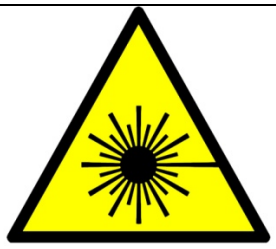
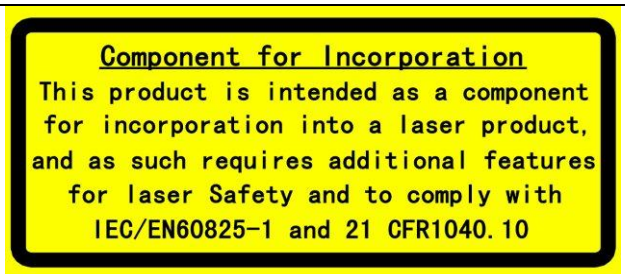
Safety

Please read this user manual carefully before operating the YDFLP fiber laser. It provides essential information regarding safety, product operation, and other necessary reference information. For the purpose of safety operation and maximizing the performance of the fiber laser, please strictly follow the safety notifications as below:

- Make sure the +24VDC power supply is connected in the correct way. Inappropriate connection might spoil the product.
- You can't open the cover of this product without the permission of JPT. It might cause safety issues and invalidate the warranty.
- Please wear laser goggle, as shown in Fig. 1, all the time during the operation. This laser module carry a Class 4 Laser rating it emits invisible laser radiation with a rated average output power of over 10W and rated peak power of over 7kW. Contact with direct or scattered laser radiation will cause permanent damage to the eyes, burn human tissue and start fires.
- Attention: Even at 0% power setting, the average output power is still about 90mW.

Table 1 Safety Labels

Symbols	Information
	Laser Warning Triangle -Label of laser emission (Attached near the output fiber)
	Component for Incorporation labeling (Attached at the upper cover of this product)

Wavelength 1040-1200nm Pulsed Output: Max Pulse Energy <2.0mj Repetition Frequency 20-500kHZ Pulse duration >10ns Max Average Power <50W CW Output Power <50W IEC/EN 60825-1:2001	Safety Information (Attached at the upper cover of this product)
CAUTION-CLASS 4 INVISIBLE LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	Safety Warning (Attached on the output fiber isolator & collimator)

Figure 1 Laser Safety Goggle

Contents

1. Product Tour

1.1 Product Description

The JPT YDFLP pulsed fiber laser adopts the MOPA (Master Oscillator Power Amplifier) configuration, in which a semiconductor laser diode serves as the master oscillator and the fiber amplifiers boost the output power. For this MOPA pulsed fiber laser, the pulse width and pulse repetition frequency are able to be adjusted independently. By changing the pulse width of the fiber laser, the peak power of this MOPA fiber laser can be maintained at the same level for different pulse repetition frequency. This feature makes the product an ideal laser source for various industrial applications.

The MOPA fiber lasers get pumps through fiber couplers, which embed them with higher slope efficiency compared to conventional solid state lasers. The fiber laser is more compact and easy to carry, because it only uses three cooling fans to effectively remove the heat generated inside the chamber. Besides, the all fiber based laser cavity enables higher beam quality of the laser output.

JPT's MOPA fiber laser adopts the standard DB25 interface, and it is power supplied with 24V/8A DC power supply, which makes it a good compatibility. A photograph of a typical JPT MOPA fiber laser is as shown in Figure 2.

Figure 2 JPT's MOPA Fiber Laser

1.2 Packaging List

Please refer to the packaging list in table 2.

Table 2 Packaging List of YDFLP

Item	Quantity	Comments
Fiber Laser	1	
24V Power Cable	1	
Isolator Dust Cap	1	
Testing Report	1	
Precautions for Usage	1	

1.3 Operation conditions and safety instructions

In order to maintain good performance and reliability of this product, please always operate the laser under normal conditions as below:

1) This fiber laser shall be operated with 24V/8A DC power supply; **wrong connection will lead the fiber laser can't work**

2) There should be 10-cm-wide air gaps in front and behind the fiber laser chamber, and the air flow direction should be the same with the fiber laser module and the rest of the whole system; **Short Ventilation distance and wrong air flow direction will lead the fiber laser can't work.**

3) The operating temperature should be 0~40℃; the fiber laser will alarm internal if the temperature above 40℃; it's a protection action in order to insure the long time operational reliability.

4) Please keep the laser module clean during the operation, especially for the fiber pigtail and output isolator; please remember cover up isolator exit during unworking time.

5) Power off the product before installing or uninstalling this fiber laser;

6) Never look at the fiber laser head, and please wear laser goggle when operate this fiber laser;

7) The YDFLP-LP1 pulse width is fixed at 200ns. If you need other pulse width, please contact us for customization;

1.4 YDFLP Product Series Naming Convention

Table 3 Naming Convention for Pulsed Fiber Laser

YDFLP-XX-XX-X-X

1 2 3 4 5

1. Product name
2. Average Output power
3. Product Series
4. Optical Fiber Types
5. Product Types

1. Product name.	YDFLP		
2. Average Output power (optional).	10W		
	20W		
	30W		
3. Product Series (optional).	Pulse width adjustable	M Series	Mid-End：M1-M5
			High-End：M6-M10
		DP1	
	Pulse width fixed	LP1/Q	
4. Optical Fiber Types	S	Single mode	
	L	Low mode	
	H	High mode	
5. Product Types	0：Standard product; 1: Customized product.		

Table 3 Naming Convention for Pulsed Fiber Laser

For example:

YDFLP-- 20—M1—S—0: Means this is a standard product of M1 using single mode type of optical fiber with the average power @ 20W.

YDFLP-- 20—M6—L—1: Means this is a customized product of M6 using low mode type of optical fiber with the average power @ 20W.

1.5 Technical Specifications

Table 4 Specifications of the LP1 series pulsed fiber laser

Laser Type	Unit	MOPA	
Product Model		YDFLP-20-LP-S	YDFLP-30-LP-L1
Average Output Power	W	20	30
M2		<1.3	<1.8
Output Fiber Length	m	2m (Customizable)	
Pulse Energy	mJ	0.66	1.2
Full Power Frequency Range	kHz	30-400	25-400
Adjustable Frequency Range	kHz	1-400	1-400
Pulse Width Range	ns	200	
Output Power Stability	%	<5%	
Cooling Method		Air Cooling	
Supply voltage	V	24	
Current demand	A	＜8	
Current Supply Consumption	A	＞8	
Power Consumption (20 °C) (W)	W	<120	<140
Center Wavelength	nm	1064	
FWHM (nm) @3dB	nm	<5	
Polarization		Random	
Anti-Reflection Protection		YES	
Output Beam Diameter (mm)	mm	7	6
Power Range	%	0-100	
Operation Temperature Range	℃	0-40	
Storage Temperature Range	℃	-10-60	

Table 6 Threshold Frequency（kHz）of LP1 series laser

Pulse Width (ns)	YDFLP-20-LP-S	YDFLP-30-LP-L
200	30kHz	25kHz

The cut-off frequency is the minimum frequency that the laser can be operated with maximum peak power and average power. Please operate the fiber laser at frequency higher than the cut-off frequency.

***Above the cut-off Frequency value is the fiber laser full power output range, oppositely, below the cut-off frequency value is the cut-off power output range. That means the fiber laser will reduce the output power to protect the machine when below the cut-off frequency value. Below is the charts that showed the change between frequency and output ：**

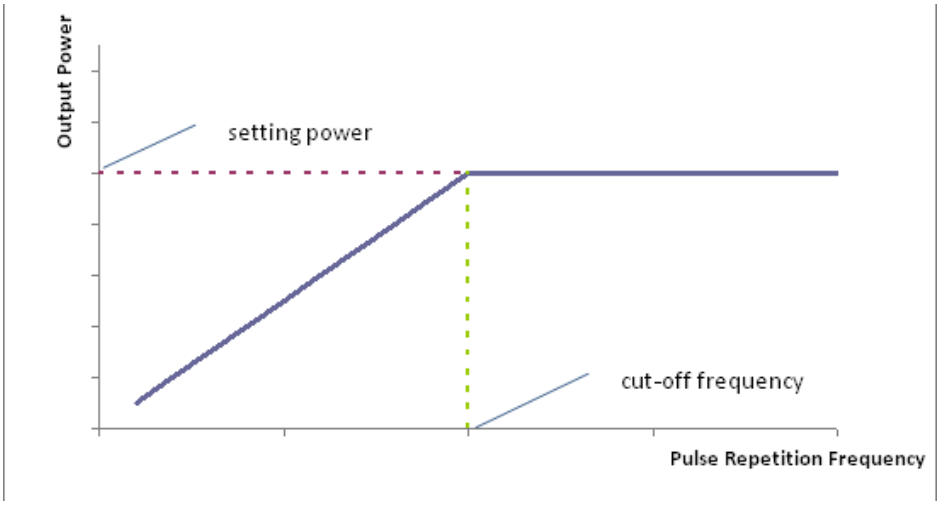


Figure 5 Cut-off Frequency & Output power relationship charts

*** Remarks:**

Threshold frequency = Cut-off frequency, whose definition are the same.

2. Installation

2.1 Dimensions

1. Dimension of main body

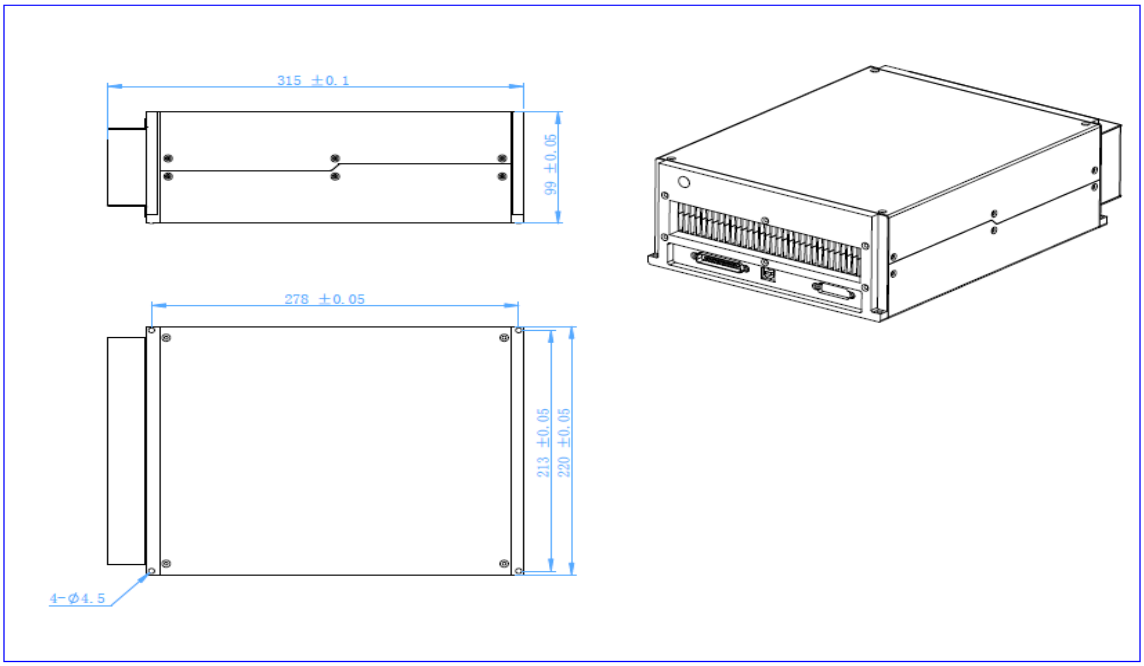


Figure 6 Mechanical Dimensions of the fiber laser module (Unit: mm)

2. Mechanical Dimensions of the output isolator

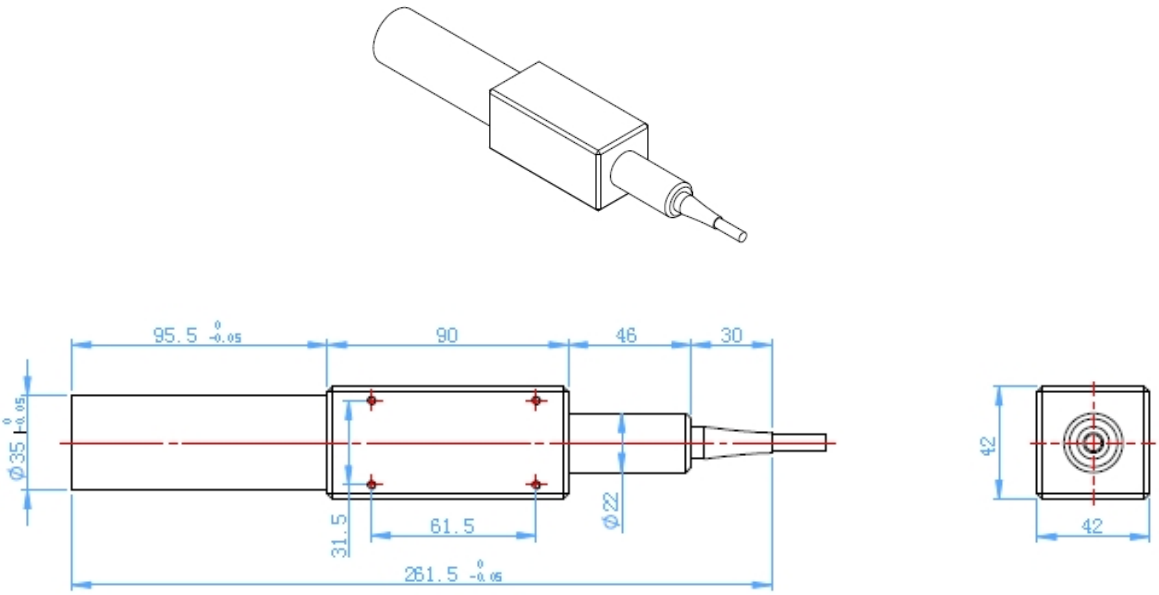


Figure 7 Mechanical Dimensions of the output isolator (Unit: mm)

2.2 Installation Procedures

1) Fix the laser module onto the mounting panel; make sure enough air gaps around the laser module for sufficient air flow.
2) Connect the power cables with the 24V DC power supply correctly according to the color code, i.e. Red: DC positive, Black: DC negative and Olivine: GND).

Figure 8 Color code of the power supply cable

3) Ensure that the control interface of the external controller can match the laser, and then connect the control cable to the laser and fix it.

3. Control and Monitoring Interfaces

3.1 Control Interface

DB25 behind the power module is the interface used to connect the control system (such as marking machines) to the laser system. Please make sure that the interface is connected firmly before the operation.

The PIN is defined as shown in Figure 9 and Table 7.

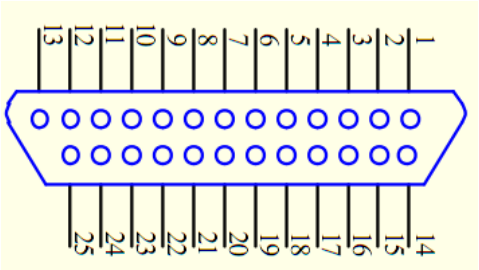


Figure 9 DB25 interface

Table 7 DB25 interface definition of LP1 pulsed fiber laser

DB25 PIN #	Description
1-8	IP0-IP7 Power Control
10-15	GND Description: PIN10-15 have connected inside fiber laser,only need to connect control card GND with another Pin
16，21	Warning signal Description:16 low level,21 high level: Normal 16 low level,21 low level: temperature alarm
19	Laser starting signals (PA) shows that high level is just as open and low level is just as off. If PIN19 at the high level before add the 24VDC main power supply, the fiber laser can't recognize (PA) is on-state
20	Frequency Modulation (TTL)
22	A. Control the pulse width ENABLE B. High Level: Red Beam Turned On; Low Level: Red Beam Turned Off
18	MO signal for turn on/off high level is just as open and low level is just as off. The laser will shooting after turning on the laser for 1s together with the rising of MO
9,17,23,24,25	No need to connect

3.1.1 Interface Setting

Please set the current of pump laser diode which is the output power through a combination of TTL signals of PIN1~8. The encoding can be set within the range of 0~255 which is

corresponding to the 0~100% power output power (the actual optical power output may not be a linear relationship with these settings). Please refer to the description in table 8:

Table 8 Current setting of the MOPA fiber laser

	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 %

1）PIN10~15 is digital. In the inner of laser 10-15 pins have been interconnected, GND of marking card can be linked to any one foot.

2）PIN19 is the input pin of laser optical signal. “1” signals refers to open laser. "0" signal refers to turn off the laser. The laser adopts TTL power level. If it is under the 24VDC power supply, Pin19 are in H power levels and lasers will not identify the on-state of PA.

3）PIN20 is a frequency-modulated signal which adopts TTL power level. The original Frequency-modulated is recommended to set at 20 kHz at 5V.

Note: frequency signals must be persisted after the opening of the laser. If not, laser will shut off the drive system and Laser does not recognize the signals of marking card.

4）Quick-stop control to PIN23, with low power level laser stop operation and with high power level laser operates normally.

5）Definition of warning signal:

Table 9 Parameters of pulsed fiber laser

PIN16	PIN21	Warning project
low	low	Temperature warning of laser
low	high	Normal

If match with all above condition, and PIN19 signal switch is at low level, you can set the power by yourself. Then put pin19 high level after finish the power set up, and the fiber laser

will output corresponding power laser. If pin19 at the high level before add 24VDC main power supply, the fiber lasers will not response this signal.

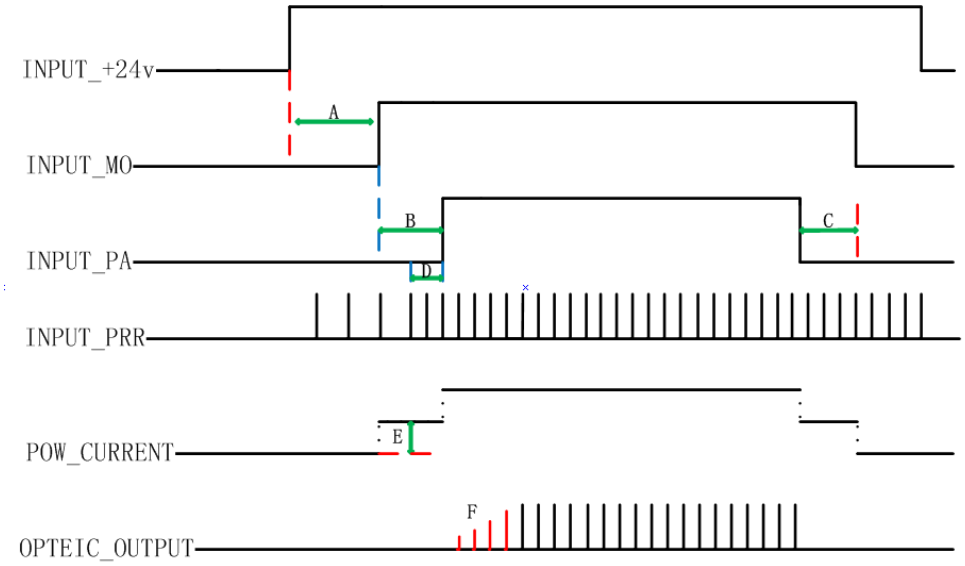


Figure 10 DB25 Controlling Time Series Diagram

➢ A System initialization time: The laser will shooting after turning on the laser for 1s together with the rising of MO

➢ B Pump charging time: Range (8ms-35ms), 8ms is recommended.

➢ C Range: 1ms-8ms, 4ms is recommended.

➢ D Frequency switching time: Range: 4-8ms, 8ms is recommended.

➢ E Class II SIMMER： Control the height of the first pulse which can be adjusted via GUI (the supporting software of the laser).

➢ F The height of the first pulse: This can be adjusted via GUI (the supporting software of the laser).

Remarks: After provide 24V voltage, you need to wait 10s to operate

① **Fiber laser control system self-locking:** If fiber laser received unusual testing signal (Just like: long time not connect control card, high temperature, high frequency signal, low 24V power supply) the fiber laser will stop to receive the instruction. Please again power supply the fiber laser if you need to recover the machine.

4. Operation Procedure

4.1 Preparatory examination of the product

1）Check the laser casing and the fiber cable for any unexpected conditions;

2）Check the connection between laser system and the fiber laser module, and tighten the connection cable.

4.2 Operation Procedure

1）Power on the system

Turn on the fiber laser at the same time or after turning on the marking machine. Wait for about 10s before move on to the next step. Please take note that the fiber laser will be locked automatically if the laser control card has not been power on within 5s after turning on the laser. If so, please restart the fiber laser in order to function normally.

2）Procedures for laser marking

To test the fiber laser, firstly please set the power to 0% and draw a simple figure using the laser marking software, drive the marking and observe the laser output using the frequency doubling piece of pottery and porcelain. Then gradually increase the laser power and change the settings for the marking process. Under normal circumstances, the laser output observed using the frequency doubling piece of pottery and porcelain should be stronger and stronger, or else, turn down the machine and check it.

4.3 Precautions during the laser operation

1）Wear laser safety goggle;

2）Please stop the laser processing before turning off the fiber laser.

Product warranty and service terms above are for users' reference only. Official service and warranty scope will be specified in the contract.

5. Maintenance, customer service and repair

5.1 Standard warranty

When all products manufactured under purchase orders or specifications are on the delivery, JPT will keep product warranty to the products which have problems in material and technology, and guarantee that products under normal use are in accordance with specifications.

JPT has the right to selectively repair or replace the products which prove to be defective during the warranty period and which shall be returned. The customer will be charges for the cost of repairing the product if the product is not under warranty or if the repair is not cover under the warranty. JPT reserves the right to collect the payment of the products which have problems under normal use.

5.2 Warranty limitation

The above warranties do not apply to defects resulting from improper or inadequate maintenance or calibration by customer; customer or third party supplied software, interfacing or supplies; unauthorized modification; improper use of operation outside the specifications for the product; abuse, negligence, accident, loss or damage in transit; or unauthorized maintenance or repair. Customers should understand and strictly follow the user manual during operation. Any problems caused by faulty operation are not under warranty. Components and accessories which are not produced in JPT, such as optical fibers, are not within the warranty.

Customer must claim under the warranty no later than thirty days after the claimed defective product is discovered. All claims under this warranty must be made by the customer and no claim will be accepted from any third party.

5.3 Service and Maintenance

CAUTION: There is no operator serviceable part inside. Please refer all servicing to qualified JPT personnel. All requests for repair or replacement under this warranty must be made as soon as possible after the defect has been noticed and must be directed to JPT or its representative in your area. Items authorized for return by us must be returned in a suitable container. Any

damage noted upon receipt of the unit must be documented for appropriate claim against the carrier.

Product warranty and service terms above are for users' reference only. Official service and warranty scope will be specified in the contract.

Thank you for your support to JPT Electronics.