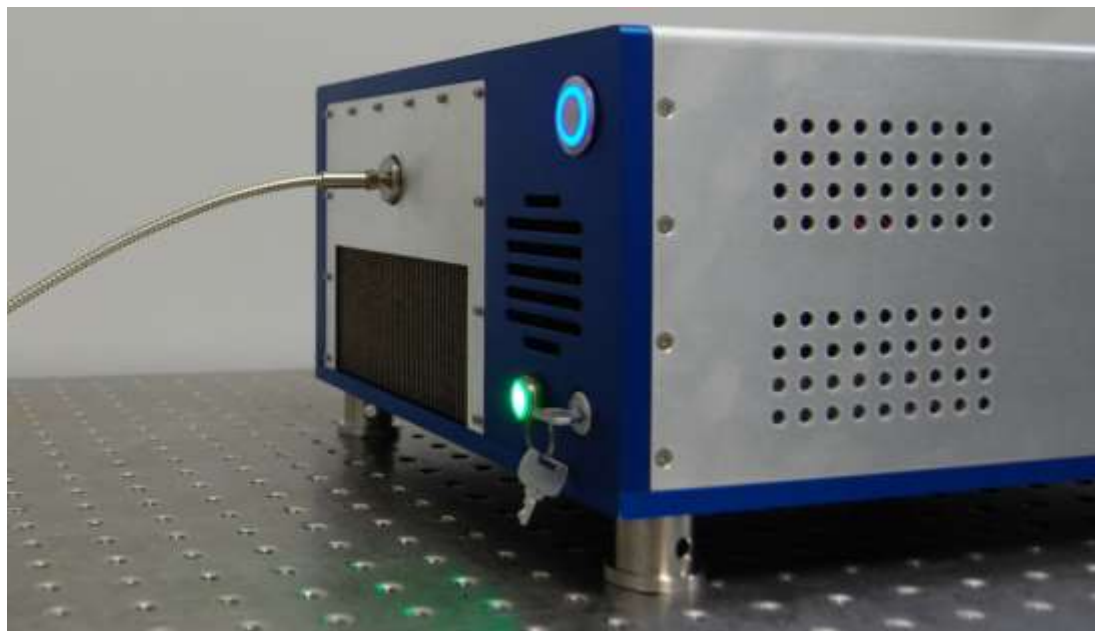


D-Light-HP

High Power Fiber-Coupled Diode Laser

Operator's Manual





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Preface

This manual provides information and guide line to use Raytum Photonics' D-light high power fiber coupled semiconductor laser system. It contains all the information you need to install, operate, and maintain the product safely and knowledgeably. Please make sure to read this manual carefully before installation of this D-light diode laser system.

Before installation, please inspect the shipping container and diode module itself for damage. In case of any damage is found, including cosmetic damage, immediately contact Raytum Photonics customer service.

U.S. Export Control Laws Compliance

It is the policy of Raytum Photonics to comply strictly with U.S. export control laws. Export and re-export of lasers manufactured by Raytum Photonics are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations.

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification should be obtained from Raytum Photonics or an appropriate U.S. Government agency.

1. Laser Safety

All manufacturers of lasers in the United States must confirm to regulations administrated by the Center for Devices and Radiological Health (CDRH), a branch of the U.S. Department of Health and Human Services. CDRH categorizes lasers as the follows:

Class	Description
I	A laser or laser system which does not present a hazard to skin or eyes for any wavelength or exposure time. Exposure varies with wavelength. For ultraviolet, .2 to .4 μm exposure is less than from .8 nW to .8 μW . Visible light exposure varies from .4 μW to 200 μW , and for near IR, the exposure is < 200 μw . Consult CDRH regulations for specific information.
II	Any visible laser with an output less than 1 mW of power. Warning label requirements — yellow caution label stating maximum output of 1 mW. Generally used as classroom lab lasers, supermarket scanners and laser pointers
IIIa	Any visible laser with an output over 1 mW of power with a maximum output of 5 mW of power. Warning label requirements — red danger label stating maximum output of 5 mW. Also used as classroom lab lasers, in holography, laser pointers, leveling instruments, measuring devices and alignment equipment.
IIIb	Any laser with an output over 5 mW of power with a maximum output of 500 mW of power and all invisible lasers with an output up to 400 mW. Warning label requirements — red danger label stating maximum output. These lasers also require a key switch for operation and a 3.5-second delay when the laser is turned on. Used in many of the same applications as the Class IIIa when more power is required.
IV	Any laser with an output over 500 mW of power. Warning label requirements — red danger label stating maximum output. These lasers are primarily used in industrial applications such as tooling, machining, cutting and welding. Most medical laser applications also require these high-powered lasers.

- **The D-light semiconductor laser system emits Class IV radiation.**
- **The greatest concern when using a laser is eye safety.**
- **Caution must be extremely exercised during operation. The laser will be operated only by those who have had training in laser theory, techniques of control, and operation of the laser(s). It is recommended that users take approved laser safety courses prior to operating any Class IV laser devices.**

	Safety glasses must be worn by all persons presented at all times while the laser is in operation. The safety glasses must be specific to the wavelength of the laser being used. Protective eyewear will be labeled according to the optical density and wavelengths filtered
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	No safety glasses or filters offer eye protection against a direct, close range impact through the safety material into the eyes. Personnel will therefore not point the laser or fiber directly at any person's face. The laser fiber will always be handled as a "loaded gun" and pointed in a safe direction in the event of an accidental firing.
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	Eyewear and filters should be without defect. Frames should not be broken and separated from the lenses. Side shields - if optionally used - should be in place, and no scratches should be on the front lenses. The laser operators or safety officer will make periodic inspections for these defects.
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	Post warning signs for Class IV lasers at entry doors and at point of use.
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2. Packaging and Accessories

Please open the packing box carefully and check the items in it as follows:

D-Light Laser	× 1
User Manual	× 1
Test Report	× 1
Spare Fuses	× 2
Packing List	× 1
AC Power Cord	× 1
USB A-A cable	× 1
USB B-A cable	× 1
USB Flash Driver	× 1

The package should be opened in an electrostatic discharge (ESD) free environment.

The operator should be properly grounded at the same level as the working surface.

The device should be unpacked on an ESD free surface. The laser electronics can be seriously damaged by the electro-static discharge. Even if the damage is not immediately apparent, it may shorten the lifetime of the unit.

Before any operation, please make sure the laser system is free from mechanical damage, which may have occurred during transportation.

Keep the original shipping container for use in case the device needs to be returned for repair or service.

3. Product General Information

3.1 Product Description

D-light-HP fiber coupled diode laser is a complete, turn-key system suitable for material processing, medical therapeutics and pumping solid-state laser media. The system consists of a single enclosure which integrates the laser head mounted on an air-cooled heat sink, thermoelectric coolers and all necessary drive and control electronics. The optical radiation is delivered via a front panel mounted SMA 905 connector with continuous wave (CW), high power, ultra-narrow linewidth output, transported by an industry standard 2 meters long and sheathed in a stainless steel jacket for rugged industrial application.

The *D-Light-HP* is controlled through computer software which provides the setting and reading of laser diode driving current and temperature. The tuning of lasing wavelength is also through the software which is a unique feature of this laser system and enabled through Raytum Photonics proprietary patent pending technology.

Features:

- High output power: >50W (CW)
- Wavelength tuning: +/- 0.2 nm around nominal value (like 794.7 nm)
- Linewidth < 0.2 nm
- High stability and reliable performance
- Turn-key system
- Fiber pigtail, 600µm diameter with NA of 0.22

Applications:

- Spin Exchange Optical Pumping (SEOP) for noble gas like ^3He or ^{129}Xe
- Alkali gas laser pumping
- Thulium doped fiber laser pumping
- Industrial laser drilling and marking
- Test and measurement

3.2 Product dimensions

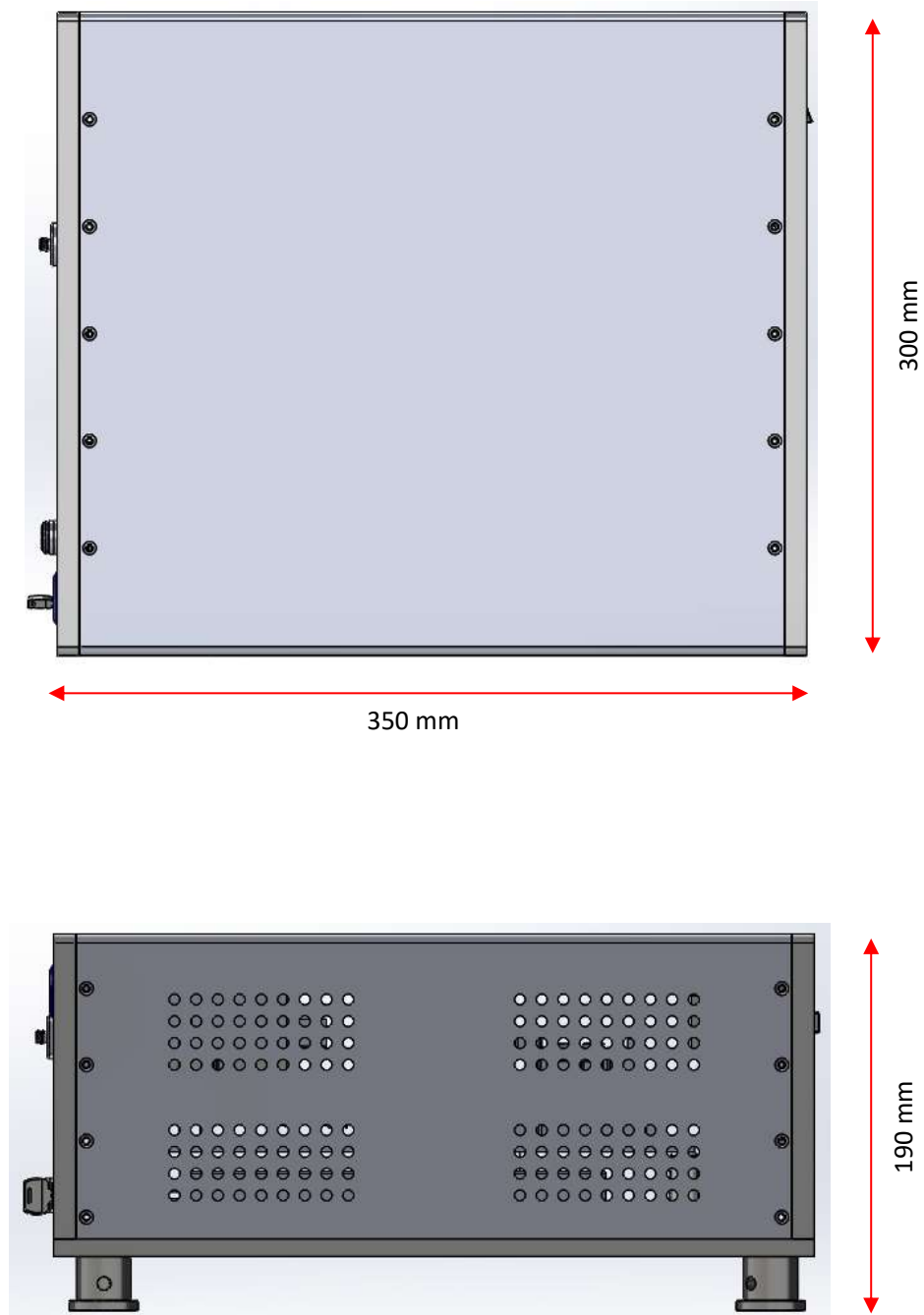


Figure 3.1 D-light diode laser system dimension

3.3 Product Specification

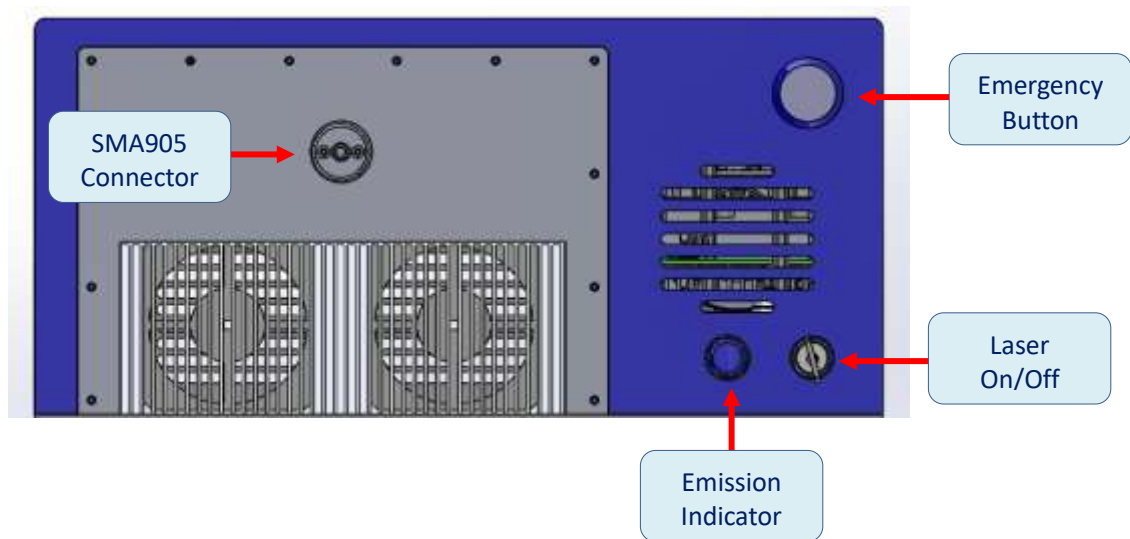
Table 3.1 D-light Diode Laser Module Specification		
Specification	Parameter	Note
Optical Parameters		
Output power	>50W	CW
Nominal Wavelength	794.7 nm	At 50W output power
Spectrum width	<0.2 nm	FHWM
Fiber diameter	600 μ m	
NA	0.22	
Electrical Parameters		
Threshold current	14 A	
Operation current	Typical 65 A	See datasheet for specific value
Operation voltage	2.0 to 3 V	
Thermal Parameters		
TEC temperature	20 to 35 $^{\circ}$ C	See data sheet for specific value
Laser Head Mechanical Parameters		
Dimension	350 \times 300 \times 190 mm	L \times W \times H
Weight	3.0 kg	
Fiber length	2.0 m	
Fiber connector	SMA 905	

4. Operation Instruction

4.1 Physical Interface

Front Panel

The details of the front panel are shown below:



- **Laser ON/OFF Key**

Turn on or off the laser. When the laser is on, the **Emission Indicator** is on.

- **Emergency Button**

Press down to shut down the laser operation when emergency happens. Press again to recover the operation status.

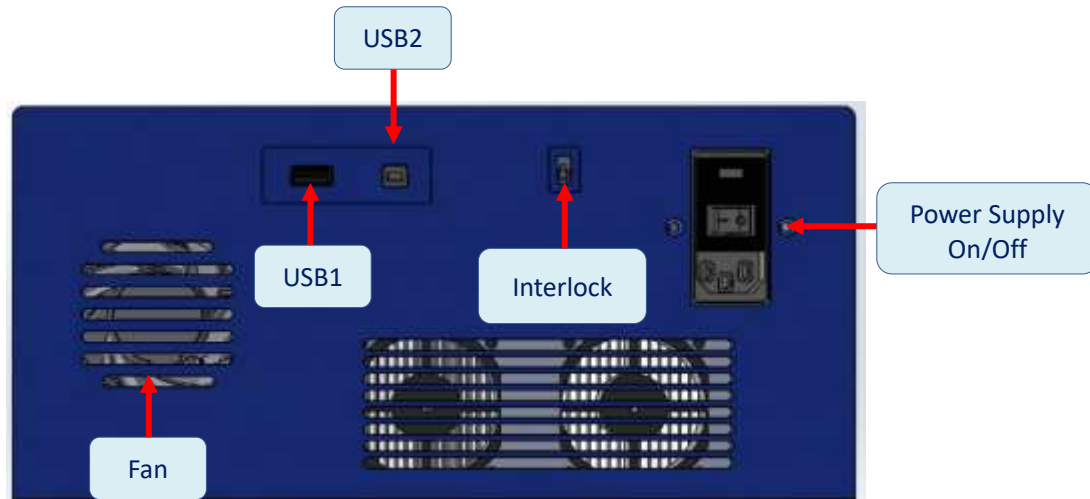
Caution: When the emergency button is back to normal position, the laser operation is also back to the status right before the emergency button is pressed. For safety, it is strongly suggested to lower the laser current below the threshold before recover the emergency button position to normal.

- **SMA905 Connector**

The SMA905 connector is shipped with protect cap. Before the laser operation, please make sure the fiber cable is inserted into the connector and secure.

Back Panel

The details of the back panel are shown below:



- **Power Supply ON/OFF**

Turn on or off the laser power supply. When the power supply is on, the blue indicator inside the **Emergency Button** is on.

- **Interlock**

Defeat this interlock to allow laser current to flow. A connector with a jumper wire installed is provided with the unit.

- **USB 1**

Serve as driving current and bar temperature control. The USB A cable is included in the package.

- **USB 2**

Serve as lasing wavelength tuning. The USB B cable is included in the package.

- **Fan:**

Do not obstruct the air flow. All fans must keep unobstructed in order to properly cool the laser. Failing to provide the adequate cooling can shorten the lifetime of the laser and/or impair the performance of the laser.

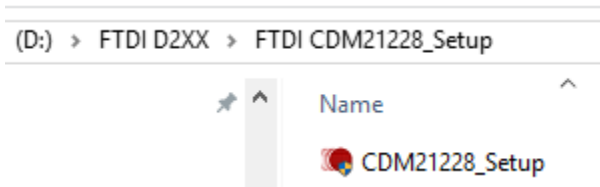
4.2 D-Light Driver

Installation

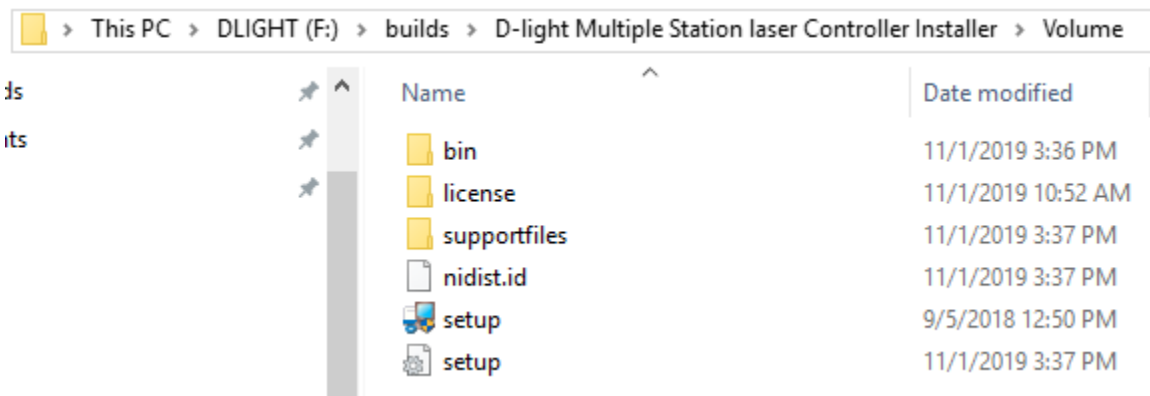
First of all, make sure the USB driver is included in the shipping package.

1) Install firmware driver

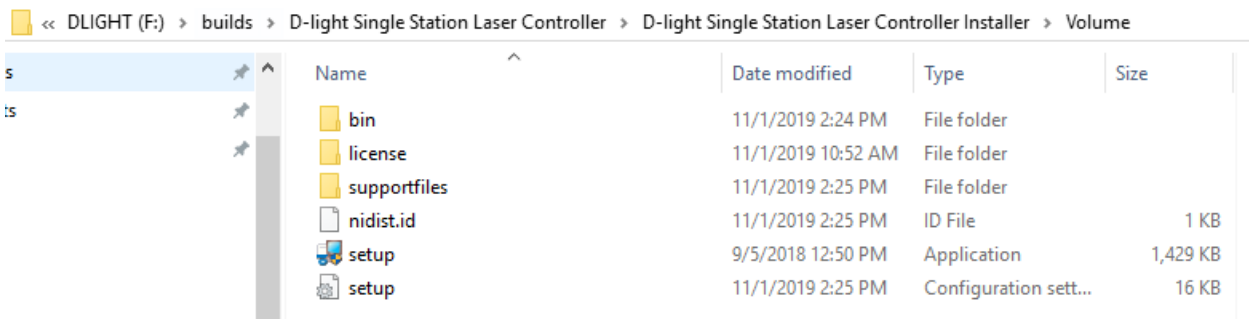
Find the file “CDM21228_Setup” from USB driver and double click



2) Install Laser controller: double click “setup”



For single station laser controller, run this “setup”

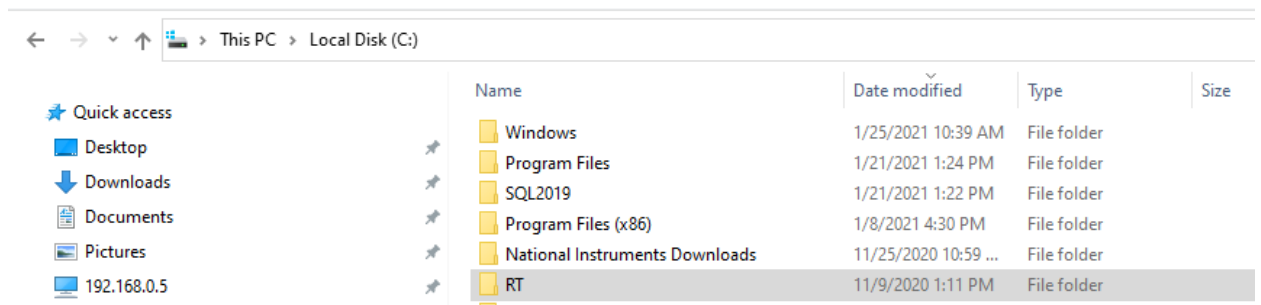


3) Copy configure file: copy “RT” folder and paste it to “C:” disk.

Copy:



Paste:



Required Connections

- AC power

Plug the supplied input power cord into the rear of the unit.

- Laser Enable Key

The key must turn on and make sure the indicator is on.

- Host computer interface cable

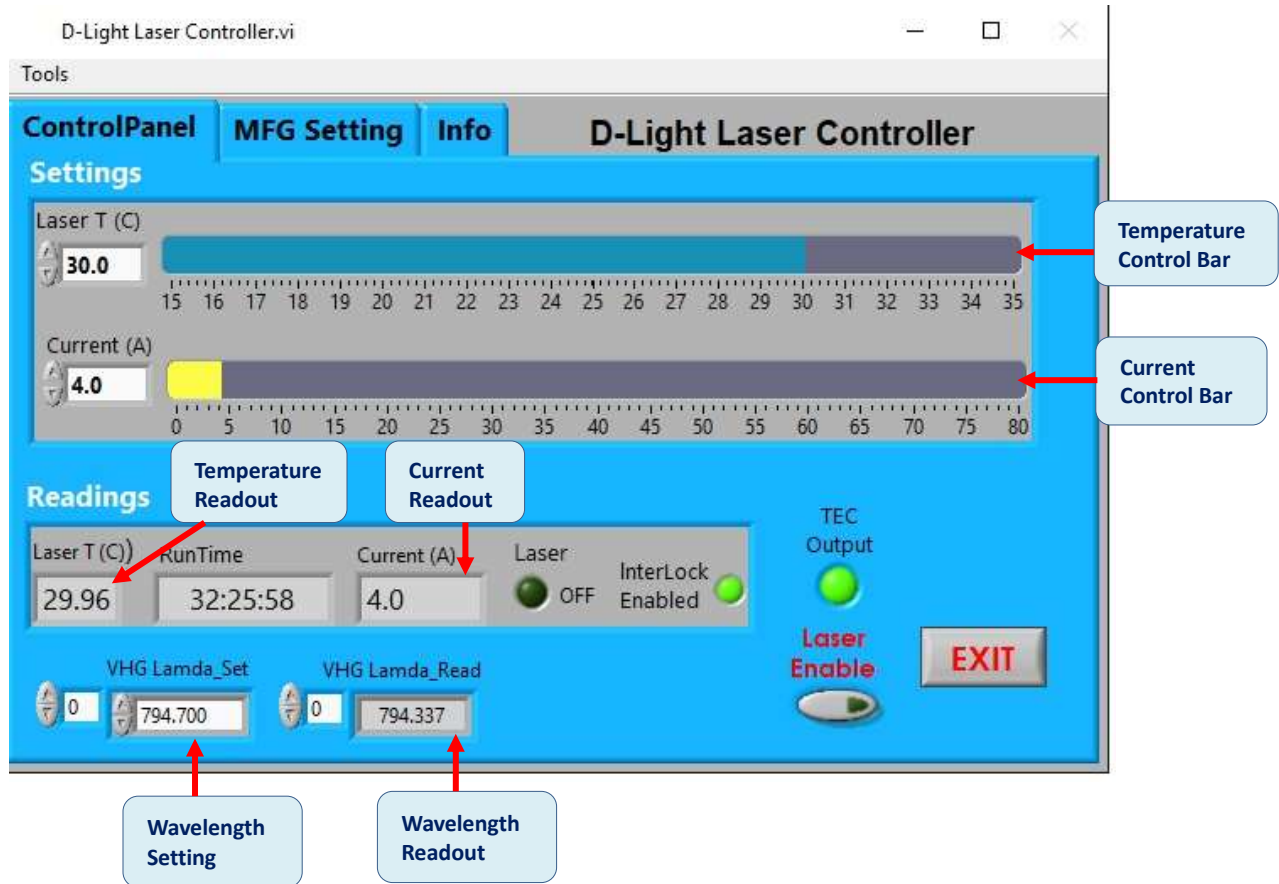
The D-Light is operated from a host computer, which need to be connected by a standard USB A-A and a USB B-A cable. Both connectors are on the rear of the unit.

- Interlock

The D-Light interlock is in the rear of the unit as shown in part 4.1. The interlock is a small two-pin connector and must be shorted to allow laser current to flow. A short between these pins will close the interlock and allow the laser to operate.

Running the Software

Double click C:\RT\D-light single station controller.exe. Self-checking process will start immediately to determine if all necessary drivers are properly installed. If the self-checking passed, the software interface is shown below:



- **Laser Temperature Setting**

The diode temperature is preset as shown as “30.0” in the window in the left of control bar while the actual temperature of laser diode is displayed on the window of “Temperature Readout”, as shown as “24.030” in the figure above. Users can easily adjust the setting temperature by moving the slider in the temperature control bar to change the set point. This value is remembered by the controller in case of the power off.

Caution: Different laser system has different temperature preset value which usually is between 25-30. User is NOT recommend adjust the temperature unless the output spectrum showing obvious pedestal or side mode from the main peak.

- **Laser Current Setting**

For safety reason, the laser current is always set at 4A every time when the software starts. The maximum current is preset at 80A.

Caution: User is STRONGLY suggested to adjust current to 12A (threshold value) first to make the system working well. The current should gradually increase by 10-20A a step.

- **Wavelength Setting**

The peak wavelength is always preset at 794.7nm as shown in the figure. If users find the deviation from their own spectrum measurement, they always can adjust the value by entering 794.7nm +/- compensation value. For example, if users find the actual spectrum measurement is 794.8nm, they can enter 794.6nm to adjust the wavelength back to 794.7nm in the actual measurement. The preset value can be adjusted from configure file too.

4.3 Operation Procedure

- **Turn on power supply for laser system**



Make sure proper laser safety precautions are in place.



Make sure the fiber cable is inserted and fixed in fiber connector.

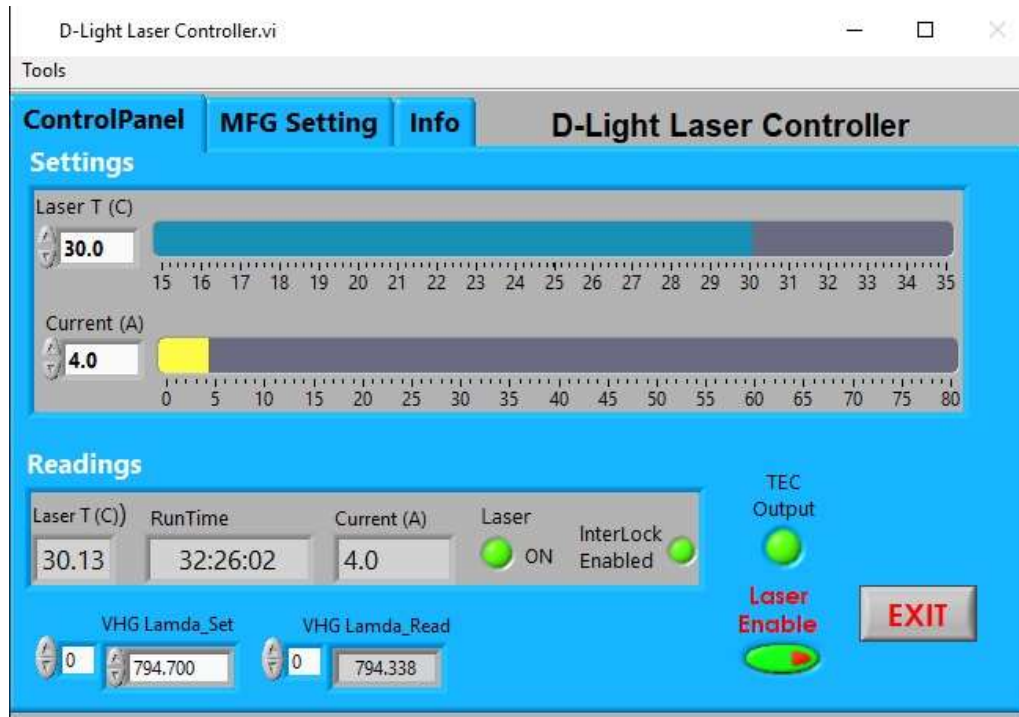


Make sure that power measurement or spectrum measurement set up is ready.

When the AC power supply is turned on, the LED indicator is right on inside the emergency button.

- **Turn on Laser**

As long as the current setting value and temperature setting value are properly, the laser output can enable by clicking “laser enable” button, and the software interface should be like the picture below. Both Laser ON and Laser Enable indicators are GREEN.







- **Shut down the laser system**
Click “Laser Enable” button to shut down the laser.
Click “EXIT” button.

4 Service and Maintenance

The D-light diode laser system is a maintenance-free device. Periodic operation, maintenance, and service of this laser are not required. The warranty will be voided if entry has been made to the laser housing and/or seals have been removed.

To achieve best performance, please comply by the following notes:

	Don't expose fiber end faces by particles. Unpack, handle and operate the diode module only in clean and under dew point environment.
	Please use proper ESD protection measures when installing, handling, and operating the device.
	Don't operate the diode laser under dew point
	When not in use, use the shorting wires to short the anode and cathode. Place the device in a static-protected place. The temperature of the storage place shall be within -10°C and 50°C.

In the rare case this diode module malfunctions, please only ask Raytum Photonics' service engineer to repair. Please follow the procedure:

- Please call Raytum Photonics' service department to request an RMA number and form. Phone: (703) 831-7809
- Fill the RMA form as instructed.
- Pack the diode laser system in its original package box.
- Ask Raytum Photonics to provide one in case the original package box is not available.
- Ship the package to:

Raytum Photonics LLC.
43671 Trade Center Place, Suite 104
Sterling, VA 20166
USA