

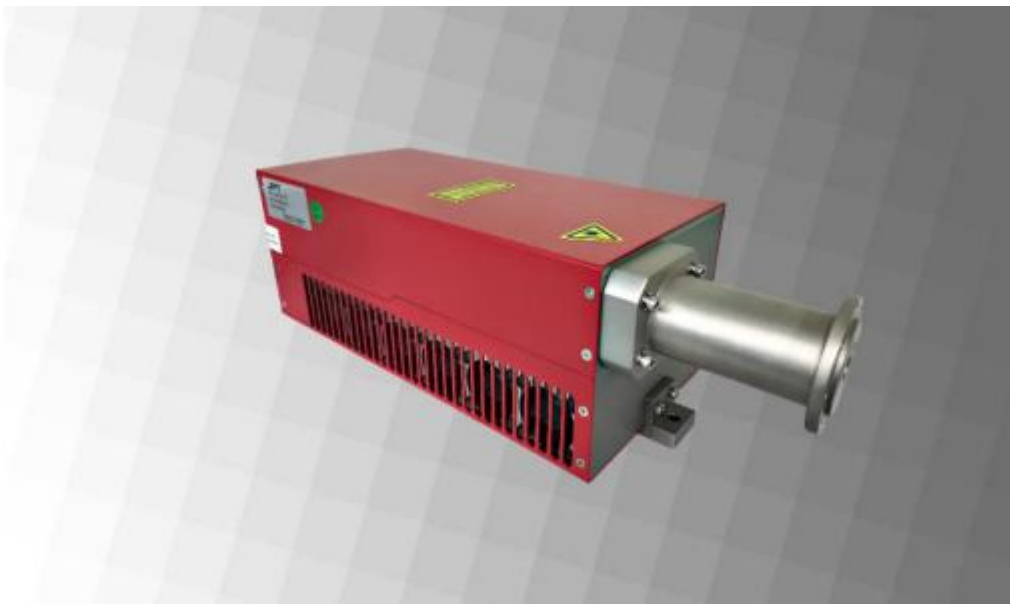


Shenzhen JPT Opto-electronics

Lark-355-5A (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 355 nm (invisible light), with an average output power over 5W, 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.
- If any abnormal condition occurs, power off, check and repair immediately.
- **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
 <p>当心激光 Caution, laser</p>	<p>Laser label (placed on the top cover of laser module near the output port).</p>
	<p>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.</p>
	<p>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!</p>
	<p>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.</p>

<p>注意高温</p>	<p>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.</p>
<p>AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION</p>	<p>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.</p>
<p>Component for Incorporation 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</p>	<p>Warnings (placed on the top cover of the laser module).</p>
<p>CAUTION-CLASS 4 INVISIBLE LASER RADIATION WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION</p>	<p>Safety warning.</p>



Laser safety glasses

Content

1. Product Introduction and Parameters.....	1
1.1 Introduction.....	1
1.2 Technical parameter.....	2
2. Installation.....	3
2.1 Dimension.....	3
2.2 Installation.....	4
3. Interface and GUI Control.....	6
3.1 Interface Explanation.....	6
3.2 GUI Control Panel.....	8
4. Laser control.....	16
4.1 Control Introduction.....	16
4.2 Control mode.....	16
4.2.1 External control mode timing.....	16
4.3 Connection of Adapter and Marking Card.....	18
4.3.1 Adapter Card Instruction.....	18
4.3.2 Common control card connection.....	20
5. Operation.....	21
5.1 Regular Startup Procedure.....	21
5.2 Regular shutdown procedure.....	21
5.3 Caution.....	21
6. Frequently Asked Questions.....	22

1. Product Introduction and Parameters

1.1 Introduction

The reason ultraviolet wave is better than infrared wave and other visible waves is because UV laser is able to directly break the chemical bond of atomic group in connection substances. It is known as the “cold” process, separate substance directly into atoms instead of producing heat to periphery area, cause less environmental damage. The UV laser has the advantages of short wavelength, easy focusing, intense energy and high resolution. Because of its high processing accuracy, narrow line width, high quality and precision, small heat-affected area, good long-term stability, it can process various irregular patterns and heterogeneous patterns. It is mainly 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.

Lark-355-5A is the product of ultraviolet Lark series. It adopts the heat management mode of conduction heat dissipation combined with air convection heat dissipation. Compared with Seal355-5C, it eliminates the water cooling system and allows customers to select multiple lasers of the same level according to the actual situation. Compared with the similar products of other brands, Lark-355-5A achieves shorter pulse duration ($<18\text{ns}@50\text{ kHz}$), higher repetition frequency (50 kHz), better beam quality ($M^2\leq 1.2$), better beam roundness ($>90\%$). It has smaller volume, lighter weight and better appearance. And it has strong ability for anti-electromagnetic interference, high thermal management efficiency and friendly GUI interactive interface. These advantages make the product has better structural stability and stronger environmental adaptability, and thus realize good beam quality, high power stability, long life, high consistency, convenient installation, maintenance-free operation and so on.

1.2 Technical parameter

Table 1. Parameters for Lark-355-5A

Parameter List	
Laser Type	5W UV laser, All-in-one
Model Number	Lark-355-5A
Wavelength	355nm
Average Output Power	>5W@50 kHz
Pulse Duration	<18ns@50 kHz
Frequency Range ^[1]	20 kHz - 150 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)	0.7±0.1 mm ^[3]
Beam Expander Inside	10X ^[4]
Polarization Ratio	>100:1
Polarization Orientation	Horizontal
Average Power Stability	RMS≤5%@24hr
Pulse-to-Pulse Stability	RMS≤3%@50 kHz
Operating Temp.&RH	0°C~40°C; <80%
Storage Temp.&RH	-15°C~50°C; <90%
Cooling Mode	Air-cooling
Cooling Capacity Requirement	500W
Electricity Requirement	DC 12V
Average Power Consumption	<200W
Three-Dimensional Size	348.5mm*144.6mm*126.2mm (L* W* H) ^[5]
Weight	≈ 6.5 kg

[1] Pulse stability will be better in this frequency range.

[2] Refers to the direct output beam from the window, without beam expansion shaping barre.

[3] The measured position is at the laser output window (without expander).

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

[5] Refers to the dimension without expander.

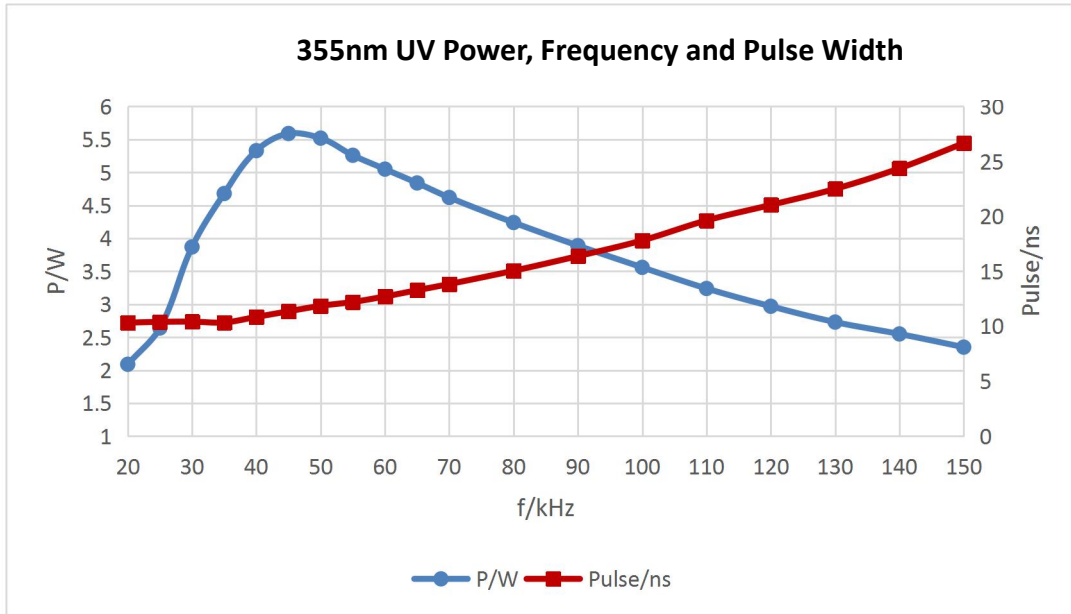


Figure 1 Power, Frequency and Pulse width for 5W UV Laser

2. Installation

2.1 Dimension

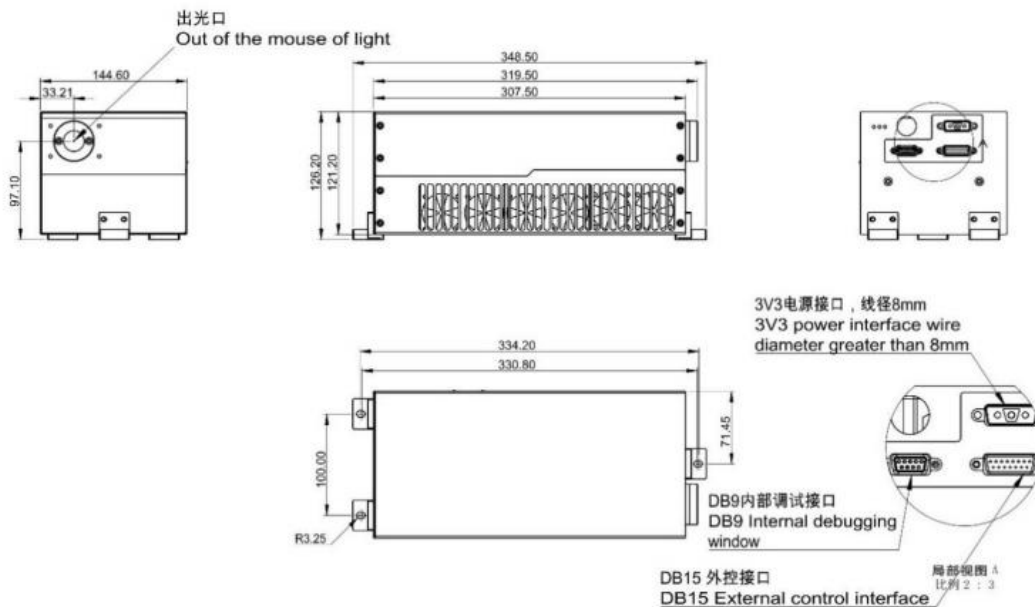


Figure 2 (a) Laser head installation dimension without beam expander

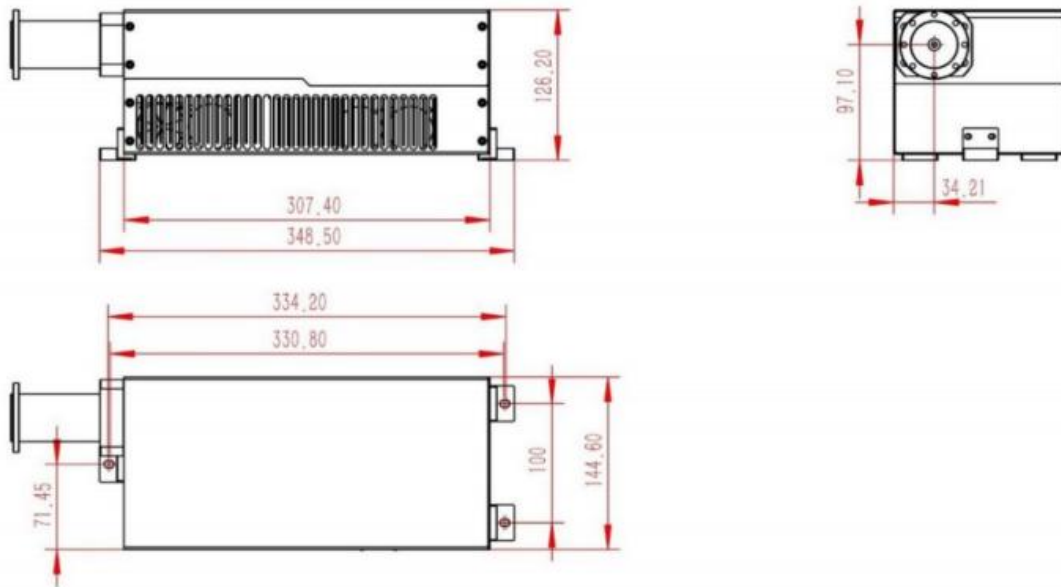


Figure 2 (b) Laser head installation dimension with beam expander

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 figure below.



Figure 3 Mounting hole diagram

- 2) For power connectors: Connect 3v3 plug to laser head and tighten the screws. Connect the

other end to switching power supply according to positive and negative marks.



Figure 4 Power supply wiring diagram

- 3) Control signal wires: Connect DB15 signal wires to the laser, tighten the screw. Connect the other end to convert card.

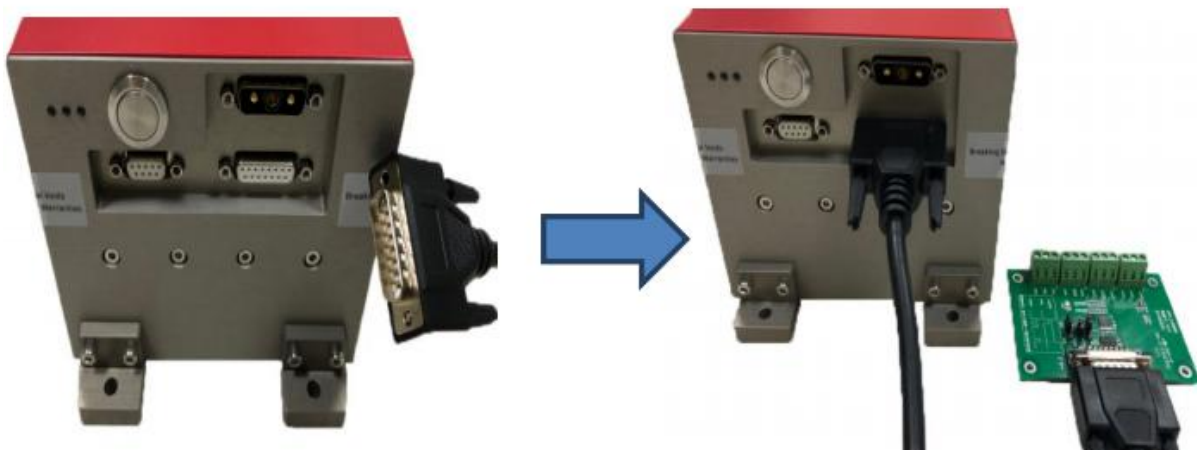


Figure 5 Control signal and convert card connected diagram

***Important Notice: It is not allow 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

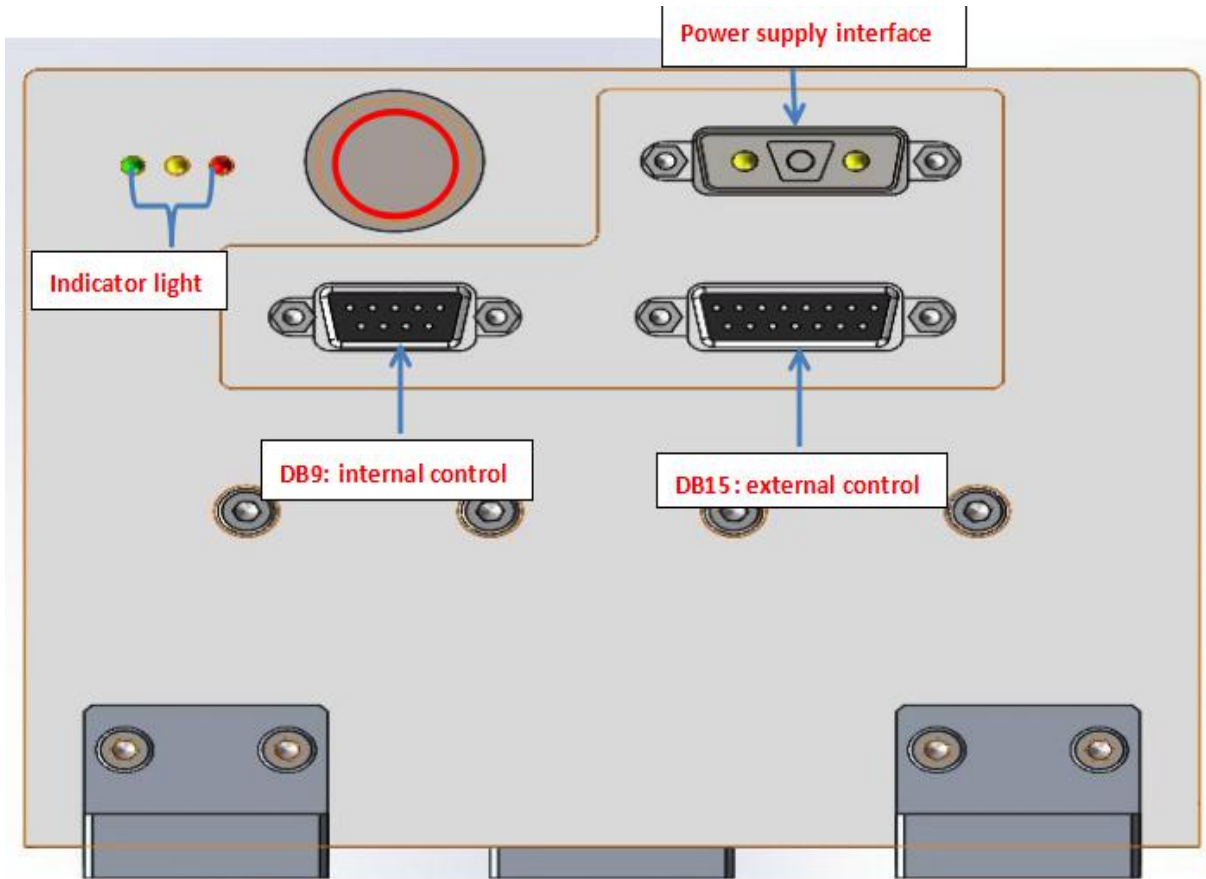


Figure 6 Laser interface

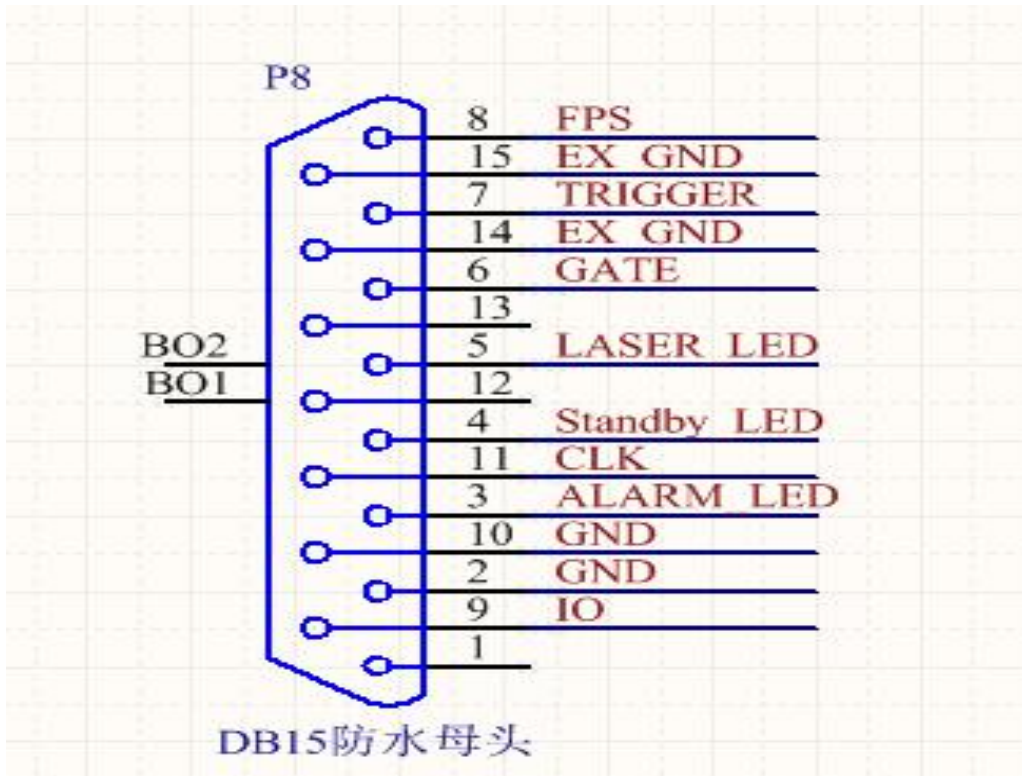
***Indicator light**

Red light Temperature alarm. Light up with buzzer warning when the temperature of LD or water is abnormal. 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 Light on means power connected, LD is in working condition.

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	Internal GND
3	Output, Digit	ALARM_LED	Alarm signal output	High: Abnormal; Low: Normal; TTL output; Driving current $\leq 25\text{mA}$.
4	Output, Digit	Standby_LED	Standby laser output	Power on: output signal with 1 Hz frequency; external LED indicator connectable; TTL output; driving current $\leq 25\text{mA}$.
5	Output, Digit	LASER_LED	Laser working signal	High: laser is on (pump current is working properly); Low: the pump current is off. TTL output; driving current $\leq 25\text{mA}$.
6	Input, Digit	GATE	Laser of signal on/off	High: Guide beam; Low: laser; TTL input

7	Input, Digit	TRIGGER	External control modulation signal	TTL input
8	Input, Digit	FPS	First pulse killer	External marking card provided. TTL input
9	Input, Digit	Loading interface_ IO	Vacant, user does NOT need to use.	Input signal less than 3.3V
11	Input , Digit	Loading interface_ CLK	Vacant, user does NOT need to use.	Input signal less than 3.3V
12~13	Reserve	N/A	N/A	Internal vacant, the board is not connect to the 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 7.

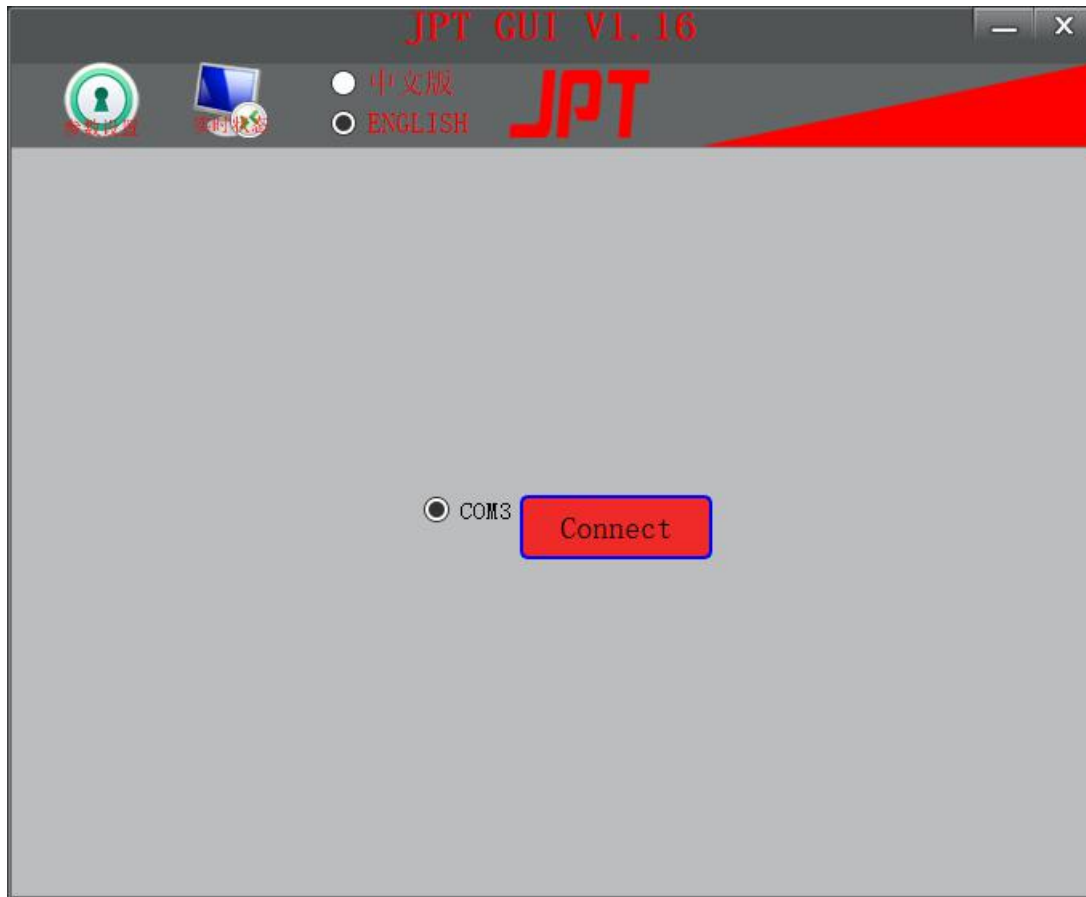


Figure 7

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 8

Table 3 GUI 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 9, and click “parameter setting” button.



Figure 9

4) Default password is 6 random digits between “0-9”. Enter the password and click “Input” button. Following figure (10) appears when password incorrect.

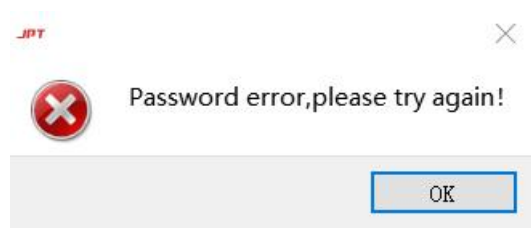


Figure 10

5) Click “reset password” button and enter password setting interface. 6 digits between “0-9”, as shown in figure 11.



Figure 11

6) A few errors might appear during password changes, as shown in figure 12.

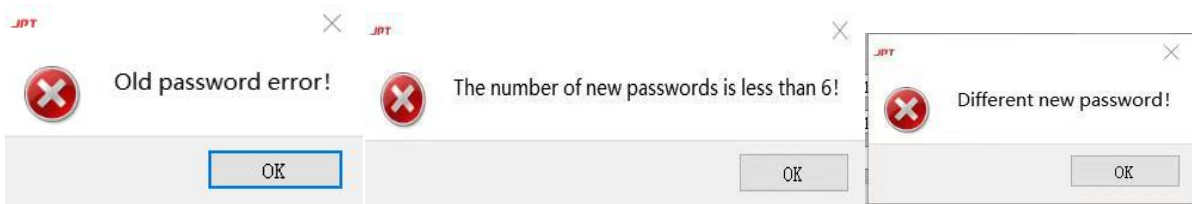


Figure 12

7) Following pop-up hint box appears when password reset successfully, as shown in figure 13.



Figure 13

8) The correct password has a memory function, it will automatically display when the password interface is opened, as shown in figure 14.



Figure 14

9) Parameter modification interface appears after entering the correct password, as shown in figure 15.



Figure 15

Table 4 GUI manual

No.	Description
1	Set the laser using time limit. LD and Q locked after expire 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 current time adjustment.
4	Set LD1 constant temperature.
5	Set LD2 constant temperature.
6	Set constant temperature of second harmonic generation crystal.
7	Setting 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 for: 0 day, 15 days, 30 days, 60 days, 90 days, 180 days, permanent.

4. Laser control

4.1 Control Introduction

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

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 50 kHz, then its clock cycle is 20 μm . If the time of high level is 6 μm , then the time of low level is 14 μm , then the duty ratio is 6:20, that is to say, the duty ratio of PWM is 3:10.

At a certain frequency, when the high level of the laser PWM signal is 1 us, is corresponds to ADJUST = 100%, which represents the maximum power, the minimum pulse width and the highest peak power at this frequency. Increase the high-level pulse width (i.e. reduce Small ADJUST value), the laser power of this frequency decreases and the laser pulse width increases.

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

4.2 Control mode

The laser has internal and external control modes to control the laser pulse. Mode selection is realized through mode switching of GUI interface.

Internal control mode: continuously output laser pulses with the frequency and duty cycle set in the GUI interface.

External control mode: output laser pulse with external given frequency and duty cycle signal.

In internal control mode or external control mode, both LD and Q drive need to be turned on to emit laser pulses normally.

4.2.1 External control mode timing

Emitting laser pulse under laser external control mode, needs to access correct timing signal in laser DB15, as shown in figure 16.

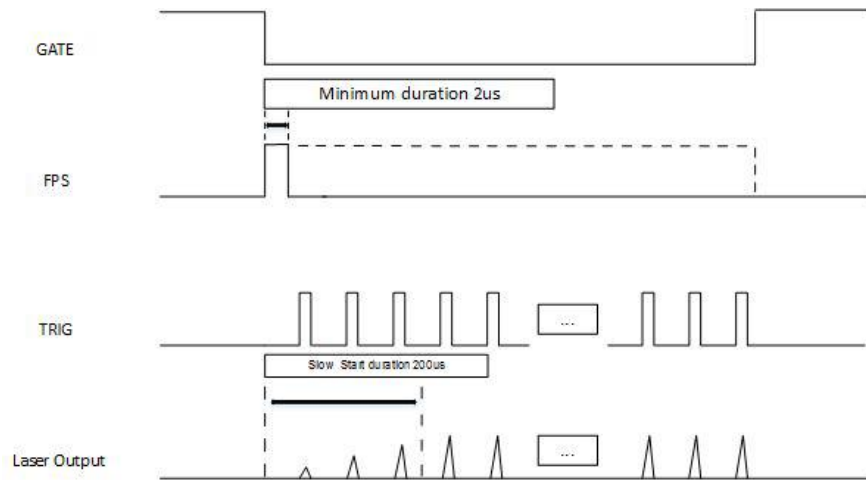


Figure 16 Control timing

Control timing specification

1. GATE is the gate signal, low level effective light emission and associate with LASER on the pinboard.
2. TRIG is the frequency signal, associate with PWM on the convert board.
3. FPS is the first pulse suppression signal, and the high level time is more than 2 us valid; when the FPS signal is used, the corresponding Slow Start duration is 150 us.
4. Enter GATE and TRIG signal when the first pulse inhibiting function is not required.
5. All the control signals are TTL level.

***Customers might be using different control card, our company made particular convert card so that customers are able to convert consistent timing signal with that in figure 19.**

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

4.3 Connection of Adapter and Marking Card

4.3.1 Adapter Card Instruction

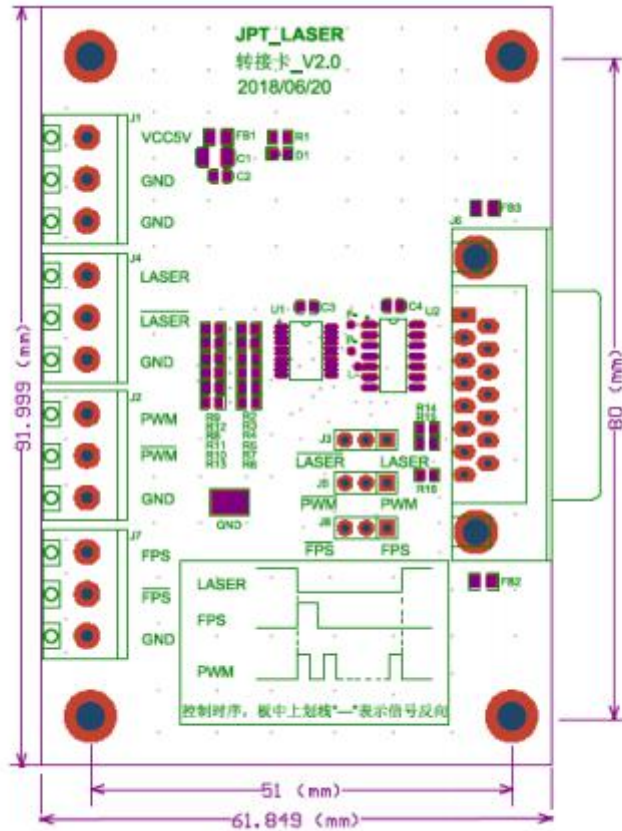


Figure 17 JPT adapter card diagram

Connection specification:

- ① Laser Control Interface of Marking Card Connected by Three Joints on the Left
- ② The right DB15 plug is connected to the corresponding interface of the laser head.

Method:

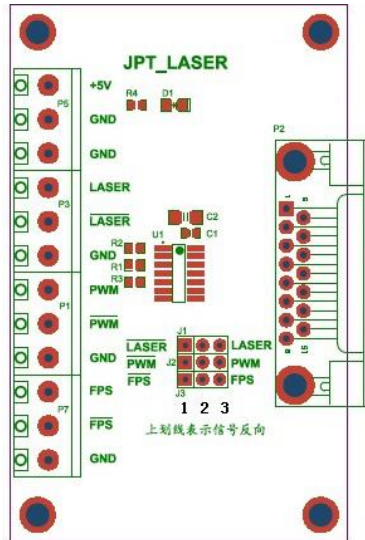
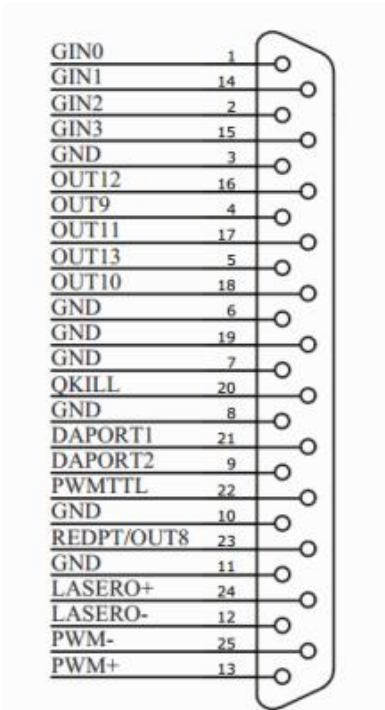


Figure 10 Convert card

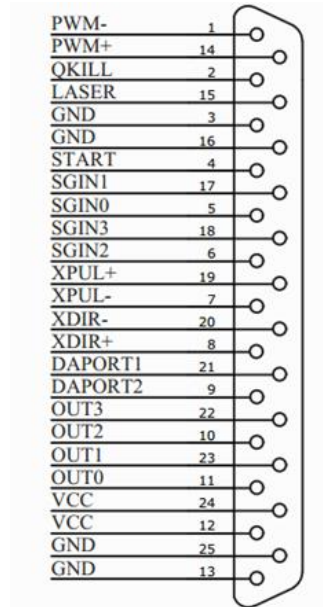
1. Convert card VCC +5V to marking control card VCC +5V; convert card GND to marking control card GND.
2. “Laser” on convert card means the input laser on signal is the same polarity as the GATE, “ $\overline{\text{Laser}}$ ” means the input laser on signal is the converse polarity as the GATE. When the laser on signal to “laser”, use the short cap short circuit PIN2 and PIN3 of J1. When the laser on signal to “ $\overline{\text{Laser}}$ ”, use the short cap short circuit PIN1 and PIN2 of J1.
3. “PWM” on convert card means the input modulation signal is the same polarity as the TRIG, “ $\overline{\text{PWM}}$ ” means the input modulation signal is the converse polarity as the TRIG. When the modulation signal to “PWM”, use the short cap short circuit PIN2 and PIN3 of J2. When the modulation signal to “ $\overline{\text{PWM}}$ ”, use the short cap short circuit PIN1 and PIN2 of J2.
4. “FPS” on convert card means the input first pulse killer signal is the same polarity as the FPS, “ $\overline{\text{FPS}}$ ” means the input first pulse killer signal is the converse polarity as the FPS. When the first pulse killer signal to “FPS”, use the short cap short circuit PIN2 and PIN3 of J3. When the first pulse killer signal to “ $\overline{\text{FPS}}$ ”, use the short cap short circuit PIN1 and PIN2 of J3. When the FPS function is not enabling, please use jumper cap to connect 1,2 pins of J3

4.3.2 Common control card connection

1) JCZ card



↑ Figure 21 Type A of JCZ card:



↑ Figure 22 Type B of JCZ card:

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

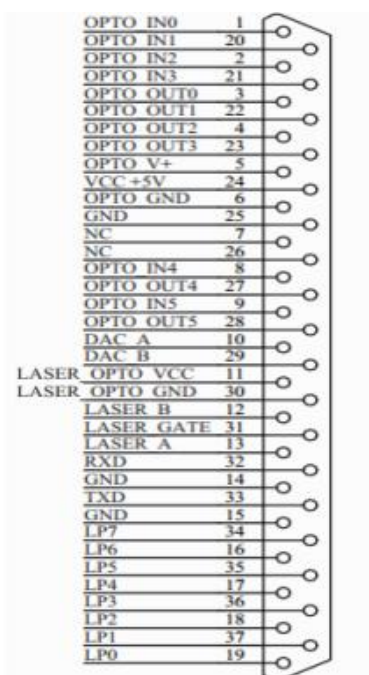
Stitch 15 to LASER, short circuit PIN 1, 2 in J3

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

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

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

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



← Figure 23 SAMlight port:

Stitch 31 to LASER, short circuit 1, 2 in J3

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

Stitch 9 to FPS, short circuit 2, 3 in J8

5. Operation

5.1 Regular Startup Procedure

- 1) Connect chiller with laser water connector, switch tight.
- 2) Make sure laser controller and laser head properly connected (must connect tightly due to high electric current), check if signal line of marking system and laser System has connected properly.
- 3) Access 220V switching power supply, press switching button (before this, please make sure convert card has been connected properly, and power supplied on PCB, in order to prevent damage to the laser). Make sure indicator light is normal and wait for stable laser light is emitting, then we can use the laser to mark.
- 4) Air fan speed control is dependent on actual ambient temperature during laser operating.

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

5.2 Regular shutdown procedure

- 1) Stop marking.
- 2) Turn off button switch.
- 3) Turn off 220V power supply (if stop using laser temporarily, we advice not to turn off power supply).

5.3 Caution

- 1) Wear Laser safety glasses all the time;
- 2) Stop marking first, and then turn off the laser.

6. Frequently Asked Questions

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

Dear customer,

Thank you for your continuing trust and support to our company. 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 laser operational manual, we will revise accordingly and provide a better service in the future.