OPERATION MANUAL

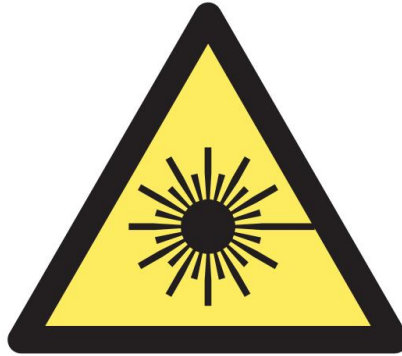**YLPS Series CW Fiber Laser**

Model: YLPS-2000-W and YLPS-3000-W

Before using this product, please read the user manual carefully and familiarize yourself with the relevant content we have compiled for you. Please keep the product manual together with the product to provide you and all other users with operational, safety, and other important information at all times.

Note

YLPS Fiber Laser is the Class 4 laser product.

This product emits an invisible laser of up to 3000W with a wavelength between 900nm and 1100nm.

Avoid eye and skin direct exposure to the output laser or scattered radiation.

Do not turn on 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.
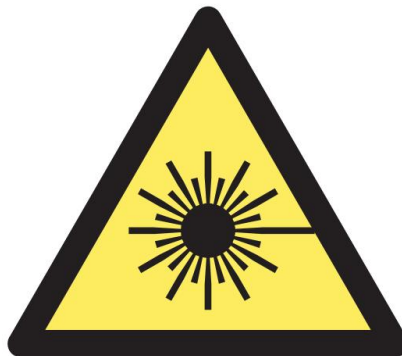
Safety Information

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.

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 WARNINGs and CAUTIONs, 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 the laser. Please use the output connector 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 fiber output connector (e.g., installing the connector, checking the end surface of the connector with an optical instrument, etc.).

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. This product can output up to 3000W 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 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.

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, ensure that the ambient temperature and humidity are within the specified range.**

CAUTION: **Do not expose the product to excessive moisture.**

CAUTION: **The laser uses water cooling mode. Please ensure that the water cooling flow rate is up to standard to effectively cool the instrument.**

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

CAUTION: **Keep the output lens clean. Close the cover of the output lens after each use. Do not touch the output lens with your hands, and do not use any solvents to clean the lens. When cleaning the lens, be sure to use lens wiping paper.**

Table of Content

1.　Laser Safety

1.1　Safety regulations

The YLPS series CW fiber laser is an OEM laser product that can be integrated into laser systems for commercial and manufacturing applications. Therefore, this product does not fully meet the definition for complete laser processing system in 21 CFR 1040.10 and 1040.11 under IEC/EN 60825-1. GW Laser Tech is not responsible for the compliance of the laser systems that integrate this product. The end user is responsible for ensuring that the system used meets all required safety regulations and rules.

1.2　Safety performance

Item	Description
Externally controlled laser interface	This interface is used for external control of the laser, providing functions such as enable, emergency stop, interlock, alarm, etc..
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.

1.3 Safety labels

Safety labels and label location

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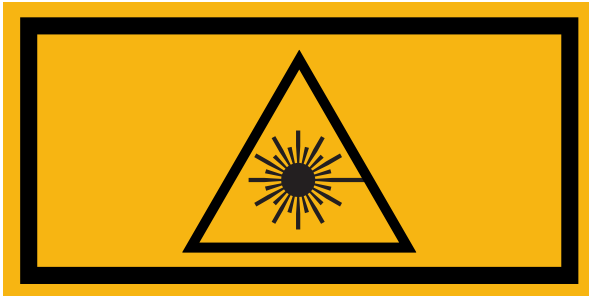
Laser outlet label

Location: Upper panel

VISIBLE AND/OR INVISIBLE
LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
Per IEC/EN 60825-1:2014

Certification label

Location: Upper panel

$\lambda = 915-1100\,nm$

$P_o \leq 3000\ W$

$P_P \leq 3000\ W$

$t = 0.05ms - \infty\ \mu s$

Warning label

Location: Upper panel

AVOID EXPOSURE—
VISIBLE AND/OR INVISIBLE
LASER RADIATION
IS EMITTED FROM THIS APERTURE
Per IEC/EN 60825-1:2014

Warning label

Location: Upper panel

VISIBLE AND/OR INVISIBLE
LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
Per IEC/EN 60825-1:2014

Certification label

Location: Upper panel

WARNING!

BLACK CABLES ARE LIVE
FROM AN EXTERNAL SOURCE
EVEN WITH THE MAINS
SWITCHED OFF.

Warning label

Location: Upper panel

GW (Shanghai) Laser Technology Co., Ltd.

Production and Assembly, Floor 5/6, Building 5-1, No. 398

Shuanglian Road, Qingpu District, Shanghai City

Name: CW fiber laser

Model: YLPS-3000-W

Manufacture date: Aug-2021

Code: 110101085

Serial number: SA7A2020

Input specification: 380VAC, 20A

Weight: 36KG
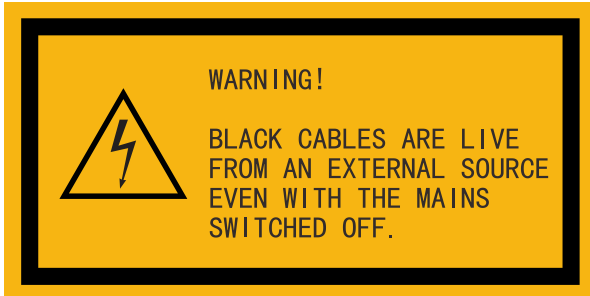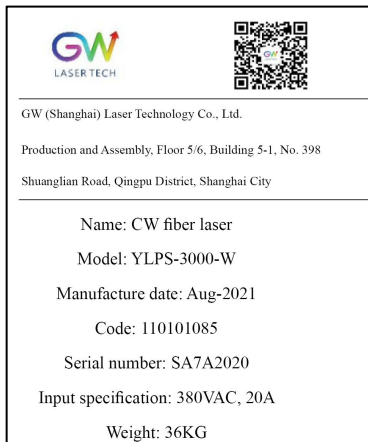
Product label

Location: Front panel

Laser safety label

Location: Rear panel

2.   Description

The YLPS series OEM fiber laser from GW Laser is designed for industrial material processing applications with reliable, efficient and proprietary ABR and SPP technologies. Key innovations in the YLPS series fiber lasers also include the proprietary thermal processing, mode-filtering technology, and a durable and novel fiber laser structure. The YLPS 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 YLPS series OEM fiber lasers from GW Laser meet your highest requirements on performance and reliability. The YLPS series lasers provide up to 3000W continuous wave (CW) single-mode output laser, with the output waveband between 1070nm and 1080nm. YLPS lasers provide high-efficiency and high-quality output laser. The beam quality M2 output from a single-mode fiber cable is less than 3.5 generally, or in case of high-brightness multi-mode fiber cable output, BPP ＜ 1.5. Such output options with higher beam quality and multiple functions 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.

2.1 Front panel

Item	Description
Power indicator	The green indicator is on after the power is turned on
Laser output indicator	The yellow indicator is on when the laser is emitted
Alarm indicator	In case of a warning for the laser, the red indicator will flicker; in case of any fault, the red indicator is normally on, and meanwhile, the laser will stop emitting immediately
Internal and external control key switch	Switch between internal control and external control
Scram switch	Press it to immediately turn off the laser pump power supply, and meanwhile, the laser stops emitting, and the alarm indicator is on. Turn clockwise to release the switch and remove the emergency stop control.

2.2 Rear panel
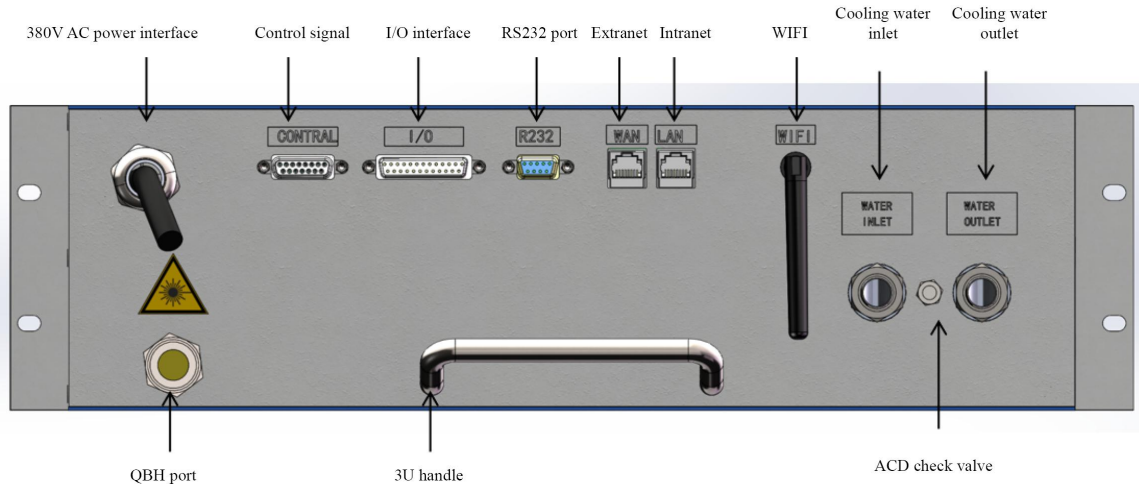
Item	Description
380V AC power port	For the laser power module 380V AC power input
Control signal interface	DB15 interface to transmit control signal and control the laser in external control mode
I/O interface	DB25 interface, to connect I/O signal, select laser output mode, transmit alarm signal, etc.
RS 232	DB9 interface, used to communicate with the upper computer, and be able to control the laser in the internal control mode
LAN	Laser LAN communication, being able to monitor the laser operation status
WAN	As to the factory default parameters, the WAN interface has the same function as the that of LAN to monitor the operation status of the laser
WIFI	Laser external network communication, being able to monitor the laser operation status
CDA check valve	Injection of dry gas (please use under the guidance of GW professionals)
Laser water-cooling interface	Connect 16mm PU tube

3.   Parameter

3.1 Optical performance

Characteristics	Min. value	Typical value	Max. value	Unit
Operation mode		CW/Pulse/M		
Polarization		Random		
Output center wavelength		1070±10		nm
Output power YLPS-2000-W	1950	2000	2050	W
YLPS-3000-W		3000		W
Output power adjustment range	1		100	%
Output bandwidth		< 3.0		nm
Modulation frequency			50	kHz
Turn-on time			5	μs
Red guide light output power			1	mW

3.2 Optical output

Characteristics	Min. value	Typical value	Max. value	Unit
Fiber output connector		QBH		
Output optical fiber cable		13 mm metal armored cable		
Beam quality, single-mode output		1.4	3.5	
Output fiber diameter, single-mode output		25	50	um
Output fiber length, single-mode output		15		m
Beam quality, multi-mode output		1.5		
Output fiber diameter, multi-mode output		50	100	um
Output fiber length, multi-mode output		15		m

3.3 Mechanical and environmental parameters

Characteristics	Min. value	Typical value	Max. value	Unit
Operating temperature range	5		45	°C
Storage temperature	-10		50	°C
Cooling method		Water-cooled		
Water flow YLPS-2000-W		20		
YLPS-3000-W		25		

Water temperature	24	25	26	°C
Water pressure	4		5	Bar
The cooling capacity of the water cooling system YLPS-2000-W		4600		
YLPS-3000-W		7200		
Operating humidity	0		95	%
Dimensions	482X513X132			mm

Note: The water cooling system needs to be equipped with a filter element with a aperture less than 200 μ. Cooling water is required to be of deionized water, and the ion concentration in water is less than 20 ppm. The use of unqualified cooling water may cause irreparable damage to the laser.

3.4 Power source requirement

Characteristics			Parameter	
Connector			4-Pin	
Pin#	Function	Wire color	Power voltage	Power current
1	AC power supply (L1)	Brown	380V AC	15A (YLPS-2000-W, and 20A YLPS-3000-W)
2	AC power supply (L2)	Black	380V AC	15A (YLPS-2000-W, and 20A YLPS-3000-W)
3	AC power supply (L3)	Grey	380V AC	15A (YLPS-2000-W, and 20A YLPS-3000-W)
5	Grounding	Green/yellow	N/C	N/C

3.5 Control and monitor I/O interfaces

X1			Interface 1 (DB15)					
Pin	Name	Input/Output	Function		Typical	Min.	Max.	Notes
1	Pin	Input	Laser power input			0V	10V	0.1V=1%
9	GNDA	Input	Pin 1# reference analog ground		0V			
2	Pout	Output	Laser power output			0V	10V	0.1V=1%
10	GNDA	Output	Pin 2# reference analog ground		0V			
3	IN1	Input	Reserved					
11	GNDA	Input	Pin 3# reference analog ground		0V			
4	IN_KEY	Input	Reserved					
5	IN_STOP	Input	Emergency stop signal	Active	24V	22V	26V	In case of the signal at low level, the laser stops outputting
				Inactive	0V	0V	0.7V	
6	IN_RED	Input	Red guide light enable signal	Turn on	24V	22V	26V	In case of the signal at high level, the red guide light is outputting
				Turn off	0V	0V	0.7V	
7	GNDD	Output	Pins #7, #5, #6, #12, #13, #14, and #15 reference digital ground		0V			
8	GNDD	Output	Pins #7, #5, #6, #12, #13, #14, and #15 reference		0V			

Pin	Name	Input/Output	Function		Typical	Min.	Max.	Notes
			digital ground					
12	IN_WAT	Input	Cooling water fault interlock signal	Normal	24V	22V	26V	In case of the signal at low level, the laser stops outputting
				Fault	0V	0V	0.7V	
13	IN_EN	Input	Laser emit enable signal	Enable	24V	22V	26V	The laser emits in case of high level and the laser stops emitting in case of low level
				Forbidden	0V	0V	0.7V	
14	IN_PULSE	Input	Modulation signal	H	24V	22V	26V	External pulse signal input
				L	0V	0V	0.7V	
15	V24V+	Output	24V power supply		24V	23.5V	24.5V	

X2			Interface 2 (DB25)					
Pin	Name	Input/Output	Function		Typical	Min.	Max.	Notes
1	S-RDY	Output	System ready signal	Ready	24V	23V	25V	Whether the system is ready for output pin
				Not ready	0V	0V	0V	
2	S-ERR	Output	System fault signal	With fault	24V	23V	25V	Whether the system has faulty output pins
				No fault	0V	0V	0V	
3	S-WAR	Output	System alarm signal	With alarm	24V	23V	25V	Check whether the system has alarm output pins
				No alarm	0V			
4	S-LAS	Output	Laser start signal	Started	24V	23V	25V	Whether the laser starts the output pin
				Unstarted	0V	0V	0V	
5	P-BIT2	Input	Internal program number selection combination encoding bit2					Refer to notes of Pin 17#
6	S-Out1	Output	Reserved					

7	P-BIT5	Input	Internal program number selection combination encoding bit5					Refer to notes of Pin 17#
8	S-END	Output	Internal built-in program execution end signal	Finished	24V	22V	26V	Whether program execution ends output pin
				Unfinished	0V	0V	0V	
9	P-ACT	Input	Internal built-in program start signal	Start	24V	22V	26V	Control program start pin
				Stop	0V	0V	0.7V	
10	S-OUT2	Output	Reserved					
11	P-RST	Input	Fault signal reset	Reset	24V	22V	26V	Clear fault signal
				Not reset	0V	0V	0.7V	
12	S-OUT3	Output	Reserved					
13	GND		Digital signal reference ground		0V			
14	GND		Digital signal reference ground		0V			
15	M-BIT0	Input	Work mode select encoding bit0	1	24V	2bit (PIN: 16, and 15) 00: CW Mode (C) 01: External pulse mode (P) 10: Internal PWM mode (M) 11: Internal RAMP mode (R)		
				0	0V			
16	M-BIT1	Input	Work mode select encoding bit1					Combined with Pin 15#
17	P-BIT1	Input	Internal program number selection combination encoding bit1	1	24V	5bit (PIN: 7#, 19#, 18#, 5#, and 17#) In total, there are 32 internal programs for choosing		
				0	0V			
18	P-BIT3	Input	Internal program number selection combination encoding bit3					Refer to notes of Pin 17#
19	P-BIT4	Input	Internal program number selection combination encoding bit4					Refer to notes of Pin 17#
20	GND		Digital signal reference ground		0V			
21	S-IN0	Input	Reserved					
22	P-END	Input	Stop program execution	Stop	24V	22V	26V	Stop executing the program
				Not stop	0V	0V	0.7V	

23	P-LPS	Input	Start the main power supply	Start	24V	22V	26V	immediately in case of the signal at high level
								Turn on the main power supply of the laser
				Stop	0V	0V	0.7V	Turn off the main power supply of the laser
24	24V+	Output	24V power supply for external use		24V	23.5V	24.5V	
25	IN24V+	Input	24V power supply input for internal		24V	22V	26V	

3.6 RS-232 interface

X3	Interface 3 (DB9)						
Pin	Name	Input/Output	Function	Typical	Min.	Max.	Notes
2	Transmit Data (TXD)	Output	Data output		-10V	10V	
3	Receive Data (RXD)	Input	Data input		-10V	10V	
5	GND		Reference ground	0V			
1, 4, 7-9	NC		Reserved				

3.7 Product dimensions

3.7.1 Laser
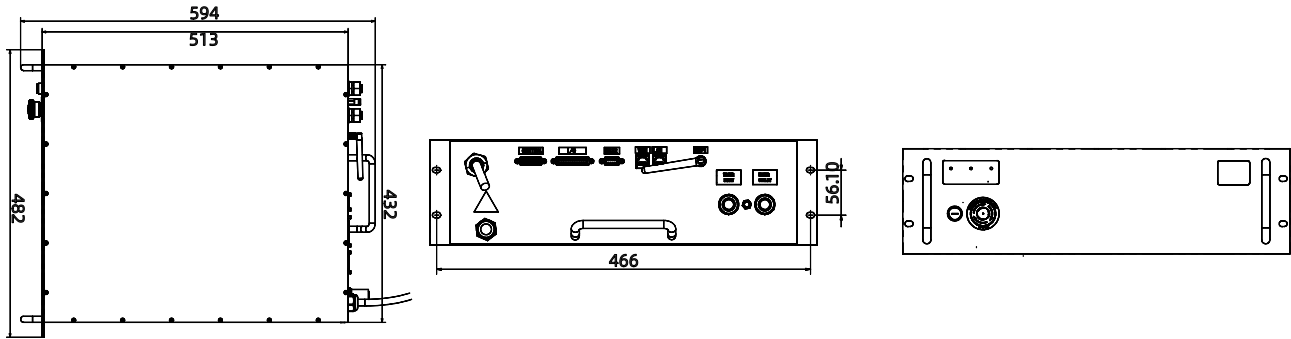
3.7.2 Optical output connector (QBH type)
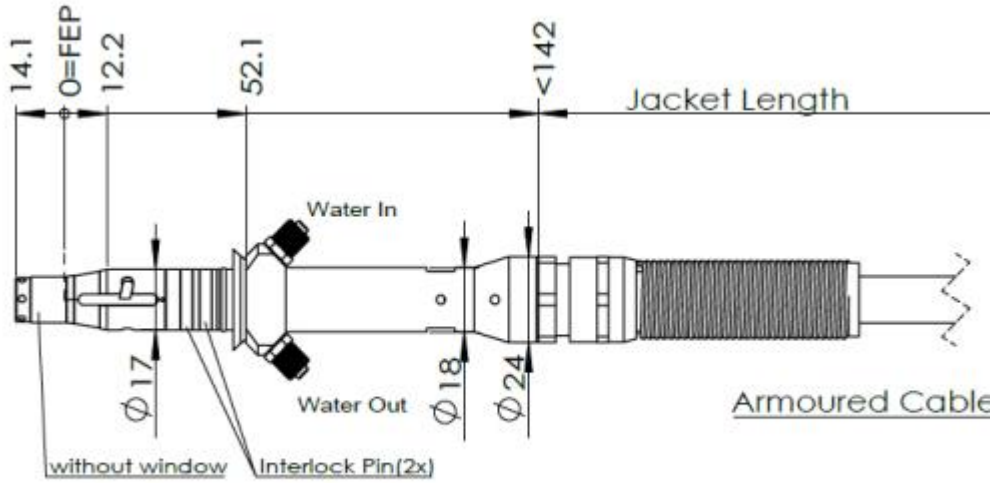
4. Preparations

4.1 Open the package

1. Check whether the container is damaged or not after receiving the product. If you find any damage caused by transport, please make a record immediately and notify the carrier and GW Laser.

2. Open the package and take out the YLPS laser as illustrated below. Pay extra attention to the optical fiber cable to avoid damage when taking out the laser.

3. Please check the laser to see if there is fiber breakage or device damage. If any, please contact GW Laser or the sales representative to send the laser back for inspection and repair. Don't try to fix it yourself. If you suspect any damage to the laser, do not attempt to install or operate the laser.

4. Please put the laser at room temperature for a few hours, and then start to operate the laser.

Step 1: Place the packed laser in the correct orientation

Top protective sponge

Step 2: Open the package and remove the protective sponge at the top

Step 3: Remove the top sponge and you will see the QBH cable as shown in the Figure. If you find any cable damage, take a photo and notify GW Laser immediately.

Step 4: Please carefully take out the QBH cable from the top sponge tray and do not remove the sponge protective film of the output connector.
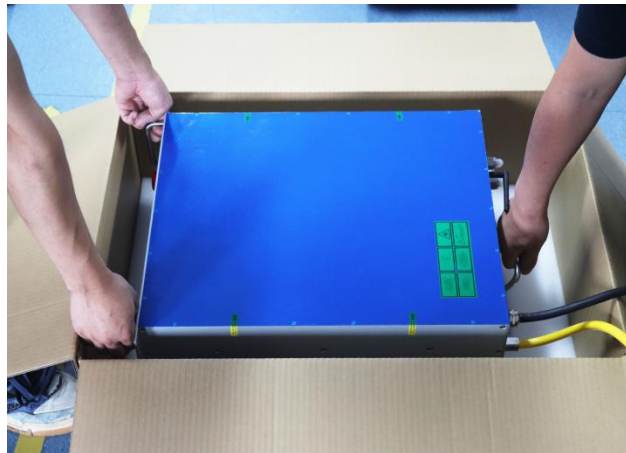
Step 5: Arrange two people to lift the laser out of the box together. As shown in the Figure, one person holds the handle of the front panel and the other person holds the handle of the rear panel to carefully lift the laser out in the correct direction.

4.2 Installation

In all installations, make sure that there is enough clearance for the back of the laser to use the rear panel.

4.3 Power Supply Connection

The power connector of the fiber laser is on the rear panel (for details about the power supply requirements, see Section 3.4). When in use, the laser must be connected to an external power supply, and its power cable must meet the regulatory requirements of the local country.

4.4 Water-cooled connection

When in use, the laser must be kept connected to an appropriate external cooling system. Its water cooling capacity should meet the corresponding parameter requirements.

Laser water cooling interface CK-3/8-16 quick connector

YLPS fiber laser water-cooled interface adopts CK-3/8-16 quick connector, which is matched with 16mm PU gas pipe;

5.   YLPS Laser Operation

5.1 Initial operation

1. Remove the protective cover of the laser output connector (QBH) and check the cleanliness of the quartz glass and QBH connector.
2.   Make sure you wear proper eye protection and protective clothing.
3.   Turn on the AC power supply connected to the YLPS fiber laser.
4.   Set the control mode and working mode of the laser.

Control method:
     Internal control: Connect the laser to the computer with the DB9 serial port cable, open the GW HMI software on the computer, and control the laser through HMI.
     External control: The laser is controlled by connecting the DB15 and DB25 connectors on the rear panel of the laser.

Working mode:
     CW mode: It is also known as continuous mode, and the output power will remain constant after this mode is selected. In the internal control mode, the constant power value is set by HMI. In the external control mode, the constant power value is controlled by the analog signal on Pin 1# of the DB15 or DB25 (0.1V = 1% and 10V = 100%).
     Modulation mode: When this mode is selected, the output power varies between IDLE (low modulated signal) and ON (high modulated signal) values. The ON value is determined by the set value of the selected working mode.

For more details on how controls and operating modes work, please refer to Section 5.2: Time Series.

5.   Make sure the interlock circuit is closed (DB15 or DB25 PIN 15# and 5#, 12#)
6.   Make sure the Laser_On signal light is off (DB15 or DB25 PIN13 input 0V)
7.   Turn on the remote key switch signal on DB25 Pin 23#. The main power supply can be started by running an external 24V voltage or short-connected PIN 24# and 23#. Wait for 5 seconds, and the driving power supply will be activated and ready to turn on the laser.
8.   The laser output is enabled by the RS-232 command or by supplying 24V voltage to the DB15 and DB25 PIN13#.
9.   It is available to check whether the laser is started through the DB25 Pin 4#.

5.2 Operation mode setting

YLPS series lasers provide different operation modes according to the selection of **control mode** and **working mode**. In internal control mode, the working mode of the laser is determined by the HMI. In external control mode, the working mode of the laser is determined by the DB25 Pin 15# and Pin 16#. For details, see Section 3.5.

Note: After the main power supply of the laser is started, the laser enable signal (Laser-ON) can be turned on only 5S later.

5.2.1 Internal control mode: "CW" working mode

Set to "Internal Control" through the HMI software on the host computer, and then select "CW" working mode. When Laser-ON is activated, the Laser output power is determined by the corresponding value set by the HMI on the host computer, and this output value can be changed at any time when the laser is emitted. When the laser is started, the ION value is equal to the IDLE power value.
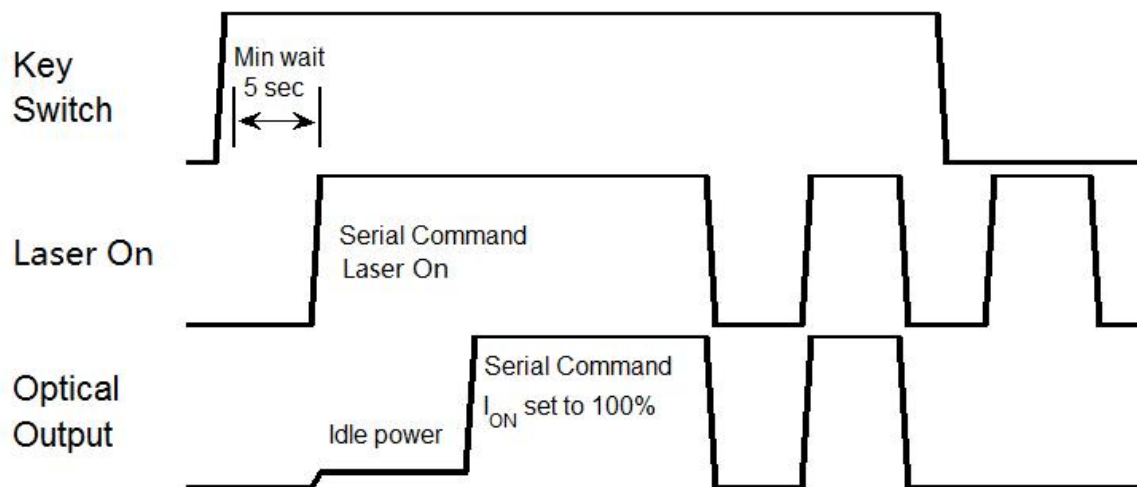
Sequence diagram of "CW" working mode in internal control mode

5.2.2   Internal control mode: "PWM" working mode

Set to "Internal Control" through the HMI software on the host computer, then select "PWM" working mode, and finally set the PWM program parameters. When the Laser-On command is activated, the output optical power is adjusted to the ION value set by the different PWM programs. When the laser is emitted, the amplitude of the output light energy in the "PWM" working mode can be changed through different PWM programs.
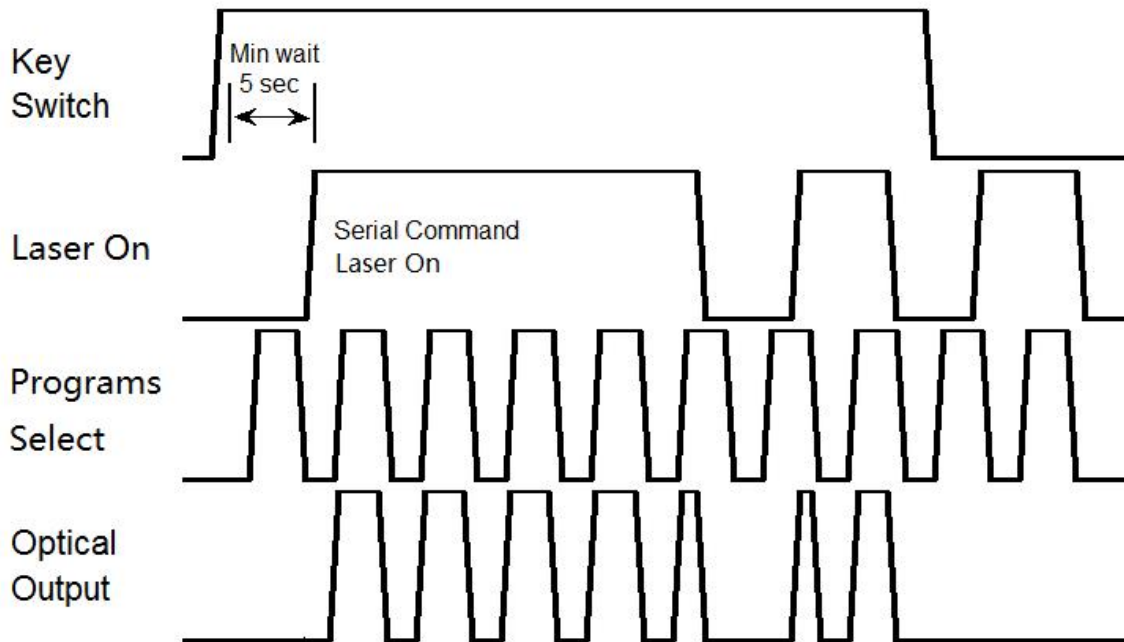
Sequence diagram of "PWM" working mode in internal control mode

5.2.3   Internal control mode, "Ramp" working mode

Set to "Internal Control" through the HMI software on the host computer, then select the "Ramp" working mode, and finally set the Ramp program parameters. When the Laser-On command is activated, the output light power is adjusted to the ION value set by the different Ramp programs. When the laser is emitted, the amplitude of the output light energy in the "Ramp" working mode can be changed through different Ramp programs.
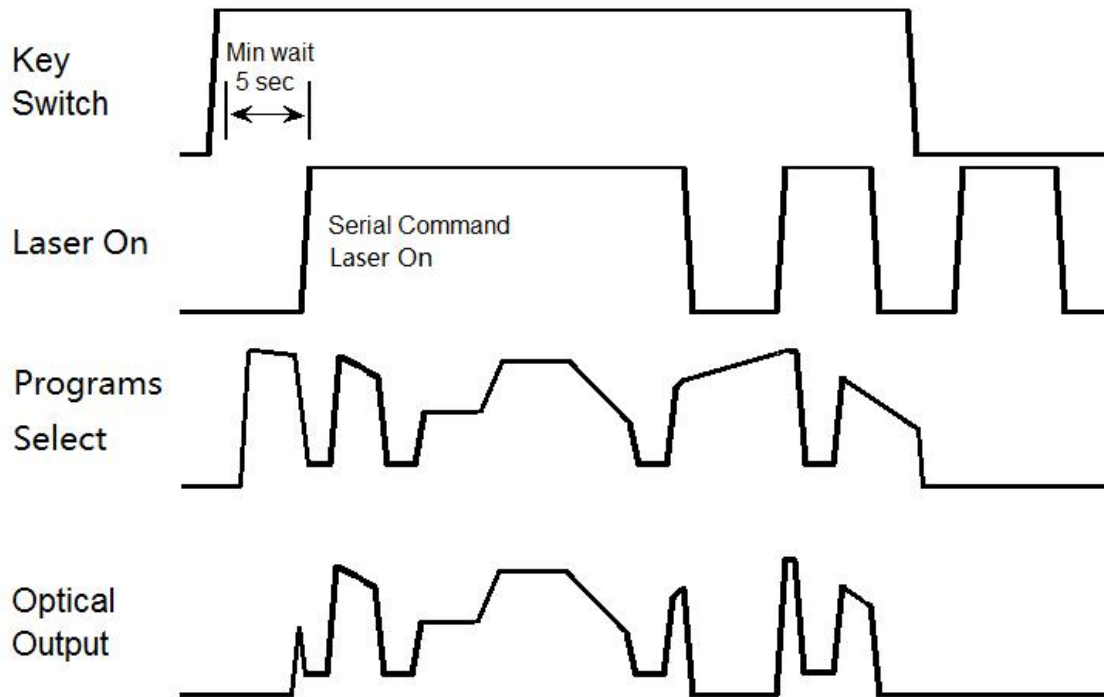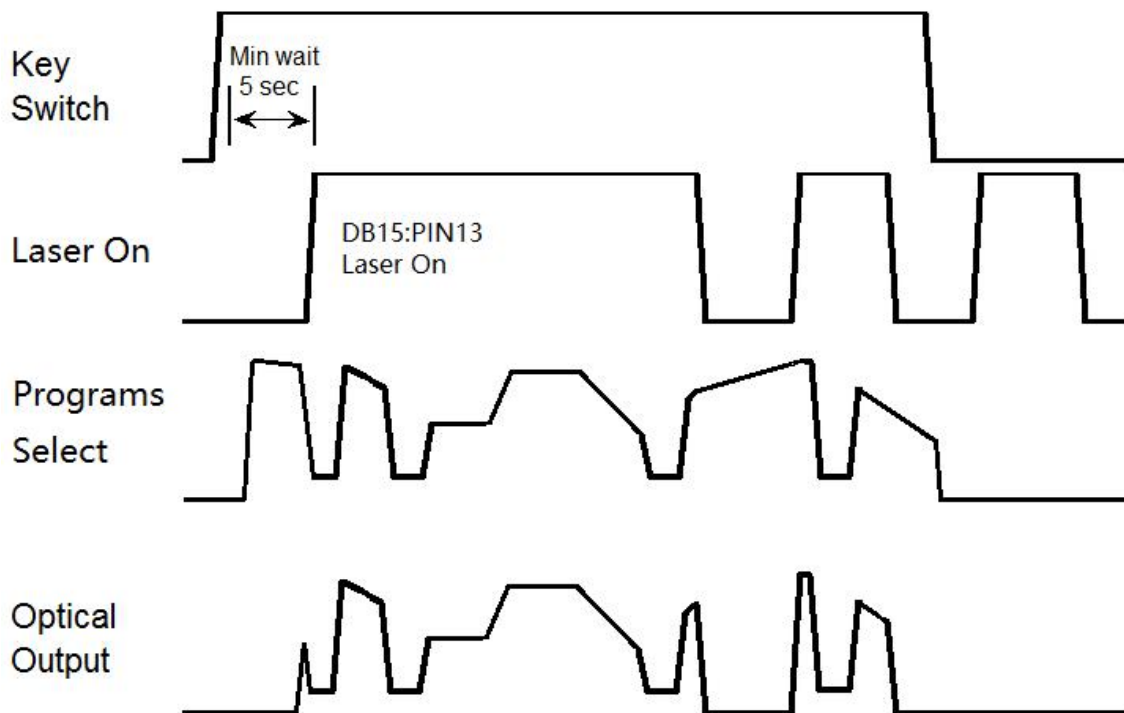

Sequence diagram of "Ramp" working mode in internal control mode

5.2.4 External control mode: "CW" working mode

The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 and PIN16 are open-circuited or grounded at the same time, the YLPS laser works in the CW mode. When the PIN13 of DB15 is connected to 24V power, the Laser-On command is activated, and the laser output power is determined by the voltage of the DB15's PIN1 analog input pin.
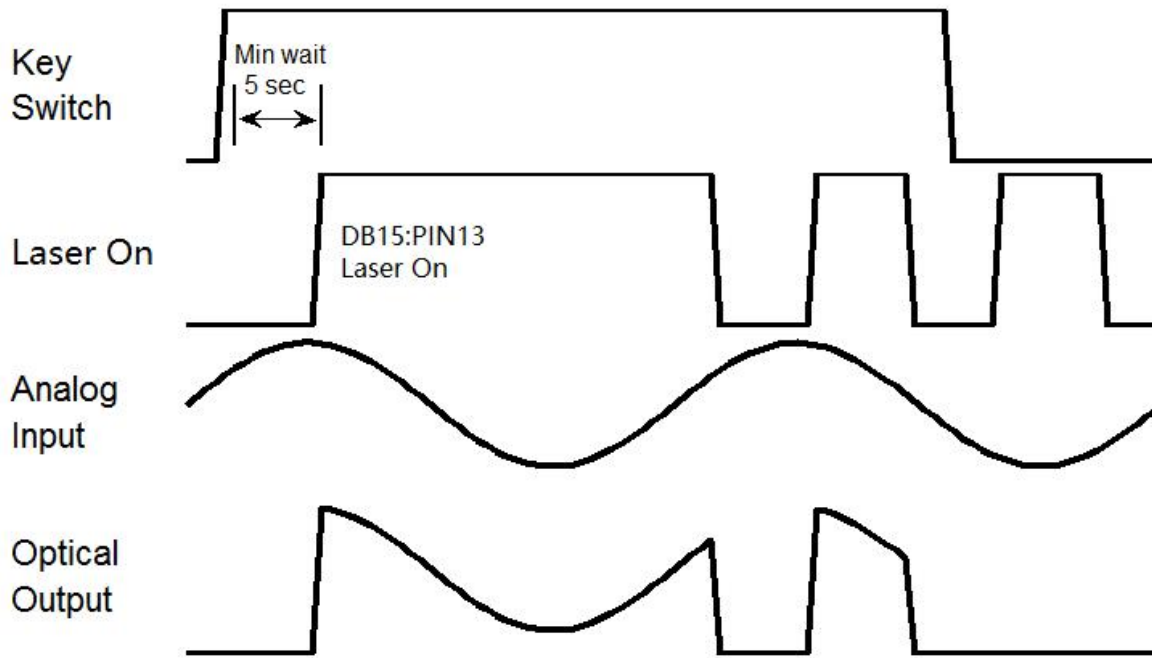
Sequence diagram of "CW" working mode in external control mode

5.2.5   External control mode, "pulse" working mode

The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 is connected to 24VDC power and the DB25 PIN16 is open-circuited or grounded, the YLPS laser operates in pulse mode. When the PIN13 of DB15 is connected to 24V power, the Laser-On command is activated, and the laser output power will be determined by the synthesizing of the voltage signal of the PIN1 analog input pin of DB15 and the pulse signal of the PIN14 of DB15.
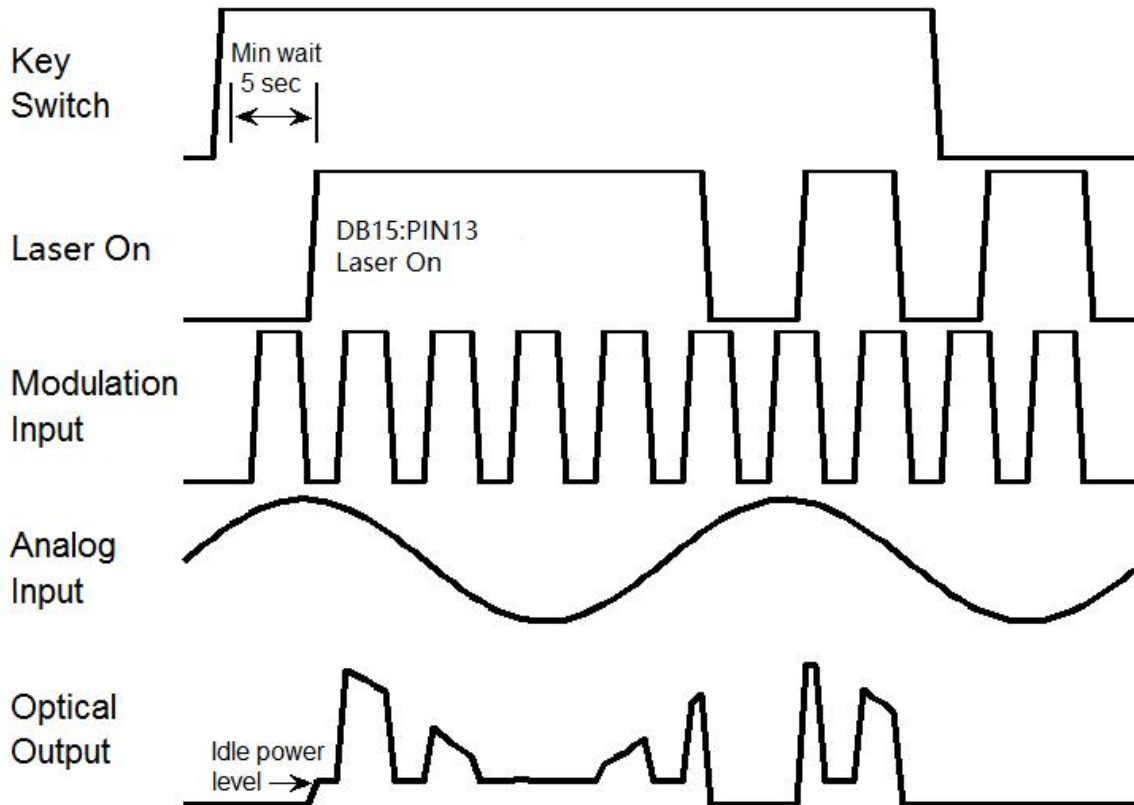
Sequence diagram of pulse working mode in external control mode

5.2.6 External control mode: "PWM" working mode

The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 is open-circuited or grounded and the PIN16 is connected to 24VDC power, the YLPS laser operates in "PWM" mode. When the PIN13 of DB15 is connected to 24V power, the Laser-On command is activated, and the laser output power will be determined by the internally-set PWM program signal. The internal PWM program can be set up to 32 types, and the program number of PWM to be used can be selected through the PIN 7#, 19#, 18#, 5#, and 17# of DB25. Please refer to the DB25 pin illustration.
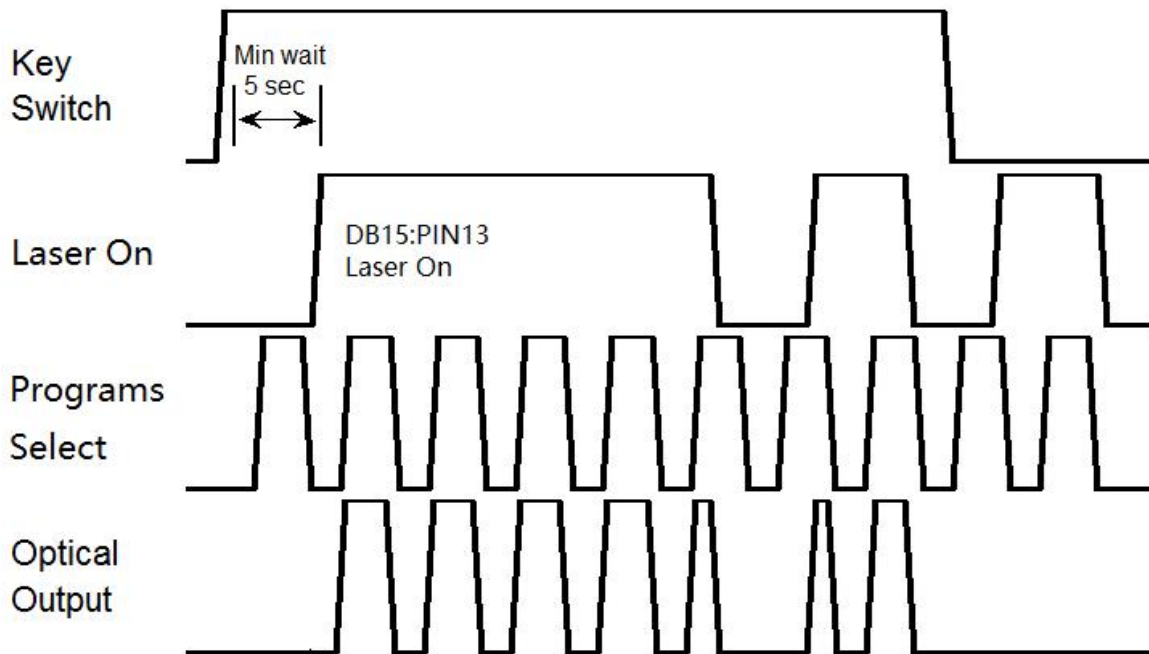
Sequence diagram of "PWM" working mode in external control mode

5.2.7 External control mode, "Ramp" working mode

The laser is in external control mode by default. You can switch between internal control and external control by using the HMI. When both the PIN16 and PIN15 of DB25 are connected to 24VDC power, the YLPS laser operates in the "Ramp" mode. When the PIN13 of DB15 is connected to 24V power, the Laser-On command is activated, and the laser output power will be determined by the internally-set Ramp program signal. The internal Ramp program can be set up to 32 types, and the program number of Ramp to be used can be selected through the PIN 7#, 19#, 18#, 5#, and 17# of DB25. Please refer to the DB25 pin illustration.

Sequence diagram of "Ramp" working mode in external control mode

5.3 Red guide laser use

The red guide laser is used only when the Laser_On signal is turned off. The red guide laser can be activated by connecting the Pin 6 of DB25 to the 24V power or by transmitting the guide laser activation command via RS-232. The red guide laser status can be obtained through the HMI interface or through the RS-232 command. The red guide laser will remain on until the guide laser activation signal is turned off. If the Laser-On command is activated, the red guide laser is automatically turned off.

6.   SMAT Laser Human-Machine Interface
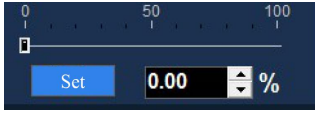## 6.1 Introduction to the man-machine interface
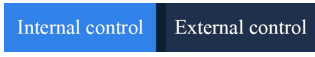
GW Laser provides the human machine interface (HMI) applications for controlling and monitoring the operation of YLPS lasers. Get the latest version of HMI program for YLPS laser control, easily install it on your computer, then double-click "GW_HMI_V5.6_ Single module 20220820" to start the program.

GW_HMI_...
Single module
202...

When the program is started, the user needs to select the appropriate serial port by clicking the "Settings" control button. The HMI will automatically establish communication. If the HMI cannot establish communication with the YLPS laser, the HMI will display a "Communication Fault" error and the user will not be able to operate the YLPS laser.
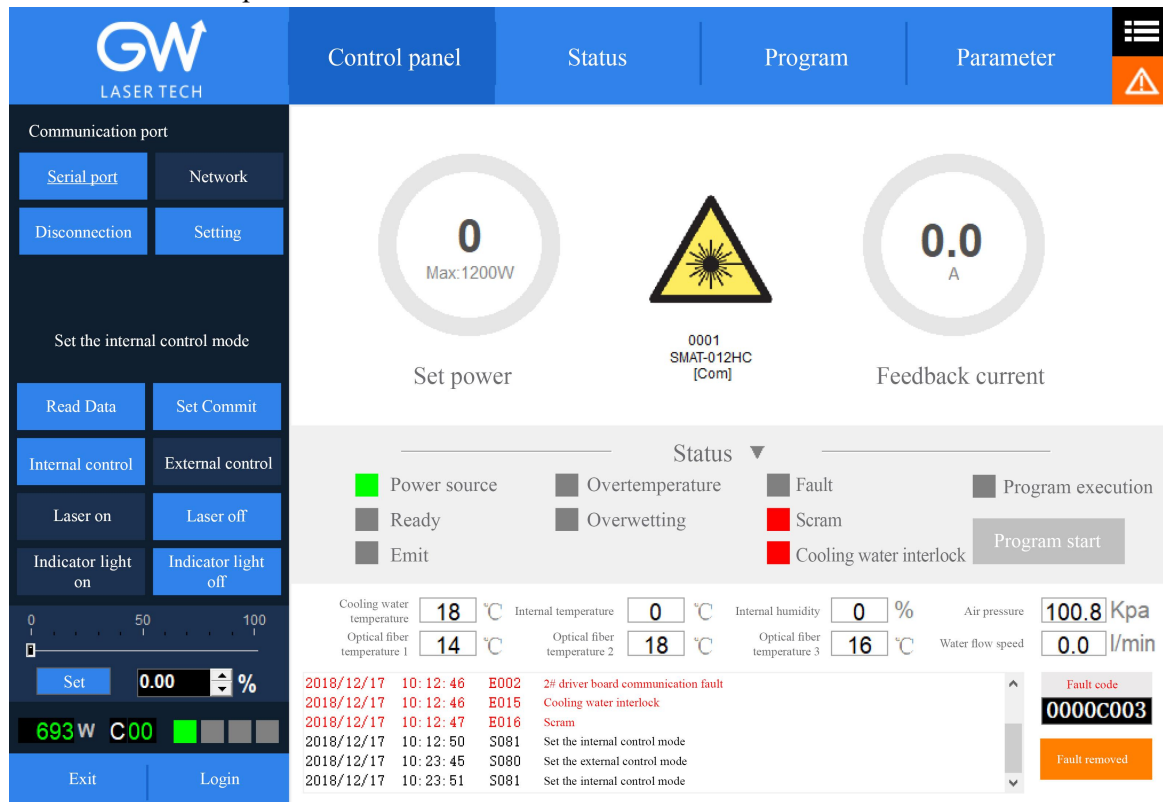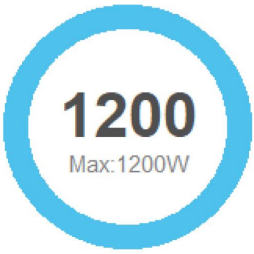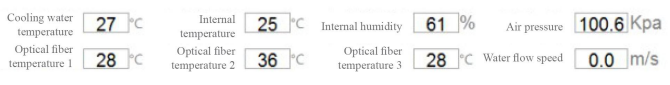
After the communication is established, the default interface is of "Control Panel", which will display all the information of YLPS, such as the temperature of YLPS laser at different po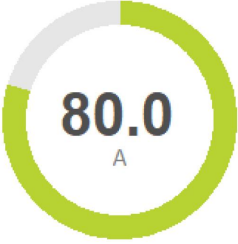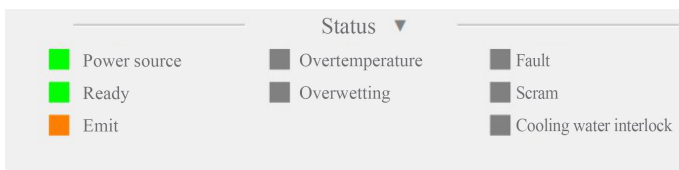sitions and the different laser status indicators: "Power", "Ready", "Emit", "Overtemperature", "Super-wet", "Fault", "Emergency stop", and "Cold water interlock". Users can operate the laser by clicking the "Login" button at the bottom of the HMI and entering the correct user name (user) and password (000000). Different users can operate different parameters of the YLPS laser. Before activating the key switch signal, the user can click the "internal control" or "external control" button to change the operation mode.

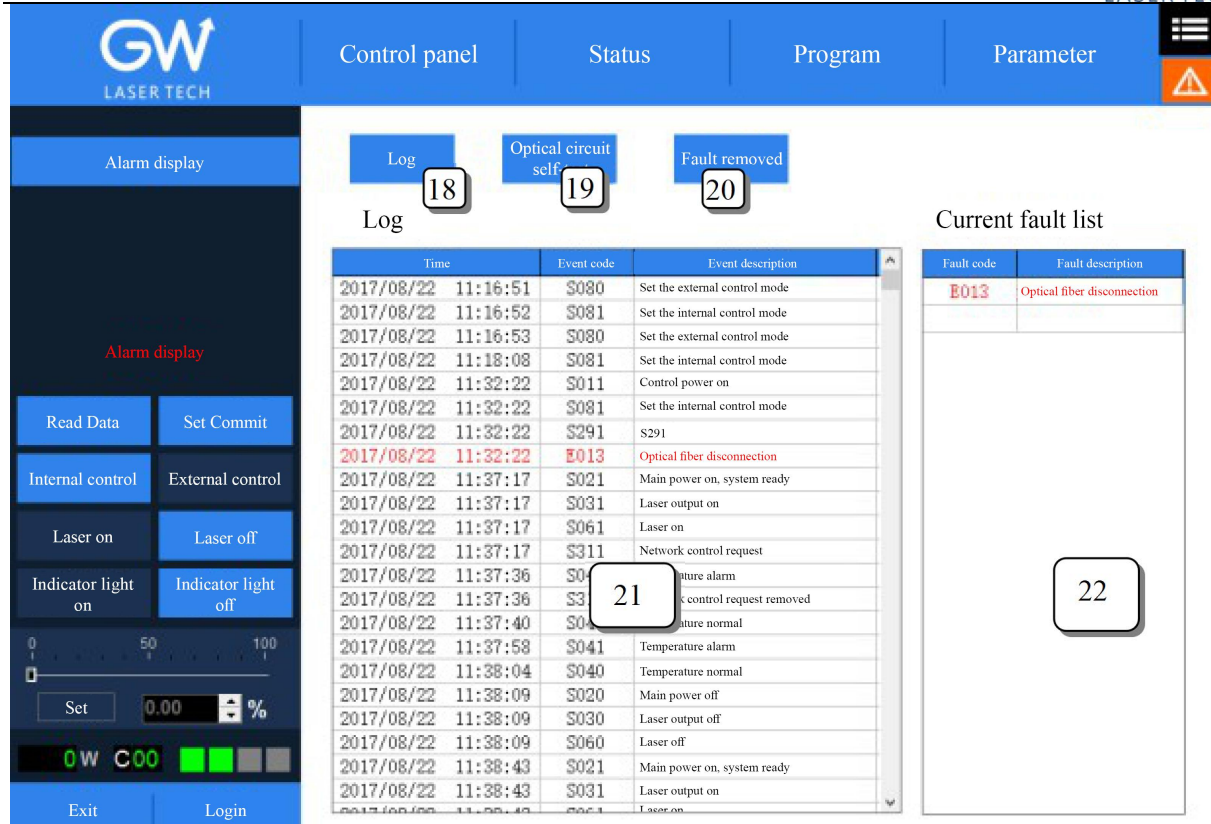| S/N	Button/indicator	Description
1	Serial port Network	Communication mode selection: Select the communication mode for establishing the connection with the YLPS laser.
2	Disconnection	Disconnect the communication with the YLPS laser.
3	Setting	Parameter setting of the communication port
4	Read Data Set Commit	In the internal control mode, "Read Data" and "Set Commit" are enabled. In the external control mode, "Read Data" and "Set Commit" are disabled. When "Read Data" is available, the button will be in blue and the HMI will start collecting the various states of the laser and display them on the HMI. Users can click the "Read Data" button to turn off the "Read data" function and stop data collection. When "Set Commit" is available, the button will be in blue and the HMI transmits the laser output power percentage value set by the user to the YLPS laser
5	Internal control External control	The user can select the control mode of YLPS laser (internal control or external control) by pressing the button. When activated, the corresponding button turns blue.
6	Laser on Laser off	In the internal control mode, the user can turn the laser on or off by clicking the "Laser On" or "Laser Off" button. When activated, the corresponding button turns blue.
7	Indicator light on Indicator light off	In the internal control mode, the user can turn on or off the red guide light by clicking the "Indicator light on" or "Indicator light off" button. When activated, the corresponding button turns blue.
8	0 50 100 Set 0.00 %	In the internal control mode, if the button is set as blue, the laser output power can be changed by entering the specified value in the power setting box or adjusting the key on the vertical slider. Users can turn this function off by clicking the "Settings" button. If the setting button is turned off, the power setting will be locked.
9	⚠	This label lights up when an error event occurs.
10	Login	Click the login button to open the user login interface.
11	Exit	Click the button to exit HMI. Before exiting the application program, you must disconnect the communication connection and then press the exit button.

When the laser is activated, the laser indicator will light up. In the internal control mode, when the laser is running, the output energy can also be adjusted by changing the set percentage value.
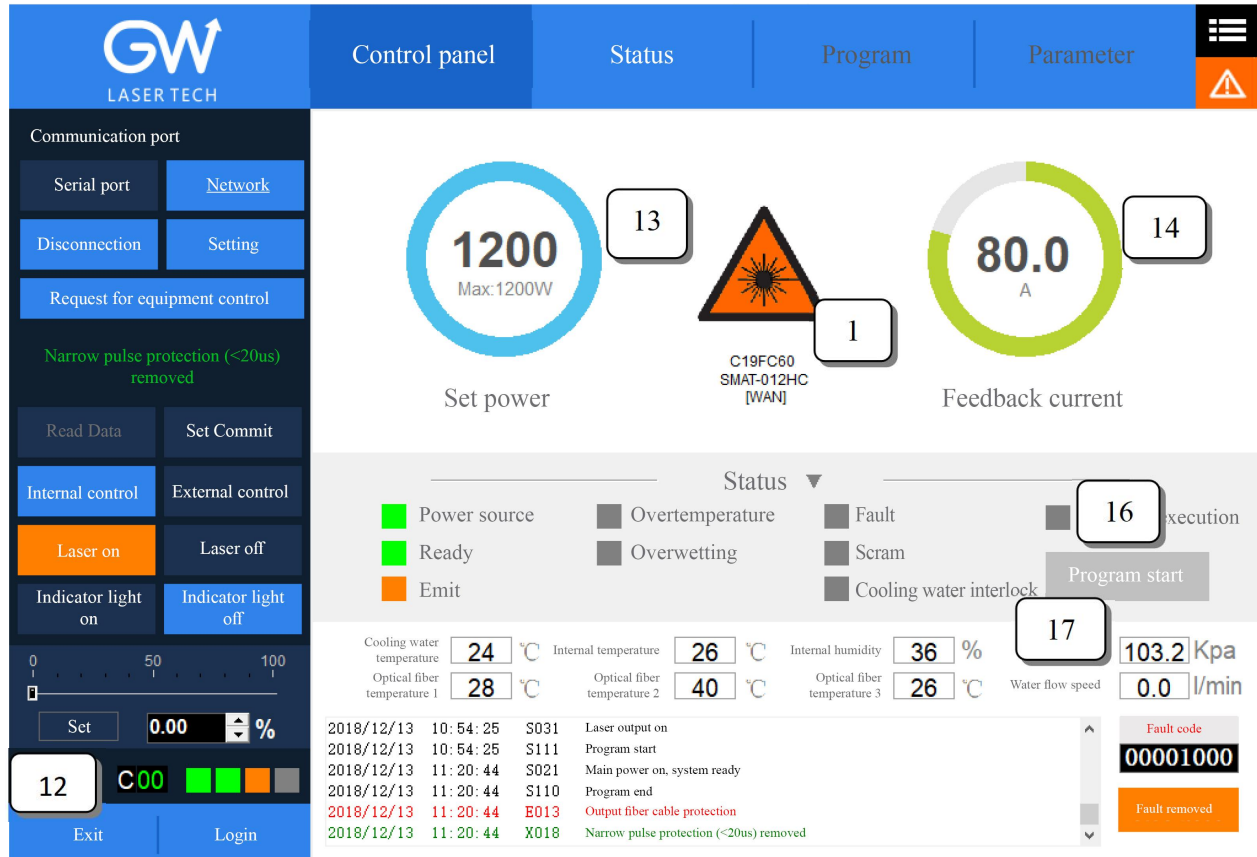
The YLPS HMI will continuously read the internally-set monitor information and display the laser information on the HMI interface in real time.

	Indicator	Description
12	**C 00** ■■■■	Display the current operation mode Status display: 1st: Power on 2nd: Laser ready 3rd: Laser turned on 4th: Alarm
13	**1200** Max:1200W Set power	Internal control mode: Read the vertical slider or manually input power values. External control mode: Read the analog input control voltage value of the DB25 Pin1
14	**80.0** A Feedback current	Read the internal [12] current feedback value
15	⚠	Laser labels are used to indicate whether the laser is emitting and warn the user of possible potential hazards,
16	Status ▼ ■ Power source ■ Overtemperature ■ Fault ■ Ready ■ Overwetting ■ Scram ■ Emit ■ Cooling water interlock	Display the various states monitored by the YLPS laser
17	Cooling water temperature **27** °C Internal temperature **25** °C Internal humidity **61** % Air pressure **100.6** Kpa Optical fiber temperature 1 **28** °C Optical fiber temperature 2 **36** °C Optical fiber temperature 3 **28** °C Water flow speed **0.0** m/s	Read the current temperature and humidity monitor value

When an error event occurs, the internal control card in the YLPS laser stores the error information in memory. The YLPS laser also has the function of counting all error messages. The user can get status records. Clearing the status record does not affect the information recorded by the error counter.

	Button/indicator	Description
18	Log	Press this button, and the HMI will download the status log.
19	Optical circuit self-test	In any case, the user can run the self-test program by pressing this button.
20	Fault removed	Press this button, and the user will reset the general error.
21	Log (event table)	Black: Indicate the execution status of the controller. Red: Indicate the error status of the controller. Green: Indicate that the error status is cleared
22	2017/08/23 16:33:50 E002 2# driver board communication fault	Read the current error message

6.2 Man-machine interface LAN remote control

6.2.1. Ensure that the laser that needs to be controlled remotely and the remote computer have been connected to the same LAN, and for the laser LAN connection method, please refer to GW laser network connection setting manual.

6.2.2. Connect the laser to the local computer with the serial port cable through the DB9 port or with the network cable through the LAN port, open the HMI software on the computer, and connect the laser.

6.2.3. Open the HMI software on the remote computer and enable the user login. The user name is "user" and the password is 000000. The login interface is as shown in the Figure below.
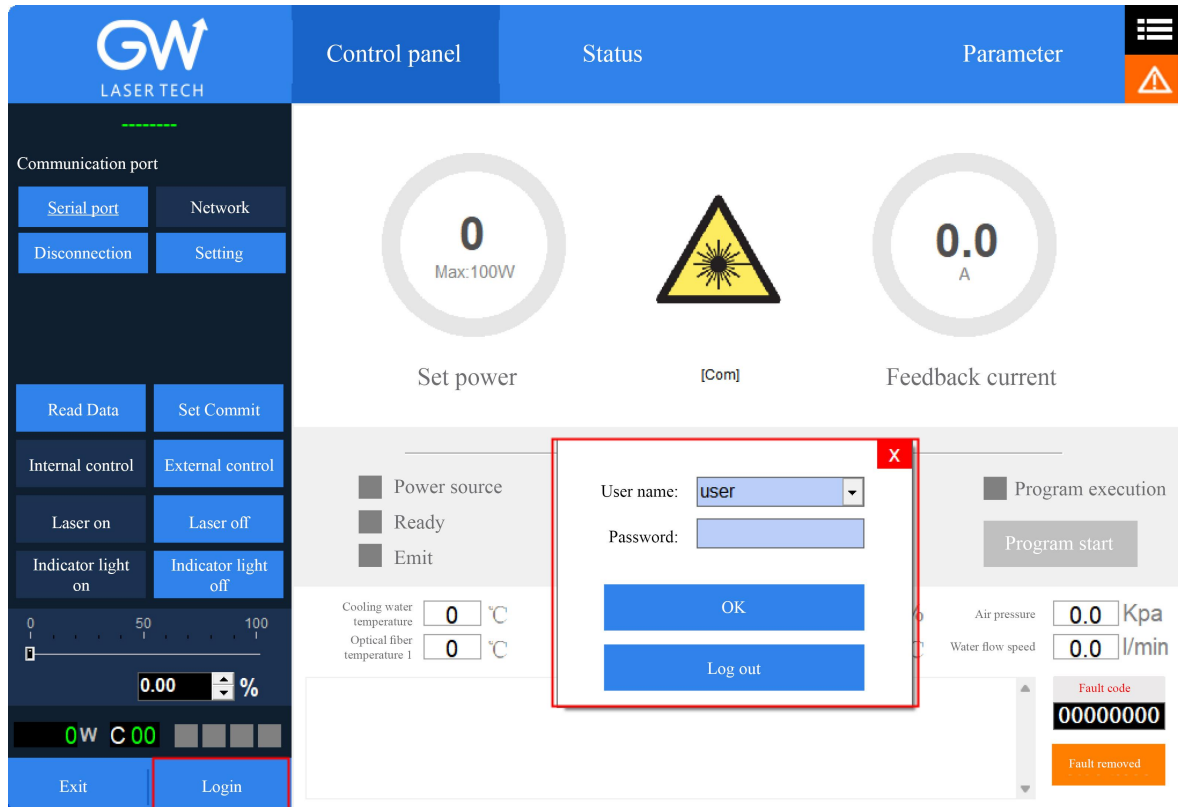
6.2.4. Click "Settings" to pop up the following interface
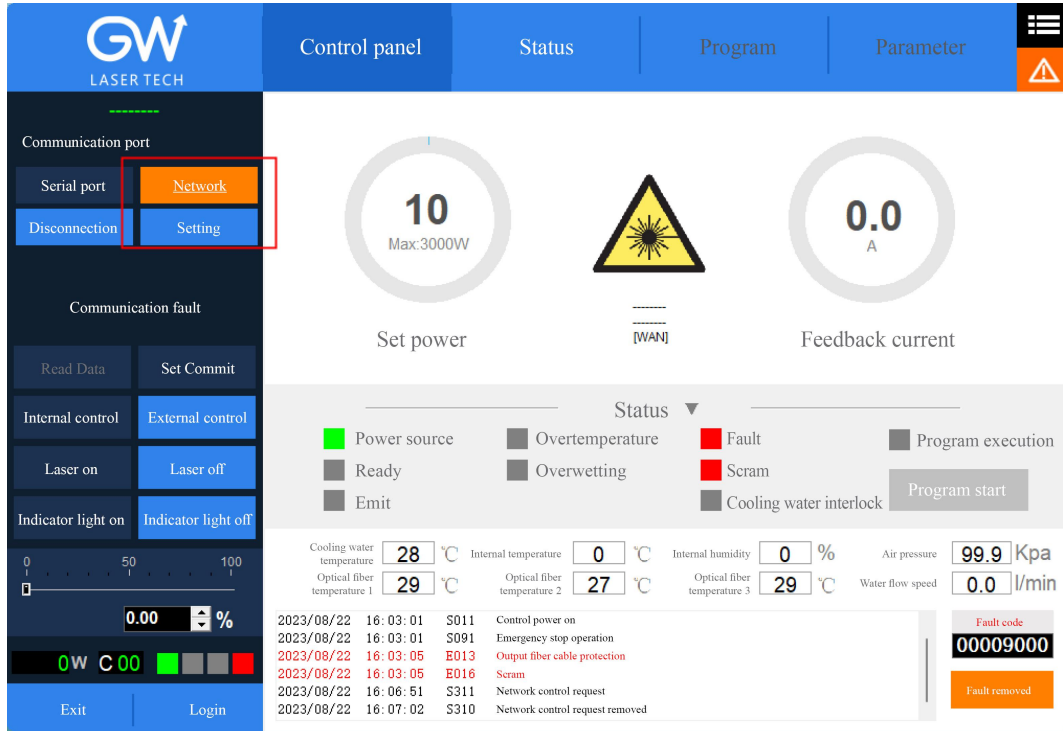
6.2.5. Select "LAN", click "OK", then click "Scan Device", select the Device Serial Number, and right click the Connect Device
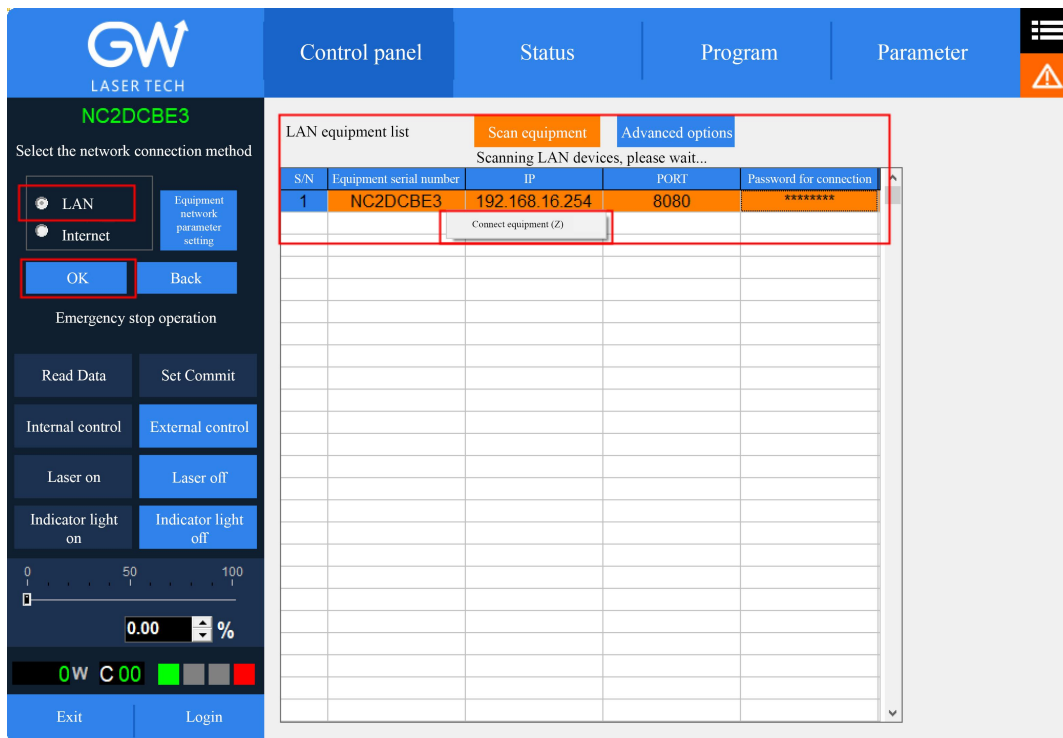
6.2.6. After successful connection, the interface is as shown in the following Figure:
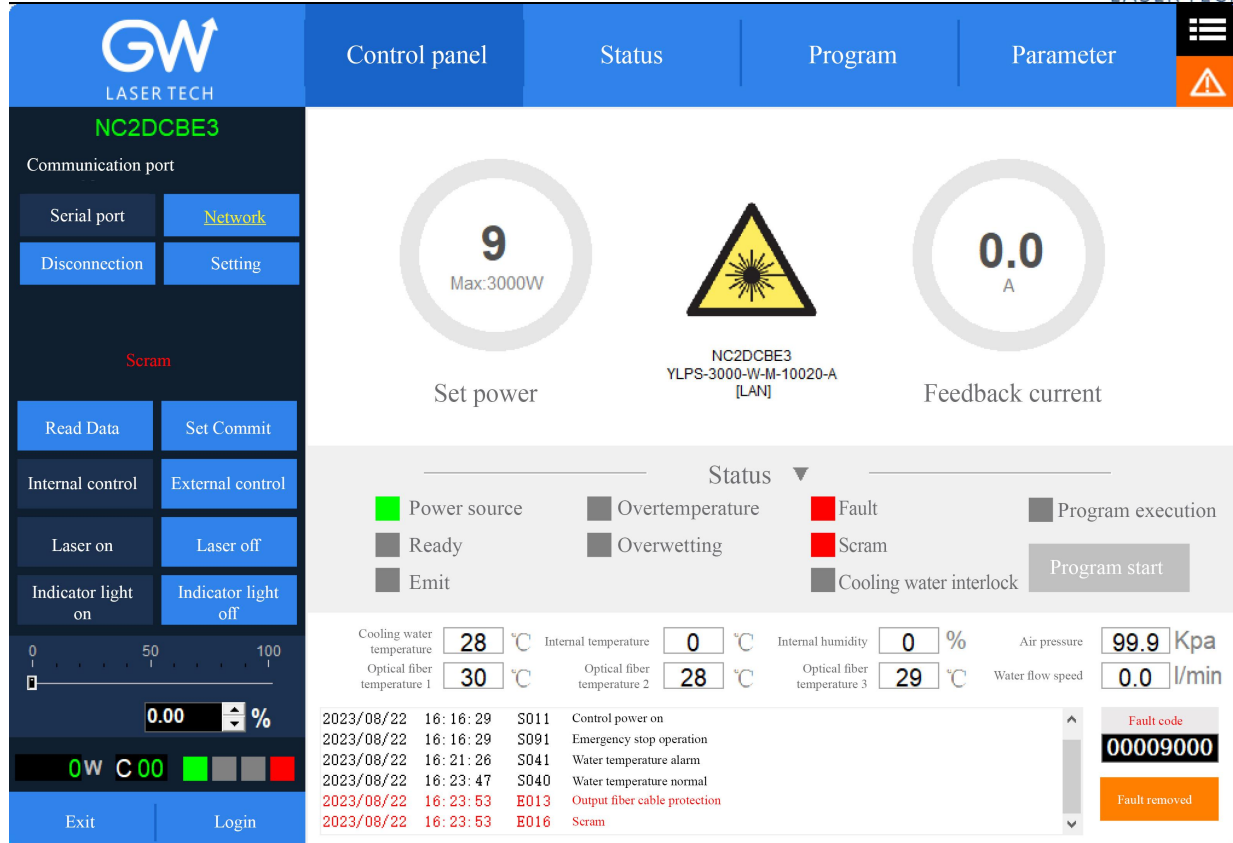
6.3. RS232 serial port connection method

6.3.1. Obtain and install the RS232 serial port cable driver
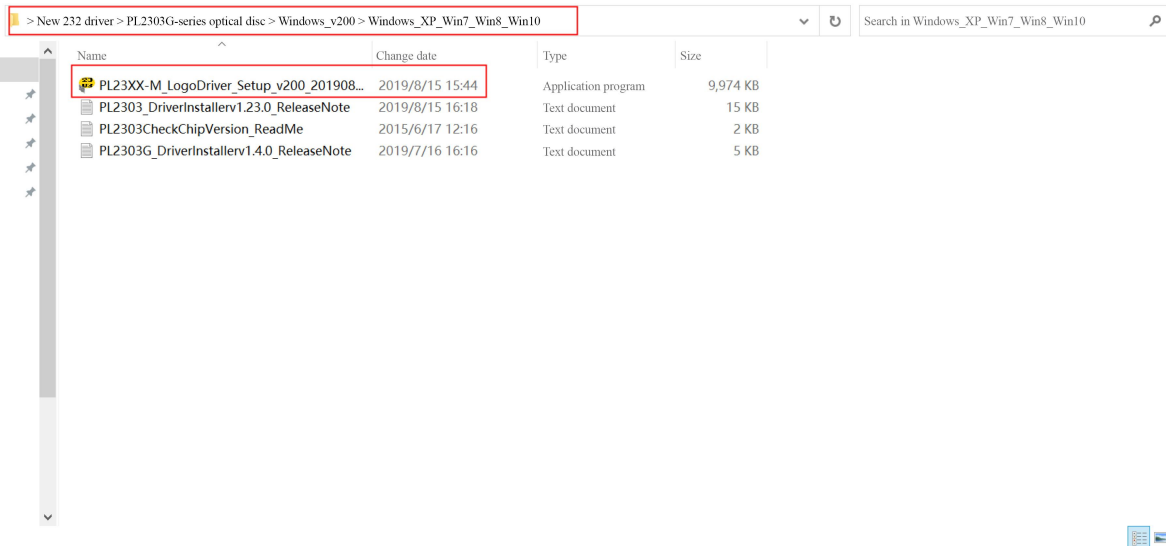
6.3.2. Query the port number of the RS232 serial port cable on the PC side: Select "This computer" and right click "Manage".

Turn on (O)

Add to zip file (A)...

Add to "This computer - Shortcut.zip" (T)

Other compression commands   >

Use ESET Endpoint Antivirus for scanning

Advanced options   >

Open folder location (I)

Fix to quick access

Management (G)

Fix to "Start" screen (P)

Map network driver (N)...

Disconnect the network driver (C)...

Restore to previous version (V)

Send to (N)   >

Cut (T)

Copy (C)

Create shortcuts (S)

Delete (D)

Rename (M)

Attribute (R)

Click "Device Management" and click "Port" to confirm the RS232 port number
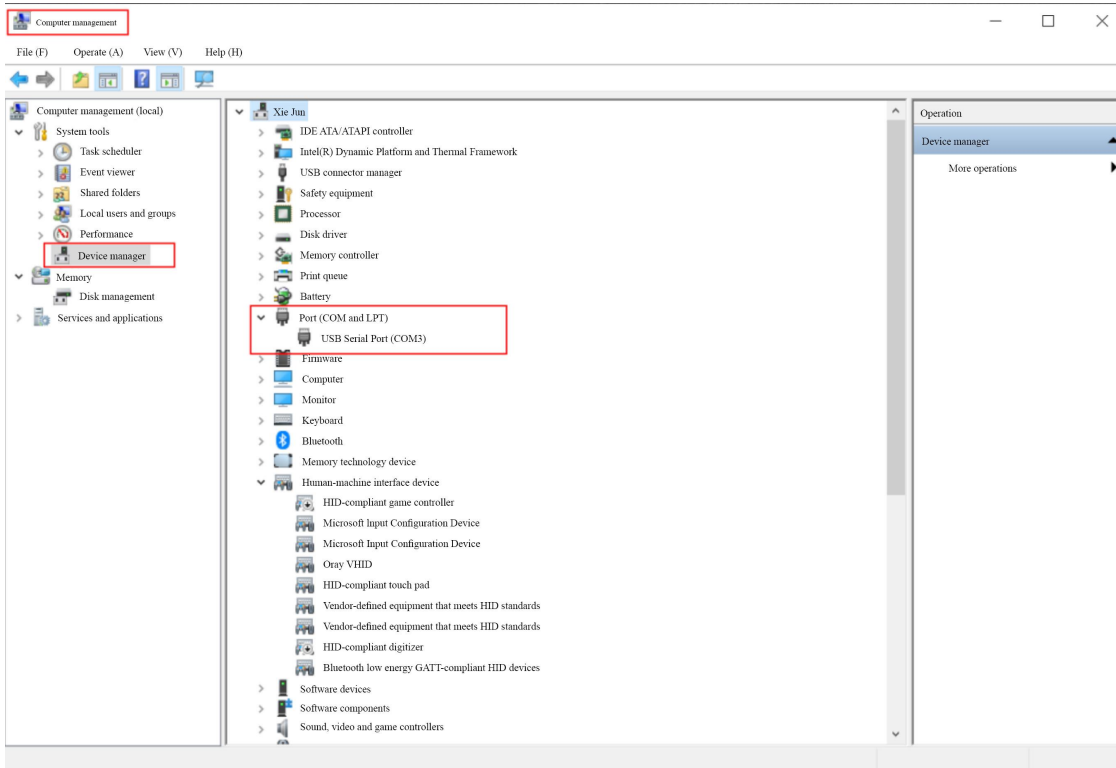
6.3.3. Double click to start HIM_SJ_V5.8_20230505B
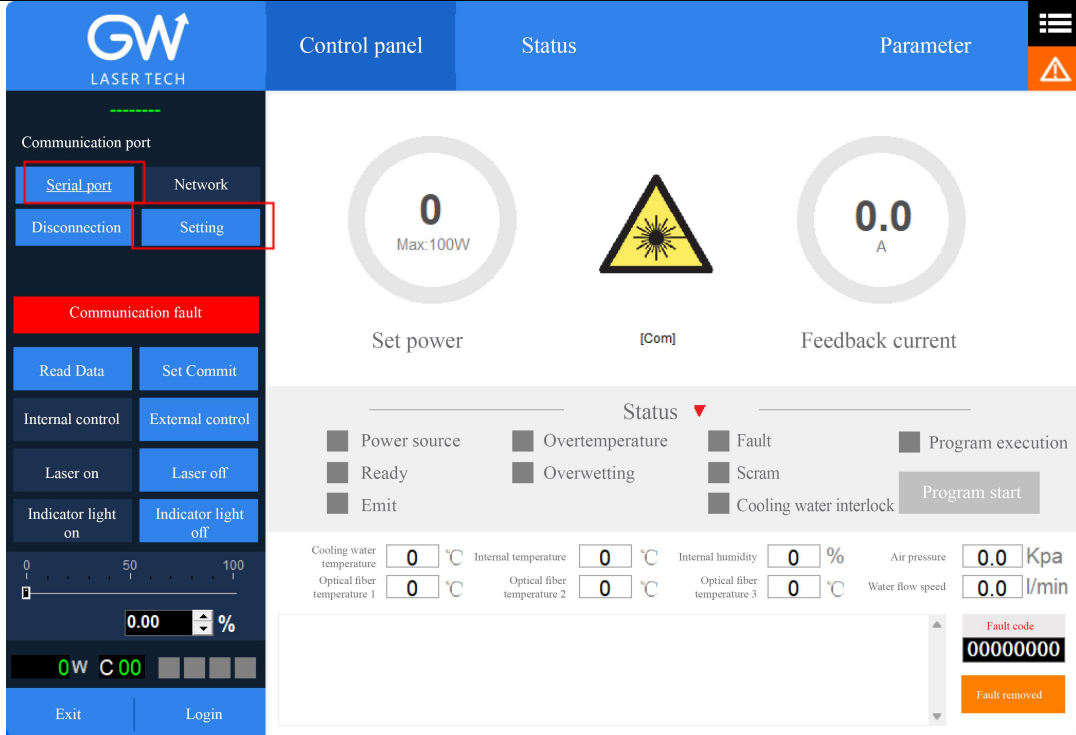
6.3.4. Enter the inquired port number of RS232 and click "OK".

The following interface is displayed when the connection is successful:

6.4. Hotspot connection mode

6.4.1. Connection mode for IOS version

Open the phone Settings → General → About this machine → Change the name to "GW_01"

Back to Settings → Personal Hotspot → Allow others to join → WLAN password changed to "gw39721122"
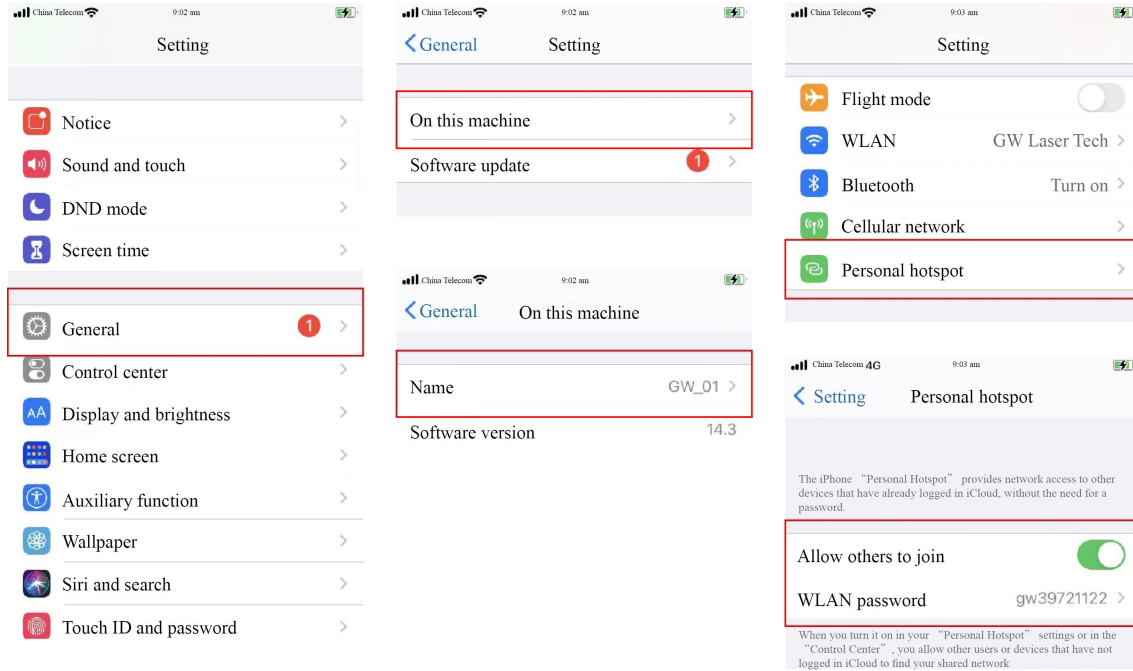
6.4.2. Connection method for Android version

Open Personal Hotspot → Portable WLAN hotspot → Network name GW_01→ Password gw39721122→AP band at 2.4GHz
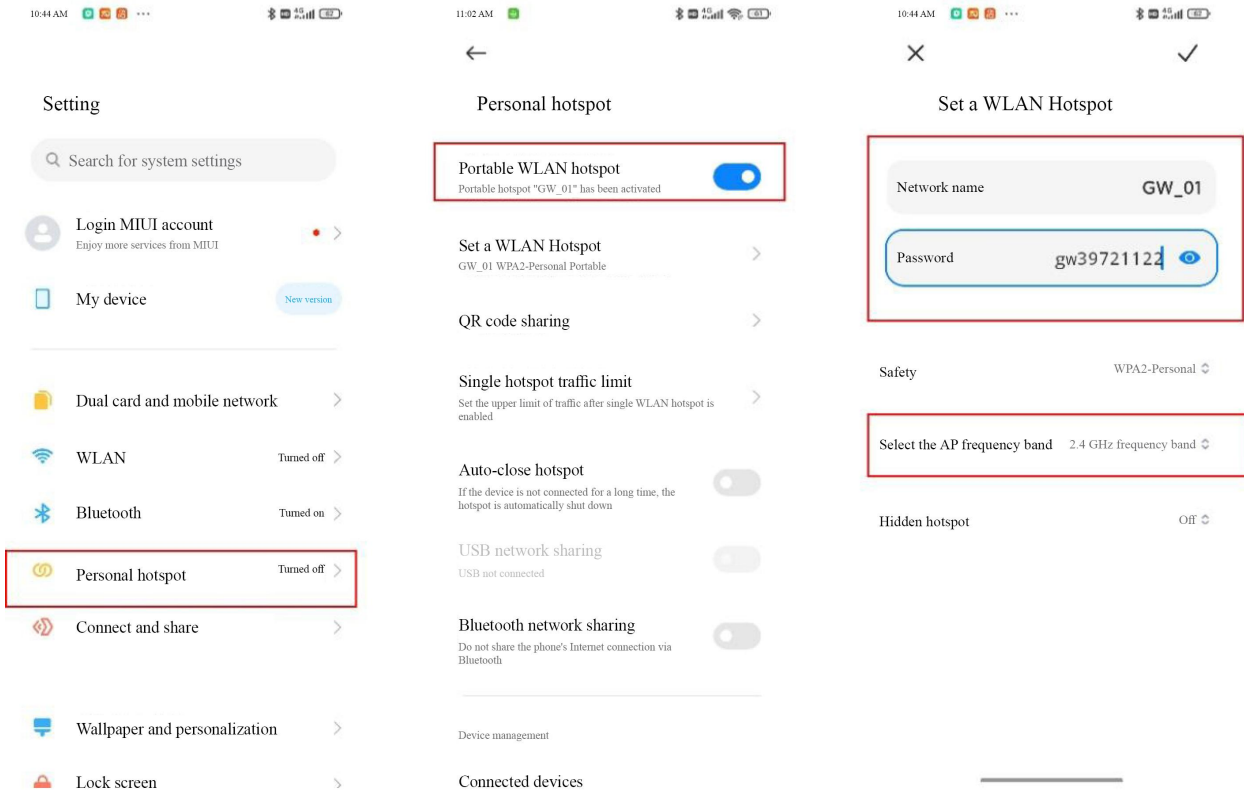
7.   Maintenance/Troubleshooting

7.1 Clean QBH quartz block

Warning:

Before cleaning the quartz block, make sure that the emergency stop button is pressed down and all lasers are disconnected from power supplies.

1. Take off the protective cover.
2. Carefully remove protective casing.
3. Check whether the quartz block is subject to any contamination. If the quartz block is contaminated by any residual debris, it must be cleaned before operating the laser.
4. For best results, clean with a soft lens cleaning paper and isopropyl alcohol.
5. Place the lens paper on the top of the quartz block.
6. Put a drop of isopropyl alcohol on the lens paper at the top of the quartz block. Move the paper horizontally until the lens dries.
7. Check visually if the quartz block is clean. If the lens is not clean, repeat the steps to clean the lens. Make sure there are no dust or other particles or traces of isopropyl alcohol on the surface of the quartz block.
8. Reinstall the protective cover.

The protective cap of the cable connector is for protection purposes only and cannot be used as an aperture. When using the laser, the temperature of the protective cap will rise if the protective cap is not removed, which will cause damage to the laser, and result in personal safety risks as well.

7.2 Error message and troubleshooting

Alarm information	Description	Correction method
1# driver board communication error	Communication error between #1 driver board and control board	Please contact GW Laser for customer support
2# driver board communication fault	Communication error between #2 driver board and control board	Please contact GW Laser for customer support
3# driver board communication error	Communication error between #3 driver board and control board	Please contact GW Laser for customer support
#1 AD board communication error	Communication error between #1 AD board and control board	Please contact GW Laser for customer support
#2 AD board communication error	Communication error between #2 AD board and control board	Please contact GW Laser for customer support
Diode module overtemperature	Some laser diodes overheat	First check whether there is any fault in the water cooling system, and check whether the coolant pressure is normal. Then check the coolant temperature, and if the problem persists, please contact GW Laser for customer support.
Driver module overheat	Some MOSFETs (s) overheat	First check whether there is any fault in the water cooling system, and check whether the coolant pressure is normal. Then check the coolant temperature, and if the problem persists, please contact GW Laser for customer support.
Water temperature overranging	The water-cooling liquid overtemperature	First check whether there is any fault in the water cooling system, and check whether the coolant pressure is normal. Then check the coolant temperature, and if the problem persists, please contact GW Laser for customer support.
Optical fiber temperature exceeds the upper limit	The optical fiber tray is detected over-temperature.	First check whether there is any fault in the water cooling system, and check whether the coolant pressure is normal. Then check the coolant temperature, and if the problem persists, please contact GW Laser for customer support.
Laser reflection energy exceeds the upper limit	For the YLPS laser detection, the emitted laser exceeds the threshold.	First clean the collimator and cutting head, and then run a self-test program for a full YLPS laser inspection. If the problem persists, please contact GW Laser for customer support.
Laser output energy exceeds the lower limit	The detected laser output power is lower than the expected value.	Run the self-test program for a full YLPS laser inspection. If the problem persists, please contact GW Laser for customer support.
Diode short-circuit fault	Laser diode short circuit	Please contact GW Laser for customer support.

Optical fiber disconnection	Fiber optic sensor detects fiber rupture	First, run the self-test program for comprehensive inspection of YLPS laser. If the problem persists, please contact GW Laser for customer support.
The internal humidity exceeds the upper limit	The humidity sensor detects overhigh humidity.	First check the ambient humidity, and then run the self-test program for a full YLPS laser inspection. If the problem persists, please contact GW Laser for customer support.
Cold water interlock	Water cooling system interlock is triggered.	If the water cooling system is interlocked and connected to the YLPS laser, check whether there is any error message for the water cooling system. If the problem persists, please contact GW Laser for customer support.
Scram	The emergency stop error is triggered	The emergency stop button is pressed. If the problem persists after the emergency stop button is released, please contact GW Laser for customer support.

8.   Warranty

8.1 General warranty

a)   GW Laser guarantees that after the product is shipped, GW Laser does not have any liens and encumbrances on the product.

b)   Unless otherwise stated by GW (Shanghai) Laser Technology Co., Ltd., GW Laser 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 Laser, GW Laser 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 Laser 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 Laser; 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 Laser 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 Laser 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 Laser to customers will not affect the warranty terms provided by GW Laser.**

8.2 Service and Repair

CAUTION: There are no built-in spare parts for user to maintain. All repairs should be carried out by the personnel from GW Laser. 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.
IMPORTANT: The user should properly save the software log file to facilitate the fault analysis of GW Laser maintenance personnel.

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.

9. System Status Code Query Form

9.1 The status code corresponds to the characters displayed on the interface

S/N	Code name	Interface character
1	S010	Control power off
2	S011	Control power on
3	S020	Main power off
4	S021	Main power on, system ready
5	S030	Laser output off
6	S031	Laser output on
7	S040	Water temperature normal
8	S041	Water temperature alarm
9	S050	Fault removed
10	S051	Fault indication
11	S060	Laser off
12	S061	Laser on
13	S070	Positioning off
14	S071	Positioning on
15	S080	Set the external control mode
16	S081	Set the internal control mode
17	S090	Emergency stop operation removed
18	S091	Emergency stop operation
19	S100	Cold water interlocking normal
20	S101	Cold water interlocking fault
21	S110	Program end
22	S111	Program start
23	S120	Internal humidity normal

24	S121	Internal humidity alarm
25	S130	Clear QCW mode
26	S131	Set QCW mode
27	S140	Fiber temperature normal
28	S141	Fiber temperature alarm
29	S150	Driver module temperature normal
30	S151	Driver module temperature alarm
31	S160	Diode temperature normal
32	S161	Diode temperature alarm
33	S170	Internal temperature normal
34	S171	Internal temperature alarm
59	S300	Network master control removed
60	S301	Network master control obtained
61	S310	Network control request removed
62	S311	Network control request

9.2 Fault codes correspond to characters displayed on the interface

S/N	Fault codes BIT31 to BIT0	Status	Internal code name	Interface character
1	BIT0	0	X001	1# driver board communication fault removed
2		1	E001	1# driver board communication error
3	BIT1	0	X002	2# driver board communication fault removed
4		1	E002	2# driver board communication fault
5	BIT2	0	X003	3# driver board communication fault removed
6		1	E003	3# driver board communication error
7	BIT3	0	X004	4# driver board communication fault removed
8		1	E004	4# driver board communication error
9	BIT4	0	X005	AD board communication fault removed
10		1	E005	AD board communication error
11	BIT5	0	X006	Diode module overtemperature
12		1	E006	Diode module overtemperature
13	BIT6	0	X007	Driver module overtemperature removed
14		1	E007	Driver module overheat
15	BIT7	0	X008	Water temperature over-limit removed
16		1	E008	Water temperature overranging
17	BIT8	0	X009	Optical fiber temperature over-upper-limit removed
18		1	E009	Optical fiber temperature exceeds the upper limit
19	BIT9	0	X010	Laser reflection energy over-upper-limit removed

20		1	E010	Laser reflection energy exceeds the upper limit
21	BIT10	0	X011	Laser output energy under-lower-limit removed
22		1	E011	Laser output energy exceeds the lower limit
23	BIT11	0	X012	Diode short-circuit fault removed
24		1	E012	Diode short-circuit error
25	BIT12	0	X013	Optical fiber disconnection removed
26		1	E013	Optical fiber disconnection
27	BIT13	0	X014	The internal humidity over-upper-limit and super-wet removed
28		1	E014	The internal humidity over-upper-limit and super-wet
29	BIT14	0	X015	Cold water interlock removed
30		1	E015	Cold water interlock
31	BIT15	0	X016	Emergency stop removed
32		1	E016	Scram
33	BIT16	0	X017	The positioning light fault removed
34		1	E017	The positioning light fault
35	BIT17	0	X018	Narrow pulse protection removed
36		1	E018	Narrow pulse protection
37	BIT18	0	X019	Overvoltage protection removed
38		1	E019	Overvoltage protection
39	BIT19	0	X020	Internal temperature protection removed
40		1	E020	Internal temperature protection
41	BIT20	0	X021	Reserved
42		1	E021	Reserved

43	BIT21	0	X022	Reserved
44		1	E022	Reserved
45	BIT22	0	X023	Reserved
46		1	E023	Reserved
47	BIT23	0	X024	Reserved
48		1	E024	Reserved
49	BIT24	0	X025	Reserved
50		1	E025	Reserved
51	BIT25	0	X026	Reserved
52		1	E026	Reserved
53	BIT26	0	X027	Reserved
54		1	E027	Reserved
55	BIT27	0	X028	Reserved
56		1	E028	Reserved
57	BIT28	0	X029	Reserved
58		1	E029	Reserved
59	BIT29	0	X030	Reserved
60		1	E030	Reserved
61	BIT30	0	X031	Reserved
62		1	E031	Reserved
63	BIT31	0	X032	Reserved
64		1	E032	Reserved

Memorandum