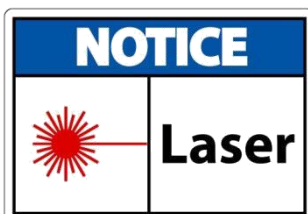


Operation Manual



Fiber Amplifier Series



Applicable to: PA, BA15–26, and LA series fiber optic amplifiers

Keep this manual properly.
Read and follow the safety procedures before operation.

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■ Safety Warnings and Precautions

- Equipment operators must strictly abide by relevant safety regulations and preventive measures.
- Operators should regularly inspect the equipment and ensure that all relevant personnel comply with safety regulations.
- Since lasers can cause damage to eyes and skin, please avoid direct or scattered laser radiation from entering the eyes or shining on the skin.
- Note that lasers can cause damage to the retina and conjunctiva.
- Do not touch the fiber end face directly with your hands to prevent dust from entering and affecting product characteristics.
- Keep the equipment away from high temperature, high pressure, and humid environments.



To prevent equipment damage due to static electricity, take appropriate defensive measures when touching the equipment!



Lasers can damage certain electronic devices,

Lasers can accelerate the deterioration of certain materials,

Laser radiation can harm the human body and certain sensitive materials!

■ Product Overview

This product uses advanced semiconductor laser pumping and rare earth gain fibers, combined with dedicated integrated circuit chips to achieve high stability, high gain, and low power operation. The laser is coupled and output through a single mode fiber, and it is easy to use. It can be widely used in testing and experiments in fields such as optical communication, fiber lasers, and fiber sensing.

Erbium-doped fiber amplifiers (EDFAs) are a series of optical amplifier products dedicated to fiber lasers or optical communication. They use short wavelength semiconductor lasers to pump rare earth fibers to provide gain for signal light in the C-band or L-band. They have the advantages of high energy conversion efficiency, high gain, and low noise. Desktop fiber amplifiers are convenient for experimental operations. Users can set parameters through the front panel. More compact modular fiber amplifiers are also available for users to perform system integration. Both desktop and modular fiber amplifiers support host computer software control or serial port command control. Users can select fiber amplifier models with appropriate parameters according to their own needs to achieve the best amplification effect. We can also provide customized fiber amplifier products according to specific customer requirements.

■ Features

- Optional desktop or modular design
 - Wide operating wavelength range
 - High gain with flat gain profile
- Good temperature adaptability

■ Applications

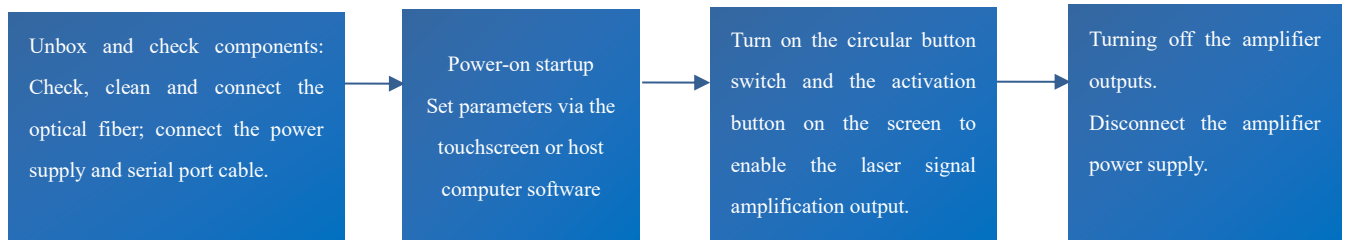
- Optical communication
- Fiber sensing
- Fiber lasers

■ Standard Accessories

	Name	Quantity
1	Fiber Amplifier (Desktop)	1
2	USB-RS232 DB9 Cable	1
3	AC Power Cord	1
4	Product Test Report	1
5	Product User Manual	1
6	Input and Output Fibers	2 (Pre-connected to the device by default)

Please check that all accessories are included upon receipt of the shipment.

■ Basic Operation Step



Preparation of cleaning tools and testing equipment: dedicated cleaning kits for fiber optic connectors, fiber end-face inspectors, optical power meters, spectrum analyzers, etc.

Step 1、 Unboxing and Assembly

Before assembly, check if all components are complete, including the power cord or power adapter, optical fiber patch cord, operation manual, test report, etc.

Connect the power supply. Desktop amplifiers can be directly connected to AC power; modular amplifiers should be connected to a DC switching power supply or regulated power supply that meets their power-supply requirements. Connect the signal light source and the amplifier input end with an optical fiber patch cord. The amplified laser signal is output through the optical fiber patch cord. The amplifier output end is usually equipped with a fixed non-detachable optical fiber patch cord. When using an optical fiber adapter to connect optical fiber patch cords, ensure that the types of optical fiber patch cord connectors are consistent. **(The input power of the signal light source should refer to the product test sheet. Otherwise, the optical fiber amplifier will be locked and unable to work).**

Step 2. Turn on the power switch on the back of the amplifier to start it.

Note: At this time, the working mode (APC/ACC/AGC) and the working current of the amplifier are the parameter settings from the last use. If adjustment is required, it can be modified through the screen or the upper - computer software. Usually, the amplifier is set to the lowest working current and the lowest output power at the factory.

Step 3. Turn on the activation key switch (Enable) on the right side of the panel, press the activation key (ON/OFF) on the screen, and set appropriate output power and pump current. Then the laser will be amplified and output.

During the experiment, adjust the working mode and output power in a timely manner as needed. It should be noted that when the amplifier is in the light - emitting state (with the activation switch on), it is strictly prohibited to perform insertion and extraction operations on the fiber optic patch cord connectors. Otherwise, it is very likely to cause damage to the end - face of the fiber optic patch cord connectors and the amplifier itself, resulting in malfunctions.

Step 4: After use, turn off the pushbutton switch (Enable) to cut off the amplifier output, and finally turn off the power switch.

■ Operating Instructions

1. Appearance

Front Panel: From top to bottom, the panel features the input optical port (input), output optical port (output), a touchscreen LCD, a push-button switch (Enable), and an output indicator. The label in the upper right corner includes the product model (PN), serial number (SN), date of manufacture (Date), and key parameters such as operating wavelength and output power. This model uses a touchscreen LCD to control and display all parameters;



Fiber Interfaces: The input and output fibers of fiber optic amplifier products are permanently mounted on the front panel by default and cannot be removed. They extend approximately 1 meter outside the chassis and are terminated with fiber optic connectors, typically FC/APC connectors. The output fiber extends outside the chassis, allowing customers to easily inspect (using a fiber end-face tester) and clean the ceramic end-face of the fiber connector (using a dedicated fiber cleaning kit). This prevents connector loss and significantly reduces failures and damage caused by contamination and dust on the connector's ceramic end-face.

Rear Panel: From left to right: external power connector and switch, RS232 DB9 communication port, and cooling fan. The power adapter supports a wide range of AC voltages (100–240 V), allowing direct use in any country or region; the RS232 DB9

communication port enables connection to a host computer for remote software control;



2. Screen:

The top-left area is the status display section, which shows the current real-time input optical power (Input Power), output optical power (Output Power), pump laser current (Pump Current), and pump laser temperature (LD Temp). The remaining areas are for control and parameter input.

Input Power -11.1 dBm	Power Set	▲
Output Power -11.1 dBm	30.0 dBm	
Pump Current 800 mA	Current Set	▼
LD Temp 25.2 °C	900 mA	
Active	Gain Set	Mode
Laser is OFF	25.0 dB	ACC

■ Working Modes and Control Methods

1. Amplifier working mode control: Fiber amplifiers natively support the following three working modes (Non-GF-type PA optical amplifiers do not support AGC). The control logic for each mode can be referred to in the subsequent descriptions.




✧ Automatic Pump Current Control Mode (ACC mode)

- ✧ Automatic Power Control Mode (APC mode)
- ✧ Automatic Gain Control Mode (AGC mode)

In the lower - right corner of the touchscreen **Mode** area is the mode selection button. Pressing it can cycle through the **APC/ACC/AGC** modes.


Note: You must first turn off the button switch (Enable) before switching modes. Mode switching is not possible while the button is enabled. This is because in ACC or APC mode, the most recently set output power may vary significantly and is stored in the amplifier’s memory. If mode switching were allowed while the button is enabled, it could result in sudden high-power laser output, potentially damaging the components or equipment connected to the optical amplifier. Therefore, the correct sequence for switching modes is: Turn off the button switch → Switch modes → Adjust parameters → Turn on the button switch → Press the “Active” button on the screen.

2. Amplifier Parameter Settings :




ACC Mode: You can directly click the  and  areas to increase or decrease the current value. Long-press for coarse adjustment and short-press for fine adjustment. Alternatively, click the **Current Set** area, then input the required pump current value (unit: Ampere, A) on the pop - up keyboard. After setting, press Enter  to take effect, as shown in the following figure:

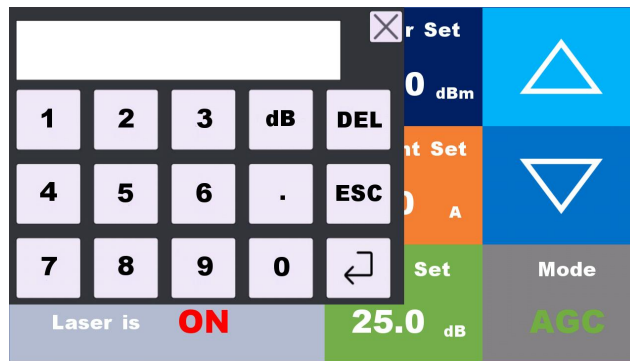


APC Mode: You can directly click the  and  areas to increase or

decrease the power value. Long-press for coarse adjustment and short-press for fine adjustment. You can also click the **Power Set** area and input the required power value (unit: dBm or mW, switchable) on the pop-up keyboard. After setting, press Enter  to take effect, as shown in the following figure:



AGC Mode: You can directly click the  and  areas to increase or decrease the power value. Long-press for coarse adjustment and short-press for fine adjustment. You can also click the **Gain Set** area and input the required gain value (unit: dB) on the pop-up keyboard. After setting, press Enter  key to take effect, as shown in the following figure:



3. Parameter setting ranges under three control modes:

APC: 10%~100% of the maximum power value

ACC: 0~maximum current value

AGC: 10~25dB

(*The maximum power and maximum current values can be found in the product test report of each fiber amplifier. In any mode, the pump laser

current will not exceed the pre - set maximum safety limit value at the factory.

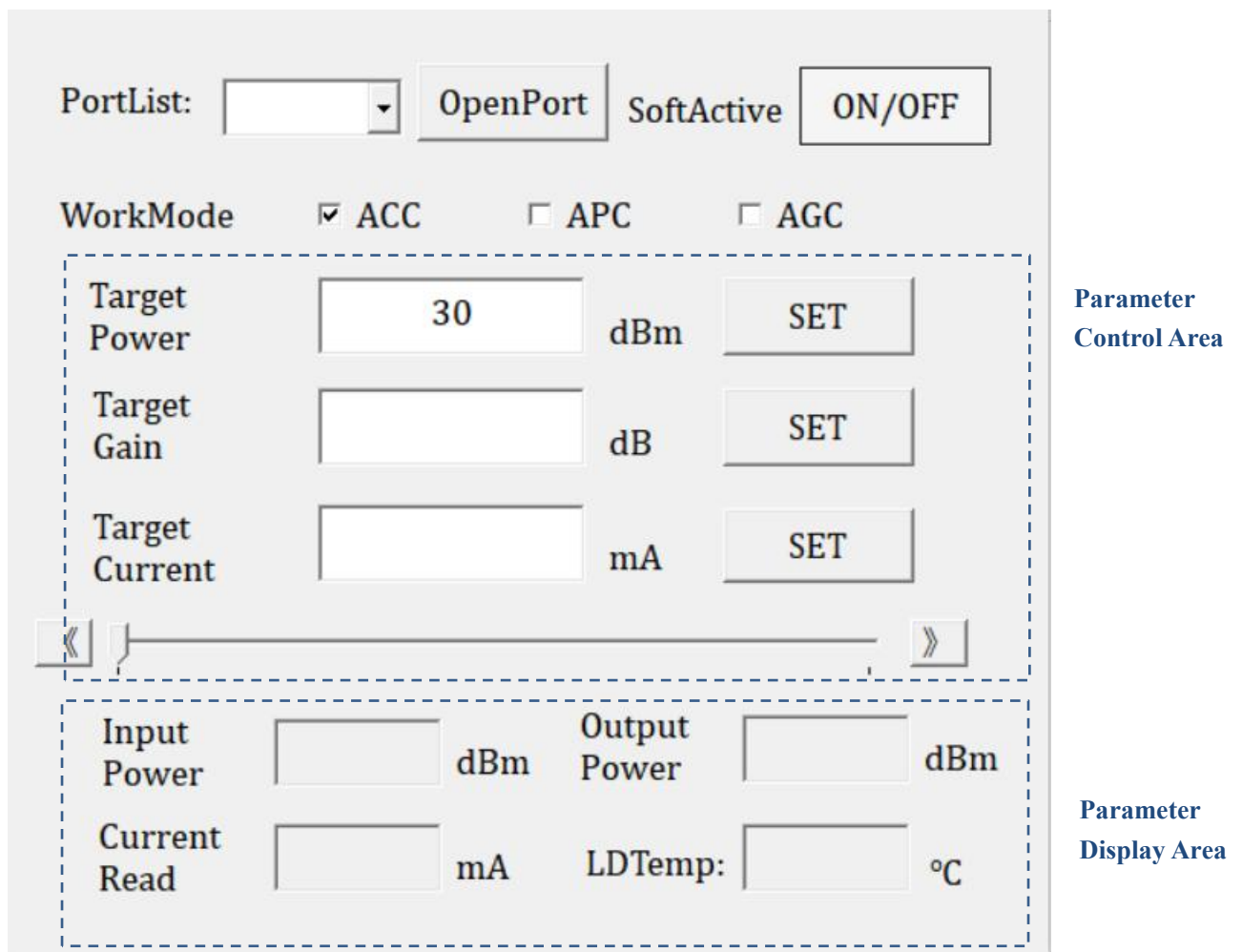
4. Output activation of the amplifier: The output activation of the amplifier is controlled by both the **Active** button on the screen and the laser output activation switch (Enable) . The **Active** button in the lower-right corner of the screen is used to control and display the current output activation status of the amplifier. When the activation switch (Enable) is pressed (the red light is on), the **Active** area in the lower - right corner of the screen can be manually switched from the **OFF** state to the **ON** state, indicating that the amplified laser is outputting. Note that you can only switch to the **ON** state after turning on the key switch (Enable);

5. Input power threshold: This amplifier model has no threshold requirement for input optical signal power. Even if the input optical power is below the rated input power range for this model (see the product test report), the amplifier will still emit light once powered on; however, it will not be operating at its optimal performance level. The amplifier will also produce output power when there is absolutely no input optical power; in this case, the output consists of ASE (spontaneous emission) light;

6. Software Control and Communication Protocol: This fiber amplifier also supports control via upper-computer software or serial port commands. The default communication port is RS232 DB9, located on the rear panel of the amplifier. Special upper - computer software and serial port communication protocol code will be provided with the goods. When using the upper - computer software and serial port communication protocol to control the amplifier, the control function of the front - panel LCD screen will be suspended.

7. Host Computer Software Interface: The host computer software displays information such as the amplifier operating mode (ACC/APC/AGC), input optical power, output optical power, target gain value, target pump laser current value, and temperature monitoring status;

8. Host Software Operation: As shown in the figure below, after launching the host software, first select the correct serial port number from the PortList, then click the OpenPort button to open the serial port. At this point, the Current Read and LDTemp windows will display the module's operating current and pump temperature. Enter the target optical power value in the TargetPower window and click the SET button. The settings take effect when both the module's physical switch and the SoftActive button in the software are in the ON position; optical power will be output from the amplifier module's OUTPUT port.



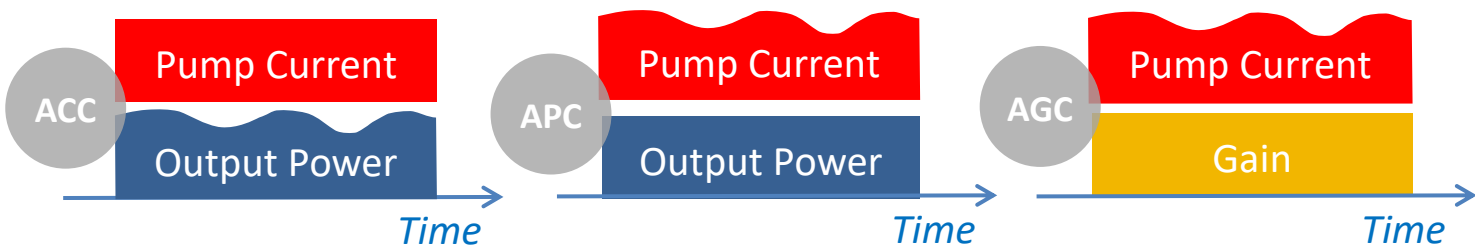
■ Explanation of Fiber Amplifier Operating Modes

Fiber amplifiers typically have the following control modes: **APC/ACC/AGC**

1. **APC Mode (Automatic Power Control Mode)**: In this mode, the user sets the output power of the amplified signal light. The amplifier automatically adjusts the pump current based on the output power monitored by the PD (Photodetector) to stabilize the output signal. In APC mode, the adjustable range of the output power for the user is usually 10% - 100% of the maximum output power. The advantage of the APC mode is that when the input optical power fluctuates, the amplifier minimizes fluctuations in the output power as much as possible, making it suitable for applications that require high precision in output optical power and long-term power stability.
2. **ACC Mode (Automatic Current Control mode)**: The user sets the pump operating current of the amplifier, and the amplifier automatically locks it to achieve a constant pump current. When the input optical power fluctuates, the output power will also fluctuate accordingly. Suitable for short-term laboratory testing, applications requiring fully stable input optical power, or scenarios where precise control of the pump current is necessary;
3. **AGC Mode (Automatic Gain Control mode)**: The user sets the gain coefficient of the amplifier. The amplifier automatically controls and adjusts the pump current based on the detected input power and output power to keep the gain multiple as stable as possible. When the input optical power fluctuates, the output power will also fluctuate accordingly, but the gain coefficient remains basically stable.

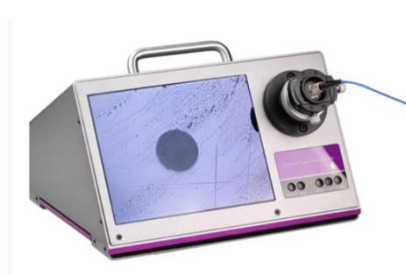
The parameters monitored/controlled under the three modes are different, resulting in different effects, as shown in the following table and schematic diagram.

Working Mode	Parameter/Range Set by User	Parameter Monitored by Amplifier	Parameter Controlled by Amplifier	Purpose and Effect Achieved
APC Mode (Auto Power Control)	Output Power/10-100%	Output Power	Pump Current	Stable Output Power
ACC Mode (Auto Current Control)	Pump Current/0~100%	Pump Current	Pump Current	Stable Pump Current
AGC Mode (Auto Gain Control)	Optical Power Gain/0-25dB	Input and output optical power, calculation of optical power gain	Pump Current	Stable Gain

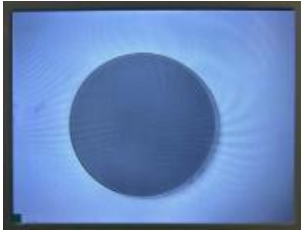


■ Operation Precautions and Maintenance

1. The optical fiber amplifier should operate within the rated optical signal wavelength and power range. Do not input optical signals beyond the wavelength and power ranges, as this may damage the optical fiber amplifier. For specific parameters, please refer to the product test sheet.
2. Before performing any operations on the input fiber optic connector, ensure that the light source is turned off. Use a dedicated fiber optic cleaning tool (see image below, left) to thoroughly clean the connector end face (press the end face of the fiber optic connector against the cleaning cloth and push it back and forth 2–3 times), and carefully inspect it using a fiber end-face inspection tool (see image below, right).



3. After confirming that the area is completely free of dust and contamination (see image below, left), connect the fiber optic flanges and then turn on the light source. It is essential to follow this procedure because a contaminated fiber optic connector end face (see image below, center) is highly susceptible to burn damage when the laser is activated, even at very low power levels (see image below, right). The following three images were all captured using a fiber end-face inspection microscope with 400x magnification;



Clean, undamaged joint



Contaminated joint



Damaged joint

4. When cleaning, inspecting, or connecting fiber optic connectors, ensure that the light source is turned off; never perform these operations while the light is on. After use, the fiber optic connector must be covered with a dust cap and must not be left exposed to the air for extended periods;
5. Standard amplifier models come equipped with FC/APC fiber optic connectors by default. For light sources and optical amplifiers with an output power of 200 mW or higher, we recommend that users use this output fiber connector solely for output power measurement (by connecting to a power meter) or for directly connecting to an FC-interface fiber collimator (see figure below, left) to output a collimated beam into free space (see figure below, right). We do not recommend using a flange to directly connect it to the user's other fiber or device pigtails, as this poses a risk of damaging the fiber connector and the product itself. If connection to other fibers is required, we recommend using a fiber fusion splicer for thermal splicing. Please ensure that the fiber types being connected are compatible; otherwise, significant optical power loss and heat generation at the splice point may occur.



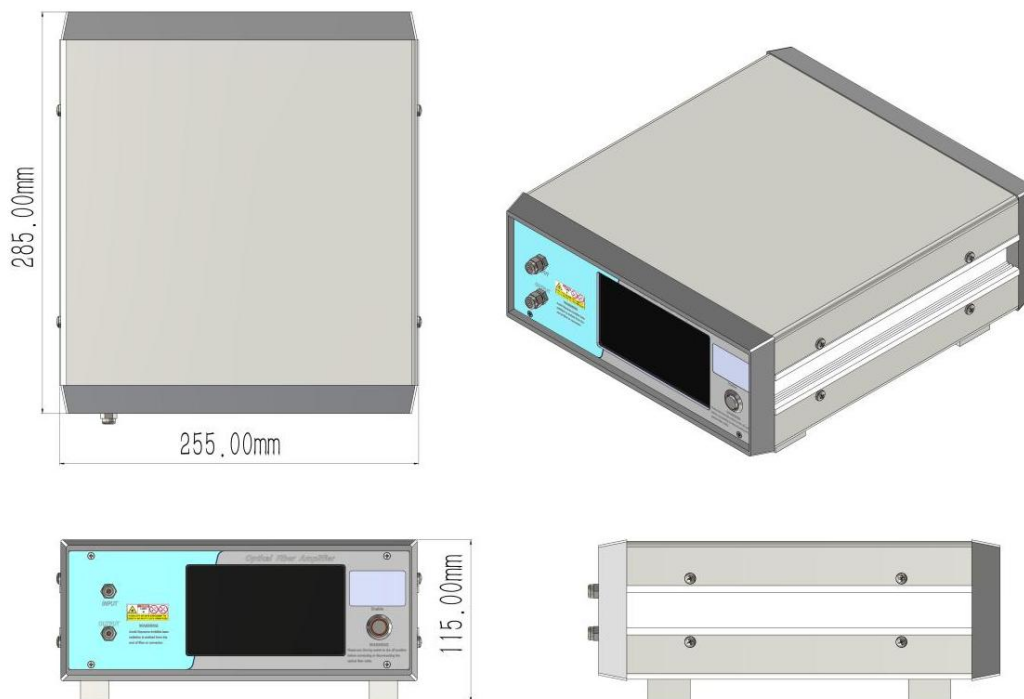
6. Frequent plugging and unplugging of the output fiber optic connector is not recommended to prevent dust accumulation from exposure to the air; dust contamination can increase insertion loss or cause the fiber optic connector end face to burn out;
7. When starting up, first ensure that the power switch and the activation button are turned off before connecting the power supply to prevent damage caused by sudden light emission upon power-up. When shutting down, first turn off the button or key switch, and disconnect the power supply only after the output indicator light has gone out. Never cut off the power supply directly while the laser is operating;
8. To prevent sudden changes in output power when switching the amplifier's operating mode (ACC, APC, AGC), turn off the pushbutton or key switch before switching modes; otherwise, the mode cannot be changed;
9. Take precautions against moisture, dust, and corrosion; keep the light source equipment away from high-temperature and high-humidity environments;

Common faults and troubleshooting solutions

Malfunction	Possible causes of the malfunction	Corresponding troubleshooting and handling solutions
The output light spot is not round	The end face of the output fiber connector is contaminated or damaged	Check the end face of the output fiber connector and return it to the factory for repair
The output optical power is slightly low	Error of the optical power measuring instrument	No need to handle (within $\pm 10\%$ is normal)
The output light has power but is significantly low	Exceeding the range of the optical power meter	Replace with a suitable optical power meter model
	The wavelength selection of the optical power meter is incorrect	Replace with the correct wavelength of the optical power meter
	The wavelength of the input signal light is incorrect	Ensure that the wavelength of the signal light is within the correct range
	The output fiber is broken or damaged	Check the integrity of the output fiber
	The end face of the output fiber connector is contaminated or damaged	Check and clean the end face of the output fiber connector
The output light has no power	The Enable physical button and the screen Active button are not turned on	Check and turn on the corresponding buttons
	The output fiber is broken or damaged	Check the integrity of the output fiber
	The end face of the fiber connector is severely contaminated or damaged	Check the end face of the output fiber connector and return it to the factory for repair
	The light source detects high temperature and shuts down automatically for protection	Restart after the temperature returns to normal
	The laser chip is damaged	Return it to the factory for repair
	The input optical power is too low and the amplifier is in the pump-off protection state	Check the input signal optical power
The stability of the output optical power is significantly worse	The end face of the output fiber connector is contaminated or damaged	Check the end face of the output fiber connector and return it to the factory for repair
	Internal optical path malfunction	Return it to the factory for repair
	The cooling air duct is blocked	Avoid blocking the air-cooling heat dissipation channel
	The input optical power is unstable or the input is pulsed light	Check the status of the input signal optical power, wavelength, etc.
A bright light spot appears at the end of the output fiber and moves along the fiber towards the light source	Non-standard operation causes the fiber core melting phenomenon	Press the emergency stop button and turn off the machine immediately. Do not turn it on again. Return it to the factory for repair
The touch screen operation has no response	The host computer software is controlling the amplifier	It is a normal phenomenon and no need to handle. Disconnect the host computer and then use the touch screen for operation

	The touch screen is malfunctioning	Return it to the factory for repair
Unable to switch between ACC and APC working modes	The button switch (Enable) is not turned off	Turn off the button switch (Enable)
The host computer software cannot control the parameters of the light source	The serial port COM is selected incorrectly	Confirm and select the correct COM port
	The driver of the serial data cable is not installed correctly	Install the correct driver for the serial data cable
	The connector of the serial data cable has poor contact	Check or replace the serial data cable
	The version of the host computer software used is incorrect	Replace with the correct version of the host computer software
The air-cooling noise is significantly louder	The fan is malfunctioning or there is a foreign object intrusion	Return it to the factory for repair
The LASER red light is flashing or the temperature display shows ALARM	The internal temperature monitoring is abnormal	Turn off the machine, let it cool down and then restart. If the malfunction does not disappear, return it to the factory for repair
Unable to turn on the machine	External power supply malfunction	Check the power switch on the rear panel and the external power supply

■ Dimension



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■ Quality Assurance and After - sales Service

1. Product Quality Assurance Period

From the date of delivery, if there are quality problems (non-human-induced) with the product within one year, the customer can request the manufacturer to replace parts or the entire unit free of charge. After one year, the manufacturer will provide paid repair services.

2. Product Warranty Scope

During the free warranty period, free repair or replacement services will be provided for malfunctions caused by product quality issues.

During the warranty period, our company reserves the right not to provide free repair services in the following situations:

- 1) The product is damaged or impaired due to natural factors or environmental influences (such as electric shock, dust).
- 2) The product is damaged due to non - standard operation by the user.
- 3) The product has obvious signs of human - induced damage.
- 4) The product has been disassembled, modified, or repaired without the authorization of our company.
- 5) The quality - assurance label on the light source housing has been tampered with or is incomplete.
- 6) The product is damaged or lost during transportation.

Product Warranty Card

Product Name	
Product Number(PN)	
Product Serial Number(SN)	
Purchase Date	
Description of Product Defects	
User Name	
Contact Address	
Contact Phone	
E-mail	

■ Appendix 1: Optical Radiation Risk Class of the Product

Laser Wavelength	Output Power	Laser Risk Class
400~700nm	≤ 0.39 mW	1; 1M
	≤ 1 mW (Collimated beam); ≤ 67 mW (Non-collimated beam)	2; 2M
	≤ 5 mW	3R
	≤ 500 mW	3B
	> 500 mW	4
700~1050nm	$\leq 0.39 \times C_4 C_7$ mW	1; 1M
	$\leq 2.0 \times C_4 C_7$ mW	3R
	≤ 500 mW	3B
	> 500 mW	4
1050~1400nm	$\leq 0.39 \times C_4 C_7$ mW	1; 1M
	$\leq 2.0 \times C_4 C_7$ mW	3R
	≤ 500 mW	3B
	> 500 mW	4
1400~4000nm	≤ 10 mW	1; 1M
	≤ 50 mW	3R
	≤ 500 mW	3B
	> 500 mW	4

Correction factors C4 and C7 in the table above

Laser wavelength λ	Correction factor C_4	Laser wavelength λ	Correction factor C_7
700~1050nm	$10^{0.002(\lambda-700)}$	700~1150nm	1
1050~1400nm	5	1150~1200nm	$10^{0.018(\lambda-1150)}$
		1200~1400nm	$8+10^{0.04(\lambda-1250)}$

*Reference Standards:

- Chinese National Standard GB44703-2024 《Technical Specifications for Safety of Light Radiation》
- International Standard IEC 60825-1 《Safety of laser products》