



Pulsed Fiber Laser

YDFLP-20-M8-S-R

USER MANUAL

Version 01



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.

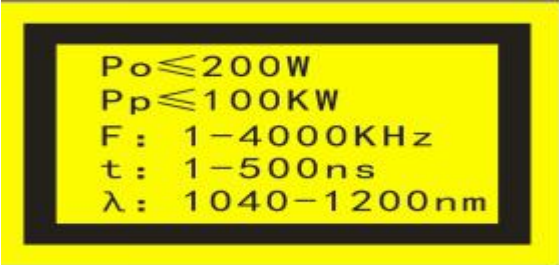
In order to ensure the safe operation and optimal performance of the product, please strictly follow the safety notification below.

- Make sure that the 24V DC 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 invalid 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 20W and peak power over 10 kW. Both direct beam and reflected 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)
 Additional Description This product is intended as a component for incorporation into a laser product, and as such requires additional features for laser safety and to comply with 21 CFR1040.10	Compliance Label (Attached on the cover plate)
 $P_o \leq 200W$ $P_p \leq 100KW$ F: 1-4000KHz t: 1-500ns λ: 1040-1200nm	Product Rating Information (Attached on the cover plate)

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1. Product Introduction

1.1 Product Description

The main oscillator power amplifier (MOPA) structure is used in JPT pulsed fiber laser. The main oscillator uses semiconductor laser as seed source, and the power amplification is realized by traveling wave fiber amplifier. This MOPA fiber laser has the characteristics of independent frequency adjustment, and can maintain a high stable peak power output even if the frequency is changed. It provides an ideal light source for industrial laser marking and other applications.

This kind of fiber laser is pumped by fiber coupled semiconductor laser, which has higher energy conversion efficiency; And the laser adopts air cooling system, which makes the heat dissipation structure more compact, smaller and more portable; Moreover, the integrated all fiber design makes the system free from maintenance and easy for customers to use.

This type of fiber laser is equipped with power adapter. Please use 220 V AC power supply, built-in universal marking control card. USB type-C interface can be used to connect marking software, with good compatibility. Compared with the similar products, JPT pulsed fiber laser can adjust the pulse frequency in a certain range and maintain stable peak power output, which is particularly prominent in high-speed marking applications. JPT M8 Series fiber laser is controlled with standard DB25 interface and powered with 24V DC. It is designed for high-speed and precise marking application. The pulse response and performance are much better comparing to similar products. Significantly compact size is ideal for small marking system.

Photographs of typical M8 type fiber lasers are shown in Fig.2:



Figure 2 YDFLP-20-M8-S-R

1.2 Packing List

Please refer to the packing list according to table 2.

Table 2 Packing List of YDFLP

Item	Quantity
Fiber Laser	1
Power Adaptor	1
USB Type-C Cable	1
Testing Report	1
Packing List	1

1.3 Operation Conditions and Safety Instructions

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

1.3.1. Power adaptor is offered. Please use 220V AC. Wrong connection or input voltage might damage the product.

1.3.2. Make sure that the bending diameter of the fiber cable is larger than 15 cm in anytime. Otherwise power will decrease or the laser may even be damaged.

1.3.3. The speed of the fan is adjustable according to ambient temperature. Make sure that 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 rises.

1.3.4. The required running ambient temperature range is 0~40℃. Laser will get internal alarm if out of this range. It is recommended that the operating temperature range of the laser is 10-30℃. Good heat dissipation is helpful to prolong the working life of the laser.

1.3.5. Due to the "thermal lens effect" of ordinary K9 glass optical lens in medium and high power range application, the phenomenon of focus drift, spot size inconsistency or light output instability might occur during material processing if using K9 glass optical field lens. Fused

silica lens is recommended.

1.3.6. 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 decrease even laser damage.

1.3.7. Please make sure that the power is off before installing and uninstalling.

1.3.8. Please **do not** look at the output window anytime when power on, and wear laser safety goggle when operating the fiber laser.

1.3.9. YDFLP-20-M8-S-R contains pulse width of 2- 500 ns. Other pulse width is available for customization request.

1.4 YDFLP Product Naming Convention

Table 3 Naming Convention for Pulsed Fiber Laser

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

1.4.1. Product Name: Ytterbium Doped Fiber Laser Pulse (YDFLP)

1.4.2. Product type

1.4.3. Average Output power

1.4.4. Pulse Characteristics:

M series - adjustable pulse width

LP series - fixed pulse width

1.4.5. Optical Fiber attributes:

M: Near single mode, $M^2 < 1.4$

L: Low mode, $M^2 < 1.8$

H: High mode, $M^2 > 2.5$

1.4.6. Additional function:

R: Built-in pilot

Examples:

YDFLP-E-50-LP-L: Type E LP, using low mode type of optical fiber with nominal output power 50W.

YDFLP-200-M7-H-R: Customized M7, using high mode type of optical fiber with the nominal

output power 200W, built-in red pilot laser.

1.5 Technical Specifications

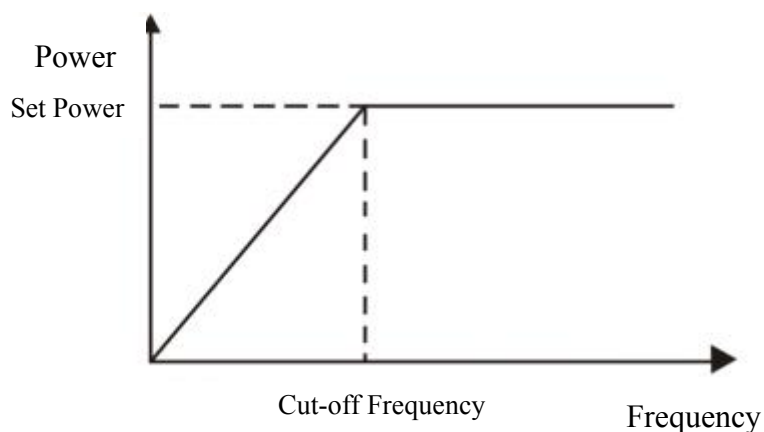
Table 4 Specifications of the M7 Series Pulsed Fiber Laser

Characteristic\ Laser Type		YDFLP-20-M8-S-R
M ² (Typical value)		1.4
Maximum Pulse Energy	mJ	1.1
Repetition Rate Range	kHz	1-4000
Full-Power Repetition Rate Range	kHz	23-4000
Pulse Width	ns	2-500
Output Power Instability	%	< 5
Cooling Method		Air-cooled
Power Supply Voltage (AC)	V	220
Power Consumption	W	< 120
Central Wavelength	nm	1064
Emission Bandwidth@3dB	nm	< 15
Polarization		Random
Anti-Reflection Protection		Yes
Built-in Red Beam		Yes
Output Beam Diameter	mm	7.0 ± 0.5
Output Power Tuning Range	%	0~100
Ambient Temperature Rang	°C	0~40
Storage Temperature Range	°C	-10~60
Dimensions	mm	272*105*76.2
Package Size	mm	460*260*140
Weight	Kg	Net: 2.7 Gross: 3.7

Table 5 M8 Series Fiber Laser Cut-off Frequency Value (kHz)

YDFLP-20-M8-S-R		
Pulse Width (ns)	Cut-off frequency (kHz)	Max. pulse frequency (kHz)
	YDFLP-20-M8-S-R	
1 (CW)	-	-
2	240	4000
4	160	4000
6	120	4000
9	85	4000
13	65	3000
20	50	3000
30	46	3000
45	42	2000
60	38	2000
80	36	2000
100	34	1000
150	24	1000
200	20	1000
250	18	900
350	18	600
500	18	500

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

**Figure 3 Cut-off Frequency & Output Power Relationship Charts**

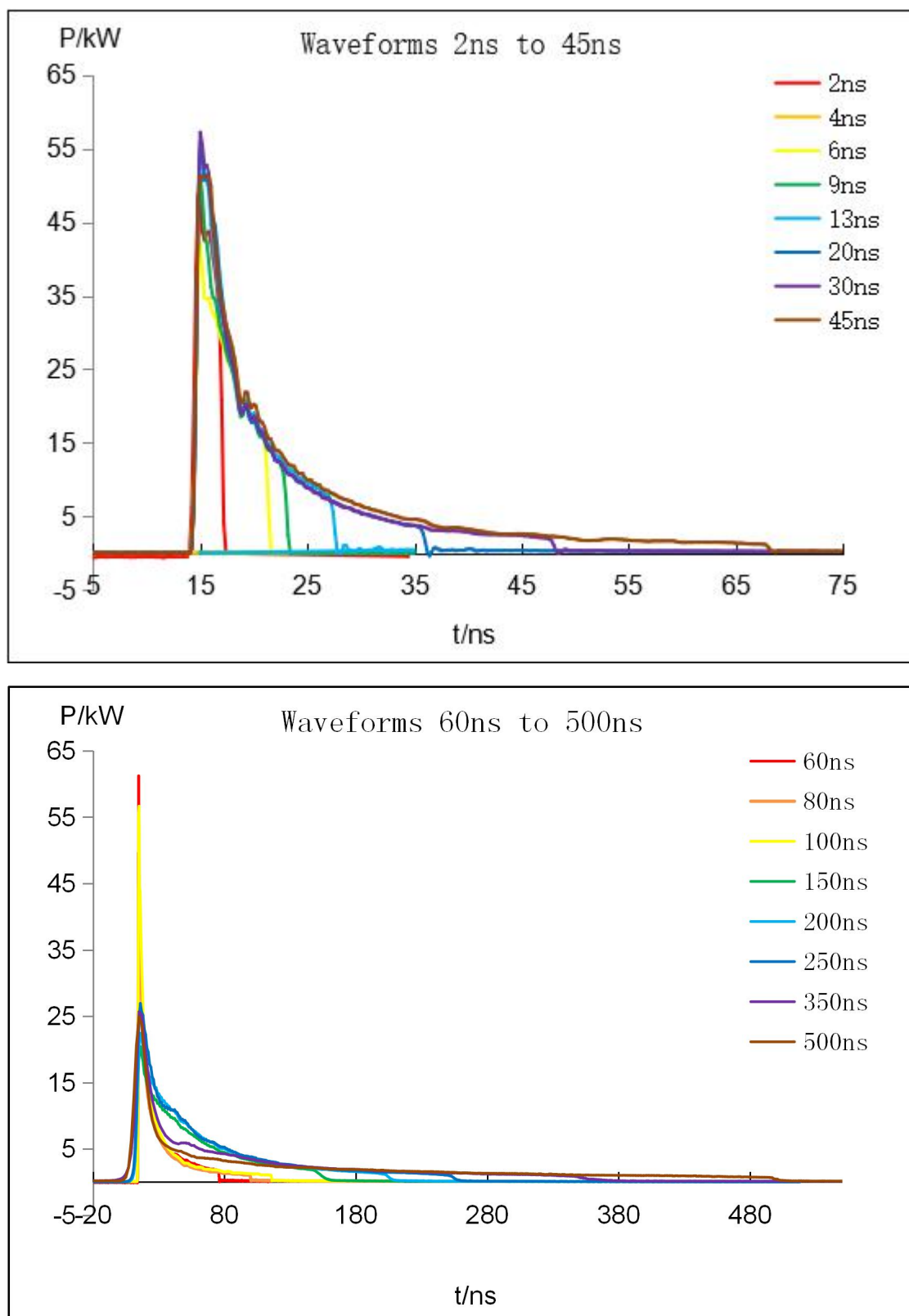
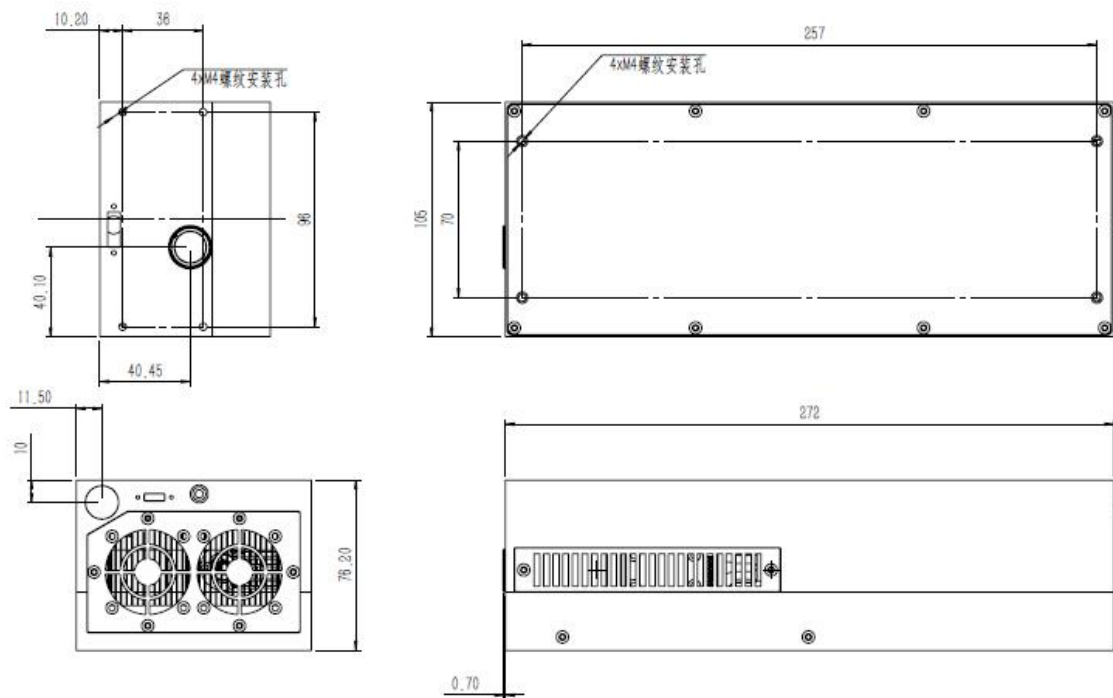


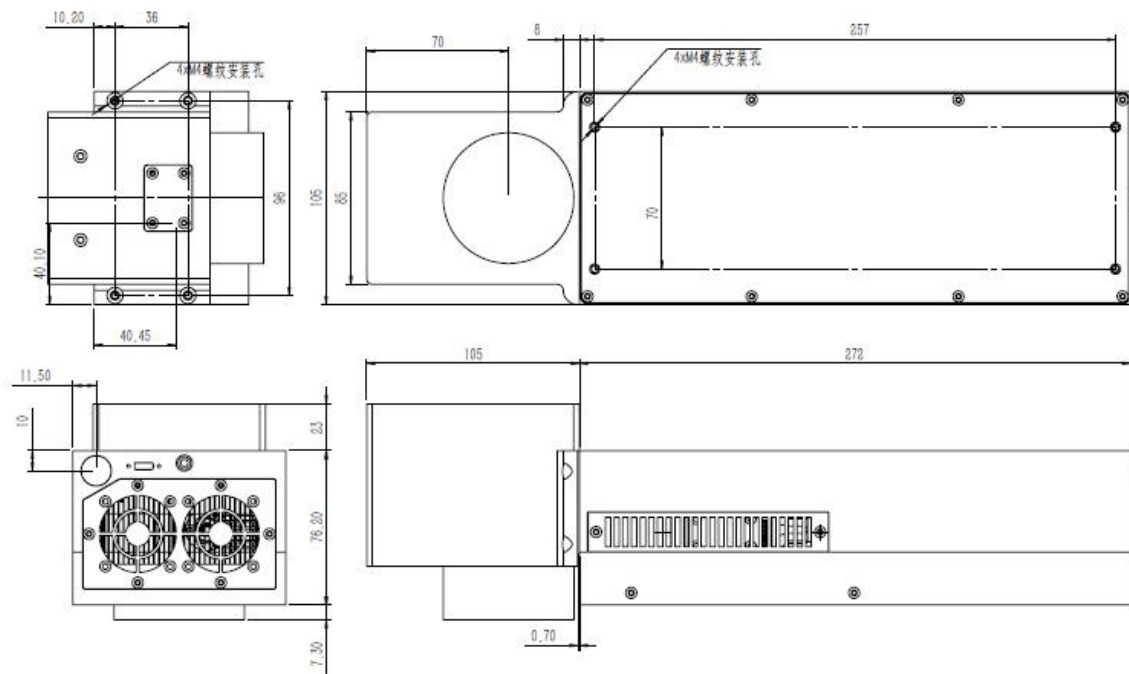
Figure 4 YDFLP-20-M8-S-R Output Waveform Graph

1.6 Installation Dimensions

YDFLP-20-M8-S-R Laser Dimension



Standard Version for Laser



Customized Version for laser + scanner

Figure 5 YDFLP-20-M8-S-R Laser Module Dimensions (Unit: mm)

2. Laser Interface

2.1 Interface Introduction

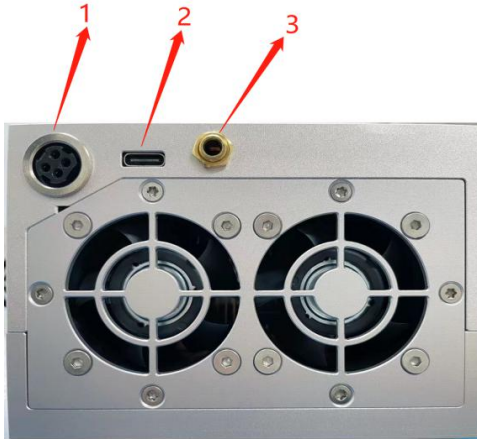


Table 6 Interface description

Item	Description
1	R7B power interface
2	USB Type-C control port
3	3.5mmAUX audio port

Figure 6 Laser Interface Introduction

2.2 Power Supply Cable and Interface Installation

The standard power adapter of the laser is GST160A24-R7B AC power adapter, which can be connected with a three-core input line. Please install it to the laser power interface according to the definition shown in Figure 7. Please pay attention to the polarity of the power line when installing.

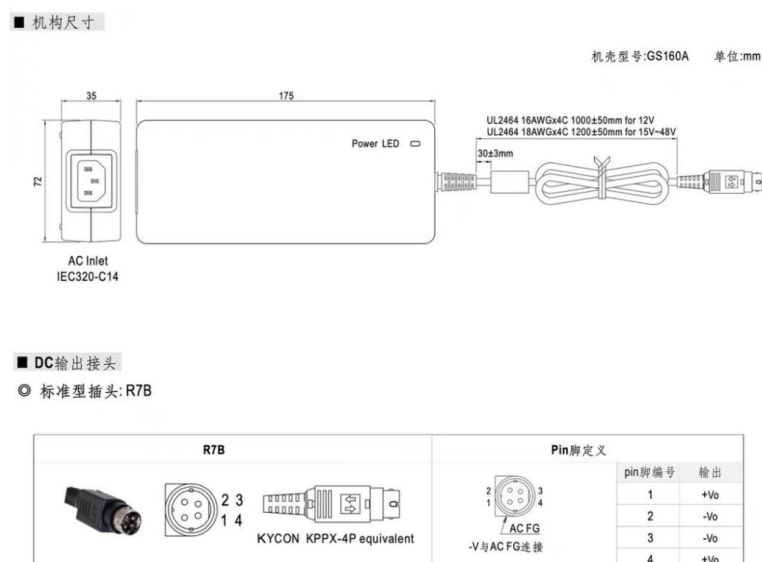


Figure 7 Schematic diagram of power supply adapter and interface

Adapter specifications:

INPUT (input): 100-240VAC, 50/60Hz, 2.0A

OUTPUT (output): 24V = 6.67A, 160W MAX

Note: If the user's control module has an independent power supply requirement, please contact JPT for customization.

2.3 3.5mmAUX Audio interface

The 3.5mmAUX audio interface of the laser can be used to connect to a computer or a red card. After the interface is connected, the user can use TypeE software, serial commands or a red card to monitor and control the laser. The pins of the control interface are defined as follows:



Figure 8 3.55mmAUX audio interface

Table 7 3.5mmAUX audio interface definition

Pin	Description
1	GND
2	RxD receive
3	TxD send

Note: If users need to use serial commands to control the laser, please refer to the "TypeE Serial Command Manual".

2.4 USB Type-C control interface

The Type-C control interface of the laser can be used to connect to a computer. After the interface is connected, the user can use the JCZ software (version: Ezcad2.14.11 (20191219)) to control the laser.

2.5 Galvo control interface

The galvanometer control interface of the laser is a 12-pin header, which is used to connect the galvanometer and the laser. The pins of the control interface are defined as follows:

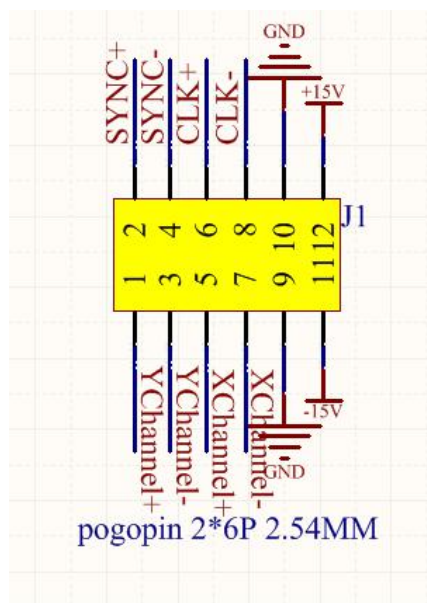


Figure 9 Definition of galvanometer control interface

2.6 DB25 Interface

The DB25 control interface of the laser is generally used to connect the marking control board. The pins of the control interface are defined as follows:

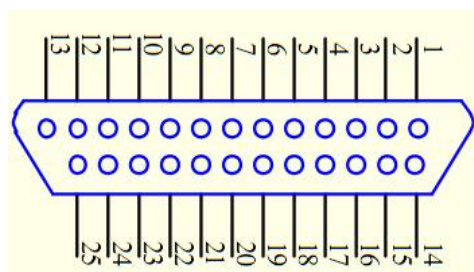


Figure 10 DB25 Interface

Table 8 DB25 Interface Definition

DB25 PIN#	Definition
1-8	IP0-IP7 Power Control
9	Latches power setting of the laser (effective during rising edge)
10-15	GND Description: PIN10-15 are connected to the ground inside the laser. Only one of the pins has to be connected to the GND on the control card.
16, 21	Alarming signal Description: '16 low level, 21 high level': Normal '16 low level, 21 low level': Temperature alarm
19	Emission Modulation input (PA) Description: High level = Emission ON Low level = Emission OFF PA signal is valid after starting 12 s and MO signal is high.
20	Frequency Modulation (TTL)
23	Emergency Stop signal Description: High level: Normal; Low level: Emergency Stop (this function can be selected in GUI). Emergency stop signal is from low to high level. By detecting the rising edge of MO firstly, the laser could be re-emitted.
22	Red beam ENABLE (Red Beam is preferred when Laser and Red Beam are mutually exclusive. * refer to note2) Description: Pulse width adjustment ENABLE (Please refer to the following pulse width control section for specific control mode). High Level: Red Beam On Low Level: Red Beam Off
18	MO signal for turn on/off Description: High level: ON Low level: OFF
17, 24, 25	No need to connect

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

Note 2: 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.

2.6.1 DB25 Control & Sequence

2.6.1.1 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 related to the frequency (see Figure 4). Please refer to the example in table 9 current setting:

Table 9 Current Setting (example)

	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%

2.6.1.2 DB25 Sequence

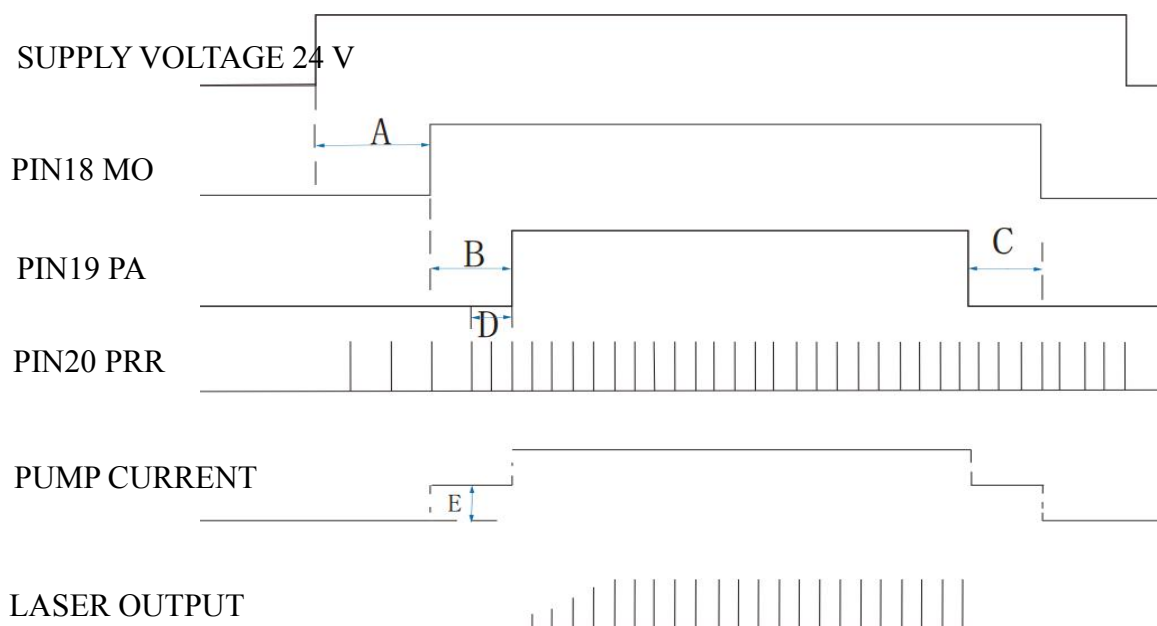


Figure 11 DB25 Control Time Sequence

➤ A: 12 seconds System initialization time

- B: MO and PA signal delay time: range (8ms-35ms), recommend 8 ms.
- C: Switching off PA should be earlier than MO or at the same time. Recommend 4 ms.
- D: Frequency sampling time under internal frequency mode, at least 1 complete frequency period before turning on the laser (PA). Recommend 8 ms.
- E: SIMMER value. The first pulse energy can be adjusted via GUI software.

Fiber laser control system self-locking: If fiber laser is on abnormal status (high temperature, low power supply etc.), it will stop working to protect the whole system. Please restart the fiber laser.

2.6.1.3 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. Table 10 shows the pulse width control pin and signal description of M7 laser.

Table 10 Pulse Width Control Pin and Signal Description of M7 Series Laser

PIN. #	Item	Description
2	Serial Input	When fiber laser is serial input, setting data bits synchronize with the rising edge of serial clock.
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:



- 0xA5 (A5h) is the active pulse width control byte. 0xA5 and all subsequent data bytes are input to Pin2 serial input.
- 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 Figure 14).
- All instruction design starts with byte 0xA5.
- Set Pin19 low before using pulse width control function.

● Pulse width control instruction code

Table 11 Pulse Width Control Instruction Code

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

It takes less than 50 ms to finish the fiber laser pulse width initialization.

Remarks: If Instruction code transmit 3 * 0x01 instruction, it will not be accepted by the laser.

● Pulse width time sequence

- 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 to 200ns.

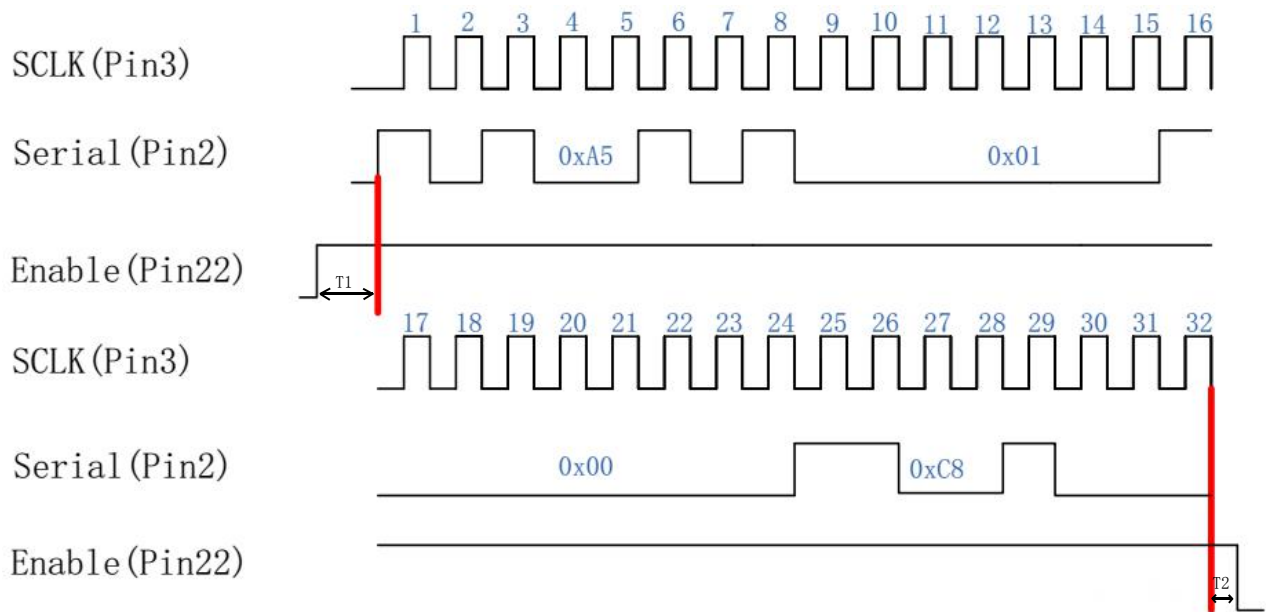


Figure 12 Diagram of 200ns Pulse Width Control Sequence

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

TypeE is designed for YDFLP M8 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. JPTLaserM8 also records error events which caused system self-locking.

3.1.1 Serial COM port

1) Connecting method

Using USB TO RS232 cable and RS232 50 3.5mmAUX Cable to connect PC's USB to the Laser's AUX connector.

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

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

Click the Serial Com Number as follow:

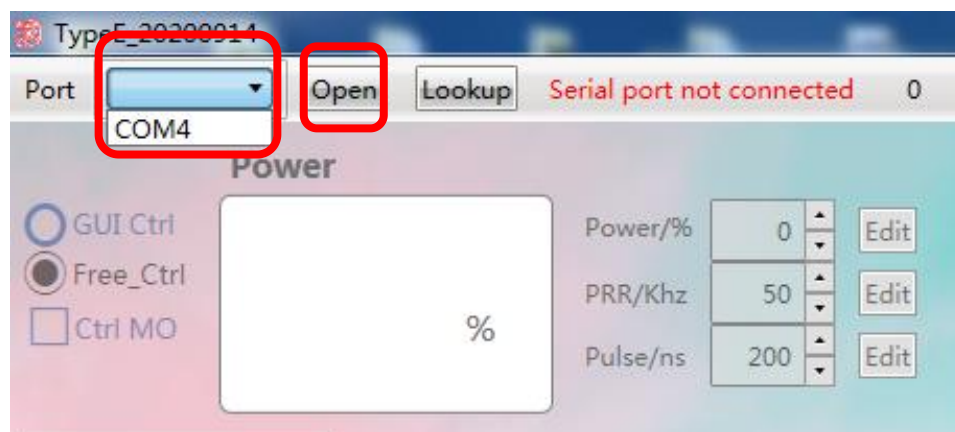


Figure 13 The selection of GUI Serial Port connection

2) Connecting state

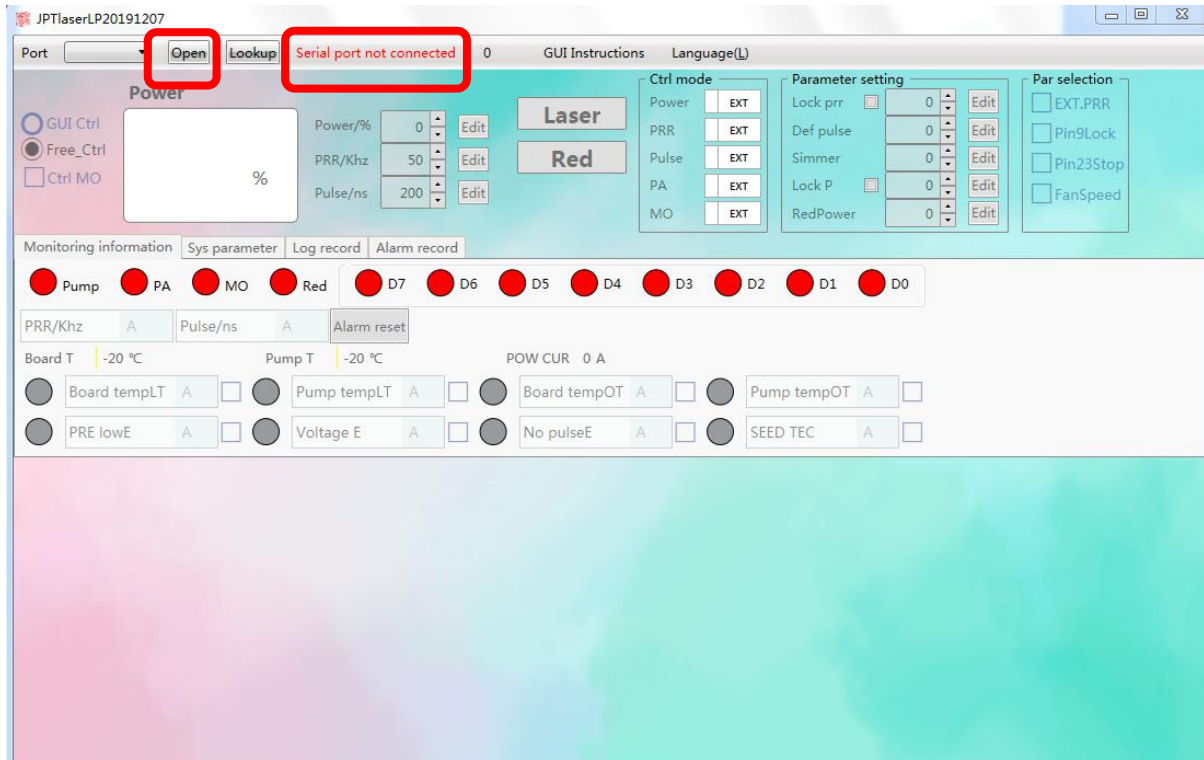


Figure 14 GUI disconnected state

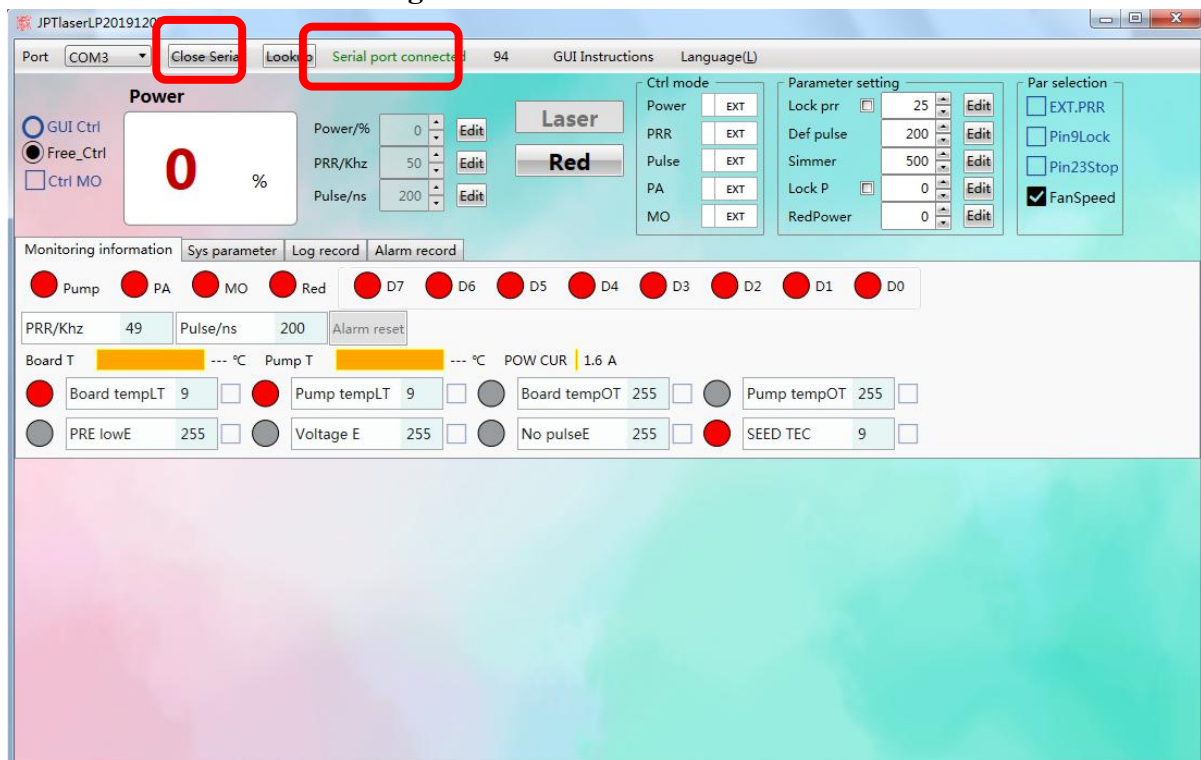


Figure 15 GUI connected state

3.1.2 GUI control function

1) GUI control the emission

- ① Choose the GUI control Mode

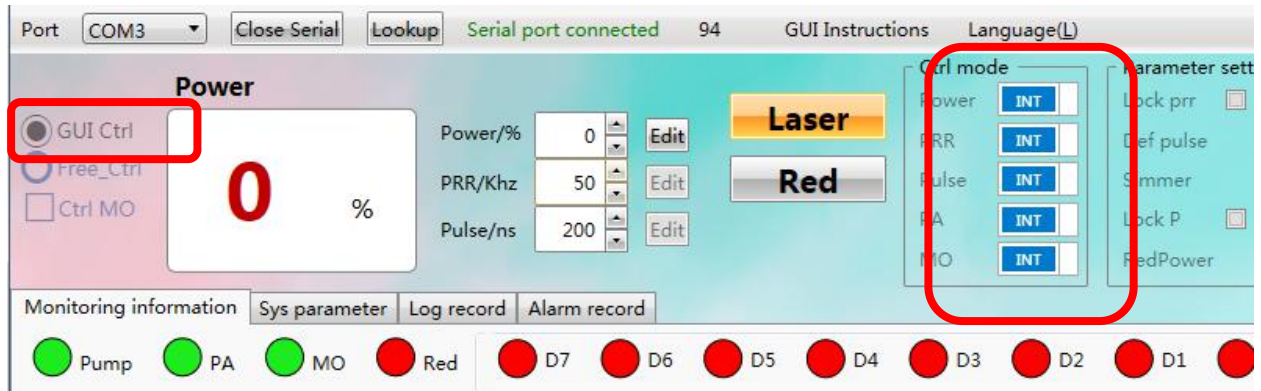


Figure 16 GUI Full Ctrl mode

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.

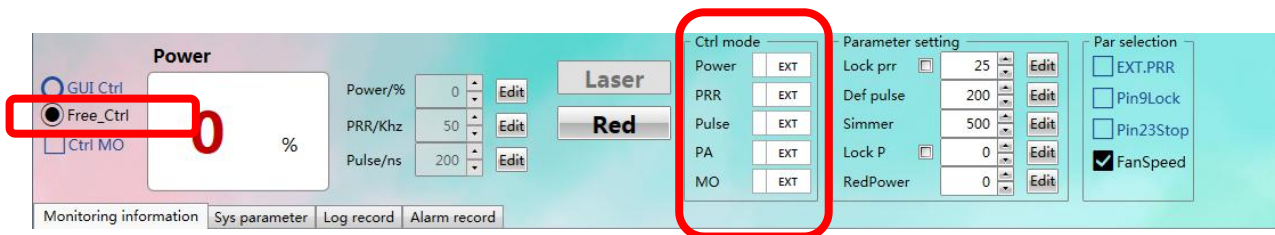


Figure 17 Free Ctrl mode

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

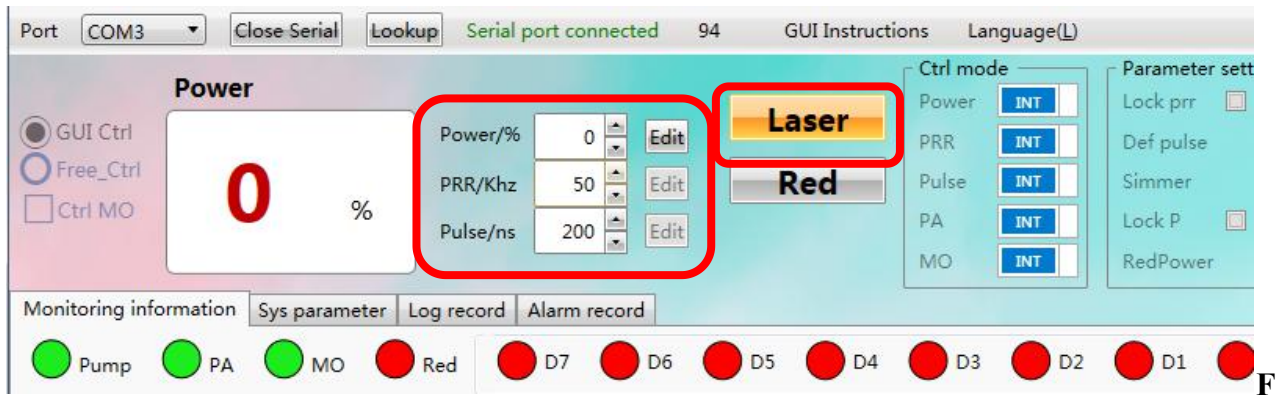


figure 18 Setting parameters and emitting

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

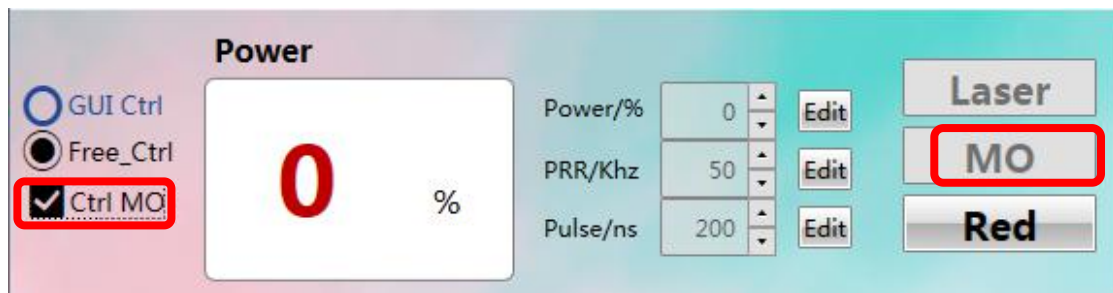


Figure 19 GUI control MO state

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

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.



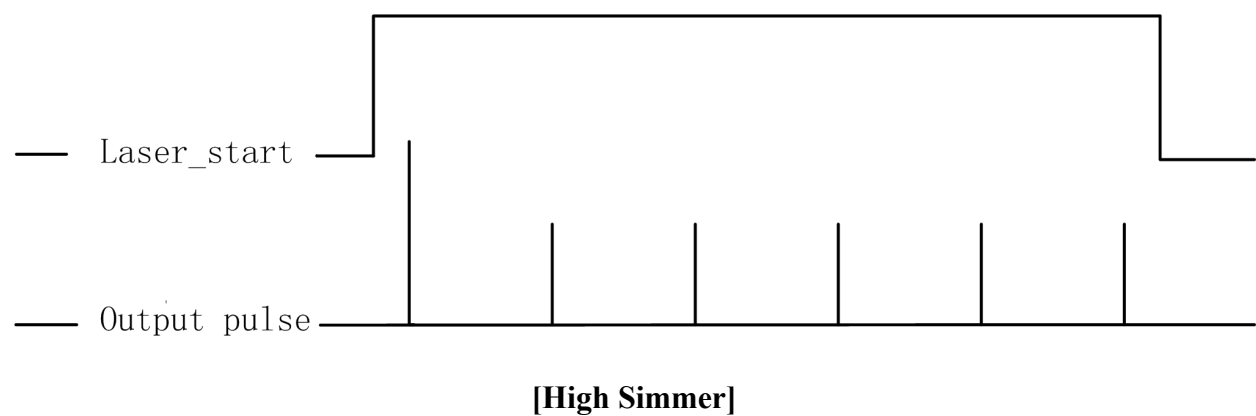
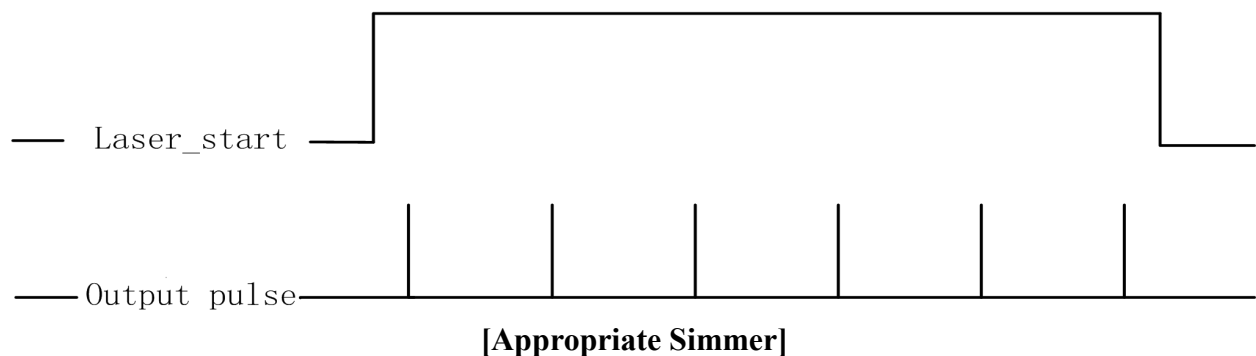
Figure20 Default parameter settings and selection

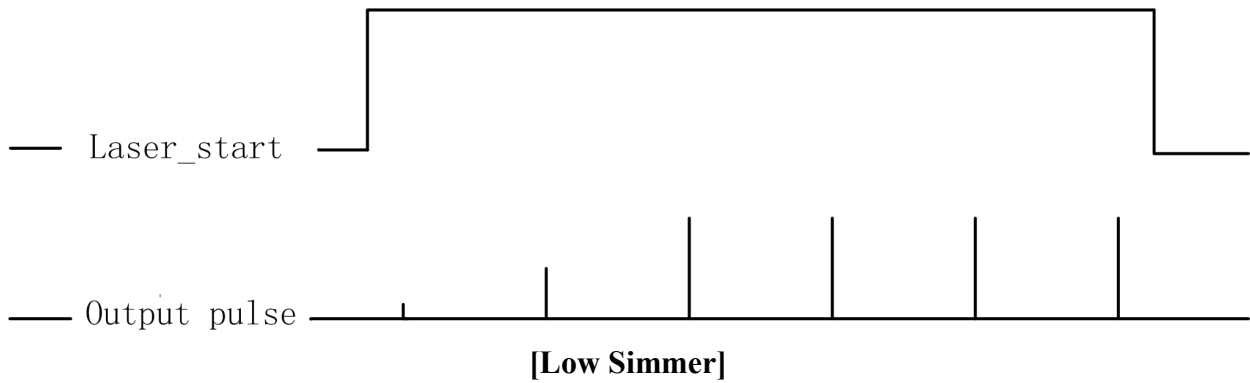
Lock PRR: Laser will lock to GUI setting frequency.

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:



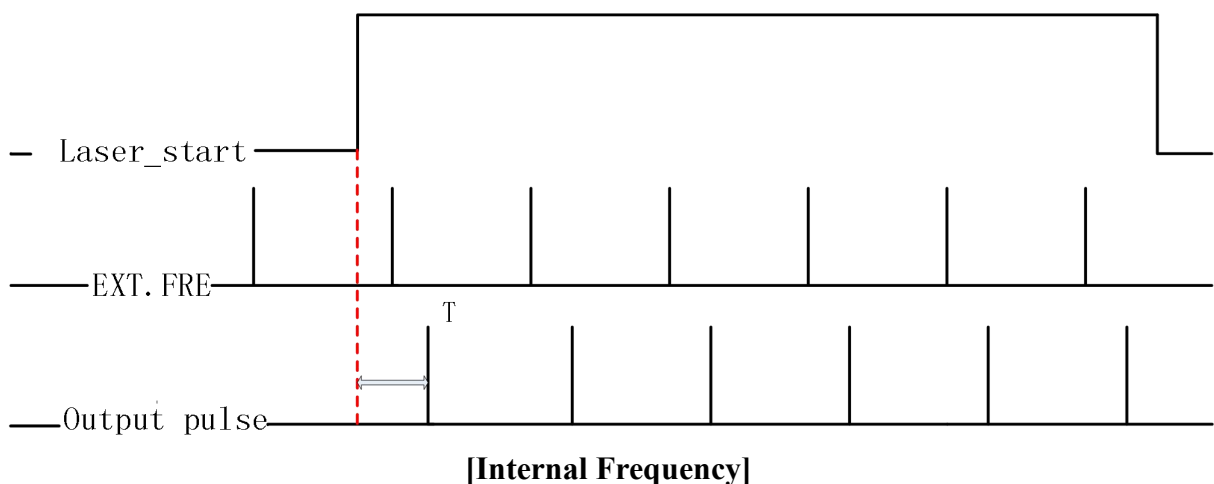
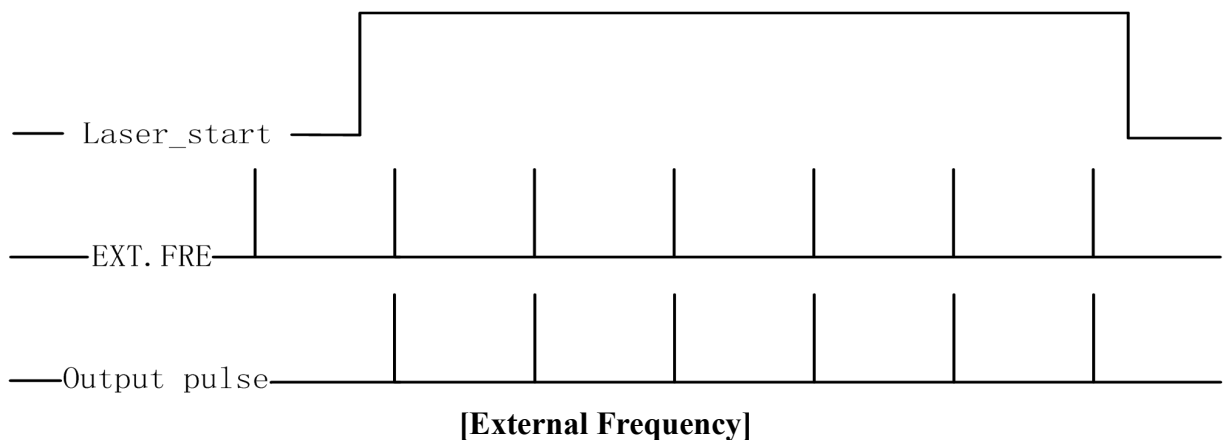


Lock power: Laser will lock to GUI setting power.

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:



*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.

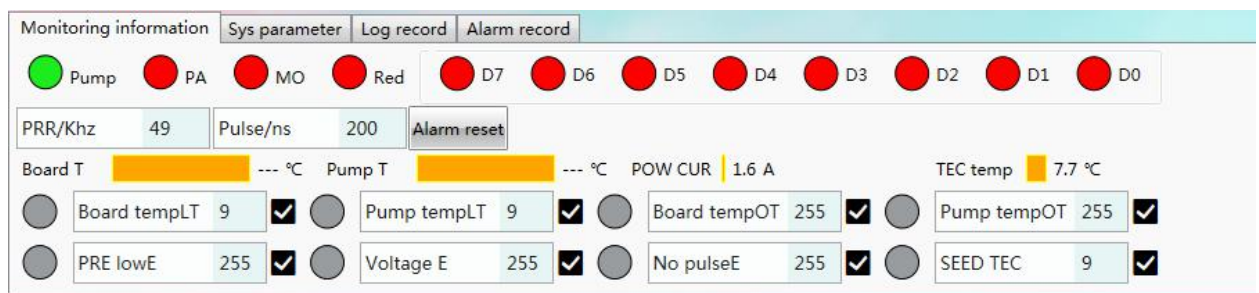


Figure 21 laser running status and alarm record

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 tempLT: Board temperature is lower than the set temperature.

Board tempOT: Board temperature is higher than the set temperature.

Pump tempLT: Pump temperature is lower than the set temperature.

Pump tempOT: Pump temperature is higher than the set temperature.

PRE lowE: Pre amplifier low current alarm.

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

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

Seed TEC: Seed source temperature is abnormal.

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