

# OPERATION MANUAL



## YLLM Series CW Fiber Laser

Model: YLLM-12000-W, YLLM-Plus-12000-W, YLLM-20000-W,

YLLM-Plus-20000-W, YLLM-30000-W, YLLM-Plus-30000-W



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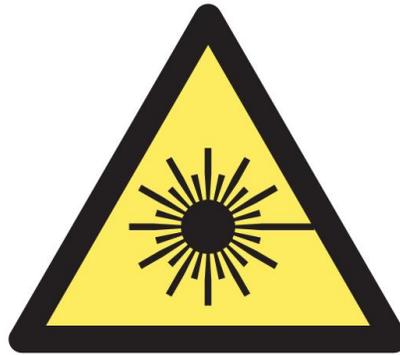
**Before using this product, please read the user manual carefully and familiarize yourself with the relevant content we have compiled for you. Please keep the product manual together with the product to provide you and all other users with operational, safety, and other important information at all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

### **Note**

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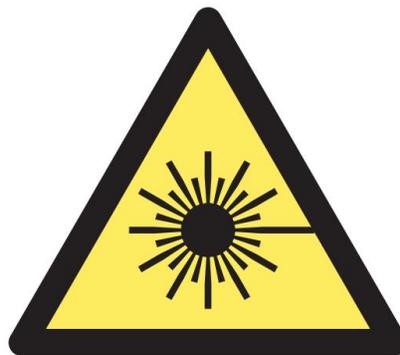


**YLLM Fiber Laser is the Class 4 laser product.**

**This product emits an invisible laser of up to 30000W 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**

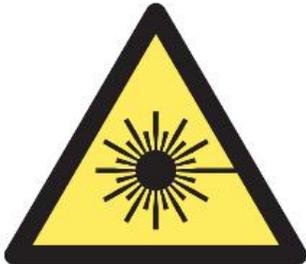
Be applicable to a variety of potential personal injuries. This signal reminds you that you need to follow the specified use methods or steps to use, and if you do not follow the prompts to operate correctly, it may cause personal injury to yourself or others. If you do not fully understand and meet 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 30000W 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.

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# 1. Laser safety

## 1.1 Safety regulations

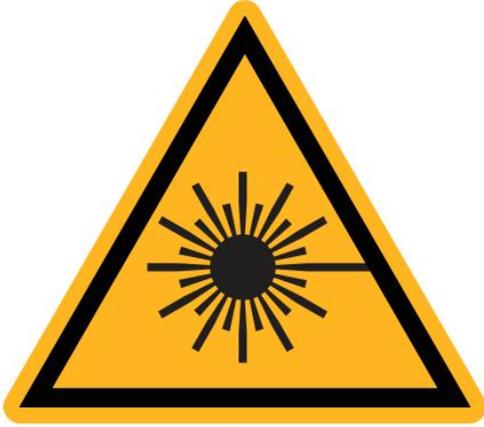
The YLLM series CW fiber laser is an OEM laser product that can be integrated into laser systems for commercial and manufacturing applications. Therefore, this product does not fully meet the definition for complete laser processing system in 21 CFR 1040.10 and 1040.11 under IEC/EN 60825-1. GW Laser 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

<b>Item</b>	<b>Description</b>
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.

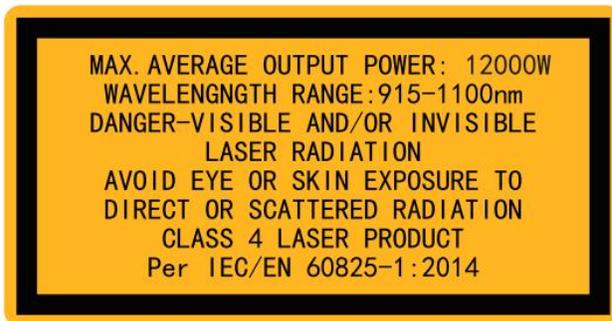
### 1.3 Safety labels

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



**Laser outlet label**

**Location: Front panel**



**Certification label**

**Location: Front panel**



**Warning label**

**Location: Front panel**



**Certification label**

**Location: Front panel**



**Product lable**

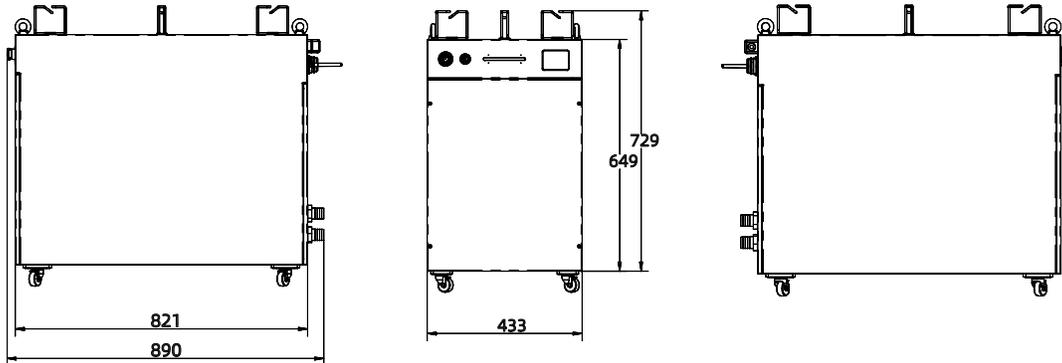
**Location: Front panel**

## 2. Description

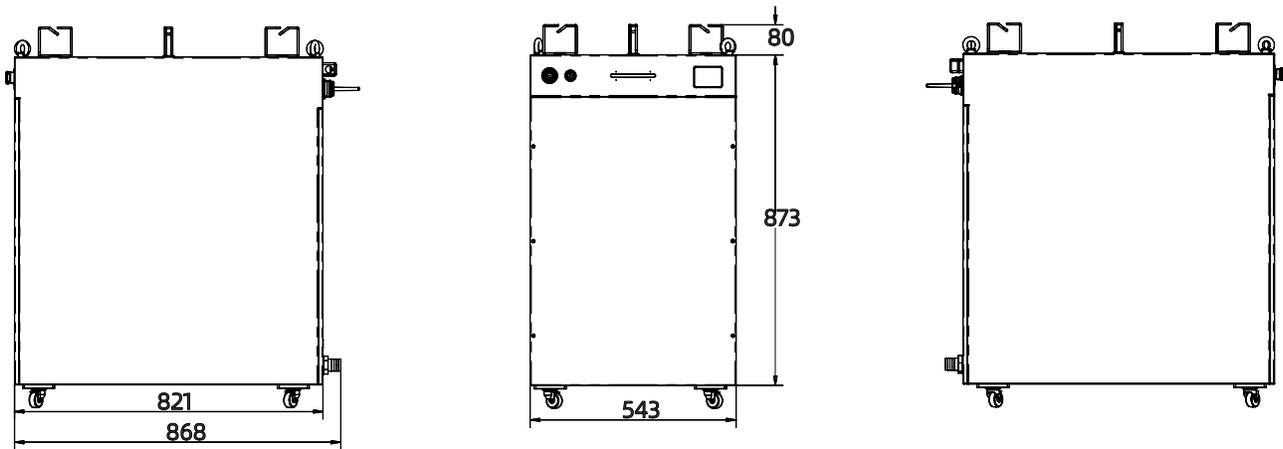
The YLLM series OEM fiber laser from GW Laser is designed for industrial material processing applications with reliable, efficient and proprietary ABR and SPP technologies. Key innovations in the YLLM series fiber lasers also include the proprietary thermal processing, mode-filtering technology, and a durable and novel fiber laser structure. The YLLM fiber laser includes a powerful optical engine, comprehensively controlling and monitoring the electronic equipment. The beam is transmitted and output through a metal-protected Q+ optical fiber cable. YLLM-12000-W and YLLM-Plus-12000-W can provide QBH type transmission cable.

The YLLM series OEM fiber lasers from GW Laser meet your highest requirements on performance and reliability. The YLLM series lasers provide up to 30000W continuous wave (CW) multi-mode output laser, with the output waveband between 1070nm and 1080nm. YLLM lasers provide high-efficiency and high-quality output laser. It adopts high-brightness multi-mode fiber cable output with the fiber cable output beam quality BPP < 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.

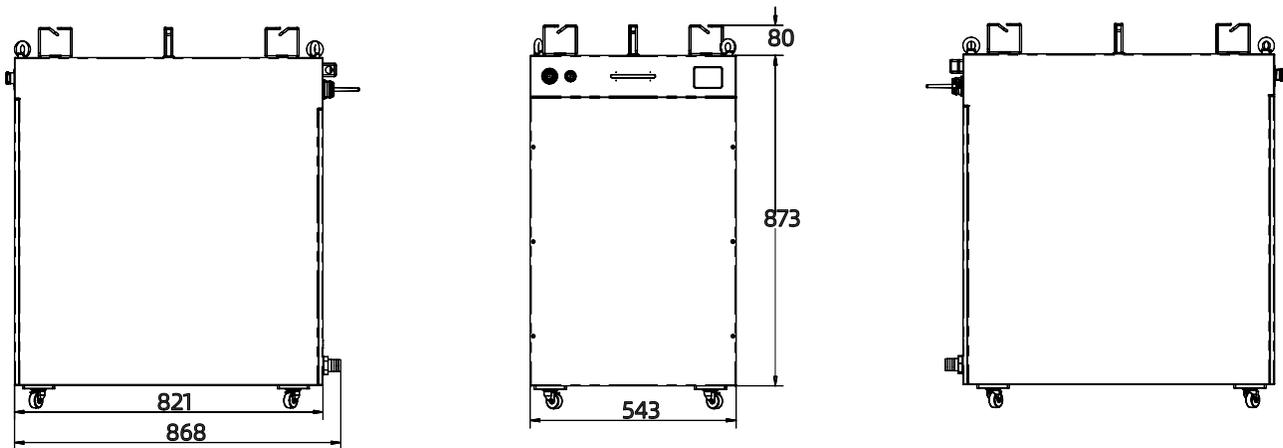
## 2.1 Laser dimensional drawings



**YLLM-12000-W, YLLM-Plus-12000-W**

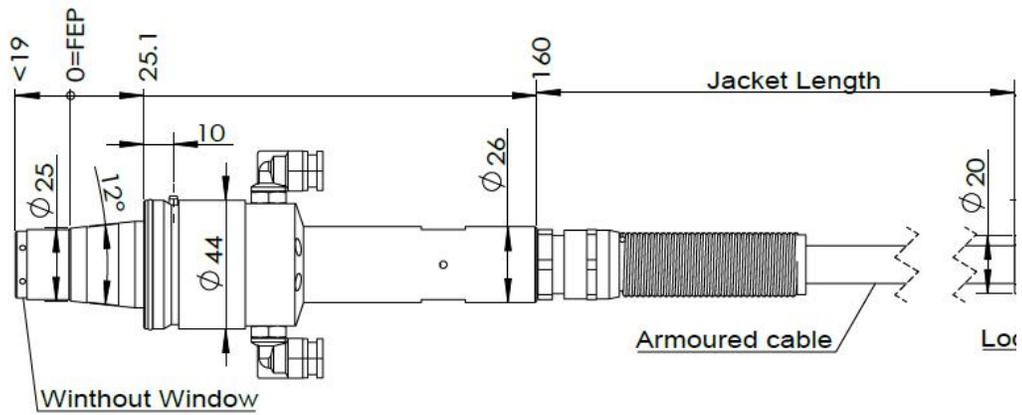


**YLLM-20000-W, YLLM-Plus-20000-W**



**YLLM-30000-W, YLLM-Plus-30000-W**

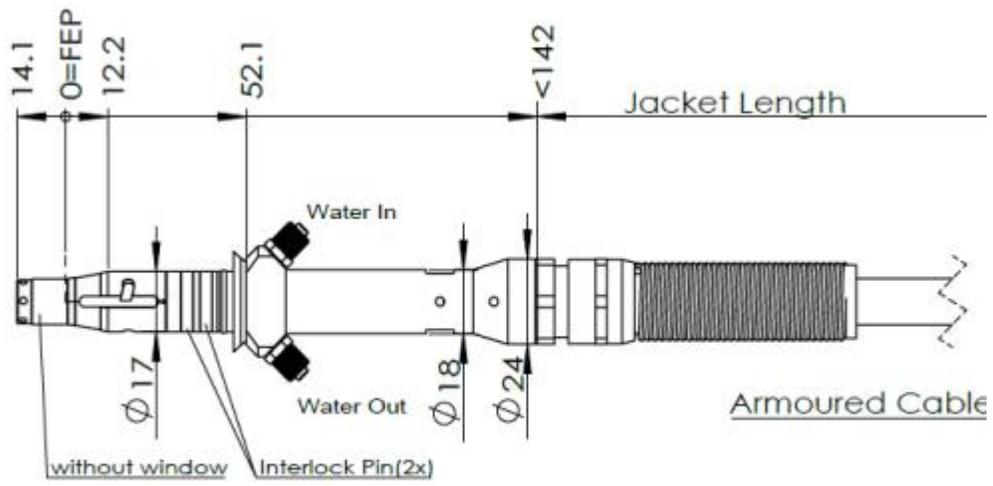
## 2.2 Optical Output connector (QBH type)



FEP=Fiber End Plane (Without Window)

### Q+ type optical beam transmission cable

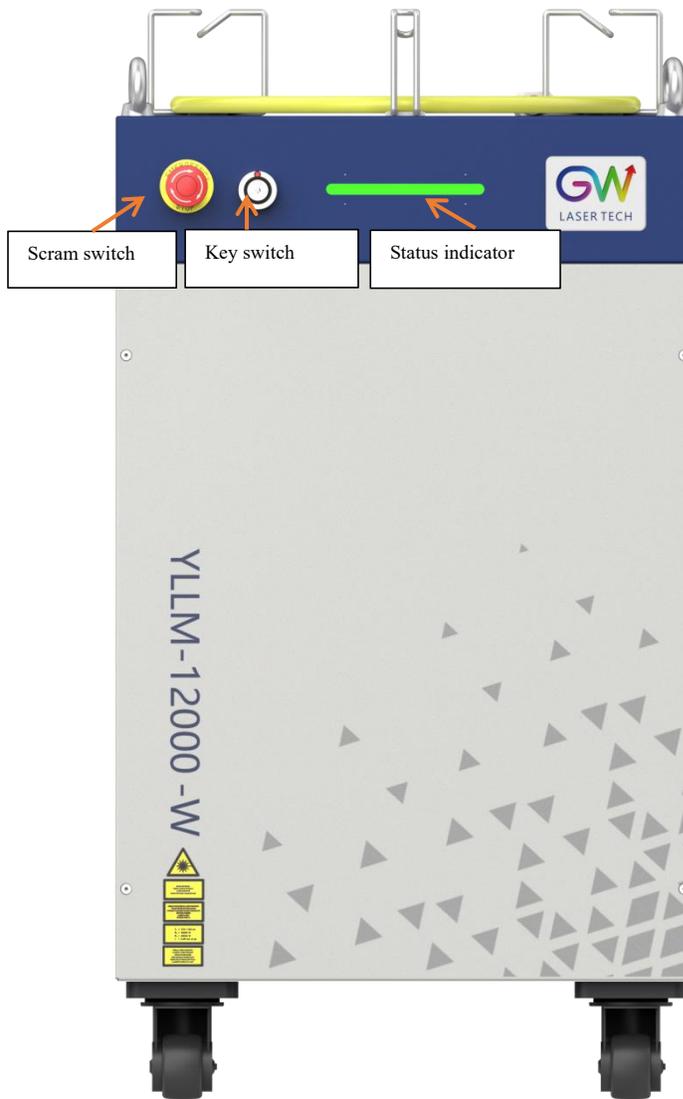




FEP=Fiber End Plane(Without

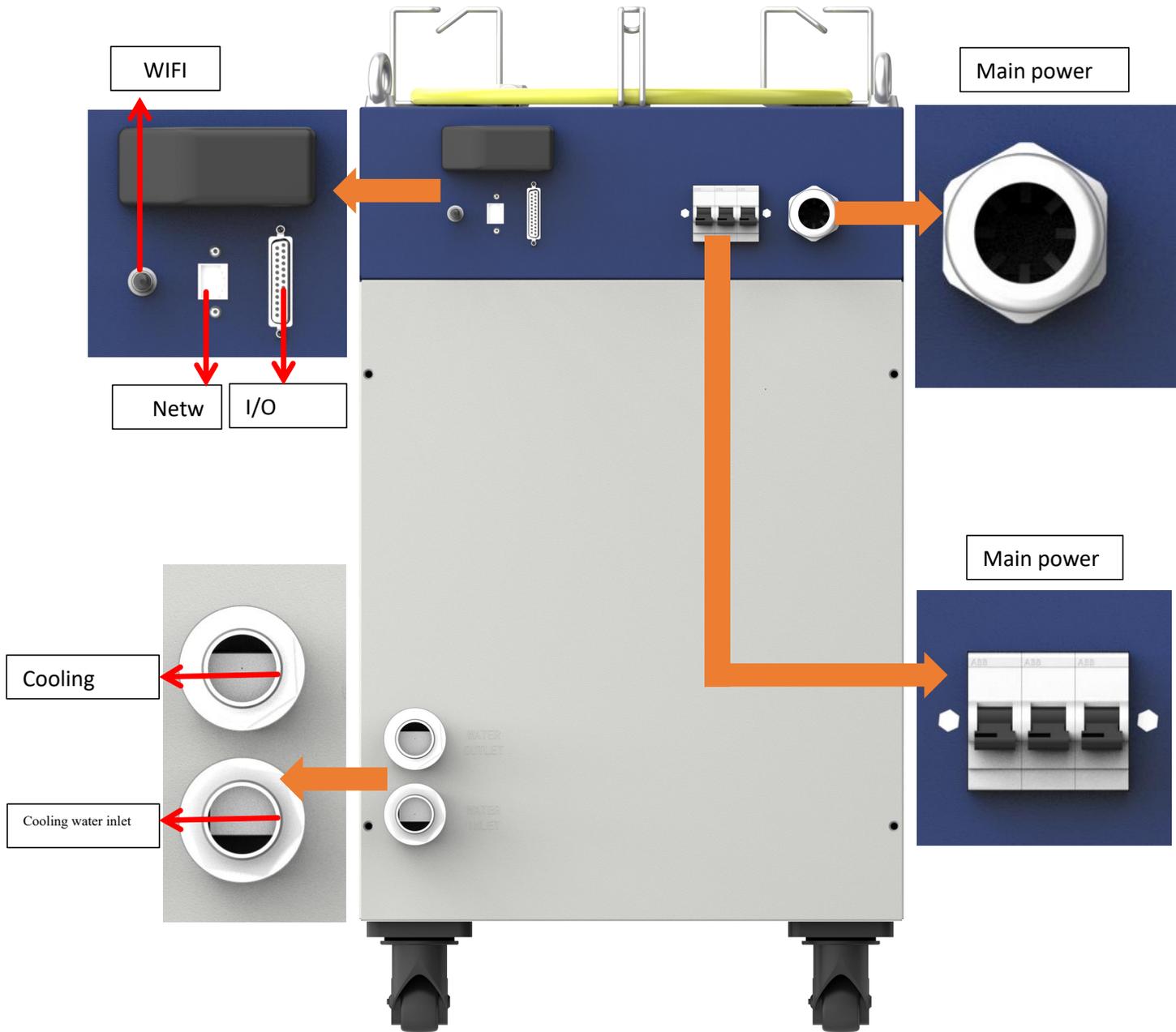
**QBH type optical beam transmission cable**

## 2.3 Front panel



Item	Description
Scram switch	Press it to immediately turn off the laser pump power supply, and meanwhile, the laser stops emitting. Turn clockwise to release the switch and remove the emergency stop control.
Key switch	OFF for turning off the main power supply and ON for turning on the main power supply
Status indicator	Ready: Green; Laser emit: Orange; Fault: Red; White: The main power supply is not ready

## 2.4 Rear panel



Item	Description
WIFI	Laser external network communication, being able to monitor the laser operation status

Network interface	RJ45 interface, the laser network communication port, being able to monitor the running status of the laser
I/O interface	DB25 interface, the laser input/output port
Main power supply switch	The main power supply switch of the laser
Main power supply interface	The main power supply input interface of the laser, the three-phase four-wire system interface
Laser water-cooling interface	In case of 12-20kW, to be connected with 32mm high-pressure rubber water pipe, and the pressure resistance required up to 2.0MPa (G1-32 pagoda joint) In case of 30kW, to be connected with 50mm high-pressure rubber water pipe, and the pressure resistance required up to 2.0MPa (G1-50 pagoda joint)

### 3. Parameter

#### 3.1 Optical performance

Characteristics	Min. value	Typical value	Max. value	Unit
Operation mode	CW/Pluse			
Polarization	Random			
Output center wavelength	1060	1070	1080	nm
Output power YLLM-12000-W	11800	12000	12200	W
YLLM-Plus-12000-W	11800	12000	12200	W
YLLM-20000-W	17000	20000	21000	W
YLLM-Plus-20000-W	17000	20000	21000	W
YLLM-30000-W		30000		W
YLLM-Plus-30000-W		30000		W
Output power range	1		100	%
Output bandwidth		< 3.0		nm
Modulation frequency			10	
Turn-on time			25	μs

Red guide light output power			2	mW
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### 3.2 Optical output

Characteristics	Min. value	Typical value	Max. value	Unit
Fiber output connector	Q+ or QBH type			
Output optical fiber cable	13 mm metal armored cable			
Beam quality, multi-mode output BBP			5	
Output fiber diameter, multi-mode output		100	150	um
Output fiber length, multi-mode output		20		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		100		L/min
YLLM-12000-W		100		
YLLM-Plus-12000-W		100		
YLLM-20000-W		175		
YLLM-Plus-20000-W		175		
YLLM-30000-W		330		
YLLM-Plus-30000-W		330		
Water temperature	22	25	28	°C
Water pressure	4.5		5.5	Bar
The cooling capacity of the water cooling system		30000		Watts
YLLM-12000-W		30000		
YLLM-Plus-12000-W		30000		

YLLM-20000-W		50000		
YLLM-Plus-20000-W		50000		
YLLM-30000-W		90000		
YLLM-Plus-30000-W		90000		
Operating humidity	0		95	%
Dimensions YLLM-12000-W, and YLLM-Plus-12000-W	649X433X890			mm
YLLM-20000-W, YLLM-Plus-20000-W	873X543X868			mm
YLLM-30000-W, YLLM-Plus-30000-W	953X543X868			mm

**Note: The water cooling system needs to be equipped with a filter element with a aperture less than 200  $\mu$ . 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

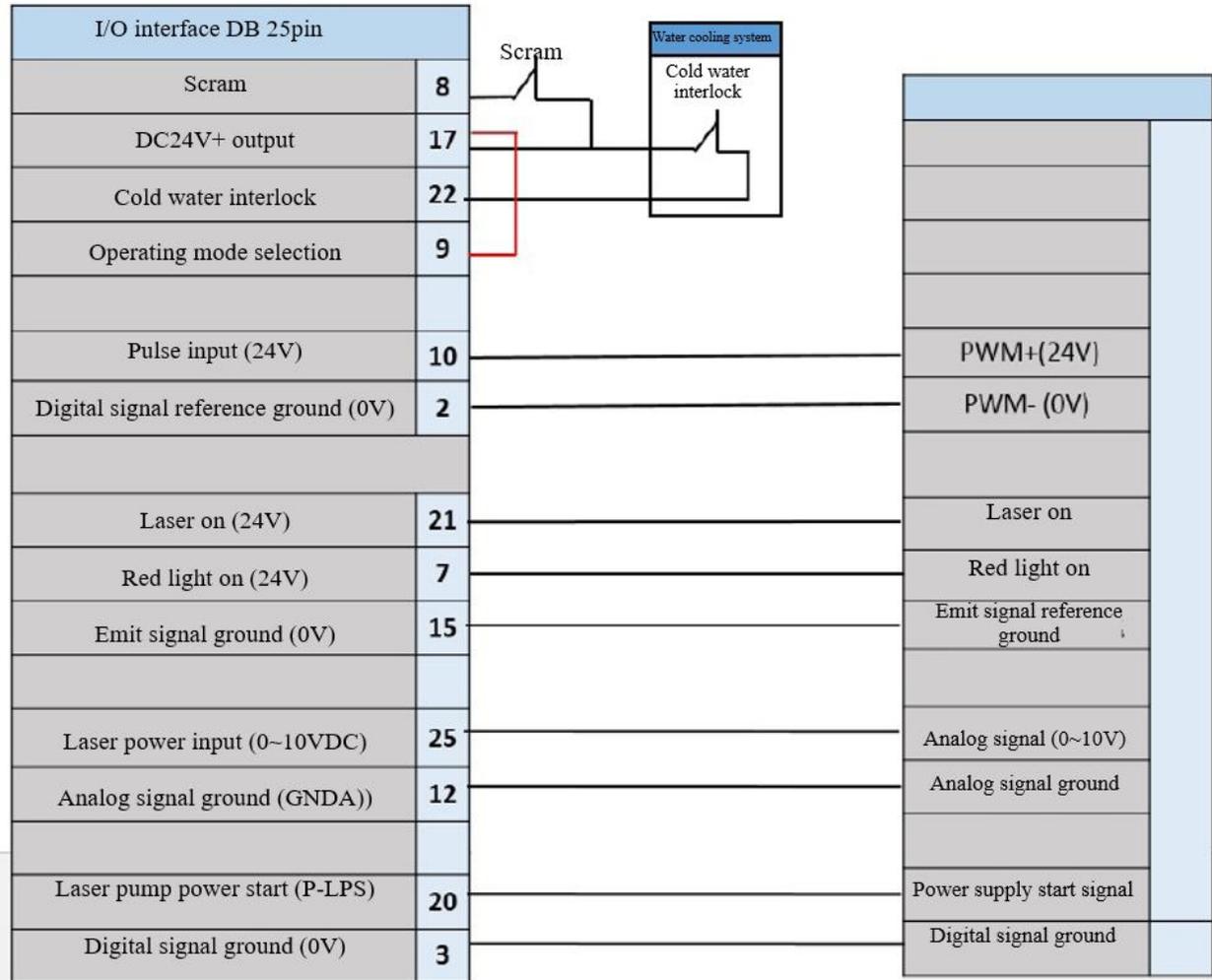
Pin	Color	Definition	Function	Power voltage	Power current
1	Yellow	L1	AC input live wire	380V AC	60A (YLLM-12000-W) 60A (YLLM-Plus-12000-W) 105A (YLLM-20000-W) 105A (YLLM-Plus-20000-W) 135A (YLLM-30000-W) 135A (YLLM-Plus-30000-W)
2	Green	L2	AC input live wire	380V AC	60A (YLLM-12000-W) 60A (YLLM-Plus-12000-W) 105A (YLLM-20000-W) 105A (YLLM-Plus-20000-W) 135A (YLLM-30000-W) 135A (YLLM-Plus-30000-W)
3	Red	L3	AC input live wire	380V AC	60A (YLLM-12000-W) 60A (YLLM-Plus-12000-W) 105A (YLLM-20000-W) 105A (YLLM-Plus-20000-W) 135A (YLLM-30000-W) 135A (YLLM-Plus-30000-W)
4	Yellow green	PE	AC input ground wire	N/C	N/C

### 3.5 I/O interface

X1	Interface 1 (DB 25Pin)			
Pin#	Definition	Description	IN/OUT	Notes
1	+24V-IN	IN+24V	IN	N/C
14	+24V-IN	IN+24V	IN	N/C
2	GNDD	0V	IN	Digital signal reference potential
15	GNDD	0V	IN	Digital signal reference potential
3	GNDD	0V	IN	Digital signal reference potential
16	GNDD	0V	IN	Digital signal reference potential
4	S-LAS	Laser enabled	OUT	Output laser enabled (24V)
17	24V+	Ext 24V	OUT	Supply 24VDC
5	S-ERR	System error	OUT	System error output (24V)
18	S-WAR	Warning	OUT	Output warning signal (24V) if it is close to 90% of the alarm threshold
6	S-RDY	System ready	OUT	The system is ready for operation
19	P-RST	Reset	IN	Reset the general error.
7	X-RED	Red guide laser	IN	Externally-controlled red guide laser activation (24V)
20	P-LPS	LPS activation	IN	Laser ready for input 24VDC input to turn on the power supply of laser
8	X-STOP	Scram	IN	Logic control signal, NC (24V)
21	X-SN	Laser on	IN	Externally-controlled laser emission activation (24V)
9	M-BIT0	Mode select encoding BIT0	IN	0: Externally-controlled CW mode 1: Externally-controlled PWM modulation mode
22	X-WAT	Cold water interlock	IN	Logic control signal, NC (24V)
10	X_PULSE	0~24V	IN	Modulation input (0~24V)
23	L-Pout	Laser power output	OUT	Laser output power monitoring 0-10VDC

11	GND A	GND	IN	Analog signal reference potential
24	IN1	Water flow detection	IN	Water flow analog voltage 0.5V-3.5V input
12	GND A	GND	IN	Analog signal reference potential
25	LPIN	Laser power input	IN	Analog input, 0-10VDC
13	GND A	GND	IN	Analog signal reference potential

## 4. YLLM laser wiring diagram



## 5. YLLM laser operation

### 5.1 Initial operation

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

#### Control method:

**Internal control:** Connect the laser to the computer via the network interface, open the GW HMI software on the computer, and control the laser through HMI.

**External control:** The laser is controlled by connecting with the analog signal of the pin 25# of DB25 (1V = 10% and 10V = 100%) 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 25# of the DB25 (1V = 10% 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 control methods and operating modes work, please refer to Section II of this Chapter.

5. Make sure the interlock circuit is closed (DB25 PIN 25# and 8#, 22#)
6. Make sure the Laser\_On signal light is off (DB25 Pin21# input 0V)
7. Turn on the remote key switch signal on the Pin 23# of DB25. The key switch signal can be turned on 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. Enable the Laser-ON by supplying 24V voltage to the Pin21# of DB25. The Laser-ON signal can also be activated by short-connected pin21 and pin17.
9. Through the laser-ON signal, the laser will be automatically activated. It is available to acquire the state of Laser-ON from the DB25 Pin 4#.

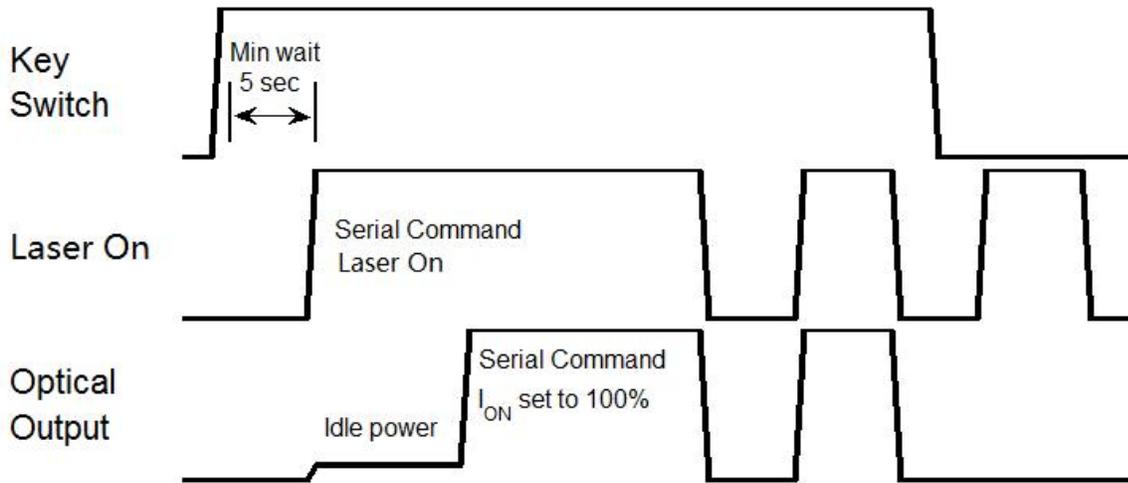
## 5.2 Operation mode setting

YLLM 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 the external control mode, the working mode of the laser is selected by the Pin9# of DB25. For detailed configuration, see the DB25 interface definition.

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 power control, "CW" output mode

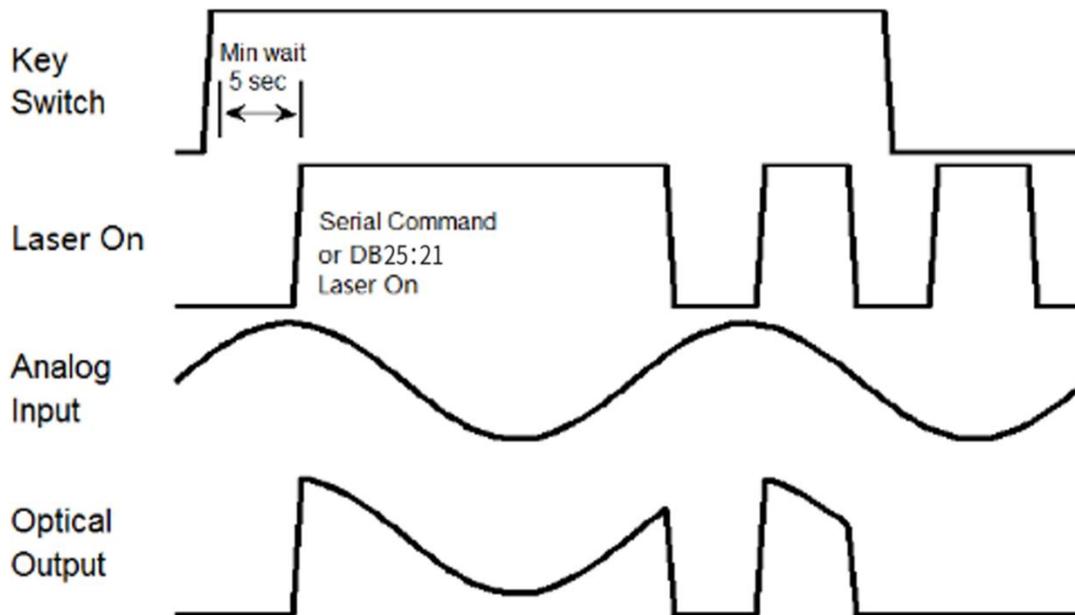
Set to "Internal Control" through the HMI software on the host computer, and then select "CW" working mode. When Laser-ON is activated, the Laser output power is determined by the corresponding value set by the HMI on the host computer, and this output value can be changed at any time when the laser 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. "External control" power control, "CW" output mode

When the PIN9 of DB25 is open-circuited or grounded, the YLLM laser works in the CW mode. If the power mode is selected as "External Control" and the output mode is set as "CW", it is required to delay the output of the Laser-On command (DB-25) for 5 seconds. When the Laser-On command is enabled, the laser output power will be determined by the analog input control voltage. If the analog input voltage falls below the programmed minimum, the BLADE laser controller will temporarily turn off Laser-On until the analog input signal again exceeds the programmed minimum.

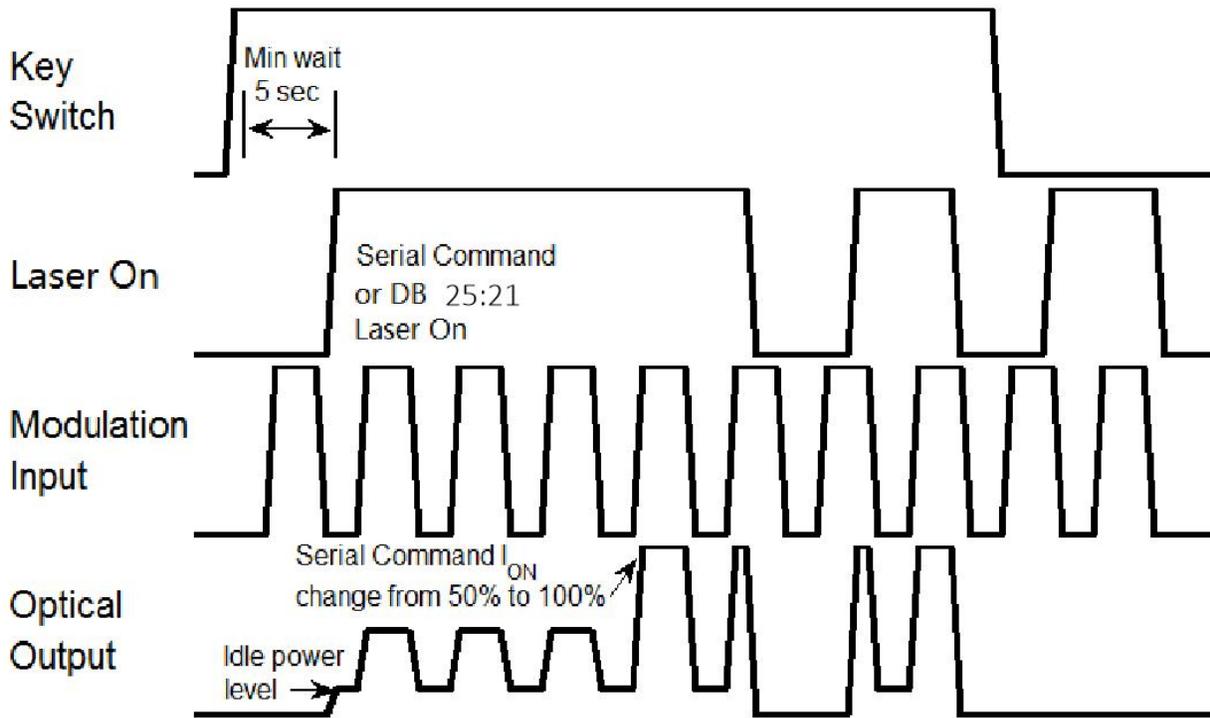


Time series of modulating "External Control" power control and "CW" output mode

### 5.2.3. “External Control” power control, “PWM” output mode, #1: Digital power setting

When the PIN9 of DB25 is connected to 24VDC, the YLLM laser will operate in the externally-controlled PWM mode.

When the power control mode is selected as “External Control” and the output mode is set as “Modulation”, it is required to delay the output of the Laser-On (DB-25) command for 5 seconds. When the Laser-On command is enabled, the output power is the preset IDLE power if the modulation input with low signal, and the output power is the preset Ion value if the modulation input with high signal. When the laser is emitted, the output power amplitude can be changed by modifying the Ion value if the modulation input with high signal.

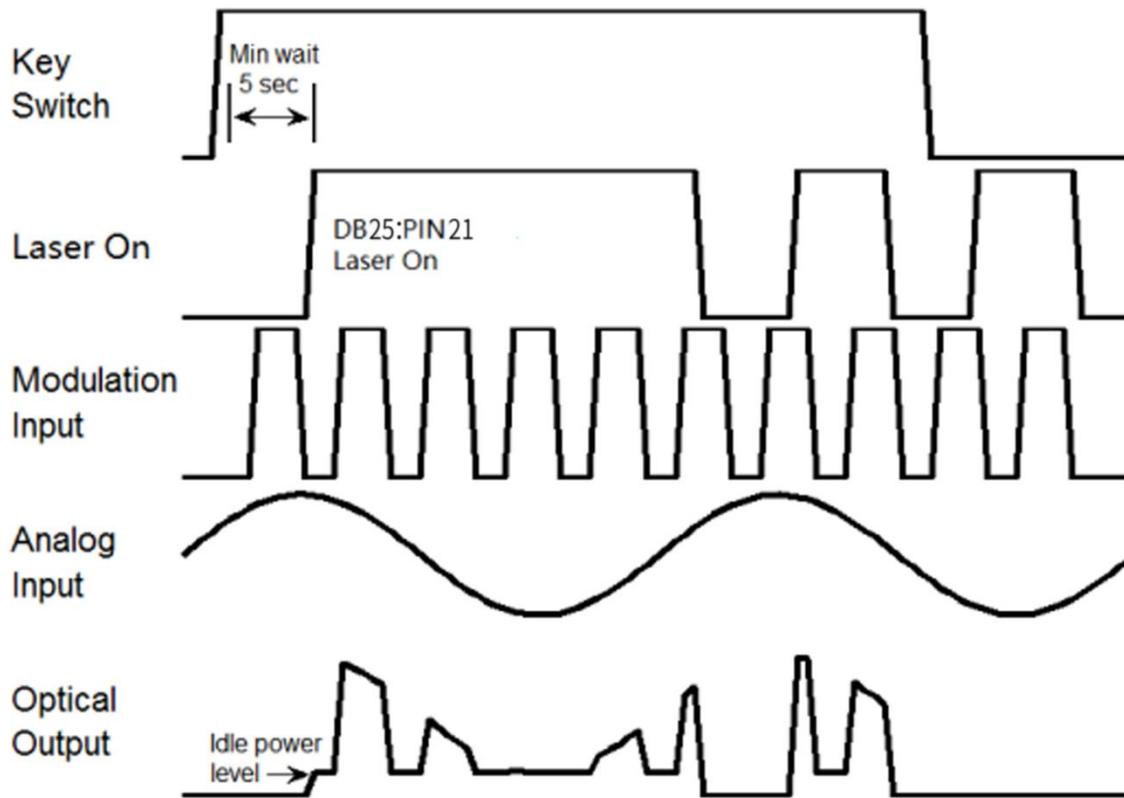


Time series of modulating "External Control" power control and "Modulation" output mode

### 5.2.4. "External Control" power control, "Modulation" output mode, #2: analog power setting

When the PIN9# of DB25 is connected to 24VDC, the YLLM laser will operate in externally-controlled pulse mode.

When the power control mode is selected as "External Control" and the output mode is set as "Modulation", it is required to delay the output of the Laser-On (DB-25) command for 5 seconds. When the Laser-On command is enabled, the output power will be determined by the analog input control voltage if the modulation input with high signal. If the modulation input is at low signal, the output power is the preset IDLE power; if the modulation input is at high signal, the output power is the preset Ion value. If the analog input voltage falls below the programmed minimum, the YLLM Laser controller will temporarily turn off Laser-On until the analog input signal again exceeds the programmed minimum.



Time series of "External Control" power control and #2 "Modulation" output 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 enabled by connecting the Pin 7# of DB25 to the 24V power to transmit the guide laser activation command. The red guide laser status can be obtained through the HMI interface 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.

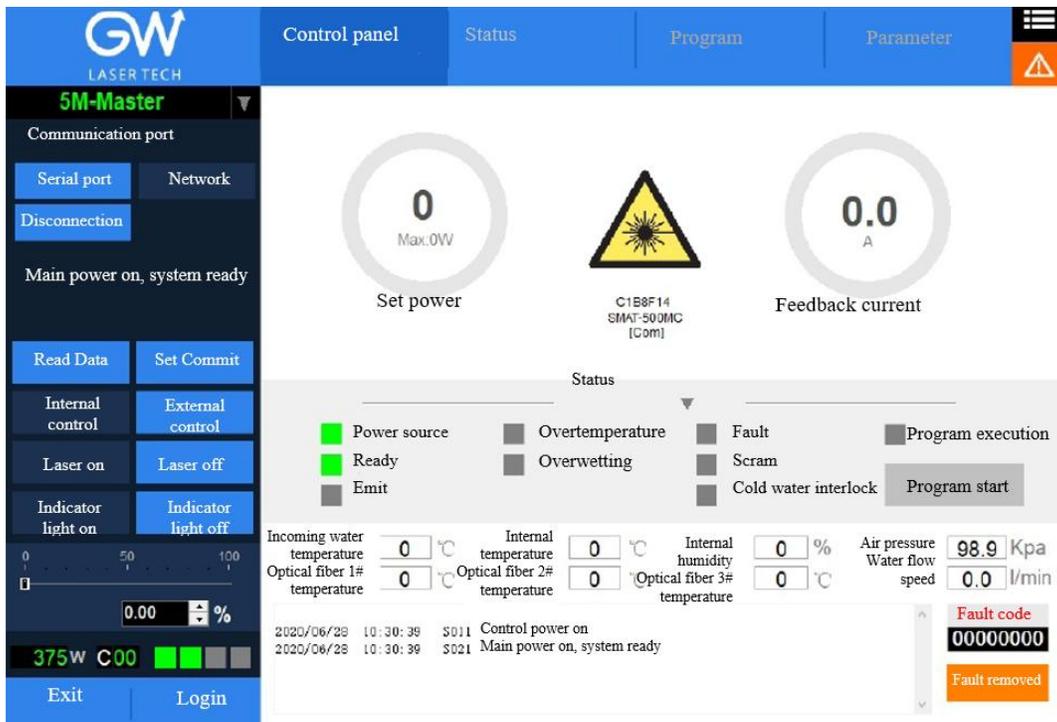
## 6. YLLM laser human-machine interface

### 6.1 Introduction to the man-machine interface

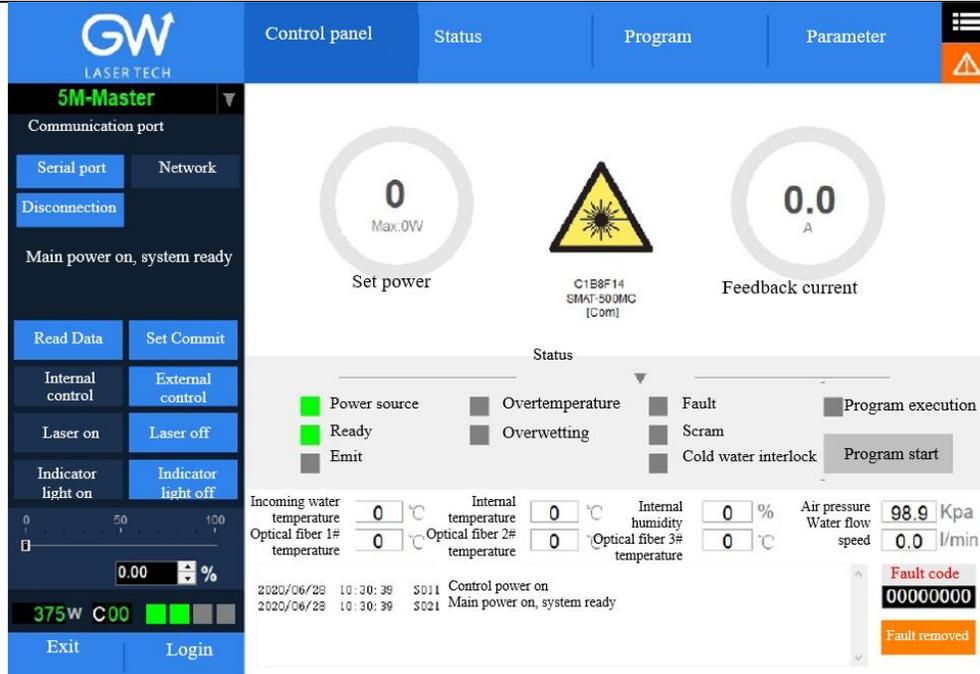
GW Laser provides the human machine interface (HMI) applications for controlling and monitoring the operation of YLPM lasers. Get the latest version of HMI program for YLPM laser control, easily install it on the computer, double-click “GW\_HMI\_V5.6\_Multi- module 20220820.rar” to unzip the package, and start the HMI program (Do not use desktop shortcuts).



Before starting the HMI program, connect the computer to our laser with the USB-to-RS232 cable, connect the RS232 interface to the RS232 port of the laser (DB9), and then double-click the shortcut icon of the HMI to start the HMI software. The interface after startup is shown as follows:



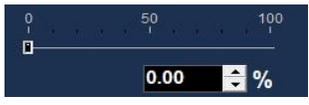
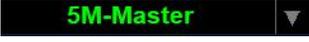
Users need to log in by clicking the "Login" button to use the software. User name (user) and password (000000). The following screen will display after login:

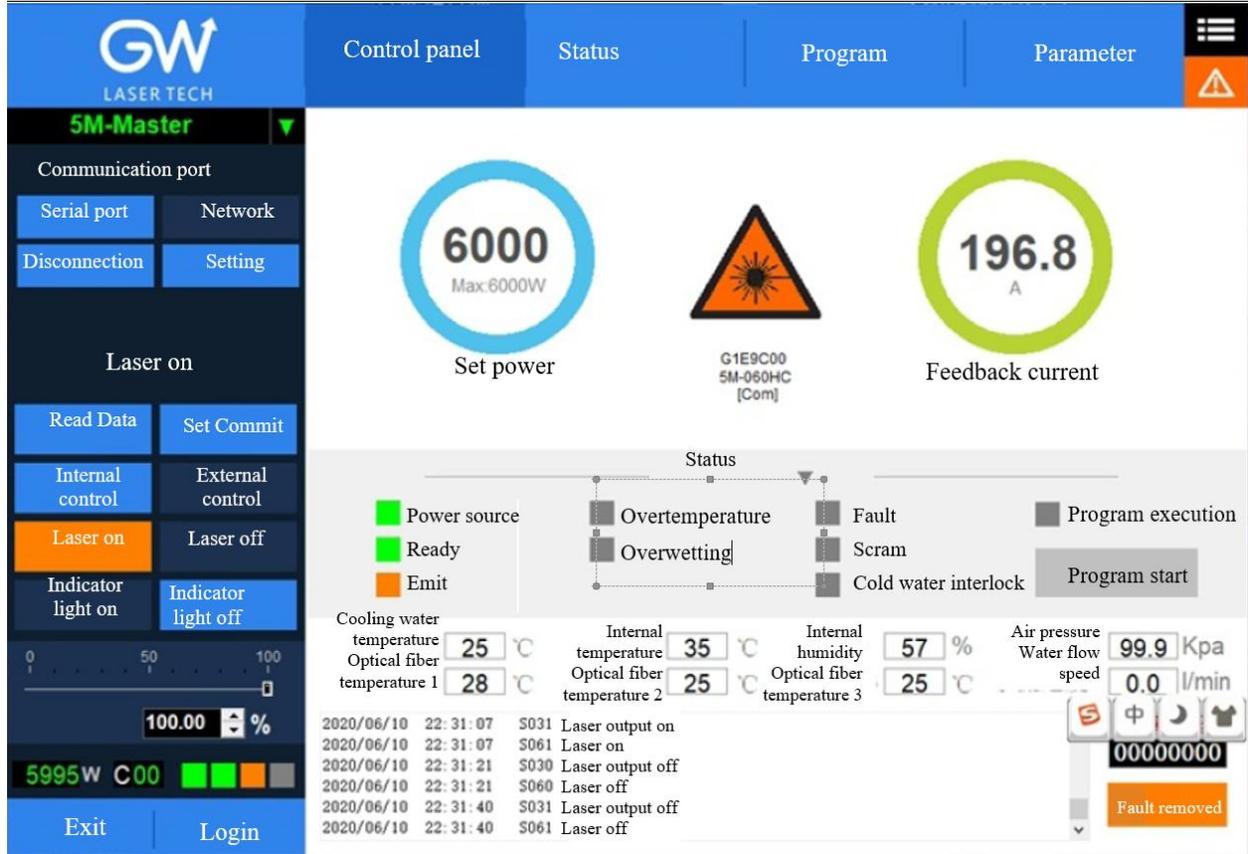


Click the "Set" button to set the serial port number, and after setting, you can communicate with the laser. Make sure that the "Read data" button is in blue shading, if not, click "read data", and then the HMI will maintain continuous communication with the laser and display the status inquiry for the laser. If the HMI fails to establish the communication with the YLLM laser, the HMI will prompt the error of "Communication Fault". At this time, it is necessary to check whether the USB-to-RS232 cable is connected correctly and whether the serial port number is set correctly.

After the communication is established, the default interface is "Control Panel", which displays all information about the YLLM laser. For example, the temperature of the YLLM laser at different locations; laser status indicators: "Power", "Ready", "Emit", "Overtemperature", "Super-wet", "Fault", "Emergency stop", and "Cold water interlock". The user can click the "Internal control" or "External control" button to change the operation mode.

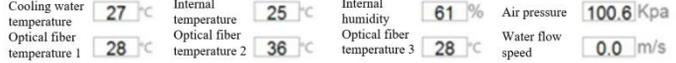
S/N	Button/indicator	Description
1	Serial port Network	Communication mode selection: Select the communication mode for establishing the connection with the YLLM laser.
2	Disconnection	Disconnect the communication with the YLLM laser.
3	Setting	Parameter setting of the communication port
4	Read Data Set 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 YLLM laser.
5		The user can select the control mode of YLLM laser (internal control or external control) by pressing the button. When activated, the corresponding button turns blue.
6		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		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		In the internal control mode, 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.
9		This label lights up when an error event occurs. Click the label to pop up a screen, on which the specific error event is displayed.
10		Click the login button to open the user login interface.
11		Click the button to exit HMI. Before exiting the application program, you must disconnect the communication connection and then press the exit button.
12		When this status is on, it indicates that the HMI interface is a multi-module master control interface



The YLLM HMI will continuously read the internally-controlled monitor information and display the laser information on the HMI interface in real time.

	Indicator	Description
13		<p><b>C 00</b> Display the current operation mode</p> <p><b>■ ■ ■ ■</b> Status display:                      1st: The laser control power supply is normal                      2nd: Laser ready                      3rd: Laser turned on                      4th: Alarm</p>
14		<p>Internal control mode:                      Read the vertical slider or manually input power values.</p> <p>External control mode:                      Read the analog input control voltage value of the Pin1# of DB15</p>

15		Read the internal current feedback value
16		Laser labels are used to indicate whether the laser is emitting. While it indicates that the laser is emitting (orange), it can also warn the user of possible potential hazards, with a string of characters below the sign being the serial number of the laser
17		Display the various states monitored by the YLLM laser
18		Read the current temperature and humidity monitor value

Click the button  to enter the HMI event display screen. On this screen, the various laser events recorded are displayed. Interface logs record various laser events obtained after the communication between the HMI and the laser is established. In addition, there is a data logger inside the YLLM laser, which also records various events of the laser. The laser events recorded by the internal data logger can be acquired by querying the device logs.

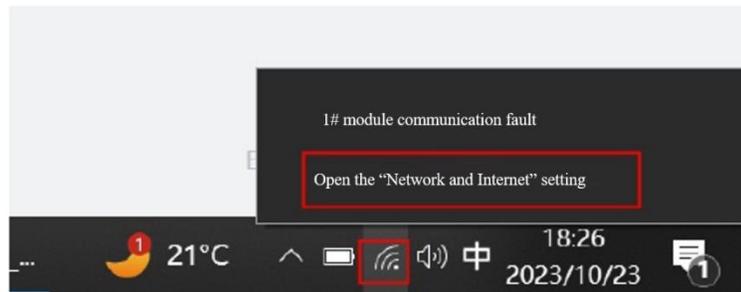
	Button/indicator	Description				
19		Press this button, and the user will reset the general error.				
20		Black: Indicate the execution status of the controller Red: Indicate the error status of the controller Green: Indicate that the error status is cleared				
21	Fault code: <input type="text" value="00000001"/> Fault mask code: <input type="text" value="FFFFFFF"/>	Display the fault codes and fault mask codes				
22	Current fault list <table border="1"> <thead> <tr> <th>Fault code:</th> <th>Fault mask code:</th> </tr> </thead> <tbody> <tr> <td>E001</td> <td>1# module communication fault</td> </tr> </tbody> </table>	Fault code:	Fault mask code:	E001	1# module communication fault	Display all existing faults at present
Fault code:	Fault mask code:					
E001	1# module communication fault					

## 6.2. Man-machine interface LAN connection mode

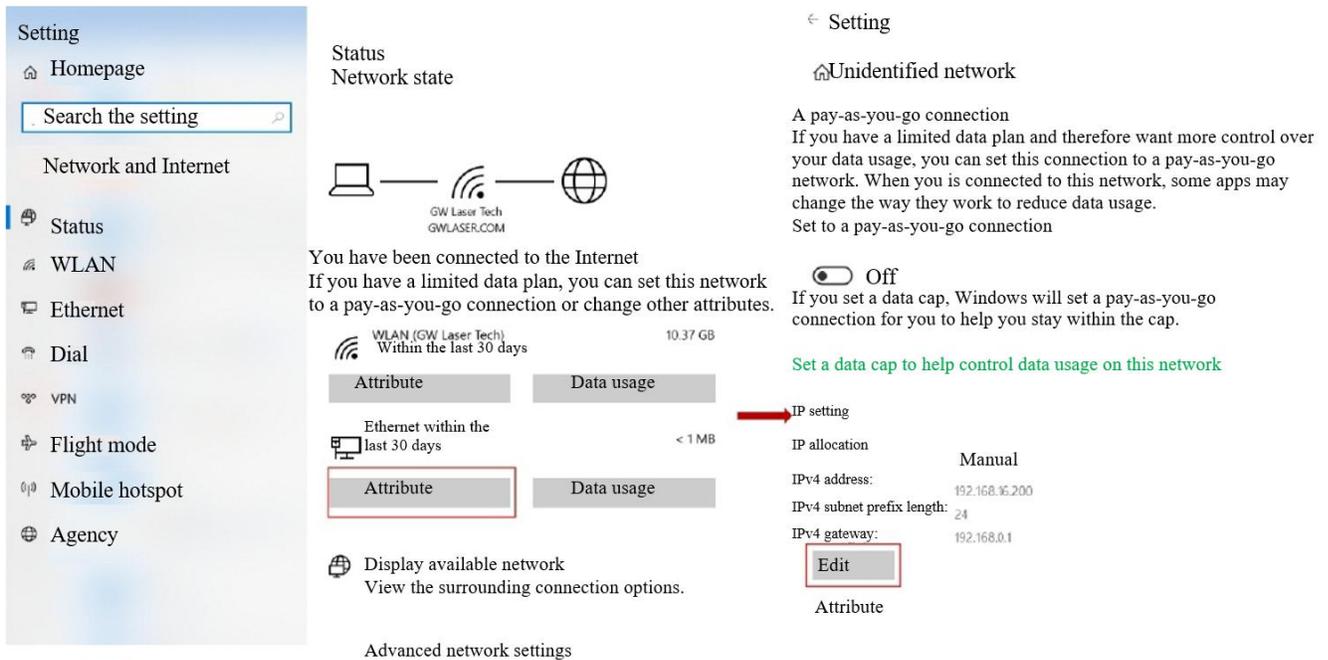
6.2.1. Ensure that the laser that needs to be controlled remotely and the remote computer have been connected to the same LAN, and for the laser LAN connection method, please refer to GW laser network connection setting manual.

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

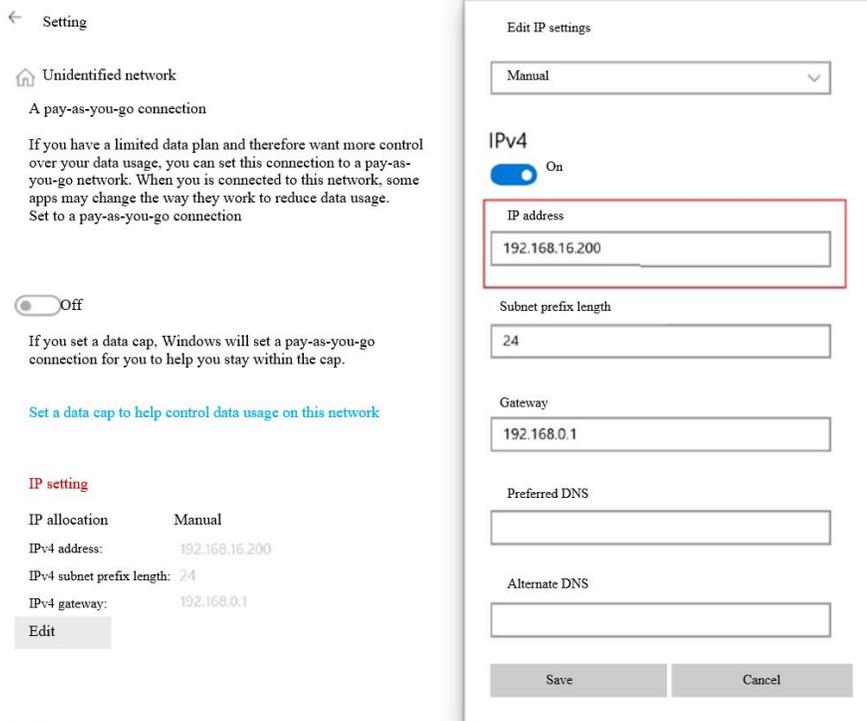
6.2.3. Change the computer's IP address, and open the computer's "Network and Internet Setting"



Click "Attribute", and click "Edit"



Enter the IP address "192.168.16.X", of which X can be any figure from 2 to 253, and click "Save".



6.2.4. Open the HMI software on the remote computer and enable the user login as shown in the figure below. The user name is "user" and the password is 000000. The login interface is as shown in the Figure below.

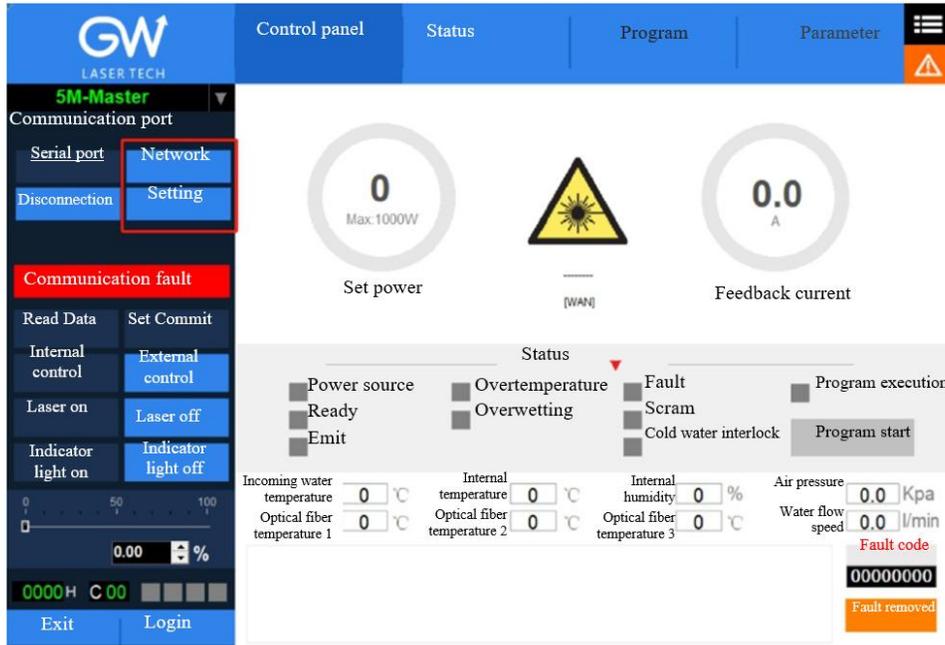
The screenshot displays the control panel interface for the YLLM Series Fiber Laser. The interface is divided into several sections:

- Navigation Bar:** Includes 'Control panel', 'Status', 'Program', and 'Parameter' tabs, along with a menu icon and a warning icon.
- Left Panel:** Contains '5M-Master' status, 'Communication port' options (Serial port, Network, Disconnection), and control buttons for 'Read Data', 'Set Commit', 'Internal control', 'External control', 'Laser on', 'Laser off', 'Indicator light on', and 'Indicator light off'. At the bottom, there are 'Exit' and 'Login' buttons.
- Main Display:** Features two large circular gauges: 'Max 1000V' (showing 0) and 'Feedback current' (showing 0.0 A). A central warning triangle is present. Below the gauges are status indicators for 'Power source', 'Ready', 'Emit', and 'Cold water interlock'. A 'Program execution' section includes a 'Program start' button.
- Parameter Section:** Displays various sensor readings with input fields: Incoming water temperature (0 °C), Internal temperature (0 °C), Internal humidity (0 %), Optical fiber temperature 1 (0 °C), Optical fiber temperature 2 (0 °C), Optical fiber temperature 3 (0 °C), Air pressure (0.0 Kpa), and Water flow speed (0.0 l/min). A 'Fault code' field shows '00000000' and a 'Fault removed' button.

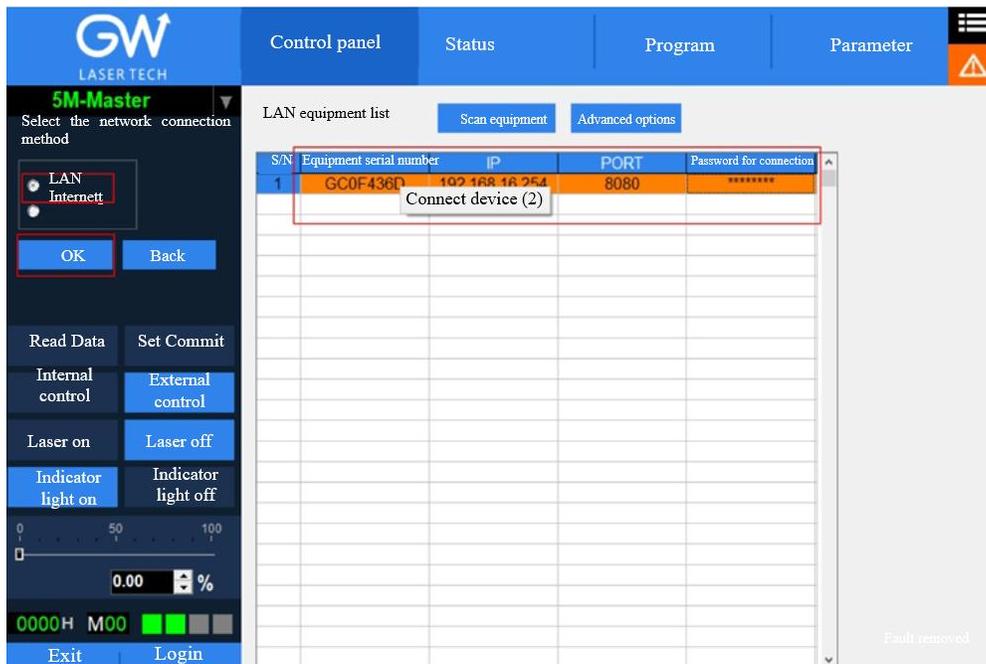
A login dialog box is overlaid in the center, containing the following fields and buttons:

- User name: user (dropdown menu)
- Password: (text input field)
- OK (blue button)
- Log out (blue button)

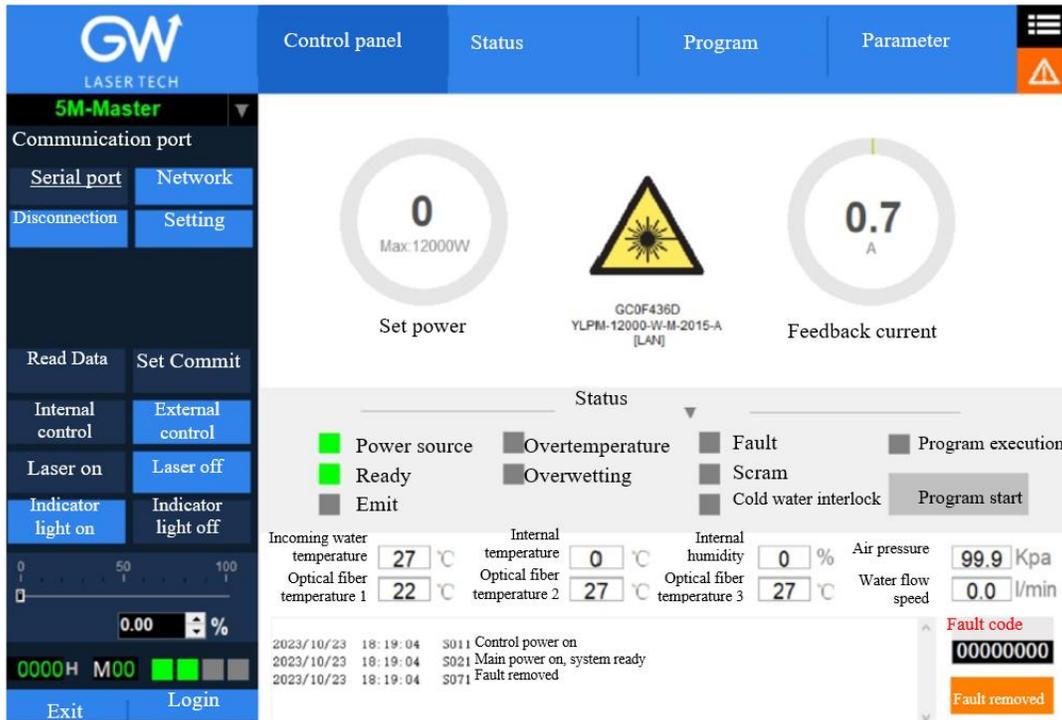
6.2.5. Click "Settings" to pop up the following interface



6.2.6. Select "LAN", click "OK", then click "Scan Device", select the Device Serial Number, and right click the Connect Device



6.2.7. After successful connection, the interface is as shown in the following Figure:

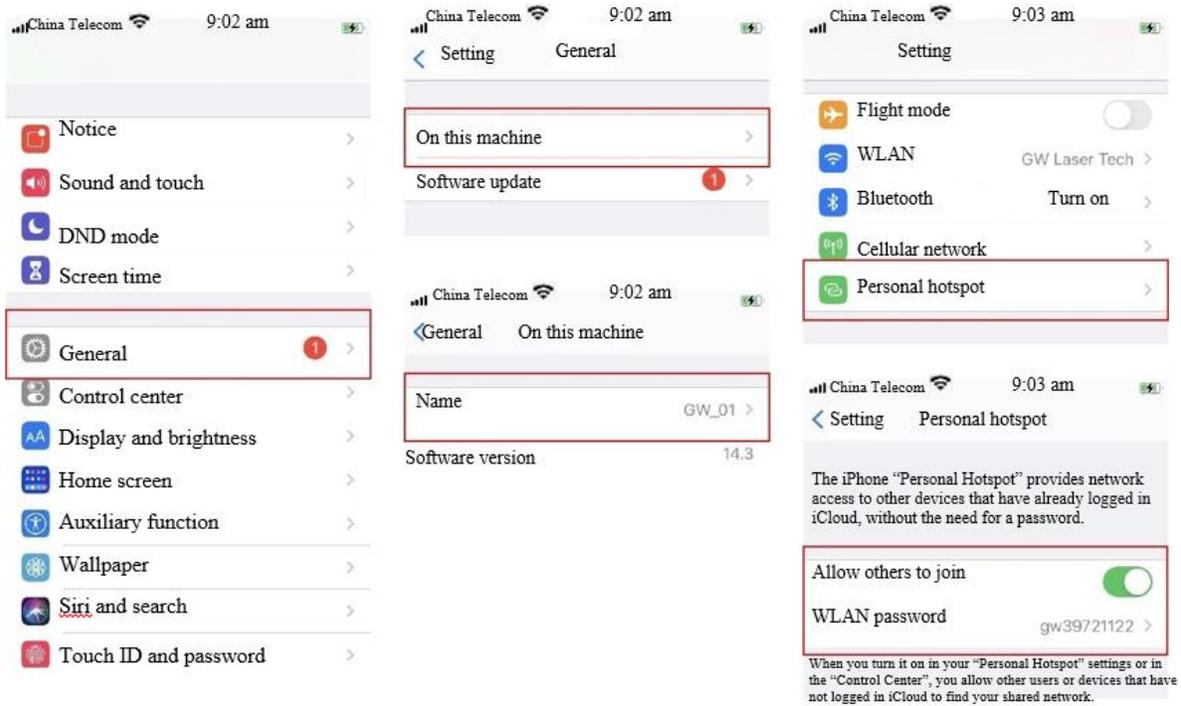


## 6.3. Hotspot connection mode

### 6.3.1. Connection mode for IOS version

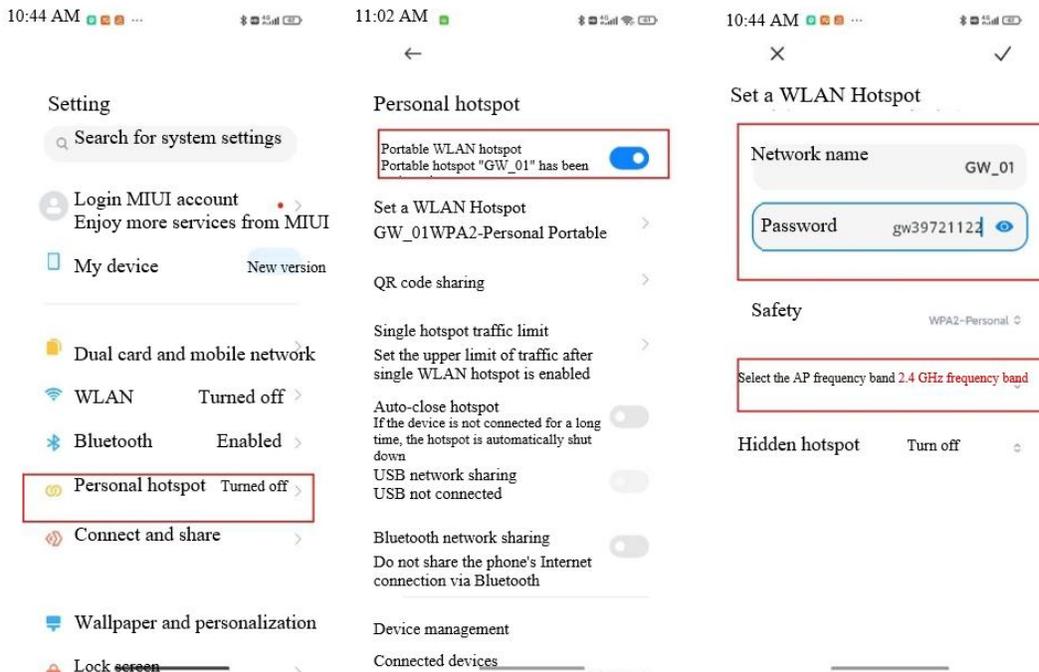
Open the phone Settings → General → About this machine → Change the name to "GW\_01"

Back to Settings → Personal Hotspot → Allow others to join → WLAN password changed to "gw39721122"



### 6.3.2. 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 Q+/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# module communication fault	Communication error between #1 module and master control board	Please contact GW Laser for customer support
2# module communication fault	Communication error between #2 module and master control board	Please contact GW Laser for customer support
3# module communication fault	Communication error between #3 module and master control board	Please contact GW Laser for customer support
4# module communication fault	Communication error between #4 module and master 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 YLLM 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 SMAT 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 SMAT 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 SMAT laser. If the problem persists, please contact GW Laser for customer support.
The internal humidity	The humidity sensor detects	First check the ambient humidity, and then run

exceeds the upper limit	overhigh humidity.	the self-test program for a full SMAT 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 SMAT 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.**

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**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 code corresponds to the characters displayed on the interface

S/N	Fault codes BIT31 to BIT0	Status	Internal code name	Interface character
1	BIT0	0	X001	1# module communication fault removed
2		1	E001	1# module communication fault
3	BIT1	0	X002	2# module communication fault removed
4		1	E002	2# module communication fault
5	BIT2	0	X003	3# module communication fault removed
6		1	E003	3# module communication fault
7	BIT3	0	X004	4# module communication fault removed
8		1	E004	4# module communication fault
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

