E6000C Mini-OTDR User's Guide

Agilent Technologies

Notices

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The battery is a consumable part and is not subject to the E6000C warranty.

Edition/Print Date

All Editions and Updates of this manual and their creation dates are listed below.

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Previous versions .... April 2001, May 2001, November 2001

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office (see *"Service and Support" on page 12*).

ISO 9001 Certification

Produced to ISO 9001 international quality system standard as part of Agilent Technologies' objective of continually increasing customer satisfaction through improved process control.

Bellcore Certification of Excellence

Agilent Technologies is officially designated Bellcore Certification Eligible, and is awarded Bellcore's Certification of Excellence for its OTDR Data Format.

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

GENERAL

This product is a Safety Class 3 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

ENVIRONMENTAL CONDITIONS

This instrument (without AC Adapter) is intended for outdoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters. Refer to the specifications tables and *"Temperature and Humidity" on page 179* for the ac mains voltage requirements and ambient operating temperature range.

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage, the correct fuse is installed, and all safety precautions are taken. Note the instrument's external markings described under Symbols.

FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes.

DO NOT REMOVE THE INSTRUMENT COVER

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

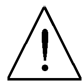
WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

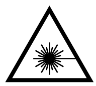
CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Symbols



Caution, refer to accompanying documents



Hazardous laser radiation

Electromagnetic interference (EMI)

Initial Laser Safety Information

	E6001A	E6003A	E6003B
Laser Type	FP-Laser InGaAsP	FP-Laser InGaAsP	FP-Laser InGaAsP
Laser Class			
According to IEC 825 (Europe)	3A	3A	3A
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	1	1
Output Power (Pulse Max)	50 mW	50 mW	50 mW
Pulse Duration (Max)	10 μs	10 μs	20 μs
Pulse Energy (Max)	500 nWs	500 nWs	500 nWs
Output Power (CW)	500 μW	500 μW	500 μW
Beam Waist Diameter	9 μm	9 μm	9 μm
Numerical Aperture	0.1	0.1	0.1
Wavelength	1310 ±25nm	1310/1550 ±25nm	1310/1550 ±25nm

	E6004A	E6007A	E6008B	
			1310 nm	1550 nm
Laser Type	FP-Laser InGaAsP	MQW-Laser AlGaInP	FP-Laser InGaAsP	FP-Laser InGaAsP
Laser Class				
According to IEC 825 (Europe)	3A	2	3A	3A
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	2	1	1
Output Power (Pulse Max)	50 mW	n/a	120 mW	200 mW
Pulse Duration (Max)	10 µs	n/a	20 µs	20 µs
Pulse Energy (Max)	500 nWs	n/a	2.4 µWs	4.0 µWs
Output Power (CW)	500 µW	500 µW	500 µW	500 µW
Beam Waist Diameter	9 µm	9 µm	9 µm	9 µm
Numerical Aperture	0.1	0.1	0.1	0.1
Wavelength	1310/ 1550 ±25nm	635 ±10nm	1310 ±25nm	1550 ±25nm

	E6012A	
	1550 nm	1625 nm
Laser Type	FP-Laser InGaAsP	FP-Laser InGaAsP
Laser Class		
According to IEC 825 (Europe)	3A	3A
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	1
Output Power (Pulse Max)	200 mW	200 mW
Pulse Duration (Max)	20 µs	20 µs
Pulse Energy (Max)	4.0 µWs	4.0 µWs
Output Power (CW)	500 µW	500 µW
Beam Waist Diameter	9 µm	9 µm
Numerical Aperture	0.1	0.1
Wavelength	1550 ±25nm	1625 ±20nm

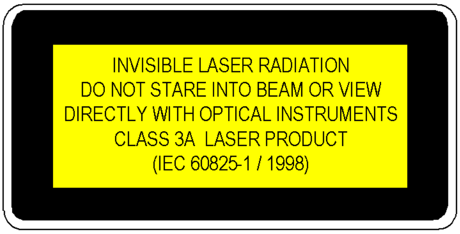
	E6005A / E6009A	
	1300 nm	**850 nm**
Laser Type	FP-Laser In-GaAsP	MOCVD GaAlAs
Laser Class		
According to IEC 825 (Europe)	3A	3A
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	1
Output Power (Pulse Max) typ ≤ 30 ns	20 mW	40 mW
Output Power (Pulse Max) typ > 30 ns	10 mW	20 mW
Pulse Duration (Max)	10 µs	100 ns
Pulse Energy (Max)	200 nWs	4 nWs
Output Power (CW)	50 µW	20 µW
Beam Waist Diameter	50 µm	62.5 µm
Numerical Aperture	0.2	0.27
Wavelength	1300 ±25nm	850 ±25nm

Safety Labels

The following laser safety warning labels are fixed on the panel of the Mini-OTDR modules (that is, all modules except the E6006A and E6007A submodules):

USA

Non-USA



The following symbol is fixed to the panel of the Mini-OTDR modules, next to the laser output:

A sheet of laser safety warnings is included with the laser module. You *must* stick the labels in the local language onto the outside of the instrument, in a position where they are clearly visible to anyone using the instrument.

The following laser safety labels should be fixed to the E6007A submodule:

Submodule E6007A

The laser safety labels for the USA, according to 21 CFR 1040.10 Class II, are already attached to the module.

A sheet of laser safety warnings is included with the laser module. You *must* stick the labels in the local language onto the outside of the instrument, in a position where they are clearly visible to anyone using the instrument.

All modules also have a CE class A label.

The recommended position for the laser safety warning label is at the rear side of the instrument near the optical output.

You **must** return instruments with malfunctioning laser modules to an Agilent Technologies Service Center for repair and calibration, or have the repair and calibration performed on-site by Agilent Technologies personnel.

About This Manual

The Structure of this Manual

This manual is divided into 4 parts:

- *"Getting Started" on page 31* tells you how to set up your Mini-OTDR.
- *"Additional Features" on page 67* shows you what you can do with your Mini-OTDR.
- The Sample Sessions (starting *"Sample Sessions: Measuring a Trace" on page 81*) give you a step-by-step guide to making typical measurements and using other Mini-OTDR features.
- The appendices contain additional information not required for routine day-to-day use.

Conventions used in this manual

- **Mini-OTDR keys** are indicated by small capitals, for example RUN/STOP, SELECT.
- **Menus** are indicated by small capitals enclosed by square brackets, for example [SETTINGS], [FILE].
- **Menu items** are indicated by small capitals enclosed by angled brackets, for example [FILE]<OPEN>, <SET OFFSET>.
- **Modes** are indicated by italics, for example *OTDR mode*, *Fiber Break Locator*.
- **Dialog** is indicated by Courier font, for example `OK`.

Related Publications

- For more information, please consult the following publications

- E4310-91016 Agilent Technologies OTDRs Programming Guide
- E6000-91017 Agilent OTDRs Pocket Guide
- 5963-3538F Cleaning Procedures for Lightwave Test and Measurement Equipment: Pocket Guide

Service and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center. You can find a list of local service representatives on the Web at: http://www.agilent.com/find/assist

If you do not have access to the Internet, one of these centers can direct you to your nearest representative:

United States	1 800 452 4844
Canada	1 877 894 4414 (905) 206 4120 (FAX)
Europe	(31 20) 547 2323 (31 20) 547 2390 (FAX)
Japan	(81) 426 56 7832 (81) 426 56 7840 (FAX)
Latin America	(305) 269 7500 (305) 269 7599 (FAX)
Australia	1 800 629 485 (613) 9272 0749 (FAX)

New Zealand	0800 738 378 64 4 495 8950 (FAX)
Asia-Pacific	(852) 3197 7777 (852) 2506 9284 (FAX)

1

Getting Started

Getting Started introduces the features of the Agilent Technologies E6000C Mini-OTDR (Optical Time Domain Reflectometer). Here you will find a quick description of the instrument, an explanation of how to insert a module and Connector Interface, and a description of the main Mini-OTDR screens.

This manual is also valid for the Agilent E6000B Mini-OTDR. Some new features, not available with the E6000B are also described.

Features of the Mini-OTDR

The Front panel

Figure 1 shows the front panel of the Mini-OTDR. The front panel contains the screen, the hardkeys discussed below, and three lights:

Laser On

- The red Laser-On LED behind the blue Run/Stop key is lit whenever the laser is active.

Battery Charging

- The red battery charging light is lit when the battery is charging.

Power On

- The green power on light is lit when the power is on.

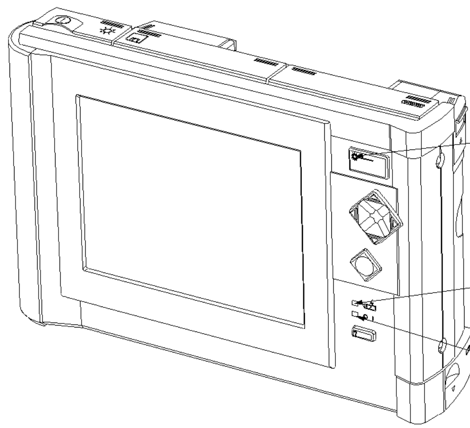


Figure 1 The Front Panel

The hardkeys

There are four keys on the front of the Mini-OTDR.

Run/Stop

- The blue RUN/STOP key starts or stops a trace acquisition.

Cursor

- The CURSOR keys enable you to navigate around the menu system, or to move markers and so on. The four corners of this key are also referred to in this manual as the UP key, DOWN key, LEFT key and RIGHT key.

Select

- The SELECT key enables you to select the currently highlighted object, or to activate the popup panel.

Help

- The HELP key, marked ?, gives you information about the currently highlighted object. If no object is highlighted, you see more general help information.

The RUN/STOP and HELP keys do not change their meaning wherever you are in the menu system.

The CURSOR keys and the SELECT key can be used for more specific purposes. The current interpretation of these keys is shown in the diagram at the right of the screen

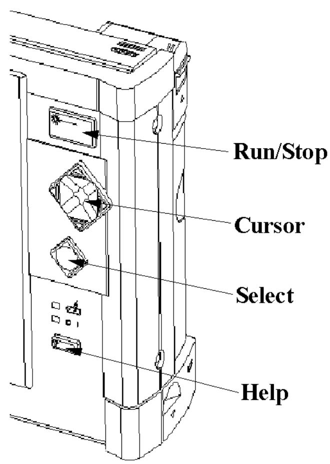
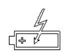
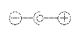


Figure 2 Mini-OTDR hardkeys

External Markings

You see the following external markings on the Mini-OTDR:

Table 1 Mini-OTDR: External Markings

Marking	Explanation	More Info
	Battery charging light	*"The Front panel" on page 31*
	Power on light	
On/Off	Power on switch	*"Switches" on page 71*
	DC Input Connector	
	Contrast Switch	
	Backlight ON/OFF	
Serial	Serial Interface	*"Serial Interfaces" on page 181*
Parallel	Parallel Interface	*"Parallel Interface" on page 180*
	DC label	
	CE label	

The Mini-OTDR module

Figure 3 shows a Mini-OTDR with a module inserted in the back.

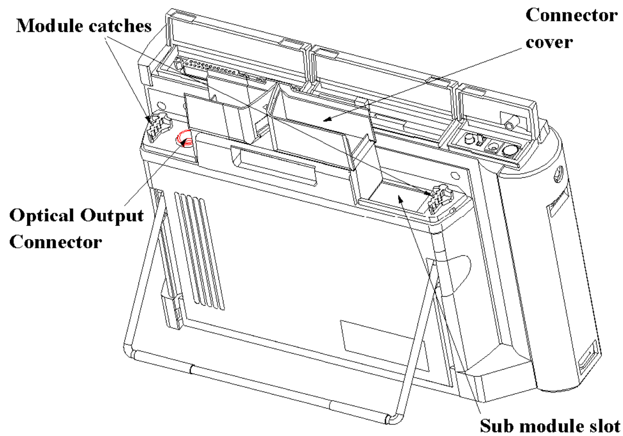


Figure 3 The Mini-OTDR module

Module catches

- You keep the module in place with the module catches. When the module is in place, the catches should be perpendicular to the screen.

Connect fiber

- You connect fibers to the Optical Output Connector. For more details, see “Adding a Connector Interface” on page 38.

Submodule

- You add submodules to the submodule slot. Submodules currently available are the Power Meter (Agilent E6006A) and the Visual Fault Finder (Agilent E6007A). See “Inserting and Removing a Submodule” on page 74.

Removing a Module

NOTE You should switch off your Mini-OTDR before inserting or removing a module or submodule.

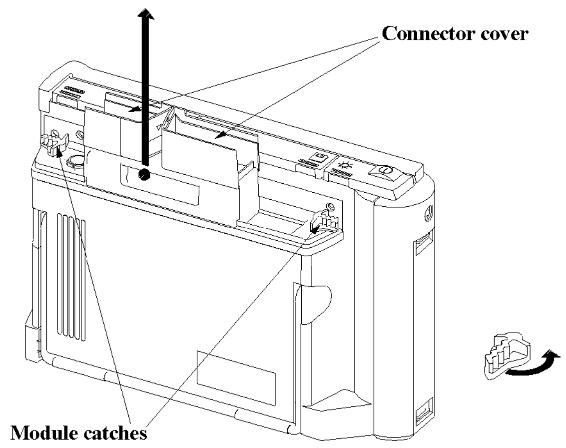


Figure 4 Removing a module

Module slot The slot in the back of the Mini-OTDR is used for the various Mini-OTDR measurement modules. When you are inserting or removing a module, open the connector covers at the top of the module.

1 Open the connector covers

   You can now see the Optical Output Connector where fibers are attached and the module catches either side of the module.

Rotate module catches

2 Rotate the module catches, so that they run parallel to the screen, as shown in Figure 4.

Remove module

3 Pull the module out of the module slot.

When the module has been fully removed, turn the catches 90 degrees so that they are perpendicular to the screen.

Inserting a Module

NOTE You should switch off your Mini-OTDR before inserting or removing a module or submodule.

Module slot

The slot in the back of the Mini-OTDR is used for the various Mini-OTDR measurement modules. When you are inserting or removing a module, open the connector covers at the top of the module.

1 Open the connector covers

   You can now see the Optical Output Connector where fibers are attached and the module catches either side of the module.

2 Make sure that the module catches run perpendicular to the screen.

3 Lower the module into the module slot until you hear a click.

4 Push the module further in, until you hear a second click.

NOTE You should make sure that your module is fully inserted into the module slot. If the module is not fully inserted, this may affect the quality of your traces.

Adding a Connector Interface

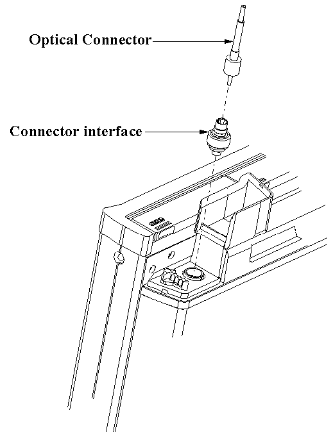


Figure 5 Adding a Connector Interface

Before you add the connector interface, you must have inserted a module to your Mini-OTDR.

On the left of the module when viewed from behind, you see an Optical Output Connector (see Figure 5).

NOTE Before you attach a connector and fiber, you should clean them both.

See “How to clean connectors” on page 284 and “How to clean bare fiber adapters” on page 288.

Insert the Connector Interface into the Optical Output Connector. You can now attach a fiber to the Connector Interface.

Switching on the Mini-OTDR

Self test When you switch on the Mini-OTDR it goes through self test.

If the Mini-OTDR indicates a problem with the module, switch off the instrument, make sure the module is properly inserted and snapped into the Mini-OTDR, and try switching the instrument on again.

Check power supply If you have no reaction, check that the machine is connected to a power source (AC/DC adapter or battery). See “Battery Handling” on page 75.

The Applications Screen

The Applications Screen is the controlling screen that allows you to choose the best application for what you want to do.

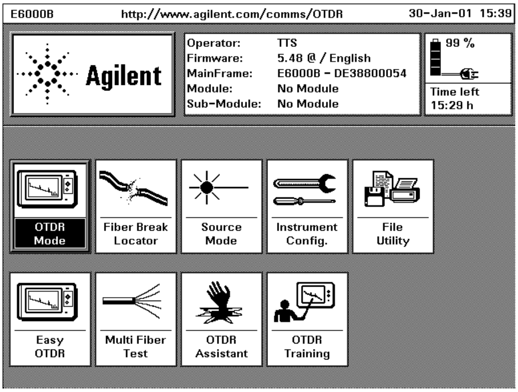


Figure 6 The Applications Screen

Application Modes

There are 9 different applications for different tasks and user groups:

- *OTDR Mode* contains all the features for making, viewing, and analyzing traces. OTDR mode gives you the full functionality of a "classical" OTDR. See "OTDR Mode" on page 41.
- *Fiber Break Locator* is a simplified trace setting that enables you to locate fiber breaks quickly.
- *Source Mode* enables the stabilized laser source for loss measurements and identification with fixed modulation frequencies.

  If a submodule is installed, this icon is labeled *Power Meter* or *Visual Light*.
- *Instrument Config* enables you to set up the configuration for general features concerning the Mini-OTDR.
- *File Utility* enables you to look at the internal directory structure of the Mini-OTDR or an added device, and to copy, delete, or print files. See "The File Utilities screen" on page 59.

- *Easy OTDR* enables you to view a trace, and to perform simple operations like Print and apply presaved settings. See “EasyMode” on page 62.
- *Multi Fiber Test* allows you to define up to 4 measurements, and apply all measurements to multiple fibers (for example, all fibers in a cable). See “How to set up a Multi Fiber Test” on page 152
- *OTDR Assistant* runs the OTDR Assistant, which walks you through a typical OTDR measurement, and gives you some hints about which parameters you need to adjust.
- *OTDR Training* runs the OTDR Training package, which gives you some background information about OTDRs.

NOTE You can change the `Boot Into` mode in *Instrument Config*. This changes the mode that appears when you power on.

Use the Cursor keys to move to the application you want, and then press SELECT.

OTDR Mode

Select *OTDR Mode* from the Applications Screen (or switch on after configuring `Boot Into` OTDR Mode, see note above).

Trace screen The first time you select *OTDR Mode* you see a blank trace window.

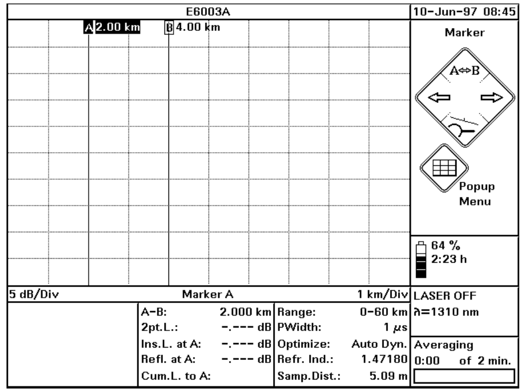


Figure 7 Blank Trace Screen

Taking a Measurement

NOTE Before you take a measurement you should attach a fiber to the Connector Interface. See “Adding a Connector Interface” on page 38.

To produce a trace, press the RUN/STOP hardkey.

Run/Stop light The light behind the RUN/STOP hardkey goes on. After a short initializing phase, the OTDR displays the first result

Stop measurement. Wait until the trace is free of noise, then press the RUN/STOP hardkey to stop the measurement

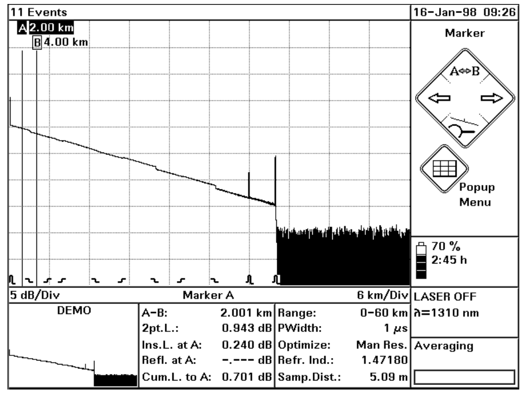


Figure 8 The Trace Screen

Trace

- When you have taken a measurement, the graph of the reflected power is displayed as a function of distance. This graph is called the trace.

Event Bar

- Below the trace, the event bar shows you the position of the detected events: non-reflective events such as splices, reflective events such as connectors, as well as any defined landmarks.

  You can add and remove the event bar by selecting [View]<EVENT BAR> from the popup panel.

Markers

- The markers are your means of marking and analyzing single events, parts of the trace, and distances. In the marker-information window, you see information such as the distance, attenuation, and loss at or between the markers.

Trace Overview

- No matter when you zoom to a point of interest on the trace, you do not lose orientation, as there is an overview display in the full-trace window. You always know where you are. The full-trace window is shown in the bottom left-hand corner of the display.

  In the title bar you can see the name of the measurement file (`UNNAMED` if you have not already saved the measurement).

Parameter window

- The most important measurement parameters of the displayed trace (such as measurement range, pulsewidth, wavelength) are always shown in the parameter window. See “The parameter windows” below.

NOTE

If the parameters are changed for the next measurement, the parameters of the actual trace are still displayed, but they are grayed to indicate that they will change on the next measurement.

Current Mode

- On the right-hand side of the screen you can see the Current mode (`Marker`) and the current interpretation of the CURSOR and SELECT keys. See “The Cursor and Select keys” on page 46.

The parameter windows

You see the following information in the parameter windows at the foot of the trace window.

A–B:	999.48 m	Range:	0–6 km
2pt.L.:	0.259 dB	PWidth:	30 ns
Ins.L. at A:	–.––– dB	Optimize:	Man Std.
Refl. at A:	–.––– dB	Refr. Ind.:	1.47110
Cum.L. to A:	–.––– dB	Samp.Dist.:	56.50 cm

Figure 9 The parameter windows

Relative to both markers

The following parameters are measured between marker A and marker B. The recorded values change when you move either marker.

- `A-B`: the distance between the markers
- One of the following (selectable in the [ANALYSIS] menu):
  - `2pt.L`: 2-point loss between the markers. This is the difference in power level between the marker points
  - `2pt.Attn.`: 2-point attenuation. This is the 2-point loss per length unit.
  - `LSA-Attn.`: LSA Attenuation. This is the least square approximation for the fiber loss per length unit between the markers.
  - `ORL`: Optical Return Loss. This represents the fraction of power reflected back to your Mini-OTDR.

Relative to current marker

The following parameters show values at the current marker. The recorded values change when you move or change the current marker.

- `Ins.L. at A/B`: the insertion loss of the event close to the marker.
- `Refl. at A/B`: the return loss (in dB) of the event close to the marker.
- `Cum.L. to A/B`: the cumulative loss between the initial backscatter value interpolated to the start of the fiber, and the marker point.

General parameters

The following parameters are independent of the marker position.

- `Range`: the start position and the measurement span, selectable from the [SETTINGS] menu. The available Ranges are module-dependent.

- `PWidth`: The pulsewidth in seconds (ns or µs), selectable from the [SETTINGS] menu. The available pulse widths are module-dependent.
- `Optimize`: The Optimizing mode. This is the range for measurements, and is selectable from the [SETTINGS] menu.
  Possible Optimizing modes are
  - *Resolution*: for short fibers,
  - *Dynamic*: for long fibers, and
  - *Standard*: for a compromise between Resolution and Dynamic.

  If you have specified Automatic measurements, you see *Auto Res.*, *Auto Dyn.*, or *Auto Std.* For more information see “The Settings screen” on page 50
- `Refr.Ind.`: the Refractive Index, selectable from the [SETTINGS] menu. The Refractive Index is between 1.0 and 2.0.
- `Sample Dist.`: the distance in the specified units (such as meters) between adjacent samples. This is a function of the Refractive Index, the number of data points, and the Range of the measurement.

The Cursor and Select keys

In *OTDR Mode*, the CURSOR and SELECT keys have the following effect when selecting markers:

Cursor Up

- The UP key toggles the highlighted marker between A, B and AB (both markers highlighted). AB is only available if you have selected <AB MARKER> from the [VIEW] menu.

Cursor Left/Right

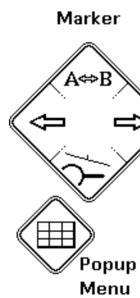
- The LEFT and RIGHT keys move the highlighted marker.

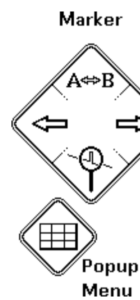
Cursor Down

- The DOWN key zooms in around the current marker, which stays in the center of the grid. If both markers are highlighted, zooming is performed around the mid-point of the markers.

  Pressing the DOWN key for a second time restores the full trace.

  The Cursor key diagram to the right of the trace shows the current mode. If you see a horizontal magnifying glass, you are viewing the whole trace. If you see a vertical magnifying glass, you are viewing around the current marker.





NOTE You can also see what is being viewed by looking at the text beneath the trace.

In Full Trace mode, it says `Marker A` (or `Marker B`). In Around Marker mode, it says `Around A` (or `Around B`).

Popup panel

- The SELECT key opens a popup panel, offering 9 menu options further functions. You can move to a menu option with the CURSOR keys, and select it by pressing SELECT again. See “The popup panel” on page 48 for more details

The popup panel

If you press the SELECT key in *OTDR mode*. you normally see a popup panel, offering fast access to various menus and important functions.

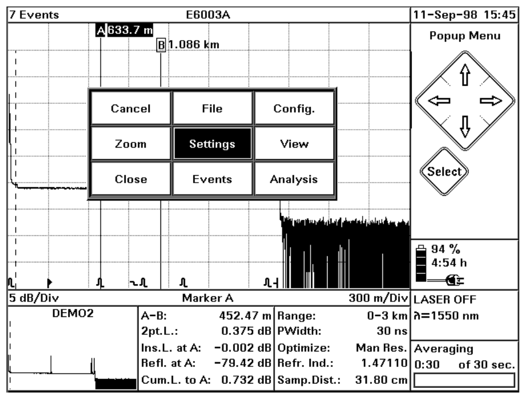


Figure 10 The popup panel

The following functions are available in OTDR mode:

- [CANCEL] - exit the popup panel and return to normal *OTDR mode*.
- [FILE] menu - File utilities, including loading and storage of data and printing a trace.
- [CONFIG] menu - configure the Mini-OTDR.
- [ZOOM] - use the Cursor keys to zoom in and out of the current trace. See “Zooming” on page 49.
- [SETTINGS] menu - change measurement and analysis parameters. See “The Settings screen” on page 50.
- [VIEW] menu - change the appearance of the trace.
- [CLOSE] - return to Applications Screen
- [EVENTS] menu - add or delete events and landmarks.

- [ANALYSIS] menu - analyze the trace.

Use the cursor keys to move to the function you require, and press SELECT again to select it.

NOTE If you do not select any option, the popup panel disappears after approximately 10 seconds.

When you select [FILE], [CONFIG], [VIEW], [EVENTS], or [ANALYSIS], you see a list of menu options. Use the UP and DOWN cursors to move to the option you want, and press SELECT or RIGHT.

Close Menu To return to the main trace screen, select the <CLOSE .. MENU> option at the top of the menu.

For more information, press the HELP key on the Mini-OTDR.

Zooming

Select [ZOOM] from the popup panel to zoom in and out of the current trace. Use the RIGHT and UP keys to zoom in, and the LEFT and DOWN keys to zoom out.

You can see a diagram of the full trace showing the segment shown in the main picture in the bottom left corner of the screen.

NOTE You can zoom around the current marker by selecting *Around Marker* mode before selecting [ZOOM]. You enter *Around marker* mode by pressing the DOWN key. Press the DOWN key again to restore the full trace.

If you are not in *Around Marker* mode, the trace is zoomed from the beginning of the fiber.

Press the SELECT key to return to the main OTDR screen.

The Settings screen

Select SETTINGS from the popup panel. You see one of the two pages of the Settings screen: `Measurement Settings` or `Pass/Fail Parameters`.

Change Settings screen

You switch between the Settings pages by selecting one of the arrows at the bottom left of the Settings screen (Figure 11).

Figure 11 Settings page navigation arrows

Change parameters

To change a parameter in the settings screen, move to the appropriate box and press SELECT. You can then change the appropriate parameter.

For details on how to change variables, see “How to Set the General Parameters” on page 130.

Store and Recall settings

If you want to save the current settings in a file, select `Store...` to see the Store menu. Select <SAVE AS..> and specify a filename with the extension `.SET`. To recall the saved settings, select <LOAD..> from the `Recall...` menu.

You can also use `Store...` to store default settings for the current Wavelength.

Default for current Wavelength

You recall the default for the current wavelength by selecting `Default`. You recall the default for other wavelength from the appropriate entry in the `Recall...` menu.

You can also recall the saved settings in EasyMode.

NOTE Changes made to the settings screen only affect subsequent measurement acquisitions. However, you can apply the changes that you have made to a trace that is currently running by pressing RUN/STOP again.

The Measurement Settings screen

The Measurement Settings page contains a list of parameters that you can set (Figure 12).

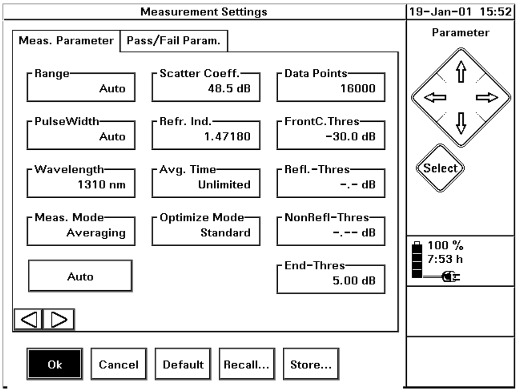


Figure 12 The Measurement Parameters Settings page

You can change the following parameters:

Range

- `Range`: the start position and the measurement span. If the Range displays `Auto`, the OTDR selects a suitable measurement range for your fiber.

  You can choose from one of the predefined ranges, or select `Range Input..` and input a range of your choice.

Pulse Width

- `PulseWidth`: the length of the pulses launched by the OTDR into the fiber. Short pulses improve resolution, but longer pulses are required for higher dynamic on long fibers.

Wavelength

- `Wavelength`: laser wavelength. This is only meaningful if you have a dual-wavelength OTDR module. The available wavelengths depend on how your module has been configured.

Measurement Mode

- `Meas. Mode`: The Measurement Mode: `Realtime` to update the settings while making a measurement, `Averaging` to reduce noise level (normal OTDR measurement mode), or `Continue` to continue averaging a measurement that you have stopped.

Automatic setting

- `Auto`: Automatic setting. This calculates appropriate values for Pulsewidth and Range.

  Use Automatic settings if you do not know the length of your fiber. You can then find the length of the fiber, change the settings and repeat the measurement.

  When you select `Auto`, the Range and PulseWidth are set to `Auto`, and suitable values are chosen by the Mini-OTDR.

Scatter Coefficient

- `Scatter.Coeff.`: the scatter coefficient, or how much light will be scattered back in this fiber. This affects the value of return loss and reflectance measurements.

Refractive Index

- `Refr. Ind.`: the Refractive index, which describes the relationship between the speed of light in a vacuum and within a given medium. The Refractive Index influences the distance scale of the OTDR.

  The Refractive Index can be set to any value between 1.0 and 2.0.

Averaging Time

- `Avg. Time`: Averaging time of a measurement. The measurement is stopped automatically when this time has elapsed. Larger Averaging Times increase the dynamic range by reducing the noise floor of the OTDR. The specified dynamic range is reached after 3 minutes.

NOTE This parameter can also be configured to be `Number of Averages`: a specified number of measurement acquisitions. Number of Averages is a power of 2.

You specify the parameter used for Averaging in the `OTDR Settings` page of the `Instrument Configuration` pages (see “How to Set the OTDR Settings” on page 134).

Optimize Mode

- `Optimize Mode: Resolution` for short fibers, `Dynamic` for long fibers, or `Standard` as a compromise between Resolution and Dynamic.

Maximum Data Points

- `DataPoints`: the maximum number of data points. A high value improves the resolution of the trace, but may limit the number of traces that you can store in the internal flash disk.

Front Connector Threshold

- `FrontC. Thres`: the Front Connector Threshold. This is a threshold for reflectance of the Front Connector.

  If reflectance is above this threshold, you receive a warning message, saying `Front Connector check failed`. If you see this message, you should clean your Connector.

NOTE If you have chosen Reflection Height (see note below and “How to Set the OTDR Settings” on page 134), the Front Connector Threshold is not adjustable.

- `Refl. Thres`: the Reflectance Threshold. Events with a Reflectance above this threshold are displayed in the Event Bar and Event Table.

NOTE The way in which the Reflectance and Front Connector Thresholds are calculated depends on how you have configured the Reflectance Parameter in the Instrument Config OTDR Settings screen (see “How to Set the OTDR Settings” on page 134).

A Reflection Height Threshold value of 0.0 dB, or a Front Connector Threshold value of -.- dB means that the Threshold is not checked.

Non-Reflectance Threshold

- `NonRefl Thres`: the Non-Reflectance Threshold. Events with an Insertion Loss above this threshold are displayed in the Event Bar and Event Table.

End Threshold

- `End Thres`: End Threshold. The first Event with an insertion loss greater than or equal to this value is declared as type End, and all subsequent Events are ignored. See “How to Set the Fiber End” on page 98.

The Pass/Fail Parameters Settings page

The Pass/Fail Parameters page allows you to set the limits checked by the Pass/Fail test (see “How to Use the Pass/Fail test” on page 92).

If any of these limits are exceeded, a fault is detected and reported in the Pass/Fail test table.

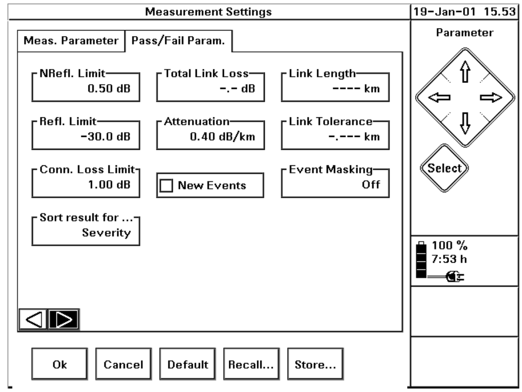


Figure 13 The Pass/Fail Parameters Settings page

You can change the following parameters from this page:

Non-Reflectance Limit

- `NRefl. Limit`: Non-Reflectance Limit. All Events with an Insertion Loss greater than this limit are reported in the Pass/Fail test Table.

  Gainers are never entered in the Pass/Fail test table. This is because it is not possible to accurately measure the true Insertion loss of a gainer without taking a two-way Averaging Measurement.

  The Non-Reflective limit can be anything up to 5 dB. Enter a value of 0 dB to deactivate this test. If the limit is not active, you see a value of `-.-- dB` in the `NRefl. Limit` edit field.

Reflectance Limit

- `Refl. Limit`: Reflectance Limit. All Events with a Reflectance greater than this limit, are reported in the Pass/Fail test Table.

  So, if the Reflective limit is -30dB, all Events with a Reflectance greater than -30dB (that is, between -30dB and 0dB) are reported in the Pass/Fail test Table.

  The Reflective limit can be anything up to -65dB. Enter a value of 0 dB to deactivate this test. If the limit is not active, you see a value of `-.- dB` in the `Refl. Limit` edit field.

Connector Loss Limit

- `Conn. Loss Limit`: Insertion Loss for the Connector.

  A Pass/Fail test checks whether any Reflective Events have an Insertion Loss greater than this limit.

  For all Events which exceed the limit, you see an entry in the Pass/Fail Test table.

  So, if the Connector Loss limit is 0.8dB, all Events with an Insertion Loss greater than 0.8dB are entered in the Pass/Fail Test table.

  The Connector Loss limit can be anything up to 5dB. Enter a value of 0 dB to deactivate this test. If the limit is not active, you see a value of `-.-- dB` in the `Conn. Loss Limit` edit field.

Sort result

- `Sort result for...`: order in which entries appear in the Pass/Fail Test.

  If you sort results for *severity*, the Event which exceeds its limit the most is listed first. Other Events follow in order of severity.

  The different parameters (NRefl. Limit, Total Link Loss, and so on) are weighted, and the Mini-OTDR software works out which was the most severe error.

  If you sort results for *location*, Events are listed according to how near they are to the start of the fiber.

  Sorting the results of the Pass/Fail Test table has no effect on the Event Table.

Total Link Loss

- `Total Link Loss`: Loss over whole fiber. This is calculated as the loss between the Horizontal Offset (see “How to Set the Horizontal Offset” on page 96) and the Fiber End.

  An End Event must be present before this test can be performed. See “How to Set the Fiber End” on page 98.

  If the Loss between the Horizontal Offset and the Fiber End is greater than this limit, this is reported in the Pass/Fail test table.

  The Total Link Loss limit can be anything up to 50dB. Enter a value of 0 dB to deactivate this test. If the limit is not active, you see a value of `-.- dB` in the `Total Link Loss` edit field.

Attenuation Limit

- `Attenuation`: Attenuation Limit. If the LSA attenuation between any 2 Events is greater than this limit, the first Event is reported in the Pass/Fail test table.

  The Attenuation limit can be anything up to 5.000dB/km. Enter a value of 0 dB/km to deactivate this test. If the limit is not active, you see a value of `-.-- dB/km` in the `Attenuation` edit field.

New Events

- `New Events`: Check for new events.

  If you select New Events, the Pass/Fail test compares the current trace with the most recent locked Event Table. If the Pass/Fail test finds any Events which do not appear in the Event Table, they are reported in the Pass/Fail test table.

If you select `New Events`, you should also set at least one other parameter in the `Pass/Fail Param.` window.

This feature is best used with a locked Event Table. See “How to Lock the Event Table” on page 91.

The check for New Events uses the current Scan Trace thresholds.

Link Length

- `Link Length`: Distance to Fiber End. This is calculated as the difference between the Horizontal Offset (see “How to Set the Horizontal Offset” on page 96) and the Fiber End.

  An End Event must be present before this test can be performed. See “How to Set the Fiber End” on page 98.

  If the Fiber End ± Horizontal Offset is more than *Length Tolerance* km (see below) from the Link Length, this is reported in the Pass/Fail test table.

  In other words, if the Link Length is 100km, and the Length Tolerance is 2km, the recorded fiber length must be between 98km and 102km, otherwise you see an entry in the Pass/Fail test table.

  The Link Length limit can be anything up to 500 km. Enter a value of 0 km to deactivate this test. If the limit is not active, you see a value of `---- km` in the `Link Length` edit field.

Length Tolerance

- `Length Tolerance`: Accepted margin of error used for checking the Link Length (see above).

  The Length Tolerance limit can be anything up to 50 km. Enter a value of 0 dB to deactivate this test. If the limit is not active, you see a value of `-.--- km` in the `Link Tolerance` edit field.

If no Length Tolerance is set, the distance between the Horizontal Offset and the Fiber End must be exactly the same as the Link Length.

If no Link Length has been set, the value of the Length Tolerance is irrelevant.

Event Masking

- `Event Masking`: Specify events to be masked. See “How to Mask Events” on page 92.

  If Event Masking is `On`, some or all Events are ignored when a Pass/Fail test is performed. They are therefore never entered into the Pass/Fail test table. If Event Masking is `Off`, no Events are masked.

The File Utilities screen

You see the File Utilities screen by selecting *File Utility* from the Applications screen, or by selecting <UTILITY> from the [FILE] menu in OTDR mode.

The File Utilities screen allows you to perform standard operations on one or more files.

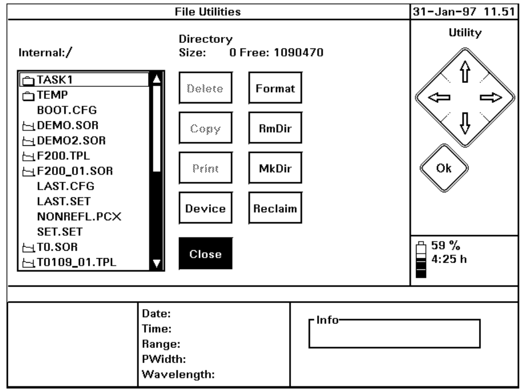


Figure 14 The File Utilities screen

Search for files

You can use the UP and DOWN cursors to look at files on the current device (by default, this is the Mini-OTDR's internal directory structure). At the bottom of the screen, you see information about the currently highlighted file.

Press SELECT to select the highlighted file or directory. When a file is selected, you see a tick next to it. You may select as many files as you like.

You may perform the following operations from the File Utilities screen:

Delete

`Delete`: Delete the currently selected file(s). If no file is selected, this option is grayed.

NOTE

If you choose `Delete`, you are asked to confirm this for each file selected. You may choose `Delete All`, to delete every file selected without being asked to confirm again.

Copy and Print

`Copy All` and `Print All` offer a similar facility for the `Print` and `Copy` options.

Copy: Copy the currently selected file(s). When you select this option, you may choose a new directory or a different device.
If no file is selected, this option is grayed.

Print: Print the currently selected file(s).

You must have a printer connected to the Mini-OTDR. For more information, see “How to Print the Measurement” on page 100.

If no file is selected, this option is grayed.

NOTE You may only print traces. Traces usually have the extension .SOR, .TRC, or .TPL.

Select device

Device: Select a device from INTERNAL, FLOPPY, SRAMCARD, and FLASHDISK. The files displayed at the left of the File Utilities screen correspond to the current device.

NOTE Before you select FLOPPY, SRAMCARD, or FLASHDISK, you must insert a floppy disk, an SRAM Card, or a Flash Disk as appropriate.

See “Inserting and Removing a Floppy Disk, Flash Disk, or SRAM Card” on page 72 for details.

Format device

Format: Format a device. You may choose between Internal, Flash Disk, SRamCard and Floppy.

Please note that the Mini-OTDR cannot perform a “low-level format” (one which involves creating a new file system) on a floppy disk. This means that you cannot format a completely unformatted floppy disk with your Mini-OTDR. This must be done on a PC.

The format function on your Mini-OTDR is similar to the “Quick Format” function on a PC.

WARNING Formatting a device will destroy all data on the device.

If you try to format the internal device, your configuration is lost and your Mini-OTDR must be reconfigured.

Delete directory

`RmDir`: Delete a directory. After you have selected `RmDir` move to the directory you want to delete, changing device if necessary. Then cursor RIGHT to Delete and press SELECT.

NOTE You cannot delete a directory if there are any files in that directory.

Create directory

`MkDir`: Create a new directory. When you have selected `MkDir` enter a name using the on-screen keyboard. You are now able to save files in the new directory.

Reclaim internal memory

`Reclaim`: Reclaim the internal memory. This may be necessary if you have deleted a number of files and require the maximum possible contiguous memory for storing new files.

EasyMode

You enter EasyMode by selecting *Easy OTDR* from the Applications screen. You see a trace screen like that in OTDR mode. However, when you press SELECT to see the popup panel, a more limited range of options is available.

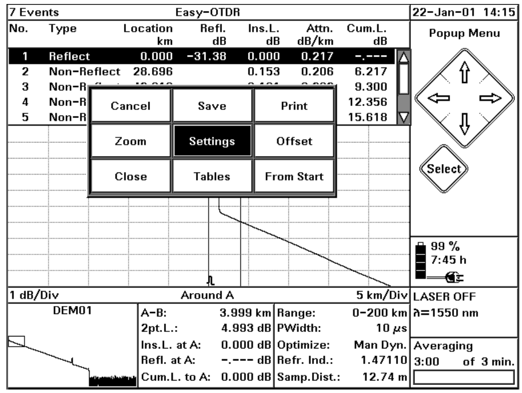


Figure 15 **EasyMode popup panel**

EasyMode popup panel

The following functions are available on the EasyMode popup panel:

- [CANCEL] - exit the popup panel.
- [SAVE] - save the current file. [SAVE] is equivalent to [FILE]<SAVE AS..> in OTDR mode. See “How to Save the Measurement” on page 104
- [PRINT]- print the current trace. [PRINT] is equivalent to [FILE]<PRINT> in OTDR mode. See “How to Print the Measurement” on page 100.
- [ZOOM] - zoom in and out of the current trace, as in the OTDR Mode popup panel option. See “Zooming” on page 49.
- [SETTINGS] - read settings from a template or a settings file.

Template

A template (“.TPL”) contains values from the Settings menu and Event Table which you can save before entering EasyMode. See “How to Read from a Presaved Template” on page 151.

Settings file A settings file (".SET") just contains values from the Settings menu. See the note on page 50.

- [OFFSET] - change the offset. Use the cursors to move the vertical position of the trace on the screen. [OFFSET] is equivalent to [VIEW]<ADJUST V-OFFSET> in OTDR Mode.
- [CLOSE] - return to Applications Screen, as in the OTDR Mode popup panel option.
- [EVENTS] - show or hide the Event Table. Equivalent to [VIEW]<EVENT TABLE> in OTDR mode. See "How to Use the Event Table" on page 89.
- [FROM START] - view the trace from the start. This hides the Event Table, turns all level markers off, sets the trace offset to auto and displays the Full Trace.

Use the cursor keys to move to the function you require, and press SELECT again to select it.

Getting Help

To get help on the Mini-OTDR you press the help key `?` to activate the online documentation. The key can be found in the lower right-hand corner of the instrument

Press SELECT to see the Help screen of the item currently highlighted. Alternatively, cursor right to `Index`, and select one of the listed screen.

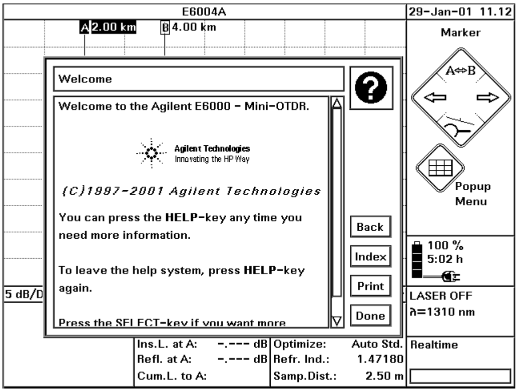


Figure 16 The Mini-OTDR's Help Display

To leave the online documentation and resume your task, press the HELP key again. Alternatively, cursor right to `Done` and press SELECT.

2

Additional Features

Additional Features introduces additional features of the Agilent Technologies E6000C Mini-OTDR (Optical Time Domain Reflectometer). Here you will find descriptions of how an OTDR works, and how you can add external features to your Mini-OTDR.

How the OTDR Works

The OTDR repeatedly outputs an optical pulse into the connected fiber and measures the reflections from this pulse. The trace displayed on the screen is a graph of this reflected power (backscatter) as a function of the distance along the fiber.

Events

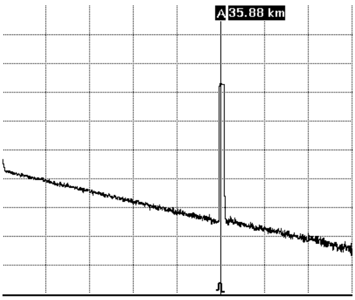
Events are changes in the fiber causing the trace to deviate from a straight line. Events can be *Reflective* or *Non-Reflective*.

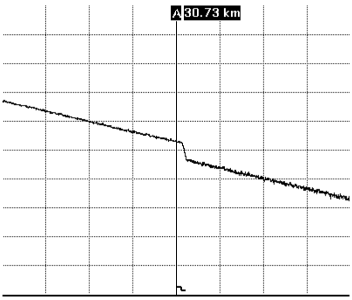
Reflective Events

Reflective Events occur when some of the pulse energy is reflected, for example at a connector. Reflective Events produce a spike in the trace (you see a steep rise and fall in the graph: see the first diagram below).

Non-Reflective Events

Non-Reflective Events occur at parts of the fiber where there is some loss but no light is reflected. Non-Reflective Events produce a dip on the trace (see the second diagram below).





The OTDR calculates the distance of such an “event” in the fiber from the time it takes the reflected signal to return. The further away an event is, the longer it takes for its reflection to return to the OTDR.

By examining the trace of the reflected signal, the parameters of the fiber and the connectors, splices and so on can be determined.

What You Can Measure with the OTDR

The OTDR displays the relative power of the returned signal against distance. With this information important characteristics of a link are determined:

What is Measured

- the location (distance) of events on the link, the end of the link or a break,
- the attenuation coefficient of the fiber in the link,
- the loss of an individual event (for example a splice), or the total end-to-end loss of the link,
- the magnitude of the reflection (or reflectance) of an event, such as a connector.
- the cumulative loss to an event can be measured automatically.

A fully automatic function is available for these measurements. The OTDR sets itself up to achieve the best results.

What else an OTDR can do

In addition to these features the OTDR is able to compare measurement results:

- You can load up to two traces and display them on the OTDR’s screen.

Scan Trace

- Scan Trace is a full automatic analysis of the trace that locates:
  - Reflective events resulting from connections and mechanical splices.
  - Non-reflective events (typically fusion splices).
  - Fiber End: the end of the fiber.

    The Mini-OTDR detects the fiber end by scanning the trace for the first Event with an insertion loss greater than the End Threshold. See “How to Set the Fiber End” on page 98 for more details.

As a result, the event parameters’ loss, reflectance, and distance are calculated and listed.

External connections

Figure 17 shows the external connections to the Mini-OTDR. There are 3 flaps on top of the Mini-OTDR:

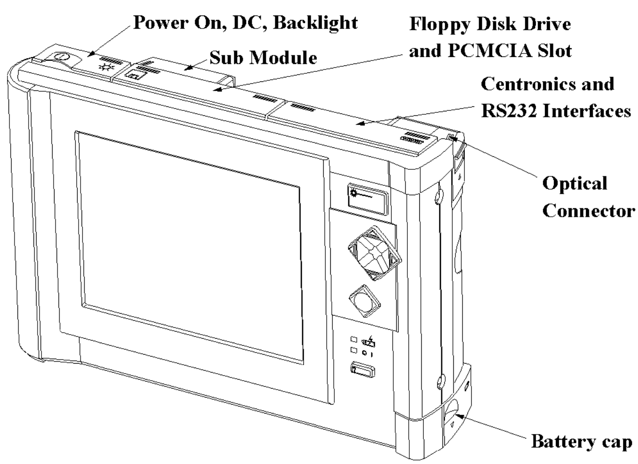


Figure 17 Mini-OTDR external connections

Flaps at top of Mini-OTDR

- Under the left flap you see switches. See “Switches” below.
- Under the middle flap you see the floppy disk drive and the PCMCIA Slot for 2 MB SRAM cards or flash disks. For more information, see “Inserting and

Removing a Floppy Disk, Flash Disk, or SRAM Card” on page 72.

– Under the right flap you see interfaces to connect with Centronics and RS232.

Shoulder strap

- You can attach a shoulder strap to points on either side of the Mini-OTDR. See “Adding a Shoulder Strap” on page 73.

Battery

- You insert the battery behind the flap in the bottom right corner of the Mini-OTDR. See “Inserting and Removing a Battery” on page 75.

Submodule

- You can insert a submodule if you have already inserted a module into the back of the Mini-OTDR. See “Inserting and Removing a Submodule” on page 74

Switches

You can see a number of switches and other features under the flap at the top left of the Mini-OTDR:

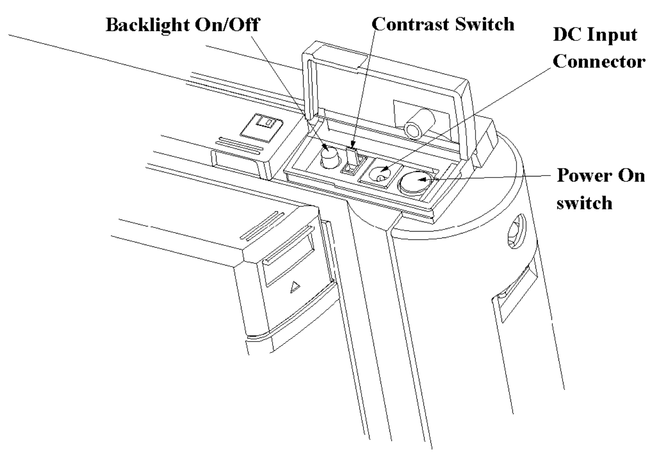


Figure 18 Switches and so on (viewed from behind the Mini-OTDR)

Brightness

- You change the brightness of the picture with the backlight button.

Contrast

- You change the contrast of the picture with the contrast switch.

Input connector

- You use the DC input connector when you want to attach an AC/DC connector. See “Connecting an AC/DC Adapter” on page 78 for more details.

Power on

- You turn the Mini-OTDR on and off with the power on switch. The power on switch can be activated when the flap is up or down

Inserting and Removing a Floppy Disk, Flash Disk, or SRAM Card

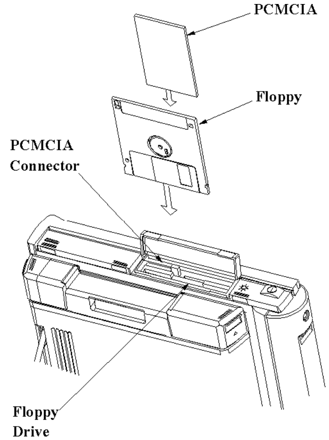


Figure 19 Inserting a Floppy Disk, Flash Disk, and SRAM Card

To insert a floppy disk, flash disk, or 2 MB SRAM card, open the center flap at the top of the Mini-OTDR (see Figure 19). You see two slots here - at the front there is a PCMCIA slot for an SRAM card or a flash disk; at the back there is a slot for floppy disks.

NOTE Please make sure that the disk that any floppy disks that you insert are pre-formatted.

The Mini-OTDR will not format disks, and does not recognize unformatted disks.

Adding a Shoulder Strap

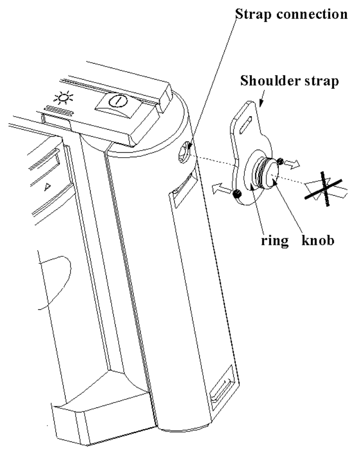


Figure 20 Adding hinges for the shoulder strap

You can attach a shoulder strap to the connection points on the left and right sides of the Mini-OTDR.

The shoulder strap has a hinge at each end, consisting of a black knob and a larger ring on the strap itself (see Figure 20).

Attach shoulder strap To attach the strap, push in the ring. **Do not try to attach the strap by pushing in the knob**.

Remove shoulder strap To remove the shoulder strap, pull the black knob away from the Mini-OTDR.

Inserting and Removing a Submodule

NOTE You should switch off your Mini-OTDR before inserting or removing a module or submodule.

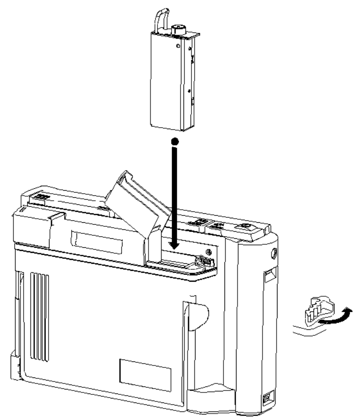


Figure 21 Inserting a submodule

Module

1 Insert a module

The submodules E6006A and E6007A go in the submodule slot at the top of main Mini-OTDR modules. Follow the steps in “Inserting a Module” on page 37.

Connector cover

2 Lift the Connector cover and rotate the module catches

If you are looking at the Mini-OTDR from the front, the submodule slot is under the left Connector Cover on the module. The submodule will only fit into the module if the module catches run parallel to the screen, that is if the module is unlocked.

Insert submodule

3 Now insert the submodule

The submodule slips easily in and out of its slot (Figure 21). When the submodule is in place, you can now connect an Optical Output Connector and a fiber, and lock the module.

Battery Handling

Inserting and Removing a Battery

The battery should be inserted in the slot at the foot of the Mini-OTDR (see Figure 22.)

NOTE Make sure that you insert the battery in the correct direction, and that you close the battery cap correctly.

NOTE Only use the Agilent spare NiMH battery pack (Agilent Product Number E6080A) or comparable batteries. Other batteries may be damaged by the Mini-OTDR battery charger

Battery cap Before inserting or removing the battery, pull down the cap at the bottom of the right-hand side of the machine. The battery will then slide in and out.

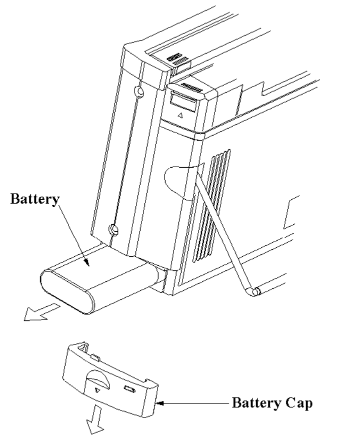


Figure 22 Removing a Battery

Once you have inserted or removed the battery, replace the cap

CAUTION Do not insert the battery while operating the instrument.

Charging the Batteries

The Mini-OTDR has a built-in charger. It is able to charge the battery operating or non-operating. Fast-charge is typically performed non-operating in 2 hours.

Charging for the first time

- When you charge the battery for the first time, insert the battery and connect the AC-Adapter (see “Connecting an AC/DC Adapter” on page 78).

Old batteries

- If your battery is new or has been in storage for a long time, you may need to charge it two or three times to achieve optimum performance levels.

Best performance

- For the best battery performance and accuracy of the fuel gauge (showing percentage use of the battery), completely discharge the battery, then make a complete fast charge cycle (non-operating), and completely discharge the battery again.

NOTE You must ensure that the charging cycle is not interrupted by a battery discharge, and that the discharge cycle is not interrupted by battery charging.

Battery temperature

- It is best if you charge the battery at a limited and controlled temperature (10°C to 35°C, 50°F to 95°F).
- It is normal for the battery to become warm during charging or after use.
- When completely charged, the battery will discharge down to 80% before a new charging cycle is activated.

Battery Storage

- Remove your battery from the Mini-OTDR when not in use. Store at room temperature (59°F to 86°F, 15°C to 30°C), and in a dry place for optimal performance.
- A charged battery will gradually lose its charge if left in storage. It is therefore better if you top-off the charge before use.
- It is good practise to recharge the battery every 2-3 months during storage.

Battery safety

Your battery has passed a UL-listed safety test. For the best results, wipe the battery with a soft dry cloth if it becomes dirty.

Do not disassemble or attempt to open the battery under any circumstances.

- The battery can explode, leak or catch fire if heated or exposed to fire or high temperatures.
- Do not short circuit the battery by directly connecting the metal terminals (+,-). Be certain that no metal objects such as coins, paper clips and so on touch the terminals.
- Do not drop the battery or subject it to mechanical shock.

NOTE The battery is a consumable part and is not subject the E6000C warranty.

Connecting an AC/DC Adapter

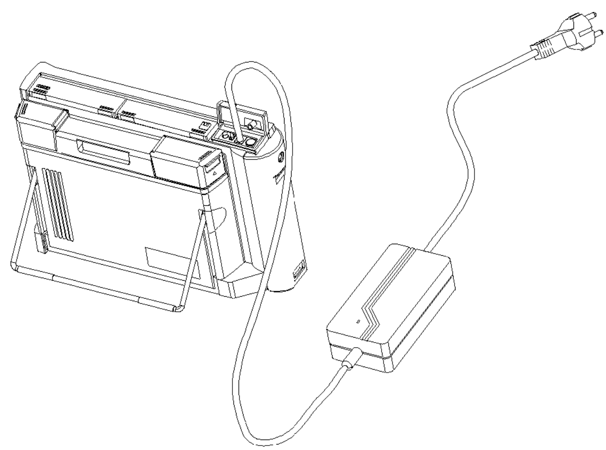


Figure 23 Connecting an AC/DC Adapter

To connect an AC/DC adapter charger, open the flap at the top of the Mini-OTDR (on the left-hand side when viewed from the front).

Input connector You see an input connector next to the On/Off button. Attach the lead from the charger to this connector (Figure 23).

The Mini-Keyboard

If you order the Agilent E6081A, you receive a PS2 keyboard, that you can attach at the back of your Mini-OTDR, to the right-hand side (see Figure 24).

You can use the keyboard in place of the screen keyboard to enter text (see, for instance, “How to change a text setting” on page 132).

Keyboard shortcuts You can also use the keyboard to control your Mini-OTDR using the following Cursor keys:

keyboard key	equivalent Mini-OTDR hardkey
<*f2*>	Run/Stop
Up arrow	Cursor Up
Down arrow	Cursor Down
Left arrow	Cursor Left
Right arrow	Cursor Right
<*Enter*> or <*Return*>	Select
<*f1*>	Help

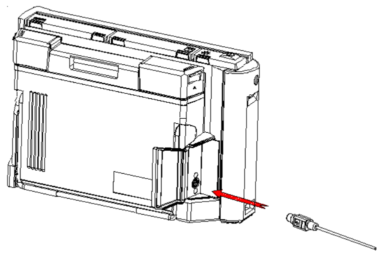


Figure 24 Attaching a keyboard

You can use a mini-DIN connector to attach any standard PS2 keyboard, such as the Agilent E6081A, to the keyboard connector.

3

Sample Sessions: Measuring a Trace

Measuring a Trace contains a number of sample sessions of step-by step guides showing how to use common features of the Mini-OTDR.

Equipment used In these sample sessions we use:

- A Mini-OTDR Agilent Technologies E6000C with an optical module Agilent E6003A (1310/1550 nm, single-mode).
- A length of fiber of about 40 km, terminated at one end with a Diamond HMS-10/Agilent connector and unterminated at the other end. The fiber has a refractive index of 1.462, and is to be used at a wavelength of 1310 nm.
- A connector interface to match the connector on the fiber being used.

Sample Sessions The following sample sessions show you how to:

- Set up your Mini-OTDR,
- Run a Measurement: Automatically, Manually, and in Real Time,
- Use the Event Table and Pass/Fail test,
- Set the Horizontal Offset and Fiber End,

- Print and Save the Measurement.

How to Connect the Fiber

Connecting the fiber to the Mini-OTDR is very easy. You do not need any tools.

1. Clean the connectors. See “How to clean connectors” on page 284.
2. Attach the required optical connector interface to the optical output. See “Adding a Connector Interface” on page 38.
3. Connect the fiber to this interface.
4. Turn on the Instrument.

How to Change the Refractive Index Setting

To get the most accurate distance measurements, you have to enter the correct refractive index of your fiber:

NOTE This example shows you how to set the Refractive Index setting. You can set other parameters from the Measurement Settings page in a similar way.

1. Switch on your OTDR. If you see the *Applications screen*, select `OTDR Mode`. You see an empty trace screen with two markers.

Measurement Settings

2 Select [Settings] from the popup panel. You see a menu headed `Measurement Settings`.

3 If you are not already viewing the `Meas. Parameter` page, cursor to either of the arrows at the bottom left of the screen. Press Select to bring up the next page.

Select Refractive Index

4 Use the Cursor keys to move to the <Refr. Ind.> box, and press Select.

You should now see a dialog containing the recommended Refractive Indexes for selected cable vendors.

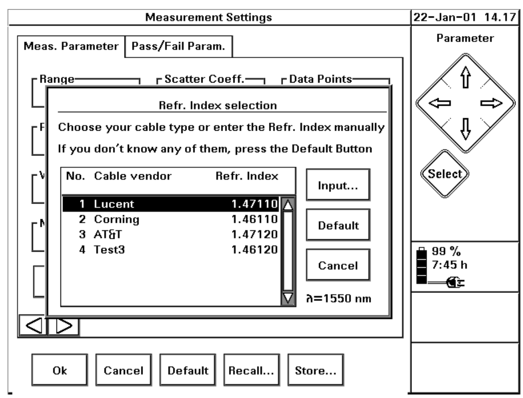


Figure 25 Altering the Refractive Index

NOTE If you don't see this dialog, this means that you do not have a vendor file (`VENDOR.INI`) in your Mini-OTDR internal memory. Please contact your Agilent representative for assistance, or see *"Appendix: VENDOR.INI" on page 311*.

If you do not have a vendor file, you can use the Cursor keys to manually input a Refractive Index.

Select vendor

5 Cursor to an appropriate vendor name, and press Select.

6 Move to `OK` in the `Measurement Settings` menu and press the SELECT key.

NOTE Parameters changed in the [SETTINGS] page only affect subsequent traces. The current trace is unaltered.

If you alter the settings while a measurement is running, press RUN/STOP again to start a new trace with the parameters that you have just set.

NOTE You can alter the Refractive Index Setting for just the current trace by selecting <ADJUST REFR.IND/DIST> from the [ANALYSIS] menu.

How to Make an Automatic Measurement

NOTE Before you run a trace, you may want to make the correct settings and configure your instrument.

See “How to Change the Refractive Index Setting” on page 82, “How to Set the General Configuration” on page 130, “How to Set the OTDR Settings” on page 134, and “How to Set the Trace Information” on page 136.

To let the Mini-OTDR set up itself for the measurement:

1 Select [SETTINGS] from the OTDR Mode popup panel.
2 If you are not already viewing the `Meas. Parameter` page (Figure 12), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

Automatic Settings

3 Cursor up to <AUTO> and press SELECT. Automatic settings are now enabled.

You see the text `Auto` in the `Range` and `PulseWidth` boxes, and the Mini-OTDR selects suitable settings for your fiber.

4 Exit the SETTINGS menu by selecting OK.

Automatic Scanning

5 Select [VIEW] from the popup panel. You see a list of menu options.

6 If there is a tick next to <AUTO SCAN>, Automatic Scanning is already enabled. If Automatic Scanning is not enabled. move down to <AUTO SCAN> and press SELECT or cursor right.

7 Leave the menu by cursor left, or selecting <CLOSE VIEW MENU>.

Start Measurement

8 Press the RUN/STOP hardkey.

The light behind the RUN/STOP hardkey goes on. After a short initializing phase, the OTDR displays the first result.

9 Press the RUN/STOP hardkey, or wait for the end of the measurement time, as indicated in the lower right corner.

The light behind the RUN/STOP hardkey goes off. No more samples are being taken.

The OTDR now generates an Event Table and displays the Event Table and Event Bar, if you have requested them from the [VIEW] menu.

NOTE If you have a color Mini-OTDR (E6000C option 003), you can select whether or not the current display is color by VIEW - PREFERENCES options.

You can choose between BLACK/WHITE, COLOR INDOOR (for indoor use) and COLOR OUTDOOR (for outdoor use).

How to Run a Manual Measurement

When you already know about the fiber under test, you can set the parameters exactly. This section describes how to setup and run a measurement manually.

How to Change the Measurement Span

1 Select [SETTINGS] from the OTDR Mode popup panel.

2 If you are not already viewing the `Meas. Parameter` page (Figure 12), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

Select Range

3 Move to <RANGE> and press SELECT. You see a list of preset typical ranges.

4 Highlight a preset range and press SELECT.

Alternatively:

♦ Select <RANGE INPUT>, and use the Cursor keys to control the start and span values.

NOTE If you want the Mini-OTDR to select a suitable range for your fiber, you can select `Auto` at the bottom left of the Settings screen.

How to Change the Optimization Mode

1 If you are not still in the `Measurement Settings` menu, select [SETTINGS] from the popup panel.

2 If you are not already viewing the `Meas. Parameter` page (Figure 12), cursor to either of the arrows at the

bottom left of the screen. Press SELECT to bring up the next page.

Optimize Mode

3 Move to <OPTIMIZE MODE> and press SELECT. You see three options: <STANDARD>, <RESOLUTION> and <DYNAMIC>.

4 If you want to increase the dynamic range of the measurement, move to <DYNAMIC> and press SELECT.

5 Exit the Settings menu by selecting OK.

NOTE Parameters changed in the [SETTINGS] page only affect subsequent traces. The current trace is unaltered.

The parameter values displayed on the Trace Screen always refer to the current trace. Any parameter that has been changed for subsequent traces is grayed.

NOTE If you alter the settings while a measurement is running, press RUN/STOP to start a new trace with the parameters that you have just set.

How to Run the Measurement

Now that you have set the range correctly, the measurement can be run:

1 Press the blue RUN/STOP hardkey.

2 Wait for the trace to become free of noise. This takes some seconds. Alternatively, wait until the measurement time expires.

3 Press the RUN/STOP hardkey.

How to Scan a Trace for Events

If you have selected <AUTO SCAN> from the [VIEW] menu, the OTDR automatically scans the trace for events when you run a measurement. You can view the events by selecting [VIEW]<EVENT TABLE> or [VIEW]<EVENT BAR>.

Scan Trace

You can scan an existing trace for Events as follows:

1 Select [ANALYSIS]<SCANTRACE>.

The current trace is scanned for Events, which are entered in the Event Bar and Event Table.

Why can't I see any Events ?

If you do not see Events that you expect to appear, it may be for one of the following reasons:

- The Events are too close together.

  Try shortening the pulse width and trying again. If you still cannot find the Event, try measuring the fiber from the other end.

- The Signal to Noise Ration (SNR) is too small.

  Try increasing the Averaging Time and try again.

- One of your user settings is incorrect.

  Check your user settings (for example, the refractive index) and try again.

If you still do not see the Event that you expect, you can add one manually. See "How to Add a Reflective Event" on page 111 or "How to Add a Non-Reflective Event" on page 119.

How to Use the Event Table

NOTE You can also add events manually. See the online documentation for further information.

By default, the OTDR automatically scans the trace for non-reflective events (for example splices) and reflective events (for example connectors). These events are shown on the event bar and in the event table.

NOTE If you do not want traces to be scanned automatically, select <AUTO SCAN> in the [VIEW] menu. There will now no longer be a tick beside <AUTO SCAN>.

To reactivate automatic scanning, select [VIEW]<AUTO SCAN> again.

This section describes how to read the event table.

How to Display the Event Table

To display the event table on the screen:

1 Select [VIEW] from the popup panel.

2 If you do not have an Event Table visible above the trace, there will be no tick next to <EVENT TABLE>. Cursor DOWN to <EVENT TABLE> and press the SELECT key.

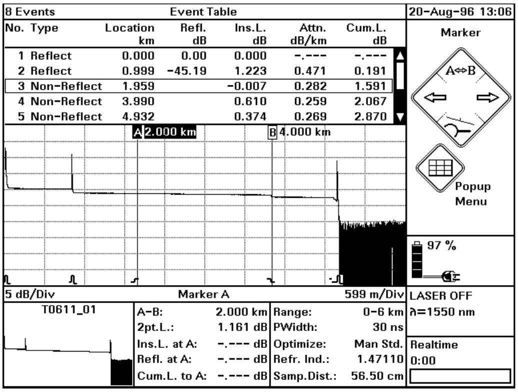


Figure 26 The Event Table

For each event in the table, you can see the type of the event and its location. You also see the following measurement results:

Contents of Event Table

- The reflectance of the event.
- The insertion loss of the event.
- The attenuation between this event and the next one.
- The cumulative loss, that is the sum of the splice, reflectance, and attenuation loss up to the point of the current event.

NOTE If you activate [VIEW]<SNAP TO EVENT>, as you cursor up and down the Event Table, the highlighted marker moves to the highlighted event.

In the Event Table, you see a box around the Event nearest to the highlighted marker (if not in Snap to Event. If <SNAP TO EVENT> is active, the maker is inverted).

How to Lock the Event Table

3 Select [EVENTS] from the popup panel. Select <LOCK EVENT TABLE>.

The first 3 columns in the Event Table (`No.`, `Type` and `Location`) are locked.

Subsequent Scan Traces do not look for new events. However the measurements for existing Events are recalculated with each new Scan Trace.

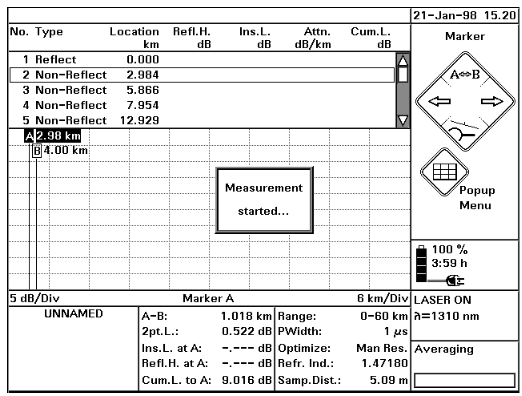


Figure 27 Taking a New Measurement with a Locked Event Table

To unlock the Event Table, select <LOCK EVENT TABLE> again. If you change the parameters for the next measurement, the table is automatically unlocked.

NOTE You should only lock the event table if you are making measurements on the same fiber, or one that is very similar.

If you measure a different fiber with different results, the displayed events will not produce useful measurements.

How to Use the Pass/Fail test

How to Set the Pass/Fail test Parameters

1 Select [SETTINGS] from the OTDR Mode popup panel.

Pass/Fail parameters

2 If you are not already viewing the `Pass/Fail Parameters` page (Figure 13), cursor to either of the arrows at the bottom left of the screen.

Press SELECT to bring up the next page.

3 Set the limits as required.

For more information, see “The Pass/Fail Parameters Settings page” on page 54.

How to Mask Events

4 Cursor to the `Event Masking` edit box, and press SELECT.

You see a window asking you to mark Events to be masked (Figure 28). The Events that are already masked have a tick beside their entry.

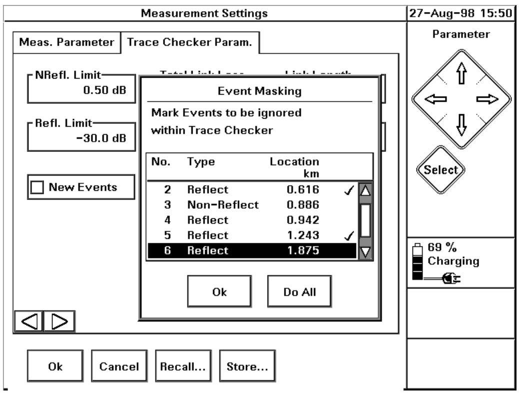


Figure 28 Select Event Masking

select Events for masking

5 Cursor to the Event(s) to be masked (or unmasked), and press SELECT.

6 When all required Events are selected, select Ok.

NOTE To select all Events for masking, select Do All.

To deselect all events select Do All again.

Masked Events are not checked by subsequent Pass/Fail tests. This means that these Events will not appear in the Pass/Fail Test table.

Masked Events are indicated by a x between the entries for No. and Type in the Event Table.

NOTE You can mask an individual event by selecting <MASK AN EVENT> from the [EVENTS] menu.

7 Select OK to exit the Measurement Settings screen.

How to run the Pass/Fail test

8 If you don't already have a trace loaded, take a trace as normal, either using the RUN/STOP key, or by opening an existing file using <OPEN..> from the FILE menu.

Lock Event Table

9 If you are checking for New Events, lock the Event Table.

See "How to Lock the Event Table" on page 91.

10 Select <PASS/FAIL TEST> from the [ANALYSIS] menu.

The Pass/Fail test checks the current trace against limits set above. You see a message Pass/Fail Test Active.., at the top of your Trace screen.

NOTE If you have not set any Pass/Fail Param. Limits, no Pass/Fail test is performed.

If there is no current trace, no Pass/Fail test is performed and you see an error message.

11 After the Pass/Fail test has been performed, you see the message `Pass/Fail Test done!` at the top of your Trace screen.

You are told whether the check has passed or failed (for example, Figure 29).

Figure 29 Pass/Fail test failed message

What you see depends on the test result, and the current configuration of your Mini-OTDR:

Test passed

- **Pass/Fail test passed**: you see `PASSED` at the top right of your Mini-OTDR screen.

Test Failed

- **Pass/Fail test failed, Pass/Fail test table not displayed**: you see the screen in Figure 29.
- **Pass/Fail test failed: Pass/Fail test table already showing**: you see a `FAILED` message and the Pass/Fail test table is updated.

This example assumes the second case (Pass/Fail test failed, no Pass/Fail test table displayed).

Test Details

12 Select `Details` to continue.

You now see the new Pass/Fail test table (Figure 30).

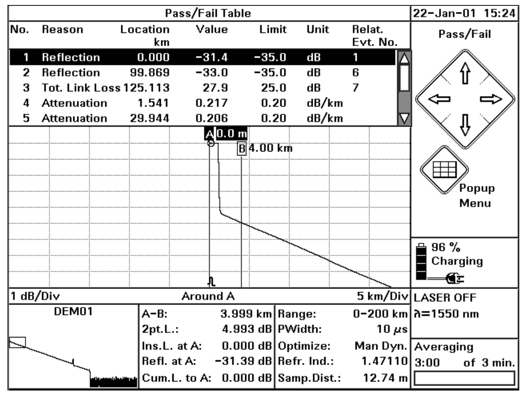


Figure 30 Pass/Fail test table

Events in the Pass/Fail test table are listed in order of severity. So, the Event whose values most exceeds its limits is listed first, with the remaining Events being listed in order of importance.

contents of Pass/Fail table The Pass/Fail test table gives you the following information:

- The number and location of the Event.
- The limit that has been exceeded (`Reason`) (see “The Pass/Fail Parameters Settings page” on page 54). This relates the parameters in the Settings screen.

NOTE The Reason given refers to the exceeded limit and not to the type of Event.

So, a Reflective Event can be reported as both `Reflect` and `Non-Reflect`, depending on the limit exceeded.

- The value of the `Limit` which has been exceeded.
- The actual `Value` recorded.

- The number of the Event at which the limit has been exceeded (`Relat. Evt. No.`).

  For Link Loss and Link Length (over the whole fiber), this is the End Event.

Printout The Pass/Fail test table is also included in a printout. See “How to Print the Measurement” on page 100.

NOTE If you want to perform a Pass/Fail test whenever a Scan Trace is performed, select <AUTO PASS/FAIL> from the [VIEW] menu.

NOTE If you want to view the Pass/Fail test table, or to stop viewing it, select <PASS/FAIL TABLE> from the [VIEW] menu.

You cannot see the Pass/Fail test table and the Event Table simultaneously. This means that selecting the Pass/Fail test table deselects the Event Table, and vice versa.

How to Set the Horizontal Offset

You use the Horizontal Offset to set all distances (for example the marker position, or locations in the Event Table) relative to this point. You do this as follows.

Position marker

1. Move your marker to the point where you want to set the offset.

   If you want to precisely position the marker, press the DOWN Cursor to view around the marker.

2. Select the menu option [VIEW]<SET H-OFFSET to A>

NOTE If the current marker is marker B, the submenu option will be called <SET H-OFFSET TO B>.

The position of the current marker is now set to 0 km and distances are reset accordingly (Figure 31).

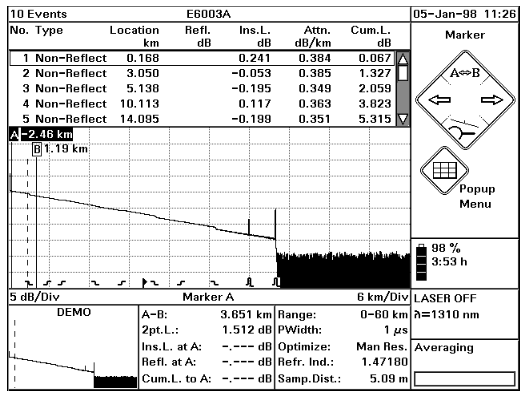


Figure 31 Trace with Horizontal Offset set

If you move the marker away from the offset, you see a dashed vertical line marking the offset. Printouts also contain this line (see “How to Print the Measurement” on page 100).

NOTE Landmarks are always positioned relative to 0 km, while Events have an absolute position on the fiber.

This means that when you set a Horizontal Offset, the location distance of the landmark stays the same, but the position of Events changes by the amount of the Offset.

By default, all Events to the left of the Offset are displayed in the Event Table and the Event Bar at the foot of the trace

How to Hide Events before the Offset

3 Select the menu option [VIEW]<EVENTS BEFORE OFFSET>

Events to the left of the Horizontal offset are now hidden in the Event Bar and Event Table.

Events to the left of the horizontal offset have negative distances in the `Location` column of the Event Table.

How to Clear the Horizontal Offset

4 Select the menu option [VIEW]<CLEAR H-OFFSET>.

The offset is cleared, and you see all events in the Event Table and Event Bar even if `Events Before Offset` is not set.

NOTE If you change the Measurement Span in the [SETTINGS] menu, and the Horizontal Offset does not lie inside the range of the current span, the Horizontal Offset is also deleted.

How to Set the Fiber End

Either

1 Select [SETTINGS] from the OTDR Mode popup panel.

2 If you are not already viewing the `Meas. Parameter` page (Figure 12), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

Select End Threshold

3 Cursor to `End Thres.` and press SELECT. Follow “How to change a numerical setting” on page 132 to select a new threshold value.

If you select an end threshold of, for example, 3.0 dB, an End will be set at the first event with an insertion loss of 3 dB or more. If you select a threshold of 0 dB, no End will be set.

Scan Trace

4 Select [ANALYSIS]<SCAN TRACE> to run a scan trace.

The first Event which exceeds the specified End Threshold is now set to type `End`, and subsequent Events are ignored.

Or

1 Use the Cursors to move the current marker to an Event.

Select [EVENTS]<DECLARE END> from the popup panel. An End is set at the event near the current marker.

NOTE If the current marker is not at an event, no End is set.

End Event

The end Event is listed as type `End` in the Event table, and marked on the Event Bar with a special symbol (see Figure 32). All events to the right of the End Event are removed

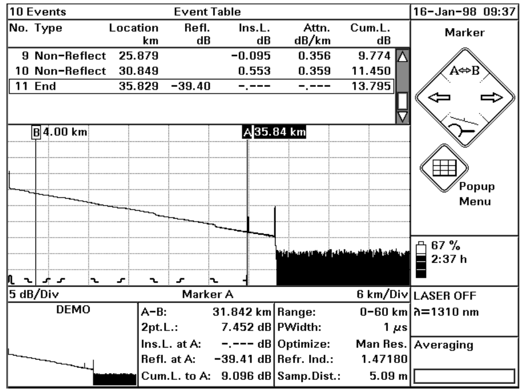


Figure 32 Trace with an End set at Marker A

If you add an Event after the End (<ADD REFL. EVENT> or <ADD NON-REFL. EVENT> from the [EVENTS] menu), the End is removed, and its Event reverts to its original type.

How to Print the Measurement

This example demonstrates how to print the results of a measurement.

NOTE You may need to configure your printer before you can print a trace. See “How to Set up the Printer Configuration” on page 141.

Color printers Please note that the E6000C Mini-OTDR only supports monochrome printouts. This means that some printers will only work with a black ink cartridge installed, even if these printers support a color ink cartridge.

For color printouts, please use the Agilent E6091A OTDR Toolkit II.

Attach printer

1 Attach an external printer to the Centronics interface of the Mini-OTDR. See “External connections” on page 70.

Print trace

Either (print the current trace):

2 Select [FILE] from the popup panel. Cursor DOWN to the <PRINT> option. and press SELECT.

Or (print a stored trace):

♦ Select [FILE] from the popup panel. Cursor DOWN to the <UTILITIES> option. Select the file(s) that you want to print listed in the menu at the left of the File Utilities screen.

Cursor RIGHT, and select <PRINT>.

NOTE Usually, you only see “`.SOR`” and “`.TRC`” files, unless you select the `All Files` button.

NOTE Printing from the File Utilities menu allows you to Batch Print, that is select more than one file to be printed.

The measurement is printed after a short initialization period. Printing will take approximately 1-2 minutes. A printer icon will appear towards the bottom right of the screen while the print is running.

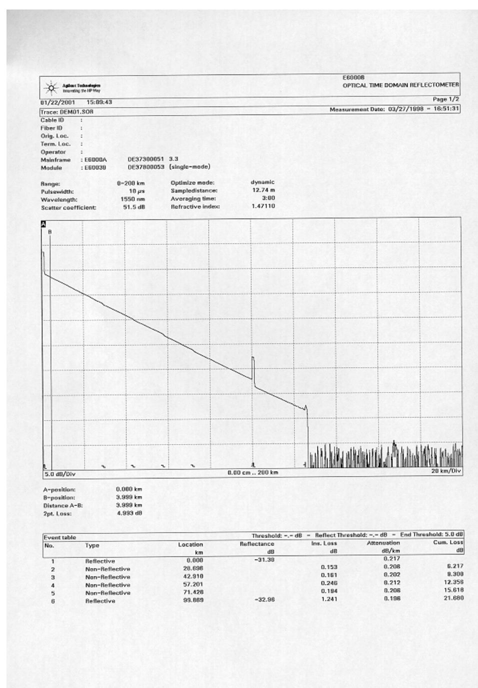
Contents of printout

The print gives you:

- The measurement parameters that show further trace information, detailed instrument information, and the most important parameters (range, pulsewidth, and so on).
- The trace.

- Information about the markers (position, attenuation, loss, and so on).
- The event table.
- The horizontal offset (marked as a dotted vertical line on the trace).
- The Labels and Comments set in “How to Set the Trace Information” on page 136.
- The Pass/Fail test table. See “How to Use the Pass/Fail test” on page 92.

This gives you all the information necessary to document the measurement, or to repeat it using the same parameters.



E6000B
OPTICAL TIME DOMAIN REFLECTOMETER
01/22/2001 15:09:43
Page 1/2
Trace: DEM01.SOR
Measurement Date: 03/27/1998 - 16:51:31
Cable ID :
Fiber ID :
Orig. Loc. :
Term. Loc. :
Operator :
Mainframe : E6000A DE37300051 3.3
Module : E6003B DE37800053 (single-mode)

Range: 0-200 km
Pulsewidth: 10 μs
Wavelength: 1550 nm
Scatter coefficient: 51.5 dB
Optimize mode: dynamic
Sampledistance: 12.74 m
Averaging time: 3:00
Refractive index: 1.47110

A-position: 0.000 km
B-position: 3.999 km
Distance A-B: 3.999 km
2pt. Loss: 4.993 dB

Event table — Threshold: -.- dB - Reflect Threshold: -.- dB - End Threshold: 5.0 dB

No.	Type	Location km	Reflectance dB	Ins. Loss dB	Attenuation dB/km	Cum. Loss dB
					0.217	
1	Reflective	0.000	-31.30			
2	Non-Reflective	20.698		0.153	0.208	6.217
3	Non-Reflective	42.910		0.161	0.202	8.300
4	Non-Reflective	57.201		0.246	0.212	12.356
5	Non-Reflective	71.428		0.184	0.206	15.618
6	Reflective	99.889	-32.96	1.241	0.196	21.680

Figure 33 Typical Printout

NOTE You can print a screen hardcopy by pressing and holding the HELP key for 4 seconds. You can print to an attached printer (which must be correctly configured), or to a PCX file (see below).

How to make a screen dump

As well as printing the current measurement, you can also make a screendump of the current page. This is saved in a PCX file, You can do this from any screen in your Mini-OTDR.

You make a screen dump as follows.

1 Hold the Help button for 4 seconds until you hear a beep.

  You see a screen asking you where you want the destination of the screen bitmap to be.

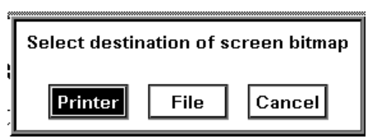


Figure 34 Make screendump dialog

2 Cursor to `File` and press SELECT.

  The file is now saved in your Mini-OTDR’s internal directory structure. You can now copy the file, for example, to a floppy disk, and view it on your pc.

  For more information about copying files, see *“The File Utilities screen” on page 59*.

NOTE You can also use this procedure to print the current screen to an attached printer. Simply select `Printer` instead of *File* when you are asked for the screen bitmap destination.

For details about connecting an external printer, see "External connections" on page 70 and "How to Print the Measurement" on page 100.

How to Save the Measurement

What is saved Saving a measurement not only saves the results, but also saves the parameter measurement, event table, and horizontal offset.

When you recall the measurement later, you can do further analyzing, or compare it with other measurements. You can also repeat the measurement using exactly the same parameters as the first time.

To save the measurement on the Mini-OTDR's internal memory:

1 Select [FILE] from the popup panel.

2 Cursor DOWN to the <SAVE AS...> option. and press SELECT. You see a screen listing the current files on the device.

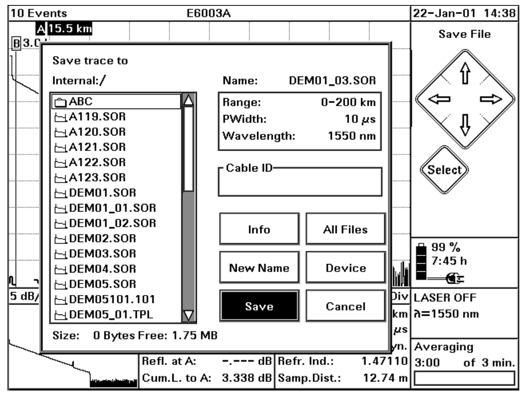


Figure 35 The Save menu

3 If you want to save the file on a different device (for example, a floppy disk), select `Device`, and choose the device that you require.

How to save with the default name

4 The default name is written under `Name:` on the right. The file name by default follows the scheme `T`*mmdd*_*nn*`.SOR`, where *mm* is the current month, *dd* is the current day and *nn* is the consecutive number of the measurements saved on that date

If you want to save to this name, select `Save`.

How to save with an existing name

♦ Cursor left to the Internal File Directory. The Internal File Directory is a list of all `.SOR` and `.TPL` files in the current directory. You can navigate to parent or subdirectories.

Select one of the filenames in the internal directory. The listed default name is changed, and you can follow the step above.

NOTE If you want to see all files in the directory, not just`*.SOR` and `*.TPL`, select the `All Files` button first.

The default name is written under `Name:` on the right. The file name by default follows the scheme `T`*mmdd_nn*`.SOR`, where *mm* is the current month, *dd* is the current day and *nn* is the consecutive number of the measurements saved on that date

If you want to save to this name, select `Save`

How to save with a new name

♦ Select `New Name`. A keyboard appears where you can select letters for a new file name. Use `Del` to delete unwanted characters, and select `OK` to confirm the new name. The file is automatically given the suffix `.SOR`.

4

Sample Sessions: Analyzing an Existing Trace

"Sample Sessions: Measuring a Trace" on page 81 showed you how to measure a trace, and to make simple settings.

This chapter contains further step-by step guides showing what you can do to analyze a trace after it has been measured.

Sample Sessions

The following sample sessions show you how to:

- Add a Landmark and Event Comment,
- Add Reflective and Non-Reflective Events,
- Measure Total Loss, Reflectance, and Insertion Loss,
- Display and Compare Two Traces,

If you have not used a Mini-OTDR before, you should first read Sample Sessions: Measuring a Trace. The equipment used in the following Sample Sessions is the same as before.

How to Add a Landmark or Event Comment

There are 2 ways of documenting points on a fiber:

Landmark

- A **landmark** documents a point on the fiber. For example, if there is a man hole 20 km from the start of the fiber, you can add a landmark at 20 km.

Event Comment

- An **event comment** documents a particular event. The position of the event comment can change, for example if you change the refractive index of the fiber.

Both landmarks and event comments can help identify the physical location of an event.

How to Add a Landmark

Position Marker

1 Move your marker near the point you wish to mark.

So, for example, if you want to add a landmark at 20 km, use the LEFT and RIGHT cursors to move the current marker to around 20.00 km.

View Around marker

2 Press the `Down` cursor to view around the marker. Move the marker so that it is at the exact point you require.

3 Select [EVENTS] from the popup menu

4 Select the submap entry <LANDMARK><ADD/MOD.>.

You see a screen keyboard asking you to enter the Landmark text (Figure 36).

NOTE If there is a landmark near to the marker, but not at exactly the same position, you see a dialog asking `Modify landmark at` *`xxx`* `km ?`

If you select `No`, you see an empty text field where you can add a new landmark name. If you select `Yes`, the edit field contains the text for the existing landmark.

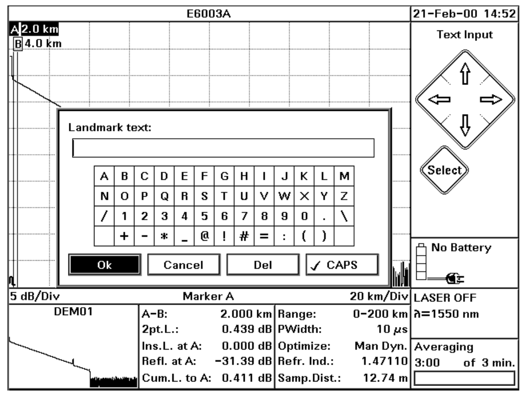


Figure 36 Landmark text box

Add landmark name

5 Use the screen keyboard to add a landmark name.

Move to the letters you want, and press the SELECT key. Move to `Del` to delete the previous character, and to `CAPS` to change the case of subsequent letters

6 When you have finished the Landmark text, move to `OK` and press the SELECT key.

The landmark is now shown on the Event Bar and in the Event Table. You can specify whether the Event Bar and Event Table are shown from the [VIEW] menu.

NOTE You can save landmarks by selecting [EVENTS]<LANDMARK><SAVE AS...>.

Previously saved landmarks can be loaded by [EVENTS]<LANDMARK><LOAD...>

How to Add an Event Comment

Select Event

1 Select the appropriate event in the event table, or position the marker at an event.

You can position the marker more accurately if you press the DOWN cursor to view around the marker.

2 Select [EVENTS] from the popup menu

3 Select the menu option <ADD/MOD. EVENT COMMENT>.

4 You see a screen keyboard, similar to Figure 36.

If there is already a comment for this Event, you see the label for the Event in the `Event comment text:` edit field. Otherwise, the edit field is empty.

Add text

5 Use the screen keyboard to add a Comment. When you have entered the Comment, move to OK and press the SELECT key.

6 When you have finished the Event Comment text, move to OK and press the SELECT key.

The Comment is now shown under the Event in the Event Table. You can specify whether the Event Table is shown from the [VIEW] menu.

NOTE To delete an Event Comment, move to the Event and select <DELETE EVENT COMMENT> from the [EVENTS] menu.

Figure 37 shows an Event Table containing a landmark and event comment. The landmark is also marked in the Event Bar at the foot of the trace.

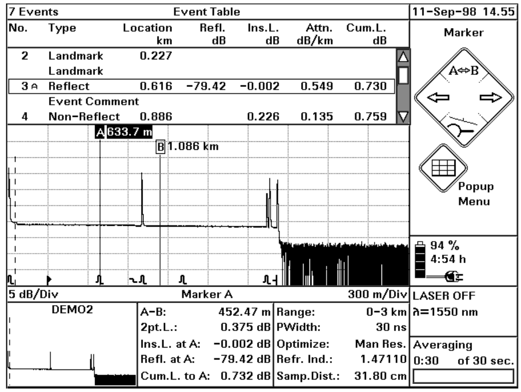


Figure 37 Landmark and Event Comment

How to Add a Reflective Event

If your trace contains a Reflective Event that has not been detected by your Scan Trace, you can add an Event manually, as described below:

Position marker

1 Use the LEFT and RIGHT cursors to move a marker to the position where you want to add the Event.

   To position the marker more accurately, press DOWN to zoom around the marker.

2 Select the menu item [EVENTS]<ADD/MOD. REFL. EVENT>.

NOTE If your marker is already at an existing Event, you are asked if you want to modify this Event.

How to Set the Level-Markers for Measuring Reflectance

Level Markers

You now see 3 *level-markers* on the trace, and a message box asking you to adjust the level-markers (Figure 38). Below this message, you see 4 buttons labeled `Zoom`, `Marker`, `Cancel`, and `Ok`.

Two level-markers are to the left of the Event, and are joined by a *regression line*. A third level-marker is to the right of the Event.

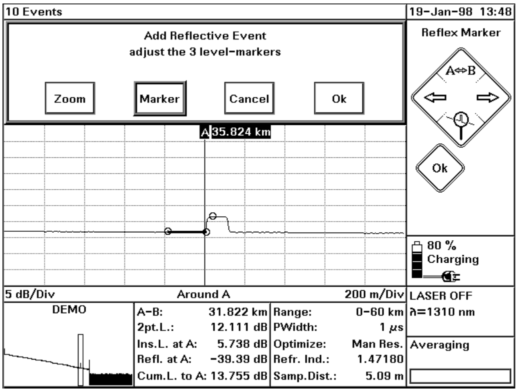


Figure 38 Level-markers for analyzing reflectance

3 Press SELECT to continue.

The `Ok` box above the trace is now highlighted.

You can now use your LEFT and RIGHT cursors to highlight any of the other buttons, and SELECT to select the highlighted command.

How to Zoom while Adding an Event

If the level-markers are too close together, or outside the screen area, you may want to change the horizontal and vertical zooming. You do this as follows:

4 Cursor left to `Zoom`, and press SELECT.

   You now see a message saying `Add Reflective Event change the zoom`.

5 Use your Cursor to change the zoom as required.

   See “Zooming” on page 49.

6 When the zooming is as you want it, press SELECT to continue.

NOTE You exit zoom directly into Marker mode. This is the mode that you enter when you select Marker from the message box.

How to adjust the level-markers.

7 If you are not already in marker mode, cursor to `Marker`, and press SELECT.

   You see a message in the box above the trace telling you to adjust the level-markers.

   You adjust the level-markers by moving the position of the current marker (marker A or marker B).

8 Use your LEFT and RIGHT cursors to move the current marker (marker A or marker B) to the Event.

Position first level marker

9 Press UP to acknowledge the marker position.

   The first level-marker is now highlighted.

10 Use your LEFT cursor to move the first level-marker as far left as you can.

11 Press Up to acknowledge the position of the first level-marker.

Position second level marker

   The second level-marker is now highlighted.

12 Use your RIGHT cursor to move the second level-marker as close as you can to the Event.

You cannot move this marker to the right of the current marker (marker A/marker B).

13 Press UP to acknowledge the position of the second level-marker.

Position third level marker

The third level-marker is now highlighted.

14 Use your LEFT and RIGHT cursors to move the third level-marker to the peak of the reflection.

Set level markers again

15 If any of the level-markers are not correctly positioned, press UP to return to step 8.

The regression line at the left of the marker now shows the path of the trace. The level-marker to the right of the marker should be at the peak of the Event (Figure 39).

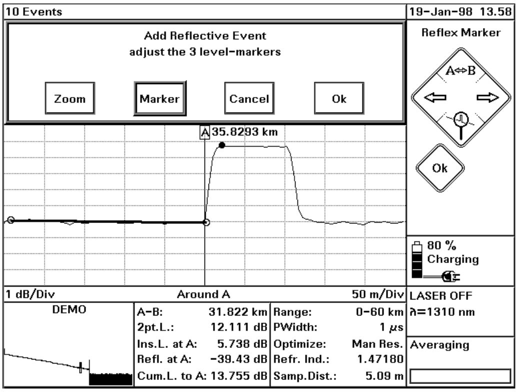


Figure 39 Measuring Reflectance: setting the level-markers

NOTE As you move the level-markers, the Reflectance value in the Parameters window changes accordingly.

This value is listed as `Refl. at A` or `Refl. at B`, depending on the current marker.

Reflection Height If you have chosen the Reflection Parameter to be Reflection Height, reflectance is listed as `Refl.H. at A` or `Refl.H. at B`.
See “How to Set the OTDR Settings” on page 134.

16 When you have positioned the level-markers correctly, press SELECT to continue.

17 Press SELECT again to select `Ok`.

How to Set the Level-markers for Measuring Insertion Loss

NOTE If you just want to measure the insertion loss, select [Events]<Add/Mod. Non-Refl Event> and observe the following steps.

See “How to Add a Non-Reflective Event” on page 119.

Level markers You now see 4 level-markers on the trace, and a message asking you to adjust them (Figure 40). These four level-markers allow you to analyze the Insertion Loss.

Two level-markers are to the left of the Event, and are joined by a regression line. Two more level-markers are to the right of the Event.

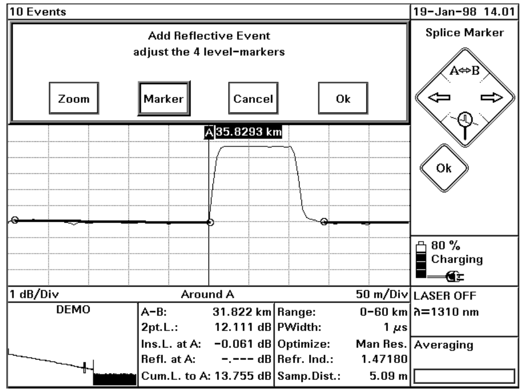


Figure 40 **Level-markers for analyzing insertion loss**

Zoom

18 If you cannot see the Event properly, or see all four markers, use the zoom facility.

See “How to Zoom while Adding an Event” on page 112.

19 If the current marker is not at the Event, move it there using the LEFT and RIGHT cursors.

20 Press UP to acknowledge the marker position.

Position first level marker

The first level-marker is now highlighted.

21 Use your LEFT cursor to move the first level-marker as far left as you can.

22 Press UP to acknowledge the position of the first level-marker.

Position second level marker

The second level-marker is now highlighted.

23 Use your RIGHT cursor to move the second level-marker as close as possible to the Event.

You may not move this level-marker to the right of the current marker.

24 Press UP to acknowledge the position of the second level-marker.

Position third level marker

The third level-marker is now highlighted.

25 Use your LEFT and RIGHT cursors to move the third level-marker as close as you can to the event.

You may not move this level-marker to the right of the current marker.

26 Press UP to acknowledge the position of the third level-marker.

Position fourth level marker

The fourth level-marker is now highlighted.

27 Use your LEFT and RIGHT cursors to move the fourth level-marker, so that the regression line to the right of the Event closely follows the path of the trace.

You may use the zoom function to increase the horizontal zoom range. See “How to Zoom while Adding an Event” on page 112.

28 Press UP to acknowledge the position of the fourth level-marker.

Set level markers again

29 If any of the level-markers are not correctly positioned, press UP to return to step 19.

The two regression lines at the left of the marker now show the path of the trace (Figure 41).

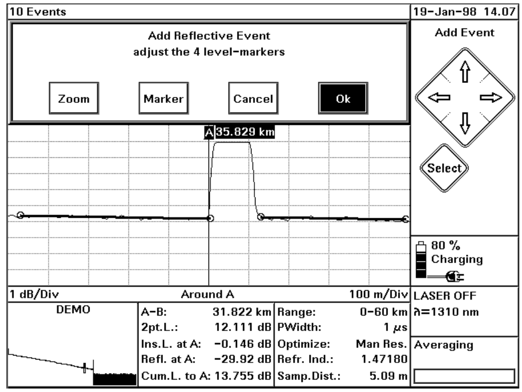


Figure 41 Measuring Insertion Loss: setting the level-markers

NOTE As you move the level-markers, the Insertion Loss value in the Parameters window changes accordingly.

This value is listed as `Ins.L. at A` or `Ins.L. at B`, depending on the current marker.

30 When you have positioned the level-markers correctly, press SELECT to continue.

31 Press SELECT again to select `Ok`.

You can now see the Reflective Event in the Event Table, and in the Event Bar at the bottom of the Trace window.

Added vs. Modified Events Added Events are indicated by an `A` between the entries for `No` and `Type` in the Event Table. Modified Events are indicated by an `M`.

How to Add a Non-Reflective Event

Most of the steps for adding a Non-Reflective Event are also required to Add a Reflective Event. Cross-references in this example refer to steps in “How to Add a Reflective Event” above.

1 Move your marker to where you want to add the event.

2 Select [EVENTS]<ADD/MOD. NON-REFL. EVENT>

level markers

3 You now see 4 level-markers on the trace, and a message asking you to adjust them (see Figure 40).

4 Follow “How to Set the Level-markers for Measuring Insertion Loss” on page 115, to set the splice markers.

You can now see the Non-Reflective Event in the Event Table, and in the Event Bar at the foot of the Trace window.

Added vs. Modified Events

Added Events are indicated by an `A` between the entries for `No` and `Type` in the Event Table. Modified Events are indicated by an `M`.

How to Measure the Total Loss of the Fiber

This section describes the examination of the fiber’s total loss. Analyzing the loss is one of a number of measurements that can be made using the OTDR. Others include measuring attenuation, insertion loss or reflectance

To measure the total loss, first mark the start and the end of the fiber:

Use marker B to...

1 Activate marker B using the UP key (marked A↔B on the screen diagram). When marker B is activated, it is highlighted at the top of the screen.

...mark end of fiber

2 Use the LEFT and RIGHT keys to place marker B where the backscatter and the left rising edge of the end-reflection meet

3 Press the DOWN key to view around the marker, and thereby check the position of the marker.

4 Place the marker as close as possible to the left rising edge for best accuracy. Use the Zoom function for better accuracy.

   The marker should now be near an Event.

Declare End

5 Select <DECLARE END> from the [EVENTS] menu.

   An End is set at the Event. See “How to Set the Fiber End” on page 98 for more details.

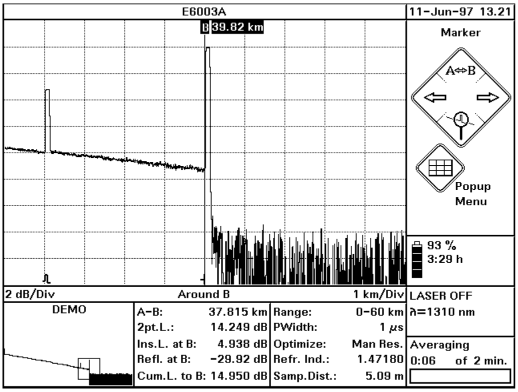


Figure 42 Declaring an End at the edge of the backscatter

6 Press the DOWN key to see the whole trace again.

Use marker A to...

7 Press the UP key to activate marker A.

...mark start of fiber

8 Move the marker to the far left-hand side and press the DOWN key to select the start of the fiber

You now see the deadzone from the front-panel reflection at the start of the fiber.

9 Position the marker so it cuts the trace in the same vertical position as the backscatter extrapolated back to 0 m to take into account the loss in the deadzone.

Analyze for 2-point Loss

10 Select [ANALYSIS] from the popup menu.

11 If there is no tick next to <2-PT LOSS>, highlight it and press SELECT. Otherwise select <CLOSE ANALYSIS MENU>.

You see the result in the text beneath the trace as `2pt.L`.

NOTE For a simpler method of viewing the loss, look at `Cum.L. to A` (or `Cum.L.to B`) in the box beneath the trace. This gives you the cumulative loss to the current marker.

How to Calculate Reflectance or Insertion Loss for existing Events

How to Calculate Reflectance

1 Move the active marker to an Event.

Analyze Reflectance

2 Select the [ANALYSIS]<ANALYZE REFLECTANCE> menu option.

Set level markers

3 Follow the steps in "How to Set the Level-Markers for Measuring Reflectance" on page 112 to position the level-markers properly.

4 Read the Reflectance for the Event in the Marker Info. window.

The Reflectance is written at `Refl. at A` (or `Refl. at B`, depending in the current marker).

NOTE If you have chosen the Reflection Parameter to be Reflection Height, reflectance is listed as `Refl.H. at A` or `Refl.H. at B`.
See "How to Set the OTDR Settings" on page 134.

Remove level markers

5 Remove the level-markers by deselecting [ANALYSIS]<ANALYZE REFLECTANCE>.

How to Calculate Insertion Loss

1 Move the active marker to an Event.

Analyze Insertion Loss

2 Select the [ANALYSIS]<ANALYZE INSERTION LOSS> menu option.

Set level markers

3 Follow the steps in "How to Set the Level-markers for Measuring Insertion Loss" on page 115 to position the level-markers properly.

4 Read the Insertion Loss for the Event in the Marker Info. window.

The Insertion Loss is written at `Ins. L. at A` (or `Ins. L. at B`, depending in the current marker).

Remove level markers

5 Remove the level-markers by deselecting [ANALYSIS]<ANALYZE INSERTION LOSS>.

How to alter measurements in real time

1 Select [SETTINGS] from the OTDR Mode popup panel.

2 If you are not already viewing the `Meas. Parameter` page (Figure 12), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

Select Realtime measurement

3 Move to <MEAS.MODE> and press SELECT. Select `Realtime` from the menu, and confirm by selecting `OK`.

4 Start a measurement by pressing the RUN/STOP key. You see a dialog box saying `Realtime Measurement Started`.

5 Select [SETTINGS] from the popup panel. You now see a smaller settings screen above the trace. This screen shows variables that can be changed while the measurement is running.

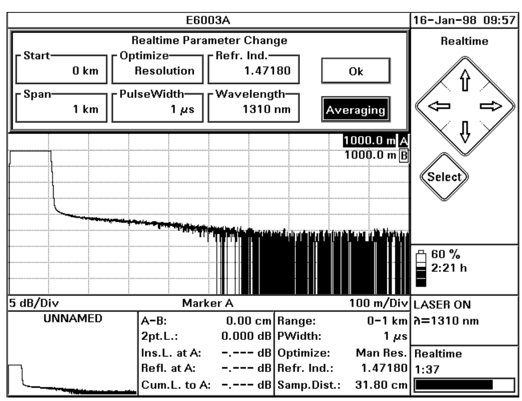


Figure 43 Realtime settings menu

Change parameters

6 Move to a parameter that you want to change and press SELECT.

7 Use the UP and DOWN cursors to alter the value of the parameter. When you have the value you want, press SELECT.

8 Repeat steps 6 and 7 until you have the settings you require.

9 Cursor RIGHT to `Averaging` and press SELECT. The Measurement Mode has now been changed back to Averaging.

NOTE If you select `OK`, the measurement stays in Realtime.

How to measure in Construction Mode

Construction mode allows you to toggle the measurement mode, keeping all marker settings and positions constant.

You take a measurement with Construction mode, as follows.

Make real time measurement

1 Make a real time measurement (see How to alter measurements in real time, above).

Analyze Insertion Loss

2 Move the Marker to where you want to measure the Insertion Loss.

3 Select <ANALYZE INSERTION LOSS> from the [ANALYSIS] menu.

You see auxiliary markers for measuring Insertion Loss.

4 Alter the auxiliary markers as appropriate. See “How to Calculate Insertion Loss” on page 122.

5 If you want to measure the Insertion Loss more precisely, stop the measurement and restart it in Averaging Mode.

Run another measurement When you press the Run/Stop button to run another measurement, all zooming and marker settings are maintained.

How to Display and Compare Two Traces

Show first trace

1 Make the first trace as normal, either using the RUN/STOP key, or by opening an existing file using <OPEN.> from the FILE menu.

Select empty trace

2 If it is not already open, select [FILE] from the popup menu. A menu appears with two trace names at the bottom. One of the traces is the one that you have just selected (the ‘Current trace’). There will be a tick next to this trace

3 Cursor down to the other trace and press SELECT. If you are currently only displaying one trace, this trace will be called `<empty>`.

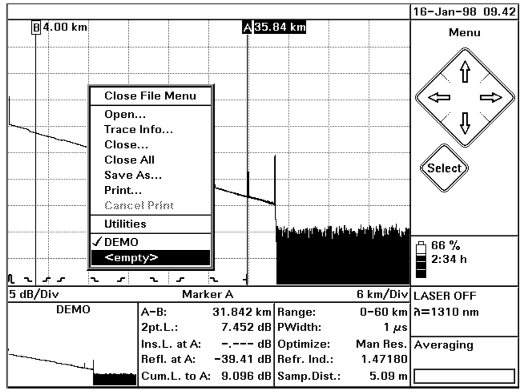


Figure 44 **Selecting the empty trace**

NOTE If you have set a Horizontal Offset (see “How to Set the Horizontal Offset” on page 96), this is retained when you select an empty trace.

However, when you select an existing trace, the Horizontal Offset set for this trace is used.

Show second trace

4 Make a second trace, as in step 1. You now see two traces (Figure 45)

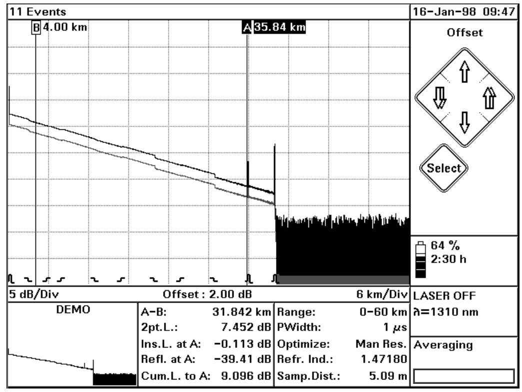


Figure 45 Two traces on the same picture

NOTE The new trace will be darker than the original trace.

If you have a color display, the second trace has the same color as the grid.

The next time you make a trace, it will replace the one you have just made. If you want to show just one trace again, select <CLOSE...> or <CLOSE ALL> from the [FILE] menu.

If you want to replace a different trace, follow step 3 to change the current trace.

How to Use the Vertical Offset

If you are viewing two similar traces, it is possible that one trace will obscure much of the other one. If this is the case, you may want to use the Vertical Offset to move one trace up or down.

You use the Vertical Offset as follows:

Adjust Vertical Offset

5 Select [VIEW] from the popup menu. Select the menu item <ADJUST V-OFFSET>.

The diagram for the Cursor changes (Figure 46). You see single arrows for UP and DOWN and double arrows for LEFT and RIGHT.

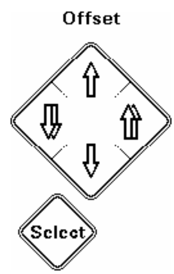


Figure 46 Cursor diagram - adjust Vertical Offset

6 If you want to move the current trace slightly, use the UP and DOWN cursors for fine tuning.

Adjust larger increments

If you want to move in larger increments, use the LEFT cursor to move down, and the RIGHT cursor to move up.

NOTE When a vertical offset has been set, you see a tick next to <ADJUST V-OFFSEt> in the [FILE] menu.

To clear the vertical offset, select [FILE]<CLEAR V-OFFSET>.

5

Sample Sessions: Instrument Configuration

"Sample Sessions: Measuring a Trace" on page 81 and *"Sample Sessions: Analyzing an Existing Trace" on page 107* showed what you can do in OTDR Mode of the Mini-OTDR.

Sample Sessions

The following Sample Sessions show you how to configure your Mini-OTDR. It should be used in conjunction with the previous sections.

The following sample sessions show you how to:

- General Configuration,
- OTDR Settings,
- Trace Information,
- Instrument Setup,
- Printer Configuration (including How to Add a Logo),
- Firmware/Language Update.

The equipment used in these Sample Sessions is the same as before.

How to Set the General Configuration

Start up screen

1 Switch on the Mini-OTDR. You will see one of the following screens:

Select Instrument Config

– If you see a series of boxes like Figure 6, you are in the Applications Screen. Cursor Right to `Instrument Config` and press SELECT.

– If you see an empty trace like Figure 7, you are in *OTDR mode* or *EasyMode*.

Press SELECT to access the popup panel:

If the top right option is [CONFIG.], you are in *OTDR Mode*. Select [CONFIG.], then select <INSTRUMENT CONFIG.> from the submenu that now appears.

If the top right menu option is [PRINT], you are in *EasyMode*. Select [CLOSE] from the popup panel. You are now at the Applications Screen, and can select `Instrument Config`.

– If you see a menu like Figure 57, you are in the Multiple Fiber Test. Select `Close`, then select `Instrument Config` from the Applications screen.

– Otherwise, you are in *Fiber Break Locator* (Figure 65) or *Source Mode* (Figure 66). Move to the `Close` box and press SELECT. You are now at the Applications Screen, and can select `Instrument Config`.

How to Set the General Parameters

2 You now see a window with the headings `Instrument Configurations` and `General Parameters`. The

window contains two columns of features that can be changed.

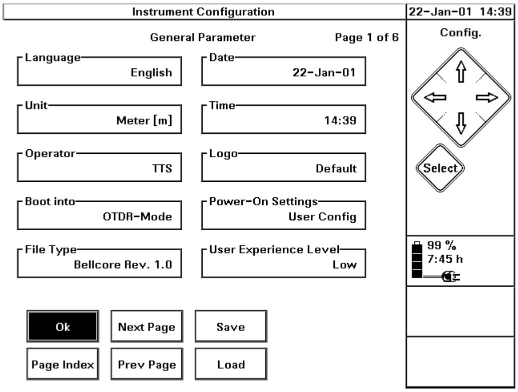


Figure 47 Instrument Configuration General Parameters Screen

You can move to any of these boxes and press Select. You can change the default setting using one of the following methods. Note that the changes are not applied until you save the settings (see step 12 below).

How to select a setting from a list

Change language

3 Move to the box headed `Language` and press SELECT. You see a list of the available languages for the User Interface.

4 Cursor DOWN to the language you want and press SELECT. The language that you have just selected appears in the dialog box.

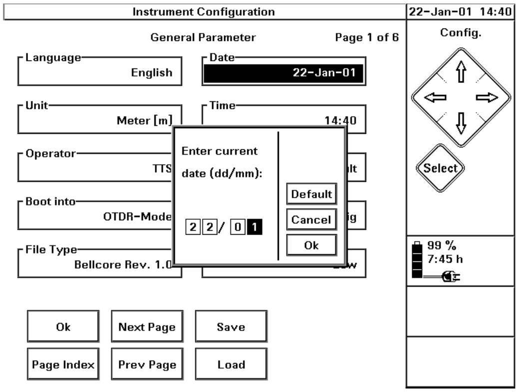


Figure 48 Entering Numerical Data

How to change a numerical setting

Change Time

5 Move to the box headed `Time` and press SELECT. You see the current time.

6 Cursor LEFT and RIGHT to highlight the digit(s) that you want to change. Cursor UP and DOWN to increase or decrease the highlighted digit.

7 When you have the correct time, cursor right to `OK` and press SELECT.

How to change a text setting

Change Operator name

8 Move to the box headed `Operator` and press SELECT. You see a keyboard with the Current Operator name.

9 Move to the letters you want, and press the SELECT key. Move to `Del` to delete the previous character, and to `CAPS` to change the case of subsequent letters.

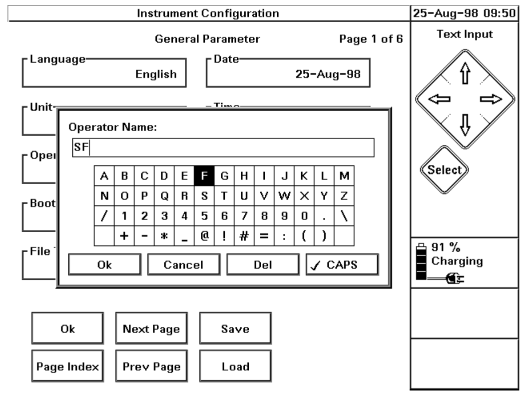


Figure 49 Keyboard to Enter Text

10 When you have the text you want, move to OK and press SELECT.

NOTE You can also add text from an external keyboard such as a PC or an organizer. Attach a serial line to the Mini-OTDR, and type `keyb`. See the *OTDR Programming Guide* (Agilent Product Number E4310-91016) for more details.

You can also operate your Mini-OTDR remotely using the Agilent E6091A OTDR Toolkit II software. See the *OTDR Toolkit Operating Instructions* (Agilent Product number E6091-91013) for more details.

Change other parameters

11 Set other features in the General Parameters screen as required:

- Select units from `Meter [m]`, `Feet [Ft]`, and `Miles [mi]`.
- Select Bellcore revision type.

  Bellcore revision 2.0 conforms to standards, but you may need to use earlier Bellcore revisions for backward compatibility.

– Select and set the Date. Confirm with `OK`, then use the same procedure to set the Year.

NOTE The date is entered in European format dd/mm, for example 08/02 for 8 February

– Select and set the screen and settings that appear when you switch on (`Boot into` and `Power-on Settings` respectively).

How to Save the Instrument Configuration

12 When you have chosen the configuration you want, move to the `Save` box and press SELECT. The configuration that you have just specified is saved as the default configuration.

Exit Instrument Configuration

13 Select `OK` to return to the previous screen (Applications Screen or Trace Screen, depending how you selected Instrument Configuration in step 1).

How to Set the OTDR Settings

Select OTDR Settings page

1 Move down to `Page Index` and press SELECT. Select `OTDR Settings`. You see a screen headed `OTDR Settings` (Figure 50).

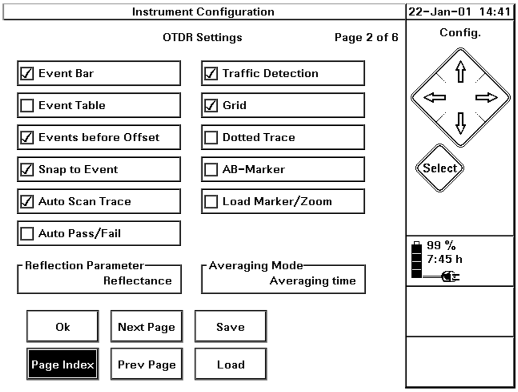


Figure 50 OTDR Settings screen

At the top of the OTDR Settings screen you see a two-column list of features that may appear on the trace screen (Event Bar, Event Table, and so on).

2 Use the CURSOR and SELECT keys to move to these features and select and deselect as required.

At the bottom of the OTDR Settings screen, you see boxes where you can choose the Reflection Parameter and Averaging Mode.

Reflectance Parameter

The Reflectance Parameter determines the way in which the Reflectance of Events is displayed (this affects the Reflectance Threshold and the Front Connector Threshold):

- **Reflectance**: The physical value of the reflective Event. This remains constant for all settings.
- **Reflection Height**: The height above the backscatter. This may change if the Pulsewidth or Scatter Coefficient are altered.

Averaging Parameter

The Averaging Parameter determines when Averaging is stopped:

- **Averaging Time**: after a specified period of time has elapsed.
- **Number of Averages**: after a specified number of measurement acquisitions.

3 Cursor to each box, and select the Reflectance and Averaging Parameter that you want.

   What you select affects the parameters that appear in the Settings menu on the Trace screen. See "The Settings screen" on page 50.

Change other settings

4 Continue selecting screens from the `Page Index` to alter other configurations. You are also able to alter the `Default Trace Info`, `Instrument Setup`, `Printer Setup`, and `Firmware/Language Update`.

NOTE If you have a color Mini-OTDR (E6000C option 003), you can select whether or not the current display is color by VIEW - PREFERENCES options.

You can choose between BLACK/WHITE, COLOR INDOOR (for indoor use) and COLOR OUTDOOR (for outdoor use).

How to Set the Trace Information

How to Set the Default Trace Information

Select Default Trace Info page

1 Access the *Instrument Configuration* Screen by following step 1 from "How to Set the General Configuration" on page 130

2 Select `Default Trace Info.` from the `Page Index` menu. You see a screen listing 5 labels and 5 comments.

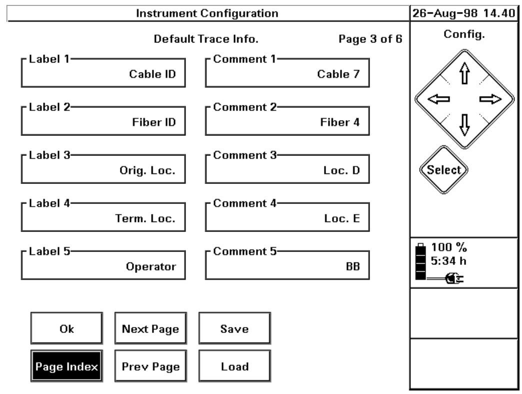


Figure 51 Default Trace Info Configuration screen

Change comments

3 Move to the box headed `Comment 1` and press SELECT. You see a keyboard on the screen (see Figure 49), Add letters from the keyboard until your comment is complete.

4 Confirm your comment by moving to `OK` and pressing SELECT.

5 Repeat steps 3 and 4 for the remaining comments.

Change labels

6 By default the labels are `Cable ID`, `Fiber ID`, `Orig.Loc.`, `Term Loc.` and `Operator`. If you want to change any of these labels, move to the appropriate box and press SELECT. Enter the text as before, selecting `Del` to delete unwanted text.

7 Cursor down to the `Save` box and press SELECT. The new Comments and Labels are now saved.

Exit Instrument Configuration

8 Select `OK` to exit Instrument Configuration. If you now return to the Applications Screen, select *OTDR Mode*.

You now see the Trace screen, where you can set features for traces.

How to Set the Information for the Current Trace

You can also use the following procedure to alter the labels and comments

Select Trace Info

9 Select the popup panel by pressing the SELECT key.

See Figure 2 on page 33 for an illustration of the Mini-OTDR hardkeys.

10 Select [FILE] from the popup panel.

You select [FILE] by pressing the UP cursor twice, or by pressing UP, then SELECT.

11 Select <TRACE INFO> from the file submenu.

You select a submenu by pressing the DOWN cursor until the submenu item is highlighted, then pressing SELECT.

You see a list of comments and labels (Figure 52).

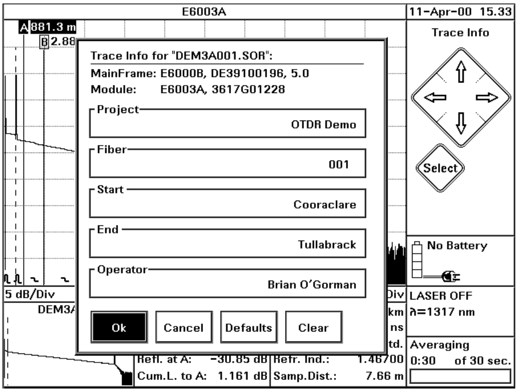


Figure 52 Trace Info Screen

Bring up default Info

12 Select `Defaults` from the Trace Info screen. You see the labels and comments that you have just set.

13 Cursor UP to each label and press SELECT. You see a keyboard on the screen which lets you modify the comment. Press `Ok` in the keyboard when you have completed each comment.

Delete label

14 If you want to delete any label, press `Clear`.

You see a menu allowing you to clear any individual label, or `All` labels.

NOTE The default comments are intended as a starting point for the file information, and should be modified for the current trace.

15 Confirm by selecting `Ok`. When you print or save a measurement, the comments and labels are also printed/saved.

See “How to Print the Measurement” on page 100 and “How to Save the Measurement” on page 104 for information on printing/saving measurements.

How to Connect to a PC using the RS232

This is a brief example of how you configure your Mini-OTDR for connecting to a PC. For more details and information about the hardware settings, please consult the *Agilent OTDRs Programming Manual* (E4310-91016).

How to Set the Instrument Setup

Instrument Configuration

1 Follow step 1 in “How to Save the Instrument Configuration” on page 134 to bring up the Instrument Configuration screen.

2 Select `Page Index` to see a list of the Configuration screens. Select <INSTRUMENT SETUP> from this list.

You see the Instrument Setup screen (Figure 53).

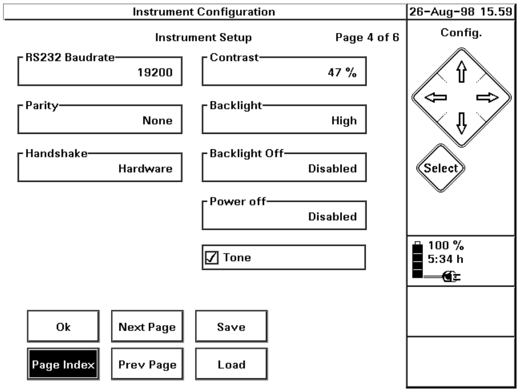


Figure 53 Instrument Setup screen

Set Baudrate and Handshaking

3 If necessary, change the baudrate to 19200. To change the baudrate, select the `RS232 Baudrate` box and choose the required menu option.

4 If necessary, select `Handshake` and change to Hardware.

Save settings

5 Select `Save` to save this configuration.

How to Set up the Printer Configuration

NOTE For information on how to print a file, see “How to Print the Measurement” on page 100.

Instrument Configuration

1 Select [CONFIG.] from the popup panel.

2 Cursor Down to the <INSTRUMENT CONFIG.> option and press SELECT. You see the configuration for `General Parameters`.

NOTE Alternatively, if you start from the Applications screen (Figure 6), just select the `Instrument Config.` box.

3 Move to `Page Index` and press SELECT. Select `Printer Setup`. You see a window showing the current printer configuration.

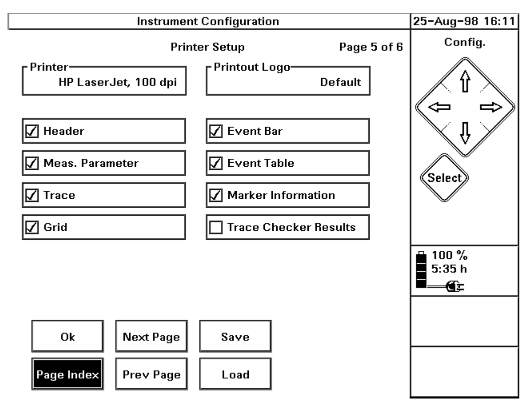


Figure 54 Printer Setup Configuration

Select printer

4 Cursor UP to the box headed `Printer`. If the printer listed there is not the one you want, press SELECT. Choose a printer from the available ones listed.

NOTE Most HP printers (but not the Thinkjet) will work in the HP LaserJet, 100dpi setting. For non-HP printers, set emulation mode on your printer, and select an appropriate print option.

So, select the `HP LaserJet/HP DeskJet` for HP emulation, `PCL` for PCL emulation, or `Epson 8-pin` for Epson emulation.

Choose a 150 dpi option if you want a compact printout.

Select logo

5 If you want to change the printed logo, cursor DOWN to `Printout Logo` and press SELECT. Choose a logo from the available .PCX files. Select `Default` for the default Logo, or `Select` for the one that is currently highlighted.

If you want to create a new logo, follow the steps in How to Add a Logo, below.

Specify what is printed

6 Look at the options on the right of the `Printer Setup` window. There is a tick next to the features that will appear on the printout. If you wish to add or delete any of these features, move to that item and press SELECT.

7 When you have the printer configuration you want, select `Save` then `OK` to return to the main trace window or Applications Screen.

How to Add a Logo

To add a specified logo to the screen and printout, you should do the following:

How to copy a Logo to the Mini-OTDR

Create PCX file

1 Create a PCX image, with 200 x 100 pixels. Make sure that the file has the extension `.PCX`.

NOTE Your .PCX image can be monochrome or with 7 colors. If your original image has more colors, you may want to save it with 7 colors to preserve its clarity.

Your PCX file must not be bigger than 25 kilobytes.

2 Record the file on a floppy disk, and insert the disk into the Mini-OTDR's floppy disk drive.

Select File Utilities

3 Select `File Utility` from the *Applications Screen*.

Alternatively,

♦ Select [FILE] from the popup panel, and the <UTILITIES> menu option.

You now see the *File Utilities* screen.

4 Select `Copy`. A dialog box appears containing a list of files.

Copy PCX to your Mini-OTDR

5 Select `Device` from the dialog box. You see a submenu listing the available devices. Select `Floppy`, if it is not selected already. The <COPY> menu now lists the files on the floppy disk.

6 Move to the correct .PCX file containing the logo, and press SELECT. A tick appears next to the filename.

7 Move to `Copy` and press SELECT. You see a dialog box asking you to select a device name. Highlight `Internal` and press SELECT.

How to Update the Firmware and Languages

Follow these instructions to update a new version of the Mini-OTDR firmware, or to update the languages of your Help and User Interface.

NOTE Updating the firmware and the language involves rebooting your Mini-OTDR.

Before starting an update, make sure that you have saved all traces, settings, and so on, that would be lost during a reboot. The internal memory is not deleted by the update.

Update floppy disks

To update the firmware or languages, you need to create floppy disks by copying some images from the Support CD provided with your Mini-OTDR.

Copy `IMG1.IMG`, `IMG2.IMG`, and `IMG3.IMG` for the firmware update, and `LANG1.IMG`, `LANG2.IMG`, `LANG3.IMG`, and `LANG4.IMG` for the language update. Be sure to use the copy disk facility provided on the Support CD.

Connect to power supply

1 Connect your Mini-OTDR to an AC/DC power supply. See “Connecting an AC/DC Adapter” on page 78

Instrument Configuration

2 Access the *Instrument Configuration* Screen by following step 1 from “How to Set the General Configuration” on page 130

3 Select `Firmware/Language Update` from the `Page Index` menu.

4 You see a screen where you can set the languages or Update the Language or Firmware (Figure 55).

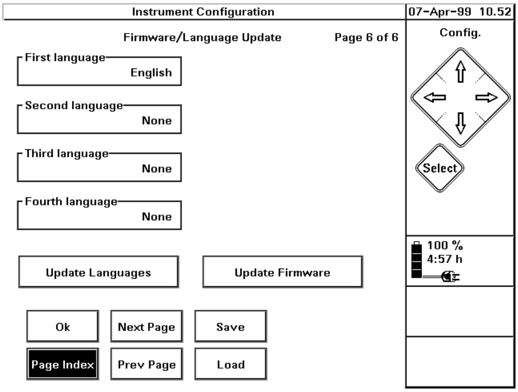


Figure 55 Firmware/Language Update configuration page

How to Update the Firmware

Update firmware

5 Cursor to `Update Firmware` and press SELECT.

You see a message reminding you to save all important data (see first note in this section).

6 Select `Yes` to continue.

You are now asked to insert update disk #1.

7 Insert the disk and press SELECT.

8 Follow the remaining instructions that you see on your Mini-OTDR screen.

How to Update the Languages

After the firmware update, you return to the `Firmware/ Language Update` screen, so that you can update the languages configured on your Mini-OTDR.

Please note that after you have updated the firmware, you should follow this procedure, even if you just have the English interface.

NOTE You can also follow these instructions to change the languages configured on your Mini-OTDR without updating the firmware.

Update first language

9 Cursor up to `First Language` and press SELECT.

You are asked to insert the Language Update Floppy disk. This disk contains the information about which languages you can select.

10 Insert the disk in your Mini-OTDR floppy disk drive and press SELECT.

You see a list of available languages.

11 Cursor up or down to the language that you want, and press SELECT.

Select more languages

12 Repeat this process as required for `Second Language`, `Third Language`, and `Fourth Language`.

If require fewer than 4 languages, you can select `None` for the extra language options.

NOTE You cannot choose the same language twice.

So, for example, if you choose French as both the second and third language, you will see an error message, and the Mini-OTDR will suggest an appropriate configuration.

13 When you selected your required languages, cursor to `Update Language` and press SELECT.

You see a message telling you to make sure that you have save all important data.

14 Follow the instructions on the Mini-OTDR screen.

After the update, your Mini-OTDR automatically reboots.

NOTE You can also update your firmware or languages using the Update executable file provided on your support CD.

Connect your Mini-OTDR to a pc with an RS232 cable (see *“External connections” on page 70*). You can then set the configuration you need, and press `Start`. The update software will tell you how to proceed.

6

Sample Sessions: Other Mini-OTDR Modes

"Sample Sessions: Measuring a Trace" on page 81 and *"Sample Sessions: Analyzing an Existing Trace" on page 107* showed what you can do in OTDR Mode of the Mini-OTDR. *"Sample Sessions: Instrument Configuration" on page 129* showed you how to configure your Mini-OTDR.

This chapter shows you how to use other modes of the Mini-OTDR. The available modes are seen as options on the Applications Screen (see "The Applications Screen" on page 39).

Sample Sessions

The following sample sessions show you how to:

- Recall Settings in EasyMode,
- Test Multiple Fibers,
- Use the Fiber Break Locator,
- Use Source Mode,
- Use Source Mode with the Power Meter and Visual Fault Finder Submodules.

If you have not used a Mini-OTDR before, you should first read the previous sections. The equipment used in the following Sample Sessions is the same as before.

How to Recall Settings in EasyMode

Templates Templates allow you to save settings from previous traces to use in EasyMode. All templates have the extension ".TPL".

The template includes the settings which have been specified in the `OTDR Settings` page of the `Instrument Configuration` menus (see "How to Set the General Configuration" on page 130).

Contents of template Formats which may be saved in a template are: the Event Table (which is locked), all measurement parameters, and the strings set in "How to Set the Trace Information" on page 136.

How to Save a Template

1 Select the settings you want to save. These may be variables from the [SETTINGS] menu, Trace Information, or information from the Event Table.

2 Run a measurement (see "How to Run the Measurement" on page 87).

3 Select [FILE] from the popup panel. Cursor DOWN to the <SAVE AS...> option. and press SELECT.

4 Select `New Name`. Enter a name for the template using the onscreen keyboard, making sure that it has the extension ".TPL".

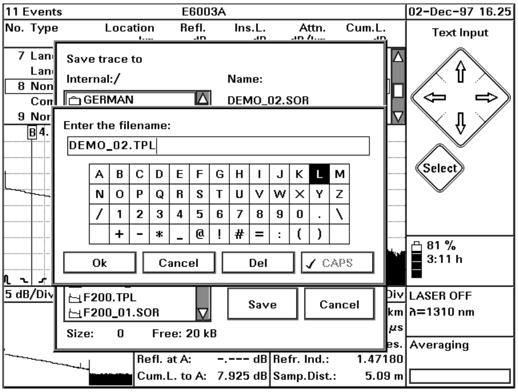


Figure 56 Saving the current settings in a template.

NOTE Only files with the extension .TPL can be used as templates. If you use any other extension, your file will be saved as a normal trace, and will not be displayed in the EasyMode Settings menu.

5 Select `OK` to confirm. Then click the `Save` box in the `Save As` menu.

6 Exit OTDR mode by selecting [CLOSE] from the popup panel.

How to Read from a Presaved Template

Easy OTDR Settings

7 Select *Easy OTDR* from the Applications screen.

8 Select [SETTINGS] from the popup panel. You see a directory structure. Move to the presaved .TPL or .SET file. Press SELECT to read from this file.

NOTE Settings (.SET) files just contain information from the Settings screen. For information about saving a settings file, see the note on page 50.

9 Start a new trace by pressing the RUN/STOP key. The new trace is made with the settings that you have previously saved.

NOTE For more details about the facilities available in EasyMode, see “EasyMode” on page 62.

How to set up a Multi Fiber Test

Multi Fiber Test Mode allows you to measure and save many traces on different fibers with up to four different measurement setups per fiber.

You can save a setup as a setting (*.SET), template (*.TPL), or Trace (*.SOR) file, then measure a series of fibers with these presaved parameters.

For details on how to save a file, see “How to Save the Measurement” on page 104, or “How to Save a Template” on page 150.

How to Navigate within the Multi Fiber Test Config page

Multi Fiber Test mode

1 Select *Multi Fiber Test* from the Applications screen.

You see the Mutifiber Test Configuration screen (Figure 57). The page that you see is the one visited last in this Configuration screen.

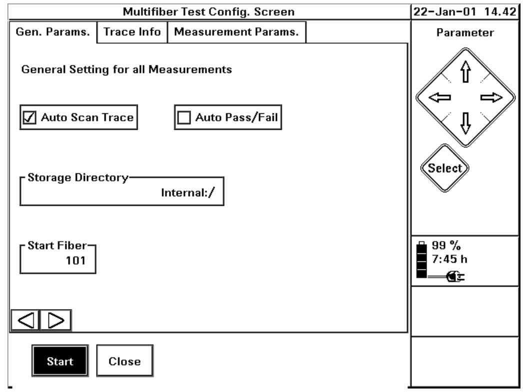


Figure 57 Mutifiber Test Configuration screen

Navigation between pages At the bottom left of this screen, you see two navigation arrows.

Figure 58 Multi Fiber Test Navigation arrows.

2 Use your cursor to highlight one of these arrows.

You can then press SELECT one or more times to move to other Multi Fiber Test Config pages.

Configuration pages The arrows cycle through the 3 Configuration pages:

- *Gen Params* sets parameters common to all measurements.
- *Trace Info* sets the comments associated with each trace.
- *Measurement Params* sets the measurement setups and names of the measurements.

How to Set the Multi Fiber Test Measurement Parameters

Measurement Parameters screen

1 Navigate to the Multi Fiber Test Measurement Parameters screen.

See “How to Navigate within the Multi Fiber Test Config page” on page 152 for details of how to navigate.

You see the Measurement Parameters screen (Figure 59).

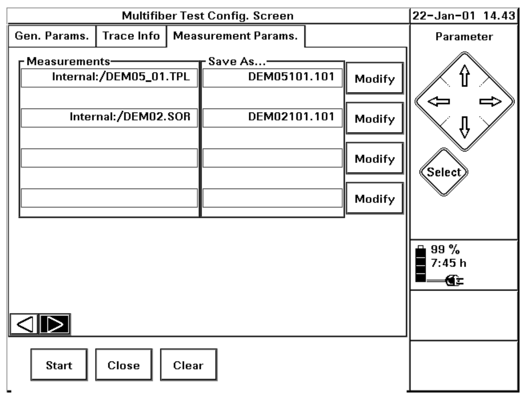


Figure 59 Multi Fiber Test Measurement Parameters screen

2 Cursor up to the first `Measurements` edit field, and press SELECT. Select the file containing your desired setting. If the file is on a different device (for example, a floppy disk), select `Device`.

How to change the settings

If you have selected a Settings file (one with the extension .SET), you may alter the settings saved within this file. Measurements are taken with the new settings and the file is permanently changed.

You change the settings as follows

3 Cursor right to the `Modify` button and press SELECT.

4 Modify the settings as you would from the OTDR Mode Settings page.

See *“How to Change the Refractive Index Setting” on page 82* for an example of how to change the settings.

5 When you have changed all the settings you want, select OK.

NOTE If you try to modify a .SOR or .TPL file, you see an error message saying that this is not possible.

How to change the file name

Default file name The measurements are saved to a file. By default, the name of this file is derived from the Measurements name, and the fiber number.

For example, if you use the measurements from DEMO.SOR with a fiber numbered 100, the saved trace will have the default name DEMO_100.SOR. This default name is written in the appropriate Save As... column.

You can select a different name as follows:

Save with new name

6 Cursor to the Save As.. edit field next to the measurement you have just set.

7 Press SELECT.

You see a screen keyboard, containing the current Save As name.

8 Use the screen keyboard to enter a new name.

You see a highlighted point in the edit field, where characters are inserted or deleted. Use the left and right cursors to move this point, which is still highlighted when you cursor down to new characters or the Del button.

9 Add your own file extension by entering a . followed by characters of your choice.

If you do not specify a file extension, the default extension .SOR is used.

NOTE File names are a maximum of 8, and file extensions are a maximum of 3 characters long.

File name limits

If you attempt to add to an 8 character file name or to a 3 character extension, you will hear a beep and no characters will be added.

How to save multiple settings

10 If you want to measure the fiber with more than one setup, repeat step 2 (and steps 6 to 9 if required) for the remaining Measurements (and Save As) edit fields.

NOTE If you choose the same name for more than one setting, the first measurement is saved to a file, and this file is overwritten when the second measurement is taken.

So, for example, if you save two separate measurements as USER_01.SOR, the first measurement will be saved to the file USER_01.SOR, and this file will be overwritten when the second measurement is taken.

How to Set the Multi Fiber Test Trace Information

Trace Info screen

1 Navigate to the Multi Fiber Test Trace Info screen.

See "How to Navigate within the Multi Fiber Test Config page" on page 152 for details of how to navigate.

You see the Trace Info screen (Figure 60).

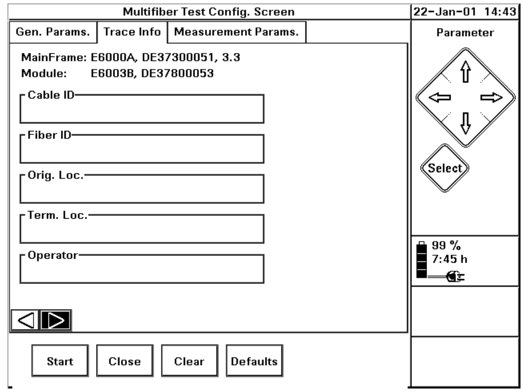


Figure 60 Multi Fiber Test Trace Info screen

Edit label

2 If you want to alter any of the labels, cursor to the appropriate edit field and press SELECT. Edit the label using the screen keyboard.

NOTE You can save the Fiber number in any of the Trace Info comments, by using the string `#000`.

For example, if you specify a Fiber ID of `Fiber #000`, and the current fiber number is 100, the Fiber ID is saved as *Fiber 100*.

How to Set the Multi Fiber Test General Parameters

General Parameters screen

1 Navigate to the Multi Fiber Test General Parameters screen.

See “How to Navigate within the Multi Fiber Test Config page” on page 152 for details of how to navigate.

You see the General Parameters screen (Figure 61).

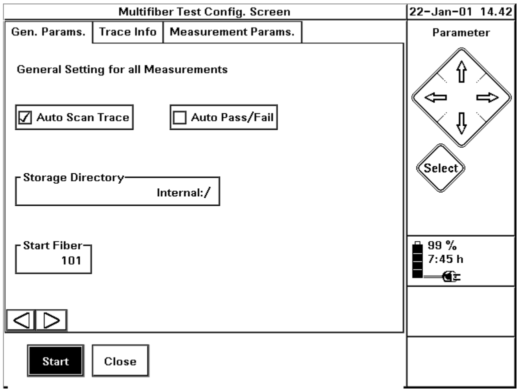


Figure 61 Multi Fiber Test General Parameters screen

Start Fiber number

2 If you want, change the Start Fiber number, by which the first fiber is identified.

The default names of traces saved in Mutifiber Test mode automatically contain the fiber number.

For example, if the Start Fiber number is 100, the first fiber saved with settings from `DEMO.SOR` will have the name `DEMO_100.SOR`, the next fiber saved will be `DEMO_101.SOR`, and so on.

Storage Directory

3 By default, traces from Mutifiber Test mode will be stored in the top-level directory in the Mini-OTDR internal memory.

If you want to store your traces somewhere else, select `Storage Directory`, and choose a new directory and/or device.

Auto Scan Trace

4 If you want to generate an Event Table for each trace, check Auto Scan Trace.

Auto Pass/Fail

5 If you want to perform a Pass/Fail test on each trace, check Auto Pass/Fail.

Please be aware that selecting *Auto Scan Trace* or *Auto Pass/Fail* may mean that traces take longer to analyze.

How to Take Multi Fiber Test Measurements

1 Select the settings you want for a Multi Fiber Test (see previous sections).

Start Measurement

2 Select `Start` to start the measurement.

You see the message, `Connect Fiber` *nnn* `and press OK!`, where *nnn* is the next fiber number (Figure 62).

Figure 62 **Connect Fiber message**

3 If you have not yet done so, attach a fiber to your connector interface.

How to Preview a Realtime Measurement

Preview

4 Select `Preview` to view the measurement in realtime.

5 Adjust the Markers as appropriate, to view the values in the parameter windows.

See “The Cursor and Select keys” on page 46.

Zoom around current marker

6 To view a particular part of the trace, use the DOWN cursor to zoom around the current marker.

7 When you have seen enough of the preview measurement, press SELECT to return to the connect fiber message (Figure 62).

How to View the Actual Measurement

Start measurement **8** Press `Ok` to start the measurement

NOTE If you want to return to the Multi Fiber Test Configuration screen (Figure 57), select `Config`.

To abandon the measurement entirely, and return to the EasyMode screen, press `Close`.

The fiber attached to your Mini-OTDR is measured for each selected measurement setup. If you have not specified any measurement setup, you see an error message, and no measurements are performed.

Saved files Files are saved to the conventions explained in “How to change the file name” on page 155.

You now see the message, `Connect Fiber` *`nnm`* `and press OK!`, where *nnm* is the next fiber number (incremented by 1).

Measure a new fiber **9** If you want to measure another fiber, connect the new fiber to your Mini-OTDR, and select `OK`. If you do not want to view any more fibers, select `Close`.

How to Use the Fiber Break Locator

The Fiber Break Assistant

When you first start the Fiber Break Locator, you see a message giving you hints on how to proceed. This is the Fiber Break Assistant.

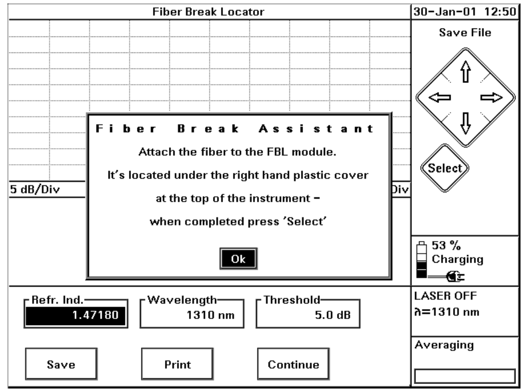


Figure 63 Fiber Break Assistant

Purpose of Fiber Break Assistant

The aim of the Fiber Break Assistant is to help people who have not used the Fiber Break Locator before.

You can turn off the Fiber Break Locator as follows:

1 Bring up the *General Settings* page of the Instrument Configuration (see *"How to Set the General Configuration" on page 130*).

Change User Experience Level

2 Select a `High` *User Experience Level*.

3 Select `Save`, then exit the Instrument Config pages.

With a High user experience level, some of the steps in the following example will be missing. To re-enable the Fiber Break Assistant, return to the Instrument Config page, and select a user experience level of Low.

Using the Fiber Break Locator

1 Select *Fiber Break Locator* from the Applications Screen.

Attach a fiber

2 If you have not already done so, attach a fiber to your Mini-OTDR module (see *"Inserting a Module" on*

page 37 and *“Adding a Connector Interface” on page 38*).

The Fiber Break Assistant gives you information about connecting a fiber and selecting a cable vendor.

3 To move to the next screen in the Fiber Break Assistant, press SELECT after reading each page.

Cable vendor list

You should see a dialog containing the recommended Refractive Indexes for selected cable vendors.

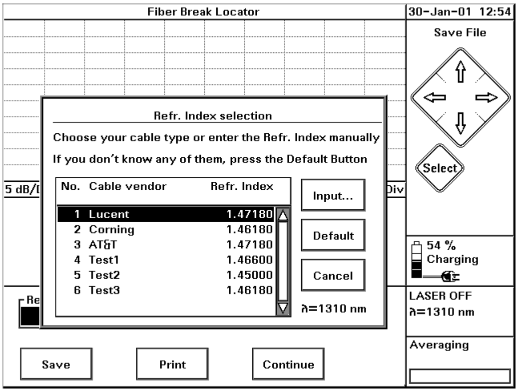


Figure 64 Fiber Break Locator: Refractive Index selection

NOTE If you don’t see this dialog, this means that you do not have a vendor file (`VENDOR.INI`) in your Mini-OTDR internal memory.

Please contact your Agilent representative if you need any assistance, or see *“Appendix: VENDOR.INI” on page 311*.

If you do not have a vendor file, you can use the Cursor keys to manually input a Refractive Index.

Select cable vendor

4 Cursor to an appropriate vendor name (or to `Default`), and press SELECT.

Start Fiber Break Locator

5 Press the RUN/STOP key to activate the laser source.The light behind the RUN/STOP key will be lit and the text `Measuring` will flash beneath the screen.

The Fiber Break Locator stops automatically as soon as a break is detected. You can also stop it manually by pressing the blue Run/Stop key.

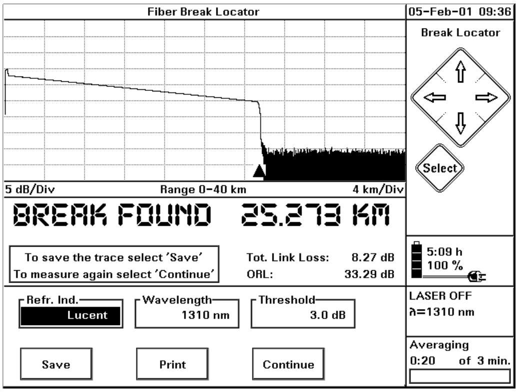


Figure 65 Fiber Break Locator trace

The first break above the specified threshold level will be marked, or you will see the text `No Break Found`.

Save or Print

6 Select `Save` or `Print` to save or print your trace as required.

Change settings

7 If you want to change the settings, cursor to the Wavelength or Threshold box and press SELECT. You can then use the Cursor and Select keys to choose new settings.

Continue or Quit

8 Cursor to Continue and press SELECT. If you want to make a new measurement, select `Start`. If you want to exit the Fiber Break Locator, select `Close`.

How to Use Source Mode

Source Mode diagram

1 Select *Source Mode* from the Applications Screen.You see two diagrams on the Source Mode screen. The Source Mode diagram is on the right.

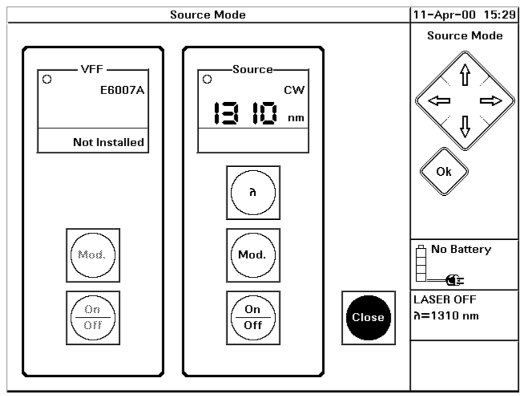


Figure 66 Source Mode

NOTE The left-hand diagram shows the current submodule. If no submodule is installed, you see `Not installed` in the screen.

See “How to Use the Power Meter Submodule” on page 165 and “How to Use the Visual Fault Finder submodule” on page 171.

Change settings

2 If you want to change the Wavelength or Modulation Frequency, use the cursor keys to move to the appropriate box on the screen. Press SELECT, and select the required value.

3 Press the RUN/STOP key to start a trace. The light behind the RUN/STOP key will be lit, and the Operation button on the screen will flash on and off.

How to Use the Power Meter Submodule

Insert submodule

1 Switch off the Mini-OTDR, and insert a module. Insert an E6006A Power Meter submodule into the submodule slot in the module (see “Inserting and Removing a Submodule” on page 74).

Connect fiber

2 Attach the required optical connector interface to the optical output.

3 Connect the fiber to this interface.

4 Attach the other end of the fiber to a Source, such as the Agilent N3974A Dual Laser Source.

   Alternatively, attach the other end of the fiber to the module currently installed in the Mini-OTDR

5 Switch on the Mini-OTDR. The third box in the Applications screen will now be called `Power Meter`. Move to this box and press SELECT.

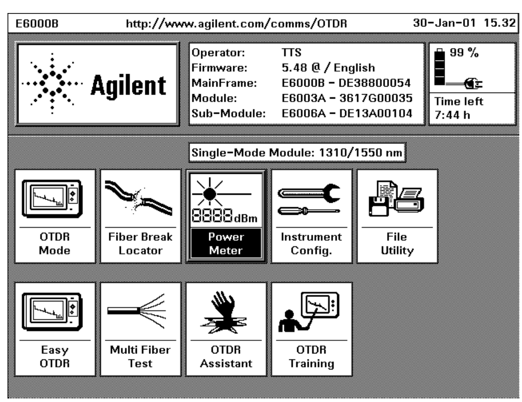


Figure 67 Applications Screen when the E6006A submodule is attached

Power Meter screen

You now see the *Power Meter* screen. You see 2 diagrams: the Power Meter is on the left, the Source is on the right. In the Power Meter screen, you see the current power level, which is updated 3 times per second.

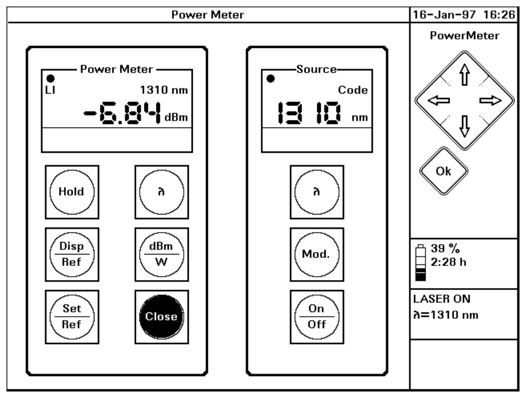


Figure 68 The Power Meter Screen

NOTE If the left-hand diagram is not titled `Power Meter`, you do not have a Power Meter submodule installed, or it is installed incorrectly. If you have a submodule in the back of your instrument, check that both the module and the submodule are in their slots properly.

Change settings

6 Move to the Power Meter (left-hand) diagram. If you want to alter the units used, select `dBm/W` to toggle between dBm, dB, and Watts.

7 If you want to alter the Wavelength, select λ from the Power Meter diagram.

The Power Meter toggles between the available wavelengths for the module.

Freeze display

8 If you want to freeze the display, press `Hold`. You see “Hold” written in the Power Meter (left-hand) screen.

The display is now not updated, so you will not see any new power levels.

Press Hold again to unfreeze the display.

How to Show the Power relative to a Reference Value

Set Reference value

Either

9 Select Disp/Ref from the left-hand screen. All subsequent power levels are shown relative to the current power level.

Or

♦ Select Set/Ref from the left-hand screen. Manually input a reference value (see “How to change a numerical setting” on page 132). All subsequent power levels are shown relative to this value.

The power level is now shown relative to the Reference value set. The Reference value is written after “Ref.” in the Power Meter (left-hand) window.

NOTE If you reset the units (by selecting dB/W), the absolute power level is shown again. To return to the relative power level, select dB/W for a second time.

How to Send Code Modulated Output

Select Code mode

10 Cursor to the Source Mode (right-hand) diagram. Select Mod., until you see the word “Code” in the Source Mode window.

If the Power Meter detects the code, it switches to the correct wavelength of the source, and you see LI in the Power Meter window.

You have now selected Code modulation. You can use Code modulation when you have connected the power meter submodule to another source (such as a second Mini-OTDR), and you want to use the wavelength of this source.

NOTE `Code` is equivalent to selecting the Dual λ or Single λ mode from the Agilent N3974 handheld Dual Laser Source.

How to Perform an Insertion Loss Measurement

How to Set up the Power Meter

Insert submodule

1. Install a Power Meter submodule, and select the Power Meter screen (see “How to Use the Power Meter Submodule” on page 165).

Set CW mode

2. Cursor to `Mod.` on the Source (right-hand) diagram. Press SELECT until you see `CW` in the Source window.

Select Wavelength

3. Staying in the right-hand diagram, cursor UP to λ. Press SELECT until you see the correct wavelength for your measurement in the Power Meter window.
4. Cursor Left to the Power Meter (left-hand) diagram. Select λ until the wavelength in the power meter window is the same as the wavelength you have selected for the Source.

How to Take a Reference value

Attach fiber

5 Attach output connectors to the module and the power meter submodule. Connect the module and submodule with a fiber (Figure 70, first picture).

6 Switch on the Source.

Select `On/Off` from the Source window.

7 Select `dBm/W` from the Power Meter diagram until the measurement in the Power Meter window is in dB.

Select Reference value

8 Wait for the measurement to stabilize, then select `Disp/Ref`.

The measurement is taken as a reference value, which you can see next to `Ref:` in the Power Meter window.

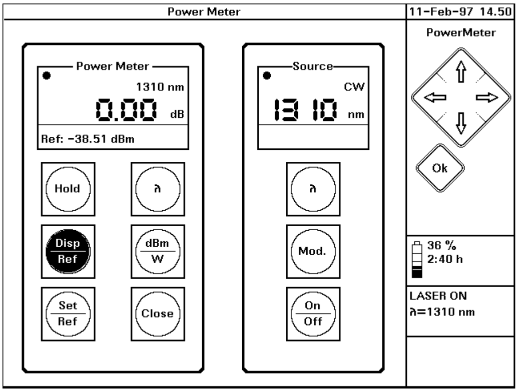
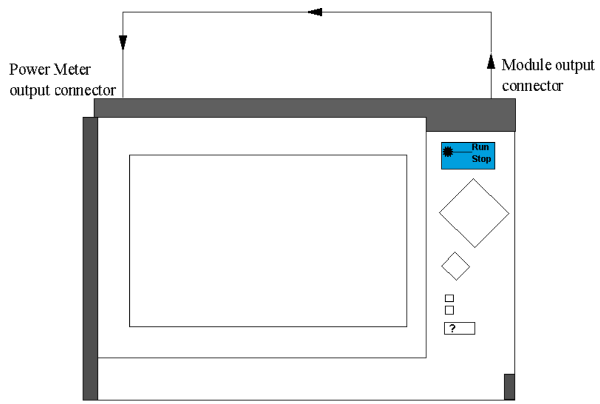


Figure 69 Taking a Power Meter Reference value

9 Switch off the Source.

Select `On/Off` from the Source window.

Steps 5 to 9: take a Reference value



Steps 10 to 14: take the measurement

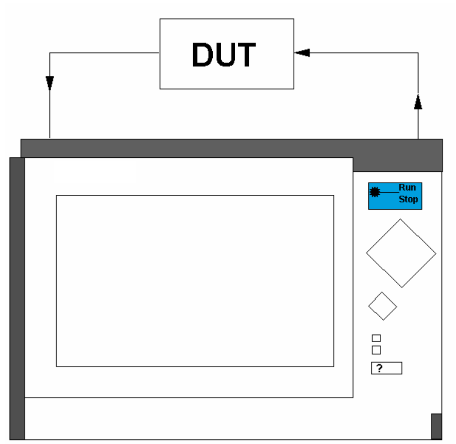


Figure 70 Fiber setups for performing an Insertion Loss measurement

How to Take the Measurement

Insert DUT

10 Insert the Device Under Test in the link between the Source and the Power Meter (Figure 70, second picture).

NOTE Figure 88 on page 260 shows how you might set up the Device Under Test (DUT) for measurements using the power meter.

11 Switch on the Source.

Select `On/Off` from the Source window.

Read Insertion Loss

12 Read the insertion loss for the DUT from the Power Meter window.

13 Switch off the Source.

Select `On/Off` from the Source window.

14 Disconnect the DUT.

How to Use the Visual Fault Finder submodule

Insert submodule

1 Switch off the Mini-OTDR, and insert a module. Insert a 6007A Visual Fault Finder submodule into the submodule slot in the module (see “Inserting and Removing a Submodule” on page 74).

Connect fiber

2 Attach the required optical connector interface to the optical output.

3 Connect the fiber to this interface.

4 Switch on the Mini-OTDR. The third box in the Applications screen will now be called `Visual Light`. Move to this box and press SELECT.

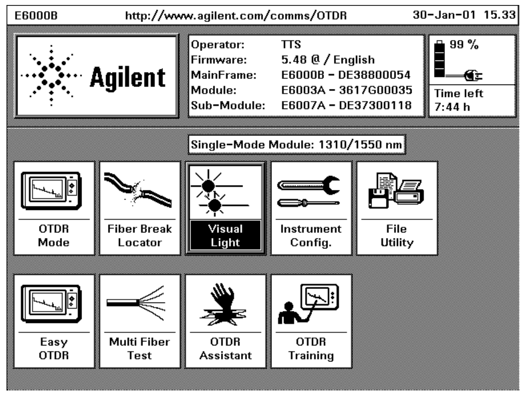


Figure 71 Applications Screen when the E6007A submodule is attached

Visual Fault Finder screen

You now see the *Visual Fault Finder* screen. You see 2 diagrams: the Visual Fault Finder is on the left, the Source is on the right

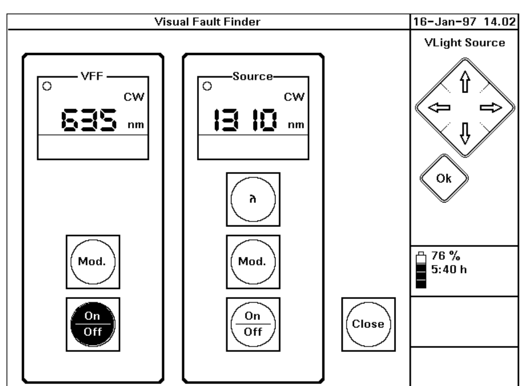


Figure 72 The Visual Fault Finder Screen

NOTE If the left-hand diagram is grayed, as in Figure 66, you do not have a submodule installed, or it is installed incorrectly. If you have a submodule in the back of your instrument, check that both the module and the submodule are in their slots properly.

Select modulation

5 Cursor to the left-hand diagram. If you want to alter the modulation, select MOD. You can choose CW for Continuous Wave modulation, or 1Hz for a light flashing at a frequency of 1 Hertz.

Activate Visual Fault Finder

6 Remain at the left-hand diagram and select ON/OFF. The Visual Fault Finder is activated, and the circle at the top of the screen is filled.

7 Examine the fiber attached to the submodule. Red light shows through the casing where there are breaks or a remote fiber outlet. If you have chosen a 1 Hz Modulation, this light is flashing.

WARNING Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational. The laser radiation can seriously damage your eyesight.

The Visual Fault Finder works on fibers with coatings of up to 3 mm, and at distances of up to 5 km.

A

Installation and Maintenance

This appendix provides installation instructions for the Mini-OTDR. It also includes information about initial inspection and damage claims, preparation for use, packaging, storage, and shipment.

Safety Considerations

Safety class and markings

The Mini-OTDR is a Class III instrument (after IEC 417 #518), that is, an instrument with no protective earth command and DC input voltages less than 60V DC. Use only the supplied AC Adapter, or see *“DC Power Supply Requirements” on page 179*.

Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically.

Performance Tests

"Single-Mode/Multimode Module Performance Tests" on page 219 gives a procedure for checking the operation of the instrument. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Agilent Technologies office.

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer housing.

Internal Back-Up Battery

This instrument contains a lithium battery. Replacing the battery should be carried out only by a qualified electrician or by Agilent Technologies service personnel.

Battery replacement

There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or an equivalent type (PANASONIC CR 2477). Discard used batteries according to local regulations.

AC Line Power Supply Requirements

The Agilent E6000C can operate through the supplied AC adapter between 100V and 240V ± 10%, at a frequency in the range from 50 to 60 Hz. The maximum power consumption is 30VA with all options installed.

Line Power Cable

According to international safety standards, the charger has a three-wire power cable.

The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 73 for the part numbers of the power cables available.

NOTE You only need to use the line power cable to connect to the AC adapter.

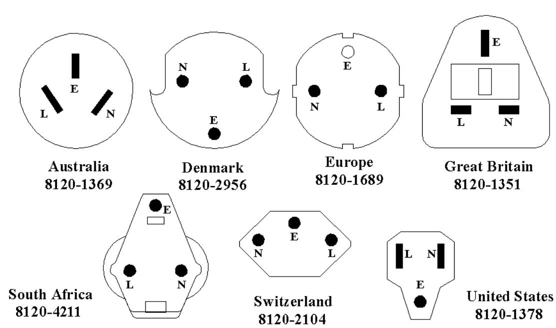


Figure 73 Line Power Cables – Plug Identification

WARNING

To avoid the possibility of injury or death, you must observe the following precautions before switching on the instrument.

- **If this instrument is to be energized via an autotransformer for voltage reduction, ensure that the common terminal connects to the earth pole of the power source.**
- **Insert the power cable plug only into a socket outlet provided with a protective earth contact. Do not negate this protective action by the using an extension cord without a protective conductor.**

The following work must be carried out by a qualified electrician. All local electrical codes must be strictly observed. If the plug on the cable does not fit the power outlet, or if the cable is to be attached to a terminal block, cut the cable at the plug end and rewire it.

Cable color coding The color coding used in the cable depends on the cable supplied.

Connecting a new plug If you are connecting a new plug, it should meet the local safety requirements and include the following features:

- Adequate load-carrying capacity (see table of specifications).
- Ground connection.
- Cable clamp.

WARNING

To avoid the possibility of injury or death, please note that the Agilent E6000C does not have a floating earth.

DC Power Supply Requirements

WARNING When using a DC line supply, before switching on the instrument, make sure that the supply meets the local protection requirements.

The Agilent E6000C can operate from a DC power source that supplies between 16V and 24V. The maximum power consumption during a quick charge is 30W with all options installed. Typical power consumption is below 8W.

Operating and Storage Environment

The following summarizes the Agilent E6000C operating environment ranges. In order for the Mini-OTDR to meet specifications, the operating environment must be within these limits.

Temperature and Humidity

Protect the instrument from temperature extremes and changes in temperature that may cause condensation within it.

The temperatures and the humidity for the Agilent E6000C are given in the table below. Please note the restricted operating range when you are using the optional floppy disk drive.

	Operating Temperature	*Storage Temperature*	*Humidity*
All/Complete Systems except ...	0°C to 50°C	-40°C to 60°C	95% at 0°C to 40°C
... using Floppy Disk Drive	5°C to 45°C	-40°C to 60°C	35% to 80% at 40°C
Battery charging	0°C to 40°C		

Altitude

The Agilent E6000C can be used up to 2000 m (6500ft.)

Installation Category

The Agilent E6000C has an Installation Category II and Pollution Degree 2 according to IEC 664

NOTE The AC Adapter is for indoor use only

Parallel Interface

This is a CENTRONICS type parallel port for a parallel printer, with a DB-25 connector.

If you do not use an Agilent 5180-0010C Centronics cable, the EMI performance of the optical time domain reflectometer cannot be guaranteed.

Serial Interfaces

There is one ST-compatible RS232 port, with DB9 connectors.

If you do not use an Agilent 5180-2477 RS232 cable or the RS232 cable supplied with the rack, the EMI performance of the optical time domain reflectometer cannot be guaranteed.

Programming user tasks on a PC

You can select Input/output commands for sending and receiving data from the serial interface and for initializing transmission parameters.

You should follow the following steps:

1 Initialize the Hardware Interface parameters
2 Check the automatic connection to the instrument
3 Send or receive commands to/from the Mini-OTDR.

The *OTDR Programming Guide* (Agilent Product Number E4310-91016) shows how to perform steps 2 and 3. Step 1 depends strongly on the Operating system.

NOTE The programming and speed performance depend on the Operating system used on the PC. Generally speaking, speed and reliability are better with Windows NT and Windows 95 than with Windows 3.1.

Claims and Repackaging

If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and the nearest Agilent Technologies Service Office. The Sales/Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.

Return Shipments to Agilent Technologies

If the instrument is to be shipped to an Agilent Technologies Sales/Service Office, attach a tag showing owner, return address, model number and full serial number and the type of service required.

Repacking instructions

The original shipping carton and packing material may be reusable, but the Agilent Technologies Sales/Service Office will provide information and recommendation on materials to be used if the original packing is no longer available or reusable.

General instructions for repacking are as follows:

Shipping box

- Put the Mini-OTDR in its softcase, then put the softcase into a shipping box. The packaging has the following part numbers:

E6000-49304	Cushion convoluted
E6000-49303	Cushion convoluted
E6000-49302	Scored sheet
E6000-49301	Carton Corrugated

- The shipping box uses single wall corrugated carton (Material 1.40 per DIN 55468), which is the equivalent of 200-pound bursting strength material.

- Inside the shipping box are 2 inserts. One insert is a folded separator to keep the power supply and the power cord. The second insert goes around the softcase. It is a corrugated part including convoluted foam on the outer side.
- If you do not have the original shipping box you must use an appropriate shock absorbing material.

Shipping container

- Seal the shipping container securely.
- Mark the shipping container FRAGILE to encourage careful handling.
- In any correspondence, refer to the instrument by model number and serial number.

CAUTION If you use foam to pack the box, make sure you use a soft foam. EPS and most other foams may be too hard.

Installing New Firmware

Follow the steps in “How to Update the Firmware and Languages” on page 144

B

Accessories

The Agilent Technologies E6000C is a high performance time domain reflectometer. It is available in various configurations for the best possible match to the most common applications.

This appendix provides information on the available options and accessories.

Instrument and Options

Agilent Product	Opt	Description
E6000C		Mini-OTDR Mainframe
	003	Color screen VGA LCD
	006	B/W Screen VGA-LCD
	AB0	Traditional Chinese user interface
	AB1	Korean user interface
	AB2	Simplified Chinese user interface
	AB8	Turkish user interface

Agilent Product	Opt	Description
	AB9	Portuguese user interface
	ABD	German user interface
	ABE	Spanish user interface
	ABF	French user interface
	ABJ	Japanese user interface
	ABX	Finnish user interface
	ABZ	Italian user interface
	ACB	Russian (Cyrillic) user interface
	AKB	Czech user interface
	AKE	Romanian user interface
E6001A		1310 nm economy single-mode module
E6003A		1310/1550 nm high performance single-mode module
	022	angled connector
E6003B		1310/1550 nm very high performance single-mode module
	022	angled connector
E6004A		1310/1550 nm economy single-mode module
	022	angled connector
E6005A		850/1300 nm high performance multimode module
E6006A		Optical Power Meter
E6007A		Visual Fault Finder
E6008B		1310/1550nm Ultra High Performance single-mode module
	022	angled connector
E6009A		850/1300 nm economy multimode module
E6012A		1550 nm/1625 nm ultra-high performance single-mode module
	022	angled connector

Support Options

For all Agilent Mini-OTDRs, the following support options are available.

R1280A	Return to Agilent Warranty and Service Plan. Available for 36 months (3 years) or 60 months (5 years)
R1282A	Return to Agilent Calibration Plan. Available for 36 months (3 years) or 60 months (5 years)

Accessories supplied

The following accessories are supplied with your Mini-OTDR Mainframe:

	Soft carrying case
	Power cord
	AC/DC adapter
	User's Guide
	OTDR Support CD
	RS 232 cable
	Mini-OTDR Reference Card
	OTDR Pocket Guide
	Cleaning Procedures Pocket Guide
	NiMH battery pack

The following accessories are supplied with your Mini-OTDR modules:

81000FI	FC/PC connector interface (single-mode modules only)
81000KI	SC connector interface
81000VI	ST connector interface (multimode modules only)

All modules come with a commercial calibration certificate.

Additional Accessories

The following accessories are also available. To order these products, please contact your Agilent Technologies representative.

Product	Description
E6080A	Spare NiMH battery pack
E6081A	Mini-Keyboard (see “The Mini-Keyboard” on page 79).
E6082A	Hard transit case
E6083A	64 MB Compac / Flash TM disk with PCMCIA adapter
E6091A	OTDR Toolkit II *Plus* software
5180-0010C	Centronics cable
24542U	RS232 cable, 9-pin to 9-pin
E6000-13601	OTDR Support CD

Connector Interfaces and Other Accessories

The Agilent E6000C Mini-OTDR is usually supplied with a straight contact output connector interface.

NOTE If you want your Mini-OTDR supplied with an angled connector, please order option #022.

Option #022 is only available for single-mode modules.

Optical Connector

To connect to the instrument, you must

1 attach your connector interface (see list of connector interfaces below) to the interface adapter,

2 then connect your fiber.

Agilent Model No.	Description
81000AI	Diamond HMS/10 connector interface
81000FI	FC/PC connector interface
81000GI	D4 connector interface
81000HI	E2000 connector interface
81000KI	SC connector interface
81000SI	DIN 47256 connector interface
81000VI	ST connector interface
81000WI	Biconic connector interface

Related Agilent Literature

Agilent Part Number	Title
5963-3538F	Cleaning Procedures for Lightwave Test and Measurement Equipment pocket guide
E6000-91017	OTDR Pocket Guide
E4310-91016	OTDRs Programming Guide

C

Specifications

Specifications describe the instrument's warranted performance, measured with typical PC-type connectors. Uncertainties due to the refractive index of fiber are not considered.

Specifications vs. Characteristics

The following section contains both Specifications and Characteristics:

- *Specifications* describe the instrument's warranted performances.
- *Characteristics* and *typical data* provide information about the non-warranted instrument performance.

ISO 9001

The Agilent Technologies E6000C Mini-OTDR is produced to the ISO 9001 international quality system standard as part of Agilent's commitment to continually increasing customer satisfaction through improved quality control.

Definition of Terms / Measurement Conditions

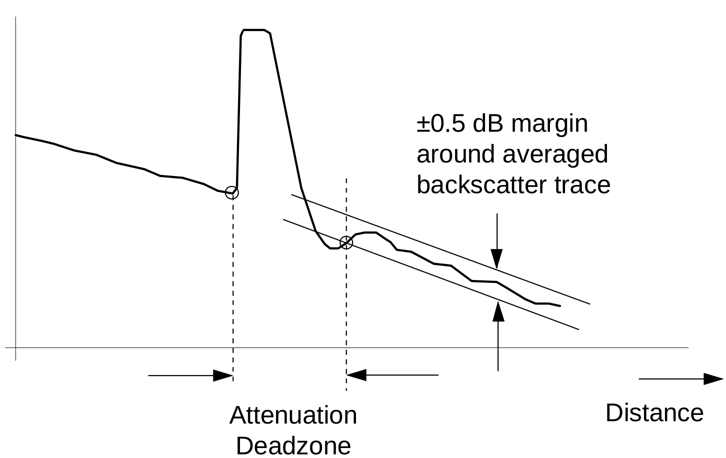
Generally, the wavelengths are given by the specific module. Therefore, the measurement conditions do not contain the wavelength. Unless otherwise limited, all specifications are valid for the specified environmental conditions.

All data presented in the ± form are to be understood as peak-to-peak variation divided by 2.

Attenuation deadzone

The distance from the start of a reflective event to the point where the receiver has recovered to within a ±0.5 dB margin around the undisturbed and averaged backscatter trace.

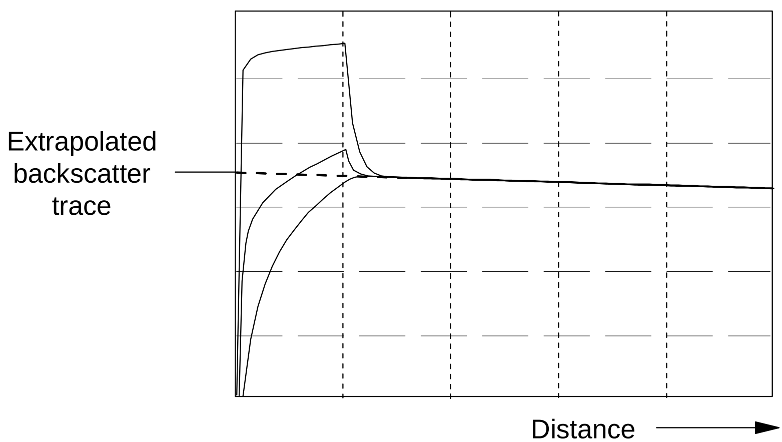
Conditions: Reflective, lossless event with specified reflectance, at specified instrument settings.



Backscatter coefficient

The ratio of the optical pulse power (not energy) at the OTDR output to the backscatter power at the near end of the fiber (z = 0). This ratio is inversely proportional to the pulse width, because the optical pulse power is independent of the pulse width. The ratio is expressed in dB.

NOTE A typical value is approximately 50 dB for 1 µs pulse width, depending on the wavelength and the type of fiber. The extrapolated backscatter trace is a measure of the near-end backscatter power. See Figure 2.



Backscatter linearity (longitudinal uniformity)

For a fiber with a constant attenuation coefficient (in other words, the attenuation is proportional to the length of fiber) the difference between the displayed OTDR trace and its least square approximation line.

Conditions: Continuous fiber with no discrete losses, for a power range from the beginning of the backscatter signal to the point where the specified →signal-to-noise ratio is reached, at specified instrument settings.

Center wavelength

The center wavelength is defined as the spectral center of gravity, at specified operating conditions:

$$\lambda_c = \frac{\sum P_i \lambda_i}{\sum P_i}$$

where:

P_i = power levels of the individual longitudinal lines

λ_i = wavelengths of the individual longitudinal lines

Distance accuracy

The largest error of the OTDR's distance measurement result.

Conditions: Generally, all distance accuracy specifications apply to reflective events only. For non-reflective events, an increased uncertainty applies because of the difficulty of locating the event precisely.

NOTE Based on the IEC error model, the distance error depends on the distance and is given by the absolute value of the sum of three quantities.

:

$$\Delta L(L) = \pm\left(|\Delta L_0| + |\Delta S_L| \cdot L + |\Delta R|\right)$$

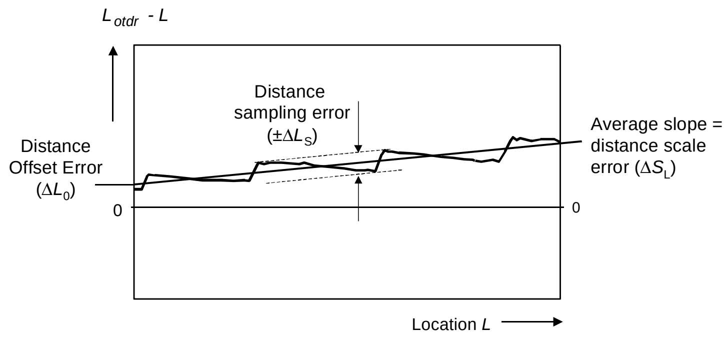
where

L = actual (true) distance

ΔL_0 = distance offset error

ΔS_L = distance scale error

ΔL_S = distance sampling error



NOTE The distance uncertainty does not include the uncertainty of the →group of the fiber under test, because the OTDR measures transit times and calculates distances by division by the user-defined fiber's group refractive index.

Distance offset error

The displayed location of the OTDR's front panel connector on the instrument's distance scale, in meters. Symbol ΔL_0. See Figure 3.

Condition: A possible influence from finite distance sample spacing is excluded.

Measurement: Select Optimize Resolution for best accuracy. Since the precise location of the front panel connector is usually not directly accessible, use a short reference fiber (for example, 100 m, to exclude any influence from distance scale error) with known length *L* and open end to create a reflective event. Then measure the length of the fiber by determining the location of the reflective event L_{OTDR} as shown in Figure 4. Then calculate the distance offset error ΔL_0 by subtracting the measured length from the known length, *L*.

$$\Delta L_0 = L_{ref} - L_{OTDR}$$

where

$$L = \frac{c\,T}{N}$$

and:

L = known length of the fiber = $(c\,T)/N$.

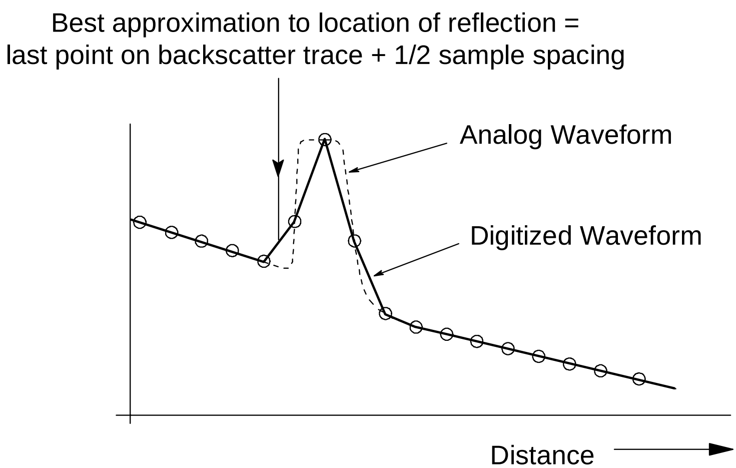
c = speed of light in vacuum

T = time of flight between the two locations on the reference fiber, measured at the wavelength of the OTDR

N = group index of the fiber (use the OTDR's →group index setting)

L_{OTDR} = the distance measured with the OTDR, at the given →group index setting

The influence of the finite sample spacing can be excluded by inserting additional fibers. Their lengths must be chosen so that they don't coincide with multiples of the distance sample spacing. For each combination, use the total length of fiber to determine the distance offset error. Finally, average all distance offset results.



Distance sampling error

The →distance uncertainty due to finite distance sample spacing, expressed as ±half the span between the maximum and minimum excursions from the straight line model, in meters. Symbol: ΔL_S. See Figure 3.

Measurement: The measurement is similar to the measurement of distance offset error. Divide the calculated distance sampling interval in at least four distance increments and prepare incremental fibers to cover all these increments. For example, to divide a sampling interval of 10 m into 4 intervals, one needs two incremental fibers of 2.5 m and 5 m to generate increments of 2.5 m, 5 m and 7.5 m. Add each combination of incremental fibers to the length *L* as described in clause "distance scale error" and record the individual differences

$$\Delta S_{L,i} = L_{otdr} - (L + i\,D)$$

where

L = known length of the fiber = $(c\,T)/N$.

i = current increment

D = length of the smallest increment (i.e. the difference between the increments).

Then calculate the distance sampling error ΔL_S by subtracting the smallest value of the $\Delta L_{S,i}$ set from the largest one. Express the result as ±half the difference.

Distance scale error

The difference between the average displayed distance between two distinct locations on the fiber, L_{OTDR}, and the correspondent actual (true) distance, L, divided by the actual distance, in meters per meter. See Figure 3.

$$\Delta S_L = \frac{L_{otdr} - L}{L} \quad \text{where} \quad L = \frac{cT}{N}$$

.and

c = speed of light in vacuum

L_{OTDR} = the distance measured with the OTDR, at the given OTDR group index setting

T = time of flight between the two locations on the fiber, measured at the wavelength of the OTDR

N = OTDR group index setting

NOTE Relatively long lengths of fibers, for example, 10 km, are to be used to evaluate the distance scale error, in order to remove the influence from finite distance sampling spacing.

NOTE The distance scale error excludes the uncertainty of the fiber's group index, N, because the same N is used in the calculation of L and L_{OTDR}.

Measurement: Measure the time of flight, T, with a pulse generator, a laser source, an opto-electronic converter, and a time interval counter by determining the time difference with and without the fiber of length L inserted. The laser source should have the same wavelength as the OTDR.

Dynamic range (RMS)

The amount of fiber attenuation that causes the backscatter signal to equal the →noise level (RMS).

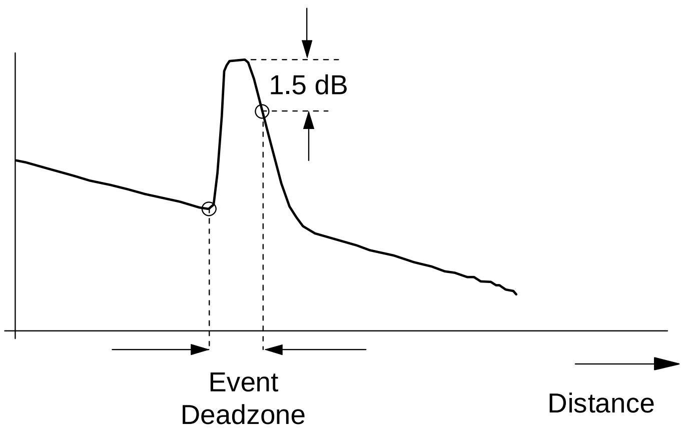
Measurement: It is recommended to connect a standard single mode fiber with a length of more than 20 times the pulse width in meters to the OTDR. Then determine the difference between the extrapolated backscatter trace (as in Figure 2) and the →noise level (RMS).

Conditions: standard single mode fiber, at specified averaging time, ambient temperature and instrument settings.

Event deadzone

The displayed length of a reflective event from the start to the point where the trace has fallen to 1.5 dB below the peak.

Conditions: Reflective, lossless event with specified reflectance, at specified instrument settings.



Group index (of a fiber)

The refractive index of a fiber that corresponds to the velocity of the modulation content (group velocity) of an optical wave in a fiber. The group index is typically slightly higher than the refractive index of the fiber, because the group velocity is slightly lower than the speed of light in vacuum divided by the refractive index of the fiber. Symbol: *N*.

NOTE The group index setting of the OTDR will influence all distance measurements.

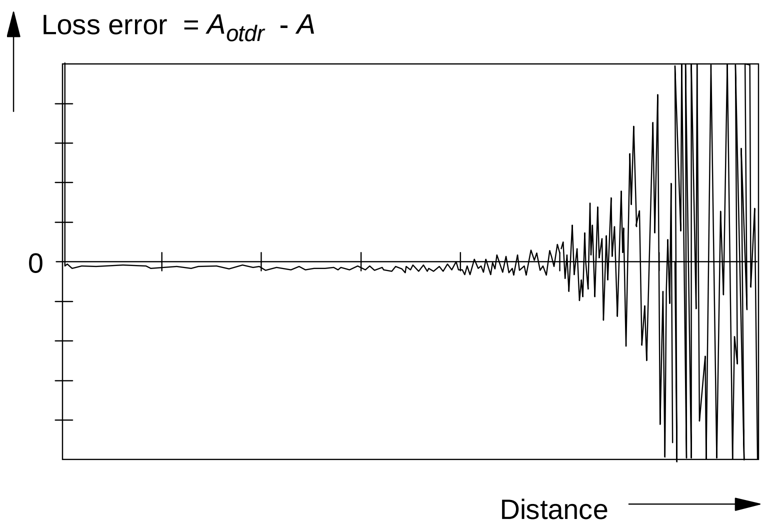
Loss accuracy, backscatter measurements (1 dB steps)

The maximum loss error, in dB, for any fiber section with a loss of 1 dB, that is the maximum difference between the displayed loss, A_{otdr}, and actual loss, A, of the section.

$$Loss\ error_{dB} = \max\left\{ A_{otdr} - A \right\}$$

Conditions: Continuous fiber with no discrete losses >1 dB, for a power range from the beginning of the backscatter signal to the point where the specified →signal-to-noise ratio is reached, at specified instrument settings.

Measurement: Connect a long fiber, for example 50 km, to the OTDR and calculate the 1 dB loss error as follows. Generate two undisturbed backscatter traces with a 1 dB vertical difference. Measure this difference, A_{OTDR}, along the length of the fiber. Also, measure the power difference, A, with a calibrated optical power meter. Calculate the loss errors along the length of the fiber and determine the maximum within specified power range as in the formula above. See Figure 6.



Loss accuracy, reflectance measurements

The maximum difference between the reflectance of an event as measured with the OTDR and the actual reflectance of the event.

Conditions: Correct backscatter coefficient for the fiber under test entered into the OTDR prior to measurement, undisturbed backscatter trace in front of the reflectance under test, for a given reflectance range and a power range from the beginning of the backscatter signal to the point where the specified →signal-to-noise ratio is reached, at specified instrument settings

Noise level (98%)

The displayed power level such that 98% of the noise data points lie below this level.

Conditions: Noise data points from locations after which the OTDR receiver response disappears in random noise.

NOTE This definition is needed to relate the →noise level (RMS) to practical measurements.

Noise level (RMS)

The displayed level which corresponds to + one standard deviation of the linear noise amplitude statistics.

Conditions: Noise data points from locations after which the OTDR receiver response disappears in random noise.

NOTE For purely Gaussian noise statistics, the noise level (RMS) is approximately 1.9 dB below the →noise level (98%).

Output power (CW)

The attainable optical output power in CW mode.

Conditions: Jumper fiber attached to the OTDR port; output power measured with an optical power meter at the end of the jumper fiber.

Output power stability (CW)

Peak-to-peak variation of the output power in CW mode.

Conditions: Jumper fiber attached to the OTDR port; output power stability measured with an optical power meter at the end of the jumper fiber. Warmup-time and observation period as specified. Power meter averaging time 100 ms.

Reflectance accuracy

For the specified reflectance range, the maximum difference between the measured reflectance of a feature on the fiber and actual (true) reflectance, in dB.

Conditions: →signal-to-noise ratio larger than specified value, at specified instrument settings, →backscatter coefficient correctly set for the specific fiber used.

Sample spacing

The distance between consecutive data points.

Signal-to-noise ratio (SNR)

The difference between the actual backscatter level and the →noise level (98%) expressed in dB.

Definition of Terms - Power Meter Submodule

Noise:	One half of the peak-to-peak change of displayed power level with constant input power level.
Conditions:	Observation time as specified (drift effects excluded).
Power range:	The power range is defined from the highest input power level to the smallest input power level that causes a noticeable change of displayed power level.
Conditions:	Wavelength and Averaging Time as specified.
Reference conditions:	The specified conditions during the spectral responsivity calibration, or conditions which are extrapolated from the conditions during calibration.
Conditions:	Power level, beam diameter or fiber type, numerical aperture, wavelength, spectral width, ambient temperature as specified, at the day of calibration. →Noise and drift observed over 15 min., with a temperature change of not more than 1 K.
Total uncertainty:	The uncertainty for a specified set of operating conditions, including noise and drift.
Conditions:	Power level, beam diameter or fiber type, numerical aperture, wavelength, spectral width, ambient temperature, recalibration period as specified. →Noise and drift observed over 15 min., with a temperature change of not more than 1 K.

Definition of Terms - Visual Fault Finder Submodule

Output Power Level (CW)	The output power at the specified wavelength, measured at the end of a jumper cable.
Center Wavelength	The wavelength representing the center of mass of selected peaks. The power and wavelength of each used to calculate the mean wavelength $\overline{\lambda}$: $\overline{\lambda} = \Sigma P_i \lambda_i / \Sigma P_1$ where: P_i is the power of a single peak.

Characteristics

Horizontal Parameters

- **Start-km:** 0 km to 400 km
- **Span:** 0.1 km to 400 km
- **Readout resolution:** 0.1 m
- **Minimum sample spacing:** 8 cm
- **Refractive index:** 1.00000 to 2.00000
- **Length unit:** km, ft, or miles
- **Measurement points:** up to 16000

Vertical Parameters

- **Vertical scale:** 0.1 to 10.0 dB/Div
- **Read-out resolution:** 0.001 dB
- **Reflectance range:** -14 dB to -60dB
- **Backscatter coefficient:** 10 to 70 dB at 1 µs

Source Mode

	E6001A	E6003A, E6003B, E6004A, E6008B	E6005A, E6009A	E6012A
	built-in CW laser source	**built-in CW dual laser source**	**built-in CW dual laser source**	**built-in CW dual laser source**
CW output power	-3 dBm		-20 dBm (850 nm), -13 dBm (1300 nm)	-3 dBm
CW stability (15 min., T=const.) after 10 minute warm-up with CW on	±0.1 dB		±0.15 dB	±0.1 dB / ±0.15 dB
Optical output	User-exchangeable Connector Interfaces			
Source Mode Modulation	270 Hz, 1 KHz, and 2 KHz squarewave			

Pulsewidth

You can select any of the following pulsewidths:

- 10 ns, 30 ns, 100 ns, 300 ns, 1 µs, 3 µs, and 10 µs (all modules). You can also select 5 ns for all multimode modules, and 20 µs for E6003B, E6008B, and E6012A.

With the E6005A module, you can select a pulsewidth from 5 ns to 100 ns at 850 nm, and from 5 ns to 10 µs at 1300 nm.

With the E6009A module, you can select a pulsewidth from 5 ns to 100 ns at 850 nm, and from 5 ns to 1 µs at 1300 nm.

Output Connector

- Optional Diamond HMS-10, FC/PC, DIN 47256, ST, Biconic, SC, NEC D4. All options are user-exchangeable.

Documentation

- **3.5” floppy disk drive:** for high density 720/1440 kByte floppy disks. MS-DOS format compatible. Reduced operating temperature of 5° to 45° C, with 35% to 80% humidity at 40° C.
- **Memory Card:** PCMCIA Type II. SRAM up to 2 MB
- **Flash Disk**: 440 MB with up to 13000 traces (typical with 16000 data points).
- **Internal memory:** up to 300 traces (typical with 4000 data points).
- **Trace format:** compliant to SR-4731 of Bellcore Version 2.0 OTDR Data Format.
- **Trace information:** 5 comment labels of up to 15 alphanumeric characters, and 5 comments of up to 41 alphanumeric characters are provided for each trace.
- **Real-time clock and date**

Scan Trace

- **Type of events:** reflective and non-reflective.
- **Maximum number of events:** 100.
- **Threshold for non-reflective events:** 0.0 to 5.0 dB, selectable in 0.01 dB steps.
- **Threshold for reflective events:** -14.0 to -65.0 dB, selectable in 0.1 dB steps.

- **Threshold for fiber breaks:** 0.1 to 10 dB, selectable in 0.1 dB steps.
- **Fiber End Threshold**: 0.1 to 20 dB, selectable in 0.1 dB steps.

Display

- **Color or monochrome VGA-LCD:** 18.3 cm (7.2”)
- **Display points:** 640 x 480 points
- **Measurement update rate**: two measurements per second in refresh mode.

Interfaces

RS232C

- **Maximum baud rate**: 115200 bps
- **Transmission time** at 115200 baud for trace data: 4000 points at approx. 1 second; 16000 points at approx. 4 seconds.
- **Centronics**: Standard parallel port (SPP).
- **Keyboard**: PS2 (Min-DIN). For English Standard, PS2, or AT keyboard.

General

- **Automatic setup and analysis**
- **Instrument settings:** storage and recall of user-selectable instrument settings.
- **Laser Safety Class (E6001A-E6005A and E6008B-E6012A):** 21 CFR Class 1, IEC 825 Class 3A
- **Recommended recalibration period:** 2 years.

  For modules only: no calibration on mainframe.

- **Dimensions:** 194 mm H, 290 mm W, 75 mm D (7.7” x 11.4” x 3.0”).
- **Weight:** net < 2.9 kg (6.4 lbs), typical, including battery pack and OTDR module.

Built in Applications

Automatic Multi Fiber Test

Pass/Fail Test

Fiber Break Locator

Power Meter / Loss Test mode

Visual Fault Finder mode

Optical Return Loss

Easy OTDR

OTDR Training

OTDR Assistant

Environmental

See “Operating and Storage Environment” on page 179

Power

See also “AC Line Power Supply Requirements” on page 177 and “DC Power Supply Requirements” on page 179.

- **AC**: 100 -240 Vrms ± 10% 50-60 Hz
- **DC**: 16 - 24 V
- **External Battery:** NiMH typically 8 hours continuous operation (minimum 4 hours). Charging time < 3 hours, non-operating.

  These characteristics apply to the black and white display (option #006) only.

- **Low battery indicator**
- **Battery charge status**

Module Specifications/ Characteristics

Specifications: Optical Performance

Measured at 22 °C ± 3°C. Guaranteed specifications unless otherwise noted. **Bold** values are typical specifications

Module	**E6001A**				**E6003A**			
Central Wavelength	**1310** ±25 nm				**1310**±25 nm/ **1550**±25 nm			
Applicable Fiber	single-mode				single-mode			
Pulsewidth	10ns	100ns	1µs	10µs	10ns	100ns	1µs	10µs
Dynamic Range[1] *[dB]*	13	18	23	28 **30**	19/17	24/22	30/29	35/34
Event Deadzone [2]	5 m (**3 m**)				5 m (**3 m**)			
Attenuation Deadzone [3]	25 m				20/25 m			
Attenuation Deadzone [4]	**10 m**				**10/12m**			

Module	**E6003B**					**E6004A**			
Central Wavelength	**1310**±25 nm/ **1550**±25 nm					**1310**±25 nm/ **1550**±25 nm			
Applicable Fiber	single-mode					single-mode			
Pulsewidth	10ns	100ns	1µs	10µs	20µs	10ns	100ns	1µs	10µs
Dynamic Range[1] *[dB]*	19/17	24/22	30/29	38/37	**40/39**	13/13	18/18	23/23	28/28 **30/30**
Event Deadzone[2]	5 m (**3 m**)					5 m (**3 m**)			
Attenuation Deadzone [3]	20/25 m					25/25 m			
Attenuation Deadzone [4]	**10/12m**					**10/12m**			

Module	E6008B	E6012A
Central Wavelength	**1310**±25 nm/ **1550**±25 nm	**1550**±25 nm/ **1625**±20 nm
Applicable Fiber	single-mode	single-mode
Pulsewidth	10ns 100ns 1µs 10µs 20µs	10ns 100ns 1µs 10µs 20µs
Dynamic Range[1] *[dB]*	24/22 29/27 35/34 42/41 **45/43**	22/18 27/24 34/30 41/37 - / **40** **43**/ -
Event Deadzone[2]	5 m (**3 m**)	5 m (**3 m**)
Attenuation Deadzone [3]	20/25 m	25/28 m
Attenuation Deadzone [4]	**10/12m**	**12/14m**

Module	E6005A	E6009A
Central Wavelength	850±30 nm / 1300±30 nm	850±30 nm / 1300±30 nm
Applicable Fiber	multimode 62.5 µm	multimode 62.5 µm
Pulsewidth	10ns 100ns 1µs 10µs	10ns 100ns 1µs
Dynamic Range [5] *[dB]*	19/17 26/22 - /28 - /34	12/12 18/18 - /23
Event Deadzone [6]	3 m	3 m
Attenuation Deadzone[7]	10 m	10 m

The guaranteed values above are tested specifications. Agilent OTDR modules have the pulsewidths listed in “Pulsewidth” on page 207.

Notes:

1 Measured with a standard single-mode fiber at SNR=1 noise level and with 3 minutes averaging time. Optimize mode: dynamic

2 Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 4 km, optimize resolution.

Typical specification at Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 400 m at 8 cm sample spacing, optimize resolution.

3 Guaranteed Specification at Reflectance ≤ -35 dB at 30 ns pulsewidth, and with span ≤ 4 km. Optimize mode: resolution.

4 Typical Specification at Reflectance ≤ -50 dB at 30 ns pulsewidth, and with span ≤ 4 km (typical value).

5 Measured with a standard 62.5 µm guided index multimode fiber at SNR=1 noise level and with 3 minutes averaging time, optimize dynamic.

6 Reflectance ≤ -35 dB at 5 ns pulsewidth, and with span ≤ 4 km, optimize resolution.

7 Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 4 km.

Characteristics

Distance Accuracy [A]

- **Offset Error**: ± 1 m
- **Scale Error**: ± 10^{-4}
- **Sampling Error**: ± 0.5 sampling spacing

Loss/Reflectance Accuracy [B]

- **Backscatter Measurements**: ± 0.05 dB (1dB step), typical
- **Reflectance Measurements**[C]: ± 2.0 dB, typical

Acoustic Noise Emission

< 40dBA, not continuous.
Data are results from type tests per ISO 7779 (EN 27779).

Notes:

A Total distance accuracy = ± (offset error + scale error*distance + sampling error).

B SNR ≥ 15 dB and with 1 µs, averaging time max. 3 minutes.

C -20 dB to -60 dB

Agilent E6006A Power Meter Submodule

Characteristics

Sensor element:	InGaAs
Wavelength range:	800 - 1650 nm
Calibrated wavelengths:	850 nm, 1300 nm, 1310 nm, 1550 nm, 1625 nm (special wavelength on request).
Power range:	+10 to -70 dBm
Max. input power (damage level)	+13 dBm / 20 mW
Display Resolution	0.01 dB
Display Units:	dBm, dB, mW, µW, nW, pW
Display Contents:	Calibrated λ in nm Modulation frequency in Hz Reference value in dB
Display Updates per second	3
Optical input:	User-exchangeable Connector Interface
Applicable fiber type	9/125 µm, 50/125 µm, 62.5/125 µm

Specifications

Uncertainty at reference conditions: ± 3%

Power level: -20 dBm
Continuous wave (CW)
Wavelength: 1300±3 nm, 1310±3 nm, 1550±3 nm
Fiber type: 50/125 µm graded index, Agilent/HMS-10 connector
Spectral bandwidth: up to 10 nm
Ambient temperature: +18 to +28 °C

At day of calibration (add 0.3% for aging of over one year; add 0.6% for aging of over two years).

Total uncertainty: ±5% ± 0.5 nW (1310, 1550 nm)

Power level: +0 to -50 dBm
Continuous Wave (CW)
Wavelength: 850±3 nm, 1300±3 nm, 1310±3 nm, 1550±3 nm
Fiber type: SM to 50 µm graded index
(add 2% to total uncertainty for fiber 62.5 µm).
Straight and angled connectors
Ambient temperature: +10 to +40 °C

Within 2 years after calibration

Supplementary Performance Characteristics

- Automatic Zeroing Circuitry.
- Automatic Ranging.
- Modulation frequency recognition (270 Hz, 1 kHz, 2 kHz) is available at power levels between +10 and -45 dBm (peak amplitude).

- Wavelength encoding recognition (350 Hz, 550 Hz) is available at power levels between +10 and -45 dBm (peak amplitude).
- Dual Wavelength measurement is available at power levels between +10 and -45 dBm (peak amplitude).
- Reference value is presettable from +30 to -80 dBm.
- Each calibrated wavelength has its own reference memory.
- The actual display content can be transferred to reference memory (DISP → REF).
- Hold Data functionality.

General Specifications:

Dimensions: ca. 120 mm H x 40 mm W x 25 mm D (4.7” x 1.6” x 1.0”)

Weight: < 130 g.

Operating Temperature: 0 to +50 °C

Storage Temperature: -40 to +60 °C

Humidity: 95% R.H. from 0 °C to 40 °C non cond.

Recommended Recalibration Period: 2 years

Agilent E6007A Visual Fault Finder Submodule

Characteristics

Source type:	Laser diode
Center Wavelength:	635 nm ± 10 nm (visible red light)
Output power level (CW):	0 dBm maximum
Output power level (CW) into 9 µm fiber (typ.):	-3 dBm
Detection range:	up to 5 km
Optical output:	User-exchangeable Connector Interface

Laser Class II (21 CFR 1040), Class II (IEC 825-1)

Supplementary Performance Characteristics

- Continuous Wave and Blink Mode (1 Hz for better visibility).
- Single-Mode and multimode fibers applicable.

General Specifications:

Dimensions: ca. 120 mm H x 40 mm W x 25 mm D (4.7” x 1.6” x 1.0”)

Weight: < 100 g.

Operating Temperature: 0 to 40 °C

Storage Temperature: -40 to +60 °C

Humidity: 95% R.H. from 0 °C to 40 °C non cond.

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name:	Agilent Technologies Deutschland GmbH
Manufacturer's Address:	Optical Communication Measurement Division (OCMD) Herrenberger Str. 130 D-71034 Boeblingen

Declares, that the product

Product Name:	Mini-OTDR	
Model Number:	E6000C	
Product Modules:	E6001A [1]	1310 nm single-mode module
	E6003A [1]	1310 nm/1550 nm single-mode module
	E6003B [1]	1310 nm/1550 nm single-mode module
	E6004A [1]	1310 nm/1550 nm single-mode module
	E6005A [1]	850 nm/1300 nm multi-mode module
	E6006A	Optical Power Meter module
	E6007A [1]	635 nm Visual fault finder module
	E6008B [1]	1310 nm/1550 nm single-mode module
	E6009A [1]	850 nm/1300 nm multi-mode module
	E6010A [1]	1625 nm single-mode module
	E6011A [1]	1550 nm single-mode module
	E6012A [1]	1550 nm/1625 nm single-mode module
	E6013A [1]	1310 nm/1550 nm/1625 nm single-mode module
Product Options:	All options included	

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

Conforms with the following product standards:

	Standard	Limit
EMC	*IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998*	
	CISPR 11:1997 / EN 55011:1998	*Group 1 Class A*
	IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995	*4kV CD, 8kV AD*
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	*3 V/m, 80-1000 MHz*
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	*0.5kV signal lines, 1kV power lines*
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	*0.5 kV line-line, 1 kV line-ground*
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	*3V, 0.15-80 MHz*
	IEC 61000-4-8:1993 / EN 61000-4-8:1993	*3 A/m, 50 Hz*
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	*1 cycle/100%*
	Canada: ICES-001:1998 *Australia/New Zealand: AS/NZS 2064.1*	
Safety	*IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995* *IEC 60825-1:2001* *Canada: CSA C22.2 No. 1010.1:1992* *USA: UL 3111-1:1994; FDA 21 CFR 1040.10 and Laser Notice No. 50*	

Supplemental Information:

The product was tested in a typical configuration with Agilent Technologies test systems.
[1] FDA Accession Numbers 8721422-14 to 8721422-18, 8721422-20, 8721422-22 to 8721422-24

2002-January-18
Date

Hans-Martin Fischer
Name

Product Regulations Engineer
Title

For further information, please contact your local Agilent Technologies sales office, agent or distributor.
Authorized EU-representative: Agilent Technologies Deutschland GmbH, Herrenberger Strasse 130, D-71034 Boeblingen, Germany

Revision: C Issue Date: 2002-January-18

D

Single-Mode/Multimode Module Performance Tests

The procedures in this section tests the optical performance of the instrument. The complete specifications to which the Agilent Technologies E6000C is tested are given in *“Specifications” on page 191*.

All tests can be performed without access to the interior of the instrument. The performance tests refer specifically to tests using the Diamond Agilent/HMS-10 connector.

General

Equipment Required

Equipment required for the performance test is listed below. Any equipment meeting the same specifications can be used.

Single-mode Modules (E6001A - E6004A, E6003B, E6008B, and E6012A-E6013A)

- Optical Attenuator Agilent 8156A #101 (Return loss > 40 dB, Repeatability < 0.01 dB).
- Single-mode fiber with 3 dB coupler and known length (between 4 and 5 km), for example, the Agilent Recirculating Delay Line (P/N 08145-67900).
- 3× Optical Connector Interface Agilent 81000AI.
- Single-mode fiber: length 25 ± 2 km.

Extra equipment for slanted connectors

If you are using slanted optical connectors, you also need the following equipment:

- Single-mode patchcord DIN angled PC Agilent 81113PC.
- Adapter PC Agilent 81000FI.
- Universal Interface Agilent 81000UI.

Multimode Module (E6005A/E6009A)

- Optical Attenuator for 850/1300 nm, 62.5 µm MM, attenuation 30-50 dB (including insertion loss).
- Multimode fiber with 3 dB coupler and known length (between 4 and 5 km).
- 3 × Optical Connector Interface Agilent 81000AI.
- 1 × Universal Thru Adapter Agilent 81000UM.
- Single-mode fiber, length 25 ± 2 km.

Test Record

Results of the performance test may be noted in the performance test record. The test record can also be used as a permanent record and may be reproduced without written permission from Agilent Technologies.

Test Failure

If the Agilent E6000C fails any performance test, return the instrument to the nearest Agilent Technologies Sales/ Service Office for repair.

Instrument Specification

Specifications

Specifications are the performance characteristics of the instrument that are certified. These specifications, listed in *"Specifications" on page 191*, are the performance standards or limits against that the Agilent E6000C can be tested.

"Specifications" also lists some supplemental characteristics of the Agilent E6000C and should be considered as additional information.

Change of Specifications

Any changes in the specifications due to manufacturing changes, design, or traceability to the National Bureau of Standards will be covered in a manual change supplement or revised manual. The specifications listed in such a change supersede any previously published.

Performance Tests

Perform each step in the tests in the order they are given, using the corresponding test equipment.

Clean connectors

Make sure that all optical connections in the test setups given in the procedure are dry and clean. For cleaning use the procedure given in *"Cleaning Information" on page 271*.

NOTE

The screens shown in the example figures are taken from the Single-Mode tests. Multimode tests will produce similar output, but the settings may be slightly different.

Conventions used in this Appendix

See "Conventions used in this manual" on page 11

Test I. Dynamic Range

Connect equipment

1 Connect the equipment as shown in Figure 74 (single-mode module), or Figure 75 (multimode model). Terminate the far end.

   The fiber is terminated by wrapping it five times around the shaft of a screwdriver (or some similar object with a diameter of around 5 mm).

   If you are using the Agilent Recirculating Delay line, connect part 1 to the Mini-OTDR.

NOTE The specific measurement techniques of the Agilent E6000C require a fiber length which is adapted in attenuation and backscatter to the requirements of the selected pulsewidth.

The fiber specified for this test is of general type and valid for all pulsewidths. A shorter fiber should not be used, as the uncertainty of the measurements would increase by some dB.

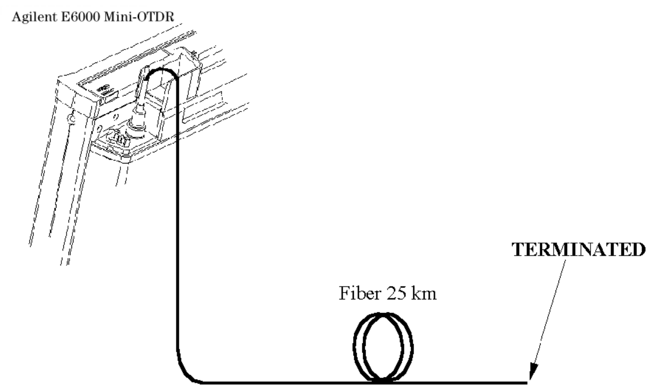


Figure 74 Dynamic Range Test Setup: Single-Mode

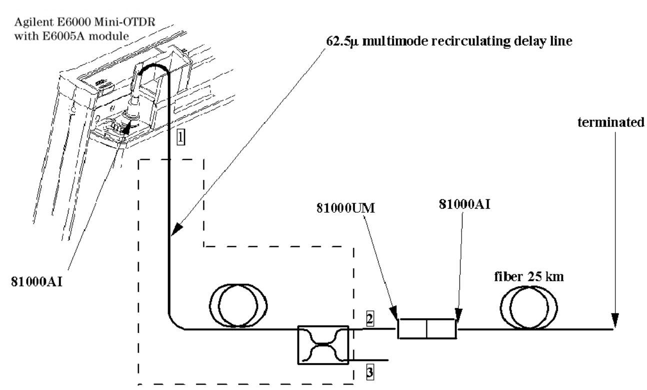


Figure 75 Dynamic Range Test Setup: Multimode

NOTE Instead of the 62.5m recirculating delay line, you can use a 62.5μm multimode fiber of length > 4km.

If you use such a multimode fiber, you do not require the coupler (within the dotted box in Figure 75).

2 Turn on the OTDR, and after the selftest has passed, recall the default settings.

Settings

3 Set the OTDR:

[SETTINGS] menu:

- <RANGE> - select <RANGE INPUT...>:

  `Start`: - enter value ST from Table 2, Table 3, or Table 4. Confirm with <OK>.

  `Span`: - enter value SP from Table 2, Table 3, or Table 4. Confirm with <OK>.

- <PULSE WIDTH>: enter value PW from Table 2, Table 3, or Table 4.
- <WAVELENGTH>: If a dual wavelength module is installed, select the required wavelength
- <MEAS. MODE>: `Averaging`
- <OPTIMIZE MODE>: `Dynamic`
- <AVG. TIME>: `3 min`

NOTE If the averaging parameter is listed for Number of Averages, you should do the following:

- Exit the [SETTINGS] menu

  Press `Ok`.

Configuration

- Enter the `Instrument Config` screen.

  Select [CONFIG.]<INSTRUMENT CONFIG>

- Bring up the `OTDR Settings` page

  Select [PAGE INDEX]<OTDR SETTINGS>

- Select Averaging time

  Move to the `Averaging Mode` box and press select, select `Averaging time` from the menu you see.

- Save this configuration

  Select `Save`.

- Exit the `Instrument Config` screen

  Select `Ok`.

- Return to the settings screen
  Select [SETTINGS].

Appearance of trace You now see a box for `Avg. Time`.

[VIEW] menu:

– <PREFERENCES><DOTTED TRACE>: ON

[ANALYSIS] menu

– <2 PT. LOSS>

.

Pulse-width PW	Start ST	Span distance SP	View start position of marker B Bpos	View end Vend	Viewed distance V
10 µs	0 km	200 km	180 km	200 km	20 km
1 µs	0 km	150 km	130 km	150 km	20 km
100 ns	0 km	70 km	50 km	70 km	20 km
10 ns	0 km	70 km	50 km	70 km	20 km

Table 2 Dynamic Range Test settings: single-mode (E6001A to E6004A)

Pulse-width PW	Start ST	Span distance SP	View start position of marker B Bpos	View end Vend	Viewed distance V
10 µs	0 km	100 km	40 km	60 km	20 km
1 µs	0 km	100 km	40 km	60 km	20 km

Table 3 Dynamic Range Test settings: single-mode (E6003B, E6008B, E6012A, E6013A)

Pulse-width	Start	Span distance	View start position of marker B	View end	Viewed distance
PW	**ST**	**SP**	**Bpos**	**Vend**	**V**
100 ns	0 km	50 km	30 km	45 km	15 km
10 ns	0 km	50 km	30 km	45 km	15 km

Table 3 Dynamic Range Test settings: single-mode (E6003B, E6008B, E6012A, E6013A)

Pulse width PW	Start ST	Span distance SP 850/ 1300nm	View start position of marker B Bpos 850/ 1300nm	View end Vend 850/ 1300nm	Viewed distance V 850/ 1300nm
10 µs	0 km	— / 150 km	— / 130 km	— / 150 km	— / 20 km
1 µs	0 km	— / 100 km	— / 80 km	— / 100 km	— / 20 km
100 ns	0 km	70 / 70 km	50 / 50 km	70 / 70 km	20 / 20 km
10 ns	0 km	70 / 70 km	50 / 50 km	70 / 70 km	20 / 20 km

Table 4 Dynamic Range Test settings: multimode

4 Terminate the fiber, start the measurement and wait until measurement stops.

RUN/STOP, wait while measuring

NOTE After the measurement has stopped the fiber must not be terminated.

5 View the complete trace. See Figure 76.

DOWN (`Full Trace`)

NOTE If you can already see the full trace, please ignore this command

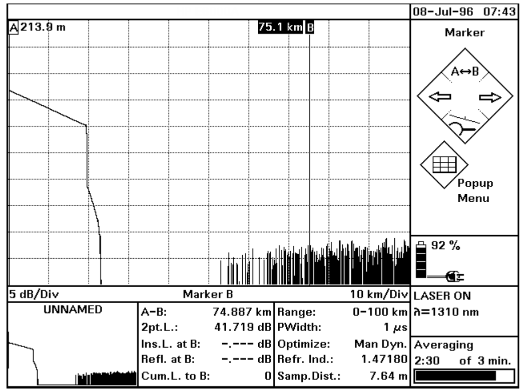


Figure 76 Dynamic Range Test: Full Trace View

Position markers

6 Use Cursor keys to position marker A and B at 2.5 km ± 0.5 km

7 Select marker B

UP (A/B) until only B is highlighted.

Zoom

8 Zoom to 0.5 dB/Div and 500m/Div

[ZOOM], then use cursors.

The current zooming figures are written below the trace to the left and right hand side.

Offset the trace

9 Select offset

[VIEW]<ADJUST V-OFFSET>

10 Offset the trace until the extrapolated beginning of the backscatter is on a horizontal grid line. The extrapolated beginning of the backscatter is the level that the backscatter would reach if it was continued back to 0 km from the OTDR, that is if there was no initial reflection.

Use the Left and Right cursors to offset by large increments, and the Up and Down cursors to ‘fine tune’.

11 Close Offset

<SELECT>

Reposition markers

12 Select Marker A

UP (A/B) until only A is highlighted.

13 Use the cursor keys to position marker A at the end of the front reflection on the level of the extrapolated beginning of the backscatter (that is, the crossing of the frontreflection and the horizontal grid line).

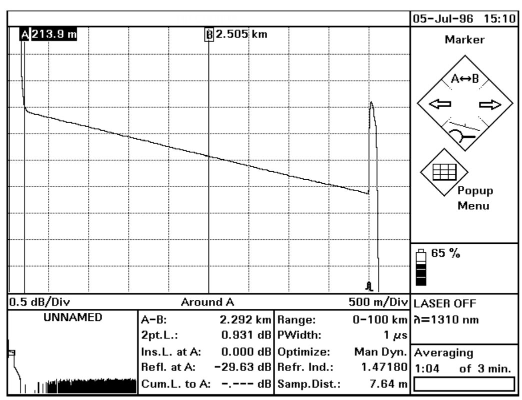


Figure 77 **Dynamic Range Test: Position Marker at End of Frontreflection**

14 Position marker B at **Bpos** km. View the trace around marker B and zoom the trace around marker B to 2 km/Div and 1 dB/Div.

The value for **Bpos** is given in Table 2, Table 3, or Table 4, depending on the module you use.

UP (A/B) until only B is highlighted. Use LEFT/RIGHT keys → **Bpos** km. Use DOWN (Around B) to get better resolution.

{<==> ZOOM} → 2 km/Div

{ZOOM} → 1dB/Div.

Note results in test record

15 Note the value of the sample spacing, “Samp.Dist.”. Calculate the number of peak samples (dots) from the viewed distance V divided by the sample spacing.

Calculate 2% thereof.

To get 98% Noise Level disregard 2% of the largest noise peaks samples (dots).

Example: PW = 10 µs → V = 50km, sample spacing = 10.28 m.

→ number of peak samples = 50 km / 10.28 m = 4863

→ 2% thereof = 97.

16 Check the calculated 2% of the highest peak samples within the viewed distance V: that is from *Bpos* to *Vend* according to the values given in Table 2, Table 3, or Table 4.

NOTE To check out and disregard the 2% of the highest peak samples you need to zoom in further to get dots.You may have to change the color of the trace to view them more clearly.

Reposition marker B

17 Position marker B at a point on the trace that equals the 98% Noise Level

Note more results

18 Note 2-pt-loss between A and B as “Dynamic $Range_{98\%}$” at the actual pulsewidth.

19 Calculate the dynamic range as follows:

Dynamic Range = Dynamic $Range_{98\%}$ + 1.9 dB

Repeat for other pulsewidths

20 Repeat steps 4 to 19 with all pulsewidths described in the test record.

Test II. Event Deadzone

NOTE The setup simulates a return loss of 35 dB. To care for the fact that – due to the coupler – the light pulse travels through the attenuator twice to sum up, the attenuator needs to be set to a value 3 dB larger than the simulated return loss, that is. 35 dB + 3 dB = 38 dB.

As this value includes the Insertion Loss of the attenuator, you may need to determine the Insertion Loss first.

Connect equipment

1 Make sure that all optical connectors are clean and connect the equipment as shown in Figure 78.

If you are using the Agilent Recirculating Delay Line, connect port 2 to the OTDR, port 1 to the input of the attenuator, and port 3 to the output of the attenuator

Be sure to use the appropriate Single-Mode/Multimode delay line for the module to be tested.

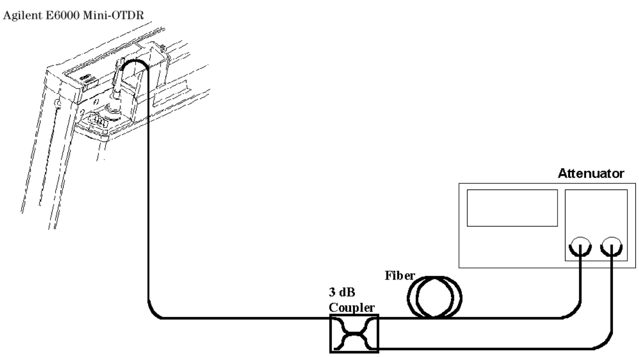


Figure 78 Event Deadzone Test Setup

Settings

2 Turn on the OTDR, and after the self-test has passed, recall the default settings and the resolution mode.

[Settings]<Recall..><Default Setting>

[Settings]<Optimize Mode><Resolution>

3 Set the linestyle to solid

{VIEW}<PREFERENCES><DOTTED TRACE>: OFF

4 Make sure that the length unit is set to meters.

[CONFIG]<LENGTH UNIT><METER [M]>

5 Set the Start and Span to 0.00–10.00 km, and the Averaging time to 3 min.

[Settings]<Range><0-10 km>

[Settings]<Avg Time><3 min> (see the note on page 224).

[Settings]<Meas. Mode><Averaging>

6 Select the required wavelength.

[Settings]<Wavelength>

7 Either (Single-mode module)

Set the pulsewidth to 10 ns.

[Settings]<PulseWidth><10 ns>

♦ Or (Multimode module)

Set the pulsewidth to 5 ns.

[Settings]<PulseWidth><5 ns>

Attenuator settings

8 Set up the attenuator.

- Set λ to the actual wavelength.
- Set the attenuation to 38 dB (see Note on page 230).
- Enable the attenuator output.

Start measurement

9 On the OTDR start the measurement.

Run/Stop

Position marker A

10 Wait until the backscatter noise is reduced (about 10 s), then position marker A close to the beginning of the first reflection after the front reflection. See Figure 79.

UP (A/B) until only A is highlighted. Use LEFT/RIGHT keys.

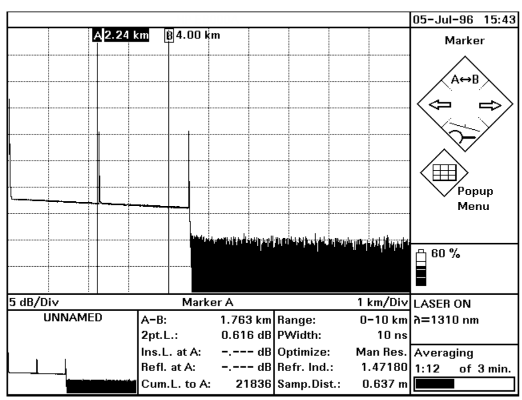


Figure 79 Event Deadzone Test: Position Marker A

Set start

11 Set the start position close to the position of marker A. The start position should be just before the front edge

of the reflection. Set the measurement span to start position+2 km.

[Settings}<Range><Range Input...>. Use Cursor keys to specify Start and Span. Confirm with OK.

NOTE The start position should be a little before the front edge of the reflection. For example, if the reflection is at 2.2 km, use a start position of 2 km.

Start measurement

12 Run the measurement.

Run/Stop

Position markers

13 Position marker A on top of the first reflection on the trace.

Up (A/B) until only A is highlighted. Use Left/Right keys to set marker A

14 Position marker B about 5 m right from marker A.

Up (A/B) until only B is highlighted. Use Left/Right keys to set marker B.

Up (A/B) until only A is highlighted. Use Left/Right keys. Use Down (Around A) to get better resolution.

Set scales and offset

15 Set the y-axis scale to 0.5 dB/Div and the x-axis to 0.5 m/Div.

{<==> Zoom} → 0.5 m/Div and [⇑⇓ Zoom] → 0.5 dB/Div. Close by OK.

16 Select offset, and move the peak of the reflection 3 divisions (1.5 dB) above the center of the graph.

[View}<Adjust V-Offset>. Use Left/Right keys. Press Select to Confirm.

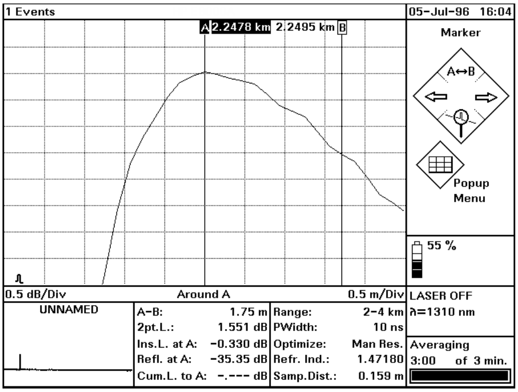


Figure 80 **Event Deadzone Test: Position Marker B**

Position markers

17 Use the LEFT/RIGHT keys to position marker B where the down slope of the reflection crosses the horizontal center line of the graph. See Figure 80.

18 Position marker A at the beginning of the event.

UP (A/B) until A is highlighted. Use LEFT/RIGHT keys.

Use DOWN (Around A) to get better resolution.

Note result in test record

19 Note the width of the reflection in the test record. The width is the distance between the markers A and B.

20 Stop the measurement.

Run/Stop

Test III. Attenuation Deadzone

NOTE The setup simulates a return loss of 35 dB. To care for the fact that – due to the coupler – the light pulse travels through the attenuator twice to sum up, the attenuator needs to be set to a value 3 dB larger than the simulated return loss, that is. 35 dB + 3 dB = 38 dB.

As this value includes the Insertion Loss of the attenuator, you may need to determine the Insertion Loss first.

Connect equipment

1 Connect the equipment as for the event deadzone test (see Figure 78).

Settings

2 Turn on the OTDR, and after the self-test has passed, recall the default settings and the resolution mode.

[Settings]<Recall..><Default Setting>

[Settings]<Optimize Mode><Resolution>

3 Set linestyle to SOLID.

[View]<Preferences><Dotted Line>: OFF

4 Set 2 pt. loss

[Analysis]<2 pt.Loss>

5 Make sure that the length unit is set to meters.

[Config]<Length Unit><Meter [m]>

6 Set the Start and Span to 0.00–10.00 km.

[Settings]<Range><0-10 km>

7 Either (Single-mode module)

Set the pulsewidth to 30 ns.

[Settings]<PulseWidth><30 ns>. Close by OK.

♦ Or (Multimode module)

Set the pulsewidth to 10 ns.

[Settings]<PulseWidth><10 ns>. Close by OK.

Attenuator settings

8 Set up the attenuator.

– Set λ to the actual wavelength.

– Set the attenuation to 38 dB (see Note on page 235).

– Enable the attenuator output.

Start measurement

9 On the OTDR start the measurement.

Run/Stop

Position marker A

10 Wait until the backscatter noise is reduced (about 10 s), then position marker A close to the beginning of the first reflection after the front reflection.

Up (A/B) until only A is highlighted. Use Left/Right keys

Stop measurement

11 Stop the measurement.

Run/Stop

Set start

12 Set the start position close to the position of marker A and the measurement span to 2 km.

[Settings]<Range><Range Input...>. Use Cursor keys to specify Start and Span. Confirm with OK.

NOTE The start position should be a little before the front edge of the reflection. For example, if the reflection is at 2.2 km, use a start position of 2 km.

Restart measurement

13 Start the measurement.

Run/Stop

Reposition markers

14 Select marker B

UP (A/B) until only B is highlighted.

15 Use the LEFT/RIGHT keys to position marker B on the peak of the event. You may choose DOWN (Around B) to get better resolution.

16 Select marker A

UP (A/B) until only A is highlighted.

17 Position marker A 70 m ± 1 m to the right of marker B, that is after the event. Do this by checking A-B.

NOTE When noise is seen on the trace, a position referring to the mean value of the trace should be selected.

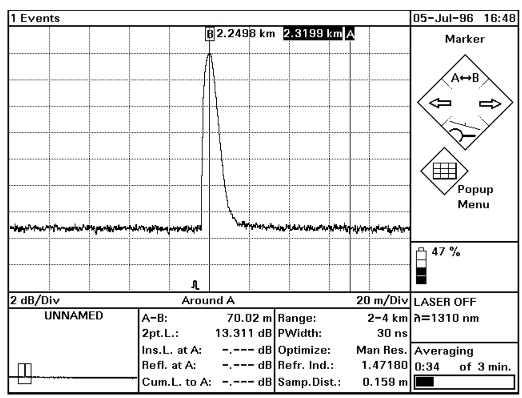


Figure 81 Attenuation Deadzone Test: Position Marker A

18 Select marker B

UP (A/B) until only B is highlighted.

19 Use the LEFT/RIGHT keys to position marker B on top of marker A

20 Use the LEFT key to move marker B until the 2 pt. Loss shows +0.5dB or -0.5dB.

NOTE When noise is seen on the trace, a position referring to the mean value of the trace should be selected.

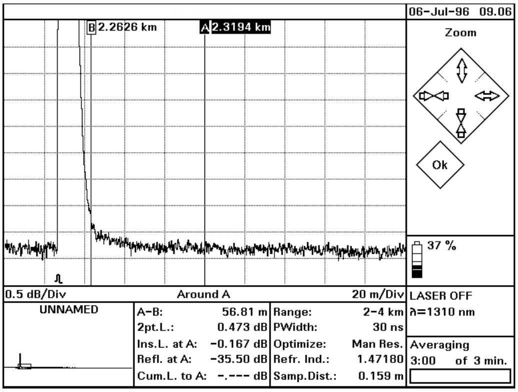


Figure 82 **Attenuation Deadzone Test: Marker B at End of Reflection**

Set scales

21 Set resolutions to: x-axis: .5m/Div, y-axis: 0.5dB

{<==> ZOOM} → 0.5 m/Div and [⇑ ⇓ Zoom] → 0.5 dB/Div. Close by OK.

Reposition marker A

22 Select marker A

UP (A/B) until only A is highlighted.

23 Use the LEFT/RIGHT keys to move marker A to the start of the front reflex.

NOTE The best approximation of the start position of the reflection is: last point on backscatter + half sample spacing, that is Samp. Dist.

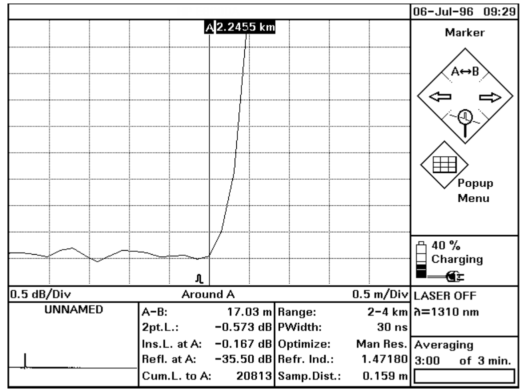


Figure 83 Attenuation Deadzone Test: Marker A at Start of Reflection

Note result in test record

24 Note the distance between the A-B markers as the attenuation deadzone in the test record.

Test IV. Distance Accuracy (Optional)

Connect equipment

1 Connect the equipment as shown in Figure 84.
If you are using an Agilent Recirculating Delay Line, connect port 2 to the OTDR, and leave port 1 open.

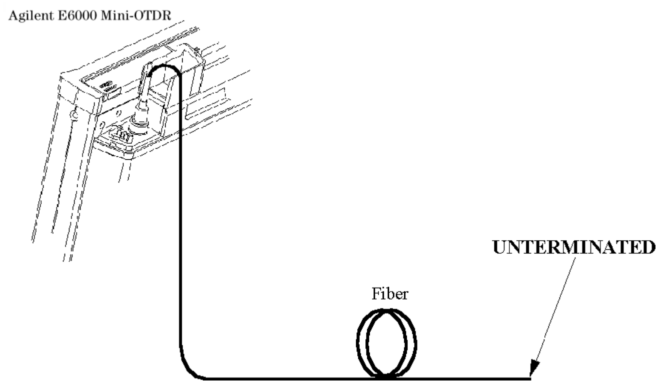


Figure 84 Distance Accuracy Test Setup

2 Turn on the Mini-OTDR, and after the self-test has passed, recall the default settings and the standard mode.

Settings

3 Set the OTDR:

[SETTINGS] menu:

- <RANGE>: 0 - 10 km.
- <PULSE WIDTH>: 1 µs
- <WAVELENGTH>: If a dual wavelength module is installed, select the required wavelength
- <MEAS. MODE>: Averaging
- <OPTIMIZE MODE>: Resolution
- <AVG. TIME>: 3 min (see the note on page 224).
- <REFR. IND.>: 1.45800
- <DATA POINTS>: 16000

[VIEW] menu:

- <PREFERENCES><DOTTED TRACE>: OFF

[ANALYSIS] menu

- <2 pt. Loss>

[CONFIG] menu

- <LENGTH UNIT><METER [M]>: ON

Start short measurement

4 Run the measurement, wait 10 seconds, then stop the measurement

Run/Stop ... Run/Stop

Position marker A

5 Move marker A to the beginning of the endreflection.

UP (A/B) until only A is highlighted. Use LEFT/RIGHT keys

Set start

6 Set the start position close to the position of marker A. The start position should be before the position of marker A (for example, if marker A is at 4.5 km, the start position should be 4.0 km).

[SETTINGS}<RANGE><RANGE INPUT...>. Use Cursor keys to specify Start and Span. Confirm with OK.

7 Set the OTDR:

[SETTINGS]<RANGE INPUT>: Start 4 km, Span 2 km

Run measurement

8 Run the measurement, and wait until the measurement has stopped.

Reposition markers

9 Set marker to the beginning of the range (4.000 km).

UP (A/B) until only A is highlighted. Use LEFT/RIGHT keys.

10 Set marker B to the beginning of the end reflection

UP (A/B) until only B is highlighted. Use LEFT/RIGHT keys.

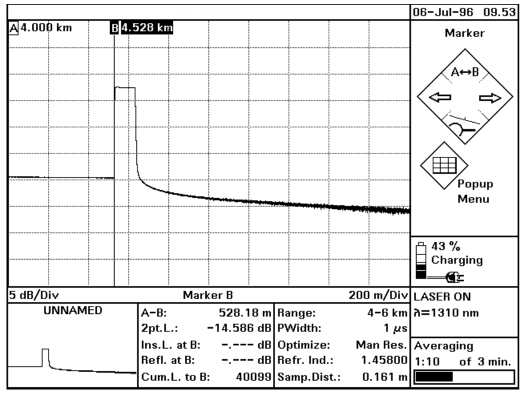


Figure 85 Distance Accuracy Test: Position Markers

11 Select DOWN (Around B).

12 Zoom the display to 0.1 m/Div and 0.2 dB/Div

13 Use the LEFT/RIGHT keys to reposition marker B to the beginning of the endreflection.

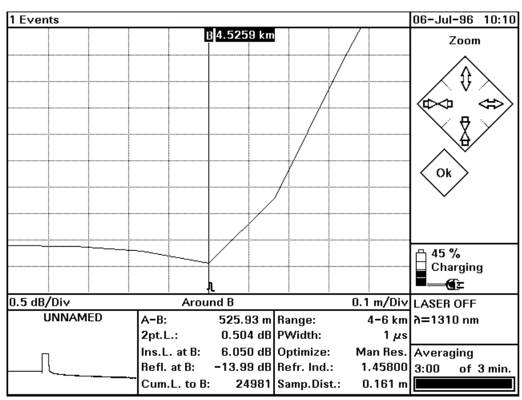


Figure 86 Distance Accuracy Test: Around Marker View

NOTE The true location of the beginning of the event cannot be determined by finite sample spacing. This is taken care of by the sampling error.

The best approximation of the start position of the reflection is: last point on backscatter + half sample spacing, that is Samp. Dist.

Note result in test record

14 Note the distance between markers A and B (A <–>B) plus the position of marker A (4.000 m), as Measured Distance to the test record.

Repeat for other pulsewidth

15 Repeat steps 12 to 14 with the pulsewidth set to 100ns.

Evaluate data and enter in test record

16 Evaluate the measurement data.

- Note the length of your optical fiber to the test record.
- Note the start position to the test record.
- Distance accuracy

  The distance accuracy is defined as:

  Distance accuracy = (Measured Distance × Scale Error
  + Offset Error ± 1/2 Sampling Spacing)

  Sampling Error = Sample Spacing

  Distance accuracy = ± Fiber Length × 10^{-4} ± 1 m ± 0.08 m

Measured Distance	Known Fiber Length of Delay Line
Offset Error	± 1 m
Scale Error	± 10^{-4}
Sample spacing with the 2km Span	0.161m

- Calculate the minimum and the maximum distances as described in the test record.
  Note them in the test record and compare them with the measured distances.

Performance Test Form Sheets

Please use copies of the following form sheets for your individual performance tests.

Performance Test for the Agilent E6000C with Single-mode Modules **Page 1 of 8**

Test Facility:

______________________	Report No.	______________________	
______________________	Date:	______________________	
______________________	Customer:	______________________	
______________________	Tested By:	______________________	

Model: **E6000C**

Serial No.	______________	Ambient temperature	______	°C
Options	______________	Relative humidity	______	%
Firmware Rev.	______________	Line frequency	______	Hz
Model	Agt. ________ Module			
Serial No.	______________			

Special Notes:

____

____

____

____

____

____

____

____

Performance Test for the Agilent E6000C with Single-mode Modules **Page 2 of 8**

Model Agt. __________ **Module** **Report No.** __________ **Date** ___________

Test Equipment Used:

Description	Model No.	Trace No.	Cal. Due Date
1. Optical Attenuator	_________	__________	__ / __ /___
2. SM Fiber with 3 dB Coupler Recirculating Delay Line	08145-67900	__________	__ / __ /___
3.____	__________	__________	__ / __ /___
4.____	__________	__________	__ / __ /___
5.____	__________	__________	__ / __ /___
6.____	__________	__________	__ / __ /___
7.____	__________	__________	__ / __ /___
8. ____	__________	__________	__ / __ /___
9. ____	__________	__________	__ / __ /___
10.____	__________	__________	__ / __ /___
11.____	__________	__________	__ / __ /___
12.____	__________	__________	__ / __ /___
13.____	__________	__________	__ / __ /___
14.____	__________	__________	__ / __ /___

Performance Test for the Agilent E6000C with Single-mode Modules **Page 3 of 8**

Model Agt. ___________ **Module** **Report No.** ___________ **Date** ____________

No. Test Description

I. Dynamic Range 1310 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6001A E6004A	E6003A	E6003B	E6008B	E6013A	Meas. Uncertainty
	dB	dB	dB	dB	dB	dB	dB	dB
10 µs	________	________	28	35	38	42	36	________
1µs	________	________	23	30	30	35	29	________
100 ns	________	________	18	24	24	29	23	________
10 ns	________	________	13	19	19	24	18	________

II. Event Deadzone 1310 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns E6001A, E6003A, E6003B, E6004A, E6008B, E6013A	________ m	5 m	________ m

Performance Test for the Agilent E6000C with Single-mode Modules **Page 4 of 8**

Model Agt. __________ Module Report No. __________ Date __________

No. Test Description

III. Attenuation Deadzone 1310 nm Wavelength

	Attenuation Deadzone	Maximum Specification		Meas. Uncertainty
		E6001A, E6004A, E6003B	E6003A, E6008B, E6013A	
	m	m	m	m
Return Loss ≥ 35dB				
Conditions: Meas. Span. 2km Pulsewidth 30ns	_______	25	20	_______

IV. Distance Accuracy 1310 nm Wavelength (Optional test)

Fiber Length: ________ m Sample Spacing: ________ m (as Δ on the screen)

Start Position: ________ m

|Distance Accuracy| = (Fiber Length x Scale Error + Offset Error + 1/2 Sample Spacing)

|Distance Accuracy| = (_______ m x 10^{-4} +1m + ________ m)

|Distance Accuracy| = ___________ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length + | Distance Accuracy|

Meas.Span	Pulsewidth	Minimum Distance (typ.) m	Measured Distance m	Maximum Distance (typ.) m	Meas. Uncertainty m
4 to 6 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

Performance Test for the Agilent E6000C with Single-mode Modules **Page 5 of 8**

Model Agt. ___________ **Module** **Report No.** ___________ **Date** ____________

No. Test Description

I. Dynamic Range 1550 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6003A	E6003B	E6004A	E6008B E6012A	E6013A	Meas. Uncertainty
	dB	dB	dB	dB	dB	dB	dB	dB
10 µs	________	________	34	37	28	41	35	________
1µs	________	________	29	29	23	34	28	________
100 ns	________	________	22	22	18	27	22	________
10 ns	________	________	17	17	13	22	17	________

II. Event Deadzone 1550 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns E6003A, E6003B, E6004A, E6008B, E6012A, E6013A	________ m	5 m	________ m

Performance Test for the Agilent E6000C with Single-mode Modules **Page 6 of 8**

Model Agt. __________ Module Report No. __________ **Date ___________**

No. Test Description

III. Attenuation Deadzone 1550 nm Wavelength

		Maximum Specification		
	Attenuation Deadzone	E6003A, E6003B, E6004A	E6008B, E6012A, E6013A	Meas. Uncertainty
	m	m	m	m
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 30ns	_______	25	25	_______

IV. Distance Accuracy 1550 nm Wavelength (Optional test)

Fiber Length: ________ m Sample Spacing: ________ m (as Δ on the screen)

Start Position: ________ m

|Distance Accuracy| = (Fiber Length x Scale Error + Offset Error + 1/2 Sample Spacing)

|Distance Accuracy| = (_______ m x 10^{-4} +1m + ________ m)

|Distance Accuracy| = ___________ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length + | Distance Accuracy|

Meas.Span	Pulsewidth	Minimum Distance (typ.) m	Measured Distance m	Maximum Distance (typ.) m	Meas. Uncertainty m
4 to 6 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

Performance Test for the Agilent E6000C with Single-mode Modules **Page 7 of 8**

Model Agt. ___________ **Module** **Report No.** ___________ **Date** ____________

No. Test Description

I. Dynamic Range 1625 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6012A	Minimum Specification E6013A	Meas. Uncertainty
	dB	dB	dB	dB	dB
10 µs	_______	_______	37	35	_______
1µs	_______	_______	30	28	_______
100 ns	_______	_______	24	22	_______
10 ns	_______	_______	18	17	_______

II. Event Deadzone 1625 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns			
E6012A, E6013A	_______ m	5 m	_______ m

Performance Test for the Agilent E6000C with Single-mode Modules **Page 8 of 8**

Model Agt. __________ Module Report No. __________ **Date ___________**

No. Test Description

III. Attenuation Deadzone 1625 nm Wavelength

	Attenuation Deadzone	Maximum Specification E6012A, E6013A	Meas. Uncertainty
	m	m	m
Return Loss ≥ 35dB			
Conditions: Meas. Span. 2km Pulsewidth 30ns	_______	28	_______

IV. Distance Accuracy 1625 nm Wavelength (Optional test)

Fiber Length: ________ m Sample Spacing: ________ m (as Δ on the screen)

Start Position: ________ m

|Distance Accuracy| = (Fiber Length x Scale Error + Offset Error + 1/2 Sample Spacing)

|Distance Accuracy| = (_______ m x 10^{-4} +1m + ________ m)

|Distance Accuracy| = ___________ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length + | Distance Accuracy|

Meas.Span	Pulsewidth	Minimum Distance (typ.)	Measured Distance	Maximum Distance (typ.)	Meas. Uncertainty
		m	m	m	m
4 to 6 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

Performance Test for the Agilent E6000C with Multimode Modules **Page 1 of 6**

Test Facility:

________________	Report No.	________________
________________	Date:	________________
________________	Customer:	________________
________________	Tested By:	________________

Model: **E6000C**

Serial No.	________________	Ambient temperature	______ °C
Options	________________	Relative humidity	______ %
Firmware Rev.	________________	Line frequency	______ Hz
Model	Agt. ________ Module		
Serial No.	________________		

Special Notes:

____

____

____

____

____

____

____

____

Performance Test for the Agilent E6000C with Multimode Modules			Page 2 of 6
Model Agt. __________ Module	**Report No. __________**	**Date __________**	
Test Equipment Used:			
Description	Model No.	Trace No.	Cal. Due Date
1. Optical Attenuator	__________	__________	__/__/___
2. MM Fiber with 3 dB Coupler Recirculating Delay Line	__________	__________	__/__/___
3.__________	__________	__________	__/__/___
4.__________	__________	__________	__/__/___
5.__________	__________	__________	__/__/___
6.__________	__________	__________	__/__/___
7.__________	__________	__________	__/__/___
8. __________	__________	__________	__/__/___
9. __________	__________	__________	__/__/___
10.__________	__________	__________	__/__/___
11.__________	__________	__________	__/__/___
12.__________	__________	__________	__/__/___
13.__________	__________	__________	__/__/___
14.__________	__________	__________	__/__/___

Performance Test for the Agilent E6000C with Multimode Modules **Page 3 of 6**

Model Agt. ___________ **Module** **Report No.** ___________ **Date** ____________

No. Test Description

I. Dynamic Range 850 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6005A	Minimum Specification E6009A	Meas. Uncertainty
	dB	dB	dB	dB	dB
100 ns	________	________	26	18	________
10 ns	________	________	19	12	________

II. Event Deadzone 850 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB			
Conditions: Meas. Span. 2km Pulsewidth 5ns			
E6005A, E6009A	________ m	3 m	________ m

Performance Test for the Agilent E6000C with Multimode Modules	**Page 4 of 6**

Model Agt. __________ Module Report No. __________ Date __________

No. Test Description

III. Attenuation Deadzone 850 nm Wavelength

	Attenuation Deadzone	Maximum Specification	Meas. Uncertainty
	m	m	m
Return Loss ≥ 35dB			
Conditions: Meas. Span. 2km Pulsewidth 10ns	________	10	________

IV. Distance Accuracy 850 nm Wavelength (Optional test)

Fiber Length: ________ m Sample Spacing: ________ m (as Δ on the screen)

Start Position: ________ m

|Distance Accuracy| = (Fiber Length x Scale Error + Offset Error + 1/2 Sample Spacing)

|Distance Accuracy| = (_______ m x 10^{-4} +1m + ________ m)

|Distance Accuracy| = ____________ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length + | Distance Accuracy|

Meas.Span	Pulsewidth	Minimum Distance (typ.)	Measured Distance	Maximum Distance (typ.)	Meas. Uncertainty
		m	m	m	m
2 km	100 ns	________	________	________	________

Performance Test for the Agilent E6000C with Multimode Modules **Page 5 of 6**

Model Agt. ___________ **Module** **Report No.** ___________ **Date** ____________

No. Test Description

I. Dynamic Range 1300 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6005A	Minimum Specification E6009A	Meas. Uncertainty
	dB	dB	dB	dB	dB
10 µs	________	________	34	*n/a*	________
1µs	________	________	28	23	________
100 ns	________	________	22	18	________
10 ns	________	________	17	12	________

II. Event Deadzone 1300 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB			
Conditions: Meas. Span. 2km Pulsewidth 10ns			
E6005A, E6009A	________ m	3 m	________ m

Performance Test for the Agilent E6000C with Single-mode Modules **Page 6 of 6**

Model Agt. __________ Module Report No. __________ Date ___________

No. Test Description

III. Attenuation Deadzone 1300 nm Wavelength

	Attenuation Deadzone	Maximum Specification	Meas. Uncertainty
	m	m	m
Return Loss ≥ 35dB			
Conditions: Meas. Span. 2km Pulsewidth 10ns	_______	10	_______

IV. Distance Accuracy 1300 nm Wavelength (Optional test)

Fiber Length: ________ m Sample Spacing: ________ m (as Δ on the screen)

Start Position: ________ m

|Distance Accuracy| = (Fiber Length x Scale Error + Offset Error + 1/2 Sample Spacing)

|Distance Accuracy| = (_______ m x 10^{-4} +1m + ________ m)

|Distance Accuracy| = ___________ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length + | Distance Accuracy|

Meas.Span	Pulsewidth	Minimum Distance (typ.)	Measured Distance	Maximum Distance (typ.)	Meas. Uncertainty
		m	m	m	m
2 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

Test V. E6006A Power Meter Submodule

Table 5 Power Meter: Test Equipment Required

Instrument or Accessories	qty	Recommended Agilent Model	Required Characteristic	Alternative Models
Lightwave Multimeter Interface Module (1 channel)	1	8163A 81618A		8164A, 8166A 81619A
Optical Detector Head	1	81624A #C01		
Laser Source 1310/1550 nm	1	81654SM	1310 ± 10 nm 1550 ± 10 nm short term stability < ±0.005 dB	81657A 81650A and 81651A 81655A and 81656A
Optical attenuator	1	8156A #101	Attenuation > 50 dB Return Loss > 45 dB Repeatability < ±0.01 dB	
Patchcord *(HMS10/ HMS10, 9/50* µm, SM)	1	81101AC		
Patchcord *(HMS10/ HMS10, 50/125 mm)*	1	81501AC		
connector interface	4	81000AI		
connector adapter	1	81000AA		

NOTE You may also use the following older, but discontinued, equipment: 8153A (for 8163A), 81533B (for 81618A), 81524A #C01 (for 81624A #C01), and 81554SM with 81210LI #011 and 81310LI #011 (for 81654A).

Uncertainty/Accuracy Test at Reference Conditions

NOTE Make sure that all equipment has warmed up, and all connectors are clean.

Make sure that all patchcords are fixed to the table and will not move during measurements.

Repeat each of the following steps for each of the specified wavelengths:

Connect equipment

1 Connect the equipment as shown in Figure 87.

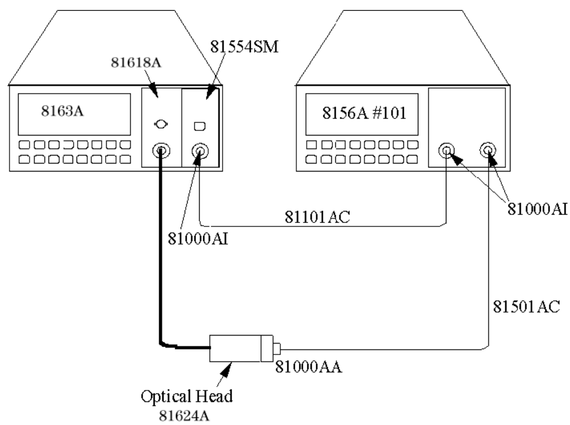


Figure 87 Test setup 1310 nm and 1550 nm: Reference Measurement

2 Disable the laser source and attenuator; zero the power meter (press {ZERO}).

Reference Measurement

Settings

3 Set the laser source to 1310 nm (nominal).

4 Set both the power meter and the attenuator to 1310.00 nm.

5 Set the power meter to MEASURE mode; select parameter T=100ms; switch AUTO range on.

6 Enable the Laser Source and the Agilent 8156A output, and wait 3 minutes until the laser has settled.

Display reading

7 On the power meter, press `[dBm W]` to get the display reading in W.

Set attenuator

8 Set the attenuation of the attenuator to a value where the power meter reads 10.00 µW

Measurement of DUT

Connect attenuator to DUT

9 Connect the attenuator output cable to the DUT, as shown in Figure 88.

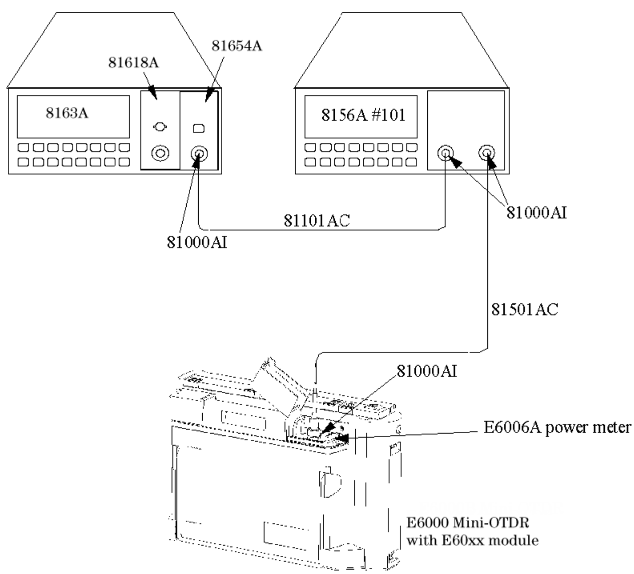


Figure 88 Test setup 1310 nm and 1550 nm: Measurement of the DUT

10 Make sure that the E6006A DUT has warmed up.

Set up equipment

11 Set the DUT to 1310.00 nm.

12 Enable the laser source and the Agilent 8156A output, and wait 3 minutes until the laser has settled.

13 Set the DUT to display power levels in W.

Note result in test record

14 Note the displayed measured value on the DUT in the test record.

Test of the other wavelength

Repeat for other wavelength

15 Set the laser source to 1550 nm (nominal), and set the attenuator and the DUT to 1550.00 nm.

16 Repeat steps 1 to 14 for this wavelength, replacing all settings of 1310 nm/1310.00 nm by 1550 nm/ 1550.00 nm.

NOTE The Reference Power Meter 81524A and the DUT are both of the same type InGaAs. This means that the wavelength dependencies are equal.

As long as both the Reference Power Meter and the DUT are set to the same wavelength, the actual wavelength of the source does not noticeably add to measurement uncertainties, if the source is within a ±20 nm limit of the measuring wavelength.

Total Uncertainty/Accuracy Test

NOTE Make sure that all equipment has warmed up, and all connectors are clean.

Make sure that all patchcords are fixed to the table and will not move during measurements.

Repeat each of the following steps for each of the specified wavelengths.

Connect equipment

1 Connect the equipment as shown in Figure 87.

NOTE If you are performing the optional accuracy test at 850 nm, it is sufficient to measure at the highest power level. This means that you do not need to use an attenuator: you can connect the laser source directly to the optical head using an Agilent 81501AC patchcord.

2 Disable the laser source and attenuator; zero the power meter (press {ZERO}).

Reference Measurement

Settings

3 Set the laser source to 1310 nm (nominal).

4 Set the Laser Source to ATT=0.

5 Set the power meter and the attenuator to 1310.00 nm.

6 Set the power meter to MEASURE mode; select parameter T=100ms; switch AUTO range on.

Set up equipment

7 Enable the Laser Source and the Agilent 8156A output, and wait 3 minutes until the laser has settled.

8 Set the attenuation of the attenuator to 0.00 dB.

9 On the power meter, press [dBm W] to get the display reading in W.

Note result in test record

10 Note the displayed reference measurement value on the power meter in the test record.

Repeat for other attenuations

11 Repeat steps 9 and 10 for all attenuation values listed in the test record.

Measurement of DUT

Connect attenuator to DUT

12 Connect the attenuator output cable to the DUT, as shown in Figure 88.

NOTE If you are performing the optional accuracy test at 850 nm, it is sufficient to measure at the highest power level. This means that you do not need to use an attenuator: you can connect the laser source directly to the optical head using an Agilent 81501AC patchcord.

13 Make sure that the E6006A DUT has warmed up.

Set up equipment

14 Set the DUT to 1310.00 nm.

15 Enable the laser source and the Agilent 8156A output, and wait 3 minutes until the laser has settled.

16 Set the attenuation of the attenuator to 0.00 dB.

17 Set the DUT to display power levels in W.

Note result in test record

18 Note the displayed measured value on the DUT in the test record.

Repeat for other attenuations

19 Repeat step 18 for all attenuation values listed in the test record.

Test of other wavelengths

Repeat for other wavelengths

20 Set the laser source to 1550 nm (nominal), and set the attenuator and the DUT to 1550.00 nm.

21 Repeat steps 1 to 19 for this wavelength, replacing all settings of 1310 nm/1310.00 nm by 1550 nm/ 1550.00 nm.

NOTE The Reference Power Meter 81524A and the DUT are both of the same type InGaAs. This means that the wavelength dependencies are equal.

As long as both the Reference Power Meter and the DUT are set to the same wavelength, the actual wavelength of the source does not noticeably add to measurement uncertainties, if the source is within a ±20 nm limit of the measuring wavelength

.

Performance Test for the Agilent E6000C with E6006A Power Meter submodule			Page 1 of 2
Description	Model No.	Trace No.	Cal. Due Date
1. Std, Lightwave Multimeter	________	________	__/__/___
2. Std Optical Head Interface	________	________	__/__/___
3. Std Optical Head	________	________	__/__/___
4. Laser Source	________	________	__/__/___
5.Attenuator	________	________	__/__/___
6.________________________________	________	________	__/__/___
7.________________________________	________	________	__/__/___
8. ________________________________	________	________	__/__/___
9. ________________________________	________	________	__/__/___
10.________________________________	________	________	__/__/___

Performance Test for the Agilent E6000C with E6006A Power Meter submodule **Page 2 of 2**

Model Agt. E6006A submodule **Report No.** ___________ **Date** ____________

Uncertainty/Accuracy test at Reference Conditions (Reference setting of power level 10.00 µW)

Wavelength	Minimum Spec (-3.6% of Ref.)	E6006A, DUT Measurement Results	Maximum Spec (+3.6% of Ref)	Measurement Uncertainty
1310.00 nm	9.640 µW	________ µW	10.360 µW	________ µW
1550.00 nm	9.640 µW	________ µW	10.360 µW	________ µW

Uncertainty/Accuracy Test: Wavelength 1310 nm

8156A setting	81524A Reference Measurement	Minimum Spec (-5% of Ref - 0.5 nW)	E6006A, DUT Measurement Results	Maximum Spec (+5% of Ref + 0.5 nW	Measurement Uncertainty
0 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
5 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
15 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
25 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
35 dB	__________nW	__________nW	__________nW	__________nW	_________ W
45 dB	__________nW	__________nW	__________nW	__________nW	_________ W

Uncertainty/Accuracy Test: Wavelength 1550 nm

8156A setting	81524A Reference Measurement	Minimum Spec (-5% of Ref - 0.5 nW)	E6006A, DUT Measurement Results	Maximum Spec (+5% of Ref + 0.5 nW	Measurement Uncertainty
0 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
5 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
15 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
25 dB	_________ µW	_________ µW	_________ µW	_________ µW	_________ W
35 dB	__________nW	__________nW	__________nW	__________nW	_________ W
45 dB	__________nW	__________nW	__________nW	__________nW	_________ W

Optional Test: Wavelength 850 nm

8156A setting	81520A Reference Measurement	Minimum Spec (-10% of Ref - 2.5 nW)	E6006A, DUT Measurement Results	Maximum Spec (+10% of Ref + 2.5 nW	Measurement Uncertainty
n/a	_________ µW	_________ µW	_________ µW	_________ µW	_________ W

Optional Test VI: E6007A Visual Fault Finder Submodule

Table 6 Visual Fault Finder: Test Equipment Required

Instrument or Accessories	qty	Recommended Agilent Model	Required Characteristic	Alternative Models
Lightwave Multimeter Meter	1	8163A		8164A, 8166A
Optical Power Sensor	1		625-645nm	
Patchcord *(HMS10/ HMS10, 9/50* µm, SM)	1	81101AC		
connector interface	2	81000AI		
Optical Spectrum Analyzer	1			

General

- Make sure that all equipment has warmed up, and all connectors are clean.
- Make sure that all patchcords are fixed to the table, and will not move during measurements.

Optional Test of Output Power Level (CW)

Connect equipment

1 Connect the equipment as shown in Figure 89.

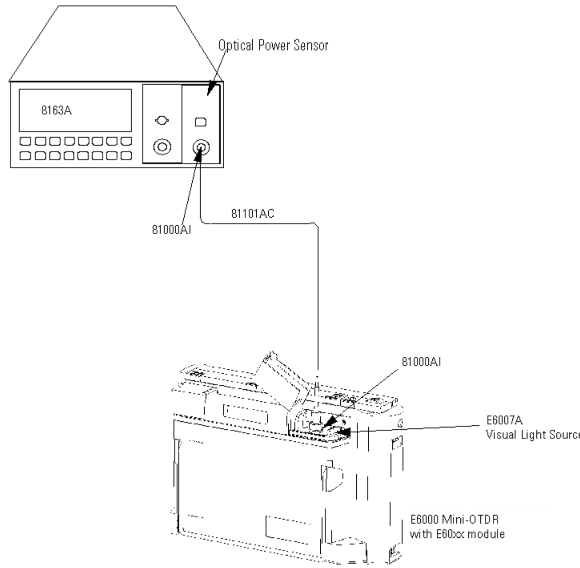


Figure 89 Measurement of the Output power

2 Apply a 9/125 µm patchcord with HMS-10 connectors.

Set up multimeter

3 Set the Multimeter:

dBm/W	dBm
wavelength	λ = 635 nm
sampling time	T = 100 ms
Range	AUTO

4 Before you switch on the DUT, zero the Multimeter: press {ZERO} on the Multimeter.

Set up DUT

5 On the DUT, select Visual Fault Finder:

Select Mod	CW
Select	ON

and allow to settle.

Note result in test record

6 Note the displayed power level on the Multimeter in the test report.

Optional test: Center Wavelength

NOTE The laser has been vendor tested, and specifications are purely typical. Therefore, this test is not mandatory.

Connect equipment

1 Connect the E6007A output to the Optical Spectrum Analyzer using an 81101A patchcord, and two 81000AI interface adapters:

- ensure that the OSA is switched on and has warmed up.
- ensure that the E6000C is switched on and has warmed up.
- enable the E6007A (DUT).

Set up OSA

2 On the Optical Spectrum Analyzer:

- press INSTRPRESET
- press AUTO/MEAS and wait until `End of Automeasure` is displayed.
- choose USER and then select the type of source to be measured as FP (for Fabry-Perot Laser).

To show the display in linear mode:

- press MENU
- select AMPT on the left side of the display

– press LINEAR on the right side of the display.

Other settings

3 To ensure an interference free reading of the display, you should stop the steady repeating calculations:

– select USER.

– press SINGLE SWEEP.

4 If the presentation of the graphic is not suitable, you may change the resolution using the SPAN key.

5 If the signal is clipped, increase the reference level.

6 From the displayed measurements, check for Mean Wavelength.

Performance Test for the Agilent E6000C with E6007A Visual Fault Finder submodule Page 1 of 1

Description	Model No.	Trace No.	Cal. Due Date

Test Facility:

______________________	Report No.	______________________
______________________	Date:	______________________
______________________	Customer:	______________________
______________________	Tested By:	______________________

Model: **E6007A Visual Light Source**

Serial No. ____________ Firmware Revision ______________________

Options ____________

E6000C Mini-OTDR

E600__ OTDR Module

Serial No. ____________ Serial Number ______________________

Ambient temperature __________ °C

Relative humidity __________ %

Line frequency __________ Hz

Test Equipment Used

	Model No.	Trace No.	Cal. Due Date
1. Std, Lightwave Multimeter	________	________	__/__/___
2. Std Optical Power Sensor	________	________	__/__/___
3.______________________	________	________	__/__/___
4.______________________	________	________	__/__/___
5. ______________________	________	________	__/__/___

E

Cleaning Information

The following Cleaning Instructions contain some general safety precautions, which must be observed during all phases of cleaning. Consult your specific optical device manuals or guides for full information on safety matters.

Please try, whenever possible, to use physically contacting connectors, and dry connections. Clean the connectors, interfaces, and bushings carefully after use.

Agilent Technologies assume no liability for the customer’s failure to comply with these requirements.

Cleaning Instructions for this Instrument

The Cleaning Instructions apply to a number of different types of Optical Equipment. The following section is relevant for this instrument.

- “How to clean instruments with a physical contact interface” on page 291

For more information, please consult the Agilent Technologies Pocket Guide *Cleaning Procedure fir Lightwave Test and Measurement Equipment* (Agilent Part Number 5963-3538F)

Safety Precautions

Please follow the following safety rules:

- Do not remove instrument covers when operating.
- Ensure that the instrument is switched off throughout the cleaning procedures.
- Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure.
- Make sure that you disable all sources when you are cleaning any optical interfaces.
- Under no circumstances look into the end of an optical device attached to optical outputs when the device is operational. The laser radiation is not visible to the human eye, but it can seriously damage your eyesight.
- To prevent electrical shock, disconnect the instrument from the mains before cleaning. Use a dry cloth, or one slightly dampened with water, to clean the external case parts. Do not attempt to clean internally.
- Do not install parts or perform any unauthorized modification to optical devices.
- Refer servicing only to qualified and authorized personnel.

Why is it important to clean optical devices ?

In transmission links optical fiber cores are about 9 µm (0.00035") in diameter. Dust and other particles, however, can range from tenths to hundredths of microns in diameter. Their comparative size means that they can cover a part of the end of a fiber core, and as a result will reduce the performance of your system.

Furthermore, the power density may burn dust into the fiber and cause additional damage (for example, 0 dBm optical power in a single mode fiber causes a power density of approximately 16 million W/m^2). If this happens, measurements become inaccurate and non-repeatable.

Cleaning is, therefore, an essential yet difficult task. Unfortunately, when comparing most published cleaning recommendations, you will discover that they contain several inconsistencies. In this section, we want to suggest ways to help you clean your various optical devices, and thus significantly improve the accuracy and repeatability of your lightwave measurements.

What do I need for proper cleaning?

Some Standard Cleaning Equipment is necessary for cleaning your instrument. For certain cleaning procedures, you may also require certain Additional Cleaning Equipment.

Standard Cleaning Equipment

Before you can start your cleaning procedure you need the following standard equipment:

- Dust and shutter caps
- Isopropyl alcohol
- Cotton swabs
- Soft tissues
- Pipe cleaner
- Compressed air

Dust and shutter caps

All of Agilent Technologies' lightwave instruments are delivered with either laser shutter caps or dust caps on the lightwave adapter. Any cables come with covers to protect the cable ends from damage or contamination.

We suggest these protected coverings should be kept on the equipment at all times, except when your optical device is in use. Be careful when replacing dust caps after use. Do not press the bottom of the cap onto the fiber too hard, as any dust in the cap can scratch or pollute your fiber surface.

If you need further dust caps, please contact your nearest Agilent Technologies sales office.

Isopropyl alcohol

This solvent is usually available from any local pharmaceutical supplier or chemist's shop.

Using isopropyl alcohol If you use isopropyl alcohol to clean your optical device, do not immediately dry the surface with compressed air (except when you are cleaning very sensitive optical devices). This is because the dust and the dirt is solved and will leave behind filmy deposits after the alcohol is evaporated. You should therefore first remove the alcohol and the dust with a soft tissue, and then use compressed air to blow away any remaining filaments.

Denatured alcohol If possible avoid using denatured alcohol containing additives. Instead, apply alcohol used for medical purposes.

Never try to drink this alcohol, as it may seriously damage to your health.

Other solvents Do not use any other solvents, as some may damage plastic materials and claddings. Acetone, for example, will dissolve the epoxy used with fiber optic connectors. To avoid damage, only use isopropyl alcohol.

Cotton swabs

Size of swab We recommend that you use swabs such as Q-tips or other cotton swabs normally available from local distributors of medical and hygiene products (for example, a supermarket or a chemist’s shop). You may be able to obtain various sizes of swab. If this is the case, select the smallest size for your smallest devices.

Foam swabs Ensure that you use natural cotton swabs. Foam swabs will often leave behind filmy deposits after cleaning.

Use care when cleaning, and avoid pressing too hard onto your optical device with the swab. Too much pressure may scratch the surface, and could cause your device to become misaligned. It is advisable to rub gently over the surface using only a small circular movement.

Reuse of swabs Swabs should be used straight out of the packet, and never used twice. This is because dust and dirt in the atmosphere, or from a first cleaning, may collect on your swab and scratch the surface of your optical device.

Soft tissues

These are available from most stores and distributors of medical and hygiene products such as supermarkets or chemists' shops.

Cellulose tissues We recommend that you do not use normal cotton tissues, but multi-layered soft tissues made from non-recycled cellulose. Cellulose tissues are very absorbent and softer. Consequently, they will not scratch the surface of your device over time.

Use care when cleaning, and avoid pressing on your optical device with the tissue. Pressing too hard may lead to scratches on the surface or misalignment of your device. Just rub gently over the surface using a small circular movement.

Reuse of tissues Use only clean, fresh soft tissues and never apply them twice. Any dust and dirt from the air which collects on your tissue, or which has gathered after initial cleaning, may scratch and pollute your optical device.

Pipe cleaner

Pipe cleaners can be purchased from tobacconists, and come in various shapes and sizes.The most suitable one to select for cleaning purposes has soft bristles, which will not produces scratches.

There are many different kinds of pipe cleaner available from tobacco shops.

Use of pipe cleaners The best way to use a pipe cleaner is to push it in and out of the device opening (for example, when cleaning an interface). While you are cleaning, you should slowly rotate the pipe cleaner.

Only use pipe cleaners on connector interfaces or on feed through adapters. Do not use them on optical head adapters, as the center of a pipe cleaner is hard metal and can damage the bottom of the adapter.

Reuse of pipe cleaners Your pipe cleaner should be new when you use it. If it has collected any dust or dirt, this can scratch or contaminate your device.

Metal tip/center The tip and center of the pipe cleaner are made of metal. Avoid accidentally pressing these metal parts against the inside of the device, as this can cause scratches.

Compressed air

Compressed air can be purchased from any laboratory supplier.

Purity of air It is essential that your compressed air is free of dust, water and oil. Only use clean, dry air. If not, this can lead to filmy deposits or scratches on the surface of your connector. This will reduce the performance of your transmission system.

Spraying When spraying compressed air, hold the can upright. If the can is held at a slant, propellant could escape and dirty your optical device. First spray into the air, as the initial stream of compressed air could contain some condensation or propellant. Such condensation leaves behind a filmy deposit.

Please be friendly to your environment and use a CFC-free aerosol.

Additional Cleaning Equipment

Some Cleaning Procedures need the following equipment, which is not required to clean each instrument:

- Microscope with a magnification range about 50X up to 300X
- Ultrasonic bath
- Warm water and liquid soap
- Premoistened cleaning wipes
- Polymer film
- Infrared Sensor Card

Microscope with a magnification range about 50X up to 300X

A microscope can be found in most photography stores, or can be obtained through or specialist mail order companies. Special fiber-scopes are available from suppliers of splicing equipment.

Light source

Ideally, the light source on your microscope should be very flexible. This will allow you to examine your device closely and from different angles.

A microscope helps you to estimate the type and degree of dirt on your device. You can use a microscope to choose an appropriate cleaning method, and then to examine the results. You can also use your microscope to judge whether your optical device (such as a connector) is severely scratched and is, therefore, causing inaccurate measurements.

Ultrasonic bath

Ultrasonic baths are also available from photography or laboratory suppliers or specialist mail order companies.

An ultrasonic bath will gently remove fat and other stubborn dirt from your optical devices. This helps increase the life span of the optical devices.

Use of solvents Only use isopropyl alcohol in your ultrasonic bath, as other solvents may damage.

Warm water and liquid soap

Only use water if you are sure that there is no other way of cleaning your optical device without corrosion or damage. Do not use hot water, as this may cause mechanical stress, which can damage your optical device.

Soap properties Ensure that your liquid soap has no abrasive properties or perfume in it. You should also avoid normal washing-up liquid, as it can cover your device in an iridescent film after it has been air-dried.

Some lenses and mirrors also have a special coating, which may be sensitive to mechanical stress, or to fat and liquids. For this reason we recommend you do not touch them.

If you are not sure how sensitive your device is to cleaning, please contact the manufacturer or your sales distributor.

Premoistened cleaning wipes

Use pre-moistened cleaning wipes as described in each individual cleaning procedure. Cleaning wipes may be used in every instance where a moistened soft tissue or cotton swab is applied.

Polymer film

Polymer film is available from laboratory suppliers or specialist mail order companies.

Using polymer film is a gentle method of cleaning extremely sensitive devices, such as reference reflectors and mirrors.

Infrared Sensor Card

Infrared sensor cards are available from laboratory suppliers or specialist mail order companies.

With this card you are able to control the shape of laser light emitted. The invisible laser beam is projected onto the sensor card, then becomes visible to the normal eye as a round spot.

Take care never to look into the end of a fiber or any other optical component, when they are in use. This is because the laser can seriously damage your eyes.

Preserving Connectors

Listed below are some hints on how best to keep your connectors in the best possible condition.

Making Connections

Before you make any connection you must ensure that all cables and connectors are clean. If they are dirty, use the appropriate cleaning procedure.

When inserting the ferrule of a patchcord into a connector or an adapter, make sure that the fiber end does not touch the outside of the mating connector or adapter. Otherwise you will rub the fiber end against an unsuitable surface, producing scratches and dirt deposits on the surface of your fiber.

Dust Caps and Shutter Caps

Be careful when replacing dust caps after use. Do not press the bottom of the cap onto the fiber as any dust in the cap can scratch or dirty your fiber surface.

Replacing caps When you have finished cleaning, put the dust cap back on, or close the shutter cap if the equipment is not going to be used immediately.

Keep the caps on the equipment always when it is not in use.

Replacement caps All of Agilent Technologies' lightwave instruments and accessories are shipped with either laser shutter caps or dust caps. If you need additional or replacement dust caps, contact your nearest Agilent Technologies Sales/ Service Office.

Immersion Oil and Other Index Matching Compounds

Where it is possible, do not use immersion oil or other index matching compounds with your device. They are liable to impair and dirty the surface of the device. In addition, the characteristics of your device can be changed and your measurement results affected.

Cleaning Instrument Housings

Use a dry and very soft cotton tissue to clean the instrument housing and the keypad. Do not open the instruments as there is a danger of electric shock, or electrostatic discharge. Opening the instrument can cause damage to sensitive components, and in addition your warranty will be voided.

Which Cleaning Procedure should I use ?

Light dirt

If you just want to clean away light dirt, observe the following procedure for all devices:

- Use compressed air to blow away large particles.
- Clean the device with a dry cotton swab.

- Use compressed air to blow away any remaining filament left by the swab.

Heavy dirt

If the above procedure is not enough to clean your instrument, follow one of the procedures below. Please consult “Cleaning Instructions for this Instrument” on page 271 for the procedure relevant for this instrument.

If you are unsure of how sensitive your device is to cleaning, please contact the manufacturer or your sales distributor

How to clean connectors

Cleaning connectors is difficult as the core diameter of a single-mode fiber is only about 9 µm. This generally means you cannot see streaks or scratches on the surface. To be certain of the condition of the surface of your connector and to check it after cleaning, you need a microscope.

Polishing a connector

In the case of scratches, or of dust that has been burnt onto the surface of the connector, you may have no option but to polish the connector. This depends on the degree of dirtiness, or the depth of the scratches. This is a difficult procedure and should only be performed by skilled personal, and as a last resort as it wears out your connector.

WARNING

Never look into the end of an optical cable that is connected to an active source.

Infrared sensor card To assess the projection of the emitted light beam you can use an infrared sensor card. Hold the card approximately 5 cm from the output of the connector. The invisible emitted light is project onto the card and becomes visible as a small circular spot.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the connector by rubbing a new, dry cotton-swab over the surface using a small circular movement.
2. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the connector:

1. Moisten a new cotton-swab with isopropyl alcohol.
2. Clean the connector by rubbing the cotton-swab over the surface using a small circular movement.
3. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.
4. Blow away any remaining lint with compressed air.

An Alternative Procedure

A better, more gentle, but more expensive cleaning procedure is to use an ultrasonic bath with isopropyl alcohol.

1. Hold the tip of the connector in the bath for at least three minutes.
2. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.

3 Blow away any remaining lint with compressed air.

How to clean connector adapters

CAUTION

Some adapters have an anti-reflection coating on the back to reduce back reflection. This coating is extremely sensitive to solvents and mechanical abrasion. Extra care is needed when cleaning these adapters.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the adapter by rubbing a new, dry cotton-swab over the surface using a small circular movement.
2. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the adapter:

1. Moisten a new cotton-swab with isopropyl alcohol.
2. Clean the adapter by rubbing the cotton-swab over the surface using a small circular movement.
3. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.
4. Blow away any remaining lint with compressed air.

How to clean connector interfaces

CAUTION

Be careful when using pipe-cleaners, as the core and the bristles of the pipe-cleaner are hard and can damage the interface.

Do not use pipe-cleaners on optical head adapters, as the hard core of normal pipe cleaners can damage the bottom of an adapter.

Preferred Procedure

Use the following procedure on most occasions.

1 Clean the interface by pushing and pulling a new, dry pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.

2 Then clean the interface by rubbing a new, dry cotton-swab over the surface using a small circular movement.

3 Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the interface:

1 Moisten a new pipe-cleaner with isopropyl alcohol.

2 Clean the interface by pushing and pulling the pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.

3 Moisten a new cotton-swab with isopropyl alcohol.

4 Clean the interface by rubbing the cotton-swab over the surface using a small circular movement.

5 Using a new, dry pipe-cleaner, and a new, dry cotton-swab remove the alcohol, any dissolved sediment and dust.

6 Blow away any remaining lint with compressed air.

How to clean bare fiber adapters

Bare fiber adapters are difficult to clean. Protect from dust unless they are in use.

CAUTION

Never use any kind of solvent when cleaning a bare fiber adapter as solvents can damage the foam inside some adapters.

They can deposit dissolved dirt in the groove, which can then dirty the surface of an inserted fiber.

Preferred Procedure

Use the following procedure on most occasions.

1 Blow away any dust or dirt with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the adapter:

1 Clean the adapter by pushing and pulling a new, dry pipe-cleaner into the opening. Rotate the pipe-cleaner slowly as you do this.

CAUTION

Be careful when using pipe-cleaners, as the core and the bristles of the pipe-cleaner are hard and can damage the adapter.

2. Clean the adapter by rubbing a new, dry cotton-swab over the surface using a small circular movement.
3. Blow away any remaining lint with compressed air.

How to clean lenses

Some lenses have special coatings that are sensitive to solvents, grease, liquid and mechanical abrasion. Take extra care when cleaning lenses with these coatings.

Lens assemblies consisting of several lenses are not normally sealed. Therefore, use as little alcohol as possible, as it can get between the lenses and in doing so can change the properties of projection.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the lens by rubbing a new, dry cotton-swab over the surface using a small circular movement.
2. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the lens:

1. Moisten a new cotton-swab with isopropyl alcohol.

2 Clean the lens by rubbing the cotton-swab over the surface using a small circular movement.

3 Using a new, dry cotton-swab remove the alcohol, any dissolved sediment and dust.

4 Blow away any remaining lint with compressed air.

How to clean instruments with a fixed connector interface

You should only clean instruments with a fixed connector interface when it is absolutely necessary. This is because it is difficult to remove any used alcohol or filaments from the input of the optical block.

Dust caps It is important, therefore, to keep dust caps on the equipment at all times, except when your optical device is in use.

Compressed air If you do discover filaments or particles, the only way to clean a fixed connector interface and the input of the optical block is to use compressed air.

Fluids and fat If there are fluids or fat in the connector, please refer the instrument to the skilled personnel of Agilent's service team.

CAUTION Only use clean, dry compressed air. Make sure that the air is free of dust, water, and oil. If the air that you use is not clean and dry, this can lead to filmy deposits or scratches on the surface of your connector interface. This will degrade the performance of your transmission system.

Never try to open the instrument and clean the optical block by yourself, because it is easy to scratch optical components, and cause them to be misaligned.

How to clean instruments with an optical glass plate

Some instruments, for example, the optical heads from Agilent Technologies have an optical glass plate to protect the sensor. Clean this glass plate in the same way as optical lenses (see “How to clean lenses” on page 289).

How to clean instruments with a physical contact interface

Remove any connector interfaces from the optical output of the instrument before you start the cleaning procedure.

Microscope Cleaning interfaces is difficult as the core diameter of a single-mode fiber is only about 9 µm. This generally means you cannot see streaks or scratches on the surface. To be certain of the degree of pollution on the surface of your interface and to check whether it has been removed after cleaning, you need a microscope.

WARNING Never look into an optical output, because this can seriously damage your eyesight.

Infrared sensor card

To assess the projection of the emitted light beam you can use an infrared sensor card. Hold the card approximately 5 cm from the interface. The invisible emitted light is project onto the card and becomes visible as a small circular spot.

Preferred Procedure

Use the following procedure on most occasions.

1. Clean the interface by rubbing a new, dry cotton-swab over the surface using a small circular movement.
2. Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the interface:

1. Moisten a new cotton-swab with isopropyl alcohol.
2. Clean the interface by rubbing the cotton-swab over the surface using a small circular movement.
3. Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.
4. Blow away any remaining lint with compressed air.

How to clean instruments with a recessed lens interface

WARNING

For instruments with a deeply recessed lens interface (for example the Agilent Technologies 81633A and 81634A Power Sensors) do NOT follow this procedure. Alcohol and compressed air could damage your lens even further.

Keep your dust and shutter caps on, when your instrument is not in use. This should prevent it from getting too dirty. If you must clean such instruments, please refer the instrument to the skilled personnel of Agilent's service team.

Preferred Procedure

Use the following procedure on most occasions.

1 Blow away any dust or dirt with compressed air. If this is not sufficient, then
2 Clean the interface by rubbing a new, dry cotton-swab over the surface using a small circular movement.
3 Blow away any remaining lint with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the interface, and using the procedure for light dirt is not sufficient. Using isopropyl alcohol should be your last choice for recessed lens interfaces because of the difficulty of cleaning out any dirt that is washed to the edge of the interface:

1 Moisten a new cotton-swab with isopropyl alcohol.

2 Clean the interface by rubbing the cotton-swab over the surface using a small circular movement.

3 Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.

4 Blow away any remaining lint with compressed air.

How to clean optical devices sensitive to mechanical stress

Some optical devices, such as the Agilent 81000BR Reference Reflector, which has a gold plated surface, are very sensitive to mechanical stress or pressure. Do not use cotton-swabs, soft-tissues or other mechanical cleaning tools, as these can scratch or destroy the surface.

Preferred Procedure

Use the following procedure on most occasions.

1 Blow away any dust or dirt with compressed air.

Procedure for Stubborn Dirt

To clean devices that are extremely sensitive to mechanical stress or pressure you can also use an optical clean polymer film. This procedure is time-consuming, but you avoid scratching or destroying the surface.

1 Put the film on the surface and wait at least 30 minutes to make sure that the film has had enough time to dry.

2 Remove the film and any dirt with special adhesive tapes.

Alternative Procedure

For these types of optical devices you can often use an ultrasonic bath with isopropyl alcohol. Only use the ultrasonic bath if you are sure that it won't cause any damage anything to the device.

1 Put the device into the bath for at least three minutes.

2 Blow away any remaining liquid with compressed air.

If there are any streaks or drying stains on the surface, repeat the cleaning procedure.

How to clean metal filters or attenuator gratings

This kind of device is extremely fragile. A misalignment of the grating leads to inaccurate measurements. Never touch the surface of the metal filter or attenuator grating.

Be very careful when using or cleaning these devices. Do not use cotton-swabs or soft-tissues, as there is the danger that you cannot remove the lint and that the device will be destroyed by becoming mechanically distorted.

Preferred Procedure

Use the following procedure on most occasions.

1 Use compressed air at a distance and with low pressure to remove any dust or lint.

Procedure for Stubborn Dirt

Do not use an ultrasonic bath as this can damage your device.

Use this procedure particularly when there is greasy dirt on the device:

1 Put the optical device into a bath of isopropyl alcohol, and wait at least 10 minutes.

2 Remove the fluid using compressed air at some distance and with low pressure. If there are any streaks or drying stains on the surface, repeat the whole cleaning procedure.

Additional Cleaning Information

The following cleaning procedures may be used with other optical equipment:

- How to clean bare fiber ends
- How to clean large area lenses and mirrors

How to clean bare fiber ends

Bare fiber ends are often used for splices or, together with other optical components, to create a parallel beam. The end of a fiber can often be scratched. You make a new cleave. To do this:

1 Strip off the cladding.

2 Take a new soft-tissue and moisten it with isopropyl alcohol.

3 Carefully clean the bare fiber with this tissue.

4 Make your cleave and immediately insert the fiber into your bare fiber adapter in order to protect the surface from dirt.

How to clean large area lenses and mirrors

Some mirrors, as those from a monochromator, are very soft and sensitive. Therefore, never touch them and do not use cleaning tools such as compressed air or polymer film.

Coated lenses Some lenses have special coatings that are sensitive to solvents, grease, liquid and mechanical abrasion. Take extra care when cleaning lenses with these coatings.

Multiple lenses Lens assemblies consisting of several lenses are not normally sealed. Therefore, use as little liquid as possible, as it can get between the lenses and in doing so can change the properties of projection.

Preferred Procedure

Use the following procedure on most occasions.

1 Blow away any dust or dirt with compressed air.

Procedure for Stubborn Dirt

Use this procedure particularly when there is greasy dirt on the lens:

CAUTION Only use water if you are sure that your device does not corrode. Do not use hot water as this can lead to mechanical stress, which can damage your device.

Make sure that your liquid soap has no abrasive properties or perfume in it, because they can scratch and damage your device.

Do not use normal washing-up liquid as sometimes an iridescent film remains.

1 Moisten the lens or the mirror with water.

2 Put a little liquid soap on the surface and gently spread the liquid over the whole area.

3 Wash off the emulsion with water, being careful to remove it all, as any remaining streaks can impair measurement accuracy.

4 Take a new, dry soft-tissue and remove the water, by rubbing gently over the surface using a small circular movement.

5 Blow away remaining lint with compressed air.

Alternative Procedure A

To clean lenses that are extremely sensitive to mechanical stress or pressure you can also use an optical clean polymer film. This procedure is time-consuming, but you avoid scratching or destroying the surface.

1 Put the film on the surface and wait at least 30 minutes to make sure that the film has had enough time to dry.

2 Remove the film and any dirt with special adhesive tapes.

Alternative Procedure B

If your lens is sensitive to water then:

1 Moisten the lens or the mirror with isopropyl alcohol.

2 Take a new, dry soft-tissue and remove the alcohol, dissolved sediment and dust, by rubbing gently over the surface using a small circular movement.

3 Blow away remaining lint with compressed air.

Other Cleaning Hints

Selecting the correct cleaning method is an important element in maintaining your equipment and saving you time and money. This section highlights the main cleaning methods, but cannot address every individual circumstance.

You will see some additional hints which we hope will help you further. For further information, please contact your local Agilent Technologies representative.

Making the connection

Before you make any connection you must ensure that all lightwave cables and connectors are clean. If not, then use appropriate the cleaning methods.

Fiber end When you insert the ferrule of a patchcord into a connector or an adapter, ensure that the fiber end does not touch the outside of the mating connector or adapter. Otherwise, the fiber end will rub up against something which could scratch it and leave deposits.

Lens cleaning papers

Note that some special lens cleaning papers are not suitable for cleaning optical devices like connectors, interfaces, lenses, mirrors and so on. To be absolutely certain that a cleaning paper is applicable, please ask the salesperson or the manufacturer.

Immersion oil and other index matching compounds

Do not use immersion oil or other index matching compounds with optical sensors equipped with recessed lenses. They are liable to dirty the detector and impair its performance. They may also alter the property of depiction of your optical device, thus rendering your measurements inaccurate.

Cleaning the housing and the mainframe

When cleaning either the mainframe or the housing of your instrument, only use a dry and very soft cotton tissue on the surfaces and the numeric pad.

Never open the instruments as they can be damaged. Opening the instruments puts you in danger of receiving an electrical shock from your device, and renders your warranty void.

F

Environmental Profile

Product Summary

The product reviewed consists of an E6000C and an E6003A as a typical configuration.

Transport restrictions:	none
Hazardous or restricted materials:	no hazardous materials
	no CFCs or brominated fire retardants
Parts requiring special disposal:	Li-Ion Backup-battery
	NiMH Main battery (recycling path)

Materials of Construction

Material	% weight	% recyclable/reusable
Metals		
Aluminium	20	100
Steel	5	100
Plastic parts:		
PC-ABS	25	100
TPU	7	100
Others:		
NiMH	20	80
Printed Circuit Boards	20	0

Energy Use/Efficiency

Normal Operation:	< 20 Watt
Standby:	< 5 Watt

Operation Emissions

Ozone:	No ozone emissions
Radio Frequency Noise:	Meets CISPR 11 (CISPR22)

Materials of Packaging

Material	% weight	% recyclable/reusable
PUR	25	100
Corrugated Paper	75	100

Learning Products

Manuals are 100% recyclable.

Agilent Technologies Manufacturing Process

Agilent Technologies have eliminated ozone depleting substances such as chlorofluorocarbons (CFCs), trichlorethane (TCA), and carbon tetrachloride from its manufacturing process worldwide.

Agilent Technologies are surveying and working with suppliers to identify and eliminate any ozone depleting substances from their manufacturing.

G

Overview

Figure 90 to Figure 93 represent sample sessions for commonly used features.

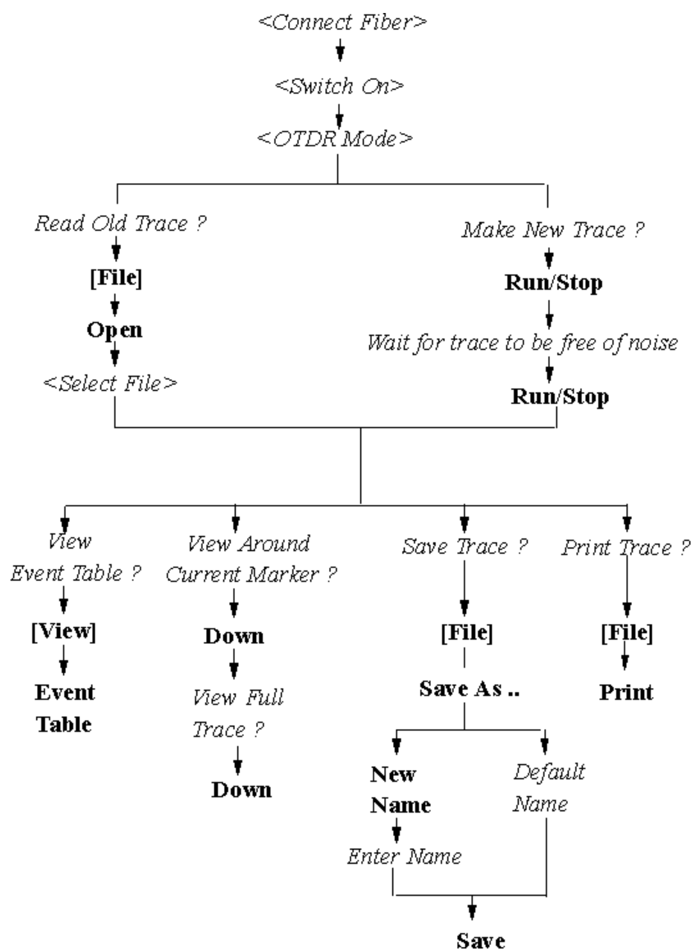


Figure 90 View a Trace

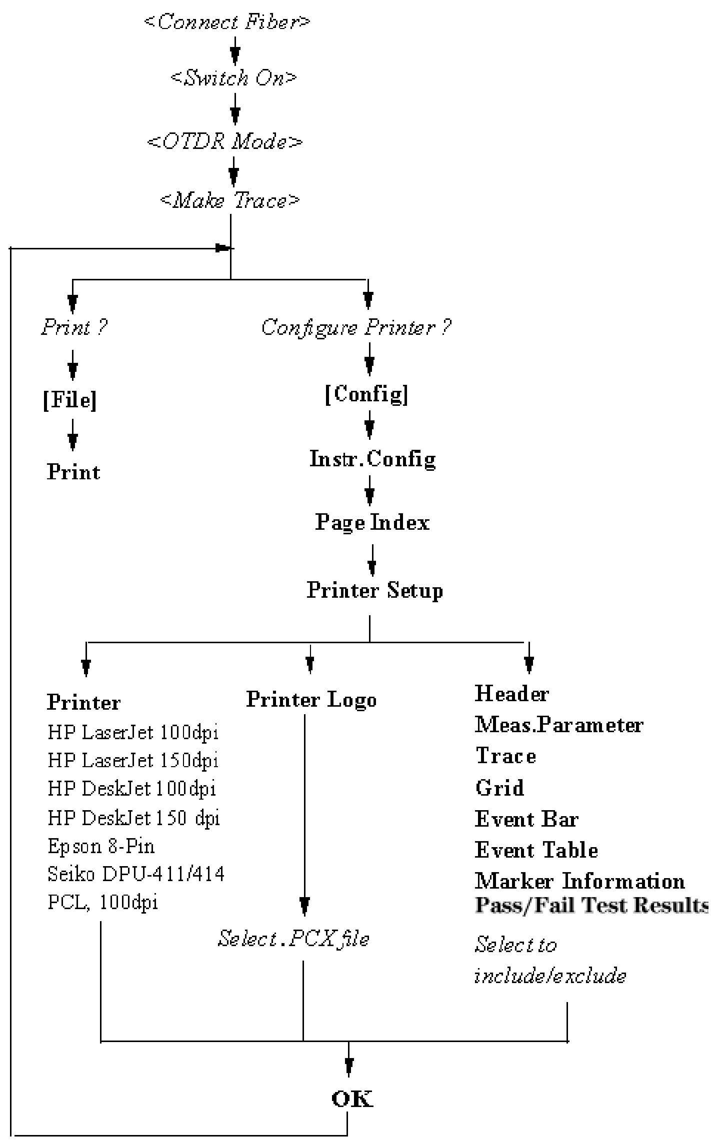


Figure 91 Use the printer

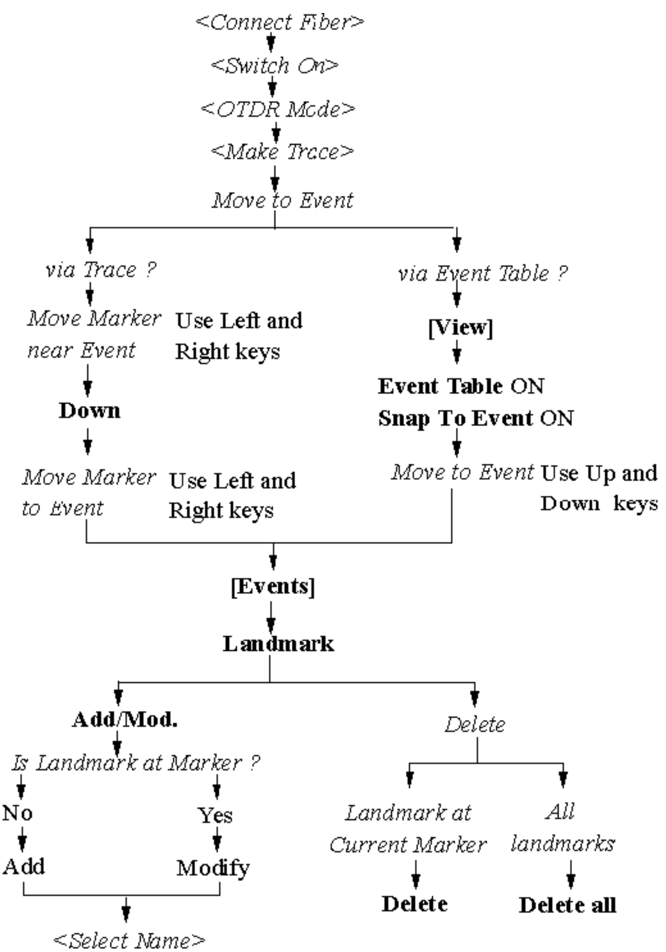


Figure 92 Add/Delete Landmarks

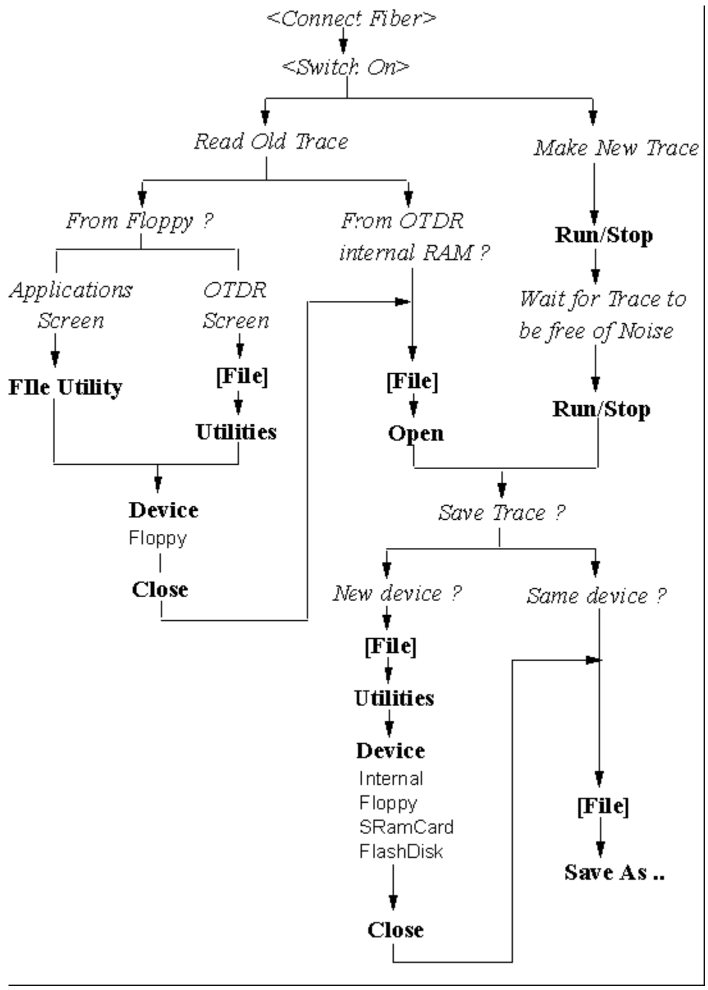


Figure 93 Read from/Write to a Floppy Disk

H

Appendix: VENDOR.INI

When you select a Refractive Index, you will normally see a table containing a list of Cable vendors, and the Refractive Index normally used by that vendor (see *"How to Change the Refractive Index Setting" on page 82* and *"Using the Fiber Break Locator" on page 161*).

The content of this table depends on the file VENDOR.INI, which should be in the top-level directory of your Mini-OTDR internal memory.

Below is an example of a typical `VENDOR.INI` file. It names the Cable vendor (in `Name=`), the wavelengths for which you see this vendor (in `WaveLen_1=`, `WaveLen_2=`, and so on), and the respective Refractive Indexes (in `RefrIndex_1=`, `RefrIndex_2=`, and so on.

Cable vendors which have no Refractive Index specified for the current Wavelength are not displayed.

[Vendor_1]

Name=Lucent

WaveLen_1=1310

WaveLen_2=1550

WaveLen_3=1625

RefrIndex_1=147180

```
RefrIndex_2=147110
RefrIndex_3=147080


[Vendor_2]
Name=Corning
WaveLen_1=1310
WaveLen_2=1550
WaveLen_3=1625
RefrIndex_1=146180
RefrIndex_2=146110
RefrIndex_3=146080


[Vendor_3]
Name=AT&T
WaveLen_1=1310
WaveLen_2=1550
RefrIndex_1=147180
RefrIndex_2=147120
```

Figure 94 Example VENDOR.INI file

If you want to configure your instrument so that you have more or different refractive index values, you can copy this file to a pc, edit it, then copy it back to your Mini-OTDR.

See *"The File Utilities screen" on page 59* for more details about copying files.

Appendix: 3-λ Module

The following information is valid for the E6013A 3-λ OTDR module.

Ordering Information

Agilent Product	Opt	Description
E6013A		1310 nm/1550 nm/1625 nm high performance single-mode module
	022	angled connector

Laser Safety Information

	E6013A	
	1310/1550 nm	**1625 nm**
Laser Type	FP-Laser InGaAsP	FP-Laser InGaAsP
Laser Class		
According to IEC 825 (Europe)	1M	1M
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	1
Output Power (Pulse Max)	50 mW	120 mW
Pulse Duration (Max)	20 µs	20 µs
Pulse Energy (Max)	1 µWs	2.4 µWs
Output Power (CW)	250 µW	250 µW
Beam Waist Diameter	9 µm	9 µm
Numerical Aperture	0.1	0.1
Wavelength	1310/1550 ±25nm	1625 ±25nm

Specifications / Characteristics

As other modules, except:

Built-in CW triple laser source

CW output power: -8 dBm/-8 dBm/-6 dBm (1310/1550/1625 nm)

Pulsewidth

You can select any of the following pulsewidths:

- 10 ns, 30 ns, 100 ns, 300 ns, 1 µs, 3 µs, 10 µs, and 20 µs.

Submodules The E6013A does not have a slot for the E6006A Power Meter submodule or the E6007A Visual Fault Finder submodule.

Module Specifications / Characteristics

Module	E6013A				
Central Wavelength	**1310**±25 nm/ **1550**±25 nm/ **1625**±25 nm				
Applicable Fiber	single-mode				
Pulsewidth	10ns	100ns	1µs	10µs	20µs
Dynamic Range[1] *[dB]*	18/17/17	23/22/22	29/28/28	36/35/35	**39/38/37**
Event Deadzone[2]	5 m (**3 m**)				
Attenuation Deadzone [3]	20/25/30 m				
Attenuation Deadzone [4]	**10/12/14m**				

Notes:

1 Measured with a standard single-mode fiber at SNR=1 noise level and with 3 minutes averaging time. Optimize mode: dynamic

2 Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 4 km, optimize mode Resolution.

Typical specification at Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 400 m at 8 cm sample spacing, optimize resolution.

3 Guaranteed Specification at Reflectance ≤ -35 dB at 30 ns pulsewidth, and with span ≤ 4 km. Optimize mode: resolution.

4 Typical Specification at Reflectance ≤ -50 dB at 30 ns pulsewidth, and with span ≤ 4 km (typical value).