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# FIBER QUICKMAP™

## Multimode Troubleshooter

## Users Manual

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## **LIMITED WARRANTY AND LIMITATION OF LIABILITY**


Fluke Networks mainframe products will be free from defects in material and workmanship for one year from the date of purchase, unless stated otherwise herein. Parts, accessories, product repairs and services are warranted for 90 days, unless otherwise stated. Ni-Cad, Ni-MH and Li-Ion batteries, cables or other peripherals are all considered parts or accessories. This warranty does not cover damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Fluke Networks' behalf.

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## Introduction

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The FIBER QUICKMAP™ Multimode Troubleshooter does these tests to help you find incidents on multimode fiber optic cables:

- Maps the connections in multimode fiber plants by showing the number of incidents on the fiber and the distance to each incident.
- Measures the length of multimode fiber optic cables
- Measures the distance to reflective and loss incidents
- Measures the reflectance of connectors

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## Registering Your Product

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When you register your product with Fluke Networks you get access to valuable information on updates, troubleshooting procedures, and other support services.

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## The Fluke Networks Knowledge Base

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The Fluke Networks Knowledge Base gives answers to typical questions about Fluke Networks products and includes information on technology and procedures for network and cable tests.

## Symbols

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	Warning or Caution: Risk of damage to or destruction of equipment or software. See explanations in the manual.
	Warning: Risk of electrical shock.
	Warning: Class 1 laser. Risk of damage to your eyes caused by hazardous radiation.
	Conforms to relevant European Union directives
	Conforms to relevant Australian standards
	Listed by the Canadian Standards Association CSA C22.2 No. 61010.1.04
	Conforms to FCC Rules, Part A, Class A
	Do not put products that contain circuit boards into waste containers. Refer to local regulations for disposal procedures.
	This key turns the Product on and off.

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## Safety Information

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### Warning: Class 1 Laser

To prevent possible damage to your eyes caused by hazardous radiation:

- Do not look directly into optical connectors. Some optical equipment emits invisible radiation that can cause permanent damage to your eyes.
- Do not turn on the troubleshooter unless a fiber is attached to the port.

- Do not use a magnifying device to look at the optical outputs without the correct filter.
- Use of controls, adjustments, or procedures that are not in this manual can cause exposure to hazardous radiation.

 **Caution**

To prevent damage to fiber connectors, to prevent data loss, and to make sure that your test results are as accurate as possible:

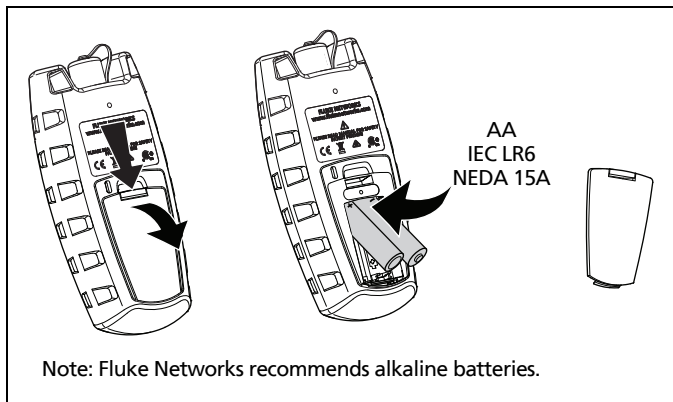
- Do not connect APC connectors to the troubleshooter. An APC connector will cause damage to the fiber endface in the connector on the troubleshooter.
- Use only test cords that comply with GR-326-CORE specifications and have UPC connectors. Other test cords can cause unreliable measurements.
- Use the correct procedures to clean all fiber connectors before each test. If you do not do this or if you use incorrect procedures, you can get unreliable test results and can cause permanent damage to the connectors.
- Put protective caps on all connectors when you do not use them.
- Do not connect the troubleshooter to a network that is on. If you do, the troubleshooter can cause problems in the network.
- If ACTIVE LINE blinks, immediately disconnect the troubleshooter from the fiber. Optical power levels more than +7 dBm can cause damage to the detector in the troubleshooter.

- The troubleshooter senses optical signals only at 850 nm. If there might be signals at other wavelengths on a fiber, use a different instrument to make sure that the fiber is not active before you connect the troubleshooter to the fiber.

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## Battery Installation and Life

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**Figure 1. How to Install the Batteries**

The troubleshooter can do approximately 1500 tests before you must replace the batteries.

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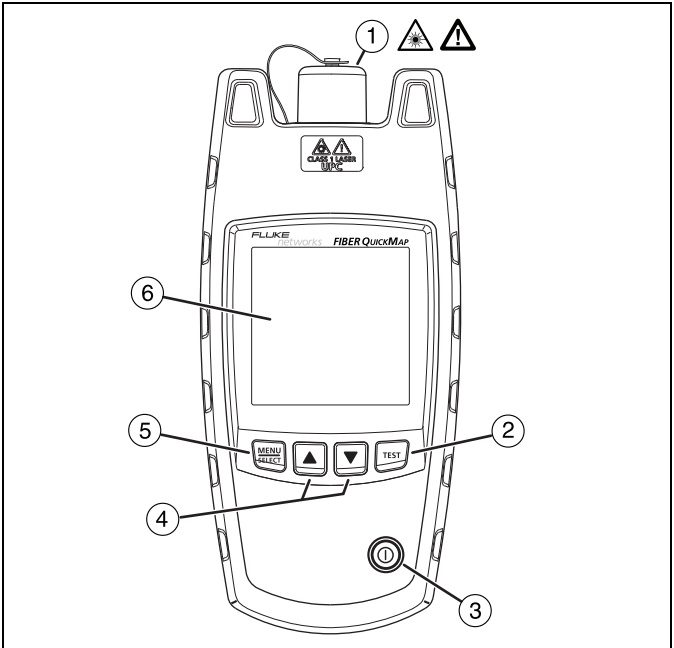
## Physical Features

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See Figure 2.

- ① Output port with SC adapter and UPC endface
- ② Starts a test
- ③ On/off key
- ④ Navigation keys

- ⑤ Press to see the setup menu, to select an item, and to save a setting
- ⑥ LCD display

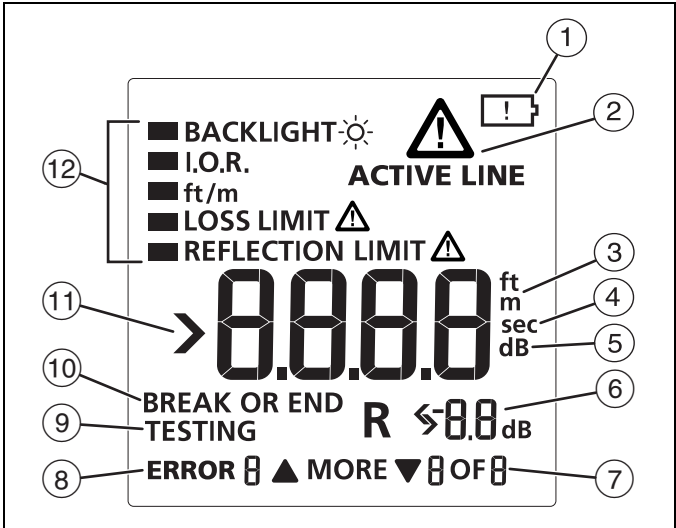


gbw04.eps

**Figure 2. Physical Features**



## Display Features



gbw01.eps



Figure 3. Display Features

- ① When the low battery symbol shows, replace the batteries soon. See page 4.
- ② When you press **TEST**, the troubleshooter looks for an 850 nm optical signal on the fiber. If there is an 850 nm signal stronger than -15 dBm on the fiber, **ACTIVE LINE** blinks and the troubleshooter will not do a test.

### ⚠ Caution

If **ACTIVE LINE** blinks, immediately disconnect the troubleshooter from the fiber. Optical power levels more than +7 dBm can cause damage to the detector in the troubleshooter.








The troubleshooter senses optical signals only at 850 nm. If there might be signals at other wavelengths on a fiber, use a different instrument to make sure that the fiber is not active before you connect the troubleshooter to the fiber.

- ③ The digits show the fiber length in feet or meters.
- ④ Shows when you look at the setting for the backlight timer. The setting is in seconds.
- ⑤ Shows when you look at the setting for the reflection limit. The setting is in decibels.
- ⑥ **R**: Shows the reflectance of an incident on the fiber. The measurement is in decibels.
- ⑦ **▼ MORE ▲**: Shows when the troubleshooter finds more than one incident. Press   to see the reflectance of the incidents. The numbers show the number of the incident and the total number of incidents.
- ⑧ **ERROR**: Shows an error number for error conditions.
- ⑨ **TESTING**: Shows as the troubleshooter does a test.
- ⑩ **BREAK OR END**: Shows when the troubleshooter shows the distance to a break or the end of the fiber.
- ⑪ **➤**: Shows when the length is more than the range of the troubleshooter. See page 19.
- ⑫ Settings for the troubleshooter. **LOSS LIMIT** and **REFLECTION LIMIT** blink after a test if a measurement exceeded the limit you select.

## Settings

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To change the settings on the troubleshooter:

- 1 Press .
- 2 To select a setting to change, press , then press .
- 3 Use   to change the setting.
- 4 Press  or  to save the setting.

### BACKLIGHT

The display backlight turns off if you do not press a key for the period of time shown. You can set the time to 15 to 60 seconds in increments of 5 seconds.

### I.O.R. (index of refraction)

The index of refraction is the ratio of the speed of light in a vacuum to the speed of light in a fiber. The troubleshooter uses the index of refraction to calculate length. If you increase  $n$ , the calculated length decreases. The default is 1.496. This value is satisfactory for most fibers.

### ft/m

Select feet or meters as the unit for length measurements.

### LOSS LIMIT

Sets the minimum value of power loss for incidents that the troubleshooter shows an incident. You can select a value from 0.50 dB (lower loss) to 6.10 dB (higher loss) in 0.2 dB increments. The default is 0.70 dB.

#### *Note*

*When you change the loss limit, the troubleshooter also applies the new limit to the results shown from a previous test.*

### REFLECTION LIMIT

Sets the minimum size of a reflection that the troubleshooter shows as an incident or the end of the fiber. You can select a value from -20 dB (larger reflection) to -45 dB (smaller reflection) in 5 dB increments. The default is -35 dB.

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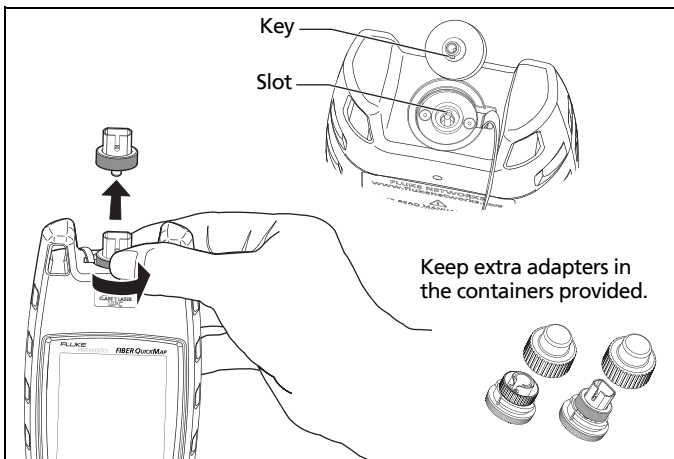
## The Connector Adapter

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You can change the SC connector adapter to connect to LC, ST, or FC fiber connectors. See Figure 4.

### Caution

**Turn only the collar on the adapter. Do not use tools to remove or install the adapters.**



gbw08.eps

**Figure 4. How to Remove and Install the Connector Adapter**

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## How to Clean Connectors

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Fluke Networks recommends that you use a mechanical device to clean connectors. See Figure 5. If you do not have such a device, use other optical-grade supplies to clean connectors. Use a video microscope, such as the Fluke Networks FI-7000 FiberInspector™ Pro, to inspect connectors.

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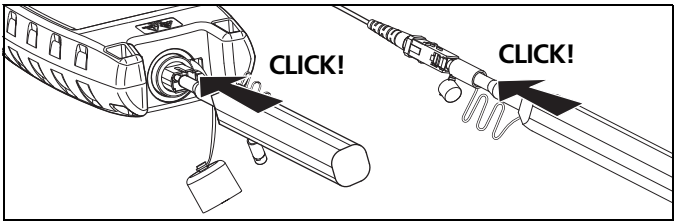
## How to Use a Mechanical Device

### Caution

**To prevent damage to the device and to connectors, read all instructions and obey all safety precautions given by the manufacturer of the device you use to clean connectors.**

- 1 Use a video microscope to inspect the connector. If it is dirty, continue to step 2.
- 2 To clean a bulkhead connector, remove the device's cap. To clean the connector on a fiber cable, remove only the tip of the cap.
- 3 If necessary for a bulkhead connector, extend the tip of the device.
- 4 Push the device straight into the connector until you hear a loud click. See Figure 5. Then remove the device.
- 5 Use a video microscope to inspect the connector. If necessary, clean and inspect the connector again.

If the mechanical device does not clean the connector sufficiently, use a swab and solvent to clean the connector.



**Figure 5. How to Use a Mechanical Device to Clean Connectors**

## How to Use Swabs, Wipers, and Solvent

**To clean bulkhead connectors:**

- 1 Use a video microscope to inspect the connector. If it is dirty, continue to step 2.
- 2 Touch the tip of an optical-grade solvent pen or swab soaked in solvent to a dry, optical-grade wiper.
- 3 Touch a new, dry swab to the solvent on the wiper.
- 4 Push the swab into the connector, twist it around 3 to 5 times against the endface, then discard the swab.
- 5 Dry the connector with a dry swab by twisting it around in the connector 3 to 5 times.
- 6 Use a video microscope to inspect the connector. If necessary, clean and inspect the connector again.

### To clean connector ends:

- 1 Use a video microscope to inspect the connector. If it is dirty, continue to step 2.
- 2 Touch the tip of an optical-grade solvent pen or swab soaked in solvent to a dry, optical-grade wiper.
- 3 Rub the connector endface across the solvent spot, then back and forth once across the dry area of the wipe or card. Typically, one or two short strokes (~ 1 cm or ~0.4 in) are sufficient to dry the endface.
- 4 Use a video microscope to inspect the connector. If necessary, clean and inspect the connector again.

#### *Note*

*A different procedure is necessary to clean some connector styles (for example, VF-45).*

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## Protect Connectors

Always put protective caps on connectors that you do not use. Clean the caps periodically with a swab or wipers and fiber optic solvent.

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### About Launch and Receive Fibers

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Launch and receive fibers give the troubleshooter a better view of the first and last connectors in the link. If you do not use a launch fiber, the troubleshooter cannot detect the loss of the first connector in the link. If you do not use a receive fiber, the troubleshooter cannot detect the loss of the last connector in the link. Also, the reflectance measurement for the first and last connectors will be inaccurate. Fluke Networks recommends that you use launch and receive fibers. The fibers must have a minimum length of 30 m (98 ft).

When you use launch and receive fibers, be sure to subtract their lengths from the length measurement to get the actual length of the fiber you are testing.



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## How to Use the Troubleshooter

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*Note*

*Always use test cords that comply with GR-326-CORE specifications and have UPC connectors. Other cords can cause unreliable measurements.*

- 1 Clean all fiber connectors.
- 2 Connect the fiber to the troubleshooter, as shown in Figure 6.

*Note*

*Use launch and receive fibers if you connect to spooled fiber that is terminated with connectors.*

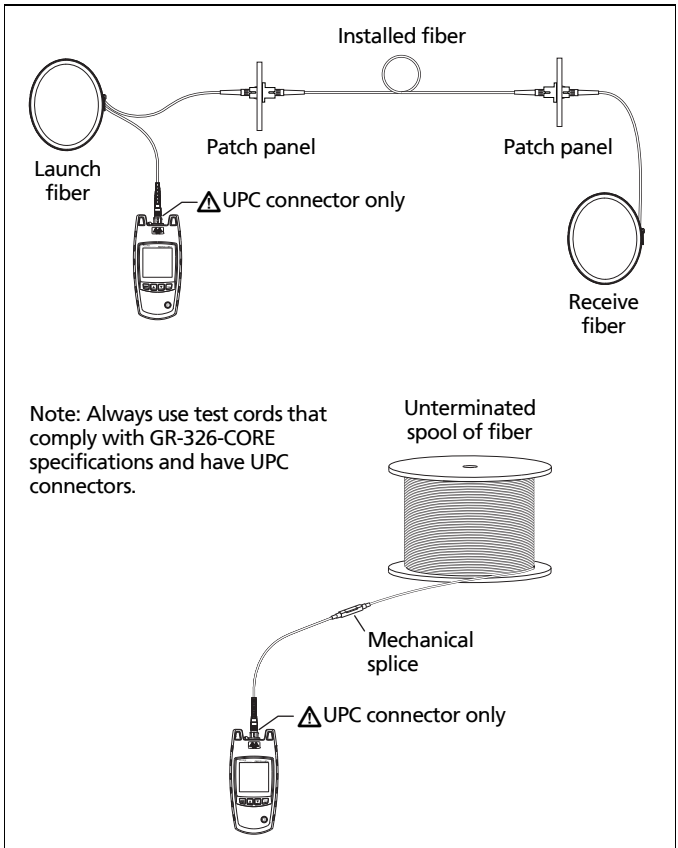
- 3 Turn on the troubleshooter, then press .

*Note*

*After you turn on the troubleshooter, it shows PASS for a short time to show that it operates correctly.*

 **Caution**

**If ACTIVE LINE blinks, immediately disconnect the troubleshooter from the fiber. Optical power levels more than +7 dBm can cause damage to the detector in the troubleshooter.**



Note: Always use test cords that comply with GR-326-CORE specifications and have UPC connectors.

gbw05.eps

**Figure 6. How to Make Connections**

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## Measurement Results

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The troubleshooter measures the reflectance of incidents on the fiber and the distance to the incidents. A reflective incident will most frequently be the end of the fiber, a break in the fiber, or a connector.

The troubleshooter shows the distance to loss incidents that are higher than the limit you selected. A loss incident can be a connector, a bad splice, a crack, or a sharp bend in the fiber.

After a test, the troubleshooter shows the distance to the end of the fiber or to a break. If there is a break in the fiber, the troubleshooter does not show incidents after the break.

If the troubleshooter shows ▼ **MORE** ▲, it found one or more reflective or loss incidents before the end of the fiber or the break. Press ▲ ▼ to see the distance to the other incidents. See Figures 7 and 8.

### *Note*

*Be sure to subtract the lengths of the launch and receive fibers from the results.*

If the reflectance or loss of a connection is higher than the limit:

- A connector endface is dirty or damaged.
- A connector is loose.
- The cable is damaged within about 3 m of the connector.
- The connection is between fibers of different types.
- The fiber has a bad splice or a sharp bend.

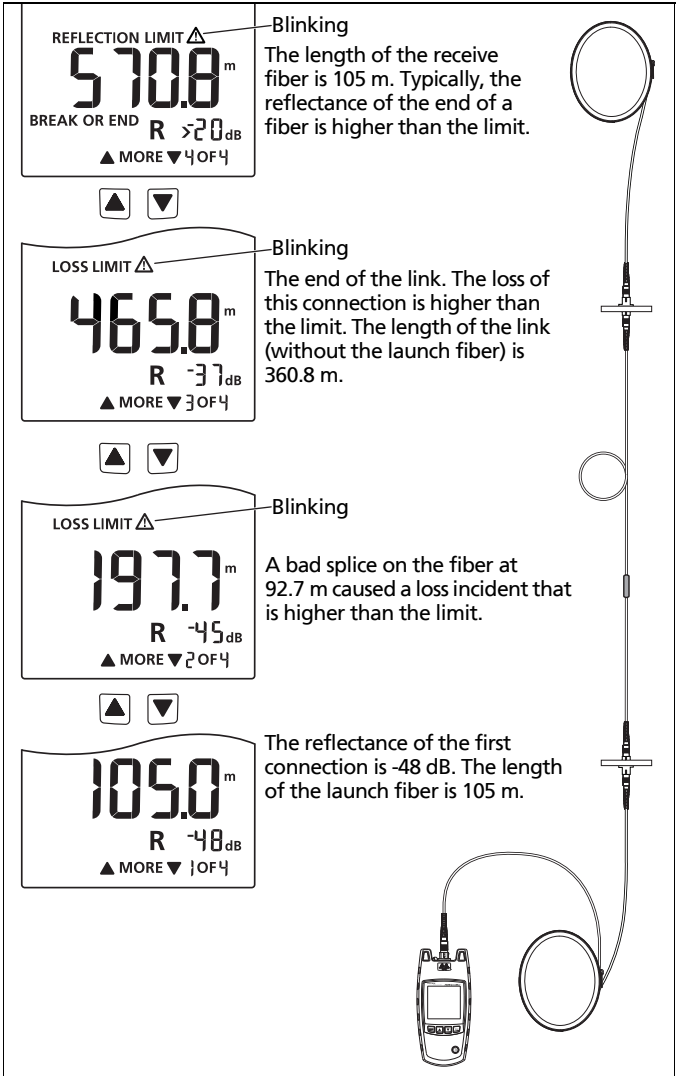
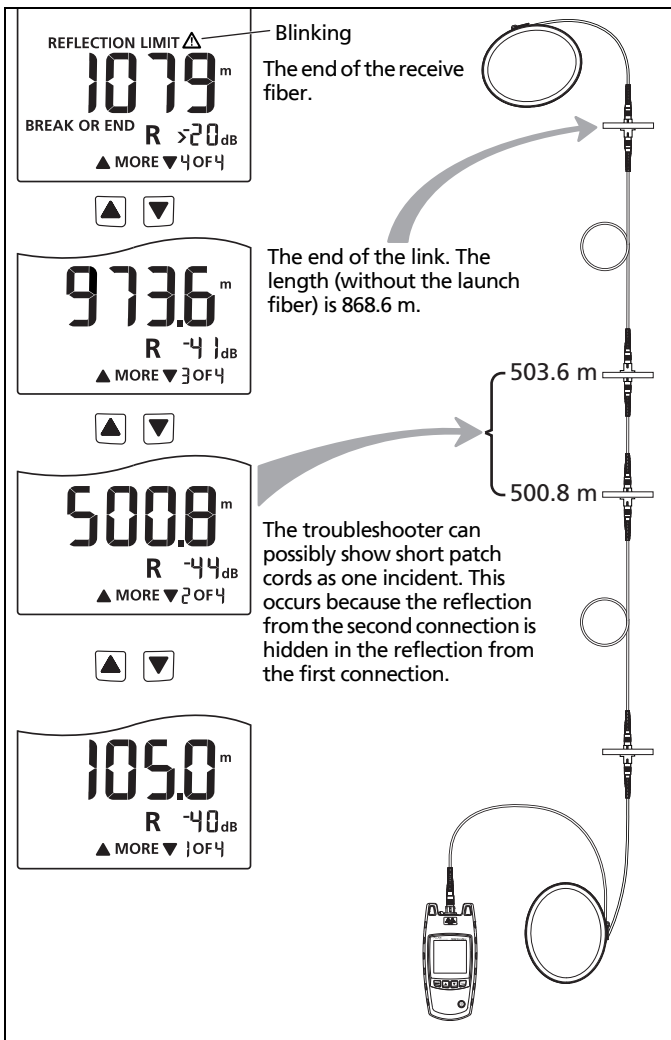


Figure 7. Examples of Results

gbw02.eps



gbw03.eps

Figure 8. Results from a Link with a Short Patch Cord

The troubleshooter can show these results in the given situations:

**The troubleshooter shows 0 m, 0 ft, or a very short length.**

- The connection to the troubleshooter is bad.
- The connector on the troubleshooter or the fiber is dirty. See page 12 for instructions on how to clean the connectors.
- A break, bad connection, or the end of the fiber is less than approximately 1 m from the troubleshooter.
- The troubleshooter is connected to a PC connector. PC connectors cause large reflections that the troubleshooter shows as the end of the fiber.

**The troubleshooter shows > 1500 m or > 4921 ft.**

The fiber is longer than the troubleshooter can measure.

**The troubleshooter shows < -55 dB for a reflectance measurement.**

The troubleshooter does not show an exact measurement for very small reflective incidents less than -55 dB.

**The length measurement is incorrect.**

- The I.O.R. (index of refraction) is incorrect. See page 8.
- The fiber is very short (approximately 1 m or less). The condition of the connectors on the meter and the fiber can affect length measurements on short fibers.

**The total number of incidents shows 9, and the 9 is blinking.**

- There are more than 9 incidents on the fiber. To see the incidents, do a test from the other end of the fiber.

## Maintenance

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To clean the display, use lens cleaner and a soft, lint-free cloth. To clean the case, use a soft cloth that is moist with water or water and a weak soap.

### Caution

To prevent damage to the display or the case, do not use solvents or abrasive materials.

To clean the optical connector, use the procedure given on page 10.

### Warning

To prevent possible fire, electrical shock, personal injury, or damage to the troubleshooter:

- Do not open the case. You cannot repair or replace parts in the case.
- Use only replacement parts that are approved by Fluke Networks.
- If you replace parts that are not specified as replacement parts, the warranty will not apply to the product and you can make the product dangerous to use.
- Use only service centers that are approved by Fluke Networks.

#### Note

If the troubleshooter shows **ERROR 2**, servicing is necessary. Speak to a Fluke Networks representative. See page 21.

## Options and Accessories

## Specifications

Specifications are typical.

<b>Operating temperature with the battery</b>	0°C to 50°C
<b>Non-operating temperature</b>	-20°C to 60°C
<b>Operating relative humidity (without condensation)</b>	95% (10°C to 35°C) 75% (35°C to 40°C) uncontrolled < 10°C
<b>Vibration</b>	Random, 5 Hz to 500 Hz, MIL-PRF-28800F CLASS 2
<b>Shock</b>	1 meter drop test
<b>Safety</b>	CSA C22.2 No. 61010.1:04 EN 61010-1 2nd Edition 2001 EN60825-1,2:2006
<b>Altitude</b>	3000 m
<b>EMC</b>	EN 61326-1: 2004
<b>Battery type</b>	2 AA alkaline batteries (no battery charger)
<b>Battery life</b>	1500 tests (typical)
<b>Laser safety</b>	Class 1 CDRH Complies to EN 60825-2
<b>LCD type</b>	Backlit black and white (segments)



<b>Index of refraction range</b>	1.45 to 1.5 (factory default is 1.496)
<b>Auto turn off</b>	Automatically turns off after 5 minutes if no keys are pressed. Backlight turns off first.
<b>Factory calibration interval</b>	None
<b>Output wavelengths</b>	850 nm $\pm$ 10 nm
<b>Laser classification</b>	Class 1 CDRH Complies to EN 60825-2
<b>Dynamic range</b>	>11 dB
<b>Maximum distance</b>	1500 meters or 4921 feet
<b>Maximum number of incidents shown</b>	9
<b>Distance accuracy (0 m to 1500 m or 0 ft to 4921 ft)</b>	$\pm$ (1 m + 0.1 % x length) for reflective incidents <sup>1</sup> $\pm$ (3 m + 0.1 % x length) for non-reflective incidents <sup>2</sup>
<b>Testing speed</b>	< 6 seconds typical
<b>Connector</b>	Removable/cleanable SC adapter, UPC polish
<b>Fiber types tested</b>	50/125 $\mu$ m or 62.5/125 $\mu$ m multimode
<b>Detection of reflective incidents<sup>3</sup></b>	-35 dB default threshold (User selectable: -20 dB to -45 dB in 5 dB increments)
<ol style="list-style-type: none"> <li>1. <math>\pm</math> user-configurable Index of Refraction (IOR) error <math>\pm</math> the incident location error. Incident location error for reflective incidents: <math>\pm</math>1 m from 1 m to 1.5 km.</li> <li>2. <math>\pm</math> user-configurable Index of Refraction (IOR) error <math>\pm</math> the incident location error. Incident location error for non-reflective incidents: <math>\pm</math>2 m for lengths <math>\leq</math>15 m, otherwise <math>\pm</math>1 m.</li> <li>3. Finds and gives the location of an incident that has a reflectance larger than -55 dB. Detects incidents &gt;1 m after the bulkhead connector when the bulkhead reflectance is &lt;-35 dB. Detects incidents &gt;6 m (typical) after an incident when the incident reflectance is &lt;-35 dB.</li> </ol>	

-continued-

<b>Reflectance accuracy<sup>4</sup></b>	± 4 dB
<b>Maximum reflectance measurement</b>	-20 dB
<b>Detection of loss incidents<sup>5</sup></b>	0.70 dB default threshold (user-configurable from 0.5 dB to 6.1 dB in 0.2 dB increments)
<b>Bulkhead quality</b>	If no fiber is attached or if the connector is dirty, the troubleshooter displays 0 m or 0 ft.
<b>Live fiber detection</b>	Detects optical signals from 600 nm to 1050 nm and shows <b>ACTIVE LINE</b> if a signal is there. Looks for a signal every 3 seconds after the first detection. +7 dBm maximum input power.
<p>4. With a backscatter coefficient of -63 dB at 850 nm using a calibrated -14 dB reference.</p> <p>5. Detects incidents &gt;20 m (typical) after the bulkhead connector or any prior incident when the bulkhead reflectance is &lt;-35 dB and the reflectance of any prior incident is &lt;-35 dB. The maximum link loss prior to the incident is &lt;7 dB.</p>	