

User Manual

Desktop Handheld Laser Welder



P/N: 110701224

Model: LW -20D LW -30D LW -40D LW -50D

Ver: V1.1

Date: 20240521

Copyright © GW LaserTech, All Rights Reserved

Thanks for choosing GW's laser welder before you use the machine.

In order to ensure the operational safety (personnel safety, equipment safety, work safety, etc.) and product operating in the best condition, please read the user manual carefully and familiarize yourself with the relevant content we have compiled for you before using this product. Please keep the user guide together with the product to provide you and all other users with operational, safety, and other important information at all times.

Note:

We reserve the right to change the information in this manual without prior notice. GW (Shanghai) Laser technology Co., Ltd. believes that the information provided in this manual is accurate and reliable, but GW (Shanghai) Laser technology Co., Ltd. does not undertake any warranties with respect to the content of this manual, including (but not limited to) the implied warranties of merchantability and applicability. In addition, GW (Shanghai) Laser technology Co., Ltd. will not be liable for any patent infringement or other damage to the rights and interests of third parties resulting from the use of the contents of this manual. GW (Shanghai) Laser technology Co., Ltd. will not be responsible for any wrong information in this manual. GW (Shanghai) Laser technology Co., Ltd. (Hereinafter referred to as “GW Laser”) shall not be liable for any accidental or indirect consequences arising from the provision, implementation or use of this manual.

Direct or indirect use of the information provided in this manual does not mean that GW (Shanghai) Laser technology Co., Ltd. grants any patent or other intellectual property rights.

This guide is intended for users who are responsible for welding in industrial and non-industrial installations.

Copyright ©2024 GW (Shanghai) Laser technology Co., Ltd. All rights reserved. Except as permitted by applicable copyright law, the content of this guide may not be reproduced, transmitted, stored in retrieval system or adapted for publication in any form or by any means without prior written authorization.

Safety Information

Safety Convention

We will use different words and characters to remind you of a variety of potential hazards and important information, including:

WARNING

Be applicable to a variety of potential personal injuries. This signal reminds you that you need to follow the specified use methods or steps to use, and if you do not follow the prompts to operate correctly, it may cause personal injury to yourself or others. If you do not fully understand and meet the required conditions, do not negotiate the WARNING symbol to continue to the next step.

CAUTION

Be applicable to potential product damage. The signal reminds you that you need to follow the specified use methods or steps. If you do not follow the prompts to operate correctly, it may cause damage to the product or parts. If you do not fully understand and meet the required conditions, do not negotiate the CAUTION symbol to continue to the next step.

IMPORTANT

Various information about the usage of this product. Please do not ignore this information.

WARNING

This symbol represents laser radiation. This symbol appears on products with laser output.

Safety Guidance

In order to ensure safe operation and optimize the operational performance of this product, please strictly comply with the following WARNING and CAUTION, as well as other information contained in this manual.

WARNING:

When using this product, make sure to use the appropriate ground power supply.

WARNING:

Any parts inside this product are not allowed to be opened by the user for maintenance. If necessary, please contact GW Laser technicians for maintenance services. Any unauthorized alteration to this product will void the warranty.

WARNING:

The output connector of this product is connected by optical fiber cable and handheld welding connector. Please use the handheld welding head with care.

WARNING:

If this product is used in a manner not specified in this document, the protection provided by the product may be impaired. This product must and should only be used under normal conditions.

CAUTION:

Do keep the AC power supply off when operating the laser welding output connector (e.g., installing the cable connector, checking the end surface of the connector with an optical instrument, filling the wire, etc.).

WARNING:

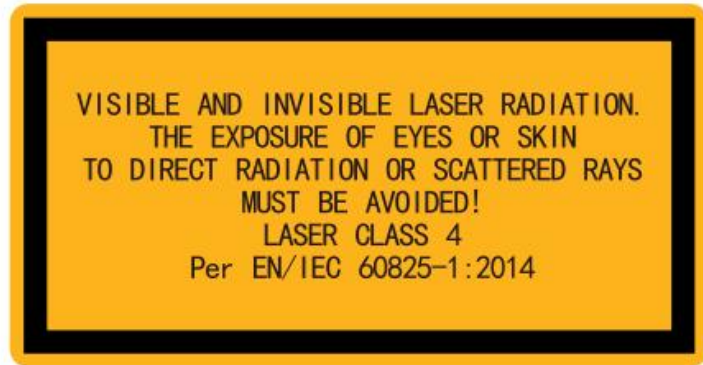
Never look directly at the fiber output connector, and be sure to wear proper protective goggles to avoid injury when using laser products.

CAUTION:

Performing operations or adjustments outside the scope specified in this manual may result in radiation

Laser Class

In accordance with 21 CFR 1040.10 and 1040.11 under IEC/EN 60825-1, this product is a high power class-4 laser. The laser of such class may cause eye or skin injury. Although the output light is invisible, it can still cause irreversible corneal damage. This product does not provide a laser safety protective goggles, but it is necessary to wear suitable protective goggles to avoid injury when using the laser.



WARNING:

Never look directly at the fiber output connector, and be sure to wear proper protective goggles to avoid injury when using the laser.

WARNING:

The air-cooled CW fiber laser handheld welder is a fourth-level laser product with a radiation wavelength between 900 nm and 1100 nm.

WARNING:

Do not open the laser as there is not product parts or accessories to be used by the users provided inside the laser. All maintenance and repair of the products can only be carried out by the service personnel authorized by GW Laser.

CAUTION:

Performing operations or adjustments outside the scope specified in this manual may result in radiation

Use environment and precautions

WARNING:

When using this product, be sure to use the appropriate grounding power supply and normal voltage.

CAUTION:

Before starting the laser product, ensure that the ambient temperature and humidity are within the specified range.

CAUTION:

Do not expose the product to excessive moisture.

CAUTION:

The laser is in air-cooled mode. Please make sure that the ambient air is dry and clean;

CAUTION:

Operation or adjustment beyond the scope specified in this manual may result in dangerous radiation injury.

CAUTION:

Keep the output welding head clean. After each use, please close the protective cover. Do not touch the welded head lens with your hands, and do not use any solvents to clean the lens. As to the necessary lens cleaning and maintenance, be sure to use lens wiping paper.

Table of Content

1. Overview	7
1.1 Introduction	7
1.2. Application	7
1.3. Testing and Certification	7
1.4. Explanation of Packaging and Disassembly	7
2. Laser Product Safety Information	8
2.1 Laser Product Safety Performance and Convention	8
2.2 Relevant Regulations and Standards	10
2.4 Welding Safety and Potential Hazards	12
2.6 Environmental Safety	15
3. Description of Handheld Laser Welder	16
3.1 Handheld Laser Welding System Performance Parameters	16
3.2 LW-series Welder Façade Interface Diagram	17
3.3 LW-series Welder Rear Diagram	19
3.4 Schematic Diagram of Handheld Welding Head	20
3.5 Product Layout and Dimensions	21
3.6 Optical Fiber Output Connection	22
4. Welding Equipment Installation	23
4.1 Preparation Before Installation	23
4.2 Air Flow and Installation Gap	23
4.3 Safety Protection Device Connection	24
4.4 Welding Auxiliary Gas Connection	24
4.4 User Interface	错误! 未定义书签。
4.5 Power Supply Connection	错误! 未定义书签。
4.6 System Startup and Shutdown	错误! 未定义书签。
5. Laser Welding System Operation	29
5.1 Control Panel Operation	29
5.2 Welding Head Usage and Operation	30
5.3 Important Safety Functions	33
5.4 Begin Welding	35
6. User Interface Function Introduction and Process Parameter Setting	36
6.1 Introduction to the Menu Structure of User Interface	36
6.2 Uasge of User Interface Status Page	37
6.3 Usage of User Interface Control Page	39
6.4 Recommended User Parameter Setting	47
6.5 Recommended Welding Parameters for Common Materials	49
7. Troubleshooting/Maintenance	50
7.1 Error Message and Troubleshooting	51
8. Warranty	54
8.1 General Warranty	54
8.2 Service and Repair	54
8.3 Change	54

1. Overview

1.1 Introduction

LW series handheld fiber laser welder is a new industrial-grade handheld infrared optical fiber laser welding system.

The LW series handheld CW fiber laser welder is specially designed for purpose of industrial material processing applications and feature the most reliable and efficient ABR and SPP proprietary technologies. Key innovations in the LW series fiber lasers also include the proprietary thermal processing, mode-filtering technology, and a durable and novel fiber laser structure. The GW fiber laser includes a powerful optical engine, comprehensively controlling and monitoring the electronic equipment. The beam is transmitted and output through a metal-protected QBH optical fiber cable.

The GW series lasers have the output waveband between 1070 nm and 1080 nm. GW light source system provides high-efficiency and high-quality laser output. The beam quality M2 output from a single-mode fiber cable is less than 1.3 at best, being of high-brightness single-mode fiber cable output. Such output options of higher beam quality and multi-mode fiber cable make this product ideal for handling a variety of materials, like the fine cutting, precision welding, and cutting and welding of different materials with different thicknesses.

GW fiber laser welders are designed and tested with safety in mind. By following this user guide and applying laser safety measures, it can be a safe and reliable equipment.

To ensure the safe operation and optimal performance of the product, please follow the use warnings and other information contained elsewhere in this document. These safety precautions must be observed at all stages of the operation, maintenance and repair of the instrument.

1.2. Application

The LW series handheld fiber laser welder is applicable for industrial and professional use. The application fields include welding and brazing. Materials include steel, aluminum, copper, stainless steel and other metal materials.

1.3. Testing and Certification

GW certifies that this system has been thoroughly tested and inspected. Before packing, it is fully inspected and verified to meet the shipping standards. When you receive the equipment, please check the packaging and components for any damage that may have occurred during transportation. In case of obvious damage, please contact the carrier and GW after-sales personnel immediately;

1.4. Explanation of Packaging and Disassembly

If there are any signs of damage to the external packaging, please check whether the equipment is damaged or not, and immediately notify the carrier and GW after-sales personnel; When you take out this system from the packing case, you must take special care to ensure that the fiber optic cable is not broken or damaged; Please check the attached packing list. Once the product is received, be sure to check all items with this list, and do not under any circumstances attempt to install or operate the laser equipment if any items are missing or the equipment has obvious or suspected damage.

2. Laser Product Safety Information

2.1 Laser Product Safety Performance and Convention

To ensure the safe operation and optimal performance of the product, please follow all warnings in this guide. Safety precautions must be observed at all stages of operation, maintenance and service. Operators must adhere to these recommendations and apply sound laser safety practices at all times. Never open the module. There are no user serviceable parts, equipment or assemblies associated with this product. All internal service and maintenance shall be carried out only by qualified GW after-sales personnel;

This user guide uses a variety of words and symbols that are intended to alert you to pay attention to possible dangers or important information.

2.1.1 Safety Performance

Performance	Description
Output power monitoring	Monitor the output power while the laser is operating.
Overheat protection	Monitor the internal temperature of the laser to protect the internal components from damage due to exceeding the safe operating temperature.
Safety/warning labels	Various labels are used to alert and warn users of possible hazards.

2.1.2 Safety Labels

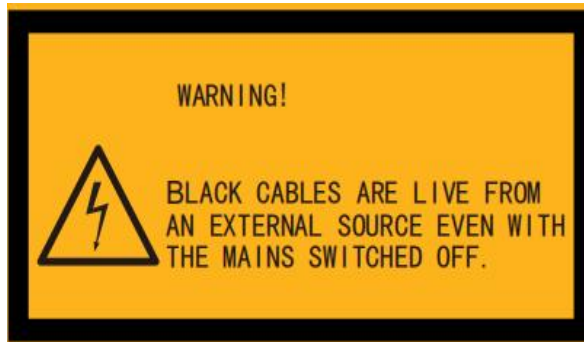
Safety labels and label location:

The following pictures show the labels and their position on the product.



Laser outlet label

Location: Front panel/welding head



Warning label

Location: Rear panel



Product lable

Location: Rear panel



2.2 Relevant Regulations and Standards

2.2.1 Product Function Safety

Electrical Safety	EN 61010 - 1:2010
Laser safety	EN 60825 - 1:2014 CDRH 21 CFR 1040.10

Optical fiber cable protection disconnection (optical fiber interlock): The optical fiber protects the loop for the fiber laser to interlock with an external device (such as a handheld welding head). The laser welding system will continuously monitor this signal and terminate the working of external device (such as a welding head) if the optical fiber connector is not connected correctly.

The said handheld welder provides a protection signal output based on wire cables contained in the fiber optic cable between the laser equipment and the handheld welding head. If the fiber optic cable is not inserted into the welding head or disconnected, the fiber cable security interlock loop will open.

Guarantee of stop and start: Install various electronic sensors inside the system, and if any abnormal conditions are detected, the monitoring program will alarm, and the system will stop continuing to start;

Safety start/restart button (scram): Used for emergency shutdown and recovery of laser welding systems.

Key switch: Start/turn off the main loop power supply of laser welding system.

2.2.2 Laser Products Classification

According to the requirements of governmental and industry standards, all lasers are classified based on their output power or energy and laser wavelength.

According to IEC/EN 60825-1, this product belongs to the high-power class-4 laser. This product can output up to 1500W of non-visible infrared light. The laser of such class may cause eye or skin injury. Although the output light is invisible, it can still cause irreversible corneal damage. This product does not provide laser safety protective goggles. But be sure to wear suitable protective goggles to avoid injury when using laser products.

Class 4 - high power lasers present the most serious of all laser hazards. Take precautions to prevent injuries caused by accidental exposure to direct and reflected light.

Diffuse and specular reflections can inflict severe retina and/or cornea injuries leading to permanent eye damage. Class 4 laser beam is also a kind of potential fire hazard and skin hazard. All personnel must wear appropriate eyewear when operating the equipment. For information on the laser safety eyewear, see the section 2.2.3.

Use of controls, adjustments or performance of procedures other than those set forth in this user guide may result in exposure to hazardous radiation.

2.2.3 Laser Safety Eyewear

When operating this equipment, please wear appropriate laser safety eyewear. The selection of appropriate laser safety eyewear requires the end user to accurately identify the range of wavelengths emitted from this product.



Usually around the laser output aperture, there are many secondary laser beams of different angles generated. These beams are called as "specular reflections", which are produced from the reflection of laser when the main laser beams are emitted onto the surface. Although the power of such secondary beams may be less than the total power of beams emitted by the laser, it is strong enough to cause

damage to the eyes, skin, and the materials around the laser. If the equipment is a tunable resonant laser or Raman product, it will emit laser in other wavelength ranges. End users should verify that the laser safety eyewear used are capable of protecting from the laser within the entire wavelength range that is emitted by the equipment.

Be careful to avoid/minimize specular reflections. This product emits invisible laser radiation at or around a wavelength of 1070nm (infrared). In addition, this product emits visible laser radiation at or around a wavelength of 600 - 700nm (infrared).

Please review the safety labeling on the product and verify that the personal protective equipment (i.e. enclosures, viewing windows, or viewports, eyewear, etc.) being utilized is adequate for the output power and wavelength ranges. Decisions on safety eyewear must also take into account any secondary radiation hazards due to the welding process

Laser safety eyewear must conform to international safety standards, including ANSI Z136.1 (the USA) and EN207/EN208/EN60825 (Europe). The regulations in force will depend on the location of the laser installation.



2.3 Laser Welding Protection

Eye protection is required during laser welding to protect your eyes from any reflected or scattered Class-4 laser beams, and also to protect from welding glare, ultraviolet rays, heat and sparks.

For laser welding, only wearing personal protective equipment against laser infrared wavelengths is not enough. A combination of a mask, helmet and/or goggles will provide the best protection during laser welding. For example, an additional welding helmet (with appropriate filter glasses) should also be worn over laser safety eyewear to protect the wearer from ultraviolet and visible light radiation. Welding helmets also protect welders from heat splash, metal particles and sparks. Therefore, personnel working near the laser welding area must wear personal protective equipment.

Exposure to infrared and ultraviolet radiation during welding can damage the skin. Depending on the intensity of the IR light, skin injuries may include thermal burns or excessive dry skin. Exposure to UV light may cause skin burns that are similar sunburns and will increase a welder's risk of skin cancer and accelerated signs of skin aging. Welding sparks may also cause burns.

Laser material processing can transfer a significant amount of energy to the part. Even after the cutting or welding process is complete, parts can be very hot. Ensure proper personal protective equipment is used to prevent potential burns. Wear protective clothing such as fire-resistant gloves, caps, leather aprons and other flame-resistant clothing to prevent skin damage. Sleeves and collars should be buttoned!

2.4 Welding Safety and Potential Hazards

2.4.1 Fire Hazard

If there are combustible or flammable materials near the welding area, the heat and sparks generated during the welding process may cause a fire or explosion. Laser welding should only be performed if the area is free of combustible materials.

Do not weld on containers containing flammable or combustible materials. If the contents of a container are unknown, you should assume that they are flammable or combustible. Fire extinguishers should be nearby and easily accessible, and personnel should be trained to use them.



2.4.2 Fume Hazard

Welding “fume” can be comprised of very fine particles and gases. Welding fumes and gases come from a combination of welding materials or any filling materials used, protective gases used, paints, coatings, chemical reactions and air contaminants. Welding fumes can adversely affect the lungs, heart, kidneys and central nervous system.

When the laser interacts with the target material (e.g. plastic, metal, composite materials), the target material may begin to evaporate. These fumes and particles are often invisible, but are highly toxic and pose a serious health hazard.

Welding in confined spaces with poor ventilation is very dangerous. The danger of toxic fumes and gases can rapidly increase, leading to coma or death by suffocation.

Ultraviolet light emitted during welding can react with oxygen and nitrogen in the air to form ozone and nitrogen oxides, which can kill people in high concentrations.

The protective gases used during welding can displace air and cause personal injury or death.

When welding, do not let your head come into contact with the gas. Be sure to weld in a well-ventilated area to ensure that the air you breathe is safe. Use a fume extraction system to remove vapors, particles and harmful debris from the welding processing area. Read and follow safety data sheets and warning labels for all welding materials used. Respirators may also be required in confined spaces and other situations. Routine air monitoring should be conducted to determine the levels of hazardous fumes in the welding area.



2.4.3 Gas Cylinder Safety

The gas cylinder may explode if damaged or placed nearby to the welding area. Shielding gas cylinders should be located in areas where they cannot be struck or damaged. Place them away from sources of heat, sparks or flame. Gas cylinders must be stored upright and secured to a fixed bracket. A working regulator suitable for the required gas and pressure is required. All hoses and fittings should also be suitable for the application and kept in good working condition.



2.4.4 Optical Safety

The laser output is delivered through a window or optionally a device with an anti-reflective coating. Make sure the windows are clean and of good quality. Any dust at the end of the head assembly can burn out the window and damage the laser. Check the quality of the light spot emitted by the laser output at low power, and then gradually increase the output power.

Never look directly at the laser aperture (such as fiber, collimator, or scanning head) while the start button or remote start circuit is activated. Always wear appropriate laser safety eyewear when handling the product. All personal protective equipment must be compatible with the output power and wavelength range listed on the laser safety label affixed to the product.

When power is supplied to the laser, do not look directly at the output port; Avoid positioning the laser and all optical elements at eye level; Avoid using lasers in dark environments; When using the output (such as installing the laser head to the fixture), please turn the switch key to the OFF position; As a precautionary measure, during the operation of this product, please gradually increase the output power from low to high;

Do not install the laser head when the laser is active.

Photosensitive components in devices, such as cameras, photomultiplier tubes and photodiodes, can also be damaged by exposure to lasers. The laser is powerful enough to burn skin, clothing and paint. Lasers can cut and weld metal. The laser can ignite volatile substances such as alcohol, gasoline, ether and other solvents. Installation and use must avoid contacting with solvents or other flammable materials and gases.



2.5 Electrical Safety

The input voltage of the laser can be lethal. All electrical cables and connections should be treated as if they were at a harmful level. All parts of the electrical cable, connector or equipment housing should be

considered dangerous. Before supplying power to the equipment, check whether the wiring harnesses are damaged and whether the welding protective gas is on. In addition, where applicable, all connections must be secured with screws to ensure proper function.

Ensure that the equipment is grounded through the protection conductor of the AC power cable. If any PGND conductor is disconnected from the PGND terminal, personal injury may occur. In order to continuously prevent fire hazards, it is necessary to only replace with line fuses of the same type and rating (if applicable); The use of other fuses or other materials is prohibited; Before supplying power to the equipment, ensure that the used AC power supply voltage is correct. Incorrect voltage will cause equipment damage; Refer to the markings on the specific model for proper power connections; There are no operator serviceable parts inside; Assign all maintenance work to qualified GW after-sales personnel; To prevent electric shock, do not remove the cover; Any tampering with the product voids the warranty. In addition to the mains electricity connection, the external connection between this product and other external equipment is PELV (Protected extra-low voltage) as defined by IEC 61140. The non-mains electricity output of other devices connected to this product should also be PELV or SELV(safe extra-low voltage).

2.6 Environmental Safety

Do not dispose of this product with household waste. Electronic equipment must be disposed of in accordance with regional directives on the disposal of electronic and electrical waste. **Note that all personal protective equipment must be compatible with the output power and wavelength range listed on the laser safety label affixed to the laser equipment.** Be careful when operating, otherwise the laser may damage the equipment.

The equipment is suitable for : (1) indoor use; (2) use below 1500 meters above sea level; (3) overvoltage class II; and (4) drying place.

This equipment is not suitable for use in places where children may be present. Keep away from striking or vibration sources. An appropriate housing should be used to ensure a laser-safe working area. This includes, but is not limited to, laser safety signs, appropriate warning devices, and training/safety procedures. Do not operate the output welding head at eye level. Ensure that the laser shield is in place to protect the eyes of those working in the area from injury.

2.6.1 Humidity

Do not expose the equipment to a high-moisture environment (>75% humidity).

3. Description of Handheld Laser Welder

3.1 Handheld Laser Welding System Performance Parameters

Optical performance parameters	
Working mode	Continuous/modulation/pulse/linear array/timing
Output power adjustment range (%)	1-100%
Output laser wavelength (nanometer)	1080 ± 10 nm
Power stability	< 5%
Maximum modulation frequency	50kHz
Laser response time	< 10us
Indication laser wavelength (nanometer)	650
Indication optical power adjustable range (milliwatt)	<1mW
Laser conduction system parameters	
Interface type	GW handheld welding head
Collimation focal length	50mm
Focusing focal length	150mm
Transmission length	Standard length 5±0.5m (or 10m, optional)
Working requirements	
Cooling and protective gases	Insert gas
Working ambient temperature range	-10° - 40°C
Working ambient humidity range	≤85 degree
Input voltage	220VAC/50Hz/60Hz
Complete machine power	≤ 4.0kW

3.2 LW-series Welder Façade Interface Diagram



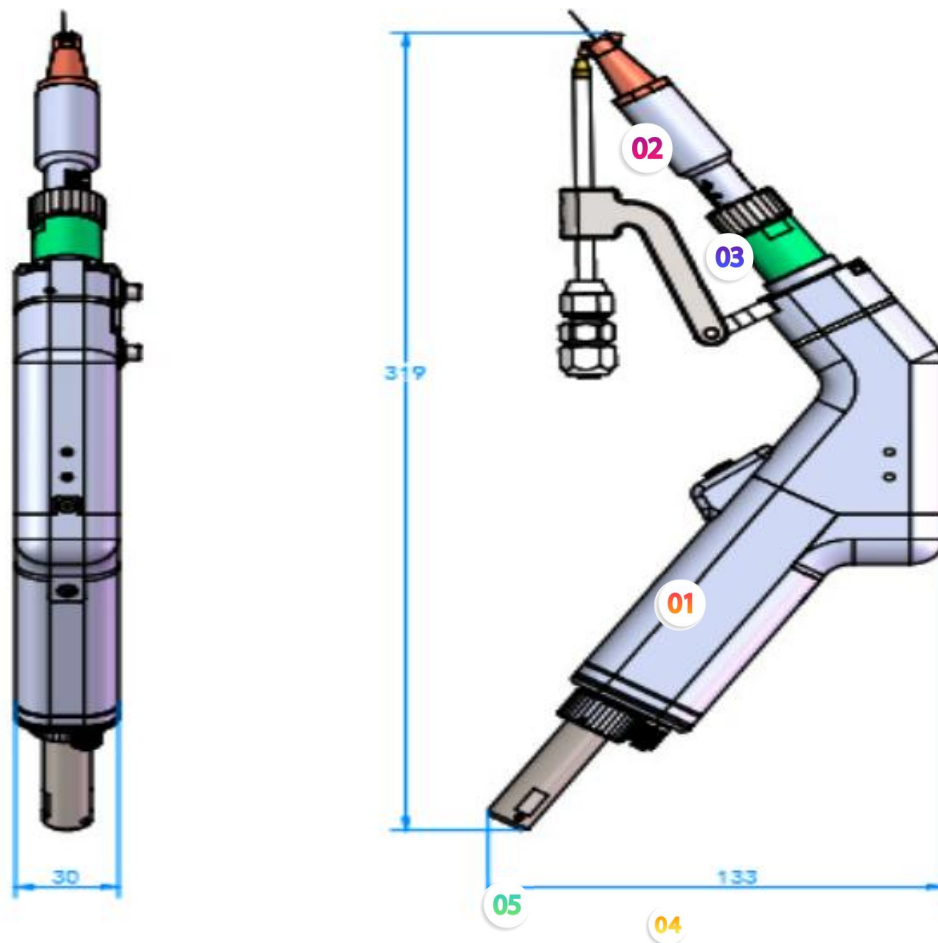
S/N	Name	Description
1	GW head	GW self-developed welding head
2	Safety lock interface	The workpiece safety clamp cable is connected to the interface. When the handheld welding head nozzle is connected to the workpiece to be welded, the security interlock loop between the handheld welding head nozzle and the safety clamp will be enabled, and only at this moment, the laser emission will be allowed.
3	User interface	Wire feed signal +, wire feed signal -, wire withdrawal signal +, wire withdrawal signal -, safety interlock +, and safety interlock -
4	Second-gear knob switch	Turn the key knob clockwise to (ON) position to turn the power on, and turn the key knob counterclockwise to (OFF) position to turn the equipment off.
5	Scram switch	In case of an emergency, you can press the scram button down to quickly cut off the power supply of the main circuit of the equipment. When pressing the stop button, turn the button clockwise to reset the scram button.
6	Output interface	As to the laser output optical fiber cable, the gas outlet is output through this position and connected to the handheld welding head (QBH output terminal), and the external of optical fiber cable is protected by a self-winding woven mesh.

3.3 LW-series Welder Rear Diagram



S/N	Name	Description
1	Equipment power input port	 AC input socket: AC 220V, 50/60Hz, 18A
2	RS232 Communication Interface (DB9)	It is used to connect the SMATLas host computer control software to monitor the operation of the equipment, and carry out more abundant equipment control and monitoring operations.
3	Main power supply switch	Used for turning on/off the main power supply
4	Gas inlet	The protective and cooling gas inlet is connected by an 8mm air pipe.
5	Cooling fan	When the equipment is running, the cooling fan will start or close according to the system command. During operation, the fan outlet position must not be blocked or be protected from foreign objects falling in

3.4 Schematic Diagram of Handheld Welding Head



S/N	Function item	Description
1	Trigger button	 Start the protective/cooling gas flow and start the laser emission, press and hold the trigger to start the protective gas flow, and start the laser output according to the light output delay set by the system; It must be kept tight throughout the welding process. When the workpiece safety clamp and the nozzle of the welding head do not form a conduction loop, press the trigger to allow only the gas to flow
2	Nozzle	One equipped with four spare nozzle heads as a standard;
3	Telescoping tube	The tip of the nozzle is threaded into the pipe.
4	Protective and cooling gas connection	Connect the protective and cooling gases
5	QCS	The optical cable has been inserted and connected to the welding head.

3.5 Product Layout and Dimensions

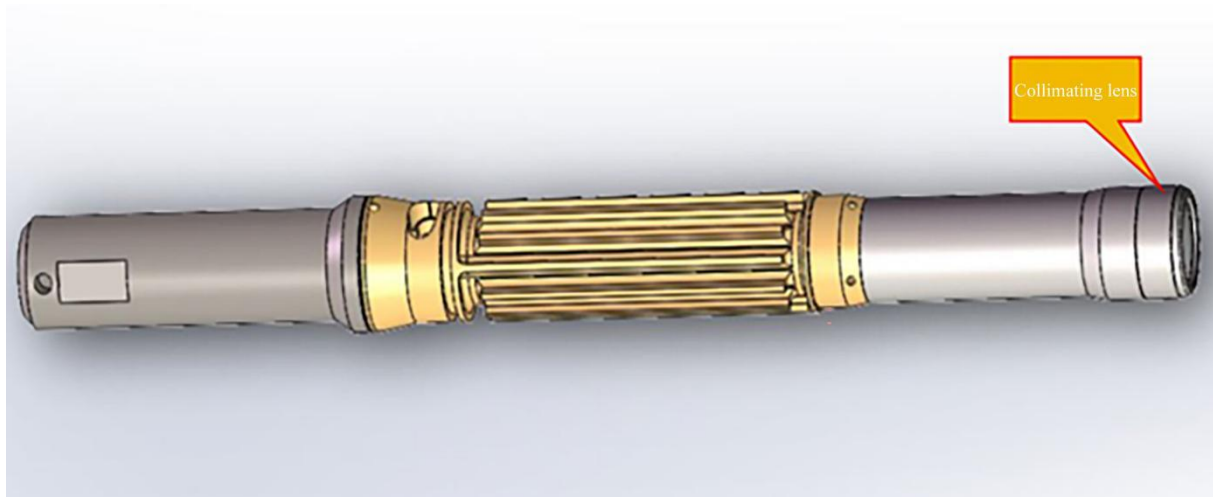


Dimensions	250*520*490 [mm] (L×W×H)
Weight	Less than 30[kg]

3.6 Optical Fiber Output Connection

When the product is delivered to the user for usage, the optical cable has been inserted and connected to the welding head. Although this is not typical, it is required to disconnect and reconnect the fiber if necessary (For example, when replacing the welding head is required, but not recommended).

The optical fiber end connector collimating lens must be optically cleaned to ensure that there is no dust or dirt; the internal of the welding head must also be guaranteed to be free of dust.



4. Welding Equipment Installation

4.1 Preparation before Installation

Please refer to the power requirements and ensure that the standards specified in the input voltage specification are met before switching on the power supply. The equipment must be connected with auxiliary gas of sufficient air volume before it can run, so as to dissipate the heat load generated during operation and protect from the damage to the welding head caused by the splash generated during the working process. If the gas is not connected, the equipment will automatically alarm and disable operation.

4.2 Air Flow and Installation Gap

Air-cooled CW fiber laser handheld welder adopts direct air-cooling heat dissipation mode. When selecting the installation position, please do not run in an airtight, narrow and small space and be sure to run in a space with good air circulation conditions. Do not place any object that may block the exhaust on the top of the machine, with the gas flow direction as shown in the figure below:



NO blockage within a radius of 10cm around the fan

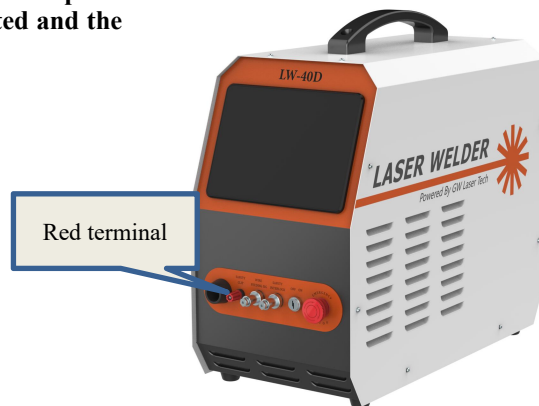


Note: The air intake at both sides of the machine, and air outlet from the fan.

4.3 Safety Protection Device Connection

A safety protection device (red wiring terminal) is provided on the front panel of the equipment. As shown in the figure below; before turning on the laser, the workpiece safety clamp cable must be connected to the ground protection device and the workpiece. When the handheld welding head nozzle is placed on the workpiece, the security protection loop will be switched on, and the laser emission will enter the ready state. At this time, the equipment panel indicator is in orange. Only when the security protection loop is effective, the laser can be emitted when the handheld welding head nozzle is always electrically connected (in contact) with the workpiece. When the security protection loop is not switched on, pressing the trigger of the handheld welding head only allows the auxiliary gas to flow.

As shown in the figure below, the operator must connect the workpiece safety clamp cable to the safety protection interface installed on the rear panel of the equipment. When the handheld welding head nozzle touches the workpiece, the safety protection of the closed loop is effective. If the operator lifts the nozzle from the workpiece during operation, the safety loop laser will automatically turn off.



4.4 Welding Auxiliary Gas Connection

The welding gas input port can only be connected with an 8mm gas pipe. As shown in the following figure, insert the gas pipe into the quick connector of the gas inlet. Once connected, open the external gas valve to supply the gas. It is recommended to use inert gas in welding work to protect the quality of the weld seam during welding. Input gas pressure should be greater than 0.1MPa and less than 0.6MPa.



Item	Specification
Standard auxiliary gas	Argon, nitrogen, argon + carbon dioxide gas mixture
Input gas pressure	Min. 0.1MPa, max. 0.6MPa

4.4 User Interface

4.4.1 RS232 interface definition



RS232 communication interface (DB 9Pin)				
Pin	Definition	Description	IN/OUT	Notes
2	RSRX1	Data input		-10V—10V
3	RSTX1	Data output		-10V—10V
5	GND	Grounding		0V
7	BOOTW			

4.4.2 USER INTERFACE definition

The USER INTERFACE adopts 6P welding-free wiring terminal with fixing flange at a spacing of 5.08 mm, which is convenient and reliable to connect.



4.4.3 Control panel interface description

Control panel interface					
	Category	Name	Interface No.	Pin S/N	Pin name
1	Power source	The mainboard uses power supply ports	P100	1	24V+
				2	GND
		Wire feeder power supply interface	J415	1	24V+
				2	GND
2	Communication	RS232 communication interface 1	J401	1	BOOTW
				2	RSTX1
				3	RSRX1
				4	GND
		RS485 communication interface	P200	1	GND
				2	RS485-
				3	RS485+
				4	VCC
		RS485 communication interface 1	J413	1	RS485+
				2	RS485-
				3	GNDC

Air-cooled CW Fiber Laser Handheld Welder

3	Red light control	Red light control port	P20 1	1	VCC
				2	RED-OUT
4	Internal emergency stop	Internal emergency stop interface	P20 2	1	IN_STO P1
				2	GND
5	Main power supply start	Main power supply start interface	P20 3	1	5V
				2	ON/OFF
				3	GNDD
6	Swing width signal	Swing head control signal interface	P20 8	1	BDT
				2	GNDA
7	Air pressure detection	Air pressure detection interface	P30 1	1	SW+
				2	SW-
8	Air valve control	Air valve control interface	P30 3	1	24V+
				2	QF
9	QBH detection	QBH detection interface	P30 2	1	QBH+
				2	QBH-
10	Wire feeder control	External wire feeder interface	P30 4	1	TS
				2	SS
				3	GND2
11	Welding gun communication wire	Gun interface	P30 5	1	SafeSW-
				2	SafeSW+
				3	GND
				4	RS485-
				5	RS485+
				6	VCC

4.5 Power Supply Connection

Before connecting the power supply, make sure that the power supply capacity meets the requirements of specifications.

4.6 System Startup and Shutdown

Before supplying power to the equipment, all electrical connections must be connected. Where applicable, all connections must be secured with screws or fasteners to ensure proper functioning. Ensure that you wear appropriate personal protective equipment when handling this product. These include welding helmets, flame-retardant protective gloves and laser safety eyewear suitable for use at 1070nm wavelengths.

WARNING



When maintaining the output cable, disconnect the main power supply of the equipment and remove the input cable connector. The minimum allowable bending radius of the optical cable is 50mm.

System start:

1. Ensure that all connections necessary for normal operation have been completed, including the limitations of external safety protection devices. At the same time, check whether the security protection loop is connected properly and the external security interlock loop is in the closed state.
2. Make sure that the scram button is not pressed. If pressed down, turn clockwise to reset the scram button.
3. Turn the key switch clockwise to the (ON) position;



Press down



Release

3. Turn the key switch clockwise to the (ON) position;



4. The display will be lit up after startup.

System shutdown:

To turn off the laser welding system, the user must stop emitting the laser after the welding is completed; 1. Release the trigger of the handheld welding head, and the system will stop emitting the laser and terminate the gas flow at the same time (if any gas extension shutdown parameter is set, the system will stop after the set time). Press the emergency stop switch, and counterclockwise turn the second-gear switch to the (OFF) position.

5. Laser Welding System Operation

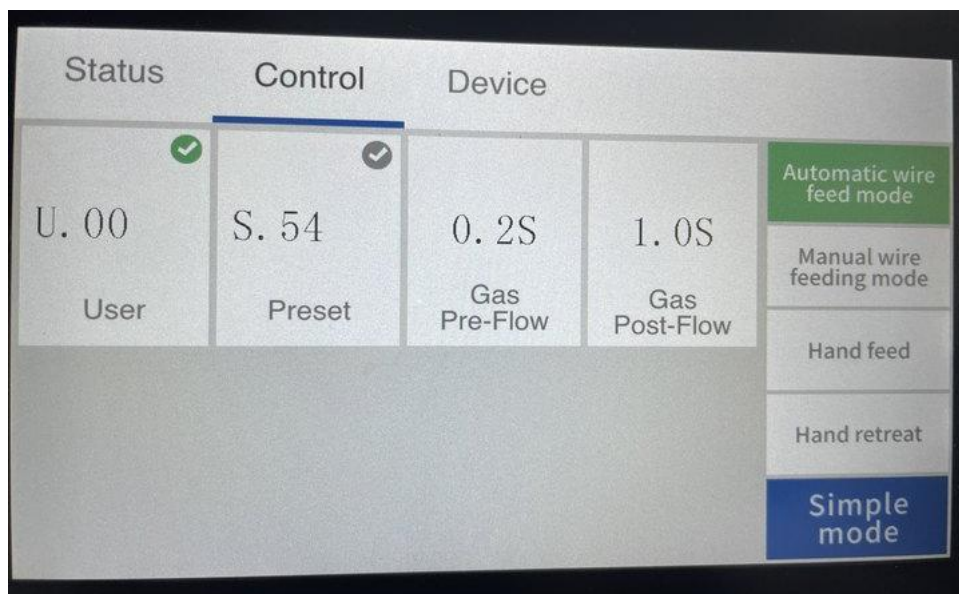
5.1 Control Panel Operation

The equipment operation panel is provided with an LCD screen for viewing equipment status and equipment information, and adjusting system operating parameters, and it is available to enter the sub-interface by clicking the relevant content on the interface:

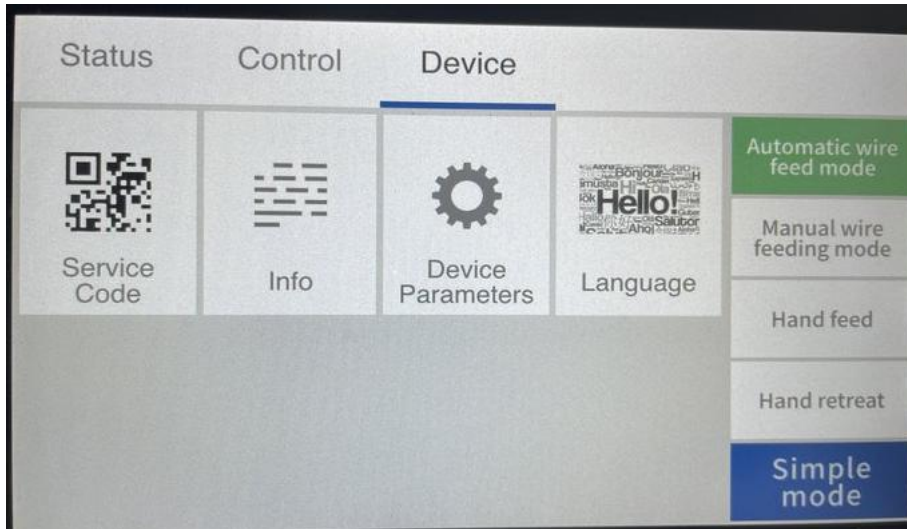
Status:



Control:



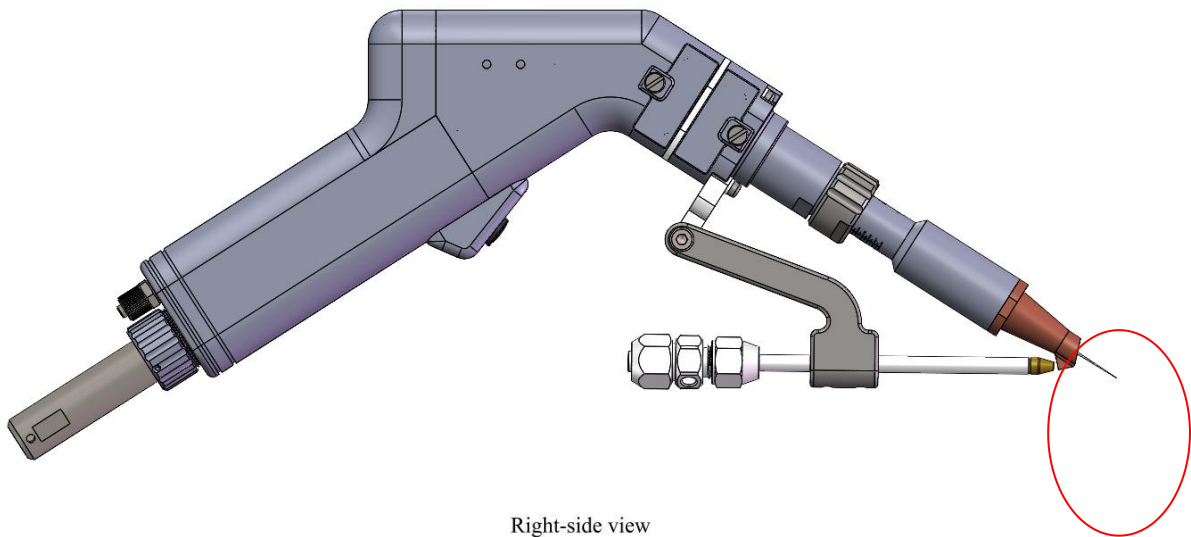
Equipment:



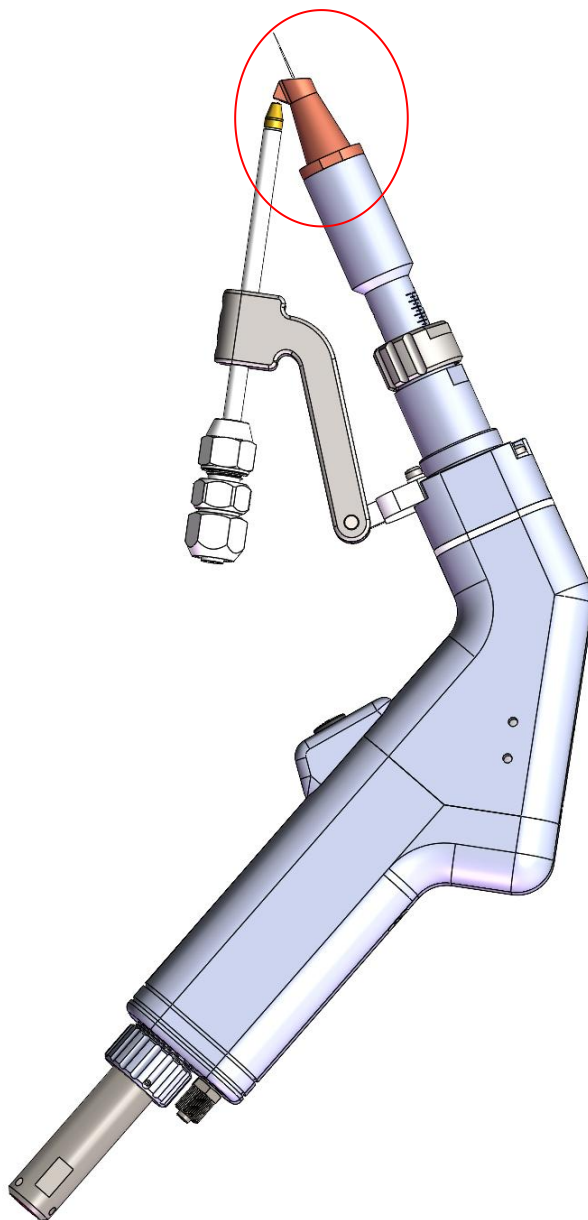
5.2 Welding Head Usage and Operation

5.2.1 Nozzle Installation

Before replacing the nozzle tip, close the equipment nozzle tip to connect the thread to the extension tube of the welding head.



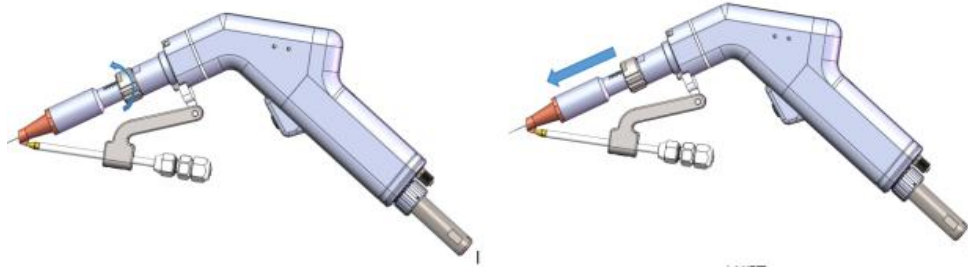
Right-side view



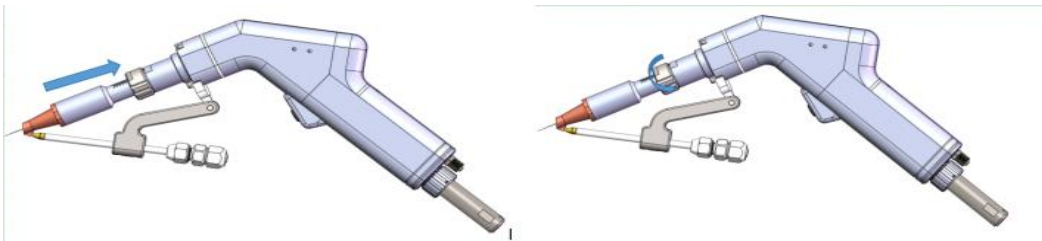
Left-side view

5.2.2 Nozzle tube adjustment

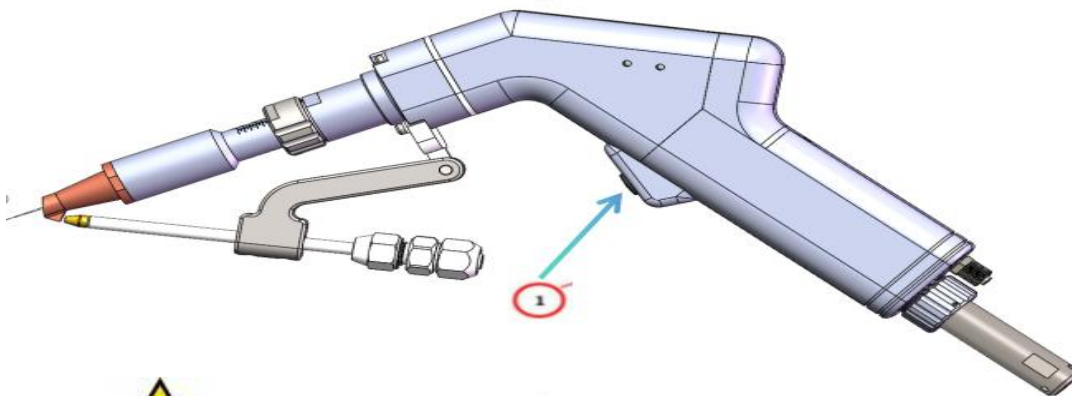
Before adjusting the nozzle tube, please use the key switch button to turn off the equipment. When adjusting the nozzle tube, loosen the nut first, as shown in the figure.



Once positioned correctly, tighten the nut and lock the nozzle tube in place, as shown in the figure. Tighten with the wrench!



5.2.3 Handheld Welding Head Operation



Laser emitting warning!

Press down Trigger 1 on the welding head to turn on the protective gas. The protective gas will be held for 2 seconds (the gas delay time can be configured through the "Gas outlet delay" parameter) and then the laser will start. The laser emission is started on the premise that all security interlock control conditions are satisfied and the preset gas outlet delay is ended. In the welding process, the operator must continue to hold the switch being pressed to keep the laser emitted. Releasing Trigger 1 or failure of the security interlock loop will terminate the laser emission.

5.3 Important Safety Functions

5.3.1 Optical Cable Connection and Interlocking

Optical fiber connection and interlocking serves as a security protection loop between the handheld welding head and the optical cable interface of the equipment, which is used to limit the laser emission of the equipment when the external optical device is not connected. It is a method to ensure the interlock protection between the optical cable output interface and the handheld welding head. If the output cable of the equipment is not correctly connected to the welding head, the laser is prohibited from emitting, and meanwhile, the system displays the interlock status of the output signal on the user interface to inform the user whether the current loop is normal.

5.3.2 External security interlock loop

The laser welding system includes an external security interlock loop, and the user's operator connects the safety grating, safety door and other safety protection devices. External interlocks need to be connected through an external user interface, and the security loop must be kept closed at all times (see Section 4.5.2 Interface Definition). Otherwise the laser emission will be prohibited, the welding system will output an alarm message, and the user interface will also inform the user through an alarm code.

5.3.3 Security protection loop between workpiece safety clamp and handheld welding head

The security loop ensures that the laser is only allowed to be emitted when the nozzle is connected (in contact) with the workpiece. The operator must fasten the workpiece safety fixing part to the metal workpiece to be machined. When the nozzle of the welding head touches the workpiece, the loop between the welding head nozzle and the workpiece safety clamp will be turned on and activated. If the operator removes the nozzle from the machined workpiece, this security interlock loop will be cut off, the laser will automatically turn off, and laser emission will be prohibited.

5.3.4 Button Function Limitations of the Handheld Welding Head

As to the trigger button on handheld laser welding head when the said security interlock loop is turned on, if the user presses down the trigger button, at this moment, only the auxiliary gas valve is allowed to open, allowing the gas flowing through the welding head nozzle, while it is not allowed to emit the laser and execute the preset operation program. If the above security interlock conditions are satisfied, the trigger button will be used as the trigger device for program operation. When the user presses down the trigger button, the preset gas outlet delay program will be executed first, and the gas outlet delay time will be executed according to the parameters set by the user. The laser will be emitted after the completion of the gas outlet delay execution. In order to complete the welding work, the operator must continuously hold the trigger button pressed so that the laser emission remains.

5.3.5 User Operation Status and System Running Status

Assuming that the above security protection interlocks are all closed, the user operation and system running status are shown as in the table below:

S/N	User operation (The security interlock loop is turned off)		Laser	Indicating light	Beam swing	Auxiliary gas
1	Workpiece safety clamp Trigger button	Disconnection Loosened	Turn off	Turn on	Turn off	Turn off
2	Workpiece safety clamp Trigger button	Disconnection Press down	Turn off	Turn on	Turn off	Turn on
3	Workpiece safety clamp	Switch on Loosened	Turn off	Turn on	Open 1	Turn off

Air-cooled CW Fiber Laser Handheld Welder

	Trigger button					
4	Workpiece safety clamp Trigger button	Switch on Press down	Open 2	Turn on	Open 1	Turn on

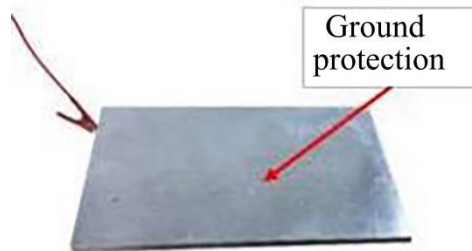
Note 1: Only if the user sets the swing width, the beam will swing according to the set value, otherwise it will remain fixed.

Note 2: If the program sets the gas close delay upon gas outlet delay, the laser will not be emitted immediately when the trigger is pressed, and the laser will be emitted only after the end of the set gas outlet delay, which is the normal operating state.

5.4 Begin Welding

All personnel in the welding area must wear personal protective equipment to protect against invisible infrared lasers and any secondary visible and invisible radiation generated during welding. Appropriate laser safety eyewear and a welding helmet with suitable filter lens are required. Safety equipment for welding operators also includes welding helmets and fire-resistant protective clothing and gloves.

1. Check whether the security loop is working properly. If the security loop is not working properly, the corresponding alarm code will be displayed in the lower right corner of display screen, and when the security loop is normal, the alarm is cleared, and the equipment is in the ready state;
2. Select the appropriate welding nozzle and install the nozzle onto the welding head extension pipe;
3. On the user operation interface, select the equipment preset parameters S.01. Process a 1mm thick aluminum plate in continuous laser mode.
4. Place the workpiece to be welded on the welding workbench and clamp it. In laser welding work, it is necessary to ensure that there is a minimum gap between the parts and as close as possible.
5. Ensure that the "workpiece safety clamp" is connected to the part or the conductive welding bench on which the part is placed. As shown in the figure below.



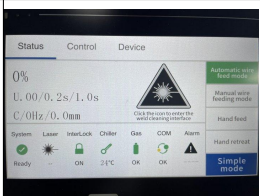
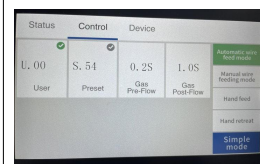
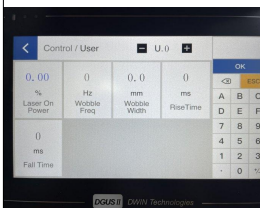
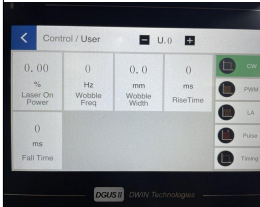
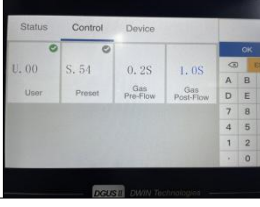
6. Make the tip of the nozzle in touch with the part being welded. This closes the security interlock loop between the workpiece safety clamp and the handheld welding head, and at the moment, the equipment is in a ready state.
7. Press the trigger button on the handheld welding head to trigger and turn on the protective gas and wait for the laser to start.
8. When the laser is emitted, the welding head can be moved slowly to complete the welding operation. During the welding process, the trigger button of the welding head should be held pressed, otherwise the welding procedure will be interrupted, and the laser emission will be terminated.

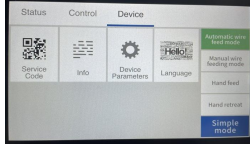
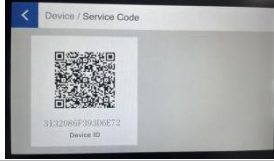
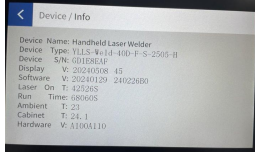
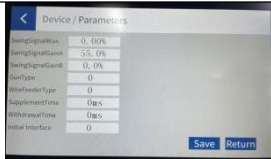
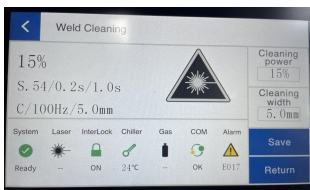
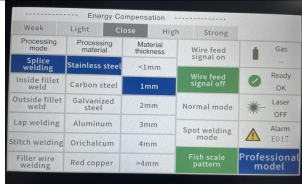
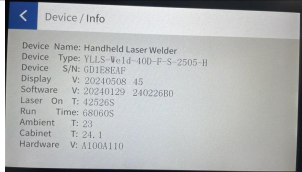
To further improve the process, the operator can click the touch panel to adjust some process settings by increasing or decreasing the laser power, swing frequency, swing width and other parameters.

6. User Interface Function Introduction and Process Parameter Setting

6.1 Introduction to the Menu Structure of User Interface

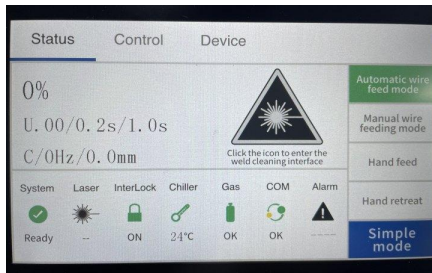
The user interface is mainly composed of status page, control page and equipment page. The following table briefly describes the hierarchical structure and function description:

Level I page	Level II page	Interface preview	Fuction description
Status			This interface is used to display information such as the operating parameters and operating status of the current equipment in a centralized manner. After the equipment is started, this interface will be displayed by default.
Control			The user can enter the process parameters through the control page. The page includes the menu entry of user parameters, preset parameters, gas outlet delay, and gas close delay. When the "=" sign is displayed in the upper right corner, single click the confirm button to activate the current selection, and double click to enter the parameter editing page.
	User parameter		After the user double-clicks the user parameters, the parameter setting is displayed. Click the item that needs to be set, and the digital input field will be displayed on the right side of the display screen. After the user has set it, click OK to save the corresponding parameter.
	Preset parameter		In the prefabricated parameter selection page, the user can select the parameter serial number by the "+-" on touch panel, and by touching the right side, select continuous mode, modulation mode, linear array mode, pulse mode, and timing mode
	Gas outlet delay		In this interface, you can set the gas outlet delay before the laser emission and set to release the auxiliary gas in advance. After pressing down the trigger button of the welding head, the system will release the gas according to the set time and then start the laser.
	Gas close delay		In this interface, you can set the gas close delay after the ending of laser emission and set to continue releasing the auxiliary gas. When the trigger button of the welding head is released, the system will release gas according to the set time and then end the program. During the execution, the laser is in the off state.

Equipment			The equipment page provides an entry for users to view equipment information
	Service code		This interface displays the unique service code of the equipment, and the applet code is used for the feature recognition of the equipment service
	Information		This page displays equipment operating information, including software version information, environment information, and hardware information of the equipment.
	Equipment parameter		This page is used to edit information about the gun head
	Language		This page displays the equipment language
	Weld seam cleaning		In the status interface of professional mode, click the laser triangulation icon to enter in. The weld seam cleaning uses S.54 program, in modulation mode, with only the cleaning power and cleaning width available for modifying; The wire feeder automatically stops feeding when the weld seam is cleaned.
	Simple mode		In the status interface of professional mode, click the simple mode to enter the simple mode interface, and quickly select the parameters corresponding to the processing material, processing method and processing thickness, which is convenient for customers to call
	Time lock		By clicking the service code, the customers can quickly understand the machine laser-emitting time, equipment serial number, and equipment identification code

6.2 Usage of User Interface Status Page

The user page is displayed by default after the equipment is started. When you are in other pages, you can click the menu key to return to the status page layer by layer.



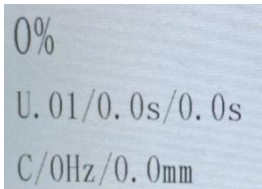
a,

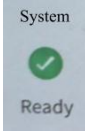
a Indicates the non-activated status



b

b Indicates the activated status

Display content (Inactivation and activation status)	Description																								
	This area displays the setting content of the current equipment operating parameters. The first line displays the power ratio used by the current equipment in percentage, and the second line is separated by a punctuation symbol of "/", respectively displaying the program number/gas outlet delay/gas close delay selected by the user. The content of the third line is separated by a punctuation symbol of "/", and the display content and definition will vary in different operating modes (See the table below) : <table><tr><th>Operating mode</th><th>Mode code</th><th>Display parameter 1</th><th>Display parameter 2</th></tr><tr><td>Continuous mode</td><td>C</td><td>Swing frequency</td><td>Swing breadth</td></tr><tr><td>Modulation mode</td><td>M</td><td>Swing frequency</td><td>Swing breadth</td></tr><tr><td>Pulse mode</td><td>P</td><td>Pulse width</td><td>Swing breadth</td></tr><tr><td>Linear array mode</td><td>S</td><td>Laser on time</td><td>Laser off time</td></tr><tr><td>Timing mode</td><td>T</td><td>Time of duration</td><td>Swing breadth</td></tr></table>	Operating mode	Mode code	Display parameter 1	Display parameter 2	Continuous mode	C	Swing frequency	Swing breadth	Modulation mode	M	Swing frequency	Swing breadth	Pulse mode	P	Pulse width	Swing breadth	Linear array mode	S	Laser on time	Laser off time	Timing mode	T	Time of duration	Swing breadth
Operating mode	Mode code	Display parameter 1	Display parameter 2																						
Continuous mode	C	Swing frequency	Swing breadth																						
Modulation mode	M	Swing frequency	Swing breadth																						
Pulse mode	P	Pulse width	Swing breadth																						
Linear array mode	S	Laser on time	Laser off time																						
Timing mode	T	Time of duration	Swing breadth																						
	When the laser is in the state ready for emitting or in the emitting state, the icon will be displayed in a yellow background, otherwise it means that the laser is neither in the state ready for emitting nor in the emitting state.																								

	Power on, and “Ready” light shows Ready
 	The icon will be activated when the laser is in the state ready for emitting or in the emitting state. At this time, the operator and the surrounding user should do a good job of safety protection. For details, please refer to Section 5.4
 	The icon is activated when all security protection loops are closed
	The diode body shell temperature is displayed
 	After the external auxiliary gas is connected to the equipment, if the access pressure meets the system requirements, the icon will be activated, and the input gas pressure shall be greater than 0.3 bar and less than 6.0 bar
 	This icon is only used for indicating the communication status of internal control signals of the system. When the internal signal communication of the system is normal, the icon is activated
 	In case of any fault or an alarm occurring during the system operation, this icon will be activated. All fault codes will be displayed below the icon in a scrolling way. Users can record the fault codes and consult the contents described in section 7.1 for information comparison.

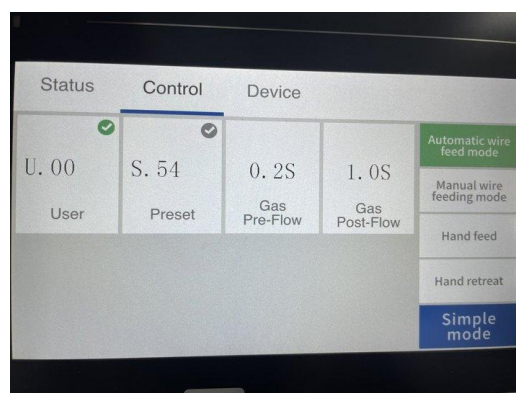
6.3 Usage of User Interface Control Page

The control page contains four options: User parameters, preset parameters, gas outlet delay, and gas close delay. After entering this page, you can view any parameter by clicking the corresponding module of the operation panel. When the parameter is selected, the check mark in the upper right corner will be green. After selection, double-click to enter the parameter setting interface.

Parameter activation status

Selected status (Green)

Parameter name



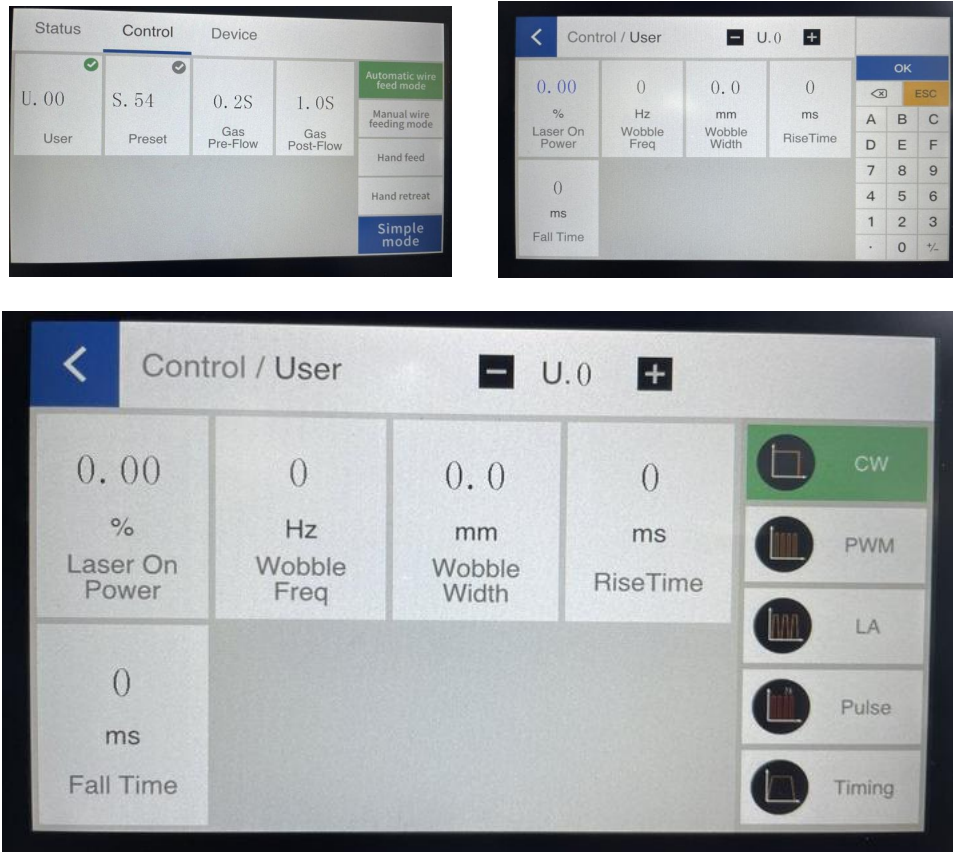
Unchosen status (grey)

6.3.1 User Parameter Setting

The system provides users with 20 groups of running programs, numbered from U.0 to U.19, which can be customized to set parameters. The operator can choose a set of programs to modify until the work needs are met, and the parameters set by the user will be saved in the system by default for reuse next time.

Specific steps to enter parameters:

Select user parameters on the control page, and double-click to enter the program selection page.



In the user program mode, you need to confirm the operating mode selected by the current program before entering the parameter setting. The system provides users with 5 operating modes to choose from.

- Continuous mode - For continuous welding of most sheet metal
- Modulation mode - For welding sheet metal
- Linear array mode - For linear segment welding
- Pulse mode - For welding of highly-reflective materials
- Timing mode - For inching-type welding

6.3.1.1 Description of the Operating Modes in the Program

The system provides users with 5 operating modes to choose from.

. Continuous mode - For continuous welding of most sheet metal

S/N	Parameter name	Unit	Min. value	Max. value	Adjustment amount	Default value	Description
1	Laser power	%	0	100	1	100	
2	Swing frequency	Hz	0	300	1	0	
3	Swing breadth	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow drop time	ms	0	9999	1	500	

For the parameter definitions, please refer to the description in the glossary of Section **6.3.1.2**

. Modulation mode - For welding sheet metal

S/N	Parameter name	Unit	Min. value	Max. value	Adjustment amount	Default value	Description
1	Laser power	%	0	100	1	100	
2	Swing frequency	Hz	0	300	1	0	
3	Swing breadth	mm	0	5	0.1	0	
4	Pulse frequency	Hz	1	50000	1	500	
5	Pulse width	%	10	100	1	50	
6	Pulse waveform	#	0	19	1	0	0 for infinity

For the parameter definitions, please refer to the description in the glossary of Section **6.3.1.2**

. Linear array mode - For linear segment welding

S/N	Parameter name	Unit	Min. value	Max. value	Adjustment amount	Default value	Description
1	Laser power	%	0	100	1	100	
2	Swing frequency	Hz	0	300	1	0	
3	Swing breadth	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow drop time	ms	0	9999	1	500	
6	On/off time	ms	0	3500	1	500	
7	Laser off time	ms	0	3500	1	500	
8	Repetition times	#	1	9999	1	0	

For the parameter definitions, please refer to the description in the glossary of Section **6.3.1.2**

. Pulse mode - For welding of highly-reflective materials

S/N	Parameter name	Unit	Min. value	Max. value	Adjustment amount	Default value	Description
1	Laser power	%	0	100	1	100	Less than twice the standard power
2	Swing frequency	Hz	0	300	1	0	
3	Swing breadth	mm	0	5	0.1	0	
4	Pulse frequency	Hz	0	50000	1	500	Meet QCW operating limits
5	Pulse width	%	10	100	1	50	Meet QCW operating limits
6	Pulse waveform	#	0	19	1	0	0 for infinity

For the parameter definitions, please refer to the description in the glossary of Section **6.3.1.2**

. Timing mode - For inching-type welding

S/N	Parameter name	Unit	Min. value	Max. value	Adjustment amount	Default value	Description
1	Laser power	%	0	100	1	100	
2	Swing frequency	Hz	0	300	1	0	
3	Swing breadth	mm	0	5	0.1	0	
4	Slow rise time	ms	0	2000	1	500	
5	Slow drop time	ms	0	9999	1	500	
6	On/off time	ms	0	3500	1	500	
7	Laser off time	ms	0	3500	1	500	

For the parameter definitions, please refer to the description in the glossary of Section **6.3.1.2**

6.3.1.2 Parameter Glossary of Operating mode

S/N	Parameter name	Unit	Parameter definition
1	Preset parameter		Be the default process parameters of the system. Some parameters in the program allow users to modify. Besides, it is available to update to the latest process parameter set through remote service.

2	Program No.		Refer to the process parameters selected by the current user. The user parameters include 20 groups of customizable programs, and the preset mode includes 55 groups of process parameters
3	Operating mode		Refer to the operating mode of the current equipment, which specifies the parameter set that the user will use in the program
4	Laser power	%	Set the maximum output power of the system, which is used to set the amplitude of the maximum output power of the equipment in non-continuous mode.
5	Swing frequency	Hz	Set the scanning frequency of the beam deflecting mirror in the handheld welding head. The equipment frequency is output in the form of triangular wave. The higher the frequency is set, the faster the scanning speed, and the smaller the vice versa.
6	Swing breadth	mm	Set the Angle value of the deflection mirror in the hand-held welding head to limit the width of the beam movement. The maximum limit of the swing width is set to 5mm. When it is set to 0, the deflection mirror will no longer move.
7	Slow rise time	ms	Be effective in the operating modes of "continuous mode", "linear array mode" and "timing mode". It is used to set the slow rise interval from 0% to the set power value after the laser emission is activated, and the result is that the laser output intensity changes from weak to strong.
8	Slow drop time	ms	Be effective in the operating modes of "continuous mode", "linear array mode" and "timing mode", it is used to set the slow decline interval from the set power value to the complete shutdown after the laser emission is turned off, and the result is that the laser output intensity changes from weak to strong..
9	Pulse frequency	Hz	In the modulation mode and pulse mode, set the pulse running period of laser output
10	Pulse width	%	In the modulation mode and pulse mode, set the effective output interval for each pulse running cycle, and when the pulse width is set to 100%, it is equivalent to that in the continuous mode. In pulse mode, the maximum value of pulse width will limit the set value of power.
11	Laser on time	ms	In linear array mode, determine how long the laser stays emitted after it is turned on.
12	Laser off time	ms	In linear array mode and timing mode, determine how long the laser stays emitted after it is turned on.
13	Time of duration		In timing mode, determine how long the laser stays emitted after it is turned on.
14	Repetition times		In linear array mode, set the number of repeated running cycle of the whole program, and stop the program execution when it runs to the set number
15	Waveform		In the modulation mode and pulse mode, the user can select different pulse waveforms to adjust the pulse transmission mode. The default waveform 0 is not changed, and the maximum value of output power will be adjusted with the preset waveform curve in case other waveforms are selected.

6.3.2 Preset Parameter Setting

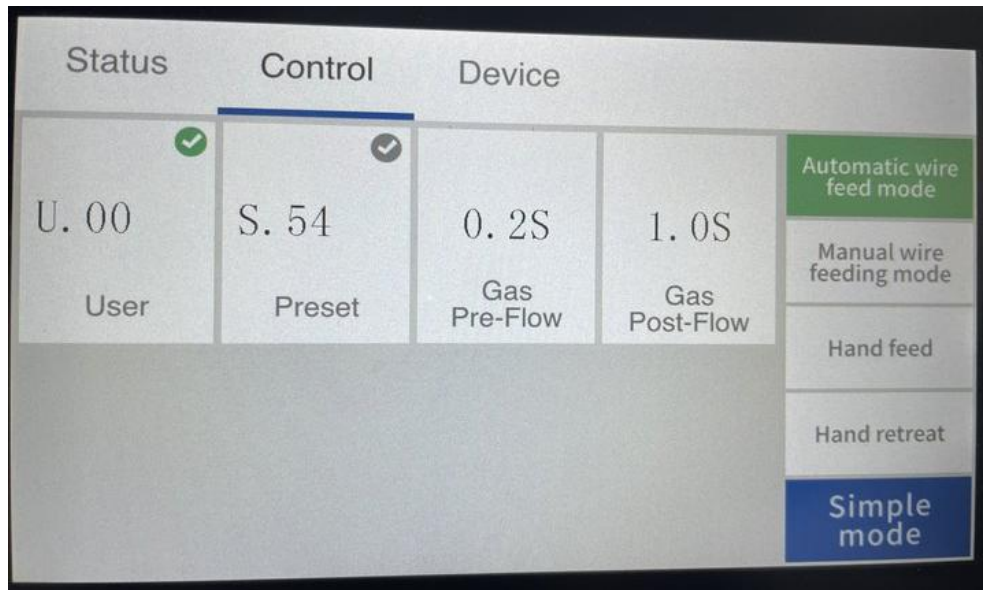
There are 55 groups of preset parameters in the system, numbered from S.00 to S.54. The program in the preset parameters is the default program of the system, and the user can choose a group of programs to modify it at will. However, compared with the user parameters, the operator can only

modify specific parameters in the operating mode set by the system program and fine-tune the parameters. The parameters set by the user will also be saved in the system by default for reuse next time.

Specific steps to enter parameters:

Select the preset parameters on the control page and click the check mark in the upper right corner to turn green.

On the preset parameter program number selection page, the current program number can be increased or decreased through the up and down buttons on the operation panel. When the up button is pressed and held, the program number will be increased up to S.54, and when the down button is pressed and held, the program number will be reduced down to S.00. When the required program number is reached after adjusting, single click the Confirm button on the operation panel to activate the selection of the current program number, and the green icon “✔” is displayed in the upper right corner, indicating the activation state.



The parameters that can be set in different operating modes vary. As shown in the figure above, the default operating mode of S.01 is the continuous mode. In continuous mode, the parameters that can be set only include: Laser power, swing frequency, and swing width.

The parameter range of default operating mode of the system program can be adjusted under the preset parameters. The adjustable parameter range is shown in the following table:

Operating mode	Continuous mode	Modulation mode	Pulse mode	Linear array mode	Timing mode
Adjustable parameter	Power	Power	Power	Power	Power
	Swing frequency	Pulse frequency	Pulse width	On/off time	Slow drop time
	Swing breadth	Swing breadth	Swing breadth	Laser off time	Time of duration

You can refer to the following table to quickly select the welding application range of the preset parameters of the system, user parameters

Preset Parameters Application Quick Query List						
Material and working mode		0.5mm	1mm	2mm	3mm	4mm
Stainless steel	Continuous mode	S.38	S.00	S.02	S.04	S.06
	Modulation mode	S.07	S.01	S.03	S.05	
	Wire fill			S.28	S.29	S.30
	Spot welding	S.52	S.55	S.54	S.53	
Carbon steel	Continuous mode	S.39	S.08	S.10	S.12	S.14
	Modulation mode	S.15	S.09	S.11	S.13	
	Wire fill			S.31	S.32	S.33
	Spot welding	S.48	S.51	S.50	S.49	
Aluminum	Continuous mode	S.40	S.16	S.18	S.20	
	Pulse mode	S.21	S.17	S.19		
	Wire fill			S.34	S.35	
	Spot welding	S.45	S.47	S.46		
Brass	Continuous mode	S.41	S.22	S.24	S.26	
	Pulse mode	S.27	S.23	S.25		
	Wire fill			S.36		
	Spot welding	S.42	S.44	S.43	S.37	

6.3.3 Gas Outlet Delay and Gas Close Delay Setting

The gas outlet delay and gas close delay are of the global parameters of the system. After the user modifies the parameters, all user programs and preset programs will execute according to the modified parameters. The setting range of gas outlet delay and gas close delay is of 0-3000ms.

6.4 Recommended User Parameter Setting

The laser is generally in the continuous mode, and the power slow rise/slow drop time is set to 500ms, which can ensure a better forming effect at the beginning and end of the weld seam.

The larger the swing size of the welding head, the better the adaptability to the gap, but at the same time, it will weaken the energy distribution; similarly, the higher the swing frequency, the lower the energy density. The recommended swing size range is of 2~3mm, and the frequency range is of 50~250HZ.

It is recommended to weld the 1mm thick sheet metal in the focus position, and to weld the 2 mm to 3 mm thick sheet metal by defocusing for -1mm.

The protective gas is an inert gas. The argon or nitrogen is recommended, and argon is preferable. The air pressure is roughly 0.2MPa. Overlarge air pressure will cause the molten pool to be blown and increase the splash, while too low air pressure will fail in providing the protective effect. The gas outlet/close delay is set to 500ms to better protect the weld seam and the welding head lens.

The appropriate welding speed is of 1~6cm/s. Too low speed leads to too large melting width and too large heat-affected zone, which reduces the performance of welded joints; and if the speed is too fast, then it is more difficult to handle.

It is recommended that the thickness of steel sheet to be welded should be of 0~3mm, and the thickness of aluminum and copper sheets should be of 0~2mm. Welding the materials with thickness beyond the said limit range, the weld seam shape and joint performance will worsen.

6.5 Recommended Welding Parameters for Common Materials

Material	Thickness	Connection method	Laser power	Swing size and frequency	Defocusing distance	Speed
Stainless steel	1mm	Splice welding	60%	2mm, 120Hz	0	4cm/s
Stainless steel	1mm	Lap welding	80%	1mm, 100Hz	-1	4cm/s
Stainless steel	1mm	Vertical welding	70%	2mm, 120Hz	-1	4cm/s
Stainless steel	2mm	Splice welding	90%	2mm, 90Hz	-1	3cm/s
Stainless steel	2mm	Vertical welding	100%	2mm, 90Hz	-1	3cm/s
Stainless steel	3mm	Splice welding	100%	2mm, 60Hz	-1	2cm/s
Stainless steel	3mm	Vertical welding	100%	2mm, 60Hz	-1	2cm/s
Aluminium alloy	1mm	Splice welding	80%	2mm, 120Hz	0	4cm/s
Aluminium alloy	1mm	Vertical welding	90%	2mm, 120Hz	0	4cm/s
Aluminium alloy	2mm	Splice welding	100%	2mm, 90Hz	-1	2cm/s
Aluminium alloy	2mm	Vertical welding	100%	2mm, 90Hz	-1	2cm/s

Brass	1mm	Splice welding	90%	2mm, 120Hz	0	4cm/s
Brass	1mm	Vertical welding	90%	2mm, 120Hz	0	3cm/s
Brass	2mm	Splice welding	100%	2mm, 90Hz	-1	1cm/s
Brass	2mm	Vertical welding	100%	2mm, 90Hz	-1	1cm/s

7. Troubleshooting/Maintenance

There are 44 kinds of possible alarms in the machine. It is required to determine which alarm point causes the specific error:

1. Check the laser power display on the front panel. The error code will be displayed on the touch panel and will begin with the letter "E" followed by three digits (For example, E003 for a 3-digit alarm). Many alarms can be cleared in one of two ways.
2. Restart the welding system after power failure, and the system will first try to automatically clear any alarms. The error should be cleared as soon as the condition that caused it is resolved.
3. Use the HMI software provided by GW to clear the alarm through the computer serial port connection.

Using restart: A small portion of these alarms can only be cleared by restarting the unit. If the conditions that caused it are not resolved, the alarm may occur again. In such cases, please contact the after-sales personnel of GW for help!

For the front panel error display, the severity of the warning increases as the number of errors increases. E027 is more serious than E001. In case of more than one kind of alarm, the one with higher-level severity number will be displayed on the front panel.

7.1 Error Message and Troubleshooting

Air-cooled CW fiber laser handheld welder fault alarm code

Code	Description	Handling method
S028	Laser locking	Contact the after-sales personnel of GW
E001	1# driver board communication error	Contact the after-sales personnel of GW
E002	2# driver board communication error	Contact the after-sales personnel of GW
E003	3# driver board communication error	Contact the after-sales personnel of GW
E004	4# driver board communication error	Contact the after-sales personnel of GW
E005	AD board communication error	Contact the after-sales personnel of GW
E006	Diode module overtemperature	Contact the after-sales personnel of GW
E007	Driver module overheat	Contact the after-sales personnel of GW
E008	Water overheat	Contact the after-sales personnel of GW
E009	Optical fiber overheat	Contact the after-sales personnel of GW
E010	Laser reflection energy exceeds the upper limit	After the collimator is cleaned, and if the alarm still can not be cleared, please contact the after-sales personnel of GW.
E011	Laser output energy exceeds the lower limit	After the collimator is cleaned, and if the alarm still can not be cleared, please contact the after-sales personnel of GW.
E012	Diode short-circuit error	Contact the after-sales personnel of GW

E013	Optical fiber disconnection	Contact the after-sales personnel of GW
E014	Overwetting	Confirm the ambient humidity, and if the alarm still can not be cleared, please contact the after-sales personnel of GW Contact GW after-sales personnel
E016	Scram	Press the scram button down, and if the alarm still cannot be cleared, contact the after-sales personnel of GW
E017	Gas pressure fault	Contact the after-sales personnel of GW
E018	Narrow pulse protection	Contact the after-sales personnel of GW
E019	Driver plate overvoltage	Contact the after-sales personnel of GW
E020	Internal temperature fault	Contact the after-sales personnel of GW
E021	Driver short circuit	Contact the after-sales personnel of GW
E022	Fault locking	Contact the after-sales personnel of GW
E023	Heat radiator not activated	Contact the after-sales personnel of GW
C001	Control system communication error	Contact the after-sales personnel of GW
E901	Heat radiator overcurrent	Contact the after-sales personnel of GW
E902	Heat radiator dissynchronization	Contact the after-sales personnel of GW
E904	Heat radiator phase loss	Contact the after-sales personnel of GW
E905	DC undervoltage	Contact the after-sales personnel of GW
E906	DC overhigh voltage	Contact the after-sales personnel of GW
E907	Temperature sensor over-temperature	Contact the after-sales personnel of GW
E908	Temperature sensor error	Contact the after-sales personnel of GW
E909	Communication error	Contact the after-sales personnel of GW
E910	AC phase-loss or CT short circuit	Contact the after-sales personnel of GW
E911	AC overcurrent	Contact the after-sales personnel of GW
E912	AC input power undervoltage	Contact the after-sales personnel of GW
E913	High-voltage switch error	Contact the after-sales personnel of GW
E914	IPM over-temperature protection	Contact the after-sales personnel of GW
E915	PFC module over-temperature protection	Contact the after-sales personnel of GW
E917	Diode temperature sensor fault	Contact the after-sales personnel of GW
E918	Ambient temperature error	Confirm the ambient temperature and the ambient humidity, and if the alarm still cannot be cleared, please contact the after-sales personnel of GW
E919	Heat radiator inlet temperature error	Contact the after-sales personnel of GW
E920	Heat radiator outlet temperature error	Contact the after-sales personnel of GW

E921	Diode temperature too low	Contact the after-sales personnel of GW
E922	Heat radiator fault	Contact the after-sales personnel of GW

8. Warranty

8.1 General Warranty

a. GW (Shanghai) Laser technology Co., Ltd. guarantees that GW (Shanghai) Laser technology Co., Ltd. has no liens or other encumbrances on the products after the delivery.

b. Unless otherwise stated by GW (Shanghai) Laser technology Co., Ltd., GW (Shanghai) Laser technology Co., Ltd. provides all products with a warranty against material defects and quality problems for a period of 24 months (Counting from the date of delivery). According to the tenth paragraph of the sales terms of GW (Shanghai) Laser technology Co., Ltd., GW (Shanghai) Laser technology Co., Ltd. will choose to 1) repair 2) replace or 3) refund the products that are confirmed defective and still within the warranty period. All repaired or replaced products follow the initial warranty period of the original products that are requested for repair, that is, such repaired or replaced products can enjoy the warranty for free only within the remaining warranty period of the original products that are requested for repair. The buyer must submit a written request for repair within 30 days after any quality problem is found. All requests for repair must be made directly by the buyer, and GW (Shanghai) Laser technology Co., Ltd. will not accept any third party the repair requests.

c) The above requests for repair does not apply to product problems caused by: 1) Incorrect or inappropriate maintenance or calibration made by personnel not from GW (Shanghai) Laser technology Co., Ltd.; 2) Usage of software, interface or power supply provided by the customer or a third party; 3)

Unauthorized modification; incorrect operation out of the limit range of product parameters; 4) –Abuse, negligence, accident, and loss or damage during transportation; or 5) Unauthorized maintenance or repair.

d. The above warranty regulations are unique. In addition, GW (Shanghai) Laser technology Co., Ltd. will not assume any form of (whether express or implied) written or oral maintenance liability and terms set forth by the regulations or laws. GW (Shanghai) Laser technology Co., Ltd. expressly waives the maintenance liability and terms of implied warranties in the laws, including (but not limited to) the implied warranties of merchantability and applicability.

e) The technical guidance and services provided by GW (Shanghai) Laser technology Co., Ltd. to customers will not affect the warranty terms provided by GW (Shanghai) Laser technology Co., Ltd..

8.2 Service and Repair

CAUTION:

There are no built-in spare parts for user to maintain. All maintenance should be carried out by the personnel of GW (Shanghai) Laser technology Co., Ltd.. Therefore, the repair or replacement requests within the warranty scope must be timely notified to GW or the service representative of your region as soon as the problem is found. Approved returned products must be placed in a suitable container. If any damage is found upon receipt of the goods, it shall be promptly informed to the carrier in writing.

IMPORTANT:

Please do not return the product to GW without returning the Return Material Authorization (RMA). If the warranty period of the product has expired, or the product is no longer within the scope of warranty, the buyer will bear the cost of repair.

8.3 Change

We reserve the right to change the design and structure of the product, and we do not assume any responsibility for the modification of product of the same model already sold.

MEMO: