

Optical Wavelength Laboratories

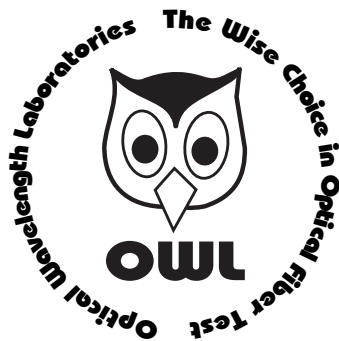
OPERATIONS GUIDE

WAVETESTER OPTICAL POWER METER

Model Numbers:

WT-1

WT-1V



Revision 1.7
25909

OWL-INC.COM

Optical Wavelength Laboratories (OWL)
N9623 West US Hwy 12
Whitewater, WI 53190
Phone: 262-473-0643
Internet: OWL-INC.COM

INTRODUCTION

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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.

ABOUT THIS MANUAL

Throughout this manual you will find various symbols that assist with understanding the procedures outlined in this manual. Below is a list of these symbols and a short description of their purpose:



Shows a helpful tip that will make a procedure go more smoothly



Tells the user some useful information about the successful completion of a procedure



Warns the operator of a potentially dangerous condition

INTRODUCTION

APPLICATIONS

Below is a list of test and measurement applications that can be performed using the WaveTester optical power meter. The procedure for each one of these applications is covered in detail in this manual.

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

Fiber Continuity Testing. Continuity can be measured with the WaveTester by placing a calibrated light source on one end of the fiber and the WaveTester on the other end. This is also a simple way to measure the attenuation of the fiber.

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

Attenuation (Optical Loss) 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. Up to 200 fiber measurements may be stored for later download into OWL Reporter software.

DESCRIPTION

This manual describes the operation of the WaveTester optical power meter. The WaveTester is a very economical option for measuring the optical power of both multimode and singlemode fibers. The WaveTester is NIST traceable, and is calibrated 850, 1300, 1310, and 1550nm, as well as 1490nm, one of the key wavelengths used in FTTx PON networks. Reference values used for optical loss readings are stored for each of these wavelengths.

The WaveTester has a user-friendly interface which includes four push-buttons, and also includes a 2.5mm universal connector, which is compatible with many popular fiber connectors, such as ST, SC, and FC, and a 1.25mm universal connector adapter that allows for connection to LC, MU, and other SFF connectors.

The WaveTester is ideal for fiber optic professionals who need to quickly measure the loss in their fiber optic links, as well as simple data storage and auto-testing fiber link certification.

For an additional charge, the charger port in the WaveTester can be replaced by 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.

INTRODUCTION

PRECAUTIONS

Safety - Exercise caution when working with any optical equipment. High-intensity fiber optic laser sources output potentially dangerous high energy invisible light, and could cause serious, irreparable damage to the eye. Thus, it is recommended to **NEVER** look into the connector port of a light source or the end of a fiber.

Operational - It is important to keep connector ferrules and optical connector ports clean. If dirt, dust, and oil are allowed to build up inside connector ports, irreparable damage may occur to the optics inside the port. For best results, replace dust caps after each use.

Connector - if you have the optional Visual Fault Locator installed, do NOT insert APC (Angled Physical Contact) connectors into the VFL port on your WaveTester as this may damage the angled ferrule on the APC connector.

PRODUCT LABEL

On the back of each WaveTester series optical power meter is a label similar to the one shown below containing model number, serial number, power requirements, and special cautionary information. If the unit is enclosed in its protective boot, the boot must be removed to view this label.



MODEL# WT-1
SERIAL# WT11019
POWER: 9V DC ===



Conforms to the Harmonized European Standards EN 61326-1 and EN 61010-1.



MODEL# WT-1V
SERIAL# WT81019
POWER: 9V DC ===



Conforms to the Harmonized European Standards EN 61326-1 and EN 61010-1.

INTRODUCTION

GENERAL FEATURES

- 1 Charger Port / Optional VFL Port** - Allows for charging of re-chargeable 9-volt batteries, as well as wall power operation (9VDC transformer and 9-volt re-chargeable battery not included).



DO NOT USE BATTERY CHARGING PORT WITH NON-RECHARGEABLE BATTERIES, AS THIS COULD POTENTIALLY CAUSE HARM TO THE UNIT AND/OR THE USER.

As an option, a Visual Fault Locator (VFL) can be installed in place of the charger port.

- 2 USB Download Port** - downloads stored data to a PC using the supplied USB download cable

- 3 2.5mm Universal Connector Port** - accepts many popular 2.5mm ferrule connectors, including ST, SC, and FC. Also included is a 1.25mm universal adapter cap (for connection to LC, MU, and other SFF connectors).

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

- 5 SAVE** - single button press saves the current measurement; press and hold to download data to terminal program such as Hyperterminal.

- 6 ON/OFF** - powers the WaveTester on and off; also turns the backlight on and off. This button also controls the operation of the optional visual fault locator port.

- 7 λ/AUTO** - single button press changes the measurement wavelength; press and hold to set the WaveTester into AUTO mode (enables auto-wavelength switching when used with an OWL WaveSource light source).

- 8 UNITS/ZERO** - single button press toggles the measurement units between dBm, dB, and microwatts; press and hold to set optical reference (also known as “zeroing”).



TEST PROCEDURES




ACTIVE EQUIPMENT POWER MEASUREMENT

Required Accessories

(1 or 2) one-meter patch cable(s) – (ensure proper connector type and fiber type)

Direct Transmitter Output Power Measurement

To measure the output power from a transmitter, use the following steps:

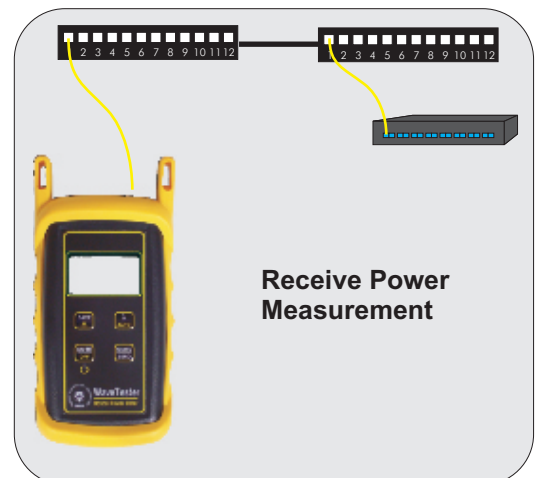
- 1 Connect the WaveTester to the transmitter port on the active equipment under test, as shown at right.
 - 2 Press  to power on the WaveTester optical power meter, if necessary.
 - 3 Determine the output wavelength of the active equipment, then press  until the wavelength on the WaveTester matches.
 - 4 Power on the transmitter port according to manufacturer instructions, if necessary.
 - 5 Monitor the reading on the screen for a few seconds. This reading may fluctuate if the output signal is made up of digital zeroes (0) and ones (1). In this case, estimate the average power level. To calculate maximum output power, add 3 dB to the average power level.
-  Some transmitters have a diagnostic mode where the output is continuously at its maximum power. This eliminates the need to compensate 3dB for digital data transmission. Consult the active equipment manufacturer's operations guide for more information.



Receive Power Measurement

The WaveTester may also be used to measure optical power levels from a transmitter through an installed link to ensure that the Receive power at the far end is within manufacturer specifications.

Follow the same steps as above, except the WaveTester must be connected to the active equipment under test through the installed link as shown at right.



TEST PROCEDURES



FIBER CONTINUITY

Required Accessories

(2) one-meter patch cables – (ensure proper connector type and fiber type)

Checking for Fiber Continuity

The WaveTester can be used to verify continuity of a fiber link, or can be used to trace an optical fiber if the fibers are not properly labeled. Use the following procedure to test either multimode and singlemode cables.

- 1 Connect a fiber optic light source to the network port under test as shown at right. Power on the light source according to manufacturer instructions.
- 2 Press  to power on the WaveTester optical power meter, if necessary.
- 3 Press  until the wavelength on the WaveTester matches the output wavelength of the light source.
- 4 Take the WaveTester optical power meter to the opposite end of the link under test, and connect into the first port. If the WaveTester does not detect any optical power, the display will read "LO". Continue connecting to subsequent optical ports until the WaveTester display shows an optical power reading.



If none of the ports display an optical power reading, then it is likely that there is a major connectivity problem with the link, and further troubleshooting is necessary to determine the nature of the problem.

TEST PROCEDURES

PATCH CABLE TESTING

Required Accessories


- (3) one-meter patch cables – (ensure proper connector type and fiber type)
- (2) fiber optic adapters/couplers – (ensure proper connector type)

Patch Cable Insertion Loss


Patch cables should be tested periodically to ensure that they are okay to use for testing. Use the following procedure to test both multimode and singlemode patch cables.

 **If testing at more than one wavelength, this procedure must be performed for each wavelength separately.**

1 Connect the WaveTester to a fiber optic light source using the 3-jumper reference method as shown at right. Power on the light source according to manufacturer instructions.

2 Press  to power on the WaveTester optical power meter, if necessary.

3 Press  until the wavelength on the WaveTester matches the output wavelength of the light source.

4 Press and hold  for approximately 2 seconds to set the reference. The WaveTester will change to show loss in 'dB', and the loss value should be very close to 0.00 dB.

 **Setting a reference is commonly referred to as “zeroing”.**

5 Remove the center cable as shown at right.

6 Insert a patch cable under test between the two fiber optic adapters/couplers, then record the loss value in 'dB'.

Repeat steps 5 and 6 for each patch cable being tested.



TEST PROCEDURES

CHECK MULTIMODE REFERENCE CABLES WITH A DUAL OWL MULTIMODE LIGHT SOURCE

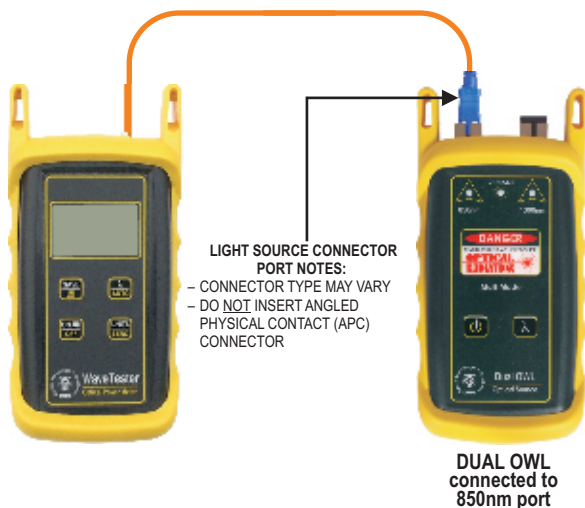
Checking WaveTester Series Optical Power Meters for Proper Operation

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 WaveTester and Dual OWL

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



STEP 2 - Power ON the WaveTester

Press to power on the WaveTester.

After a few seconds, the WaveTester 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 WaveTester to 'dBm'

Press on the WaveTester until the measurement units read 'dBm' as shown at right. You may need to press the



STEP 4 - Set WaveTester to 850nm

Press on the WaveTester 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 WaveTester 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 -21.0 dBm	-21.00 dBm
50/125 μM	-22.0 to -24.0 dBm	-24.00 dBm

NOTE: the following steps are only required if the optical power reading on the WaveTester 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 WaveTester 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.

TEST PROCEDURES

CHECK MULTIMODE REFERENCE CABLES WITH A WAVESOURCE MULTIMODE LIGHT SOURCE

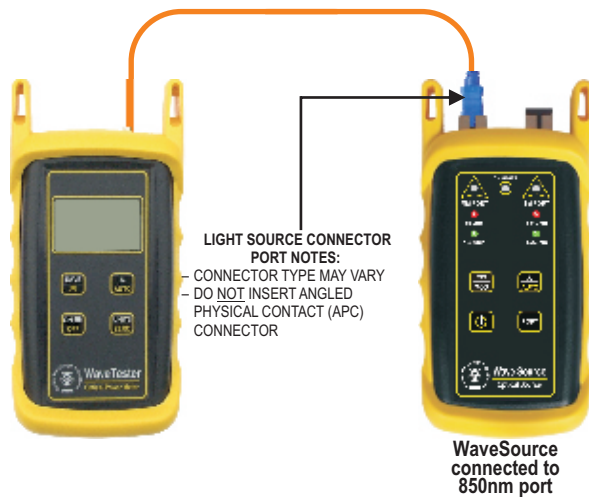
Checking WaveTester Series Optical Power Meters for Proper Operation

USING A WAVESOURCE MULTIMODE LIGHT SOURCE

NOTE: thoroughly clean and inspect all patch cord connectors before making any connection.

STEP 1 - Connect WaveTester and WaveSource

Connect the WaveTester and WaveSource together with an orange multimode patch cable as shown below.

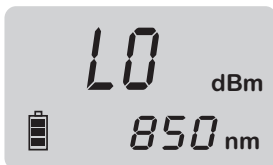


STEP 2 - Power ON the WaveTester

Press **ON/OFF** to power on the WaveTester.

After a few seconds, the WaveTester 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 WaveTester to 'dBm'

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



STEP 4 - Set WaveTester to 850nm

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



STEP 5 - Power ON the WaveSource

Press **POWER** to power on the WaveSource.

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



STEP 6 - Check optical power

The power reading that appears on the WaveTester 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 -21.0 dBm	-21.00 dBm
50/125 μM	-22.0 to -24.0 dBm	-24.00 dBm

NOTE: the following steps are only required if the optical power reading on the WaveTester 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 WaveTester and the WaveSource, 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.

TEST PROCEDURES

CHECK SINGLEMODE REFERENCE CABLES WITH A LASER OWL SINGLEMODE LASER SOURCE

Checking WaveTester Series Optical Power Meters for Proper Operation

USING A LASER OWL SINGLEMODE LASER SOURCE

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

STEP 1 - Connect WaveTester and Laser OWL

Connect the WaveTester and Laser OWL together with a yellow singlemode patch cable as shown below.



STEP 2 - Power ON the WaveTester

Press to power on the WaveTester.

After a few seconds, the WaveTester 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 WaveTester to 'dBm'

Press on the WaveTester until the measurement units read 'dBm' as shown at right. You may need to press the



STEP 4 - Set WaveTester to 1310nm

Press on the WaveTester until the wavelength display shows '1310nm' as shown at right. You may need to press the button several times.



STEP 5 - Power ON the Laser OWL

Press to power on the Laser OWL.

The 1310nm indicator LED should now be lit as shown at right.



STEP 6 - Check optical power

The power reading displayed on the WaveTester will probably not be exactly -10.00 dBm as shown at right, but should be fairly close.



Repeat this procedure for each additional patch cable that needs testing.

NOTE: the following steps are only required if the optical power reading on the WaveTester is -12.00 dBm or below.

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 WaveTester and the Laser 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 below -12.00 dBm, even after a thorough cleaning and inspection and patch cable replacement, contact OWL technical support at 262-473-0643 for more information.

TEST PROCEDURES

CHECK SINGLEMODE REFERENCE CABLES WITH A WAVESOURCE SINGLEMODE LASER SOURCE

Checking WaveTester Series Optical Power Meters for Proper Operation

USING A WAVESOURCE SINGLEMODE LASER SOURCE

NOTE: thoroughly clean and inspect all patch cord connectors before making any connection.

STEP 1 - Connect WaveTester and WaveSource

Connect the WaveTester and WaveSource together with a yellow singlemode patch cable as shown below.



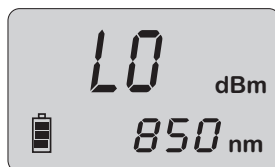
WaveSource connected to 1310nm port

STEP 2 - Power ON the WaveTester

Press **ON/OFF** to power on the WaveTester.

After a few seconds, the WaveTester 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 WaveTester to 'dBm'

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



STEP 4 - Set WaveTester to 1310nm

Press **λ AUTO** on the WaveTester until the wavelength display shows '1310nm' as shown at right. You may need to press the button several times.



STEP 5 - Power ON the WaveSource

Press **POWER** to power on the WaveSource.

The 1310nm indicator LED should now be lit as shown at right.



STEP 6 - Check optical power

The power reading displayed on the WaveTester will probably not be exactly -10.00 dBm as shown at right, but should be fairly close.



Repeat this procedure for each additional patch cable that needs testing.

NOTE: the following steps are only required if the optical power reading on the WaveTester is -12.00 dBm or below.

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 WaveTester and the WaveSource, 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 below -12.00 dBm, even after a thorough cleaning and inspection and patch cable replacement, contact OWL technical support at 262-473-0643 for more information.

QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
DUAL OWL Series Multimode Sources



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Required Accessories

- (2-3) one-meter patch cables – ensure proper connector type and fiber type
- (1) fiber optic mandrel – used for setting references with multimode cables only; see table below for mandrel sizes

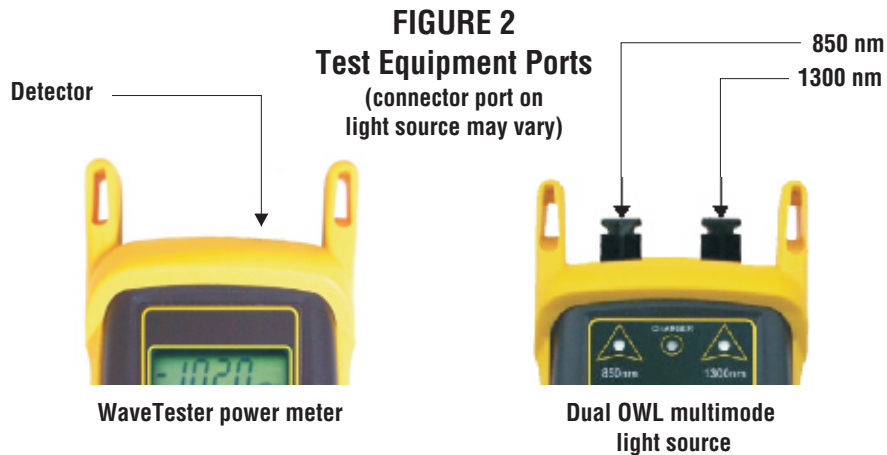
	50/125 μm	62.5/125 μm
Diameter	0.9 in.	0.7 in.
Wraps	5	5



-  multimode reference cables must be wrapped and secured around a mandrel as required by national and international Fiber Optic Test Procedures (FOTPs). See Figure 1 above for a diagram of a mandrel wrap.
-  if you are testing at both 850nm and 1300nm, each light source wavelength will require its own mandrel-wrapped patch cable.

Equipment Ports

Figure 2 shows the ports used during this procedure. These ports may vary depending upon the model of equipment.



QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:




WAVETESTER
DUAL OWL Series Multimode Sources

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Verify Proper Operation of the Equipment

- 1 Connect the power meter and light source together with the first patch cable as shown in Figure 3.



- 2 Press  to power on the Dual OWL multimode light source. The 850nm port powers on first by default.
- 3 Press  to power on the WaveTester optical power meter.
- 4 Press  several times on the WaveTester until the wavelength is set to 850nm.
- 5 Compare the reading on the WaveTester to Table 1 for acceptable power levels for non-mandrel wrapped reference cables. The patch cable should be replaced if it is below the acceptable power level.

Core Size	Acceptable Power Level	Replace at
62.5/125 μM	-19.0 to -21.0 dBm	-21.00 dBm
50/125 μM	-22.0 to -24.0 dBm	-24.00 dBm

TABLE 1

- 6 Once proper operation has been verified, remove the first patch cable from both units and set it aside.
- 7 Connect the power meter and light source together with the second patch cable as shown in Figure 3.
- 8 Compare the reading on the WaveTester to Table 1 for acceptable power levels. The patch cable should be replaced if it is below the acceptable power level.
- 9 Once proper operation has been verified, remove the second patch cable from both units and set it aside.

QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
DUAL OWL Series Multimode Sources

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Verify Proper Operation of the Equipment, cont.

- 10 Connect the power meter and light source together with the mandrel-wrapped patch cable as shown in Figure 4 below.



FIGURE 4
Set
Optical
Reference

- 11 Compare the reading on the WaveTester to Table 2 for acceptable power levels. The patch cable should be replaced if it is below the acceptable power level.

Core Size	Acceptable Power Level	Replace at
62.5/125 μM	-19.0 to -21.0 dBm	-21.00 dBm
50/125 μM	-22.0 to -24.0 dBm	-24.00 dBm

TABLE 2

- 12 Once proper operation has been verified, continue on to the next step.

Set Reference

Setting a reference is commonly referred to as “zeroing”.

- 13 With the power meter and light source still connected as shown in Figure 4, press and hold on the WaveTester to set the reference for 850nm.

The WaveTester display should change to show readings in ‘dB’, and the power reading should be approximately 0.00 dB. This means that the meter and light source have been successfully “zeroed” at 850nm.

If testing at 1300nm is also required, connect a mandrel-wrapped patch cable to the 1300nm port, then perform 14 through 16. Otherwise, skip to 17.

QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
DUAL OWL Series Multimode Sources

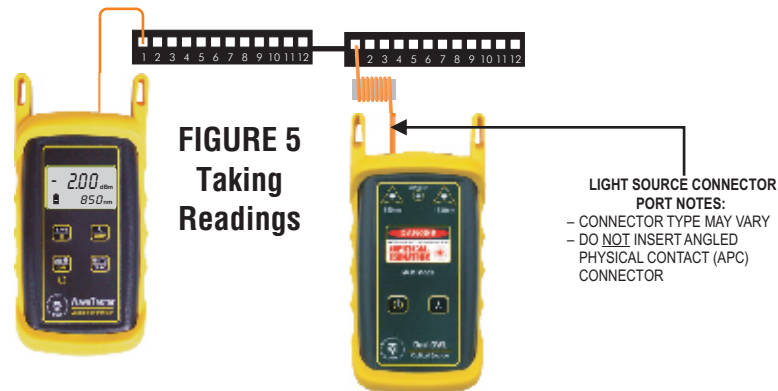
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Verify Proper Operation of the Equipment, cont.

- 14 Connect the 1300nm mandrel-wrapped patch cable to the detector port on the WaveTester.
- 15 Press $\frac{\lambda}{0}$ several times until the WaveTester is set to 1300nm.
- 16 Press and hold **UNITS ZERO** on the WaveTester to set the reference for 1300nm. The WaveTester display should show a power reading of approximately 0.00 dB. This means that the meter and light source have been successfully “zeroed” at 1300nm.

Take Readings

- 17 Remove the patch cable from the detector port on the WaveTester, and bring both units to the opposite ends of the link under test.
- 18 Connect the WaveTester and Dual OWL to the link under test as shown in Figure 5 below.



- 19 Press $\frac{\lambda}{\text{AUTO}}$ several times until the WaveTester is set to 850nm.
- 20 Press λ on the Dual OWL to set the Dual OWL to 850nm, if necessary.
- 21 Press **SAVE** to store the optical power measurement in the WaveTester. The stored fiber number will increment by '1'.
- 22 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.
- 23 Repeat 21 and 22 for each fiber in the cable under test until all fibers have been tested at 850nm.
- 24 For testing 1300nm, again connect to the first fiber under test, except this time use the mandrel-wrapped patch cable connected to the 1300nm port.




QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
DUAL OWL Series Multimode Sources

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Take Readings, cont.

- 25 Press  several times until the WaveTester is set to 1300nm.
- 26 Press  to store the optical power measurement in the WaveTester.
 -  The fiber number on the WaveTester will increment by 1.
- 27 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.
- 28 Repeat 26 and 27 for each fiber in the cable under test until all fibers have been tested at 1300nm.

(end of procedure)

QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
WAVESOURCE Series Multimode Sources

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Required Accessories

- (2) one-meter patch cables – ensure proper connector type and fiber type
- (1) fiber optic mandrel – used for setting references with multimode cables only; see table below for mandrel sizes

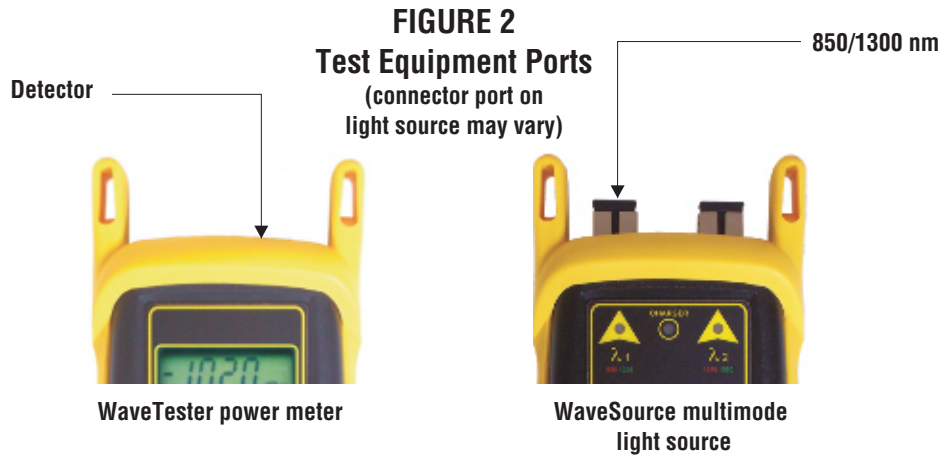
	50/125 μm	62.5/125 μm
Diameter	0.9 in.	0.7 in.
Wraps	5	5



multimode reference cables must be wrapped and secured around a mandrel as required by national and international Fiber Optic Test Procedures (FOTPs). See Figure 1 above for a diagram of a mandrel wrap.

Equipment Ports

Figure 2 shows the ports used during this procedure. These ports may vary depending upon the model of equipment.



(continued on next page)



QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:


WAVETESTER
WAVESOURCE Series Multimode Sources

PAGE 2 OF 4

Verify Proper Operation of the Equipment

- 1 Connect the power meter and light source together with the first patch cable as shown in Figure 3.
- 2 Press  to power on the light source. The red LED on the left-hand side (850nm) will be lit by default.
- 3 Press  to power on the WaveTester.



- 4 If necessary, press  on the WaveTester several times until the wavelength is set to 850nm.
- 5 Compare the reading on the WaveTester to Table 1 for acceptable power levels. The patch cable should be replaced if it is below the acceptable power level.

Core Size	Acceptable Power Level	Replace at
62.5/125 μM	-19.0 to -21.0 dBm	-21.00 dBm
50/125 μM	-22.0 to -24.0 dBm	-24.00 dBm

TABLE 1

- 6 Once proper operation has been verified, remove the first patch cable from both units and set it aside.

QUICK REFERENCE GUIDES

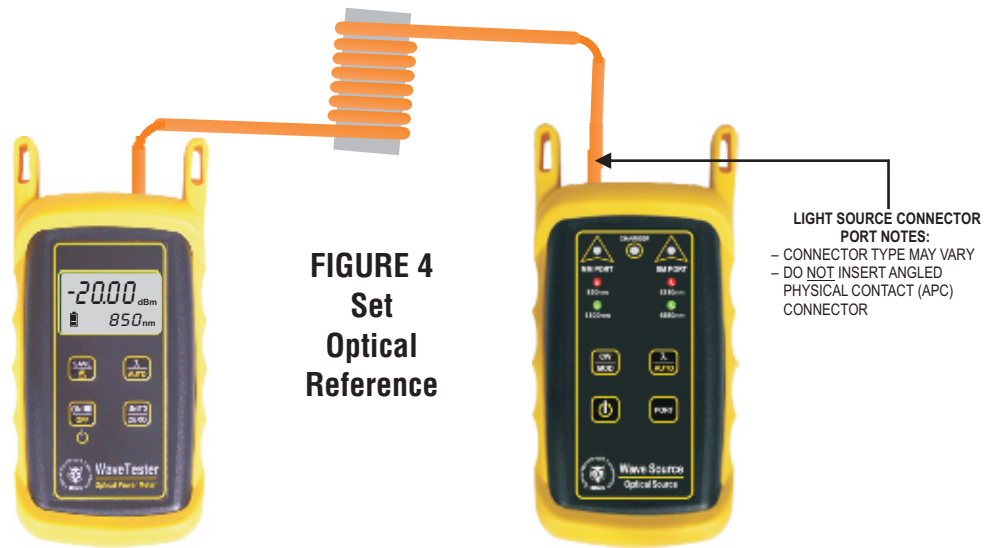
Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
WAVESOURCE Series Multimode Sources

PAGE 3 OF 4


Verify Proper Operation of the Equipment, cont.


- 7 Connect the power meter and light source together with the mandrel-wrapped patch cable as shown in Figure 4 below.



- 8 Compare the reading on the WaveTester to Table 1 for acceptable power levels. The patch cable should be replaced if it is below the acceptable power level.
- 9 Once proper operation has been verified, continue on to the next step.

Set Reference

- 10 Press and hold  on the WaveTester to set it into AUTO mode. The WaveTester display should change to show readings in 'dB'.

- 11 Press and hold  on the WaveSource until you see the indicator LED begin flashing, then immediately release the button.

The right-hand indicator LED on the WaveSource will begin alternating between the colors red and green, which indicates that the output wavelengths are automatically switching.

The WaveTester will automatically sense the wavelength switching, and will co-ordinate with the WaveSource.

- 12 Press and hold  on the WaveTester to set the reference for both wavelengths simultaneously.

-  After the references have been set, do NOT press  on either the WaveTester or the WaveSource. Doing so will take the units out of AUTO mode.

QUICK REFERENCE GUIDES


Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
WAVESOURCE Series Multimode Sources

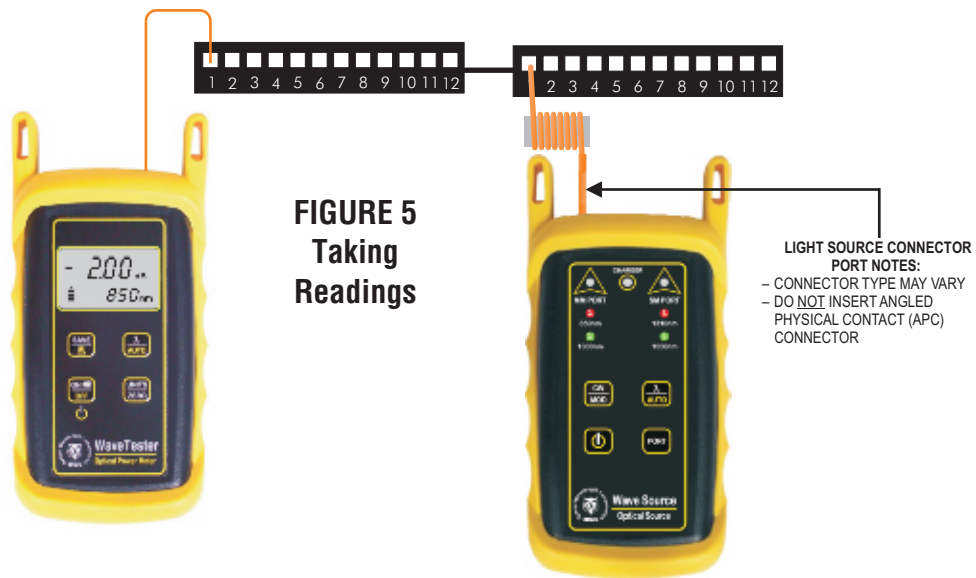
PAGE 4 OF 4


Take Readings

13 Remove the patch cable from the detector port on the WaveTester, and bring both units to the opposite ends of the link under test.

 Be careful to ensure that you do NOT remove the patch cable from the WaveSource.

14 Connect the WaveTester and WaveSource to the link under test as shown in Figure 5 below.



15 Press  on the WaveTester to store readings for both 850nm and 1300nm simultaneously for the current fiber under test.

 The fiber number on the WaveTester will increment by 2.

16 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.

17 Repeat 15 and 16 for each fiber in the cable under test until all fibers have been tested.

(end of procedure)

QUICK REFERENCE GUIDES


Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
LASER OWL Series Singlemode Sources

PAGE 1 OF 3

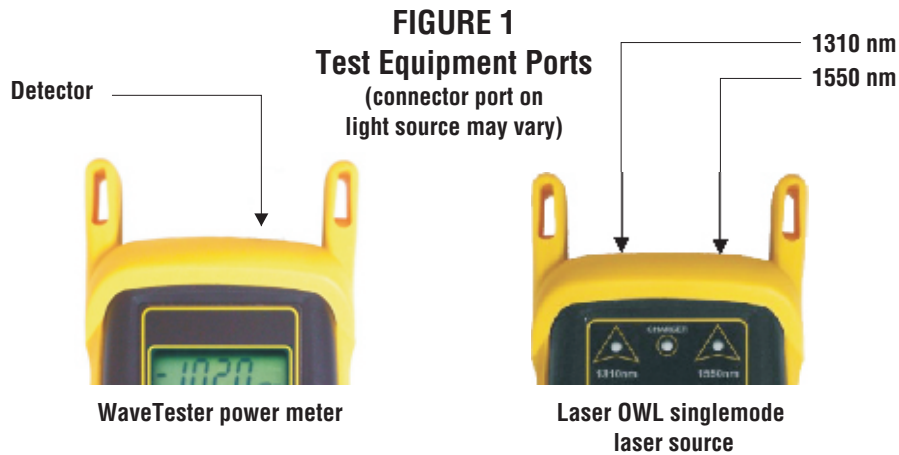
Required Accessories

(2-3) one-meter patch cables – ensure proper connector type and fiber type

 if you are testing at both 1310nm and 1550nm, each light source wavelength will require its own patch cable.

Equipment Ports


Figure 1 shows the ports used during this procedure. These ports may vary depending upon the model of equipment.



Verify Proper Operation of the Equipment

1 Connect the power meter and light source together with the first patch cable as shown in Figure 2.



2 Press  to power on the Laser OWL singlemode laser source. The 1310nm port powers on first by default.

3 Press  to power on the WaveTester optical power meter.


QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
LASER OWL Series Singlemode Sources

PAGE 2 OF 3


Verify Proper Operation of the Equipment, cont.

- 4 Press  several times on the WaveTester until the wavelength is set to 1310nm.
- 5 The WaveTester should show approximately -10.00 dBm. If the reading is below -12.00 dBm, the patch cable should be replaced.
- 6 Once proper operation has been verified, remove the first patch cable from both units and set it aside.
- 7 Connect the power meter and light source together with the second patch cable as shown in Figure 2.
- 8 The WaveTester should show approximately -10.00 dBm. If the reading is below -12.00 dBm, the patch cable should be replaced.
- 9 Once proper operation has been verified, remove the second patch cable from both units and set it aside.
- 10 Connect the power meter and light source together with the third patch cable as shown in Figure 2.
- 11 The WaveTester should show approximately -10.00 dBm. If the reading is below -12.00 dBm, the patch cable should be replaced.
- 12 Once proper operation has been verified, continue on to the next step.

Set Reference





Setting a reference is commonly referred to as “zeroing”.

- 13 With the power meter and light source still connected as shown in Figure 2, press and hold  on the WaveTester to set the reference for 1310nm.

The WaveTester display should change to show readings in ‘dB’, and the power reading should be approximately 0.00 dB. This means that the meter and light source have been successfully “zeroed” at 1310nm.



If testing at 1550nm is also required, connect a singlemode patch cable to the 1550nm port, then perform 14 through 16. Otherwise, skip to 17.

- 14 Connect the 1550nm singlemode patch cable to the detector port on the WaveTester.
- 15 Press  several times until the WaveTester is set to 1550nm.
- 16 Press and hold  on the WaveTester to set the reference for 1550nm. The WaveTester display should show a power reading of approximately 0.00 dB. This means that the meter and light source have been successfully “zeroed” at 1550nm.

QUICK REFERENCE GUIDES

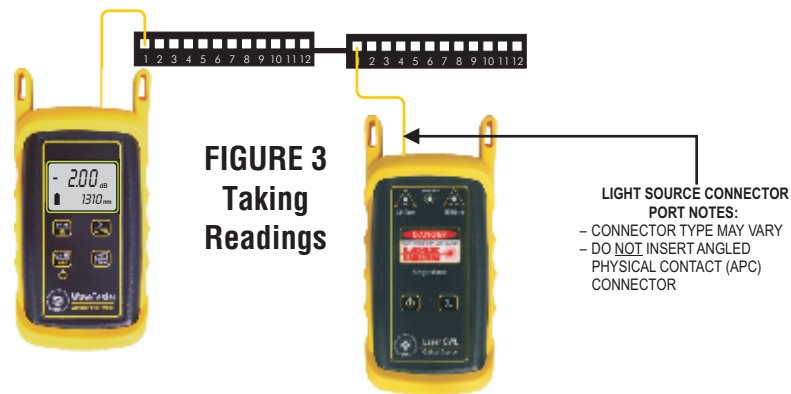
Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
LASER OWL Series Singlemode Sources

PAGE 3 OF 3

Take Readings

- 17 Remove the patch cable from the detector port on the WaveTester, and bring both units to the opposite ends of the link under test.
- 18 Connect the WaveTester and Laser OWL to the link under test as shown in Figure 3 below.



- 19 Press several times until the WaveTester is set to 1310nm.
- 20 Press on the Laser OWL to set the Laser OWL to 1310nm.
- 21 Press to store the optical power measurement in the WaveTester. The stored fiber number will increment by '1'.
- 22 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.
- 23 Repeat 21 and 22 for each fiber in the cable under test until all fibers have been tested at 1310nm.
- 24 For testing 1550nm, again connect to the first fiber under test, except this time use the patch cable connected to the 1550nm port.
- 25 Press several times until the WaveTester is set to 1550nm.
- 26 Press on the Laser OWL to set the Laser OWL to 1550nm.
- 27 Press to store the optical power measurement in the WaveTester.
 - The fiber number on the WaveTester will increment by 1.
- 28 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.
- 29 Repeat 27 and 28 for each fiber in the cable under test until all fibers have been tested at 1550nm.

(end of procedure)

QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:

WAVETESTER
WAVESOURCE Series Singlemode Sources

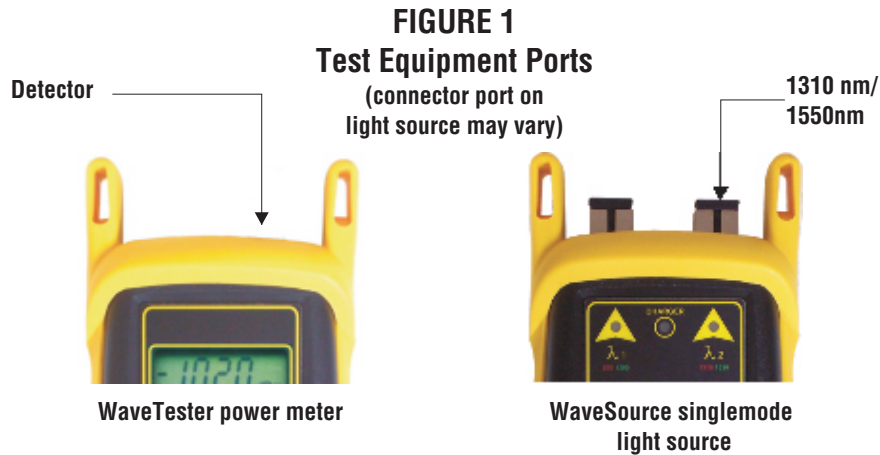
PAGE 1 OF 3

Required Accessories

(2) one-meter patch cables – ensure proper connector type and fiber type

Equipment Ports


Figure 1 shows the ports used during this procedure. These ports may vary depending upon the model of equipment.



Verify Proper Operation of the Equipment

1 Connect the power meter and light source together with the first patch cable as shown in Figure 2.



2 Press  to power on the WaveSource singlemode laser source.

3 Press  to switch the WaveSource to the SM PORT. The right-hand indicator LED should be the color red.


QUICK REFERENCE GUIDES

Optical Power Meter:
Fiber Optic Light Source:


WAVETESTER
WAVESOURCE Series Singlemode Sources


PAGE 2 OF 3

Verify Proper Operation of the Equipment, cont.

- 4 Power on the WaveTester.
- 5 Press  on the WaveTester several times until the wavelength is set to 1310nm.
- 6 The WaveTester should show approximately -10.00 dBm. If the reading is below -12.00 dBm, the patch cable should be replaced.
- 7 Once proper operation has been verified, remove the first patch cable from both units and set it aside.
- 8 Connect the WaveTester and WaveSource together with the second patch cable as shown in Figure 2.
- 9 The WaveTester should show approximately -10.00 dBm. If the reading is below -12.00 dBm, the patch cable should be replaced.
- 10 Once proper operation has been verified, continue on to the next step.


Set Reference

11 Press and hold  on the WaveTester to set it into AUTO mode. The WaveTester display should change to show readings in 'dB'.

12 Press and hold  on the WaveSource until you see the indicator LED begin flashing, then immediately release the button.

The right-hand indicator LED on the WaveSource will begin alternating between the colors **red** and **green**, which indicates that the output wavelengths are automatically switching.

The WaveTester will automatically sense the wavelength switching, and will co-ordinate with the WaveSource.

13 Press and hold  on the WaveTester to set the reference for both wavelengths simultaneously.



After the references have been set, do NOT press the  on either the WaveTester or the WaveSource. Doing so will take the units out of AUTO mode.

QUICK REFERENCE GUIDES


**Optical Power Meter:
Fiber Optic Light Source:**

**WAVETESTER
WAVESOURCE Series Singlemode Sources**

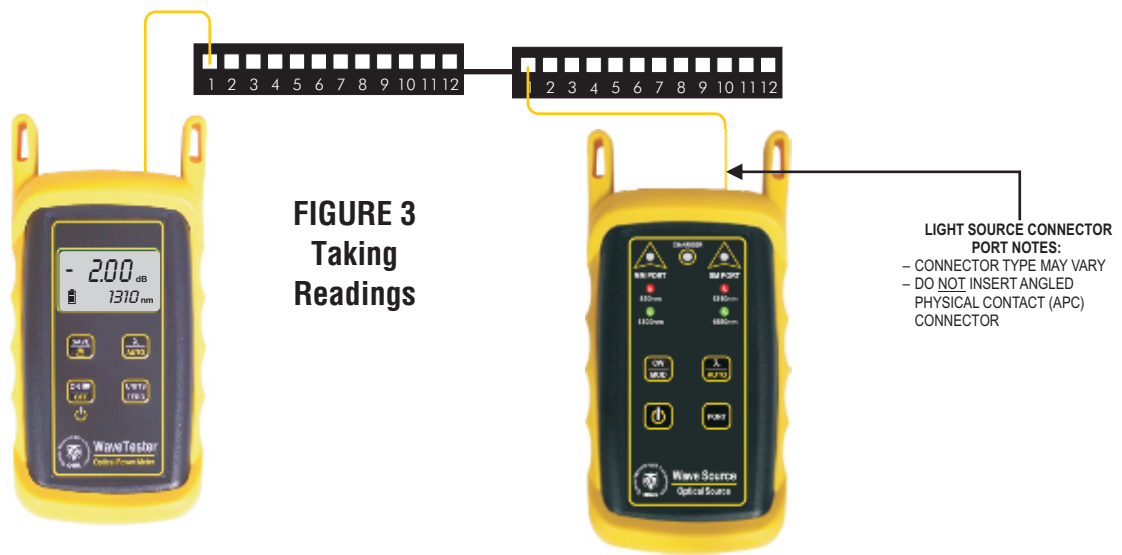
PAGE 3 OF 3


Take Readings

14 Remove the patch cable from the detector port on the WaveTester, and bring both units to the opposite ends of the link under test.

 Be careful to ensure that you do NOT remove the patch cable from the WaveSource.

15 Connect the WaveTester and WaveSource to the link under test as shown in Figure 3 below.



16 Press  on the WaveTester to store readings for both 1310nm and 1550nm simultaneously for the current fiber under test.

 The fiber number on the WaveTester will increment by 2.

17 Disconnect the patch cables from both ends of the patch panel and move to the next port on the patch panel.

18 Repeat steps 16 and 17 for each fiber in the cable under test until all fibers have been tested.

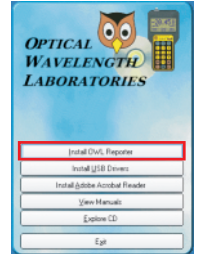
(end of procedure)

OWL REPORTER

INSTALLING OWL REPORTER

OWL Reporter software must be installed before the WaveTester is able to download data to a PC. Follow the instructions below:

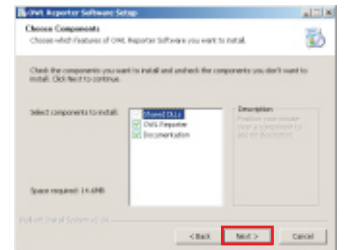
- 1 Insert the OWL CD into your CD-ROM drive.
- 2 When the CD Installation panel appears on your screen, click the “**Install OWL Reporter**” button.



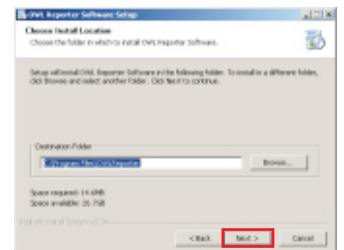
- 3 Click “**Next**” on the “**Welcome to the OWL Reporter Software Setup Wizard**” dialog box.



- 4 Click “**Next**” on the “**Choose Components**” dialog box.



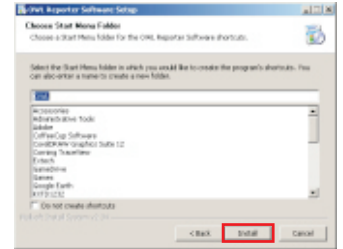
- 5 Click “**Next**” on the “**Choose Install Location**” dialog box.



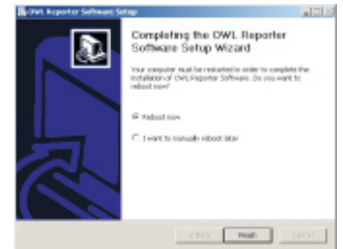
OWL REPORTER

INSTALLING OWL REPORTER, cont.

6 Click **“Install”** on the **“Choose Start Menu Folder”** dialog box to begin the OWL Reporter installation.



7 Once the OWL Reporter installation has completed, click **“Finish”** on the **“Completing the OWL Reporter Software Setup Wizard”** dialog box.



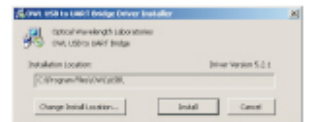
(end of procedure)

OWL REPORTER

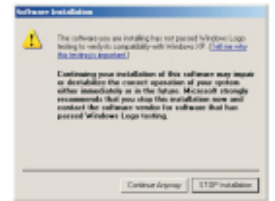
INSTALLING THE OWL USB DRIVER

To avoid USB driver conflicts, the OWL USB driver must be installed before connecting the WaveTester to the PC. Follow the instructions below:

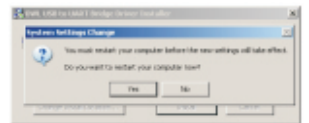
- 1 Insert the OWL CD into your CD-ROM drive.
- 2 When the CD Installation panel appears on your screen, click the “**Install USB Drivers**” button.
- 3 Click the “**Install**” button on the “**OWL USB to UART Bridge Driver Installer**” dialog box.



- 4 Click the “**Continue Anyway**” button on the “**Software Installation**” dialog box.



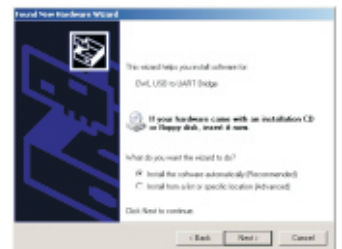
- 5 Once the software installation is complete, click “**Yes**” to reboot the computer.



- 6 Connect the WaveTester optical power meter to a USB port on the PC using the supplied USB download cable. The computer will automatically detect the WaveTester.



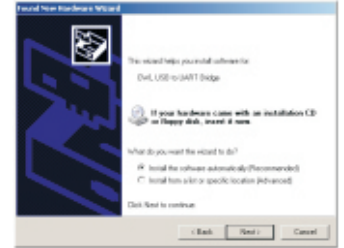
- 7 If Windows asks you to use Windows update to search for the driver, click the radio button labeled “**No, not this time**”, then click “**Next**” to continue.



OWL REPORTER

INSTALLING THE OWL USB DRIVER, cont.

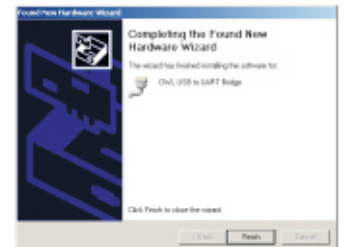
- 8 Click the radio button labeled “Install the software automatically (Recommended)”, then click “Next” to continue.



- 9 Click the “Continue Anyway” button on the “Software Installation” dialog box.



- 10 Once the drivers have been completely installed, click the “Finish” button.




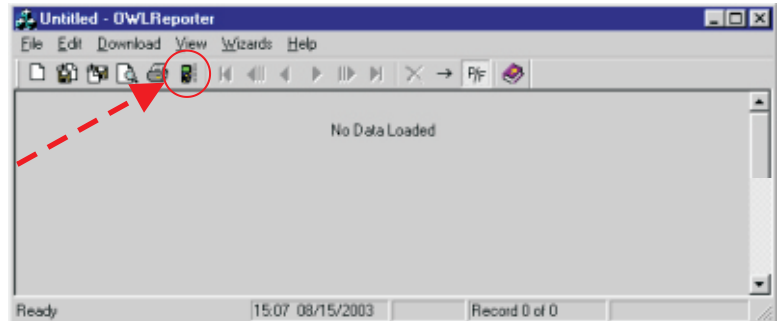
(end of procedure)

OWL REPORTER

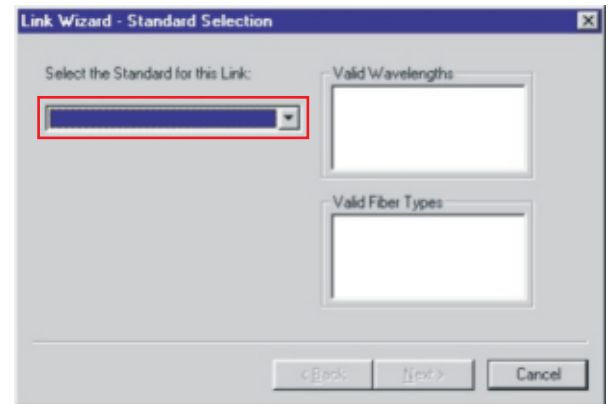
DOWNLOADING DATA TO A PC

OWL Reporter must be installed to download data from the WaveTester to the PC. See page 27 for installation instructions.

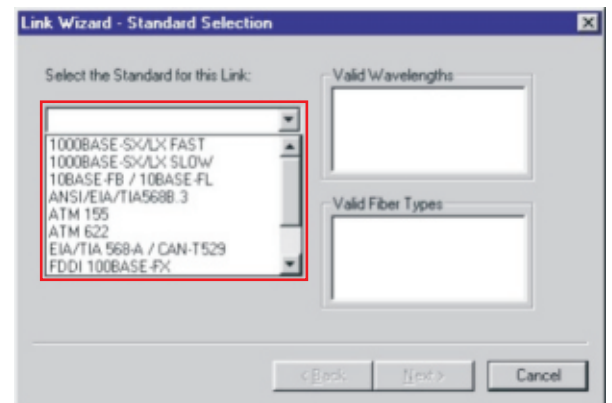
- 1 Press  to power on the WaveTester, if necessary.
- 2 Connect the WaveTester to one of the USB ports on the PC using the supplied USB cable. **NOTE: to avoid USB driver conflicts, the OWL USB driver must be installed before connecting the WaveTester to the PC.**
- 3 Start OWL Reporter. The default location for the OWL Reporter shortcut is **Start » Programs » OWL » OWL Reporter**.
- 4 Begin the download by clicking the Download icon (as shown at right) or the Download menu option.



- 5 Click the down arrow to view the list of cabling standards.



- 6 Select the cabling standard from the drop-down list.

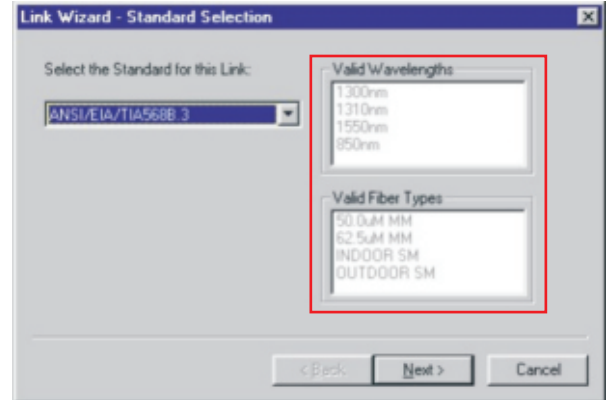


OWL REPORTER

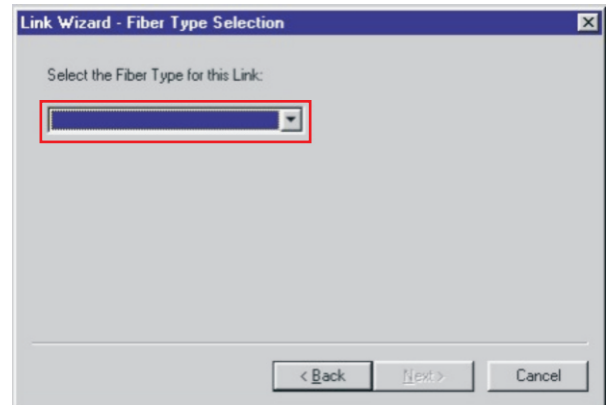
DOWNLOADING DATA TO A PC, cont.

7 Once the the cabling standard has been chosen, the wavelengths and fiber types that the standard supports appear in the boxes on the right.

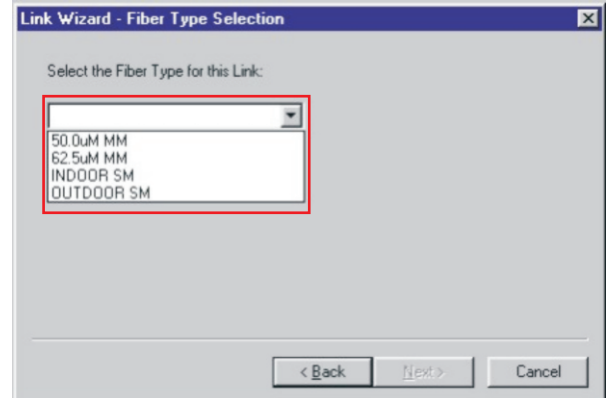
Click “Next” to continue.



8 View the list of available fiber types. The list will appear when the down arrow is clicked.



9 Select the fiber type from the list. The selected fiber type should match the type of fiber of the link under test.

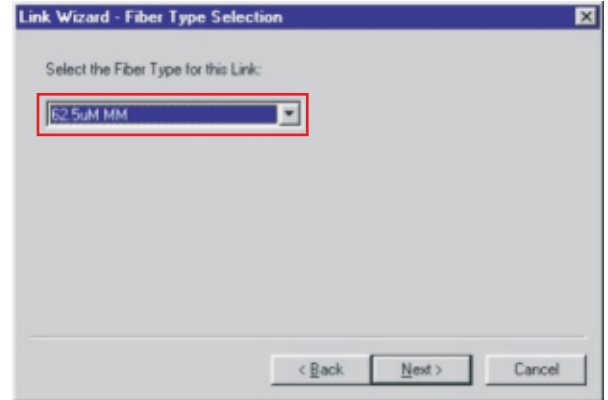


OWL REPORTER

DOWNLOADING DATA TO A PC, cont.

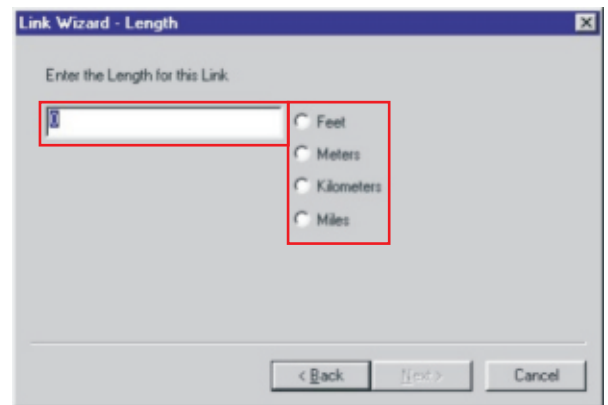
10 Once the fiber type has been chosen, it appears in the drop-down box.

Click “Next” to continue.

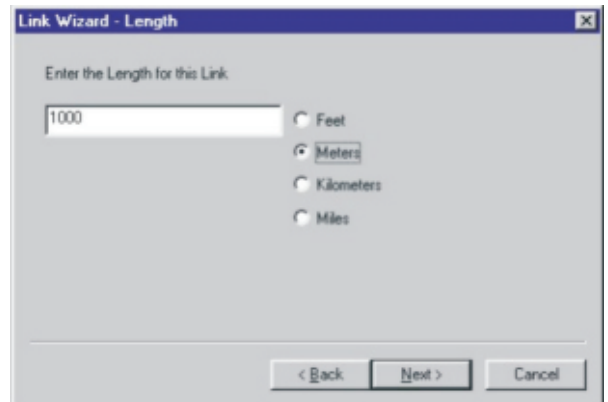


11 Enter the length of the fiber link under test. This length will apply to all of the data points downloaded from the WaveTester.

Type the length in the input box, and select the length units at the right.



12 Once the fiber link length and the length units are entered, click Next to continue.



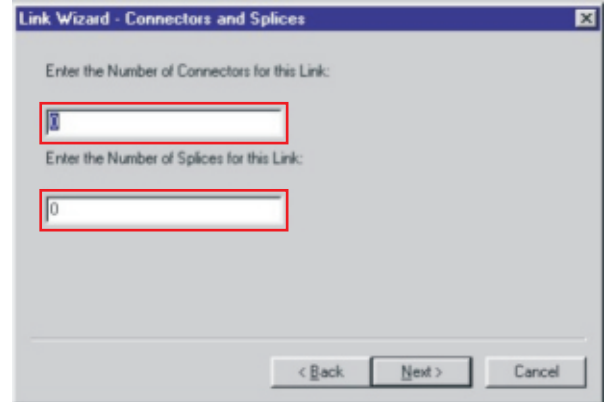
OWL REPORTER

DOWNLOADING DATA TO A PC, cont.

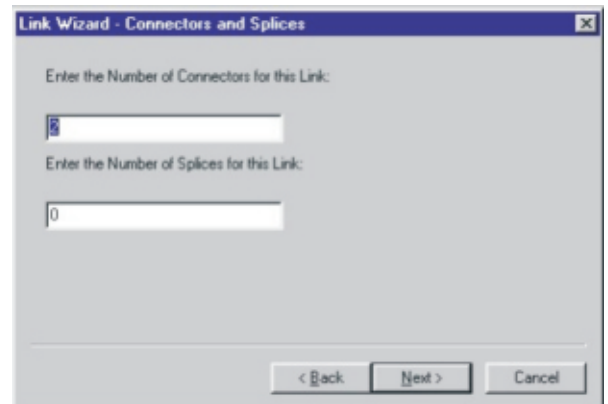
13 If there are any connections or splices in the link, enter them into the input boxes.

✓ *Connections* - typical fiber networks will have 2 connections – one for a patch panel located at each end of the link.

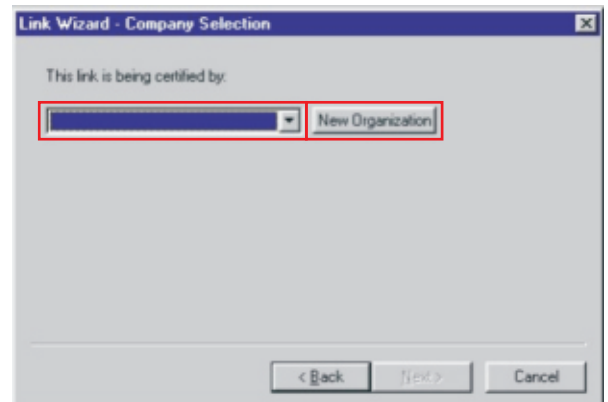
✓ *Splices* - some connectors use mechanical splice technology for termination. If the link under test is terminated with these “no-polish, no-epoxy” type connectors, they should be considered as mechanical splices.



14 Once the number of connections and splices have been entered, click Next to continue.



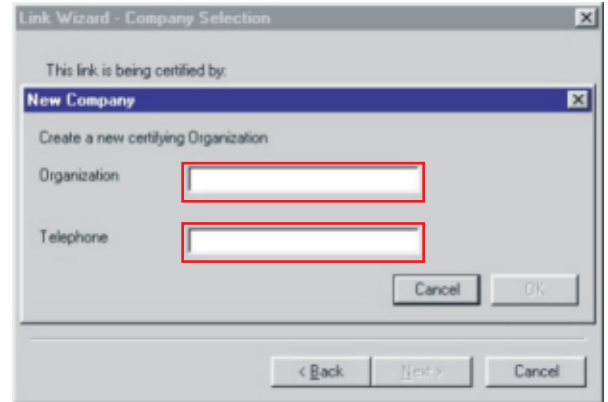
15 Select the company name from the drop-down list. If it is not listed, click the New Organization button.



OWL REPORTER

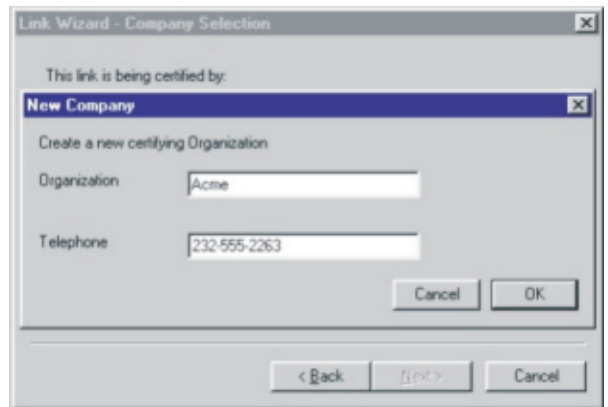
DOWNLOADING DATA TO A PC, cont.

16 Type in the organization's name and telephone number into the input boxes.



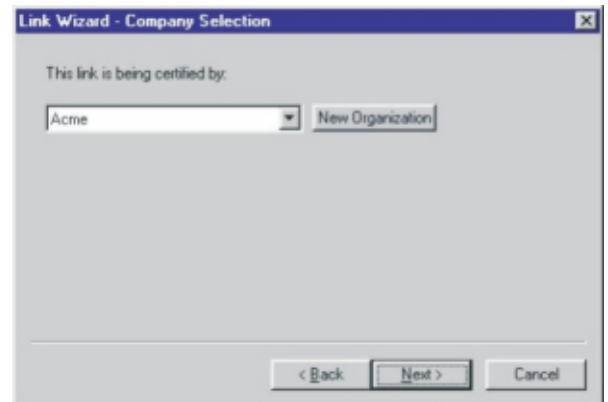
The screenshot shows a 'Link Wizard - Company Selection' dialog box. Inside, there is a sub-dialog titled 'New Company' with the instruction 'Create a new certifying Organization'. It contains two text input fields: 'Organization' and 'Telephone'. The 'Organization' field is highlighted with a red rectangular box. At the bottom of the sub-dialog are 'Cancel' and 'OK' buttons. At the bottom of the main dialog are '< Back', 'Next >', and 'Cancel' buttons.

17 Once the organization's name and telephone number have been entered, click OK to continue.



The screenshot shows the same 'Link Wizard - Company Selection' dialog box. The 'New Company' sub-dialog now has 'Acme' entered in the 'Organization' field and '232-555-2263' entered in the 'Telephone' field. The 'OK' button is now visible and highlighted.

18 The organization name should now appear in the drop-down box. Click Next to continue.

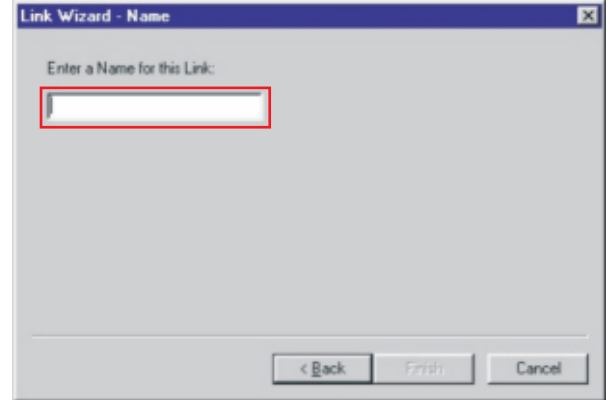


The screenshot shows the 'Link Wizard - Company Selection' dialog box. The 'New Company' sub-dialog is no longer present. Instead, there is a drop-down menu with 'Acme' selected and a 'New Organization' button next to it. The 'Next >' button at the bottom of the main dialog is now highlighted.

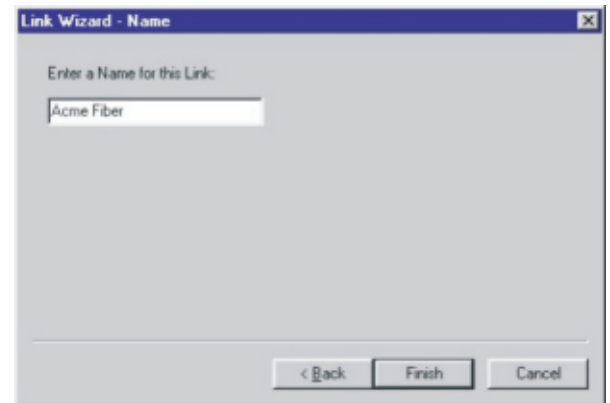
OWL REPORTER

DOWNLOADING DATA TO A PC, cont.

- 19 Enter a descriptive name for the link into the input box.



- 20 Once the link name has been entered, click Finish to continue.



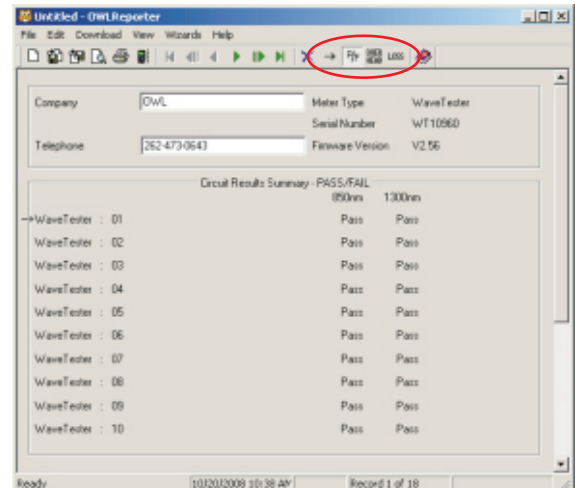
Viewing OWL Reporter Data

By default, OWL Reporter opens up into Detail View. However, Summary view may be more useful for fiber loss test evaluation.

To switch between Summary View and Detail View, press the button that looks like an arrow, highlighted at the right. After you press this button, the view will change to look like the screen shot at the right.

By default, Circuit Results Summary shows the Link ID, each stored data point, and whether the test passed or failed.

The circuit summary results may be viewed in three different ways: Pass/Fail; Optical Loss; and Overhead. Toggle the view by using the P/F, Overhead, and Loss buttons, highlighted at right.




OWL REPORTER

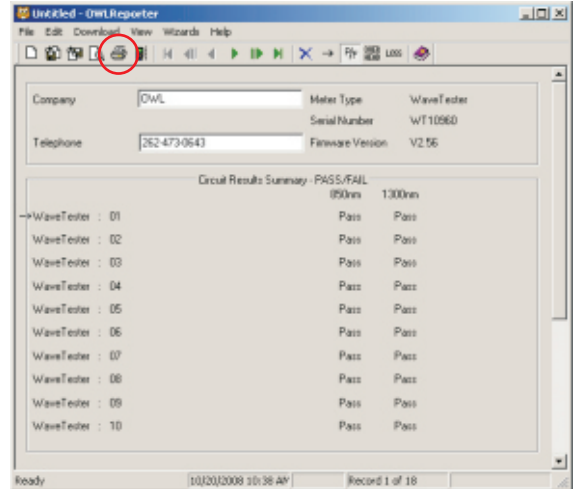
DOWNLOADING DATA TO A PC, cont.

Report Printing

To print the current view to a PC printer, press the print button highlighted at right to print the Summary report.

The printed report will look very much like the screen. See below for a sample report.

 Circuit detail reports may also be printed by pressing the printer icon while in Circuit Detail view.



Example Printout


At right is an example of the Circuit Summary Report. Below are descriptions of the columns:

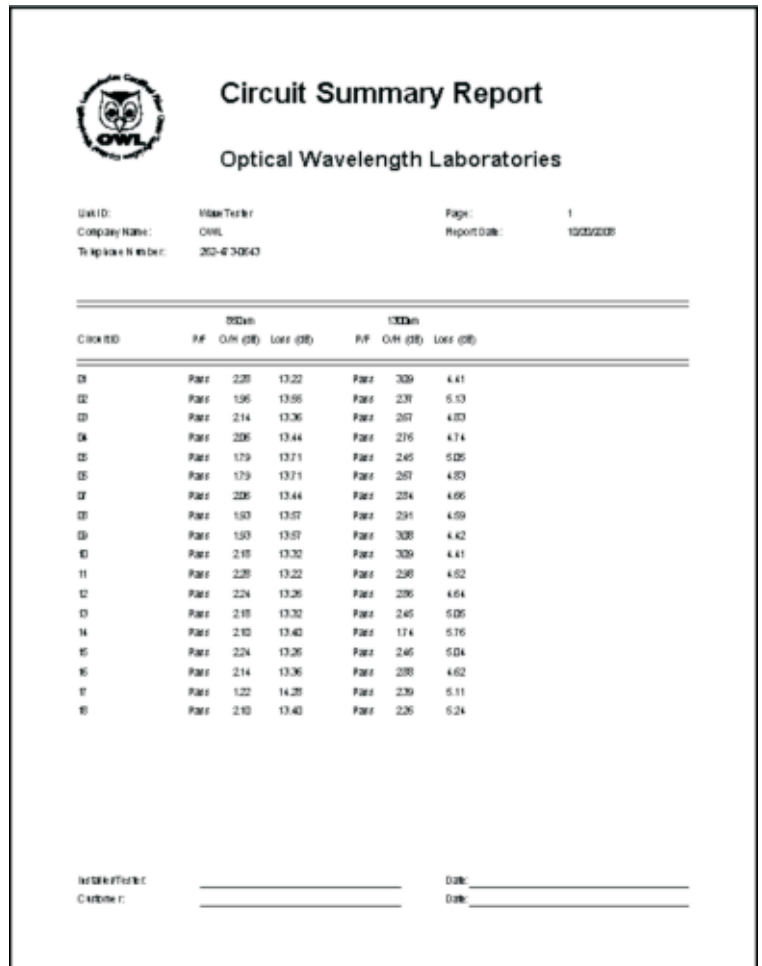
Circuit ID - this is the name of the fiber that was tested

P/F shows whether the test passed or failed against the chosen cabling standard

O/H shown in dB; shows the amount of Overhead in the link, or the amount of loss the link can sustain before it will reach a Fail result

Loss shown in dB; shows the actual amount of loss measured through the link

 If you are interested in creating a PDF file of your printouts, there is a shareware program called PDF995 that installs a PDF printer onto your system. Print the file as normal, and save the PDF file to the folder of your choice. See <http://pdf995.com> for more information.



OWL REPORTER

INTERPRETING OWL REPORTER SCREENS AND REPORTS

The following list of terms appear on the OWL Reporter software screen and/or printed report.

- Connector Loss
- Fiber Loss
- Light Source Reference Power
- Measured Power
- Operating Margin (%)
- Optical Loss
- Pass/Fail
- Splice Loss
- System Overhead
- System Reference Power
- Total Allowable System Loss

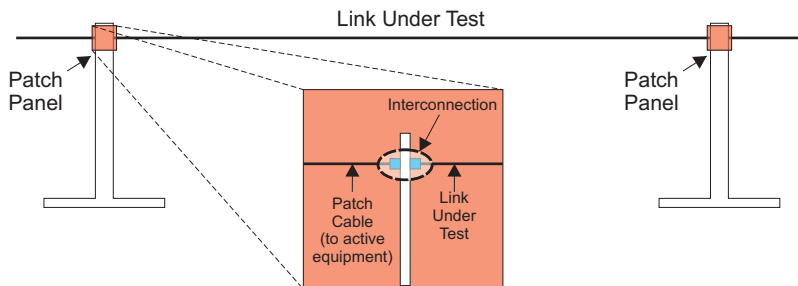
Descriptions for each of these terms are listed on the following pages.

Connector Loss

Definition: during the calculation of an optical loss budget, the amount of optical loss attributed to interconnections in the link under test. An interconnection is a device that brings two fiber connectors together; e.g. the ports on a patch panel or a fiber optic adapter. Connector loss is specified by cabling standards that base link budget calculation on the passive components of the link under test; examples of this type of standard are the TIA-568 and the ISO IEC 11801.

Units: dB per connection

Calculation: (Number of interconnections) x (dB loss per connection)



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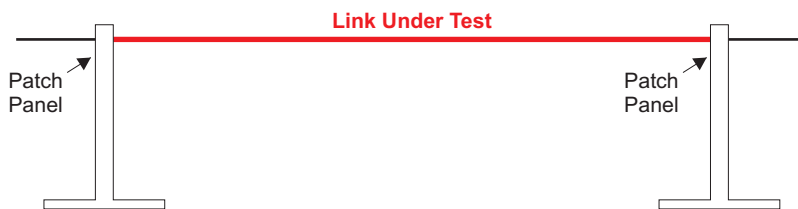
INTERPRETING OWL REPORTER SCREENS AND REPORTS, cont.

Fiber Loss

Definition: during the calculation of an optical loss budget, the amount of optical loss attributed to the optical fiber in the link under test. Fiber loss is specified by cabling standards that base link budget calculation on the passive components of the link under test; examples of this type of standard are the TIA-568 and the ISO IEC 11801.

Units: dB per kilometer; loss values are different for different wavelengths and different fiber types

Calculation: (fiber length in kilometers) x (dB loss per kilometer)




Light Source Reference Power

Definition: the amount of absolute optical power being received directly from the light source by the power meter during the setting of the optical reference. Light Source Reference Power is used as a reference, or starting point, on which a standards-based optical reference is set.

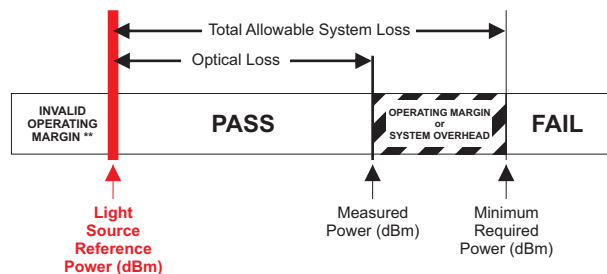
Units: dBm

Calculation: none; Light Source Reference Power is measured via a single patch cord of the appropriate type.



 testing standards require multimode reference cables to be wrapped around a device called a mandrel, which is used to filter high-order modes and achieve EMD, or Equilibrium Mode Distribution (shown here).

Singlemode test jumpers do NOT require this mandrel.



OWL REPORTER

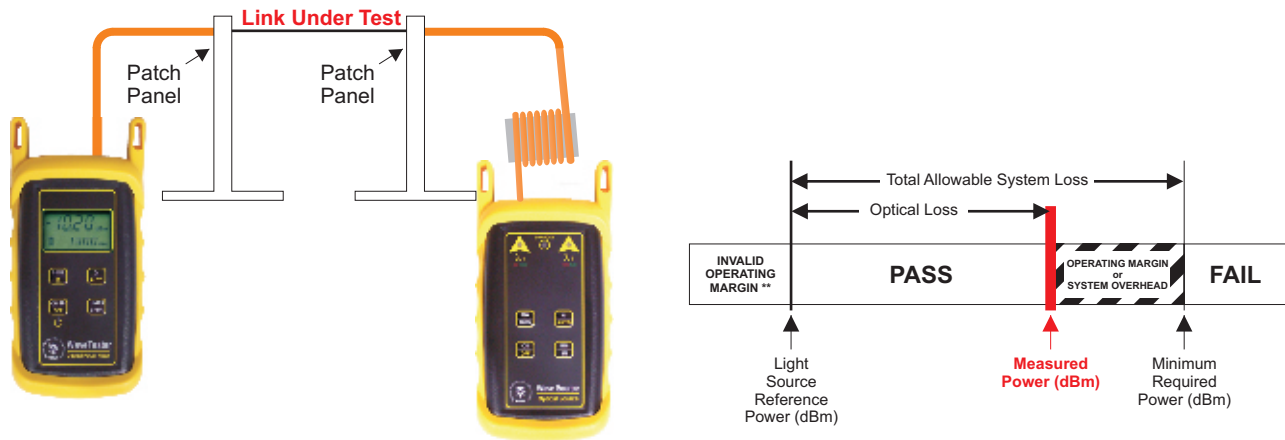
INTERPRETING OWL REPORTER SCREENS AND REPORTS, cont.

Measured Power

Definition: the amount of absolute optical power being received from the light source by the power meter after they have been connected to the link under test. Measured Power is compared to the System Reference Power for Pass/Fail analysis; if Measured Power is greater than the System Reference Power, the link passes; likewise if Measured Power is less than the System Reference Power, the link fails.

Units: dBm

Calculation: none



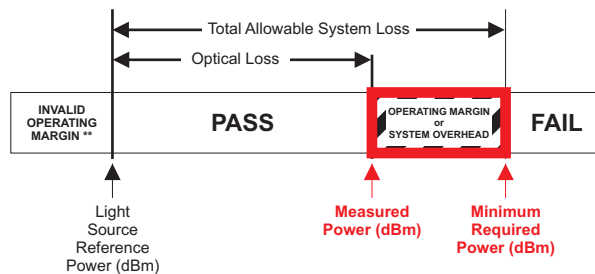
Operating Margin %

(only appears on printed circuit detail reports)

Definition: the difference between the Measured Power and the System Reference Power, also known as headroom, expressed as a percentage.

Units: percentage (%)

Calculation: none



OWL REPORTER

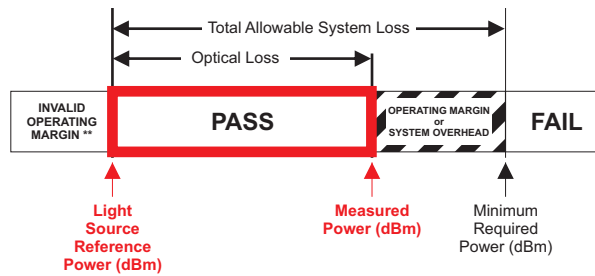
INTERPRETING OWL REPORTER SCREENS AND REPORTS, cont.

Optical Loss

Definition: the amount of optical power that is lost through the link under test due to the attenuation of the passive components of the link (i.e. optical fiber, interconnections, and splices).

Units: dB

Calculation: (Light Source Reference Power) - (Measured Power)

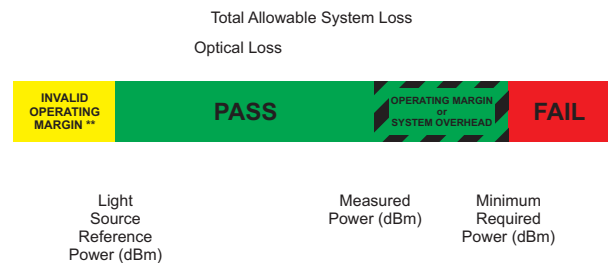


Pass/Fail

Definition: the rating a link receives when its Measured Power is compared to its System Reference Power, based upon the attenuation parameters or loss values specified by cabling standards. A link passes when Measured Power is greater than the System Reference Power. A link fails when Measured Power is less than the System Reference Power.

Units: N/A

Calculation: N/A



**** If the Measured Power is greater than the Light Source Reference Power, then the circuit will receive an Invalid Operating Margin error, indicating an invalid test condition. Circuit test results receiving this error should be considered as a FAIL.**

In other words, more light is received through the whole link from end to end than was received through the single reference patch cable. This is physically impossible since this would indicate GAIN in the system rather than LOSS.

This condition usually occurs when the reference was set up incorrectly. The correct sequence of steps to set a reference follow:

- 1) MULTIMODE ONLY - wrap the reference cable seven (7) times around a 0.7" mandrel (0.7" for 62.5um, and 0.9" for 50um) and secure.
- 2) Connect the ends of the reference cable to the power meter detector port and the appropriate light source port.
- 3) Power ON and set the units to the same wavelength.
- 4) Set the reference (or "ZERO") in the power meter using the procedure in the operations guide.

The most important part of certification testing is to ensure that the integrity of the reference (or "ZERO") is maintained.

Two factors to keep in mind are:

- Do NOT remove the patch cord from the light source port until all tests have been completed
- MULTIMODE ONLY - do NOT allow the patch cord to unwrap from the mandrel

OWL REPORTER

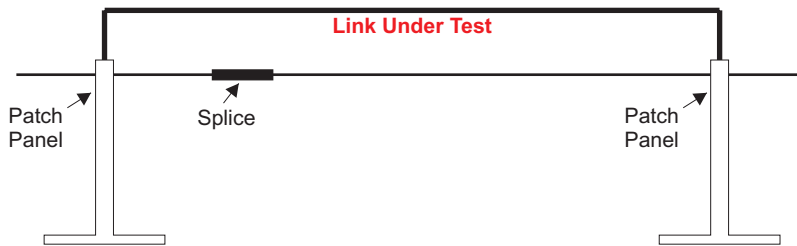
INTERPRETING OWL REPORTER SCREENS AND REPORTS, cont.

Splice Loss

Definition: during the calculation of an optical loss budget, the amount of optical loss attributed to splices in the link under test. Splice loss is specified by cabling standards that base link budget calculation on the passive components of the link under test; examples of this type of standard are the TIA-568 and the ISO IEC 11801. Splices can be either mechanical or fusion, and can be located anywhere along the link under test.

Units: dB per splice

Calculation: (number of splices) x (dB loss per splice)



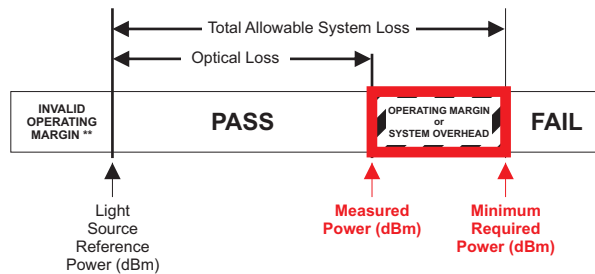
✓ some connectors use mechanical splice technology for fiber termination, such as the Unicam[®]-compatible. These connectors should be considered splices when calculating optical loss budgets.

System Overhead

Definition: the difference between the Measured Power and the Minimum Required Power. System Overhead is also known as headroom. With a PASS rating, System Overhead shows how much additional loss a link can bear before it will fail. With a FAIL rating, System Overhead shows how much optical loss must be overcome before it will pass.

Units: dB

Calculation: (Measured Power) - (Minimum Required Power)




OWL REPORTER

INTERPRETING OWL REPORTER SCREENS AND REPORTS, cont.

System Reference Power

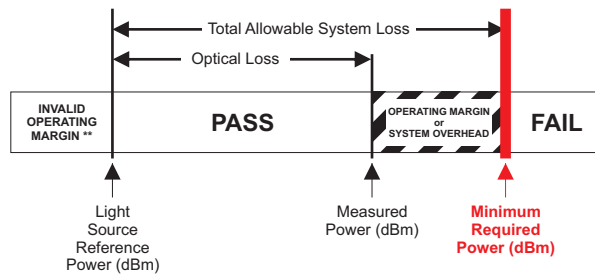
(shown as Minimum Required Power on Circuit Detail Reports)

Definition: the optical power level that determines whether a link passes or fails; a.k.a. Pass/Fail threshold. If the Measured Power is greater than the System Reference Power, the link will show PASS; likewise, if the Measured Power is less than the System Reference Power, the link will show FAIL.

 link measurements that are marginal (meaning that they are close to the System Reference Power, within the accuracy of the test equipment) should be evaluated further.

Units: dBm

Calculation: (Light Source Reference Power) + (Total Allowable System Loss)

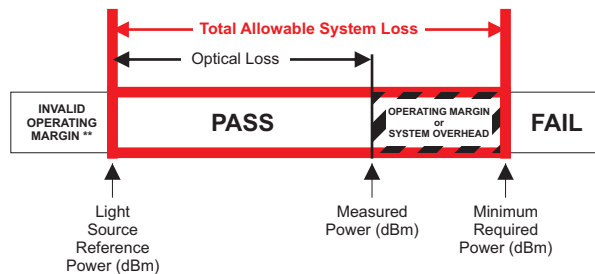


Total Allowable System Loss

Definition: the total amount of optical loss attributed to the passive components of the link (i.e. Fiber Loss, Connection Loss, and Splice Loss). Total Allowable System Loss is also known as a Link Budget. For generic cabling standards such as the TIA 568 or the ISO/IEC 11801, link budgets are calculated based upon the actual configuration of the link under test. Some standards (e.g. various Ethernets) have pre-defined link budget loss values based upon the upper limits of the link configuration.

Units: dB

Calculation: (Fiber Loss) + (Connection Loss) + (Splice Loss)



OPERATION/MAINTENANCE

WAVETESTER DATA STORAGE ERROR CODES

ERR - This error code will appear when the user has not waited long enough for the meter to acquire power readings for the wavelengths associated with the selected fiber type (850 and 1300nm for MM; 1310 and 1550nm for SM). This error will only occur when the WaveTester power meter and WaveSource light source are both in AUTO mode, and only occurs during data storage or setting reference.



HZ - This error code will appear when the user attempts to store data and the meter is NOT in AUTO mode, but is receiving a modulated tone from the light source.


BAD - This error code will appear when the user attempts to store data at too many wavelengths. The WaveTester can only store data for a maximum of 3 different wavelengths.


FUL - This error code will appear when the storage memory is full, and no more data can be stored. The WaveTester can store up to 200 data points.

CLEARING DATA FROM WAVETESTER MEMORY

After data has been downloaded to the PC with OWL Reporter, it is recommended to save the data to a file, and clear the memory from the WaveTester.

To clear data from the WaveTester, while the unit is OFF, press and hold  then press .

The  icon will disappear from the display when the data has been successfully cleared.


 Data cleared from the WaveTester is irretrievable. Please ensure that you have downloaded and saved the data to a PC before clearing the WaveTester memory.

OPERATION/MAINTENANCE

PC-BASED METER CONTROL

When connected to a USB port on a PC using a terminal program (such as Hyperterminal), many of the WaveTester's functions can be activated from the PC keyboard. The list of functions follows:

Key: A
Function: Auto mode

Description: Pressing the 'A' key is the equivalent to holding  on the WaveTester. The wavelength display will begin toggling between the currently selected wavelength and 'AUO'. Auto mode scans incoming power for modulated optical signals, and switches wavelengths automatically when a corresponding modulated signal is received.

Key: C
Function: Clear memory

Description: Pressing the 'C' key is the equivalent to holding  on the WaveTester while pressing  to power ON the WaveTester. The data indicator icon will disappear from the display.

Key: D
Function: Download memory

Description: Pressing the 'D' key is the equivalent to holding  on the WaveTester. This will download all data into the PC in comma-delimited format. The display will say 'DONE' when the download is complete.

Key: M
Function: Monitor mode

Description: Pressing the 'M' key will cause the meter to send wavelength and power level information to the serial port. This data will appear in the terminal window. Monitor mode is useful for checking the stability and power level of a source over a long period of time. Most terminal programs have a data capture function. Data captured this way can be imported as a comma-delimited file into a spreadsheet for creating a chart.

Key: U
Function: Units set

Description: Pressing the 'U' key is the equivalent to pressing  on the WaveTester. Each time the 'U' key is pressed, the display units will change between dBm, dB, and uW or mW.

Key: W
Function: Wavelength set

Description: Pressing the 'W' key is the equivalent to pressing  on the WaveTester. Each time the 'W' key is pressed, the display wavelength will change between the WaveTester's calibrated wavelengths.

Key: Z
Function: Zero function

Description: Pressing the 'Z' key is the equivalent to holding  on the WaveTester. Once the WaveTester display changes to 'dB' units, an optical reference has been set for the currently selected wavelength, otherwise known as 'zeroed'.

Key: ?
Function: Firmware version display
Description: Pressing the '?' button will send the firmware version to the serial port.

OPERATION/MAINTENANCE

OPTIONAL VFL (visual fault locator) PORT


As an option, a Visual Fault Locator (VFL) can be installed into the WaveTester optical power meter in place of the charger port. The VFL is an invaluable troubleshooting tool with two important uses:

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 Optional Visual Fault Locator (VFL) Port

There are three modes for the optional VFL port: off, continuous, and flash. The VFL will be off when the power meter is first powered on.

To toggle the VFL mode, starting with the VFL and backlight both OFF, pressing  several times will control the WaveTester in the following order:


- 1 backlight on
- 2 VFL on continuous (backlight turns off)
- 3 VFL on flashing
- 4 VFL off

OPERATION/MAINTENANCE

VISUAL FAULT LOCATION

The optional VFL port in the WaveTester VFL can 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.
 -  **do NOT insert an APC (Angled Physical Contact) connector in to the VFL port as this could damage the angled ferrule on the APC connector.**
- 2 Power on the VFL. See page 46 for instructions on operating the VFL port.
- 3 Inspect the splice tray for anomalies. Optical fiber jackets are differently colored, making it difficult to see red light shining through, so for best results, it is recommended to keep the room light at a minimum.




OPERATION/MAINTENANCE

VISUAL FIBER IDENTIFICATION

The optional VFL port in the WaveTester optical power meter 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 .

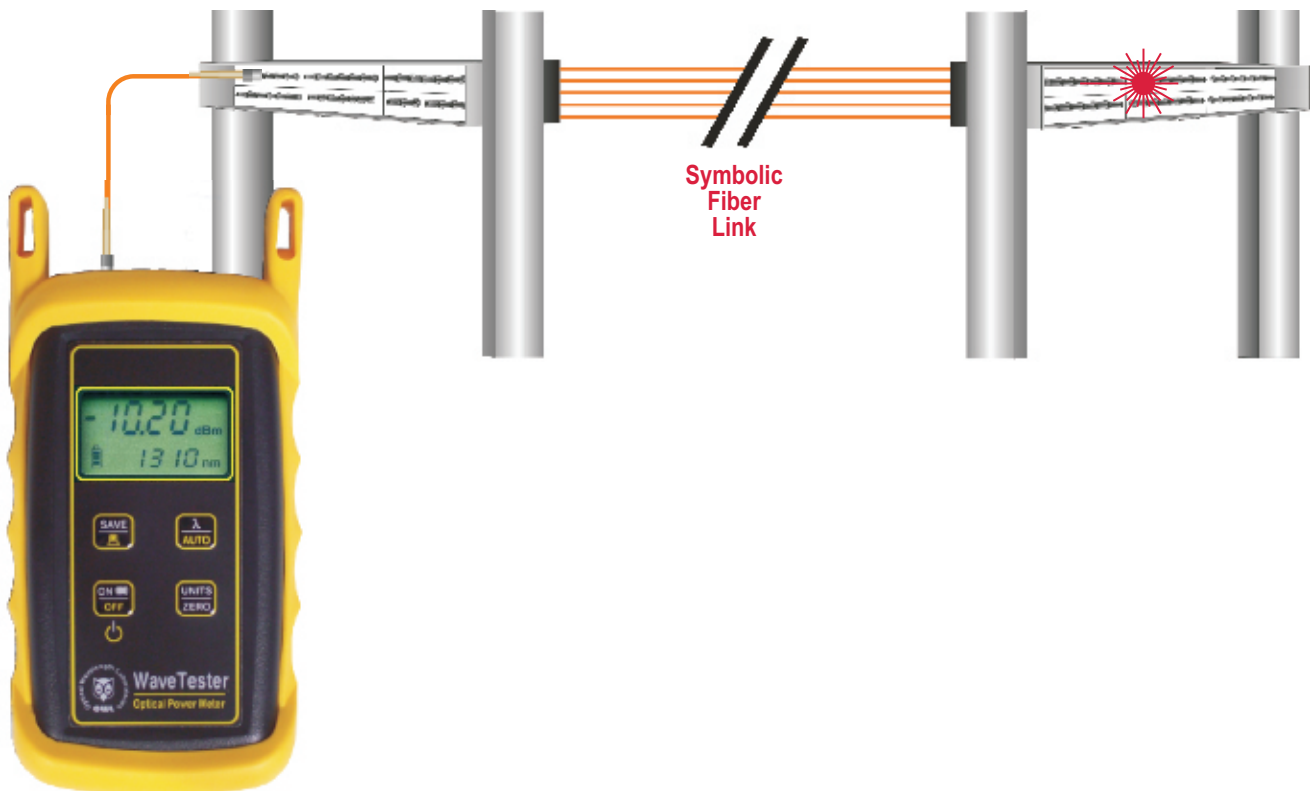
 **do NOT insert an APC (Angled Physical Contact) connector in to the VFL port as this could damage the angled ferrule on the APC connector.**

2 Power on the VFL. See page 46 for instructions on operating the VFL port.

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

 **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.**



OPERATION/MAINTENANCE

BOOT REMOVAL/REPLACING THE BATTERY

Boot Removal

To remove the boot from the WaveTester optical power meter, place your thumb on the back of the unit, then use your fingers to pull the lip off of the front of the unit (as shown below).



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.



DO NOT USE BATTERY CHARGING PORT WITH NON-RECHARGEABLE BATTERIES. THERE IS THE POTENTIAL FOR EXPLOSION AND DAMAGE MAY OCCUR TO THE UNIT AND/OR THE USER.



OPERATION/MAINTENANCE

UNIVERSAL PORT

Universal Port

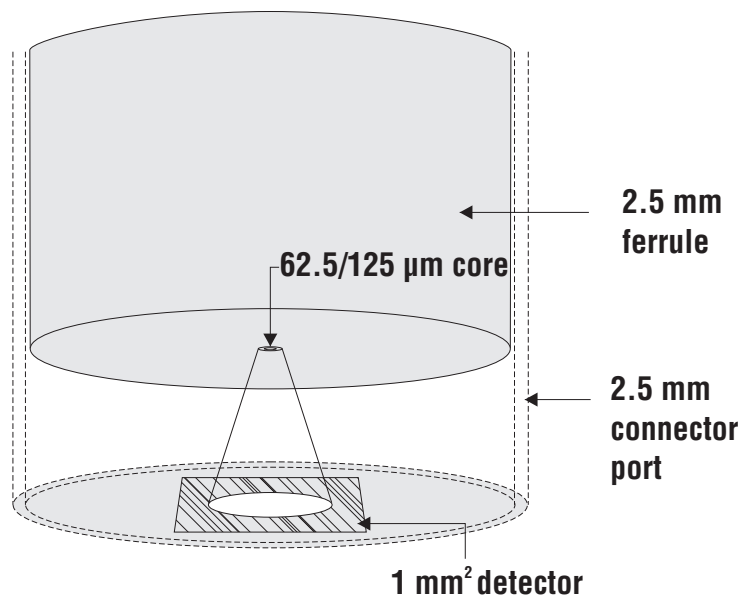
The WaveTester optical power meter contains a universal connector port which allows for coupling to any fiber optic connector that uses a 2.5mm ferrule (e.g. ST, SC, FC, etc.).

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 WaveTester allows the user to remove the 2.5mm adapter and place a 1.25mm adapter (included with each WaveTester) 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.



Use of SC Connectors with 2.5mm Universal Port

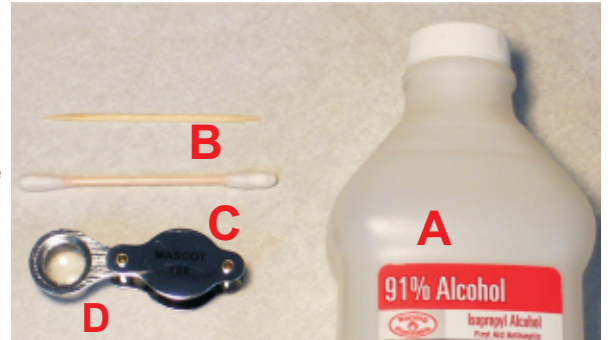
Take extra care when inserting SC connectors into the 2.5mm universal port as the spring-loading action of the SC connector may cause improper insertion. Call OWL at (262) 473-0643 with any questions.

OPERATION/MAINTENANCE

CLEANING THE DETECTOR PORT

Required accessories:

- A) Isopropyl Alcohol (91% or better)
- B) Round **wooden** toothpick with sharp point
(NOTE: do not use a metal pin or needle since metal will scratch the surface of the detector)
- C) Cotton swab
- D) Jeweler's loupe (10x magnification recommended)
- E) Compressed Air (not shown)



- 1 Place a small amount of cotton from the swab onto the wooden toothpick as shown at right.
- 2 Wet the cotton toothpick tip with the isopropyl alcohol.
- 3 Remove the adapter cap from the power meter detector port.



- 4 **USING GREAT CARE**, gently insert the cotton toothpick tip into the detector port.



WARNING! BE VERY CAREFUL WHEN INSERTING THE TOOTHPICK INTO THE DETECTOR PORT. THERE IS A VERY THIN GLASS WINDOW THAT WILL EASILY BREAK WITH TOO MUCH PRESSURE.

- 5 Using as little pressure as possible, rotate the cotton toothpick tip in the detector port to clear away any dust or dirt that has accumulated on the detector.
- 6 Using light pressure from the compressed air, blow out the detector port.
- 7 Use the jewelers loupe to inspect the detector end face.



If dust or dirt are still present, repeat steps **5** **6** **7** until the detector port is free of debris.

If no dust or dirt is found, replace the adapter cap on the detector port and cover the detector port with the dust cap.



OPERATION/MAINTENANCE

CLEANING THE OPTIONAL VFL PORT

This cleaning procedure applies to the optional VFL port on the WaveTester optical power meter. For more information about cleaning the DETECTOR port on the WaveTester, see page 23.

Required Accessories:

- › Isopropyl alcohol (91% or better)
- › In-adapter fiber optic cleaning accessories, such as 2.5mm cleaning swabs or 2.5mm HUXCleaner™
- › In-adapter fiber optic inspection scope (200x magnification or greater recommended)
- › Compressed Air (optional)

Below are procedures for “wet” cleaning and “dry” cleaning. For best results, a combination of these cleaning methods is recommended.



IMPORTANT SAFETY NOTE: WHEN INSPECTING AN OPTICAL PORT, NEVER LOOK DIRECTLY OR INDIRECTLY INTO THE PORT WITHOUT SUFFICIENT EYE PROTECTION. THE OPTICAL PORT MAY BE ENERGIZED WITH POWERFUL INVISIBLE RADIATION THAT IS HARMFUL TO THE HUMAN EYE.

INVISIBLE LIGHT IS ESPECIALLY DANGEROUS SINCE THE EYE IS NOT AWARE OF EXPOSURE TO HARMFUL INVISIBLE ENERGY, AND BECOMES INCREASINGLY DANGEROUS WITH PROLONGED EXPOSURE.

TO AVOID ACCIDENTAL EXPOSURE TO OPTICAL ENERGY, IT IS HIGHLY RECOMMENDED TO POWER OFF EQUIPMENT BEFORE INSPECTING OPTICAL PORTS.

IT IS ALSO HIGHLY RECOMMENDED TO USE AN LCD-BASED FIBER INSPECTION SCOPE, WHICH CAN INSPECT OPTICAL PORTS AND FIBER ENDFACES WITHOUT EXPOSING THE EYE TO HARMFUL OPTICAL RADIATION.

“WET” CLEAN PROCEDURE

- 1 Wet the tip of a 2.5mm cleaning swab with isopropyl alcohol.
- 2 Carefully insert the wet tip of the swab into the optical port.
- 3 Clean out the optical port according to the directions provided with the swabs.
- 4 Blow dry the optical port with the compressed air. If compressed air is not available, allow 2 minutes for the alcohol to evaporate.
- 5 Inspect the optical port with the in-adapter fiber optic inspection scope to ensure the port is clear of obstructions.

“DRY” CLEAN PROCEDURE

- 1 Carefully insert a dry 2.5mm cleaning swab or a 2.5mm HUXCleaner™ into the optical port.
- 2 Clean out the optical port according to the directions that came with the cleaning accessories.
- 3 Inspect the optical port with the in-adapter fiber optic inspection scope to ensure the port is clear of obstructions.

If the port is still dirty, another round of cleaning will be necessary. You may also want to use a combination of “wet” and “dry” cleaning to achieve best results.

If the port is still dirty, another round of cleaning will be necessary. You may also want to use a combination of “wet” and “dry” cleaning to achieve best results.

APPENDICES

SPECIFICATIONS

Detector Type: _____	1mm InGaAs
Calibrated Wavelengths: _____	850, 1300, 1310, 1490, 1550nm
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 55° C
Storage Temperature: _____	-30 to 70° C
Size: _____	2.75"W x 4.94"H x 1.28"D
Weight: _____	116g
Low Battery Indicator: _____	Yes
NIST Traceable: _____	Yes
Data Storage Points: _____	up to 200
	1) 0 to -45 dBm

MAINTENANCE AND CALIBRATION INFORMATION

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

Battery Replacement. The WaveTester ships with one 9-volt alkaline non-rechargeable battery. 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 WaveTester 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 WaveTester comes standard with a two-year factory warranty, which covers manufacturer defect and workmanship only.

CONTACT INFORMATION

Address:

Optical Wavelength Laboratories, Inc.
N9623 US Hwy 12
Whitewater, WI 53190

Phone:

262-473-0643

Internet:

OWL-INC.COM

OPTIONAL UPGRADE INFORMATION

Visual Fault Locator Port Upgrade

The WaveTester optical power meter may be upgraded to include an optional visual fault locator (VFL), useful for locating bends, breaks, and other anomalies in the near-end splice tray, as well as visual fiber identification up to 5km away!



Upgrading to a VFL port requires the charger port to be removed from the unit.

APPENDICES

SUPPORTED CABLING STANDARDS

The WaveTester supports the following fiber optic network cabling standards:

ITU G.983.3	EIA/TIA-568	CAN-T529	ISO/IEC 11801
10 Gigabit Ethernet	1000Base-SX	1000Base-LX	100Base-FX
10Base-FL	10Base-FB	FDDI	ATM-155
ATM-622	Fibre Channel	Token Ring	FTTH

10-GIGABIT ETHERNET STANDARD

Support for the IEEE 802.3ae 10-Gigabit Ethernet standard has been added to OWL Reporter, which means that WaveTester users can now certify their 10GbE networks.

With this new standard, users are given the option of choosing from one of several versions of this standard, based on the fiber type, wavelength, and 10GbE electronics used. Below is a summary of the various 10GbE standards.

In order to choose the correct 10GbE standard, it is important to know the specifications of the fiber under test, especially the fiber type and modal bandwidth.

If these specifications are unknown, contact the optical fiber manufacturer for more details.

IEEE Standard Name	Fiber OWL Link Wizard Name	Fiber Type	Modal Bandwidth	Wavelength	Loss (dB)	Maximum Distance (m)
10GBASE-S	10GBASE-S LEGACY	62.5/125 multimode	160 MHz • km	850nm	2.6	26
10GBASE-S	10GBASE-S OM1/OM2	62.5/125 multimode	200 MHz • km	850nm	2.5	33
10GBASE-S	10GBASE-S LEGACY	50/125 multimode	400 MHz • km	850nm	2.2	66
10GBASE-S	10GBASE-S OM1/OM2	50/125 multimode	500 MHz • km	850nm	2.3	82
10GBASE-S	10GBASE-S OM3	laser-optimized 50/125 multimode	2000 MHz • km	850nm	2.6	300
10GBASE-LX4	10GBASE-LX4 LEGACY	62.5/125 multimode	500 MHz • km	1300nm	2.5	300
10GBASE-LX4	10GBASE-LX4 LEGACY	50/125 multimode	400 MHz • km	1300nm	2.0	240
10GBASE-LX4	10GBASE-LX4	50/125 multimode	500 MHz • km	1300nm	2.0	300
10GBASE-LX4	10GBASE-LX4	50/125 multimode	2000 MHz • km	1300nm	2.0	300
10GBASE-LX4	10GBASE-LX4	singlemode	NA	1310nm	6.3	5000
10GBASE-L	10GBASE-L/E	singlemode	NA	1310nm	6.2	5000
10GBASE-E	10GBASE-L/E	singlemode	NA	1550nm	11.4	5000

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.