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Ytterbium Pulsed Fiber Laser

User's Guide

RFL-P20QB ~ P30QB

Wuhan Raycus Fiber Laser Technologies Co., Ltd.

2021

Safety Information

Please read this instruction carefully and familiarize yourself with the information we have provided before you use the product. In this brochure, important operation procedures, safety and other information are provided for you and all future users. In order to ensure operations safely and optimal performance of the product, please do according to following warnings, cautions and other information.

- a) Raycus pulsed fiber laser is classified as a high power Class IV laser device. Before supplying the power to the device, please make sure that the correct voltage of 24V DC power source is connected and the anode and cathode are right. Failure to connect power source correctly will cause damage to the device.
- b) The device emits invisible 1060~1085nm wavelength light with average power 20W/30W. Do not expose your eyes or skin to the radiation of the laser.
- c) Do not take apart the device, because there are no replaceable accessories available for users to use. Any maintenance can only be proceeded in Raycus.
- d) Do not look into the light output end directly. Use appropriate laser safety eyewear when operating the device.

Safety labels and locations



The two labels above are located on the top of the cover of the device, representing laser radiation.

Content

| | | |
|-----------|--|----------|
| 1. | Description | 1 |
| 1.1. | Product description | 1 |
| 1.2. | Actual configuration list | 1 |
| 1.3. | Environmental requirements and cautions..... | 1 |
| 1.4. | Specifications..... | 2 |
| 2. | Mounting | 3 |
| 2.1 | Mounting dimensions | 3 |
| 2.2 | Method of installation..... | 3 |
| 3. | Control Interface | 5 |
| 4. | Operation Regulations | 7 |
| 4.1 | Pre-inspection | 7 |
| 4.2 | Operation procedures..... | 7 |
| 4.3 | Cautions | 8 |
| 5. | Instructions for warranty, return and maintenance | 8 |
| 5.1 | General warranty | 8 |
| 5.2 | Limitations of warranty | 8 |
| 5.3 | Service and repairs..... | 8 |

1. Description

1.1. Product description

Raycus P20QB/P30QB pulsed fiber laser is an ideal high power laser source with high speed and high efficiency. It is specially designed for industrial laser making system and other applications.

Compared with traditional lasers, pulsed laser has some unique advantages in increasing the conversion efficiency of the pump light 10 times higher. Its low power consumption and automotive design make it appropriate for operating both in and outside the lab. Besides, it is exquisite and convenient for its independence in placement, free time in using and facility in connecting to equipment directly.

The device can emit 1060~1085nm wavelength pulsed light under the control of industrial laser's standard interface driven by 24VDC power source.

1.2. Actual configuration list

Table 1. Configuration list

| Items | Quantity | Remark |
|-------------------|----------|--------|
| Fiber Lasermodule | 1 | |

1.3. Environmental requirements and cautions

Pulsed laser should be driven by 24VDC \pm 1V power source.

- Caution: Make sure the corresponding wires of the device are properly grounded.
- All the maintenance to the device should only be done by Raycus, because there is no replacement or accessory provided with the device. Please do not try to damage the labels or open the cover in order to prevent against electric shock, or the warranty will be invalid.
- The output head of the product is connected with an optical cable. Please be careful handling the output head. Avoid dirt and any other contaminations. Please use the specialized lens paper when cleaning the lens. Please lid the laser with protective cover of the light isolator to be against dirt only when the laser is not installed in the device or not in working.
- If the operating the device fails to follow this instruction, the protective function will be weakened. Therefore, it should be used under normal conditions.

- e) Do not install the collimating device into the output head when the laser device is in working
- f) The device has three cooling fans at the rear panel to dissipate heat. In order to guarantee enough airflow to help giving heat off, there must be a space of at least 10cm's width for airflow in front and rear side of the device. As the cooling fans are working at blow condition, if laser is mounted in a cabinet with fans, the direction should be same as laser's fans.
- g) Do not look into the output head of the device directly. Please do wear appropriate laser safety eyewear during the time when operating the device.
- h) Make sure the pulse repetition rate higher than 20kHz.
- i) For the longest time without pulse is only 100 us. If there is no pulse output, please stop marking at once, to avoid further damage of the device.
- j) Power source sudden interruption will do great harm to the laser device. Please make sure the power supply works continuously.

1.4. Specifications

Table 2. P20QB/P30QB pulsed fiber laser specifications

| Pulsed fiber laser | P20QB | P30QB |
|----------------------------------|-------------------|-------------------|
| Wavelength(nm) | 1060~1085 | 1060~1085 |
| Polarization | Random | Random |
| Optical isolator | Yes | Yes |
| Nominal average output power (W) | ≥ 20 | ≥ 30 |
| Single pulse energy (mJ) | 1 @ 20kHz | 1 @ 30kHz |
| Beam quality(M ²) | <1.5 | <1.5 |
| Beam Diameter(mm) | 7 \pm 1 | 7 \pm 1 |
| Pulse duration(ns) | 90-110@20kHz | 120-150@30kHz |
| Pulse repetition rate(kHz) | 20 - 60 | 30 - 60 |
| Output Power Tunability(%) | 10-100 | 10-100 |
| Output Fiber Cable length(m) | 3.0 | 3.0 |
| Working voltage(VDC) | 24 \pm 1 | 24 \pm 1 |
| Power consumption(W) | 200@20°C | 300@20°C |
| Cooling | Forced Air Cooled | Forced Air Cooled |
| Dimension W×D×H(mm) | 215×286×95 | 215×286×95 |
| Operating temperature(°C) | 0~40 | |
| Store temperature(°C) | -20~60 | |
| Operating Humidity(%) | $\leq 80\%$ | |

2. Mounting

2.1 Mounting dimensions

a) Fiber Laser module dimensions (As shown in Fig. 1).

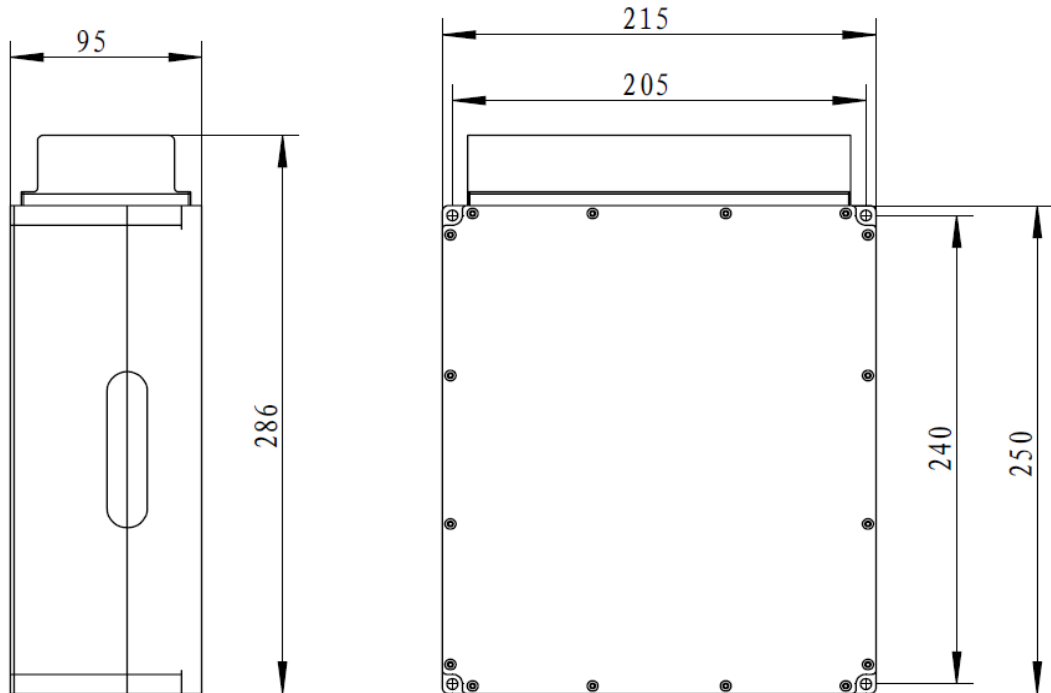


Figure 1. Dimension drawing of laser module (Unit: mm).

b) Isolated output isolator (As shown in Fig. 2).

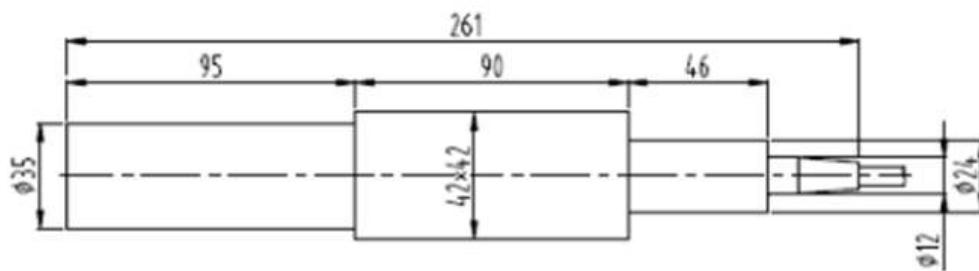


Figure 2. Dimension drawing of output isolator (Unit: mm).

2.2 Method of installation

a) The laser output fiber is the key but very sensitive component. During the package, transport and operation, the bending radius of output fiber must not exceed 15 cm, or the laser may be damaged. The leading and tail parts of the output fiber must not be excessively bended, in case of damaging. When returning the laser for warranty, it suggests using the original package. If the original package is not accessible, the laser device and output isolator must be packed with suitable soft materials in case of

damaging due to vibration during the transportation.

- b) Fix the laser device steady on the holder and ensure good ventilation.
- c) The power connector of this high performance small volume laser device is DB7 dual power supply. Connect the power line to the 24V DC power supply and ensure sufficient output power. Notice the polarity of the power line.

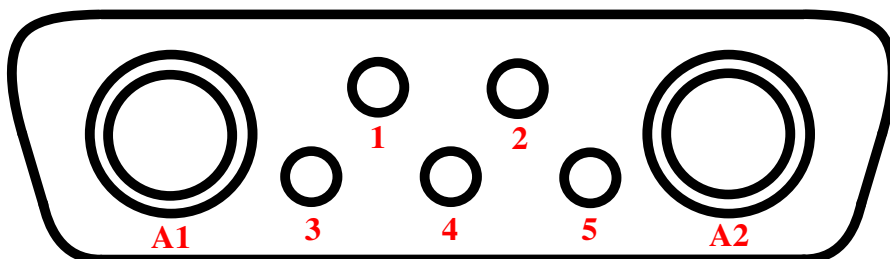


Figure 3. Schematic of DB7 power supply connector.

Table 3. Definition of small volume laser power connector.

| Pin | Definition | Color | Function |
|-------|------------|--------------|---|
| A1 | P24V+ | Red | 24 V laser driver power supply positive input |
| A2 | P24V- | Black | 24 V power supply negative input forboth laser driver and control board |
| 1,3,4 | / | / | / |
| 2 | C24V+ | Red | 24 V control board power supply positive input |
| 5 | PE | Yellow-green | GND |

- d) Pin A1 & A2 are the positive and negative power line connector to the control board. Pin 2 & A2 are the positive and negative power line connector to the laser driver. During the operation, all the power connectors must be correctly connected, or laser wouldn't operate. Depending on the specific requirements in actual operation, the control board and laser drive can be powered together or separately.
- e) During the operation, disconnection of any connect wire will lead the disable of laser emission.
- f) Make sure the control connector of external controller is compatible with the laser device. Fix the control wire steady onto the laser control connector.

3. Control Interface

There are DB9 and DB25 interfaces at the rear of the laser. The DB9 is a RS232 interface only used for debugging, no needs to connect. And DB25 is the joint interface connecting control system to the laser system, please make sure the connection is reliable before operation. Feet of the DB25 are defined as follows in Fig. 5.

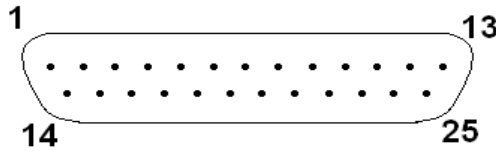


Figure 4. Connect port of controller.

Table 4 Definition of connect ports of controller.

| PIN No. | Name | Description |
|----------------|---------------------|---|
| 1-8 (D0-D7) | PowerSetting | 8 bitsparallel port, D0 is minimum bit and D7 is maximum bit; Range: 0-255 (hexadecimal: 0x00-0xFF); |
| 10,13-15,24-25 | Ground | Digital GND. |
| 11,12,16,21 | Laser alarms status | See alarm codes in Table 4 |
| 17 | VCC | +5V DC power supply input, providing power for inside chips of DB25 to ensure that the input and output signals are valid. Input current >20mA |
| 18 | EE | Emission Enable (EE) signal. HIGH: Emission Enable; LOW or disconnected: Emission Disable. |
| 19 | EM | Emission Modulation (EM) input. HIGH (>3V): Emission ON;LOW or disconnected (<1V): Emission OFF. |
| 20 | Sync | Pulse Repetition Rate (Synchronization) input, square wave. |
| 22 | Guide Laser signal | Guide Laser (red diode) ON/OFF input. |
| 9,23 | Obligate PIN | Reserved. |

- The pump current of diode laser and the laser output power are controlled by setting the value of PIN1-PIN8 (TTL level). PIN1-PIN8 can be set from 0~255, corresponding to the laser output power from 0~100%(the actual laser power may not be strictly linear with the setting value). The relationship between PIN value and output power is shown

in Table 4:

Table 5. Definition of power control PIN value.

| | Setting 1 | Setting 2 | Setting 3 | Setting 4 |
|---------|-----------|-----------|-----------|-----------|
| PIN 1 | 0 | 0 | 0 | 0 |
| PIN 2 | 0 | 0 | 0 | 0 |
| PIN 3 | 0 | 0 | 0 | 0 |
| PIN 4 | 0 | 0 | 0 | 0 |
| PIN 5 | 0 | 0 | 0 | 1 |
| PIN 6 | 0 | 0 | 1 | 1 |
| PIN 7 | 0 | 1 | 1 | 1 |
| PIN 8 | 1 | 1 | 1 | 1 |
| Current | ~50 % | ~75 % | ~87.5 % | ~93.75 % |

- b) PIN 17 is the external 5V DC input, providing power for inside chips of DB25 to ensure that the input and output signals are valid: input current $> 20\text{mA}$.
- c) The external input signals (Pin 1-8, 18-20, 22) are connected to the optical coupler inside the system. Input voltage 3V-5V are defined as digital High, below 1.7V are defined as digital Low.
- d) Alarm setting: Pins 11, 12, 16 and 21 are the alarm and status outputs which driven by +5V power from Pin 17. Pin 12 is reserved (always be high). These pins indicate the following device states.

Table 6. Definition of alarm states.

| PIN 12 | PIN 11 | PIN 16 | PIN 21 | Alarm item |
|--------|--------|--------|--------|--|
| × | Low | Low | Low | Temperature alarm |
| × | Low | Low | High | Normal |
| × | Low | High | Low | Obligate alarm |
| × | Low | High | High | System alarm |
| × | High | Low | Low | Supply voltage |
| × | High | Low | High | Laser system is not ready for emission state |
| × | High | High | Low | Obligate alarm |
| × | High | High | High | Obligate alarm |

- e) PIN 18 is the start signal of the MO. PIN19 is the input for the optical output signal. The electrical level for both PIN18 and PIN19 are 5V. Before turning on PIN 19, MO

signal must be switched ON, in other word, the signal of PIN 18 must be ahead of PIN 19 at least 5 ms, and otherwise the laser machine may be damaged.

- f) I/O connection of digital signal: the supply current of inputsignals are less than 10mA, and the supply current of outputsignals are less than 3 mA . The connection circuit of input/output signals is shown in Figure 6.

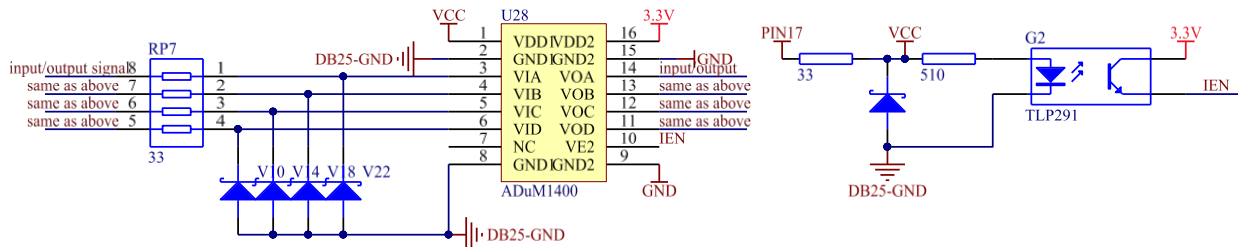


Figure 5.Schematic of input and output signals.

- g) The control board and laser driver can be powered separately. When there is failure in 24V control board power supply, the laser will stop emission after 20 ms. When there is failure in 24V laser driver power supply, the laser will stop emission after 4 ms.

4. Operation Regulations

4.1 Pre-inspection

- Make sure the device appearance is in good condition and the output fiber is neither excessively bended nor broken.
- Make sure signal line of laser and marking system are properly connected.

4.2 Operation procedures

a) Starting procedures

Please make sure the control system is on before you turn on the fiber laser. Only after at least 1 minute since the power turned on, the subsequent operations can be preceded.

b) Frequency set introductions

For this special laser device, the frequency setting range is from 20 kHz to 60 kHz (P20QB), or from 30 kHz to 60 kHz (P30QB).

c) Laser marking checking

For the device initial testing, first turn the power down to zero without turning on the marking system after the device is successfully started. Then draw a quadrate, marking continuously while slowly increasing the power from 0% to 100% at the same time. Meanwhile, use a ceramic material to observe the laser and the laser should become

stronger, otherwise shut down the device and check. If operating normally, the marking system can be used in common order afterwards.

4.3 Cautions

- a) Marking frequency must be in the range of 20 kHz~60 kHz (P20QB), or 30 kHz~60kHz (P30QB).
- b) It should not modulate the frequency while marking.
- c) Stop marking first before shutting down the device, then turn the power down to zero and cut the power off.

5. Instructions for warranty, return and maintenance

5.1 General warranty

All products are warranted by Raycus against defects and problems in materials and workmanship during the warranty period according to the purchase order or specifications and we guarantee the product will accord with the specification under normal use.

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 in this warranty. According to the warranty, client should write to us within 31 days since 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 repairs

Raycus is responsible for all the maintenance, for there is no accessory available inside for users to use. Please contact Raycus as soon as possible when problems under warranty about maintenance happen to the product. The product returned with permission should be placed in a

suitable container. If any damage happens to the product, please notify the carrier in document immediately.

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

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