TWL-C-M Series Module User's Manual

Tunable Wavelength Laser, C-Band Module

Caution: The user must read this manual before operating the TWL-C-M unit. Operations other than those described in this manual may result in personal injury and/or damage to the unit.

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

Ver. 1.6
May 25th 2021

Revision History

Version	Date	Summary
1.0	9/03/15	Manual introduced.
1.1	02/06/18	Housing and PS revision
1.2	02/01/19	Logo change
1.3	11/04/19	GUI Software revision
1.4	12/11/19	GUI Software v1.0.1 revision
1.5	7/27/2020	Added note: Scan mode available for HP version only
1.6	05/25/2021	Software User Manual Updated

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1. General Information

1.1. Introduction

This manual contains information on the installation and operation of the TWL-C-M C-band tunable wavelength laser source.

1.2. Product Overview

The TWL-C-M is a wavelength tunable laser module in C band based on integrated tunable laser assembly (ITLA). The TWL-C-M alleviates inventory and costs in high-channel-count DWDM systems by allowing a single device to replace each of the single-channel devices. Full-band tunable assemblies also enable system functionality such as hot back-up and dynamic provisioning in addition to applications of optical regeneration and wavelength conversion, with the HP version also including a built-in sweep function for continuous scanning applications. The TWL-C-M has a low Relative Intensity Noise (RIN), a high Side-Mode Suppression Ratio (SMSR), an ultra-narrow linewidth, and excellent wavelength accuracy. Its RS232 control complies to OIF ITLA Multi Source Agreement (MSA) standard, with a provided GUI software for intuitive control of the wavelength and optical power. The TWL-C-M can be used for Dense Wavelength Division Multiplexing (DWDM) optical transceivers and DWDM discrete line card designs.

1.3. Features

- Wide wavelength tuning range from 1527.6nm to 1567.13nm
- Precise Wavelength step resolution of 1 MHz
- High optical output power of 50 mW
- Ultra narrow laser line width <10 kHz
- Continuous wavelength sweeping function
- Linewidth broadening to 750 MHz
- Excellent Side Mode Suppression Ratio of 55 dB
- Polarization Maintaining (PM) Output
- Intuitive and easy to use USB interface

1.4. User Safety

1. The TWL-C-M unit uses high intensity invisible 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 TWL-C-M unit, and discusses the location and function of the controls and connectors.

2.2. Initial Inspection

Your TWL-C-M 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.

Each TWL-C-M shipment should include the following:

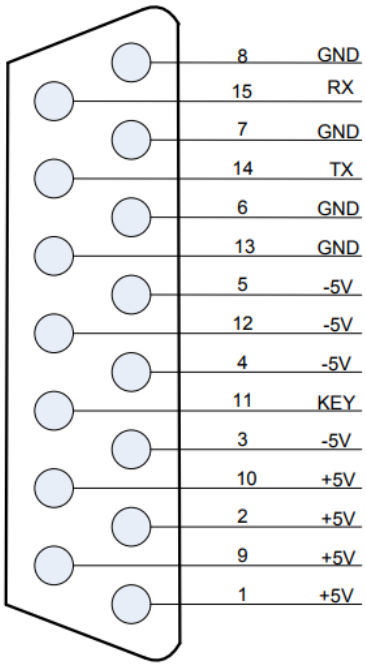
- TWL-C-M module unit
- User Manual
- Test Datasheet
- AC/DC Power Supply with Power Cords
- USB Cable

2.3. Controls

TWL-C-M Laser Module

FEATURE	FUNCTION
① OPTICAL OUTPUT PORT	This receptacle accepts the indicated fiber-optic connector for the tuned optical output, which is polarization-maintaining type (PM).
② **DB15 ELECTRICAL PORT**	This port connects directly to the included power supply unit, which relays the ±5VDC and RS232 pin terminals for remote interfacing. Please refer to the pin-out diagram below.
③ **LED INDICATORS**	These LED indicators provide the status of the TWL-C-M. The "Power" indicator will illuminate blue when the device has received proper DC and the power supply AC switch is enabled. The "Laser" indicator will illuminate blue when the laser is enabled for operation, as set by the Laser Enable Switch.
④ **SRQ OUTPUT**	Used to externally synchronize the lasers high performance scanning function. Only functional with the HP model firmware upgrade.

DB15 Pin-Out Diagram



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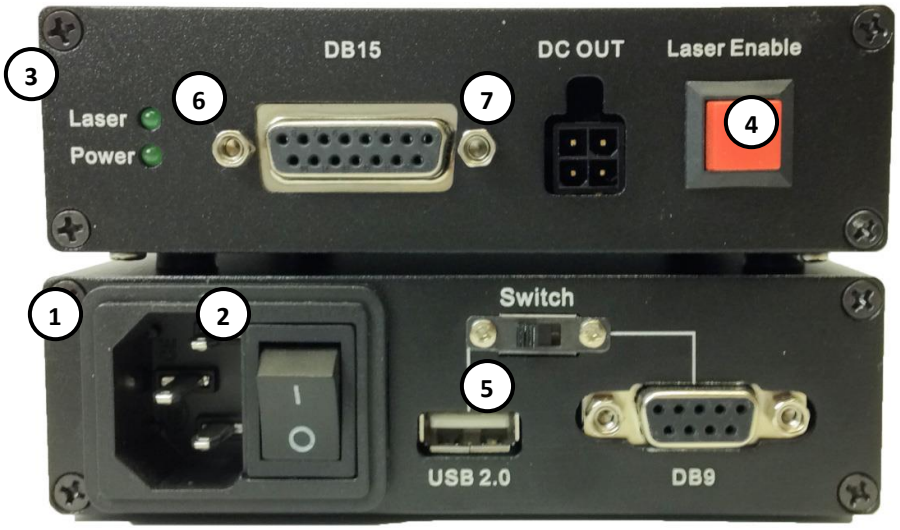
TWL-C-M Power Supply



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 TWL-C-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 TWL-C-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 TWL-C-M laser unit, which relays the ±5VDC and RS232 pin terminals for remote interfacing.
⑦ MOLEX DC OUT	This four-pin output port is used as an alternative to the DB-15 port, and is not necessary for the TWL-C-M operation.

2.4. Operation Instructions

Start-up Procedure

1. Insert the AC power cord into an appropriate AC power supply source and the power supply AC Power Socket on the TWL-C-M unit.
2. Make the proper PC communication port connection, either USB or DB9 via serial cable, ensuring the communication switch is set to the intended primary control method.
3. To ensure proper remote communication, ensure the Laser Enable button is in the enabled (inward) position prior to switching the AC Power Switch to the on position.
4. Once all proper communication and optical connections are made, enable the rear panel AC Power Switch to the On position; the Power LED should enable green on the DC supply (blue on the TWL unit), and the Laser LED should also enable green (blue on the TWL unit).
5. The TWL-C-M unit is now fully operational; please refer to the Software Interface and Control section for more adjustment and operation details.

Patchcord Swapping Procedure

1. Toggle the AC Power Switch to the OFF position to disable the TWL-C-M module output.
2. Swap patchcords as desired. Only connect the indicated connector patchcords to the optical input/output receptacles, cleaning them as necessary.
3. Toggle the AC Power Switch to the ON position; refer back to the Start-Up procedure to resume operation.

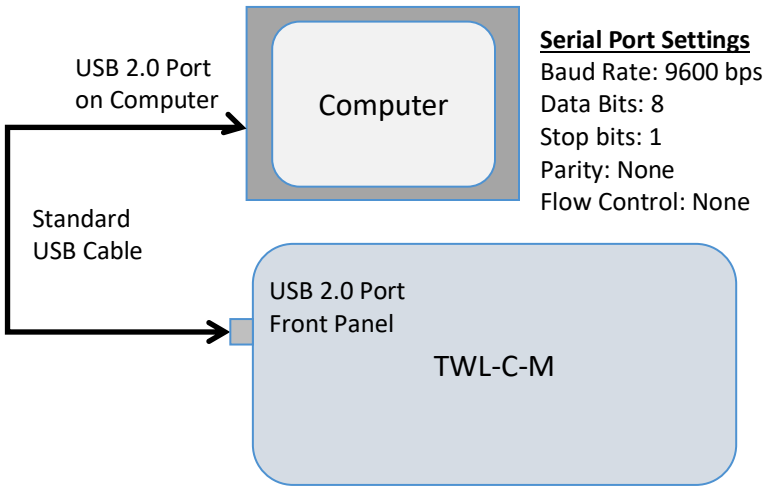
3. Software

'Optilab TWL GUI' is provided to control TWL-C-M. There are main three categories in software, 'General', 'Laser Setting', and 'Scan Mode' depends on usage. Please refer to following instruction for more detail.

3.1. Software Interface and Control

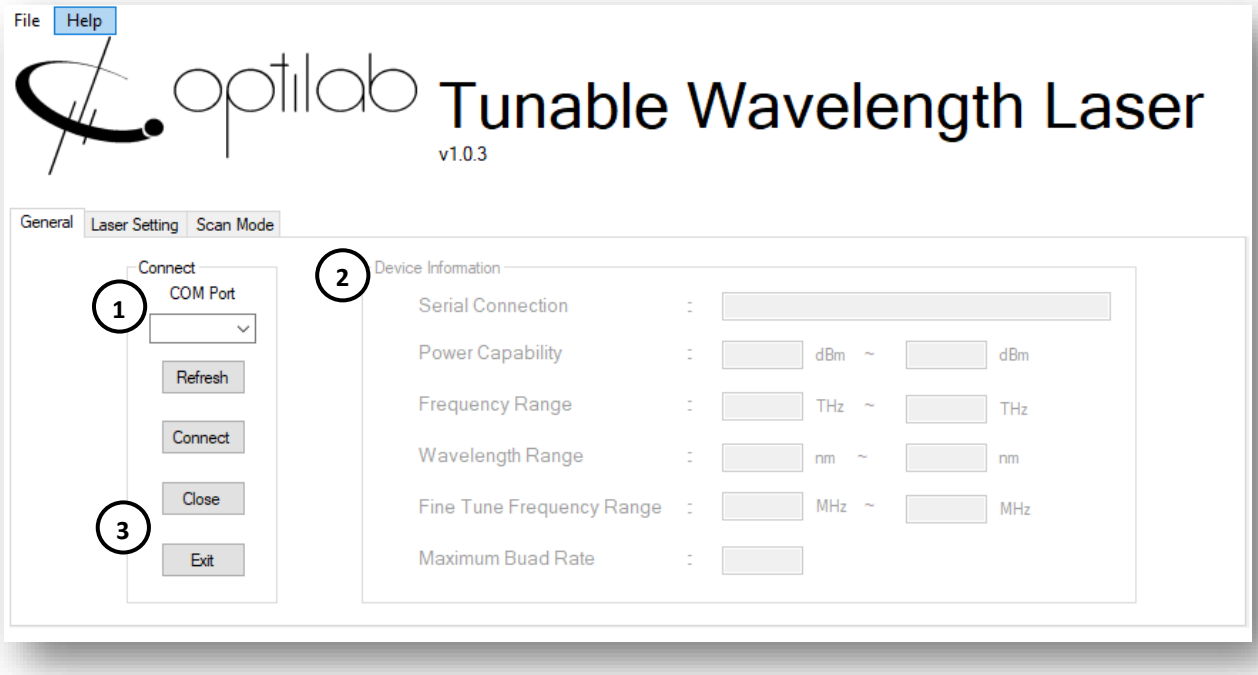
For the standard TWL-C-M, connecting the rackmount unit to an external PC will allow for parameter monitoring and power and wavelength adjustments.

Using the front panel USB 2.0 port and an appropriate Optilab TWL software (Provided by Optilab), connect the TWL-C-M to a PC using the following connection diagram and serial port settings:



3.2. General

This is first tab of software for connection between software and TWL-C-M unit through RS232.



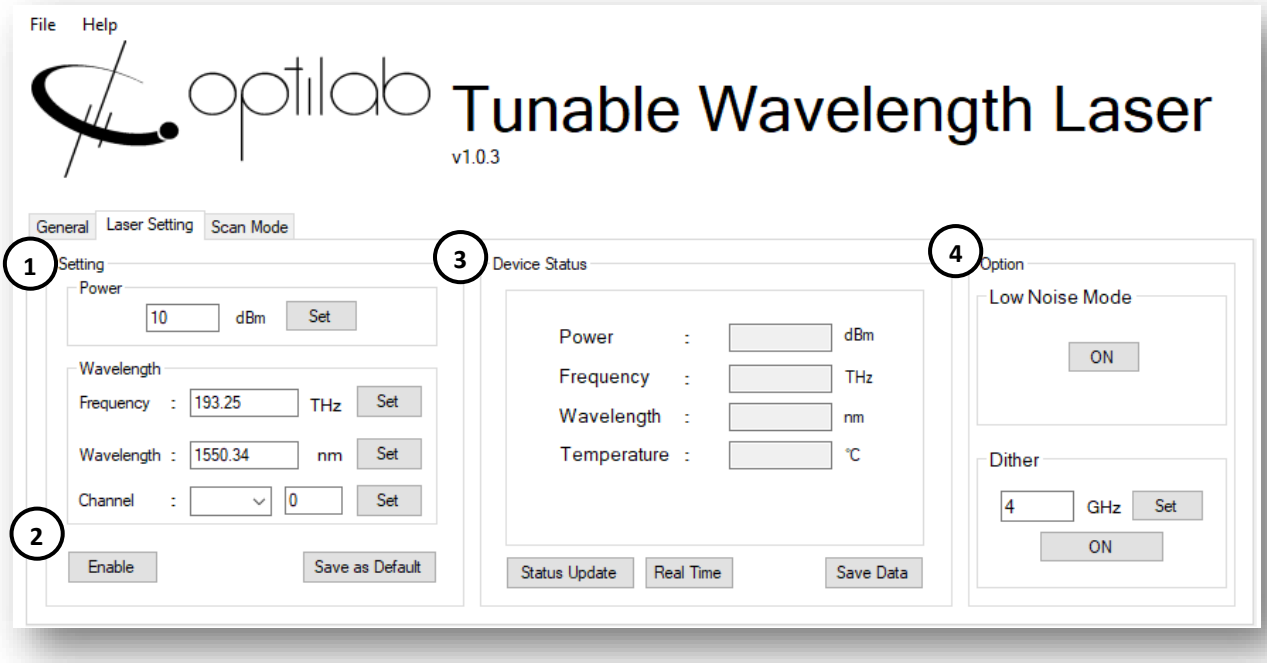
<General Tab>

COMMAND	DESCRIPTION
① COM PORT SETTING	Select the appropriate COM Port for the TWL-C-M. Then click 'Connect' to connect Please 'Refresh' if your COM port is not listed
② DEVICE INFORMATION	'Device Information' section will be activated if RS232 connection has been successfully completed. It read & display information from laser.
③ CLOSE/EXIT	'Close' button will disconnect RS232 connection. 'Exit' button will close application completely.

3.3. Laser Setting

This tab is for CW setting of laser. User can control power, frequency, wavelength or channel and observe status of TWL-C-M.

[Note that Interlock should be shorted and key should be positioned at 'ON' to fully utilize current tab]



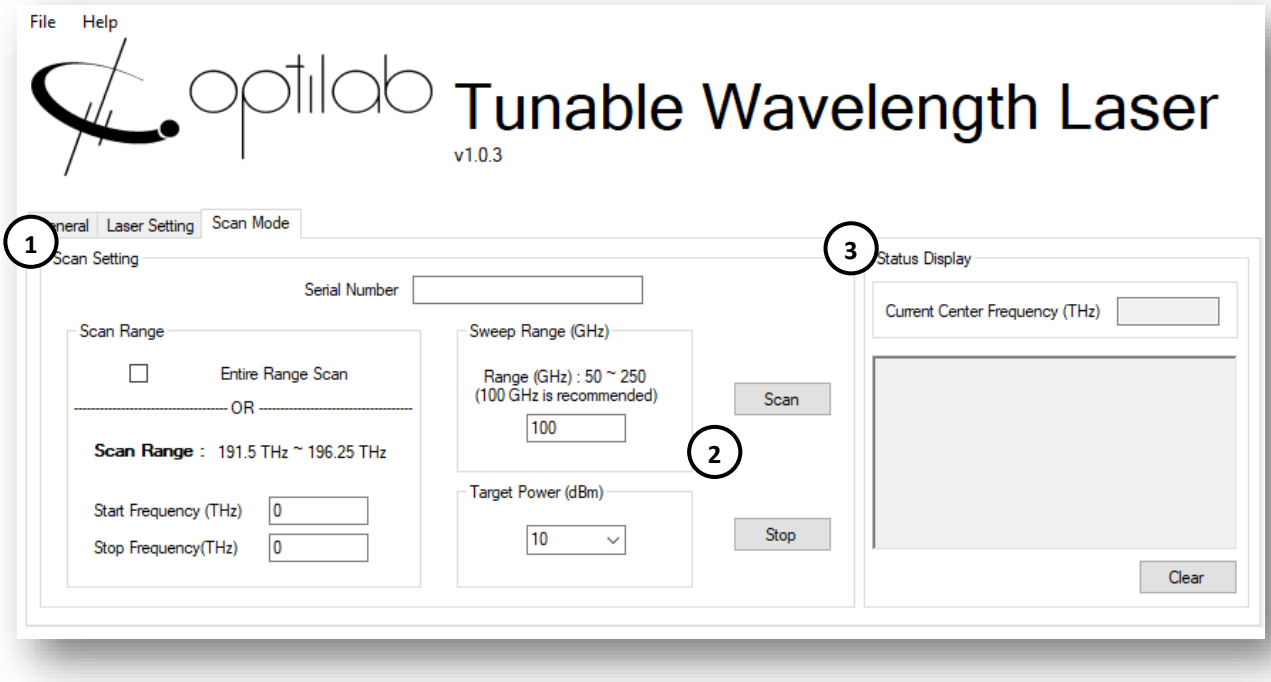
<Laser Setting Tab>

COMMAND	DESCRIPTION
① LASER DIODE POWER AND WAVELENGTH SETTING	On 'Setting', these boxes are for entering in the desired laser diode driving power and wavelength values. Adjusting 'Power (in terms of 'dBm')' will increase or decrease the optical output power. Please refer to 'General' tab for available range of power level. Adjusting 'Wavelength' will set TWL-C-M wavelength to desired point. There are three independent options for this setting, which are 'Frequency (THz)', 'Wavelength (nm)', and 'Channel'. For 'Frequency' and 'Wavelength' options, you can set its value up to MHz point (i.e. 193.312435). Please refer to 'General' tab for available range of wavelength. 'Channel' option follows *ITU-Grid*. Please refer to 'ITU-Grid' tab under 'Help' page for more detail.
② ENABLE/DISABLE LASER	Click on 'Enable' to turn on the laser. Once Laser is on, 'Disable' will be visible on same button. You can disable laser with 'Disable' button.
③ DEVICE STATUS	This box will display unit's current status of 'Power', 'Frequency', 'Wavelength', and 'Temperature'. 'Status Update' button will update status of laser diode one time. 'Real Time' button will enable real-time status update. Once it real-time update starts, 'Stop' will be visible on same button. You can stop this function with 'Stop' button. [*Once 'Stop' button has clicked, please allow '~ 2 second' to fully stop*] 'Save Data' button will save and extract current values on 'Device Status' to excel file, named as 'saved data.csv'
④ OPTION	'Low Noise Mode' button will enable low noise mode of laser. Once it is on, 'OFF' will be visible on same button. User can disable with 'OFF' button. 'Dither' is for dithering laser. Enter value (GHz) and click 'Set' button to set the amount of dithering. Then click 'ON' will enable dither mode. Once enabled, 'OFF' will be visible on same button. User can disable with 'OFF' button.

3.4. Scan Mode

This tab is for TWL-C/L-R-CUST's scanning function. It provides several options such as scan range, sweep range and target power for user with status display.

[Note that Interlock should be shorted and key should be positioned at 'ON' to fully utilize current tab]



<Scan Mode Tab>

SCAN MODE AVAILABLE FOR HP VERSION ONLY

COMMAND	DESCRIPTION
① SCAN MODE SETTING	On 'Scan Setting', these boxes are for entering/selecting in the desired scan mode values. First, user needs to enter 'Serial Number' on text field. User can find such information on module or test report. [*Note that selecting wrong 'Serial Number' and proceeding scan function may cause laser damage of TWL-C-M unit*] 'Scan Range' needs to be entered by user. It provides two options, 'Entire Scan Range' or 'Manual Range Setting'. If 'Entire Scan Range' box has checked, scanning range will be set from first to last available frequency of unit. If checkbox remains unchecked, user needs to enter desired range of scanning. Available range can be observed from the '**Scan Range :** " or 'General' tab. 'Sweep Range' needs to be entered by user within the range of '50 ~ 250' in terms of GHz. This range defines center frequency of one sweep among total sweeps (Clean Scan). [*We recommend 100 GHz for optimal speed and coverage*] 'Target Power' needs to be selected by user from dropdown menu. It is limited to 10 dBm (Optilab TWL GUI v1.0).
② ENABLE/DISABLE SCAN MODE	'Scan' button will initiate scanning of laser. Once it starts scanning, you can stop scan function at any point with 'Stop' button [*Once 'Stop' button has clicked, please allow '~ 3 second' to fully stop*]
③ DEVICE STATUS	This box will display unit's 'Center Frequency' of sweep and current status of scanning 'Current Center Frequency' will display center frequency of current sweep range (range defined by 'Sweep Range') in terms of 'THz' 'Status box' tells user the current status of scanning such as start, cancel or stop. User can delete record with 'Clear' button

5. Troubleshooting

SYMPTOM	POSSIBLE CAUSE AND SOLUTION
OPTICAL OUTPUT POWER NOT HIGH ENOUGH.	**C:** Optical input / output connector is dirty. **S:** Disable optical output to seed laser and clean optical connectors.
	C: Use of incorrect optical adapter or connector. **S:** Use only the indicated optical adapter and connector. If measurement instruments accept different connector type, then use a hybrid patchcord.
	C: Optical input / output connector damaged. **S:** Measure optical output power with power meter and compare with original 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 receptacles to prevent the damage of internal optical connectors.
OPTICAL OUTPUT POWER UNSTABLE.	**C:** Insufficient optical output isolation. **S:** Connect isolator of corresponding wavelength to optical output connector.
UNIT DOES NOT POWER UP.	**C:** Blown fuse. **S:** Contact Optilab, LLC to replace fuse.
	C: Insufficient electrical voltage. **S:** Check that the electrical supply is 110 / 220 VAC.
	C: 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 100 VAC.

6. Technical Specifications

Optical Specifications	
Operating Wavelength	1527.6nm to 1567.13nm
Wavelength Accuracy	± 1.5 GHz
Wavelength Stability	± 1pm over 24 hours
Output Power	50mW max.
Output Stability	0.02 dB over 8 hours
Linewidth (FWHM)	< 10 kHz w/o SBS < 750 MHz w/ SBS
Carrier to Noise Ratio (CNR)	50 dBc typ. @ -5 dBm
Side Mode Suppression Ratio	55 dB typ.
Relative Intensity Noise (RIN)	-145dB/Hz
Polarization Extinction Ratio	20 dB min.
Optical Isolation	30 dB min.
Fiber Type	Panda 1550 PM Fiber

7. Mechanical Specifications

Power Supply Requirements	100-240 VAC
Optical Connectors	PM Narrow Key FC/APC Standard, additional types available
Operating Temperature	0°C to +40°C
Storage Temperature	-40°C to +70°C
Control	Output Power Level, Wavelength
Communication Interface	RS232, via DB9 serial or USB 2.0
Dimensions	120mm x 112mm x 32mm

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8. Service and Support

8.1. Warranty

Optilab, LLC guarantees its TWL-C-M 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

8.2. Service and Calibration

Your TWL-C-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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8.3. 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.