

**USER MANUAL**

- **FX150**
- **FX300**
- **MTTplus-410**
- **RXT-4100**
- **TX300s**

**OTDR Series**

Please direct all questions to your local VeEX Sales Office, Representative, or Distributor. Or, contact VeEX technical support at www.veexinc.com.

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1.0 About This User Manual

This user manual is suitable for novice, intermediate, and experienced users and is intended to help you successfully use the features and capabilities of the FX150, FX300, MTTplus, RXT, and TX300s OTDR series. It is assumed that the user has basic computer experience and skills, and is familiar with Optical Fiber, telecommunication concepts, terminology, and safety.

Every effort was made to ensure that the information contained in this user manual is accurate. Information is subject to change without notice and we accept no responsibility for any errors or omissions. In case of discrepancy, the web version takes precedence over any printed literature. The content in this manual may vary from the software version installed in the unit.

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2.0 Product Introduction

The FX150, FX300, MTTplus, RXT, and TX300s feature an OTDR optimized for the installation and troubleshooting of FTTx, PON, CATV, Mobile Backhaul, and Metro fiber networks.

2.1 Platform Highlights (FX150/FX300/MTTplus/RXT/TX300s)

- Robust, compact hand-held design for demanding field test environments
- High resolution, TFT color touch-screen viewable in any lighting condition. See the platform's datasheet for screen size.
- Fast boot-up time essential for fiber restoration
- Internal data storage varies with model. See the platform's datasheet for more information at www.veexinc.com.
- USB-A Host Interface supporting (FX300/MTTplus/RXT/TX300s):
 - USB flash drives (not available on FX150)
 - Fiber inspection probe connection (FX150 requires OTG cable)
 - Bluetooth option available
 - 3G UMTS data card support (not available on all models). See the platform's datasheet for more information at www.veexinc.com.
- Micro USB interface OTG to support (FX150):
 - USB flash drives
 - Fiber inspection probes
- Ethernet (10/100T) LAN Interface supporting (FX300/MTTplus/RXT/TX300s):
 - Remote control
 - Transfer OTDR test data
 - Perform software upgrades
 - Basic IP testing (Ping, Trace route, Web browser)
- Built-in Wireless and Bluetooth options supporting (FX150 standard; FX300/MTTplus/RXT optional. See the platform's datasheet for availability at www.veexinc.com):
 - Software upgrades and uploading test data via wireless connection
 - Pairing applications with Mobile Smartphones and Tablet PCs
- Rechargeable Li-Ion battery with capacity indicator, low voltage alarm and Auto-off function:
 - FX150 platform – 10,000 mAH battery
 - FX300/TX300s platform – 5200 mAH battery
 - MTTplus platform – 5400 mAH battery
 - RXT platform - 8400 mAH battery

- Continuous operation of > 8 hours per Bellcore TRNWT-001138 (platform dependent)
- ReVeal software to transfer fiber test data, upgrade software and perform remote control (check with factory on availability)
- Fiberizer Cloud to upload fiber test data
- VeExpress to check/upgrade software and installed options status (not available on FX300 or FX150)

2.2 Key Features

- FTTx optimized parameters for best dead zones
- Filtered 1625 or 1650 nm OTDR port for in-service measurements
- Live fiber detection with embedded power meter
- Dynamic range up to 50 dB (model dependent)
- Event dead zone < 1m, attenuation dead zone < 4m
- Singlemode wavelength options - 1310, 1490, 1550, 1625 and 1650 nm (CWDM and DWDM C-band also available)
- Multimode wavelength options - 850 and 1300 nm
- Telcordia SR-4731.sor file formats
- Generate and save traces in sor, pdf or csv format (model dependent)
- Auto mode with automated trace diagnostics, simplified setup and events detection
- Optional V-Scout mode – Intelligent Link Mapping using intuitive icons derived from multiple test acquisitions
- Markers for distance, attenuation, reflectance and splice loss measurements
- Optional universal interface with interchangeable optical adaptors (SC, ST, FC, LC) for OTDR port
- Power meter, light source, fiber inspection probe and VFL options
- Remote measurement via USB or WiFi connection using Fiberizer Desktop software

2.3 Package Contents

- OTDR (FX300, FX150, TX300S OTDR blade, RXT-4100 module or MTTplus-410 module)
- AC/DC adaptor
 - Input: 100-240 VAC (50/60 Hz), 1.5A max - (MTTPLUS: 5.3A max; FX150: 1.5A max)
 - Output: 16VDC - (MTTPLUS: 15VDC; FX150: 12VDC)
- Ethernet cable (FX300, TX300S OTDR blade, RXT module or MTTplus module)
- Li-Ion battery (capacity depends on platform)
- USB memory stick or CD-ROM containing:
 - OTDR Users' Manual (pdf)
 - Reveal and Fiberizer Desktop software
 - Software Upgrade Instructions
- Nylon Soft Carry case

3.0 Safety Information



Safety precautions should be observed during all phases of operation of this instrument. The instrument has been designed to ensure safe operation however please observe all safety markings and instructions. Do not operate the instrument in the presence of flammable gases or fumes or any other combustible environment. VeEX Inc. assumes no liability for the customer's failure to comply with safety precautions and requirements.



Optical Connectors

The test platform displays a laser warning icon when the laser source is active to alert the user about a potentially dangerous situation. Make sure that optical sources are inactive before connecting fiber to the test set to avoid skin or eye damage, or damage to the unit. It is recommended to:

- Deactivate the laser before connecting or disconnecting optical cables or patchcords.
- Never look directly into an optical patchcord or an optical interface (e.g. CFP, CFP2, CFP4, QSFP+, SFP+, SFP, OTDR, LS, VFL) while the laser is enabled. Even though optical transceivers are typically fitted with Class 1 lasers, which are considered eye safe, optical radiation for an extended period can cause irreparable damage to the eyes.
- Never use a fiber microscope to check the optical connectors when the laser source is active.

Electrical Connectors

Telephone lines may carry dangerous voltages. Always connect the electrical test ports to known test interfaces which carry low level signals.

4.0 Theory of Operation

4.1 OTDR

The principle of OTDR operation is based on measuring the Rayleigh back scattering signal when a single powerful optical pulse passes through an optical fiber. The weak back scattering signal is registered by an optical receiver, converted into digital form and averaged many times.

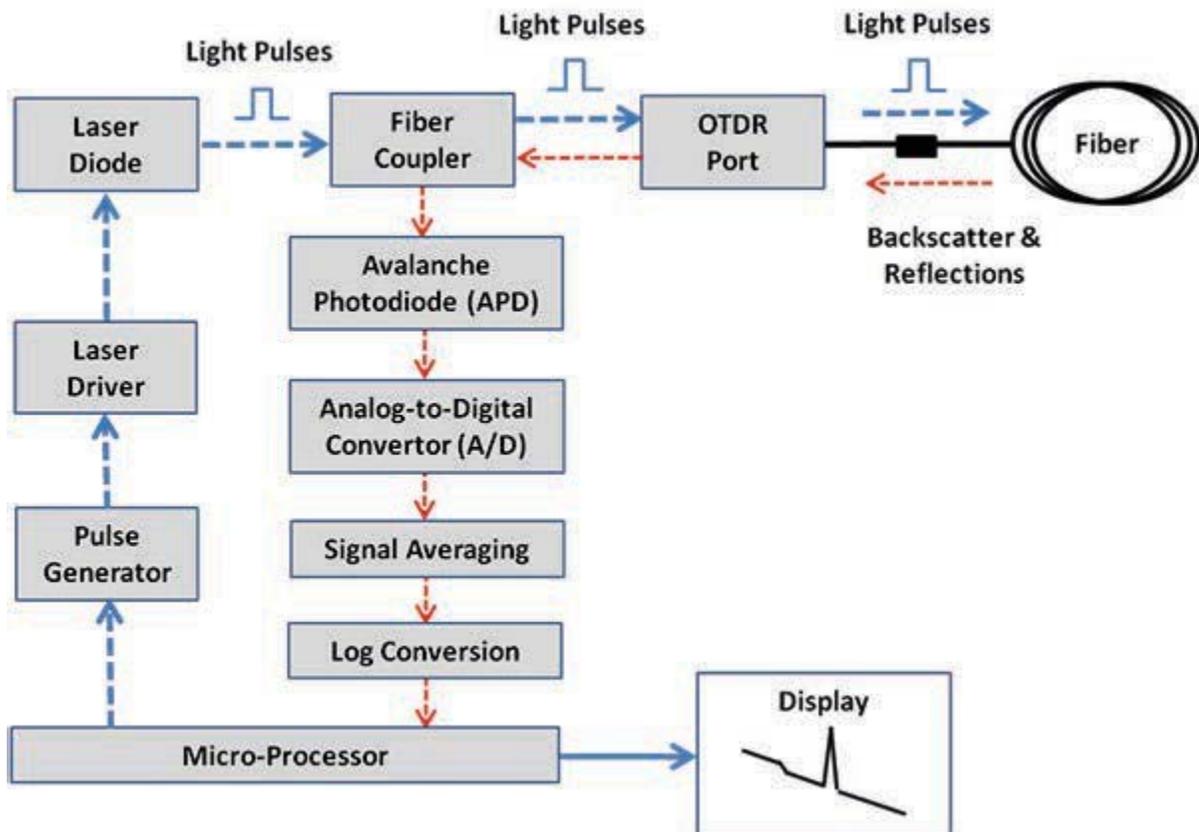
The OTDR calculate distance with next formula:

$$\text{Distance} = c * t / (2 * n)$$

where c - light speed in vacuum, n - optical fiber index of refraction, t - time delay between pulse emit and it registration by receiver

Each sample converted by ADC into digital form is registered in the RAM. To measure the back-scattering signal precisely, repeated triggering optical pulses is performed. The processor averages samples, corresponding to the same points of the optical fiber that leads to the increasing signal-noise ratio. After several cycles, the obtained signal values are transferred from RAM and displayed. Then, the process of measuring, averaging, and cleaning RAM registers is repeated again.

OTDR – Principle of Operation



4.2 Light Source

An optional light source is available and designed for generating continuous optical radiation. The light source output is the same as the OTDR port and uses the same laser diodes and optical splitter. The radiation power is stabilized with the help of external photodiode and power stabilization circuit.

The light source has two operation modes: Continuous and Modulated/tone (270, 1000 and 2000Hz).

The average power at modulation mode is 2 times lower (3dB) than in continuous mode of operation.

4.3 Optical Power Meter

The OPM is equipped with an InGaAs photodiode (1mm diameter) to measure optical power. For standard power PM1 measurement range (+10dBm), radiation falls directly on the photodiode. The OPM will support both MM and SM fiber with the APC or UPC connector type.

For extended measurement PM2 range (+25dBm), an integrating sphere with a photodiode is used. Input power is attenuated by the integrating sphere by approximately 100 times.

The current of the photodiode is amplified and converted into digital form with the help of analog-digital converter. The received digital signal is processed by microprocessor and the value of the measured optical power is displayed.

4.4 Visual Fault Locator

The unit is equipped with an optional Visual Light Locator (VFL) to visually identify breaks in the fiber typically hidden in the OTDR dead zone.

- Output power: 0 dBm (Typical)
- Operation modes: Continuous wave (CW) or 2Hz modulation

5.0 Basic Operation

5.1 Test Ports and Interfaces

OTDR testing: The optical fiber under test is connected to either the OTDR or OTDR Aux (Filtered SM or MM) port on the top panel. The type of the optical fiber connector must correspond to the OTDR connector or adaptor type, including the connector polish.

Optical Power Meter (OPM) testing: The optical fiber is connected to the OPM port on the top panel. Depending on fiber connector type, use interchangeable adaptors. FC, SC, ST or LC type are supplied standard.

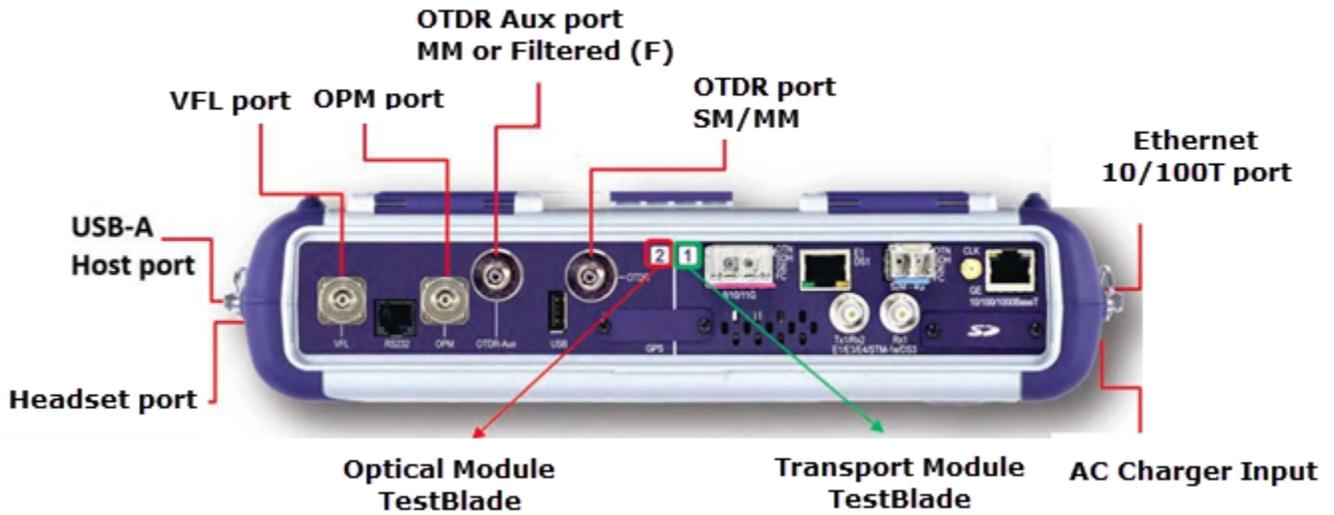
Visual Fault Locator ((VFL) testing: The optical fiber is connected to the VFL port on the top panel. The VFL interface is fitted with universal 2.5mm sleeve accepting all 2.5 mm connector ferrules.



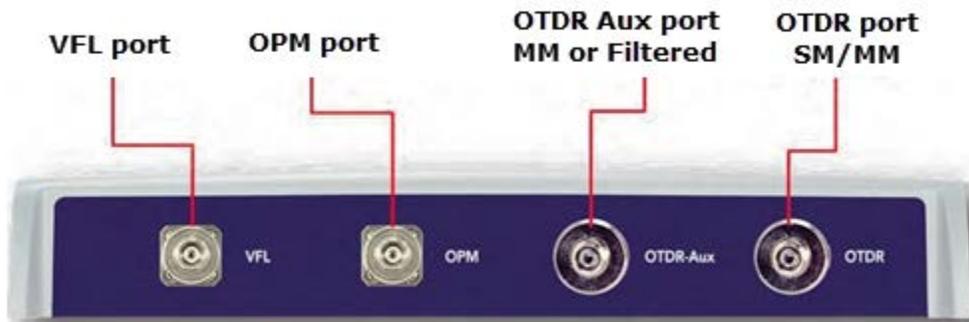
Note:

Optical Connections - The optical fiber connector must be cleaned prior to connecting to the fiber under test. Dust and dirt severely impacts optical performance.

Refer to Fiber handling procedures for cleaning tips and information.



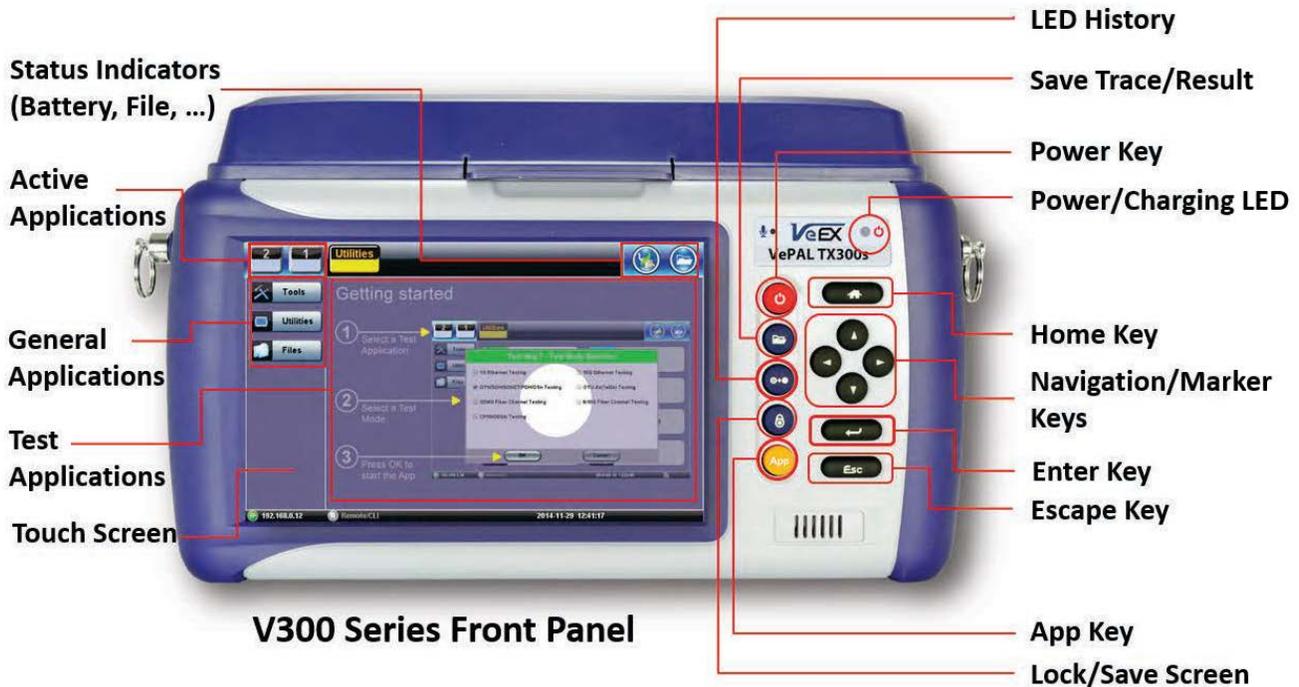
TX300s Top View



RxT-4100 OTDR Module

5.2 Front Panel Layout

The picture below depicts the TX300s. Layout will vary depending on FX150, FX300, MTTplus, or RXT platforms.



V300 Series Front Panel

5.2.1 LED Indicators

Power/Charge LED - indicates battery charging is in progress. LED turns off when battery is fully charged.

Note: The device is powered from the built-in Li-Ion battery and can be operated with the AC/DC adaptor plugged in.

5.2.2 Rubber Keypad

- **Home Key:** Resets user interface to Main menu
- **Navigation/Marker Keys:** Used to move markers or navigate menus (in the event touch screen is disabled for any reason) Enter Key: Enters the desired value or selects active menu, check box or radio button
- **Escape Key:** Exits the menu
- **App Key:** Toggles between active test applications (OTDR, OLS, OPM, VFL)
- **Lock/Save Screen Key:** Locks the touch panel or saves the screen (bmp) depending on setting defined in Utility menu
- **LED History Key:** Resets LED condition (depends on test application)
- **Save Trace/Result Key:** Saves test result file (OTDR, OPM, Ethernet, Fiberscope - depends on active application and unit configuration)

5.2.3 Menu Navigation

Navigate between test applications, setup menus, tabs, or active functions using the supplied stylus or by using up/down arrows followed by “Enter.”



“Getting started” information is displayed after power up.

Select a Test Application

- **FX150:** Application #1 is loaded by default. Select OTDR, VFL, OPM, OLS by clicking the icon on the main menu. The Fiberscope icon can be found on the Advanced Tools screen.
- **TX300s:** Select Application 2, which corresponds to the optical test function blade #2, located on the top connector panel. Select OTDR, VFL, OPM, or OLS by clicking the icon on the main menu
- **FX300/MTTplus/RXT:** Select Application 1, which corresponds to the module, inserted into the module slot. Select Fiber testing from the Test mode selection and press OK. The OTDR, VFL, OPM, and OLS test functions will be displayed on the main menu.

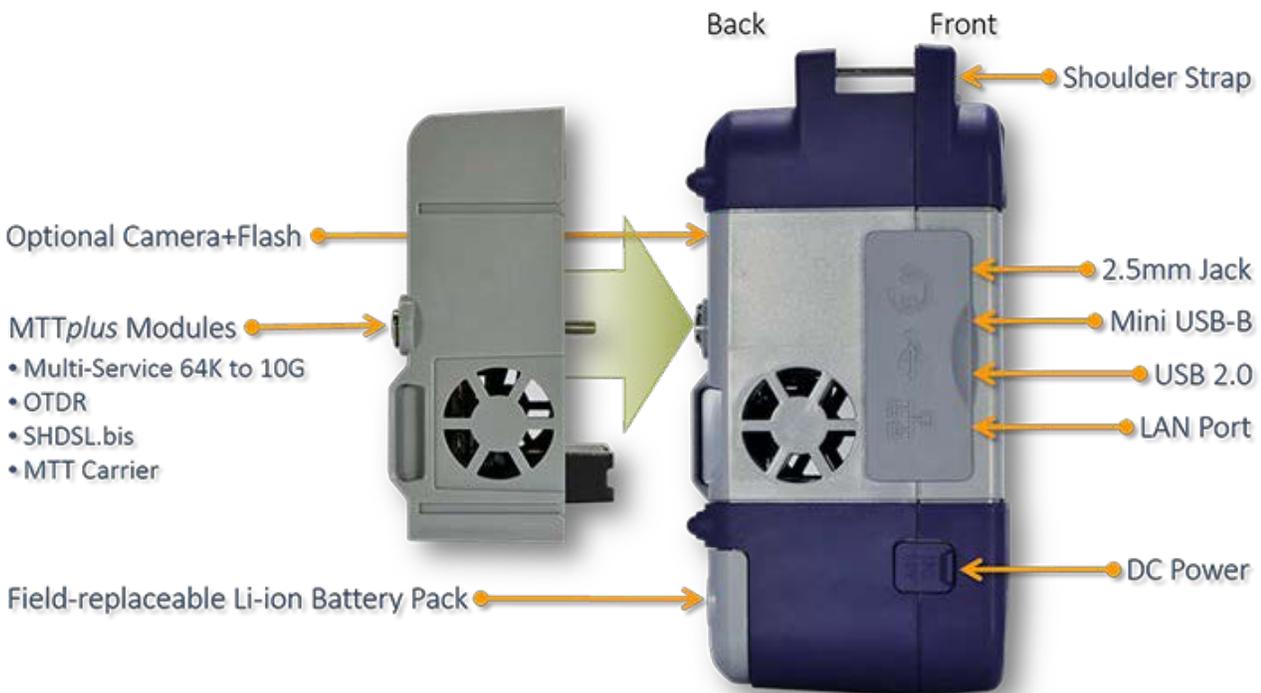
Note:

Touch Screen Navigation - The unit is equipped with a state of art, full color, LCD TFT touch screen. When used properly, the screen is designed to give years of reliable and precise operation. Always use the stylus supplied with the unit to operate the touch screen. Never use any sharp object such as a ballpoint pen, screwdriver, or similar item as this will damage the screen and void the warranty.

5.3 MTTplus Overview



5.3.1 MTTplus Side View



5.3.2 MTTplus Control Panel



- **Power:** Press for 2 seconds to turn the test set ON or OFF (prevents accidental ON/OFF) If a test is running when the power off is started, test is terminated and results may not be automatically saved.
- **Save Test Results:** Saves the current Test Results with customized or auto naming.
- **Lock/Unlock Touch Screen or Screen Capture:** Can also be programmed to Capture Screen images. Go to **>Utilities >Settings >Global >Save Settings** to set save and image compression options.
- **Volume and Brightness Control:** (it also acts as the MTT F1 key, when the is active) Brings up the Sound and screen Brightness controls; Use cursor buttons to adjust the levels.
- **Clear History:** Resets blinking LED reminders of past Errors or Alarms Test results are not affected. (not used with OTDR)
- **Camera App:** Launches the optional Camera App to help document the job site, damage, connections, etc. Requires the camera (factory-installed option).

5.3.3 MTTplus OTDR Module Top View



5.4 RxT Overview



5.4.1 RxT Front Panel

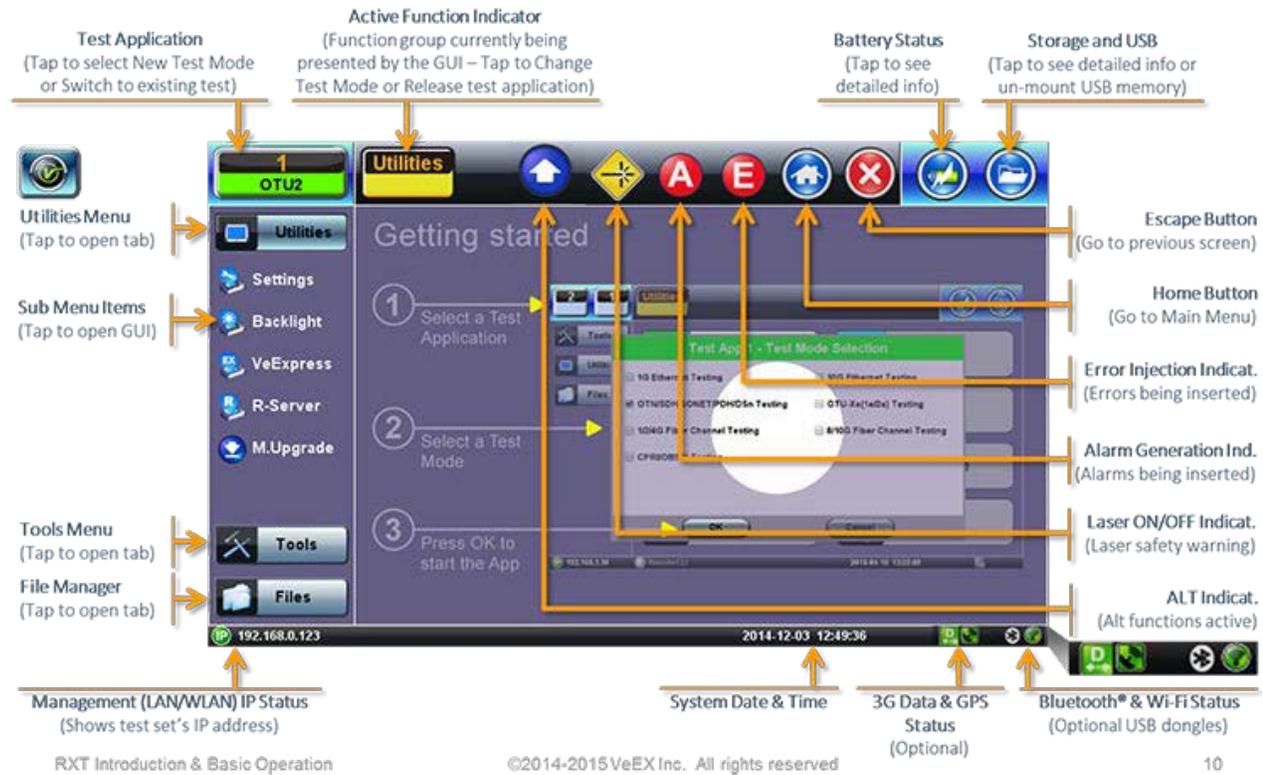


- **Power:** Press for 2 seconds to turn the test set ON or OFF (prevents accidental ON/OFF)
- **Cursor Keys:** Application dependent; May offer alternative GUI Navigation to touch screen (e.g. while wearing gloves in cold weather)
- **Enter:** Application dependent
- **Escape:** Application dependent
- **Alt Alternate function:** Links the buttons to the GUI soft Function Keys (MTT Emulation Mode only)
- **Clear History:** Resets blinking LED reminders of past Errors or Alarms. Test results are not affected. (not used in OTDR)
- **Volume and Brightness Control:** (it also acts as the MTT F1 key, when the Alt key is active) Brings up the Sound and screen Brightness controls; Use cursor buttons to adjust the levels
- **Test Application Selector** (it also acts as the MTT F2 key, when the Alt key is active): Quickly switches back and forth between the active Test Application and RXT platform. Utilities functions; Active test is not affected.
- **Lock/Unlock Touch Screen:** Can also be programmed to capture Screen Shots (>Utilities >Settings>Global>Save Settings)
- **Home:** Quickly bring users back to the Main Menu
- **Save Test Results:** Saves the current Test Results with customized or auto naming format

5.4.2 Getting Started

A Quick Guide is always present in the Home screen after boot up.

This screen can be displayed at any time from any screen.



The test port group is assigned to the Fiber application when the 410 module is installed. All options associated with the 410 OTDR module will be installed.

5.5 FX150 Overview



FX150 Platform

5.5.1 FX150 Test Ports



VFL/OPM/Aux-OTDR/OTDR-OLS

5.5.2 FX150 Keypad



- **Save:** Saves the screen (bmp)
- **Power:** Press for 2 seconds to turn the test set ON or OFF (prevents accidental ON/OFF)
- **Home:** Resets user interface to Main menu

5.5.3 FX150 Screen Navigation



OTDR Screen

Use the top tabs of the FX150 screen to access test measurement controls and view results.

On the bottom bar, you can see:

- IP address, when connected
- Remote control connection status
- Date and time
- Bluetooth and WiFi connection indicators

5.5.3.1 View/Hide side menu panels

The left and right panels of the display provide icons to access key functions of the FX150. These panels can be turned on or off to enable a better view of the application screens.

Use the shift keys located on the left and right sides of the unit to toggle on/off the left and right menu panels.

Press the **LEFT SHIFT KEY** to access:



File Storage – Tap to see the size and current capacity of the internal SSD storage.

Power Source Indicator– Indicates when unit is powered by external AC power and battery charging level. Tap to see battery charge status.

V key / Fiber – Tap to access all Fiber Test Modes or access the Utilities screen.

Press the **RIGHT SHIFT KEY** to access test control buttons and the following:



Home – Tap to return to the OTDR Main Menu.

Escape/Exit – Tap to return to the previous screen.

Arrow – Tap to enter the unit System Settings and Tools screen.

Start – Begin trace.

Green arrow – Switch λ active trace

Real Time OTDR – See trace in real time.

5.5.4 Setting up FX150 WiFi

The FX150 unit contains an optional built-in WiFi interface allowing you to easily transfer OTDR traces and upgrade software on the unit.

5.5.4.1 Access WiFi option

1. Press **Utilities** or the **HOME** key, and then press **Bluetooth/WiFi**.



2. Select the **WiFi Wiz** tab.



5.5.4.2 Connect to a WiFi network

1. Press **Scan** to see all networks



2. Select one of the available networks and the **Edit Settings** key will appear to the right. Once selected, an **Edit Settings** function key appears to the right.
3. Tap on **Edit Settings** to change the Encryption Type and enter the WiFi Key or **Connect AP**. The label will change to **Disc. AP** upon successful connection and the **Connect Net** key will appear.

Encryption Type: Supported encryption types include WEP, WPA, and WPA2.

Password: Security phrase or password necessary to access SSID and network. Tap the Password field to enter the network password on the pop-up keypad (ASCII formatting supported).

4. Press **Apply** after selecting the Encryption Type and entering the Key.
5. If the encryption menu was accessed via **Connect AP**, the test set will connect to the AP automatically after hitting Apply.
6. If the encryption menu was accessed via Edit Settings, press **Connect AP** to connect to the AP.
7. After a successful connection to the Access Point, press **Connect Net** to obtain an IP address and access the additional IP tests like Ping, Trace Route etc.

Note: Passwords are case sensitive. If the user enters the wrong network key, the test set will still connect to the Access Point, but will not be able to connect to the web or perform the Ping test.

5.6 Customizing Your Tester

You can customize the settings on your OTDR device in the **Utilities>Settings** menu:

- **About:** Displays serial #, MAC address, software version, software options installed and related product information
- **Screen:** Displays calibration menu.



Activating Touchscreen Calibration Mode

You can activate the Touchscreen Calibration Mode using the keypad by pressing **SAVE + HOME** keys simultaneously, then releasing. Press **SAVE + HOME** again to start a new calibration.



Press **SAVE** and **HOME** simultaneously, then release.

- **Backlight:** User defined settings when unit is used on Battery or AC power including Brightness settings



- **Global:** Various settings including:
 - **General**
 - **Language:** English, German, French, Chinese, Japanese, Korean and others (depends on software version). You must reboot the device to fully activate the new language
 - **Unit:** Metric or US
 - **Audible alarm:** sounds alarm when battery runs low or other alarm condition is met
 - **Show Password:** Shows/Hides password in IP setups and other menus where password is displayed.
 - **User Interface:** International or USA
 - **WiFi Auto Connect:** On or Off
 - **Auto Color Scheme:** On or Off
 - **RTU-410 (OTDR) Emulation Mode:** On or Off
 - **OTG Port Mode:** Host or Device
 - **Telnet:** On or Off
 - **Share Result:** On or Off

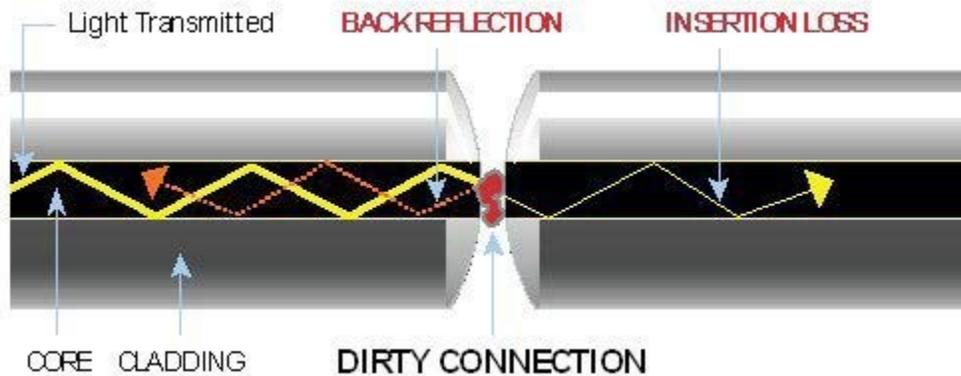
- **Storage Settings**
 - **File name prefix** (for setting prefix for OTDR sor files or other test results):
 - **Profile deleting:** Auto or Prompt user before Deleting
 - **Profile saving:** Auto or Prompt user before Overwrite
 - **Result saving:** Manual or prompt user before saving
 - **Advance saving:** Enables/Disables advanced saving properties

- **Save Settings**
 - **Lock/Save Screen:** Lock Screen or Save Screen (compression level and maximum number of screenshots that can be saved).

6.0 Test Fiber and Initial Preparation Introduction

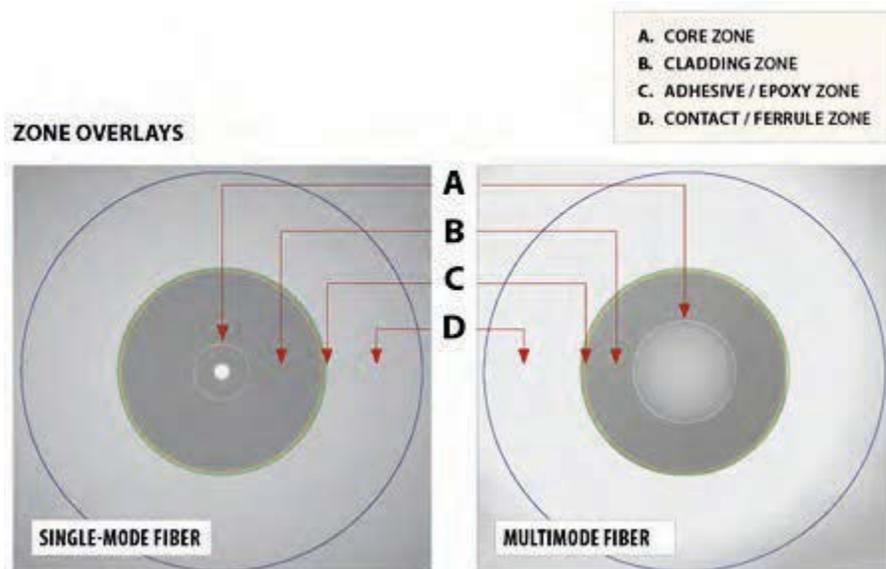
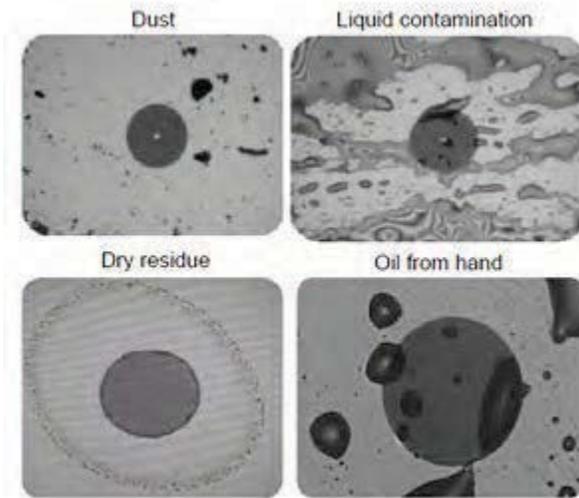
Dirt, dust, and other contaminants severely impact high-speed data transmission in optical fibers and dirty connector end-faces are often the #1 cause of link failures. High insertion loss and/or high back reflection can result in transmission loss or high bit errors and poor BER.

Furthermore, most measurement variations and test repeatability conditions in fiber-optic systems can be traced back to the cleanliness of optical connections. Contamination of fiber end faces not only affects optical power levels but also impacts back reflectance performance and levels which is harmful to sensitive optical components.



6.1 Contamination

Optical connectors are susceptible to contamination from air borne particles and human body oils when exposed. Left over liquid residue from improper cleaning can also leave the fiber end face contaminated. The smaller the fiber core, the more severe the problem is likely to be, especially when you consider that fiber core diameters can range from 62.5 microns all the way down to 8 microns in size. Below are some examples viewed by a 400x Fiber microscope:



6.2 Inspection

Whenever possible, inspect the fiber-optic connection (connectors, bulkheads, and test interfaces) with a fiber microscope. It is recommended to wear laser safety glasses when you work with fiber-optic connections, and always check that you disconnect the laser or transmitter before you begin cleaning the connector end faces.

6.3 Cleaning Procedure

To ensure proper and effective cleaning of optical fiber connectors and interfaces, please equip yourself with the following cleaning materials:

- Isopropyl alcohol
- Lint free soft tissues
- Ferrule cleaners (1.25mm and 2.5mm versions)
- Connector reel cleaners (CleTop or similar)



Procedure

1. Dab the contaminated connector end-face with a wipe that has been dampened with Isopropyl alcohol - the solvent will dissolve and remove contaminants that have dried and attached to the connector or fiber end-face.
2. Rub the fiber end-face perpendicularly against a dry lint free wipe several times.
3. Alternatively, use compressed air to dry the surface quickly. Do not blow or allow the connector end face to air dry as this may leave a residue behind which is often more difficult to clean and which can attract even more dirt.
4. Re-inspect the fiber end-face with an optical microscope to check that all the contaminants have been removed properly - if not, please repeat the process.

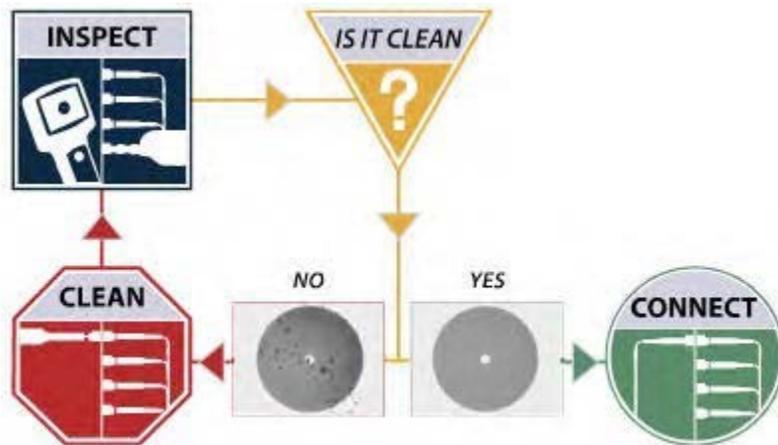
Note:

Using Compressed Air - In some clean air situations, you can use filtered air, which is free of oil and moisture to remove debris and clean a fiber optic connection. However, unless you follow very strict cleaning procedures, air-driven contaminants can cause more problems.

If you need to use compressed air, hold the can upright. If the can is held at a slant, propellant could escape and dirty your optical device. First spray into the air, as the initial stream of compressed air could contain some condensation or propellant. Such condensation leaves behind a filmy deposit.

6.4 Best Practices

- Never touch the end face of an optical fiber connector with your hands or fingers.
- Always install dust caps on unplugged fiber connectors.
- Store unused dust caps in a re-sealable plastic bag to prevent dust accumulating.
- Never re-use optic cleaning swabs or lint free wipes. Always discard materials that have been used.
- Ensure all alcohol or solvent residues are removed after using wet cleaning techniques
- It is recommended to re-inspect the bulkhead receptacles and connector end face using a fiber microscope following the cleaning and prior to use.
- The flow diagram below describes a best practice prior to connecting your optical fiber.



6.5 Connectors

6.5.1 Connector Types

In fiber optic networks, you will come into contact with many different connector types, the most common being described below:

ST Connector

ST stands for Straight Tip—a quick release bayonet style connector developed by AT&T. STs were predominant in the late 80s and early 90s and are still one of the most commonly used fiber optic connectors in networking applications. They are cylindrical with twist lock coupling, 2.5mm keyed ferrule.



ST connectors are used both short distance applications and long line systems. The ST connector has a bayonet mount and a long cylindrical ferrule to hold the fiber.

FC Connector

FC stands for Fixed Connection - it is fixed by way of a threaded barrel housing. FC connectors are typical in test and measurement environments and for single-mode applications.



FC is the fiber optic connector standard for Nippon Telephone & Telegraph (NTT) installations, developed with Nippon Electric Co. (NEC).

Note: *The FC screws on firmly, but make sure you have the key aligned in the slot properly before tightening.*

LC Connector

LC stands for Lucent Connector. It is a small form-factor fiber optic connector that uses a 1.25 mm ferrule, which is half the size of the ST / SC connectors.



It uses a standard ceramic ferrule connector. The LC has good performance and is highly favored for both multimode and single mode applications, especially in high-density connector facilities. The LC connector is available in simplex or duplex cables.

SC Connector

SC officially stands for Subscriber Connector; however, some people believe that “Square Connector,” is the correct name. It is a general purpose push/pull style connector. It was developed by NTT, which has an advantage in LAN/enterprise networks where duplex cabling to support TX/RX channels are commonly used.



SC Connectors are frequently used network applications. The connector is square and keyed with push-pull mating, 2.5mm ferrule, and molded housing for protection. The SC is a snap-in connector that is widely used in singlemode systems due in part for its performance. The snap-in connector latches with a simple push-pull motion.

E2000 Connector

Developed by Diamond, this connector has proven its performance worldwide in CATV and telecommunication networks. The connector features a spring-loaded shutter used to protect the ferrule from dust and scratches, and to provide increased safety protection. It uses a high precision Zirconia full ceramic ferrule with an insertion loss of 0.1dB. The APC version has a return loss of better than 85dB. The connector is especially suited for installation in global high performance networks.



The E2000 patchcords is available in simplex and duplex versions and comply with IEC 61754-15 and TIA/EIA 604-16 standards

6.5.2 Connector Performance and Polishing

Polishing of fiber optic connectors is the process of polishing the end-face of the ceramic ferrule within the fiber optic connector. The purpose is to improve the light transfer between the mating of connectors, in order to minimize optical losses and reducing reflections. This is an important aspect of fiber optic communications as losses affect the quality of the light signals.

There are two main types of losses that are affected by the style and quality of polishing, which dictate the optical performance level of terminated fiber optic connectors:

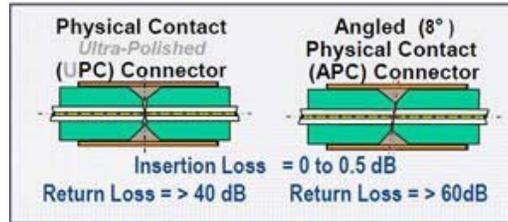
- **Insertion Loss (IL)** - The most important performance indicator of a fiber optic connection. This is the loss of light signal, measured in decibels (dB), during the insertion of a fiber optic connector.
- **Return Loss (RL)** - Also known as back reflection, is the portion of the light signal that is reflected back to the original light source. This occurs as the light is reflected off the connector and travels back along the fiber to the light source. This indicator is measured in negative decibels (dB). When reading return loss figures, the higher the absolute value of the decibel unit means the better the performance of the interconnection.

The amount of insertion loss is affected by fiber alignment, and/or the quality of the finishing on the end of ferrule, while reflectance is affected by the style of polishing on the ceramic ferrule in a connector. There are three different styles of polishing, reflected by their shape of the finish:

- **Physical Contact (PC)** - In the PC style finish, the fiber is polished to a smooth curve. As the name implies (i.e. physical contact), the ferrules of adjoining fibers come into physical contact and this reduces the air gap between the contacting ferrules, resulting in lower insertion losses. The smooth curve in the PC style is designed to reduce the return loss by reflecting the light out of the fiber. However, the PC polishing style incurs more return loss than other styles.

- Ultra Physical Contact (UPC)** - The UPC style ferrule has the shape of the PC style, except they are polished with several grades of polishing film that allows for an ultra-smooth surface. The main difference between UPC and PC is that the former have lower return loss.
- Angled Physical Contact (APC)** - The APC style produces the lowest return loss when compared to other styles. The ferrule is polished to an angle of 8 degrees. The angle is calculated so that it is less than the critical angle, which ensures light is not propagated back along the fiber.

Connector Polish and Performance



Typical Return loss values are:

Polished Connector ~ -45dB

Ultra-Polished Connector ~ -55dB

Angled Polished Connector up to ~ -65dB

6.6 Fiber Cables and Fiber Patchcords

6.6.1 Fiber Cable

Styles of Fiber Optic Cable vary in outer appearance, materials, application, features, and benefits. In OTDR applications, you will regularly come across the following types:

Bare Fiber

- Usually Spooled in 25km spools
- 250 to 400um acolyte buffer / polyimide
- PM Light Sensitive Bare
- Fiber Adaptor is a useful accessory and provides quick connection to check fiber length/continuity

PVC or Plenum Jacketed

- Many colors that mean very little
- Used mostly in internal applications

900um

- Patchcords
- Simplex (single fiber) or Duplex (two fibers) construction
- Singlemode or Multimode
- Pig tails
- Outer Diameter is usually 1.6mm, 2.0mm, and 3.0mm
- Duplex versions - Zip cord with outer diameters of 1.6mm, 2.0mm, 3.0mm

Break Out

- Both Multimode and Singlemode
- Indoor / Outdoor applications
- 1.6mm, 2.0mm, and 3.0mm sub units
- 2, 4, 6, 8, 12, 24, 48, 72 or greater fiber counts Outer Jacket can be of a variety of materials
- Terminated with all styles of connectors
- Often field terminated

Distribution

- Both Multimode and Singlemode
- Indoor / Outdoor applications
- 900um sub units

2, 4, 6, 8, 12, 24, 48, 72, 144 or greater fiber counts

- Outer Jacket can be of a variety of materials
- Usually longer runs and can be terminated with almost any style of connector

Ribbon

- Commonly used in LAN and PON applications with MTP/MPO connectors

6.6.2 Fiber Patchcord

A fiber patch cord is a piece of fiber cable that is used to connect the OTDR to the fiber under test. In a typical installation, fibers comprising the incoming cable will be “broken out” and terminated in a patch panel or wiring closet. One end of the patch cord is usually connected to the OTDR while the other end is progressively moved along the patch panel as measurements are made on each fiber.

The patchcord plays a critical role in fiber measurements and users should ensure that a high quality patchcord is always used, because this can and will have profound performance on test results and traces.

Factors affecting the choice of patchcord include:

- Fiber type – singlemode, multimode or ribbon
- Connector type (ST, SC, FC, LC, E2000, MTP/MPO, etc.)
- Dead-zone requirements (Refer to Section 4.2) Back reflection performance
- Insertion Loss
- Durability and Longevity
- Bend Limitation

Color Coding

The buffer or jacket on patchcords is often color-coded to indicate the type of fiber used.

Connector boot

The strain relief “boot” that protects the fiber from bending at a connector is color-coded to indicate the type of connection.

Connectors with a plastic shell (such as SC or E2000) typically use a color-coded shell. Standard color coding for jackets and boots (or connector shells) are shown below:

Color Code of Jacket	Definition or Meaning
Yellow	Singlemode fiber
Orange	Multimode fiber
Aqua	10G laser-optimized 50/125um multimode optical fiber
Grey	Obsolete color code for multimode fiber
Blue	Sometimes used to designate polarization maintaining fiber

Color Code of Connector Boot	Definition or Meaning
Blue	Physical Contact (PC), 0° Mostly used for singlemode fibers; some manufacturers use this for polarization-maintaining optical fiber.
Green	Angle Polished (APC), 8° Singlemode only, not available for multimode fibers
Black	Physical Contact (PC), 0°
White	Physical Contact (PC), 0°
Red	High optical power. Sometimes used to connect external pump lasers or Raman pumps



6.7 Inserting the Fiber

Carefully align the optical fiber connector to the port to avoid rubbing the fiber against the external part of the port or any other surface. If the interface of the connector has an alignment key, make sure to insert it correctly into the corresponding groove.

Push the connector in and make sure the optical cables are inserted to guarantee sufficient contact. If the connector has screw bushing, screw down the connector to fix in the optical fiber. Do not over-screw the connector or it will damage the optical fiber and the port.

6.7.1 Preventing Inaccurate Readings

To achieve maximum power and prevent false readings, clean the optical fiber connector interfaces before inserting them into the test port.

Please ensure the correct fiber connector type is used before inserting it into the test port or connector. Mismatched connector types will damage the optical end faces and the test set.

Note: If the optical fiber is not aligned properly and/or completely connected, it will cause serious loss and reflection.

6.8 Fiber Scope Utility (FX150, FX300, MTTplus, RxT)

6.8.1 Fiber Scope Overview

DI-1000 Digital Fiber Scope

The DI-1000 uses auto focus and capture the image and grade the connector's health and cleanliness after it is polished or cleaned. It is compatible with the FX300, RX-1200, and TX300S platforms.

VS-500 Video Fiber Scope

The VS-500 features a single-finger focusing knob, brightness control, and a digital sensor with detectable resolution to 0.5 μm . It is compatible with the FX300, MTTplus, RXT-1200, and TX300S platforms.

6.8.2 Connecting the Fiber Scope

Note: VS-400D, VS-500 and DI-1000 Fiber Inspection Scopes are currently supported if the Fiber Scope Expert option is installed.



1. Connect the Fiber Scope to the test set, using any available USB port (Older analog fiber scopes require a USB adapter). To connect to the FX150 microUSB port, use an approved OTG cable.
2. Select the **Utilities** or  button on the top-left corner of the screen.
3. Tap the **Tools** menu item, and then tap **Advanced Tools**.
4. Select the **Fiber Scope** options.

Note: The OTDR Viewer app is for the portable USB/Bluetooth OPX BOX micro OTDR option. The Optical Power Meter app is for the UPM-100 USB dongle option.

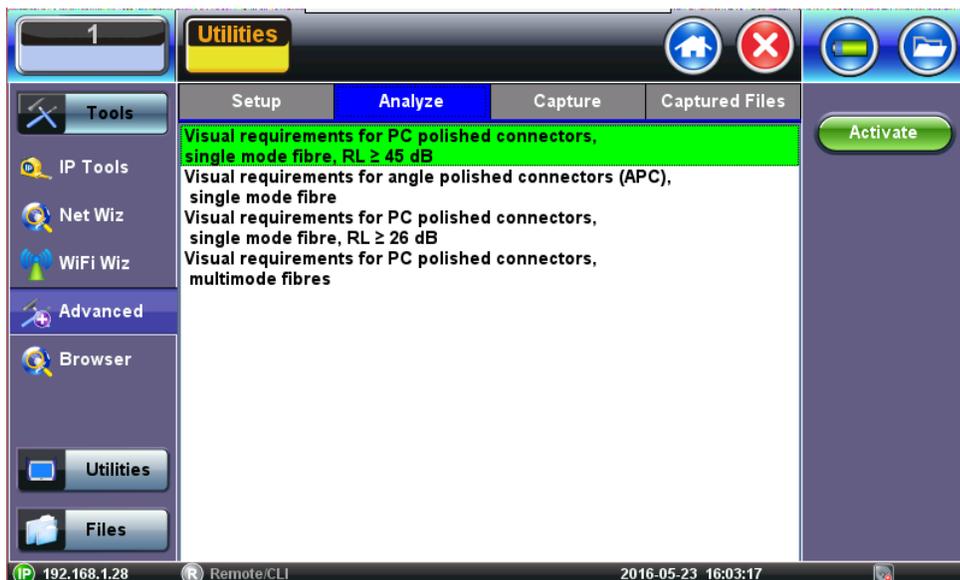


6.8.3 Setup



- **File Prefix:** Enter any name to identify the cable, site, technician, job, etc.
- **Starting #:** Enter the initial sequence number. This number will increase with each image captured.
- **Scope mode:** Select Local or Remote operation.

6.8.4 Analysis

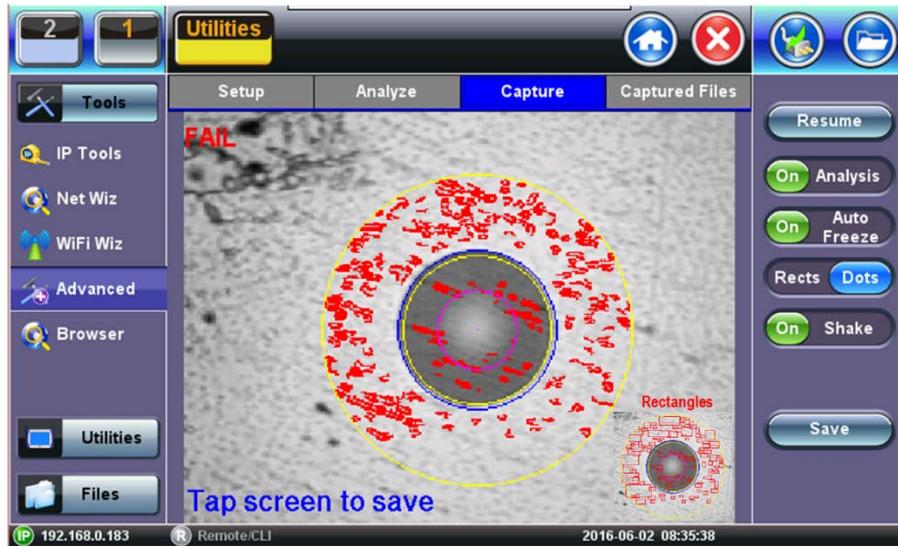


To begin the analysis:

- Select the Connector Analyze Profile and press the green **Activate** button.

Note: Currently, no IEC Analysis is available for MTP/MPO connectors.

6.8.5 Capture Screen



- **Freeze / Resume:** Stops the real time video so users can look at the static picture.
- **Analysis On / OFF:** Turn the Auto Analysis ON and OFF (software option).
- **Auto Freeze:** Turn On and OFF the ability to freeze the image automatically, when in Focus.
- **Rectangles / Dots:** Dots draw a red contour around scratches and defects. Rectangles highlight scratches and defects without obstructing the view.
- **Shake:** Turn On or OFF the ability to Auto Freeze and Analyze when probe image is unsteady.
- **Save:** Saves the fiber picture that is on the screen (in Freeze mode) or just Tap the Screen.

Notes:

1. When the DI-1000 Fiber Scope is plugged into USB, a blue LED will emit. The round FOCUS knob is on top. Turn right or left to focus.
2. When the VS-400 Fiber Scope is plugged into USB, a white light will emit. The FOCUS adjustment is located at base of barrel.

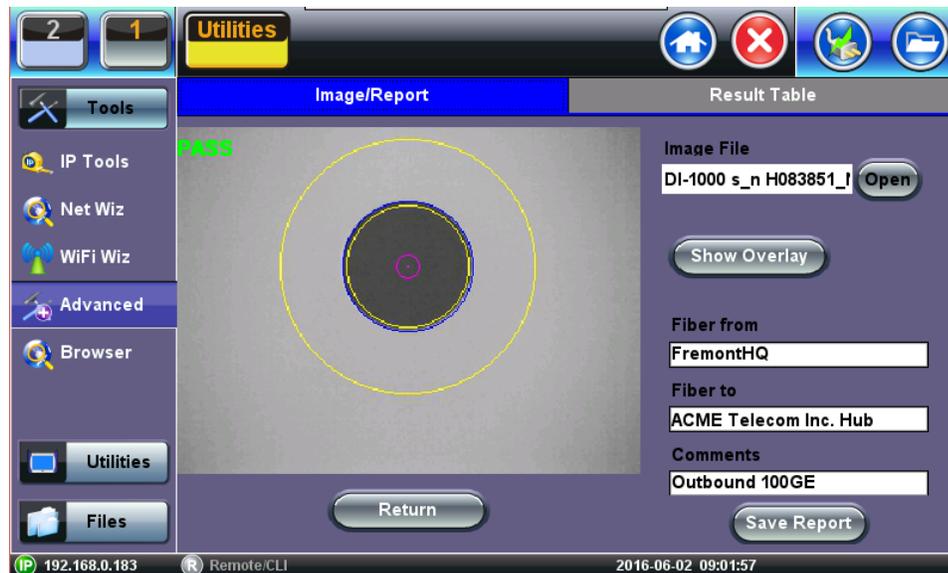
6.8.6 Captured Files



Use check boxes to select one (View) or two (Compare) files.

- **Clear All:** Deletes all files saved in memory.
- **Delete:** Deletes all selected files.
- **Compare:** If two files are selected, they can be compared. For example, pictures of the same connector before and after cleaning.
- **Analyze:** Open the connector face analysis feature.

6.8.7 Connector Face Analysis



Select a file from the Captured Files screen and press the Analysis button.

- **Open:** Provides a visual navigation tool to select files. Use the stylus to slide left or right until the correct file is in view, tap on the image to load it.
- **Show/Hide Overlay:** Enables or disables the analysis mask and defect detection.
- **Comments:** Add information about the fiber ends, comment about the result, status or any other meaningful information about connector, application, or case. This information will be included in the report.
- **Save Report:** Generates a test report for the selected file (html format). Test set can convert reports to PDF and send them to USB memory sticks.
- **Return:** Exit and return to Captured Files Tab.

6.8.8 Connector Face Analysis Results Table

	Scratches			Defects		
	Criteria(µm)	Thresholds	Count	Criteria(µm)	Thresholds	Count
A-Core 0-65 µm	[3;∞)	0	0	[0;5) [5;∞)	4 0	0 0
B-Cladding 65-120 µm	[5;∞)	0	0	[2;5) [5;∞)	5 0	0 0
C-Adhesive 120-130 µm	-	-	-	-	-	-
D-Contact 130-250 µm	-	-	-	[10;∞)	0	0

Select the **Result Table** tab. The test set displays a table with all numeric results from the analysis. **Catalogs**, **Defect** and **Scratch** events found for all four zones.

Scratch requirements refer to width.

Note: This table will also be included in the reports.

6.8.8.1 HTML Report

The Fiber Scope test report can be viewed in HTML format.

Analysis Report:

Setup

Parameter	Test Data
Fiber From	FremontHQ
Fiber To	ACME Telecom Inc. Hub
Comments	Outbound 100GE

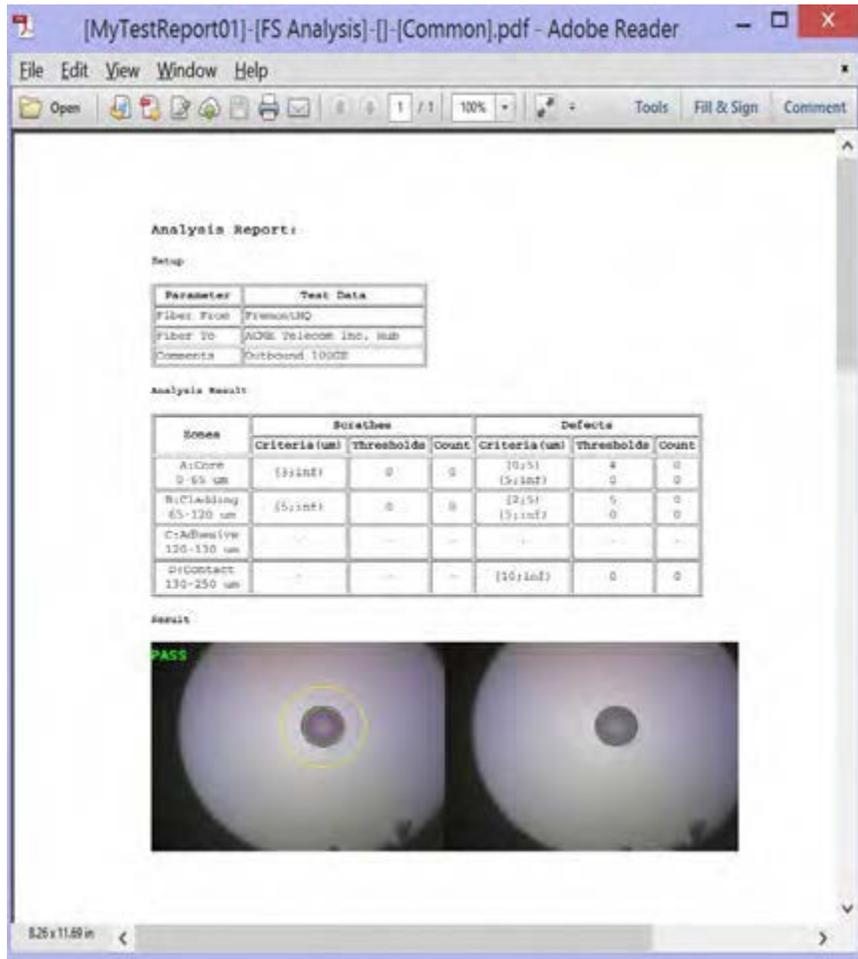
Analysis Result

Zones	Scratches			Defects		
	Criteria(um)	Thresholds	Count	Criteria(um)	Thresholds	Count
A-Core 0-65 um	[3;inf)	0	0	[0;5) [5;inf)	4 0	0 0
B-Cladding 65-120 um	[5;inf)	0	0	[2;5) [5;inf)	5 0	0 0
C-Adhesive 120-130 um	-	-	-	-	-	-
D-Contact 130-250 um	-	-	-	[10;inf)	0	0

Result

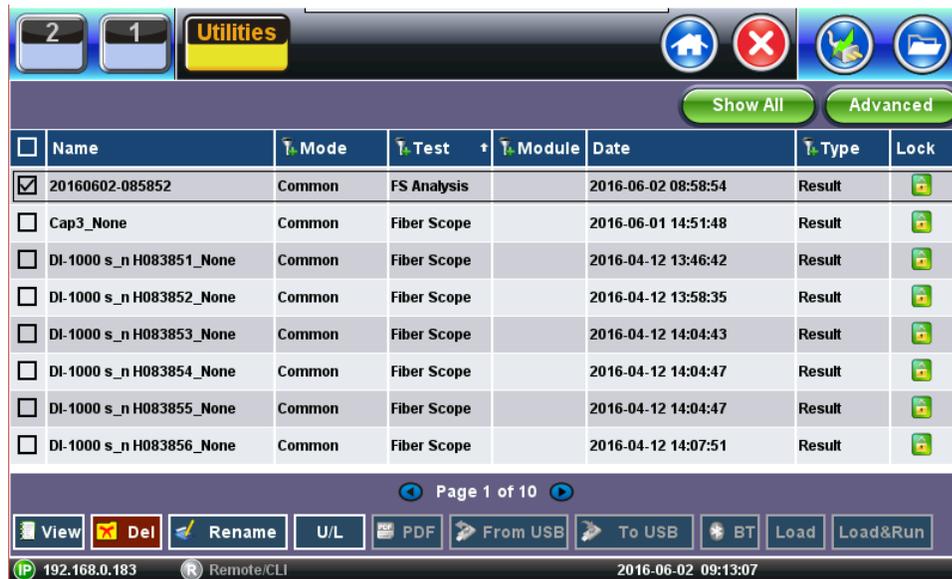
6.8.8.2 PDF Report

The Fiber Scope test report can be viewed in PDF format.



6.8.9 Managing Fiberscope Results with File Manager

1. Go to **Utilities >Files >Saved**. All results stored in the test set are displayed.
2. Use the to select the desired files.
3. Tap on any column header to sort by that specific parameter (FS Analysis or Fiber Scope). Tap again to change the sorting order.



- **U/L**: Unlock or locks files to prevent accidental deletion.
- **PDF**: Converts all selected files: Requires FAT32 USB Memory stick.



To backup and restore files, use a USB Memory stick.

- **To USB**: Copies all selected files to the stick.
- **From USB**: Restores all files from the stick.
- **BT**: (Bluetooth®) File Transfer the requires compatible USB dongle.

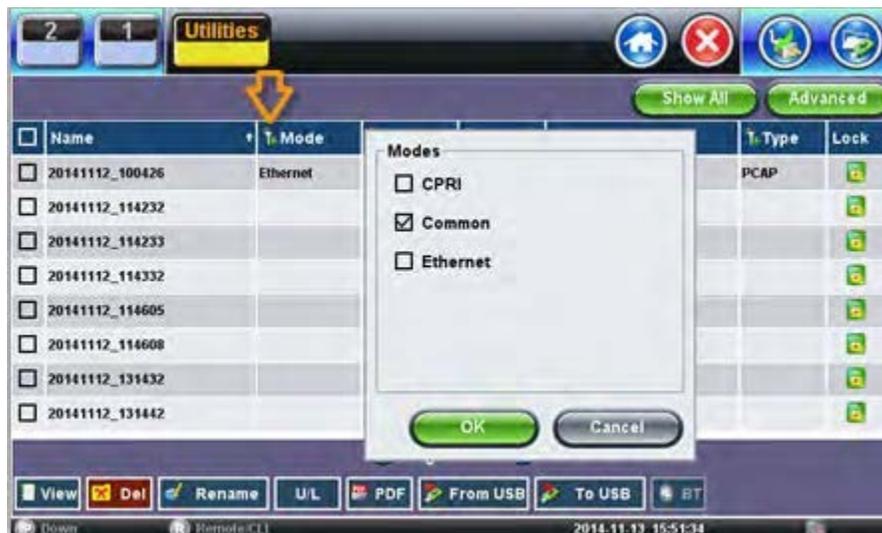
6.8.9.1 File Manager Filters

File Filters make it easier to isolate desired types of results from all other test results stored in the test set. It also reduces the number of pages displayed.

To activate filters, use the stylus to tap the + icon.



Fiber inspection test results belong to **Common Mode** and **Fiber Scope Tests**. Filter parameters can be combined.



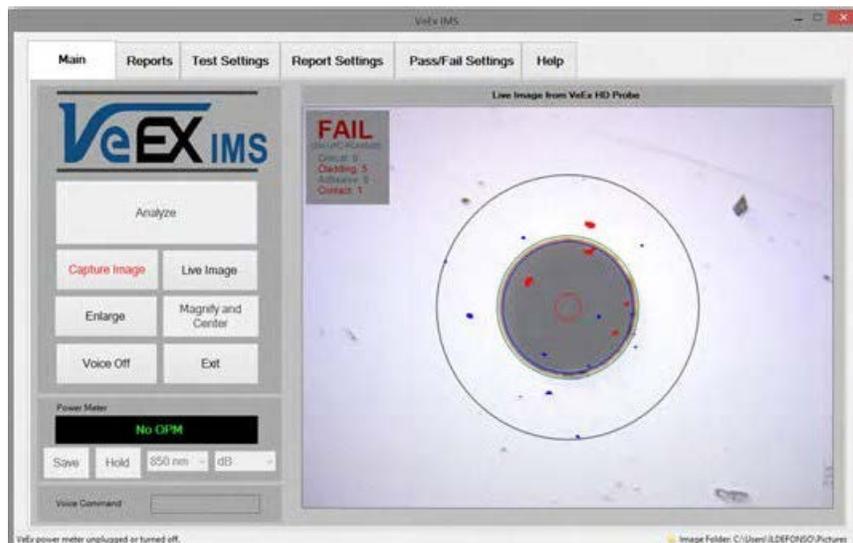
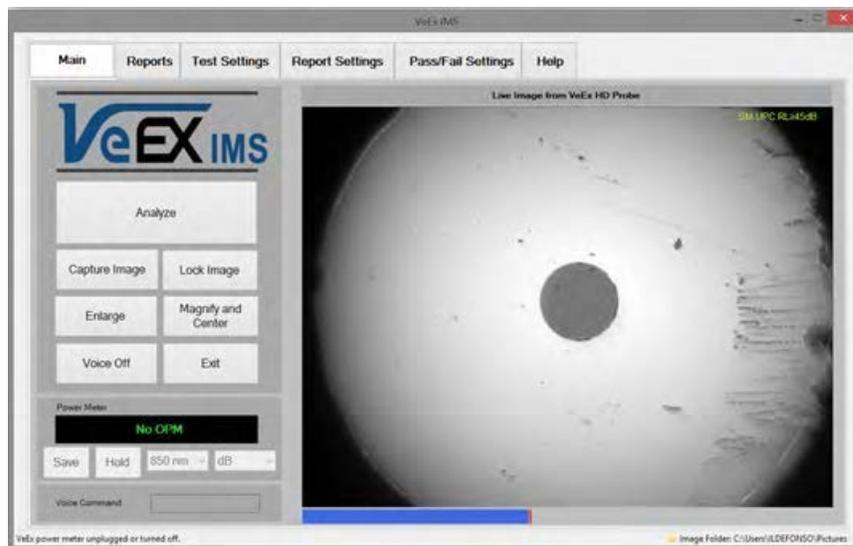
To reset filters, press the **Show All** button.

To make locating test results and reports easier, sort the results by tapping a header to sort by that field's type, in ascending or descending order.

6.8.10 Fiber Scope Image Management Software (ViS400D only)

Detailed PC-based Fiber Inspection Monitor & Analysis: Compatible with VIS400D

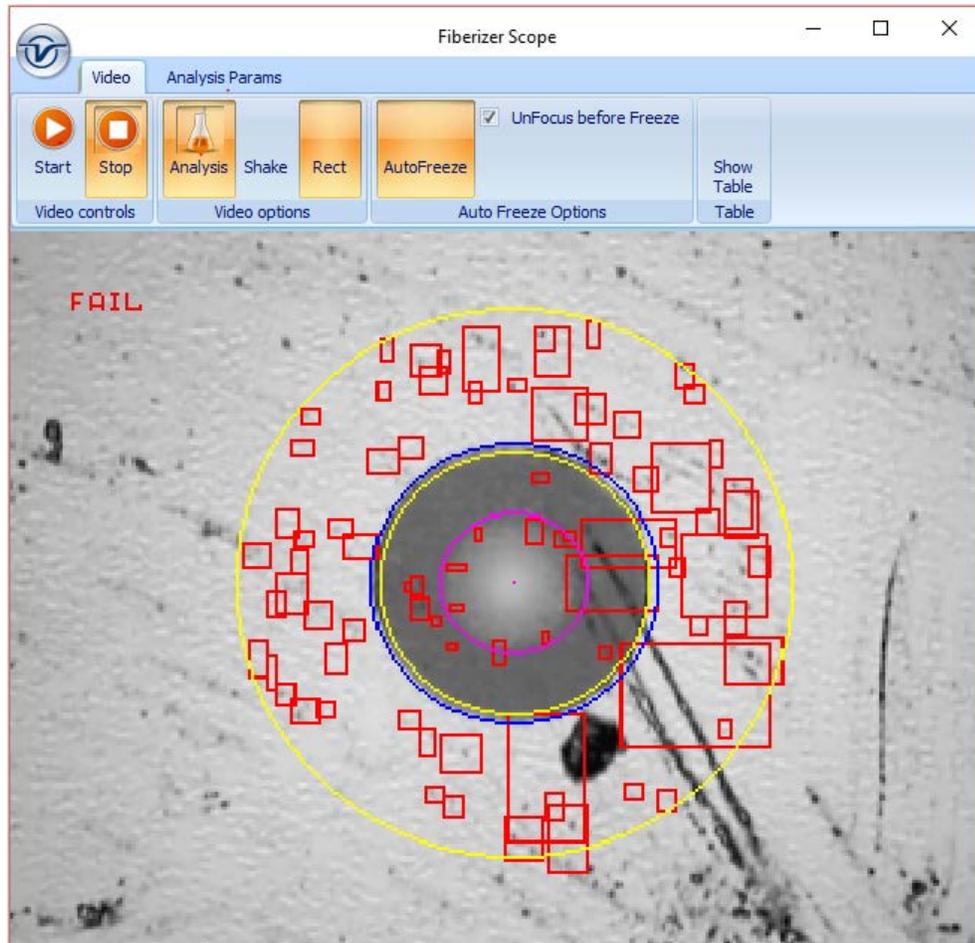
- IEC 61300-3-35 Profiles
 - SMF UPC >45 dB
 - SMF APC
 - SMF PC RL>26 dB
 - MMF PC
- Manual & Auto Analysis
- Focus level indicator
- Report Generation
- Optical Power Measurement: Compatible with UPM-100 OPM



6.8.11 Fiber Scope Image Management Software (VS-500 and DI-1000 only)

Detailed PC-based Fiber Inspection Monitor & Analysis: Compatible with DI-1000 Fiber Scope

- IEC 61300-3-35 Profiles



Analysis Profile Parameters:

- AnalysisParam1: SMF UPC >45 dB
- AnalysisParam2: SMF APC
- AnalysisParam3: SMF PC RL>26 dB
- AnalysisParam4: MMF PC

Video Mode:

- **Start:** Activate Real Time viewing mode
- **Stop:** Halt Real time viewing mode and display last image
- **Analysis:** Turn ON/OFF Auto IEC Analysis when image is in Focus
- **Shake:** Turn ON/OFF Shake function to facilitate auto-freeze and analysis when image is unsteady
- **Rect:** Toggle between dot or rectangular marking of events

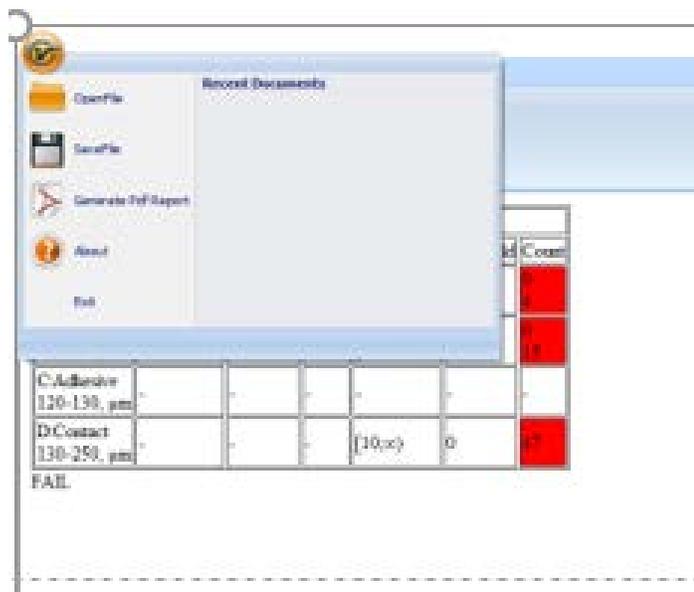
- **AutoFreeze:** Turn ON/OFF Auto Freeze when Fiber Scope image is in Focus
- **UnFocus before Freeze:** Select if you wish to unFocus Image prior to Freezing image
- **Show Table:** Select to switch from connector image to Table view



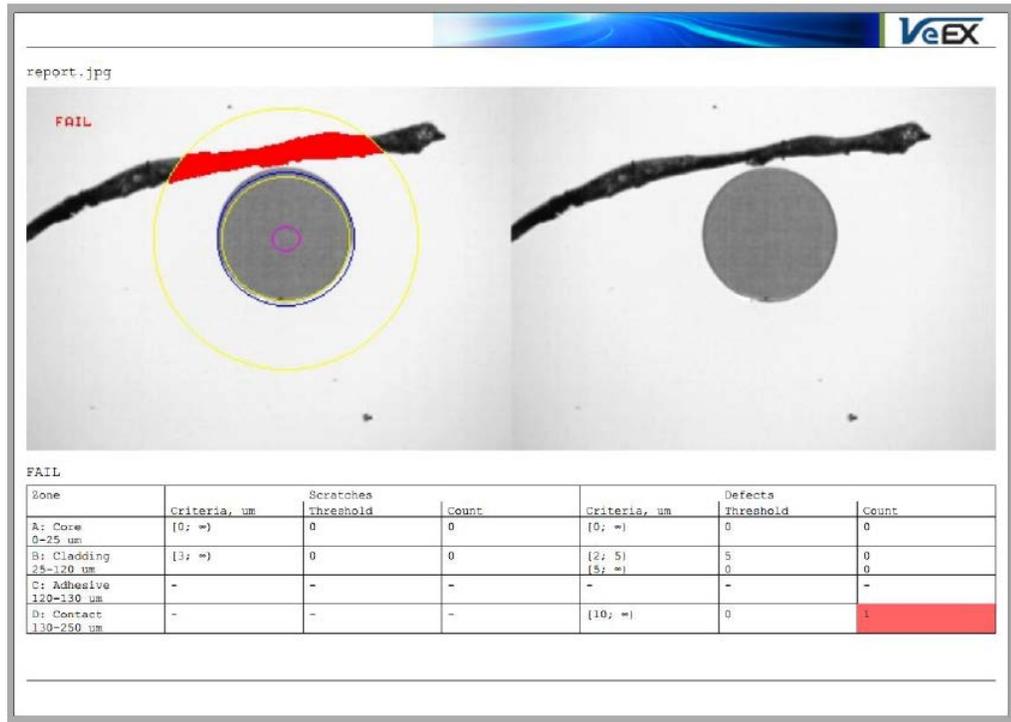
Zone	Scratches			Defects		
	Criteria, μm	Threshold	Count	Criteria, μm	Threshold	Count
A:Core 0-65, μm	[5; ∞)	0	0	[0;5) [5; ∞)	4 0	0 4
B:Cladding 65-120, μm	[5; ∞)	0	0	[2;5) [5; ∞)	5 0	0 15
C:Adhesive 120-130, μm	-	-	-	-	-	-
D>Contact 130-250, μm	-	-	-	[10; ∞)	0	47

FAIL

Click the  to pop up the File Management Window.



- **OpenFile:** To View saved files
- **SaveFile:** To Save Fiber Scope results
- **Generate Pdf Report:** To save Fiber Scope results in pdf file format.



- **About:** To check the Fiberizer Scope software revision for the Fiber Scope

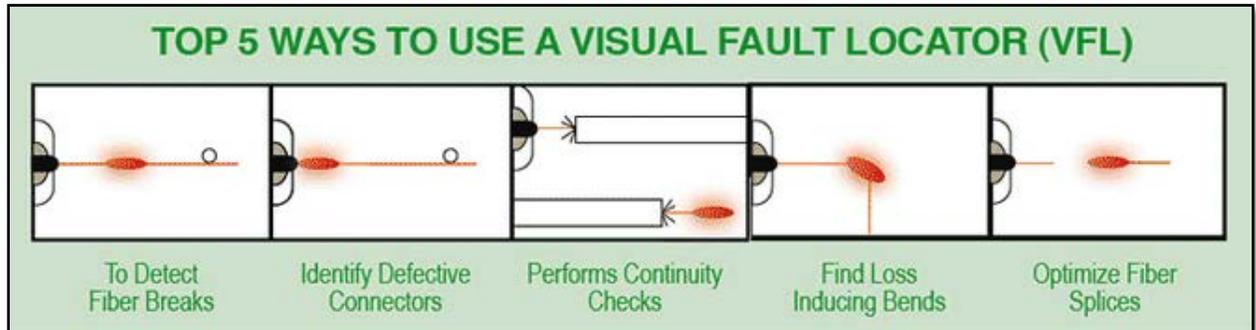


- **Exit:** To quit the Fiberizer Scope program.

6.9 Visual Fault Locator (VFL)

The unit is equipped with an optionally built-in Visual Fault Locator (VFL) to trace and visually identify breaks in ODFs, bare fibers (900 μm), and patch cords that are typically hidden in the OTDR dead zone.

The VFL works by injecting a 650nm visual red light into the fiber (up to 5 kilometers/3 miles) to bend a single fiber strand and force light to exit the center of the fiber. It traces it to identify faults through light leakage. It identifies fiber strands, connectors, breaks, bends and other potential problems or anomalies on events.



To see the most recent VFL specifications, go www.veexinc.com.



PROTECT YOUR EYES!

Never look directly into the VFL's light. It is a Class II laser and emits laser radiation that will harm your eyes.

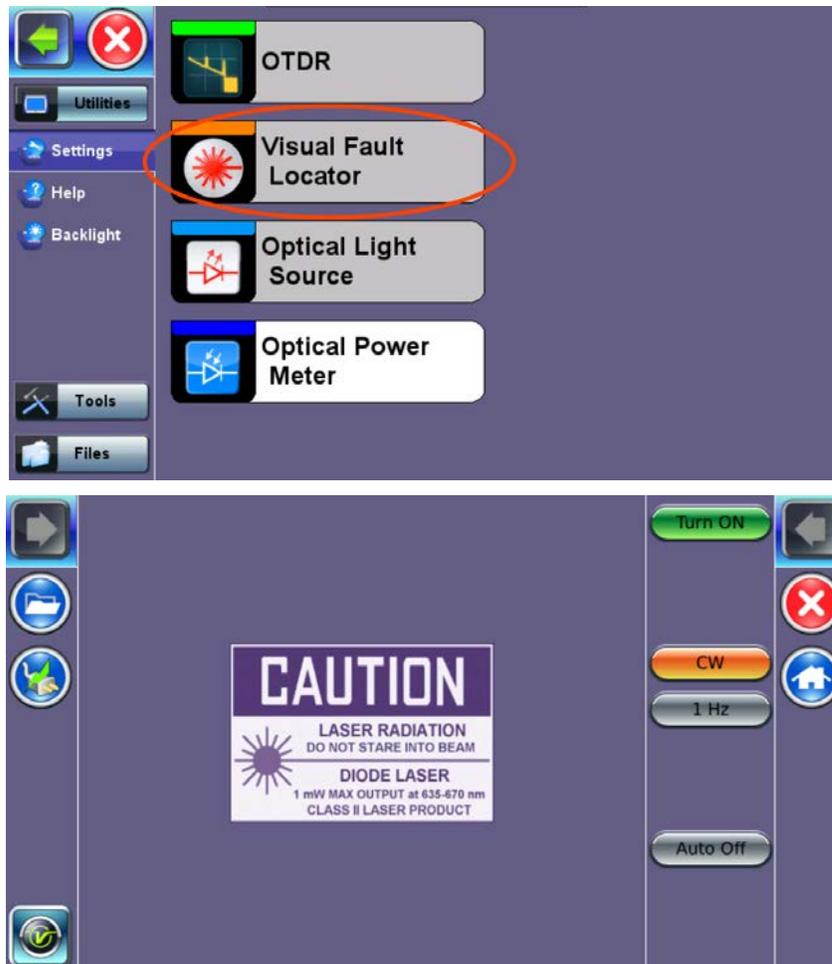
Use the  **Home** icon (FX150/FX300) or  **App** key (FX300) to toggle between active test applications (OTDR, OPM, VFL).

VFL can be used with OTDR simultaneously.

6.9.1 Using the VFL

To operate the VFL:

1. Make sure laser is turned off. Remove connector covers from the cable.
2. Connect the fiber to the VFL port located at the top of the unit. The VFL interface is fitted with universal 2.5mm sleeve accepting all 2.5 mm connector ferrules.
3. Use **Test App 1 – Test Mode Selection Fiber testing** to display the VFL App.
4. Press **Visual Fault Locator** on the main menu. The **Caution** screen appears.



5. Select the operation mode.

CW: Continuous Wave. Select this option to turn on the VFL continually to check for faults.

1 Hz: Pulse. Select this option to send intermittent light pulses. In some cases, this makes it easier to identify faults (than continuous light). It can also be used with audible detectors (toners) that can identify faint light or in well-lit (bright) environments.

6. Press **Auto Off**. When VFL application is exited, the VFL powers down automatically.
7. Press **Turn ON** to power the laser. The **Caution** box turns yellow.
8. You will observe that a red light emits from the end of the fiber to confirm continuity. This red light will also appear at splices, joints, connectors, ODLs, etc. if any light is leaking.

9. Press **Turn OFF**.

10. Disconnect the cable and replace covers.



When not in use, disconnect the cord from the port, replace dust covers, and keep the port cap securely closed.

For patchcords with dark cabling or any outdoor cable or bend-insensitive patchcords (armored cables), VFL will not work because there is no way to bend fibers.

6.10 Optical Light Source (OLS)

The unit can be equipped with an optional Optical Light Source (OLS) to use in conjunction with the OPM and test the entire fiber infrastructure. It identifies microbends, bad splices/connectors, and fiber breaks through visible laser light leakage. Use the automated feature to control both units at each end and test the fiber (multimode or singlemode) at different wavelengths. The OLS radiates continuously or in pulses.

To see the most recent OLS specifications, go www.veexinc.com.



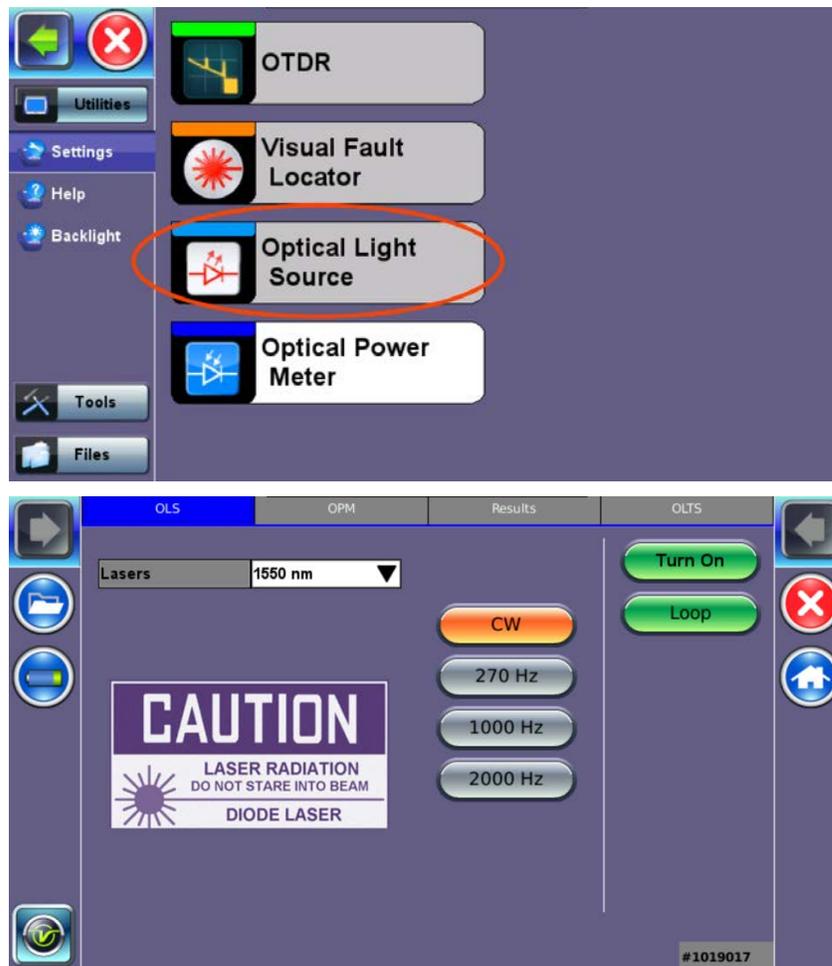
PROTECT YOUR EYES!

Never look directly into the OPL's light. The laser radiation emitted will harm your eyes.

6.10.1 Accessing and setting up the Optical Light Source

To access and set up the OLS option:

1. Make sure that the Optical Light Source option is installed on the test unit.
2. Power on the unit. **Test App 1 – Test Mode Selection** is loaded by default. Select **Fiber testing**, and then press **OK**.
3. Press **Optical Light Source** on the main menu. The **OLS** screen appears with the **Caution** warning.



4. In the **Lasers** drop-down list box, select the calibrated wavelength (**1550nm/1310nm**) to match the signal being measured.
5. Select the operation mode (**CW, 270 Hz, 1000 Hz, or 2000 Hz**) for the test.

CW (Continuous Wave): Select to continually measure level, loss, and reflectance in optical components.

270 Hz, 1000 Hz, 2000 Hz (Pulse). Select this option to send intermittent light pulses. In some cases, this makes it easier to identify faults (than continuous light). It can also be used with audible detectors (toners) that can identify faint light or in well-lit (bright) environments.

6.10.2 Using the Optical Light Source

To use the OLS:

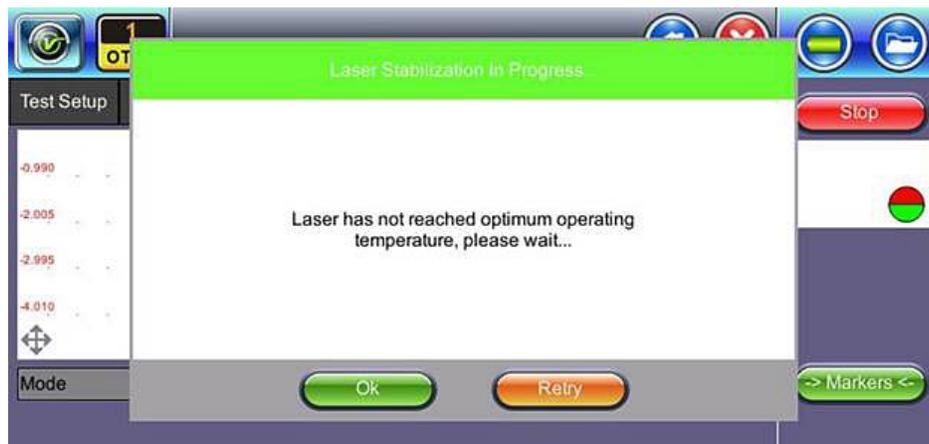
1. Connect a patchcord between the OLS and OPM test ports.
2. Select **Optical Light Source** from the main menu. The **OLS** screen appears.
3. Tap **Turn ON** to power on the OLS.
4. If WaveID is available, tap **Loop** mode, to auto cycle through all available wavelengths on the test port. The laser will change every three seconds.
5. When testing is complete, tap **Turn OFF** to power off the OLS, and then disconnect the cable and replace the port covers.



RXT-4111DWDM OTDR Laser Stabilization

The RXT-4111 DWDM OTDR test module offers advanced TEC laser stabilization for hot and cold weather operating conditions. If the optimal temperature for usage has not been reached, a **Laser Stabilization** message appears.

Laser Stabilization message



6.11 Optical Power Meter (OPM)

The unit can be equipped with an optionally built-in Optical Power Meter (OPM). It can also access an external Optical Power Meter using the Micro-USB port. It works by testing average output power from a light source and can be used to measure the span loss in dB of an optical fiber systems. On the test set display, view measurement loss in real-time.

Note: Only optical power meters (e.g. Built-in, UPM-100 or FX40 series meters) approved by VeEX are supported.

To see the most recent OPM specifications, go www.veexinc.com.

Use the  **Home** icon (FX150/FX300) or  **App** key (FX300) to toggle between active test applications (OTDR, OPM, VFL).

6.11.1 Setting up the Optical Power Meter

To access and set up the external OPM:

1. Make sure the external Optical Power Meter is connected to the Micro-USB port via an OTG cable.
2. Power on the unit. **Test App 1 – Test Mode Selection** is loaded by default. Select **Fiber testing**, and then press **OK**.
3. On the Home menu left panel, tap **Tools>Advanced**.



4. On the main menu, tap **Optical Power Meter**. The **OPM setup** screen appears.



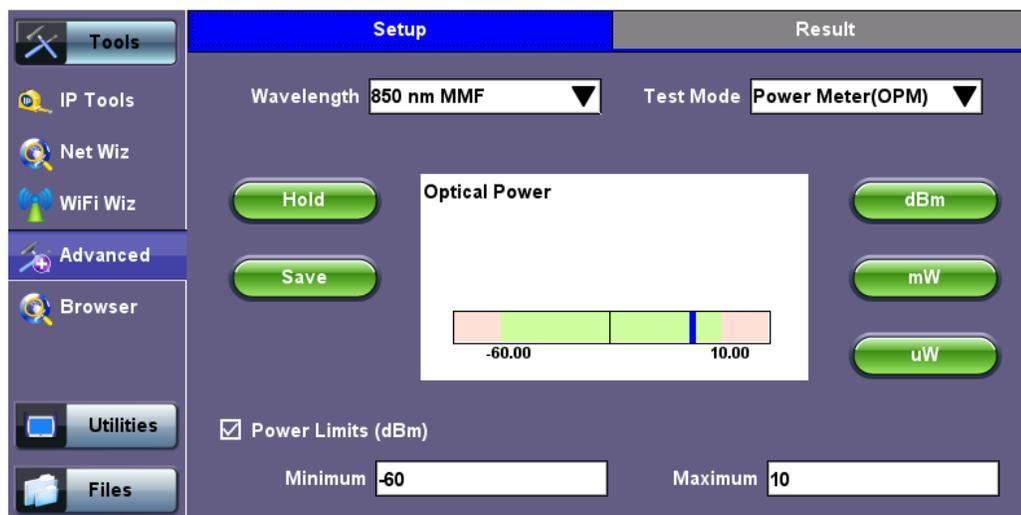
Accessing the Optical Power Meter module shuts down GPS and the atomic service.

To access and set up the internal OPM:

1. Check the test ports to ensure that the Optical Power Meter option is installed on the test unit.
2. Power on the unit. **Test App 1 – Test Mode Selection** is loaded by default. Select **Fiber testing**, and then press **OK**.
3. Press **Optical Power Meter** on the main menu. The **OPM** screen appears with the **Caution** warning.

See [6.11.2 Using the built-in OPM](#) for information on using the built-in OPM.

6.11.1.1 USB OPM Setup Options



Use the following options to configure the OPM:

- **Wavelength:** Provides a list of calibrated wavelengths to match the signal being measured.
- **Test Mode:** Select between Power or Loss measurements.
 - **Power Meter (OPM):** In Power Meter mode, the test set presents the direct power readings, which are displayed in dBm, mW or uW units. You can perform unit conversions by using the **dBm**, **mW** or **uW** buttons.
 - **Loss Meter:** In Loss Meter mode, the test set reports the difference in power readings between the Laser Source (LS) output being used and what is currently present at the connector after being attenuated by the fiber. The results are presented in dB.

Loss meter must be referenced (calibrated) to the Laser Source output.

To calibrate the Loss meter to the LS:

1. Connect the LS the OPM using a short patch cord.
2. Tap the **Reference** button to record the 0dB point. A reference point is established and the calibrated LS can be connected to the far-end of the fiber to measure the loss.
 - **Hold:** Freezes the last power or loss reading on the screen. Hold appears on the white screen when tapped. Tap **Hold** again to unfreeze it.
 - **Save:** Records instantaneous power or loss readings in the **Results** tab. The **Save** button must be used to record these individual readings (e.g. same cable at different wavelengths). Use the **Folder** button to save the complete set of results.



Saving the power or loss readings is useful when measuring multiple fibers or testing one fiber with multiple wavelengths.

- **Reference (Reference Power Level for Loss Meter Test Mode):** Sets the output reference level to measure against when a short and clean optical patch cord for the LS is connected directly to the unit's OPM port.

Press **Set** to store the reading or press **Cancel** to keep the previously stored value.

6.11.1.2 Setting Pass/Fail Limits

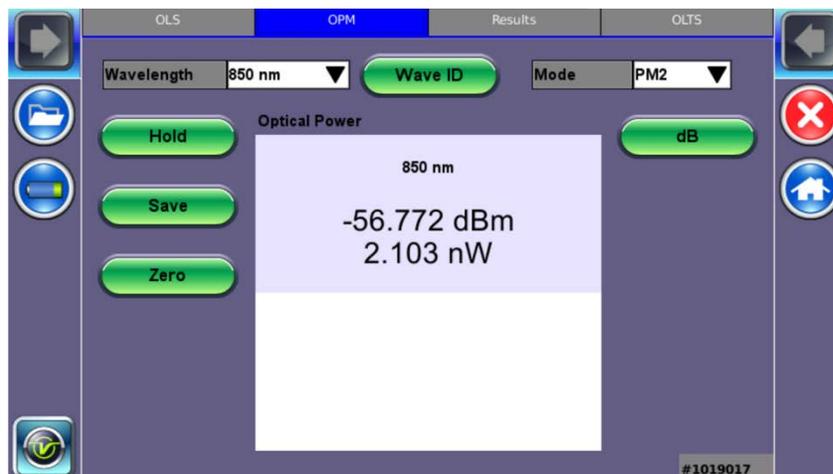
Whether measuring optical power or loss, there are always power input limits (saturation and loss) or attenuation allowances that determine whether the fiber cable meets the requirements for the desired application or network elements.

- **Power Limits:** Select the **Power Limits (dBm)** checkbox and enter the **Minimum** and **Maximum** power levels allowed for the application (e.g. in line with the transceiver's dynamic range). If the power reading falls beyond those limits, the power measurement reading will turn red.
- **Loss Limits:** Select the **Loss Limits** checkbox and enter the **Minimum** and **Maximum** amounts of optical power loss that are acceptable for the application or specified for the cable or installation. You can specify the total amount of attenuation in dB, or select the dB/km or dB/mi if the results are being compared against cable specifications. If needed, enter the **Length** of the cable under test for the test set to make the conversion.

6.11.2 Using the built-in OPM

1. Connect the fiber to the OPM port located at the top of the unit.
2. Power on the unit.
3. Select **Test App 1** or **Fiber** to see the OTDR/VFL/OLS/OPM selection screen.
4. Tap **Optical Power Meter**. The **OPM** menu appears.
5. If the light source has a WaveID option, tap **Wave ID** to detect the wavelength of the incoming signal automatically.
6. When testing is complete, tap **Turn OFF** to power down the OLS, and then disconnect the cable and replace the port covers.

Use the following options to configure the OPM:



- **Wavelength:** Matches the calibrated wavelength to the signal being measured.
- **Wave ID:** Detects the incoming wavelength automatically. Use when operating the OLS in CW mode with or without Loop enabled.
- **Mode:** Designates the measurement specification built-in: PM1 or PM2. For specific information on the PM1 or PM2 specifications, see the platform's datasheet at www.veexinc.com.

To calibrate the Loss meter to the LS:

Note: For more information on patchcords, see [6.6.2_Fiber Patchcord](#).

1. Connect the LS to the OPM using a patch cord.
2. Tap the green **dB** button.
3. Go to OLS and select the laser wavelength or Loop mode. The wavelength should match the light source wavelength, unless Wave ID is available.
4. Press **Set** to record the 0.00 dB point. A reference point is established and the calibrated LS can be connected to the far-end of the fiber to measure the loss.

- **dB/dBm:** Switches between dB and dBm measurement units.
- **Set:** Sets the reference value for the current wavelength.
- **Enter:** Edits reference values.
- **Hold:** Freezes the last power or loss reading on the screen. Hold appears on the white screen when tapped. Tap **Hold** again to unfreeze it.
- **Save:** Records instantaneous power or loss readings in the **Results** tab. Up to 12 measurements can be logged in the **Results** tab. The **Save** button must be used to record these individual readings (e.g. same cable at different wavelength). Use the **Folder** button to save the complete set of results. This is useful when measuring multiple fibers or testing one fiber with multiple wavelengths.

Note: If your device is equipped with a built-in clock, the saved measurement result will have a time stamp.

- **Zero:** Recalibrates the OPM to zero value for when measurement conditions change significantly. When in doubt, perform this procedure prior to making any measurements. For example, when you are testing in cold outdoor temperatures and then move testing inside to a heated building.

Note: Put cover over OPM test port **BEFORE** recalibrating.

6.12 Optical Loss Test Set (OLTS) (not currently supported)

The unit's OLTS option is used for end-to-end loss testing. It works by measuring a stable (reference) fiber first. The subsequent OLS test measurements are compared against the reference baseline to determine the end-to-end return losses.



6.13 Results

To view and save results using the FX150 meter:

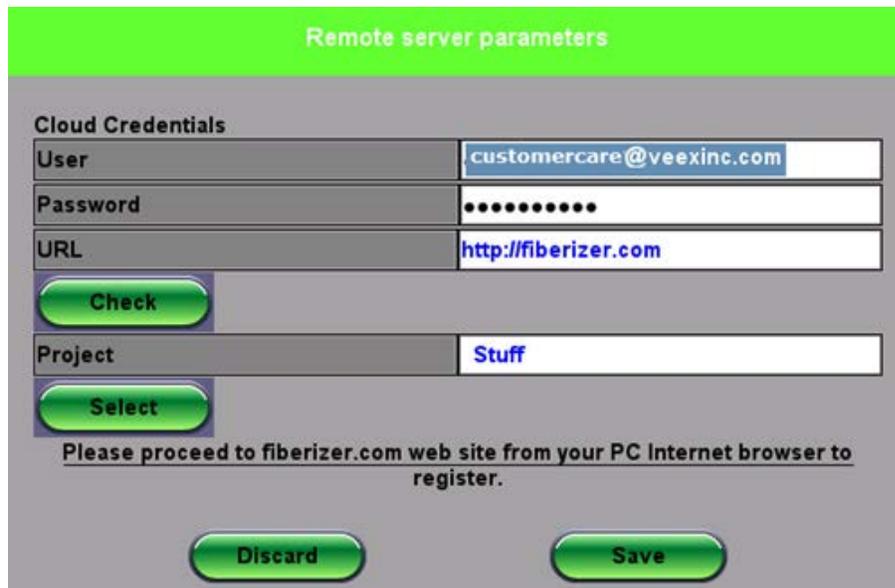
1. On your device, select the results you wish to save, and then press **Back**.
2. To save locally, press **Save**.

--OR--

To push the results to Fiberizer Cloud, ensure connection to the network via Ethernet or WiFi, and then press **Modify>Settings** to sync with Fiberizer Cloud. Then, press **Push** to sync saved files to the cloud.

To delete records, select the record(s), and then press **Remove**.

- **Table**: To view results in a table format.
- **New**: To create a new folder.
- **Save**: Saves results.
- **Modify**: Renames or removes (deletes) files.
- **Pull**: Downloads files from a Collection folder.
- **Save continuously**: To autosave results at a specified interval (1 to 60 seconds). Use this option to check power drift.



7.0 Working with the OTDR

7.1 Test Setup

Note: Screens provided in this section are based on the V300 series OTDR. Slight differences may occur between FX150, FX300, MTTplus, or RxT platform screens when describing OTDR and OPM operation.

7.1.1 Initial Settings

Wavelength: Select the wavelengths, which you wish to use to test the fiber.

- **OTDR** - If the OTDR contains both single and multi-mode optical fiber test ports, selecting a single-mode OTDR wavelength (SM1310, SM1550, SM1625) automatically prevent the selection of multimode OTDR wavelengths (MM 850, MM1300) and vice versa.
- **OTDR Aux** - The Aux port is reserved for:
 - In-service filtered testing at 1625nm or 1650nm.
 - Multimode testing when OTDR is equipped with both singlemode and multimode capability

For RxT-4111 only

- **DWDM Grid** - Select the channel that you wish to test
- **Frequency** – The displayed frequency automatically matches the chosen test wavelength/Channel
- **Wavelength** - Select the test channel/wavelength

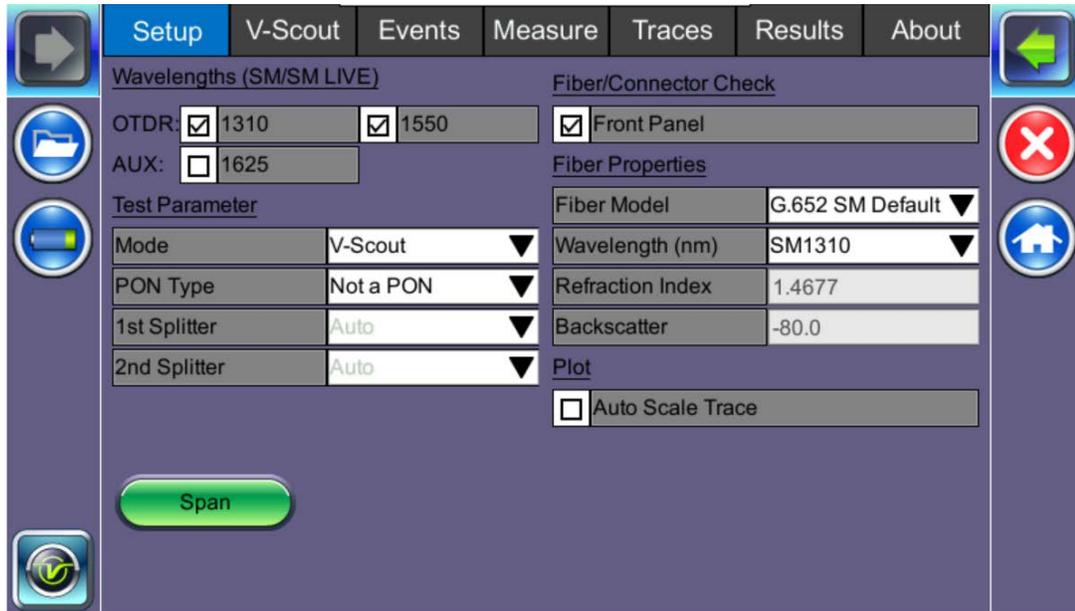
Fiber/Connector Check: (Can only be deactivated in Manual mode)

- **Fiber Check** - Confirms if a live fiber carrying customer traffic is connected to the OTDR if a live fiber is detected, a warning is displayed, and the OTDR laser will not transmit thus preventing any service disruption.
- **Connector Check** - When selected, the unit will check the loss and reflectance of the OTDR connection to the Fiber-Under-Test or launch fiber. If excessive loss or poor reflectance is detected, the OTDR displays a “Bad connection detected” message. If a patchcord is too short, the user may also get this message. The User has the option to stop the test and check the fiber or resume the measurement.

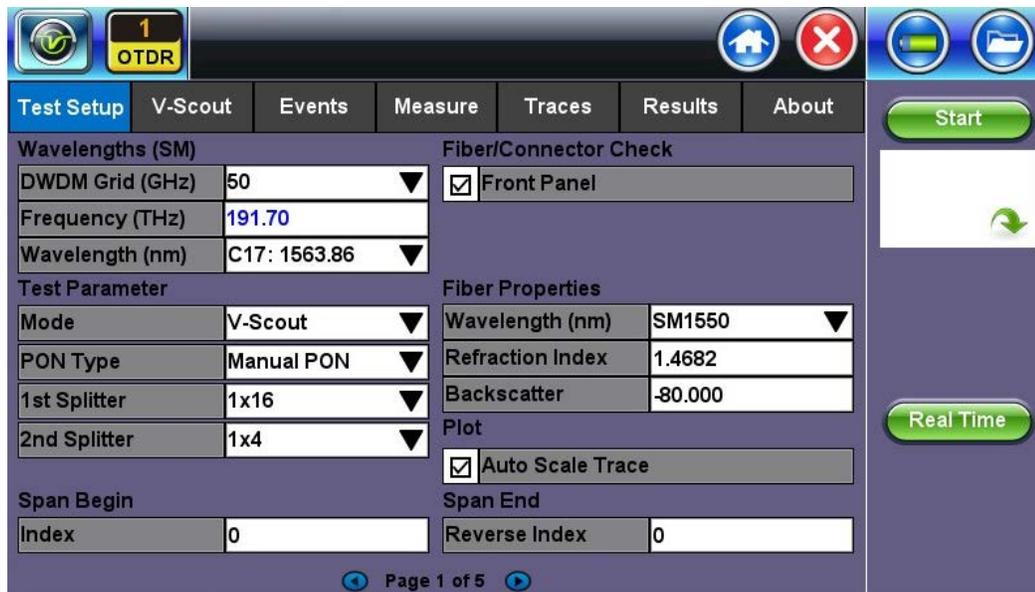
7.1.2 Manual mode

To set test parameters manually, select **Manual Mode**.

Manual Test Setup (page 1)



Manual Test Setup (RxT-4111 only)



OTDR Setup (Page 1):

Test Parameters (all OTDR models)

- **Mode:** Manual, Auto, VScout, or VScout Profiles (optional)
- **PON Type:** Not A PON, Manual PON or Auto PON
 - 1st Splitter (manual mode)
 - 2nd Splitter
- **Distance range (km, m, miles, kilofeet):** maximum value of measured distances; the value of distance range should exceed the expected length of the fiber under test (20% more). The distance unit type can be set in page 2 of **Test Setup**.
- **Pulse Width, ns:** the value of the optical pulse duration; the range of acceptable optical pulse values depend on the selected distance range and is automatically set by the OTDR software. Short pulse widths provide better resolution and produce the best event and attenuation dead zones. Short pulse widths however inject less optical energy into the Fiber-Under-Test (FUT), resulting in a noisier trace and lower dynamic range. Longer pulse widths provide the highest dynamic range and are used to test long fibers.
- **Resolution, m:** distance between two samples (sampling interval) of the trace; values depend on the selected distance range. Select smallest value to measure events spaced close together and use largest value to for longer ranges. Auto mode will determine best value for Fiber Under Test
- **Measurement time, min:sec:** determines the duration of measurement process with averaging. Use Live mode to perform monitoring of the fiber in Real Time. Longer averaging time improves the SNR and produces a “smoother” trace.
- **Optimized For: Select Test Mode:** Automatic DR/DZ, maximize dynamic range (DR mode) or best deadzone, sacrifice range (DZ mode)

Fiber Properties

- **Fiber Model:** Select type of fiber to be tested to auto populate Index of Refraction (IoR) and Backscatter co-efficient (BS) values.
- **Wavelength (nm):** Select desired wavelength for fiber properties.
- **Refractive index N:** Setting for each available wavelength (also known as group index) is used to convert time to distance. Setting proper value (1.2000-1.8000) determines accurate distance measurement. IoR provided by the cable of fiber manufacturer.
Refractive index can be changed for any stored trace. Enter a custom value or select fiber type to populate corresponding values.
- **Backscattering coefficient, BC:** represents level of backscattering in a particular fiber. It is used for Reflectance and ORL measurement and can be obtained from the fiber manufacturer. Backscattering coefficient can be changed for any stored trace.

Other Parameters

- **Auto Zoom Trace:** Use this mode to auto scale the viewing window at the end of the test.

*Note: Disable this feature when using **Realtime** test mode.*

The **Fiber/Connection Check** is set to **ON** by default. Tap the checkbox to disable.

- **Fiber Check:** alerts that live traffic detected and disables OTDR laser to prevent service disruption.
- **Connector Check:** checks the loss **and** reflectance of the OTDR's connection to the Fiber-Under-Test or launch fiber. Excessive loss (>1.5dB) **or** poor reflectance (<-35) will result in a "Bad connection detected" message. User can stop the test and check the fiber or resume the measurement.

For OTDR with built-in internal launch fiber, (G.657), the OTDR connector insertion loss will depend on the fiber type connected to the test set. Mismatched fibers can result in higher panel loss than expected connector loss. Use the **Span** button to enter fiber mismatch compensation. Mismatch fibers should not impact Reflectance.

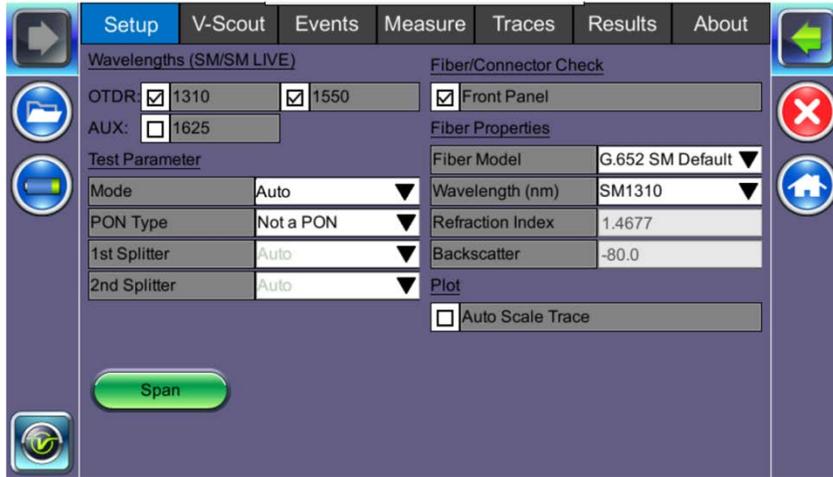
Span Settings

Press the **Span** button to configure Span settings.

- **Span begin:** Used to identify where a launch cable ends and test fiber begins. Defines the start of analysis by distance or event index. This will appear as a large green arrow pointing right on screen.
If **Event #1** is the end of the launch fiber, set the **Span Begin Index** to "1".
- **Span end:** Defines the end of analysis by distance or event index and mark the end of the test fiber. This will appear as a large green arrow pointing left on screen.
If a launch fiber is used at the far end of the test fiber, set the **Span End Index** to the **Event #** associated to the location where the far end launch fiber starts.
- **Include Event Loss:** Check if you don't want to include connector loss in Total loss summary.
- **Compensated Loss (dB):** For OTDR with built-in internal launch fiber, (G.657), the OTDR connector insertion loss will depend on the fiber type connected to the test set. Mismatched fibers can result in higher panel loss than expected connector loss. Use the **Span** button to enter fiber mismatch compensation. Mismatch fibers should not impact Reflectance.

7.1.3 Auto mode

To set OTDR test parameters automatically, select **Auto Mode** under **Test Parameters**. In this mode, the OTDR performs a short measurement and analysis of the fiber and automatically determines optimal test settings. This process typically takes less than 5 seconds.



Auto mode is intended for inexperienced operators and only uses single pulse/wavelength. However, the user must still specify if they are testing point-point or a point-to-multi-point network which are typical of PON and RFoG networks. In Auto mode, the user can only set the test wavelength/s. Distance Range, Pulse Width, Resolution and Measurement time are set automatically by the unit.

- **Test Wavelength/s**
 - (singlemode, multimode, singlemode live or filtered (1625 nm or 1650 nm))
- **PON Type**
 - **Not a PON** (point-to-point)
 - **Manual PON** - 1st Splitter and 2nd Splitter (1x2, 1x4, 1x8, 1x16, 2x2, 2x4, 2x8, or 2x32)

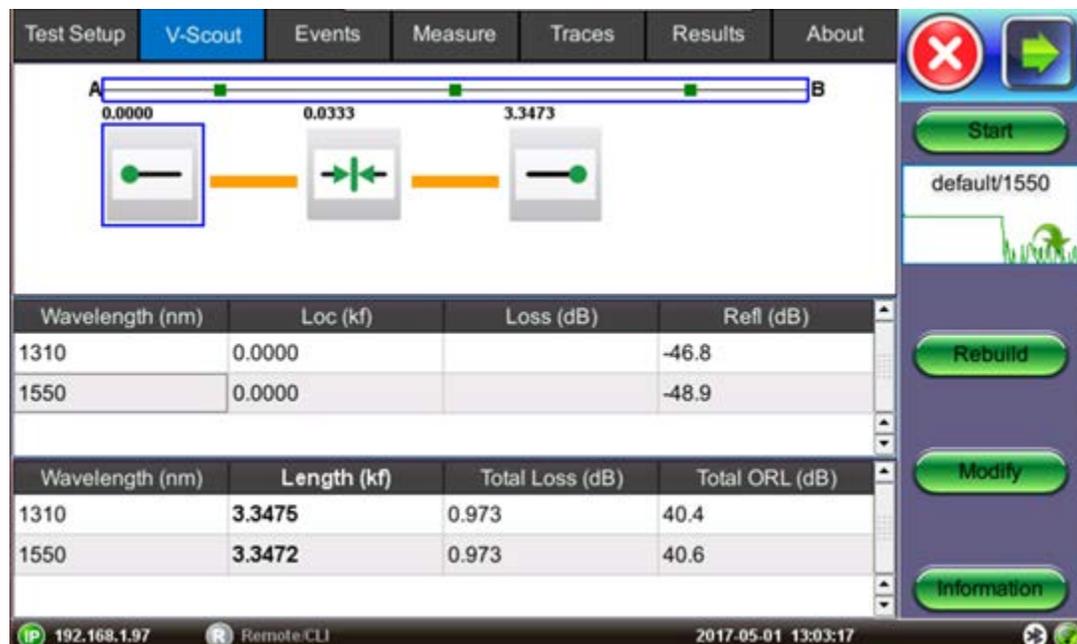
For information on defining splitter loss values, see **Splitters**.
- **Auto PON** - Used only if user does not know their PON configuration
- **Fiber properties** - Refractive Index and Backscatter coefficient as provided by cable manufacturer
- **Real Time button** - Used when checking initial connection, VFL testing or splice alignment (On the FX150, press the right side rocker button to expand the menu on the right side.)

- **Auto Zoom Trace** – Auto scale viewing window at end of test.
- **Front Panel Check** – Report Insertion Loss and Reflectance and advise if acceptable or not. If testing PON or MUX, use a launch fiber between the OTDR and Splitter or MUX or disable this feature.
- **Span** – See the Manual mode section for more information.
- **V-Scout** – See the V-Scout mode (*optional*) section for more information.

7.1.4 V-Scout mode (*optional*)

V-Scout is a fully automated fault location feature which evaluates separate test acquisitions comprising of multiple wavelengths to detect anomalies. Traces are analyzed, compared, and merged into a single symbolic link map. Multiple OTDR trace files (.sor) are saved in a single file folder for simplified archiving and easy future analysis. Each individual acquisition can be customized and user defined as a test profile depending on network type or application. This optional feature eliminates event interpretation.

Any event that exceeds user-defined Pass/Fail thresholds will be displayed in **RED** font. The icon box will be outlined in red.



- **Start:** Begins the measurement.
- **Rebuild:** Reanalyzes the trace. Use this option when you change the trace event table(s) or icons want to rebuild the LinkMap to apply the changes.
- **Modify:** Modifies the trace.

Modify Node	
Type	Link Start ▼
Splitter Ratio	Not Present ▼
Comments	

OK Abort

- **Information:** Edits group information.

Group Information	
PON Type	Not a PON ▼
1st Splitter	Not Present ▼
2nd Splitter	Not Present ▼

OK Abort

Type: Link Start, Link End, Subscriber Splitter, Connector, APC Connector, Splice, Macrobend, Office Splitter, Unknown

Splitter Ratio: Not present, 1x2, 1x4, 1x8, 1x16, 2x2, 2x4, 2x8, or 2x32

Comments: Enter information regarding the modification.

7.1.4.1 Setting up and Using V-Scout mode

V-Scout has been improved to give the operator the ability to optimize automated testing further by creating **custom** V-Scout test plans. A **unique profile** can be created for specific test environments.



V-Scout Profiles give the operator the power to override and optimize test parameters for specific test needs. Create a PON, Access Fiber, or FTTA test plan. Select **V-Scout** test plan and the unit will apply your directives to test setup for every test fiber automatically.



Plan: Select default or build your own (Add) custom V-Scout plan.

Distance: Select a test range value 25-30% longer than actual length of test fiber.

Pulse Width: Select 1-10 pulsewidths that you wish to use to build V-Scout Link Map by checking Enabled. An asterisk will mark any Pulse Width that you have already selected for use in your new test plan.

Resolution: Choose Auto or manually select the available resolution you desire. (Options will vary with distance range).

Time per Trace: Select the time to use in each test. (The more pulsewidths, the longer the total test time will be). For record keeping, using short test times is not recommended test times. Bellcore recommends up to 3 minutes per test.

When the V-Scout test plan is complete and OTDR traces performed, the operator can view the V-Scout link map.

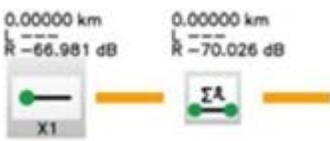
To set up and use the automated V-Scout mode:

1. Select the **Autosave** parameters in the **Test Setup** tab. See the [Autosave Parameters](#) section for more details.
2. Tap the green **Start** button. Elapsed time and acquisition wavelength is indicated below the red **Stop** button.
3. When the acquisition is complete, the **Stop** button will revert back to a green **Start** button. If needed, tap **Stop** to terminate the measurement manually.
4. To view the results, select the **V-Scout** tab.

7.1.4.2 V-Scout symbols

The V-Scout Icons facilitate quick fiber diagnosis so that technicians can fix issues quickly and efficiently ensuring fast turnaround time and reduced truck rolls.

The table below summarizes the symbols used to represent various events on the fiber link.

Icon	Description
	Span start (indicates start of analysis section) – as defined in Test Setup
	X1(2)(3) means ONE (or 2 or 3) merged events followed by “short patchcord” icon Xxx km Distance to the node L ---- Loss cannot be measured R -40.5 dB Reflectance
	Span end (indicates start of analysis section) – as defined in Test Setup (distance or event index)
	Splice Loss >0.01 dB, Reflectance <-50 dB
	Connector Loss >0.05 dB, Reflectance > -50 dB

Icon	Description
	Angled Connector Loss >0.05 dB, Reflectance >-60 dB
	Macrobend (difference between two non-reflective events exceeding defined dB) Threshold measured at different wavelengths
	Several aggregated or grouped events
	1xN Splitter from the OLT side Loss > 4dB, Reflectance not applicable
	1xN Splitter from the ONT (end-user) side Loss > 4dB, Reflectance not applicable

7.2 Thresholds

Threshold settings are available on *page 2* of the **Setup tab**. This allows you to preset and enable measurement thresholds. Events will be placed into the table only if the Analysis threshold is met/exceeded. Events that fail to meet the Pass/Threshold will be flagged and highlighted as red in the event table.

Analysis Thresholds		Pass/Fail Thresholds	
Splice Loss (dB)	0.200	Wavelength (nm)	1550
Reflectance (dB)	-65.0	<input checked="" type="checkbox"/> Splice Loss (dB)	0.350
Fiber End (dB)	20.000	<input checked="" type="checkbox"/> Conn. Loss (dB)	1.100
Macrobend (dB)	0.400	<input checked="" type="checkbox"/> Reflectance (dB)	-41.0
<input type="checkbox"/> Default Settings		<input checked="" type="checkbox"/> Slope (dB/kf)	0.091
		<input type="checkbox"/> Total Loss (dB)	16.000
		<input type="checkbox"/> Total ORL (dB)	30.0
		<input type="checkbox"/> Fiber Length (ft)	68898
		<input type="checkbox"/> Default Settings	

Event Table

Show Fiber Sections

Distance Unit: Feet

Page 2 of 5

Threshold Setup

7.2.1 Analysis Thresholds

OTDR Setup (Page 2):

Events that exceed the Analysis Threshold settings are reported in the Event table - these parameters include:

- **Splice Loss (dB)** - The setting range for this parameter is 0.01 dB to 9.99 dB in 0.01 dB increments. The default value is 0.020dB.
- **Reflectance (dB)** - Defines the lowest Reflectance value that will be reported by the analysis. The setting range for this parameter is -70.0 dB to -20.0 dB in 0.1 dB increments. The default value is -65.0dB.
- **Fiber End (dB)** - Defines the value which will be reported in the Events analysis. The setting range for this parameter is 1 dB to 99 dB in 1 dB increments. The default value is set to 20dB but for non-PON spans, a 3dB value is recommended.
- **Macrobend (dB)** - Defines the detection value with a default value 0.200dB.

A non-reflective event will be reported as a macrobend if its loss at a longer wavelength exceeds its loss at a shorter wavelength. Macrobend detection requires at least two singlemode wavelengths being tested - 1310 nm and another either at 1550 nm or 1625 nm. The range for this parameter is 0.3 dB to 2 dB in 0.1 dB increments. The default value is 0.2dB

- **Default Settings:** Resets Analysis Thresholds to factory defaults

Splitters – Defines splitter loss values to be applied when building the LinkMap.

Splitter Thresholds		
Profile	Default ▼	
	Min (dB)	Max (dB)
1x2	3.000	4.500
1x4	6.000	8.100
1x8	9.000	11.700
1x16	12.000	15.300
1x32	15.300	18.900
2x2	3.000	4.800
2x4	6.000	8.400
2x8	9.000	12.000
2x16	12.000	15.600
2x32	15.600	19.200

OK

7.2.2 Pass/Fail Thresholds

Events exceeding the Pass/Fail Thresholds are highlighted in Red in the Event table. Different Pass/Fail Thresholds values can be set for each test wavelength.

Event Loss (splice, connectors) and Reflectance threshold settings determine if a detected anomaly should be reported and included in the event table including its event type (reflective or non-reflective).

- **Wavelength (nm)** - Wavelength to which Pass/Fail Thresholds apply
- **Splice loss (dB)** - Non-Reflective Event Loss (fusion splices). The range for this parameter is 0.10 dB to 9.99 dB in 0.01dB increments
- **Connector Loss (dB)** - Reflective Event Loss (connectors and mechanical splices). The range for this parameter is 0.10 dB to 9.99 dB in 0.01 dB increments
- **Reflectance (dB)** - Events in the Event table exceeding the set Reflectance value. The range for this parameter is -50.0 dB to -10.0 dB in 0.1 dB increments
- **Slope (dB/km)** - Average Fiber Section Loss in dB/km that exceeds the set value.
- **Total Loss (dB)** - Total fiber loss in dB for Fiber-Under-Test (FUT) that exceeds the set value.
- **Total ORL (dB)** - Total Optical Return Loss in dB for Fiber-Under-Test (FUT) that exceeds the set value.
- **Fiber Length (km, miles)** - Total fiber length that exceeds set value
- **Default Settings:** Resets Pass/Fail Thresholds to factory defaults

7.2.3 Event Table

- **Show Fiber Sections** – Shows fiber section in event table.
- **Distance Unit** – Sets metric for distance between fiber sections in viewing window (km, kft, feet, meter, miles).

7.2.4 Autosave Parameters

- **Auto Save:** Select Disabled, Enabled, Enabled+Report or Enabled+V-Scout Report
- **Ask Before Save:** Check this if you want to be prompted to save after measurement is completed

The following information can be pre-set to create a name and increment fiber or trace number automatically (*Page 3*). The filename will begin with the Index value, Trace ID, Wavelength, Pulse Width, and S/N, if checked.

- **Job ID**
- **Cable ID**
- **Fiber I/D** - Check Add Index if you wish to auto-increment or Check Add Date/Time
- **Trace ID** - Check Add Index if you wish to auto-increment or Check Add Date/Time
The filename will include details entered in this field automatically. The fiber count can be incremented in Trace ID or Fiber ID.
- **Wavelength:** Include test wavelength used for each trace
- **Pulse Width:** Include pulse width used for test
- **S/N:** Include tester serial number
- **Increment:** Choose to increment Fiber ID or Trace ID

- **Real Time:** To view trace in real time. Used when checking initial connection, VFL testing or splice alignment.
- **Fiber Index:** Test counter. When saving test results, count auto increments and is added to filename.
- **Trace Index:** Place counter for Fiber field or Trace part of filename.

The following information can be pre-set and automatically saved in the file (Page 4).

- **Originating location** - where fiber starts
- **Terminating location** - where fiber ends
- **Comments**

To view a saved result, select the **Results** tab to see the screen below. To push test results to your Cloud account, just select the **Push** command for the folder that you wish to upload to the Cloud.



Save: Saves file when autosave is disabled.

Load: Displays selected trace for viewing.

Modify: Renames or removes selected file.

Pull: When connected, pulls file from Fiberizer Cloud onto test set.

USB Export: Exports selected test results to USB stick using standard MyVeEX tree directory format or a flat file when all files should be saved in a single folder.

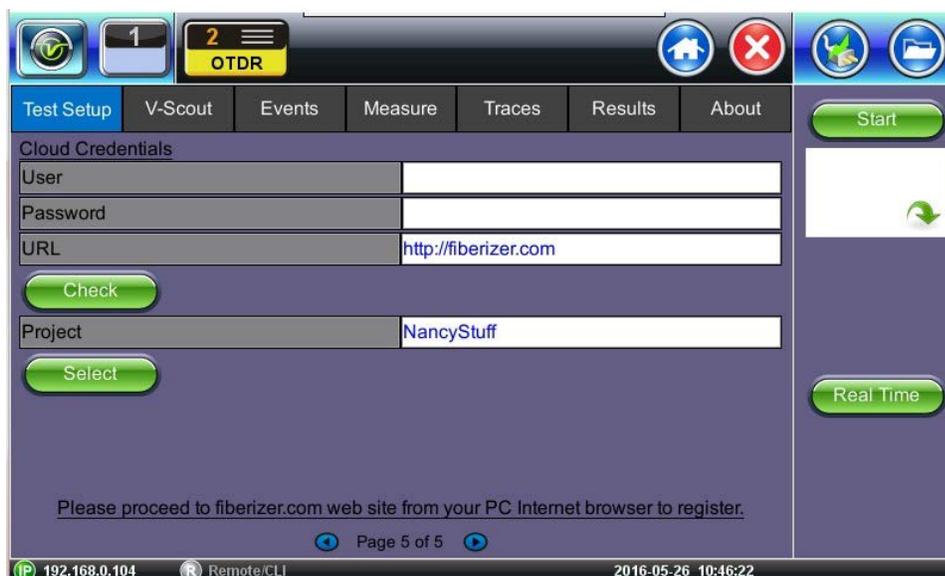
Alternatively, you can access files and copy **To USB** stick via **Utilities>Files>Saved**. Each trace will be saved in a separate file folder.

<input type="checkbox"/>	Name	Mode	Test	Module	Date	Type	Lock
<input checked="" type="checkbox"/>	Trace Wave-1550nm-100ns-SN9	OTDR	SORS	Cable1A	2016-06-07 12:03:04	PDF+sors	
<input type="checkbox"/>	Last configuration	Common	IP Addr	MAN	2016-06-02 17:19:32	Profile	
<input type="checkbox"/>	Cap22_None	Common	Fiber Scope		2016-06-02 10:27:49	Result	
<input type="checkbox"/>	Cap21_None	Common	Fiber Scope		2016-06-02 10:27:47	Result	
<input type="checkbox"/>	Cap18_None	Common	Fiber Scope		2016-06-02 10:27:46	Result	
<input type="checkbox"/>	Cap19_None	Common	Fiber Scope		2016-06-02 10:27:46	Result	
<input type="checkbox"/>	Cap20_None	Common	Fiber Scope		2016-06-02 10:27:46	Result	
<input type="checkbox"/>	Cap17_None	Common	Fiber Scope		2016-06-02 10:27:45	Result	

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7.2.5 Cloud Credentials

The user can register for a Cloud account: <https://cloud.fiberizer.com>.



After creating a Cloud Account, the user can then login and push test results into their account (Page 5 of **Test Setup** tab):

- **User** - Enter the email address that was used to create the Cloud account
- **Password** - Enter the Password that was created with the Cloud account
- **URL** - The default is <https://fiberizer.com>. Consult factory if customer wishes to use their own account.
- **Check:** Select the green Check button to verify login credentials are valid
- **Project** - Select a specific Project folder. This will default to the folder you created at registration. Project folders can be shared by approved team members.

7.3 Making Measurements

Press **Start** and the measurement will begin according to the test parameters entered in the **Test Setup** menu.

- The elapsed time is indicated below red stop button on the right side of the display. The stop button will revert back to a green **Start** button when acquisition is complete. For V-Scout measurements, the acquisition wavelength is also displayed.

Press **Stop** to terminate the measurement manually, if required.

Use the  **Home** icon (FX150/FX300) or  **App** key (FX300) to toggle between active test applications (OTDR, OPM, VFL).

7.3.1 Trace Display

When a new measurement is started, only those traces will be displayed on the screen. Any previous traces can be accessed via the **Traces** tab until unit is switched off. Upon completion, the view will default initially to the selected test mode viewing screen (V-Scout, Event (Auto), or Measure (Manual)).

If multiple wavelengths are selected in the **Test Setup** menu, the measurement will be performed using all selected wavelengths one after another without stopping and will be overlaid on screen for comparison and review. V-Scout traces are overlaid and displayed automatically.

7.4 Events

7.4.1 Event Table

The Events table is available in all measurement modes. Select the **Events** tab to display the trace with events. The Event table displays all events found during the analysis including those added manually by the user.



Event Table (maximized)

- The Event table is displayed automatically when the Events tab is selected.
- The Event table can be minimized by tapping the plus symbol just above the left of table. This optimizes the display area and allows better viewing of the OTDR trace.
- Use Up/Down arrows to navigate the event table and to display or move to the highlighted event.
- Use the green left/right arrows to move the marker between the start and end of fiber being tested.
- To maximize the Event table, select the cross symbol again.

7.4.2 Event Types

Symbol	Event Type	Description
	Start of fiber	Start of the fiber under test
	End of fiber	End of the fiber under test
	Fiber section	Fiber section with attenuation
	Reflective Event	Event with both loss and reflectance – typically caused by a crack, connection or mechanical splice
	Non-Reflective Event	Event with loss but without reflectance - typically caused by a fusion splice, macrobend or PON splitter
	Gainer	Event with 'negative loss' as viewed by the OTDR – typically occurs when two fibers with different backscatter coefficients are spliced together. Usually a gainer will be seen as a normal event with 'positive' loss when tested from the opposite end of the fiber.
	Merged Event	Event that consists of two or more real events that are spaced too close together to be resolved or measured by the OTDR

The Event is color coded depending on Threshold settings defined in the test setup.

- Red indicates the event fails or exceeds the Pass threshold criteria.
- Green indicates the event passes the Fail threshold criteria.

7.4.3 Event Editing

Adding events:

1. Ensure the Trace view is active.
2. Position marker at the point where a new event will be inserted. You can use the Left/Right rubber keys to position the marker more precisely, if needed.
3. Press the **Add** button on the right sidebar. A new event number will appear on the trace and in the event table.
4. Select the new event in the event table and click the **Modify** button in the right sidebar. Position the splice loss markers to measure the new event accurately. Once markers are positioned, click the **Accept** button.

Deleting events:

1. Select the event in the Event table or by using the marker on the trace.
2. Use the left/right arrows to position the marker more accurately, if needed.
3. Once selected, press the **Delete** button on the right sidebar. The event will now be deleted from the event table and the event number will no longer appear on the trace.

Modifying events:

1. Ensure the Trace menu is active and the Event table is shown on the screen.
2. Use the left/right arrows to highlight the necessary event in the Event Table. Press the **Modify** button on the right sidebar. A marker with two small markers will appear on the trace. When markers and measurement is performed, click the **Accept** button on the right sidebar.
 - **Span Begin** – Position marker at end of the Launch fiber and press the green **Span Begin** button to set the beginning of fiber under test.
 - **Span End** - Position marker at end of the fiber under test and press the green **Span End** (if launch box is used).
 - **Markers** - Brings marker onto the visible area of the display.
 - **Modify** - Changes the display to allow the user to make manual adjustments to the event table and reanalyze.

7.5 Measure Mode

There are several methods available to manually measure fiber characteristics. Prior to performing manual measurements, it is important you become familiar with the Markers and Zooming capabilities of the unit.

7.5.1 Markers Controls

7.5.1.1 Marker Operation

Markers are provided to measure distances accurately. Depending on measurement mode and viewing window, one or more markers are at the User's disposal. The Markers can be moved using the touchscreen or using the left/right buttons on the rubber keypad (not available on MTTplus or FX150).

The Markers display the following:

- Distance from the start of the trace to Marker "A"
- Distance from the start of the trace to Marker "B"
- Distance in between Marker "A" and Marker "B"

Note: *As you move the Markers, the distance information updates automatically.*

The active Marker is depicted by two small arrows pointing inwards at the base of the Marker

The Marker is divided into a thick (bottom) and thin (top) line. To move Marker A or Marker B individually, select and drag the Marker on the thin portion of the marker. To move both Markers together, select and drag any Marker on the thick portion of the line.

If the Markers appear off screen, use the Markers button on the right side bar to bring and display the Markers on screen.

If a marker is moved too close to another, both will move together to ensure minimal distance between them.

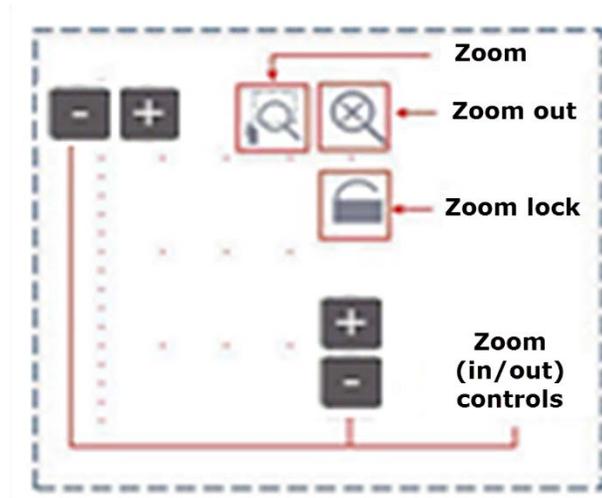
The markers can be moved separately as well as in pair (or 5 markers simultaneously in the LSA attenuation measuring mode).

At the top part of the screen next to the markers, the position of the marker with respect to the beginning of the optical fiber is indicated in kilometers, miles or feet.

In the data line at the bottom of the screen you will see the parameters of the trace corresponding to the markers' position and measurement mode.

7.5.1.2 Zoom/Scroll Controls

Zooming operations are possible in both Events and Measure mode.



Zoom Operations

- **Zoom/Scroll icon** - Toggle between and enables Zoom/Scroll mode.
 - **Zoom mode** - Magnifying glass icon appears on screen. Draw a rectangular box over the trace with the stylus to create a zoom area. Visible part of the trace in Preview window is marked with dotted rectangle.
 - **Scroll mode** - Trace can only be scrolled after zooming. Hand icon appears on screen.

User is now able to drag the trace in any direction. The mode resets to Zoom immediately after one scroll operation has been completed.

- **Zoom Out** - Resets display area completely.
- **Zoom Lock** - Locks horizontal and vertical controls so zoom aspect is kept uniform.

7.5.2 Distance Measurements



Distance measurement – measure expanded trace view mode

When a trace is displayed as show above, the fiber length is automatically measured from the start of the trace (or Span Begin) to each of the two markers and in between the markers. Proper marker placement is critical for accurate measurements. To position the marker/s accurately, expand the trace horizontally and vertically (using the Zoom Controls) and position the marker on event’s left edge (first rising or falling pixel).

The distance (km, miles or feet) will be indicated next to the top of the marker.

Note: The distance accuracy depends on the correctness of optical fiber refraction index value setting.

7.5.3 Loss Measurements

Loss Modes - Several Loss modes are available for manual measurements depending on measurement application:

- 2-Pt Loss
- 2-Pt LSA

Two Point Loss measurement

- Reflectance
- ORL (Optical Return Loss)
- Splice Loss

7.5.3.1 Two Point Loss (2-Pt Loss)

The 2-Point Loss mode uses a data point at Marker A and Marker B to calculate the dB level difference between the two points. Usually the backscatter level value of Marker A is greater than the level of Marker B and a positive loss measurement is displayed. If the loss value is reported as a negative quantity, it is termed a “gainer.” Measure loss between two points using the Loss (2-point) mode (using two markers):

- The data at the bottom of the screen displays: Distance between markers A-B
- Loss between markers A-B in dB
- Attenuation between markers A-B

7.5.3.2 Two Point LSA (2-Pt LSA)

To increase the accuracy of a loss or attenuation measurement, a section of the trace preceding and following the marker A and marker B can be approximated by a straight line. In this mode, a Least Squares Approximation technique is used to determine the best intercept values based on the marker positions. The length of these LSA sections is user selectable.

- Select LSA from drop-down list - An approximation line will appear on the screen between markers. The data box at the bottom displays:
- Distance between marker A and B (km, miles, feet)
- Level difference in dB
- Attenuation based loss/distance

7.5.4 Splice Loss Measurement

Determines the Splice Loss in the optical fiber connection using the five markers method.



Splice Loss using 5-Point LSA method

1. Select trace for measurement (if multiple traces are displayed on screen). The trace to be measured can be selected using the green arrow in the trace overview window.
2. Select **Splice (Spl)** from drop-down list.
3. Expand or zoom the trace horizontally and vertically (using Zoom Controls) and position event in the middle of the screen using the scroll function. Always ensure that a part of the trace is visible on either side of the event so you can place markers properly.
4. Position center marker on the event's rising or falling edge. You can use the rubber keypad to place the marker exactly, if needed.

5. Position the first two markers on a section of backscatter preceding the event and position the last two markers on a section of backscatter after the event ensuring that enough pre/post backscatter is used to make an accurate measurement. Markers A and B should be placed on the left and right but as close to one another as possible. The whole transition section should stay between them.

Note: All five markers can be moved independently or moved as a group simultaneously depending which marker is active.

The sections between the first two markers and the last two markers are approximated by straight lines (LSA) whilst the value of event loss is defined by the position of the center marker.

The result box at the bottom of the screen displays:

- Spl (km, meters, miles or feet) - distance of center marker
- Loss of the event in dB based on the pre/post LSA sections and center marker
- Reflectance in dB if event is reflective

7.5.5 Reflectance Measurement

Reflectance is measured in -dB (negative decibels). A smaller negative value (-65dB) indicates a smaller reflection whereas a larger negative value (-45dB) indicates a larger reflection. Larger reflectance will appear as a higher spike on the trace.

1. Select trace for measurement (if multiple traces are displayed on screen). The trace to be measured can be selected using the green arrow in the trace overview window.
2. Select **Reflectance (Refl)** from the drop-down list at the bottom of the display.
3. Expand the trace horizontally and vertically (using Zoom Controls) to display the reflection correctly. The entire reflection should be displayed including a small section of the trace preceding and following the event.
4. Place the left marker on the event's rising edge. The right marker is placed on the peak of the reflection.

The result box at the bottom of the screen displays:

- Distance of A cursor (reflection) from Start of test fiber
- Distance of B cursor (top of reflection) from Start of test fiber
- Distance between markers A->B
- Reflection for this even (-dB)

7.5.6 ORL Measurement

ORL is the total amount of light being reflected back towards the transmitter or source. This includes all backscatter and all reflections. The OTDR can calculate ORL from the fiber trace using the following procedure:

1. Make sure the Trace is active.
2. Select **ORL** from drop-down list.
3. Place the marker A at the beginning of the fiber and marker B at the end of the fiber span under measurement.

The **Result** box at the bottom of the screen displays:

- Distance to A cursor
- Distance to B cursor
- Distance between markers A-B
- Loss between the markers A-B (dB)
- Optical Return loss (ORL), dB

7.6 Traces

Select the **Traces** tab to view the active or measured OTDR traces. The color-coded blocks represent the corresponding trace viewed in the OTDR display.

The OTDR can display up to ten traces simultaneously i.e. an active trace and nine additional traces.



To view the trace, select the necessary file using the check box. The trace will be activated automatically and displayed on screen. Traces are displayed along with the following parameters;

- **Name** - File name as saved
- **Dir** – AB or BA
- **LMax (km)** - Distance range (km) used for the test
- **Tp (ns)** - Pulse width used for the test
- **Time (m:s)** - Acquisition time used for the test

7.6.1 Trace Properties

The traces in the memory are saved in BELLCORE, version 2.0 format. The OTDR trace files have the extension .sor which means Standard OTDR Record.

These OTDR trace files can be opened by the software of other OTDR vendor applications provided the format is supported.

If the measurement was performed at several wavelengths simultaneously, the traces are saved as a group i.e. they will share the same common name but with wavelength added (e.g. 01_meas_1310 and 01_meas_1550, etc.)

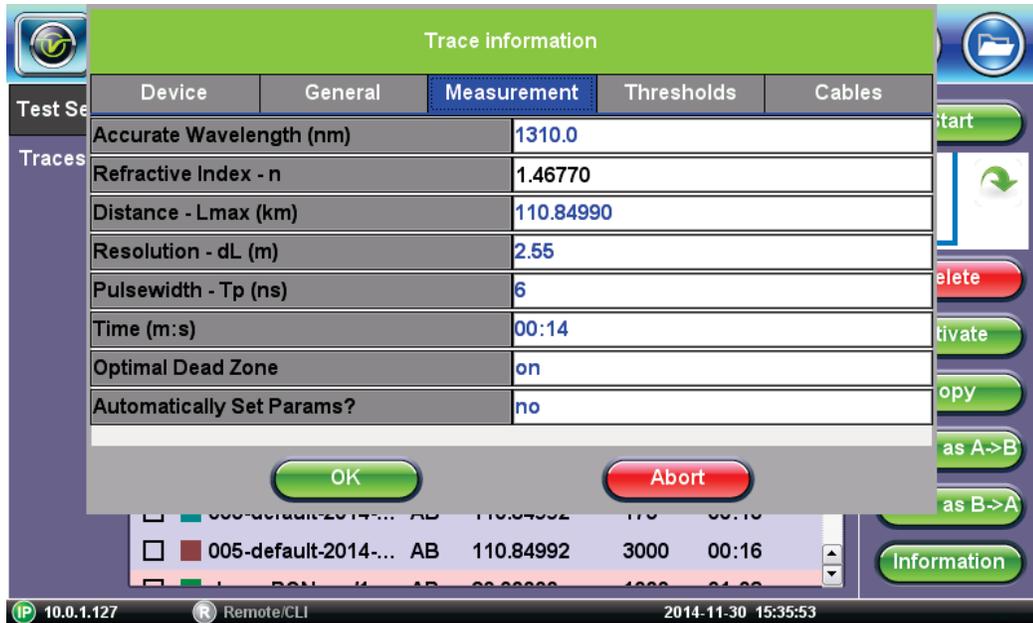
Press the **Information** button in the right sidebar to open the **Trace Information** window. The window contains following information relating to the saved file:

- **Device:** OTDR supplier name, Mainframe ID and serial #, and optical module serial # (if applicable)



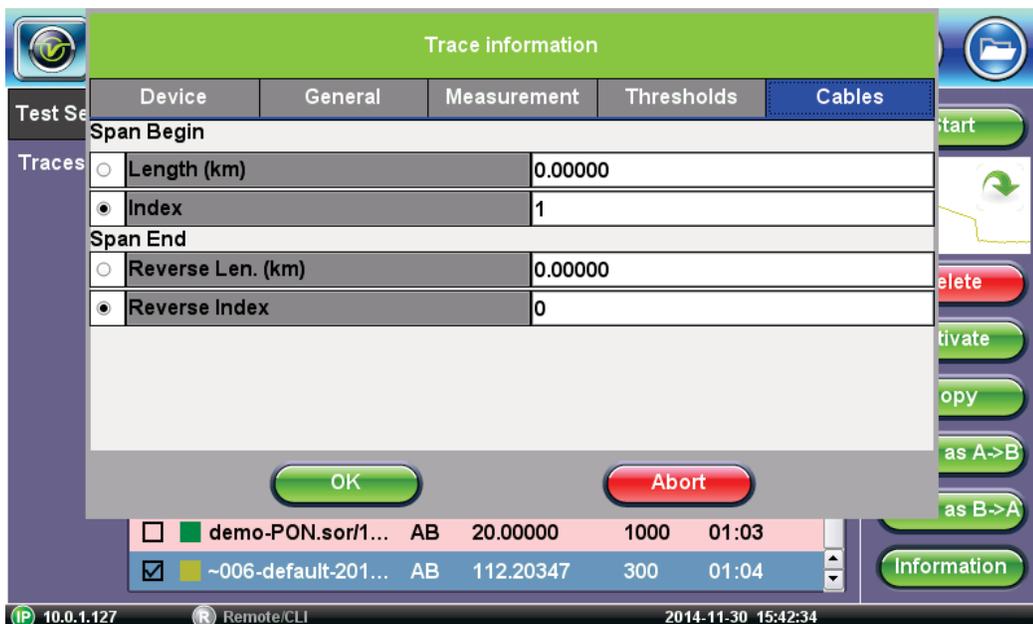
Trace Information - Devices

- **General:** Date/Time, Job ID, Cable ID, Fiber ID, Group ID, Fiber Type, Originating/Terminating locations, and Comments
- **Measurement:** Test parameters used to make measurement



Trace Information - Measurement

- **Thresholds:** Analysis thresholds used to analyze the trace, as well as PON identification for LinkMap
- **Cables:** Span Start and Span End information



Trace Information - Cables

Span Begin and Span End

Refer to section Launch/Receive fiber offset.

The user can offset the length of an external launch fiber or patchcord, which is connected to the fiber under test; otherwise, it becomes part of the fiber span and analysis. The launch fiber can be offset or compensated in any of the following ways:

- Entering the known distance manually in km, meters, miles or feet.
- Entering the index # based on the event table.
- Positioning the left marker at the event and pressing Span start in the right side column.

7.6.2 Saving OTDR Traces

The same procedure applies to offsetting Receiver fibers which are often used in Fiber to The Antenna (FTTA) applications.

Note: The FX300 and RXT OTDRs have a built-in launch fiber which is 40 meters in length. This fiber section will appear in grey color preceding the first event. This internal launch fiber allows the user to characterize the first connector of the fiber under test and evaluate its performance (insertion loss and reflectance). The MTTplus OTDR has an optional built-in launch fiber.

Using any of the above methods, the launch fiber can be offset and excluded from the fiber span measurement.

Result saving	
Name	veex_test_001
Fiber ID	veex-fiber#1
Cable ID	veex-cable#1
Job ID	veex2014
Comments	quick test
Originating Location	Fremont
Terminating Location	Milpitas

Trace Information – Cables Launch Offset

7.6.3 Saving OTDR Traces with Embedded GPS and Camera Image

7.6.3.1 Obtaining GPS Coordinates

To obtain the GPS coordinates for your current location:

1. Access **Utilities>More>GPS/High Precision Clock**.
2. Connect the antenna to the RF connector port (brass) located at the top of the unit.
3. Turn GPS '**ON**' to begin searching until your GPS Status is **Lock**.



Note: To include GPS coordinates and camera images with OTDR files, the test set must have the GPS option enabled, an external 'active' antenna connected and the Camera option installed.

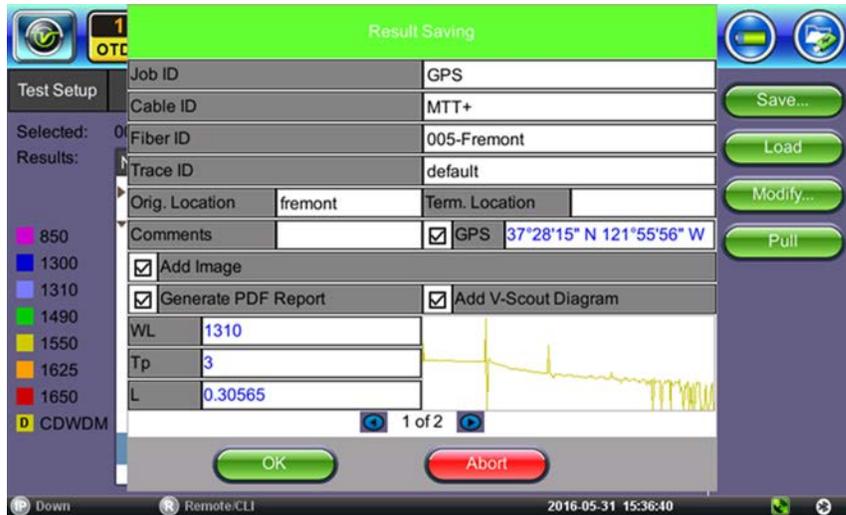
7.6.4 Adding GPS to OTDR file (optional feature)

The GPS coordinates can be added by using:

- **AutoSave:** Select the **Ask Before Save** checkbox.
- **Manual Save mode:** Select the **GPS** checkbox.

7.6.5 Adding Camera Image OTDR file (MTTplus only)

A Camera image can be added using the **Manual Save only** mode (AutoSave disabled) mode to display the Result AutoSaving pop up window. Enter all AutoSave field entries and select **Generate PDF Report** and/or select **Add V-Scout Diagram**.



1. Select the **Add Image** to pop up the camera image.
2. Select red **Camera** button to capture results.



or select red **X** button to exit Camera capture mode.

3. Click the green **OK** button to finalize the save process.

The screenshot displays the 'Result Saving' interface of an OTDR. The interface is divided into several sections:

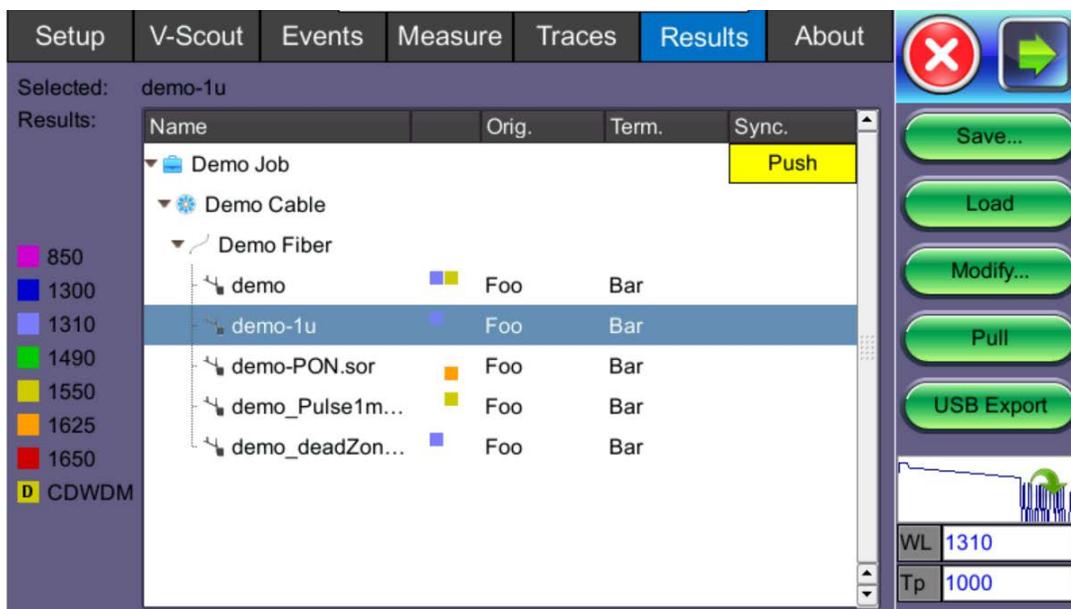
- Test Setup:** A sidebar on the left lists selected wavelengths: 850, 1300, 1310, 1490, 1550, 1625, 1650, and CDWDM.
- Form Fields:** A central area contains input fields for:
 - Job ID: GPS+ CAMERA
 - Cable ID: 2spools
 - Fiber ID: 003-fiber
 - Trace ID: 1550nm-1550nm-3ns-30ns-SN567215
 - Orig. Location and Term. Location (empty)
 - Comments: Includes a checked 'GPS' box and coordinates '37°28'15" N 121°55'56" W'.
 - Options: 'Add Image' (unchecked), 'Generate PDF Report' (checked), and 'Add V-Scout Diagram' (checked).
 - WL: 1310
 - Tp: 3
 - L: 1007.80
- Graph:** A line graph on the right shows a signal trace with a peak. Below the graph are summary statistics: WL 1310, Tp 3, and L 1007.80.
- Buttons:** On the right side, there are buttons for 'Save...', 'Load', 'Modify...', and 'Pull'. At the bottom, there are 'OK' and 'Abort' buttons.
- Footer:** The bottom status bar shows '192.168.0.151', 'Remote/CLI', and the date/time '2016-05-19 16:47:03'.

7.7 Results

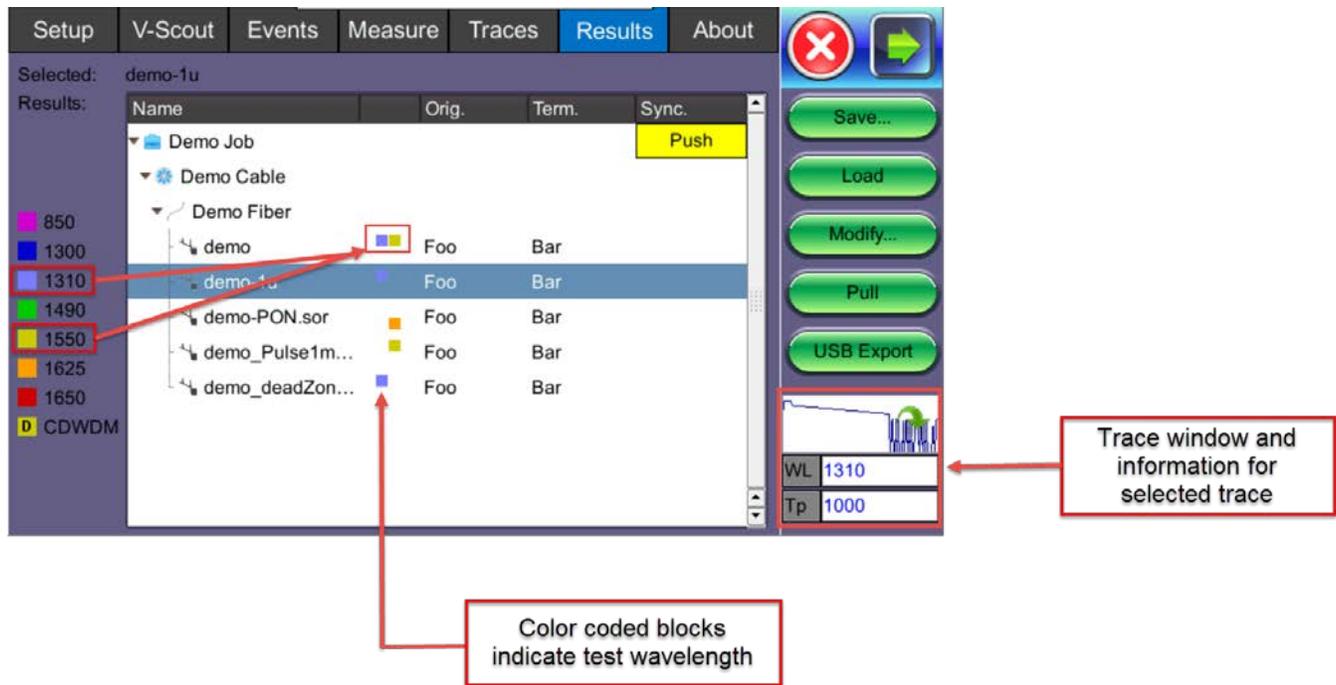
The **Results** tab displays the following information pertaining to OTDR traces. To expand the selection or folder directory, tap on the arrow. An arrow pointing to the right indicates the branch is collapsed whereas an arrow pointing downwards indicates the branch is expanded.

The traces are saved in the following folder directory hierarchy:

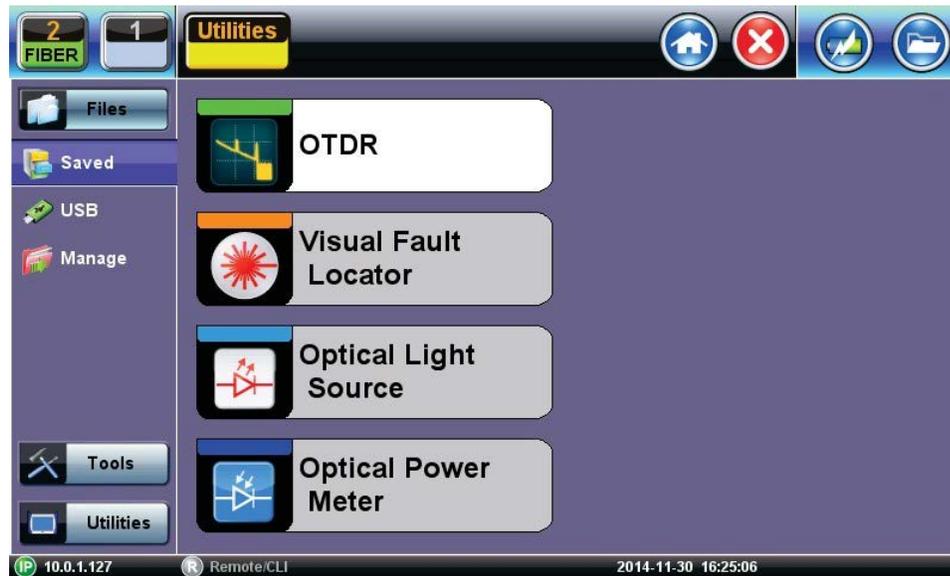
- Job ID
- Cable ID
- Fiber ID
- Results – Traces



- **Save:** Saves file when autosave is disabled.
- **Load:** Displays selected trace for viewing.
- **Modify:** Renames or removes selected file.
- **Pull:** When connected, pulls file from Fiberizer Cloud onto test set.
- **USB Export:** Exports selected test results to USB stick using standard MyVeEX tree directory format or a flat file when all files should be saved in a single folder.



7.7.1 File Management



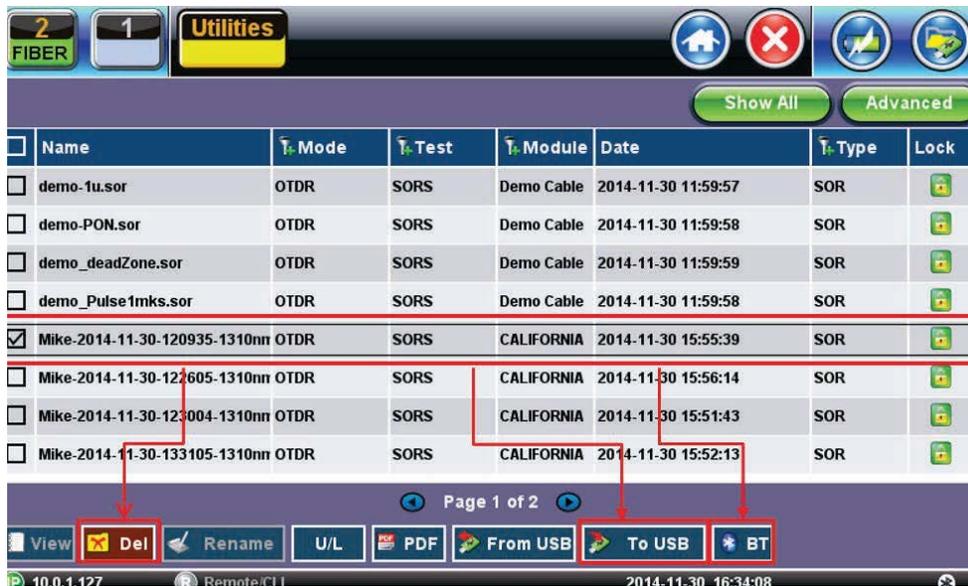
File Location

- Select **Files/Saved** menu to access saved traces or results
- Use the stylus to select a file from the list.
- Files types are as follows:
 - OTDR traces are saved as SOR files
 - Fiberscope images are saved as PNG files
 - Optical Power Meter (OPM) results are saved as text/xml files



File Manager

7.7.2 Saving/Printing Traces to PDF/USB/Bluetooth

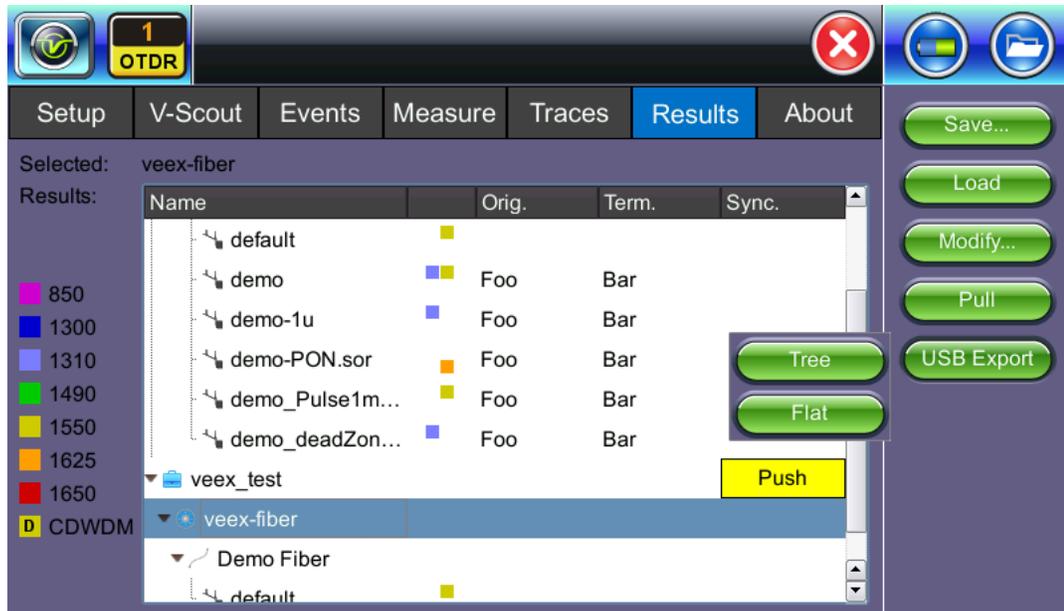


Printing/Saving Result to PDF/USB/Bluetooth

The saved OTDR sor file can be exported in several ways:

- **To save to PDF:**
 - Use the **Save as** feature on **Setup Page 3** and select **Enable+Report (pdf)** or **Enabled+V-Scout+Report**. (User can browse and open a file with help of standard Adobe Reader software.)
- **Saving to USB** - exports saved file to USB memory device if plugged in. Each file is saved into its own folder using MyVeEX tree directory format. Use the **Results View USB Export Flat** feature if you want all files to be saved in the same folder.

- **Export to Bluetooth** - transfers OTDR sor file via Bluetooth connection to a PC or Mobile phone.
- **Tablet.** Requires Bluetooth dongle accessory



Select the folder containing the test results you want to export to highlight it. Tap **USB Export** and select tree (“MyVeEX”) or Flat (same folder) in which to export to USB. The files can be found on the USB stick in the **OTDR Export** folder.

7.7.3 File Operations

In the **File** menu, you are able to delete or rename a selected result file or trace.

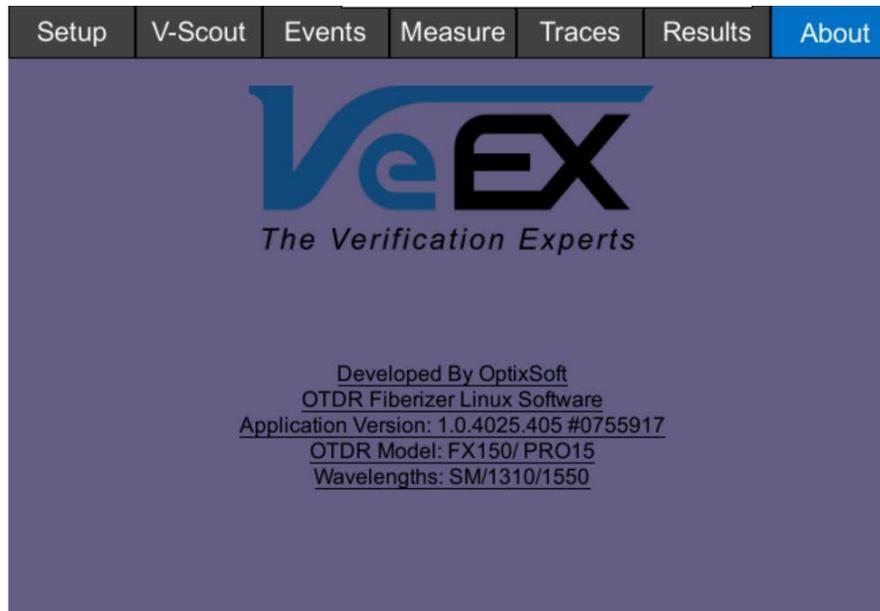


*File Operations***Deleting Directories/Files**

1. Select a directory or file from the list.
2. Press **Delete** icon at the bottom of the screen to remove a selected file from the memory.

Renaming Directories/Files

1. Select a directory or file from the list.
2. Press the **Rename** icon at the bottom of the screen.
3. Rename the file as needed.

7.8 About Tab*About tab*

The following information is displayed in the About tab:

- Developer name
- OTDR firmware type
- Firmware build
- OTDR model
- Platform serial #
- OTDR wavelength/s

8.0 ReVeal Software

For more information on using the ReVeal software, refer to the ReVeal User Manual at www.veexinc.com.

9.0 Warranty and Software

Warranty Period: The warranty period for hardware, software and firmware is one (1) year from the date of shipment to the customer. The warranty period for battery pack, LCD, LCD touch panel, LCD protective cover, and accessories (including, but not limited to patch cords, AC adaptor, SFP, USB adaptors, carrying case, carrying pouch) is limited to one (1) year.

Hardware Coverage: VeEX Inc. warrants hardware products against defects in materials and workmanship. During the warranty period, VeEX Inc. will, at its sole discretion, either

- Repair the products
- Replace hardware which prove to be defective

provided that the products that the customer elects to replace are returned to VeEX Inc. by the customer, along with Proof of Purchase, within thirty (30) days of the request by the customer, freight prepaid.

Software Coverage: VeEX Inc. warrants software and firmware materials against defects in materials and workmanship. During the warranty period, VeEX Inc. will, at its sole discretion, either

- Repair the products
- Replace software and/or firmware which prove to be defective

provided that the products that the customer elects to replace are returned to VeEX Inc. by the customer, along with proof of purchase, within thirty (30) days of the request by the customer, freight prepaid.

Additionally, during the warranty period, VeEX Inc. will provide, without charge to the customer, all fixes, patches and enhancements to the purchased software, firmware and software options. VeEX Inc. does not warrant that all software or firmware defects will be corrected. New enhancements attached to a software option require the option to be purchased (at the time of order or the time of upgrade) in order to benefit from such enhancements.

Limitations: The warranty is only for the benefit of the customer and not for the benefit of any subsequent purchaser or licensee of any merchandise (hardware, software, firmware and/or accessories).

Revoking the warranty: VeEX Inc. does not guarantee or warrant that the operation of the hardware, software or firmware will be uninterrupted or error-free. The warranty will not apply in any of the following cases:

- Improper or inadequate maintenance by the customer

- Damage due to software installed by the customer on the unit without prior authorization (written) from VeEX Inc.
- Unauthorized alteration or misuse
- Damage occurred from operating the unit outside of the environmental specifications for the product
- Improper installation by the customer

10.0 Product Specifications



The most recent product specifications can be found on the VeEX web site at www.veexinc.com.

11.0 Certifications and Declarations



Declaration of Conformity

What is CE?

The CE marking is a mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements set out in European Directives. To permit the use of a CE mark on a product, proof that the item meets the relevant requirements must be documented.

Use of this logo implies that the unit conforms to requirements of European Union and European Free Trade Association (EFTA). EN61010-1

For a copy of the CE Declaration of Conformity relating to VeEX products, please contact VeEX customer service.



ROHS Statement

What is RoHS?

RoHS is the acronym for Restriction of Hazardous Substances. Also known as Directive 2002/95/EC, it originated in the European Union and restricts the use of specific hazardous materials found in electrical and electronic products. All applicable products imported into the EU market after July 1, 2006 must pass RoHS compliance.

For more information about RoHS as it relates to VeEX Inc, go to the VeEX web site at www.veexinc.com.

12.0 About VeEX

VeEX Inc., the Verification EXperts, is an innovative designer and manufacturer of test and measurement solutions addressing numerous technologies. Global presence through a worldwide distribution channel provides uncompromised product support.

Visit us online at www.veexinc.com for the latest updates and additional documentation.

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