HP E6000B Mini-OTDR

User's Guide

Notices

Subject Matter

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Printing History

New editions are complete revisions of the guide reflecting alterations in the functionality of the instrument. Updates are occasionally made to the guide between editions. The date on the title page changes when an updated guide is published. To find out the current revision of the guide, or to purchase an updated guide, contact your Hewlett-Packard representative.

Control Serial Number: First Edition applies directly to all instruments.

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Serial Numbers

This guide applies to E6000B Mini-OTDRs. It replaces the E6000-91011 manual for the E6000A Mini-OTDR.

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory.

Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, NIST (formerly the United States National Bureau of Standards, NBS) to the extent allowed by the Institutes’s calibration facility, and to the calibration facilities of other International Standards Organization members.

ISO 9001 Certification

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

E6000-91021 E0599

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HP E6000B Mini-OTDR

User’s Guide

The following general safety precautions must be observed during all phases of operation, service, and repair 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. Hewlett-Packard Company assumes no liability for the customer’s failure to comply with these requirements.

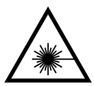
General This is a Safety Class 3 instrument (no protective earth command and DC input voltages less than 60V DC) and has been manufactured and tested according to international safety standards.

Operation – Before applying power Comply with the installation section. Additionally, the following shall be observed:

- Do not remove instrument covers when operating.
- Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.
- Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Be aware that energy at many points may, if contacted, result in personal injury.
- Any adjustments, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible, and when unavoidable, should be carried out only by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation is present. Do not replace components with power cable connected.
- Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
- Do not install substitute parts or perform any unauthorized modification to the instrument.
- Be aware that capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Safety Symbols

The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.



Hazardous laser radiation.

Electromagnetic interference (EMI)

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 injury or loss of life. 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, practice or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Initial Safety Information for Laser Source

	E6001A	E6002A	E6003A	E6003B
Laser Type	FP-Laser InGaAsP	FP-Laser InGaAsP	FP-Laser InGaAsP	FP-Laser InGaAsP
Laser Class				
According to IEC 825 (Europe)	3A	3A	3A	3A
According to 21 CFR 1040.10 (Canada, Japan, USA)	1	1	1	1
Output Power (Pulse Max)	50 mW	50 mW	50 mW	50 mW
Pulse Duration (Max)	10 µs	10 µs	10 µs	20 µs
Pulse Energy (Max)	500 nWs	500 nWs	500 nWs	500 nWs
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 ±25nm	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

	E6010A	E6012A	
	1625 nm	1550 nm	1625 nm
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)	200 mW	200 mW	200 mW
Pulse Duration (Max)	20 µs	20 µs	20 µs
Pulse Energy (Max)	4.0 µWs	4.0 µWs	4.0 µWs
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	1625 ±20nm	1550 ±25nm	1625 ±20nm

	E6005A / E6009A	
	1300 nm	850 nm
Laser Type	FP-Laser InGaAsP	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

NOTE **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

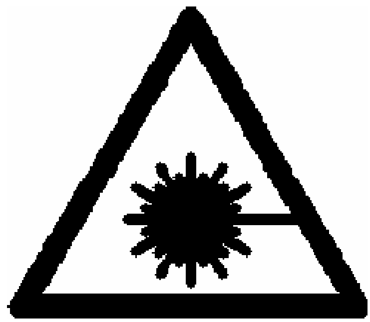
CLASS 1 LASER PRODUCT
COMPLIES WITH 21 CFR 1040.10

MANUFACTURED: ______________________
HEWLETT-PACKARD GMBH
HERRENBERGER STR. 130, D-71034 BÖBLINGEN

Non-USA

INVISIBLE LASER RADIATION
DO NOT STARE INTO BEAM OR VIEW
DIRECTLY WITH OPTICAL INSTRUMENTS
CLASS 3 A LASER PRODUCT
(IEC 825-1:1993: EN 60825-1:1994)

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.

NOTE

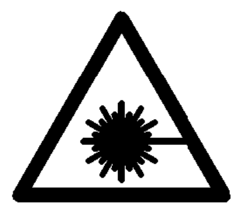
The following laser safety labels should be fixed to the E6007A submodule:

Module E6007A

Non-USA

MAX OUTPUT POWER
WAVELENGTH 635±5nm
PULSE DURATION CW
MAX POWER 1mW
(IEC 825-1:1993 EN 60825-1:1994)

VISIBLE LASER RADIATION
DO NOT STARE INTO BEAM OR VIEW
CLASS 2 LASER PRODUCT
(IEC 825-1:1993; EN 60825-1:1994)



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.

WARNING

Use of controls or adjustments or performance of procedures other than those specified for the laser source may result in hazardous radiation exposure.

WARNING **Refer Servicing only to qualified and authorized personnel.**

WARNING **Do not enable the laser when there is no fiber attached to the optical output connector.**
The optical output connector is at the top right corner of the instrument, under the right cap.
The laser is enabled by pressing the blue RUN/STOP button. The laser is enabled when the red LED on the RUN/STOP Button is lit.

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.

There is a safety circuit which monitors the average laser power output. If the average is greater than the limit for the module, the laser will be disabled.

WARNING **The use of optical instruments with this product will increase eye hazard.**

NOTE **All modules also have a CE class A label (HP Part number 7121-5585 CLA).**

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 a HP Service Center for repair and calibration, or have the repair and calibration performed on-site by HP personnel.

The Structure of this Manual

This manual is divided into four parts:

- Chapter 1 tells you how to set up your Mini-OTDR.
- Chapter 2 shows you what you can do with your Mini-OTDR.
- Chapters 3 to 6 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`.

Bellcore Certification of Excellence

Hewlett-Packard is officially designated Bellcore Certification Eligible, and is awarded Bellcore's Certification of Excellence for its OTDR Data Format.

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1

Getting Started

Getting Started

This chapter introduces the features of the HP E6000B 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.

1.1 Features of the Mini-OTDR

The Front panel

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

- The red Laser-On LED behind the blue Run/Stop key is lit whenever the laser is active.
- The red battery charging light is lit when the battery is charging.
- The green power on light is lit when the power is on.

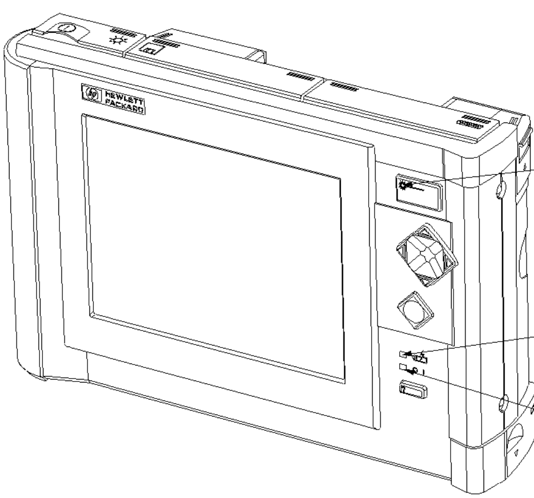


Figure 1-1 **The Front Panel**

The hardkeys

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

- The blue RUN/STOP key starts or stops a trace acquisition.
- 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.
- The SELECT key enables you to select the currently highlighted object, or to activate the popup menu.
- 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.

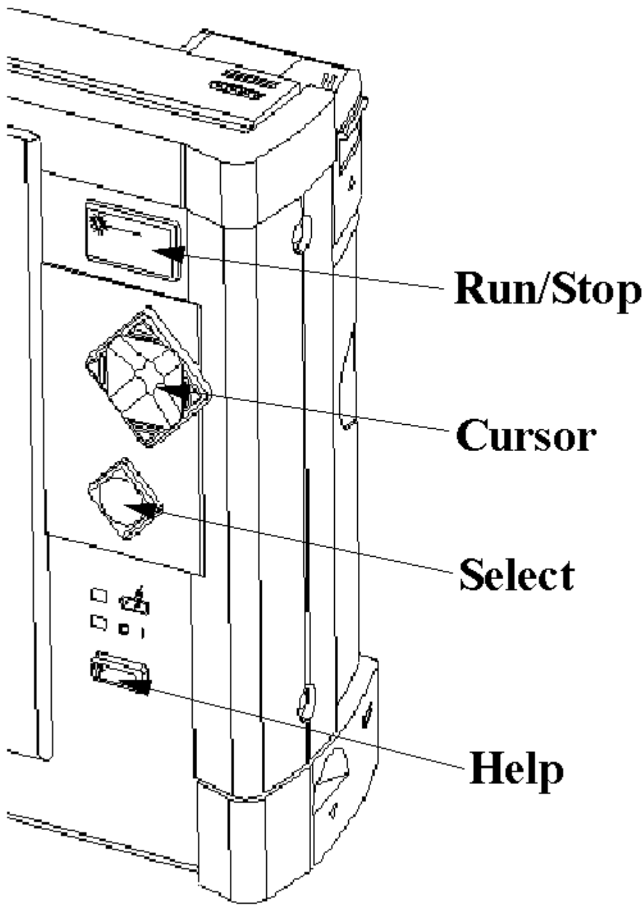


Figure 1-2 **Mini-OTDR hardkeys**

1.2 The Mini-OTDR module

Figure 1-3 shows a Mini-OTDR with a module inserted in the back.

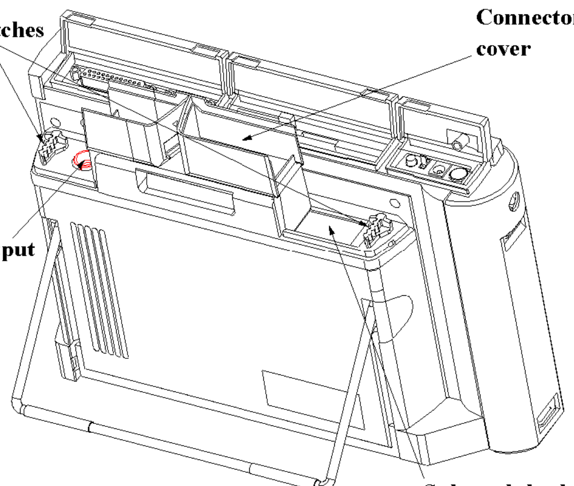


Figure 1-3 **The Mini-OTDR module**

- You keep the module in place with the module catches. When the module is in place, the catches should be perpendicular to the screen.
- You connect fibers to the Optical Output Connector. For more details, see “Adding a Connector Interface” on page 39.
- You add submodules to the submodule slot. Submodules currently available are the Power Meter (HP E6006A) and the Visual Fault Finder (HP E6007A). See “Inserting and Removing a Submodule” on page 77.

Inserting and Removing a Module

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

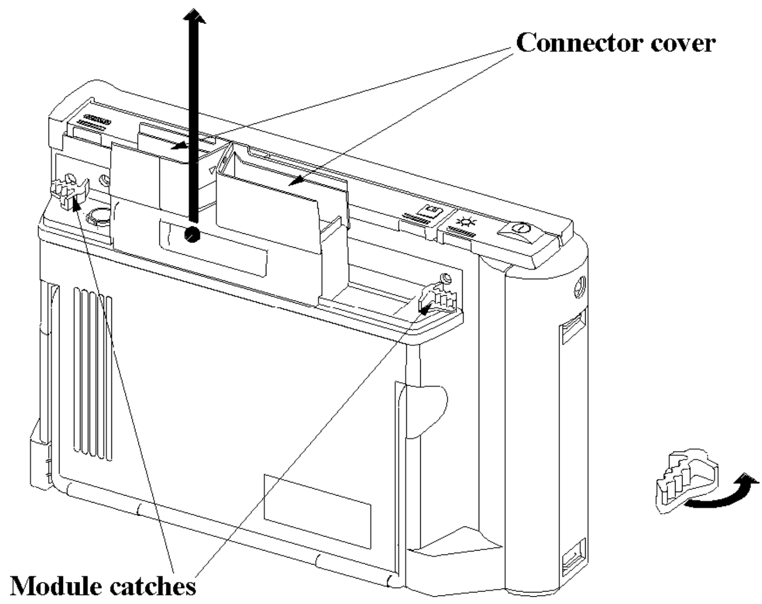


Figure 1-4 **Removing a module**

1 Open the connector covers

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

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

2 Rotate the module catches

Make sure that the module catches run parallel to the screen, as shown in Figure 1-4.

3 Add/remove the module then rotate the catches again

When the module is in place, turn the catches 90 degrees so that they are perpendicular to the screen. This locks the module in place. Then close the connector covers.

Adding a Connector Interface

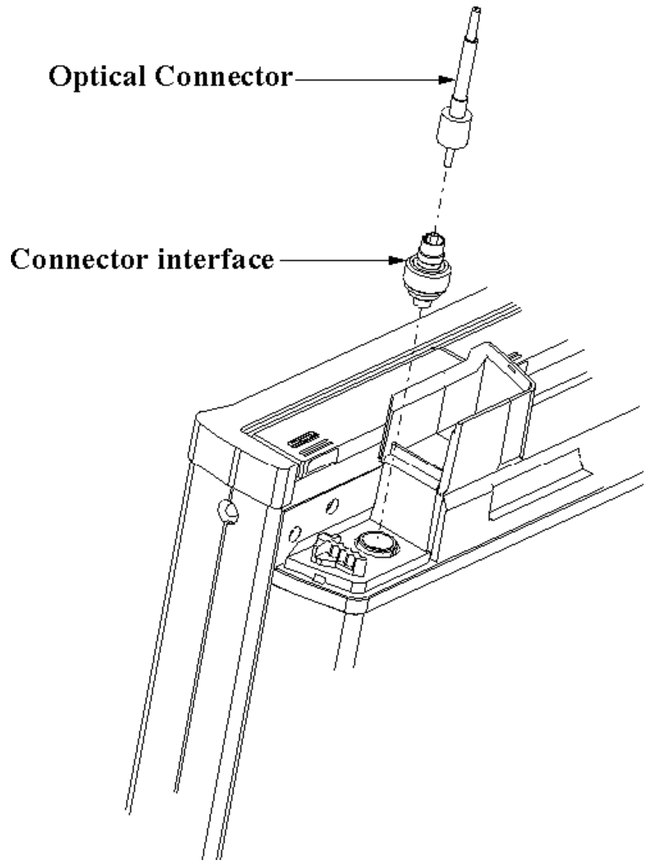


Figure 1-5 **Adding a Connector Interface**

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

On the left of the module when viewed from behind, you see an Optical Output Connector (see Figure 1-5).

NOTE

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

See “Cleaning Fiber/Panel Connectors” on page 287 and “Cleaning Connector Interfaces” on page 288.

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

1.3 Switching on the Mini-OTDR

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.

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 78.

1.4 The Applications Screen

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

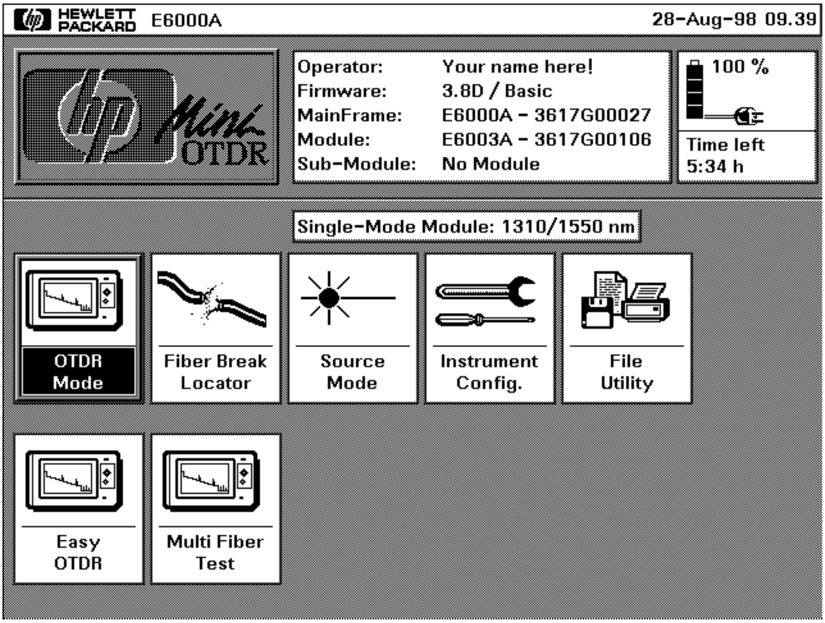


Figure 1-6 **The Applications Screen**

There are 7 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 42.
- *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* (Task Mode) allows you to measure and save many traces on different fibers with different measurement setups. See “How to Test Multiple Fibers with Preset Setups” on page 163

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.

1.5 OTDR Mode

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

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

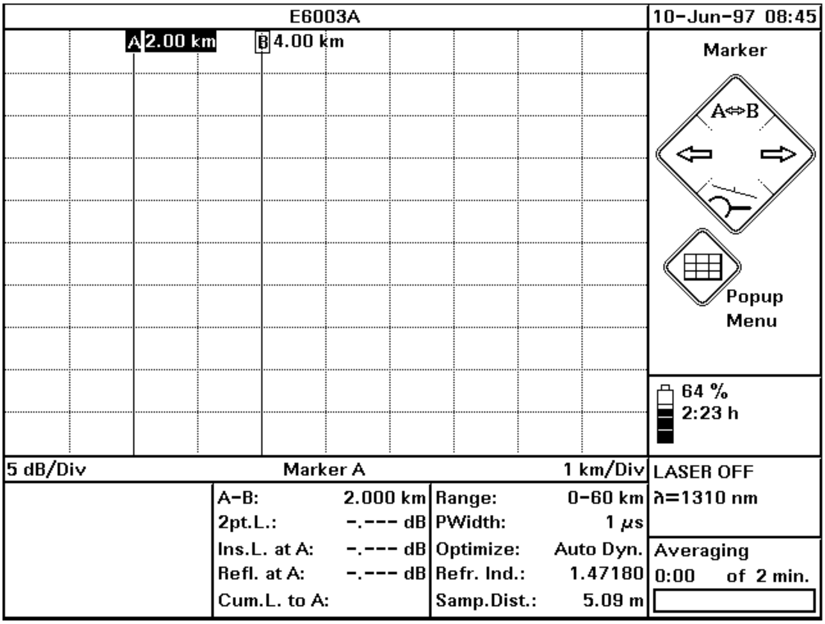


Figure 1-7 **Blank Trace Screen**

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 39.**

To produce a trace, 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.

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

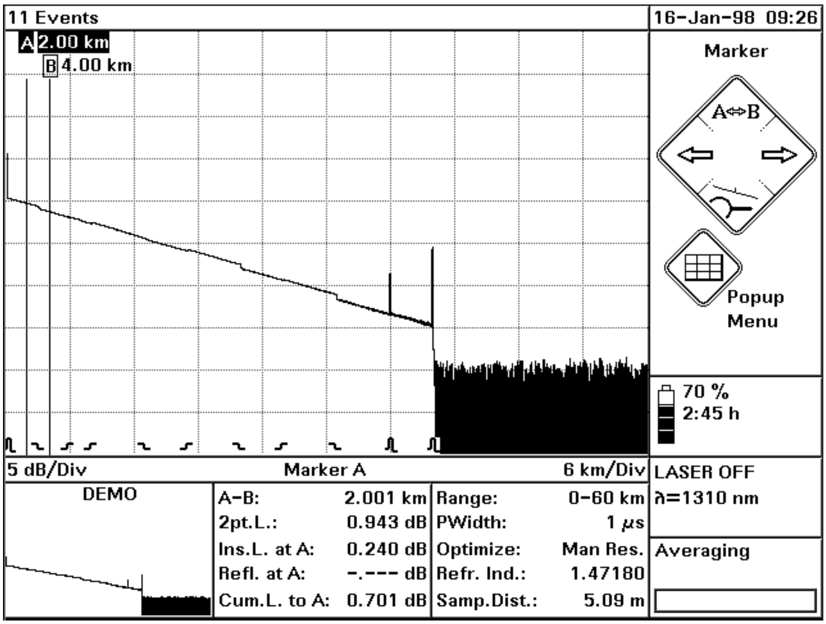


Figure 1-8 **The Trace Screen**

- 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.
- 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 menu.
- 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.

- 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).

- 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**

- 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 47.

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 1-9 **The parameter windows**

- `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.
- `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.
- `Range`: the start position and the measurement span, selectable from the [SETTINGS] menu. The Ranges available are module-dependent.
- `PWidth`: The pulsewidth in seconds (ns or µs), selectable from the [SETTINGS] menu.
- `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 screens” on page 51

- `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 and the number of data points.

The Cursor and Select keys

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

- 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.
- The LEFT and RIGHT keys move the highlighted marker.
- 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.

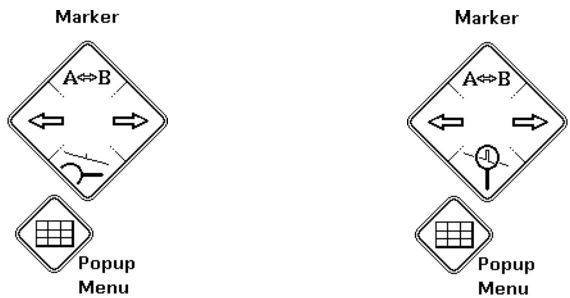


Figure 1-10 **Viewing Full Trace (Left) and Around Current Marker (Right)**

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`).

- 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 menu” on page 49 for more details

1.6 The popup menu

If you press the SELECT key in *OTDR mode*. you normally see a popup menu, offering fast access to 9 menus and important functions.

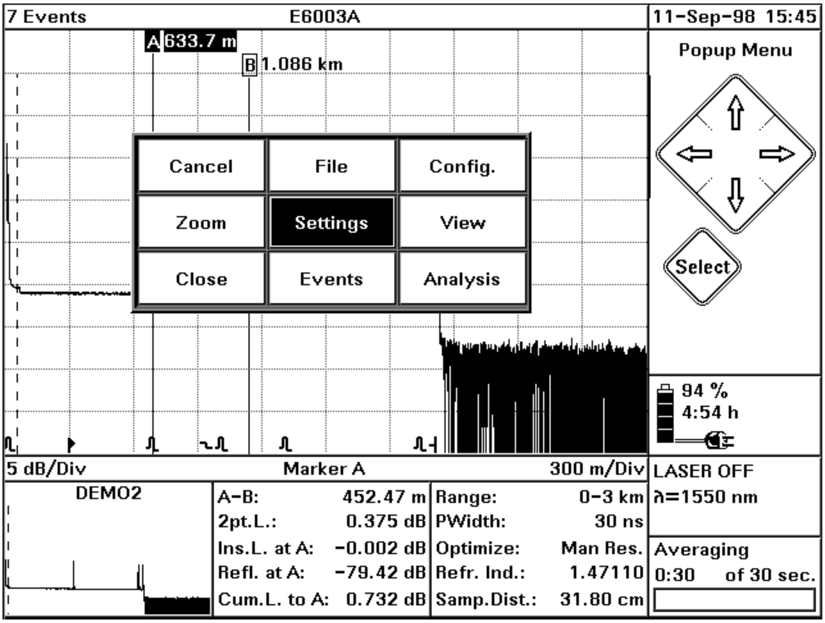


Figure 1-11 **The popup menu**

The following functions are available:

- [CANCEL] - exit the popup menu 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 50.
- [SETTINGS] menu - change measurement parameters. See “The Settings screens” on page 51.
- [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 **You can also select an option by highlighting the option, then leaving the popup menu - for example, cursor LEFT to select [ZOOM], UP to select [FILE], DOWN or RIGHT to select [ANALYSIS], and so on.**

NOTE **If you do not select any option, the popup menu 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.

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

Figure G-2 on page 301 summarizes the options available in each menu. For more information, press the HELP key on the Mini-OTDR.

Zooming

Select [ZOOM] from the popup menu 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.

1.7 The Settings screens

Select SETTINGS from the popup menu.You see one of the two Settings menus: `Measurement Settings` or `Trace Checker Parameters`.

You switch between the settings menus by selecting one of the arrows at the bottom left of the Settings menu (Figure 1-12).

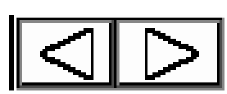


Figure 1-12 **Settings menu navigation arrows**

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

For details on how to change variables, see steps 3 to 5 in “How to Set the General Parameters” on page 141.

NOTE **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 recall the saved settings in EasyMode (see "Function Overview" on page 299).

NOTE **Changes made to the settings menu 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 menu contains a list of parameters that you can set (Figure 1-13).

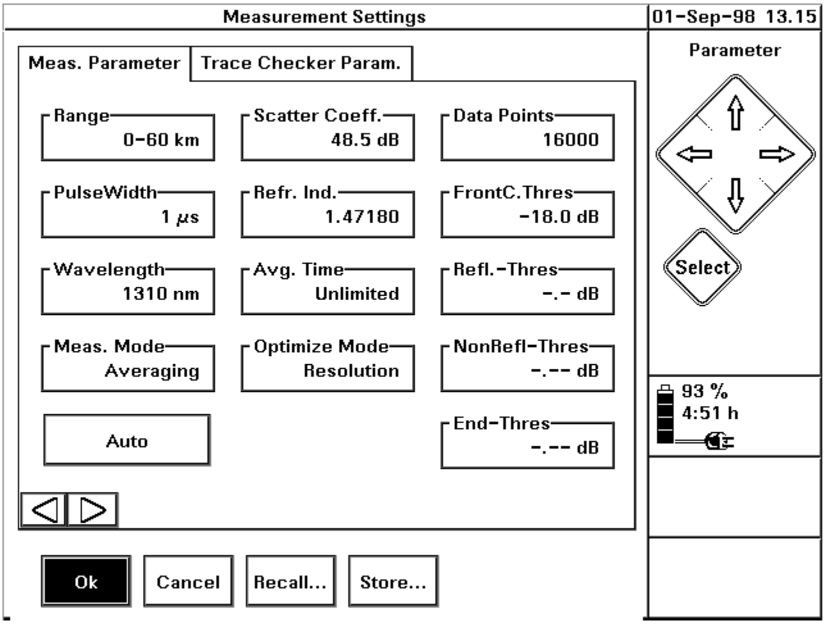


Figure 1-13 **The Measurement Parameters menu**

You can change the following parameters:

- `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.

- `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`: laser wavelength. This is only selectable if you have a dual-wavelength OTDR module. The available wavelengths depend on how your module has been configured.
- `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.
- `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.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.
- `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.
- `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` menus (see “How to Set the OTDR Settings” on page 146).

- `Optimize Mode: Resolution` for short fibers, `Dynamic` for long fibers, or `Standard` as a compromise between Resolution and Dynamic.
- `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.
- `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 146), 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 146).**

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

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

- `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 105.

The Trace Checker Parameters screen

The Trace Checker Parameters menu allows you to set the limits checked by the Trace Checker (see “How to Use the Trace Checker” on page 98).

If any of these limits are exceeded, a fault is detected and reported in the Trace Checker table.

Events in the Trace Checker 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.

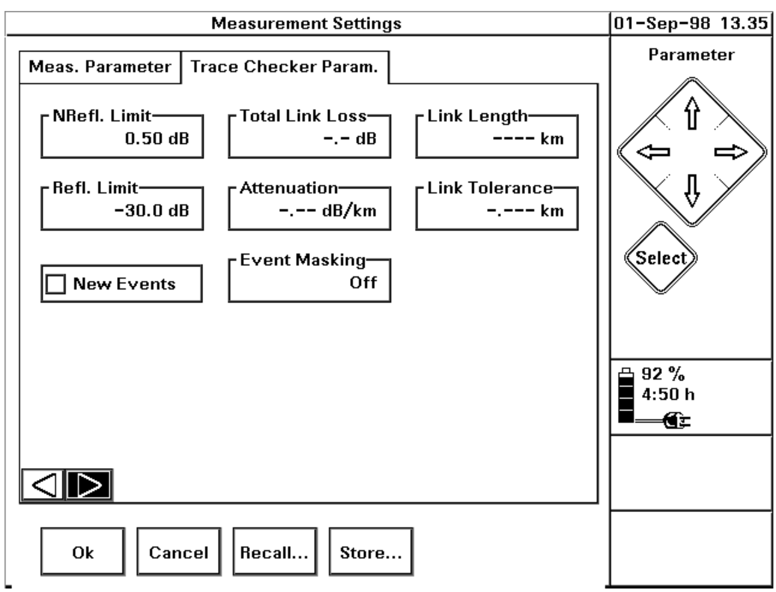


Figure 1-14 **The Trace Checker Parameters menu**

You can change the following parameters from this screen:

- `NRefl. Limit`: Non-Reflectance Limit. All Events with an Insertion Loss greater than this limit are reported in the Trace Checker Table.

  Gainers are never entered in the Trace Checker 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.

- `Refl. Limit`: Reflectance Limit. All Events with a Reflectance greater than this limit, are reported in the Trace Checker 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 Trace Checker 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.

- `New Events`: Check for new events.

  If you select New Events, the Trace Check compares the current trace with the most recent locked Event Table. If the Trace Check finds any Events which do not appear in the Event Table, they are reported in the Trace Checker Table.

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

  This feature is best used with a locked Event Table. See “How to Lock the Event Table” on page 97.

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

- `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 103) 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 105.

If the Loss between the Horizontal Offset and the Fiber End is greater than this limit, this is reported in the Trace Checker 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`: Attenuation Limit. If the LSA attenuation between any 2 Events is greater than this limit, the first Event is reported in the Trace Checker 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.

- `Event Masking`: Specify events to be masked. See “How to Mask Events” on page 98.

  If Event Masking is `On`, some or all Events are ignored when a Trace Check is performed. They are therefore never entered into the Trace Checker Table. If Event Masking is `Off`, no Events are masked.

- `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 103) 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 105.

  If the Fiber End Horizontal Offset is more than *Length Tolerance* km (see below) from the Link Length, this is reported in the Trace Checker 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 Trace Checker 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`: 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.

1.8 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.

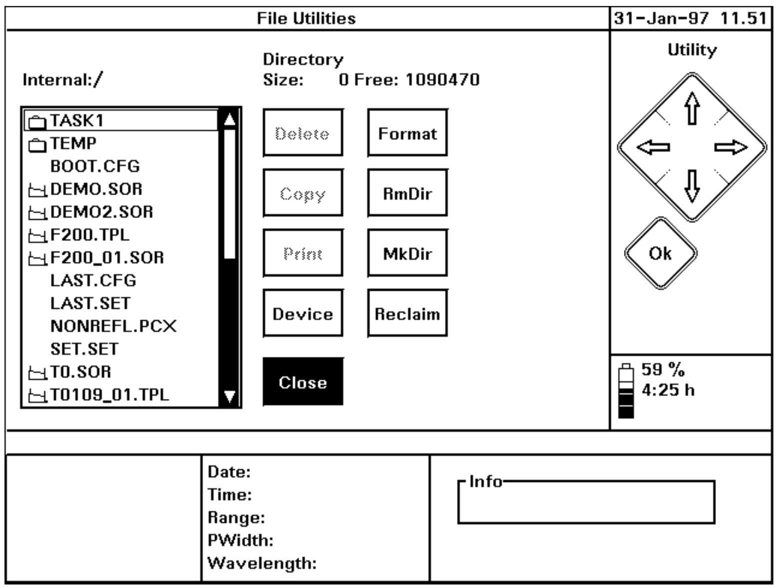


Figure 1-15 **The File Utilities screen**

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 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 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 107. If no file is selected, this option is grayed.

NOTE

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

`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 74 for details.

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

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.

`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.**

`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`: 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.

1.9 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 menu, a more limited range of options is available.

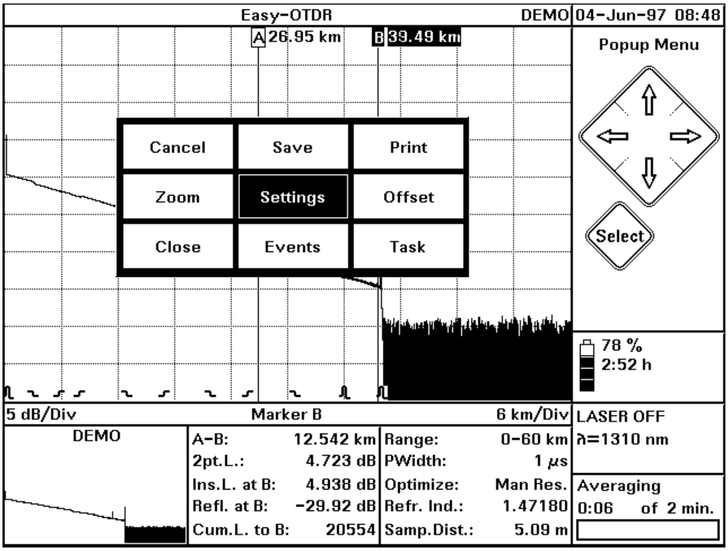


Figure 1-16 **EasyMode popup menu**

The following functions are available on the EasyMode popup menu:

- [CANCEL] - exit the popup menu.
- [SAVE] - save the current file. [SAVE] is equivalent to [FILE]<SAVE AS..> in OTDR mode. See “How to Save the Measurement” on page 111
- [PRINT]- print the current trace. [PRINT] is equivalent to [FILE]<PRINT> in OTDR mode. See “How to Print the Measurement” on page 107.
- [ZOOM] - zoom in and out of the current trace, as in the OTDR Mode popup menu option. See “Zooming” on page 50.

- [SETTINGS] - read settings from a template or a settings file. 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 162. A settings file (".SET") just contains values from the Settings menu. See the note on page 52.
- [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 menu 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 95.
- [TASK] - Enter Task Mode. Task mode enables you to view a series of fibers with up to 4 preset measurement setups. See "How to Test Multiple Fibers with Preset Setups" on page 163.

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

1.10 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

Getting Help

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

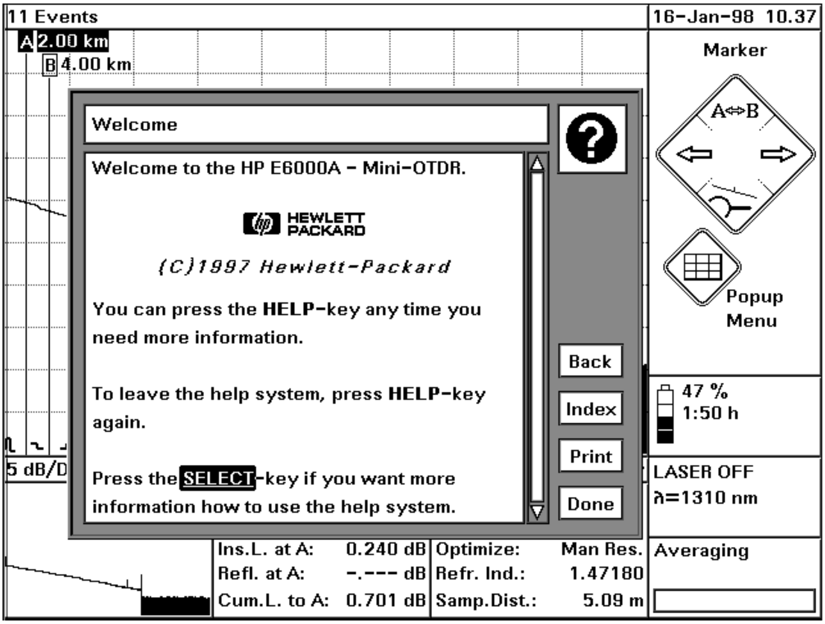


Figure 1-17 **The Mini-OTDR’s Help Display**

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

This chapter introduces additional features of the HP E6000B 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.

2.1 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 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 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).

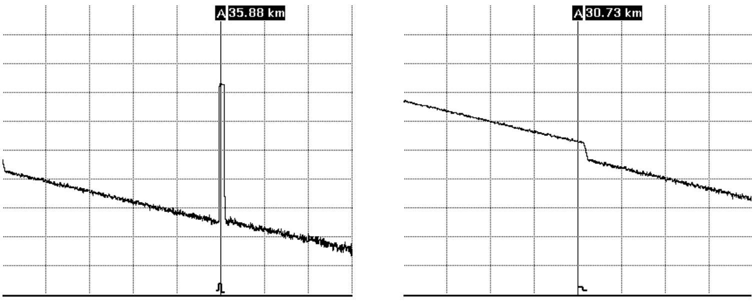


Figure 2-1 **Reflective (Left) and Non-Reflective (Right) Events**

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:

- 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.

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 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 105 for more details.

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

2.2 External connections

Figure 2-2 shows the external connections to the Mini-OTDR.

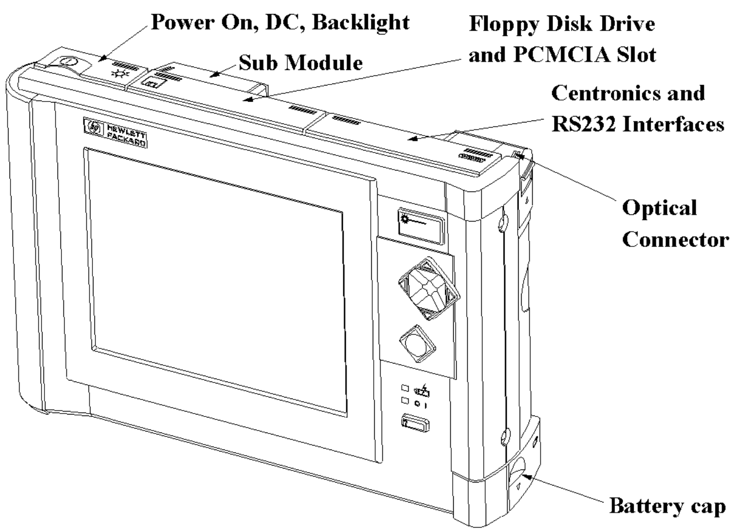


Figure 2-2 **Mini-OTDR external connections**

There are 3 flaps on top of the 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 74.

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

- You can attach a shoulder strap to points on either side of the Mini-OTDR. See “Adding a Shoulder Strap” on page 75.
- You insert the battery behind the flap in the bottom right corner of the Mini-OTDR. See “Inserting and Removing a Battery” on page 78.
- 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 77

Switches

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

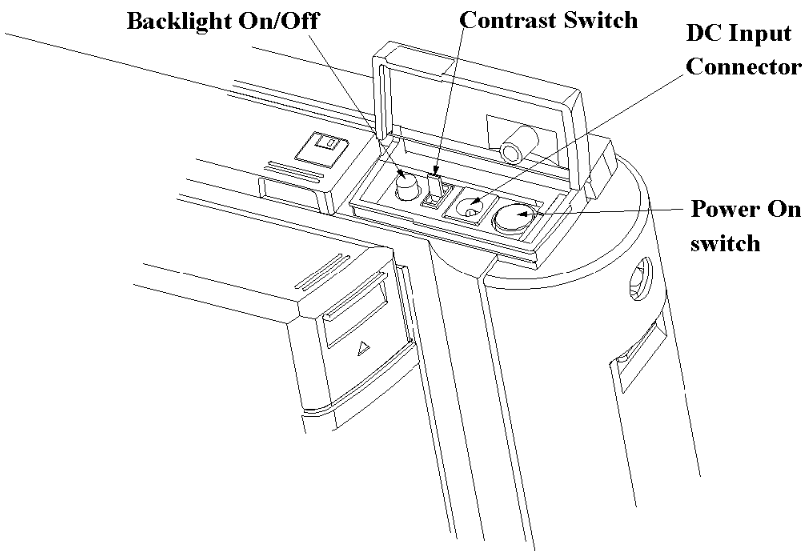


Figure 2-3 **Switches and other features (viewed from behind the Mini-OTDR)**

- You change the brightness of the picture with the backlight button.
- You change the contrast of the picture with the contrast switch.
- You use the DC input connector when you want to attach an AC/DC connector. See “Connecting an AC/DC Adapter” on page 82 for more details.
- 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

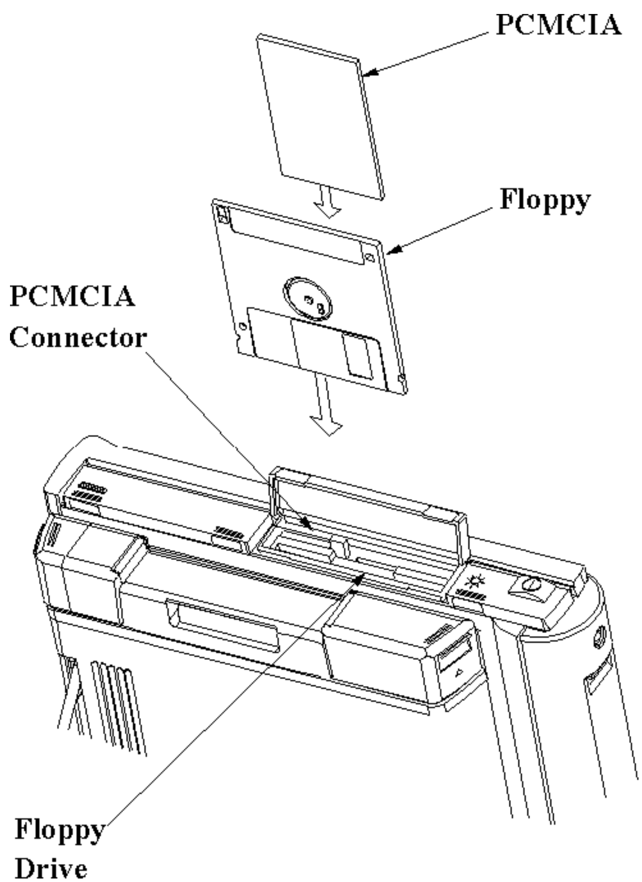


Figure 2-4 **Inserting a Floppy Disk, Flash Disk, and SRAM Card**

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 2-4). 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.

Adding a Shoulder Strap

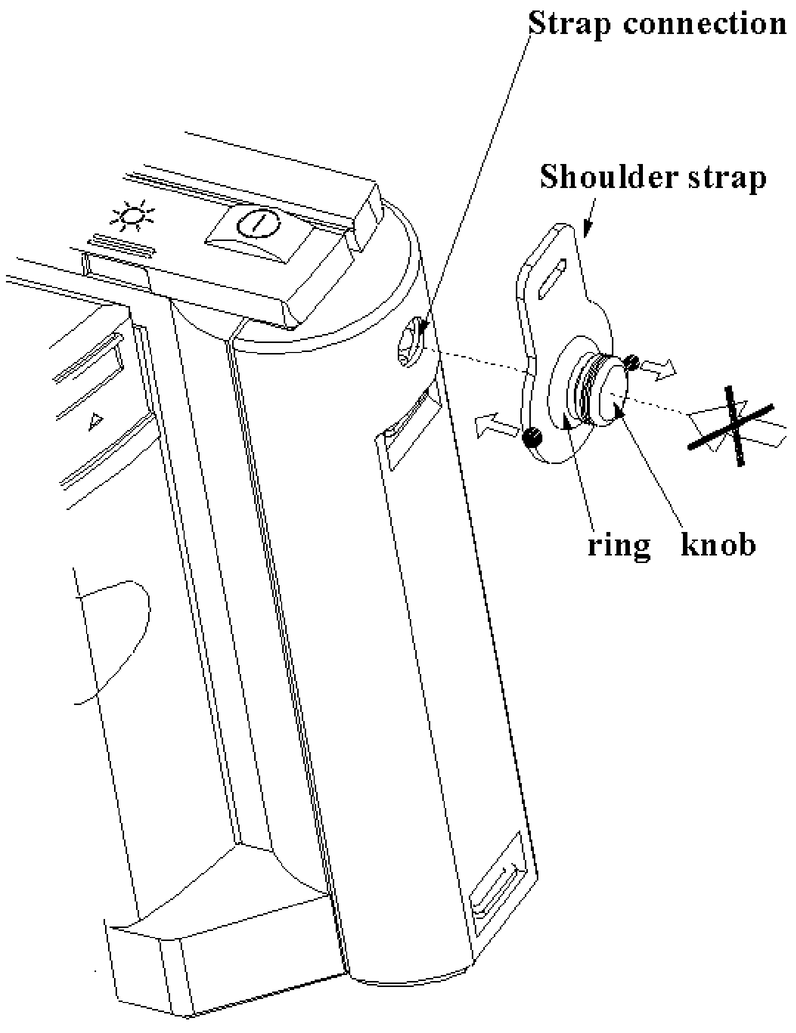


Figure 2-5 **Adding hinges for the shoulder strap**

External connections

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 2-5).

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

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 submodule.**

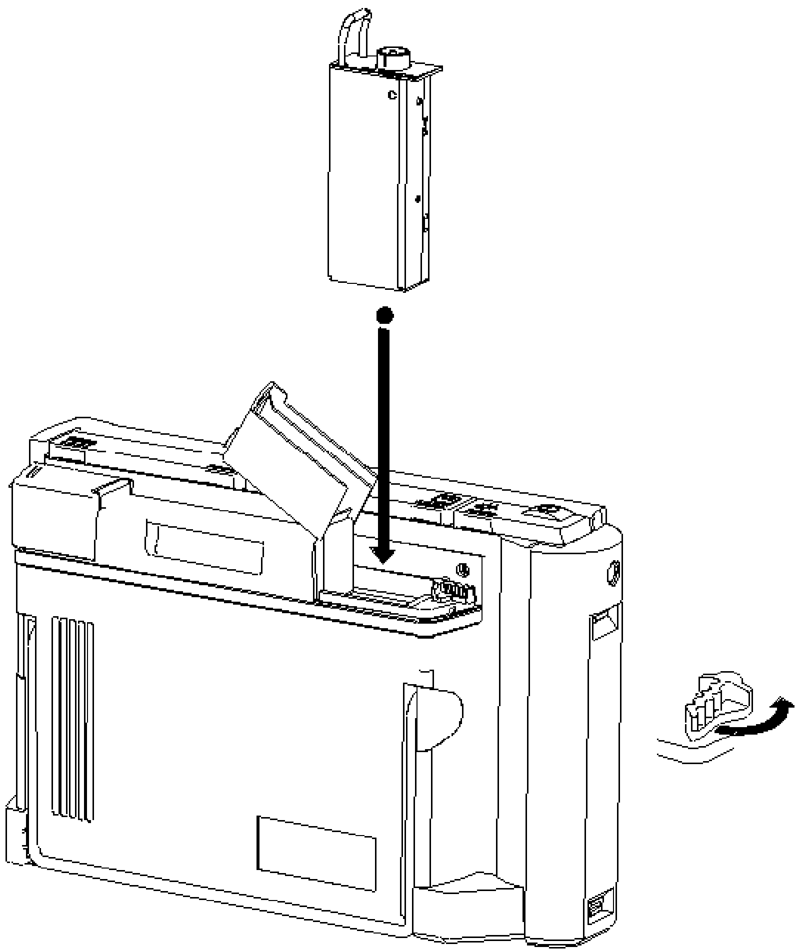


Figure 2-6 **Inserting a submodule**

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 and Removing a Module” on page 37.

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.

3 Now insert the submodule

The submodule slips easily in and out of its slot (Figure 2-6). When the submodule is in place, you can now connect an Optical Output Connector and a fiber, and lock the module.

2.3 Battery Handling

Inserting and Removing a Battery

The battery should be inserted in the slot at the foot of the Mini-OTDR (see Figure 2-7.)

NOTE **Only use the HP spare NiMH battery pack (Product Number E6000-68950) or comparable batteries. Other batteries may be damaged by the Mini-OTDR battery charger.**

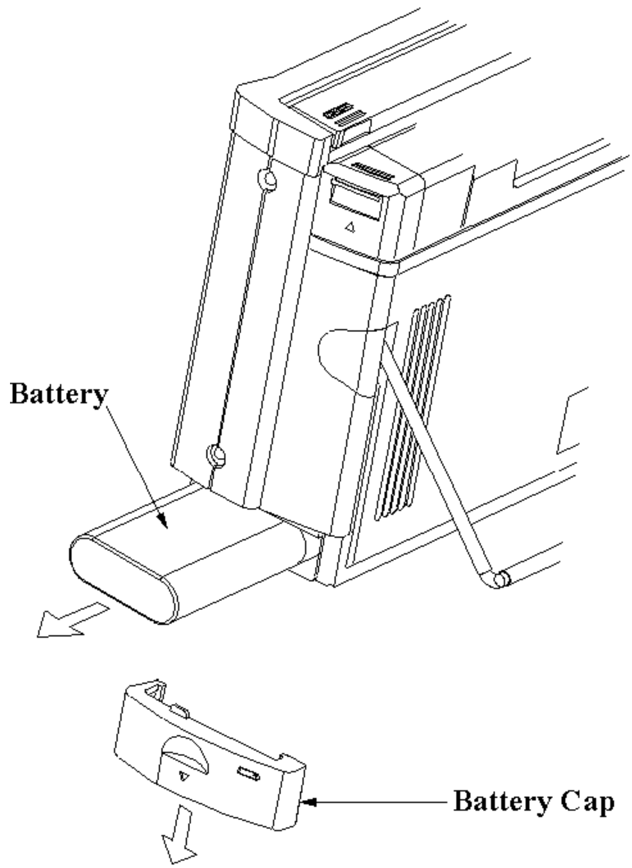


Figure 2-7 **Removing a Battery**

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.

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.

- 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 82).
- If your battery is new or it has been in storage for a long time, you may need to charge it two or three times to achieve optimum performance levels.
- 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.**

- 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.

Connecting an AC/DC Adapter

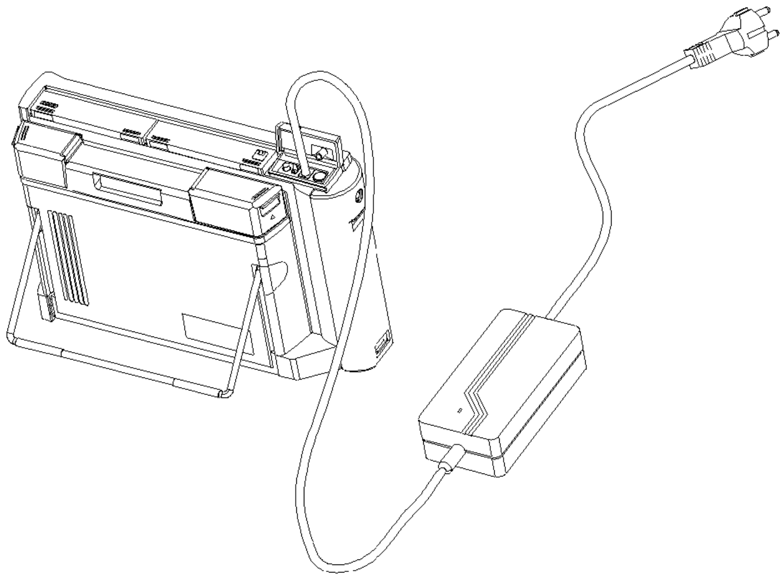


Figure 2-8 **Connecting an AC/DC Adapter**

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).

You see an input connector next to the On/Off button. Attach the lead from the charger to this connector (Figure 2-8).

2.4 The Mini-Keyboard

If you order the HP E6000B, option 007, you receive a PS2 keyboard, that you can attach at the back of your Mini-OTDR, to the right-hand side (see Figure 2-9).

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 143).

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

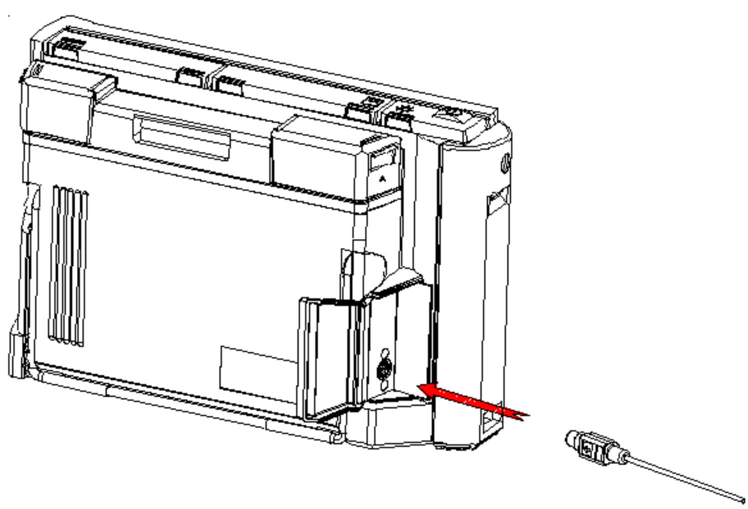


Figure 2-9 **Attaching a screen keyboard**

The Mini-Keyboard

You can attach any standard PS2 keyboard to the keyboard connection, with a mini-DIN connector (for example, the E6000B #007 Mini keyboard E6000-61901).

3

Sample Sessions: Measuring a Trace

Sample Sessions: Measuring a Trace

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

In these sample sessions we use:

- A Mini-OTDR HP E6000B with an optical module HP E6003A (1310/1550 nm, single-mode).
- A length of fiber of about 40 km, terminated at one end with a Diamond HMS-10/HP 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.

The sample sessions in this chapter show you how to do the following:

- Set up your Mini-OTDR,
- Run a Measurement: Automatically, Manually, and in Real Time,
- Use the Event Table and Trace Checker,
- Set the Horizontal Offset and Fiber End,
- Print and Save the Measurement.

You can see some further Sample Sessions in the following chapters.

3.1How 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 “Cleaning Fiber/Panel Connectors” on page 287.
2. Attach the required optical connector interface to the optical output. See “Adding a Connector Interface” on page 39.
3. Connect the fiber to this interface.
4. Turn on the Instrument.

3.2 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 (Figure 1-7).
2. Select [SETTINGS] from the popup menu. You see a menu headed `Measurement Settings` (see Figure 1-13 on page 53 and Figure 1-14 on page 56).
3. If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

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

5 Use the Cursor keys to alter the Refractive Index. Use the Left and Right keys to move to a different digit. Use the Up and Down keys to change the value of the highlighted digit.

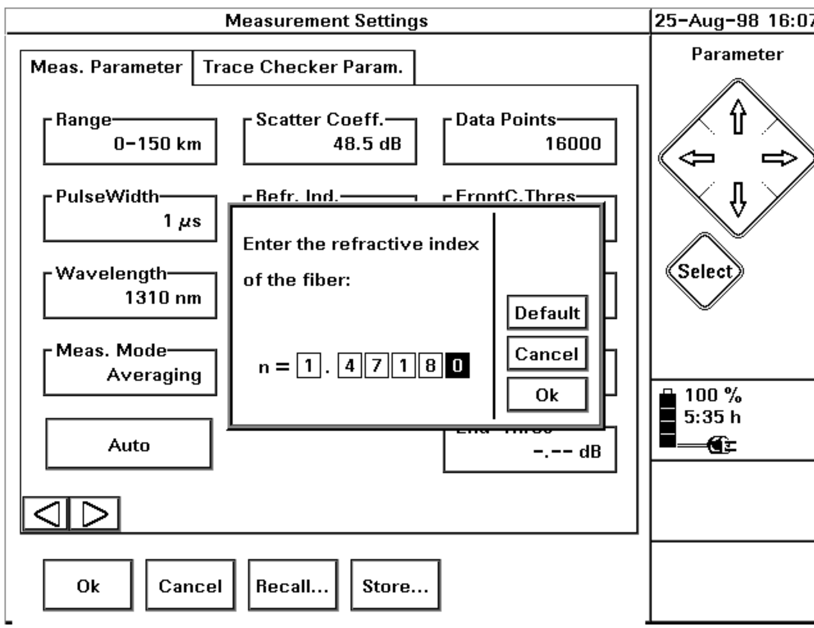


Figure 3-1 **Altering the Refractive Index**

6 When you have the Index you want, move to `OK` and press the Select key.

7 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.

3.3 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 87, "How to Set the General Configuration" on page 141, "How to Set the OTDR Settings" on page 146, and "How to Set the Trace Information" on page 148.

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

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

2 If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.

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`.

5 Select [VIEW] from the popup menu. 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>.

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 (E6000B option 003), you can select whether or not the current display is color by the VIEW - PREFERENCES option COLOR MODE.**

A color screen is usually preferable, but if you are working outside, with light reflecting on your screen, you may wish to switch to a monochrome display.

3.4 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 menu.
2. If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.
3. Move to <RANGE> and press SELECT. You see a list of preset typical ranges.
4. Highlight a preset range and press SELECT.

   Alternatively:

4. 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 menu.
2. If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.
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.

NOTE **If you have selected <AUTO SCAN> from the [VIEW] menu, the OTDR has automatically scanned the trace for events. You can view the events by selecting [VIEW]<EVENT TABLE> or [VIEW]<EVENT BAR>.**

To scan an existing trace, select [ANALYSIS]<SCANTRACE>

3.5 How to Alter measurements in real time

1. Select [SETTINGS] from the OTDR Mode popup menu.
2. If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press SELECT to bring up the next page.
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 menu. You now see a smaller settings screen above the trace. This screen shows variables that

can be changed while the measurement is running.

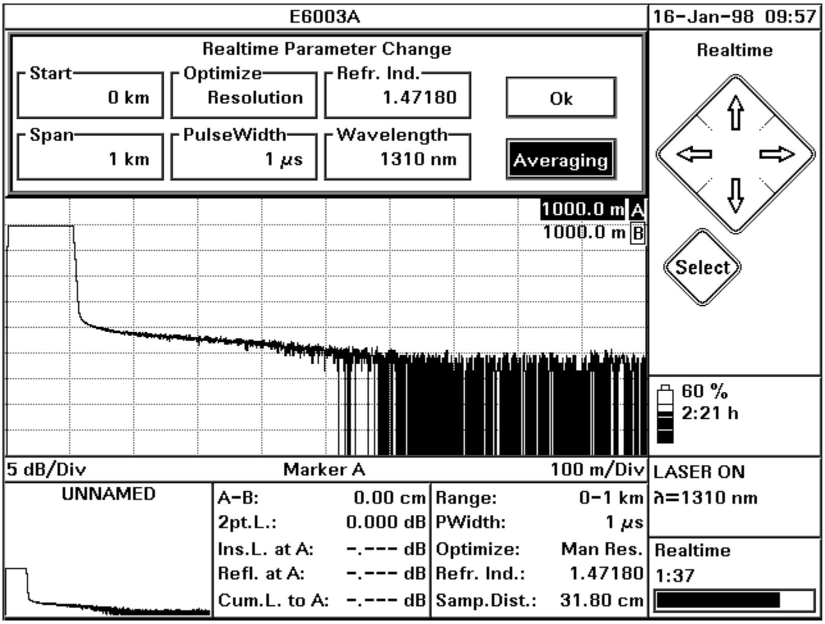


Figure 3-2 **Realtime settings menu**

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.**

3.6 How to Use the Event Table

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 menu.

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.

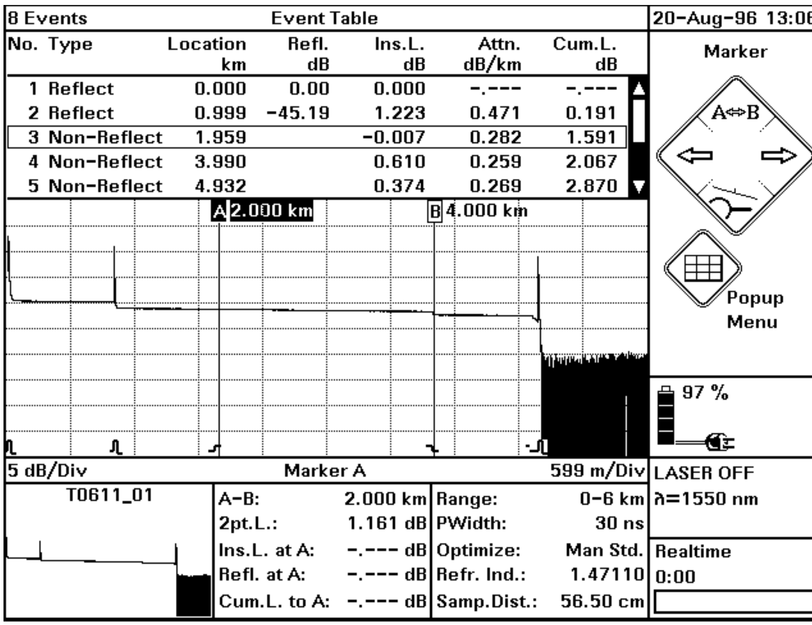


Figure 3-3 **The Event Table**

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

- 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 menu. 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.

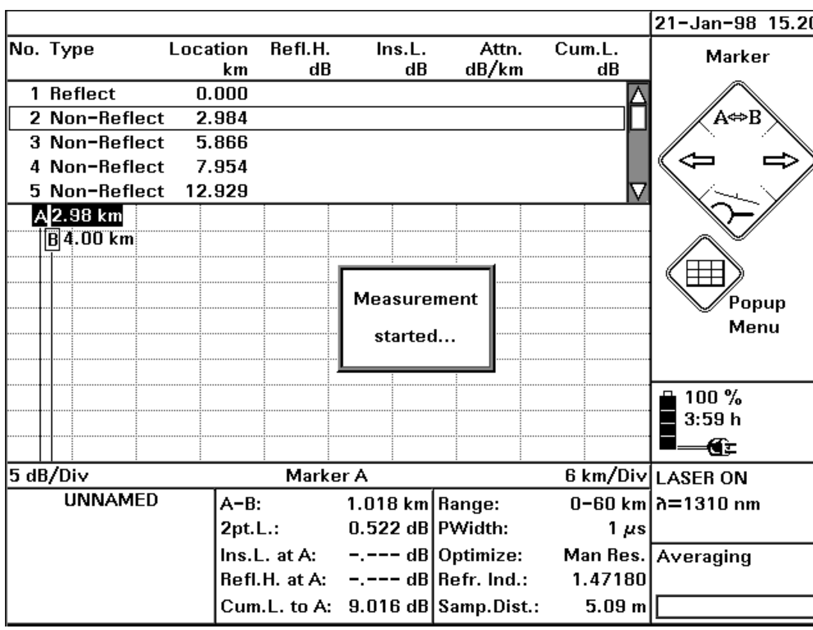


Figure 3-4 **Taking a New Measurement with a Locked Event Table**

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.

3.7 How to Use the Trace Checker

How to Set the Trace Checker Parameters

1. Select [SETTINGS] from the OTDR Mode popup menu.
2. If you are not already viewing the `Trace Checker Parameters` page (Figure 1-14), 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 Trace Checker Parameters screen” on page 56.

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 3-5). The Events that are already masked have a tick beside their entry.

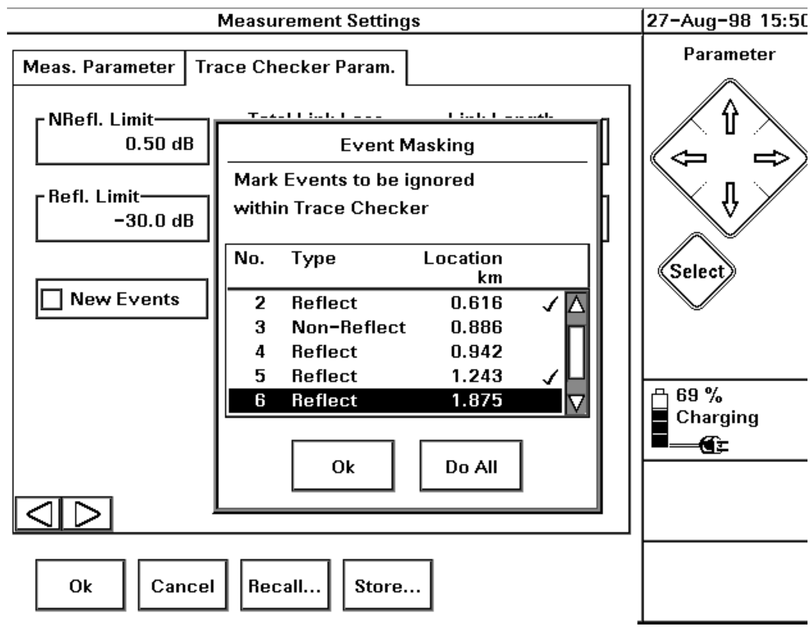


Figure 3-5 **Select Event Masking**

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 Trace Checks. This means that these Events will not appear in the Trace Checker 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 Trace Checker

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.

9 If you are checking for New Events, lock the Event Table.
See "How to Lock the Event Table" on page 97.

10 Select <TRACE CHECKER> from the [ANALYSIS] menu.
The Trace Checker checks the current trace against limits set above. You see a message `Trace Checker active..`, at the top of your Trace screen.

NOTE **If you have not set any Trace Checker Param. Limits, no Trace Check is performed.**

If there is no current trace, no Trace Check is performed and you see an error message.

11 After the Trace Check has been performed, you see the message `Trace checking done!` at the top of your Trace screen.

You are told whether the check has passed or failed (for example, Figure 3-6).

Figure 3-6 **Trace Check failed message**

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

- **Trace Check passed**: you see `PASSED` at the top right of your Mini-OTDR screen.
- **Trace Check failed, Trace Checker Table not displayed**: you see the screen in Figure 3-6.
- **Trace Check failed: Trace Checker Table already showing**: you see a `FAILED` message and the Trace Checker Table is updated.

This example assumes the second case (Trace Checker failed, no Trace Checker Table displayed).

12 Select `Details` to continue.

You now see the new Trace Checker Table (Figure 3-7).

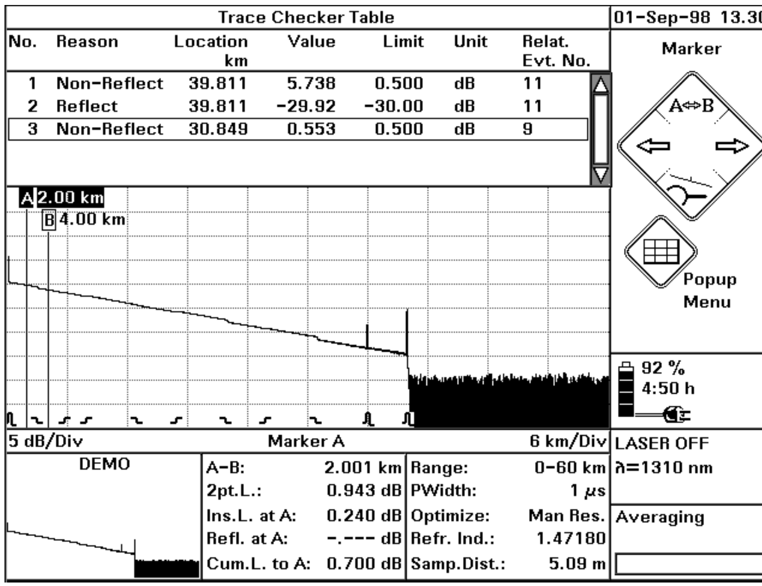


Figure 3-7 **Trace Checker Table**

Events in the Trace Checker 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.

The Trace Checker table gives you the following information:

- The number and location of the Event.
- The limit that has been exceeded (`Reason`) (see “The Trace Checker Parameters screen” on page 56). 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.

The Trace Checker Table is also included in a printout. See “How to Print the Measurement” on page 107.

NOTE **If you want to perform a Trace Check whenever a Scan Trace is performed, select <AUTO TRACE CHECK> from the [VIEW] menu.**

NOTE **If you want to view the Trace Checker Table, or to stop viewing it, select <TRACE CHECKER TABLE> from the [VIEW] menu.**

You cannot see the Trace Checker Table and the Event Table simultaneously. This means that selecting the Trace Checker Table deselects the Event Table, and vice versa.

3.8 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.

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 3-8).

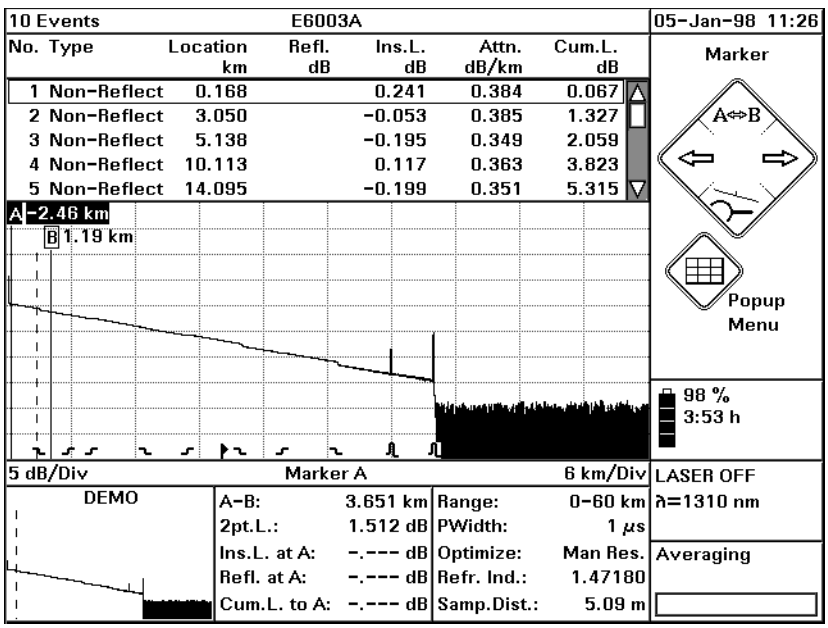


Figure 3-8 **Trace with Horizontal Offset set**

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 107).

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.**

3.9 How to Set the Fiber End

Either

1 Select [Settings] from the OTDR Mode popup menu.

2 If you are not already viewing the `Meas. Parameter` page (Figure 1-13), cursor to either of the arrows at the bottom left of the screen. Press Select to bring up the next page.

3 Cursor to `End Thres.` and press SELECT. Follow “How to change a numerical setting” on page 143 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.

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

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

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

The end Event is listed as type `End` in the Event table, and marked on the Event Bar with a special symbol (see Figure 3-9). All events to the right of the End Event are removed.

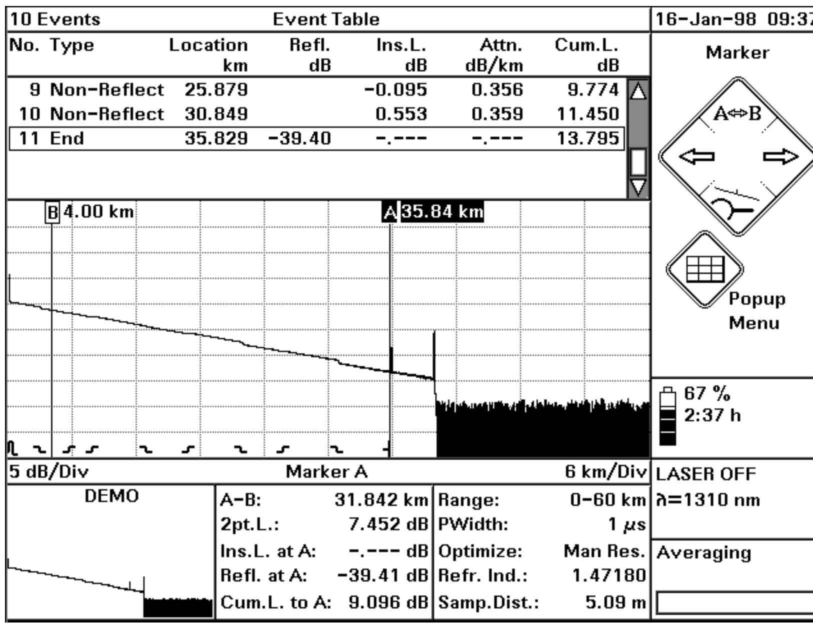


Figure 3-9 **Trace with an End set at Marker A**

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.

3.10 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 151.

1 Attach an external printer to the Centronics interface of the Mini-OTDR. See "The Mini-OTDR module" on page 36.

Either (print the current trace):

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

Or (print a stored trace):

2 Select [FILE] from the popup menu. 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.

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 148.
- The Trace Checker Table. See “How to Use the Trace Checker” on page 98.

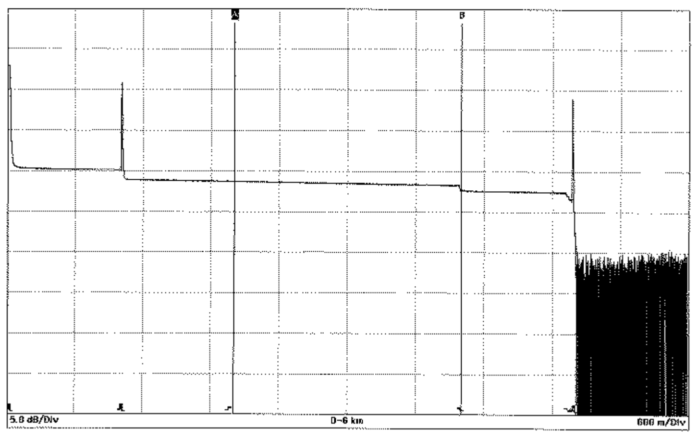
This gives you all the information necessary to document the measurement, or to repeat it using the same parameters.

HEWLETT PACKARD
HP E6000A
OPTICAL TIME DOMAIN REFLECTOMETER
01/24/1997 11:52:10
Page 1/1

Trace: TBB11_01.SOR
Measurement Date: 01/26/1995 – 21:36:59

Cable ID : Cable A
Fiber ID : Fiber C
Orig. Location : Start Pos. 2
Term. Location: Pos. B
Operator : PB
Mainframe : HP 8147 OTDR 3502G00056 0.972 S
Module : E4316A 3525G00056 (single-mode)

Range:	0–6 km	Optimize mode:	standard
Pulsewidth:	30 ns	Sampledistance:	56.40 cm
Wavelength:	1550 nm	Averaging time:	2:00
Scatter coefficient:	51.5 dB	Refractive index:	1.47110



A–position:	2.000 km
B–position:	4.000 km
Distance A–B:	2.000 km
2pt. Loss:	1.161 dB

Event table — Threshold: –.– dB – Reflect Threshold: –.– dB – End Threshold: 3.0 dB

No.	Type	Location km	Reflectance dB	Ins. Loss dB	Attenuation dB/km	Cum. Loss dB
1	Reflective	0.000				
2	Reflective	0.899	–45.18	1.223	0.471	0.191
3	Non–Reflective	1.959		–0.007	0.282	1.581
4	Non–Reflective	3.990		0.610	0.259	2.087
5	Non–Reflective	4.932		0.374	0.269	2.870
6	Non–Reflective	4.954		0.374	3.886	3.345
7	Non–Reflective	4.968		–1.248	4.240	3.767
8	Reflective	4.981	–41.82	18.835	–16.333	4.013

Figure 3-10 Typical Printout

NOTE **You can print a screen hardcopy by pressing and holding the HELP key for 4 seconds. A correctly configured printer must be attached.**

3.11 How to Save the Measurement

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 menu.
2. Cursor DOWN to the <SAVE AS...> option. and press SELECT.

You see a screen listing the current files on the device.

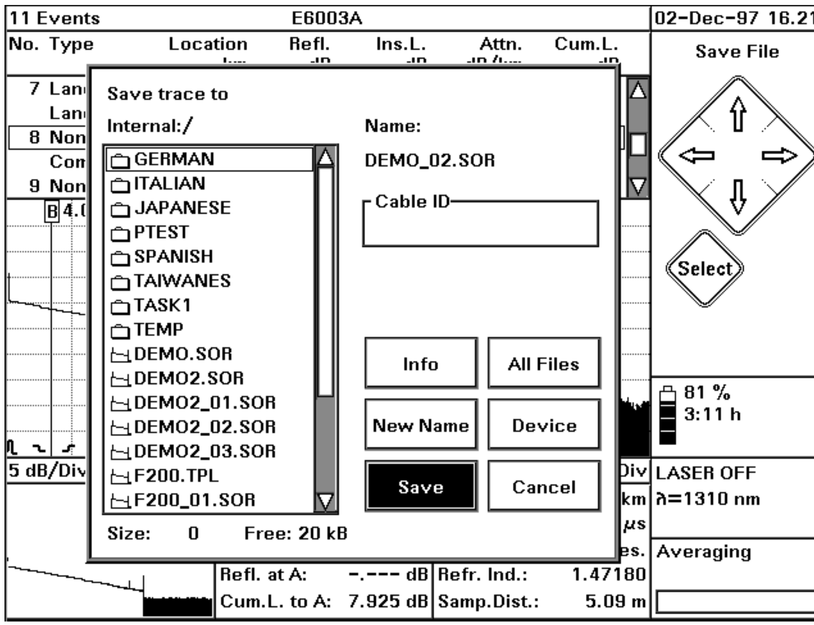


Figure 3-11 **The Save menu**

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

4 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

4 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: Analyzing an Existing Trace

Chapter 3 “Sample Sessions: Measuring a Trace” 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.

The sample sessions in this chapter show you how to do the following:

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

If you have not used a Mini-OTDR before, you should first read the previous chapter. The equipment used in this chapter is the same as before.

4.1 How to Add a Landmark or Event Comment

There are 2 ways of documenting points on a fiber:

- 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.
- 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

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.

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 4-1).

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.

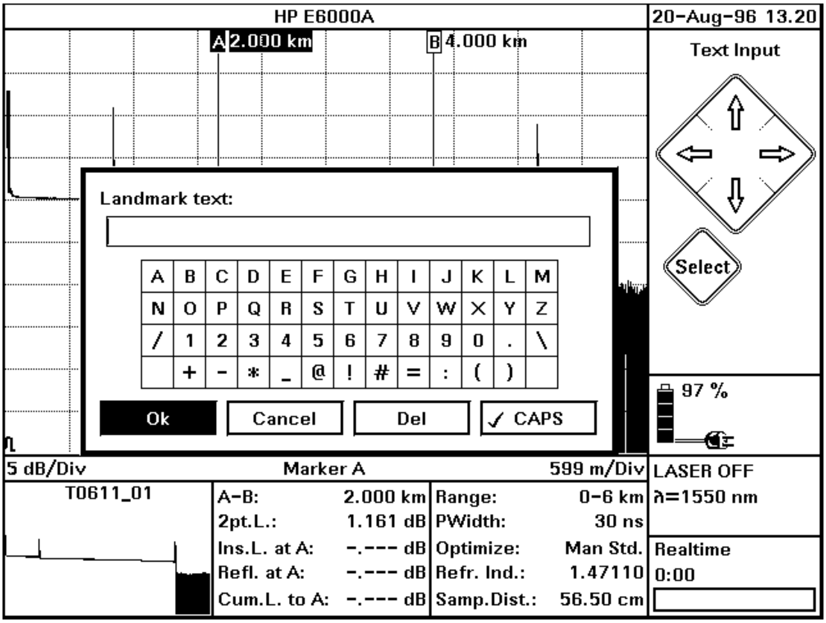


Figure 4-1 **Landmark text box**

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

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 4-1.

   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.

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 4-2 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.

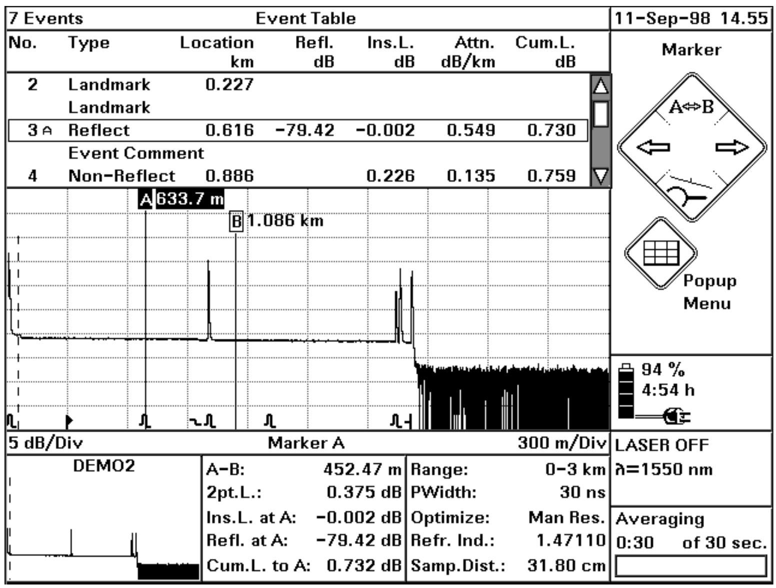


Figure 4-2 **Landmark and Event Comment**

4.2 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:

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

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

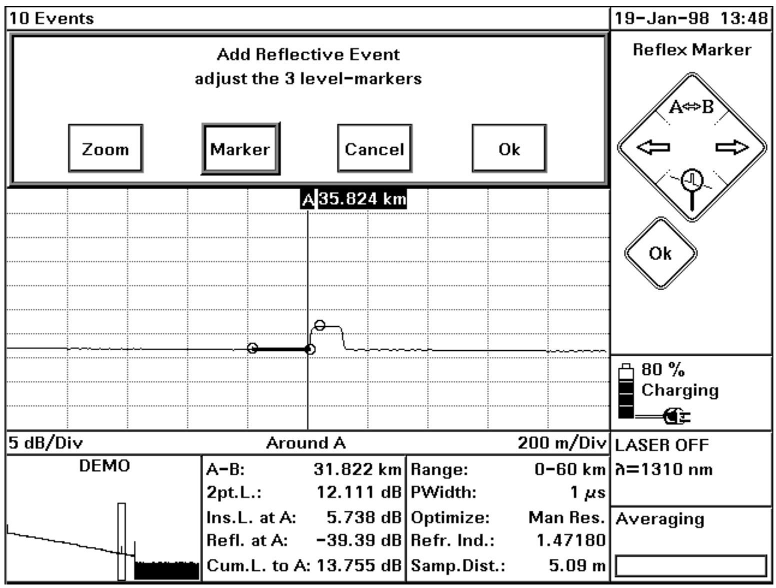


Figure 4-3 **Level-markers for analyzing reflectance**

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 50.

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.

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.

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.

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.

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 4-4).

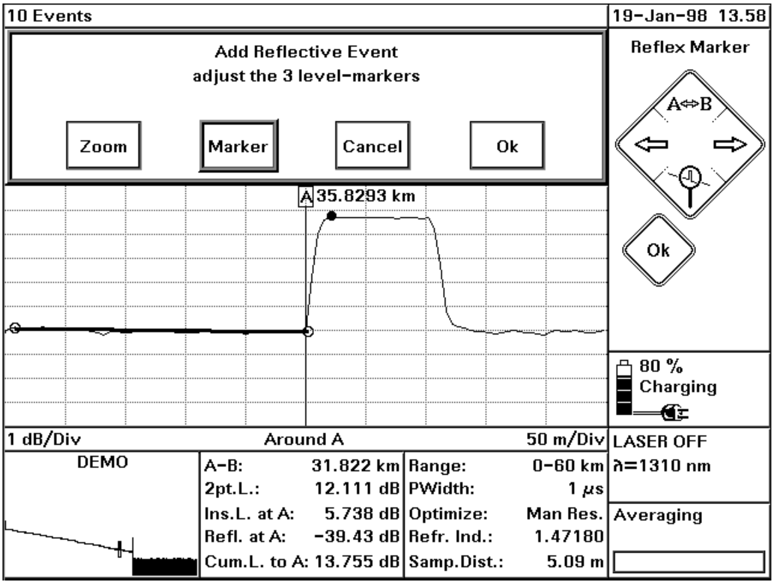


Figure 4-4 **Measuring Reflectance: setting the level-markers**

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.

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 146.

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 129.

You now see 4 level-markers on the trace, and a message asking you to adjust them (Figure 4-5). 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.

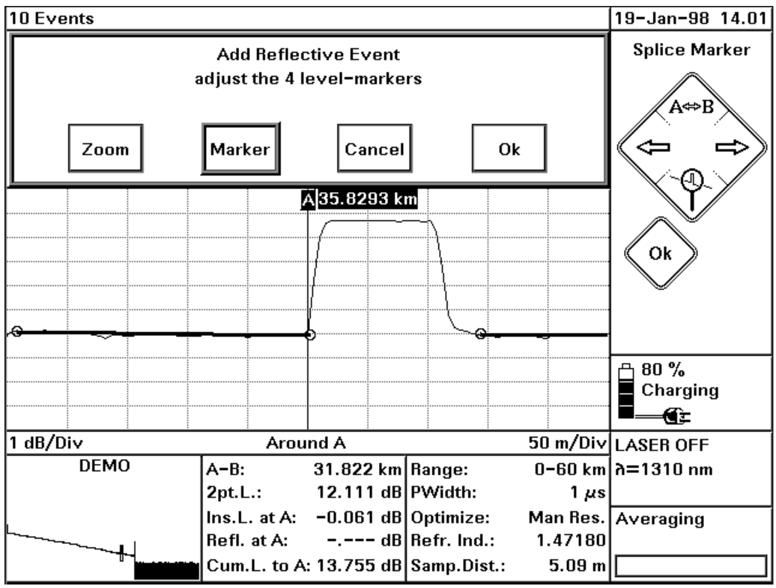


Figure 4-5 **Level-markers for analyzing insertion loss**

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 122.

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.

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.

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.

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.

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 122.

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

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 4-6).

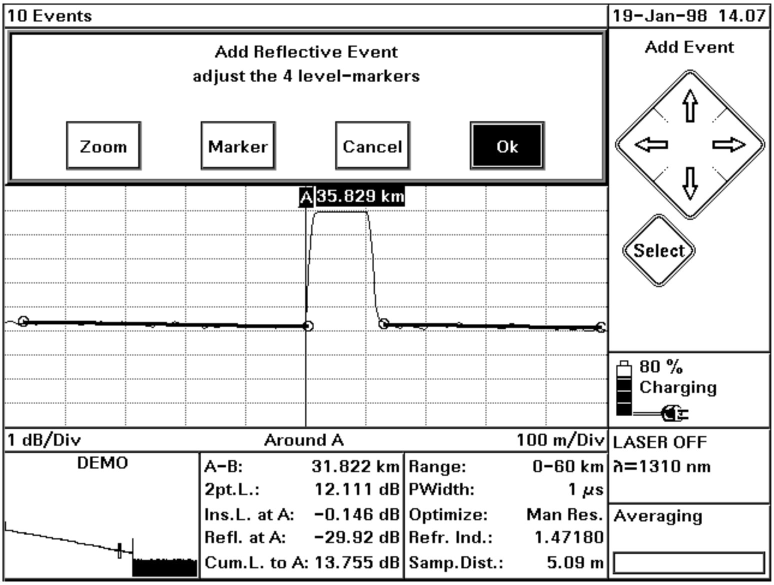


Figure 4-6 **Measuring Insertion Loss: setting the level-markers**

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

4.3 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 Follow “How to Zoom while Adding an Event” on page 122 to move your marker to where you want to add the event.

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

3 You now see 4 level-markers on the trace, and a message asking you to adjust them (see Figure 4-5).

4 Follow “How to Set the Level-markers for Measuring Insertion Loss” on page 125, 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 Events are indicated by an `A` between the entries for `No` and `Type` in the Event Table. Modified Events are indicated by an `M`.

4.4 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:

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.

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.

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

An End is set at the Event. See “How to Set the Fiber End” on page 105 for more details.

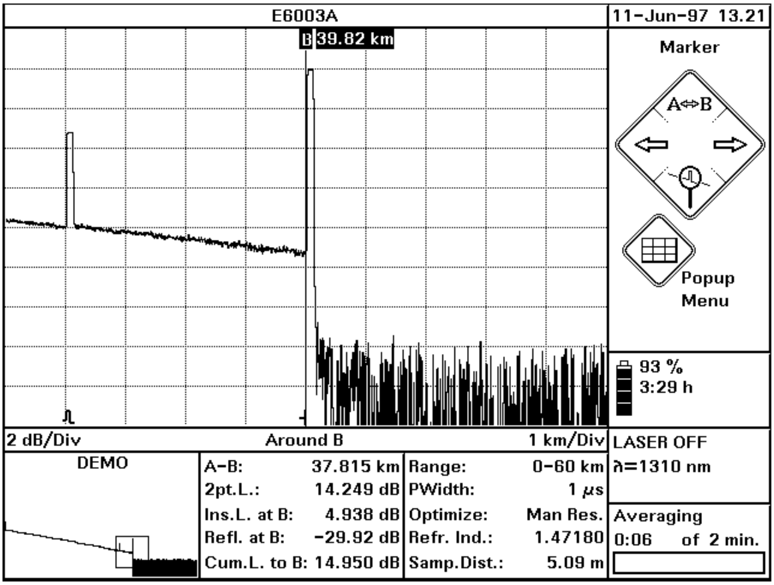


Figure 4-7 **Declaring an End at the edge of the backscatter**

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

7 Press the UP key to activate marker A.

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.

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.**

4.5 How to Calculate Reflectance or Insertion Loss for existing Events

How to Calculate Reflectance

1 Move the active marker to an Event.

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

3 Follow the steps in “How to Set the Level-Markers for Measuring Reflectance” on page 121 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 146.

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

How to Calculate Insertion Loss

1. Move the active marker to an Event.
2. Select the [ANALYSIS]<ANALYZE INSERTION LOSS> menu option.
3. Follow the steps in “How to Set the Level-markers for Measuring Insertion Loss” on page 125 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).
5. Remove the level-markers by deselecting [ANALYSIS]<ANALYZE INSERTION LOSS>.

4.6 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.

1. Make a real time measurement (see “How to Alter measurements in real time” on page 93).
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 132.
5. If you want to measure the Insertion Loss more precisely, stop the measurement and restart it in Averaging Mode.

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

4.7 How to Display and Compare Two Traces

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.
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>`.

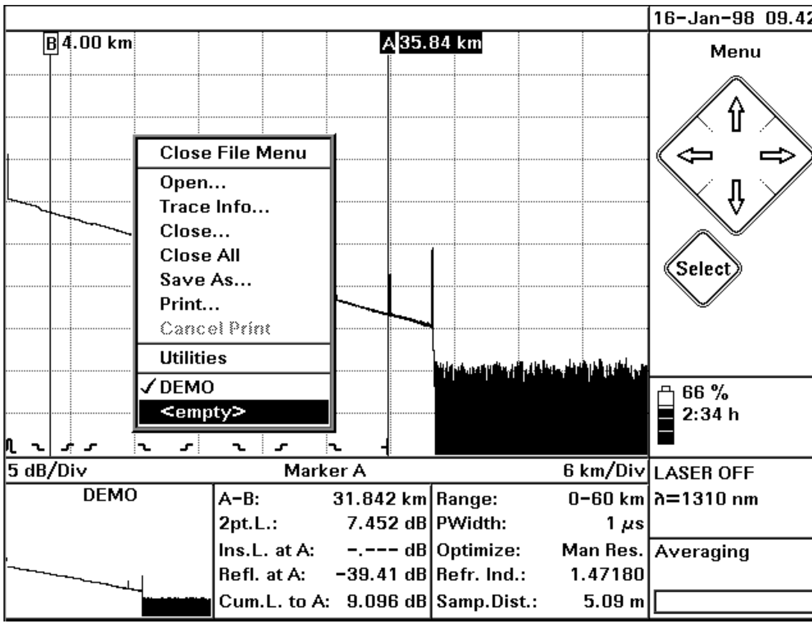


Figure 4-8 **Selecting the empty trace**

NOTE **If you have set a Horizontal Offset (see “How to Set the Horizontal Offset” on page 103), 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.

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

4-9)

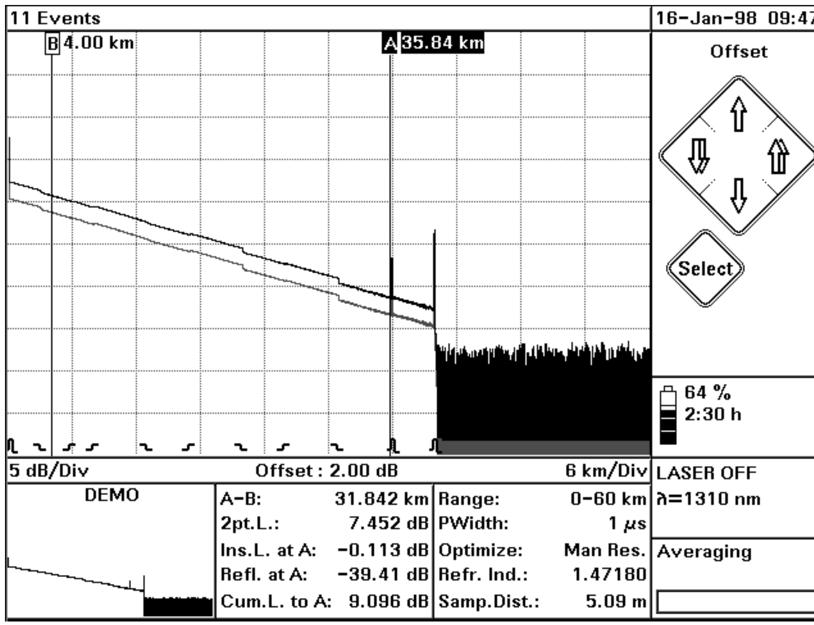


Figure 4-9 **Two traces on the same picture**

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:

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

The diagram for the Cursor changes (Figure 4-10). You see single arrows for UP and DOWN and double arrows for LEFT and RIGHT.

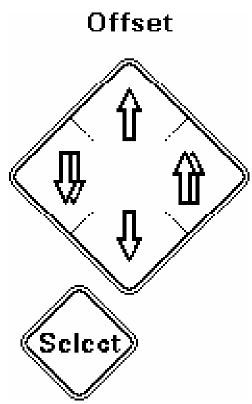


Figure 4-10 **Cursor diagram - adjust Vertical Offset**

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

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>.

4.8 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

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.

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

Alternatively,

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

4 You now see the *File Utilities* screen. Select `Copy.` A dialog box appears containing a list of files.

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 Include a Logo

8 Select [CONFIG] from the popup menu. Select the menu item <INSTRUMENT CONFIG>. You see the `General Parameters` screen (Figure 5-1).

9 Use the cursor keys to move to `Logo` and press SELECT. You see a list of the internal .PCX files. Select the file that you have just copied.

10 Move to the bottom of the `General Parameters` Screen and select `OK`. Confirm that you do want to change the changes just made.

NOTE **To include a logo in a printout, follow step 5 on page 153**

5

Sample Sessions: Instrument Configuration

Sample Sessions: Instrument Configuration

Chapter 3 “Sample Sessions: Measuring a Trace” and Chapter 4 “Sample Sessions: Analyzing an Existing Trace” showed what you can do in OTDR Mode of the Mini-OTDR.

This chapter shows you how to Configure your Mini-OTDR. It should be used in conjunction with the previous two chapters.

The sample sessions in this chapter show you how to set the following:

- General Configuration,
- OTDR Settings,
- Trace Information,
- Printer Configuration,
- Instrument Setup,
- Firmware/Language Update.

Although the sample sessions in the previous chapters can be followed for all configurations, you should follow at least the first 2 sections in this chapter to guarantee the correct results.

The equipment used in this chapter is the same as before.

5.1How to Set the General Configuration

1 Switch on the OTDR. You will see one of 4 possible screens:

a If you see a series of boxes like Figure 1-6, you are in the Applications Screen. Cursor Right to `Instrument Config` and press SELECT.

b If you see an empty trace like Figure 1-7, you are in *OTDR mode* or *EasyMode*.

Press SELECT to access the popup menu:

- 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 menu. You are now at the Applications Screen, and can follow step a.

c If you see a menu like Figure 6-2, you are in the Multiple Fiber Test. Select `Cancel` from the popup panel to enter EasyMode, then follow step b.

d Otherwise, you are in *Fiber Break Locator* (Figure 6-4) or *Source Mode* (Figure 6-5). Move to the `Close` box and press SELECT. You are now at the Applications Screen, and can follow step a.

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.

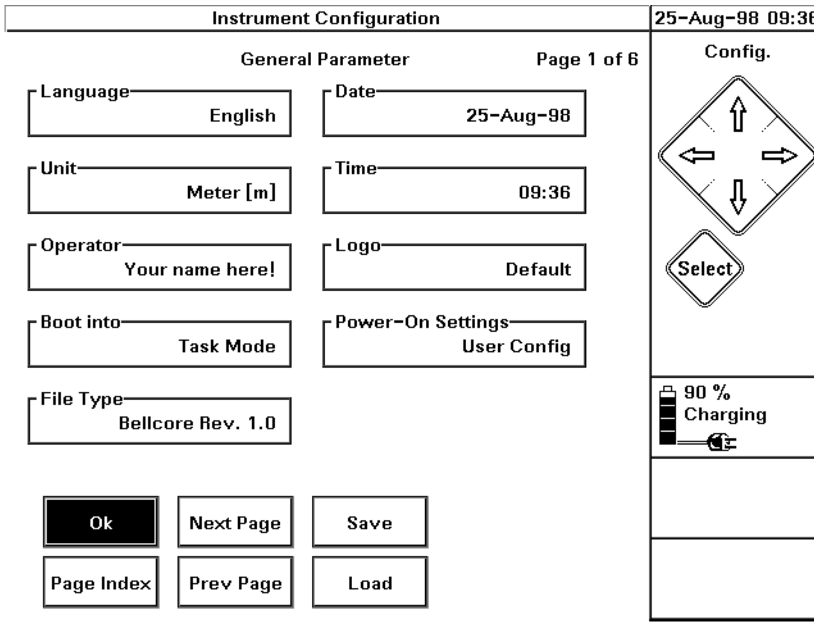


Figure 5-1 **Instrument Configuration General Parameters Screen**

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 7 below).

3 How to select a setting from a list

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

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

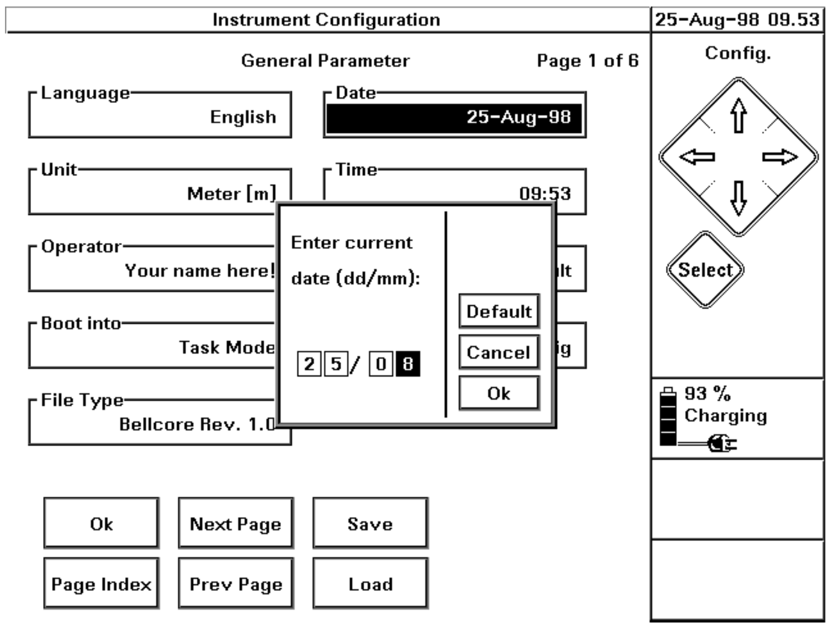


Figure 5-2 **Entering Numerical Data**

4 How to change a numerical setting

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

b 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.

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

5 How to change a text setting

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

b 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.

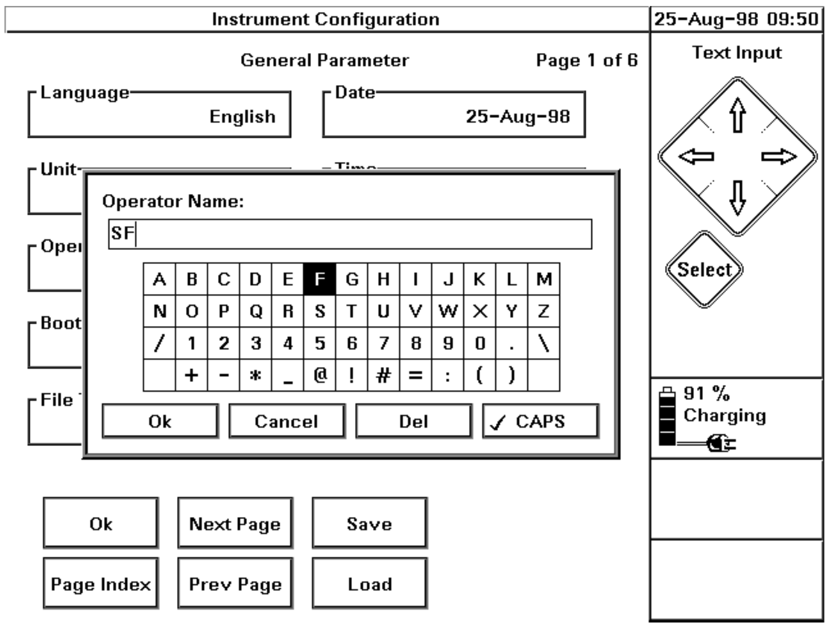


Figure 5-3 **Keyboard to Enter Text**

c 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* (HP Product Number E4310-91018) for more details.**

You can also operate your Mini-OTDR remotely using the HP E6090A OTDR Toolkit software. See the *OTDR Toolkit Operating Instructions* (English edition: HP Product number E6090-91013) for more details.

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

- Follow step 3 to select units from `Meter [m]`, `Feet [Ft]`, and `Miles [mi]`.
- Follow step 3 to select Bellcore revision type.

  Bellcore revision 1.1 conforms to standards, but you may need to use Bellcore revision 1.0 for backward compatibility.
- Follow step 4 to 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**

- Follow step 3 again to set the screen and settings that appear when you switch on (`Boot into` and `Power-on Settings` respectively).

How to Save the Instrument Configuration

7 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.

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

5.2 How to Set the OTDR Settings

1 Move down to `Page Index` and press SELECT. Select `OTDR Settings`. You see a screen headed `OTDR Settings` (Figure 5-4).

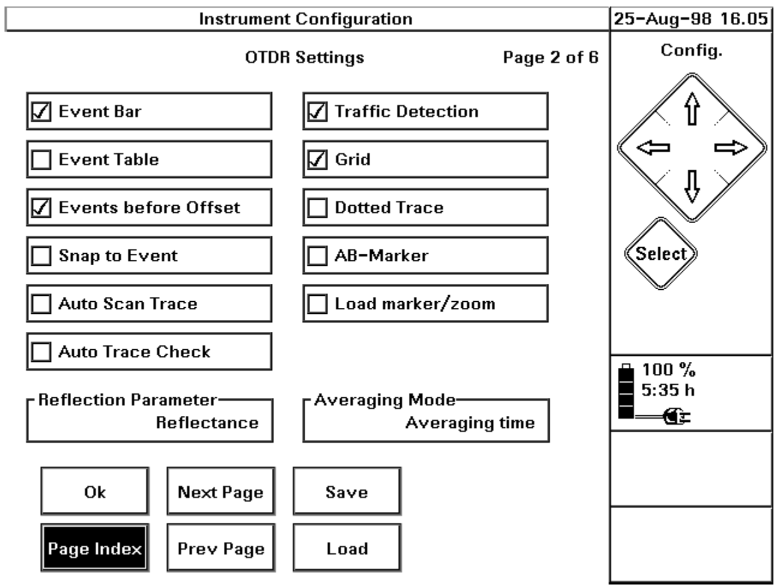


Figure 5-4 **OTDR Settings screen**

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.

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.

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 screens” on page 51.

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 (E6000B option 003), you can select whether or not you want color displayed in the `Instrument Setup` screen.**

A color screen is usually preferable, but if you are working outside, with sunlight reflecting on your screen, you may wish to switch to a monochrome display for better contrast.

5.3 How to Set the Trace Information

How to Set the Default Trace Information

1 Access the *Instrument Configuration* Screen by following step 1 from “How to Set the General Configuration” on page 141

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

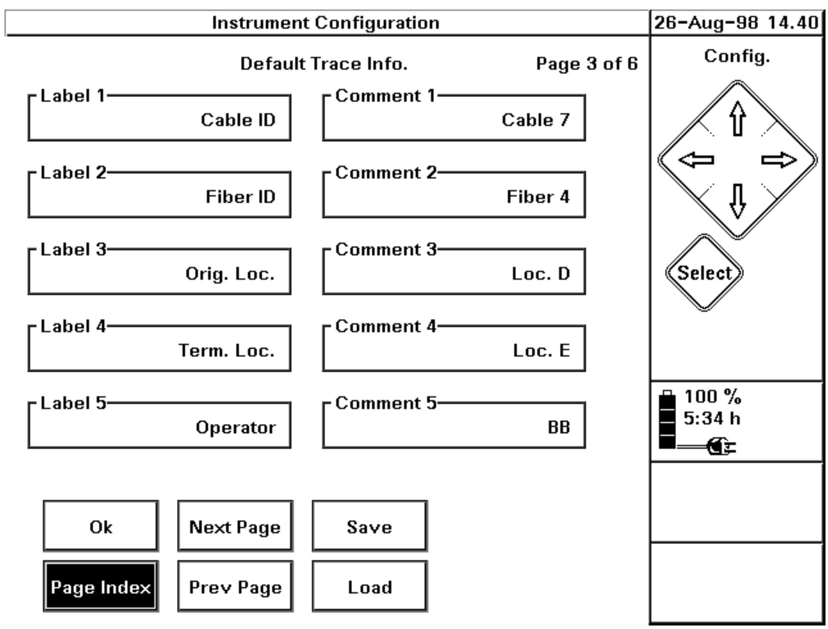


Figure 5-5 **Default Trace Info Configuration screen**

3 Move to the box headed `Comment 1` and press SELECT. You see a keyboard on the screen (see Figure 5-3), 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.

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.

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

9 Select the popup menu by pressing the SELECT key.

See Figure 1-2 on page 35 for an illustration of the Mini-OTDR hardkeys.

10 Select [FILE] from the popup menu.

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 5-6).

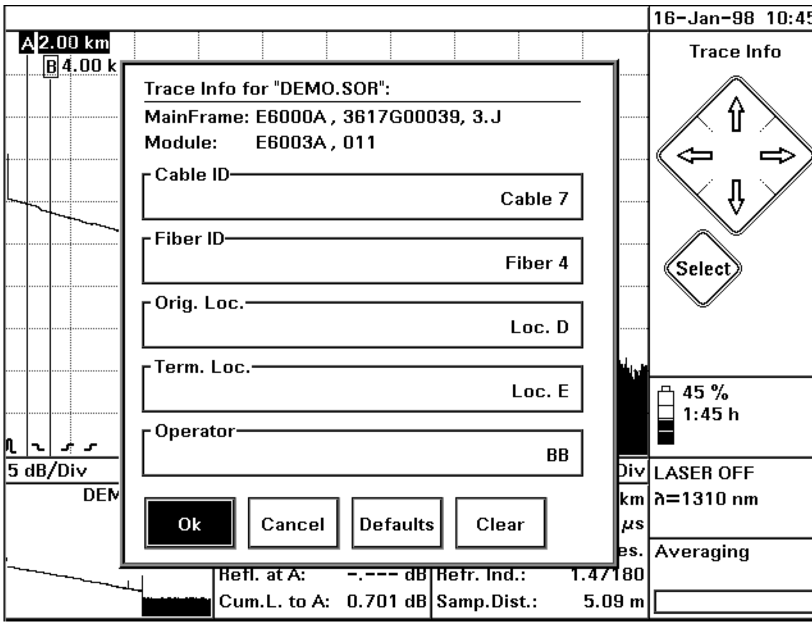


Figure 5-6 **Trace Info Screen**

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.

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 107 and “How to Save the Measurement” on page 111 for information on printing/saving measurements.

5.4 How to Set up the Printer Configuration

NOTE **For information on how to print a file, see “How to Print the Measurement” on page 107.**

1. Select [CONFIG.] from the popup menu
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 1-6), 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.

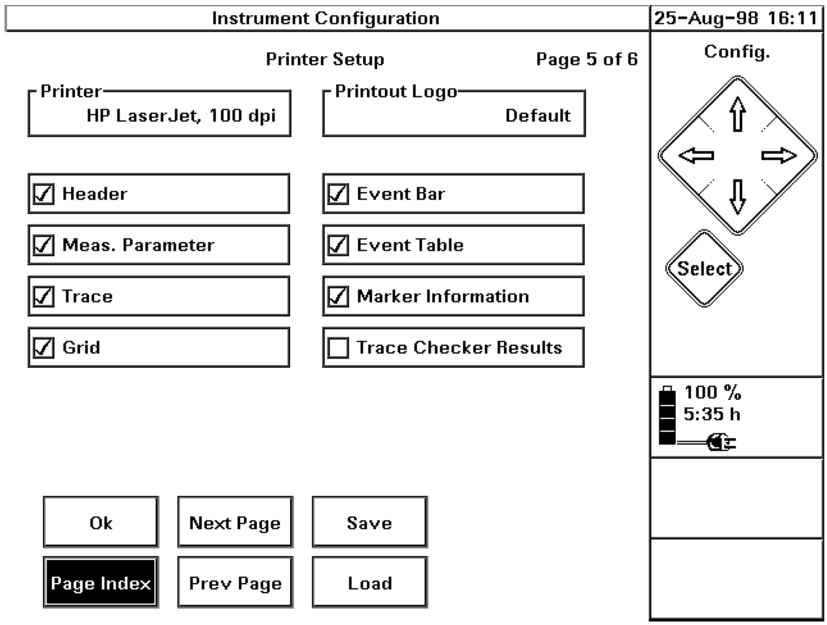


Figure 5-7 **Printer Setup Configuration**

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

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” on page 137

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 `OK` to return to the main trace window

5.5 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 *HP OTDRs Programming Manual* (E4310-91016).

How to Set the Instrument Setup

1 Follow step 1 in “How to Save the Instrument Configuration” on page 145 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 5-8).

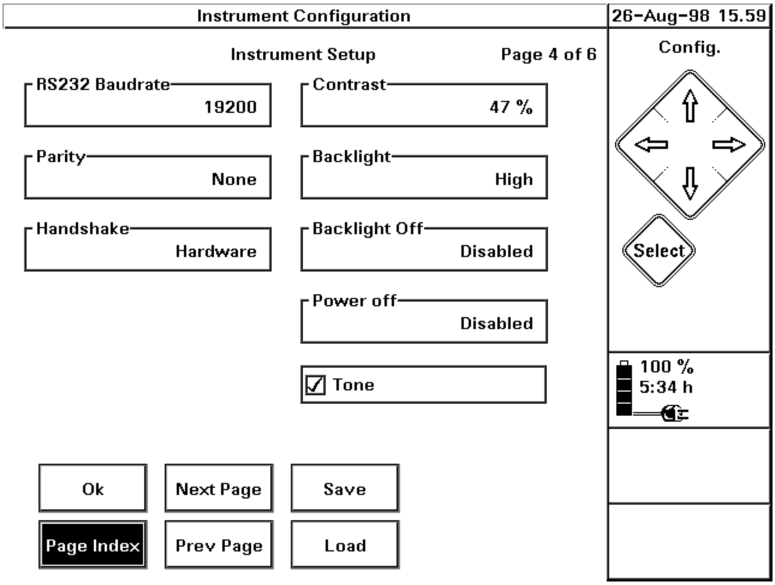


Figure 5-8 **Instrument Setup screen**

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.

5 Select `Save` to save this configuration.

5.6 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.

To update the firmware or languages, you need the floppy disks provided with your Mini-OTDR. There are 2 floppy disks for the firmware update, and 3 for the language update.

NOTE **Make sure that the language update disks and the firmware update disks are for the same revision of the Mini-OTDR software.**

The update revision is noted on each disk.

1 Connect your Mini-OTDR to an AC/DC power supply.
See "Connecting an AC/DC Adapter" on page 82

2 Access the *Instrument Configuration* Screen by following step 1 from "How to Set the General Configuration" on page 141

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 5-9).

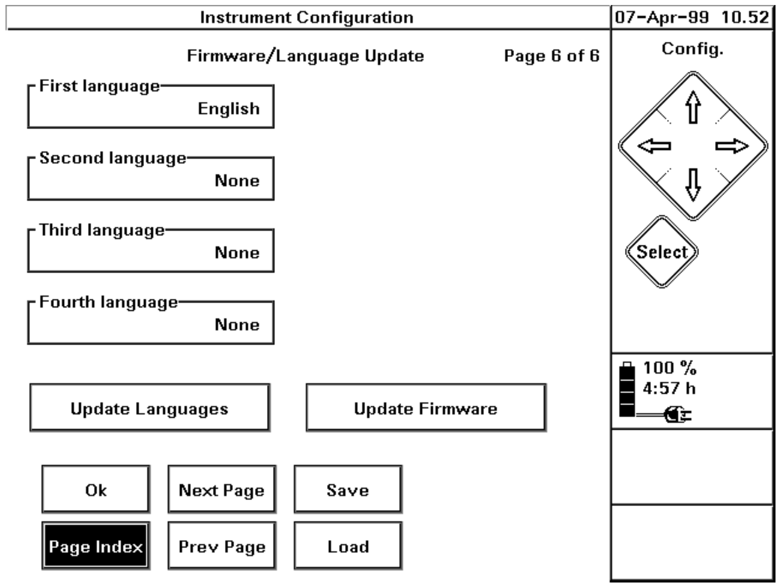


Figure 5-9 **Firmware/Language Update configuration page**

How to Update the 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.

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

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.

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.

6

Sample Sessions: Other Mini-OTDR Modes

Sample Sessions: Other Mini-OTDR Modes

Chapter 3 “Sample Sessions: Measuring a Trace” and Chapter 4 “Sample Sessions: Analyzing an Existing Trace” showed what you can do in OTDR Mode of the Mini-OTDR. “Sample Sessions: Instrument Configuration” on page 139 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 41).

The sample sessions in this chapter show you how to do the following:

- 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 chapters. The equipment used in this chapter is the same as before.

6.1 How to Recall Settings in EasyMode

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 141).

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 148.

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 92).

3 Select [FILE] from the popup menu. 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".

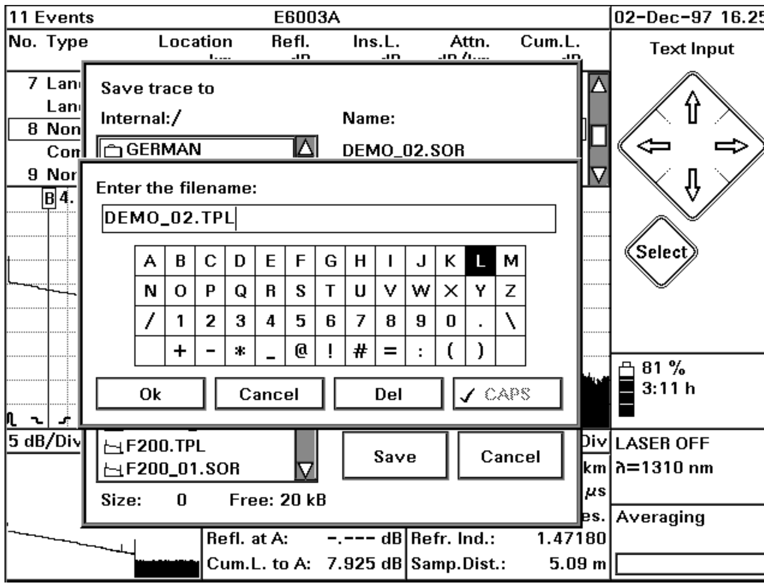


Figure 6-1 **Saving the current settings in a template.**

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 menu.

How to Read from a Presaved Template

7 Select *Easy OTDR* from the Applications screen.

8 Select [SETTINGS] from the popup menu. 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 52.**

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.**

6.2 How to Test Multiple Fibers with Preset Setups

Task 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 111, or “How to Save a Template” on page 161.

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

NOTE **Alternatively, you can select [TASK] from the EasyMode popup menu. See “EasyMode” on page 62.**

You see the Task Configuration menu (Figure 6-2).

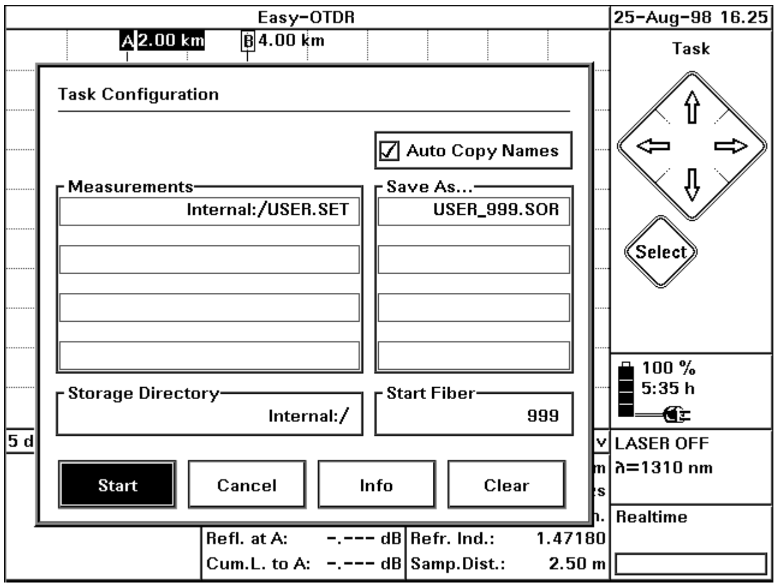


Figure 6-2 **Task Configuration screen**

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 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...` edit field.

You can select a different name as follows:

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

4 Press SELECT.

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

5 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.

6 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.**

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

7 If you want to measure the fiber with more than one setup, repeat step 2 (and steps 3 to 6 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 change the Start Fiber number

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

The default names of traces saved in Task 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.

How to customize the file name

Task Mode contains a number of different facilities which you can use to set up future file names. These facilities are discussed in this section.

Auto Copy Names

9 Select `Auto Copy Names`.

If Auto Copy Names is active, you see a tick in the box to the left of `Auto Copy Names`.

When Auto Copy Names is active, all similar names are updated at the same time. When a file name is updated, all file names with the same number of characters are updated.

So, if you have defined file names `TEST_01.SET`, `TEST_02.SET`, `TEST_03.SET`, and update the first file name to `TEST2_01.SET`, the other file names are similarly updated (to `TEST2_02.SET`, `TEST2_03.SET`, and so on).

10 To deselect this feature, Select `Auto Copy Names` again.

The tick disappears.

Include the Start File number

By default, the body of the file name contains the fiber number (see “How to change the Start Fiber number” above). However, you can specify that the fiber number is used as the file extension as follows.

11 Specify a File Name with only digits in its extension (for example, `DEMO.000`).

Files are now saved with an extension corresponding to the fiber number. So, if fiber number 100 is saved with settings from `DEMO.000`, the measurement will be saved in the file `DEMO.100`.

NOTE **The saved file name will be the same for ALL numerical extensions. This means that you should avoid using the same file body name if you have a numerical extension.**

So, for example, you should not specify filenames of both `DEMO.001` and `DEMO.002`, as both measurements will be written to the same file.

How to change the Storage Directory

12 By default, traces from task 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.

How to save Trace Info labels

13 If you want to save the Trace Info associated with the saved trace, select Info.

You see the current Trace Info labels (see Figure 5-6).

14 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*.

15 Select `Ok` to return to the Task Configuration screen.

How to Clear Some or All Settings

16 Cursor to `Clear` and press SELECT.

You see a menu allowing you to clear an individual setting.

17 Select `First set` to clear the first row, `Second set` to clear the second row, and so on. Select `All` to clear all settings.

Both the **`Measurements`** and the **`Save As...`** file name are cleared.

How to Take the Measurements

18 Select `Start` to start the measurement.

You see the message, `Connect Fiber` *`nnn`* `and press OK!`, where *nnn* is the next fiber number (Figure 6-3).

Figure 6-3 **Connect Fiber message**

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

How to Preview a Realtime Measurement

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

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

See "The Cursor and Select keys" on page 47.

22 To view a particular part of the trace, use the DOWN cursor to zoom around the current marker.

23 When you have seen enough of the preview measurement, press SELECT to return to the connect fiber message (Figure 6-3).

How to View the Actual Measurement

24 Press `Ok` to start the measurement

NOTE **If you want to return to the Task Configuration screen (Figure 6-2), select `Config`.**

To abandon the measurement entirely, and return to the EasyMode screen, press `Cancel`.

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.

Files are saved to the conventions explained in “How to change the file name” on page 164 and “How to customize the file name” on page 166.

You now see the message, `Connect Fiber` *`nnm`* `and press OK!`, where *nnm* is the next fiber number (incremented by 1).

25 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 `Cancel`.

6.3 How to Use the Fiber Break Locator

1 Select *Fiber Break Locator* from the Applications Screen. You see the Fiber Break Locator screen.

2 Move to `Refractive Index`, `Wavelength`, or `Threshold`, and press SELECT. Adjust the value as required

3 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. After a few seconds a trace will appear.

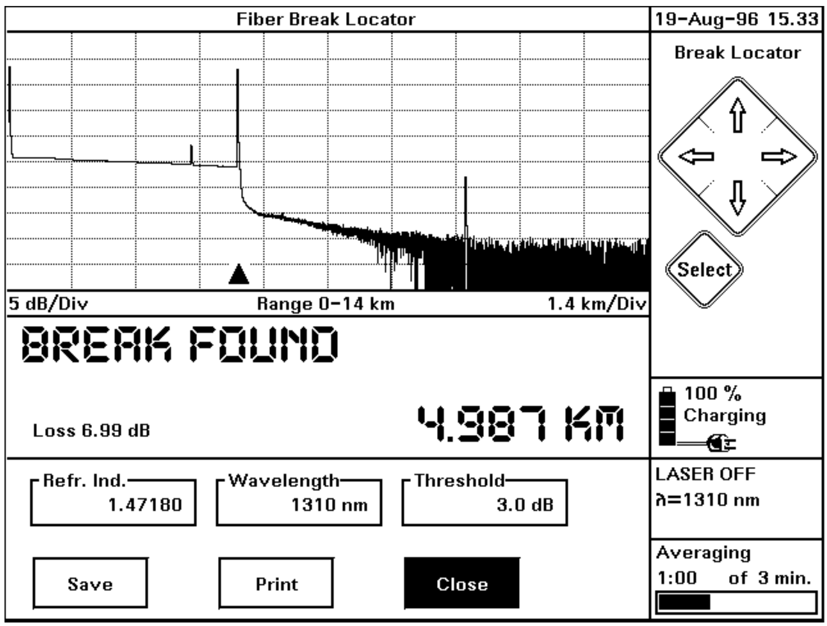


Figure 6-4 **The Fiber Break Locator**

4 The first break above the specified threshold level will be marked, or you will see the text `No Break Found`.

5 Select `Save` or `Print` to save or print your trace as required.

6.4 How to Use Source Mode

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.

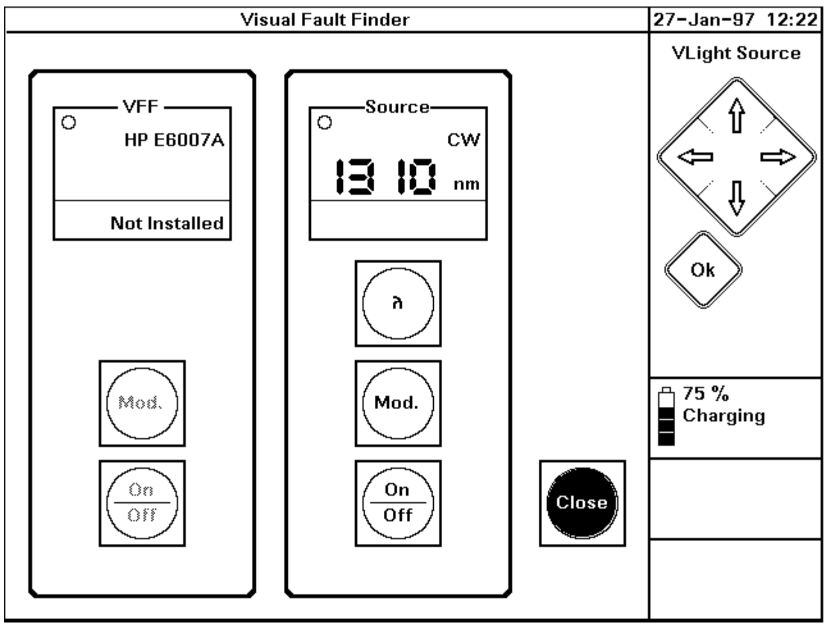


Figure 6-5 **Source Mode**

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 172 and “How to Use the Visual Fault Finder submodule” on page 179.

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.

6.5 How to Use the Power Meter 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 77).

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 HP E5974A Dual Laser Source.

   Alternatively, attach the other end of the fiber to the module currently installed in the Mini-OTDR

5 Switch on the OTDR. The third box in the Applications screen will now be called `Power Meter`. Move to this box and press

SELECT.

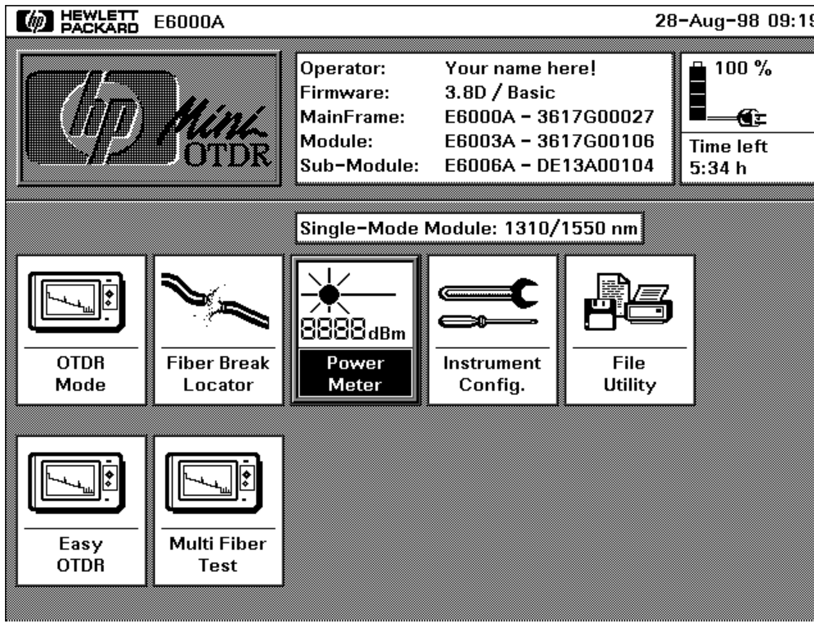


Figure 6-6 **Applications Screen when the E6006A submodule is attached**

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.

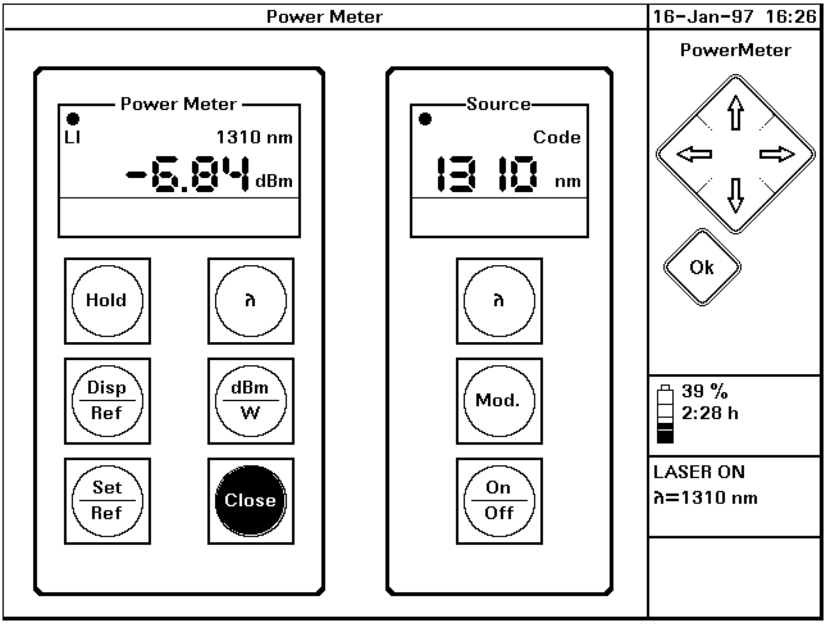


Figure 6-7 **The Power Meter Screen**

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.**

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.

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

Either

9 Select `Disp/Ref` from the left-hand screen. All subsequent power levels are shown relative to the current power level.

Or

9 Select `Set/Ref` from the left-hand screen. Manually input a reference value (see “How to change a numerical setting” on page 143). 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

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 remote OTDR or source, 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 HP E5974 handheld Dual Laser Source.**

6.6 How to Perform an Insertion Loss Measurement

How to Set up the Power Meter

1 Install a Power Meter submodule, and select the Power Meter screen (see “How to Use the Power Meter Submodule” on page 172).

2 Cursor to `Mod.` on the Source (right-hand) diagram. Press SELECT until you see `CW` in the Source window.

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

5 Attach output connectors to the module and the power meter submodule. Connect the module and submodule with a fiber (Figure 6-9, 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.

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.

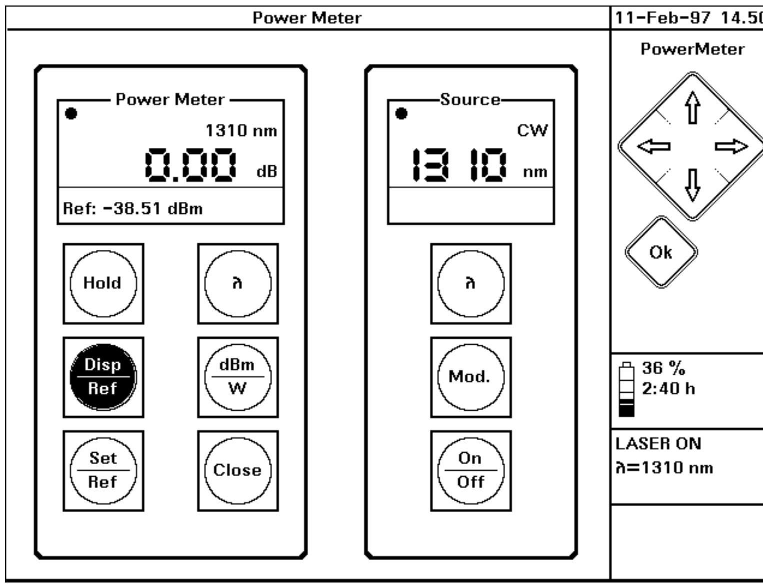
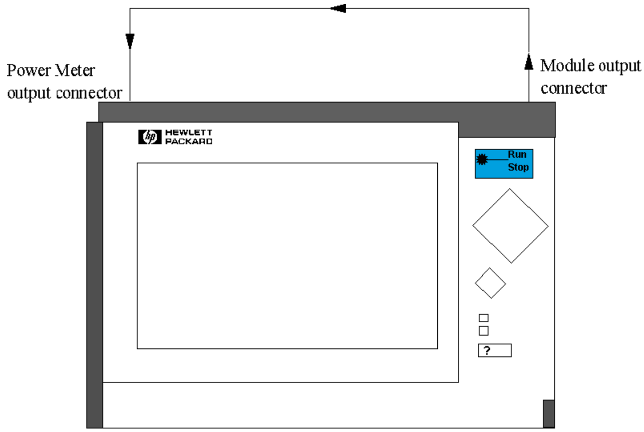


Figure 6-8 **Taking a Power Meter Reference value**

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

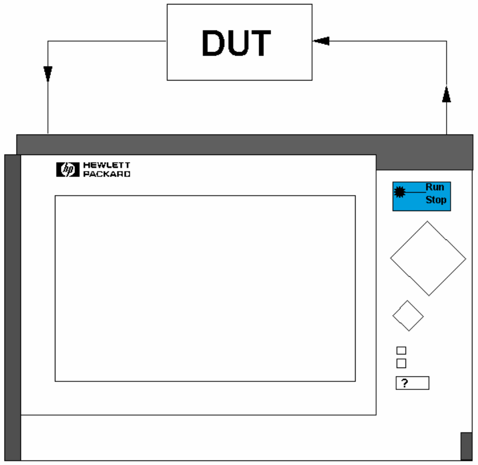


Figure 6-9 **Fiber setups for performing an Insertion Loss Measurement**

How to Take the Measurement

10 Insert the Device Under Test in the link between the Source and the Power Meter (Figure 6-9, second picture).

NOTE **Figure D-14 on page 272 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.

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.

6.7 How to Use the Visual Fault Finder 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 77).

2 Attach the required optical connector interface to the optical output.

3 Connect the fiber to this interface.

4 Switch on the OTDR. The third box in the Applications screen will now be called `Visual Light`. Move to this box and press

SELECT.

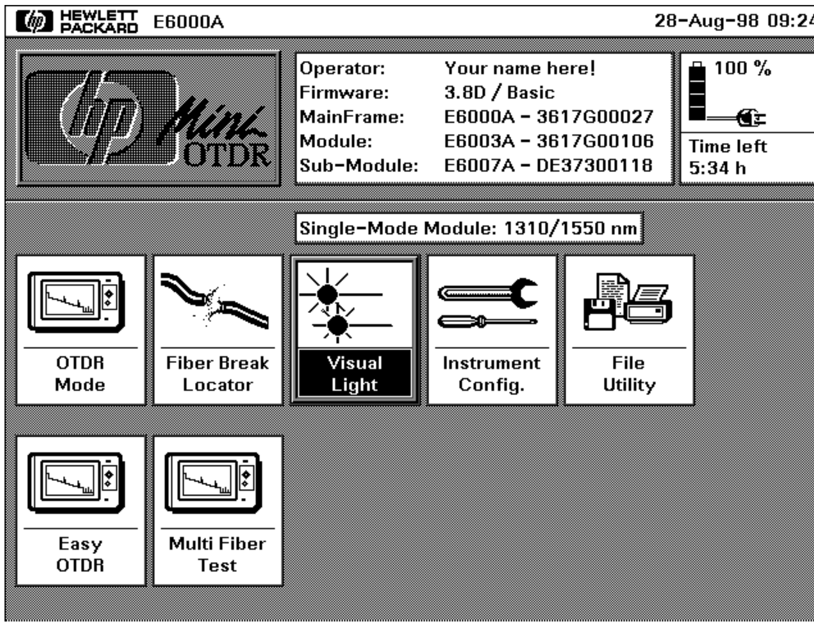


Figure 6-10 **Applications Screen when the E6007A submodule is attached**

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.

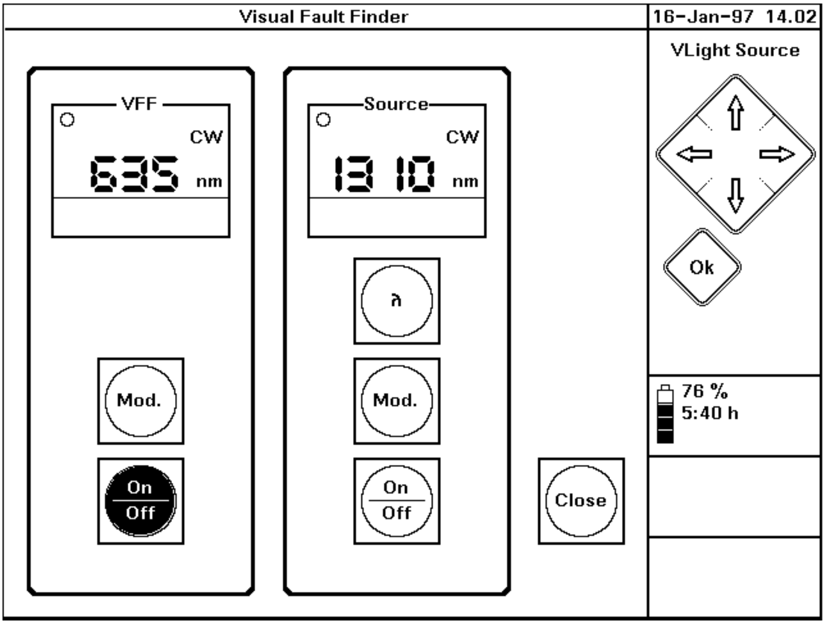


Figure 6-11 **The Visual Fault Finder Screen**

NOTE **If the left-hand diagram is grayed, as in Figure 6-5, 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.**

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.

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

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.

A.1 Safety Considerations

The Mini-OTDR is a Class 3 instrument (that is, an instrument with no protective earth command and DC input voltages less than 60V DC).

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.

A.2 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.

Appendix D “Single-Mode/Multimode Module Performance Tests” 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 Hewlett-Packard 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 HP service personnel.

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.

A.3 AC Line Power Supply Requirements

The HP E6000B 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 A-1 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.

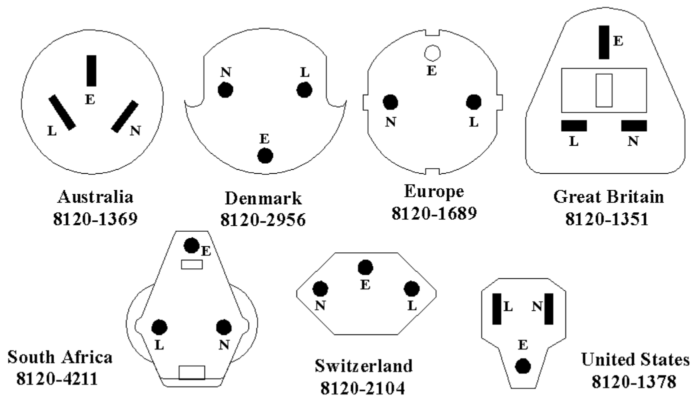


Figure A-1 **Line Power Cables – Plug Identification**

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.

The color coding used in the cable depends on the cable supplied. 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 HP E6000B does not have a floating earth.**

A.4 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 HP E6000B 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.

A.5 Operating and Storage Environment

The following summarizes the HP E6000B 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 HP E6000B 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 HP E6000B can be used up to 3300m (10800ft.)

Installation Category

The HP E6000B has an Installation Category II and Pollution Degree 2 according to IEC 664

NOTE **The AC Adapter is for indoor use only**

A.6 Parallel Interface

This is a CENTRONICS type parallel port for a parallel printer, with a DB-25 connector.

If you do not use an HP C2950M Centronics cable, the EMI performance of the optical time domain reflectometer cannot be guaranteed.

A.7 Serial Interfaces

There is one ST-compatible RS232 port, with DB9 connectors.

If you do not use an HP 24542 RS232 cable or the RS232 cable supplied with the rack, the EMI performance of the optical time domain reflectometer cannot be guaranteed.

A.8 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* (HP Product Number E4310-91018) 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.**

A.9 Claims and Repackaging

If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and the nearest Hewlett-Packard 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 HP

If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag showing owner, return address, model number and full serial number and the type of service required.

The original shipping carton and packing material may be reusable, but the Hewlett-Packard 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:

- 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.
- 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.**

A.10 Installing New Firmware

To install firmware on the Mini-OTDR, you need the floppy disks provided with your Mini-OTDR. There are 2 floppy disks for the firmware update, and 3 for the language update.

Follow the steps in “How to Update the Firmware and Languages” on page 154

B

Accessories

Accessories

The HP E6000B 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.

B.1 Instrument and Options

Product	Opt	Description
HP E6000B		Mini-OTDR Mainframe
	002	Hardcase
	003	Color display
	004	Software upgrade kit (CD)
	005	Mass storage 20 MB (Flash Disk)
	006	B/W Screen VGA-LCD
	007	Mini-Keyboard (see “The Mini-Keyboard” on page 82).
	AB0	Traditional Chinese user interface
	AB1	Korean user interface
	AB2	Simplified Chinese user interface
	AB8	Turkish user interface
	AB9	Portuguese user interface
	ABD	German user interface
	ABE	Spanish user interface
	ABF	French user interface
	ABJ	Japanese user interface
	ABZ	Italian user interface
	ACB	Russian (Cyrillic) user interface
	AKB	Czech user interface
HP E6001A		1310 nm economy single-mode module
	UK6	Calibration Report

Instrument and Options

Product	Opt	Description
HP E6002A		1310 nm high performance single-mode module
	UK6	Calibration Report
HP E6003A		1310/1550 nm high performance single-mode module
	UK6	Calibration Report
	022	angled connector
HP E6003B		1310/1550 nm very high performance single-mode module
	UK6	Calibration Report
	022	angled connector
HP E6004A		1310/1550 nm economy single-mode module
	UK6	Calibration Report
	022	angled connector
HP E6005A		850/1300 nm high performance multimode module
	UK6	Calibration Report
HP E6006A		Optical Power Meter
	UK6	Calibration Report
HP E6007A		Visual Fault Finder
HP E6008B		1310/1550nm Ultra High Performance single-mode module
	UK6	Calibration Report
	022	angled connector
HP E6009A		850/1300 nm economy multimode module
	UK6	Calibration Report
HP E6010A		1625 nm ultra-high performance single-mode module

Product	Opt	Description
	UK6	Calibration Report
HP E6012A		1550 nm/1625 nm ultra-high performance single-mode module
	UK6	Calibration Report
	022	angled connector

Accessories supplied

The following accessories are supplied with your Mini-OTDR:

E6000-68950	NiMH battery pack
	Soft carrying case
	Power cord
	AC/DC adapter charger
	User's Guide
	Upgrade CD
	RS 232 cable

Accessories available

The following accessories are also available. To order these products, please contact your Hewlett-Packard representative.

Product	Description
E6000-68950	Spare NiMH battery pack
C2950A	Centronics cable
24542U	RS232 cable, 9-pin to 9-pin
E4310-91016	OTDRs Programming Guide

B.2 Connector Interfaces and Other Accessories

The HP E6000B 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 the E6003A, E6003B, E6004A, and E6008B modules.

Straight Contact 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.

Model No.	Description
HP 81000AI	Diamond HMS/10 connector interface
HP 81000FI	FC/PC connector interface
HP 81000GI	D4 connector interface
HP 81000HI	E2000 connector interface
HP 81000KI	SC connector interface
HP 81000SI	DIN 47256 connector interface
HP 81000VI	ST connector interface
HP 81000WI	Biconic connector interface

Specifications

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.

The HP E6000B Mini-OTDR is produced to the ISO 9001 international quality system standard as part of HP's commitment to continually increasing customer satisfaction through improved quality control.

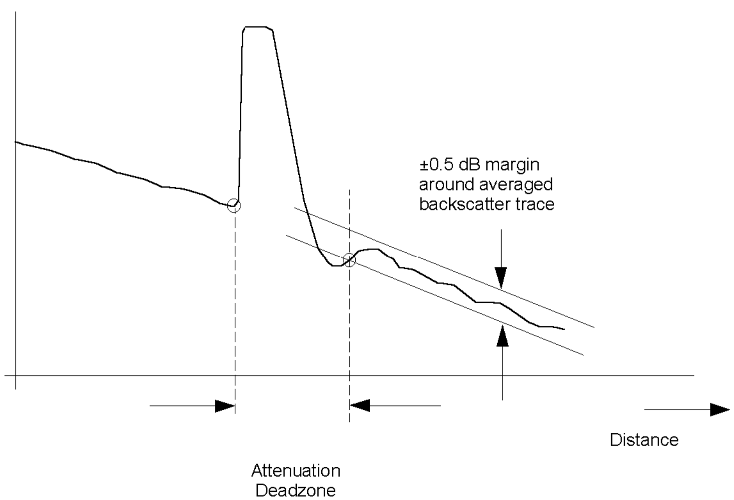
C.1 Definition of Terms

Generally, the wavelengths are given by the specific OTDR module. Therefore, the measurement conditions listed below 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 reflection to the point where the receiver has recovered to within a ±0.5 dB margin around the undisturbed and averaged backscatter trace.

Conditions: Reflective event with specified reflectance, at specified instrument settings.

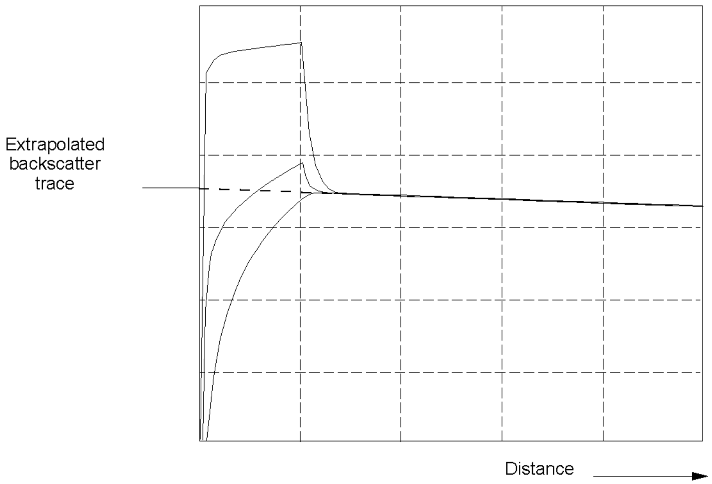
Figure C-1 **Attenuation deadzone definition**



Backscatter coefficient: The ratio of the optical pulse power 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. It is expressed in dB.

NOTE **A typical value is approximately 50dB 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 C-2**

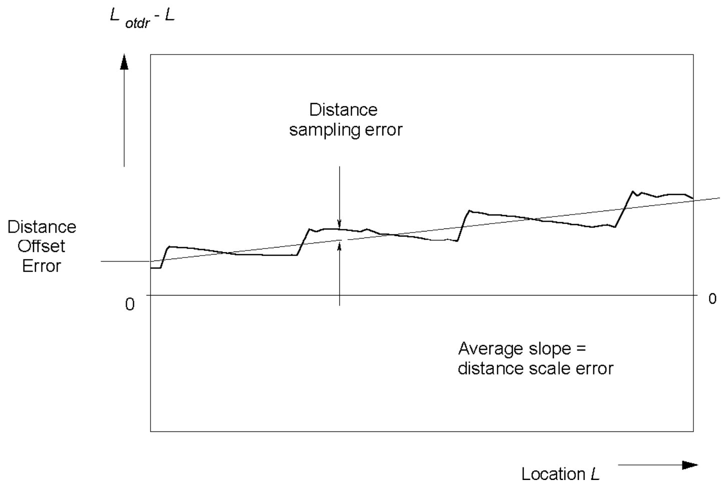
Figure C-2 **Near-end backscatter level for 3 different near-end reflectances**



Distance accuracy: The linear sum of the distance offset error, distance scale error multiplied by distance, and distance sampling error.
See Figure C-3

Figure C-3 **Elements of the distance accuracy**

(L_{otdr} = position measured with OTDR, L = actual position)



NOTE

The distance uncertainty does not include the group index uncertainty of the fiber under test.

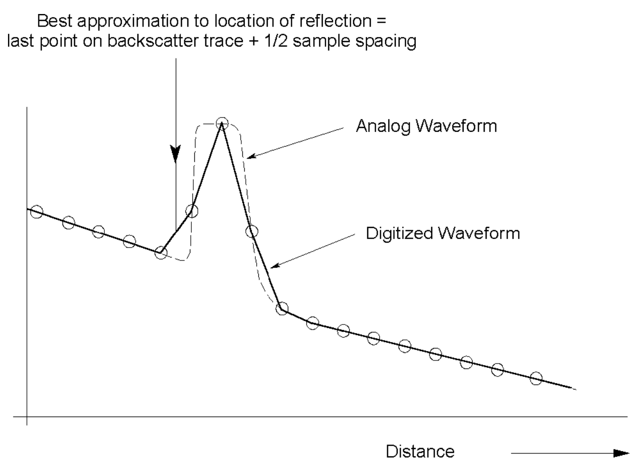
This is because the OTDR measures transit times and calculates distances by dividing by the user-defined fiber's group refractive index.

Distance offset error: The displayed location of the OTDR's front panel connector on the instrument's distance scale. See Figure C-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 fiber (for example 100m, to exclude any influence from distance scale error) with known length and open end to create a reflective event.
Measure the length of the fiber by determining the location of the reflective event as shown in Figure C-4. Then calculate the distance offset error by subtracting the measured length from the known length.
The influence of the finite sample spacing can be excluded by inserting additional fibers. The fiber lengths must be chosen so that they do not 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

Figure C-4 Determining the location of a reflective event



Distance sampling error: The distance uncertainty due to finite distance sample spacing. See Figure C-3.

Distance scale error: The difference between the average displayed distance between two distinct locations on the fiber L_{OTDR}, and correspondent actual (true) distance, L, divided by the actual distance. in meters per meter. See Figure C-3

$$\Delta S_L = \frac{(L_{otdr} - L)}{L} \quad \text{where} \quad L = \frac{cT}{2N}$$

c = the speed of light in a vacuum
L_{OTDR} = the distance measured with the OTDR at the given OTDR group index setting
T = the time of flight between the two locations on the fiber, measured at the wavelength of the OTDR
N = the OTDR group index setting

NOTE 1 **Relatively long lengths of fibers (for example, 10 km) should be used to evaluate the distance scale error. This is to remove the influence of finite distance sampling spacing.**

NOTE 2 **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 length of 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).

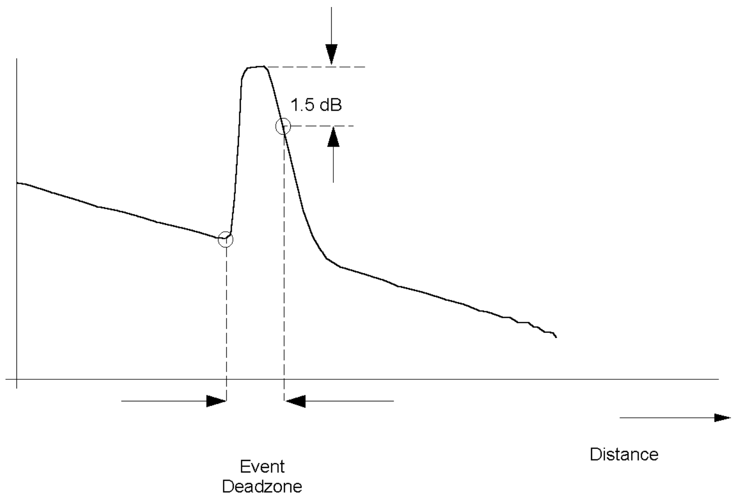
Measurement: It is recommended that you connect a single mode fiber to the OTDR with a length of more than 20 times the pulse width in meters.
Then you can determine the difference between the extrapolated backscatter trace (as in Figure C-2), and the →noise level (RMS).

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 event with 35 dB return loss, at specified instrument settings.

Figure C-5 **Definition of event deadzone**



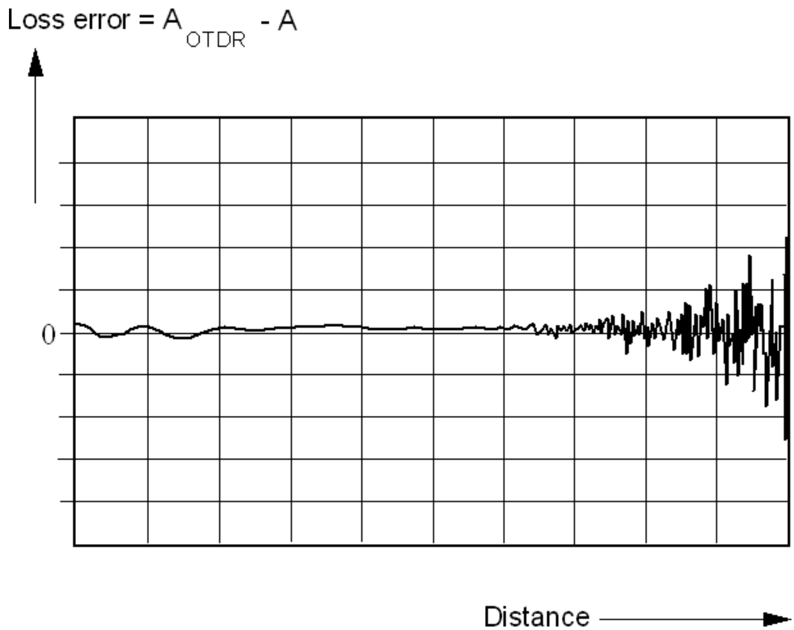
Loss accuracy, 1dB: The maximum loss error for any fiber section with a loss of 1 dB. This is the maximum difference between the displayed loss A_{OTDR}, and the actual loss, A, of the section

$$\text{Loss error}_{1dB} = \max \{ A_{OTDR} - A \}$$

Conditions: A continuous fiber with no discrete losses greater than 1 dB, for a power range from the beginning of the backscatter signal to the point where the →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.
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 the specified power range as in the formula above.
See Figure C-6.

Figure C-6 **Loss error samples for 1 dB loss (arbitrary units)**



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 +1 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 RMS noise level is approximately 1.9 dB below the →noise level (98%).**

Reflectance accuracy: For the specified reflectance range, the maximum difference between the measured reflectance of a feature on the fiber and actual (true) reflectance.

Conditions: →signal-to-noise ratio larger than the specified value, at specified instrument settings, →backscatter coefficient correctly set for the specific fiber used.

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 100 km
- **Span:** 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:** 20 to 60 dB at 1 µs

Source Mode

	E6001A E6002A	E6003A, E6003B, E6004A, E6008B	E6005A, E6009A	E6010A	E6012A
	built-in laser CW source	**built-in dual laser CW source**	**built-in dual laser CW source**	**built-in CW laser source**	**built-in CW dual laser source**
CW output power	-3 dBm		-17 dBm (850 nm), -13 dBm (1300 nm)	-3 dBm	
CW stability (15 min., T=const.) after 10 minute warm-up	±0.1 dB		±0.15 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” disk drive:** for high density 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**: 20MB with up to 3000 traces.
- **Internal memory:** up to 200 traces (typical with 4000 data points selected).
- **Trace format:** compliant to Bellcore GR-196-CORE Issue 1 OTDR Data Standard.
- **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**: provided

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.

Display

- **VGA-LCD:** 18.3 cm (7.2”), mono
- **Display points:** 640 x 480 points
- **Measurement update rate**: two measurements per second in refresh mode.

Optional color display available.

NOTE **For use in bright sunlight, we recommend the monochrome display.**

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).

General

- **Automatic setup and analysis:** provided.
- **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
- **Recalibration period:** 2 years.
- **Dimensions:** 194 mm H, 290 mm W, 75 mm D (7.7” x 11.4” x 3.0”).
- **Weight:** net < 2.8 kg (6.2 lbs) including battery pack.

Environmental

See “Operating and Storage Environment” on page 189

Power

See also “AC Line Power Supply Requirements” on page 186 and “DC Power Supply Requirements” on page 188.

- **External Battery:** NiMH typically 8 hours continuous operation (minimum 4 hours). Charging time < 3 hours, non-operating.
- **Low battery indicator:** provided.
- **Battery charge status:** provided.

C.2 ModuleSpecifications/Characteristics

Specifications: Optical Performance

Measured at 22 °C ± 3°C. Guaranteed specifications unless otherwise noted

Module	**E6001A**				**E6002A**			
Central Wavelength	1310 ±25 nm				1310 ±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	19	24	30	35
typical				30				
Event Deadzone[2]	5 m				5 m			
Attenuation Deadzone [3]	25 m				20 m			
Attenuation Deadzone [4]	10 m				10m			

Module	**E6003A**				**E6003B**				
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	10ns	100ns	1µs	10µs	20µs
Dynamic Range[1] [dB]	19/17	24/22	30/29	35/34	19/17	24/22	30/29	38/37	- / -
typical									40/39
Event Deadzone[2]	5 m				5 m				
Attenuation Deadzone [3]	20/25 m				20/25 m				
Attenuation Deadzone [4]	10/12m				10/12m				

Module Specifications/Characteristics

Module	E6004A				E6008B				
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	10ns	100ns	1µs	10µs	20µs
Dynamic Range[1] [dB]	13/13	18/18	23/23	28/28	24/22	29/27	35/34	42/41	- / -
typical				30/30					45/43
Event Deadzone[2]	5 m				5 m				
Attenuation Deadzone [3]	25/25 m				20/25 m				
Attenuation Deadzone [4]	10/12m				10/12m				

Module	E6010A				E6012A				
Central Wavelength	1625 ±20 nm				1550±25 nm/ 1625±20 nm				
Applicable Fiber	single-mode				single-mode				
Pulsewidth	10ns	100ns	1µs	10µs	10ns	100ns	1µs	10µs	20µs
Dynamic Range[1] [dB]	18	24	30	37	22/18	27/24	34/30	41 / 37	- / -
typical				40				- /40	43/ -
Event Deadzone[2]	5 m				5 m				
Attenuation Deadzone [3]	28 m				25/28 m				
Attenuation Deadzone [4]	14m				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. HP OTDR modules have the pulsewidths listed in “Pulsewidth” on page 213.

Notes (1-7):

1 Measured with a standard single-mode fiber at SNR=1 noise level and with 3 minutes averaging time.

2 Reflectance ≤ -35 dB at 10 ns pulsewidth, and with span ≤ 4 km, optimize resolution.

3 Reflectance ≤ -35 dB at 30 ns pulsewidth, and with span ≤ 4 km.

4 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 [8]

Offset Error:	± 1 m
Scale Error:	$\pm 10^{-4}$
Sampling Error:	± 0.5 sampling spacing

Loss/Reflectance Accuracy [9]

Backscatter Measurements	± 0.05 dB (1dB step), typical
Reflectance Measurements[10]	± 2.0 dB, typical

Acoustic Noise Emission

< 40dBA, not continuous.
Data are results from type tests per ISO 7779 (EN 27779).

Notes (8-10):

8 Total distance accuracy = ± (offset error + scale error*distance + sampling error).

9 SNR ≥ 15 dB and with 1 µs, averaging time max. 3 minutes.

10 -20 dB to -60 dB

C.3 HP 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, HP/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 (1300, 1310, 1550 nm)
±10% ± 2.5 nW (850 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

C.4 HP 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.

C.5 Declaration of Conformity

Manufacturer: Hewlett-Packard GmbH
Optical Communication Measurement
Herrenberger Strasse 110-140
D-71034 Böblingen
Germany

We declare that the system:

		Mini-OTDR
consisting of:	**HP E6000B**	Mainframe [1]
and modules:	**HP E6001A**	1310nm single-mode module
	HP E6002A	1310nm single-mode module
	HP E6003A	1310nm/1550nm single-mode module
	HP E6003B	1310nm/1550nm single-mode module
	HP E6004A	1310nm/1550nm single-mode module
	HP E6005A	850nm/1300nm multimode module
	HP E6006A	Optical Power Meter module
	HP E6007A	Visual fault finder module
	HP E6008B	1310nm/1550nm single-mode module
	HP E6009A	850nm/1300nm multimode module
	HP E6010A	1625nm single-mode module
	HP E6012A	1550nm/1625nm single-mode module

conforms to the following standards:

Safety: IEC 1010-1:1990 incl. Adm. 1:1992 EN 61010:1993

EMC[2]:	EN 55011:1991 / CISPR 11 Group 1, Class A	
	EN 50082-1:1992	
	EN 50082-1: 1997	
	EN 61000-4-2:1995	ESD: 4 kV cd, 8 kV ad
	IEC 1000-4-2:1995	
	EN 61000-4-3: 1996	Radiated Immunity: 3 V/m
	IEC 1000-4-3: 1995	
	ENV 50204: 1995	
	EN 61000-4-4: 1995	Fast Transients: 0.5 kV, 1 kV
	IEC 1000-4-4: 1995	
	EN 61000-4-5: 1995	Surges 1 kV, 2 kV
	IEC 1000-4-5: 1995	
	EN 61000-4-6: 1996	Conducted Immunity 3V; 80%
	IEC 1000-4-6: 1996	
	EN 61000-4-8:1993	Power freq. magn. Field 3A/m
	IEC 1000-4-8: 1993	
	EN 61000-4-11: 1994	Voltage Dips and Interruptions
	IEC 1000-4-11: 1994	

Supplementary Information

The product herewith complies with the requirements of the

- Low Voltage Directive (73/23/EEC), and the
- EMC Directive (89/336/EEC).

[1] This product includes the AC/DC Adapter (Product Number 0950-3122) with CE Mark.

[2] The system was tested in a typical configuration with HP systems.

This system also conforms to other standards not listed here. If you need further information on conformance to a particular standard, please contact your local Hewlett-Packard Sales and Service Office.

Böblingen, 15 April 1999 — Wolfgang Fenske

OCM Regulations Consultant

D

Single-Mode/Multimode Module Performance Tests

Single-Mode/Multimode Module Performance Tests

The procedures in this section tests the optical performance of the instrument. The complete specifications to which the HP E6000B is tested are given in Appendix C “Specifications”. All tests can be performed without access to the interior of the instrument. The performance tests refer specifically to tests using the Diamond HMS-10/HP connector.

D.1 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, E6010A, and E6012A)

- Optical Attenuator HP 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 HP Recirculating Delay Line (P/N 08145-67900).
- 3× Optical Connector Interface HP 81000AI.
- Single-mode fiber: length 25 ± 2 km.

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 HP 81000AI.
- 1 × Universal Thru Adapter HP 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 Hewlett-Packard.

Test Failure

If the HP E6000B fails any performance test, return the instrument to the nearest Hewlett-Packard Sales/Service Office for repair.

Instrument Specification

Specifications are the performance characteristics of the instrument that are certified. These specifications, listed in Appendix C "Specifications", are the performance standards or limits against that the HP E6000B can be tested. Appendix C "Specifications" also lists some supplemental characteristics of the HP E6000B and should be considered as additional information.

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.

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 Appendix E "Cleaning Procedures".

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 13

D.2 Test I. Dynamic Range

1 Connect the equipment as shown in Figure D-1 (single-mode module), or Figure D-1B (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 HP Recirculating Delay line, connect part 1 to the Mini-OTDR.

NOTE **The specific measurement techniques of the HP E6000B 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.**

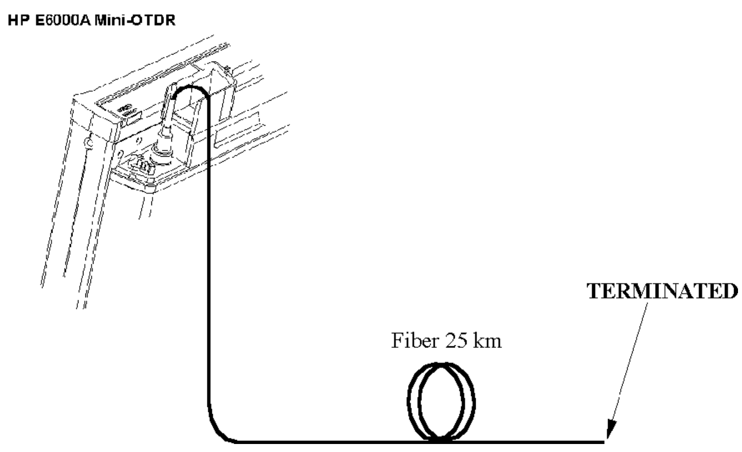


Figure D-1 **Dynamic Range Test Setup: Single-Mode**

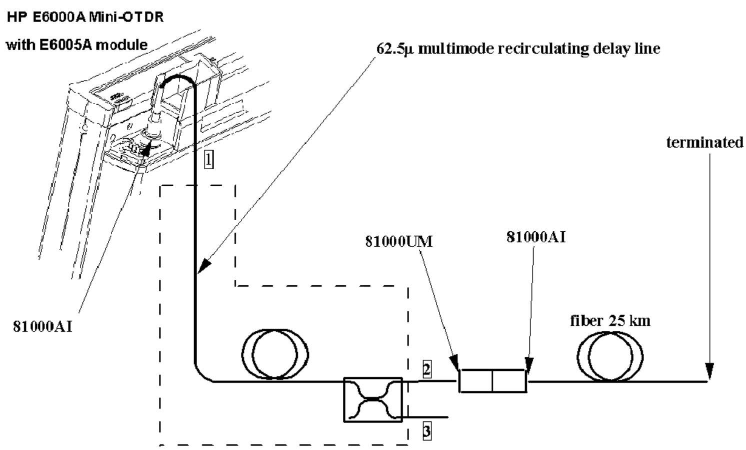


Figure D-1B **Dynamic Range Test Setup: Multimode**

NOTE

Instead of the 62.5m recirculating delay line, you can use a 62.5μ multimode fiber of length > 4km.

If you use such a multimode fiber, you do not require the coupler (within the dotted box in Figure D-1B).

2 Turn on the OTDR, and after the selftest has passed, recall the default settings.

3 Set the OTDR:

[SETTINGS] menu:

- <RANGE> - select <RANGE INPUT...>:

  `Start`: - enter value ST from Table D-1, Table D-1A, or Table D-1B. Confirm with <OK>.

  `Span`: - enter value SP from Table D-1, Table D-1A, or Table D-1B. Confirm with <OK>.

- <PULSE WIDTH>: enter value PW from Table D-1, Table D-1A, or Table D-1B.

- <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`.
- **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].

You now see a box for `Avg. Time`.

[VIEW] menu:

- <PREFERENCES><DOTTED TRACE>: ON

[ANALYSIS] menu

- <2 PT. LOSS>.

Table D-1 **Pulse Width dependent settings for Dynamic Range Test: Single-Mode (E6001A-E6004A)**

Pulsewidth	Start	Span distance	View start position of marker B	View end	Viewed distance
PW	**ST**	**SP**	**Bpos**	**Vend**	**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 D-1A **Pulse Width dependent settings for Dynamic Range Test: Single-Mode (E6003B, E6008B, E6010A, and E6012A)**

Pulsewidth	Start	Span distance	View start position of marker B	View end	Viewed distance
PW	**ST**	**SP**	**Bpos**	**Vend**	**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
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 D-1B **Pulse Width dependent settings for Dynamic Range Test: Multimode**

Pulse width	Start	Span distance	View start position of marker B	View end	Viewed distance
PW	**ST**	**SP 850/1300nm**	**Bpos 850/1300nm**	**Vend 850/1300nm**	**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

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 D-2.

DOWN (`Full Trace`)

NOTE **If you can already see the full trace, please ignore this command**

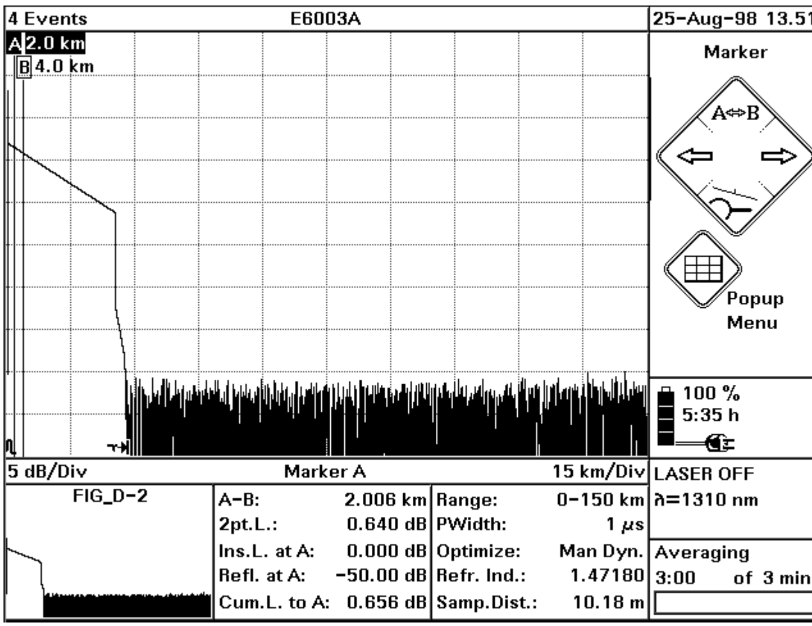


Figure D-2 **Dynamic Range Test: Full Trace View**

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.

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.

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>

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).

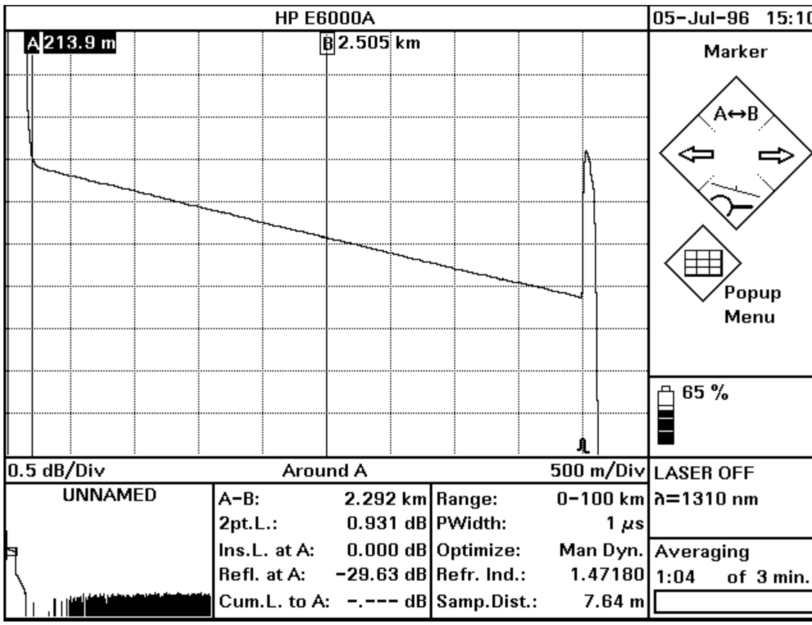


Figure D-3 **Dynamic Range Test: Position Marker at End of Frontreflection**

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 D-1, Table D-1A, or Table D-1B, 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.

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 D-1, Table D-1A, or Table D-1B.

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.**

17 Position marker B at a point on the trace that equals the 98% Noise Level

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

20 Repeat steps 4 to 19 with all pulsewidths described in the test record.

D.3 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.

1 Make sure that all optical connectors are clean and connect the equipment as shown in Figure D-4.

If you are using the HP 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.

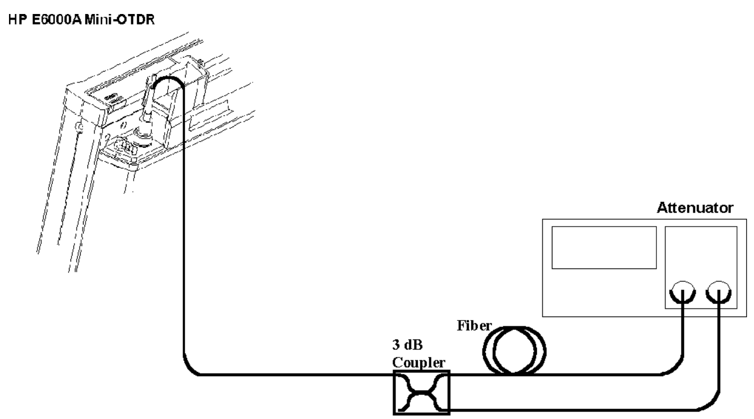


Figure D-4 **Event Deadzone Test Setup**

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 233).
[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>

7 **Or (Multimode module)**
Set the pulsewidth to 5 ns.
[SETTINGS]<PULSEWIDTH><5 NS>

8 Set up the attenuator.

a Set λ to the actual wavelength.

b Set the attenuation to 38 dB (see Note on page 239).

c Enable the attenuator output.

9 On the OTDR start the measurement.
RUN/STOP

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 D-5.

UP (A/B) until only A is highlighted. Use LEFT/RIGHT keys

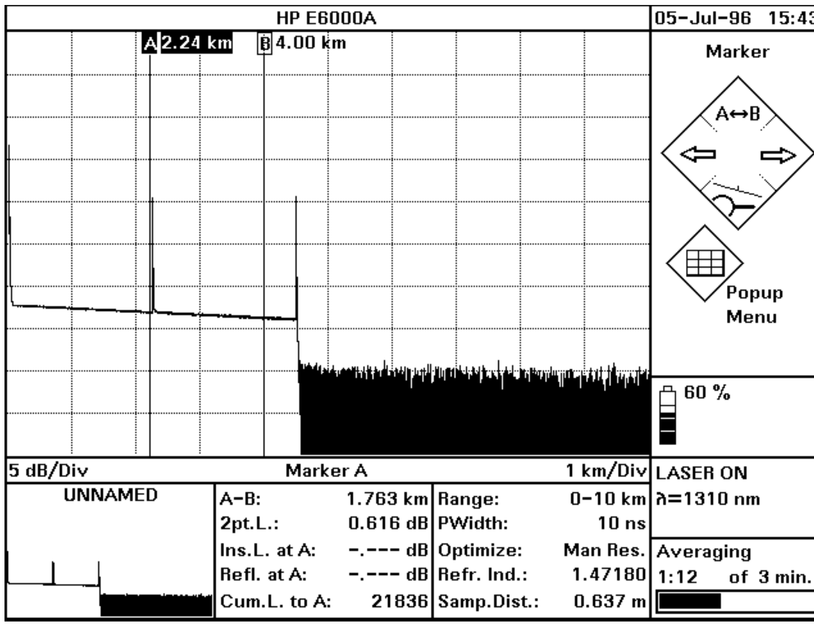


Figure D-5 **Event Deadzone Test: Position Marker A**

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.**

12 Run the measurement.

RUN/STOP

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.

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.

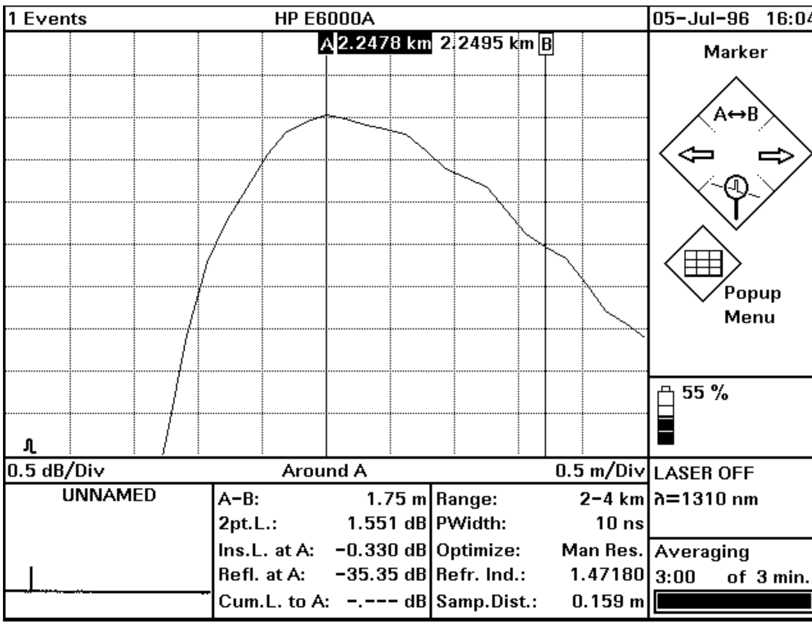


Figure D-6 **Event Deadzone Test: Position Marker B**

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 D-6.

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.

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

D.4 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.

1 Connect the equipment as for the event deadzone test (see Figure D-4).

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.

7 **Or (Multimode module)**

Set the pulsewidth to 10 ns.

[SETTINGS]<PULSEWIDTH><10 NS>. Close by OK.

8 Set up the attenuator.

a Set λ to the actual wavelength.

b Set the attenuation to 38 dB (see Note on page 245).

c Enable the attenuator output.

9 On the OTDR start the measurement.

RUN/STOP

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

11 Stop the measurement.

RUN/STOP

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.**

13 Start the measurement.

RUN/STOP

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.**

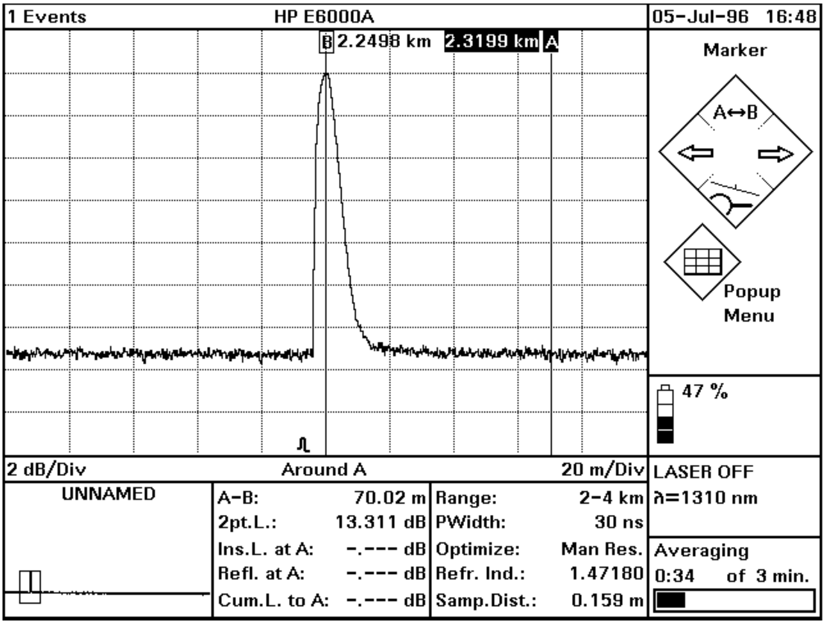


Figure D-7 **Attenuation Deadzone Test: Position Marker A**

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.**

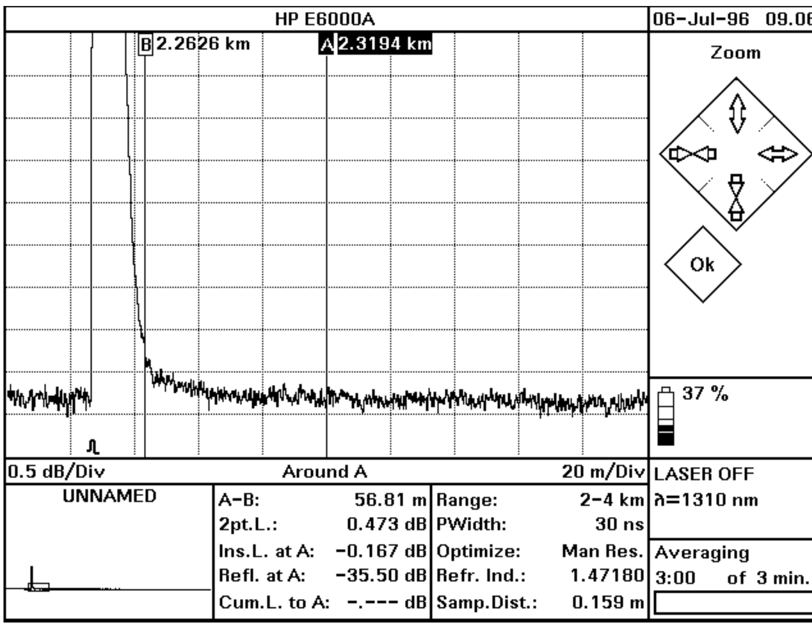


Figure D-8 **Attenuation Deadzone Test: Position Marker B at End of Reflection**

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.

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. (see “” on page 211).**

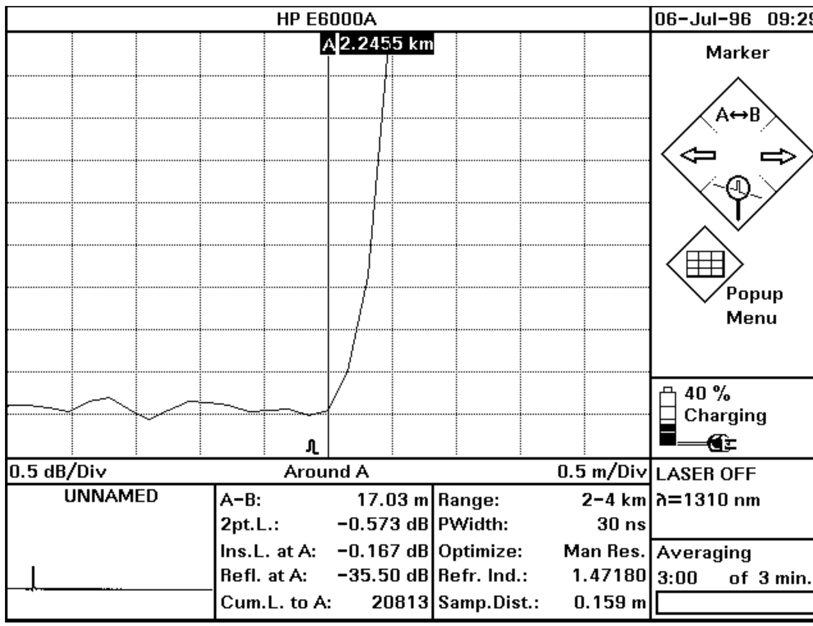


Figure D-9 **Attenuation Deadzone Test: Position Marker A at Start of Reflection**

24 Note the distance between the A-B markers as the attenuation deadzone in the test record.

D.5 Test IV. Distance Accuracy (Optional)

1 Connect the equipment as shown in Figure D-10.
If you are using an HP Recirculating Delay Line, connect port 2 to the OTDR, and leave port 1 open.

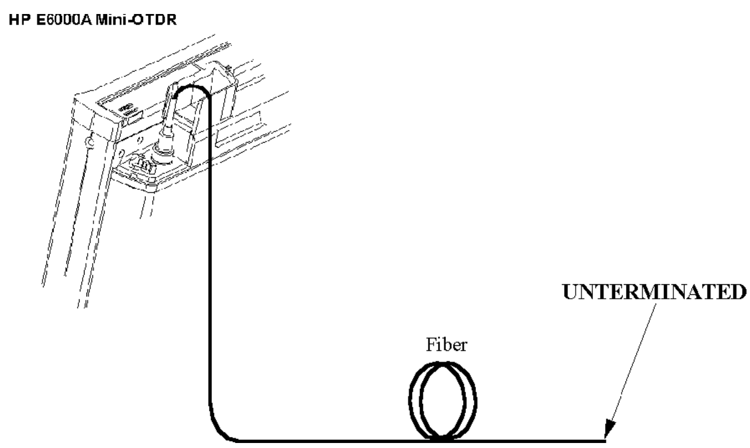


Figure D-10 **Distance Accuracy Test Setup**

2 Turn on the Mini-OTDR, and after the self-test has passed, recall the default settings and the standard mode.

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 233).

- <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

4 Run the measurement, wait 10 seconds, then stop the measurement

Run/Stop ... Run/Stop

5 Move marker A to the beginning of the endreflection.

Up (A/B) until only A is highlighted. Use Left/Right keys

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

8 Run the measurement, and wait until the measurement has stopped.

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.

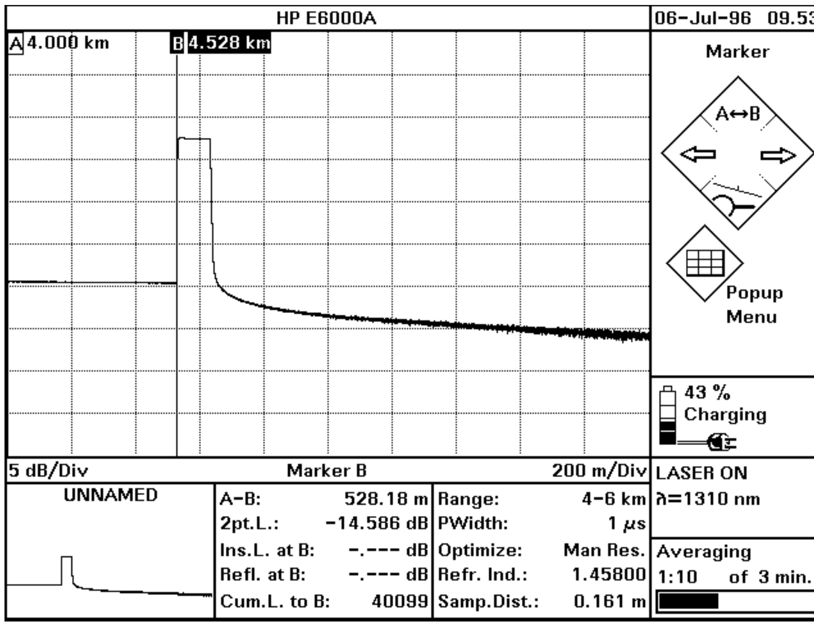


Figure D-11 **Distance Accuracy Test: Position Markers**

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.

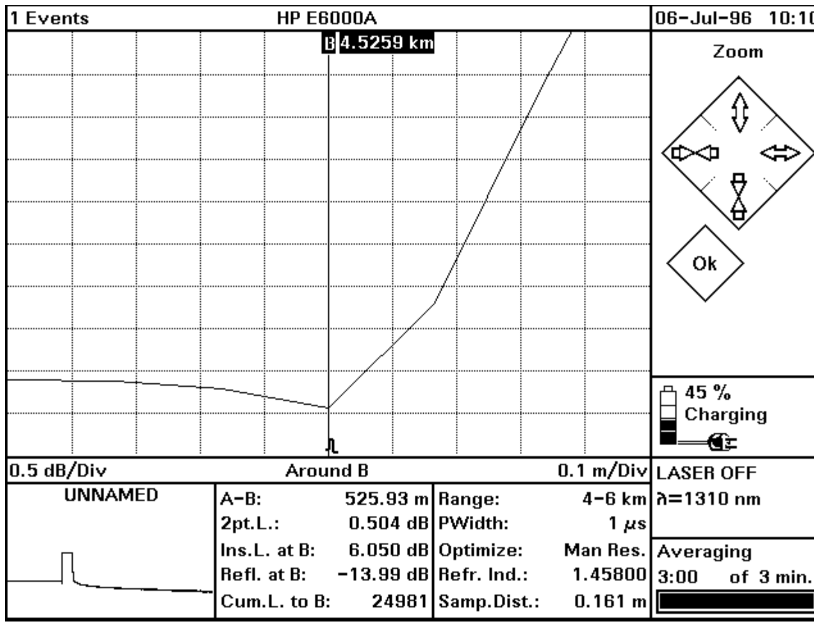


Figure D-12 **Distance Accuracy Test: Around Marker View**

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. (see “” on page 211)

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.

15 Repeat steps 12 to 14 with the pulsewidth set to 100ns.

16 Evaluate the measurement data.

a Note the length of your optical fiber to the test record.

b Note the start position to the test record.

c Distance accuracy

The distance accuracy is defined as:

Distance accuracy = (Measured Distance $\times$ Scale Error + Offset Error $\pm$ 1/2 Sampling Spacing)

Sampling Error = Sample Spacing

Distance accuracy = $\pm$ Fiber Length $\times$ 10^{-4} $\pm$ 1 m $\pm$ 0.08 m

Measured Distance	Known Fiber Length of Delay Line
Offset Error	$\pm$ 1 m
Scale Error	$\pm$ 10^{-4}
Sample spacing with the 2km Span	0.161m

d 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.

D.6 Performance Test Form Sheets

Please use copies of the following form sheets for your individual performance tests

Performance Test for the HP E6000B with Single-mode Modules

Page 1 of 8

Test Facility:

______________________	Report No. ______________________
______________________	Date: ______________________
______________________	Customer: ______________________
______________________	Tested By: ______________________

Model: **E6000B**

Serial No.	______________	Ambient temperature	______ °C
Options	______________	Relative humidity	______ %
Firmware Rev.	______________	Line frequency	______ Hz
Model	HP ________ Module		
Serial No.	______________		

Special Notes:

____

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Performance Test for the HP E6000B with Single-mode Modules

Model HP __________ Module Report No. _______ Date ________ Page 2 of 8

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 HP E6000B with Single-mode Modules

Model HP ______ Module **Report No. ________** **Date _________** **Page 3 of 8**

No. Test Description

I. Dynamic Range 1310 nm Wavelength

			Minimum Specification				
Pulsewidth	Dynamic Range$_{98\%}$	**Dyn Range** = Dyn Range$_{98\%}$ + 1.9dB	E6001A E6004A	E6002A E6003A	E6003B	E6008B	Meas. Uncertainty
	dB	dB	dB	dB	dB	dB	dB
10 µs	_______	_______	28	35	38	42	_______
1µs	_______	_______	23	30	30	35	_______
100 ns	_______	_______	18	24	24	29	_______
10 ns	_______	_______	13	19	19	24	_______

II. Event Deadzone 1310 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns E6001A, E6002A, E6003A, E6003B, E6004A, E6008B	_______ m	5 m	_______ m

Performance Test for the HP E6000B with Single-mode Modules

Model HP _______ Module Report No. _______ Date ________ Page 4 of 8

No. Test Description

III. Attenuation Deadzone 1310 nm Wavelength

	Attenuation Deadzone	Maximum Specification E6001A, E6004A, E6003B	Maximum Specification E6002A, E6003A, E6008B	Meas. Uncertainty
	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 (typical)	Measured Distance	Maximum Distance (typical)	Meas. Uncertainty
		m	m	m	m
4 to 6 km	1 µs		_______		
	100 ns	_______	_______	_______	_______

Performance Test for the HP E6000B with Single-mode Modules

Model HP _________ Module **Report No. _______** **Date ________** **Page 5 of 8**

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	Meas. Uncertainty
	dB	dB	dB	dB	dB	dB	dB
10 µs	_______	_______	34	37	28	41	_______
1µs	_______	_______	29	29	23	34	_______
100 ns	_______	_______	22	22	18	27	_______
10 ns	_______	_______	17	17	13	22	_______

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	_______ m	5m	_______ m

Performance Test for the HP E6000B with Single-mode Modules

Model HP _______ Module Report No. _______ Date ________ Page 6 of 8

No. Test Description

III. Attenuation Deadzone 1550 nm Wavelength

	Attenuation Deadzone	Maximum Specification E6003A, E6003B, E6004A	Maximum Specification E6008B, E6012A	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 (typical)	Measured Distance	Maximum Distance (typical)	Meas. Uncertainty
		m	m	m	m
4 to 6 km					
	1 µs		________		
	100 ns	________	________	________	________

Performance Test for the HP E6000B with Single-mode Modules

Model HP _________ Module **Report No. _______** **Date ________** **Page 7 of 8**

No. Test Description

I. Dynamic Range 1625 nm Wavelength

Pulsewidth	Dynamic $Range_{98\%}$	**Dyn Range** = Dyn $Range_{98\%}$ + 1.9dB	Minimum Specification E6010A, E6012A	Meas. Uncertainty
	dB	dB	dB	dB
10 µs	_______	_______	37	_______
1µs	_______	_______	30	_______
100 ns	_______	_______	24	_______
10 ns	_______	_______	18	_______

II. Event Deadzone 1625 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns			
E6010A, E6012A	_______ m	5m	_______ m

Performance Test for the HP E6000B with Single-mode Modules

Model HP _______ Module Report No. _______ Date ________ Page 8 of 8

No. Test Description

III. Attenuation Deadzone 1625 nm Wavelength

	Attenuation Deadzone	Maximum Specification E6010A, E6012A	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 (typical)	Measured Distance	Maximum Distance (typical)	Meas. Uncertainty
		m	m	m	m
4 to 6 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

Performance Test for the HP E6000B with the Multimode Module

Page 1 of 6

Test Facility:

______________________	Report No. ______________________
______________________	Date: ______________________
______________________	Customer: ______________________
______________________	Tested By: ______________________

Model: **E6000B**

Serial No.	______________	Ambient temperature	_______ °C
Options	______________	Relative humidity	_______ %
Firmware Rev.	______________	Line frequency	_______ Hz
Model	HP _________ Module		
Serial No.	______________		

Special Notes:

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Performance Test for the HP E6000B with the Multimode Module

Model HP __________ Module Report No. _______ Date ________ Page 2 of 6

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 HP E6000B with the Multimode Module

Model HP _______ Module Report No. _______ Date ________ Page 3 of 6

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	3m	_______ m

III. Attenuation Deadzone 850 nm Wavelength

	Attenuation Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns E6005A, E6009A	_______ m	10 m	_______ m

Performance Test for the HP E6000B with the Multimode Module

Model HP _______ Module **Report No. _______** **Date ________** **Page 4 of 6**

No. Test Description

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} + 1 m + ________ m)

| Distance Accuracy | = _______ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length +| Distance Accuracy|

		Minimum Distance (typical)	Measured Distance	Maximum Distance (typical)	Meas. Uncertainty
Meas. Span	Pulsewidth	m	m	m	m
2 km	100 ns	_______	_______	_______	_______

Performance Test for the HP E6000B with the Multimode Module

Model HP _______ Module Report No. _______ Date ________ Page 5 of 6

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 Deadzone1300 nm Wavelength

	Event Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 5ns E6005A, E6009A	_______ m	3m	_______ m

III. Attenuation Deadzone1300 nm Wavelength

	Attenuation Deadzone	Max Spec	Meas. Uncertainty
Return Loss ≥ 35dB Conditions: Meas. Span. 2km Pulsewidth 10ns E6005A, E6009A	_______ m	10 m	_______ m

Performance Test for the HP E6000B with the Multimode Module

Model HP _______ Module Report No. _______ Date ________ Page 6 of 6

No. Test Description

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} + 1 m + ________ m)

| Distance Accuracy | = _______ m

Minimum Distance = Fiber Length - | Distance Accuracy|
Maximum Distance = Fiber Length +| Distance Accuracy|

		Minimum Distance (typical)	Measured Distance	Maximum Distance (typical)	Meas. Uncertainty
Meas. Span	Pulsewidth	m	m	m	m
2 km					
	1 µs		_______		
	100 ns	_______	_______	_______	_______

D.7 Test V. E6006A Submodule

Test Equipment Required

Instrument or Accessories	qty	Recommended Model	Required Characteristic
Lightwave Multimeter Meter	1	HP 8153A	
Interface Module	1	HP 81533B	
Optical Detector Head	1	HP 81524A #C01	
Laser Source 1310/1550 nm	1	HP 81554SM	1310 ± 10 nm 1550 ± 10 nm short term stability < ±0.005 dB
Optical attenuator	1	HP 8156A #101	attenuation > 50 dB Return Loss > 45 dB repeatability < ±0.01 dB
Patchcord *(HMS10/HMS10, 9/50 µm, SM)*	1	HP 81101AC	
Patchcord *(HMS10/HMS10, 50/125 mm)*	1	81501AC	
connector interface	4	HP 81000AI	
connector adapter	1	HP 81000AA	

Optional Test Equipment

Laser Source 850 nm	1	HP 81551MM	850 ± 10 nm short term stability < ±0.01 dB
Optical Head	1	HP 81520A	#C01 recommended

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:

1 Connect the equipment as shown in Figure D-13.

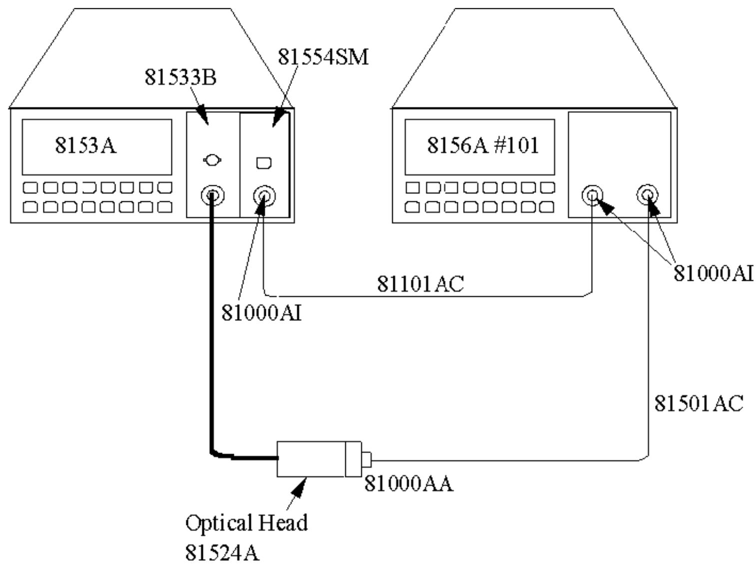

Figure D-13 **Test setup 1310 nm and 1550 nm: Reference Measurement**

2 Disable the laser source and attenuator; zero the power meter (press {ZERO}).

Reference Measurement

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 HP 8156A output, and wait 3 minutes until the laser has settled.

7 On the power meter, press `[dBm W]` to get the display reading in W.

8 Set the attenuation of the attenuator to a value where the power meter reads 10.00 µW

Measurement of DUT

9 Connect the attenuator output cable to the DUT, as shown in Figure D-14.

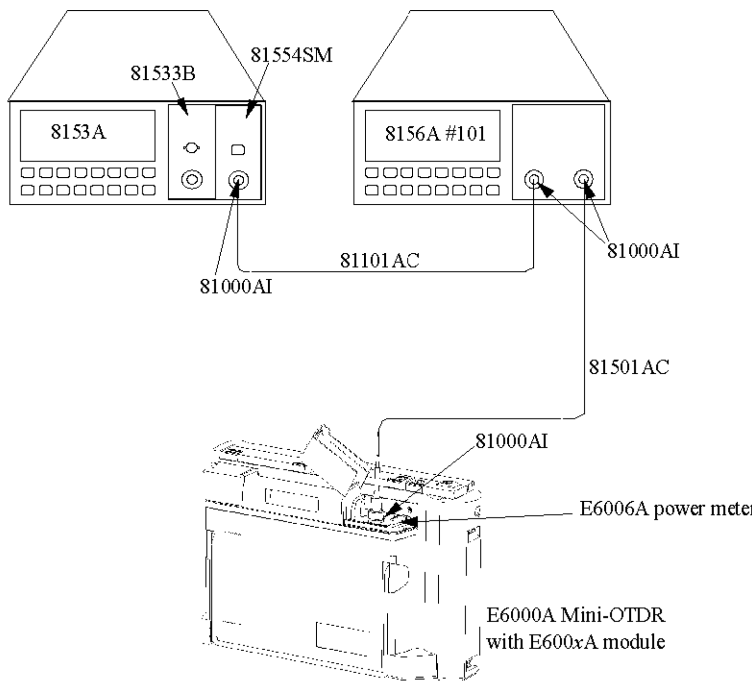

Figure D-14 **Test setup 1310 nm and 1550 nm: Measurement of the DUT**

10 Make sure that the E6006A DUT has warmed up.

11 Set the DUT to 1310.00 nm.

12 Enable the laser source and the HP 8156A output, and wait 3 minutes until the laser has settled.

13 Set the DUT to display power levels in W.

14 Note the displayed measured value on the DUT in the test record.

Test of the 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.

1 Connect the equipment as shown in Figure D-13.

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 HP 81501AC patchcord.**

2 Disable the laser source and attenuator; zero the power meter (press {ZERO}).

Reference Measurement

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.

7 Enable the Laser Source and the HP 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.

10 Note the displayed reference measurement value on the power meter in the test record.

11 Repeat steps 9 and 10 for all attenuation values listed in the test record.

Measurement of DUT

12 Connect the attenuator output cable to the DUT, as shown in Figure D-14.

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 HP 81501AC patchcord.**

13 Make sure that the E6006A DUT has warmed up.

14 Set the DUT to 1310.00 nm.

15 Enable the laser source and the HP 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.

18 Note the displayed measured value on the DUT in the test record.

19 Repeat step 18 for all attenuation values listed in the test record.

Test of 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 HP E6006A with Power Meter submodule

Page 1 of 3

Test Facility:

______________________	Report No.	______________________
______________________	Date:	______________________
______________________	Customer:	______________________
______________________	Tested By:	______________________

Model: **HP E6006A Power Meter**

Serial No. ______________________

Options ______________________ Firmware Revision ______________________

.

HP E6000B
Handheld OTDR Mainframe

Serial No. ______________________

E600__A
OTDR Module

Serial No. ______________________

Ambient Temperature ____________ °C
Relative Humidity ____________ %
Line Frequency ____________ Hz

Test Equipment used:

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. ______________	__________	__________	____ / ____ / ____

Performance Test for the HP E6000B with Power Meter Submodule

Model: HP E6006A Module   Report No. __________   Date: ___________   **Page 2 of 3**

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

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

Performance Test for the HP E6000B with Power Meter Submodule					
Model: HP E6006A Module	Report No. __________		Date: ___________		**Page 3 of 3**
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

D.8 Test VI: E6007A Visual Fault Finder Submodule

Test Equipment Required

Instrument or Accessories	qty	Recommended Model	Required Characteristic
Lightwave Multimeter Meter	1	HP 8153A	
Optical Power Sensor	1	HP 81530A	
Patchcord *(HMS10/HMS10, 9/50 µm, SM)*	1	HP 81101AC	
connector interface	2	HP 81000AI	
Optical Spectrum Analyzer *(optional test only)*	1	HP 75450A #101	

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.

Test of Output Power Level (CW)

1 Connect the equipment as shown in Figure D-15.

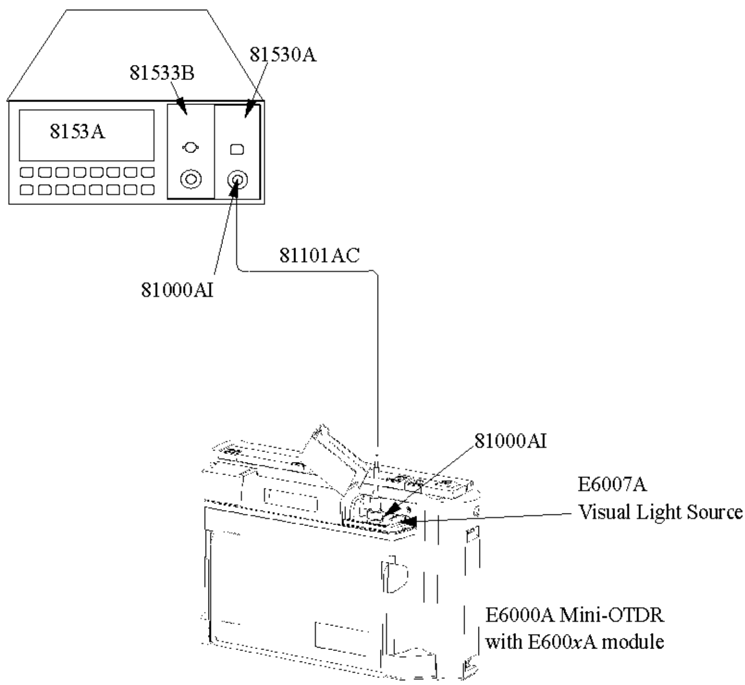

Figure D-15 **Measurement of the Output power**

2 Apply a 9/125 µm patchcord with HMS-10 connectors.

3 Set the 8153A:

dBm/W	`dBm`
wavelength	λ = 635 nm
sampling time	T = 100 ms
Range	AUTO

4 Before you switch on the DUT, zero the 8153A:
press {ZERO} on the 8153A.

5 On the DUT, select Visual Fault Finder:

Select Mod	`CW`
Select	ON

and allow to settle.

6 Note the displayed power level on the 8153A 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.**

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 E6000B is switched on and has warmed up.
- enable the E6007A (DUT).

2 On the OSA:

- 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.

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 HP E6007A

Page 1 of 2

Test Facility:

______________________	Report No.	______________________
______________________	Date:	______________________
______________________	Customer:	______________________
______________________	Tested By:	______________________

Model: **HP E6007A Visual Light Source**

Serial No. ______________________

Options ______________________ Firmware Revision ______________________

.

HP E6000B
Handheld OTDR Mainframe

Serial No. ______________________

E600__A
OTDR Module

Serial No. ______________________

Ambient Temperature ____________ °C
Relative Humidity ____________ %
Line Frequency ____________ Hz

Test Equipment used:

Description	Model No.	Trace No.	Cal. Due Date
1. Std. Lightwave Multimeter	____________	____________	____ / ____ / ____
2. Std. Optical Power Sensor	____________	____________	____ / ____ / ____
3. ____________	____________	____________	____ / ____ / ____
4.____________	____________	____________	____ / ____ / ____
5.____________	____________	____________	____ / ____ / ____

Performance Test for the HP E6000B with Visual Light Source Submodule

Model: HP E6007A Module Report No. __________ Date: _________ **Page 2 of 2**

Output Power Level (CW)

Wavelength 635 nm

fiber type	Minimum Specification	Measured value	Maximum Specification	Measurement Uncertainty
9/125 µm SM	-5.00 dBm (-3 dBm typ.)	_________ dBm	0 dBm	________ dB

Optional Center Wavelength Performance Test

	Minimum Specification	Measured value	Maximum Specification	Measurement Uncertainty
Wavelength	615 nm (625 nm typ.)	_________ nm	655 nm (645 nm typ.)	________ nm

E

Cleaning Procedures

Cleaning Procedures

In general, *whenever possible use physically contacting connectors, and dry connections*. Fiber connectors may be used dry or wet. Dry means without index matching compound. Clean the connectors, interfaces and bushings carefully each time after use.

WARNING **Make sure to disable all sources when you are cleaning any optical interfaces.**
Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational.
The laser radiation is not visible to the human eye, but it can seriously damage your eyesight.

E.1 Cleaning Materials

	HP P/N
Lens Cleaning Paper	9300-0761
Special Cleaning Tips	9300-1351
Blow Brush	9300-1131
Adhesive Cleaning tape	15475-68701
Isopropyl Alcohol	Not available from HP. This should be available from any local pharmaceutical supplier.
Pipe Cleaner	

WARNING **To prevent electrical shock, disconnect the HP model E6000B 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.**

E.2 Cleaning Fiber/Panel Connectors

1. To clean the instrument panel connector remove the connector interface.
2. Apply some isopropyl alcohol to the lens cleaning paper and clean the surface and the ferrule of the connectors.
3. Using a new dry piece of cleaning paper, wipe the connector surface and ferrule until they are dry and clean.

4 Lightly press the adhesive tape several times against the connector surface to remove any remaining particles. After use store the tape in the container.

5 Protect the connector surface with a cap.

E.3 Cleaning Connector Interfaces

NOTE **If any index matching compound was used, use an ultrasonic bath with isopropyl alcohol to clean the connector interfaces.**

- Apply some isopropyl alcohol to the pipe cleaner and wash the inside the connector interface.
- Using a new dry pipe cleaner, dry the inside the connector interface.
- Remove the brush part from the blow brush and blow air through the inside the interface to remove any remaining particles.

E.4 Cleaning Connector Bushings

As used on the HP 8158B Optical Attenuator and HP 81000AS/BS Optical Power Splitter.

Normally the connector bushings require no cleaning. However, if it appears that cleaning is necessary, use only the blow brush with the brush part removed.

CAUTION

NEVER insert any cleaning tool into the bushing as this may affect the optical system.
NEVER use any index matching compound, cleaning fluid or cleaning spray.

E.5 Cleaning Detector Windows

As used on the HP 81520A and HP 81521B Optical Heads (large area).

1 Use the blow brush to remove any particles from the surface.

2 Wipe the surface with cleaning paper or special cleaning tips.

E.6 Cleaning Lens Adapters

CAUTION

Do not use any cleaning fluid or cleaning spray.

1 Using the blow brush, remove dust.

2 Wipe the surfaces with the special cleaning tips.

E.7 Cleaning Detector Lens Interfaces

As used on the HP 81522A Optical Head (small area) and HP 8140A and HP 8153A detector modules.

Normally, the lens interface can be cleaned by using the blow brush. If adhesive dirt must be removed perform as follows:

1 Using the blow brush, remove the dust from the lens surface.

2 Press the special cleaning tip to the lens surface and rotate the tip.

NOTE **Use alcohol for cleaning only when the above procedure does not help or if the dirt is caused by oil or fat.**

F

Environmental Profile

Environmental Profile

F.1 Product Summary

The product reviewed consists of an E6000B 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 Mainbattery (recycling path)

F.2 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

F.3 Energy Use/Efficiency

Normal Operation:	< 20 Watt
Standby:	< 5 Watt

F.4 Operation Emissions

Ozone:	No ozone emissions
Radio Frequency Noise:	Meets CISPR 11 (CISPR22)

F.5 Materials of Packaging

Material	% weight	% recyclable/reusable
PUR	25	100
Corrugated Paper	75	100

F.6 Learning Products

Manuals are 100% recyclable.

F.7 HP Manufacturing Process

Hewlett-Packard has eliminated ozone depleting substances such as chlorofluorocarbons (CFCs), trichlorethane (TCA), and carbon tetrachloride from its manufacturing process worldwide.

Hewlett-Packard is surveying and working with suppliers to identify and eliminate any ozone depleting substances from their manufacturing.

G

Overview

Overview

G.1 Function Overview

Figure G-1 shows how to navigate through the Mini-OTDR screens and applications, and shows the different uses of the CURSOR and SELECT keys.

Figure G-2 shows what you can change using the popup menu in OTDR mode..

Figure G-3 shows what you can set after you select *Instrument Config*. from the Applications Screen

Figure G-4 to Figure G-8 represent sample sessions for commonly used features.

Function Overview

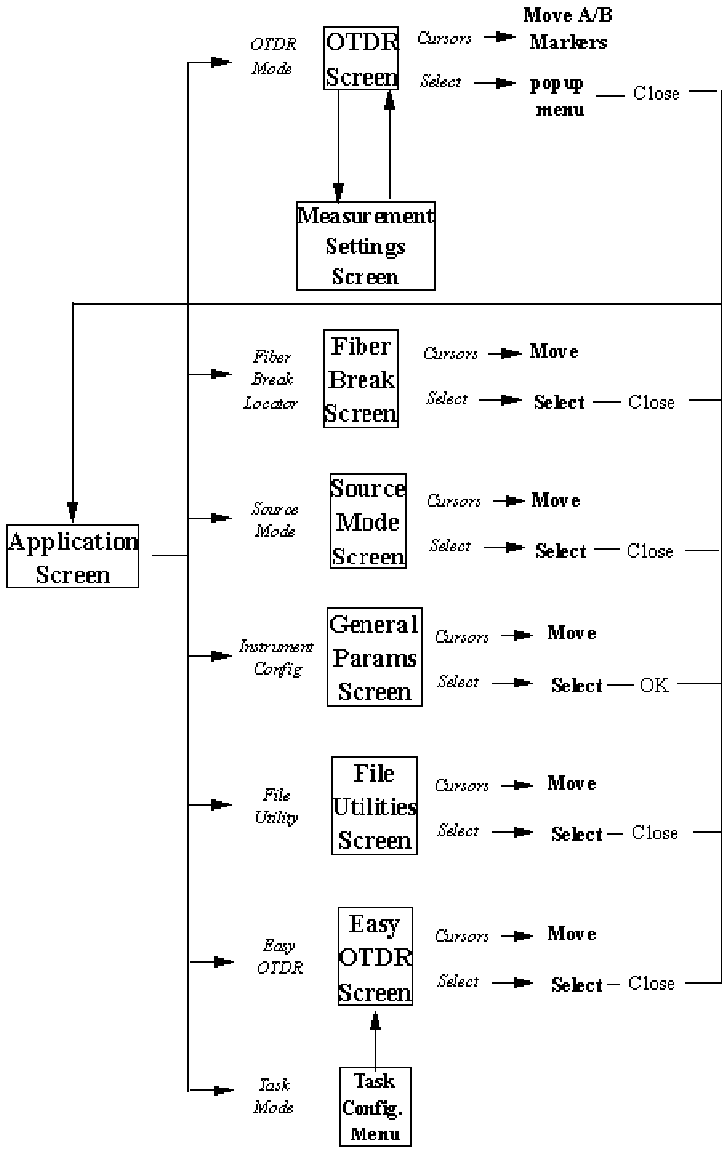

Figure G-1 **The Mini- OTDR menu system**

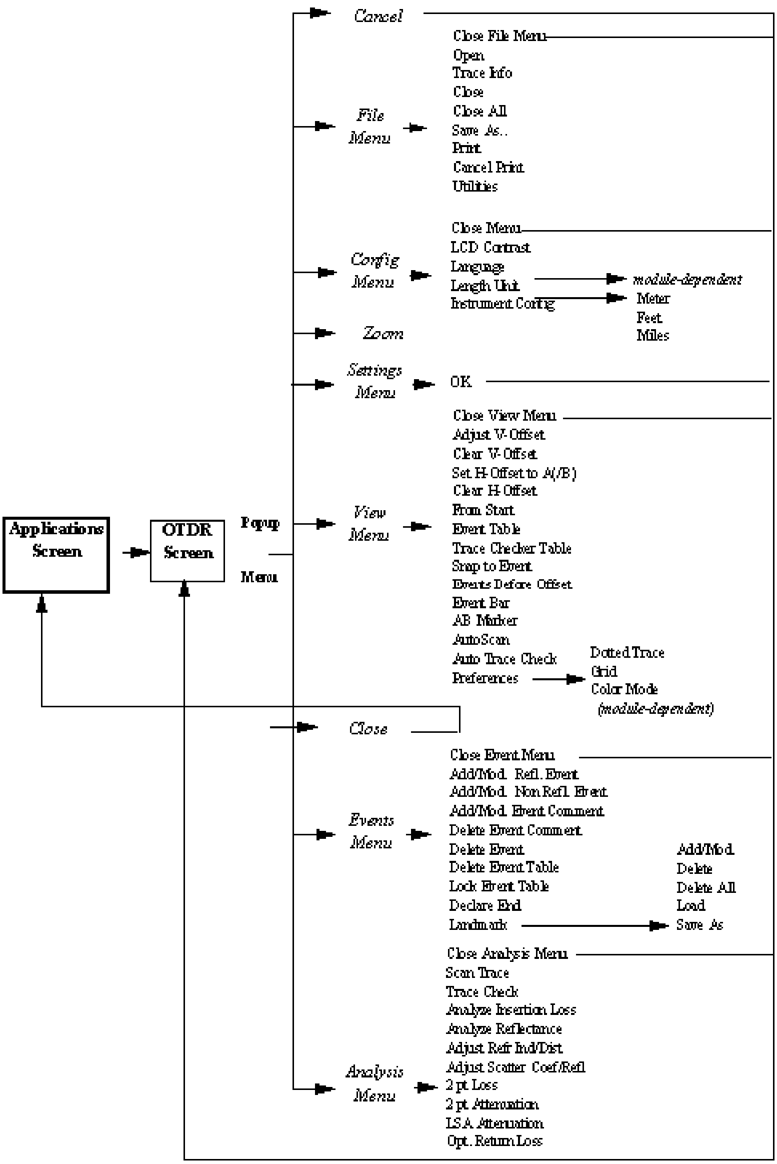

Figure G-2 **The OTDR Mode menu options**

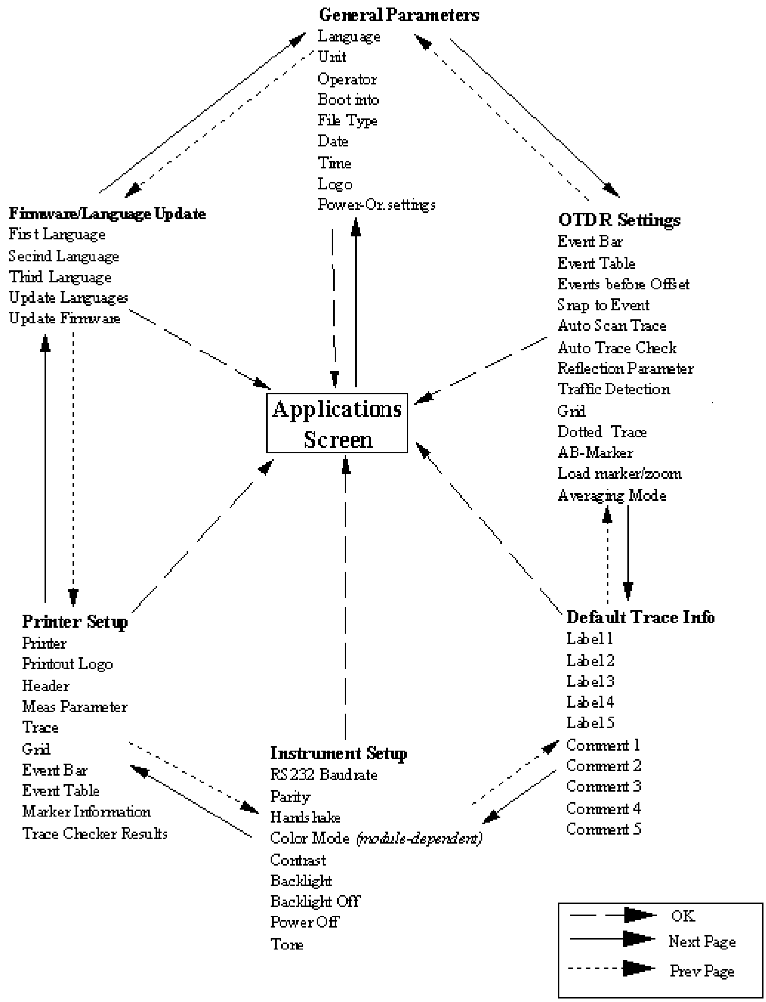

Figure G-3 **The Instrument Config menu options**

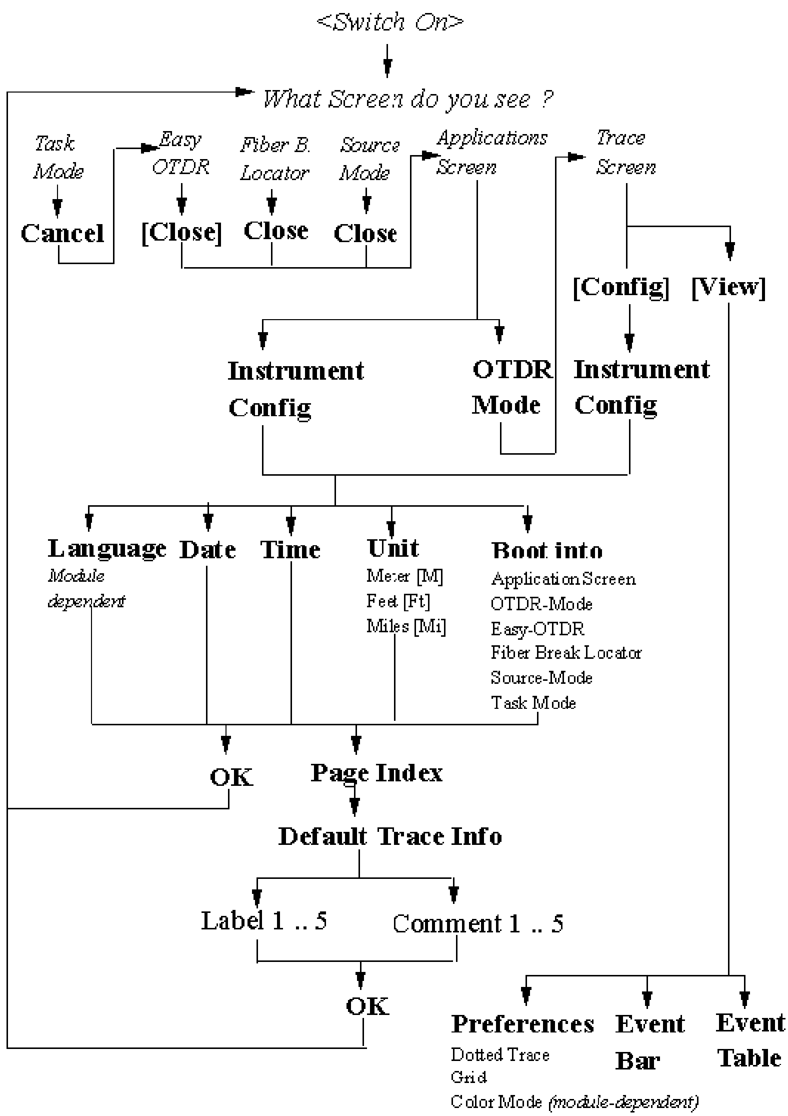

Figure G-4 **Configure the instrument**

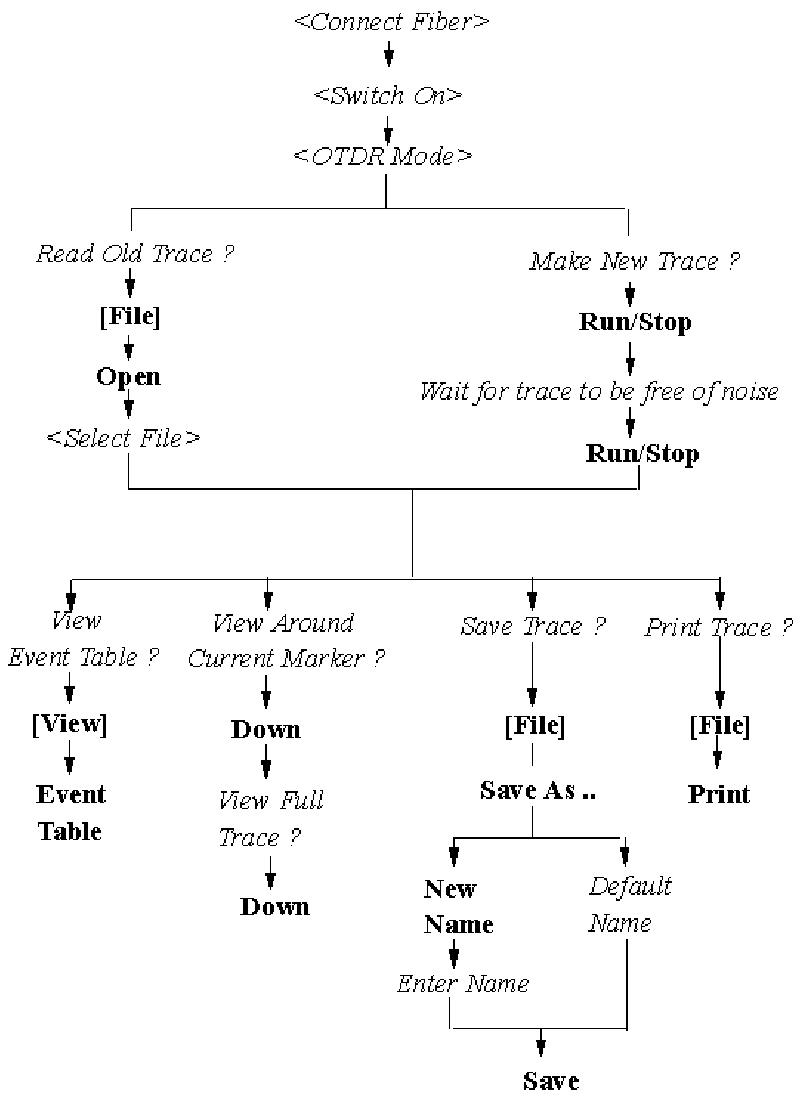

Figure G-5 **View a Trace**

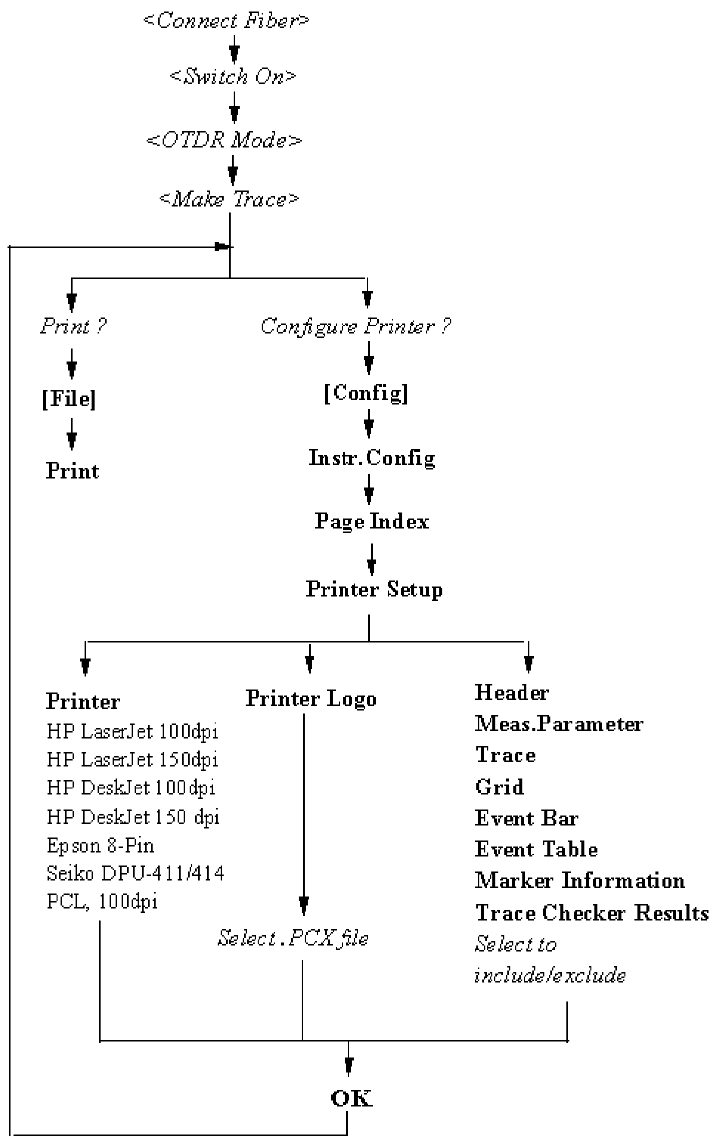

Figure G-6 **Use the printer**

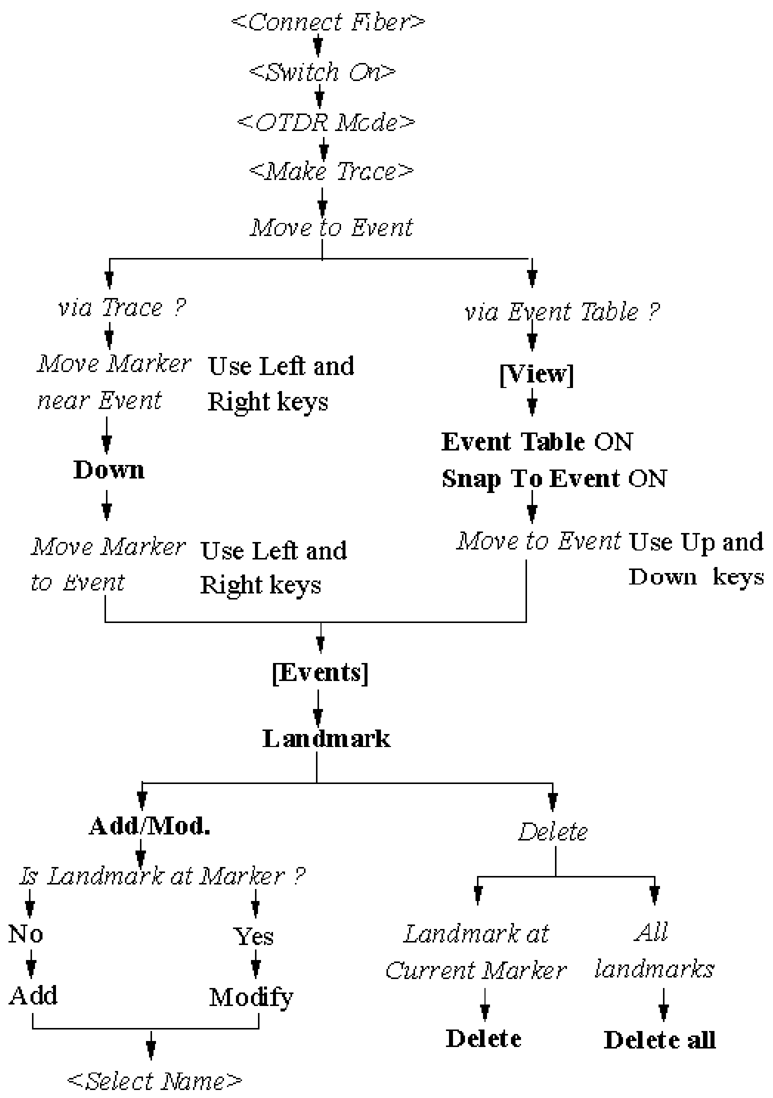

Figure G-7 **Add/Delete Landmarks**

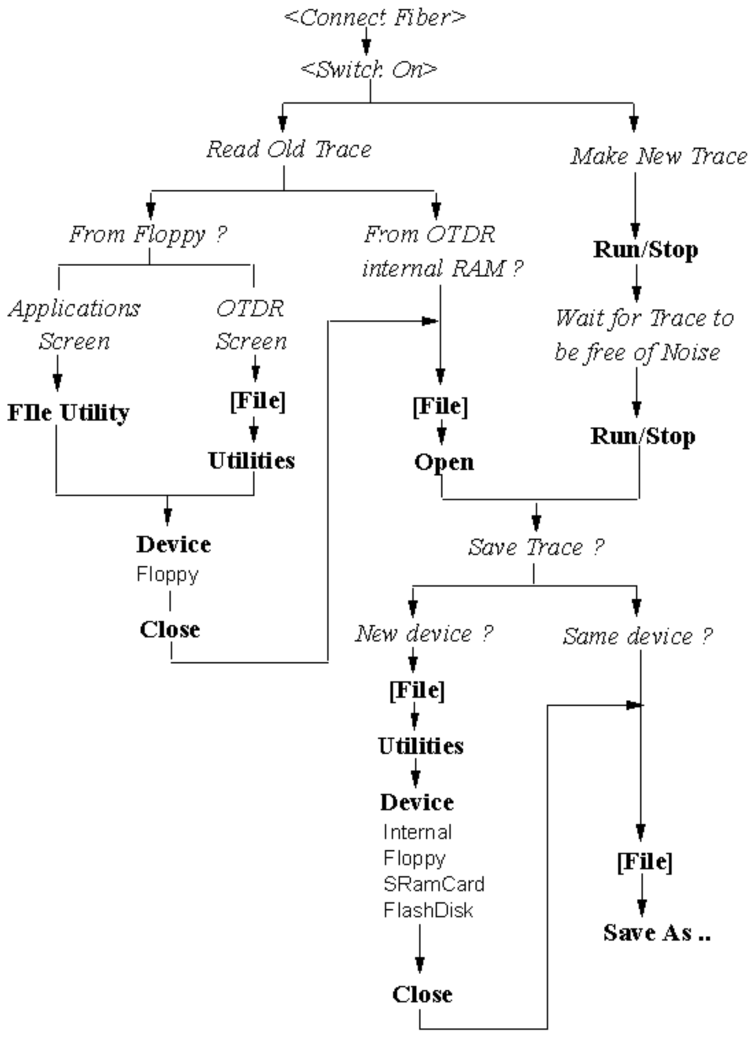

Figure G-8 **Read from/Write to a Floppy Disk**

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