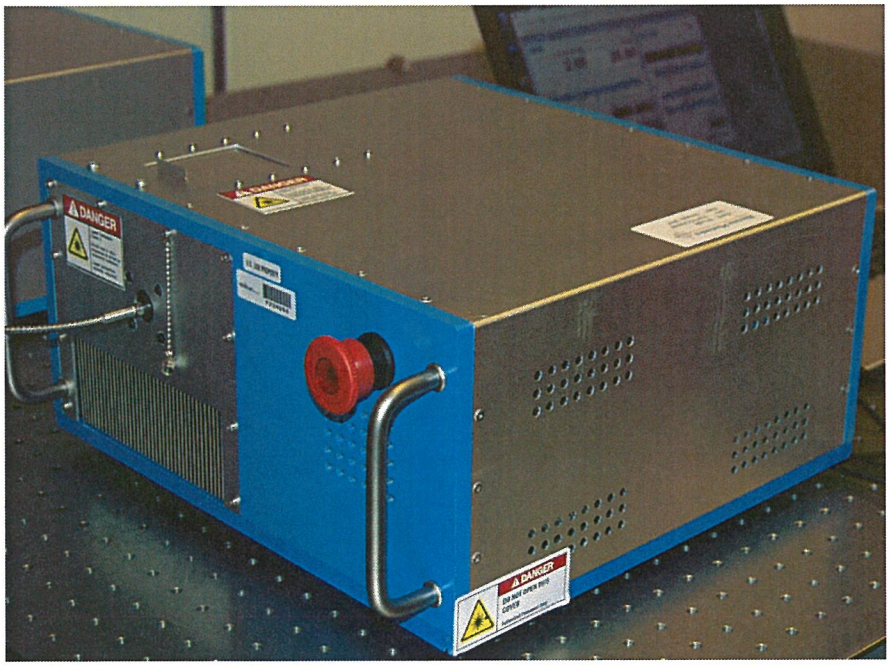
D-Light-HP

High Power Fiber-Coupled Diode Laser

Operator's Manual



Raytum Photonics

Rev. 3.0

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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.

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:

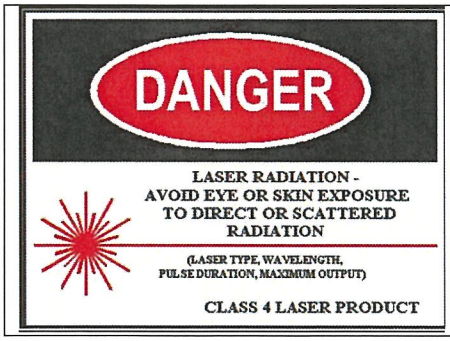
Class	Description
I	A laser or laser system which does not present a hazard to skin or eyes for any wavelength or exposure time. Exposure varies with wavelength. For ultraviolet, .2 to .4 µm exposure is less than from .8 nW to .8 µW. Visible light exposure varies from .4 µW to 200 µW, and for near IR, 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

	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.

	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.

	Post warning signs for Class IV lasers at entry doors and at point of use.

2. Product General Information

2.1 Product Description

D-light diode laser system delivers CW, high power, ultra narrow linewidth semiconductor laser via a 2-meter long, 800 um diameter silica fiber terminated by an industry standard SMA 905 optical connector.

With Raytum Photonics' proprietary patent pending technology, our D-light series provide fiber-coupled high power diode laser with both ultra-narrow linewidth and wide tuning range.

D-light diode laser is electrically driven by a low voltage, high current electrical current source. It is actively air-cooled by Thermoelectric Cooler (TEC) modules. The center wavelength of the laser is insensitive to environmental temperature. It is adjusted mechanically through a micrometer to accurately tune the wavelength. These features are enabled through Raytum Photonics proprietary patent pending technology.

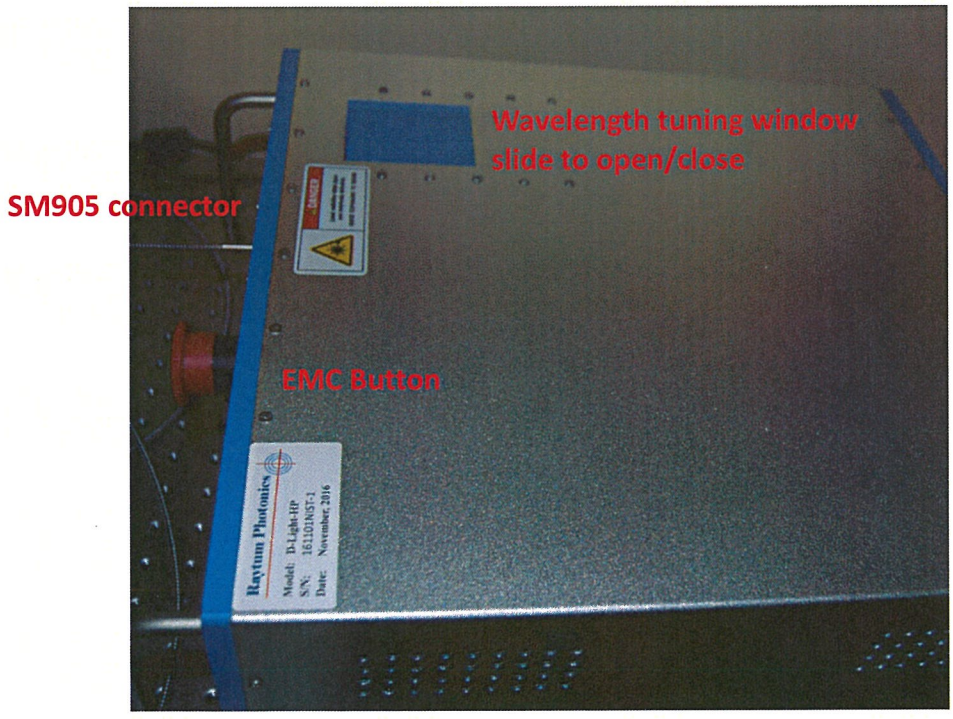


Figure 2.1 Laser head of D-Light high power diode laser system.

Table 2.1 below list the detailed descriptions of each features.

Table 2.1 D-light Diode Laser Module Feature Description	
1.1 Fiber	Deliver laser diode power
1.2 SMA connector protection cover	Protect fiber connector surface during shipping and storage.
2.Water cooling tubing and connectors (For water cooling version)	Provide water cooling channel.
3.1 Electrical connector Cathode (-)	Provide cathode connection for electric power supply
3.2 Electrical connector Anode (+)	Provide anode connection for electric power supply
4.Protection cover for WL tuning micrometer	Protect micrometer during shipping, operation, and storage
5.Micrometer for WL tuning	Adjust wavelength of diode laser beam by turning the micrometer.

The following figure shows the dimension of D-light diode laser head.

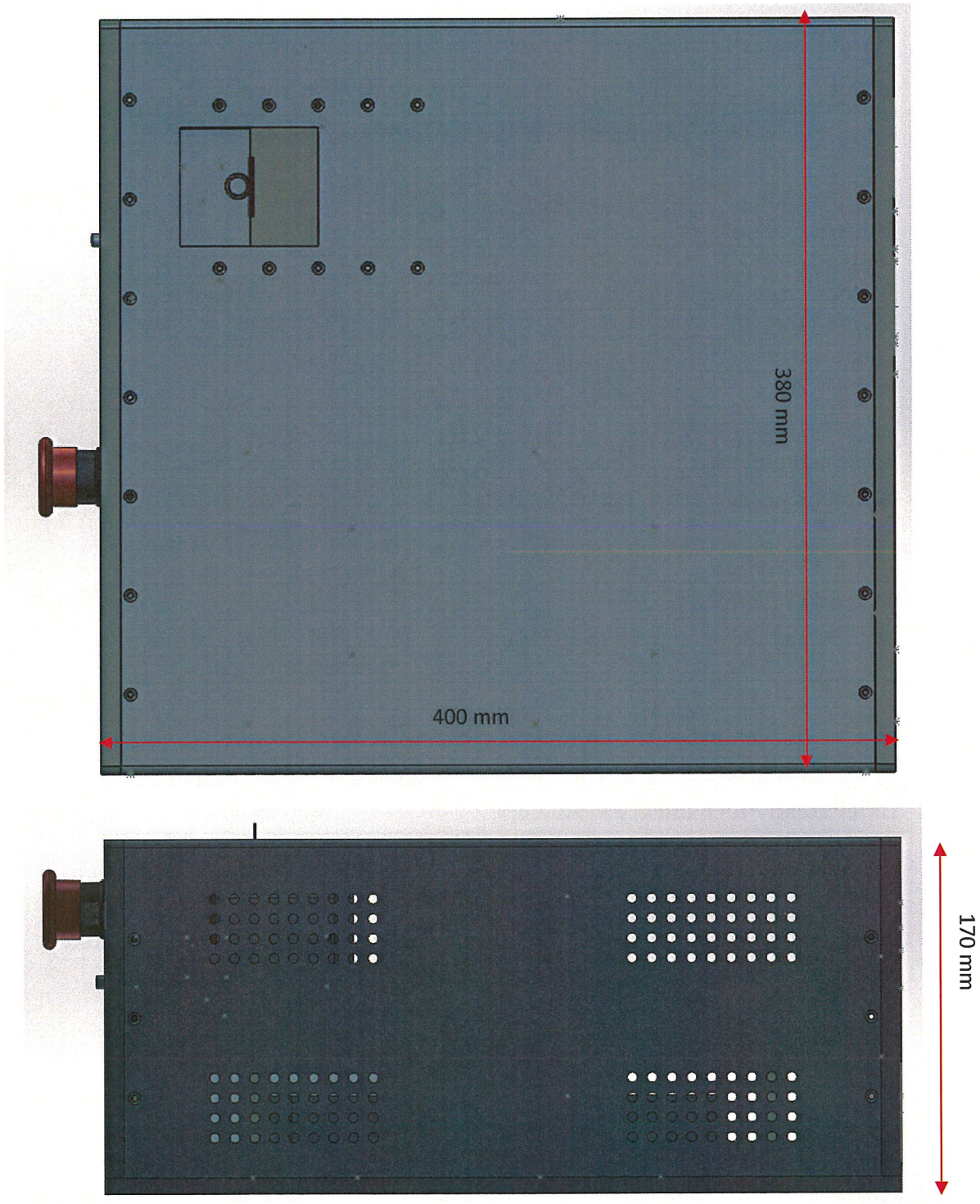


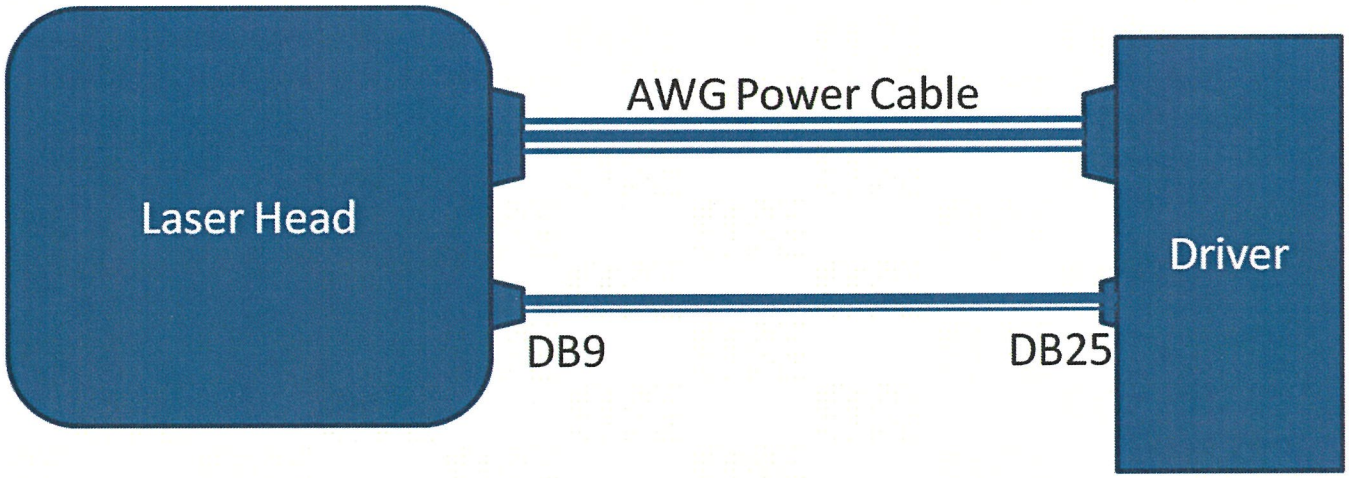
Figure 2.2 D-light diode laser head dimension

2.2 Product Specification

Table 2.2 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	800 um	
Beam NA	0.22	
Electrical Parameters		
Threshold current	12 A	
Operation current	Typical 65 A	See datasheet for specific value
Operation voltage	2.0 to 3 V	
Thermal Parameters		
TEC temperature	20 to 30 °C	See data sheet for specific value
Laser Head Mechanical Parameters		
Dimension	400 X 380 X 170 mm	L x W x H
Weight	3.0 kg	
Fiber length	2.0 m	
Fiber connector	SMA 905	

3. Installation

D-light diode laser system is very easy to wire and install. The following is the cable wiring diagram.



	Like all semiconductor laser, The D-light diode system can be damaged by one single electro-static discharge (ESD) strike. Please be cautious when installing, handling, and operating the device.

3.1 Unpack D-light diode module

Use proper ESD protection when unpack D-light diode module.

	Unpack, handle and operate the diode module only in clean and under dew point environment.

	Please use proper ESD protection when installing, handling, and operating the device.

3.2 Fiber cable installation.

D-light diode laser system is delivered with a 2- meter long optical fiber cable terminated by SMA 905 connector at both ends, which are protected by protection caps, as shown in Figure 3.3.

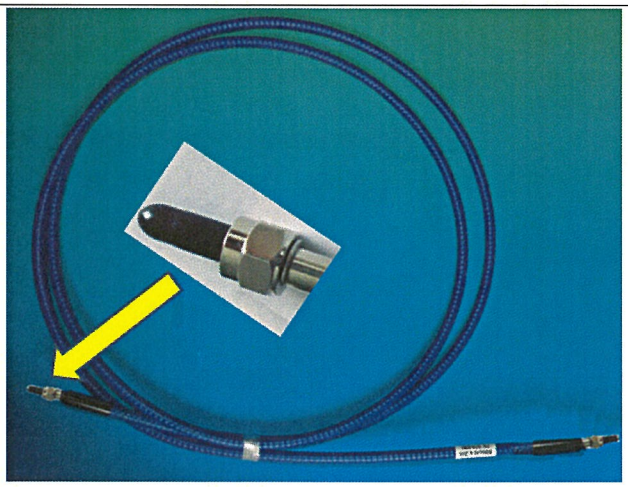
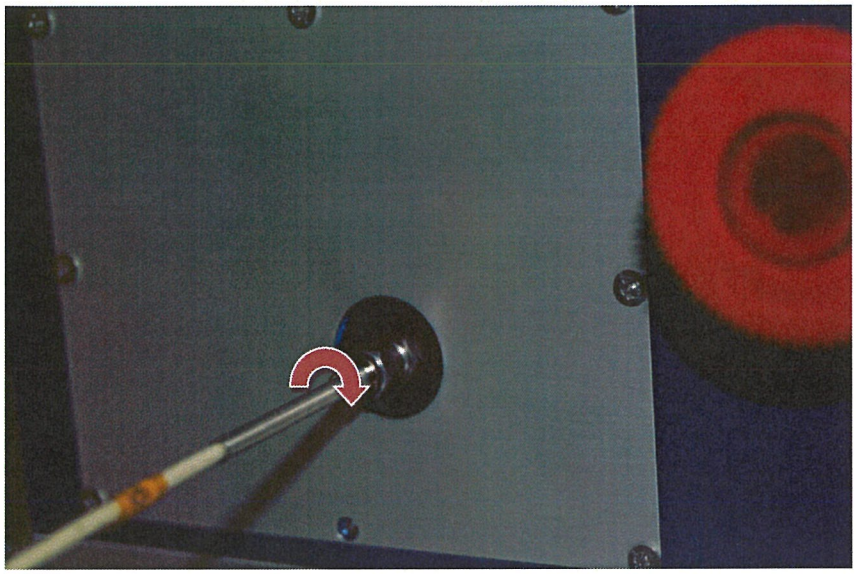


Figure 3.1 Fiber cable terminated by SMA905 connector

Carefully remove the protection cap of one of the two connectors, and install the fiber optical cable as shown in Fig 3.3.

	Don't expose fiber end faces by particles. Unpack, handle and operate the diode module only in clean and under dew point environment.



Push the ferrule all the way into the fiber connector on the diode module output. Then turn the hex head knob clockwise until it fully thread in and tight.

⚠	Don't use force when feel resistance. Unplug the ferrule and repeat. The connector shall fit nice and smooth.

Hold the connector on the other end with a height adjustable stand. Remove the protection cap. Put a beam block in front of the connector output. Save both protection caps in a safe, clean, and dry place.

⚠	To prevent fiber breaks, do not bend the fiber in a radius less than 100 mm.

3.3 TEC Temperature setting

1) Set temperature limit.

To set temperature limit, one click "configure window" button on "Main TEC Control" window. A "User configuration" window pops up. Enter "15" and "30" as the min and max temperature limit and click "ok". This make the laser only run within that temperature range.

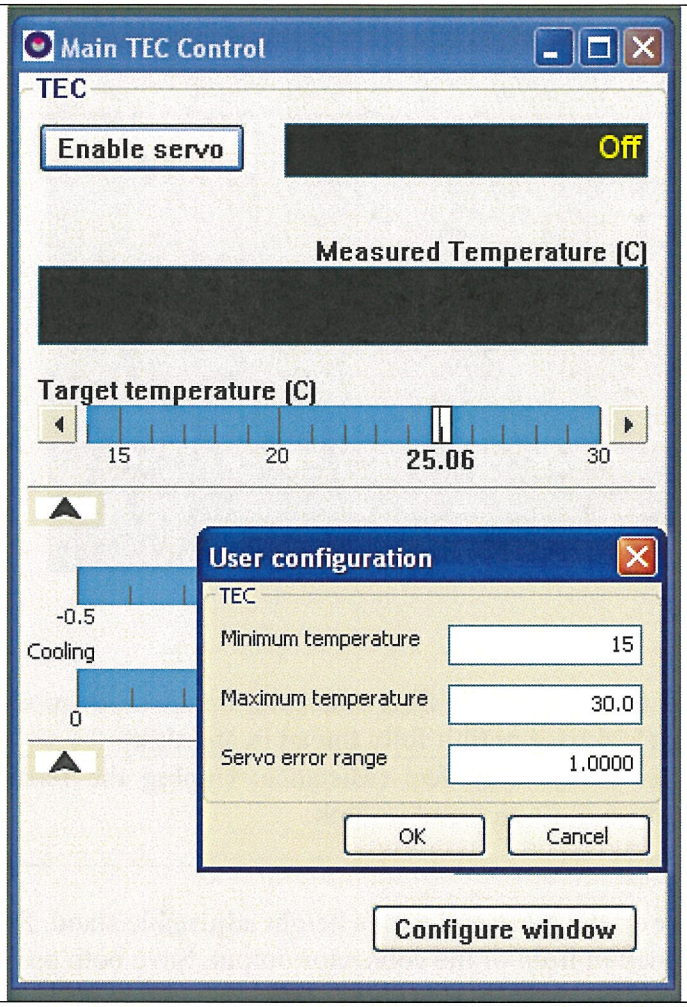


Figure 3.2 Set temperature current limit

2) Set diode temperature.

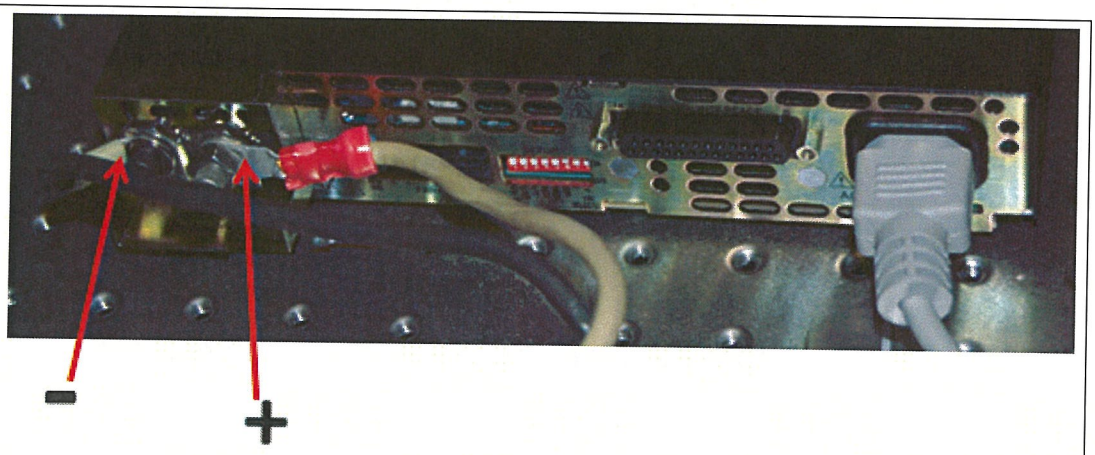
There are three ways to set the temperature. Use the mouse to drag the slider of "target temperature" bar; Use the mount to click the arrows of the "target temperature" bar; or right click the on the "target temperature" bar, and enter the operation temperature and click "ok" on the "Enter desired setting" window.

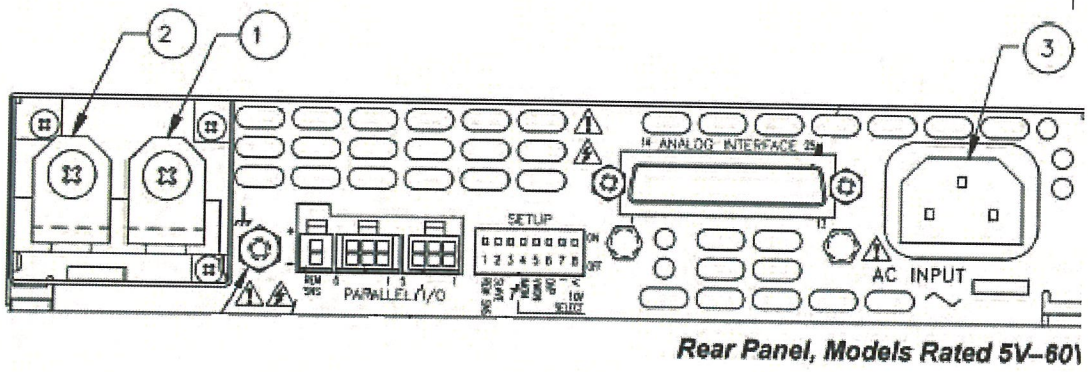
After desired temperature is set, click "Enable servo" button on the "Main TEC Control" window to enable the TEC temperature controlling. One can see the "Enable servo" status change to "on". Figure 3.2 shows the windows for temperature setting. User can also enable "Autoset" which allows turning on TEC every time the power with the computer off-line.

3.4 Electric Wire Connection

3.4.1 Diode Power supply electrical wire connection.

If customers choose the option to use power supply provided by Raytum, connect the electrical wires according to Figure 3.3 below.



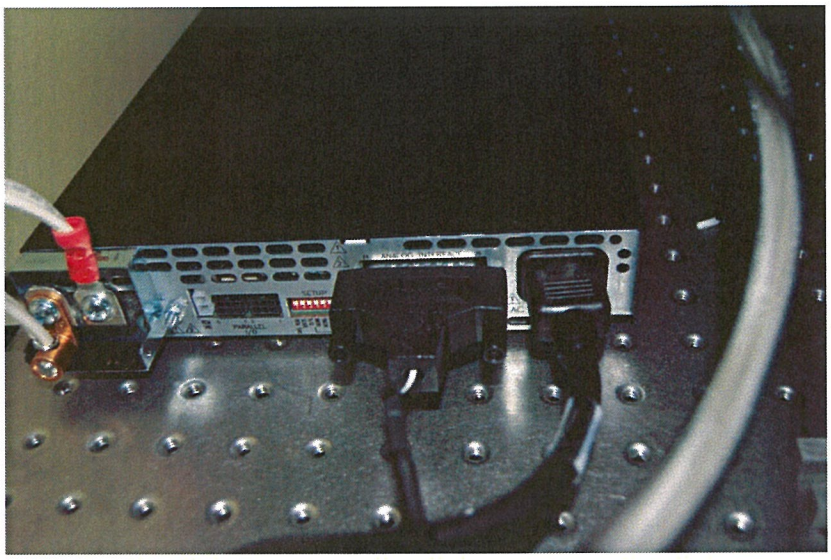


Rear Panel, Models Rated 5V–60V

1. Positive (+) DC output, with # 10-32 screw.
2. Negative (-) DC output, with # 10-32 screw.
3. AC line input. 90-132 VAC or 180-264 VAC max, 47-63 Hz, single phase, auto ranging, without user setup.

Figure 3.3 Diode Power Supply Wire Connection

3.5 Connecting power line and control cable



As shown in figure above, customer needs to connect power line with red end to "+" and flat wire to "-" port. The D25 control connector must be connected to power supply's D25 receiving port. The cable is included in the package.

4 Operation Procedure

4.1 Setup

4.1.1 Turn on power supply of laser head. Connect the USB cable between laser head and computer to set the diode temperature. If the "Autoset" of TEC controller is enabled, no need to use computer to setup the temperature unless a newer temperature setting is required.

4.1.2 Remove protection cap from fiber connector. Hold it at the right height. Put a power detector in front of it, preparing for power measurement; one can select not to verify the power output, in this case, go to 4.1.3 directly.

4.1.3 Set up spectrum measurement setup.

4.2 Turn on power supply for diode module

	Make sure proper laser safety precautions are in place.

	Make sure the protection cap is removed from fiber connector.

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

Follow the following step to turn on power supply.

4.2.1 Turn the front panel POWER switch to the ON position and the OUTPUT switch to the OFF position.

Figure 4.1 Turn POWER switch on

4.2.2 Set output voltage and current. Follow steps in Figure 4.2

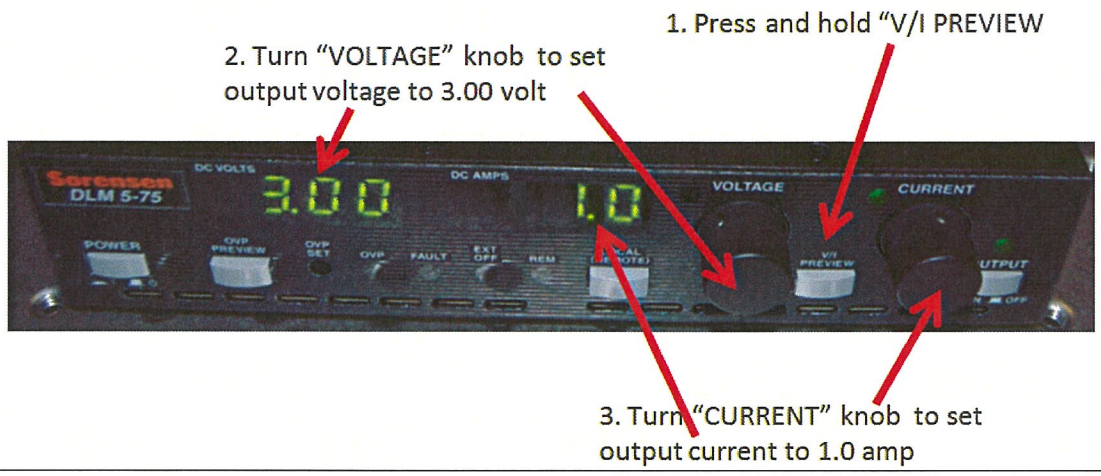


Figure 4.2 Set output voltage and current

4.2.3 Set OVP. Follow instruction in Figure 4.3 to set OVP.

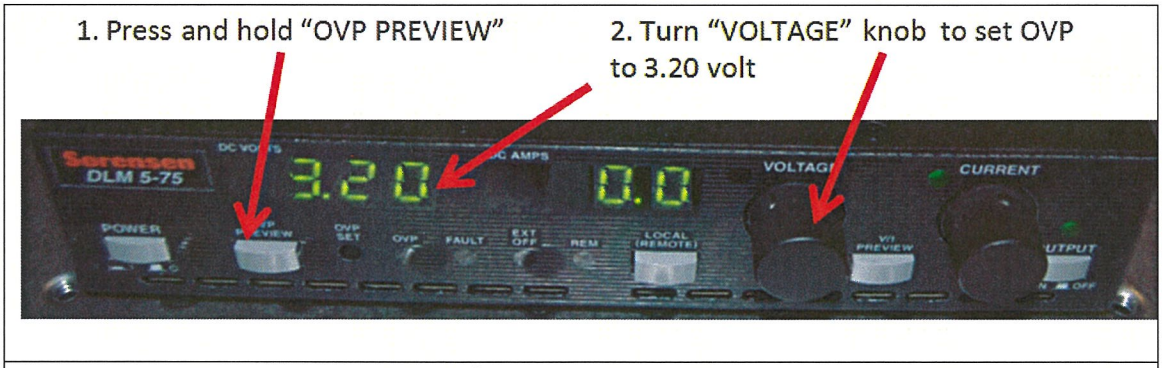


Figure 4.3 Set OVP

4.2.4 Turn on output. As shown in Figure 4.4, press "OUTPUT" to "ON" position. This enables the current source output. You will see the "DC Amps" shows "1.0", which is the preset output current, while the "DC volts" shows a voltage which is required to deliver 1.0 Amp current. (note: it is NOT the 3.00 volts preset output voltage)

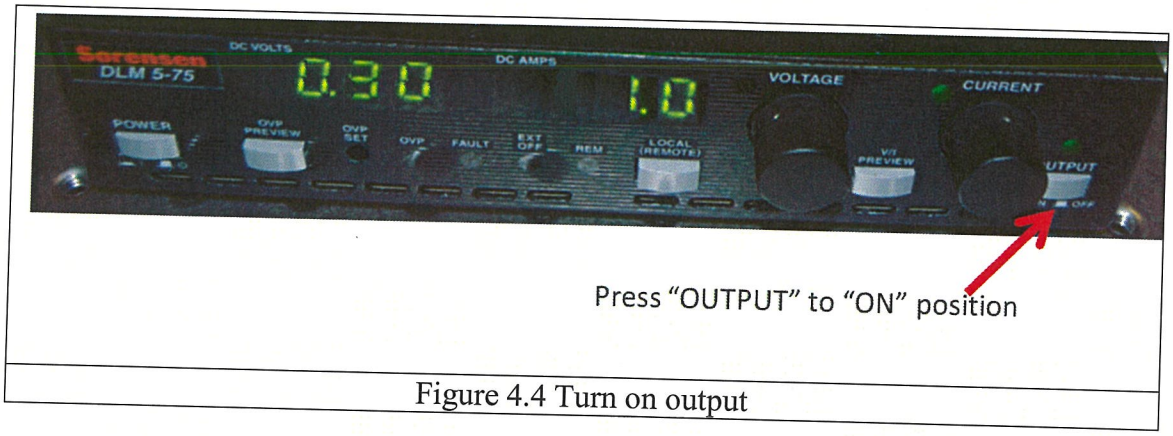


Figure 4.4 Turn on output

4.2.5 Set operation current for diode module. As shown in Figure 4.5, turn "CURRENT" knob clockwise to set the "DC Amps" to operation current per datasheet. Please be noted that the "DC VOLTs" also increased with the current. It is usually between 2.0 to 3.0 volts, depending on the resistance of the electrical wires connected for diode module.

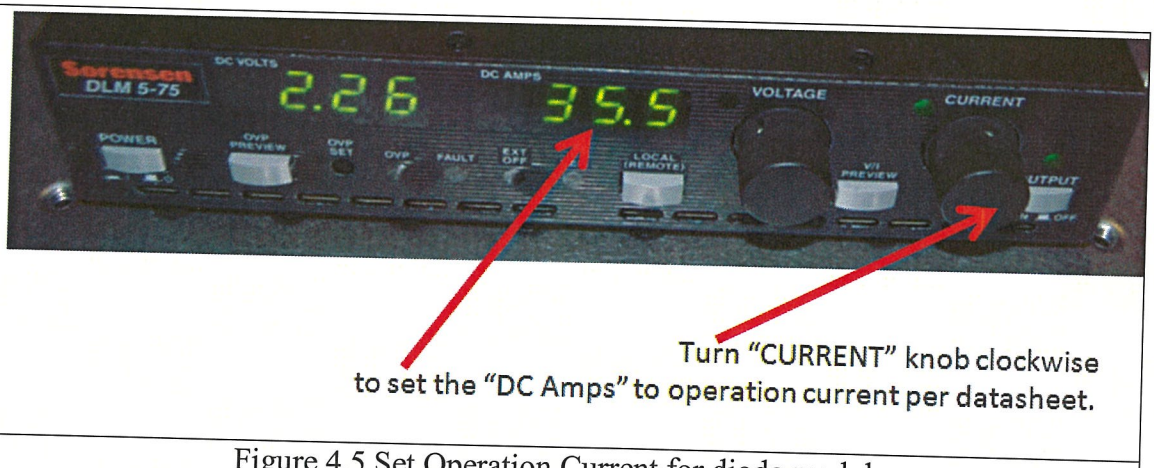


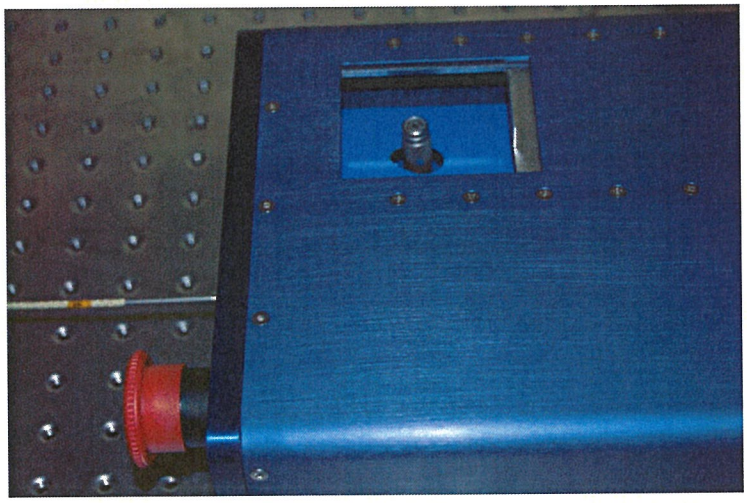
Figure 4.5 Set Operation Current for diode module

⚠	While increasing the current, pay attention to the power meter reading. Verify that the output power is at least 30W at operation current.

4.2.6 One can turn the "CURRENT" knob to change the current so that the change to output power of the diode module.

4.3 Adjust wavelength of diode module

Once setting the diode module to operation current and verifying the operation power is 50W, measure the spectrum of the laser. First verify the FWHM of less or equal to 0.2 nm; then check the peak wavelength to see if it is in accordance with the datasheet. To adjust the wavelength, one needs to slide the protection window to the end and gently adjust the micrometer.



Turn the micrometer clockwise or counter clockwise until reaching the desired wavelength.

⚠	The wavelength changes approximate 0.1 nm for each full turn of the micrometer.

⚠	Do not turn the micrometer more than 4 turns each direction from the original position.

4.4 Shut down the diode module.

Follow the following steps to shut down the diode module.

4.4.1 Turn "CURRENR" knob counter clockwise to reduce the current output to 1.0 Amp.
4.4.2 Push the "OUTPUT" button to "OFF" position.
4.4.3 Push the "POWER" button to "OFF" position.
4.4.4 Turn off the power supply of laser head.
4.4.5 Put on the protection cap for fiber connector.

4 Service and Maintenance

The D-light diode module 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 module 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 50C°.

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.
15443 Eagle Tavern Lane
Centreville, VA 20120
USA