# AIR-COOLED LASER WELDING MACHINE

# ALW-1200

# OPERATION MANUAL


LUOYANG XINCHENG PRECISION MACHINERY CO., LTD.

## Usage Instructions

To ensure safe operation (personnel safety, equipment safety, production safety, etc.) and optimal product performance, please read the operation manual carefully before using this product and familiarize yourself with the content we have compiled for you. Keep the user guide together with the product so that it can be readily available to you and all other users for operation, safety, and other important information.

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| | |
|---|---|
|  | It is prohibited to use this product in places with flammable and explosive materials. |
|  | When cleaning highly reflective materials (copper, aluminum, etc.), it is forbidden to have people stand around to avoid damage caused by reflected light. |
|  | It is forbidden to aim the cleaning head at the human body to avoid injury. |
|  | It is forbidden to make the tip of the cleaning head upward. Pay attention to the dustproof of the lens. |
|  | Make sure that the equipment is reliably grounded. |
|  | Clean combustible items carefully and equip with fire-fighting equipment. |
|  | This product is a Class IV radiation laser. Goggles must be worn. |
|  | The minimum bending radius of the integrated cable should be more than 200mm. |

# Content

## I Overview

1.Introduction

The ALW series fiber laser handheld welding machine is a new industrial-grade handheld infrared fiber laser welding system. Its maximum continuous power is 1200W, with an average power ≤1500W in pulse mode.

2.Applications

The ALW series fiber laser handheld welding machine is intended for industrial and professional use. Applications include welding and brazing. Materials include steel, aluminum, copper, stainless steel and other metal materials.

3.Testing and Certification

SFX certifies that this system has been thoroughly tested and inspected. It is fully tested and verified to meet shipping standards before being packed. When you receive the package, please check the packaging and components for possible damage during shipment. If damage is obvious, please contact the shipping carrier and SFX after-sales personnel immediately.

4.Packaging Unpacking Instructions

Please be especially careful to ensure that the fiber optic cable is not cracked or damaged when removing the system from the packaging. Upon receiving the product, please inspect all items against this list, and if any items are missing or the equipment shows obvious or suspected damage, please do not attempt to install or operate the laser equipment under any circumstances.

## II Laser Product Safety Information

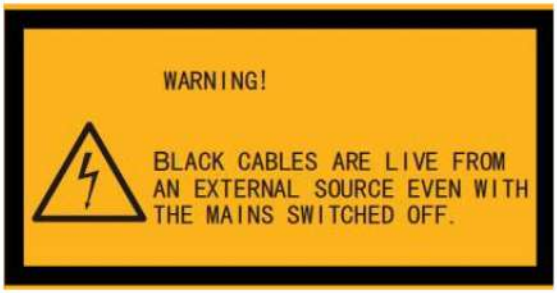
1.Laser Product Safety Performance and Conventions

1.1 Safety Signs

Safety Labels and Label Locations:

The following illustrations show the labels and their locations on the product to remind and warn users of possible hazards.

**Laser Output Port Label**
**Location: Front Panel / Welding Head**




**Warning Label Location:**
**Rear Panel**

2.Relevant Regulations and Standards

2.1Product Functional Safety

Optical Fiber Protection Disconnect (Fiber Interlock): The optical fiber protection provides an interlock circuit between the fiber laser and external devices (such as handheld welding heads). The laser welding system will continuously monitor this signal and terminate the operation of external devices (such as welding heads) if the fiber connector is not properly connected.

Overheat protection: Monitors the internal temperature of the laser to protect internal components from damage due to exceeding the safe operating temperature.

The handheld welding machine provides a protection signal output based on the cables contained in the fiber optic cable between the laser device and the handheld welding head. If the fiber optic cable is not inserted into the welding head or is disconnected, the fiber optic safety interlock circuit will open.

Stop Start Protection: Various electronic sensors installed within the system will trigger an alarm if an abnormal condition is detected, and the monitoring program will stop the system from continuing to start.

Safety Start / Restart Button (Emergency Stop): Used for the emergency shutdown and recovery of the laser welding system.

2.2. Electrical Safety

The device input voltage of 220VAC (±10%) 50Hz/60Hz is fatal. All parts of the cables, connectors or housing of the equipment should be considered dangerous. Before powering the equipment, all connecting harnesses must be checked for damage and welding shielding gas conduction. In addition, where applicable, all connections must be tightened with screws to ensure normal function.

Please make sure the equipment is grounded through the protective conductor of the AC power cable. Any disconnection of the protective ground conductor from the protective ground terminal may result in personal injury.

## III Description of Handheld Laser Welding Machine

1.Performance Parameters of Handheld Laser Welding System

| Parameters | |
|---|---|
| Output Power (Watts) | 1200W |
| Operating Mode | Continuous / Modulation / Pulse / Line Array / Timed |
| Output Power Adjustment Range (%) | 1-100% |
| Output Laser Wavelength (Nanometers) | 1080 ± 10 nm |
| Power Stability | < 5% |
| Maximum Modulation Frequency | 50Hz |
| Laser Response Time | < 10us |
| Interface Type | SFX Handheld Welding Head |
| Focusing Focal Length | 150mm |
| Transmission Length | Standard Length 5±0.5m (10m Optional) |
| Weight | 32Kg |
| Dimensions | 320*550*550 mm |
| **Operational Requirements** | |
| Cooling and Protective Gas | Inert Gas |
| Operating Ambient Temperature Range | -10°-40° C |
| Operating Ambient Humidity Range | < 75% |
| Input Voltage | 220VAC(±10%) 16A 50Hz/60Hz |
| Total Power | ≤ 4.0kW |

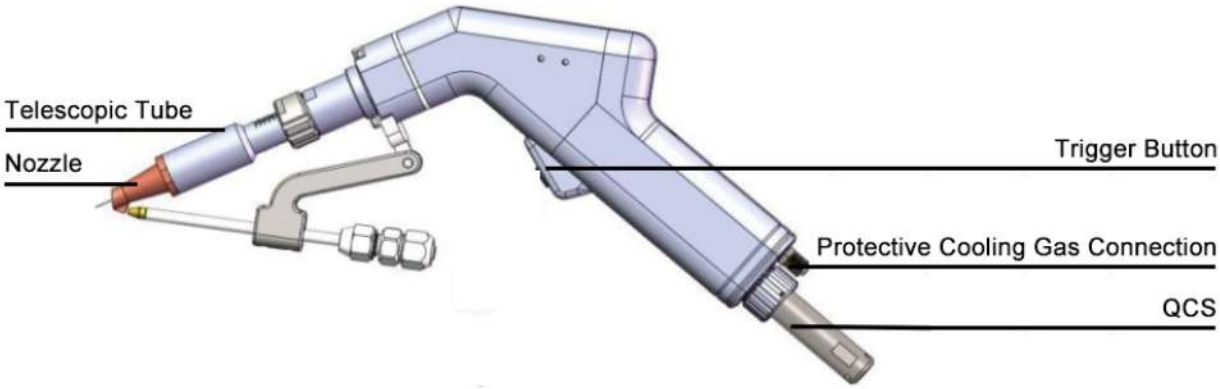
2.Front Interface Diagram of ALW Series Laser Welding Machine


| Serial Number | Name | Description |
|---|---|---|
| 1 | Handheld welding gun head | ---- |
| 2 | Safety Lock Interface | Connect the workpiece safety clamp cable to the interface. When the handheld welding head nozzle is connected to the workpiece to be welded, the safety interlock circuit between the handheld welding head nozzle and the safety clamp will be activated, allowing the laser emission. |
| 3 | User Interface | Wire Feeder Interface |
| 4 | Two-position Rotary Switch | Turn the key knob clockwise to (ON) to power on the device, and turn the key knob counterclockwise to (OFF) to power off the device. |
| 5 | Emergency Stop Button | In case of an emergency, press the emergency stop button to quickly cut off the main circuit power of the device. When the stop button is pressed, turn the button clockwise to reset the emergency stop button. |
| 6 | Output Interface | The fiber optic cable for laser output and the gas outlet are output through this position and connected to the handheld welding head (QBH output terminal). The exterior of the fiber optic cable is protected by a self-coiling braided mesh. |

3.Rear View of ALW Series Welding Machine


| Serial Number | Name | Description |
|---|---|---|
| 1 | Equipment Power Input Port | AC Input Socket: AC 220V (±10%), 50/60Hz, 16A |
| 2 | RS232 Communication Interface | Used to connect to the upper computer control software to monitor equipment operation. |
| 3 | Main Power Switch | Used to switch the main power on and off |
| 4 | Gas Inlet | Inlet for protective and cooling gas, connected via an 8mm gas pipe. |
| 5 | Cooling Fan | When the equipment is operating, the cooling fan will start or stop according to system commands. During operation, the fan outlet must not be obstructed or have foreign objects fall into it. |

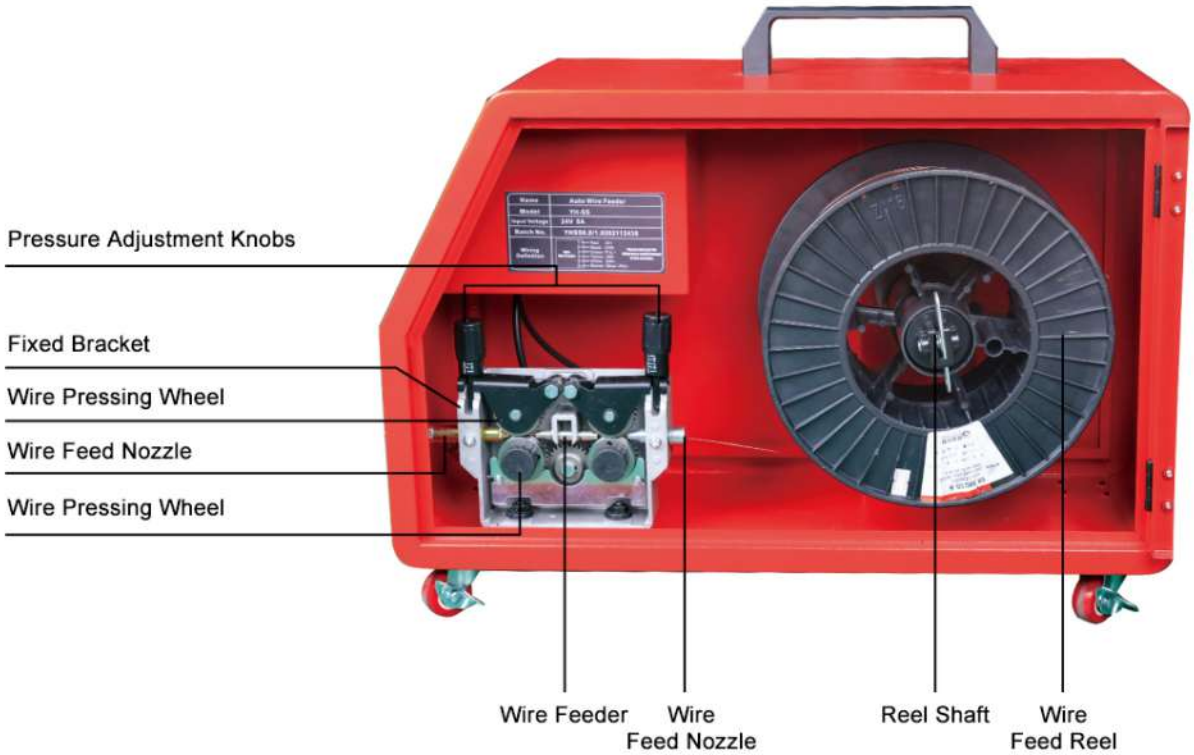
4.Schematic Diagram of the Structure of Handheld Welding Head




5.Operation of Welding Head

| Serial Number | Function Item | Description |
|---|---|---|
| 1 | Trigger Button | The laser output is started according to the light output delay set by the system; the clamping state must be maintained throughout the entire welding process. |
| 2 | Nozzle | Replace the corresponding nozzle according to different welding scenarios. |
| 3 | Telescopic Tube | There are scales on the graduated tube for adjusting the focal length. |
| 4 | Protective Cooling Gas Connection | Connect the shielding and cooling gases. |
| 5 | QCS | The optical cable has been inserted and connected to the welding head. |

6.Schematic Diagram of the Structure of Wire Feeder



## IV Installation of Welding Equipment

1.Preparation Before Installation

Ensure that the input power requirement is 220VAC (±10%) 50Hz/60Hz, and the power supply current is ≥16A, and then connect the power supply. The equipment must be connected to a sufficient amount of auxiliary gas to operate, and to protect the splashes generated during the work process from possible damage to the welding head. If the gas is not connected to operate, the equipment will automatically alarm and prohibit operation.

2.Airflow and Installation Clearance

The air-cooled continuous fiber laser handheld welder adopts direct air cooling. Install it in a location with good air circulation conditions, ensure a 10cm gap around it, and no obstructions. The air enters from both sides of the machine and the fan exhausts. Do not place any objects that may block the exhaust on the top of the machine. The airflow direction is shown in the figure below:

3.Schematic Diagram of Equipment Connection

4.Installation Steps

4.1Connect the Laser Welding Machine Power Cord

4.2Connect the Protective Gas

4.3Connect the Wire Feeder Control Line to the Laser Welding Machine

4.4Insert the Safety Clip

4.5Connect Wire Guide Tube

4.6Install Welding Wire

Place the wire feeding reel into the reel shaft, aligning the small hole of the wire feeding reel with the positioning pin of the reel shaft. And then open the pressure adjustment knob outward ,open the wire pressing wheel, insert the welding wire from the right side of the wire feeding nozzle, pass through the two wire pressing wheels into the wire guide tube, ensure that the welding wire is exposed from the wire guide nozzle of the handheld welding head, and finally retract the wire pressing wheels at both ends.

## V Operation Process

Make sure you wear appropriate personal protective equipment when operating. These include welding helmets or glasses, flame retardant protective gloves.

1.Startup of the System

1.1Ensure that all connections required for proper operation have been made, including limits for external safety devices.

1.2Make sure the emergency stop button is not pressed. If pressed, turn it clockwise to reset it.

1.3Turn the key switch clockwise to the ON position

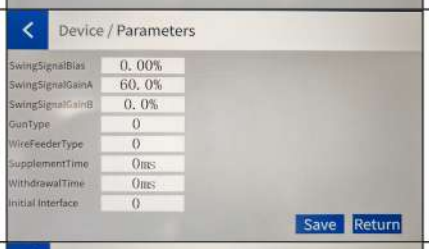
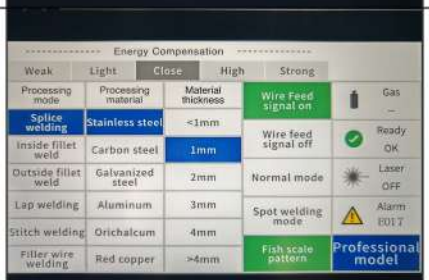
1.4After startup the display screen will light up.



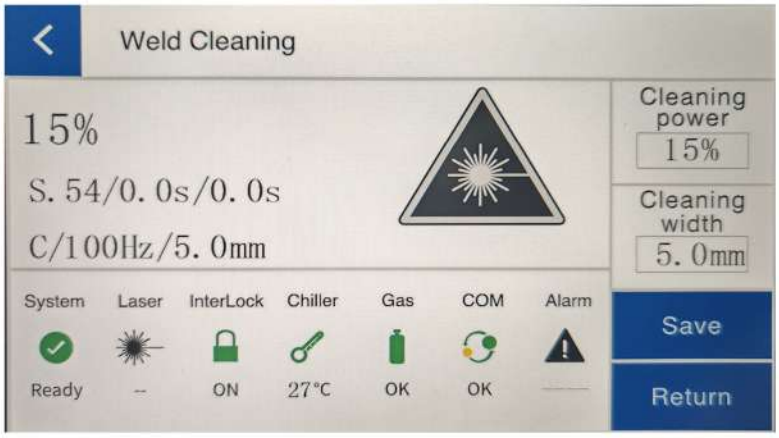
2.Introduction of User Interface Functions and Setting of Process Parameter

2.1The user interface mainly consists of the status page, control page, and device page. The following table briefly describes the hierarchical structure and functions:

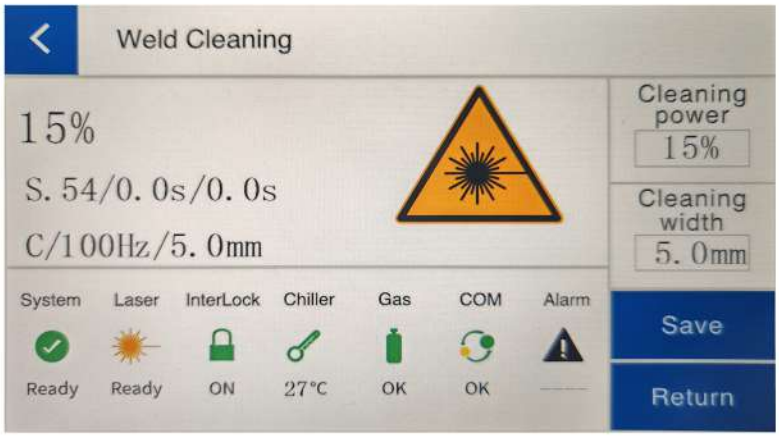
| Primary Page | Secondary Page | Interface Preview | Function Description |
|---|---|---|---|
| Status | |  | It is used to centrally display information such as the operating parameters and status of the current equipment.This interface will be displayed by default after the device is started. |
| Control | |  | Users can enter the process parameters through the control page, this page contains user parameters, preset parameters, gas out delay, gas shutdown delay menu entry, when there is a "√" sign in the upper right corner, click the confirmation button to activate the current selection, double-click to enter the parameter editing page. |
| | User Parameters |  | After the user double-clicks the user parameter, enter the parameter setting. Click on the item to be set, the right side of the display shows the digital input field, when the user set up, click "OK" to save the corresponding parameters. |
| | Preset Parameters |  | In the preset parameter selection page, users can select the parameter number through the +/- on the touch panel, and choose continuous mode, modulation mode, line array mode, pulse mode, and timing mode by touching the right side. |
| | Gas Pre-Flow |  | In this interface, you can set the gas out delay time before firing the laser, release the auxiliary gas in advance, when the welding head trigger button is pressed it will release the gas according to the set time before starting the laser. |
| | Gas Post-Flow |  | In this interface, you can set the gas shut-off delay after stopping the laser emission, and continuously release the auxiliary gas. After releasing the welding head trigger button, the gas will be released according to the set time and then the program will end. The laser is in the off state during execution |

| Primary Page | Secondary Page | Interface Preview | Function Description |
|---|---|---|---|
| Equipment | |  | The equipment page is mainly used to provide users with an interface to view equipment information. |
| | Information |  | This page displays the operating information of the equipment, including software version information, environmental information, hardware information, etc. |
| | Equipment Parameters |  | This page is used to edit information related to the welding head. |
| | Language |  | This page displays the device language. |
| | Weld Seam Cleaning |  | Click the light emission triangle icon in the status interface of professional mode to enter. Weld seam cleaning uses program S.54, modulation mode. Only the cleaning power and cleaning width can be modified. The wire feeder automatically stops feeding wire during weld seam cleaning. |
| | Simple Mode |  | Click simple mode in the status interface of professional mode to enter simple mode. Quickly select the corresponding parameters for processing materials, processing methods, and processing thickness, making it convenient for customers to use. |
| | Time Lock |  | Click the service code to quickly find out the machine's light-emitting time, equipment serial number, and equipment identification code. |

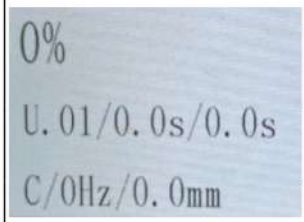
The user page is displayed by default after the device is started. When you are on other pages, you can return to the status page layer by layer by tapping the menu key.

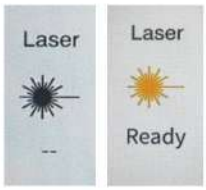
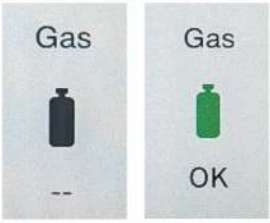
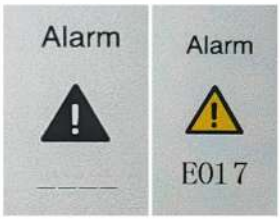



**a. Display in inactive state**




**b. Display in active state**

<table>
<tr><th>Display content (inactive, active state)</th><th>Description</th></tr>
<tr><td rowspan="7"> 
</td><td>This area displays the set parameters of the current device operation. The first line shows the power ratio used by the current device as a percentage.<br>The second line content is separated by a “/” symbol, showing the selected program number / gas delay / gas off delay. The third line content is also separated by a “/” symbol, and the displayed content and definitions vary under different operating modes (see the table below):</td></tr>
<tr><td><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>Oscillation Frequency</td><td>Oscillation Width</td></tr>
<tr><td>Modulation Mode</td><td>M</td><td>Oscillation Frequency</td><td>Oscillation Width</td></tr>
<tr><td>Pulse Mode</td><td>P</td><td>Pulse Width</td><td>Oscillation Width</td></tr>
<tr><td>Linear Array Mode</td><td>S</td><td>Light On Time</td><td>Light Off Time</td></tr>
<tr><td>Timing Mode</td><td>T</td><td>Duration</td><td>Oscillation Width</td></tr>
</table></td></tr>
</table>

| Display content (inactive, active state) | Description |
|---|---|
|  | When the laser is in standby or emission state, the icon will display a yellow background. Otherwise, it indicates that the laser is not in standby or emission state. |
|   | When the power is on, the Ready light will indicate Ready. |
|   | When the laser is in standby or emission state, the icon will be activated. At this time, the operator and surrounding users should take appropriate safety precautions. Please refer to section 5.4 for details. |
|   | The icon will be activated when all safety protection circuits are turned off. |
|   | Displayed is the secondary shell temperature. |
|   | After the external auxiliary gas is connected to the equipment, if the input pressure meets the system requirements, the icon will be activated. The input gas pressure should be greater than 0.1MPa and less than 0.6MPa. |
|   | This icon is only used for the communication status of the system's internal control signals. When the internal signal communication is normal, the icon will be in an activated state. |
|   | When a system malfunction or alarm occurs, this icon will be activated, and all fault codes will scroll below the icon. Users can record the fault codes. |

2.2Glossary of Operating Mode Parameters

| Serial Number | Name | Unit | Parameter Definitions |
|---|---|---|---|
| 1 | Preset Parameters | | These are the system's default process parameters. Some parameters within the program can be modified by the user. |
| 2 | Program Number | | Refers to the process parameters currently selected by the user. User parameters include 20 customizable programs, and preset modes include 55 sets of process parameters. |
| 3 | Operating Mode | | Refers to the operating mode currently used by the equipment, specifying the parameters that the user will use in the program. |
| 4 | Laser Power | % | Sets the maximum output power of the system, used to set the amplitude of the maximum output power in non-continuous mode. |
| 5 | Oscillation Frequency | Hz | Sets the scanning frequency of the beam deflector mirror in the handheld welding head. The equipment frequency is output in the form of a triangular wave, and the higher the set frequency the faster the scanning speed, and vice versa. |
| 6 | Oscillation Width | mm | Set the angle value of the deflection mirror in the handheld welding head to limit the width of the beam movement Oscillation Width. The maximum swing width setting is 5mm. When setting is 0, the deflection mirror will no longer move. |
| 7 | Ramp-up Time | ms | Effective under "Continuous Mode", "Linear Array Mode", and "Timed Mode" operation modes. It is used to set the gradual increase interval of power from 0% to the set power value after the laser emission takes effect. The result is a change in laser output intensity from weak to strong. |
| 8 | Ramp-down Time | ms | Effective under “Continuous Mode”, “Linear Array Mode”, and “Timed Mode” operation modes. It is used to set the gradual decrease interval of power from the set power value to completely off after the laser emission is turned off. The result is a change in laser output intensity from strong to weak. |
| 9 | Pulse Frequency | Hz | In modulation mode and pulse mode, set the pulse operation cycle of the laser output. |

| Serial Number | Parameter Name | Unit | Parameter Definitions |
|---|---|---|---|
| 10 | Pulse Width | % | In modulation mode and pulse mode, set the effective output interval for each pulse operation cycle.<br>When the pulse width is set to 100%, it is equivalent to continuous mode. In pulse mode, the maximum value of the pulse width is limited by the power setting value. |
| 11 | Light On Time | ms | In linear mode, determine the time the laser remains emitting after being turned on. |
| 12 | Light Off Time | ms | In linear mode and timed mode, determine the time the laser remains emitting after being turned on. |
| 13 | Duration | | In timer mode, determine the time the laser remains emitting after being turned on. |
| 14 | Repetition Count | | In linear mode, set the number of repetitions for the entire program cycle. The program will stop executing after reaching the set number of repetitions. |
| 15 | Waveform | | In modulation mode and pulse mode, users can select different pulse waveforms to adjust the emission method of the pulse. The default waveform 0 makes no changes. When other waveforms are selected,the maximum output power will be adjusted according to the preset waveform curve. |

3.Description of Wire Feeder Interface

3.1Main operation interface: After power on, the wire feeder control screen will enter the main operation interface

3.2 Settings interface: Click Settings on the main operation interface


When the wire feeding stops, the system will first retract a certain distance and then feed the wire a certain distance. This function is mainly used for wire breakage. When the wire is still outside at the beginning of each welding, please set the retraction length to be greater than the wire patching length.

4.Start Welding

4.1Manual focus is required when using the device for the first time. First, loosen the fixing screws of the scale tube of the handheld welding head, insert the scale tube completely into the gun head until it can no longer be inserted, adjust the laser power to 30%, clamp the safety clip on the handheld welding head and stop feeding the wire. Trigger the laser at an iron plate or stainless steel plate, and find the point with the largest laser energy from far to near. Sparks are flying, which is the focus of the laser. After finding the focus, pull the scale tube outward so that the distance between the focus and the scale tube is about 4mm, record the scale position on the scale tube, and lock the scale tube.

4.2 Connecting workpiece safety clamp.

After focusing, the laser is only allowed to be emitted when the nozzle is connected (in contact) with the workpiece. If the operator removes the nozzle from the workpiece, this safety interlock circuit will be disconnected, the laser will automatically shut off, and laser emission will be prohibited.

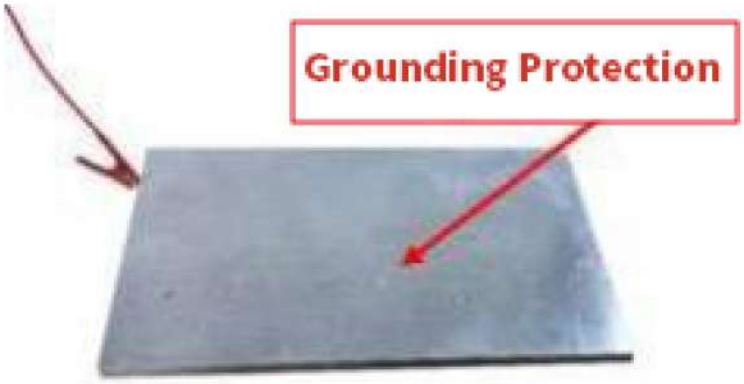
4.3 User Operation Status and System Running Status

Assuming all the aforementioned safety interlocks are disabled, the user operation and system running status are as follows:

| Serial Number | User Operation (Safety Interlock Circuit in Off State) | | Laser | Indicator Light | Beam Oscillation | Assist Gas |
|---|---|---|---|---|---|---|
| 1 | Workpiece Safety Clamp | Disconnect | Off | Turn on | Off | Off |
| | Trigger Button | Loosen | | | | |
| 2 | Workpiece Safety Clamp | Disconnect | Off | Turn on | Off | Turn on |
| | Trigger Button | Press | | | | |
| 3 | Workpiece Safety Clamp | Turn on | Off | Turn on | Turn on | Off |
| | Trigger Button | Loosen | | | | |
| 4 | Workpiece Safety Clamp | Turn on | Turn on | Turn on | Turn on | Turn on |
| | Trigger Button | Press | | | | |

4.4 Select the preset parameter S.01 on the user interface to process the 1mm thick aluminum plate in continuous laser mode.

4.5 Place the workpiece to be welded on the welding workbench and clamp it securely. During laser welding, please ensure that there is a minimal gap between the parts and that they are in close contact as much as possible. Ensure the 'Workpiece Safety Clamp' is connected to the part or the conductive welding table where the part is placed. As shown in the figure below.




4.6 Bring the tip of the nozzle into contact with the part being welded. This will close the safety interlock circuit between the workpiece safety clamp and the handheld welding head, putting the equipment in a ready state.

4.7 Press the trigger button on the handheld welding head to start welding. During the welding process, the trigger button of the welding head should be kept pressed, otherwise the welding process will be interrupted and the laser emission will stop.

5.User Parameter Setting Recommendations

The laser is usually used in continuous mode, and the power ramp-up/ramp-down time is set to 500ms, which can ensure a good forming effect from the beginning to the end of the weld. The larger the swing size of the welding head, the better the gap adaptability, 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 2-3mm and the frequency range is 50-250HZ.

When welding 1mm thick plates, it is recommended to focus at the focal position, and when welding 2 or 3mm thick plates, it is recommended to defocus -1mm.

The shielding gas uses an inert gas, argon or nitrogen is recommended, argon is better. The gas pressure is roughly 0.2MPa. Too high a pressure will blow away the molten pool and increase spatter, while too low a pressure will not provide protection. The gas outlet/gas off delay is set to 500ms to better protect the weld and the welding head lens.

The appropriate welding speed is 1-6cm/s. If the speed is too low, the weld width will be too wide and the heat affected zone will be too large, which will reduce the performance of the welded joint; if the speed is too fast, it will be difficult to control.

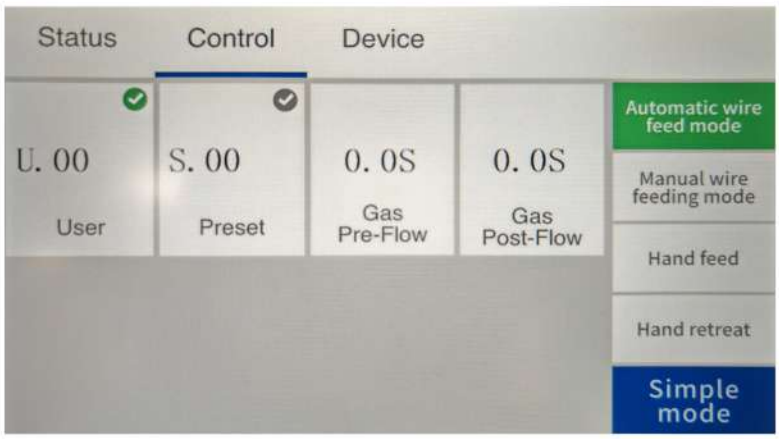
The recommended thickness for welding steel is 0-3mm, and for aluminum and copper is 0-2mm. When welding materials with a thickness exceeding this, the weld morphology and joint

5.1 User Parameter Settings

The system provides users with 20 groups of running programs with customizable parameters, numbered from U.0 to U.19. The operator can select any group of programs to modify until the work requirements are met. The parameters set by the user will also be saved in the system by default for reuse next time.

Specific steps to enter the parameters;

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





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

Continuous Mode - Used for continuous welding of most sheet metal materials.

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 1 | Laser Power | % | 0 | 100 | 1 | 100 | |
| 2 | Oscillation Frequency | Hz | 0 | 300 | 1 | 0 | |
| 3 | Oscillation Width | mm | 0 | 5 | 0.1 | 0 | |
| 4 | Ramp-up Time | ms | 0 | 20000 | 1 | 500 | |
| 5 | Slow-down Time | Ms | 0 | 9999 | 1 | 500 | |

Modulation Mode - Used for welding thin metal sheets.

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 1 | Laser Power | % | 0 | 100 | 1 | 100 | |
| 2 | Oscillation Frequency | Hz | 0 | 300 | 1 | 0 | |

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 3 | Oscillation Width | mm | 0 | 500 | 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 infinite |

Linear Array Mode - Used for segmental welding.

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 1 | Laser Power | % | 0 | 100 | 1 | 100 | |
| 2 | Oscillation Frequency | Hz | 0 | 300 | 1 | 0 | |
| 3 | Oscillation Width | mm | 0 | 500 | 0.1 | 0 | |
| 4 | Ramp-up Time | ms | 0 | 2000 | 1 | 500 | |
| 5 | Slow-down Time | ms | 0 | 9999 | 1 | 500 | |
| 6 | Switching Time | ms | 0 | 3500 | 1 | 500 | |
| 7 | Light Off Time | ms | 0 | 3500 | 1 | 500 | |
| 8 | Repetition Count | # | 1 | 9999 | 1 | 0 | |

Pulse Mode - Used for welding highly reflective materials.

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 1 | Laser Power | % | 0 | 100 | 1 | 100 | Less than 2 times the standard power |
| 2 | Oscillation Frequency | Hz | 0 | 300 | 1 | 0 | |
| 3 | Oscillation Width | mm | 0 | 5 | 0.1 | 0 | |
| 4 | Pulse Frequency | Hz | 0 | 50000 | 1 | 500 | Meet QCW Operation Limits |
| 5 | Pulse Width | % | 10 | 100 | 1 | 50 | Meet QCW Operation Limits |
| 6 | Pulse Waveform | # | 0 | 19 | 1 | 0 | 0(for infinite) |

Timing Mode - Used for spot welding

| Serial Number | Parameter Name | Unit | Minimum Value | Maximum Value | Adjustment Amount | Default Value | Description |
|---|---|---|---|---|---|---|---|
| 1 | Laser Power | % | 0 | 100 | 1 | 100 | |
| 2 | Oscillation Frequency | Hz | 0 | 300 | 1 | 0 | |
| 3 | Oscillation Width | mm | 0 | 5 | 0.1 | 0 | |
| 4 | Ramp-up Time | ms | 0 | 2000 | 1 | 500 | |
| 5 | Slow-down Time | ms | 0 | 9999 | 1 | 500 | |
| 6 | Switching Time | ms | 0 | 3500 | 1 | 500 | |
| 7 | Light Off Time | ms | 0 | 3500 | 1 | 500 | |

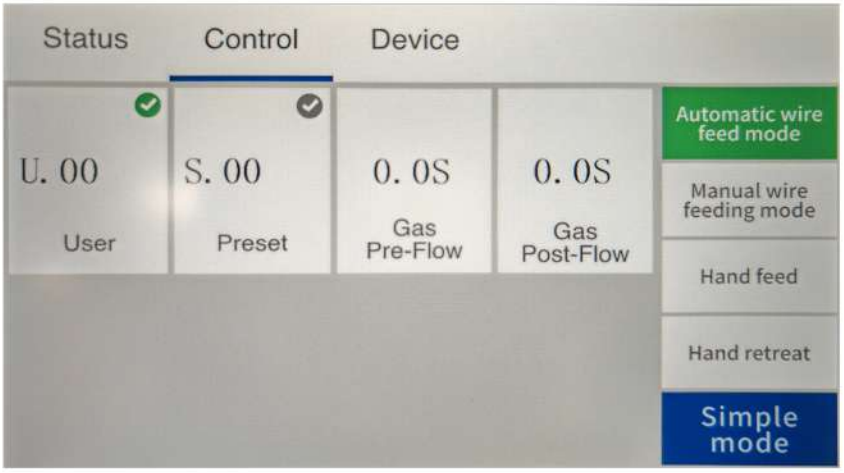
5.2 Setting of preset parameters

There are 55 groups of preset parameters in the system, numbered from S.00 to S.54. The programs in the preset parameters are the system default programs. Users can select any group of programs to modify. However, compared with user parameters, operators can only modify specific parameters in the operating mode set by the system program and make fine adjustments to 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 the parameters:

Select the preset parameters on the control page, click the hook in the upper right corner, and it will turn green.

On the preset parameter program number selection page, the current program number can be increased or decreased by pressing the up and down buttons on the operation panel. When the desired program number is adjusted, click the confirmation button on the operation panel to activate the current program number selection. At the same time, a green icon "" is displayed in the upper right corner, indicating the activation status.




The parameters that can be set in different operating modes will be different. As shown in the figure above, the default operating mode of S.00 is continuous mode. In continuous mode, the parameters that can be set are only laser power, oscillation frequency, and oscillation width.

The adjustable parameter range for the system program's default operating mode under preset parameters is shown in the table below:

| Operating Mode | Continuous Mode | Modulation Mode | Pulse Mode | Linear Array Mode | Timing Mode |
|---|---|---|---|---|---|
| Adjustable Parameters | Power | Power | Power | Power | Power |
| | Oscillation Frequency | Pulse Frequency | Pulse Width | Switching Time | Ramp-down Time |
| | Oscillation Width | Oscillation Width | Oscillation Width | Light Off Time | Duration |

Refer to the table below to quickly select the welding application range of the system preset parameters and user parameters.

| Quick Reference Table for Preset Parameter Applications | | | | | | |
|---|---|---|---|---|---|---|
| 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 Filling | | | S.28 | S.29 | S.30 |
| | Spot Welding | S.52 | S.55 | S.54 | S.53 | |
| Carbon Stee | Continuous Mode | S.39 | S.08 | S.10 | S.12 | S.14 |
| | Modulation Mode | S.15 | S.09 | S.11 | S.13 | |
| | Wire Filling | | | 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 Filling | | | 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 Filling | | | S.36 | | |
| | Spot Welding | S.42 | S.44 | S.43 | S.37 | |

5.3 Recommended Welding Parameters for Common Materials

| Material | Thickness | Connection Method | Laser Power | Oscillation Size and Frequency | Defocusing Amount | Speed |
|---|---|---|---|---|---|---|
| Stainless Steel | 1mm | Butt Welding | 60% | 2mm, 120Hz | 0 | 4cm/s |
| | 1mm | Lap Welding | 80% | 1mm, 100Hz | -1 | 4cm/s |
| | 1mm | Vertical Welding | 70% | 2mm, 120Hz | -1 | 4cm/s |
| | 2mm | Butt Welding | 90% | 2mm, 90Hz | -1 | 3cm/s |
| | 2mm | Vertical Welding | 100% | 2mm, 90Hz | -1 | 3cm/s |
| | 3mm | Butt Welding | 100% | 2mm, 60Hz | -1 | 2cm/s |
| | 3mm | Vertical Welding | 100% | 2mm, 60Hz | -1 | 2cm/s |
| Aluminum Alloy | 1mm | Butt Welding | 80% | 2mm, 120Hz | 0 | 4cm/s |
| | 1mm | Vertical Welding | 90% | 2mm, 120Hz | 0 | 4cm/s |
| | 2mm | Butt Welding | 100% | 2mm, 90Hz | -1 | 2cm/s |
| | 2mm | Vertical Welding | 100% | 2mm, 90Hz | -1 | 2cm/s |
| Brass | 1mm | Butt Welding | 90% | 2mm, 120Hz | 0 | 4cm/s |
| | 1mm | Vertical Welding | 90% | 2mm, 120Hz | 0 | 3cm/s |
| | 2mm | Butt Welding | 100% | 2mm, 90Hz | -1 | 1cm/s |
| | 2mm | Vertical Welding | 100% | 2mm, 90Hz | -1 | 1cm/s |

6.Shutdown of the System

If shutting down the laser welding system, the user must stop emitting the laser after welding is completed.

6.1Release the trigger of the handheld head, and the system will stop emitting laser light and stop the gas flow (if the gas extended shutdown parameter is set, it will stop after the set time).

6.2Press the emergency stop button and turn the key switch counterclockwise to the (OFF) position.

**VI Troubleshooting/Maintenance**

The machine has 44 possible alarms. To determine which alarm bit caused a specific error:

1. Check the laser power display on the front panel. The error code will be displayed on the touch screen panel and will start with the letter 'E', followed by three digits (e.g., 3-digit alarm E003). Many alarms can be cleared in one of the following two ways.

2. When you restart your welding system after a power outage, the first thing it will do is try to automatically clear any alarms. The first thing it will do is attempt to automatically clear any alarms. As long as the condition causing the error is resolved, the error should be cleared.

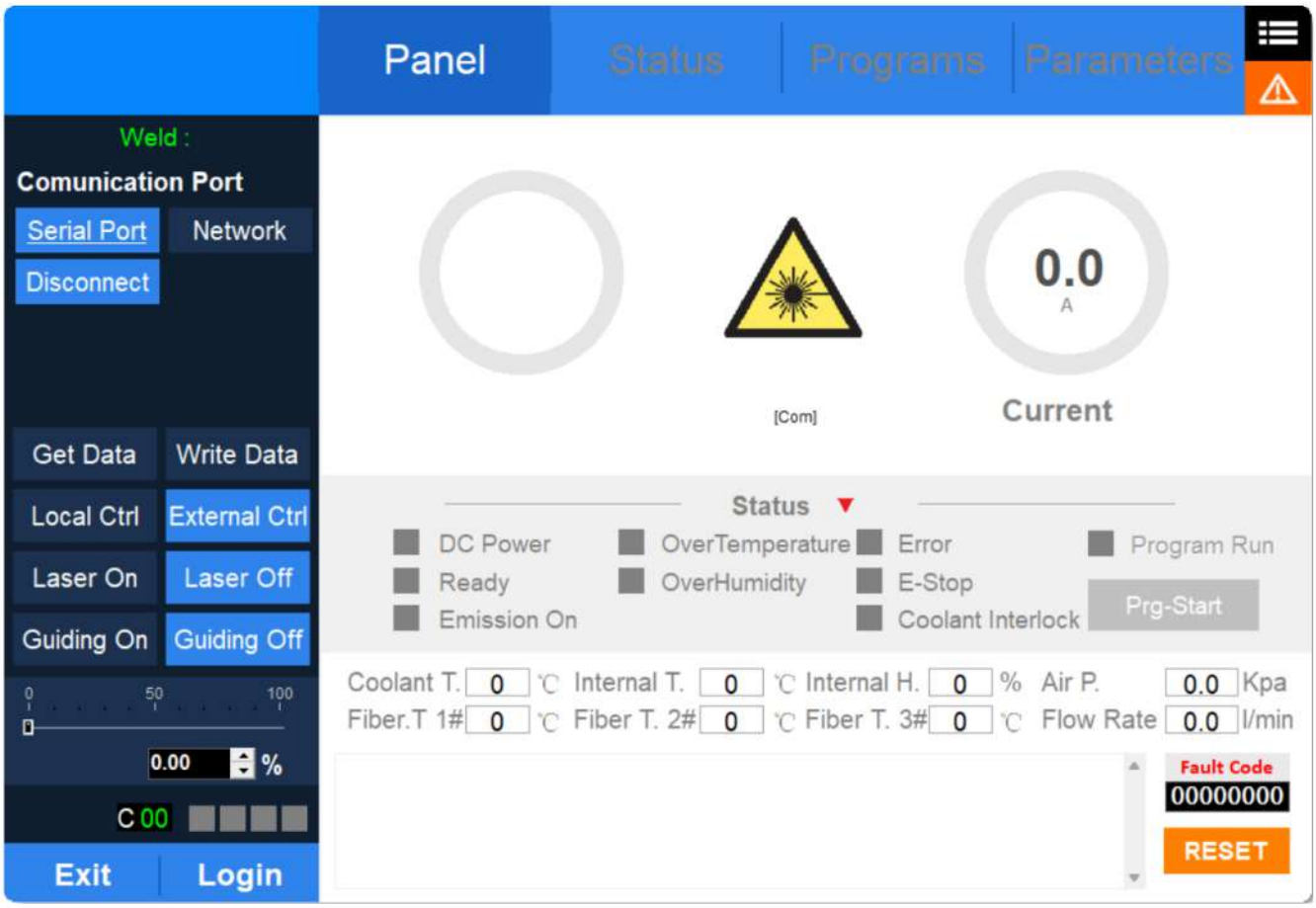
3. Connect external devices for troubleshooting.

3.1 Connect via computer serial port and use the HMI software provided by SFX to clear the alarm.

Using Restart: A small portion of these alarms can only be cleared by restarting the unit. If the condition causing it is not resolved,. the alarm may occur again. If this happens, please contact SFX after-sales personnel for assistance!

3.2 Hotspot connection detection

Use your mobile phone to open the personal hotspot → set the network name to "GW_01" → password to "gw39721122" → AP frequency band is 2.4GHz. After connecting to the hotspot, SFX after-sales personnel can remotely monitor the device alarm information and handle it.




For the front panel error display, the severity of the warning increases as the number of errors increases. E027 is more severe than E001. If multiple alarms occur, the higher-level alarm number will be displayed on the front panel.

3.3 Error Information and Troubleshooting

Air-cooled Continuous Fiber Laser Handheld Welding Machine Fault Alarm Codes

| Code | Description | Solution |
|---|---|---|
| S028 | Laser Locked | Contact SFX After-sales Personnel |
| E001 | Driver Board 1 Communication Fault | |
| E002 | Driver Board 2 Communication Fault | |
| E003 | Driver Board 3 Communication Fault | |
| E004 | Driver Board 4 Communication Fault | |
| E005 | AD Board Communication Fault | |
| E006 | Diode Module Overtemperature | |
| E007 | Driver Module Overtemperature | |
| E008 | Water Temperature Overtemperature | |
| E009 | Fiber Temperature Overtemperature | |
| E010 | Laser Reflection Energy Exceeds Upper Limit | Cleaning the collimator, if the alarm persists, please contact SFX after-sales personnel |
| E011 | Laser output energy below lower limit | |
| E012 | Diode short circuit fault | Contact SFX After-sales Personnel |
| E013 | Optical fiber disconnection | |
| E014 | Excessive humidity | Check the environmental humidity. If the alarm persists, please con- tact SFX after-sales personnel. |
| E016 | Emergency stop | Emergency stop button pressed. If the alarm persists, contact SFX after-sales personnel. |
| E017 | Air pressure fault | Contact SFX After-sales Personnel |
| E018 | Narrow pulse protection | |
| E019 | Driver board overvoltage | |
| E020 | Internal temperature fault | |
| E021 | Laser Locked | |

| Code | Description | Solution |
|---|---|---|
| E022 | Fault lock | Contact SFX After-sales Personnel |
| E023 | Radiator not started | |
| C001 | Control system communication fault | |
| E901 | Radiator overcurrent | |
| E902 | Radiator step loss | |
| E904 | Radiator Phase Loss | |
| E905 | DC. Voltage Too Low | |
| E906 | DC. Voltage Too High | |
| E907 | Temperature Sensor Overtemperature | |
| E908 | Temperature Sensor Malfunction | |
| E909 | Communication Error | |
| E910 | AC. Phase Loss or CT. Short Circuit | |
| E911 | AC. Overcurrent | |
| E912 | AC. Input Voltage Too Low | |
| E913 | High Voltage Switch Malfunction | |
| E914 | IPM. Overtemperature Protection | |
| E915 | PFC. Module Overtemperature Protection | |
| E917 | Diode Temperature Sensor Fault | |
| E918 | Ambient Temperature Fault | |
| E919 | Radiator Inlet Temperature Fault | |
| E920 | Radiator Outlet Temperature Fault | |
| E921 | Diode Temperature Too Low | |
| E922 | Radiator Fault | |

## VII Maintenance

Note: To avoid personal injury and damage, maintenance of the handheld laser cleaning machine must be performed by professional personnel.

1. Daily Inspection: Check the protective lens, and if there is dirt, clean it promptly with a special dust-free cotton swab dipped in industrial alcohol. If there is coating damage or bad spots, please replace it in time to avoid burning other optical lenses.

2. Observing the Light Spot: Operators can use black photographic paper to check the laser output spot. If the spot is found to be uneven or skewed, maintenance should be performed promptly.

## VIII After-sales Service

1. The warranty period of this product is one year for the whole machine, and the warranty period for the laser source is two years:

1.1 From the date of purchasing this product, our company provides free warranty within one year(excluding non-warranty item). If the machine need to be returned to the factory for repair, the user only needs to bear the cost of two-way transportation.

1.2 This product is repaired free of charge for life, and the user only needs to bear the cost of spare parts and two-way transportation.

Note: Purchase date is based on invoice date or order receipt date.

2. The following scopes are not covered by warranty:

2.1. Damage caused by improper use such as violent bumping, bending, etc.

2.2. Human-caused damage.

2.3. Laser accessories and consumables are not warranted (optical parts such as vibrators and field mirrors, integrated cables, etc. are not covered by warranty).

3. After-sales service process:

3.1 Customers call the after-sales 400 phone number, and the professional staff will answer and diagnose the problem.

3.2 If the machine need to return to the factory for repair, we arrange for the customer to send it back.

3.3 Receive the returned machine, repair it and resend it.

3.4 Check back with customers to improve service quality and provide better protection for customers.

3.5 If you are not satisfied with the service, please call the complaint number: +1 (760) 623-5118.

*The relevant technical parameters listed in this manual are for reference only. The relevant product information is subject to change without prior notice. All technical parameters and agreements are subject to the terms of the sales contract.

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