ООО «4ТЕСТ»
Телефон: +7 (499) 685-4444
info@4test.ru
www.4test.ru

User Guide

LTB-1

www.EXFO.com
Telecom Test and Measurement

EXPERTISE REACHING OUT

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Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

Patents

The design patent is pending for these products.

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Contents

Certification Information vii

1 Introducing the LTB-1 1

Main Features 1
LED Indicators Description 6
Function Buttons Description 8
Power Sources 9
Automatic Fan Speed Management 9
Product Registration 10
Technical Specifications 10
Conventions 11

2 Safety Information 13

Other Safety Symbols on Your Unit 14
Laser Safety Information 15
Electrical Safety Information 15

3 Getting Started with Your Unit 19

Positioning Your Unit 19
Turning On Your Unit 20
Turning Off Your Unit 20
Configuring Your Unit At First Startup 26
Accessing and Exiting Toolbox X 28
Starting Module Applications 29
Using the On-Screen (Virtual) Keyboard 30
Working with Windows Embedded 8 Standard 31
Right-Clicking with the Touchscreen 33
Installing or Upgrading the Applications 34
Activating Software Options 37
Installing Third-Party Software on Your Unit 40
Protecting your Unit with an Antivirus Software 40
Securing your Unit Using the Kensington Lock 41
Using a Keyboard, Mouse or Other USB Devices 42
Inserting and Removing microSD Cards 44

4 Setting Up Your LTB-1 49
Adjusting Brightness 49
Adjusting Speaker and Microphone Volume 50
Customizing the Right-Click Feature 56
Enabling or Disabling the Automatic Logon 60
Selecting the Startup Applications 64
Configuring Network Printers 66
Selecting the Language of Operation 68
Setting Date and Time Formats 77
Adjusting the Date, Time and Time Zone 79
Configuring the Power Management Options 80
Setting Toolbox X Behavior 90
Configuring the Internet Options 92
Configuring Parameters via Windows Mobility Center 95
Setting Other Parameters 96

5 Working with Your Unit 97
Printing Documents 97
Viewing PDF Files 98
Taking Screen Captures 99
Browsing the Web 100
Accessing the Internet with a 3G USB Modem Key 101
Managing Favorites 103
Using the Calculator 111
Using the Text Editor 111
Accessing Other Tools 112

6 Inspecting Fibers with a Probe 113

7 Managing Data 115
Viewing Disk Space and Managing Files 116
Using the USB to RS-232 Adapter 117
Freeing Up Disk Space with the Disk Cleanup Utility 123
Connecting to a VPN from Your Unit 127

8 Accessing Your Unit Remotely 133
Working with Remote Desktop 134
Working With VNC 144
Adding Exceptions to the Firewall 151

9 Preparing for Automation 155
Preparing Hardware for GPIB Control 158
Linking Units with the GPIB Port 160
Linking Units with the Ethernet Port 160
Linking Units Using a Serial Port 160
Getting Optimum Performance from Your Unit 161
Changing Communication Settings 163
Configuring DCOM Access to Your Unit 169
Preparing to Control Modules with a Dedicated Application 192

10 Using Your Unit and Module in an Automated Test Environment 197
Standard Status Data Structure 198
SCPI Command Structure 202
Consulting Data Types 205
Writing Remote Control Code 206
Error Message Format 207
Monitoring Remote Commands 208

11 Maintenance 213
Cleaning the Touchscreen 214
Recharging the Battery 214
Replacing the Battery 217
Managing Windows Updates 222
Recycling and Disposal (Applies to European Union Only) 224

12 Troubleshooting 225
Solving Common Problems 225
Restoring Your Unit to Normal Operation 229
Accessing the Online Documentation 245
Contacting the Technical Support Group 247
Viewing System Information 248
Retrieving Network Interfaces Information 251
Transportation 253

13 Warranty 255
General Information 255
Liability 255
Exclusions 256
Certification 256
Service and Repairs 257
EXFO Service Centers Worldwide 258

A Data Types 259
Applicable Data Types for Input—IEEE 488.2 260
Applicable Data Types for Output —IEEE 488.2 269
Applicable Data Types for Input—SCPI 279
Special Numeric Values Received on Output 280

B IEEE 488.2 and Specific Command Reference 281
IEEE 488.2 Commands–Quick Reference 281
IEEE 488.2 Required Commands 282
Specific Commands—Quick Reference 302
Specific Commands 303

C SCPI-Based Errors 321

D COM Properties and Events 337
ActiveX (COM/DCOM)—Quick Reference 338
Properties 339
Events 346

E Communicating Through TCP/IP over Telnet 347
Introducing TCP/IP over Telnet 347
Features 348
Configuring Your Unit and Modules to Work With TCP/IP over Telnet 349
Executing SCPI Commands Over Telnet 355
Releasing Modules 361
Internal Commands of the TCP/IP over Telnet Protocol 362

Index 371

Certification Information

North America Regulatory Statement

This unit was certified by an agency approved in both Canada and the United States of America. It has been evaluated according to applicable North American approved standards for product safety for use in Canada and the United States.

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America and from ICES-003 compliance in Canada. 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 guide, 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.

European Community Declaration of Conformity

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.

An electronic version of the declaration of conformity for your product is available on our website at *www.exfo.com/library*.

1 Introducing the LTB-1

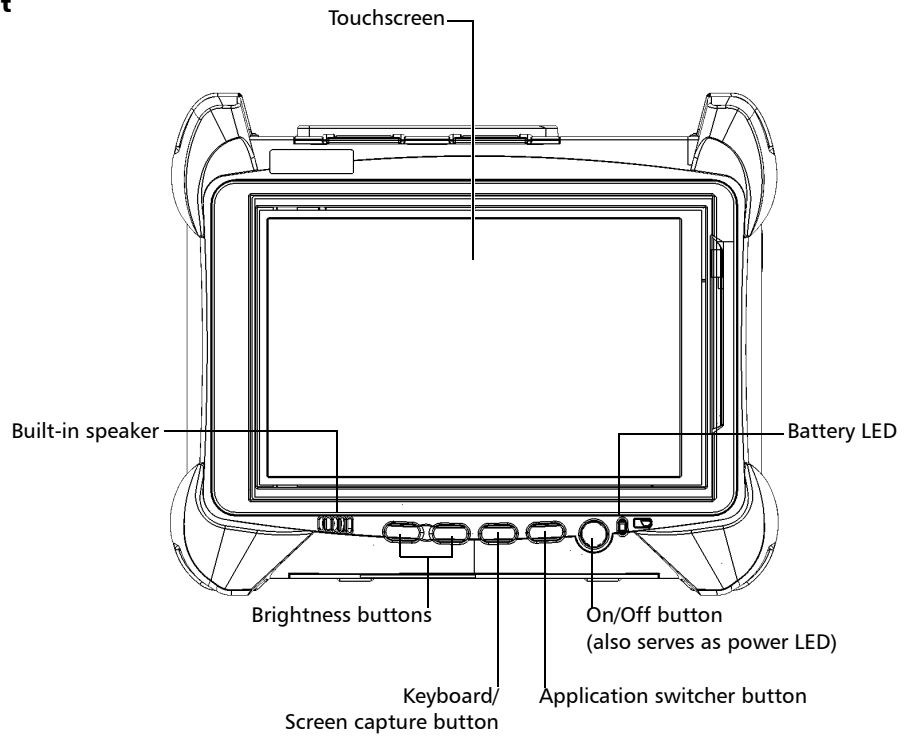
Note: *In this documentation, the words "tap" and "double-tap" (related to the use of a touchscreen) replace the words "click" and "double-click".*

Main Features

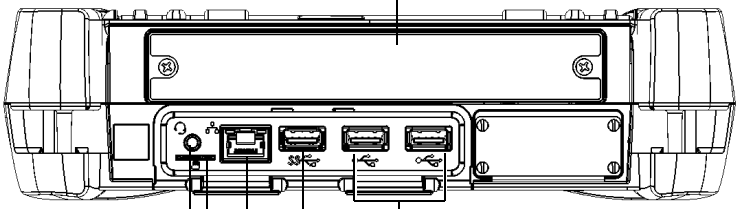
Your unit includes the following:

- 8-inch color capacitive touchscreen (LCD and touchscreen optimized for outdoor use available as an option)
- Two USB 2.0 host ports and one USB 3.0 host port
- Ethernet port (10/100/1000 Base-T)
- Headset/microphone port (for headsets equipped with a microphone)
- MicroSD card slot for extended storage space
- Windows Embedded 8 Standard operating system
- Multitasking possibilities
- Remote access to your unit (via VNC or Remote Desktop)
- Direct Web access from your unit
- Possibility to take screen captures
- PDF file viewer available from your unit
- Easy transfer of files and folders to an external storage device
- Easy software updates

Front


Touchscreen
Built-in speaker
Battery LED
Brightness buttons
On/Off button
(also serves as power LED)
Keyboard/
Screen capture button
Application switcher button

Top



Headset/microphone port
(for any commercially available stereo headset equipped with a microphone, and having a 3.5 mm connector)

MicroSD card slot
(for any commercially available microSD card compatible with the Secure Digital eXtended Capacity (SDXC) format)

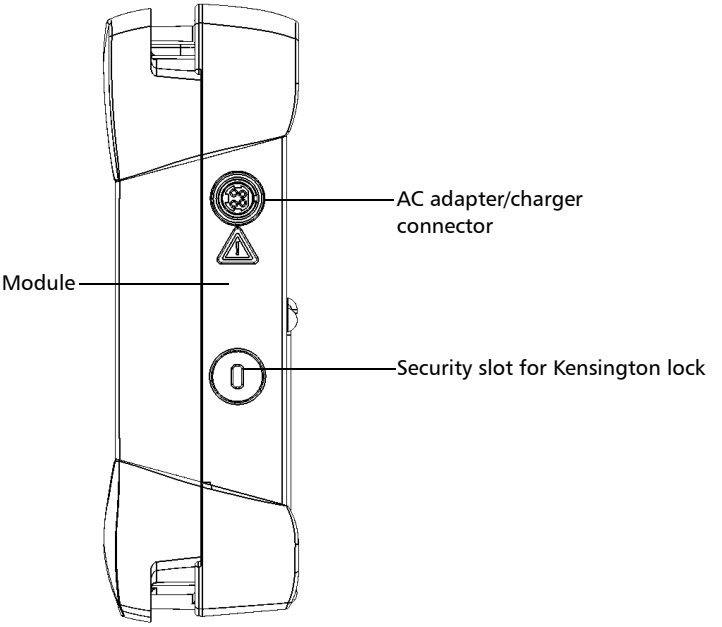
USB 2.0 host ports

Ethernet (RJ-45) port

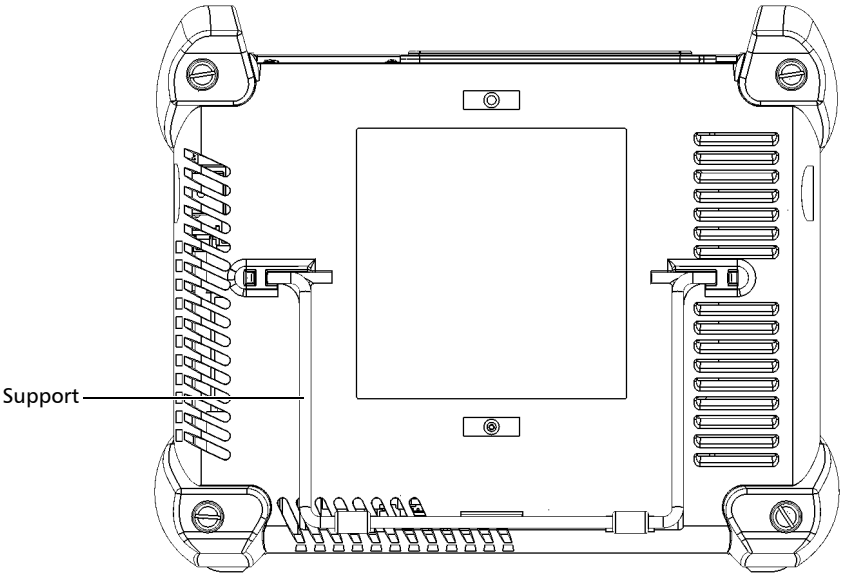
USB 3.0 host port

Note: *For a description of your module's ports, refer to its user documentation.*

Right panel


AC adapter/charger connector
Module
Security slot for Kensington lock

Back



LED Indicators Description

There are two LED indicators located on the front panel of your unit, providing you with information about the power and battery statuses.

LED	Status	Meaning
	Green	Unit is on.
	Green, blinking	Unit is in Sleep mode.
	Off	Unit is off or in Hibernation mode.
	Red	There is a major hardware problem with the unit. Contact EXFO.
(when unit is connected to an external power source)	Green	All batteries are fully charged.
	Green, blinking	The battery is charging.
	Yellow, blinking	The unit would be using more power than what is available from the battery. Do not disconnect AC power while it is in use. A blinking yellow LED takes precedence over a blinking green one, so when AC power is connected, even if the LED is blinking yellow, the battery is probably charging (depending on conditions).
	Red	Battery error. Contact EXFO.
	Red, blinking	The detected temperature is too high. This could lead to a thermal shutdown of the unit if no action is taken to reduce the temperature.
	Off	No battery present in the unit.

LED	Status	Meaning
(when unit is not connected to an external power source)	Off	The global level of the batteries is above the “low-battery threshold”.
	Yellow	The global level of batteries is low.
	Yellow, blinking	The unit would be using more power than what is available from the battery. Connect AC power as soon as possible.
	Red, blinking	The detected temperature is too high. This could lead to a thermal shutdown of the unit if no action is taken to reduce the temperature.

Function Buttons Description

Your unit is equipped with function buttons that give you access to features at all times.

The table below shows an overview of their purpose.

Button	Meaning
	Adjust the display brightness level. Press the desired button as many times as needed. For more information, see *Adjusting Brightness* on page 49.
	➤ Displays the on-screen keyboard. Press once to show the keyboard. Press once again to hide it. ➤ Takes a screen capture. Hold down for a few seconds. For more information, see *Taking Screen Captures* on page 99.
	Enables you to switch from one task to another. It is the equivalent of pressing the ALT + TAB key combination on a hardware keyboard. ➤ Press once to view the list of running applications. ➤ Press as many times as needed to select the desired application.
	Turns your unit on and off. Press to turn the unit on. For more information on the various ways to turn off your unit, see .

Power Sources

Your unit operates with the following power sources:

- AC adapter/charger (connected to standard power outlet—indoor use only). Compatible car outlet adapter available upon request.

  When it is connected to an external power source with the AC adapter/charger, the unit will function even if the battery is not present.

- One lithium-ion rechargeable battery (automatically takes over if you disconnect the unit from its external power source).

  - Possible to switch from an external power source to battery power or vice versa without affecting operation.

  - The battery recharges automatically when the unit is connected to an external power source (with the AC adapter/charger or car outlet adapter).

Note: *When the ambient temperature is below 0 °C (32 °F) or when it reaches or exceeds about 40 °C, the batteries can either charge more slowly than usual, or not charge at all, depending on the internal temperature of your unit.*

For more information, see *Electrical Safety Information* on page 15.

Automatic Fan Speed Management

Your unit will determine the most appropriate fan speed, depending on the power requirements.

If the temperature keeps rising and reaches the limit: your unit will turn off as self-protection.

Product Registration

You can now register your new EXFO products either online or directly from your unit (if it is connected to the Internet), and benefit from every possible opportunity to optimize their performance. By doing so, you will always be notified of the latest software updates, key product enhancements and up-to-date support information related to your products.

To register your product directly from your unit:

1. Ensure that your unit can access the Internet.
2. From Toolbox X, tap **Utilities**, and then **Product Registration**.
3. Follow the on-screen instructions.

To register your product online:

1. Open a Web browser and go to www.exfo.com.
2. Log in to your EXFO account.
3. Tap **Support**.
4. Under **Tools**, tap **Manage My Products**.
5. Tap **Register**.
6. Follow the on-screen instructions.

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.

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

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.

Other Safety Symbols on Your Unit

One or more of the following symbols may also appear on your unit.

Symbol	Meaning
	Direct current
	Alternating current
	The unit is equipped with an earth (ground) terminal.
	The unit is equipped with a protective conductor terminal.
	The unit is equipped with a frame or chassis terminal.
	On (Power)
	Off (Power)
 OR 	On/Off (Power)
	Fuse

Laser Safety Information

Your unit does not include laser components in itself. For this reason, the laser class of your unit depends on the instruments that you use. Refer to the user guide or the online help of the instruments for the exact information.

Electrical Safety Information

If you need to ensure that the unit is completely turned off, disconnect the power cable and remove the battery. For more information on how to remove the battery, see the section about replacing the battery in this user documentation.

WARNING

- **Never connect the unit to the AC mains (with the adapter/charger) when it is used outdoors.**
- **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.**
- **Unless otherwise specified, all interfaces are intended for connection to Safety Extra Low Voltage (SELV) circuits only.**
- **Capacitors inside the unit may be charged even if the unit has been disconnected from its electrical supply.**

WARNING

- **Use only the listed and certified AC adapter/charger 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.**
- **Use only accessories (such as the car outlet adapter, batteries, and fiber inspection probe) designed for your unit and approved by EXFO. The car outlet adapter contains a replaceable fuse. Replace the damaged fuse ONLY with a fuse of the same type: 3AB fast-acting fuse, certified, 250 V, 15 A, with a nominal I^2t of 292 A^2sec. For a complete list of accessories available for your unit, refer to its technical specifications.**
- **When you use the unit outdoors, ensure that it is protected from liquids, dust, direct sunlight, precipitation, and full wind pressure.**

Equipment Ratings	
Temperature ➤ Operation	➤ unit powered by batteries: 0 °C to 50 °C (32 °F to 122 °F)[a,b] ➤ unit connected to AC adapter: 0 °C to 40 °C (32 °F to 104 °F)
➤ Storage	➤ unit without batteries: –40 °C to 70 °C (–40 °F to 158 °F) ➤ unit with batteries: –20 °C to 60 °C (–4 °F to 140 °F)
Relative humidity[c]	➤ unit: ≤ 95 % non-condensing ➤ AC adapter: 10 % to 80 % non-condensing
Maximum operation altitude	➤ 2000 m (6562 ft) (unit connected to external power supply) ➤ 5000 m (16405 ft) (unit operated from battery)
Pollution degree	➤ 2 (unit connected to external power supply) ➤ 3 (unit operated from battery)[d]
Overvoltage category	➤ unit: I ➤ AC adapter: II
Measurement category	Not rated for measurement categories II, III, or IV
Input power[e]	➤ unit: ⎓ 24 V; 3.75 A ➤ AC adapter: ∼ 100 - 240 V; 50/60 Hz; 2 A

a. When the unit is used at an altitude of 5000 m, the maximum operating temperature is 32 °C (89.6 °F)
b. Operating time is dependent upon power consumption and temperature. If the unit is used at maximum power and maximum temperature, it will power off automatically any time after 10 minutes for safety reasons.
c. Measured in 0 °C to 31 °C (32 °F to 87.8 °F) range, decreasing linearly to 50 % at 40 °C (104 °F).
d. Equipment must be normally protected against exposure to direct sunlight, precipitation and full wind pressure.
e. Not exceeding ± 10 % of the nominal voltage.

CAUTION

The use of voltages higher than those indicated on the label affixed to your unit may damage the unit.

CAUTION

The operation and storage temperatures, as well as the altitude and relative humidity values of some modules may differ from those specified for your unit. In this case, always ensure that you comply with the most restrictive conditions (either module or unit).

3 Getting Started with Your Unit

Positioning Your Unit

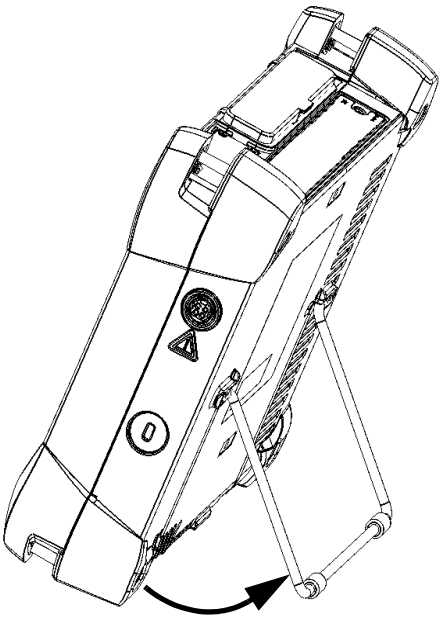
You can position your unit either vertically (with the screen facing you), or at an angle, using the support on the back panel.

You can also hold your unit with the provided hand strap.

Note: *The stand ensures optimum stability to the unit during your tests.*

To position the unit using the support:

Pull out the support.



Turning On Your Unit

When you turn on the unit for the very first time, a wizard for license agreements and safety instructions is displayed (see the corresponding section for more information).

Once you have accepted all the license agreements and confirmed the reading of safety instructions, the main window is displayed.

To turn on the unit:

Press the On/Off button.

Turning Off Your Unit

There are several ways to turn off the unit, including the following:

- *Sleep*: keeps the unit's status information in memory (RAM). The next time you turn your unit on, you will quickly return to your work environment (running applications will still be running). This mode will take more battery power while the unit is off.
- *Hibernation*: saves the unit's status information that was in memory (RAM) to a special file on the disk. The next time you turn your unit on, this file will be used to ensure that you return to your work environment (running applications will still be running). The unit will take longer to start up than in *Sleep* mode, but it requires less battery power when the unit is off.
- *Shutdown*: the unit will perform a complete restart routine the next time you use it. You should perform a shutdown if you do not intend to use your unit for a week or more.

  After a shutdown, the unit will start in Toolbox X or in the application you defined as the startup application.

Note: *Should the unit ever stop responding, you can force a hardware reset by pressing and holding down the power button for more than 10 seconds.*

By default, your unit will shut down when you press the power button. However, you can configure your unit to perform a different action when the power button is pressed.

You can also configure your unit to automatically restart when AC power comes back after the unit has turned off (power outage, emergency shutdown, sleep, or hibernation modes) when battery level is too low.

To exit the sleep mode (or hibernation mode) and resume your work:

Press the On/Off button.

To turn off the unit completely from the unit itself:

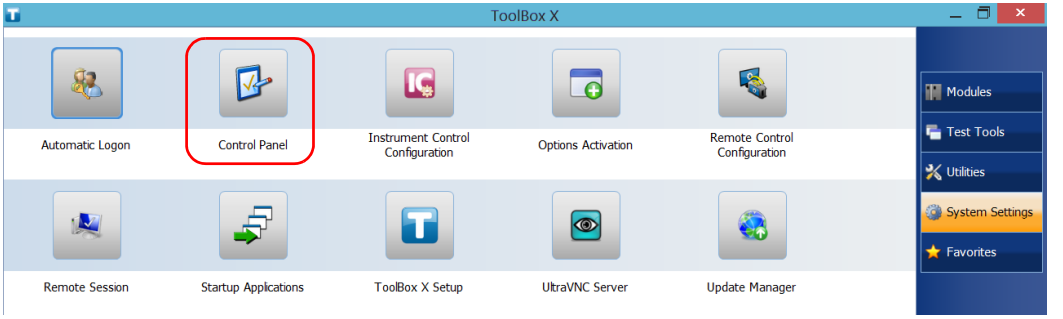
Press the On/Off button.

To turn off the unit completely from Windows:

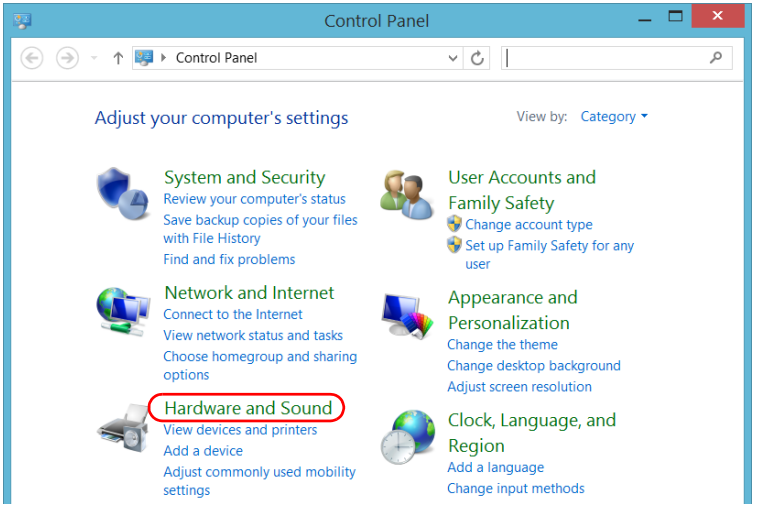
1. From the right side of the screen, swipe left to display the Charm bar. For more information, see the section about working with Windows Embedded 8 Standard.
2. Tap **Settings** > **Power** > **Shut down**.

To define the behavior of the power button:

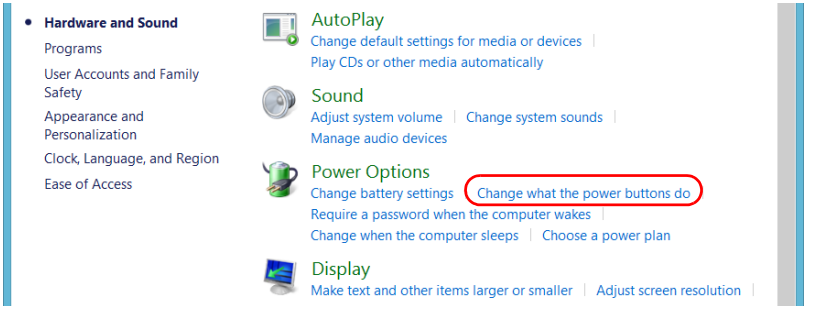
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



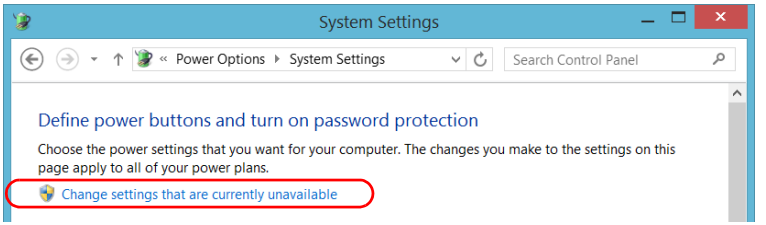
3. Tap **Hardware and Sound**.



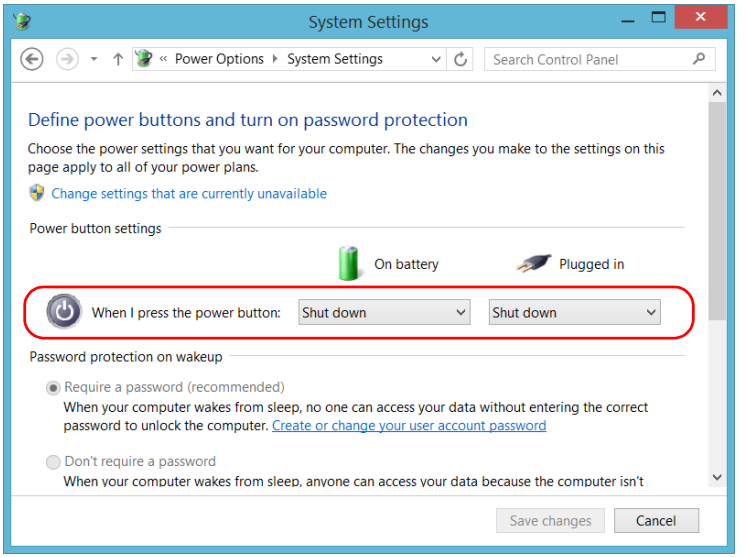
4. Under **Power Options**, tap **Change what the power buttons do**.



5. Tap **Changes settings that are currently unavailable**.



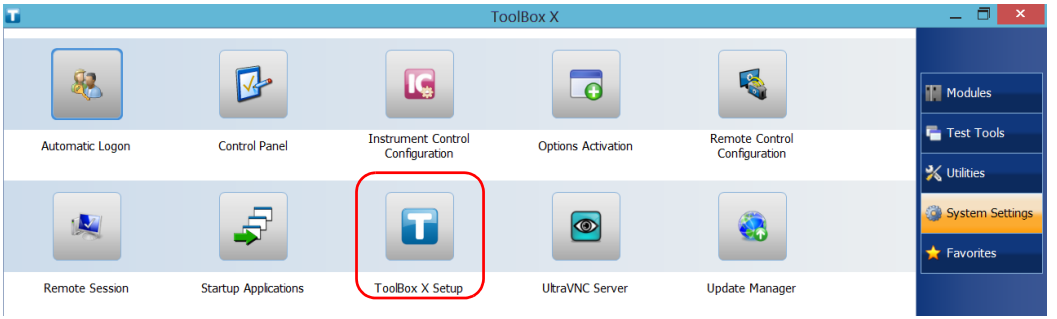
6. From the **When I press the power button** lists, select the desired behavior when the unit is powered by batteries, or by AC current (**Shut down** option is selected by default in both cases).



7. Tap **Save changes** to confirm the changes and return to the **Power Options** window.

To configure your unit to automatically restart after AC power comes back:

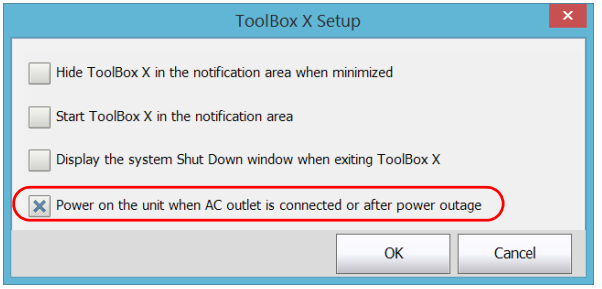
1. From the main window, tap the **System Settings** button.
2. Tap **ToolBox X Setup**.



3. Select the **Power on the unit when AC outlet is connected or after power outage** box to enable the corresponding option.

   OR

   Clear the box if you prefer that your unit does not restart automatically after AC power comes back.



4. Tap **OK** to confirm the changes and return to the **System Settings** window.

Configuring Your Unit At First Startup

The first time you turn on the unit, a Windows configuration wizard is displayed, enabling you to set all the regional and language settings such as the country and operation language.

IMPORTANT

The operation language that you select at the first startup (labelled "App language") becomes the default system language, that is the language that will be available at logon.

During the configuration process, you will also be asked to read and accept the Microsoft end-user license agreement (EULA).

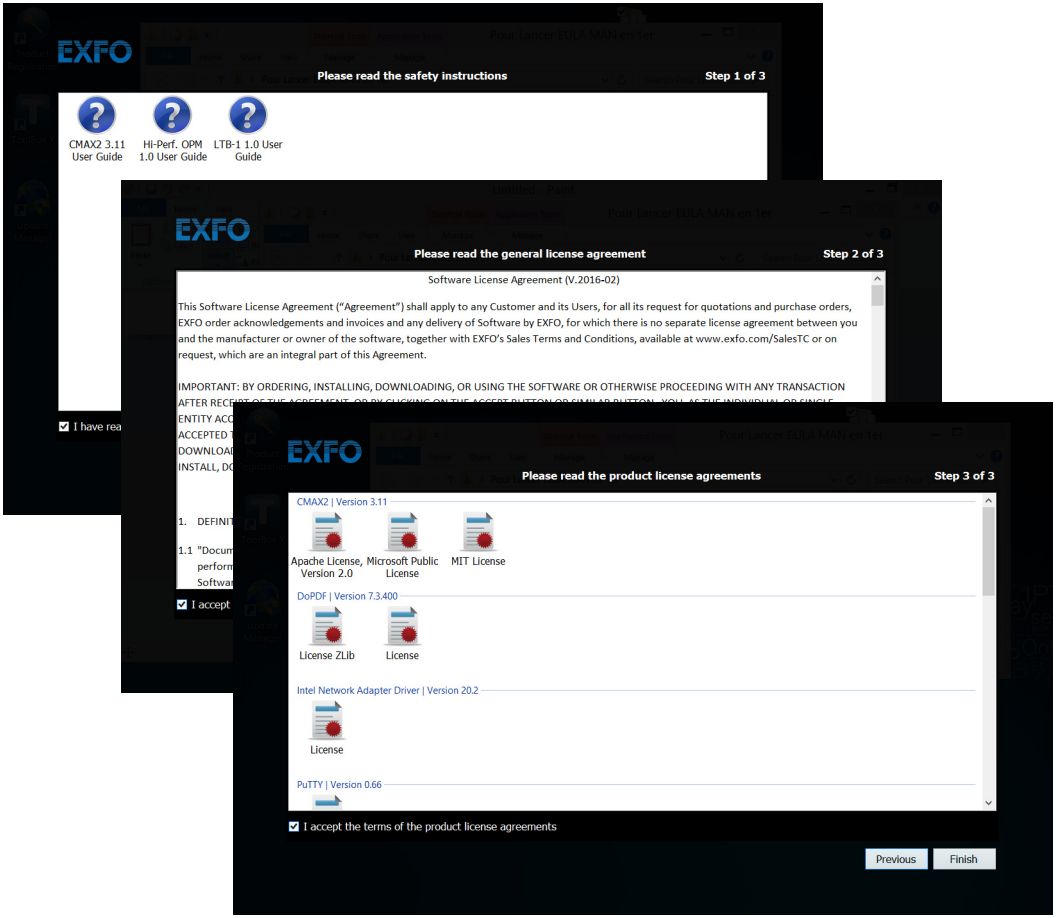
Once the configuration is complete in Windows, an EXFO wizard will be displayed, allowing you to read the user documentation for important safety information, and to read and accept the EULA related to your unit and instruments.

Note: *To be able to work with the unit, you must accept all the EULA (from Microsoft and EXFO), and confirm that you have read the security information.*

To configure your unit at first startup:

1. If it is not already done, turn on the unit (see *Turning On Your Unit* on page 20).
2. When the Windows wizard is displayed, set the parameters according to your needs.
3. Read and accept the Microsoft EULA.
   The configuration of Windows parameters may take several minutes.

4. When the EXFO wizard is displayed, follow the on-screen instructions.



5. Tap **Finish** to close the wizard and start working.

Accessing and Exiting Toolbox X

By default, Toolbox X is displayed automatically when you turn on the unit.

However, you can configure your unit to send Toolbox X to the notification area (see *Setting Toolbox X Behavior* on page 90). This could be useful, for example, if you prefer to start working in Windows. You can also configure your unit to start any of the available applications as soon as Toolbox X is started (see *Selecting the Startup Applications* on page 64).

To access Toolbox X from the Windows environment:

Double-tap the

icon on your desktop.

Note: *If Toolbox X has been sent to the notification area, from this location, right-click the* *icon, and then select* ***Restore ToolBox X****.*

To exit Toolbox X:

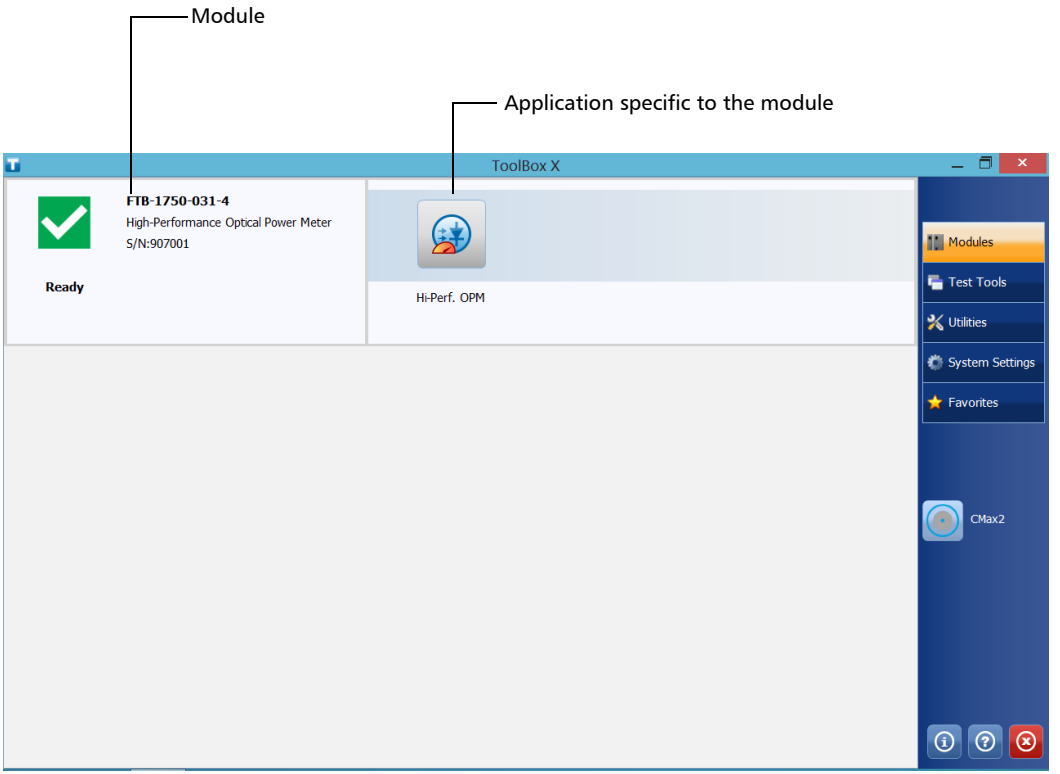
Tap .

Starting Module Applications

Your module can be configured and controlled from its dedicated application in Toolbox X.

To start a module application:

1. If necessary, tap the **Modules** button to display the module window.



2. On the row corresponding to your module, tap the icon of the application with which you want to work.

Using the On-Screen (Virtual) Keyboard

Whenever you need to enter alphanumeric data, you can use the on-screen keyboard. This keyboard supports multilingual features, and functions according to the keyboard settings set in Windows.

To use the on-screen keyboard:

1. Select the location where you want to enter text.
2. From the unit's front panel, press the / button.

   OR

   From the taskbar, tap the on-screen keyboard icon (located to the left of the clock).

3. Enter the data as required.
4. Close the keyboard when you are done entering data.

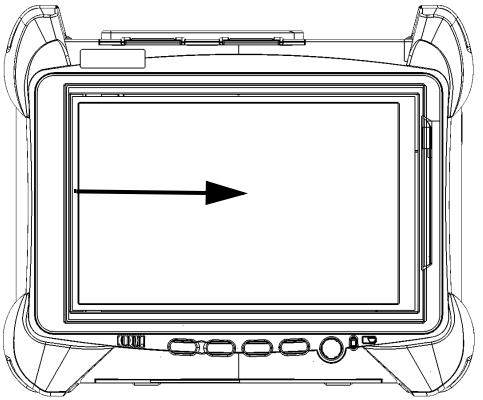
Working with Windows Embedded 8 Standard

If you are not familiar with Windows Embedded 8 Standard, you may want to visit Microsoft Web site for tutorials as well as detailed information on the features and concepts brought by this operating system.

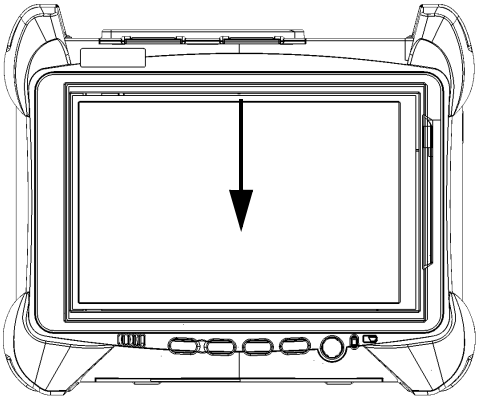
One of the new features is the use of touchscreen gestures to perform certain tasks. In this documentation, all the necessary gestures are explained throughout the procedures.

Here is an overview of the gestures that you may use the most with your unit.

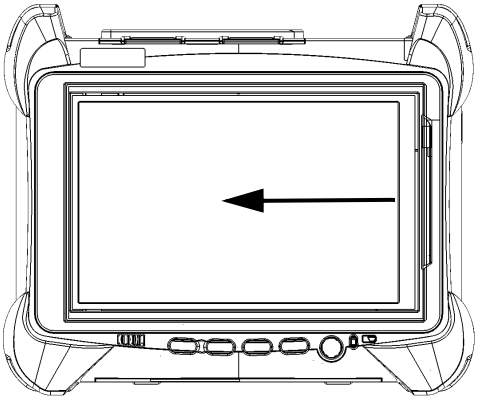
- Tap and double-tap: Equivalent of a click and double-click with a mouse.
- Swipe right: To return to the last used application.
  From the left edge of the screen, swipe towards the right.



➤ Swipe down: To close windows that do not have a close button.
From the top edge of the screen, swipe towards the bottom.



➤ Swipe left: To display the Charm bar, which is a special toolbar that gives you access to many tools and settings.
From the right edge of the screen, swipe towards the left.



Right-Clicking with the Touchscreen

If you are used to work with a mouse, you may find it useful to be able to perform a right-click on your touchscreen.

This feature is enabled by default, but you can disable it if you prefer. You can also modify the right-click behavior. For more information, see *Customizing the Right-Click Feature* on page 56.

To right-click with the touchscreen:

From the location where you want to right-click, using the provided stylus or any capacitive (conductive) stylus, press the screen for a few seconds until the shortcut menu appears.

If you want to hide the shortcut menu without performing any action, simply tap anywhere outside the menu.

Installing or Upgrading the Applications

All the necessary applications have been preinstalled and configured at the factory. However, you may have to upgrade some applications when new versions become available or to reinstall them.

Note: *Only administrator-level users can install software under Windows.*

When updates are available for an application, you will need to download them from EXFO Apps, either directly on your unit or on a computer. The update files must be copied to the location that has been specified for the deployment packages in Update Manager.

For the installation or upgrade, you will need:

- your unit
- a computer equipped with a USB port; Windows must be installed on the computer
- a USB memory key

Note: *The computer and USB key are only necessary if you do not wish to download the files directly on your unit.*

Note: *For more information on the installation, refer to the Update Manager online help.*

To update or reinstall Update Manager:

1. If necessary, retrieve the desired installation files from EXFO Apps at http://www.exfo.com/software/exfo-apps.

   If you do not intend to download files directly on your unit, connect a USB memory key to one of the USB ports of the computer and copy the installation files to this USB key.

2. If it is not already done, turn on your unit.

3. Exit Toolbox X and the modules' applications.

4. If you want to install Update Manager using the USB key, disconnect it from the computer and connect it to one of the USB ports of your unit.

5. On your unit, create a folder on the Windows desktop.

6. Copy the installation files (from the USB key) to the newly created folder.

7. From the newly created folder, double-tap the Update Manager setup file to start the installation.

8. Follow the on-screen instructions.

9. When the installation is complete, simply disconnect the USB memory key.

To install or upgrade the applications:

1. If necessary, retrieve the desired installation files from EXFO Apps at http://www.exfo.com/software/exfo-apps.

   If you do not intend to download files directly on your unit, connect a USB memory key to one of the USB ports of the computer and copy the installation files to this USB key.

2. If it is not already done, turn on your unit.

3. Exit Toolbox X and the modules' applications.

4. If you want to install or update applications using the USB key, disconnect it from the computer and connect it to one of the USB ports of your unit.

5. Copy the installation files (from the USB key) to the folder containing the update and installation packages on your unit. By default, Update Manager will search for files at the root of the USB key. For more information, refer to the Update Manager online help.

6. On your unit, from Windows desktop, double-tap the **Update Manager** icon to start the corresponding application. For more information on how to install or upgrade applications, refer to the Update Manager online help.

7. When the installation is complete, simply disconnect the USB memory key.

Activating Software Options

The software options purchased at the same time as your unit have been activated for you already. However, if you purchase options afterwards, you will have to activate them yourself.

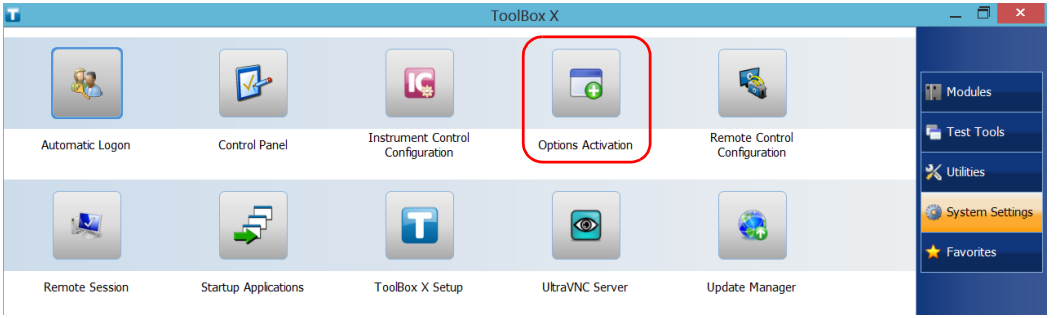
Before being able to activate options, you need to contact EXFO with the following information:

- Purchase order number of the newly purchased options
- Module or platform serial number (depending on whether the software options were purchased for the module or the unit itself)
- Customer's name
- Customer’s company name
- Customer’s phone number
- Customer’s e-mail address
- Module or unit on which the option will be installed

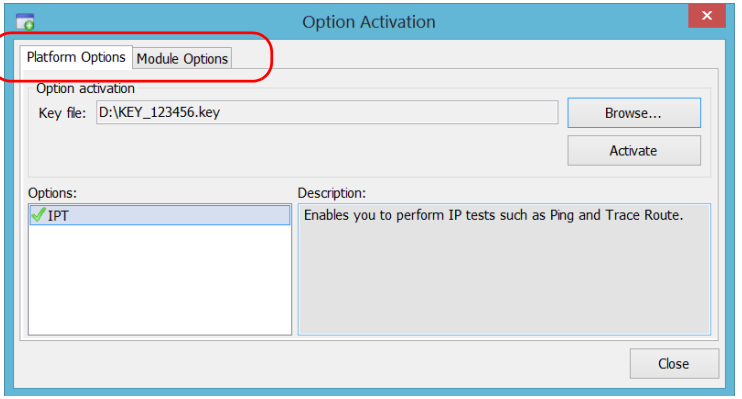
You will receive a single key (.key) file with which you will be able to unlock all the new options that you have purchased.

To activate software options for your unit or module:

1. Connect a USB memory key to one of the USB ports of your computer.
2. Copy the key file to the USB memory key.
3. Disconnect the USB key from the computer and connect it to your unit.
4. From the main window, tap the **System Settings** button, and then tap **Options Activation**.



5. Tap the **Platform Options** tab or the **Module Options** tab, depending on the type of options that you want to activate.



6. Use the **Browse** button to locate the key file that you want to use.
7. Tap **Activate**.

   The option indicator will turn into a green check mark to confirm that the option is now active.

Note: *You can see the supported options in the **Options** list.*

8. Tap **OK** to close the confirmation message, and then **Close** to exit.

Note: *At this point, if you have used a USB key to copy your key file, you can remove it as it is not required to use your new options.*

Installing Third-Party Software on Your Unit

To comply with the terms of the Microsoft license for your unit, you should only install antivirus software and the applications provided by EXFO.

IMPORTANT

EXFO does not provide any support for the installation, use or troubleshooting of third-party software. Should you need help, refer to the corresponding third-party software documentation or technical support.

Protecting your Unit with an Antivirus Software

By default, your unit is protected with the Windows Defender antivirus software. However, you can apply your own security standards and antivirus strategy.

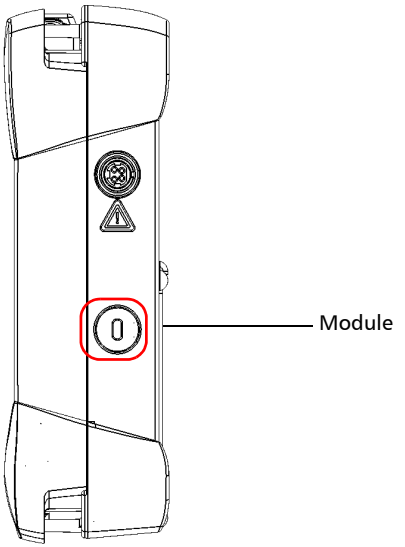
Securing your Unit Using the Kensington Lock

You can connect an optional Kensington lock (security cable) to your unit to prevent theft.

To secure your unit:

Connect your lock to the security slot located on the side panel of your unit.

Right panel



Using a Keyboard, Mouse or Other USB Devices

Your unit supports many USB devices. The table below gives an overview of the supported USB devices.

Device	Details
Memory key	For data transfer between your unit and a computer when you do not have access to a network. If you need information on how to transfer data using a memory key, see *Managing Data* on page 115.
Keyboard	When you are required to enter alphanumeric data, an on-screen (virtual) keyboard is displayed. However, if you prefer, you can use a hardware keyboard. ***Note:*** *Even if a keyboard is connected, the on-screen keyboard will still be displayed when you work in Toolbox X.*
Mouse	If your prefer to use a mouse instead of the touchscreen, you can connect one.
Composite device	You can use composite devices, that is devices that input information to your unit using more than one mean (for example, combinations of keyboard and mouse).
Hub	This device will be particularly useful to you if you need extra USB ports.
Printer	To print documents such as reports directly from you unit. If you prefer to use a network printer, you can also configure one. For more information, see *Configuring Network Printers* on page 66.

Device	Details
3G USB modem key	To access the Internet without having to connect to an Ethernet network. For more information, see *Accessing the Internet with a 3G USB Modem Key* on page 101.
USB to RS-232 adapter (purchased from EXFO)	To be able to transfer data between your unit and a device only equipped with RS-232 (serial) ports. For more information, see *Using the USB to RS-232 Adapter* on page 117.

You can connect several devices at the same time.

To use a USB device with your unit:

Connect the USB device to any of the USB ports located on the top of the unit (see *Main Features* on page 1).

Note: *It is not necessary to turn off the unit before connecting the USB device. The software will automatically detect its presence.*

Your device is automatically recognized and immediately usable (provided that it uses the drivers already available on your unit).

Inserting and Removing microSD Cards

Your unit is equipped with a slot for microSD cards for extra storage capacity. You can use any commercially available microSD card compatible with the Secure Digital eXtended Capacity (SDXC) format.

CAUTION

- **Inserting a microSD card upside down could damage both your unit and the card. Always ensure that the card is properly positioned before trying to insert it into the slot.**
- **To prevent damage to your microSD card, avoid touching its gold area.**

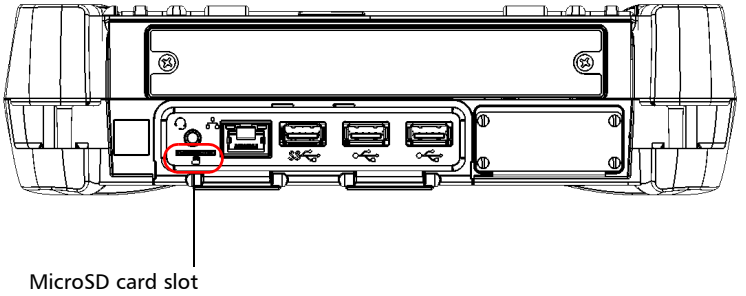
IMPORTANT

Always insert or remove the microSD card while the unit is completely off (shutdown).

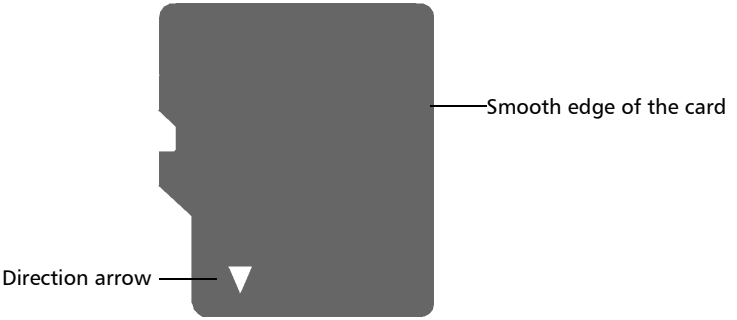
Otherwise, the microSD card may not be detected properly.

To insert a microSD card into your unit:

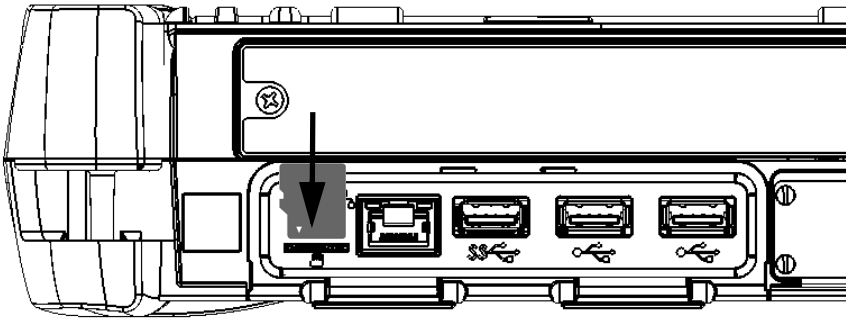
1. Locate the microSD card slot on the top panel of your unit.



2. Position the card vertically so that its smooth edge is on the right and you do not see its gold area. If an arrow is printed on your card, it should point toward the bottom.



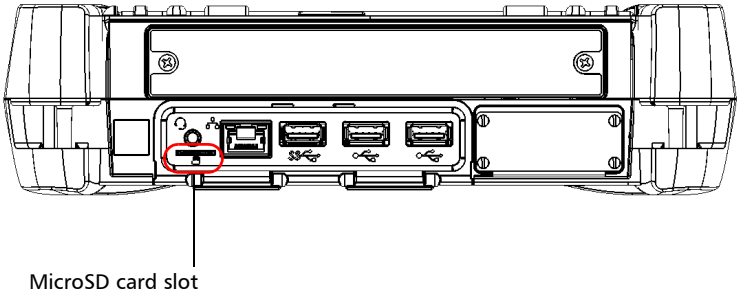
3. Slide the card into the unit's microSD card slot, and push it all the way to the bottom of the card slot.



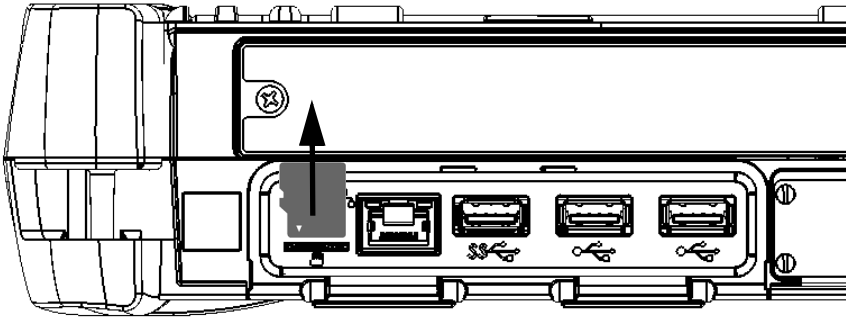
The microSD card is now ready to be used.

To remove a microSD card from your unit:

1. Locate the microSD card slot on the top panel of your unit.



2. Pull the card out of the unit's microSD card slot.



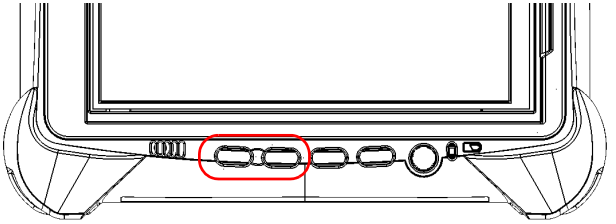
4 Setting Up Your LTB-1

Adjusting Brightness

You may want to adjust the display brightness yourself to better fit your work environment or preferences. Values are kept in memory even when you turn the unit off.

To adjust the display brightness:

From the unit's front panel, press the ☼ ▼ (decrease) or ☼ ▲ (increase) button until the brightness level suits you.



The new brightness value is taken into account immediately.

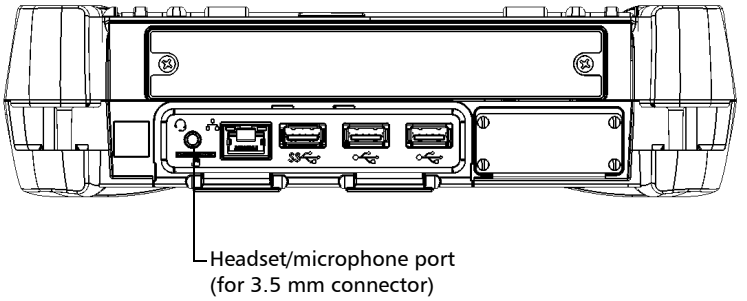
Adjusting Speaker and Microphone Volume

Your unit is equipped with a built-in speaker, but you can also connect a headset to your unit.

To fit your work environment, you may adjust the volume of the speaker, the headphones, or the microphone. Values are kept in memory even when you turn the unit off.

To adjust the speaker (or headphones) volume:

1. If necessary, ensure that the headset is connected to the audio port located on the top panel of the unit.

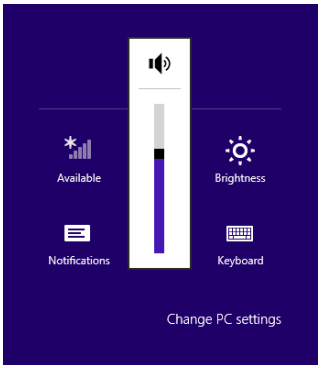


2. From the right side of the screen, swipe left to display the Charm bar.

3. Tap **Settings**, and then the

icon.

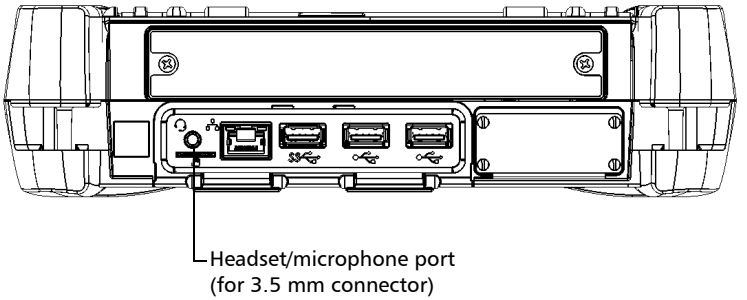
4. Move the slider until the sound level is to your liking.



Note: *You can also access the sound level slider by tapping the* *icon from the taskbar.*

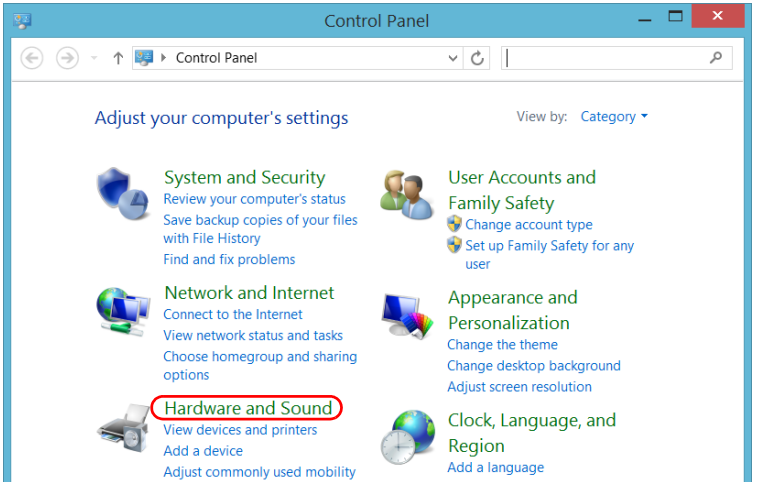
To adjust the microphone volume:

1. Ensure that your headset is connected to the audio port located on the top panel of the unit.

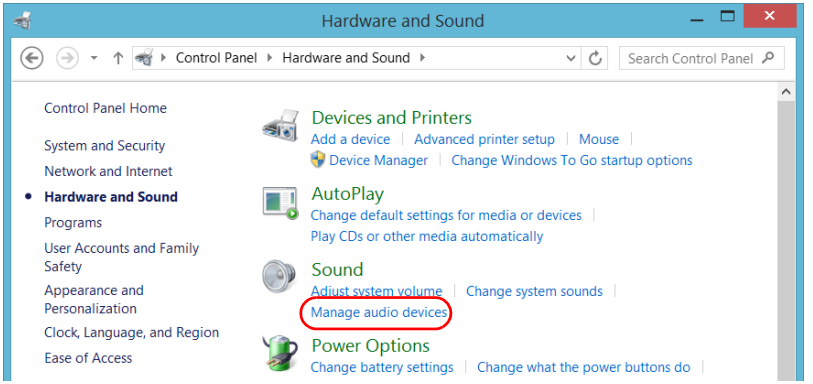


2. From the main window, tap the **System Settings** button.
3. Tap **Control Panel**.

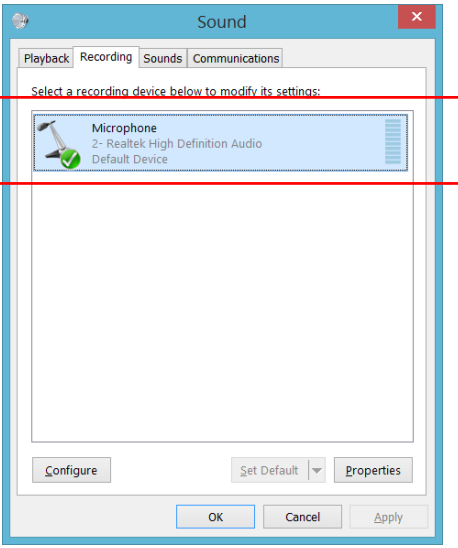
4. Tap **Hardware and Sound**.



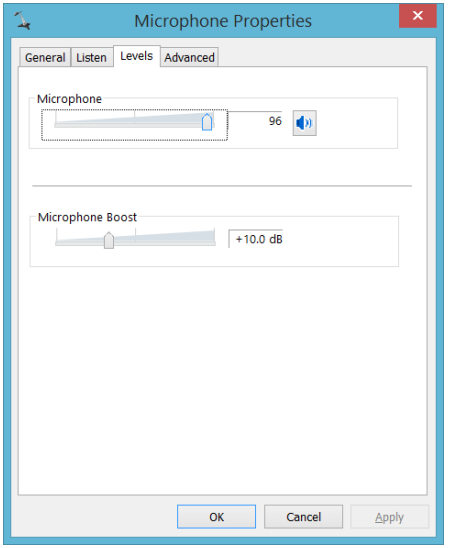
5. Under **Sound**, tap **Manage audio devices**.



6. Select the **Recording** tab.
7. Ensure that your microphone is selected, and then tap **Properties**.



8. From the **Levels** tab, move the sliders until the settings are to your liking. If the sound coming from your microphone is too low, you may want to adjust the boost level as well.



9. Tap **OK** to confirm your new settings and close the window.

10. Tap **OK** to close the window and return to Control Panel.

The new value is taken into account immediately.

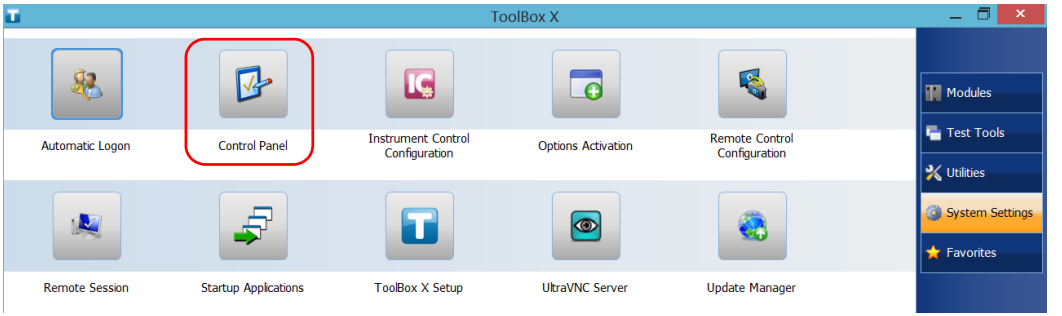
Customizing the Right-Click Feature

By default, you can perform a “press and hold” action which corresponds to right-clicking with your touchscreen (see *Right-Clicking with the Touchscreen* on page 33). However, you can disable this feature if you prefer.

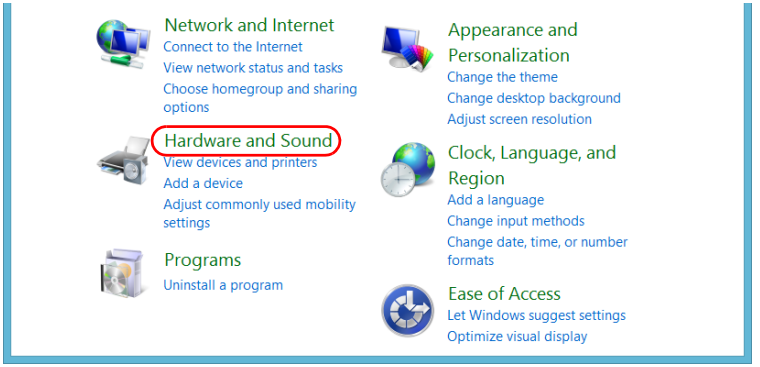
You can also modify the delay before the unit considers that you are right-clicking, as well as the amount of time before displaying the shortcut menu once you have right-clicked.

To customize the right-click feature:

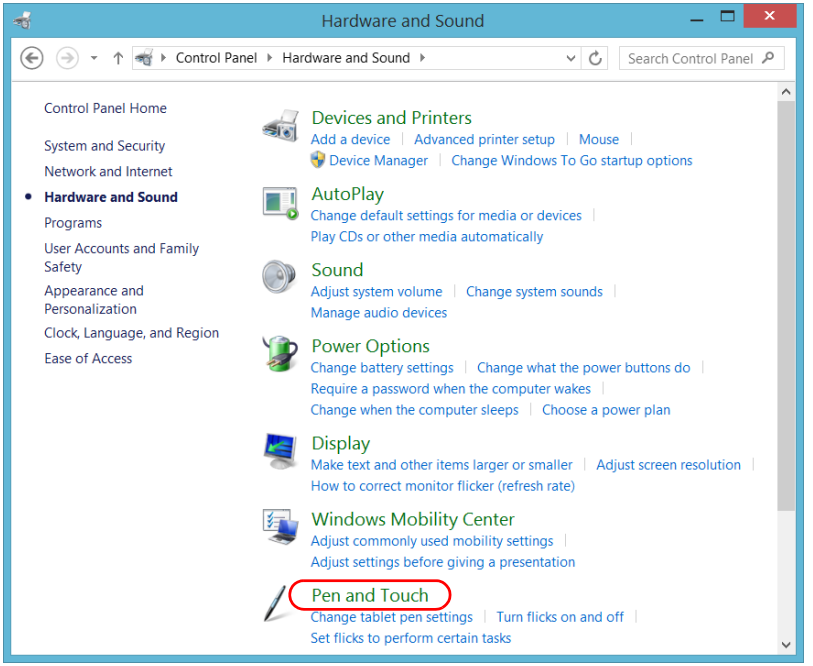
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



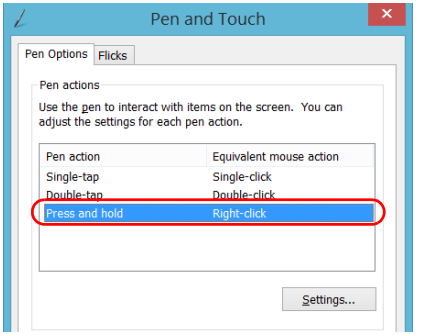
3. Tap **Hardware and Sound**.



4. Tap **Pen and Touch**.

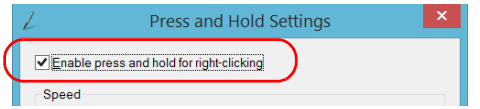


5. From the list, select **Press and hold**.

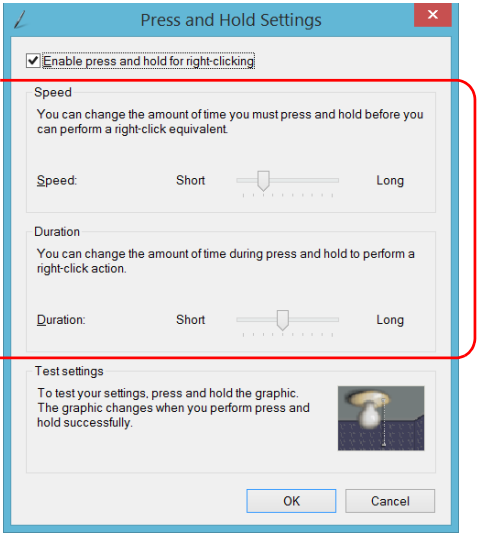


6. Tap **Settings**.

7. If you want to use the right-click feature with your unit, select the **Enable press and hold for right-clicking** check box. Clear the check box if you prefer not to use this feature.



8. If you want to modify the response time of the right-click, move the **Speed** or **Duration** sliders to adjust the configuration to your needs.



9. Tap **OK** to confirm your changes.

Enabling or Disabling the Automatic Logon

Note: *Only administrator-level users can enable or disable the automatic logon feature.*

You can configure your unit to automatically log on to Windows at startup (no need to select a user and enter a password). You can also disable this feature if you prefer to define separate user accounts with different user access rights and passwords.

Note: *For security reasons, when the unit comes back from sleep mode, the application will prompt you to select a user and enter a password, even if you have enabled the automatic logon feature.*

Also for security reasons, by default, the automatic logon is not enabled. Once it is enabled, if you want to modify the password of the user account for which the automatic logon is enabled, you will have to disable the feature first, and then enable it again once the new password is defined.

If you want to modify the account used for the automatic logon, you will also have to disable the feature first, and then enable it again for the new account.

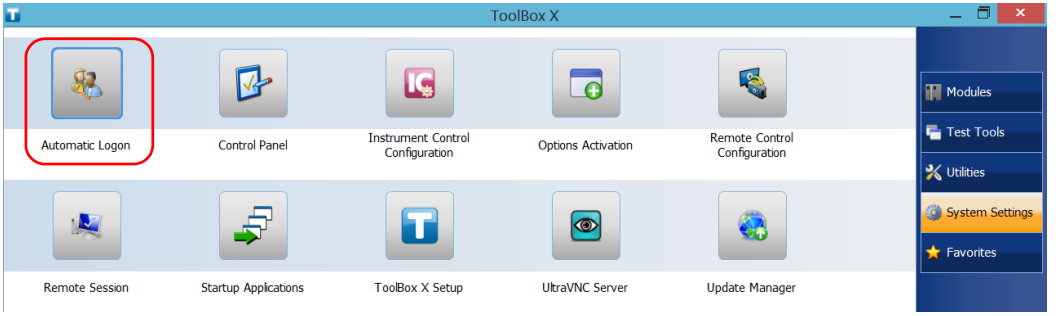
IMPORTANT

The user name and password that you specify for the automatic logon must correspond to those of an existing user account.

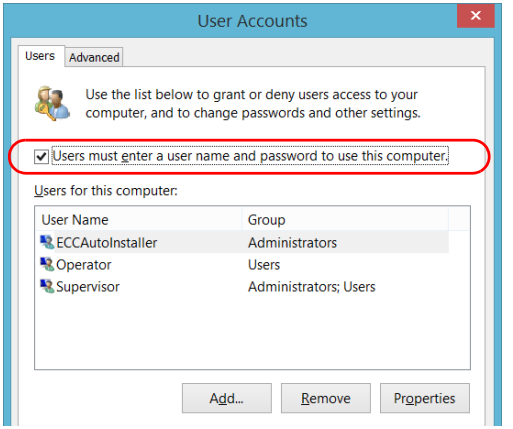
You can create user accounts or modify passwords from the Accounts window (Charm bar > Settings > Change PC settings > Users).

To enable the automatic logon:

1. From the main window, tap the **System Settings** button.
2. Tap **Automatic Logon**.

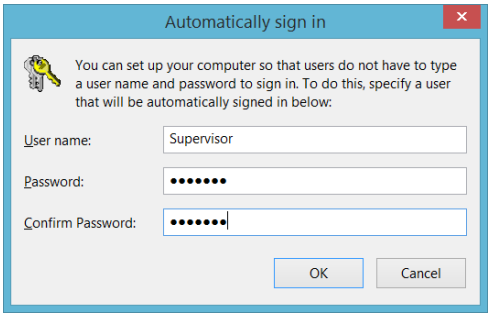


3. From the User Accounts window, clear the **Users must enter a user name and password to use this computer** check box.



4. Tap **OK** to confirm.

5. Enter the desired user name (account) and the corresponding password.

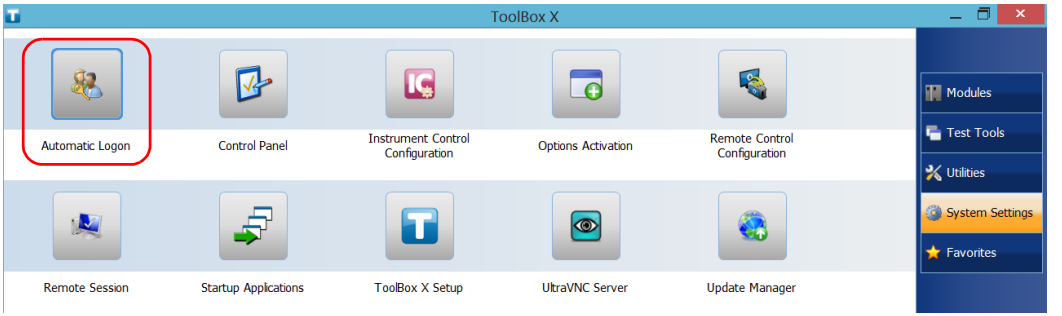


6. Tap **OK** to confirm and to return the **System Settings** window.

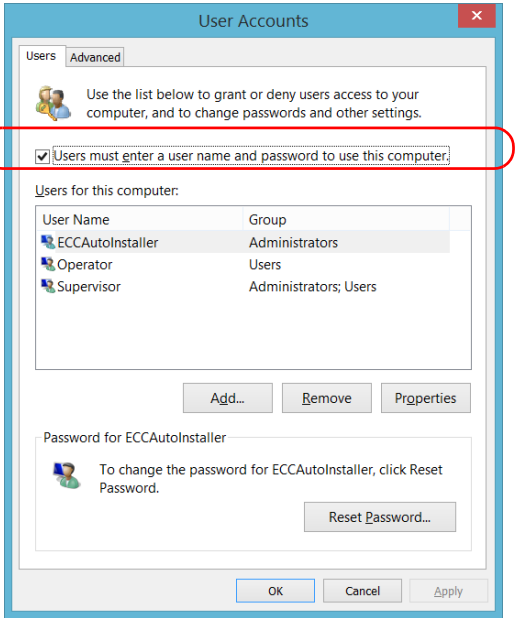
   At next startup, you will no longer need to specify a user name and password (except if the unit comes back from sleep mode).

To disable the automatic logon:

1. From the main window, tap the **System Settings** button.
2. Tap **Automatic Logon**.



3. From the User Accounts window, select the **Users must enter a user name and password to use this computer** check box.



4. Tap **OK** to confirm and to return the **System Settings** window.

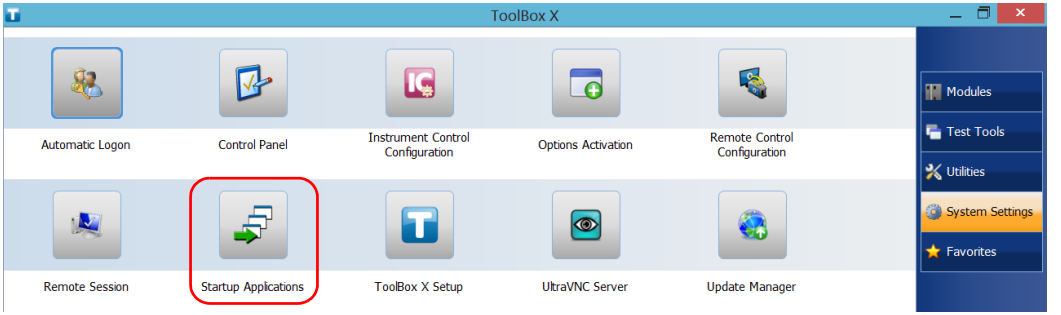
At next startup, you will have to specify the user name and password.

Selecting the Startup Applications

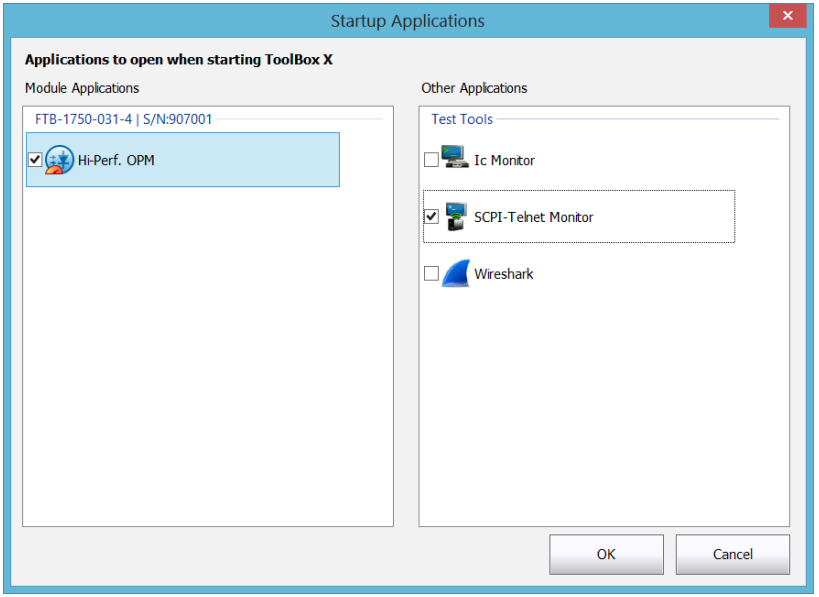
The first time you start your unit, Toolbox X is displayed. You can configure your unit to automatically start any of the available applications as soon as Toolbox X is started. This can save you time, as you do not need to ensure that they are already running before starting your tests.

To set applications to start automatically at Toolbox X startup:

1. From the main window, tap the **System Settings** button.
2. Tap **Startup Applications**.



3. Under **Module Applications** or **Other Applications**, select the applications you want to start automatically by selecting the corresponding check boxes.



4. Tap **OK** to use the new settings. Tap **Cancel** to exit without using the new settings.

Note: *The new settings will be taken into account the next time Toolbox X is started.*

Configuring Network Printers

Your unit supports both (local) USB and network printers (you may have to install specific drivers on your unit).

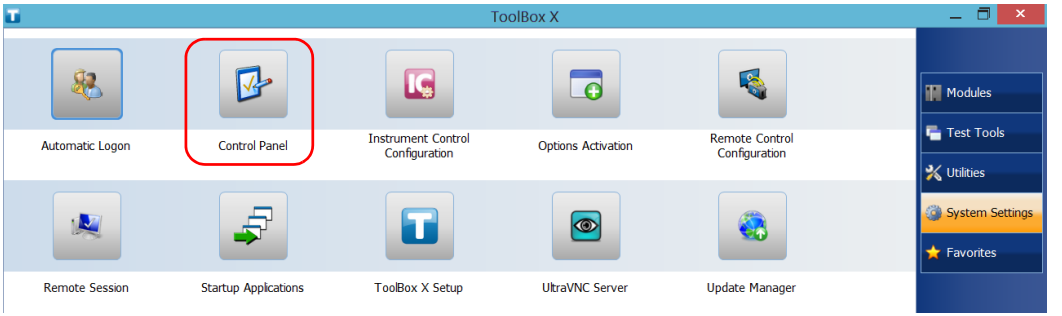
For more information on USB printers connection, see *Using a Keyboard, Mouse or Other USB Devices* on page 42.

To print documents and images on a network printer, you must configure the printer first. You must know the IP address of the network printer that you want to configure, and ensure that your unit is connected to the same network as the printer. Contact your network administrator for more information on your specific network configuration.

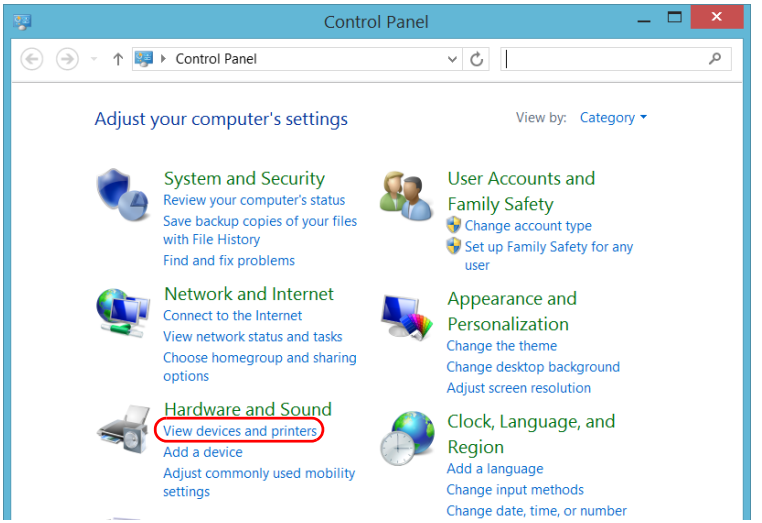
For more information on printing, see *Printing Documents* on page 97.

To configure the printer:

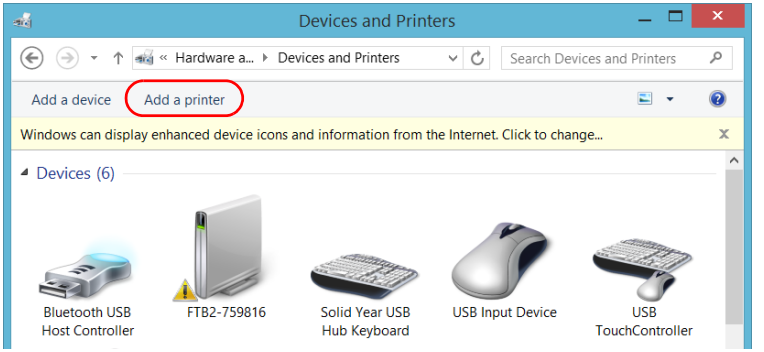
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



3. Under **Hardware and Sound,** tap **View devices and printers**.



4. Tap **Add a printer**.



5. Follow the on-screen instructions.

Selecting the Language of Operation

You may display the user interface in one of the available languages.

The availability of the languages is function of the language group that was installed on your unit at time of purchase. It is possible to download language packs from the Microsoft Website to add extra languages if necessary.

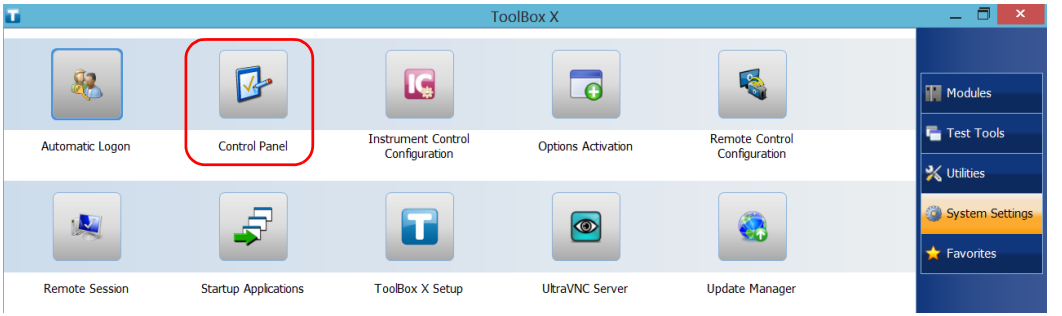
The Toolbox X application is offered in several languages. This means that if Toolbox X supports the language currently selected in Windows, it will automatically be displayed in this language. If the selected language is not supported, the English version will be used.

When you change the interface language, the corresponding keyboard is automatically added to the list of available keyboards. You can then enter text in a specific language (both on-screen or "real" keyboards). Once the keyboards are added, you can switch easily from one input language to another.

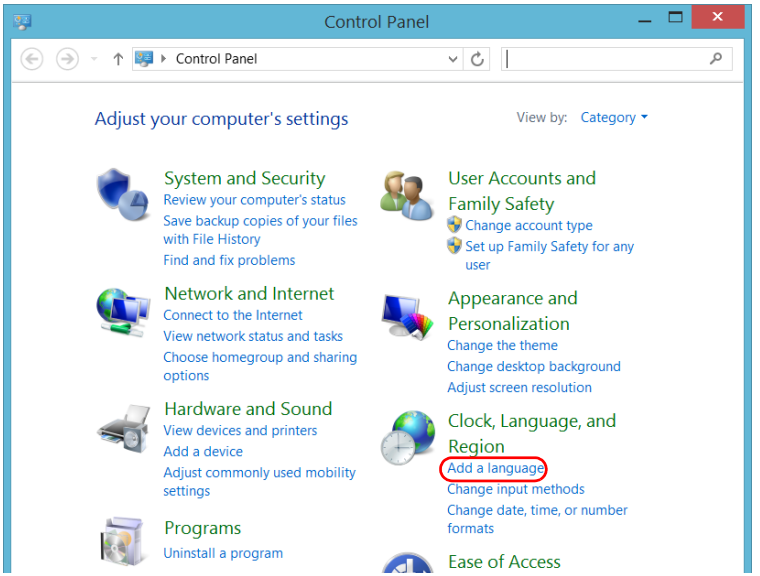
Values are kept in memory even when you turn the unit off.

To select a new interface language:

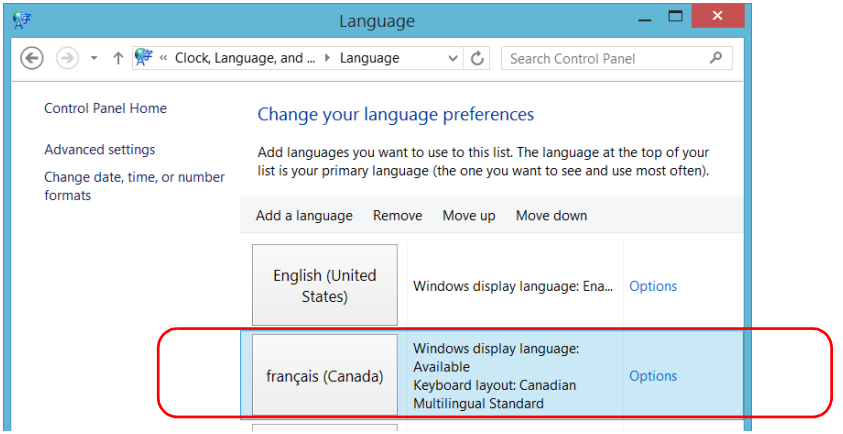
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



3. Under **Clock, Language, and Region**, tap **Add a language**.



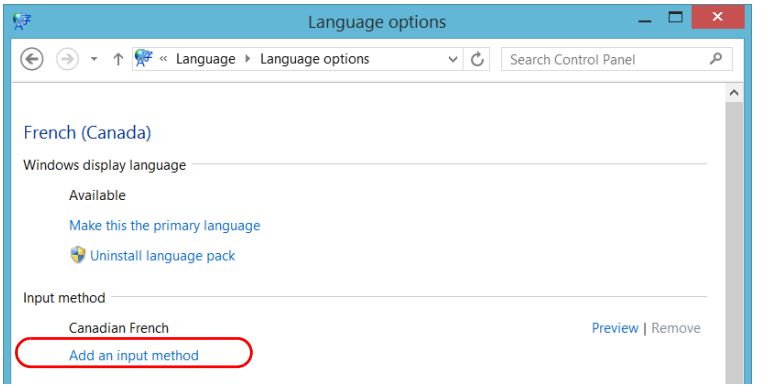
4. Select the desired language from the list.



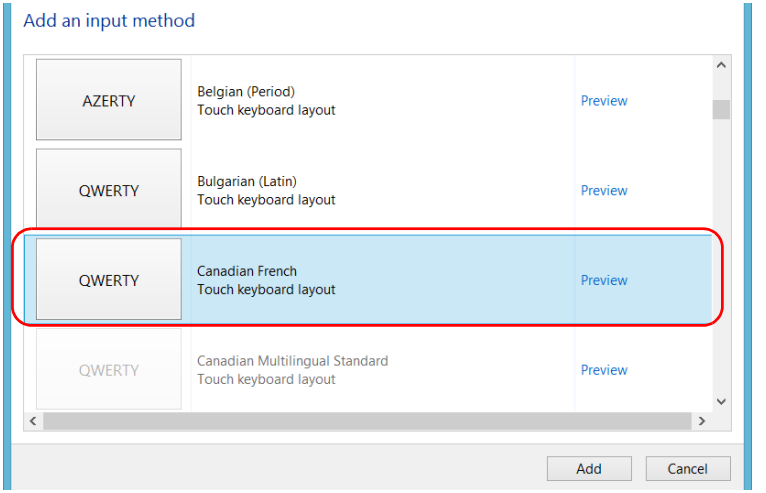
5. Tap **Options**.

6. If you want to select another keyboard layout than the one that has been added by default, proceed as follows.

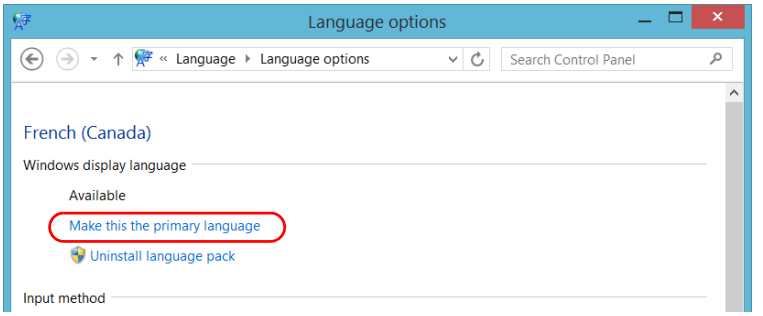
6a. Under **Input method**, tap **Add an input method**.



6b. Select the desired keyboard layout, and then tap **Add**.



7. Under **Windows display language**, tap **Make this the primary language**.



8. When the application prompts you to log off, tap **Log off now**.
9. Once you see the lock screen, swipe it down to reveal the user accounts.
10. Log to your user account.

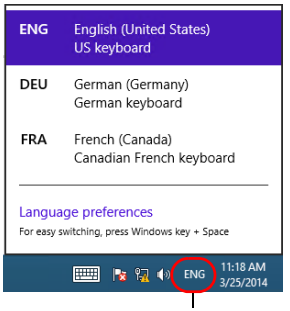
The new language is now selected and you are able to switch from one input language to another.

IMPORTANT

When you select a language that you have installed manually, the Windows interfaces do not switch to the selected language. They remain in the language configured at time of purchase. However, the EXFO applications are displayed in the selected language (when available).

To switch from one of the available input languages to another:

1. From the taskbar, tap the language code to display the list of available input languages.



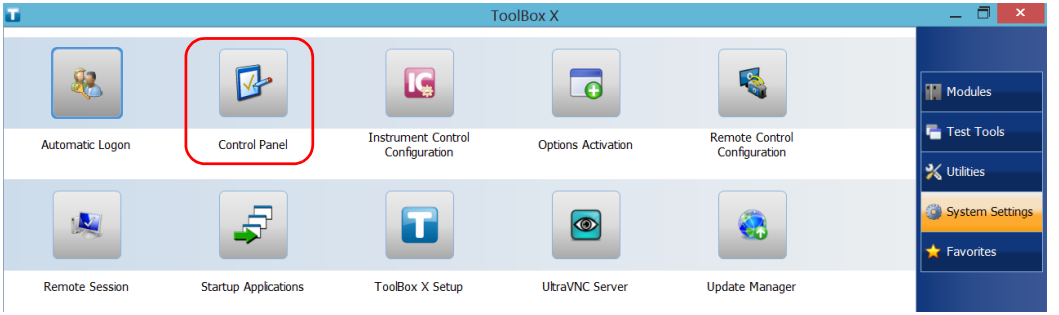
2. From the list of languages, select the desired one.

You are now ready to start entering text in the selected input language.

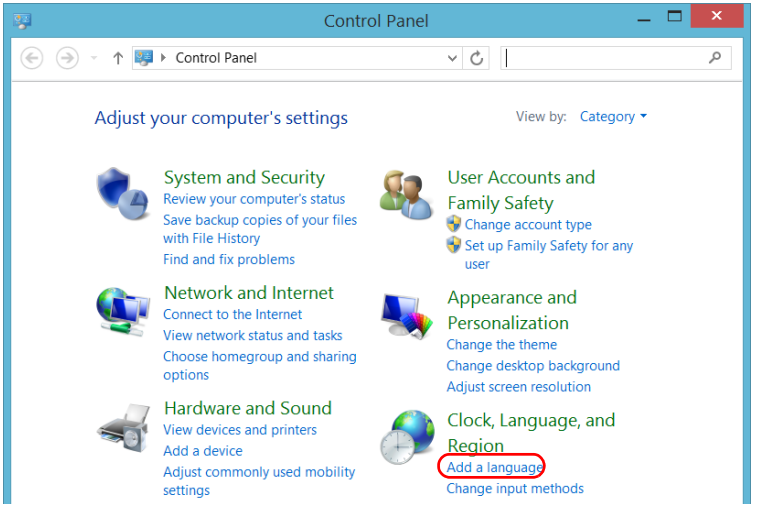
Note: *Modifying the input language does not modify the language of the interface.*

To download language packs:

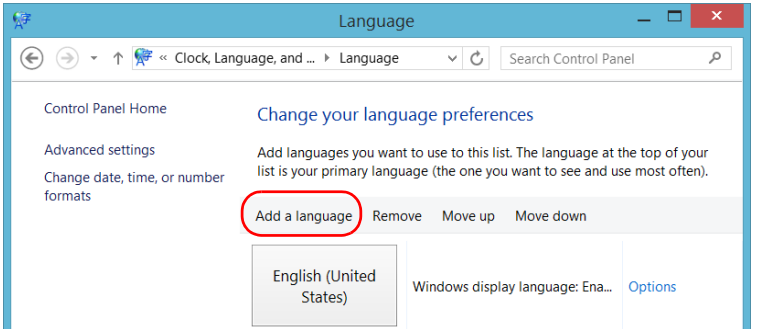
1. Ensure that your unit has access to the Internet.
2. From the main window, tap the **System Settings** button.
3. Tap **Control Panel**.



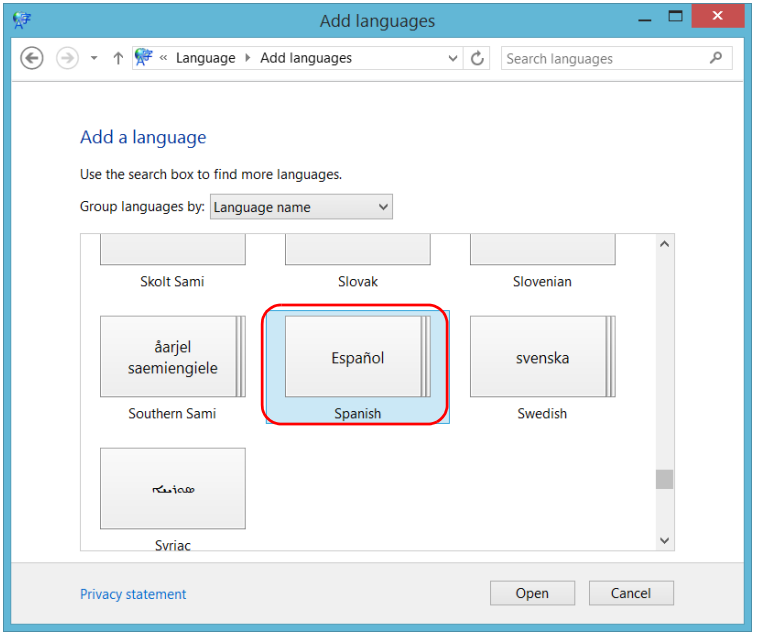
4. Under **Clock, Language, and Region**, tap **Add a language**.



5. Tap **Add a language**.

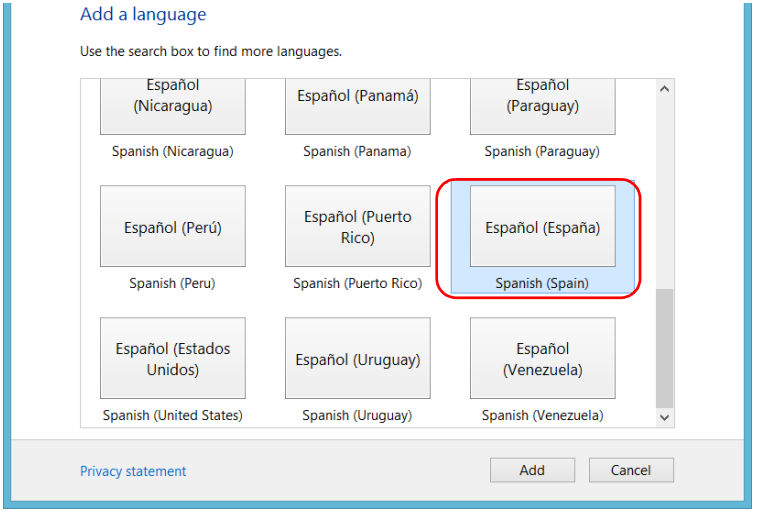


6. Browse the list of languages, and then select the one that you want to use.

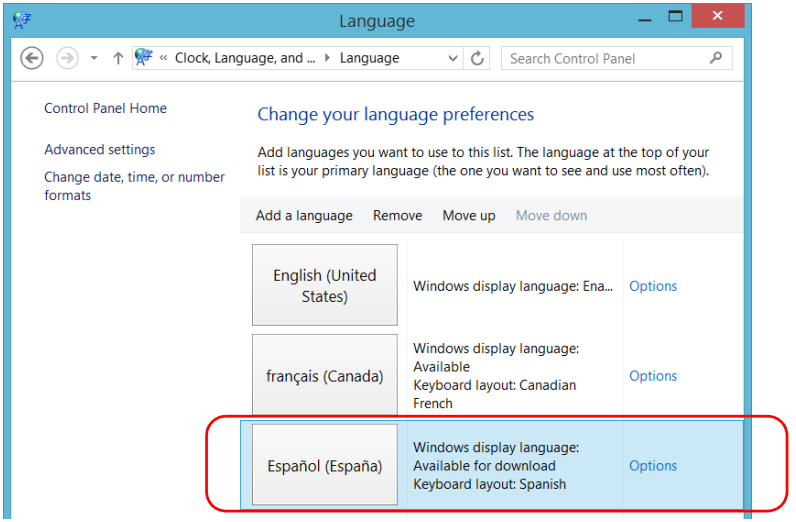


7. Tap **Open** to access the list of sub-languages.

8. Select the desired sub-language, and then tap **Add**.

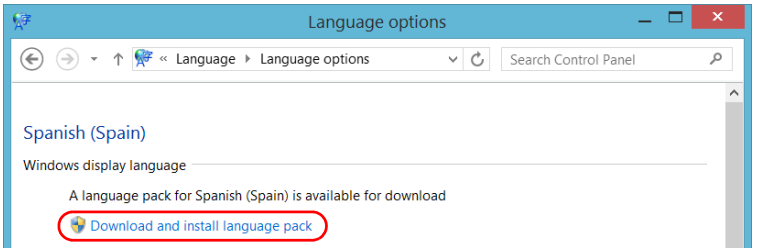


9. Select the desired language from the list.



10. Tap **Options**.

11. Tap **Download and install language pack**.



12. When the application prompts you to allow the installation, tap **Yes**. The installation may take a few minutes.

13. When the installation is complete, restart your unit.

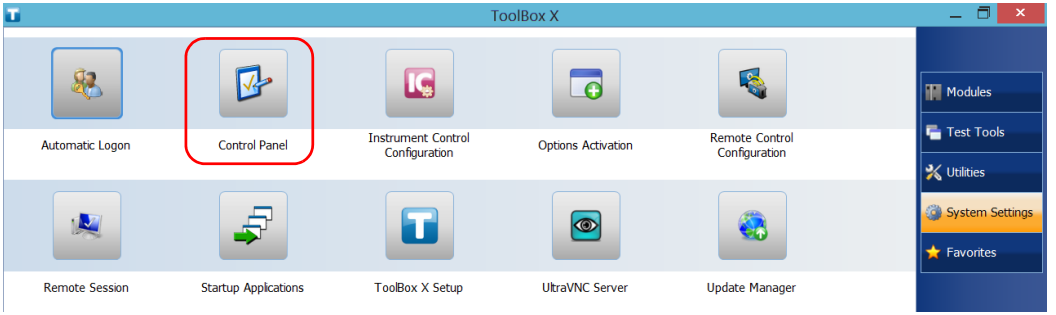
Setting Date and Time Formats

By default, the dates (short and long) and time are displayed in the formats associated with the global language format (locale). The time can be expressed with a 12- or a 24-hour notation. You can modify the way dates and time are displayed if the default values do not suit your needs.

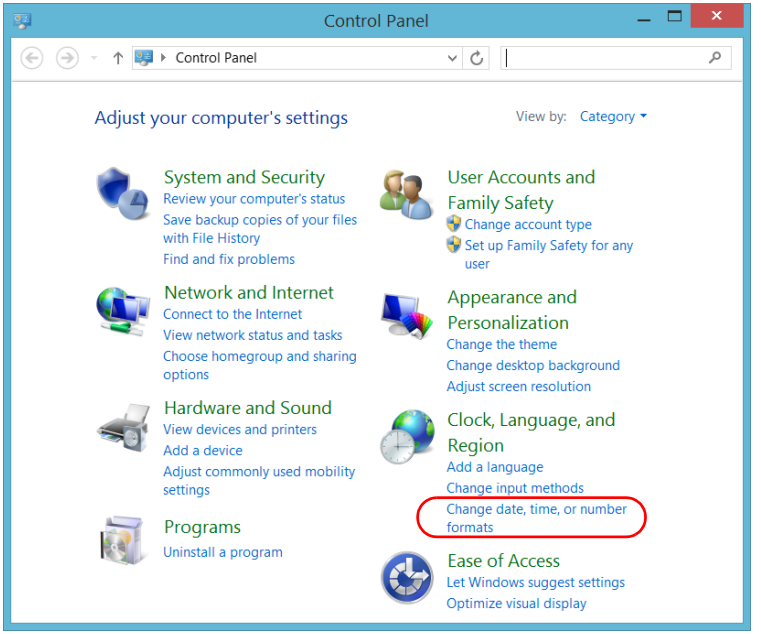
For information on how to adjust the date, the time, and the time zone, see *Adjusting the Date, Time and Time Zone* on page 79.

To set date and time formats:

1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



3. Under **Clock, Language, and Region**, tap **Change date, time, or number formats**.



4. Refine the settings according to your needs.

5. Tap **Apply** to confirm, and then **OK** to close the window.

The new values are taken into account immediately.

Adjusting the Date, Time and Time Zone

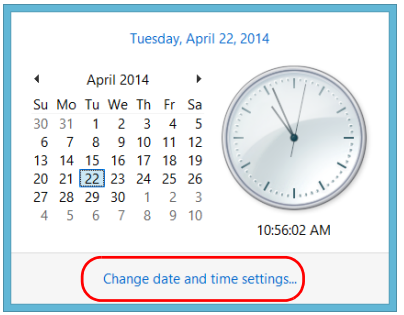
Note: *Only administrator-level users can adjust the date and time. All users can modify the time zone.*

The current date and time are displayed at the bottom of the main window. When saving results, the unit also saves the corresponding date and time.

For information on how to modify the format in which the date and time are displayed, see *Setting Date and Time Formats* on page 77.

To adjust the date, time or time zone:

1. From the main window, tap the date and time displayed in the lower right corner of the screen.
2. Tap **Change date and time settings**.



3. Modify the settings according to your needs.
4. Tap **Apply** to confirm, and then **OK** to close the window.

The new values are taken into account immediately.

Configuring the Power Management Options

To help you get the optimum performance out of your unit, it comes with predefined sets of parameters (plans) to manage power.

When you do not use the unit for a while, the display may be turned off to save power. You can also configure the unit to go into sleep mode after the specified duration has expired (see *Turning Off Your Unit* on page 20).

For all of these actions, you can set idle durations for AC adapter/charger and battery operation. The values that you set are kept in memory even when you turn the unit off.

Note: *When the backlight is turned off and the* ⏻ *LED is lit and not blinking, the unit operation is not interrupted. Touch anywhere on the screen to return to normal operation.*

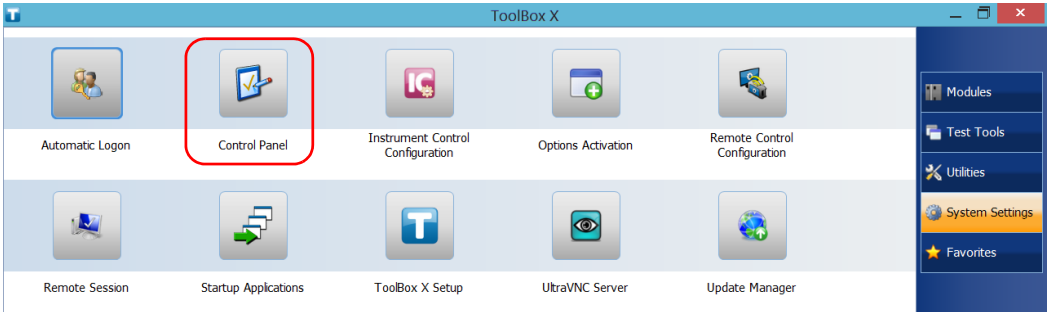
The table below identifies the predefined power plans.

Power Plan	Characteristics
High Performance (selected by default)	Provides maximum power when you work with your unit without optimizing the energy consumption.
Balanced	Provides extra power when your unit needs it, and saves power when your unit consumes less.
Power Saver	Optimizes the energy consumption, which could be particularly useful when you operate the unit on batteries.

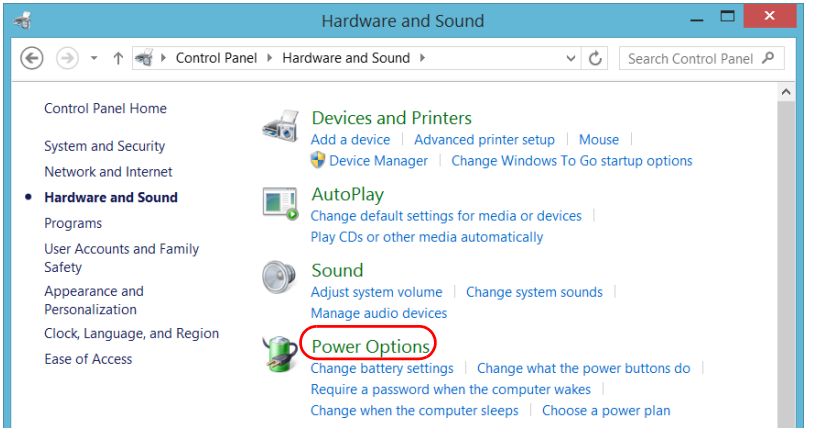
You can either modify one of the existing power plans or create one (based on an existing power plan). It is always possible to revert to factory default values for the predefined plans. You can delete custom power plans that you no longer use, but not the predefined plans.

To select a power plan:

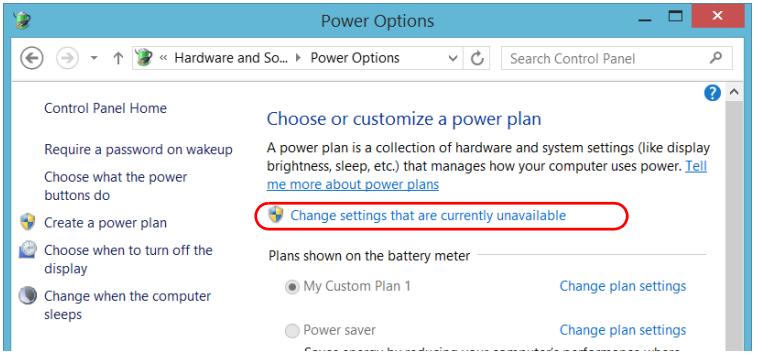
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



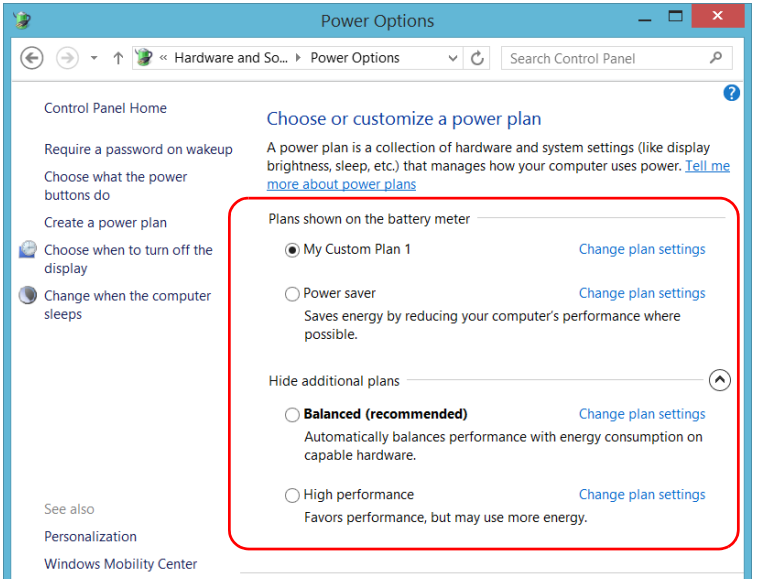
3. Tap **Hardware and Sound** > **Power Options**.



4. If necessary, tap **Change settings that are currently unavailable**.



5. From the list of available power plans, select the desired set of parameters.

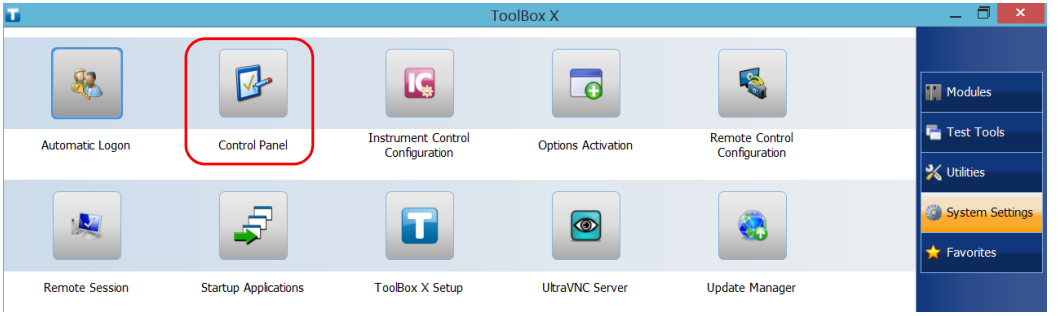


6. Close the window.

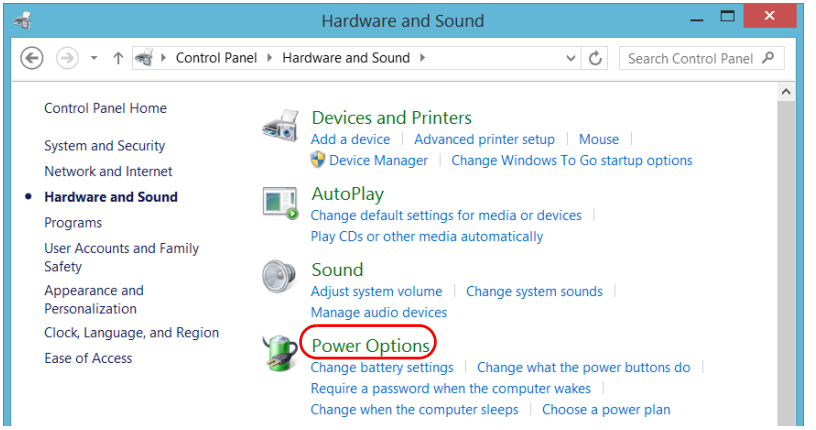
The new values are taken into account immediately.

To create a power plan:

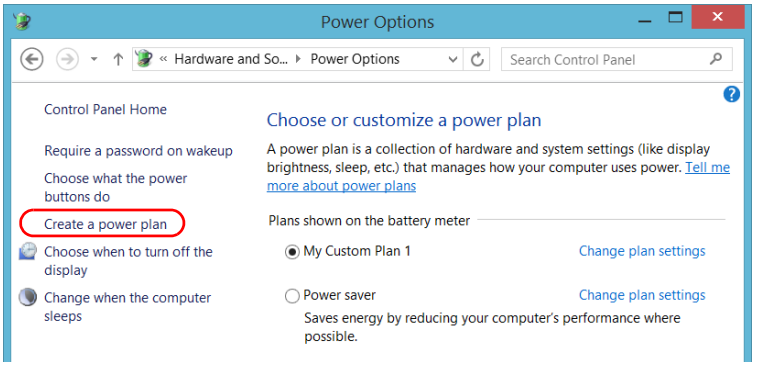
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



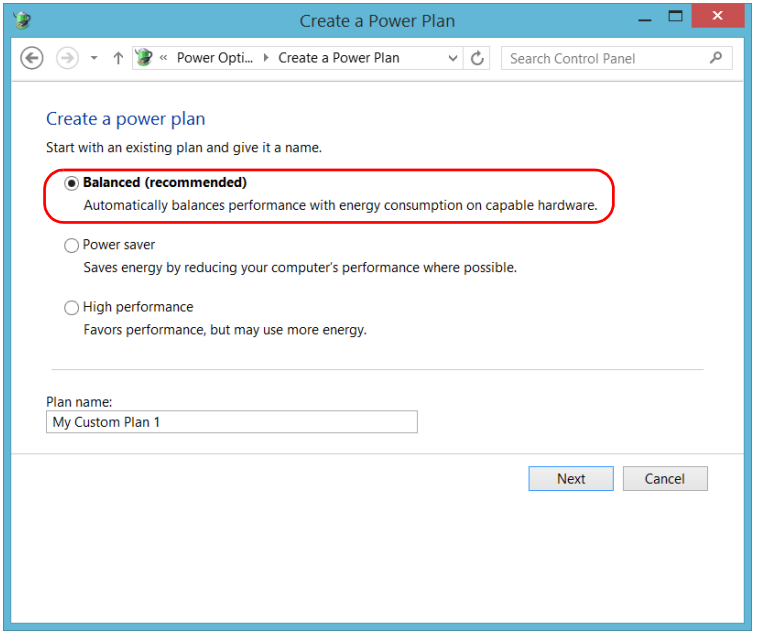
3. Tap **Hardware and Sound** > **Power Options**.



4. From the list on the left, tap **Create a power plan**.

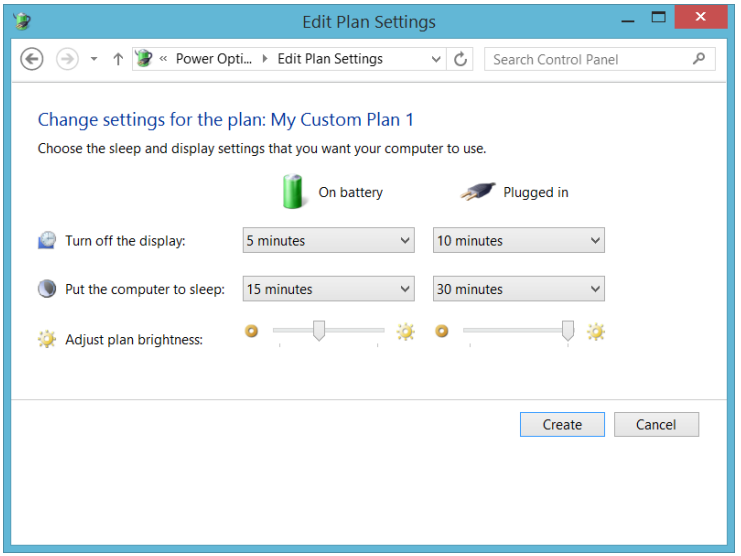


5. Select a power plan that will serve as a basis.



6. Enter a name, and then tap **Next**.

7. Modify the parameters to suit your needs.

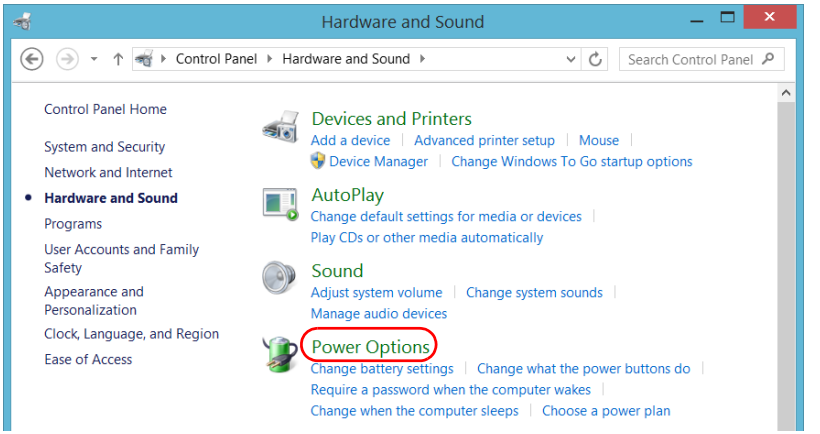


8. Tap **Create**.

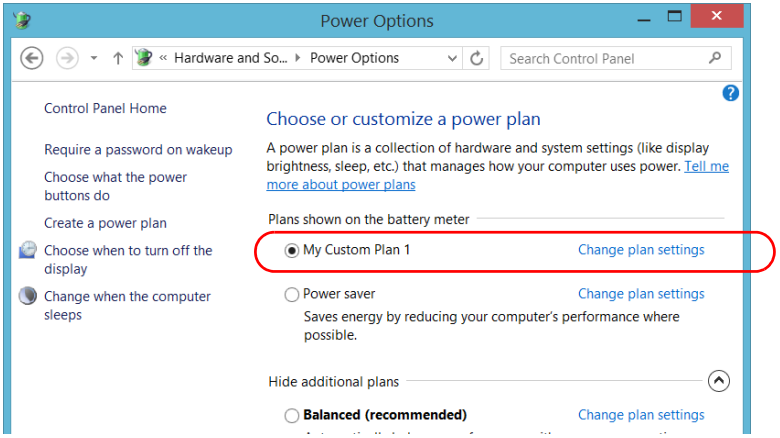
To modify or delete an existing power plan:

1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.

3. Tap **Hardware and Sound** > **Power Options**.



4. From the list of available power plans, locate the set of parameters that you want to modify or delete.

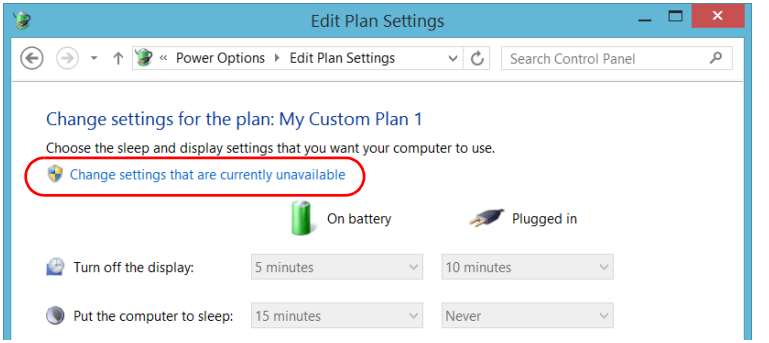


Note: *You can only delete custom power plans, not predefined ones. If the custom power plan that you want to delete is currently in use, you must select another plan first.*

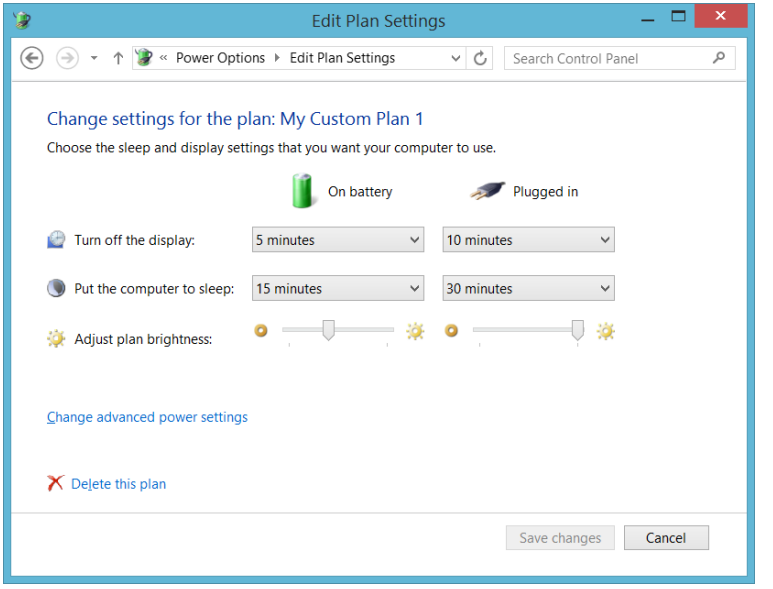
5. Tap **Change plan settings** (appearing next to the power plan).

6. If you want to modify the parameters, proceed as follows:

6a. If necessary, tap **Change settings that are currently unavailable**.

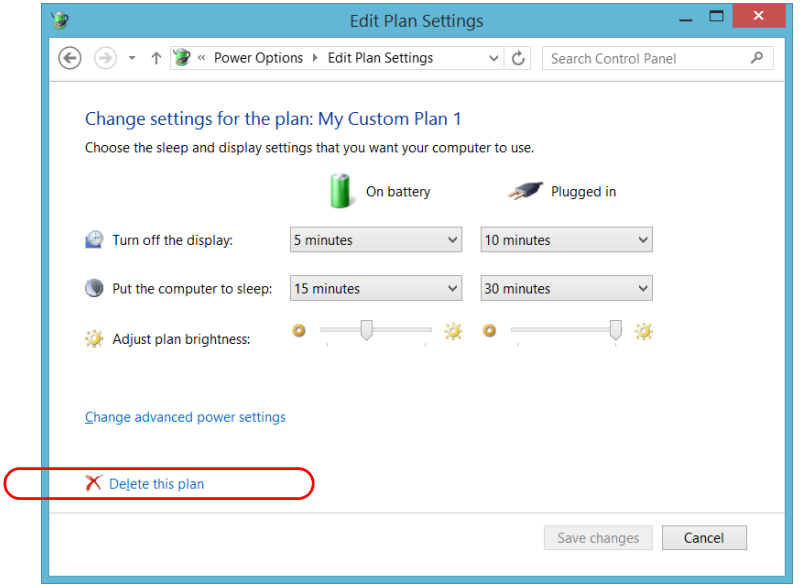


6b. Modify the parameters to your needs.



6c. Tap **Save changes**.

7. If you want to delete the power plan, tap **Delete this plan**, and then confirm the deletion.



8. Close the window.

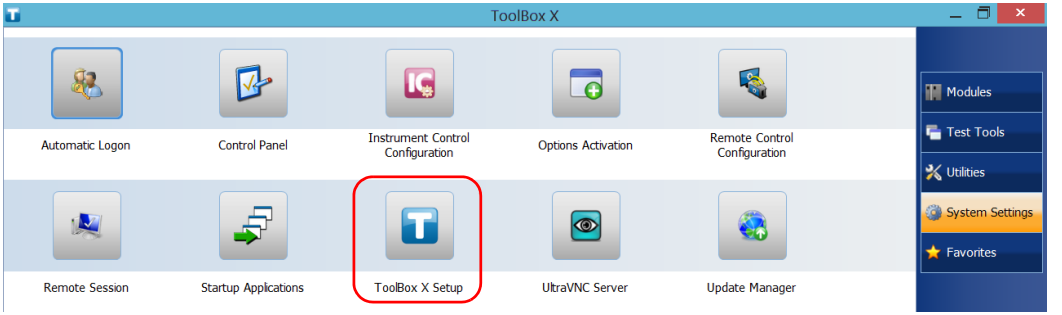
The changes are taken into account immediately.

Setting Toolbox X Behavior

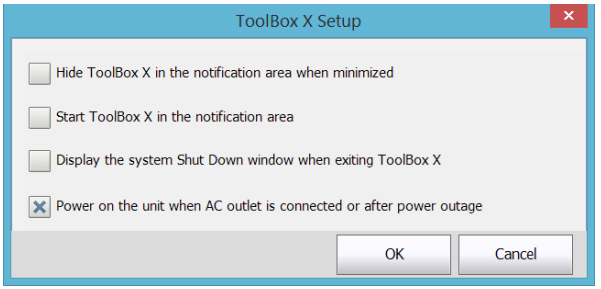
You can specify how Toolbox X behaves when the application is started, minimized or closed.

To set the Toolbox X behavior:

1. From the main window, tap the **System Settings** button.
2. Tap **ToolBox X Setup**.



3. Select the items corresponding to the desired behavior.



- **Hide ToolBox X in the notification area when minimized**: If this option is selected, the Toolbox X icon appears in the notification area (where the clock is located) when you minimize the window.
- **Start ToolBox X in the notification area**: If this option is selected, Toolbox X is automatically started, then minimized to the notification area (system tray).
- **Display the system Shut Down window when exiting ToolBox X**: If this option is selected, the standard system Shut Down window appears to let you shut down the unit directly instead of closing the Toolbox X application, then shutting down the unit from Windows. For more information on the different ways to turn off your unit, see *Turning Off Your Unit* on page 20.

4. Tap **OK** to confirm your settings and close the window.

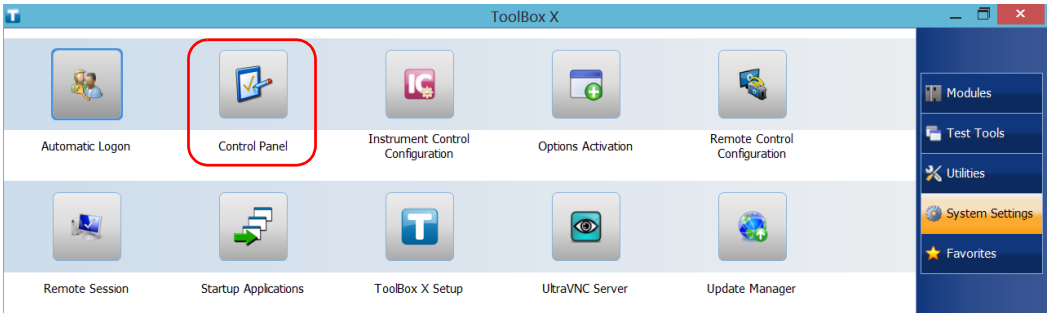
Configuring the Internet Options

You can browse the Web directly from your unit, provided that you have access to an Internet connection and that the Internet options are configured properly.

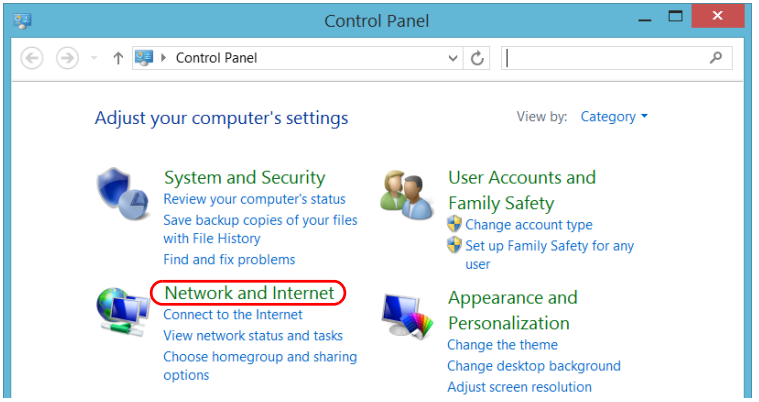
If you are not sure about how you should configure your Internet access, contact your network administrator.

To configure the Internet options:

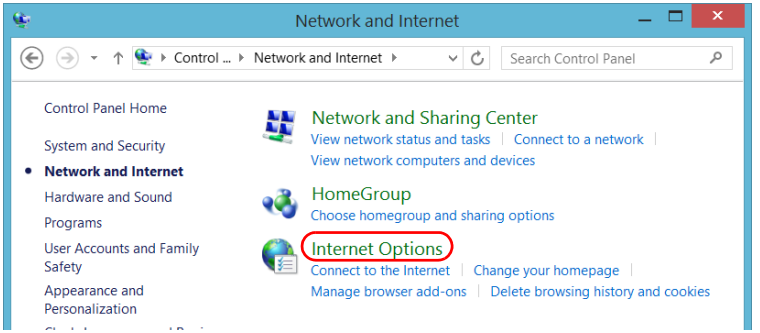
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



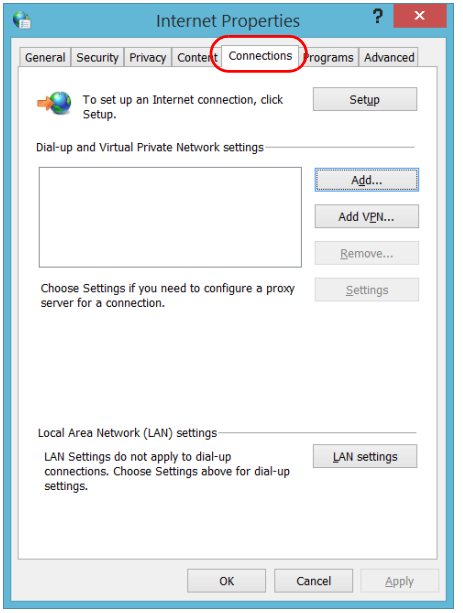
3. Tap **Network and Internet**.



4. Tap **Internet Options**.



5. Go to the **Connections** tab.



6. Modify the settings using the information provided by your network administrator.

7. Tap **OK** to return to the **Control Panel** window.

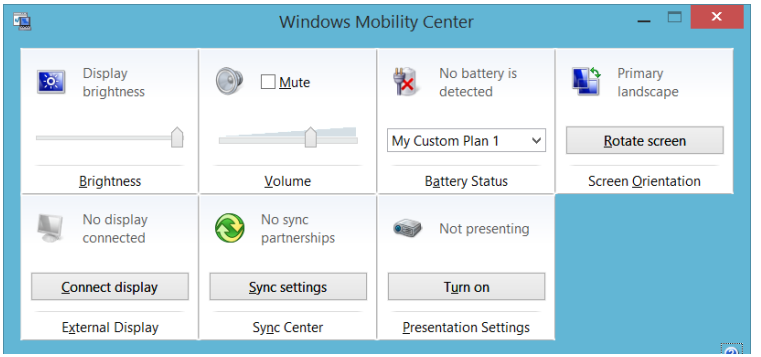
Configuring Parameters via Windows Mobility Center

For a quick access to various parameters such as the volume or power plans, you may want to use the Windows Mobility Center.

To configure the parameters via Windows Mobility Center:

1. From the main window, tap the **System Settings** button.
2. Tap **Windows Mobility Center**.

3. Set the parameters as desired.



Note: *To adjust the brightness, from the unit's front panel, press the ☼ ▼ or ☼ ▲ button until the brightness level suits you.*

Setting Other Parameters

You can also configure many other parameters via the **Control Panel** window. Refer to Windows Embedded 8 Standard documentation for details.

5 Working with Your Unit

Printing Documents

You can print documents and images directly from your unit by using either the provided PDF creation tool or an external printer (for printing on paper).

You can view the PDF files from your unit, using the provided PDF reader. For more information, see *Viewing PDF Files* on page 98.

You can use a local or a network printer to print on paper.

- Local printer: You must connect the printer to your unit and install the required software and drivers provided by the manufacturer of the printer.
- Network printer: Your unit must be accessible from this network by standard Ethernet. You must also define the printer on your unit before attempting to access it (see *Configuring Network Printers* on page 66).

Note: *Some applications may not offer print functions.*

To print documents:

1. Open the document that you want to print.
2. From the application in which you have opened your file, access the print function.

Note: *In most applications, you can access the print function by the **File** menu or by a **Print** button.*

3. Select the desired printer (PDF creation tool by default).
4. If necessary, adjust the printer's parameters to your needs.
5. Tap **Print** to start the printing process, and follow the on-screen instructions.

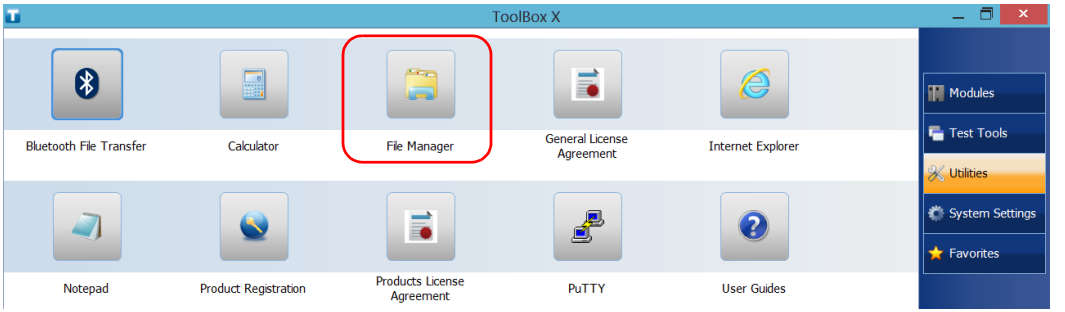
Viewing PDF Files

You can view PDF files directly from your unit using the provided PDF file viewer. For more information on the available features for this viewer, refer to the PDF viewer online help.

Note: *You may need a connection to the Internet to access the PDF viewer online help.*

To view PDF files:

1. From the main window, tap the **Utilities** button.
2. Tap **File Manager**.



3. Browse through the folders to find the desired PDF file.
4. Double-tap the file.
5. The file opens automatically in the PDF viewer.

Taking Screen Captures

You can take captures of what is displayed on your screen, directly from your unit. This could be useful for troubleshooting when you need another person to have a look at a specific configuration or problem. You could also use this tool for training purposes.

If you want to capture images of the fibers that you examine with the fiber inspection probe, you can use the capture feature of the probe instead.

➤ The images are saved in .png format. They are sent to the following folder (in the account of the user currently logged on the unit):

This PC|Pictures|Screenshots

➤ The application generates file names as follows:

Screenshot (<Sequential_number>).png

where

Sequential_number corresponds to the number that is added each time you take a screen capture.

Note: *The name of the folders and of the files described above will vary according to the language that is currently selected in Windows.*

To take a screen capture:

From the unit's front panel, press the button and hold it down for a few seconds.

The screen capture is automatically taken (a visual effect typical of a camera taking a picture indicates that the capture is complete).

Note: *If a keyboard is connected to your unit, you can also press the Windows logo key + PRINT SCREEN.*

Browsing the Web

You can browse the Web directly from your unit, provided that you have access to an Internet connection.

If you need to modify the Internet options, see *Configuring the Internet Options* on page 92. For more information on how to connect to the Internet using a 3G USB modem key, see *Accessing the Internet with a 3G USB Modem Key* on page 101.

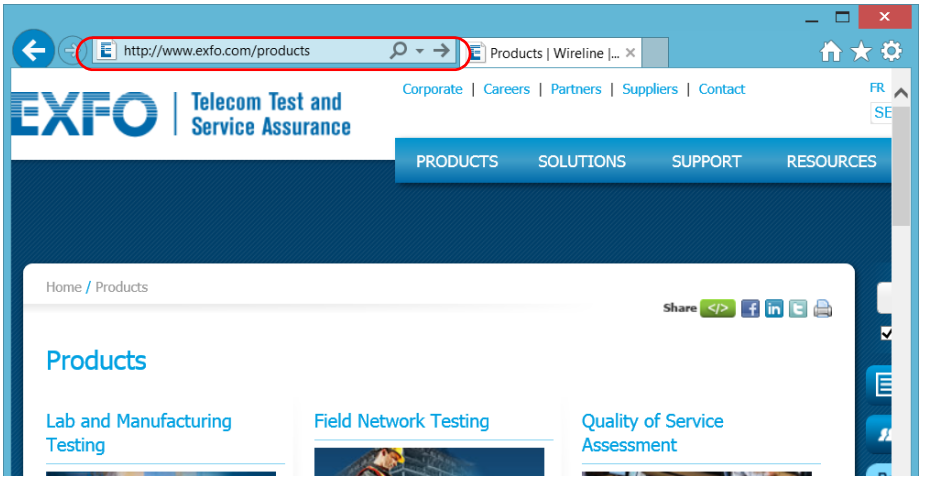
To browse the Web:

1. Open a Web browser as follows:

   1a. From the main window, tap the **Utilities** button.

   1b. Tap the **Internet Explorer** icon to open the browser.

2. Enter the desired Web address in the address bar and tap the → button (located at the right of the address bar) to start browsing.



3. Close the window to return to the **Utilities** window.

Accessing the Internet with a 3G USB Modem Key

Note: *Only administrator-level users can install software. However, when the installation is complete, all users will have the possibility to access the Internet with a USB modem key.*

Your can connect a 3G USB modem key to your unit to have a wireless access to the Internet.

You need to use a 3G modem key equipped with an unlocked and activated Subscriber Identity Module (SIM) card (you must subscribe to a package of mobile services). If you need more information on the 3G coverage in your area, contact your provider of mobile services.

Usually, you have to install an application with which you will establish a connection with the mobile network whenever you want to work with your USB modem key. Most of the time, this application is installed automatically the very first time you connect a USB modem key to your unit. In all cases, you only need to install this application once.

To work with a 3G USB modem key:

1. If necessary, turn on your unit and wait for the startup sequence to complete.
2. If necessary, connect the USB modem key to one of the USB ports of your unit.
3. Start the application allowing you to establish a connection to the mobile network.
4. Once the application starts, connect to the mobile network.

   As soon as the connection is established, you are ready to browse the Web.

Note: *Depending on the package that you have purchased with your service provider and the type of network, you may have to set specific parameters. If you are not sure on how to proceed or need more information about the configuration, contact your service provider.*

5. When you have finished working, disconnect from the mobile network, and then remove the USB modem key from your unit.

Managing Favorites

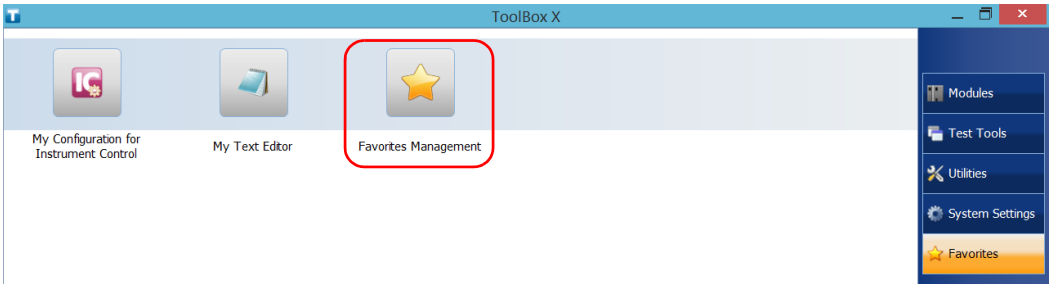
For a quicker access to the applications that you use most often, you may want to build your own list of favorite applications (Favorites).

You can add and remove Favorites from the list. You can also import and export lists of Favorites, which could be useful for backup and recovery purposes, or to share the same Favorites among several units.

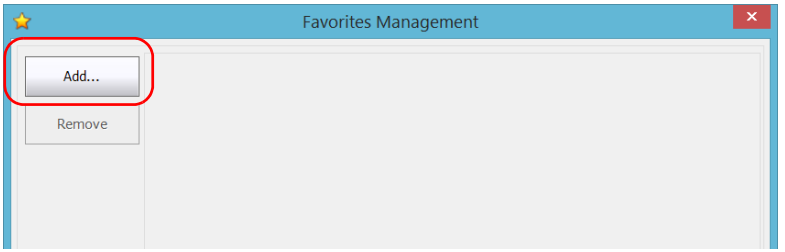
Note: *To have access to the same Favorites on several units, the corresponding applications must be available on all units.*

To add Favorites:

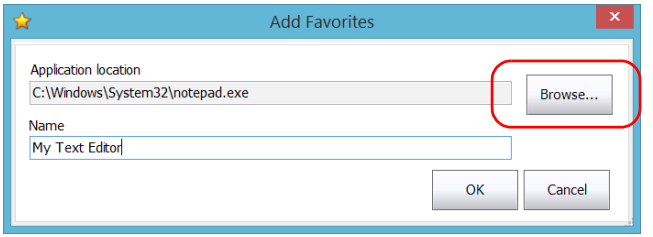
1. From the main window, tap the **Favorites** button.
2. Tap **Favorites Management**.



3. Tap **Add**.



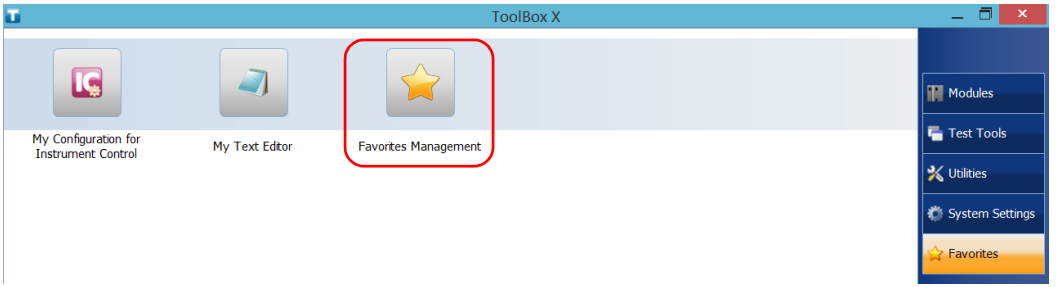
4. Tap **Browse** to locate the desired application.



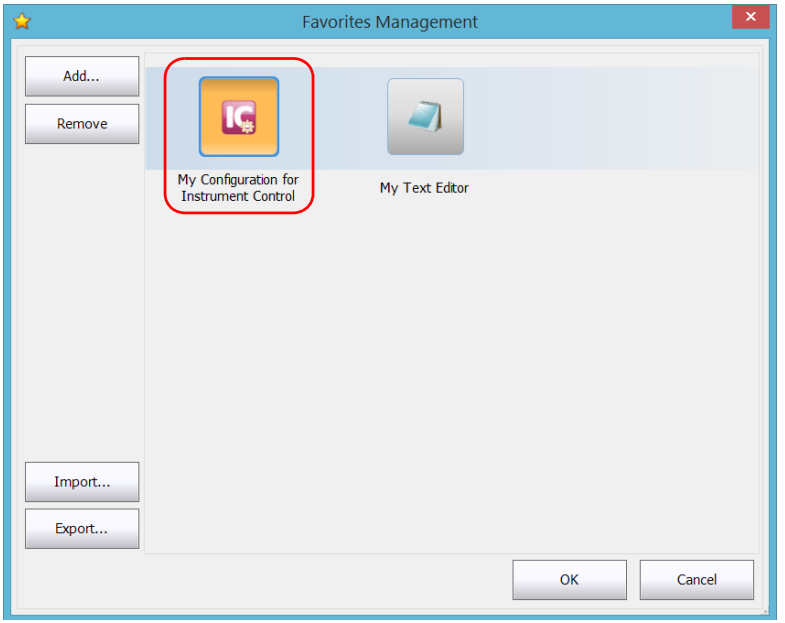
5. Type a name for the new Favorite.
6. Tap **OK** to confirm the location and name.
7. Repeat the previous steps with all the Favorites that you want to add.
8. Tap **OK** to apply the changes and close the window.

To remove Favorites:

1. From the main window, tap the **Favorites** button.
2. Tap **Favorites Management**.



3. Tap the icon corresponding to the Favorite that you want to remove from the list.



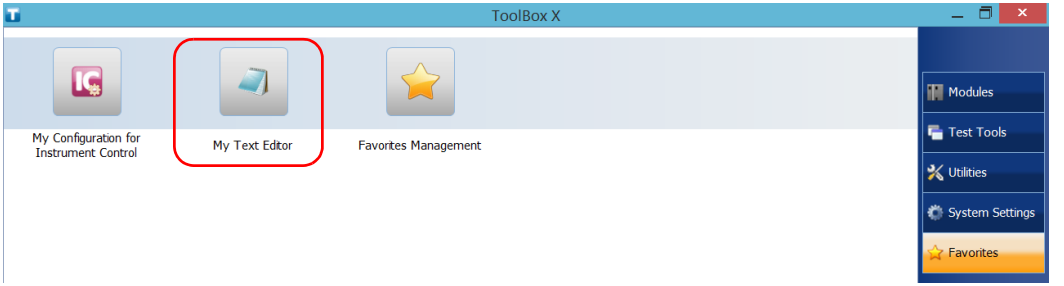
4. Tap **Remove**.

Note: *The application will not prompt you to confirm the removal of the Favorite from the list. Removing a Favorite from the list does not uninstall the application from the unit.*

5. Tap **OK** to apply the changes and close the window.

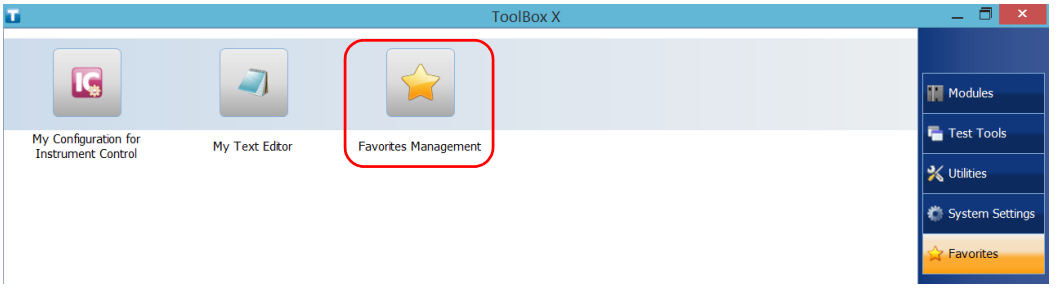
To work with Favorites:

1. From the main window, tap the **Favorites** button.
2. Tap the icon corresponding to the application that you want to use.

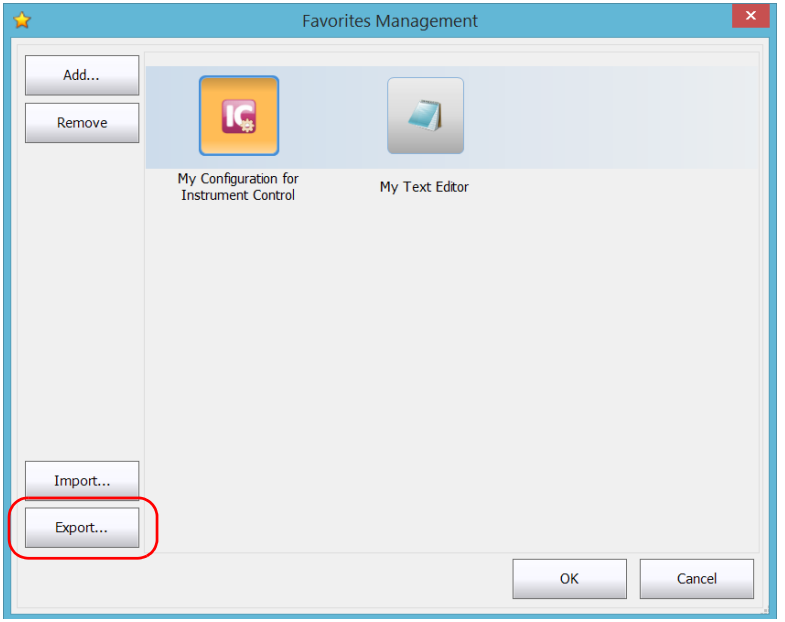


To export the list of Favorites:

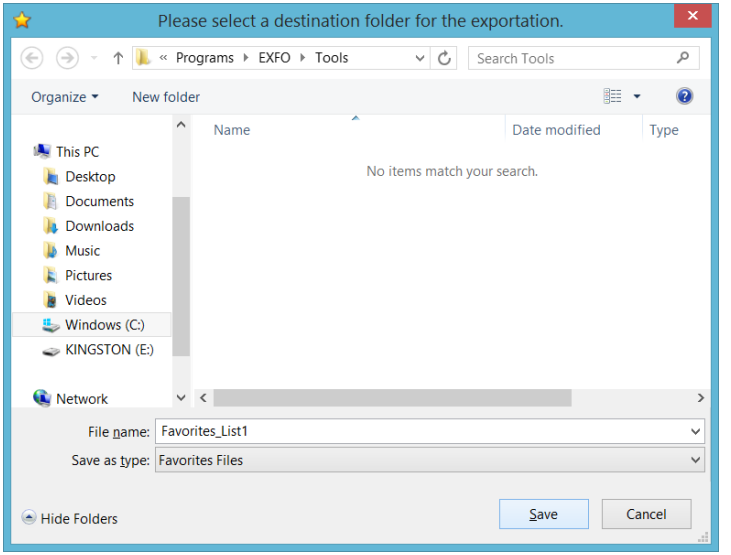
1. From the main window, tap the **Favorites** button.
2. Tap **Favorites Management**.



3. Tap **Export**.


Favorites Management
Add...
Remove
My Configuration for Instrument Control
My Text Editor
Import...
Export...
OK
Cancel

4. Select a location and type a name for the Favorites list.

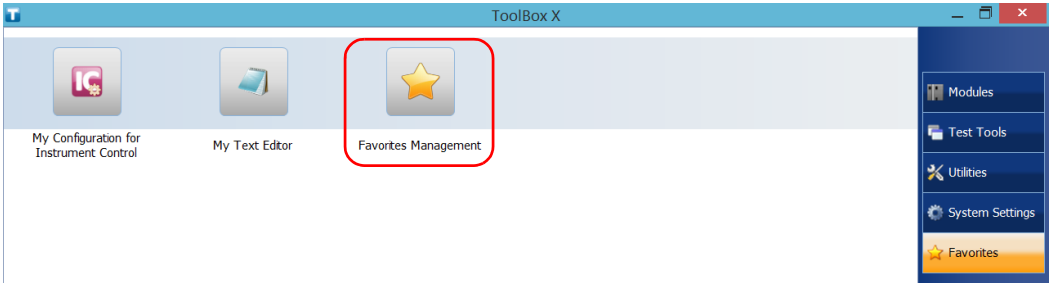


5. Tap **Save**.

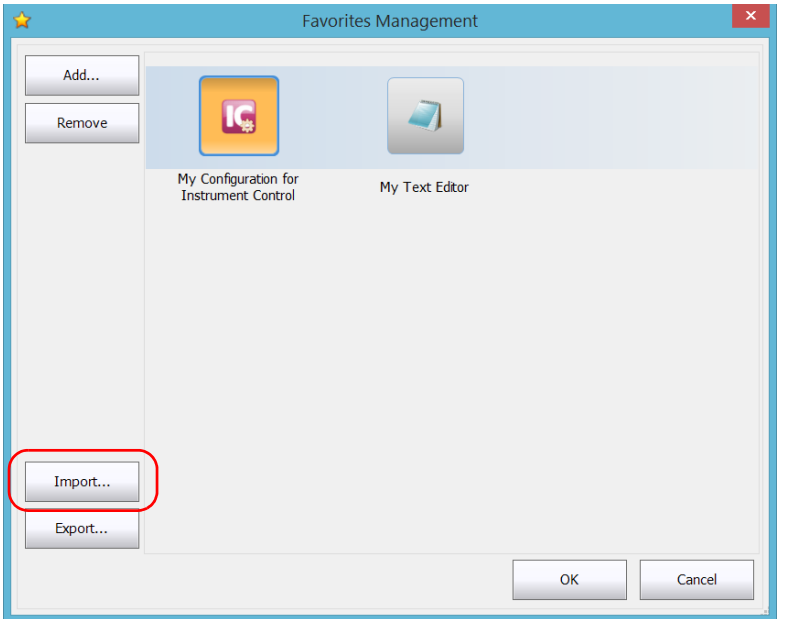
6. Tap **OK** to apply the changes and close the window.

To import a list of Favorites:

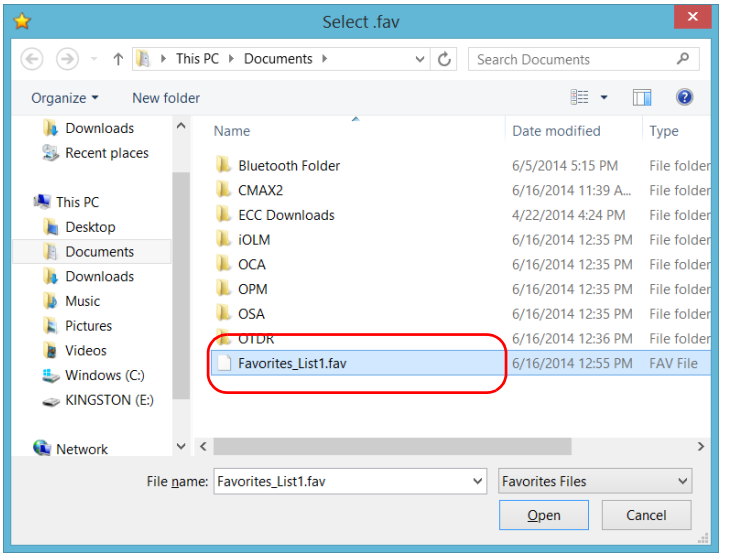
1. From the main window, tap the **Favorites** button.
2. Tap **Favorites Management**.



3. Tap **Import**.



4. Select the desired Favorites list.



5. Tap **Open**.

6. Tap **OK** to apply the changes and close the window.

Using the Calculator

You can use Microsoft Calculator directly from your unit.

To use the Calculator:

1. From the main window, tap the **Utilities** button.
2. Tap **Calculator**.

Using the Text Editor

You can use Microsoft Notepad directly from your unit.

To use the text editor:

1. From the main window, tap the **Utilities** button.
2. Tap **Notepad**.

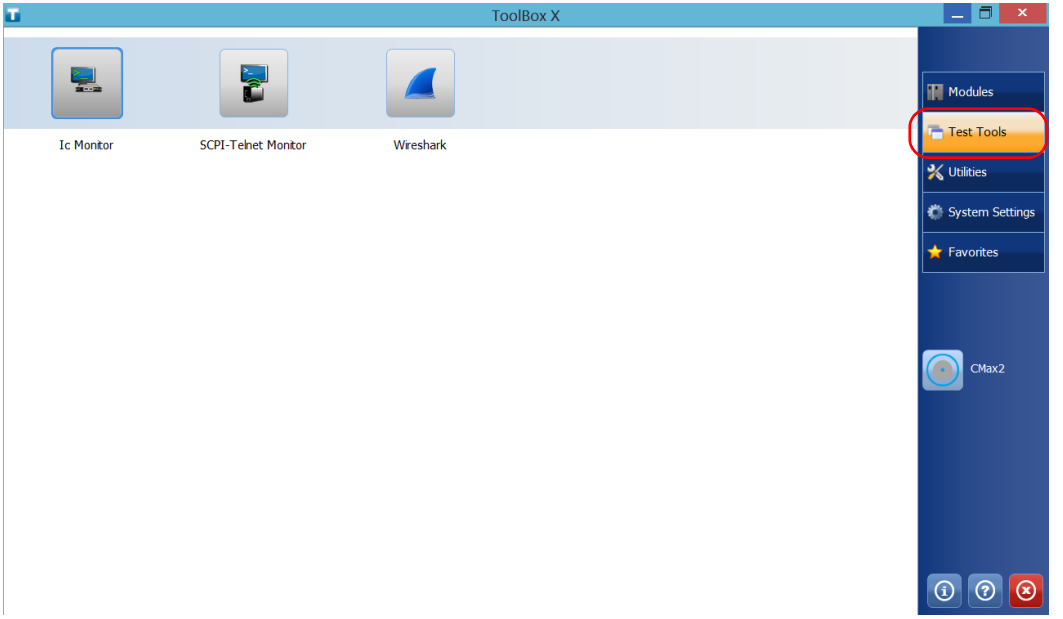
Accessing Other Tools

Your unit comes with various tools that can help you better analyze or manage your data.

You have also access to free tools such as Wireshark to help you troubleshoot networks. For more information, refer to the online help provided with these tools, when applicable.

To access the applications:

1. From the main window, tap the **Test Tools** button.



2. Tap the icon corresponding to the application that you want to start.

6 Inspecting Fibers with a Probe

The fiber inspection probe (FIP) is used to find dirty or damaged connectors by displaying an enlarged view of the connector surface. You can connect an FIP to your unit to view fiber ends.

IMPORTANT

Only the probes of the FIP-400B series are supported on your unit.

Fiber inspections are made using the ConnectorMax2 application. For more information, refer to the ConnectorMax2 online help.

To inspect fibers with a probe:

1. Connect the probe to one of the USB ports of your unit (right or top panel).
2. From Toolbox X, tap the **CMax2** button to open the application.

Note: *You can access the online help by tapping the* *button from the ConnectorMax2 application.*

7 Managing Data

You can copy, move, rename, delete files and folders directly on your unit.

You can transfer files from your unit to a USB memory key or a computer. You can also transfer data from a storage device or a computer to your unit.

Your unit is equipped with the following ports and devices for data transfer:

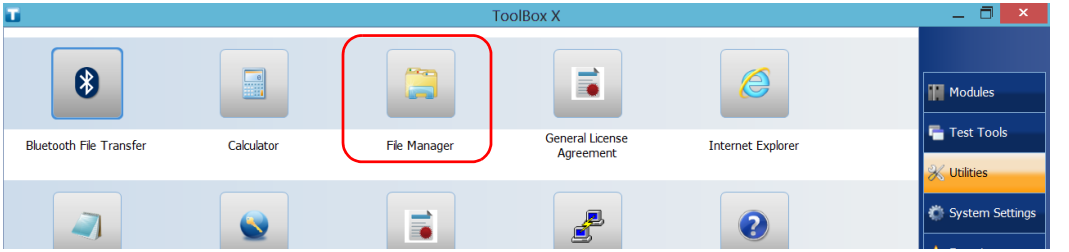
- A microSD card slot to insert a memory card
- Two USB 2.0 ports and one USB 3.0 port to connect a memory key
- an Ethernet port to connect to a network (for transfer via VNC or Remote Desktop - see *Accessing Your Unit Remotely* on page 133)

Viewing Disk Space and Managing Files

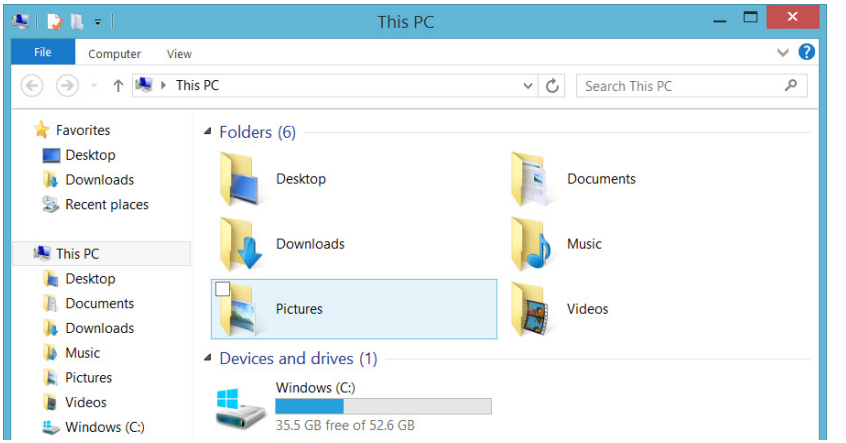
To help you manage the data that is stored on your unit, you can easily view the remaining disk space. You can also copy, move, rename, delete files and folders directly from your unit.

To view the free disk space, and manage files and folders:

1. From the main window, tap the **Utilities** button.
2. Tap **File Manager**.



The file explorer is displayed.



Note: *The free disk space is also visible from the **Platform** tab (tap* *in the lower right corner of the main window).*

Using the USB to RS-232 Adapter

If you want to transfer data between your unit and a device that is only equipped with RS-232 (serial) ports, you have to use a USB/RS-232 adapter (sold by EXFO).

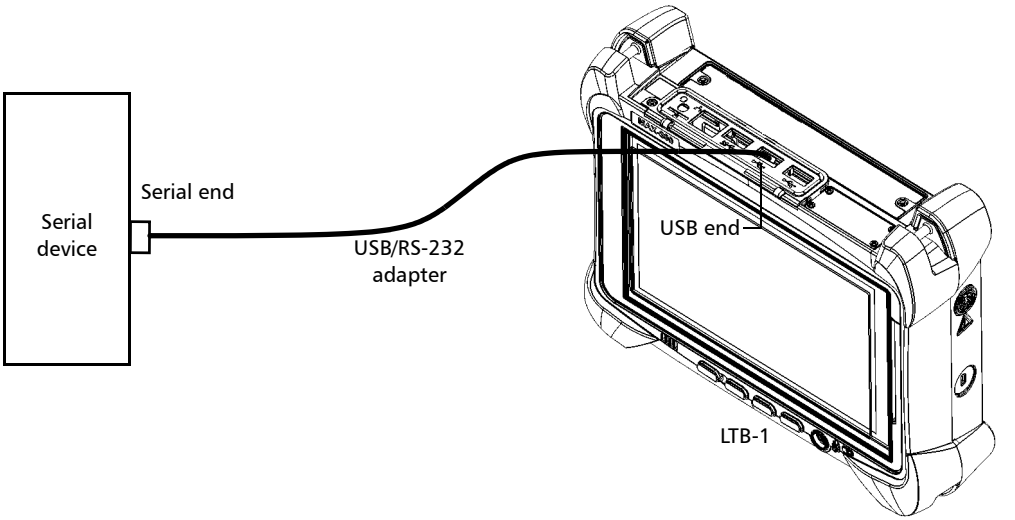
Once the adapter has been detected, the unit assigns it a COM port number (for some adapters, values do not begin at COM 1). This COM port number is kept in memory even when you turn the unit off. This means that next time you connect the same adapter to any of the USB ports, the unit will recognize the adapter and identify it with the saved COM port number.

The communication between your unit and the device is established using the PuTTY application.

To use the USB/RS-232 adapter:

1. Turn on both the unit and the serial device.

2. Connect as shown. You can connect the USB end of the adapter to any of the USB ports.



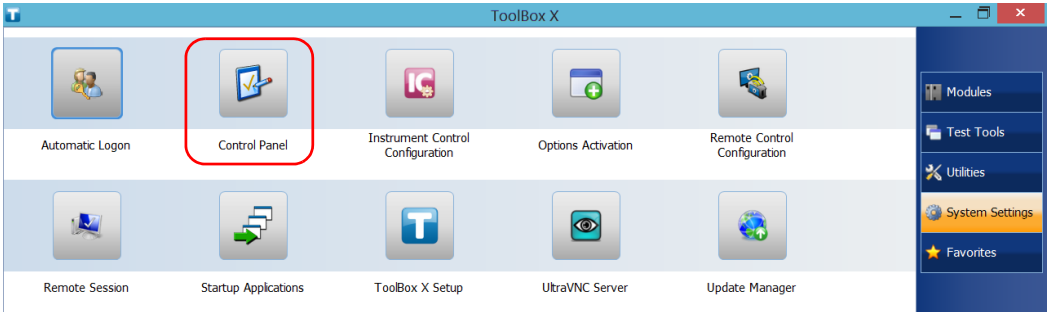
Note: *If the device that you want to use is a computer (not equipped with USB ports) you may want to use a null-modem serial cable as an "extension cable" between the device and the USB/RS-232 adapter.*

The adapter will be detected automatically on your unit.

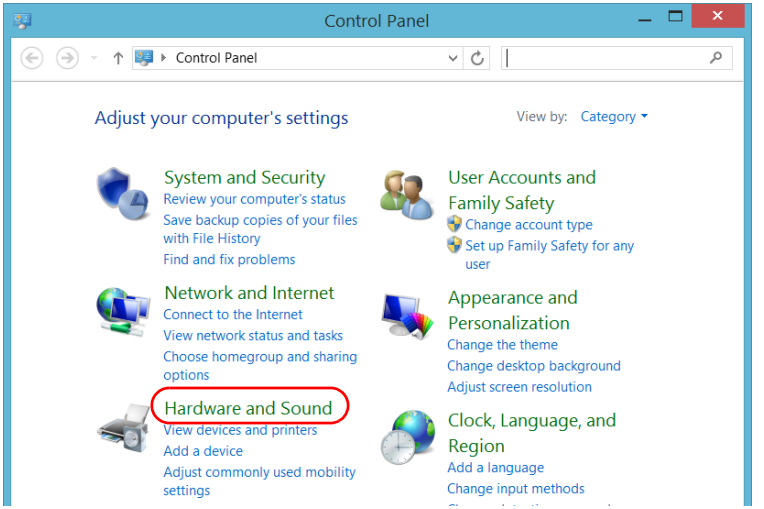
3. From your unit, retrieve the COM port of the adapter as follows:

3a. From the main window, tap the **System Settings** button.

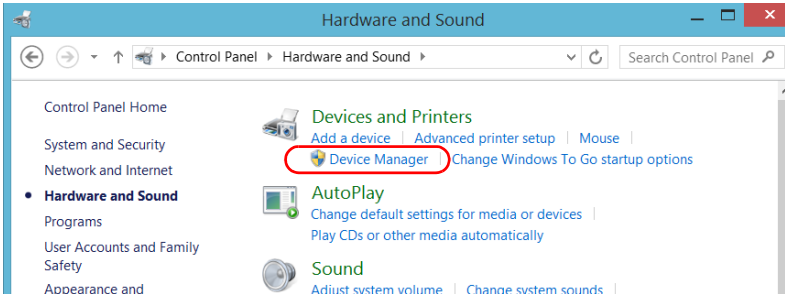
3b. Tap **Control Panel**.



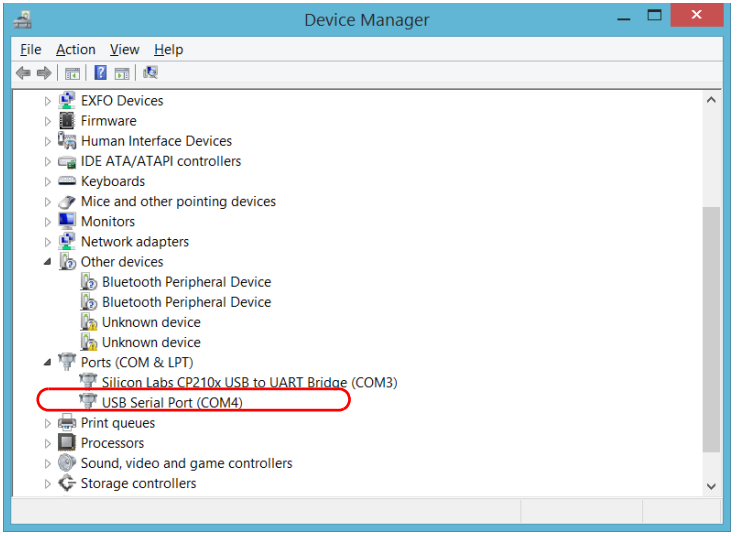
3c. Tap **Hardware and Sound**.



3d. Under **Devices and Printers**, tap **Device Manager**.



3e. Expand the **Ports (COM & LPT)** list to retrieve the COM port number that has been assigned to the adapter (identified as *USB Serial Port*) and write it down.



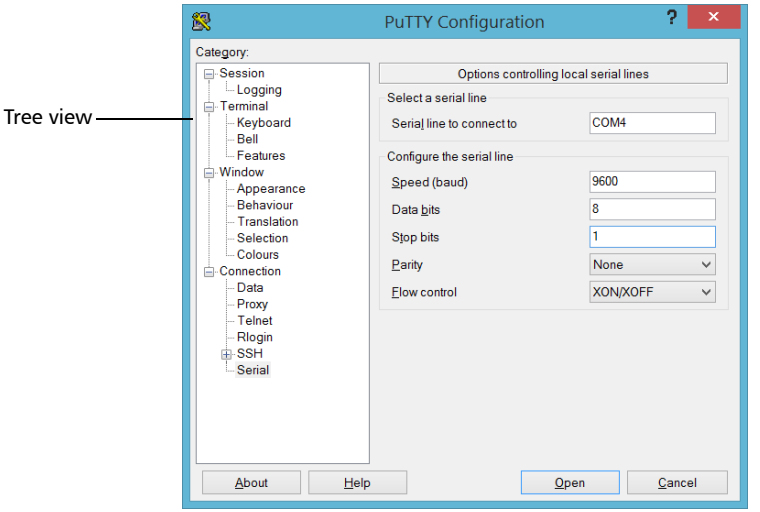
3f. Close the *Device Manager*.

4. From your unit, configure the communication parameters as follows:

4a. From the main window, tap the **Utilities** button.

4b. Tap **PuTTY**.

4c. Configure the parameters.



➤ From the tree view, select **Connection** > **Serial** and set the parameters as needed. Ensure that the COM port that you specify corresponds to the one that you wrote down at step 3e.

➤ If you want to view the characters that you type on screen, from the tree view, select **Terminal**. Under **Local echo**, set the value to **Force on**.

➤ From the tree view, select **Session**. Select **Serial**. The COM port number and the speed should correspond to those that you have previously entered.

4d. Tap **Open**. The unit is now ready to receive or send data.

5. From the device, set the communications parameters.

IMPORTANT

To be able to establish a communication between the unit and the device, you must set the following parameters to the same values as those defined on your unit:

- **Speed**
- **Data bits**
- **Stop bit**
- **Parity**
- **Flow control**

Note: *The COM port number that you set on your device will probably differ from the one that you used on your unit.*

6. From the device, establish communication with the unit using your favorite communication tool (PuTTY, HyperTerminal, etc.).

Freeing Up Disk Space with the Disk Cleanup Utility

If you need to free up disk space on your unit, you can use the Windows Disk Cleanup utility.

With this utility, you can clear files such as the Internet temporary files, files from the Recycle bin, or even files that you no longer need from the previous installation. The files from the previous installation are stored in the *Windows.old* folder that Windows creates automatically when you perform a refresh operation.To avoid losing data, you may want to back up files from this folder before removing it.

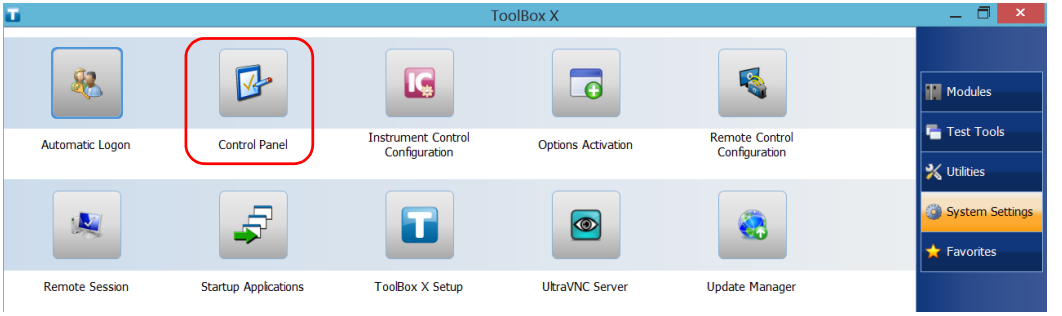
To free up disk space with the Disk Cleanup utility:

1. If desired, back up your data.

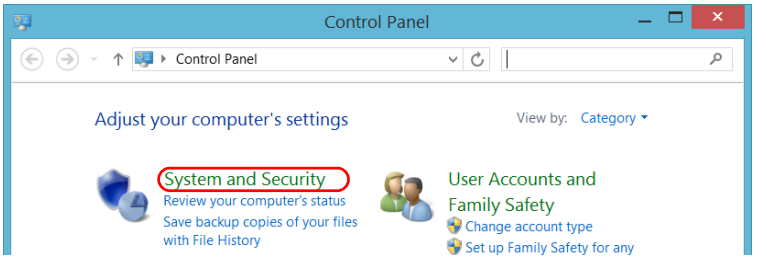
Note: *If you want to have a look at the content of the Windows.old folder containing files of the previous installation, go to the root of the C drive (Windows (C:)). If you do not see the Windows.old folder, it means no refresh operation has ever been performed on your unit.*

2. From the main window, tap the **System Settings** button.

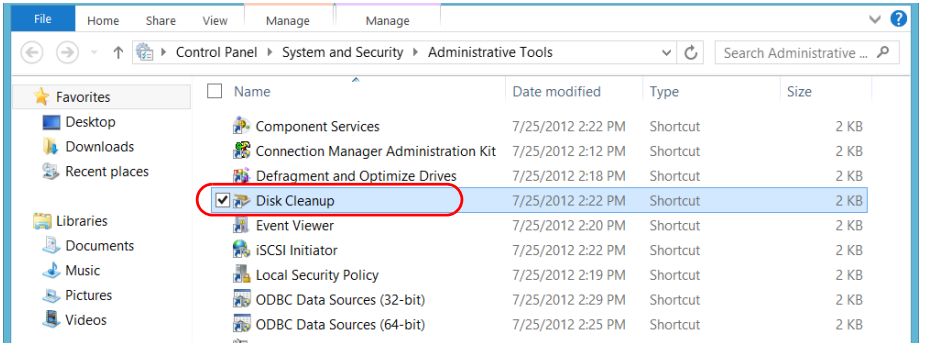
3. Tap **Control Panel**.



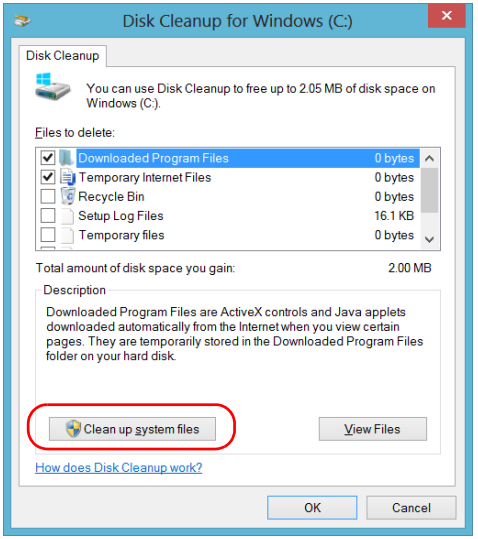
4. Tap **System and Security**.



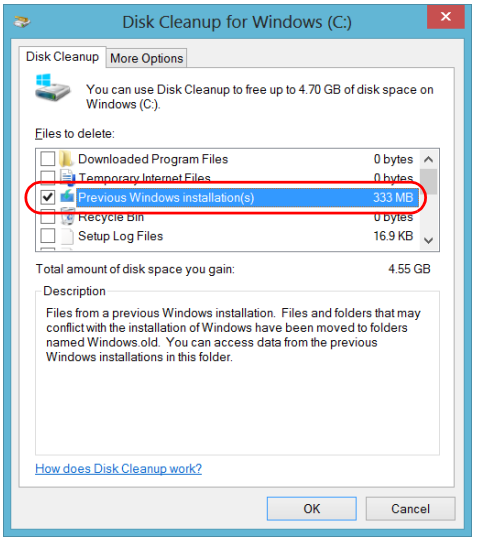
5. Tap **Administrative Tools**, and then double-tap **Disk Cleanup**.



6. If you want to remove system files such as the files from the Windows.old folder, tap **Clean up system files**.



7. When the folders are displayed, select the check box corresponding to the desired item. If you want to clear the Windows.old folder, select the **Previous Windows installation(s)** check box. Ensure that all the other check boxes are cleared.



Note: *If you cannot see the **Previous Windows installation(s)** check box, this means that no refresh operation has been made on your unit yet.*

8. Tap **OK**.
9. When the application prompts you to confirm the deletion of the folder, tap **Delete Files**.

Connecting to a VPN from Your Unit

Note: *Only administrator-level users can install software under Windows. However, when the installation is complete, all users have the possibility to connect to the newly installed VPN from the unit.*

You can connect to a Virtual Private Network (VPN) from your unit if you use one of the VPN clients (applications) that are part of Windows Embedded 8 Standard. Such clients allow you to connect to the VPN of your company from anywhere in the world and have access to network resources as if your unit was connected locally to the network. This could be useful if you need to transfer data to a centralized folder on the company's private network, for example.

To establish the communication between the VPN client and the VPN server, you can use either a 3G USB modem key (see *Accessing the Internet with a 3G USB Modem Key* on page 101) or a standard Ethernet connection.

Note: *Since all networks are different, the parameters that you need to configure before being able to connect to the VPN may vary. For information on the configuration specific to your network, contact your network administrator.*

IMPORTANT

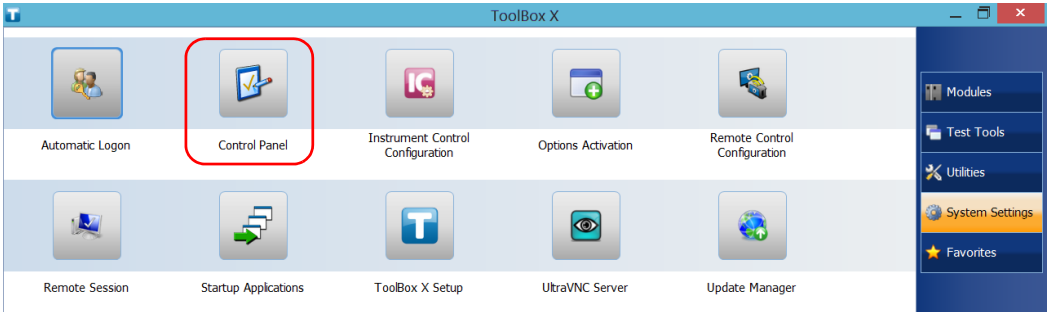
EXFO will not provide any support regarding the VPN clients or connection.

IMPORTANT

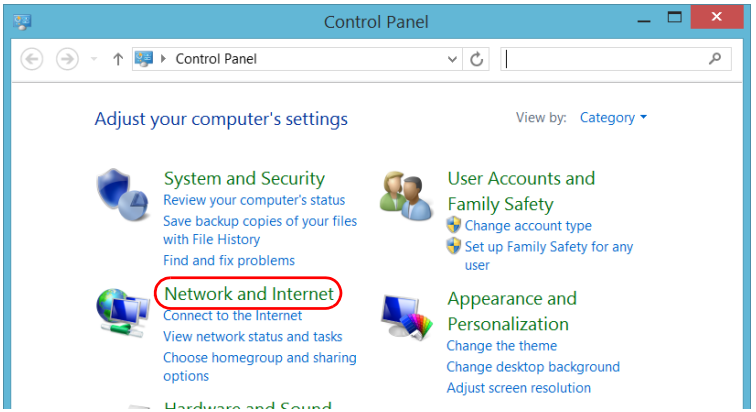
To avoid communication problems between the VPN client and the VPN server, ensure that the date set on your unit corresponds to the current date.

To add a VPN connection on your unit:

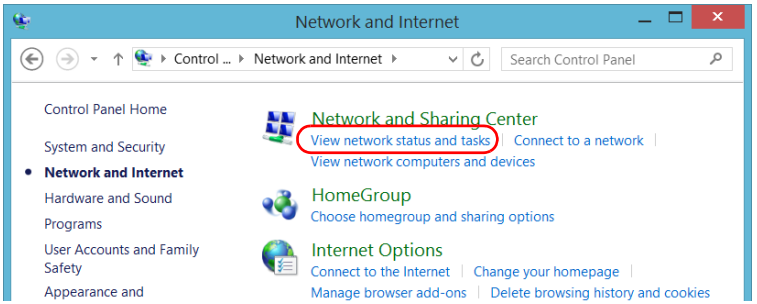
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



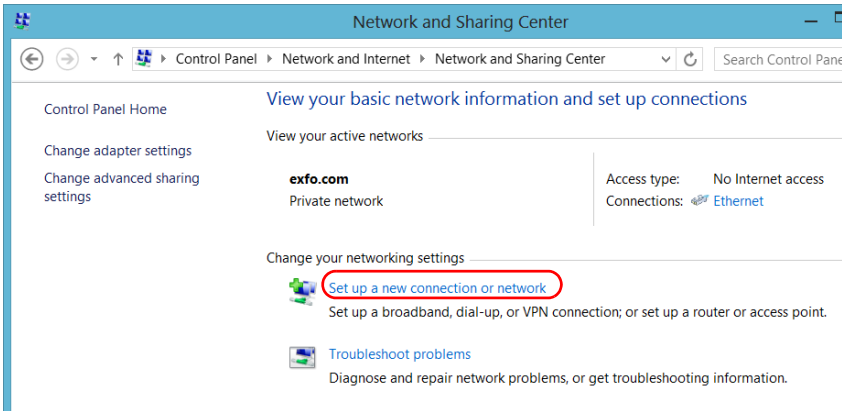
3. Tap **Network and Internet**.



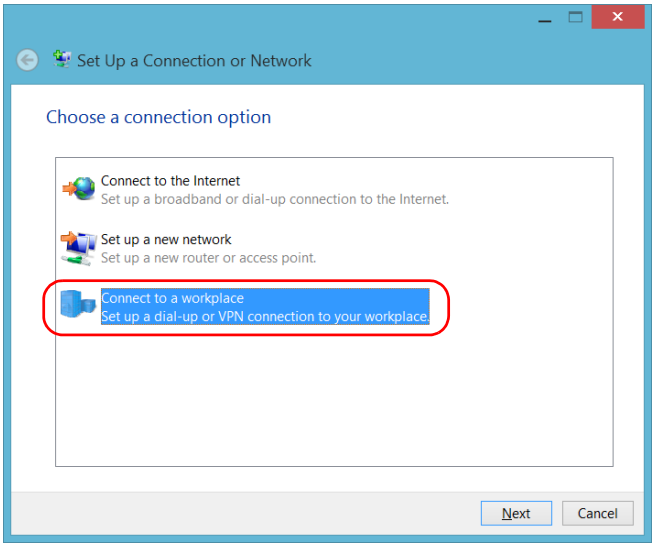
4. Under **Network and Sharing Center**, tap **View network status and tasks**.



5. Tap **Set up a new connection or network**.



6. Tap **Connect to a workplace**, and then tap **Next**.

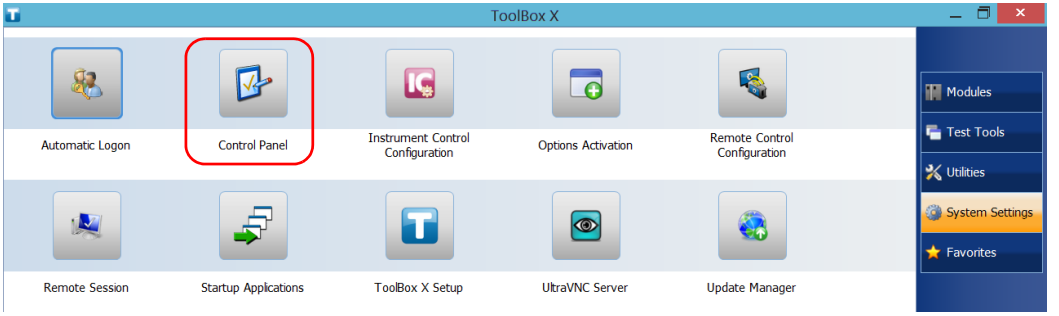


7. Follow the on-screen instructions.

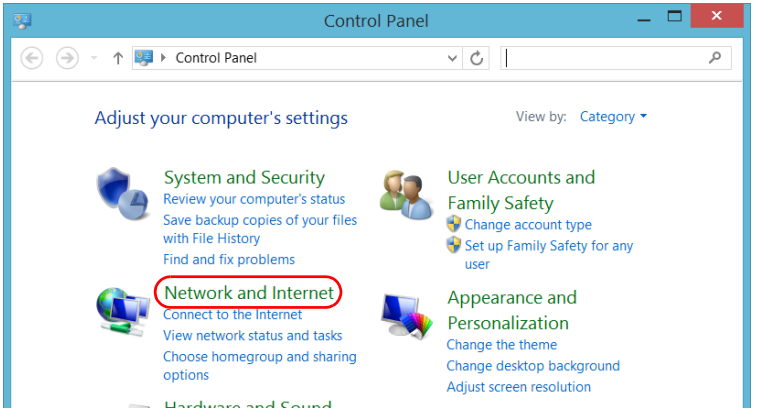
To connect to a VPN from your unit:

1. From the main window, tap the **System Settings** button.

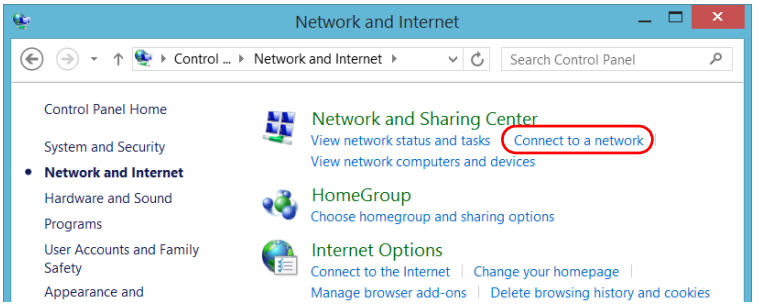
2. Tap **Control Panel**.



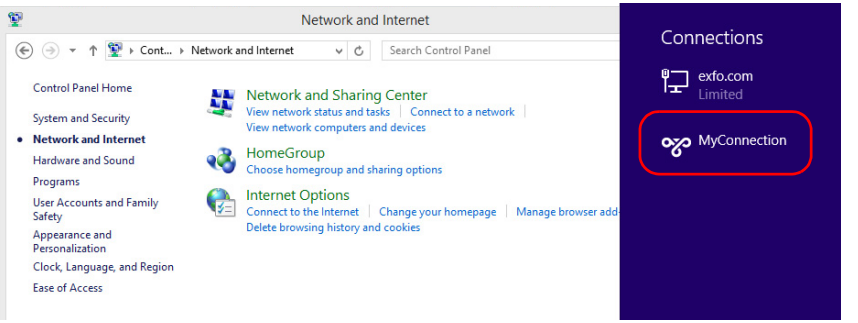
3. Tap **Network and Internet**.



4. Under **Network and Sharing Center**, tap **Connect to a network**.



5. Under **Connections**, select the desired VPN connection.



6. Follow the on-screen instructions.

If you are not sure about the information that you should provide, contact your network administrator.

8 Accessing Your Unit Remotely

You can access your unit remotely from a computer using the Remote Desktop Connection application.

You can access your unit remotely from a computer using either the Remote Desktop Connection application or a VNC viewer.

The table below presents the differences between the two applications.

Characteristic	Remote Desktop Connection	VNC Viewer
Type of connection	Direct between the unit and the computer; only one user can be connected to the unit at a time. Usually, the connection is made with the user name of the person currently logged on the unit. Otherwise, this person will be automatically disconnected.	Not exclusive; several users can be connected to the unit at the same time (sharing the same session).
Windows user rights	Taken into account.	Not taken into account.
Password-protected	Yes; mandatory. The user name and password are the same as those used to connect to the unit. By default, all the accounts with administrator rights can use Remote Desktop Connection. If you want accounts with limited rights to be able to use Remote Desktop as well, you must specifically grant them access.	Yes; mandatory. You must define a password on the UltraVNC Server the first time you start the server. By default, all people that use the UltraVNC Viewer (or another VNC viewer) will enter the same password (as defined on the server). Each user to whom you provide the password will be able to connect to the unit via VNC.

Working with Remote Desktop

By default, the remote access to your unit with Remote Desktop is not enabled. However, once you enable it, all the accounts with administrator rights can use Remote Desktop. If you want accounts with limited rights to be able to use it as well, you must specifically grant them access.

You can also configure the unit to prevent users from accessing it remotely.

Accessing Your Unit with Remote Desktop

To be able to connect to the unit using Remote Desktop, you must:

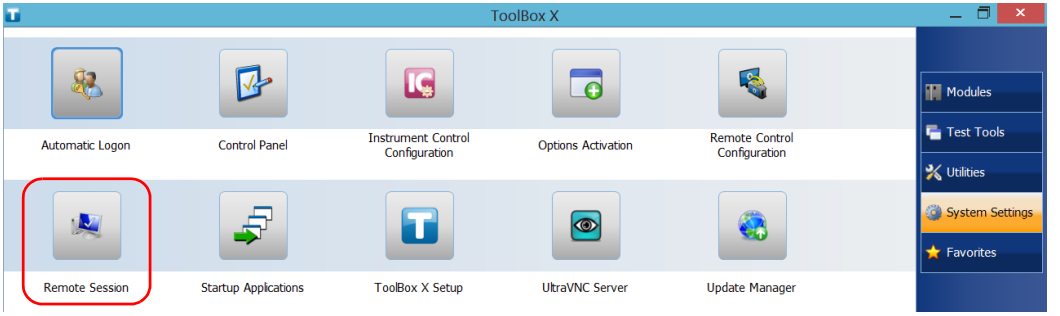
- Allow the remote access to your unit (only necessary the first time that you access your unit with Remote Desktop).
- Know the IP address of the unit and provide it in the connection settings on the computer.

Note: *If your unit and the computer are on the same network, you can even use the computer name of your unit, which corresponds to the model of your unit, followed by its serial number. You can view the computer name of your unit from* ***System Settings*** *>* ***Remote Session*** *>* ***Computer Name****.*

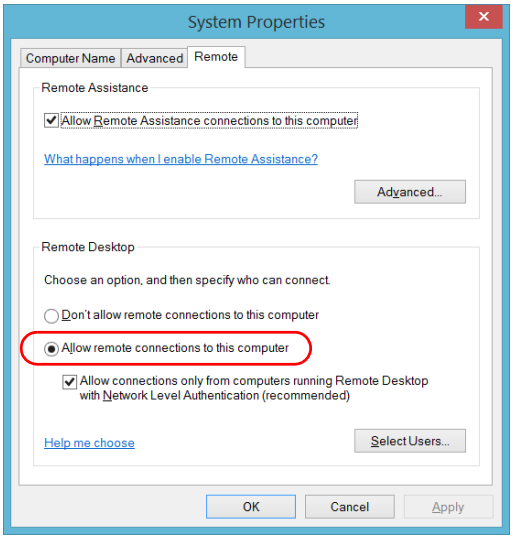
- Use an account that is secured by a password. Remote Desktop will not allow any connection with empty passwords.
- Enter the appropriate user name when Remote Desktop application prompts you. Usually, this user name must correspond to the user name of the person currently logged on the unit. Otherwise, you will disconnect the person that was already connected.

To allow the remote access to your unit with Remote Desktop:

1. From the main window, tap the **System Settings** button.
2. Tap **Remote Session**.



3. Under **Remote Desktop**, select **Allow remote connections to this computer**.



4. Tap **OK** to confirm the changes and return to the **System Settings** window.

To access your unit remotely with Remote Desktop:

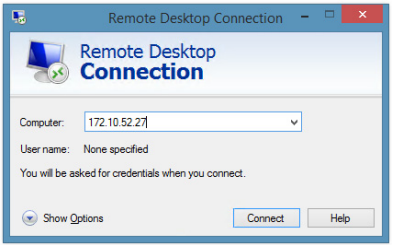
1. Connect both the computer and your unit to the same network and make sure they can "see" each other as network restrictions might prevent them from communicating.
2. Turn on both the computer and the unit.
3. On your unit, from Toolbox X, tap the button (located at the bottom of the button bar).
4. Select the **Platform** tab, write down the IP address, and then close the window.

Note: *It may take a few seconds before you see the IP address on the list.*

5. From the computer, open the Remote Desktop Connection window.

   - If your computer runs Windows Vista or Windows 7: On the taskbar, click **Start**, then select **All Programs** > **Accessories** > **Remote Desktop Connection**.
   - If your computer runs Windows 8: On the taskbar, point the lower left corner, and then click the **Start** screen icon. Right-click the bottom of the screen, and then click **All apps**. Under **Windows Accessories**, select **Remote Desktop Connection**.
   - If your computer runs Windows 8.1 or Windows 10: On the taskbar, click the **Start** button ( ), then under **Windows Accessories**, select **Remote Desktop Connection**.

6. In the **Connecting to Remote Desktop** window, in the **Computer** list, type the IP address of the unit that you wrote down at step 4.



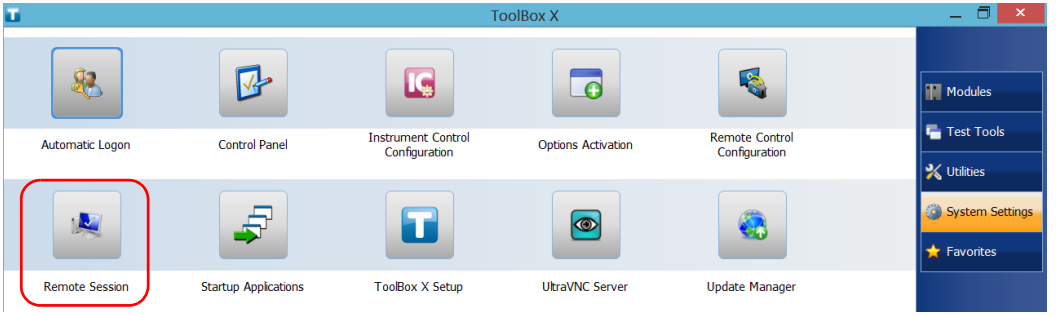
7. Click **Connect**.
8. When the application prompts you, enter your user name and password.
9. Click **OK** to open the session.

Allowing Users with Limited Accounts to Use Remote Desktop

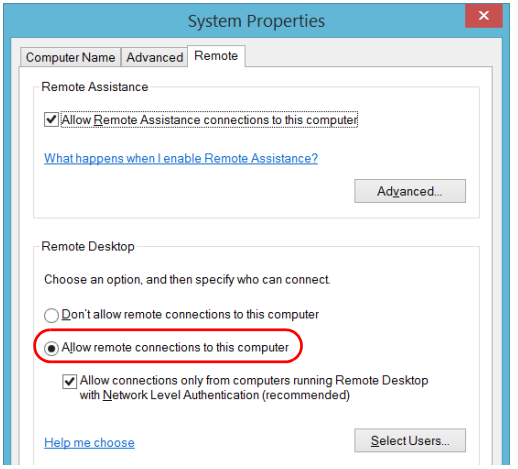
By default, only the accounts with administrator rights can use Remote Desktop. However, you can assign extra user rights to accounts with limited rights so that they can also use Remote Desktop.

To allow a user with limited accounts to use Remote Desktop:

1. From the main window, tap the **System Settings** button.
2. Tap **Remote Session.**

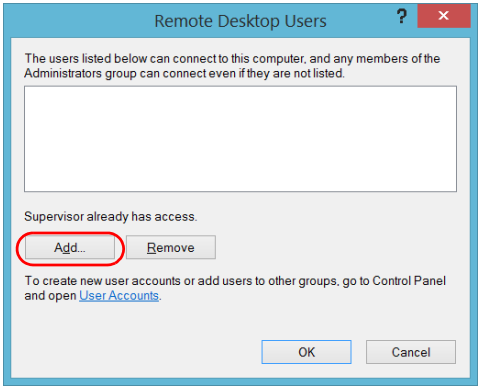


3. Under **Remote Desktop**, select **Allow remote connections to this computer**.

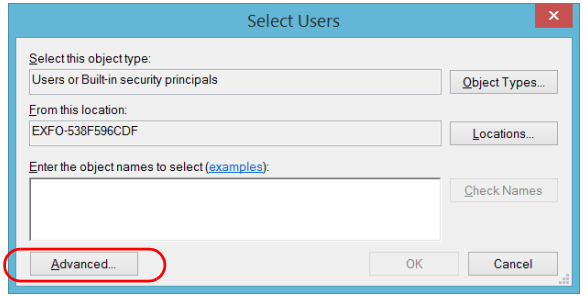


4. Tap **Select Users**.

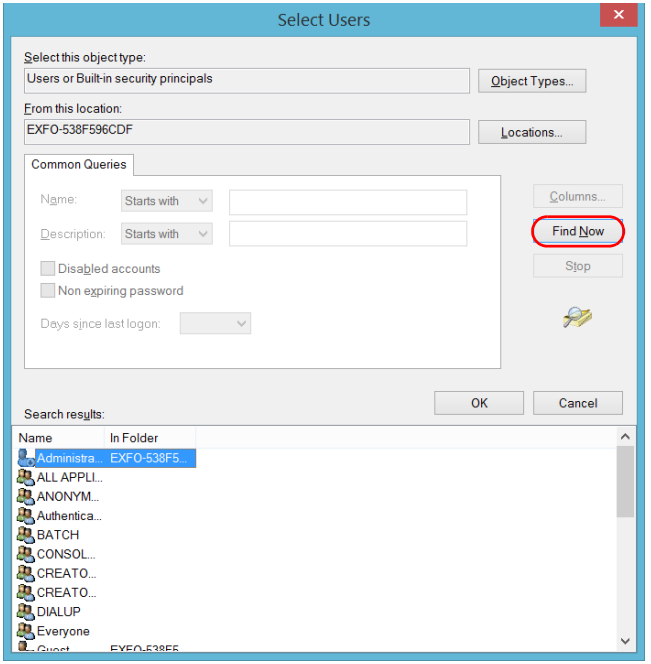
5. From the **Remote Desktop Users** dialog box, tap **Add**.



6. From the **Select Users** dialog box, tap **Advanced**.

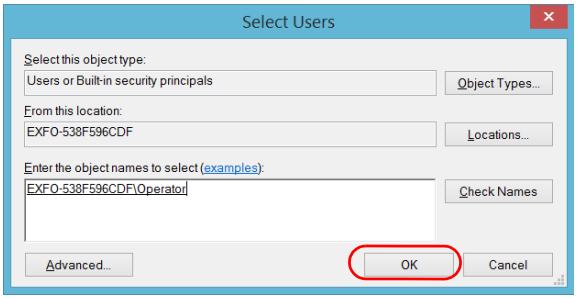


7. Tap **Find Now** to let the system find and display the list of users.



8. Select the user to which you want to grant access rights, and then tap **OK**.

9. From the list of users, select the user that you have just added, and then tap **OK**.



10. Repeat steps 7 to 9 with all the users to which you want to grant access rights.

11. From the **Remote Desktop Users** dialog box, tap **OK**.

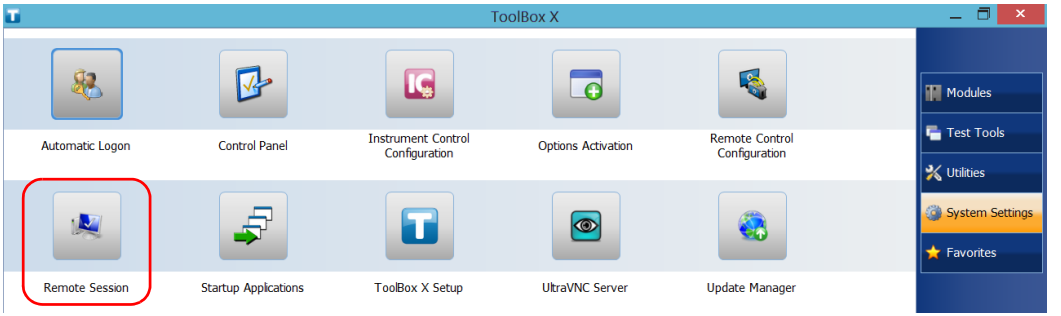
12. From the **System Properties** dialog box, tap **OK** to confirm the changes and return to the **System Settings** window.

Preventing Users from Connecting with Remote Desktop

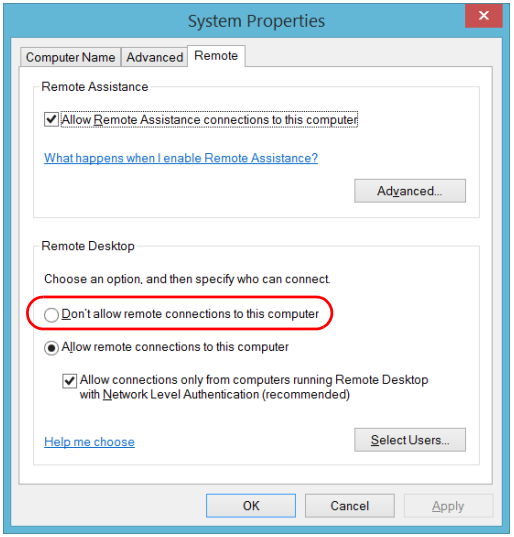
You can also configure the unit to prevent users to access it using Remote Desktop. However, all users having administrator user rights will be able to modify this setting at any time.

To prevent users from connecting to the unit using Remote Desktop:

1. From the main window, tap the **System Settings** button.
2. Tap **Remote Session**.



3. Under **Remote Desktop**, select **Don't allow remote connections to this computer**.



4. Tap **OK** to confirm the changes and return to the **System Settings** window.

Working With VNC

The control of your unit with VNC requires the UltraVNC Server (already installed on your unit) and a VNC viewer (that you must install on your computer).

To be able to connect to the unit using VNC, you must:

- Know the IP address of the unit and provide it in the connection settings on the computer.
- Know the password (same for all users by default).

This section provides you with the basic information to control your unit with VNC.

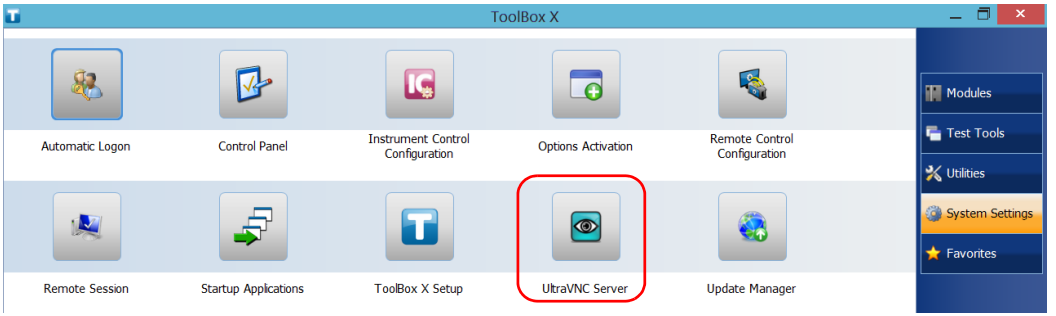
Configuring the VNC Server

The UltraVNC Server is already installed on your unit. By default, the server is configured to accept secured connections only. This means that you must configure a password before establishing a connection between a computer and your unit.

You can modify various connection settings to better suit your needs.

To configure the VNC Server:

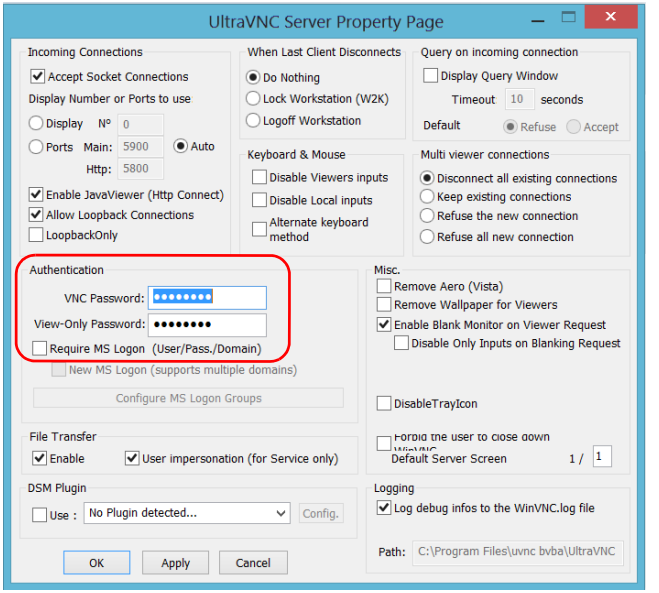
1. From the main window, tap the **System Settings** button.
2. Tap **UltraVNC Server**.



3. From the notification area, right-click the UltraVNC icon.

4. From the shortcut menu, tap **Admin Properties**.

5. Depending on the type of connection that you want, under **Authentication**, enter a value in the **VNC Password** or **View-Only Password** box.



Note: *The VNC and view-only passwords are independent of each other. They do not have to be identical.*

6. Tap **Apply**, and then **OK**.

Installing the VNC Viewer on a Client Computer

If no VNC viewer is already installed on your computer, you can download the UltraVNC Viewer from the Web for free.

IMPORTANT

EXFO does not provide licenses for UltraVNC Viewer. Always ensure that you are entitled to install it on your computer.

To install the UltraVNC Viewer on your computer:

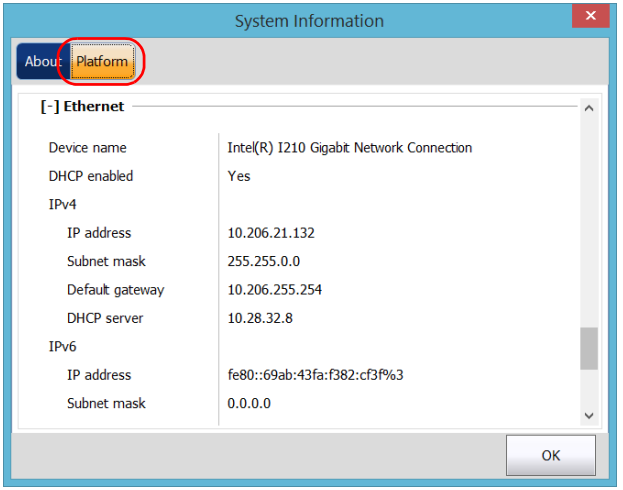
1. Open a Web browser and go to http://www.uvnc.com/downloads/ultravnc.html.
2. Download the version of the viewer that corresponds to the operating system that your computer is running.
3. Double-click the file that you have just downloaded to start the installation.
4. Follow the on-screen instructions.

Connecting to Your Unit with VNC

Once the UltraVNC Viewer is installed on your computer, you are ready to access your unit remotely.

To connect to your unit with UltraVNC:

1. Connect both the computer and your unit to the same network and make sure they can "see" each other as network restrictions might prevent them from communicating.
2. Turn on both the computer and the unit.
3. On your unit, ensure that Toolbox X is open.
4. At the bottom of the button bar, tap .
5. Tap **Platform**.
6. Scroll down until you can see the IP address.

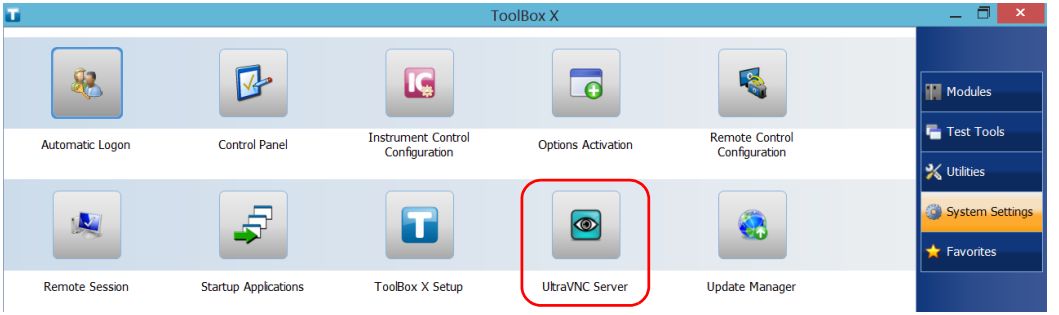


7. Write down the IP address, and then close the window.

Note: *It may take a few seconds before you see the IP address on the list.*

8. From the main window, tap the **System Settings** button.

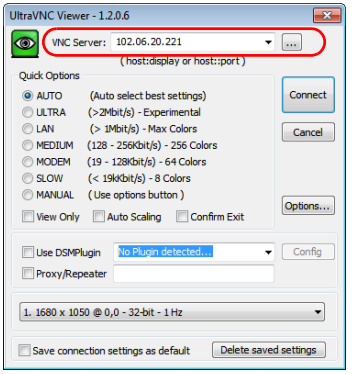
9. Tap **UltraVNC Server** to start the server.



Note: *For security reasons, the UltraVNC Server is not started automatically. However, if you prefer that your unit remains ready for remote connections at all times, you can install the corresponding service (right-click the UltraVNC icon, and then tap **Install Service**). Refer to the Web site of UltraVNC (http://www.uvnc.com) for more information.*

10. From your computer, start the UltraVNC Viewer.

11. In the **VNC Server** list, type the IP address of your unit that you wrote down at step 7.



Note: *The appearance of the UltraVNC Viewer window may vary depending on the version of the viewer that you have.*

12. Click **Connect**.

13. When the application prompts you for a password, enter it and click **OK** to confirm.

Adding Exceptions to the Firewall

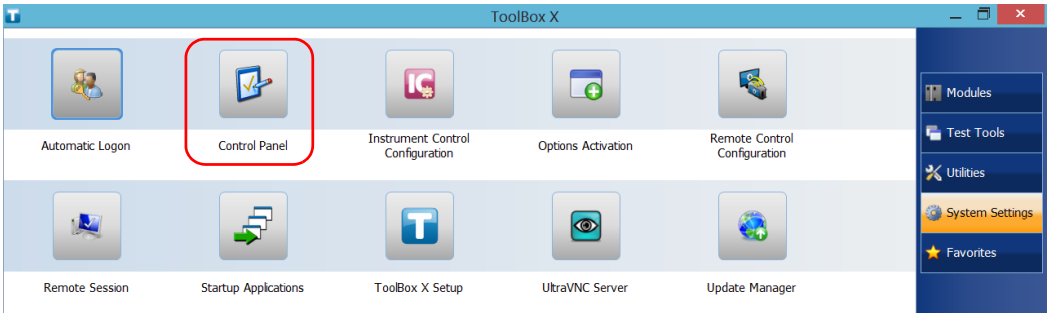
Note: *Only administrator-level users can add exceptions to the firewall.*

Your unit is protected by the Microsoft firewall to prevent unauthorized access when it is connected to a network or to the Internet. The firewall has been preconfigured so that all the applications that come with your unit work properly. However, you can allow other applications to access the network or the Internet by adding exceptions.

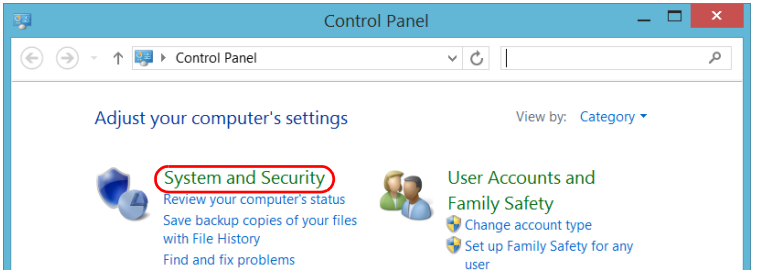
If you are not sure about how to configure the firewall, contact your network administrator.

To add exceptions to the firewall:

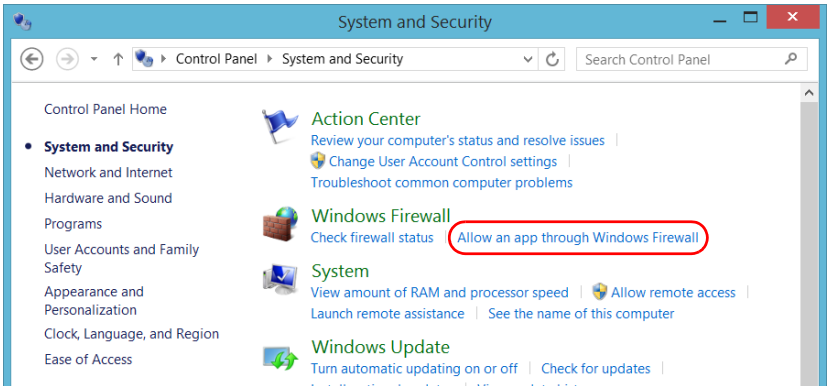
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.



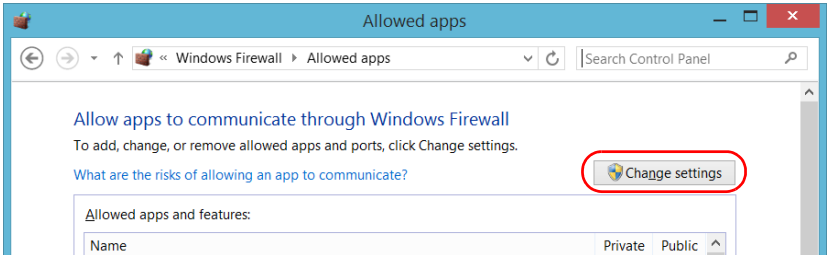
3. Tap **System and Security**.



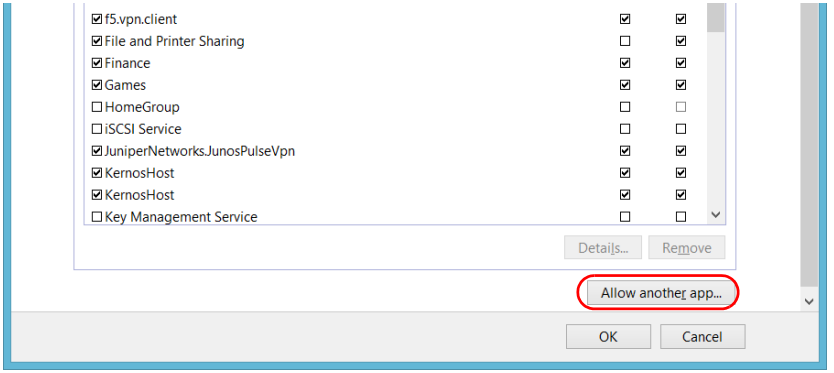
4. Under **Windows Firewall**, tap **Allow an app through Windows Firewall**.



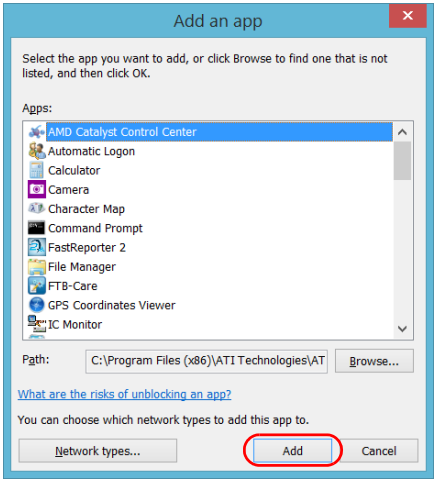
5. Tap the **Change settings** button.



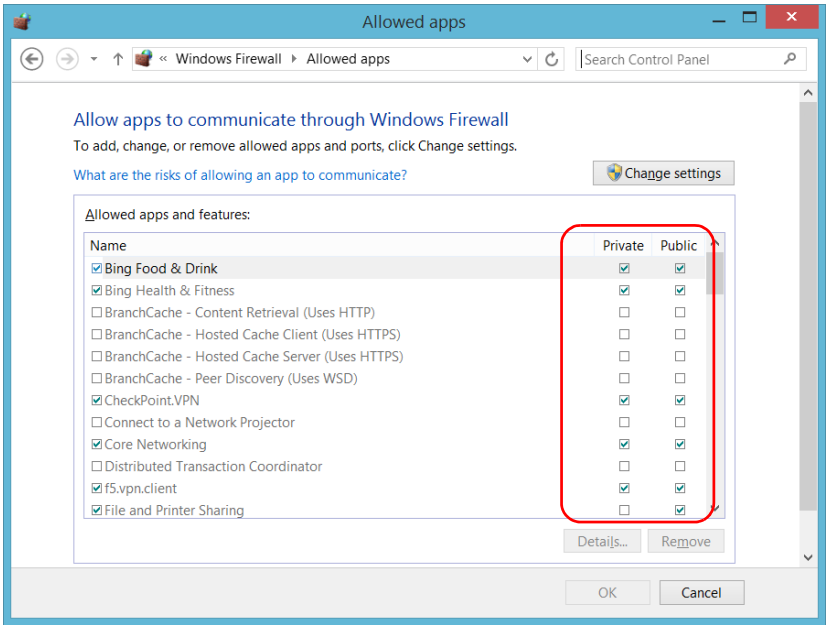
6. Tap the **Allow another app** button.



7. Select the desired application from the list, and then tap **Add**.



8. Ensure that the **Private** and **Public** settings of the added application suit your needs.

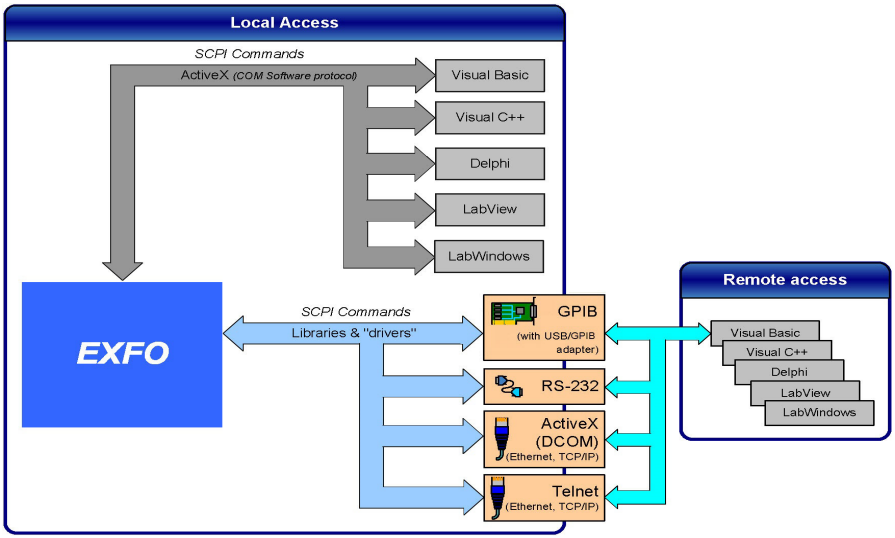


9. When you have finished, tap **OK** to confirm the changes and return to the **Control Panel** window.

9 Preparing for Automation

Your unit was designed to meet the requirements of automation and to facilitate its integration with your test environment.

EXFO supplies commands that follow the guidelines determined by the SCPI consortium for many instruments. EXFO also supplies COM properties and events allowing you to build your own application. The instruments can be controlled either locally or remotely via the following technologies:



The choice of a technology depends on your particular needs.

Control	Technology	Characteristics
Local	ActiveX (COM)	➤ Allows you to develop an application that will run locally on your unit within Windows ➤ Best approach when speed is your top priority (no physical connection that slows down the process) ➤ Supported by most development software ➤ Lower cost
Remote	ActiveX (DCOM) (Ethernet, TCP/IP)	➤ Allows the sharing of network resources ➤ Allows you to develop computer-based applications to directly communicate with your unit
Remote	GPIB	➤ The optional USB/GPIB adapter must be connected to the unit ➤ The unit can be used as a device in a GPIB chain (it meets the IEEE 488.2 standard) ➤ A single GPIB address allows you to control up to 100 logical optical instruments ➤ Most commonly used interface to simultaneously control many instruments
Remote	RS-232	➤ Null-modem cable or USB to RS-232 adapter required to establish connection between the computer and your unit ➤ For increased speed and performance, run the application locally on your unit through ActiveX instead of using RS-232

Control	Technology	Characteristics
Remote	Telnet (Ethernet, TCP/IP)	➤ Your unit can be directly connected to a Local Area Network (LAN) or Wide Area Network (WAN) via its 10/100/1000 Base-T interface ➤ Allows the sharing of network resources ➤ Allows you to develop computer-based applications very easily to directly communicate with your unit

For more information on programming aspects, see the section on using your product in an automated test environment.

Preparing Hardware for GPIB Control

If you intend to use GPIB to remotely control your instruments, you must first connect the optional USB/GPIB adapter sold by EXFO.

To ensure the optimum efficiency of your system, EXFO recommends that you follow these restrictions:

For the IEEE 488.1 protocol:

- Maximum of 15 devices physically connected to each GPIB bus.
- Maximum separation of 4 m between two devices and an average separation of 2 m over the entire range (bus).
- Maximum total cable length used in the system is 20 m.
- At least two-thirds of the connected devices must be turned on.

For the HS488 protocol:

- Maximum of 15 devices physically connected to each GPIB bus.
- Maximum total cable length used in the system is 15 m (that is, 1 m per device physically connected to the GPIB bus).
- All connected devices must be turned on.
- For each meter of cable used in the system, there must be a device connected to it or an equivalent device load.

The LTB-1 configuration complies with the IEEE 488.1 (also known as IEC60625.1) and the IEEE 488.2 (also known as IEC60625.2) standards to the extent shown in the following table.

Mnemonic	Function
SHE1[a]	Complete source handshake extended capability
AHE1[b]	Complete acceptor handshake extended capability
T6	Basic talker with serial poll; unaddressed to talk if addressed to listen
L4	Basic listener; unaddressed to listen if addressed to talk
SR1	Complete service request capability
RL2	No local lockout capability
PP0	No parallel poll capability
DC1	Complete Device Clear capability
DT0	No Device Trigger capability
C0	No controller capability
E2	Three-state driver capability

a. SHE1 corresponds to the extended capability of SH1, defined in the IEEE 488.1 standard. This extended capability is made possible by the device capability to use the HS488 high-speed protocol.

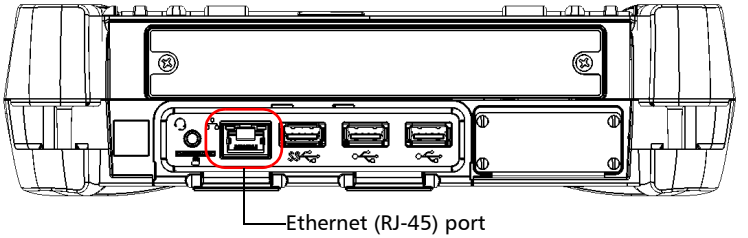
b. AHE1 corresponds to the extended capability of AH1, defined in the IEEE 488.1 standard. This extended capability is made possible by the device capability to use the HS488 high-speed protocol.

Linking Units with the GPIB Port

Your unit is not equipped with a GPIB port, but you can connect a USB to GPIB adapter (sold by EXFO) to one of the USB ports of your unit if you wish to send and receive data via GPIB.

Linking Units with the Ethernet Port

Your unit is equipped with Ethernet ports (10/100/1000) to send and receive data. Refer to the Windows documentation for information about Ethernet port settings and possibilities.



Linking Units Using a Serial Port

Your unit is not equipped with a serial (RS-232) port, but you can connect a USB to RS-232 adapter (sold by EXFO) to your one of the USB ports of your unit if you wish to send and receive data via RS-232. Refer to the Microsoft Windows documentation for information about serial port settings and possibilities.

Getting Optimum Performance from Your Unit

Several factors influence the data transfer rate ofyour unit. The information presented hereafter will help you get the best transfer rate possible.

➤ *Protocol (GPIB control only)*: You can use the IEEE 488.1 (standard) or the HS488 (high-speed) protocol. Both protocols can co-exist in the same system; communication between devices can then be achieved using the IEEE 488.1 protocol.

HS488 is a non-interlocked handshake protocol that allows data transmission between devices at higher rates (six to seven times faster for small systems) than those possible with the IEEE 488.1 protocol. Higher transfer rates are particularly interesting in systems containing devices that return long data blocks. However, the transfer rate is affected by the physical limitations of the cables used in the system.

For information on cabling, see *Preparing Hardware for GPIB Control* on page 158.

➤ *Bus timing (GPIB control only)*: Required if you intend to work with IEEE 488.1, for it affects the handshake rate of this protocol. It indicates the minimum amount of time a GPIB controller waits, once data is placed on the bus, before setting the data valid bus line (DAV) to true.

The possible bus timings are:

Mode	Bus timing delay
Normal	1100 ns
High speed	500 ns
Very high speed	350 ns

If your setup supports it, select the very-high-speed timing to get the best performance.

- *Output unit (GPIB, RS-232, ActiveX and TCP/IP):* Your unit can return results in
  - linear units (for example, watts)
  - log units (for example, dBm)

  Since internal units are linear, you will get optimal performance by using linear units for output (no need for an internal conversion to log).

Note: *You must make the choice of output unit for each instrument offering such a feature. Refer to the user guide of each optical instrument for a list of available commands and queries.*

- *Output format (GPIB, RS-232, ActiveX and TCP/IP)*: Your unit provides the following output formats for measurement results:
  - ASCii
  - PACKed

  Generally, the PACKed format allows to pass three to four times more information than the ASCii format for the same transfer rate. Often, the PACKed format is also more efficient since it reduces your unit's CPU work load (no need for an internal conversion to ASCII format).

Note: *The PACKed format will only be applied to <DEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA> and <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>.*

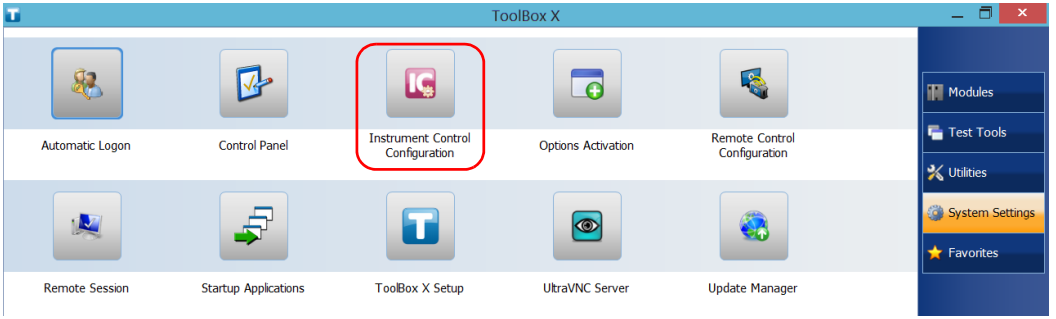
Note: *The choice of data format cannot be made directly via the ToolBox X software.*

For more information on how to set the output format and data types, see *:FORMat[:DATA]*(IEEE 488.2 and specific commands appendix), *Read* and *ReadBinary* (COM properties and events appendix), and the data types appendix.

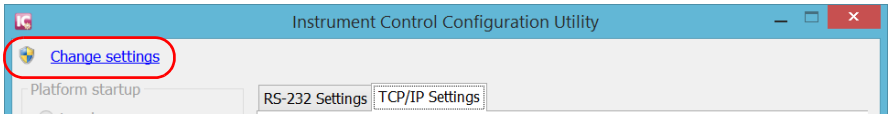
Changing Communication Settings

Communication settings cannot be modified without turning on your unit and starting ToolBox X.

1. Tap the **System Settings** button, then tap **Instrument Control Configuration**.



2. Tap **Change settings**, and then, when the application prompts you to authorize the changes to your unit (identified as “computer”), tap **Yes**.



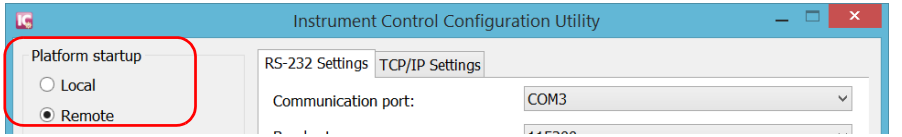
3. Under **Platform Startup**, determine whether your module applications will be started locally or remotely by clicking the corresponding option.

   ➤ If **Local** mode is selected, you will not be able to send remote commands to your unit.

   ➤ If **Remote** mode is selected, the module in your unit will be initialized upon startup so you are ready to send remote commands.

IMPORTANT

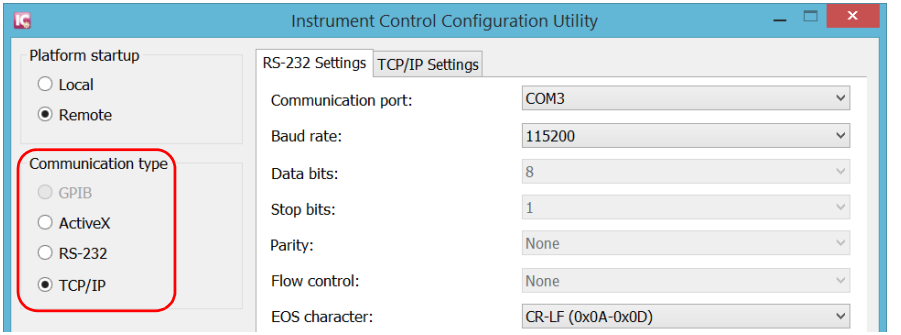
Before being able to control instruments with SCPI commands, you must also allow remote access to these instruments. For more information, see *Preparing to Control Modules with a Dedicated Application* on page 192.



If you selected **Local** mode, you can go directly to step 6.

4. Under **Communication Type**, select **GPIB**, **ActiveX**, **RS-232**, or **TCP/IP**.

For more information on the choice of a particular type, see the table on page 156.

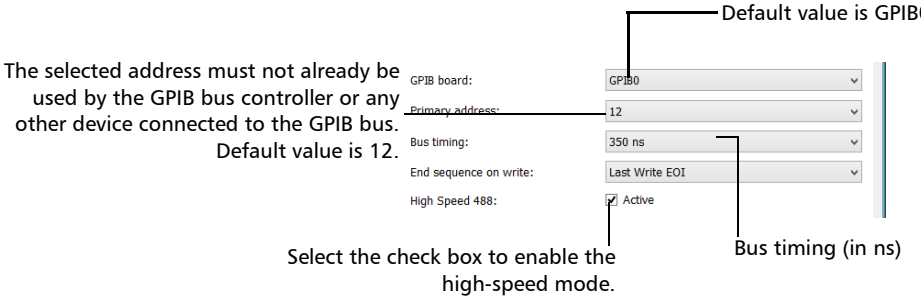


Note: *The GPIB option is only visible if the USB to GPIB adapter is connected to one of the USB ports of your unit.*

Note: *If the selected communication type does not match the protocol that will actually be used, an error message is displayed when attempting to control the instruments.*

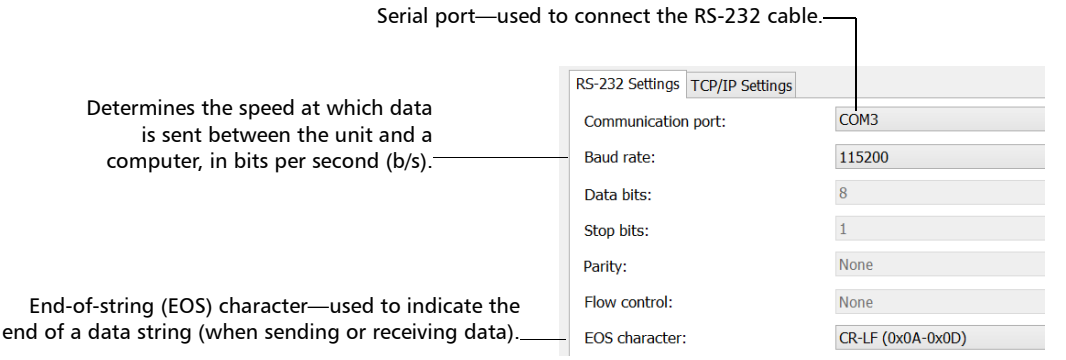
5. According to the communication type you have selected, customize the corresponding parameters as shown below.

➤ For GPIB

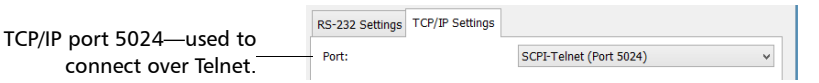


For information on bus timing or on high-speed mode, see the section pertaining to obtaining an optimum performance from your unit.

➤ For RS-232



➤ For TCP/IP

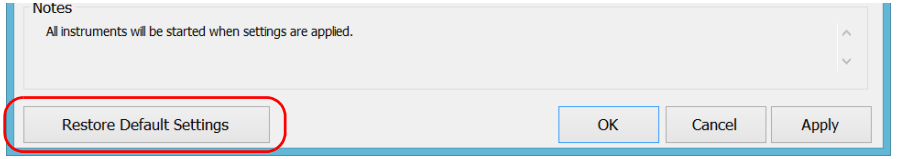


For information on communicating with TCP/IP over Telnet, see the section pertaining to communication through TCP/IP over Telnet.

6. Tap **Apply** to confirm your changes.

To revert to default general settings:

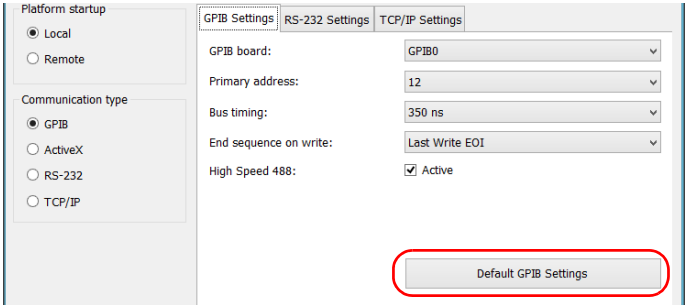
1. Tap the **Restore Default Settings** button.



2. Tap **Apply** to confirm your changes.

To revert to default GPIB settings:

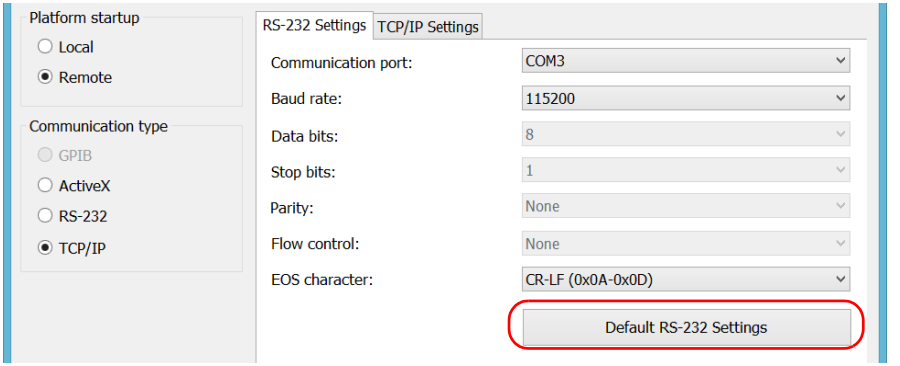
1. Tap the **Default GPIB Settings** button.



2. Tap **Apply** to confirm your changes.

To revert to default RS-232 settings:

1. Tap the **Default RS-232 Settings** button.



2. Tap **Apply** to confirm your changes.

Configuring DCOM Access to Your Unit

DCOM technology allows to control devices and optical instruments via Ethernet. The EXFO IcSCPIAccess Class component provided with your unit acts as a communication link between a client application and EXFO's Instrument Control. For more information, refer to the EXFO Remote Control Demo available in EXFO Apps, at http://www.exfo.com/software/exfo-apps/exfo-remote-control-demo.

DCOM ensures communication between the client application and Instrument Control via your local network. Since each network has its own configuration, you need to be familiar with network security, users, groups, domain management, etc. Basic programming skills are also required to work with DCOM. For more information, you can refer to the Microsoft MSDN Help feature, which provides exhaustive technical documentation on all DCOM issues.

The example presented in the following pages illustrates how to make the EXFO IcSCPIAccess Class component available to all users of a local network under Windows 8.1 Pro. The example provided below is for guidance only; it may not work properly with all networks and interfaces may slightly differ depending on the operating system used.

To enable DCOM access to your unit, you must:

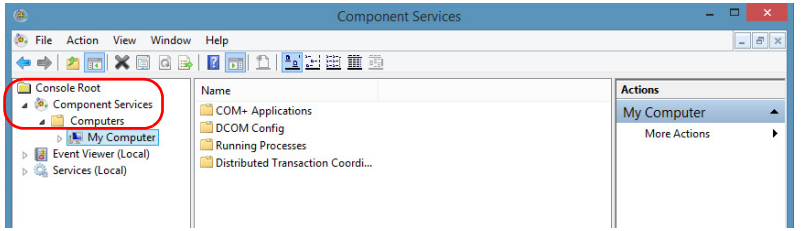
- set the general security parameters
- customize the specific security parameters
- register callback events.

Setting the General Security Parameters

Note: *To modify the security parameters, you need administrator access rights.*

To set the general security parameters:

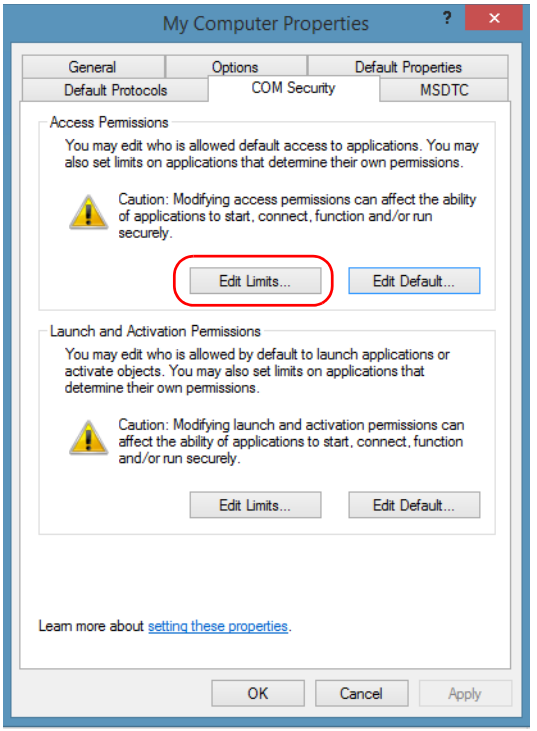
1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.
3. Tap **System and Security** > **Administrative Tools**.
4. Double-tap **Component Services**.
5. In the **Component Services** dialog box, go to **Console Root** > **Component Services** > **Computers**.



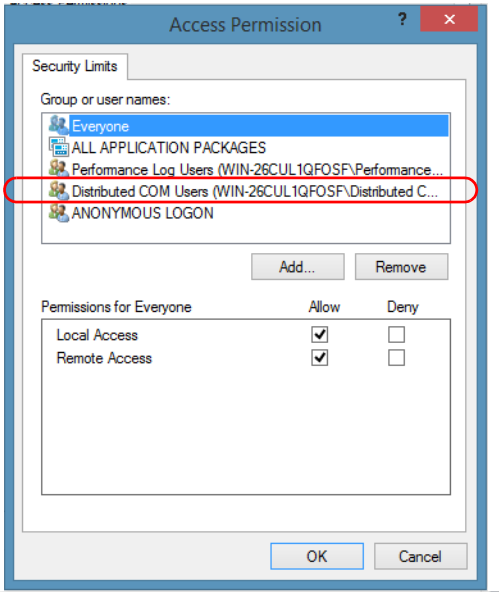
6. Right-click **My Computer**, and then select **Properties**.

7. In the **My Computer Properties** dialog box, tap the **COM Security** tab.

8. Under **Access Permissions**, tap **Edit Limits**.



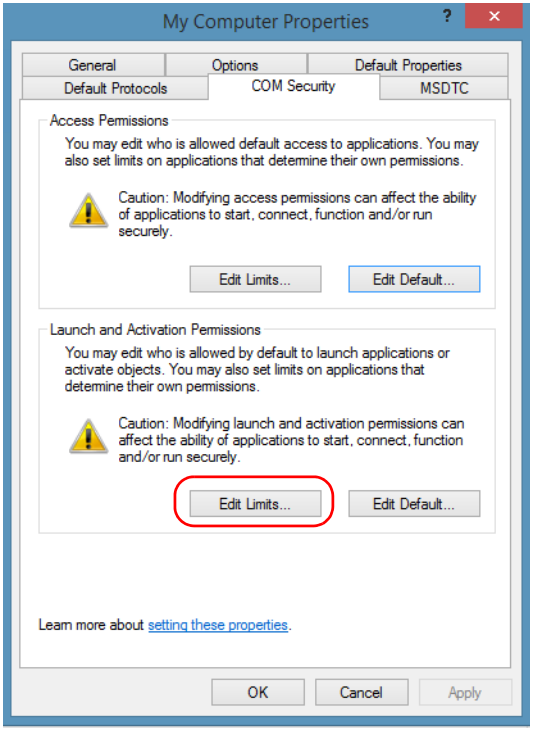
9. In the **Access Permission** dialog box, ensure that the **Distributed COM Users** group appears in the **Group or user names** list.



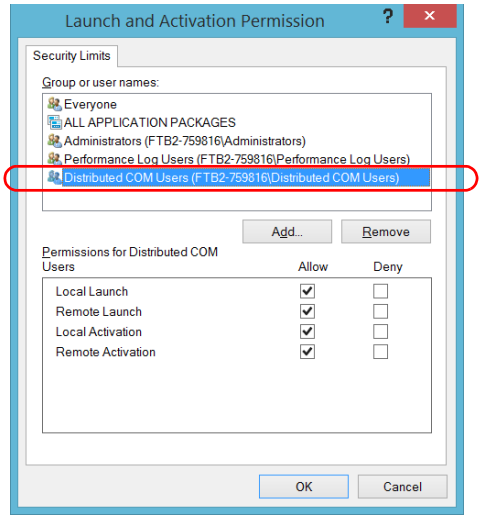
10. Tap **OK**.

11. In the **My Computer Properties** dialog box, tap the **COM Security** tab.

12. Under **Launch and Activation Permissions**, tap **Edit Limits**.



13. In the **Access Permission** dialog box, ensure that the **Distributed COM Users** group appears in the **Group or user names** list.



You can now allow users to access general DCOM services on your unit. You can either:

➤ Add a user to the **Distributed COM Users** group (refer to Microsoft help).

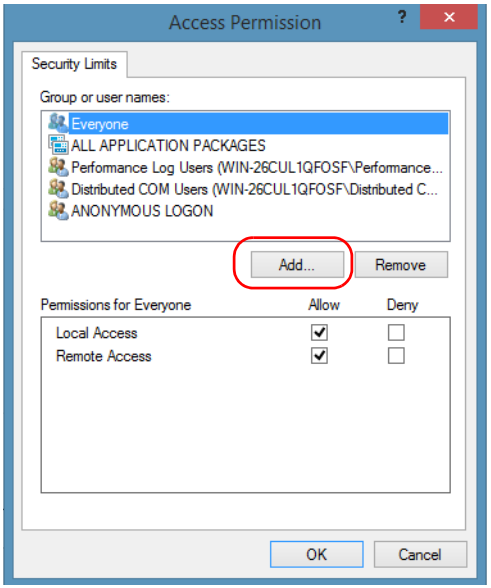
OR

➤ Add a user explicitly and define both, access and launch permissions (see procedure below).

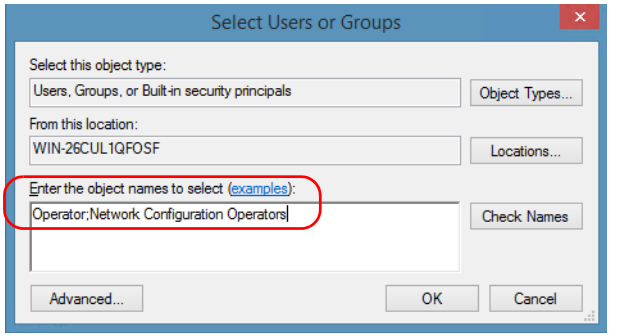
Note: *If you add a user explicitly, ensure to give remote access rights to the new user.*

To add a user explicitly:

1. In the **My Computer Properties** dialog box, tap the **COM Security** tab.
2. Under **Access Permission**, tap **Edit Limits**.
3. In the **Access Permission** dialog box, tap **Add**.



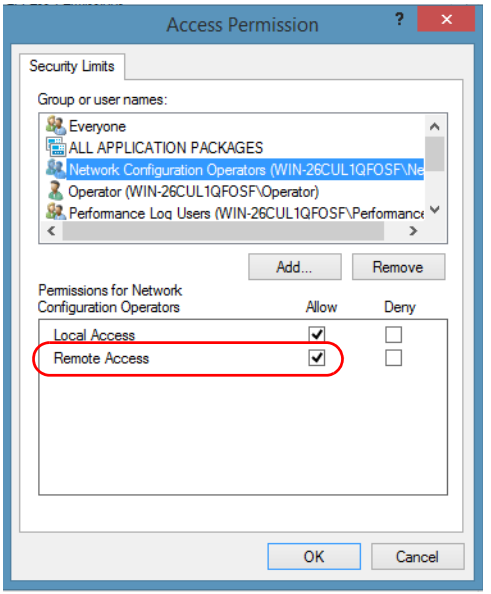
4. In the **Select Users or Groups** dialog box, under **Enter the object names to select**, type the name of the user to whom you want to give access rights.



5. Tap **OK**.

6. Confirm the newly added user has remote access permission as follows:

6a. In the **Access Permission** dialog box, select the name of the new user.



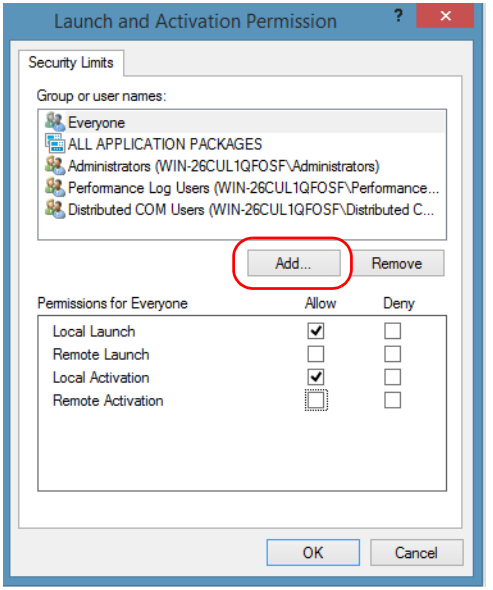
6b. Under **Permissions for** (new user), ensure **Allow** is selected for **Remote Access**.

6c. Tap **OK**.

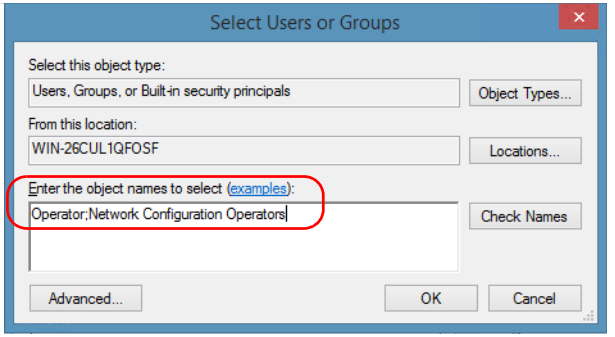
7. In the **My Computer Properties** dialog box, tap the **COM Security** tab.

8. Under **Launch and Activation Permissions**, tap **Edit Limits**.

9. In the **Launch and Activation Permission** dialog box, tap **Add**.



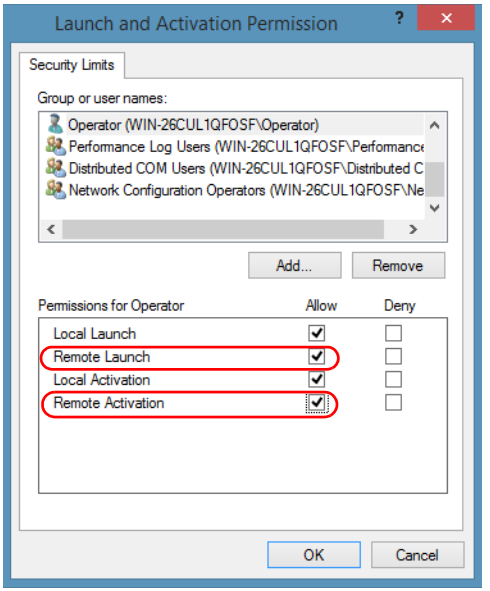
10. In the **Select Users or Groups** dialog box, under **Enter the object names to select**, type the name of the user to whom you want to give start and activation access rights.



11. Tap **OK**.

12. Confirm the newly added user has **Remote Launch** and **Remote Activation** permissions as follows:

12a. In the **Launch Permission** dialog box, select the name of the new user.



12b. Under **Permissions for** (new user), ensure **Allow** is selected for both **Remote Launch** and **Remote Activation**.

12c. Tap **OK**.

Customizing the Specific Security Parameters

Once you have defined the general security parameters, you can define the specific security parameters.

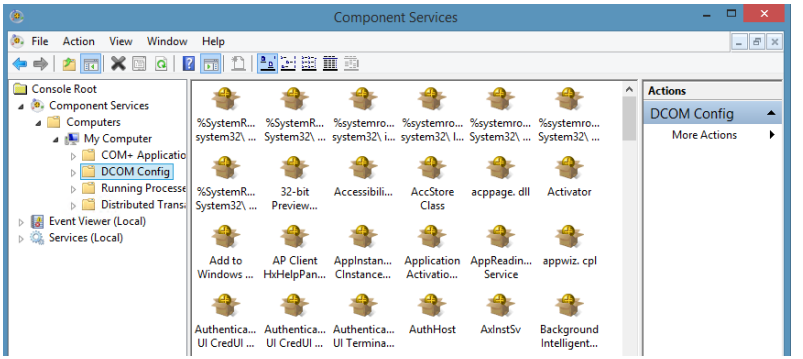
IMPORTANT

Customizing access rights sets both remote AND local permissions. As a result, you will have to specify every user who must have local access to the system (see *Setting the General Security Parameters* on page 170).

If you do not specify local access rights, no user will be able to access EXFO KernosHost and, therefore, no user will be able to start ToolBox X.

To customize the specific security parameters:

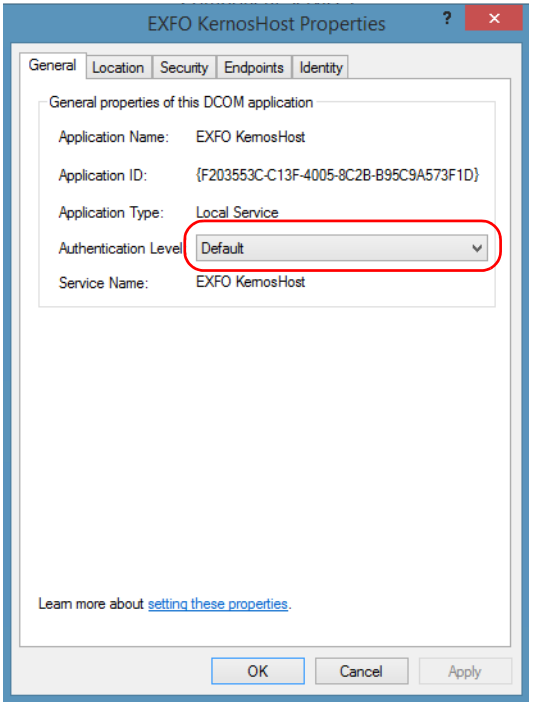
1. From the **Component Services** window, select: **Console Root** > **Component Services** > **Computers** > **My Computer** > **DCOM Config** to show the contents of the **DCOM Config** folder.



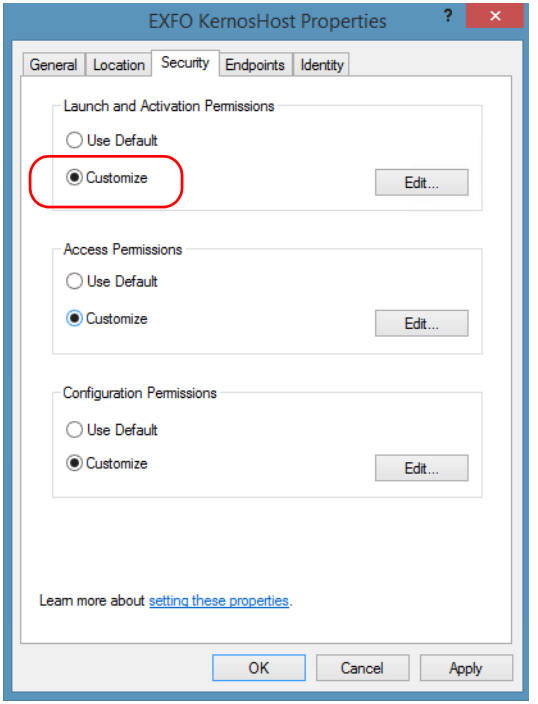
2. From **DCOM Config**, right-click **EXFO KernosHost**, and select **Properties**.

3. Tap the **General** tab.

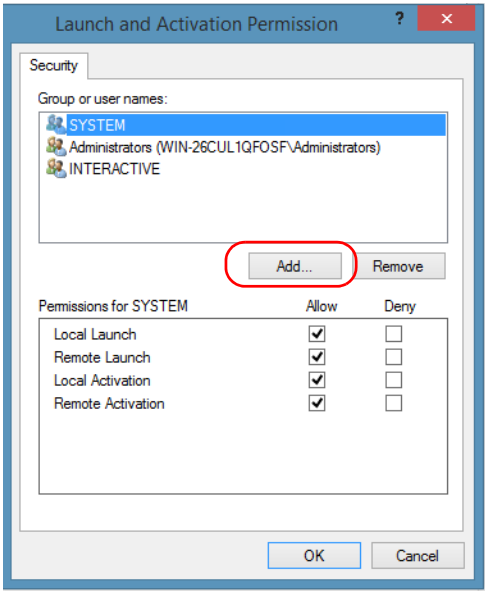
4. In the **Authentication Level** list, select **Default**.



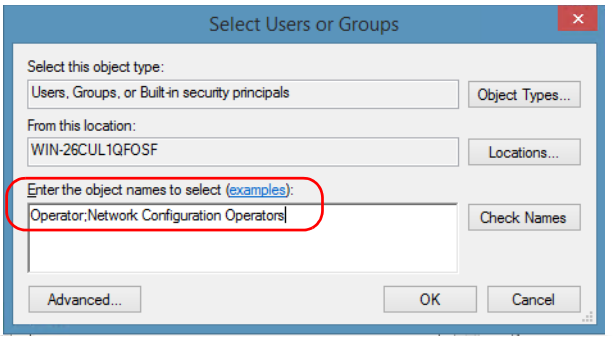
5. In the **EXFO KernosHost Properties** dialog box, tap the **Security** tab.
6. Under **Launch and Activation Permissions**, select **Customize**, and then click **Edit** to edit the list of allowed users.



7. In the **Launch and Activation Permission** dialog box, tap **Add**.



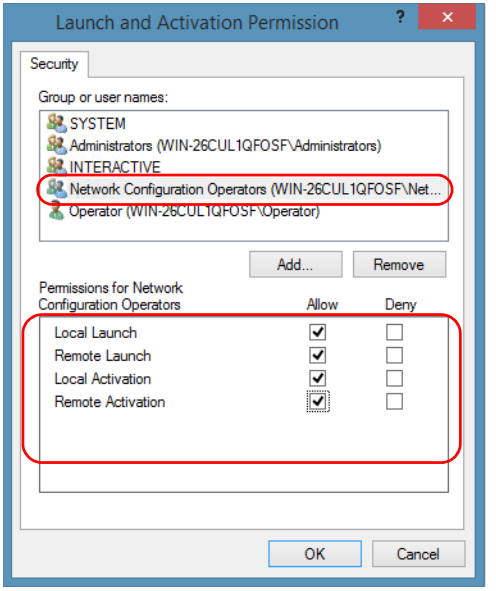
8. In the **Select Users or Groups** dialog box, under **Enter the object names to select**, type the name of the user to whom you want to give start and activation permissions for remote access.



9. Tap **OK**.

10. In the **Launch and Activation Permission** dialog box, select a user.

11. To allow this user to start and activate the unit remotely, select **Allow** for all four permission choices.

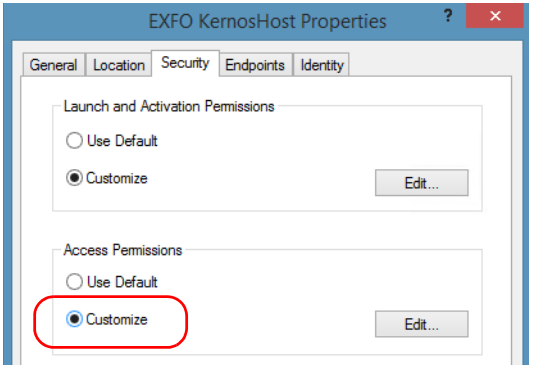


12. Repeat steps 10 and 11 for each newly added user.

13. Tap **OK**.

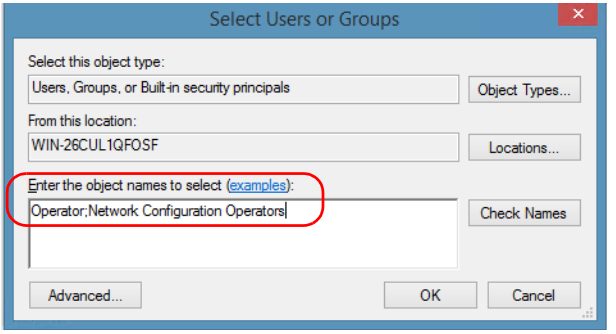
14. In the **EXFO KernosHost Properties** dialog box, tap the **Security** tab.

15. Under **Access Permissions**, select **Customize**, and tap **Edit** to edit the list of allowed users.



16. In the **Access Permission** dialog box, tap **Add**.

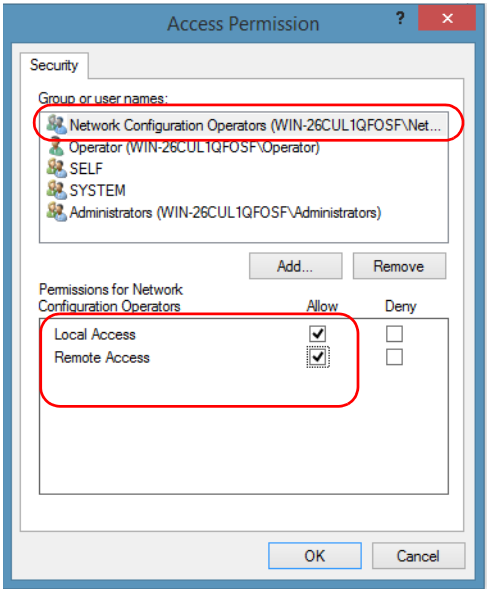
17. In the **Select Users or Groups** dialog box, under **Enter the object names to select**, type the name of the user to whom you want to give access permissions for remote access.



18. Tap **OK**.

19. In the **Access Permission** dialog box, select a user.

20. To allow this user to access the unit remotely, select **Allow** for both permission choices.



Note: *You can also deny connection permission for specific users.*

21. Repeat steps 19 and 20 for each newly added user.

22. Tap **OK** to close the **Access Permission** dialog box.

23. Tap **OK** to close the **EXFO KernosHost Properties** dialog box.

24. Restart your unit.

The EXFO IcSCPIAccess Class component, located on your unit, can now be accessed with DCOM.

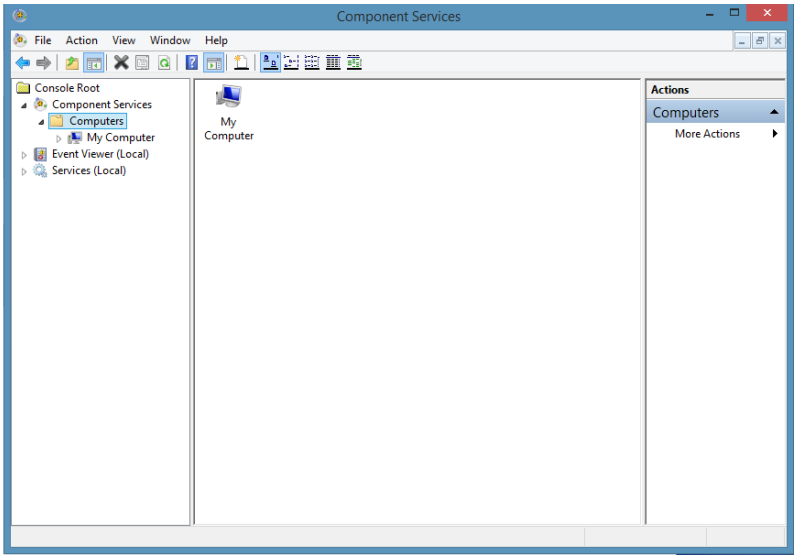
Enabling DCOM on Client Computer

Note: *To run DCOMCNFG.EXE, you need Administrator access rights.*

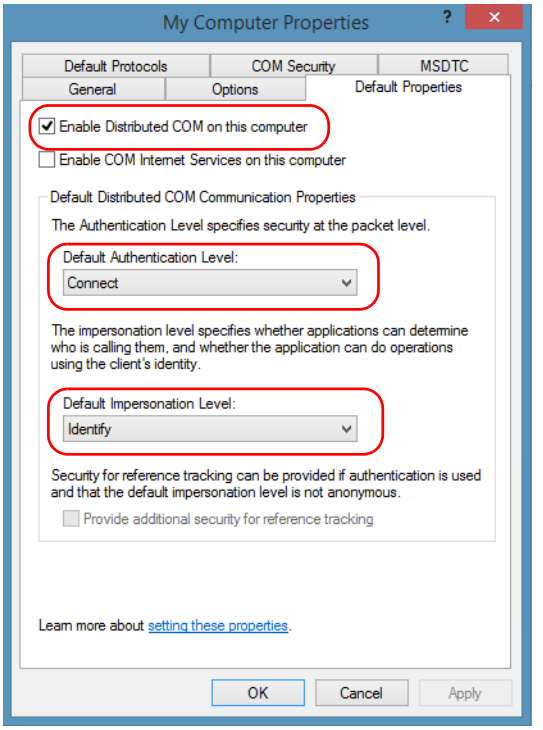
If you want to subscribe to EXFO IcSCPIAccess Class component events, you need to set security parameters on the client computer.

To enable DCOM on the client computer:

1. Start Windows, on the taskbar, click **Start** (Start button ( ) under Windows 8.1 and Windows 10) and select **Run**.
2. In the **Open** box, type “DCOMCNFG.EXE” and tap **OK**.
3. In the **Component Services** dialog box, select: **Console Root** > **Component Services** > **Computers** to show available computers.

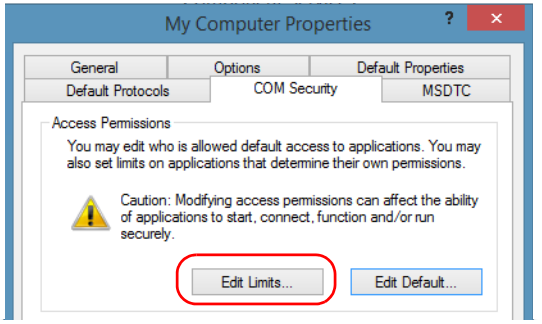


4. Right-click **My Computer**, and then select **Properties**.
5. In the **My Computer Properties** dialog box, tap the **Default Properties** tab.
6. Select **Enable Distributed COM on this computer**.



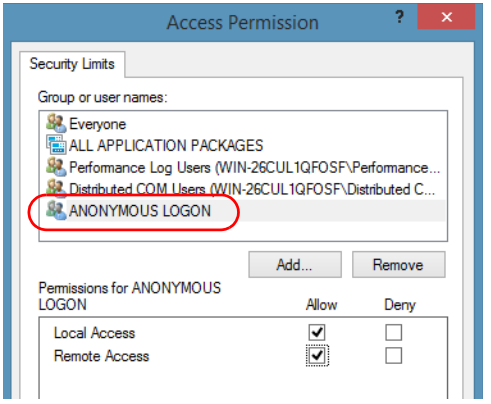
7. Under **Default Distributed COM Communication Properties**, in the **Default Authentication Level** list, select **Connect**.
8. In the **Default Impersonation Level** list, select **Identify**.
9. Tap **Apply**.

10. Tap the **COM Security** tab and, under **Access Permissions**, tap **Edit Limits**.



11. In the Access Permission dialog box, ensure that, for **ANONYMOUS LOGON**, local and remote accesses are allowed.

If **ANONYMOUS LOGON** is not listed under Group or user names, tap **Add** to add it.



For more information on enabling events with DCOM, refer to *AppId Key* in MSDN Documentation.

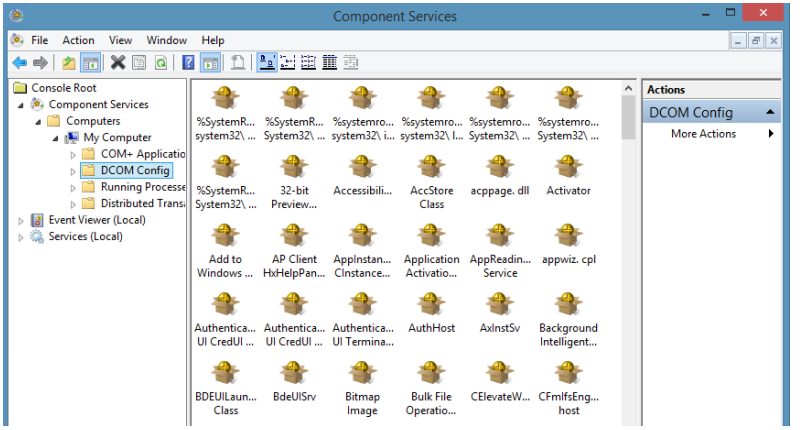
Disabling DCOM Access to Your Unit

Note: *To change the DCOM access to your unit, you need Administrator access rights.*

If you no longer want client computers to access your unit using DCOM, you can disable this access.

To disable DCOM access to your unit:

1. From the main window, tap the **System Settings** button.
2. Tap **Control Panel**.
3. Tap **System and Security** > **Administrative Tools**.
4. Double-tap **Component Services**.
5. From the **Component Services** window, select: **Console Root** > **Component Services** > **Computers** > **My Computer** > **DCOM Config** to show the contents of the **DCOM Config** folder.

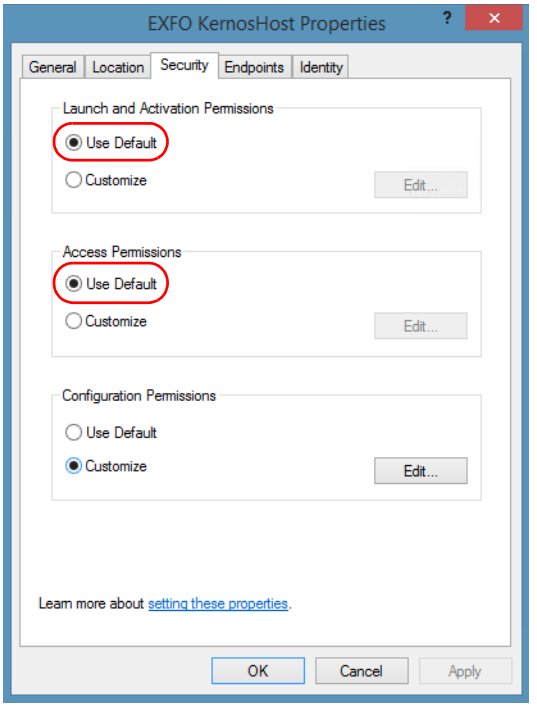


6. From **DCOM Config**, right-click **EXFO KernosHost**, and select **Properties**.

7. In the **EXFO KernosHost Properties** dialog box, clicktap the **Security** tab.

8. Under **Launch and Activation Permissions** and **Access Permissions**, select **Use Default**.

   This ensures the EXFO IcSCPIAccess Class component uses the default lists instead of the customized lists.



9. Tap **OK**.

10. Restart your unit.

    The EXFO IcSCPIAccess Class component, located on your unit, *cannot* be accessed with DCOM.

Preparing to Control Modules with a Dedicated Application

Some modules come with a dedicated application designed to control them remotely from a computer. The main characteristic of this application is that it lets another user control the module as if it was close at hand.

To control the module remotely, you must configure it on the unit containing the module, including a description that can help you identify it. The user controlling the module from a computer must install the dedicated application (for more information on the installation, refer to the application documentation).

Note: *The module can be controlled both remotely and locally at the same time.*

Note: *Some modules do not support the remote control.*

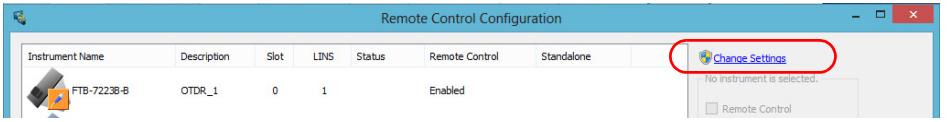
IMPORTANT

Before being able to control instruments with SCPI commands, you must first allow remote access to these instruments.

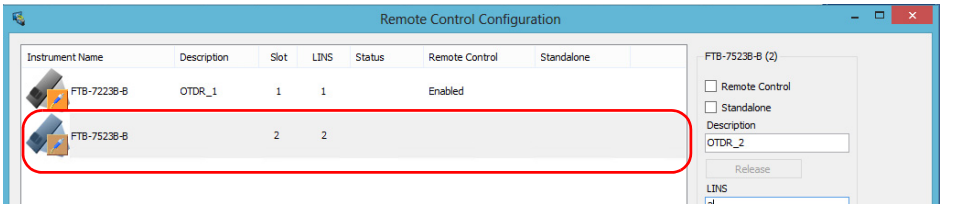
To activate or deactivate remote control:

1. From the main window, tap the **System Settings** button.
2. Tap **Remote Control Configuration**.

3. If necessary, tap **Change settings**, and then, when the application prompts you to authorize the changes to your unit (identified as "computer"), select **Yes**.



4. From the **Remote Control Configuration** window you will see all the modules. Select the module for which you want to have a remote access.

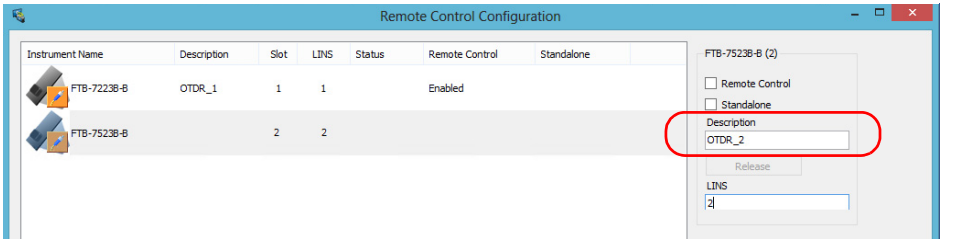


5. Set the parameters:

- ➤ Select **Remote Control** to be able to access the module remotely (via TCP/IP over Telnet or other).
- ➤ Select **Standalone** to leave the module active even if all users close their dedicated applications.

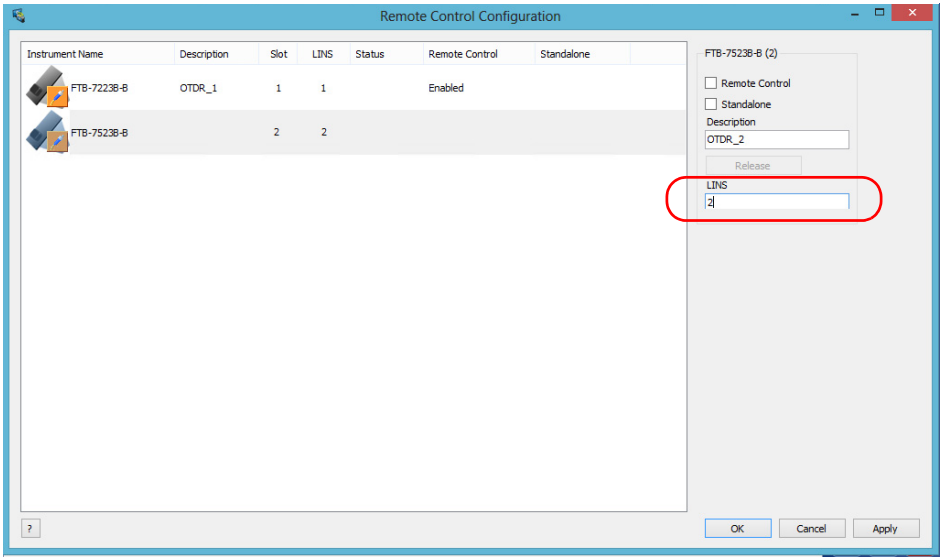
Note: *When a standalone module is no longer used, you can simply release it. See the corresponding procedure below to know how to proceed.*

6. If desired, under **Description**, type a description that will help you identify the instrument.



Note: *You can enter up to 10 characters. The description can correspond to the test interface ID or to any other short text of your choice.*

7. If necessary, under **LINS**, modify the logical instrument number that you will use to access the instrument remotely.



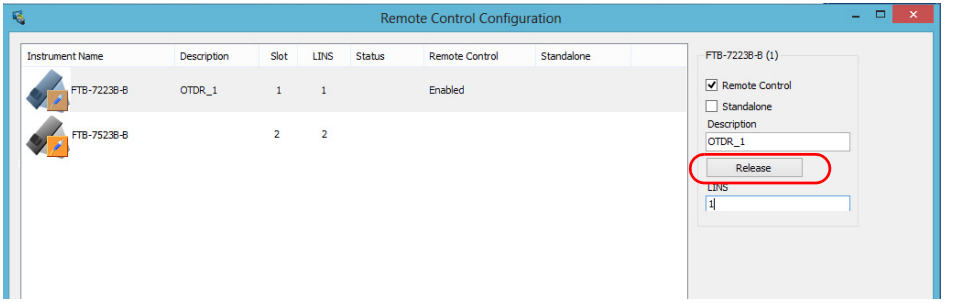
Note: *If the **LINS** column is empty, it means that the corresponding module cannot be controlled using SCPI commands.*

8. Tap **Apply** to confirm your changes or **OK** to apply your changes and close the window.

Note: *This information will be updated the next time you start the module application and will appear in the title bar if the module application allows it. Refer to the corresponding module documentation for more details.*

To release the remotely-controlled module:

Tap **Release**.



10 Using Your Unit and Module in an Automated Test Environment

EXFO supplies commands that follow the guidelines determined by the SCPI consortium for all available instruments. EXFO also supplies COM properties and events allowing you to build your own application.

The present chapter gives you information to help you use the provided commands as well as COM properties and events to remotely control your instruments.

If you need information on how to prepare your unit for remote control, see the corresponding section in this documentation.

Standard Status Data Structure

Each device that is physically connected to the remote bus has four status registers with a structure complying with the IEEE 488.2 standard. These registers allow the controller to monitor events and get useful information on the status of the devices it controls.

- Standard Event Status Register (ESR)
- Standard Event Status Enable Register (ESE)
- Status Byte Register (STB)
- Service Request Enable Register (SRE)

ESR and ESE

The standard event status register and status enable register information is presented in the following table.

Bits	Mnemonics	Bit Value
7	Power On (PON)	128
6	User Request (URQ)	64
5	Command Error (CME)	32
4	Execution Error (EXE)	16
3	Device-Dependent Error (DDE)	8
2	Query Error (QYE)	4
1	Not Used (N.U.)	0
0	Operation Complete (OPC)	1

The following table presents a summary of the possible operations on ESR and ESE registers.

Register	Read	Write	Clear
ESR	Use *ESR?.	Impossible to write.	➤ Use *CLS. ➤ Read the register.
ESE	Use *ESE?.	Use *ESE.	Use *ESE with a value equal to 0.

STB and SRE

The status byte register and service request enable register information is presented in the following table.

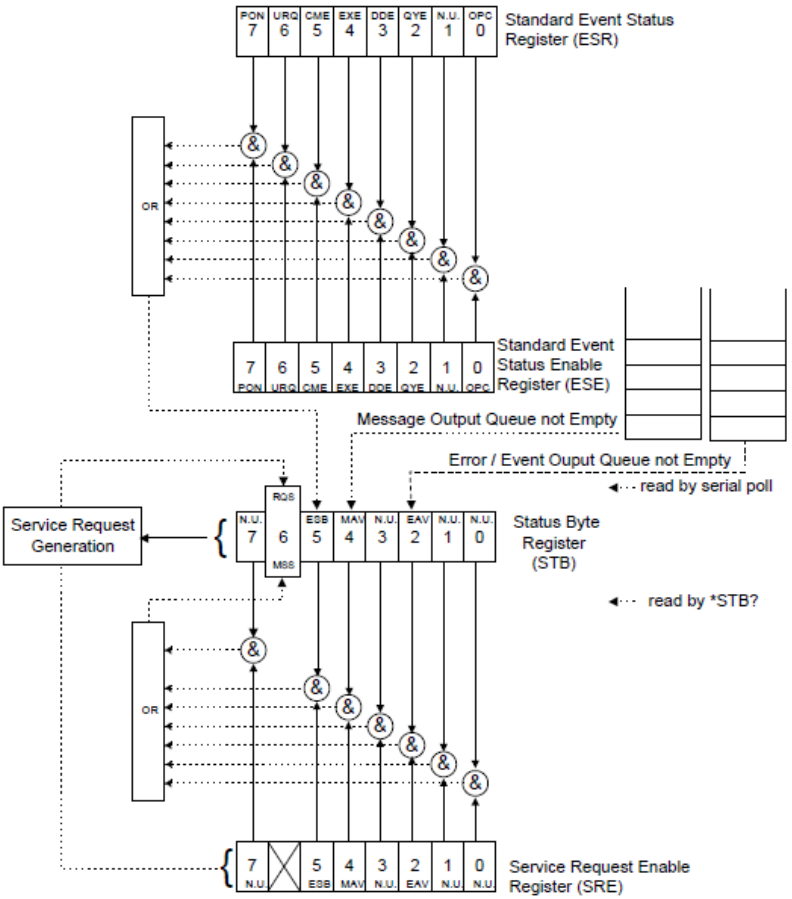
Bits	Mnemonics	Bit Value
7	Not Used (N.U.)	0
6	Master Summary Status (MSS)/ Service Request (RQS)	64
5	Event Summary Bit (ESB)	32
4	Message Available (MAV)	16
3	Not Used (N.U.)	0
2	Error Available (EAV)	4
1	Not Used (N.U.)	0
0	Not Used (N.U.)	0

The following table presents a summary of the possible operations on STB and SRE registers.

Register	Read	Write	Clear
STB	➤ Use *STB?. ➤ Use serial poll (GPIB bus sequence that allows retrieval of the value without interrupting the current process).	Impossible to write; the register content is only modified when the Event registers or Queues are modified.	Use *CLS before sending a query (to clear the Event registers and Queues and by the same token clear the STB register).
SRE	Use *SRE?.	Use *SRE with a value equal to 0 to disable the register or with a value equal to 1 to enable it.	➤ Use *SRE with a value equal to 0. ➤ At startup, the register is set to 0.

The diagram displayed on the next page is a useful aid in understanding the general commands and how a service request (SRQ) is generated.

Using a service request, a device notifies the controller that an event requiring special attention occurred. The controller will then find which device generated a SRQ (its RQS bit is set) and the causes of it.


PON 7
URQ 6
CME 5
EXE 4
DDE 3
QYE 2
N.U. 1
OPC 0
Standard Event Status Register (ESR)
OR
Standard Event Status Enable Register (ESE)
Message Output Queue not Empty
Error / Event Ouput Queue not Empty
read by serial poll
Service Request Generation
RQS
MSS
ESB 5
MAV 4
EAV 2
Status Byte Register (STB)
read by *STB?
Service Request Enable Register (SRE)

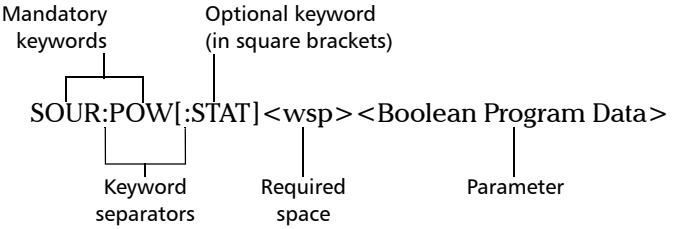
SCPI Command Structure

The information presented in this section provides an overview of SCPI programming. If you need detailed information, refer to:

- The International Institute of Electrical and Electronics Engineers. *IEEE Standard 488.2-1992, IEEE Standard Codes, Formats, Protocols and Common Commands For Use with ANSI/IEEE Std. 488.1-1987*. New York, 1992.
- *Standard Commands for Programmable Instruments (SCPI). Volume 1: Syntax and Style*. Vers. 1999.0 May, U.S.A, 1999.

The provided commands follow the guidelines determined by the Standard Commands for Programmable Instruments (SCPI) consortium. A *program message* consists of one or more commands (and/or queries) with their appropriate parameters.

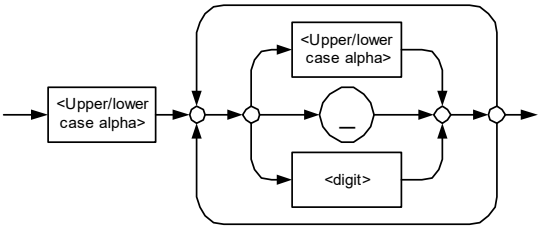
For example, a program message could contain a command used to activate or deactivate a source. The corresponding command syntax would be:



When sending a message containing the previous command, you would actually type: SOUR:POW ON.

The following table shows elements that are commonly used in the commands or queries syntax.

Item	Meaning
[ ]	Enclose optional keywords or parameters. *Do not include square brackets in your program message.*
[1..n]	Indicates that the instrument provides multiple capabilities and that you have to specify which one you want to use. If you omit the value, the command will take effect on the first capability. Multiple capabilities can be found at any branch of the command tree (root, intermediate node or terminal node). Example: If the command is :SENSe*[1..n]*:CORRection:COLLect:ZERO and you want it to take effect on the second SENSe (sensor) capability of the instrument, you may send this: :SENSe*2*:CORRection:COLLect:ZERO. *Do not include square brackets in your program message; simply enter the number.*
<wsp>	Indicates that a space is required ("wsp" stands for "white space"). Corresponds to ASCII character codes (0 to 9 and 11 to 32, in decimal). *Do not include* "<wsp>" *in your program message; simply type a space.*
<digit>	Element used in the construction of various numeric data types. Can take any value between 0 and 9 inclusively (corresponds to ASCII character codes 48 to 57, in decimal).

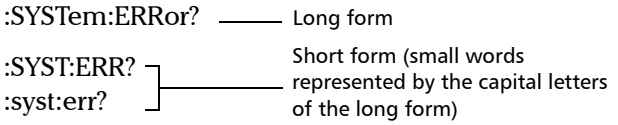
Item	Meaning
<mnemonic>	Element used in the construction of certain data types and program messages.  In the diagram above, ➤ "<Upper/lower case alpha>" corresponds to ASCII character codes (65 to 90 and 97 to 122, in decimal). ➤ "_" corresponds to an underscore character (code 95, in decimal).
< >	Text appearing between angled brackets specifies the command parameter to be sent or the response you will receive from an instrument. *Do not include angled brackets in your program message.*
|	Indicates that one, and only one, value must be selected from the available choices. Example: If the list is 0|1, you can only select 0 *or* 1. *Do not include the pipe character in your program message.*
{ }	Indicate that the enclosed parameters can appear 0 to n times when the command is used. *Do not include braces in your program message.*
:	Mandatory to separate keywords. Can be omitted at the beginning of a program message. For example, you can use either :SYST:ERR or SYST:ERR.

Item	Meaning
;	➤ Mandatory to separate the different commands of a program message when more than one command is sent at a time. In this case, it is called *<PROGRAM MESSAGE UNIT SEPARATOR>*. ➤ Also used to separate responses when multiple queries were sent in a single program message. In this case, it is called *<RESPONSE MESSAGE UNIT SEPARATOR>*.
,	➤ Mandatory to separate parameters in a command or a query. In this case, it is called *<PROGRAM DATA SEPARATOR>*. ➤ Also used to separate the various responses from a query. In this case, it is called *<RESPONSE DATA SEPARATOR>*.

There are also several conventions regarding command syntax:

- Spelling errors will cancel the command or query.
- Commands and queries are not case-sensitive. You can type your program messages using either lower-case or upper-case letters.
- The command or query can be written using only the three- or four-letter shortcuts, only full words, or a combination of both.

  The example below shows the long and the short forms of a same query.



Consulting Data Types

If you need information about data types used in EXFO's documentation, see the appendix on data types.

Writing Remote Control Code

Your unit offers many commands permitting complete remote control of all the supported components. These commands adhere to the SCPI standard.

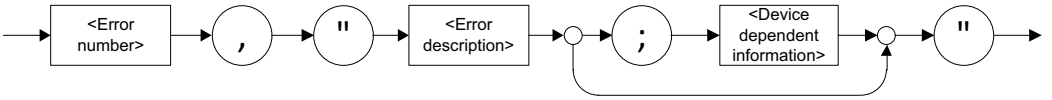
You can find all the commands and queries supported by your unit in the *IEEE 488.2 and Specific Commands* appendix. For information on commands specific to particular instruments, refer to each instrument's user guide.

When you write code, you must follow these rules on message reception and transmission:

- The controller must have sent a complete message to the instrument (including the message terminator) before retrieving a response.
- The controller must retrieve all the responses from previous queries (including the response terminator) before sending a new message to an instrument.
- The controller must not try to retrieve a response from an instrument if the corresponding query has not been previously sent to the instrument.
- You must pay special attention to queries that return an indefinite ASCII response. To avoid any confusion, the IEEE 488.2 standard requires that this data type be immediately followed by a response termination character. For this reason, when working with compound queries, you must ensure that a query sending an indefinite ASCII response is the last query of the series.
- Be careful when sending program messages containing multiple queries that return large amounts of data. Since the controller can only retrieve data when the instrument has finished processing the queries, it could result in problems ranging from a saturation of the output queue to the complete blocking of the whole system.

Error Message Format

System and device-specific errors are managed by your unit. The generic format for error messages is illustrated in the following figure.



As shown in the above figure, the message contains three parts:

- error number
- error description
- device-dependent information

Error messages ending in a negative number are SCPI-based errors.

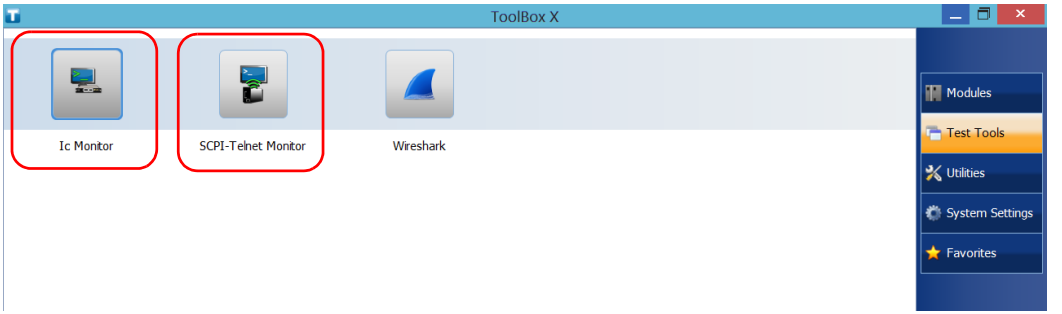
For a complete list of possible errors, see the appendix on SCPI-based errors.

Monitoring Remote Commands

ToolBox X allows you to monitor remote commands sent to your units, if desired.

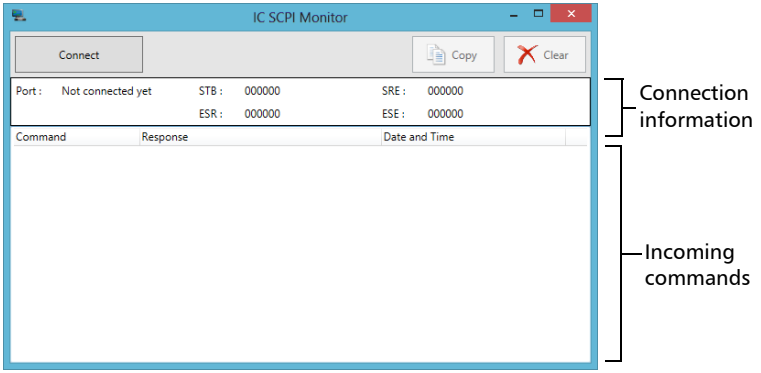
To monitor remote commands:

1. From the main window, tap the **Test Tools** button.
2. Depending on which type of communication protocol you are using, select **IC Monitor** or **SCPI Telnet Monitor**.



3. Do one of the following:

➤ If monitoring using GPIB, ActiveX or RS-232, tap **Connect**.



You are automatically connected to the monitoring system, and the **Connect** button changes to a **Disconnect** button, enabling you to disconnect from IC when you have finished your work.

Once connected, your current connection information will appear in the upper part of the window, and the commands will appear as a list in the lower part of the window.

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

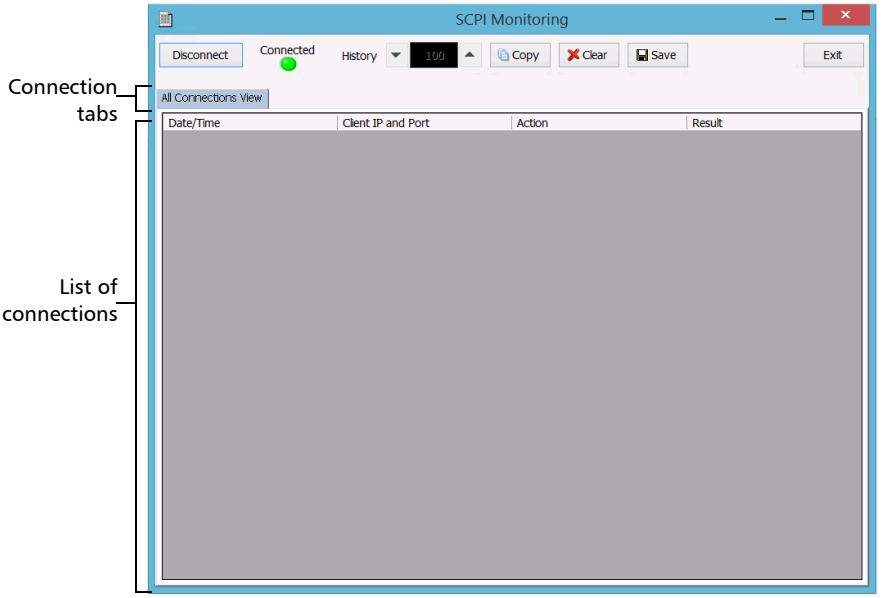
To view the list in any word processor, tap **Copy** to send it to the clipboard, and then paste it in your document. You can use any program, as the list is copied in text format.

To exit the monitoring utility, tap ×.

For more information, see the section on using your unit in an automated test environment.

➤ If monitoring using TCP/IP, which provides sending SCPI commands over TCP/IP through Telnet from the EXFO Instrument Control, you are automatically connected to the monitoring system.

Note: *Port 5024 is designated for sending SCPI commands in the Telnet protocol.*



Once connected, your current connection information will appear in the **All Connections View** tab, and the commands will appear as a list in the lower part of the window.

The **Disconnect** button becomes available for you to tap when you are ready to disconnect.

Connection information is also displayed in a separate tab, identified by its IP address, from where you can monitor the commands and other actions sent through TCP/IP over Telnet, as well as the results.

With the **History** parameter, you determine how many commands you want to keep in the list. You can increase or decrease the number by using the arrow buttons on each side of the list.

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

To view the list in any word processor, tap **Copy** to copy it to the clipboard, and then paste it in your document. You can use any program, as the list is copied in text format.

To save the list as a file, tap **Save**.

To exit the monitoring utility, tap **Exit**.

For more information, refer to the user documentation about communication through TCP/IP over Telnet.

11 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 batteries 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.

Cleaning the Touchscreen

Clean the touchscreen with a soft, non-abrasive cloth, such as one used for cleaning reading glasses, dampened with water.

CAUTION

Using anything else than water can damage the special coating of the touchscreen.

Recharging the Battery

Your unit uses one smart lithium-ion (Li-Ion) battery.

- The charge status is shown in the taskbar (at the left of the clock). Simply tap the battery icon for more information.
- The unit also indicates the charge status with the LED on its front panel (see *LED Indicators Description* on page 6).

CAUTION

Only charge the battery with the AC adapter/charger (or the car outlet adapter) provided by EXFO with your unit.

IMPORTANT

- **Batteries are not charged at the factory. You must fully charge them before using the unit for the first time.The batteries are fully charged after a few hours or when the battery LED indicator stops flashing.**
- **The time required to charge batteries depends on various factors such as the type of modules currently in use and the ambient temperature.**
- **To ensure that batteries function or charge properly, keep them in temperatures between 0 °C and 40 °C (32 °F and 104 °F). Store them between –20 °C to 60 °C (–4 °F to 140 °F).**
- **Do not leave a battery discharged for several days.**
- **After 300 cycles (approximately 18 months of use), you may want to replace the battery with a new one to maintain optimal operation conditions. Otherwise, the operating time might be reduced.**

IMPORTANT

- **If the unit will not be used for more than two weeks, turn it off (shutdown).**
- **If you need to store the batteries for an extended period of time, place them in a cool dry place, and ensure that they are charged at around 50 % of their capacity. Every three months during the storage period, verify the battery level. Recharge the batteries when necessary, so that their charge level remains around 50 % of the total capacity. This will ensure that you get the optimum performance out of the batteries.**

To recharge the battery:

Connect the unit to a power outlet using the AC adapter/charger (or the car outlet adapter). The charge cycle will start and end automatically.

The charge cycle will start and end automatically.

Replacing the Battery

Your unit can be powered either by battery or from an appropriate power outlet when used with the provided AC adapter/charger.

WARNING

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

WARNING

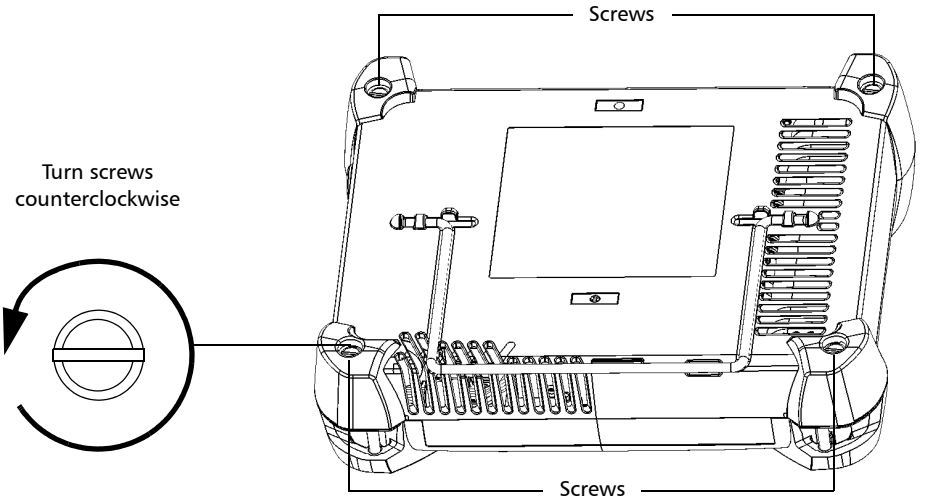
Your unit uses a smart lithium-ion (Li-Ion) battery with built-in protection that has been especially designed for EXFO. For this reason, you can only replace it with batteries of the same type and model.

The use of other batteries may damage your unit and compromise your safety.

For more information on the available power sources for your unit, as well as their characteristics, refer to the *Technical Specifications* of your product.

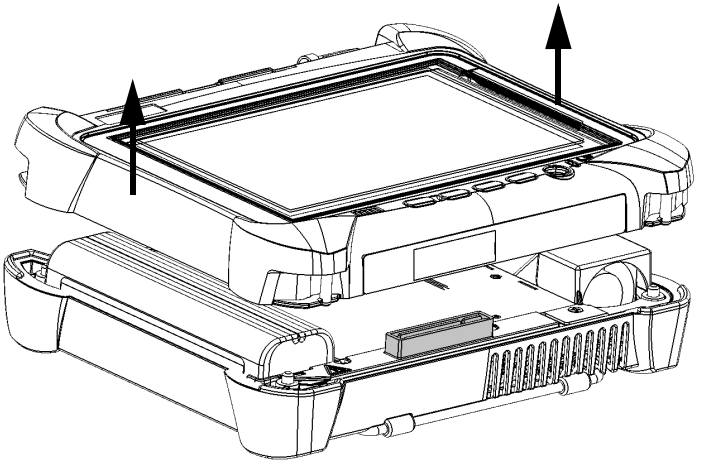
To remove the battery:

1. Turn off the unit (shutdown) and disconnect it from AC power.
2. Position the unit so that its front panel rests on a flat surface such as a table.
3. On the back of the unit, using a flat screwdriver, turn the screws (4) counterclockwise until they are loose. Since they are captive screws, you cannot remove them completely.

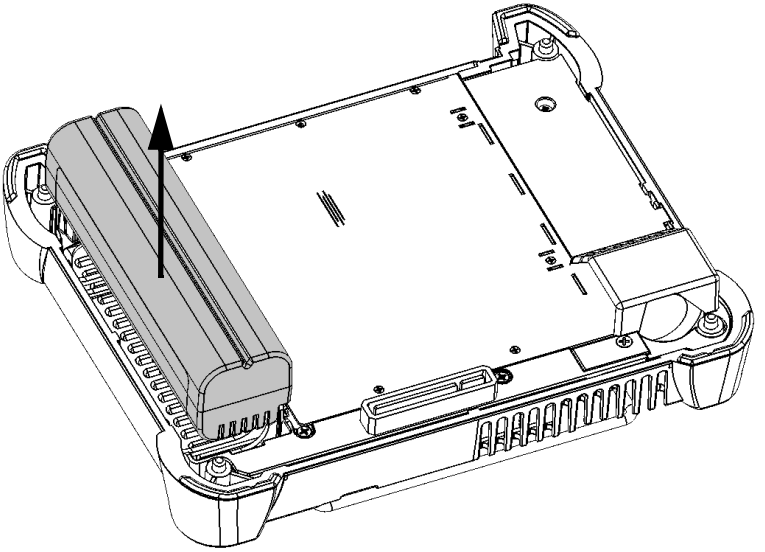


4. While holding the front and the back panels firmly together, turn the unit over, and position it so that its *back* panel rests on a flat surface such as a table.

5. Hold the front panel by its sides and pull it up.



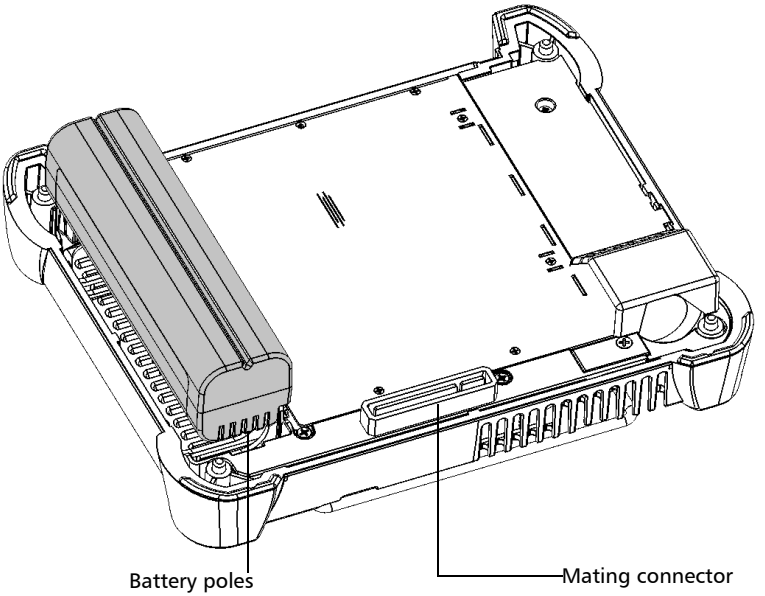
6. Pull on the battery's tab to free it from its socket.



You are now ready to replace the battery.

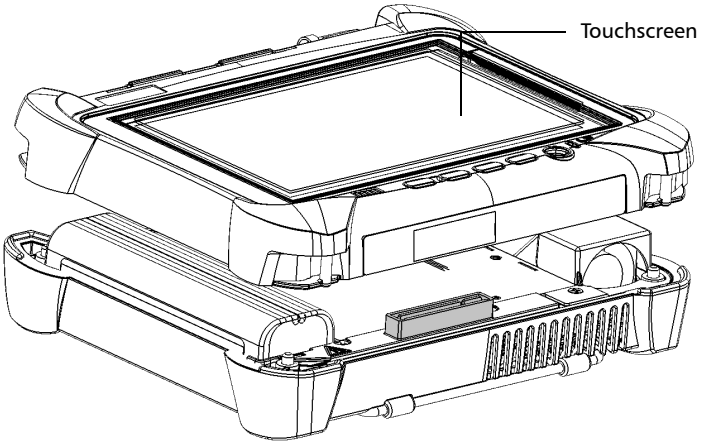
To replace the battery in the unit:

1. Place the new battery so that its poles are facing down and that they point to the same side of the case as the mating connector of the back panel.

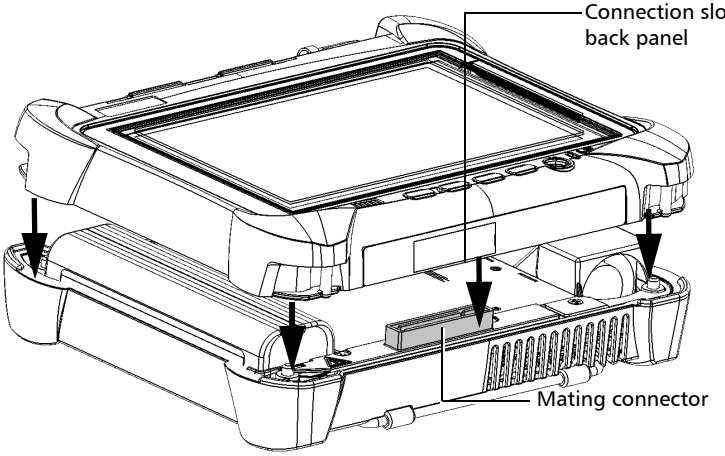


2. Push the new battery toward the bottom of the case until it stops.

3. Hold the front panel so that you can see the touchscreen.



4. Place the front panel on the back panel of the unit, making sure that the mating connector of the back panel is well aligned with the corresponding slot on the front. The bumpers of the back panel should be flush with those of the front. If necessary, slightly move the front panel until alignment is correct.



5. While holding the front and the back panels firmly together, turn the unit over, and position it so that its *front* panel rests on a flat surface such as a table.

6. Using a flat screwdriver, turn the screws (4) clockwise until they are tightened.

   This will secure the back panel into its “seated” position.

Managing Windows Updates

By default, your unit is configured to check for updates, but to let you choose whether you want to download and install them or not.

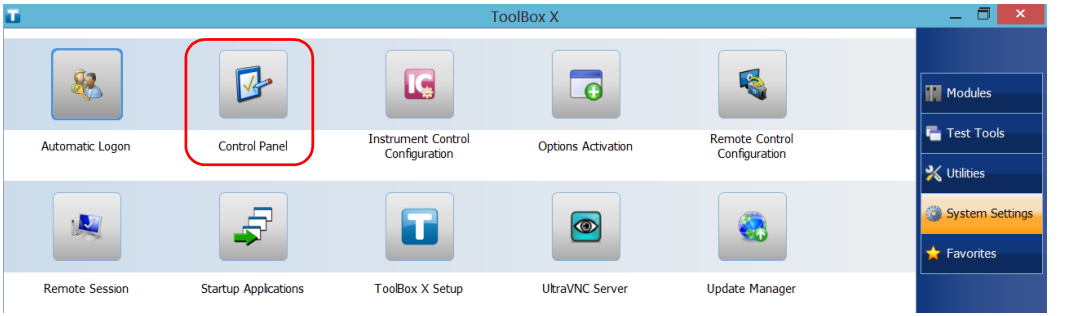
However, if you prefer, you can configure your unit to automatically search and install Windows updates to ensure that you benefit from the latest versions of the Windows applications. Your unit will need an Internet access for the updates.

Only the applications from Microsoft will be updated with the automatic Windows update feature. If you want to update EXFO applications, see *Installing or Upgrading the Applications* on page 34. The third-party applications will need to be updated manually.

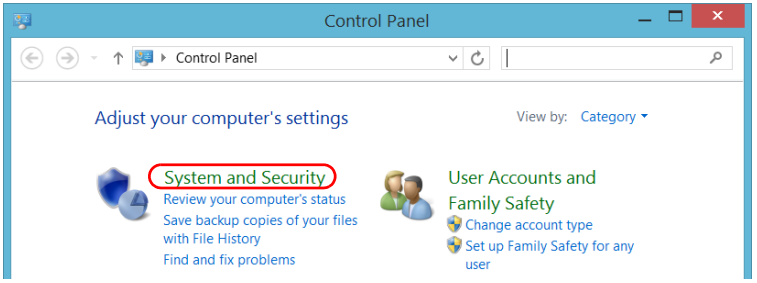
To manage the updates for Windows applications:

1. From the main window, tap the **System Settings** button.

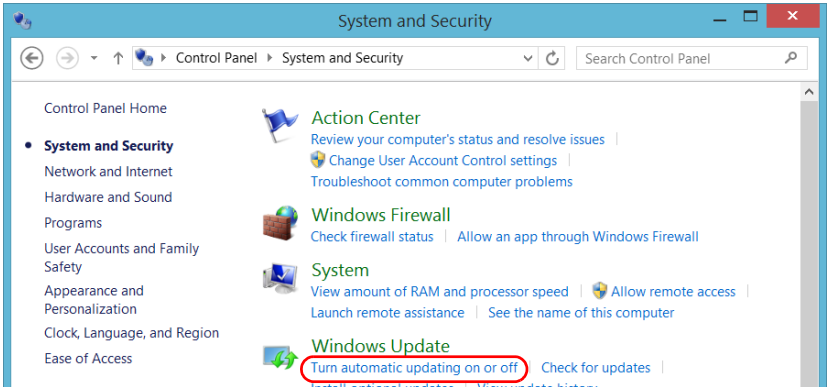
2. Tap **Control Panel**.



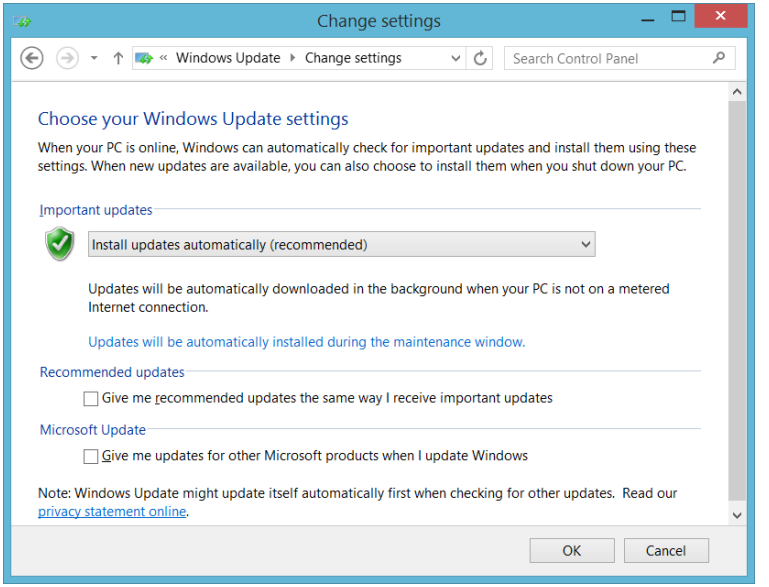
3. Tap **System and Security**.



4. Under **Windows Update**, tap **Turn automatic updating on or off**.



5. Select the update options that best suit your needs.



6. Tap **OK** to confirm your changes and return to Control Panel.

Recycling and Disposal (Applies to European Union Only)

For complete recycling/disposal information as per European Directive WEEE 2012/19/UE, visit the EXFO Web site at www.exfo.com/recycle.

12 Troubleshooting

Solving Common Problems

Before calling EXFO's technical support, you may want to consider the following solutions to problems that could occur.

Problem	Possible Cause	Solution
My unit does not start.	It is not connected to a power source.	Make sure that the external power supply is connected at both ends.
	The battery is completely discharged.	Change or recharge the battery.
	The system has encountered a problem.	Press the On/Off button for at least ten seconds to force a hardware reset on the unit.
	Windows startup files have been corrupted.	Contact EXFO.

Problem	Possible Cause	Solution
My unit is running slower than expected.	The configuration of some of the Windows components is underway in the background.	The first few times that you start your unit, after a reset operation, or after certain updates, you may notice that the performance of your unit is not optimum. If this is the case, you may want to leave your unit idle for about an hour to give Windows the time to complete its configuration tasks.
My unit is not responding.	The system has encountered a problem.	Press the On/Off button for at least ten seconds to force a hardware reset on the unit.
The USB device I have just connected is not working.	The device has not been detected.	Disconnect, then reconnect the device. Turn off the unit, then turn it on again.
	You do not have the proper driver for this device.	Ensure that you have the right driver (can be provided with the device itself).

Problem	Possible Cause	Solution
The 3G USB modem key is connected, but I am not able to access the Internet.	There is no SIM card in the USB modem key.	Insert the SIM card into the USB modem key. For complete instructions, refer to the documentation that came with your modem key.
	The USB modem key is not detected properly.	Disconnect the modem key from your unit, and try connecting it again. If the modem key is still not detected, try connecting it to another USB port.
	The SIM card has not been activated or there is a problem with service package that you purchased. There is a problem with the mobile network.	Contact your provider of mobile services.
The battery is not recharging.	Ambient temperature is too high or too low.	Make sure that the temperature in the location where you recharge the battery is within the specifications
	The AC adapter is not connected properly.	Make sure that the AC power cord is connected to the unit and the AC outlet.
I cannot adjust the brightness of the screen using the Windows controls.	The brightness can only be adjusted with the physical buttons.	From the unit's front panel, press the ▼ or ▲ button until the brightness level suits you.

Problem	Possible Cause	Solution
An error message warns me that there is not enough disk space to perform a refresh operation on my unit.	➤ When you perform a refresh operation, Windows creates a folder (*Windows.old*) in which the files from the previous installation are stored. This folder now uses too much disk space. ➤ The disk needs a cleanup.	Remove the Windows.old folder or the unused files with the Disk Cleanup utility. For more information, see *Freeing Up Disk Space with the Disk Cleanup Utility* on page 123.
The Windows interfaces do not switch to the selected language.	When you select a language that you have installed manually, the Windows interfaces remain in the language configured at time of purchase. However, the EXFO applications are displayed in the selected language (when available).	Contact EXFO if you think that the language that was configured at time of purchase does not cover your needs.

Restoring Your Unit to Normal Operation

If you ever encounter major problems with your unit (for example, the unit does not behave the way it used to), you can revert it to a previous state. You can revert your unit either to its initial state (as it was at time of purchase), or to a specific state with a backup image (WIM file) created previously.

Note: *For current updates, use Update Manager.*

You can create your own WIM files directly from your unit and store them on a USB key for future use.

IMPORTANT

The WIM files that you create are based on the serial number of your unit. This means that the WIM files created on one unit are only valid to restore this particular unit.

When you want to restore your unit, there are several options. The table below gives an overview of the possibilities.

Method	Description
Refresh	➤ The unit will be reverted to its initial state. ➤ All data files that were saved to the default personal folders (Documents, Pictures, etc.) will still be available once the operation is complete. ➤ If you have installed products and updates since you purchased your unit, you will have to reinstall them. ➤ Refer to Microsoft documentation for more information.
Reset	➤ The unit will be reverted to its initial state. ➤ All data files will be lost once the operation is complete. ➤ If you have installed products and updates since you purchased your unit, you will have to reinstall them. ➤ Refer to Microsoft documentation for more information.
Restore	➤ The unit will be reverted to the state in which it was when the WIM file was created. ➤ All data files will be lost once the operation is complete. ➤ If you have installed products and updates since the WIM file was created, you will have to reinstall them.

CAUTION

- **Before starting one of the recovery operations, connect your unit to a power outlet using the provided AC adapter/charger.**
- **DO NOT TURN OFF your unit while the recovery operation is underway. Doing so may severely damage your unit. Damaged units will need to be sent back to EXFO for repair.**

IMPORTANT

- **Refresh operation: All the data that is stored in the default personal folders will still be available once the operation is complete. However, any data stored in other folders will be lost. You may want to back up this data before refreshing your unit.**
- **Reset and restore operations: To avoid losing the data that is stored on your unit, you may want to back it up before resetting or restoring your unit. Otherwise, all your files will be lost.**

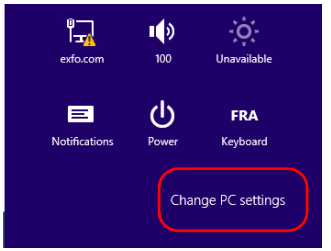
To revert your unit to a previous state:

1. Ensure that your unit will remain powered on during the operation by connecting it to a power outlet using the provided AC adapter/charger.
2. If desired, back up your data.

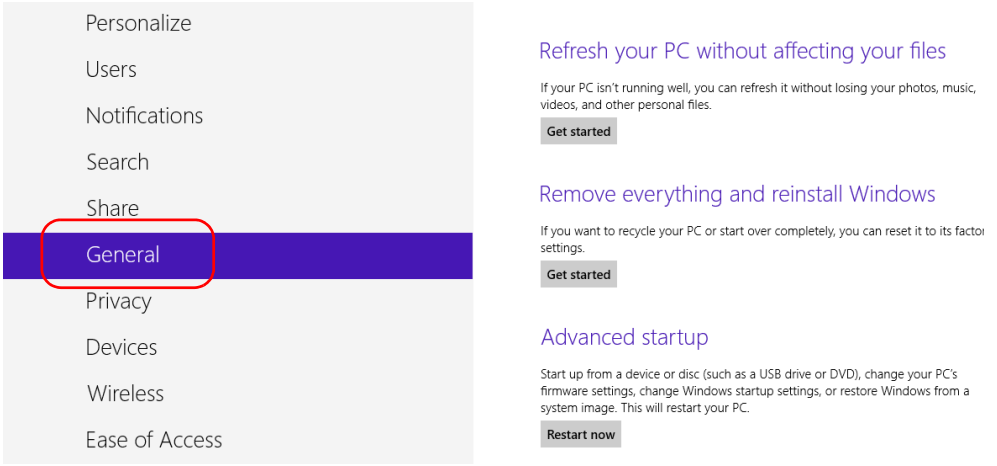
Note: *If you want to have a look at the content of the Windows.old folder containing files of the previous installation, go to the root of the C drive (Windows (C:)). If you do not see the Windows.old folder, it means no refresh operation has ever been performed on your unit.*

3. If you intend to refresh your unit and a refresh operation has been performed on it before, remove the existing *Windows.old* folder (with Disk Cleanup). Otherwise, you will receive an error message indicating that the disk space is insufficient and your unit will not be refreshed. For more information on how to remove the Windows.old folder, see *Freeing Up Disk Space with the Disk Cleanup Utility* on page 123.

   When the cleanup operation is complete, you are ready to perform a refresh operation on your unit.
4. On your unit, from the right side of the screen, swipe left to display the Charm bar.
5. Tap **Settings** > **Change PC settings**.

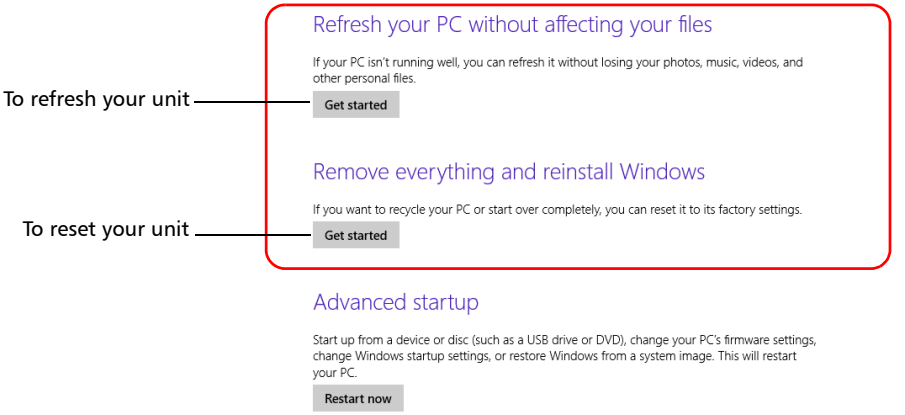


6. Tap **General**, and then scroll down the list.



7. If you want to refresh or reset your unit, proceed as follows:

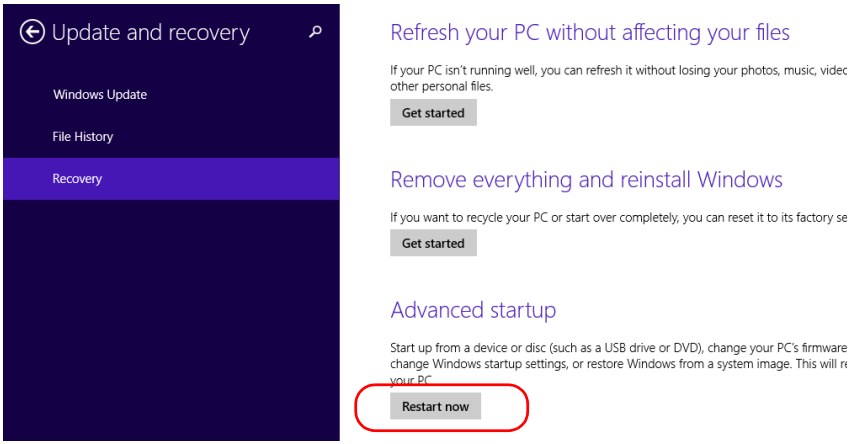
7a. Tap the **Get started** button corresponding to your choice.



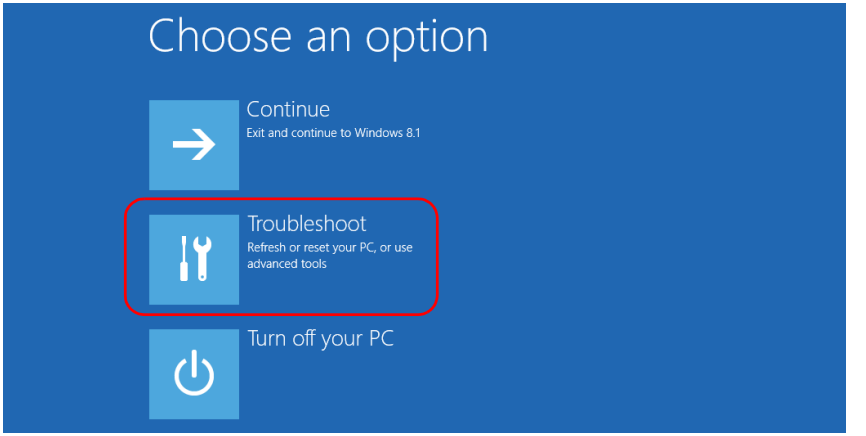
7b. Follow the on-screen instructions.

8. If you want to restore your unit (with a WIM file), proceed as follows:

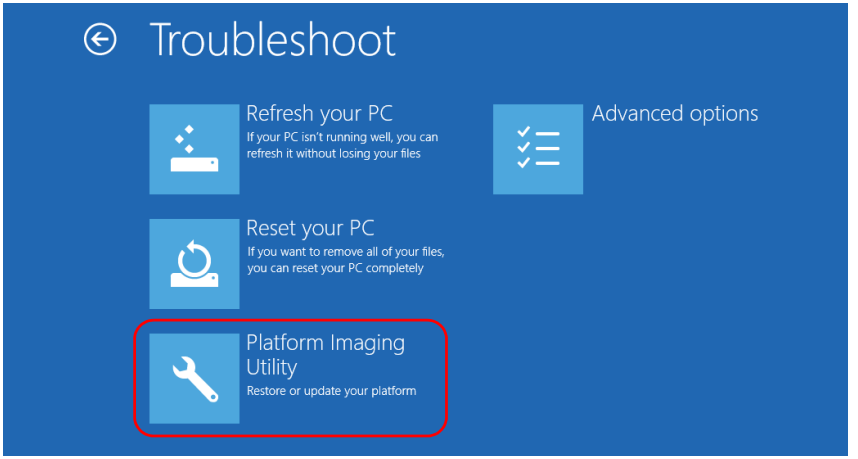
8a. Under **Advanced Startup**, tap **Restart now**.



8b. Under **Choose an option**, tap **Troubleshoot**.

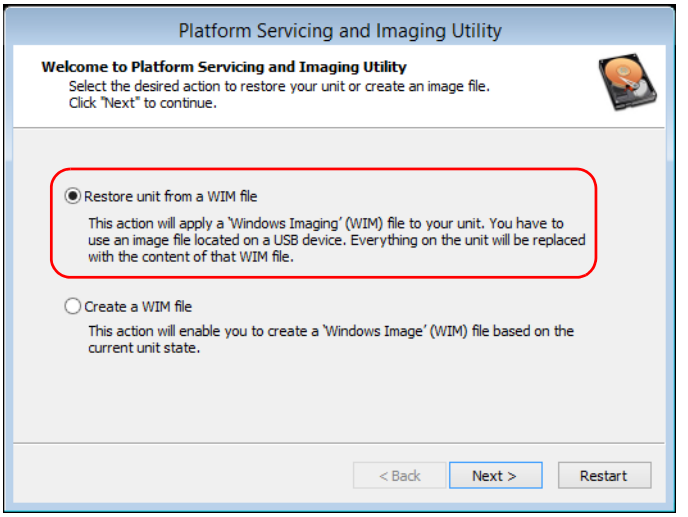


8c. Tap **Platform Imaging Utility** to display the corresponding application.

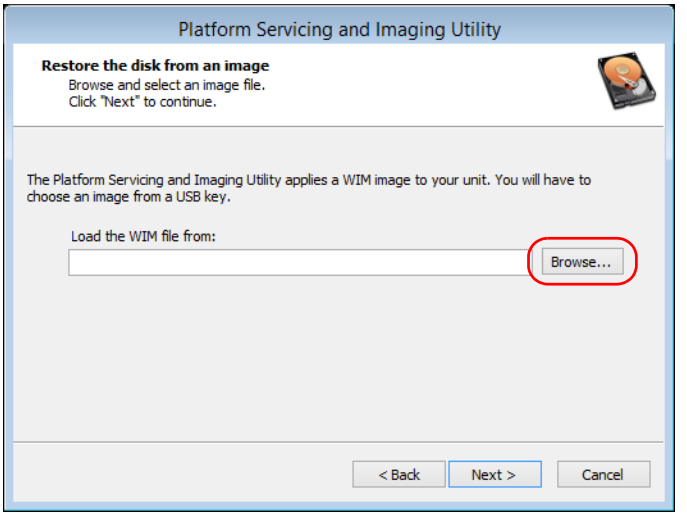


8d. Connect the USB key with the desired WIM file to your unit.

8e. From the Platform Servicing and Imaging Utility wizard, select **Restore unit from a WIM file**, and then tap **Next**.



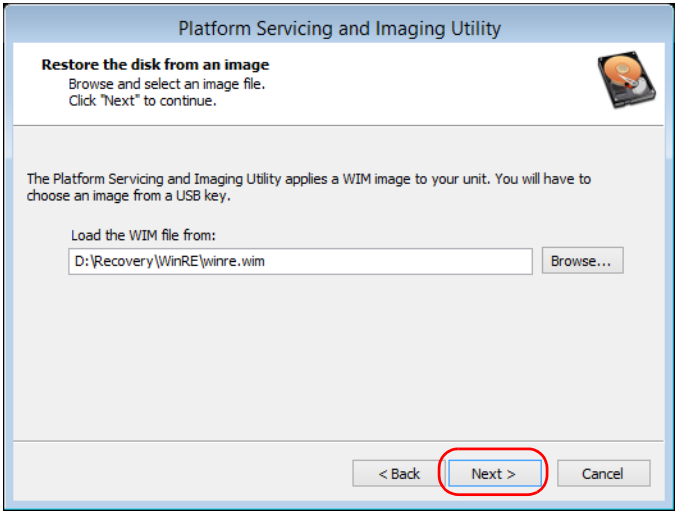
8f. Tap **Browse**.



8g. Locate the USB key, and then double-tap its identifier to access the contents.

8h. Select the desired WIM file.

8i. Tap **Next**.



8j. Read the warning, and then tap **Start** to restore the unit with the selected image.

8k. When the operation is complete and the application prompts you, disconnect the USB key, and then tap **OK**.

The unit will restart.

IMPORTANT

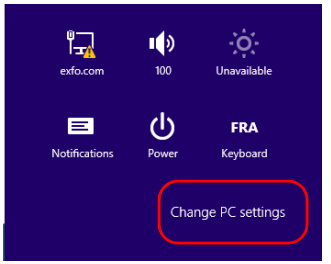
The creation of a WIM file implies a compression of the files that are currently installed on your unit. The size of the files after compression cannot be estimated beforehand.

For this reason, the application WILL NOT PROMPT YOU AT THE BEGINNING of the operation if the storage capacity (or the file system) of your USB key is not appropriate.

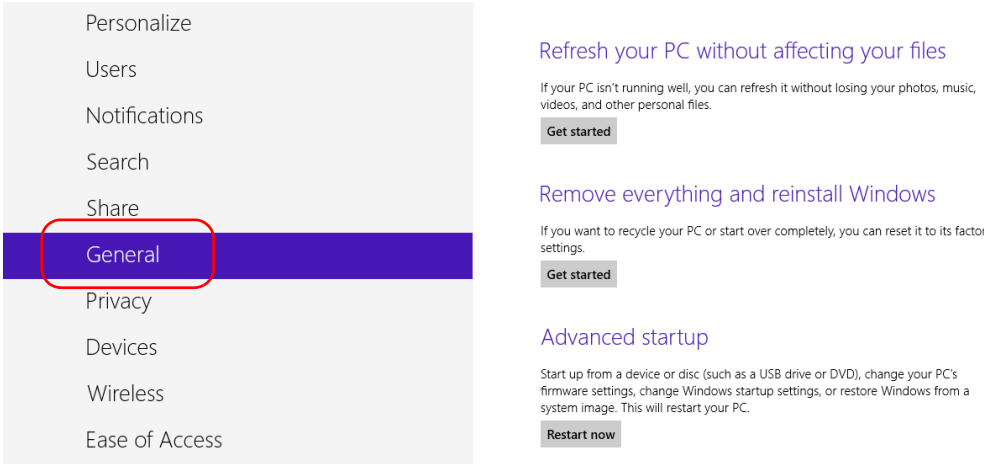
To avoid problems, always use a USB key with an NTFS file system, and a minimum of 16 GB of free disk space.

To create a WIM file for your unit:

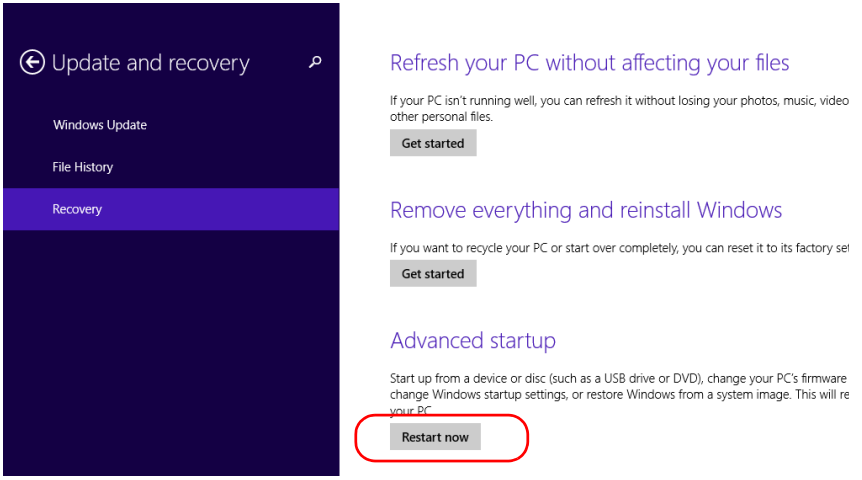
1. On your unit, from the right side of the screen, swipe left to display the Charm bar.
2. Tap **Settings** > **Change PC settings**.



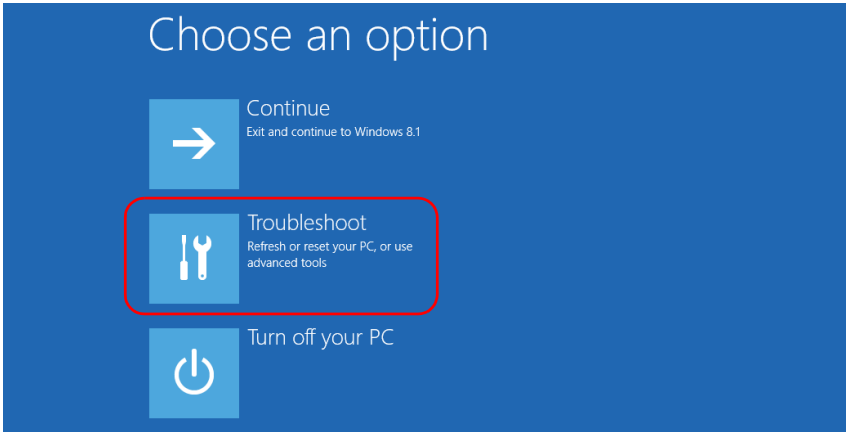
3. Tap **General**, and then scroll down the list.



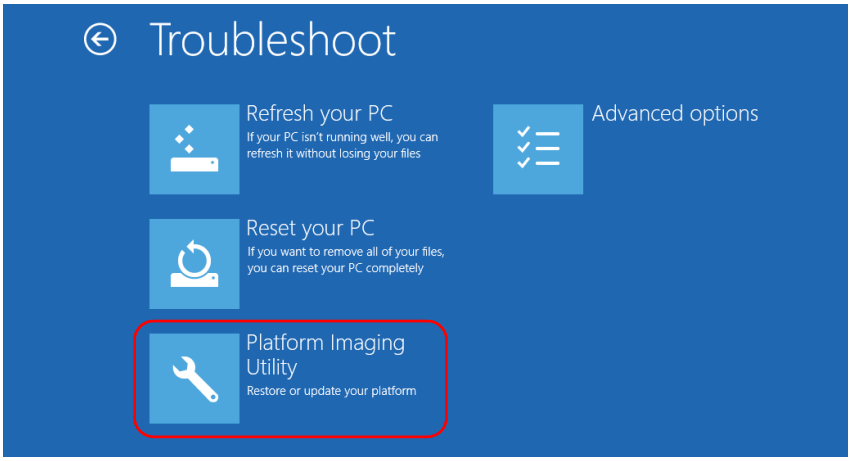
4. Under **Advanced Startup**, tap **Restart now**.



5. Under **Choose an option**, tap **Troubleshoot**.

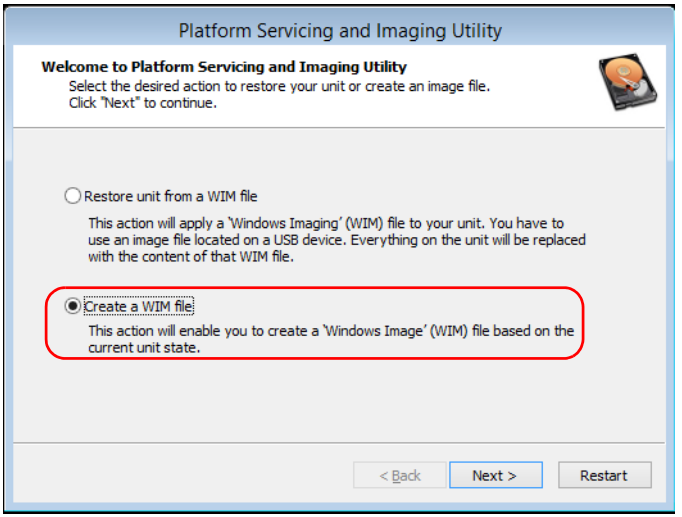


6. Tap **Platform Imaging Utility** to display the corresponding application.

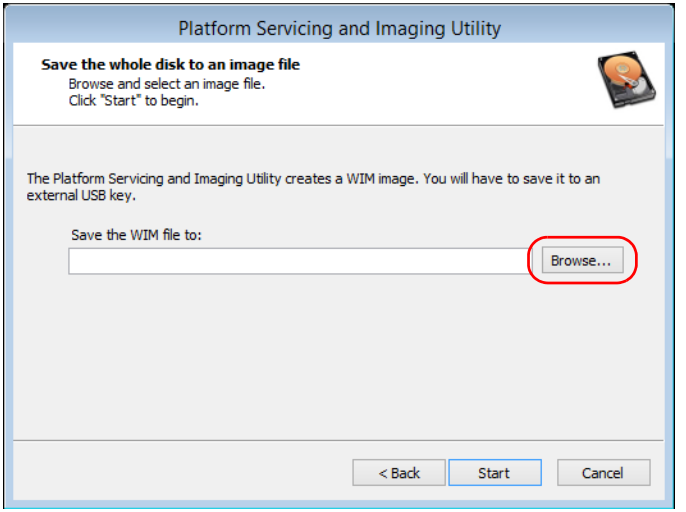


7. Connect a USB key to your unit.

8. From the Platform Servicing and Imaging Utility wizard, select **Create a WIM file**, an then tap **Next**.



9. Tap **Browse**.

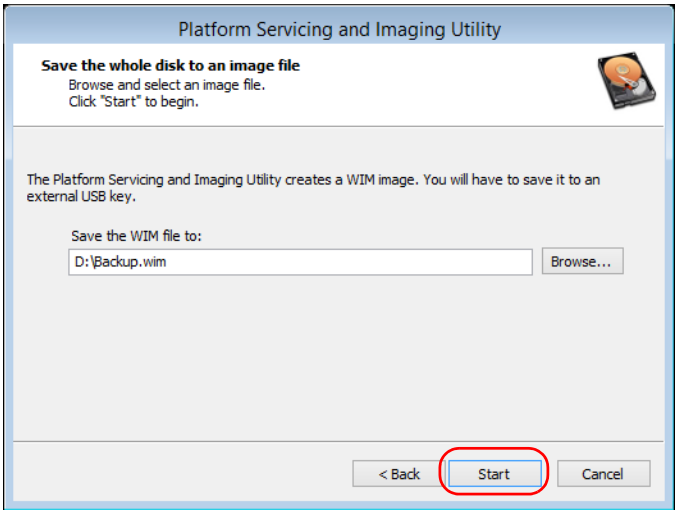


10. Locate the USB key, and then double-tap its identifier to access the contents.

11. Select the desired folder.

12. Enter a file name, and then tap **Save**.

13. Tap **Start**.



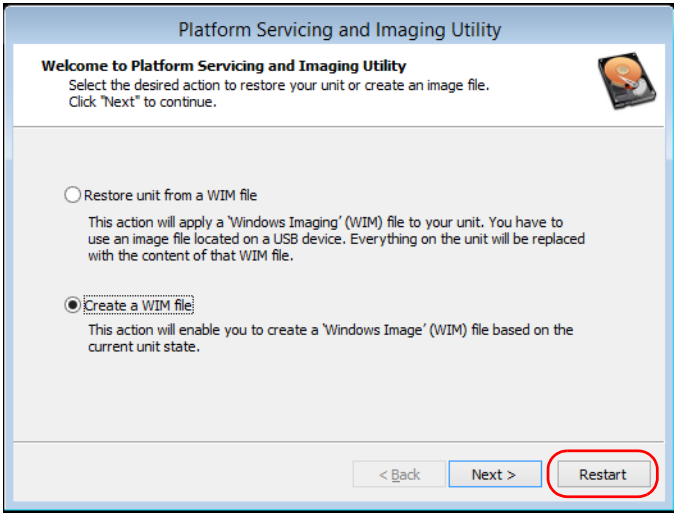
Note: *The time required to create the image varies with the configuration of your unit.*

14. When the operation is complete and the application prompts you, tap **OK**.

15. Disconnect the USB key.

16. Tap **Cancel** to return to the Welcome window of the utility.

17. Tap **Restart**.



The WIM file is ready for future use.

Accessing the Online Documentation

You can access the user documentation as well as the license agreements at all times from your unit.

There are two formats of user documentation provided on your unit: online help and complete user guides (for products having safety instructions). When you open user documentation in PDF format from Toolbox X (or the configuration wizard), the files are displayed automatically in the provided PDF viewer.

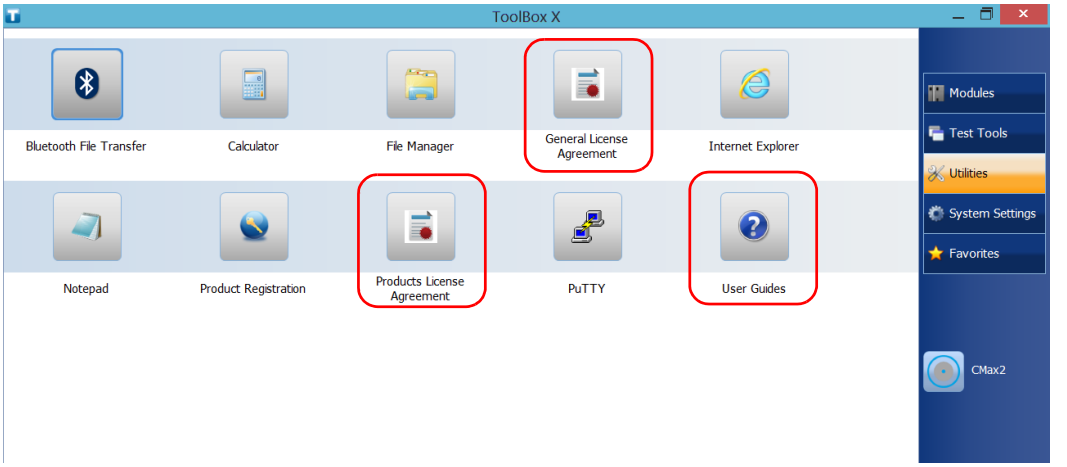
Note: *The user guides of all products are available from the My EXFO section of the EXFO Web site (www.exfo.com) for download in PDF format.*

To view the online help:

From Toolbox X or an instrument application, tap (or the equivalent).

To view the documentation in PDF format:

1. From the main window, tap the **Utilities** button.
2. Tap the icon corresponding to the type of document that you want to view.



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.

Viewing System Information

You can easily access important information such as the serial number, version numbers for Toolbox X and hardware components, or network interfaces information directly from your unit. You can also find the contact information if you ever need to reach EXFO.

Retrieving the Serial Number of Your Unit

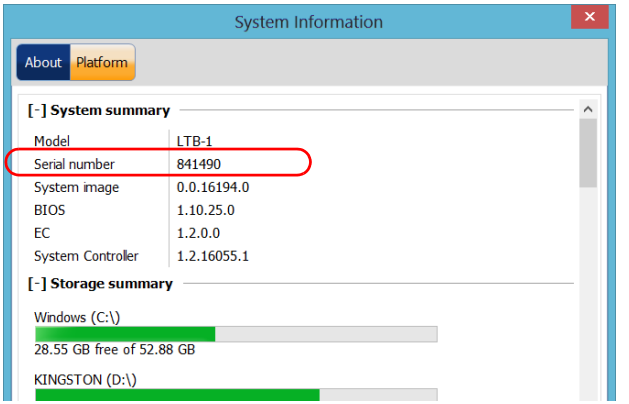
The serial number of your unit is easily accessible from Toolbox X.

Note: *You can also view the serial number on the label affixed to the bottom of your unit.*

To retrieve the serial number of your unit:

1. In the lower right corner of the main window, tap .
2. Tap the **Platform** tab.

   The serial number is displayed.



Note: *The serial numbers of your modules are visible from the **Modules** window.*

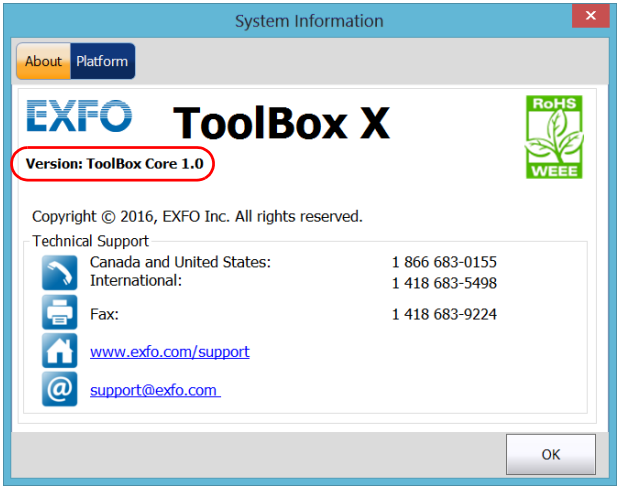
Retrieving the Component Versions

You can view the version of Toolbox X as well as those of the system image and hardware components that are installed on your unit.

To retrieve the Toolbox X version:

1. In the lower right corner of the main window, tap .
2. Tap the **About** tab.

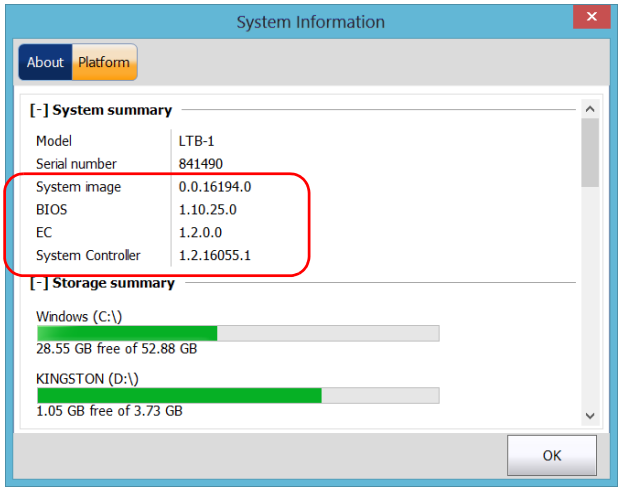
   The version number is displayed.



To retrieve the version numbers of the system image and hardware components:

1. In the lower right corner of the main window, tap .
2. Tap the **Platform** tab.

   The version numbers are displayed.



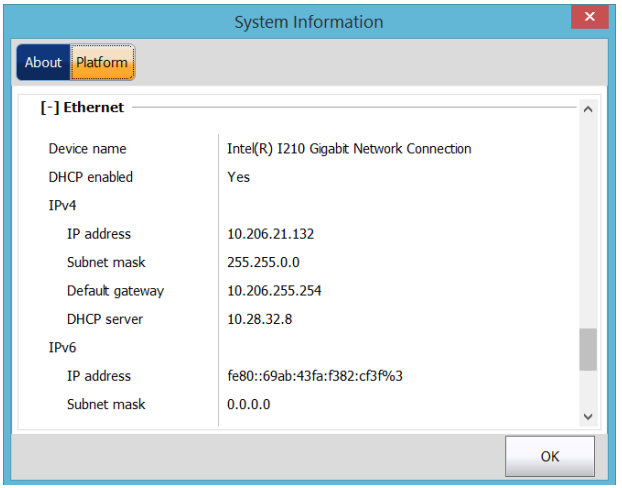
Retrieving Network Interfaces Information

You can view the information related to the network interfaces (adapters) such as the status of the interfaces, the IP address, etc.

To retrieve network interfaces information:

1. In the lower right corner of the main window, tap .
2. Tap the **Platform** tab.

   The information is displayed.



Retrieving the Contact Information

All the information necessary to contact EXFO is available from your unit.

To retrieve the contact information:

1. In the lower right corner of the main window, tap .
2. Tap the **About** tab.

   The contact information is displayed.

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.

13 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.

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 EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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)(UI) 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.

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 258). 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 258).

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,
Fuyong, 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.

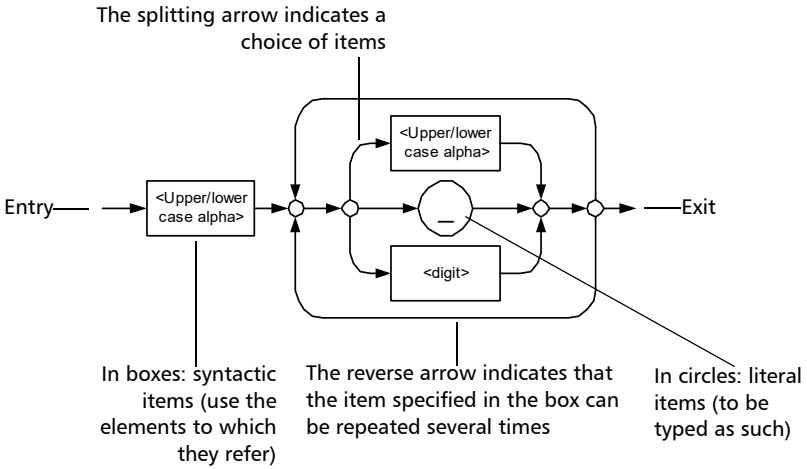
A Data Types

The following section provides an overview of the most common data types that may appear in EXFO's documentation on commands and queries. The information is supplied for guidance only.

For more detailed information, please refer to IEEE 488.2 and SCPI standards.

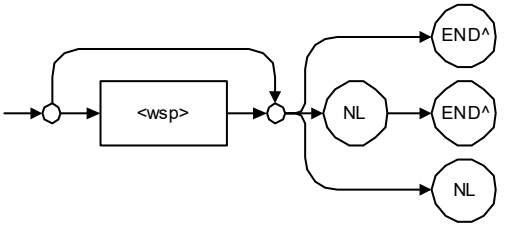
Data types are divided into two groups: <PROGRAM DATA> for the types that are used when you want to send messages to a device and <RESPONSE DATA> for the types that are used when a device sends responses to the controller.

The data types are presented in graphics often referred to as "railroad diagrams". The following example illustrates how to interpret such diagrams.



Applicable Data Types for Input—IEEE 488.2

➤ <PROGRAM MESSAGE TERMINATOR>



In the diagram above,

➤ "NL" corresponds to ASCII character code 10, in decimal (0A in binary)

➤ "END ^ " corresponds to the last data byte of the message sent with EOI = True and ATN = False

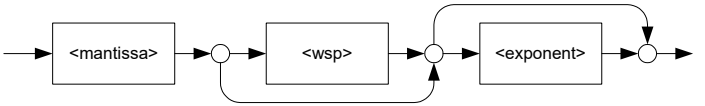
➤ <CHARACTER PROGRAM DATA>

This data type will be used to send short mnemonics when a *<DECIMAL NUMERIC PROGRAM DATA>* cannot be used.

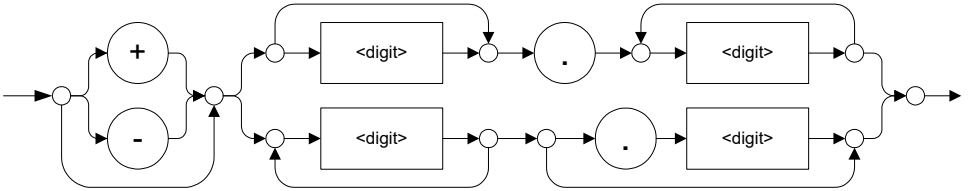
Examples: TRIANGLEWAVE, NCONTINUOUS

➤ <DECIMAL NUMERIC PROGRAM DATA> (or <NRf>)

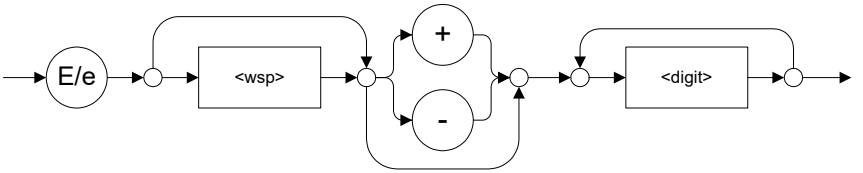
This data type includes <NR1>, <NR2> and <NR3> data types. It will be used for decimal fractions with or without an exponent. Instruments will adapt the values they receive to fit their degree of precision. For example, if an instrument has a precision of two digits after the decimal point and the incoming value is 12.048, this value will be rounded off to 12.05.



The second diagram below illustrates the <mantissa> syntax.



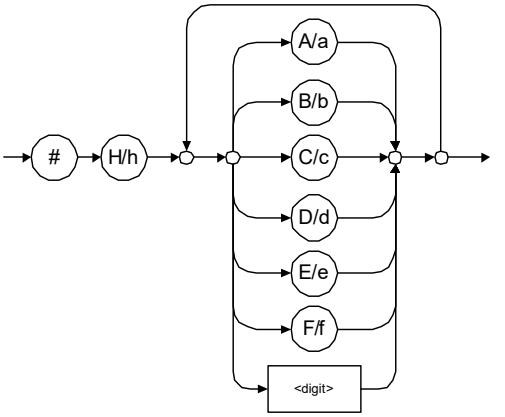
The third diagram illustrates the <exponent> syntax.



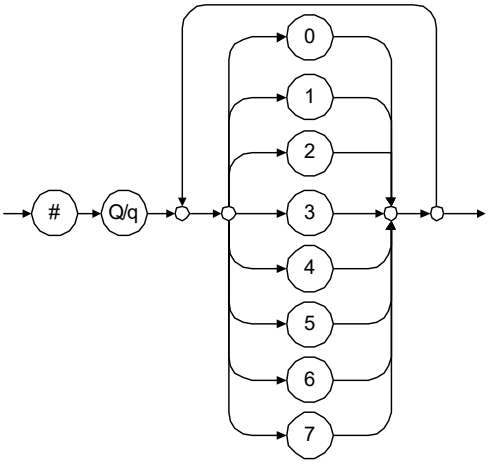
Examples: +2.0 e5, –.56E+4, 6.5e–10

➤ <NON-DECIMAL NUMERIC PROGRAM DATA>

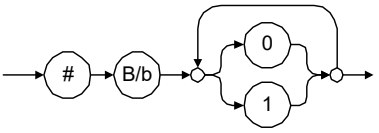
This data type will be used for integer representation in hexadecimal (base 16), octal (base 8) or binary (base 2). The numeric representations will begin with "#H" for hexadecimal, "#Q" for octal and "#B" for binary.



Examples: #Hf3bc015d, #h01a4, #hfe



Examples: #Q1234567, #q1275, #q07

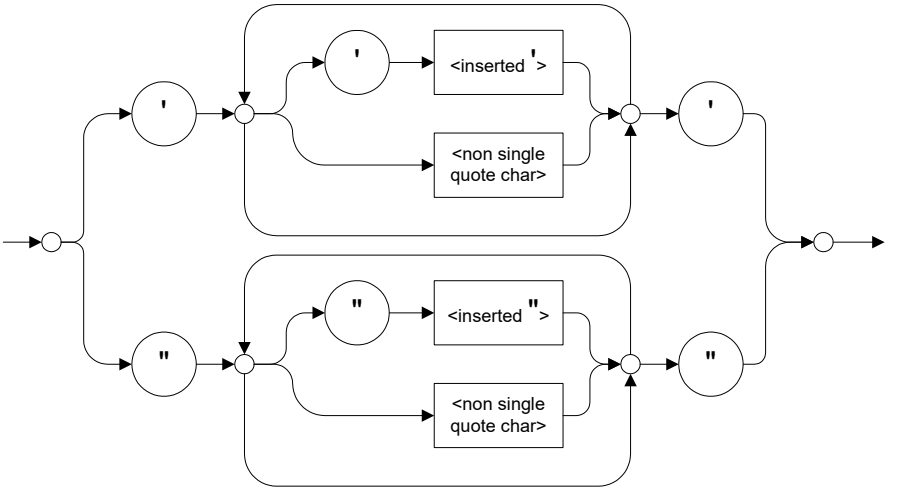


Examples: #B10010111, #b10110, #b1100

➤ <STRING PROGRAM DATA>

This data type will be used for strings containing 7-bit ASCII characters that have to be enclosed in either single- or double-quotes delimiters.

If a string needs to contain a character that is exactly the same as the delimiter, make sure to double the character to avoid syntax errors.



Examples: "SCPI Commands", 'SCPI Commands', "SCPI 'Commands'", 'SCPI "Commands"', "SCPI ""Commands""", 'SCPI ''Commands'''

➤ <ARBITRARY BLOCK PROGRAM DATA>

This data type is used to send blocks of arbitrary 8-bit information when you need to work with large amounts of data.

The actual length of the data that you send has the following structure:

➤ The first byte contains the # character.

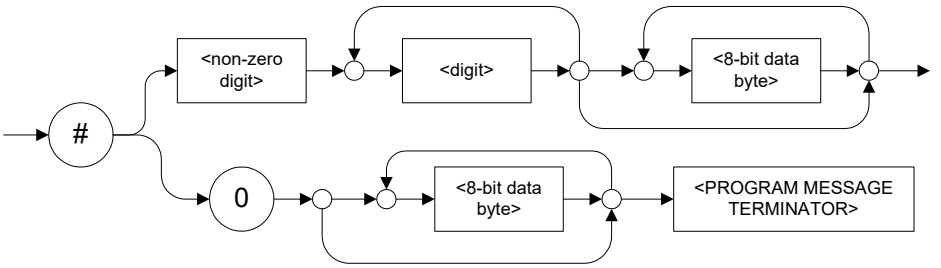
➤ The byte that immediately follows contains the number of subsequent bytes that you have to check to obtain the total length.

Note: *If you use a zero as the first digit (#0), it has to be followed by a <PROGRAM MESSAGE TERMINATOR > so that the device will detect the end of the <ARBITRARY BLOCK PROGRAM DATA>. This will also force immediate termination of the message.*

For example, if you send the following data (here, values are expressed in decimal instead of binary for easier readability):

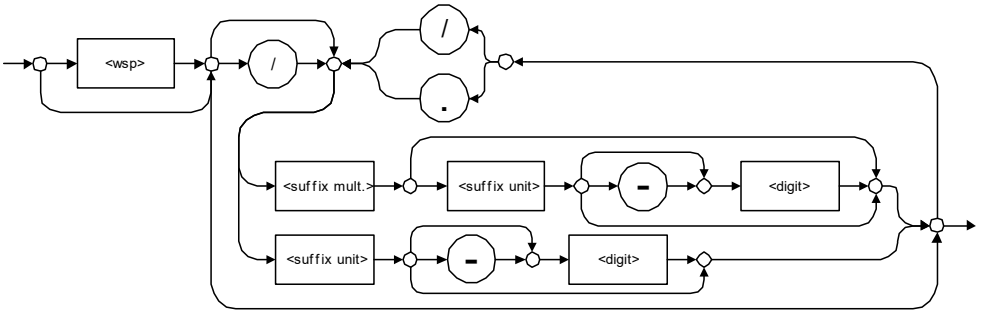
2 1 3 7 6 8 9 2 ...

The byte that immediately follows the # contains 2, which means that you would have to read the two following bytes to know the length (in bytes) of the retrieved data. The bytes indicate 1 and 3. The length will then be 13 bytes. The actual response will begin at byte number 5, in this case.



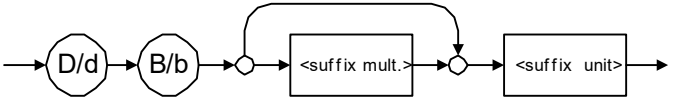
➤ <SUFFIX PROGRAM DATA>

This data type is used when units and multipliers have to be sent.



Examples: nm, kHz, km/s2, uW

A relative unit (dB) can be referenced to an absolute level, as shown on the following diagram.



Examples: db, dbm, dBW

The following table illustrates the possible forms for <suffix mult.>:

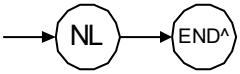
Name	Value	Mnemonic
Exa	1E18	EX
Peta	1E15	PE
Tera	1E12	T
Giga	1E9	G
Mega	1E6	MA
Kilo	1E3	K
Milli	1E-3	M
Micro	1E-6	U
Nano	1E-9	N
Pico	1E-12	P
Femto	1E-15	F
Atto	1E-18	A

The table below gives the possible forms for <suffix unit>:

Reference Unit	Suffix Unit
Degrees	DEG
Radians	RAD
Amperes	A
Volts	V
Hertz	HZ
Meters	M
Watts	W
DBs ref to 1mW	DBM
Decibels	DB
Degrees Celsius	CEL
Degrees Fahrenheit	FAR
Kelvins	K
Seconds	S
Hours	HR
Minutes	MIN

Applicable Data Types for Output —IEEE 488.2

- <RESPONSE MESSAGE TERMINATOR>



In the diagram above,

- "NL" corresponds to ASCII character code 10, in decimal (0A in binary)
- "END ^ " corresponds to the last data byte of the message sent with EOI = True and ATN = False

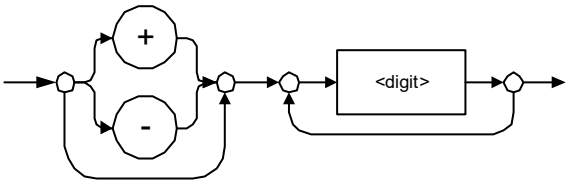
- <CHARACTER RESPONSE DATA>

This data type will be used by a device to return short mnemonics when a *<DECIMAL NUMERIC PROGRAM DATA>* cannot be used. The returned information is sent in the long form and in upper case.

Examples: TRIANGLEWAVE, NCONTINUOUS

➤ <NR1 NUMERIC RESPONSE DATA> (or <NR1>)

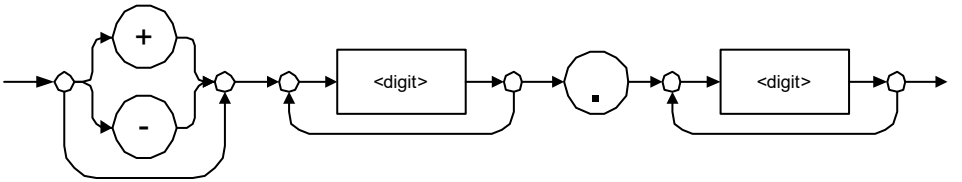
This data type will be used by a device to return positive or negative integers.



Examples: 4, –23, 90

➤ <NR2 NUMERIC RESPONSE DATA> (or <NR2>)

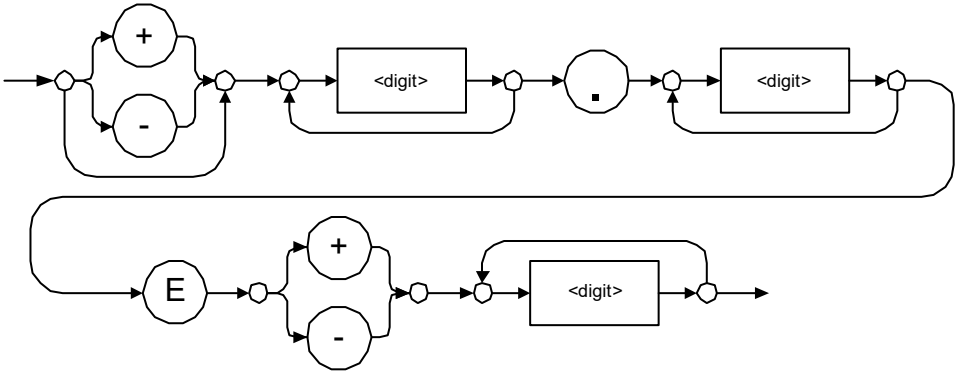
This data type will be used by a device to return positive or negative real numbers (fixed-point numbers).



Examples: 23.45, 1.22, –4.55

➤ <NR3 NUMERIC RESPONSE DATA> (or <NR3>)

This data type will be used by a device to return positive or negative exponential numbers (floating-point numbers).



Examples: 4.3E–3, –8.9456E8, 123E–5

➤ Special Numeric Values Received on Output

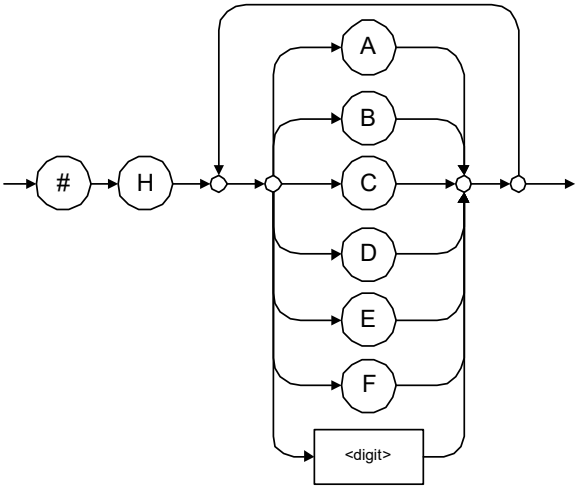
In some cases, an instrument may send values indicating that an unusual event has occurred. The following tables present the possible values.

Value is	ASCII 4 bytes	PACKED 4 bytes
Under range	2143289345.000000	7FC00001
Over range	2143289346.000000	7FC00002
Invalid	2143289347.000000	7FC00003
Inactive	2143289348.000000	7FC00004

Value is	ASCII 8 bytes	PACKED 8 bytes
Under range	9221120237577961472	7FF8000020000000
Over range	9221120238114832384	7FF8000040000000
Invalid	9221120238651703296	7FF8000060000000
Inactive	9221120239188574208	7FF8000080000000

➤ <HEXADECIMAL NUMERIC RESPONSE DATA>

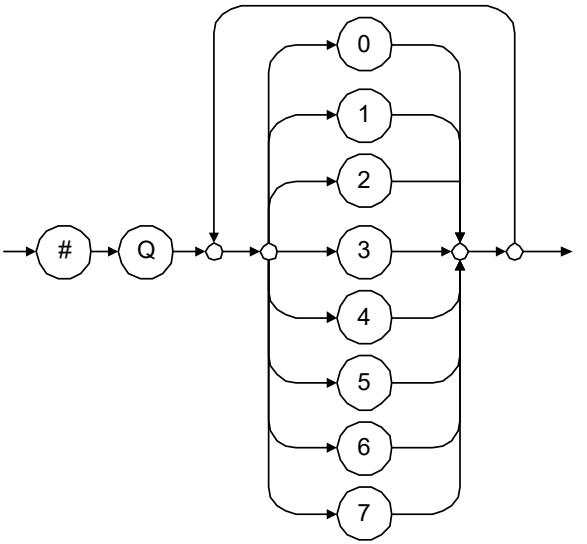
This data type will be used by a device to return integer representations in hexadecimal (base 16).



Examples: #HA3C5, #H0123C, #H010F

➤ <OCTAL NUMERIC RESPONSE DATA>

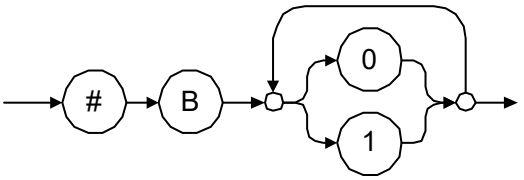
This data type will be used by a device to return integer representations in octal (base 8).



Examples: #Q753214, #Q0124, #Q0725

➤ <BINARY NUMERIC RESPONSE DATA>

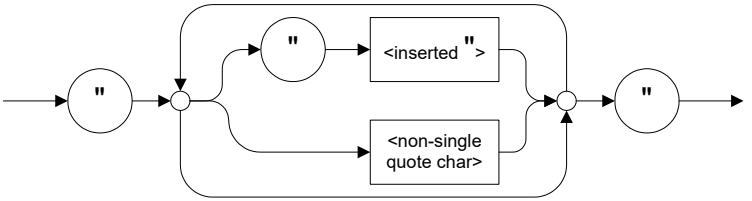
This data type will be used by a device to return integer representations in binary (base 2).



Examples: #B11011110101, #B110100, #B0100

➤ <STRING RESPONSE DATA>

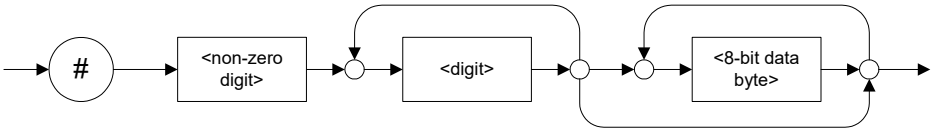
This data type will be used by a device to return strings containing 7-bit ASCII characters and especially when text has to be displayed since even the non-printable characters are also returned.



Examples: "SCPI Commands", "SCPI ""Commands"""

➤ <DEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>

This data type is used by a device to return blocks of 8-bit binary information with a fixed and predetermined length.



The actual length of the retrieved data has the following structure:

➤ The first byte contains the # character.

➤ The byte that immediately follows contains the number of subsequent bytes that you have to check to know the total length.

For example, if you receive this response (here, values are expressed in decimal instead of binary for easier readability):

2 1 3 7 6 8 9 2 ...

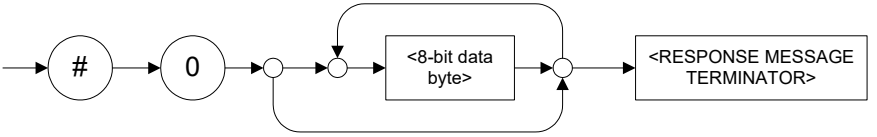
The byte that immediately follows the # contains 2, which means that you have to read the two following bytes to know the length (in bytes) of the retrieved data. The bytes indicate 1 and 3. The length will then be 13 bytes. The actual response will begin at byte number 5, in this case.

Examples: #14<DAB><DAB><DAB><DAB>,
#3004<DAB><DAB><DAB><DAB>

where "<DAB>" stands for data byte

➤ <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>

This data type is used by a device to return blocks of 8-bit binary information when the block length was not predefined or when data has to be computed later.

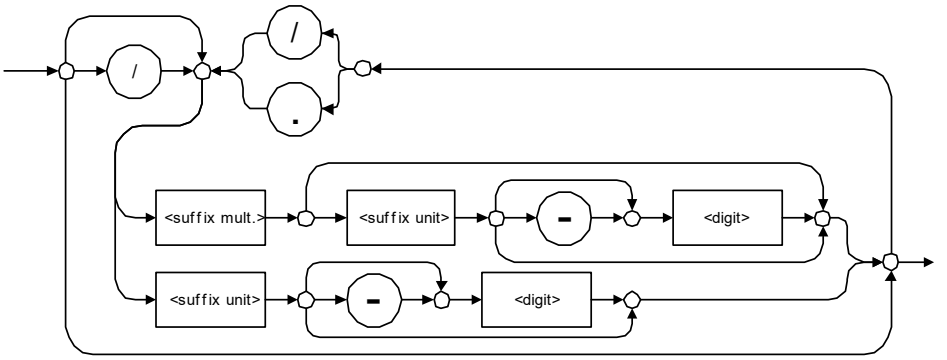


Note: *If you receive a zero as the first digit (#0), it is necessarily followed by a <RESPONSE PROGRAM MESSAGE TERMINATOR> so that you will detect the end of the <INDEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>.*

Example: #0<DAB><DAB><DAB><DAB><terminator> where "<DAB>" stands for data byte.

➤ <SUFFIX RESPONSE DATA>

This data type is used by a device to return units and multipliers.

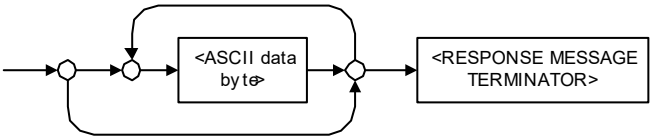


Examples: DBW, W, KHZ

➤ <ARBITRARY ASCII RESPONSE DATA>

This data type is used by a device to return information when it is impossible to use any other data type.

Example: To the *IDN? query, the device will return this response in an arbitrary ASCII bytes format:
EXFO E.O. Engineering,125-2A55,1.0.1.97



Applicable Data Types for Input—SCPI

SCPI data types include the IEEE 488.2 data types (see *Applicable Data Types for Input—IEEE 488.2* on page 260) with certain additional restrictions.

- <numeric_value>: abbreviated form of the decimal numeric element. It differs from the <DECIMAL NUMERIC PROGRAM DATA> "<NRf>" described in IEEE 488.2.

  Several forms of <CHARACTER PROGRAM DATA> are defined as special forms of numbers. These are: MINimum, MAXimum, DEFault, UP, DOWN, Not A Number (NAN), INFinity and Negative INFinity (NINF). The following special forms are likely to be used by EXFO's instruments in certain commands or queries:

  - DEFault: This special <numeric_value> parameter forces the instrument to select a value, which is deemed to be convenient to the user.
  - MINimum|MAXimum: These special <numeric_value> parameters refer to the instrument's limit values. MINimum corresponds to the value closest to negative infinity that the function can accept. MAXimum corresponds to the largest value that the function can accept.
  - <Boolean Program Data>: This form is often used as a shorthand of the <DECIMAL NUMERIC PROGRAM DATA>ON|OFF form.

    <Boolean Program Data> parameters have a value of 0 or 1 and are not followed by any unit.

    On input, an <NRf> is rounded to an integer.

    A non-zero result is interpreted as 1.

    ON and OFF are accepted on input for readability purposes. They correspond respectively to 1 and 0. However, on output, they appear as 1 or 0, never ON or OFF.

Special Numeric Values Received on Output

It is possible that an instrument returns unusual values in certain cases. For information on these values, see Applicable Data Types for Output —IEEE 488.2 *on page 269*.

B IEEE 488.2 and Specific Command Reference

This chapter presents detailed information about the commands and queries supplied with your LTB-1.

IEEE 488.2 Commands–Quick Reference

The LTB-1 recognizes the required commands identified in IEEE 488.2. The table below summarizes these commands. These commands are fully explained on the following pages.

Command	Function
*CLS	Clear status command
*ESE	Standard event status enable command
*ESE?	Standard event status enable query
*ESR?	Standard event status register query
*IDN?	Identification query
*OPC	Operation complete command
*OPC?	Operation complete query
*RST	Reset command
*SRE	Service request enable command
*SRE?	Service request enable query
*STB?	Read status byte query
*TST?	Self-test query
*WAI	Wait for pending operations to be completed

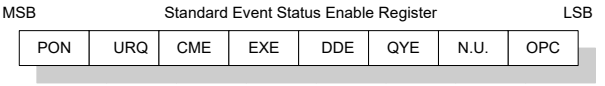
IEEE 488.2 Required Commands

	*CLS
Description	The *CLS command clears the Standard Event Status Register and the Error/Event Queue.
Syntax	*CLS
Parameter(s)	None

*ESE

Description

The *ESE command sets the Standard Event Status Enable Register bits, as defined in the table below. This register contains a mask value for the bits to be enabled in the Standard Event Status Register.



Syntax

*ESE<wsp><RegisterValue>

Parameter(s)

RegisterValue:

The program data syntax for <RegisterValue> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <RegisterValue>, expressed in base 2, represents the bit values of the Standard Event Status Enable Register.

*ESE

The table below shows the contents of this register.

Bit	Weight	Meaning
PON	128	Power ON Enable
URQ	64	User ReQuest Enable
CMD	32	CoMmanD Error Enable
EXE	16	Execution Error Enable
DDE	8	Device Dependent Error Enable
QRY	4	QueRry Error Enable
N.U.	2	Not used
OPC	1	Operation Complete Enable

A value of 1 in the Enable Register enables the corresponding bit in the Status Register, a value of 0 disables the bit. The value of the <RegisterValue> shall be in the range of 0 through 255.

Example(s)

*ESE 25
where 25 = (bit EXE, bit DDE and bit OPC)

*ESE 0
clears the content of the Standard Event Status Enable register

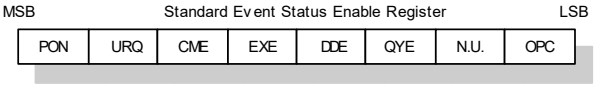
See Also

*ESE?
*ESR?

*ESE?

Description

With the *ESE? query you can determine the current contents of the Standard Event Status Enable Register. See the contents of this register below.



Syntax

*ESE?

Parameter(s)

None

Response Syntax

<RegisterValue>

*ESE?

Response(s)

RegisterValue:

The response data syntax for <RegisterValue> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <RegisterValue> ranges from 0 through 255.

The <RegisterValue> value expressed in base 2 (binary) represents the bit values of the Standard Event Status Enable register. See below.

Bit	Weight	Meaning
PON	128	Power ON Enable
URQ	64	User ReQuest Enable
CMD	32	CoMmanD Error Enable
EXE	16	Execution Error Enable
DDE	8	Device Dependent Error Enable
QRY	4	QueRry Error Enable
N.U.	2	Not used
OPC	1	Operation Complete Enable

Example(s)

*ESE? returns 133
where 133 = (bit PON, bit QYE and bit OPC)

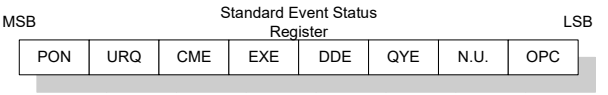
See Also

*ESE
*ESR?

*ESR?

Description

With the *ESR? query you can determine the current contents of the Standard Event Status Register. Reading the Standard Event Status Register clears it. See the contents of this register below.



Syntax

*ESR?

Parameter(s)

None

Response Syntax

<RegisterValue>

*ESR?

Response(s)

RegisterValue:

The response data syntax for <RegisterValue> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <RegisterValue> ranges from 0 through 255.

The <RegisterValue> value expressed in base 2 (binary) represents the bit values of the Standard Event Status register. See below.

Bit	Weight	Meaning
PON	128	Power ON Enable
URQ	64	User ReQuest Enable
CMD	32	CoMmanD Error Enable
EXE	16	Execution Error Enable
DDE	8	Device Dependent Error Enable
QRY	4	QueRry Error Enable
N.U.	2	Not used
OPC	1	Operation Complete Enable

Example(s)

*ESR? returns 33
where 33 = (bit CME and bit OPC)

See Also

*ESE
*ESE?

*IDN?

Description	The intent of the *IDN? query is for the unique identification of devices over the system interface.
Syntax	*IDN?
Parameter(s)	None
Response Syntax	<Identification>
Response(s)	*Identification:* The response data syntax for <Identification> is defined as an <ARBITRARY ASCII RESPONSE DATA> element. The response syntax for the *IDN? query, <Identification> is defined as an <ARBITRARY ASCII RESPONSE DATA> element. This implies that the *IDN? query should be the last <QUERY MESSAGE UNIT> in a <TERMINATED PROGRAM MESSAGE>. The response is organized into four fields separated by commas. The field definitions are as follows: Field 1 (Manufacturer): EXFO Inc. Field 2 (Model): Instrument Model

*IDN?	
	Field 3 (Serial number): ASCII character (0 if not available) Field 4 (Firmware level): ASCII character (0 if not available) ASCII character 0 represents a single ASCII-encoded byte with a value of 30 (48 decimal). The presence of data in all fields is mandatory. If either field 3 or 4 is not available, the ASCII character 0 shall be returned for that field. A field may contain any 7-bit ASCII-encoded bytes in the range of 20 through 7E (32 through 126 decimal) except commas (2C, 44 decimal) and semicolons (3B, 59 decimal).
Example(s)	*IDN? returns EXFO Inc., LTB-1,125-2A55,1.0.1.97
Notes	The overall length of the *IDN? response is less than or equal to 72 characters.

*OPC

Description	The *OPC command makes synchronization between the instrument and an external controller possible. The *OPC command causes the instrument to set bit 0 (Operation Complete) in the Standard Event Status Register to the TRUE (logic 1) state when the instrument completes all pending operations. Detection of the Operation Complete message can be accomplished by continuous polling of the Standard Event Status Register using the *ESR? common query command. However, using a service request eliminates the need to poll the Standard Event Status Register thereby freeing the controller to do other useful work.
Syntax	*OPC
Parameter(s)	None
See Also	*OPC? *WAI

	*OPC?
Description	The *OPC? query makes possible the synchronization between the instrument and an external controller by reading the Output Queue or by waiting for a service request on the Message Available (MAV) bit in the Status Byte Register. The *OPC? query causes the instrument to place an ASCII character, 1, into its Output Queue when the device completes all pending operations. A consequence of this action is that the MAV bit in the Status Byte Register is set to state 1.
Syntax	*OPC?
Parameter(s)	None
Response Syntax	<Acknowledge>
Response(s)	*Acknowledge:* The response data syntax for <Acknowledge> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <Acknowledge> response is a single ASCII-encoded byte corresponding to 1. The receipt of an <Acknowledge> response indicates that all pending selected device operations have been completed.
Example(s)	*OPC? returns 1
See Also	*OPC *WAI

*RST

Description

The *RST command performs a device reset. This command is the third reset level in a three-level reset strategy. The Reset command shall do the following:

a) Sets the device-specific functions to a known state that is independent of the past-use history of the device.
b) Forces the device into OCIS state (Operation complete Command Idle State).
c) Forces the device into OQIS state (Operation complete Query Idle State).

The Reset command explicitly DOES NOT affect the following:
a) The state of the Communication interface.
b) The Output Queue.
c) Any Event Enable Register setting, including the Standard Event Status Enable Register setting.

d) Any Event Register setting, including the Standard Event Status Register settings.
e) Calibration data that affects device specifications.
f) The Service Request Enable Register setting.

Syntax

*RST

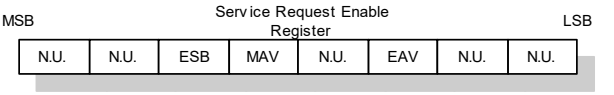
Parameter(s)

None

*SRE

Description

The *SRE command sets the Service Request Enable Register bits. See the contents of this register below. This register contains a mask value to enable the bits in the Status Byte Register.



Syntax

*SRE<wsp><RegisterValue>

Parameter(s)

RegisterValue:

The program data syntax for <RegisterValue> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <RegisterValue> value ranges from 0 through 255.

The <RegisterValue>, expressed in base 2 (binary), represents the bit values of the Service Request Enable Register.

*SRE

See the contents of this register below.

Bit	Weight	Meaning
N.U.	128	Not used
N.U.	64	Not used
ESB	32	Event Summary Bit Enable
MAV	16	Message AVailable Enable
N.U.	8	Not used
EAV	4	Error / Event AVailable Enable
N.U.	2	Not used
N.U.	1	Not used

A bit value of zero shall indicate a disabled condition.

Example(s)

*SRE 52
where 52 = (bit ESB, bit MAV and bit EAV)

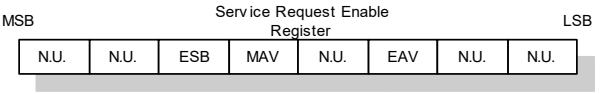
See Also

*SRE?
*STB?

*SRE?

Description

With the *SRE? query you can determine the current contents of the Service Request Enable Register. See the contents of this register below.



Bit	Weight	Meaning
N.U.	128	Not used
N.U.	64	Not used
ESB	32	Event Summary Bit Enable
MAV	16	Message AVailable Enable
N.U.	8	Not used
EAV	4	Error / Event AVailable Enable
N.U.	2	Not used
N.U.	1	Not used

Syntax *SRE?

Parameter(s) None

Response Syntax <RegisterValue>

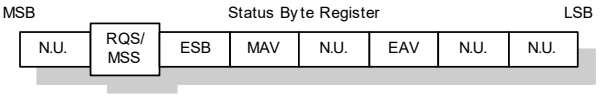
*SRE?

Response(s)	*RegisterValue:* The response data syntax for <RegisterValue> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <RegisterValue> ranges from 0 through 255. When converted to binary (base 2), the <RegisterValue> represents the current bit values of the Service Request Enable Register.
Example(s)	*SRE returns 32 (bit ESB)
See Also	*SRE *STB?

*STB?

Description

With the *STB? query you can read the status byte and Master Summary Status bit. See the content of this register below.



Syntax

*STB?

Parameter(s)

None

Response Syntax

<RegisterValue>

*STB?

Response(s)

RegisterValue:

The response data syntax for <RegisterValue> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <RegisterValue> ranges from 0 through 255.

The <RegisterValue> value, expressed in base 2 (binary) represents the bit values of the Status Byte Register. See the contents of this register below.

Bit	Weight	Meaning
N.U.	128	Not used
RQS/ MSS	64	ReQuest Service (read by serial polling)/MaSter Summary bit (read by *STB?)
ESB	32	Event Summary Bit Enable
MAV	16	Message AVailable Enable
N.U.	8	Not used
EAV	4	Error / Event AVailable Enable
N.U.	2	Not used
N.U.	1	Not used

Example(s)

*STB? returns 68
where 68 = (bit MSS and bit EAV)

See Also

*SRE
*SRE?

	*TST?
Description	The *TST? query causes an internal self-test and places a response into the Output Queue indicating whether or not the device completed the self-test without any detected errors. Upon successful completion of *TST?, the device settings is restored to their values prior to the *TST?.
Syntax	*TST?
Parameter(s)	None
Response Syntax	<Result>
Response(s)	*Result:* The response data syntax for <Result> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <Result> value ranges from -32767 through +32767. A <Result> with a value of zero indicates that the self-test has been completed without errors detected. A <Result> with a value not equal to zero indicates that the self-test was not completed or was completed with errors detected.
Example(s)	*TST? returns 0 (self-test was completed with success)

	*WAI
Description	The *WAI command shall prevent the device from executing any further commands or queries until the no-operation-pending flag becomes TRUE.
Syntax	*WAI
Parameter(s)	None
Example(s)	*WAI
See Also	*OPC *OPC?

Specific Commands—Quick Reference

The table below contains a summary of the LTB-1 specific commands. These commands are fully explained on the following pages.

Command						Parameter(s)
FORMat	[DATA]					ASCii|PACKed[,<Length>]
	[DATA]?					
INSTrument	CATalog?					
	CATalog	FULL?				
SYSTem	DATE					<Year>,<Month>,<Day>
	DATE?					
	ERRor	[NEXT]?				
	TIME					<Hour>,<Minute>,<Seconds>
	TIME?					
	VERSion?					

Specific Commands

:FORMat[:DATA]

Description

The FORMat[:DATA] command selects the data format and <Length>. The <Length> parameter is optional for all data format, its meaning is dependent on the data format selected.

If PACKed type is selected, the data is transferred in a <DEFINITE BLOCK RESPONSE DATA>. The ASCii-type data is automatically identified by its syntax. Therefore, in these cases, the FORMat subsystem is only necessary to determine the output format.

At *RST, ASCii is selected as the default data format and the <Length> is set to 0.

Syntax

:FORMat[:DATA]<wsp>ASCii|PACKed[,<Length>]

Parameter(s)

➤ *Type:*

The program data syntax for the first parameter is defined as a <CHARACTER PROGRAM DATA> element. The allowed <CHARACTER PROGRAM DATA> elements for this parameter are: ASCii|PACKed.

:FORMat[:DATA]

In ASCii format, the numeric data is transferred to ASCii bytes in <NR1 NUMERIC RESPONSE DATA>, <NR2 NUMERIC RESPONSE DATA> or <NR3 NUMERIC RESPONSE DATA> representation, as appropriate.

In PACKed format, data is transferred to a <DEFINITE BLOCK RESPONSE DATA>, in a manner specified in the device documentation.

➤ *Length:*

The program data syntax for <Length> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

When ASCii data format is selected, the optional <Length> parameter specifies the number of significant digits to be returned. A <Length> value of zero indicates that the device selects the number of significant digits to be returned. When a <Length> of zero has been specified, the FORMat[:DATA]? query returns zero as its second parameter.

When the PACKed data format is selected, the optional parameter <Length> it not used.

Example(s)

```
FORM ASC
FORM ASC,6
FORM:DATA  PACKED
```

See Also FORMat[:DATA]?

:FORMat[:DATA]?

Description

The FORMat[:DATA]? query returns the data format and the <Length>.

At *RST, ASCii is selected as the default data format and the <Length> is set to 0.

Syntax

:FORMat[:DATA]?

Parameter(s)

None

Response Syntax

<Type>,<Length>

Response(s)

➤ *Type:*

The response data syntax for <Type> is defined as a <CHARACTER RESPONSE DATA> element.

The ASCII <Type> is returned when numeric data is transferred to ASCII bytes in <NR1 NUMERIC RESPONSE DATA>, <NR2 NUMERIC RESPONSE DATA> or <NR3 NUMERIC RESPONSE DATA> representation, as appropriate.

The PACKED <Type> is returned when data is transferred to a <DEFINITE BLOCK RESPONSE DATA>, as specified in the device documentation.

➤ *Length:*

The response data syntax for <Length> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

:FORMat[:DATA]?

	When the data is returned in ASCII, the <Length> is the number of significant digits to be returned. A <Length> value of zero indicates that the device selects the number of significant digits to be returned. When the data is returned in PACKED <Type>, the <Length> is not used and always returns 0.
Example(s)	FORM? returns ASCII,6 FORM? returns PACKED,0
See Also	FORMat[:DATA]?

:INSTrument:CATalog?

Description	The INSTrument:CATalog? query returns a comma-separated list of <STRING RESPONSE DATA>, which contains the names of all logical instruments and groups. If no logical instruments are defined, a single null <STRING RESPONSE DATA> is returned. This is not affected by a *RST command.
Syntax	:INSTrument:CATalog?
Parameter(s)	None
Response Syntax	<Catalog>
Response(s)	*Catalog:* The response data syntax for <Catalog> is defined as a <STRING RESPONSE DATA> element. The list of <STRING PROGRAM DATA> contains the names of all logical instruments and groups.
Example(s)	INST:CAT? returns “FTB-5240BP Optical Spectrum Analyzer (1250nm-1650nm)”,”FTB-5240S Optical Spectrum Analyzer (1250nm-1650nm)”
See Also	INSTrument:CATalog:FULL?

:INSTrument:CATalog:FULL?

Description	The INSTrument:CATalog:FULL? returns a list of <STRING RESPONSE DATA> - <NR1 NUMERIC RESPONSE DATA> pairs. The <STRING RESPONSE DATA> contains the name of the logical instrument. The immediately following <NR1 NUMERIC RESPONSE DATA> formatted number is its associated logical instrument number. All response data elements are separated by commas. If no logical instrument is defined, a null <STRING RESPONSE DATA> value followed by a zero is returned. This is not affected by a *RST command.
Syntax	:INSTrument:CATalog:FULL?
Parameter(s)	None
Response Syntax	<Catalog>
Response(s)	*Catalog:* The response data syntax for <Catalog> is defined as a <STRING RESPONSE DATA> element. The list of <STRING RESPONSE DATA> contains the names of all logical instruments and groups. The immediately following <NR1 NUMERIC RESPONSE DATA> formatted number is its associated logical instrument number.
Example(s)	INST:CAT:FULL? returns “FTB-5240BP Optical Spectrum Analyzer (1250nm-1650nm)”,1,”FTB-5240S Optical Spectrum Analyzer (1250nm-1650nm)”,2
See Also	INSTrument:CATalog?.

:SYSTem:DATE

Description

The SYSTem:DATE command is used to set the device's internal calendar.

This is not affected by a *RST command.

Syntax

:SYSTem:DATE<wsp><Year>,<Month>,<Day>

Parameter(s)

➤ *Year:*

The program data syntax for <Year> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Year> is rounded to the nearest integer. Its range is limited by the capability of the device. The year shall be entered as a four-digit number, including century and millennium information.

➤ *Month:*

The program data syntax for <Month> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Month> is rounded to the nearest integer. Its range is 1 to 12 inclusive. The number 1 corresponds to January, 2 to February, and so on.

:SYSTem:DATE

➤ *Day:*

The program data syntax for <Day> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Day> is rounded to the nearest integer. It ranges from 1 to the number of days in the month from the previous parameter. This command keeps track of the number of days in each month, accounting for leap years through the range of years that it accepts.

Example(s) SYST:DATE 2016,07,29

See Also SYSTem:DATE?

:SYSTem:DATE?

Description	The SYSTem:DATE query returns the instrument's internal calendar. This is not affected by a *RST command.
Syntax	:SYSTem:DATE?
Parameter(s)	None
Response Syntax	<Year>,<Month>,<Day>

:SYSTem:DATE?

Response(s)

➤ *Year:*

The response data syntax for <Year> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Year> is a four-digit number, including century and millennium information.

➤ *Month:*

The response data syntax for <Month> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Month> ranges from 1 to 12, inclusively. The number 1 corresponds to January, 2 to February, and so on.

➤ *Day:*

The response data syntax for <Day> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Day> ranges from 1 to the number of days in the month from the previous field. This command keeps track of the number of days in each month, accounting for leap years through the range of years that it accepts.

Example(s) SYST:DATE? returns 2016,07,29

See Also SYSTem:DATE

:SYSTem:ERRor[:NEXT]?

Description

The SYSTem:ERRor[:NEXT]? queries the error/event queue for the next item and removes it from the queue. The response message consists of two fields separated by commas <Code>,<Description[,Info]>.

SYSTem:ERRor[:NEXT]? is a query only and, therefore, does not have an associated *RST state.

Syntax

:SYSTem:ERRor[:NEXT]?

Parameter(s)

None

Response Syntax

<Code>,<Description[,Info]>

Response(s)

➤ *Code:*

The response data syntax for <Code> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Code> is a unique integer in the range [-32768, 32767]. All positive numbers are instrument-dependent. All negative numbers are reserved by the SCPI standard with certain standard error/event codes described in an appendix of this document. The zero value is also used to indicate that no error or event has occurred.

➤ *Description[,Info]:*

The response data syntax for <Description[,Info]> is defined as a <STRING RESPONSE DATA> element.

:SYSTem:ERRor[:NEXT]?

The <Description[,Info]> parameter of the full response is a quoted string containing a description followed by information text [,Info]. Each <Code> has a unique and fixed <Description> associated with it. The <Date> and <Time> are appended to the [,info] separated by a semi-colon using the following format:
<Date><wsp><Time> where
<Date> = Year/Month/Day
<Time> = Hour,Minute,Second (24 hour time)

The maximum length of <Description[,Info]> is 255 characters. For standard defined error/event <Codes>, the <Description> is sent exactly as indicated in the appendix of this document.

Example(s)

SYST:ERR:NEXT? returns -222,"Data out of range"
SYST:ERR:NEXT? returns -222,"Data out of range,instrument monomodule 5240S, 2016/07/29 14:56:16.259"

:SYSTem:TIME

Description

This device has an internal clock and implements the SYSTem:TIME command to set the clock time over the interface.

This is not affected by a *RST command.

Syntax

:SYSTem:TIME<wsp><Hour>,<Minute>,<Seconds>

Parameter(s)

➤ *Hour:*

The program data syntax for <Hour> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Hour> is always rounded to the nearest integer. It ranges from 0 to 23 inclusively. The device accepts hour information in 24-hour format.

➤ *Minute:*

The program data syntax for <Minute> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Minute> is always rounded to the nearest integer. It ranges from 0 to 59 inclusively.

:SYSTem:TIME

➤ *Seconds:*

The program data syntax for <Seconds> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <Second> is rounded to the resolution of the clock. It ranges from 0 to 60. A value of 60 is allowed since rounding may cause a number greater than 59.5 to be rounded to 60. When this element is rounded to 60 it shall be set to 0 and the minute value incremented. Any other carries shall be rippled through the date.

Example(s) SYST:TIME 12,47,29

See Also SYSTem:TIME?

:SYSTem:TIME?

Description	This device has an internal clock and implements the SYSTem:DATE? query to get the clock time over the interface. This is not affected by a *RST command.
Syntax	:SYSTem:TIME?
Parameter(s)	None
Response Syntax	<Hour>,<Minute>,<Second>

:SYSTem:TIME?

Response(s)

➤ *Hour:*

The response data syntax for <Hour> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Hour> ranges from 0 to 23. The instruments returns hour information in 24-hour format.

➤ *Minute:*

The response data syntax for <Minute> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Minute> ranges from 0 to 59.

➤ *Second:*

The response data syntax for <Second> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <Second> ranges from 0 to 59. The resolution of the clock is the second.

Example(s) SYST:TIME? returns 16,55,38

See Also SYSTem:TIME

:SYSTem:VERSion?

Description	The SYSTem:VERSion? query returns a value corresponding to the SCPI version number to which the device complies. The SYSTem:VERSion? is a query only and, therefore, does not have an associated *RST state.
Syntax	:SYSTem:VERSion?
Parameter(s)	None
Response Syntax	<Version>
Response(s)	*Version:* The response data syntax for <Version> is defined as a <NR2 NUMERIC RESPONSE DATA> element. The <Version> is shown in the form Year.Revision, where Year represents the year-version (that is 1990) and Revision represents an approved revision number for that year. If no approved revisions are claimed, then this extension is 0.
Example(s)	SYSTem:VERSion? returns 1999.0 (no approved revisions are claimed)

C SCPI-Based Errors

Error Number	Description	Probable Cause
–100	“Command error”	This is the generic syntax error for devices that cannot detect more specific errors. This code indicates only that a Command Error as defined in IEEE 488.2, 11.5.1.1.4 has occurred.
–101	“Invalid character”	A syntactic element contains a character which is invalid for that type; for example, a header containing an ampersand, SETUP&. This error might be used in place of errors –114, –121, –141, and perhaps some others.
–102	“Syntax error”	An unrecognized command or data type was encountered; for example, a string was received when the device does not accept strings.
–103	“Invalid separator”	The parser was expecting a separator and encountered an illegal character; for example, the semicolon was omitted after a program message unit, *EMC 1:CH1:VOLTS 5.
–104	“Data type error”	The parser recognized a data element different than one allowed; for example, numeric or string data was expected but block data was encountered.
–105	“GET not allowed”	A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7).
–108	“Parameter not allowed”	More parameters were received than expected for the header; for example, the *EMC common command only accepts one parameter, so receiving *EMC 0,1 is not allowed.
–109	“Missing parameter”	Fewer parameters were received than required for the header; for example, the *EMC common command requires one parameter, so receiving *EMC is not allowed.

Error Number	Description	Probable Cause
–110	“Command header error”	An error was detected in the header. This error message should be used when the device cannot detect the more specific errors described for errors –111 through –119.
–111	“Header separator error”	A character which is not a legal header separator was encountered while parsing the header; for example, no white space followed the header, thus *GMC"MACRO" is an error.
–112	“Program mnemonic too long”	The header contains more that twelve characters (see IEEE 488.2, 7.6.1.4.1).
–113	“Undefined header”	The header is syntactically correct, but it is undefined for this specific device; for example, *XYZ is not defined for any device.
–114	“Header suffix out of range”	The value of a numeric suffix attached to a program mnemonic (see IEEE 488.2, Syntax and Style section 6.2.5.2) makes the header invalid.
–115	“Unexpected number of parameters”	The number of parameters received does not correspond to the number of parameters expected. This is typically due an inconsistency with the number of instruments in the selected group (see section on INSTrument:DEFine:GROup).
–120	“Numeric data error”	This error, as well as errors –121 through –129, are generated when parsing a data element which appears to be numeric, including the non-decimal numeric types.This particular error message should be used if the device cannot detect a more specific error.
–121	“Invalid character in number”	An invalid character for the data type being parsed was encountered; for example, an alpha in a decimal numeric or a "9" in octal data.

Error Number	Description	Probable Cause
–123	“Exponent too large”	The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).
–124	“Too many digits”	The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).
–128	“Numeric data not allowed”	A legal numeric data element was received, but the device does not accept one in this position for the header.
–130	“Suffix error”	This error, as well as errors –131 through –139, are generated when parsing a suffix. This particular error message should be used if the device cannot detect a more specific error.
–131	“Invalid suffix”	The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.
–134	“Suffix too long”	The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).
–138	“Suffix not allowed”	A suffix was encountered after a numeric element which does not allow suffixes.
–140	“Character data error”	This error, as well as errors –141 through –149, are generated when parsing a character data element. This particular error message should be used if the device cannot detect a more specific error.
–141	“Invalid character data”	Either the character data element contains an invalid character or the particular element received is not valid for the header.
–144	“Character data tool long”	The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).
–148	“Character data not allowed”	A legal character data element was encountered where prohibited by the device.

Error Number	Description	Probable Cause
–150	“String data error”	This error, as well as errors –151 through –159, are generated when parsing a string data element. This particular error message should be used if the device cannot detect a more specific error.
–151	“Invalid string data”	A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2); for example, an END message was received before the terminal quote character.
–158	“String data not allowed”	A string data element was encountered but was not allowed by the device at this point in parsing.
–160	“Block data error	This error, as well as errors –161 through –169, are generated when parsing a block data element. This particular error message should be used if the device cannot detect a more specific error.
–161	“Invalid block data”	A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2); for example, an END message was received before the length was satisfied.
–168	“Block data not allowed”	A legal block data element was encountered but was not allowed by the device at this point in parsing.
–170	“Expression error”	This error, as well as errors –171 through –179, are generated when parsing an expression data element. This particular error message should be used if the device cannot detect a more specific error.
–171	“Invalid expression”	The expression data element was invalid (see IEEE 488.2, 7.7.7.2); for example, unmatched parentheses or an illegal character.
–178	“Expression data not allowed”	A legal expression data was encountered but was not allowed by the device at this point in parsing.

Error Number	Description	Probable Cause
–180	“Macro error”	This error, as well as errors –181 through –189, are generated when defining a macro or executing a macro. This particular error message should be used if the device cannot detect a more specific error.
–181	“Invalid outside macro definition”	Indicates that a macro parameter placeholder ($<number) was encountered outside of a macro definition.
–183	“Invalid inside macro definition”	Indicates that the program message unit sequence, sent with a *DDT or *DMC command, is syntactically invalid (see IEEE 488.2, 10.7.6.3).
–184	“Macro parameter error”	Indicates that a command inside the macro definition had the wrong number or type of parameters.
–200	“Execution error”	This is the generic syntax error for devices that cannot detect more specific errors. This code indicates only that an Execution Error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.
–201	“Invalid while in local”	Indicates that a command is not executable while the device is in local due to a hard local control (see IEEE 488.2, 5.6.1.5); for example, a device with a rotary switch receives a message which would change the switches state, but the device is in local so the message can not be executed.
–202	“Settings lost due to rtl”	Indicates that a setting associated with a hard local control (see IEEE 488.2, 5.6.1.5) was lost when the device changed to LOCS from REMS or to LWLS from RWLS.
–203	“Command protected”	Indicates that a legal password-protected program command or query could not be executed because the command was disabled.

Error Number	Description	Probable Cause
–210	“Trigger error”	-----
–211	“Trigger ignored”	Indicates that a GET, *TRG, or triggering signal was received and recognized by the device but was ignored because of device timing considerations; for example, the device was not ready to respond. Note: a DT0 device always ignores GET and treats *TRG as a Command Error.
–212	“Arm ignored”	Indicates that an arming signal was received and recognized by the device but was ignored.
–213	“Init ignored”	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.
–214	“Trigger deadlock”	Indicates that the trigger source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
–215	“Arm deadlock”	Indicates that the arm source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
–220	“Parameter error”	Indicates that a program data element related error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –221 through –229.
–221	“Settings conflict”	Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2, 6.4.5.3 and 11.5.1.1.5).

Error Number	Description	Probable Cause
–222	“Data out of range”	Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the device (see IEEE 488.2, 11.5.1.1.5).
–223	“Too much data”	Indicates that a legal program data element of block, expression, or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.
–224	“Illegal parameter value”	Used where exact value, from a list of possible, was expected.
–225	“Out of memory”	The device has insufficient memory to perform the requested operation.
–226	“Lists not same length”	Attempted to use LIST structure having individual LIST's of unequal lengths.
–230	“Data corrupt or stale”	Possibly invalid data; new reading started but not completed since last access.
–231	“Data questionable”	Indicates that measurement accuracy is suspect.
–232	“Invalid format”	Indicates that a legal program data element was parsed but could not be executed because the data format or structure is inappropriate. For example when loading memory tables or when sending a SYSTem:SET parameter from an unknown instrument.

Error Number	Description	Probable Cause
–233	“Invalid version”	Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device. This particular error should be used when file or block data formats are recognized by the instrument but cannot be executed for reasons of version incompatibility. For example, a not supported file version, a not supported instrument version
–240	“Hardware error”	Indicates that a legal program command or query could not be executed because of a hardware problem in the device. Definition of what constitutes a hardware problem is completely device-specific. This error message should be used when the device cannot detect the more specific errors described for errors –241 through –249.
–241	“Hardware missing”	Indicates that a legal program command or query could not be executed because of missing device hardware; for example, an option was not installed. Definition of what constitutes missing hardware is completely device-specific.
–250	“Mass storage error”	Indicates that a mass storage error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –251 through –259.
–251	“Missing mass storage”	Indicates that a legal program command or query could not be executed because of missing mass storage; for example, an option that was not installed. Definition of what constitutes missing mass storage is device-specific.
–252	“Missing media”	Indicates that a legal program command or query could not be executed because of a missing media; for example, no disk. The definition of what constitutes missing media is device-specific.

Error Number	Description	Probable Cause
–253	“Corrupt media”	Indicates that a legal program command or query could not be executed because of corrupt media; for example, bad disk or wrong format. The definition of what constitutes corrupt media is device-specific.
–254	“Media full”	Indicates that a legal program command or query could not be executed because the media was full; for example, there is no room on the disk. The definition of what constitutes a full media is device-specific.
–255	“Directory full”	Indicates that a legal program command or query could not be executed because the media directory was full. The definition of what constitutes a full media directory is device-specific.
–256	“File name not found”	Indicates that a legal program command or query could not be executed because the file name on the device media was not found; for example, an attempt was made to read or copy a nonexistent file. The definition of what constitutes a file not being found is device-specific.
–257	“File name error”	Indicates that a legal program command or query could not be executed because the file name on the device media was in error; for example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.
–258	“Media protected”	Indicates that a legal program command or query could not be executed because the media was protected; for example, the write-protect tab on a disk was present.The definition of what constitutes protected media is device-specific.

Error Number	Description	Probable Cause
–260	“Expression error”	[Indicates that a expression program data element related error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –261 through –269.]
–261	“Math error in expression”	[Indicates that a syntactically legal expression program data element could not be executed due to a math error; for example, a divide-by-zero was attempted. The definition of math error is device-specific.]
–270	“Macro error”	[Indicates that a macro-related execution error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –271 through –279.]
–271	“Macro syntax error”	[Indicates that a syntactically legal macro program data sequence, according to IEEE 488.2, 10.7.2, could not be executed due to a syntax error within the macro definition (see IEEE 488.2, 10.7.6.3).]
–272	“Macro execution error”	[Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition (see IEEE 488.2, 10.7.6.3).]
–273	“Illegal macro label”	[Indicates that the macro label defined in the *DMC command was a legal string syntax, but could not be accepted by the device (see IEEE 488.2, 10.7.3 and 10.7.6.2); for example, the label was too long, the same as a common command header, or contained invalid header syntax.]
–274	“Macro parameter error”	[Indicates that the macro definition improperly used a macro parameter placeholder (see IEEE 488.2, 10.7.3).]

Error Number	Description	Probable Cause
–275	“Macro definition too long”	[Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle (see IEEE 488.2, 10.7.6.1).]
–276	“Macro recursion error”	[Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive (see IEEE 488.2, 10.7.6.6).]
–277	“Macro redefinition not allowed”	[Indicates that a syntactically legal macro label in the *DMC command could not be executed because the macro label was already defined (see IEEE 488.2, 10.7.6.4).]
–278	“Macro header not found”	[Indicates that a syntactically legal macro label in the *GMC? query could not be executed because the header was not previously defined.]
–280	“Program error”	[Indicates that a downloaded program-related execution error occurred. This error message should be used when the device cannot detect the more specific errors described for errors –281 through –289. A downloaded program is used to add algorithmic capability to a device. The syntax used in the program and the mechanism for downloading a program is device-specific.]
–281	“Cannot create program”	[Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.]
–282	“Illegal program name”	[The name used to reference a program was invalid; for example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.]
–283	“Illegal variable name”	[An attempt was made to reference a nonexistent variable in a program.]

Error Number	Description	Probable Cause
–284	“Program currently running”	[Certain operations dealing with programs may be illegal while the program is running; for example, deleting a running program might not be possible.]
–285	“Program syntax error”	[Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.]
–286	“Program runtime error”	-----
–290	“Memory use error”	[Indicates that a user request has directly or indirectly caused an error related to memory or <data_handle>, this is not the same as “bad” memory.]
–291	“Out of memory”	-----
–292	“Referenced name does not exist”	-----
–293	“Referenced name already exist”	-----
–294	“Incompatible type”	[Indicates that the type or structure of a memory item is inadequate]
–300	“Device-specific error”	[This is the generic device-dependent error for devices that cannot detect more specific errors. This code indicates only that a Device-Dependent Error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.]
–310	“System error”	[Indicates that some error, termed "system error" by the device, has occurred. This code is device-dependent.]
–311	“Memory error”	[Indicates some physical fault in the device's memory, such as parity error.]

Error Number	Description	Probable Cause
–312	“PUD memory lost”	[Indicates that the protected user data saved by the *PUD command has been lost.]
–313	“Calibration memory lost”	[Indicates that nonvolatile calibration data used by the *CAL? command has been lost.]
–314	“Save/Recall memory lost”	[Indicates that the nonvolatile data saved by the *SAV? command has been lost.]
–315	“Configuration memory lost”	[Indicates that nonvolatile configuration data saved by the device has been lost. The meaning of this error is device-specific.]
–320	“Storage fault”	[Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.]
–321	“Out of memory”	[An internal operation needed more memory than was available.]
–330	“Self-test failed”	-----
–340	“Calibration failed”	-----
–350	“Queue overflow”	[A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.]
–360	“Communication error”	[This is the generic communication error for devices that cannot detect the more specific errors described for errors –361 through –363.]
–361	“Parity error in program message”	[Parity bit not correct when data received for example, on a serial port.]
–362	“Framing error in program message”	[A stop bit was not detected when data was received for example, on a serial port (for example, a baud rate mismatch).]

Error Number	Description	Probable Cause
–363	“Input buffer overrun”	[Software or hardware input buffer on serial port overflows with data caused by improper or nonexistent pacing.]
–365	“Time out error”	[This is a generic device-dependent error.]
–400	“Query error”	[This is the generic query error for devices that cannot detect more specific errors. This code indicates only that a Query Error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.]
–410	“Query INTERRUPTED”	[Indicates that a condition causing an INTERRUPTED Query error occurred (see IEEE 488.2, 6.3.2.3); for example, a query followed by DAB or GET before a response was completely sent.]
–420	“Query UNTERMINATED”	[Indicates that a condition causing an UNTERMINATED Query error occurred (see IEEE 488.2, 6.3.2.2); for example, the device was addressed to talk and an incomplete program message was received.]
–430	“Query DEADLOCKED”	[Indicates that a condition causing an DEADLOCKED Query error occurred (see IEEE 488.2, 6.3.1.7); for example, both input buffer and output buffer are full and the device cannot continue.]
–440	“Query UNTERMINATED after indefinite response”	[Indicates that a query was received in the same program message after an query requesting an indefinite response was executed (see IEEE 488.2, 6.5.7.5).]
–500	“Power on”	[The instrument has detected an off to on transition in its power supply.]
–600	“User request”	[The instrument has detected the activation of a user request local control.]

Error Number	Description	Probable Cause
–700	“Request control”	[The instrument requested to become the active IEEE 488.1 controller-in-charge.]
–800	“Operation complete”	[The instrument has completed all selected pending operations in accordance with the IEEE 488.2, 12.5.2 synchronization protocol.]

D COM Properties and Events

The LTB-1 also provides objects based on Microsoft Component Object Model (COM). COM defines a common way to access and create software components and services.

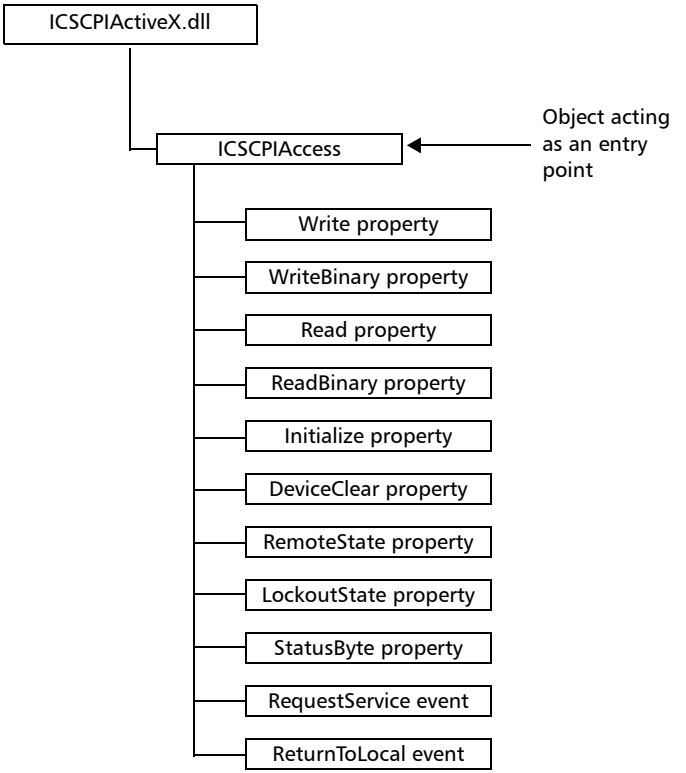
COM promotes the integration and the reuse of software components, as well as interoperability. In order to interoperate, components developed in different languages must adhere to a binary structure specified by Microsoft.

OLE and ActiveX are based on COM. Many programming languages can create and use COM components.

You can build your own programs using the provided properties and events via the IcSCPIAccess interface (available on your unit). For information on how to configure your LTB-1 for DCOM control, see *Configuring DCOM Access to Your Unit* on page 169.

ActiveX (COM/DCOM)—Quick Reference

The following diagram illustrates the different properties and events available.



These properties and events are fully explained in the following pages.

Properties

	Write
Description	With this method you can send a program message (single command or compound of commands) to the device input buffer.
Syntax	object.*Write* (*Message*)
Parameter(s)	*Message*: Required. A string value corresponding to the program message to be sent.
Possible error(s)	*Timeout*: This error will occur if the operation could not be completed within the allowed delay. For information on timeout setting, see *Initialize* on page 343.

WriteBinary	
Description	With this method you can send a program message (single command or compound of commands) as an array of bytes into the device input buffer.
Syntax	object.*Write* (*BinaryArray*)
Parameter(s)	*BinaryArray*: Required. An array of bytes corresponding to the program message to be sent.
Notes	Use this method instead of the *Write* method if you need to send commands in binary (COM is UNICODE).
Possible error(s)	*Timeout*: This error will occur if the operation could not be completed within the allowed delay. For information on timeout setting, see *Initialize* on page 343.

IMPORTANT

Before you retrieve data with the Read or ReadBinary methods, you must specify the format in which the information must be returned. Details on how to correctly set the format can be found below.

Read

Description	With this method you can retrieve all the data from the device output queue in a UNICODE format.
Syntax	object.*Read*
Parameter(s)	None.
Response(s)	A string value (in UNICODE format).
Notes	This method must be used in conjunction with the *Write* method. Always ensure that a query has been previously sent before attempting to read a response from the output queue. To properly set the data format, send the following command (using the *Write* method): FORM:DATA<wsp>ASCII <number_of_digits> where <*number_of_digits*> corresponds to the number of digits after the decimal point that you require. Remember that the retrieved data will have to be converted to a numeric format before you can use it in calculations, for example.
Possible error(s)	*Timeout*: This error will occur if the allowed delay has expired before the preceding *Write* operation could send a response to the output queue. For information on timeout setting, see *Initialize* on page 343. *QueryUnterminated*: This error will occur if the output queue is empty (for example, no query has been made previously).

ReadBinary

Description	With this method you can retrieve data from the device output queue in a binary format.
Syntax	object.*ReadBinary*
Parameter(s)	None.
Response(s)	An array of bytes.
Notes	This method must be used in conjunction with the *Write* method. Always ensure that a query has been previously sent before attempting to read a response from the output queue. To properly set the data format, send the following command (using the *Write* method): FORM:DATA<wsp>PACKED The retrieved data *does not* need to be converted to a numeric format before you can use it in calculations, for example. To help you know the actual length of the retrieved data, it has the following structure: ➤ The first byte contains the # character. ➤ The byte that immediately follows contains the number of subsequent bytes that you have to check to know the total length.

ReadBinary

	For example, if you receive this response (here, values are expressed in decimal instead of binary for easier readability): # 2 1 3 7 5 8 9 2 ... The byte that immediately follows the # contains 2, which means that you have to read the two following bytes to know the length (in bytes) of the retrieved data. The bytes indicate 1 and 3. The length will then be 13 bytes. The actual response will begin at byte number 5, in this case.
Possible error(s)	*Timeout*: This error will occur if the allowed delay has expired before the preceding *Write* operation could send a response to the output queue. For information on timeout setting, see *Initialize* on page 343. *QueryUnterminated*: This error will occur if the output queue is empty (for example, no query has been made previously).

Initialize

Description	With this method you can configure the timeout value that is, the allowed delay for Read and Write operations, in milliseconds.
Syntax	object.*Initialize*(*Timeout*)
Parameter(s)	*Timeout*: Required. A numeric value corresponding to the delay in milliseconds.
Notes	If the *Initialize* method is not invoked, the default value is 10 000 milliseconds.

DeviceClear	
Description	This method performs a *Device Clear* operation as specified in the IEEE 488.1 standard.
Syntax	object.*DeviceClear*
Parameter(s)	None.

RemoteState	
Description	This property returns or sets the device's remote state.
Syntax	object.*RemoteState* (to retrieve the state) object.*RemoteState*=*State* (to set the state) *State*: a Boolean value corresponding to: True: Remote False: Local
Parameter(s)	None.
Response(s)	If the property is used to get the device's remote state, the property will return a Boolean value.
Access	Get/Set

LockoutState

Description	This property returns or sets the device's lockout state.
Syntax	object.*LockoutState* (to retrieve the state) object.*LockoutState*=*State* (to set the state) *State*: a Boolean value corresponding to: True: Lockout False: No lockout
Parameter(s)	None.
Response(s)	If the property is used to get the device's lockout state, the property will return a Boolean value.
Access	Get/Set

StatusByte

Description	This read-only property returns the device's status byte. Refer to IEEE 488.2 standard for status byte description.
Syntax	object.*StatusByte*
Parameter(s)	None.
Response(s)	A value corresponding to the device's status byte.
Notes	This property can be used in conjunction with *RequestService* event (see *RequestService* on page 346) to find out why the device caused a Service Request (SRQ).
Access	Get

Events

RequestService	
Description	This event is triggered whenever the device causes a Service Request (SRQ).
Parameter(s)	None.
Notes	It is the user's responsibility to configure the different registers (*SRE, *ESE) as stated in the IEEE 488.2 standard to receive SRQ. When used in conjunction with *StatusByte* property (see *StatusByte* on page 345), this event allows you to determine the cause of the SRQ.

ReturnToLocal	
Description	This event is triggered when the user presses the Local button from the controller's front panel when the device is in Remote state.
Parameter(s)	None.

E Communicating Through TCP/IP over Telnet

Introducing TCP/IP over Telnet

The EXFO Instrument Control provides SCPI automation or remote control over Telnet through TCP/IP as a Windows Service that continuously listens to a port from a Telnet server (FTB/IQS/LTB) on which modules to be tested are connected.

TCP/IP protocols are used for communication.

Note: *Port 5024 is designated for sending SCPI commands in the Telnet protocol.*

All Windows versions include the Telnet client and the Telnet server components. With these components, you can create a remote command console session on a remote computer.

Commands can be executed simply by logging on the server using the Telnet interface.

There are two types of commands that can be sent over Telnet: SCPI commands and internal protocol commands of the TCP/IP over Telnet service. The internal commands allow you to perform certain actions such as send SCPI commands as a script instead of one by one, force the disconnection of an active session, view the status of modules and of connected clients, etc.

Features

- A client from any operating system (Windows, Linux, or Unix) can use the freely available Telnet components to connect to the service.
- A client can connect to multiple modules at a time.
- A user can connect to multiple modules through single/multiple sessions.
- A client can execute single commands or a batch of commands.
- A user can disconnect any client/session that is already connected.

Configuring Your Unit and Modules to Work With TCP/IP over Telnet

The TCP/IP over Telnet Service, which is part of the EXFO Instrument Control, is a mediator between the Telnet client and the test instrument.

Once your unit is configured properly, any request from the Telnet client is transferred to the appropriate instrument. The instrument executes the request and returns the response to TCP/IP over Telnet accordingly.

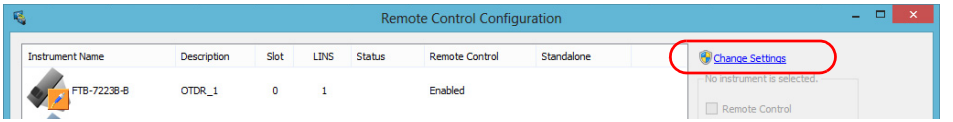
IMPORTANT

If you are working with an FTB-2/ FTB-2 Pro, an LTB-1, or an LTB-8 unit, before being able to control instruments with SCPI commands, you must first allow remote access to these instruments.

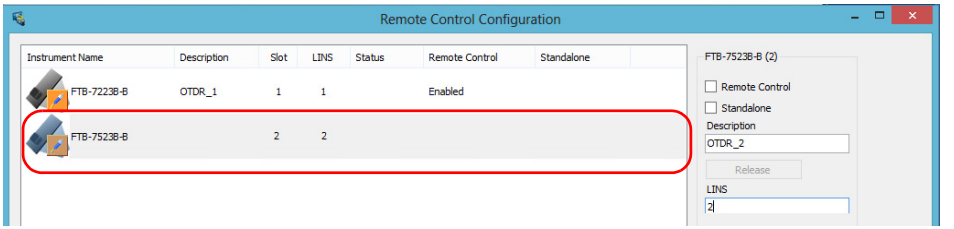
To allow remote access to your instruments (FTB-2/FTB-2 Pro, LTB-1, and LTB-8 only):

1. From ToolBox X, tap or click the **System Settings** button.
2. Tap or click **Remote Control Configuration**.

3. If necessary, tap or click **Change settings**, and then, when the application prompts you to authorize the changes to your unit (identified as “computer”), select **Yes**.



4. From the **Remote Control Configuration** window you will see all the inserted modules. Select the module for which you want to have remote access.

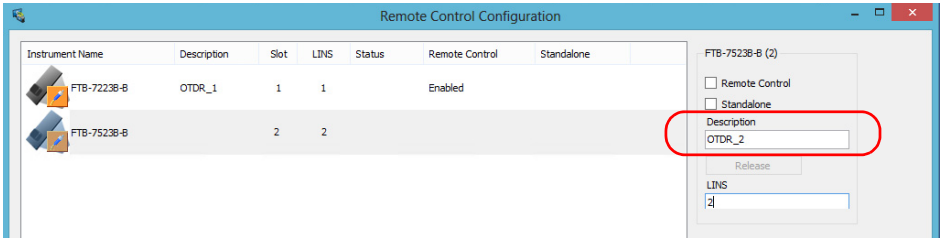


5. Set the parameters:

   ➤ Select **Remote Control** to be able to access the module remotely (via TCP/IP over Telnet or other).

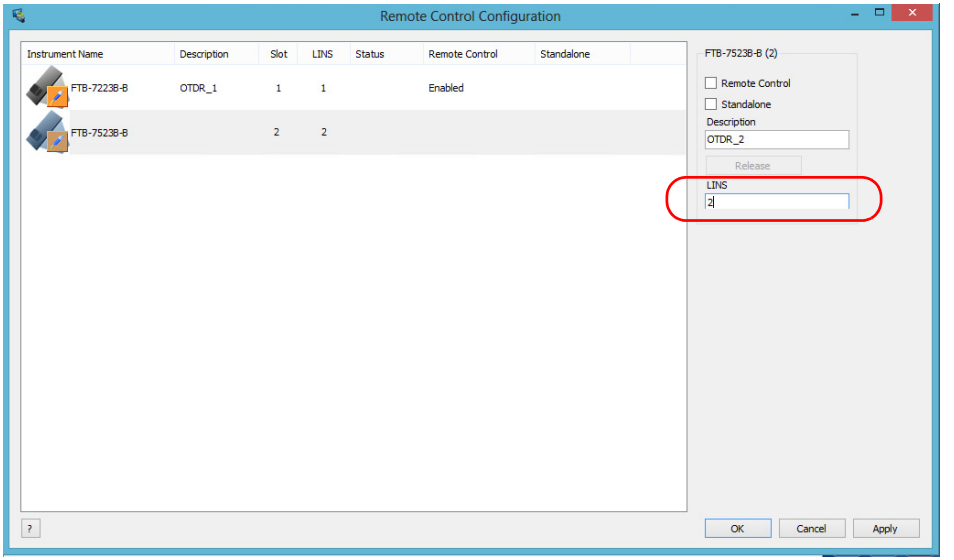
   ➤ Select **Standalone** to leave the module active even if all users close their dedicated applications.

6. If desired, under **Description**, type a description that will help you identify the instrument.



Note: *You can enter up to 10 characters. The description can correspond to the test interface ID or to any other short text of your choice.*

7. If necessary, under **LINS**, modify the logical instrument number that you will use to access the instrument remotely.



Note: *If the **LINS** column is empty, it means that the corresponding module cannot be controlled using SCPI commands.*

8. Tap or click **Apply** to confirm your changes or **OK** to apply your changes and close the window.

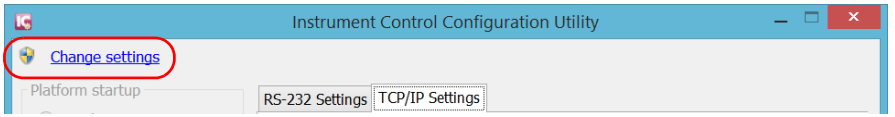
Note: *This information will be updated the next time you start the module application, or set Instrument Control in remote mode. Refer to the corresponding module documentation for more details.*

To activate TCP/IP over Telnet on your unit:

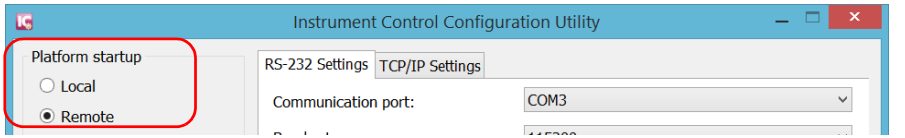
1. Access the Instrument Control Configuration utility:

- ➤ On an IQS-600: From IQS Manager, click the **Utilities** function tab, and then click **Instrument Control Configuration**.
- ➤ On an FTB-500: From ToolBox, tap the **System Settings** button, then tap **Instrument Control Configuration**.
- ➤ On an FTB-2/FTB-2 Pro, an LTB-1, or an LTB-8: From ToolBox X, tap or click the **System Settings** button, then tap or click **Instrument Control Configuration**.

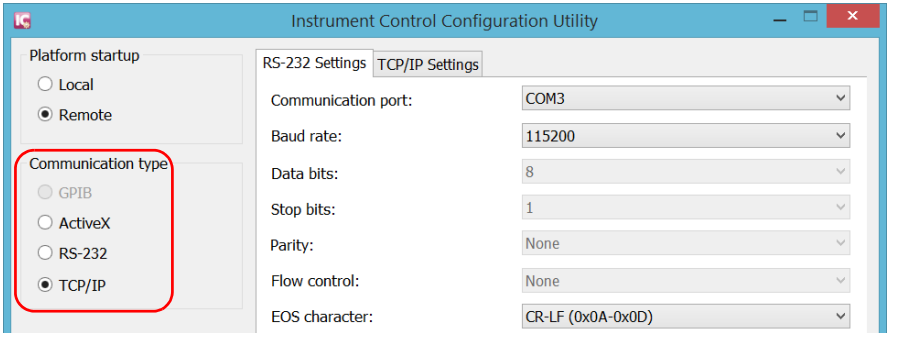
2. If necessary, tap or click **Change settings**, and then, when the application prompts you to authorize the changes to your unit (identified as “computer”), select **Yes**.



3. Under **Platform Startup**, select **Remote**.



4. Under **Communication Type**, select **TCP/IP**.



5. Tap or click **Apply**, and then **OK**.

6. Depending on the unit you are using, restart either IQS Manager, ToolBox, or ToolBox X.

Executing SCPI Commands Over Telnet

You can remotely control the modules by executing SCPI commands through TCP/IP over Telnet. The commands are sent remotely from the Telnet client (on a computer) to the Telnet server (in this case, the IQS, FTB, or LTB unit).

To execute a single SCPI command, you can type or paste the command directly in the Telnet editor window.

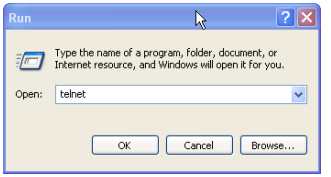
To execute multiple SCPI commands (script), you must enclose them within a BEGIN and END block in the Telnet editor window.

You can connect from a remote Windows client or a Linux (or Unix) remote client.

Note: *The Telnet client is available on the FTB-500, FTB-2 Pro, LTB-8, and IQS-600 controller if you intend to use these units as computers to connect to a Telnet server. However, on an FTB-2 or an LTB-1, the Telnet client is not available. You must use the PuTTY application to establish communication.*

To connect through TCP/IP over Telnet from a remote Windows client:

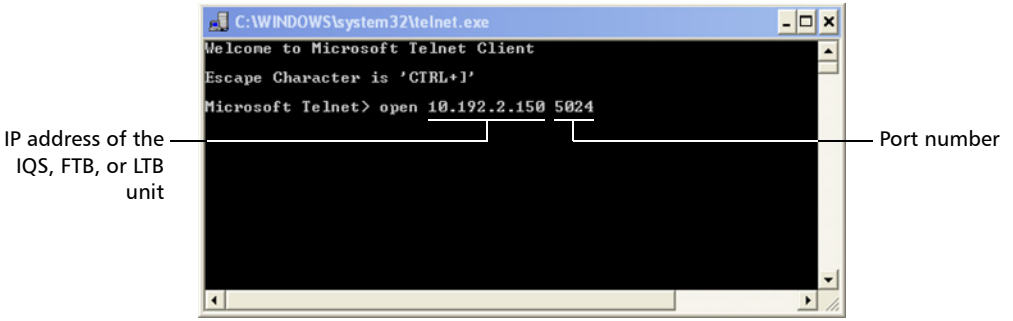
1. From your computer, start Windows.
2. On the taskbar, click **Start** (Start button ( ) under Windows 8.1 and Windows 10) and select **Run**.
3. In the **Open** box, type *telnet*, and then click **OK**.



Note: *If you receive an error message, it probably means that the Telnet client is not already activated on your computer. In this case, in the* ***Open*** *box, type* pkgmgr /iu:TelnetClient*, and then click* ***OK*** *to enable the client. Once it is done, perform step 3 again.*

4. In the displayed Telnet editor window, type the *OPEN <IP_ADDRESS_OF_TELNET_SERVER> <PORT>* command to connect to the TCP/IP Telnet Service.

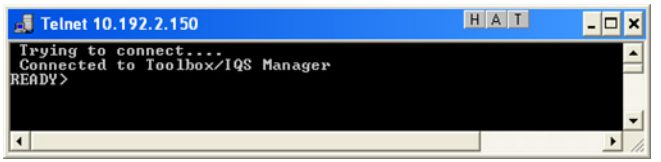
Example: *open 10.192.2.45 5024*



Note: *Port 5024 is designated for sending SCPI commands in the Telnet protocol.*

5. Press ENTER to establish a connection with the Service.

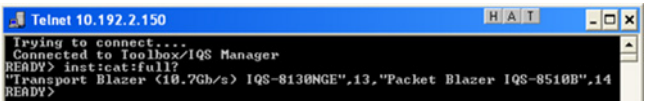
Once the connection is established, the READY> prompt is displayed in the Telnet editor window.



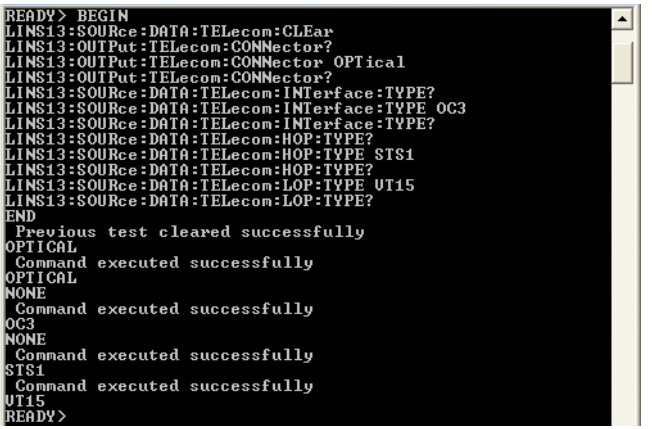
Note: *If the connection cannot be established, the **Connection to host lost** message is displayed instead.*

6. Enter the desired SCPI commands as follows:

➤ For a single SCPI command: Type or copy the desired command in the Telnet editor window, and then press ENTER to execute it.



➤ For multiple SCPI commands: Copy the desired commands from any script file, enclose them in a BEGIN and END block in the Telnet editor window, and then press ENTER. For more information, see *Internal Commands of the TCP/IP over Telnet Protocol* on page 362.



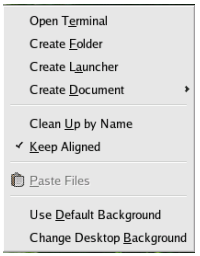
Note: *Multiple commands that are not enclosed in BEGIN...END blocks will be executed, but problems may occur (results of one command mixed with the results of another one, skipped commands, etc.).*

Once at least one valid command is executed, the module is blocked for any other sessions until the module is released. For more information, see *Releasing Modules* on page 361.

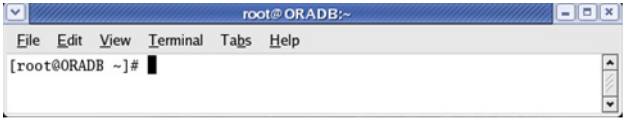
7. Click ✕ to close the session.

To connect through TCP/IP over Telnet from a remote Linux client:

1. From your computer, right-click on the desktop, and then click **Open Terminal**.



The command prompt is displayed in the Telnet editor window.



2. Connect to the TCP/IP Telnet Service by typing the *OPEN <IP_ADDRESS_OF_TELNET_SERVER> <PORT>* command:

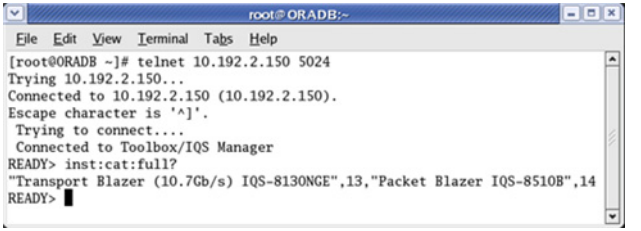
Example: *open 10.192.2.45 5024*

Note: *Port 5024 is designated for sending SCPI commands in the Telnet protocol.*

The connection is established when the message **Connected to Toolbox/IQS Manager** is displayed in the Telnet editor window.

3. Enter the desired SCPI commands as follows:

➤ For a single SCPI command: Type or copy the desired command in the Telnet editor window, and then press ENTER to execute it.



➤ For multiple SCPI commands: Copy the desired commands from any script file, enclose them in a BEGIN and END block in the Telnet editor window, and then press ENTER. **For more information, see** *Internal Commands of the TCP/IP over Telnet Protocol* on page 362**.**

Note: *Multiple commands that are not enclosed in BEGIN...END blocks will be executed, but problems may occur (results of one command mixed with the results of another one, skipped commands, etc.).*

Once at least one valid command is executed, the module is blocked for any other sessions until the module is released. For more information, see *Releasing Modules* on page 361.

4. Click to close the session.

Releasing Modules

A module is blocked as soon as a connection is established from any user session executing the internal command CONNECT LINS, or a valid instrument (SCPI) command.

For example, when the SCPI command LINS10:SOURce:DATA:TELecom:CLEar command is executed for the first time by client session 10.192.2.155:1364, the module is blocked for any other client/session until you release it.

A module is released by one of the following actions:

- Executing the CLOSE LINS command to disconnect the link with the module. For more information, see *CLOSE LINS* on page 366.
- Executing the CLOSE command to end the current session once the execution of all the desired commands has been completed. For more information, see *CLOSE* on page 365.
- Closing the current session by clicking the Close button on the Telnet editor windows' title bar.
- Shutting down and restarting the client computer.
- A network interruption.

A module can also be released when you terminate the communication by using the KILL LINS command. For more information, see *KILL LINS* on page 368.

Internal Commands of the TCP/IP over Telnet Protocol

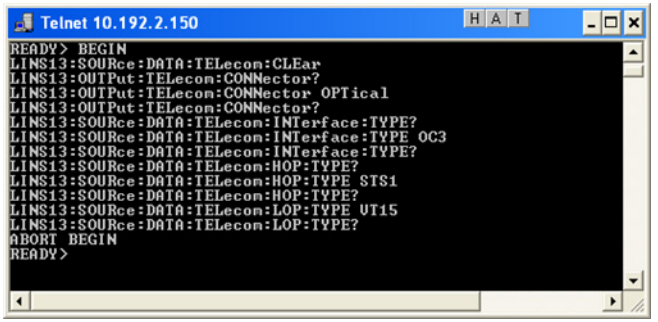
The internal commands allow you to perform certain actions such as send SCPI commands as a script instead of one by one, force the disconnection of an active session, view the status of modules and of connected clients, etc. The internal commands are not case-sensitive.

By default, log files are generated both for client and server (all logs are kept on your unit). You can delete them with the CLEAR LOGS command (see *CLEAR LOGS* on page 365), or manually via the file explorer. The client and sever logs are kept respectively in the *C:\ProgramData\EXFO\SCPI Over TCPIP Logs\Client log* and in the *C:\ProgramData\EXFO\SCPI Over TCPIP Logs\Server* log folders.

ABORT BEGIN

Syntax: ABORT BEGIN

The ABORT BEGIN command stops the execution of the SCPI commands that are enclosed in a BEGIN and END block, and returns to the READY> prompt in the Telnet editor window.

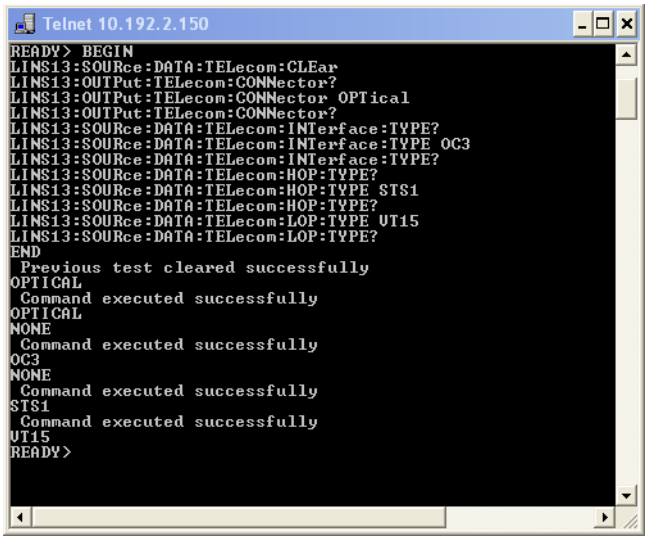


BEGIN and END

To execute multiple SCPI commands, you must enclose them in BEGIN and END blocks in a Telnet editor window.

Note: *To execute a single command, simply type or paste the command in the Telnet editor window.*

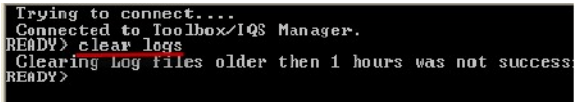
Note: *You cannot enclose internal commands in a BEGIN and END block, except the* ABORT BEGIN *command.*



CLEAR LOGS

Syntax: CLEAR LOGS

This command clears all the client and server log files that are older than 36 hours (default value) from the time you execute the command.

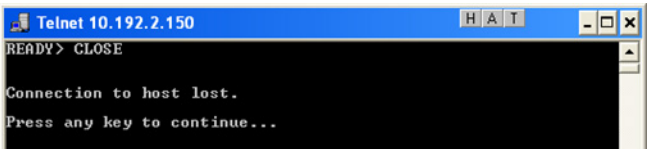


Note: *You can also delete the logs manually via the file explorer. The client and sever logs are kept respectively in the* C:\ProgramData\EXFO\SCPI Over TCPIP Logs\Client log *and in the* C:\ProgramData\EXFO\SCPI Over TCPIP Logs\Server log *folders.*

CLOSE

Syntax: CLOSE

The CLOSE command terminates the current Telnet session.



CLOSE LINS

Syntax: CLOSE LINS<Unit_Number><Module_Slot_Number>

You must specify the unit number and the slot number identifying the module for which you want to close the connections.

This command allows to close active connections. You can send this command to close all client's connections with any module, including the current connection.

If the command is not executed successfully, the possible reasons could be:

- The module is not present at the specified position.
- The provided information does not correspond to a valid LINS.

CONNECT LINS

Syntax: CONNECT LINS<Unit_Number><Module_Slot_Number>

You must specify the unit number and the slot number identifying the module to which the session will connect.

This command allows to connect to different modules through TCP/IP. You can connect to multiple modules from a single session.

If the command is not executed successfully, the possible reasons could be:

- The module is already connected to a different client session.
- The module is not present at the specified position.
- The provided information does not correspond to a valid LINS.

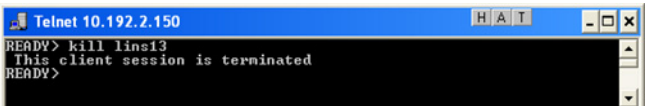
Note: *For backward compatibility reasons, to connect to a single module, you do not have to use the CONNECT LINS command. A valid instrument command (for example, Lins10:SOURce:DATA:TELecom:CLEar) for a valid LINS position will work for a first module. However, you will need to use the CONNECT LINS command if you want to connect to other modules as well.*

KILL LINS

Syntax: KILL LINS<Unit_Number><Module_Slot_Number>

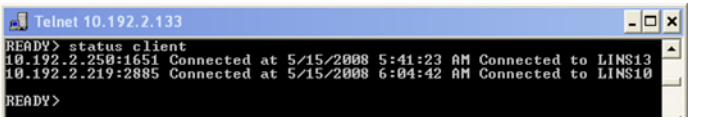
You must specify the unit number and the slot number identifying the module for which you want to terminate the session.

This command allows any user to terminate the session that contains the specified connection (LINS). This means it will terminate all active connections that belongs to a session.

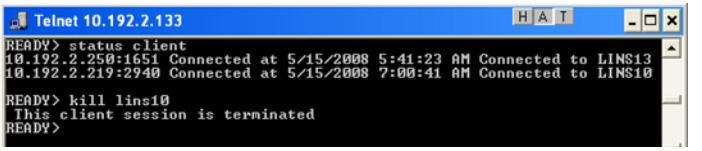


To know the status of the modules before terminating connections using the KILL LINS command, you can first enter the STATUS CLIENT command. For more information, see *STATUS CLIENT* on page 369.

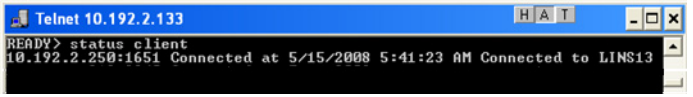
In the example below, two modules are connected: LINS13 and LINS10.



To disconnect the LINS10 module used by another session, enter the *kill lins10* command. The **This client session is terminated** message is displayed once the module is disconnected.



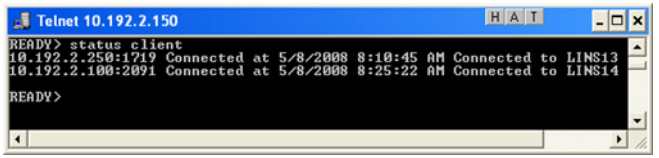
Enter again the STATUS CLIENT command to confirm the termination of the module (LINS10 in our example). Only the information of the remaining connected client is displayed.



STATUS CLIENT

Syntax: STATUS CLIENT

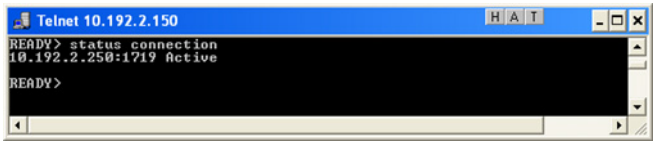
This command lists out all clients with their connection time and modules.



STATUS CONNECTION

Syntax: STATUS CONNECTION

This command lists out all the connections with their *Idle* or *Active* status.

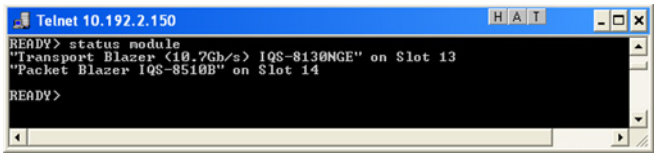


Note: *If any connection is idle for a certain period (5 minutes by default), the service automatically changes the status to* Idle.

STATUS MODULE

Syntax: STATUS MODULE

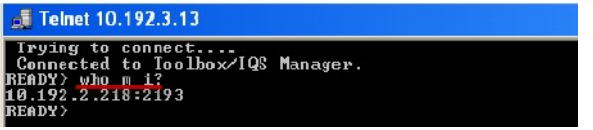
This command lists out all the modules with the slot numbers where they are located.



WHO M I?

Syntax: WHO M I?

This command retrieves the IP address and the communication port of the current session.



Index

2.0 USB port 3
3.0 USB port 3
3G USB modem, using 101

A

AC power
  adapter 9
  connector 4
AC requirements 17, 18
accessing
  Internet with a 3G USB modem 101
  online help 245
  ToolBox X 28
activating on-screen keyboard 30
ActiveX
  control 156
  linking units 160
  output units and formats 161
  selecting 165
adapter 16
adjusting
  brightness 49
  date, time and time zone 79
  right-click 56
  volume 50
after-sales service 247
amber LED 6
angled brackets 204
anti-theft mechanism 4, 41
antivirus software 40
appearance, date and time 77
applications
  installing 34
  module, starting 29
  ToolBox X, starting 112
ASCii format 162
automatic
  fan speed 9
  Windows updates 222
automation 155

B

backlight, setting 49
battery
  error 6
  information 9
  LED 2
  level 214
  maintenance recommendations 214
  type allowed 217
black LED 6
blinking LED 6
boot, first 26
braces 204
brackets
  angled 204
  square 203
brightness, adjusting 49, 95
browsing Web 100
bus timing 161
buttons 8

C

capacitors 15
capacity, storage 116
capturing images 2, 99
caution
  of personal hazard 11
  of product hazard 11
certification information vii
changing
  communication settings 163
  date and time 79
  language 68

charge icon 214
charger 16
Charm bar, display 31
choosing
  language 68
  power management option 80
  time zone 79
cleaning
  front panel 213
  touchscreen 214
cleanup disk 123
close window 31
codes, error 207
colon 204
colors, LEDs 6
COM, local control 156
COM/DCOM
  events 346
  properties 339
comma 205
commands
  IEEE 488.2 282
  SCPI 202
  specific 303
  TCP/IP 362–369
communication
  ActiveX 156
  changing settings 163
  default settings 167
  Ethernet TCP/IP 155, 156
  GPIB 156
  RS-232 ..... 155, 156
  TCP/IP over Telnet 157, 347–354
configuring
  GPIB 158
  power management options 80
  unit 26
connecting
  to a VPN 127
  USB device 42
ConnectorMax2 113
consulting PDF files 98
control
  ActiveX 156
  Ethernet TCP/IP 155, 156
  GPIB 156
  module 155
  remote 155
  RS-232 156
  TCP/IP over Telnet 157
conventions, programming 202, 205, 206
conventions, safety 11
copying
  commands into text document 209, 211
  files and folders 116
creating PDF files 97
current, electrical 17
customer service 257

D

data input
  IEEE 488.2 260
  SCPI 279
data output IEEE 488.2
  special 272, 280
  standard 269
data types 259
date and time
  adjusting 79
  formats 77
DCOM
  configuring computers 169
  technology 156
deleting
  files and folders 116
  unused system files 123
description, function buttons 8
digit 203
dirty fibers 113
Disk Cleanup 123
disk space, free 116, 123
display Charm bar 31
documentation 245

documents, printing 97
dongle, 3G USB 101
down, swipe 31

E

equipment returns 257
error messages in remote control 207
Ethernet port 3
Ethernet TCP/IP
  control 155, 156
  port 160
exiting ToolBox X 28
Explorer, Internet 100
external power supply 16

F

fan speed 9
fiber probe 113
files and folders, managing 116
first startup 26
flashing LED 6
free disk space 116, 123
front panel, cleaning 213
function buttons description 8

G

gestures, touchscreen 31
GPIB
  address 156
  capability 159
  chain 156
  configuring parameters 165
  control 156
  hardware configuration 158
  optimizing performance 161
  output units and formats 161
  port 160
  restrictions 158
  selecting 165
green LED 6

H

handshake rate 161
hazard, laser radiation 15
headset
  port 3
  volume 50
help, online 245
hibernation mode 20
high speed (HS488) 158, 161, 165
host ports, USB 3
hour, setting 79

I

icon, battery 214
identification label 247
identifying defects on fibers 113
IEEE 488.1 protocol 158, 161
IEEE 488.2 commands 282
indoor use 15
input
  IEEE 488.2 data types 260
  SCPI data types 279
input current 17
inspection probe 113
installing
  software 34
  third-party software 40
  VPN clients 127
instrument control settings 163
interface, changing language 68
Internet connection 100, 101

K

Kensington lock 4, 41
keyboard
  button 8
  on-screen 30
  USB 42
keywords, SCPI 204

L

label, identification 247
LAN network 157
language, selecting 68
laser safety information 15
launching probe application 113
LED
  battery 2
  indicators 6
left, swipe 31
level, battery 214
linking units
  Ethernet port 160
  GPIB port 160
list separator 204
local control 156, 164
lock mechanism 41

M

maintenance
  battery 214
  front panel 213
  general information 213
  touchscreen 214
managing files and folders 116
mandatory commands 282
manuals 245
maximum input current 17
microphone
  port 3
  volume 50
mnemonic, definition 204
modifying power plans 80
module
  controlling 155
  view 29
monitoring remote commands 208
mouse, USB 42
moving files and folders 116
multiple capabilities 203

N

navigating the Internet 100
network, LAN/WAN 157

O

off LED 6
on/off button 2
online help 245
on-screen keyboard 2, 30
opening user guides 98
operating system 31
operation language 68
options
  software 37
  ToolBox X 90
orange LED 6
output IEEE 488.2
  special 272, 280
  standard 269

P

PACked format 162
PDF files
  generating 97
  viewing 98
physical keyboard 42
pipe character 204
platform commands 303
port
  Ethernet 3, 160
  GPIB 160
  USB 3
power
  management 80
  selecting and modifying plans 80
  sources 9, 17
  supply 16
press and hold 33
printing documents 97

product
identification label 247
specifications 10
program switcher button 8
programmable instruments,
standards 155, 202
protocol
HS488 158
IEEE 488.1 158
purchased options 37

R

radiation hazard, laser 15
reading PDF files 98
real keyboard 42
receiving data
with Ethernet port 160
with GPIB port 160
red LED 6
regional and language settings 26
register
diagram 200, 201
ESE 198
ESR 198
SRE 198
STB 198
remaining disk space 116
remote control
ActiveX (DCOM) 156, 160
configuring 164, 169, 354
description of commands 202
error messages 207
GPIB 156, 160
limitations 158
methods 155
monitoring 208
RS-232 ..... 155, 156
TCP/IP 157, 347–369
repairing unit 15
return merchandise authorization (RMA) .. 257
returned values, setting 161
reverting to default settings 167
right, swipe 31
right-clicking with touchscreen 33, 56
RJ-45 port 3
RS-232
communication 155
configuring parameters 165
control 156
selecting 165
rules
programming 206
syntax 205
syntax conventions 202

S

safety
caution 11
conventions 11
information 15
warning 11
SCPI
commands 202
data types 279
guidelines 155, 202
screen captures 2, 8, 99
securing unit 41
selecting
language 68
startup applications 64
time zone 79
semicolon 205
sending data
with Ethernet port 160
with GPIB port 160
separator 204, 205
service and repairs 257
service centers 258
service request enable register (SRE) 198
setting
date and time 77, 79
instrument control utility 163

shipping to EXFO 257
short and long formats, date 77
show Charm bar..... 31
shutdown modes 20
sleep mode..... 20
software
  accessing 28
  exiting 28
  installing..... 34
  options 37
  upgrading..... 34
space..... 203
speaker volume 50, 95
specific commands..... 303
specifications, product 10
speed of right-click..... 56
square brackets 203
stand for unit 19
standard event status
  enable register (ESE)..... 198
  register (ESR) 198
standard status data structure
  diagram..... 200, 201
  general 198
starting
  applications 29, 112
  probe application 113
  ToolBox X 28
startup, selecting applications for 64
status byte register (STB)..... 198
storage requirements 213
support for unit..... 19
surfing the Internet 100
swipe..... 31
symbols, safety..... 11
syntax
  rules..... 202, 205
  SCPI 202
  symbols 203

T

TCP/IP
  activating..... 349
  commands..... 362–369
  configuring parameters 165
  connecting to Linux 359
  connecting to Windows..... 355
  control 155, 156, 157
  features..... 348
  introduction..... 347
  port number 5024 347
  release examples..... 361
  selecting 165, 354
technical specifications..... 10
technical support..... 247
temperature for storage 213
third-party software 40
time zone, selecting 79
ToolBox X
  applications 112
  language..... 68
  options 90
touchscreen
  cleaning 214
  gestures 31
  location..... 2
  right-clicking..... 33
transportation requirements 213, 253
turning off unit 20
turning on unit..... 20
types, data..... 259

U

unit
  back support..... 19
  first configuration..... 26
  repairing 15
updating
  applications 34
  Windows applications..... 222
upgrading software..... 34

USB
device 42
ports 3
user guides 245
using a 3G USB modem 101

V

vertical bar 204
viewing
current module 29
PDF files 98
virtual private network (VPN) 127

W

WAN network 157
warranty
certification 256
exclusions 256
general 255
liability 255
Web browser 100
white space 203
Windows
Embedded 8 Standard 31
update of applications 222
Windows Mobility Center 95
Windows.old folder 123
wireless connection 101
wizard, configuration 26
working with Windows 31
wsp 203

Y

yellow LED 6

NOTICE
通告

CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES
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和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (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 电子和电子组件	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

a. If applicable.
如果适用。

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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 [a]	5	

a. If applicable.
如果适用。

4TECT
ООО «4TECT»
Телефон: +7 (499) 685-4444
info@4test.ru
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