Optilab SWL-1550-M User's Manual

Swept Wavelength Laser Module, 1550nm Type

Caution: The user must read this manual before operating the SWL-1550-M 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.

Ver. 1.5
Dec 15th, 2021

Revision History

Version	Date	Summary
1.0	10/22/10	Manual introduced.
1.1	8/05/15	Manual revision.
1.2	1/15/17	Power supply revision.
1.3	09/11/2020	Document format update
1.4	11/17/2021	Power supply revision
1.5	12/15/2021	Updated DC voltage input range

Table of Contents

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1. General Information

1.1 Introduction

This manual contains information on the installation and operation of the SWL-1550-M modular swept wavelength laser unit.

1.2 Product Overview

The SWL-1550-M is a turn-key solution for fiber sensor interrogation, Optical Coherence Tomography (OCT), and other optical sensing applications. Inside a ruggedized anodized-aluminum housing, the SWL-1550-M contains a fast tunable laser source with driver circuit and control electronics. Through the electrical voltage input, the SWL-1550-M is a laser source that provides a fast, continuous wavelength sweeping from 1520 nm to 1610 nm (90nm version)

The optional RS-232 port will provide laser status monitoring and laser control functions. This laser requires a single +5/-5 VDC power supply to initiate as well as an additional voltage source for wavelength sweeping and tuning.

1.3 Features

- Sweeping range of up to 90nm
- Laser linewidth (FWHM) of 0.15 nm
- Output power of 10mW minimum
- Optical Signal to Noise Ratio of 40 dB
- Continuous sweeping driven by external voltage source < 2 kHz
- Modular Design for OEM Integration
- One year warranty standard

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1.4 User Safety

1. The SWL-1550-M unit emits high intensity invisible light from the optical output receptacle. Avoid direct exposure to skin and eyes.

2. The module case is fully certified for EMS protection. The user should never open the module 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 exterior. It may result in damage to the surface and internal circuits.

2. Operation

2.1 Introduction

This chapter describes how to operate the SWL-1550-M unit, and discusses the location and function of the controls and connectors.

2.2 Initial Inspection

Your SWL-1550-M 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 Controls

SWL-1550-M – Laser Module

FEATURE	Function
① ELECTRICAL CONNECTION PORT	This port is used to connect the SWL module to the power supply and RS232 cable. It is a DB15 type connector, with the full pin-out diagram shown on page 6 of this manual.
② Optical Output Fiber Port	The output fiber port for the SWL unit. The fiber port shown is FC/APC type.
③ Voltage Tuning Port	This 50-Ohm SMA port is used to sweep the SWL-1550-M device across its wavelength potential range. For more information, please see page 7.
④ Status LEDs	These LEDs show the current status of the Laser: Optic: Green – Optical output power enabled; Red – Optical output power disabled Power: Green – Electrical power enabled; Off – Electrical power disabled.

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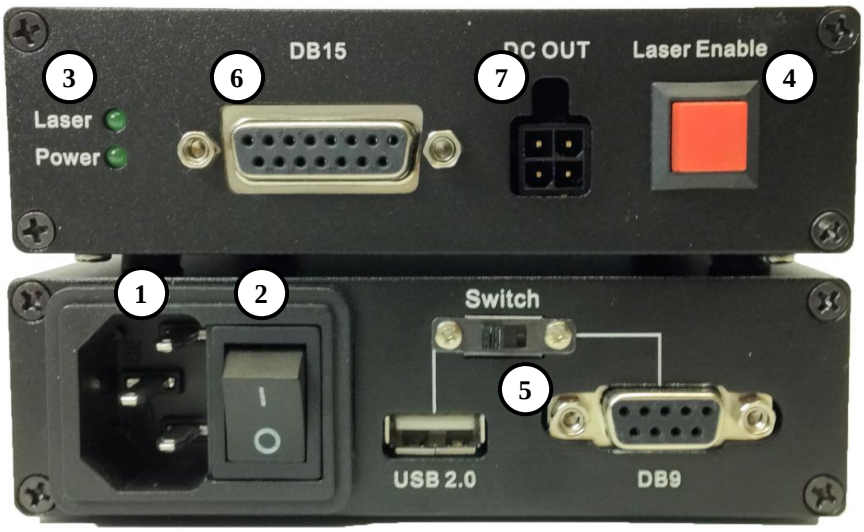
SWL-1550-M – Power Supply Assembly



FEATURE	Function
① **AC POWER SOCKET**	This receptacle accepts the electrical input for the 110/220VAC source
② **AC Power Switch**	Enables / disables the AC electrical power to the module unit.
③ **LED Indicators**	These LED indicators provide the status of the SWL-1550-M. The 'Power" indicator will illuminate green when the device has received proper AC power connections and the rear panel AC switch is enabled. The "Laser" indicator will illuminate green when the laser is enabled for operation, as set by the Laser Enable Switch.
④**LASER ENABLE SWITCH**	This key switch toggles the internal SWL-1550-M laser source On and Off
⑤**USB / DB9 COMMUNICATION PORTS**	These ports are used to send the software commands for proper interface and control. Using the switch selects between either USB or DB9 as the primary interface.
⑥**DB15 ELECTRICAL PORT**	This port connects directly to the SWL-1550-M laser unit, which relays the +5 / -5 VDC and RS232 pin terminals for remote interfacing.
⑦**MOLEX DC OUT**	This four-pin output port is not used with the SWL-1550-M series of lasers, as the DB15 provides the primary electrical power signals.

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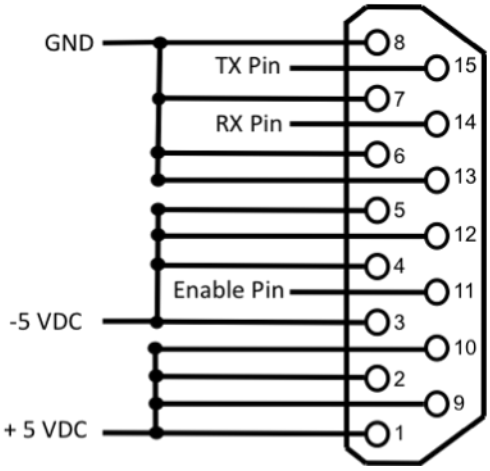
2.4 DB15 Pin-Out Diagram

Listed below is the pin-out diagram for the DB15 pin port on the external of the SWL-1550-M module:



Pins 1, 2, 9, 10 – +5 VDC. It is important to have all pins connected for proper operation.

Pins 3, 4, 5, 12 – -5VDC. It is important to have all pins connected for proper operation.

Pins 6, 7, 8, 13 – Ground

Pin 11 – Enable, short this pin to Ground to enable Laser operation.

Pin 14 – RS232 RX, for receiving data via standard serial communication.

Pin 15 – RS232 TX, for transmitting data via standard serial communication.

2.5 Operation Instructions

Start-up Procedure

1. Ensure that the proper cable connections are made, which includes the power assembly interconnects (as shown on page 4) and the DB15 connection between the module and power supply.
2. Due to the increased temperature of the device over time, it is strongly recommended to use the SWL in a well-ventilated area with an adequate heat sink in contact with the SWL for proper heat dissipation.
3. After plugging in the appropriate power plug into the AC Power Socket, flip the Main AC Switch to the On position to enable electrical power to the unit. The AC/DC converter supply's LED will enable.
4. Connect the Optical Output Port using the indicated connector patchcords to the appropriate signal destination to utilize the swept wavelength optical output signal.
5. Turn the Laser Key Switch to the On position.
6. The SWL-1550-M is now enabled, with both status LEDs enabling to green.
7. To voltage tune the device, you can use either a DC programmable power supply to manually adjust and sweep the wavelength (from -5 to +45 VDC; voltages below -5VDC may cause permanent damage to the SWL-1550-M device, and is not covered by your warranty!), or you can use a function generator to sweep across this same voltage potential, up to 2 kHz. The electrical connection should be made to the Voltage Tuning Port, which is a 50 Ohm SMA termination.

Patchcord Swapping Procedure

1. Turn the Laser Key Switch to the OFF position to disable the SWL-1550-M output.
2. Swap patchcords as desired. Only connect the indicated connector patchcords to the optical output receptacle, cleaning them as necessary.
3. Turn the Laser Key Switch back to the ON position; normal operation will resume after a few seconds.

Over-temperature Procedure

1. When the **Temp Overheat** warning enables the pump laser will shutdown automatically and the system will freeze up.
2. Flip the main AC switch to the Off position.
3. Restart the unit using the Start-up Procedure described above.
4. To prevent temperature issues in the future, please allow for adequate ventilation and increased heat sinks for proper dissipation of heat.

Swept Wavelength Tuning Details

Due to the wide variety of applications for the SWL, it may require some fine-tuning and trial and error to get the best possible swept wavelength range and frequency for your specific use. Here are some tips for the best performance.

1. Using an Optical Spectrum Analyzer (OSA) or other wavelength meter will aide you in determining the best voltage range to sweep. Due to the Free Spectral Range (FSR) trait of the SWL, the wavelength tuning will loop for increased voltage potentials. One full voltage sweep (0 VDC to +15 VDC, for example), may see as many as two full wavelength sweeps in one function cycle.

2. Due to the physical characteristics of the SWL, there are certain limitations to its fine voltage tuning. For any particular DC voltage potential, the output wavelength will shift over time (as much as 1nm per 10 minutes), though the effect will dissipate over time. For this reason it is impossible to develop a high-resolution voltage vs. wavelength relationship, though a general range can be reliably determined.

3. When using a function generator, it is highly recommended to use a sawtooth function, as the most repeatable results will happen from a similar voltage adjustment for each cycle. For example, you will see a slightly different wavelength range tuning from 0 to 5 VDC than from 5 to 0 VDC for a triangle wave function.

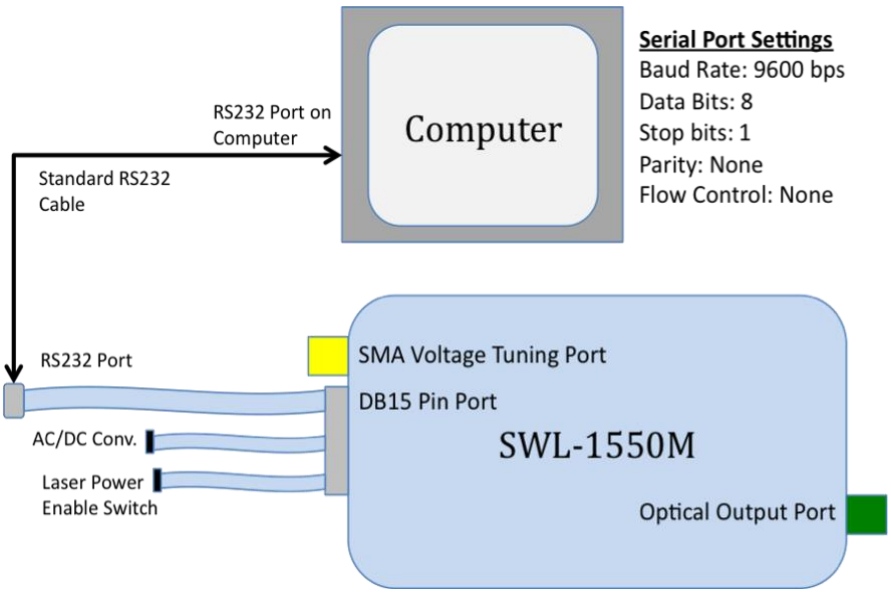
4. Though the 50-Ohm impedance should be observed for connecting a function generator, setting the generating device to High-Z impedance output will work as well. If you are unsure you are using the correct voltage level, it is best to check the function on an electrical oscilloscope first.

5. As you increase the frequency at which the SWL is swept, you may notice a slight decrease in the total wavelength sweeping range. For this reason it is best to use the slowest allowable speed in your application, and not to exceed 2 kHz sweeping frequency. Frequencies used beyond 2 kHz may cause permanent damage to the SWL-1550-M device, and is not covered by your warranty!

2.6 PC Connection Mode

For the standard SWL-1550-M, connecting the module to an external PC will allow for parameter monitoring and pump current adjustments. If you have an SWL-1550-M with additional software control, please refer to the additional supplemental manual for complete information.

Using the RS232 port on the cable assembly, connect the SWL module to a PC using the following connection diagram and serial port settings:



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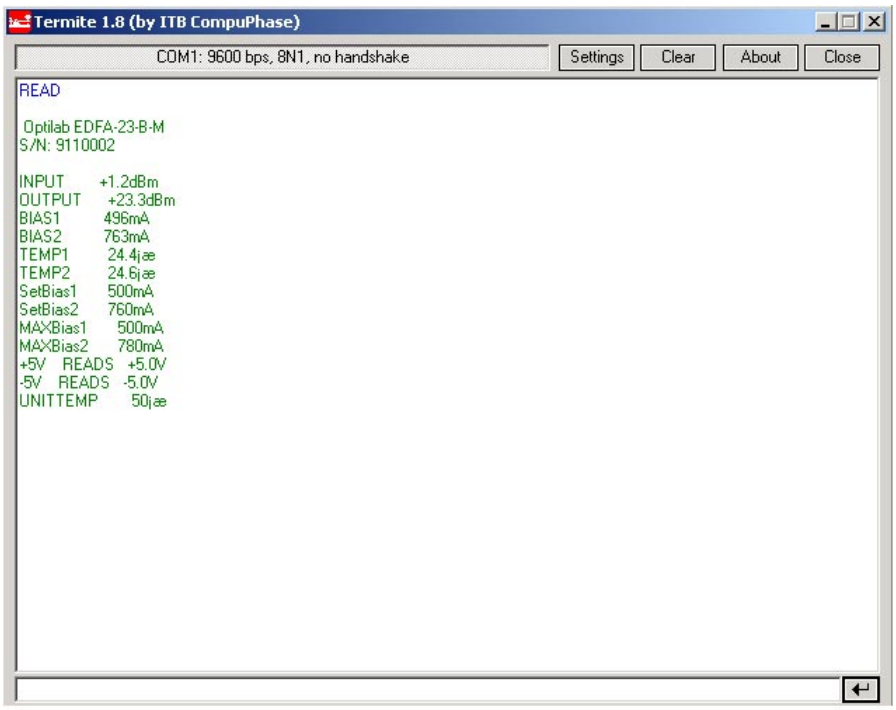
2.7 RS232 Command Set

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 LR module. For the basic SWL-1550-M, there is only the READ command, which displays the current parameters and settings.

The screenshot below shows a typical RS232 response for the 'READ' command:



3. Troubleshooting

SYMPTOM	Possible Cause and Solution
OPTICAL OUTPUT POWER NOT HIGH ENOUGH.	**C:** SWL is tuned to a lower output region. **S:** The SWL will have a slightly lower output power level on the edges of its usable bandwidth. If using a DC power supply, adjust the voltage until you see the optimum power level.
	C: Optical input/output connectors dirty. **S:** Disable optical output and clean optical connectors.
	C: Use of incorrect optical adapters or connectors. **S:** Use only the indicated optical adapters and connectors. If measurement instruments accept different connector type, then use hybrid patchcords.
	C: Optical output connector damaged. **S:** Measure optical output power with power meter and compare with original Optilab test data. Return to Optilab for repair if the difference is high (>4 dB) and cannot be corrected by cleaning or replacing the optical connectors. Always apply dust cover plugs to unused optical ports to prevent the damage of optical connectors.
	C: Improper pin connections **S:** If directly connecting the voltage to the DB15 pins, ensure that all +/- 5 VDC pins are making adequate contact to your supply.
SWL MODULE IS OVERHEATING	**C:** Insufficient ventilation / heat dissipation. **S:** Place unit in well-ventilated area or supply additional fans for ventilation. You may need to add a heat sink for additional heat dissipation.
UNIT DOES NOT POWER UP.	**C:** Improper pin connections **S:** If directly connecting the voltage to the DB15 pins, ensure that all +/- 5 VDC pins are making adequate contact to your supply.
	C: Insufficient electrical voltage. **S:** Check that the electrical supply is at least 110 VAC.
	C: AC Power cord is loose. **S:** Plug power cord is firmly into the unit.
UNIT RESETS OR BLINKS ON AND OFF.	**C:** Insufficient electrical voltage. **S:** Check that the electrical supply is at least 110 VAC.

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4. Service and Support

4.1 Warranty

Optilab, LLC guarantees its SWL-1550-M unit is guaranteed 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-1550-M 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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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.