

# DFB-PM-M Module User's Manual

**Caution:** The user must read this manual before operating the DFB module unit. Operations other than those described in this manual may result in personal injury and damage to the unit.

**Note that any attempt to open or fix the equipment without prior approval by Optilab, LLC voids the warranty.**

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## 1. General Information

### 1.1. Introduction

This manual contains information on the installation and operation of the Optilab DFB-PM-M module unit.

### 1.2. Product Overview

The Optilab DFB-PM-M is a Distributed Feedback (DFB) laser source module designed for integration with an optical modulator to form a high bandwidth analog or digital photonics link. Perfect for OEM integration, the DFB-PM-M can be ordered from more than 20 wavelengths in C-band and O-band, with the DFB laser's operating temperature and output power precisely controlled to ensure constant wavelength and power stability. The DFB-PM-M is designed to work with the Optilab Compact Modulator w/ Bias Control (CMB) for RFoF applications. Utilizing the USB /RS-485 port, the user can control the laser drive current and wavelength via PC interface.

### 1.3. Features

- Polarization Maintaining (PM) output
- Laser linewidth 500 KHz is available
- Relative Intensity Noise (RIN) of -145 dB/Hz
- Up to 40 mW output
- Wavelength stability to +/- 10 pm
- Over 20 wavelengths available
- RS-485 or USB interface
- Wavelength tuning range: +/- 1.5 nm
- Power adjustment: 10% to 100%

### 1.4. User Safety

1. The DFB-PM-M module unit emits high intensity light from the optical output receptacle. Avoid direct exposure to skin and eyes.
2. The equipment case is fully certified for EMS protection. The user should never open the equipment case; any attempt will void the warranty and may result in electric shock and EMS attack to equipment in the vicinity.
3. The user should avoid using any solvent or vaporizing chemical to clean the equipment panel or case. It may result in damage to the surface and internal circuits.

## 2. Operation

### 2.1. Introduction

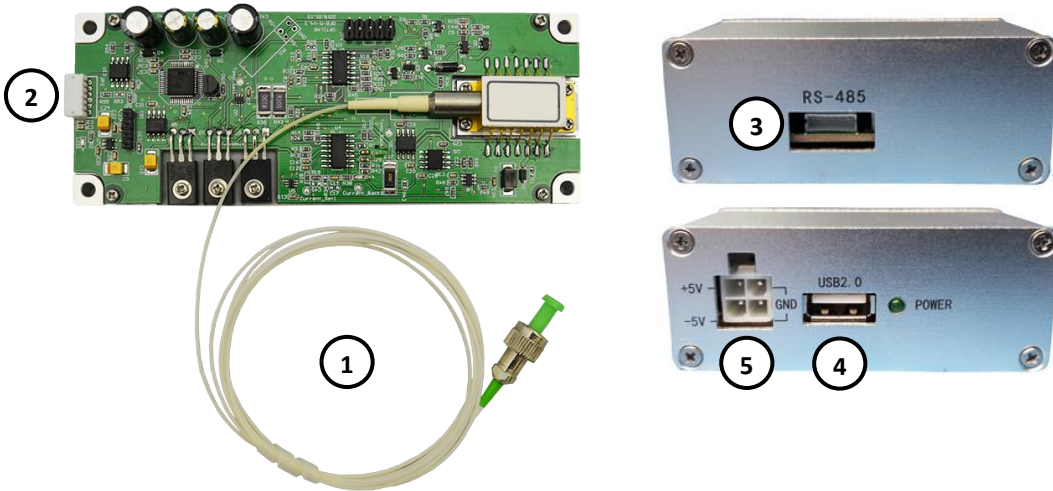
This chapter describes how to operate the DFB-PM-M module unit and discusses the location and function of the controls and connectors.

### 2.2. Initial Inspection

Your DFB-PM-M module unit was carefully inspected before it left the manufacturer. It should be in proper working order upon receipt. You should, however, inspect the unit for any damage that may have occurred in transit. If the shipping container or the packing material is damaged, keep it until the contents of the shipment have been checked to be free of mechanical and electrical damages. Notify Optilab, LLC promptly if any notable damage is found.

### 2.3. Diagram and Interface

#### DFB-PM-M Module and Cable Assembly Box

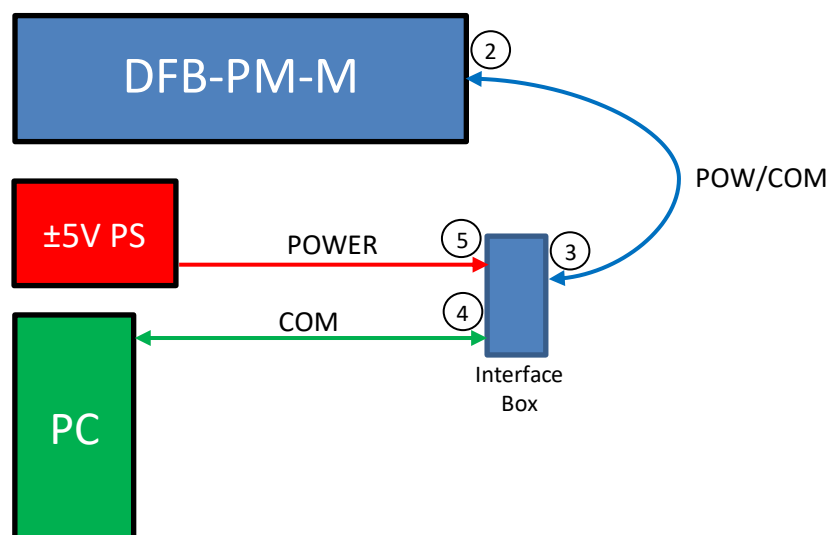


FEATURE	FUNCTION
① OPTICAL OUTPUT FIBER	This fiber and corresponding optical connector emits the optical light when the module is initialized. Take proper precautions and care when handling this fiber and connector, noting the appropriate mating adapter.
② ELECTRICAL CONNECTION PORT	This plug connects to the cable assembly, to allow for both DC power and USB remote access functionality of the DFB-PM-M. See appendix B at the end of this manual for pinout.
③ CABLE ASSEMBLY BOX RS-485 PLUG	Connect this plug into the electrical connection port to provide DC power and USB remote access to the DFB-PM-M with the provided cable. Ensure this connection is made properly to avoid damage to the plug / port.
④ USB PORT	This port connects to any standard PC interface to allow for the remote access and feature adjustment options.
⑤ DC MOLEX PORT	Connect this port either the Optilab PS-5 power supply (with the provided Molex cable), or to the appropriate +5VDC, -5VDC, GND terminals. The pin out diagram is noted in Appendix A at the end of this manual. The Power LED will enable when the proper connection and supply is made.

## 2.4. Operation Instructions

### Start-up Procedure

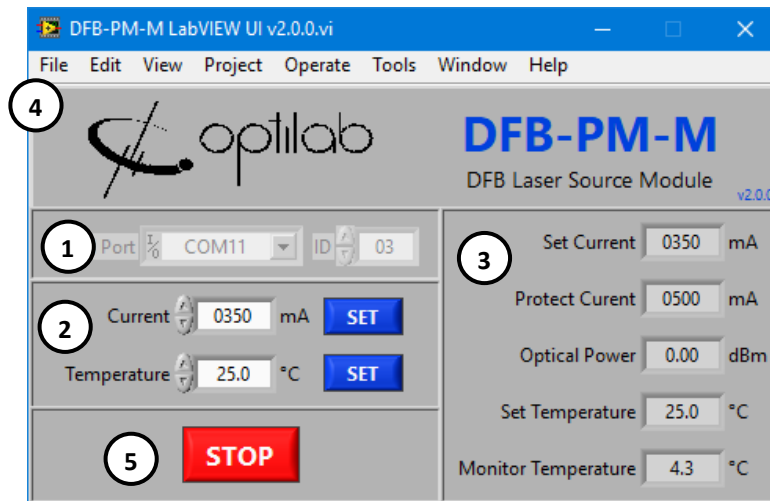
1. Connect the optical output port using the proper connector patchcord to the appropriate signal destination to utilize the laser output signal.  
  
**NOTE:** Be sure you use the correct type of patchcord to minimize losses when connecting the optical output to its destination. Special patchcords are designed for wavelengths such as 850nm and 980nm to ensure maximum light coupling. Please contact Optilab for more details and ordering options.
2. If using the Optilab PS-5 power supply, plug in the appropriate power plug into the AC Power Socket, though do not turn the AC switch to the ON position. Connect the Molex port on the cable assembly box to the proper location on the PS-5.
3. If using a separate  $\pm 5\text{VDC}$  power supply source, you can make the connections to the four pin Molex port on the cable assembly, with the electrical pinout noted in appendix A. Ensure that the DC supply signal is not yet enabled.
4. Insert the electrical plug from the cable assembly box to the DFB-PM-M module, to provide both DC power and USB remote access (see connection diagram below).
5. After ensuring all optical and electrical connections are properly made, switch on the DC power supply source (or turn on the AC switch on the PS-5 unit), to enable the electrical power to the DFB-PM-M.
6. To access the remote-control features, connect the USB port on the cable assembly to an appropriate PC interface.
7. The DFB-PM-M is now enabled for use; please refer to section 2.5 for the PC connection mode instructions.




## 2.5. PC Connection Mode

The DFB-PM-M unit is capable connecting to an external PC to allow for parameter monitoring and laser diode adjustments. Please refer to the following below for the software connection.

1. Using the USB port on the cable assembly, connect the DFB-PM-M to a PC, either directly to a USB port, or through a USB port with an appropriate USB to RS232 cable (sold separately).
2. By using the Device Manager (or other similar PC device tool), the DFB-PM-M should be recognized as COM Port device. If the DFB-PM-M does not appear as a COM Port device, you may need to install the necessary RS232 / RS485 drivers included in the software package.
3. Once the device is recognized by the PC interface, check to see if the operating PC has LabVIEW installed. If no such program is installed, then locate the "DFB-PM-M LabVIEW UI Installer" folder and run the setup.exe file to install the program as well as any needed support files. A shortcut will be created on your desktop for your convenience.
4. After LabVIEW / LabVIEW 2012 RTE is installed, then the DFB-PM-M executable software file can be opened, with the screen displayed on the following page, with the appropriate adjustment options noted below.



SETTING	DESCRIPTION
① COM PORT / ID NUMBER	Select the appropriate COM Port and ID number for the DFB-PM-M determined earlier in this manual. Set this value first before running the program.
② LASER DIODE CURRENT AND TEC POINT SETTINGS	This box is for entering the desired laser diode driving current and temperature values. Adjusting the Current setting will increase or decrease the optical output power, changing the Set Temp will set the TEC temperature, affecting the wavelength. The maximum setting for the current is limited by the firmware, and the Temperature is limited between 15°C and 35°C. NOTE: The changes are not set in place until the adjacent Set button is pressed; any changes will go into effect in about 2-3 seconds.
③ CHANNEL MONITOR	This box displays the current, set temp, temperature, and max current points for the laser diode module.
④ RUN BUTTON	Shaped as a  button, pressing this will initialize the program, and allow for the settings to be adjusted. This button only appears when the program is not running. NOTE: Once the run button is pressed, the COM port and ID number selection boxes will be disabled. Therefore, be sure to select the COM port and ID number before pressing the run button to prevent runtime errors.
⑤ STOP BUTTON	Pressing this button will stop the program, however the individual laser will still be active. You will need to turn off the DC power to the module or set the drive current to zero to disable the laser output.

- Alternatively, the DFB-PM-M device can be controlled via a terminal program such as Terminate, which can be downloaded for free here: [https://www.compuphase.com/software\\_termite.htm](https://www.compuphase.com/software_termite.htm).
- Please refer to Appendix C at the end of this manual for the required COM port settings and the DFB-PM-M command set.

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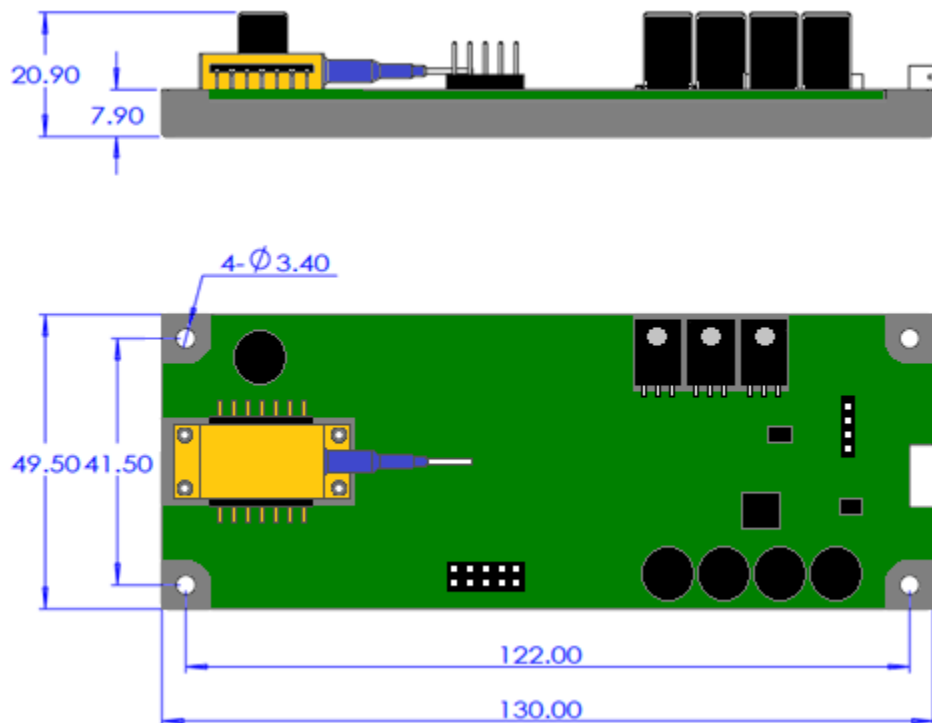
### 3. Troubleshooting

SYMPTOM	POSSIBLE CAUSE AND SOLUTION
OPTICAL OUTPUT POWER NOT HIGH ENOUGH.	<p><b>C:</b> Optical output connectors dirty.  <b>S:</b> Disable optical output and clean optical connectors.</p>
	<p><b>C:</b> Use of incorrect optical adapters or connectors.  <b>S:</b> Use only the indicated optical adapters and connectors. If measurement instruments accept different connector type, then use hybrid patchcords. For shorter wavelengths (&lt;1300nm), use of special coupling patchcords with matching wavelength will be necessary to couple the light efficiently.</p>
	<p><b>C:</b> Optical output connector damaged.  <b>S:</b> Measure optical output power with power meter and compare with readout on Main Display. Return to Optilab for repair if the difference is high (&gt;4 dB) and cannot be corrected by cleaning or replacing the optical connectors. Always apply dust cover plugs to unused optical receptacles to prevent the damage of internal optical connectors.</p>
	<p><b>C:</b> Insufficient optical output isolation.  <b>S:</b> Connect isolator of corresponding wavelength to optical output connector. The use of angled patchcords (APC) will help minimize the light being reflected back into the laser and improve stability.</p>
UNIT DOES NOT POWER UP.	<p><b>C:</b> Blown fuse on Optilab power supply.  <b>S:</b> Contact Optilab, LLC for fuse replacement procedure.</p>
UNIT RESETS OR BLINKS ON AND OFF.	<p><b>C:</b> Insufficient electrical voltage.  <b>S:</b> Check that the electrical supply is at least 110 VAC on the Optilab power supply, or +/- 5V, 1A DC.</p>
	<p><b>C:</b> Power cord / cabling is loose.  <b>S:</b> Plug the power cord / cabling firmly into the unit.</p>
	<p><b>C:</b> Insufficient electrical voltage.  <b>S:</b> Check that the electrical supply is at least 110 VAC on the Optilab power supply, or +/- 5V, 1A DC.</p>

## 4. Technical Specifications

	PARAMETER	SPECIFICATION
General	Wavelength Accuracy	Within $\pm 50$ pm
	Output Power Level	10 mW, 20mW, 30 mW, 40 mW
	Output power Stability	$\pm 0.2$ dB over 8 hours
	Wavelength Stability	$\pm 10$ pm over 8 hours
	Laser Linewidth	2 MHz typ. 500 KHz available
	Side Mode Suppression Ratio	40 dB min.
	Optical Isolation	30 dB typ.
	Relative Intensity Noise (RIN)	-145 dB/Hz min., -155 dB/Hz available
	Polarization Extinction Ratio	20 dB typ.
Adjustable Features & Output	DFB Power Output	10-100% adjustable range
	DFB Wavelength Tuning	$\pm 1.5$ nm (from wavelength center)
Mechanical	Operating Temperature	+10°C to +50°C
	Operating Temperature (TQ Version)	-55°C to +70°C
	Storage Temperature	-65°C to +85°C
	Operating Humidity	0% to 85% Relative Humidity
	Power Supply	$\pm 5$ VDC, 500 mA
	Power Consumption	5 W max.
	Dimensions	130 x 49.50 x 21 mm
	Control/Monitoring	LD Current, Laser Wavelength
	Remote Control	RS-485 or USB
	Optical Connectors	FC/APC; Other options are available
	Optical Fiber Type	PANDA for PM Output
	Accessories Included	USB cable, power supply

## 5. Mechanical Drawing



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## 6. Service and Support

### 6.1. Warranty

Optilab, LLC guarantees its DFB-PM-M module unit to be free of defects for 1 year from the date of shipment. The guarantee does not cover any damages resulting from the misuse or improper handling of the equipment, or any incidental or consequential loss. Note that the warranty will be void upon any attempt to open or to fix the equipment by the user without prior approval of Optilab, LLC

### 6.2. Service and Calibration

Your DFB-PM-M module unit has been designed to provide years of trouble-free operation. No internal maintenance is required provided that the equipment is properly handled, operated, and kept away from contamination. For any questions regarding the operation and performance of the unit, please contact Optilab, LLC at:

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Phoenix, AZ 85012

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### 6.3. Care of Fiber-optic Connectors

Damage to optical connectors account for more than 70 percent of equipment performance degradation. To avoid such damage, the user should use only industrial grade 99% pure isopropyl alcohol and follow the procedures below to keep the connectors, adaptors, and receptacles clean.

#### **Cleaning Optical Connector End-face with Wipe and Alcohol**

To properly clean optical connectors utilizing lens tissue grade wipes and alcohol follow the procedure below. The moist wipe removes dust particles, oil and contaminants that may damage or blot the end-face of the connector during connection. The dry wipe removes residual alcohol that may be ignited by optical emission.

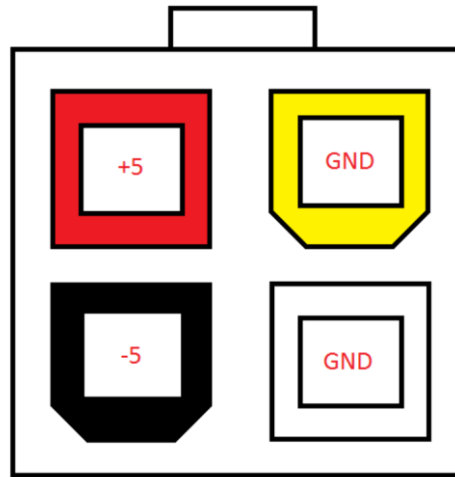
1. Disable the optical output and turn off unit to prevent accidental exposure or damage to the optical connector by optical emission.
2. Moisten a wipe with alcohol by placing on top of the alcohol dispenser and push down to saturate the wipe.
3. Place the moist wipe on a work surface and place a second dry wipe next to it.
4. Wipe the optical connector, end-face down on the moist wipe 3 times and then repeat on the dry wipe.
5. Visually inspect the end-face of the optical connector with an optical microscope to verify cleanliness. Repeat steps 2 to 5 as needed.

#### **Cleaning Optical Connector Sides, Receptacles, Adaptors with Swab and Alcohol**

Dust or particles can adhere to the insides of receptacles and adaptors or the sides of the optical connector ferrule. Their presence can affect the alignment of the optical fiber connectors and increase connection loss. To properly clean optical connectors, receptacles, and adaptors utilizing a swab and alcohol follow the procedure below:

1. Disable the optical output and turn off unit to prevent accidental exposure or damage to the optical connector by optical emission.
2. Moisten the swab by placing it on top of the alcohol dispenser and push down to saturate the swab.
3. For receptacles, adaptors, or other connection points, insert the moistened swab and rotate the tip 1/2 turn clockwise and counterclockwise 6 times while applying light but firm pressure.
4. For fiber connectors, rotate the tip of the moistened swab 5 revolutions around the connector while applying light but firm pressure.
5. Visually inspect the end face of the connector with an optical microscope to verify cleanliness. Clean end-face as needed.

## Appendix A: 4-pin Molex wiring diagram

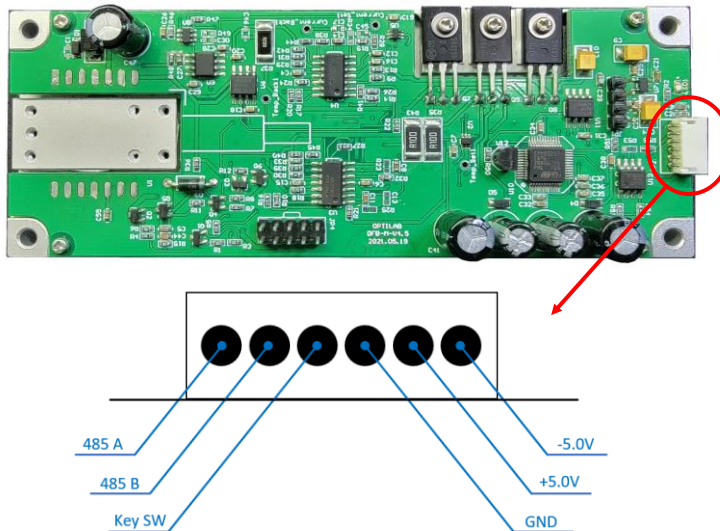


PCB Connector P/N: Molex: 353180420

Mating Connector P/N: Housing: Molex: 39012040

Terminal: Molex: 39000039

## Appendix B: 6-pin Molex wiring diagram



PCB Connector P/N: JST: S6B-ZR(LF)(SN)

Mating Connector P/N: Housing: JST: ZHR-6

Terminal: JST: SZH-002T-P0.5

6" Cable Assembly: JST: A06ZR06ZR28H152B

### **Optilab, LLC**

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## Appendix C: Remote Command Set

### Port Settings

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: none

Flow Control: none

Transmitted Text: Append CR-LF

**xx** = ID number of the device; minimum field width = 2; pad with zeros on left; Range: 00 ~ 99

**nn...** = Data to be set/programmed; # of n's = minimum field width; pad with zeros on left

### Standard Commands (Return data is formatted for easy reading)

#### **Query Commands:**

**READxx** → Read all device data

ie. Send: **READ03** → Return: **OPTILAB, LLC.**  
**DFB-PM-M**  
**FW Version: v3.8.4**  
**ID: 03**  
**Set Current: 0450 mA**  
**Protect Current: 0500 mA**  
**Optical Power: 10.35 dBm**  
**Set Temperature: 25.0 °C**  
**Monitor Temp: 24.9 °C**

**READxxPC** → Read device protect current in mA

ie. Send: **READ03PC** → Return: **Protect Current: 0500 mA**

#### **Set Commands:**

**SETID:nn** → Set the device ID; Range: 00 ~ 99

ie. Send: **SETID:03** → Return: **ID: 03**

**SETxxC:nnnn** → Set LD drive current in mA; Range: 0000 ~ Protect Current

ie. Send: **SET03C:0350** → Return: **Set Current: 0350 mA**

**SETxxP:nnnn** → Set protect current in mA; "SETxxC:nnnn" cannot be set above this value

ie. Send: **SET03P:0500** → Return: **Protect Current: 0500 mA**

**SETxxT:nn.n** → Set TEC temperature set point in °C; Range: 15.0 ~ 35.0 °C

ie. Send: **SET03T:25.0** → Return: **Set Temp: 25.0 °C**

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## Programming Commands (Return data is formatted for easy programming)

### Query Commands:

RA? → Read device ID

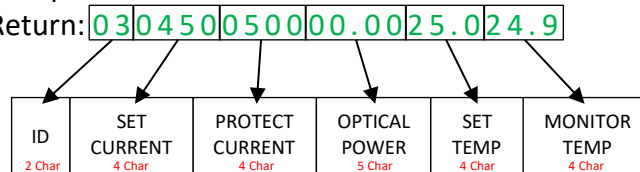
ie. Send: RA? → Return: 03

RCxx? → Read LD drive current set point in mA

ie. Send: RC03? → Return: 0350

RDxx? → Read all data; See output format below:

ie. Send: RD03? → Return: 030450050000.0025.024.9



RMxx? → Read monitor temperature in °C

ie. Send: RM03? → Return: 24.9

ROxx? → Read optical power in dBm

ie. Send: RO03? → Return: 10.35

RPxx? → Read protection current in mA

ie. Send: RP03? → Return: 0500

RTxx? → Read TEC temperature set point in °C

ie. Send: RT03? → Return: 25.0

### Set Commands:

SCxx:nnnn → Set LD drive current set point in mA; Range: 0000 ~ Protect Current

ie. Send: SC03:0350 → Return: 0350

SPxx:nnnn → Set protect current in mA; "SETxxC:nnnn" cannot be set above this value

ie. Send: SP03:0500 → Return: 0500

STxx:nn.n → Set TEC temperature set point in °C; Range: 15.0 ~ 35.0 °C

ie. Send: ST03:25.0 → Return: 25.0

## Error Codes

ERR01 → Value out of range

ERR02 → Command not recognized or not in proper format