M100

Optical Time Domain Reflectometer

User's Guide

NOYES
Test & Inspection

AFL Telecommunications
A Fujikura Business

M100

Optical Time Domain Reflectometer
User's Guide

NOYES
Test & Inspection

Limited Warranty

One Year Limited Warranty

All Noyes products are warranted against defective material and workmanship for a period of one year from the date of shipment to the original customer. Any product found to be defective within the warranty period will be repaired or replaced by Noyes. In no case will Noyes liabilities exceed the original purchase price of the product.

Exclusions

The warranty on your equipment shall not apply to defects resulting from the following:

• Unauthorized repair or modification

• Misuse, negligence, or accident

CE Information

These instruments have been designed and tested to comply with the relevant sections of any applicable specifications including full compliance with all essential requirements of all applicable EU Directives.

Returning Equipment

To return equipment, please contact Noyes to obtain additional information and a Service Request (S.R.) number. To allow us to serve you more efficiently, please include a brief description specifying the reason(s) for the return of the equipment.

AFL Telecommunications

Noyes
16 Eastgate Park Road
Belmont, NH 03220
Phone: 800-321-5298
             603-528-7780
Fax: 603-528-2025

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Safety Information

⚠️ **WARNING!** Use of procedures or adjustments other than those specified herein may result in hazardous radiation exposure.

850/1300 nm multimode OTDR port	☀️ CLASS 1 LASER PRODUCT — This is a CLASS I LASER output
1310/1550 nm single-mode OTDR port	☀️ CLASS 1 LASER PRODUCT — This is a CLASS I LASER output
VFL port	This is a CLASS II LASER output. Do not stare into beam. ⚠️ ☀️ LASER RADIATION DO NOT STARE INTO BEAM CLASS 2 LASER PRODUCT WAVELENGTH: 650nm MAX OUTPUT: 1.0mw PULSE RATE: 2Hz, 50% DUTY IEC825-1:1993, EN60825-1:1994

CAUTION! To avoid serious eye injury, never look directly into the optical outputs of fiber optic network equipment, test equipment, patch cords, or test jumpers. Refer to your company's safety procedures when working with optical systems.

WARNING! Use only the specified AC adapter. Use of another type of AC adapter can damage the instrument and create the danger of fire and electrical shock.

WARNING! To avoid the danger of fire and electrical shock:

- Never use a voltage that is different from that for which the AC adapter is rated.

- Do not plug the unit into a power outlet that is shared by other devices.

- Never modify the power cord or excessively bend, twist, or pull it.

- Do not allow the power cord to become damaged. Do not place heavy objects on the power cord or expose it to heat.

- Never touch the AC adapter while your hands are wet.

- Should the power cord become seriously damaged (internal wiring exposed or shorted), contact the manufacturer to request servicing.

CAUTION! Do not run any tests or perform functions that activate an M100 laser unless fiber is attached to the corresponding OTDR port.

NOTICE! An M100 OTDR contains no user serviceable parts. Except for changing batteries and cleaning optical ports, this instrument must be returned to Noyes or authorized agents for repair and calibration.

IMPORTANT! Proper care in handling should be taken when using any precision optical test equipment. Scratched or contaminated optical connectors can impact the performance of the instrument. It is important to keep the dust caps in place when the unit is not being used.

Section 1: General Information

This User's guide provides operating instructions for testing fiber optic networks with the M100 OTDR and assumes that you have basic knowledge about testing fiber optic networks. The purpose of this user's guide is to explain how to use and maintain this test equipment. Please check our web site at **www.AFLtele.com (click on Products > Noyes Test & Inspection)** for updates to this manual, software updates, and additional application information. If you have any questions about your instrument and recommended accessories, or if you need technical or sales support, please contact Noyes Customer Service.

Contacting Noyes Customer Service

You may call Noyes Customer Service between 8 a.m. and 5 p.m., United States Eastern Time, as follows:

Phone   800-321-5298

           603-528-7780

Fax   603-528-2025

Web   www.AFLtele.com (click on Products > Noyes Test & Inspection)

Unpacking and Inspection

This instrument has been carefully packed in accordance with standard shipping procedures. Examine the equipment for damage that may have occurred during shipment. If you find any damage, or if any of the following items are not included, please contact Noyes.

The M100 package includes:

- M100 instrument
- Protective rubber boot
- Adapter caps
- AC power adapter and cord
- CompactFlash™ card 16M
- CompactFlash™ card reader
- Trace analysis software and user's guide
- User's guide
- Carry case
- Stylus

Feature Overview

The Noyes M100 OTDR is a hand-held, single-mode and multimode, four-wavelength Optical Time Domain Reflectometer with integrated VFL (visual fault locator). Based on the latest "PDA" technology the M100 reaches a new level of value and portability. By combining a simple user interface with the features of a mini-OTDR in a "micro" package, the M100 is ideal for premises network Tier 2 fiber link certification and fault-location measurements including: connection loss and reflectance, splice loss, and fiber loss slope (attenuation rate). The M100 is also suited for broadband service providers looking for a highly portable OTDR to document and trouble-shoot fiber links in their access and FTTx (fiber to the home/curb/office) networks.

Both the multimode and single-mode OTDR ports are equipped with modular ports that accept ST, SC, or FC connector adapters. The VFL port is equipped with a universal adapter that accepts standard 2.5 mm connectors.

Recommended Accessories

You will need fiber optic test cables (or jumpers) to connect your M100 to the fiber under test. Test cables must have the same core and cladding size as the fiber under test. The connector at one end of the test cable must mate with the appropriate optical port on the M100. The connector on the other end must mate with the fiber optic link under test. Test cables and jumpers with a variety of lengths and connector styles are available from Noyes.

Fiber Boxes or Fiber Rings may be used as launch and receive cables, which are required to measure the insertion loss and reflectance of the near-end and far-end connectors respectively, on the fiber link being tested. Fiber Boxes and Fiber Rings with a variety of lengths and connector styles are available from Noyes.

Optical ports must be kept free from dirt or other contaminates to ensure accurate measurements and operation. For cleaning optical connectors on instruments and test jumpers, a supply of optical cleaning wipes and IPA (Reagent Grade Isopropyl Alcohol 99% or better) or a connector-cleaning cartridge and a can of filtered compressed air may be used. For cleaning connector adapters, a supply of fiber optic cleaning swabs or a can of filtered compressed air may be used.

Noyes recommends using our exclusive FCC2 non-hazardous cleaning fluid and CCT molded cleaning tips, which may be combined into FCP1 cleaning kits, for cleaning connector end faces in fiber frames, adapters, and on jumpers. Noyes offers a complete selection of FCP1 fiber optic cleaning kits for field cleaning of connector end faces in fiber frames, adapters and on jumpers. The FCP1 Series of kits delivers compact, safe, easy to use, reliable cleaning for all types of fiber optic connector end faces.

Section 2: Functional Description

M100 Ports, Keys, and Indicators

Top Panel

The table below and Figure 2-1 describe the M100 top panel ports and indicators.

1	MM optical port	850/1300 nm multimode OTDR port
		This is a CLASS I LASER output
2	SM optical port	1310/1550 nm single-mode OTDR port.
		This is a CLASS I LASER output
3	VFL port	VFL module, 650 nm Visible Fault Locator (red laser).
		This is a CLASS II LASER output
		LASER RADIATION DO NOT STARE INTO BEAM CLASS 2 LASER PRODUCT WAVELENGTH: 650nm MAX OUTPUT: 1.0mw PULSE RATE: 2Hz, 50% DUTY IEC825-1:1993, EN60825-1:1994

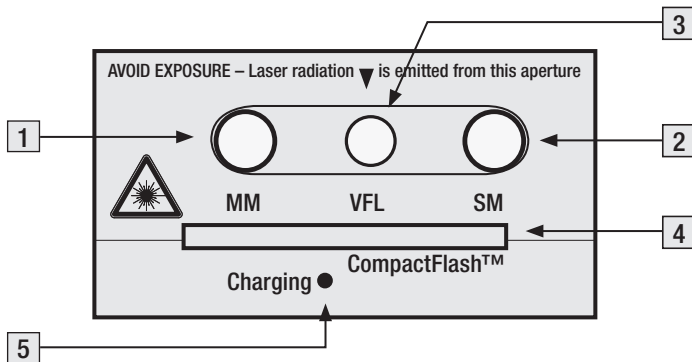| 4 | CompactFlash™ | CompactFlash™ drive is used for CompactFlash™ memory card |
| 5 | Charging indicator | Turns ON when AC adapter is plugged in
Turns OFF when battery is fully charged |

Figure 2-1. M100 top panel

Front Panel

The table below and Figure 2-2 describe the M100 front panel ports, keys and display.

1	[⏻] - Power key	Press and hold (about 2 sec.) to turn the M100 on or off
2	[Test] key	Press to start or stop a test
3	[Set]key	Press to access the Settings screen
4	[◄] - Back key	Press to return the previous screen
5	[⌐L] - Event key	Press to display the [Event Table] screen
6	[☀] - VFL key	Press to turn the VFL (red laser) on or off
7	︿〈 〉﹀ Arrow keys	Press to navigate menus, change setup parameters, move cursors, and change the zoom level
8	Power port	Interface for the supplied AC power adapter/charger
9	[Menu] key	Press to access the [Menu] screen
10	[Zoom] key	Press to switch to zoom/move mode
11	[Select] key	Press to toggle between [a] and [b] cursor. In zoom/move mode toggle between zoom and move option and move trace display
12	Display	Used to show the OTDR [Trace] screen, [Event Table] screen, Test settings screen, and other sub-screens and menus
13	[Reset] button	Used for the M100 software reinstallation and backup

M100 OTDR NOYES
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1

Test

2

Set

3

4

5

6

Select

Menu Zoom

7

8

9 11

10

13

[Reset] button
(Located on the
side panel)

12

Power port
(Located on the
side panel)
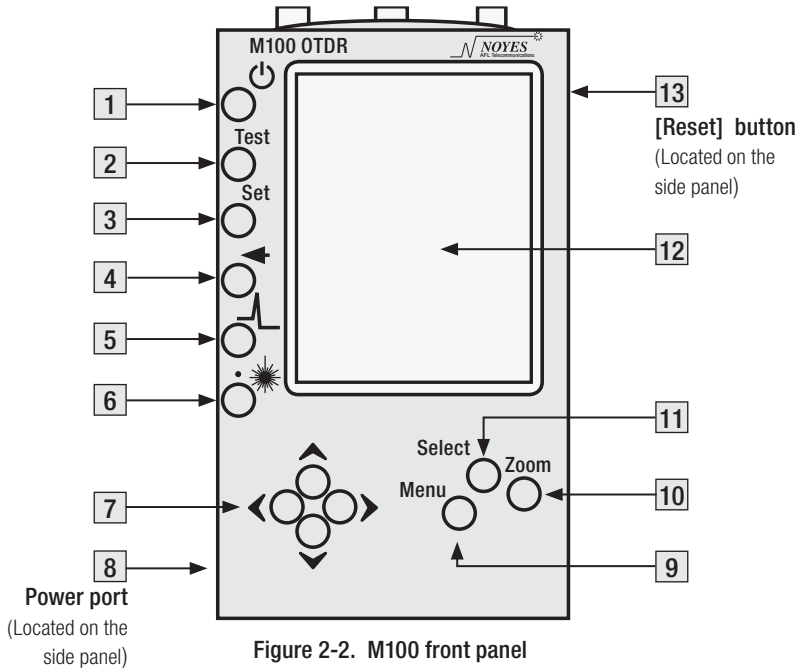
Figure 2-2. M100 front panel

Section 3: Test Setup

Test Settings Screen

Use this screen to view and edit the settings for the next test.

1. Press the [Set] Key to enter the [Settings] screen.

2. Use either [▲] or [▼] arrow key to highlight the test parameter to be changed.

3. Use either [►] or [◄] arrow key to edit the selected test parameter.

4. When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start testing.

Next Test Settings:	
Wavelength (nm):	MM 850
Range:	20 km
Pulse Width:	0.3 uS
Averages:	2
Filter (smooth):	OFF
Index (GIR):	1.4960
Backscatter, 1 nS (dB):	-68.0
Reflectance (dB):	-52.7
Loss (dB):	0.22
Auto Events Table:	yes
Launch Cable:	-
Receive Cable:	-
Options:	
Length Units:	km

Test Start Measurement	Change ◄ ►	▼ ▲ Move

Setting Test Parameters

Wavelength

The [Wavelength] parameter determines which laser (MM or SM) is used to generate the OTDR trace.

To set [Fiber Type] and [Wavelength] parameters:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Wavelength (nm)] label.

3 Use either [▶] or [◀] arrow key to display the available fiber type and wavelength.

   • Select either MM 850 or MM 1300 for multimode fiber.

   • Select either SM 1310 or SM 1550 for single-mode fiber.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Range

The [Range] parameter determines the distance range of the full (unzoomed) trace. It also determines [Resolution] - the distance between data points in the trace: the longer the range, the wider the data point spacing. We recommend selecting the shortest distance range that is longer than the fiber under test. For example, to test a fiber that is 1.5 km

long, select the 2.5 km range.

To set the [Range] parameter:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Range] label.

3 Use the [►] and [◄] arrow keys to select the desired [Range] value as follows:

Wavelength (nm)	Distance Range (Length units)	Resolution (set by M100)
MM 850	0.3 • 0.6 • 1.2 • 2.5 • 5 • 10 • 20 km	1.25 m
	0.9 • 1.8 • 3.7 • 7.5 • 15 • 30 • 60 kft	4.1 ft
	0.2 • 0.4 • 0.8 • 1.5 • 3 • 6 • 12 mi	4.1 ft
MM 1300	0.3 • 0.6 • 1.2 • 2.5 • 5.0 • 10 • 20 km 40 km	1.25 m 2.5 m
	0.9 • 1.8 • 3.7 • 7.5 • 15 • 30 • 60 kft 120 kft	4.1 ft 8.2 ft
	0.2 • 0.4 • 0.8 • 1.5 • 3 • 6 • 12 mi 25 mi	4.1 ft 8.2 ft

Wavelength (nm)	Distance Range (Length units)	Resolution (set by M100)
SM 1310 SM 1550	0.3 • 0.6 • 1.2 • 2.5 • 5.0 • 10 • 20 km	1.25 m
	40 km	2.5 m
	80 km	5.0 m
	160 km	10.0 m
	0.9 • 1.8 • 3.7 • 7.5 • 15 • 30 • 60 kft	4.1 ft
	120 kft	8.2 ft
	250 kft	16.4 ft
	500 kft	32.8 ft
	0.2 • 0.4 • 0.8 • 1.5 • 3 • 6 • 12 mi	4.1 ft
	25 mi	8.2 ft
	50 mi	16.4 ft
	100 mi	32.8 ft

4 When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Note: Because [Range] availability depends on [Wavelength], always select the [Wavelength] parameter before [Range].

Pulse Width

The M100 can operate using different pulse widths. Short pulse widths provide the shortest event and attenuation dead zones. Long pulse widths provide the best event detection on long fibers. We recommend setting the [Pulse Width] parameter to the lowest value that provides the event detection range you need.

To set the [Pulse Width] parameter:

1 Press [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Pulse Width] label.

3 Use the [▶] and [◀] arrow keys to select the desired [Pulse Width] value as follows:

Wavelength (nm)	Pulse Width
MM 850	30 nS • 100 nS • 300 nS • 1 μS
MM 1300	30 nS • 100 nS • 300 nS • 1 μS
SM 1310	30 nS • 100 nS • 300 nS • 1 μS • 3 μS
SM 1550	30 nS • 100 nS • 300 nS • 1 μS • 3 μS • 10 μS

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Note: Because [Pulse Width] availability depends on [Wavelength] and [Range], always

set [Wavelength] and [Range] parameters before setting [Pulse Width].

Averages (Live or Timed test mode)

The [Averages] parameter determines the number of samples taken and averaged per trace data point during a timed test. This parameter also determines the duration of a timed test. To set the [Averages] parameter:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Averages] label.

3 Use the [▶] and [◀] arrow keys to select the desired average setting as follows:

Average Setting	Test Mode	Test Time (approximately)
0	Live	Continuous
1	Timed	7 seconds
2		8 seconds
4		9 seconds
8		11 seconds
16		16 seconds
32		26 seconds
64		47 seconds
128		1.5 minute
255		3 minutes

4 When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Note: Increasing the number of averages reduces trace noise and, therefore, makes it easier to see events at the end of a long fiber. However, increasing the number of averages also increases test time. We recommend setting [Averages] to the lowest value that provides the trace smoothness that you need.

Filter

Turning the [Filter] ON makes a choppy or noisy trace smoother.

To turn the [Filter] ON or OFF:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Filter, (smooth)] label.

3 Use the [►] and [◄] arrow keys to turn the filter ON or OFF.

4 When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Index (group index of refraction - GIR)

The refractive index of an optical fiber, also known as its Group Index of Refraction or GIR, determines the speed of light in the fiber. Refractive index is used by the M100 to determine cursor and event distances. When setting Refractive Index, enter the value specified by the

manufacturer of the fiber optic cable you are testing.

To set the [Index] parameter for next test perform the following steps:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Index] label.

3 Use the [▶] and [◀] arrow keys to increase or decrease the [Index] value.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Note: If you don't know the refractive index value of the fiber you are testing, use the following default values:

Wavelength, nm	Index of Refraction
MM 850	1.4960
MM 1300	1.4870
SM 1310	1.4675
SM 1550	1.4681

These values are within 1% of the values specified for most fiber optic cables. If you later learn the exact values specified by the cable manufacturer, you can correct the refractive index values in the stored M100 trace file.

Backscatter

The backscatter coefficient is used to calculate a reflectance value. Backscatter coefficient values are specified by the manufacturer of the fiber optic cable. To set Backscatter Coefficient:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Backscatter, 1 nS (dB)] label.

3 Use the [►] and [◄] arrow keys to increase or decrease the value.

4 When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start a test.

If the backscatter coefficient is not specified by the fiber manufacturer, use the default values as follows:

Wavelength	Backscatter Coefficient
850 nm	-68.00 dB
1300 nm	-76.00 dB
1310 nm	-80.00 dB
1550 nm	-83.00 dB

Reflectance and Loss

In an automatically generated event table, events that are not end events will be included if they exceed the event Loss, Reflectance, or both thresholds. After an [Event Table] has been generated automatically, you can insert or delete events, correct events location, and recalculate an event table.

To set Reflectance:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Reflectance (dB)] label.

3 Use the [▶] and [◀] arrow keys to increase or decrease the value.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

To set Loss:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Loss] label.

3 Use the [▶] and [◀] arrow keys to increase or decrease the setting.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Auto Events Table

The [Auto Events Table] option allows you creating an automatic [Event Table] based on current test settings.

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Auto Events Table] label.

3 Use the [▶] and [◀] arrow key to turn the [Auto Events Table] option On and Off.

   Note: If the [Auto Events Table] option is disabled, the [Launch Cable] and [Receive Cable] options are disabled automatically.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Launch Cable and Receive Cable

OTDRs require launch and receive test cables to measure the end-to-end loss of optical fiber links. A launch cable, which connects the OTDR to the link under test, reveals the insertion loss and reflectance of the near-end connection. A receive cable, which is connected to the far-end of the link, reveals the insertion loss and reflectance of the far-end connection.

Note: Noyes offers OTDR test cables in two forms. Fiber Rings, which provide 150 m of 50 µm, 62.5 µm, or single-mode fiber in a compact, light-weight ring, are ideal for testing optical fiber links (up to about 2 km) in Premises networks. Fiber Boxes, which are available

in standard lengths up to 1 km, are ideal for testing single-mode fiber spans (up to 50 km or longer) in Telco and Broadband networks.

To enable /disable Launch and Receive Cable options:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Launch Cable] / [Receive Cable] label.

3 Use the [▶] and [◀] arrow key to turn the [Launch Cable] / [Receive Cable] option On and Off.

   Note: If the [Auto Events Table] option is disabled, the [Launch Cable] and [Receive Cable] options are disabled automatically.

4 When setup is complete, press the [◀] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Example of using Launch and Receive Cables
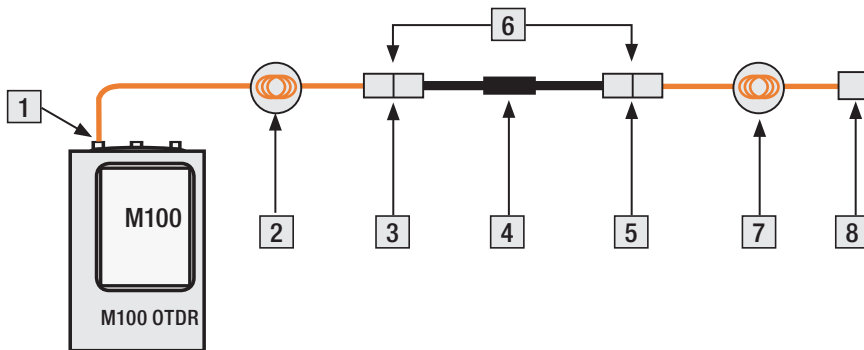
To measure link loss using Launch and Receive Cables:

• Connect the launch cable (Fiber Ring /Box) between your OTDR and the fiber link under test. This will allow you to measure the loss of the near-end connection.

• Connect the receive cable (Fiber Ring/Box) to the far-end connector of your fiber link under test. This will allow you measure the loss of the far-end connection.

- By using launch and receive cables, as shown in the diagram below, you can measure total insertion loss of the fiber link under test.

Example OTDR test configuration with Launch and Receive cables.

Ref #	Trace Feature		Ref #	Trace Feature
1	OTDR port		5	Far-end connection
2	Launch cable		6	Fiber link under test
3	Near-end connection		7	Receive cable
4	Fusion splice		8	End of receive cable

Example OTDR trace made using Launch and Receive cables
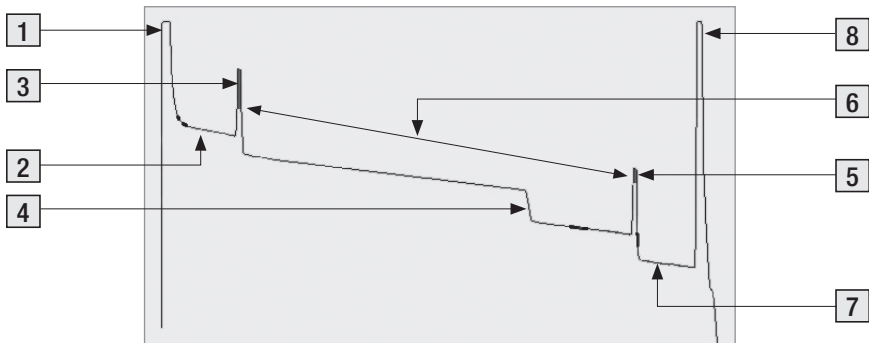
Ref #	Trace Feature
1	OTDR port
2	Launch cable
3	Near-end connection
4	Fusion splice

Ref #	Trace Feature
5	Far-end connection
6	Fiber link under test
7	Receive cable
8	End of receive cable

The example trace and table below shows correlation between enabled / disabled [Launch Cable] / [Receive Cable] options and trace events added to the [Auto Events Table].
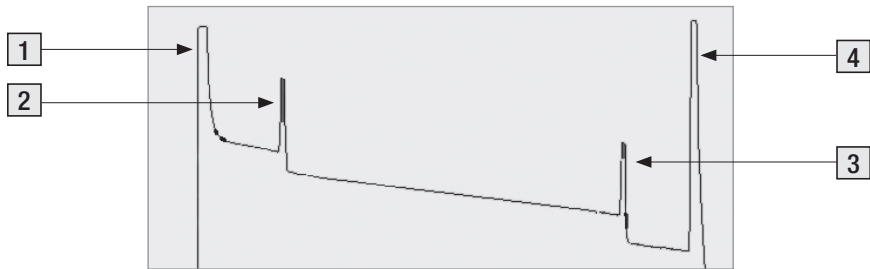
Ref No.	Trace Event Measured	Launch Cable - OFF Receive Cable - OFF	Launch Cable - ON Receive Cable - OFF	Launch Cable - ON Receive Cable - ON
1	OTDR port	●		
2	Near-end connection	●	●	●
3	Far-end connection	●	●	●
4	End of receive cable	●	●	

Length Units

Length Units may be set to km (kilometer), kft (kilofoot), or mi (mile)

To set Length Units:

1 Press the [Set] key to enter the [Test Settings] screen.

2 Use either [▲] or [▼] arrow key to highlight the editable data field beside the [Length Units] label.

3 Use either [▶] or [◀] arrow keys to select the desired Length units as follows:

   • km (kilometer), kft (kilofoot), mi (mile).

4 When setup is complete, press the [◄] - Back key to return to the [Trace] screen or the [Test] key to start a test.

Section 4: Operation

Trace Screen Features

The [Trace] screen displays a graph of the OTDR trace, setup parameters, cursors location, and other test data. The table below and Figure 4-1 describe the [Trace] screen features.

| Ref#	[Trace] screen feature	Description
1	[Range] setting	Shows the [Range] setting for the currently displayed test.
2	[Averages] setting	This field displays the [Averages] setting for the current test.
3	[Pulse Width] setting	Shows the [Pulse Width] setting for the currently displayed test.
4	[Fiber type, Wavelength]	Displays the selected [Fiber type and Wavelength].
5	File name field	Displays file name of the currently displayed trace.
6	Current view bar	This bar shows the size of the current view and the location of the cursors relative to the entire trace.
7	Trace	This is a graph of insertion loss vs. distance. The vertical axis shows loss in dB. The horizontal axis shows distance in user-selected [Length] units.
8	Cursors	Used to measure loss, and distance. The active cursor can be moved using either [◀] or [▶] arrow key. Press the [Select] key to toggle between [a] and [b] cursor.
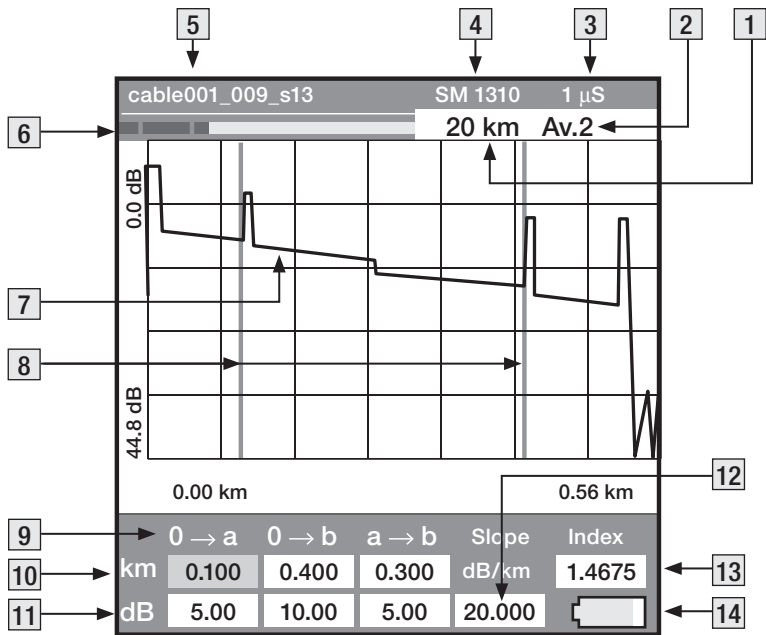
Figure 4-1. Trace screen.

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9	Test data labels	This line displays labels as follows: [o→a] - test data measured from origin to [a] cursor [o→b] - test data measured from origin to [b] cursor [a→b] - test data measured from [a] to [b] cursor
10	Cursor location data	This line displays [a] cursor location, [b] cursor location, and distance from [a] to [b] in user-selected [Length] units.
11	[dB] - loss data	This line displays measured dB value at [a] cursor, [b] cursor, and loss [a to b] cursor.
12	[Slope] field	Displays [a-b] attenuation rate (slope).
13	[Index]	Displays the [Index} of refraction setting.
14	Battery status indicator	Displays estimated battery life remaining.

Performing a Test

1 Turn on the M100 by pressing and holding the [Power] key for two seconds.

2 Press the [Set] key to view or edit test settings.

3 Press the [◄] - Back key to return to the [Trace] screen.

4 Connect the M100 to the fiber under test and press the [Test] key to begin testing.

5 You may press the [Test] key to stop the test before all of averages have been run or wait until the test is complete. Once test is complete or stopped, the [Trace] screen will display test results (refer to section titled "Trace Screen Features", page 24).

Moving Cursors

The [a] and [b] cursors may be positioned to measure distance, loss, and attenuation rate (slope) between any two points on a trace. To move a cursor, you need to enable it - make it active.

To move a cursor:

- When in the [Trace] screen, press the [Select] key to toggle between cursors. The highlighted location data box below the cursor label will indicate the active cursor (see Figure below).

- Press the [▶] key to move the active cursor to the right. Press and hold for fast movement.

- Press [◀] key to move the active cursor to the left. Press and hold for fast movement.

Note: The active cursor set for the current test will remain active for the following tests.

	[a] cursor label	[b] cursor label			
	$0 \rightarrow a$	$0 \rightarrow b$	$a \rightarrow b$	Slope	Index
km	0.100	0.400	0.300	dB/km	1.4675
dB	5.00	10.00	5.00	20.000	

Highlighted location data box below the [a] cursor label indicates that [a] is the active cursor

Zooming and Moving Trace Image

To view different parts of a trace at various magnifications, you can zoom (expand) the trace graph in the horizontal or vertical direction and move the trace image. M100 zooms horizontally around the active cursor and vertically from the trace level at the active cursor.

Entering Zoom/Move Mode

1 Press the [Zoom] key, to enter the [Zoom]/ [Move] mode. The [Trace] screen will display [zoom] and [move] option labels as follows:

[Zoom] mode label   **[Move] mode label**

	$0 \rightarrow a$	$0 \rightarrow b$	zoom	move	Index
km	0.100	0.400			1.4675
dB	5.00	10.00			

Active mode indicator - will be displayed below the enabled mode label. In this example [Zoom] is the active mode.

2 Press the [Select] key to toggle between [Zoom] and [Move] options. The [Active mode] indicator will be displayed below the enabled mode.

Zoom and Move Keys

The table below gives a summary of the arrow keys and function associated with each key in the [Zoom] and [Move] modes.

Mode	Key	Function
Zoom	▲	Press to zoom-in (increase magnification) vertically
	▼	Press to zoom-out (decrease magnification) vertically
	▶	Press to zoom-in (increase magnification) horizontally
	◀	Press to zoom-out (decrease magnification) horizontally
Move	▶	Press to move the trace image horizontally to the right
	◀	Press to move the trace image horizontally to the left

Viewing Event Table

The [Event Table] screen displays a graph of the current OTDR trace, trace events listed in a table format, and events data.

1 To access the [Event Table] screen, press the [⌐_] - Event Table key.

2 Use either [▲] or [▼] arrow key to highlight the desired event in the event table. Notice that trace display will change accordingly to show the selected event on the trace.

3 You may use the [►] and [◄] arrow keys to zoom and un-zoom the displayed trace.

4 You may press the [Menu] key to access the [Event Table Options] screen, which allows you to add or delete events, correct events location, and recalculate an [Event Table]. See the following section titled "Editing Event Table" for details.

Cable001_009_s13		SM 1310	0.1 μS

| | | | 20 km | Av.2 |

Event No	type	Location (km)	Reflect. (dB)	Loss (dB)
start	⌐_	0.100	-35	1.00
2	⌐_	0.240		0.75
3	⌐_	0.400	-30	0.80
end	⌐_	0.500	-20	

Total Number = 4
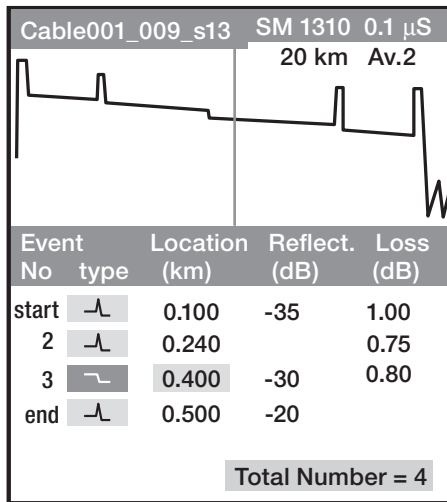
5 To return to the [Trace] screen, press the [◄] - Back key.

Editing Event Table

You may edit an automatically generated event table by adding or deleting events, correcting events location, and recalculating events data.

Note: We recommend to use the supplied Trace600 software for editing an [Event Table] in an M100 file. With Trace600 you can analyze, edit, and print traces using your PC. Refer to the supplied Trace600 user's guide for details.

To edit an [Event Table] using your M100 OTDR perform the following:

1 Press the [⌐] - Event Table key to access the [Event Table] screen.

2 Press the [Menu] key to access the [Event Table Options] screen.

3 Use either [▲] or [▼] arrow key to choose the desired option as follows:

Event Table option	Description
Insert non-reflect	Use this option to add a non-reflective event
Insert reflect	Use this option to add a reflective event
Correct	Use this option to edit an event location
Delete	Use this option to delete an event
Recalculate Table	Use this option if you changed [Loss] and/or [Reflectance]

4 Press the [▶] key to activate the selected option and display the corresponding screen.

5 Follow the on-screen instructions (see the following sections for more information).

Inserting Events

To add events to the [Event Tale], perform the following:

1 From the [Event Table] screen, press the [Menu] key to access the [Event Table Options] screen.

2 Use either [▲] or [▼] arrow key to choose the [Insert] option.

3 Press the [▶] key to activate the selected option and display the corresponding sub-screen.

4 From the displayed sub-screen, press the [▶] and [◀] arrow keys to move the active cursor along the trace graph and indicate the desired event location.

5 You may press the [Select] key to toggle between the [Fast] and [Slow] cursor movement mode.

6 When you are satisfied with the desired event location, press the [◀] - Back key to add the selected event to the [Event Table] and return to the [Event Table] screen.

Correcting Events Location

To correct an event location, perform the following:

1 In the [Event Table], use either [▶] and [◀] arrow keys to highlight the desired

event.

2 From the [Event Table] screen, press the [Menu] key to access the [Event Table Options] screen.

3 Use either [▲] or [▼] arrow key to choose the [Correct] option.

4 Press the [▶] key to activate the selected option and display the corresponding sub-screen.

5 From the displayed sub-screen, press the [▶] and [◀] arrow keys to move the active cursor to the correct location.

6 You may press the [Select] key to toggle between the [Fast] and [Slow] cursor movement mode.

7 When you are satisfied with the corrected location, press the [◀] - Back key to update the [Event Table] and return to the [Event Table] screen.

Deleting Events

To delete events from the [Event Table], perform the following:

1 In the [Event Table], use either [▶] and [◀] arrow keys to highlight the desired event.

2 From the [Event Table] screen, press the [Menu] key to access the [Event Table Options]

screen.

3 Use either [▲] or [▼] arrow key to choose the [Delete] option.

4 Press the [▶] key to delete the selected event from the [Event Table] and return to the [Event Table] screen.

Recalculating Events Data

The [Recalculate] option is available if the current trace settings have been changed.

To recalculate an Event Table perform the following:

1 From the [Event Table] screen, press the [Set] key to access the [Current Trace Settings] screen.

2 Use either [▲] or [▼] arrow key to choose the desired setting.

3 Use either [▲] or [▼] arrow key to increase or decrease the setting value as needed.

4 When you are satisfied with changed trace settings, press the [⌐L] - Event Table key to recalculate the Event Table and return to the [Event table] screen.

Saving Trace Files

1. From the [Trace] screen, press the [Menu] key to display the [File] menu.

2. Use either [▲] or [▼] arrow key to highlight the [Save File] option.

3. Press the [▶] key to access the [Save File] screen.

4. If you need to edit cable name and fiber number, perform the following:

   • Use either [▶] or [◀] arrow key to select the character to be changed.

   • Use either [▲] or [▼] arrow key to change the value.

5. Press the [Select] key to save changes or the [◀] - Back key to cancel.

Opening, Viewing, and Deleting Saved Files

1. From the [Trace] screen, press the [Menu] key to access the [File] menu.

2. Use either [▲] or [▼] arrow key to highlight [Open File] option.

3. Press the [▶] key to display the list of saved files.

4. Use arrow keys to highlight the desired file.

5. To open the selected file, press the [Select] key.

6. To delete the selected file, press the [Zoom] key.

7. You may press the [◀] - Back Key to return to the [Trace] screen.

Transferring Files to a PC

With the supplied Trace600 Windows™ software, you can analyze, edit, and print M100 traces using your PC.

1 Install Trace600 software on your PC.

2 Move the CompactFlash™ card from the M100 to your PC.

3 Use the Trace600 software to:

   – Save traces to a folder on your PC

   – Analyze traces

   – Edit traces and event tables

   – Print /batch print traces

Note: Refer to the supplied Trace600 user's guide for instructions.

Using the VFL Port

1 Connect the fiber under test to the VFL port.

   Note: The VFL port is a 2.5 mm universal connector adapter that can be used on ST, SC, FC or any other connectors with a 2.5 mm ferrule.

2 Turn on the VFL by pressing the [VFL] key.

3 The VFL port can be used for locating faults in fiber links and to trace fibers.

Loading New Firmware

Note: With the unit turned off, use the supplied AC adapter to charge your M100 for at least one hour BEFORE performing the following procedure.

1 Remove the CompactFlash™ card you are currently using.

2 Insert the CompactFlash™ card with the upgraded firmware.

3 Wait until the M100 screen displays: "About to upgrade...". Tap OK.

Note: Do not input anything or tap the screen.

4 The screen will display: "Installing M100". Tap OK.

5 The M100 will install the firmware and power down.

6 Press the ⏻ - [Power] key to return to the M100 [Trace] screen.

Setting Date and Time

1 Press the [Reset] button located on the right side of the M100 (Figure 2-2, page 7).

2 When the [PDA] main screen is displayed, tap [Start] > [Settings].

3 From the [Setting] screen, tap [System] > [Clock] to display settings screen.

To Set Time Zone

- On the [Time Zone] row, tap the [▼] arrow to display the drop-down list.
- Select your current time zone.

To Set Date

On the [Date] row, select the item you want to change. Tap the [▼] arrow next to the displayed date to open the drop-down calendar.

- To change the month, tap either [◀] or [▶] arrows to display the correct month.
- To change the year, tap either [◀] or [▶] arrows to display the correct year.
- To change the day, tap the correct day on the displayed calendar.

To Set Time

On the [Time] row, select the item you want to change.

- To change the AM/PM indicator, tap either [▲] or [▼] arrows to display the correct indicator.

- To change the hour, select the hour, and then tap either [▲] or [▼] arrows to increase or decrease the value.

- To change the minutes, select the minutes, and then tap either [▲] or [▼] arrows to increase or decrease the value.

- To change the seconds, select the seconds, and then tap either [▲] or [▼] arrows to increase or decrease the value.

4 When settings are done, choose [OK].

5 When prompted to save changes to the clock settings, choose [Yes].

6 Press the ⏻ - [Power] key to return to the M100 [Trace] screen.

Section 5: Maintenance

Cleaning the Optical Ports

⚠️ **CAUTION:** Before conducting the following procedures be sure to have the M100 turned OFF.

Optical ports must be kept free from dirt or other contaminates to ensure accurate measurements and operation. Noyes recommends using our new non-flammable, environmentally safe FCC2 Fiber Optic Cleaning solution and CCTP molded dual-head connector end-face cleaning tips.

To Clean the Multimode and Single-mode Ports

1. Rotate the adapter base counterclockwise approximately four times.

2. Pull the adapter directly out away from the universal adapter mount.

3. Perform one of the following:
   If using Noyes Cleaning Supplies:

   • Leaning the FCC2 can back (30°), press the button on the FCC2 to fill the well.

   • Dip the CCTP tip into the well of the FCC2 to dampen the tip with optical cleaning fluid.

   • Place the damp tip over the ferrule to be cleaned.

   • Rotate the tip clockwise 10 revolutions while applying varying pressure to create a

gentle pumping action where the tip contacts the ferrule.

- Discard the CCTP stick after using both tips.

If using lint-free optical cleaning pads and isopropyl alcohol:

- Be sure to use 99% IPA that has not been contaminated.
- Dampen the wipe with the alcohol and gently wipe the exposed ferrule. Then dry the ferrule using a new optical wipe.

4 Using a can of filtered compressed air (held vertically), blow out any contaminants from the adapter.

5 Once completed, replace the adapter over the ferrule, centering it onto the alignment pin. Tighten the adapter base.

To Clean the VFL Port

1 Unscrew the adapter (counterclockwise) and pull the adapter straight out to expose the ferrule.

2 Perform one of the following:
   If using Noyes Cleaning Supplies:

- Leaning the FCC2 can back (30°), press the button on the FCC2 to fill the well.
- Dip the CCTP tip into the well of the FCC2 to dampen the tip with optical cleaning fluid.

- Place the damp tip over the ferrule to be cleaned.

- Rotate the tip clockwise 10 revolutions while applying varying pressure to create a gentle pumping action where the tip contacts the ferrule.

- Discard the CCTP stick after using both tips.

 If using lint-free optical cleaning pads and isopropyl alcohol:

- Be sure to use 99% IPA that has not been contaminated.

- Dampen the wipe with the alcohol and gently wipe the exposed ferrule. Then dry the ferrule using a new optical wipe.

- Using a can of filtered compressed air (held vertically), blow out any contaminants from the adapter.

- Replace and tighten the adapter.

Repair and Calibration

Repair of the Noyes test equipment in the field is NOT recommended.

Calibration is recommended every 12 months. Noyes' Calibration Department is in compliance with ANSI/NCSL Z540-1, ISO 10012-1, MIL STD 45662A, ISO Guide 25 and traceability to the National Institute of Standards and Technology. Call Customer Service to obtain a Service Request (S.R.) number before sending units in for calibration.

Recharging Batteries

You may charge the batteries with the M100 switched on or off by attaching an AC power adapter. Batteries can be recharged to full capacity in about 4 hours.

> **IMPORTANT!** Not all batteries are being fully charged while the M100 is in [Live] mode (Averages = 0). The M100 OTDR must be taken out of the [Live] mode to fully charge the batteries.

1 Plug the AC adapter/charger into a standard wall outlet.

2 Connect the AC adapter/charger to the Power port located on the M100 left side panel (refer to Figure 2-2, page 7).

3 The [Charging] LED on the top panel will turn on.

4 Charge batteries for approximately 4 hours or until The [Charging] LED turns off.

Note: If used occasionally, the M100 may be left connected to an AC power adapter to maintain batteries at full charge.

Section 6: Troubleshooting

Memory Recovery Procedure (M100 powers up in the "PDA" mode)

When the M100 is fully charged, the M100 software is stored in the PDA memory for at least 2 weeks (up to 4 weeks). To maintain the M100 software stored in the PDA memory, charge the M100 continuously or overnight once a week. If an M100 is not charged for about one month, it may power up in the "PDA" mode. If this happens, you will need to restore the M100 software.

IMPORTANT! With the unit turned OFF, use the supplied AC adapter to charge your M100 for at least one hour BEFORE performing the Memory Recovery Procedure.

• Press the [Reset] button immediately after turning the unit ON to keep the unit from shutting down. Repeat until the unit stays ON if needed.

• Tap the screen to set up the PDA. Use the stylus provided with the M100 or equivalent to tap the display, do not use a sharp object.

• Follow the instructions to align screen. You will have to tap the screen several times.

• Follow the tutorials on the stylus and pop-up menus. Tap the [NEXT] button at the bottom of each screen to continue.

• On the Location screen select your nearest city and your time zone. Tap [NEXT]. Setup is complete; tap the screen. You should see the PDA main screen.

1 Wait until the M100 screen displays: " Installing M100...". Tap [OK].

Note: Do not input anything or tap the screen.

2 The M100 screen will display: "Installing Noyes M100". You will be prompted to set the date, time, and time zone after the firmware is loaded.

3 To set the date:

- To set the year, tap the year and use either [▲] or [▼] arrow to display the correct year.

- To set the month, tap either [▲] or [▼] arrow to display the correct month.

- To set the day, tap the correct day on the displayed calendar.

4 To set the time:

- To set the AM/PM, tap the AM/PM indicator, and then tap either [▲] or [▼] arrow to display the correct indicator.

- To set the hour, tap the hour, and then tap the [▲] or [▼] arrows to increase or decrease the value.

- To set the minutes, tap the minutes, and then tap the [▲] or [▼] arrows to increase or decrease the value.

- To set the seconds, tap the seconds, and then tap the [▲] or [▼] arrows to increase or decrease the value.

5 To set Time Zone:

- On the "Time Zone" row, tap the [▼] arrow to display the drop-down list and use either [▲] or [▼] arrow to locate the time zone.

- Tap on the proper time zone to select it.

6 Tap [Apply] when all settings are complete.

7 Tap [OK].

8 Press the ⏻ - [Power] key to turn the unit On in the M100 mode.

Software "locks - up"

- If the M100 software "locks-up" ("frozen" display), press the [Reset] button located on the right side of the M100 (refer to Figure 2-2, page 7).

- If the M100 remains unresponsive, press and hold the [Reset] button for about 15 seconds.

- If after pressing the [Reset] button for 15 seconds, the M100 remains unresponsive, perform the following:

  Power the M100 Off. Remove the batteries from the M100 for about 10 minutes before re-installing them. Perform the "Memory Recovery Procedure" described above.

Low Battery Messages

If the M100 is powered up without recharging, the following screens may be displayed.

Warning (ok)	Main Batteries Very Low (ok)
⚠ Due to high current demand by the hardware, the system powered down in order to protect memory contents. To continue operation, make the display dimmer, avoid using sound playback, card and other high power consumption functions, use the AC adapter for power, or charge batteries.	❗🔋 To prevent possible data loss, replace or recharge your main batteries according to the owner's manual

If after the M100 batteries are fully recharged the warning screens are still displayed, do the following.

1 Tap [OK] to close each warning screens.

2 When warning screens are closed, the [Main PDA] screen is displayed.

Note: If the warning screen cannot be removed, press the [Reset] button located on the right side of the M100 (refer to Figure 2-2, page 7).

3 Press the ⏻ - [Power] key to turn the M100 Off.

4 Press the ⏻ - [Power] key again to turn the unit On in the M100 mode.

Section 7: Specifications

M100 Specifications

M100 OTDR	Multimode	Single-mode
Emitter type	Laser	Laser
Safety class	Class I, FDA 21 CFR 1040.10 & 1040.11	Class I, FDA 21 CFR 1040.10 & 1040.11
Center wavelengths	850/1300 nm	1310/1550 nm
Wavelength tolerance	± 20 / ± 30 nm	± 30 / ± 30 nm
Dynamic range (SNR = 1)	21/23 dB @ 1 µs, 3 min. test	26/ 26 dB @ 10 µs, 3 min. test
Event dead zone [1]	6 m	6 m
Attenuation dead zone [2]	20 m	20 m
Pulse width	30 ns, 100 ns, 300 ns, 1 µs	30 ns, 100 ns, 300 ns, 1 µs, 3 µs, 10 µs
Distance ranges	300 m to 20 km (40 km at 1300 nm only)	300 m to 160 km
Group Index of Refraction adjustment range	1.4000 to 1.6000	
Trace file format	Bellcore GR-196, Version 1.1	

M100 OTDR	Multimode	Single-mode
Trace file storage medium	CompactFlash™ Type 1 memory card	
Trace file storage capacity	> 200 per 16 MB CF memory card	
Distance accuracy	$\Delta L = \pm (dl + L \cdot \Delta n / n + 5 \cdot 10^{-5} L)$, where: $dl = 3$ m at the 20 km range, 6 m at 40 and 80 km, and 12 m at 160 km L = length of fiber under test in meters n = fiber group index of refraction (GIR) Δn = GIR setting error	

Visual Fault Locator

Emitter type	Laser
Safety class:	Class II complies with FDA 21 CFR 1040.10 & 1040.11 except for deviations pursuant to Laser Notice No. 50. 7/26/01
Wavelength	650 nm
Output power (nominal)	0.8 mW into 9/125 µm single-mode or multimode optical fiber

[1] 1.5 dB down from each side of the peak, -40 dB reflective event, 30 ns pulse width

[2] To within 0.5 dB of backscatter, -40 dB reflective event, 30 ns pulse width

General specifications

Size (H x W x D)	190 x 100 x 70 mm (7.5 x 4 x 2.75 inches)
Weight	1.2 kg (2.6 lb)
Operating temperature	0 °C to + 40 °C
Storage temperature	-10 °C to + 60 °C
Relative humidity	0 to 95%, non-condensing
Power	Rechargeable NiMH or 110/220 VAC 50/60/Hz adapter
Battery life	> 2 hours
AC adapter	5.9 VDC, 2A (center positive)

AC Adapter Input

Regulated, center positive

$\ominus$——————C——————$\oplus$ **5.9 VDC, 2A**

Appendix: ImageMate™ USB 2.0 Reader/Writer

The ImageMate USB Reader/Writer is a single slot, Hi-Speed reader and writer that connects to your computer's USB 2.0 port. The ImageMate USB 2.0 provides the ability to read data from the CompactFlash™ memory card used with the M100 OTDR.

Removing media

IMPORTANT! Never remove the media when the RED ACTIVITY LED is FLASHING, BLINKING.

To remove windows media:

1 Open **My Computer.**

2 Right click on the corresponding drive icon.

3   Select **Eject.** (This is not applicable for Windows 98SE)

4 Pull the media out of the slot.

Disconnecting

You don't need to shut down your computer to disconnect the ImageMate USB Reader/ Writer, but you should never remove the device from the USB port without first reading the steps below. If a drive window is open or the ImageMate USB 2.0 Reader/ Writer is active, close any associated windows before attempting to remove the Reader/ Writer.

Use the **[Safe to Remove Hardware]** hotplug icon in the notification area of the taskbar

or Control Panel > Add/Remove Hardware to safely remove the device before unplugging. The notification area is to the right of the taskbar where you usually see the current time displayed.

These steps are not required for Windows 98SE or Windows XP.

1 In the notification area, right-click on the **[Safe to Remove Hardware]** hotplug icon.

2 Select the device you want to unplug, and then click [**Stop**].

3 When Windows notifies you that it is safe to do so, unplug the Reader/ Writer from your computer.