Silicon ZOOM 2 VFL
(Zeroed Output Optical Meter w/integrated VFL)

Optical Power Meter
Operations Guide

Optical Wavelength Laboratories

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INTRODUCTION

Before You Begin

All personnel testing optical fibers should be adequately trained in the field of fiber optics before using any fiber optic test equipment.

If the user is not completely familiar with testing fiber optics, they should seek competent training. Such training can be acquired from a variety of sources, such as local hands-on training classes.

Valuable information about fiber optic testing can also be gathered from reading printed literature carefully or by thoroughly reading supplied operations manuals.

Fiber optic testers vary from other types of test equipment due to issues such as:

1) standards-based testing
2) proper fiber optic test procedures (FOTPs)
3) "zeroing" or referencing of power levels
4) determining the correct link budget to pass or fail by

Complete understanding of each of these issues is critical for performing proper fiber optic tests.

UNIT 1 Introduction

Description

This manual describes the operation of the Silicon ZOOM 2 VFL optical power meter with integrated visual fault locator (VFL). ZOOM stands for Zeroed Output Optical Meter.

The Silicon ZOOM 2 VFL is a very economical option for measuring the optical power of both multimode and singlemode fibers. It is NIST-Traceable at 850nm, making it ideal for multimode network testing.

Its user-friendly interface includes two push-buttons: one for power and wavelength selection, and one for setting references and toggling between dBm (optical power) and dB (optical loss).

The Silicon ZOOM 2 VFL includes a 2.5mm universal connector, which is compatible with many popular fiber connectors, such as ST, SC, and FC. A 1.25mm universal connector port can be purchased for an additional charge that allows for connection to LC, MU, and other SFF connectors.

The Silicon ZOOM 2 VFL is ideal for fiber optic professionals who need to quickly measure the loss in their fiber optic links and do not require data point storage. This unit can also be upgraded to include data storage and auto-testing fiber link certification.

The Silicon ZOOM 2 VFL also contains a precision-coupled visual fault locator optimized for fiber optics. An optical ball lens placed near the laser output focuses the light for optimum input into fiber optic cables, and special current-limiting electronics prevents laser burnout (a common problem with pen-style laser pointers), increasing the life of the VFL.

Its high-intensity red laser allows for fiber identification up to 5 kilometers away through both multimode and singlemode fibers.

It can also be used to check for faults within a few feet of its launch point. When the bright red light encounters a fault, the light is deflected into the jacket, producing a red glow at the point of the fault.

Applications

Attenuation Measurements. After a fiber cable has been installed and terminated, it must be tested to determine if the fiber is installed according to standards and specifications. A comparison of the actual power measurement and the reference value determines if the installation will pass or fail.

Fiber Continuity Testing. Continuity can be measured by connecting the VFL port to the fiber under test and visually inspecting the far end for the red light exiting the fiber connector.

Visual Fault Location. Faults, such as breaks and microbends, can be located in the near-end of the fiber link (within a few feet) using the VFL port. When the bright red light encounters a fault, the light is deflected into the jacket, producing a red glow at the point of the fault.

Patch Cord Testing. Fiber links that are producing incorrect results may have bad patch cords. The Silicon ZOOM 2 VFL can be used to test the attenuation of a patch cord to see if it is usable, or should be replaced.

Active Equipment Optical Power Measurements. Active equipment needs to be measured periodically for correct power levels and stability. The transmitters in this equipment have a known power value. The Silicon ZOOM 2 VFL can be directly attached to this equipment via a patch cord to check whether the transmitter is stable and is within the manufacturer's specified power range.

UNIT 1 Introduction

General Features

1 Visual Fault Locator (VFL) port - contains a bright red laser for the purpose of visual fault location or fiber identification.

2 2.5mm Universal Connector Port - accepts many popular 2.5mm ferrule connectors, including ST, SC, and FC. Also, for an additional charge, a 1.25mm universal port is available (for connection to LC, MU, and other SFF connectors).

3 LCD Display - shows optical power/loss levels, power units, wavelength, and battery status icon.

4 λ / POWER Button - single press changes wavelength; holding button powers the unit ON or OFF.

5 UNITS / ZERO Button - single press toggles the power units between dBm, dB, and uW; holding sets the reference for the selected wavelength.

Precautions

Operational. In order to ensure accurate and reliable readings, it is vitally important to clean ferrules containing optical fibers. If dirt, dust, and oil is allowed to build up inside the connector, this may scratch the surface of the photodetector, producing erroneous results. Replace dust caps after each use.

Required Accessories

Cleaning Supplies. Fiber ferrules should be cleaned before each insertion with 99% or better isopropyl alcohol and a lint free cloth, or with a specially designed fiber ferrule cleaner. A can of compressed air should be available to dry off the connector after wiping, and to blow out dust from bulkheads.

Patch Cords. Patch cords are required to connect the Silicon ZOOM 2 VFL to the system under test. The connector styles and fiber type of the patch cord must match the type on the Silicon ZOOM 2 VFL and the type of the system under test.

UNIT 1 Introduction

Applications

Optical Power Measurement Description. When displaying power in dBm mode, the Silicon ZOOM 2 VFL will measure the absolute amount of power being received in the 2.5mm Universal detector port.

Optical Loss Measurement Description. When displaying power in dB mode, the Silicon ZOOM 2 VFL will measure the optical power being received in the detector port relative to the reference point that was set. The formula for calculating loss in a fiber link is:

$$L = P_r - P_a$$

where L is the amount of optical loss in dB, P_r is the reference power in dBm, and P_a is the absolute power in dBm.

Both of these tests requires a light source at the other end of the fiber under test.

Typical systems include telecommunications networks, data networks, cable television, and industrial equipment control.

Visual Fault Location. Faults, such as breaks or microbends, can be located in the near end of the fiber link under test (within a few feet). When the bright red laser encounters a fault, the light is deflected into the fiber jacket, producing a glow at the point of the fault.

Visual Fiber Identification. Optical fibers can be visually identified by connecting the VFL port to the fiber under test, then inspecting the far end for red light exiting the fiber connector.

Operation of the Visual Fault Locator Port

There are three modes for the VFL port, which toggle in the following order: continuous, flashing, and off. The VFL will be off when the power meter is first powered on.

To toggle the VFL mode:

1) press the  button until 'VFL' appears in the lower right-hand corner of the display. 'VFL' will appear after '1550nm'.

2) do not press any buttons for approximately 3 seconds while 'VFL' is shown on the wavelength display. This will toggle the VFL to the next mode, and then set the wavelength back to '850nm'.

To maintain the current VFL mode while scrolling through the list of wavelengths, press the  button again before 3 seconds have elapsed.

The VFL port can be turned off two different ways:

- power off the meter completely, or
- toggle through the VFL modes using the above steps until the VFL turns off.

UNIT 2 Operation

Optical Power Measurement

The Silicon ZOOM 2 VFL can be used to measure the actual amount of power being received by the detector. This is useful for checking the power level of a light source or for testing patch cords.

Use the following steps for measuring absolute optical power:

1 - Connect the Silicon ZOOM 2 VFL and your light source to the fiber under test.

2 - Power ON and set the light source to the wavelength you are using for your measurement. Remember to allow the light source to warm up according to manufacturer specifications.

3 - Power ON and set the wavelength on the Silicon ZOOM 2 VFL to the match the wavelength of your light source.

4 - Set the power units mode on the Silicon ZOOM 2 VFL to dBm, or absolute mode.

The resultant reading is the absolute optical power being received by the Silicon ZOOM 2 VFL. Repeat these

Optical Loss Measurement

The Silicon ZOOM 2 VFL is also capable of measuring the loss of a fiber link. This is done by setting a “zero” reference point, then measuring the power through the link. A simple calculation gives you the actual loss in the link. This loss is then compared to the link budget to see if the link passes or fails.

You will need two identical patch cords for optical loss measurement. Follow the steps below:

1 - Power ON and set the light source to the wavelength you are measuring. Remember to allow the light source to warm up according to manufacturer specifications.

2 - Power ON and set the wavelength on the Silicon ZOOM 2 VFL to the wavelength you are measuring. Make sure that the wavelength on the meter matches the wavelength on the light source.

3 - Connect one of the patch cords to the Silicon ZOOM 2 VFL and to the light source you are using for the test. This patch cord will be used on the meter side of the link under test. If the power level shown on the Silicon ZOOM 2 VFL is close to the power level of the light source, this patch cord is good. If it is not, replace it with a good patch cord. Once you have verified that the meter side patch cord is good, disconnect it from the meter and light source, and set it aside.

4 - Connect the second patch cord to the Silicon ZOOM 2 VFL and to the light source you are using for the test. This patch cord will be used for the light source side of the test. NOTE: if you are testing a multimode fiber link, you must wrap this patch cord 5 to 7 times around a mandrel (0.7 in. for 62.5/125uM core, and 0.9 in. for 50/125uM core) to achieve Equilibrium Mode Distribution (EMD). The purpose of a mandrel is to remove “high-order” modes of light, or light that would not ordinarily travel the full length of a fiber link. If this excess optical energy is not removed, it will cause the power meter to set an incorrect reference and will throw off the final loss readings.

Optical Loss Measurement, cont.

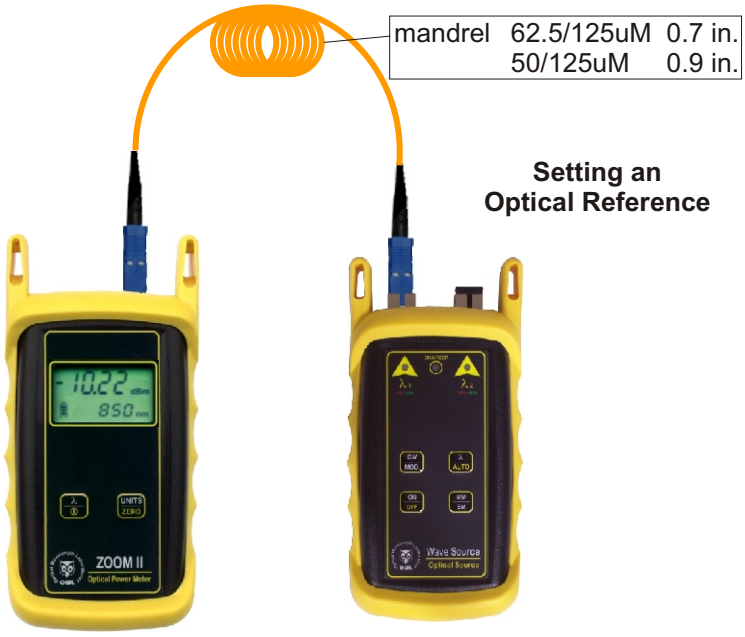
5 - Press and hold the UNITS / ZERO button for two seconds to “zero” the Silicon ZOOM 2 VFL. The Silicon ZOOM 2 VFL will automatically switch to display optical power in dB, and should display approximately 0.00 dB. Press the UNITS / ZERO button to switch back to dBm mode. Record the number on the display as your reference value.

6 - Disconnect the patch cord from the Silicon ZOOM 2 VFL without disturbing the connection to the light source. NOTE: it is vitally important that you leave this patch cord connected to the light source for the duration of the test. Disconnecting the light source before you have finished testing will invalidate the optical reference you set.

7 - Take the light source to the other end of the fiber link, and connect it to the first fiber under test.

8 - Connect the Silicon ZOOM 2 VFL to the first fiber under test. Record both the absolute power (dBm) and loss value (dB). Compare the dB value to the loss value on your link budget. The link will PASS if the number on the ZOOM is less than the loss value on the link budget. Record the dB and dBm values for future reference. Repeat this step for each fiber under test.

Repeat steps 4 through 8 for each wavelength you are testing.



Setting an Optical Reference

Visual Fault Location

The VFL port in the Silicon ZOOM 2 VFL can also be used as a troubleshooting tool to determine if there are breaks, micro-bends, or any other anomalies causing excessive loss within the first few feet of the fiber under test located in the splice tray. The bright red laser injects high-intensity red laser light into the near-end connector. If this light encounters any anomalies, such as a break or a micro-bend, the light is deflected into the fiber jacket, producing a red glow at the point of the anomaly.

Follow the steps below:

1) Connect the VFL port to the fiber under test. It is recommended to use a fiber patch cable as shown below to avoid handling the fragile jacketed fiber in the splice tray.

NOTE: do NOT insert an APC (Angled Physical Contact) connector in to the VFL port as this could permanently damage the light source inside the port.

2) Power on the VFL. See page 1-3 for instructions on operating the VFL port.

3) Inspect the splice tray for anomalies. Optical fiber jackets are differently colored, making it is difficult to see red light shining through, so for best results, it is recommended to keep the room light at a minimum.

Visual Fiber Identification

The Silicon ZOOM 2 VFL can help take the guesswork out of identifying ports in a fiber patch panel or checking polarity of a duplex connector. Connect the VFL port to one end of a fiber link, and the high-intensity, precision-coupled red laser diode will allow the user to visually identify the port by the presence of a red glow emitting from the connector on the other end, allowing for visual port identification of fiber optic links up to 5 kilometers (3.1 miles) away.

Follow the steps below:

1) Connect the VFL port to the fiber under test. It is recommended to use a fiber patch cable as shown below to avoid handling the fragile jacketed fiber in the splice tray.

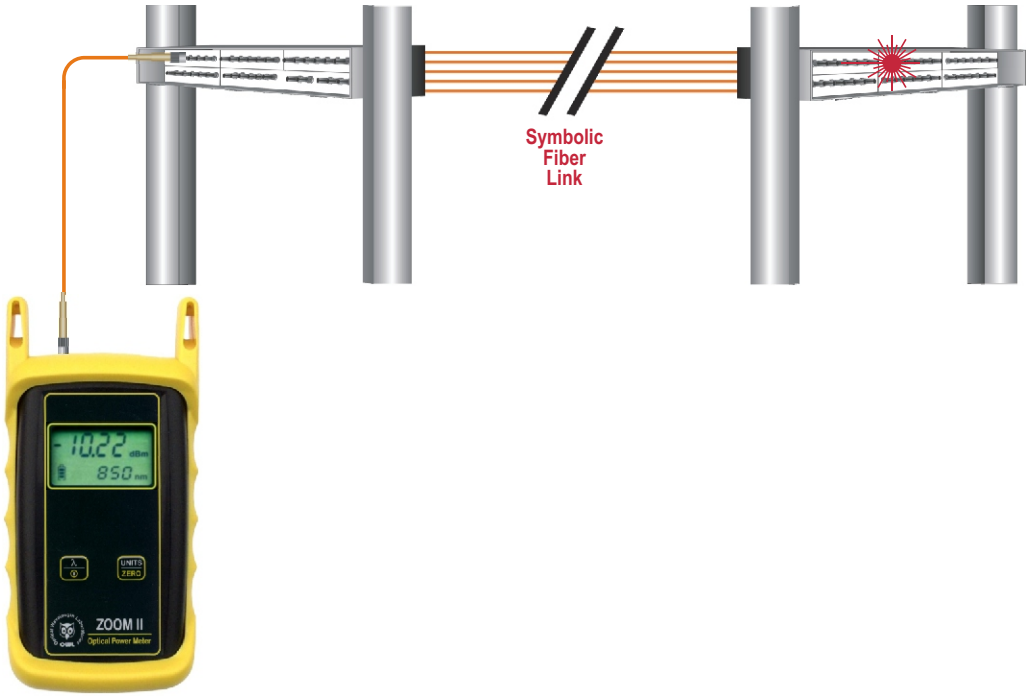
NOTE: do NOT insert an APC (Angled Physical Contact) connector in to the VFL port as this could permanently damage the light source inside the port.

2) Power on the VFL. See page 1-3 for instructions on operating the VFL port.

3) Inspect the far-end connectors for the red light exiting the connector.

IMPORTANT SAFETY NOTE: the laser light exiting the fiber is very bright and could cause damage to your eye if viewed directly.

To assist with viewing of the light exiting the connector, hold a piece of white paper in front of the connectors. This will sufficiently diffuse the light for safe viewing.



UNIT 3 Appendix

MAINTENANCE AND CALIBRATION PROCEDURES

Repair. Repair of this unit by unauthorized personnel is prohibited, and will void any warranty associated with the unit.

Battery Replacement. The battery compartment is covered by a sliding plate on the back of the unit. Remove the rubber boot to expose the back of the unit. One 9v battery is required for operation.

Cleaning. For accurate readings, the optical connectors on the Silicon ZOOM 2 VFL and the connectors on the patch cords should be cleaned prior to attaching them to each other. Minimize dust and dirt buildup by replacing the dust caps after each use.

Calibration. It is recommended to have Optical Wavelength Laboratories calibrate this unit once per year.

Warranty. The Silicon ZOOM 2 VFL comes standard with a two-year factory warranty, which covers manufacturer defect and workmanship only.

CONTACT INFORMATION

Address:
Optical Wavelength Laboratories
N9623 Hwy 12
Whitewater, WI 53190

Phone:
(262) 473-0643

Web:
http://owl-inc.com

USE OF SC CONNECTORS WITH 2.5MM UNIVERSAL PORT

Take extra care when inserting SC connectors into the 2.5mm universal port as the spring-loading action of the SC connector may cause improper insertion. Call OWL at (262) 473-0643 with any questions.

SPECIFICATIONS

Detector Type:	1mm
NIST-Traceable Wavelengths:	850nm
Measurement Range:	+5 to -60 dBm
Measurement Units:	dBm; uW (absolute) dB (relative)
Accuracy:	± 0.15 dB[1]
Resolution:	0.01 dB
Battery Life:	up to 250 hours (9v)
Connector Type:	2.5mm Universal
Operating Temperature:	-10 to 55º C
Storage Temperature:	-30 to 70º C
Size:	2.75”W x 4.94”H x 1.28”D
Weight:	116g
Low Battery Indicator:	Yes
NIST Traceable:	Yes
VFL Visual Range:	5 kilometers (3.1 miles)
VFL Optical Output:	≥1 milliwatt
VFL Optical Transmission:	Modulated (flashing)

UNIT 5 Appendices

Universal Port

The Silicon ZOOM 2 VFL contains a universal detector port which allows for coupling to any fiber optic connector that uses a 2.5mm ferrule (e.g. ST, SC, FC, etc.).

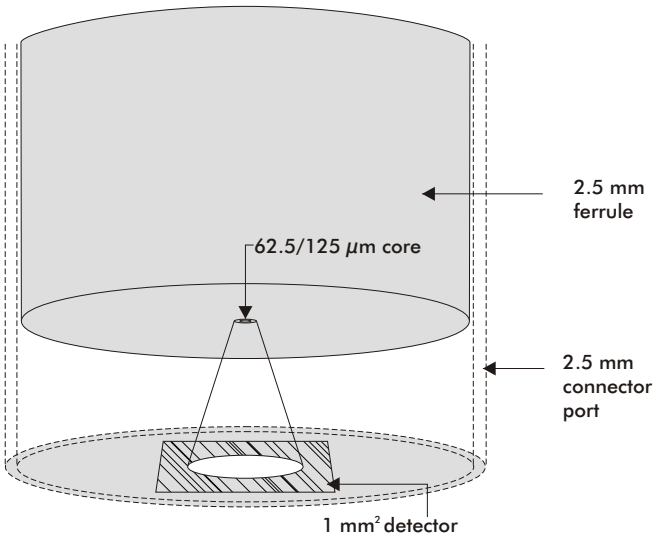
What gives this port its flexibility is that only the ferrule is inserted into the port. Since there is no latching mechanism to speak of, any 2.5mm ferrule connector can be inserted into the same port without having to swap adapter ports. There is no longer the need to purchase or maintain additional adapter caps for each different connector type.

This detector port is designed so that the cone of acceptance falls completely onto the detector, regardless of how the connector may turn, twist, or wiggle in the port. Because of this, you can be assured that the connection will always produce an accurate reading as long as it is inserted completely into the port (see the diagram below).

Additionally, some connectors use a 1.25mm ferrule. The flexible universal port system on the Silicon ZOOM 2 VFL allows the user to remove the 2.5mm adapter and place a 1.25mm adapter (which may be purchased as an option) for connection to LC, MU, and other SFF connectors which use the 1.25mm ferrule.

Please call 262-473-0643 with any questions you may have about the universal port, or any other of our fiber optic test products.

NOTE: if the integrated VFL port is a fixed 2.5mm universal port, it is not removable like the detector port.



Link Budget Calculation Worksheet

Operating Wavelength _____ Fiber Type _____

Calculate System Attenuation

Fiber Loss at Operating Wavelength (Distance x Fiber Loss)

Total Cable Distance		km
Individual Fiber Loss (at operating wavelength)		dB/km
Total Fiber Loss		dB

Connector Loss (Connector Loss x Connector Pairs)

Individual Connector Loss		dB
Number of Connector Pairs		
Total Connector Loss		dB

Splice Loss (Splice Loss x Splices)

Individual Splice Loss		dB
Number of Splices		
Total Splice Loss		dB
Other Components		dB
Total System Attenuation		dB

Calculate Link Loss Budget

Determine System Gain (Avg. Transmitter Power - Receiver Sensitivity)

Average. Transmitter Power		dBm
Receiver Sensitivity		dBm @ 10^{-9} BER
System Gain		dB

Power Penalties (Operating Margin + Receiver Power Penalties + Repair Margin # Splices at 0.3dB each)

Operating Margin		dB
Receiver Power Penalties		dB
Repair Margin		dB
Total Power Penalty		dB

Determine Link Loss Budget (System Gain - Power Penalty)

System Gain		dB
Total Power Penalty		dB
Total Link Loss Budget		dB

Verify Performance

Verify Adequate Power (Total Link Loss Budget - Total System Attenuation)

Total Link Loss Budget		dB
Total System Attenuation		dB
System Performance Margin*		dB

* System Performance Margin must be greater than 0 dB in order for the system to operate using the specified electronics.

Procedure for Checking ZOOM 2 Series Optical Power Meters For Proper Operation

USING OWL DUAL OWL SERIES MULTIMODE SOURCES

LIGHT SOURCE MODEL NUMBERS:
DO2xx
DO2-85xx

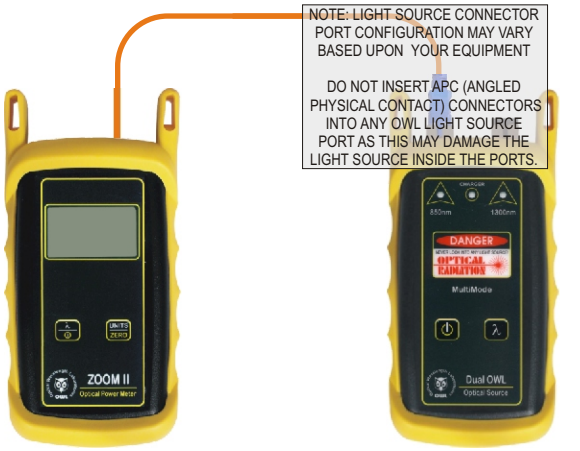
Checking ZOOM 2 Series Optical Power Meters for Proper Operation

USING A DUAL OWL MULTIMODE LIGHT SOURCE

NOTE: it is recommended to thoroughly clean and inspect all patch cord connectors before making any connection.

STEP 1 - Connect ZOOM 2 and Dual OWL

Connect the ZOOM 2 and Dual OWL together with an orange multimode patch cable as shown below.



DUAL OWL connected to 850nm port

STEP 2 - Power ON the ZOOM 2

Press ON OFF to power on the ZOOM 2.

After a few seconds, the ZOOM 2 display should read 'LO', and will appear similar to the diagram shown at right.

NOTE: the wavelength and measurement units may be different from the display at right.

STEP 3 - Set the ZOOM 2 to 'dBm'

Press UNITS ZERO on the ZOOM 2 until the measurement units read '**dBm**' as shown at right. You may need to press the button several times.

STEP 4 - Set ZOOM 2 to 850nm

Press λ AUTO on the ZOOM 2 until the wavelength display shows '**850nm**' as shown at right. You may need to press the button several times.

STEP 5 - Power ON the Dual OWL

Press ⏻ to power on the Dual OWL.

The 850nm indicator LED should now be lit as shown at right.

STEP 6 - Check optical power

The power reading that appears on the ZOOM 2 display will depend upon cable type. Consult the table below for a list of acceptable power readings.

Core Size	Acceptable Power Level	Replace at
62.5/125 µM	-19.0 to -22.0 dBm	-22.00 dBm
50/125 µM	-22.0 to -25.0 dBm	-25.00 dBm

NOTE: the following steps are only required if the optical power reading on the ZOOM 2 is too low.

STEP 7 - Replace the patch cable

The easiest way to troubleshoot low power levels is to try another patch cable. Over time, patch cables can wear out or become damaged the more they are used for optical loss testing. Replacing the patch cable usually fixes the problem.

STEP 8 - Clean patch cables and optical ports

If the problem still exists after patch cable replacement, there may be some debris, such as dust, dirt, or finger oil, that has collected on the connector endface or in the equipment optical ports.

Thoroughly clean and inspect the optical ports of the ZOOM 2 and the Dual OWL, as well as the fiber connector endfaces, according to the brochures that have been included with this kit. Several cleaning cycles may be required.

If the power level is still too low, even after a thorough cleaning and inspection and patch cable replacement, contact OWL technical support at 262-473-0643 for more information.