



RFL-DDL
Fiber Delivered Direct Diode
Lasers User Guide



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1.Safety Information


Thank you for choosing Raycus Fiber Delivered Direct Diode laser. This User Guide provides important safety, operation, warranty and other information. Please read it carefully before you use this product. In order to ensure safe operation and optimal performance of the product, please follow the warnings, cautions, operating procedures and other instructions accordingly.

1.1 Symbols Used in this User Guide

	WARNING: Describes a hazard that lead to a personal injury or death.
	CAUTION: Describes a hazard that lead to a minor personal injury or product damage.




1.2 Laser Classification

According to the national standard GB 7247.1, clause 9, this type of laser is a class 4 laser instrument. The product emits laser radiation with a wavelength of 915nm or around 915nm, and the optical power radiated by the output head is 100W (100W is used as an example, the same below). Direct or indirect exposure to such light intensity can cause damage to the eyes or skin. Although the radiation is invisible, the beam can still cause irreversible damage to the retina or cornea. Appropriate and certified laser safety glasses must be worn at all times when the laser is running.

	<p>Make sure to wear laser safety glasses during the operation of the product. Laser safety glasses have laser wavelength protection selectivity, so users are requested to choose laser safety glasses that are separate from the laser output of the product. When the laser is energized (regardless of whether it is in the light-emitting state), you cannot also directly watch the output head.</p>
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1.3 Safety Labels

These safety signs include: safety warnings, laser output head warnings, product nameplates, etc.

		
<p>The Danger of Laser Radiation</p>	<p>Product Nameplate</p>	<p>Strong Electric Hazard</p>

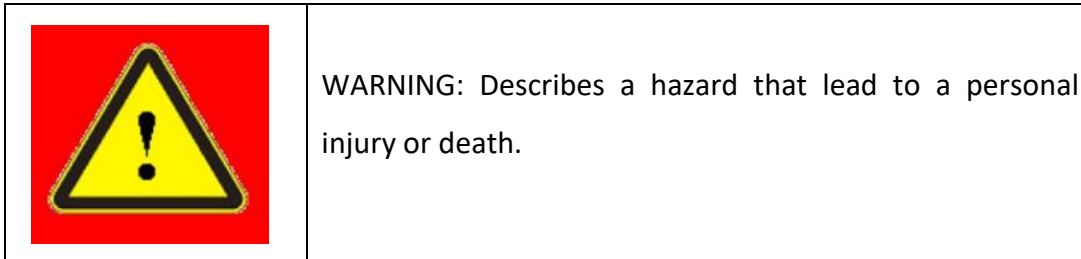
1.4 Optical Safety

If there is dust on the lens of the laser output head, the lens will be burnt when the light is emitted.

	<p>Do not output laser without opening the protective cap of the laser output head, otherwise the lens or crystal of the laser output head will be burned.</p>
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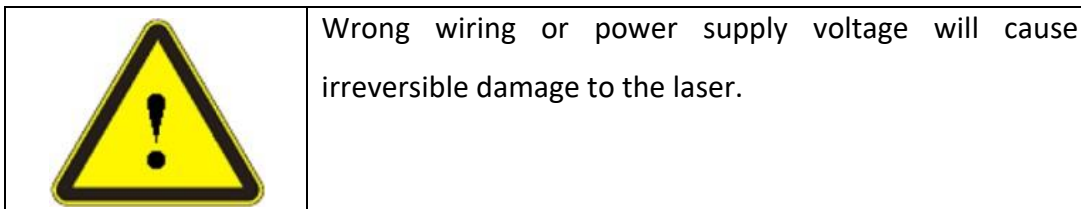
1.5 Electrical Safety

1) Please ground the product through the PE wire in the power cord, and ensure that the grounding is firm and reliable.



2) If the internal fuse of the laser is damaged and the laser cannot work normally, please do not try to open the product cover, otherwise it may cause electric shock injury and the warranty will be invalid. Please contact Raycus technical staff to provide relevant information and technical support.

3) Ensure that the DC voltage supply is normal.



There are no components in the product that need to be used by the operator, please do not try to open the product cover, otherwise it may cause electric shock injury, and the warranty will be invalid.

1.6 Other Safety Rules

- (1) Never look into the laser output port when power is supplied to the laser.
- (2) Avoid using the laser in a dim or darkened environment.

(3) If this device is used in a manner not specified in this document, the protection provided by the device may be impaired and the warranty will be voided.

(4) Do not remove the covers of the laser, or the warranty will be void. All maintenance must be performed in Raycus or by qualified Raycus personnel.

2. Product Description

2.1 Features

Raycus Fiber Delivered Direct Diode laser is designed for industrial and scientific research applications with high pump conversion efficiency, low power consumption and excellent beam quality.

It is compact and ready to use. Because of its flexible laser output mode, it can be easily integrated with system equipment.

Main Features

- Flexible optical fiber output
- High reliability, long life
- Maintenance-free operation
- High photoelectric conversion efficiency
- Diversified control methods

Applications

- Laser plastic welding
- Laser soldering
- Laser research

2.2 Package Contents


Please refer to the packing list in the box.

2.3 Unpacking and Inspection

Raycus uses specially designed packaging materials and boxes to ensure that the laser is always fully protected during transportation. Nevertheless, in order to prevent unpredictable situations during transportation, the user still needs to carefully check whether the packing box is placed correctly before opening the box, and whether there is any damage or phenomenon such as collision, cracking, and flooding on the outside of the box. Once you find any abnormality in the external cabinet, please notify Raycus to deal with the armor as soon as possible.

After unpacking, please check whether the packing list is consistent with the actual items. If you have any questions, please contact Raycus in time.

Take care to avoid collision or severe vibration to the laser when taking out the laser. When taking out the coiled output optical cable and laser output head, pay special attention not to twist, bend, or pull, and avoid collision and vibration of the laser output head.

	The output optical cable and output head of the laser are precision optical devices. Twisting or excessive bending of the output optical cable, vibration and impact of the laser output head will cause irreversible damage to the laser.
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2.4 Operation Environment

Table 1 Operating environment of laser

Place the environment	Flat, no vibration and shock
Working temperature	0°C ~ 40°C
Working environment humidity	< 70%

We recommended to install the laser in an air-conditioned environment to make the laser run under the best conditions.

2.5 Precautions for Use

- 1) Before connecting the laser to the DC power supply, make sure that it is connected to the correct 24VDC voltage. Wrong connection to the power supply will cause irreversible damage to the laser;
- 2) When the laser is running, don't install or remove the output head;
- 3) Do not look directly at the output head, make sure to wear laser protective glasses when operating the machine;
- 4) When not using the laser, please cover the protective cap and do not touch the output terminal. When necessary, use special lens paper and alcohol to clean the lens;
- 5) The loss of optical power may be caused by incorrect operation in accordance with the above specifications. Such loss will not be covered by the warranty;
- 6) Do not operate the laser in accordance with the control or adjustment methods specified in this manual, which may cause damage.

2.6 Specifications

The specifications are listed in the following table.

Model	RFL-FDDL100X	RFL-FDDL80X	RFL-FDDL50X
Input power /W	>600	>500	>300
V DC	24VDC±10%		
Continuous output power rate/W	>100	>80	>50
Power instability	≤1%		
Wavelength range /nm	915±10nm, Other wavelengths can be customized		
Indicating laser	650±10nm, 0.25~1mW		

parameters		
Fiber core diameter / μm	200	105/200
Fiber NA	0.22	
Output interface type	SMA905/D80	
Control interface	DB25、DB9	
Control Method	External control、RS232	
Modulation pulse frequency	1Hz~10KHz	
Cooling	Air-cooled	
Operating temperature	0~40°C	

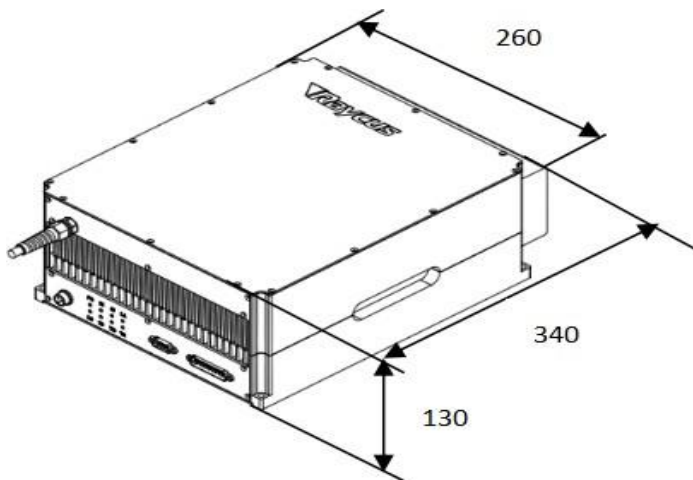
Note:

*RFL-A100D/B/5/B/T——model coding rules

100——100W Output, B——915nm wavelength, 5——5 meters output optical cable, B——SMA905 output optical cable (C——D80 output optical cable), T——air cooling.

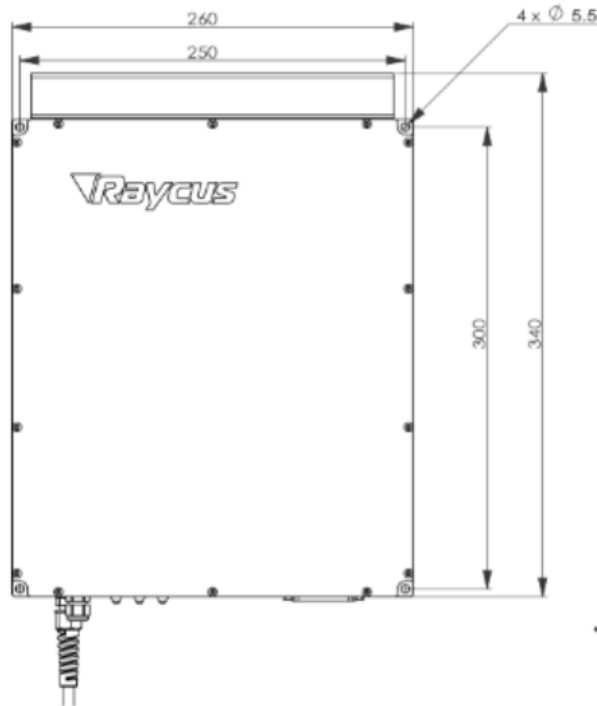
2.7 Installation

2.7.1 The whole machine adopts a professional customized chassis, and the appearance of the laser:







Overall dimensions: depth × width × height 340 × 260 × 130mm (including the rear panel fan, excluding the output cable bending size).

2.7.2 Laser shape and installation dimensions



2.7.3 Installation considerations

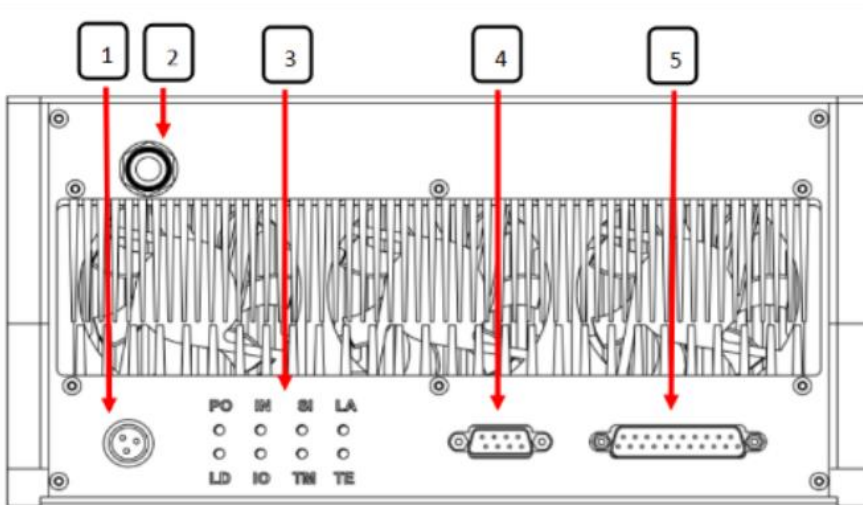
- 1) Place the laser horizontally in a well-ventilated position and fix it;
- 2) Before powering on the laser, please check whether the DC power supply of the laser is at the required voltage;
- 3) Correctly connect the power line and control signal line of the laser in the uncharged state;
- 4) Please check the laser output head and make necessary cleaning according to the specifications, and then install it in the equipment;
- 5) Do not step on, squeeze or excessively bend the metal armored protective tube during the installation of the jumper to avoid damage to the optical fiber;
- 6) Ensure that the surrounding environment is clean during the installation of the jumper output head, otherwise the output head may be contaminated (do not turn on the fan during the installation of the output head, so as to avoid large dust in the air);
- 7) The minimum bending radius of the laser transmission cable in non-working conditions such as transportation and storage should not be less than 10cm, and the minimum bending radius should not be less than 15cm when the laser is emitting light.

	All control lines of the laser should be connected in a non-powered state. Installing the control lines with power may damage the laser.
	The placement of the laser output cable must be as natural as possible, and it is forbidden to twist the output cable. If the coil diameter of the output cable is too small, the laser will be damaged.
	During the installation and disassembly process, please handle the laser output head gently, and do not subject it to vibration or impact.
	Before assembling the output head, ensure that the optical lens and the welding head cavity are clean and free from pollution. Please keep the protective cap of the output head properly to prevent it from being contaminated; otherwise, it will cause indirect pollution to the output head when the protective cap is closed.

3. Using the Product

3.1 Front Panel

3.1.1 Laser front panel:



① Power interface-24VDC power input interface; M16 cable connector is adopted.

Laser power cord:



1: +24V brown wire; 2: GND blue wire; 3: PE yellow-green wire (ground wire must be connected)

② Optical cable outlet-laser optical cable output port;

③ Working status indicator:

PO (power indicator light)-the green indicator light is on after the laser is powered on; IN (interlock indicator light)-the green indicator light is on when the interlock signal is connected; SI (signal indicator light)-when the external control mode inputs the correct EXT Laser EN, EXT_MOD and EXT_ADC, the green indicator light is on when the internal control mode MCU gives the correct output power signal;

LA (light emitting indicator)-the green indicator light is on when the laser emits light;

LD (abnormal light output alarm indicator)-the red indicator light is on when the laser light is abnormal; IO (drive alarm indicator light)-the red indicator light is on when the laser is driving alarm;

TM (temperature alarm indicator)-the red indicator light is on when the laser temperature exceeds the set range; TE (temperature control alarm indicator)-the red indicator light is on when the temperature control alarms.

④ RS-232 interface-connect an external serial cable for laser working mode setting, operation control and working status monitoring.

⑤ DB25 interface-connect an external cable for laser working mode setting, operation control and working status monitoring.

3.2 Interface Definition

3.2.1 DB25 control interface

DB25 is a multi-function multiplex port. The user can set the laser working mode, input analog voltage signal, and is also the output port for light signal and fault signal.

PIN	Name	Function			Voltage	electric
1	Interlock+	Input	Chain signal+	Enable	0V	/
				Prohibition	Hanging	/
2	EXT Laser EN	Input	External control light	Enable	5V	<1mA
				Prohibition	0V	/
3	MODE_CHS	Input	Internal and external control mode selection	External control	5V	<1mA
				Internal control	0V	/

4	Ext ADC	Input	External control power given analog quantity	/	0V~10V	<1mA
5	②EXT_ON/OFF	Input	External control main power switch	Enable	0V	/
				Prohibition	5V	<1mA
6	Ext Foot EN	Input	Pedal enable	Enable	5V	<1mA
				Prohibition	0V	/
7/19	EXT_+5V	Output	+5V	/	5V	<50mA
8	③Ext Red Always	Input	External control red light forced enable	Enable	5V	<1mA
				Prohibition	0V	/
11	④ALARM-COM	Output	Alarm signal relay common node	/	/	/
12	④ALARM-NO	Output	Alarm signal relay normally open node	/	30V	<200mA
13	④EXT Laser-NC	Output	Light emitting signal relay normally closed node	/	30V	<200mA
14	Interlock-	Ground	Chain signal	/	/	/
16/18	+24V_GND	Ground	External control signal ground	/	/	/
15	Ext_MOD	Input	External control modulation signal	Enable	5V	<1mA
				Prohibition	0V	/
17	④Ext_Red_EN	Input	External control red light enable	Enable	5V	<1mA
				Prohibition	0V	/
23	④ALARM-NC	Output	Alarm signal relay normally closed node	/	30V	<200mA
24	④EXT_Laser-COM	Output	Light emitting signal relay common node	/	/	/
25	④EXT Laser-NO	Output	Light emitting signal	/	30V	<200mA

			relay normally open node			A
Other	Reserved		No access			

Note:

- ① Ext Red EN: When this signal is high, the laser will output red light; when the laser is outputting laser, it will automatically cut off the red-light output. When this signal is low, the laser will not output red light.
- ② EXT_ON/OFF: External control on/off control signal of laser main power supply. When the signal is low or suspended, the laser works normally; when the signal is high, the main power supply of the laser does not work and the laser is in the standby state.
- ③ Ext Red Always: This signal is a combined signal; when this signal is at high level and EXT Red EN is at high level, the laser always keeps red light output.
- ④ The light signal and alarm signal are relay output, providing passive normally open and normally closed nodes.

3.2.2 DB9 serial port control interface

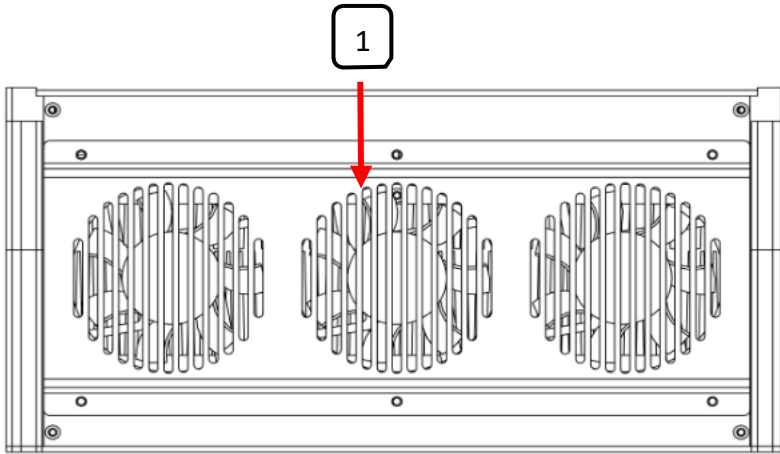
DB9 serial port control interface, interface pin definition:

RS-232 serial port definition

Pin number	Definition
2	RX
3	TX
5	GND
Other	NC

3.3 Rear panel function

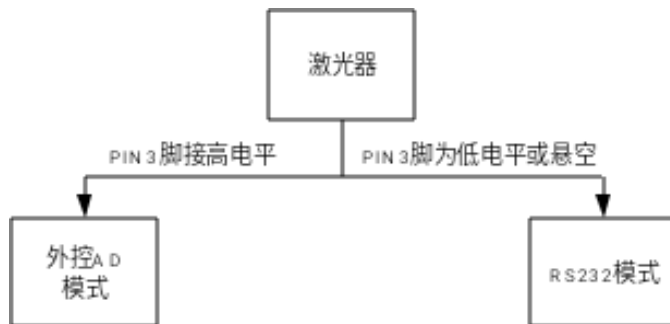
Laser rear panel:



① Cooling fan group

3.4 Laser control mode

The laser has 2 control modes: external control AD mode and RS232 mode. How to choose laser control mode:



3.4.1 External control AD mode

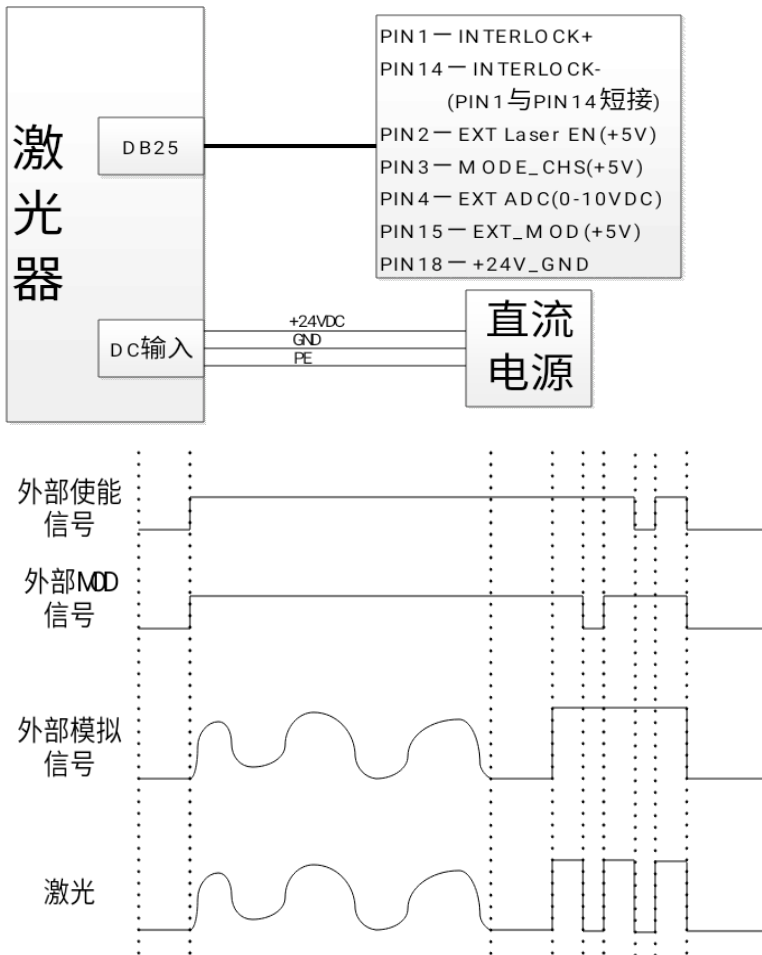
External control AD mode: The output power is controlled by the input analog voltage, and the light output is controlled by the Ext MOD modulation signal and the light enable EXT Laser EN signal.

There are two working modes in external control AD mode: continuous working mode and pulse working mode. These two working modes are set by external signals, and then external signals are input according to the selected mode.

3.4.1.1 Continuous working mode

In the continuous working mode, the output power of the laser is controlled by the external analog input 0 ~ 10VDC, and the laser is turned on or off by the external control light enable signal to realize the continuous output of the laser power. Continuous work mode wiring:

Sequence of continuous working mode:

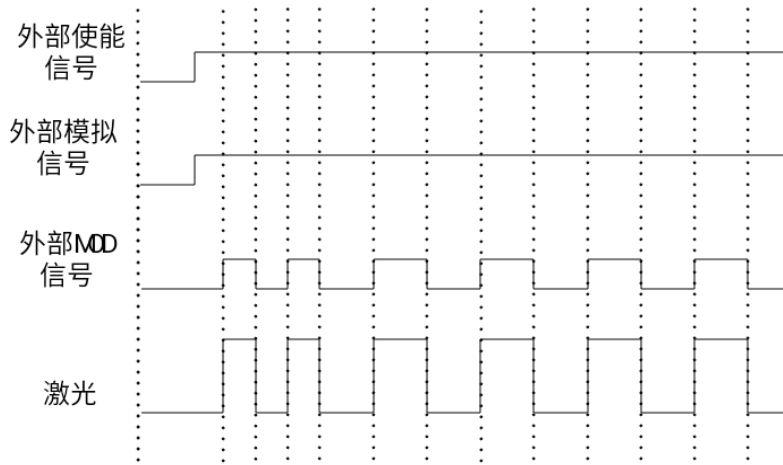


3.4.1.2

In pulse working mode, the output power of the laser is controlled by the external input analog 0 ~ 10VDC, and the laser is turned on or off by the external control Ext MOD signal and the light enable EXT Laser EN signal to realize the laser power output.

The wiring diagram of pulse working mode is the same as that of continuous working mode.

Pulse working mode timing:

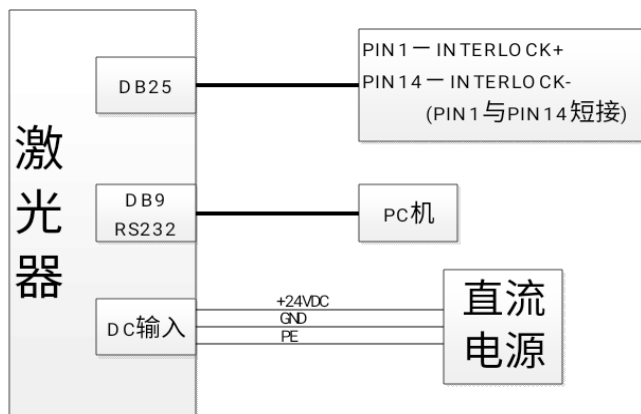


The pulse working mode touch screen interface is the same as the continuous working mode.

3.4.2 RS232 mode

RS232 mode: The PC controls the laser operation through serial communication, including setting parameters, obtaining laser status, and alarm information.

RS232 mode wiring:



RS232 mode has three working modes: continuous working mode, modulation working mode and customized working mode.

6 groups of parameters can be set in continuous working mode: power.

6 groups of parameters can be set for modulation working mode, including power, frequency, and duty cycle.

The custom working mode can be set to 6 groups, each with 16 segments of parameters, including the power and time of each segment.

Serial communication protocol:

RS232 mode serial communication protocol

Number	Function	Frame header	instruction	Set data	Tail frame	Return data (Hexadecimal)
1	Read the ambient working humidity	AA	A1	00,00,00,01	E0	D1 02 00 X X F0
2	Read the ambient working temperature	AA	C1	00,00,00,01	E0	D1 01 00 X X F0
3	Read the radiator alarm temperature	AA	C2	00,00,00,00	E0	D2 00 X X F0
4	Read LD alarm temperature	AA	C3	00,00,00,00	E0	D3 00 X X F0
5	Set LD enable and power value (current group in continuous mode)	AA	A4	X,X,X,X	E0	B4 F0
6	Read current group LD power in continuous mode	AA	C4	00,00,00,00	E0	D4 X X F0
7	Set custom mode group Y segment power	XAA	A5	X,X,X,X	E0	B5 01 F0
8	Read custom mode group Y segment power	XAA	C5	X,X,00,00	E0	D5 X X X X F0
9	Set custom mode group Y segment time	XAA	A6	X,X,X,X	E0	B6 01 F0
10	Read custom mode group Y segment time	XAA	C6	X,X,00,00	E0	D6 X X X X F0
11	Set working mode	AA	A7	00,00,0,X	E0	B7 F0
12	Read working mode	AA	C7	00,00,00,00	E0	D7 01 F0
13	Read system status	AA	A9	00,00,00,00	E0	B9 00 F0
14	Save parameters	AA	AA	00,00,00,01	E0	BA F0

15	Save parameters	AA	AB	00,00,00,55	E0	BB F0
16	Set current group LD power in continuous mode	AA	AC	0,0,X,X	E0	BC F0
17	Read the system version number	AA	E9	0,0,0,0	E0	E9 56 32 2E 31 2E 33 F0
18	Read current time	AA	EA	0,0,0,0	E0	EA 19 07 05 14 54 36 F0
19	Set current group power of modulation mode	AA	AE	0,0,X,X	E0	BE F0
20	Read current group power of modulation mode	AA	CE	0,0,0,0	E0	DE X X F0
21	Set the current group frequency of modulation mode	AA	AF	0,0,X,X	E0	BF F0
22	Read current group frequency of modulation mode	AA	CF	0,0,0,0	E0	DF X X F0
23	Set the current group duty cycle of modulation mode	AA	A8	0,0,X,X	E0	B8 F0
24	Read the current group duty cycle of modulation mode	AA	C8	0,0,0,0	E0	D8 X X F0
25	Read failure times	AA	E1	0,0,0,0	E0	E1 X X X X X F0
26	Set sleep/start mode	AA	E2	0,0,0,X	E0	E2 X F0
27	Set custom mode	AA	E3	0,0,0,X	E0	E3 X F0

	group value					
28	Read custom mode group value	AA	E4	0,0,0,0	E0	E4 X F0
29	Set the continuous mode group value	AA	E5	0,0,0,X	E0	E5 X F0
30	Read continuous mode group value	AA	E6	0,0,0,0	E0	E6 X F0
31	Set modulation mode group value	AA	E7	0,0,0,X	E0	E7 X F0
32	Read modulation mode group value	AA	E8	0,0,0,0	E0	E8 X F0

Serial port settings:



Note:

The serial port number is set according to the actual use of the computer.

Set the baud rate, data bit, stop bit, parity bit, flow control as shown in the figure, check "HEX display", "HEX sending", click "open serial port", the indicator light turns on. Serial communication application description:

1) Function: Read working humidity

Example: Send byte AA A1 00 00 00 01 E0;

Return byte D1 02 00 00 FA F0.

00 FA is converted to a decimal number of 250, which represents a working humidity of 25.0 %RH

2) Function: Read working temperature

Example: Send byte AA C1 00 00 00 01 E0;

Return byte D1 01 00 00 FA F0.

00 FA is converted into a decimal number of 250, which represents a working temperature of 25.0°C

3) Function: Read the alarm temperature of the radiator

Example: Send byte AA C2 00 00 00 00 E0;

Return byte D2 00 00 FA F0.

00 FA is converted into a decimal number of 250, which means that the radiator alarm temperature is 25.0°C

4) Function: Read LD alarm temperature

Example: Send byte AA C3 00 00 00 00 E0;

Return byte D3 00 00 FA F0.

00 FA is converted into a decimal number of 250, which means that the LD alarm temperature is 25.0°C

5) Function: Set continuous mode LD enable and power value (continuous mode) Example: AA A4 00 01 00 64 E0

AA A4 means frame header and command

00 01 means LD enable is turned on, if it is 00 00 means LD enable is turned off

00 64 means to set the continuous mode output power value (10W):

Power conversion: $10W * 10 = 100$, converted into hexadecimal number 00 64;

The returned byte is B4 F0, which means that the LD enable is turned on and the continuous mode output power is set to 10W successfully.

6) Function: Read continuous mode LD power value

Example: Send byte AA C4 00 00 00 00 E0;

Return byte D4 00 64 F0

00 FA is converted into decimal system as 100, which represents the LD power value is 10W.

7) Function: Set the power of Y section of X group in custom mode

X value range is 01-06; Y value range is 01-16;

Example: Set the first pulse power to 5W; $5 * 10 = 50$ is converted into hexadecimal to 00 32;

The sent byte is AA A5 01[group] 01[segment] 00 32 E0; the returned byte is B5 01 F0, which means the setting is successful.

8) Function: Read the power of Y section of X group in customized mode

X value range is 01-06; Y value range is 01-16; Example: Read the first segment pulse power of the first group;

Send byte AA C5 01 01 00 00 E0;

Return byte D5 01 01 00 32 F0.

00 32 is converted to decimal number 50, which represents 5W;

Read the first segment pulse power of the first group as 5W.

9) Function: Set the time of X group Y in custom mode

X value range is 01-06; Y value range is 01-16;

Example: Set the pulse time of the first segment of the first group to 50ms; 50 is converted into hexadecimal to 00 32;

The byte sent is AA A6 01[group] 01[segment] 00 32 E0; the returned byte is B6 01 F0, which means the setting is successful.

10) Function: Read the Y segment time of X group in custom mode

X value range is 01-06; Y value range is 01-16;

Example: Read the first segment pulse time of the first group as 50ms; send byte AA C6 01 01 00 00 E0;

Return byte D6 01 01 00 32 F0.

00 32 is converted into decimal number 50, which represents 50ms;

Reading the first segment pulse time of the first group is 50ms.

※Note The laser can set 6 groups of process waveforms, and each group of process waveforms can be set with 16 segments of power and time. The setting method is the same as above.

11) Function: Set working mode

01 means continuous, 02 means modulation, 03 means customization. Example: Set the control mode to continuous mode;

The sent byte is AA A7 00 00 00 01[Working Mode] E0; the returned byte is B7 F0, which means the setting is successful.

12) Function: Read working mode

Example: Send byte AA C7 00 00 00 00 E0; return byte D7 01[Working Mode] F0.

Indicates that the current working mode is continuous.

13) Function: Read system status

Example: Read system status (over temperature, over current, etc.); send byte AA A9 00 00 00 00 E0;

The returned byte is B9 00 F0 and the system status is normal;

The returned byte is B9 01 F0 system power overcurrent alarm; the returned byte is B9 02 F0 system ambient temperature alarm; the returned byte is B9 03 F0 system temperature control alarm;

The returned byte is B9 04 F0 system Intlock disconnects the alarm; the returned byte is B9 05 F0 system emits light alarm;

The returned byte is B9 06 F0 system radiator temperature alarm; the returned byte is B9 07 F0 system pump source temperature alarm.

14) Function: Save parameters

Send byte AA AA 00 00 00 01 E0;

The returned byte is BA F0, which means the save is successful.

15) Function: Set LD enable (any mode) Example: AA AB 00 00 00 55 E0

AA AB stands for frame header and command

00 00 00 55 means LD enable is turned on, if it is 00 00 00 00 means LD enable is turned off

The returned byte is BB F0, which means success.

16) Function: Set continuous mode LD power example: AA AC 00 00 00 64 E0 AA AC means frame header and command

00 64 represents the output power value (10W):

Power conversion: $10W * 10 = 100$, converted into hexadecimal system 00 64;

The returned byte is BC F0, indicating that the continuous mode LD output power is 10W successfully.

17) Function: Read system version number

Example: AA E9 00 00 00 00 E0

The returned byte is E9 56 32 2E 31 2E 33 F0, which represents the version number V2.1.3.

18) Function: read system time

Example: Send byte AA EA 00 00 00 00 E0;

Return byte EA 19 07 05 14 54 36 F0, which means the time is July 5, 2019 14

Hours 54 minutes and 36 seconds.

19) Function: Example of setting modulation mode power: AA AE 00 00 00 64 E0

00 64 represents the output power value (10W):

Power conversion: $10W * 10 = 100$, converted into hexadecimal to 00 64; The returned byte is BE F0, indicating success.

20) Function: Read modulation mode power

Example: Send byte AA CE 00 00 00 00 E0;

Return byte DE 00 64 F0

00 64 is converted into decimal system as $100 = 10 * 10$, which means that the power value of modulation mode is 10W.

21) Function: Set modulation mode frequency

Example: AA AF 00 00 03 E8 E0

Indicates that the set frequency is 1KHz;

1000 is converted into hexadecimal as 03 E8; the returned byte is BF F0, which means success.

22) Function: Read modulation mode frequency

Example: Send byte AA CF 00 00 00 00 E0; return byte DF03 E8 F0

03 E8 is converted into a decimal system as 1000; Read the modulation mode frequency as 1KHz.

23) Function: Set the duty cycle of the modulation mode. Example: AA A8 00 00 00 50

E0 Set the duty cycle to 80%;

80 is converted into hexadecimal as 00 50; the returned byte is B8 F0, indicating success.

24) Function: Read the duty cycle of modulation mode

Example: Send byte AA C8 00 00 00 00 E0;

Return byte D8 00 50 F0

00 50 is converted to 80 in decimal, which means that the duty cycle is 80%.

25) Function: Read the number of failures

Example: Send byte AA E1 00 00 00 00 E0;

Return byte E1 06 05 04 03 02 01 F0

06 05 04 03 02 01 respectively correspond to the number of ambient temperature alarms, radiator temperature alarms, pump source temperature alarms, temperature control alarms, overcurrent alarms, and light-emitting alarms.

26) Function: Set sleep/start mode

Example: Send byte AA E2 00 00 00 01 E0;

AA E2 means frame header and command

00 00 00 00 means the sleep mode is enabled, if it is 00 00 00 01, it means the startup mode is on

The returned byte is E2 01 F0, which means success.

27) Function: Example for setting the number of custom mode groups: AA E3 00 00 00 01 E0 Set the number of custom mode groups as the first group;

The returned byte is E3 01 F0, which means success.

28) Function: Read custom mode group value

Example: Send byte AA E4 00 00 00 00 E0; return byte E4 01 F0

Indicates that the custom mode group is the first group.

29) Function: Example of setting continuous mode group value: AA E5 00 00 00 01 E0

Set the number of continuous mode groups as the first group;

The returned byte is E5 01 F0, which means success.

30) Function: Read continuous mode group value

Example: Send byte AA E6 00 00 00 00 E0; return byte E6 01 F0

Indicates that the continuous mode group is the first group.

31) Function: Example of setting the modulation mode group value: AA E7 00 00 00

01 E0 Set the modulation mode group number as the first group;

The returned byte is E7 01 F0, which means success.

32) Function: Read the value of the modulation mode group

Example: Send byte AA E8 00 00 00 00 E0;

Return byte E8 01 F0

Indicates that the modulation mode group is the first group.

4. Common Faults and Treatment

Various failures of the laser and possible solutions are as follows:

Number	Malfunction	Solution
1	PO indicator does not light up	Check the voltage value of the input power supply and ensure that the cable is connected accurately and reliably; Restart the laser to try; If the fault continues to occur, please contact Raycus.
2	TM/TE alarm indicator is on	Check whether the cooling fan on the back of the laser is operating normally; Check whether the ambient temperature exceeds the usage limit; If the ambient temperature meets the laser usage requirements, shut down and cool down for a period of time, and restart the laser to try; If the fault continues to occur, please contact Raycus.
3	IN alarm indicator is on	Check whether the Interlock pin is reliably shorted (please refer to Table 3); Restart the laser to try; If the fault continues to occur, please contact Raycus.
4	LD alarm indicator light is on	Restart the laser to try; If the fault continues to occur, please contact Raycus.
5	Laser does not emit light	Check whether the LA signal light is on; Check whether the SI signal light is on. If it is not, check the external input signal (refer to the description of SI signal light in "3.1 Front Panel Function") to ensure that the signal is input

		correctly; Restart the laser, connect the correct input signal for debugging; If the fault continues to occur, please contact Raycus.
6	LD and IO alarm indicator lights are always on	The laser is locked if the light alarm or over-current alarm exceeds three times, please contact Raycus.

5. Warranty and Repair Process

5.1 General warranty

After all products manufactured according to the order or specifications are shipped, Raycus will guarantee the products with material and technical problems, and ensure that they meet the specifications under normal use.

Raycus has the right to selectively repair or replace any products with material or technical problems during the warranty period. All products repaired or replaced during the warranty period, only those products with special problems are guaranteed free of charge. Branch reserves the right to collect payment for products that have problems under normal use.

5.2 Limitation of the warranty

Damage to the product and its parts (including optical fiber) caused by tampering, opening, detachment, incorrect installation or improvement caused by non-Raycus personnel; or damage caused by misuse or accident; or out of specification The damage caused by the use, incorrect installation and maintenance, abuse or use not

in accordance with the information and warnings in the user manual are not covered by the warranty.

Parts such as the power cord, the output fiber on the laser and the output head are not covered by the warranty.

Within the scope of the warranty, the buyer must make a written request within 30 days from the date of discovery of the product problem. The warranty does not involve a third party.

5.3 Technical Support and Product Maintenance

- This product has no built-in parts for user maintenance, so all repairs should be performed by Raycus technicians.
- any failure occurs during the use of the product, the Raycus technicians should be notified in time, and the fault should be resolved.
- All repaired or replaced products must be placed in the original packing box provided by Raycus, otherwise Raycus will have the right not to repair it for free if any product damage is caused.
- When the user receives the Raycus product, please check whether the product is intact and undamaged. If there is any abnormality, please contact the carrier and Raycus in time.

Raycus will continue to develop new products. The product information listed in the manual may change without notice. All technical parameters are subject to the contract terms.

The above-mentioned product warranty and service terms of Raycus are for users' reference only. The formal service and warranty content shall be subject to the agreement in the contract.