The Verification Experts

USER MANUAL

FX41xT PON Optical Power Meter

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

 D07-00-159P RevA00

Contents

1.0 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 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 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.

This manual describes software and/or a device that uses software either developed by VeEX Inc. or licensed by VeEX, Inc. from third parties. The software is confidential and proprietary of VeEX, Inc. The software is protected by copyright and contains trade secrets of VeEX, Inc. or VeEX's licensors. The purchaser of this device and/or software, downloaded or embedded, agrees that it has received a license solely to use the software as embedded in the device and/or provided by VeEX Inc., and to use it solely as intended and described in this manual. The purchaser is prohibited from copying, reverse engineering, decompiling, or disassembling the software.

1.1 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

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

MPA Product Technical Support

Support is generally available 8:30 AM to 5:30 PM, Eastern Standard Time, Monday to Friday.
Phone: +1 877 929 4357
International: +1 727 475 1206
E-mail: serviceandsupport@veexinc.com

1.2 Warranty

For warranty information on VeEX products, go to https://www.veexinc.com/Support/Warranty.

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

1.3 Patent Information

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

1.4 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 missteps.

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.

2.0 Safety Information

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

Optical Connectors

The test 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:

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

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

3.0 Introduction

The FX41xT optical power meter is designed to verify, troubleshoot and perform service activation on next generation Passive Optical Networks (PON). The unit features a pass-through mode to measure optical levels on various wavelengths being transmitted between the Optical Line Terminal (OLT) and the Optical Network Terminal (ONU/ONT).

FX41xT supports GPON/EPON including XG(S)-PON and 10G-EPON. The unit can be connected onto the PON network at any available access point along the Optical Distribution Network (ODN). The access point can be at the OLT (central office - CO, head end or sub-headend or remote hut), Fiber Distribution Point (FDP 1 or 2/splitter (if connectorized) or at the ONU/ONT (customer premises - CP). The figure in Section 6.2.2 PON Measurement Procedure shows a typical PON with the four possible locations for measurement.

The FX41xT unit passively measures only downstream signal levels to standard compliance:

- GPON and EPON channels: 1490 nm
- XG(S)-PON and 10G EPON channels: 1577 nm

FX41xT power meter can be equipped with an optional VFL or Broadband OPM.

3.1 FX41xT Features

- Testing B/E/GPON and/or XG(S)-PON optical signal levels at OLT, FDP or ONT/ONU
- Optional Broadband InGaAs power meter
- High contrast LCD 96x80 pixels with backlight
- Tone detection for fiber identification
- Rechargeable NiMH battery including AC/DC adapter operation with 5V USB output
- Rugged compact design
- QR code functionality for data transfer to PC, R-server or Fiberizer Cloud for further analysis and reporting

4.0 Overview

4.1 Control Elements

Colors, labeled function keys, and screen fonts and inscriptions can vary with different device models, firmware, and backlight settings. Shown below are schematic images which fully represent the device interface and functionality.

FX41xT general views, OPM and VFL options

FX41xT control panels, OPM and VFL options

4.1.1 Button Combinations

Mode	*Function*	*Button combination*
PON and PM	Setting ZERO (see Section 6.2.1 Setting ZERO Level)	**|Shift|+|Mode|**
PON	Setting Class for 1490 nm	**|Shift|+|Setup|**
PON	Setting Class for 1577 nm	**|Shift|+|Save|**
READ	Delete the current record in the READ mode (see Chapter 8.0 Saving and Reading Measurement Results)	**|Shift|+|Save|**

4.2 FX41xT Test Ports

4.2.1 Optical Ports

FX41xT optical ports, OPM and VFL versions

XG-PONT: Combined port for downstream measurement

OPM (optional): Port for measuring broadband optical power in absolute and relative mode

VFL (optional): 650 nm visual fault locator to visually locate breaks or excessive bends in fibers.

The FX41xT can be configured with either OPM or VFL, but not both.

4.2.2 Service Port

The service port (micro-USB) located at the bottom of the device is used for battery charging.

5.0 Getting Started

Before using the power meter for the first time, fully charge the battery and set the local date and time. The date and time are required to time-stamp the test results.

5.1 Battery Charging

The unit is equipped with a built-in, rechargeable NiMH smart charge battery which is partially charged upon delivery. VeEX recommends charging the battery to full capacity before using the power meter for the first time.

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

It is recommended to charge the battery at room temperature to preserve its life and to obtain maximum charge.

To charge the test set, connect the AC/DC adaptor to the micro-USB service port located at the bottom of the device. The charging time depends on the battery condition and ambient temperature. Use only the USB cables provided with the device to charge the battery.

LED Indicator Status

FX41xT is OFF and NOT charging	**off**
FX41xT is OFF and charging (plugged into the AC/DC adapter)	**red**
FX41xT is OFF and charged	**off**
FX41xT is ON and charging (plugged into the AC/DC adapter)	**orange**
FX41xT is ON and not charging	**green**

The NiMH battery is designed for maximum safety. However, to prevent exploding, leaking, or catching fire avoid:

- Exposing them to high temperatures
- Damaging them for any reason

5.1.1 Battery Replacement

To replace the batteries, remove the cover on the back and insert AA batteries observing the polarity. The device can take regular alkaline batteries and NiMH rechargeable batteries. For alkaline batteries, move the battery type switch up. For NiMH rechargeable batteries, move the switch down.

If any problem arises, contact the authorized VeEX service center or sales partner.

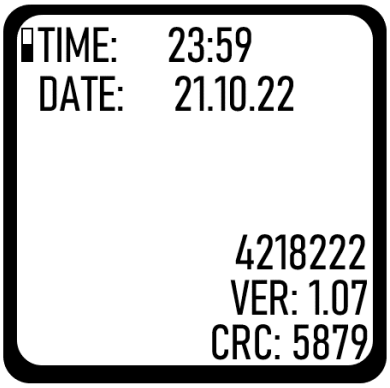
Removing the batteries causes the device to reset *(please see Section 5.3 Resetting FX41xT for detail).*

5.2 Configuring Device Settings

Before saving measurement results for the first time, set the device date and time.

To configure settings:

1. To power ON the FX41xT unit, press and hold the **Power** button for 3 seconds.
2. Press and hold **Shift** to enter the **Settings** mode. The test parameter selected then flashes and is available to edit. The following parameters can be set:
   - **Time**: current time
   - **Date**: current date



FX41xT Settings screen

3. To edit the flashing parameter, press the **UP** and **DOWN** buttons marked ▲ and ▼respectively. To jump to the next parameter, press the **Mode** button.
4. Press and hold **Shift** to save the settings.

5.3 Resetting FX41xT

To reset the FX41xT power meter to factory default settings, disconnect the external power supply from the device and remove the batteries. Then insert the batteries again and turn the device on.

After the device reboots, set again:

- Date and time (see Section 5.2. Configuring Device Settings)

- Threshold and reference values (see Section 6.1.1 Setting User-Defined PON Thresholds)

The reset DOES NOT erase any previously stored measurement data and previously set ZERO levels.

5.4 Modes for Optical Power Measurements

1G+10G PON-T: Terminated PON test mode that measures downstream PON signal levels for 1490 nm and 1577 nm.

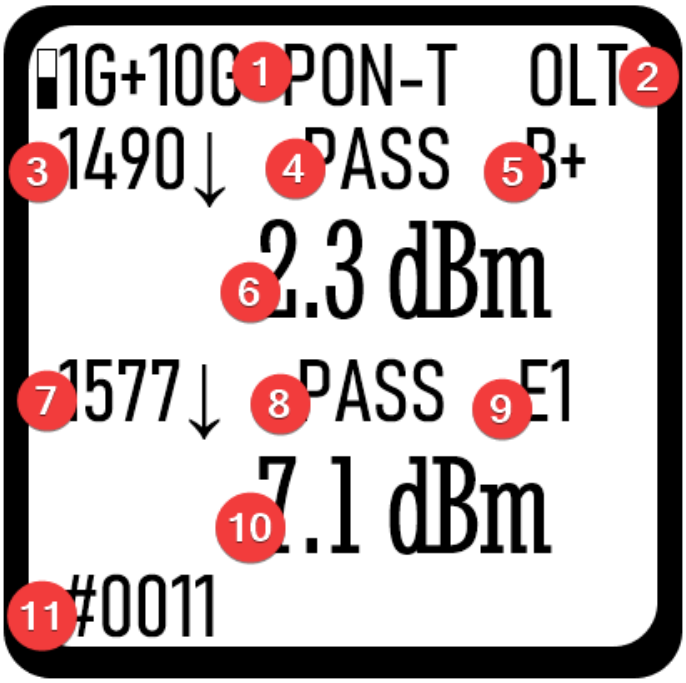
10G PON-T: Terminated PON test mode that measures downstream PON signal levels for 1577 nm only.

1G PON-T: Terminated PON test mode that measures downstream PON signal levels for 1490 nm only.

PM (PM2): OPM test mode to measure any optical signal level from 800 nm to 1700 nm. The signal can be CW, or modulated with 270, 330, 1000, or 2000 Hz. The Wave ID function will automatically set the wavelength calibration to match the input wavelength provided a compatible VeEX source is used.

6.0 Terminated PON Power Measurement

An example of terminated PON (PON-T) measurement results is shown below:



An example of terminated PON measurement results for combined 1G+10G PON-T mode

(1) **Mode** (see Section 5.4 Modes for Optical Power Measurements)

(2) **Measurement location**: see the Figure in Section 6.2. Measuring Optical Power in PON showing a typical PON with the four possible locations for measurement. To change it, press the **Setup** button. The available options for sites (locations) are:

- **ONT**: Optical Network Terminal. The **min** and **max** values for **1490** nm and **1577** nm wavelengths are set according to the IEC Standard and cannot be changed. For the **ONT** site the **1490** nm ITU-T classes available are **A**, **B**, **B+**, **C**, **C+**, and **E1**, **E2**, **N1**, **N2** for **1577** nm.
  - To change the class for **1490** nm, press **Shift** and then **Setup**. To change the class for **1577** nm, press **Shift** and then **Save**.
- **OLT**: Optical Line Terminal. The **min** and **max** values for **1490** nm and **1577** nm wavelengths are set according to the IEC Standard and cannot be changed. For the **OLT** site the ITU-T classes available are **A**, **B**, **B+**, **C**, **C+** for **1490** nm, and **E1**, **E2**, **N1**, **N2** for **1577** nm.
  - To change the class for **1490** nm, press **Shift** and then **Setup**. To change the class for **1577** nm, press **Shift** and then **Save**.
- **NONE**: Pass/Fail functionality is off.
- **USER**: see Section 6.1.1 Setting User-Defined PON Thresholds.

(3) **The wavelength for 1G measurement**: fixed.

(4) **The 1G Pass/Fail result according to the thresholds**: the thresholds are fixed according to the IEC Standard.

(5) **PON class for 1490 nm**: to change the Class, press **Shift** and then **Setup**.

(6) **The measured optical power in dBm**

(7) **The wavelength for 10G measurement**: fixed.
(8) **The 10G Pass/Fail result according to the thresholds**: the thresholds are fixed according to the IEC Standard.
(9) **PON class for 1577 nm**: to change the Class, press **Shift** and then **Save**.
(10) **The measured optical power in dBm**
(11) **Numerical index of the memory cell where the result is to be saved**

6.1.1 Setting User-Defined PON Thresholds

1. Press the **Mode** button to enter any of the PON modes.
2. Press and hold the **Setup** button until the Thresholds Setup screen appears (see below).

Setting User-Defined PON Thresholds

3. To edit the flashing parameter, press the **UP** and **DOWN** buttons marked ▲ and ▼respectively. To jump to the next parameter, press the **Mode** button.
4. Press and hold the **Setup** button to finalize setting PON thresholds.

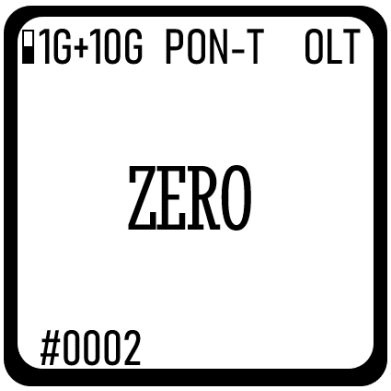
6.2 Measuring Optical Power in PON

6.2.1 Setting ZERO Level for PON

Set the ZERO level with the dust caps closed before first using the device for PON power measurements. Do NOT zero the power meter with the light source transmitting into the port, or the device may stop reading values or display random or inaccurate values. *It is recommended to set the ZERO level prior to each new batch of measurements, or after measurement conditions have changed.*

For best results, wait for 15 minutes after the FX41xT is powered ON. *This is especially recommended for environments with extreme temperature changes.*

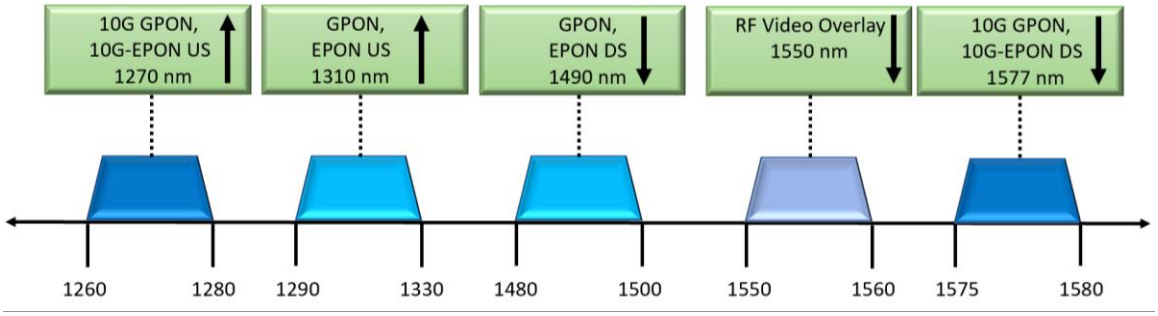
1. Close the dust caps.
2. Press the **Mode** button to enter the PON mode.
3. Press **Shift** and then **Mode**. The ZERO notification then displays briefly on screen.



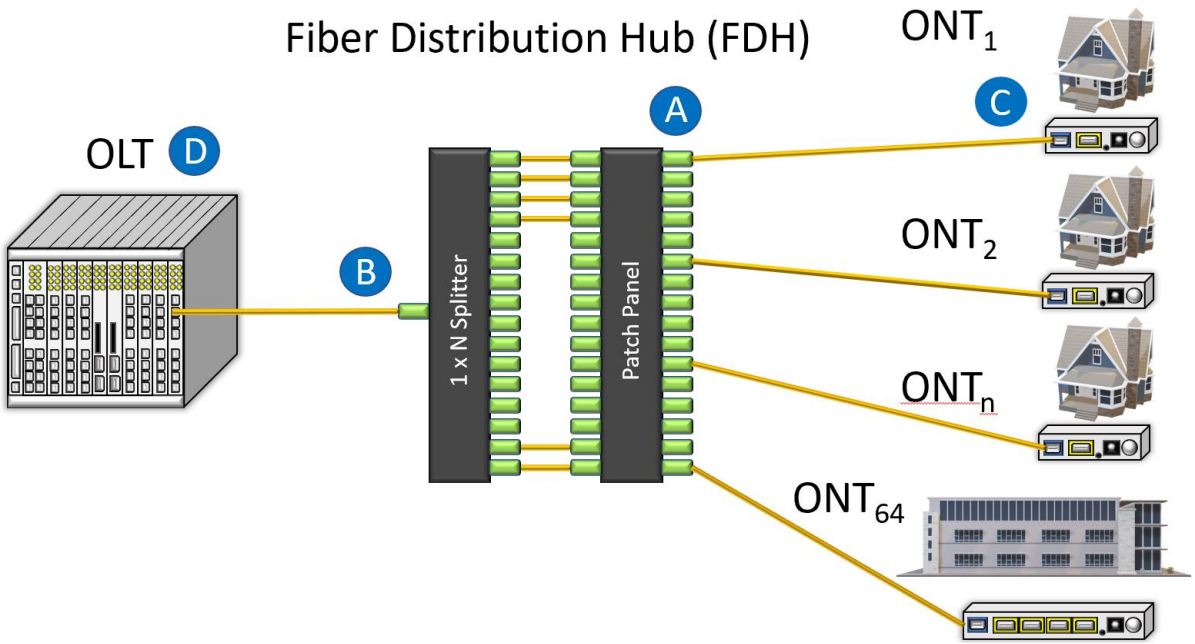
ZERO level set for PON measurement

The FX41xT is now ready for PON measurements.

6.2.2 PON Measurement Procedure



PON measurement ranges



A typical passive optical network (PON) with possible sites (locations) of measurement

To measure optical power in a passive optical network (PON):

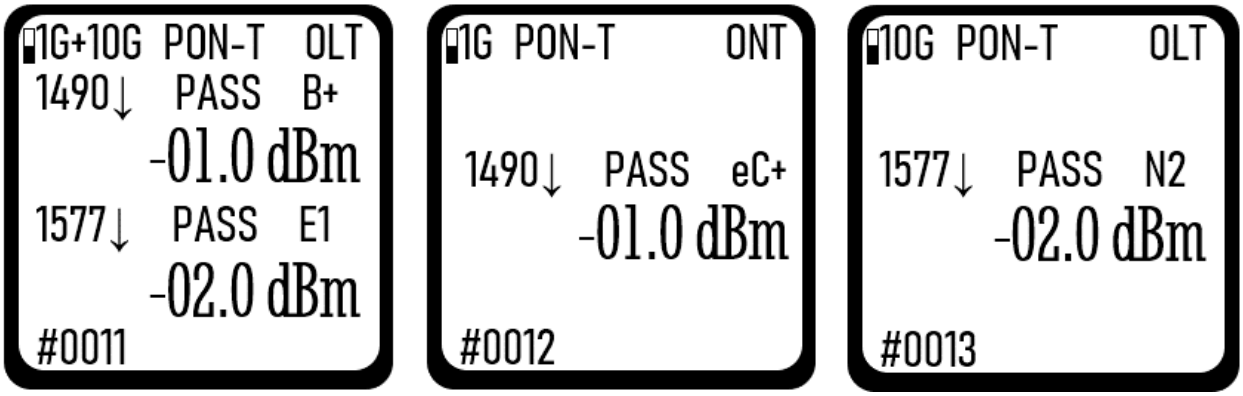
1. Press the **|MODE|** button to select the necessary mode (see Section 5.4. Modes for Optical Power Measurements for detail).
2. Select the point where to connect FX41xT (see the Figure above). The locations OLT (**B** or **D**), Fiber Distribution Hub/Point (**A**) or ONU/ONT (**C**) are the possible test points.

Please inspect and clean fibers before connecting to the device.

3. Connect fiber carrying downstream traffic from the OLT to the OLT test port. Confirm that the 1490 nm (GPON/EPON) and 1577 nm (XGS-PON/10G-EPON) wavelengths are detected.

If the ONT/ONU undergoes a power-cycle, it can take up to one minute or longer for ranging and activation to complete before the PON network is fully operational again.

4. Read the result onscreen (see examples below).



Measurement results in different PON-T modes

5. To save the result, press **Save**. It is then saved into the memory cell indicated in the bottom left corner.

To transfer result to other devices, follow the procedure described in Chapter 9.0 Transferring Results to Another Device via QR Code.

7.0 Broadband Power Measurements

The Broadband OPM functionality is optionally available on FX41xT. The optional Broadband OPM features an InGaAs detector with a wavelength range from 800 to 1700 nm. Power readings are presented as absolute (dBm or watts) or relative (dB). To measure optical power, insert the test fiber on the OPM test port and press **MODE** until the PM2 test mode appears at the upper left corner of the display.

7.1 Mode for Broadband Power Measurements

PM (PM2): BB-OPM test mode to measure any incoming optical signal level (CW, 270, 330, 1000, or 2000 Hz) within the specified wavelength range of 800-1700 nm. Select a calibrated wavelength that matches the incoming source wavelength.

VeEX offers an additional OPM (factory) calibration option on FX41xT OPM to support all 18 CWDM wavelengths, 1271-1611 nm, upon order (not field upgradable).

An example of OPM measurement results

Item	*Description*
PM2	Mode
1550nm	Wavelength
4.898µW	Optical power in watts
-23.1 dBm	Optical power in dBm
270HZ	Modulation frequency—CW, 270, 330, 1000, or 2000 Hz
#0003	Numerical index of the memory cell where the result is to be saved

7.2 Broadband Power Measurement Procedure

7.2.1 Setting ZERO Level for PM

Set the ZERO level with the dust caps closed before first using the device for PON power measurements. Do NOT zero the power meter with the light source transmitting into the port, or the device may stop reading values or show display random or inaccurate values. *It is recommended to set the ZERO level prior to each new batch of measurements, or after measurement conditions have changed.*

For best results, wait for 15 minutes after the FX41xT is powered ON. *This is especially recommended for environments with extreme temperature changes.*

The procedure is similar to setting the ZERO level for PON modes:

1. Close the dust caps.
2. Press the **Mode** button to enter the PM mode.
3. Press **Shift** and then **Mode**. The ZERO notification then displays briefly on screen.

ZERO level set for PM measurement

The FX41xT is now ready for PON measurements.

7.2.2 Performing Broadband Power Measurements

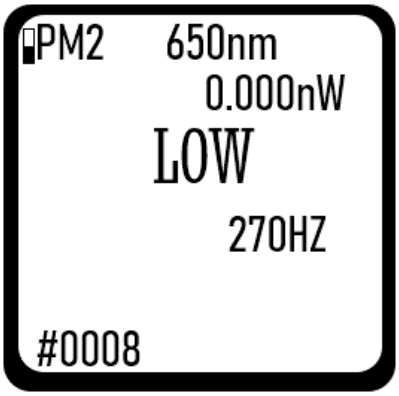
Clean the fiber before connecting it to the device.

To measure the optical power in a fiber:

1. Make sure the device is in the PM mode. If not, press the **Mode** button to enter the PM mode.

2. Insert the test fiber on the OPM test port.

The result is then shown onscreen:



Results of PM measurement

3. To change the wavelength, press the **Setup** button.

The fiber under test must have only one wavelength present. If there are several wavelengths present, the measurement results are NOT valid.

7.2.3 Using WaveID

Besides calibrated wavelengths, the mode also has the WaveID functionality (working only if the signal from a VeEX-manufactured light source contains WaveID information).

Press until **A------** appears at the top of the screen, then connect the fiber. The wavelength is then detected automatically.

*The WaveID functionality is guaranteed to work **with VeEX-manufactured light sources**. Devices from other manufacturers WILL NOT produce any correct wave identification.*

Possible WaveID cases:

- **Standard scenario**: The VeEX-manufactured light source (LS) operates in WaveID mode AND the wavelength it produces matches one of the FX41xT calibrated wavelengths AND the signal is powerful enough. The A letter appears next to the identified wavelength (see the Figure below).

WaveID standard scenario

- **Not enough power**: The VeEX-manufactured light source (LS) operates in the WaveID mode AND the wavelength it produces matches one of the FX41xT calibrated wavelengths BUT the signal is too weak. The ✸ sign next to the power value indicates that the value cannot be determined correctly (see the Figure below).

Not enough power for WaveID

- **No WaveID mode from the LS**: The VeEX-manufactured light source (LS) is NOT in the WaveID mode, or non-VeEX LS is used. The ✸ sign next to the power value indicates that the value cannot be determined correctly (see the Figure below).

No WaveID mode from the LS

- **The wavelengths do not match**: The LS operates in the WaveID mode AND The PM determined the LS wavelength BUT The LS wavelength (1270 nm) does not match any

PM calibrated wavelength in FX41xT. The ✸ sign next to the power value indicates that the value cannot be determined correctly (see the Figure below).

The wavelengths do not match

- **No WaveID mode in FX41xT**: The VeEX-manufactured LS is in the WaveID mode, but FX41xT is not; the measurement wavelength has been set manually. The **A** letter is flashing (see the Figure below).

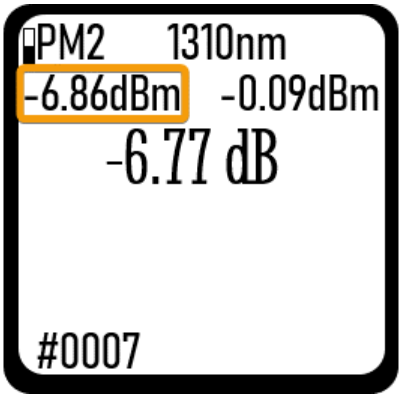
No WaveID mode in FX41xT

7.3 Measuring FUT Span Loss

7.3.1 Setting Power Reference Level

To measure the FUT (fiber under test) span loss, first set a reference level for a wavelength. In the **PM** mode, press **Shift** and then press **Setup**. The current optical power value is then set as the reference level and displayed onscreen (highlighted in the Figure below). The value onscreen then changes to 0.00 dB. The current reference level value is shown on the second row to the left.

The next measurement is taken against this level, with the difference shown on the right.

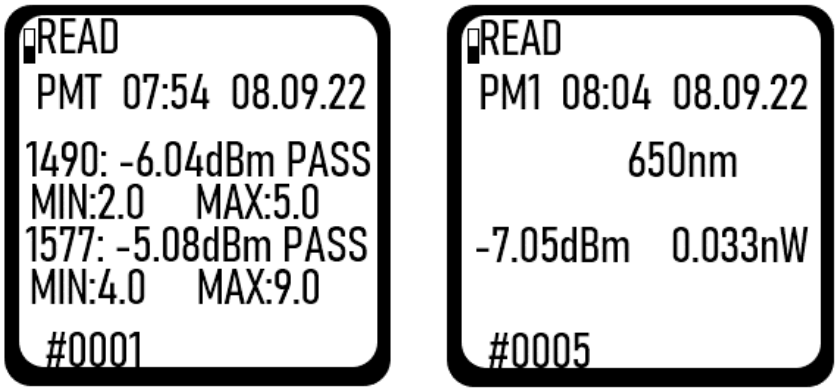


Broadband measurement taken against a reference level (highlighted)

8.0 Saving and Reading Measurement Results

To save the result on either PON or PM measurement, press the **Save** button. The result is then saved into the memory cell shown onscreen during measurement, and the memory cell # in the bottom left corner increments by 1. The device can save up to 2729 records.

To read the previously saved results, press Mode to get **READ** mode.



Examples of results in READ mode (PON and PM)

To jump to the next or previous record, press the **UP** and **DOWN** buttons marked ▲ and ▼respectively. To delete a record, press **Shift** and then **Del** (**Save**).

9.0 Transferring Results to Another Device via QR Code

To conveniently transfer results to another device, use the QR Code functionality, which works from any mode except VFL.

When a measurement result is displayed onscreen, either PON or PM or READ mode, press the **QR** button. Within about three seconds the device generates a QR code and displays it onscreen. Scan the QR code with any relevant application on the smartphone. Tap the resulting link to get the result full information (see an example below).

Measurement result information via QR code

Scroll down to get the icons to share the record in various formats.

10.0 Testing Fiber Continuity with Visual Fault Locator

FX41xT can be optionally equipped with a Visual Fault Locator (VFL). To test fiber continuity:

1. Connect the fiber to the VFL port.
2. Press the **Mode** button until the VFL mode appears (see the Figure below).

VFL mode

3. Press the **QR** button to turn the Visual Fault Locator on.

Visual light source is on, with 1 Hz modulation

4. To change the VFL modulation, press **Setup**. The available options are 1 Hz, 2 Hz, CW (Continuous Wave).

11.0 Certifications and Declarations

Declaration of Conformity

What is CE?

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

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

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

ROHS Statement

RoHS Compliance

VeEX 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 the VeEX web site at https://www.veexinc.com/company/rohscompliance.

12.0 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, Fiber 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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Appendix: PON Test Profiles and Thresholds

A/B/E/G-PON

(G.984.2 2019/08)

GPON	**DS Wavelength, nm**	1490					
	DS Passband, nm	1480 to 1500					
XGS-PON	**DS Wavelength, nm**						
	DS Passband, nm						
25G PON	**DS Wavelength, nm**						
	DS Passband, nm						
GPON	**US Wavelength, nm**	1310					
	US Passband, nm	1260 to 1360					
XGS-PON	**US Wavelength, nm**						
	US Passband, nm						
25G PON	**US Wavelength, nm**						
	US Passband, nm						
PON Class		A	B	B+	C	Ext C+	Ext D
OLT Site	**OLT Tx min/max**	0 to +4	+5 to +9	+1.5 to +5	+3 to +7	+3 to +7	+6 to +10
	ONU Rx min/max	-24 to -3	-28 to -7	-28 to -8	-29 to -8	-32 to -12	-35 to -15
ONU Site	**ONT Tx min/max**	-3 to +2	-2 to +3	+0.5 to +5	+2 to +7	+0.5 to +5	+0.5 to +5
ONT Site	**OLT Rx min/max**	-21 to -1	-21 to -1	-27 to -8	-28 to -8	-30 to -8	-30 to -8
OPL Loss	**min., dB**	5	10	13	15	17	20
	max., dB	20	28	28	30	32	35

GPON+XGSPON

(G.9807.1-2020/10 Amd2)

GPON	**DS Wavelength, nm**	1490					
	DS Passband, nm	1480 to 1500					
XGS-PON	**DS Wavelength, nm**	1577					
	DS Passband, nm	1575 to 1580					
25G PON	**DS Wavelength, nm**						
	DS Passband, nm						
GPON	**US Wavelength, nm**	1310					
	US Passband, nm	1270 to 1350					
XGS-PON	**US Wavelength, nm**	1270					
	US Passband, nm	1260 to 1280					
25G PON	**US Wavelength, nm**						
	US Passband, nm						
PON Class		B+	C+	10G-N1	10G-N2	E1	E2
OLT Site	**OLT Tx min/max**	+2 to +5	+6 to +9	+2 to +5	+4 to +7	+6 to +9	+8 to +11
	ONU Rx min/max	-26 to -5	-30 to -9	-26 to -5	-28 to -7	-30 to -9	-32 to -11
ONU Site	**ONT Tx min/max**	+3 to +8	+3 to +8	+4 to +9	+4 to +9	+4 to +9	+4 to +9
ONT Site	**OLT Rx min/max**	-27 to -8	-27 to -8	-28 to -9	-28 to -9	-28 to -9	-28 to -9
OPL Loss	**min., dB**	13	17	14	16	18	20
	max., dB	28	32	29	31	33	35