

TFS-2000™ Series

Optical Time Domain Reflectometers

TFS-2225 - Dual Wavelength (850/1300 nm)

TFS-2250 - Dual Wavelength (1310/1550 nm)

TFS-2500 - Quad Wavelength (850/1300/1310/1550 nm)

Operation Manual



Avoid exposure Laser Radiation Emitted from the Aperture
This product conforms to CDRH standards for laser products
Per 21 CFR 1040.10 & 1040.11

think ahead.

Trilithic Company Profile

Trilithic is a privately held manufacturer founded in 1986 as an engineering and assembly company that built and designed customer-directed products for telecommunications, military, and industrial customers. From its modest beginnings as a two-man engineering team, Trilithic grew over the years and broadened its offerings of RF and microwave components by adding broadband solutions to its product line. This was accomplished with the acquisition of components manufacturer Cir-Q-Tel and instruments manufacturer Texscan.

Today, Trilithic is an industry leader providing telecommunications solutions for major broadband, RF, and microwave markets around the world. As an ISO 9000:2001 certified company with over 40 years of collective expertise in engineering and custom assembly, Trilithic is dedicated to providing quality products, services, and communications solutions that exceed customer expectations.

Trilithic is comprised of five major divisions:

- **Broadband Instruments and Systems**
Offers test, analysis, and quality management solutions for the major cable television systems worldwide.
- **RF Microwave Components**
Provides components and custom subsystems for companies specializing in cellular, military, and other wireless applications.
- **Emergency Alert Systems**
Leading supplier of government-mandated emergency alert systems used by broadcast TV, cable TV, IPTV, DBS, and radio stations.
- **XFTP**
Offers a specialty line of field technical products for cable operators and technicians, as well as a line of products for installing electronics in the home of the future.
- **Network Services**
Provides network data management and support services to safeguard and protect your network and data by employing certified, experienced, and dedicated network engineers.

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Chapter 1

General Information

Helpful Website

The following website contains general information which may be of interest to you:

<http://www.trilithic.com>

Trilithic's website contains product specifications and information, tips, release information, marketing information, Frequently Asked Questions (FAQs), bulletins and other technical information. You can also check this website for product updates.

Where to Get Technical Support

Trilithic technical support is available Monday through Friday from 8:00 AM to 5:00 PM EST. Callers in North America can dial 317-895-3600 or 800-344-2412 (toll free). International callers should dial 317-895-3600 or fax questions to 317-895-3613. You can also e-mail technical support at techsupport@trilithic.com.

For quicker support response when calling or sending e-mail, please provide the following information:

- Your name and your company name.
- The technical point of contact (name, phone number, e-mail).
- Product name, model number, and serial number.
- A detailed description of the problem you are having, including any error or information messages.

How this Manual is Organized

This manual is divided into the following chapters:

- Chapter 1, “General Information” provides information, technical support, how this manual is organized, conventions, and safety precautions relative to the TFS-2000 Series Optical Time Domain Reflectometers.
- Chapter 2, “Introduction” describes the purpose, mechanical and physical features, package contents, display screen elements, and settings of the TFS-2000 Series Optical Time Domain Reflectometers.
- Chapter 3, “OTDR Operation” describes the operation, settings, and controls of the Optical Time Domain Reflectometer Application.
- Chapter 4, “LTS Operation” describes the operation, settings, and controls of the Loss Test Set Application.
- Chapter 5, “Video Scope” describes the operation of the Video Scope Application.
- Chapter 6, “Visible Fault Finder” describes the operation of the Visible Fault Locator Application.
- Chapter 8, “Appendix” describes the troubleshooting, specifications, and warranty information for the TFS-2000 Series Optical Time Domain Reflectometers.

Conventions Used in this Manual

This manual has several standard conventions for presenting information.

- Connections, menus, menu options, and user-entered text and commands appear in **bold**.
- Section names, web and e-mail addresses appear in *italics*.



A ***WARNING*** alerts you to any condition that could cause personal injury.



A ***CAUTION*** alerts you to any condition that could cause a mechanical failure or potential loss of data.



A ***NOTE*** is information that will be of assistance to you related to the current step or procedure.

Laser Safety

The TFS-2000 Series OTDR has been configured with laser diodes having central wavelengths of 850, 1300, 1310, or 1550 nm. The unit has been designed to comply with 21 CFR, *Code of Federal Regulations*, 1040.10 and 1040.11, for Class I emission limits. Although the CDRH does not consider Class 1 levels to be hazardous, we suggest limiting exposure by not looking directly into the laser aperture. Also, do not under any circumstance view or inspect the laser output fibers, connectors or the fiber under test through collimating or focusing optics unless the unit is turned off, batteries are removed and power adapter is disconnected.

The VFL is equipped with a 650 nm Class II laser.

Precautions



When working with any fiber optic test equipment or in an area with active fiber optic links, be aware there can be infrared optic energy present.



Never clean or look directly into the fiber optic connector or the end of the fiber attached to the Optical Time Domain Reflectometer or VFL unit while they are energized; to do so will expose the user to laser radiation and could result in personal injury or instrument damage.



To prevent fire or shock hazard: do not install other battery types; do not use the charger without the batteries installed; do not expose the battery charger to rain or excessive moisture; do not use the AC adapter when there are signs of damage to the enclosure or cord; ensure that you are using the correct charger for the local line voltage; do not use any other charger than the one provided with this instrument. Any other condition will void the warranty.



Before connecting to a patch cord or fiber under test, be certain the fiber has no active optical sources or instruments connected to the other end. Skin or eye damage could result from other high power sources e.g. EDFAs, or instrument damage could occur voiding the warranty.



Fiber-optic connectors are easily contaminated or damaged. The connection to the TFS-2000 Series is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at the minimum and at worst result in the need to return the TFS-2000 Series to the factory for repairs. Prior to making any connection to the unit, ensure that all proper cleaning procedures have been followed.



Do not under any circumstance view or inspect the laser output fibers, connectors, or the fiber under test through collimating or focusing optics. A video inspection microscope should be used to examine all fiber ends.

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Chapter 2

Introduction

This chapter:

- Provides an overview of the TFS-2000 Series Optical Time Domain Reflectometers
- Describes the mechanical and physical features
- Lists the display screen elements, features, and settings
- Describes the included equipment and identification of device software version number
- Describes how to charge the batteries of the device
- Identifies the physical features of the device

Overview

The Trilithic TFS-2000 Series Optical Time Domain Reflectometer is designed to test for loss over distance of a fiber optic link. This OTDR is the ideal tool for commissioning, maintenance and trouble shooting and also includes an optical Loss Test Set (LTS), Visible Fault Locator (VFL) and Video Probe feature. All controls are accessible via an 8 key weatherproof keypad with a capacitive touch/scroll wheel, offering simple, straightforward functionality. The TFS-2000 Series is housed in a rugged aluminum case and is further protected by a rubberized boot with a bright 4" color display. Trilithic offers three different models of the TFS-2000 Series Optical Time Domain Reflectometers.

- **TFS-2225** - Dual wavelength (850/1300 nm)
- **TFS-2250** - Dual wavelength (1310/1550 nm)
- **TFS-2500** - Quad Wavelength (850/1300/1310/1550 nm)

Equipment Supplied with the TFS-2000 Series

The TFS-2000 Series Optical Time Domain Reflectometers include the following equipment:

- Trilithic TFS-2000 Series Optical Time Domain Reflectometer, with protective boot and eight AA NiMH rechargeable batteries installed.
- Protective Carrying Case with Shoulder Strap
- AC to DC Universal Adapter/Charger with US, UK, European & Australian Plugs
- USB cable
- Set of interchangeable adapters, ST, SC and FC adapters for each OTDR Port and the Power Meter Port.
- Windows® compatible ToolBox software and Operation Manual on CD

Key Features

Onboard Help Feature

The TFS-2000 Series has an onboard help feature that keeps the learning curve as short as possible and facilitates field reference.

Full Featured OTDR

There is an Autotest feature for fibers of unknown length, trace analysis with pass/fail feature and dual trace capability. A Simple zoom feature and quick event selection with the active cursor makes maneuvering within a trace quick and easy. There is also an event select feature within the trace analysis table that makes returning to a particular event on the trace screen fast and accurate. Up to 1000 traces may be stored in the onboard memory and downloaded via USB/PC port to a computer or to a USB flash drive of up to 4 gigabytes in size. Traces may be viewed and reports can be generated with the supplied Windows™ compatible software.

Loss Test Set

Use the on board LTS to complete the testing requirements. The TFS-2000 Series has auto wavelength and auto test capabilities if used with another TFS-2000 Series OTDR or with a compatible Loss Test Set. Up to 4 wavelengths may be saved on a single test and downloaded for reporting purposes, using the same software as the OTDR.

Video Probe

The OTDR includes a Video Probe feature that displays a digital image of the connector end face that can be zoomed to approximately 400X. In the Zoom state, the image may be centered on the display for best viewing. Use this video scope to check a connector for cleanliness and/or damage. Store the image for later review or print it with trace documentation.

Visible Fault Locator

The VFL may be used for fiber identification or for trouble shooting by assisting in the identification of near end damage.

Model & Configuration Information

The instrument's Model, Part Number, Serial Number, Date of Manufacture, and Configuration are indicated on a label located on the bottom plate of the unit. The instrument's history is filed at the factory by part number and serial number.



Software Version Number

The software version number is accessible at start up on the lower right hand corner of the display.

Recalibration and Verification



Periodic verification of the TFS-2000 calibration is recommended to ensure that your instrument remains within specification. We recommend a recalibration and verification once a year to make certain the instrument is functioning properly and performing to its rated specifications.

The calibration feature is only available to certified Trilithic repair facilities and is password protected to prevent unauthorized calibration changes from being made.

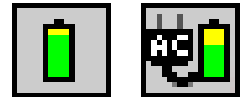


Battery Charging

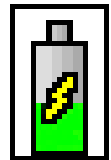
The instrument is equipped with a 100-240 VAC, 0.4 A input, universal battery charger with 13.6 VDC, 0.75 A, center positive output with interchangeable adapter plugs for US, Great Britain, Europe, and Australia. The charger is used to power the unit and recharges the unit's internal NiMH batteries (8 - AA, 2500 mAh). Depending on usage, a fully charged battery pack will typically enable 8 hours of use. Typically, fully discharged batteries require 6 to 8 hours of recharging.

Battery Level/Power Indicator

The bottom right hand corner of the screen shows the battery level and charge indicator. In the final hour of operation, the battery charge indicator will change to red. A warning indicator will sound a few minutes before the instrument automatically turns off. Ensure the unit is turned off when plugging it into the battery charger.



When the OTDR is plugged in to the battery charger, the charge indicator will be lit. The charge indicator will dim when the battery is fully charged. The battery level indicator section on the display will either have a yellow lightning bolt overlaid on the indicator or an AC Plug to the left, indicating AC power.

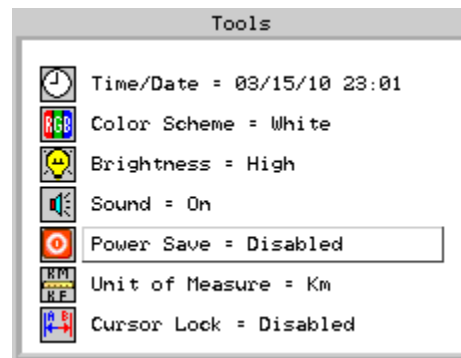
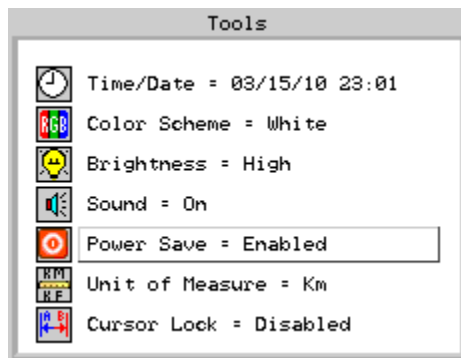


To prevent fire or shock hazard: do not install other battery types; do not use the charger without the batteries installed; do not expose the battery charger to rain or excessive moisture; do not use the AC adapter when there are signs of damage to the enclosure or cord; ensure that you are using the correct charger for the local line voltage; do not use any other charger than the one provided with this instrument. Any other condition will void the warranty.

Power Save



To toggle on and off the Power Save feature, press the **Menu** button to enter the Menu Display. Scroll to the **Tools** icon and press the **Select** button. The **Tools** dialog box will appear, scroll to the **Power Save** icon. Press the **Select** button to Enable or Disable the Power Save feature. Press the **Menu** button to close the **Tools** dialog box. When the Power Save feature is active, the instrument will automatically turn off after 15 minutes of non use.



OTDR Port Adapter Replacement

The TFS-2000 Series is supplied with three easily interchangeable adapters per OTDR port, FC (Ferrule Connector), ST (Straight Tip Connector) and SC (Square Connector). The FC connector is installed in the device at the factory. To change adapters, perform the following steps:

1. Remove the two screws that hold the adapter in place.
2. Pull the adapter straight up from the adapter receptacle.
3. Clean the exposed ferrule with an appropriate cleanser and a lint free wipe.
4. Insert the new adapter by gently pushing downward into the ferrule, being careful to properly orient the alignment pin in the adapter with the alignment hole of the adapter receptacle.
5. Replace the two screws that hold the adapter in place.



SC Adapter

ST Adapter



NOTE

When replacing the adapter with one that does not have a chained protective cap, use the small screw in place of the larger screw that retains the end of the chain to the adapter base.



NOTE

In order to maintain a low loss fiber connection, care should be taken to adequately clean the ferrule of any connector to be connected to the TFS-2000 Series. In the event that the port needs to be cleaned, the first step is to be certain that the instrument is off. We suggest the use of isopropyl alcohol and foam swabs specifically designed for cleaning connectors accepting 2.5 mm ferrules.

Power Meter Port Adapter Replacement

The TFS-2000 Series is supplied with three easily interchangeable adapters for the Power Meter Port, FC (Ferrule Connector), ST (Straight Tip Connector) and SC (Square Connector). To change adapters, perform the following steps:

1. Gently unscrew the adapter counterclockwise.
2. Pull the adapter straight up from the adapter receptacle.
3. Gently screw the adapter counterclockwise to tighten, taking care not to overtighten.



FC Adapter

SC Adapter

ST Adapter

Physical Features

Instrument Enclosure

The OTDR is packaged in a rugged aluminum housing which is further protected with a rubberized boot. Although the front panel is weather resistant, care must be taken to avoid liquids and other contaminants around the device. Use a mild cleaning agent and damp soft cloth to clean the panels and the outside case. Never open the instrument for cleaning. Return to the factory for servicing if necessary.

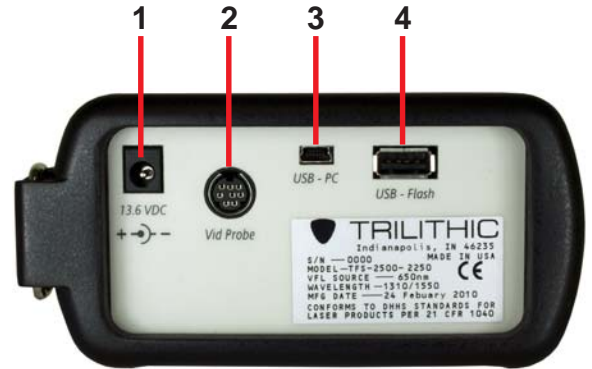
Front View

1. Charge Indicator
2. Display
3. Key Pad
4. Scroll Wheel
5. Power Button



Bottom View

1. Power Input Port (13.6 VDC)
2. Video Probe Input Port
3. USB PC Port - Use this port to connect the OTDR to a Windows PC for data analysis using the supplied ToolBox software.
4. USB Flash Drive Port - Use this port to connect to a USB flash drive to the OTDR.

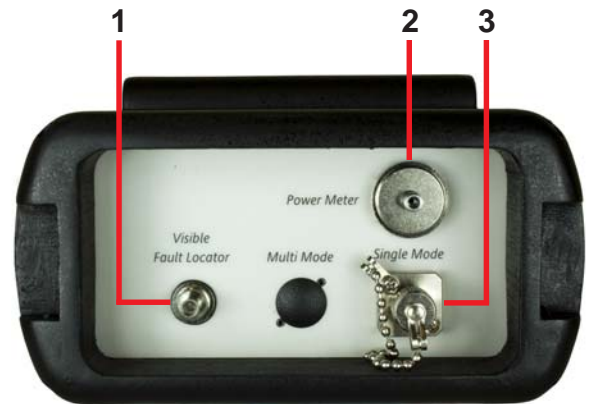


Top View (Single Mode)

1. Visible Fault Locator Laser Output
2. Power Meter Input
3. Single Mode OTDR Port

TFS-2225 - 850/1300 nm

TFS-2250 - 1310/1550 nm



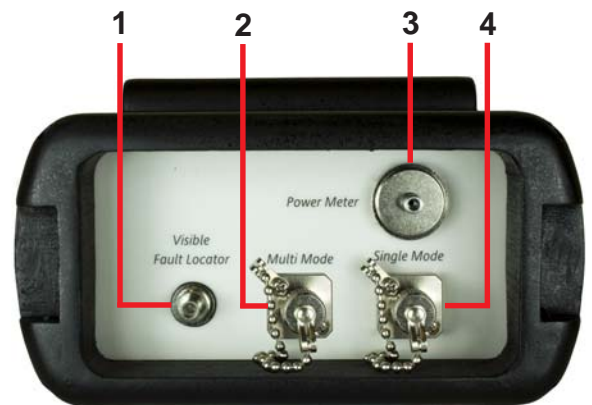
TFS-2225 & TFS-2250

Top View (Multi Mode)

1. Visible Fault Locator Laser Output
2. Multi Mode OTDR Port
3. Power Meter Input
4. Single Mode OTDR Port

TFS-2500 - 1310/1550 nm

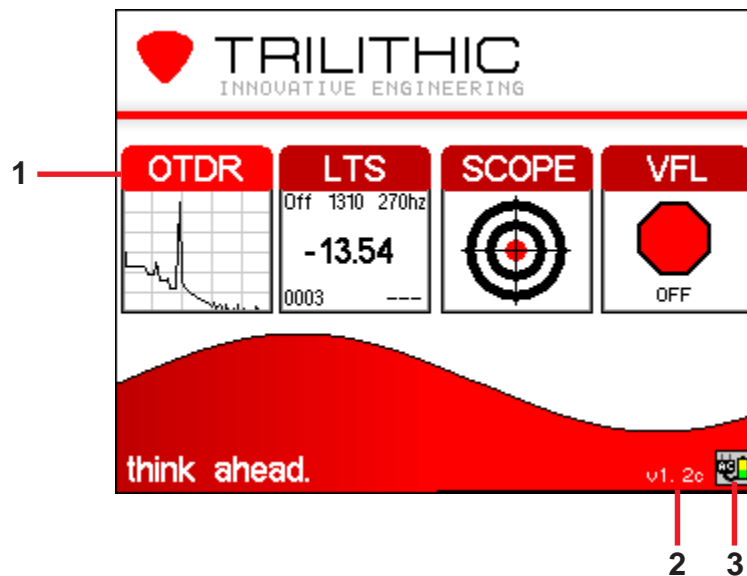
TFS-2500 - 850/1300 nm



TFS-2500

Main Display Features

The OTDR displays the following screen when it is turned on:



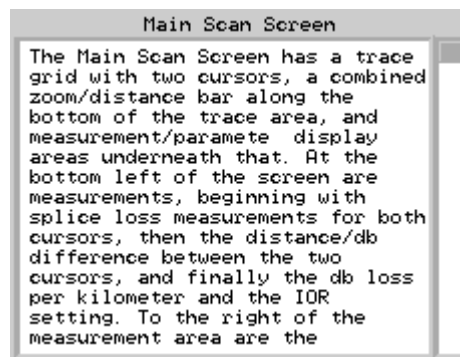
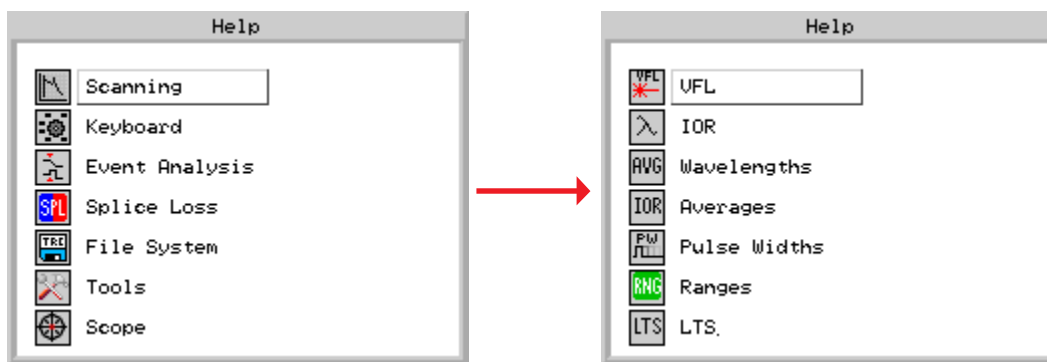
1. **Application Choices** - Use the scroll wheel to highlight the desired application, and press the **Select** button to enter the application.
2. **Version Number** - Displays the software version number.
3. **Battery Level Indicator** - Displays the battery/charging status of the device.

Onboard Help



The device has an onboard help feature. To access the help feature, press the **Menu** button. Use the scroll wheel to highlight the **Help** icon and then press the **Select** button.

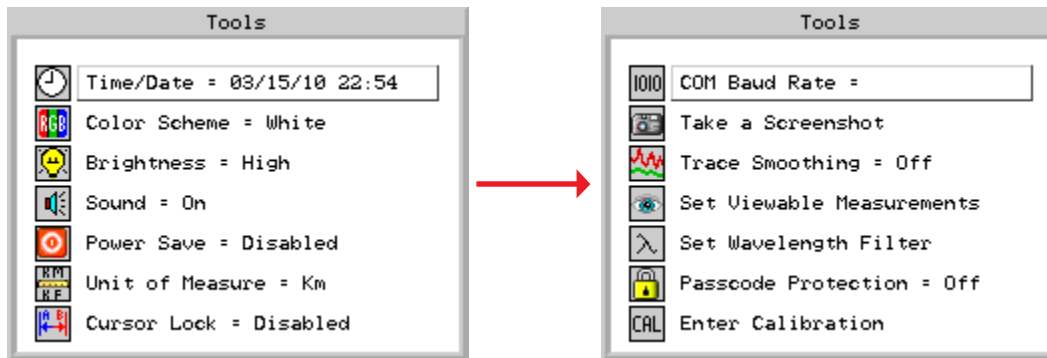
The **Help** dialog box will be displayed. Use the scroll wheel to move up and down through the list of help topics and then press the **Select** button. Press the **Menu** button again to exit the help feature.



General Setup & Preferences



To access these features and preferences, press the **Menu** button. Use the scroll wheel to highlight the **Tools** icon, and then press the **Select** button. The **Tools** dialog box will appear. Use the scroll wheel to move between settings. Press the **Menu** button to close the **Tools** dialog box.



NOTE

The Tools dialog box is only accessible from within the Optical Time Domain Reflectometer and Loss Test Set Displays.

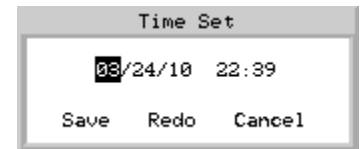
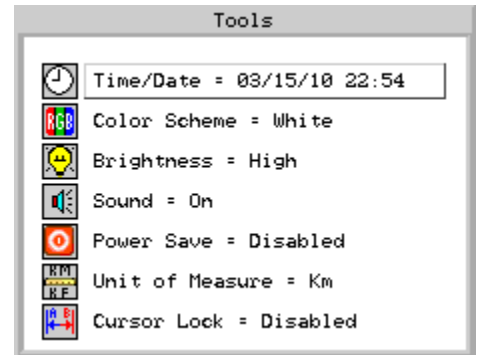
Date & Time



The TFS-2000 Series applies a time/date stamp to the saved scans. The time and date are set at the factory with a MM/DD/YY date and 24-hour format, Eastern time zone clock. This setting has a memory of approximately one month of no instrument activity. To refresh the memory, turn the instrument on for five minutes. To change the date and time, press the **Menu** button, scroll to the **Clock** icon and press the **Select** button.

The **Time Set** dialog box will be displayed.

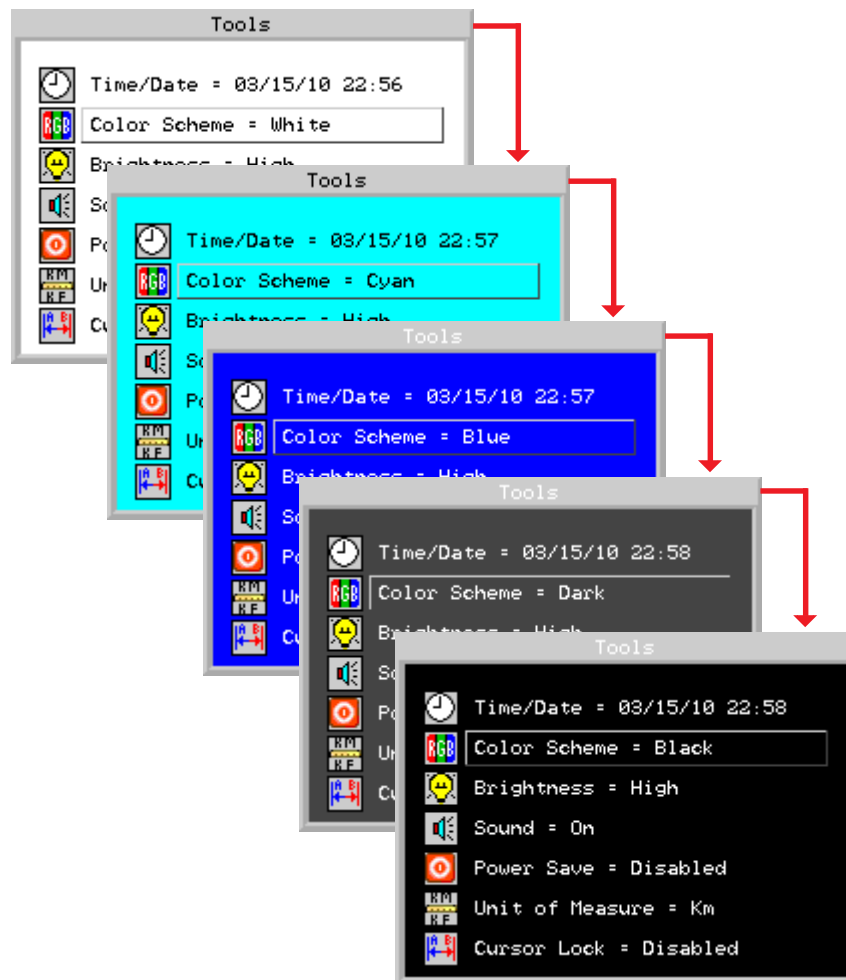
- Use the scroll wheel to adjust the value of each segment.
- Press the **Select** button to move between segments.
- Press the **Select** button again to move to the **Save/Redo/Cancel** Option.
- Use the scroll wheel to select from **Save**, **Redo**, or **Cancel** and then press the **Select** button again to complete setting the date and time.



Color Scheme



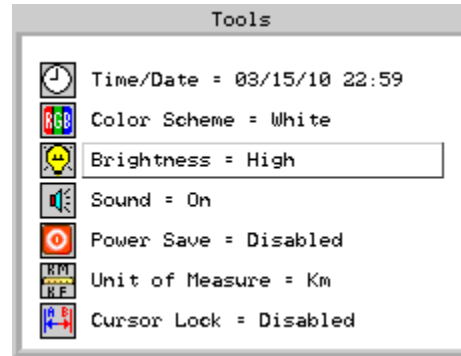
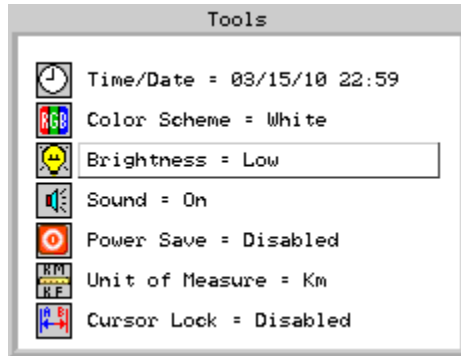
To change the color scheme of the display, scroll to the **Color Scheme** icon and press the **Select** button to toggle through the available color schemes as shown below.



Brightness



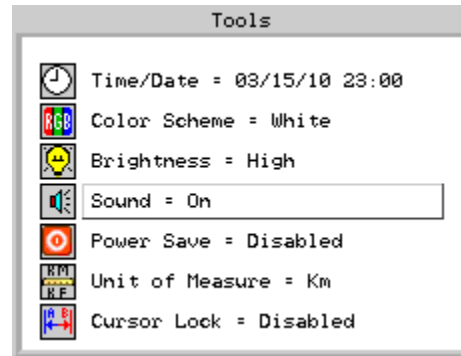
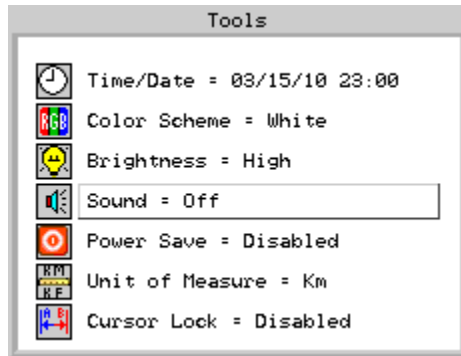
To set the brightness of the screen use the scroll wheel to scroll to the **Brightness** icon, and press the **Select** button to adjust the brightness between **Low** and **High**.



Sound



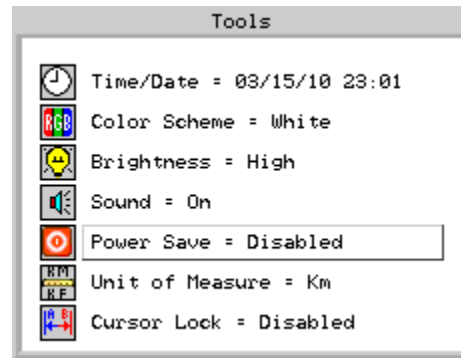
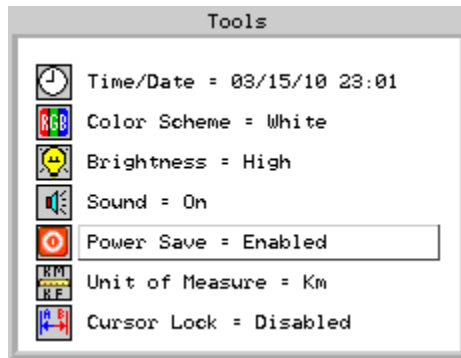
To turn on or off the button press and scroll sounds, scroll to the **Sound** icon, and press the **Select** button to toggle the sound **On** and **Off**.



Power Save



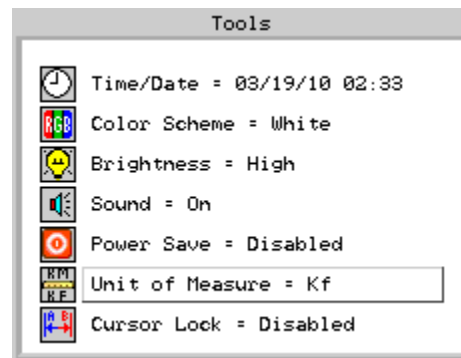
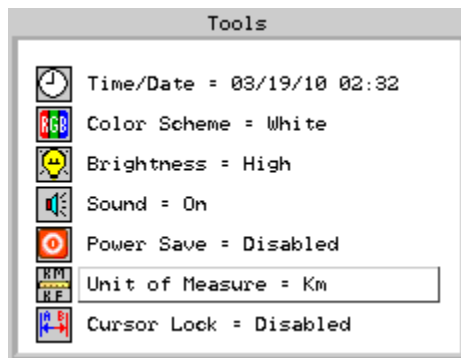
To toggle on and off the Power Save feature, scroll to the **Power Save** icon and press the **Select** button to toggle the Enable or Disable the Power Save feature. When the Power Save feature is Enabled, the instrument will automatically turn off after 15 minutes of non use.



Unit of Measure



To change the distance unit of measure, scroll to the **Unit of Measure** icon and use the **Select** button to toggle between **Km** (Kilometer) and **Kf** (Kilo feet).



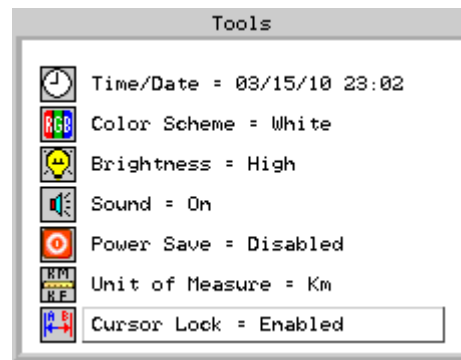
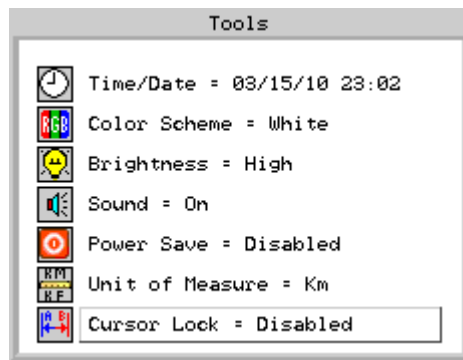
Cursor Lock



The cursors may be locked for more accurate measurements. Scroll to the **Cursor Lock** icon and press the **Select** button to Enable or Disable the Cursor Lock feature.

When the Cursor Lock feature is set to Enable:

- With the A cursor as the active cursor, both A and B cursors move.
- With the B cursor as the active cursor, the B cursor will move independently in order to set the distance between the two cursors.

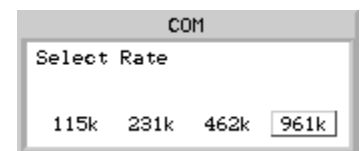
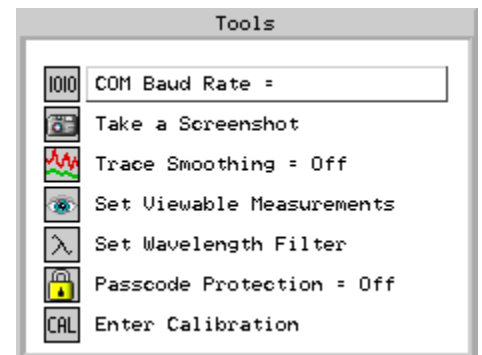


COM Baud Rate



It is necessary to set a COM port speed for communication with a computer. Scroll to the **COM Baud Rate** icon and press the **Select** button.

The **COM** dialog box will be displayed. Use the scroll wheel to select baud rates from 115 k to 961 k. Press the **Select** button again to select the baud rate and close the dialog.



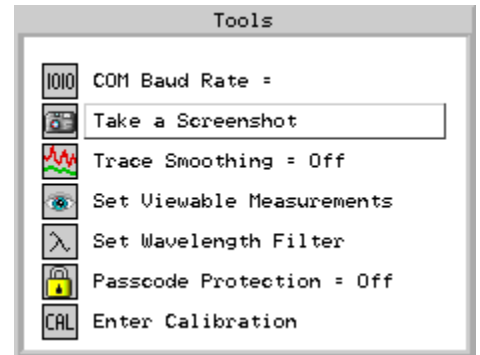
Saving Screen Shots



The TFS-2000 Series is equipped with a Screen Shot feature where a bitmap image of the current scan screen may be saved directly to a USB Flash Drive with a file name of `hmmss.bmp`, where `h` = hour, `m` = minute and `s` = second.

To use the Screen Shot feature, perform the following steps:

1. Insert a Flash Drive into the USB Flash Drive Port.
2. From the Tools dialog box use the scroll wheel to highlight the Take a Screenshot icon and press the **Select** button.
3. The display will show the progress of the screen capture by displaying the inverse color pattern of the image while progressing from the bottom to the top of the screen.
4. When the screen shot storage is complete, the display returns to the normal color screen.



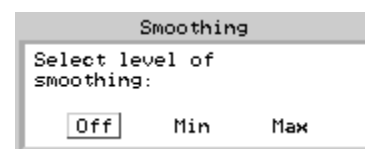
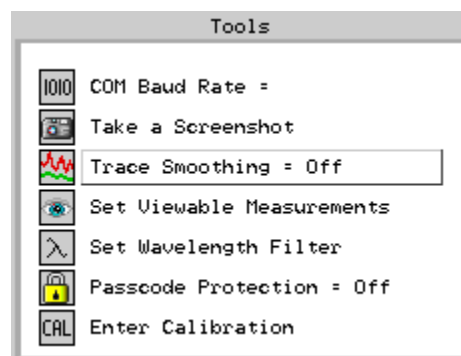
NOTE

Do not remove the USB Flash Drive while it is accessing. To do so could corrupt the data being stored or accessed.

Trace Smoothing



To filter enable trace smoothing, scroll to the **Trace Smoothing** icon and press the **Select** button. The **Smoothing** dialog box will appear. Use the scroll wheel to highlight the **Off**, **Min**, or **Max** and press the **Select** button to return to the **Tools** dialog box.

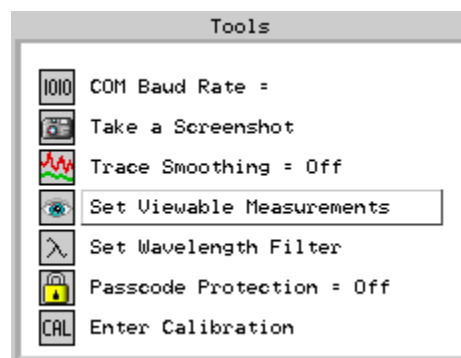


Set Viewable Measurements



The OTDR allows the user to set which loss measurements will be displayed; including splice loss for both cursors, dB value between cursors, distance between cursors, and dB per Km(Kf). If any of these measurements are not of importance for a series of tests, one or more may be turned off for ease of viewing. To change which measurements are displayed, perform the following steps:

1. Scroll to the **Set Viewable Measurements** icon and press the **Select** button.



2. A box will be drawn around the Splice Loss measurement area. Use the scroll wheel to cycle the measurement between Splice Loss, LSA Splice Loss or off.

dB 1.468

Splice
+0.000
+0.000 dB 1.468

LSA
+0.000
+0.000 dB 1.468

3. Press the **Select** button to move to the A-B Loss & Distance measurement area and use the scroll wheel to turn this measurement on or off.

A-B
25.094Km
+0.000dB 1.468

4. Press the **Select** button to move to the dB/Km(Kf) measurement area and use the Scroll Wheel to turn this measurement on or off.

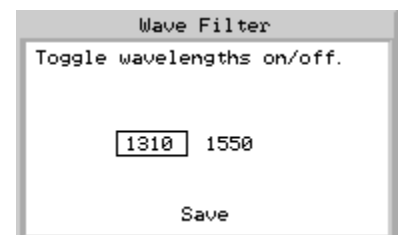
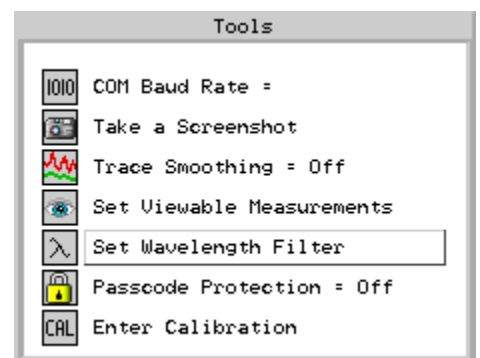
dB/Km
+0.000
dB 1.468

5. Press the **Select** button to return to the **Tools** dialog box.

Set Wavelength Filter



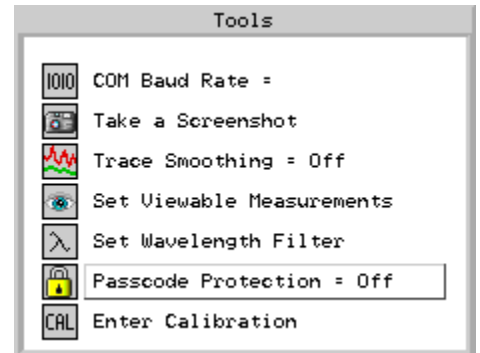
To filter unwanted wavelengths, scroll to the **Set Wavelength Filter** icon and press the **Select** button. The **Wave Filter** dialog box will appear. Use the scroll wheel to highlight the wavelength that you wish to filter and press the **Select** button. Use the scroll wheel to highlight **Save** and then press the **Select** button to return to the **Tools** dialog box.



Passcode Protection



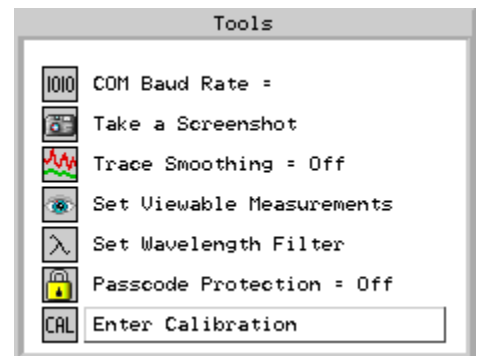
To protect the OTDR from unauthorized use. Scroll to the **Passcode Protection** icon and press the **Select** button. The **Set Password** dialog box will appear. Use the scroll wheel to set the first digit from 0 to 9 and press the **Select** button. Continue until all four positions are entered. Press the **Select** button on the last digit to move the cursor to **Enter** or **Cancel**. Press the **Select** button to complete the setting of the pass code or use the scroll wheel to highlight **Cancel** and then press the **Select** button to abandon any changes.



Enter Calibration



The calibration feature is only available to certified Trilithic repair facilities and is password protected to prevent unauthorized calibration changes from being made.



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Chapter 3

OTDR Operation

This chapter:

- Describes the operation and control of the OTDR Application of the TFS-2000 Series Optical Time Domain Reflectometers.

Precautions



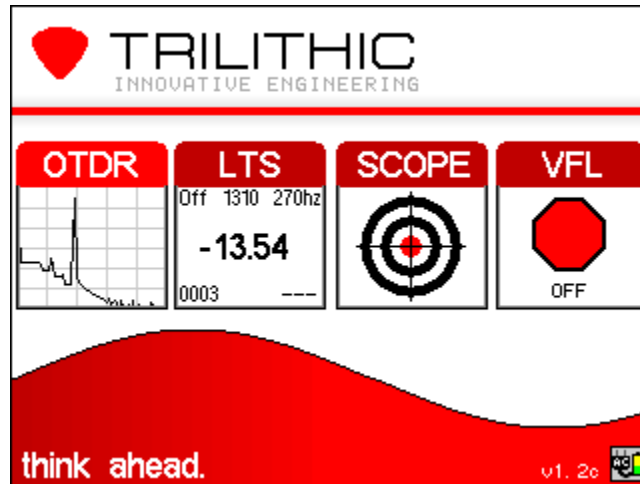
Before connecting to a patch cord or fiber under test, be certain the fiber has no active optical sources or instruments connected to the other end. Skin or eye damage could result from exposure to high power sources (e.g. EDFA's) and instrument damage could occur, thereby voiding the warranty.



Fiber-optic connectors are easily contaminated or damaged. The connection to the TFS-2000 Series is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at the minimum and at worst result in the need to return the TFS-2000 Series to the factory for repair. Prior to making any connection to the unit, ensure that all proper cleaning procedures have been followed.

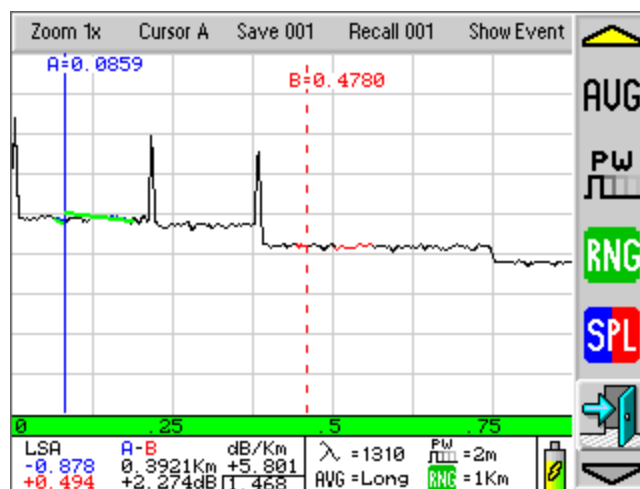
How to Enter the OTDR Application

To enter the OTDR Application from the **Main** Display, use the scroll wheel to highlight the **OTDR** icon and then press the **Select** button.



How to Exit the OTDR Application

To exit the OTDR Application from the **Trace** Display, press the Menu button, use the scroll wheel to highlight the **Exit** button and then press the **Select** button.



OTDR Application Overview

The TFS-2000 Series Optical Time Domain Reflectometers are designed to be used as installation, troubleshooting, and maintenance tools. This is a full featured Optical Time Domain Reflectometer that measures distance and loss of fiber links up to 240 km by launching an optical pulse down one end of the fiber and analyzing the returned energy in time (or distance) from reflections.

The TFS-2000 Series OTDR uses an advanced high speed embedded controller and display processor with proprietary technology to analyze, store and average the fiber trace data in the quickest time. This high speed processing engine allows the user to make distance and loss measurements immediately after energizing the instrument. With its advanced Event Table, Splice Loss Mode, and dB/km Mode, it also can assist the user in interpreting major events such as bad splices, connections or broken ends. Minor perturbations along otherwise normal fiber links can also be detected using a simple moving cursor approach in Splice Loss Mode. Complex return signals with many major or minor events can be analyzed by the TFS-2000 Series OTDR. Then the signals can be stored away for archiving and later retrieval.

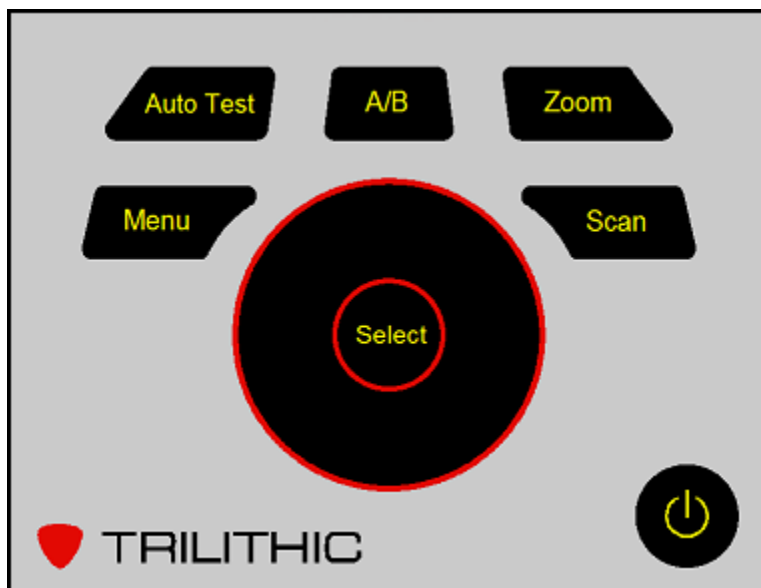
Index of Refraction

As with any OTDR, to assist in obtaining reliable, consistent measurements, the user must be aware of the Index of Refraction of their fiber or cable. The fiber Index of Refraction (IOR) is an important parameter that must be entered by the user to maximize the distance measurement accuracy. The IOR is proportional to the speed of light in glass compared to the speed in a vacuum and can be calculated by the equation $IOR = C$ (the speed of light in a vacuum) / V (the speed of light in fiber). The IOR number can be obtained by the fiber or cable manufacturer or can be calculated with a known length of cable. IOR numbers generally fall around 1.468 SM, 1.486 MM. These are the default values in the OTDR but can be adjusted from 1.0 to 2.0.

To calibrate the IOR for your particular fiber, take a known distance of fiber or cable (best if around 1 kilometer), and measure the distance with the OTDR set for 2m pulse width, changing the IOR until the measured distances closely match. An error of .001 of the IOR entry (1.468 vs. 1.469) equates to an error of approximately 0.7 meters per kilometer of distance measured.

Key Pad

The Key Pad is used to control the different functions of the TFS-2000 Series when in the OTDR Application. The following is a list of the buttons and what they control:

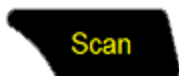


Power



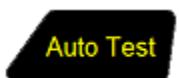
The **Power** button turns the device on and off. Press and hold the **Power** button for one second to turn the device on. Press the **Power** button again for one second to turn the device off.

Scan



The **Scan** button will start a scan or stop the current scan and reset the table of data.

Auto Test



The **Auto Test** button will start the Auto Test function. The Auto Test momentarily checks test conditions and starts a scan at the wavelength selected by the user but allows the OTDR to determine the pulse width and range parameters. This test will flash Auto in the Pulse Width and Range settings until the instrument has determined the best setting and then displays the test parameters on the display.

Menu



The **Menu** button toggles between:

The **Trace** Display where the the scroll wheel and the **Select** button are used to adjust the active cursor

and

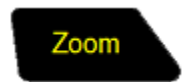
The **Menu** Display where the scroll wheel moves through the soft key menu and the Menu Bar.

A/B



The **A/B** button toggles between A and B as the active cursors.

Zoom



The **Zoom** button selects the zoom level. Each press increments through the levels of 1X, 2X, 4X, 8X, and 16X.

Select

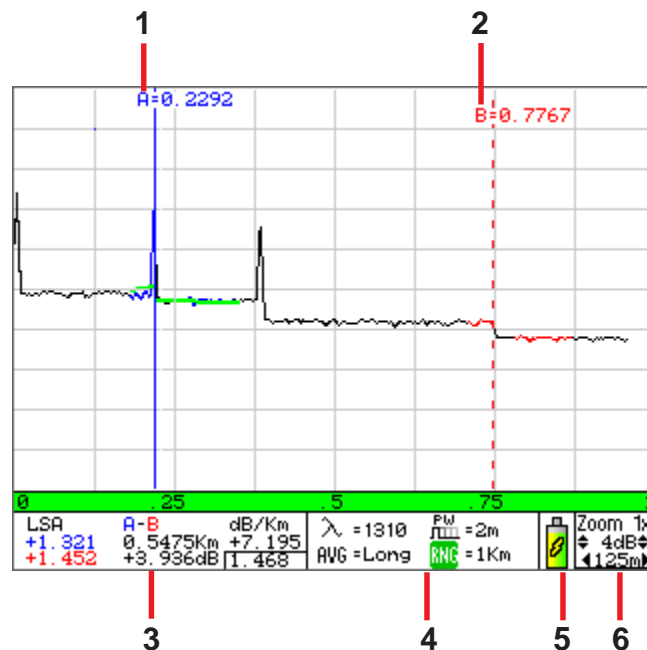


While in the **Trace** Display, the **Select** button will move the “Active” cursor to the next channel. While in the **Menu** Display, the **Select** button activates the highlighted item.

OTDR Displays

Trace Display

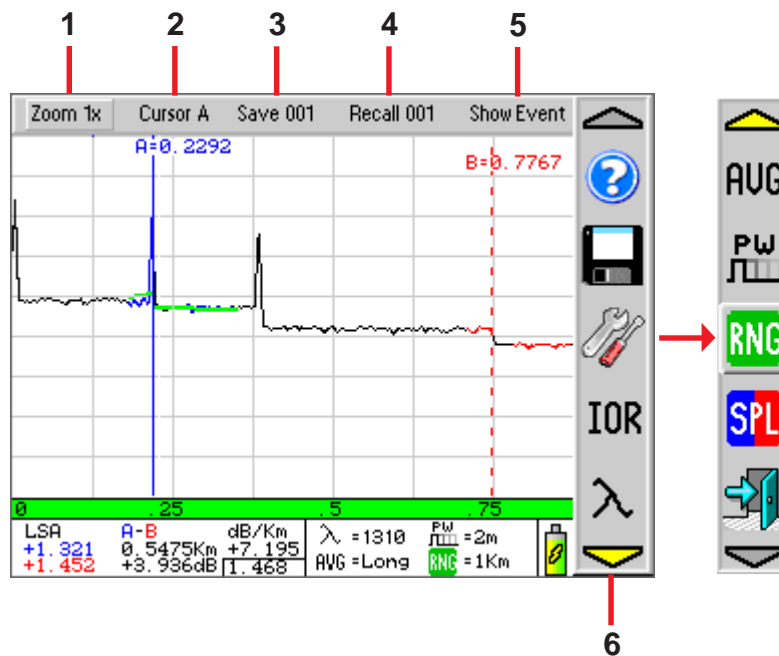
The TFS-2000 Series displays the following screen when the OTDR function is selected:



1. **Cursor A** - Displays the distance (Km or Kf) to the location of Cursor A.
2. **Cursor B** - Displays the distance (Km or Kf) to the location of Cursor B.
3. **Measurement Area** - Displays the Splice or LSA Loss of Cursors A and B, distance and loss between Cursors A and B, dB loss per Kilometer (Kilofeet), and index of refraction.
4. **Trace Parameters** - Displays the Wavelength, Pulse Width, Range Settings, and the Averaging Mode.
5. **Battery Indicator** - Displays the battery level and charge indicator.
6. **Zoom Status & Grid Values** - Displays the zoom level, vertical resolution in dB/div, and horizontal resolution that is currently selected. The zoom value is changed by selecting the **Zoom** button or the **Zoom** soft key from the Menu Display.

Menu Display

The TFS-2000 Series displays the following screen when the OTDR function is selected and the **Menu** button is pressed:



1. **Zoom Soft key** - Select this soft key to zoom in on the display. The soft key will also display the current zoom level. The zoom level can also be changed by selecting the **Zoom** button.
2. **Active Cursor Soft key** - Select this soft key to switch between Cursor A and Cursor B. The soft key will also display the name of the active cursor.
3. **Quick Save Soft key** - Select this soft key to save the currently displayed trace.
4. **Quick Recall Soft key** - Select this soft key to recall all previously saved traces in the order in which they were saved.
5. **Show Event Soft key** - Select this soft key to display an event table view of the measurement data shown in the currently displayed trace.
6. **Menu Bar** - Displays the buttons used for setup, testing, and measurement.

Event Table Display

To open the **Event Table** Display from the OTDR function, press the **Menu** button, scroll to the **Show Event** soft key and press the **Select** button. Use the scroll wheel to move through the events. If the **Select** button is pressed while an event is highlighted, The OTDR will revert to the **Trace** Display with the active cursor positioned at the selected event. An alternative method to return to the **Trace** display is to press the **Menu** button, scroll to the **Show Trace** soft key and press the **Select** button.

#	P/F	KM	SPLICE	2POINT	DB/KM	TYPE
1	X	0.2215	+0.465	-0.732	-3.605	-53.5
2	X	0.3943	+2.028	-0.127	-0.774	-55.1
E	✓	0.3943	-NA-	+0.257	+0.685	Link

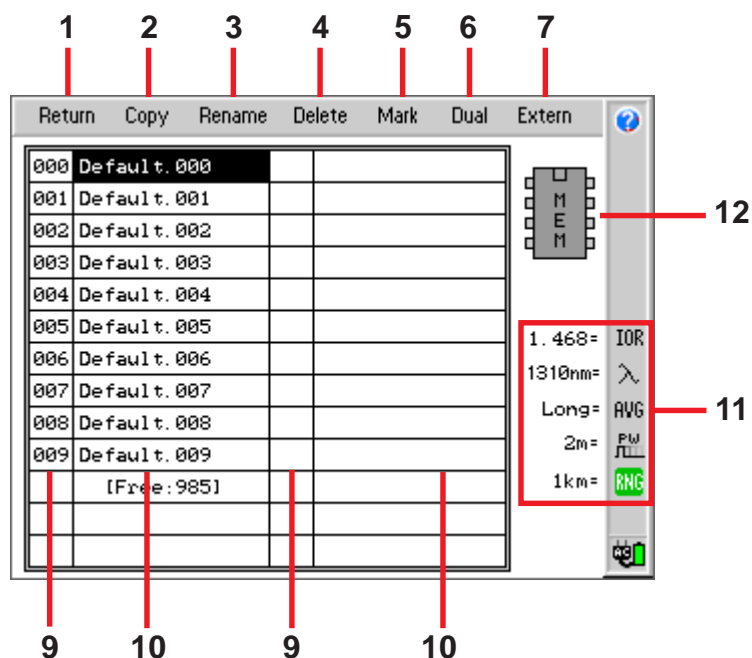
- Sensitivity & Pass/Fail Soft keys** - These soft keys are used to adjust the trace sensitivity and pass/fail limits.
- # (Event Number)** - Indicates the detected events in sequence of occurrence. Higher event numbers are further distances from the OTDR. “E”, which is always displayed in the bottom row is the event determined to be the End of Fiber (EOF).
- E (End of Fiber)** - The bottom row of the table is the loss and distance information as it pertains to the entire fiber link.
 - The **KM** column is the end of fiber distance measurement
 - The **SPLICE** column is not used
 - The **2POINT** column is the measurement from the origin (OTDR) to the determined end of fiber in the **Km** column
 - The **DB/KM(KF)** column is the measurement for the entire link
 - The **TYPE** column will display **Link**

4. **P/F (Pass/Fail)** - This column displays the pass/fail status of each event. If any one of the pass/fail thresholds are not met for an event, the **P/F** column will display a red "X". The parameter that failed will also be displayed in red. If all the parameters are met, a green check mark will be displayed.
5. **KM (Event Location)** - This column displays the event location in Km or Kf. This is the distance/location that the event occurs in the respective unit of measure.
6. **SPLICE (Event Loss)** - This column displays the event loss, where a positive number is the amount of loss and a negative number would indicate a gain. This is a settable threshold for the Pass/Fail feature.
7. **2-Point Loss** - This column displays the 2 point loss, which is measured from the end of the dead zone of the previous event to the beginning of current event.
8. **DB/KM (dB Loss per Km/Kf)** - This column displays the dB loss per Km or Kf. This is the calculated loss per Km or Kf from the end of the dead zone of the previous event to the beginning of the current event.
9. **TYPE (Event Type/ORL)** - This column displays the type of event or the Optical Return Loss (ORL) measurement. If the event is no reflection, "splc" will be displayed and if the event contains a reflection, the ORL value will be displayed. This is a settable threshold for the Pass/Fail feature.
10. **Parameter Settings** - Displays the parameter settings of the current trace.
11. **Page Number** - Displays the current page number and total pages.
12. **Scroll Bar** - The scroll bar will be active if the amount of events exceeds one page.
13. **Show Trace Soft key** - Select this soft key to return to the **Trace** Display.

File Management Display



The **File Management** Display shows the files stored in the internal memory of the device or on a connected USB Flash Drive. To view the **File Management** Display, press the **Menu** button, scroll to the **File** icon, and then press the **Select** button. The following screen will be displayed.



1. **Return Soft key** - Select this soft key to return to the **Trace** Display.
2. **Copy Soft key** - Select this soft key to copy the selected files to a PC via a USB connection.
3. **Rename Soft key** - Select this soft key to change the name of the highlighted file.
4. **Delete Soft key** - Select this soft key to delete the selected files.
5. **Mark Soft key** - Select this soft key to select multiple files.
6. **Dual Soft key** - Select this soft key to view more than one trace at a time.
7. **Extern Soft key** - Select this soft key to display the contents of a connected USB Flash Drive.
8. **File Storage Position** - Displays the file storage position of the corresponding files.
9. **File Name** - Displays the file name of the corresponding file storage position.

10. **Scan Information** - Displays a summary of the highlighted scan.
11. **File Source** - Display either MEM for onboard memory or USB for an external USB Flash Drive.



NOTE

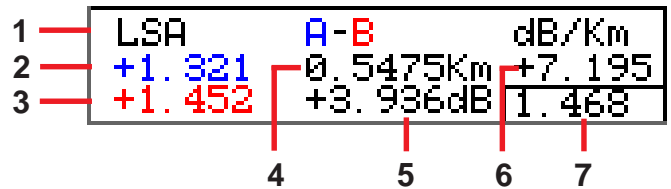
For more detailed information on how to save, recall, delete, and transfer files using the File Management Display, see the File Management Section later in this Chapter.

Trace Display Features

Measurement Area

The trace measurements are located in the lower left corner of the display as follows:

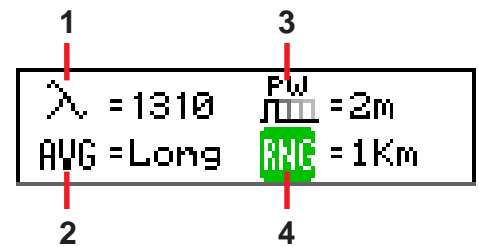
1. **LSA/Splice** - This field indicates whether the loss being measured is LSA or Splice loss.
2. **Cursor A Loss** - This field indicates the loss in dBm at the location of Cursor A.
3. **Cursor B Loss** - This field indicates the loss in dBm at the location of Cursor B.
4. **A to B Distance** - This field indicates the distance between Cursor A and Cursor B.
5. **A to B Loss** - This field indicates the loss in dB between Cursor A and Cursor B.
6. **dB/Km(Kf)** - This field indicates the loss in dB per distance **Km** (Kf).
7. **Index of Refraction** - This field indicates the index of refraction of the fiber being tested.



Trace Parameters

The trace parameters are located to the right of the Measurements area as follows:

1. **Wavelength Setting** - This field indicates the currently selected wavelength.
2. **Averaging Mode** - This field indicates the currently selected averaging mode.
3. **Pulse Width Setting** - This field indicates the currently selected pulse width setting.
4. **Range Setting** - This field indicates the currently selected range setting.



Pass/Fail Settings

Splice, ORL and Link are all settable thresholds for Pass/Fail purposes. To set the thresholds, press the **Menu** button, scroll to highlight the desired soft key and press the **Select** button. Then, use the scroll wheel to adjust the threshold and press the **Select** button again to lock in the settings.

If the trace fails any of the three thresholds, a red "X" will be displayed in the P/F column and the suspect threshold value will be displayed in red.

1. **Splice** - If a splice needs to be less than 1 dB, set the threshold to <1.0. If 1.0 would be accepted, set threshold to 1.01 db.
2. **ORL** - If an ORL needs to be less than 50 dB, set the threshold to <50. If 50 dB is acceptable, set the threshold to <51.
3. **Link** - If the link loss needs to be less than 20 dB, set the threshold to <20. If 20 db link loss is acceptable set the threshold to <21.
4. **End** - This threshold setting is used to determine the end of fiber. If set to 3 dB, the first event that meets this threshold will be identified as the end of fiber.

#	P/F	KM	SPLICE	2POINT	DB/KM	TYPE
1	X	0.2215	+0.465	-0.732	-3.605	-53.5
2	X	0.3943	+2.028	-0.127	-0.774	-55.1
E	✓	0.3943	-NA-	+0.257	+0.685	Link

Auto Test

To start an Auto Test, perform the following steps:

1. Power on the instrument and enter the OTDR application.
2. Press the **Menu** button to enter the **Menu** display
3. Use the scroll wheel to highlight the **Wavelength** button and press the **Select** button to cycle to desired wavelength.
4. The OTDR will automatically start a scan with the change of the wavelength. To abort this test, press the **Scan** button.
5. Press the **Auto Test** button, the **PWR** and **RNG** icons (located in the Trace Parameters Area) will flash until the instrument has determined the acquired parameters.
6. The acquired parameter values will be displayed next to the **PWR** and **RNG** icons.
7. The OTDR will immediately proceed with a normal scan in the Short AVG mode.

Manual Trace Settings

To change any of the following scan settings, press the **Menu** button, use the scroll wheel to highlight the desired icon, and then press the **Select** button.

Index of Refraction



It is necessary to have the Index of Refraction set as close as possible to the actual IOR of the fiber. If this is unknown, it is best to use the default setting on the OTDR.

See **Chapter 3: OTDR Operation**, *Index of Refraction* for more information on how to calculate the IOR.

To change the IOR, select the **IOR** button from the **Menu** Display, use the scroll wheel to change the IOR value, and then press the **Select** button again to lock-in the setting. The **Confirm Changes** dialog box will appear to either save or cancel the changes or set the value back to default. Use the scroll wheel to highlight desired action and press the **Select** button.

Wavelength



To change the wavelength, select the **Wavelength** button from the **Menu** Display and then press the **Select** button to cycle through the available wavelengths.

Averaging



To change the averaging time, select the **AVG** button from the **Menu** Display and then press the **Select** button to cycle through the following averages:

R/T - Real-time averaging with up to 4 pps (points per second) refresh rate.

Short - Short averaging time of approximately 12 second.

Long - Long averaging time of approximately 5 minutes.

Once this setting is changed, a scan will be automatically initiated.

Pulse Width



To change the pulse width, select the **PW** button from the **Menu** Display and then use the **Select** button to cycle through the pulse widths of 2 m, 10 m, 100 m, and 1k.

Making changes to the pulse width automatically changes the range setting to ensure that proper measurement parameters are maintained. For example: if the unit is in short range at 2 meters, when the pulse width is changed to 10 m, the range will change to 4 Km which is the short range for the 10 m pulse width. Once this setting is changed, a scan will be automatically initiated.

Range



To change the range, select the **RNG** button from the **Menu** Display and then use the **Select** button to cycle through the ranges of 64 Km and 240 Km.

Splice Loss Measurement Area



The splice loss measurement areas around the cursors are adjustable. This feature is used for both Basic Splice Loss and LSA Splice Loss. For more information, see the Splice Loss section later in this chapter. To change the Splice Loss Measurement Area, select the **SPL** button from the **Menu** Display. An arrow will be displayed above the point of the measurement area to be adjusted. Perform the following steps to adjust the three available points (left, middle, and right of active cursor):

1. Use the scroll wheel to adjust the first point, then press the **Select** button to move to the next point for adjustment.
2. Use the scroll wheel to adjust the second point, then press the **Select** button to move to the next point for adjustment.
3. Use the scroll wheel to adjust the second point, then press the **Menu** button to return to the **Menu** Display.

Advanced Trace Tools

Once you have performed a scan, it may be necessary to maneuver within the scan to gain the information required. There are a number of tools that can be used to accomplish this.

Cursor Movement and Measurements

The active cursor is shown as a solid line while the inactive cursor is a dashed line. The A and B cursors are moved with the scroll wheel while in the Trace Display. There are two methods to switch between active cursors.

- Press the **Menu** button, scroll to the **Cursor** soft key, and then press the **Select** button to toggle the focus from one cursor to the other. Press the **Menu** button again to exit the **Menu** Display.

OR

- Press the **A/B** button to quickly toggle between the two cursors.

The loss at each cursor is shown in the bottom left corner of the display in blue and red. Blue is the loss of the channel identified by the A cursor and red for the B cursor. Just to the right of the loss reading is the distance and loss between the cursors. While in the **Trace** Display, simply press the **Select** button to quickly move the active cursor to the next event.

Zoom

The current zoom level is indicated in the bottom right corner of the display. There are five zoom levels to choose from:

1X Zoom - Vertical spacing of 4 db/div with a horizontal range of 125 m.

2X Zoom - Vertical spacing of 2 db/div with a horizontal range of 65 m.

4X Zoom - Vertical spacing of 1 db/div with a horizontal range of 32 m.

8X Zoom - Vertical spacing of 1/2 db/div with a horizontal range of 16 m.

16X Zoom - Vertical spacing of 1/4 db/div with a horizontal range of 8 m.

To zoom in on a scan, perform one of the following actions:

- Press the **Menu** button, scroll to the **Zoom** soft key, and press the **Select** button to cycle through the five zoom levels.

OR

- Press the **Zoom** button on the front panel.

Zoom Bar

The bottom most portion of the trace is a Zoom Bar. This represents the entire range of the trace being viewed. The green bar within the area represents the amount of the trace that is being viewed while in the zoom function.

- While in Zoom Level 1X the green bar will fill the zoom bar area, meaning the entire range of the trace can be viewed.
- While in Zoom Level 2X the green bar will fill only half of the zoom bar area, meaning half of the entire range of the trace can be viewed.
- As the zoom levels increase, the green zoom bar will decrease in size to indicate the amount of the trace that can be viewed at one time.
- As a cursor is moved with the Scroll Wheel, the green zoom bar moves to indicate what portion of the trace is being seen.

For example, if the green bar is to the left of the zoom Area, the beginning portion of the trace is being viewed and if the green bar is to the right of the zoom Area, the end of the trace is being viewed.

Loss Measurements

The TFS-2000 Series OTDRs use the following four methods to calculate loss measurements:

2 Point Loss Method

2 Point loss method takes the difference in vertical height between where the A and B cursors cross the trace to determine the amount of loss in that section of fiber.

dB/Km (dB/Kf) Method

The dB/Km (dB/Kft) loss method takes the 2 Point loss in dB and divides by the distance between the cursors in Kilometers (Kilo feet). For accurate dB/Km (dB/Kft) loss measurements, the two cursors must be on level reflection points at least 100m apart (NA will be shown for distances that are too short).

Splice Loss Method

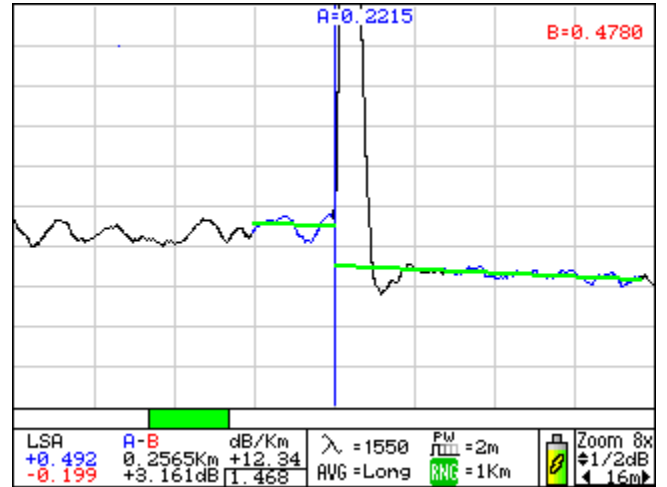
Splice Loss method is meant to be used in noisy environments when it is difficult to attain an LSA area that lays flat on the reflection before and after the cursor. This method takes an average of the selected points before and after the active cursor and uses this average to make a good estimation of the event loss. This is an estimation but this method may be more accurate than LSA Splice Loss method in noisy environments.

Least Squares Approximation (LSA) Method

Least Squares Approximation (LSA) Splice loss method gives the user a visual aid in setting splice loss areas. The splice loss lines must be set to overlay the reflection of a trace without overlapping any other events. The LSA areas are set properly when the LSA visualization lines overlay the reflection sections of the trace before and after the event. This method can be more accurate by affording the ability to see the slope of the splice loss areas. However, it can also supply a reading with greater error if not used properly. In Noisy environments, the LSA Lines will have an exaggerated movement making the Basic Splice Loss Measurement potentially more accurate.

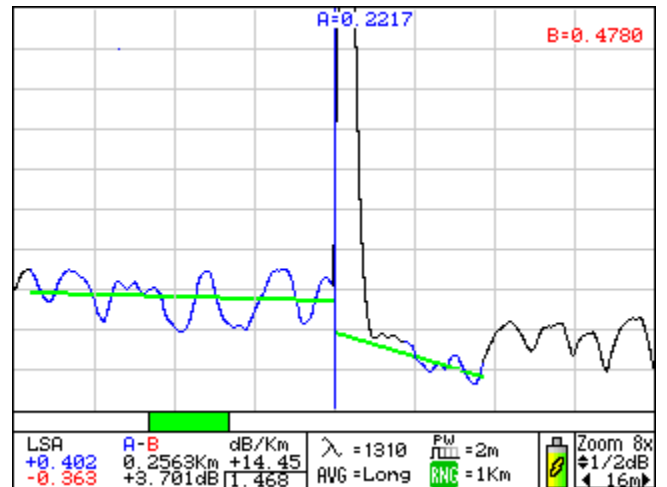
Proper LSA Setting

The LSA area and cursor are set properly. The green LSA indicator line is overlaying the reflection of the trace properly.



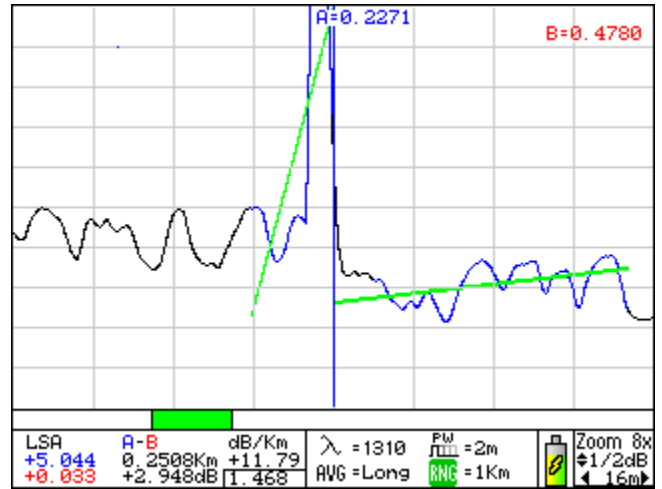
LSA Set Too Early

The LSA area and cursor are set too early. The green LSA indicator line to the right is not overlaying the reflection of the trace properly.



LSA Set Too Late

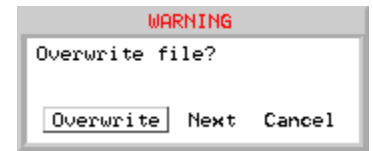
The LSA area and cursor are set too late. The green LSA indicator line to the left is not overlaying the reflection of the trace properly.



Quick Save of Scan & Measurement Data

A scan may be easily stored to memory by using the **Save ###** soft key. To quickly save measurement data, perform the following steps:

1. Press the **Menu** button and use the scroll wheel to highlight the **Save ###** soft key.
2. Press the **Select** button. The scan will be saved to the location indicated.
3. If that storage position is full, a dialog will be displayed with the options of overwriting the file, storing to the next available location, or canceling the command.
4. Use the scroll wheel to highlight the desired action and then press the **Select** button. The action will be complete and the display will return to the Scan Mode.



NOTE

Each time a file is saved with this method, the file name will default to a base file name of the last manually entered file. Each subsequent file will then assume the base file name and increment the file suffix by one.

Quick Recall of Scan & Measurement Data

A scan may be easily recalled from memory by using the **Recall ###** soft key. To quickly recall measurement data, perform the following steps:

1. Press the **Menu** button and use the scroll wheel to highlight the **Recall ###** soft key.
2. Press the **Select** button. The scan that is stored in the indicated storage location will be displayed.
3. Continue to press the **Select** button to cycle through any stored scans.

File Management Overview



The TFS-2000 Series has the capability to store up to 1000 traces. Once stored, these files may be copied to a PC via a USB cable or copied to a USB Flash Drive. The files are listed in order of file storage position with the xxxxxxxx.### (8.3) naming convention.

To enter the **File Management** Display, press the **Menu** button, scroll to the **File Management** icon, and press the **Select** button. Use the scroll wheel to move from one stored scan to another. As a file is highlighted, the trace information is displayed.

There are two methods to return to the Scan Display from the **File Management** Display. The first method is to enter the Menu Display, scroll to the **Exit** soft key, and press the **Select** button. The second method is to press the **Select** button while a file is highlighted; this will open the **Trace** Display with the highlighted file displayed.

	Return	Copy	Rename	Delete	Mark	Dual	Extern
000	Default.000						
001	Default.001						
002	Default.002						
003	Default.003						
004	Default.004						
005	Default.005						
006	Default.006						
007	Default.007						
008	Default.008						
009	Default.009						
	[Free:985]						

MEM

1.468= IOR
1310nm= λ
Long= AVG
2m= PW
1km= RNC

File Naming Convention

The file name is formatted as xxxxxxxx.### (8.3) style. The file storage system uses digits after the period to make the file name unique with an identifier digit starting at “000” through “999”.

For example: If a file name of bbbbbbb.000 was given to the first scan, when the following scans are saved, they will be named: bbbbbbb.001, bbbbbbb.002, bbbbbbb.003, and so on.

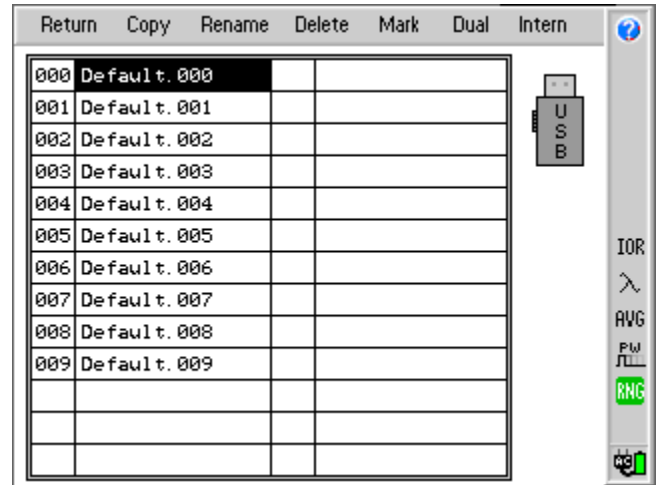
Viewing a Stored Trace

To view a scan that has been stored in the onboard file management system, simply press the **Select** button while the desired file is highlighted and the file will open in the **Trace** Display.

Viewing Scans from a USB Flash Drive

The TFS-2000 Series can view files from a USB Flash Drive. Insert the USB Flash Drive into the proper port and enter the **Menu** Display. Scroll to highlight the **Extern** soft key and press the **Select** button. The TFS-2000 Series will read any scan files in the root directory of the Flash Drive. Highlight the file to be viewed and press the **Select** button.

To exit the Flash Drive directory, press the **Select** button a second time while the **Extern** soft key is highlighted and the focus will revert back to the onboard file management system.



Do not remove the USB Flash Drive while it is accessing. To do so could corrupt the data being stored or accessed.



Flash drives are limited to 4 gigabytes in size. It is suggested that any new flash drive be tested prior to use. Save traces to the flash drive from the OTDR and test them on the computer with the supplied software to ensure they operate properly.

Naming a File

The **Name** soft key is used to name a file for a new scan or to rename a currently stored file. Files stored with the **Save** soft key will take the base name of the last stored file.

To start a new set of scans with a new base file name, perform the following steps:

1. Enter the **Menu** Display while the first scan is displayed.
2. Scroll to the desired storage location for the first scan of the project.
3. Press the **Menu** button, scroll to the **Name** soft key, and press the **Select** button.
4. The storage location will display a black box with a .### extension.
5. Use the **Scroll Wheel** to cycle through the available characters. The available characters are (space), 0-9, A-Z, and a-z.
6. Press the **Select** button to enter the character and move to the next character.
7. Once the desired file name is in place, press the **Menu** button and **Save Changes** or **Discard Changes** will be displayed in the soft key bar. Scroll to highlight **Save** or **Discard** and press the **Select** button to complete the action.

Renaming a File

To rename a file, highlight the file to be renamed, press the **Menu** button, and scroll to the **Name** soft key. Press the **Select** button and the first character of the file name will be highlighted. Continue to name the file as described earlier. Press the **Menu** button when done to either save changes or discard changes.

Dual Trace/Trace Overlay

With a trace on the display (either a trace just taken or one from file storage), use the scroll wheel to highlight the trace to be placed in the background. Press the **Menu** button, scroll to the **Dual** soft key and press the **Select** button. The background trace will be displayed in green. All the measurement information will be derived from the main trace. If the trace for the background does not have the same range as the main trace, a range mismatch message will be displayed. Press the **Select** button to clear the message.

To exit the Dual Trace function, start a new scan or open a new main trace from the **File Management** Display.

Copying & Deleting Files

Marking Files

Mass copying and deleting can be accomplished with the **Mark** soft key. Highlight the first file to be copied or deleted, press the **Menu** button, scroll to the **Mark** soft key and press the **Select** button. Use the scroll wheel to move through the files. Move clockwise to mark any files that are passed and move counterclockwise to unmarks any files that are passed. Marked files will be displayed in red. Press the **Menu** button again and then select the desired soft key function to be completed.

Copying Files

To copy files to the internal device storage or an external Flash Drive highlight or mark the desired file(s) to be copied and scroll to the **Copy** soft key. Press the **Select** button to display the Destination? dialog box. Use the scroll wheel to highlight Flash, PC, or Cancel and then press the Select button to finish copying the file or to exit.



Do not remove the USB Flash Drive while it is accessing. To do so could corrupt the data being stored or accessed.

NOTE



Flash drives are limited to 4 gigabytes in size. It is suggested that any new flash drive be tested prior to use. Save traces to the flash drive from the OTDR and test them on the computer with the supplied software to ensure they operate properly.

Delete Files

Highlight or mark the desired file(s) to be deleted, press the **Menu** button and scroll to the **Delete** soft key. Press the **Select** button and **Cancel** or **Confirm Delete** will be displayed in the soft key bar. Use the scroll wheel to highlight the desired action and press the **Select** button.

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Chapter 4

Loss Test Set Operation

This chapter:

- Describes the operation and control of the Loss Test Set (LTS) Application of the TFS-2000 Series Optical Time Domain Reflectometers.

Precautions



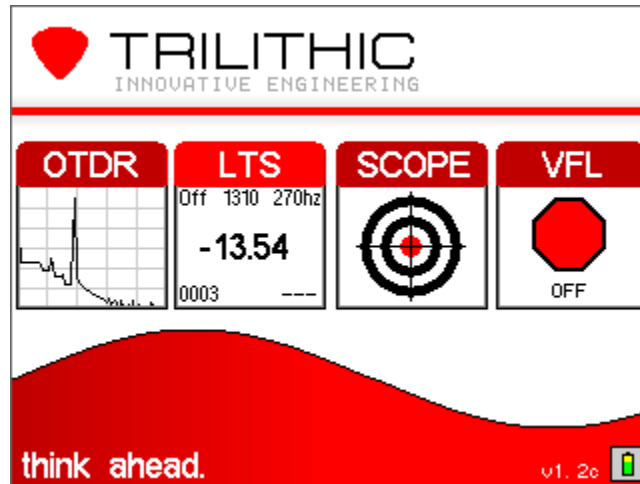
Before connecting to a patch cord or fiber under test, be certain the fiber has no active optical sources or instruments connected to the other end. Skin or eye damage could result from exposure to high power sources (e.g. EDFA's) and instrument damage could occur, thereby voiding the warranty.



Fiber-optic connectors are easily contaminated or damaged. The connection to the TFS-2000 Series is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at the minimum and at worst result in the need to return the TFS-2000 Series to the factory for repairs. Prior to making any connection to the unit, ensure that all proper cleaning procedures have been followed.

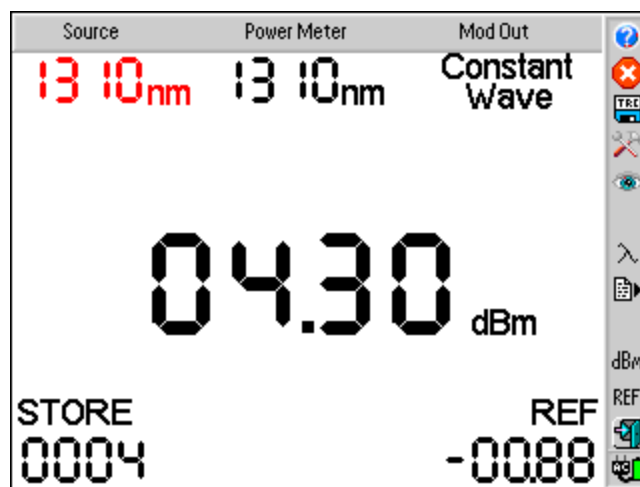
How to Enter the LTS Application

To enter the LTS Application from the **Main** Display, use the scroll wheel to highlight the **LTS** icon and then press the **Select** button.



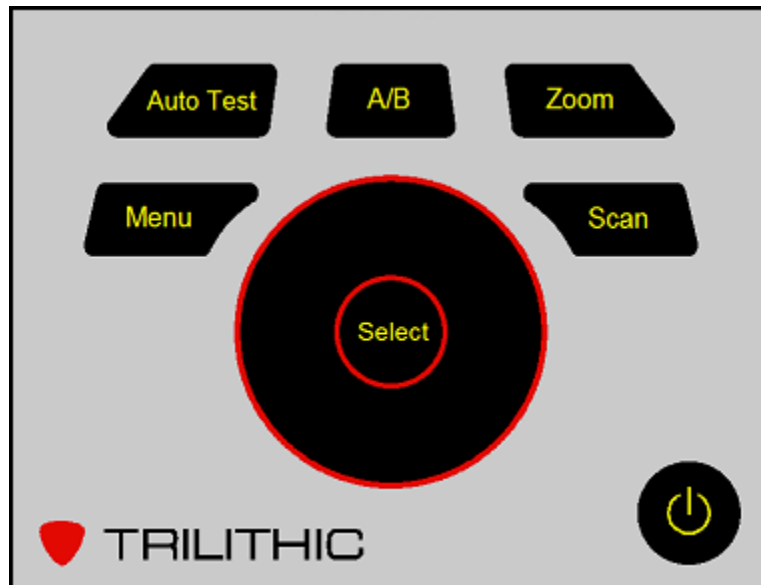
How to Exit the LTS Application

To exit the LTS Application from the **Measurement** Display, press the **Menu** button, use the scroll wheel to highlight the **Exit** button and then press the **Select** button.



Key Pad

The Key Pad is used to control the different functions of the TFS-2000 Series when in the LTS Application. The following is a list of the buttons and what they control:



Power



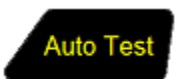
The **Power** button turns the device on and off. Press and hold the **Power** button for one second to turn the device on. Press the **Power** button again for one second to turn the device off.

Scan



The **Scan** button resets any temporary memory values before they have been stored with the select button.

Auto Test



The **Auto Test** button will start the Auto Test function. The Auto Test will turn on the light source and cycle through the wavelengths that can be selected by the **Wavelength** button in the **Menu Display**.

Menu



The **Menu** button toggles between:

The **Trace** Display where the the scroll wheel and the **Select** button are used to adjust the active cursor

and

The **Menu** Display where the scroll wheel moves through the soft key menu and the Menu Bar.

A/B



The **A/B** button cycles through the power meter wavelengths that can be selected by the **Wavelength** button in the **Menu** Display. In the **File Selector** Display, this button will toggle through the saved wavelength values for a particular storage position.

Zoom



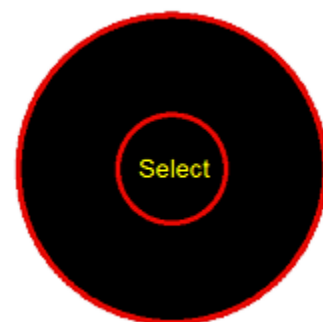
The **Zoom** button changes the display to the **Zoom** Display where all stored tests for a memory location are displayed. There can be up to 4 tests stored per location.

Select



While in the **Measurement** Display, the **Select** button will move through all measurements in the temporary memory to the storage position shown in the bottom left corner of the display. In the **Menu** Display, this button will activate the highlighted soft key or button.

Scroll Wheel



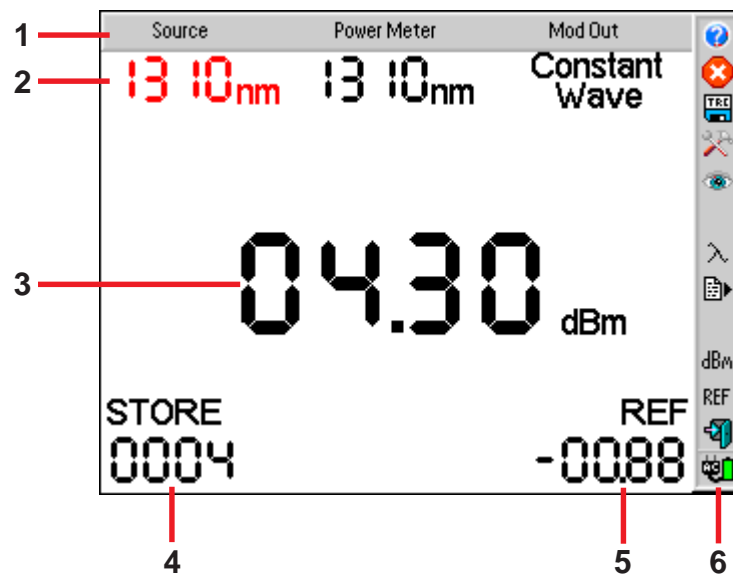
When the scroll wheel is moved, the **File Selector** Display is shown for quick reference and if no key is pressed for 5 seconds, the screen returns to the **Measurement** Display. To immediately return to the **Measurement** Display, press the **Scan** button

When in **Menu** Display, the scroll wheel moves through the soft keys and buttons.

LTS Displays

Measurement Display

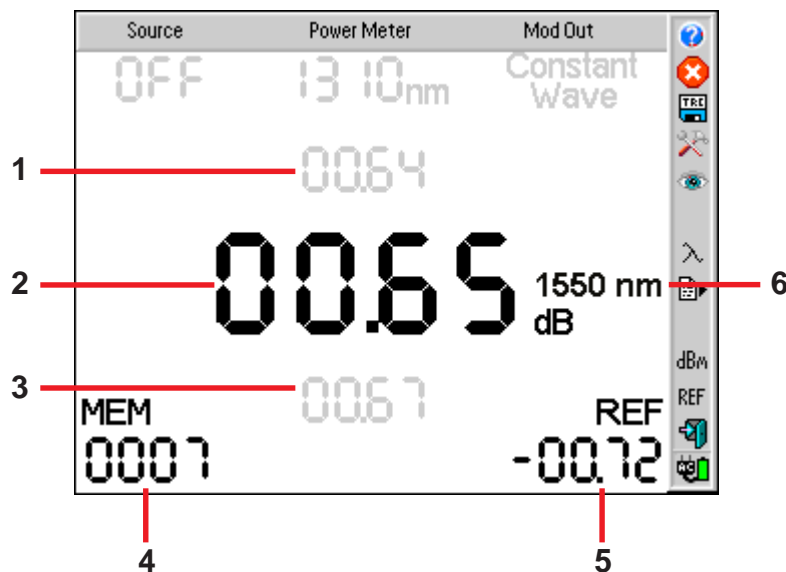
The TFS-2000 Series displays the following screen when the LTS Application is selected:



1. **Soft keys** - These soft keys are used to control the modulation and wavelength of the source output and the power meter input wavelength.
2. **Status** - Displays the selected modulation and wavelength of the source output and the power meter input wavelength.
3. **Measurement Area** - Displays the active loss measurement.
4. **Storage Location** - Displays the next available storage location.
5. **Reference Value** - Displays the stored reference level of the displayed power meter wavelength. For more information see the *Relative Measurements* section later in this chapter.
6. **Menu Bar** - Displays the buttons used for setup, testing, and measurement.

File Selector Display

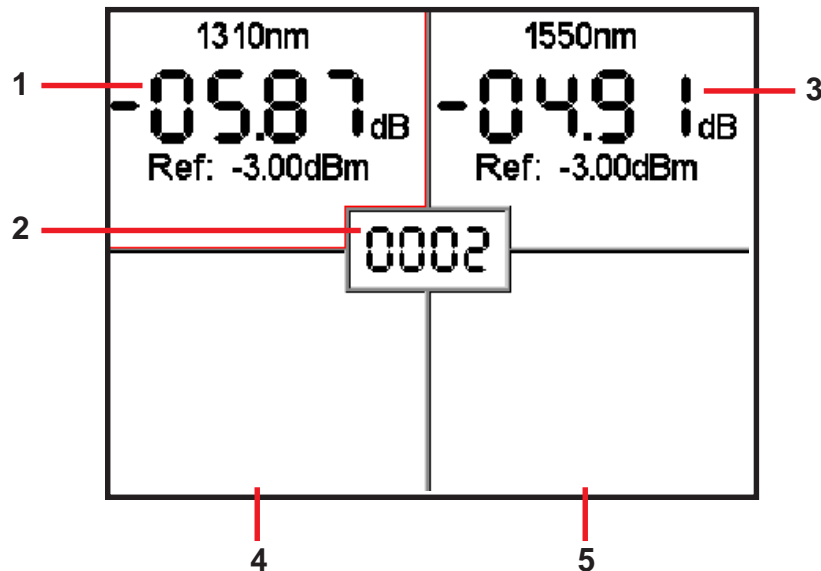
When in LTS Application mode and the scroll wheel is used, the TFS-2000 Series displays the following screen:



1. **Next Loss** - This displays the loss measurement of the next memory location. Move the scroll wheel clockwise to display the next loss measurement.
2. **Current Loss** - This displays the loss measurement of the current memory location.
3. **Previous Loss** - This displays the loss measurement of the previous memory location. Move the scroll wheel counter-clockwise to display the previous loss measurement.
4. **Memory Location** - This displays the memory location of the current loss measurement.
5. **Reference** - This displays the reference value associated with the current loss measurement. For more information see the [Relative Measurements](#) section later in this chapter.
6. **Wavelength** - Displays the wavelengths of the current loss measurement. Press the **A/B** Button to cycle through the wavelengths associated with the current loss measurement.

Zoom Display

When in the LTS Application mode and the **Zoom** button is pressed, the TFS-2000 Series displays the following screen :



1. **First Wavelength** - This displays the first wavelength test data of the current memory location.
2. **Memory Location** - This displays the memory location of the current loss measurement.
3. **Second Wavelength** - This displays the second wavelength test data of the current memory location.
4. **Third Wavelength** - This displays the third wavelength loss test data of the current memory location.
5. **Fourth Wavelength** - This displays the fourth wavelength test data of the current memory location.

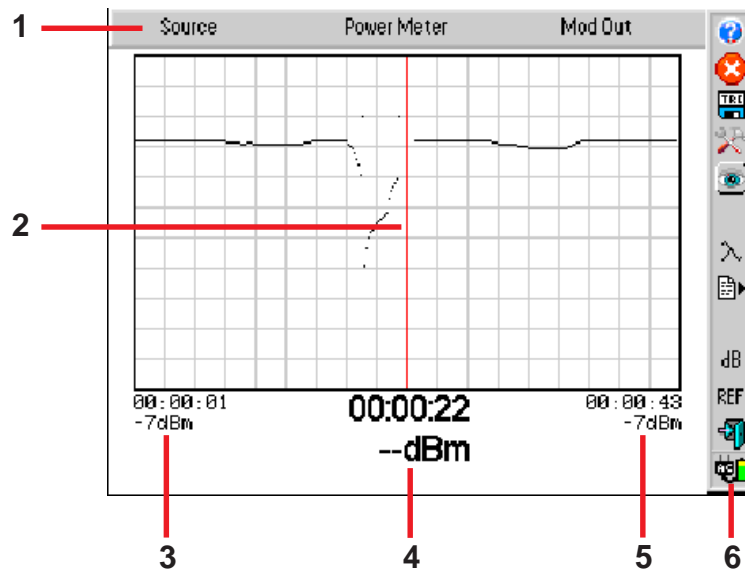


Up to four wavelength measurements can be saved in each loss measurement memory location.

NOTE


Graph Display

The **Graph** Display shows a graph of the current loss measurement. To view the **Graph** Display, press the **Menu** button, scroll to the **View** icon, and then press the **Select** button. The following screen will be displayed:



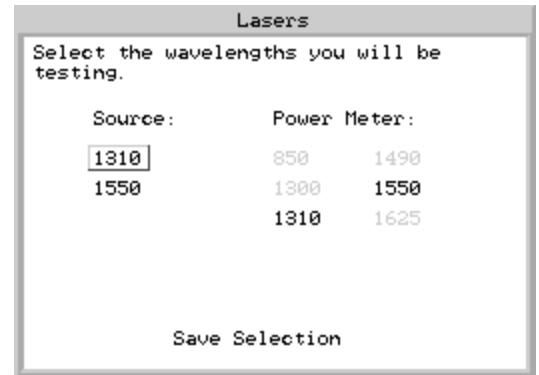
1. **Soft keys** - These soft keys are used to control the modulation and wavelength of the source output and the power meter input wavelength.
2. **Center Cursor** - This location corresponds to the cursor time and power that is displayed below the cursor.
3. **Start Time & Power** - This displays the start time and power of the loss measurement.
4. **Cursor Time & Power** - This displays the time and power of the loss measurement at the center cursor.
5. **End Time & Power** - This displays the end time and power of the loss measurement.
6. **Menu Bar** - Displays the buttons used for setup, testing, and measurement.

Input/Output Wavelength Selection

To select which wavelengths you will be testing, press the **Menu** button and use the scroll wheel to highlight the  Button. Press the **Select** button and the **Lasers** dialog box will be displayed. Use the scroll wheel to highlight the wavelengths to be selected for use with the light source and power meter and then press the **Select** button to toggle them on and off.

The selected wavelengths will be the only wavelengths tested using the Auto Test function and the only wavelengths available when cycling through the **Source** and **Power Meter** soft keys. Use the scroll wheel to

highlight **Save Selection** at the bottom of the dialog box and then press the **Select** button to save the setting and return to the **Measurement Display**.



Light Source Operation

Energizing Light Source

The output lasers are initially in the off state when the LTS Application is launched. Press the **Menu** button and use the scroll wheel to highlight the **Source** soft key. Press the **Select** button to cycle through and activate the available wavelengths. The displayed source wavelength is the active source. Turn off all sources, by cycling to the **Off** position.



NOTE

If used with a compatible test set or a companion TFS-2000 OTDR, the light source will transmit the wavelength information automatically to the receiving unit which then changes the power meter wavelength setting to correspond to the wavelength of the light source.

Light Source Modulation

To change the modulation of the light source, press the **Menu** button and use the scroll wheel to highlight the **Mod Out** soft key. Press the **Select** button to toggle through the available modulation rates of CW (Constant Wave), 270 Hz, 1000 Hz, and 2000 Hz. The modulation rate will be displayed directly under the **Mod Out** soft key. When measuring average power of the lasers, the output will drop by exactly 3.01 dB as the source is off precisely half of the time. The modulation function is useful for fiber identification and for general purpose optical component testing. The unit that receives one of the modulated frequencies will flash the appropriate frequency annunciator.



The 3.01dB drop is also true of the laser output when using the Auto Test Function. However, the unit receiving this signal automatically compensates for the loss in average power and this is transparent to the user.

Autotest Operation

To use the Auto Test feature, connect the fiber to be tested to a compatible test set.

- The unit being used as the source should be set to Auto Test.
- If Two TFS-2500 Quad Wavelength OTDRs are being used, only the wavelengths to be tested should be selected as sources by entering the **Laser** dialog box.
- Only the wavelengths that are energized will be displayed on the power meter end.
- Once the source and power meter have cycled through the wavelengths to be tested, press the **Select** button to store the measurements.

A reference measurement is not used in the Auto Test feature. The source is modulated and has a power level of -3 dBm (-6 dBm @ 1625 nm). This method of measurement does not take into account the launch condition. Therefore, the manual method of testing should be used when highly accurate measurements are required such as when testing the loss of an individual connector.

The text **Auto** will be displayed at the bottom of the display during Auto Test loss measurements.

Two or more loss measurements are best viewed using the Zoom feature where all the selected wavelengths will be displayed at the same time on the display.

Power Measurements

With the TFS-2000 in the LTS Application, connect the fiber carrying the optical power to be measured to the Power Meter detector utilizing the appropriate adaptor. To select the power meter wavelength that matches the wavelength of the light being measured, press the **Menu** button and use the scroll wheel to highlight the **Power Meter** soft key. Press the **Select** button to toggle through the available wavelengths.

The power reading will now indicate the optical power in units of dBm. The power will display an out-of-range condition indicated by a series of four dashes on the display if the signal is greater than +25 dBm or less than -57 dBm.

To save the power measurement to the storage location shown in the lower left corner of the display, press the **Select** button. The memory location will auto increment to the next available memory location.

Relative Measurements

Storing Reference Levels

To make a relative power measurement, you must first save the reference power level. To store a reference level, perform the following steps:

1. Attach reference cord/s and energize the light source.
2. Press the **Menu** button and then use the scroll wheel to highlight the **REF** button.
3. Press the **Select** button to store the reference value.

The reference is now stored in non volatile memory and displayed in the bottom right corner of the display. The units of the display will now change to dB and subsequent readings will now be displayed in terms of dB relative to the stored reference value. A reference memory location is available for each selected wavelength.

Changing Power Level Units of Measurement

To change the power level units, press the **Menu** button and then use the scroll wheel to highlight the **dBm** button. Press the **Select** button to toggle between **dB** and **dBm**.

Performing a Relative Measurement



To perform a relative measurement, perform the following steps:

1. Remove the connector from the power meter port and place the fiber under test inline between the reference cord and the power meter port.
2. The reading displayed will be the loss of the fiber under test relative to the reference.
3. Ensure that the Menu is not activated and then press the **Select** button to store the measurement.

Stored power measurements may be recalled by moving the scroll wheel and the File Selector Display will be shown. If no buttons are pressed for 5 seconds after entering the File Selector Display, the unit will revert to the Measurement Display. The **Scan** button may also be pressed to re-enter Measurement Display.

Loss Measurement Graph

To view measurements in the **Graph** Display, perform the following steps:

1. Press the **Menu** button and use the scroll wheel to highlight the **Source** soft key.
2. Use the **Select** button to cycle to the desired wavelength for the test. If a source other than one compatible for auto-wavelength recognition with the OTDR is being used, ensure that the proper power meter wavelength is selected.
3. Once the source is energized, press the **Menu** button and scroll to the  button.
4. Press the **Select** button and then press the **Scan** button to start the graph. Press the **Scan** button again to stop the graph.
5. The elapsed time of the scan is noted at the beginning middle and end of the graph with the absolute value at each of those points displayed.
6. To exit the **Graph** Display, press the **Select** button again when the  button is highlighted.

File Selector Operation


To enter the **File Selector** Display, move the scroll wheel clockwise or counter-clockwise. In the File Selector, the soft keys will be inactive and grayed out. The **Store** field in the bottom left of the screen will be changed to **MEM** location and there will be three loss values on the display. The middle loss measurement is stored in the indicated memory location with the wavelength of the reading to the right. Pressing the **A/B** button will cycle through the readings stored in that location if more than one wavelength was stored. The grayed out readings above and below the main reading are the measurements of the previous and next memory locations. If there is not activity in 5 seconds, the screen will revert back to the **Measurement** Display. The **Scan** button will also return to the **Measurement** Display.




Pressing the Select button will overwrite the displayed test with what is in the temporary memory.

NOTE

Quick File Locator

To quickly move through the loss storage locations, press the **Menu** button and then use the scroll wheel to highlight the  button. Press the **Select** button and the memory location at the bottom of the display will be highlighted. Press the **Select** button to focus the highlighted area on just the 1000's position and then use the scroll wheel to adjust the value. Press the **Select** button again to move the focus to the 100's position and repeat this procedure until the desired storage location is found. Using the scroll wheel when all the digits are highlighted will move through the positions one at a time. Press the **Menu** button again to exit the Quick File Locator function.


Deleting Stored Loss Measurements



To delete individual measurements from a single memory location, while in the File Selector Display, highlight the desired test to be deleted. Press the **Menu** button and use the scroll wheel to highlight the  button and then press the **Select** button.



There is not any warning or confirmation necessary to delete one memory location.

NOTE


To delete all of the memory locations at one time, follow the procedure for deleting a single file while starting from an empty memory location. While the  button is selected when an empty location is highlighted, a **Confirm** dialog box will appear. Use the scroll wheel to highlight the **Delete** or **Cancel** option and then press the **Select** button to complete the desired action.

Measurements may also be deleted in the **Quick File Locator** Display. With the storage location highlighted, press the **Menu** button, use the scroll wheel to highlight the  button and then press the **Select** button. There is a time-out period associated with the Quick File Select function. If the display reverts to the **Measurement** Display before the  button is selected, the file will not be deleted.



A loss measurement of (—) is not empty if there is a wavelength displayed to the right. This indicates a null measurement. An empty location is (—) with no wavelength displayed to the right.

Transfer Files to a PC

The File Upload function is used to send the saved Loss Test Measurement Data to a PC. Once the TFS-2000 is connected to a computer running the ToolBox software, press the **Menu** button and then use the scroll wheel to highlight the  button. When the ToolBox software directs you to proceed, press the **Select** button to immediately start an upload to the computer via the USB cable. The upload progress will be indicated by the upload counter in the bottom left corner of the display. Press the **Menu** button to return to the **Measurement** Display.

Chapter 5

Video Scope

This chapter:

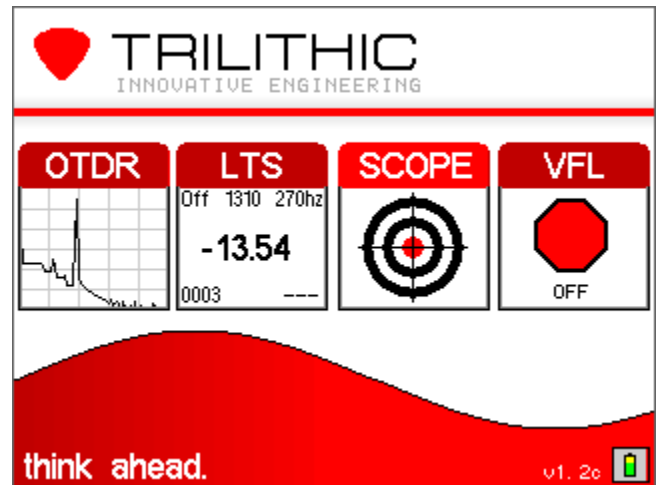
- Describes the Video Scope Application

Video Scope Overview

The TFS-2000 Series can accommodate the Trilithic Video Probe (Optional) that connects to an 8-pin DIN connector labeled “Vid Probe” on the bottom panel of the device. The TFS-2000 Series can be used to view a connector endface to look for contamination and damage.

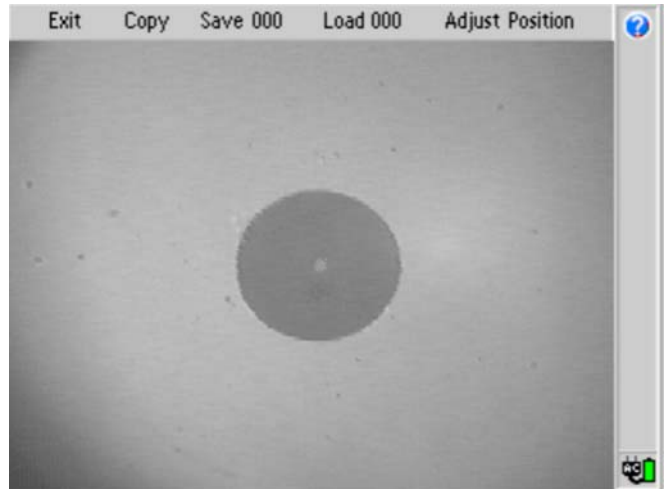
Video Scope Operation

This Video Scope Application is accessed from the **Main** Display. Use the scroll wheel to highlight the **Scope** icon, and press the **Select** button. To exit the Video Scope Application, press the **Menu** button, scroll to the **Exit** soft key, and press the **Select** button.



Perform the following steps to use the video probe:

1. Connect the video probe to the connector labeled "Vid Probe".
2. Turn on the probe light by moving the switch on the probe to the on position. The LED will illuminate indicating the probe light is on.
3. Insert a connector into the probe or insert the probe into a fiber adapter.
4. Use the thumb wheel on the video probe to focus the image.



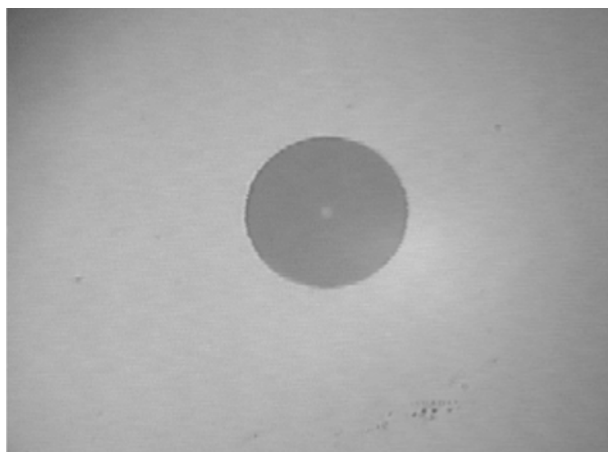
NOTE

Only the soft keys and the Help icon are accessible on the Video Probe display.

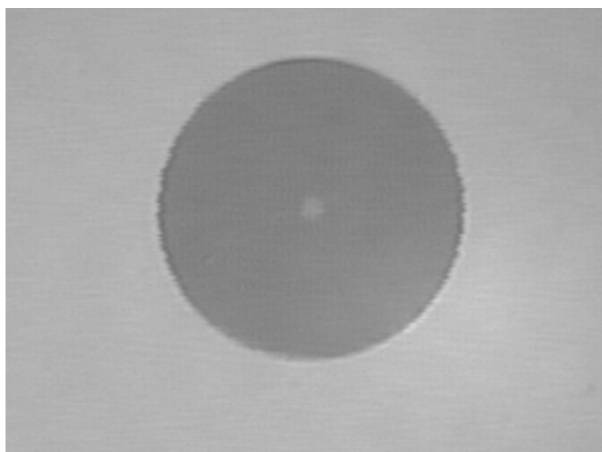
Adjusting the Video Scope Image

Zoom

To adjust the zoom from 200X to 400X, press the **Zoom** button. Pressing the **Zoom** button again will revert back to 200X.



Zoom 200X



Zoom 400X

Position

To adjust the position on the display, the image must be in 400X zoom mode and the soft key located in the top right corner of the display must indicate Adjust Position. Pressing the **Select** button will auto center the image if there is sufficient contrast. The image may be manually centered by pressing and holding the scroll wheel in the direction of the desired movement.

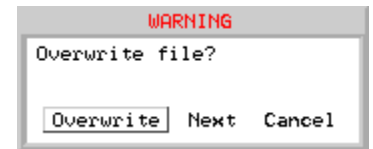
Contrast

To adjust the contrast of the image, the soft key located in the top right corner of the display must be set to Adjust Contrast. If it is not, and Adjust Position is displayed, press the **Menu** button and scroll to the **Adjust Position** soft key. Press the **Select** button to toggle to the **Adjust Contrast** soft key. With **Adjust Contrast** displayed, use the scroll wheel to increase or decrease the contrast of the image.

Quick Save of Scope Image

A scope image may be easily stored as a BMP image to memory by using the **Save ###** soft key. To quickly save scope images, perform the following steps:

1. Press the **Menu** button and use the scroll wheel to highlight the **Save ###** soft key.
2. Press the **Select** button. The scan will be saved to the location indicated.
3. If that storage position is full, a dialog will be displayed with the options of overwriting the file, storing to the next available location, or canceling the command.
4. Use the scroll wheel to highlight the desired action and then press the **Select** button. The action will be complete and the display will return to the Video Scope Display.



Each time a file is saved with this method, the file name will default to a base file name of the last manually entered file. Each subsequent file will then assume the base file name and increment the file suffix by one.

Quick Recall of Scope Images

A scope image may be easily recalled from memory by using the **Load ###** soft key. To quickly recall scope images, perform the following steps:

1. Press the **Menu** button and use the scroll wheel to highlight the **Load ###** soft key.
2. Press the **Select** button. The image that is stored in the indicated storage location will be displayed.
3. Continue to press the **Select** button to cycle through any stored images.

Visible Fault Locator Operation

This chapter:

- Describes the Video Scope Application



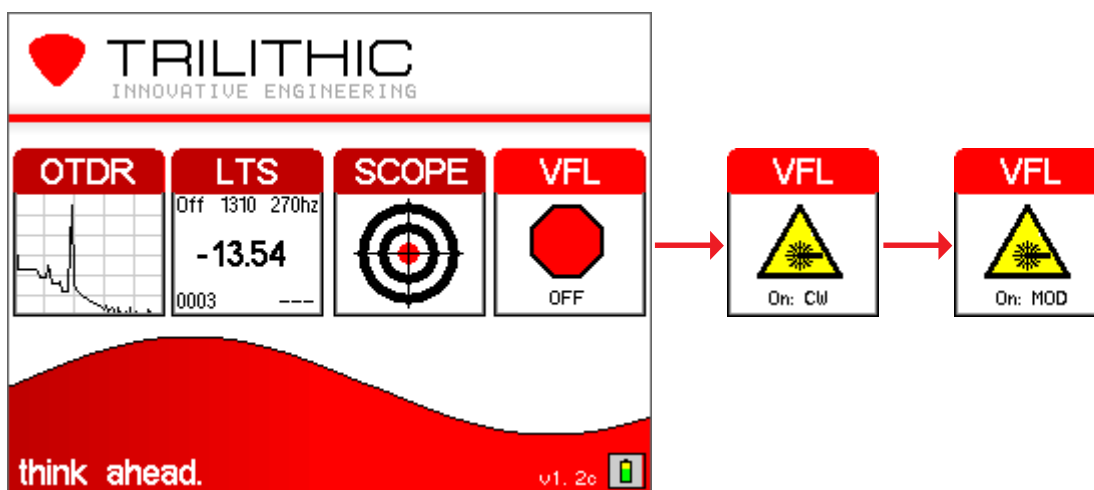
Never clean or look directly into the fiber optic connector or the end of the fiber attached to the Optical Time Domain Reflectometer or VFL unit while they are energized; to do so will expose the user to laser radiation and could result in personal injury or instrument damage.

Overview

The Visible Fault Locator (VFL) is a stabilized fiber optic laser source that emits visible (red) light at 650nm. The intended function of the VFL is to allow an operator to identify fibers or find the exact location of a break, micro bend, or other discontinuity in a fiber optic cable. As the radiation is visible, light emanating from a break or micro bend enables the user to locate the exact position of a fault even at very short distances that would not be detectable by other means. It is also useful for identifying a particular fiber in a cable by exciting the fiber to be located with visible radiation.

Operation

To enter the FVL Application from the **Main** Display, use the scroll wheel to highlight the **VFL** icon and then press the **Select** button to cycle through the VFL through CW (constant wave) mode or MOD (modulated) mode and Off.



Replacing the VFL Split Sleeve

The split sleeve is removable for ferrule cleaning and to replace a broken split sleeve. To remove the split sleeve, grasp the universal adapter and unscrew it counterclockwise. This will expose the split sleeve. Firmly grasp the sleeve and pull straight off of the ferrule. You may now clean the ferrule with the appropriate cleanser and cloth. Once cleaned, replace the split sleeve over the ferrule and return the adapter over the sleeve and screw clockwise until snug, ensuring not to over tighten.



Troubleshooting

Before You Begin Troubleshooting

- A low battery may cause the detector to not turn on or operate incorrectly. Make sure you have properly charged NiMH batteries installed before troubleshooting the unit.

LCD is Dark

- The **Power** button has not been pressed to turn the unit on. Press the **Power** button.
- The batteries are drained. Recharge the batteries.
- The batteries need replacing. Contact Trilithic for servicing requirements.

LCD is White

- The power was cycled too quickly. Turn off the unit and wait five seconds and then turn the unit back on.

Instrument is Locked Up

- Unexpected Operational Mode; turn the unit off (hold the **Power** button in for one second) and wait for five seconds, then press the **Power** button again to turn the unit back on.

Initial Backscatter Low

- The cord is defective. Replace the cord.
- A connector is dirty. Clean or replace the connector.
- The fiber optic port requires cleaning. Clean and inspect the port.
- Angle polish is mated with UPC polish. Examine the connector ends.

Extra or “Ghost” Reflections on Backscatter

- Fiber too long for short pulse, switch to 10m pulse if >4Km
- Fiber over 16Km/53Kft, switch to 100m pulse if >16Km
- Fiber over 64Km/200Kft, switch to 1km pulse if >64Km

USB to PC Communication Interface is Not Functioning Properly

- The USB baud rate is not set properly or is too quick for the computer. Set the port baud rate properly or decrease the baud rate in the instrument and ToolBox software.
- The PC drivers are not set properly. Uninstall and reinstall the ToolBox software and drivers.

USB Flash Drive is Not Functioning Properly

- The USB Flash Drive is full. Remove all unnecessary files from the Flash Drive or use a different Flash Drive that has sufficient storage space.

Specifications

Optical Time Domain Reflectometer

- Wavelength
TFS-2225: 850, 1300 nm \pm 20 nm
TFS-2250: 1310, 1550 nm \pm 20 nm
TFS-2500: 850, 1300, 1310, 1550 nm \pm 20 nm
- Dynamic Range
27/26 dB MM, 32/30 dB SM, 30/29 dB TRI
- Pulse Width
20 - 10,000 ns
- Units of Measurement
km, kf
- Event Dead Zone
2 m
- Attenuation Dead Zone
5 m
- Resolution
0.25 - 0.64 m
- Distance Uncertainty
 $\pm(0.75 \text{ m} + .005\% \times \text{distance} + \text{sampling resolution})$
- Full Scale Distance Range
1-64 km MM, 1-240 km SM
- Typical Real-Time Refresh Rate
4 Hz
- Group Index of Refraction (GIR)
1.000 - 2.000
- Linearity
 $\pm 0.05 \text{ dB/dB}$
- Memory Capacity
1000 traces

Visible Light Source

- Emitter Type
Laser
- Wavelength
650 nm \pm 5 nm
- Laser Safety Class
Class IIFDA21
FCR1040.10 & 1040.11
IEC 825-1:1993
- Connector Type
2.5 mm Universal
- Output Power
< 1 mW Max.

Power Meter

- Detector Type InGaAs
- Calibrated Wavelength 850, 1300, 1310, 1490, 1550, and 1625 nm
- Units of Measure dBm, dB
- Resolution 0.01 dB
- Power Measurement Range +5 dBm to -77 dBm
(CATV +25 dBm to -57 dBm)
- Power Measurement Uncertainty ± 0.18 dB under reference conditions,
 ± 0.25 dB from 0 to -65 dBm,
 ± 0.35 dB from 0 to +5 dBm and -65 to -77 dBm
- Autotest Measurement Range Four seconds per wavelength
- Autotest Range 0 to -36 dB
- Storage Locations 10,000 loss measurements

IR Light Source

- Wavelengths TFS-2225: 850, 1300 nm ± 20 nm
TFS-2250: 1310, 1550 nm ± 20 nm
TFS-2500: 850, 1300, 1310, 1550 nm ± 20 nm
- Output Power (CW) 0 dBm (-3 dBm @ 1625 nm)
- Laser Safety Class Class I safety per FDA/CDRH and IEC-825-1 regulations
- Modulation Modes CW, 270 Hz, 1000 Hz, 2000 Hz

General

- Memory Type Internal and USB Flash Drive
- Display 4" color TFT
- Dimensions 7.75" x 4.5" x 2.25"
(19.68 cm x 11.43 cm x 5.72 cm)
- Weight 2 lbs (0.91 kg)
- Battery Rechargeable NiMH - 8 hours operating time
- Power 100-240 universal US, GB, EU, AU adapter plugs
- Operating Temperature -10°C to +50°C
- Storage Temperature -20°C to +60°C

Warranty Information

Trilithic, Inc. warrants that each part of this product will be free from defects in materials and workmanship, under normal use, operating conditions and service for a period of one (1) year from date of delivery. Trilithic, Inc.'s obligation under this Warranty shall be limited, at Trilithic, Inc.'s sole option, to replacing the product, or to replacing or repairing any defective part, F.O.B. Indianapolis, Indiana; provided that the Buyer shall give Trilithic, Inc. written notice.

Batteries are not included or covered by this Warranty.

The remedy set forth herein shall be the only remedy available to the Buyer under this Warranty and in no event shall Trilithic, Inc. be liable for incidental or consequential damages for any alleged breach of this Warranty. This Warranty shall not apply to any part of the product which, without fault of Trilithic, Inc., has been subject to alteration, failure caused by a part not supplied by Trilithic, Inc., accident, fire or other casualty, negligence or misuse, or to any cause whatsoever other than as a result of a defect.

Except for the warranty and exclusions set forth above, and the warranties, if any, available to the Buyer from those who supply Trilithic, Inc., there are no warranties, expressed or implied (including without limitation, any implied warranties of merchantability or fitness), with respect to the condition of the product or its suitability for any use intended for it by the Buyer or by the purchaser from the Buyer.



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