

## SWL-15XX-MC User's Manual

**Caution:** The user must read this manual before operating the Scanning Wavelength Laser (SWL) module. Operations other than those described in this manual may result in personal injury and damage to the module.

**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 SWL-15XX-MC module unit.

### 1.2 Product Overview

The Optilab SWL-15XX-MC is a high frequency, broad band tunable laser module, designed for general laboratory and industry applications. The module uses a low noise, tunable VCSEL as the light source, and can be ordered with various central wavelengths. The maximum output optical power level is around 1 mW. The wavelength of the module is tunable in a wide range ( $\geq 10$  nm) and can be tuned by applying a DC voltage on the VCSEL through the knob on the top of the module. The wavelength can also be scanned at variable frequencies (1 Hz~100 kHz) through the internal scanning function or by applying an external scanning signal.

### 1.3 Features

- Large wavelength tunable range.
- High wavelength scanning frequency.
- Trigger in and trigger out function.
- Local control and monitoring.
- Remote control and monitoring via USB/RS-485.

### 1.4 User Safety



This product emits invisible laser radiation from the optical connector(s) that classifies it to be a **CLASS 3R** laser product accordingly to IEC 60825-1:2007. **The optical output is not hazardous to eyes and skin. HOWEVER, AVOID DELIBERATELY LOOK OR STARE INTO THE LASER BEAM.**



**THE OPTICAL OUTPUT MUST BE DISABLED WHEN SWAPPING PATCHCORD CONNECTIONS.**



**NEVER USE ADAPTOR OR CONNECTOR TYPE OTHER THAN SPECIFIED IN THE TEST REPORT OR USER MANUAL.** If measurement instruments accept different connector type, use hybrid patch-cords.



**THE LASER CAN BE A DISTRACTION, GLARE OR FLASHBLINDNESS HAZARD FOR PILOTS AND DRIVERS. NEVER AIM ANY LASER TOWARDS AN AIRCRAFT OR VEHICLE THAT IS IN MOTION.**



The equipment is certified for EMC requirements. **THE USER SHOULD NEVER OPEN THE EQUIPMENT CASE;** any attempt will void the warranty and may result in electric shock and EMI attack to equipment in the vicinity.



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

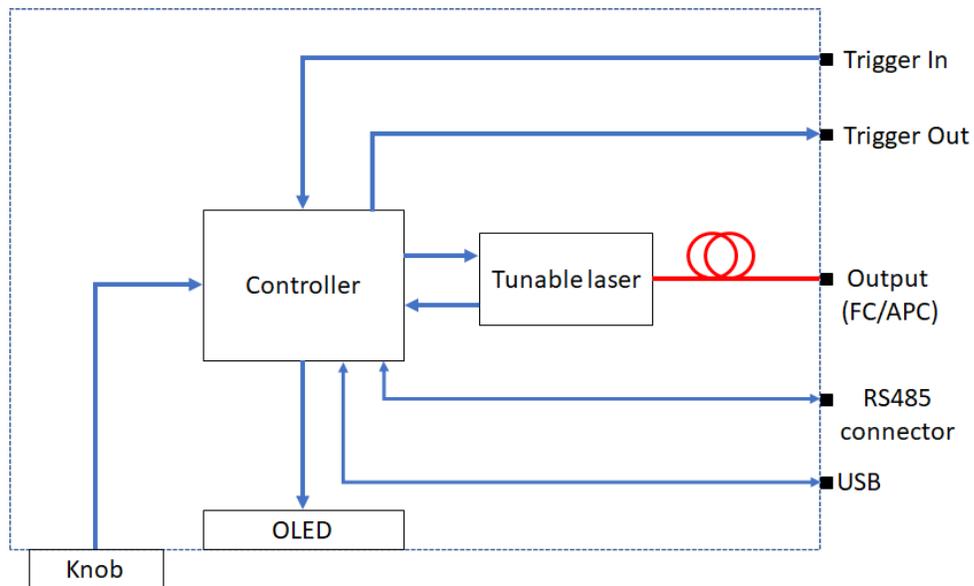
This chapter describes how to operate the SWL-15XX-MC module, and introduces the location and function of the controls and connectors.

### 2.2 Initial Inspection

Your SWL-15XX-MC module 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 Function Diagram

The function diagram of the SWL-15XX-MC module is shown in the figure below.



## 2.4 Panel Diagrams and Controls

### SWL-15XX-MC Front Panel



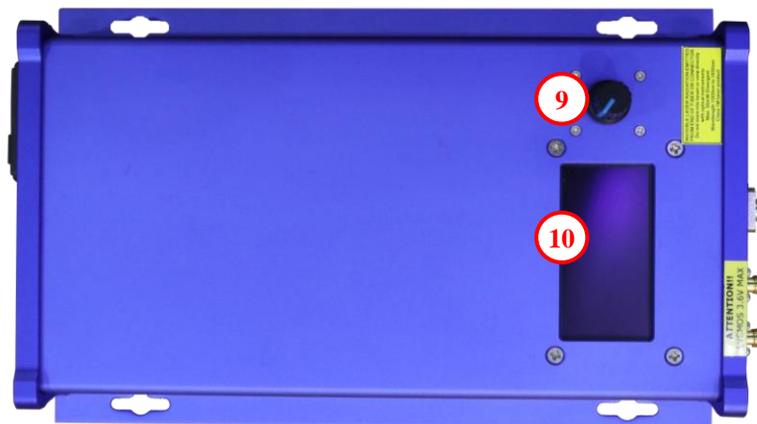
FEATURE	FUNCTION
① TRIGGER IN PORT	This receptacle accepts an electrical SMA connection for external trigger signal. <b>Note:</b> <i>Trigger In</i> should be a LVCMOS signal, and Voltage level larger than +3.6 V may damage the module.
② TRIGGER OUT PORT	This receptacle accepts an electrical SMA connection for output sync signal. <b>Note:</b> <i>Trigger Out</i> sends out a LVCMOS signal with the voltage level as +3.3 V.
③ OPTICAL OUTPUT PORT	The optical output receptacle for the module, this receptacle is FC/APC type.
④ REMOTE CONNECTION SWITCH	The remote connection switch enables the customer to select either the RS-485 connector or USB connector for remote control/monitoring.
⑤ RS-485 CONNECTOR	This port provides RS-485 connection for control/monitoring from a PC. Refer to section 2.6 for pinout information.
⑥ USB FEMALE CONNECTOR	This port provides USB connection for control/monitoring from a PC.

### SWL-15XX-MC Rear Panel



FEATURE	FUNCTION
⑦ AC POWER SOCKET	The AC power socket is the input for the AC power source. A three-pin standard power cord should be used to connect this equipment to any 110 or 220 V main supply.
⑧ MAIN AC POWER SWITCH	This switch enables the electrical power to the SWL-15XX-MC module.

### SWL-15XX-MC Top Panel



FEATURE	FUNCTION
⑨ CONTROL KNOB	Use this Knob to change the SWL-15XX-MC module settings. Refer to section 2.5.
⑩ OLED DISPLAY	The OLED display shows the optical settings and wavelength tuning parameters of the SWL-15XX-MC module. Refer to section 2.5.

## 2.5 Operation Instructions

### Prepare Procedure

1. Prior to the operation, read the user manual carefully and refer to laser safety information in Sec 1.4. Inappropriate operation may cause severe damage to the instrument and harm the health of the operators and people close by the device.

### Start-up Procedure

1. Make sure main power button on the back panel is off.
2. After plugging in the appropriate power plug into the AC Power Socket, flip the rear panel Main AC Power Switch to the ON position to enable electrical power to the module. The OLED Display will turn on.
3. Connect the optical output port using the indicated connector patchcord to the appropriate signal destination to utilize the optical output signal.
4. The LD current, TEC temperature and the wavelength tuning parameters can be read from the OLED display, and the SWL-15XX-MC is ready for operation.

**Note:** The SWL-15XX-MC should have been set to the default output status. Once the Laser Power Switch is ON, the LD current is set to be 00.0 mA, TEC temperature is set to be 25.0 °C, scanning mode is OFF and the DC tuning voltage is set to be 00.0 V.

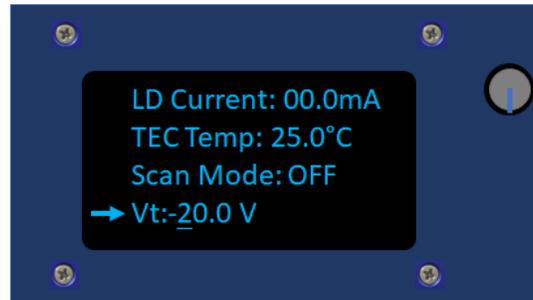
### OLED Display and Control Knob

The OLED Display and the Knob is on the top side of the module. Four settings are shown on the OLED once the module is powered on, they are LD Current, TEC temperature, Wavelength scanning mode and Wavelength DC tuning voltage. Rotate the Knob to select the setting (an arrow will appear before the setting once it is selected). Press the Knob to edit the setting (a line will appear under the value of the digit), rotate the Knob to change the number of the underlined digit, press the Knob to select the digit or exit the edit.



### Wavelength tuning via the DC voltage

The laser wavelength can be tuned by changing the DC voltage (**Vt**, unit: V) that is applied to the laser module. Refer to the test report for the tuning range and the relation between the wavelength and Vt.

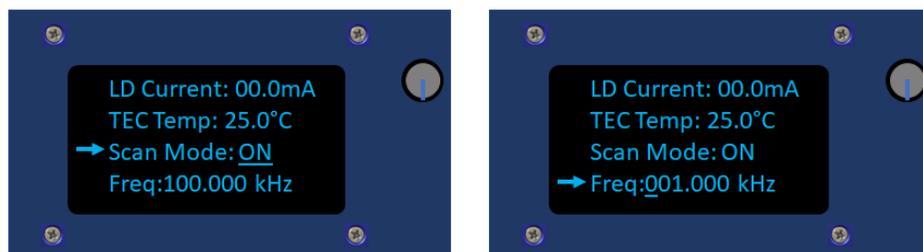


**Note:** The Scanning Mode should be OFF when the wavelength is tuned by applying the DC voltage.

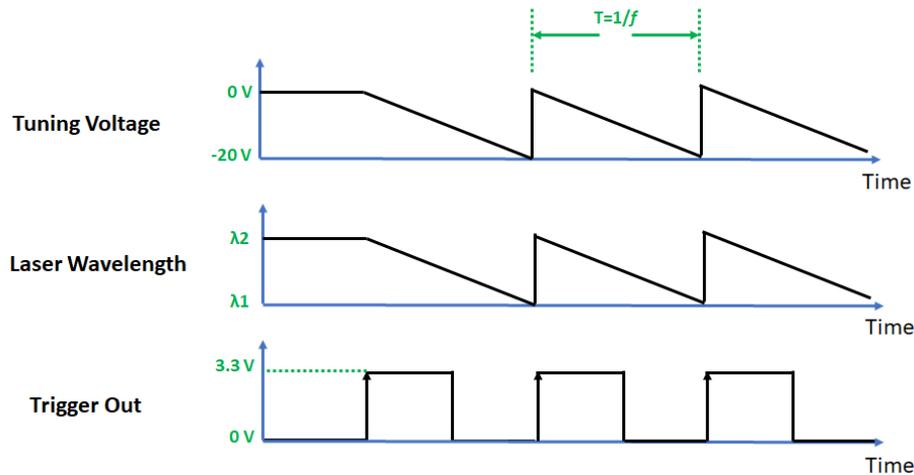
### Wavelength scanning via the internal trigger

The laser wavelength can be scanned via the internal trigger function, the scanning frequency is adjustable through the Knob, A sync signal is available at the Trigger Out port for synchronization applications.

To enable the wavelength scanning via internal trigger function, first set the Scan Mode ON, then adjust the Scanning frequency (SWL-155XX-MC supports the scanning frequency of 1 Hz, 10 Hz, 100 Hz, 1 kHz, 5 kHz, 10 kHz, 50 kHz, and 100 kHz. **Note:** The scanning frequency can be set continuously within 1Hz~100 kHz if the module is operated in remote control mode, refer to section 2.6).



The time diagram of the scanning under Internal Trigger is shown below:



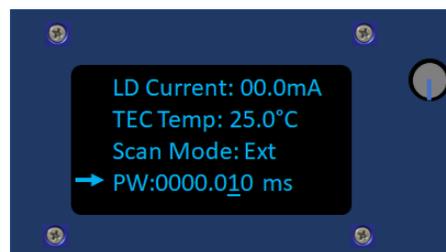
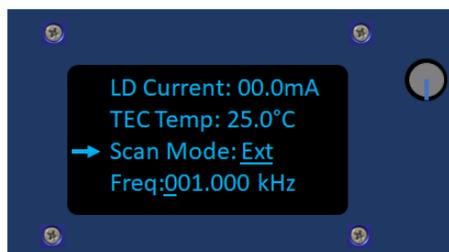
In the Internal Trigger mode, the module will apply a sawtooth wave (0~-20 V) on the laser, the laser wavelength will blue shift/red shift when the applied voltage level is decreasing/increasing. The module also output a 3.3 V 50% duty ratio square wave LVCMOS signal at the beginning of each scanning round.

### Wavelength scanning via the external trigger

The laser wavelength can also be scanned by applying an external trigger (+3.3 V LVCMOS clock) signal to the module through the Trigger In port, the scanning will be triggered on the rising edge of the Trigger In signal. The scanning duration is adjustable through the Knob. A sync signal is available at the Trigger Out port for synchronization applications.

To enable the wavelength scanning via external trigger function, first set the Scan Mode to External, then apply the external signal to the module through the Trigger In port and adjust the scanning duration (**PW**, the time range for one scanning round).

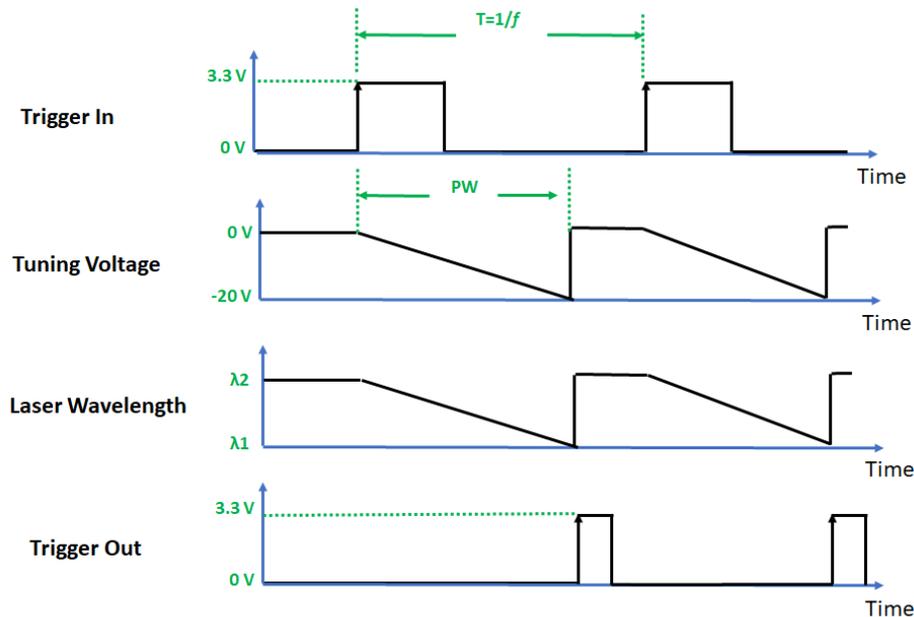
SWL-15XX-MC supports up to 99.99 kHz scanning frequency when working in the external trigger mode. The minimum scanning duration is  $PW=0.005$  ms.



The time diagram of the scanning under External Trigger is shown below:

The module will apply a Sawtooth signal (0 V~-20 V) once it sees the rising edge of the Trigger In signal, the duration of the sawtooth signal equals to PW. The laser wavelength will blue shift/red shift when the applied voltage level is decreasing/increasing. Once the scanning is finished, the module will send out a Trigger Out signal to the Trigger Out port.

The module will ignore any Trigger In signal before it finishes the on-going scanning process.

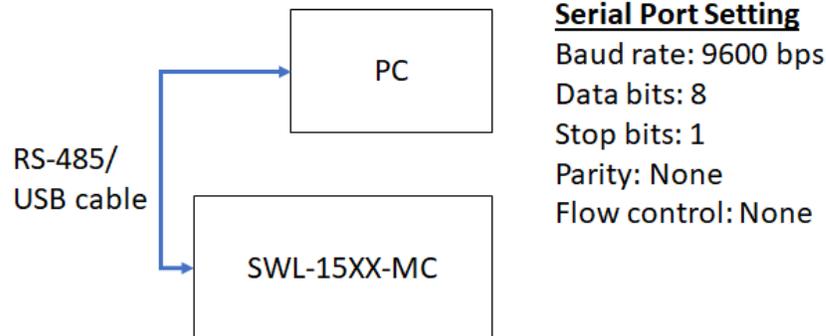


## 2.6 Remote Control (OPTIONAL)

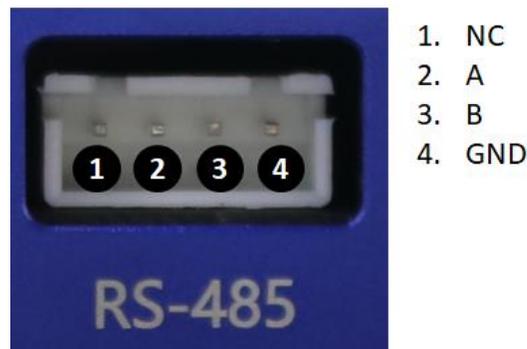
As an optional feature, the SWL-1550-MC is capable connecting to an external PC to allow for parameter monitoring and setting.

1. Set the remote connection switch to either RS-485 or USB connector type. Using an RS-485 cable or USB cable to connect the module to a PC.
2. By using the Device Manager (or other similar PC device tool), the SWL-15XX-MC should be recognized as COM Port device. If the SWL-15XX-MC does not appear as a COM Port device, you may need to install the necessary RS485 driver first.

3. Once the device is recognized by the PC interface, you can use the following connection diagram and settings to initialize communication to the module:



4. The RS-485 connector pinout is shown below:



5. When the electrical connections have been made, and the software settings for serial port transmission are set correctly, you are now able to send commands to the module. Please see the list below for the available commands and actions.

COMMAND	DESCRIPTION	EXAMPLE	RESPONSE
SETC	Set the current of the LD.	<b>SETC:10.0{CR,LF}</b>  <i>This command will set LD current to be 10 mA.</i>	<b>Successful</b>
SETM	Set the wavelength tuning/scanning mode:  0: Wavelength tuning via DC Voltage. 1: Wavelength scanning via Internal Trigger. 2: Wavelength scanning via External Trigger.	<b>SETM:1{CR,LF}</b>  <i>This command will set the scanning mode to be Internal Trigger mode.</i>	<b>Successful</b>

COMMAND	DESCRIPTION	EXAMPLE	RESPONSE
SETDC	<p>Set the wavelength tuning voltage when the module is in DC voltage tuning mode.</p> <p>The value can be set between 000 and 999. The corresponding DC voltage (Vt) is between 0 V and -20 V.</p>	<p><b>SETDC:050{CR,LF}</b></p> <p><i>This command will set the DC voltage to be -01.0 V.</i></p>	Successful
SETF	<p>Set the wavelength scanning frequency when the module is in the Internal Trigger mode.</p> <p>The value can be set between 1 and 100000. The corresponding frequency is between 1 Hz and 100 kHz.</p>	<p><b>SETF:50000{CR,LF}</b></p> <p><i>This command will set the scanning frequency to be 50 kHz.</i></p>	Successful
SETP	<p>Set the wavelength scanning duration when the module is in the External Trigger mode.</p> <p>The value can be set between 0 and 199999. The corresponding scanning duration is <math>PW=(SETP+1)*0.005</math> ms</p>	<p><b>SETP:2{CR,LF}</b></p> <p><i>This command will set the scanning duration to be 0.015 ms</i></p>	Successful
SETT	<p>Set the TEC value.</p> <p>The value can be set between 412 and 612. The corresponding TEC temperature is between 35°C and 15°C.</p>	<p><b>SETT:512{CR,LF}</b></p> <p><i>This command will set the TEC temperature to be 25.0 °C</i></p>	Successful

### 3. Troubleshooting

SYMPTOM	POSSIBLE CAUSE AND SOLUTION
OPTICAL OUTPUT POWER NOT HIGH ENOUGH.	<p><b>C:</b> Optical output connector dirty.  <b>S:</b> Disable optical output and clean optical connector.</p>
	<p><b>C:</b> Use of incorrect optical adapter or connector.  <b>S:</b> Use only the indicated optical adapter and connector. If measurement instruments accept different connector type, then use hybrid patchcords.</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>
MAIN DISPLAY GOES BLANK.	<p><b>C:</b> Static electrical discharge.  <b>S:</b> Wait 10 to 30 seconds for the display to refresh.</p>
	<p><b>C:</b> Insufficient ventilation.  <b>S:</b> Place unit in well ventilated area or supply additional fans for ventilation.</p>
OPTICAL OUTPUT POWER UNSTABLE.	<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.  <b>S:</b> Contact Optilab, LLC for fuse replacement procedure.</p>
	<p><b>C:</b> Insufficient electrical voltage.  <b>S:</b> Check that the electrical supply is at least 110 VAC.</p>
	<p><b>C:</b> Power cord is loose.  <b>S:</b> Plug the power cord firmly into the unit.</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.</p>

## 4. Service and Support

### 4.1 Warranty

Optilab, LLC guarantees its SWL-15XX-MC module 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.

### 4.2 Service and Calibration

Your SWL-15XX-MC module 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:

Optilab, LLC  
600 E. Camelback Road  
Phoenix, AZ 85012

Phone: (602) 343-1496  
Fax: (602) 343-1489  
Email: [sales@oequest.com](mailto:sales@oequest.com)

### 4.3 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, adapters, or other connection points, insert the moistened swab and rotate the tip 1/2 turn clockwise and counter-clockwise 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.