

Fiber Delivered Direct Diode

RFL-A200D

Laser User Guide

(compact module)

Wuhan Raycus Fiber Laser Technologies Co., Ltd

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.
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	CAUTION: Describes a hazard that lead to a minor personal injury or product damage.
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1.2 Laser Classification

This series of lasers are classified as a high power Class 4 laser instrument according to the European Community standards EN 60825-1, clause 9. This product emits invisible laser radiation at or around a wavelength of 915 nm, and the total light power radiated from the optical output is greater than 200W. Direct or indirect exposure of this level of light intensity may cause damage to the eye or skin. Despite the radiation being invisible, the beam may cause irreversible damage to the retina and/or cornea. Appropriate and approved laser safety eyewear must be worn all the time while the laser is operational.

	WARNING: You must use appropriate laser safety eyewear when operating this device. The laser safety eyewear is selected according to the range of wavelengths emitted from this product. The end user must ensure that the laser safety eyewear used protects against light emitted by the device over its entire range of wavelengths. Please check the safety labeling on the product and verify that the personal protective equipment (e. g. enclosures, viewing windows or view ports, eyewear, etc.) being utilized is adequate for the output power and wavelength ranges listed on the product.
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1.3 Safety Labels

These include warning labels, apertures through which laser radiation is emitted and labels of certification and identification, etc.

Specifications of these labels are as follows:

		
1: Laser Radiation Hazard	2: Aperture Label	3: Aperture Label(CN)
		
4: Class 4 Laser Product(EN)	5: Class 4 Laser Product(CN)	6:Class 2M Laser Product Label for Guide Laser(EN)
		
7: Class 2M Laser Product Label for Guide Laser(CN)	8: Electrical Hazard Label	9:Identification Plate

1.4 Optical Safety

Any dust on the end of the collimator assembly can burn the lens and damage the laser.

	CAUTION: If the output of the device is delivered through a lens with an anti-reflection coating, make sure that the lens is of good quality and clean.
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	CAUTION: DO NOT emit when the protective cap is not removed, or the laser will be damaged.
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1.5 Electrical Safety

- a) Make sure your product is grounded through the PE line of the AC power cord. The grounding must be firm and reliable.

	WARNING: Any interruption from the protective earth will electrify the enclosure, which may result in personal injury.
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- b) Make sure that the correct voltage of the DC power source is used.

	CAUTION: Failure to connect the laser to the correct voltage could damage the product.
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- c) There are no operator serviceable parts inside, so do not try to remove covers, or electrical shock may be caused, and warranty will be void.

1.6 Other Safety Rules

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

d) Do not remove the covers of the laser, or the warranty will be voided.

All maintenance must be performed in Raycus or by qualified Raycus personnel.

2. Product Description

2.1 Features

Your 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. It can be used as a stand-alone unit or easily inserted into user' s apparatus.

Main Features:

- Fiber delivery
- Reliable, long lifetime
- Maintenance free operation
- High wall-plug efficiency
- Convenient control interface
- Fast modulation

Applications:

- Soldering Tin
- Welding plastics
- Scientific research

2.2 Package Contents

Please refer to the packing list accompanying the shipment to check actual items included.

2.3 Unpacking and Inspection

Your Raycus fiber delivered direct diode laser is shipped in a package designed to provide maximum protection. Upon delivery, please inspect all packaging for evidence of mishandling or damage. If you find any evidence

of mishandling, please save the damaged material and contact the shipping agent and Raycus immediately.

Remove all the contents from the packing case. Take extra care when removing the unit from the packing case to ensure that the fiber optic cable is not snagged and damaged. A comprehensive packing list is included with the system documentation. Check all items against the list and contact Raycus immediately if there is any missing item or evident damage to the unit.

DO NOT attempt to install or operate the laser, if there is any evident or suspected damage to the unit.

It is recommended that you do not discard the packing materials, as they will be necessary if you ever need to ship the unit back for service at a later date.



CAUTION: The fiber optic cable and output head are precise optic instrument, Any vibration or impact to the output head, and twist or excessive bend to the cable will damage the instrument.

2.4 Operation Environment

Table 1 The Operation Conditions for the Laser

Installation Environment	Flat and no vibration
Ambient Temperature	0℃~30℃
Relative Humidity	<70%

It is recommended to install the product in an environment with air conditioning.

2.5 Precautions for Use

- Make sure the instrument is properly grounded before you use it;
- Make sure that the correct voltage of 48VDC power source is used.
Failure to connect power source correctly will damage the device;
- There are no user serviceable parts, equipment or assemblies inside the product. All service and maintenance shall be performed by qualified Raycus personnel. In order to prevent electric shock, please do not break the seal or uncover the shield. Failure to comply with this instruction will void the warranty;

- d) Please inspect the output head carefully for dust or other contamination. Use appropriate lens paper to clean it if necessary. Do not touch the output lens at any time;
- e) Please cap the output head when it is not in use, and make sure the cap is clean;
- f) It is not allowed to install the output head when the laser is in operation;
- g) Do not look into the output head directly. Wear appropriate protective eye glasses all the time when operating the laser;
- h) Failure to follow the instructions may cause malfunction and damage to the device, such damage is not covered by warranty.

2.6 Specifications

The specifications are listed in the following table.

Table 2 Product Specifications

Model	*RFL-A200D/B/5/B/T
Max Power Consumption (W)	1200
Power Supply	48VDC $\pm$ 10%
Nominal Output Power(W)	>200
Output Power Instability	$\leq$ 2%
Emission Wavelength(nm)	915 $\pm$ 10
Red Guide Laser	650 $\pm$ 10nm, 0.25~1mW
Core Fiber (μ m)	200
Fiber NA	0.22
Connect model	SMA905
Connect Port	DB25、DB9
Operation Mode	EXT control/RS232
Modulation Frequency (Hz)	50Hz~10KHz
Cooling Method	wind
Operating Ambient Temperature($^{\circ}$ C)	0~30 $^{\circ}$ C

NOTE:

*RFL-A200D/B/5/B/T——code rule:

200——output laser power

B——wavelength 915nm

5——delivery cable length (m)

B——connect model SMA905

T——wind cooling

2.7 Dimensions and Installation

Figure1 and Figure2 show dimensions and Installation of the product.

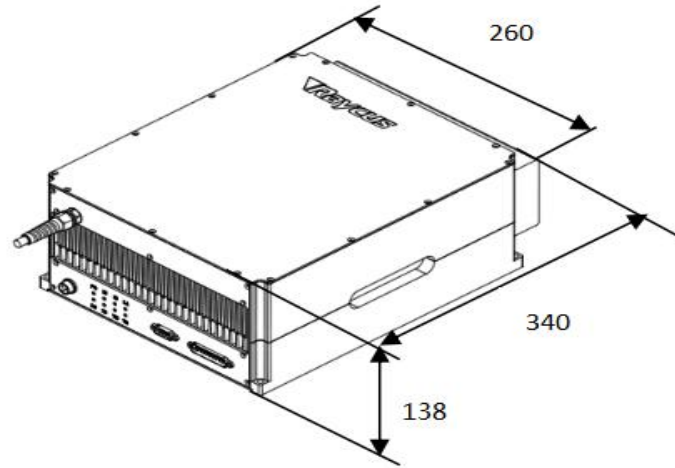


Figure 1 dimensions (unit: mm)

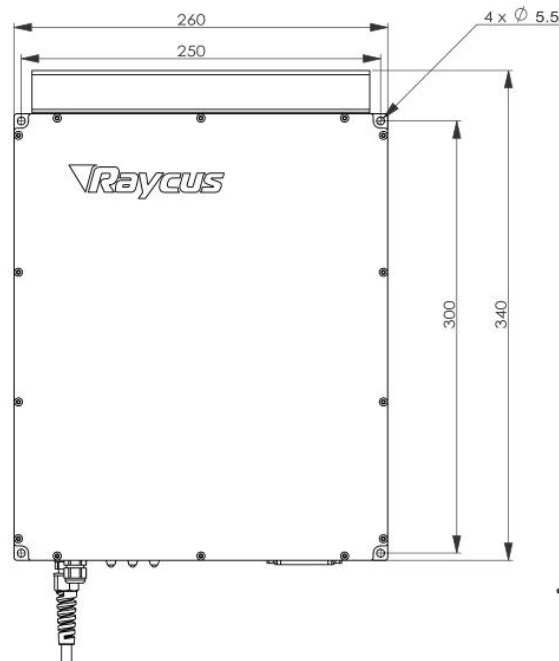


Figure 2 Installation (unit: mm)

Please leave a space as table 3 between Raycus fiber on every side for the necessary air circulating.

Table 3 gap wanted (unit: mm)

	GAP
UPPER	200
FRONT SIDE	300
REAL SIDE	300

2.8 Installation Procedure

- a) Check if the power supply has the correct voltage ($48\text{VDC} \pm 10\%$), and the earth line is connected, make sure it is firm and reliable;
- b) Place the product in an appropriate position, immobilize it if necessary;
- c) Connect the power cable and control cable to the product when power supply is OFF;
- d) Check the output head and clean it if necessary. This procedure must be performed by Raycus personnel or person authorized by Raycus. Make sure the environment is clean, or the output head may be contaminated. It is prohibited to use fan during installation, which will cause dust in the air;
- e) Prevent the delivery cable from treading, pinching or excessive bending during installation.

	CAUTION: All the cables can only be connected when power supply is off. Hot plug may damage the laser.
	CAUTION: Ensure that there are no fiber bends with radius less than 20cm when the product is installed. Avoid excessive twisting and tight bends during the robotic arm movements. Tight bends will damage the laser delivery system. When the product is in storage, the bending radius of the delivery cable should be more than 20cm.
	CAUTION: Avoid vibration and impact to output head, or it may be damaged.
	CAUTION: Make sure the aperture and the cavity of the processing head is clean; Keep the protective cap properly, prevent it from contamination; Or the aperture will be contaminated when capped.

2.9 Precautions for Product

Fiber Delivered Direct Diode Lasers RFL-A200D adopts air cooled miniaturization design, which requires high heat dissipation. Users in different industries have different technology application plans when using lasers. According to the heat dissipation capacity of this laser, the recommended and restricted use conditions are given, as shown in Table 4 and Figure 3.

Table 4 Laser operating state at different ambient temperatures

The working temperature °C	Continuous use of duty cycle %	Limit duty cycle usage %
0	100	100
10	100	100
20	100	100
25	100	100
28	*95	**97
30	*80	**85
35	0	**30
>35	0	0

Note:

* Continuous use: working time $\leq$ 1 Hour.

** Restricted use: the laser working for a long time under this condition may cause the radiator to overheat, the laser alarm, automatically shut down the laser output; Turn off the power supply of the laser, wait for the laser to cool down, and then re-energize it for normal use.

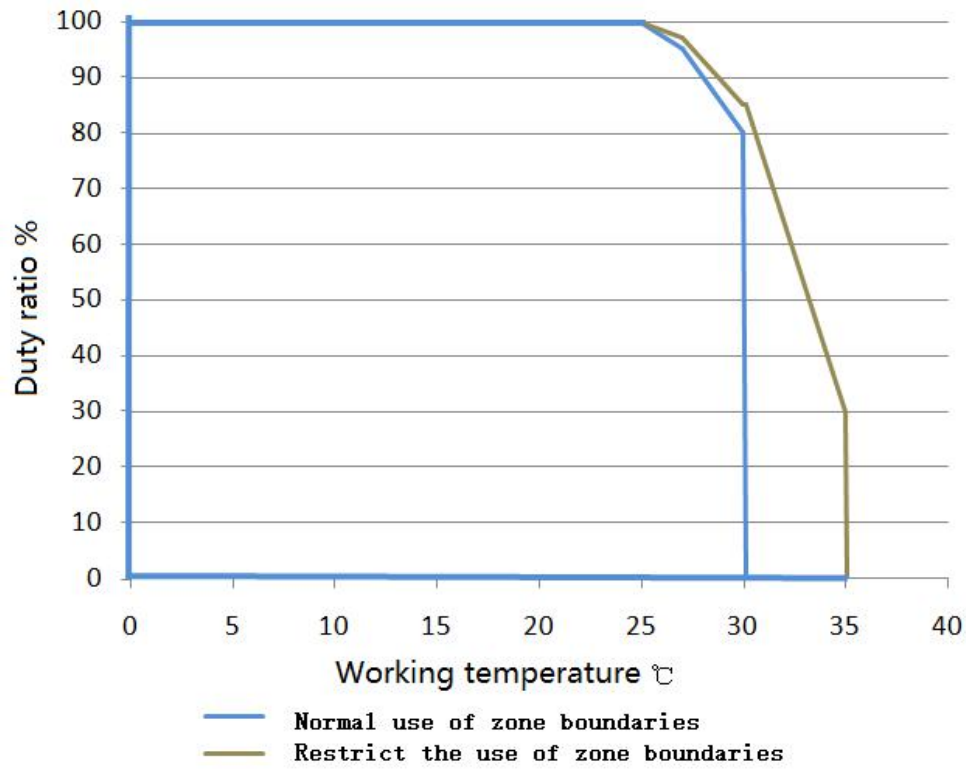


Figure 3 Diagram of laser use area

3. Using the Product

3.1 Front Panel

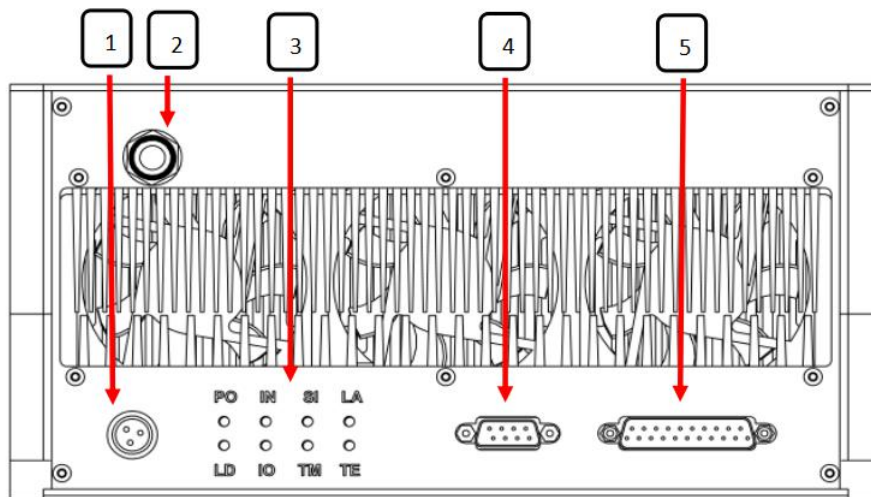


Figure 4 Front Panel View

- ① Power Cord ,USE M16 cable connector



Figure 5 The Power Cord of the Laser

1: +48V ; 2: GND ; 3: PE

② Laser output

③ Status Leds

P0: power led

IN: interlock led

SI: signal led

LA: laser emit led

LD: laser error led

IO: LD driver alarm led

TM: temperature alarm led

TE: temperature controller alarm led

④ RS-232 serial port, this interface is a male DB9 connector, and will be used in RS-232 mode.

⑤ Control Interface, a female DB25 connector, multiple function port.

3.2 Interface Definitions

3.2.1 Control Interface DB25

The definitions of the control interface are as follows:

Table 5 Control Interface Definitions

PIN	NAME	DESCRIPTION		
1	Interlock+	input	Interlock plus signal	0V:enable
				forbidden
2	EXT_Laser_EN	input	Enable laser output in external mode	5V:enable
				forbidden

3	MODE_CHS	input	Control Mode select	5V:external mode
				internal mode
4	Ext_ADC	input	Analog Voltage Signal	0-10V
6	Ext_Foot_EN	input	Foot pedal	5V:enable
				forbidden
7/19	EXT_+5V	output	+5V	/
8	③Ext_Red_Always	input	always enable red light in external mode	5V:enable
				forbidden
11	④ALARM-COM	output	Common point	/
12	④ALARM-NO	output	Normal open point	/
13	④EXT_Laser-NC	output	Normal close point	/
14	Interlock-	GND	Interlock minus signal	/
16/18	EXT_GND	GND	external power GND	/
15	Ext_MOD	input	Modulation signal in external mode	5V:enable
				forbidden
17	①Ext_Red_EN	input	enable red light in external mode	5V:enable
				forbidden
23	④ALARM-NC	output	Normal close point	/
24	④EXT_Laser-COM	output	Common point	/
25	④EXT_Laser-NO	output	Normal open point	/
others	reserve		Connect forbidden	

NOTE:

①Ext_Red_EN: laser emits red light when this signal is high;red light shuts down automatically when laser emits;

②EXT_ON/OFF: switch on/off power unit inside laser;

③Ext_Red_Always: use with Ext_Red_EN signal, red light keeps on when these two signals are high;

④use relay to provide normal close point and normal open point of laser emit signal and alarm signal.

3.2.2 RS-232 Serial Port

Definitions of the pins are in the following table:

Table 6 RS-232 Serial Port Definitions

PIN	DESCRIPTION
2	RX
3	TX
5	GND
others	NC

3.3 Rear Panel

Figure 6 shows the rear panel.

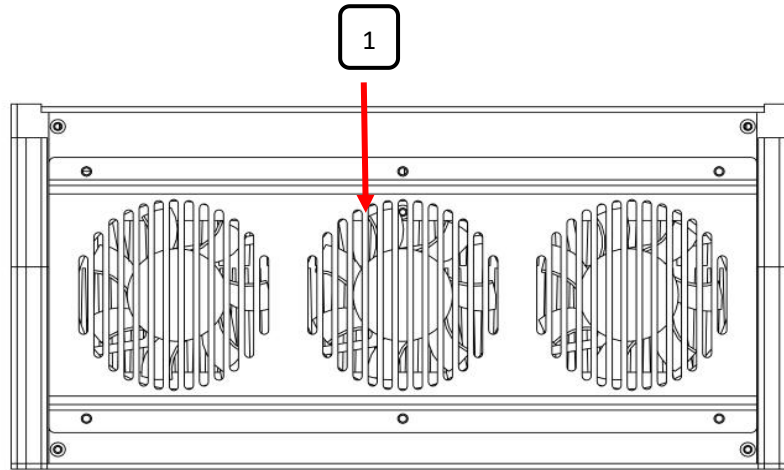


Figure 6 Rear Panel View

① cooling fans

3.4 Control Modes

There are two different modes of operation: external AD mode and RS232 mode.

The following diagram shows the process of entering a certain control mode.

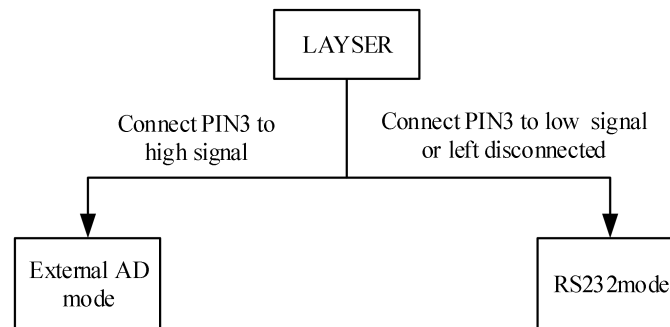


Figure 7 The Process of Entering Different Control Modes

3.4.1 AD Mode

AD mode is a remote control mode. There are two working modes in AD Mode: CW mode and pulse mode.

The output power is set by analog signal, and pulse mode is available in this control mode.

3.4.1.1 CW mode

In this mode, the laser emissions continuous, so just one parameter needs

to be set AD signal according to output power.

Wiring in AD Mode

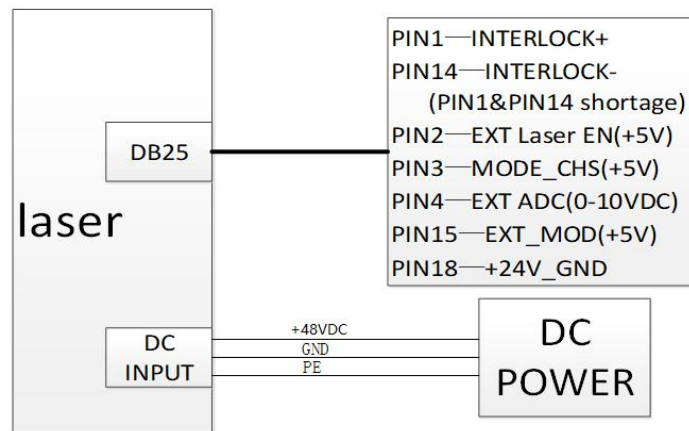


Figure 8 Wiring Diagram in AD mode

CW mode wave diagram

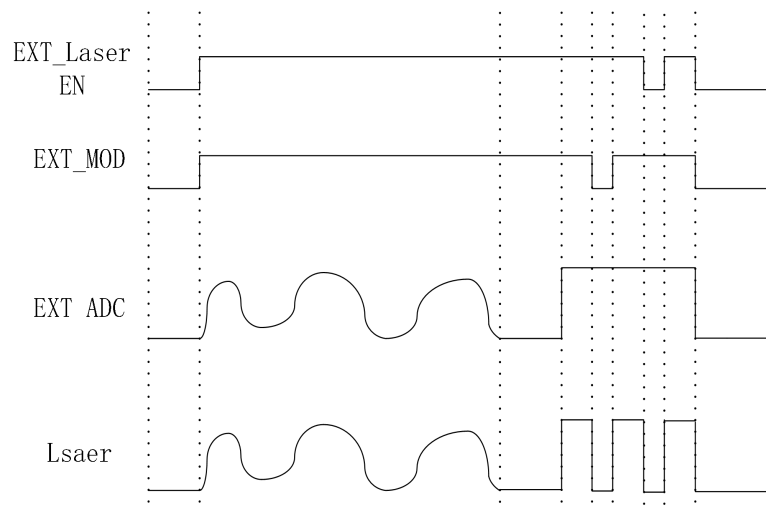


Figure 9 CW mode wave

3.4.1.2 Pulse mode

In this mode, the laser emissions under modulation, so set parameters including Ext_MOD, EXT_Laser_EN and EXT_AD to switch on laser emission. When the parameters are set, laser emission is enabled, and the remote modulation signal inputs from EXT_MOD, the laser emits.

Pulse mode wave diagram

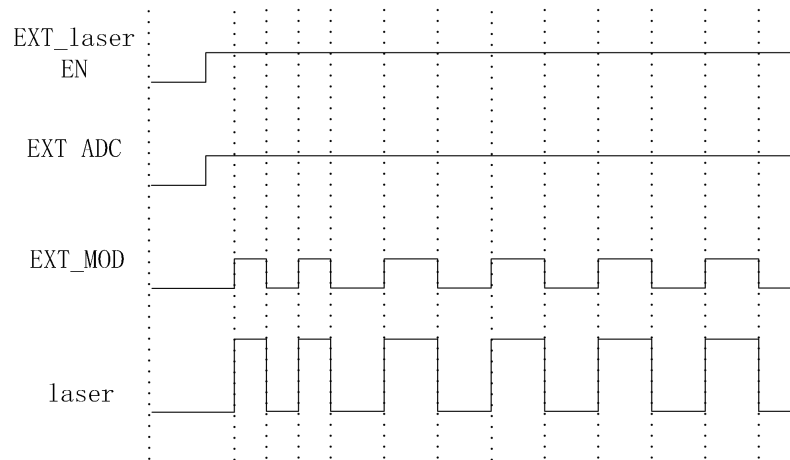


Figure 10 Pulse mode wave

3.4.2 RS232 Mode

RS-232 mode is a remote control mode. In this mode, we have a protocol for communication between the laser and the upper computer, and you can set emission parameters and get information from the laser.

Wiring in RS-232 Mode

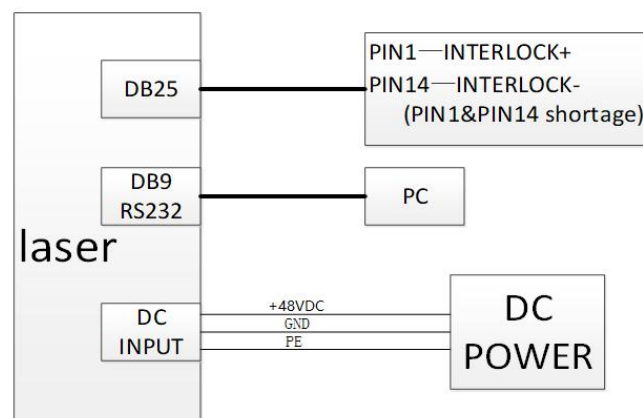


Figure 11 Wiring Diagram in RS-232 Mode

There are three working modes in RS-232Mode: CW mode, modulation mode and preset mode.

Six groups of laser power can be set in CW mode.

Six groups of parameters including laser power, frequency and duty cycle can be set in modulation mode.

Six groups of parameters divided into 16 segments including laser power

and time can be set in preset mode.

Communication Protocol:

Table 7 The Communication Protocol for RS-232 Mode (HEX)

NO.	function	header	code	data	tail	Response
1	Get working humidity	AA	A1	00,00,00,01	E0	D1 02 00 X X F0
2	Get working temperature	AA	C1	00,00,00,01	E0	D1 01 00 X X F0
3	Get preset alarm working temperature	AA	C2	00,00,00,00	E0	D2 00 X X F0
4	Get LD alarm temperature	AA	C3	00,00,00,00	E0	D3 00 X X F0
5	enable LD with preset power	AA	A4	X, X, X, X	E0	B4 F0
6	get LD preset power	AA	C4	00,00,00,00	E0	D4 X X F0
7	Set LD power of group X segment Y	AA	A5	X, X, X, X	E0	B5 01 F0
8	get LD power of group X segment Y	AA	C5	X, X, 00, 00	E0	D5 X X X X F0
9	Set time of group X segment Y	AA	A6	X, X, X, X	E0	B6 01 F0
10	get time of group X segment Y	AA	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	get working mode	AA	C7	00,00,00,00	E0	D7 01 F0
13	get working status	AA	A9	00,00,00,00	E0	B9 00 F0
14	Save parameter	AA	AA	00,00,00,01	E0	BA F0
15	enable LD	AA	AB	00,00,00,55	E0	BB F0
16	Set power in selected group	AA	AC	0,0,X,X	E0	BC F0
17	Get version	AA	E9	0,0,0,0	E0	E9 56 32 2E 31 2E 33 F0
18	Get time	AA	EA	0,0,0,0	E0	EA 19 07 05 14 54 36 F0
19	Set power of selected group	AA	AE	0,0,X,X	E0	BE F0
20	get power of selected group	AA	CE	0,0,0,0	E0	DE X X F0
21	Set frequency of selected group	AA	AF	0,0,X,X	E0	BF F0
22	get frequency of selected group	AA	CF	0,0,0,0	E0	DF X X F0
23	Set duty cycle of selected group	AA	A8	0,0,X,X	E0	B8 F0
24	get duty cycle of selected group	AA	C8	0,0,0,0	E0	D8 X X F0
25	get time of errors	AA	E1	0,0,0,0	E0	E1 X X X X X X F0

26	Enable red light	AA	EB	0, 0, 0, X	E0	EB X F0
27	Set group number in preset mode	AA	E3	0, 0, 0, X	E0	E3 X F0
28	get group number in preset mode	AA	E4	0, 0, 0, 0	E0	E4 X F0
29	Set group number in CW mode	AA	E5	0, 0, 0, X	E0	E5 X F0
30	Get group number in CW mode	AA	E6	0, 0, 0, 0	E0	E6 X F0
31	Set group number in modulation mode	AA	E7	0, 0, 0, X	E0	E7 X F0
32	get group number in modulation mode	AA	E8	0, 0, 0, 0	E0	E8 X F0
33	enable red light	AA	EB	0, 0, 0, X	E0	EB X F0

RS232 parameters set: N, 8, 1

Baud rate: 9600

Data type: HEX

4. Common errors

Error instructions and solutions are as follows:

Table 8 common errors and solutions

NO.	error	error instructions and solutions
1	Led PO not on	Laser power error. Check DC power input and make sure Power Cord is connected firmly; Restart laser system is a way to solve the problem.
2	Led TM/TE on	Make sure working temperature is under limited; Check whether cooling fans are working; Shut down laser for a while, then restart laser.
3	Led IN not on	Check connection of interlock pins; Restart laser system is a way to solve the problem.
4	Led LD on	Restart laser system is a way to solve the problem.
5	No laser emission	Check whether led LA is on, Check whether led SI is on, Make sure external signals are connected correctly, Restart laser system is a way to solve the problem.

5. Warranty and Maintenance

5.1 General Warranty

Raycus warrants that all Raycus fiber delivered direct diode laser products are conformed to applicable product specifications under normal use and are free from defects in materials and workmanship. The warranties start on the date of shipment from Raycus for a period of time asset forth in the applicable purchase contracts or product specifications.

Raycus has the right to choose to repair or replace any product that proves to be defective in materials and workmanship selectively during the warranty period. Only products with particular defects are under warranty. Raycus reserves the right to issue a credit note for any defective products produced in normal conditions.

5.2 Limitations of Warranty

The warranty does not cover the maintenance or reimbursement of our product of which the problem results from tampering, disassembling, misuse, accident, modification, unsuitable physical or operating environment, improper maintenance, damages due to excessive use or not following the instructions caused by those who are not from Raycus. Customer has the responsibility to understand and follow this instruction to use the device. Any damage caused by fault operating is not warranted. Accessories and fiber

connectors are excluded from this warranty.

According to the warranty, client should write to us within 31days after the defect is discovered.

This warranty does not involve any other party, including specified buyer, end-user or customer and any parts, equipment or other products produced by other companies.

5.3 Service and Repair

- Do not open the device. There are no user serviceable parts, equipment or assemblies for user in this product. All service and maintenance shall be performed by qualified Raycus personnel.
- Please contact Raycus as soon as possible when problems under warranty about maintenance happened to the product.
- The product returned with permission should be placed in a suitable container.
- If any damage happened to the product, please notify the carrier in document immediately.

We reserve the right to make changes in design or constructions of any of our products at any time without incurring any obligation to make changes or install the same on units previously purchased.

All the items about warranty and service above provided by Raycus are for user' s reference; formal contents about warranty and service are subject to the contract.