EXTECH INSTRUMENTS

FiberMeter Optical Power Meter

Model #: FO600 / FO602 / FO610

Operations Guide

Firmware Revision 4.62
March 1, 2007

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INTRODUCTION

Why Use An Optical Fiber Power Meter?

Standards organizations such as the TIA or the IEEE provide performance standards that the cabling plant must adhere to in order to support high-speed protocols such as Gigabit Ethernet. Fiber can be tested against these standards, ensuring that it is able to handle a high amount of traffic with a maximum amount of reliability.

It is standard procedure to produce a hard-copy report (or digital file) of the test results generated from appropriate test equipment for tracking and auditing purposes. These reports can be used as verification of compliance to performance standards in case a question comes up about the quality of an installation. These signed documents cover the installer from liability provided that the link meets specified performance standards.

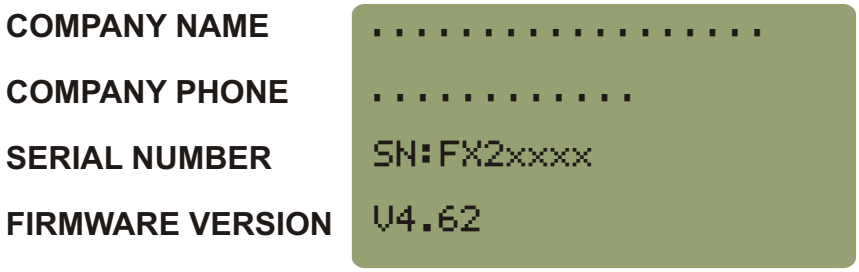
Our optical fiber power meters are designed with cabling standards in mind because we understand the importance of qualifying fiber installations with standards-compliant test equipment. The meter you have just purchased prints professionally formatted reports showing the conformity to these popular industry standards. These reports can be printed as a record of the original conformity to quality and performance set by the standards. These documents signed by all associated parties may prove valuable in any future disputes concerning the installation.

Checking Your FiberMeter Firmware Version

This manual is written for the FiberMeter firmware version 4.62. It is not valid for previously released FiberMeter versions. Follow the instructions below to verify your firmware version.

1 - Press ⏻ to start up the meter.
2 - After the initial boot-up screen, your display should look like the diagram below. This screen remains viewable for approximately 2 seconds.

If the firmware version is not V4.62, contact Extech Instruments at 781-890-7440 for more information about acquiring the correct version of the manual.



INTRODUCTION

Description

The FiberMeter is a high-accuracy, high-resolution, microprocessor-controlled optical power meter. It has a wide dynamic range making it ideal for both singlemode and multimode fiber testing.

It has an attractive handheld case made from high impact plastic, a large backlit graphic LCD, and an 18-key keypad for easy data entry. The 2.5mm universal connector port accepts ST, SC, and FC, as well as many other 2.5mm ferrule connectors. It will operate for over 200 hours on a standard 9-volt battery and has a built-in auto shutdown feature. A 1.25mm universal port is also included for connection to LC or other SFF connectors.

The FiberMeter includes a built-in link wizard that helps you easily calculate optical references (link budgets) used for fiber optic certification testing. It will store up to 1000 measured data points with descriptive link and fiber run labels.

The stored information can be selectively viewed, edited (measured again), printed, or deleted. The meter will print formatted reports of selected stored data directly using the built-in serial port, or all of the stored data can be downloaded to a computer spreadsheet or our free Extech Reporter software to produce professional-looking formatted certification reports.

Applications

Attenuation Measurements. After a fiber link has been installed, optical attenuation should be measured to determine the quality of the installation. When compared to a pre-calculated link budget, a simple calculation can be used to determine if the link will perform as installed. See the appendix at the end of this manual for a link budget calculation worksheet.

Fiber Network Certification Testing. The Link Wizard in the FiberMeter uses attenuation parameters from popular cabling standards to certify fiber links. Stored data can be referenced to the standards to determine if the link passes or fails. Stored data can be downloaded into our FREE Extech Reporter software, where certification reports can be printed out with details or summaries of the fibers being certified.

Fiber Continuity Testing. Continuity can be measured by placing a calibrated light source on one end of the fiber and the FiberMeter on the other end. A power reading on the liquid-crystal display (LCD) shows the presence of optical power.

Patch Cord Testing. Fiber links that are producing incorrect results may have bad patch cords. The FiberMeter 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 should be monitored periodically to test its power levels and stability. The FiberMeter can be directly attached to this equipment via a patch cord to check whether the transmitter is stable and within the manufacturer's specified power range.

Length Measurement of Fiber Optic Links or Spools (optional for FO602). Generic cabling standards such as the TIA-568 use the actual length of the cable under test to calculate loss budgets. Spool testing can verify that the amount of fiber delivered on the spool is accurate.

NOTE ON BACKLIGHT OPERATION

By default, the backlight in FiberMeter series optical power meters is set to be always ON. To save power, the backlight status may be set to OFF by following these steps below:

FROM CERTIFICATION METER

1) Press MENU to activate the MAIN MENU.
2) Press 4 JKL to activate the METER CONFIG MENU.
3) Press 2 DEF to activate the USER PREFERENCES menu.
4) Press F2 to set the STARTUP BACKLIGHT STATE: OFF.
5) Press DONE twice to return to the MAIN MENU.

FROM SIMPLE METER

1) Press MENU to activate the MAIN MENU.
2) Press 2 DEF to activate the METER CONFIG MENU.
3) Press 2 DEF to activate the USER PREFERENCES menu.
4) Press F2 to set the STARTUP BACKLIGHT STATE: OFF.
5) Press DONE twice to return to the MAIN MENU.

UNIT 1 FEATURES & FUNCTIONS

General Features

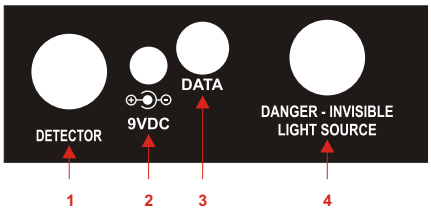
Ports

1 **DETECTOR** - houses detector port, and accepts 2.5mm cap (for ST, SC, FC, plus others) or 1.25mm cap (for LC, MU, or other SFF connectors)

2 **9VCD** - charges battery when a re-chargeable 9-volt battery is in use. WARNING - Use ONLY re-chargeable batteries when charger port is in use. Failure to comply to this warning may damage the unit or cause harm to the user.

3 **DATA** - downloads data from the meter to a PC via supplied 9-pin RS-232 serial cable

4 **DANGER - INVISIBLE LIGHT SOURCE** - contains light source for use with optical length testing feature (FO602 model only)



Ports Diagram

Keypad

1 **FUNCTION KEYS** - activate the options on the Function Options Menu

2 **ALPHA-NUMERIC KEYS** - enter letters, numbers, and symbols into field prompts

3 **MENU KEY** - used to enter the menu system

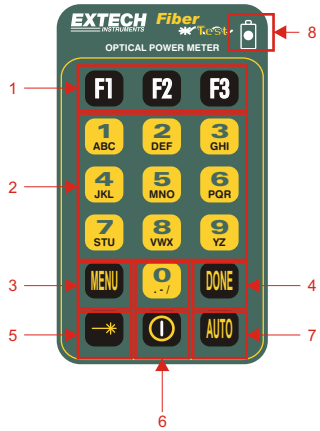
4 **DONE KEY** - activates menu options

5 **LIGHT SOURCE KEY** - activates the SOURCE SETTINGS menu when an optional light source is installed

6 **POWER KEY** - turns the meter ON or OFF, and toggles the backlight ON or OFF.

7 **AUTO KEY** - toggles the automatic wavelength recognition mode ON and OFF

8 **BATTERY INDICATOR LED** - indicates when the battery charger is in use



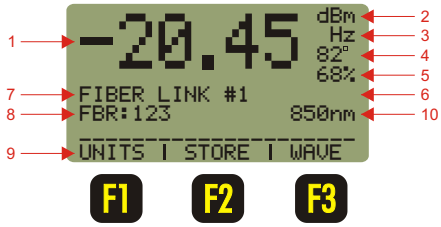
Keypad Diagram

UNIT 1 FEATURES & FUNCTIONS

General Features

Liquid Crystal Display (LCD)

The screen at right shows information when power readings are being taken. We will refer to this screen throughout this manual as Immediate Mode.



Liquid Crystal Display (LCD) Diagram

IMMEDIATE MODE

1 **POWER READING** - shows the amount of optical power being received by the photodetector based upon the type of power units currently being displayed. The display may also show **UNDER** when there is no measurable optical power or **OVER** when there is too much optical power to measure

2 **POWER UNITS** - shows the power units which are currently being displayed
dBm - optical power in decibels relative to a milliwatt of optical energy
dB - optical power in decibels relative to a previously set optical reference, also known as optical loss
uW - optical power in watts; either microwatts (uW) or milliwatts (mW)

3 **TONE DETECTION** - shows 'Hz' if a modulated signal is being detected by the meter

4 **TEMPERATURE** - shows current temperature in degrees (selectable Fahrenheit or Celcius)

5 **BATTERY LIFE** - shows the amount of remaining battery life; will flash BAT when battery is low

6 **LIGHT SOURCE WAVELENGTH** (only appears if optional light source is installed) - displays the current light source wavelength output

7 **LINK NAME** - shows the name of the currently loaded fiber link (if shown)

8 **FIBER RUN** - shows the current fiber information (if shown)
FBR: - user-configurable descriptive fiber name
123 - auto-incrementing fiber number (from 1 to 999)

9 **FUNCTION OPTIONS MENU** - functions corresponding to the function keys on the keypad; the options on this menu will change according to the current function

10 **POWER METER WAVELENGTH** - shows the currently selected wavelength (see the specifications in the appendix at the end of this manual for a list of wavelengths); will also alternate between wavelength and 'AUTO' when set to automatic wavelength detection mode

UNIT 1 FEATURES & FUNCTIONS

Keyboard Entry Method

Several screens in the FiberMeter menu system require the user to enter some input, e.g. a fiber length measurement or a descriptive name for a fiber run. This feature allows the FiberMeter to be more user-friendly.

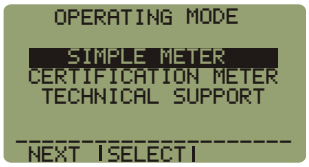
Alpha-numeric Fields. These fields allow the user to enter either a number, a letter, or a special character. This is accomplished by pressing and holding the key until the desired character appears. When the key is released, the cursor automatically advances to the next position.

Numeric Fields. These fields are for numeric input only, e.g. fiber length, user-defined reference values, etc. The cursor will automatically advance once a number key is pressed. Exception: some numeric operators may be required, such as the minus sign or a decimal point. The 0 key contains special characters. In this case, they are treated like alpha-numeric fields.

Press the DONE key when character input is complete.

Modes of Operation

As an added convenience, the FiberMeter has been designed to operate as two different types of meters: SIMPLE METER and CERTIFICATION METER.



OPERATING MODE MENU

SIMPLE METER is used for simple optical power or attenuation (loss) measurements. Users may set up temporary reference values for each wavelength for quick loss readings. SIMPLE METER is covered in more detail in Unit 2.

CERTIFICATION METER is a user-friendly and powerful auto-testing fiber optic network certification tool. Fiber links can be certified against one of many popular cabling standards, as well as against user-defined standards. Up to 1000 data points can be stored for download to a PC. Extech Reporter software organizes and formats these data points, and prints them into professional certification reports. CERTIFICATION METER is covered in more detail in Unit 3.

Users may return to the OPERATING MODE menu from:

1) SIMPLE METER by pressing DONE from the main power measurement screen, or

2) CERTIFICATION METER by pressing DONE from the MAIN MENU.

Extech's Internet URL and technical support number appears when TECHNICAL SUPPORT is chosen.

Monitor Mode

Monitor Mode sends absolute power measurements in a comma-delimited format to the serial port. A terminal program is required to view data in real time, and captured data files can be imported into a spreadsheet for charting purposes.

Monitor Mode is useful for live monitoring of a light source or fiber optic transmitter.

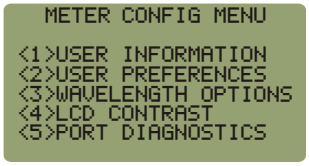
To enter Monitor Mode, press 5 MNO while viewing a data point. Press DONE to exit Monitor Mode.

Monitor Mode

METER CONFIGURATION FUNCTIONS

Several features of the FiberMeter can be configured from the METER CONFIG MENU. In SIMPLE METER, pressing MENU, then <2>METER PROPERTIES will open this menu. While in CERTIFICATION METER, press MENU then select <4>METER PROPERTIES.

METER CONFIG MENU is shown at right. These configuration functions are activated by pressing the corresponding key, and are described in more detail below.



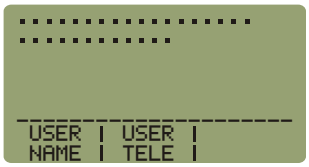
METER CONFIG MENU

Changing User Information

<1>USER INFORMATION - this option changes the name and telephone number of the owner of the FiberMeter.

The dots appear in these fields by default when the meter is turned on for the very first time. These dots will be replaced with company information.

Press DONE to return to the METER CONFIG MENU.

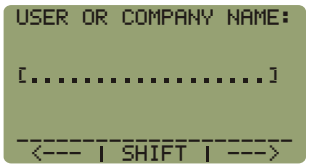


Company Information Screen

Changing User Name

F1 USER NAME - dots will first appear in the USER OR COMPANY NAME field. Press and hold the F1 key to backspace to the beginning of the field, then enter the company name. Use the F2 as a shift key for lower case letters. This field allows for 18-character names.

Press DONE when finished to return to the USER INFORMATION screen.

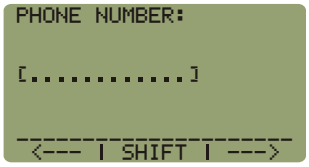


Change Company Name

Changing User Telephone Number

F2 USER TELE- dots will first appear in the PHONE NUMBER field. Press and hold the F1 key to backspace to the beginning of the field, then enter the company phone number. This field allows for 12-character phone numbers.

Press DONE when finished to return to the USER INFORMATION screen.



Change Company Phone Number

Setting User Preferences

<2>USER PREFERENCES - sets the power saving features and the displayed temperature of the FiberMeter.

F1 AUTO SHUTDOWN - toggles the auto-shutdown feature between ON and OFF. This feature is ON by default.

Set Power Saving Features

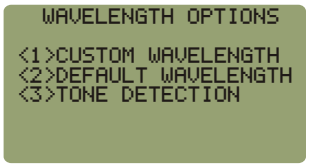
NOTE: the memory in the FiberMeter allows for permanent storage of data, including reference and power readings. Data will remain in the meter, even when the unit is powered off, until it is removed by the user.

F2 STARTUP BACKLIGHT STATE - determines whether the backlight is ON or OFF when the FiberMeter is powered ON. This feature is ON by default.

F3 TEMPERATURE UNITS - toggles between Fahrenheit (F) and Celcius (C) degrees. This feature is Fahrenheit (F) by default.

Changing Wavelength Options

<3>WAVELENGTH OPTIONS - this option is used to set various wavelength-related options in the FiberMeter, including setting custom wavelengths and tone detection options.

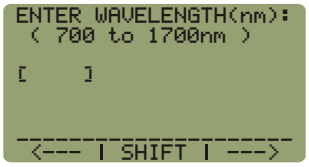


WAVELENGTH OPTIONS MENU

Entering Custom Wavelength

<1>CUSTOM WAVELENGTH - the FiberMeter has the capability of setting a custom wavelength. The custom wavelength temporarily replaces 980nm, and requires a singlemode light source tuned to -10dBm for calibration.

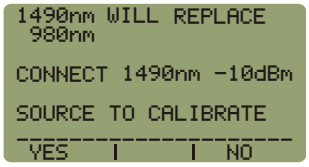
Enter the 3- or 4-digit custom wavelength between 700nm and 1700nm in the entry field provided, then press DONE to continue. An example of a custom wavelength would be 1490nm.



Setting Custom Wavelength

Connect a -10 dBm singlemode light source of the appropriate wavelength to the FiberMeter using a singlemode patch cord.

Press F1 to confirm calibration. The meter will then return to the METER CONFIG MENU.



Resetting Custom Wavelength to Default

<2>DEFAULT WAVELENGTH - this WAVELENGTH OPTION resets a previously set custom wavelength to the default wavelength of 980nm.

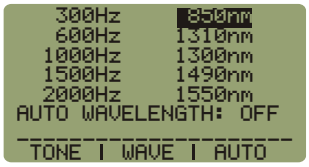
Press F1 to confirm the default wavelength. The meter will then return to the METER CONFIG MENU.

NOTE: if the wavelength is already set to 980nm, pressing the 2 DEF button has no effect.

Setting Tone Detection Options

<3>TONE DETECTION - this WAVELENGTH OPTION is used to associate five tone detection frequencies with five calibrated wavelengths, as well as set the FiberMeter into AUTO WAVELENGTH detection mode.

The screen at right shows pre-configured tone options.



Set Toning Options

NOTE: shown above is the default tone configuration

- F1 TONE - moves the tone selection highlight to the next tone.
- F2 WAVE - toggles the wavelength of the currently selected tone.
- F3 AUTO - toggles the AUTO WAVELENGTH detection feature ON or OFF.

Setting LCD Contrast

<4>LCD CONTRAST - this option allows the user to set the contrast of the liquid crystal display (LCD).

Set LCD Contrast

- F1 DOWN - lightens the screen in case it is too dark
- F3 UP - darkens the screen in case it is too light

Press DONE to return to the METER CONFIG MENU.

Port Diagnostics

<5>PORT DIAGNOSTICS - this option performs diagnostic tests on the RS-232 serial port, and also the optical ports, if the optional light source is installed.

NOTE: <2>OPTICAL DATA PORT WILL ONLY APPEAR ON THE SCREEN ON MODEL FO602

PORT DIAGNOSTICS

Test Download Port

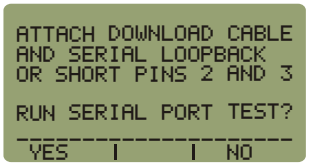
<1>DOWNLOAD PORT - this test checks the RS-232 download port for send and receive capability.

1) Attach the download cable that came with the FiberMeter to the serial port on the top of the unit.

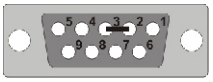
2) Short pins 2 and 3 on the download cable with a short piece of wire as shown in the diagram at right.

3) Press F1 to confirm the test.

If the test fails, double-check the wire that is shorting pins 2 and 3, and re-test. If the test still fails, contact technical support.



RS-232 Serial Port Test



Short Pins 2 & 3

Test Optical Data Port

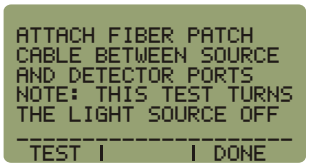
<2>OPTICAL DATA PORT - this advanced diagnostic test is used during technical support calls as a diagnostic to check the transmission status of the detector port and the integrated light source port.

NOTE: THIS FUNCTION IS ONLY AVAILABLE ON MODEL # FO602.

1) Attach a patch cord between the detector port and source port.

2) Press F1 to start the test. The RECEIVED DATA should begin to count up, and for every 256 counts, the PASS NUMBER should increment by one.

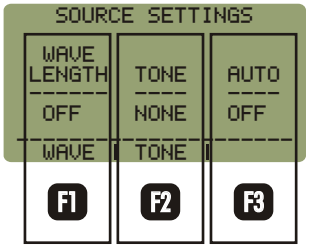
3) Press F3 to complete the test.



Optical Data Port Test

LIGHT SOURCE MENU (FO602 versions only)

In the FiberMeter model FO602, the SOURCE SETTINGS menu allows the user to control the options of the light source. The options on this menu will change based upon the configuration of the installed light source.



SOURCE SETTINGS MENU

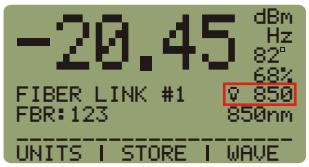
1) Press ✳ .

2) F1 WAVELENGTH - turns the light source OFF or ON. If multiple wavelengths are present, this button will cycle through all of the available wavelengths.

F2 TONE - toggles the TONE option for the currently selected wavelength, and shows the toning frequency.

F3 AUTO - this option sets the light source into AUTO mode when multiple wavelengths are present; it is deactivated for single-wavelength configurations.

3) Press DONE when finished.



IMMEDIATE MODE Light Source Indicator

An indicator will appear in Immediate Mode (shown in red box at right).

The lightbulb icon indicates whether the light source is in continuous wave (CW) mode (icon stays on), or in toning mode (icon flashes). The number next to the icon shows the currently selected light source wavelength.

UNIT 2 SIMPLE METER

Overview

SIMPLE METER is a mode within the FiberMeter that allows the user to quickly and easily display the attenuation of a fiber link. This mode is used when data storage is not necessary, only the most basic functions are required: fiber loss measurement, optical power measurement, patch cord testing, or active equipment monitoring.

Operation

1) Press the ⏻ button.

2) After a few seconds, you will be prompted to choose an operating mode. When SIMPLE METER is highlighted, press F2 to select.

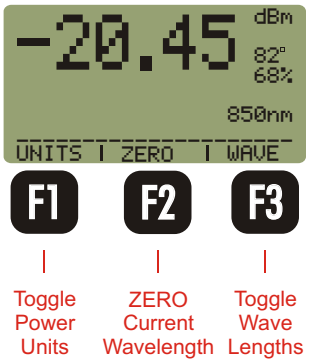
You are now ready to take fiber measurements.

Function Options Menu

Immediate Mode will appear after the unit is booted up into SIMPLE METER. Your display may show 'UNDER' - this will occur if the dustcap is still covering the detector port.

There are three functions on the function options menu:

- F1 UNITS - toggles the power units between dBm, dB, and microwatts;
- F2 ZERO - sets an optical reference, or "zero" for the currently selected wavelength; and
- F3 WAVE - toggles the wavelength between the calibrated wavelengths (see the specifications in the appendix for a list of calibrated wavelengths).



SIMPLE METER Test Procedures

SIMPLE METER can be used for several different types of tests. These tests include:

Attenuation Measurement
Fiber Continuity Testing
Patch Cord Testing
Active Equipment Measurement
Optical Fiber Length Measurement (light source versions only)

Each of these tests will be described in more detail in this unit.

SIMPLE METER - Attenuation Test

After a fiber link has been installed, optical attenuation (or loss) should be measured to determine the quality of the installation. When compared to a pre-calculated link budget, a simple comparison of power values can be used to determine if the link will perform as installed. A light source and two patch cords are also required for this test. Use the following steps to perform an attenuation test in SIMPLE METER:

Calculate Maximum System Attenuation.

1) Use the link budget calculation worksheet at the end of this manual to calculate the Maximum System Attenuation. This is the first section on the worksheet.
2) Record the Maximum System Attenuation.

Set the optical reference (or "ZERO").

3) Power on the FiberMeter and select SIMPLE METER.
4) Power on the light source being used for the test, and allow it to warm up according to manufacturer's specifications.
5) Set the FiberMeter and light source to matching wavelengths.
6) Connect the FiberMeter to the light source using a single patch cord of the appropriate type. The core size of the patch cord should match the core size of the fiber link under test. If the fiber link under test is multimode, the patch cord must be wrapped and secured around a mandrel. Please see the appendix at the end of this manual for more information about setting optical references.
7) Press F2 or 0 to set the optical reference. The power units will automatically change to dB, and the power reading should be very close to 0.00 dB. The optical reference in dBm will also appear below the power reading.
   NOTE: the memory in the FiberMeter allows for permanent storage of data, including reference and power readings. Data will remain in the meter, even when the unit is powered off, until it is removed by the user.

Measure attenuation (or loss) of the fiber link under test.

8) Disconnect the patch cord from the FiberMeter, taking great care to leave the patch cord connected to the light source.
9) Take the FiberMeter and light source to opposite ends of the fiber link under test.
10) Connect the FiberMeter and light source to the corresponding fiber connector using appropriate patch cords.
11) Record the power value that appears in the upper left hand corner of the display without the minus (-) sign. This is the amount of loss across the link.
12) Remove the patch cords from the fiber connector.
13) Repeat steps 10 through 12 for each fiber in the fiber link under test. Repeat this procedure for each wavelength to be tested.

Optical Loss Displayed in dB

Interpreting the results.

Compare the Total System Attenuation from the link budget to the actual recorded loss. If the Maximum System Attenuation exceeds the actual recorded loss, the link passes.

For example, if the Maximum System Attenuation is 2.0 dB, and the actual recorded loss is 1.54 dB (like the display above), then the link is said to pass, and has a margin of 0.46 dB.

UNIT 2 SIMPLE METER

SIMPLE METER - Fiber Continuity Test / Fiber Identification

A fiber continuity test determines if optical power can be passed through the entire fiber link, and can also be used as a simple way to identify fibers. A light source is also required for this test.

Use the following steps to perform an fiber continuity test in SIMPLE METER:

1) Power on the FiberMeter and select SIMPLE METER.
2) Power on the light source being used for the test.
3) Set the FiberMeter and light source to matching wavelengths.
4) Take the FiberMeter and light source and connect them to opposite ends of the fiber under test.

The FiberMeter will display either a power level (which means continuity has been achieved), or 'UNDER' when it cannot detect any optical power. 'UNDER' can mean one of the following:

a) there is too much attenuation in the link (e.g. broken fiber, excessive length, dirty connections, microbends, etc.);
b) the FiberMeter is not connected to the correct fiber; or
c) the light source is powered off.

To use the FiberMeter as a fiber identifier, follow the steps above and connect the FiberMeter to each fiber until a power reading appears.

SIMPLE METER - Testing Patch Cords

Poor quality patch cords can cause instability in fiber optic attenuation tests. The FiberMeter can be used to determine if the patch cord is of sufficient quality to be used for fiber optic attenuation tests, or whether it should be replaced. A light source is also required for this test.

Use the following steps to test a patch cord in SIMPLE METER:

1) Power on the FiberMeter and select SIMPLE METER.
2) Power on the light source being used for the test, and allow it to warm up according to the manufacturer's specifications.
3) Set the FiberMeter and light source to matching wavelengths, and ensure that the FiberMeter is set to dBm mode.
4) Clean the connectors of the patch cord under test, and connect the FiberMeter and light source to the opposite ends of the patch cord.
5) Consult the manufacturer's specifications for the light source's calibrated power level, and compare this number to the power level displayed on the FiberMeter.

Quality patch cords will produce very little loss, so the power levels compared in step 5 should be fairly close, usually within 0.3 dB. Consider replacing the patch cord if the loss of the patch cord exceeds 0.3 dB.

UNIT 2 SIMPLE METER

SIMPLE METER - Active Equipment Measurement

Active equipment should be monitored periodically to test its power levels and stability. The FiberMeter can be directly attached to this equipment via a patch cord to check whether the transmitter is stable and within the manufacturer's specified power range.

NOTE: maximum transmitter output power exceeding the high end of the FiberMeter measurement range could damage the photodector in the FiberMeter. If this is the case, a fiber optic attenuator will be necessary to attenuate the signal sufficiently. Consult the manufacturer's specification sheet for more information.

Use the following steps to measure the optical power of active equipment in SIMPLE METER:

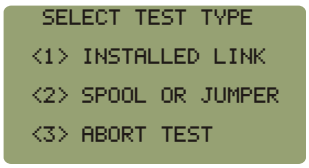
1) Power on the FiberMeter and select SIMPLE METER.
2) Power on the active equipment to be tested.
3) Set the FiberMeter to match the output wavelength of the active equipment, and ensure that the FiberMeter is set to dBm mode.
4) Connect the FiberMeter to the active equipment with a patch cord of the appropriate type.
5) Consult the active equipment manufacturer's specifications to determine the correct power level of the transmitter, and compare this number to the displayed optical power.

SIMPLE METER - Fiber Length Measurement

NOTE: THIS FUNCTION IS ONLY AVAILABLE FOR MODEL FO602.

The FiberMeter uses a loop-back method to measure the length of a fiber link. Use the following steps to perform the length test:

1) Power ON the FiberMeter, and select SIMPLE METER.
2) Press MENU to enter the MAIN MENU.
3) Select TEST FIBER LENGTH by pressing 4 JKL .
4) At the SELECT TEST TYPE menu, choose the menu option that best matches the configuration of the fiber under test.



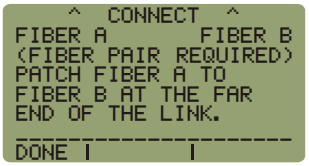
1 ABC INSTALLED LINK - measures the end-to-end length of an installed fiber cable, which is useful for calculation of loss budgets that are based on length (requires two fibers)

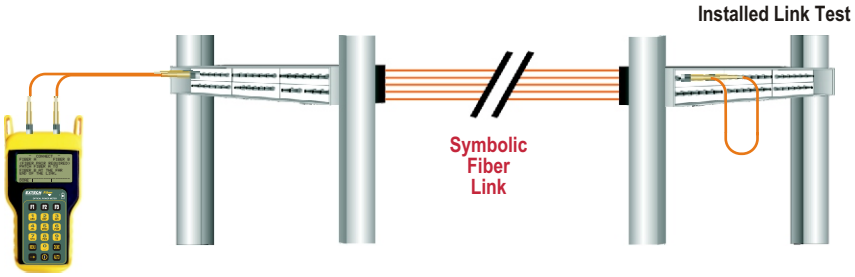
2 DEF SPOOL OR JUMPER - measures the length of a spool of fiber or a test jumper

3 GHI ABORT TEST - returns the user to the previous menu

SIMPLE METER - Fiber Length Measurement - Installed Link

1) Connect the detector port and light source port to two fibers in the link via patch cords.
2) On the other end of the link, connect the same two fibers with a single patch cord, thus creating a loop.
3) Once the patch cords are connected as shown in the diagram below, press F1 or DONE to run the LENGTH TEST.





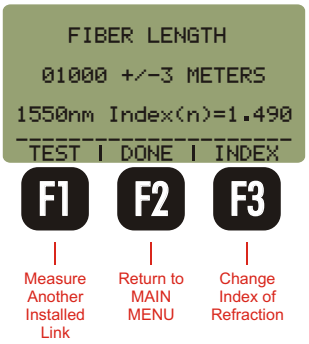
4) After the length test is complete, the fiber length will be displayed in meters, and the index of refraction used for the test is shown.

5) Three options are available once the length measurement is complete:

F1 TEST - perform another length measurement

F2 DONE - return to the MAIN MENU

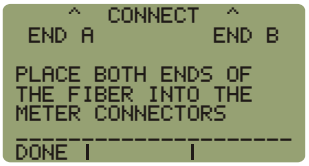
F3 INDEX - change the index of refraction



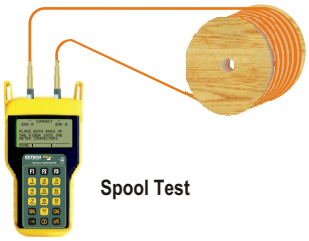
INDEX OF REFRACTION

Index of refraction (IOR) is an expression of the speed of light in the optical fiber and is used to calculate the length. Since IOR varies from cable to cable, the FiberMeter allows the user to change the IOR to match the cable under test, ensuring the most accurate length measurement. The IOR is typically between 1.400 and 1.600, and can be found on the cable manufacturer's specification sheet.

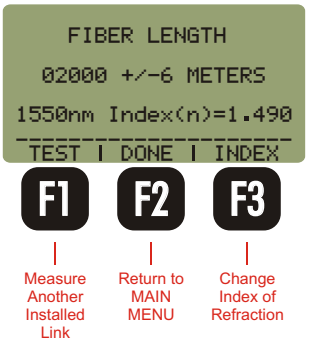
SIMPLE METER - Fiber Length Measurement - Spool or Jumper



1) Connect the detector port and light source port to the terminated ends of a patch cable or fiber spool as shown below.
2) Once the patch cable or spool is connected as shown in the diagram below, press F1 or DONE to run the LENGTH TEST.
3) After the length test is complete, the fiber length will be displayed in meters, and the index of refraction used for the test is shown.



4) Three options are available once the length measurement is complete:



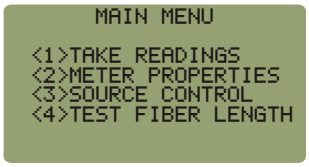
- F1 TEST - perform another length measurement
- F2 DONE - return to the MAIN MENU
- F3 INDEX - change the index of refraction

INDEX OF REFRACTION

Index of refraction (IOR) is an expression of the speed of light in the optical fiber and is used to calculate the length. Since IOR varies from cable to cable, the FiberMeter allows the user to change the IOR to match the cable under test, ensuring the most accurate length measurement. The IOR is typically between 1.400 and 1.600, and can be found on the cable manufacturer's specification sheet.

SIMPLE METER - MAIN MENU

Pressing MENU will enter the MAIN MENU.



<1>TAKE READINGS - return to Immediate Mode.
<2>METER PROPERTIES - see page 1-4.
<3>SOURCE CONTROL - see page 1-9.
<4>TEST FIBER LENGTH - see page 2-4.

NOTE: OPTIONS 3 AND 4 WILL ONLY APPEAR FOR MODEL FO602.

UNIT 3 CERTIFICATION METER

Overview

Certification Meter allows the user to store data points for the purpose of certifying fiber links against known industry cabling standards; EIA/TIA 568, ISO/IEC 11801, and Gigabit Ethernet are some examples. A user-friendly link configuration wizard is provided to enter fiber link parameters, which are used to calculate reference values for easy PASS/FAIL readings.

The FiberMeter is capable of certifying and storing up to 1000 data points with user-configurable fiber labels.

Data points are downloaded into our free Extech Reporter Windows-compatible software for organizing data points and printing professional certification reports.

Operation

1) Press the ⏻ button.
2) After a few seconds, you will be prompted to choose an operating mode. Highlight "CERTIFICATION METER" and press F2 to select.
3) From the START MENU, you may either enter <1>LINK WIZARD (see page 3-2), <2>TAKE READINGS, or enter <3>MAIN MENU (see below).

CERTIFICATION METER Test Procedures

CERTIFICATION METER is designed to certify fiber links against popular cabling standards. An easy to use Link Wizard is provided to walk the user through the certification setup process.

All of the tests listed in SIMPLE METER can also be done in CERTIFICATION METER, as well as three additional advanced test methods:

Cabling Standard Certification Test
Manual Link Budget Test
Manual Reference Test

Manual Link Budget Test and Manual Reference Test are only recommended for users who have a firm grasp of calculating link budgets manually.

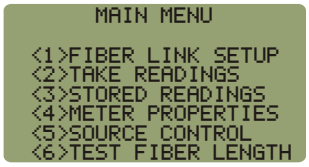
UNIT 3 CERTIFICATION METER

MAIN MENU

The MAIN MENU activates the advanced functions of the FiberMeter. To open the MAIN MENU, press MENU and it will appear as shown as the figure at the right.

These functions are activated by pressing the corresponding key, and are described in more detail below.

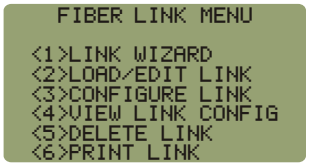
NOTE: OPTIONS 5 AND 6 WILL NOT APPEAR IF THE OPTIONAL LIGHT SOURCE IS NOT INSTALLED.



MAIN MENU

MAIN MENU - FIBER LINK MENU

<1>FIBER LINK SETUP - enters the FIBER LINK MENU. This menu allows the user to configure and manage fiber links in the FiberMeter. The meter can store up to eight separate fiber link configurations. The parameters contained in each fiber link apply to all data points stored while that link was loaded.



FIBER LINK MENU

MAIN MENU - FIBER LINK MENU - LINK WIZARD

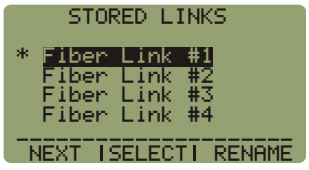
This menu option runs the Link Wizard. See the section "CERTIFICATION METER - Cabling Standard Certification Test" in this unit for instructions on running the Link Wizard.

MAIN MENU - FIBER LINK MENU - LOAD/EDIT LINK

1) From the FIBER LINK MENU, press 2 DEF to LOAD/EDIT the link.

2) From the STORED LINKS menu, highlight the link name you wish to use. The currently loaded link is denoted by an asterisk.

   NOTE: take care to NOT overwrite a previously configured link unless it is no longer needed.

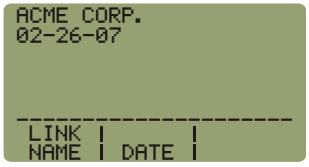


STORED LINKS MENU

3) Press F3 to set the link information.

4) Edit the LINK NAME by pressing F1. It is recommended to change the link name to better describe the link. The link name field can support up to 17-character names. Press DONE when finished.

5) Edit the DATE by pressing F2. It is of vital importance to change the date using the format **MM-DD-YY**. If the date is entered incorrectly, or not entered at all, Extech Reporter will display an incorrect date on the software and reports. Press DONE when finished entering the date, then press DONE again to continue.



Link Information

6) Press F2 to load the link.

MAIN MENU - FIBER LINK MENU - CONFIGURE LINK

From the STORED LINKS menu, highlight the link name you wish to use. The currently loaded link is denoted by an asterisk.

NOTE: take care to NOT overwrite a previously configured link unless it is no longer needed.

STORED LINKS MENU

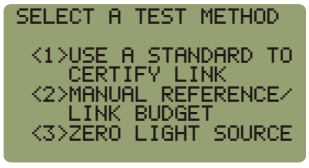
Configure Link Properties and Set Reference

There are three different test methods used to configure a link:

<1>USE A STANDARD TO CERTIFY LINK - this is the same as running the Link Wizard. See the section "CERTIFICATION METER - Cabling Standard Certification Test" in this unit for instructions.

<2>MANUAL REFERENCE - see below

<3>ZERO LIGHT SOURCE - see page 3-5

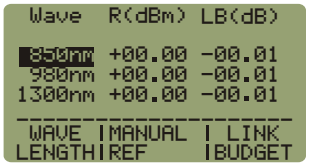


Select a Test Method

Configure Link Properties and Set Reference - Manual Reference Method

Manual references are used to configure the FiberMeter with custom link loss requirements.

There are two types of manual reference methods: Link Budget and Manual Reference. Each of these methods are recommended for advanced users only.



Wavelength Reference Screen

The **Wave** column shows the wavelengths available for referencing.

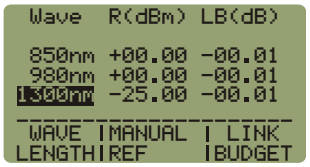
The **R(dBm)** column shows the light source reference power level in dBm. By default, this shows **+00.00dBm**.

The **LB(dB)** column shows the manually-set link budget in dB. By default, this shows **-00.01 dB**.

- **F1** WAVELENGTH - scrolls between the wavelengths in the FiberMeter. The currently selected wavelength is highlighted.
- **F2** MANUAL REF - allows the user to manually set a reference level. See page 3-4 for instructions.
- **F3** LINK BUDGET - allows the user to manually set their own link budget. See page 3-4 for instructions.

Setting a Manual Reference

NOTE: this method is recommended for advanced users only.



Wavelength Reference Screen

Manual Reference Method sets an optical reference by allowing the user to input an absolute optical power level (in dBm).

1) Connect a light source of the appropriate wavelength to the FiberMeter, and power on the light source. Remember to allow the light source to warm up according to manufacturer's specifications.

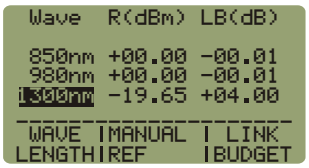
2) Using the F1 key, scroll to the appropriate wavelength.

3) Press F2 . The actual optical power being received by the FiberMeter will be shown in the entry field. Backspace over this number to enter the desired reference level in dBm. Follow steps 2 & 3 for each wavelength, then press DONE to continue.

The Wavelength Reference Screen will now show the optical reference as previously entered. Readings may be now stored as normal.

Setting a Manual Reference Using a Link Budget

NOTE: this method is recommended for advanced users only.



Wavelength Reference Screen

Link Budget Method sets an optical reference by adding a pre-calculated link budget (in dB) to the optical power from a light source.

1) Connect a light source of the appropriate wavelength to the FiberMeter, and power on the light source. Remember to allow the light source to warm up according to manufacturer's specifications.

2) Using the F1 key, scroll to the appropriate wavelength.

3) Press F3 to enter the pre-calculated link budget. Backspace over the characters in the entry field and type the amount of link budget (for example, 4.00). Follow steps 2 & 3 for each wavelength, then press DONE to continue.

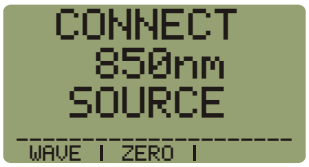
The Wavelength Reference Screen will now show the light source reference level as well as the link budget.

For example: a 1300nm light source is outputting -19.65 dBm and the pre-calculated link budget is 4.00 dB. The PASS/FAIL threshold would then be -23.65 dBm.

Readings may be now stored as normal.

Setting an Optical Reference by Zeroing the Light Source

This method allows the user to "zero" the light source for the purpose of viewing optical attenuation values, or loss, in Immediate Mode.



Zero Reference Confirmation Screen

1) Connect a light source of the appropriate wavelength to the FiberMeter, and power on the light source. Remember to allow the light source to warm up according to manufacturer's specifications.

2) Using the F1 key, change to the appropriate wavelength.

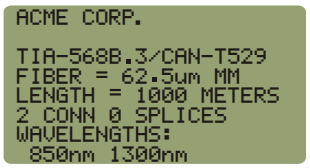
3) Press F2 to "zero" the light source power. Press DONE to continue.

Optical loss may be viewed in Immediate Mode by setting the power units to dB. Readings may now be stored as normal.

NOTE: zeroing the light source can also be done from Immediate Mode by pressing 0 .

MAIN MENU - FIBER LINK MENU - VIEW LINK CONFIG

Users may view the configuration of links in the FiberMeter.



Link Configuration Screen

1) From the FIBER LINK MENU, press 4 JKL to VIEW LINK CONFIG.

2) Highlight and select the link to view from the STORED LINKS menu.

The link configuration will appear on the display. If the link was stored by using the Link Wizard, a display similar to the one at the right will appear. The items on the display are explained below:

ACME CORP. - link name
TIA-568B.3/CAN-T529 - fiber cabling standard
FIBER = 62.5um MM - fiber type
LENGTH = 1000 METERS - fiber length
2 CONN 0 SPLICES - number of connections and splices
WAVELENGTHS: 850nm 1300nm - wavelengths used with standard

If the link was stored by a manual reference method, or is not in use, the display will say ALL MANUAL REFERENCES.

Press DONE to return to the FIBER LINK MENU.

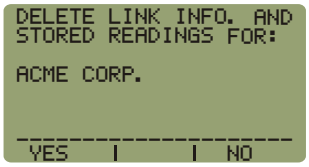
MAIN MENU - FIBER LINK MENU - DELETE LINK

At times, it may be necessary to delete a link's configuration in order to use it for a new link. This process will delete the link information and all readings that were stored while this link was loaded. The following steps show how to delete a link:

1) From the FIBER LINK MENU, press 5 MNO .

2) Highlight and select the link to delete.

3) Press F1 to confirm deletion, and return to FIBER LINK MENU.



Delete Link Confirmation Screen

NOTE: once this information is deleted from the FiberMeter, it can no longer be retrieved. Double-check to ensure that the link is no longer needed before confirming deletion.

MAIN MENU - FIBER LINK MENU - PRINT LINK

The data points stored for particular links can be downloaded to the serial port in an easy-to-read format. This data can be viewed and captured to file by terminal programs such as HyperTerminal for Windows.

1) From the FIBER LINK MENU, press 6 PQR .

2) Highlight and select the link to print.

The display will show a confirmation, then will return to the FIBER LINK MENU.

Link Printing Confirmation Screen

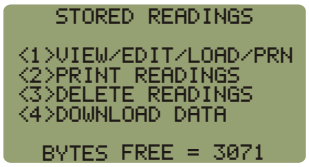
MAIN MENU - TAKE READINGS

<2>TAKE READINGS - returns the user to Immediate Mode, where readings can be stored for the currently loaded link.

MAIN MENU - STORED READINGS

<3>STORED READINGS - opens the STORED READINGS menu, which is used to manage the data stored in the FiberMeter.

NOTE: the memory in the FiberMeter allows for permanent storage of data, including reference and power readings. Data will remain in the meter, even when the unit is powered off, until it is removed by the user.



STORED READINGS MENU

MAIN MENU - STORED READINGS - VIEW/EDIT/LOAD/PRN

<1>VIEW/EDIT/LOAD/PRN - opens a data point review screen. This first appears showing the first data point in memory. Information about the data point includes:

Data Point Review Screen

Link Name (ACME CORP.)
Fiber Name and Number (FBR:1)
Fiber Type (INDOOR SM)
Wavelength (1310nm)
Absolute Optical Power (-10.98dBm)
Relative Power (-1.98dB)
Test Result (PASS)

Several control functions can be performed from this screen. The function keys are used to navigate among the stored data.

F1 NEXT NAME - scrolls through all of the different fiber names stored in the FiberMeter.

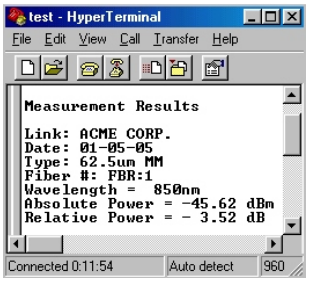
F2 NEXT RUN - scrolls through the data points stored with the currently displayed fiber name.

F3 NEXT WAVE - each data point may have data stored for multiple wavelengths. This option scrolls through the different wavelengths stored with this data point.

0 .-/ 0=LOAD - loads the currently displayed fiber link, and returns the user to Immediate Mode to resume taking data at the end of the stored readings of the link. *For example, if there are 12 data points for this link, then Immediate Mode will show FBR:13.*

5 MNO 5=EDIT - loads the currently displayed fiber link, and returns the user to Immediate Mode to re-save the data point. After the data point is edited, the user is returned to the end of the stored readings of the current link. *Using the example from above, Immediate Mode will show FBR:1, and after the data is stored, the fiber name and number will show FBR:13.*

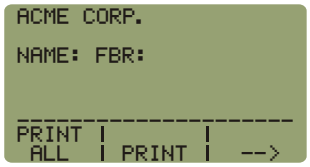
7 STU 7=PRINT- sends detailed, formatted information about the data point to the serial port. An screenshot of the serial port print format is at right.



Serial Port Print Format

MAIN MENU - STORED READINGS - PRINT READINGS

<2>PRINT READINGS - opens the data point print screen. All data for specific links and fiber names are sent to the serial port in an easy-to-read print format.



Data Point Print Screen

Information shown on this screen includes:

Link Name (ACME CORP.)
Fiber Name (FBR:)

The function keys are used to navigate among the stored data.

- F1 PRINT ALL - sends all data to the serial port
- F2 PRINT - sends stored data for the displayed link to the serial port
- F3 --> - scrolls through all of the links that have stored data

MAIN MENU - STORED READINGS - DELETE READINGS

<3>DELETE READINGS - opens the data point delete screen. Data for specific links can be deleted, or all data can be deleted.

Data Point Delete Screen

Information shown on this screen includes:

Link Name (ACME CORP.)
Fiber Name (FBR:)

The function keys are used to navigate among the stored data.

- F1 DELETE ALL - deletes all data stored in the FiberMeter
- F2 DEL - deletes data for the currently displayed link and fiber name
- F3 --> - scrolls through all of the links that have stored data

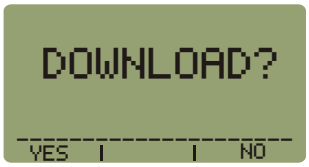
UNIT 3 CERTIFICATION METER

MAIN MENU - STORED READINGS - DOWNLOAD DATA

<4>DOWNLOAD DATA - downloads all data points stored in the FiberMeter to a PC via serial port. There are two methods of download:

Extech Reporter - data can be downloaded into Extech Reporter software for printing and saving professional-looking certification reports.

The FiberMeter does not have to be at this screen to download into Extech Reporter. Details on how to download data to Extech Reporter are explained in more detail in the Extech Reporter unit of this manual.



Manual Download Confirmation Screen

Manual Download - data can be downloaded in a comma-delimited format using a terminal program. Comma-delimited data can be captured from the terminal program and imported into word processing programs, spreadsheets, or databases for making custom reports.

Once the PC terminal program is correctly configured and set to capture data, press F1 from the manual download confirmation screen to download stored data.

MAIN MENU - METER PROPERTIES

METER CONFIG MENU is covered in more detail in Unit 1.

MAIN MENU - LIGHT SOURCE MENU

See the section “LIGHT SOURCE MENU (light source versions only)” in Unit 1 for instructions.

MAIN MENU - TEST FIBER LENGTH

See the section “FIBER LENGTH MEASUREMENT on Page 2-4 for instructions.

UNIT 3 CERTIFICATION METER

CERTIFICATION METER - Cabling Standard Certification Test

The main function of CERTIFICATION METER is to test and certify fiber links using attenuation parameters of various cabling standards. Certification includes setting a standards-based optical reference, measuring the attenuation of a fiber using this reference, storing the measurement, and finally downloading and printing the data as a professional certification report.

It is important to understand the term "LINK" as it applies to a FiberMeter certification test. In the FiberMeter, a link is defined as ***any number of fibers, or fiber cables, that all have the same set of characteristics from one end to the other; typically begin together and end together; and follow the same pathway. These characteristics include fiber length, fiber type, connector loss, and splice loss, as well as the cabling standard.***

CERTIFICATION METER includes a Link Wizard which is used to configure the FiberMeter for certification. The Link Wizard will prompt the user to enter information about the link. Prior to running the Link Wizard, have the following information ready:

Cabling Standard (a list of supported standards is in the appendix at the end of this manual)
Fiber Type
Fiber Length (not necessary if the optional light source is installed)
Number of connections (a connection is where two fiber connectors meet; e.g. a patch panel)
Number of splices

CERTIFICATION METER - Cabling Standard Certification Test

LOAD/EDIT LINK INFORMATION

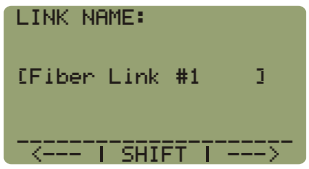
1) From the MAIN MENU, press 1 ABC to start the LINK WIZARD.

2) From the STORED LINKS menu, use F1 to scroll through the list of links, and highlight the link name you wish to use. The currently loaded link is denoted by an asterisk. NOTE: a warning screen will appear at any time when link information is about to be overwritten.

F1 F2

3) Press F2 to load the selected link.

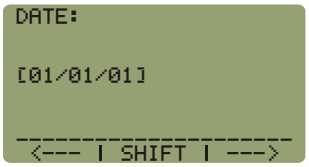
4) Edit the LINK NAME. Use F1 to backspace, then enter the link name using the alpha-numeric keys. Press DONE when finished entering the link name.



NOTE: changing the link name is not required, however, it is recommended in order to more easily interpret the data in a certification report.

CERTIFICATION METER - Cabling Standard Certification Test; cont.

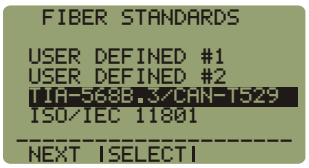
5) Edit the DATE. Use F1 to backspace, then enter the link name using the alpha-numeric keys. Press DONE when finished entering the date.



NOTE: It is of vital importance to change the date using the format **MM-DD-YY**. If the date is entered incorrectly, or not entered at all, Extech Reporter will display an incorrect date on the software and reports.

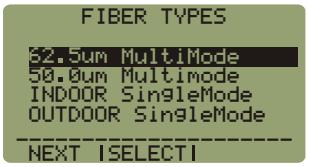
CONFIGURE LINK PROPERTIES AND SET REFERENCE

6) Use F1 to scroll through the list of fiber standards. Once the chosen standard is highlighted, press F2 to select.



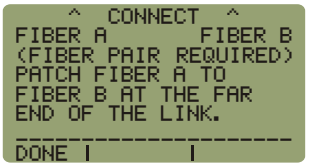
NOTE: users may create their own standards. See page 3-15 for instructions.

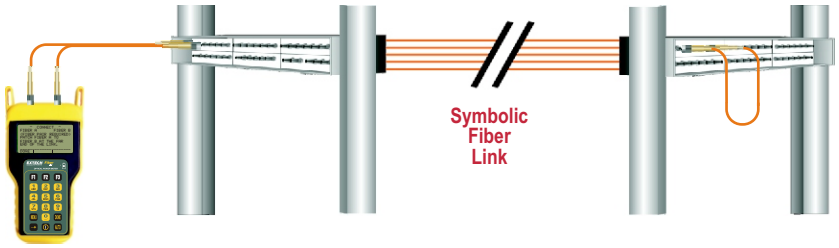
7) Use F1 to scroll through the list of fiber types. Once the fiber type that matches the cable under test is highlighted, press F2 to select.



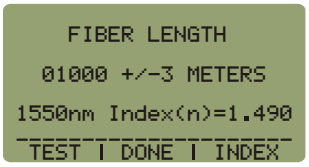
THE METER WILL SKIP TO STEP 10 IF THE OPTIONAL LIGHT SOURCE IS NOT INSTALLED.

8) Connect the detector port and light source port to two fibers in the link via patch cords. On the other end of the link, connect the same two fibers with a single patch cord, thus creating a loop. When the patch cords are connected, press F1 to run the LENGTH TEST.





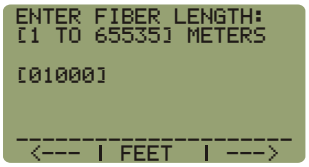
9) After the length test is complete, the fiber length will be displayed in meters. Press F2 to continue.



NOTE: if **CANNOT DETERMINE LENGTH** appears on the display, double-check to make sure that the fiber link is connected as shown above. To test the equipment ports, take a single patch cord and connect it between the two ports, then press F1 to re-test. If the fiber length comes up as 00003 +/-3 meters, then the problem rests in the fiber link itself.

CERTIFICATION METER - Cabling Standard Certification Test; cont.

10) Enter the fiber length in meters. If entering the length in feet is preferred, press F2 to toggle the length units to FEET.

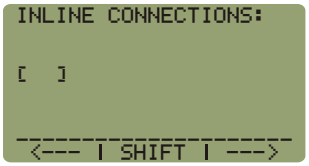


NOTE: if the FiberMeter has the optional installed light source, the length will already be entered into this field.

11) Press DONE to continue.

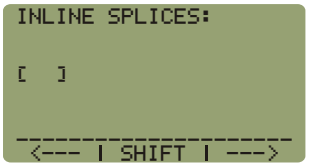
Once the fiber length has been acquired, remove the patch cords from both ends of the link if necessary.

12) Enter the number of connections in the link, and press DONE to continue.



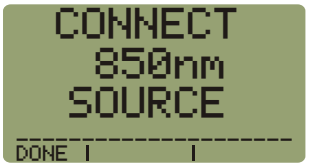
NOTE: an inline connection is the junction where two fiber connector endfaces meet, such as in a patch panel or bulkhead adapter. For example, if the link under test is installed into patch panels, then the number of connections to be entered would be '2'.

13) Enter the number of splices in the link, and press DONE to continue. Splices can be either fusion or mechanical.



NOTE: some pre-polished connectors, such as the Unicam®, use mechanical splice technology for fiber termination. These connectors should be counted as splices when running the FiberMeter Link Wizard.

14) Connect the light source to the detector port on the FiberMeter using a patch cord that matches the fiber type of the cable under test.



NOTE FOR MULTIMODE SOURCES ONLY: multimode reference jumpers need to be wrapped around a mandrel, which is simply a cylinder of a specific size. Mandrels are used to filter out excess modes of light in order to achieve Equilibrium Mode Distribution (EMD), a requirement of test procedures based on national and international cabling standards. See the table below for mandrel size information.

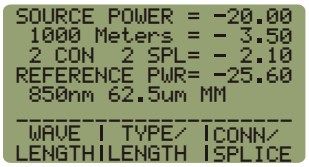
Fiber Type	Mandrel Diameter
62.5/125 uM	0.7 inches
50/125 uM	0.9 inches
3mm jacket patch cords should be wrapped around the mandrel 5 times	

15) Power on the light source and set it to the wavelength shown on the FiberMeter display. Allow the source to warm up according to manufacturer's specifications.

NOTE: only wavelengths that are supported by the chosen cabling standard will appear on the screen during the LINK WIZARD.

16) Press F1 to continue.

CERTIFICATION METER - Cabling Standard Certification Test; cont.



17) Review the reference data to ensure that the proper link characteristics were used.

F2 modify fiber type and fiber length

F3 modify number of connections and splices

18) Press DONE to continue.

19) Press F1 to confirm setting the wavelength reference.

NOTE: if a reference was previously set for this link position, a prompt will appear asking to replace the reference.

NOTE: most cabling standards support testing for multiple wavelengths, so the meter may prompt the user to set an additional wavelength. To set the reference for the additional wavelength, repeat steps 14 through 19. However, **IF THE ADDITIONAL WAVELENGTH IS IN A SEPARATE LIGHT SOURCE PORT, DO NOT USE THE REFERENCE JUMPER FROM THE FIRST WAVELENGTH**. A separate reference jumper must be used (and wrapped around a mandrel if multimode).

20) Press F1 to begin taking readings. The meter will begin to display power readings.

The FiberMeter is now ready to store readings. Immediate Mode will appear and should be set to display power in 'dB' for PASS/FAIL readings.

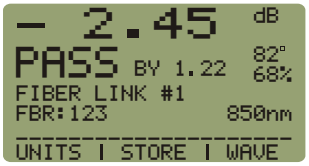
While measuring in 'dB', the display will show the amount of attenuation in the fiber under test, and whether it passes or fails and by what amount. Attenuation will always be shown as a negative number. The amount of optical loss is known by removing the minus sign.

22) Disconnect the patch cord from the FiberMeter. NOTE: remember to keep the patch cord connected to the light source for the duration of the test.

23) Connect the meter and light source to opposite ends of the link under test. The display should appear similar to the figure at the right.

24) Once a readings appears, press F2 to store the reading.

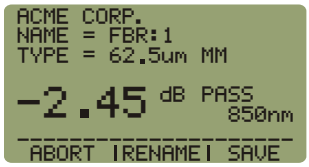
25) If this is the first data point stored for this link, a prompt will appear for entering a more descriptive fiber name. Press DONE to continue.



CERTIFICATION METER
Immediate Mode

CERTIFICATION METER - Cabling Standard Certification Test; cont.

26) A review screen will appear with three options:



Data Point Review

F1 ABORT - do NOT save the data point, and return to Immediate Mode to re-test the same data point. If a FAIL reading appears, it is recommended to ABORT, clean all connections, and then re-test.

F2 RENAME - change the descriptive fiber name (same as step 27).

F3 SAVE - save the data point, and advance to the next data point in Immediate Mode. Notice that the fiber number automatically increments to the next number.

27) Once the data has been stored for the current fiber, move the units to the next fiber, and repeat steps 24 through 26 until all fibers have been tested.

Once all data is stored in the FiberMeter, they can be downloaded to a PC which has Extech Reporter installed. Please consult the Extech Reporter unit for more information.

NOTE: the memory in the FiberMeter allows for permanent storage of data, including reference and power readings. Data will remain in the meter, even when the unit is powered off, until it is removed by the user.

CERTIFICATION METER - Creating User-Definable Cabling Standards

Some companies have their own set of optical fiber loss parameters – such as fiber loss, connector loss and splice loss – that they need their network to adhere to. Thus, the FiberMeter allows the user to configure two user-definable cabling standards for the purpose of fiber certification.

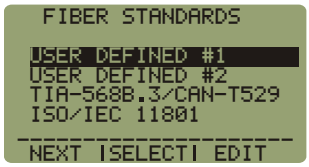
These standards are defined when selecting the fiber standard during the Link Wizard process.

NOTE: one of the key parameters for defining these custom cabling standards is fiber loss (dB per kilometer). Each custom standard supports a different range of optical losses (for up to 2 wavelengths), thus it is important to know what the fiber loss is because this determines which user-definable standard to use.

USER DEFINED #1 supports fiber losses for up to two wavelengths from 0.01 dB to 2.55 dB per kilometer
USER DEFINED #2 supports fiber losses for up to two wavelengths from 0.1 dB to 25.5 dB per kilometer

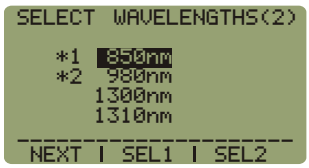
1) Press F1 to scroll through the list of fiber standards.

2) When the correct custom standard is highlighted, press F3 to EDIT.



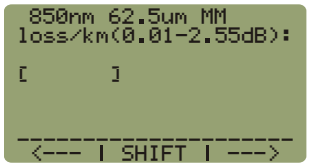
3) From the SELECT WAVELENGTHS screen, press F1 to scroll to the first wavelength to configure.

4) Press F2 to select this wavelength as the first wavelength.

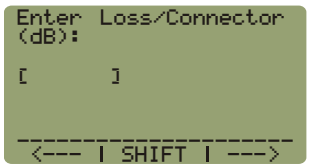


5) Enter the loss per kilometer in dB for 62.5/125 MM fiber in the entry field. Decimals can be entered by holding the O key to scroll through the special characters. If it is not necessary to enter a value, leave the entry field blank.

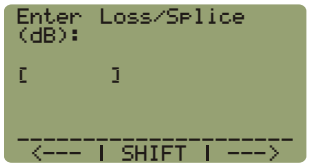
6) Press DONE to continue. Repeat Steps 5 & 6 for the remaining fiber types.



7) Enter the loss per connection in dB, then press DONE to continue.



8) Enter the loss per splice in dB, then press DONE to continue.



9) Highlight the other wavelength to use for this standard and press F3 to select.

10) Repeat steps 5 through 8 for the second wavelength. Press DONE to return to the fiber standard selection screen, then press F2 to select the custom standard.

UNIT 4 Extech Reporter

Overview

Extech fiber optic certification meters are designed to certify fiber optic links using cabling standards because we understand the importance of qualifying your fiber installations with standards-compliant test equipment.

Extech Reporter software comes FREE with Extech certification meters, and is used to print professionally formatted reports showing the conformity to these popular industry standards. You can print out these reports as a record of the original conformity to quality set by the standards. These documents signed by all associated parties may prove valuable in any future disputes concerning the installation.

Each Extech certification meter comes with a CD-ROM containing Extech Reporter software and a RS-232 download cable. Extech Reporter requires a PC with a Pentium or better processor and Windows 95 or later, as well as a RS-232 serial port. PCs that only have USB ports can use a USB-to-serial converter.

Installing Extech Reporter

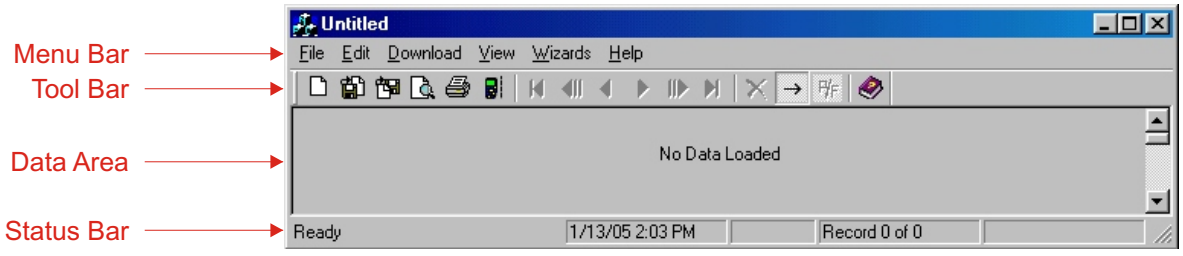
Use the following steps to install Extech Reporter onto a PC.

1) Insert the Extech CD-ROM into the PC. You may be prompted to choose your language.
2) Click the "Install Extech Reporter" button from the installation selection panel.
3) Click "Next" on the Setup Wizard greeting screen.
4) Choose the components to install, then click "Next" on the Choose Component screen.
5) Click "Next" on the Choose Install Location screen.
6) Click "Next" on the Choose Start Menu Folder screen.
7) Select the appropriate software option for your meter and click "Next" on the Choose Software Version screen to begin copying files to the hard drive.

Once the files have completed copying you will be prompted to reboot your PC to complete the installation.

Using Extech Reporter

Below is a screenshot of the opening screen. When Extech Reporter is opened, the data area will be empty, and the status bar will show a status of "Ready".



Downloading Data into Extech Reporter

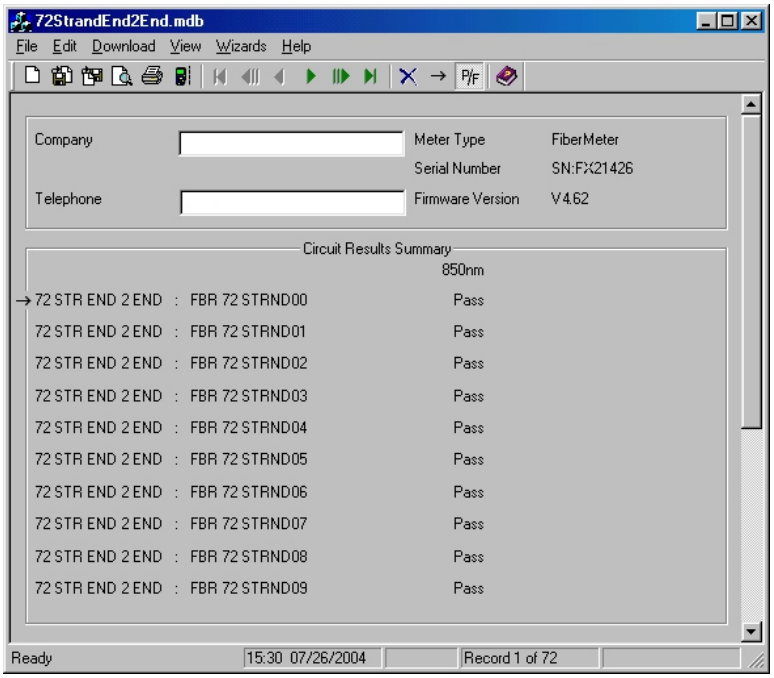
Once testing is complete, data should be downloaded to the PC for report printing and data storage. The following steps demonstrate how to download data from the FiberMeter.

1) Power on the FiberMeter meter, and select CERTIFICATION METER.
2) Connect the meter to the PC serial port via the supplied download cable.
3) Launch Extech Reporter.
4) Either click the Download menu option, or press the button from the Tool Bar.

All stored readings will be downloaded into Extech Reporter.

Viewing Extech Reporter Data - Summary View

Once data has been downloaded, they appear in the data area of Extech Reporter in an easy-to-read summary format, called Summary View.

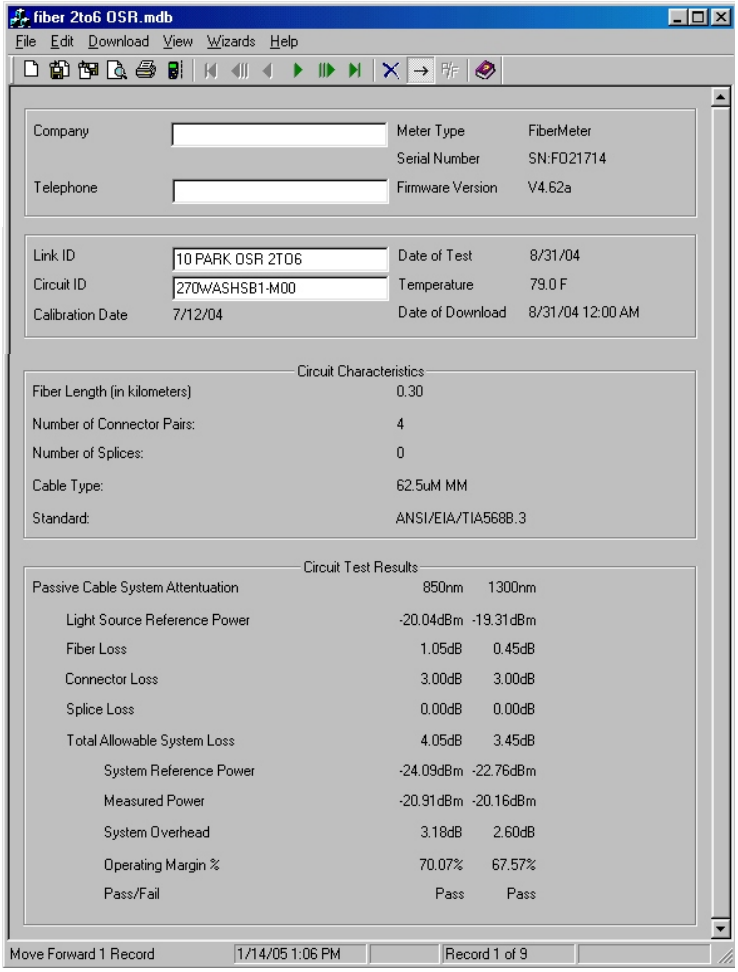


The top section contains information about the meter, including company name and telephone, meter type, serial number, and firmware version.

The bottom section (called Circuit Results Summary) shows a summary of data points. This information includes fiber link name, fiber name and number, and a PASS or FAIL rating. Different wavelengths will have separate columns.

Wavelength information can be toggled between PASS/FAIL and overhead in dB by using the tool bar button . Overhead will be either positive (PASS) or negative (FAIL).
Use the navigation buttons on the tool bar (the green arrows) to advance forward or backward in the data, either one at a time, 10 at a time, or to the beginning or end of the data. Data points may also be deleted by using either the delete button or the delete option under the Edit menu.

Viewing Extech Reporter Data - Detail View



Data can also be viewed in more detail for each fiber name and number. This view is called Detail View.

Use the → button to toggle between Summary View and Detail View.

The top section contains information about the meter, including company name and telephone, meter type, serial number, and firmware version.

The next section contains information such as Link ID, Circuit ID, date of meter calibration, date of test, temperature, and date of download. NOTE: if the Date of Test has an incorrect date, and you have not deleted the data, you can fix this by editing the link date in the Configure Link option from the FIBER LINK MENU.

The Circuit Characteristics section shows the information that was entered during the Link Wizard, and used to calculate the optical reference.

The Circuit Test Results section shows detailed information about the specific data point for each wavelength.

System Reference Power is the optical power level that determines if a link will pass or fail the certification test. All data points with the link are measured against this number. If the Measured Power is higher than the System Reference Power, the fiber passes. Likewise, if it is lower, it fails.

NOTE: fibers with marginal System Overhead values (0.5 dB or less) may indicate a fail rating and should be re-examined and re-tested. Clean all fiber connections and examine all connector endfaces for dirt or cracks. Replace patch cords or re-terminate fiber connectors, if necessary, then re-test the fiber link.

If the link continues to be marginal, further troubleshooting will be necessary.

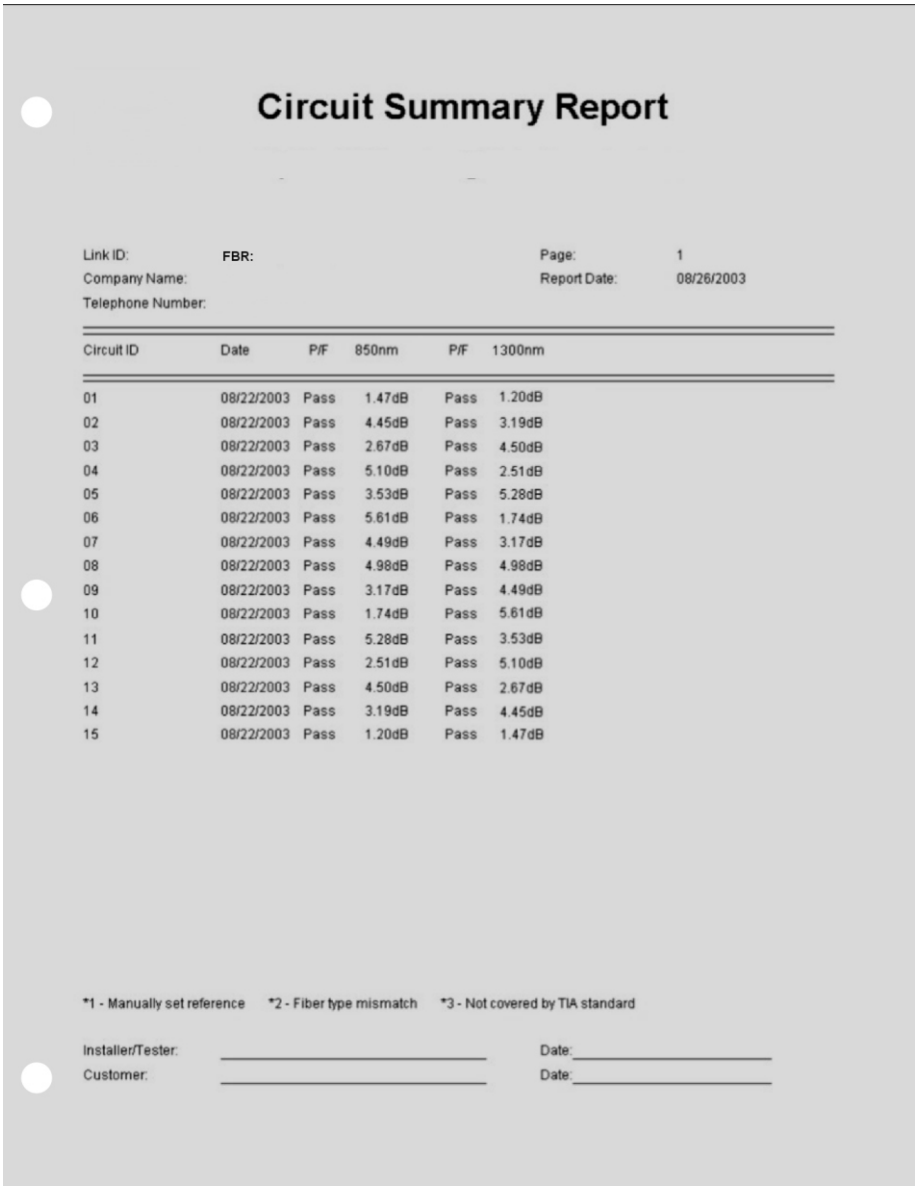
Printing Reports from Extech Reporter

Reports can be printed from Extech Reporter by using the print function, either from the File Menu or the Print button on the Tool Bar.

The current view will determine which report will be printed, (i.e. if data is being viewed in Summary View, a Circuit Summary report, like the one at right, will be printed).

Reports will look nearly the same as the views they were printed from.

Areas for signatures and dates are included at the bottom of the reports.



Circuit Summary Report

Link ID: FBR: Page: 1
Company Name: Report Date: 08/26/2003
Telephone Number:

Circuit ID	Date	P/F	850nm	P/F	1300nm
01	08/22/2003	Pass	1.47dB	Pass	1.20dB
02	08/22/2003	Pass	4.45dB	Pass	3.19dB
03	08/22/2003	Pass	2.67dB	Pass	4.50dB
04	08/22/2003	Pass	5.10dB	Pass	2.51dB
05	08/22/2003	Pass	3.53dB	Pass	5.28dB
06	08/22/2003	Pass	5.61dB	Pass	1.74dB
07	08/22/2003	Pass	4.49dB	Pass	3.17dB
08	08/22/2003	Pass	4.98dB	Pass	4.98dB
09	08/22/2003	Pass	3.17dB	Pass	4.49dB
10	08/22/2003	Pass	1.74dB	Pass	5.61dB
11	08/22/2003	Pass	5.28dB	Pass	3.53dB
12	08/22/2003	Pass	2.51dB	Pass	5.10dB
13	08/22/2003	Pass	4.50dB	Pass	2.67dB
14	08/22/2003	Pass	3.19dB	Pass	4.45dB
15	08/22/2003	Pass	1.20dB	Pass	1.47dB

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

Installer/Tester: _____ Date: _____
Customer: _____ Date: _____

NOTE: 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.

Saving and Retrieving Data in Extech Reporter

It is recommended to save Extech Reporter data to disk after downloading for backup and later retrieval. The save function can be activated from the File Menu or the Tool Bar.

Extech Reporter data files can be re-opened by using the File Menu or Tool Bar.

NOTE: if data downloaded from the FiberMeter needs to be separated into multiple files, it is recommended to save the original file as a master. This master file is then used to create individual files by deleting the unneeded data.

Help Menu

The Help Menu contains Extech Reporter software version information, as well as links to several operations manuals.

Interpreting Extech Reporter Screens and Reports

The following list of terms appear on the Extech 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

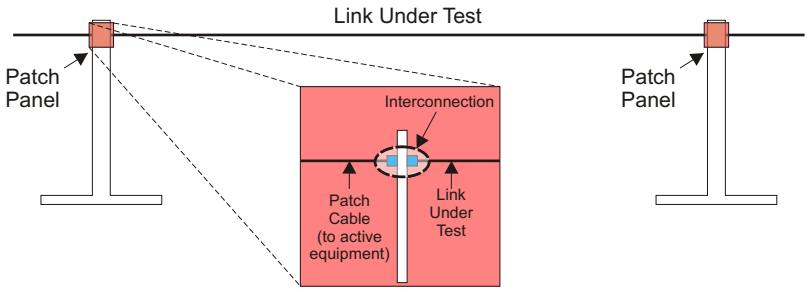
Descriptions for each of these terms are listed on the following pages.

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 the junction between two fiber connectors; e.g. a patch panel or fiber opticadapter. 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)

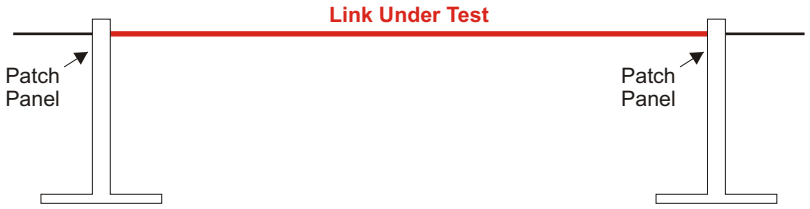


Fiber Loss

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

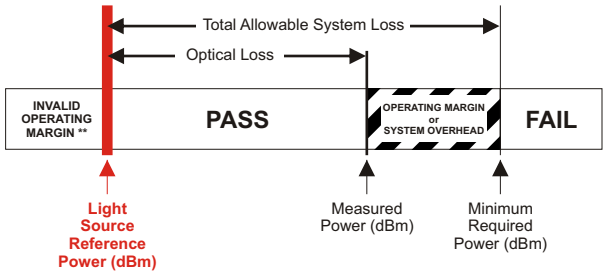
Definition: the amount of absolute optical power being received directly from the light source by the power meter during the setting of the optical reference. Light Source Reference Power is used as a reference, or starting point, on which a standards-based optical reference is set.

Units: dBm

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

NOTE: 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.

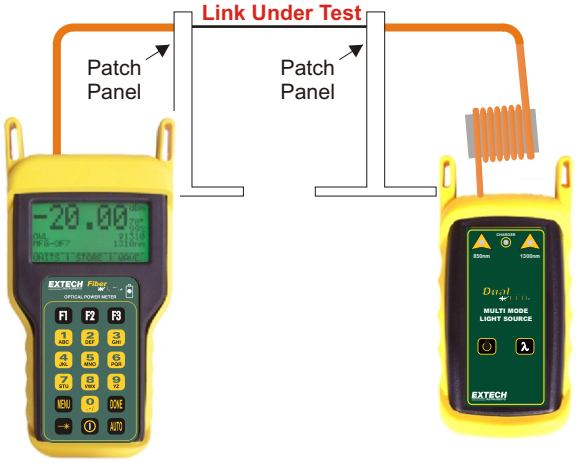


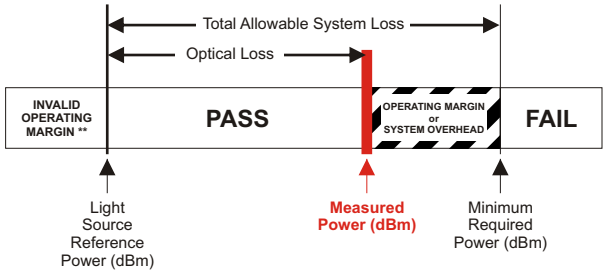
Measured Power

Definition: the amount of absolute optical power being received from the light source by the power meter after theyhave been connected to the link under test. Measured Power is compared to the System Reference Power forPass/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





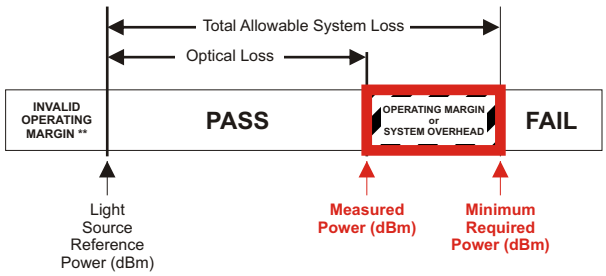
Operating Margin %

(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



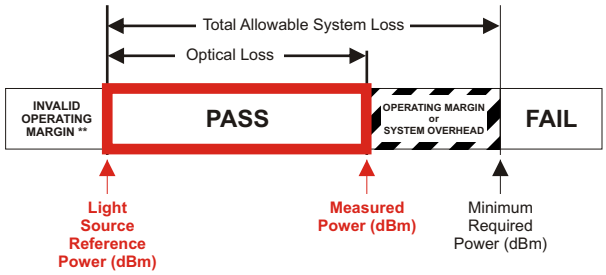
Interpreting Extech Reporter Screens and Reports, cont.

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)

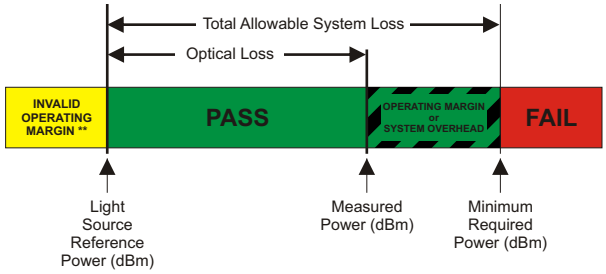


Pass/Fail

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

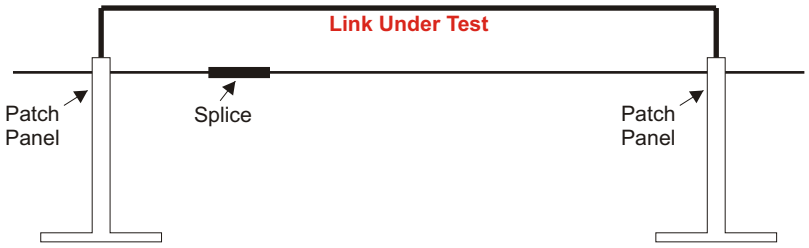
– MULTIMODE ONLY - do NOT allow the patch cord to unwrap from the mandrel

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)



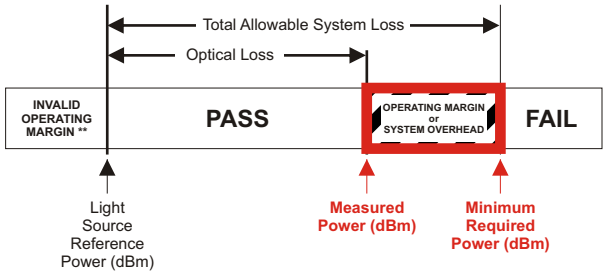
NOTE: some connectors use mechanical splice technology for fiber termination, such as the Unicam®-compatible. These connectors should be considered splices when calculating optical loss budgets.

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)



System Reference Power

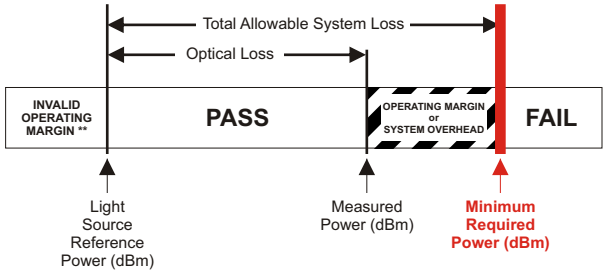
(shown as Minimum Required Power on Circuit Detail Reports)

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.

NOTE: 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)

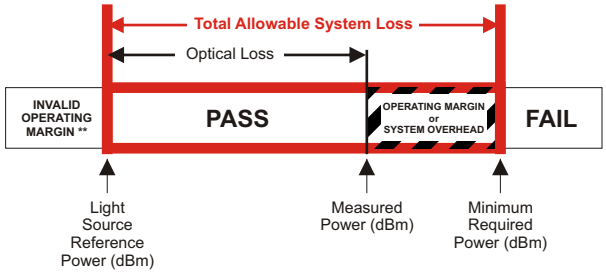


Total Allowable System Loss

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)



UNIT 5 Appendices

Glossary

Absorption. The loss of power in an optical fiber, resulting from conversion of optical power into heat and caused principally by impurities, such as transition metals and hydroxyl ions, and also by exposure to nuclear radiation.

Acceptance Angle. The half-angle of the cone within which incident light is totally internally reflected by the fiber core. It is equal to arcsin (NA).

Application Cabling Standard. A cabling standard that has been developed for a specific network protocol, such as Ethernet. These standards use pre-defined link budgets for optical loss measurements.

Attenuation. A general term indicating a decrease in power from one point to another. In optical fibers, it is measured in decibels per kilometer at a specified wavelength.

Bandwidth. The transmission capacity of a system.

Buffering. 1. A protective material extruded directly on the fiber coating to protect the fiber from the environment (tight buffering). 2. Extruding a tube around the coated fiber to allow isolation of the fiber from stresses on the cable (loose buffered)

Buffer Tubes. Loose-fitting covering over optical fibers used for protection and isolation.

Bundle. Many individual fibers contained within a single jacket or buffer tube. Also, a group of buffered fibers distinguished in some fashion from another group in the same cable core.

Cladding. The outer concentric layer that surrounds the fiber core and has a lower index of refraction.

Connector. A mechanical device used to provide a means for aligning, attaching, and achieving continuity between fibers.

Consolidation Point. A location for interconnection between horizontal cables that extend from building pathways and horizontal cables that extend into work area pathways.

Core. The central, light-carrying part of an optical fiber; it has an index of refraction higher than that of the surrounding cladding.

Cross-Connection. A connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end.

Decibel (dB). In fiber optics, a standard logarithmic unit for the ratio of the power that was received over the power that was originally sent.

dBm. Decibel referenced to a milliwatt.

dBμ. Decibel referenced to a microwatt.

Glossary, cont.

Detector. An optoelectronic transducer used in fiber optics for converting optical power to electric current. In fiber optics, usually a photodiode.

Diffraction. The bending of radio, sound, or light waves around an object, barrier, or aperture edge.
Dispersion. A general term for those phenomena that cause a broadening or spreading of light as it propagates through and optical fiber. the three types are modal, material, and waveguide.

Entrance Facility. An entrance to a building for both public and private network service cables including the entrance point at the building wall and continuing to the entrance room or space.

Equilibrium Mode Distribution (EMD). The steady modal state of a multimode fiber in which the relative power distribution among modes is independent of fiber length.

Equipment Room. A centralized space for telecommunications equipment that serves the occupants of the building. Equipment housed herein is considered distinct from a telecommunications closet because of its nature or complexity of the equipment.

Frequency. Of a periodic wave, the number of identical cycles per second. Usually expressed in Hertz.

Fresnel Reflection. The reflection that occurs at the planar junction of two materials having different refractive indices; Fresnel reflection is not a function of the angle of incidence.

Graded-index Fiber. An optical fiber whose core has a nonuniform index of refraction. The core is composed of concentric rings of glass whose refractive indices decrease from the center axis. The purpose is to reduce modal dispersion and thereby increase fiber bandwidth.

Generic Cabling Standard. A cabling standard that calculates link budgets based on the passive component configuration of the network, and is protocol-independent. Examples are TIA/EIA-568 and ISO 11801.

Horizontal Cross-Connect (HC). A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

Index of Refraction. The ration of the velocity of light in free space to the velocity of light in a given material.

Insertion Loss. The loss of power that results from inserting a component, such as a connector or splice, into a previously continuous path.

Interconnection. A connection scheme that provides for the direct connection of a cable to another cable or to an equipment cable without a patch cord or jumper.

Intermediate Cross-Connect (IC). A cross-connect between the main cross-connect and the horizontal cross-connect in backbone cabling.

Laser. Light Amplification by Stimulated Emission of Radiation. A light source producing, through stimulated emission, coherent, near monochromatic light. Lasers in fiber optics are usually solid-state semiconductor types.

Glossary, cont.

Light-Emitting Diode (LED). A semiconductor diode that spontaneously emits light from the PN junction when forward current is applied.

Main Cross-Connect (MC). The cross-connect in the main equipment room for connecting entrance cables, backbone cables, and equipment cables.
Material Dispersion. Dispersion resulting from the different velocities of each wavelength in an optical fiber.

Modal Dispersion. Dispersion resulting from the different transit lengths of different propagating modes in a multimode optical fiber.

Mode. A possible path followed by light rays.

Multimode Fiber. A type of optical fiber that supports more than one propagating mode.

Numeric Aperture (NA). The number that expresses the light-gathering ability of a fiber.

Optical Time Domain Reflectometry (OTDR). A method of evaluating optical fibers based on detecting backscattered (reflected) light. Used to measure fiber attenuation, evaluate splice and connector joints, and locate faults. Also, the equipment used to perform such measurements (Optical Time Domain Reflectometer).

Photodetector. An optoelectronic transducer, such as a PIN photodiode or avalanche photodiode.

Photodiode. A semiconductor diode that produces current in response to incident optical power and used as a detector in fiber optics.

Photon. A quantum of electromagnetic energy; a particle of light.

Receiver. An electronic device which converts optical signals to electrical signals.

Responsivity. The ratio of a photodetector's electrical output to its optical input in an optical fiber.

Singlemode Fiber. An optical fiber that supports only one mode of light propagation above the cutoff wavelength.

Source. The light emitter, either an LED or laser diode, in a fiber optic link.

Spectral Width. A measure of the extent of a spectrum. For a source, the width of wavelengths contained in the output at one half of the wavelength of peak power. Typical spectral widths are 20 to 60 nm for an LED and 2 to 5 nm for a laser diode.

Splice. An interconnection method for joining the ends of two optical fibers in a permanent or semi-permanent fashion.

Step-Index Fiber. An optical fiber, either multimode or single mode, in which the core refractive index is uniform throughout so that a sharp step in refractive index occurs at the core-to-cladding interface. It usually refers to a multimode fiber.

UNIT 5 Appendices

Glossary, cont.

Telecommunications Closet (TC). An enclosed space for housing telecommunications equipment, cable terminations, and cross-connects. The closet is the recognized cross-connect between the backbone cable and horizontal cabling.

Tight Buffer. A cable construction where each fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900 uM.

Transmitter. An electronic package which converts an electrical signal to an optical signal.

Wavelength. The distance between the same two points on adjacent waves; the time required for a wave to complete a single cycle.

Work Area. A building space where the occupants interact with telecommunications terminal equipment; i.e. PCs, telephones, and other office equipment.

FiberMeter Specifications

Detector Type	InGaAs
NIST-Traceable Wavelengths	850, 1300, 1310, 1550
	980, 1490, 1625
Measurement Range	+5 to -70 dBm (FO600; FO602)
	+25 to -50 dBm (FO610)
Accuracy	±0.15 dB
Resolution	0.01 dB
Battery Life	up to 100 hours (9V)
Connector Type	Universal w/2.5 and 1.25mm cap
Operating Temperature	-10 to 55 C
Storage Temperature	-30 to 70 C
Size	3.48”W x 6.48”H x 1.1”D
Weight	373g (12 oz.)
Data Storage Points	up to 1000
Download Data Points	Extech Reporter Software
Absolute/Relative Measurements	Yes
Battery Capacity Display	Yes
Backlight	Yes
NIST Traceable	Yes

UNIT 5 Appendices

Cleaning and Care Instructions

1 - Do NOT drop any piece of sensitive scientific equipment. Damage may occur to the case or electronic components on the circuit board may become dislodged, and inaccuracy may occur.

2 - Keep the meter in an enclosed case when not in use. This will help protect the meter from the elements and accidental droppage.

3 - Store the meter in a cool dry area when not in use in order to keep the meter in top working condition.

4 - We recommend not removing the universal connector as it is not necessary for cleaning. Its parts are very fragile, small, and easy to lose.

5 - Always remember to replace the rubber cap on the connector. This will keep out dust and dirt when the meter is not in use.

6 - Use only 99% or better Isopropyl alcohol when cleaning the detector. Any less than 99% contains too much water and will begin to corrode the components. 99% Isopropyl alcohol is very flammable, so additional care must be taken when cleaning the detector. 99% Isopropyl alcohol can be purchased at your local drug store.

7 - Whenever possible, use specially designed 2.5mm cleaning sticks to clean the detector. These do not require alcohol and do not damage the insides of the connector. Do not used sticks or swabs of any other type because they may damage the zirconium ferrule or the coating of the detector inside the connector, or may leave behind dust or fibers that will add loss to the fiber reading.

8 - The detector port should be cleaned at the beginning and end of each testing day to keep connector loss during testing at a minimum.

9 - When cleaning the meter itself, do not use any household cleaner that contains ammonia as this will damage any plastic it comes in contact with.

10 - The case is splash-proof, so it is not necessary to clean the inside of the meter.

11 - Only use lint-free cloths when cleaning the display. Anything else may scratch the plastic.

UNIT 5 Appendices

Warranty Information

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 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.

Calibration and Repair Services

Extech offers complete repair and calibration services for all of the products we sell. For periodic calibration, NIST certification on most products or repair of any Extech product, call customer service for details on services available. Extech recommends that calibration be performed on an annual basis to ensure calibration integrity.

UNIT 5 Appendices

Supported Cabling Standards

This version of FiberMeter firmware supports the following fiber optic network cabling standards, and also supports 2 user-definable 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

Reference Cable Setup

Your test jumpers must be cleaned and inspected prior to using them for fiber link testing. You should have one jumper for the power meter side of the test, and one jumper for each of the connector ports on your light source. Make sure that these patch cords match the fiber under test (i.e. same fiber type, same core/cladding size, same connector type).

Use the following steps to set up your reference jumpers for link testing:

1 - Connect the first jumper to the power meter and light source. Verify that it is working properly and not introducing significant loss to the test. Disconnect this patch cord from the light source and meter and set it aside.

2 - Connect the other patch cord(s) to the light source. If you have a dual wavelength light source with two connector ports, then it is recommended to connect one jumper to each port.

3 - MULTIMODE ONLY. If you are testing multimode fibers, you will need to wrap each of the jumpers connected to the light source around a mandrel seven times. This is done to achieve Equilibrium Mode Distribution (EMD), which eliminates unwanted optical energy that can cause inaccurate test results.

4 - Set the optical reference. See the appropriate unit for detailed instructions on setting each optical reference method.

NOTE: Do NOT remove the patch cords from the light source until you have completed testing all of the fibers in the link. Disconnecting the test jumper from the light source and re-connecting it will cause the optical reference to be incorrect, thereby producing incorrect readings, and may cause a link to fail.

Multimode Reference

Singlemode Reference

10 Gigabit Ethernet Standard

Support for the IEEE 802.3ae 10-Gigabit Ethernet standard has been added to the FiberMeter Link Wizard, which means that 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 as they are defined in the FiberMeter.

In order to choose the correct standard in the FiberMeter Link Wizard, 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	FiberMeter 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 Maximum 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
Maximum 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
Maximum 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.