



# **FTE-7000A-DWDM Optical Time Domain Reflectometer User's Guide**

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## Chapter 1 Using This Manual

This manual contains operation information for the Terahertz Technologies Inc. DWDM Optical Time Domain Reflectometer. This OTDR may be operated by using the touch screen or the onboard key pad. The touch screen is a resistive style screen and only proper stylus devices should be used when operating the OTDR using the touch screen capability.

This guide is written to instruct operation via the onboard keypad. There will be tips throughout the manual to assist with touch screen operation.

### **Precautions**

Optical Time Domain Reflectometers are optical instruments that do emit laser radiation and though this level of radiation is not considered a danger, there are safety considerations and certain practices that should be followed.

Please read and follow all warning and caution information noted in this manual.

*There are warnings, cautions and notes posted throughout this manual.*

### **Warning**

A warning alerts to situations that could cause personal injury.

### **Caution**

A caution alerts to situations that may cause damage to the equipment or produce poor testing conditions resulting in inaccurate test results.

### **Note**

A special annotation that will assist the user with operational features.

### **Touch Screen Tip**

These tips will be found throughout the manual to assist with touch screen operation.

Chapter 3 of this manual is a quick start guide. Prior to using the quick start guide or operating the equipment in any way, it is highly suggested the user reads all safety information.

The information in this chapter pertains to safety consideration of OTDRs in general.

This product has been designed and tested in accordance with the manufacturer's safety standards, and has been supplied in a safe condition.

This document contains information that must be followed by the user to ensure safe operation and to maintain the product in a safe condition. Failure to follow these safety warnings and cautions can result in harm to the user or damage to the instrument.

### **Warning**

Personnel should always be aware when working with fiber optic test equipment that active fibers may be present, therefore infrared optical energy may be present.

### **Warning**

Never look directly into the end of a connected fiber optic cable or fiber optic interface of optical test equipment, to do so could expose the user to laser radiation and could result in personal injury.

### **Warning**

To Prevent Fire or Shock Hazard:

- Do not install battery types other than those specified by the manufacturer
- 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 the correct charger is being used for the local line voltage
- Do not use any other charger than the one provided with this instrument.

*Failure to follow these cautions statements may void the warranty of, or cause damage to this equipment.*

### **Caution**

Fiber-optic connectors are easily contaminated or damaged. The connection to the OTDR is physical contact type of connections and dirty or damaged connectors may impair the instruments capabilities at minimum and at worst result in the need to return the OTDR to the factory for expensive repairs. Prior to making any connection to the unit, ensure that all proper cleaning procedures have been followed. Use UPC Finish Connectors Only -- DO NOT insert APC connectors into the optical ports.

### **Caution**

The OTDR is equipped with a protection circuit to avoid damage from live fiber connections. The instrument will not operate properly with active fibers. Even with this protection, high power output from EDFA's or other equipment can damage detectors and should never be connected to the OTDR.

If a live fiber is connected to the OTDR and a scan is attempted, a warning dialog will be displayed as in fig. 2.1. Immediately remove the live fiber from the OTDR and press select to continue testing.

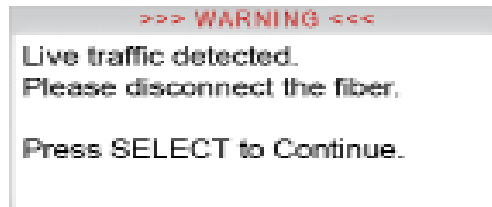


Fig 2.1




## Chapter 3 OTDR Quick Start Guide

Press  to turn on the OTDR.


This quick start guide demonstrates use by way of the touch screen unless the keypad is required..

Touch the OTDR icon located in the center of the Home screen.

Connect the fiber to the appropriate OTDR Optical Port)


Touch the  (wavelength (Lambda) icon) on the left side of the parameter area of the display to bring up the wavelength selection pages. Touch the desired wavelength for testing or select the next page.


**If approximate fiber length is unknown:**


Press  to have the OTDR start a test using the selected wavelength with the OTDR determining the most appropriate range and pulse width.

**If approximate fiber length is known:**

Set the Wavelength as above.

Touch the  (Average icon) to cycle through the available averaging times of Real-Time, 15 seconds, 1, 4, 16 or 40 minutes.

Touch the  (Pulse Width icon) to cycle through the available pulse widths of 5ns, 10ns, 30ns, 100ns, 300ns, 1us, 3us, 10us or 30us. (Not all pulse widths will be available, only pulse widths appropriate for the selected range will be presented)

Touch the  (Range icon) to cycle through the available ranges of 250, 500m, 1km, 2km, 4km, 8km, 16km, 32km, 64km, 100km or 200km.



Touch scan or press the Scan button to start a trace. A second touch or press will stop a trace.

## Chapter 3 FTE7000A-DWDM Quick Start Guide

To operate the cursors, touch the A ➡ B area of the screen or press the A/B button to toggle between A and B as the active cursor. To move the cursors, with the desired cursor as the active cursor (solid vertical cursor line) touch the screen and the cursor will snap to that location, leave the cursor in contact with the display and drag the cursor to the desired location. The left and right buttons on the display may also be used.

To view the event table with the trace, touch the Event tab in the center of the display.

To view the schematic with the trace, touch the Schematic tab in the center/right of the display

To save a trace, touch the  button and use the left or right buttons to highlight the Quick Save icon and touch it or press . The file will be saved to the active folder.

## Chapter 4 Introduction

Dear Valued Customer,

Thank you for choosing Terahertz Technologies Inc. for your fiber optic testing requirements. Our professional staff is available to answer any questions or provide assistance that you require. We, at Terahertz Technologies Inc., strive to provide premier customer care and technical support by providing timely responsiveness and training. We are proud of our quality and high standards and assure you, our customer, the most user friendly and affordable fiber optic solutions to meet individual needs.

## Chapter 5 Inspection and Identification

### 5.1 Inspection

Before shipment, this instrument was inspected and found to be in perfect working order and free of defects.

The shipping carton contains the following:

1. OTDR with Protective boot
2. Universal AC/DC charger with interchangeable mains
3. USB cable
4. Manual and CertSoft software on CD.
5. Set of interchangeable adapters, SC, and FC.

### 5.2 Identification and Configuration

The instrument's Model/Part Number, Serial Number and Date of Manufacture are indicated on a label located on the back of the unit. The instrument's history is filed at the factory by model/part number and serial number. The unit's serial number is also located on the top plate just above the USB Port.

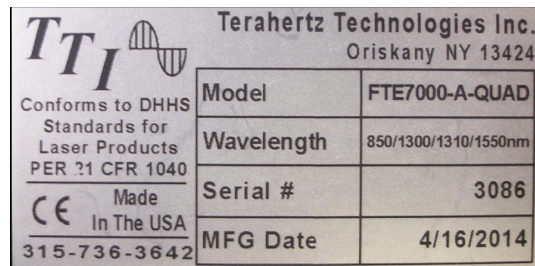


Fig 5.1

## Chapter 6 Description

### 6.1 OTDR Physical Description

#### Instrument Enclosure

The FTE7000A-DWDM is packaged in a rugged housing which is further protected with a rubberized boot. Although the front panel is weather resistant, care must be taken to avoid liquids and contaminants around the fragile optical and electrical connectors, and the glass display. Use a mild cleaning agent and soft damp cloth to clean up the panels and the outside case. See the maintenance section to clean the optical connector. NEVER open the instrument for cleaning. Return to the factory for servicing if necessary.

#### Front Panel



Fig 6.1

#### Top panel

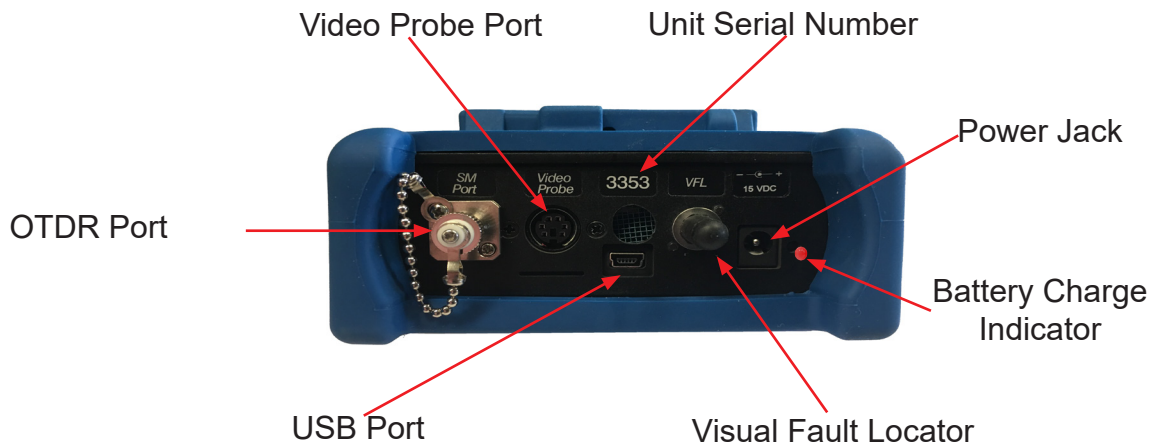


Fig 6.2

## Chapter 6 Description

### 6.2 Home Screen Display

This unit is equipped with a 4" color TFT resistive touch display. All keyboard functions are also executable on the touch screen.

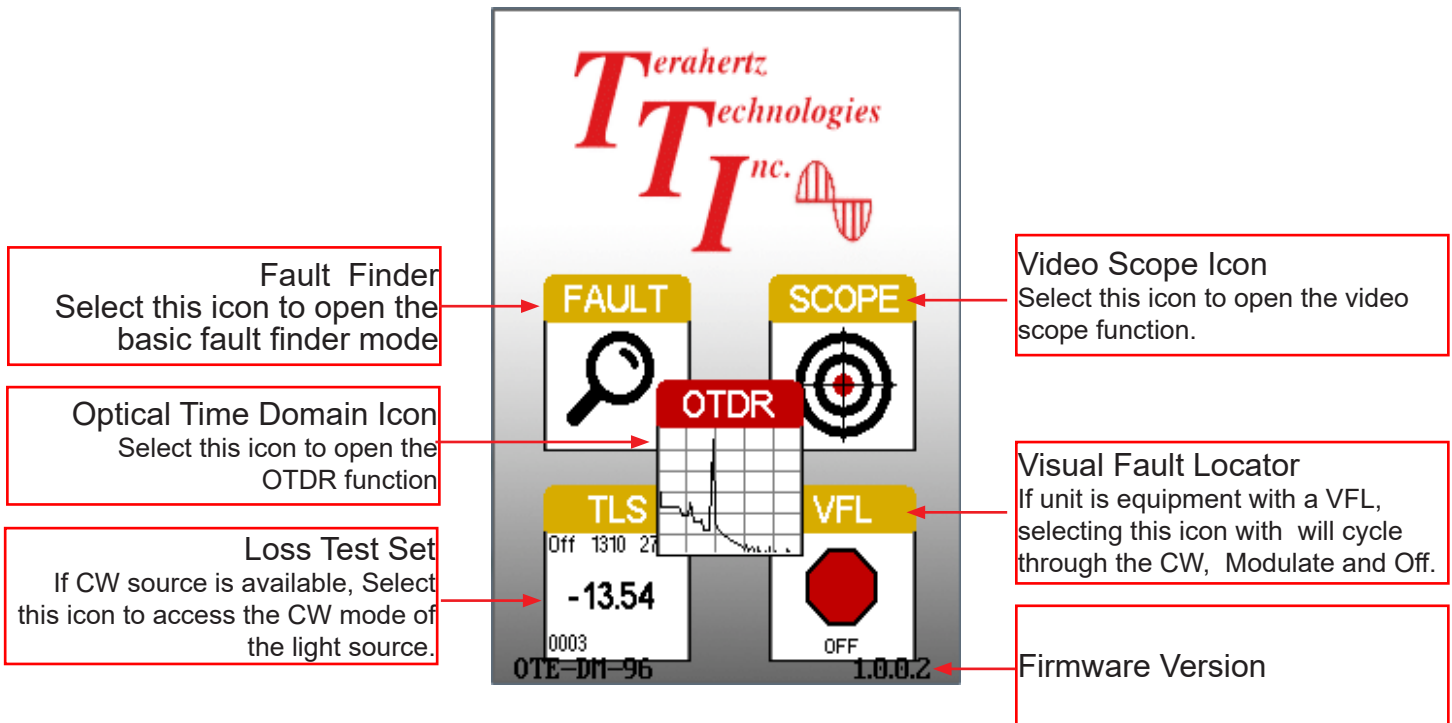


Fig 6.3

### Touch Screen Tip

The home page icons are highlighted by using the left and right buttons, pressing the select button will open the highlighted function. These icons may also be selected with the touch screen function.

### 6.3 Power Requirements

The FTE7000A-DWDM is equipped with a 100-240V-0.4A input universal battery charger with 15V, 1.2A, (center positive output). The charger is supplied with interchangeable mains plugs for North America, Great Britain, Europe and Australia. The units internal power supply is an 11.1V 2600 mAh Li-ion battery. Typically, fully discharged batteries require 2 hours of recharging.

### **WARNING**

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. Do not use any charger other than the one provided with this instrument. Any other condition will void the warranty.

### 6.4 Battery Replacement

Batteries are factory installed. The unit should be returned to the factory for a new battery if required. It is suggested batteries receive a charge at least one a month.

#### **Warning**

To Prevent Fire or Shock Hazard:

- Do not install battery types other than those specified by the manufacturer
- 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 the correct charger is being used for the local line voltage
- Do not use any other charger than the one provided with this instrument.

**Failure to follow these caution statements could cause unsafe conditions for the operator and equipment and may void the warranty.**

## Chapter 7 OTDR Operation

### 7.1 Key Pad



Power button, turns the unit On and Off. (Hold for 1 second)



Scan button starts a scan or stops scan.



AutoTest button operates range finder trace mode. The Range Finder mode 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.



The Menu button displays and hides the icon menu at the top of the display. It will also back out of most menu selected screens. In the project folder and file manager it opens the file/edit menu bar. When the menu is displayed at the top of the screen, the focus of the LRUD buttons and the select buttons are on the icon menu and no longer on the trace cursors.



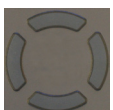
Toggles between A and B as the active cursors.



Selects the Zoom level, each press increments through the levels of 1x, 2x, 4x, 8x, 16x and 32x.



In the menu mode, the select button actuates highlighted item.



While in the trace mode the directional buttons are used to move the cursors. In the Menu mode, the Left and right buttons move between the icons. The up button hides the menu bar or moves cursor up in drop-down menus and the down button opens drop-down menus or move cursor down while in a drop-down menu.



Fig 7.1


















## Chapter 7 OTDR Operation

### 7.2 Entering OTDR Function

Press the power button to turn on the OTDR.

Use the LRUD button buttons to highlight the OTDR icon and press the select button to enter the OTDR function.

### 7.3 Icon Definitions

	Home	Brings the user back to the home page
	Quick Save	Saves the current trace to the current folder, incremented using last named file
	Quick Load	Recalls the next file, chronologically in the current folder.
	Tool Box	Set brightness, calibrate touch screen and set USB or Bluetooth
	Project Folder	Opens project management
	File Manager	Opens file management
	Schematic View/Event Analysis	Opens the Fib-R-Map and event analysis view
	Settings	Opens the parameters setting page.
	Splice Zone Setting	Turns on LSA/Splice markers
	Help	Opens the context sensitive help menu
	Lambda (Wavelength)	Cycles through available wavelengths
	Averaging	Cycles through averaging times
	Pulse Width	Cycles through available pulse widths
	Range	Cycles through available test ranges
	Index of Refraction	Opens the Index of Refraction entry screen

## Chapter 7 OTDR Operation

### 7.4 Main OTDR Screen

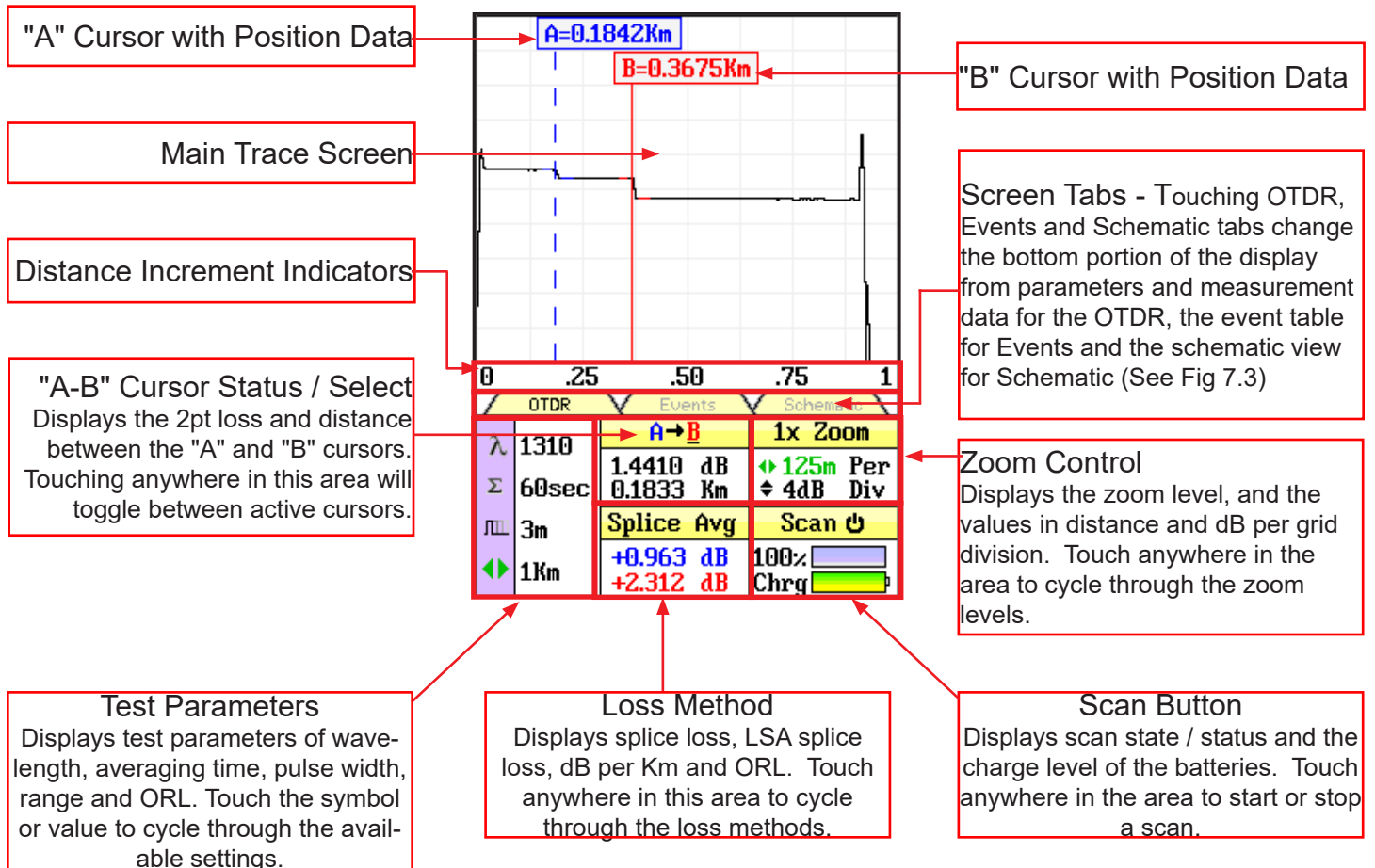


Fig 7.2

### Touch Screen Tip

Use the touch screen to snap cursors to a position by touching that point along the trace curve. The active cursor will move directly to that point. For finer movement, touch active cursor and drag it to the desired position. Finest movement can be accomplished with the LRUD buttons.

### Touch Screen Tip

All the test parameters may be change by touching the value on the touch screen. A long touch in the test parameter section of the screen will open the parameter settings page. A/B cursor, zoom, loss method and scan may all be operated with the touch screen.

## Chapter 7 OTDR Operation

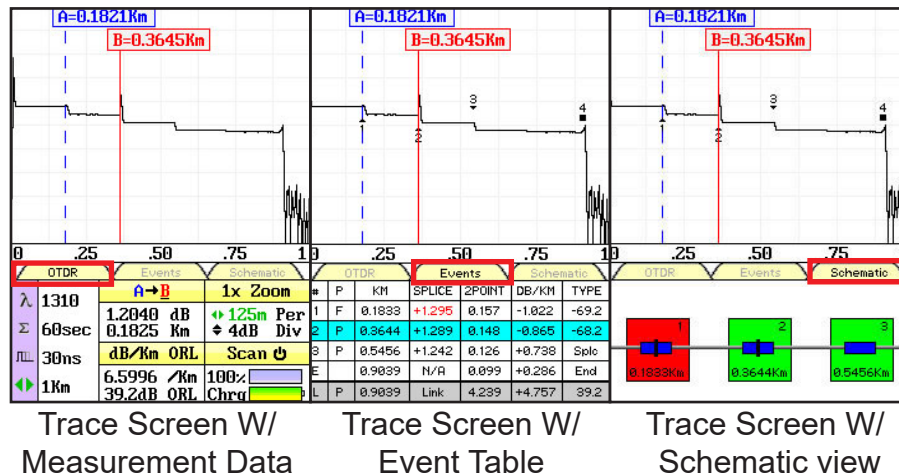


Fig 7.3

There are three tabs on the main OTDR screen. OTDR, Events and Schematic. Use the OTDR tab to view the trace with the loss and distance measurements. Use the Events tab to view an interactive event table with the trace and numbered events or the Schematic tab to view an interactive schematic view of the events with the trace and numbered events. Selecting an event in the event table or the schematic view will snap the active cursor to that event.

### 7.5 OTDR Parameter Settings Screen

To access the parameter settings screen press the menu button, use the LRUD buttons to highlight the setting icon and press the select button. An alternate manner to open this screen is to long touch the screen in the test parameter section of the main OTDR screen.

#### Touch Screen Tip

All operations on this page are accessible via the touch screen. To change parameters or event sensitivity, simply touch the desired value. To set thresholds and time, touch the setting and the block will show yellow. The digits may now be adjusted with the up and down arrows.

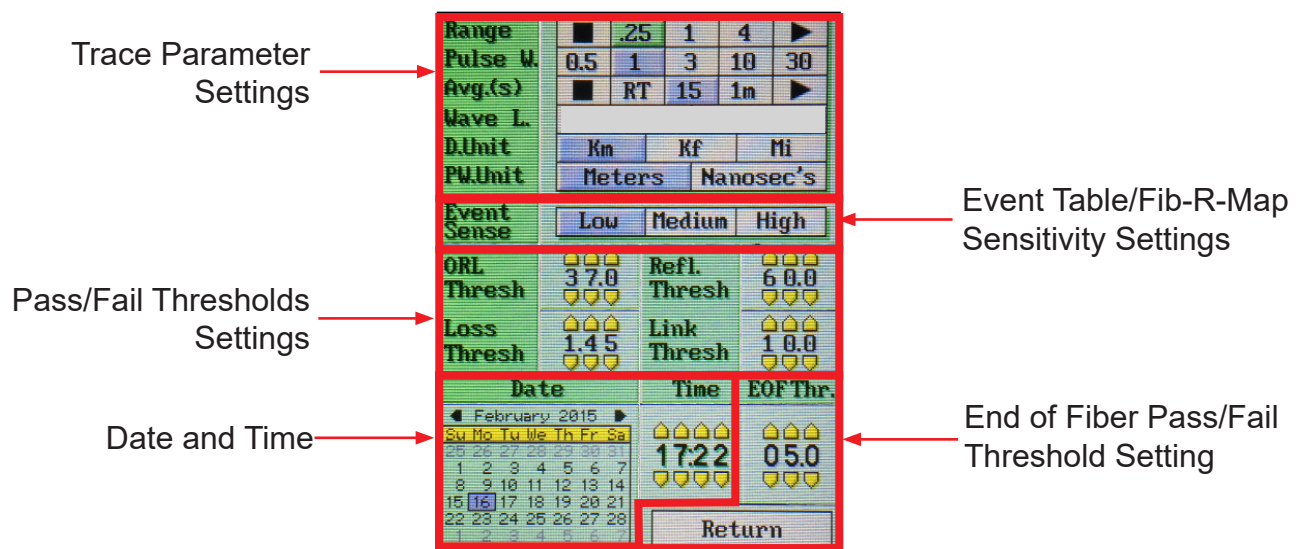


Fig 7.4

## Chapter 7 OTDR Operation

### **Trace Parameter Settings**

The cursor is the yellow highlighted area. (If the yellow cursor is on a value that is selected, that block will be highlighted green) The blue values are the currently selected values. To move through this section, use the Up/Down buttons to move between parameters and the Left/Right buttons to change parameter values.

There are two additional setting in this area that are not available on the main OTDR screen, distance unit and pulse width unit.

### **Touch Screen Tip**

When using the touch screen feature, only a single touch is required to set trace parameters.

### **Note**

An arrow at the beginning or end of a list indicates additional setting are available. A black square at either end indicated the end of the list.

### **Event Table/Fib-R-Map Sensitivity Settings**

The cursor is the yellow highlighted area. (If the yellow cursor is on a value that is selected, that block will be highlighted green) The blue values are the currently selected values. There are three levels of sensitivity for the event table and Fib-R-Map. The lowest setting possible should be used to help filter out any events, that may be caused by short pulse widths, but are not true perturbations in the optical signal

### **Pass/Fail Threshold Settings**

There are five pass/fail thresholds that may be set. Use the LRUD buttons to move between threshold categories, once a categories is highlighted, press select to change the focus of the LRUD buttons. Use the up/down button to make changes to the highlighted digit and the left/right buttons to move the another digit. Once the desired value is entered, press selected again. Continue until all thresholds settings have been completed.

### **Note**

There is an ORL Threshold and a Reflection Threshold setting. The ORL is the return loss for the entire link/system and reflection threshold is the return value of a given event.

### **Date/Time Settings**

Use the LRUD buttons to highlight the calendar month and press select. Use the left and right buttons to change the month and press select. Use the LRUD buttons, highlight the date and press select.

Use the LRUD to buttons to highlight the clock and press select. Use the up/down buttons to make changes to the highlighted digit and the left/right buttons to move the another digit. Once the desired time is entered, press selected.

### **Exit Parameter Setting Screen**

Press the menu button or touch Return to exit the parameter page.

## Chapter 7 OTDR Operation

### **Warning**

Before connecting 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.

### **Warning**

Clean connector thoroughly prior to connection to the appropriate port of the OTDR. Failure to ensure the connectors used with the OTDR are properly cleaned can result in poor launch conditions at the minimum or damage to the optical interface that requires the unit be returned to the factory for repair.

## 7.6 Auto Test

Auto Test is a useful feature when the approximate length of the fiber to be tested is unknown. To use the AutoTest, only the IOR and Wavelength need to be set by the user.

### **Note**

To assist in obtaining reliable, consistent measurements, the user should be aware of the Index of Refraction of their fiber. The proper Index of Refraction (IOR) will maximize the distance measurement accuracy. The IOR is proportional to the speed of light in glass compared to the speed of light in a vacuum and can be calculated using the equation  $IOR = C$  (the speed of light in a vacuum) /  $V$  (the speed of light in fiber). The IOR number can be obtained from 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. If this is unknown it is best to use the default setting on the OTDR.

### **Set IOR**

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. To view the current IOR for a wavelength, open the menu use the left/right button to highlight the IOR Icon. Press select and the IOR for the wavelength that is the active will be displayed. To change the IOR, use the on screen QWERTY keyboard to enter the new value and touch save. Each wavelength stores an independent IOR.

### **Set Wavelength**

To select the wavelength, press the menu button to display the menu at the top of the display. Use the LRUD buttons to highlight the Lambda (Wavelength) icon, press select to open the page with available wavelengths displayed. Use the touch screen to select a wavelength or move to the next page of available wavelengths.

### **Start Auto Test**

Press the AutoTest button and the unit will set the average time to short, the appropriate pulse width and range parameters for the fiber under test.

### **Warning**

Before connecting 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.

### **Warning**

Clean connector thoroughly prior to connection to the appropriate port of the OTDR. Failure to ensure the connectors used with the OTDR are properly cleaned can result in poor launch conditions at the minimum or damage to the optical interface that requires the unit be returned to the factory for repair.

## 7.7 Manual/Expert Mode

### **Note**

To assist in obtaining reliable, consistent measurements, the user should be aware of the Index of Refraction of their fiber. The proper Index of Refraction (IOR) will maximize the distance measurement accuracy. The IOR is proportional to the speed of light in glass compared to the speed of light in a vacuum and can be calculated using the equation  $IOR = C$  (the speed of light in a vacuum) /  $V$  (the speed of light in fiber). The IOR number can be obtained from 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. If this is unknown it is best to use the default setting on the OTDR.

### **Set IOR**

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. To view the current IOR for a wavelength, open the menu use the left/right button to highlight the IOR icon. Press select and the IOR for the wavelength that is the active will be displayed. To change the IOR, use the on screen QWERTY keyboard to enter the new value and touch save. Each wavelength stores an independent IOR.

### **Touch Screen Tip**

All the test parameters may be change by touching the value on the screen to the right of the icon. A long touch in the test parameter section of the screen will open the parameter settings page.

### **Set Wavelength**

To select the wavelength, press the menu button to show the menu at the top of the display. Use the LRUD buttons to highlight the Lambda (Wavelength) icon, press select to open or simply touch the wavelength value on the OTDR screen. A touch screen only menu will be displayed to select one or multiple wavelengths. The top of the menu has the option to select these values in Wavelength, Frequency or Channel Number. There are three pages of values to select from. Touch the desired value to select. If multiple values need to be tested, touch the Multi selection in the top right of the screen. A single touch turns on and a second touch turns off a value, A dragging motion may also be used to select and deselect. Once all values are selected, touch Done in the top left of the display. This will bring up the main OTDR screen with a wavelength indication of 1/# of values selected. Touching scan will cycle through all the wavelengths and save each test.

## Chapter 7 OTDR Operation

### Note

When setting the range and pulse width, it is necessary to keep in mind that it may not be beneficial to use certain pulse widths with some ranges. For this reason not all pulse widths are available for use with all ranges. The chart below the pulse widths that are available with each range.

**Pulse Width**

Range		5ns	10ns	30ns	100ns	300ns	1μ	3μ	10μ	30μ
	250m	✓	✓	✓	✓	✓				
	500m	✓	✓	✓	✓	✓				
	1km	✓	✓	✓	✓	✓				
	2km		✓	✓	✓	✓	✓			
	4km		✓	✓	✓	✓	✓			
	8km			✓	✓	✓	✓	✓		
	16km			✓	✓	✓	✓	✓		
	32km			✓	✓	✓	✓	✓		
	64km					✓	✓	✓	✓	✓
	100m					✓	✓	✓	✓	✓
	200km					✓	✓	✓	✓	✓

### Set Range

To set the range, press the menu button and use the LRUD buttons to highlight the range icon or simply touch the range value on the display. Both methods will display a touchscreen menu on the screen. Touch the desired pulse width to select.

### Set Pulse Width

To set the pulse width press the menu button and use the LRUD buttons to highlight the pulse width icon or simply touch the pulse width value on the display. Both methods will display a touchscreen menu on the screen. Touch the desired range to select. Pulse widths will be limited to appropriate values for use with the selected range.

### Set Averaging Time

To set the averaging time press the menu button and use the LRUD buttons to highlight the averaging icon or touch the average time on the display and a touchscreen menu with available average times will be displayed. Touch the desired value to select. the available average times are: RT (Real Time), 15, or 60 seconds and 4, 16 or 40 minutes.

### Scan

Once all the proper settings have been entered, press the Scan button to take the trace. To stop the trace press the scan button again.



### 7.8 Trace Analysis

#### Unit of Measure

The distance unit of measure may be either displayed in Kilometer (Km), Kilo feet (Kf) or Miles (Mi). To set the unit of measure, press the menu button, use the LRUD buttons to highlight the settings icon and press select to open the parameter screen. Use the down button to move the cursor to the D.Unit line in the parameter menu, and use the left or right button to highlight the desired unit of measure and press select. Press the menu button or touch Return to exit the parameter settings page.

#### Note

When in the Kilo feet (Kf) mode, the distance measurements are displayed in feet for the 820 foot and the 3.2 Kf ranges. All longer ranges have the distance measurements displayed in Kf.

#### Zoom

There are six zoom levels, 1x, 2x, 4x, 8x, 16x and 32X. To change the zoom level, press the zoom button on the keypad. This will cycle through the six levels. When viewing the trace at a zoom level other than 1x, the active cursor is centered on the trace display and when the cursors are moved, the trace moves and the cursor will remain centered.

#### Cursor Movement

The active cursor is displayed as a solid line and the non-active cursor as a dashed line. Pressing the A/B button on the keypad toggles between the two cursors as the active cursor. The cursors are moved using the left and right buttons.

#### Touch Screen Tip

Use the touch screen to snap cursors to a position by touching that point along the trace curve. The active cursor will move directly to that point. For finer movement, touch active cursor and drag it to the desired position. The finest movement can be accomplished with the left and right buttons.

### 7.9 Loss Measurements

#### 2 Point loss

2 Point loss measurements take into account the difference in vertical height between where the A and B cursors cross the fiber trace to determine loss. This information is located on the main OTDR screen in the A-B section of the trace information as shown in Fig. 7.2. This is a quick method of checking the loss between any two points on a fiber optic link.

#### dB/km

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



## Chapter 7 OTDR Operation

### **Optical Return Loss**

This Optical Return Loss (ORL) is separate from the event ORL (Reflectance) that is displayed in the event analysis under the TYPE header for an individual event. The measurement displayed in the loss measurement area of the main OTDR screen and in the E (End of Fiber) row in the TYPE column is an optical return loss based on the entire link. It is the total accumulated light reflected back to the source along the telecommunication link.

### **Basic Splice Loss**

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 back scatter 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.

When using the splice loss It is necessary to set these areas in clear back scatter (areas that do not consist of other events) to acquire the most accurate measurements. For accurate measurements, these areas can not include other events such as reflective or splice events. Set a cursor at the beginning of an event and set splice loss measurement areas as directed below and as shown in Fig. 7.6 for accurate splice loss measurements. Splice loss measurement areas will follow the undulations of the back scatter line unlike LSA areas.

### **Least Squares Approximation (LSA)**

Least Squares Approximation (LSA) Splice loss method gives the user a visual aid in setting splice loss areas. 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. The splice loss lines must be set to overlay the back scatter of a trace without over lapping any other events. Unlike basic splice lose, LSA measurement areas are drawn as straight lines without regard to the undulations of the back scatter

## **7.10 Loss Measurement Settings**

### **Touch Screen Tip**

The loss measurement/LSA areas may only be set with the key pad. Use the menu to enter the LSA settings function, but once there, use the key pay to adjust the areas as described. It is best to be zoomed in on an event to best set the loss measurement areas.

### **Setting Splice Loss Measurement Areas**

To set the basic splice loss measurement/ LSA ares, the OTDR must be in Splice AVG or Splice LSA mode. To adjust the splice loss areas around the cursors, press the menu button, highlight the LSA icon and press select. The splice lose position indicator will be displayed at splice loss position number 1 as indicated in Fig. 7.6. Use the left and right buttons to adjust the loss measurement area. Press the select button to move the splice lose position indicator to the position number 2, set the area and continue with positions 3 and 4 in the same manner. Press select when done with position number 4 to hide the splice lose position indicator and reset the focus of the keyboard back to the cursors. Press the menu button at any time to escape the splice lose settings sequence.

### **Note**

It is necessary to set these areas in clear back scatter to acquire the most accurate measurements, they must not include other events.

## Chapter 7 OTDR Operation

### Splice Loss Adjustment Areas

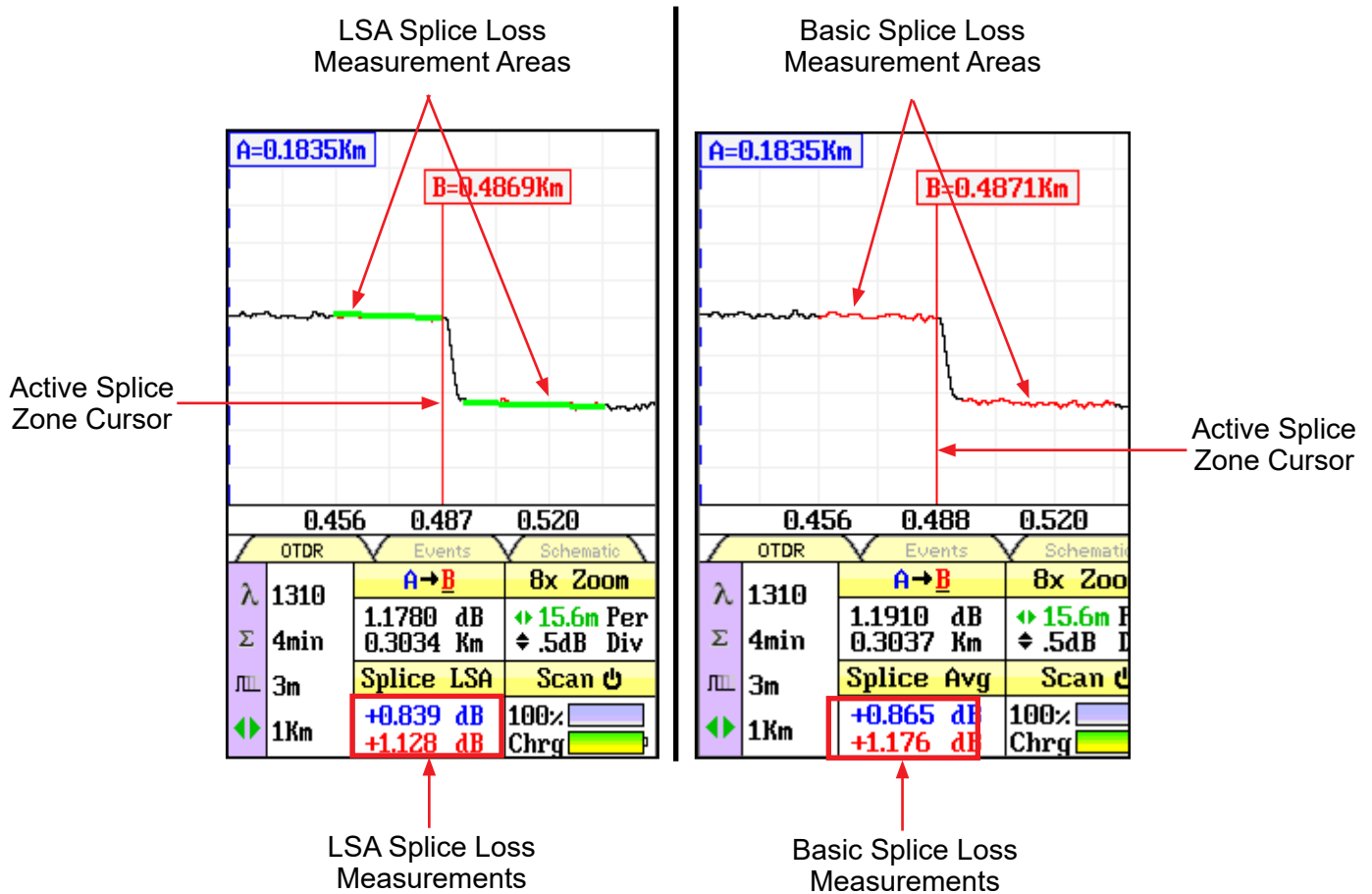


Fig 7.5

### Splice Loss Adjustment Positions

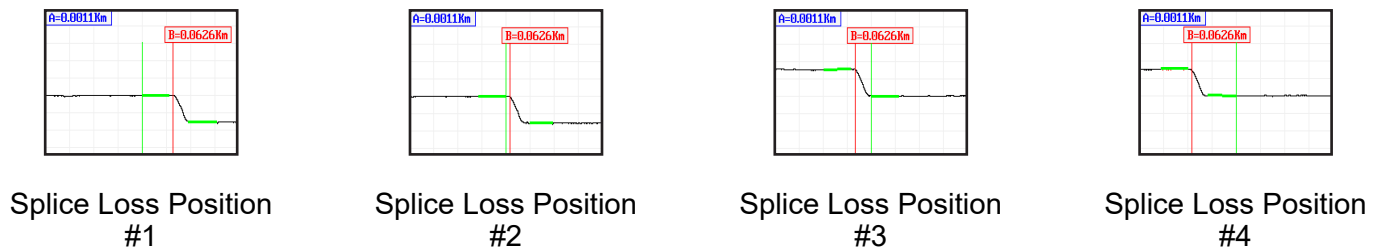


Fig 7.6

## Chapter 7 OTDR Operation

### LSA Examples

LSA Set Too Early:

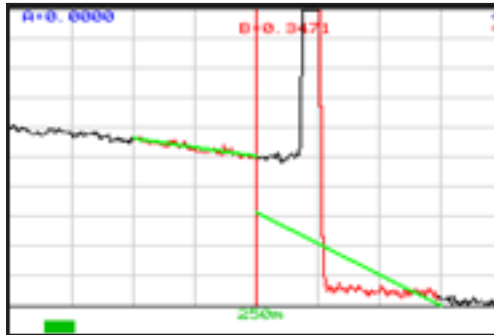


Fig 7.7

The LSA area and cursor are set too early. The right most green LSA indicator line is not over laying the back scatter of the trace properly

LSA Set Too Late:

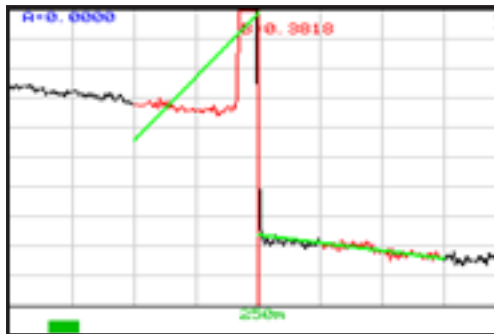


Fig 7.8

The LSA area and cursor are set too late. The left most green LSA indicator line is not over laying the back scatter of the trace

Proper LSA Setting:

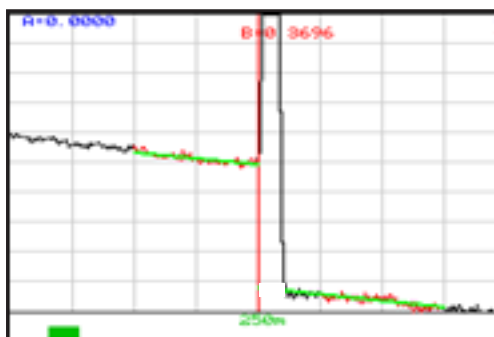


Fig 7.9

The LSA area and cursor are set properly. The green LSA indicator line is over laying the back scatter of the trace properly.

### 7.11 Event Analysis

#### **NOTE:**

When using the event table and the Fib-R-Map, it is necessary to keep in mind that event analysis provides approximate loss and distance measurements to quickly assist in network evaluation. Automatic detection results are not guaranteed and have their limits, possibly causing erroneous readings or detection failure. User interaction by interfacing with the trace display is recommended for final qualitative and quantitative analysis.

#### **Enter Event Analysis**

To enter event analysis, press the menu button and use the left / right buttons to highlight the event analysis icon and press select.

#### **NOTE:**

All the entries on the parameter screen are operational with the touch screen. To exit the parameter screen with touch screen function, touch the Return button.

#### **Threshold Settings**

There are four threshold settings, EOF, Loss, ORL and Link. (See Fig 7.4) The EOF is not a Pass/Fail threshold, it is used to set a loss value to determine the end of fiber. IF the EOF threshold is set for 3dB, then the first event that has a loss of 3dB or greater will be deemed the EOF.

To change the threshold settings, press the Menu button, use the left/right buttons to highlight the settings icon and press select. The cursor is the yellow highlighted area. (If the yellow cursor is on a value that is the current selection, that block will be highlighted green.) The setting highlighted in blue is the current setting. Use the LRUD buttons to highlight the desired threshold category and press the select button. Use the up/down buttons to set the digit, and use the left/right buttons to move to the next or previous digit. Once the desired setting is entered, press the select button. Use the LRUD buttons to move to the next setting until all thresholds have been set as desired. To exit the parameter screen, press the menu button.

Splice, ORL and Link are all thresholds for Pass/Fail purposes.

#### **NOTE:**

Thresholds are "pass thresholds", a value entered as a threshold is a passing value.

Examples of these settings are as follows:

- Splice: If a 1.00dB splice loss is acceptable, set the threshold to 1.00. If a splice loss of 1.00 is the fail point, set the threshold to 0.99
- ORL: If a -50dB reflectance is acceptable, set the threshold to 50. If -50dB is the fail point, set the threshold to 50.5.
- Link: If a 20dB, link loss is acceptable, set the threshold to 20. If 20db link loss is the fail point, set the threshold to 19.5.

## Chapter 7 OTDR Operation

### Sensitivity Settings

There are three levels of sensitivity for the event table and Fib-R-Map. (See Fig 7.4) To change the event sensitivity, press the Menu button, use the left/right buttons to highlight the settings icon and press select. The cursor is the yellow highlighted area. (If the yellow cursor is on a value that is the current selection, that block will be highlighted green.) The setting highlighted in blue is the current setting. Use the LRUD buttons to highlight the desired setting and press select. To exit the parameter screen, press the menu button.

The lowest setting possible should be used to help filter out any false events that may be caused by short pulse widths, but are not true perturbations in the optical signal. High sensitivity presents events with loss down to approximately 0.1dB, Medium (Md) with events down to approximately 0.2dB and Low (Lo) for event down to about 0.5dB. Longer pulse widths, and averaging help to lower the number of false events. Highest sensitivity settings should only be used for traces with high signal level, low noise, long pulse width and long average.

### Macro Bend Analysis

Macro bend analysis is performed with the dual trace operation and displayed in the event table. The traces to be compared must have been performed at the same range and the primary trace must be of the longer wavelength.

To conduct a macro bend analysis, open the file manager as described in chapter 9. Highlight the first trace to be loaded (the trace of the longer wavelength) and select to open. Open the file manager again and highlight the trace to be compared (the trace of the short wavelength), open the drop-down menu under the file tab and touch dual or use the up or down buttons to highlight dual and press select. Open the event analysis screen to check for macro bends. If an event on the longer wavelength trace has 0.25db or greater loss than the same event on the shorter wavelength trace, a macro bend event will be generated on the event table, identified by a Macro label in the Type column. This event will immediately follow the event it is related to. For example: If event number one was 5 dB at 1550nm and .5 db at 1310nm, the second event will be blank for location, +4.5dB for splice, blank for 2point and DB/KM. The type field will be listed as Macro.

To exit dual trace and macro bend analysis, simply start a new scan.

### Event Analysis Screen

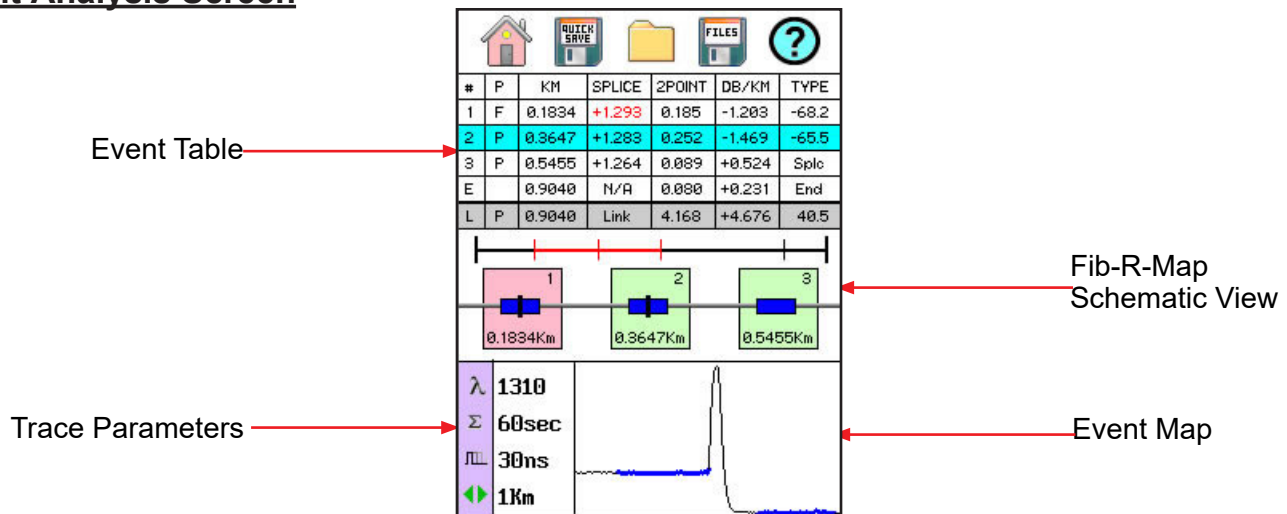


Fig 7.10

## Chapter 7 OTDR Operation

## Fib-R-Map

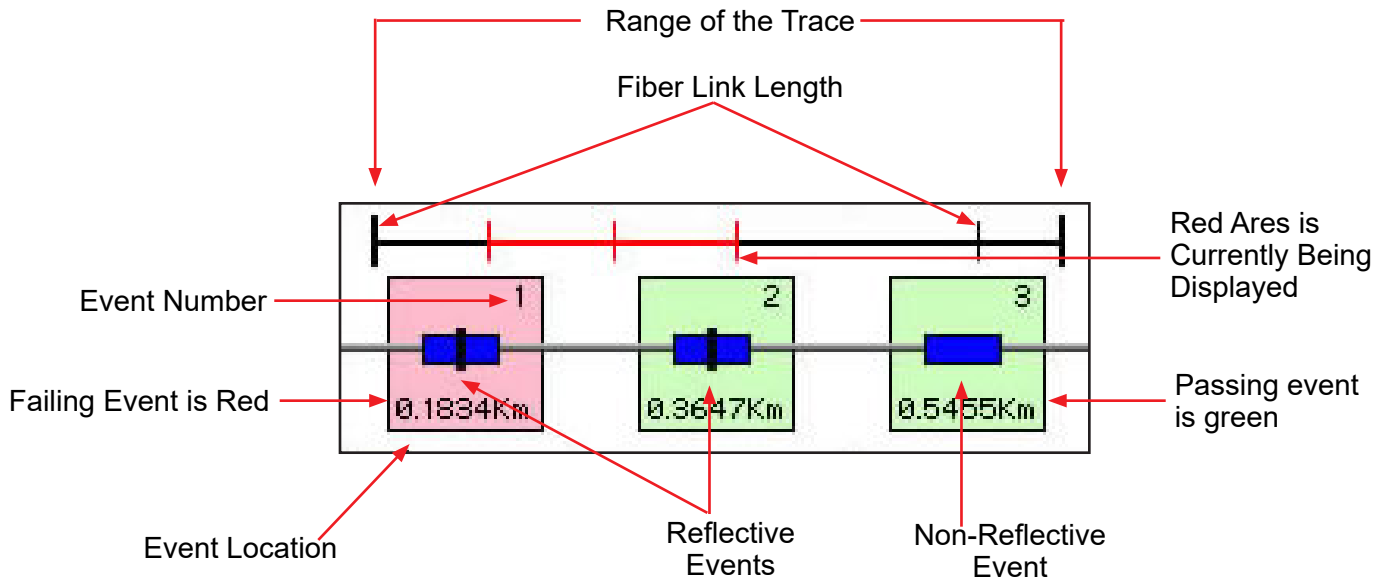


Fig 7.11

## Note

The Link is the last item in the schematic view. It is labeled E in the event number position. The loss value just prior to this item is the Link Loss and the Event location above the item is the same as the location of the event deemed the EOF.

## Event Table

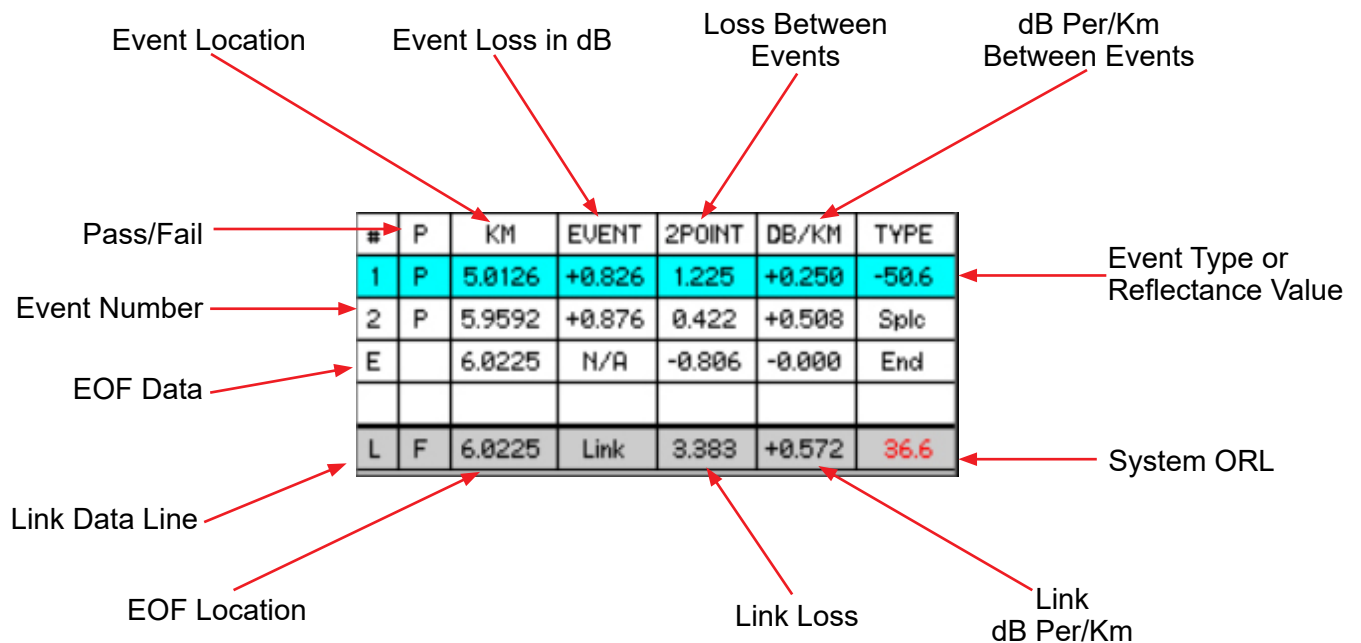


Fig 7.12

## Chapter 7 OTDR Operation

### Table Definitions

#### **# Event Number:**

Indicates the event in sequence, where the higher the number the further distance from the OTDR the event occurs. "E" (End) is the event determined to be the End of Fiber (EOF). "L" is the link row and contains information about the entire link tested.

#### **P:**

Pass/Fail, if any one of the thresholds are not met for an event, the P/F column will display a red F. The parameter that failed will also be displayed in red. If all the parameters are met, this column will display P. The Pass/Fail threshold for the event labeled "L" is the loss displayed in the 2POINT column, the link loss threshold.

#### **Km or KF or MI:**

Event Location, Km for Kilometer or KF if unit of measure is Kilo-feet MI for mile. This is the distance/location that the event occurs along the fiber link.

#### **Event:**

Event Loss, is the splice loss (event loss) of the numbered event. (A positive number is the amount of loss and a negative number indicates a gain normally due to mismatched index of refraction.) This is a selectable threshold for the Pass/Fail feature. The "E" event will display N/A as this is not an event that would have meaning. The "L" line of the table is the link and as such does not have an event (Splice) loss.

#### **2POINT:**

2 Point Loss is the loss measured from the end of the dead zone of the previous event to the beginning of current event. The value in the "L" line of the table for this column is the link loss. The loss from the beginning of the trace to the event determined to be the EOF. This is the value used to determine if the fiber link passes or fails its loss threshold.

#### **dB/Km:**

dB per Kilometer if in KM and DB/KF if in Kilo-Feet and DB/MI if in mile unit of measure. This is the calculated loss per Km, Kf or Mi from the end of the dead zone of the previous event to the beginning of the current event. The value in the "L" line of the table for this column is the dB Per/KM, Kf or Mi for the total link.

#### **TYPE:**

Event Type is the type of event or the ORL measurement. If the event has no reflection, "splc" will be displayed and if the event contains a reflection, the event reflectance value will be displayed. For the last event which is labeled "L" in the # column, the value displayed is the system ORL.

## Chapter 8 Project Management

### 8.1 Project Management Description

Project Management allows the user to save a set of parameters to be recalled for use at a later time. It also incorporates the file management system to save traces to the active project folder. When the OTDR is turned on, the default project is [NONE]. If an existing project is not open or a new one not set, all traces will be saved to the [NONE] folder.

#### **Note**

In project and file management screens, the down button opens drop-down menus when and moves the cursor down through the drop-down menus and the up button hides the menu or moves the cursor up through the drop-down menus.

#### **Note**

It is necessary to create the project prior to taking a trace as the file will not be available to save after going through the project creation sequence.

### Project Management Screen

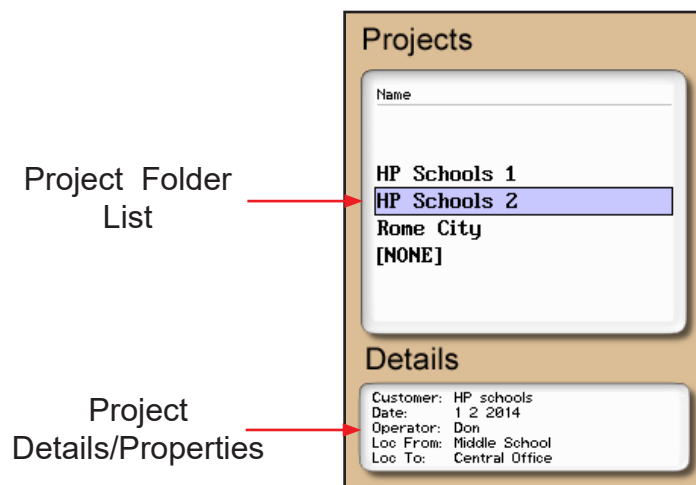


Fig 8.1

### Project Management Menu

The menu for project management may be operated with the touch screen, however, this manual describes the manner of operation with the keypad. To open the menu press the menu button. There are four tabs available, File, Edit, View and Help. Use the left or right buttons to move to a desired tab and use the select or the down button to open the drop-down menus. Pressing the menu button again or the up button will hide the operations menu.



Fig 8.2

### Touch Screen Tip

The menu may be pulled down with the stylus the same as the menu on the main trace screen. Once the file menu is open, it is fully operable with the touch screen function.



## Chapter 8 Project Management

**Project Management File Tab** To open the drop down menu under file, with file tab highlighted, press select or the down button. Use the down or up buttons to move through the drop down menu and select to choose an operation. Selecting new will open a new project folder using the current parameter settings. Open will open the highlighted project, dual is not operational in the project management and therefore greyed out, delete permanently removes the highlighted project. (The delete button must be held for at least one second to remove projects.) Once delete is selected, the project and all files associated with that project are deleted. Use exit to leave the project manager and return to the trace screen.

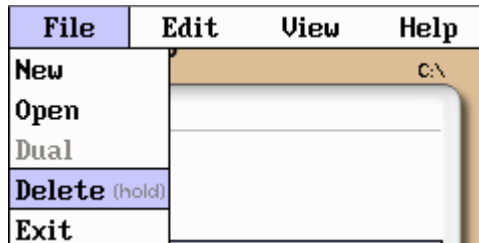


Fig 8.3

### **NOTE:**

Once a project is established the settings cannot be permanently changed. They may be changed Temporarily, but the original setting will be defaulted every time the project is opened.

### **Project Management Edit Tab**

To open the drop-down the menu under edit, with the edit tab highlighted, press select or the down button. Use the down or up buttons to move through the drop down menu and press select to choose an operation. Upload is used to transfer files to the CertSoft software. Rename allows the highlighted folder name to be modified while maintaining all settings and associated files. Properties allows the user to edit the properties displayed at the bottom of the project window.

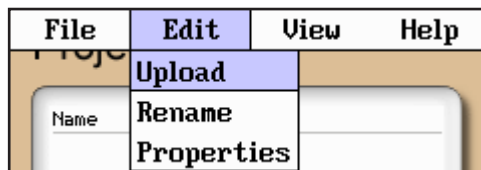


Fig 8.4

### **Project Management View and Help Tabs**

View offers the user the opportunity to move to the file manager from the projects page. With view highlighted, press select or the down button to open the drop-down menu, with the files tab highlighted, press select to move to the file management page. For onboard help pages, highlight the help tab and press select.

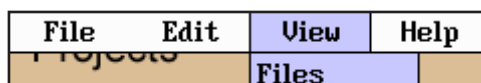


Fig 8.5

### 8.2 Project Management Operation

#### **Create a New Project**

The parameters that are stored for a project are; range, pulse width, average, wavelength, distance units, pulse width units, event sensitivity and the thresholds. To create a new project, press menu, select the settings icon, set the parameters as required, when all setting are established, use the arrow button to highlight the return button or touch return at any time while in the settings screen. Press the menu button, highlight the project folder icon and press select. With the file tab highlighted, press select or the down button to open the drop down menu. Use the down or up buttons to highlight new and press select again. Use the on screen QWERTY keyboard to name the folder and touch save. The folder names are limited to 16 characters.

To enter details about the project, use the up and down buttons to highlight the project that was just created and press the menu button. Use the left or right button to highlight the edit tab, use the down button to highlight properties and press select. Use the up and down buttons to select the desired field to be entered or modified and press select. Use the QWERTY keyboard to enter the information and touch save when complete. Up to 24 characters may be entered for these fields. To exit the project screen, press menu, press select, use the down button to highlight exit and press select again.

#### **Open an Existing Project**

To open a project, press the menu button, highlight the project folder and press select. Use the up or down buttons to highlight the desired project folder and press select. This will open the file management screen listing all the files previously stored in this project. All saved traces will now be stored to this project ,until a new project is created or another project is opened.

#### **Delete a Project**

To delete a project, with the project to be deleted highlighted, open the file drop down menu, highlight delete and press and hold select. Ensure the proper project is selected as once deleted, the folder and files cannot be recalled.

#### **NOTE:**

Delete must be held for approximately 1 second to complete the delete function.

#### **Upload a Folder to CertSoft**

To upload a folder and all it's associated files from the OTDR to the computer, open the CertSoft software and ensure the OTDR is connected to the computer with the USB cable.

#### **NOTE:**

The two plugs in the top right corner of the screen should show as connected and green.

Highlight the project to be uploaded, press menu to open file manager menu, use the right button to highlight edit tab, press select or the down button to open the drop down menu and with upload highlighted, press select. The folder with all files will be uploaded to the target folder selected on the computer.

## Chapter 8 Project Management

### **Rename a Project**

To rename a project, have the project to be renamed highlighted, press menu, to open the project management menu. Use the left and right buttons to highlight edit tab and press select or the down button to open the drop-down menu. Use the down button to highlight rename and press select. The project name will be displayed with the onboard QWERTY keyboard. Use the keyboard to rename the project and touch save.

### **Modify Properties**

To modify the properties, have the project to modified highlighted. Press menu, highlight edit/properties and press select. The project properties will be displayed, use the up/down buttons to highlight the field to be changed, use the onboard QWERTY keyboard to make the change and touch save. Continue with the changes needed, when complete highlight close and press select.

Use the left and right buttons to highlight edit tab and press select or the down button to open the drop-down menu. Use the down button to highlight properties and press select. The properties list will be display, use the up or down buttons to highlight the property to be modified and press select. The QWERTY keyboard will be displayed with the property information. Press save when done with the change. Continue with the changes needed, when complete highlight close and press select.

### **Temporary Modification of Parameters**

Test parameters may be temporarily changed by selecting new settings, such as wavelength, average time, pulse width, and range directly on the main OTDR screen with the touch screen capabilities or open the parameter settings screen, set the new parameter and save. All subsequent test will use the new settings until the original settings are returned or the folder is reopened resetting the project parameters. To make temporary changes to event sensitivity or thresholds, open the parameters settings page.

### **Exit Project Management**

To exit the project management, press menu, use the left or right buttons to highlight the file tab, press select or the down button to open the drop down menu. Use the down button to highlight Exit and press select.

## Chapter 9 File Management

### 9.1 File management Description

File Management is used to save and recall traces. It operates in conjunction with the projects manager in that if a project folder is open, the files saved to and listed in the file manager are associated with the open project. When the OTDR is turned on, the default folder is [NONE], therefore, any files saved without opening a project will be saved to the [NONE] folder. Any files saved in the scope function will also be associated with the open folder.

#### File Management Screen

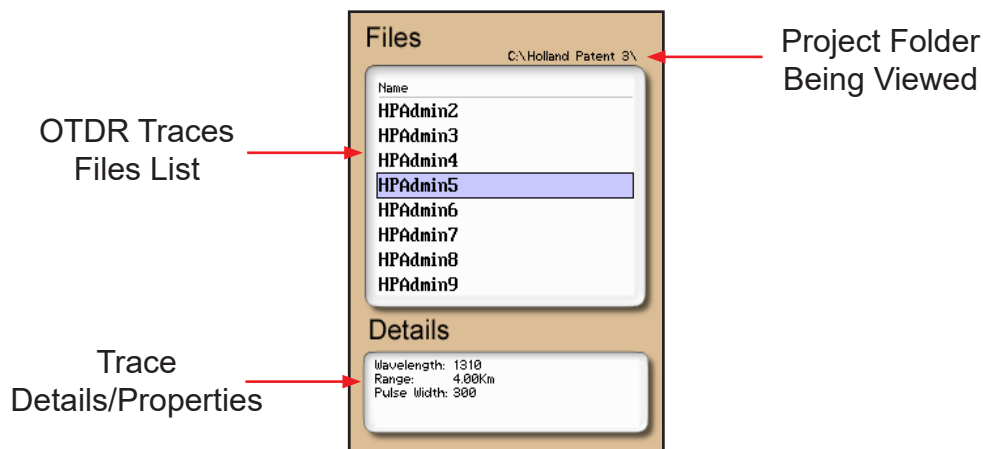


Fig 9.1

#### File Management File Menu

The menu for file management may be operated with the touch screen, however, this manual describes the manner of operation with the keypad. To open the file management menu press the menu button.

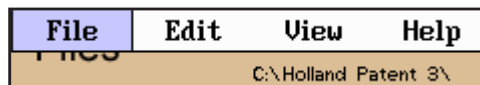


Fig 9.2

### Touch Screen Tip

The file menu may be pulled down with the stylus the same as the menu on the main trace screen. Once the file menu is open, it is fully operable with the touch screen function.

## Chapter 9 File Management

### File Management File Tab

To open the drop down menu under file, with file highlighted, press select or press the down button. Use the down or up arrow to move through the drop down menu and press select to open the highlighted operation. The operations are Save, Open, Dual, Delete and Exit. Save stores the current trace, Open displays the trace that is currently highlighted, Dual opens a secondary trace, Delete permanently removes a file and Exit closes the file management screen.

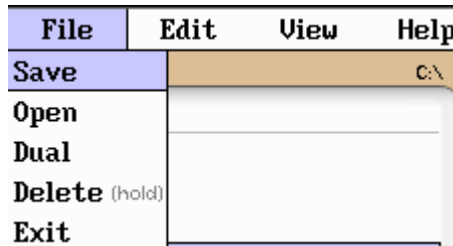


Fig 9.3

### File Management Edit Tab

To open the drop down menu under edit, with edit highlighted, press select or press the down button. Use the down or up arrow to move through the drop down menu and press select to choose a highlighted operation. Upload is used to transfer the highlighted file to the CertSoft software. Rename allows the highlighted file name to be modified. Properties is grayed out and not accessible from this location.



Fig 9.4

### File Management View/Help Tab

View offers the user the opportunity to move to the projects management page from the file management page. With view highlighted, press select or the down arrow to drop down the view tab and press select to move to the file management page. For onboard help pages, highlight the help tab and press select.

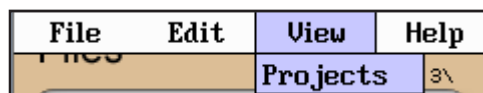


Fig 9.5

## 9.2 File management Operation

### Save a Trace File

To save a trace, press menu, highlight the file manager icon and press select. Press select or the down button to open the drop down menu and with save highlighted, press select again. The file naming window will open and the onboard QWERTY key board will be available. Use the touch keyboard to name the file and touch save. The file names are limited to 16 characters. This method should be used to set the base file name for a group of traces. These file names are save exactly as entered. To save files with a chronologically numbered suffix, use the quick save. Quick Save uses the last enter base file name.

## Chapter 9 File Management

### **Open/View a Trace**

To open a trace, press the menu button, highlight the file folder and press select. Use the up or down buttons to highlight the trace to be viewed and press select.

### **Dual Trace**

Dual trace mode may be used to view and compare two traces. Both traces must be of the same range setting. To utilize dual trace feature, first open the primary trace as you would a normally, by highlighting the trace in file management, pressing menu to open the file management menu, with file highlighted, open the drop-down menu use the down button to highlight dual and press select. The trace opened using the dual feature is the secondary trace and all information displayed is that of the primary trace. To exit the dual trace mode, start a scan with the scan button.

### **Delete a File**

To delete a file, with the file to be deleted highlighted, press menu or the down button to open the file drop down menu, use the down or up buttons highlight delete and press select for at least one second. Ensure the proper file is selected as once deleted, the file cannot be recalled.

#### **NOTE:**

Delete must be held for approximately 1 second to complete the delete function.

### **Upload a Trace to CertSoft**

To upload a trace from the OTDR to the computer, Open the CertSoft software and ensure the OTDR is connected to the computer with the USB cable.

#### **NOTE:**

The two plugs in the top right corner of the screen should show as connected and green.

Highlight the file to be uploaded, press menu to open file manager menu, use the right button to highlight the edit tab, press select or the down button to open the drop down menu and with upload highlighted, press select. The file will be uploaded to the target folder on the computer .

### **Rename a Trace File**

To rename a trace file, have the file to be renamed highlighted. Press menu, use the left or right button to highlight edit, press select, or the down button to open the drop-down menu, press the down button to highlight rename and press select. The file name will be displayed with the onboard QWERTY keyboard. Use the keyboard to rename the project and touch save.

### **Exit File Management**

To exit the file management, press menu, use the left or right buttons to highlight the file tab, press select or the down button to open the drop down menu. Use the down button to highlight Exit and press select.

### 10.1 Laser Safety

The Tunable Laser Source has been configured to provide laser radiation in the C Band of operation. (1530-1565nm) L Band may be available upon request with a range of (1565-1625nm). Please see the warning label in figure 1.1. This is displayed on the left hand side of the body of the TLS.

The unit has been designed to comply with 21 CFR (Code of Federal Regulations) 1040.10 and 1040.11, for Class 1M emission limits. Although Class 1 levels are not considered to be hazardous, we suggest limiting exposure by never looking directly into the optical 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 the power adapter is disconnected.



Fig 1.1

#### **Caution**

Personnel should always be aware when working with fiber optic test equipment that active fibers may be present, therefore infrared optical energy may be present.

Fiber-optic connectors are easily contaminated or damaged. The connection to this tunable light source is a physical contact type of connection and dirty or damaged connectors will impair the instrument's capabilities at the minimum and at worst result in the need to return the equipment to the factory for expensive repairs.

#### **Caution**

Never look directly into the end of a connected fiber optic cable or fiber optic interface of optical test equipment, to do so could expose the user to laser radiation and could result in personal injury.

## Chapter 10 Tunable Laser Source

### 10.2 TLS Quick Start Guide

Prior to any operation please read the laser safety section of this chapter.

To operate the TLS at a specific wavelength/frequency/channel in CW mode follow this quick start guide.

**T**ouch the TLS icon on the Home screen.

**T**he Laser Output is displayed in the center of the screen. Touch this value to cycle through units of, Wavelength (nm), Frequency (THz) and Channel (Ch). 0.4nm (0.05THz), 0.8nm (0.10THz) or 1.6nm (0.20THz).

**T**ouch and hold the blue wavelength/frequency/channel selector on the scale. Drag the selector to the desired output value.

**T**ouch the step size indicator to cycle through step sizes until set at 0.40nm for wavelength, 50 GHz for frequency or 0.5 Ch for channel is displayed.

**T**ouch the power value and a numeric keypad will be displayed. Enter the desired power value within the ranges set at the top of the display and touch OK.

**T**ouch the Laser icon to energize the laser in a CW mode. Touch the Laser icon a second time to turn off the laser.



## Chapter 10 Tunable Laser Source

### 10.3 Operation

From the home screen, touch the TLS icon to enter the tunable laser source feature.

#### TLS Screen Description

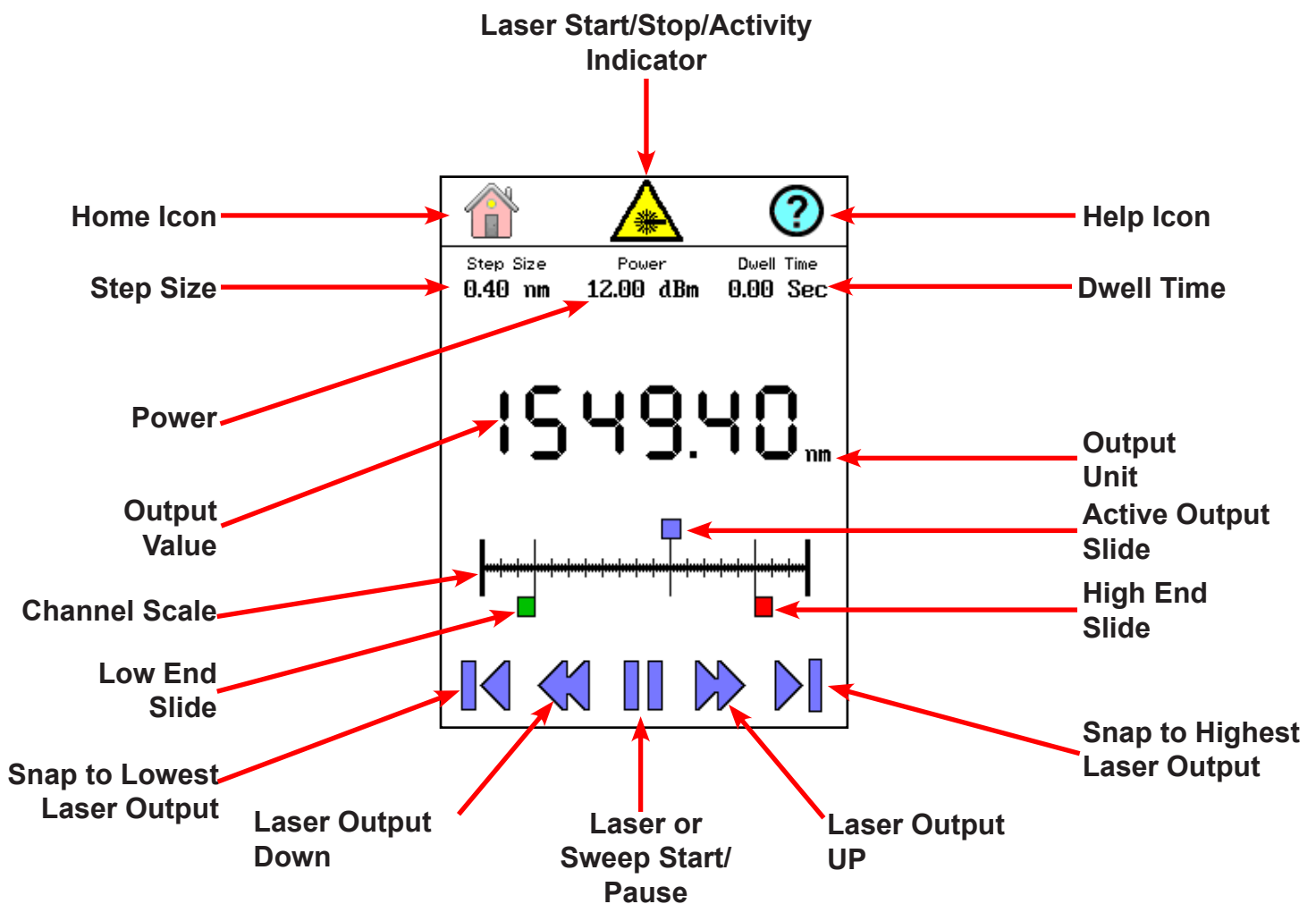


Fig 5.2

## Chapter 10 Tunable Laser Source

### Touch Screen Operation

Laser Start/Stop /Activity Indicator	Flashing indicates active laser Starts and stops laser/sweep
Home Icon	Brings the user back to the home page
Help Icon	Opens the context sensitive help menu
Step Size	Cycles through available step sized in nm, Freq, and Ch
Power	Opens numeric keypad to enter power level
Dwell Time	Opens numeric keypad to enter dwell time or CW mode
Output Value	Laser output value in nm, Freq or Ch
Output Unit	Indicates displayed output unit
Active Output Slide	Used to select/indicate output laser
Channel Scale	Full scale of available laser output
Low end Slide	Used to select lowest laser output of sweep
High End Slice	Used to select highest laser output of sweep
Snap to Lowest laser Output	Moves the active slide to the lowest laser output set by the Low End Slide
Snap to highest laser Output	Moves the active slide to the highest laser output set by the High End Slide
Laser Output Down	Moves the low end slide down the scale
Laser or Sweep Start/Pause	Start and stops the laser/sweep
Laser Output Up	Moves the high end slide up the scale

## Chapter 10 Tunable Laser Source

### Setting Parameters

#### Set Output Units

The output may be displayed in wavelength or frequency or channel. To set the units, touch the output value in the center of the screen to cycle through the available units.

#### Set Step Size

There are three available step sizes when selecting output or for sweep purposes. While in wavelength mode, the steps are 0.4nm, 0.8nm or 1.6nm. In Frequency mode they are 0.05THz, 0.10THz or 0.20THz, and in channel mode they are .5, 1 or 2 channel steps. The step size changes to the appropriate unit when the output units are changed. To set the step size, touch the step size indicator to cycle through the available choices.

#### Power Level

The power level of the signal is adjustable from approximately +7 dBm to +13 dBm in increments of 0.01 dBm. To set the power level, touch the power level indicator and a numeric keypad will be displayed. At the top of the keypad will be the available power level range. Enter the desired power to 0.01dBm. Once entered touch OK or to back out without change, touch cancel.

#### Dwell Time

To set the dwell time when operating in sweep mode, touch the dwell time indicator. A numeric keypad will be displayed. The dwell time may be set from 2.00 to 60.00 seconds for sweep mode operation. Enter the desired dwell time and touch OK or to exit without change touch cancel.

A dwell time of 0.00 is used for manual operation. This will set the laser to a CW mode at the output value displayed. The output may be changed with either the active output slide or the up or down channel select buttons.

#### Set Low and High End Laser Output

To set the low end laser output, touch the Low end slide and release. The output indicator and the Up and down arrows will change to green. The focus of the up down movement arrows and snap to end arrows changes to the low end slide. Use these arrows, or the slide to set the low end laser output.

Touch the red high end slide to change the output indicator and focus of the arrows to the high end slide to set the high end laser output.

## Chapter 10 Tunable Laser Source

### **Manual/CW Operation**

To fire the laser in a CW mode, Set the output to the desired unit, set the step size if required and set the power lever to dBm level required. Set the dwell time to 0.00. When the laser is fired with the Laser Start/Stop / Activity Indicator or the Laser or Sweep Start/Pause, it will be in CW mode. To change the output laser, use the arrows at the bottom of the display to move or snap the laser to a value or use the Active Output Slide to set the desired wavelength, frequency or channel. Touch the Laser Start/Stop /Activity Indicator or the Laser or Sweep Start/Pause again to turn off the laser.

### **Sweep Operation**

To run a sweep of the laser, set the output to the desired unit, set the step size, power level and dwell Time as described above. Use the low end and high end sliders to set the low and high end laser levels to be fired. Touch the Laser Start/Stop /Activity Indicator or the Laser or Sweep Start/Pause

### **Exit Tunable Laser Feature**

Touch the Home icon to return to the home screen.

### **WARNING:**

Even if the indicator shows the laser to be off never looking into the end of a fiber connected to the TLS or directly into the connector port. 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 the power adapter is disconnected.

# Chapter 11 Fault Locator

## 11.1 Fault Locator Description

The Fault Locator is a simple auto test feature which displays the test results in event table with the Fib-R-Map schematic view. The fault locator will take a scan of the fiber in auto test mode. The user sets the wavelength to be tested and the OTDR will set the pulse width and range to best suite the fiber under test at the selected wavelength.

If Pass/Fail information is desired, first enter the OTDR mode and set the Pass/Fail threshold to meet requirements.

To enter the Fault Locator mode, touch the Fault icon on the home screen. The screen below will be displayed. The first time the mode is entered it will be void if data, it may be populated with data from a previous session.

### Fault Locator Screen

The fault locator screen includes the event table, Fib-R-Map (Schematic View) and event map view of highlighted event.

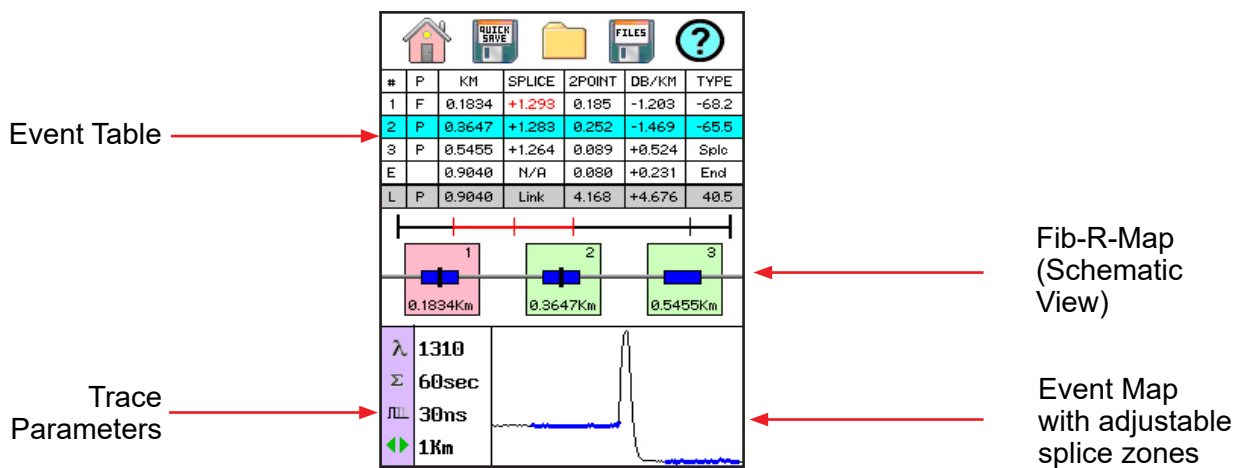


Fig 7.2

# Chapter 11 Fault Locator

## Fib-R-Map

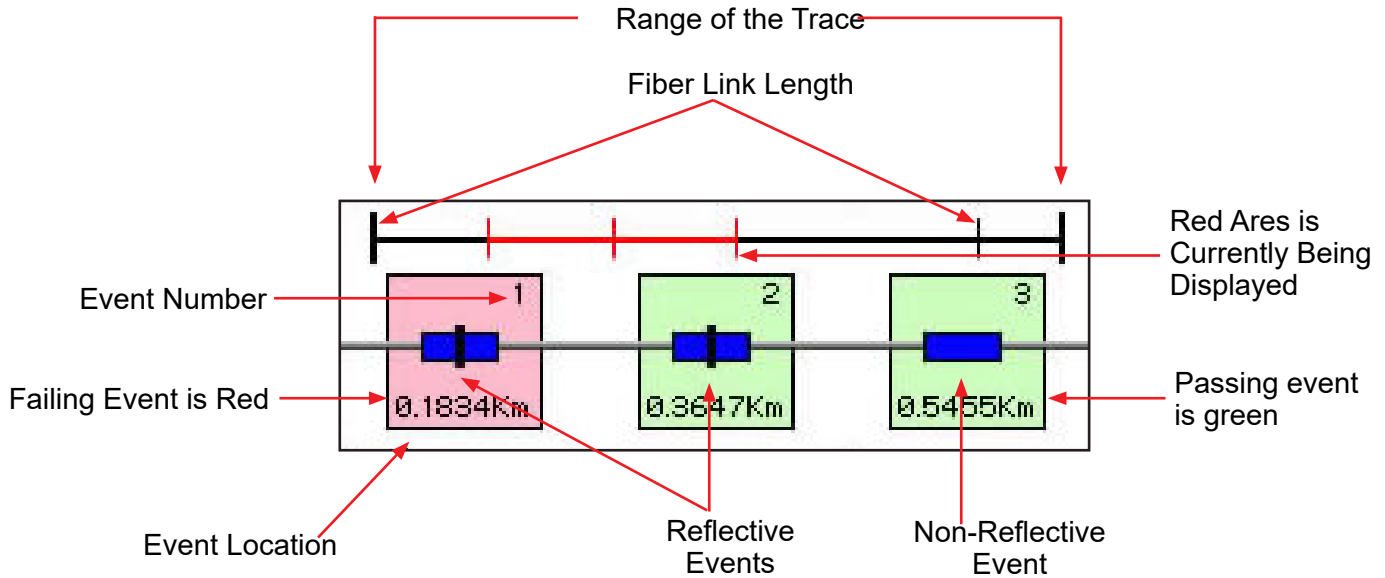


Fig 7.3

## Note

The End of Fiber is the last item in the schematic view. It is labeled E in the event number position and displays a vertical Bar instead of horizontal.

## Event Table

#	P	KM	SPLICE	2POINT	DB/KM	TYPE
1	F	0.1834	+1.293	0.185	-1.203	-68.2
2	P	0.3647	+1.283	0.252	-1.469	-65.5
3	P	0.5455	+1.264	0.089	+0.524	Splc
E		0.9040	N/A	0.080	+0.231	End
L	P	0.9040	Link	4.168	+4.676	40.5

Event Location

Event Loss in dB

Loss Between Previous and Current Events

dB Per/Km, Kf or Mi Between Events

Pass/Fail

Event Number

EOF Event Information

Link Information

Event Type or Reflectance Value

System ORL

Link Loss

Link dB Per/Km, Kf or Mi

Fig 7.4

### Event Table Definitions

#### **# Event Number:**

Indicates the event in sequence, where the higher the number the further distance from the OTDR the event occurs. "E" (End) is the event determined to be the End of Fiber (EOF). "L" is the link row and contains information about the entire link tested.

#### **P:**

Pass/Fail, if any one of the thresholds are not met for an event, the P/F column will display an F. The parameter that failed will be displayed in red. If all the parameters are met, this column will display a P. There is no Pass/Fail threshold for the last event labeled "E" (End) and the Pass/Fail for the "L" (Link) row includes the 2POINT column, which for the link is the total link loss and the TYPE column which for the link row is the system ORL.

#### **Km or KF or MI:**

Event Location, Km for Kilometer or KF if unit of measure is Kilo-feet MI for mile. This is the distance/location that the event occurs along the fiber link.

#### **Event:**

Event Loss, is the splice loss (event loss) of the numbered event. (A positive number is the amount of loss and a negative number indicates a gain normally due to mismatched index of refraction.) This is a selectable threshold for the Pass/Fail feature. The "E" event will display N/A as this is not an event that would have meaning. The "L" line of the table is the link and as such does not have an event (Splice) loss.

#### **2POINT:**

2 Point Loss is the loss measured from the end of the dead zone of the previous event to the beginning of current event. The value in the "L" line of the table for this column is the link loss. The loss from the beginning of the trace to the event determined to be the EOF. This is the value used to determine if the fiber link passes or fails its loss threshold.

#### **dB/Km:**

dB per Kilometer if in KM and DB/KF if in Kilo-Feet and DB/MI if in mile unit of measure. This is the calculated loss per Km, Kf or Mi from the end of the dead zone of the previous event to the beginning of the current event. The value in the "L" line of the table for this column is the dB Per/KM, Kf or Mi for the total link.

#### **TYPE:**

Event Type is the type of event or the ORL measurement. If the event has no reflection, "splc" will be displayed and if the event contains a reflection, the event reflectance value will be displayed. For the last event which is labeled "L" in the # column, the value displayed is the system ORL.

### 11.2 Fault Locator Operation

#### **Set Wavelength**

To set the wavelength first enter the OTDR mode and touch the Lambda icon or wavelength to open the wavelength selection pages. Use the touch screen to select a wavelength or move to the next pages of available wavelengths.

#### **Start Scan**

To start a scan, touch in the bottom right corner of the display. A "Please Wait, Scanning" message will be displayed. The scan will take about 15 seconds.

#### **View Test in OTDR Screen**

To View a test in the full OTDR mode, touch an event in the table and the scan will be displayed in trace mode with the active cursor at the selected even.

#### **Exit Fault Locator**

To exit the fault locator mode touch the Home icon.



## Chapter 12 Video Scope

### 12.1 Entering Video Scope Function

To operate the video scope, from the home screen, highlight the Scope icon and press the select button. If a probe is not connected already, connect the VIS300 video probe to the video probe port on the top of the OTDR.

### 12.2 Video Scope Display

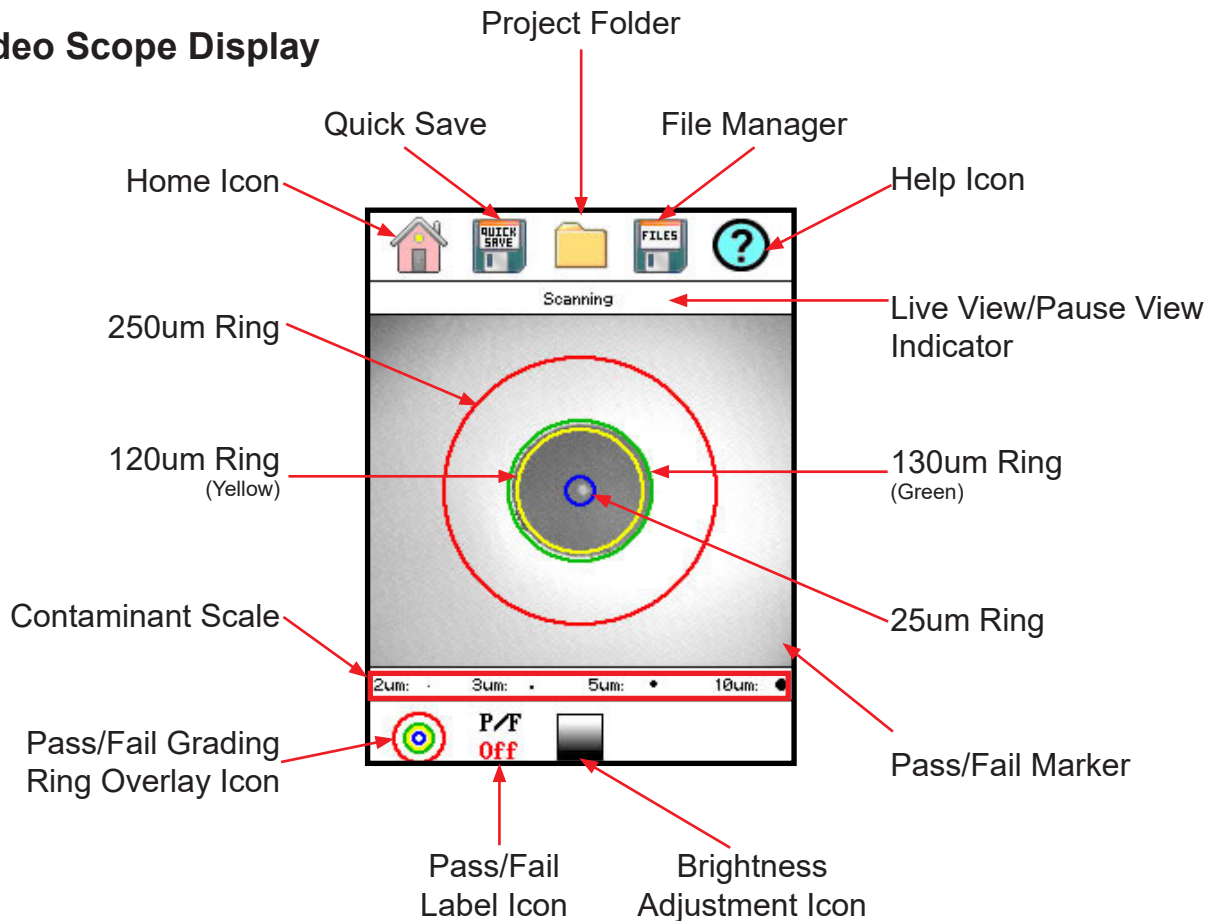


Fig 11.1

### Touch Screen Tip

The icons on the video scope screen are operational with the touch screen feature, though this guide is written using the keyboard whenever it is available.

### 12.3 Video Scope File/help Icon Menu

The Icons at the top of the display are Home, file save, project management, file management and Help.

#### Home

Press the menu button, use the left and right buttons to highlight the home icon and press select to return to the home Screen.

## Chapter 12 Video Scope

### **Quick Save**

Press the menu button, use the left or right buttons to highlight the quick save icon and press the select button to store a file image of the scope screen in the file folder within an active project. Scope files will be preceded by a target icon.

### **Project Management**

To open project management, press the menu button, use the left or right buttons to highlight the project management folder icon and press select. Use the project management folder to open the project that the scope images are to be stored. When entering the video scope function, the active folder will be the one last used in the OTDR or LTS. For more information about the project management system, please refer to Chapter 9 of this guide.

### **File Management**

To open file management, press the menu button, use the left or right buttons to highlight the file management icon and press select. Use File management to view a list of saved files or to open a stored image. File types are identified by the preceding icon. Trace files are indicated by a trace icon, LTS file by an LTS icon and scope files are preceded by scope (target) icon

### **Help**

Press the menu button, use the left and right buttons to highlight the help icon and press select to view the help information.

## **12.4 Video Scope Operation Icon Menu**

The following functions are only available for use when the video scope is in live scan mode.

### **Grading Rings**

Used to turn on and off the rings that indicate the IEC61300-3-35 grading zones.

Enter the menu mode with the menu button, use the LRUD buttons to highlight the pass/fail grading rings overlay icon and press the select button. Exit the menu mode and use the LRUD buttons to center the image in the rings. Use the Pass/Fail Criteria Tables from page 44 to grade the connector end face. 2, 3, 5 and 10 micron contaminant examples are displayed just below the connector image on the video scope display.

### **Pass/Fail Label**

Used to turn cycle through P/F (Pass/Fail) Off, P/F Man (In Red "Fail"), P/F Man (In Green "Pass") and P/F auto. To set the pass/fail indicator, press the menu button, use the left or right buttons to highlight the pass/fail icon and press select to cycle through the pass/fail states.

### **Touch Screen Tip**

The touch screen may also be used to make these selections.

## Chapter 12 Video Scope

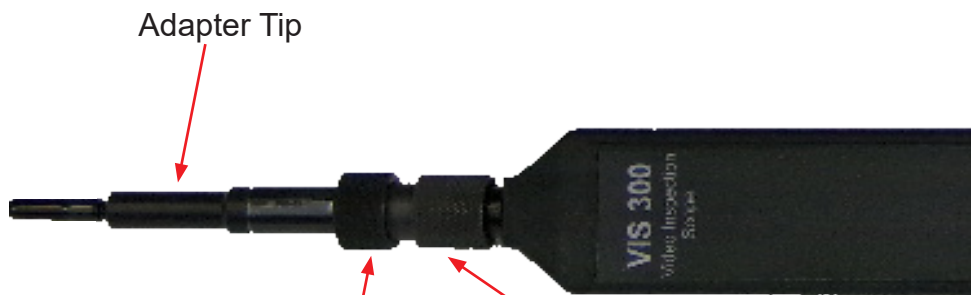
### **Brightness**

Press the menu button, use the left and right buttons to highlight the brightness icon, use the Select button to cycle through the adjustments for the brightness level.

## 12.5 Video Scope Operation

### **Video Probe Tips**

There are a number of video probe tips available. To remove a tip from the Probe, grasp the probe tip and unscrew the tip retention nut from the tip. Pull the tip straight up from the probe. To place a tip on the probe, ensure the lens is clean, slide the tip on to the end of the probe and tighten the tip retention nut. Do not overtighten the retention nut.



### **Viewing/Focusing a Connector**

With the video scope turned on and the video probe plugged into the OTDR, insert a connector in to universal tip or insert the panel adapter tip into the appropriate port. The scope must be in the live scanning mode to make focus adjustments. Use the focus ring to get the connector image as sharp as possible. When using panel adapters it is possible to turn the body of the probe to while the adapter is inserted into the panel to make focus adjustments.

### **NOTE**

To make position adjustments with the LRUD buttons, the unit must not be in menu mode. Menu mode is evident when there is a light blue box positioned around one of the icons. When the touch screen is used to roughly center the connector image, the menu mode is automatically turned off.

## Chapter 12 Video Scope

### **Centering a Connector Image**

Once the image is stable and focused, use the stylus to touch the approximate center of the connector to snap the image near the center of the display and the center of the grading rings. Use the LRUD buttons to fine tune the image to the center of the display.

### **Pausing Image Scan**

To freeze an image in position and focus level for inspection, press the scan button. This will pause the image at the current position and focus level. Simply press the scan button again to set the operational mode back to live mode for focus and position adjustments

### **Grading Rings**

Turn on or off the grading rings by pressing menu and using the left or right buttons to highlight the grading ring icon and press select. The unit must be in live scan mode to turn the rings off or on.

### **Manual Pass/Fail**

Use the pass/fail criteria tables on the next page to determine if the connector passes the IEC61300-3-35 standard. There is a guide to contamination size located at the bottom of the image. To mark a connector as Pass or Fail, enter the menu mode, highlight the Pass/Fail Label icon and press select to cycle through pass, fail, or no grading. This must be done in the Live Scan mode. Once the pass fail status has been entered, the scan may be paused with the scan button and the points of contamination that caused a failure may be marked on the image.

### **Manually Marking Points of Contamination**

To mark the points of contamination the unit must be in paused mode. Pick up the contamination marker by using the stylus and touching the contamination sample size that is required. Touch the image to place the marker. The marker may be fine tuned with the stylus to cover the contamination point on the image to be marked. Once the marker is positioned properly, touch the area just below the image that states, "Place marker, touch here to apply" to lock the marker in place. Repeat this as necessary to mark all the points that need to be indicated for the pass/fail status. At this point the image should be saved with the Quick Save icon

### **NOTE**

Marking the points of contamination should be done last, just before saving the image. Once the unit is returned to live mode the markers are removed.

### **Auto Pass/Fail**

Once the image has been centered in the grading rings, set the P/F icon to Auto and press the scan button. The video scope will evaluate the image and grade it with Pass or Fail. Contamination will be displayed on the image.

### **Exiting Video Scope Operation**

Enter the menu mode, use the left or right buttons to highlight the Home icon and press select.

## Chapter 12 Video Scope

### 12.6 Pass/Fail Criteria Tables

#### Fiber End Face Criteria Table for Angled PC Polished Connectors

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 $\mu$ m to 25 $\mu$ m	$\leq 4\mu$ m	None
B	Cladding Zone	25 $\mu$ m to 120 $\mu$ m	No limit	No Limit < 2 $\mu$ m 5 from 2 $\mu$ m to 5 $\mu$ m None > 5 $\mu$ m
C	Adhesive Zone	120 $\mu$ m to 130 $\mu$ m	No limit	No limit
D	Contact Zone	130 $\mu$ m to 250 $\mu$ m	No limit	None $\geq 10 \mu$ m

#### Fiber End Face Criteria Table for Ultra PC Polished Connectors

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 $\mu$ m to 25 $\mu$ m	None	None
B	Cladding Zone	25 $\mu$ m to 120 $\mu$ m	No limit $\leq 3\mu$ m None > 3 $\mu$ m	No Limit < 2 $\mu$ m 5 from 2 $\mu$ m to 5 $\mu$ m None > 5 $\mu$ m
C	Adhesive Zone	120 $\mu$ m to 130 $\mu$ m	No limit	No limit
D	Contact Zone	130 $\mu$ m to 250 $\mu$ m	No limit	None $\geq 10 \mu$ m

#### Fiber End Face Criteria Table for SM PC Polished Conn. (Single Mode Fiber, RL $\geq 26$ dB)

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 $\mu$ m to 25 $\mu$ m	2 $\leq 3\mu$ m None > 3 $\mu$ m	2 $\leq 3\mu$ m None > 3 $\mu$ m
B	Cladding Zone	25 $\mu$ m to 120 $\mu$ m	No limit $\leq 3\mu$ m None > 3 $\mu$ m	No Limit < 2 $\mu$ m 5 from 2 $\mu$ m to 5 $\mu$ m None > 5 $\mu$ m
C	Adhesive Zone	120 $\mu$ m to 130 $\mu$ m	No limit	No limit
D	Contact Zone	130 $\mu$ m to 250 $\mu$ m	No limit	None $\geq 10 \mu$ m

## Chapter 13 Visual Fault Locator

### 13.1 VFL Safety



#### **Caution**

This Visual Fault Locator is classified as a Class II laser system and must be used with all commensurate safety precautions. Never view the light emanating from the fiber directly. Place a white piece of paper at the end of the fiber and look for the presence of a red spot on the paper.

### 13.2 VFL Description

The Visual Fault Locator emits visible (red) light at the 650 nm wavelength. Its intended function is to allow an operator to identify 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 conventional means such as an Optical Time-Domain Reflectometer, (OTDR). It is also useful for identifying a particular fiber in a cable by exciting the fiber to be located with visible radiation.

### 13.3 VFL Operation

The Visual Fault Locator is access from the Home screen.

The fiber to be tested is connected to the VFL port of the OTDR by means of a standard 2.5 mm fiber optic connector. The source may be used in one of its two modes, Modulated or Continuous. In the modulated mode the laser is turned on and off at a 6 Hz rate. The laser is on for approximately one third of the cycle. This mode is helpful in permitting the user to identify the source radiation in the presence of high levels of ambient light. It also aids in conserving battery life.

The usable range for fault location depends on many factors, the type of fiber, the type of cable, the overall loss.

To activate the VFL, tap the VFL icon to cycle through the available states of off, Continuous and Modulated.



### Caution

Never look directly into the end of a connected fiber optic cable or fiber optic interface of optical test equipment, to do so could expose the user to laser radiation and could result in personal injury.

Optical Time Domain Reflectometer	
Wavelength	1527.6 - 1565.31nm (Channels 14-62.5)
Dynamic Range	35 dB
Pulse Width	5 - 20,000 ns
Units of Measurement	Kilometer, Kilo feet and Mile
Event Dead zone	2m
Attenuation Dead Zone	6m
Resolution	.125 - 32m
Distance Uncertainty	$\pm(0.75\text{m} + 0.005\% \times \text{distance} + \text{sampling resolution})$
Full Scale Distance Range	0.25-200km SM
Typical Real-time Refresh Rate	2 Hz
Group Index of Refraction (GIR)	1.024 - 2.048
Linearity	$\pm .05 \text{ dB/dB}$
Memory Capacity	~1000
Memory Type	Internal

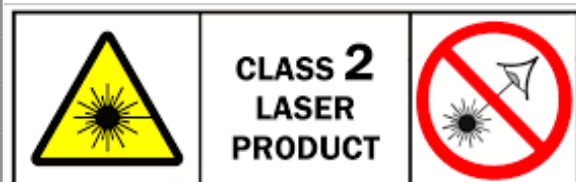
*TTI reserves the right to change specifications without notice.*

Tunable Laser Source	
Range	Frequency 191.4 - 196.25 THz ITU Channels 14 - 62.5
Frequency Accuracy	1.5 GHz
Line Width	1 MHz
Side Mode Suppression Ration	45 dB
Output Power Range	3 dBm to 11 dBm (Typ.)
Power Setting Resolution	0.01 dB
Power Variation over Wavelength Range	$\pm 0.5 \text{ dB}$
Minimum Channel Spacing	50 GHz (0.4nm)
Fiber Type	9/125 $\mu\text{m}$
Relative Intensity Noise	-140 dB/Hz

*TTI reserves the right to change specifications without notice.*

**Visible Fault Locator**

Emitter Type	Laser Photo diode 1100 - 1700nm InGaAs -70-+9dBm with interchangeable FC Adapter
Wavelength	650nm $\pm$ 5nm
Connector Type	2.5mm Universal
Output Power	1mW Max.

**Laser Safety**

*TTI reserves the right to change specifications without notice.*

**General**

Display	4" color touch screen
Power Supply / Charger	100-240V universal
Battery	Li-ion 10 hr typ.
Storage Temperature	-20 to 60 C
Operating Temperature Range	-10°C to + 40°C
Dimensions (without rubber boot)	8.4607" L x 3.89" W x 1.65" H (215mm L x 99mm W x 42mm H)
Weight	1.7 lbs.
Communications ports	USB-PC
Connector Styles	FC and SC Interchangeable, APC
Accessories Included	Universal power supply with mains for US, UK, CE and AU. Interchangeable FC and SC adaptors, Windows <sup>TM</sup> Compatible Software, USB Cable, Manual on CD, 2 stylus and Rubber Boot

*TTI reserves the right to change specifications without notice.*



## **15.1 Repair Information**

If repair is required, simply call the Terahertz Technologies Inc., for return instructions and a RMA number.

## **15.2 Warranty Information**

This product, including all mechanical, electrical, and optical parts and assemblies are unconditionally warranted to be free of defects in workmanship and material for a period of one (1) year from the date of delivery.

This warranty does not apply to expendable parts such as batteries or optical panel connectors, nor to any instrument or component which has been subjected to misuse, alteration, or fiber connector damage. It is the customer's responsibility to understand all the instructions and specifications prior to operating this instrument. This warranty does not extend to any loss or damage consequent to the failure of the warranted product.

## 16.0 Version Control

Through a Program of continuous improvement the upgrade of the features and performance of this instrument are an on going process. The instrument firmware version is accessible in the lower right corner of the home screen. The version changes and approximate release dates are as follows.

OTDR            V1.0.0.2 - 05/2017- Original release

V1.0.1.4 - 05/2018- Added clean sweep operation

V1.0.11.0 - 12/2021- Adds 50GHz/100GHz-A/100GHz-B switch to wavelength selection screen.