



Pulsed Fiber Laser

YDFLP-E2-100-M7--M-R

USER MANUAL

Version2.0



JPT

深圳市杰普特光电股份有限公司
SHENZHEN JPT OPTO-ELECTRONICS CO., LTD.

Safety Information

Please read this manual carefully before operating the YDFLP fiber lasers.

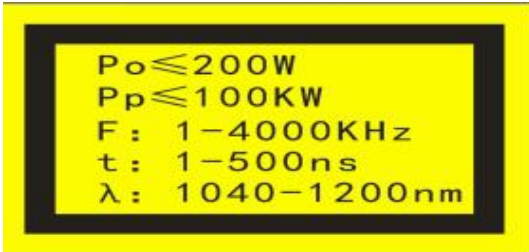
In order to ensure the safe operation and optimal performance of the product, please strictly follow the safety notification below.

- Make sure the +24VDC power supply is connected in the correct way. Inappropriate connection might damage the product.
- To prevent electrical shock, please do not remove the laser cover. Warranty will be void if warranty label is removed.
- Please wear appropriate laser safety goggle (see below Fig.1.) before emitting the laser. We recommend OD4 goggle or better. This laser module carries a Class 4 laser rating, which emits invisible 1064nm wavelength laser radiation with average output power over 100W and peak power over 10kW. Both direct beam and reflect beam will cause permanent damage to the eyes, skin, and might cause fire.
- Caution: Even at 0% power emitting, the average output laser power is still around 100mW.



Figure 1 Laser Safety Goggle

Table 1 Safety Labels and Labeling Locations

Symbols	Information
	Laser Warning Triangle -Label of laser emission (Attached on the cover plate, near the output fiber)
	Compliance Label (Attached on the cover plate)
	Product Rating Information (Attached on the cover plate)

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1. Product Introduction

1.1 Product Description

JPT E2-M7 type fiber laser control with standard DB25 interface and powered with 24V DC. It is designed for high speed and precise marking applications. The pulse response and performance are much better comparing to the similar products. Significantly compact size is perfect for smaller marking system.

Photographs of typical E2-M7 type fiber lasers are shown in Fig.2 (the specific appearance is subject to actual delivery):



Figure 2 YDFLP-E2-100-M7-M-R

1.2 Packing List

Please refer to the packing list according to table 2.

Table 2 Packing list of YDFLP

Items	Quantity
Fiber Laser Source	1
Specification List (tested)	1
Packing List	1
Precautions	1

1.3 Operation conditions and safety instructions

Please read the following instructions carefully. Product reliability and lifetime probably be effected if not following the user's manual.

- 1) Make sure the +24VDC power supply is connected in the correct way. Wrong connection or input voltage might damage the product.
- 2) Make sure the bending diameter of the fiber cable is larger than 18cm in anytime. Otherwise will cause power lost even laser damage.
- 3) Make sure minimum 10cm air gaps behind and in front of the fiber laser. And the air flow direction of the system should be the same as the laser. Short ventilation distance and wrong air flow direction will lead to the laser temperature rise.
- 4) The laser running ambient temperature range is 0~40°C, laser will get internal alarm if out of this range. It's a protection action to insure the lifetime of the laser. The recommended temperature range for laser operation is 10~30 °C. Good heat dissipation can help extend the lifespan of the laser!
- 5) The output isolator is the most important device to prevent the laser from reflecting back to the inside of the light source, and its optimal working temperature is 10-40°C. Laser in the continuous processing of highly reflective materials, will produce the return of light will lead to the isolator internal device temperature rise, the installation of appropriate consideration should be given to the use of the isolator fixed fixture to the device to do passive cooling, in order to ensure that the temperature of the isolator is in the best working condition!
- 6) Please keep the fiber laser source clean especially the laser output window. Please remember to cover the output window when it's exposed to the open environment. Dust on the window will cause heat and damage the lens, which results in output power lost even laser damage.
- 7) Please make sure the power is off before installing and uninstalling the fiber laser.
- 8) Please **do not** look at the output window anytime when power on, and wear laser safety goggle when operating the fiber laser.

- 9) YDFLP-E2-100-M7-M-R contains 17 wave-forms: CW, 2ns, 4ns, 6ns, 9ns, 13ns, 20ns, 30ns, 45ns, 60ns, 80ns, 100ns, 150ns, 200ns, 250ns, 350ns, 500ns. Other pulse width is available for customization request.

1.4 YDFLP Product Naming Convention

Table 3 Naming Convention for Pulsed Fiber Laser

YDFLP – XX – XX – XX – X – X
 1 2 3 4 5 6

- 1、 Product Name : Ytterbium Doped Fiber Laser Pulse (YDFLP)
- 2、 Product type : E: refers to the E series E2: generally refers to the upgraded version
- 3、 Average Output power
- 4、 Pulse Characteristics: **M series - adjustable pulse width**
LP series - fixed pulse width
- 5、 Optical Fiber attributes: **S: Single mode, $M^2 < 1.4$**
M: Near-single mode fiber, $M^2 \leq 1.6$
L: Low mode, $M^2 > 1.6$
- 6、 Additional function: R: Built-in red pilot laser

Examples:

YDFLP-E-20-LP-S : E type LP, using single mode type of optical fiber with nominal output @20W.

YDFLP-80-M7-M-R: M7, using near single mode type of optical fiber with the nominal output power 80W, built-in red pilot laser.

1.5 Technical Specifications

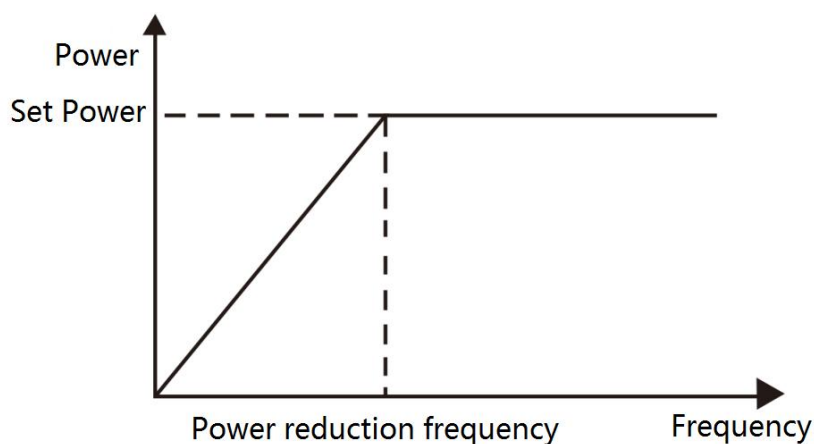
Table 4 Specifications of the E2-M7 series pulsed fiber laser

Characteristic\Laser Type	Unit	YDFLP-E2-60-M7-M-R
M ²		<1.6
Delivery Cable Length	m	3
Average Output Power	W	>100
Maximum Pulse Energy	mJ	1.5
Frequency Range	kHz	1-4000
Pulse Width	ns	2-500
Output Power Instability	%	<5
Cooling Method		Air Cooled
Power Supply Voltage	V	24 (DC)
Power Consumption	W	>440
Power Supply Current Requirement	A	>18
Central Wavelength	nm	1064
Bandwidth@3dB	nm	<15
Polarization		Random
Anti-Reflection Protection		Yes
Output Beam Diameter	mm	7.0±0.5
Power Adjustable Range	%	0~100
Working Temperature Range	°C	0~40
Storage Temperature Range	°C	-10~60
Dimensions	mm	336*255*90
Package Size	mm	455*340*215
Weight	Kg	Net: 8.50 Gross: 9.70

Table 5 YDFLP-E2-M7 Series Fiber Laser Power Cut-off Frequency Value (kHz)

Pulse Width (ns)	Cut-off Frequency (kHz)	Max Pulse Frequency (kHz)
	YDFLP-E2-100-M7-M-R	
1 (CW)	-	-
2	2960	4000
4	2160	4000
6	1400	4000
9	960	4000
13	680	3000
20	420	3000
30	300	3000
45	250	2000
60	200	2000
80	180	2000
100	160	1000
150	95	1000
200	75	1000
250	70	900
350	67	600
500	67	500

*The laser will have expected output power when working above power reduction frequency. When working below power reduction frequency, the power will drop accordingly to maintain the output peak power. Below chart shows the relationship between frequency and output power:

**Figure 3 Power reduction frequency & Output power relationship charts**

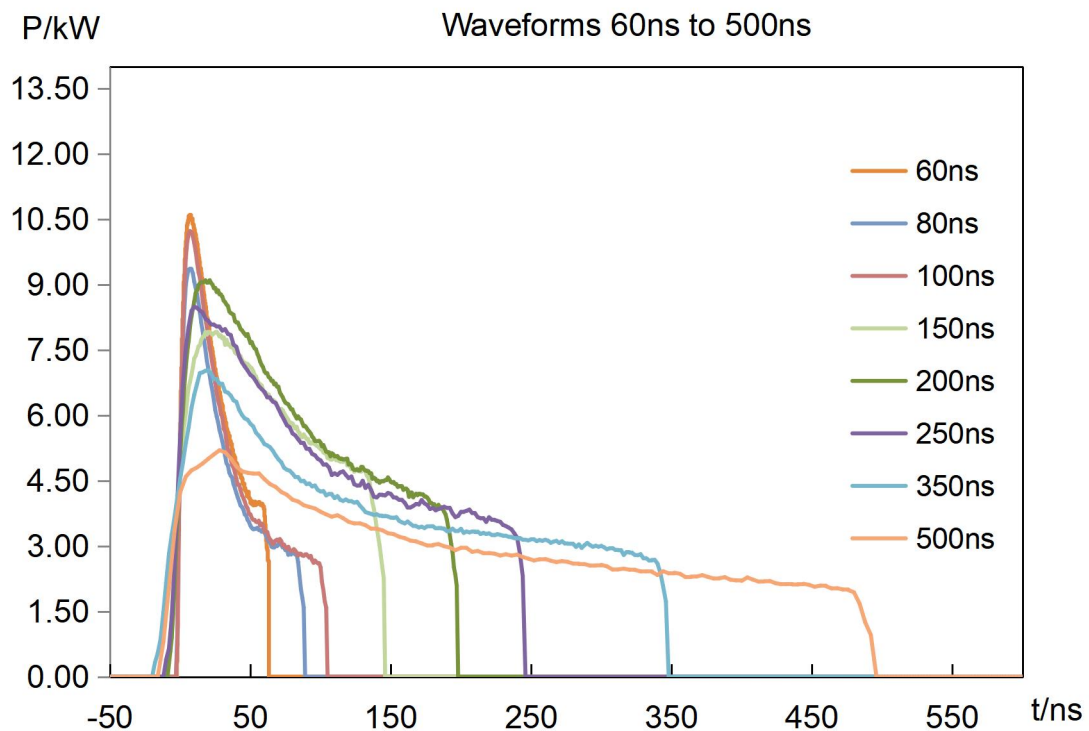
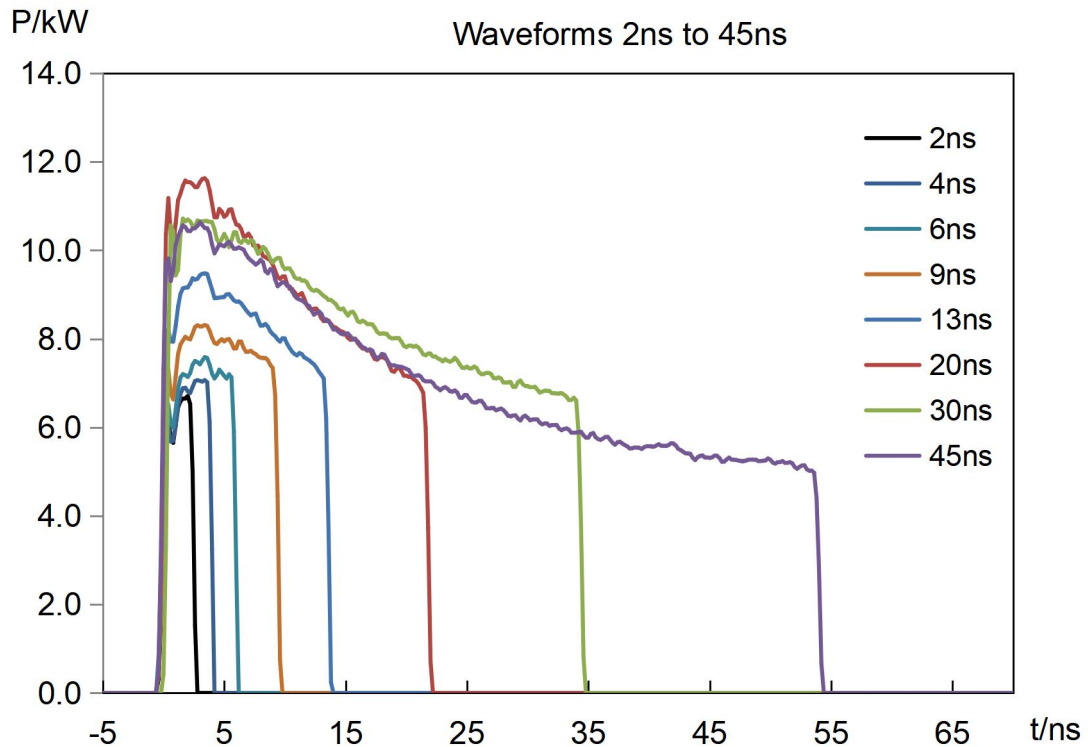


Figure 4 YDFLP-E2-100-M7-M-R Output waveform graph

1.6 Installation Dimensions

YDFLP-E2-100-M7-M-R Laser dimensions

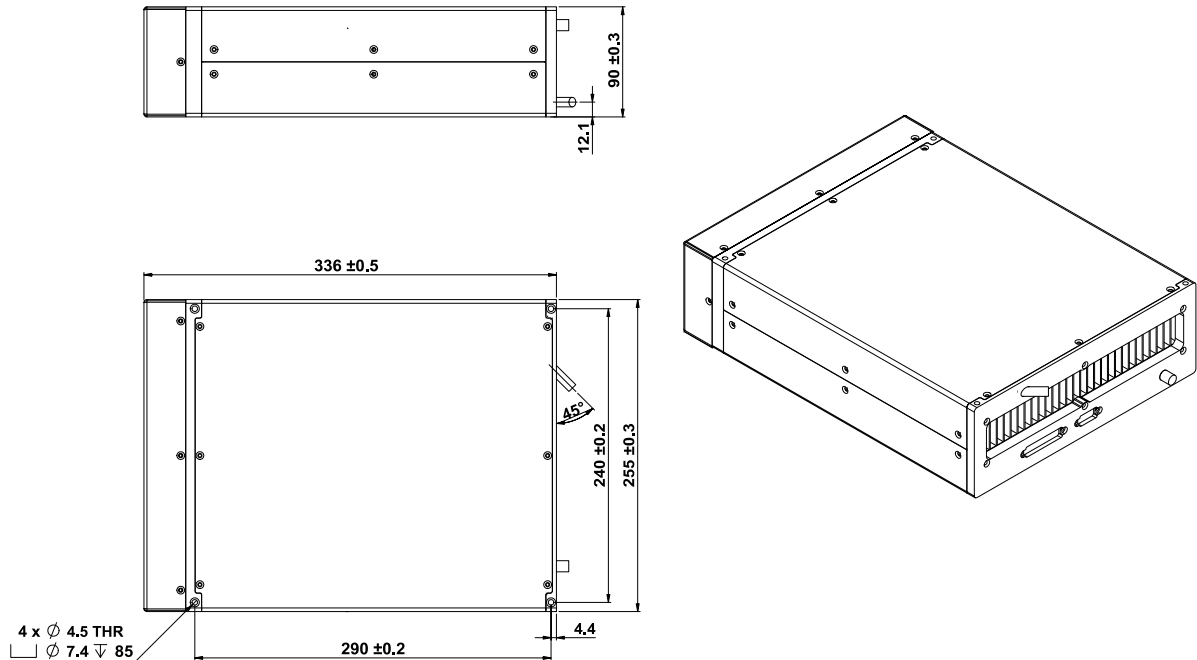


Figure 5 YDFLP-E2-100-M7-M-R Laser module dimensions (Unit: mm)

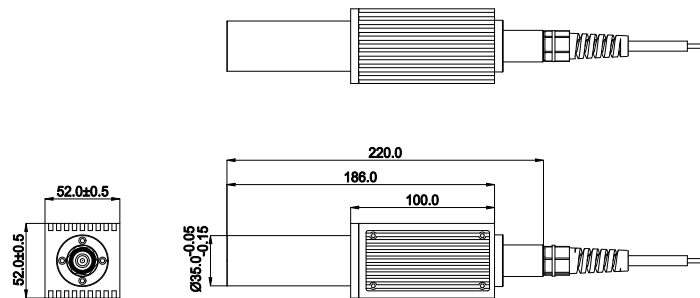


Figure 6 YDFLP-E2-100-M7-M-R isolated output head dimensions (Unit: mm)

*The output isolator head is only for reference. Please be subject to the actual product.

2. Laser Interface

2.1 Power Supply Connector

The length of standard power cord for laser is around 1200 mm. Please refer below to install the power cable to the 24V DC power supply, and ensure the DC power supply can provide enough output power. Please also note the polarity of the cable when connecting.

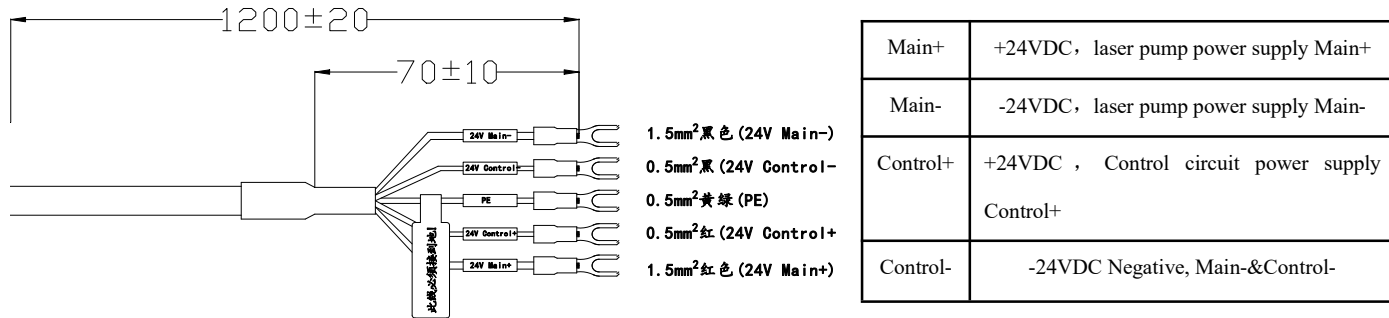


Figure 7 Diagram of the power supply cable

"Main +" and "Main -" are power supply pins of laser pump, "Control +" and "Control -" are power supply pins of control circuit. If independent power supply function is not required, main and control power cable can be used in parallel.

2.2 RS232 interface

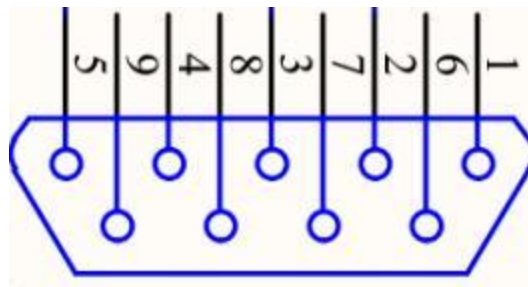


Figure 8 RS232 connector-DB9

Table 6 RS-232 Interface Definition

PIN#	Description
1, 4, 6-9	No need to connect
2	RxD
3	TxD

5	GND
---	-----

2.3 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 below.

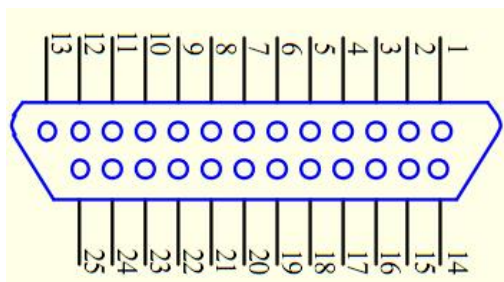


Figure 9 DB25 Connector

Table 7 DB25 interface definition

DB25 PIN#	Definition
1-8	IP0-IP7 Power Control
9	Latches power setting into the laser by rising edge
10-15	GND Description: PIN10-15 have connected to the ground inside the fiber laser, only need to connect control card GND with one of Pins.
16, 21	Warning signal Description: 16 low level, 21 high level: Normal 16 low level, 21 low level: temperature alarm
19	Emission Modulation input (PA) HIGH: Emission ON LOW: Emission OFF
20	Frequency Modulation (TTL)
23	Emergency Stop signal High level: Normal; Low level: Emergency Stop (this function can be selected in GUI) Emergency stop signal is from low to high, need to detect the rising edge of MO firstly, then the laser can be re-emitted.
22	Control the pulse width ENABLE (Red Beam is preferred when Laser and Red Beam are mutually exclusive. * refer to note2) High Level: Red Beam On

	Low Level: Red Beam Off
18	MO signal for turn on/off HIGH: ON LOW: OFF
17, 24, 25	No need to connect

Note 1: 4.6-5.4V will be recognized as TTL high; 0-0.5V will be recognized as TTL low.

Note 2: The default setting is red beam preferred. Red beam Pin22 signal has higher priority than MO and PA signal. When Pin22 signal is high, MO and PA signal will be shut down internally. The laser can be emitted by restarting MO and PA after Pin22 signal is low. Priority mode can be set up in GUI (please refer to Chapter 3.1.2).

2.4 DB25 Control & Sequence

1) Output power control

PIN1~8 controls the output laser power by TTL signal. The encoding can be set within the range of 0~255 which is corresponding to the 0~100% output power. The actual output laser power may not be a linear relationship with these settings. And the actual output power also relate to the frequency (see Figure 4). Pls refer to the example in table 8 current setting:

Table 8 Current setting of E-M7 fiber laser (example)

	Setting1	Setting2	Setting3	Setting4
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 %

2) DB25 Sequence

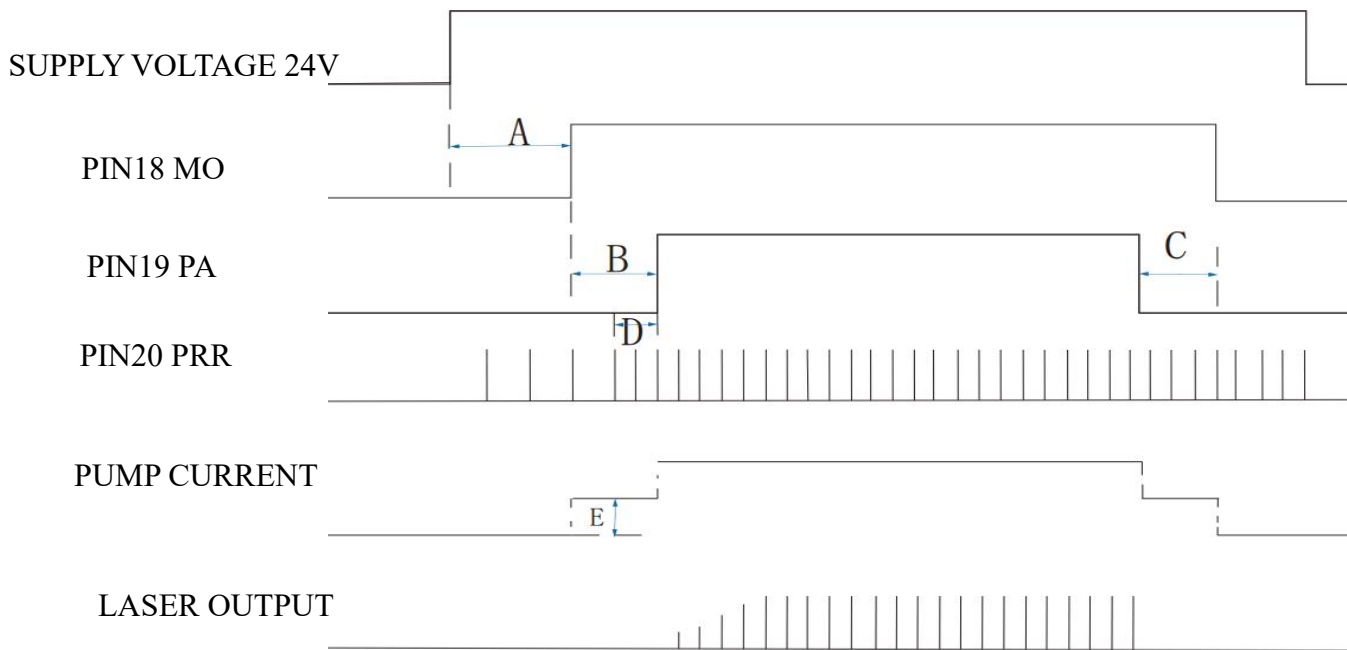


Figure 10 DB25 Controlling Time Series Diagram

- A: 12 seconds System initialization time.
- B: $\geq 4\text{ms}$ MO and PA signal delay time.
- C: Switching off PA should earlier than MO or at same time.
- D: Frequency sampling time under internal frequency mode, at least 1 complete frequency period before turning on the laser (PA).
- E: SIMMER value. The first pulse energy can be adjusted via E type software.

Fiber laser control system self-locking: If fiber laser is on abnormal status (eg.frequency signal $<1\text{kHz}$, high temperature, low power supply etc.), it will stop working to protect the whole system. Please restart the fiber laser and power on.

3) Pulse width control

PIN2, PIN3 and PIN22 pins of DB25 control interface are not only used for basic control of laser, but also for pulse width control. Table9 shows the pulse width control pin and signal description of M7 laser.

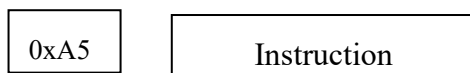
Table 9 Fiber laser pulse width control pin and signal

Pin#	Item	Description
2	Serial Input	Fiber laser serial input, setting data bits synchronize with serial clock rising edge.
3	Serial Clock	Serial digital clock, $8\text{kHz} \leq \text{Clock Frequency} \leq 10\text{kHz}$, 10KHZ is recommended.

22	Enable	Pulse width control function: High: Enable, Pin2 and Pin3 to control the pulse width Low or Not connection: Disable
----	--------	---

● Pulse width control instruction

- Send instruction to Pin2 of DB25 connector and send clock signal to Pin3 at the same time. The instruction description will be transmitted in binary form, with its most significant bit transmitted first.
- The instruction structure transmitted by the user to the laser is as follows: Fiber laser instruction structure as below:



- Data length of input laser is 4-bit bytes.
- The first byte of instruction code is 0x01.
- The Pin22 signal needs to be turned on 10us in advance before sending Pin2 and Pin3 signals. After finished pulse width adjustment, Pin2 and Pin3 signals need $\geq 10\mu s$ delay before turning off Pin22 signal (as shown in Table 11).
- All instruction design starts with byte 0xA5.
- Set Pin19 low before using pulse width control function.

● Pulse width control instruction code

Table 10 Pulse width control instruction code

Instruction	Instruction Code	Description
Set-up pulse width	0x01	Set-up pulse width (ns)

It takes less than 50ns to finish the fiber laser pulse width initialization. Remarks: If Instruction code transmit 3 * 0x01 instruction, that will not be accept by the laser.

● Pulse energy control clock diagram

- The following figure is an example to illustrate the sampling series diagram with a pulse width of 200ns. The series of 0x01 bytes of instructions is as follows:

Example: 0xA5 → 0x01 → 0x00 → 0xC8

0xa5: for activating pulse width control instruction

0x01: for setting pulse width instruction

0x00 and 0xc8: set the pulse width @200ns.

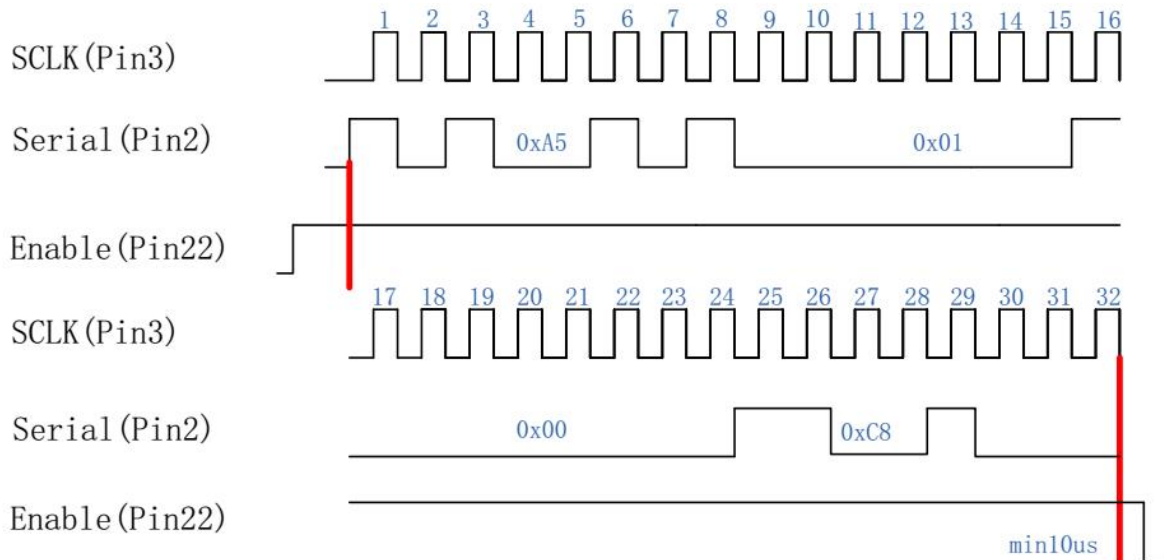


Figure 11 Pulse control clock diagram

T1: the duration is 10us, and the enabling signal of pulse width adjustment needs to be turned on 10us in advance before adjusting the serial input and the serial clock signal.

T2: the duration is 10us. After pulse width adjustment, it needs to delay 10us before closing.

- If the user sets 350ns pulse width, the input instruction is: 0xa5 → 0x01 → 0x01 → 0x5e, where 0x01 and 0x5e represent the pulse width value 350.
- The parameter of this instruction is the binary value of pulse width.
- The user can compile any pulse width, but the laser only accepts the specified pulse width (refer to the specifications of various versions for specific pulse width). If the given pulse width is out of the range, the laser will output with the close pulse width value.

3. JPT GUI Laser Testing Software-E type

E type is designed for YDFLP-E series laser. It has multiple functions including laser control, setting the default parameters, setting the control mode, alarm monitoring, DB25 interface monitoring, internal parameters monitoring etc. E type also records error events which caused system self-locking.

3.1 GUI Operation

3.1.1 Serial COM port

1) Connecting method

Using USB TO RS232 cable to connect PC's USB to the Laser's RS-232 connector.

Check the port number after connecting cable: my computer - > properties - > hardware - > device manager - >

Port (COM and LPT)
Prolific USB-to-Serial Comm Port (COM2)

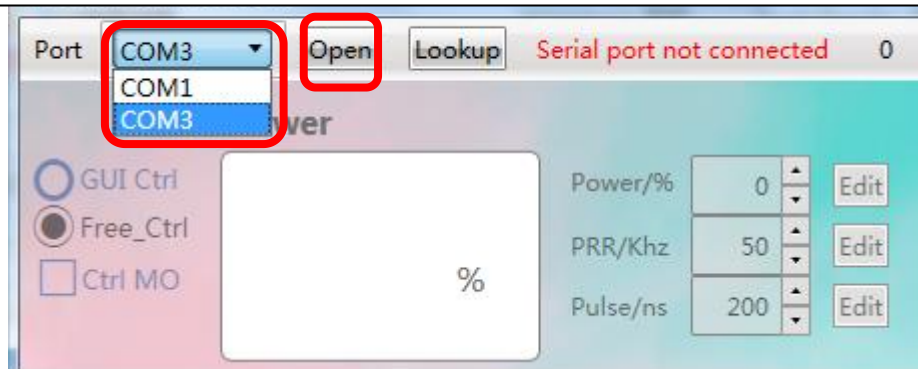


Figure 12 The selection of GUI Serial Port connection

2) Connecting state

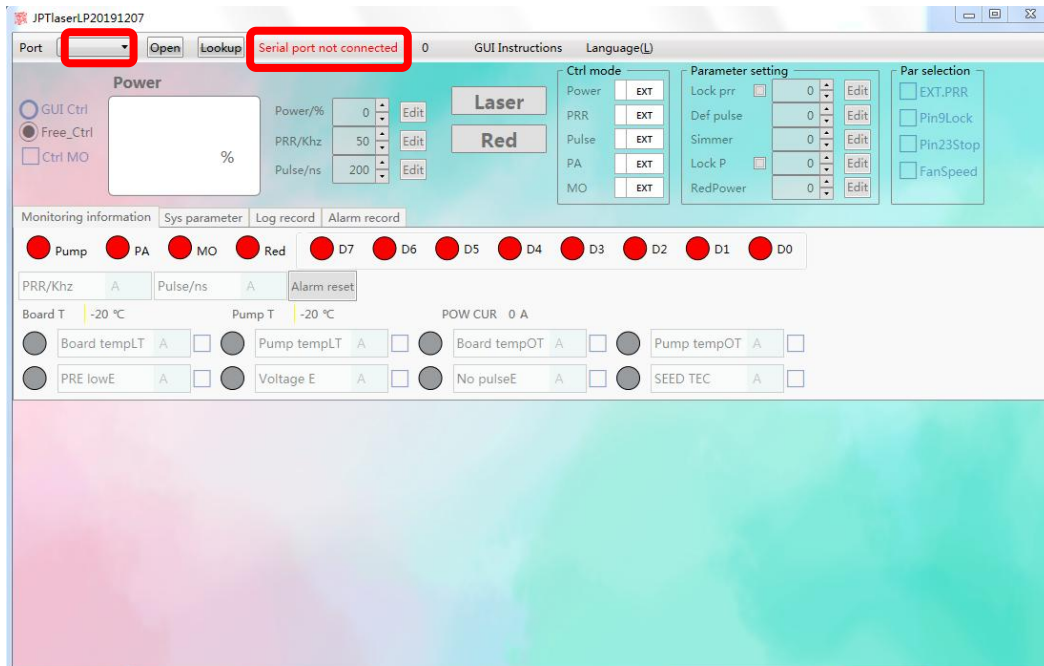


Figure 13 GUI disconnected state

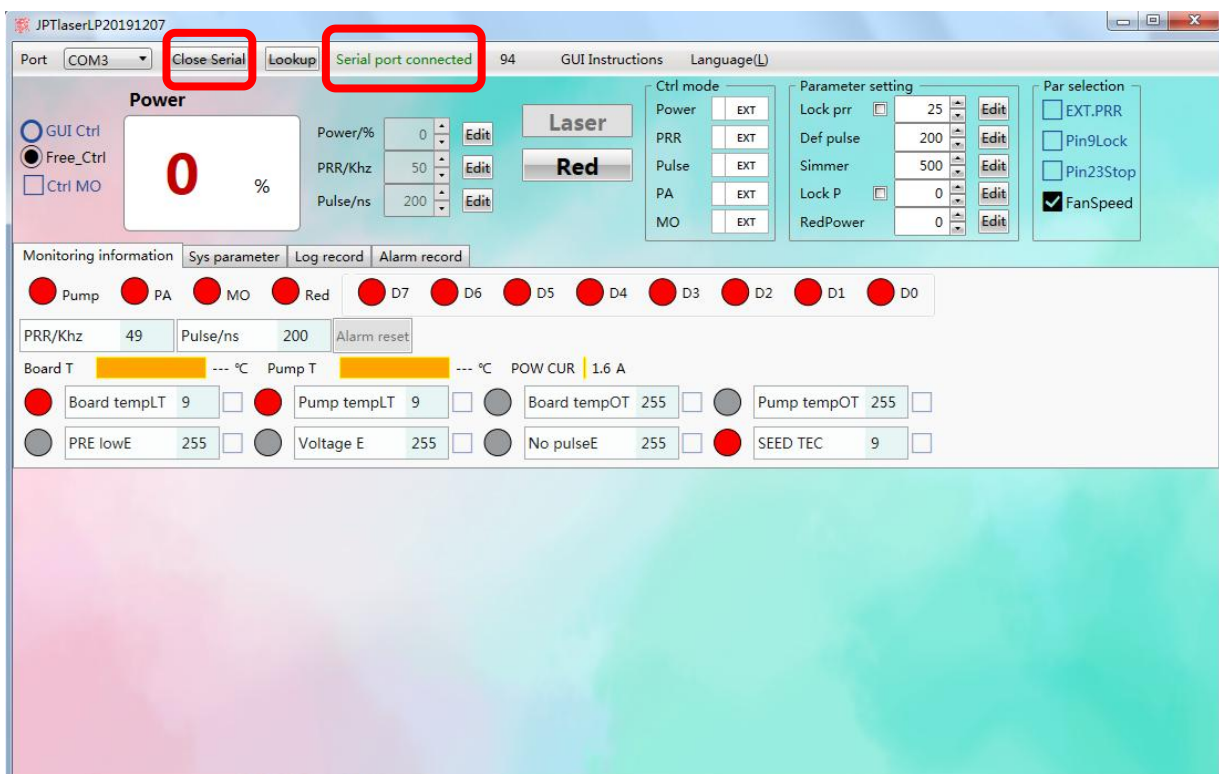


Figure 14 GUI connected state

3.1.2 GUI control function

1) GUI control the emission

① Choose the GUI control Mode

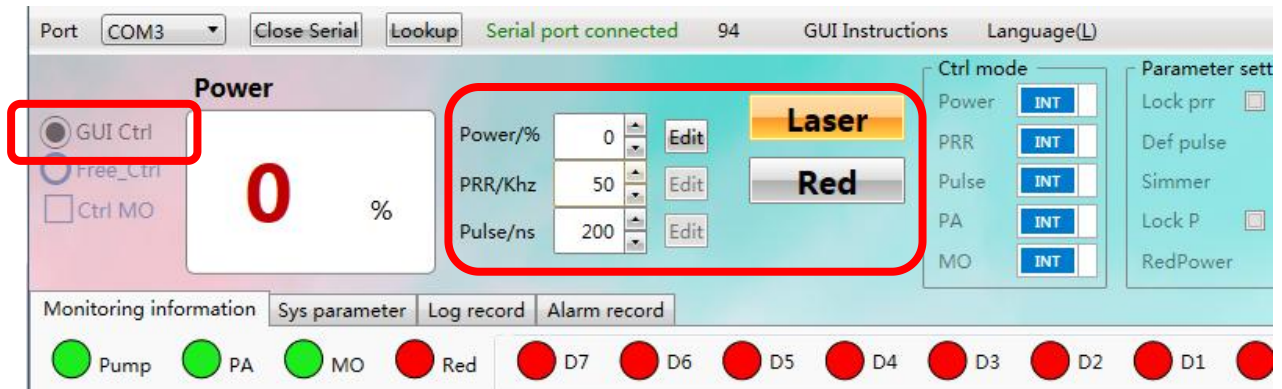


Figure 15 GUI Full Ctrl mode

GUI Full Control mode(GUI Ctrl) : When selecting the GUI full Control mode, all the parameters of Internal/External Control mode (EG. power, frequency, pulse width, PA, MO) will change to Internal Control mode. **This mode will not be preserved after power off.** It will change to “Free Ctrl” mode after serial port closed, and all the parameters of Internal/External Control mode will be changed to the previous free control mode setting. User can select this mode to test the emission of laser temporarily.

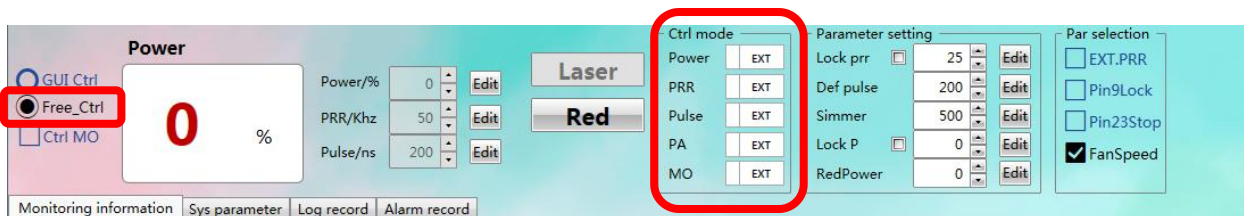


Figure 16 Free Ctrl mode

Free Control Mode (Free Ctrl): When selecting free Control mode, user can choose parameter control mode individually. **In this mode, all the settings will be preserved after power off.** EG. User can select this mode to lock a specific frequency or output power individually when don't want to control it by external signal.

② Set parameters and emitting

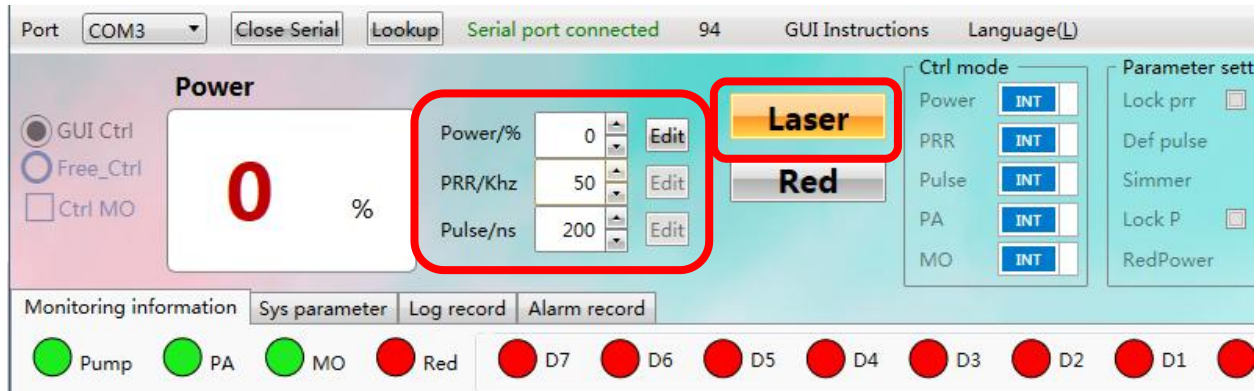


Figure 17 Setting parameters and emitting

After selecting full control mode, user can set power, frequency, pulse width and then press “edit” button to confirm. User can switch on/off emission when clicking “Laser” button.

Note: All the parameters except power can’t be modified during emission.

③ Control MO signal

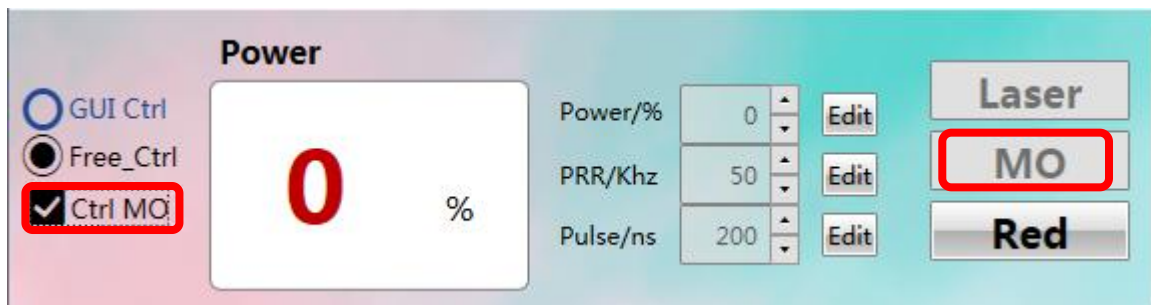


Figure 18 GUI control MO state

Ctrl MO: The “MO” button will be appeared on the interface after selecting Ctrl MO. User can control the switching of MO signal while clicking this button. This setting will not be preserved after power off.

2) Default parameter setting and selection

① Selecting red beam/laser priority mode

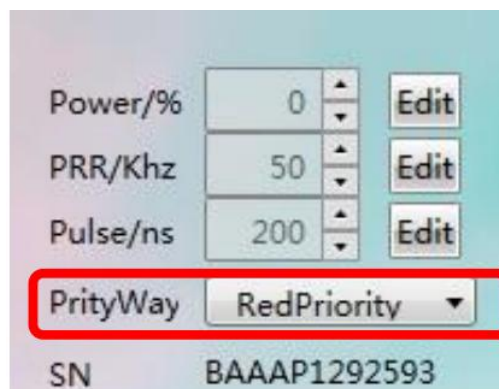


Figure 19 Selection Red Beam/ Laser Priority Mode

Laser priority: Laser is prior when laser and red beam are mutually exclusive.

Red priority: Red beam is prior when laser and red beam are mutually exclusive.

Laser priority and red beam switching on: Laser and red beam are mutually exclusive.

Red beam is enabled by default setting when there is no laser emission(*password is required for this setting).

- ② E type software can modify laser default parameter setting and selection in the option of "Parameter setting" and "Parameter selection". The parameter settings take effect immediately and save automatically after power down.



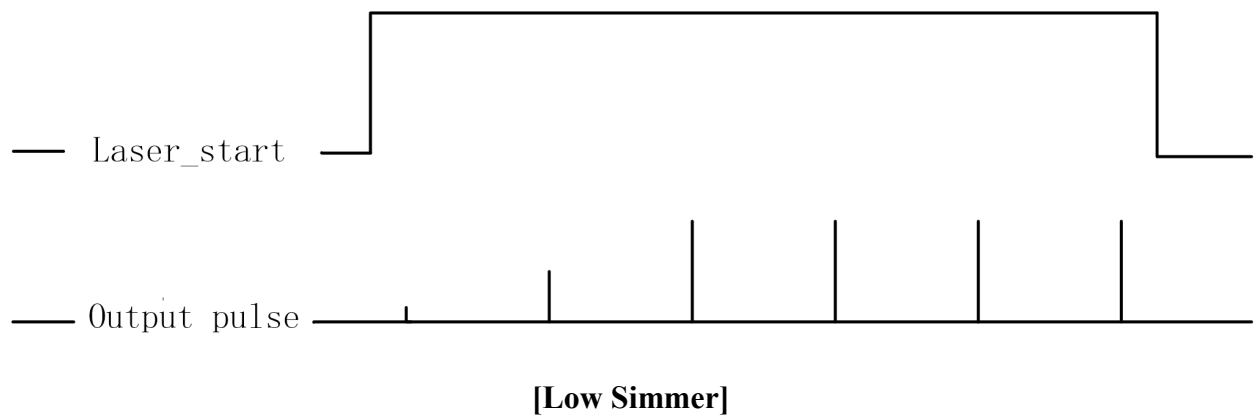
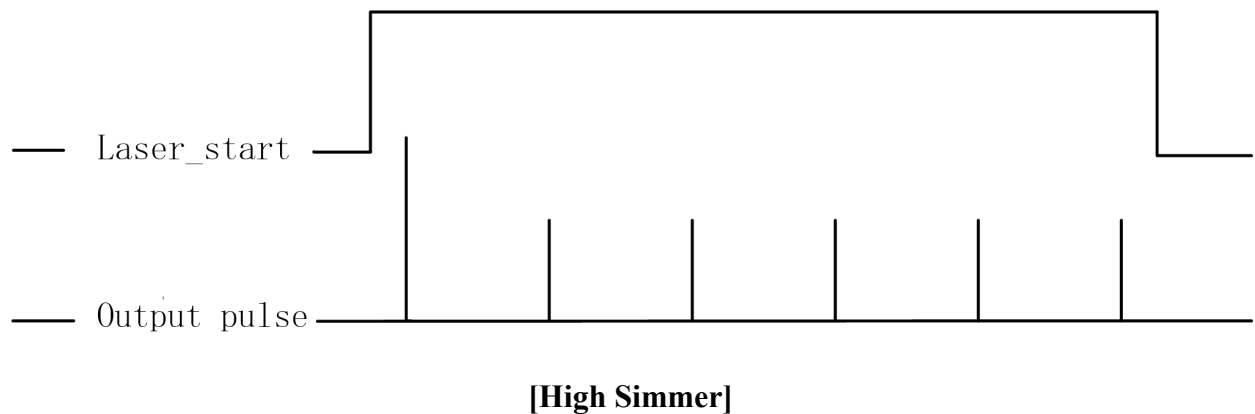
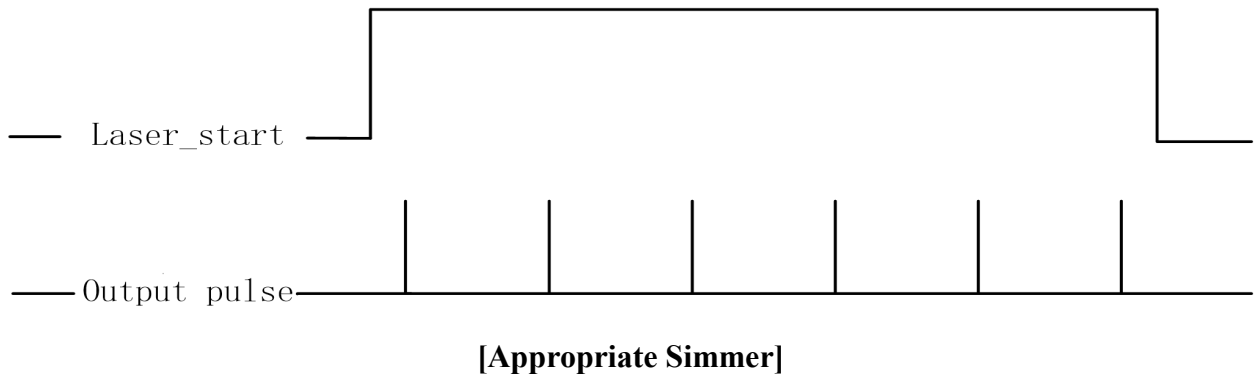
Figure 20 Default parameter settings and selection

Lock PRR: Laser will lock to GUI setting frequency.

Default pulse: The laser will use GUI default pulse when no pulse width control command received.

Simmer: Can be used for controlling the height of the first pulse, the higher the value, the larger the first pulse. Setting range: 0-1000

Simmer setting examples:

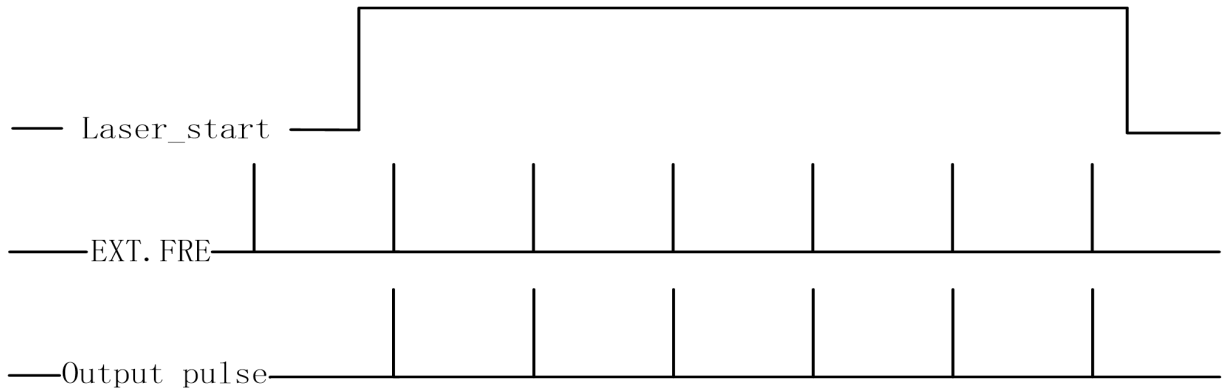


Lock power: Laser will lock to GUI setting power.

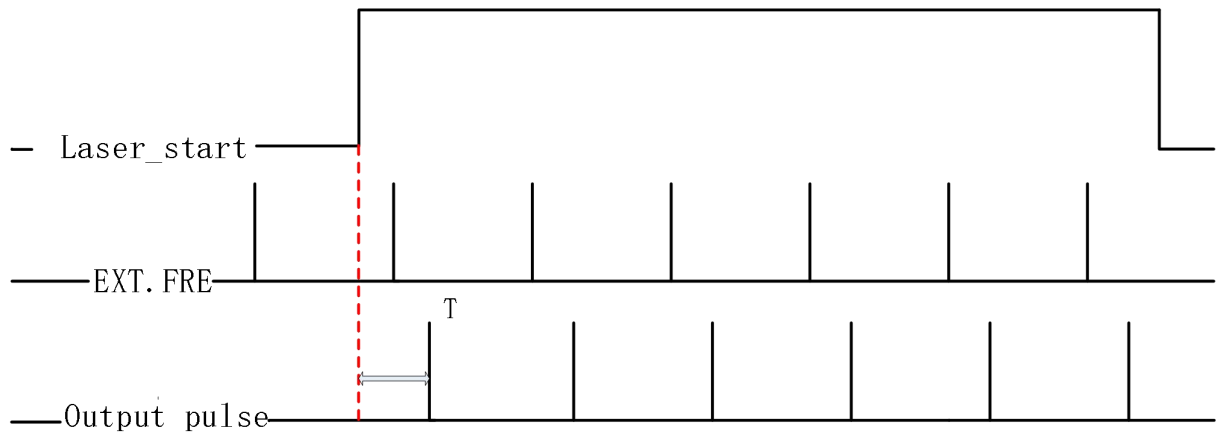
Red Power: Brightness of built-in red pilot(optional) can be adjusted, value range is 0-100.

External frequency: When selecting external frequency mode, the laser output pulse will be synchronized with external frequency signal. When not selecting this option, the laser will use with internal frequency mode. And the laser will calculate external frequency signal in MO and PA delay time. Default setting is internal frequency mode.

External frequency and internal frequency setting examples:



**[External
Frequency]**



[Internal Frequency]

*T=Duration of pulse period, maximum duration $\leq$ cut off frequency period

Pin9Lock: Power latch function is enabled if selected, rising edge is effective. Default setting is not selected.

Pin23Stop: Emergency stop function is enabled if selected, low level is effective. Default setting is not selected

Fan Speed Control: The laser fan speed will be control according to the value of the built-in temperature sensor. If not selected, the fans will run at full speed. Default setting is selected.

Note: The parameter setting of E type software takes effect immediately, no need to restart laser.

3.2 Laser monitoring function

The laser running status and alarm record can be read by E type software.

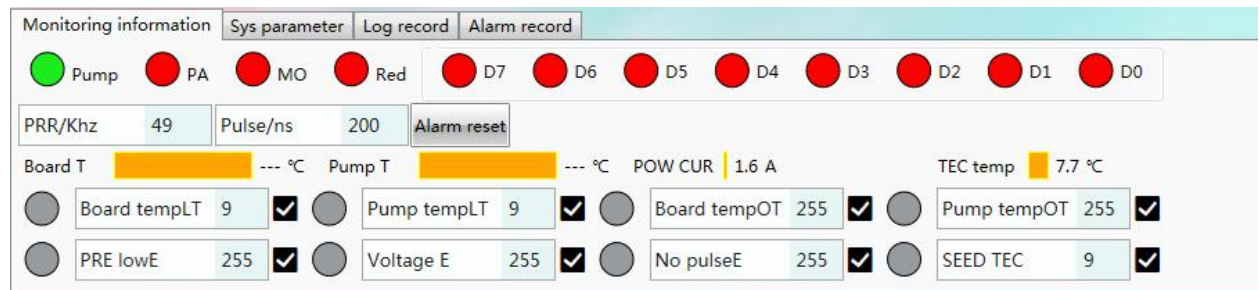


Figure 21 laser running status and alarm record

1) Status monitoring

Pump indicator light: Monitor whether the pump of the laser is currently in normal working state, which is green under normal conditions, and red light if abnormal alarm occurs.

PA、MO、Red indicator light: Monitor the control signal. Green light means signal is effective (high level), and red light means signal is not effective (low level).

D0-D7 indicator light: Monitor the current power signal of the laser, corresponding the 8-bit binary mode, D0 is the lowest and D7 is the highest. Green light means this pin signal is effective (high level), and red light means this pin signal is not effective (low level).

PRR/kHz and PULSE/ns: Monitor the actual laser working frequency and pulse width.

Pump temperature: Monitor the temperature of optical module.

Power current: Monitor the post amplifier driving current value of the laser.

System parameter: Internal system parameter setting interface (For JPT internal use only).

Log record: To record the laser setting and alarm.

Alarm record: To record the sequence of the latest 10 laser alarms.

2) Alarm description

Board temp LT: Board temperature is lower than the set temperature.

Board temp OT: Board temperature is higher than the set temperature.

Pump temp LT: Pump temperature is lower than the set temperature.

Pump temp OT: Pump temperature is higher than the set temperature.

PRE low E: Pre amplifier low current alarm.

Voltage error: Supplying voltage is too low or too high.

No pulse E: No seed source backlight signal detected or backlight signal frequency less than 1kHz.

Seed TEC: Seed source temperature is abnormal.

3) Alarm description of flashing Red indicator light

Alarm of the laser under the abnormal condition, not only can be viewed in GUI monitoring status, but also can be directly reflected by the irregular flashing indicator light. (refer to below Table 11)

Table 11 Alarm Description of Red indicator light

Status of flashing Red Light	Alarm descriptions
Short flashing	Sensor1 alarm
Long flashing	Sensor2 alarm
Long-Short-Short	No pulse E alarm
Short-Long-Short	PRE low E alarm
Short-Long-Long	Seed TEC alarm
Long-Short-Long	Low voltage alarm

The temperature alarm for sensor1 and sensor2 can be recovered automatically, which means the laser will be released the alarm state after the alarm temperature restores to the normal temperature range, but the laser can emit is required to receive the emission signal again. Except the alarm for sensor1 and sensor2, all other alarms are required to restart the laser before the alarm state can be released.

4.Troubleshooting

Item	Common Issues	Causes and Measures
1	Laser fan does not rotate and power is not supplied	(1) Check the positive and negative wiring of laser power supply. (2) Check the power supply of the laser and test whether the power supply meets the power supply requirements of the laser. (3) By default, the laser emits heat by fan speed mode. When the ambient temperature is low, the fan will run at full speed and then stop rotating. This is normal. When the temperature rises, the fan will rotate. (4) If the laser is still not powered on after replacing the power supply that meets the requirements, please contact our technical personnel as soon as possible.
2	Laser Alarm	(1) Check whether the laser output has red light flicking. If the red light flickers, refer to "alarm red light flicker indication description". (2) Other alarms can be monitored and checked in combination with GUI internal control software.
3	Power supply is normal without alarm, but no light	(1) Check the DB25 wiring, and the correct wiring shall be defined according to the laser (refer to table 8 definition of laser DB25 control interface). Pin18 and pin19 signals control the laser on. (2) Check power supply of marking card and software settings. (3) Check the status of the red light signal. Due to the principle of red light priority, the red light signal is at high level (pin22 pin is at high level). The laser outputs red light preferentially and no laser light is emitted.
4	Low laser output power	(1) Check the power supply of the laser. The rated output current of the power supply shall be greater than the required current of the laser. (2) Check the output lens of the laser, and other lenses passing through the laser light path such as the red beam combiner, galvanometer and field mirror. If there is any dirt, use a cotton swab to dip in absolute ethanol and gently wipe it. Please be careful not to scratch the coating layer of the lens. (3) Check whether the output spot of the laser is shielded. During

		installation, ensure that the output port of the laser is coaxial with the optical inlet of the galvanometer. (4) Check the focus position and confirm that the parameters used are set to the optimal state of the laser. (5) After the laser is used, it is normal for the laser power to have a power attenuation of less than 8% /year.
5	The laser emits light intermittently	(1) Check whether the laser and the power supply are properly grounded, and whether there is strong current or strong magnetic interference around the laser. If there is interference, it is recommended to use the signal line with shielding function. The strong current and weak current are routed separately. Based on the principle of red light priority, if the interference causes the triggering of red light, the laser will not be emitted. (2) Check that the parameters and configurations used are consistent with the characteristics of the processing materials. For materials with high reflection or high damage threshold (such as ceramics), high peak power parameters and strong energy density parameters are required for processing. Intermittent light emission may occur if the parameters and configurations are not good.

5. Maintenance and service

5.1 general warranty

After all products manufactured according to orders or specifications are delivered, JPT will guarantee the products with defects in materials and technology within the warranty period of the contract and ensure that they meet the specifications under normal use. JPT has the right to selectively repair or replace any product with material or technology problems during the warranty period, and provide repair or replacement services for any product with failure due to material or production process. JPT reserves the right to collect payment for the products with problems under normal use.

5.2 warranty limitation

- (1) Being tampered, disassembled or modified by personnel other than JPT;
- (2) Damage caused by improper use, negligence or accident;
- (3) Used beyond the scope of product specifications and technical requirements;

- (4) The laser is damaged indirectly due to the failure of user software or interface;
- (5) Used under improper installation, maintenance or other abnormal operating conditions not included in this manual;
- (6) Accessories are not covered by warranty.

The above instructions for the use of the products are provided by for users' reference only. The formal service and warranty contents are subject to the agreement in the contract and after-sales service commitment. Thank you for your support.

**Warranty and service terms in User's Manual are for reference only.
Official service and warranty are subject to official contract.**

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