



Pulsed Fiber Laser

YDFLP-200-M7-M-R

USER MANUAL

Version 1.1



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.

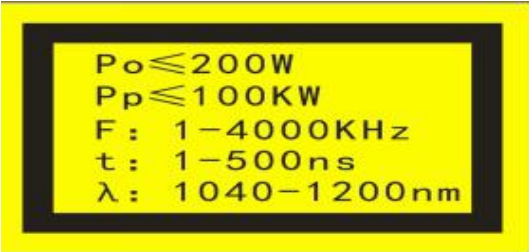
In order to ensure the safe operation and optimal performance of the product, please strictly follow the safety notification below.

- Make sure that the 48V 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 200 W and peak power over 8 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 3 W.



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)

Contents

Safety Information	I
1. Product Introduction.....	1
1.1 Product Description.....	1
1.2 Packing List.....	1
1.3 Operation Conditions and Safety Instructions.....	2
1.4 YDFLP Product Naming Convention.....	3
1.5 Technical Specifications.....	4
2. Installation.....	7
2.1. Laser Dimensions.....	7
2.2 Installation Methods.....	8
3. Laser Connector.....	8
3.1 Power Supply Interface.....	8
3.2 RS-232 Connector.....	9
3.3 Control Interface.....	9
3.4 Interface Setting.....	10
3.5 Pulse Width Control.....	12
4. JPT GUI Testing Software.....	14
4.1 GUI Installation.....	15
4.1.2 Serial COM Port.....	15
4.1.3 GUI Control Function.....	16
4.2 Laser Monitoring Function.....	20
5.Operation Procedure.....	21
5.1 Preparatory Examination.....	21
5.2 Operation Procedure.....	21
5.3 Precautions during Laser Operation.....	22

1. Product Introduction

1.1 Product Description

JPT M7-200W Series fiber laser control with standard DB25 interface and powered with 48V DC, which makes it a good compatibility. This series 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.

Photograph of typical M7 type fiber lasers is shown in Fig.2 (For the specific appearance, please refer to the actual product shipped):



Figure 2 YDFLP-200-M7-M-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
Testing Report	1
Power Cable	1
Dust Cap for Laser Isolator	1
Laser Usage Notes	1
Product 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) Make sure that the 48V DC power supply is connected in the correct way. Wrong connection or input voltage might damage the product.

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

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.

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

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.

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.

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

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-200-M7-M-R contains 15 wave-forms: CW, 9ns, 13ns, 20ns, 30ns, 45ns, 55ns, 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 – X – XX – XX – X – X					
	1	2	3	4	5	6
1. Product Name:	Ytterbium Doped Fiber Laser Pulse (YDFLP)					
2. Product type						
3. Average Output power						
4. Pulse Characteristics:	M series - adjustable pulse width LP series - fixed pulse width					
5. Optical Fiber attributes:	M: Near single mode, $M^2 < 1.4$ (200W, $M^2 < 1.6$) L: Low mode, $M^2 < 1.8$ H: High mode, $M^2 > 2.5$					
6. Additional function:	R: Built-in red pilot laser					

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-200-M7-M-R
M ²		<1.6
Delivery Cable Length	m	5
Average Output Power	W	>200
Maximum Pulse Energy	mJ	1.5
Pulse Repetition Rate Range	kHz	1-4000
Pulse Width	ns	2-500
Output Power Instability	%	<5
Cooling Method		Air-cooled
Power Supply Voltage (DC)	V	48V
Power Consumption	W	< 800
Power supply current requirement	A	> 16
Central Wavelength	nm	1064
Emission Bandwidth@3dB	nm	< 20
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	430*351*133
Package Size	mm	800*550*180
Weight	Kg	Net: 24.8

Table5 M7 Series Fiber Laser Cut-off Frequency Value (kHz)

YDFLP-200-M7-M-R		
Pulse Width (ns)	Cut-off frequency (kHz)	Max frequency (kHz)
	200-M7-M	
1 (CW)	-	-
2	4000 (>45W)	4000
4	4000 (>75W)	4000
6	4000 (>100W)	4000
9	4000	4000
13	2600	3000
20	1700	3000
30	1100	3000
45	950	2000
55	750	2000
60	650	2000
80	550	2000
100	480	1000
150	300	1000
200	240	1000
250	210	900
350	150	600
500	130	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:

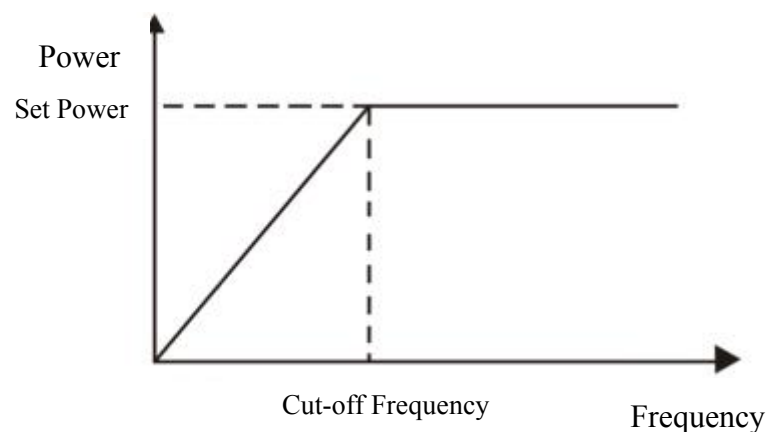


Figure3 Cut-off Frequency & Output Power Relationship Charts

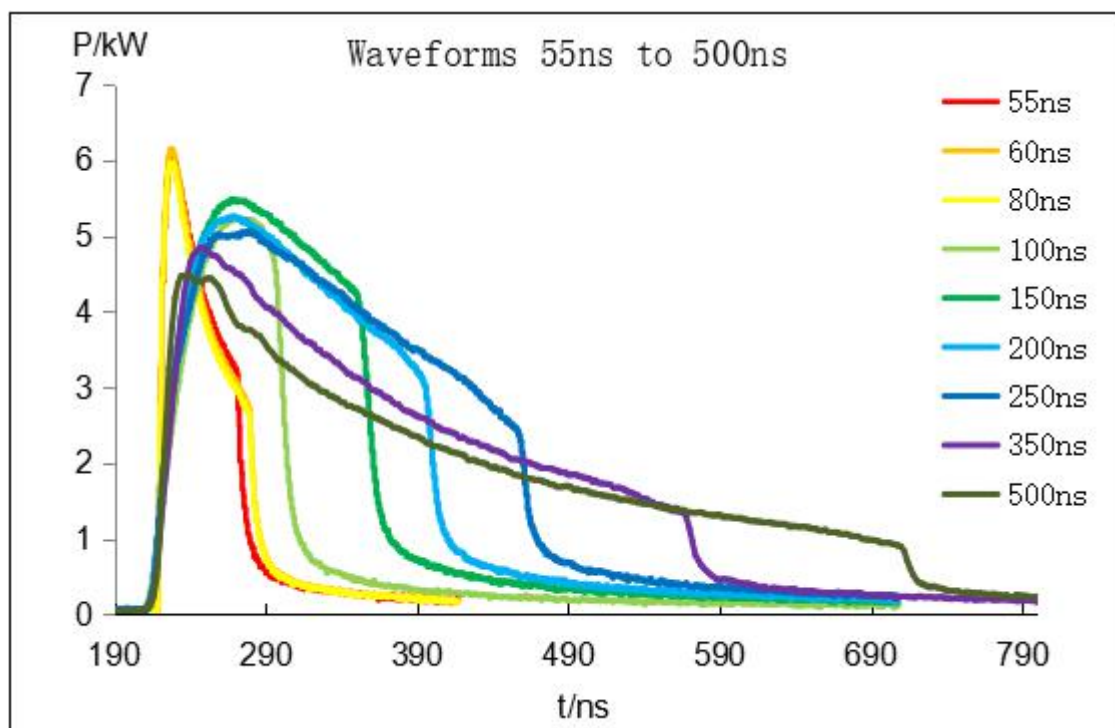
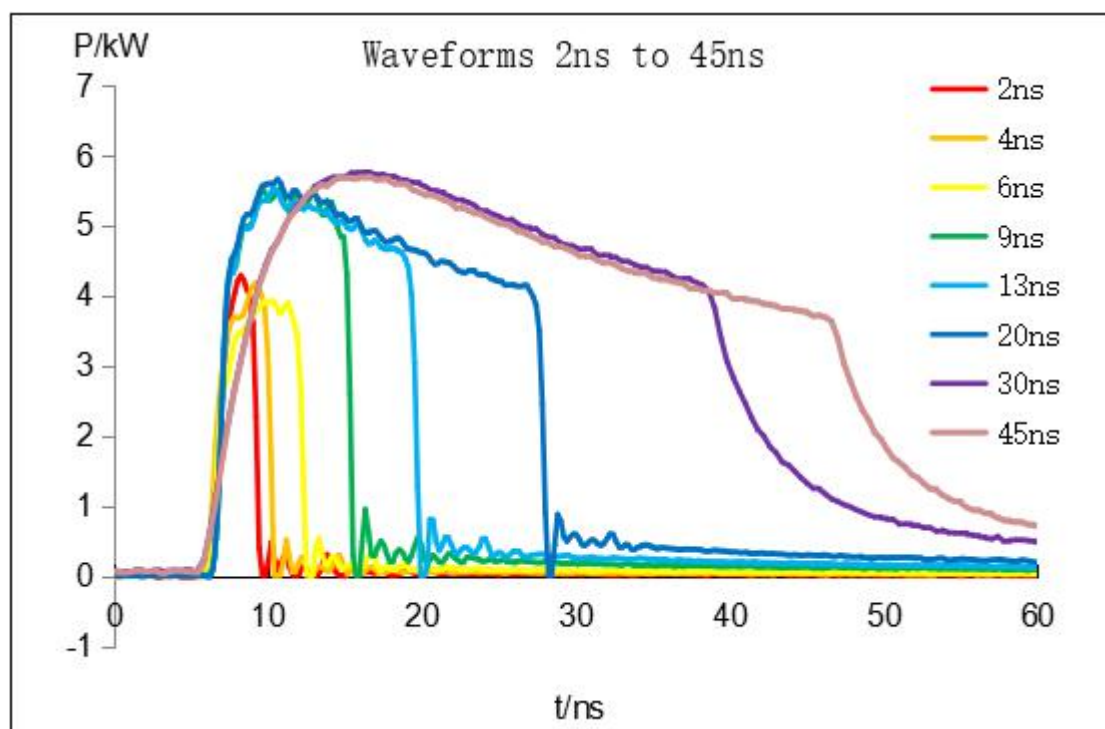


Figure4 YDFLP-200-M7-M-R Output Waveform Graph

2. Installation

2.1. Laser Dimensions

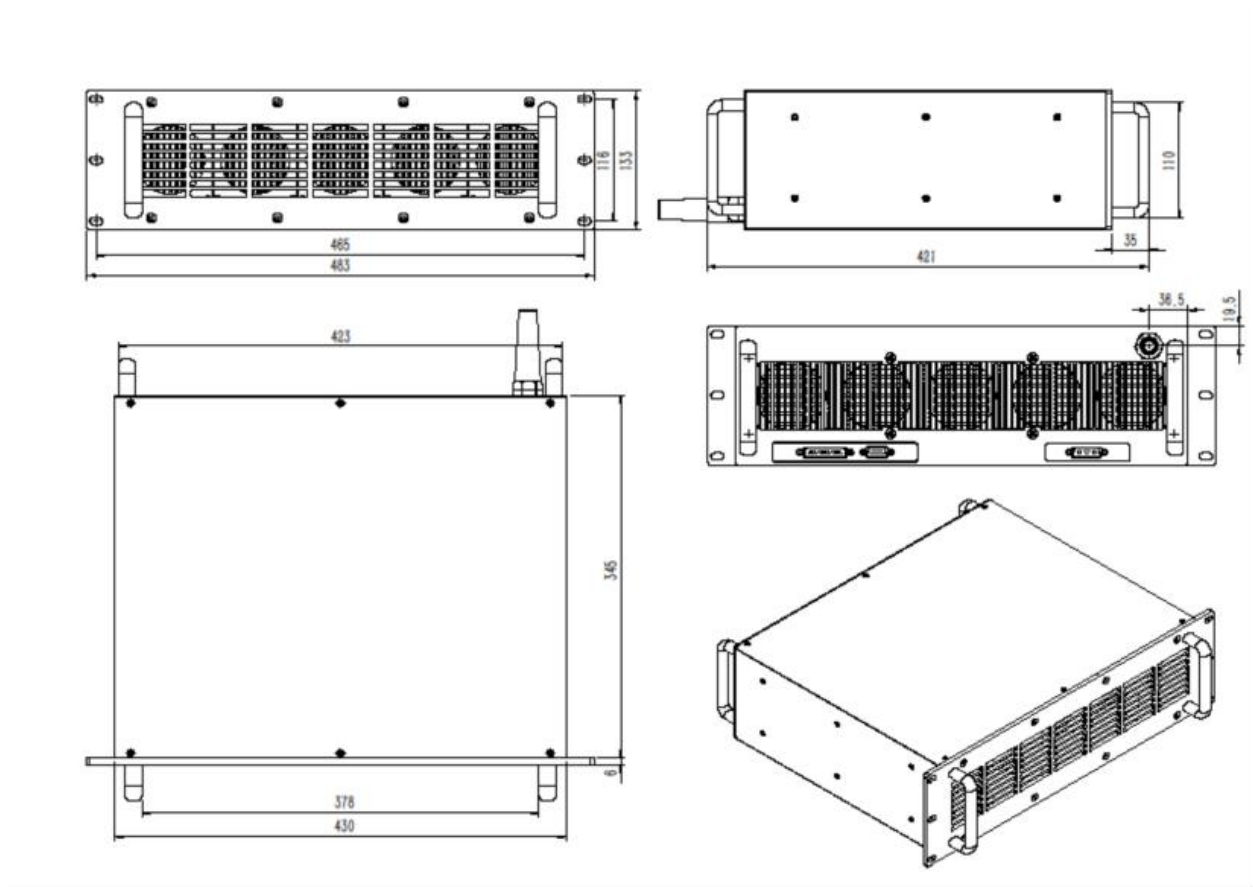


Figure 5 YDFLP-200-M7-M-R Laser Module Dimensions (Unit: mm)

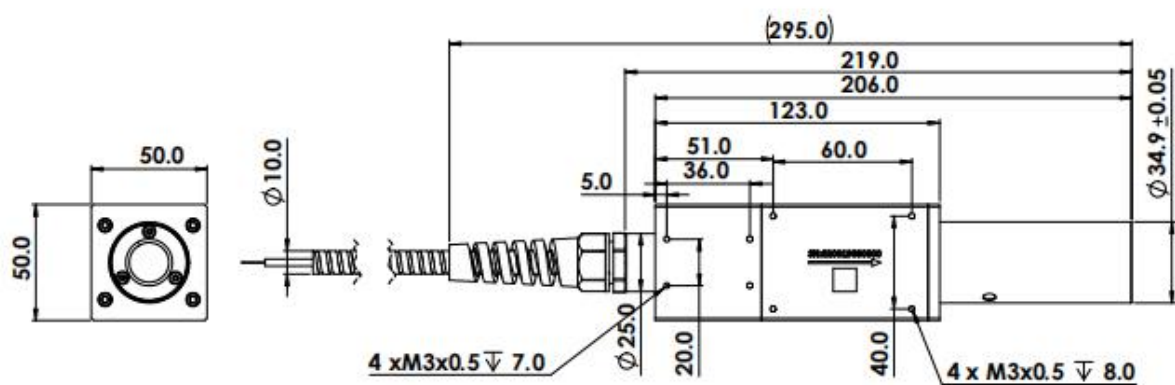


Figure 6 YDFLP-200-M7-M-R Dimension of the Output Isolator (Unit:mm)

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

2.2 Installation Methods

1) Fix the laser module onto the mounting panel, make sure enough air gap around the laser module for sufficient air flow.

2) To connect the power supply cable to the 48 V DC power supply, and make sure that the DC power supply can provide enough output power. Please note the polarity of the cable. Power supply cable “+” is DC positive and “-” is DC negative and GND is ground wire. Below figure8 is shown 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.

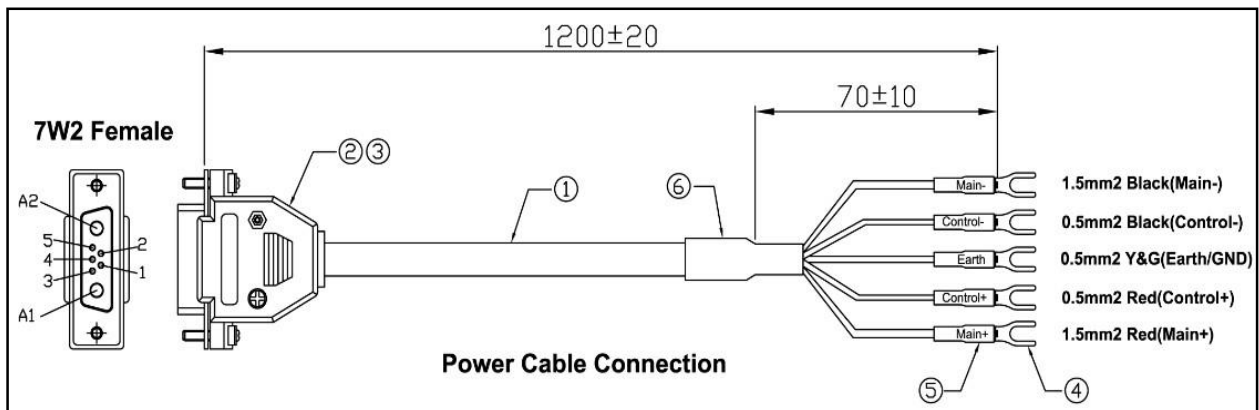


Figure 7 Diagram of the Power Supply Cable

3. Laser Connector

3.1 Power Supply Interface

The power connector is DB-7W2 type (Male), and the pins are as follow Table 6:

Table 6

PIN#	Description
A1	+48VDC, power supply for optical module (Main+)
A2	48VDC negative (Main1&Control-)
1,3,4	No need to connect
2	+48VDC, control Circuit Power supply, Max current 0.2A
5	Connect to ground

PIN_A1 and PIN_2 in Table 6 connect to “48VDC+”, PIN_A2 connect to “48VDC-”, PIN_5 connect to “GND”. If need power separately, please separate the PIN_A1 and PIN_2.

3.2 RS-232 Connector

RS-232 connector is available for connecting PC or the Red Control card. Customer can monitor and control laser by GUI software, serial commands or red card after connected.

Pins definition is shown in below Figure8 & Table 7:

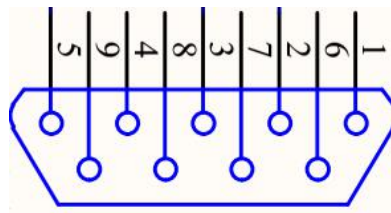


Figure 8 RS232 Connector DB9

Table 7 RS-232 Interface Definition

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

3.3 Control Interface

DB25 is the interface usually used to connect the marking control system. The Pins are defined as shown in Figure 9 and Table 8.

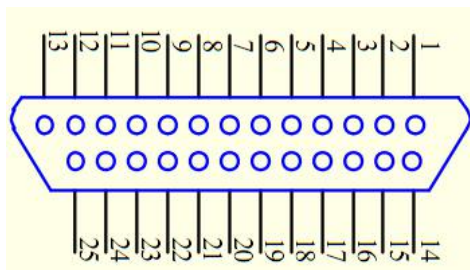


Figure 9 DB25 Connector

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 have connected to the ground inside the fiber laser, only need to connect control card GND with one of the 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	Red beam ENABLE (Red Beam is preferred when Laser and Red Beam are mutually exclusive. * refer to note2) 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 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: 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.

3.4 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 9:

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%

The following is DB25 Control Time Sequence:

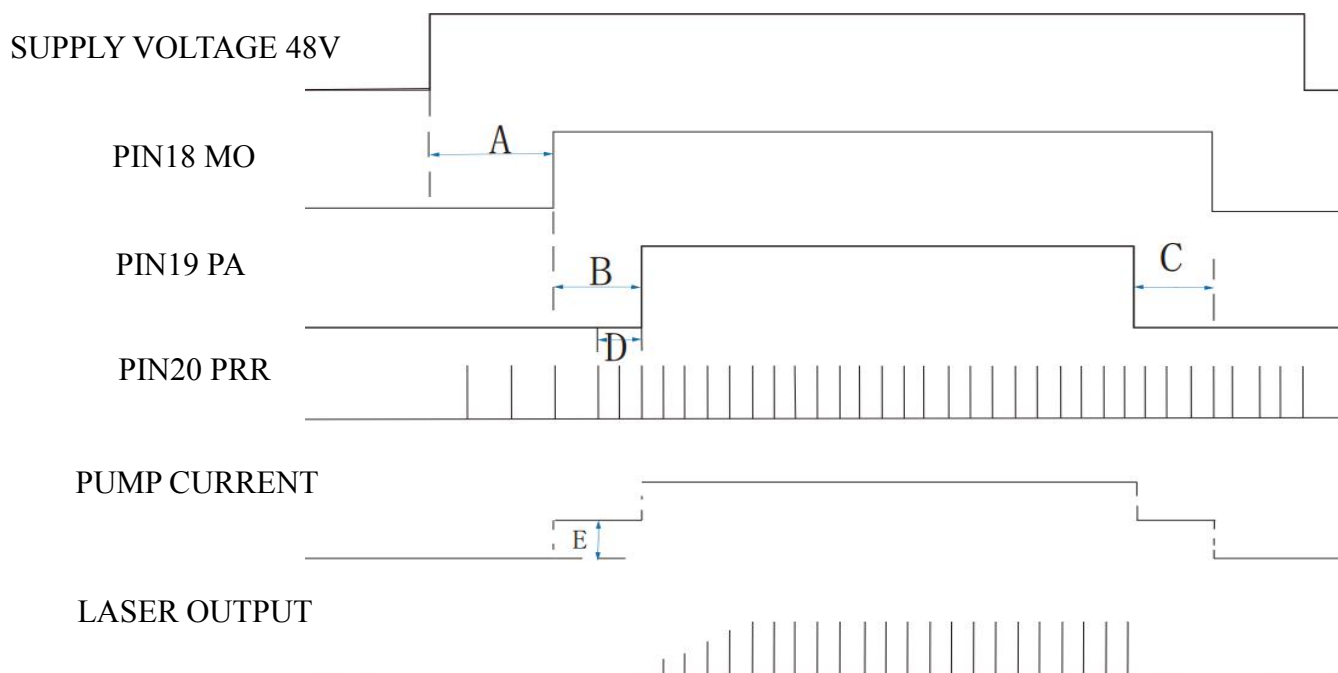


Figure 10 Diagram of DB25 Control Time Sequence

- A: 12 seconds System initialization time
- B: MO and PA signal delay time: range(8ms-35ms), recommend 8ms.
- C: Switching off PA should be earlier than MO or at the 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 GUI software.

Note: After the laser provided 48 v voltage, please wait 12s to do the follow-up operation.

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.

3.5 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 Structure

- 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 $\geq 10\mu\text{s}$ 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 50ns 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.

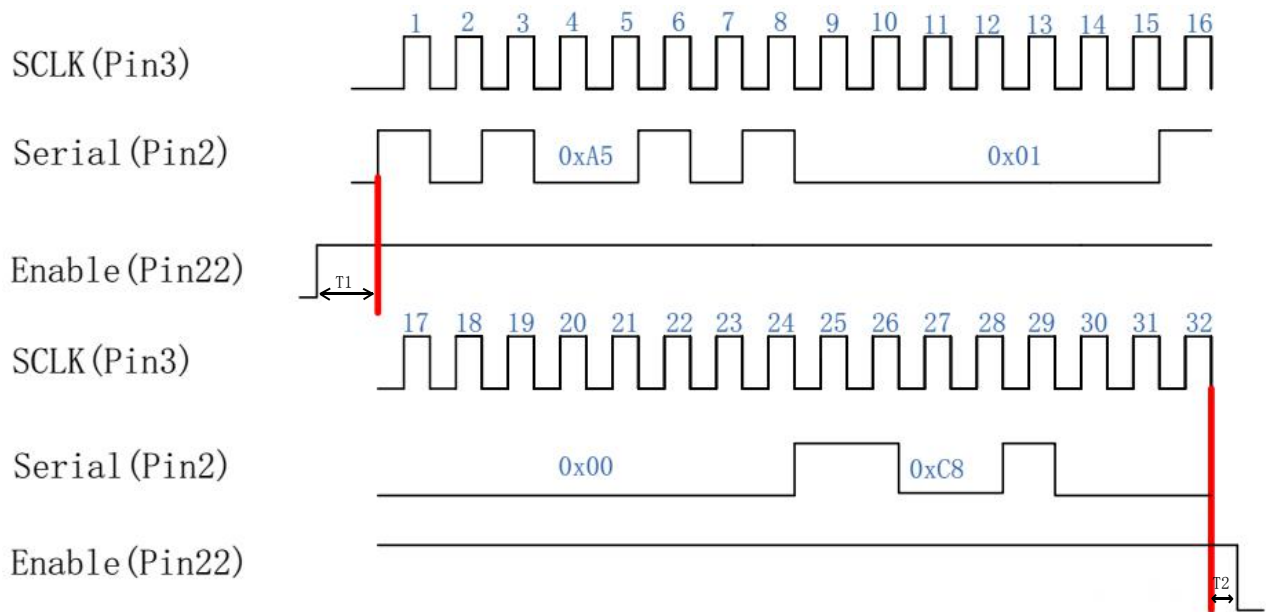


Figure 11 Diagram of 200ns Pulse Width Control Sequence

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.

4. JPT GUI Testing Software

JPT LaserM7 is designed for M7 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. JPT LaserM7 also records error events which caused system self-locking.

4.1 GUI Installation



Figure 12 Installation Package and Driver

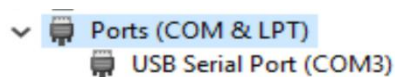
Installation steps: decompress installation package → install driver → install software library → open JPTLaserM7-GUI software

4.1.2 Serial COM Port

4.1.2.1 Connecting Method

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

After connecting the data line, check the serial port number: my computer → properties → hardware → device manager →



If the Serial Port Number is bigger than 4, revise the COM number to ≤ 4 .

Click and open the Serial Com Number as follow:

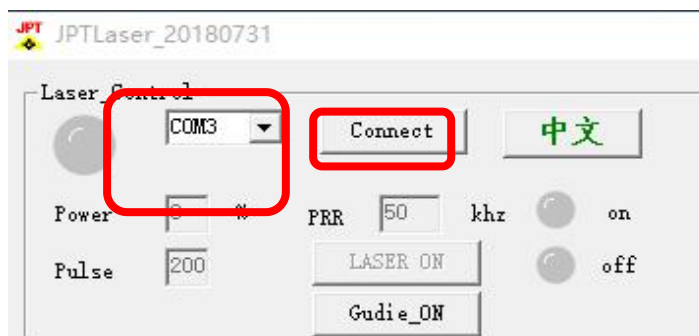


Figure 13 The Selection of GUI Serial Port Connection

4.1.2.2. Connecting State

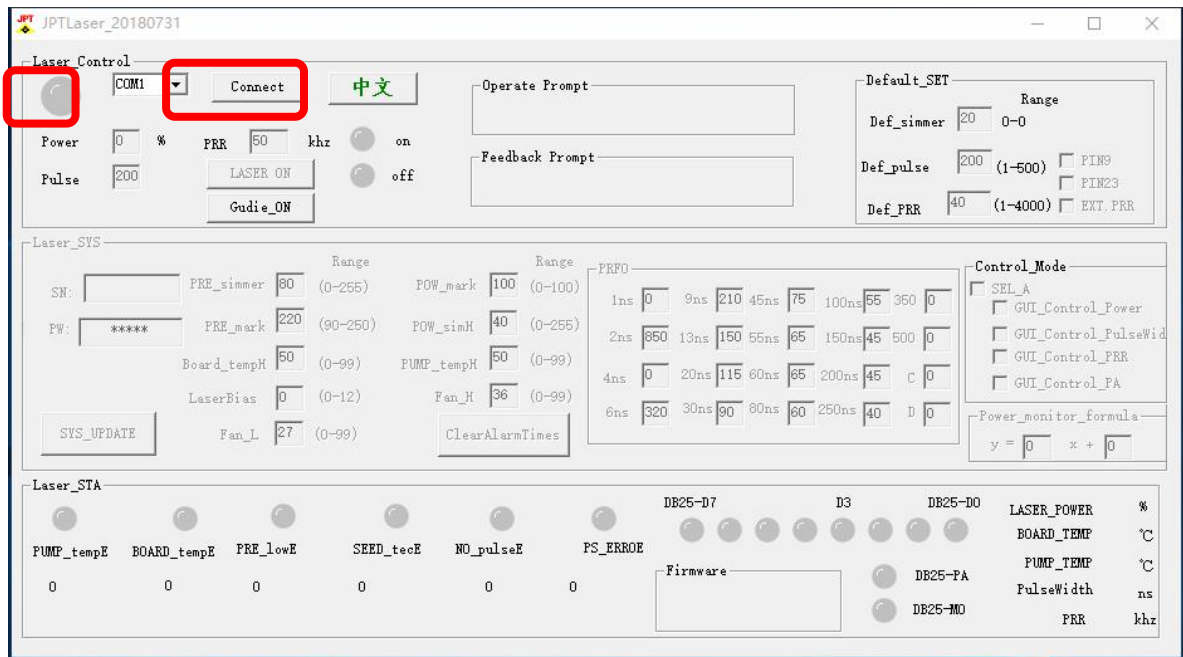


Figure 14 GUI Disconnected State

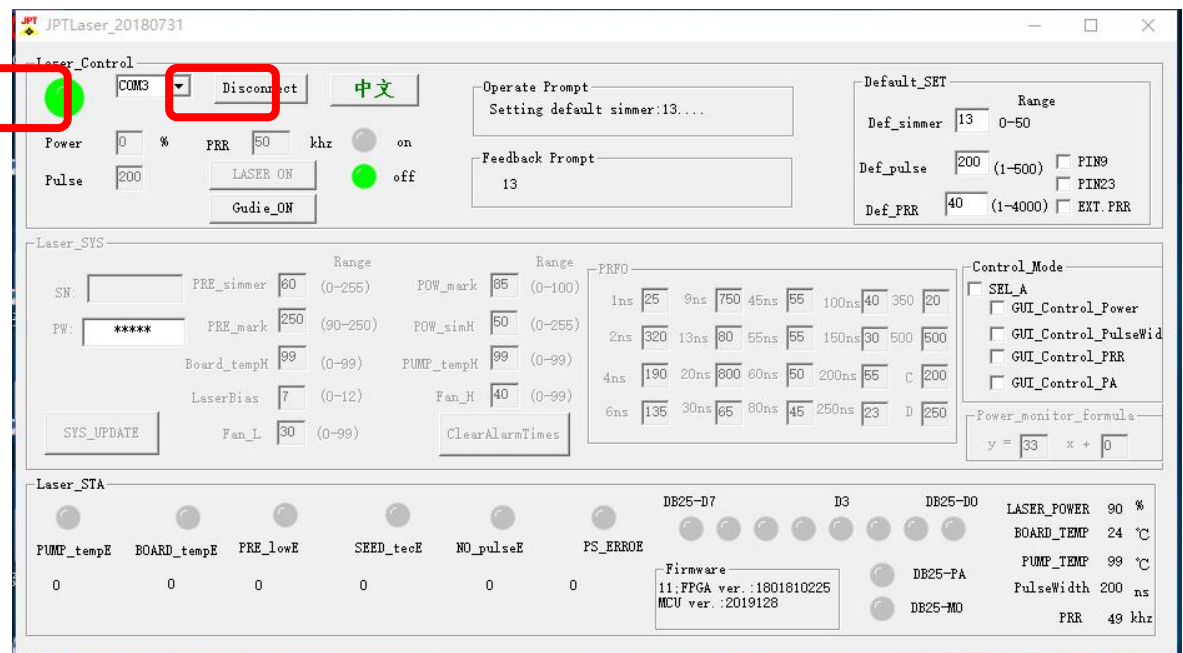


Figure 15 GUI Connected State

4.1.3 GUI Control Function

4.1.3.1 GUI Control the Emission

- Choose the GUI control Mode

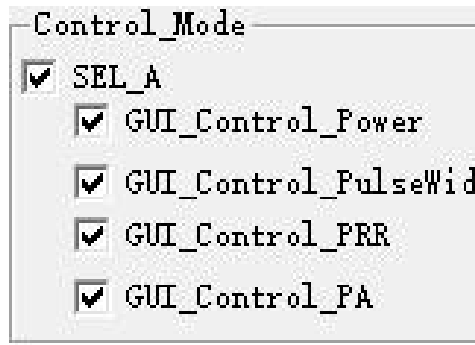


Figure 16 The Selection of GUI Control Mode

Control mode: different control modes can be selected for laser power, pulse width, frequency and switch optical signal. If it is selected, it represents GUI internal control mode. If it is not selected, it represents external control state (DB25 control). Default factory settings are no selection.

Note: the control mode option has the function of power-off saving. If it is used for troubleshooting, please restore the selected mode.

- Set parameters and emitting

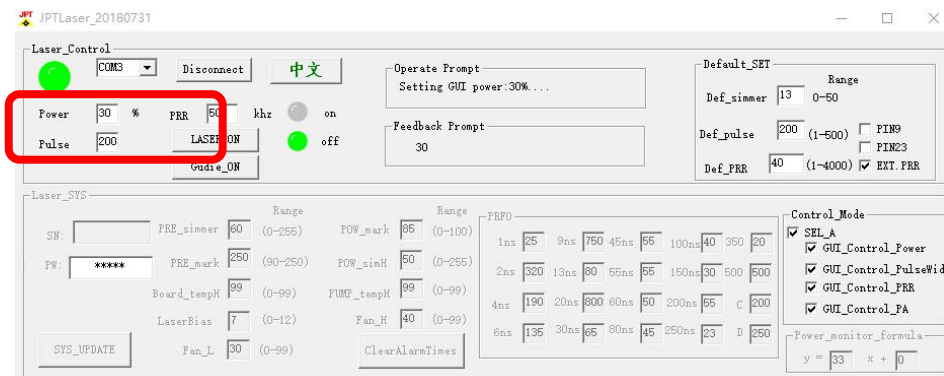


Figure 17 Setting Parameters And Emitting

After selecting control mode, user can set power, frequency, pulse width in the "parameter setting" column at the upper left corner, and then click the "laser" button to switch on/off emission.

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

4.1.3.2 Default Parameter Setting and Selection

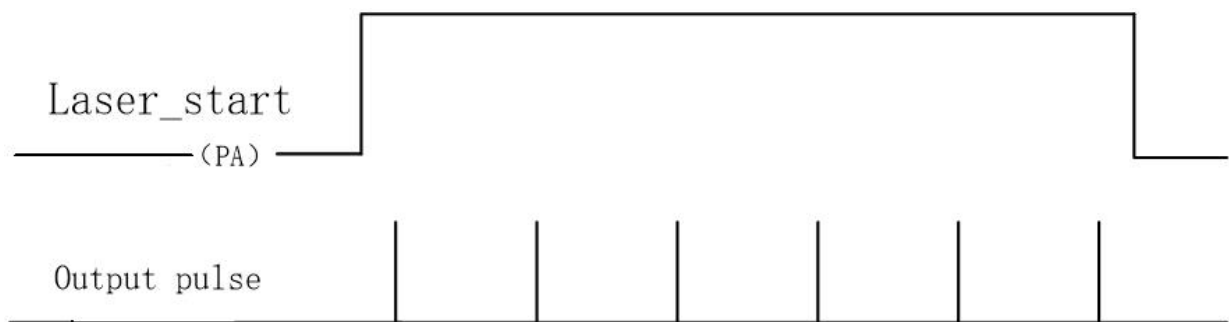
JPTLaserM7 software can modify the laser's default parameter setting and selection in the "default setting" option. The parameter setting is effective immediately, and it has the power-off saving function.

Default_SET			
Def_simmer	13	Range	0-50
Def_pulse	200	(1-500)	☐ PIN9
			☐ PIN23
Def_PRR	40	(1-4000)	☒ EXT. PRR

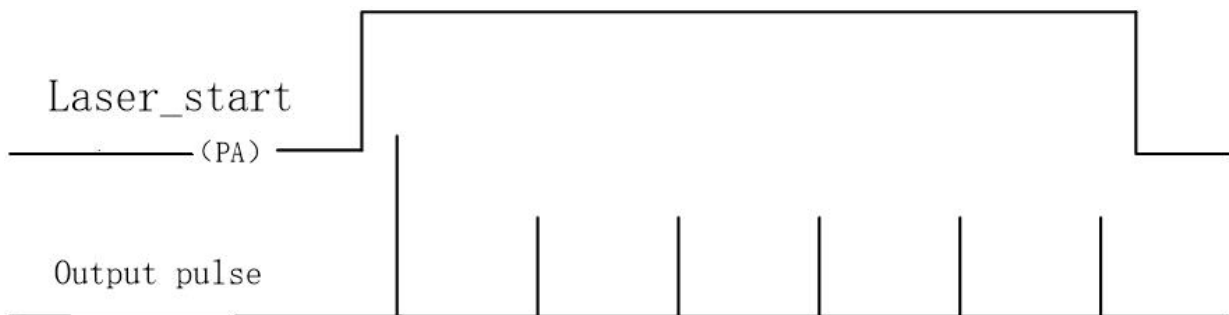
Figure 18 Default Parameter Settings and Selection

Default Simmer: Controlling the first pulse energy. Higher value means higher first pulse energy.

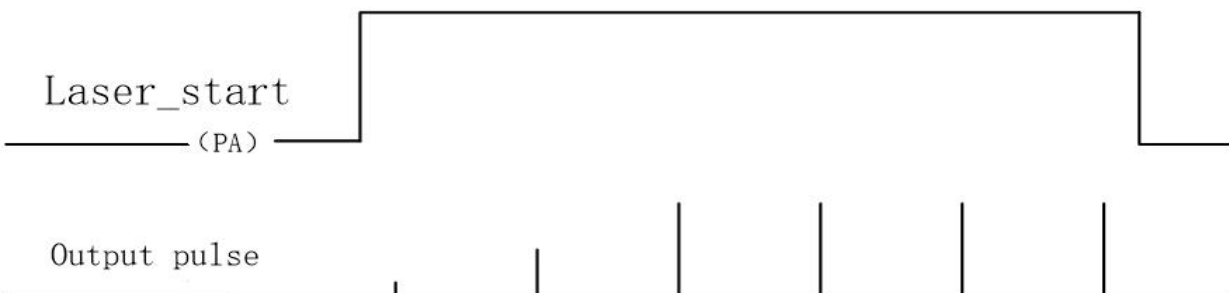
Simmer setting examples:



[Appropriate Simmer]



[High Simmer]



[Low Simmer]

Default pulse width: If the external control fails to provide the pulse width signal, the laser will work according to the default pulse width window setting value.

Default frequency: If the external control fails to provide frequency signal, the laser will work according to the default frequency window setting value.

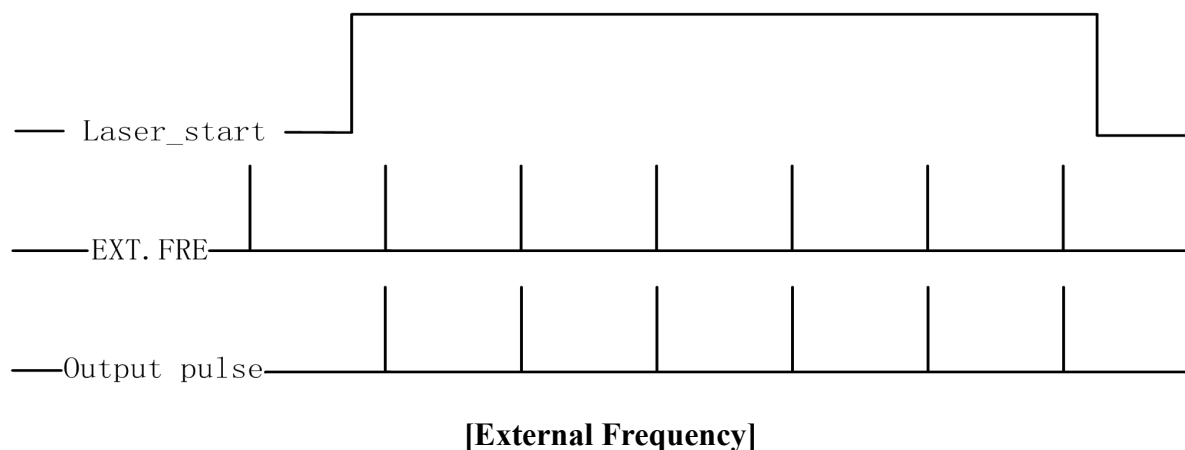
Pin9Lock: Power latch function is enabled if selected, the value of Pin1 to Pin8 is latched during the rising edge. Default setting is not selected.

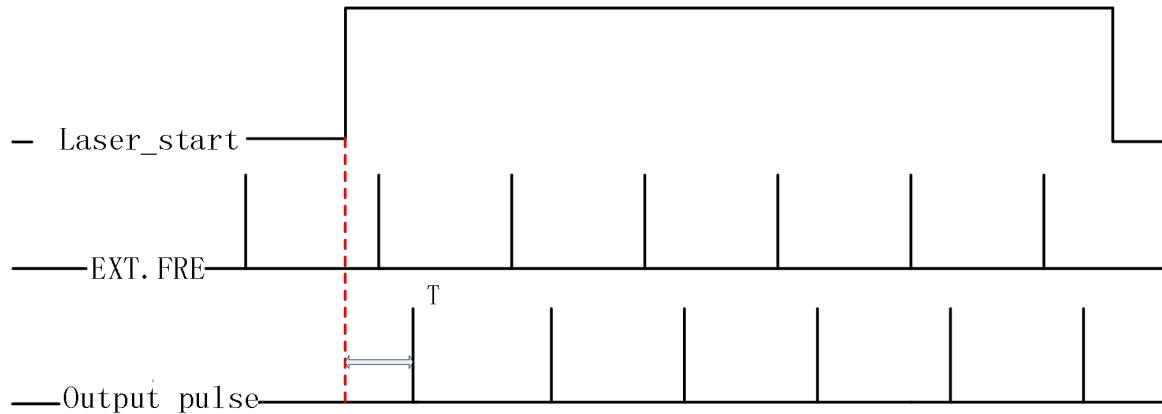
Pin23Stop : Emergency stop function is enabled if selected. Low level is effective. Default setting is not selected.

External frequency: When selecting external frequency mode, the laser output pulse will be synchronized with external frequency signal. If the control card has optimized the external frequency signal, this mode can be used.

When this option is not selected, 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:





[Internal Frequency]

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

4.2 Laser Monitoring Function

The monitoring function of JPTLaserM7 software can observe some operation parameters and alarm conditions. The laser will send the number of alarms saved in the system to the GUI software each time when it is turned on.

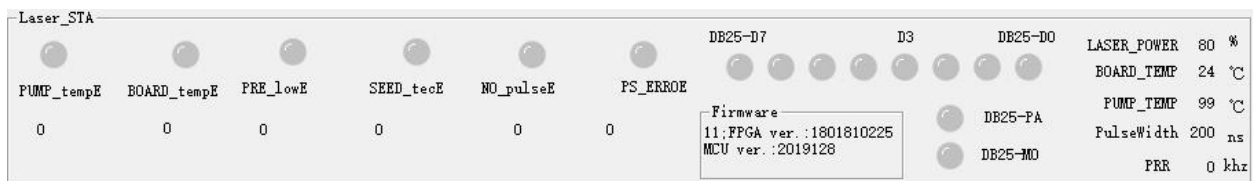


Figure 19 Laser Running Status Monitoring

Status Monitoring

Optical circuit temperature alarm: alarm when the optical circuit temperature exceeds the set temperature range.

Circuit temperature alarm: alarm when the circuit temperature exceeds the set temperature range.

Low primary current: abnormal alarm for low primary current.

Seed TEC: alarm when seed source temperature is abnormal.

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

Voltage error: alarm when supplying voltage is too low or too high.

DB25-D7-D0: monitor the current power signal of the laser, corresponding to the 8-bit binary mode. D0 is the lowest bit, D7 is the highest bit, and the green light is the status of the received signal of this bit.

DB25-PA: monitor whether the laser currently receives the PA signal, and the green light is the status of the received signal.

DB25-MO: monitor whether the laser currently receives MO signal, and the green light is the status of received signal.

Laser power: the power percentage of the pump source current conversion (it can be used to refer to whether the output of the circuit is normal, not the output optical power value).

Circuit temperature: monitors the current laser circuit module temperature.

Optical path temperature: monitor the temperature of the optical path module of the current laser.

Pulse width: monitor the working pulse width parameter of the current laser.

Frequency: monitor the current laser operating frequency parameter.

5.Operation Procedure

5.1 Preparatory Examination

- 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.

5.2 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 1 minute 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.

5.3 Precautions during Laser Operation

- Wear laser safety goggle;
- Please stop the laser processing before turning off the fiber laser.

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