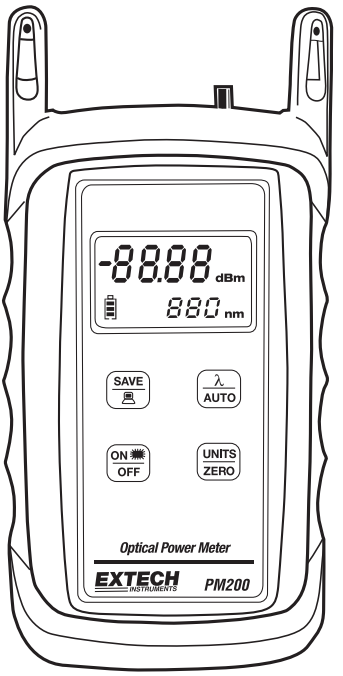
User's Guide

EXTECH INSTRUMENTS

PM200
Fiber Optic Power Meter



Introduction

Congratulations on your purchase of the Extech PM200 Fiber Optic Power Meter. The PM200 is a high accuracy high resolution optical power meter. It is NIST traceable at 850, 1300, 1310 and 1550nm making it ideal for both single-mode and multimode fiber testing. The PM200 can store up to 100 measured datapoints. This stored data can be downloaded via the software to produce formatted certification reports. Careful use of this meter will provide years of reliable service.

Table of Contents

Specifications

Optical Specifications

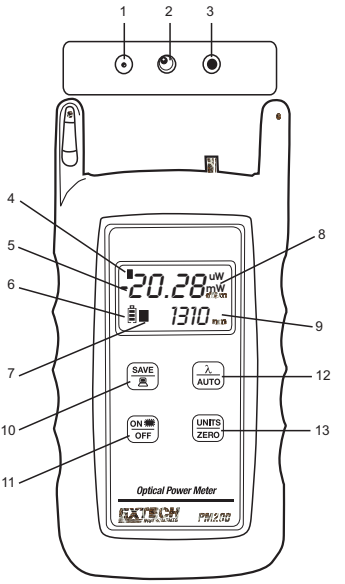
Detector Type Germanium	(Ge)
Calibrated Wavelengths (nm)	850, 1300, 1310, 1550
Measurement Range (dBm)	+5 to -60
Accuracy (dB)	±0.15
Resolution (dB)	0.01

General Specifications

Battery Life	100+ hours (9-volt)
Optical Connector	2.5mm universal
Data Storage up to	100 storage points
Download	DB-9 serial
Software	Reporter
Dimensions	4.94 x 2.75 x 1.28 in
Weight (with battery)	10 ounces

Meter Description

1. Battery Charging Port
2. Download Port
3. Detector Port
4. Tone Mode
5. Power Reading
6. Battery Indicator
7. Data Indicator.
8. Units Indicator
9. Wavelength Indicator
10. SAVE / DOWNLOAD button
11. ON / OFF / Backlight button
12. λ / AUTO button
13. UNITS / ZERO button



1. Battery Charging Port - If rechargeable 9-volt batteries are used in the PM200, the battery charging port is used to re-charge them when used with an approved wall transformer. NOTE: DO NOT USE BATTERYCHARGING PORT WITH NON-RECHARGEABLEBATTERIES. THERE IS THE POTENTIAL FOREXPLOSION AND DAMAGE MAY OCCUR TO THE UNITAND/OR THE USER.
2. Download Port - The download port is used to download stored data into a PC via the supplied serial cable.
3. Detector Port - The detector port is a fixed 2.5mm universal port, and connects to ST, SC, or FC connectors equally well without any loss of accuracy. There is no need to change or maintain expensive adapter caps.
4. Tone Mode - When 'Hz' is visible on the display, the PM200 is checking for the presence of a modulated optical signal. These modulated signals are used to automatically switch wavelengths when they are sent by an OWL light source with modulation capability.
5. Power Reading - The power reading displays the level of optical power being received by the photo detector, and is displayed in either dBm, dB, milliwatts, or microwatts.
6. Battery Indicator - The battery indicator shows the amount of life is remaining in the battery. Also, when the battery recharger is in use, the bars in the battery icon are animated to show that the recharger is active.
7. Data Indicator - This icon shows whether there is data stored in the PM200.
8. Units Indicator - The units indicator shows which units are being currently displayed. Units are shown in either dBm, dB, uW, or mW.
9. Wavelength Indicator - The wavelength indicator shows the currently selected wavelength in nanometers (nm).
10. SAVE / DOWNLOAD button - To store a data point, press this button. Hold the button to down load data points in comma-delimited format. This button can also be used to erase all stored data if it is held while the meter is being powered ON.
11. ON / OFF / Backlight button - When the unit is off, press this button to power on. When the unit is on, press this button to toggle the backlight on and off. When the unit is on, hold this button to power off.
12. λ / AUTO button - Press this button to change wavelengths. Hold this button to set the meter in AUTO mode. AUTO mode scans incoming power for modulated optical signals, and switches wave lengths automatically when a corresponding modulated signal is received (for use with WaveSource light sources only.)
13. UNITS / ZERO button - Press this button to change display units - either dBm, dB, uW or mW. Holding this button will set a ZERO reference for the currently selected wavelength.

Operation

1.0 Applications

1.1 Precautions

1.1.1 Safety - Caution must be exercised when working with optical equipment. Most transmission equipment and light sources use light that is invisible to the human eye. High energy light is potentially dangerous, and can cause serious, irreparable damage to the eye. Thus, it is recommended to look into the connector port of a light source or the end of a fiber.

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

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1.2 Required Accessories

1.2.1 Cleaning Supplies - It is recommended to clean fiber ferrules 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.

1.2.2 Patch Cords - Patch cords may be needed to connect the PM200 to the system under test. The connector styles on the patch cord must match the type on the PM200 and the type of the system under test.

1.2.3 Optical Fiber Adapters - Optical fiber adapters are used to connect two connectorized fibers together, and may be necessary to adapt your patch cords to the system under test.

1.3 Typical Applications

PM200 test kits can be used as diagnostic and measurement tools of optical transmission systems and fiber optic links. These applications can be found in several industries, including premise, LAN, CATV, and Telco.
Two types of measurements are possible with the PM200 optical power meter: optical power and optical loss.

1.3.1 Optical Power Measurement - When displaying power in dBm mode, the PM200 will measure the absolute amount of power being received in the 2.5mm Universal detector port. Absolute power is shown in dBm (decibels referenced to a milliwatt), meaning the power being received by the photodetector is compared to 1 milliwatt of optical energy. Optical power measurement is useful for checking the output power and/or stability of an optical transmission system or stabilized fiber optic light sources.

1.3.2 Optical Loss Measurement - When displaying power in dB mode, the PM200 can be used to measure the optical power through a fiber optic link relative to an optical reference point. Setting a reference point is also known as “zeroing” the meter with a light source. Optical loss measurements are useful for measuring the attenuation, or loss, of a fiber link. The loss value can then be compared to a pre-calculated link budget, which is used to determine if the fiber link will operate within the parameters of the transmission equipment.

The formula for calculating loss in a fiber link is: **L = P - P a r**

where **L** is the amount of optical loss in dB, **P** is the absolute power in dbm, and **P** is the reference power in **a r** dBm.
Optical loss measurements can also be used for fiber optic link certification. Link certification is a process where optical loss measurements are compared to a link budget calculated using fiber optic cabling standards.
Data stored in the PM200 can be downloaded into the Reporter certification report software. Fiber optic links can be certified against one of several popular fiber optic cabling standards or one of two user configurable standards. Many fiber optic installation bids are requiring certification reports, which makes the PM200 an invaluable tool for fiber optic professionals.

1.4 Optical Power Measurement

a) Connect the PM200 to the equipment under test (EUT). In the example below, the EUT is a fiber optic light source.

b) Power on the EUT, set it to the desired wavelength, and allow it to stabilize.

c) Power on the PM200, and set it to match the wavelength of the EUT.

d) Set the units to dBm. The resultant reading is the output power. (The example in Figure 2 shows an optical output power of -20.58 dBm).

This reading should be within the light source manufacturer's specified power level. If the reading is not within the specification, clean and check the connections and take another measurement.

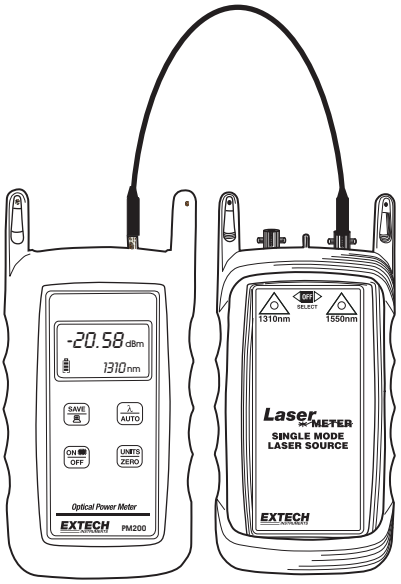


Figure 2

1.5 Optical Loss Measurement (Set Reference)

Two patch cords are required for this procedure - one for the meter side and one for the light source side.

a) Connect the PM200 to a light source using the first patch cord.
b) Power on the light source and allow it to stabilize according to the manufacturer's specifications.
c) Power on the PM200, and set it to match the current wavelength of the light source.
d) Check to make sure the power level displayed on the PM200 is approximately equal to the calibrated power level of the light source (see Figure 2 on the previous page). If it is good, then remove it from the PM200 and light source and set it aside. This will be the patch cord for the meter side.
e) Connect the other patch cord to the PM200 and light source as shown in Figure 3. The example shows a reference setting procedure for multimode light sources. Notice the insertion of a 1/2" mandrel. Mandrels are used to achieve EMD (Equilibrium Mode Distribution) when setting the reference from a multimode light source. EMD is achieved by wrapping the reference patch cord around the mandrel 5-7 times. Single-mode sources do not require a mandrel.
f) Press the λ / AUTO button on the PM200 to set it to the desired wavelength.
g) Set the light source to the match the wavelength on the PM200.
h) Press and hold the UNITS / ZERO button on the PM200. This will set the reference for the currently selected wavelength. The display will switch to show dB units, and should show approximately 0.00 dB.

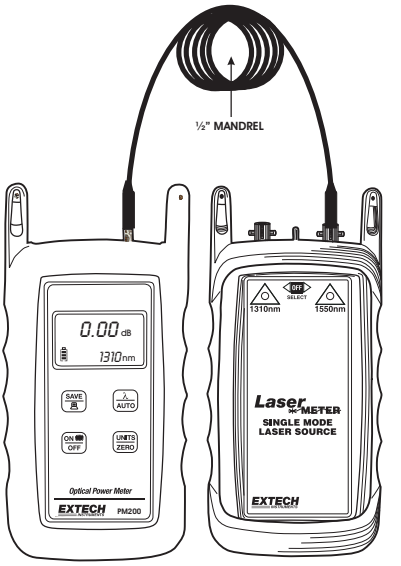


Figure 3

If there is a second wavelength to 'zero', repeat steps f through h. The indicator LED will change colors for the second wavelength.

The PM200 is now 'zeroed', and is ready to test fiber links.

NOTE: DO NOT REMOVE THE PATCH CORD FROM THE LIGHT SOURCE, AS THIS WILL MAKE THE OPTICAL REFERENCE INVALID.

1.6 Optical Loss Measurement

a) Leaving the patch cord attached to the light source, remove the patch cord from the PM200 optical power meter.

b) Connect the PM200 and light source to opposite ends of the link under test.

c) The PM200 will show the amount of loss in the link (in dB). Figure 4 shows a power level of -2.45 dB. This means that the optical power being received by the meter is 2.45 dB below the optical reference, which is the same as saying there is 2.45 dB of optical loss in the link.

Optical loss measurements are compared to a pre-calculated link budget. If the optical loss does not exceed the link budget calculation, the link will perform as installed within the specifications shown on the link budget.

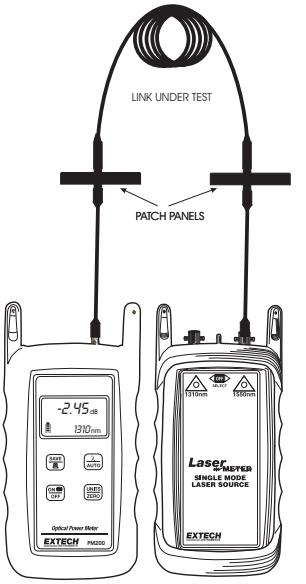


Figure 4

1.7 Data Storage

a) Connect the PM200 and light source to opposite ends of the link under test.

b) Press the SAVE / DOWNLOAD button. The PM200 will store a data point for each wavelength, and will briefly show the number of data points currently stored in place of the wavelength. The presence of the data storage icon () shows that there is data stored in the meter. From time to time, an error code may appear. These error codes and descriptions are located later in this manual.

c) Connect the units to the next fiber in the link, and repeat step b. Notice the number of data points will increment by 2 (one data point per wavelength).

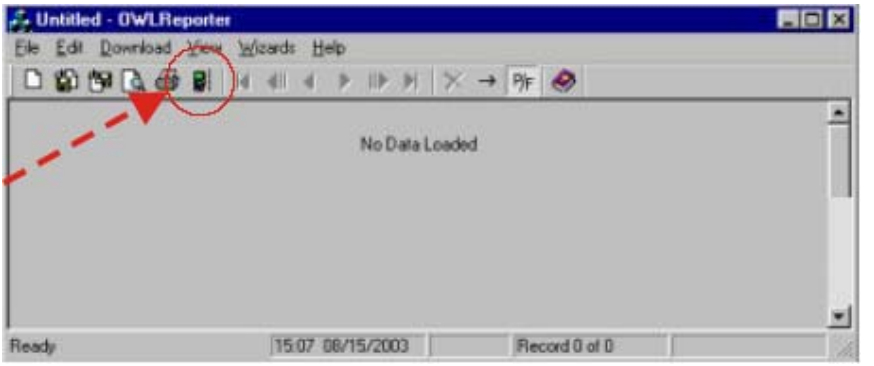
NOTE: the PM200 can store up to 100 data points. It is highly recommended to download the stored data periodically using the Reporter software.

1.8 Downloading Data to a PC With Reporter Software

Once testing is complete or the PM200's memory is full, the stored data points may be downloaded to a PC running the Reporter software. A Pentium PC (or better) running Windows 95 or later operating system is required for Reporter Software. Please use the included CD to install the software. Insert the CD to begin the installation. Follow the on-screen steps to install. Once Reporter is installed on the PC, it is ready to download the data points from the PM200.

Connect the PM200 to the PC COM port via the supplied download cable.

First, prepare the PM200 for download to PC. Follow the steps below:



With the PM200 powered ON, run Reporter. The shortcut is located in the Start Menu, under Programs, Extech, and is named Reporter. There may also be a shortcut on the desktop.

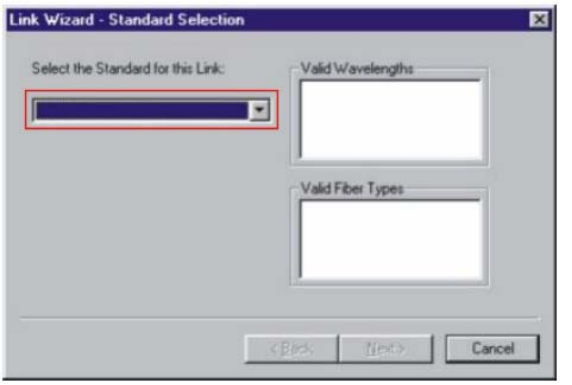
Begin the data download by pressing the download button which is highlighted on the screen shot at the right. The software automatically downloads all that is stored in the meter. First, the software searches for the meter, then it transfers the data, then gives a confirmation of download success.

If the download fails, communications cannot continue and no data will download into the PC. Check the cable connections, test the current COM port, and/or try a different COM port or try a different PC.

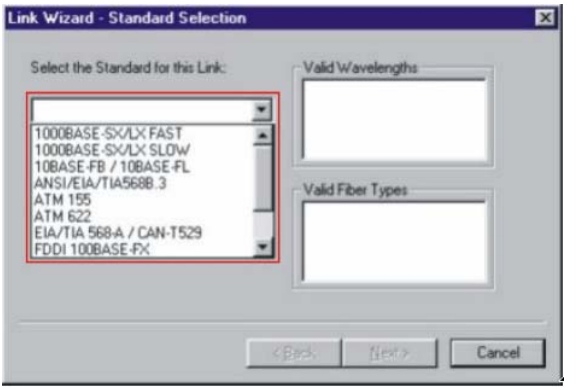
The following pages explain the steps of the Link Wizard in Reporter. This will allow certification of fiber links using a fiber cabling standard.

1.8.1 - Standard Selection

1.8.1.1 - View the list of cabling standards. The list will appear when you click the down arrow.

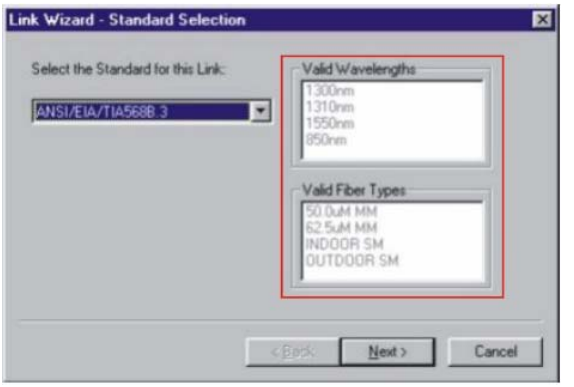


1.8.1.2 - Select the cabling standard from the drop-down list.



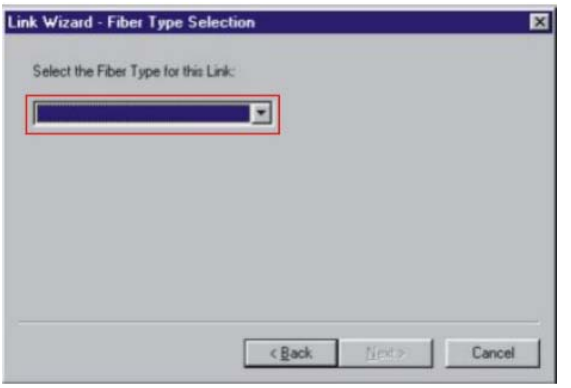
1.8.1.3 - Once the cabling standard has been chosen, the wavelengths and fiber types that the standard supports appear in the boxes on the right.

Click Next to continue.

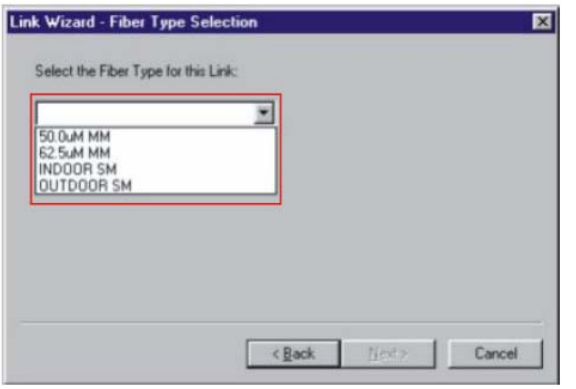


1.8.2 - Fiber Type Selection

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

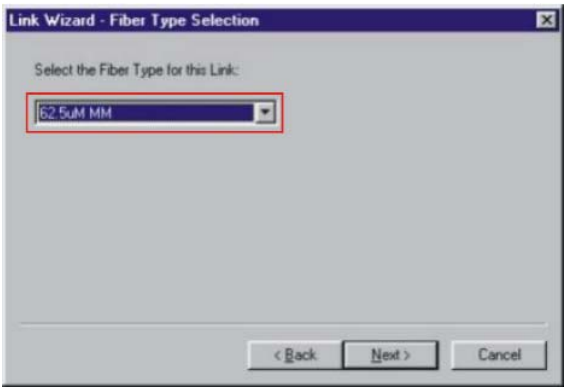


1.8.2.2 - Select the fiber type from the list. The selected fiber type should match the type of fiber of the link under test.



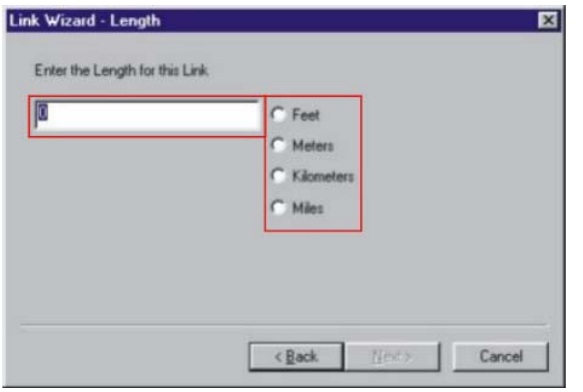
1.8.2.3 - Once the fiber type has been chosen, it appears in the dropdown box.

Click Next to continue.



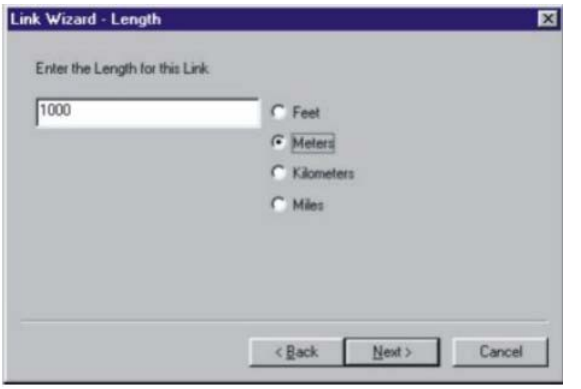
1.8.3 - Fiber Length Input

1.8.3.1 - Enter the length of the fiber link under test. This length will apply to all of the data points downloaded from the PM200. Type the length in the input box, and select the length units at the right.



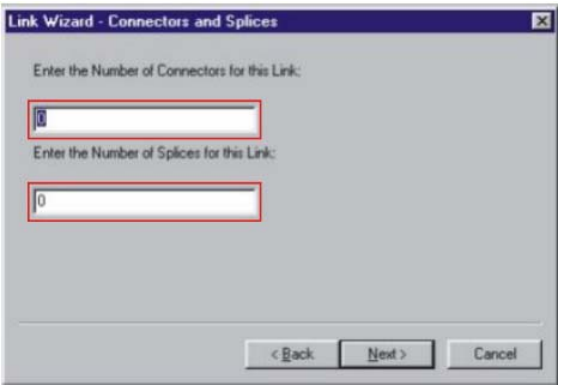
1.8.3.2 - Once the fiber link length and the length units are entered.

Click Next to continue.



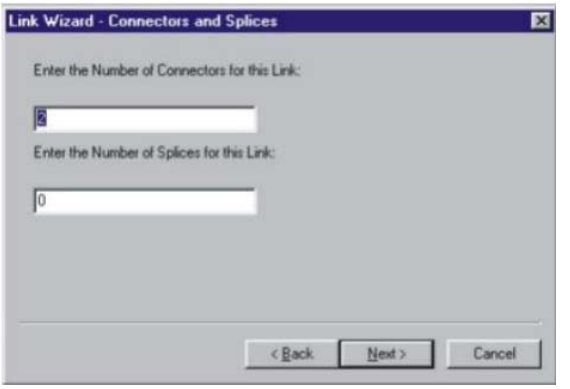
1.8.4 - Connectors and Splices Input

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



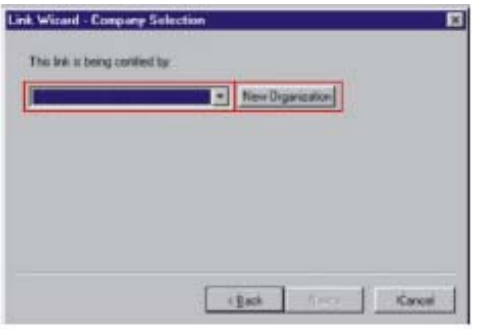
1.8.4.2 - Once the number of connections and splices have been entered.

Click Next to continue.

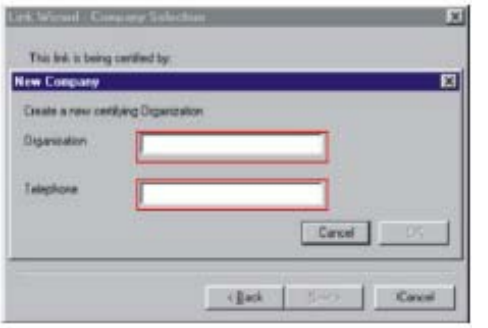


1.8.5 - Company Selection

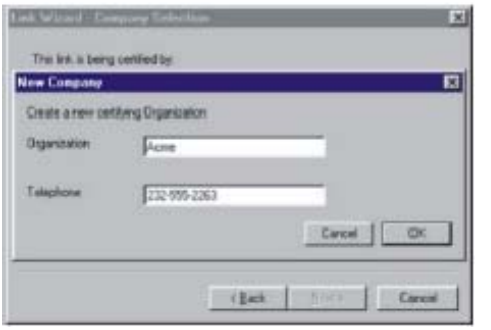
1.8.5.1 - Select the company name from the drop-down list. If it is not listed, click the New Organization button.



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

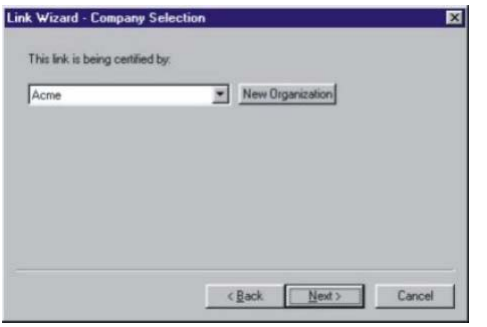


1.8.5.3 - Once the organization's name and telephone number have been entered, click OK to continue.



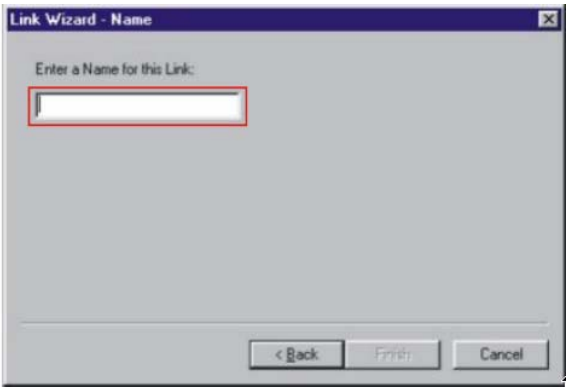
1.8.5.4 - The organization name should now appear in the dropdown box.

Click Next to continue.

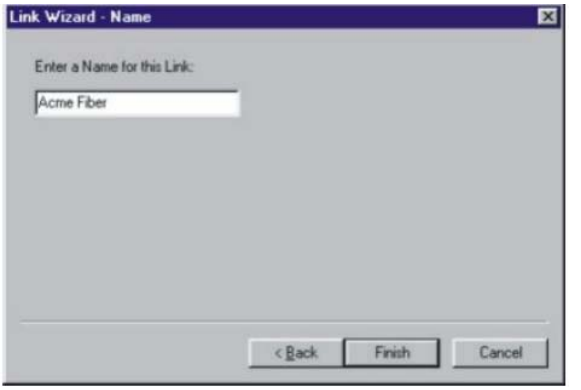


1.8.6 - Name Input

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

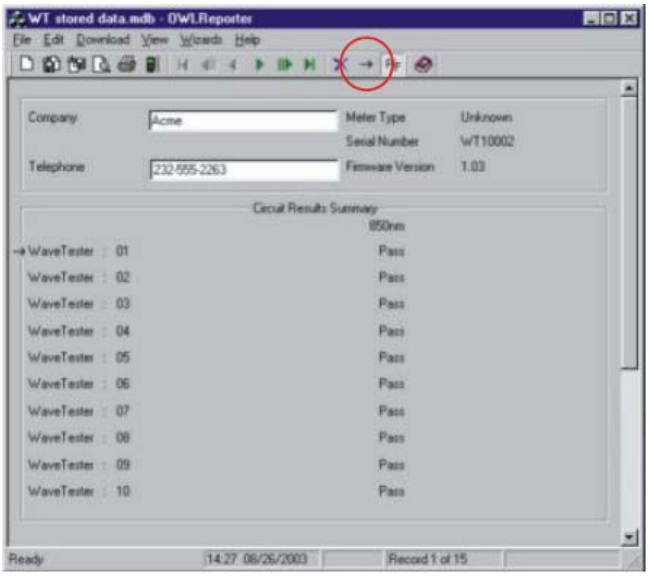


1.8.6.2 - Once the link name has been entered, click Finish to continue.



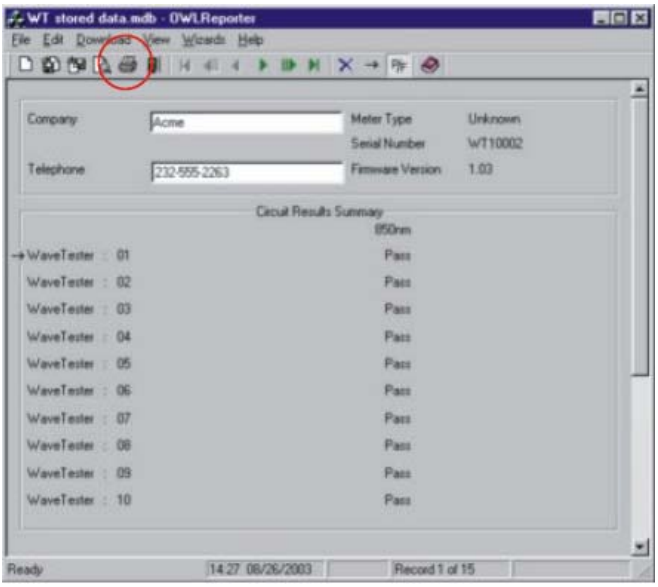
1.8.7 - Summary View

By default, 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. This screen shows the Link ID, each stored data point, and whether the test passed or failed.



1.8.8 - 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 an example report on the next page.



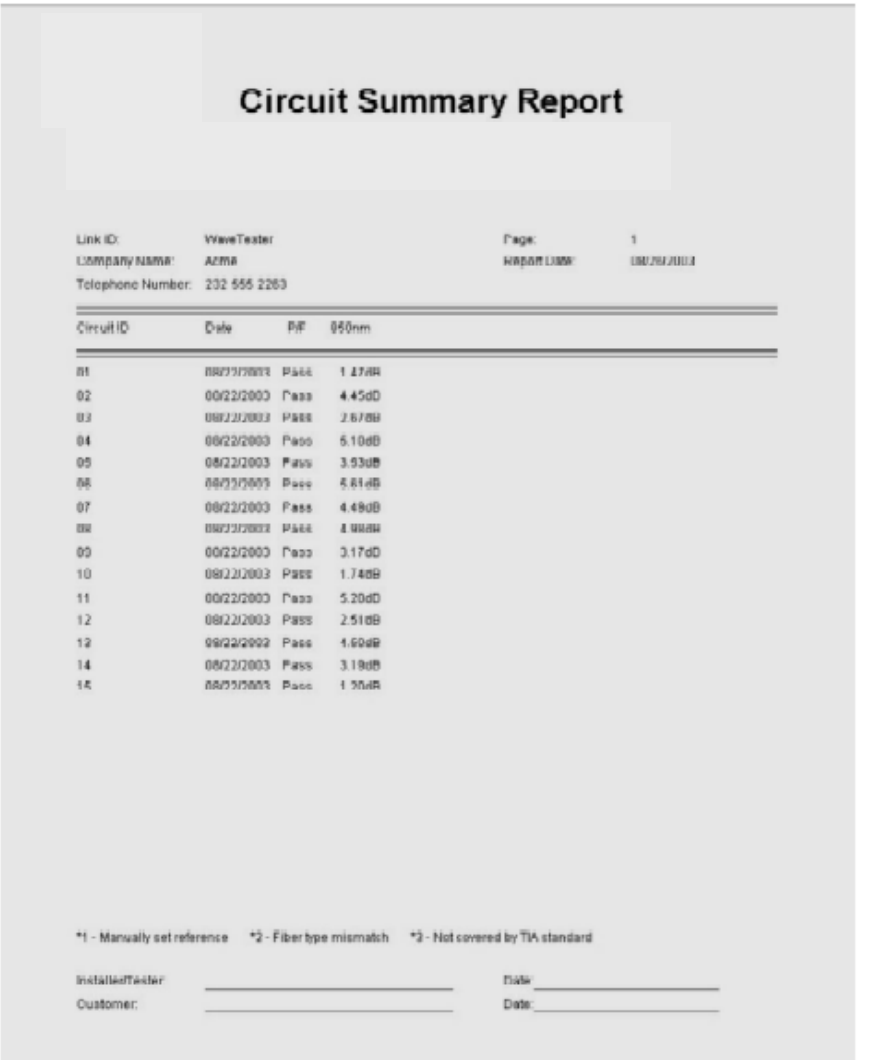
1.8.9 - Example Printout

Below 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

850nm - shows the amount by which the test passed or failed by at the wavelength tested



Circuit Summary Report

Link ID: WaveTester
Company Name: Azma
Telephone Number: 232 555 2263
Page: 1

Circuit ID	Date	P/F	850nm
01	[illegible]	Pass	1.27dB
02	08/22/2003	Pass	4.45dB
03	[illegible]	Pass	2.67dB
04	08/22/2003	Pass	5.10dB
05	08/22/2003	Pass	3.53dB
06	[illegible]	Pass	5.81dB
07	08/22/2003	Pass	4.49dB
08	[illegible]	Pass	4.98dB
09	08/22/2003	Pass	3.17dB
10	08/22/2003	Pass	1.74dB
11	08/22/2003	Pass	5.20dB
12	08/22/2003	Pass	2.51dB
13	08/22/2003	Pass	1.69dB
14	08/22/2003	Pass	3.19dB
15	[illegible]	Pass	1.35dB

*1 - Manually set reference *2 - Fiber type mismatch *3 - Not covered by TIA standard

Installed Tester: _____ Date: _____
Customer: _____ Date: _____

1.9 - Clearing Data

After data has been downloaded to the PC with the Reporter software, it is recommended to save the data to a file, and clear the memory from the PM200.

To clear data from the PM200, while the unit is OFF, press and hold the SAVE / DOWNLOAD button and press the ON / OFF / Backlight button. The  icon will disappear from the display when the data has been successfully erased.

2.0 PC-Based Meter Control

When connected to the RS-232 port on a PC using a terminal program (such as Hyperterminal), many of the PM200'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 the / AUTO button on the PM200. 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 the SAVE / DOWNLOAD button on the PM200 while the unit is powered ON. The data indicator icon will disappear from the display.

Key: D
Function: Download memory
Description: Pressing the 'D' key is the equivalent to holding the SAVE / DOWNLOAD button on the PM200. 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 the UNITS / ZERO button on the PM200. 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 the / AUTO button on the PM200. Each time the 'W' key is pressed, the display wavelength will change between the PM200's calibrated wavelengths.

Key: Z
Function: Zero function
Description: Pressing the 'Z' key is the equivalent to holding the UNITS / ZERO button on the PM200. Once the PM200 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.

3.0 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.

4.0 PM200 Data Storage Error Codes

ERR - the user has not waited long enough to get data stored for both wavelengths
BAD - data can only be stored for a maximum of 3 wavelengths
FUL - memory is full, and no more data can be stored

Warranty

EXTECH INSTRUMENTS CORPORATION *warrants this instrument to be free of defects in parts and workmanship for* ***one year*** *from date of shipment (a six month limited warranty applies to 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 www.extech.com for contact information. 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.*

Calibration and Repair Services

Extech offers repair and calibration services for the products we sell. Extech also provides NIST certification for most products. Call the Customer Service Department for information on calibration services available for this product. Extech recommends that annual calibrations be performed to verify meter performance and accuracy.

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