



PM200

Optical Power Meter

Operations Guide



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1.0 GENERAL

Thank you for your purchase of an Extech Instruments PM200 optical power meter.

The PM200 is a lightweight hand-held test instrument designed to measure optical power in both multi-mode and single mode optical fibers. Each PM200 comes with a protective rubber boot, a CD with Reporter certification software and PDF manual, DB-9 download cable, and 9-volt battery.

The PM200 uses a fixed 2.5mm universal connector port that can accept many popular connector types, including ST, SC, and FC, without the need for changing and maintaining expensive adapter caps.

NIST calibrated wavelengths include 850, 1300, 1310, and 1550nm, making it ideal for LAN, premise, CATV, and telco applications.

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

2.0 FUNCTIONAL DESCRIPTIONS

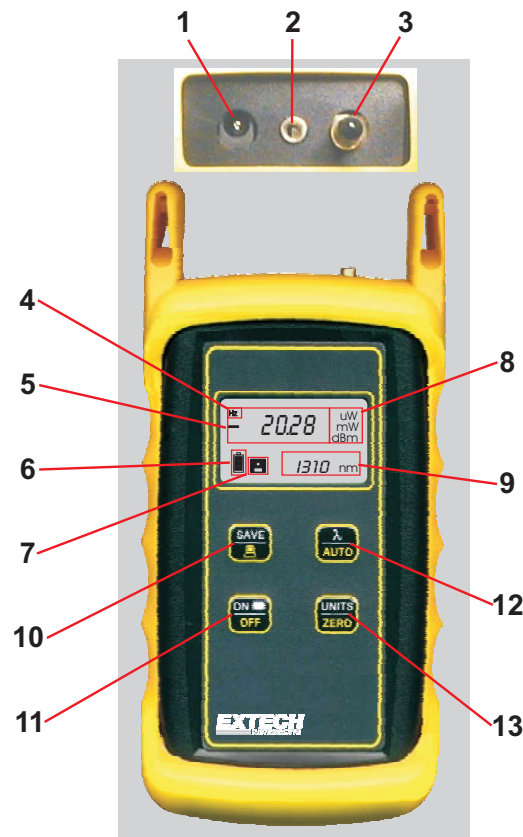


Figure 1 - PM200
Optical Power Meter

2.0.1 CONNECTIONS

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 BATTERY CHARGING PORT WITH NON-RECHARGEABLE BATTERIES. THERE IS THE POTENTIAL FOR EXPLOSION AND DAMAGE MAY OCCUR TO THE UNIT AND/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.

2.0.2 DISPLAY

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 photodetector, and is displayed in either dBm, dB, uW, or mW.

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).

2.0.3 BUTTONS

10. SAVE / DOWNLOAD button - To store a data point, press this button. Hold the button to download 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 wavelengths 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.

3.0 APPLICATIONS

3.1 PRECAUTIONS

3.1.1 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 **NEVER** look into the connector port of a light source or the end of a fiber.

3.1.2 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.

3.2 REQUIRED ACCESSORIES

3.2.1 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.

3.2.2 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.

3.2.3 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.

3.3 TYPICAL APPLICATIONS

The PM200 can be used as a diagnostic and measurement tool 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.

3.3.1 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.

3.3.2 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:

$$L = P_a - P_r$$

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

3.4 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 -20.28 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 - Optical Power Measurement

3.5 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.

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.



Figure 3 - Setting an Optical Reference

3.6 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.

The following section will explain how to store data in the PM200.

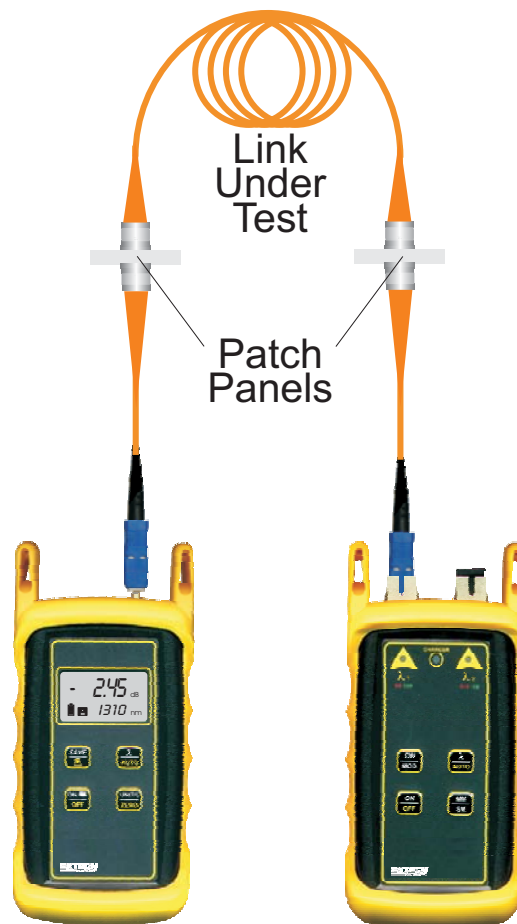



Figure 4 - Optical Loss Measurement

3.7 DATA STORAGE

- b) Connect the PM200 and light source to opposite ends of the link under test.
- c) 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.
- d) Connect the units to the next fiber in the link, and repeat step c. 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.

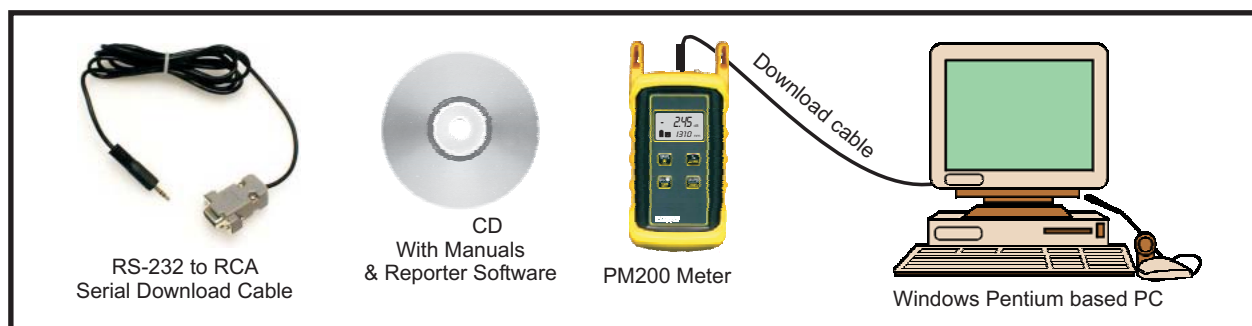
3.8 DOWNLOADING DATA INTO A PC WITH REPORTER SOFTWARE

Once testing is complete or the PM200's memory is full, the stored data points may be downloaded to a PC running Reporter software.

A Pentium PC (or better) running Windows 95 or later operating system is required for Reporter. 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.

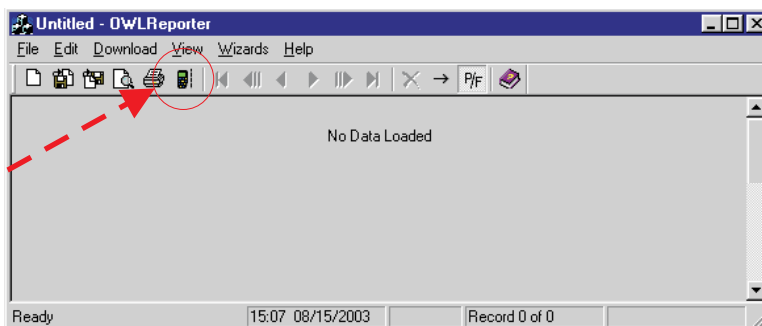
Connect the PM200 to the PC COM port via the supplied download cable.

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



With the PM200 powered ON, run OWL Reporter. The shortcut is located in the Start Menu, under Programs, OWL, and is named OWL 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 data



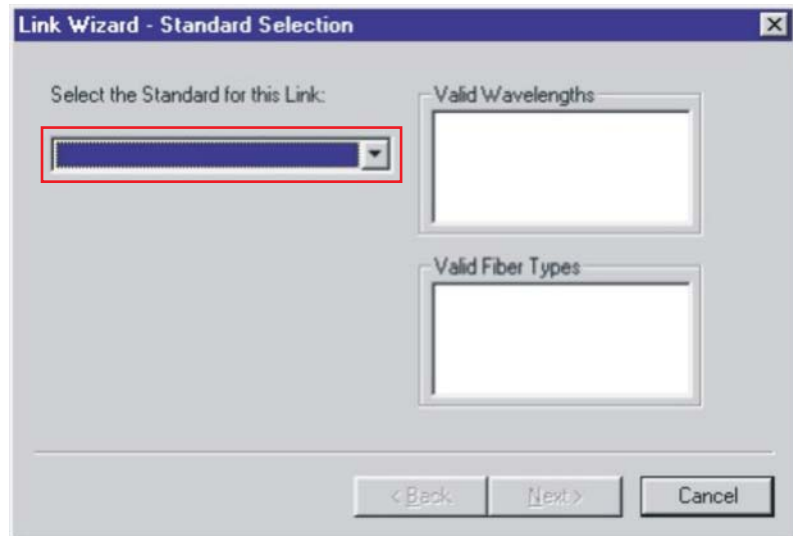
that is stored in the meter. First, the software searches for the meter, then it transfers the data, then gives a confirmation of download success.

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.

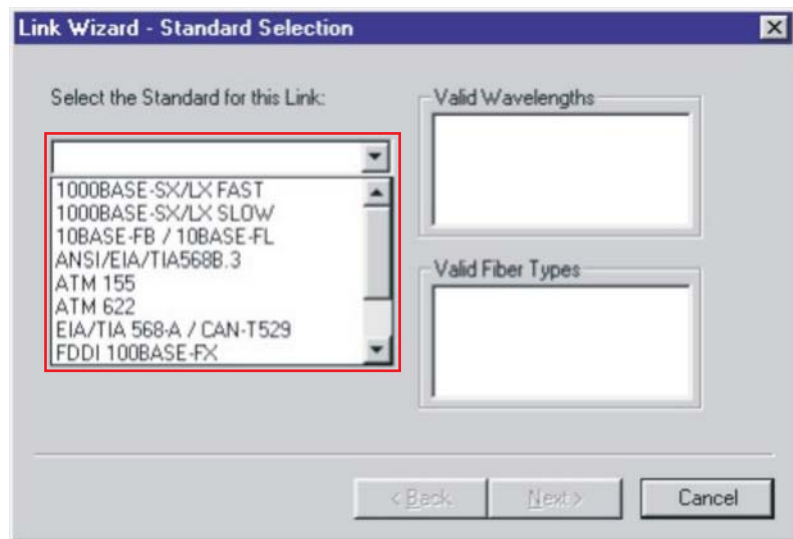
The following pages explain the steps of the Link Wizard in OWL Reporter. This will allow certification of fiber links using a fiber cabling standard.

3.8.1 - Standard Selection

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

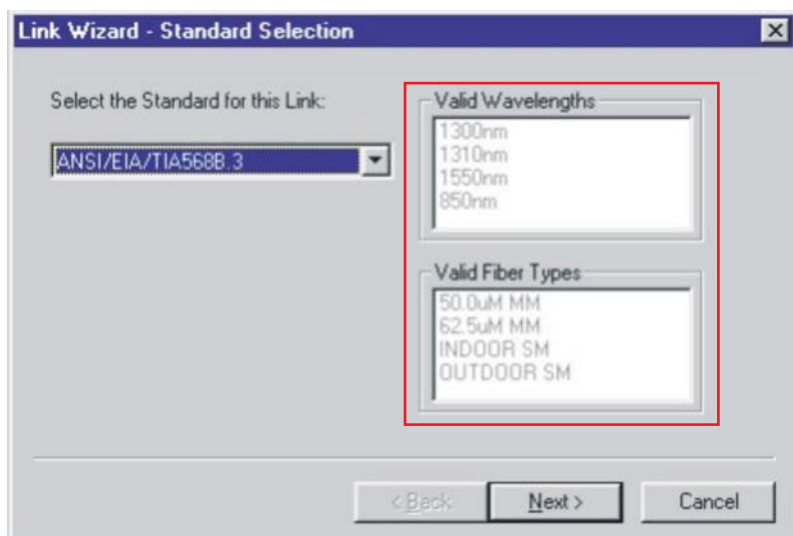


3.8.1.2 - Select the cabling standard from the drop-down list.



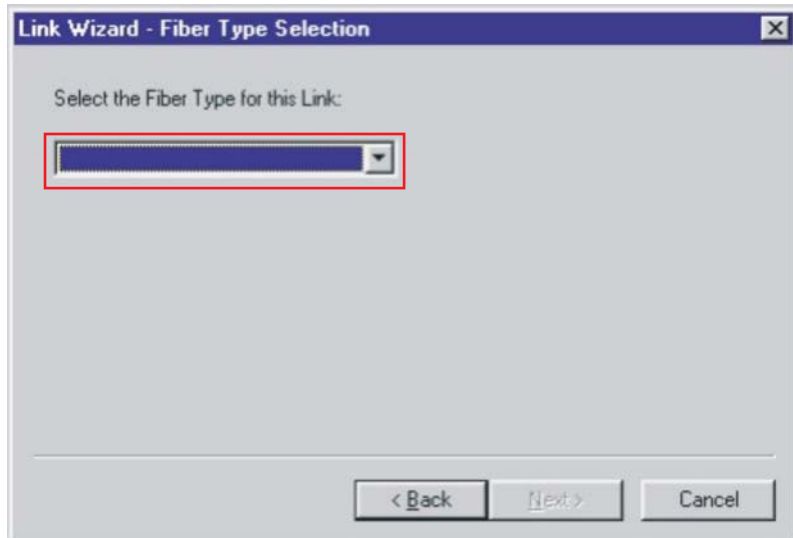
3.8.1.3 - Once the the cabling standard has been chosen, the wavelengths and fiber types that the standard supports appear in the boxes on the right.

Click Next to continue.

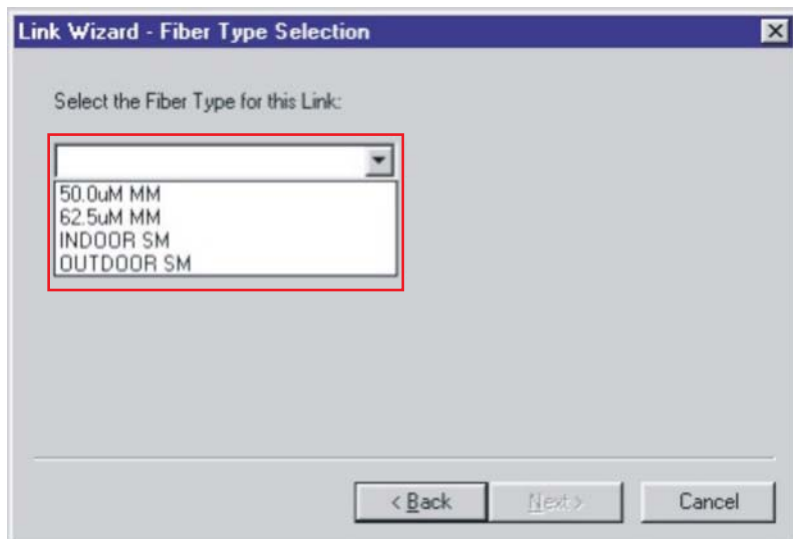


3.8.2 - Fiber Type Selection

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

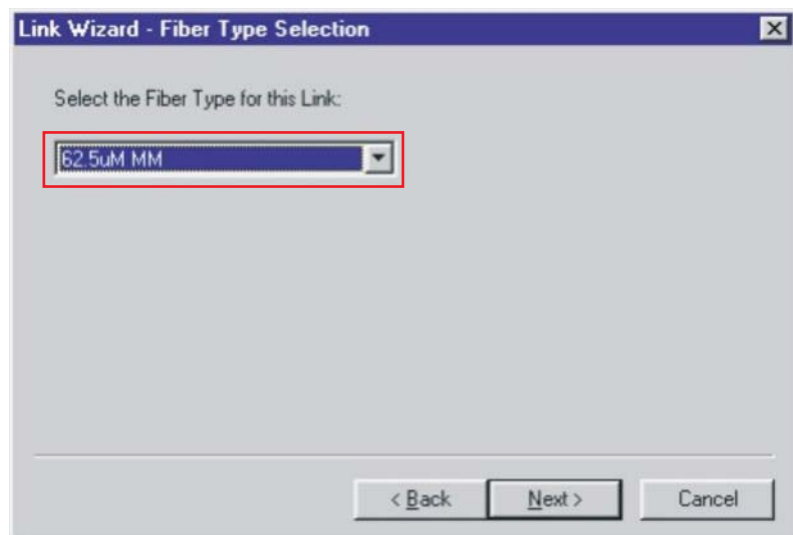


3.8.2.2 - Select the fiber type from the list. The selected fiber type should match the type of fiber of the link under test.



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

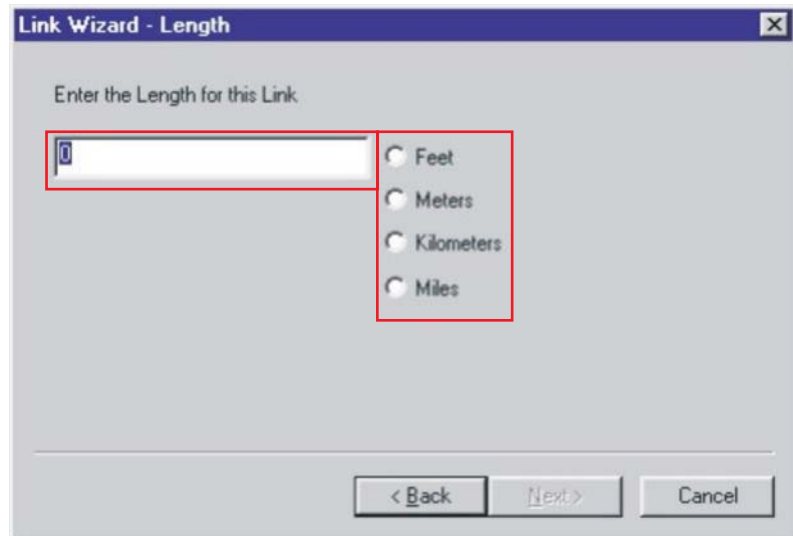
Click Next to continue.



3.8.3 - Fiber Length Input

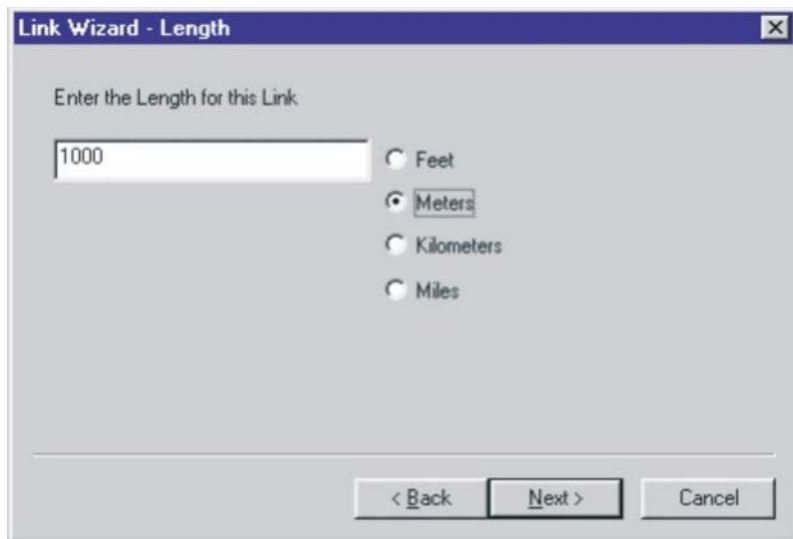
3.8.3.1 - Enter the length of the fiber link under test. This length will apply to all of the data points downloaded from the PM200.

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



The dialog box is titled "Link Wizard - Length". It contains the instruction "Enter the Length for this Link". Below this is a text input box containing the number "0". To the right of the input box are four radio buttons labeled "Feet", "Meters", "Kilometers", and "Miles". At the bottom of the dialog are three buttons: "< Back", "Next >", and "Cancel".

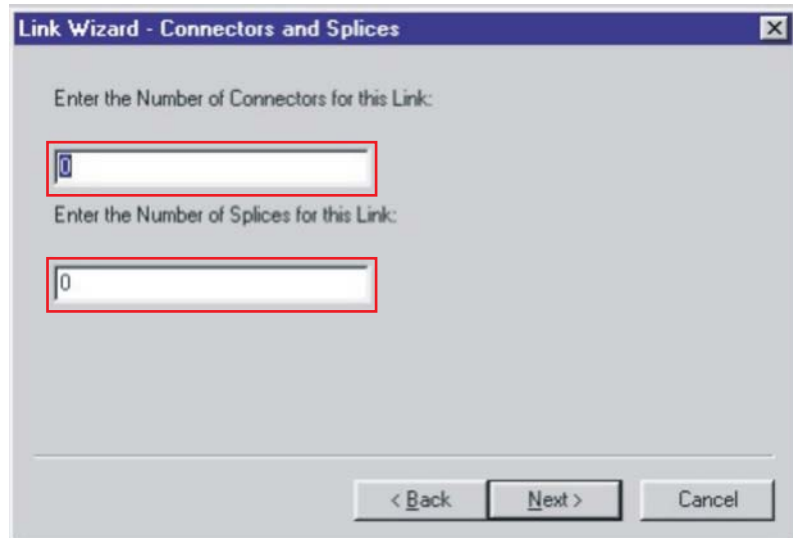
3.8.3.2 - Once the fiber link length and the length units are entered, click Next to continue.



The dialog box is titled "Link Wizard - Length". It contains the instruction "Enter the Length for this Link". Below this is a text input box containing the number "1000". To the right of the input box are four radio buttons labeled "Feet", "Meters", "Kilometers", and "Miles". The "Meters" radio button is selected. At the bottom of the dialog are three buttons: "< Back", "Next >", and "Cancel".

3.8.4 - Connectors and Splices Input

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



Link Wizard - Connectors and Splices

Enter the Number of Connectors for this Link:

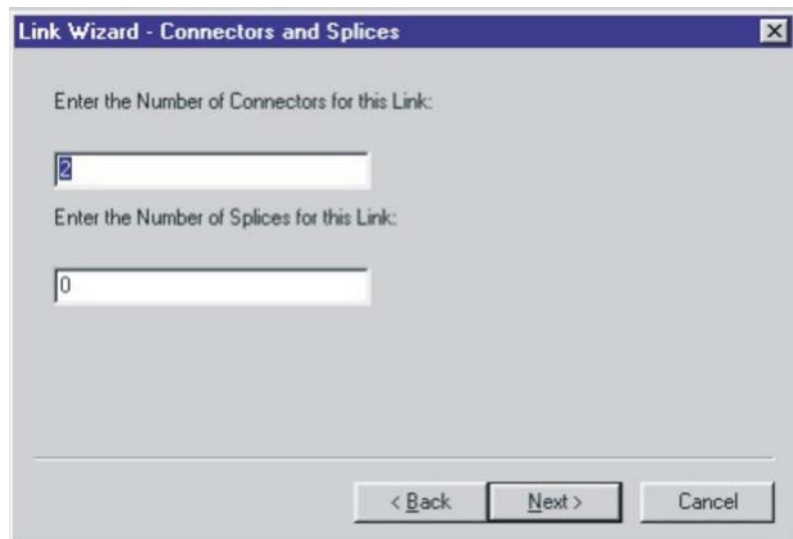
0

Enter the Number of Splices for this Link:

0

< Back Next > Cancel

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



Link Wizard - Connectors and Splices

Enter the Number of Connectors for this Link:

2

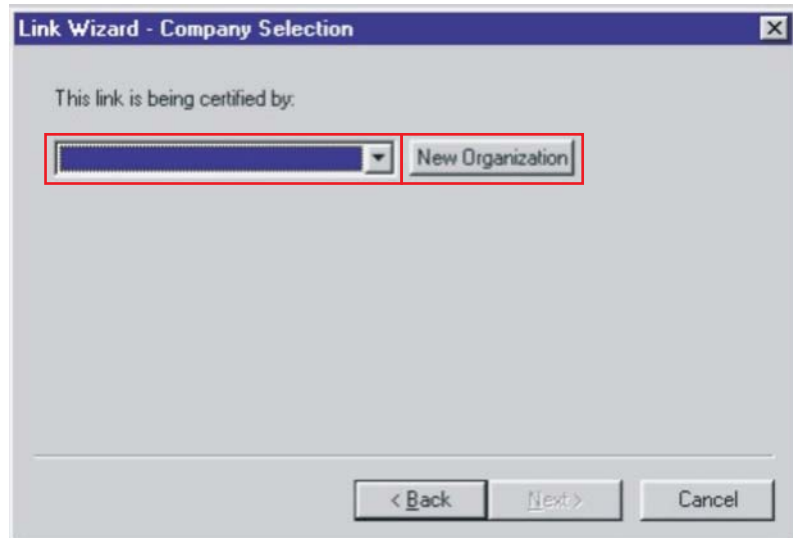
Enter the Number of Splices for this Link:

0

< Back Next > Cancel

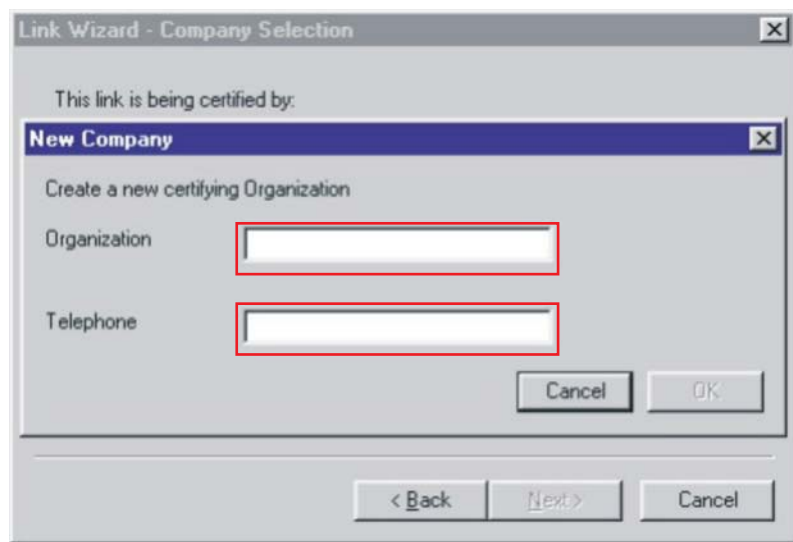
3.8.5 - Company Selection

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




The dialog box titled "Link Wizard - Company Selection" has a close button (X) in the top right corner. Below the title bar, it says "This link is being certified by:". There is a drop-down menu with a downward arrow, and a button labeled "New Organization" to its right. Both the drop-down menu and the "New Organization" button are highlighted with a red rectangular border. At the bottom of the dialog, there are three buttons: "< Back", "Next >", and "Cancel".

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



The dialog box titled "Link Wizard - Company Selection" is shown with a sub-dialog box titled "New Company" open. The "New Company" dialog has a close button (X) in the top right corner and the text "Create a new certifying Organization". It contains two input fields: "Organization" and "Telephone". Both input fields are highlighted with a red rectangular border. To the right of the "Telephone" field are "Cancel" and "OK" buttons. At the bottom of the "Link Wizard" dialog, there are three buttons: "< Back", "Next >", and "Cancel".

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



The dialog box titled "Link Wizard - Company Selection" is shown with the "New Company" sub-dialog box open. The "New Company" dialog has a close button (X) in the top right corner and the text "Create a new certifying Organization". The "Organization" input field now contains the text "Acme", and the "Telephone" input field contains the text "232-555-2263". To the right of the "Telephone" field are "Cancel" and "OK" buttons. At the bottom of the "Link Wizard" dialog, there are three buttons: "< Back", "Next >", and "Cancel".

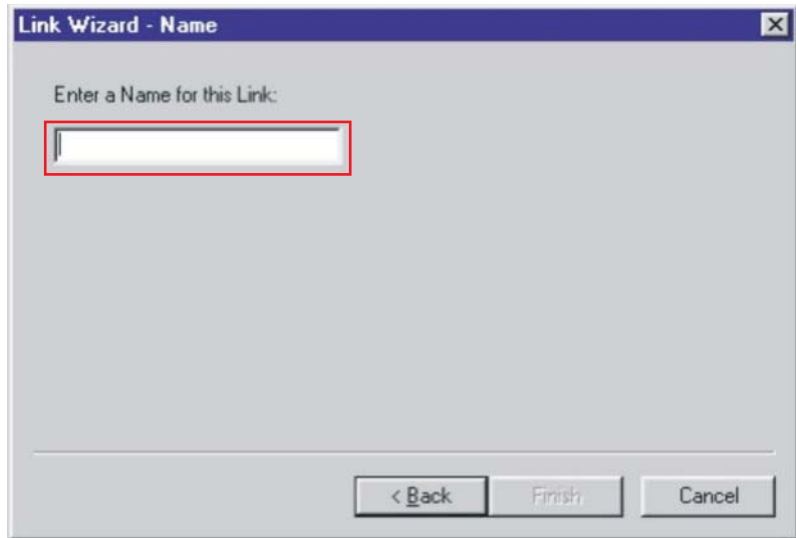
3.8.5.4 - The organization name should now appear in the drop-down box. Click Next to continue.



The image shows a Windows-style dialog box titled "Link Wizard - Company Selection". The dialog has a blue title bar with a close button (X) in the top right corner. The main area of the dialog is light gray. At the top, it says "This link is being certified by:". Below this text is a horizontal row containing a drop-down menu and a button. The drop-down menu currently displays the text "Acme" and has a small downward-pointing arrow on its right side. To the right of the drop-down menu is a button labeled "New Organization". At the bottom of the dialog, there is a horizontal line, and below it are three buttons: "< Back", "Next >", and "Cancel". The "Next >" button is highlighted with a black border.

3.8.6 - Name Input

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



The image shows a Windows-style dialog box titled "Link Wizard - Name". It has a standard title bar with a close button (X). The main area contains the text "Enter a Name for this Link:" followed by a text input field. The input field is currently empty and is highlighted with a red rectangular border. At the bottom of the dialog, there are three buttons: "< Back", "Finish", and "Cancel".

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



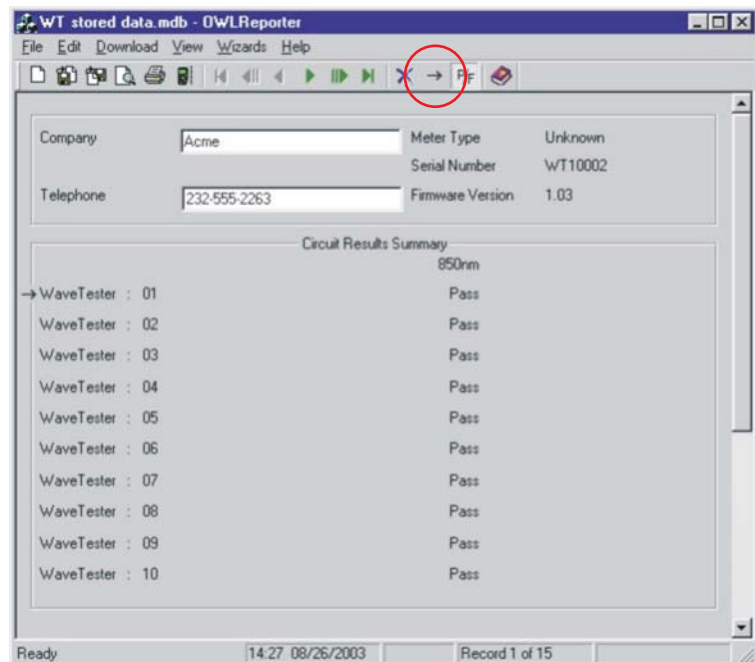
The image shows the same "Link Wizard - Name" dialog box. The text "Enter a Name for this Link:" is present. The text input field now contains the text "Acme Fiber". The "Finish" button at the bottom is highlighted with a black border, indicating it is the next step in the process. The other buttons, "< Back" and "Cancel", are also visible.

3.8.7 - 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.

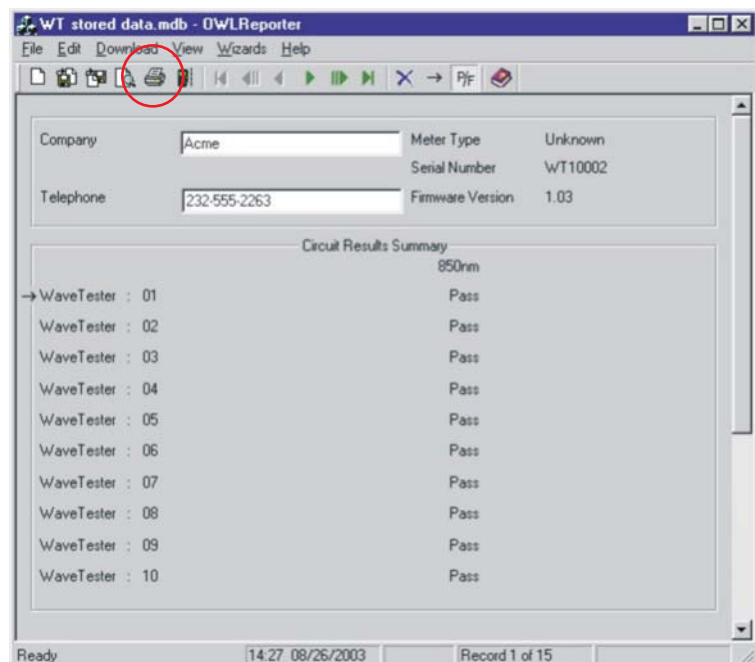
This screen shows the Link ID, each stored data point, and whether the test passed or failed.



3.8.8 - 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.



3.8.9 - 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: Acme
Telephone Number: 232-555-2263

Page: 1
Report Date: 08/26/2003

Circuit ID	Date	P/F	850nm
01	08/22/2003	Pass	1.47dB
02	08/22/2003	Pass	4.45dB
03	08/22/2003	Pass	2.67dB
04	08/22/2003	Pass	5.10dB
05	08/22/2003	Pass	3.53dB
06	08/22/2003	Pass	5.61dB
07	08/22/2003	Pass	4.49dB
08	08/22/2003	Pass	4.98dB
09	08/22/2003	Pass	3.17dB
10	08/22/2003	Pass	1.74dB
11	08/22/2003	Pass	5.28dB
12	08/22/2003	Pass	2.51dB
13	08/22/2003	Pass	4.50dB
14	08/22/2003	Pass	3.19dB
15	08/22/2003	Pass	1.20dB

*1 - Manually set reference

*2 - Fiber type mismatch

*3 - Not covered by TIA standard

Installer/Tester: _____


Date: _____

Customer: _____

Date: _____

3.9 - 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.

4.0 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 λ / 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 λ / 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.

5.0 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 PM200 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.

6.0 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

7.0 SPECIFICATIONS

Optical Specifications

Detector Type	Germanium
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

8.0 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