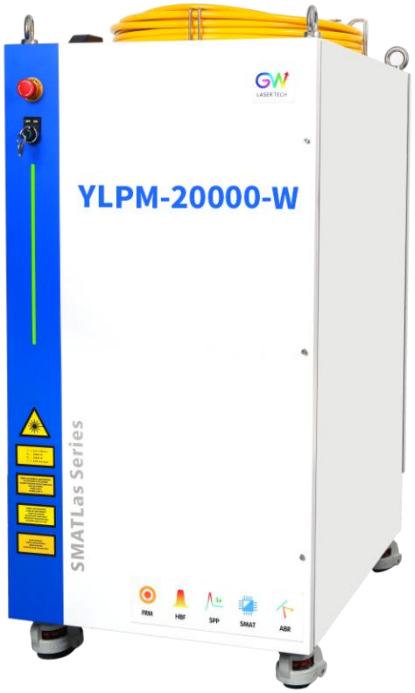
OPERATION MANUAL



YLPM Series CW Fiber Laser

Model: YLPM-6000-W and YLPM-12000-W

YLPM-20000-W, YLPM-30000-W, and YLPM-40000-W

LASER TECH

Document V1.0 20200721

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

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

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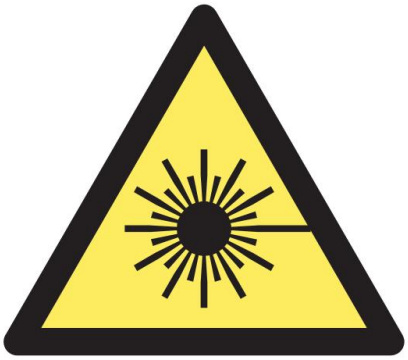
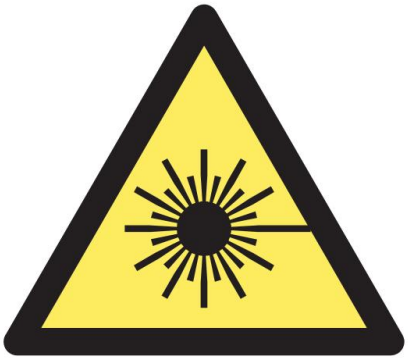


YLPM Fiber Laser is the Class 4 laser product.

This product emits an invisible laser of up to 40000W 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 40000W 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

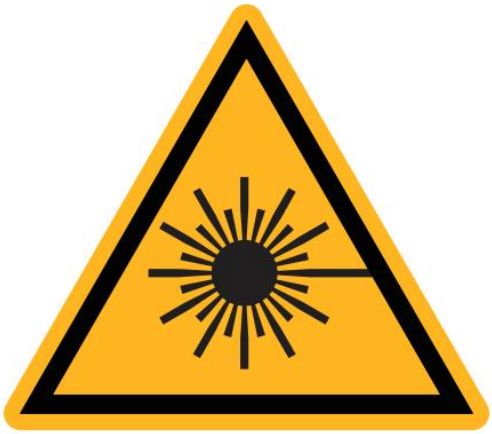
The YLPM series CW fiber laser is an OEM laser product that can be integrated into laser systems for commercial and manufacturing applications. Therefore, this product does not fully meet the definition for complete laser processing system in 21 CFR 1040.10 and 1040.11 under IEC/EN 60825-1. GW Laser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

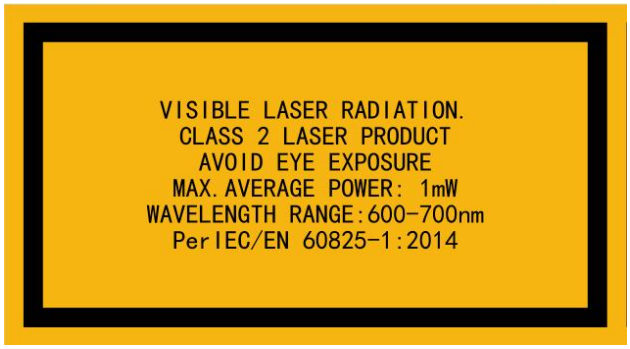
1.3 Safety labels

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



Laser outlet label

Location: Front panel



Certification label

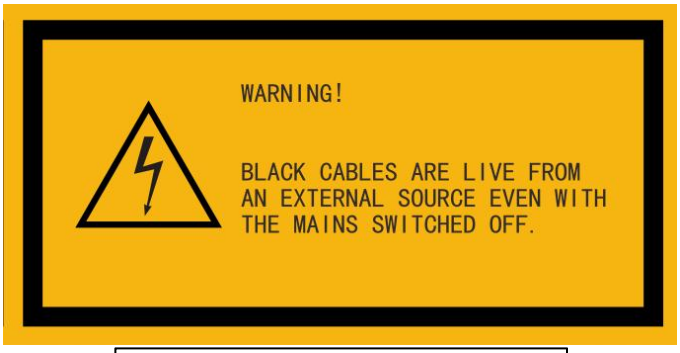
Location: Front panel

Warning label

Location: Front panel

Certification label

Location: Front panel



Warning label

Location: Front panel

Product lable

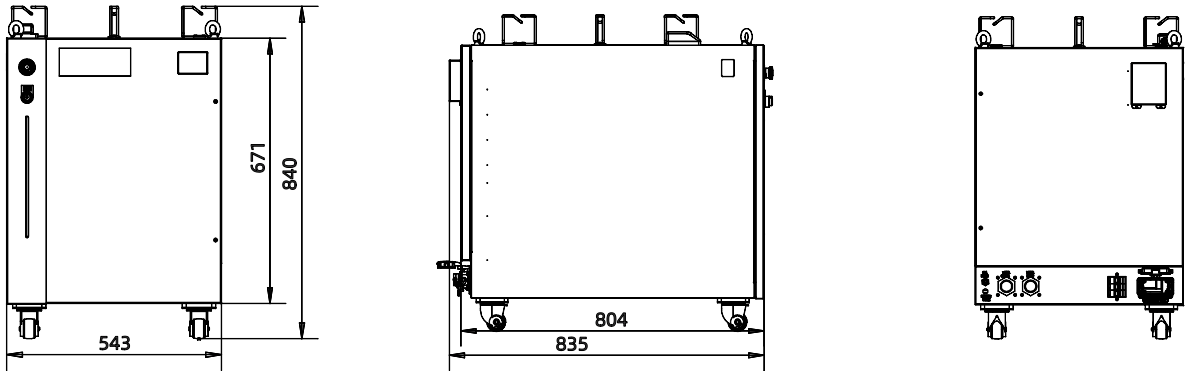
Location: Front panel

2. Description

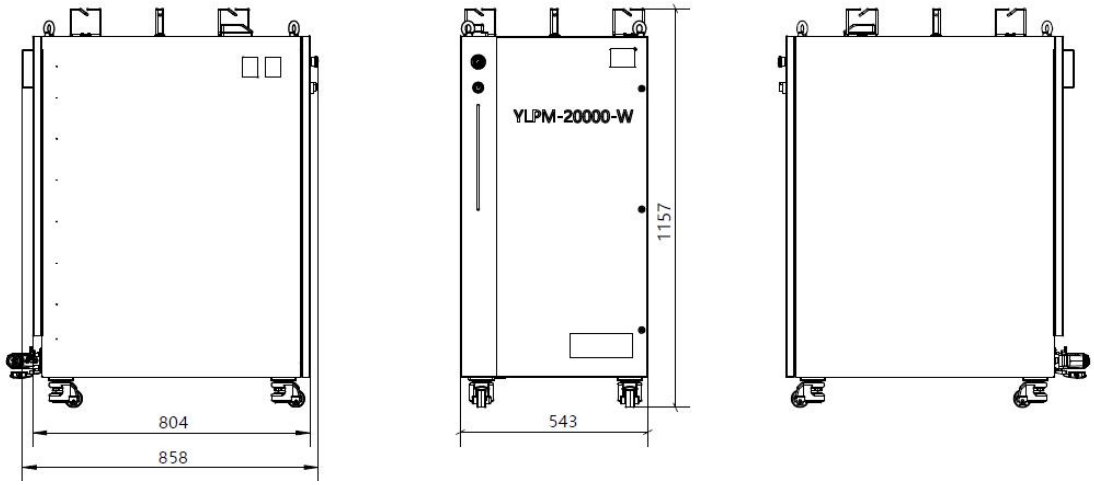
The YLPM series OEM fiber laser from GW Laser is designed for industrial material processing applications with reliable, efficient and proprietary ABR and SPP technologies. Key innovations in the YLPM series fiber lasers also include the proprietary thermal processing, mode-filtering technology, and a durable and novel fiber laser structure. The YLPM 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. YLPM-6000-W can provide QBH type transmission cable.

The YLPM series OEM fiber lasers from GW Laser meet your highest requirements on performance and reliability. The YLPM series lasers provide up to 40000W continuous wave (CW) multi-mode output laser, with the output waveband between 1070nm and 1080nm. YLPM 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 < 6.5. 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.

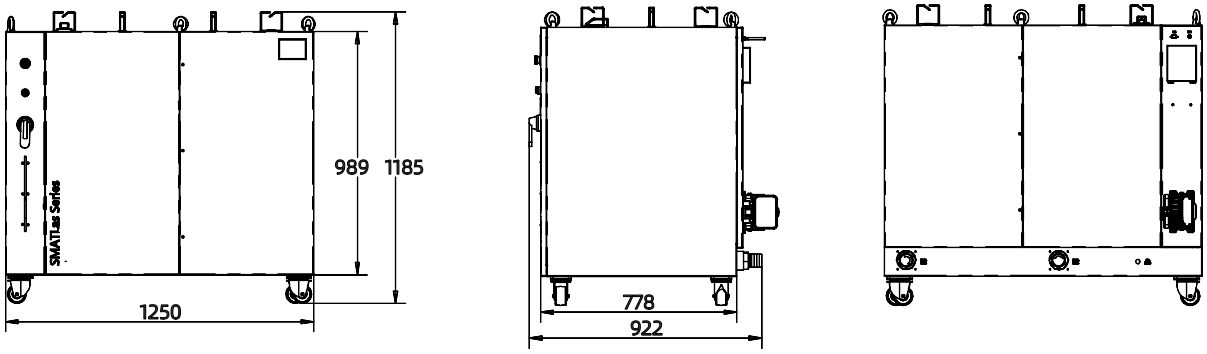
2.1 Laser dimensional drawings



YLPM-6000-W and YLPM-12000-W dimensions

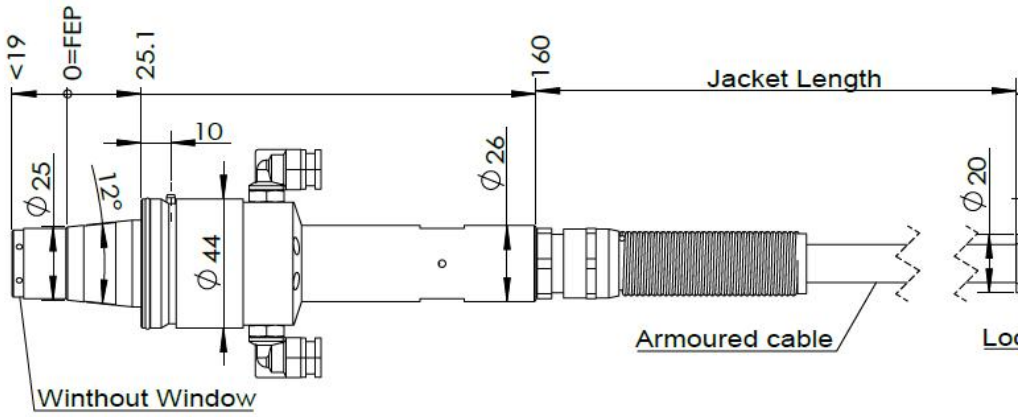


YLPM-20000-W dimensions



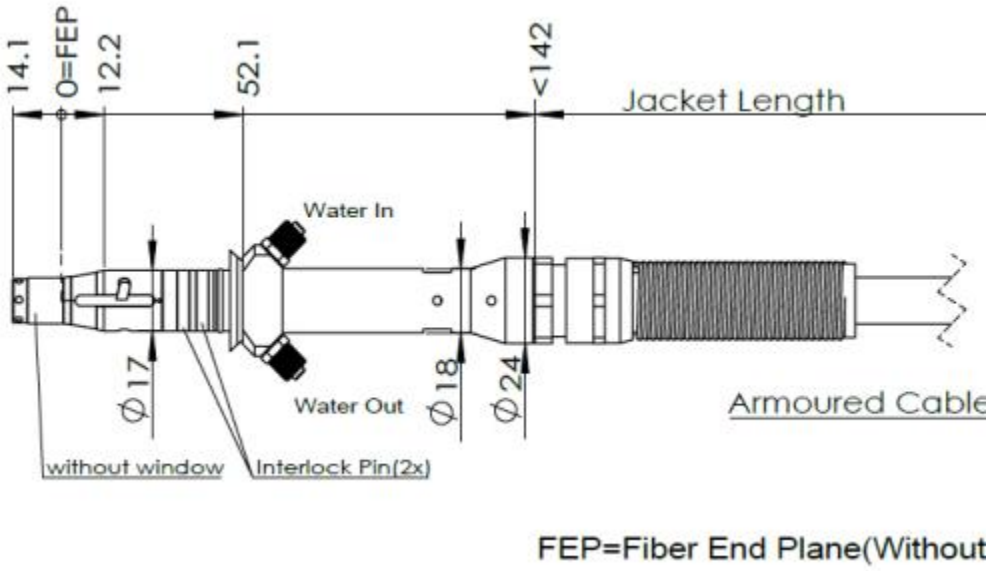
YLPM-30000-W and YLPM-40000-W dimensions

2.2 Optical Output connector (QBH type)



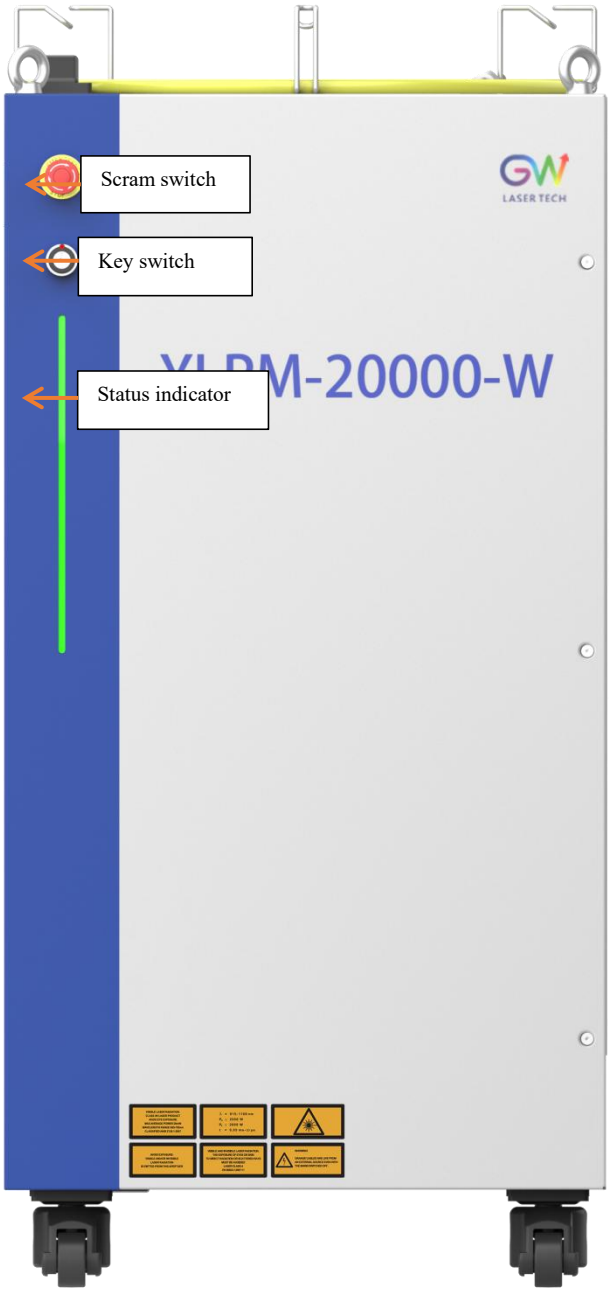
FEP=Fiber End Plane (Without Window)

Q+ type optical beam transmission cable



QBH type optical beam transmission cable

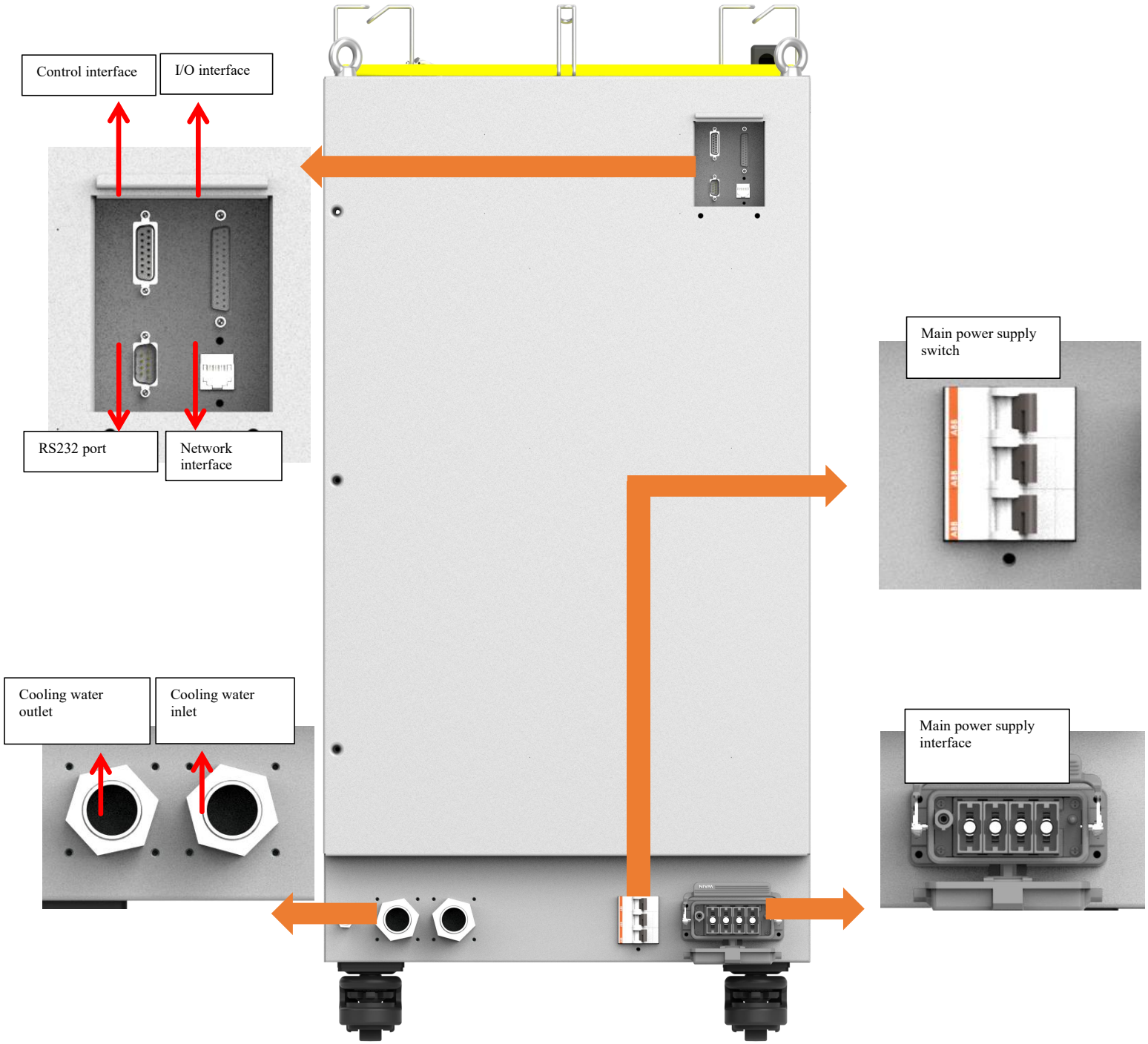
2.3 Front panel



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

RS232 port	DB9 interface, used to communicate with the upper computer, and monitor the running status of the laser
Control interface	DB15 interface, the laser control signal interface
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 five-wire system interface
Laser water-cooling interface	In case of 6-20kW, 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 and 40kW, to be connected to 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 YLPM-6000-W		6000		
Output power YLPM-12000-W	11800	12000	12200	W
YLPM-20000-W	17000	20000	21000	W
YLPM-30000-W		30000		W
YLPM-40000-W		40000		W
Output power range	1		100	%
Output bandwidth		< 3.0		nm
Modulation frequency			50	kHz

Turn-on time			5	μs
Red guide light output power	1		2	mW

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 BPP	3		6.5	
Output fiber diameter, multi-mode output	70	100	150	um
Output fiber length, multi-mode output		20	30	m

3.3 Mechanical and environmental parameters

Characteristics	Min. value	Typical value	Max. value	Unit
Operating temperature range	5		45	℃
Storage temperature	-10		50	℃
Cooling method	Water-cooled			
Water flow YLPM-6000-W		45		L/min
YLPM-12000-W		100		
YLPM-20000-W		185		
YLPM-30000-W		300		
YLPM-40000-W		400		
Water temperature	22	25	28	℃
Water pressure	4		6	Bar
The cooling capacity of the water cooling system YLPM-6000-W		15000		Watts

YLPM-12000-W		30000		
YLPM-20000-W		50000		
YLPM-30000-W		75000		
YLPM-40000-W		105000		
Operating humidity	0		95	%
Dimensions YLPM-6000-W	857X543X840			mm
YLPM-12000-W	835X433X840			mm
YLPM-20000-W	804X543X1157			mm
YLPM-30000-W, YLPM-40000-W	922X1250X1185			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

Pin	Color	Definition	Function	Power voltage	Power current
1	Yellow	L1	AC input live wire	380V AC	30A (YLPM-6000-W) 60A (YLPM-12000-W) 105A (YLPM-20000-W) 135A (YLPM-30000-W) 165A (YLPM-40000-W)
2	Green	L2	AC input live wire	380V AC	30A (YLPM-6000-W) 60A (YLPM-12000-W) 105A (YLPM-20000-W) 135A (YLPM-30000-W) 165A (YLPM-40000-W)
3	Red	L3	AC input live wire	380V AC	30A (YLPM-6000-W) 60A (YLPM-12000-W) 105A (YLPM-20000-W) 135A (YLPM-30000-W) 165A (YLPM-40000-W)
4	Blue	N	AC input neutral line	N/C	(YLPM-12000-W) (YLPM-20000-W)
5	Yellow green	PE	AC input ground wire	N/C	N/C

3.5 RS-232 interface

RS232	Interface (DB 9)						
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				

3.6 Control interface

DB15	Control interface (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	Turn on	24V	22V	26V	In case of the signal
				Turn off	0V	0V	0.7V	

			signal					at high level, the red guide light is outputting
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 digital ground		0V			
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	

3.7 I/O interface

DB25	**I/O interface (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	

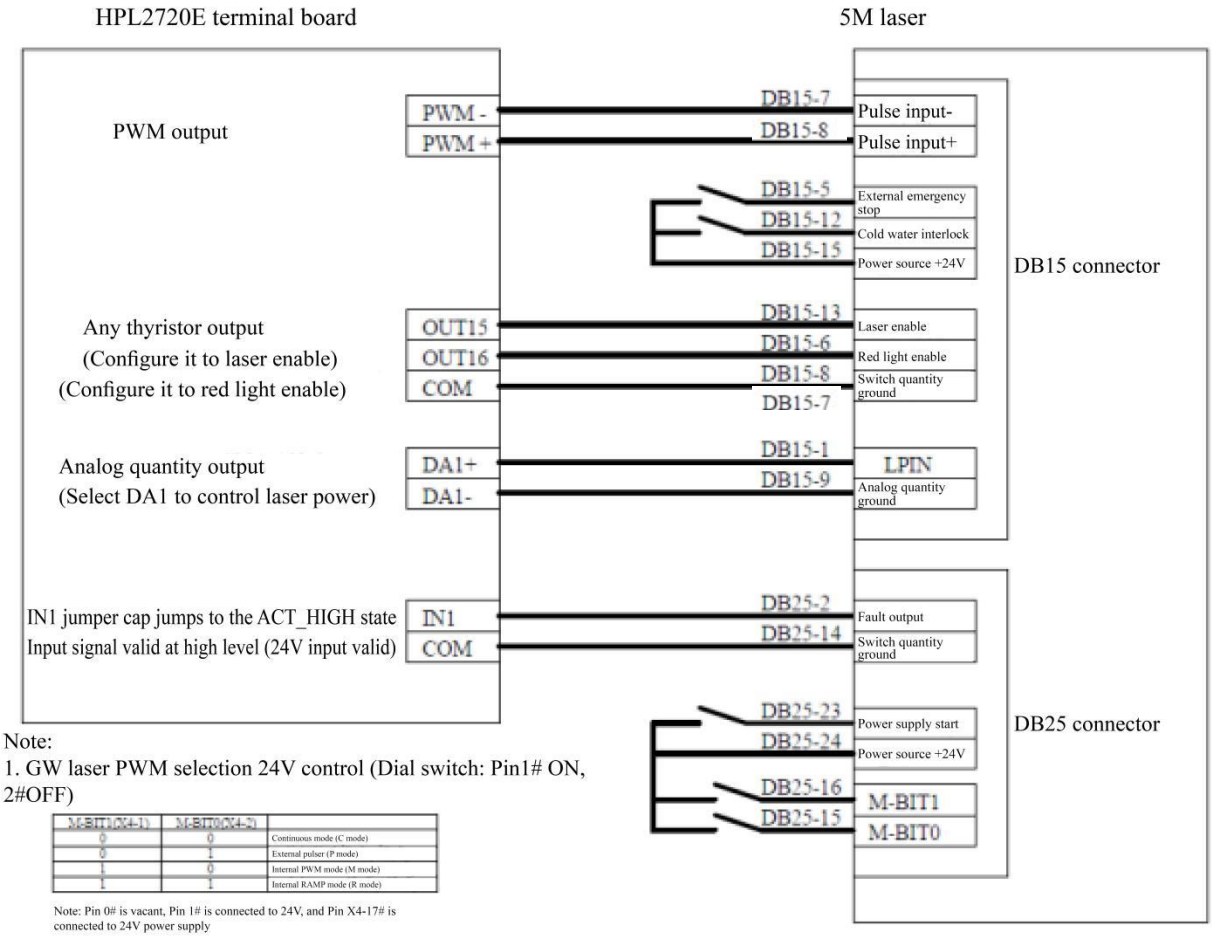
2	S-ERR	Output	System fault signal	With fault	24V	23V	25V	Whether the system has faulty output pins
				No fault	0V	0V	0V	
3	S-WAR	Output	System alarm signal	With alarm	24V	23V	25V	Check whether the system has alarm output pins
				No alarm	0V			
4	S-LAS	Output	Laser output indication signal	Output	24V	23V	25V	Whether the laser is output or not
				No output	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	Program start pin
				Stop	0V	0V	0.7V	
10	S-OUT2	Output	Reserved					
11	P-RST	Input	Fault alarm reset	Reset	24V	22V	26V	Clear fault alarm signal
				Not	0V	0V	0.7V	

				reset				
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 immediately in case of the signal at high level
				Not stop	0V	0V	0.7V	
23	P-LPS	Input	Start the main power supply	Start	24V	22V	26V	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	

4. YLPM laser wiring diagram

5M laser and BOCHU HPL2720E terminal board wiring schematic diagram (V1.0)



Note:

1. GW laser PWM selection 24V control (Dial switch: Pin1# ON, 2#OFF)

M-BIT1(X4-1)	M-BIT0(X4-2)	
0	0	Continuous mode (C mode)
0	1	External pulser (P mode)
1	0	Internal PWM mode (M mode)
1	1	Internal RAMP mode (R mode)

Note: Pin 0# is vacant, Pin 1# is connected to 24V, and Pin X4-17# is connected to 24V power supply

5. YLPM 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 YLPM 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 interface 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 interface (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 control methods and operating modes work, please refer to Section II of this Chapter.

5. Ensure that the interlock circuit is closed, that is, the "Emergency stop signal (Pin5)" and "Cooling water fault interlock signal (Pin12)" of DB15 are connected to high-level voltage (24V).

6. Ensure that the laser emit enable signal (Pin13 of DB15) is disabled, that is, it is connected to the low-level voltage (0V).

7. Ensure that the main power supply start signal (Pin23 of DB25) is valid, that is, it is connected to the high-level voltage (24V). Wait for 5 seconds, and the output voltage is stable after the main power supply is started, being ready to turn on the laser.

8. The laser output is enabled by the RS-232 command or by supplying 24V voltage to the laser emit enable signal terminal (Pin13 of DB15).

9. It can be known whether the laser is emitting or not through the electrical level of the laser output indication signal (Pin4# of DB25d) terminal.

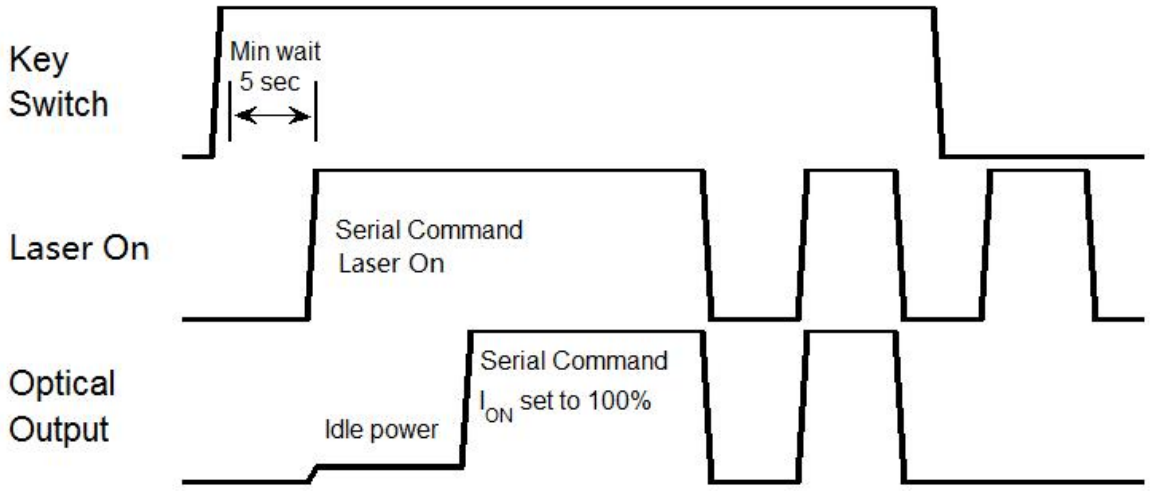
5.2 Operation mode setting

YLPM 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 determined by the electrical levels of Pin 15# and Pin 16# of DB25. For details, see the interface definition of DB25.

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

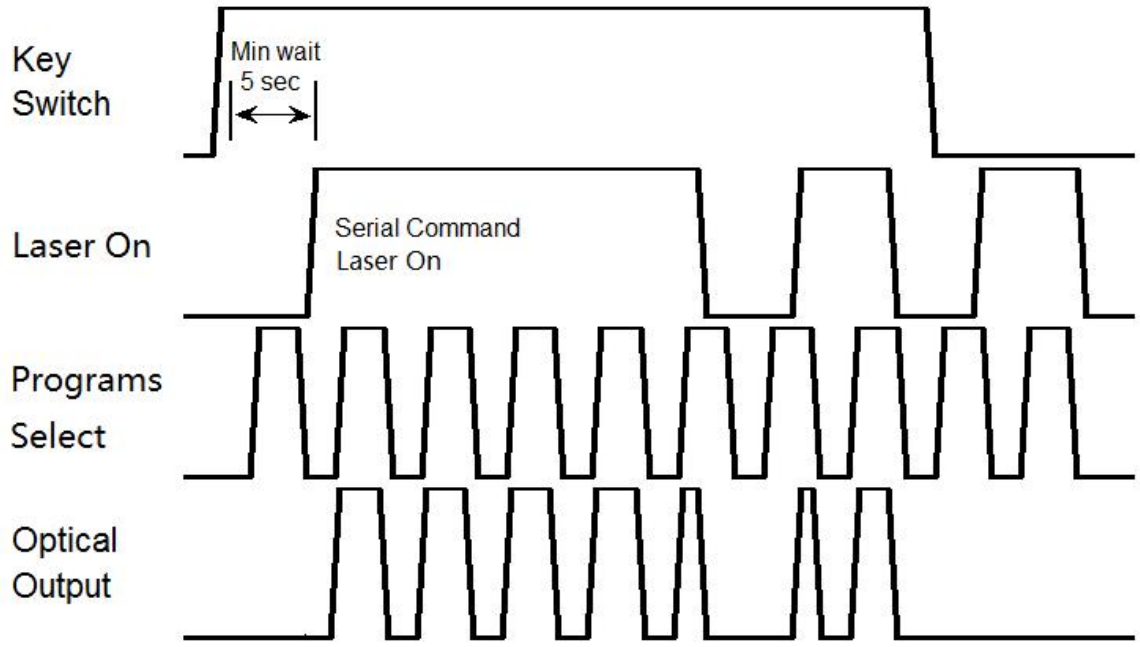
Set to "Internal Control" through the HMI software on the host computer, and then select "CW" working mode. When Laser-ON is activated, the Laser output power is determined by the corresponding value set by the HMI on the host computer, and this output value can be changed at any time when the laser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

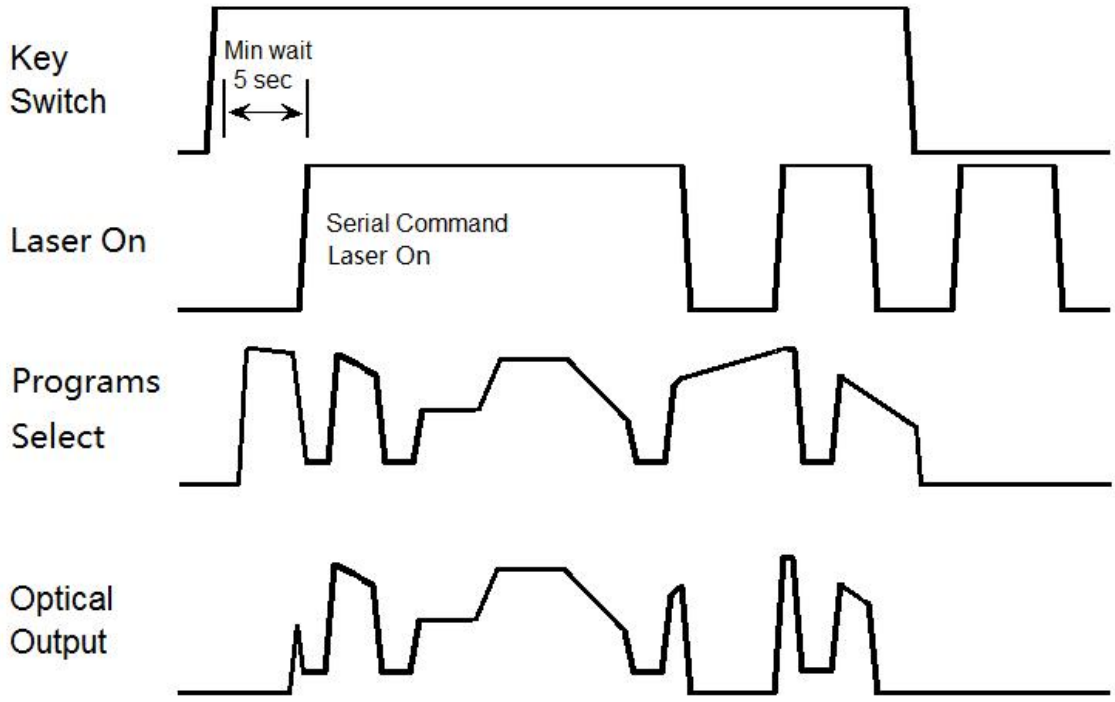
Set to "Internal Control" through the HMI software on the host computer, then select "PWM" working mode, and finally set the PWM program parameters. When the Laser-On command is activated, the output optical power is adjusted to the ION value set by the different PWM programs. When the laser is emitted, 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

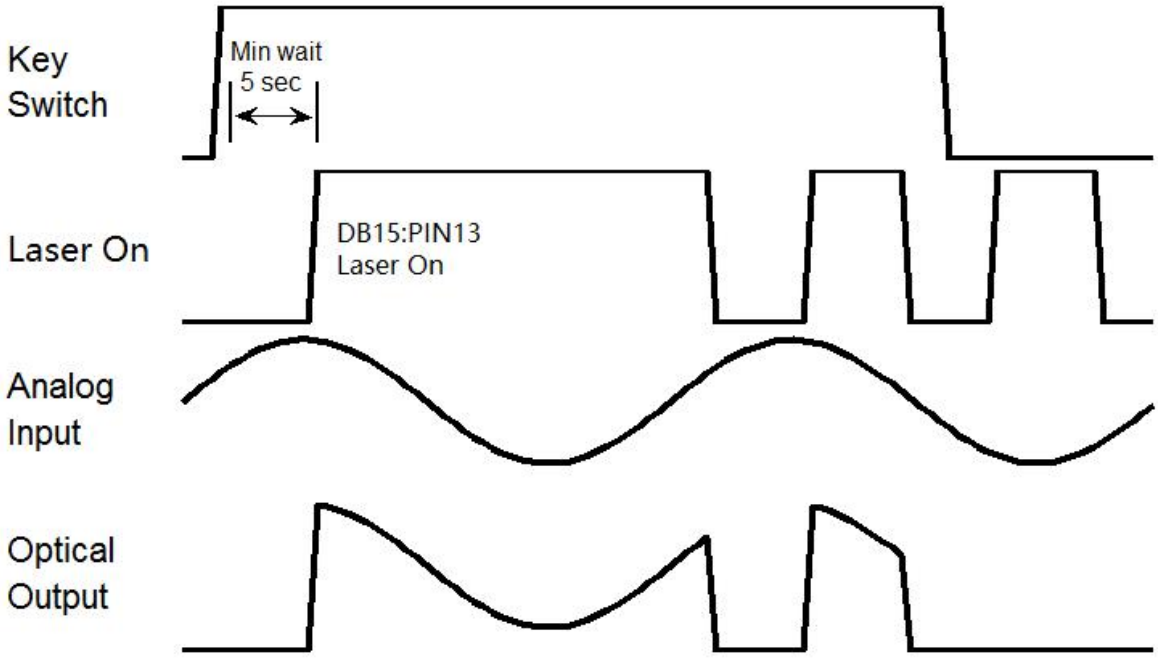
Set to "Internal Control" through the HMI software on the host computer, then select the "Ramp" working mode, and finally set the Ramp program parameters. When the Laser-On command is activated, the output light power is adjusted to the ION value set by the different Ramp programs. When the laser is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

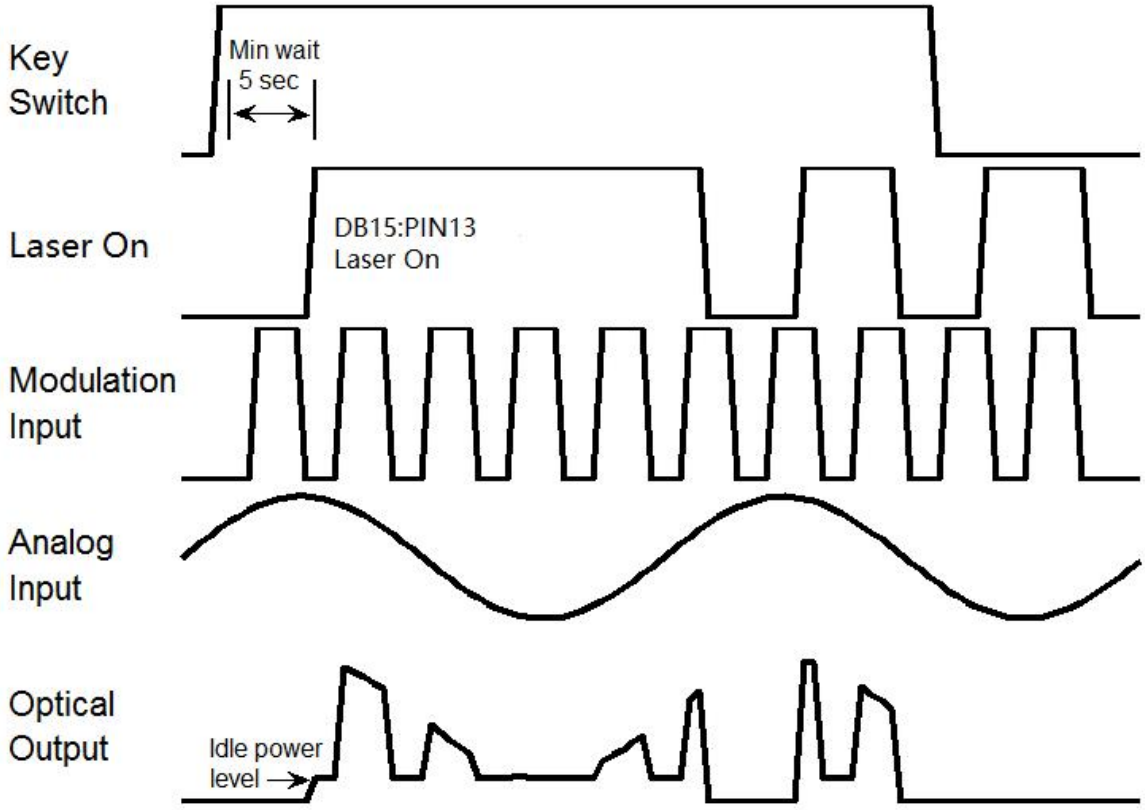
The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 and PIN16 are open-circuited or grounded at the same time, the YLPM laser works in the CW mode. When the PIN13 of DB15 is connected to 24V power, the 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

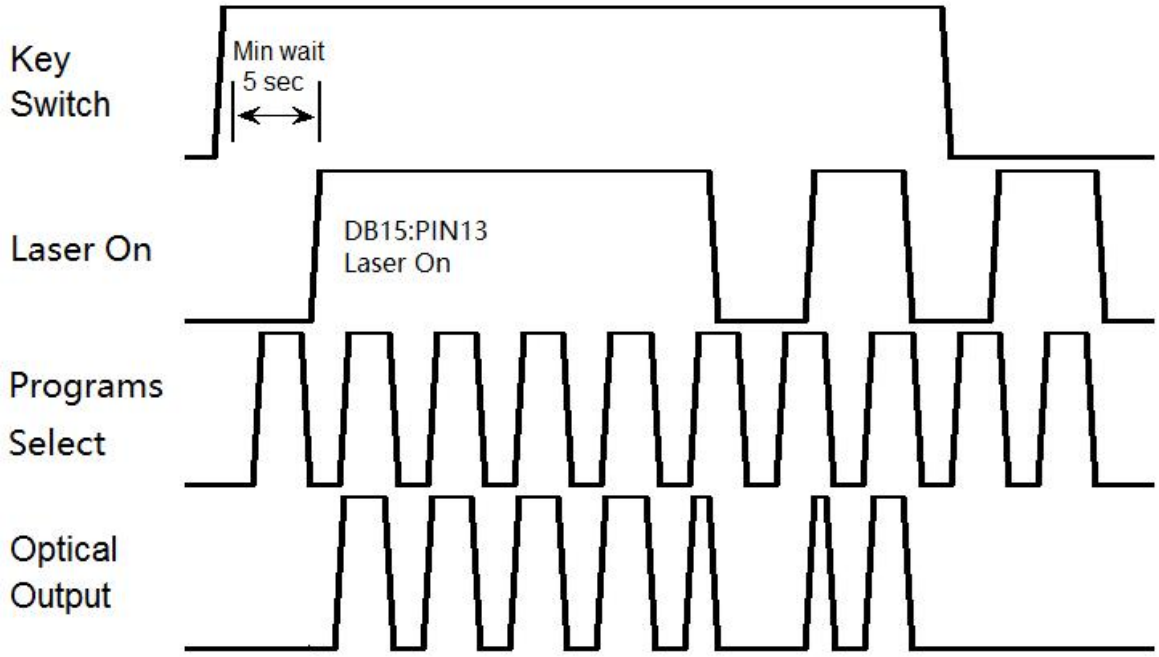
The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 is connected to 24VDC power and the DB25 PIN16 is open-circuited or grounded, the YLPM laser operates in pulse mode. When the PIN13 of DB15 is connected 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

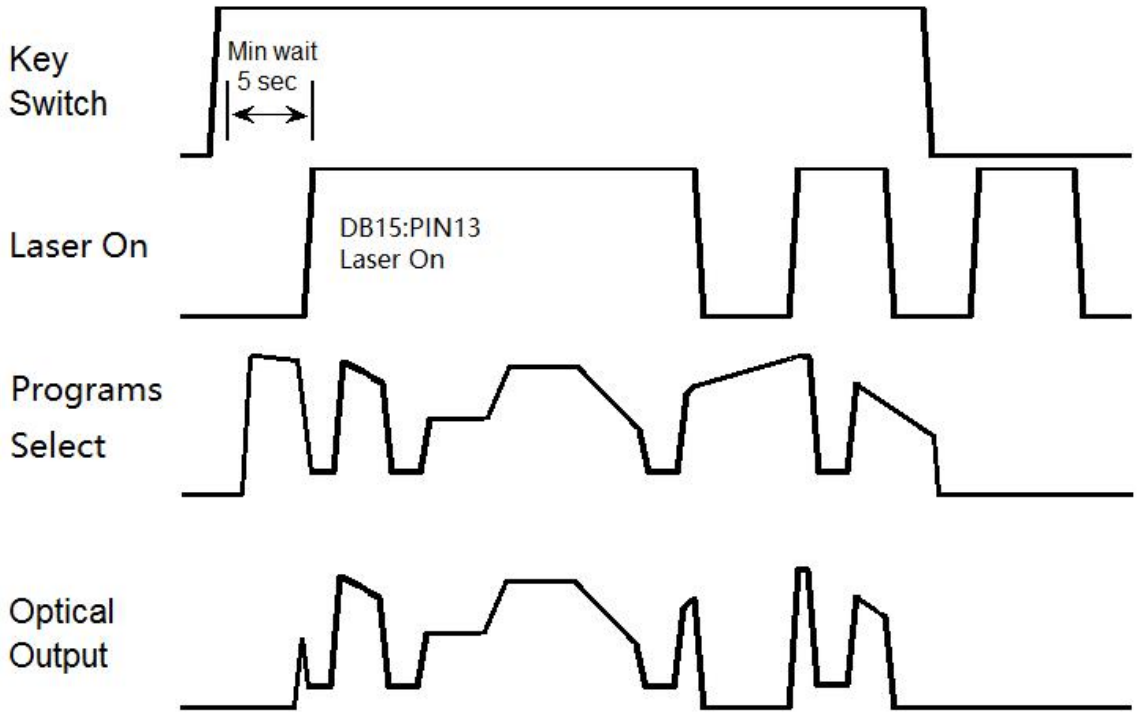
The laser is in external control mode by default. You can also switch between internal control and external control by using the HMI. When the DB25 PIN15 is open-circuited or grounded and the PIN16 is connected to 24VDC power, the YLPM laser operates in "PWM" mode. When the PIN13 of DB15 is connected 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 pin definition of DB25.



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 YLPM 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 enabled by connecting the Pin 6# of X4 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.

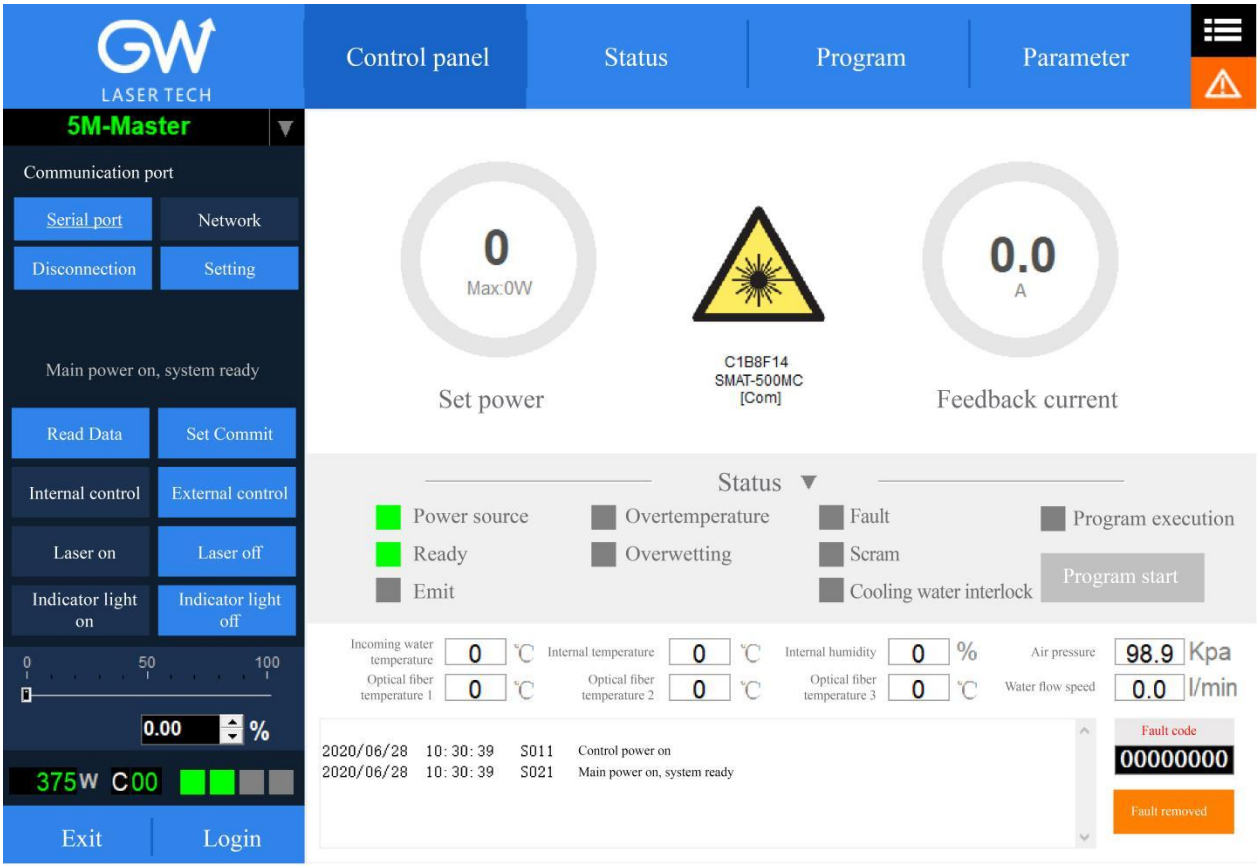
6. YLPM laser human-machine interface

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:

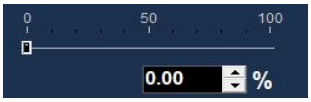
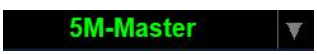
Users need to log in by clicking the "Login" button to use the software. User name (user) and password (000000). The following screen will display after login:

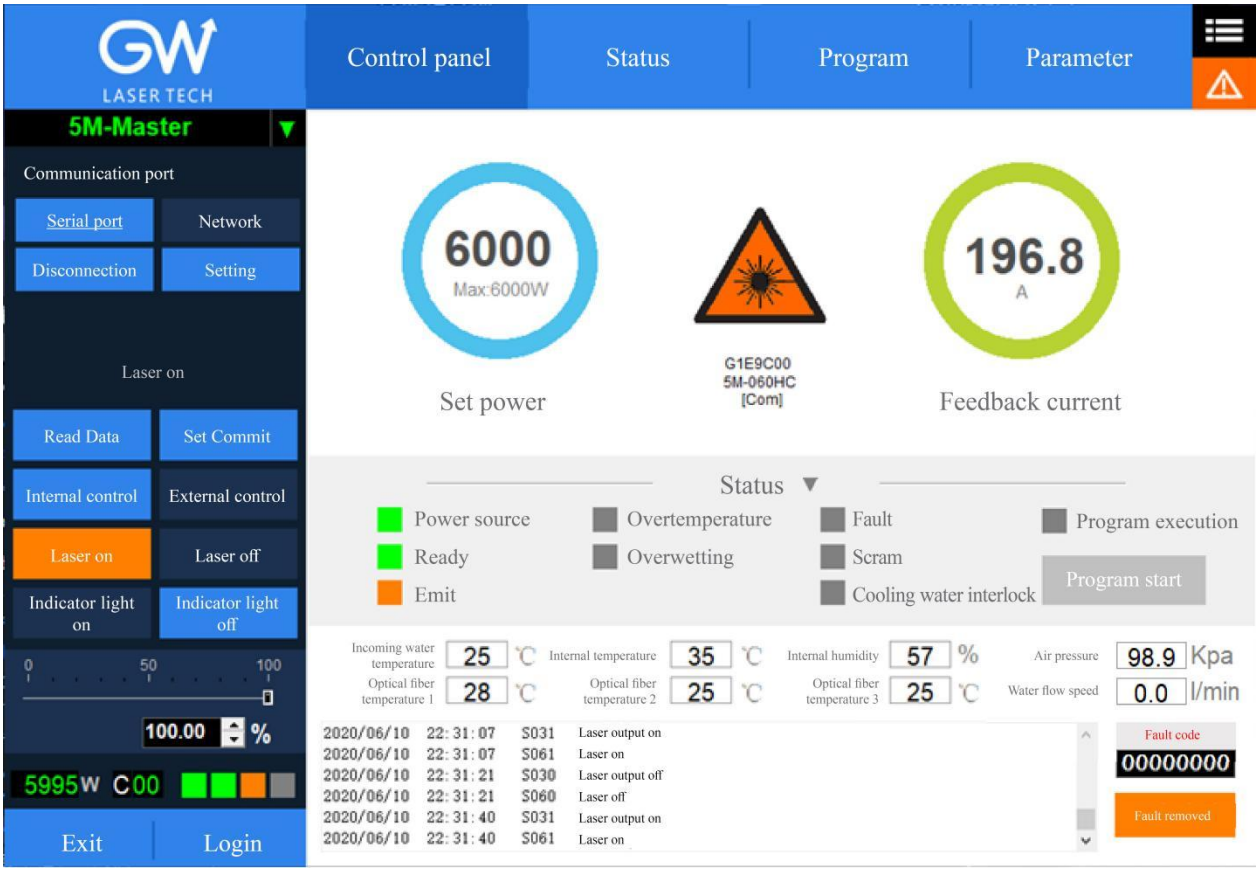


Click the "Set" button to set the serial port number, and after setting, you can communicate with the laser. Make sure that the "Read data" button is in blue shading, if not, click "read data", and then the HMI will maintain continuous communication with the laser and display the status inquiry for the laser. If the HMI fails to establish the communication with the YLPM 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 YLPM laser. For example, the temperature of the YLPM 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.

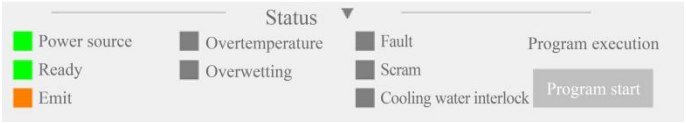
S/N	Button/indicator	Description
1	Serial port / Network	Communication mode selection: Select the communication mode for establishing the connection with the YLPM laser.
2	Disconnection	Disconnect the communication with the YLPM laser.
3	Setting	Parameter setting of the communication port

4		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 YLPM laser.
5		The user can select the control mode of YLPM 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

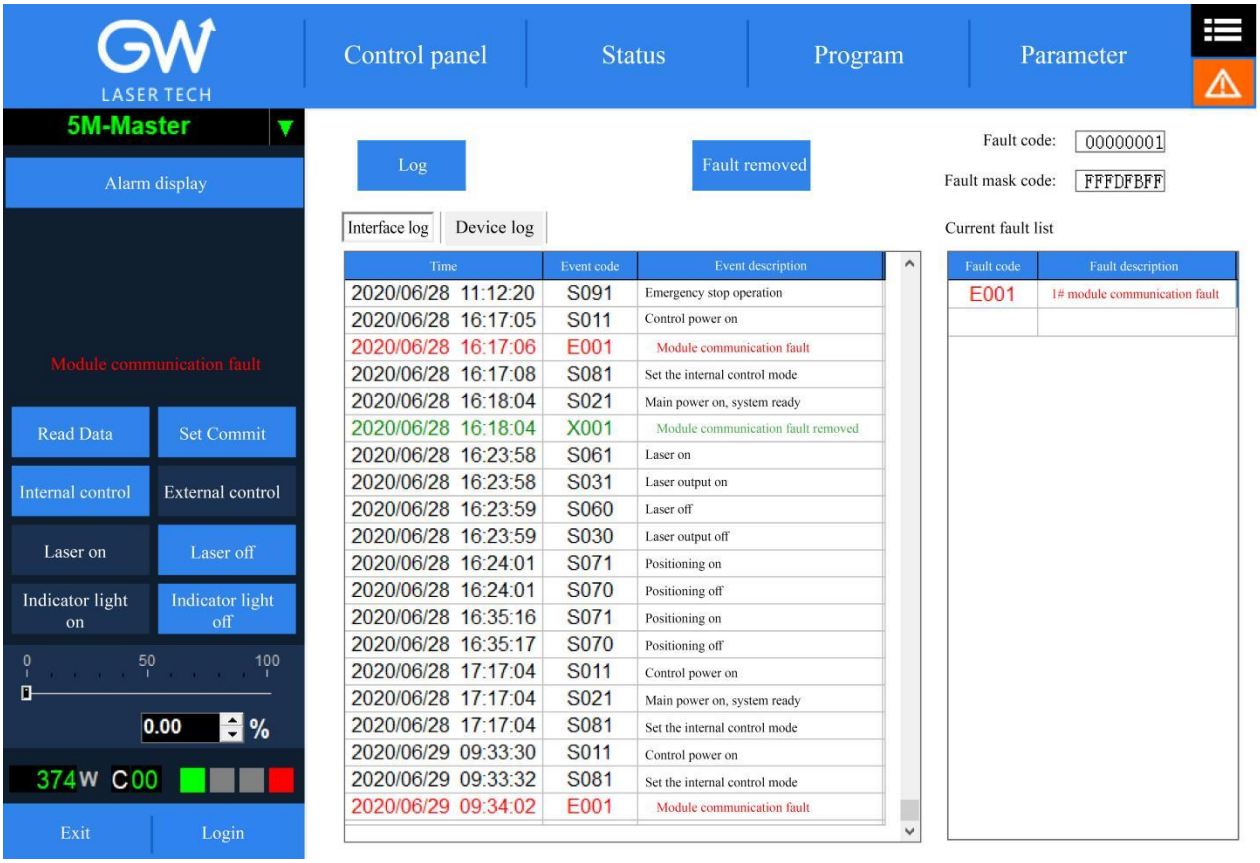


The YLPM HMI will continuously read the internally-controlled monitor information and display the laser information on the HMI interface in real time.

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

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 YLPM 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 YLPM 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.



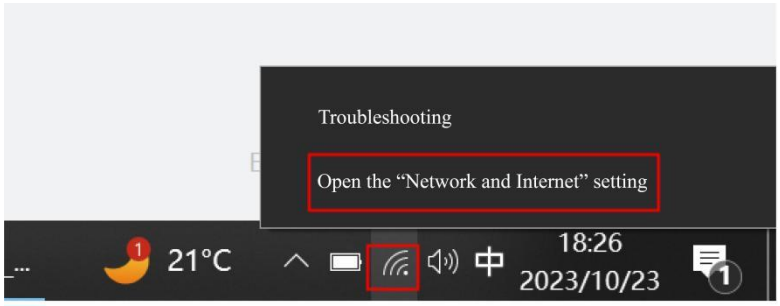
	Button/indicator	Description
19	Fault removed	Press this button, and the user will reset the general error.
20	Interface log / Device log Time / Event code / Event description 2020/06/28 11:12:20 S091 Emergency stop operation 2020/06/28 16:17:05 S011 Control power on 2020/06/28 16:17:06 E001 Module communication fault 2020/06/28 16:17:08 S081 Set the internal control mode 2020/06/28 16:18:04 S021 Main power on, system ready 2020/06/28 16:18:04 X001 Module communication fault removed 2020/06/28 16:23:58 S061 Laser on 2020/06/28 16:23:58 S031 Laser output on 2020/06/28 16:23:59 S060 Laser off 2020/06/28 16:23:59 S030 Laser output off 2020/06/28 16:24:01 S071 Positioning on	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: 00000001 Fault mask code: FFFDFBFF	Display the fault codes and fault mask codes
22	Current fault list Fault code / Fault description E001 1# module communication fault	Display all existing faults at present

6.2. Man-machine interface LAN connection mode

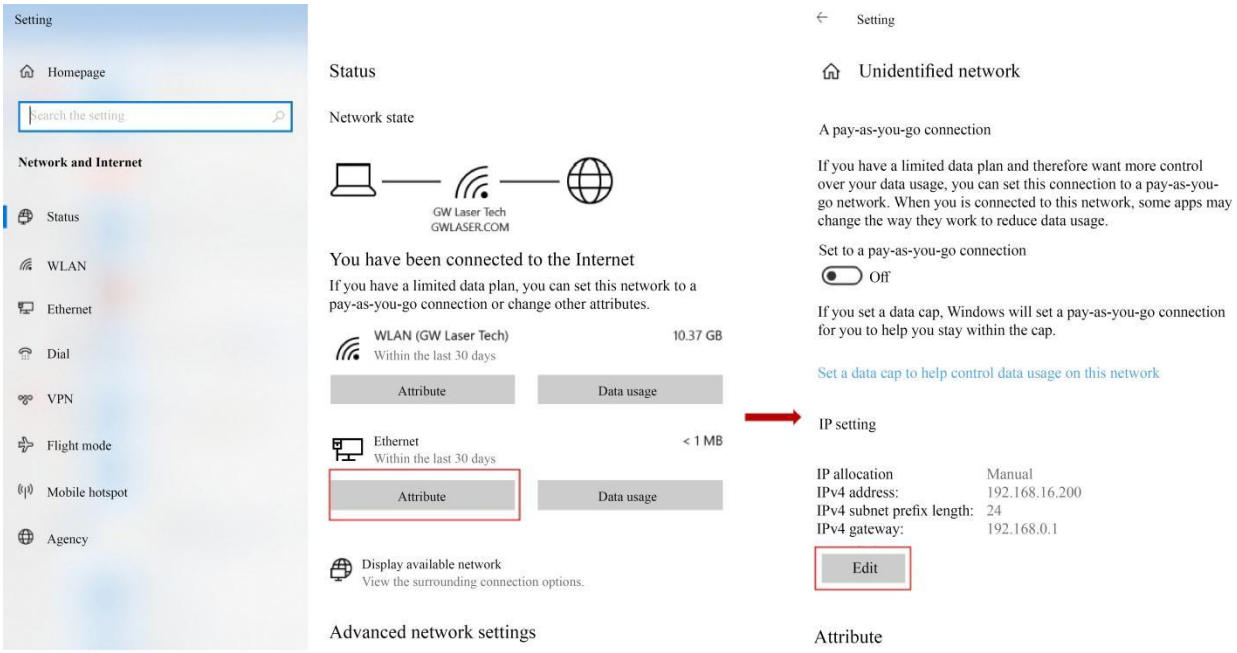
6.2.1. Ensure that the laser that needs to be controlled remotely and the remote computer have been connected to the same LAN, and for the laser LAN connection method, please refer to GW laser network connection setting manual.

6.2.2 Connect the laser to the local computer with the 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.

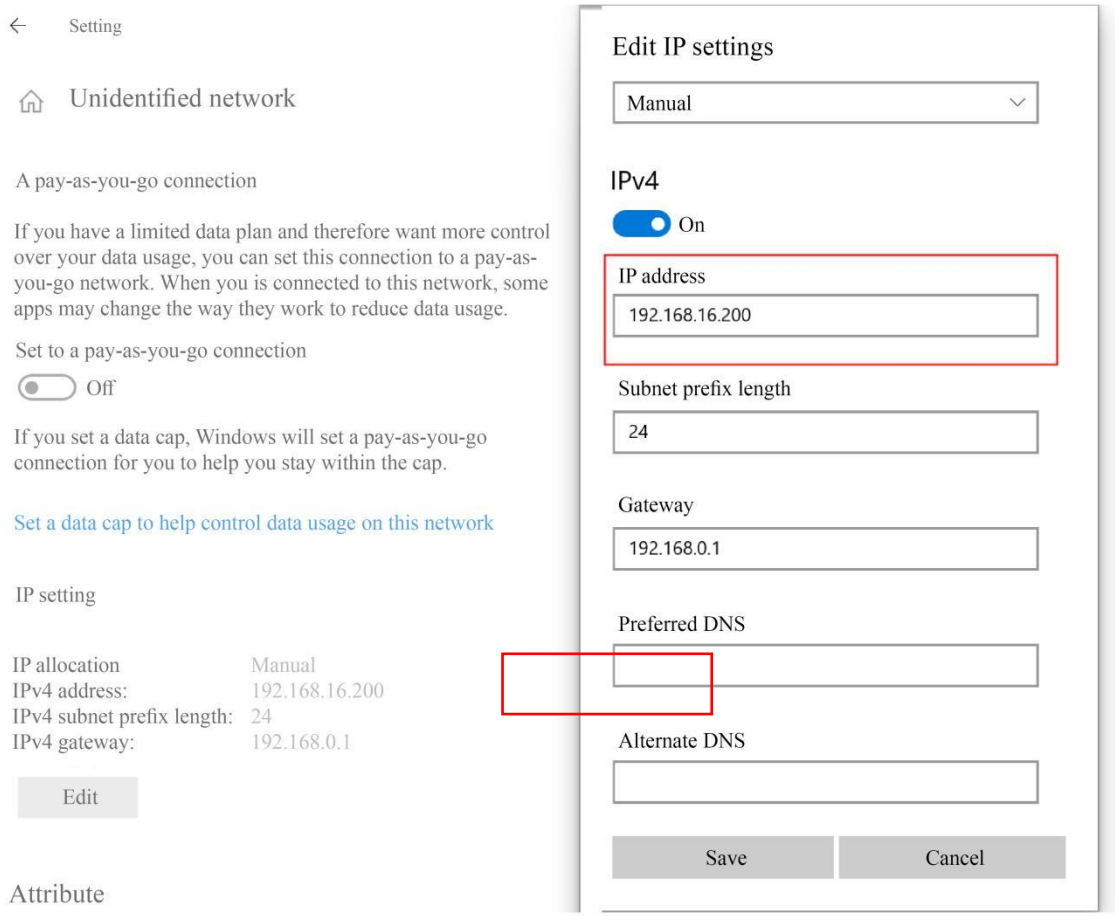
6.2.3. Change the computer's IP address, and open the computer's "Network and Internet Setting"



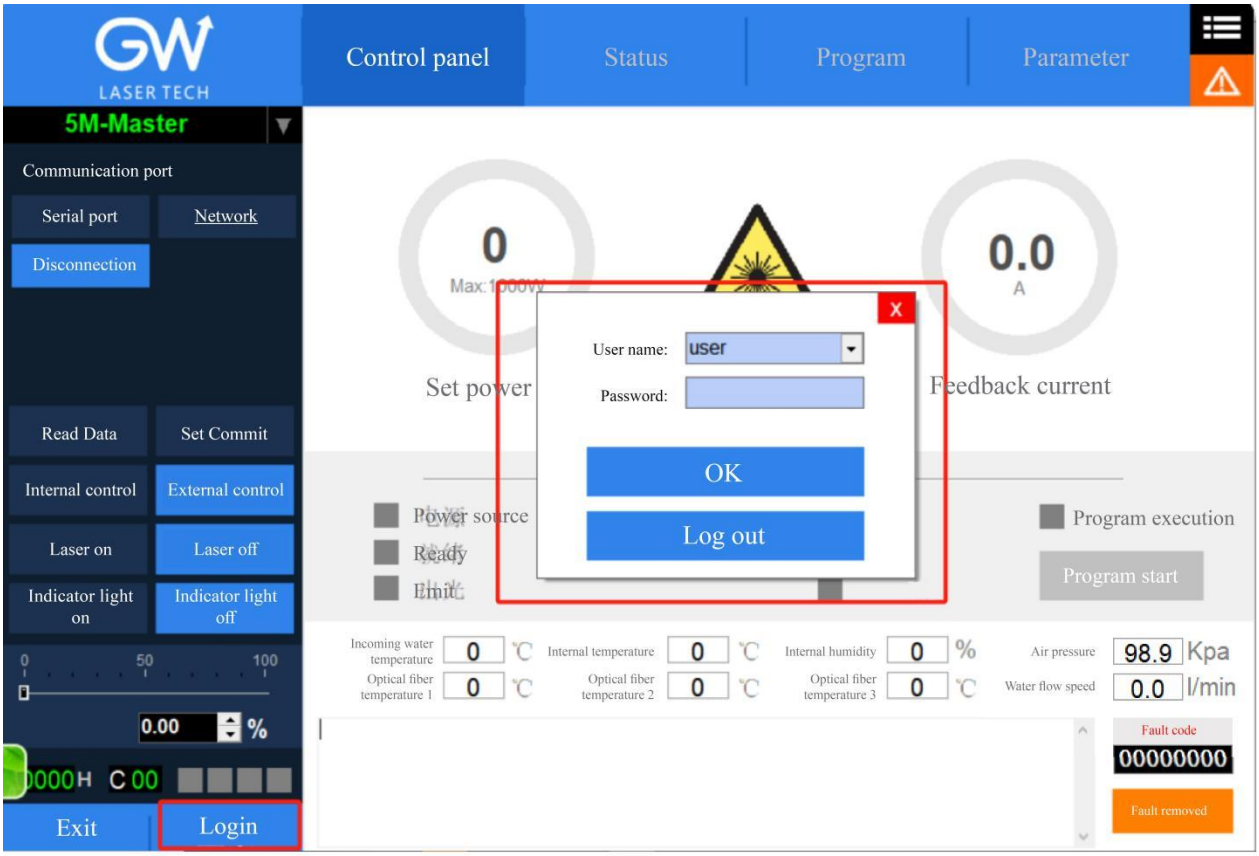
Click "Attribute", and click "Edit"



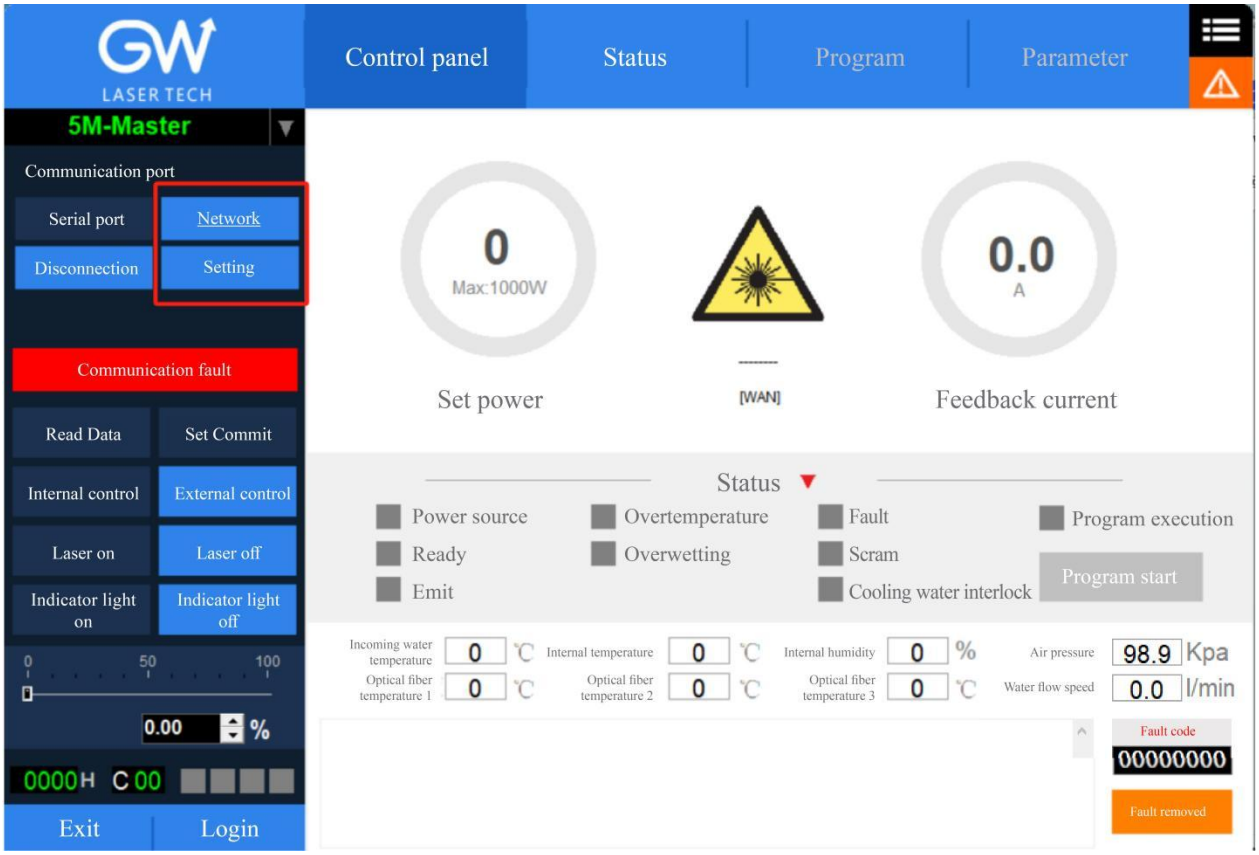
Enter the IP address "192.168.16.X", of which X can be any figure from 2 to 253, and click "Save".



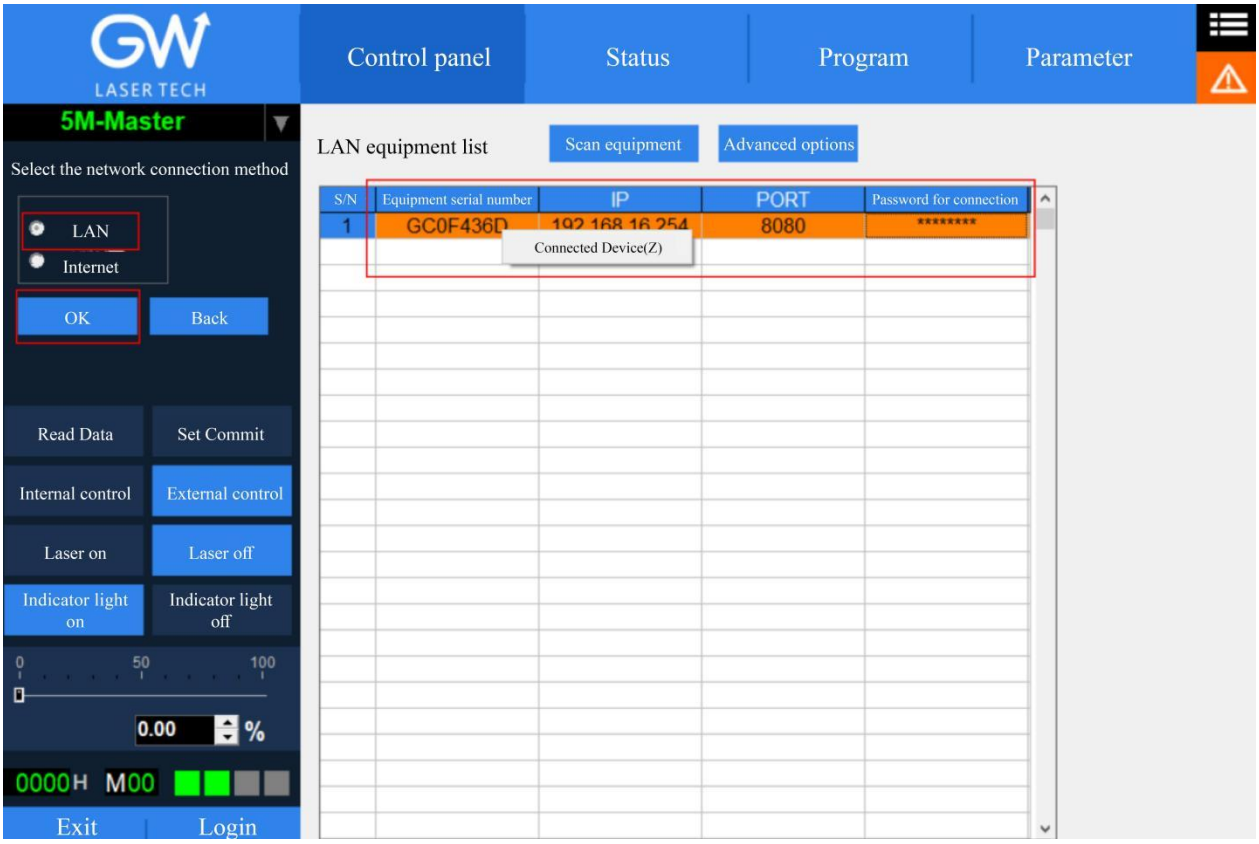
6.2.4. Open the HMI software on the computer and enable the user login as shown in the figure below. The user name is "user" and the password is 000000. The login interface is as shown in the Figure below.



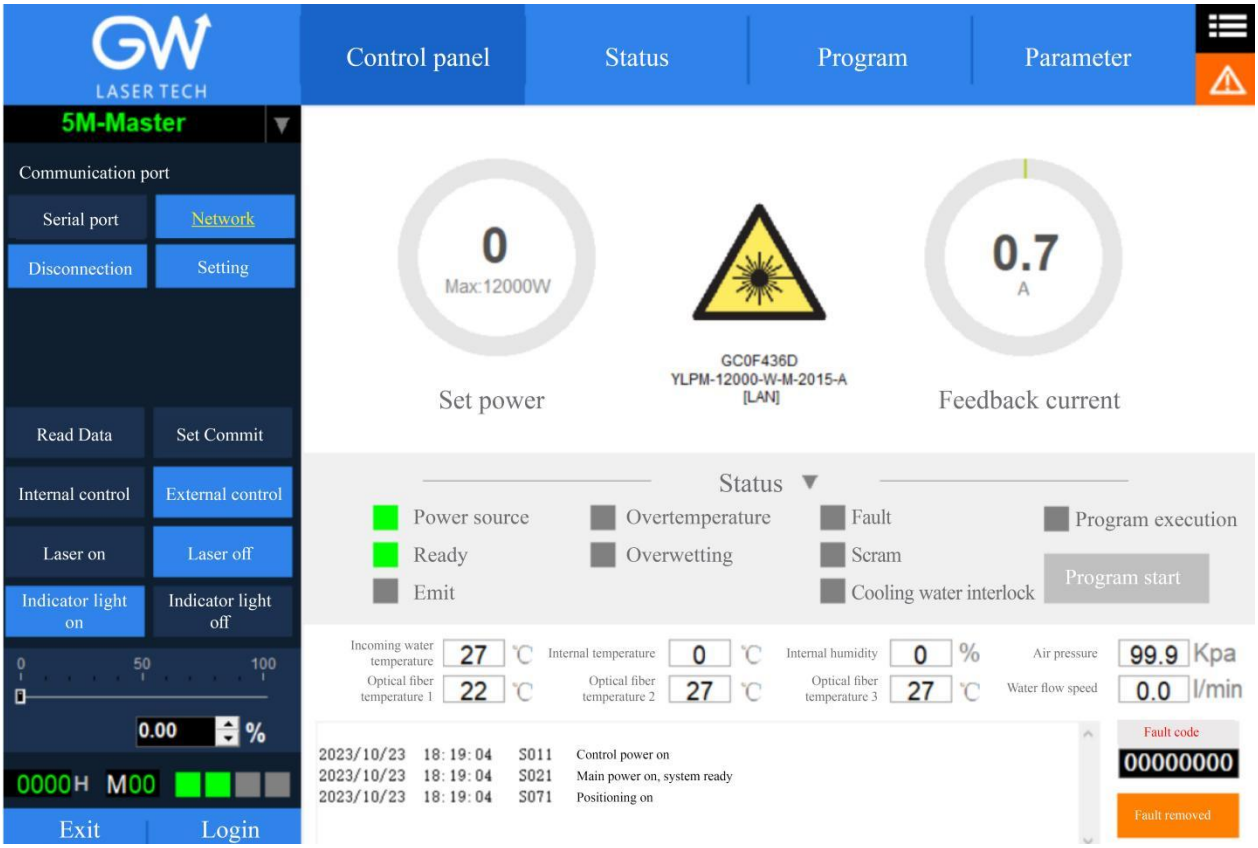
6.2.5. Click "Settings" to pop up the following interface



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

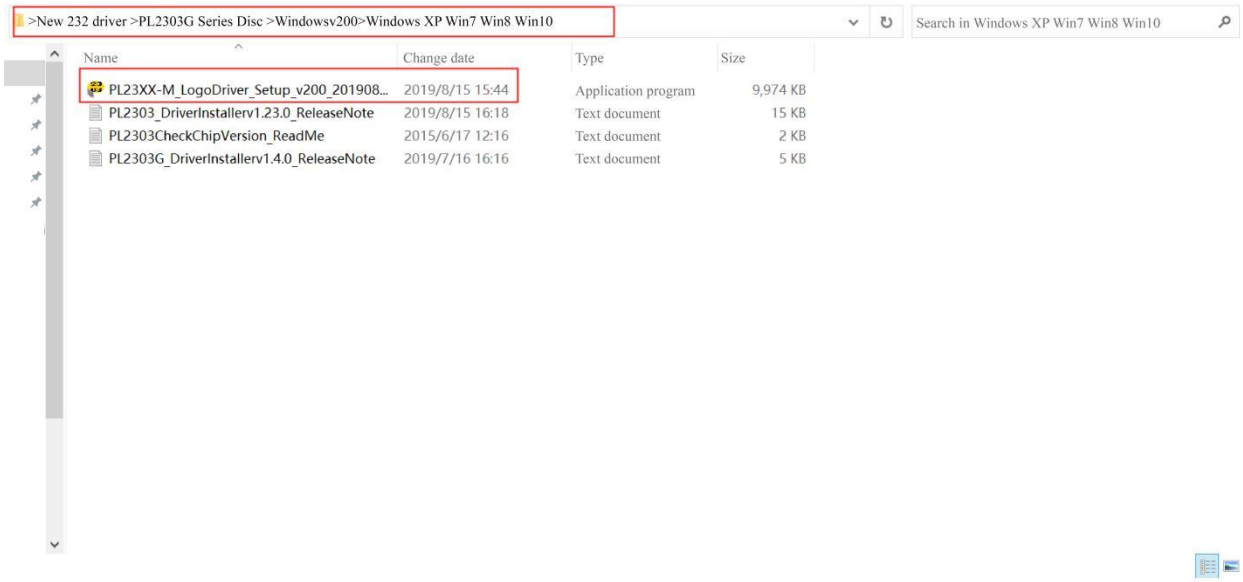


6.2.7. After successful connection, the interface is as shown in the following Figure:

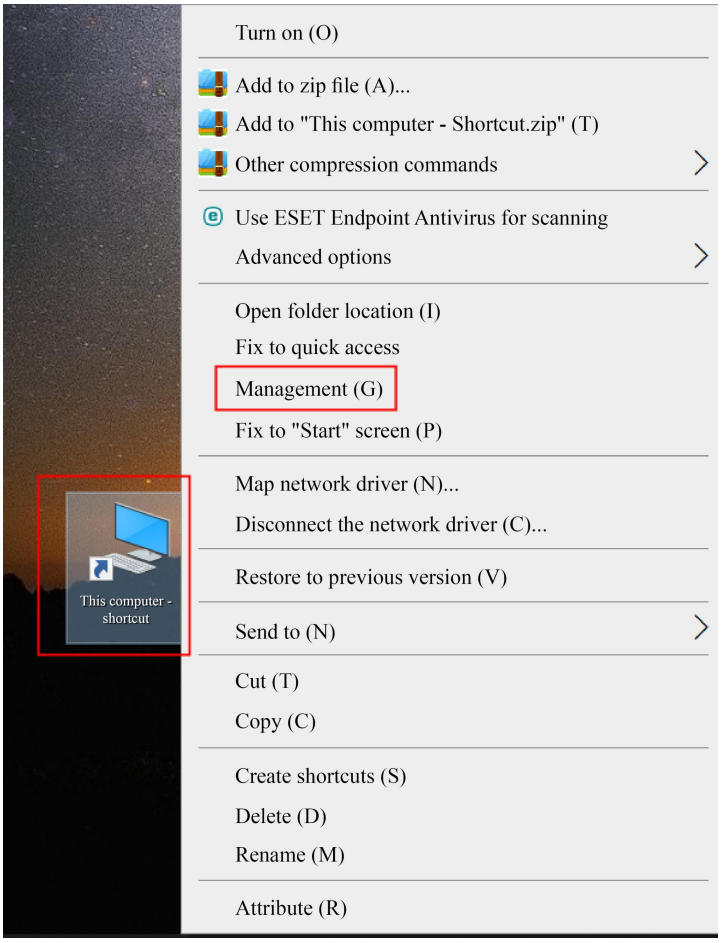

LASER TECH
Control panel
Status
Program
Parameter
5M-Master
Communication port
Serial port
Network
Disconnection
Setting
Read Data
Set Commit
Internal control
External control
Laser on
Laser off
Indicator light on
Indicator light off
0
50
100
0.00
%
0000H
M00
Exit
Login
0
Max:12000W
Set power
GC0F436D
YLPM-12000-W-M-2015-A
[LAN]
0.7
A
Feedback current
Status
Power source
Ready
Emit
Overtemperature
Overwetting
Fault
Scram
Cooling water interlock
Program execution
Program start
Incoming water temperature 27 ℃
Internal temperature 0 ℃
Internal humidity 0 %
Air pressure 99.9 Kpa
Optical fiber temperature 1 22 ℃
Optical fiber temperature 2 27 ℃
Optical fiber temperature 3 27 ℃
Water flow speed 0.0 l/min
2023/10/23 18:19:04 S011 Control power on
2023/10/23 18:19:04 S021 Main power on, system ready
2023/10/23 18:19:04 S071 Positioning on
Fault code
00000000
Fault removed

6.3. RS232 serial port connection method

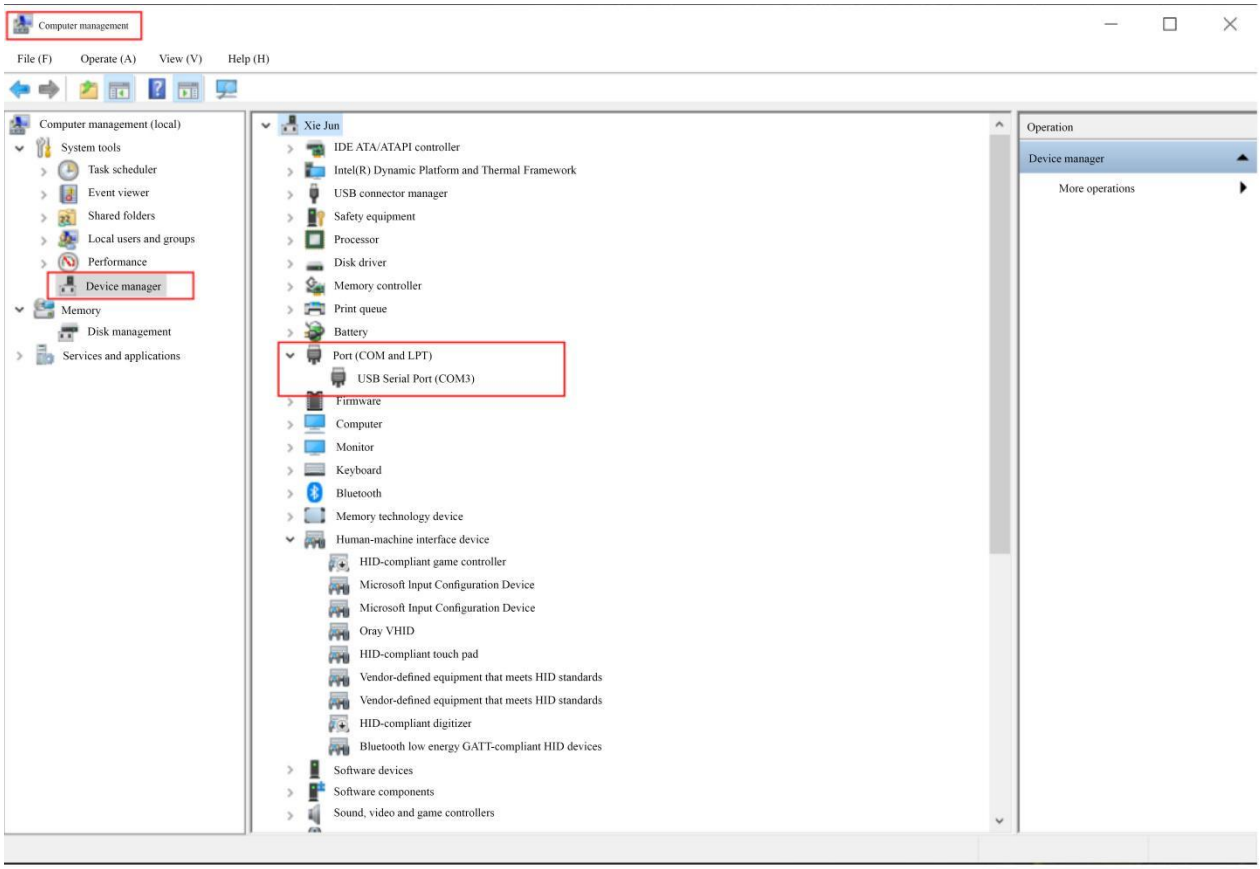
6.3.1. Obtain and install the RS232 serial port cable driver



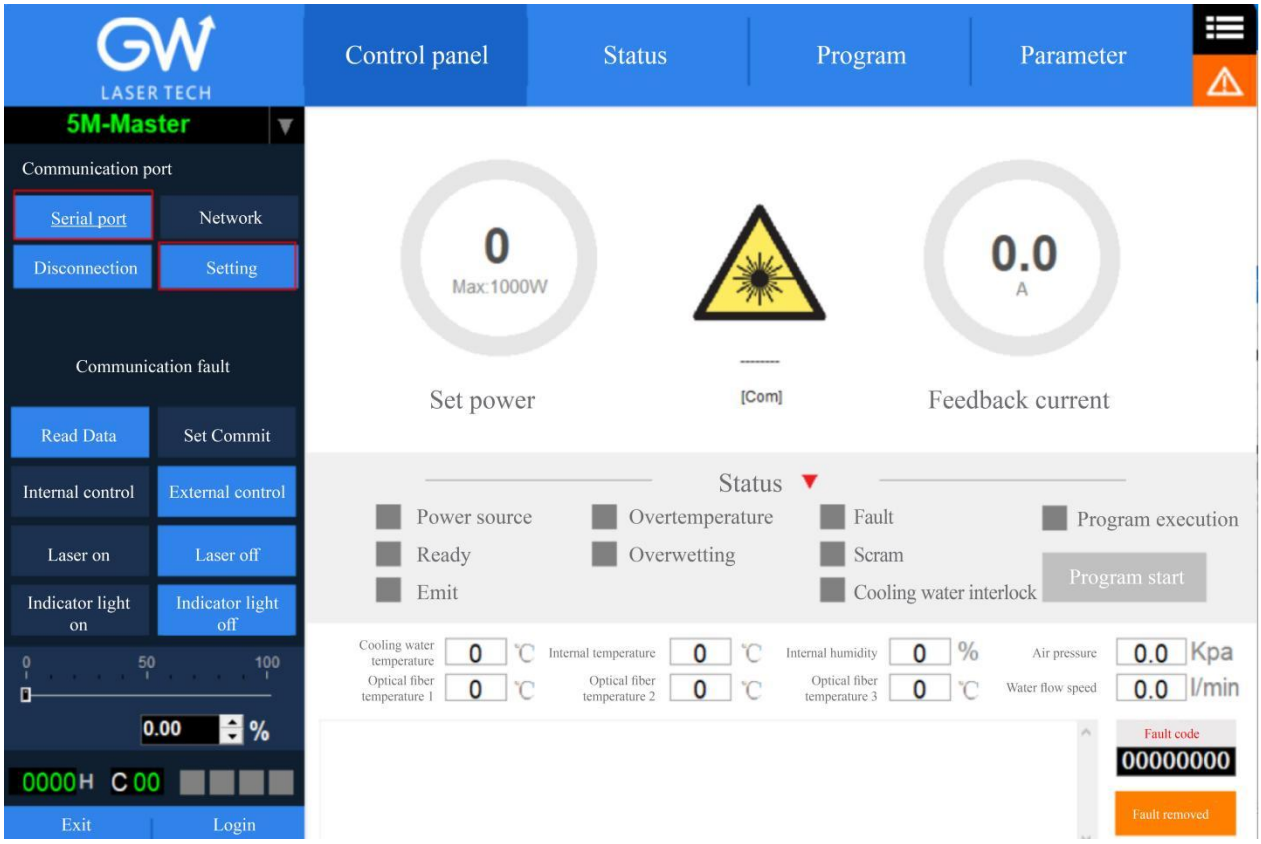
6.3.2. Query the port number of the RS232 serial port cable on the PC side: Select "This computer" and right click "Manage".



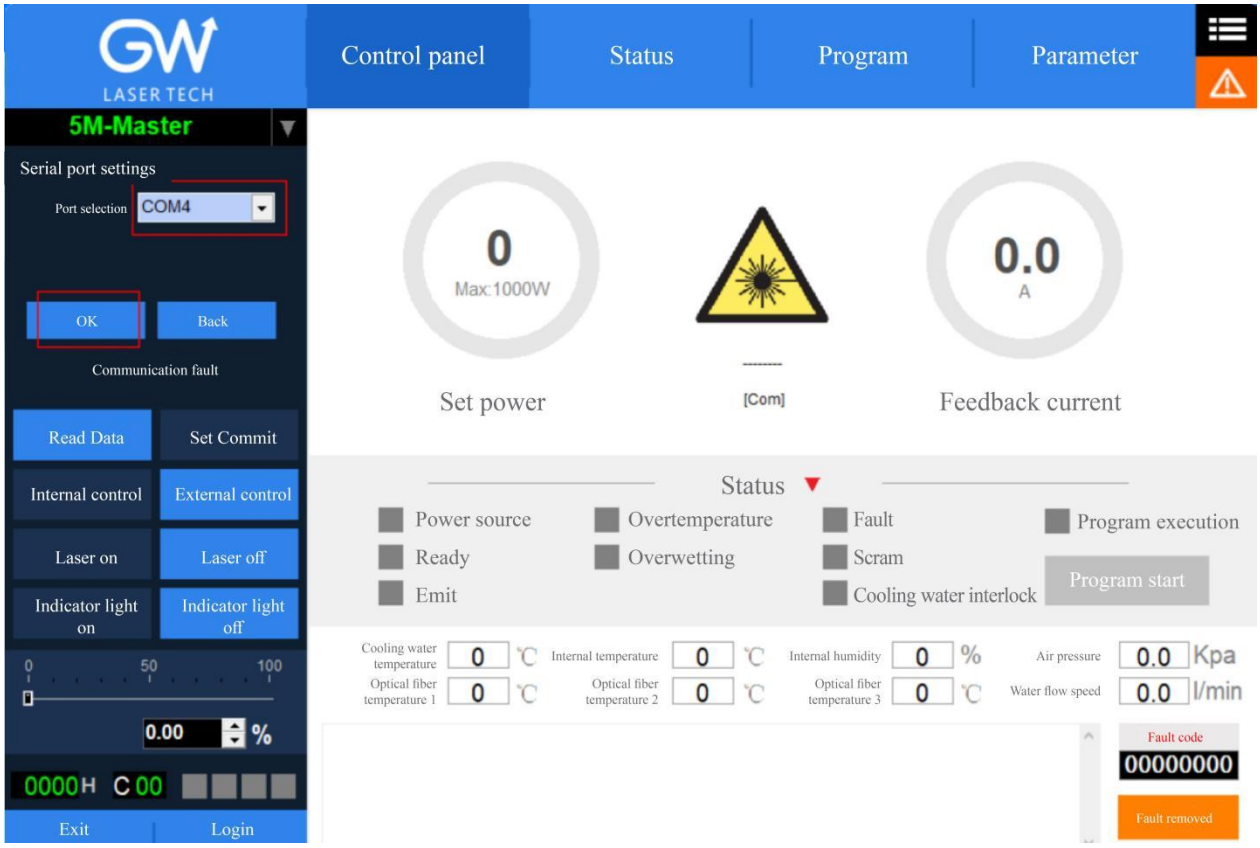
Click "Device Management" and click "Port" to confirm the RS232 port number



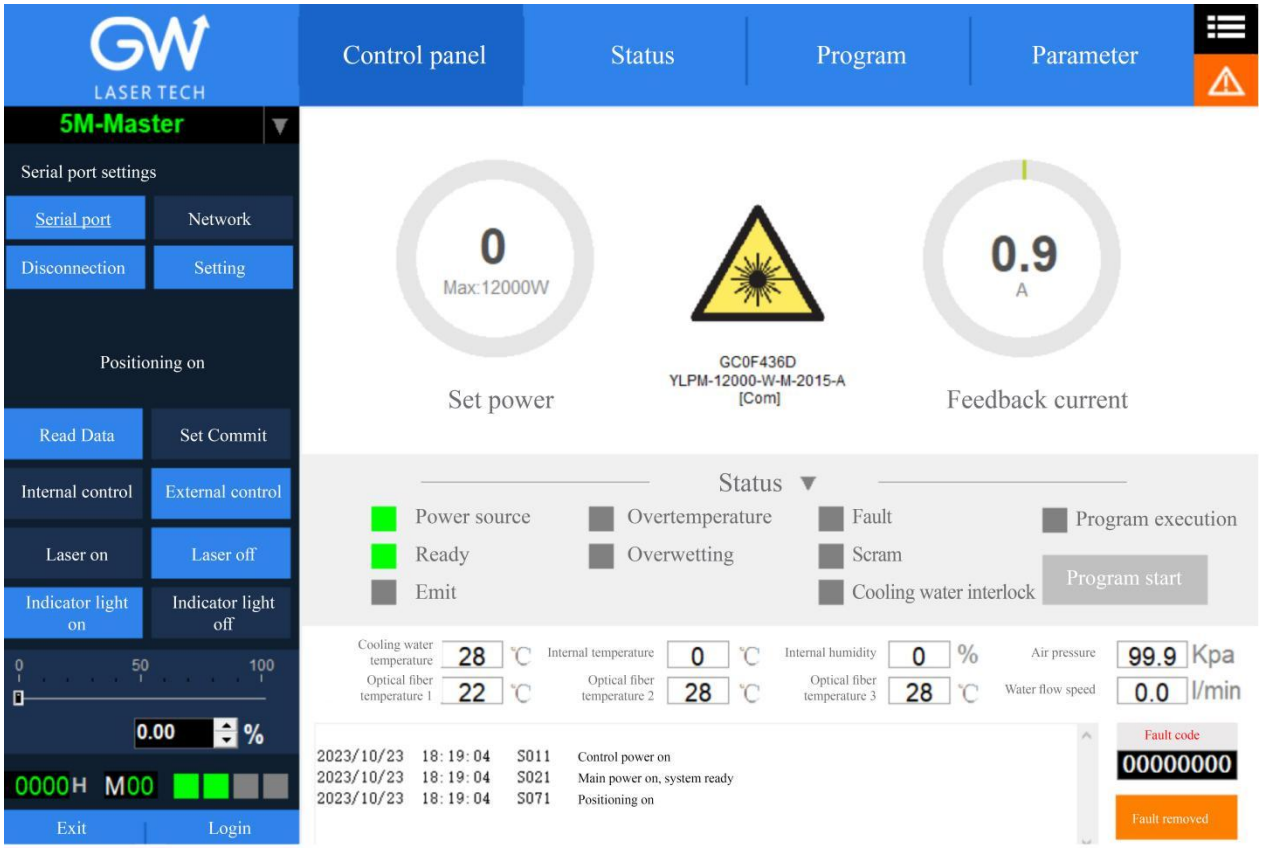
6.3.3. Double click to start “GW_HMI_V5.6_Multi-module 20220820



6.3.4. Enter the inquired port number of RS232 and click "OK".



The following interface is displayed when the connection is successful:

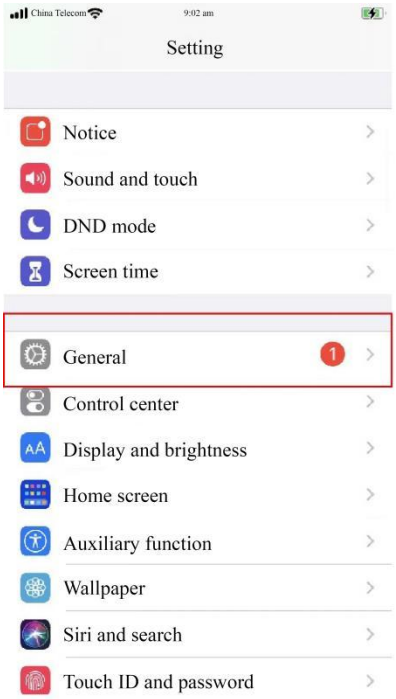

LASER TECH
Control panel
Status
Program
Parameter
5M-Master
Serial port settings
Serial port
Network
Disconnection
Setting
Positioning on
Read Data
Set Commit
Internal control
External control
Laser on
Laser off
Indicator light on
Indicator light off
0
50
100
0.00
%
0000H
M00
Exit
Login
0
Max:12000W
Set power
GC0F436D
YLPM-12000-W-M-2015-A
[Com]
0.9
A
Feedback current
Status
Power source
Ready
Emit
Overtemperature
Overwetting
Fault
Scram
Cooling water interlock
Program execution
Program start
Cooling water temperature 28 ℃
Internal temperature 0 ℃
Internal humidity 0 %
Air pressure 99.9 Kpa
Optical fiber temperature 1 22 ℃
Optical fiber temperature 2 28 ℃
Optical fiber temperature 3 28 ℃
Water flow speed 0.0 l/min
2023/10/23 18:19:04 S011 Control power on
2023/10/23 18:19:04 S021 Main power on, system ready
2023/10/23 18:19:04 S071 Positioning on
Fault code
00000000
Fault removed

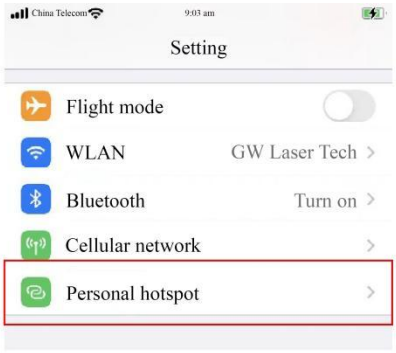
6.4. Hotspot connection mode

6.4.1. Connection mode for IOS version

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

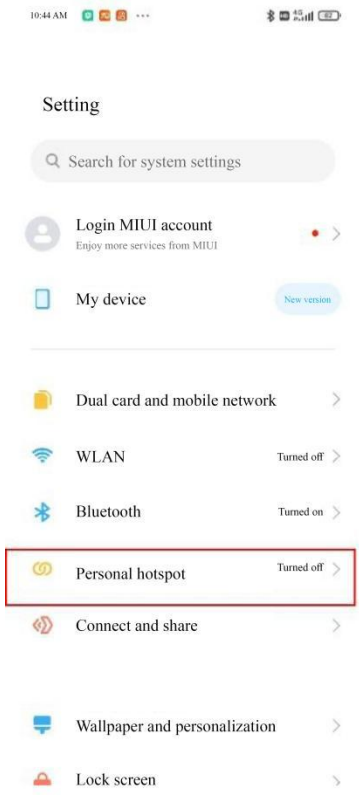
Back to Settings → Personal Hotspot → Allow others to join → WLAN password changed to "gw39721122"

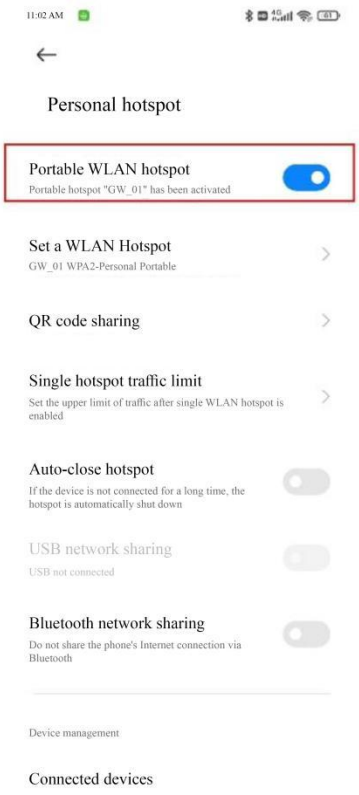




6.4.2. Connection method for Android version

Open Personal Hotspot → Portable WLAN hotspot → Network name GW_01→ Password gw39721122→AP band at 2.4GHz





7 Maintenance/troubleshooting

7.1. Clean 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 YLPM 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 exceeds the upper	The humidity sensor detects overhigh humidity.	First check the ambient humidity, and then run the self-test program for a full SMAT laser

limit		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.

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

Memorandum