FX120/FX120 Lite User Manual

XG(S)-PON Analyzer & Multi-Gig Service Test Set

XG(S)-PON Analyzer

P/N D07-00-153P Rev. B01

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

Table of Contents

General Information **8**
Customer Support 8
Product Technical Support Contact Information 8
Warranty 9
Patent Information 9
Documentation Conventions 9
Safety Information **10**
Lithium-ion Battery Precautions 10
Optical Connectors 11
Electrical Connectors 11
Introduction **12**
Key Features 12
Optical Specifications 13
Product Specifications 15
Basic Operation **16**
Chassis Overview 16
Connector Panel 17
Special Functions 22
Hard Buttons 22
Touch-Screen Display 24
Platform Screen Icons 25
LEDs 27
GPON/EPON LED Status Indicators 27
Ethernet Single Port LED Status Lights 28
Mode/Port Selection 29
GPON **30**
Preparing for PON Testing 30
OPM Setup 31
GPON/XGS-PON Test Procedure 35
GPON and XGS-PON Threshold Standards 37
Synchronizing the FX120/FX120 Lite with the ONU Activation Process 38

OPM Test Mode ... 39
GPON/EPON LED Status Indicators ... 41
OLT and ONT/ONU Messages and Measurements ... 42
Signal and Synchronization Status ... 44
ONU/ONT Statuses ... 46
Rogue ONTs ... 46
How to Detect Rogue ONTs ... 47
Histogram and ODN Loss History ... 48
Advanced OPM Mode ... 50
Active ONU ... 51
PLOAM Messaging Decoder ... 52
PLOAM Decoder Filtering ... 53
OC Decode ... 54
Auditing/Rebuilding a Fiber Distribution Hub (SuperPM option) ... 55
Splitter Analysis (optional) ... 56
Distribution Analysis (optional) ... 60
Fault Locator ... 64
Screen Help ... 65
EPON/10G-EPON Testing ... 66
EPON/10G-EPON Test Procedure ... 66
Synchronizing the FX120/FX120 Lite with the ONU Activation Process ... 69
EPON Thresholds ... 70
Ethernet ... 71
Setup ... 71
Ports ... 71
IP ... 76
IP Connection ... 76
Setup ... 76
Status ... 78
Trace Route ... 79
ARP Wiz ... 81
Ping ... 83
Layer 4+ Applications ... 85

Configuration 90
V-TEST 92
Run a Speed Test 92
Server Selection Modes 94
Speed Test Modes 94
V-PERF 98
Server/Client - Unidirectional Configuration and Results 99
Bi-Directional Configuration and Results (VeEX Enhanced Testing Methodology Implementation) 104
V-FTP 105
Run a FTP Speed Test 105
Platform Functions 107
Results & Files 110
File Manager 110
Tests Results/Reports 110
Working with Saved Results, Profiles, Images 111
Viewing and Managing Files 112
Enabling To USB and From USB Functions 113
Downloading Files To USB 113
Exporting Files to Mobile Devices via Bluetooth 113
Exporting Results to PDF 114
Transferring Results to Phone/Tablet via NoApp QR Code 114
Viewing Results on Phone 115
Advanced Saving of Test Results 117
USB Memory Browser 118
Test Tools 119
OTDR Viewer 121
Fiber Scope 122
Optical Power Meter (OPM) 146
Web Browser 155
LAN & Connectivity 156
LAN (USB OTG Adapter) 156
Setup 157
IP Connection Status 158

Ping Testing ... 159
Trace Route ... 161
Bluetooth/WiFi Wiz ... 163
Bluetooth ... 163
WiFi Wiz ... 166
Remote Access ... 172
Remote Control (Screen Mirroring) ... 173
EZ Remote ... 175
Initiate an EZ Remote Session from the Test Set ... 175
Connect to the Remote Test Set from a Computer, Tablet or Phone ... 177
Save Test Results ... 179
Access Remote Test Result Files ... 179
R-Server ... 182
Register a test set (establish IP connection) ... 183
Upload Results ... 184
System Utilities Overview ... 185
System Information ... 186
Global Settings ... 188
Backlight ... 191
Battery Status ... 193
Standby Mode ... 194
Touch Screen Calibration ... 195
Date and Time ... 197
Manage Internal SD Card ... 199
Help ... 201
Software Update Process ... 202
Certifications and Declarations ... 204
About VeEX ... 206
Customer Care ... 206
FX120 Quick Guide ... 207
Step 1: Power on Test Set ... 207
Step 2: Configure Test Profile ... 208
Step 3: Insert Patch Cord into FX120 OLT test port. ... 208

Step 4: Connect Splitter to FX120 ONU/ONT test port. 209
Signal and Synchronization Status 210
Step 5: Save Results 211
Step 6: View Results & Generate Report 212
Other Test Features 215

General Information

This user manual is suitable for novice, intermediate, and experienced users and is intended to help use the features and capabilities of VeEX Inc. products successfully. It is assumed that the user has basic computer experience and skills, and is familiar with telecommunication and other concepts related to VeEX Inc. product usage, 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. For condition of use and permission to use these materials for publication in other than the English language, contact VeEX Inc.

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Customer Support

For more technical resources, visit www.veexinc.com.

For assistance or questions related to the use of this product, call or e-mail our customer care department for customer support. Before contacting our customer care department, have the product model, serial number, and software version ready. Please locate the serial number on the back of the chassis. Please provide this number when contacting VeEX Inc. customer care.

Support hours may vary depending on the product.

Product Technical Support Contact Information

Hours: Support is generally available 8:00 AM to 8:00 PM, Eastern Standard Time, Monday to Friday.
Phone: +1 510 651 0500
E-mail: customercare@veexinc.com

Warranty

For warranty information on VeEX Inc. products, go to www.veexinc.com.

To activate the warranty, please register your production at www.veexinc.com/Support/ProductRegistration.

Patent Information

VeEX Inc. product hardware and software may be protected by one or more patents on file with the United States Patent Office.

Documentation Conventions

Icons used in this manual:

	Marks a helpful tip (action or method), which can save time and improve usability of the product.
	Provides important information needed to use this product and avoid mis-steps.
	Cautions against and action or inactivity, which can hinder productivity.
	Strongly warns against a condition, an action, or inactivity which can lead to a health hazard, injury, equipment damage, data loss, and/or financial losses.
	Stop and read before continuing.

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.

Lithium-ion Battery Precautions

Lithium-ion (Li-ion) battery packs are compact and offer high capacity and autonomy, which make them ideal for demanding applications, like providing long lasting power to portable test equipment. For safety reasons, due to their high energy concentration, these batteries packs and products containing them must be used, charged, handled, and stored properly, according to the manufacturer’s recommendations.

Li-ion battery packs contain individual Li-ion cells as well as battery monitoring and protection circuitry, sealed in its plastic container that shall not be disassembled or serviced.

The test set unit's battery pack is also fitted with a safety connector to prevent accidental short circuits and reverse polarity.

- Always charge the unit's battery pack inside the test platform battery bay using the AC/DC adapter supplied by VeEX.
- Do not charge or use the battery pack if any mechanical damage is suspected (shock, impact, puncture, crack, etc).
- Do not continue charging the battery if it does not recharge within the expected charging time.
- Storage: For long term storage, the battery pack should be stored at 20°C/68°F (room temperature), charged to about 30 to 50% of its capacity. Spare battery packs should be charged and used at least once a year to prevent over-discharge (rotate them regularly).
- It is recommended to charge and use battery packs at least every three months. Battery packs shall not go without recharging (reconditioning) for more than six months.

- After extended storage, battery packs may reach a deep discharge state or enter into sleep mode. For safety reasons, Li-ion batteries in deep discharge state may limit the initial charging current (pre-recharge) before starting their regular fast charging cycle. The pre-charging state may take several hours.
- Air transportation of Li-ion batteries is regulated by United Nations' International Air Transportation Association (IATA) Dangerous Goods Regulations and by country-specific regulations. Please check local regulations and with common carriers before shipping Li-ion battery packs or products containing relatively large Li-ion battery packs.

Optical Connectors

The test sets display a laser warning icon when the laser source is active to alert the user about a potentially dangerous situation. It is recommended to:

1. Deactivate the laser before connecting or disconnecting optical cables or patchcords.
2. Never look directly into an optical patchcord or an optical connector interface (SFP+) while the laser is enabled. Even though optical transceivers are typically fitted with Class 1 or 2 lasers, which are considered eye safe, optical radiation for an extended period can cause irreparable damage to the eyes.
3. Never use a fiber microscope to check the optical connectors when the laser source is active.

Electrical Connectors

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

Introduction

The VeEX® FX120PON Analyzer and Multi-Gig Service Test Set/ FX120 Lite PON Analyzer is designed to assist with PON service activation and aid in troubleshooting as well as support Layer 4+ testing. When connected at the customer site between the splitter and Optical Network Unit/Optical Network Terminal (ONU/ONT), the unit passively monitors downstream GPON, XG(S)-PON, EPON and 10G EPON traffic, tests optical power levels for compliance to ITU-T and IEEE standards and when available captures/decodes PLOAM messages exchanged from the OLT and ONT to provide PON-ID per ITU-T and OLT Mac per IEEE, OLT Transmit power, PON type and Class, ONU ID, ONU LLID, ONU Serial Number, ONU Mac and ONU Status. It makes testing easier by using the optional fault locator to ensure the length of drop fiber cables. Additionally, use the test set to certify QoE by using Speed Test and V-PERF to check internet connectivity and speed up to 10 Gbps.

The operator is assumed to have received basic training in fiber optics and related testing and measurement practices.

- Compatible with GPON, XG(S)-PON, and EPON, 10G EPON networks
- Pass-through selective wavelength PON meter for ONT/ONU service verification
- Pass/Fail ITU-T thresholds enable fast, efficient, and consistent turn-up of services.
- Layer 4+ Test option including V-TEST Ookla Speedtest, V-PERF TCP Throughput Test, and V-FTP Upload/Download Test up to 10GE; SFP+ cage for additional test options
- Fault Locator – End of Fiber detection (option)

Key Features

Ethernet

- IPv4/IPv6 and PPPoE, DHCP and static IP
- Ping, trace route, IP PCAP, Traffic PCAP
- Complete Layer 4+ test suite: V-TEST (Ookla® Speedtest™), V-PERF (RFC6349), and V-FTP upload and download tests

Basic Mode

- Wavelengths: 1270/1310/1490/1577nm with optional 1550nm
- Upstream/downstream LED status indicators for signal and frame status

- TC-SYNC status
- Low insertion loss: ≤1.5 dB typ.

GPON/XG(S)-PON

- Automatic PON-ID detection including OLT-ID, ODN class, OLT TX power level and ODN link pass/-fail
- ONU/ONT ID, serial number and status

EPON/10G EPON (option)

- Automatic OLT Mac detection
- ONU LLID, ONU MAC and ONU status

Advanced Function Mode

- Track/manage active ONT IDs and serial numbers
- PLOAM Capture/Decode
- OC decode
- Super PM - Advanced Splitter and Distribution Cabinet Analysis (option)

Optical Specifications

Optical – xPON (designed to meet levels as defined by ITU standard when testing at ONT site)

Downstream 1490 nm OLT Signal	-35 to +2 dBm Spectral passband 1470 to 1510 nm
Downstream 1550 nm OLT Signal 1550 nm only displays signal level	-40 to +18 dBm Spectral passband 1540 to 1560 nm
Downstream 1577 - 1578 nm OLT Signal	-35 to +2 dBm Spectral passband 1572 to 1582 nm
Upstream ONU/ONT 1310 nm Signal (power measurement), burst mode	-28 to +12 dBm Spectral passband 1300 to 1320 nm

Optical – xPON (designed to meet levels as defined by ITU standard when testing at ONT site)

Upstream ONU/ONT 1270 nm Signal (power measurement), burst mode	-27 to +12 dBm Spectral passband 1260 to 1280 nm
Isolation (dB)	40
ORL (dB)	50
Pass-through insertion loss (dB) Measured at 2 dBm	≤1.5
Power uncertainty (dB) Measured at -10 dBm	0.5
Auto Pass/Fail levels by Class or user threshold	ITU-T or user specified
Fiber Inspection	Optional Fiberscope via OTG cable

ITU-T PON Data Analysis (designed to meet levels as defined by ITU standard when testing at ONT site)

ONT serial numbers identification	Standard offering
PON identification (OLT-ID, OLT-Class, OLT-Tx, ONU/ONT SN) Requires activation of PON-ID functionality in PON system per ITU-T G.984.3 Amd 3	Standard offering
Active ONU/ONT List	Standard offering
PLOAM Decoder	Standard offering

Fault Locator option

Wavelength (nm)	1625 ± 10 nm
Passband (nm)	1610 to 1680

Filter Isolation (nm)	50
Distance Range 10m distance range assuming initial reflection at most -55dBm	10 m to 20 km
Distance Measurement Accuracy (m) For fiber length <10km and reflectance -42 dBm with refractive index 1.468. For non-reflectance, distance measurement accuracy can be up to ±2.5%.	±(1 + .01 x L)
Laser Safety	Class 1 per 60825-1:2014 edition

Product Specifications

The most recent product specifications can be downloaded from the product page of the VeEX Inc.website (www.veexinc.com).

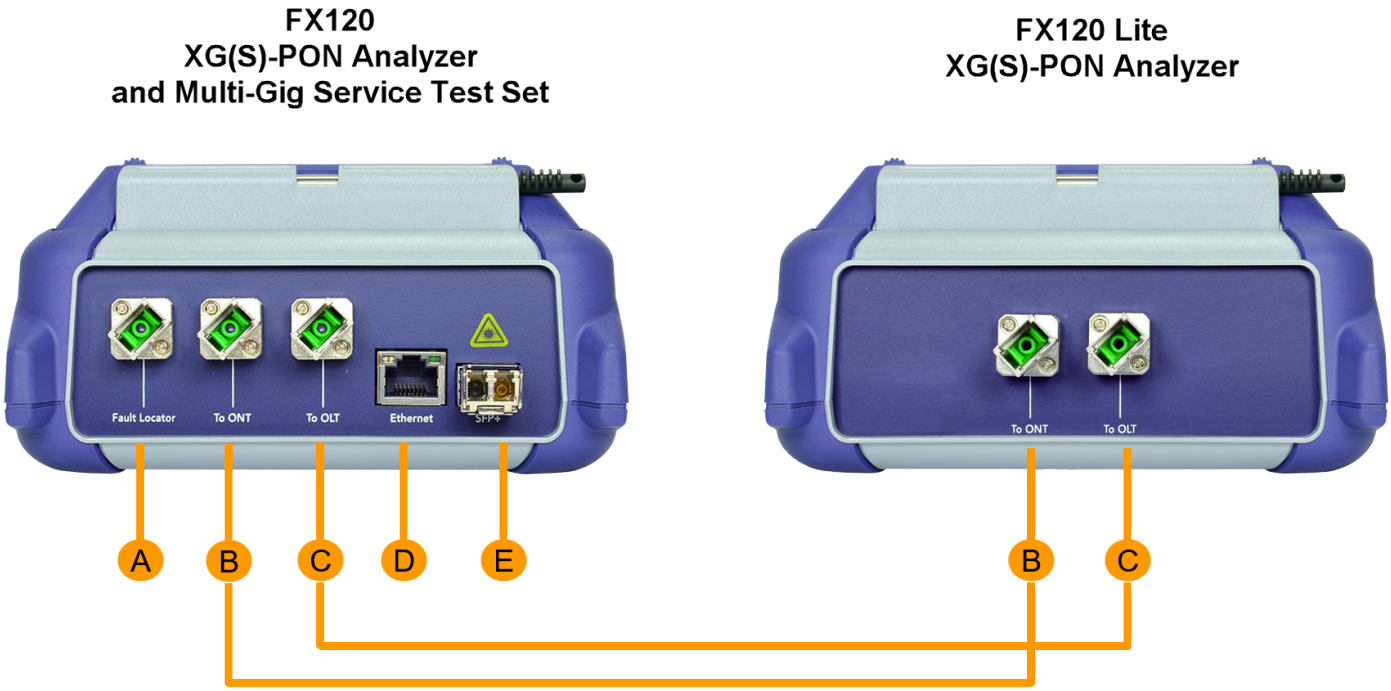
Basic Operation

Chassis Overview

To power on the test set, press for approximately two seconds, until the test set beeps once. See Hard Buttons and Interface for more information on the test set's buttons and interface.

Connector Panel

The FX120 connector panel features an ONU port (to ONU), an OLT port (to OLT), a native RJ45 and SFP+ cage, and an optional fault locator port.



A. **Fault Locator:** Drop Fiber Testing

B. **ONU:** port to Optical Network Unit

C. **OLT:** port to Optical Line Termination

D. **RJ45 UTP:** 1000BASE-T, 2.5G/5G/10G BASE-T

E. **SFP+:** 100BASE-FX, 1000BASE-X, 10GBASE-X

Use the appropriate copper (UTP) or duplex-LC fiber test cord to connect the port or device under test (DUT) to the test port.

Copper UTP: Use patch cords that are rated to support the port's maximum Ethernet speeds. Good quality **Cat6a** and **Cat7** patch-cord cables are required for devices supporting **2.5GE** (2.5GBASE-T), **5GE** (5GBASE-T) and/or **10GE** (10GBASE-T).

Using lower quality or non-certified for Cat6a or Cat7 cables will produce lower results and limit maximum data rate.

Fiber Optics: Make sure to clean all male and female connectors. Verify them using a digital Fiber Scope. (Cross-contamination build-up can degrade the test set's performance.) Insert the appropriate SFP+ transceiver into the test set's slot and make the connections.

The optical transceiver's laser will automatically turn on, so it is ready to activate the link and run the tests. Although most common optical transceivers are considered safe, please follow standard eye safety procedures and common sense (e.g., avoid using optical scopes or looking directly at active connectors).

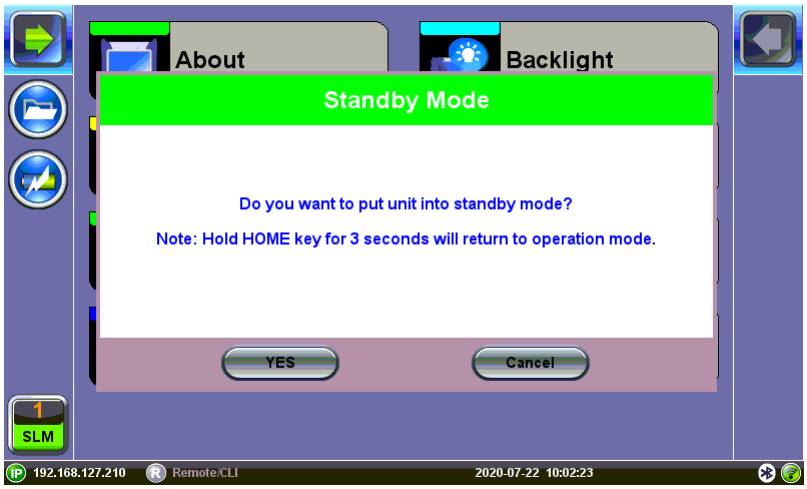
A. Save: Saves current test results in the unit's memory and provides automatic naming and time stamping function.

B. Power: Press for 2 seconds to turn the test set ON or OFF.

C. Home: Returns the screen to the home menu. Pressing the Home key for 3 seconds puts the unit in sleep mode. Once in Sleep Mode, press the Home key for 3 seconds to return to normal operation.

More about sleep mode

This is not full power shutdown.



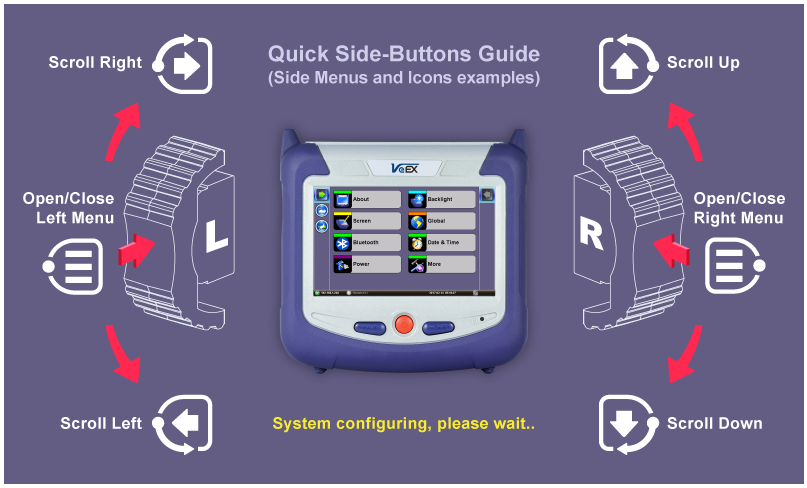
Standby/Sleep Mode

F. Side Buttons: Side buttons on the left and right side of the unit provide additional feature-specific functionality such as revealing menus and scrolling through table results. Button functions vary depending on individual applications (e.g., push to expand left or right menu bar, scroll left/right or up/down, capture screenshots). Refer to "Hard Buttons" on page 22 for the Quick Guide displayed during boot-up sequence.

Side Button Shortcuts:

- **Right side + Save:** Saves the screen (bmp)
- **Right side + Home:** Hibernates device

More about side buttons



Side buttons on the left and right of the unit can reveal menus or other functions depending on the unit

D. LED: Power ON and battery charge LED indicator

- **Off** - Power is OFF, not charging.
- **Orange** - Battery is charging.
- **Green** - Power is ON.

E. Micro-B USB: Use an USB-A OTG cable (optional with purchase) to connect a USB to the micro-B USB port. The port supports memory drives and USB add-on devices such as fiberscopes. An optional Micro-B OTG to Ethernet adapter is also available for network connection. *(Only VeEX approved OTG to Ethernet Cables can be used.)*

G. Test port connector

Fault Locator: Drop Fiber Testing

ONU: port to Optical Network Unit

OLT: port to Optical Line Termination

Optical Test Port (SFP+): Ethernet 100BASE-FX, 1/10GBASE-X *(applies to FX120 only)*

UTP Test Port (RJ45): Ethernet 10/100/1000BASE-T, 2.5/5/10BASE-T *(applies to FX120 only)*

Use certified CAT 6a or CAT 7 UTP test patch cords.

H. Touch screen LCD

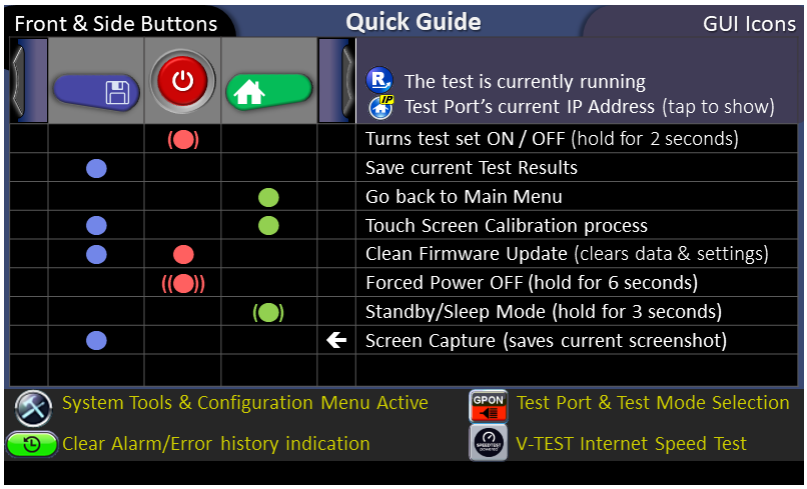
I. Stylus: Use when finer touch screen control is required.

J. DC power socket: Use VeEX-supplied AC/DC chargers only.

Special Functions

Hard Buttons

The test set buttons provide additional functions when using specific combinations.



Button Quick Guide

Power ON/OFF: Press and hold for approximately two seconds, until the test set emits one beep to turn it **ON**. and two beeps to turn it **OFF**, then wait for the power LEDs to turn **OFF**.

Wait at least 10 seconds before turning the test set back on.

Forced Power OFF: In the unlikely event that the test set becomes non-responsive or behaves improperly, press and hold for approximately six seconds to force the test set off.

No results will be saved when forcing the test set to power down.

Standby/Sleep Mode: This mode is used to conserve battery when the test set is required to "boot up" and be ready to test faster.
First, release any active test application. Then, press and hold the for approximately three seconds to activate the Sleep or Standby mode. Once activated, the power LEDs will flash green to indicate that the test set is in standby mode (the fans may stay on until all electronics cool down).

After switching to Standby mode, the fans may stay on until all electronics cool down.

While in Standby mode, quickly press to see the current standby time and remaining battery charge. Press the button again for three seconds to bring the test set back to full operation.

Save Results: Press save the current test results.

Home Menu: Press to go back to the Main Menu. Tap on the screen to return to the previous menu level.

Screen Capture: Press **+ right slider buttons** simultaneously to store a picture of the current screen (screenshot). The test set will emit a confirmation beep/tone when the screen is captured. The images are named with a date + time code. Go to **>Files >Saved** to manage, view, or transfer captured screens. Refer to "Working with Saved Results, Profiles, Images" on page 111 for more details.

Touch Screen Calibration: If the touch screen becomes non-responsive, press + simultaneously to invoke the touch screen calibration procedure. Refer to "Touch Screen Calibration" on page 195 for more details.

Clean Software Install: With the test set OFF, press + buttons simultaneously to initiate a clean software install from an USB memory stick. Refer to "Software Update Process" on page 202 for more details.

All settings, test results and user data will be erased when performing a Clean Software Install. Backing up all data to a USB memory stick is recommended. To back up to USB, go to >Files >Saved and tap . Refer to "Working with Saved Results, Profiles, Images" on page 111 for more details.

Touch-Screen Display

The LCD supports touch-screen operation. To operate the touch-screen, use the stylus located in the top cover to navigate the menus and tabs. Please observe the following precautions:

- Never use excessive pressure on the touch-screen as this may damage its functionality.
- Never use sharp objects such as a pen, screwdriver etc. as this may damage the surface.
- Clean the surface of the touch screen using a soft cloth and mild detergent only. Do not use alcohol.

See "Touch Screen Calibration" on page 195 for instructions on how to recalibrate the touch-screen.

Platform Screen Icons

File: Provides general internal storage information. indicates the presence/detection of compatible USB memory stick and provides proper memory stick ejection function (before removing).

Exit: Return to the previous screen.

Home: Return to the Home Menu.

Help: Displays product help.

Active Test Application: Access to test applications or test application menu which varies depending on the test set mode. WiFi, SLM, FIBER, OSA, and Fiberscope are some of the applications available.

Application Tools: Access applications, depending on options purchased i.e. OTDR Viewer, VeEX Flow, GPON, OLTS, Speedtest, etc.

Utilities Test Application: Opens the System Tools and Utilities menu.

Shift Key: Serve the same function of expanding the side menu bars as pushing the physical side buttons on the sides of the unit. Tap to reveal/hide icons and test function keys.

AC Charging: The unit is plugged into external AC power. Tap to see battery charge status.

Battery Powered: The unit is powered by the battery. Tap to see battery charge status and estimated autonomy time.

Fiberscope: Indicates that a fiberscope is connected to the unit. Tap the icon to go to the Fiberscope application.

OTDR Viewer: Analyzes standard OTDR .SOR files created by supported VeEX test sets and controls the OPX-BOXe OTDR.

FX40/45/48 Viewer: Controls FX40/45/48 optical test loss test sets and analyzes standard OPM files.

PON: Access Advanced PON tools

Flow: Access the Flow feature to perform and compile multiple tests into a single job report.

LEDs

Power LED: A single LED indicates the power state of the unit

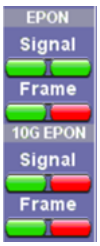
- The LED is off when the unit is powered off.
- The LED is green when the unit is powered on.
- The LED is orange when the unit is connected to the AC Mains and powered off (charging).

Soft LEDs: Each tests module offers detailed soft LEDs and indicators in its test application.

GPON/EPON LED Status Indicators

On screen LED colors indicate the status of upstream (**Up**) and downstream (**Dn**) signals and frame/error detection.

GPON/XG(S)-PON Upstream/Downstream LED Status



EPON/10G EPON Upstream/Downstream LED Status

- **Green**: Signal level detected. No errors or alarms are present. No further action required.
- **Red** : An error condition is detected and is currently present. Flashing red indicates a history condition—an error was detected during the measurement interval but it is no longer present or active. Tap **TOOLS** to view PLOAM, and Active ONU.

The **History** button resets the LEDs of past statuses.

If any LED remains red, clean the patch cord connectors that will connect the FX120/FX120 Lite to the ONU/ONT, the FX120/FX120 Lite test ports (To ONU, To OLT), and the ONU/ONT ports. Refer to Inspection for information on inspecting and cleaning fiber connectors.

Ethernet Single Port LED Status Lights

- **Signal:** A valid input signal is detected.
- **Frame:** Valid framing on the input signal is detected.
- **Pattern:** Indicates test pattern synchronization in BERT, RFC, and Throughput modes.
- **Alarm/Error:** Alarms or errors are detected.

The color indicates the alarm status:

- **Green**: No error or alarm is present
- **Red**: An error or alarm condition is currently detected
- **Red** *flashing*: Event history reminder. Any error or alarm has occurred in the past, but no longer present.
- **Yellow**: An error or alarm was detected during the measurement interval but is no longer present or active
- **Grey**: Status not applicable or the test has not begun yet

Mode/Port Selection

Test mode, test port(s), and network settings are required prior to performing any measurements or applications.

The test set has a default RJ45 port selected with 1000M/2.5G/5G/10G Base-T Test Mode. If the port is connected to a switch it acquires the IP address automatically (if DHCP is set up). But, the test mode can always be manually switched.

Test modes are accessed by selecting the Test Application button 

. Tap on a technology group then select a test interface.

GPON

Preparing for PON Testing

Equipment Checklist

The following tools are required to operate the FX120/FX120 Lite unit for GPON testing:

- SC/APC is the recommended connector.
- Cleaning supplies to clean patch cord connectors and equipment optical connectors.
- Fiberscope with Universal 2.5mm UPC and APC male tip, SC/APC bulkhead and SC/UPC bulkhead tips to inspect optical connectors.
- Patch cord – one to two patch cords depending on what is required to insert the FX120/FX120 Lite between the splitter and ONT.

Mating blue (UPC) with green (APC) connectors will result in excessive insertion loss, reflectance, and possible damage to the optical connector.

xPON Test Standards

VeEX is providing these architecture diagrams as an example. For the latest specifications, it is recommended users should check ITU-T website for the latest revision.

1G PON Architecture Specifications

Bit Rate [Mbit/s]		Max Reach [km]	Max Split Ratio	Loss Budget		ITU-T Rec.
DS	US			Class	Value [dB]	
Time Division Multiplexing (TDM) 2488.32 1244.16	Time Division Multiple Access (TDMA) 2488.32 1244.16 622.08 155.52	20 / 20[1] Extended to 60	1:64	A	5 to 20	G.984.2
			1:64	B	10 to 25	G.984.2
			1:64	C	15 to 30	G.984.2
			1:64	Industry	13 to 28	G.984.2 Amd. 1
		20 / 60	1:64	Industry: C+	17 to 32	G.984.2 Amd. 2
		20 / 60	1:64	B+	13 to 28	G.984.6
		20 / 60	1:64	C+	18 to 31	G.984.6
		40 / 40	1:64	B+	13 to 28	G.984.7
		40 / 40	1:64	C	15 to 30	G.984.7
		40 / 60	1:64	C+	17 to 32	G.984.7

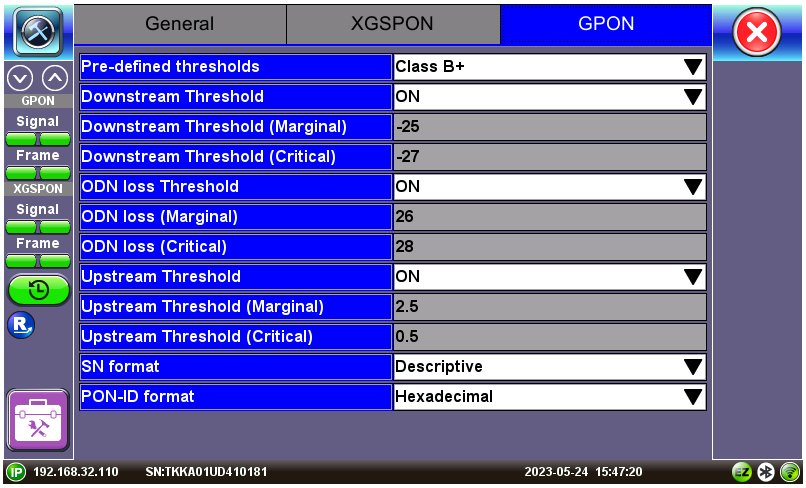
10G PON Architecture Specifications

Bit Rate [Mbit/s]		Max Reach [km]	Max Split Ratio	Loss Budget		ITU-T Rec.
DS	US			Class	Value [dB]	
Time Division Multiplexing (TDM) 9953.28	Time Division Multiple Access (TDMA) 2488.32	20 / 20[1] 20 / 40	1:64 to 1:256	N1	14 to 29	G.987.2
				N2	16 to 31	G.987.2
				E1	18 to 33	G.987.2
				E2	20 to 35	G.987.2
	Time Division Multiplexing Access (TDMA) 9953.28	20 / 40 / 60	1:32	B+	13 to 28	G.9807.1
			1:64 to 1:256	C+	18 to 31	G.9807.1
				N1,N2,E1,E2		G.9807.1
		20 / 60	1:64	B+	13 to 28	G.987.4
				C+	18 to 31	G.987.4

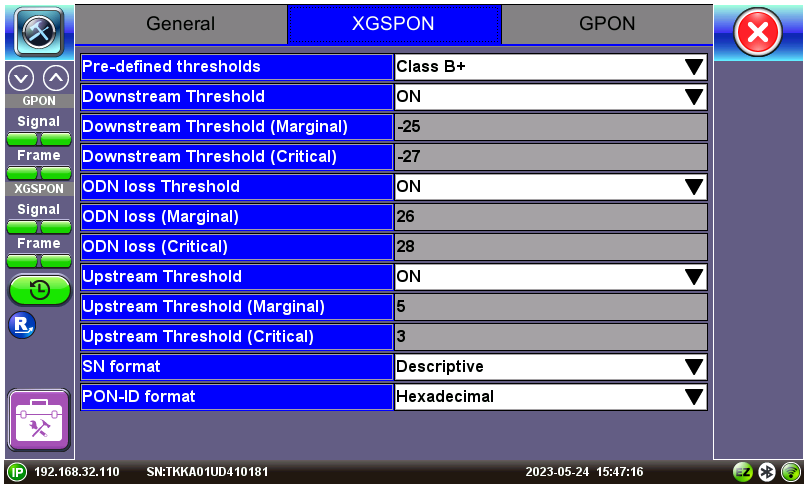
OPM Setup

In the OPM Setup screen, configure the test profile settings and thresholds according to the xPON class based on the ITU-T and IEEE Test standards or customize a unique profile.

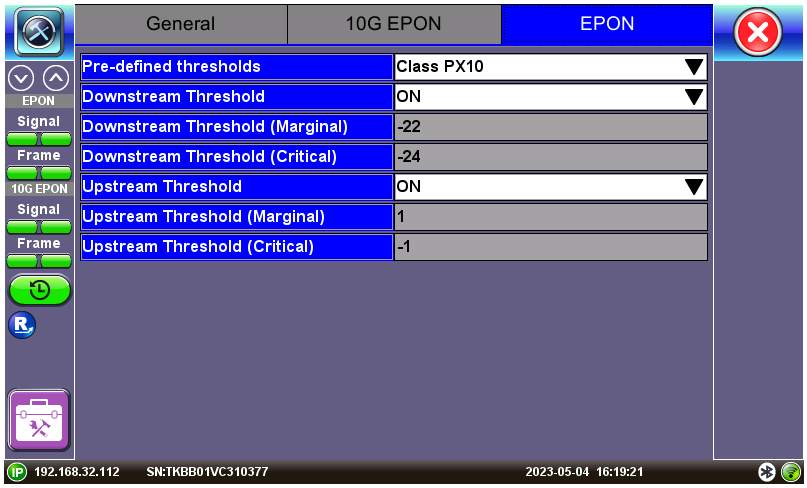
Tap **Setup** on the OPM screen to access the setup screen.



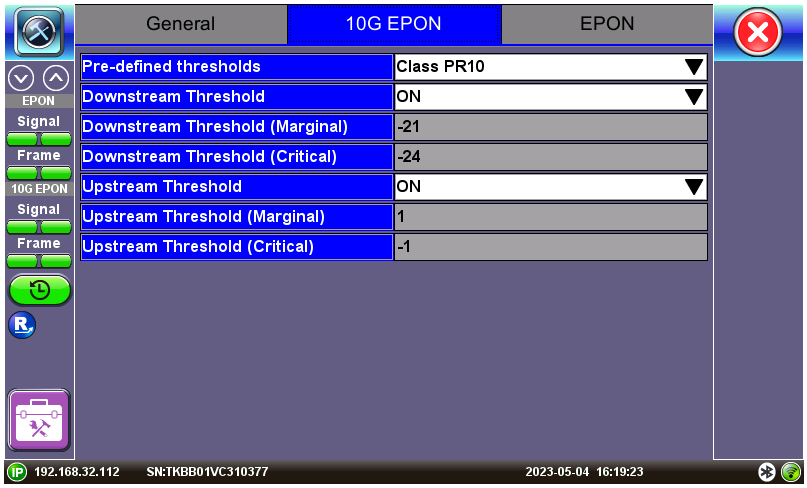
GPON OPM Setup menu



XG(S)-PON OPM Setup menu



EPON OPM Setup menu



10G EPON OPM Setup menu

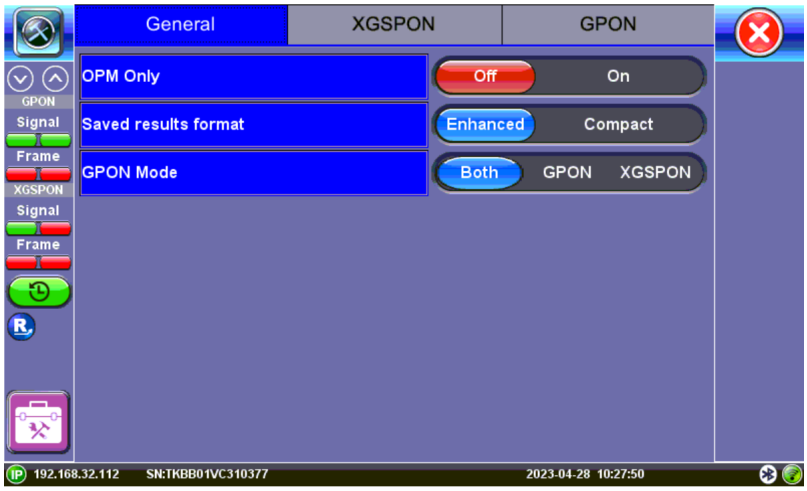
See "GPON and XGS-PON Threshold Standards" on page 37 for information on GPON/XGS-PON Threshold Standards.

See "EPON Thresholds" on page 70 for information on EPON Threshold Standards.

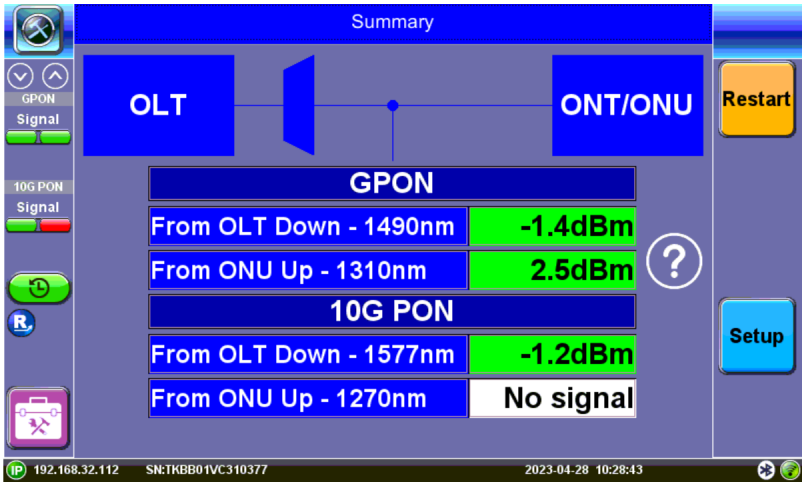
General Setup

Display and measurement mode settings are configured in the General tab of the Setup screen. Select which mode to measure on the main screen and the format of saved results.

To simplify the view and see the OPM readings only on the main screen, select **On** for **OPM Only**.



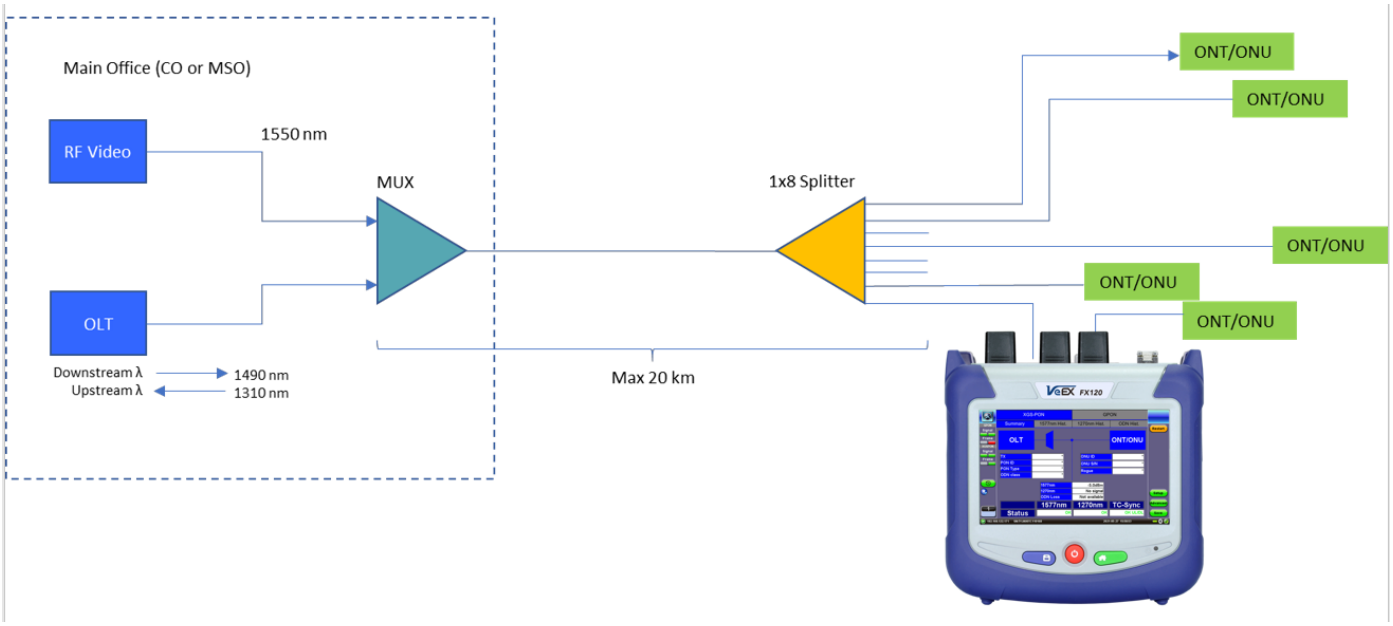
General Setup



OPM Only View

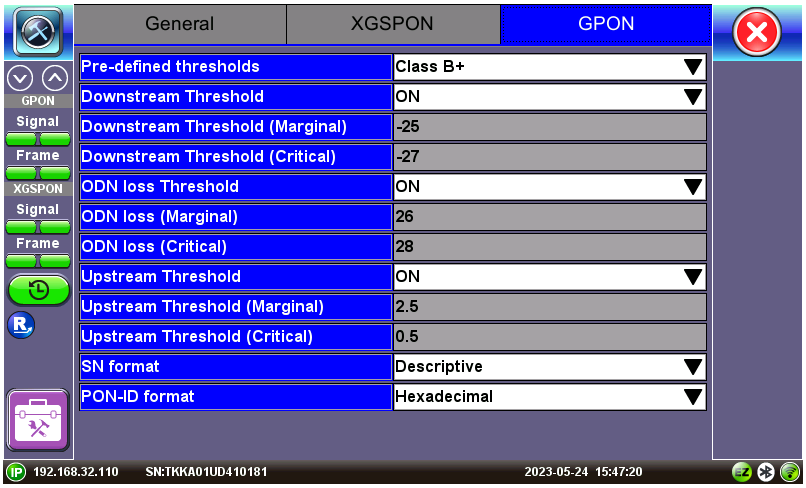
GPON/XGS-PON Test Procedure

The FX120/FX120 Lite is designed for use at the customer premises to aid with ONT/ONU activation and troubleshooting.

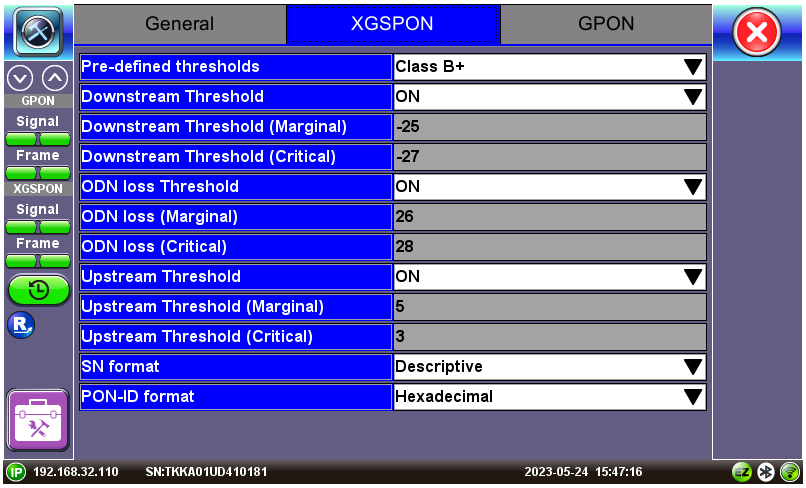


The FX120 is connected at the customer premises.

1. Power on the FX120/FX120 Lite test set. Testing should start automatically. Restarting measurements from the OPM menu (see OLT Information Table) resets items in the OPM Summary screen - the power level graphs and the Active ONU list in **Advanced Mode**. To clear the PLOAM list, go to the respective PLOAM menu and press the clear button.
2. Tap on **Setup** and configure the test profile settings according to the xPON class and ITU-T Test standards.



GPON OPM Setup menu



XGS-PON OPM Setup menu

3. Inspect and clean the FX120/FX120 Lite test ports. Inspect and clean the fiber patch cord from the OLT and insert it into the FX120/FX120 Lite OLT test port.

   ***Warning**: Never look directly into the beam of an active optical source as this may result in harmful eye damage from radiation exposure.*

4. If 1490/1577nm light is detected, the 1490/1577nm **Status** will display **OK**. Verify that the measured 1490/1577nm signal level is green (see " OPM Test Mode" on page 39).
5. All DS LEDs should turn from red to Green. If any LED remains red, clean and inspect the connectors again as specified in **Step 4** (see "GPON/EPON LED Status Indicators" on page 41).
6. Inspect and clean the patch cord connectors that will connect FX120/FX120 Lite to ONU/ONT and the ONU/ONT test port.
7. Connect the FX120/FX120 Lite to the ONU/ONT test port. If 1310/1270nm light is detected, the **Status** will display **OK**. Verify that the measured 1310/1270nm signal level is green (see " OPM Test Mode" on page 39).
8. All US LEDs should turn from red to green. If any LED remains red, clean the ONU connections again as outlined in **Step 6**.
9. Confirm TC-Sync status displays **OK DL**. If you are not able to achieve TC-Sync, contact VeEX Inc. Support.

GPON and XGS-PON Threshold Standards

Thresholds Adhering to the Current GPON Standards

Downstream (2488.32 Mbps)						
			T-A1		A V	A V
ODN Class	**A**	**B**	**B+**	**C**	**C+**	D
ONU receiver minimum sensitivity (dBm)	-21.0	-21.0	-27.0	-28.0	-30.0	-30.0
ONU minimum overload (dBm)	-1.0	-1.0	-8.0	-8.0	-8.0	-8
Downstream Threshold – Critical (dBm)	-21.0	-21.0	-27.0	-28.0	-30.0	-30.0
Downstream Threshold – Marginal (dBm)	-19.0	-19.0	-25.0	-26.0	-28.0	-28.0
Upstream (1244.16 Mbps)						
ODN Class	**A**	**B**	**B+**	**C**	**C+**	**D**
ONU mean launched power MIN (dBm)	-3.0	-2.0	+0.5	+2.0	+0.5	+0.5
ONU mean launched power MAX (dBm)	+2.0	+3.0	+5.0	+7.0	+5.0	+5.0
Upstream Threshold – Critical (dBm)	-3.0	-2.0	+0.5	+2.0	+0.5	+0.5
Upstream Threshold – Marginal (dBm)	-1.0	0.0	+2.5	+4.0	+2.5	+2.5
Link Budget						
ODN Class	**A**	**B**	**DD20 B+**	**C**	**DD20 C+**	**D**
Maximum optical loss at 1490 nm / 1310 nm (dB)	+20.0	+25.0	+28.0	+30.0	+32.0	+35.0
ODN Loss – Critical (dB)	+20.0	+25.0	+28.0	+30.0	+32.0	+35.0
ODN Loss – Marginal (dB)	+18.0	+23.0	+26.0	+28.0	+30.0	+33.0

Thresholds Adhering to the Current XGS-PON Standards

Downstream (9953.28 Mbps)						
	T B9.3				T B9.5	
ODN Class	**N1**	**N2**	**E1**	**E2**	**B+**	**C+**
ONU receiver minimum sensitivity (dBm)	-28.0	-28.0	-28.0	-28.0	-27.0	-27.0
ONU minimum overload (dBm)	-9.0	-9.0	-9.0	-9.0	-8.0	-8.0
Downstream Threshold – Critical (dBm)	-28.0	-28.0	-28.0	-28.0	-27.0	-27.0
Downstream Threshold – Marginal (dBm)	-26.0	-26.0	-26.0	-26.0	-25.0	-25.0
Upstream (9953.28 Mbps)						
	T B9.4				T B9.5	
ODN Class	**N1**	**N2**	**E1**	**E2**	**B+**	**C+**
ONU mean launched power minimum(dBm)	+4.0	+4.0	+4.0	+4.0	+3.0	+3.0
ONU mean launched power maximum (dBm)	+9.0	+9.0	+9.0	+9.0	+8.0	+8.0
Upstream Threshold – Critical (dBm)	+4.0	+4.0	+4.0	+4.0	+3.0	+3.0
Upstream Threshold – Marginal (dBm)	+6.0	+6.0	+6.0	+6.0	+5.0	+5.0
Link Budget						
	T B6.1					
ODN Class	**N1**	**N2**	**E1**	**E2**	**B+**	**C+**
Maximum optical loss (dB)	+29.0	+31.0	+33.0	+35.0	+28.0	+32.0
ODN Loss – Critical (dB)	+29.0	+31.0	+33.0	+35.0	+28.0	+32.0
ODN Loss – Marginal (dB)	+27.0	+29.0	+31.0	+33.0	+26.0	+30.0

For latest revisions of GPON standards, please visit https://www.itu.int/rec/T-REC-G.984.2-201908-I and for XGS-PON standards, please visit https://www.itu.int/rec/T-REC-G.9807.1/en.

Synchronizing the FX120/FX120 Lite with the ONU Activation Process

The FX120/FX120 Lite will synchronize to the downstream frame (from the OLT) provided the OLT is operational and 1490/1577nm signal level is good. The downstream frame synchronization indicator should occur almost immediately.

In order to synchronize with the ONU, the FX120/FX120 Lite needs to see the ONU registration process. Therefore, only connect the ONU AFTER the FX120/FX120 Lite application is already running. Otherwise, unplug and replug the ONU the ONU after the FX120/FX120 Lite application is running if the ONU is already connected to the FX120/FX120 Lite.

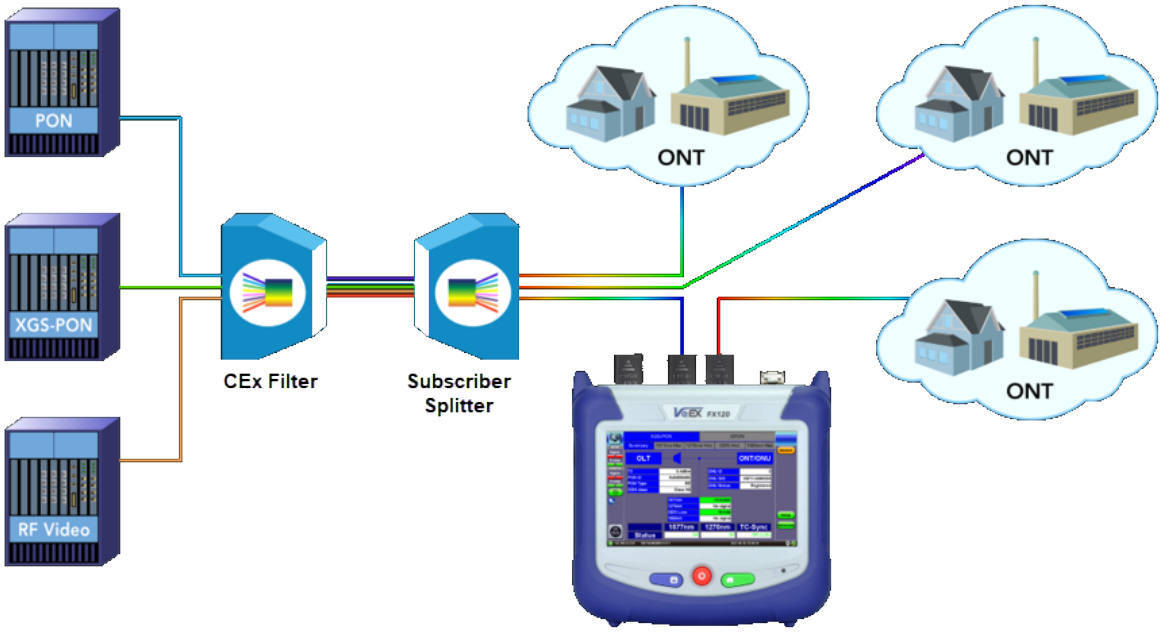
If the OLT and an active ONU are connected to the FX120/FX120 Lite before starting the test application, the FX120/FX120 Lite will not see the ONU activation and the above process will not be completed. In this instance, LOF will be reported for the upstream side; no ONU ID or ONU S/N information on the OPM results page will be displayed.

OPM Test Mode

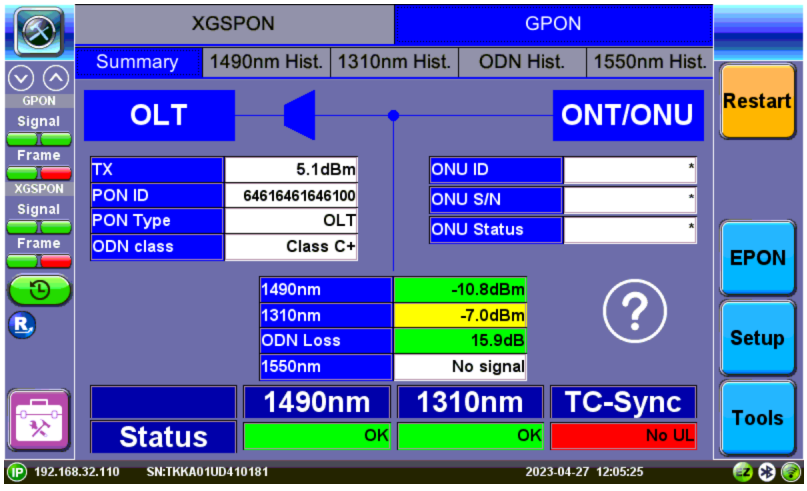
GPON/XGS/EPON PON Diagram

Network diagram of the GPON network. Connect the FX120/FX120 Lite between the splitter and ONT/ONU.

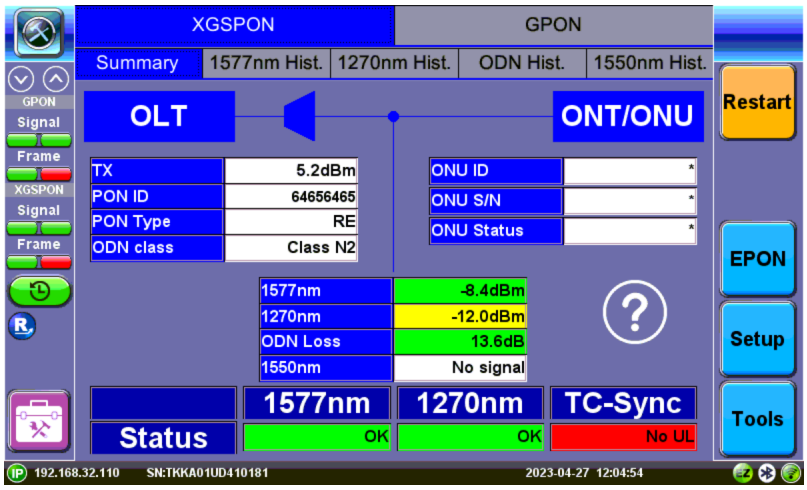
Do NOT connect the FX120/FX120 Lite between the OLT and splitter.



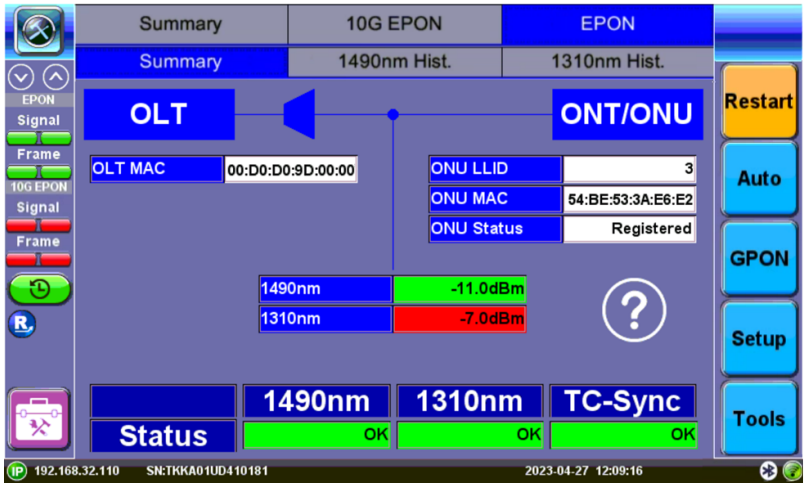
The FX120/FX120 Lite should be connected between the splitter and ONT.



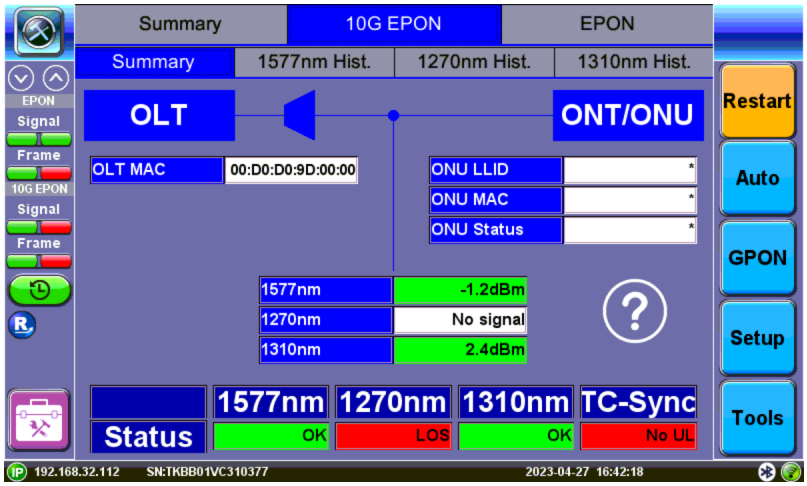
GPON Summary Screen



XGS-PON Summary Screen



EPON Summary Screen

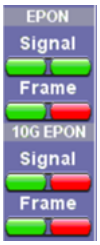


10G EPON Summary Screen

GPON/EPON LED Status Indicators

On screen LED colors indicate the status of upstream (**Up**) and downstream (**Dn**) signals and frame/error detection.

GPON/XG(S)-PON Upstream/Downstream LED Status



EPON/10G EPON Upstream/Downstream LED Status

- **Green**: Signal level detected. No errors or alarms are present. No further action required.
- **Red** : An error condition is detected and is currently present. Flashing red indicates a history condition—an error was detected during the measurement interval but it is no longer present or active. Tap **TOOLS** to view PLOAM, and Active ONU.

The **History** button resets the LEDs of past statuses.

If any LED remains red, clean the patch cord connectors that will connect the FX120/FX120 Lite to the ONU/ONT, the FX120/FX120 Lite test ports (To ONU, To OLT), and the ONU/ONT ports. Refer to Inspection for information on inspecting and cleaning fiber connectors.

OLT and ONT/ONU Messages and Measurements

TX	6.9dBm
PON ID	0xDEADBEEF
PON Type	RE
ODN class	Class N1

OLT Information Table

OLT MAC	00:D0:D0:9D:00:00

EPON OLT Information Table

Below the OLT and splitter diagram block, a table displays the transmitting signal level (TX), PON ID, PON Type, and ODN class. For EPON testing, the MAC number is displayed. This is decoded from downstream PLOAM messages from the OLT. This information is only available when sent by the OLT and may need to be enabled.

ONU ID	3
ONU S/N	HWTC-EE8E4023
ONU Status	Registered

GPON/XGSPON ONU Information Table

ONU LLID	3
ONU MAC	54:BE:53:3A:E6:E2
ONU Status	Registered

EPON/10G EPON ONU Information Table

GPON/XGSPON ONU ID, ONU S/N information and EPON ONU LLID, ONU MAC information is decoded from downstream PLOAM messages from the OLT that was received from the ONT/ONU during the first service activation. If the information is not displayed, it may have been missed. Power cycle the ONU to initiate the ranging process again.

ONU Status	Cause	Result
Activated	ONU/ONT registered with OLT, Communication established and in Sync	PON network will operate properly
Rogue/De-Activated	ONU/ONT = faulty => ROGUE ONT. ONU transmission detected outside Bwmap; CW Tx; BIP errors detected	ONU Operations stopped. Deactivated PLOAM sent
Unregistered	ONU/ONT not registered at OLT. Not in OLT list of registered ONU/ONTs	ONU Operations stopped. Deactivated or eStop PLOAM sent
Alien	Unknown device connected	May lead to disruption on some or all services on shared PON-ID

ONU Status

See "ONU/ONT Statuses" on page 46 for more information.

1490nm	-1.3dBm
1310nm	2.5dBm
ODN Loss	Not available

GPON Signal Measurement Table

1577nm	-1.2dBm
1270nm	No signal
ODN Loss	Not available

XGS-PON Signal Measurement Table

1490nm	-1.3dBm
1310nm	2.5dBm
1577nm	-1.2dBm
1270nm	No signal

EPON Signal Measurement Table

At any customer location after the OLT and splitter, the FX120/FX120 Lite will display 1490nm and 1310nm signal level values for GPON, 1577nm and 1270nm for XGS-PON, and 1550nm for RF/CATV. ODN Loss is the difference between the transmitting signal from the OLT (TX) and the DS signal level measured at the FX120/FX120 Lite location.

If the OLT is not broadcasting its output power, the span loss value cannot be calculated.

Green, yellow, and red table colors indicate whether signal levels pass or fail against ITU-T/IEEE standard threshold values configured in Setup.

Refer to "OPM Setup" on page 31 for information on test profile setup.

Green: The measured signal is above the critical threshold.

Yellow: The measured signal is below marginal and above critical.

Red: The measured signal level is below the critical threshold and does not meet the specification.

Upstream/Downstream/TC-Sync Signal Status

See "Signal and Synchronization Status" below for information on TC-Sync statuses.

Test and Profile Settings

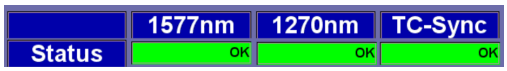
- **Setup**: Setup Test profile
- **Advanced**: Leads to the Advanced Setup, Results, PLOAM and OMCI Decoder, and Active list.

Signal and Synchronization Status

The Status table displays detected 1490nm/1577nm downstream, 1310nm/1270nm upstream, and TC-Sync status.

	1490nm	1310nm	TC-Sync
Status	OK	OK	No UL

GPON Signal and Synchronization Status Table



XGS-PON Signal and Synchronization Status Table

10G EPON Signal and Synchronization Status Table

Status Table

- **1490nm/1310nm**: If OK is displayed, light in the downstream 1490nm or upstream 1310nm direction is detected.
- **1577nm/1270nm**: If OK is displayed, light in the downstream 1577nm or upstream 1270nm direction is detected.
- **1577nm/1270nm/1310nm**: If OK is displayed, light in the downstream 1577nm or upstream 1270nm direction or upstream 1310nm is detected.
- **Transmission Connectivity Sync (TC-Sync)**: OK UL/DL indicates that the FX120 is properly synchronized with the OLT and ONU/ONT traffic. No UL/DL indicates the OLT and ONU/ONT are not synchronized properly. Consult VeEX technical support if unable to achieve TC-Sync.

***OK** indicates US or DS light is detected, but does not indicate whether ITU-T Threshold values (IEEE values for EPON) are met or if the OLT and ONU/ONT are properly synchronized.*

ONU/ONT Statuses

The FX120/FX120 Lite can report three ONT statuses:

1. Registered
2. Unregistered
3. Rogue

Registered (Activated)

Registered means that the ONT/ONU serial number was acknowledged by the OLT port (aka PON-ID) to be a valid SN so the activation process can continue through the remaining steps. This means that communication between the ONT and OLT was established and continues on. The activation process can resume until the OLT and ONT are both in sync.

Unregistered (Alien)

An Unregistered status displays when the ONT is an Unknown or Alien device. A common reason for this is that the ONT does not belong on this PON-ID.

Examples :

- If a technician were to connect an EPON ONT or an XGS-PON ONU with a GPON OLT.
- If the ONT SN was never registered to the PON-ID.

In these types of situations, the OLT will send a message that it does not recognize this ONT SN and will request the ONT to deactivate itself.

Rogue (Deactivated)

A Rogue ONT is when a registered ONT transmits outside of the OLT allocated transmission time slot either intermittently or continuously. This can happen when an ONT is defective or overheated. This causes the ONT transmission to collide with other registered ONTs transmission on the same PON-ID who are keeping within their timeslot, resulting in transmission errors. In many cases, a rogue ONT does not have service issues, but other ONTs on the same PON-ID are may report service issues.

Refer to "Rogue ONTs" below for more information on detecting Rogue ONTs.

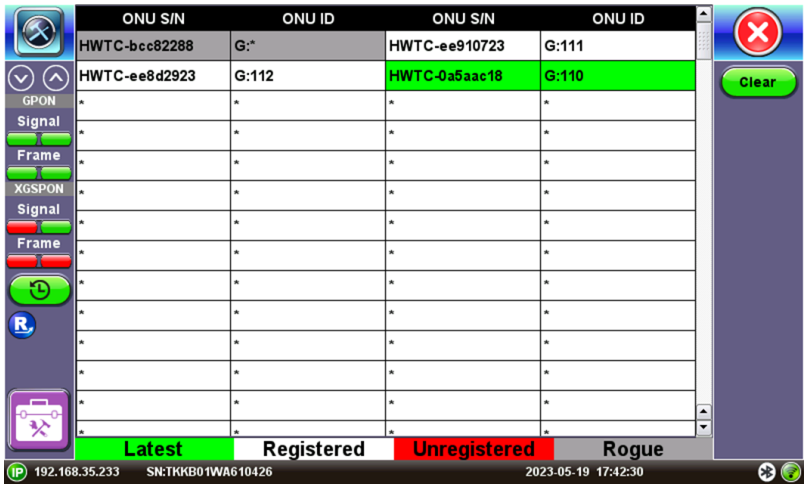
Rogue ONTs

A rogue ONT refers to an unauthorized or unapproved Optical Network Terminal connected to a passive optical network (PON) without the knowledge or permission of the service provider. It can occur due to unauthorized connections, fraudulent activity, or misconfiguration. Rogue ONTs pose risks such as network security vulnerabilities, degraded service quality, service abuse, and network instability. Service providers employ measures such as monitoring the network, authentication, and authorization processes, and remedial actions to address rogue ONTs.

How to Detect Rogue ONTs

To detect rogue ONTs, the ability to decode upstream messages is needed, which is why the MTTplus-420 is recommended. However, the detection of rogue ONTs also depends on the capabilities of the equipment used. The FX120, for example, lacks upstream decoding capabilities required for rogue ONT detection. Despite that, the FX120 can still report rogue activity if the OLT has rogue detection capabilities and sends specific commands to shut down the ONT.

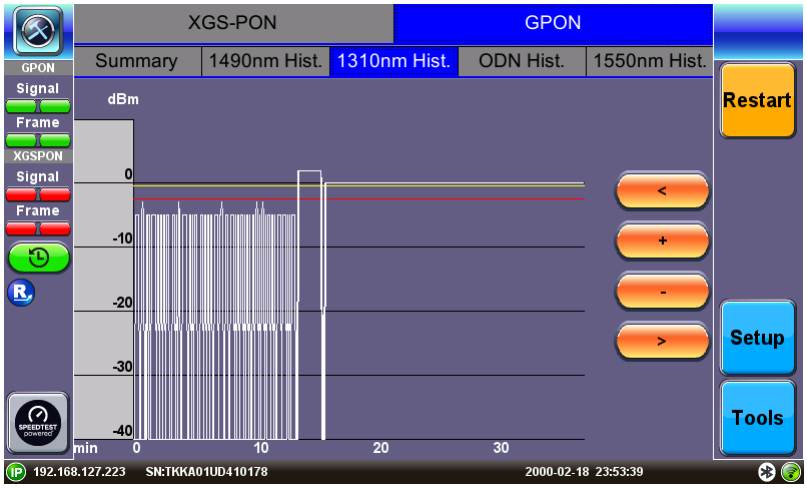
When testing for rogue ONTs, the FX120 should be placed after the last splitter and right before the ONT to capture downstream information. The OLT will send messages to request ONTs to shut down if they are transmitting outside their timeslot. The FX120 analyzes PLOAM messages, such as *disable_SN* or *emergency_stop*, sent from the OLT to the ONT to detect rogue activity. Upon multiple tests that were conducted to determine the time required for proper rogue detection, it was found that the unregistration and disabling of ONTs were instant, yet it could take up to 15 mins to reenable all except the rogue ONT.



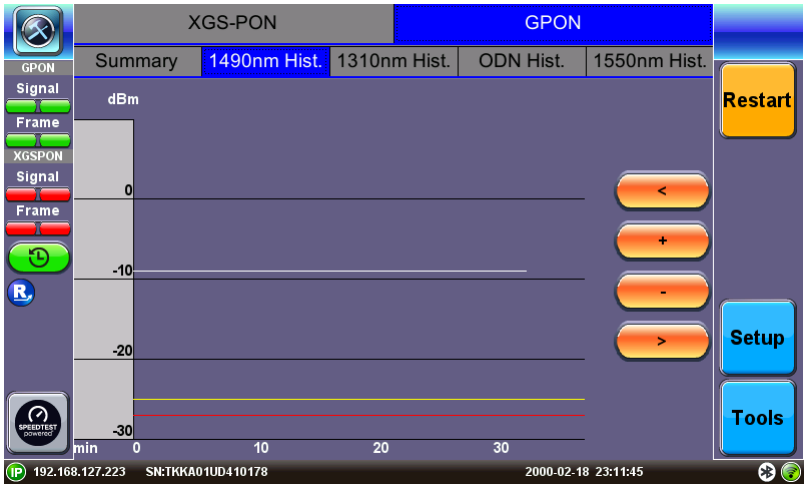
Rogue ONT Detection

Histogram and ODN Loss History

Tap on the **1490/1577nm** Histogram, **1310/1270nm** Histogram, and **ODN** (Span Loss) Histogram tabs to monitor Downstream and Upstream signals. Tap on the upper left and right arrows to scroll through the measurement period. The + and – keys zoom in/out of the time axis.



1310nm Histogram showing Upstream signals



1490nm Histogram showing Downstream signals

ODN Loss Histogram shows the budget between OLT TX level and ONT downstream (1490nm) received level. Exceeding the range will cause the ONT to fail to go online. The ODN link budget and optical power loss calculation need to be planned in advance.

Advanced OPM Mode

Advanced Mode features advanced troubleshooting tests beyond basic signal level measurements. Further investigation may be required when the OPM test mode indicates good signal level, but TCSync is not good and the network is generating alarm or errors.

- **PLOAM** captures and decodes PLOAM messages exchanged between the Optical Line Terminal (OLT) and ONT.

  See "PLOAM Messaging Decoder" on page 52.

- **Active ONU** lists all active ONUs currently on the network as determined by the OLT.

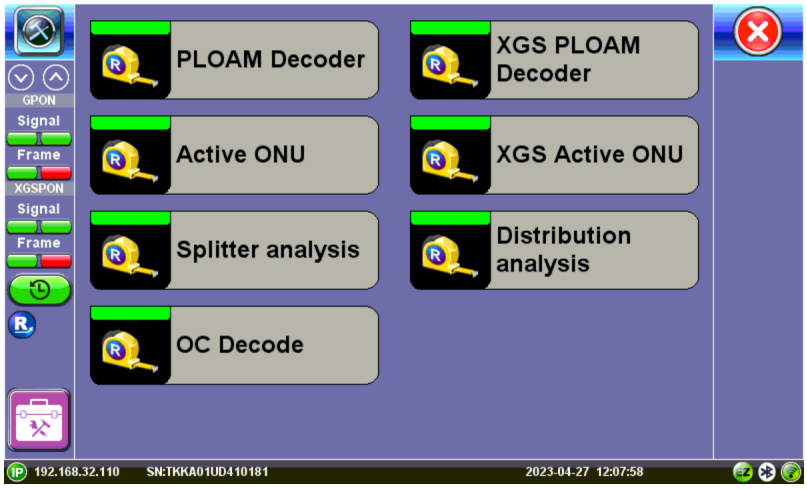
  See "Active ONU" on the next page

- **OC Decode** displays information from the OLT in an easy to read format.

  See "OC Decode" on page 54.

- **Splitter analysis** and **Distribution analysis** assist in performing an ONT port audit on the splitter and distribution panel.

  See "Splitter Analysis (optional)" on page 56 and "Distribution Analysis (optional)" on page 60.



Advanced home menu

To access the Advanced menu, press the **Tools** button on the OPM screen.

Active ONU

Active ONU lists all of the ONUs that have been detected by the OLT since the measurement was started/restarted from the OPM summary screen.

To see all active ONUs, tap **TOOLS** to access the Advanced Tools menu. Then, tap **Active ONU**.

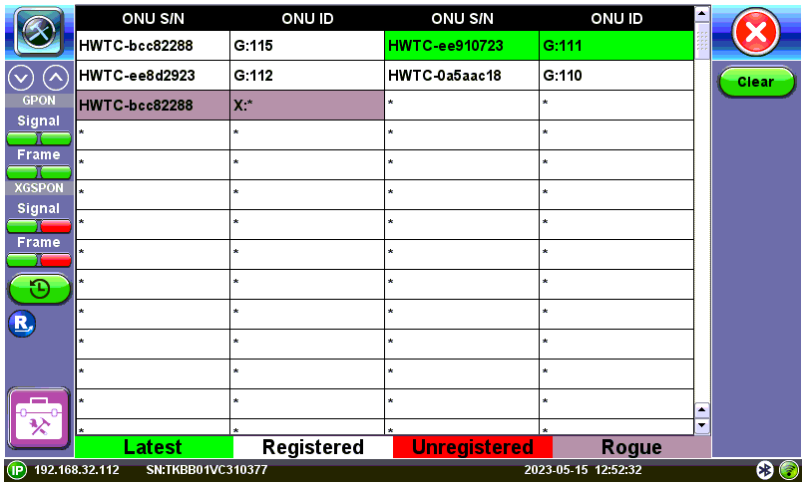
To clear the list, tap **Clear**.

White: Registered ONU

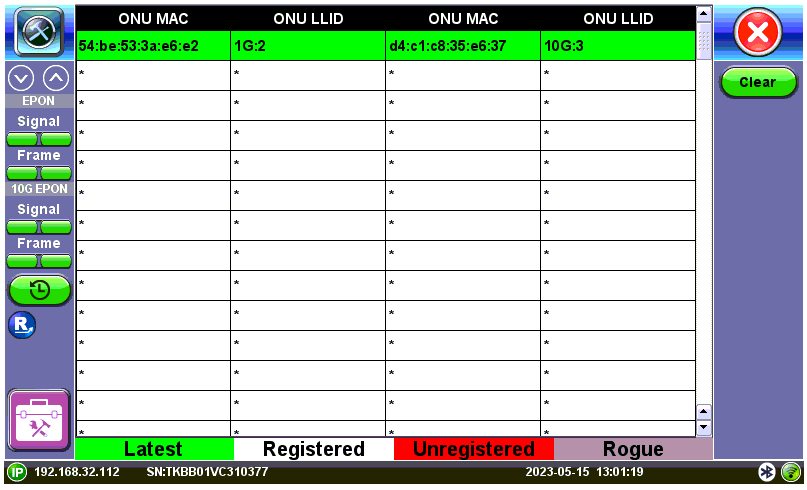
Red: Unregistered ONU

Green: Most recently registered ONU

Grey: Rogue ONU



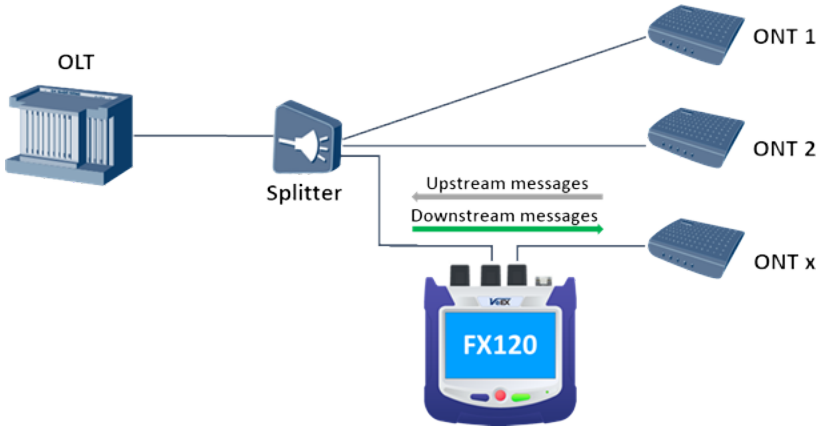
GPON/XG(S)-PON ONT/ONU Active Devices



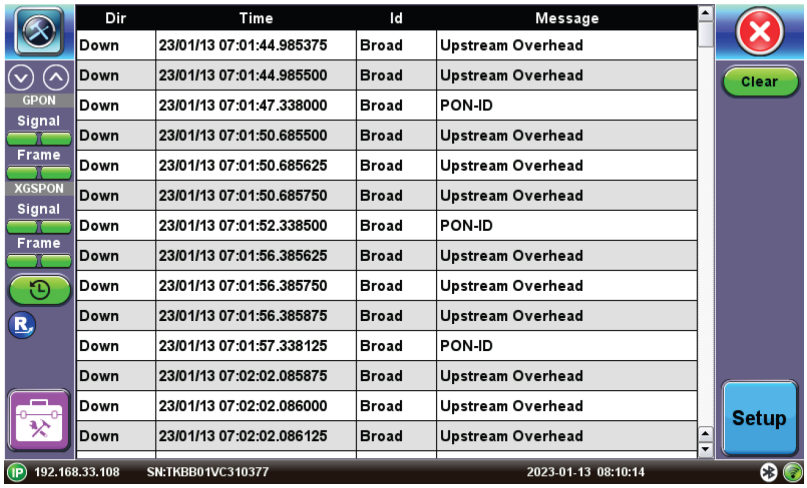
EPON/10G EPON ONT/ONU Active Devices

PLOAM Messaging Decoder

The PON tester captures and decodes downstream Physical Layer Operations, Administrations and Maintenance (PLOAM) messages between the OLT and ONUs/ONTs.



To see a list of PLOAM messages, tap **TOOLS** to access the Advanced Tools menu. Then, tap **PLOAM Decoder** or **XGS PLOAM Decoder**.



GPON/XG(S)-PON PLOAM Decoder

PLOAM displays the activation process showing the message exchange from OLT to ONT. Use the PLOAM messages to determine OLT commands to ONT including ONT disconnect commands, thus aiding in troubleshooting when the activation process fails.

Use **Setup** to filter out unwanted messages to streamline your work.

Use the scroll buttons on the side to help navigate and scroll through the messages. To navigate up, scroll up. To navigate down, scroll down.

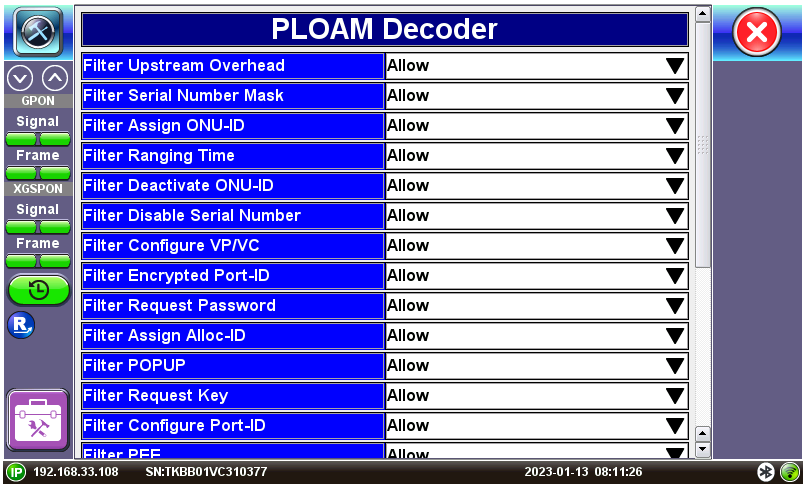
Tap **Clear** to clear the list or tap the message to see additional message details.

PLOAM messages can be filtered so only ones that are applicable are displayed. For more information on filtering, see "PLOAM Decoder Filtering" below.

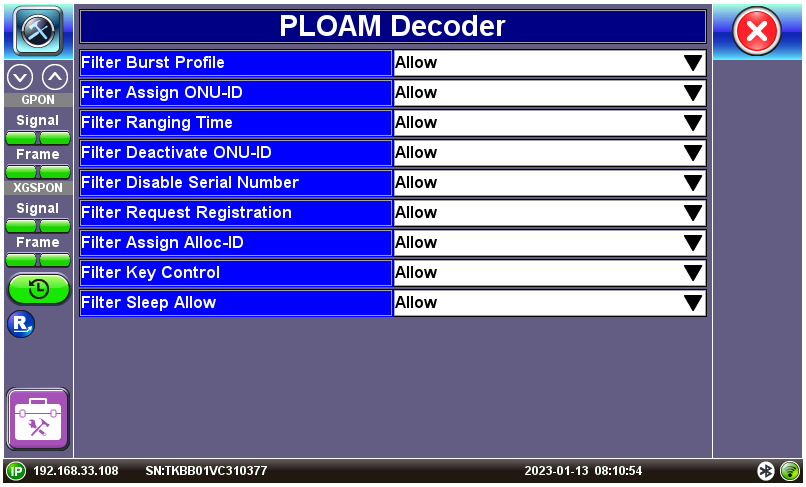
PLOAM Decoder Filtering

GPON/XG(S)-PON Advanced Tools includes test management and PLOAM Decoder Filter options.

Use the PLOAM Decoder Setup to allow or block certain messages to streamline troubleshooting.



GPON PLOAM Setup

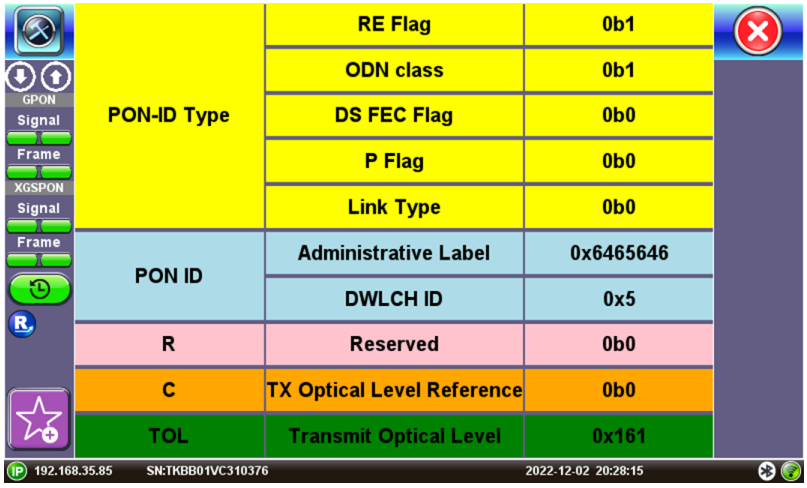


XG(S)-PON PLOAM Setup

OC Decode

The advanced OC Decode feature breaks down information that is sent from the OLT to help troubleshoot OLT information per ITU-T standards. Color-coded for visibility, it is broken down by PON-ID Type, PON ID, Reserved, TX Optical Level Reference, and Transmit Optical Level.

To see the OC Decode screen, tap **TOOLS** to access the Advanced Tools menu. Then, tap **OC Decode**.



OC Decode screen

Auditing/Rebuilding a Fiber Distribution Hub (SuperPM option)

Use the optional Splitter Analysis and Distribution Analysis features on the FX120 to do a full survey of a street cabinet by identifying all the ONTs by serial number and locating each ONT to each PON ID - both on the splitter side and on the distribution panel. The operator can fully update their database according to the field reality from one result file, fixing all the discrepancies caused by undocumented changes in the field. The process is secured with libraries and graphical display, limiting the risk of errors.

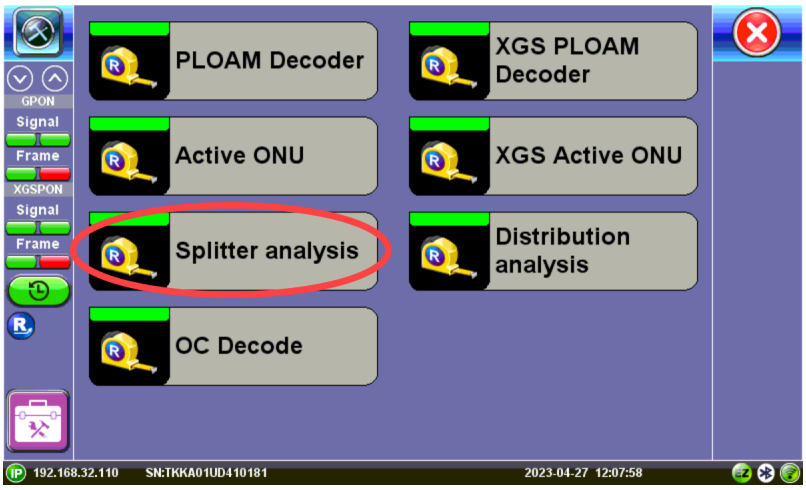
Each ONT can be bound to an operator when several operators share the same street cabinet, allowing a full audit.

Splitter Analysis (optional)

The optional Splitter Analysis provides a way to sync records with actual field results, so connection discrepancies that may be the result of undocumented changes can be repaired. The process is secured with libraries and graphical display, limiting the risk of errors.

Process

A connection from the FX120 OLT port to a free port (any) on the Splitter Panel allows the FX120 to monitor a copy of all signals happening on all ports. The test set listens to see if there is a signal (capturing the SSN/PID), no signal, or empty port.



To use the advanced Splitter Analysis feature:

1. Connect one end of the patchcord to the **FX120 To OLT** port and the other end of the patchcord to any free port on the **Splitter panel**.
2. On the **FX120**, press **Tools** to access the Advanced menu, and then tap **Splitter analysis**.
3. After entering a location, select the Panel Type profile being audited.

   If the Panel Type is not listed, speak to your regional sales team about importing a custom profile first before beginning the auditing process.
4. On the **FX120**, press **Start**.
5. On the **Splitter panel** starting at **position A01**, disconnect and reconnect the customer ONT port after 1-2 seconds. While the connection is under test three dots [...] are displayed.

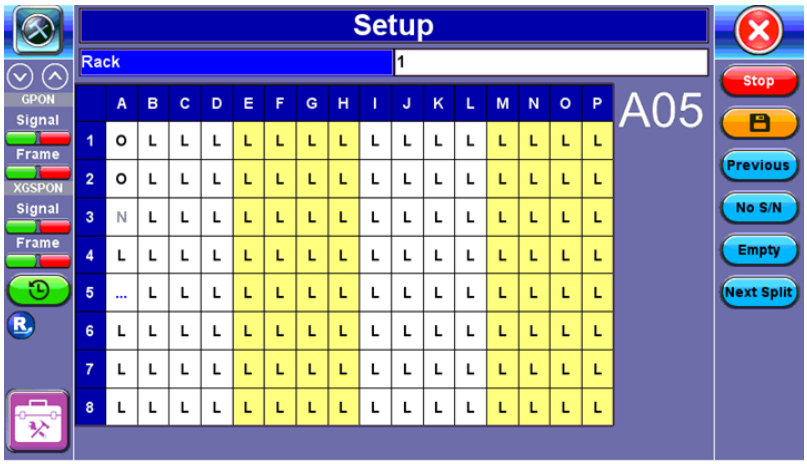
Do not disconnect the patchcord to the FX120 at any time so each port signal can be continuously scanned during the audit process.

6. Wait until a letter is displayed, then disconnect the customer patchcord from the splitter and connect it to the next customer port. If the port is empty, mark it **"Empty"** until the next occupied port is reached. If the port has a patchcord but no letter, mark the port as **"No SN"**. The FX120 will listen to and collect information associated with that port. It may take up to ten seconds for the OLT/ONT to restart the connection and the FX120 to detect the information exchanged between them.

   Check all positions to avoid incorrect information being captured.

7. After the scan is complete, press the **Stop** button to end the test, then **Okay** at the prompt. This generates a CSV file containing the information collected from the port scanning process, including Rack, Position (Port), SSN (if captured), and/or PON ID (if captured). This file can be used to compare to the PON network database. See "Working with Saved Results, Profiles, Images" on page 111 for details on exporting the CSV file.

   *At any point during the test, a restore point can be set by pressing the orange **Save** button. The analysis can then be resumed from the point at which it was saved. In the event of low battery or reboot, the unit will automatically create a restore point in which the analysis may be resumed as long as the location and panel type match.*



Splitter Analysis

Analysis Actions

Description	Action
To re-test the previous port	Press **Previous** to go back one port at a time. If multiple ports are skipped back, the scan process restarts from that point. *Stepping back more than one port at a time is not recommended because the sequential scan process restarts from the port that was skipped back to. For example, skipping back from E08 to E02 results in E03 – E08 needing to be rechecked sequentially to avoid incorrect information captured.*
To jump to the next splitter bank (in splitter analysis)	Press **Next Split**. The unit will mark all skipped positions in the current splitter bank L (empty) automatically and move to the next splitter bank.
To jump to the next port (in distribution analysis)	Press **Skip**. The unit will move to the next port automatically.
If no SSN is detected	Press **No S/N**.
If there is no patch cord connected	Press **Empty**.
To stop analysis	Press **Stop**. All ports not analyzed will be marked Empty automatically.
To manually create a restore point	Press the orange "**Save**" button. The analysis can then be resumed from the point at which it was saved. In the event of low battery or reboot, the unit will automatically create a restore point in which the analysis may be resumed, as long as the location and panel type match.

To save results to a CSV file	Press **Stop** to end the test, then **OK** at the prompt. This file can be used to compare to the PON network database.

Position Indicators

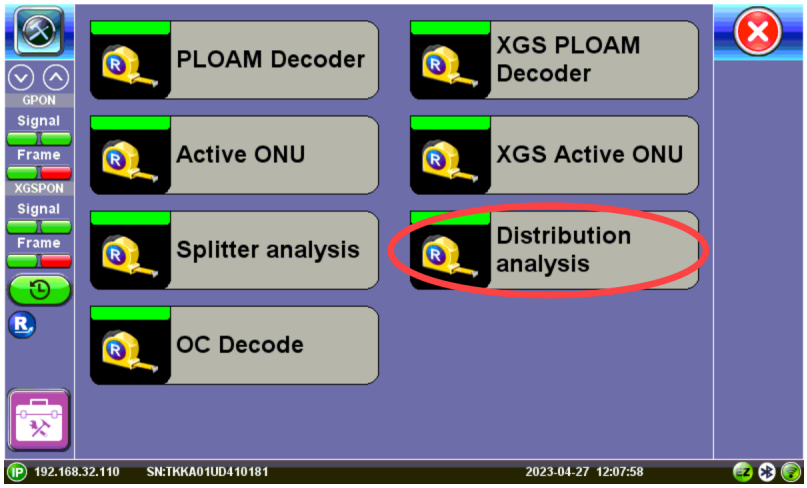
Port Position Indicator	Meaning	Action
...	The FX120 is waiting to detect a change in the received signal for that position.	Disconnect and reconnect the patchcord from the port position on the ODP panel after 1-2 seconds. It may take up to ten seconds for the OLT/ONT to restart the connection and the FX120 to detect the information exchanged between them.
O	The SSN Serial Number and/or PON-ID has been captured.	No action needed. The unit will move to the next port automatically.
N	No SSN Serial Number was detected.	After a few seconds, press **No S/N**. The unit will then move to the next port automatically.
L	Empty port. This could be the default or manually set. When scanning ports for the first time, all positions are L by default because the unit assumes they are all empty.	Press **Empty**. The unit will then move to the next port automatically.
X	Skipped port	If needed, skip a port and recheck later, so no misinformation is collected.

Distribution Analysis (optional)

Use the optional Distribution Analysis to help perform a cabinet audit and realign the splitter to ensure proper connection. Both the ONT and OLT ports on the FX120 are used.

Process

The patchcord connected between the FX120 OLT port and the splitter should remain after scanning splitter ports. Use another patchcord to connect the FX120 ONT port and the ODF (Distribution frame) port(s). The test set listens to see if there is a signal (capturing the SSN/PID), no signal, or empty port.



To use the advanced Distribution Analysis feature:

1. Keep the connection from the **FX120 To OLT** port to the Splitter (any free port) and connect another patchcord from the **FX120 To ONT** port to the customer port on the **ODF** by swapping out the customer patchcord.
2. On the **FX120**, press **Tools**to access the Advanced menu, and then press **Distribution analysis**.
3. After entering a location, select the Panel Type profile being audited.

   If the Panel Type being audited is not listed, speak to your regional sales team about importing a custom profile before beginning the auditing process.
4. On the **FX120**, press **Start**.

5. On the **ODF**, beginning at **position A01**, swap out the customer ONT patchcord with your FX120 ONT patchcord. The FX120 will listen for a re-establishment of connection from the OLT to the ONT. While the connection is under test three dots [...] are displayed.

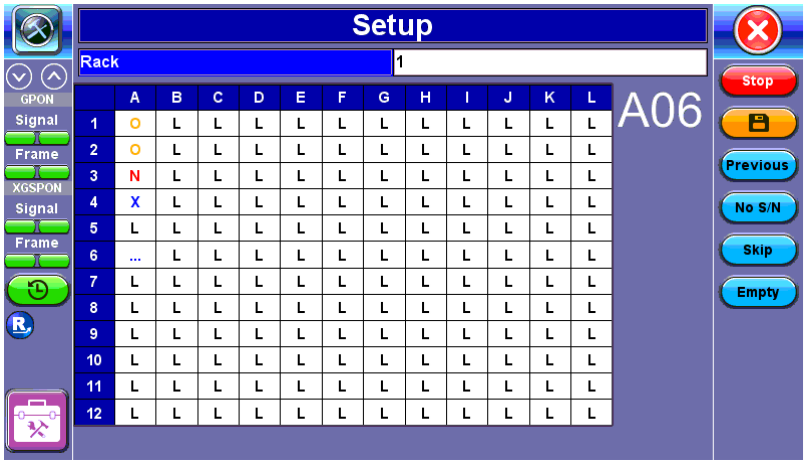
   Do not disconnect the FX120 OLT patchcord at any time so each port signal can be continuously scanned during the audit process. Disconnecting the customer ONT patchcord will briefly disrupt the customer connection.

6. Wait until a letter is displayed, then disconnect the FX120 ONT patchcord from the customer port, reconnect the customer patchcord, and move the patchcord to the next customer port on the ODF. If the port is empty, mark it **"Empty"** until the next occupied port is reached. If the port has a patchcord but no letter, mark the port as **"No SN"** or **"Skip"**.The FX120 will listen to and collect information associated with that port. It may take up to ten seconds for the OLT/ONT to restart the connection and the FX120 to detect the information exchanged between them.

   Check all positions to avoid incorrect information being captured.

7. After the scan is complete, press the **Save** button to generate a CSV file containing the information collected from the port scanning process, including Rack, Position (Port), Cable Color, SSN (if captured), Level, and/or PON ID (if captured). This file can be used to compare to the PON network database. See "Working with Saved Results, Profiles, Images" on page 111 for details on exporting the CSV file.

   *At any point during the test, a restore point can be set by pressing the orange **Save** button. The analysis can then be resumed from the point at which it was saved. In the event of low battery or reboot, the unit will automatically create a restore point in which the analysis may be resumed as long as the location and panel type match.*



Distribution Analysis

Analysis Actions

Description	Action
To re-test the previous port	Press **Previous** to go back one port at a time. If multiple ports are skipped back, the scan process restarts from that point. *Stepping back more than one port at a time is not recommended because the sequential scan process restarts from the port that was skipped back to. For example, skipping back from E08 to E02 results in E03 – E08 needing to be rechecked sequentially to avoid incorrect information captured.*
To jump to the next splitter bank (in splitter analysis)	Press **Next Split**. The unit will mark all skipped positions in the current splitter bank L (empty) automatically and move to the next splitter bank.
To jump to the next port (in distribution analysis)	Press **Skip**. The unit will move to the next port automatically.
If no SSN is detected	Press **No S/N**.

If there is no patch cord connected	Press **Empty**.
To stop analysis	Press **Stop**. All ports not analyzed will be marked Empty automatically.
To manually create a restore point	Press the orange "**Save**" button. The analysis can then be resumed from the point at which it was saved. In the event of low battery or reboot, the unit will automatically create a restore point in which the analysis may be resumed, as long as the location and panel type match.
To save results to a CSV file	Press **Stop** to end the test, then **OK** at the prompt. This file can be used to compare to the PON network database.

Position Indicators

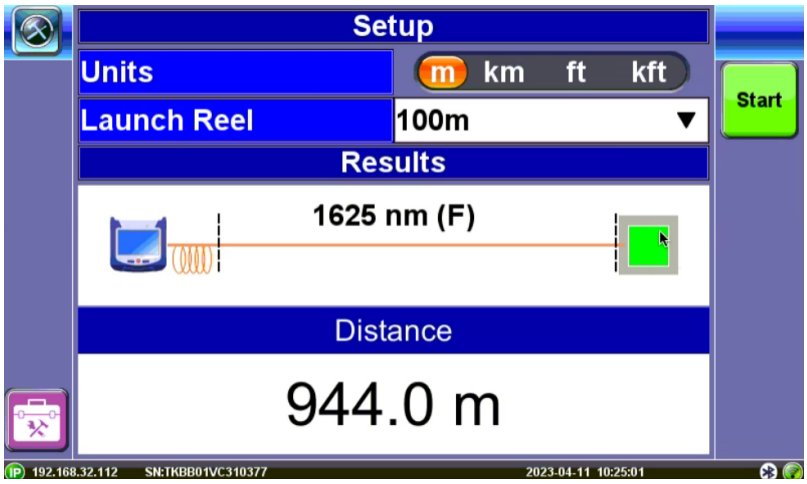
Port Position Indicator	Meaning	Action
...	The FX120 is waiting to detect a change in the received signal for that position.	Disconnect and reconnect the patchcord from the port position on the ODP panel after 1-2 seconds. It may take up to ten seconds for the OLT/ONT to restart the connection and the FX120 to detect the information exchanged between them.
O	The SSN Serial Number and/or PON-ID has been captured.	No action needed. The unit will move to the next port automatically.
N	No SSN Serial Number was detected.	After a few seconds, press **No S/N**. The unit will then move to the next port automatically.
L	Empty port. This could be the default or manually set. When scanning ports for the first time, all positions are L by default because the unit assumes they are all empty.	Press **Empty**. The unit will then move to the next port automatically.
X	Skipped port	If needed, skip a port and recheck later, so no misinformation is collected.

Fault Locator

When measuring short fibers links and drop cable fibers for PON, 5G roolout, FTTx, LAN/WAN, and CATV applications, use the optional built-in Fault Locator to find the end of the fiber (or up to the first event). Ensure cable length is correct for fibers with a measuring range between 10 m to 20 km.

To measure using the auto fault locator:

1. Select the unit of measurement.
2. If using a launch fiber, select the length from the Launch Reel drop-down.
3. Tap **Start**.



Fault Locator

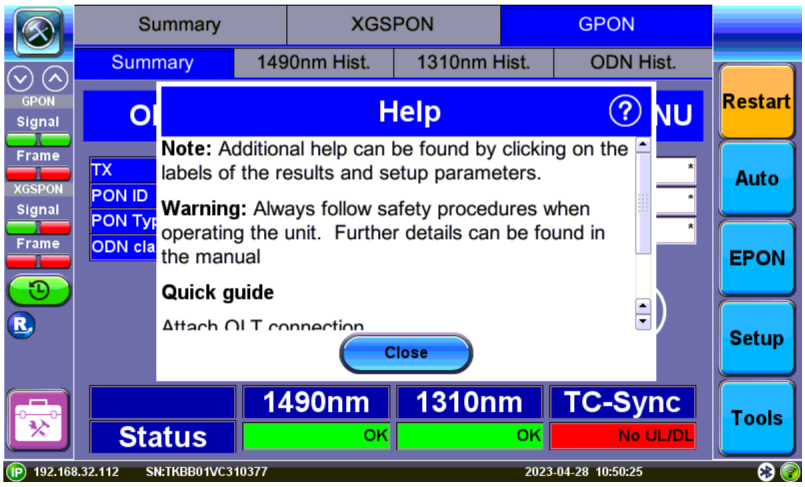
If measurement is in **green**, the test is complete.

If measurement is in **red**, the fiber length is too short or too long.

**factory-installed option*

Screen Help

For information on how to use the in-line help feature, tap the question mark on the screen. A Help box pops up. Tap the labels of the setup parameters or results to view specific explanations.



Help displayed

EPON/10G-EPON Testing

EPON testing uses Ethernet *packets* instead of the *ATM cells* that GPON uses. Additionally, EPON testing follows IEEE standards.

Testing EPON networks is similar to testing GPON/XG(S)-PON networks. The FX120/FX120 Lite should be inserted at the customer premises between between the ONU/ONT and the last splitter in the ODN.

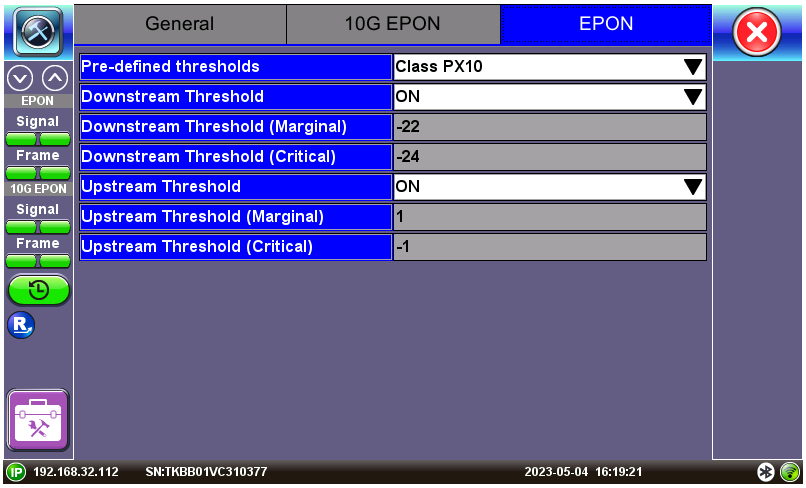
Do NOT connect the FX120/FX120 Lite between the OLT and splitter.

EPON/10G-EPON Key Features

- Low loss, pass-through mode for ONT/ONU verification
- Measures 1490/1577 downstream & 1310/1270 upstream
- Displays MAC address from OLT
- Displays ONU LLID, ONU MAC, and ONU Status
- Time stamped histogram function for level monitoring
- Low reflectance, SC/APC Interfaces for ONU/OLT test ports
- TC-Sync per IEEE
- Pre-defined Thresholds or User defined

EPON/10G-EPON Test Procedure

1. Power on the FX120/FX120 Lite test set. The unit connects to any network it finds, recognizes the type of network and performs tests using built-in thresholds that follow IEEE protocols and standards. Starting/stopping/restarting measurements from the OPM menu (see OLT Information Table) starts/stops/resets items in the OPM Summary screen - the power level graphs and the Active ONU list in **Advanced Mode**. To clear the PLOAM list, go to the respective PLOAM menu and press the clear button.
2. Tap on **Setup** and configure the test profile settings according to EPON IEEE Test standards.

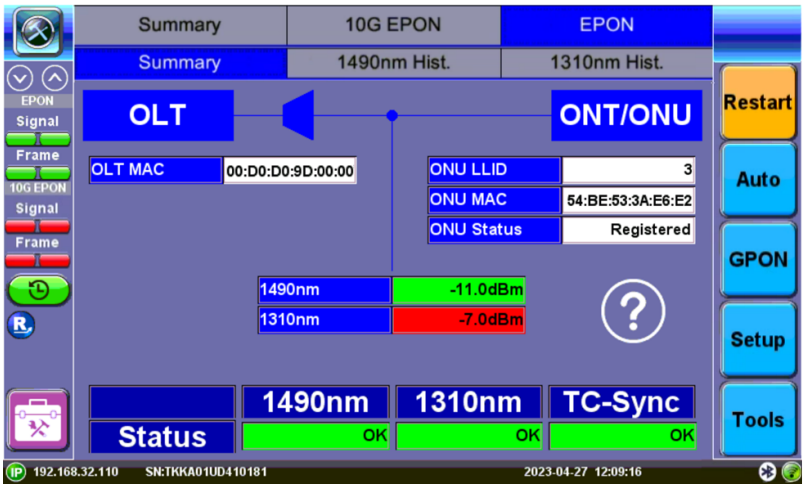


EPON Setup menu

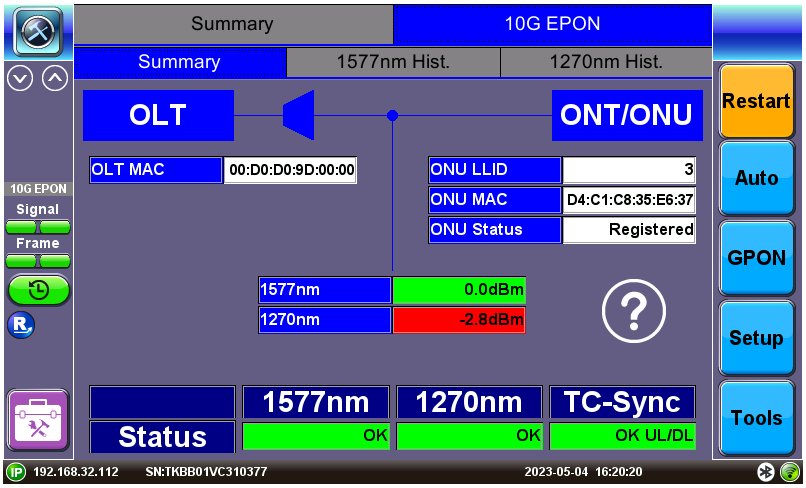
3. Inspect and clean the FX120/FX120 Lite test ports. Inspect and clean the fiber patch cord from the OLT and insert it into the FX120/FX120 Lite OLT test port.

***Warning**: Never look directly into the beam of an active optical source as this may result in harmful eye damage from radiation exposure.*

4. If 1490/1577nm light is detected, the 1490/1577nm **Status** will display **OK**. Verify that the measured 1490/1577nm signal level is green (see " OPM Test Mode" on page 39).



EPON Summary Screen

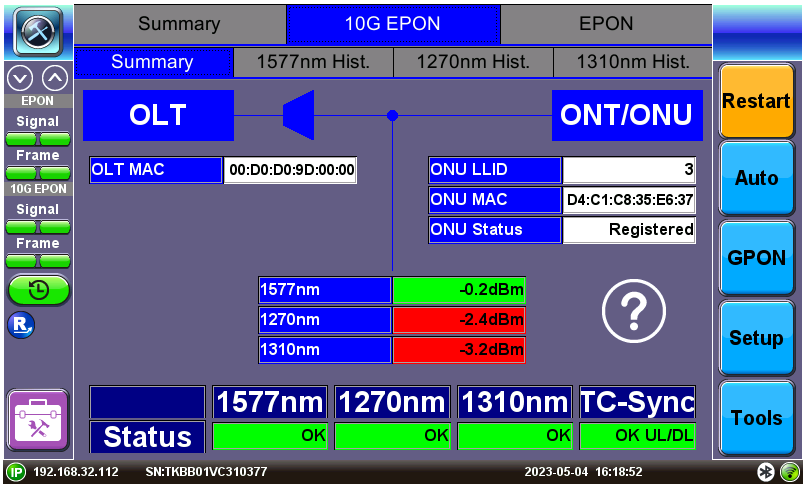


10G EPON Symmetric Summary Screen

5. All DS LEDs should turn from red to Green. If any LED remains red, clean and inspect the connectors again as specified in **Step 4** (see "GPON/EPON LED Status Indicators" on page 41).

EPON/10G EPON Upstream/Downstream LED Status

6. Inspect and clean the patch cord connectors that will connect FX120/FX120 Lite to ONU/ONT and the ONU/ONT test port.
7. Connect the FX120/FX120 Lite to the ONU/ONT test port. If 1310/1270nm light is detected, the Status will display **OK**. Verify that the measured 1310/1270nm signal level is green (see " OPM Test Mode" on page 39).



10G EPON Asymmetric Summary Screen

8. All US LEDs should turn from red to green. If any LED remains red, clean the ONU connections again as outlined in **Step 6**.
9. Confirm TC-Sync status displays **DL**. If you are not able to achieve TC-Sync, contact VeEX Inc. Support.

Synchronizing the FX120/FX120 Lite with the ONU Activation Process

The FX120/FX120 Lite will synchronize to the downstream frame (from the OLT) provided the OLT is operational and 1490/1577nm signal level is good. The downstream frame synchronization indicator should occur almost immediately.

In order to synchronize with the ONU, the FX120/FX120 Lite needs to see the ONU registration process. Therefore, only connect the ONU AFTER the FX120/FX120 Lite application is already running. Otherwise, unplug and replug the ONU the ONU after the FX120/FX120 Lite application is running if the ONU is already connected to the FX120/FX120 Lite.

If the OLT and an active ONU are connected to the FX120/FX120 Lite before starting the test application, the FX120/FX120 Lite will not see the ONU activation and the above process will not be completed. In this instance, LOF will be reported for the upstream side; no ONU ID or ONU S/N information on the OPM results page will be displayed.

EPON Thresholds

		PX10	PX20	PR10	PR20	PR30
ONU Site	**Upstream ONT TX**	-1 to	-1 to	+3 to +8	+3 to +8	+4 to +9
ONT Site	**Downstream ONT RX**	-24 to	-27 to	-27 to -8	-27 to -8	-28 to -9

Ethernet

Setup

Ethernet Home Menu

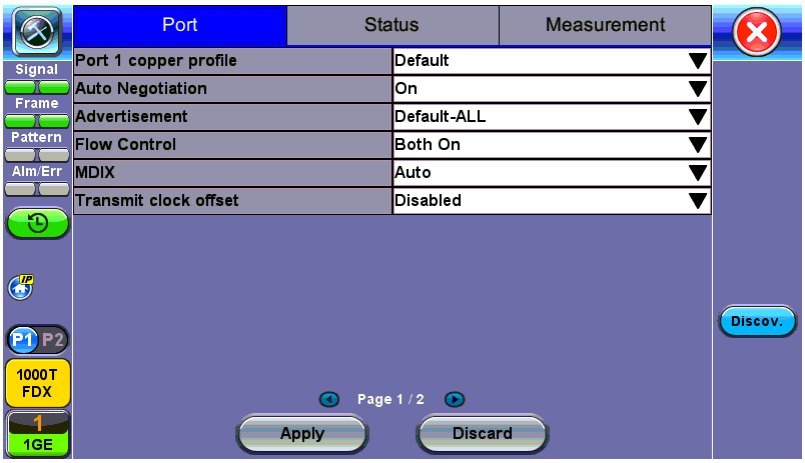
When the soft LEDs are steady green, this indicates that the module is ready to perform different tests. This may require turning the **LASER On** button for optical interfaces or tapping the **History** tab to clear blinking LED reminders of past Errors and Alarms (test results are not affected).

Ports

Port setup or test interface configurations are accessed via the **Setup** menu located on the Home page. The available configuration settings depend on the interface selected in the Test Mode selection.

Select the operation mode and the interfaces that will be used to carry out tests. Once the operating mode and interfaces are selected, independently configure the auto-negotiation, speed, duplex, and flow control settings for each port (where applicable).

After configuring settings, tap **Apply** to save changes. Tap **Discard** to revert to previous selections.



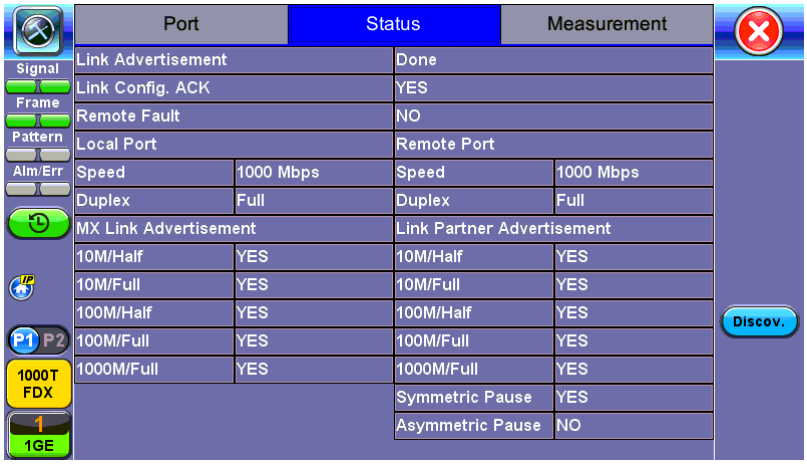
100/1000Base-X Port Setup

100/1000Base-X and 100/1000Base-T Port

- **Auto Negotiation:** On or Off. Matches the test set's negotiation settings to those of the link partner
- **Speed** *(only when Auto Negotiation is Off for 100/1000T)*: 10 Mbps, 100 Mbps, or 1000 Mbps
- **Duplex** *(only when Auto Negotiation is Off):* Half or Full
- **Advertisement** *(only when Auto Negotiation is On for 100/1000 Base-T)*: Default-All or Custom. Custom options include 10/100/1000M/Half or 10/100/1000M/Full.
- **Flow Control:** TX On, RX On, Both On, or Off
    - When flow control is On, the test set will respond to pause frames received by the link partner by adjusting the transmit rate
    - When flow control is Off, the test set ignores all incoming pause frames from the link partner and continues transmitting at the configured transmit rate
- **Clock Offset** *(1000 Mbps only)*: The frequency may be offset in parts per million

- **MDIX** *(100/1000Base-T only):* **Off, On, or Auto.** When MDIX is set to Auto, the test set detects the required cable connection type and configures the port connection properly for interfacing the partner device, eliminating the need for crossover cables.
- **Transmit clock offset** *(100/1000Base-T only)*: Disabled or Enabled. Due to hardware limitation, transmit clock offset is only valid when PHY is working on Master mode. Clock offset measurement is only valid when PHY is working on Slave mode.
    - **PHY working mode**: Master or Slave.
- **Transmit Ignore Link Status**: On/Off
- **Synchronous Ethernet (SyncE)**: Disabled or Enabled. When Enabled, makes the signal traceable to an internal or external reference clock.

Status



Status tab for 10/100/1000Base-T

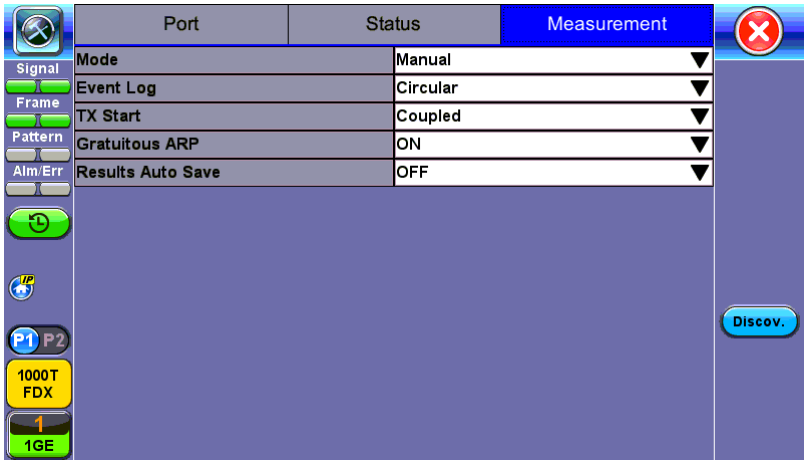
The **Status** tab lists current port settings. Please note that the Status tab is only available if a fiber port option is selected from the **Test Port Selection** menu.

10 GE Port

- **10GE Mode:** LAN or WAN
- **WIS Mode** (only available in WAN mode): SDH or SONET
- **Flow Control:** Enable chosen as default option

- **Clock Offset (ppm):** The frequency may be offset in parts per million
- **Link Fault Response:** Disable or Enable (also enables Local link and failure, remote, failure)
- **Transmit Ignore Link Status:** On/Off
- **Synchronous Ethernet**: (SyncE) Disabled or Enabled. When Enabled, makes the signal traceable to an internal or external reference clock.

Measurement Settings



Measurement Setup

The measurement and event log settings are configured in this screen.

- **Mode:** Manual, timed, or auto mode are available.
  - **Manual mode:** Starts and stops the measurements manually.
  - **Timed mode:** Defines the duration of the test; after the test is started, the test will run for the configured duration and stop automatically.
- **Event Log**: Logs up to 1000 event entries. If there are more than 1000 events,
  - **Circular** keeps the latest entries. The oldest entry will be deleted so that the new event can be added.
  - **Blocked** stops recording new events after 1000 entries. The latest entries will not be logged.

- **TX Start:** Separated or Coupled. Configures how the measurements are started when in BERT and Multiple Streams test modes.
    - **Separated:** Independent control (Start/Stop) of the transmitter is enabled. At the start of the test only the receiver is turned on -- the user must start the transmitter manually.
    - **Coupled:** Transmitter and receiver are turned on at the same time, and the Tx and Rx measurements start at the same time at the start of the test.
- **Clock (ToD) Synchronization Device:** Disable, GPS, 1PPS, Local, Atomic 1PPS. Select the device to be used to synchronize the clock to perform the One Way Delay measurement.

When a device is selected the following fields can be seen on the screen:

- **External Clock Input**: 1pps (SMA Port). The SMA Port must be used for the 1pps signal.
- **UTC ToD**: Displays the Coordinated Universal Time (UTC) Time of Day once it is acquired.
- **Clock Sync Time**: Time field to configure the UTC ToD that both test sets, carrying out a one-way delay test between each other, will be synchronizing their internal time stamping at.

Both test sets must be configured to the same Clock Sync Time.

Clock Synchronization is not supported on all the test set models. Check with customer care for availability.

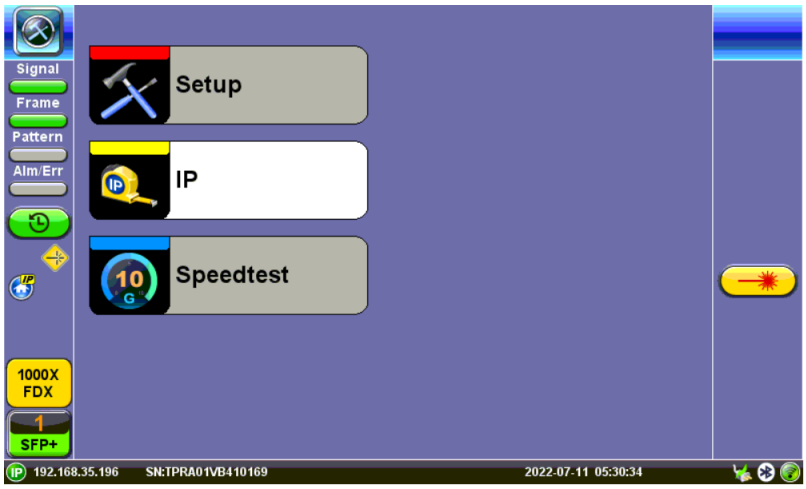
- **Gratuitous ARP**: ON or OFF. If set to ON, a gratuitous ARP is performed. When the test port has an IP connection, an ARP request will be transmitted at regular intervals to keep the router/gateway ARP table aware of the test set's IP address. This setting is useful for long-term L3 routed testing.
- **Results Auto Save**: ON or OFF. If set to ON, results will be saved automatically.

IP

IP Connection

Port setup and IP connection are required prior to performing the following Ethernet applications: Ping, Trace Route, Web/FTP, ARP Wiz, VoIP, IPTV testing, and 1388v2 (except Layer 2).

Tap **IP** from the Ethernet home menu to access Port and IP settings.



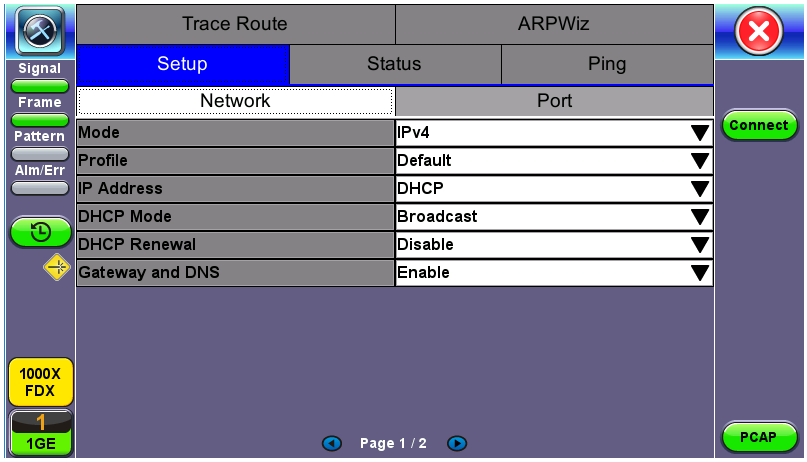
IP menu option

Setup

Select **PPoE**, **IPv4**, or **IPv6** from the **Mode** menu.

Point-to-Point Protocol over Ethernet (PPoE)

- **Authentication:** PAP, CHAP, or CHAP & PAP.
- **VLAN:** Off or 1 Tag.
- **ID:** VLAN ID. Enter value 0 to 4095.
- **Pri:** VLAN priority 0 to 7.
- **DNS:** Selecting Manual DNS opens another menu. Select from Off, Primary, or Primary & Secondary. Enter the Primary and/or Secondary DNS if required.



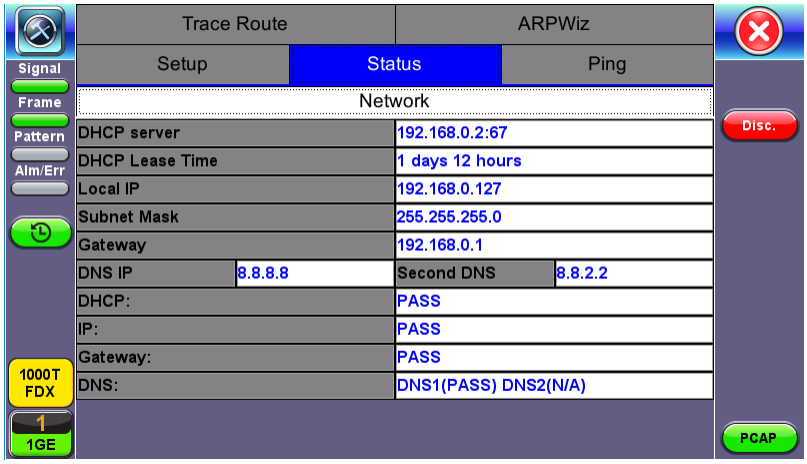
IP Setup - IPv4

IPv4 or IPV6

- **IP Type:** IPv4 or IPv6
- **Profile:** Delete, Save, Save as ..., Default
- **IP Address:** Static, DHCP (IPv4 only) or AUTO (IPv6 only)
- **Static:** Enter a Local IP, Gateway address, and Subnet. All Static fields can be filled by tapping on the section to access an alphanumeric keyboard.
    - **Local IP:** IPv4/IPv6 address of the test set
    - **Gateway:** IPv4/IPv6 address of the network gateway
    - **DNS:** Input a primary and secondary DNS.
    - **CIDR** (IPv6 only)**:** Enter a Classless Inter -domain Routing Network.
    - **Subnet** (IPv4 only)**:** Enter a subnet mask.
- **Gateway and DNS:** Enable/Disable. Enables entering the Gateway and DNS.
- **VLAN:** Off, 1 Tag, 2 Tags. For each VLAN tag, enter the following:
    - **ID:** VLAN ID. Enter value 0 to 4095.
    - **Pri:** VLAN priority 0 to 7.

Status

Ensure the Status is **PASS** before continuing with any IP tests. If the connection fails, go back to the setup screen to verify that the parameters are entered correctly. Verify that the Ethernet cable is properly connected on the management port on the left hand side of the unit.

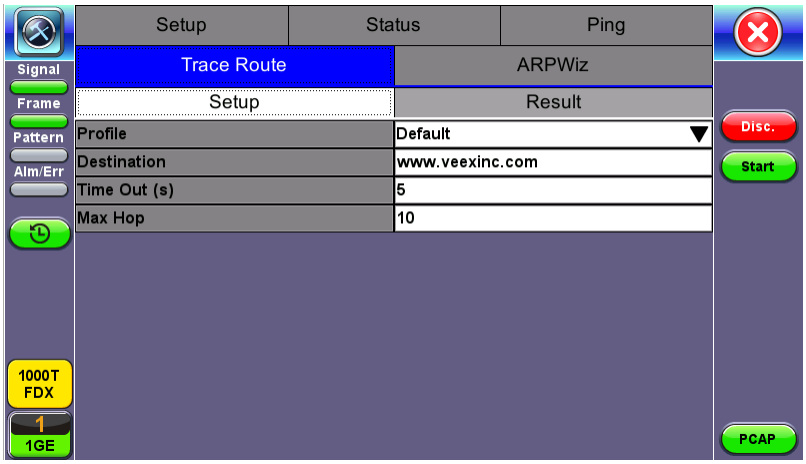


PASS Status

- **DHCP:** PASS indicates that an IP address has successfully been assigned.
- **IP:** PASS indicates that the IP address assigned has been verified to be unique in the network.
- **Gateway:** PASS indicates that the gateway IP address is valid.
- **DNS:** PASS indicates that the DNS IP address is valid.

Trace Route

Trace Route is a common method used to find the route to the destination IP address or URL. It is often used to identify routing problems and unreachable destinations. All the remote IP addresses and their response times are displayed indicating possible network congestion points.



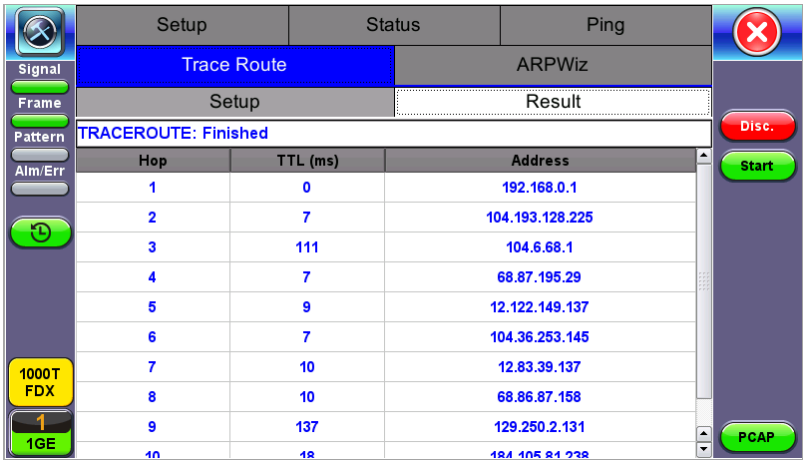
Trace Route - Setup

Trace Route Setup

The following setup selections are available:

- **Profile:** Delete, Save, Save as..., Default. Select Default to recall a trace route file or create a new test.
- **Destination:** Enter the IP address or URL of the network device to be detected.
- **Time Out:** Enter the maximum time allowed between an ICMP echo and response at each hop.
- **Max Hop:** Enter the maximum number of network devices the packet is allowed to transit.

Once the parameters are configured, press **Start** to begin the test.



Trace Route - Results

Results

- **Hop:** Order of the routers on the route
- **TTL:** Time to reach each router on the route
- **Address:** Address of each router on the route

If there is no response from a particular hop, an asterisk will be displayed.

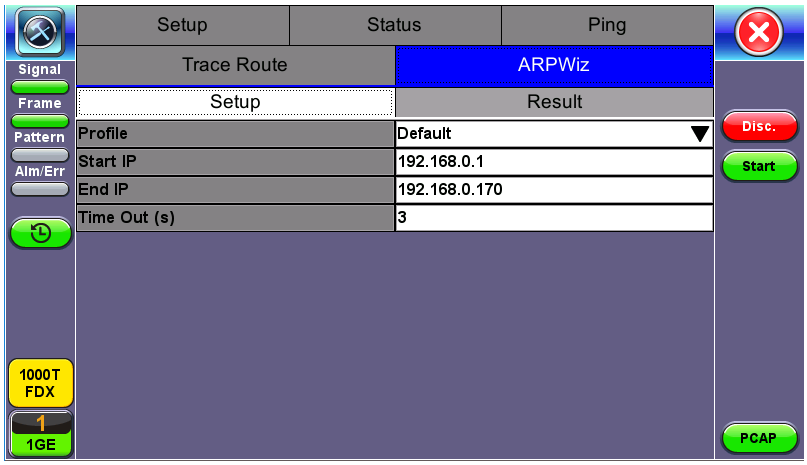
ARP Wiz

ARP Wiz uses the Address Resolution Protocol (ARP) to verify the status of each IP address in a user-selectable IP range. ARP is the standard method for finding a host's hardware address when only its network layer address is known. In other words, ARP is used primarily to translate IP addresses to Ethernet MAC addresses. ARP is defined in RFC826.

ARP Setup

Configure the following parameters and press **Start**. The test will continue to run until **Stop** is pressed. A finished status indication will display when the test finishes.

- **Profile:** Default, Delete, Save, or Save As...
    - **Start IP:** Starting IP Address
    - **End IP:** Ending IP Address
    - **Time Out(s):** Range from 1-99 seconds. Input using the numeric keypad.

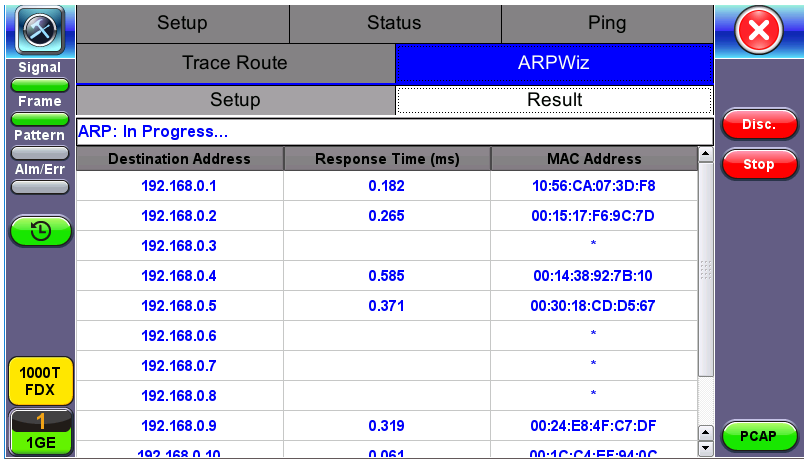


ARP Wiz Setup

ARP Result

The MAC addresses associated with active IP addresses in the range are displayed. If no MAC address is associated with the IP address, a **FAILED** status is displayed.

ARP Wiz uses the ARP protocol and can only work within the same subnet as the IP address provided to the test set in IP Status.



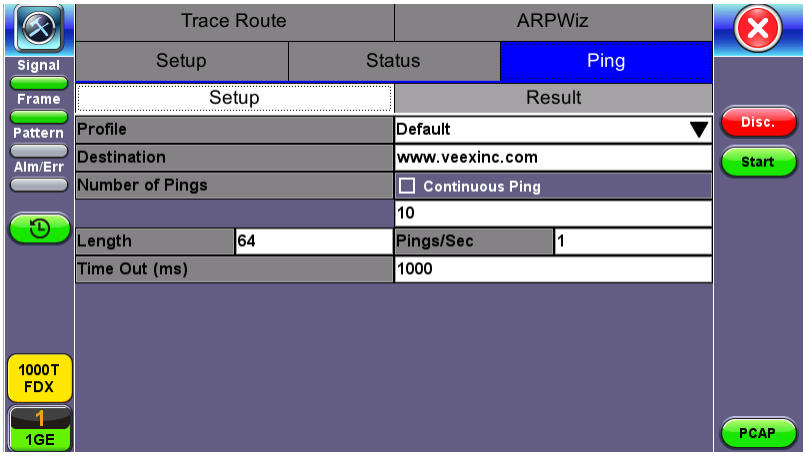
ARP Wiz Result

Ping

The Ping Result provides the number of Sent, Received, Unreach, Missing, and the Round Trip delay.

Ping Testing

Ping is a popular computer network tool used to test whether a particular host is reachable across an IP network. A ping is performed by sending an echo request or ICMP (Internet Control Message Protocol) to the echo response replies.



Ping Setup

Ping Setup

- **Profile:** Delete, Save, Save as..., or Default
- **Destination:** Press the drop -down menu and enter the destination IP address or URL to ping.
- **Number of Pings:** Enter the number of ping attempts (up to 10000) that will be performed to reach the network device.

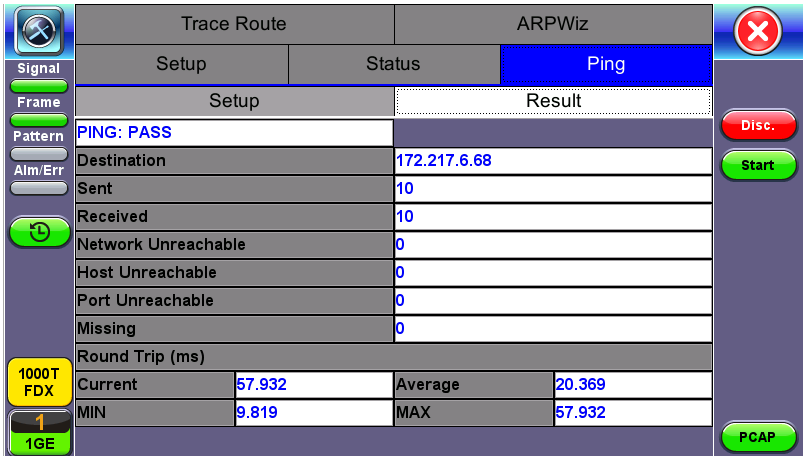
  *If Continuous Ping is selected, the user is not required to enter the number of pings. The test set will continuously ping the target host until the user presses **Stop**.*

- **Length:** Enter the length of the ICMP echo request packet transmitted.
- **Ping/Sec:** Enter the Ping repetition rate (Ping/second).
- **Time Out:** Time-to-Live (TTL) in milliseconds. Enter the maximum time allowed (in ms, up to 99999 ms) between an ICMP ping and echo response.

Once the parameters are configured, press **Start** to begin the test.

Ping Results

Pressing **Ping** will take you to the **Result** tab and start the Ping test.



Ping Result

- **Destination:** Destination IP address
- **Ping status:** In Progress, PASS, or FAIL
- **Sent, Received, Unreach, Missing:** Number of pings sent, received, unreached or missing. A Ping is counted missing if no response is received before timeout. A Ping is counted unreached if an echo response is received with host unreachable set.
- PING also estimates the **Round-Trip** time in milliseconds.
    - **Current:** Current time for a Ping request to be answered
    - **Average:** Average time recorded for a Ping request to be answered
    - **Max:** Maximum time recorded for a Ping request to be answered
    - **Min:** Minimum time recorded for a Ping request to be answered.

Layer 4+ Applications

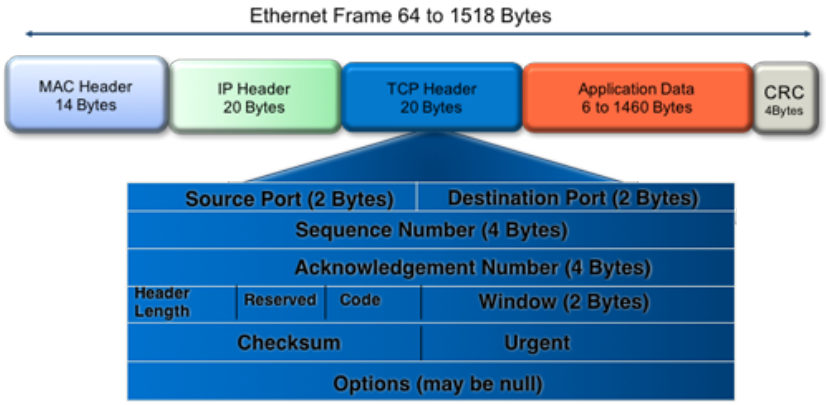
Layer4+ refers to the Internet layers 4 and above (transport and application layers), which are more closely related to the customers/subscribers' applications and the way they use Ethernet, the Internet, and how they perceive performance (quality).

Stateful TCP testing refers to the validation of TCP connections used for the TCP/IP Protocol Stack. A V-Perf test will validate that the TCP parameters in the network were set up correctly. The optional V-PROBE is used as remote server to establish TCP connections and validate that the network is configured correctly for seamless passing of TCP traffic. It will also verify the maximum throughput for TCP traffic. Typically in the field, after running layer 2 & layer 3 tests successfully, a customer may still complain that their connection is slow to deliver their applications. Running a stateful TCP test will help verify maximum throughput rates in the download and upload direction. If throughput performance is poor, the test can help identify what the issue could be.

TCP Protocol and Overview

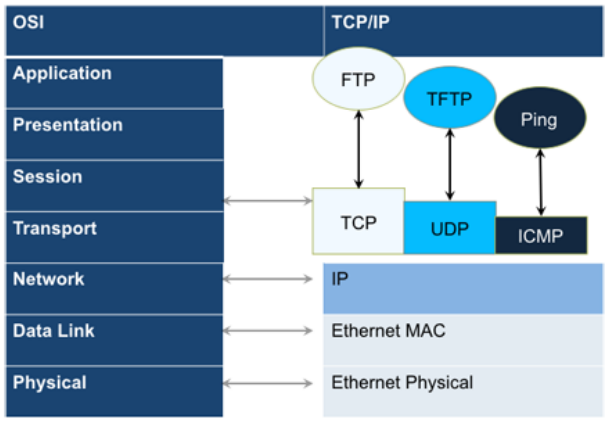
Fundamental TCP parameters are the ideal TCP Window Size and Throughput. The complete list of relevant measurements include:

- TCP Window Size
- TCP Throughput
- Number of Connections Established
- Download Time
- File Transfer Size
- Retransmits



Transmission Control protocol is the most widely used transport layer protocol. TCP is used by most application protocols: HTTP, FTP, Telnet. It provides the following services:

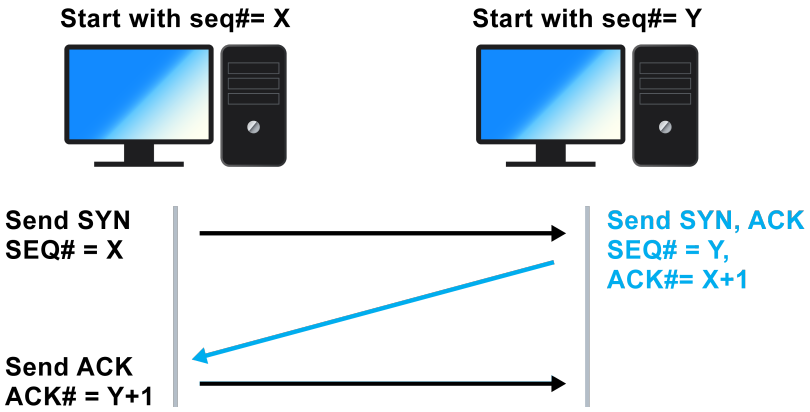
- End-to-end connection
- Multiplexing/Demultiplexing of separate sessions
- Flow control



TCP is a connection-oriented protocol. A Connection is established prior to data transmission between the two end devices (client and server). A 3-way handshake procedure is used to establish connection.
When a connection is established, the data transfer can start. TCP uses sequence numbers to reassemble data and verify that no data has been lost.

TCP uses the Window mechanism for Flow Control:

1. The Sender indicates in the Window size the data it is prepared to receive.
2. The **Window size** is the amount of outstanding data that can be sent before acknowledgment is received.
3. If data is lost, the window size is decreased and less data is sent prior to acknowledgment.



- **Step 1:** Client sends a SYN message with SYN flag set in the TCP header. The Sequence number specifies the number assigned to the first segment.

- **Step 2:** Server receives SYN packet and sends SYN + ACK packet SYN flag set, ACK flag set Sequence number specifies the server's starting sequence number. Acknowledgment number means that the server has received X and expects X+1.

- **Step 3:** Client receives SYN + ACK and send ACK back. ACK number means that server has received Y and expects Y+1.

RFC 6349 Testing Methodology

RFC 6349 is a practical testing methodology consisting of 4 different steps for measuring end-to-end TCP Throughput and Performance in a managed IP network.

- **Step 1 Max MTU Search**:

  Search for the maximum packet length that can be sent through the network without segmentation. The Path MTU search follows RFC4821 (Packetization Layer Path MTU Discovery).

- **Step 2 Round Trip Time (RTT) Search**:

  Measure of the round trip time between the TCP segment sent and the acknowledgment received, the test has to be done in a network that is not congested to obtain the real round trip delay (not accounting for network buffer delay).

- **Step 3 Bottleneck Bandwidth (BB) Search**:

  For this step, a Layer2/3 test can be done (RFC2544 or Y.1564) to determine the maximum throughput rate supported by the network.

- **Step 4 Bandwidth Delay Product Calculation**:

  Based on RTT and BB results, the BDP is computed to estimate the optimal window size that should be used for testing (Auto mode). Fixed window size can also be specified.

Key Metrics:

- TCP Bandwidth Delay Product
- Transfer Time Ratio
- TCP Efficiency
- Buffer Delay

TCP Bandwidth Delay Product is the theoretical maximum of data that can be transmitted based on network delay and throughput rate.

$$\text{BDP (Bytes)} = \text{Link Bandwidth (bps)} \times \text{RTT (s)}/8$$

To completely occupy the available bandwidth the Window size must be set to the BDP value.

The ideal TCP transfer time is based on the Maximum achievable TCP transfer rate, calculated based on the Bottleneck Bandwidth (BB) and the layer 1-2-3-4 overheads associated with the network path. The actual TCP transfer time measures the time it takes to transfer data.

$$\text{Transfer Time Ratio} = \text{Actual TCP Transfer Time} \,/\, \text{Ideal TCP Transfer Time}$$

Link Speed	MAX Achievable TCP Throughput	Ideal TCP Transfer Time (rounded)
100Mbps Ethernet	94.9 Mbps	9 s
1G Ethernet	949.2 Mbps	1 s
10G Ethernet	9492.2 Mbps	0.1 s

Example of an ideal TCP transfer time based on a 1500 Bytes size MTU and 100MB file download

TCP retransmission is done when TCP segments are lost during transmission or an acknowledgment is missing. Segments can be retransmitted more than once.

There is no direct correlation between the number of Ethernet frames lost at the physical layer and the number of TCP retransmission, since a single lost acknowledgment could trigger many retransmission.

$$\text{TCP Efficiency} = \text{Transmitted Bytes} + \text{Retransmitted Bytes}/\text{Transmitted Bytes} \times 100$$

The Buffer Delay represents the increase (or decrease) in Round Trip Time (RTT) during a TCP throughput test compared to the baseline RTT.

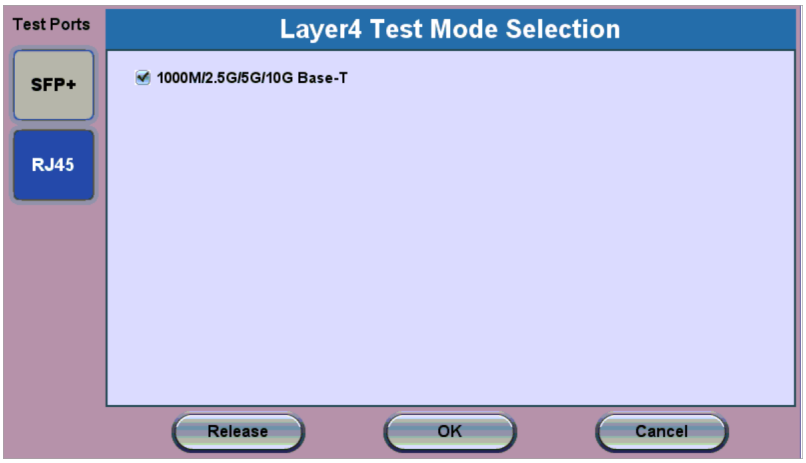
A large RTT Buffer delay indicates that the network is experiencing congestion and that segments are being delayed.

$$\text{Buffer Delay} = \text{Average RTT} - \text{Baseline RTT}/\text{Average RTT} \times 100$$

Configuration

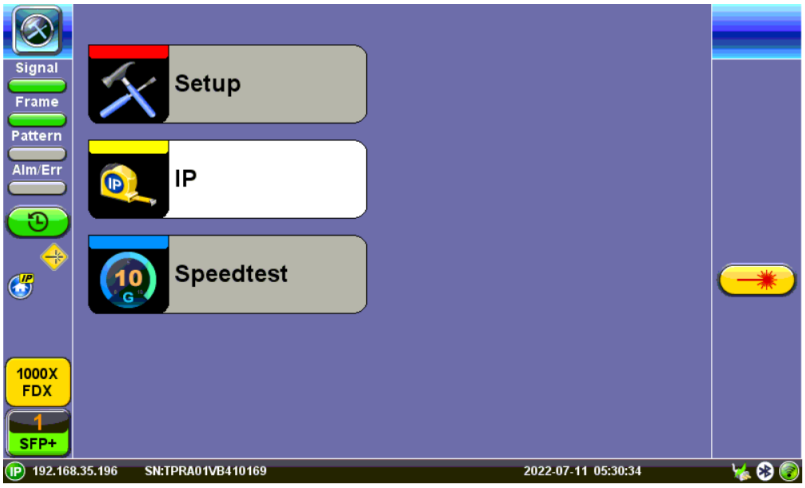
Before launching V-Perf, V-Test, or V-FTP tests, it's necessary establish an IP connection. For V-Perf testing, repeat these steps for both the far end and near end test sets.

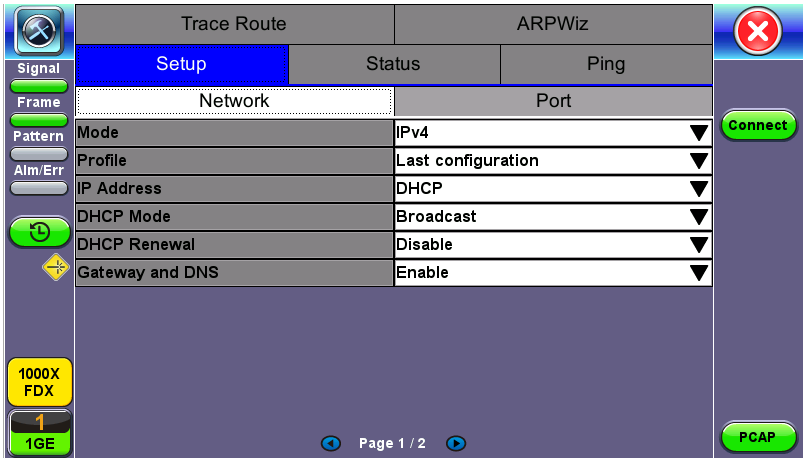
1. Select a Layer 4 test application to launch from the Test Mode menu.



2. For testing on SFP ports, turn the **laser on**.

3. Tap the **IP** icon. Configure a static IP address for testing. If the environment supports DHCP, select DHCP from the IP Address menu, then tap **Connect**.





4. Once the proper IP information is entered, press **Connect**. An **IP: PASS** status indicates proper connection.
5. Go to **Layer 4+ Applications**. The test application will load.

For more information about IP Connections, refer to "IP" on page 76 .

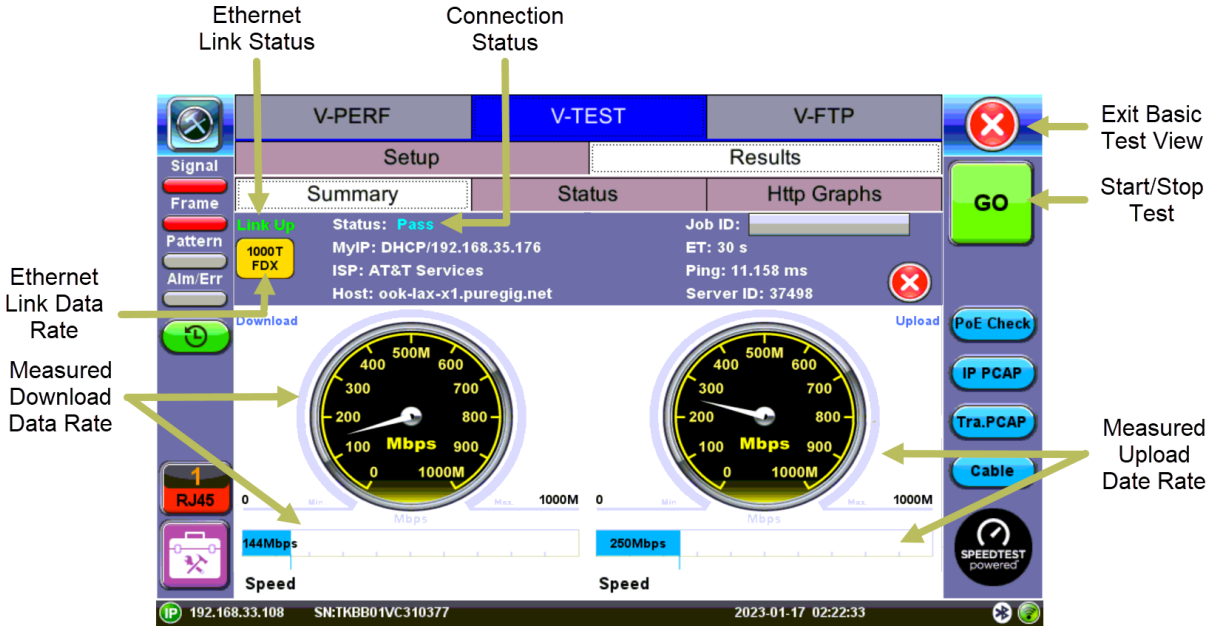
Saving Test Results

Test results can be saved to the File Server using the **Save** hard key. Results can be retrieved via USB drive or remotely using the Web UI. Refer to "File Manager" on page 110.

V-TEST

The V-TEST feature qualifies network TCP/HTTP protocol performance by testing Internet speeds up to a full line rate against a server to verify the maximum download and upload data rates attainable by subscribers' high-speed or Gigabit Internet services.

Run a Speed Test



V-TEST

Press GO to run the Internet speed test.

After pressing GO, the test set does the following:

1. Identifies the internet service provider (ISP) and searches for the closest Ookla Speedtest® server, based on round-trip response times.
2. Runs the Internet speed test for the Download direction (from server to test set), then the Upload (from test set to server) and displays the results.
3. Once finished, the GO button will turn back to green. It is ready to save the results and/or run more tests.

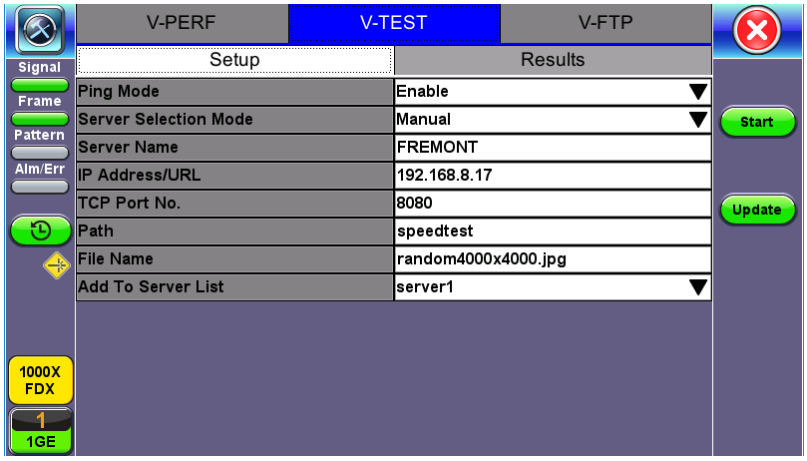
ISP & Sponsored Server Selection Modes

V-TEST or Speedtest® verify/certify the **Internet Access** data rates which are the rates advertised by the Internet (access) Service Provider (ISP), from the customer's premises to the point of entry to the Internet. For that reason, the selection of the centralized speed test server is very important.

Before starting the Download and Upload throughput tests, the test set pings nearby servers, then it generally selects the one that has the fastest ping response. However, all the nearby Ookla® servers would be a combination of ISP-owned or sponsored servers, and some other servers that are hosted by independent companies, which may reside outside of the footprint of the ISP providing the service. Testing to a server that is not owned/sponsored by the ISP may not guarantee reliable test results, since the server has not been vetted by the ISP providing the service.

Turning the **ISP/Sponsor Match** setting **ON**, instructs the test set to prioritize the server search for servers that are sponsored by the ISP and select one of these servers for testing. If no ISP-sponsored servers are found, then the test set would carry out its normal search for the fastest ping-response server.

Managed Server Tests



Server Named *FREMONT* Can Be Added to *server1*

Creating New Server Profiles and Server Lists

1. From the **Setup** tab, select **Manual** from **Server Selection Mode**.
2. The different tabs provide access to detailed test Results (Summary, Status, Graphs), Setup (manual configuration), and offers buttons for direct access to other related troubleshooting test tools.

To return to PON testing, select select  >  .

Toolbox Menu - PON option

More about Advanced V-TEST Modes

Server Selection Modes

- **Ookla® Speedtest®**

Speed Test Modes

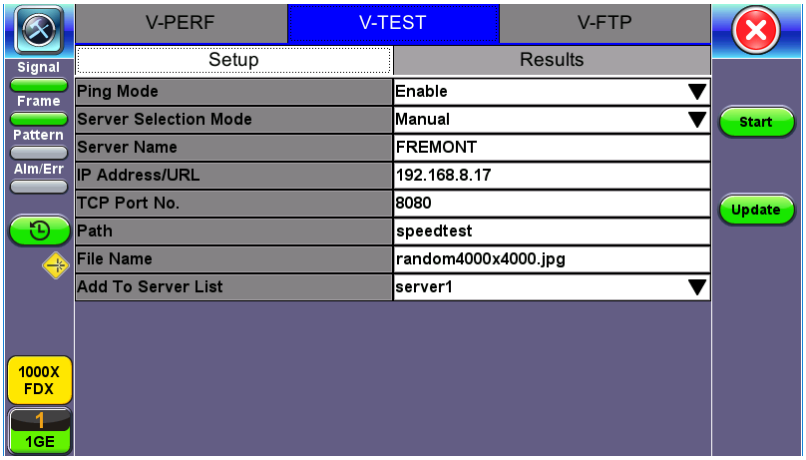
Auto Mode: This is the default and recommended mode, and it is also known as "Speedtest Powered" mode. It automatically selects the best speedtest.net server from lists maintained by Ookla. It will scan nearby servers in the local market and test to the server with the fastest (lowest latency) response.

Manual Mode: Manually select a specific Server ID from a list of public Ookla servers. A list of all nearby servers is displayed automatically. The corresponding server ID and server information (URL/IP, location, and ISP) are also provided.

- **VeEX Managed** – Perform internet speed tests by manually selecting servers from lists created and maintained by VeEX. These non-public lists are created for specific customers. The **Update** button is used to update the servers' list. Internet access is required to receive the server lists maintained by VeEX.

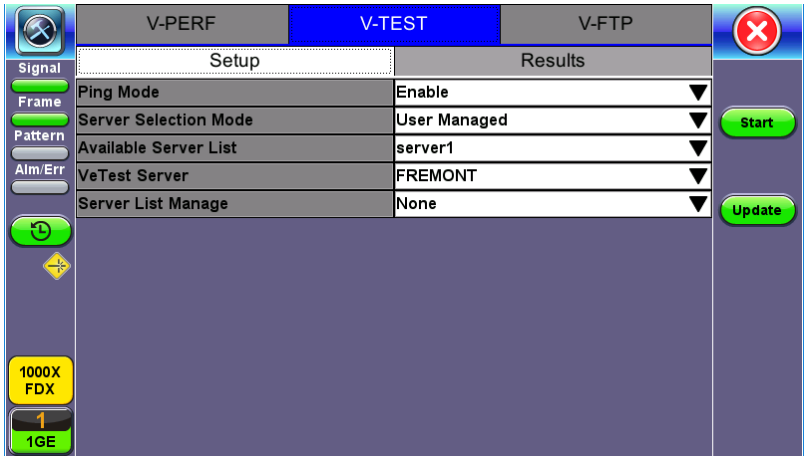
- **User Managed** – Advanced users can perform internet speed tests by manually selecting servers from pre-configured lists, using the Manual mode. In User Managed mode, enter the server IP/URL and save it to a server list that can be maintained and managed on its own. Options to modify or delete server lists are available under **Server List Manage**.
- **Manual** – Advanced users, with detailed knowledge of their Speedtest servers, can manually add their own servers, test files and maintain their own server lists. Enter the IP/URL of the server to test. If TCP port number 8080 is used, there is no need to enter a Path and File name. Port 8080 is used by Ookla netgauge servers, therefore the proper Speedtest handshaking will take place between the test set (client) and Ookla server. If TCP port number 80 is used, the correct Path and Filename need to be entered.

3. Tap **Update** and select a file to transfer. The **File Name** and **Path** will populate into the field. After setting up the new server profile, tap the **Add To Server List** drop-down menu. **Save as new** creates a new server list and adds the current server profile to that list. The option to add the profile to an existing server list is also available.



Server Named *FREMONT* Can Be Added to *server1*

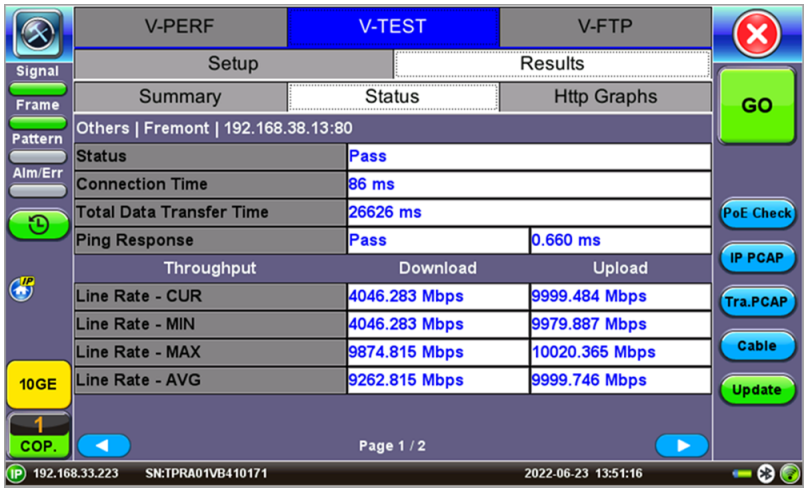
4. Server profiles and server lists created from here are available in **Server Selection Mode** > **User Managed**.



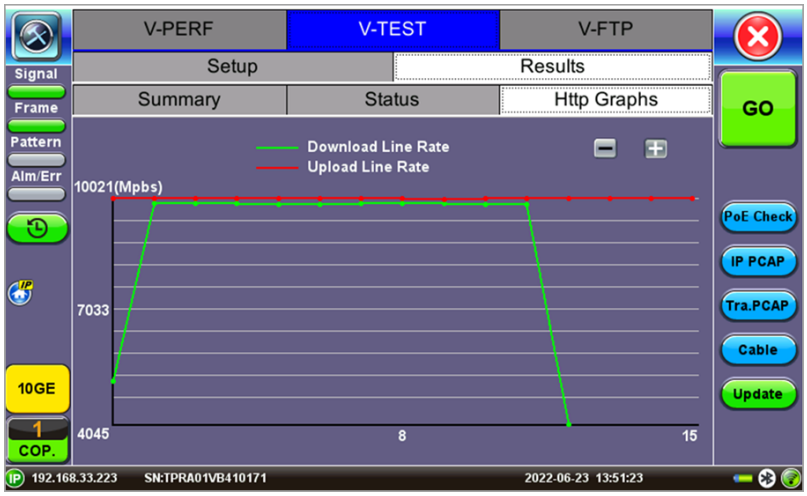
***FREMONT* and *server1* appearing in User Managed**

Starting a V-TEST

Select a server from User Managed or VeEX Managed. Enabling Ping mode simultaneously runs a Ping test. Ping Response results will appear under the Results tab. Tap **GO** to initiate testing. The download test starts first, followed by the upload test.



V-TEST - Results - Status



V-TEST - Results - Http Graphs

More about Link Statuses

Link Status Indicator Labels

A yellow status box will be displayed when the link has been properly established with the port under test and it is considered active.

10GE: 10 Gbit/s, 10GBASE-T copper interface (RJ45 UTP) or 10GBASE-X optical interface (LC-UPC duplex)

5GE: 5 Gbit/s, 5GBASE-T copper interface (RJ45 UTP) or 5GBASE-X optical interface (LC-UPC duplex)

2.5GE: 2.5 Gbit/s, 2.5GBASE-T copper interface (RJ45 UTP) or 2.5GBASE-X optical interface (LC-UPC duplex)

1GE: 1 Gbit/s, 1GBASE-T copper interface (RJ45 UTP) or 1GBASE- optical interface (LC-UPC duplex)

1000T: 1 Gbit/s, 1000BASE-T copper interface (RJ45 UTP)

100T: 100 Mbit/s, 100BASE-T copper interface (RJ45 UTP)

10T: 10 Mbit/s, 10BASE-T copper interface (RJ45 UTP)

FDX: Full Duplex

HDX: Half Duplex

UTP: Unshielded Twisted (copper) Pairs cable

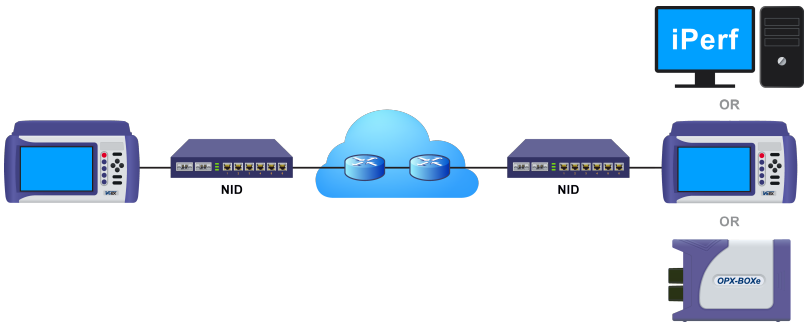
V-PERF

TCP/UDP-based business Internet speed performance test based on RFC6349 and compatible with RTU-300 hardware-based centralized test heads as well as iPerf and iPerf3 servers.

A common source of customer complaints come from file transfer speeds not matching the throughput rates guaranteed in the SLA. While many factors affect TCP applications performance, including customer's operating system hardware performance and settings (TCP window size), carriers need to prove SLA with a test tool that can show TCP performance independent of Operating System or Server limitations and present repeatable reliable results. The test set V-PERF feature uses RFC6349 test methodology and metrics for qualifying network TCP or UDP performance. It offers a full line rate stateful TCP test with configurable window sizes, client and server modes as well as compatibility with iPerf servers.

The V-PERF test suite consists of the full TCP Throughput test Compliant with RFC6349 (Test Set to Test Set only) and also the original stateful TCP testing to iPerf/iPerf3 server or to our V-Probe.

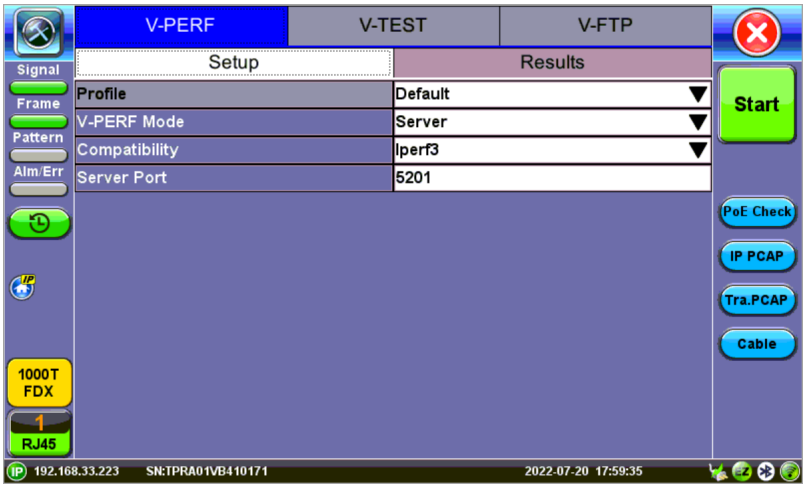
- Stateful TCP Test up to 10GE line rate
- TCP Client/Server and Bi-Directional modes
- Compatible with iPerf Client/Server
- MTU search per RFC4821
- Round Trip Time Measurement
- Configurable TCP Window
- Multi-Window size tests
- Measurements: TCP Throughput rate (min, max, average), Transfer file size and duration, Transfer time ratio, TCP Efficiency %, Buffer Delay %



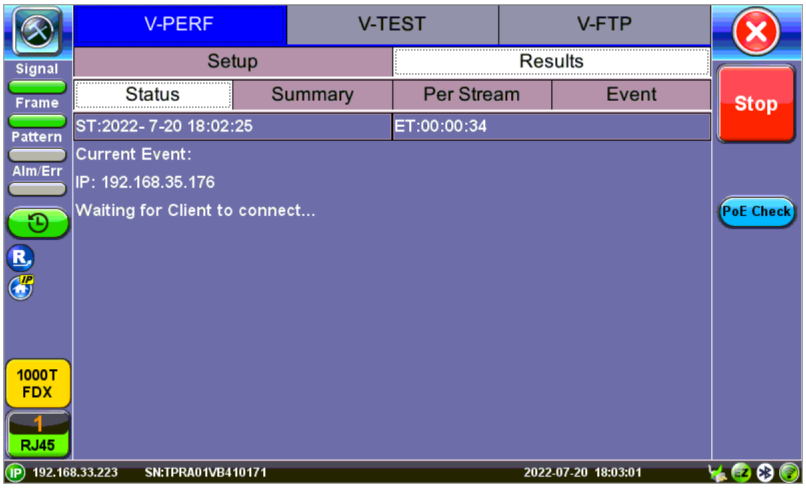
TCP Throughput Test Diagram

Server/Client - Unidirectional Configuration and Results

1. After loading the Layer 4+ Application, set one test set as a Server from **TCP Mode**. Press **Start**.

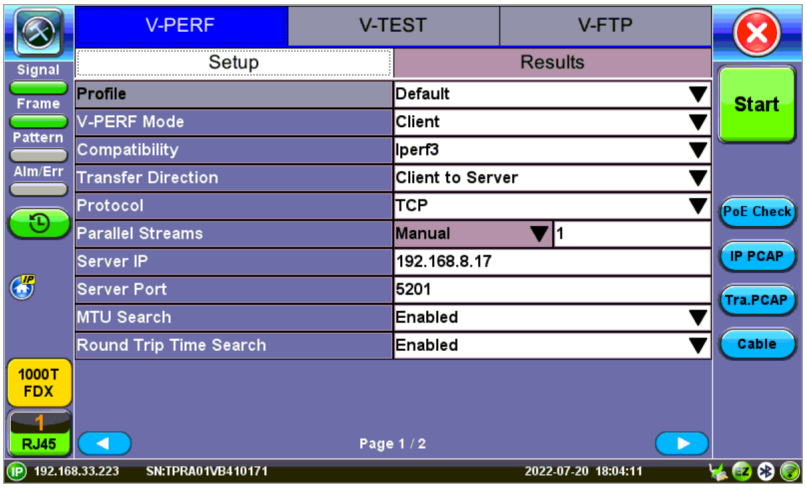


Test Set #1 - V-PERF Setup - Server



Test Set #1 After Pressing Start - Server Mode

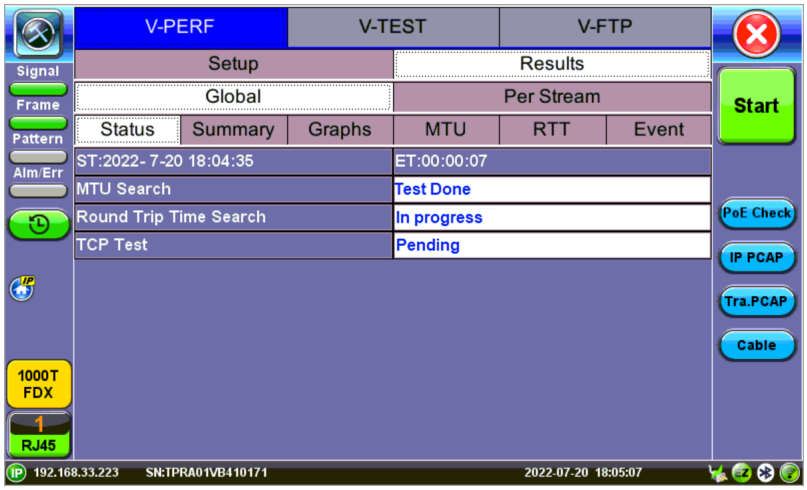
2. Set the other test set as a Client for **FTP Mode**. On the bottom of the screen, go to **Page 2** to configure the Throughput Test Mode type. MTU Search, Round Trip Time Search, Bottleneck Bandwidth, and Window Size options are also on Page



Test Set #2 - V-PERF Setup - Client

3. Connect the two test sets to the Near End (NE). Press **Start** on the Client unit.

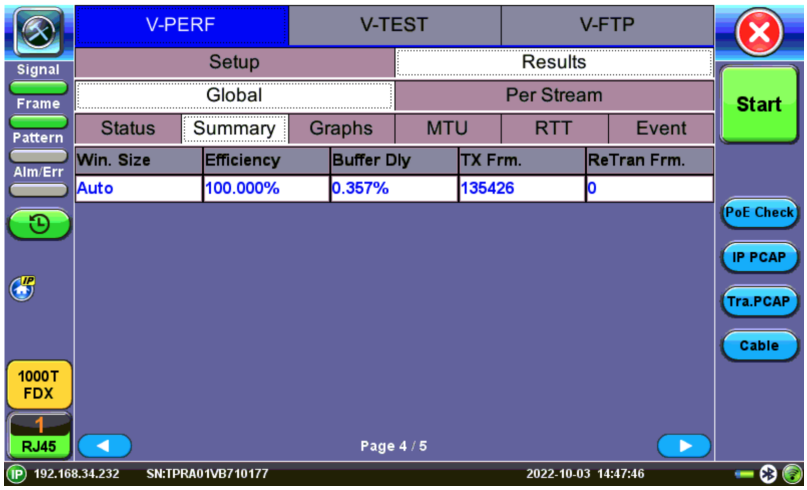
Status: Global



Client - Results - Status

The **Status** tab displays test progress and pass/fail results for MTU Search, RTT Search, and TCP Test.

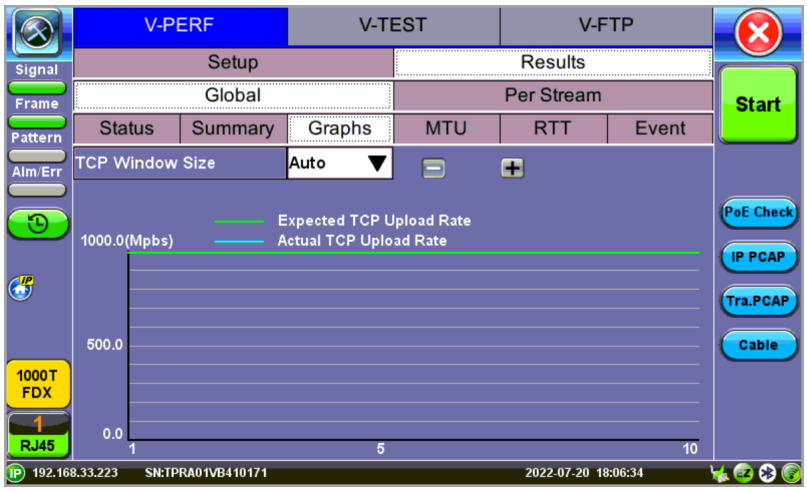
Summary: Global



Client - Results - Summary

The **Summary** tab displays test progress and pass/fail results for RFC 6349 measurements.

Graphs: Per Stream



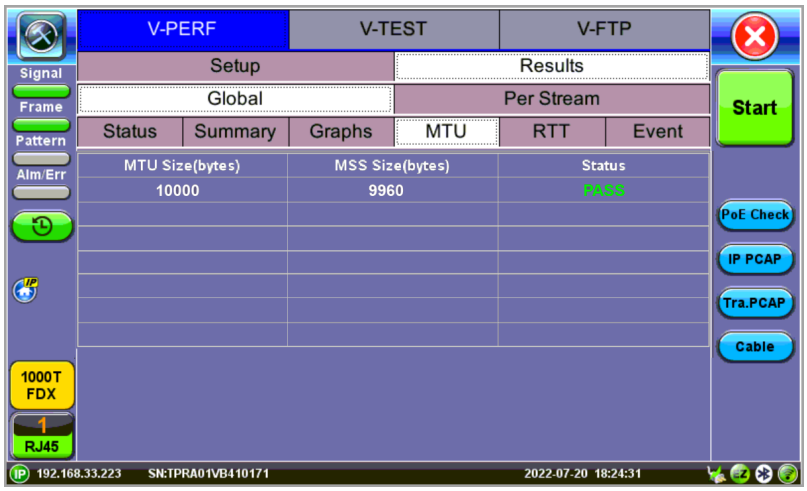
Client - Results - Per Stream TCP Graphs

Graphs compare the Expected TCP Upload Rate with the measured TCP rate for all tested window sizes. Graph display options can be modified in the following ways:

- Change the Mbps range with the - and **+** buttons.
- Display all window sizes on one graph or individual window sizes using the drop-down menu.
- View the legend for each color-code line measurement with **Lines Color**.

MTU and RTT: Global

MTU and **RTT** measurements are displayed in their respective tabs.



Client - Results - MTU

Event: Global

The **Event** tab displays the time and date for each event that occurs during testing.

Per Stream

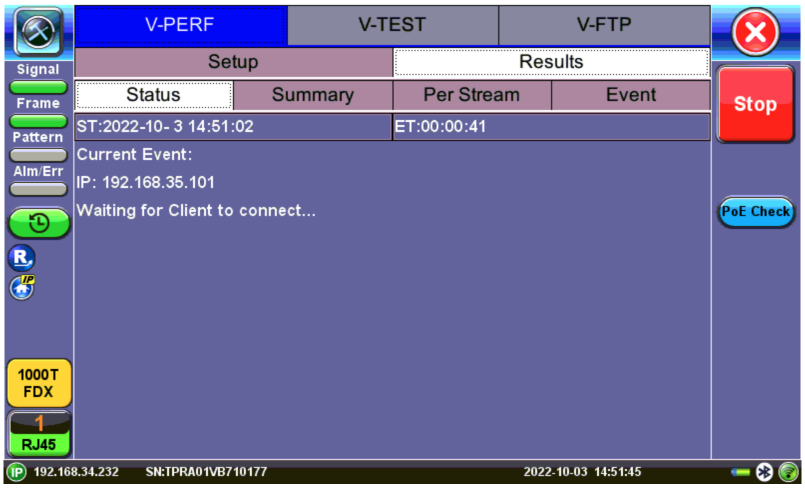
Per Stream results display the TCP results for each stream.

TCP Status displays test progress and pass/fail results for RFC 6349 measurements identical to the Summary (Global Results) tab.

TCP Graphs displays per stream graphs identical to the Graphs (Global Results) tab.

Server Results

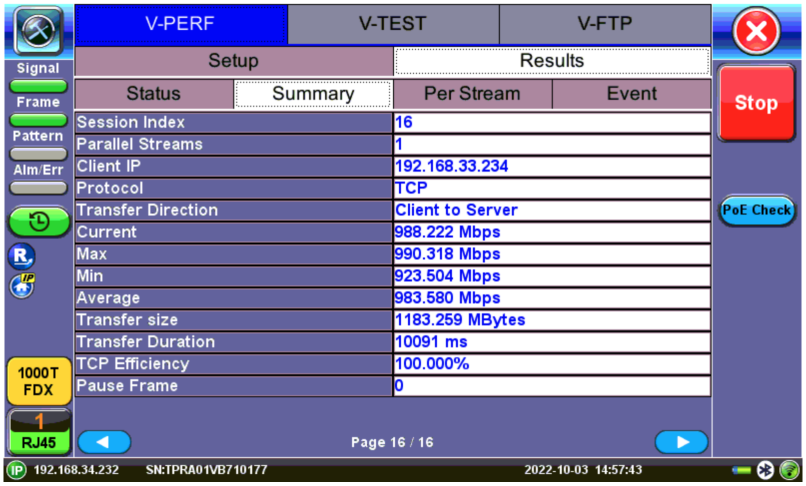
The **Status** tab displays the Client IP and current test event.



Server - Results - Status

Summary Results

The **Summary** tab displays information on the current session and the RFC-6349 key performance indicators. Summary results per stream are viewable in the **Per Stream** tab.



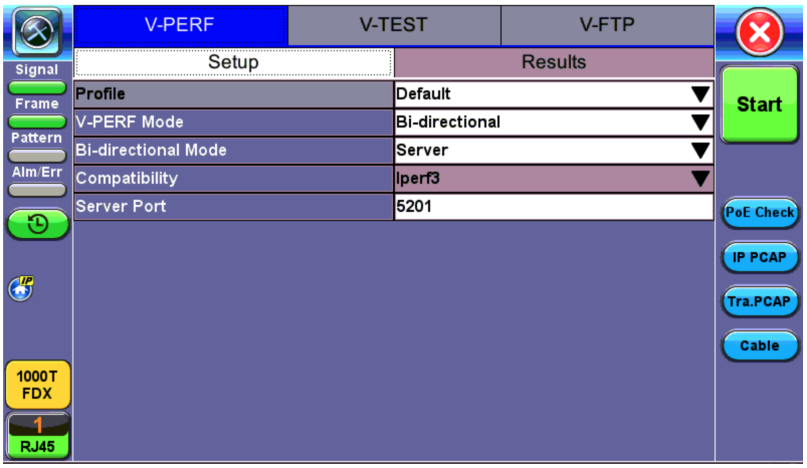
Server Results - Summary

Bi-Directional Configuration and Results (VeEX Enhanced Testing Methodology Implementation)

The Bi-Directional TCP testing methodology is unique as it allows two separate tests to run simultaneously on the same link in different directions. Both Test Sets are actually configured as Client & Server at the same time, saving the time of having to run each direction separately.

To simplify the configuration for this example, one test set is configured as a Client and the other as a Server. In reality however, as mentioned previously, both tests will be running simultaneously.

1. Select **Bi-Directional** from the **V-PERF Mode** drop-down menu on both test sets. Select the **Bi-Directional Mode** as **Client** on the Local End and **Server** on the Remote end.



Local End Tester - Bi-Directional *Server* Setup

2. Press **Start** test at the Near End. The entire test flow is automated. Results will show up as the tests run – a total of 4 sessions.
   - Current test progress is shown in **Event**.
   - **Summary (Page 1)** provides information on the current session running and the RFC-6349 key performance indicators. Tap on **Client Results** to verify the metrics.
   - Final results of the completed test will show under **Status**.

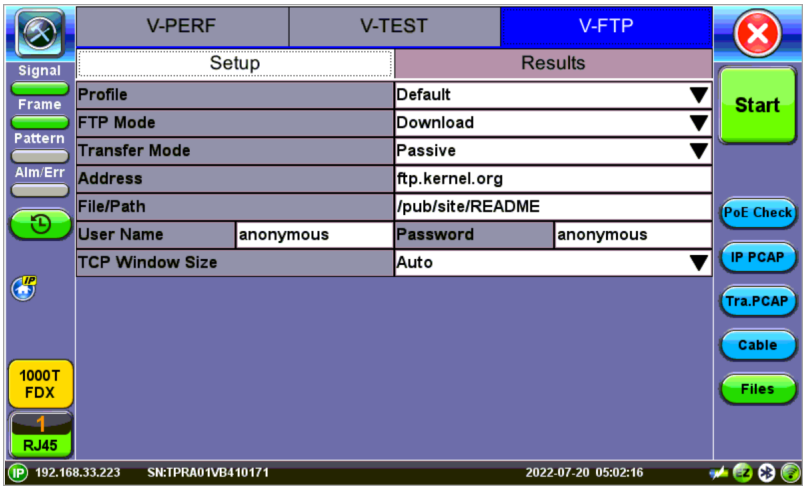
V-FTP

V-FTP is an internet speed performance test based on uploading and downloading large test files to an FTP server. The V-FTP Throughput feature allows users to test up to full line rate FTP protocol performance to any FTP Server by uploading and downloading files.

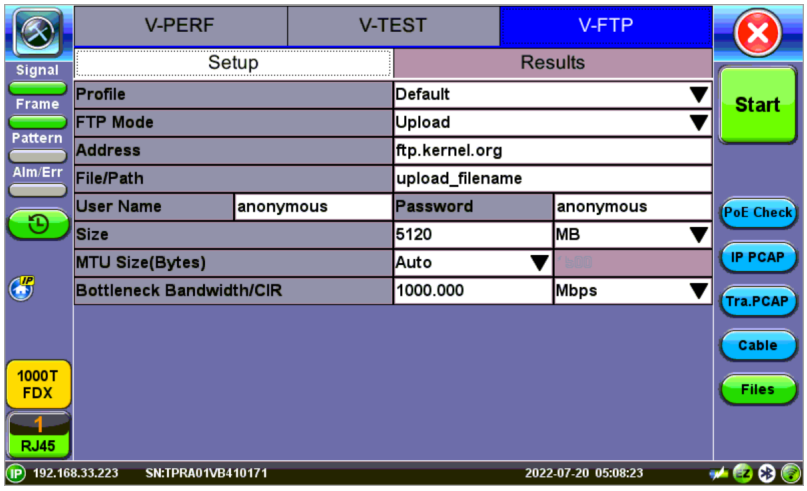
Run a FTP Speed Test

1. Select **Speedtest** on the test application main menu. Tap the **V-FTP** tab.
2. On the **Setup** subtab, select **Download** or **Upload** from **FTP Mode**.
3. Enter the FTP server IP **Address,File/Path, User Name,** and **Password** information.
4. **A.** If setting up for a Download Test, select the **TCP Window Size**.

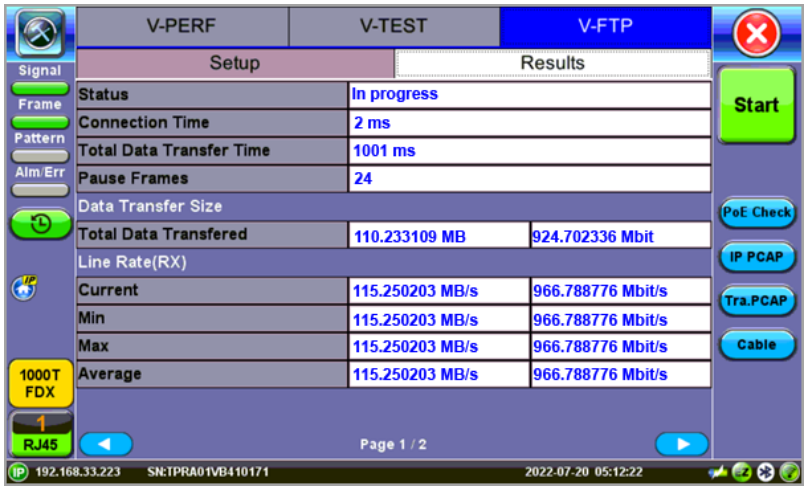
   B. If setting up for an Upload Test, select the **MTU Size** and enter the **Size** and **Bottleneck Bandwidth**.
5. Tap **Files** to open up the FTP file selection window and view all the files on the server. Select a file to transfer and tap **Start** to run the test.



V-FTP - Setup - Download



V-FTP - Setup - Upload

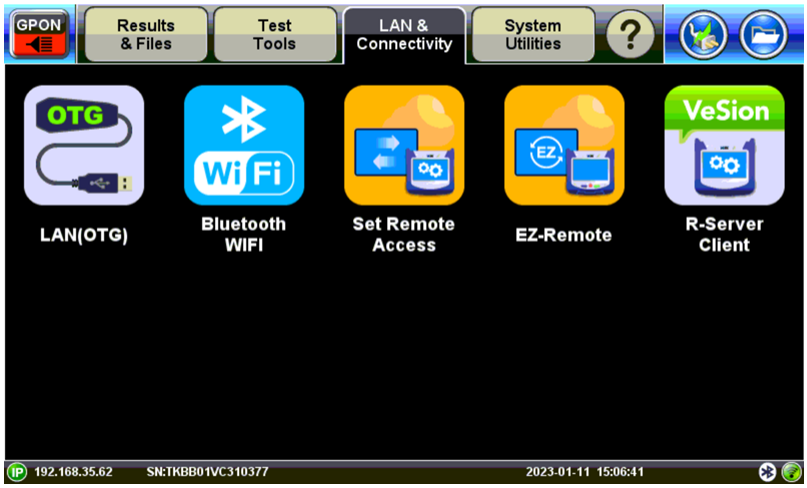


V-FTP - Download - Results

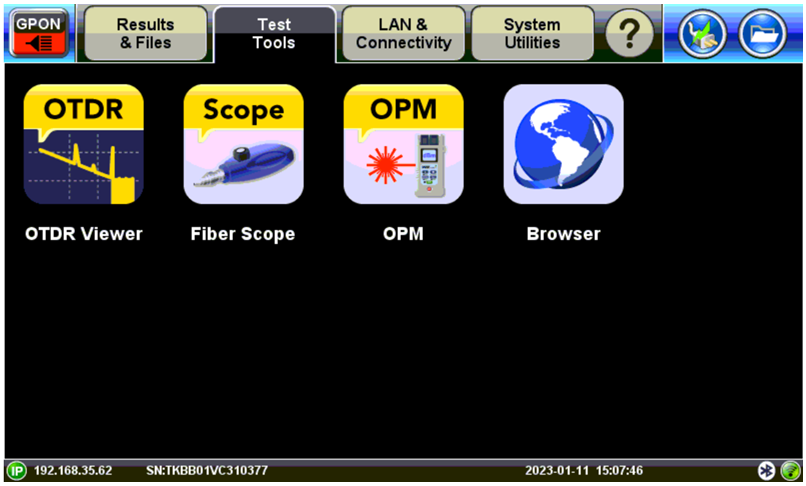
Platform Functions

To access platform functions tap on tools icon  .

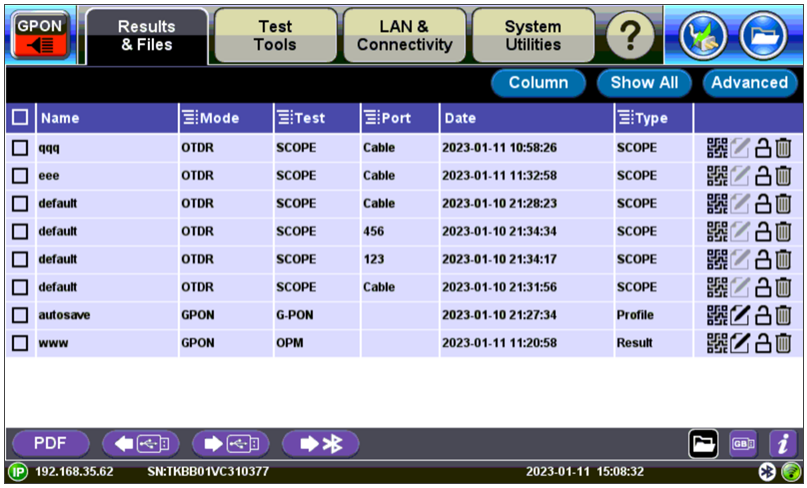
System Utilities



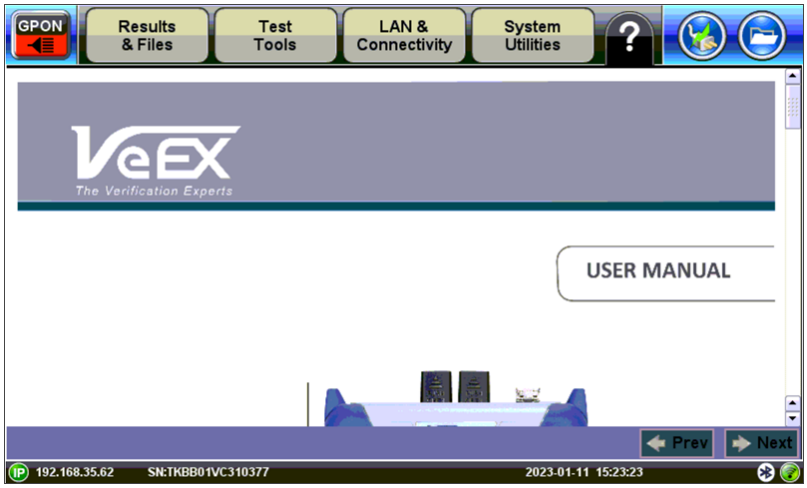
LAN & Connectivity



Test Tools



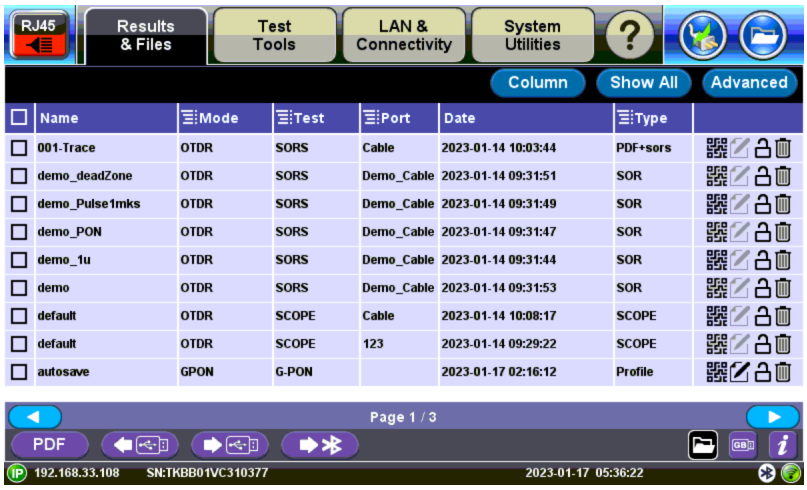
Results & Files



Guides and Manual

Results & Files

File Manager



Results & Files: File Management

The **Results & Files** tab displays files stored in the test set, including profiles, test results, and screen shots.

When managing files, use the check box ☑ to select the desired file(s). The File Management system offers backup **To USB** and restore **From USB** functions to preserve user data.

Tests Results/Reports

To access the test results stored in the test set:

1. Press , then press on the top left of the screen.
2. Select the **Results & Files** tab. The File Management screen is displayed.
3. Select the desired results file to open the test report.

To navigate the test results report, use the links in its Table of Contents and the right rocker switch to scroll Up and Down.

Working with Saved Results, Profiles, Images

Access the File Manager by selecting **Results & Files**. Files can be viewed, edited, or exported to a USB dongle, Windows PC, SD card, or a PDF file (using a FAT32 USB Memory stick). Use the check box ☑ to select the desired file(s) or choose all files by selecting the check box in the top header row.

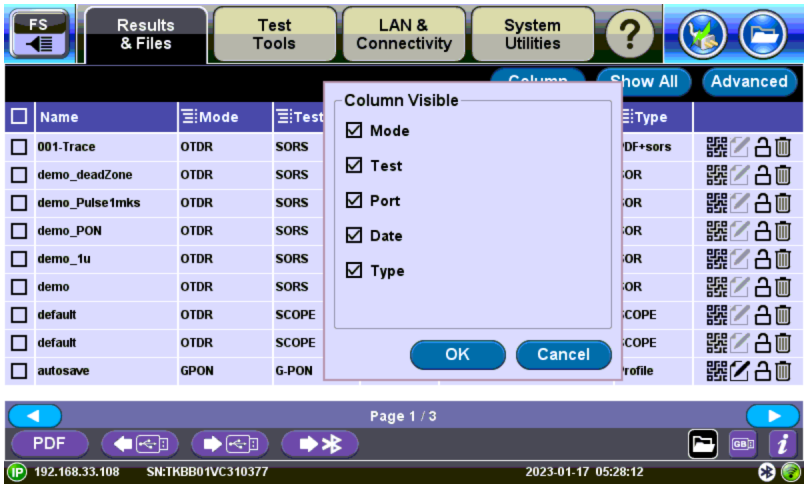
Table Sorting

Tap a column header to sort the table in ascending or descending order by the column selected.

Tap the list icon in the column header row to filter for specific test results stored on the unit.

At the top of the screen, tap the blue buttons for view options.

- **Column** Select columns to make visible.
- **Show All** Displays all records.
- **Advanced** Search for specific file(s) using advanced search terms.



Selecting columns to make visible

Viewing and Managing Files

Use the options at the bottom of the screen to manage selected file(s).

Tap the file to open and display it.

Navigates right and left to view all files.

Close — Closes the current test report and goes back to the File Manager.

Exports the selected test report to mobile device via QR Code.

Deletes all unlocked test reports that are selected with checkmarks.

Renames the selected test report (one).

Unlocks or Locks test reports. Locked reports are identified by a red padlock icon. Locked test reports cannot be deleted or renamed.

PDF — Generates a PDF copy of the test report and stores it in an attached USB memory stick (required) for distribution (e.g., via email).

Imports (restores) all test results, test profiles and screenshots stored in an attached USB Memory Stick. The included On-The-Go (OTG) micro-B USB to USB-A adapter cable is required for the USB memory stick.

Exports (backup) all selected test results, test profiles and screenshots stored to an attached USB Memory Stick. The included On-The-Go (OTG) micro-B USB to USB-A adapter cable is required for the USB memory stick.

Transfers selected test results, test profiles and screenshot files to a paired Bluetooth® smartphone, tablet or PC.

Enabling To USB and From USB Functions

1. Insert a USB Memory stick (FAT32 file format) into a USB port on the side of the unit.
2. Wait for the USB memory to be detected. After the unit detects the USB memory stick, files can be downloaded to or restored from USB. See "USB Memory Browser" on page 118 for details about using a USB memory stick with the test set.

Downloading Files To USB

1. Select the test results, test profiles, screen capture files to be saved. For a full backup, tap the check box in the top header row to select all files.
2. At the bottom of the screen, tap the **To USB** button  to initiate the file transfer procedure and wait for the progress bar to finish. Original files won't be deleted from the test set. Each file is saved into it's own folder using the "MyVeEX" tree directory format.
3. When all files have been copied to the USB, tap the folder icon (top-right corner)  and to make sure all cached data is transferred to the USB drive, especially when transferring small files.

Exporting Files to Mobile Devices via Bluetooth

Applies to test sets with optional built-in Bluetooth or compatible Bluetooth USB dongle attached.

1. Select the test results, test profiles, screen capture files to be exported. For a full backup, tap the check box in the top header row to select all files.
2. At the bottom of the screen, tap  . The test set scans for Bluetooth devices automatically.
3. After pairing the device, tap **Send** to export the selected files. Original files won't be deleted from the test set. Each file is saved into it's own folder using the "MyVeEX" tree directory format.

Exporting Results to PDF

1. Select the test result files to be exported.
2. At the bottom of the screen, tap PDF. A "PDF file will be generated to USB disk" message appears.
3. Tap **Yes**.

Transferring Results to Phone/Tablet via NoApp QR Code

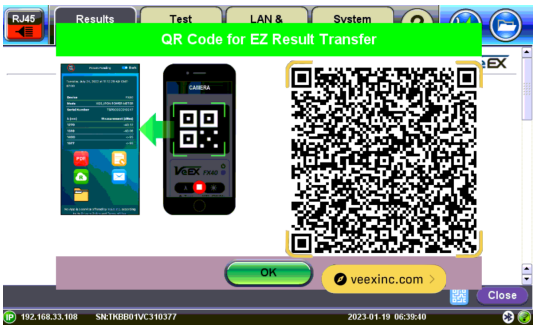
Test Results QR Transfer and Report Generation

Once the test report is displayed, company information, logo, job ID, geolocation, comments, picture, other test results, etc. can be added. The test results can also be uploaded directly to the centralized/cloud server (for R-Server subscribers). PDFs can also be generated and results shared using email or SMS.

Multiple tests reports, from the same or different testers, can be combined into a single report. For example, a PON Internet access activation may require some optical power measurements at the drop, an optical fault locator measurement to verify the length of the drop, a PON signal analysis test, and an Internet speed test to verify the QoE. Since they all belong to the same job, with NoApp, they can be assembled and filed on a single comprehensive report.

QR Code generation must be enabled on the test set and mobile device, or it can be launched later, from the File Manager by tapping on the QR icon. QR Result generation is only supported by some test applications.

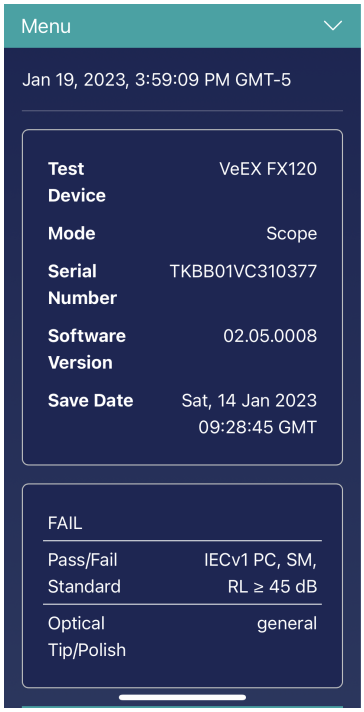
To transfer results to mobile device:

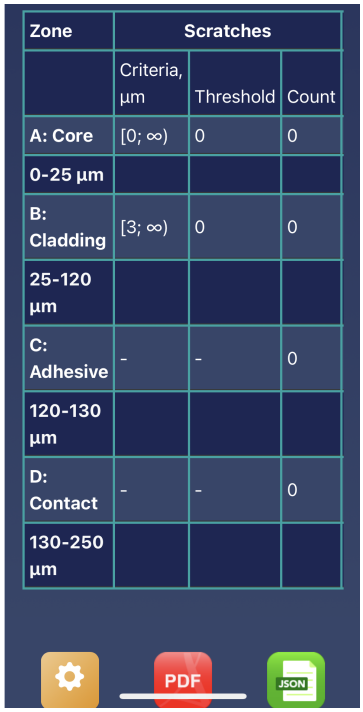


1. On the **Results & Files** tab, select the test results to view.
2. Tap . The **QR Code for EZ Result Transfer** screen displays.
3. Using the mobile device's camera, focus on the **QR code** and tap it. The results appear in the browser.

Viewing Results on Phone

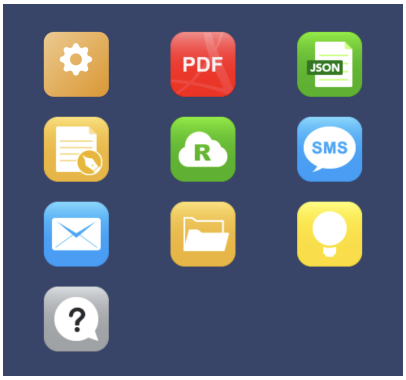
After transferring results to a mobile device via the QR reader, the browser launches automatically and displays them.





The top of the screen shows the device type, mode, serial number, and software version, and the date results were saved on the device.

Export options appear at the bottom on the screen. Alternatively, tap the **Menu** drop-down menu to view the options.



Results - Mobile View Export Options

Interactive descriptions of FX120 Speed Test report options.

Interactive descriptions of FX120 GPON/XGS-PON report options.

- Adds/Removes location (GPS coordinates) from results report; customize report with logo.
- Generates complete report in PDF format, which can be shared with the customer (subscriber) or emailed to a supervisor.
- Exports to JSON format, for third-party integration or processing.
- Adds extra job-related information to the report (e.g., Job ID, tech's information, comments, pictures, etc.).
- Uploads results to R-Server (for R-Server users).
- Texts results via SMS protocol.
- Emails current test report.
- Creates a new project for results so multiple test results, from the same or different test sets, can be combined into a single job report.
- Opens knowledge base.
- Opens documentation resources for test set.

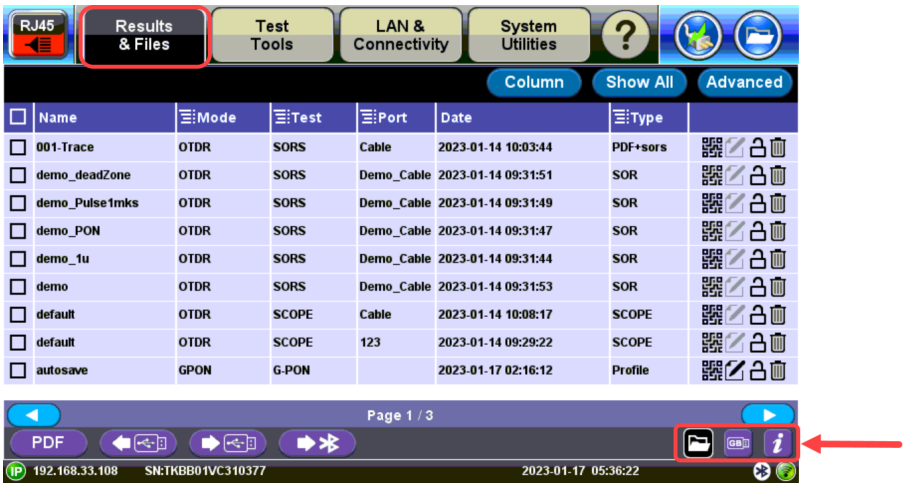
Advanced Saving of Test Results

To append additional information to test reports:

1. Press  , then press  on the top left of the screen.
2. Select the **System Utilities** tab, then select **Global Settings**.
3. Select the **Storage Setting** tab and set **Advance Saving** to **ON**.

USB Memory Browser

Use an USB-A OTG cable (optional with purchase) to connect a USB to the micro-B USB port. The port supports memory drives and USB add-on devices such as fiberscopes.



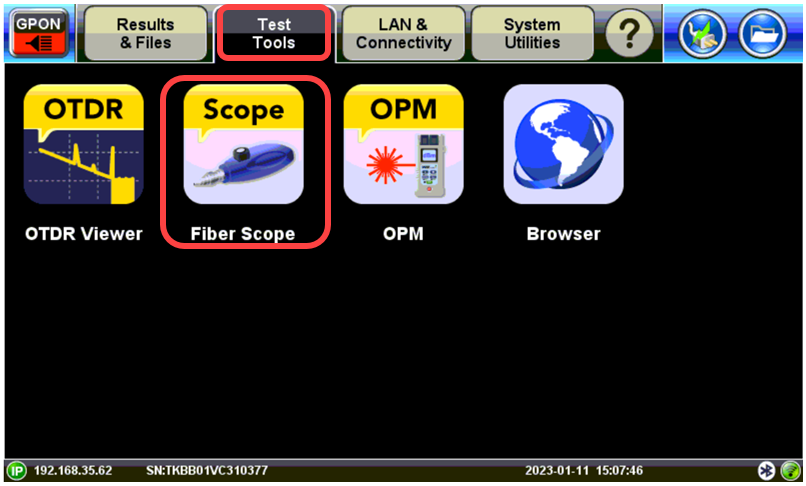
The File Manager provides basic USB memory stick management tools to browse and manage files without the need of a PC. If needed, use the micro-B USB to USB-A adapter to connect to the USB memory stick.

Shows the test results, test profiles, protocol PCAP and screen shot files stored on the test set.

Displays files on USB memory stick.

Displays space used/available on internal SD card.

Test Tools



Test Tools Home Menu (FX120 reference)

Available Tool applications depend on the product model.

Fiber Scope

- "DI-1000 Digital Fiber Inspection Microscope" on page 123
- "DI-1000MPO Digital Fiber Inspection Microscope for Single and Multi-Fiber Connectors" on page 124
- "DI-3000 Auto-Focus Digital Fiber Inspection Microscope" on page 128

The VeEX digital fiber inspection scopes evaluate fiber optic connectors for dirt and end face quality. The hand-held probe design enables easy inspection of patch cords and connector panels. Extended tips are available for hard to reach bulkhead or patch panel connectors. Clear images are displayed on the test sets for immediate analysis and can be saved for record keeping.

The Fiberscope test application can be used in conjunction with any VeEX Digital Fiber Inspection Microscope.

All DI series fiberscopes can auto freeze image when focus is achieved to capture the image and qualify the connector endface for cleanliness and damage per IEC 61300-3-35. For more information about available connector tips, see the *DI-1000/DI-1000MPO/DI-3000 Digital Fiber Inspection Microscope Adapter Tips Guide*.

All wired fiber inspection scopes are powered via a USB Type-A connection with a host device or the VeEX Power Bank/WiFi Bridge. For host devices that have Micro-B or Micro-C input ports, USB Type A to Micro-B or Micro-C OTG dongle adapters are available as an add-on order from VeEX.

More about Fiber Scope functions

OTDR Viewer

This built-in application allows the test platform to view previously saved .sor trace results and edit events, as needed. IF an OPX-BOXe is connected to the platform via direct USB connection, WiFi or Bluetooth®., this built-in application can also be used to control all OTDR test functions.

More about OTDR Viewer functions

OPM

The VeEX Inc Optical Power meters are made with fast and accurate testing in mind. They are used to measure the power running through a cable at a given wavelength, and interface with phone, PC, or other VeEX devices to save and generate reports on the findings. This information is used to verify that the cable span is working correctly and to find the source of the problem when it's not. When paired with a VeEX Optical Light Source (OLS) or as part of a VeEX Optical Loss Test Set (OLTS), which includes both, WaveID can be used to quickly test several wavelengths without having to adjust the OPM settings.

More about OPM functions

Browser

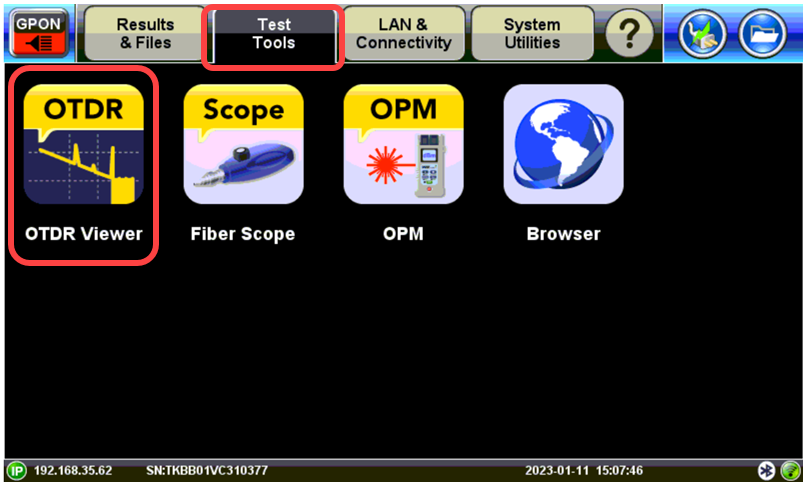
The built-in web browser uses the management port IP connection. An active IP connection can be established either through Ethernet or WiFi. The web browser defaults to VeEX's test website. Use the Web browser's navigation bar to enter the name of the website you wish to reach. Navigation capabilities may be limited.

More about Browser functions

OTDR Viewer

This built-in application allows the test platform to view previously saved .sor trace results and edit events, as needed. IF an OPX-BOXe is connected to the platform via direct USB connection, WiFi or Bluetooth®., this built-in application can also be used to control all OTDR test functions.

To access the OTDR Viewer from the Platform Screen, select **Test Tools** > **OTDR Viewer**.



OTDR Viewer

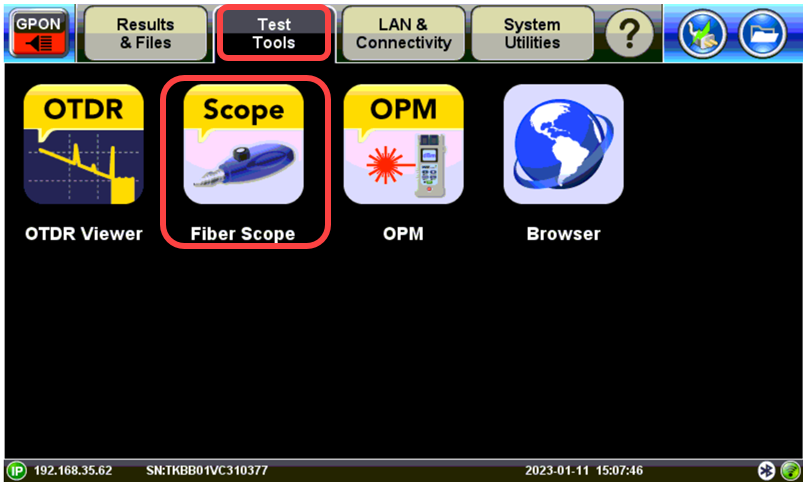
Once paired or connected to the micro OTDR, the test set displays a virtual OTDR user interface that is used to control the OPX-BOXe and perform measurements.

- Traces and Events table view
- Loss calculations
- V-Scout Link Mapper option
- Compatible with Fiberizer Cloud (upload and download)
- Controls external OPX-BOXe OTDR

Since fibers are commonly placed in access, metro, and transport networks, having a companion add-on OTDR to inspect drop fiber reduces dependence on specialized fiber construction crews troubleshooting fiber related problems.

Refer to the OPX-BOXe User Manual for further details about OTDR operations.

Fiber Scope



- "DI-1000 Digital Fiber Inspection Microscope" on the facing page
- "DI-1000MPO Digital Fiber Inspection Microscope for Single and Multi-Fiber Connectors" on page 124
- "DI-3000 Auto-Focus Digital Fiber Inspection Microscope" on page 128

The VeEX digital fiber inspection scopes evaluate fiber optic connectors for dirt and end face quality. The hand-held probe design enables easy inspection of patch cords and connector panels. Extended tips are available for hard to reach bulkhead or patch panel connectors. Clear images are displayed on the test sets for immediate analysis and can be saved for record keeping.

The Fiberscope test application can be used in conjunction with any VeEX Digital Fiber Inspection Microscope.

All DI series fiberscopes can auto freeze image when focus is achieved to capture the image and qualify the connector endface for cleanliness and damage per IEC 61300-3-35. For more information about available connector tips, see the *DI-1000/DI-1000MPO/DI-3000 Digital Fiber Inspection Microscope Adapter Tips Guide*.

All wired fiber inspection scopes are powered via a USB Type-A connection with a host device or the VeEX Power Bank/WiFi Bridge. For host devices that have Micro-B or Micro-C input ports, USB Type A to Micro-B or Micro-C OTG dongle adapters are available as an add-on order from VeEX.

The Importance of Fiber Connector Inspection

Dirty or scratched connectors introduce loss, increase ORL and/or damage other connectors (Loss and Return Loss becomes more critical at higher data rates). End-face contamination is a leading cause of fiber link failures in data centers, corporate networks, MSOs and Telecom environments.

Fiber Inspection Scopes provide a magnified image of the fiber optic connector's end face, focusing on the contact areas (most likely to impact network performance or permanent damage by mating of contaminated

connectors). Images, visual inspection, and automated tools are often used to grade the health and cleanliness of connectors, after polishing or cleaning and before being used.

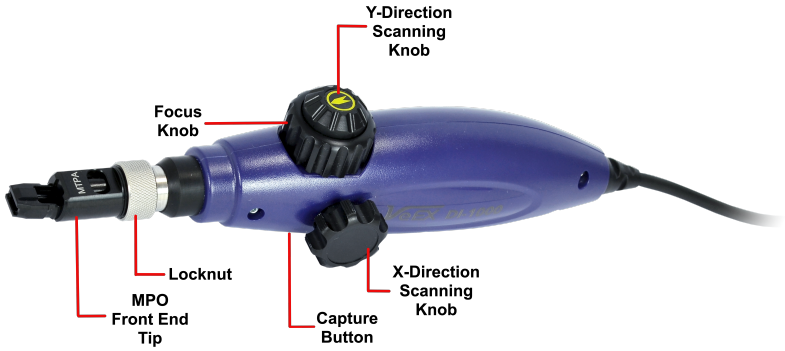
To achieve maximum power and prevent false readings, clean the optical fiber connector interfaces before inserting them into the test port.

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.

DI-1000 Digital Fiber Inspection Microscope

DI-1000 Digital Fiber Inspection Microscope

- **Locknut**: a threaded fastener that secures the tips in place.
- **Inspection Tip**: a front-end component inserted to view the connector endface
- **Capture Button**: a button that starts and stops (play or pauses) the video stream of the fiber end-face to save an image at the current frame.
- **Focus Knob**: a rotating dial that can be turned clockwise or counterclockwise to view clearer image. Make sure connector is properly seated in the adapter tip.
- **USB Type A output**: USB connector to plug into host power source to enable operation.



DI-1000MPO Digital Fiber Inspection Microscope for Single and Multi-Fiber Connectors

- *WiFi support requires VeEX Power Bank/WiFi Bridge accessory and host device/test set has built-in WiFi capability. See the test set's data sheet on www.veexinc.com or contact VeEX Customer Care for more information.*
- *To work with single fiber tips, the front end tip should be replaced with the collar provided with the scope. For more information adapter tips, see the DI-1000 Digital Fiber Inspection Microscope Adapter Tips Guide on www.veexinc.com.*

For more information on using the DI-1000MPO, see the DI-1000MPO Quick Guide on www.veexinc.-com.

DI-1000MPO Fiber Analysis

There are two methods to inspect MPO fibers using the DI-1000MPO:

1. **Touchscreen (standard)**

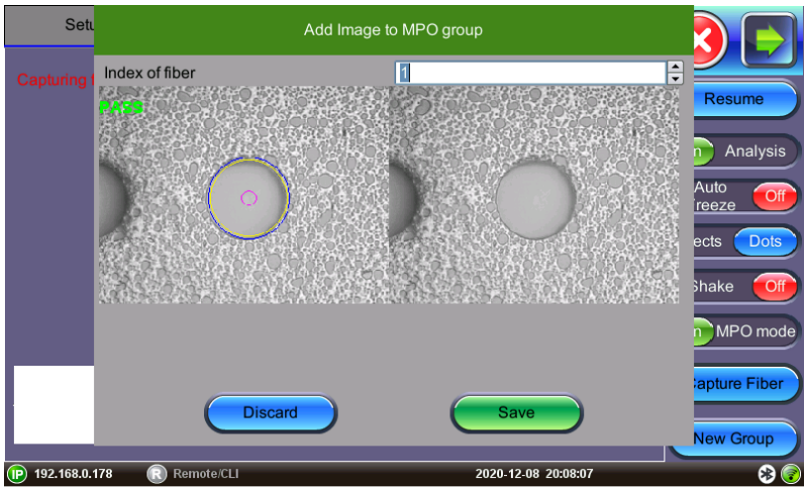
   Press the **Capture Fiber** button on the touchscreen for every MPO fiber properly focused, analyzed, and scoped.

   Press **OK** in the pop-up window to confirm the MPO fiber number, then adjust the scope controls (horizontal (x-axis) control only) to navigate to the next fiber.

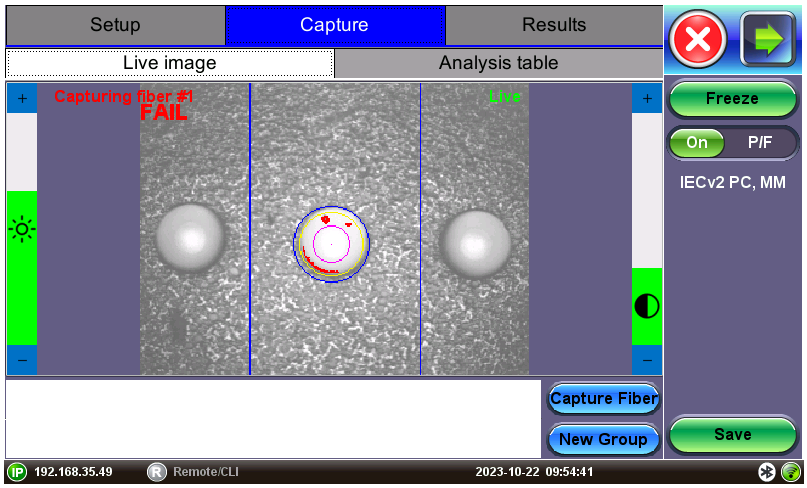
2. **Fiber Scope button (fast)**

   Press the Capture button (located on the bottom of the DI-1000MPO fiberscope) successively to capture, confirm the MPO fiber number, and add the fiber screenshot to the list. As the x-direction (horizontal control) is rotated to the next consecutive MPO fiber the logging actions are done on the fiberscope itself. Scoping an MPO-12 fiber can be done under a minute.

   Press **New Group** to create a new set of MPO images.



MPO Group - Add Image

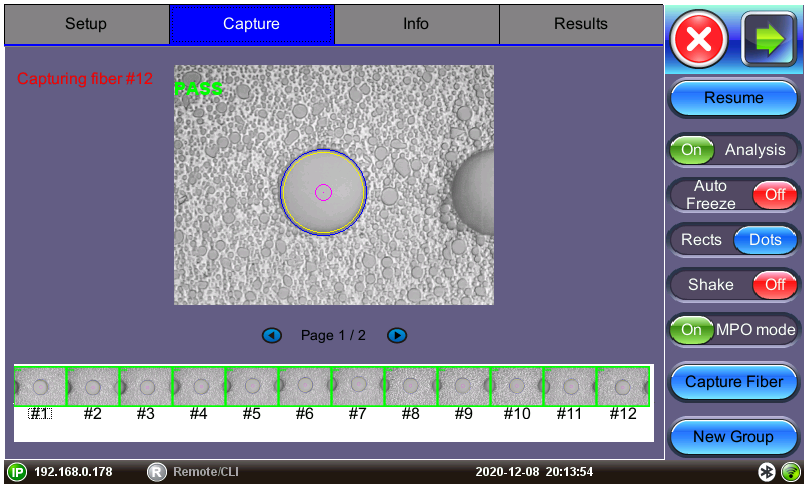


Aligning Fiber for Analysis

When using a DI-1000MPO+, which has a wider field of view, align the correct fiber between the two lines for analysis.

The example below shows a completed MPO-12 cable inspection.

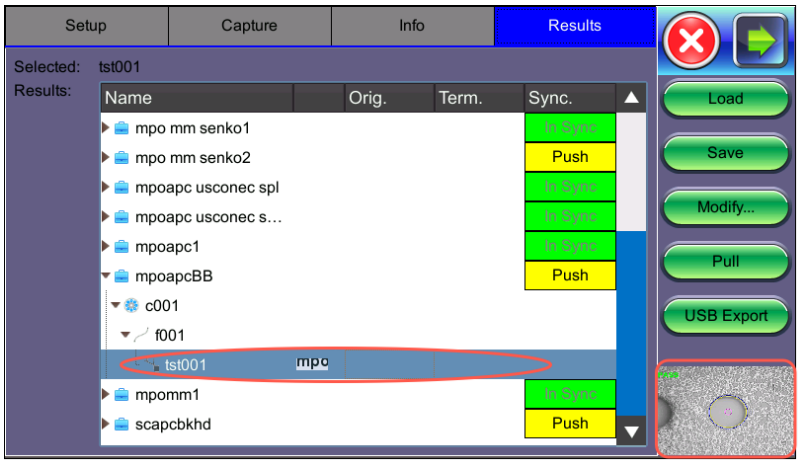
The key-up and key-down adapter that comes with the DI-1000MPO standard package is a straight-through connection so the MPO fiber # at the start matches the MPO fiber # at the end (not flipped). When using the adapter, fibers will be in the opposite orientation of the camera. In the below example, fiber #1 is on the right.



MPO Group - Completed (PASS)

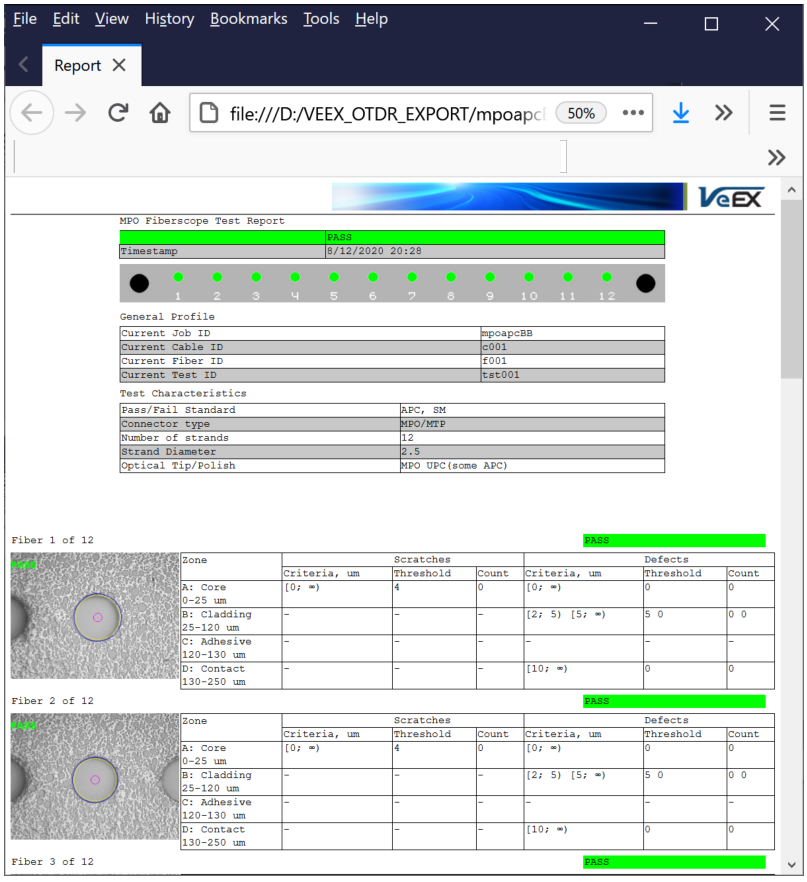
To save MPO results, navigate to the **Results** tab once all fibers have been captured and press the **Save** button.

To view results on the unit, on the **Results** tab navigate to the **mpo** heading on the saved trace and press **Load**. Tap each individual screenshot to view the individual MPO fibers.

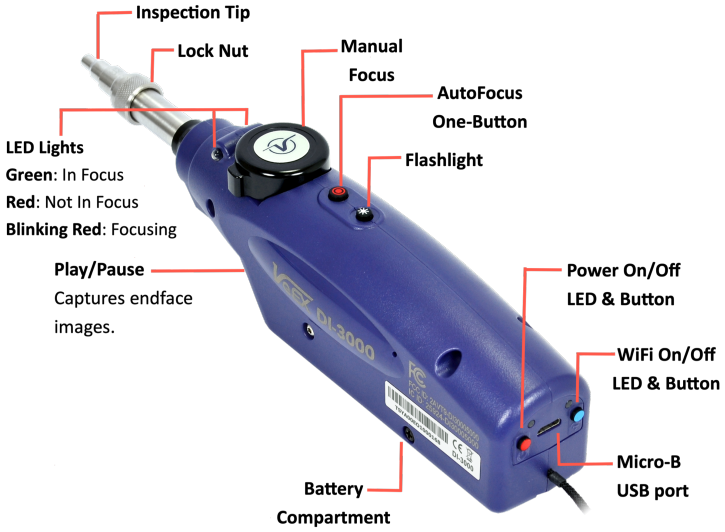


MPO results

(Scope image appears on bottom right corner of the screen.)



Fiberscope MPO endface test viewed in an HTML browser



DI-3000 Wi-Fi Autofocus digital inspection scope

WiFi support requires host device/test set has built-in WiFi capability. See the test set's data sheet on www.veexinc.com or contact VeEX Customer Care for more information.

Connecting the Fiberscope

Use an USB-A OTG cable (optional with purchase) to connect a USB to the micro-B USB port. The port supports memory drives and USB add-on devices such as fiberscopes.

OPTICAL SAFETY

- *Deactivate the laser before connecting or disconnecting optical cables or patchcord.*
- *Never look directly into an optical patchcord or optical interface while the laser is enabled. Exposure to optical radiation for an extended period can caused irreparable damage to eyes.*
- *Never use a fiber microscope to check the optical connectors when a laser source is active.*

The operator is assumed to have received basic training in fiber optics and related testing and measurement practices.

Read the "Safety Information" on page 10 before beginning using optical features of the test set.

Fiber Scope image view requires the Fiber Scope Expert option to be enabled on the chassis/platform except for the VS500 which can already include this option. This can be confirmed by viewing the device ID is either -1500 or -2500.

Attach the DI-1000/DI-1000MPO/DI-3000

Attach one end of the OTG cable (optional with purchase) to the microUSB port on the test set and the other end to the fiberscope USB port.

Older analog fiberscopes require a USB adapter.

If using a DI-3000, WiFi can be used to connect to a platform with WiFi available. See below.

When the DI-1000, DI-1000MPO, or DI-3000 are powered, they will emit a blue LED. Select the tip that best matches the connector endface that is to be inspected.

For more information about available connector tips, see the DI-1000 Digital Fiber Inspection Microscope Adapter Tips Guide on www.veexinc.com.

After powering on and setting up the fiberscope, select the tip that best matches the connector endface that is to be inspected.

Scope tips are secured in place with a locknut. There is a slot (specialty tips may have more than one slot) that will ensure the tip is aligned properly to the top of the fiberscope prior to securing the locknut. Attach a tip by rotating the locknut clockwise (tip faced away). Remove a tip by rotating the locknut counterclockwise (tip faced away). With the correct tip fastened and secured, launch the Fiberizer application (PC, mobile, VeEX test set) and plug into an available USB interface or connect to the WiFi network.

Rotate the round focus knob to manually bring the image into focus. For the DI-3000 scope, a built-in autofocus button can also be used.

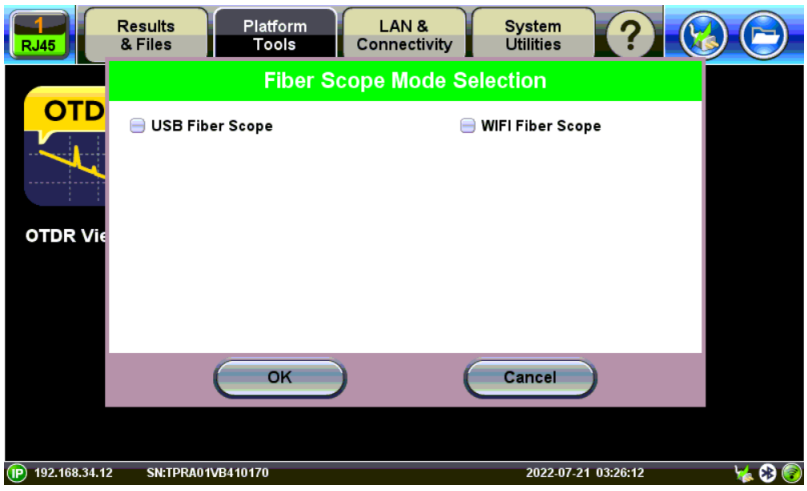
Once the fiberscope is detected, tap **Yes** in the pop-up window to enter the Fiberscope menu.

The fiberscope menu can also be accessed at any time from the Fiberscope icon.  .

Fiber Scope Detected Message

Alternatively, select  >  .

Toolbox Menu - Fiberscope option



Fiber Scope Connection Mode Selection (USB for direct connection, Wi-Fi for DI-3000 AP)

Select the **USB Fiber Scope** checkbox for wired fiberscopes, such as the DI-1000, DI-1000MPO, VS500 *(discontinued)*, or DI-3000 via USB.

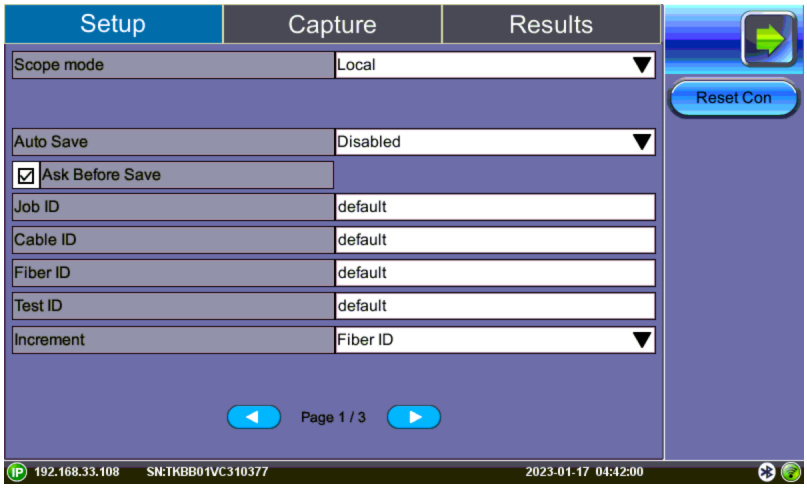
Select **WiFi Fiber Scope** to initiate a scan for an available DI-3000.

See the WiFi Wiz section for more information on setting up a WiFi Access Point if automatic scanning fails.

The WiFi Access Point password is: "veex" plus the last six digits of the serial number of the DI-3000 to connect with e.g. "veexA00700", where the serial number is SN:LA-3KA00700.

Fiberscope Setup

Captured patch cord image files are saved within a folder directory. In the **Setup** tab, name each folder and file in the directory and select a save increment.



Fiber Scope Setup - Page 1

- **Scope mode**: Sets Fiber Scope connection method.
  - **Local**: Direct USB (wired) connection.
  - **Remote DI-3000**: Wifi connection to DI-3000.
- **Reset Con**: Resets connection method currently used (Remote or Local) with fiberscope, so another can be selected.
- **Auto Save**: **Disable**, **Autosave on Tap**, or **Autosave after freeze**. If **Autosave on Tap** or **Autosave after freeze** is enabled, the unit automatically saves and creates the filename using the Trace ID after the test. The file location and name will display. Auto Save is available for single fiber analysis only.
  - **Disabled**: Turns off Autosave function. When Autosave is disabled, results can be manually saved on the Results tab after finishing the fiber endface inspection.
  - **Autosave on Tap**: On the **Capture** tab, tap the screen to automatically save the captured image. “Tap screen to save” will appear to indicate that the feature is enabled.

- **Autosave after freeze**: Automatically saves the captured image upon freezing the image. (Auto-freeze enabled or normal Freeze.)

When **Ask Before Save** is selected, the **Save** menu will display with naming and comment options.

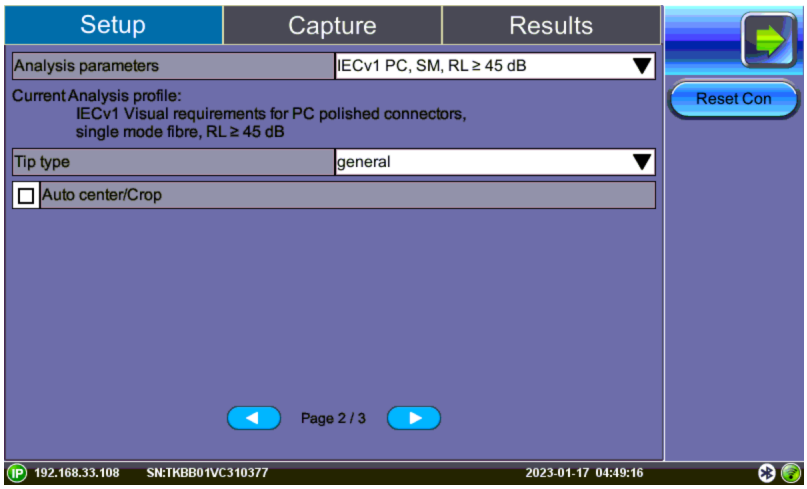
The details entered in the following fields can be used to pre-set the filename automatically and increment the fiber or test number automatically.

- **Job ID**, **Cable ID**, **Fiber ID**, and **Trace ID** are nested folders that store saved results. Folders are nested in the following order: **Job** > **Cable** > **Fiber** > **Trace**.

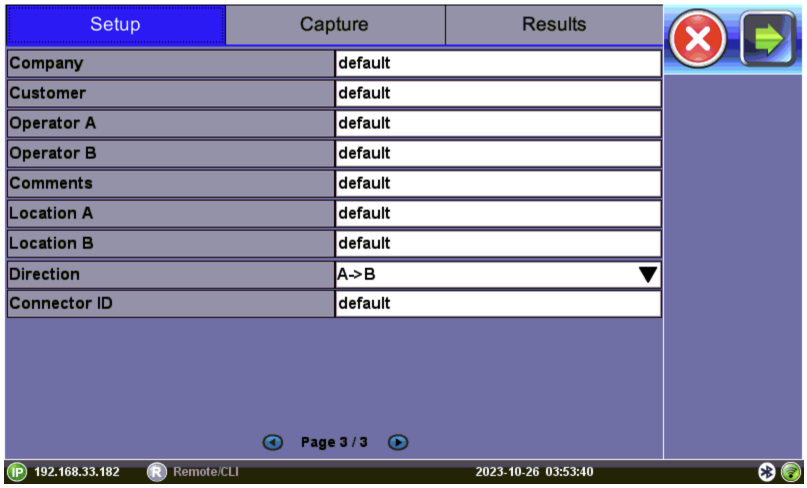
  Tap the blank fields to edit the names.

- **Increment**: Increments the selected ID name if an Auto Save option is selected.

Saved image files can be retrieved from File Manager or managed from the **Results** tab. Refer to "Working with Saved Results, Profiles, Images" on page 111 for more details.



Fiber Scope Setup - Page 2



Fiber Scope Setup - Page 3

Analyze Fiber Connectors

1. After assigning the scope mode and save options on Page 1, select the analysis profile from the **Analysis parameters** drop-down box on **Page 2/2** of the **Setup** tab.
   The analysis profile is based on the fiber endface connector inspected, as well as applicable to MTP™/MPO (multi-fiber) connectors. .
   - **PC, SM RL ≥ 45 dB**: SPC or UPC polished connector
   - **PC, SM RL ≥ 26 dB**: Older connectors with flat or PC polish (used with LC/MU)
   - **APC, SM**: Angled polished connector
   - **PC, MM**: Multi-mode connector
2. Select the **Tip Type** from the drop-down box. Tip Type is used to optimize Pass/Fail analysis for certain types of connector tips.
   - **General**: Encompasses standard SC, FC, ST, and other 2.5 mm ferrules. LC/APC and E2000/APC should not use general tip type.
   - **LC**: Lucent connector (male). Use on all 1.25 mm connectors with ceramic (LC/MU connectors).

- **LC female**: Lucent connector (coupler/bulkhead). Use when inspecting 1.25 mm type patch panels, MUX and test ports.
- **E2000™**: Proprietary family of connectors invented by Diamond SA known for its low insertion loss characteristics and built-in (latched) shutter. Use when inspecting Diamond E2000 connector with ceramic ferrule.
- **E2000/APC Metal**: Use when inspecting Diamond E2000 APC connector with metal ferrule.
- **Evolv™**: Use when inspecting Corning Evolv terminal connector ports.
- **LC APC short extended A6 female**: Use when inspecting hard to reach LC/APC connector coupler/bulkhead.
- **MPO PC female**: Use when inspecting SM ribbon cables with MPO/MTP via coupler.
- **MPO APC female**: Use when inspecting SM ribbon cables with MPO/MTP angle polished connector via coupler.
- **MPO MM female**: User when inspecting MM ribbon cables with MPO/MTP connector via coupler.

3. After the image is frozen, select the **Auto center/Crop** checkbox to take the current video frame and center it by the detected fiber image inside the program window, i.e. in case of long (extension) tips or handshaking. Initially, a blank screen will display. This is ideal for APC images. This is recommended when inspecting Angled bulkheads/couplers with Shake OFF.
4. Select the **Capture** tab.

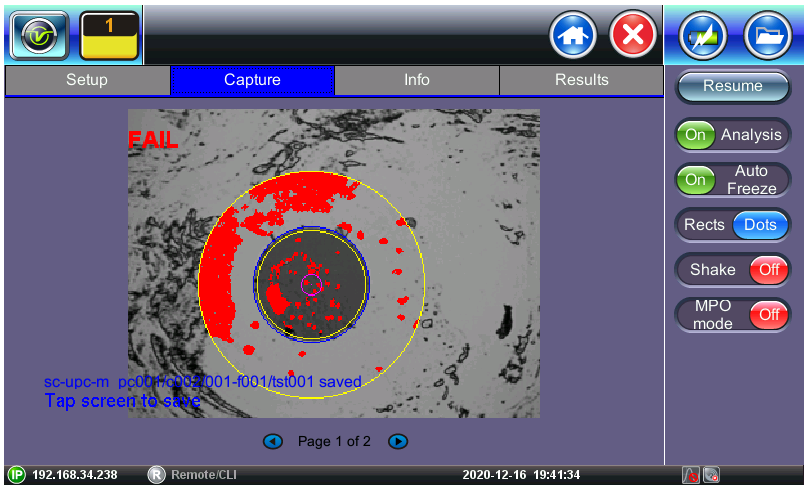
Capture Images (View)

The **Capture** tab is the main user interface for the connector end face inspection and analysis. It presents a real-time view of the connector's end face allowing for alignment and focus. **Page 1** of the capture screen displays a live image of the connector face and features analysis and freeze tools.

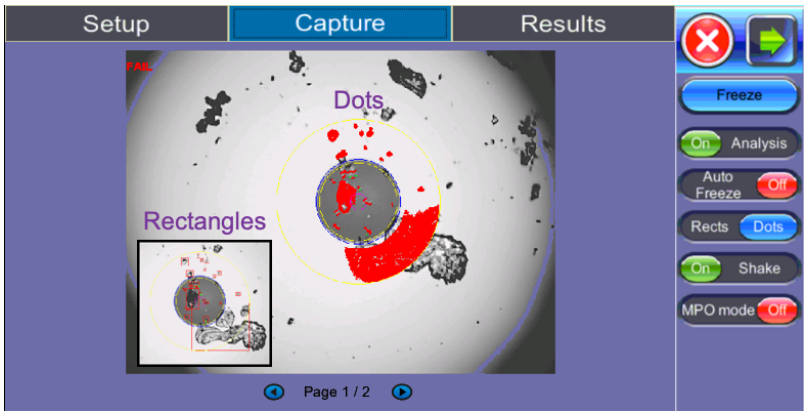
The fiber end face image will normally display near the middle of viewing window area. The exception will be when inspecting bulkhead/couplers of APC connectors or using A6 type tips. The end face image will appear off-center. AutoFocus and Shake OFF setting is recommended when inspecting couplers. Gently adjust centering while manually focusing the image and image will freeze as soon as focus is achieved.

For the DI-3000, press the autofocus (red target) button when the image is out of focus to enable the device's automated focusing operation. With a steady hand, the end face will be promptly autofocused and ready for capture.

*Initially, there is no screen shown until **Resume** is pressed.*



Real time video of the connector face. Red contours indicate scratches and defects.



Fiber Scope Capture - Dots vs Rectangles

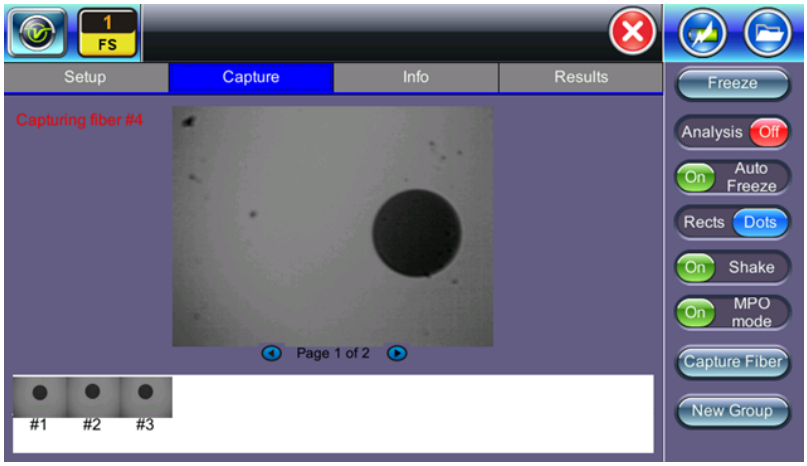
The radio buttons on the right panel do not indicate the current state or setting, they indicate the action that would take place if pressed. For example, if “Analysis OFF” is tapped, the analysis function is turned OFF and the button displays “Analysis ON”.

- **Resume / Freeze**: Stops the video capture from the fiberscope. If the optional Auto Freeze feature is enabled, the test set will automatically freeze the image when it comes into focus. Once the image is frozen, tap the image to save it.
- **Analysis On / OFF**: Turn ON/OFF the automatic Pass/Fail threshold defined by IEC 61300-3-35.
- **Auto Freeze**: Turn ON/OFF the ability to freeze the video automatically, when in Focus. The default is set to OFF. To see the image after it freezes, tap **Resume**.

Auto Freeze may be useful when scoping certain angled polish fibers.

- **Rectangles / Dots**: Dots draw a red contour around scratches and defects. Rectangles highlight scratches and defects without obstructing the view. The selection between dots or rectangles does not affect the area calculation or the Pass/Fail results. Dots are set as default.
- **Shake**: Turn ON or OFF the ability to Auto Freeze or Analyze when probe image is unsteady, such as when inspecting a female connector or bulkhead. It minimizes significant vibrations and unsteadiness generated from the fiberscope being held. Typically, this function is not always needed with the use of image focusing.
  When inspecting bulkhead couplers or MUX/transceivers set Shake to OFF.
- **MPO mode**: Turn ON when inspecting ribbon fibers (MPO/MPT connectors). Create a **New Group** for each MPO ribbon and **Capture Fiber** to save an image for each strand.

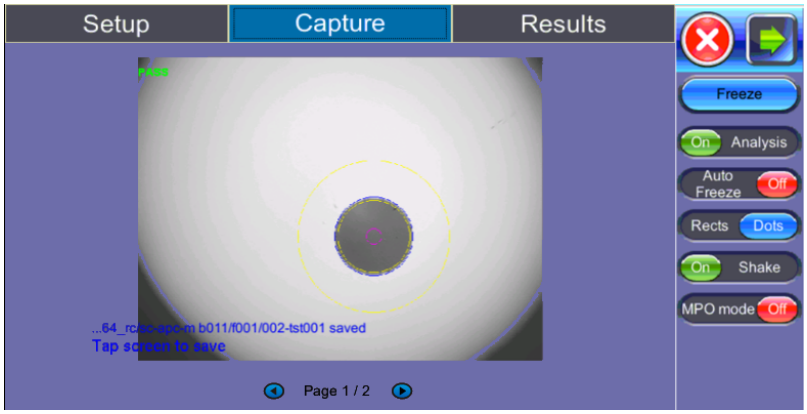
*When inspecting MPO/MPT connectors, it is recommended to set **Auto Freeze** and **Shake** to **OFF**.*



Fiber Scope MPO mode

To save the image on the screen, tap the screen after freezing.

After saving, go to **Results** or **> Utilities > FilesFiles** to view the report and export to PDF or USB.

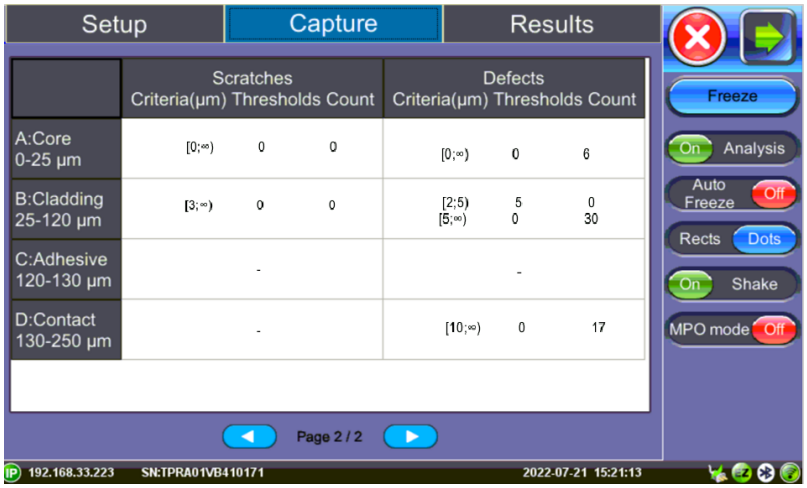


Fiber Scope Capture - PASS

In the example above, the message in blue states that the image can be saved when tapped. This indicates that the **Autosave** on Tap option was enabled on **Page 1** of the **Setup** tab. If **Autosave after freeze** were selected, no message to tap the screen would appear.

Page 2 displays all numeric results from defect and scratch events found for all four zones. These are used for the evaluation of the Pass/Fail criteria, according to the IEC 61300-3-35 standard. (Scratch requirements refer to width.)

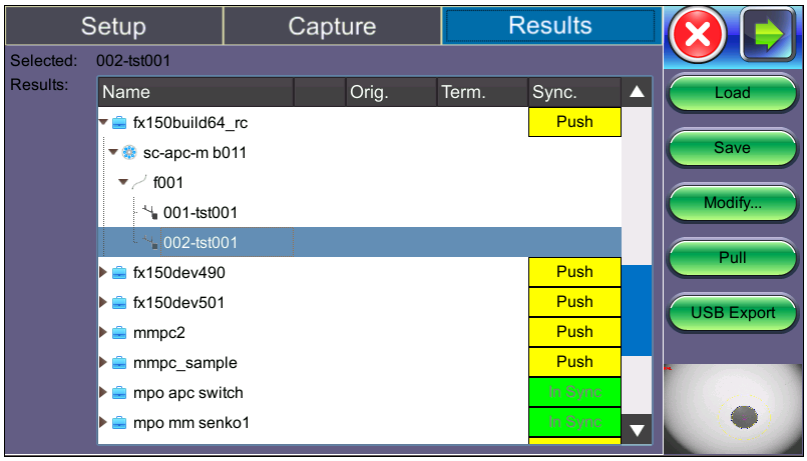
This table will also be included in the reports.



Pass/Fail IEC analysis table

(Measured scratches and defects compared with threshold criteria for each fiber layer)

Results/Reports

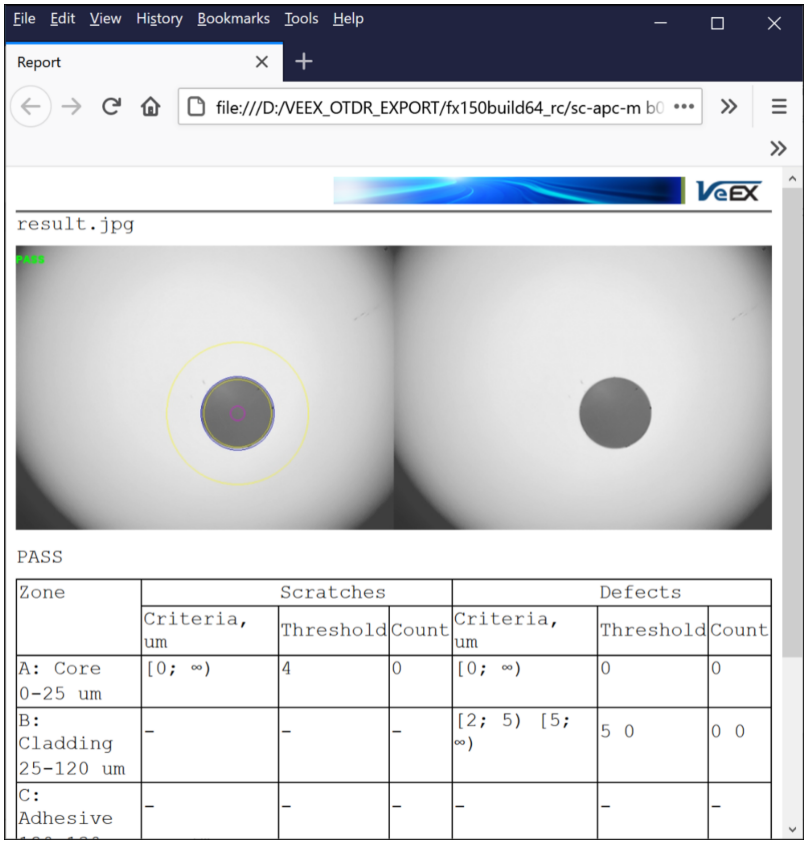


Fiber Scope Analysis

(For Fiberscope Results, Scope image appears on bottom right corner of the screen.)

The results screen is used to view previously saved results. Test results can be pushed/pulled from Fiberizer Cloud. The directory displays the location of stored files. Connect to Fiberizer Cloud, then select the file(s) by tapping them.

- **Push/In Sync**: Uploads locally saved results to Fiberizer Cloud. *In Sync* indicates the results have been saved to Fiberizer Cloud successfully.
- **Load**: Loads the selected image onto the Capture tab.
- **Save**: Manually saves and names the image displayed in Capture (autosave is disabled). Once saved, the files can be accessed in the "File Manager" on page 110 or "R-Server" on page 182.
- **Modify**: Select a file or folder in the directory to modify. Options to Rename, Remove, and upload the selection to Fiberizer Cloud are available.
- **Pull**: When connected, pulls file from Fiberizer Cloud onto test set.
- **USB Export**: Exports files to USB stick. Choose Export Group to retain the tree format (sub-directory) or Export Flat to create a single filename using sub-directories to build a name.
  In the Result Files example above when choosing to retain the tree format, the highlighted 022-tst001 results file can be found in the following directory after exporting:
  >fx150build64_rc > sc-apc-m b01.

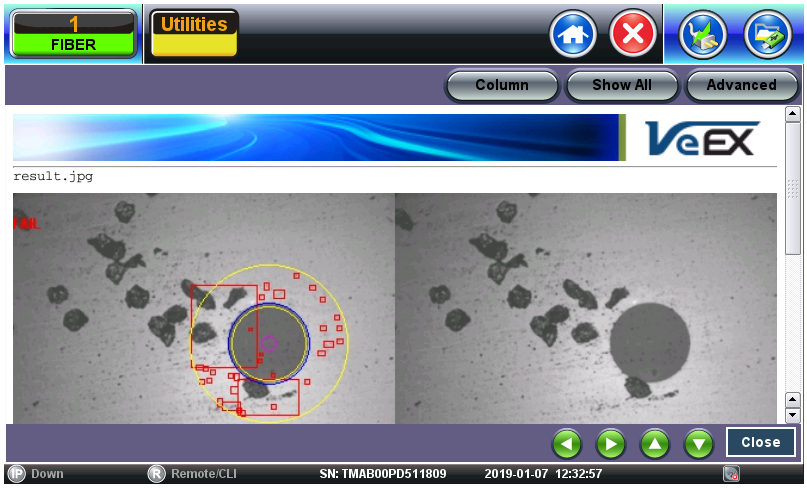


Fiberscope test viewed in an HTML browser

Reports can also be viewed as pdf files.

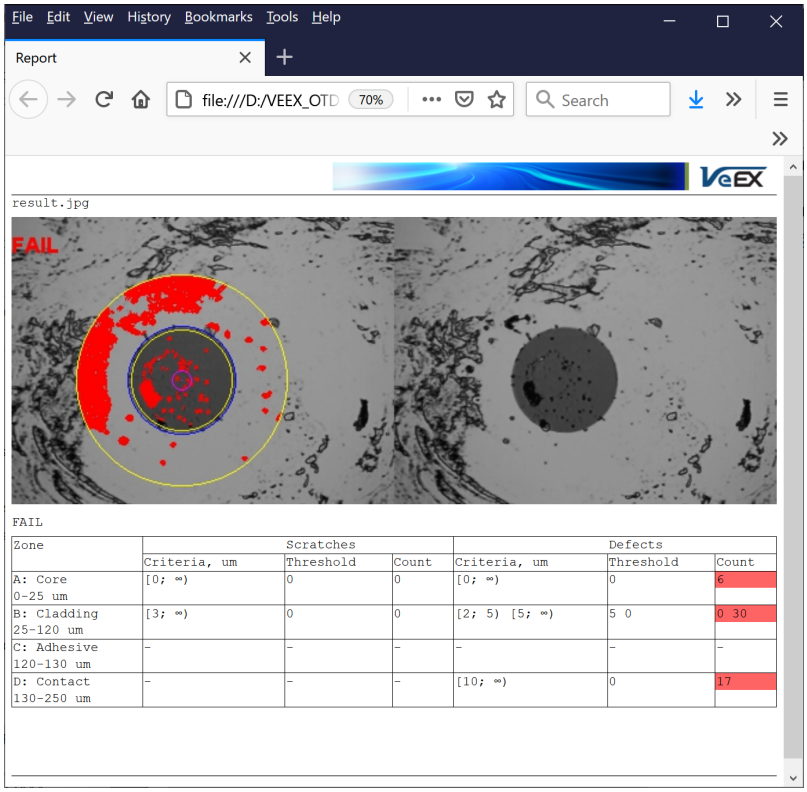
Test Analysis Report

To view the report files, tap **Utilities>Files>Save**. The Fiber Scope test report can be viewed in JPG format or exported to PDF. In addition, all fiber optic test results can be viewed using Fiberizer Cloud or the Fiberizer Desktop Plus PC software. For more information on viewing reports, see "File Manager" on page 110.



Analysis Report (.jpg format)

The test report can also be viewed in HTML format.



Zone	Scratches			Defects		
	Criteria, um	Threshold	Count	Criteria, um	Threshold	Count
A: Core 0-25 um	[0; ∞)	0	0	[0; ∞)	0	6
B: Cladding 25-120 um	[3; ∞)	0	0	[2; 5) [5; ∞)	5 0	0 30
C: Adhesive 120-130 um	-	-	-	-	-	-
D: Contact 130-250 um	-	-	-	[10; ∞)	0	17

Test Report viewed in an HTML browser

Fiberizer Cloud

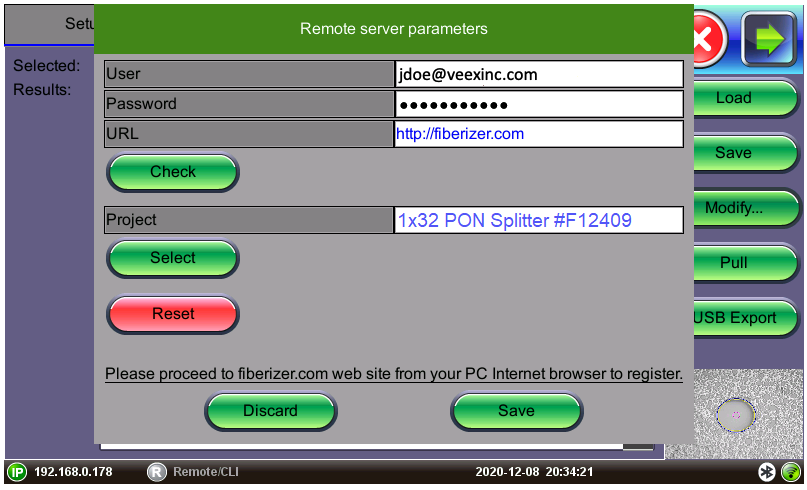
Fiber test results including Fiberscope images can also be uploaded to a registered Fiberizer Cloud account. Registration is free.

Connecting to Fiberizer Cloud

To connect the test set to Fiberizer Cloud, you must be a registered user. For new users, go to the fiberizer.com website from a PC Internet browser to register before proceeding with these directions.

Go to http://fiberizercloud.com to register.

1. After registering, tap on **Modify > Settings**.
2. Enter the username and password, then tap **Check**. If the message ***Connection has been successfully verified*** does not display, recheck the username and password.
3. Tap **Select** to choose a project folder to upload files to and tap **OK**.
4. **Save** or **Discard** the cloud login details.



Settings to connect to Fiberizer Cloud

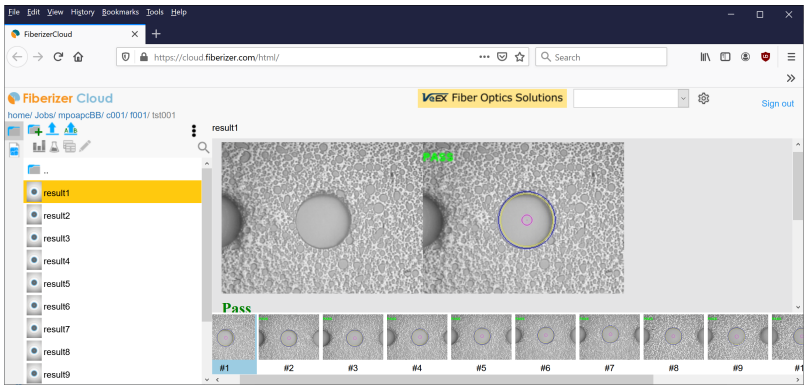
Uploading/Downloading Files with Fiberizer Cloud

Before attempting to upload or download, ensure that the test set is successfully connected to Fiberizer Cloud. Tap **Push** next to a directory item to upload it into Fiberizer Cloud. Tap **Pull** to download the directory collection from Fiberizer Cloud.

The Project selection defines the project folder location on the Fiberizer Cloud account to which to save the results. The default setting uploads to the global root folder.

For a project folder to appear in the project list, it must be created in Fiberizer Cloud first. The test set cannot create Fiberizer Cloud project folders.

After pushing results to the Fiberizer Cloud project, check the Jobs folder to which the saved cable folder was uploaded. Use Fiberizer Cloud to create professional reports or serve as an online storage backup. The example below shows MPO results on Fiberizer Cloud.

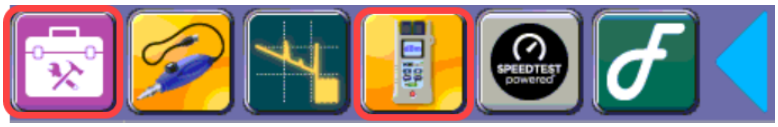


MPO Fiber View on Fiberizer Cloud

Optical Power Meter (OPM)

The VeEX Inc Optical Power meters are made with fast and accurate testing in mind. They are used to measure the power running through a cable at a given wavelength, and interface with phone, PC, or other VeEX devices to save and generate reports on the findings. This information is used to verify that the cable span is working correctly and to find the source of the problem when it's not. When paired with a VeEX Optical Light Source (OLS) or as part of a VeEX Optical Loss Test Set (OLTS), which includes both, WaveID can be used to quickly test several wavelengths without having to adjust the OPM settings.

To access the OPM Viewer from the Test Application screen, select  >  .



Toolbox Menu - OLTS/OPM Viewer option

Only optical power meters (e.g. Built-in or FX4x/8x OPM series meters) approved by VeEX are supported. WaveID will work with OLS in CW mode only. Accessing the Optical Power Meter module shuts down GPS and the atomic service.

Do not connect the fiber before opening the OPM application. First, zero the meter with the dust cap closed before making any measurements.

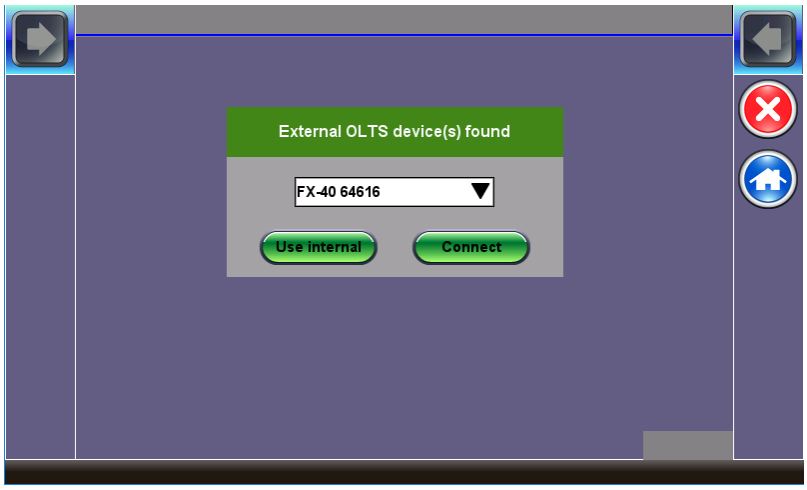
Connecting to the internal (built-in) OPM

1. Tap the **X** icon to close OTDR mode. The **Fiber main menu** appears.
2. Tap **Optical Power Meter** on the main menu. The **OPM** screen appears with the **Caution** warning.

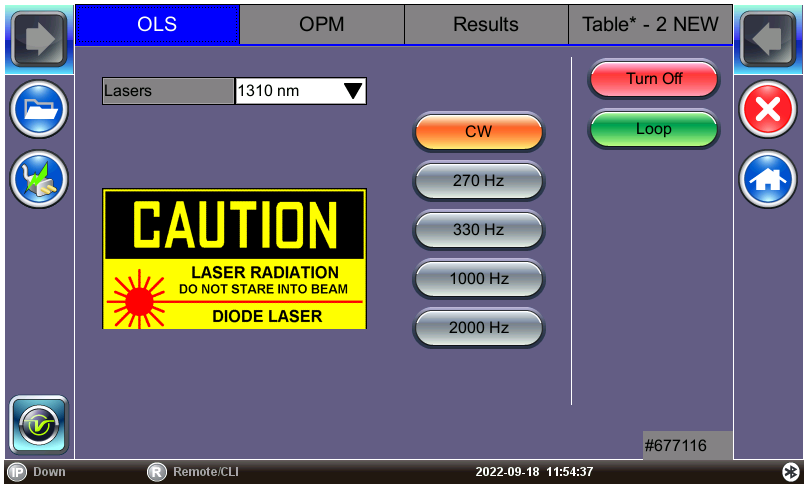
Alternatively, access the OPM screen by selecting **Optical Power(USB)** from the Platform menu.

Connecting an External OLTS Device

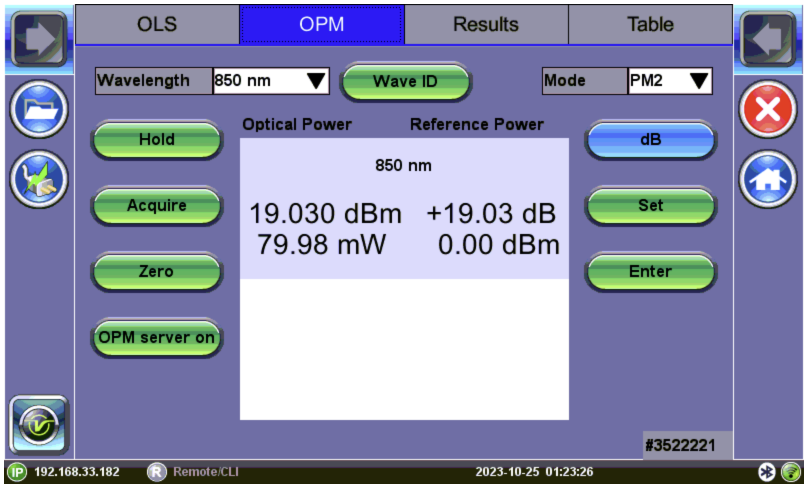
1. Insert USB dongle into the test set's microUSB port and connect it to a VeEX Inc. supported Optical Light Test Set (OLTS) device before launching the application.
2. Power on the external meter. Then, tap **Optical Power Meter** on the menu. The **External OLTS device(s) found** screen appears. Power on the external meter. Tap **Test Tools < OPM** on the menu. The **External OLTS device(s) found** screen appears.
3. Select the connected external meter and tap **Connect** to proceed to the external OPM menu or **Use Internal** to use the built-in OPM menu if it supported by the test set. The **OPM** screen appears with the **Caution** warning.



The Name of the External OLTS device is Displayed Once Detected



OLS Menu



OPM Menu

- **Wavelength**: Matches the calibrated wavelength to the signal being measured.
- **Wave ID**: Detects the incoming wavelength automatically from a supported VeEX Inc.OLS. Use when operating the OLS in continuous wave (CW) mode with or without Loop enabled.
- **dB/dBm:** Switches between dB and dBm measurement units. A Green dB button shows absolute power level in dBm. A Blue dB button measures relative power loss in dB. Use the Set (Reference) and Enter (edit Reference) to set Reference, edit Reference, and view measurements in three units: dBm, dB, and Watts.

  After toggling to the dB button to blue, the Set and Enter buttons appear.
- **Set**: Sets the reference value for the current wavelength.
- **Enter**: Edits current wavelength reference value.

- **Hold**: Freeze measurement to the last power or loss reading on the screen. “HOLD” appears next to “Optical Power” when tapped. Tap **Hold** again to unfreeze it.
- **Acquire**: Loads current measured value into the **Table** tab. The **Table** tab indicates how many new records have been temporarily saved into memory. In manual IL test mode, the **Acquire** button must be used to capture each individual reading (e.g. same fiber at different wavelengths) unless Loop is turned on.

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

   *To permanently save the table of results, you must save into a test file.*
- **Zero**: Recalibrates the OPM to treat current conditions as zero. Used when measurement conditions change significantly or to re-calibrate the OPM. Make sure the cover is shut on the OPM test port before tapping **Zero**. When in doubt, recalibrate prior to making any measurements, e.g, when testing in cold outdoor temperatures and then moving testing into a heated building.

   *Put the cover over the OPM test port BEFORE recalibrating.*
- **OPM Server On:***Remote control feature not currently supported.* Broadcasts the IP address on the current network for users to connect to the test set module's built-in optical power meter through Ethernet/TCP/IP using **Fiberizer LTSync Windows Desktop** software for remote control and access.
- **Mode**: Designates the measurement specification built-in: PM1 (-70 to +10dBm), PM2 (-50 to +25dBm), or PM3 (-65 to +15dBm). For specific information on the PM1, PM2, and PM3 specifications, see the platform's datasheet at *www.veexinc.com*.

Calibrating to Laser Source

To perform loss (dB) testing, the meter must be referenced (calibrated) to the Laser Source output.

To measure reference cable loss using the built-in light source (Loopback Referencing):

1. If beginning testing, zero the meter by closing the dust cap and pressing the **Zero** button.
2. Connect the port with the desired wavelength OLS to the OPM port using a patch cord.
3. Turn on dB measurement by toggling the **dB** button to **blue**.
4. Select the **OLS** tab, select the laser wavelength, and turn **ON**. Press **Loop** to cycle through all supported wavelengths.
5. Select the **OPM** tab and select the measurement wavelength or press **Wave ID** to automatically detect the correct wavelength.
6. Tap **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. Tapping **Set** will overwrite previously saved reference value(s).

To measure reference cable loss using an external light source:

1. Connect the OLS to the OPM port using a patch cord.
2. Turn on dB measurement by toggling the **dB** button to **blue**.
3. Select the measurement wavelength. If using a supported VeEX light source in CW mode, pressing "Wave ID" automatically selects the correct wavelength.
4. Tap **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. Tapping **Set** will overwrite previously saved reference value(s).

Measuring Power (dBm)

1. If beginning testing, zero the meter by closing the dust cap and pressing the **Zero** button.
2. Insert the fiber being tested into the OPM port.
3. Select the measurement wavelength. If using a supported VeEX light source in CW mode, pressing "Wave ID" automatically selects the correct wavelength.
4. Tap **Acquire** to record a result. Acquired results can be viewed from the **Table** tab and saved from the **Results** tab.

Measuring Loss (dB)

1. Set reference values for all testing wavelengths (refer to [Calibrating to Laser Source] for more details.
2. Remove the reference cable and connect fiber to the OPM port on the unit.
3. Tap **Acquire** to record a result. Acquired results can be viewed from the **Table** tab and saved from the **Results** tab.

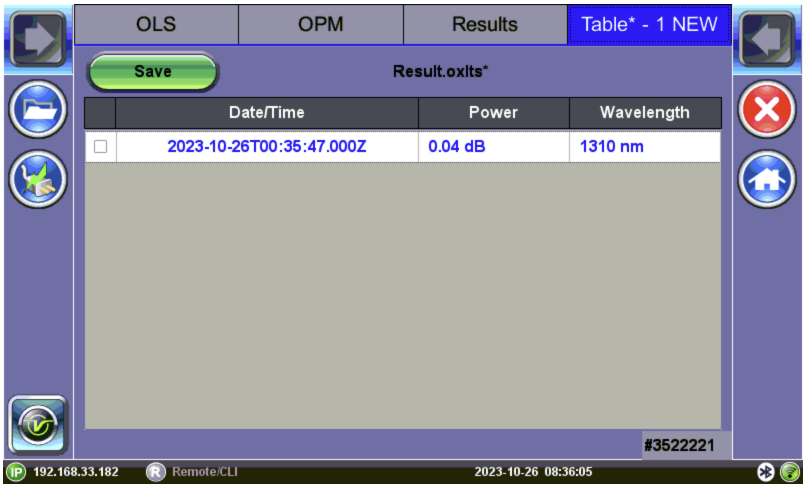
Readings (Table tab)

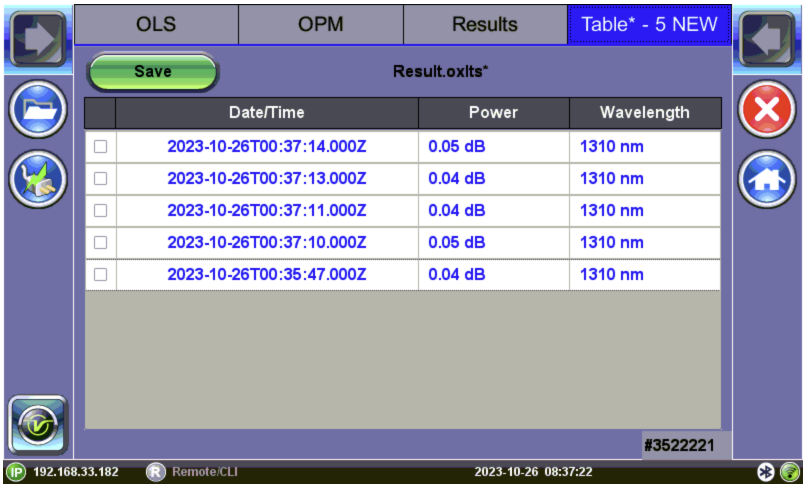
OPM readings appear in the **Table** tab. Saving readings will permanently write data to the **Results tab**. More than one reading can be saved at a time. Use this function to organize/filter results in project batches, so that the correct set of results are grouped together appropriately. Pressing **Remove** will permanently remove the readings from the current list.

To view and save (enter) test results into the Results table:

1. Select the OPM tab. Verify the insertion loss (IL) values are acceptable, then tap **Acquire** to load values into the **Table** tab. The **Table** tab title shows how many fiber records have been temporarily saved in the format **Table*-*n* NEW**, where n is the number of new records.

2. To view the active results table, select the **Table** tab.





3. To permanently save the fiber record locally, select the record(s) and press **Save**. The **Result saving** screen appears. The filename will default to the date/time stamp unless a specific file name is entered.

The JobID/CableID/FiberID/TraceID fields determine the location to which the trace is saved. If these settings are not set accurately, the trace will not save to the desired location.

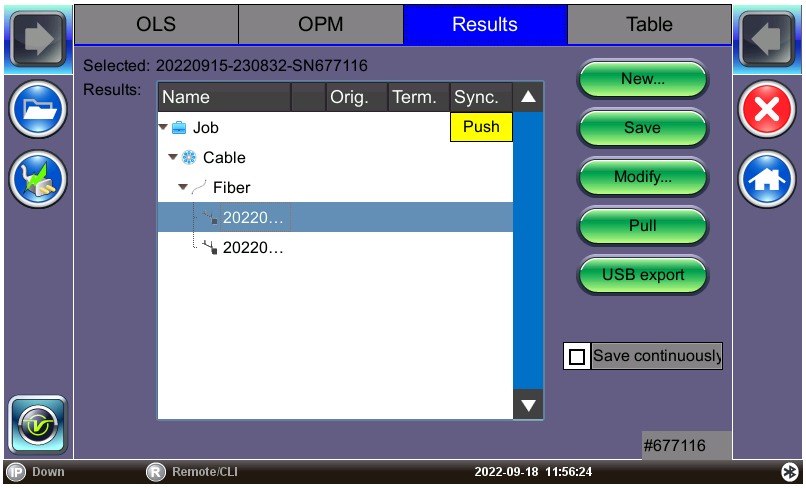
4. Tap **OK**. The readings are saved to a file and the table resets.

To remove results before saving, select the checkbox next to the reading(s), then tap **Remove**.

After saving power or loss readings to a file, access the file in the **Results** tab.

Results

Results can be saved to the test set, exported to USB, or uploaded to Fiberizer Cloud.

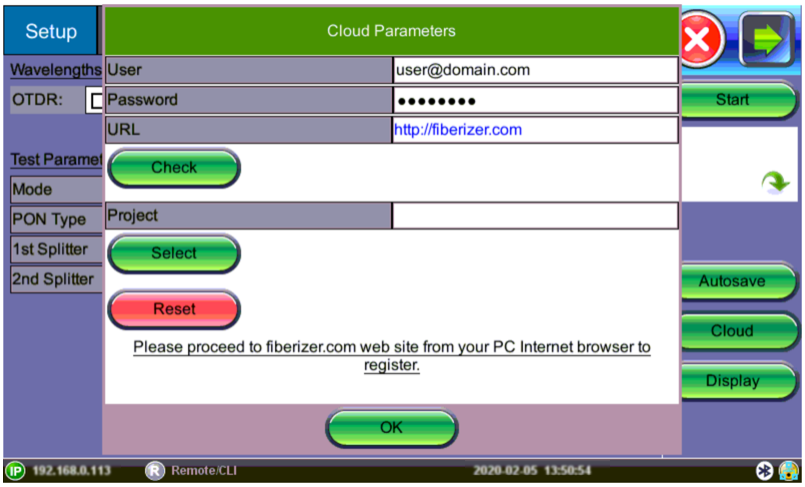


Results Management Menu

The results screen is used to view previously saved results. Test results can be pushed/pulled from Fiberizer Cloud. The directory displays the location of stored files. Connect to Fiberizer Cloud, then select the file(s) by tapping them. Refer to "Fiberizer Cloud" on page 144 for details on connecting to Fiberizer Cloud. Refer to "Results/Reports" on page 141 for more details on fiber test results.

Use the following options when using the **Results** screen:

- **Push/In Sync**: Uploads locally saved results to Fiberizer Cloud. *In Sync* indicates the results have been saved to Fiberizer Cloud successfully. To push the results to Fiberizer Cloud, ensure connection to the network via Ethernet or WiFi, and then tap **Modify>Settings** to sync with Fiberizer Cloud. Then, tap **Push** to sync saved files to the cloud.



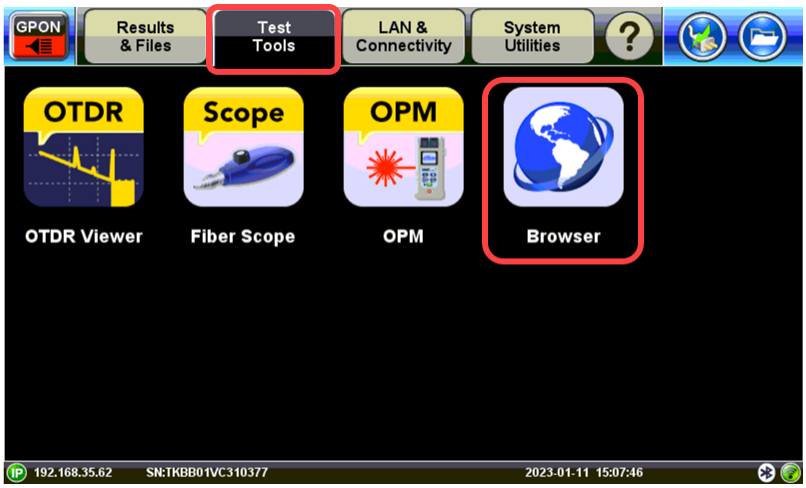
Fiberizer Cloud set up screen

- **New**: To create a new folder.
- **Save**: Saves results. Once saved, the files can be accessed in File Manager and R-Server (if available). Refer to "Working with Saved Results, Profiles, Images" on page 111 and "R-Server" on page 182 for more information.
- **Modify**: Select a file or folder in the directory to modify. Options to Rename, Remove, and upload the selection to Fiberizer Cloud are available.
- **Pull**: When connected, pulls file from Fiberizer Cloud onto the test set.
- **USB Export**: Exports files to a USB stick. Choose Export Group to retain the tree format (sub-directory) or Export Flat to create a single filename using sub-directories to build a name.
- **Save continuously:** To autosave results at a specified interval (1 to 60 seconds). Use this option to check power drift.

Web Browser

A web browser is available in the **Test Tools > Browser** menu and can be used to quickly verify Internet connectivity.

The built-in web browser uses the management port IP connection. An active IP connection can be established either through Ethernet or WiFi. The web browser defaults to VeEX's test website. Use the Web browser's navigation bar to enter the name of the website you wish to reach. Navigation capabilities may be limited.

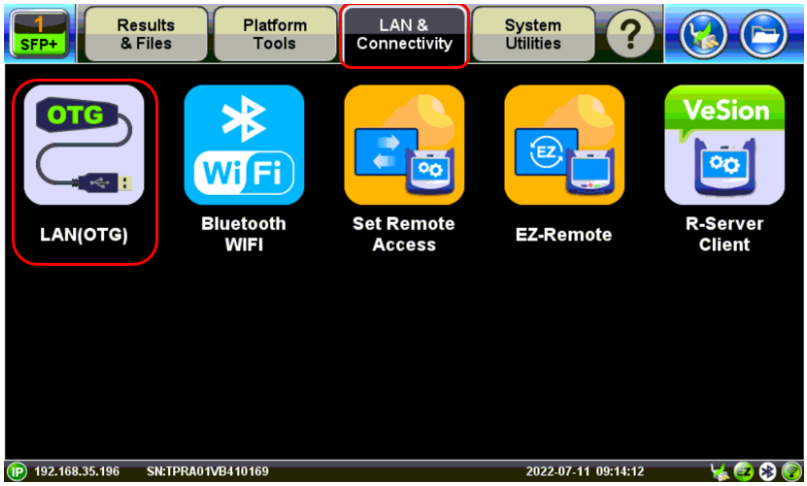


LAN & Connectivity

LAN (USB OTG Adapter)

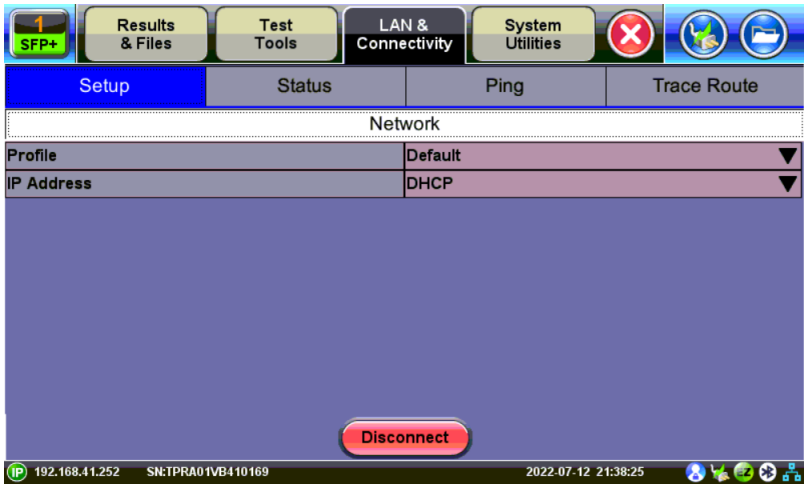
The LAN port, also known as Management Port, is used by the test platform functions, to communicate with remote clients, Internet, cloud applications and run some basic connectivity tests. Network parameters must be configured prior to performing any connection dependent measurements. An IP connection needs to be established in order to perform a Ping or Trace Route test. An (optional) external USB OTG to 10/100BASE-T adapter is required for LAN connection.

You can access the management port configuration on the **LAN & Connectivity > LAN(OTG)** menu.



Setup

Network configuration settings are available in the Setup menu.



Setup

By default, the IP configuration is set to DHCP and the unit will automatically attempt to connect. Additional fields will vary depending on Static or DHCP connection:

- **Profile:** Default, Delete, Save, Save as..., Default, or Last configuration
- **IP Address:** Select from Static or DHCP
  - **Static:** If Static is selected, enter the Local IP, Gateway address (if Gateway and DNS are set to Enable), and Subnet. All Static fields can be filled by tapping on the section to access an alphanumeric keypad.
  - **DHCP:** If DHCP is selected, the unit will obtain IP address parameters from the DHCP server
- **Local IP:** IP address of the test set
- **Subnet:** Enter the subnet mask
- **Gateway and DNS:** ON or OFF
  - **ON:** If enabled, enter the IP address of the Gateway and DNS server in Static mode, or use the IP address provided by the DHCP server in DHCP mode

If DNS is set to Primary or Primary & Secondary, a DNS IP is required in order to use the

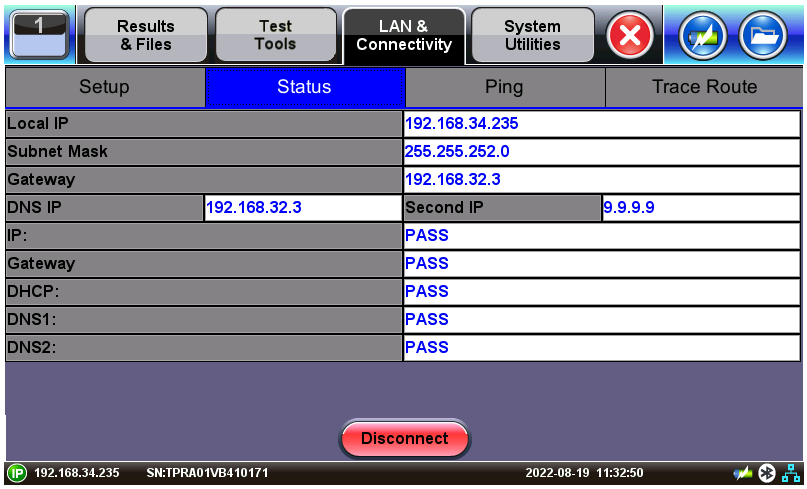
URL as a destination.

- **OFF:** If disabled, no Gateway or DNS server will be used for the tests

Enter all parameters then press **Connect** to start the test.

IP Connection Status

Ensure the Status is **PASS** before continuing with any IP tests. If the connection fails, go back to the setup screen to verify that the parameters are entered correctly. Verify that the Ethernet cable is properly connected on the management port on the left hand side of the unit.



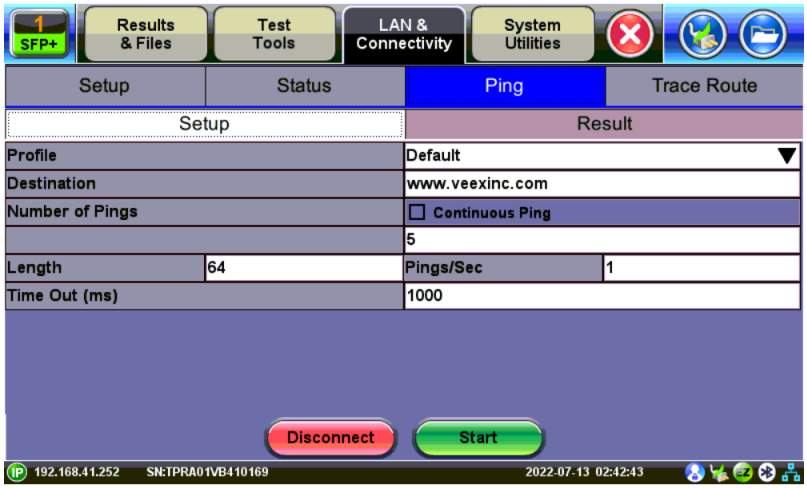
Status

- **DHCP:** PASS indicates that an IP address has successfully been assigned.
- **IP:** PASS indicates that the IP address assigned has been verified to be unique in the network.
- **Gateway:** PASS indicates that the gateway IP address is valid.
- **DNS:** PASS indicates that the DNS IP address is valid.

Ping Testing

The Ping Result provides the number of Sent, Received, Unreach, Missing, and the Round Trip delay.

Ping is a popular computer network tool used to test whether a particular host is reachable across an IP network. A ping is performed by sending an echo request or ICMP (Internet Control Message Protocol) to the echo response replies.



Ping Setup

Ping Setup

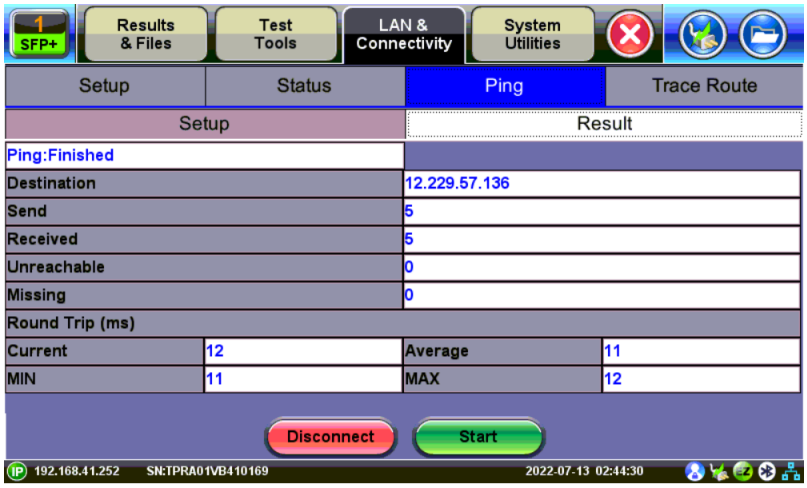
- **Profile:** Delete, Save, Save as..., or Default.
- **Destination:** Press the drop -down menu and enter the destination IP address or URL to ping.
- **Number of Pings:** Enter the number of ping attempts (up to 10000) that will be performed to reach the network device.

  *If Continuous Ping is selected, the user is not required to enter the number of pings. The test set will continuously ping the target host until the user presses **Stop**.*
- **Length:** Enter the length of the ICMP echo request packet transmitted.
- **Ping/Sec:** Enter the Ping repetition rate (Ping/second).
- **Time Out:** Time-to-Live (TTL) in milliseconds. Enter the maximum time allowed (in ms, up to 99999 ms) between an ICMP ping and echo response.

Once the parameters are configured, press **Start** to begin the test.

Ping Results

Pressing Ping will take you to the **Result** tab and start the Ping test.

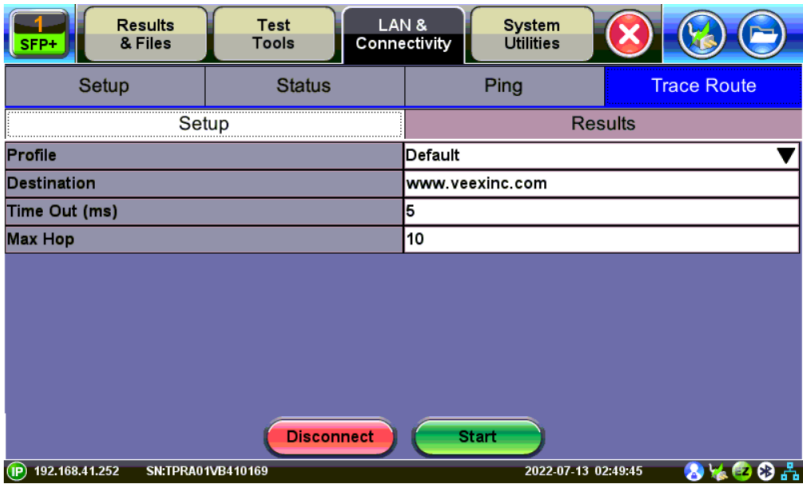


Ping Result

- **Destination:** Indicates the destination IP address.
- **Ping status:** In Progress, PASS, or FAIL.
- **Sent, Received, Unreach, Missing:** Number of pings sent, received, unreached or missing. A Ping is counted missing if no response is received before timeout. A Ping is counted unreached if an echo response is received with host unreachable set.
- PING also estimates the round-trip time in milliseconds.
    - **Current:** The current time for a Ping request to be answered.
    - **Average:** The average time recorded for a Ping request to be answered.
    - **Max:** The maximum time recorded for a Ping request to be answered.
    - **Min:** The minimum time recorded for a Ping request to be answered.

Trace Route

Trace Route is a common method used to find the route to the destination IP address or URL. It is often used to identify routing problems and unreachable destinations. All the remote IP addresses and their response times are displayed indicating possible network congestion points.



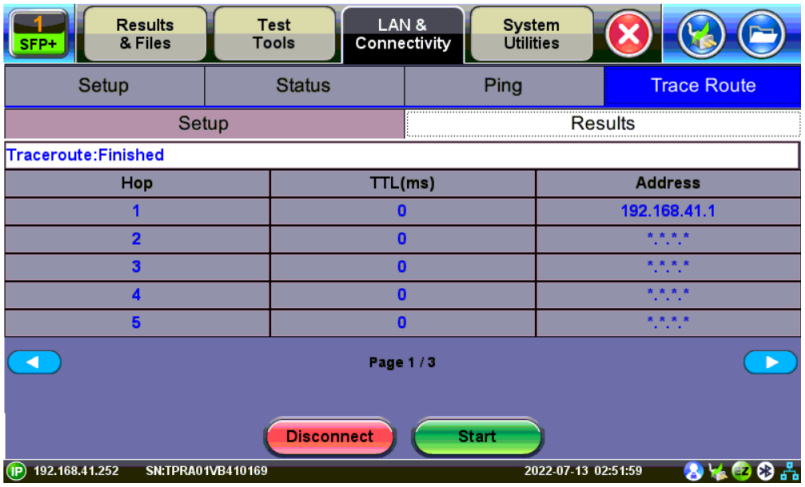
Trace Route - Setup

Trace Route Setup

The following setup selections are available:

- **Profile:** Delete, Save, Save as..., Default. Select Default to recall a trace route file or create a new test
- **Destination:** Enter the IP address or URL of the network device to be detected
- **Time Out:** Enter the maximum time allowed between an ICMP echo and response at each hop
- **Max Hop:** Enter the maximum number of network devices the packet is allowed to transit

Once the parameters are configured, press **Start** to begin the test.



Trace Route - Results

Results

- **Hop:** Order of the routers on the route
- **TTL:** Time to reach each router on the route
- **Address:** Address of each router on the route

If there is no response from a particular hop, an asterisk will be displayed.

Bluetooth/WiFi Wiz

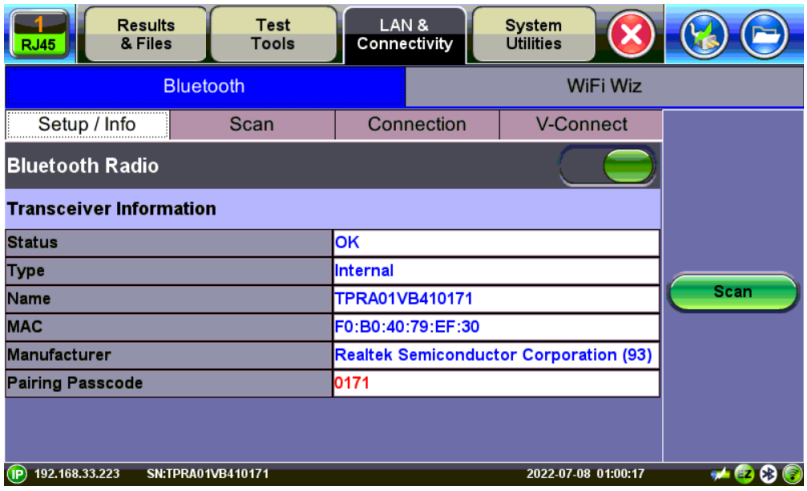
Bluetooth

Built-in Bluetooth support offers wireless connectivity up to 10 meters (30 feet), providing an untethered connection between the tester and other Bluetooth compatible devices such as a PCs and smart phones, enabling users to transfer test results and other files.

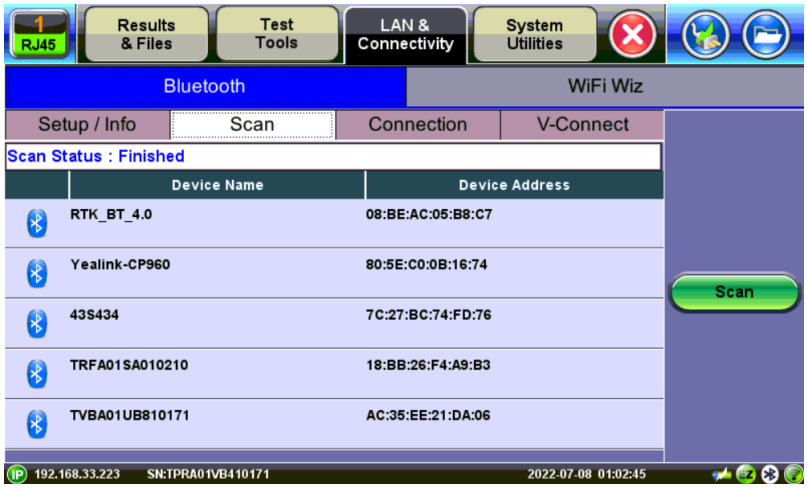
A **Bluetooth** icon displayed on screen indicates the Bluetooth connectivity status. A grey icon indicates no Bluetooth connectivity, while a green icon indicates a successful Bluetooth connection.

Bluetooth Adaptors - Compatibility Not all Bluetooth adaptors on the market are supported. Please use adaptors that have been tested and supplied by VeEX only to ensure compatibility and correct operation.

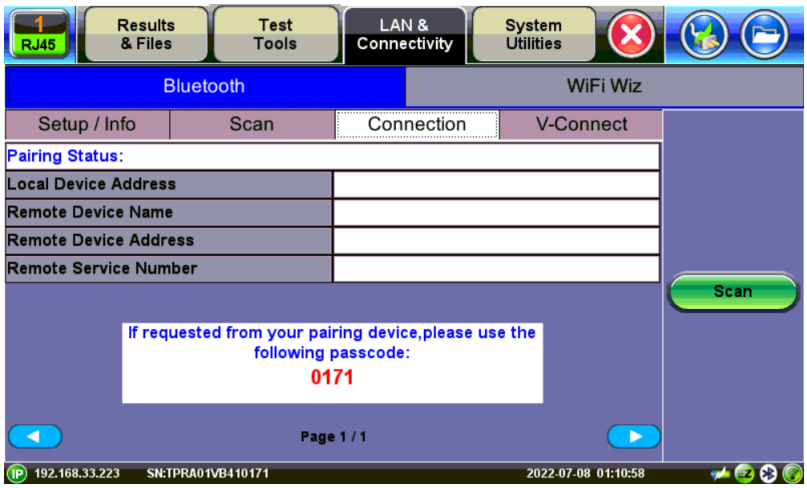
Bluetooth details will be displayed including the MAC address of the device and the last 4 digits of the test set serial #. The last 4 digits of the test set will be the pairing code between the unit and the external device.



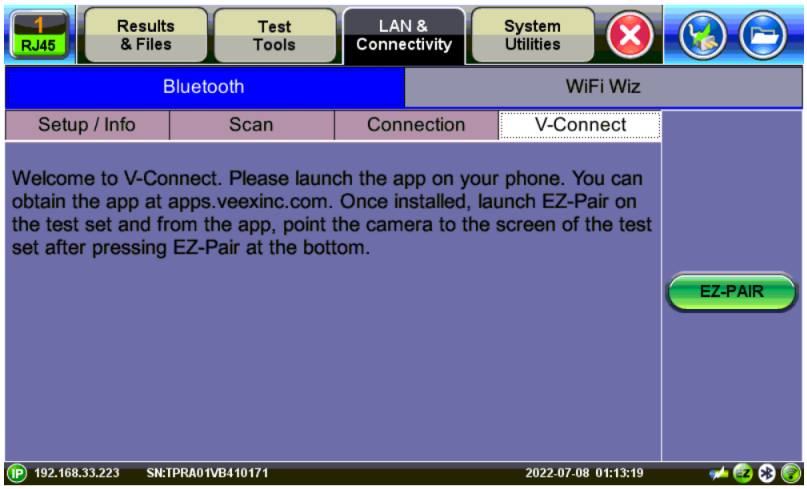
Bluetooth Setup/Info



Scan



Bluetooth - Connection - Passcode

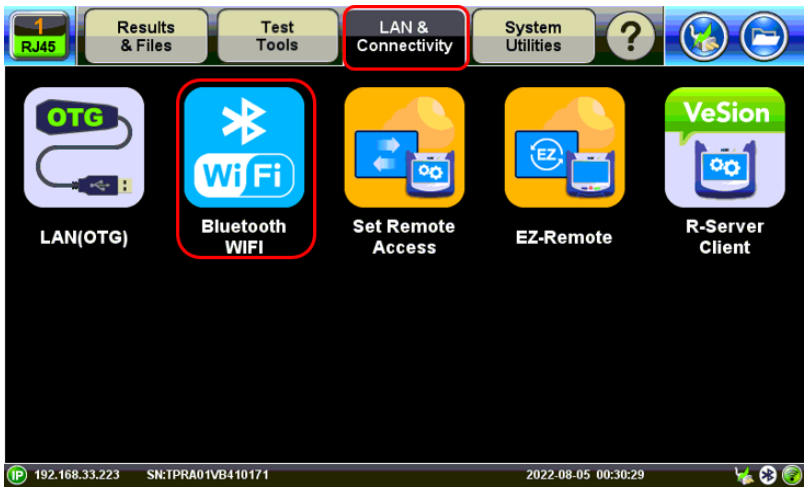


V-Connect/VxConnect

Bluetooth Setup

1. Press **Scan** to check for available Bluetooth devices. Once scanning is complete, a list of discovered Bluetooth devices will be listed. Please ensure the peripheral device is set to **Discoverable** during Scanning and Pairing operation.
2. Press **Pair BT** to begin the pairing process. During the pairing operation, you will be prompted to enter a code on the peripheral device (PC or Mobile Phone) in order to pair successfully. Enter the last 4 digits of the test set's serial number as shown in the **Connection** tab.
3. Once paired, click the **Services** button at the bottom of the screen to check the service attributes. To upload test results via Bluetooth, full data upload service will be required.

WiFi Wiz



Built-in web browser remote control is available when WiFi is enabled.

Passwords are case sensitive. If the wrong network key is entered, 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.

The WiFi Wiz function can be used to provide WiFi connectivity to the unit. Depending on the unit's model, it supports 802.11 b/g/n (2.4 GHz frequency band) connectivity or 802.11 a/b/g/n/ac (2.4 GHz and 5 GHz frequency bands) connectivity. Refer to the unit's specification sheet for details.

The WiFi Wiz function supports:

- WEP, WPA, WPA2 Encryption
- Scanning
- SSID broadcasting and report
- Signal Strength
- IP Connection and Ping Test

WiFi Procedure

1. To access the WiFi option, tap **Tools**, and then tap **Bluetooth/WiFi**.
2. Select the **WiFi Wiz** tab.
3. Tap **Scan** to scan the list of available WiFi APs.

   AP List

   The following information is displayed for each AP:

   - SSID name of the AP
   - BSSID (MAC address) of the AP
   - AP's radio channel number
   - Lock symbol indicates if security is set on the AP (WEP, WPA or WPA2).
     When the AP is unsecured, no lock symbol is displayed.
   - Signal strength of the AP
4. Select one of the Access Points (AP) to start a connection. If the AP is locked, a network key is required to complete the connection. The key can either be 10 characters or 26 characters. Once selected, an **Edit Settings** function key appears.

   If the wrong network key is entered, 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. Tap **Edit Settings** or **Connect AP** to change the Encryption Type and enter the WiFi Key.
   - **Encryption Type:** Supported encryption types include WEP, WPA, and WPA2.
   - **Password/Key:** Security phrase or password necessary to access SSID and network. Tap the **Password** field to enter the AP password on the pop-up keypad.

- ASCII formatting supported
- The password/phrase can be hidden (**Global Settings** > **Show Password** > **Yes/No**).

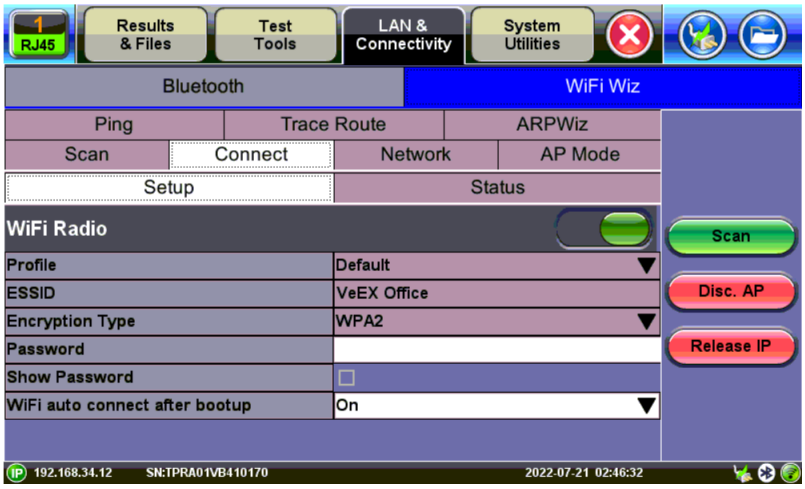
Passwords are case sensitive.

6. Tap **Apply** after selecting the Encryption Type and entering the key/password. The **Connect AP** button will change to **Disc. AP** upon successful connection and the **Connect Net** key will appear.

WiFi Wiz - AP Encryption Settings

Connect

The **Setup** tab displays the Profile, ESSID, Encryption Type and Password.

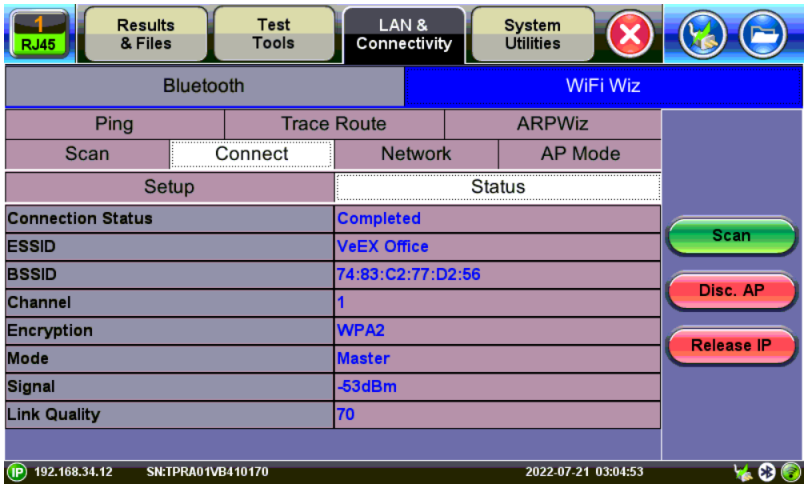


WiFi Wiz Connection Setup

Status

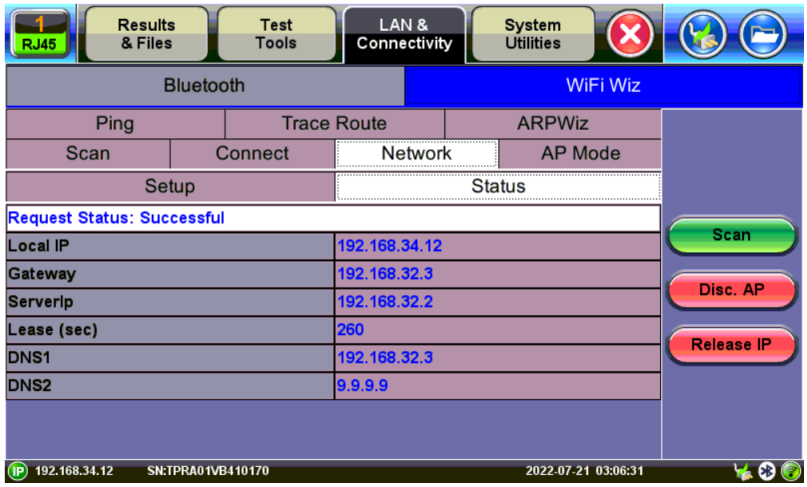
The Status Tab displays the following information on the connection:

- **Connection Status**
- **ESSiD:** Name connected to
- **BSSiD:** MAC address of wireless router/device connected to
- **Channel:** WiFi Channel # connected to
- **Encryption:** Encryption type
- **Mode**
- **Signal:**
    - Radio signal level (dBm)
    - Link quality score



WiFi Wiz Connection Status

After a successful connection to the Access Point, tap **Connect IP** to obtain an IP address and access the additional IP tests like Ping, Trace Route etc.



WiFi Wiz Connect IP

AP Mode

In AP Mode, the unit emulates a WiFi access point/DHCP server and allows WiFi Clients (PC/Phone/Tablet) to connect to the unit.

- **Mode:** Auto, Manual
    - Auto mode uses the default SSID and IP range
    - In Manual mode, the user can configure AP SSIDs and the IP range used by the DHCP server
- **SSID:** Displays the default SSID or the manually configured SSID used by the AP
- **IP Address:** Displays the default or manually configured IP address range used by the AP

Press **Enable** to enable AP Mode. After pressing enable, the test set will broadcast its SSID, which any WiFi client device can connect to.

Remote Access

There are different ways to control or access the test set and the information it contains, from a local (LAN) or remote (WAN) connected PC.

The EZ Remote service provides public registration servers to help users and test sets establish remote sessions, without having to get IT departments involved. It is considered a convenient on-demand service, for quick/temporary collaboration tasks. It should not be used for long-term applications (VeEX offers other remote tools for long-term applications). Refer to "EZ Remote" on page 175 for more information.

After accessing the test set remotely, a tab will open up for each selection made, allowing for quick access to each function.

Profiles

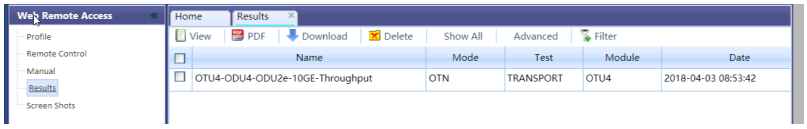
Test Profiles are configurations saved by the user that can be retrieved and reapplied to the test set. For example, commonly used configurations and test limits/threshold can be saved as test profiles, for different types of services.

Manual

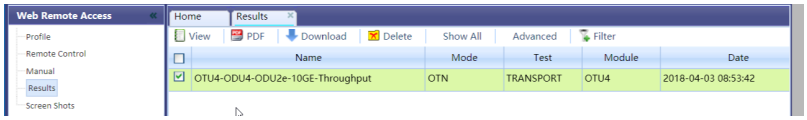
The feature provides access to the user manual that is built into the test set. In this application, the use of a local copy of the PDF file is recommended as the PDF client in the local computer is most likely faster than accessing the remote one and may offer better tools and function, including search capabilities. User manuals can be downloaded from the products' page at www.veexinc.com.

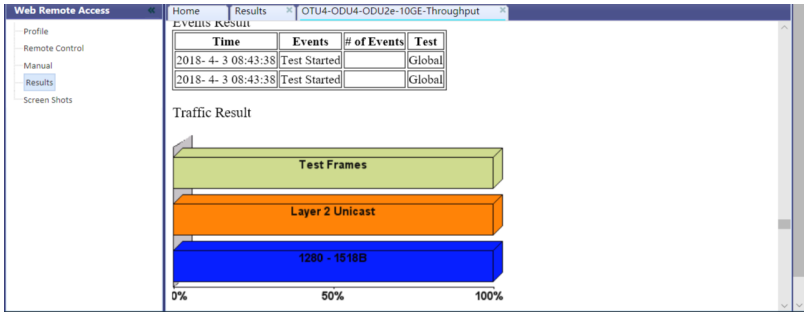
Results

Results list all the test results files currently stored in the remote test set. Users can **View**, **Rename** and **Delete** files stored in the remote test set, as well as **Download** selected files to the local computer or convert them to **PDF** and download.



To open a test results file, select it from the list and tap on **View**.





Files can be downloaded by clicking on **Download** (original file format) or **PDF**.

Screen Shots

Pictures (PNG) taken of the screen can be accessed from this link and sub-tab. Pictures can be viewed or downloaded to the local computer.

Screen captures can be made using the Lock button ( ) on the test set or from the remote computer, using the links provided or the respective F-key on the computer's keyboard. The screen capture function can be enabled in **>System Utilities>Global Settings>Save Settings**.

Remote Control (Screen Mirroring)

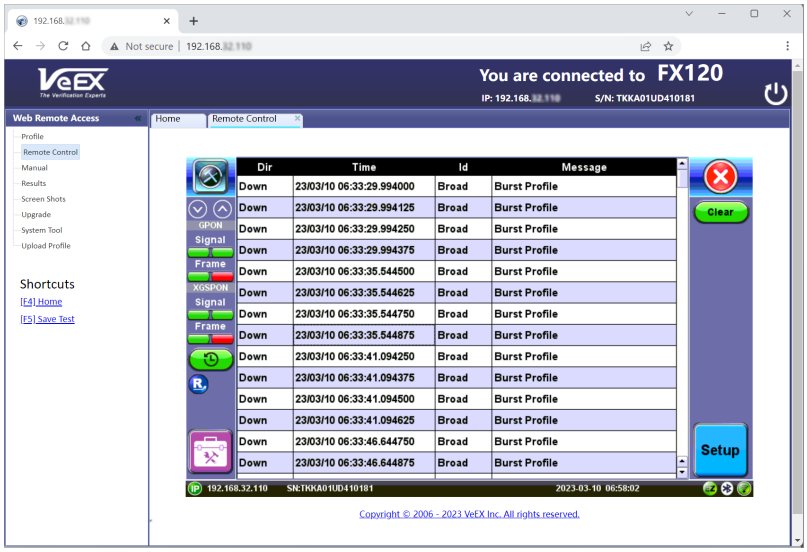
It is similar to using VNC, but in this case no VNC client installation is required. It uses standard Java-based web browser as a client. It mirrors the screen, mouse inputs and the rubber buttons available in the front panel of the test set.

1. On the test set, select the **Remote Access** option and enter the following information:

    - **VNC Service:** Enable or disable the remote access through remote web-browser clients running on PCs, Macs or certain tablets. The web browser must support Java (tm)

- **Web Super User Password:** Defines the password for users allowed to control the test set via standard web browser clients
- **Web Regular User Password:** Defines the password given to users who are only allowed to view the test set current screen via standard web browser clients, but not make any changes to test or test set.

2. In a web browser, enter the test set IP address. To locate the test set local IP address, refer to "WiFi Wiz" on page 166.
3. Click **vnc-home.html** and enter the Super/Regular password when prompted for a password. Use the buttons and icons on the right to navigate the test set remotely.



Web Browser - Remote Access

EZ Remote

The EZ Remote functionality allows users to quickly and securely connect to VeEX test sets all over the world, without the need for VPN, port forwarding or public IP addresses. This VeEX hosted service and user interface take care of all the complex tasks required, and present users with a simple application. Connect online anytime anywhere with any computer, tablet or smartphone, using standard web browser clients for screen-sharing, remote control and access to test results. Use it for remote control, collaboration, technical support or training purposes.

The basic EZ Remote service is offered by VeEX free of charge. It provides public registration servers to help users and test sets establish remote sessions, without having to get IT departments involved. All you need is internet access for the test set and a remote user. Feature location and functionality may vary from product to product.

VeEX's EZ Remote provides:

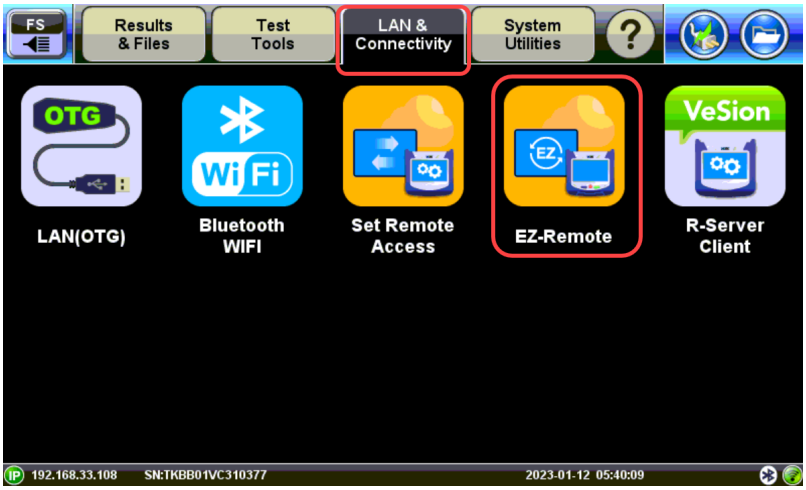
- **Remote Control** functionality to give users full control of remote test sets (screen mirroring and control).
- **Remote Access** functionality allows users to View, Download, Rename, Delete, Export and Convert results (PDF).

EZ Remote is considered a convenient on-demand service, for quick/temporary collaboration tasks. It should not be used for long-term applications (VeEX offers other remote tools for long-term applications).

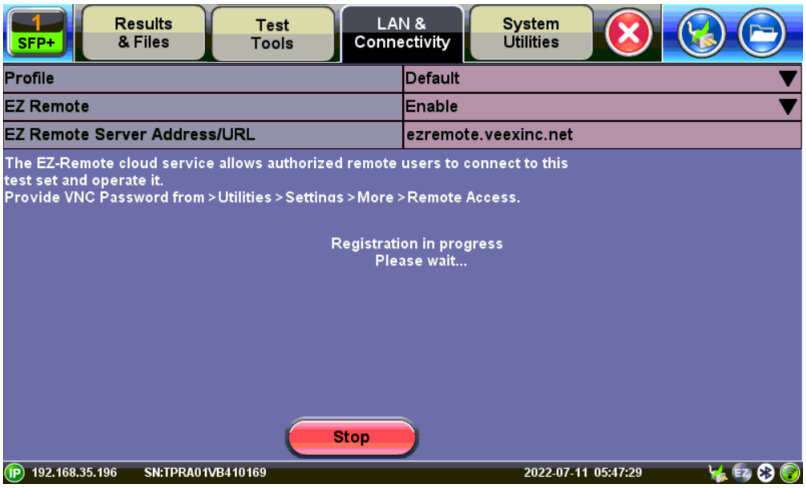
Initiate an EZ Remote Session from the Test Set

1. Use the **IP Tool** to connect the test set to a LAN using the RJ45 Ethernet management port (or using the micro-B USB OTG to 100BASE-T adapter), located on the side of the unit (recommended), or use **WiFi Wiz** to connect to a WLAN (using built-in Wi-Fi or a compatible external USB dongle). Make sure the test set gets a local IP address and that the LAN/WLAN provides access to the public internet (web).

2. . Go to  **> LAN & Connectivity> EZ-Remote**.



3. On the EZ Remote screen, set **EZ Remote** to **Enable**, confirm the **URL** is **ezremote.veexinc.net** (without www.), and tap on **Apply** to connect and establish a session with the EZ Remote server.



4. Provide the resulting **URL** and **Session ID** to the intended remote user.

5. You may continue to use the test set until a remote user logs in, then both will share control over the unit. Make sure the test set remains connected to the LAN/WLAN/Internet and that the **EZ remote session indicator** at the bottom of the screen stays green.

6. When finished, use the **Stop** button to terminate the EZ Remote session and disconnect from the server.

Connect to the Remote Test Set from a Computer, Tablet or Phone

Establish a Remote Access Connection

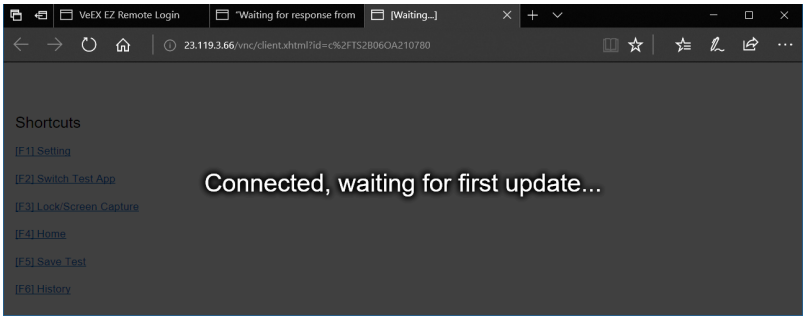
EZ Remote provides two types of services:

- **Remote Control** (screen and mouse/touch mirroring) to operate a test set from a different location.
- **Remote Platform Access** to access information stored in the remote test set, such as Test Results, Profiles, User Manual, Screen Captures (screen shots), information about the test set (Home) and its local IP address.

Although multiple users could simultaneously log-in to the same test set, they would be sharing the same mirrored GUI image and mouse control. This is not recommended since it is equivalent to having multiple users

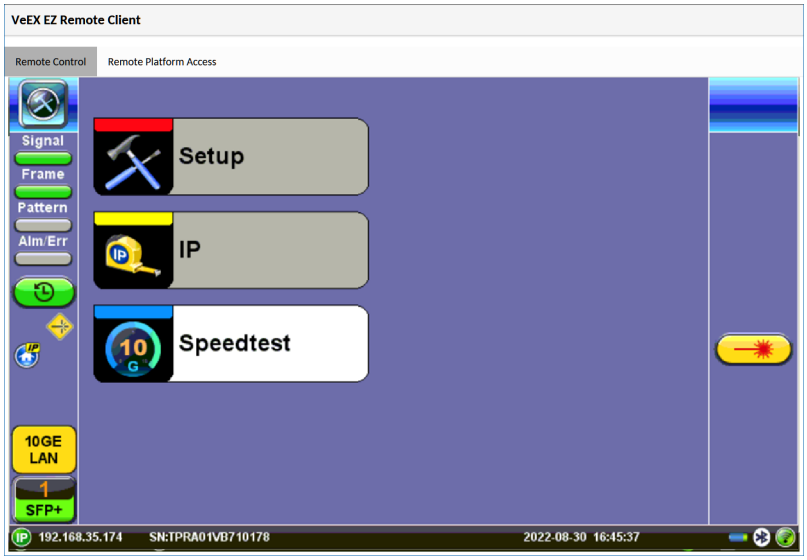
trying to operate one test set at the same time (also known as "mouse fight"). Nonetheless, it may be effective for training purposes with one or two extra users.

1. From a PC, Mac, Tablet or Smartphone launch an industry-standard Web Browser application and enter the URL http://ezremote.veexinc.net (without the www.). Enable pop-ups for your browser and be sure to authorize access to the site, if confirmation is requested by the browser or OS.
2. Enter the **Session ID** provided, making sure not to confuse zeroes (0) with Os. Click **Search** to find the target test set and stablish a peer-to-peer connection.
3. Once verified and connected, wait for the remote user interface to refresh. This may take a few seconds.



4. Shortcut buttons are provided below the mirrored screen, allowing access to functions provided by physical buttons on the instrument, such as **Settings**, **Home**, **Save Test** results. Click or tap on the shortcut to activate it.

5. Once the remote GUI appears, you can use the **Remote Control** tab to operate the test set in the same way you would control a local unit from its touch screen.



Save Test Results

To save the results of a test, from the remote computer, press the **Save** button below the screen image. Then use the pop-up keypad and/or the PC keyboard to enter the file name and add any extra details (if Advanced Save is enabled).

Access Remote Test Result Files

The **Remote Platform Access** tab provides links to access test results, test profiles, screen shots, the user manual and other information stored in the test set.

After accessing the test set remotely, a tab will open up for each selection made, allowing for quick access to each function.

Profiles

Test Profiles are configurations saved by the user that can be retrieved and reapplied to the test set. For example, commonly used configurations and test limits/threshold can be saved as test profiles, for different types of services.

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The feature provides access to the user manual that is built into the test set. In this application, the use of a local copy of the PDF file is recommended as the PDF client in the local computer is most likely faster than accessing the remote one and may offer better tools and function, including search capabilities. User manuals can be downloaded from the products' page at www.veexinc.com.

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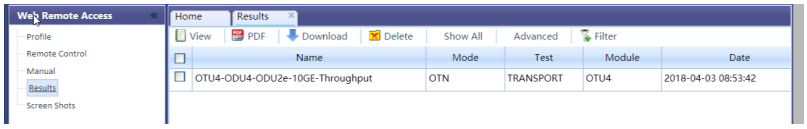
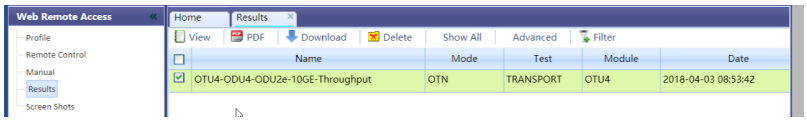
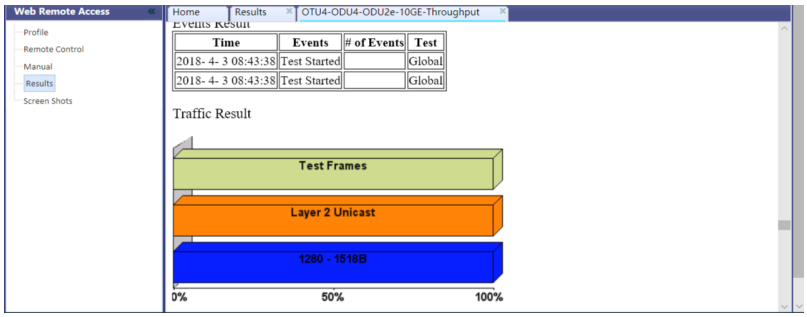


To open a test results file, select it from the list and tap on **View**.





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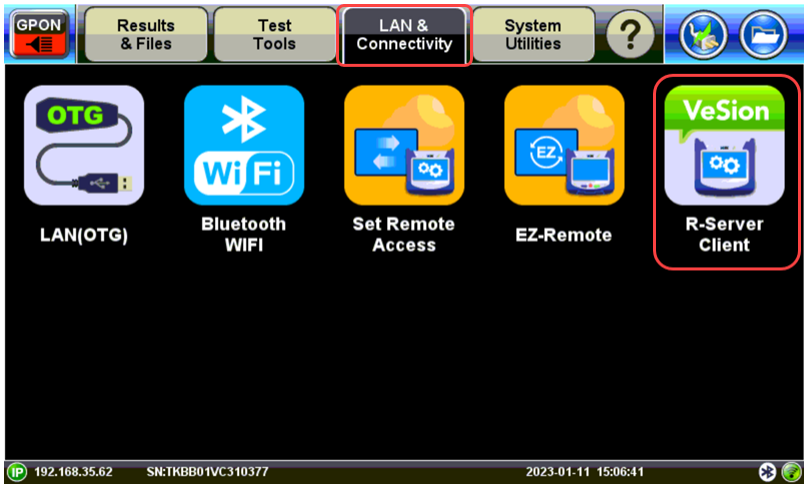
R-Server



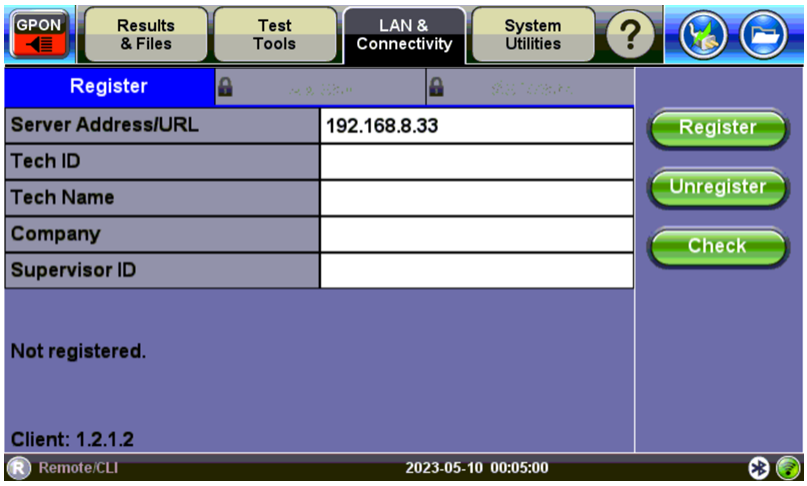
Use the R-Server option to manage test sets and store test results.

Part of VeEX's VeSion® centralized monitoring and management solutions, the R-Server Workflow and Asset Management system provides crucial tools to manage fleets of technicians, test equipment, standardized test profiles, thresholds, centralized test results collection, reporting, jobs/ticketing, and software update delivery to create coordinated and efficient disciplined workforce and test procedures. R-Server enhances the workflow to achieve the level of quality and repeatability required by telecommunications service providers, MSOs and their contractors. The flexible R-Server can be deployed in cloud, hosted, and corporate networks, on physical or virtualized servers.

Supervisors can preset and upload test parameters which are provided to the test sets as profiles. Technicians can download profiles, run tests, and upload results to a centralized system that stores and secures the data.

A test set must register to an R-Server (establish IP connection) before it can upload results to the server; otherwise, a reminder message will pop up.

Register a test set (establish IP connection)



R-Server on test set

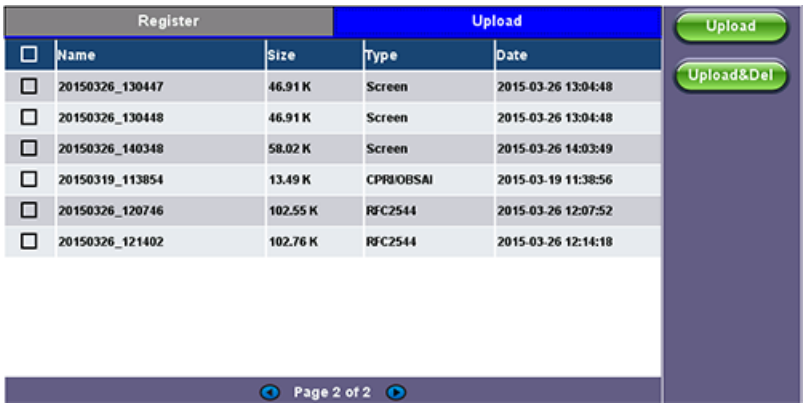
*If you are unsure if a test set has already been registered, press **Check**. If it has not been registered, complete the steps to register the unit.*

1. Contact the R-Server administrator and/or supervisor to get and enter the following information in the corresponding fields.
    - **Server Address/URL**: IP address or URL of the R-Server
    - **Tech ID**: Registered Tech ID
    - **Tech Name**: Registered Tech Name
    - **Company**: Company name
    - **Supervisor ID**: Supervisor ID
2. Press the **Register** button to register the test set on the R-Server. The test set sends the request to register to R-Server and a message appears saying that the registration is complete. Next, the registration must be authorized and approved by the R-Server manager in order to allow access.

3. When the test set registration is complete and approved by the R-Server manager, press the **Check** button to verify that the test has been authorized for use. Once authorized, results can be uploaded. If authorized, a message appears saying the test set has been registered and authorized.

*To unregister a test set from a R-Server account, press the **UnRegister** button.*

Upload Results

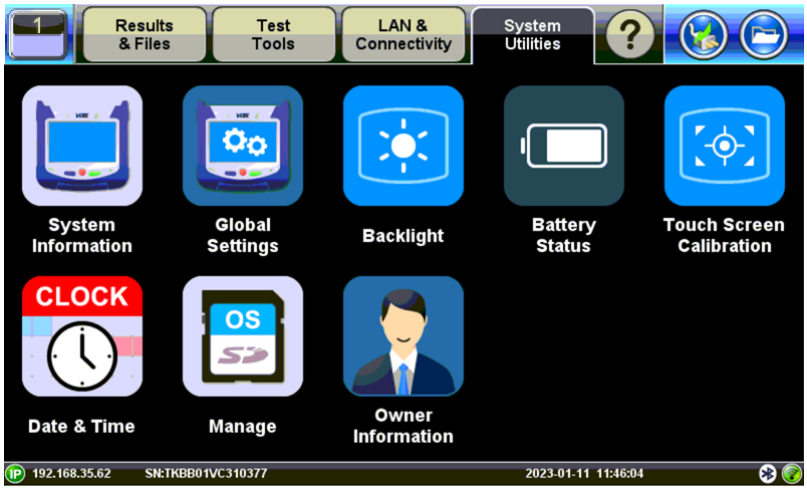


Uploading results to R-Server

1. Select the **Upload** tab and select the desired files to upload.
2. Tap **Upload** or **Upload&Del**.
    - **Upload**: Transfers the selected result file(s) and keeps the file(s) in the test set.
    - **Upload&Del**: Deletes the file(s) from the test set after uploading them.

System Utilities Overview

The **System Utilities** tab provides settings for the global parameters of the test set or platform (system settings).

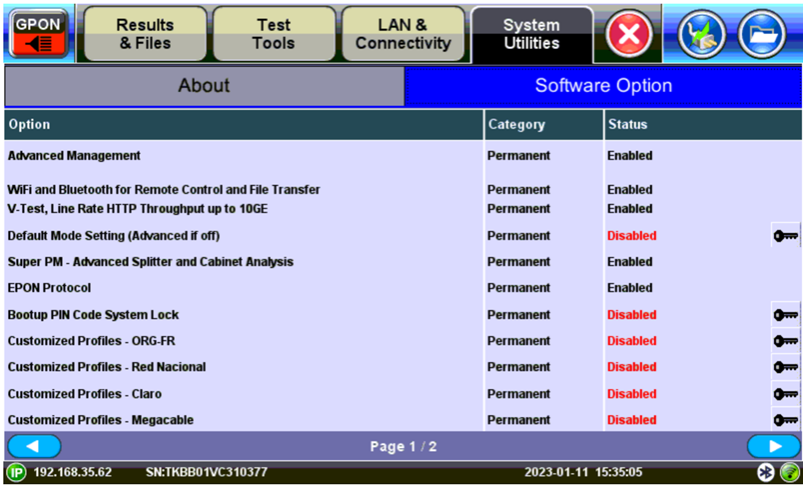


System Utilities/Settings Menu

System Information

This section provides information about the software platform version, serial number, and as well other information relevant to the test set, which may be required when contacting Customer Support. The tab provides a list of software licenses (optional test features) currently loaded in the test set.

About Tab



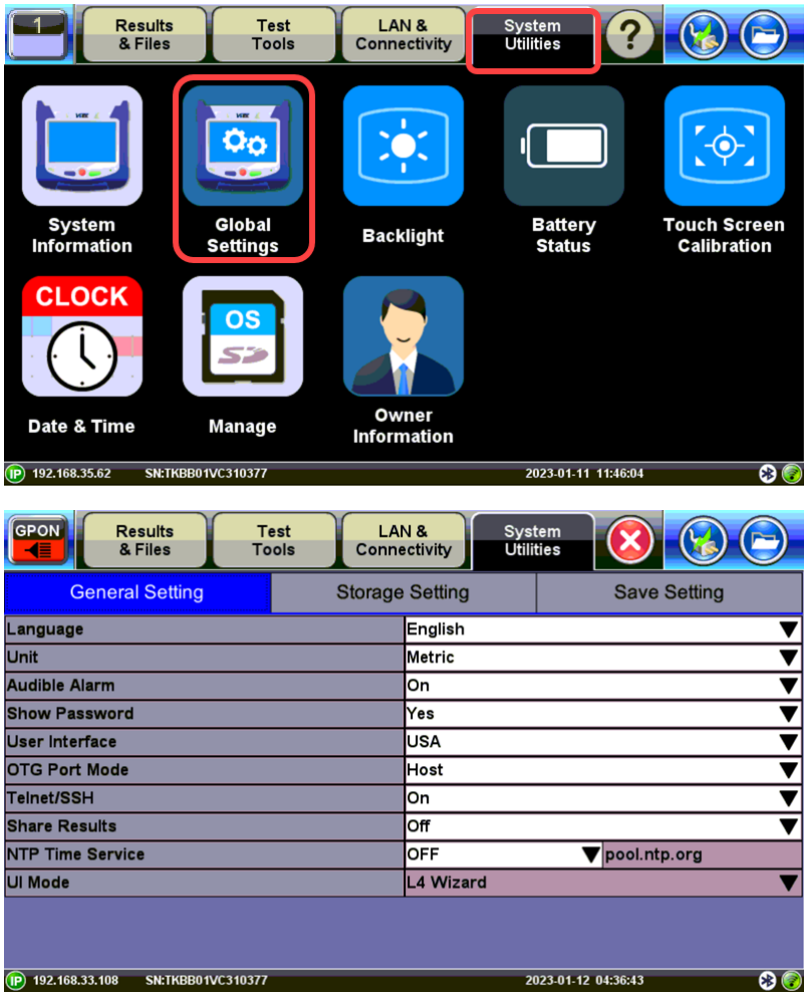
Software Options Tab

Activating New Licenses: Features and options marked as ‘Expired’ or "Disabled" (not currently loaded into the test set) can be purchased at any time and activated via VeExpress using an internet connection. Upon order confirmation, connect the test set to the internet via LAN or Wi-Fi, go to **>System Utilities >VeExpress** and press the **Check** button. The test set will download all newly added features and options from VeExpress servers and install them automatically.

If company policy doesn’t allow access to the public internet or the test sets are used within a secured network, request License Keys for manual activation. License keys must be requested at the time new options are purchased. To activate new features, tap on the **expired item** and enter the Activation Code received from VeEX,

VeEX partner or manager. Press **Activate** to complete the licensing process. Each activation code is specific to a test set and a feature. If multiple features are ordered, individual activation codes will be sent for each of them. Manually activated features are specific to a test set and can't be shared with other test sets.

Global Settings



Utility Settings - General Setting

General Setting

- **Language:** An alternative language for the user interface (if available). The device must be rebooted to fully activate the new language.
- **Unit:** Measurement system (English - feet or Metric - meter).
- **Audible Alarm:** When enabled, the test set's buzzer will sound (beep) when alarms and errors are being detected (if supported by the test application).
- **Show Password:** Hides/unhides username and password information associated with FTP and related IP functions.

- **User Interface:** The USA user interface version presents SONET/DSn application-oriented menus, while the International setting is more open to all settings.
- **OTG Port Mode:** Configures how the micro-B USB port will appear to any USB device connected to it via an USB on-the-go (OTG) cable. Later models may detect and configure the OTG port to host or device mode automatically.
    - **Host:** Enables the micro-B USB port to connect with USB devices, dongles, or accessories, such as a USB memory stick or Fiberscope. USB devices (dongles) will not be recognized if the OTG port is not set to Host mode.
    - **Device:**Enables the test set's micro-B USB port to connect directly with a Windows® PC and act as a storage device (like a memory stick), for the Share Results function.
- **Telnet/SSH:** Allow or disallow telnet connection to the unit (e.g., remote terminals, Customer Support troubleshooting, CLI or automation via scripts).
- **Share Results:**Enables direct transfer of saved results from a unit to a Windows PC. To directly transfer files, connect the unit to a PC via an OTG cable, set the OTG port to Device mode and turn Shared Results ON. In this mode, all new saved test results are copied to a shared partition that the PC can see as a drive.

  If Share Results is turned OFF, results are saved to the internal partition of the unit and can only be transferred to a USB memory stick using the in the File Manager To USB or To OTG function. To directly transfer saved files to a PC, refer to the **Share Results** function.
- **NTP Time Service**: Turn ON to allow the test unit periodically to obtain the current time from a public time server. Whenever the test set is connected to the Internet, the time will be updated.

If R-Server is used, the time service option can be made unavailable by the R-Server administrator. This ensures that all test sets have the same time, which is set by the R-Server.

Storage Setting

Storage Settings are not currently supported for OTDR, OPM, and Fiberscope results.

- **File Name Prefix:** Tap on the box to enter the file name prefix using the pop up alphanumeric keypad. Not used for OTDR filenaming.
- **Profile Deleting:** Auto Delete or Prompt before deleting profile.
- **Profile Saving:** Auto Overwrite or Prompt before saving profile.
- **Result Saving:** Manual or Prompt before saving results.
- **Advanced Saving:** Turn ON to add extra information to the results file to be uploaded to a centralized R-Server. *Requires Advanced Management Option.*.

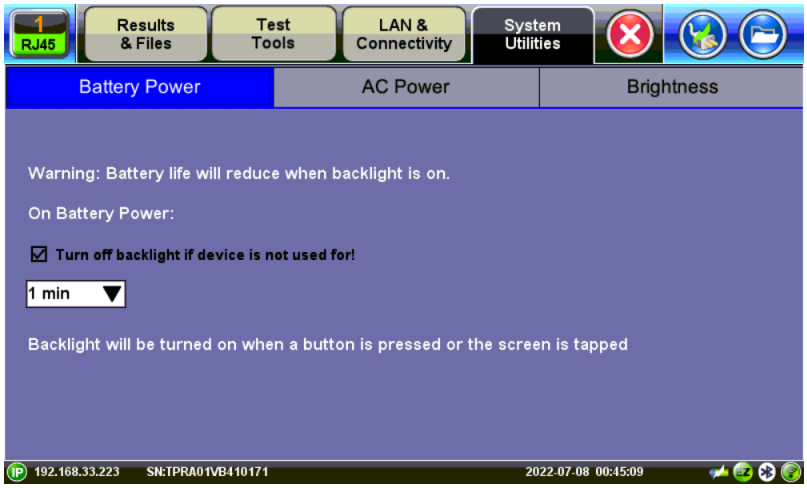
Backlight

This section provides backlight control of the unit. There are two intensity settings:

1. Battery power and
2. AC power.

On Battery Power

- Select a timer to turn off the backlight if the unit is not in use. This function helps improve the battery autonomy and preserve LCD life.
- To enable the timer, check "Turn off backlight if device is not used for" and with the drop-down menu, adjust the duration of the idle time before the backlight is turned off.
- Once the timer is active and the backlight turned off, any action on the test set (touch screen, keypad) will turn on the backlight again.

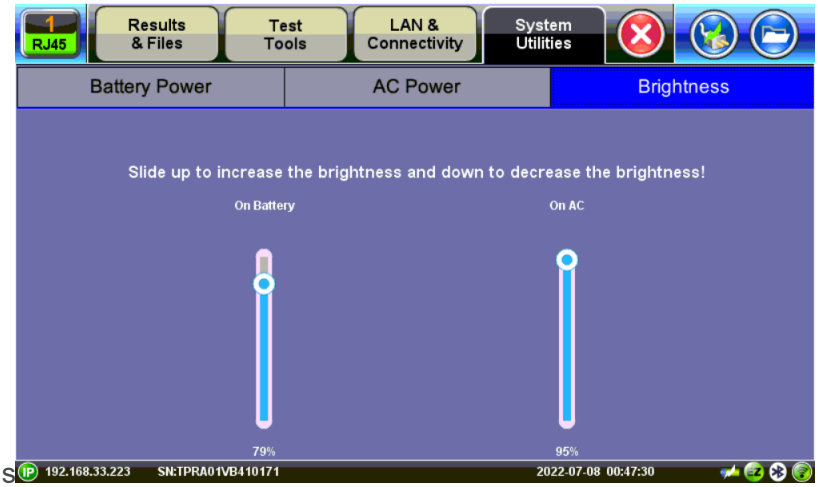


Backlight - Battery Power

Similar settings can be applied for when the test set is operating on **AC Power**.

Brightness

Select the brightness level for Battery and AC operation modes.



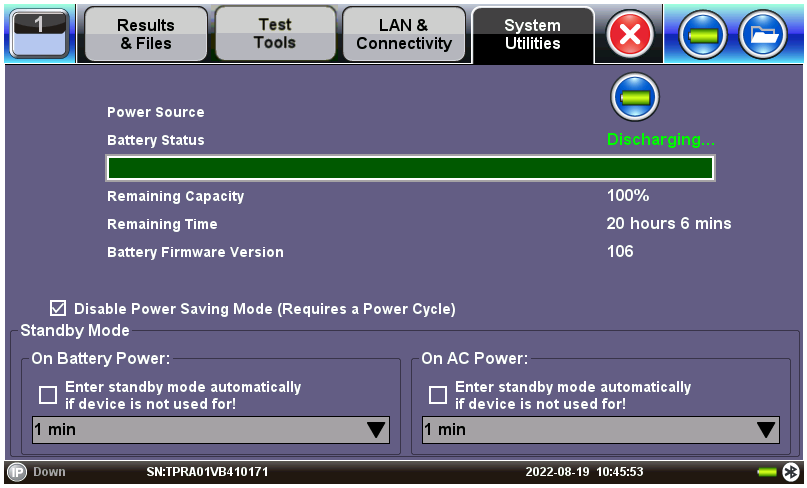
Backlight - Brightness

Battery Status

This section provides information about current power source and information about the battery's charge level and estimated autonomy (under current load conditions) . Tap the **battery icon** on the top bar to bring battery charge and estimated autonomy information.

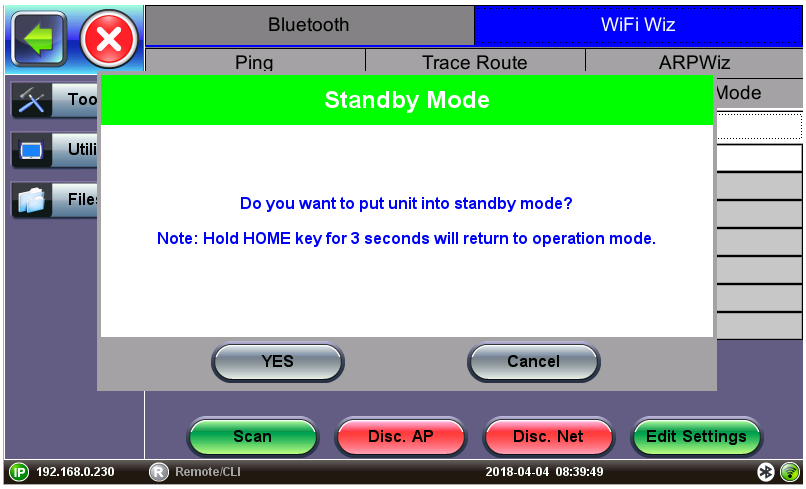
To disable Power Saving Mode, plug in the power cable and click the checkbox.

Standby Mode puts the unit to sleep, so that it wakes up faster than pressing **Power** to turn on the unit. Use the settings at the bottom of the screen to configure Standby Mode settings. To manually enter standby mode, press and hold the **Home** key for 3 seconds until the unit beeps, then tap **YES**. The screen will be off, but the power LED will blink. Press **Home** to view battery life and standby mode run time. Pressing and holding **Home** for 3 seconds again will return the unit to normal operation.



Utility Settings - Battery Power

Standby Mode

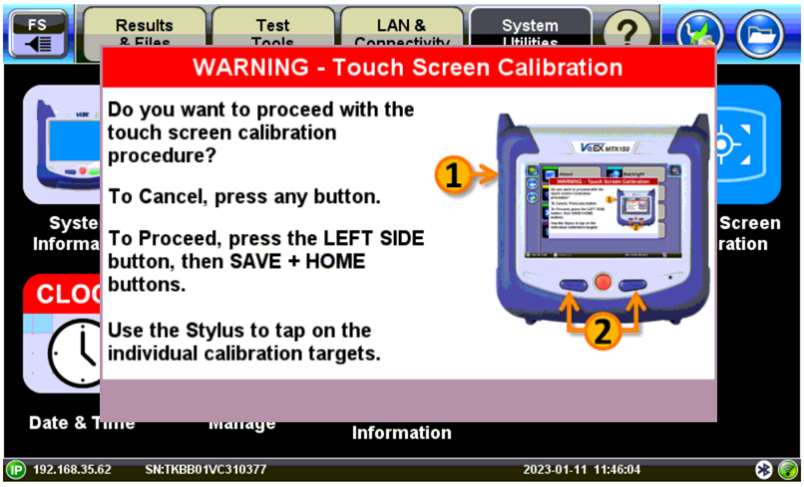


Standby Mode Message

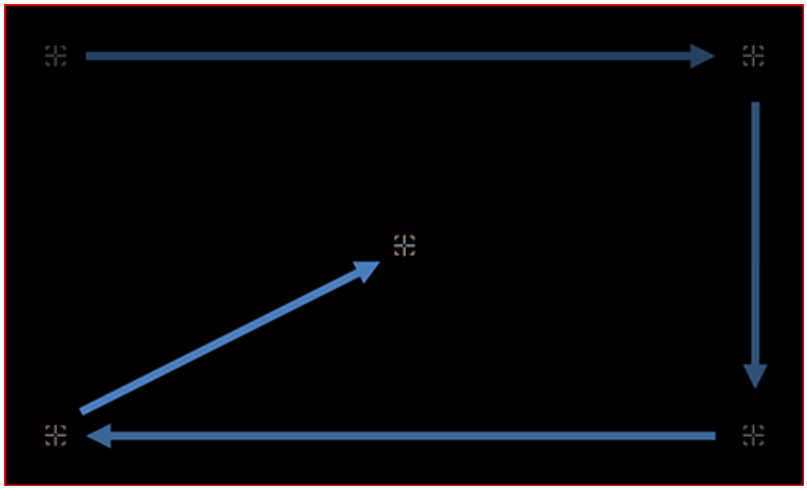
Standby Mode puts the unit to sleep, so that it wakes up faster than pressing **Power** to turn on the unit. To enter standby mode, press and hold the **Home** key for 3 seconds until the unit beeps, then tap **YES**. The screen will be off, but the power LED will blink. Press **Home** to view battery life and standby mode run time. Pressing and holding **Home** for 3 seconds again will return the unit to normal operation.

Touch Screen Calibration

Screen calibration can be accessed from **System Utilities** > **Touch Screen Calibration**.



Press the **Save** and **Home** buttons simultaneously, until you hear a tone (beep), quickly press the **LeftSideButton+** + combination to confirm. Then the touch screen calibration procedure starts.



Once the touch screen calibration sequence has been started, it must be completed. Accurately touch the calibration points with the tip of the stylus.

If the above procedures do not fix the touch screen issues, go to the VeEX website's Contact Us page, select [√] Customer Service/Tech Support, then provide the Product Type, Serial Number and a brief description of the behavior being experienced. If it is related to colder ambient temperatures, please state the approximate temperatures.

Date and Time

This screen allows the date, time and time zone to be set. Daylight Daylight Savings Time (DST) is enabled automatically.

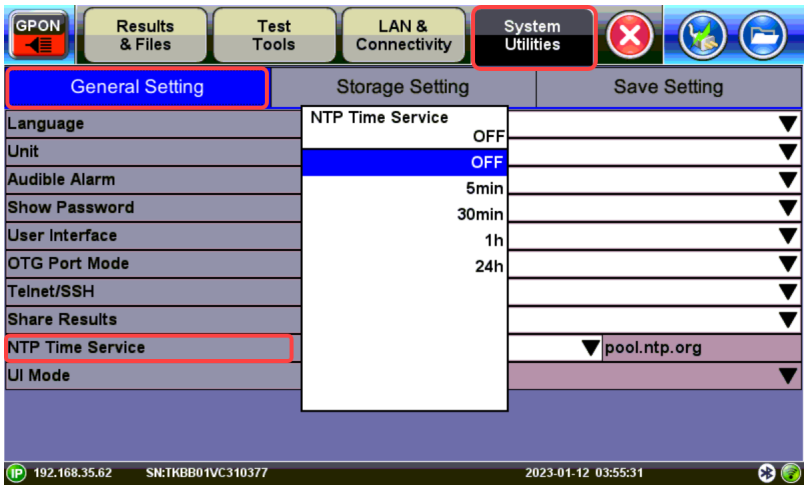
Date Setup

Using NTP Server

For automatic time of day (ToD) synchronization, go to **>System Utilities>General Settings**, and enable the **NTP Time Services** field by selecting a synchronization period (e.g., 1 hour).

Click here for a list of local, regional and global public NTP servers.

An internet connection (WiFi or LAN) is required to reach the selected public or private NTP server.

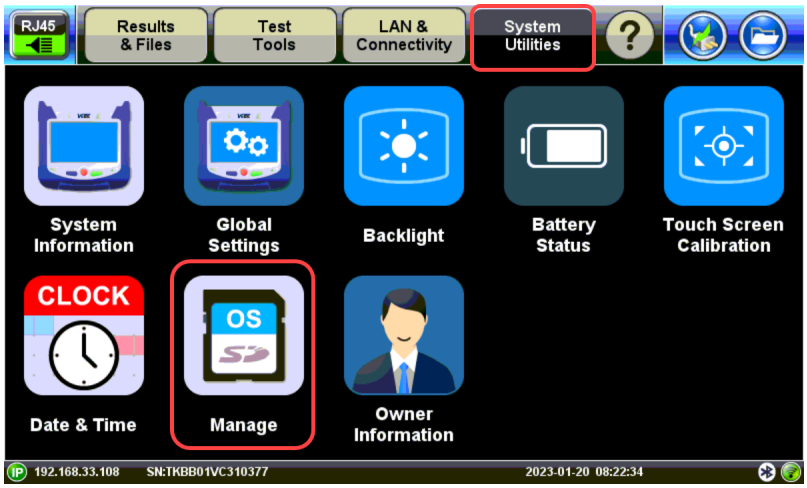


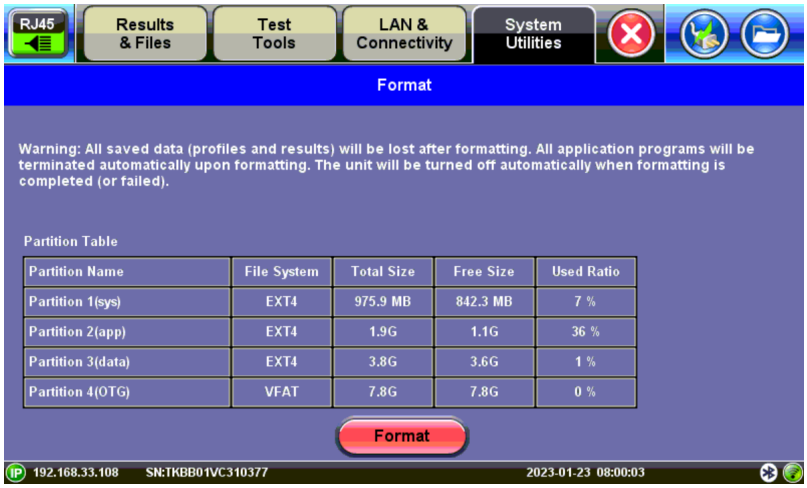
General Setting - NTP Time Service

Go to **System Tools >Utilities >Settings >Date & Time**, to manually set the date, time and time zone. Then, tap **Apply**.

To enable daylight saving time (DST), manually select a neighboring time zone with a +1:00 relative to the standard time zone of the current location. Set it back to the standard time zone offset when DST ends.

Manage Internal SD Card





Internal SD Card Format

The SD card tool (**System Utilities** > **Manage**) provides Internal SD card's partition capacity information. All saved files, such as profiles, test results, and screen shots, are stored in the Data partition 3(data). If the data partition is nearly full, use the File Manager to backup files to USB, then delete selected files.

The **Format** function is exclusively a maintenance tool. Use **ONLY** when instructed by a VeEX Customer Care representative. **It erases all the information stored in the test set!**

- *The internal SD Card contains the System OS, all the Test Applications (Apps) and user's data.*
- *Only the Data partition is accessible to users, through the test set's functions.*
- *Do not remove or reformat the SD Card outside of the test set.*
- *The SD card can only be accessed by opening the test set.*

Help

Tap the **question mark** and use a tablet or smartphone to scan the QR code that appears on the LCD screen, to access the **User Manual** and **Quick Guides** specific to the product. The manual and user guides can be accessed on-line or downloaded as a .pdf file.

Software Update Process

1. To download the latest software version, go to www.veexinc.com and use any of the following options:

   a) Enter the full product name in the **Search** box, click on the **Software** section to expand it, and download the appropriate software installer package.

   b) Go to the >**Support** > **Software** section and enter the first four characters of the product's serial number, to obtain the software installer package specific to the product.

2. Unzip the downloaded file(s) and copy the file ending in **.tar.gz** or **.tar.xz** to the root directory of a FAT32 USB flash drive.
3. Connect the AC/DC adapter to the test set.
4. Turn off the test set and plug the USB into a USB-A to micro-B USB OTG adapter.
5. Connect the USB OTG adapter to the test set's micro-B USB port.

At this point, it is possible to perform a clean or standard software update. Be sure to back up all data prior to performing a clean software update as it will reformat the internal storage and erase all user settings and test results.

A clean software update will erase all user settings, test profiles and saved results. Use the "USB Memory Browser" on page 118 in the >File Manager to back up all data prior to performing a clean software update.

- **Clean software update**: Press and hold the **Save** and **Power** buttons simultaneously.
- **Standard software update**: Press and hold the **Home** and the **Power** buttons simultaneously.

In both instances, press and hold the buttons for at least 3 seconds, then release.

The unit will automatically locate and load the software file from the USB flash drive. Wait for the upgrade process to finish.

After the software upgrade is completed, go to the **Utilities** > **About** menu to confirm the software version.

Software Version is displayed in the About section.

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

RoHS ComplianceVeEX QUALITY AND ENVIRONMENTAL POLICY

Our quality and environmental policy is to limit and progressively eliminate the use of hazardous substances and chemicals in the design and manufacture of our products.

VeEX products are classified as Monitoring and Control Instruments under Article 2, Section (1), Category 9 of the WEEE 2002/96/EC Directive.

RoHS and WEEE Position Statement

The Council of the European Union and the European Parliament adopted Directive 2002/95/EC (January 27, 2003), to Reduce the use of certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment, and Directive 2002/96/EC on Waste Electrical and Electronics Equipment (WEEE), with the purpose of reducing the environmental impact of waste electrical and electronic equipment. Both were later recast by Directives 2011/65/EU and 2012/19/EU respectively. All VeEX products being placed on the EU market conform with these directives.

Additional RoHS substance restrictions for the Monitoring and Control Instruments were adopted by EU Directive 2015/863 (March 31, 2015). These new restrictions will take effect from July 22, 2021. VeEX has established a program to ensure that from July 22, 2021, all its products to be sold and shipped into the EU market will conform with (EU) 2015/863.

VeEX Inc. is committed to comply with RoHS and WEEE Directives to minimize the environmental impact of our products.

For more information about RoHS as it relates to VeEX Inc, go to www.veexinc.-com/company/rohscompliance .

About VeEX

VeEX Inc., a customer-oriented communications test and measurement company, develops innovative test and monitoring solutions for next generation telecommunication networks and services. With a blend of advanced technologies and vast technical expertise, VeEX products address all stages of network deployment, maintenance, field service turn-up, and integrate service verification features across copper, fiber optics, CATV/DOCSIS, mobile 4G/5G backhaul and fronthaul, next generation transport network, Fibre Channel, carrier & metro Ethernet technologies, WLAN and synchronization.

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

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FX120 Quick Guide

When powered on the test set automatically loads the GPON application.

Watch FX120 Introduction video.

Step 1: Power On Test Set.

Step 2: Configure Test Profile.

Step 3: Insert Patch Cord into FX120 OLT test port.

Step 4: Connect Splitter to FX120 ONU/ONT test port.

Step 5: Save results.

Step 6: View Results & Generate Report.

Step 1: Power on Test Set

Press and hold the **Power** button for two seconds, until a confirmation tone (beep) is heard, and the VeEX logo appears on the screen, then release the power button. The test set will take a few seconds to boot up, automatically start the **GPON** application, detect the optical light source, load the default test profile, and begin monitoring.

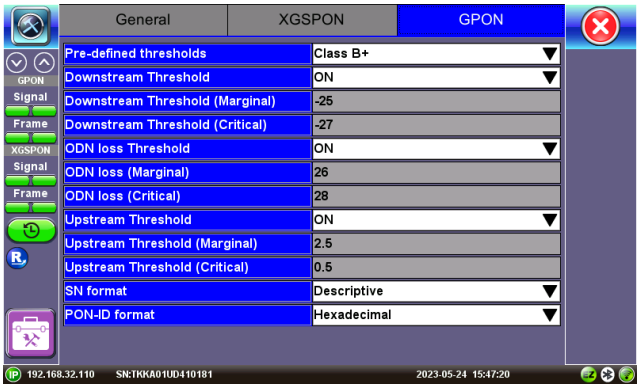
To turn the test set OFF, press and hold the Power button until two confirmation tones (beeps) are heard.

By default, the test set always starts in GPON mode, as indicated by the Test Mode Selection button. It can detect GPON, XG(S)-PON, EPON, and 10G-EPON automatically. When in Speed Test mode, it can detect 10GBASE-T, 5GBASE-T, 2.5GBASE-T, 1000BASE-T and even legacy 10/100BASE-T automatically.

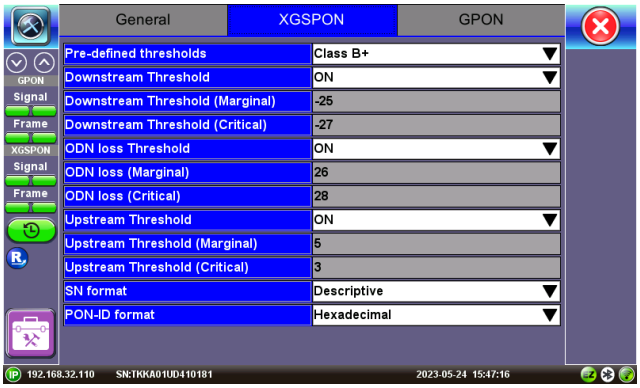
Starting/stopping/restarting measurements from the OPM menu (see "OLT and ONT/ONU Messages and Measurements" on page 42) starts/stops/resets items in the "GPON Summary Screen" on page 39 , such as the Power Level Graphs and Active ONU List in "Advanced OPM Mode" on page 50. To clear the PLOAM list, go to the respective PLOAM menu and press the **Clear** button.

Step 2: Configure Test Profile

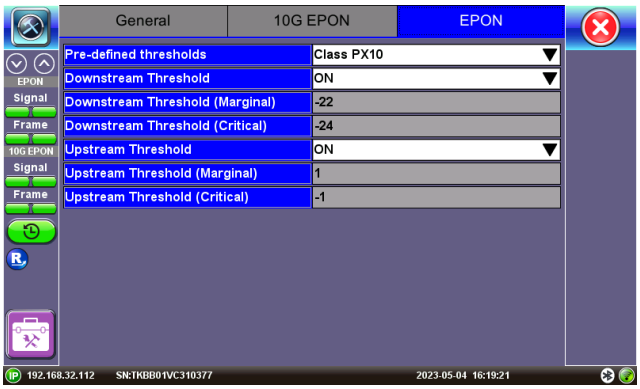
Tap **Setup** and configure the test profile settings according to the **PON class** and **xPON / XGS-PON ITU-T and IEEE Test standards**.



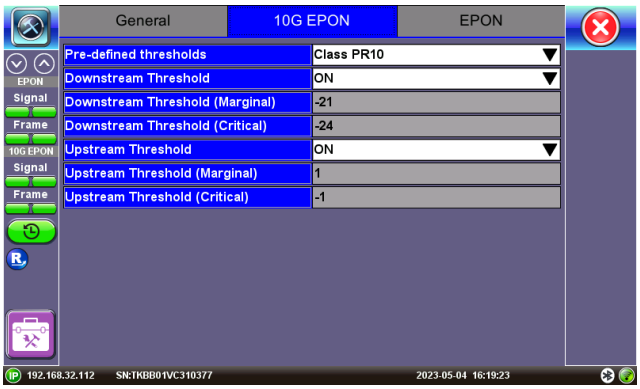
GPON OPM Setup menu



XG(S)-PON OPM Setup menu



EPON OPM Setup menu



10G EPON OPM Setup menu

Step 3: Insert Patch Cord into FX120 OLT test port.

Inspect and clean the FX120 test ports. Inspect and clean the fiber patch cord from the ***OLT and insert it into the FX120 OLT test port***.

> ***Warning: Never look directly into the beam of an active optical source as this may result in harmful eye damage from radiation exposure.***

If 1490/1577nm light is detected, the 1490/1577nm **Status** will display **OK**. Verify that the measured 1490/1577nm signal level is **Green** (see "Signal and Synchronization Status" on page 44). Confirm TC-Sync DS displays **OK DL**.

If you are not able to achieve TC-Sync, contact VeEX technical support.

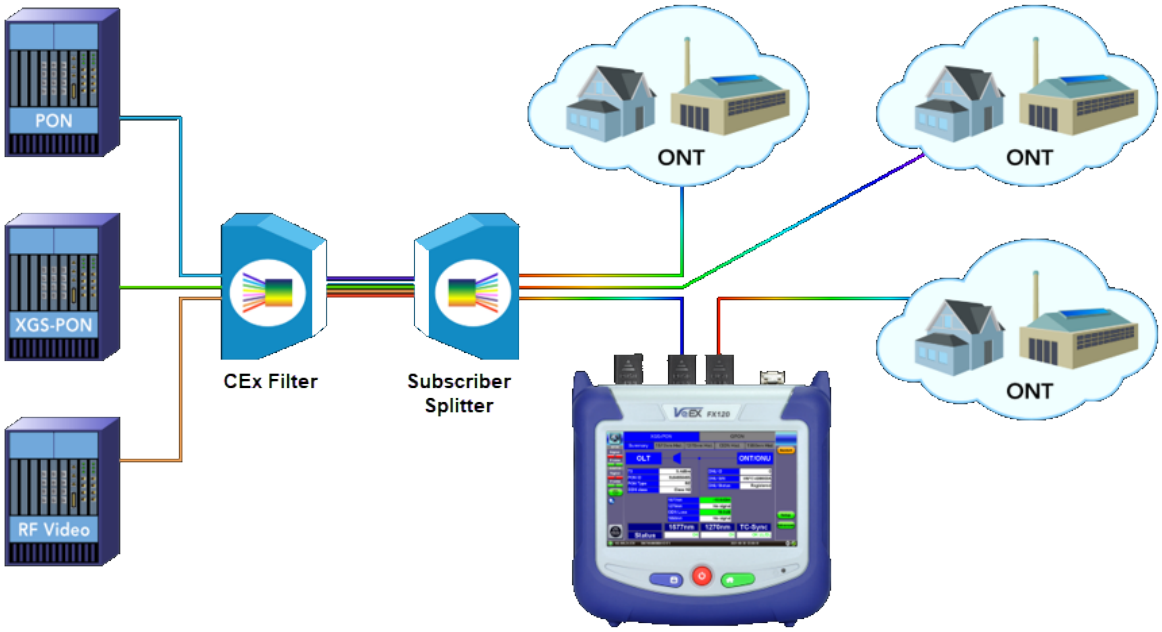
All DS LEDs should turn from **Red** to **Green**. If any LED remains **Red**, clean and inspect the OLT connectors again.

Step 4: Connect Splitter to FX120 ONU/ONT test port.

Inspect and clean the patch cord connectors and connect the ***FX120 ONU/ONT test port to the Splitter ONU/ONT test port***.

If 1310/1270nm light is detected, the Status will display **OK**. Verify that the measured 1310/1270nm signal level is **Green** (see " OPM Test Mode" on page 39).

Do NOT connect the FX120 between the OLT and splitter.



The FX120 should be connected between the splitter and ONT.

If you are not able to achieve TC-Sync, contact VeEX technical support.

All US LEDs should turn from **Red** to **Green**. If any LED remains **Red**, clean and inspect the ONU connections again.

LEDs

Green, yellow, and red table colors indicate whether signal levels pass or fail against ITU-T/IEEE standard threshold values configured in Setup.

Refer to "OPM Setup" on page 31 for information on test profile setup.

Green: The measured signal is above the critical threshold.

Yellow: The measured signal is below marginal and above critical.

Red: The measured signal level is below the critical threshold and does not meet the specification.

Signal and Synchronization Status

Signal and Synchronization Status

The Status table displays detected 1490nm/1577nm downstream, 1310nm/1270nm upstream, and TC-Sync status.

	1490nm	1310nm	TC-Sync
Status	OK	OK	No UL

GPON Signal and Synchronization Status Table

	1577nm	1270nm	TC-Sync
Status	OK	OK	OK

XGS-PON Signal and Synchronization Status Table

	1577nm	1270nm	1310nm	TC-Sync
Status	OK	LOS	OK	No UL

10G EPON Signal and Synchronization Status Table

Status Table

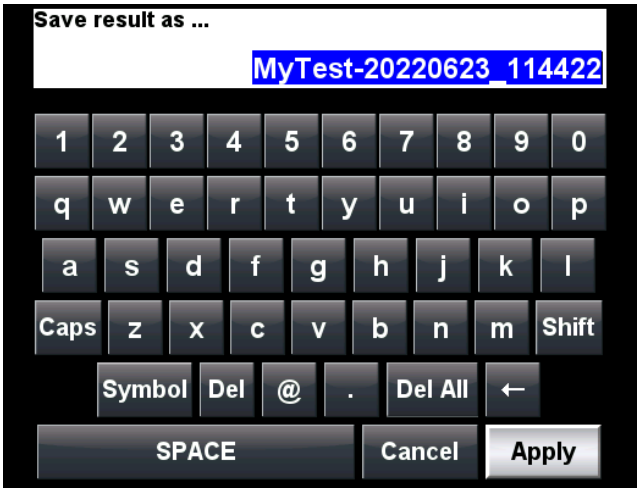
- **1490nm/1310nm**: If OK is displayed, light in the downstream 1490nm or upstream 1310nm direction is detected.
- **1577nm/1270nm**: If OK is displayed, light in the downstream 1577nm or upstream 1270nm direction is detected.

- **1577nm/1270nm/1310nm**: If OK is displayed, light in the downstream 1577nm or upstream 1270nm direction or upstream 1310nm is detected.
- **Transmission Connectivity Sync (TC-Sync)**: OK UL/DL indicates that the FX120 is properly synchronized with the OLT and ONU/ONT traffic. No UL/DL indicates the OLT and ONU/ONT are not synchronized properly. Consult VeEX technical support if unable to achieve TC-Sync.

***OK** indicates US or DS light is detected, but does not indicate whether ITU-T Threshold values (IEEE values for EPON) are met or if the OLT and ONU/ONT are properly synchronized.*

Step 5: Save Results

Press the **SAVE** button and use the touch-screen keypad to enter the name (overwrite or edit), then tap **Apply**.



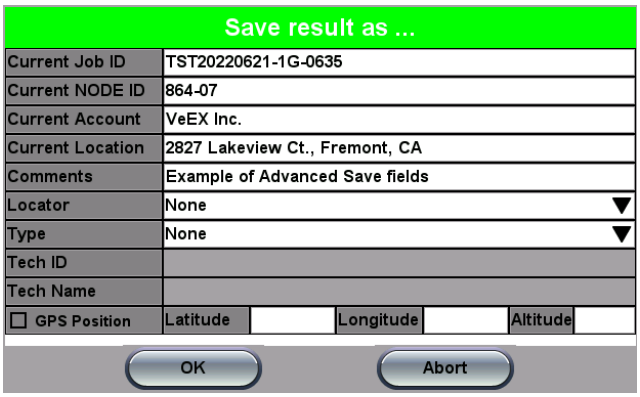
Auto-Naming: By default, the test set auto-naming feature uses the current date and time to generate a default unique name for every test result (YYYYMMDD_hhmmss). The auto name can be rewritten or specific prefix defined to be added to it (e.g., to identify site, cabinet, rack, customer or the technician running the test).

To configure the prefix:

1. From a test application, press and/or on the top left of the screen to access the system configuration menu.

2. Select the **System Utilities** tab, then select **Global Settings**.
3. Select the **Storage Setting** tab and set **File Name Prefix** to the desired prefix. For example, after setting the File Name Prefix to "*MyTest-*", all subsequent tests would be automatically named "*MyTest-YYYYMMDD_hhmmss*".

Upon saving results, a secondary form is displayed to enter additional information about the Job ID/Work Order, technician, location, and comments.



This creates more complete test reports and is required if the test set is registered to the VeSion R-Server Centralized Workflow and Results Management System.

When the **Advanced Saving** option in **System Utilities** > **Global Settings** > **Storage Settings**, is turned **ON**, additional information to the results file can be appended to test results/report.

Step 6: View Results & Generate Report

To access the test results stored in the test set:

1. Press  , then press  on the top left of the screen.
2. Select the **Results & Files** tab. The File Management screen is displayed.
3. Select the desired results file to open the test report.

To navigate the test results report, use the links in its Table of Contents and the right rocker switch to scroll Up and Down.

More about File Manager functions

Tap the file to open and display it.

 Navigates right and left to view all files.

 Closes the current test report and goes back to the File Manager.

Exports the selected test report to mobile device via QR Code.

Deletes all unlocked test reports that are selected with checkmarks.

Renames the selected test report (one).

Unlocks or Locks test reports. Locked reports are identified by a red padlock icon. Locked test reports cannot be deleted or renamed.

PDF Generates a PDF copy of the test report and stores it in an attached USB memory stick (required) for distribution (e.g., via email).

Imports (restores) all test results, test profiles and screenshots stored in an attached USB Memory Stick. The included On-The-Go (OTG) micro-B USB to USB-A adapter cable is required for the USB memory stick.

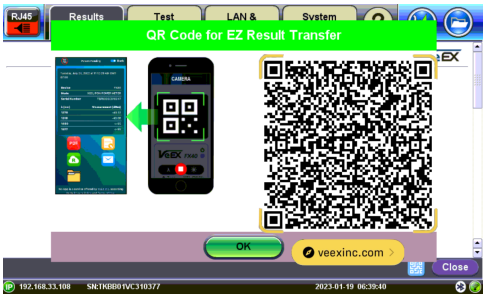
Exports (backup) all selected test results, test profiles and screenshots stored to an attached USB Memory Stick. The included On-The-Go (OTG) micro-B USB to USB-A adapter cable is required for the USB memory stick.

Transfers selected test results, test profiles and screenshot files to a paired Bluetooth® smartphone, tablet or PC.

Transfer Results to Phone/Tablet via QR Transfer

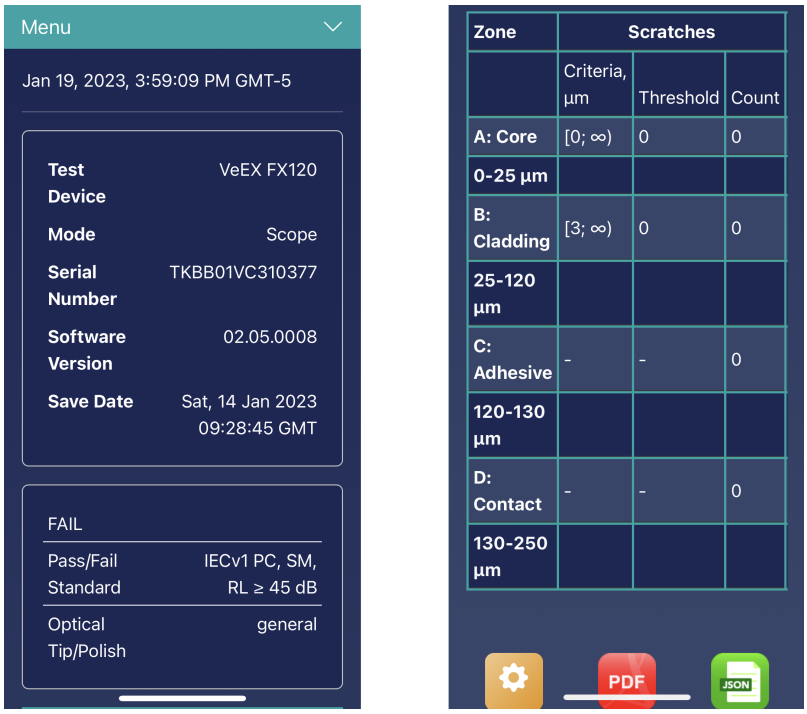
To transfer results to mobile device:

1. On the **Results & Files** tab, select the test results to view.
2. Tap . The **QR Code for EZ Result Transfer** screen displays.
3. Using the mobile device's camera, focus on the **QR code** and tap it. The results appear in the browser.



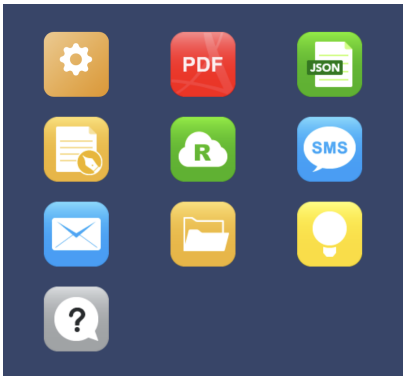
Viewing Results on Mobile Device

After transferring results to a mobile device via the QR reader, the browser launches automatically and displays them.



The top of the screen shows the device type, mode, serial number, and software version, and the date results were saved on the device.

Export options appear at the bottom on the screen. Alternatively, tap the **Menu** drop-down menu to view the options.



Results - Mobile View Export Options

Interactive descriptions of FX120 Speed Test report options.

Interactive descriptions of FX120 GPON/XGS-PON report options.

 Adds/Removes location (GPS coordinates) from results report; customize report with logo.

 Generates complete report in PDF format, which can be shared with the customer (subscriber) or emailed to a supervisor.

 Exports to JSON format, for third-party integration or processing.

 Adds extra job-related information to the report (e.g., Job ID, tech's information, comments, pictures, etc.).

 Uploads results to R-Server (for R-Server users).

 Texts results via SMS protocol.

 Emails current test report.

 Creates a new project for results so multiple test results, from the same or different test sets, can be combined into a single job report.

 Opens knowledge base.

 Opens documentation resources for test set.

Other Test Features

Fiberscope

The Fiberscope test application can be used in conjunction with any VeEX Digital Fiber Inspection Microscope.

Flow

The Flow application performs and compiles multiple tests into a single job report.

OLTS/OPM

The Fault Locator test application can be used to identify fiber bends and breaks.

OTDR Viewer

This built-in application allows the test platform to view previously saved .sor trace results and edit events, as needed. IF an OPX-BOXe is connected to the platform via direct USB connection, WiFi or Bluetooth®., this built-in application can also be used to control all OTDR test functions.

V-TEST

The V-TEST feature qualifies network TCP/HTTP protocol performance by testing Internet speeds up to a full line rate against a server to verify the maximum download and upload data rates attainable by subscribers' high-speed or Gigabit Internet services.