

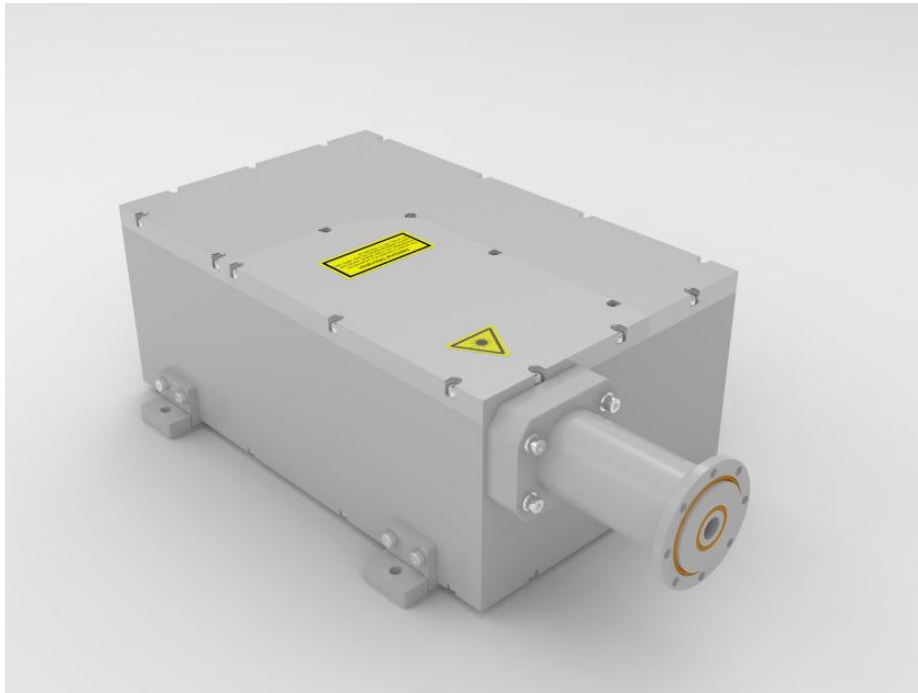


Shenzhen JPT Opto-electronics

Seal-355-10S (New version)

Solid-state laser source

User manual



Security information

Please read this manual carefully before using this product.

In this user manual, important product safety operation specifications, as well as other reference information are provided. In order to ensure your personal safety during the operation of this product and to achieve the best performance of the product, please follow the following cautions and warnings and other relevant operating specifications in this manual.

- Do not disassemble the equipment without permission. All maintenance and repair can only be carried out within the company. The upgrade can be carried out by technical support personnel on site. If the equipment is disassembled without permission, the damage will not be covered by the warranty.
- The output wavelength of the laser is 355nm (invisible light), with an average output power of more than 10W, categorized as Class IV laser. It not only does great harm to the eyes, but also burns the skin. The reflected and scattered light of the device may cause harm to the human body. So please wear laser safety glasses throughout the using process.
- It is forbidden to place inflammable and explosive articles on laser path and low ignition point substances such as black paper, cloth and leather.
- User can run the laser only when all the external conditions (eg. Electricity, cooling water) and protections are normal.
- Pay close attention to not exposing eye and any body part under laser during operation.
- Intense laser beam might be reflected when it hit metallic processed parts and measures must be taken to block them out, or adopt working platform equipped with Class IV protective capability during using process.
- Constantly check ground protection, button and other safety precautions of laser during

the using process.

- Immediately power off if any abnormal condition occurs.
- **Caution:** Even when the indicator light is set, there will be a weak output of the ultraviolet indicator light at the laser output port.

Laser safety label

Label figure	Label information
 当心激光 Caution, laser	Laser label (placed on the top cover of laser module near the output port).
	Caution! If you do not follow the “Warning” correctly, it may lead to physical injury to you or others. Do not use beyond the scope of “Security Notice”, unless you fully understand the product and use it in the specified environment.
	Danger! The product should be integrated into terminal equipment. Required 12V power supply, 220V of input supported switching power supply. Please beware of high voltage risk and electric shock!
	Caution! To prevent accidental exposure to laser or reflected laser, protective glasses with specific wavelength should be worn during using, maintaining and repairing the laser.

 注意高温	Danger! Laser have enough energy to burn the skin. And in a certain, the laser can ignite the volatile substances, which may cause explosion. It is forbidden to place inflammable and explosive dangerous goods in the laser processing area, and use volatile substances carefully.
	Caution! Visible or invisible light emitted by laser can cause serious damage to eyes and skin and may cause blindness. Reflected, scattered and diffuse light are also dangerous. Please note: wavelength beyond 400-700nm is invisible to human eye, so in fact, laser may exist but they are invisible to human eye.
<u>Component for Incorporation</u> 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 IEC/EN60825-1 and 21 CFR1040.10	Warnings (placed on the top cover of the laser module).
CAUTION-CLASS 4 INVISIBLE LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	Safety Warning.



Laser safety goggles

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1. Product Introduction and Technical Parameter

1.1 Introduction

UV laser is able to directly break the chemical bond of atomic group in connection substances compared with infrared and other visible waves. It is known as the “cold” process, separate substances directly into atoms instead of producing heat to peripheral area, and it has less environmental damage. UV laser has advantages of short wavelength, easy focusing, intense energy, high resolution. Because of its high processing accuracy, narrow line width, high quality and precision, small heat-affected area, good long-term stability, it is able to process various irregular patterns and heterogeneous patterns. UV laser is widely used in fine micro-processing, especially in high-quality drilling, cutting and grooving. It has been successfully applied in metals, semiconductors, ceramics, glass and a variety of polymer materials.

High-power UV series in Seal family including 10W UV, emitted laser with excellent beam quality ($M^2 < 1.2$) and perfect beam characteristics (Beam Circularity greater than 90%). The complete machine adopted one piece structural design, optical circuit, external drive circuit integrated as one which greatly enhances the anti-interference. The laser is effective dust-proof with upgraded complete sealed structure. Meanwhile, completely isolated external water molecules makes the laser possess remarkable damp-proof feature so that it is more adaptable to tough industrial environment. Besides, introducing intracavity self-cleaning system greatly expand the lifetime. As upgrade version of DPSSLP-UV-10, Seal-355-10S has very short pulse width ($< 15 \text{ ns}@60 \text{ kHz}$) under medium-high repetition frequency, and excellent pulse stability ($< 3\% \text{ RMS}@80 \text{ kHz}$). Use efficiency greatly improve due to the expansion of repetition frequency range.

1.2 Technical Parameter

Table 1. Parameters for Seal-355-10S

Parameter List	
Laser Type	10W UV laser, All-in-one
Model Number	Seal-355-10S
Wavelength	355nm
Average Output Power	>10 W@60 kHz
Pulse Duration	<15 ns@60 kHz
Frequency Range ^[1]	40 kHz - 300 kHz
Spatial Mode	TEM ₀₀
Beam Quality (M ²)	M ² ≤1.2
Beam Roundness	> 90%
Beam Full Divergence Angle	≤ 2 mrad ^[2]
Beam Diameter (1/e ²)	0.8±0.1 mm ^[3]
Beam Expander Inside	10X ^[4]
Polarization Ratio	>100:1
Polarization Orientation	Horizontal
Average Power Stability	RMS≤3%@24hr
Pulse-to-Pulse Stability	RMS≤3%@80 kHz
Operating Temp.&RH	0℃~40℃; <80%
Storage Temp.&RH	-15℃~50℃; <90%
Cooling Mode	Water-cooling
Cooling Capacity Requirement	500 W
Electricity Requirement	DC 36V
Average Power Consumption	< 250 W
Three-Dimensional Size	302mm*180mm*114mm (L* W* H) ^[5]
Weight	≈ 9.26 kg

[1] The output pulse is much stable in this frequency range.

[2] Refers to the laser output directly from the window, without beam expander

[3] The measured position is at the laser output window.

[4] Standard is 10 x expander, 6x expander could be customized.

[5] Dimension without expander.

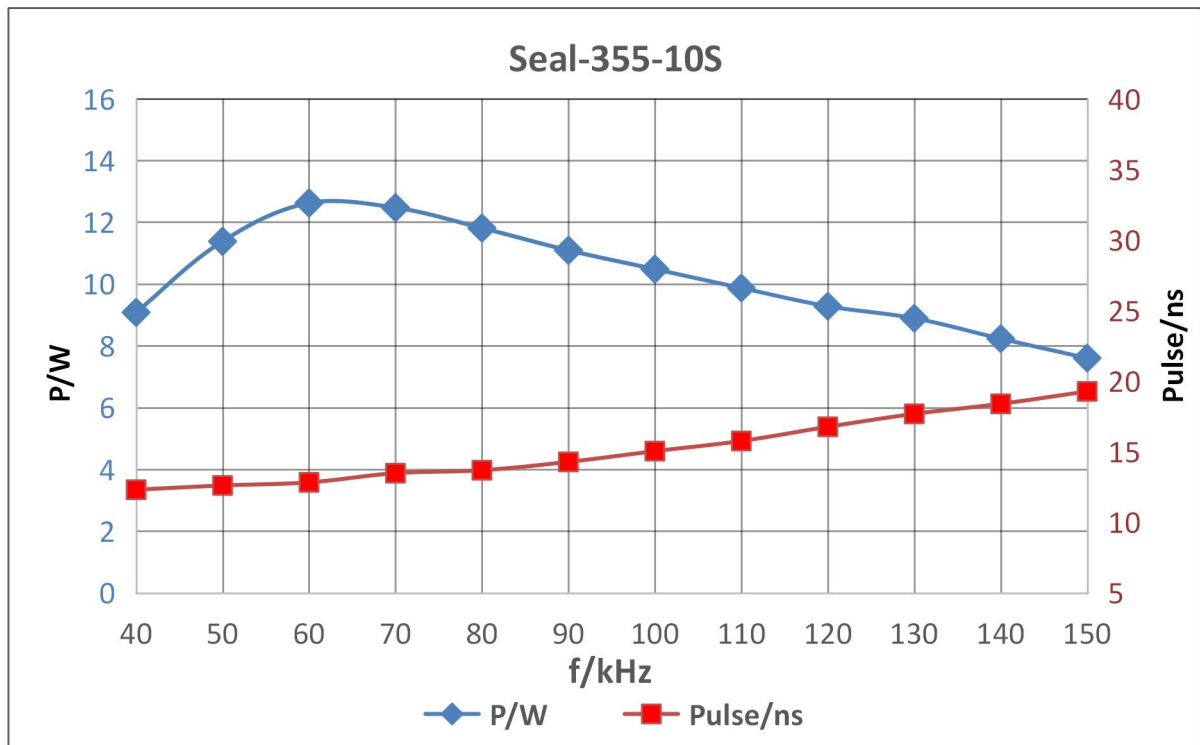


Figure 1 Power, Frequency and Pulse Width for 10W UV Laser

2. Installation

2.1 Dimension

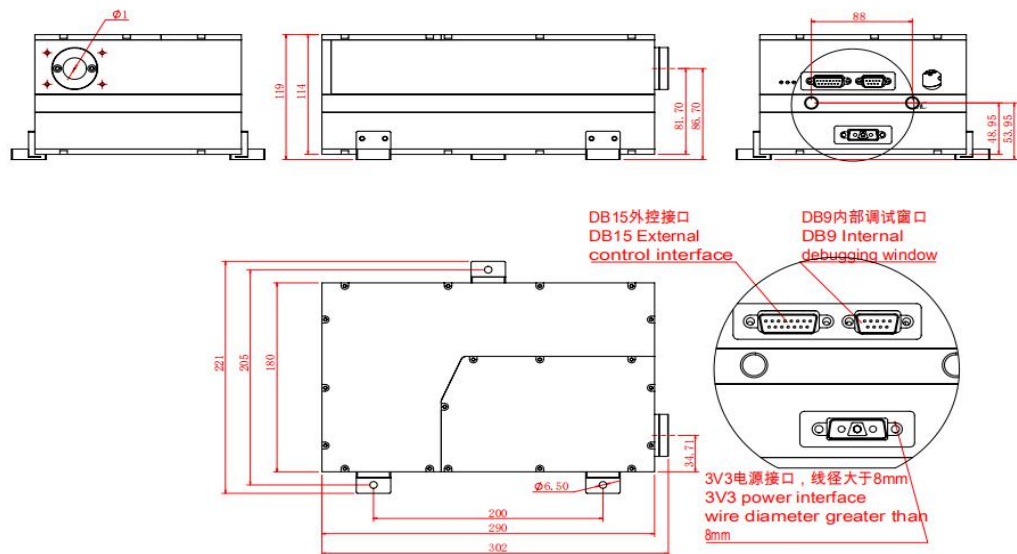


Figure 2 (a) Laser head installation dimension without beam expander

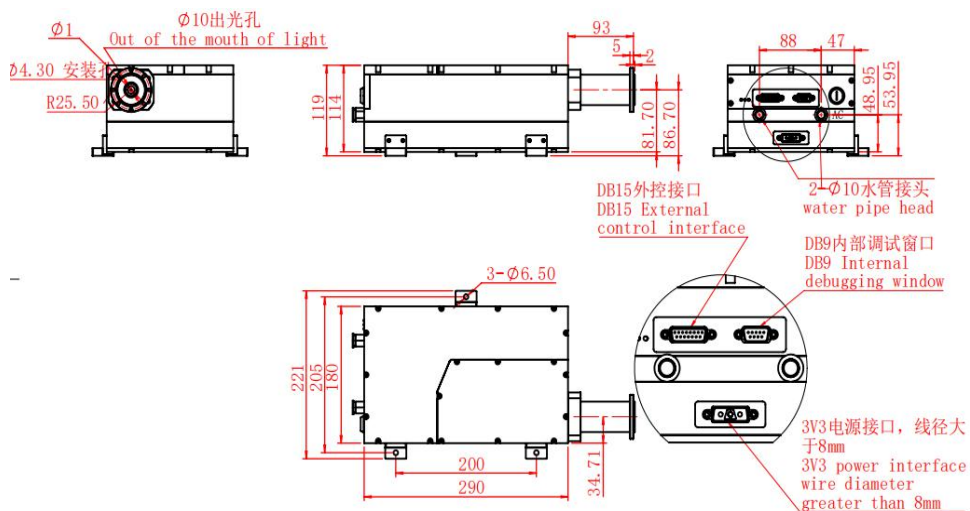


Figure 2 (b) Laser head installation dimension with beam expander

2.2 Installation

- 1) Fix method: Fix three M6*20 screw holes on both sides of laser housing on the worktable with M6*20 screw (suggested length) and corresponding cushion flat pad, as shown in the below.

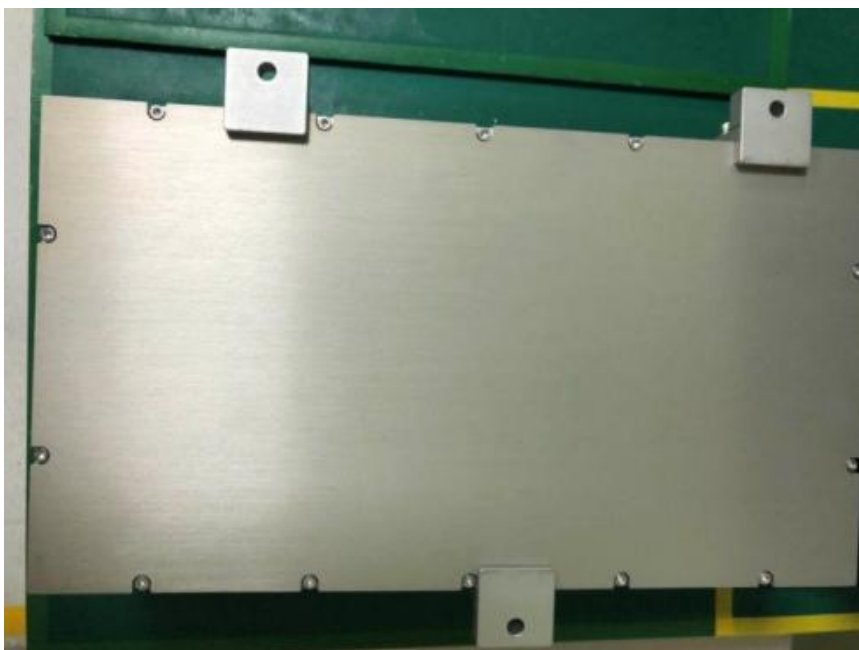


Figure 3 Mounting hole diagram

- 2) Chiller connection method: Connect the output end and input end of the chiller (external diameter 10mm) to the connector (through joint) on the laser output head, as shown in the figure below (Please notice the chiller is power off during this process).



Figure 4 Water pipe joints

- 3) For power connectors: Connect the 3V3 plug to the laser head and tighten the screw. The other end is connected to the switching power supply (+36V) according to the positive and negative marks.



Figure 5 Power supply wiring diagram

- 4) Control board connection: Connect the DB15 signal wires to the laser, tighten the screws, and connect the adapter card at the other end if required.



Figure 6 Control signal and adapter card connection

- 5) Dismantle the beam expander: For the convenience of customers, there will be a complimentary 10X beam expander with holder. It is well installed and easily to be dismantled if not needed. Please refer to instructions as below:

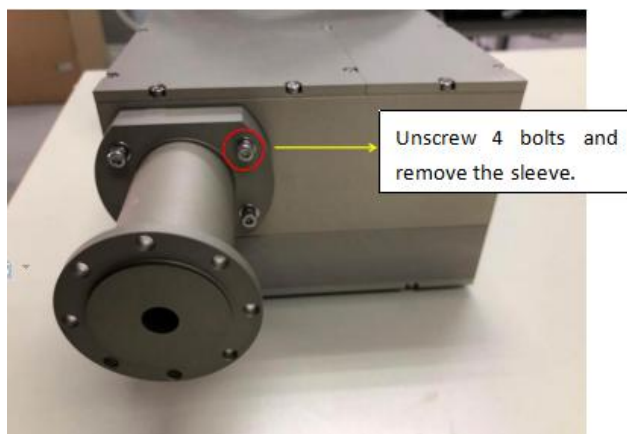


Figure 7 Dismantle expander sleeve

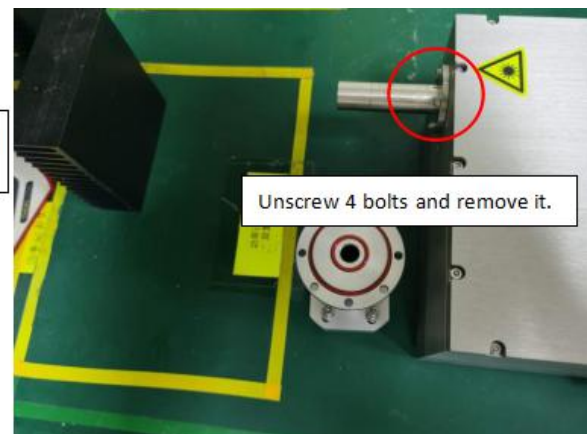


Figure 8 Dismantle expander

***Note:** It is not allowed to dismantle and replace the beam expander under normal circumstances. Please contact our technical support for replacement guidance if it is required, we have corresponding expander replacement procedure and guidance video.

3. Interface and GUI Control

3.1 Interface Explanation

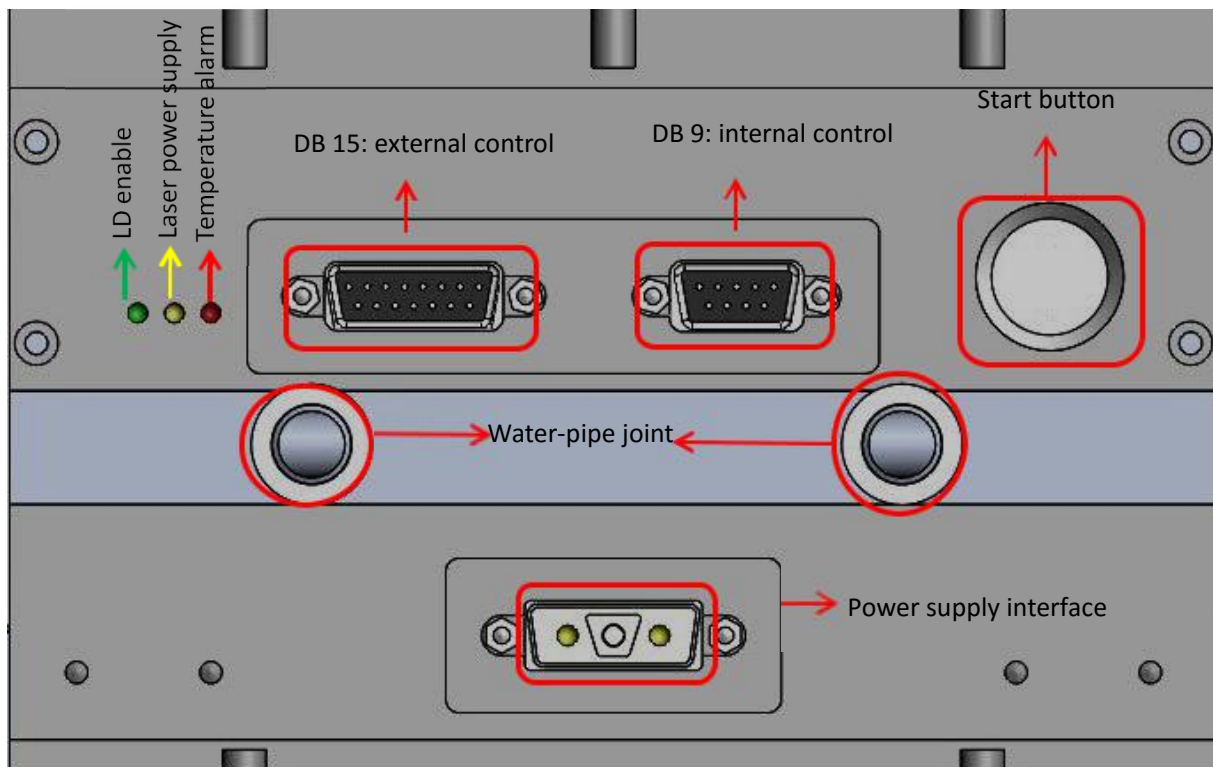


Figure 9 Laser interface diagram

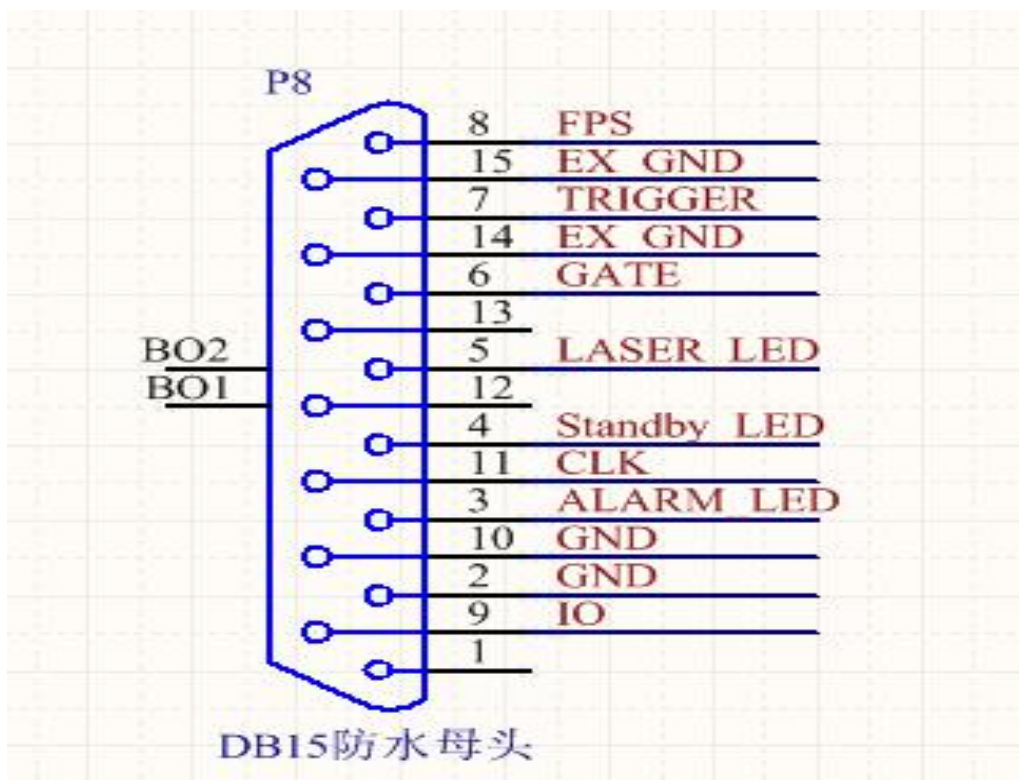
*Indicator light

Red light Temperature alarm. Light up with buzzer warning, LD or water-cooling abnormal temperature. Should cut off the power of laser immediately, find the issue and troubleshooting.

Yellow light It flickers when LD is with power supply properly, shows LD power on and standby.

Green light The LD and laser work well.

Table 2 DB15 Interface Definition



Pin	Type	Definition	Description	Comment
1	Reserve	N/A	N/A	Internal hanging, not connected to the control card internal signal
2, 10	Ground, Digit	GND	GND for PIN3 / PIN4 / PIN5 / PIN9 / PIN11	Return circuit
3	Output, Digit	ALARM_LED	Alarm signal output	High level: Abnormal; Low level : Normal; TTL level output; Drive current $\leq 25\text{mA}$.
4	Output, Digit	Standby_LED	Laser standby signal	Power on: output signal with 1 Hz frequency; External LED indicator connectable; TTL level output; Drive current $\leq 25\text{mA}$.
5	Output, Digit	LASER_LED	Laser working signal	High level: laser is on (pump current is working properly);

				Low level: the pump current is off. TTL level output; Drive current $\leq 25\text{mA}$.
6	Input, Digit	GATE	Laser on-off optical signal	High level ; indicator light Low : laser TTL input
7	Input, Digit	TRIGGER	External control modulation signal	TTL input
8	Input, Digit	FPS	First pulse killer	External control card provided. TTLinput
9	Input, Digit	Loading interface_IO	Unnecessary for user, must hanging	Input signal less than 3.3V
11	Input, Digit	Loading interface_C LK	Unnecessary for user, must hanging	Input signal less than 3.3V
12~13	Reserve	N/A	N/A	Internal hanging, not connected to the control card internal signal
14	GND, Digit	EX_GND	GND for PIN6/PIN7/PIN8	External GND
15	GND, Digit	EX_GND	GND for PIN6/PIN7/PIN8	External GND

3.2 GUI Control Panel

The function of GUI control is internal debugging and monitoring. All parameters have been debugged before ship out. Customers only need to ensure that the external control signals are properly connected, and can be used easily according to the correct operation procedure

1) Activate JPT.exe program, the interface 1 will display as figure 10.

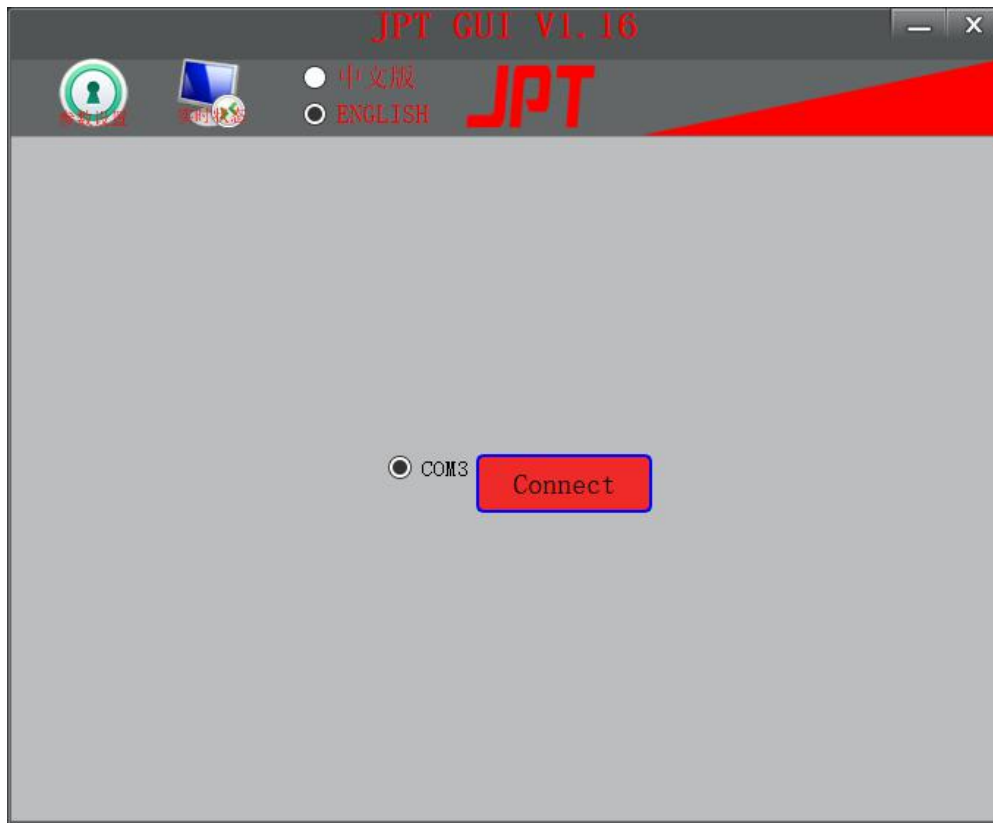


Figure 10

2) Select COM port connected with laser and click “Connect” button to enter interface 2 (Figure 11). If the connection fails, the COM port may be selected incorrectly. Reselect COM port and connect again.

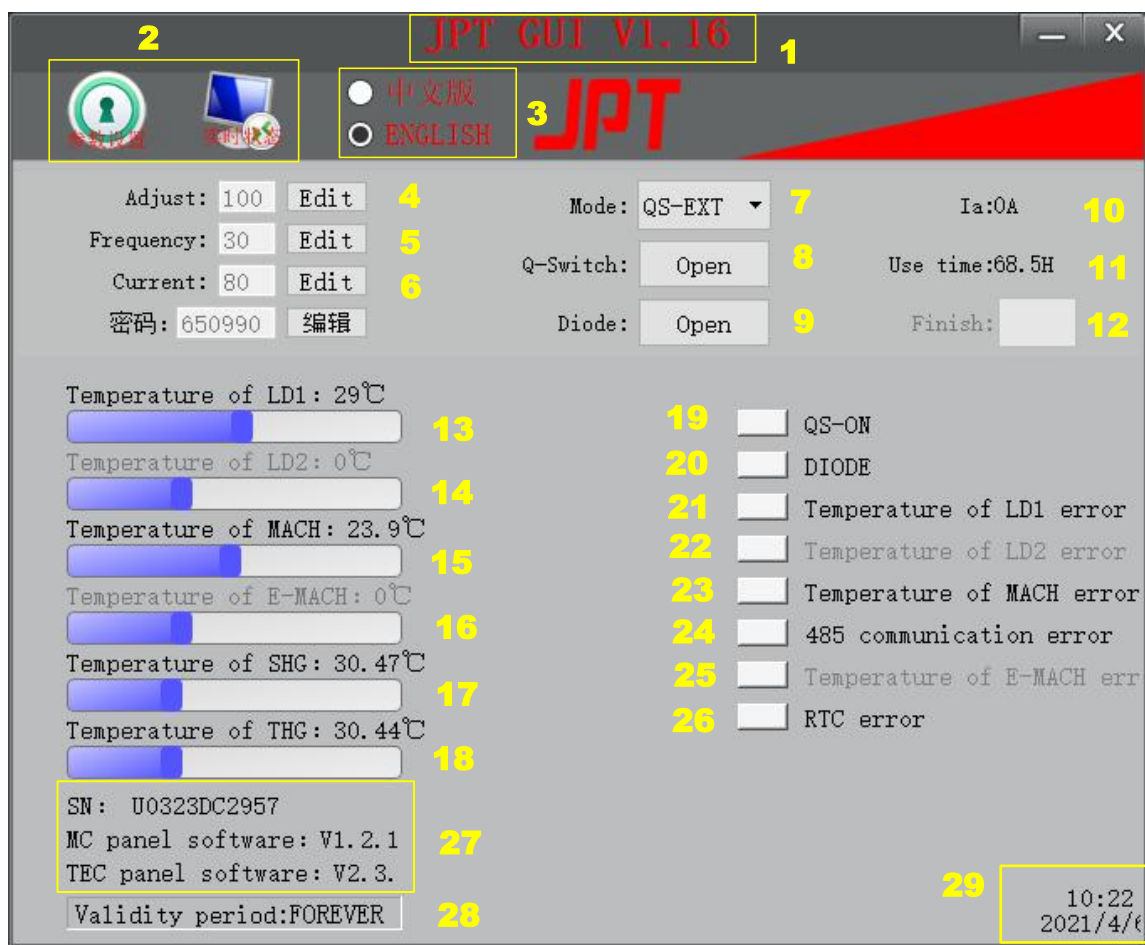


Figure 11 GUI function explanation

Table 3 GUI function explanation

No.	Description
1	GUI software edition number.
2	Switch button between Interface 2 and Interface 3.
3	Switch button between GUI Chinese and English version.
4	Set the duty ratio of Q Switch of laser under internal control mode to achieve power regulation.
5	Set the Q Switch frequency of laser in internal control mode, eg. "30" represents 30 kHz.
6	Set LD electricity current, unit "***/10"A, eg. "250" represents 25.0A.
7	Select Q-switch trigger mode, external control by default. External control mode denotes external input Q-switch signal: internal control mode denotes Q-switch signal generates from LD itself and the frequency and duty cycle are set by code 4 and 5.

8	On/Off Q drive.
9	On/Off LD.
10	Display LD actual current.
11	Record laser light emitting time.
12	Display LD warm up progress (Only for Lark series, switch on LD, Q under complete status).
13	Display LD1 real-time temperature.
14	Display LD2 real-time temperature.
15	Display real-time temperature of laser source cavity (MACH).
16	Display real-time temperature of electronic control box (E-MACH). (Only for Lark series).
17	Display real-time temperature of the second harmonic generation crystal (SHG).
18	Display real-time temperature of the third harmonic generation crystal (THG).
19	Q drive enable indicator light. Green-On, White-Off.
20	LD enable indicator light. Green-On, White-Off.
21	LD1 abnormal temperature warning indicator light. Red-Warning, White-Normal.
22	LD2 abnormal temperature warning indicator light. Red-Warning, White-Normal.
23	Indicator light of abnormal temperature in laser source cavity. Red-warning, White- normal.
24	Warning indicator light of abnormal laser internal communication. Red-Warning, white- Normal.
25	Warning indicator light of abnormal temperature in laser electric control box. (Only for LARK series).
26	Clock abnormal indicator light. Yellow-abnormal, white-normal.
27	Laser SN and circuit board software version number.
28	Laser usage permission. Cannot switch on LD, Q when period of validity terminated.
29	Real time display.

3) Enter access password as figure 12, and click “parameter setting” button.



Figure 12

4) Default password is 6 random digit between “0-9”. Click “enter ” button and enter the password. Following figure (13) appears when password incorrect.

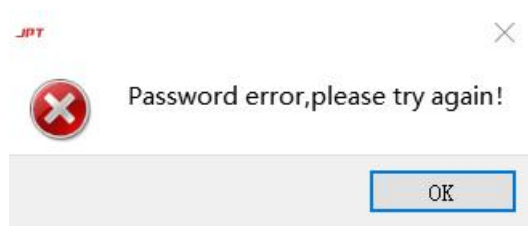


Figure 13

5) Click (reset password) button and enter password setting interface. 6 digit number between “0-9”, as shown in figure 14.



Figure 14

6) A few errors might appear during password modification, as shown in figure 15.

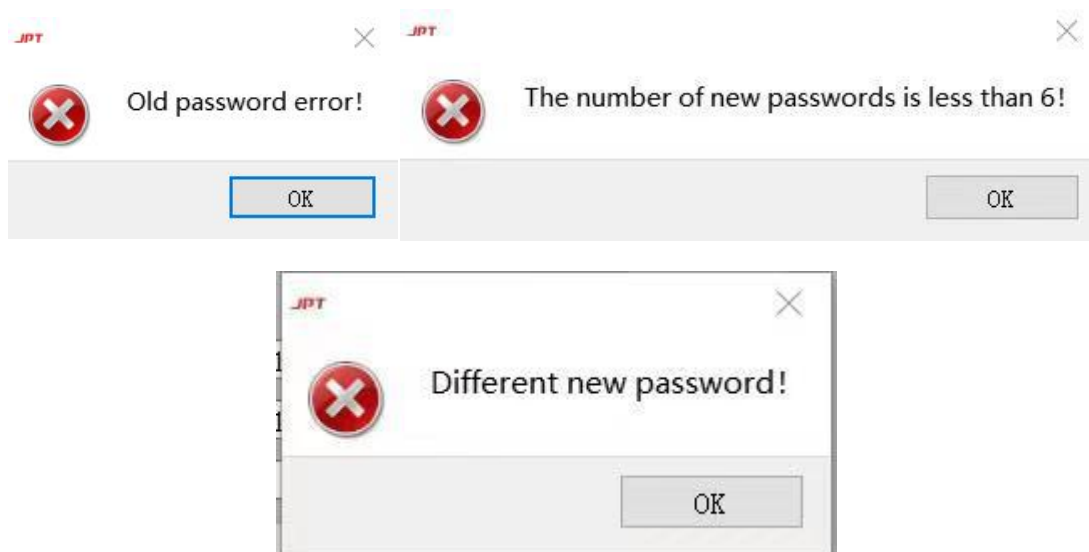


Figure 15

7) Following pop-up hint box appears when password reset successfully, as shown in figure 16.



Figure 16

8) The correct password has a memory function, and the password will be automatically display when the password interface is opened, as shown in figure 17.



Figure 17

9) Parameter modification interface appears after entering the correct password, as shown in figure 18.



Figure 18

Table 4 GUI manual

No.	Description
1	Setting laser time limit, LD and Q locked after expiration and will not be able to emit light.
2	Set date and clock, to calculate the time limit set in Number 1. Update number 1 setting effectively requires update number 2's date.
3	Time setting for adjusting current time.
4	Set LD1 constant temperature.
5	Set LD2 constant temperature.
6	Set constant temperature of second harmonic generation crystal.
7	Set constant temperature of third harmonic generation crystal.
8	Display electric current set by default.
9	Restore current sets of parameters are the parameters by default, including duty ratio (ADJ), frequency (PRF), electric current (IS), mode switch (Mode), Q drive switch (QS), LD switch (Diode), LD1 temperature, LD2 temperature, SHG temperature, THG temperature.

Note:

1. Number 1 available setting time limit: 0 day, 15 days, 30 days, 60 days, 90 days, 180 days, permanent.

4. Laser Control

4.1 Control Introduction

The output control of the laser is mainly controlled by the GATE signal. The output frequency, output power, and other related parameters are controlled by the PWM signal by changing frequency and duty cycle.

Duty ratio: the ratio of the high-level holding time to the time of the clock cycle in the output PWM signal. For example, if the frequency of a PWM is 50KHZ, then its clock period is 20 μ s. If the time of high level is 6 μ s, then the time of low level is 14 μ s, then the duty cycle is 6:20, that is to say, the duty cycle of PWM is 3:10.

Under a certain frequency, the ADJUST = 100% corresponds to the high level of the laser PWM signal when it is 1 μ s, which represents the maximum power, the minimum pulse width, and the highest peak power at that frequency. When the high-level pulse width (i.e. reducing the ADJUST value) is increasing at this frequency, ~~then~~ the power of the flat rate laser will decrease and the optical pulse width increases.

By changing the frequency and duty ratio of the PWM signal (the signal is driven by Q), the frequency, power, and pulse width of the laser pulse can be controlled.

4.2 Control Mode

This laser has both internal and external control modes to control laser pulse. User can choose different control modes by selecting the mode switching option on the GUI interface.

Internal control mode: continuous output of GUI interface setting frequency and duty ratio value of laser pulse.

External control mode: output external given frequency and duty ratio signal of laser pulse.

The LD and Q drive needs to turn on for the laser pulse to emit properly under both internal and external control mode.

4.2.1 External Control Mode Timing

For the emitting of laser pulse under external control mode, a correct timing signal has to access at laser DB15, as shown in figure 19.

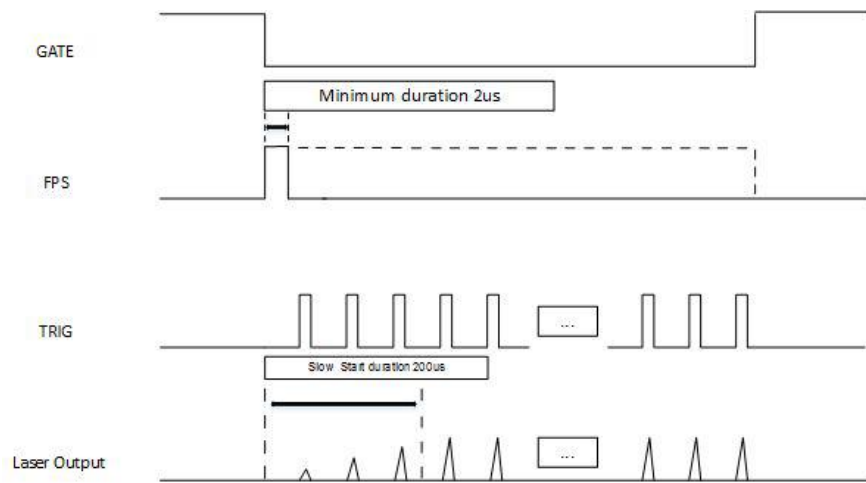


Figure 19 Control timing

Control timing specification

1. GATE represents gate signal, low-level effective light emission which corresponds with LASER on the pinboard.
2. TRIG represents the frequency signal, correspond with PWM on the pinboard.
3. FPS represents the first pulse inhibiting signal, effective only when high-level is above 2 μ s;
When using FPS signal corresponding Slow Start duration will be 150 μ s.
4. Enter GATE and TRIG signal only when the first pulse inhibiting function is not required.
5. All the control signals are TTL level.

* For customers might be using different marking card, we made particular convert card so that the customers may convert corresponding timing signal as figure 19.

*Regarding FPS first pulse inhibiting signal function, the default inhibiting time is 150 μ s. Please contact with our technical support if customization is required.

4.3 Connection of Adapter and Marking Card

4.3.1 Adapter Card Instruction

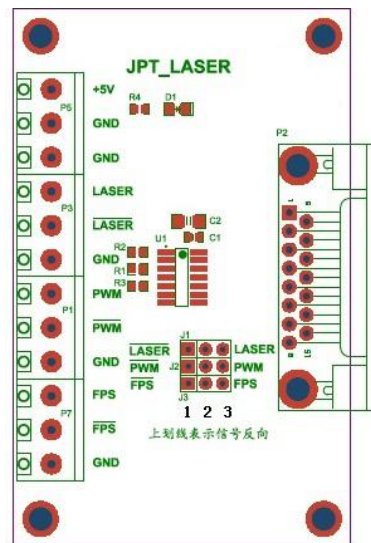


Figure 20 JPT convert card diagram

Connection specification:

- ① Laser control interface of marking card is connected by three joints on the left;
- ② The right DB15 plug is connected to the corresponding interface of the laser head;

Instruction:

- ① Connect adapter card +5V with marking control card VCC +5V; connect adapter card GND with marking card GND.
- ② “Laser” on adapter card means the input laser on signal is the same polarity as the GATE, “ $\overline{\text{Laser}}$ ” means the input laser on signal is the converse polarity as the GATE. When connecting the laser signal from the marking card to “laser” on the adapter card, short circuit

PIN2 and PIN3 of J3 with the short cap. When the laser on signal to " $\overline{\text{Laser}}$ ", short circuit PIN1 and PIN2 of J3 with short cap.

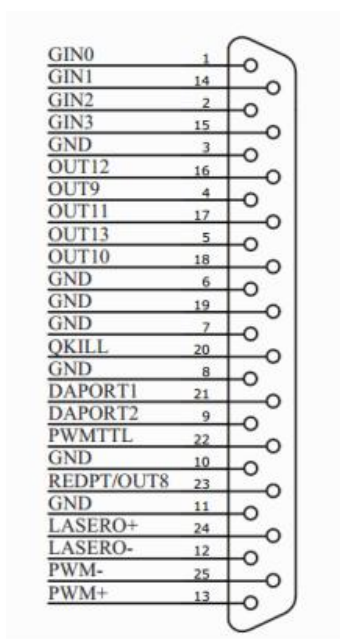
③ "PWM" on the adapter card means the PWM signal output on the marking card is the same co-phase as TRIG signal (as figure 19 shows). " $\overline{\text{PWM}}$ " means the output PWM signal on the marking card is the inverse as the TRIG signal (as figure 19 shows). When the modulation signal to "PWM", short circuit PIN2 and PIN3 of J5 with the short cap. When the modulation signal to " $\overline{\text{PWM}}$ ", short circuit PIN1 and PIN2 of J5 with short cap.

4. "FPS" on adapter card means the output signal is the same phase as the FPS on laser source (as figure 19 shows), " $\overline{\text{FPS}}$ " means the output signal is the converse polarity as the FPS on the marking card. When connecting the "FPS" on marking card with FPS on the adapter card, short circuit PIN2 and PIN3 of J3 with short cap. When the first pulse killer signal to " $\overline{\text{FPS}}$ ", use short circuit PIN1 and PIN2 of J8 with short cap . When the FPS function is not enabling, please use jumper cap to connect 1,2 pins of J8.

***Regarding FPS first pulse inhibiting signal function, please connect FPS signal in adapter card if the function is required; Enter GATE and TRIG signal if the function is not required.**

4.3.2 Standard control card connection

1) JCZ card

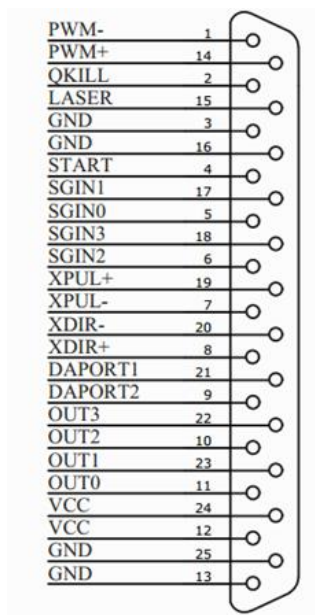


↑ Figure 21 Type A of JCZ card:

Stitch 12 to LASER, short circuit PIN 2, 3 in J3

Stitch 22 to PWM, short circuit PIN 2, 3 in J5

Stitch 20 to FPS, short circuit PIN 2, 3 in J8

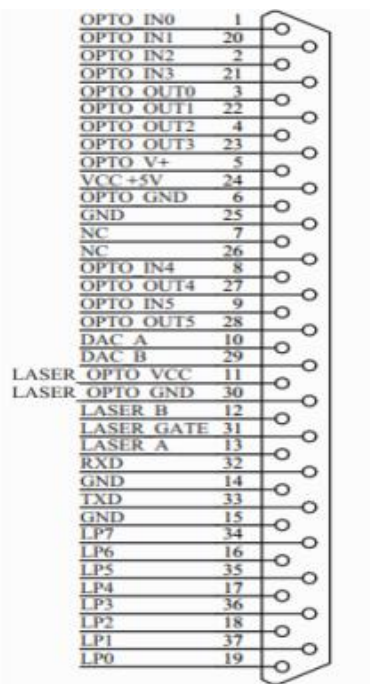


↑ Figure 22 Type B of JCZ card:

Stitch 24 to LASER, short circuit PIN 1, 2 in J3

Stitch 14 to PWM, short circuit PIN 2, 3 in J5

Stitch 2 to FPS, short circuit PIN 2, 3 in J8



← Figure 23 SAMLight port:

Stitch 31 to $\overline{\text{Laser}}$, short circuit 1, 2 in J3

Stitch 13 to PWM, short circuit 2, 3 in J5

Stitch 12 to FPS, short circuit 2, 3 in J8

5. Operation of laser source

5.1 Start-up introduction

- 1) Connect chiller with laser head, and tighten it up to avoid leaking.
- 2) Turn on chiller and set temperature control at 25°C until it is stable at 25±0.5°C
- 3) Check laser outlook condition. If any object/sticker blocks output port, please remove it.
- 4) Make sure laser power connection and laser head properly connected (must connect tightly due to high electric current), check if signal wire of marking system and laser System has connected properly.
- 5) Switch on 220V power supply and the key switch (before this, please make sure the marking card has been connected properly, and power supplied on PCB, in order to prevent damage to the laser). Confirm there is no abnormal indicator light, and wait until stable laser light-emitting, then we can use the laser to mark.

***When laser temperature is abnormal, it will trigger the protective alarm and shut down the laser. Please check if the chiller is running properly, or the power cable is connected normally.**

5.2 Shutdown Procedure

- 1) Stop marking process.
- 2) Turn off key switch
- 3) Turn off 220V power supply (if the laser only stop temporarily, we advice not to turn off power supply)
- 4) Turn off the chiller.

5.3 Caution

- 1) Wear Laser safety glasses during the operation;
- 2) Power off: Stop marking process first, and then turn off the laser.

6. Frequently Asked Questions

Common questions	Causes and solutions
Parameters setting incorrectly	Cause: Frequently setting is under 40kHz, light become weaker, the single pulse energy is intense which will damage laser easily under this situation. Light is extremely weak when frequency setting is above 300kHz. Solution: Setting frequency range within 40-300kHz.
	Cause: Pulse length setting should be less than $\frac{1}{f}$, the laser light will not emit if pulse length setting is above this value. Solution: Setting the pulse length range between $1\mu s$ to $\frac{1}{f}\mu s$.
Laser temperature alarm	Cause: Water temperature over the range of 15-30°C will trigger protective alarm automatically. Solution: Turn off the power supply and wait for the chiller temperature is back between 15-30°C again. Then turn the laser on.
No laser and indicator light	Cause: Key switch may not turn on, and both power supply connector or DB15 USB cable may become loose. Solution: Switch tight power supply connector, fasten screw, and turn on key switch.
Laser is normal, but no indicator light	Cause: Laser wire of convert card is unconnected or wrongly connected (must connect wire base on board card definition) Solution: Check if laser wire is connected properly, if not connect it correctly.
No laser and indicator emits	Cause: PWM wire is unconnected or wrongly connected.

	Solution: Check if PWM wire of covert card is connected properly, and connect PWM wire.
Non-circular, gaps, hollow light spot	Cause: Expander unclean or in improper position. Solution: Check the expander's status or readjust the position.

Dear customer,

Thanks for continue to trust and support JPT product. Please do not hesitate to contact us and feel free to let us know your valuable opinions if there is any area of improvement in this operational manual, we will revise it accordingly and continue to provide a better service for you in the future.