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KSL Nanosecond Laser

User Manual

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DONGGUAN KST LASER TECH CO., LTD.

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1. Laser Safety

1.1 Laser Classification Description

KSL series lasers are all Class 4 high-power lasers and should be operated with extreme caution to avoid fire and other safety hazards.

1.2 Laser Safety Responsibilities

KSL lasers are equipped with a switching power supply rated for 100-240 VAC, 50-60 Hz input AC voltage.

KSL series lasers are safe and reliable under reasonable conditions of use and have passed rigorous reliability testing.

Please strictly follow the installation and operation requirements outlined in this manual. If the laser system is used in a manner not specified in this manual, the safety features provided by the equipment may be compromised.

Failure to follow the correct safety guidelines is extremely hazardous to both personnel and property. The danger increases significantly when the laser output wavelength is invisible.

The company shall not be held legally liable for any property damage or personal injury resulting from the operator's failure to use the laser correctly in accordance with our company's operating specifications.

1.3 Laser Safety Operating Guidelines and Symbol Descriptions

1.3.1 Safety Operation Guidelines

DANGER WARNING

Before using the laser, operators must carefully read this manual and familiarize themselves with the relevant operating specifications. While strictly adhering to operating procedures, measures must be taken to prevent accidental injury caused by direct or reflected beams. Non-operating personnel must stay away from the laser operation area.

Direct exposure of the eyes to the laser output beam can cause serious injury or blindness. It can also burn skin and clothing, leave scars, and even ignite volatile and flammable substances within a certain distance. Our company recommends that users strictly follow the following precautions and other safety considerations mentioned in this manual.

- Control and limit the personnel operating the laser in the room, and restrict usage to qualified users who can clearly recognize laser safety practices and fully understand the inherent hazards. Only personnel who have been trained and qualified, are familiar with standard laser safety specifications, and fully understand laser hazards are permitted to operate this laser system.
- Operating a laser in an enclosed room while maintaining beam collimation over long distances poses a significant risk. Direct eye contact with the laser beam can cause severe injury or even permanent blindness. The greatest danger when using a laser is the risk of eye injury.
- In addition to the primary beam, there are typically numerous smaller beams present at various

angles near the laser system. These beams are formed by the stray reflections of the primary beam off polished surfaces, such as lenses, mirrors, and other optical components. Although these stray reflections are weaker than the main beam, their intensity is still sufficient to cause eye damage.

- Laser beams are powerful enough to burn skin, clothing, or paint, and they can ignite volatile substances like solvents even from a distance. Laser beams can damage photosensitive elements in cameras and photodiodes. Even indirect exposure via reflective surfaces can cause injury.
- This laser is classified as a Class IV laser, which is exceptionally bright and intense compared to conventional light sources. Operators of the laser system should be clearly aware of the hazards associated with using this laser.
- Before operating the laser, operators must wear appropriate protective eyewear, gloves, and protective clothing, and operate in accordance with laser safety procedures.
- A safety operation zone must be established within the laser workspace to prevent inexperienced personnel from entering the laser work area at will.
- Around the laser workspace, users must utilize non-reflective materials to block any laser leakage.
- The laser should be securely installed and must not be moved arbitrarily to avoid risks caused by beam deviation.
- Class IV laser warning signs must be posted in prominent locations within the laser operation area.
- Maintain the laser experimental setup at a specific height. The laser beam must not be at the same level as human eyes to prevent the beam from entering the eyes.
- Do not look directly into the laser beam. Both reflected and diffusely reflected laser light are hazardous.
- Avoid wearing jewelry or any reflective objects when using lasers to eliminate the risk of reflected light.
- After using volatile substances in the laser operation area, they must be removed from the area immediately.
- Avoid direct exposure to the laser output. the intensity of the laser beam can easily cause skin burns or ignite clothing.
- Set up enclosed beam delivery paths as much as possible.

1.3.2 Description of Laser Hazard Signs

#	Illustration	Description
1		Laser Radiation Warning Label
2		Laser Radiation Class Label
3		Safety Warning Signs

1.4 KSL Laser Safety Features

- Keyswitch: Located on the rear cover of the laser. When the keyswitch is turned off, the laser diode cannot be activated, and the laser will not turn on.
- DB25 Communication Cable: The 25-pin interlock communication cable is located on the electrical rear panel of the laser. This cable provides circuit connections for the laser control software and other functions.
- Emission Indicator: If the laser is turned on, the emission indicator on the laser's rear panel will light up.
- Warning Labels: The danger label on the rear panel of the laser head indicates information such as the laser class, the triangle points in the direction of the laser emission.

2. Laser Usage Requirements and Precautions

2.1 Electrical Requirements

#	Item	Requirement
1	Input Voltage	90V - 264V
3	Power	450W

2.2 Environmental Requirements

#	Item	Requirement
1	Ambient Temperature	15-35°C
2	Ambient Humidity	20-80%
3	Vibration Source	Keep the laser away from vibration sources
4	Cleanliness	Clean environment or dust-free workshop
5	Installation platform flatness	High-flatness surface
6	Electromagnetic Environment	National Standard Grade II

2.3 Chiller Requirements

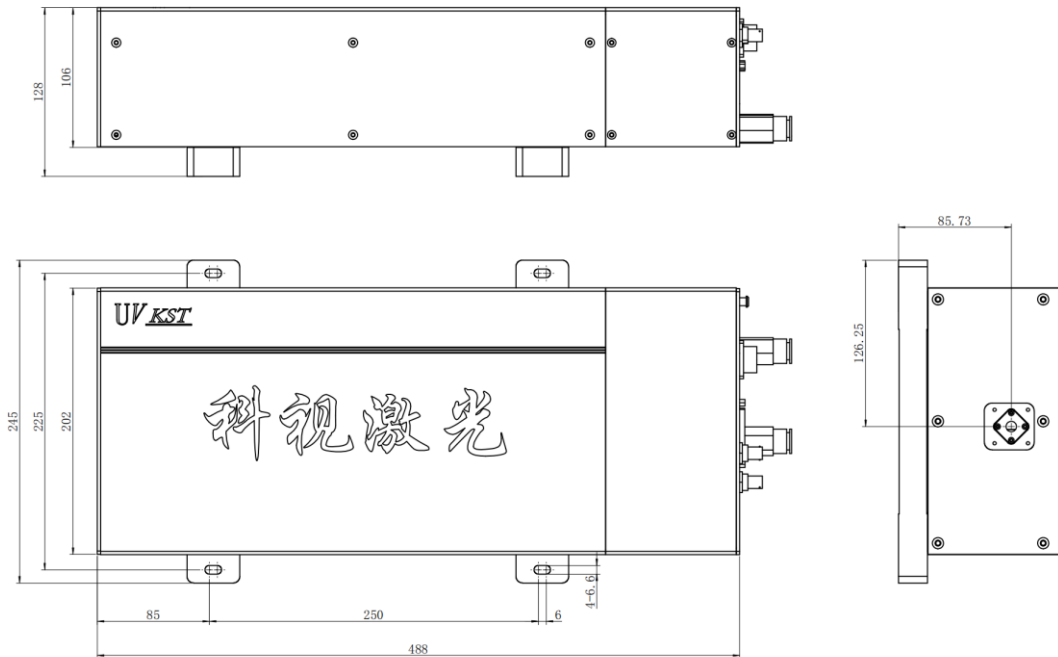
#	Item	15W / 20W	≥ 30W
1	Cooling Capacity	> 800 W	> 1000 W
2	Water Flow Rate	7-10 L/min	8-12 L/min
3	Temperature Control Accuracy	± 0.2°C	± 0.1°C
4	Water Pump Head	10-20m	
5	Circulating Water Quality	Distilled Water / Purified Water	
6	Water Pipe Size	Standard single-sided water pipe 3m	

2.4 Other Precautions

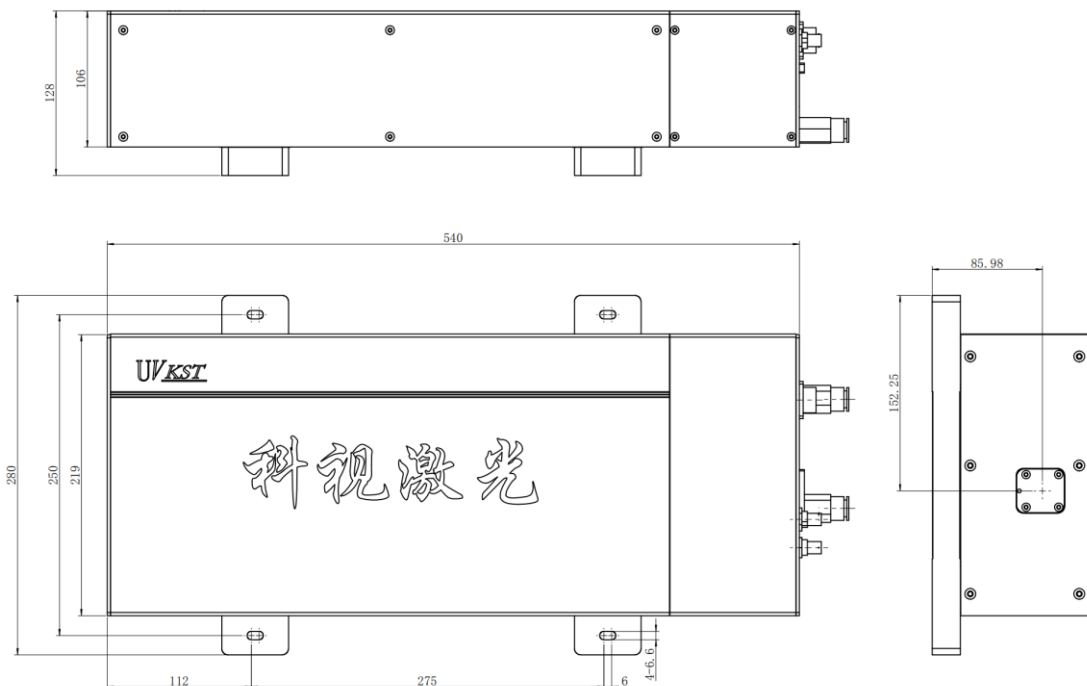
- The switching power supply provided with the laser must be used. Ensure the power cord is connected correctly to guarantee reliable and stable operation. **Any damage to the laser caused by using a power supply not provided by our company is not covered under warranty.**
- The laser should be used with a water tank that meets the requirements. Excessive water pressure will compress the cavity, causing deformation and resulting in power attenuation.
- The chiller must be set to the correct water temperature according to the factory test report provided with the laser.
- The circulating water in the chiller must be distilled or purified water, and it is recommended to replace it once every month.
- The external optical path following the laser output port must be sealed to reduce contact between the window lens and the external environment, thereby extending the service life of the window lens (**Note: the window lens is a consumable item**).
- The laser needs to be stored while powered on. Harmonic lasers (Green or UV lasers) must remain connected to a power source at all times to maintain the temperature of the harmonic crystal, which maximizes the reliability of the laser.
- When the laser is out of service for an extended period, the window cover must be installed.

3. Laser Interface Descriptions and Accessories

3.1 Laser Dimensional Drawing



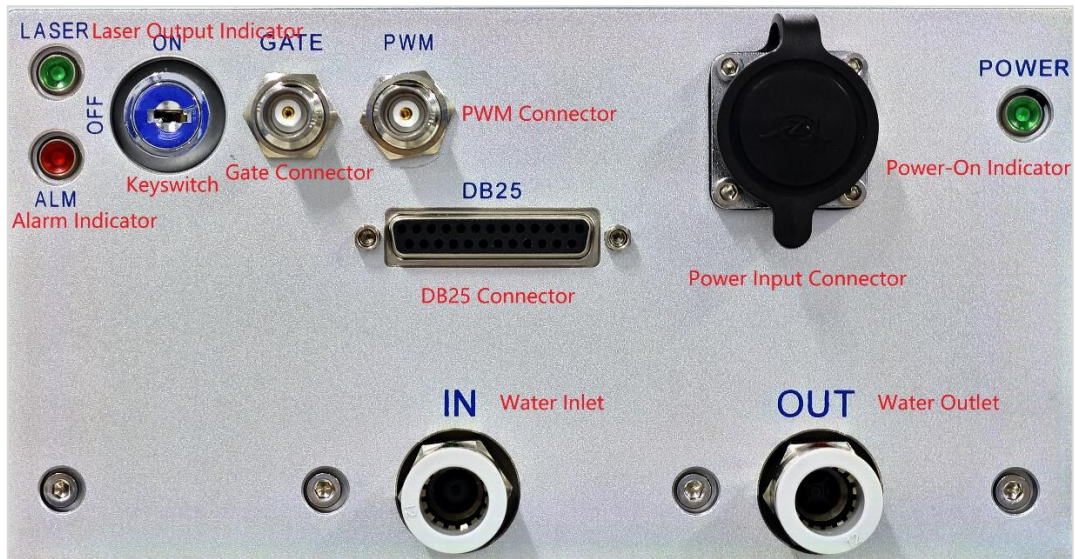
KSL-355-15/20 and KSL-532-25/35 laser Dimensional drawings



KSL-355-30, KSL-532-50 Laser Dimensional Drawings

3.2 Laser Interface Introduction

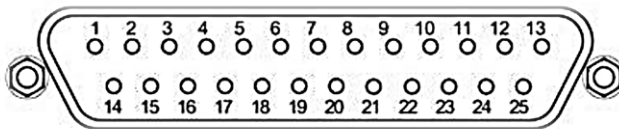
3.2.1 Laser Interface



Laser Rear Panel Physical Diagram

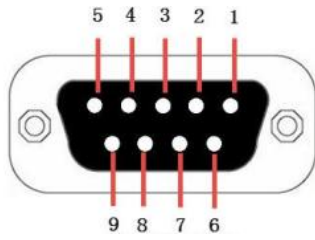
3.2.2 Communication Interface

- DB25 Connector (Male) Definition:



Pin	Definition	Description	Remarks
7-21	Laser Output Status	Conductive when light is emitted. Disconnected when no light is emitted.	
13	GND	Reference Ground	
14	Serial RX	Receive Data	
15	Serial TX	Send Data	
16	GND	Reference Ground	
18	Safety Interlock	The laser emits light when connected. The laser does not emit light when disconnected.	
19	GND	GND, Reference Ground	
22-23	Error Status	Conducts when the laser has a fault Disconnects when the laser is fault-free.	
1-6, 17	Empty		

- RS 232 interface (female) definition:



Pin	Definition	Description	Remarks
2	Serial TX	Send Data	
3	Serial RX	Receive Data	
5	GND	Reference Location	
1, 4, 6-9	Empty		

3.2.3 Water Pipe Connection

- Use the standard water pipes provided for the connection.
- When connecting the water pipes, ensure they are firmly inserted into the quick connectors to prevent them from loosening due to improper connection.
- **Connection direction: Chiller water outlet — Laser water inlet. Chiller water inlet — Laser water outlet.**
- Chiller installation requirements: Sufficient space should be left around the sides and top to facilitate heat dissipation and maintenance.
- Before turning on the water chiller, ensure that all connectors are tightly secured to prevent loosening or water leakage.

3.3 Packing List

Standard configuration. Please contact sales personnel for any additional requirements.

#	Name	Quantity	Remarks
1	Laser	1	
2	Switching Power Supply	1	
3	3m Water Pipe	2	
4	Signal Port Connection Cable	2	
5	DB 25-RS232 Connection Cable	1	
6	Key	2	
7	USB Flash Drive	1	Includes manual and software package
8	Paper Inspection Report	1	

Note: The beam expander is an optional external accessory and is susceptible to damage due to variations in external operating conditions. It is not covered under warranty.

4. KSL Laser Control Software Instructions

4.1 Computer Configuration Requirements

The computer system must be a Windows 32/64-bit operating system.

Confirm that .NET 4.0 or higher is installed on the computer to use the KSL laser control software.

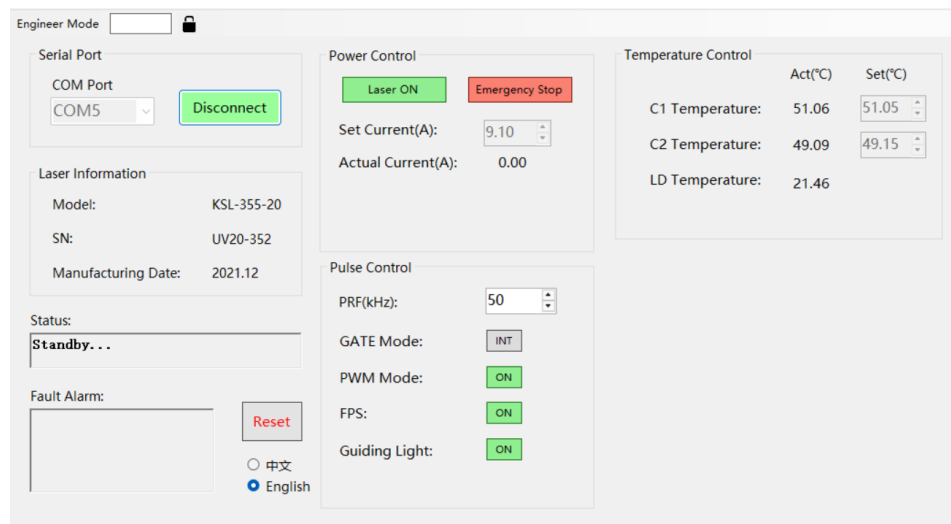
4.2 Software Installation Instructions

The KSL series laser control software is a portable application provided on the USB drive included with our shipment. It can be used immediately by double-clicking to open, with no installation required.

Software Name: **KSL_LASER**.

4.3 Introduction to the Control Interface

The following is the KSL series laser control software, which is primarily divided into 5 major sections: Serial Connection, Laser Status Display, Power Control, Temperature Control, and Pulse Control.



- **Serial Settings:** Once the laser is powered on, you can connect the serial connection to the laser by searching for the COM port.
 - **Device Status:** Indicates the status of the laser, such as whether it is currently emitting laser.
 - **Power Control:** Includes Laser on/off, Emergency stop, and Current control.
 - Laser On/Off: One-step start/shutdown of the laser.
 - Emergency Stop: Click this button to turn off the laser in case of an emergency. (In this case, it is recommended to directly turn off the laser key switch or disconnect the power supply).
 - Current Control: Users can adjust the current rise and fall within the limits. The actual current in the software can be checked and compared with the factory report (modifying current settings is not recommended).
 - **Temperature Control:** Displays the LD temperature and the C1 & C2 crystal temperature.
 - **Pulse Control:** Includes 5 sections: PRF, FPS, Guiding Light and Gate/PWM control.
- Note:** To ensure safe use and prevent accidental laser emission that could cause injury, KSL lasers are set to external PWM frequency control by default from the factory. (This default setting applies to specific models. Green laser models do not support PWM frequency control. Please refer to Section 6.2.2 for details.)

5. Basic Laser Operation

5.1 Pre-installation Confirmation

5.1.1 Ensure the flatness of the laser installation platform.

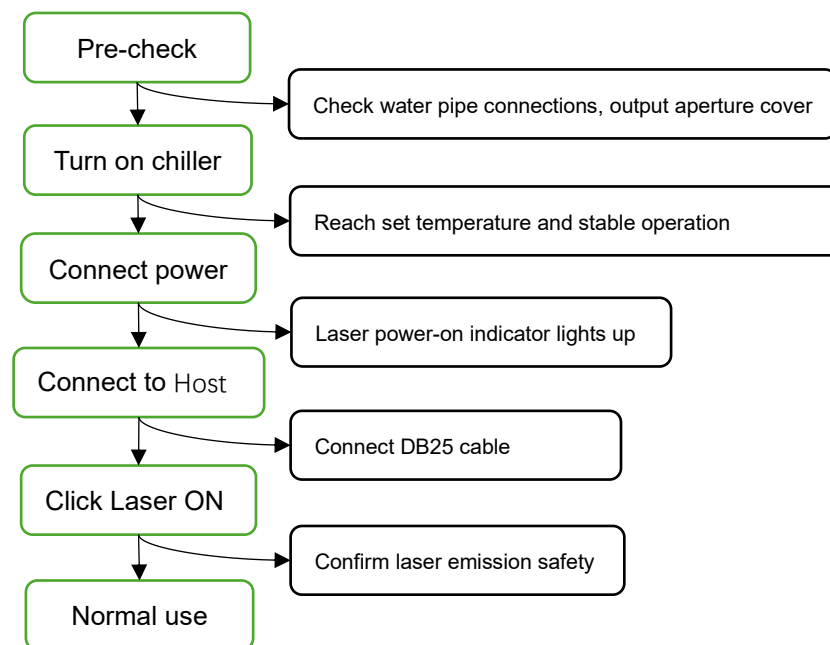
5.1.2 Ensure that safety protection measures around the laser installation are in place.

5.1.3 Connect the laser and the chiller according to the specified water flow direction, and check whether the water pipe connections are tight.

5.1.4 Turn on the chiller and check for any water leaks.

5.1.5 Wait for the chiller water temperature to reach the set value and remain stable for 10-15 minutes.

5.2 Powering on the Laser



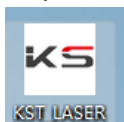
Laser Startup Procedure

Precautions:

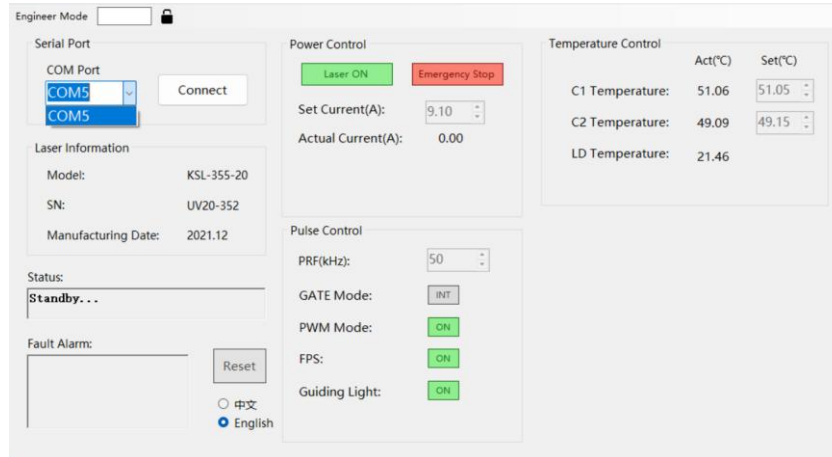
- Pre-emission check: Ensure the laser output cover has been removed. External signal lines are either disconnected or not inputting signals.
- The laser should only be turned on after the chiller is started and the water temp has stabilized.
- Connect the laser to the computer using a DB25-RS232 cable, then turn on the laser power supply and the laser key switch in sequence.

5.2.1 Connection and Use of the Host Computer Software

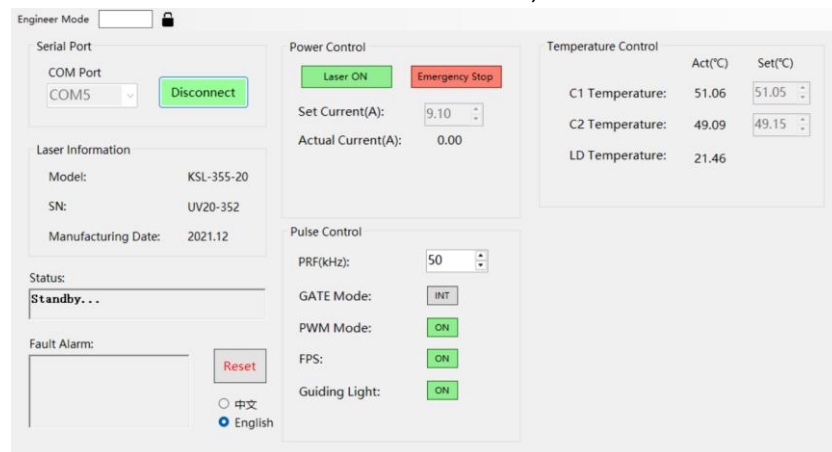
- No installation is required. Double-click the control software (KSL Laser Control Software) on your computer to enter the following interface:



- Select the serial port number, click "Connect", and the serial port button will turn green. The following interface will be displayed, indicating that the laser has been successfully connected.



5.2.2 By default, the PWM frequency mode is set to ON. Click the "Laser ON" button and wait approximately 5-10 minutes for the laser to stabilize. Once safety is ensured, customers can set different control modes to operate the laser (Internal Control, Gate Control, PWM Frequency). (Note: This default setting applies to specific models. Green laser models do not support PWM frequency control. Please refer to Section 6.2.2 for details.)



5.2.3 At this point, the laser startup is complete. The weak light output can be used as a Guiding Light. Once safety is ensured, customers can set different control modes to operate the laser (Internal Control, GATE Control, PWM Frequency).

Begin adjusting the optical path or setting up power meter testing (please re-confirm optical path safety before emitting high-power light to avoid injury).

5.2.4 Precautions

- The laser system should be set to internal control for high-power emission and external control for guide light when no signal is provided. If any abnormalities occur, please contact our after-sales personnel.

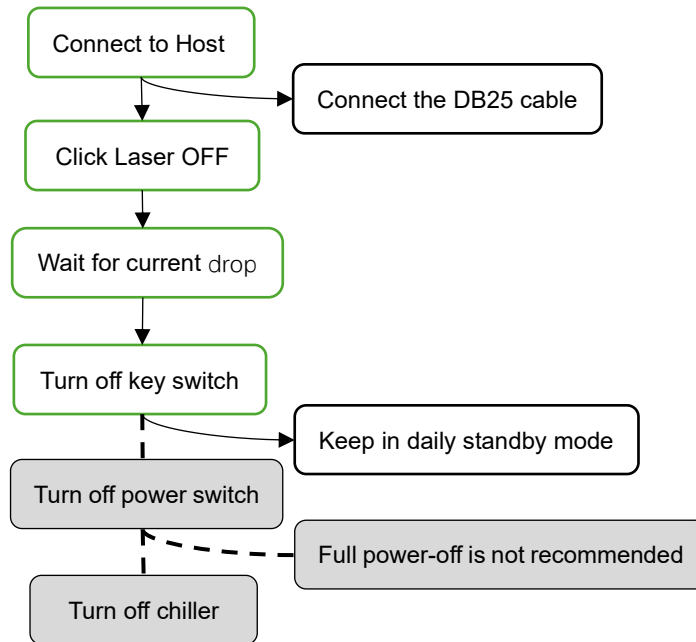
For safety reasons, to prevent accidental Laser emission from causing injury, and for the convenience of the customer, the laser's PWM mode is set to "ON" by default. (Note: This default setting applies to specific models. Green laser models do not support PWM frequency control. Please refer to Section 6.2.2 for details.)

5.3 Powering off the Laser

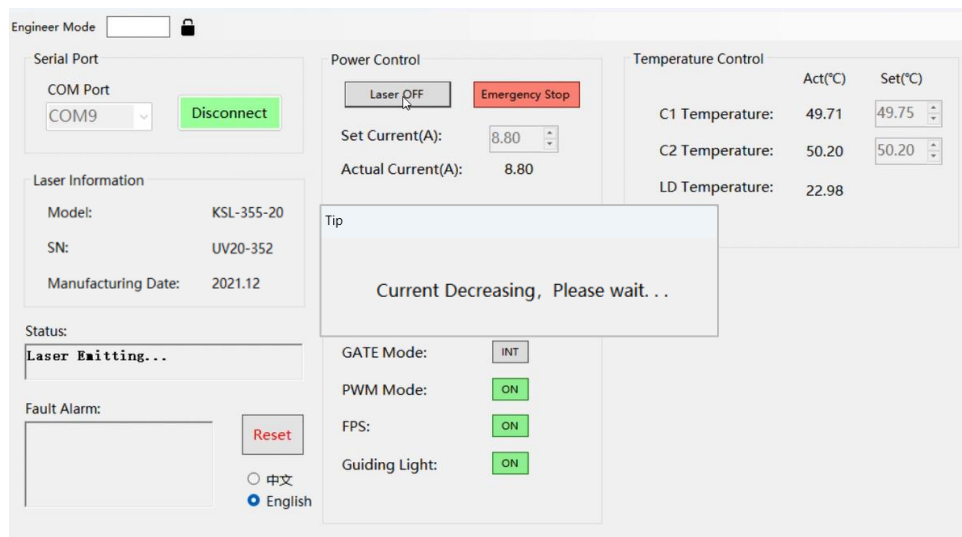
5.3.1 Laser shutdown requirements: The water chiller must not be turned off before the laser is shut down.

5.3.2 Open the laser control software, select the serial port, and establish the communication connection.

5.3.3 Click the "Laser Off" button and wait for the current to decrease.



Laser Shutdown Procedure



5.3.4 Click the " Disconnect" button to disconnect from the laser.

5.3.5 Turn off the laser's key switch.

Note: After turning off the laser output, please keep the laser powered on. At this time, the laser's crystal temperature control remains active, which not only reduces the warm-up time when the laser system is restarted but also extends the operating life of the crystal.

6 Laser Control Mode

The KSL series lasers offer two operating modes (Internal Control and External Control, where External Control is further divided into Gate mode and PWM frequency mode). These can be accessed and modified via the host computer, allowing users to select the most suitable operating mode for their application.

6.1 Internal Control

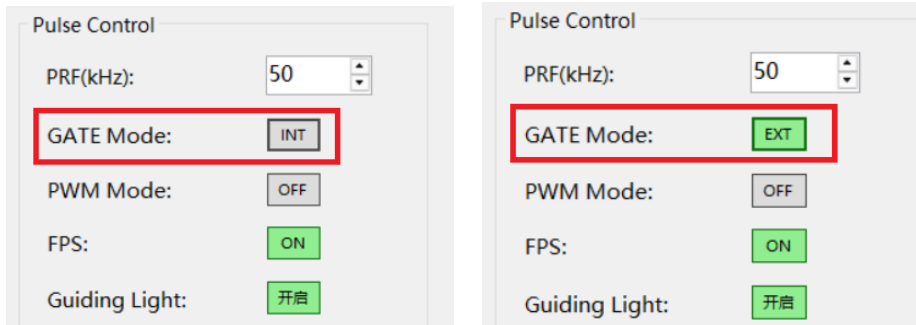
When the laser receives no external signal, it operates in pure internal control output mode.

6.2 External Control Modes: Gate Control and PWM Frequency

6.2.1 Using External Gate Control

As shown in the red marked position in the figure below, click the "Internal / External" button for the gate signal to switch to External Gate control.

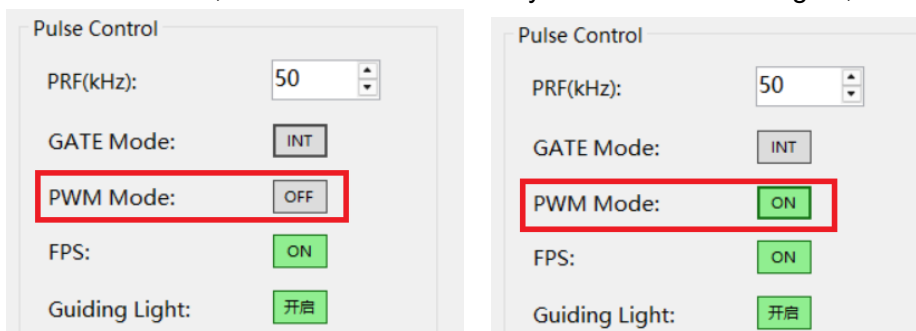
At this point, the laser gate accepts an external TTL signal (0-5V) to control the laser's on/off state.



6.2.2 Using PWM Frequency Control

As shown in the red marked position in the figure below, click the "ON / OFF" button for the frequency mode to switch to External PWM Frequency control.

Once enabled, the laser is modulated by an external PWM signal, TTL signal (0-5V).



Note: Green model lasers currently do not support PWM frequency control.

6.2.3 Precautions

- Please ensure the use of shielded signal cables to prevent interference.
- Do not connect signal cables with unnecessary wires or terminals to prevent crosstalk.
- Please ensure that the signal transmission voltage is within the specified range of 0-5V. Excessive voltage may damage the laser.

7 Warranty and Maintenance

During the Warranty Period:

Dongguan KSL Laser Tech Co., Ltd. pledges that all products designed and manufactured according to the specifications of the order or contract will be warranted against any defects caused by materials, technology, or production processes for the duration of the warranty period stipulated in the order or contract after shipment, and guarantees that they will conform to specifications under normal use.

However, damage caused by the following reasons is not covered by the warranty:

- 1) Damage to products and components caused by disassembly, incorrect installation, or modification performed by personnel other than our company's technicians.**
- 2) Damage caused by improper use, negligence, or accidents.**
- 3) Use, incorrect installation, or maintenance that exceeds the product specifications and technical requirements.**
- 4) Abuse or failure to follow the information and warnings provided in the user manual.**

It is the customer's responsibility to understand the above information in detail and operate the equipment in accordance with the requirements specified in the user manual and operating procedures. Otherwise, any malfunctions caused by improper operation will not be covered under warranty.

Dongguan KSL Laser Tech Co., Ltd. has not authorized any third party (including authorized agents, designated purchasers, end users, or customers) to perform repairs on the laser.

This warranty also does not cover components, equipment, or other products not manufactured or provided by KSL Laser.

Out of Warranty:

For products outside the warranty period, the company provides paid repair services. Relevant material and labor costs will be charged accordingly, with specific fees determined by the material procurement prices and service standards at the time of repair.

The above warranty and service terms from KSL are for user reference only. The official service and warranty content shall be subject to the provisions stipulated in the contract.

KSL reserves the right of final interpretation.