



PM100

Optical Power Meter

Operations Guide



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Description

This manual describes the operation of the PM100 Output Optical Meter.

The meter is a very economical option for measuring the optical power of both multimode and single-mode fibers. NIST calibrated wavelengths include 850, 1300/1310, and 1550nm, and reference values used for optical loss readings are stored for each of these wavelengths .

Its user-friendly interface includes selector switches for power and wavelength selection, and a push button used for setting references and toggling between dBm (optical power) and dB (optical loss).

The meter includes a 2.5mm universal connector, which is compatible with many popular fiber connectors, such as ST, SC, and FC.

The meter 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.

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 with by placing a calibrated light source on one end of the fiber and the meter 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 meter 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 meter 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.

General Features

- 1 ON / OFF selector switch - turns the unit on or off.
- 2 Wavelength selector switch - toggles the unit between 850nm, 1300nm, and 1550nm.
- 3 2.5mm universal connector port - accepts many popular 2.5mm ferrule connectors, including ST, SC, and FC.
- 4 Power Indicator LED - indicates the meter's power status, and also whether the battery power is sufficient to provide accurate readings.
- 5 Power Units LED - indicates whether the units displayed are in dBm or dB.
- 6 Optical Power Display - displays power units in dBm or dB with a resolution of 0.1 dB.
- 7 UNITS / ZERO Button - sets the reference for the selected wavelength, and also is used to toggle power readings between dBm and dB.



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. A can of compressed air should be available to dry off the connector after wiping, and to blow out dust from bulkheads.

Patch Cords. A patch cord is required to connect the PM100 to the system under test. The connector styles and fiber type of the patch cord must match the type on the PM100 and the type of the system under test for accurate results.

Applications

Optical Power Measurement Description. When displaying power in dBm mode, the PM100 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 PM100 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.

Optical Power Measurement

The PM100 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 PM100 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 selector switch on the PM100 to match the wavelength of your light source.
- 4 - Set the power units mode on the PM100 to dBm, or absolute mode. Absolute mode is active when the Power Units LED is OFF.

The resultant reading is the absolute optical power being received by the PM100. Repeat these steps for each wavelength to be measured.

Optical Loss Measurement

The PM100 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 selector switch on the PM100 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 PM100 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 PM100 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 PM100 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 1/2" mandrel 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 PM100. The PM100 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 PM100 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 PM100 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 PM100 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.

Remember, pressing the UNITS / ZERO button easily switches the display between dBm and dB.

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 PM100 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 Extech Instruments calibrate this unit once per year.

Warranty

EXTECH INSTRUMENTS CORPORATION warrants this instrument to be free of defects in parts and workmanship for three years from date of shipment (a six month limited warranty applies on sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (781) 890-7440 ext. 210 for authorization or visit our website at www.extech.com (click on 'Contact Extech' and go to 'Service Department' to request an RA number). A Return Authorization (RA) number must be issued before any product is returned to Extech. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Extech's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

Support line (781) 890-7440

Technical support: Extension 200; E-mail: support@extech.com

Repair & Returns: Extension 210; E-mail: repair@extech.com

Product specifications subject to change without notice

For the latest version of this User's Guide, Software updates, and other up-to-the-minute product information, visit our website: www.extech.com

SPECIFICATIONS

Detector Type:	1mm Germanium
Calibrated Wavelengths:	850, 1300/1310, 1550nm
Measurement Range:	+3 to -52 dBm
Measurement Units:	dBm (absolute) dB (relative)
Accuracy:	± 0.24 dB
Resolution:	0.1 dB
Battery Life:	15+ 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

Link Budget Calculation WorksheetOperating 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 dBTotal 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.