HWS5000 Handheld Laser Welding Equipment User Manual (Electronic control part)

Manual For Holding Welding System Equipment (control part)

Version: V1.01

Contents

Preface

This document mainly describes the use, installation, wiring and maintenance of the electric control part of the HWS5000 handheld laser welding equipment. Before using this controller and related equipment, please read this manual carefully to help you use this equipment better.

Due to the continuous update and improvement of product functions, the product you received may differ from the statement in this manual in some respects.

Audience

This manual is mainly applicable to the following staff:

- Equipment operator

- Equipment maintenance personnel

- Equipment installer

1. System Overview

The HWS5000 handheld welding control system is mainly composed of a controller and a touch screen. The user can implement parameter setting, enable control, switch working mode, view alarm information and other operations through the touch screen. The controller completes the control of the laser, wire feeder, and welding torch.

Both the touch screen and the controller use 24V DC power supply, and the external wiring is simple and reliable. Users can quickly get started after the system is powered on and initialized.

2. Product features

- Good human-computer interaction interface, providing users with a friendly operating experience
- Support continuous light emission and point light emission
- A variety of parameters can be adjusted to improve the welding process
- Automatically breaks the wire after the light stops, and the welding wire is easily separated from the workpiece
- The system is highly integrated, the peripheral configuration is rich, and the welding is intelligent

3. Main interface description

3.1 Homepage

Figure 3-1: Home page interface

After the system is powered on and initialized, the welding work interface is entered by default. Click the "Home" button to enter the home page interface. Under the home page interface, you can enter the system settings, start welding, and controller configuration interfaces.

3.2 System Setting Interface
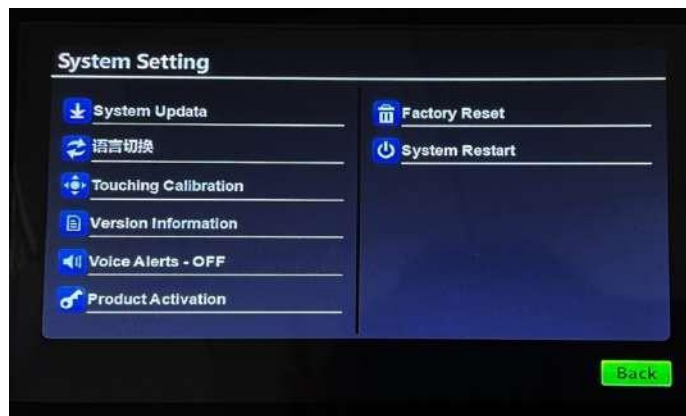
image 3-2: System setting interface

Click the "System Settings" button under the home page interface to enter the system settings interface.

"System Upgrade": See page 14, paragraph 5.2 for details.

"Language switch": This system supports simplified Chinese, traditional Chinese, English, Korean, Russian and Spanish. After clicking Language Switch, click the required language, and the language will be displayed on all system interfaces.

"Touch Calibration": When there is a touch offset or insensitivity, click "Touch Calibration" and click the "+" on the screen to complete the calibration.
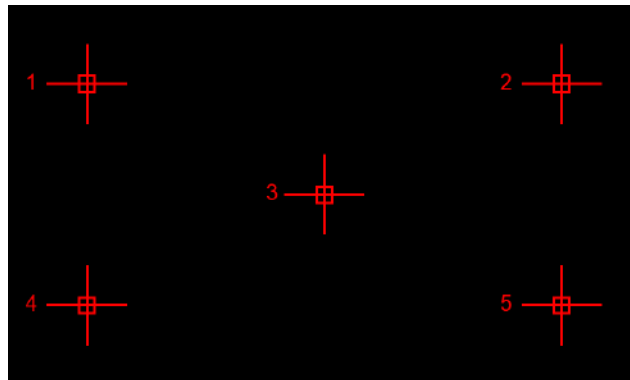
"Version Information": Display the current system's touch screen version, controller software version, and controller hardware version.

"Alarm sound reminder": Turn on/off, when an alarm occurs, the screen emits a sound.

"Product Activation": Query the current device ID and encryption status. The activation code is divided into six segments, each with 4 digits. After entering the correct activation code, click "Activate" to update the encryption time or permanently decrypt.
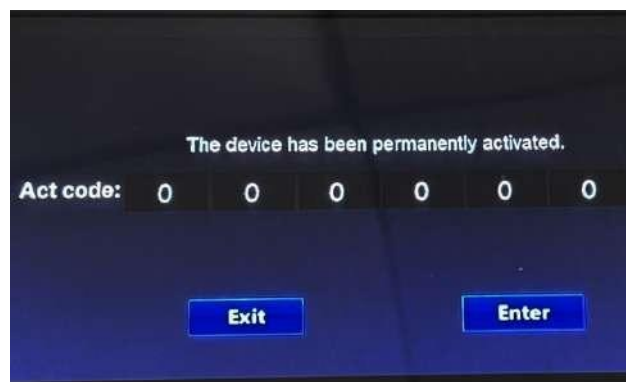
"Restore factory settings": The device is restored to the factory state.

"System restart": Restart the device.

3.3 Controller configuration interface

Figure 3-3: Control configuration interface

Click the 'controller configuration' button under the homepage to enter the control configuration interface, you can configure some functions and parameters of the controller.
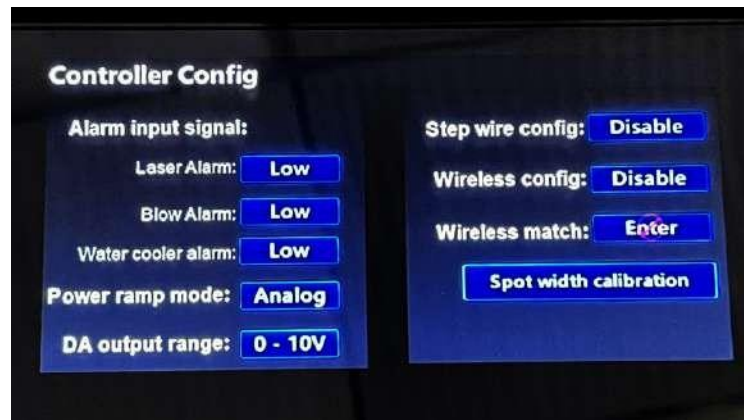
Alarm input signal: Configure the corresponding alarm signal as a high-level alarm or a low-level alarm. The system defaults to a low level alarm and supports two IO port input signals, namely, the laser alarm input signal and the air pressure alarm input signal.

Analog output range: You can select the analog voltage output range of the controller, and adapt to different lasers by changing the output range.

Stepping wire feeder configuration: Choose to enable or disable the stepping wire feed (users who use our MARS8000-S series wire feeder, please set this to enable).

Wireless controller configuration: Choose to enable or disable the wireless communication module (users who use our HW960 series handheld laser welding head, please set this option to enable).

Wireless controller pairing: To communicate and pair with the wireless control module. This button is available when the wireless controller is configured as "Enable".

3.4 Welding work interface

After the system is powered on, it will enter the welding work interface by default, as shown in the figure below:

Figure 3-4: Welding interface

The welding work interface is the most commonly used interface for users. Under this interface, users can set parameters, turn on/off enable control, switch working modes, and light emitting methods.

Output power of the welding head = laser power x peak power x PWM duty cycle

Click the "LaserMd" button to switch the light emitting mode.

Figure 3-5: Continuous light emission   Figure 3-6: Point emitting light

The three different light emitting methods are as follows:

Continuous light: After turning on the laser enable, when the light-emitting conditions are met, the light can be continuously emitted by pressing the light-emitting switch of the welding head, and the light can be turned off by releasing the light-emitting switch.

Point shot light: When the light is spotted, after the laser enable is turned on, the light will be emitted only once per press. The light emission time is determined by the spotting time. If you need to spot the light again, you need to release the switch and press the light switch again.

Scaly welding line: after the laser is enabled, the light emitting conditions are met, the light spot swings slowly to achieve the effect of scaly pattern.

The enable button has an indication function. The closed and open states are as shown in the figure below:

Figure 3-7: Turn off enable   Figure 3-8: Enable enable

Enable and switch control buttons:

"Red light indicator" button: Turn on/off the red light indicator.

"Spot enable" button: Turn on/off the light spot swing.

"Light emitting mode" button: Set the light emitting mode of "continuous"\"spot shot".

"Laser enable" button: turn on/off the laser enable, only when the laser enable is turned on can light be emitted.

"Wire feed switch" button: Turn on/off the wire feed.

"Wire feeding mode" button: can switch between inching wire feeding and automatic wire feeding. When the wire feeding is inching, the wire feeding switch must be pressed continuously before the wire feeder moves, and the wire feeding switch stops when the wire feeding switch is released. During automatic wire feeding, if the wire feeding is turned on, the wire will be fed automatically during the light emitting process, and the wire will stop automatically when the light is stopped.

"Wire feeding direction" button: It can be switched to wire feeding and wire return. In the automatic wire feeding mode, the wire feeding direction is "Wire feeding" and cannot be modified.

Description of welding interface parameters:

"scanning frequency": Set the oscillation frequency of the galvanometer motor of the gun head. The higher the scan frequency is set, the faster the light spot moves. This parameter is limited by the sweep width parameter:

Scanning width≤2mm, scanning frequency≤600HZ; 2mm≺

scanning width ≤3mm, scanning frequency ≤400HZ; 3mm≺

scanning width≤4mm, scanning frequency≤350HZ. "Scan

width": set the beam swing width;

"Blowing out of light": Set the delay time of blowing out before light is emitted;

"Turn off light and blow": set the blowing delay time after turning off the light;

"Peak Power": The maximum power during stable light emission.

"PWM frequency": Adjust the frequency of the PWM pulse signal of the laser.

"PWM Duty Cycle": Adjust the duty cycle (pulse width) of the PWM pulse signal of the laser. The power of the welding head is adjusted by the peak power and the PWM duty cycle.

Welding head output power = laser power * peak power * PWM duty cycle.

"Wire feed speed": Set the running speed of the wire feeder.

"Blow before light is emitted": Set the delay time of blowing before light is emitted.

"Blow after light off": Set the delay time for blowing after light off.

Light emitting must meet the following 5 conditions at the same time:

Turn on the laser enable;

The LA-ON-pin of the controller is connected to the metal welding workpiece through a wire (refer to the device wiring chapter);

The tip of the gun contacts the metal welding workpiece;

Press the light control switch of the welding gun;

The device currently has no alarms.

In the case that the laser can work normally, the light cannot be emitted

when one of the above 5 conditions is not met.

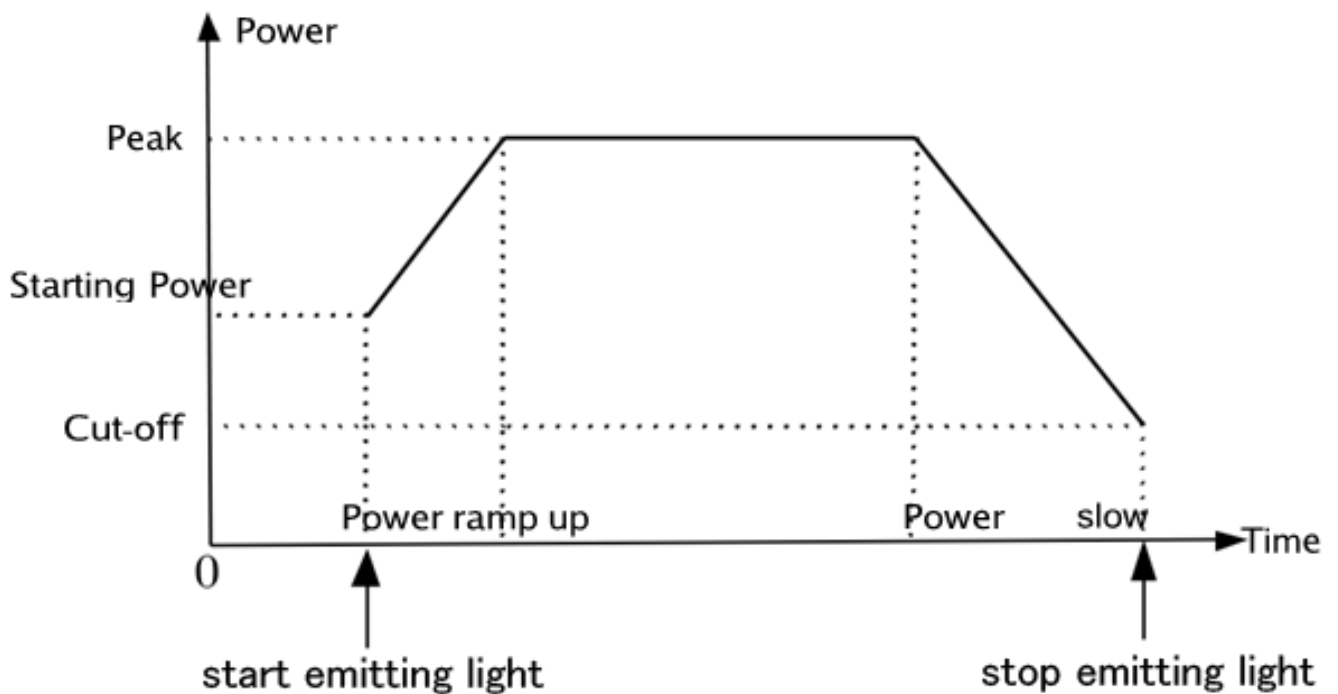The process of power change during light emission is shown in Figure 4-1.

Figure 4-1: Schematic diagram of power changes

3.5 Process selection interface

Figure 3-10: Process interface

Click the "PARAM" button under the welding interface to enter the process selection interface. After selecting a certain group of processes, click "Export" to directly import this group of process parameters into the welding work interface. The process parameters under the process interface can be permanently saved even when the power is off. The user can input the process name to identify different process parameters.

3.6. Advanced parameter description

Figure 3-11: Advanced parameter interface

The password for entering advanced parameters is 2000. The explanation and description of the advanced parameters of the handheld welding control system

are listed below. Users can set appropriate parameters according to actual needs during use.

Fac delay:

When the laser enable is turned on, after stopping the light, the motor stops rotating after this period of delay. The maximum stop delay is 999s.

Power ramp up

Set the power ramp-up delay (the time required for the output power to rise from the starting power to the peak power);

Power ramp down

Set the power slow-down delay (the time it takes for the output power to drop from the peak power to the cut-off power).

Note: Only the system with optional wireless control module has the power slow down function!

Power start:

The power when the light starts.

Power off:

The power when the light is stopped.

WireMoment:

If the control system is equipped with a stepping wire feeder, the torque of the stepping wire feeder can be adjusted according to the load of the stepping wire feeder.

Stop delay:

After setting the light-off delay time, the light will not be turned off immediately after releasing the off switch of the welding head, but the light will really stop after the light-off delay period. Use the time of the light-off delay to realize that the welding wire is separated from the workpiece after the light is stopped.

Note: The light-off delay time is up to 500ms. When the light-off delay time is set too long, please confirm that the light has been stopped before placing the

welding head to prevent laser damage.

Back Feed:

After the light is stopped, the welding wire will automatically return to a certain length, which is convenient for the next welding. The length of the wire back is determined by the set parameters.

Pulse-Time:

Set the light emission time in burst mode, the maximum burst time is 1000ms.

Blow switch

Open/close solenoid valve

Offset

Adjust the lateral offset of the optical core

4. Equipment alarm and handling

4.1 Equipment alarm

When the device is faulty, the interface will pop up an alarm window and prompt the current alarm information, as shown in the following figure:
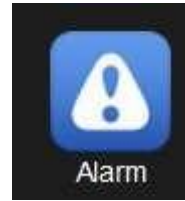

picture4-1: Warning pop-up window

If the alarm is not cleared, there will be a flashing red indicator next to the alarm button. Only after all alarms are cleared (there is no current alarm), the red indicator next to the alarm button will disappear, as shown in the following figure:

| Figure 4-2: Alarm not cleared | 4-3: Alarm cleared |

4.2 Solutions to the warning

Once the equipment is alarmed, the user must stop using the handheld laser welding equipment immediately, troubleshoot the fault. Use it only after the fault is resolved. Users can refer to the alarm information in the alarm window to troubleshoot faults. The alarm information and solutions are shown in the following table:

Serial number	Warning message	Solution	Remark
1	Alarm Err-E001: The controller is not connected!	Check whether the RS485 communication line between the touch screen and the controller is properly connected, and check whether the controller is normally powered on and started.	
2	Alarm Err-B001: The air pressure is too low!	Check whether the air pressure is normal.	
3	Alarm Err-L001: Laser failure!	Check whether the laser is working properly.	
4	Alarm Err-W001: Wireless communication failure!	Check whether the green indicator light of the controller flashes normally, if the green	This alarm is only for the optional wireless

		indicator light is always on, plug and unplug the wireless receiver again.	control module.
5	Alarm Err-S001: Wire feeder communication failure!	Check the communication line between the controller and the stepping wire feeder, and plug the communication interface again after power off.	This alarm is only for the optional stepping wire feeder.
6	AlertErr-S002: Stepping wire feeder driver alarm	Check the line connection between the motor and the drive, check whether the power supply voltage is at 24V.	This alarm is only for the optional stepping wire feeder.
7	Alarm Err-S003: Motor shaft lock failure!	After the power is off, check the line connection between the motor interface of the stepping wire feeder and the motor driver, and re-plug and unplug the motor terminal of the driver.	This alarm is only for the optional stepping wire feeder.
8	Alarm Err-C001: Chiller alarm!	Check whether the chiller works normally	
9	Alarm Err-All: There are many faults at present, please check detailed fault information!	There are many current faults, please troubleshoot them one by one.	
10	There is no alarm when the equipment is running normally!	The current device is operating normally.	

5. Program update

5.1 Touch screen program update

Note: The U disk uses the USB2.0 interface and has a capacity smaller than 16GB. The format of U disk is FAT32.

Please follow the steps below to update the touch screen program:

1.   Insert the U disK with the update file into the USB port on the bacK of the touch screen, and wait for the screen to see if the DUpgrade SettingsD interface pops up (Figure 5-1). If the DUpgrade SettingsD interface pops up, clicK DUpgrade ConfigurationD DYes, wait for the program upgrade to complete, and then pull out the U disK.

Figure 5-1: Touch screen program upgrade

5.2 Controller program update

Click the "Program Update" button under the homepage to enter the controller update interface, as shown in the figure below

Figure 5-2: Controller program update

Please follow the steps below to update the controller program:

1. After inserting the U disk with the updateable file into the USB port of the controller, click the "Start Update" button. If an updateable file is detected, the automatic update program will start. If there is no updateable file in the U disk, it will prompt "No updateable file detected";

2. The progress bar indicates the current update progress. After the program update is completed (100%), follow the prompts to remove the U disk and restart the system;

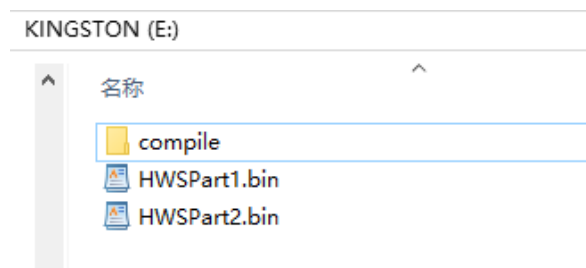3. If the update fails, you can click the "Start Update Button" again.

Figure 5-3: Touch screen and controller update file

Notice:

1）The update files of the touch screen and the controller should be placed in the root directory of the U disk, as shown in Figure 5–3. Among them, "compile" is the update file of the touch screen, and "HWSPart1.bin" and

"HWSPart2.bin" are the update files of the controller. The user must not change these two file names, otherwise the program cannot be updated!

2）It is recommended to use a FAT32 format USB flash drive for updating the program. (After entering the U disk catalog, right-click "Properties" to view the format of the U disk, as shown in the figure below.)
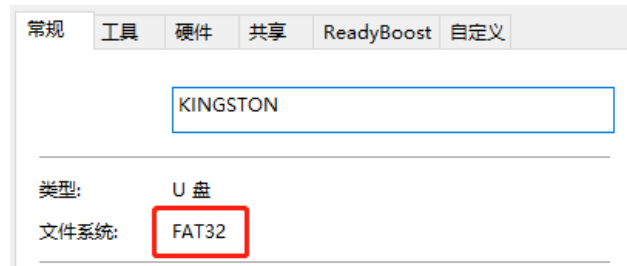
注意：

Figure 5-4: U disk format used for upgrade

6. Equipment installation and wiring

6.1 Wiring instructions for touch screen terminals

Figure 6-1: Touch screen wiring terminal

Terminal wiring instructions:

1. Power terminal: The screen uses 24V DC power supply. The terminals from

right to left are: power supply positive, power supply negative, and ground wire.

2. RS485 communication terminal: This terminal and the controller RS485 communication terminal are connected through the RS485 communication line.

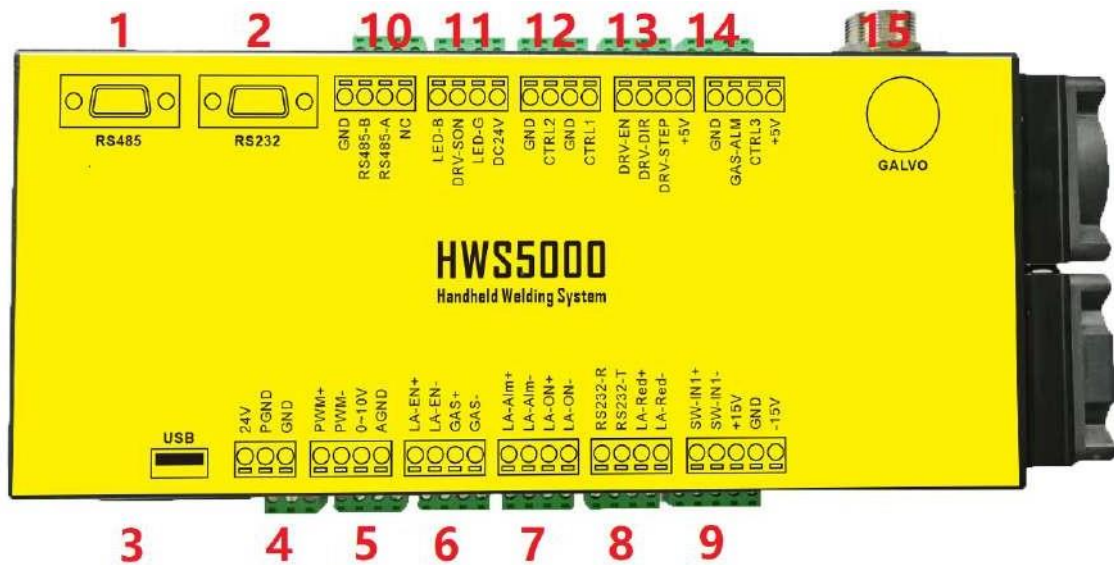## 6.2 Controller wiring terminal description

Figure 6-2: Controller wiring terminal

For detailed description of the controller terminals, please refer to the table below.

					Controller terminal description
NO.	Port screen printing	Input/ Output	Pin	Pin Definition	Terminal description
1	RS485	IN/OUT	/	RS485	Touch screen communication interface
2	RS232	IN/OUT	/	RS232	RS232 interface (wireless control receiver)
3	/	IN/OUT	/	USB	USB interface (wireless communication/U disk download)

4	POWER	IN	1	24+	Controller DC24V power input
			2	PGND	
			3	GND	
5	CON1	OUT	1	PWM+	DC24V\DC5VPWM output signal
			2	PWM-	(The output amplitude can be configured)
			3	0~10V(0~4V)	0~10V\0~4V analog output signal
			4	AGND	(The output range can be configured)
6	CON2	OUT	1	LA-EN+	DC24V laser enable output signal
			2	LA-EN-	
			3	GAS+	DC24V output connected to solenoid valve to control blowing
			4	GAS-	(Drive current Max 2A)
7	CON3	IN	1	LA-ALM+	Laser alarm input port
			2	LA-ALM-	(DC24V high level valid)
			3	LA-ON+	Connect to the hand gun button switch, turn on the light
			4	LA-ON-	(Short the two points to give out light and breathe out)
8	CON4	IN/OUT	1	RS232-R	Reserved
			2	RS232-T	
		OUT	3	LA-Red+	Red light indicating control signal
			4	LA-Red-	(DC24V high level effective)
9	CON5	OUT	1	SW-IN1+	Reserved
			2	SW-IN1-	
		IN	3	+15V	Controller DC±15V power input
			4	GND	
			5	-15V	
10	CON6	OUT	1	NC	Reserved

			2	RS485-A	Stepping wire feeder communication port
			3	RS485-B	
			4	GND	Reserved
11	CON7	OUT	1	DC24V	DC24V power output
			2	LED-G	Stepping wire feeder green indicator light
			3	DRV-SON	Stepping wire feeder enable
			4	LED-B	Stepping wire feeder blue indicator light
12	CON8	OUT	1	CTRL1	Reserved
			2	GND	
			3	CTRL2	Reserved
			4	GND	
13	CON9	OUT	1	+5V	Reserved
			2	DRV-STEP	
			3	DRV-DIR	
			4	DIR-EN	
14	CON10	IN/OUT	1	+5V	Reserved
			2	CTRL3	Reserved
			3	GAS-Alm	Low air pressure warning input signal
			4	GND	Reserved
15	GALVO	IN/OUT	/	10 pin aviation plug	Connect the welding gun (welding gun control input／output)

surface6-1: Definition of controller wiring terminal

In order to improve the safety performance of the product, the hand-held welding head adopts the method of contacting light, that is, the welding head and the welding workpiece must be in contact, and the light can be emitted after pressing the light switch of the hand-held welding head.
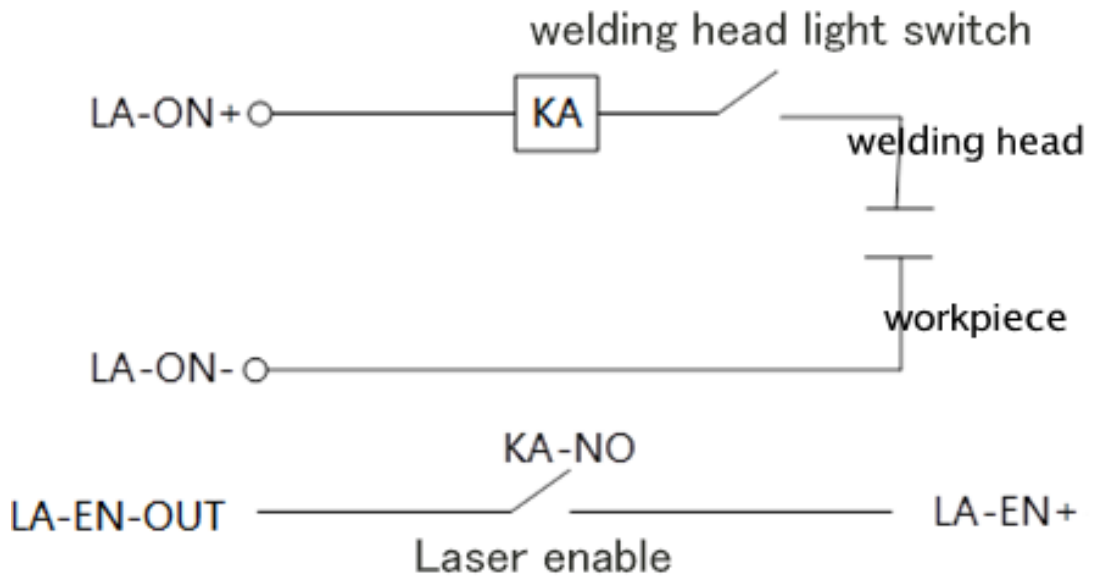
Figure 6-3: Schematic diagram of exposure to light

7. Wireless module installation and use

7.1 Introduction

Figure 7-1 (Introduction to the appearance of the wireless control module)

Display screen: displays the man-machine interaction interface such as parameter functions.

OK key: Short press to enter the parameter editing state, each time you press,

the next parameter item is selected, the selected parameter flashes, and the parameter is set by the left or right button; if no key is pressed within 5 seconds or the parameter is not set, return to non-editing Status, the parameter stops flashing; long press in the non-editing state to trigger the power slow-down function, release it to stop the power slow–down.

Left button: Press to decrease parameter value or switch function state in parameter editing state. Long press in the non-editing state to turn on the wire feeding function, release it to stop the wire feeding.

Right key: Press to increase the parameter value or switch the function state in the parameter editing state. Long press in the non-editing state to turn on the thread rewinding function, and release it to stop thread rewinding.

7.2 Wireless control module interface
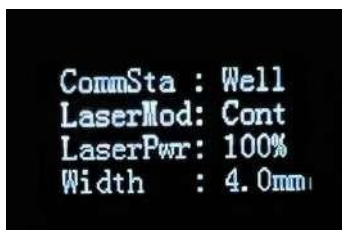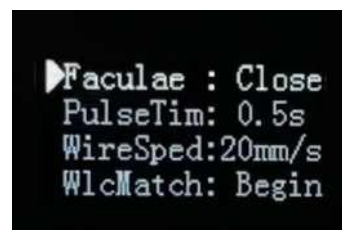

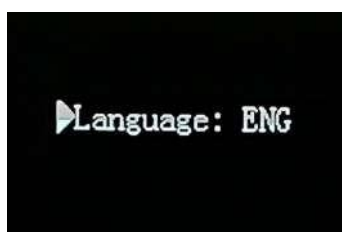Figure 7-2 (First page)

Figure 7-3 (Second page)

Figure 7-4 (Third page)

7.3 Function and parameter description

1. Communication status: (status: normal\disconnected)

Shows whether the wireless connection is successful. "Normal" means that the wireless communication is connected, and "disconnected" means that the wireless communication is not connected.

2. Light emitting mode: (status: spot shooting\continuous\scaly figure)

Corresponding to the touch screen "light mode" parameter. The "continuous" light mode, "spot shot" light mode and "scaly figure" mode can be adjusted

3. Laser power: (range 0%-100%)

Corresponding to the "peak power" parameter of the touch screen, adjust the maximum power during the stable light emission period.

4. Scanning width: (range 0mm-4mm)

Corresponding to the "scan width" parameter of the touch screen,Set the beam swing width.

5. Spot enable: (status: on\off)

Corresponding to the touch screen "spot enable" parameter, turn on/off the swinging spot.

6. Spotting time: (range: 0S-1.0S)

Set the light emission time in the spot mode corresponding to the "pulse time" parameter in the "advanced parameters" interface of the touch screen.

7. Wire feeding speed: (range: 0%-100%)

Set the running speed of the wire feeder corresponding to the "Wire feeding speed" parameter on the touch screen.

8. Wireless pairing: (Status: On\Off)

Cooperate with "Enter Pairing" in the "Controller Configuration" interface of the touch screen to achieve wireless pairing.

9. Language switching: (Status: Chinese\English\Traditional)

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

Traditional Chinese.

7.4 Wireless control module installation

The wireless control module is installed on the top of the HW960 handheld welding head and connected with a 1.25mm–3Pin terminal line. The top of the screen is fixed with M2.5*12 screws, and the bottom of the button is fixed with M2.5*8 screws.
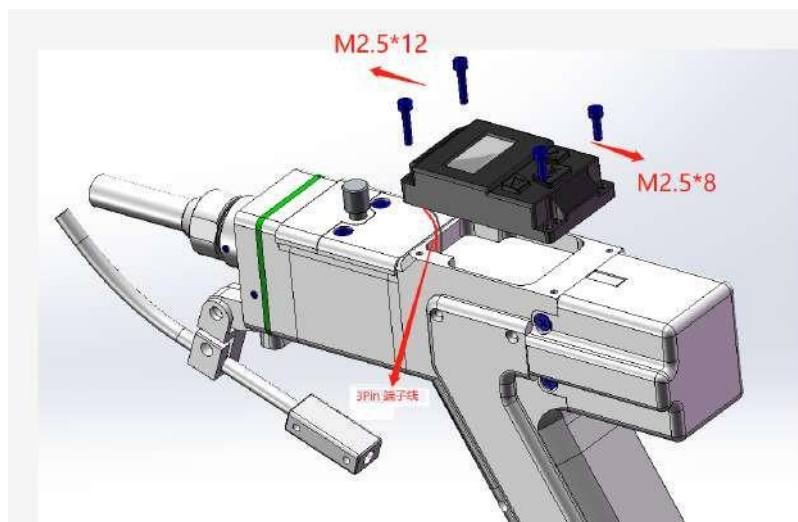

Figure 7-5 (Wireless control module installation)

7.5 Wireless module pairing

Check whether the wireless receiver-DB9 is plugged into the DB9 female connector of the HWS 5000 controller.

Note: The wireless receiver-DB9 cannot be plugged or unplugged under power.

Figure 7-6 (Wireless receiving module installation)

Open "Home" → "Controller Configuration" on the touch screen. Set "Wireless Controller Configuration" to enable, click "Enter Pairing" → click "Start".
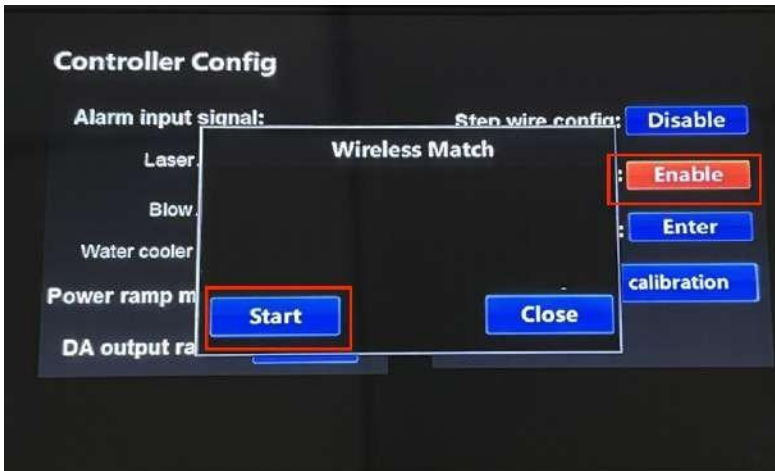

Figure 7-7 (Touch screen operation pairing)

Short press the "OK button" to move the triangle cursor to the "Wireless Pairing" line, and long press the "OK button" to enter the pairing mode. When a paired HWS 5000 controller is detected, the pairing will be successful.
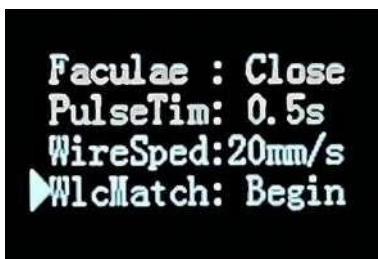

Figure 7-8 (Wireless control module operation pairing)

8. Precautions for the use of equipment

In order to ensure the normal use of HWS5000 handheld laser welding equipment, avoid damage to the welding equipment due to abnormal operations, and protect the personal safety of equipment users when operating the equipment, relevant personnel must carefully read the following precautions:

1、 The bar codes of the HWS5000 controller must match those of the HW960 welding head. Otherwise, the motor will howl or even be damaged by overheating；

2、 The laser welding equipment and the third party welding machine such as argon arc welding, electric welding, gas shielded welding should not share the same welding workbench (the ground wires of different welders cannot be clamped on the same welding workbench);

3、 The input power supply of laser welding Equipment a third-party welding machines such as argon arc welding, electric welding and gas shielded welding needs to be isolated (use different AC input, or isolate with isolation transformer)

4、 It is strictly forbidden to aim the laser welding gun head at the human body, flammable and explosive objects and other dangerous objects;

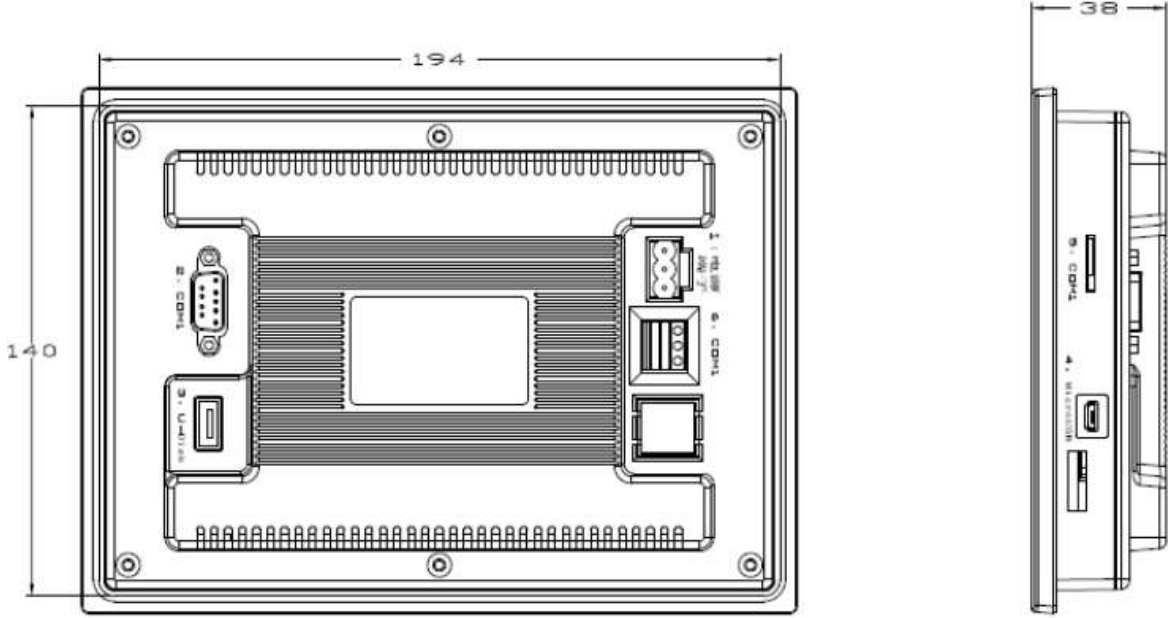5、 The welding gas must be a protective inert gas (argon and

nitrogen are recommended);

6、 When the laser welding equipment is not used, put the welding gun head in place and turn off the laser.

9. Equipment dimensions
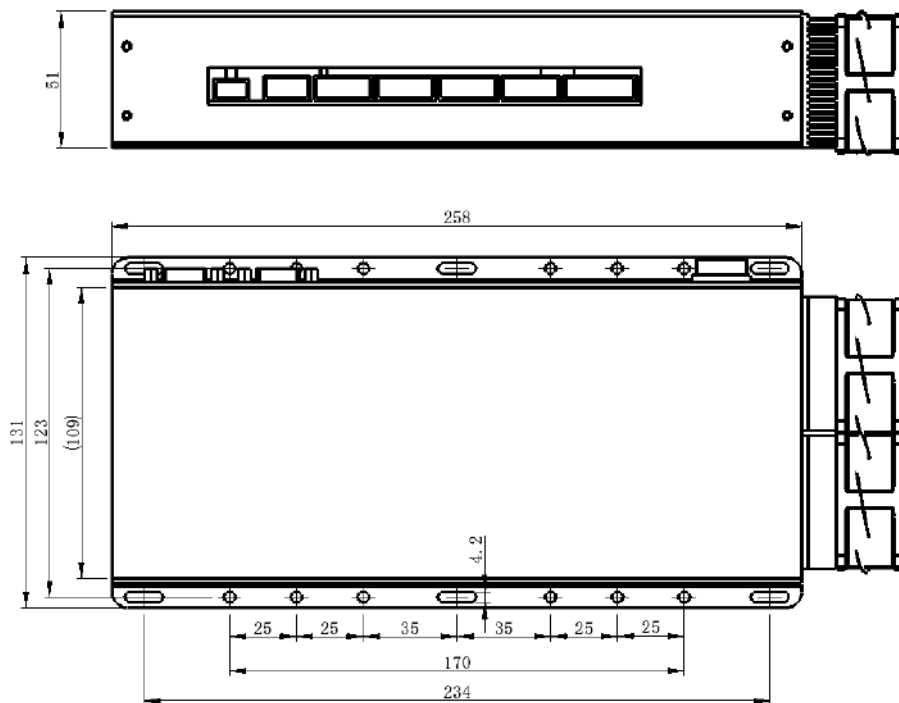
picture9-1: External dimensions of the controller

picture9-2: Dimensions of the touch screen