User Guide

EXFO EX Series

Ethernet Services Broadband Tester

www.EXFO.com

EXFO's Commerce And Government Entities (CAGE) code under the North Atlantic Treaty Organization (NATO) is 0L8C3.

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The exhaustive list of patents is available at EXFO.com/patent.

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Regulatory Information

USA Electromagnetic Interference Regulatory Statement

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America. However, EXFO Inc. makes reasonable efforts to ensure compliance to the applicable standards.

The limits set by these standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user documentation, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Canada Electromagnetic Interference Regulatory Statement

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference.

Cet équipement génère, utilise et peut émettre de l'énergie radio-fréquence et, s'il n'est pas installé et utilisé conformément à la documentation de l'utilisateur, il peut occasionner une interférence néfaste aux communications radio. L'utilisation de cet équipement dans une zone résidentielle est susceptible d'occasionner une interférence néfaste.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Attention : Cet appareil n'est pas destiné à être utilisé dans des environnements résidentiels et peut ne pas assurer la protection adéquate à la réception radioélectrique dans ce type d'environnements.

This is a class A, group 1 product.

Ceci est un produit de classe A, groupe 1.

- Class A equipment: Equipment that is, by virtue of its characteristics, highly unlikely to be used in a residential environment, including a home business shall be classified as class A and shall comply with the class A limits specified in the applicable ICES standard. Characteristics considered in this assessment include price, marketing and advertising methodology, the degree to which the functional design inhibits applications suitable to residential environments, or any combination of features that would effectively preclude the use of such equipment in a residential environment.

  Classe A : Matériel qui, en raison de ses caractéristiques, ne sera fort probablement pas utilisé dans un milieu domiciliaire ni par des entreprises établies à domicile. Parmi les caractéristiques considérées dans cette évaluation, il y a le prix, les méthodes de commercialisation et de publicité, la mesure dans laquelle les fonctions de l'appareil font qu'il ne se prête pas à des applications convenant au milieu domiciliaire ou toute combinaison de ces caractéristiques qui aurait pour conséquence d'en prévenir effectivement l'utilisation à domicile. Utilisé également pour indiquer les limites d'émission correspondantes qui s'appliquent à un tel matériel.

- Class B equipment: Equipment that cannot be classified as Class A shall comply with the Class B limits specified in the applicable ICES standard.

  Classe B : Matériel qui ne peut pas être inclus dans la classe A. Utilisé également pour indiquer les limites d'émission correspondantes qui s'appliquent à un tel matériel.

➤ Group 1 equipment: group 1 contains all equipment which is not classified as group 2 equipment, and includes equipment such as laboratory and scientific equipment, industrial process, measurement and control equipment.

Group 2 equipment: group 2 contains all ISM RF equipment in which radio-frequency energy in the frequency range 9 kHz to 400 GHz is intentionally generated and used or only used locally, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material for inspection/analysis purposes, or for transfer of electromagnetic energy.

Appareils du groupe 1 : le groupe 1 réunit tous les appareils compris dans le domaine d'application de la présente Norme, qui ne sont pas classés comme étant des appareils du groupe 2. Le groupe 1 inclut les appareils scientifiques et de laboratoire, les processus industriels, appareils de mesure ou de contrôle.

Appareils du groupe 2 : le groupe 2 réunit tous les appareils ISM à fréquences radioélectriques dans lesquels de l'énergie à fréquences radioélectriques dans la plage de fréquences comprises entre 9 kHz et 400 GHz est produite et utilisée volontairement ou uniquement utilisée localement sous forme de rayonnement électromagnétique, de couplage inductif et/ou capacitif, pour le traitement de la matière, à des fins d'examen ou d'analyse ou pour le transfert d'énergie électromagnétique.

Supplier's Declaration of Conformity (SDoC)

The SDoC for your product is as follows:

CAN ICES-001 (A) / NMB-001 (A)

EU and UK Electromagnetic Compatibility Regulatory Statement

Warning: This is a class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures. EX1: Your product is suitable for use in industrial electromagnetic environments. EX10: Your product is suitable for use in basic electromagnetic environments.

General Wireless Compliance Related Information

Your unit comes with an internal wireless module (adapter) and antenna for which the information hereafter applies:

This product does not contain any wireless user-serviceable components. Any unauthorized product changes or modifications will invalidate warranty and all applicable regulatory certifications and approvals.

Canada and USA Wireless Compliance Related Information

Your unit comes with an internal wireless module (adapter) and antenna for which the information hereafter applies:

- This device complies with Part 15 of the FCC Rules.
- This device complies with Innovation, Sciences and Economic Development Canada license-exempt RSS standards.
- Operation is subject to the following two conditions:
  (1) This device may not cause harmful interference

  and

  (2) this device must accept any interference received, including interference that may cause undesired operation.

Use in Specific Environments:

- The use of wireless products in hazardous locations is limited by the constraints posed by the safety directors of such environments.
- The use of wireless products on airplanes is governed by the Federal Aviation Administration (FAA).
- The use of wireless products in hospitals is restricted to the limits set forth by each hospital.
- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment.
- This wireless product is restricted to indoor use due to its operation in the 5.15 to 5.25 GHz and 5.470 to 5.75 GHz frequency ranges.
- Innovation, Sciences and Economic Development Canada requires this product to be used indoors for the frequency range of 5.15 GHz to 5.25 GHz to reduce the potential for harmful interference to co-channel mobile satellite systems.
- High-power radars are allocated as the primary users of the 5.25 to 5.35 GHz, and 5.65 to 5.85 GHz bands. These radar stations can cause interference with and/or damage to this device.

Radiation Exposure Statement:

- The product complies with the US/Canada portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this user documentation.
- Further RF exposure reduction can be achieved if the device can be kept as far as possible from the user's body. For compliance to RF exposure requirements, a minimum separation distance of 20 centimeters (8 inches) must be maintained between the EXFO EX device and the user or bystanders.

EU and UK Wireless Compliance Related Information

The information about the Bluetooth and Wi-Fi frequency bands is as follows:

- Bluetooth: Between the frequencies 2400.0 MHz - 2483.5 MHz.
  For the EX1, the output power is 12 dBm typical. For the EX10, the output power is 14.0 dBm.
- Wi-Fi: Between the frequencies 2400.0 MHz - 2483.5 MHz.
  For the EX1 and EX10, the maximum output power is 18 dBm typical.
- Wi-Fi: Between the frequencies 5180.0 MHz - 5885.0 MHz.
  For the EX1, the maximum output power is 19 dBm typical. For the EX10, the maximum output power is 17.5 dBm.
- Wi-Fi (EX10 only): Between the frequencies 5955.0 MHz - 7115.0 MHz.
  The maximum output power is 14.5 dBm.

The EX1 is a 2.4 GHz and 5 GHz wideband transmission system (transceiver). The EX10 is a 2.4 GHz, 5 GHz, and 6 GHz wideband transmission system (transceiver). Your device is intended for use in all EU member states, United Kingdom, and EFTA countries, except in France and Italy where restrictive use applies.

In Italy, the end-user should apply for a license at the national spectrum authorities in order to obtain authorization to use the device for setting up outdoor radio links and/or for supplying access to telecommunications and/or network services.

This device may not be used for setting up radio links in France, and in some areas the RF output power may be limited to 10 mW EIRP in the frequency range of 2454 - 2483.5 MHz. For detailed information, the end-user should contact the national spectrum authority in France.
In the European Union, the low bands 5.15 - 5.35 GHz and 5.945 - 6.425 GHz are for indoor use only.

Local Restrictions on 802.11a, 802.11b, 802.11d, 802.11g, 802.11n, 802.11ac, and 802.11ax Radio Usage

- EX1: Due to the fact that the frequencies used by 802.11a, 802.11b, 802.11d, 802.11g, 802.11n, and 802.11ac wireless LAN devices may not yet be harmonized in all countries, 802.11a, 802.11b, 802.11d, 802.11g, 802.11n, and 802.11ac products are designed for use only in specific countries, and are not allowed to be operated in countries other than those of designated use.
- EX10: Due to the fact that the frequencies used by 802.11a, 802.11b, 802.11d, 802.11g, 802.11n, 802.11ac, and 802.11ax wireless LAN devices may not yet be harmonized in all countries, 802.11a, 802.11b, 802.11d, 802.11g, 802.11n, 802.11ac, and 802.11ax products are designed for use only in specific countries, and are not allowed to be operated in countries other than those of designated use.

As a user of these products, you are responsible for ensuring that the products are used only in the countries for which they were intended and for verifying that they are configured with the correct selection of frequency and channel for the country of use.

For the EX1, the device transmit power control (TPC) interface is part of the Intel® PROSet/Wireless WiFi Connection Utility Software.

Operational restrictions for Equivalent Isotropic Radiated Power (EIRP) are provided by the system manufacturer. Any deviation from the permissible power and frequency settings for the country of use is an infringement of national law and may be punished as such.

Simplified EU and UK Declaration of Conformity

Hereby, EXFO declares that the radio equipment type “EXFO EX” is in compliance with European Directive 2014/53/EU and the UK legislation S.I. 2017/1206 Radio Equipment Regulations 2017.

The full text of the declaration of conformity is available at the following Internet address: *www.exfo.com/en/resources/legal-documentation*.

EU Economic Operator

EXFO Solutions SAS
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Saint-Jacques-de-la-Lande,
35091 Rennes Cedex 9
FRANCE

Japanese Technical Conformity Mark for Radio Law (EX10)

This equipment contains specified radio equipment that has been certified to the Technical Regulation Conformity Certification for Japan, under the Radio Law.

R **003-220316**

Japan Wireless Compliance Related Information (EX10)

Your unit complies with the IEEE 802.11a/b/g/n/ac/ax (2x2) standards.

The information about the Bluetooth and Wi-Fi frequency bands is as follows:

- Bluetooth: 2402 - 2480 MHz, 40 channels, 2 MHz, 0.005 W.
- WiFi:
  - 2412 - 2472 MHz (13 channels, 5 MHz) 0.007 W/MHz
  - 2422 - 2462 MHz (9 channels, 5 MHz) 0.0036 W/MHz
  - 5.18 - 5.32 GHz (8 channels, 20 MHz) 0.0045, 0.004 W/MHz
  - 5.19 - 5.31 GHz (4 channels, 40 MHz) 0.0022, 0.002 W/MHz
  - 5.21, 5.29 GHz, 0.001 W/MHz
  - 5.25 GHz, 0.0005 W/MHz
  - 5.50 - 5.72 GHz (12 channels, 20 MHz) 0.01, 0.009, 0.005 W/MHz
  - 5.51 - 5.71 GHz (6 channels, 40 MHz) 0.005, 0.002 W/MHz
  - 5.53 - 5.69 GHz (3 channels, 80 MHz) 0.001 W/MHz
  - 5.57 GHz, 0.0005, 0.0004 W/MHz
  - 5.955 - 6.415 GHz (24 channels, 20 MHz) 0.00038 W/MHz
  - 5.965 - 6.405 GHz (12 channels, 40 MHz) 0.00019 W/MHz
  - 5.985 - 6.385 GHz (6 channels, 80 MHz) 0.00009 W/MHz
  - 6.025 - 6.345 GHz (3 channels, 160 MHz) 0.00004 W/MHz

1 Introducing the EXFO EX Series

Designed to be paired with a smart device, the EXFO EX is a one-of-a-kind Ethernet tester used to qualify broadband connections delivered to both residential and business Ethernet customers—enabling service providers to validate delivery of full line rate Ethernet speeds to their subscribers. The EXFO EX provides the industry-leading **Speedtest** powered by Ookla[1] algorithm, which gives service providers repeatable and reliable metrics, every time. The EX10 PRO's advantage is two-fold: it includes FPGA-powered hardware, as well as the industry-leading Speedtest powered by Ookla algorithm, which together give service providers repeatable and reliable metrics, every time.

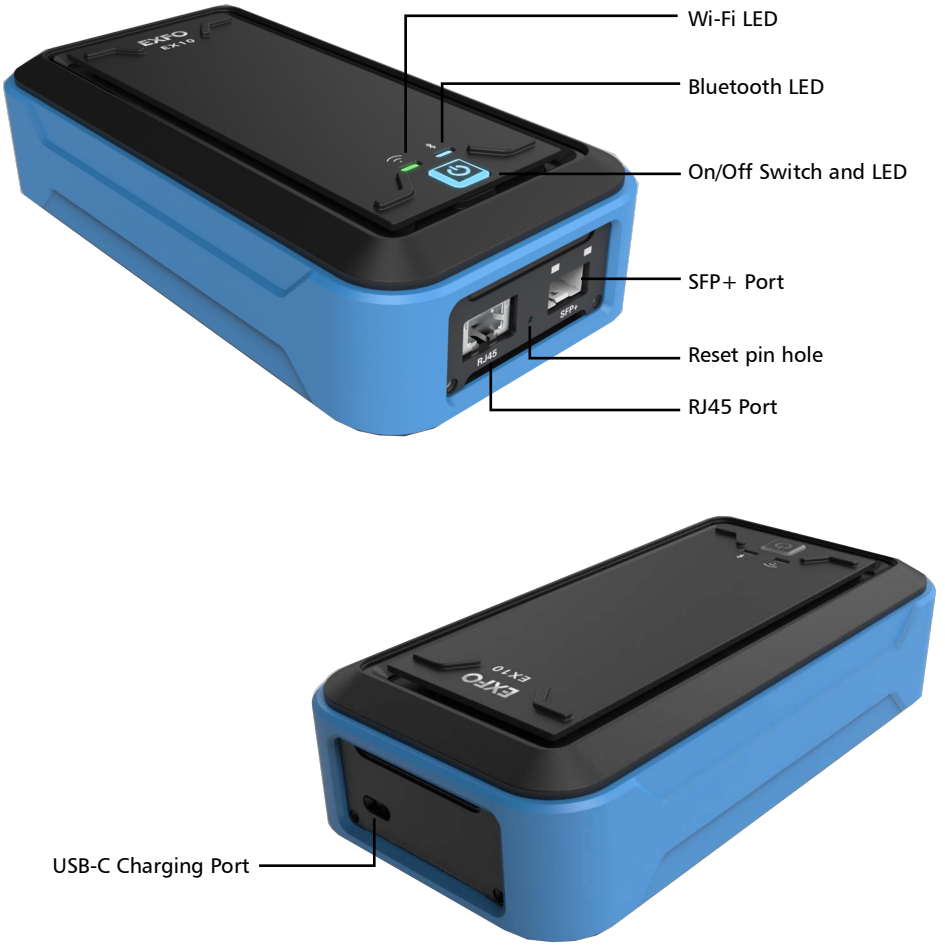
The EXFO EX ultra-intuitive application runs directly on a field technician's smart device to visualize all tasks performed including connection, setup, results-gathering, report generation, and cloud-enabled firmware upgrades.

1. Ookla is a third party provider. The Ookla Speedtest Powered technology involves Ookla owned and/or controlled servers that may or may not be within your network. Ookla retains the right to aggregate test results and to monetize aggregated results as they see fit.

EXFO EX Series Devices

EX1

EX10 and EX10 PRO



Note: ***EX10*** *is used in this user guide to represent both EX10 and EX10 PRO devices unless otherwise specified.*

USB-C Charging Port

The battery of the EXFO EX device is not fully charged at the factory. Charge the battery before using the EXFO EX device for the first time or when it has been unused for extended periods.

The battery needs to be fully charged before using the unit for the first time.

To charge the EXFO EX device:

1. Connect the supplied USB cable to the USB power adapter.
2. Connect the other end of the USB cable to the EXFO EX USB-C charging port.
3. Connect the USB power adapter to a power outlet.

The battery is fully charged when the:

EX1: battery green LED stops flashing

EX10: On/Off switch LED stops flashing while connected to the USB power adapter.

The charge cycle starts and stops automatically.

Note: *Refer to Recharging the Battery* on page 72 *for more information.*

On/Off Switch and LED

Turns the EXFO EX device on or off.

➤ To turn the EXFO EX device on, press and hold the on/off switch (about 1 second) until the LED starts flashing.

IMPORTANT

The EXFO EX device automatically shuts down after 3 minutes (by default on EX1) of inactivity when the EXFO EX device is not charging using the provided USB power adapter. For EX1 refer to Power Saving on page 68 for more information.

➤ To turn the EXFO EX device off, press and hold the on/off switch (about 5 seconds) until the LED starts flashing, then the LED turns off.

For EX1, the on/off switch LED reports the EX1 device status as follows:

LED State	Description
Off	EXFO EX device is turned off.
Green	EXFO EX device is turned on and ready to be used.
Green flashing fast	EXFO EX device is booting or shutting down.
Amber flashing	EXFO EX device is performing a firmware update.
Red	EXFO EX device failed to boot.

For EX10, the on/off switch LED reports the EX10 device/battery status as follows:

EXFO EX On/Off	LED State	Description
Off	Off	Unplugged.
	Blue flashing slow	Battery is charging.
	Green	Battery charging is completed, plugged-in.
On	Blue	EXFO EX device is ready to be used.
	White	EXFO EX device is booting or shutting down.
	White flashing fast	EXFO EX device is performing a firmware update.
	Red flashing very fast	EXFO EX device failed to boot and hardware fault has been detected.
	Blue flashing fast	Battery is charging.
	Red	Battery very low (less than 5%), not charging.
	Yellow	Battery low (between 5 and 25%), not charging.

Battery LED (EX1)

The battery LED of the EXFO EX device indicates the battery state as follows:

LED Color/State	Description
Red	Battery very low (less than 5%), not charging.
Red flashing	Battery very low (less than 5%), charging.
Amber	Battery low (between 5 and 25%), not charging.
Amber flashing	Battery low (between 5 and 25%), charging.
Green	Battery charging is completed, plugged-in.
Green flashing	Battery charging (more than 25%).
Off	Either the EXFO EX device is turned off or the battery is above 25% and not charging.

Reset Pin Hole

The reset pin hole button restores respectively the EX1 device to its factory settings or the EX10 device to its previous firmware version.

IMPORTANT

The reset pin hole should only be used as a last solution when encountering a serious problem with the EXFO EX device.

Resetting the EXFO EX device performs the following:

- Returns to factory (EX1) / previous (EX10) firmware version.
- Returns to factory default settings.
- Clears all test reports from the EXFO EX device memory.

To reset the EXFO EX device:

1. Turn the EXFO EX device off.
2. Press and hold the pin hole button.
3. Press and hold the on/off switch (about 2 seconds).
4. Release the on/off switch.
5. Release the pin hole button, after about 10 seconds, when the power LED starts flashing amber (EX1) / white (EX10) indicating the reset is in progress. Once the reset is completed, the EXFO EX device will reboot.

Wi-Fi LED (EX10)

The Wi-Fi green LED is on when the Wi-Fi is enabled.

Bluetooth LED (EX10)

The Bluetooth blue LED is on when a Bluetooth connection is established.

RJ45 Port and LEDs

The RJ45 port is mainly used for testing the Ethernet network using an electrical wired connection. It can also be used to connect to the network for firmware upgrade (refer to **Software on page 69**).

Device	Rate
EX1	1GE, 100M[a], 10M[a]
EX10	10GE, 5GE, 2.5GE, 1GE, 100M

a.Only available with EXFO EX1 revision ***C*** and older.

LEDs:

- The LINK green LED is on when the link is up, off when the link is down, and flashing when frames are transmitted and/or received.
- The DUPLEX yellow LED (EX1) is on for Full Duplex mode, off for Half Duplex mode, and flashing when collisions are detected.
- The SPEED yellow/green LED (EX10) is on indicating the detected speed:
  Yellow for speed under 10GE
  Green for 10GE speed

SFP/SFP+ Port and LEDs

The SFP (EX1) and SFP+ (EX10) ports are used for optical interfaces.

Device	Rate
EX1	1GE XGS-PON[a] GPON[a]
EX10	10GE 1GE XGS-PON GPON[a]

a. Upstream/Downstream with Speedtest is limited to 1GE.

LASER red LED is on when the EXFO EX device is emitting an optical laser signal.

LINK green LED is on when the link is up, off when the link is down, and flashing when frames are transmitted and/or received.

Technical Specifications

To obtain this product's technical specifications, visit the EXFO Web site at *www.exfo.com*.

Conventions

Before using the product described in this guide, you should understand the following conventions:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.

IMPORTANT

Refers to information about this product you should not overlook.

2 Safety Information

WARNING

Do not install or terminate fibers while a light source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

WARNING

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

WARNING

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING

Use only accessories designed for your unit and approved by EXFO. For a complete list of accessories available for your unit, refer to its technical specifications or contact EXFO.

IMPORTANT

Refer to the documentation provided by the manufacturers of any accessories used with your EXFO product. It may contain environmental and/or operating conditions limiting their use.

IMPORTANT

When you see the following symbol on your unit  **, make sure that you refer to the instructions provided in your user documentation. Ensure that you understand and meet the required conditions before using your product.**

IMPORTANT

When you see the following symbol on your unit  **, it indicates that the unit is equipped with a laser source, or that it can be used with instruments equipped with a laser source. These instruments include, but are not limited to, modules and external optical units.**

IMPORTANT

Other safety instructions relevant for your product are located throughout this documentation, depending on the action to perform. Make sure to read them carefully when they apply to your situation.

WARNING

Use in specific environments: (1) The use of wireless adapters in hazardous locations is limited by the constraints posed by the safety directors of such environments. (2) The use of wireless adapters in hospitals is restricted to the limits set forth by each hospital.

Do not operate a portable transmitter (including this wireless adapter) near unshielded blasting caps or in an explosive environment.

CAUTION

Electrostatic Discharge (ESD) Sensitive Equipment:

The EX10 may experience disturbances when used in a highly electrostatic charged environment. To minimize the risk, dissipate static electricity by touching a grounded unpainted metal object

- before connecting or disconnecting cables to/from the.
- before inserting or removing a transceiver to/from the.

Laser Safety Information

Your instrument is in compliance with standards IEC 60825-1: 2014 and 21 CFR 1040.10, as per Laser Notice No. 42, dated December 18, 1989.

Laser radiation may be encountered at the optical output port.

The following label indicates that a product contains a Class 1 source:

WARNING

When the LASER LED is on, the module is transmitting an optical signal on the SFP/SFP+ transceiver port.

Electrical Safety Information

CAUTION

When you use the unit outdoors, ensure that it is protected from liquids, dust, direct sunlight, precipitation, and full wind pressure.

Use the external power supply indoors only.

Note: *To ensure that the unit is completely turned off, disconnect the power cable and remove the battery.*

WARNING

- Use the external power supply indoors only.
- Position the unit so that the air can circulate freely around it.
- Operation of any electrical instrument around flammable gases or fumes constitutes a major safety hazard.
- To avoid electrical shock, do not operate the unit if any part of the outer surface (covers, panels, etc.) is damaged.
- Only authorized personnel should carry out adjustments, maintenance or repair of opened units under voltage. A person qualified in first aid must also be present. Do not replace any components while the power cable and battery are connected.
- Capacitors inside the unit may be charged even if the unit has been disconnected from its electrical supply.
- Use only the listed and certified USB power adapter provided by EXFO with your unit. It provides reinforced insulation between primary and secondary, and is suitably rated for the country where the unit is sold.

Other Safety Symbols

One or more of the following symbols may also appear on the EXFO EX device or its USB power adapter.

Symbol	Meaning
	Direct current
	Alternating current

3 Getting Started

This section describes the EXFO EX device setup, smart device software installation, then a quick procedure to initiate a test.

Turning the EXFO EX Device On

Note: *Make sure the EXFO EX device is fully charged, refer to Recharging the Battery* on page 72.

Turn the EXFO EX device on by pressing the on/off switch for 1 second (refer to *On/Off Switch and LED* on page 5).

Connecting the RJ45 and SFP/SFP+ Ports

Note: *For wireless test (Wi-Fi) there is no need to connect these ports. However a network connection using the RJ45 port may be required for firmware upgrade (refer to* ***Software*** **on page 69***).*

EX1

EX10

RJ45 Port

The RJ45 port is used for testing the Ethernet network using a wired electrical connection. It can also be used to connect to the network for firmware upgrade (refer to **Software on page 69**).

Connect the RJ45 port of the EXFO EX device to the Ethernet network and make sure the link is up (refer to *RJ45 Port and LEDs* on page 8).

SFP/SFP+ Port

The SFP/SFP+ port is used for testing optical Ethernet (EX1) / PON network. Insert an SFP/SFP+ optical transceiver module into the EXFO EX interface receptacle.

Carefully connect optical fibre cable(s) to the transceiver IN/OUT port(s). To ensure good signal quality, make sure that the optical fibre connector is fully inserted into the optical connector port.

CAUTION

To prevent exceeding the maximum input power level please use an attenuator. Use proper attenuation specially when using higher power devices, like PON, to avoid damaging the connected equipment.

CAUTION

Before inserting an optical module into the interface receptacle, inspect the receptacle to make sure nothing is inside.

WARNING

Use only EXFO supported transceivers. Refer to www.exfo.com for the list of supported transceivers. Using non-supported transceivers can affect the performance and accuracy of the test; in the case of GPON/XGS-PON the test may won't work.

Note: *Do not replace the transceiver while the test is running to avoid distorting results. First stop the test, replace the transceiver, and then restart the test.*

Installing the Smart Device Application

The EXFO EXs application needs to be installed on the smart device that will be used to control the EXFO EX device.

Smart Device Minimum Requirements

- Operation System:
  - Android 7.0 or above.

    OR
  - Apple iOS 13 or above.
- Bluetooth Low Energy (BLE): version 4.0 or above; minimum recommended is version 4.2.

Software Installation

To install the EXFO EXs application on a smart device:

1. From an Android smart device, open **Play Store** (Google).

   OR
2. From an Apple smart device, open **App Store**.
3. Search for EXFO or EXFO EX Series to locate the EXFO EXs application.
4. Install the EXFO EXs application.

Starting a Test for the First Time

It is possible to start a test from the smart device EXFO EXs application assuming the EXFO EX device is turned on and connected to the network to be tested.

To start a test:

1. Start the EXFO EXs application on the smart device. Ensure that Bluetooth is enabled on the smart device.

   1a. For Android smart devices, confirm that the EXFO EXs application can access the smart device location otherwise the application will not work.

   1b. For EX1: Confirm the enabling of **Report Diagnostic Data**. Refer to *Diagnostics* on page 67 for more information.

2. From the **Connection** page, select an EXFO EX device from the list (refer to *Connection* on page 24).

3. Once connected, the application opens automatically the **Speedtest** page. To select another test:

   3a. Tap the main menu button .

   3b. Select the test.

4. Set the test parameters.

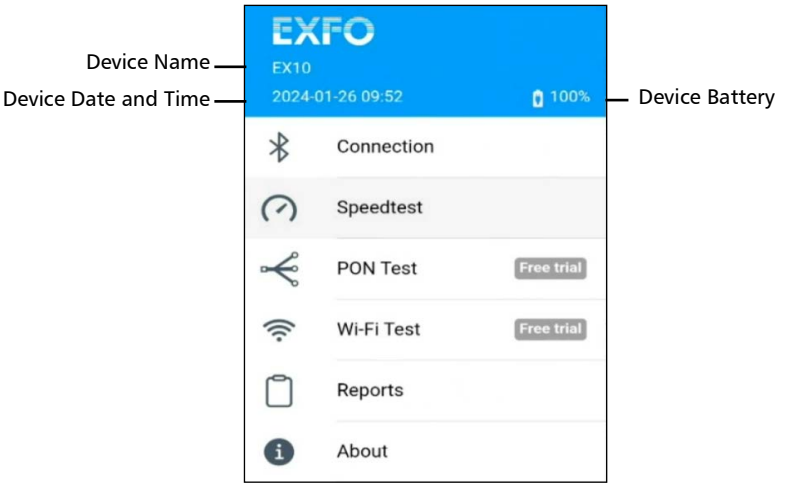
   4a. Tap the settings icon and set the test parameters (see *Speedtest Settings* on page 39, *PON Test Settings* on page 55, or Wi-Fi Test *Settings* on page 62).

   4b. Make sure the status bar is displaying the interface rate (refer to *Speedtest* on page 31, *PON Test* on page 51, or *Wi-Fi Test and Settings* on page 57).

5. Tap the start button (refer to *Start/Stop* on page 32 for Speedtest, *Start* on page 51 for PON Test, or *Start* on page 61 for Wi-Fi Test).
6. Once the test is completed, tap the quick report button to consult the full test results (refer to *Speedtest* on page 31, *PON Test* on page 51 or *Wi-Fi Test and Settings* on page 57).

4 EXFO EX Main Menu

Tab the main menu button: 



Note: *Only **Connection** and **About** are available when not connected to an EXFO EX device.*

Device Information

The following device information is only available when connected to an EXFO EX device.

- Device Name: Indicates the name of the connected EXFO EX device which is editable, refer to *Device Information* on page 69.
- Device Date and Time: Indicates the current date and time of the EXFO EX device.
- Device Battery: Indicates the battery status and the percentage of the remaining battery charge level of the EXFO EX device. Tapping on the battery icon, opens the battery information and settings, refer to *Battery* on page 67 for more information.

Connection

Accessing this page automatically scans and lists all discovered EXFO EX devices using Bluetooth Low Energy (BLE).

Note: *The **Connection** page is displayed by default when the application is started for the first time or when the application cannot re-connect to the previously connected EXFO EX device.*

Available Devices

Discovered EXFO EX devices appear with their device name and serial number, an update message may appear, and an icon to its left as follows:

Icon	Description
	Indicates that the firmware of the EXFO EX device is compatible with the EXFO EX Series smart device application.
	Indicates that either: ➤ **EX1/EX10 update required**: The EXFO EX device firmware is not compatible with the smart device application and must be updated. ➤ **App update required**: The smart device application is not compatible with the EXFO EX device firmware and must be updated.

To establish a connection with an EXFO EX device:

1. Select a device from the list. A pop-up is displayed while trying to establish the connection with the selected EXFO EX device.

   If the connection succeeds, **Connected** is displayed next to the connected EXFO EX device.

2. If the connection fails (not connected) ensure that the EXFO EX device is in-range, within 1 meter to 30 meters depending on the obstacle and interference, and select the device again.

3. If the **Incompatibility Detected** page is displayed, the firmware of the EXFO EX device is not compatible with the smart device application and must be updated:

3a. If the message:

No Network connection on <electrical interface> is displayed, make sure the EXFO EX device is connected to the Internet using the RJ45 port (refer to *Connecting the RJ45 and SFP/SFP+ Ports* on page 17).

OR

No Network connection on Wi-Fi is displayed, make sure the EXFO EX device is connected to the Internet using a Wi-Fi connection (tap the settings button and connect to a Wi-Fi access point).

OR

Server unreachable through <electrical interface> / **Wi-Fi** is displayed, contact EXFO technical support.

3b. Tap the **DOWNLOAD AND INSTALL** button to download and install the new firmware on the EXFO EX device. The EXFO EX device battery charge level must be more than 30% to perform a system update. Once the installation is completed, the EXFO EX device is automatically rebooted and the connection is established with the smart device.

To disconnect from an EXFO EX device:

1. Select the **Connected** EXFO EX device.

2. Select **Yes** to confirm its disconnection.

Speedtest

Note: *The **Speedtest** by Ookla is only available when connected to an EXFO EX device.*

From the **Speedtest** page it is possible to start the test, see the test in-progress, results/verdicts, and access the test report. Refer to *Speedtest* on page 31 for more information.

PON Test

From the **PON Test** page it is possible to start the test, see the test results, and access the test report. Refer to *PON Test* on page 51 for more information.

Wi-Fi Test

From the **Wi-Fi Test** page it is possible to capture the Wi-Fi network data and start the test to generate a report. Refer to *Wi-Fi Test and Settings* on page 57 for more information. Only available on EX10.

Reports

Note: *The **Reports** page is only available when connected to an EXFO EX device.*

The **Reports** page lists the EXFO EX test reports and allows report file management as follows:

Icon/Label	Action	Description
	Sort	Tap to change the report sorting oder. Reports are sorted by date from newest to oldest by default.
Speedtest *<Report File Name>* *<Report Tag>*	Open the Speedtest report	Tap on a report file name to open the report file. *<Report File Name>* is the report file name. *<Report Tag>* is an optional report tag name.
PON Test *<Report File Name>* *<Report Tag>*	Open the PON Test report	
	Select the Speedtest Report	Tap on an icons to select the report or combined report. When at least one report is selected, the report is in the selection mode allowing additional controls as described in the following table. The number of selected reports is displayed next to the back button.
	Select the PON Test Report	
	Select the Wi-Fi Test Report	
	Select Combined Report	
	Cancel the selection	Indicates that the report is selected. Tap on this icon to cancel the selection.

The following controls are available/displayed when at least one report is selected:

Icon	Action	Description
	Back	Exits the report selection mode and returns to the **Reports** page.
	Rename a Report[a]	Tap to change the name of a report.
	Tag a Report[a]	Tap to tag a report. Select a predefined tag or **User Defined** to create your own tag.
	Combine Reports[b]	Combines reports together to create a new combined report. Reports are appended one after the other without altering the content of individual reports and ordered based on their generation date and time. It is possible to add additional individual reports (not combined reports) to an existing combined report.
	Delete	Deletes the selected report(s) from the EXFO EX device memory.
	Share	Shares the selected report(s) with relevant applications installed on the smart device. A JSON report must be selected in order to share with Exchange; it is recommended to select the PDF format as well (All other formats as well as Combined reports are not supported with Exchange).
	Select all	Selects all reports.

a. Available when a single report is selected.
b. Available when at least two reports are selected.

Note: *Reports are stored on the EXFO EX device memory which is limited to 500 reports. It will not be possible to start a test once this limit is reached, a message will be displayed.*

About

Version and Copyrights

Displays the version of the EXFO EXs application and copyrights (**EXFO** and **Speedtest by Ookla**).

Help

User Guide opens the EXFO EX's user guide (PDF format) describing both the EXFO EX device and the EXFO EXs application.

Technical Support

Displays technical support phone numbers, website and e-mail in order to contact EXFO. Refer to *Contacting the Technical Support Group* on page 82 for more information.

License Agreements

Displays respectively the **EXFO License Agreement**, **Ookla Terms & conditions**, and **GNU General Public Licenses** containing links to access the latest online license agreements and/or terms & conditions.

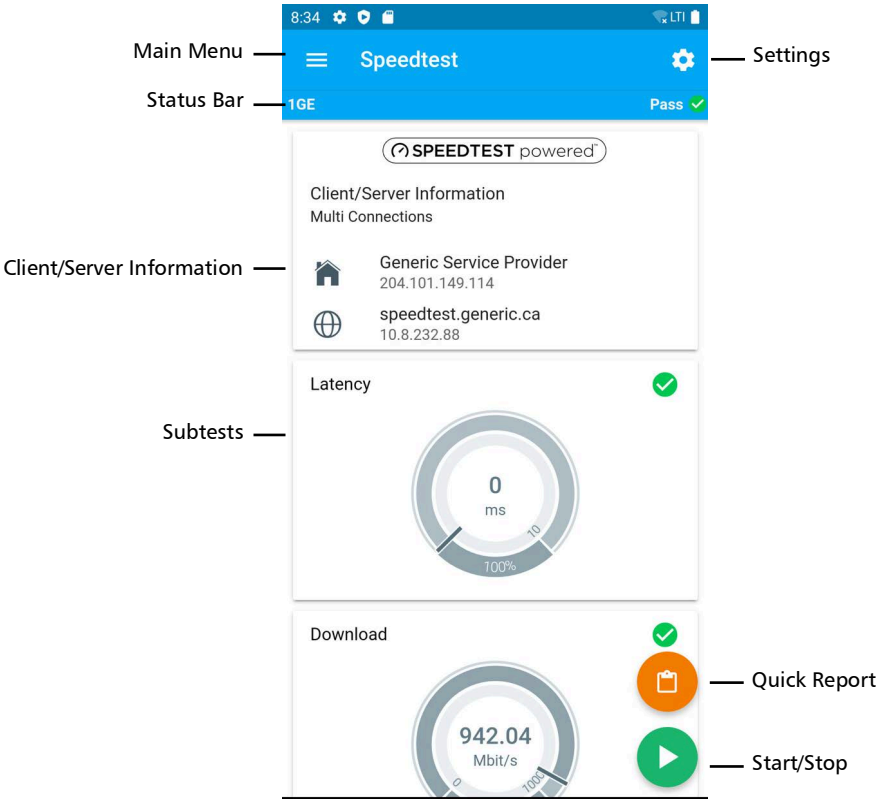
What's New on EX Series

Lists the new features introduced with the current release on EX1/EX10.

5 Speedtest

The Speedtest is a proprietary testing methodology developed by Ookla[1] and used by EXFO EX Series to determine the quality of the Internet connection offered by a given Internet Service Provider (ISP). It also allows the user to determine if the Service Level Agreement (SLA) is properly met. The quality of the connection is evaluated by determining the round-trip delay and throughput speed in the download and upload directions between a client located at an access point and an Ookla server.

From the main menu select **Speedtest**.



1. Ookla is a third party provider. The Ookla Speedtest Powered technology involves Ookla owned and/or controlled servers that may or may not be within your network. Ookla retains the right to aggregate test results and to monetize aggregated results as they see fit.

Note: *The **Speedtest** page is selected by default whenever the EXFO EXs application successfully connects to any EXFO EX device. The page displays the results of the last executed test when available.*

Start/Stop

The Start/Stop button starts or stops the **Speedtest**.

Button	Description
	Starts the **Speedtest**.
	Stops the **Speedtest**.

Note: *Every time the **Speedtest** is run, the following Ookla privacy policy agreement is displayed:*
You, end user, understand and acknowledge by performing the test contained in the Speedtest Software Application, that Ookla, LLC, may collect your IP Address during the test and share it with selected third parties.

*The **Don't remind me again** check box, when selected, forgoes displaying the Ookla privacy policy agreement next time the test is run. This setting can also be enabled/disabled from Ookla Privacy Notice* on page 49.

Ookla Privacy Policy: http://www.speedtest.net/privacy

Client/Server Information

Single Connection / **Multi Connections** indicates respectively that one or multiple TCP connections are used. Refer to *Speedtest Settings* on page 39.

Client/Server Information displays the client and server information as follows:

Icon	Information
	The name of the Internet Service Provider. The WAN client IP Address.
	The name of the host server. The IP address of the host server.

Status Bar

The status bar is an expandable area that is collapsed by default. The collapsed view displays the following information:

Information	Description
Link	For RJ45: Indicates the auto-negotiated rate: 10GE, 5GE, 2.5GE, 1GE, 100M, or 10M.
	For SFP: Indicates either **GPON**, **XGS-PON** or the interface rate for 10GE/1GE, laser status, and power level. The presence of the laser icon indicates that the laser is on; otherwise the laser is off (the icon is not displayed). The rate and power level (dBm) are displayed when a valid signal is received.
	For Wi-Fi: EX1: Indicates the Wi-Fi radio signal strength (icon), the frequency band in GHz, and the link speed in Mbit/s. EX10: Indicates the Wi-Fi radio signal strength (icon), and the frequency band in GHz.

Information	Description
Current alarms/errors	For RJ45: Indicates if a **Link Down** alarm occurred during the last second.
	For SFP (10GE/1GE): Indicates if a **Link Down** or **LOS** alarm occurred during the last second.
	For SFP (GPON/XGS-PON): Indicates if a **LOS** or **PON Down** alarm occurred during the last second. **PON Down** is declared when the ONU is not in operation-state.
	For Wi-Fi: Indicates if a **Wi-Fi Down** (no connection) alarm occurred during the last second.
Global Pass/Fail verdict	Displays the global test pass/fail verdict icon, when enabled. **Pass** indicates that all result values meet the configured threshold criteria. **Fail** indicates that at least one result value does not meet the configured threshold criteria, an alarm is detected, or the test is aborted.

Once the test is completed, the status bar is automatically expanded. The expanded view displays the following additional information:

Information	Description
Started at	The date and time the test started.
Stopped at	The date and time the test ended.
Status is	The status of the test: **Idle**: The test is not running or results are not available. **In-Progress**: The test is running. **Completed**: The test is completed. **Aborted** - <reason>: The test has been interrupted and the reason is displayed: **Link Down**, **LOS**, **PON Down**, **Network Timeout**, **Unresolved IP Address**, **Server Unavailable**, **Ookla Server Unreachable**, **User Stopped**, **Report Count Exceeded**, **Wi-Fi Down**, etc.

To expand the status bar:

1. Tap on the status bar.

   OR

2. Tap and swipe down the status bar.

To collapse the status bar:

1. Tap on the status bar, within the status bar area, or anywhere outside the expanded status bar area.

   OR

2. Tap and swipe up the status bar area.

Subtests

Latency, **Download**, and **Upload** subtests are performed sequentially and report their results using live visual meters. While the test is running, the Speedtest page auto-scrolls to display the current running subtest but can be overruled by touching the screen. A progress indicator is displayed indicating the subtest that is currently running and live results are reported on the meter. At the end of each test, the visual meter indicates the final results and an individual verdict is displayed when enabled (refer to *Thresholds* on page 40). Once a first subtest is completed, the global verdict is calculated and reported when enabled (see *Status Bar* on page 33). Once all subtests are completed, the quick report button is available to see the test report.

Wi-Fi reports the live Wi-Fi statistic values. Only available on EX10 when using the Wi-Fi interface.

Note: *Speedtest uses TCP and requires that the port 8080 is not blocked allowing TCP type transactions on the network.*

Latency

Measures the round-trip time between the client and the Ookla server.

Download[1]

Measures the aggregated throughput speed from the Ookla server to the client. Once the test is completed, click on the button to view the estimation number of video streams in HD (5 Mbit/s), 4K (20 Mbit/s), and 8K (50 Mbit/s). The provided numbers are simply arithmetic calculations using the measured throughput.

Upload[1]

Measures the aggregated throughput speed from the client to the Ookla server.

Wi-Fi

For Wi-Fi interface, the download/upload - Min/Max values are reported for the following statistics when available:

- **Link Speed** theoretical value in upload/download
- **Standard (tech)** 802.11 standard letters and technology (for example HT, VHT, HE)
- **Ch. BW** (Channel Bandwidth)
- **MCS** (Modulation Coding Scheme)
- **GI** (Guard Interval)
- **NSS** (Number of Special Stream)

1. When performed over Wi-Fi, these tests are influenced by the Wi-Fi network meaning that on the fly the channel link speed may change to a lower or higher value depending on the surrounding environment which includes: Wi-Fi protocol lowering the link speed for backward compatibility, interference from other device types such as microwave oven, Bluetooth devices, the number of devices present in the vicinity dividing the bandwidth to the access point, and the load balancing between assess points in business type environments. The Wi-Fi parameters are continuously updated to represent what is on-going in the Wi-Fi environment, except while the test is running.

Quick Report

Tap the quick report button to view and share the current test report. Refer to *Reports* on page 27 to view and share a previously saved Speedtest report.

Tools

Tap the tools button to access the available tools:

- **LLDP Neighbor**
- **Ping**
- **URL Validation**
- **Wi-Fi Channel Map**

Note: *Refer to* Tools *on page 63 for more information.*

Settings

Tap the settings button to configure the test, reports, and system parameters. Refer to *Speedtest Settings* on page 39 for more information.

6 Speedtest Settings

The **Settings** page allows the configuration of the test, reports, and system parameters.

From the Speedtest page, tap the button. Click either on the back arrow or the button to return to Speedtest.

Test

Speedtest

- **Single Connection** / **Multi Connections** determines whether one or multiple TCP connections are used for the download and upload subtests.
  - **Single Connection** indicates that the Ookla Speedtest uses a single connection for each subtest to determine the throughput performance. Single connection is intended to simulate the download of a single file.
  - **Multi Connections** indicates that the Ookla Dynamic Connection Scaling algorithm automatically determines the number of connections to be used. Multi connections is intended to simulate either general web browsing or multiple applications usage by one or multiple users in a household.
- **Server Selection** determines how the Speedtest server will be selected.
  - **Automatic** (default) indicates that the server closest to the client is automatically selected following the Ookla proprietary method.
  - **Manual** followed by the server name indicates that the server has been manually selected by the user. To manually select a SpeedTest server, tap on the **Speedtest** field and select either a server from the list of the 25 closest servers or use the search to find the desired server based on its server name, country, or sponsor (Service Provider Name).

Thresholds

Allows enabling and setting the threshold values that will be used to declare the pass/fail verdict for each test. Thresholds are disabled by default. Threshold settings are saved independently for each interface type: RJ45 and Wi-Fi.

- **Latency Threshold** when enabled, allows entering the maximum threshold value in ms.
- **Download Threshold** when enabled, allows entering the minimum and maximum threshold values in Mbits/s.
- **Upload Threshold** when enabled, allows entering the minimum and maximum threshold values in Mbits/s.

Interface

Allows selecting the test interface and its parameters.

- **Type/Rate** allows the selection of the EXFO EX device test port to use for the Speedtest:

Device	Type/Rate
EX1	**BASE-T Electrical** (default) **1GE Optical** **XGS-PON** **GPON** **Wi-Fi**
EX10	**BASE-T Electrical** (default) **10GE Optical** **1GE Optical** **XGS-PON** **GPON** **Wi-Fi**

For RJ45 port (BASE-T Electrical):

- **Connector** indicates the port connector type which is **RJ45**.
- **Auto-Negotiation** indicates the state of auto-negotiation which is enabled.
- **Speed** allows to force the auto-negotiated speed to 10GE, 5GE, 2.5GE, 1GE, 100M, or 10M to facilitate negotiation in certain environment. Default is auto detection (**Auto**) or a specific rate when there is only one rate available.

For SFP port (1GE Optical / 10GE Optical / GPON / XGS-PON):

- **Transceiver Type**, available with GPON/XGS-PON, allows selecting the type of transceiver:

  EXFO Managed provides specific adaptation to the GPON/XGS-PON transceiver for normal operation. In addition, it provides access to the supported configuration parameters and statistics.

  Others does not apply any specific adaptation to the transceiver. Configuration and statistics are not available.
- **Connector** indicates the port connector type: **SFP** for 1GE Optical / GPON, **SFP+** for 10GE Optical / XGS-PON.
- **Laser** when enabled (default) activates the laser on the optical transceiver.
- **Lasers OFF at Start-Up** when enabled (disabled by default) automatically turns off the laser when starting the EXFO EX device.
- **Auto-Negotiation** when enabled (default) advertises to the remote port which parameters to use. Only available for 1GE Optical.
- **TX Power** indicates the transmit power level in dBm.
- **RX Power (Min/Current/Max)** indicates respectively the receive power level minimum, current, and maximum level in dBm.
- **RX Power Range** indicates the receive power range level in dBm supported by the optical transceiver.

- **SFP Information/SFP+ Information**, available with SFP/SFP+ transceiver, gives detailed information related to the transceiver module.
- **GPON Information**, available with GPON transceiver, displays the following information: **ONU Serial Number**[1], **ONU Password**[1], **Equipment ID**[1], **Active SW Version**[1], **Inactive SW Version**[1], **ONU State**, **ONU ID**, **PON ID** (HEX and ASCII values and other fields if applicable), **OLT Vendor ID**, **OLT Version**, **Transmit Optical Level (TOL)**, **ODN Class**, and **ODN Loss**, and **Transceiver FW Version**.
- **XGS-PON Information**, available with XGS-PON transceiver, displays the following information: **ONU Serial Number**[2], **ONU Registration ID**[1], **Equipment ID**[1], **Active SW Version**[1], **Inactive SW Version**[1], **ONU State**, **ONU ID**, **PON ID** (HEX and ASCII values and other fields if applicable), **OLT Vendor ID**, **OLT Version**, **Transmit Optical Level (TOL)**, **ODN Class**, **ODN Loss**, and **Transceiver FW Version**.

1. These ONU parameters are configurable for **EXFO Managed** GPON transceivers.
2. These ONU parameters are configurable for **EXFO Managed** XGS-PON transceivers.

For Wi-Fi:

When selecting Wi-Fi as the interface type/rate, the Wi-Fi connection status is reported as follows:

Status Message	Description
Connecting…	Trying to connect to an access point.
Connection Error	Unable to connect to the access point.
Authentication Error Occurred	Unable to connect to the access point du to invalid credential.
Connected	Connection is established with an access point.
Not Connected	No connection to an access point (SSID) has been established yet.
Not in Range	A known access point that is not available.

- **Not Connected** indicates that no connection to an access point has been established yet.
- **Wi-Fi** followed by an access point indicates that the EXFO EX device is connected to an access point.

For Wi-Fi, the setting button ( ) allows either setting, changing, or disconnecting an access point.

- **MAC Address** is the default and unique Media Access Control (MAC) address given to the Wi-Fi of the EXFO EX device.

- **Wi-Fi Access Points** allow the EXFO EX device to connect to a Wi-Fi access point[1] for testing, or downloading and installing new firmware update (see *Device Information* on page 23).

  For a secured access point enter the password and tap **CONNECT**.

  - **Show Password** check box when selected displays the password.
  - **Show Advanced** check box when selected displays the access point DHCP and security information.

  Tapping on the **Connected** Wi-Fi access point displays the following information:

  Wi-Fi Details

  - **BSSID**: Basic Service Set Identifier
  - **Vendor**: Manufacturer name
  - **Frequency Band**: **2.4 GHz**, **5 GHz** or **6 GHz**
  - **Channel**: Actual number associated to a channel: **1** to **14** for 2.4 GHz; **36** to **177** for 5 GHz; **1** to **233** for 6 GHz.
  - **Signal Strength**: The received signal strength of the Beacon frame in dBm.

Signal Strength	Signal strength value in	
	Percentage	dBm
Excellent	100 %	> -50 dBm
Good	80 % to 100 %	-50 dBm to -60 dBm
Fair	60 % to 80 %	< -60 dBm to -70 dBm
Weak	40 % to 60 %	< -70 dBm to -80 dBm

1. Connection is only possible on access points having their security mode set to either **Open**, **Enhanced Open**, **WPA2 - Personal**, **WPA3 - Personal_Transition**, or **WPA3 - Personal**.

- **Link Speed**: Link speed value of the connected Wi-Fi network in Mbit/s.
- **Security**: The Wi-Fi interface security mode.

Security Mode	Description
Open	No authentication
Enhanced Open	No authentication but encrypted
WPA2 - Personal	Wi-Fi Protected Access Personal Version 2
WPA3 - Personal Transition	Wi-Fi Protected Access Personal Version 2/3
WPA3 - Personal	Wi-Fi Protected Access Personal Version 3

Network: The connected Wi-Fi network information: **IP Address**, **Subnet Mask**, **Gateway**, **DNS 1**, **DNS 2**.

CANCEL and **FORGET** allows respectively to close the pop-up or disconnect from this Wi-Fi access point.

To connect to an access point (when Not Connected is displayed):

1. Tap the settings button.
2. Enter the credentials to connect to this access point.

To disconnect from an access point:

1. Tap the settings button.
2. Tap the **Connected** access point.
3. Tap **FORGET**.

To change the access point:

1. Tap the settings button.
2. Tap the new access point.
3. Enter the credentials to connect to this access point.

To display the parameters of an access point:

1. Tap the settings button.
2. Tap the connected access point (SSID) to display its parameters (see *Wi-Fi Channel Map* on page 66).

Network

- **MAC Address** is the unique Media Access Control Address given to the EXFO EX device Ethernet or Wi-Fi port and is editable. Each port has its own MAC address that is editable for the RJ45 and SFP connectors. To change the MAC address, tap on the MAC address, enter the new MAC address, and tap **OK**. The new MAC is displayed followed by **(custom)**. To retrieve the default MAC address, tap on the MAC address and tap **RESTORE TO DEFAULT**.
- **VLAN** when enabled (disabled by default), enables one level of VLAN encapsulation: C-VLAN (type 8100).
- **VLAN ID** allows selecting the VLAN ID: **0** through **4095** (default is **2**). Special VID values (IEEE Std 802.1Q-1998):

ID	Description
0	The null VLAN ID. Indicates that the tag header contains only user priority information; no VLAN identifier is present in the frame. This VID value must not be configured as a PVID, configured in any Filtering Database entry, or used in any Management operation.
1	The default PVID value used for classifying frames on ingress through a Bridge Port. The PVID value can be changed on a per-Port basis.
4095	Reserved for implementation use. This VID value shall not be configured as a PVID, configured in any Filtering Database entry, used in any Management operation, or transmitted in a tag header.

- **VLAN Priority** allows selecting the VLAN priority: **0** (default) to **7**:

0	000 - Low Priority	4	100 - High Priority
1	001 - Low Priority	5	101 - High Priority
2	010 - Low Priority	6	110 - High Priority
3	011 - Low Priority	7	111 - High Priority

- **VLAN Type** allows selecting the VLAN Ethernet Type: **8100** (default), **88A8**.

➤ **DHCP/Static/PPPoE**

DHCP when selected (default) dynamically obtains an IP address from a Dynamic Host Configuration Protocol (DHCP) server. The source **IP Address**, **Subnet Mask**, **Gateway**, **DNS1**, and **DNS2** parameters are displayed. **DHCP Option 60** when enabled (disabled by default) allows specifying a string (**Vendor Class ID** (VCI)) identifying the EXFO EX to the DHCP server. To enable the **DHCP Option 60**, tap on this field, enable the option and enter the **Vendor Class ID** (default is **EXFO**). If the EXFO EX is not whitelisted, then it will not receive an IP address.

Note: *__DHCP__ is enabled and not configurable when using Wi-Fi; __DHCP Option 60__ is not available with Wi-Fi.*

Static when selected allows setting the source parameters: **IP Address**, **Subnet Mask**, **Gateway**, **DNS1**, and **DNS2**.

PPPoE when selected allows using a Point-to-Point Protocol over Ethernet connection.

➤ **Authentication** allows configuring the **User Name** and **Password** and displays the connection status: **Not Connected**, **Connecting**, **Connected**.

➤ **Connection Mode**:

Always On automatically connects and maintains the connection to the PPPoE server.

On-Demand (default) automatically connect/disconnect to/from the PPPoE server when data transmission is initiated/terminated on the PPPoE client.

The source **IP Address**, **DNS1**, and **DNS2** parameters are displayed.

Ookla Privacy Notice

Ookla Privacy Notice when enabled (default) displays the following message every time the High-Speed Multiservice Test Module is started:

You, end user, understand and acknowledge by performing the test contained in the Speedtest Software Application, that Ookla, LLC, may collect your IP Address during the test and share it with selected third parties.

Reports

Allows configuration of report identification information and file format.

Job Information

Note: *Job Information may not be available on all EXFO EX device versions.*

These fields are not mandatory and are used to identify the report. Enter the following job information if required: **Job ID**, **Customer Name**, **Contractor Name**, **Operator Name**, **Circuit ID**, and **Comment**.

Up to 32 characters are allowed for each field with the exception of **Comment** which allows 160 characters.

Share Format

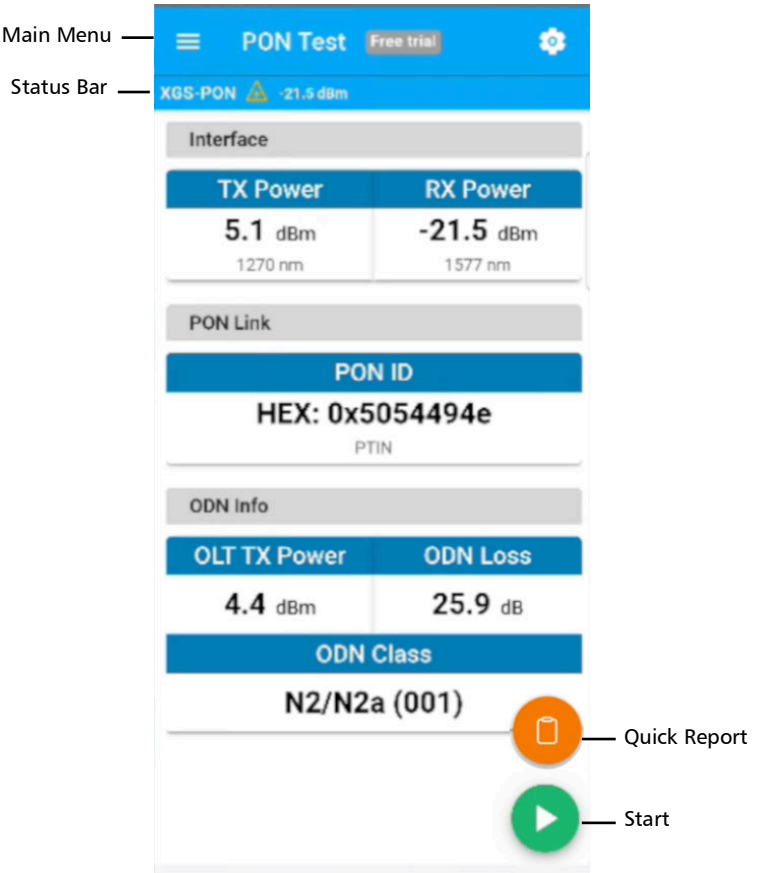
Allows the selection of the report file format to be generated, either **PDF** (default) and/or **CSV**.

System

Refer to *System* on page 67.

7 PON Test

From the main menu select **PON Test**.



Start

The Start button in the PON Test takes a snap shot of the live results in a few seconds, as such the button is dimmed then turn back green once completed.

Status Bar

The status bar displays the following information:

Information	Description
Link	Indicates the **XGS-PON** interface, laser status, and power level. The presence of the laser icon indicates that the laser is ready for transmission. The power level (dBm) is displayed when a valid signal is received.

Interface

- **TX Power** indicates the generated TX Power level of the pluggable optical module in dBm.

  1270 nm indicates the upstream wavelength (not measured) of the pluggable optical module.

- **RX Power** indicates the measured RX Power level of the pluggable optical module in dBm.

  1577 nm indicates the downstream wavelength (not measured) of the pluggable optical module.

PON Link

PON ID indicates the PON ID value in HEX and ASCII formats.

ODN Info

Reports the following Optical Distribution Network (ODN) information:

- **OLT/RE TX Power** is the TX power reported by the Optical Line Terminal (OLT) or the Reach Extender (RE).
- **ODN Loss** is the calculated power attenuation introduced by the ODN (OLT/RE TX Power minus ONU RX Power).
- **ODN Class** identifies the nominal optical parameters of the transceiver according to the ODN optical path loss class.

Quick Report

Tap the quick report button to view and share the current test report. Refer to *Reports* on page 27 to view and share a previously saved test report.

Settings

Tap the settings button to configure the test, reports, and system parameters. Refer to *PON Test Settings* on page 55 for more information.

8 PON Test Settings

The **Settings** page allows the configuration of the PON test and reports parameters.

From the PON Test page, tap the  button. Click either on the back arrow or the  button to return to the PON Test.

Test

Interface

Allows selecting the test interface parameters.

- **Type/Rate** allows selecting the EXFO EX device test port used for the PON Test: **GPON** or **XGS-PON**
- **Transceiver Type** indicates the type of transceiver supported:

  EXFO Managed provides specific adaptation to the PON transceiver for normal operation.
- **Connector** indicates the port connector type: **SFP/SFP+**.
- **Laser** when enabled (default) activates the laser on the optical transceiver.
- **Lasers OFF at Start-Up** when enabled (disabled by default) automatically turns off the laser when starting the EXFO EX device.
- **SFP/SFP+ Information** gives detailed information related to the transceiver module.
- **GPON/XGS-PON Transceiver FW Version** displays the firmware version of the PON transceiver module.

Reports

Allows configuration of report identification information and file format.

Job Information

Note: *Job Information may not be available on all EXFO EX device versions.*

These fields are not mandatory and are used to identify the report. Enter the following job information if required: **Job ID**, **Customer Name**, **Contractor Name**, **Operator Name**, **Circuit ID**, and **Comment**.

Up to 32 characters are allowed for each field with the exception of **Comment** which allows 160 characters.

Share Format

Allows the selection of the report file format to be generated, either **PDF** (default), **CSV**, **XML**, and/or **JSON**.

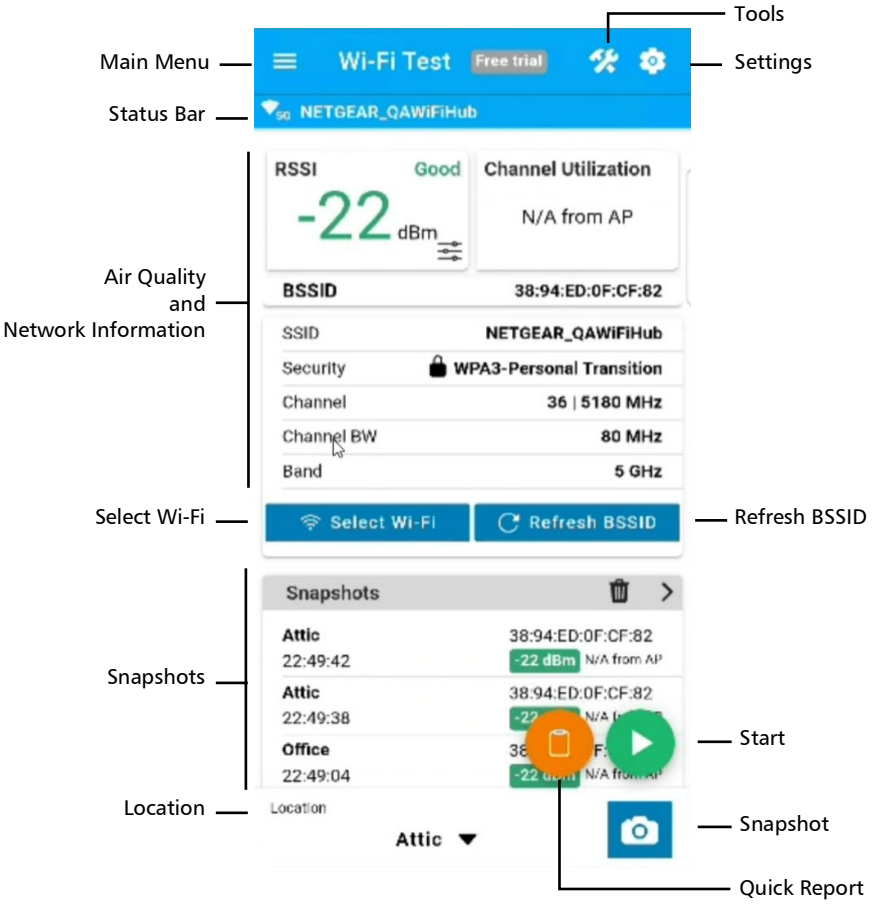
System

Refer to *System* on page 67.

9 Wi-Fi Test and Settings

The Wi-Fi test is a test dedicated to discover and monitor a specific Wi-Fi network providing its identification and quality metrics.

From the main menu select **Wi-Fi Test**.



Status Bar

The status bar displays the connected network Wi-Fi radio signal strength (icon), the frequency band in GHz, and the SSID name.

Wi-Fi Down, when displayed, indicates that no connection occurred during the last second.

Air Quality and Network Information

Displays the connected Wi-Fi access point information:

Air Quality

- **RSSI** (Received Radio Signal Strength Indicator) indicates the signal strength color-coded value based on the configured thresholds: green for **Good**, yellow for **Fair**, or red for **Weak**. Clicking on  gives access to RSSI thresholds settings (see *RSSI Thresholds (dBm)* on page 62).
- **Channel Utilization** indicates the current STA population and traffic levels in the BSS (Basic Service Set). **N/A from AP** is displayed when the information is not available from the access point.
- **Channel BW** (Channel Bandwidth) indicates the bandwidth used by the channel.

Network Information

- **BSSID** indicates the Basic Service Set Identifier.
- **SSID** indicates the Service Set Identifier.
- **Security** indicates the Wi-Fi interface security mode:

Security Mode	Description
Open	No authentication
Enhanced Open	No authentication but encrypted
WPA2 - Personal	Wi-Fi Protected Access Personal Version 2

Security Mode	Description
WPA3 - Personal Transition	Wi-Fi Protected Access Personal Version 2/3
WPA3 - Personal	Wi-Fi Protected Access Personal Version 3

- **Channel** (Channel | Frequency) indicates the actual number associated to a channel (**1** to **14** for 2.4 GHz; **36** to **177** for 5 GHz; **1** to **233** for 6 GHz) and its frequency.
- **Band** indicates the frequency band of the Wi-Fi network: **2.4 GHz**, **5 GHz** or **6 GHz**.

Select Wi-Fi

Allows selecting a Wi-Fi SSID[1] that will used for testing.

Select a Wi-Fi access point from the list.

For a secured access point enter the password and tap **CONNECT**.

- **Show Password** check box when selected displays the password.
- **Show Advanced** check box when selected displays the access point DHCP and security information.

To forget the connected network:

1. Tap on the connected network.
2. From the pop-up, tap **Forget**.

1. Connection is only possible on access points having their security mode set to either **Open**, **Enhanced Open**, **WPA2 - Personal**, **WPA3 - Personal_Transition**, or **WPA3 - Personal**.

Refresh BSSID

Initiates the re-association to another BSSID to find and switch to a more suitable signal performance within the same ESS for a given SSID. Note that refreshing the BSSID may not update the value if the original BSSID signal remains the best performing. When the BSSID changes a new badge is displayed for 10 seconds.

Snapshots

Lists the last 3 snapshots taken. The following summary Wi-Fi network information is displayed for each snapshot: **Location**, **Time**, **BSSID**, **RSSI** (color-coded status, see page 58), and **Channel Utilization**.

- Clicking on allows deleting ALL snapshots.
- Clicking on the **Snapshots** title bar (including the '**>**') or on any snapshot allows viewing all snapshots. Snapshots are listed per location with latest on top (up to 50 snapshots).

To delete one snapshot:

1. Tap on the snapshot to be deleted and drag it to the right.
2. Tap to delete.

To delete all snapshots:

1. Tap on **Select All** to select all snapshots.
2. Tap on **Delete Selection** to delete.

To delete multiple snapshots:

1. Select the snapshots to be deleted

   1a. Tap individually on of all snapshots to be select.

   or

   1b. Tap on **Select All** to select all snapshots then, tap individually on of all snapshots to be remove from the selection.

2. Tap **Delete Selection** to confirm.

Location

Indicates and allows selecting the location where the test is performed: **No Location** (Default), **Basement**, **Bedroom 1**, **Bedroom 2**, **Garage**, **Home Theater**, **Kitchen**, **Living Room**, **Master Bedroom**, **Office**, and **User Defined**.

User Defined allows defining a personalized location (up to 20 characters).

Snapshot

Tap the snapshot button to capture the current Wi-Fi network data. The captured snapshot is then listed under **Snapshots**. Up to 50 snapshots are possible (see *Snapshots* on page 60).

Start

The start button generate a report of the Wi-Fi test including all snapshots. A snapshot is auto-generated when no snapshots were previously taken, otherwise no additional snapshot are added to the existing list. The button is dimmed while generating the report then turn back green once completed.

Quick Report

Tap the quick report button to view and share the current test report. Only available when the test has run (see Start above). Refer to *Reports* on page 27 to view and share a previously saved report.

Tools

Tap the tools button to access the **Wi-Fi Channel Map** tool.

Note: *Refer to* Tools *on page 63 for more information.*

Settings

Tap the settings button to configure the RSSI qualifier threshold values. Click either on the back arrow or the button to return to the Wi-Fi Test.

RSSI Thresholds (dBm)

Allows enabling and setting the signal strength threshold limits. Default is enabled and set as follows:

To enter new RSSI threshold values manually:

1. Tap on the **Fair Lower Limit (dBm)** filed and enter the new value
2. Tap on the **Good Lower Limit (dBm)** field and enter the new value
3. Tap **OK**

To adjust new RSSI threshold values by scrolling:

1. Tap on the fair lower limit blue bulb and drag it to the desired value.
2. Tap on the good lower limit blue bulb and drag to the desired value.
3. Tap **OK**

System

Refer to *System* on page 67.

10 Tools

Tap the tools button to access the available tools.

Tools	Availability			Page
	Speedtest	PON Test	Wi-Fi Test	
LLDP Neighbor	Yes[a]	No	No	63
Ping	Yes	No	No	64
URL Validation	Yes	No	No	65
Wi-Fi Channel Map	Yes	No	Yes	66

a. Only available on EX10.

LLDP Neighbor

The LLDP (Link Layer Discovery Protocol) Neighbor allows listening and decoding LLDP packet content.

- **Listening MAC Address** allows selecting the MAC address used to listen for LLDP packets: **01:80:C2:00:00:0E** (default), **01:80:C2:00:00:03**, or **01:80:C2:00:00:00**.
- **TTL Expired**, when displayed, indicates either that no LLDP packet was received since the last link-up or the TTL timer has elapsed.

The following information is displayed when an LLDP packet was received and not yet expired:

- **Chassis ID** including its subtype
- **Port ID** including its subtype
- **Port Description**
- **System Name**
- **System Description**
- **Management Address** (IPv4 or IPv6)
- **Port VLAN ID**

Ping

- **Destination Address** allows selecting the address of the network device to be detected: IP address (IPv4), FQDN, or hostname.
- **Ping** button starts the ping tool.
- **Results/Statistics** (status) displays the ping color-coded status (green for successful or red for failed) and detailed results/statistics. To succeed, a ping command shall be acknowledged by the network device within a given delay (**Timeout**). Typically a ping command can fail for the following reasons:
  - The address is unavailable or unknown.
  - The remote device is not supporting ICMP messaging.

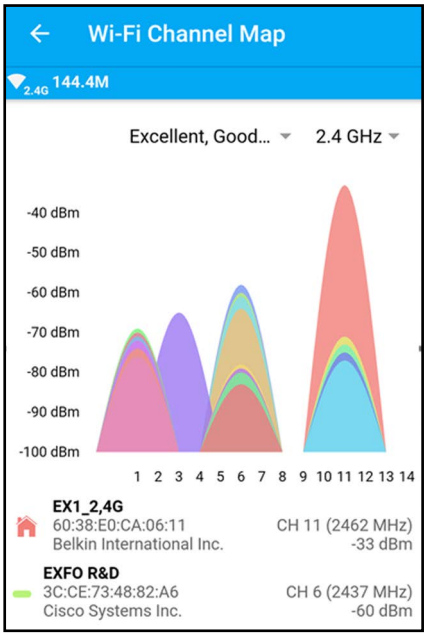
URL Validation

URL Validation allows collecting key output information returned by a successful server URL query. Tap on this field to change or validate the server URL.

- **Server URL** indicates the server address: **https://www.exfo.com** by default. To change the server URL, tap on this field and enter a new valid **Server URL**.
- **Server Response** indicates the status of the server connectivity as well as the response:
  - Gray when not yet validated.
  - Green when the client receives a response back from the server successfully; **Text content** or **Binary content** is reported to qualify the type of response. For **Text content**, the first 80 characters are reported. For **Binary content**, no further information is reported.
  - Red when the server is unreachable; **Server unreachable** is displayed.
- **Validate** queries the **Server URL** and reports the **Server Response** as described above.

Wi-Fi Channel Map

The Wi-Fi channel map provides a dynamic view of all active 2.4 GHz, 5 GHz, or 6 GHz (EX10) access points.



- **Excellent**, **Good**, **Fair**, **Weak** selection allows displaying access points based on their signal strength.
- **2.4 GHz**, **5 GHz**, and **6 GHz** selection allows displaying access points based on the selected frequency band.
- **All** / **36-64** / **100-144** / **149-177** for 5 GHz or **All** / **1-93** / **95-157** / **159-233** for 6 GHz, allows selecting the channel range to be displayed.
- The graph displays each Wi-Fi channel (X axis) with their signal strength (Y axis) and are color coded allowing their identification with the list of access points that appear below the graph.
- The list of access points are color coded allowing their identification on the graph. Each access point (SSID) is listed with its SSID, BSSID, vendor name, channel number, frequency (in parenthesis), and signal strength. If the connected Wi-Fi access point is part of the list, it appears as the first access point in the list with the icon to its left.

  Tap on an access point to highlight it on the graph. Tap again on the access point to un-select it. It is possible to highlight more access points by tapping on each access point.

11 System

Allows configuration of the EXFO EX device settings.

From any test page, tap the button to access the system parameters.

Diagnostics

Report Diagnostic Data (EX1)

Enable this feature to help improve your EX1 experience by automatically sending diagnostic data (Settings, activity logs, fault logs, …) to EXFO. This information will not be used to identify you and will help improve the performance and stability of the product.

See Section 4.8 and Section 6 of the Software License Agreement (refer to *License Agreements* on page 29) for additional details.

Turning off this feature does not affect your device's ability to operate normally to share reports or request firmware updates.

Date/Time

Automatic Date/Time is enabled (not configurable) and set to **Automatic** meaning that the EXFO EX device uses the smart device date and time.

Battery

➤ **Charge remaining** indicates the EXFO EX device battery status (icon) and the percentage of the remaining battery charge level as follows:

Icon	Level of charge
	Charge remaining when above 5%. A low battery message is displayed when the battery goes below 25% indicating to charge the EXFO EX device to extend operation.
	Charge remaining when below 5%. A very low battery message is displayed when the battery goes below 5% indicating that the EXFO EX device will shortly shut down and to charge the EXFO EX device to extend operation.

Icon	Level of charge
	Plugged in and charging.
	Plugged in but not charging, either the battery is fully charged (100%) or the power source is not sufficient to charge the EXFO EX device.

➤ **Power Saving**

➤ **Auto-Shutdown** when enabled (default: enable on EX1; disabled on EX10), allows the EXFO EX device to shut down once the period of inactivity is reached. The EXFO EX device shuts down when there is no activity on the device (no HTTP communication, test not running, no firmware update, EXFO EXs application in closed or in background, etc.) for the defined period. For EX1, when the EXFO EX device is charging using the provided USB power adapter, the Auto-Shutdown feature is disabled.

➤ **Period**, available when **Auto-Shutdown** is enabled, allows setting the inactivity time before turning off the EXFO EX device: **1:00 min** to **5:00 min** (**3:00 min** by default) in 30-second steps; in addition for EX10 **10:00 min** and **15:00 min**.

Device Information

Displays EXFO EX device information and allows firmware update and device name edition.

- **Software**
  - **Product Version** indicates the installed EXFO EX device firmware version.
  - **FW Delivery Identifier** is a keyword that provides the location of the EXFO software update. This identifier should not be altered unless requested by EXFO technical representatives. The identifier can be restored to its default by pressing the **RESTORE TO DEFAULT** button.
- **Device**

  Displays the following EXFO EX device information: **Device Name**, **Model Number**, **Client ID**, **Serial Number**, **Assembly Hardware Revision**, and **Manufacturing Date**. The **Device Name** is editable.

12 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately, disconnect from any external power source, remove the battery and let the unit dry completely.

WARNING

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

Recalibrating the Unit

The EXFO EX device does not require any calibration.

Recharging the Battery

The battery in the EXFO EX device is a rechargeable Li-ion smart battery. The EXFO EX device USB-C adapter connector is used to recharge its battery. The EXFO EX device has a LED indicating the battery charge status (refer to *Battery LED (EX1)* on page 6 for EX1 and *On/Off Switch and LED* on page 5 for EX10). The EXFO EX device battery charge status is also available on the smart device application (refer to *Device Information* on page 23 and *Battery* on page 67).

CAUTION

Only charge the EXFO EX device battery with the USB cable and USB power adapter provided by EXFO.

You can purchase a new battery from EXFO.

IMPORTANT

The battery of the EXFO EX device is not fully charged at the factory. Charge the battery before using the EXFO EX device for the first time or when it has been unused for extended periods. The battery is fully charged when the battery green LED stops flashing. The charge cycle starts and stops automatically.

The time required to charge the battery depends on various factors such as the ambient temperature.

To ensure that the battery functions or charges properly, keep it within operation and storage temperature range.

It is possible to use the provided USB cable alone connected to a USB port of a computer to recharge the battery only when the EXFO EX device is turned off. The power supplied from a computer USB port is not sufficient to charge the EXFO EX device when it is turned on.

Replacing the Battery

The EXFO EX device is powered by a rechargeable smart Li-ion battery.

WARNING

Battery replacement should only be done by a qualified technician with the appropriate tools on an electronic bench or similar environment.

CAUTION

To avoid irremediable damage to the battery, always remove the battery compartment door carefully, ensuring that the battery does not fall.

Note: *See* Battery Maintenance Recommendations *on page 77 for more information on battery replacement type and model.*

To replace the EX1 battery:

1. Turn off the EXFO EX device.
2. Unplug any power cable.
3. Using a #2 Phillips screwdriver, remove the screw that is located on the back of the EXFO EX device.

4. Remove the battery compartment door.

CAUTION

Gently pull on the battery to avoid damaging the wires.

5. Remove the battery and disconnect the wires.
6. Replace the battery and reconnect the wires.
7. Close the battery compartment door.
8. Re-screw the battery compartment door in place using the screw that was removed at step 3.

To replace the EX10 battery:

1. Turn off the EXFO EX device.
2. Unplug any power cable.
3. Place the device upside down on a flat surface.
4. Using a #2 Phillips screwdriver, remove the screws that are located at each end of the device; two screws at each end located as follows:

5. Pull out the bottom of the case to access the battery. Flip the device right-side up to help the bottom of the case to become loose.

CAUTION

Gently pull on the battery to avoid damaging the wires.

6. Remove the battery and disconnect the wires.
7. Replace the battery making sure its label is facing down, twist the wires as shown below, and reconnect the wires to the device connector.

8. Replace the bottom of the case.
9. Re-screw the bottom of the case in place using the screws that were removed at step 4.

Battery Maintenance Recommendations

WARNING

Your unit uses the following type of batteries: smart Li-ion.

These are batteries with built-in protection that have been especially designed for EXFO. For this reason, you can only replace them with EXFO-approved batteries of the same type and model.

WARNING

The use of unapproved batteries may result in the batteries expanding or igniting (that is, catching fire).

WARNING

Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the manufacturer's instructions.

WARNING

Do not throw batteries into fire or water and do not short-circuit their electrical contacts. Do not disassemble.

IMPORTANT

Recycle or dispose of used batteries properly, in accordance with local regulations. Do not dispose of them in ordinary garbage receptacles. For more information, see the section about recycling and disposal in this user documentation.

- At EXFO, we take the safety of our customers very seriously and want to make sure any battery replacement is done properly.

  The batteries of all EXFO-branded products are tested, certified, and in compliance with these international safety standards:

  - United Nations (UN) Transport Regulations UN38.3: Covers battery safety during air transport.
  - UL 61010-1, CAN/CSA C22.2 61010-1 and International Standard IEC/EN 61010-1: Covers the use of batteries for test and measurement equipment.
  - International Standard IEC 62133: Covers secondary cells and batteries containing alkaline or other non-acid electrolytes.
  - In some countries, when required, EXFO-approved batteries have been certified and are marked as per local regulation.

- To get pricing and correct part number for replacement batteries for your products, please contact (via email):
  - For Americas: Isales.us@exfo.com
  - For Europe: Isales.emea@exfo.com
  - For APAC: Isales.apac@exfo.com
  - For China: Isales.China@exfo.com
- You may also obtain replacement batteries for your products by contacting your local distributor:

  https://www.exfo.com/en/how-to-buy/find-distributor
- You may return your unit for service at your local service center:

  https://www.exfo.com/en/services/field-network-testing/exfo-service-centers/

Cleaning LC Connectors

Under normal circumstances the cleaning of the LC connector is not required. However if the connector shows signs of debris or contamination, cleaning may be required.

To clean an LC connector

1. Use a clean dry air (CDA) or a air gun to blow out the dust or contamination.
2. Re-inspect the connector.
3. If the connector is still not clean, use a commercial cleaner recommended by the transceiver manufacturer.

Note: *Refer to the transceiver manufacturer for more detailed cleaning recommendations and instructions.*

Recycling and Disposal

This symbol on the product means that you should recycle or dispose of your product (including electric and electronic accessories) properly, in accordance with local regulations. Do not dispose of it in ordinary garbage receptacles.

For complete recycling/disposal information, visit the EXFO Web site at www.exfo.com/recycle.

13 Troubleshooting

Solving Common Problems

Before calling EXFO's technical support, please read the following common problems that can occur and their respective solution.

Problem	Possible Cause	Solution
Unable to establish the connection between the smart device and an EXFO EX device.	Too much distance between the smart device and the EXFO EX device.	Reduce the distance between the two devices.
	The Smart Device hardware may not be supported by the application. Need to contact EXFO for list of supported devices.	Make sure that both devices use compatible firmware and application versions.
The EXFO EX device is not appearing in the list of **Available Devices** from the **Connection** menu.	Too much distance between the smart device and the EXFO EX device.	Reduce the distance between the two devices.
	EXFO EX device is already connected to another smart device.	Disconnect the EXFO EX device from the other smart device.
	EXFO EX device is powered off.	Turn the EXFO EX device on.
	EXFO EX device is booting.	Wait until the EXFO EX device is completely booted (refer to *On/Off Switch and LED* on page 5).
The EXFO EX device automatically turns off.	Insufficient battery power.	Recharge the battery using the supplied USB power adapter.
	The EXFO EX device automatically shuts down after 3 minutes (by default) of inactivity when the EXFO EX device is not charging using the supplied USB power adapter.	Turn the EXFO EX device on and if required, increase the inactivity time before turning the unit off. Refer to **Power Saving on page 68** for more information.
	High temperature environment.	Make sure to use the EXFO EX device within its operating temperature range. Refer to *Equipment Rating* on page 89.
Unable to combine reports.	Reports were generated with a version prior to version 1.3.	Ensure reports were created with version 1.3 or above.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

Technical Support Group
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at www.exfo.com.

If you have comments or suggestions about this user documentation, you can send them to customer.feedback.manual@exfo.com.

To accelerate the process, please have information such as the name and the serial number (see the product identification label), as well as a description of your problem, close at hand.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in its original packing material when shipping.
- Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

14 Warranty

General Information

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.

IMPORTANT

The warranty can become null and void if:

- **unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**
- **warranty sticker has been removed.**
- **case screws, other than those specified in this guide, have been removed.**
- **case has been opened, other than as explained in this guide.**
- **unit serial number has been altered, erased, or removed.**
- **unit has been misused, neglected, or damaged by accident.**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Gray Market and Gray Market Products

Gray market is a market where products are traded through distribution channels that are legal but remain unofficial, unauthorized, or unintended by the original manufacturer. Intermediaries using such channels to distribute products are considered to be part of the gray market (hereafter unauthorized intermediary).

EXFO considers that a product originates from the gray market (hereafter gray market product) in the following situations:

- A product is sold by an unauthorized intermediary.
- A product is designed and destined for a particular market and sold on a second market.
- A product is resold, despite being reported lost or stolen.

When products are purchased on the gray market, rather than through an authorized EXFO distribution channel, EXFO is unable to guarantee the source and quality of those products nor the local safety regulations and certifications (CE, UL, etc.).

EXFO will not honor warranty, install, maintain, repair, calibrate, provide technical support nor make any support contracts available for gray market products.

For complete information, refer to EXFO's policy regarding gray market products at www.exfo.com/en/how-to-buy/sales-terms-conditions/gray-market/

Liability

EXFO shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which the product is connected or the operation of any system of which the product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI) used with EXFO products are not covered by this warranty.

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.

IMPORTANT

In the case of products equipped with optical connectors, EXFO will charge a fee for replacing connectors that were damaged due to misuse or bad cleaning.

Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

Service and Repairs

EXFO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 87). Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.
3. If possible, back up your data before sending the unit for repair.
4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 87).

EXFO Service Centers Worldwide

If your product requires servicing, contact your nearest authorized service center.

EXFO Headquarters Service Center
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

EXFO Europe Service Center
Winchester House, School Lane
Chandlers Ford, Hampshire S053 4DG
ENGLAND

Tel.: +44 2380 246800
Fax: +44 2380 246801
support.europe@exfo.com

EXFO Telecom Equipment (Shenzhen) Ltd.
3rd Floor, Building C,
FuNing Hi-Tech Industrial Park, No. 71-3,
Xintian Avenue,
Fuhai, Bao'An District,
Shenzhen, China, 518103

Tel: +86 (755) 2955 3100
Fax: +86 (755) 2955 3101
support.asia@exfo.com

To view EXFO's network of partner-operated Certified Service Centers nearest you, please consult EXFO's corporate website for the complete list of service partners:
http://www.exfo.com/support/services/instrument-services/exfo-service-centers.

A Specifications

IMPORTANT

The following technical specifications can change without notice. The information presented in this section is provided as a reference only. To obtain this product's most recent technical specifications, visit the EXFO Web site at .

Equipment Rating

Specification	EX1	EX10
Temperature - Operating	0 °C to 40 °C (32 °F to 104 °F)	
Temperature - Charging battery	10 °C to 45 °C (50 °F to 113°F)	
Temperature - Storing	Without battery: -40 °C to 70 °C (-40 °F to 158 °F) With battery (less than 1 month): -10 °C to 40 °C (14 °F to 104 °F) With battery (1 to 12 months): 0 °C to 30 °C (32 °F to 86 °F)	
Relative humidity	0 % to 93 %, non-condensing	
Maximum operation altitude	2000 m (6560 ft)	
Pollution degree	3	
Measurement category	Not rated for measurement categories II, III, or IV	
Input Power	⎓ 5 V; 2 A	⎓ 15 — 20 V; 3 A
USB Adapter Power	~ 100 — 240 V; 50/60 Hz; 1 A ⎓ 5 V; 2.4 A	

B Glossary

Acronym List

?	Help

A

AC	Alternating Current

B

BLE	Bluetooth Low Energy
BSS	Basic Service Set
BSSID	Basic Service Set Identifier
BW	Bandwidth

C

CAGE	Commerce And Government Entities
CDA	Clean Dry Air
CSV	Comma Separated Value

D

D	Depth
dBm	Decibel milliwatts
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System

E

EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
ESS	Extended Service Set
EU	European Union
EUI	EXFO Universal Interfaces

F

FCC	Federal Communications Commission
FPGA	Field-Programmable Gate Array

G

Gbit/s	Gigabit per second
GHz	Giga Hertz
GI	Guard Interval
GPON	Gigabit Passive Optical Network

H

H	Height
HTTP	Hypertext Transfer Protocol
Hz	Hertz

I

ICED	Interference-Causing Equipment Standard
ID	Identification
IEC	International Electrotechnical Commission

IEEE	Institute of Electrical & Electronics Engineers
ISED	Innovation, Science and Economic Development
ISP	Internet Service Provider

L

LAN	Local Area Network
LED	Light-Emitting Diode
LLDP	Link Layer Discovery Protocol

M

MAC	Media Access Control
Mbit/s	Megabit per second
MCS	Modulation Coding Scheme
MHz	Mega Hertz
ms	milliseconds
mW	milli Watt

N

NATO	North Atlantic Treaty Organization
NSS	Number of Spatial Streams

O

ODN	Optical Distribution Network
OLT	Optical Line Terminal

P

PDF	Portable Document Format
PPPoE	Point-to-Point Protocol over Ethernet

R

RE	Reach Extender
RF	Radio Frequency
RMA	Return Merchandise Authorization
RSS	Radio Standards Specifications
RSSI	Received Radio Signal Strength Indicator

S

SFP	Small Form Factor Pluggable
SI	International System
SLA	Service Level Agreement
SSID	Service Set Identifier

T

TCP	Transmission Control Protocol

U

USA	United States of America
USB	Universal Serial Bus

V

VCI	Vendor Class ID
VLAN	Virtual Local Area Network

W

W	Width
Wi-Fi	Wireless Fidelity

X

XGS-PON	10-Gbit/s Symmetric Passive Optical Network

Ethernet Interface and Signal

Ethernet Interface	Ethernet Signal
BASE-T Electrical	10Base-T
	100Base-TX
	1000Base-T
	2.5GBase-T
	5GBase-T
	10GBase-T
100 Mbit/s Optical[a]	100Base-FX
	100Base-LX10
	100Base-BX10
1GE Optical	1000Base-SX
	1000Base-LX
	1000Base-ZX
	1000Base-BX10
10GE Optical	10GBase-SR
	10GBase-LR
	10GBase-ER

a. Future use.

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CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)
中国关于危害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS CONTAINED IN THIS EXFO PRODUCT
包含在本 EXFO 产品中的有毒有害物质或元素的名称及含量

Part Name 部件名称	Lead 铅 （Pb）	Mercury 汞 （Hg）	Cadmium 镉 （Cd）	Hexavalent Chromium 六价铬 （Cr(VI)）	Polybrominated biphenyls 多溴联苯 （PBB）	Polybrominated diphenyl ethers 多溴二苯醚 （PBDE）
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电气组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

Note:
注：
This table is prepared in accordance with the provisions of SJ/T 11364.
本表依据 SJ/T 11364 的规定编制。
O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.
O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。
X: indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572. Due to the limitations in current technologies, parts with the “X” mark cannot eliminate hazardous substances.
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 标准规定的限量要求。
标记“X”的部件，皆因全球技术发展水平限制而无法实现有害物质的替代。
a. If applicable.
如果适用。

MARKING REQUIREMENTS
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限 （年）	Logo 标志
This EXFO product 本 EXFO 产品	10	
Battery[a] 电池	5	

a. If applicable.
如果适用。

P/N: 17.0.0.1

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