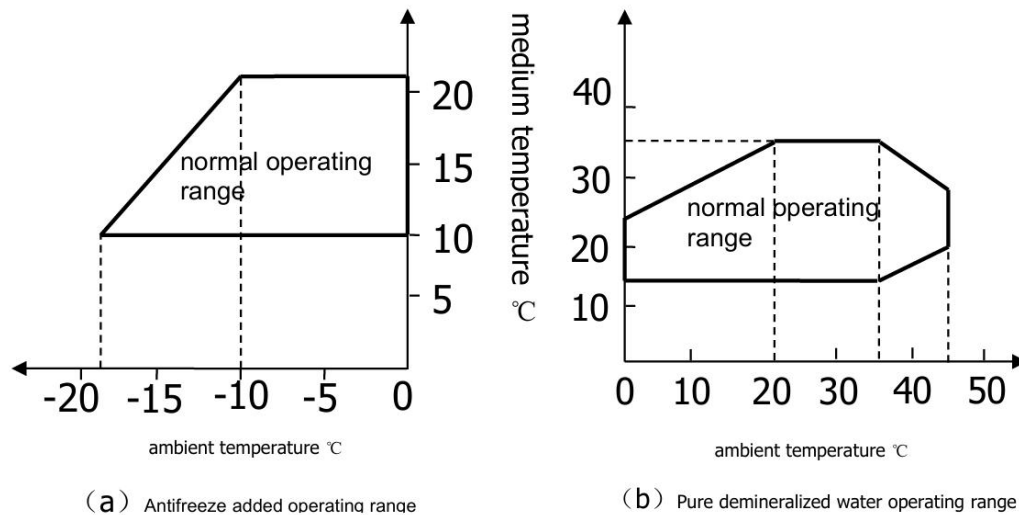
5. Environmental requirements

ambient temperature	ambient humidity	height
0~40°C	≤90%RH	≤3000m

6. Medium requirements

The refrigeration unit is permitted to use cooling media such as purified water, distilled water, high-purity water, and other softened water. The use of oily liquids, liquids containing solid particles, or corrosive liquids is prohibited. Regular cleaning of the filter element and replacement of cooling water should be performed (recommended every three months) to ensure normal operation of the refrigeration unit.

When the ambient temperature drops below 2°C and water storage is required, chillers should be filled with antifreeze containing ethylene glycol or propylene glycol. It's recommended to use antifreeze with a concentration of no more than 30%. After temperatures rise, switch back to pure water or distilled water as the medium. Run the chiller for 30 minutes to flush out residual antifreeze. Drain the system completely before refilling with fresh circulating water for continued operation.



4.3 Layout of inlet and outlet water pipes

According to the equipment import and export signs, determine the pipeline layout direction to ensure that the water pipeline is clean and free of impurities, so as to avoid impurities entering the water pipeline to cause blockage or pump failure.

The inlet and outlet pipes are labeled and distinguished by color. The transparent blue pipe with diameter 6*4mm is the high temperature end outlet, and the transparent pipe is the high temperature end return pipe; the transparent blue pipe with diameter 12*8mm is the low temperature end outlet, and the transparent pipe is the low temperature end return pipe.

4.4 Start up and operation

Plug in the power cord and turn on the power switch (do not turn on without water).

1. After turning on the power switch, the circulating pump of the chiller starts to work. There will be more in the pipeline when the new machine is first started

The bubble causes the machine to occasionally alarm for traffic, and it will return to normal after a few minutes of operation.

2. After the first start up, it is necessary to check whether there is any leakage in the water pipe immediately.

3. After turning on the power, if the water temperature is lower than the set temperature, it is normal for the fan and other devices of the machine not to work. The thermostat will automatically control the working status of the compressor, solenoid valve, fan and other devices according to the set control parameters.

4.5 Electrical connection

1. When wiring, please follow the maximum rated current on the label of the chiller.

2. Recommended reference standards for power cord diameter selection.

rated current /A	≤5	≤10	≤15	≤25	≤35	≤50
Power cable diameter (copper wire)/mm ²	1.0	1.5	2.5	4.0	6.0	10.0

Note: This data is provided according to IEC 60204-1 standard for reference only. Power cables must be used.

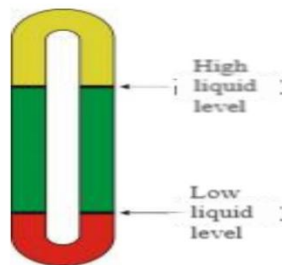
3. The main circuit of the power supply must be equipped with appropriate leakage and overload protection devices, and ensure that the chiller is well grounded

4. The allowable fluctuation of power voltage is less than $\pm 10\%$, the fluctuation of frequency is less than $\pm 1\text{Hz}$, and it is far away from the source of electromagnetic interference.

4.6 Water filling and air venting

4.6.1 Watering

After the new unit is turned on, air is expelled from the water pipes, causing a slight drop in the tank's water level. To maintain the water level within the green zone, you can add water in moderation. Observe and note the current water level. After running the chiller for some time, check the water gauge again. If the water level drops significantly, inspect the water pipes for leaks.



4.6.2 Exhaust

After the first water filling and replacement, the pump must be drained of air before it can be used, otherwise the equipment will be damaged.

Method 1: When the machine is turned off, add water and remove the low-temperature end outlet (OUTLET L) and connect the water pipe. Drain for 2 minutes, and then install it firmly.

Method 2: Open the water injection port, turn on the machine (water flow), and repeatedly press and fold the pipe several times to discharge the air inside the pipeline.

4.7 Pre-test inspection

- (1) Check whether the pipeline connection is correct, no bubble leakage phenomenon;
- (2) Check whether the drain is closed;
- (3) Check the water tank level;
- (4) Confirm that the electrical circuit of the equipment is connected correctly;
- (5) Confirm whether the equipment is grounded.

4.8 Operation status and parameter adjustment

1. Introduction to the temperature controller panel



- Refrigeration indicator light
- Low temperature end heating indicator light
- High temperature end heating indicator light
- Water pump indicator light
- Alarm indicator light
- Low temperature indicator light
- High temperature indicator light
- Flow indicator light

2. The working status indicator light of the thermostat

 Refrigeration indicator: the refrigeration lamp is on during the refrigeration process; the refrigeration lamp is flashing during the delay process.

 Water pump indicator light: on when connected; off when disconnected.

 Low temperature end heating indicator: on when the light is on; off when the light is off.

H High temperature end heating indicator: on when the light is on; off when the light is off.

3. Operation of the thermostat panel

(1) Turn on/off: Press the  button for three seconds to turn off all control outputs  and display "OFF", then press the button for one second to display the measured temperature and enter the working mode: The power on/off status is controlled by F7.

(2) Quick adjustment: Press the "SET" key to display F0, then press Δ or 7 to change the value and remember; press the "SET" key to display F1, then press Δ or 7 to change the value and remember.

(3) Press the  button to enter the status display menu, showing the high  temperature end  temperature, the light is on, press the button  again to show the low  temperature end flow (unit L/min, resolution 0.1), the light is on, press the button again to return to normal operation mode.

4. User parameter setting (only F0~F7 parameters can be set)

Press the left/right arrow keys to change settings and store values. Press the SET key to modify parameters. While holding down the SET key, Δ for six seconds to enter parameter configuration mode, with the display flashing "00". Press Δ or 7 to change the password (F6: Factory default value 08). Press the SET key again. If the password is correct, the display will show "F0" indicating parameter modification; if incorrect, it returns to the temperature display. If no key is pressed within 20 seconds, the controller will automatically exit the parameter configuration mode.

5. Restore factory Settings

Within 30 seconds of power on, press  Δ and key at the same time for six seconds to display "rE", the user parameters are restored to factory value, and after three seconds, the temperature display returns.

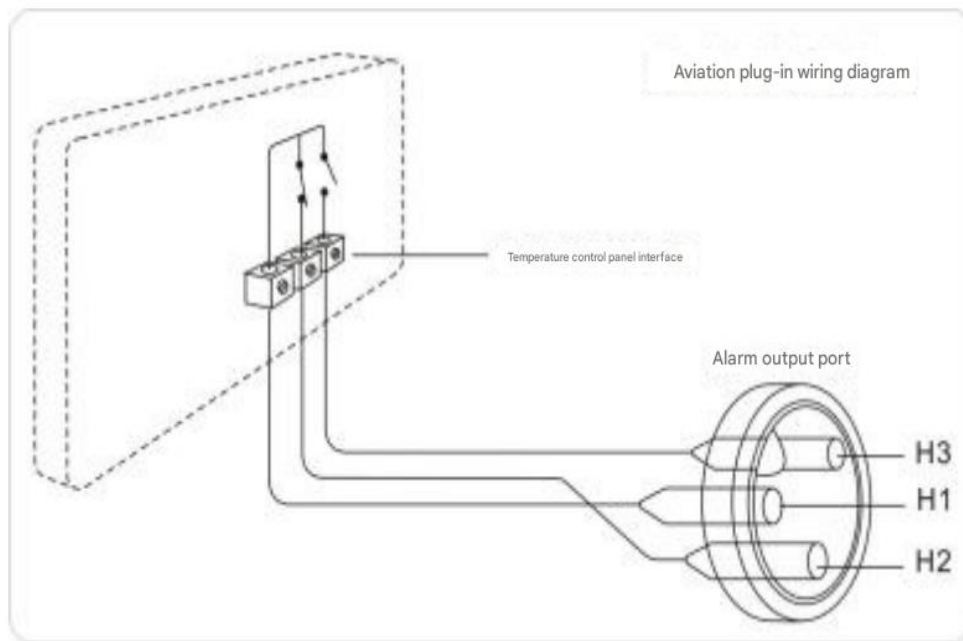
4.9 Parameter Settings Table

parameter	function	Set the range	Factory value
F0	Set the temperature at low temperature	-20~40.0°C	25.0°C
F1	Set the temperature at high heat	-20~40.0°C	30.0°C
F2	Refrigeration return difference	0.1~3.0°C	0.8°C
F3	High water temperature alarm	1.0~20.0°C	10.0°C
F4	Water temperature alarm	1.0~60.0°C	15.0°C
F5	Low temperature terminal flow alarm	0.0~20.0	2.0L/min
F6	password	00~99	08
F7	Enable or disable the switch	00~01	00

4.10 Alarm and output ports

In order to ensure that the abnormal situation of cooling water circulation does not affect the safety of the equipment, the chiller is equipped with alarm protection function.

1. Alarm output port and wiring diagram



2. Alarm cause and working status table

System instructions	Alarm code	buzzer	output port H1、H2	output port H1、H3
operative mode			broken circuit	breakover
The circulating pump is working normally			broken circuit	breakover
Low temperature end water temperature alarm	E1	sound production	breakover	broken circuit
Low temperature end water temperature ultra-low alarm	E2	sound production	breakover	broken circuit
High temperature end water temperature alarm	E3	sound production	breakover	broken circuit
High temperature end water temperature ultra-low alarm	E4	sound production	breakover	broken circuit
Low temperature end water temperature sensor failure	E5	sound production	breakover	broken circuit
High temperature end water temperature sensor failure	E6	sound production	breakover	broken circuit
Switching flow alarm/level alarm	E7	sound production	breakover	broken circuit
Sensing flow alarm	E8	sound production	breakover	broken circuit

Note: The alarm output port is connected to a set of normally open and normally closed contacts of the relay in the machine. The working current should be less than 3A and the working voltage should be less than 300V.

4.11 Maintenance

Equipment maintenance must be stopped first, cut off the power supply, 3 minutes before the operation can be carried out, otherwise there will be a risk of electric shock. When the ambient temperature is lower than 2°C, long-term shutdown must be drained of internal water.

Clean the dust screen regularly and blow away the dust in the condenser with a compressed air gun (it is recommended to do so about once a week, and the dust screen should not be missing for a long time).

4.12 Simple troubleshooting

fault phenomenon	failure cause	processing method
Power on without electricity	The power line is not in good contact	Check the power interface, whether the power cord plug is properly connected and in good contact
	Insurance fuse blown	Replace the fuse in the power interface of the machine behind it
Flow alarm, the water pipe is directly connected to the outlet and inlet without water flow	The water level in the storage tank is too low	Check the water level indicator display window, add water to the green area of the water level display; and check whether there is any leakage in the water circulation pipeline
The flow alarm is used when the connecting device is in use, but there is water flow when the water pipe is directly connected to the outlet and inlet of the water supply, and no alarm is given	The water circulation pipeline is blocked or the pipe is bent and deformed	Check the water circulation line
Temperature limit alarm	The dust screen is blocked and the heat dissipation is poor	Clean the dust screen regularly
	Poor ventilation at air outlet or air inlet	Ensure smooth ventilation of air outlet and air inlet
	The voltage is too low or unstable	Improve the power supply line or use a voltage regulator
	The thermostat is not properly set	Reset the control parameters or restore factory Settings

	Cooling machine is switched on and off frequently	Ensure that the chiller has enough refrigeration time (more than five minutes)
	Excessive thermal load	Reduce the heat load, or choose a larger refrigeration capacity model
Condensate condensation is serious	The water temperature is lower than the ambient temperature and the humidity is high	Adjust the water temperature or insulate the pipeline
Drain slowly when changing water	The water inlet is not open	Open the water inlet
Power on flow alarm	There are bubbles in the pipeline	Perform an emptying operation

4.13, specification description

Project/parameter		1500W	2000W	3000W
refrigerating output	KW	3.5	5.2	6.8
	Kcal/h	3016	4300	5590
source	V, Hz	AC220V,50Hz		
power rating	KW	2.2	3.2	3.65
rated current	A	6.8	12	16.5
水泵功率.	KW	0.132	0.25	0.55
pump capacity	L/min	17.5	33	60
水泵扬程.	M	33	38	45
Water temperature range	°C	15 ~ 35		
control accuracy	°C	± 0.5		
ambient temperature	°C	5 ~ 45		
noise	DB(A)	62	68	68
Water tank volume (effective)	L	16		
cryogen	L	R22/350g	R410a/530g	R410a/650g

V. Introduction to laser

5.1 Safety instructions

5.1.1 Laser safety level

This Class4 laser product emits high-power invisible light with a wavelength of 1080 ± 10 nm. Direct or indirect exposure to this intense laser can cause eye and skin injuries, and may even trigger fires at the scene. Therefore, all personnel operating near the laser must strictly comply with EU EN60825-1:2014 standards. They should wear wavelength-matched certified laser protective goggles and implement comprehensive safety measures to mitigate these hazards.



There are safety risks, which may cause serious injury or even endanger life safety.

5.1.2 Safety protection measures

order number	project	description
1	Safety/Warning signs	Remind and warn the installer and operator of possible hazards.
2	Self-locking, interlocking and alarm	Built-in safety control sensors, including temperature, current voltage, light path, QBH and other monitoring, to achieve automatic safety self-locking. Can be connected to water cooler and other safety interlock signals, for product external switch interlock connection control;
3	External communication security control	The communication port can be set to realize external safety emergency stop control.

5.1.3 Other safety precautions

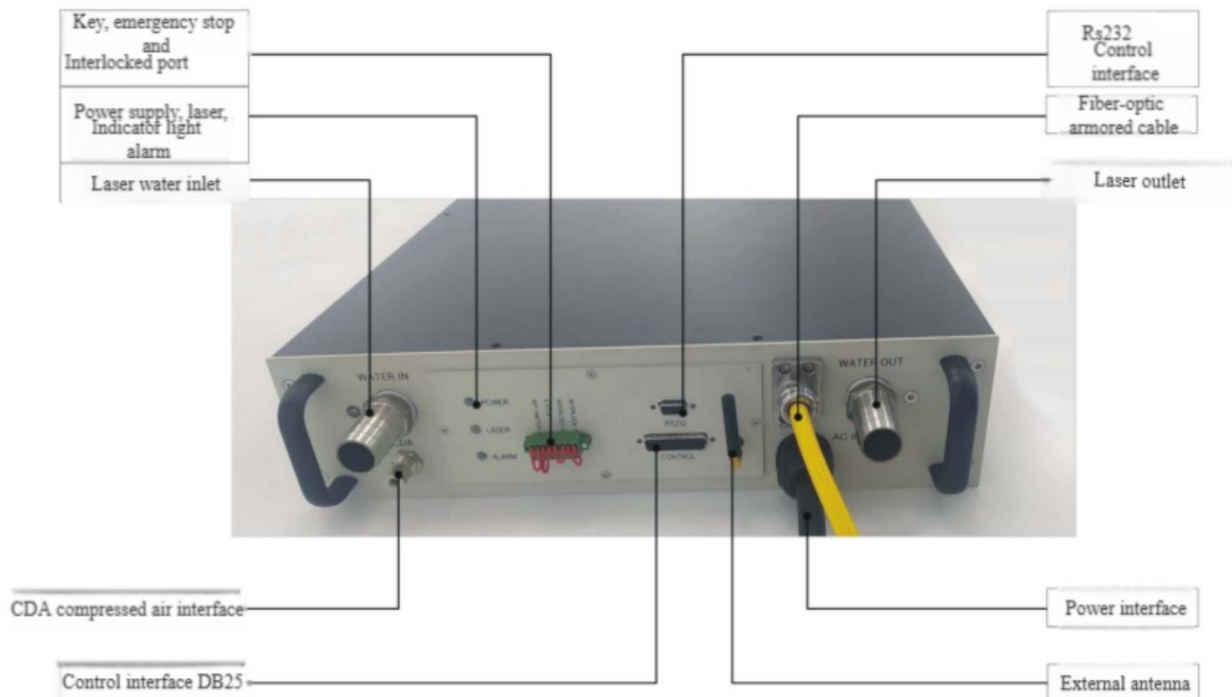
1. After the indicator light is turned on, do not expose your eyes to the indicator light to avoid injury.
2. The laser is invisible to infrared light. After the laser is turned on, no part of the body should be exposed to the laser, so as not to cause personal injury.
3. Installation and Operation When installing this product, you must wear special laser protective glasses. Please select laser protective glasses according to the laser wavelength range and power level. When the laser is powered on, even if you wear laser protective glasses, do not directly view the output head.
4. Please replace the cooling water of the water-cooled machine regularly to avoid blocking the water-cooled module of the laser due to the decay of the cooling water.
5. When operating the laser in winter, add antifreeze to the cooling water in an appropriate proportion according to the local temperature, so as to avoid internal damage caused by ice.
6. If the laser is not used for a long time, please drain the cooling water in the laser in time. Cover the output head protection cap and do a good job of dustproofing.
7. Please ensure that the PE line of the power line is reliably grounded to avoid losses.
8. Ensure that the alternating voltage supply is normal. Incorrect wiring or power supply voltage will cause irreversible damage to the equipment.
9. There is no maintenance device inside the laser. Do not open the laser shell to avoid personal injury.
10. Do not damage the anti-dismantling label on the laser case, so as not to lose the right to warranty.

5.2 Product Description

5.2.1 Product technical specification sheet

model	BFL-CW1500	BFL-CW2000	BFL-CW3000
power	1500W	2000W	3000W
wavelength coverage	1080±10nm		
Optical fiber core diameter	20/25/50μm		50μm
Cable length	10m or custom		
Output connector	QBH or custom		
Indicating light	glow		
work pattern	Continuous or modulated		
Power adjustment range	10%~100%		
Power stability 25°C	<3%(2h)		
Maximum modulation frequency	5kHz		
weight	<26kg	<35Kg	<45Kg
outline dimension mm	80*402*346	80*402*346	80*482*581/80*482*521
voltage	Single phase, AC220±20V,50/60Hz		Three phases, AC380±20V,50/60Hz
power dissipation	4.5kW	6.0kW	10.0kW
control method	RS-232/AD		
Refrigeration capacity requirements	≥3.5kW	≥4.5kW	≥7.0KW
Water cooling is set to temperature	25°C (Laser Module), 30°C (QBH)		
cooling water flow	>8 L/min	>8 L/min	>8 L/min
water gage	≤0.5MPa		
QBH cooling water flow	1.5 ~ 2.0L/min		
Size of water pipe	External diameter φ12mm		Inner diameter φ19mm

5.2.2 Laser panel description



1. WATER IN and WATER OUT are the inlet and outlet of the laser: see 5.4 cooling system requirements for details.
2. Power interface AC INPUT is the AC 220V/380V voltage input interface, please refer to the product technical specification table for details.
3. Power indicator (POWER): After the power is connected, the laser preparation status is indicated by the flashing indicator light. After the laser is ready, the indicator light is always on. In case of failure, the indicator light is extinguished.
4. Alarm light (ALARM): When the laser is faulty, the alarm light is lit.
5. Laser indicator (LASER): always on when light is on, off when light is off.
6. Control interface (Control): the control signal connection port between DB25 and the cutting machine board, which is used to control or operate the laser in external control mode.
7. Control interface (RS232): DB9 is used to connect the host computer. The laser can be used in debugging mode through the host computer software, and the laser can be controlled internally or its status can be queried by the host computer software.
8. Key, emergency stop and interlock ports: Among them, PIN1~PIN2 is connected to the key switch, PIN3~PIN4 is connected to the emergency stop switch, PIN5~PIN6 is connected to the water cooling interlock, and PIN7~PIN8 is connected to the safety interlock, which can be used for the external switch interlock connection control of the product.
9. Laser output (Laser): laser output fiber armored cable.
10. CDA: Dry and clean air interface, access to dry and clean compressed air (0.1Mpa), prevent condensation of laser, do not use compressed gas with water or oil.
11. External antenna for receiving Bluetooth signals.

5.3 Definition of laser control interface

5.3.1 Control interface definition

Control mode: laser products include RS-232 communication interface, DB25 control interface and switch interlock interface.

Control interface DB25 (Control): used for remote AD mode connection control line use, the end of the control line is marked with the line number, which is defined as shown in the table:

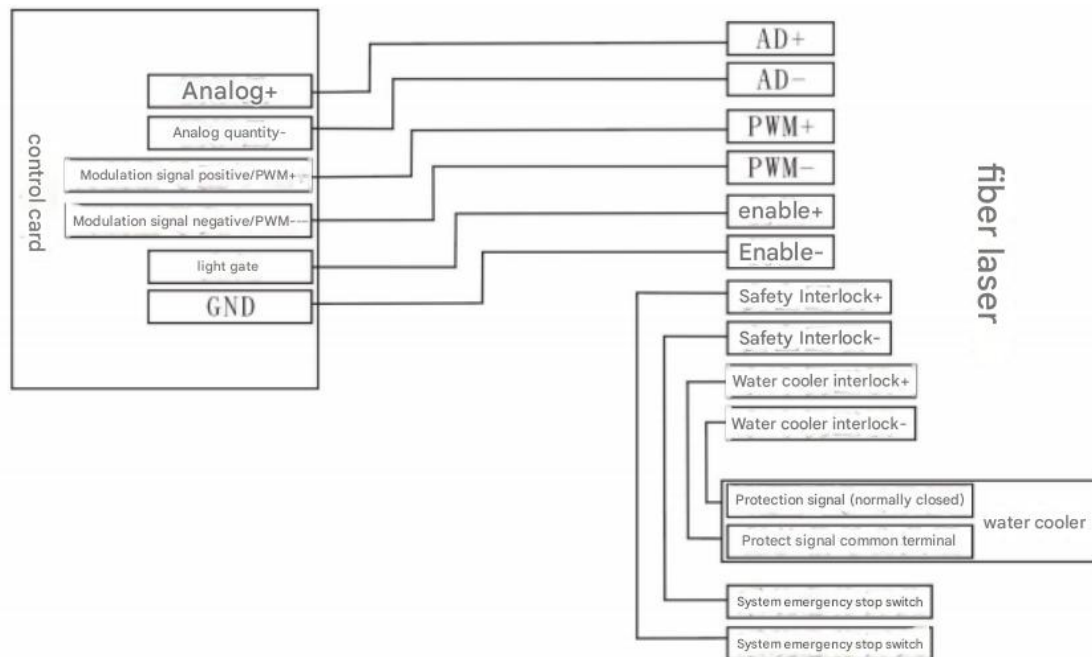
PIN order number		Function drive capability description		Function
7	breakdown signal -	Where the fault signal is output		When the laser is faulty, port 7 and 20 will be short circuit, the maximum short circuit current here should not exceed 1A, please add series resistance according to the use environment; when the laser is working normally, port 7 and 20 will be open circuit
20	breakdown signal +	The + output of the fault signal		
6	enable -	External enable input signal-	Input current $\geq$ 5mA	High level 18V-24V effective
19	enable +	External enable input signal +		
8	PWM-	External modulation input signal-	Input current $\geq$ 5mA	Modulated light control, high level 18V-24V effective
21	PWM+	External modulation input signal +		
14	AD-	read analogue input -	Input current $\geq$ 1mA	The output power of the laser is controlled by 1V-10V, and 10V corresponds to 100% output power Please ensure that the maximum analog voltage does not exceed 10.3V,
15	AD+	read analogue input +		
10	safety interlock +	External on/off signal (normal when on)		Client interlock signal can be connected to the system emergency stop switch
23	safety interlock -			
12	Water cooling machine interlock +	External on/off signal (normal when on)		Connect the water cooler separately when in use Signal + and fault signal-
25	Water cooling machine interlock-			
9	glow +	External control red light signal +	Input current $\geq$ 5mA	External signal high red light mode: high level 18V-24V effective; External signal low red light mode: Low level 0-5V is valid
22	glow -	External control red light signal-		
	Signal ground	Connect the card to the earth		Connect to the application side of the chassis

It is used for the switch interlock interface. There are labels on the panel. The water cooling interlock and safety interlock are connected in parallel with the water cooling interlock and safety interlock defined in the external control line control interface respectively, and only one connection is required. Its definition is shown in the table:

PIN order number		function	explain
1	key switch +	External key switch signal (open when on)	Client key switch signal, The system key switch can be externally connected
2	key switch -		
3	jerk +	External emergency stop signal (Normal when conducting)	Client emergency stop signal, An external system emergency stop switch can be used
4	jerk -		
5	Water cooling machine interlock +	External on/off signal (Normal when conducting)	The product is connected to the water cooler, fault signal + and fault signal-respectively during use
6	Water cooling machine interlock-		
7	safety interlock +	External on/off signal	Client interlock signal,

8	safety interlock -	(Normal when conducting)	External door switch signal can be connected
---	--------------------	--------------------------	--

illustrate :



5.3.2 Power supply requirements and wiring definition

Power Supply Specifications: The 2000W model operates on AC 220V/50-60Hz with standard plug configuration (L1-live wire, N-neutral wire, PE-ground wire). The 3000W model uses AC 380V/50-60Hz with a three-pole plug design (L1-live wire, L2-live wire, L3-live wire, PE-ground wire).

If the voltage fluctuation in the end user area exceeds $\pm 5\%$ and exceeds the requirements of this product, please configure a suitable power supply.

Laser model power consumption		maximum operating current	Input power supply	Definition of power supply wiring
BFL-CW1500	4.5KW	21A	220V/50Hz-60Hz	1-L-live wire, 2-N-neutral wire, 3-PE-ground wire.
BFL-CW2000	6.0KW	36A		
BFL-CW3000	10.0KW	16A	AC 380V/50-60Hz	L1-live wire, L2-live wire, L3-live wire, PE-ground wire.

5.4 Operation instructions

5.4.1 Usage Notes

1.QBH The minimum bending diameter of the optical fiber is 400mm, and the minimum bending diameter when the light is out of the state should not be less than 600mm. Too small bending diameter will cause product damage.

2. The staff should wear laser protective glasses with corresponding wavelength and protection level when operating the laser. The laser wavelength is $1080 \pm 10\text{nm}$.

3. When the laser is turned on, the power supply (green) light will flash. When the power supply (green) light is normally on, the laser can work normally.

4. When the laser test time expires, the rear panel indicator lights (3) flash at the same time. You can contact the manufacturer to apply for the password.

5. When using the CDA interface function, cold-dried air must be processed through a dryer before passing through 5 μ m and 0.3 μ m particle filters, followed by filtration via a 0.1 μ m oil mist filter. The gas temperature should be maintained between 5-40°C (close to the main laser's water supply temperature), with a pressure below 0.1MPa. The interface shall use either 4mm or 6mm quick-connect connectors.

6. When using the CDA interface function in a high temperature and humidity environment, it is necessary to start ventilation 30 minutes before the laser is watered and lighted to reduce the humidity inside the laser and ensure no condensation inside the laser. When the ambient temperature is 10°C lower, the CDA interface can be omitted.

5.4.2 Cooling system requirements

In order to ensure the stable and reliable operation of the laser, it is necessary to use a dual temperature controlled water cooler (with heating and cooling functions) and work continuously.

When installing and using the cooling system for the first time, check the entire water circuit system and connectors for leaks. Ensure external water pipes are installed and connected according to the laser's specified water inlet and outlet requirements; otherwise, the laser may malfunction. This single-mode fiber laser requires cooling water at two critical points: The main laser unit has its water inlet/outlet interface on the rear panel, while the QBH fiber output unit requires separate cooling treatment.

The requirements of the laser for the cooling system are shown in the table.

Cooling requirement/models BFL1500W Cooling requirement/models BFL1500W		BFL2000W	BFL3000W
Laser cooling	refrigerating output	≥3.5KW	≥4.5KW
	rate of flow	>15L/min	>18L/min
	Laser interface	Quick connector, connect water pipe with outer diameter 12mm/inner diameter 8mm	
	pressure	≤0.5Mpa	
	Temperature Settings	25±1°C	
QBH water cooling interface	Temperature Settings	28-30°C	
	rate of flow	1.5-2.0L/min	
	Water cooling machine water pipe	DN>8 water pipe, length <15m	
	QBH cooling	Quick connector, connect to 6mm outer diameter water pipe, length <1m	

Note: The cooling water should be deionized water or distilled water, and tap water is strictly prohibited; the cooling water should be replaced regularly every month, and the filter element of the water cooler should be replaced regularly.

Adding 5%-10% anhydrous alcohol to the water cooling machine can effectively prevent the production of microorganisms in the water and ensure more reliable products.

When using the laser in winter, it is necessary to prevent the water circuit inside the laser from freezing with the water cooler. Add an appropriate amount of antifreeze to the cooling water for protection. The freezing point temperature of the antifreeze must be lower than the minimum ambient temperature by 5°C.

Because ethylene glycol antifreeze is corrosive, it is necessary to add ethylene glycol corrosion inhibitor when changing antifreeze before winter comes (add alcohol corrosion inhibitor, take Kelangqi KS-5007 as an example, add 10-20kg corrosion inhibitor per 1000kg antifreeze).

Note: the addition ratio of corrosion inhibitors of different brands and models is different, please refer to the specification of the purchased corrosion inhibitors for details.

When the equipment is shut down for a long time, please drain the water inside the equipment and inside the QBH in time, otherwise the laser equipment will be damaged. The cooling water should be replaced once every two months. When draining the water inside the QBH, the air pressure must be less than 0.1Mpa, and the excessive air pressure should be avoided to damage the optical fiber.

During summer laser operation, internal condensation prevention is essential. When the cooling temperature of water-cooled systems drops below the laser's dew point, airborne moisture will condense on electrical and optical components. Without proper measures, condensation will spread across the laser's exterior surface. The presence of condensation on the casing indicates internal moisture buildup. In such cases, immediate power shutdown and work stoppage must be implemented, followed by optimizing the laser's operating environment.

To reduce the risk of condensation, it is recommended to inject clean, dry compressed air into the laser from the CDA on the back panel of the laser. The gas pressure should be controlled at 0.1MPa. Do not use compressed gas with water or oil.

air temperat ure T	Dew point temperature at different relative humidity°C								
	40%	50%	60%	70%	75%	80%	85%	90%	95%
16°C	2	6	8	11	12	13	13	14	15
18°C	4	7	10	12	13	14	15	16	17
20°C	6	9	12	14	15	16	17	18	19
22°C	8	11	14	16	17	18	19	20	21
24°C	10	13	16	18	19	20	21	22	23
26°C	11	15	18	20	21	22	23	24	25
28°C	13	17	19	22	23	24	25	26	27
30°C	15	18	21	24	25	26	27	28	29
32°C	17	20	23	26	27	28	29	30	31
34°C	18	22	25	28	29	30	31	32	33
36°C	20	24	27	30	31	32	33	34	35
38°C	22	26	29	32	33	34	35	36	37
40°C	21	28	31	33	35	36	37	38	39

5.4.3 Turn on and off the laser

Before powering on the laser, check that the laser status meets the following requirements:

1. The flow rate and temperature of the water cooling system meet the requirements;
2. The power line and control line are connected correctly, and the input voltage meets the product requirements;
3. The emergency stop button is in the up state;
4. The interlock signal of the laser is connected in series with the output fault signal of the water cooler and the door switch signal to better protect the safety of the laser and operators;
5. When the laser is powered on, the POWER indicator light is lit, and the laser starts self-test. After 5 seconds, the laser can receive analog signals.

6. In the external control mode, when the external enable signal of the laser is provided as required, the laser will output the corresponding 10%-100% power according to the high state of the external modulated PWM signal and the size of the external analog quantity 1-10V.

7. When the laser is faulty and needs to be powered off, the laser should be powered off for about 20 seconds before being powered on again.

5.4.4 Installation and use of the host computer

The installation and use of the host computer software are detailed in the accompanying software instruction manual.

5.4.5 Installation and use of Bluetooth APP

1. Overview

The mobile Bluetooth APP can read the laser's status (including light emission, alarm, etc.) and important information (including serial number, product number, set power, frequency, duty cycle, etc.) in real time. When the laser alarms, users can query the alarm information. When the laser usage time expires, it will prompt users and provide an unlocking method.

2. Installation of mobile phone APP

The QR code on the scanning laser is used to obtain the APP resources. After obtaining the mobile APP resources, click install. After successful installation, the Android 10 or above system models and iOS system models can start using the APP.

3. APP software usage instructions

(1) Permission is enabled

Before using the APP, please first enable the Bluetooth and location information functions of your phone, and authorize the APP to use the above functions.

(2) Laser connection

To connect a laser, first click the TLLaser icon on your desktop. As shown in the image, when you first open the APP, a prompt window will appear – this doesn't affect normal app functionality. Click "OK" to proceed. On the main interface, tap the Bluetooth icon in the red box to access the laser list interface (see image). Simply select the required laser's SN number to establish connection. Once connected, you can monitor the laser's operational status in real-time.

(3) Introduction of APP interface

[Device Status] The interface is shown in the figure below. The contents of the interface are described separately below.

Figure 1: Laser Operation Status Indicator. The power indicator light illuminates when the laser power supply is operational, with a grayed-out status indicating no power supply. The alarm indicator light activates when a fault occurs, with a grayed-out status indicating no detected fault information. The enable indicator light shows active operation when the laser is emitting light, with a grayed-out status indicating inactive operation. The red light indicator illuminates when the laser's red light is enabled, with a grayed-out status indicating the red light function remains disabled.

Figure 2: Laser remaining time display box. The time in the box represents the remaining time of the laser. If you need to unlock the laser password, click the display box and pop up the interface shown in Figure 7. Please screenshot this interface and provide it to our after-sales engineers.

Figure 3: The power setting bar can display the percentage of the laser power set.

Figure 4: Displays the model number, serial number, MCU version and APP version of the laser.

Figure 5: Connect/disconnect laser button. Click to connect or disconnect the laser.

[Other states] The interface is shown in Figure 8. The contents of the interface are described below.

Power mode diagram box: real-time display of laser internal/external control power mode;

Modulation mode diagram box: real-time display of laser internal/external control modulation mode;

Enable mode diagram: real-time display of laser internal/external control enable mode;

Set the power diagram: display the laser power value in real time;

Modulation frequency graph box: real-time display of the laser setting frequency value;

Duty cycle diagram box: real-time display of the duty cycle value set by the laser;

Running waveform diagram box: real-time display of the waveform sequence number of the laser operation;

Water outlet temperature diagram: real-time display of the temperature value of the laser water outlet;

Humidity chart: Real-time display of the value of humidity inside the laser. (Note: After humidity exceeds the alarm value, the background color of the humidity chart will change from white to light yellow. At this time, the query alarm information will prompt that the humidity is too high, and please connect to CDA)

[I/O status] The interface is shown in Figure 9. The contents of the interface are described below.

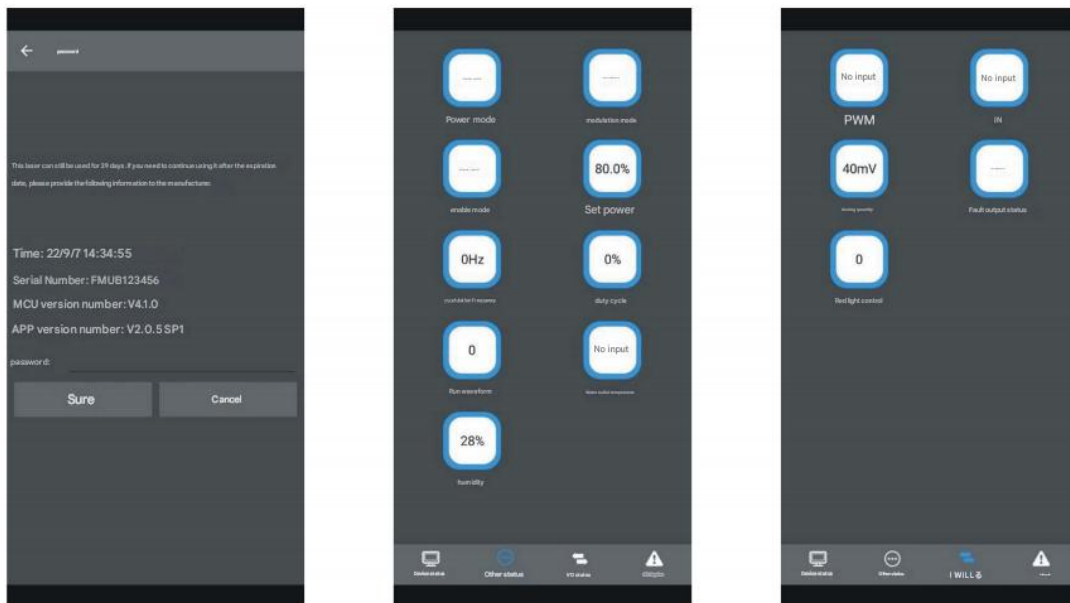
PWM diagram: real-time display of the laser receiving external PWM signal;

EN Figure: The laser receiver receives external enable signal in real time;

Analog meter box: real-time display of the amplitude of the laser receiving external analog signal;

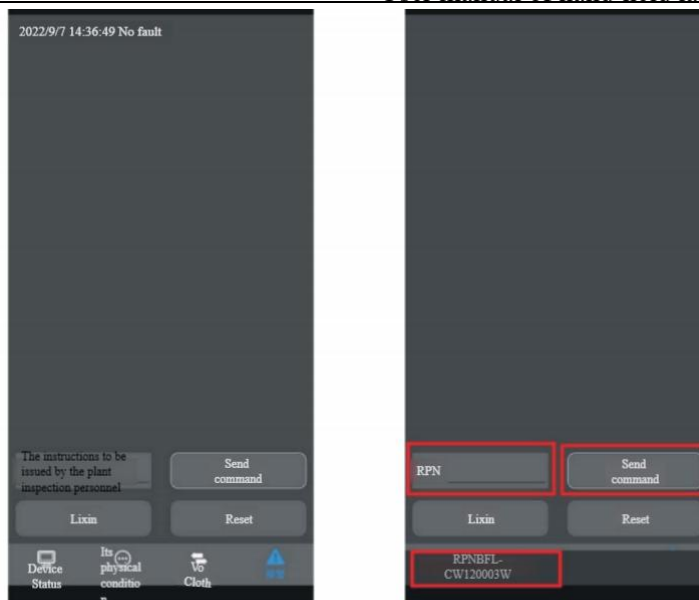
Fault output state diagram: real-time display of laser fault output normally open/closed mode;

Red light control mode box: Click the box to display the current red light control mode of the laser.



[Alarm] Interface. Click the refresh button in the figure to display the alarm information of the laser in the current state.

[Send instruction] button As shown in the figure, the button can be adjusted under the guidance of the after-sales engineer. The instruction response is shown in the status banner at the bottom of the figure.



5.5 Common faults and solutions of laser

This laser has the detection functions of optical path, temperature, current, input voltage, QBH, etc. If there is any abnormality in the work, the alarm area of the control software will show the fault. The common faults and solutions of this laser are shown in the table below.

Note: Laser damage caused by condensation is not covered by the normal warranty of the laser

order number	Name of the fault	Description and solution
1	trip	Check that the power supply is connected correctly.
2	Lockout-water cooling failure	If the water cooler is not turned on or stopped due to failure, please check whether the water cooler is working.
3	QBH	The QBH is not connected to the external cutting head. Make sure that the QBH is securely connected to the cutting head, and power on the laser again before proceeding with the corresponding operation.
4	Emergency stop alarm	This alarm will occur when the interlock signal is open or when the emergency stop is pressed on the front panel. Please determine whether the water cooler is faulty and check that the emergency stop button has been popped up. The laser is re-powered and the corresponding operation is performed.
5	Password alert	If the front panel indicator lights (3) flash at the same time, it means that the laser trial period has expired. Please contact the after-sales service for the relevant time management password.
6	Light paths 1, 2, 3, 4	Reconnect power, turn on the red light first to confirm that there is red light output, and then turn on the laser. If there is no red light output, please contact our after-sales service.
7	Temperature fault	When this fault occurs, determine whether the water cooling machine flow rate meets the requirements. Increase the output flow of the water cooler to the product requirement value and then restart the laser.

8	temperature 1、2 、 3、 4	When a temperature alarm occurs, determine whether the output flow rate and output water temperature of the water cooler meet product requirements. When the temperature is at the lower limit, it indicates that the input water temperature of the laser is too low; when the temperature is at the upper limit, it indicates that the input water temperature of the laser is too high or the flow rate is too low.
9	Drive overcurrent	When the laser driver circuit outputs an overcurrent, a current alarm will occur. Check whether the amplitude of the analog signal is greater than 10.5V.
10	overvoltage crowbar	The input voltage is above the normal range. Please adjust the input power supply voltage to $\pm 10\%$ range
11	superheat	The temperature of the switching power supply is too high. Please make sure that the water cooler is on, And meet the flow and temperature requirements, as well as the use environment is not higher than the product requirements.
12	Communication input fault	The laser input power supply is out of range.
13	Light road alarm lock	If the continuous alarm of the optical path exceeds the set number, the laser will be locked and contact our after-sales service.

When a fault occurs and the laser needs to be powered off, please wait about 20s after the laser is powered off, and then power on the laser again for subsequent operations. If the fault cannot be eliminated after taking the above measures, please contact us.

VI. Warranty and repair

1. General warranty

The Company provides warranty for all products manufactured by the Company during the warranty period specified in the contract and has the right to repair or replace any products with material or technical problems during the warranty period at its option.

2. Limitations of warranty

Products and components are not covered by the warranty under the following circumstances:

- (1) Damage to products or components caused by human tampering, opening, disassembling, misinstallation or modification of non-company technicians
- (2) Damage caused by improper use, negligence or accident
- (3) Damage caused by use beyond the scope of product technical requirements
- (4) Damage caused by incorrect installation, maintenance or other abnormal operation of the use not included in the manual

The customer is responsible for understanding and operating the above information according to the user manual and specifications. Otherwise, the faults caused will not be covered by the warranty.

3. Service and maintenance

Within the warranty period, the buyer must provide feedback within 30 days of discovering the fault. The company does not grant any third party to repair the product or parts.

When you receive our products, please check whether the products are intact or not. If there is any abnormal situation, please contact the carrier and our company in time.

Please do not mail any products back to the company without communication and confirmation, otherwise they will be rejected for return processing, and the loss caused thereby shall be borne by the customer.

The company will continue to develop new products. The product information listed in the manual may change without prior notice. All technical parameters are subject to the terms of the contract.

The above warranty and service terms of the Company for the products are for users' reference only, and the formal service and warranty shall be subject to the agreement in the contract.

7. welding condition

Material	Thickness/mm	Scan speed	Scan width/mm	Peak power/W	Duty cycle	Pulse frequency	Spool speed cm/s	Welding wire
Carbon steel	1	300	3	350	100	2000	60	1
	2	300	3	700	100	2000	60	1.2
	3	300	3	1100	100	2000	60	1.2
	4	300	3	1500	100	2000	60	1.6
	5	220	3	1800	100	2000	50	1.6
	6	220	3	2200	100	2000	50	1.6
	8	220	3	3000	100	2000	40	2
Aluminum	1	300	3	500	100	2000	60	ER5356 1.0
	2	300	3	800	100	2000	60	ER5356 1.2
	3	300	3	1400	100	2000	60	ER5356 1.2
	4	300	3	1800	100	2000	60	ER5356 1.6
	5	220	3	2000	100	2000	50	ER5356 1.6
	6							
	8							
Stainless steel	0.5	300	2	260	100	2000	80	ER3040.8
	0.8	300	2	300	100	2000	80	ER3040.8
	1	300	2	350	100	2000	60	ER3041.0
	2	300	3	700	100	2000	60	ER3041.0
	3	300	3	1100	100	2000	60	ER3041.2
	4	300	3	1500	100	2000	60	ER3041.2
	5	220	3	1800	100	2000	50	ER3041.6
	6	220	3	2200	100	2000	50	ER3041.6
	8	220	3	3000	100	2000	40	ER3042.0

The following principles are followed in welding

- ① The thicker the plate, the thicker the welding wire, the greater the power, and the slower the feeding speed
- ② The lower the power, the whiter the welding surface. The higher the power, the black color of the weld seam, and at this time, the single side is formed.
- ③ The thickness of the welding wire should not be greater than the plate thickness and be biased towards the plate thickness. The welding wire affects the fullness of the weld
- ④ The thinner the welding wire, the lower the scanning width

Affected by different brands of lasers, the following processes use the following lasers for sample testing, for reference only, and appropriate fine-tuning is required when using them

- ① Spurs / Chong Hsin / Jepet
- ② Argon/nitrogen

The aluminum material process is similar to the stainless steel process, and the power can be increased by 20%-30%. In addition, there are differences in the focus, which need manual adjustment