FLS-2800

Tunable Laser Source

EXFO | **Telecom Test and Service Assurance**

Trademarks
EXFO's trademarks have been identified as such. However, the presence or absence of such identification does not affect the legal status of any trademark.

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

Version Number: **4.0**

Contents

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, maybe cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different form that to which the receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help.**

Conventions

Before using the instrument described in this manual, 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.

1. Safety Information

WARNING

➤ This instrument must be used with an approved IEC cable with an EARTH terminal. Do not attempt to use this instrument without a proper earth terminal, doing so may lead to a hazardous condition and/or damage to the equipment.

➤ Do not install or terminate fibers while a light source is active. Care must be taken to ensure that the instrument has been turned OFF before inspecting the end face(s) of the instrument, or any optical patch cords connected to this instrument. Never look directly into a live fiber and ensure that your eyes are protected at all times.

➤ The use of controls, adjustments and procedures other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.

IMPORTANT

➤ For electromagnetic compatibility, this instrument is a Class A product. It is intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

➤ 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.

Your instrument is a Class 1M laser product in compliance with standards IEC 60825-1:2007 and 21 CFR 1040.10. Laser radiation may be encountered at the output port.
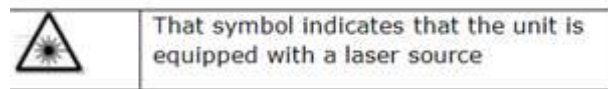
VIEWING THE LASER OUTPUT WITH CERTAIN OPTICAL INSTRUMENTS (FOR EXAMPLE, EYE LOUPES, MAGNIFIERS AND MICROSCOPES) WITHIN A DISTANCE OF 100 MM MAY POSE AN EYE HAZARD
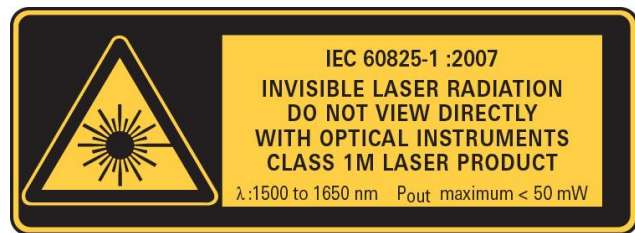
Figure 1a - Class 1M Laser Product Warning

L'OBSERVATION DE LA SORTIE DU LASER AVEC CERTAINS INSTRUMENTS D'OPTIQUE (PAR EXEMPLE LOUPES D'HORLOGER, LOUPES À MAIN ET MICROSCOPES) À UNE DISTANCE INFÉRIEURE À 100 MM PEUT PRÉSENTER UN DANGER POUR LES YEUX.

Figure 2b – Avertissement : Produit de classe laser 1M

2. Introducing the FLS-2800 Tunable Laser Source

The FLS-2800 Tunable Laser Source is a bench top single (or dual) channel Continuous Wave (CW) laser system. With its high power output, narrow linewidth and the ability for high resolution tuning, the FLS-2800 is a low cost solution for various applications including coherent detection of high speed complex modulation formats, DWDM component testing and optical sensor interrogation.

There are several variants of this instrument. Depending on your configuration, the FLS-2800 will have C, L or both C and L-band lasers. The FLS-2800-1-2-CC-H-89 model for example (shown below) is a dual-channel unit. The various models available are listed in

IMPORTANT

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

Table 1 - FLS-2800 Specifications.

Figure 3 - EXFO FLS-2800 Tunable Laser Source

Figure 4 - LCD Control Interface

The laser is calibrated at the time of manufacture and controls its wavelength through the use of a look-up table and a small, low-frequency wavelength dither. As such, the displayed wavelength will be accurate to better than 1 MHz at the start of life; after 25 years, the calibration may drift by as much as 1.5 GHz.

Note that the 100 kHz maximum linewidth specification is an instantaneous measurement. In order to guarantee frequency stability, a small FM dither (magnitude of 47 MHz at 888 Hz) is used to make the laser appear to have a linewidth of 47 MHz if any integration time greater than 1 ms is used.

The FLS-2800 can be controlled via the LCD Control Interface as well as remotely through a TCP/IP connection (Ethernet or USB). Both methods of control can act in parallel as required, although the

front-panel 'Laser On/Off' switch will override the software commands for that particular optical output.

The Tunable Laser Manager software is provided to allow you to control the instrument remotely. Alternatively, VISA programming environments such as MATLAB can also be implemented to integrate with existing test software or data collection procedures.

3.   Features

FLS-2800 Front Panel

1. Power On/Off
2. LCD Control Interface
3. LCD Control Knob
4. Laser On/Off
5. Laser 1 Optical Output
6. *Laser 2 Optical Output

FLS-2800 Back Panel

7. USB 2.0 Connection
8. Ethernet Connection
9. AC Power 100-240V, 50-60 Hz
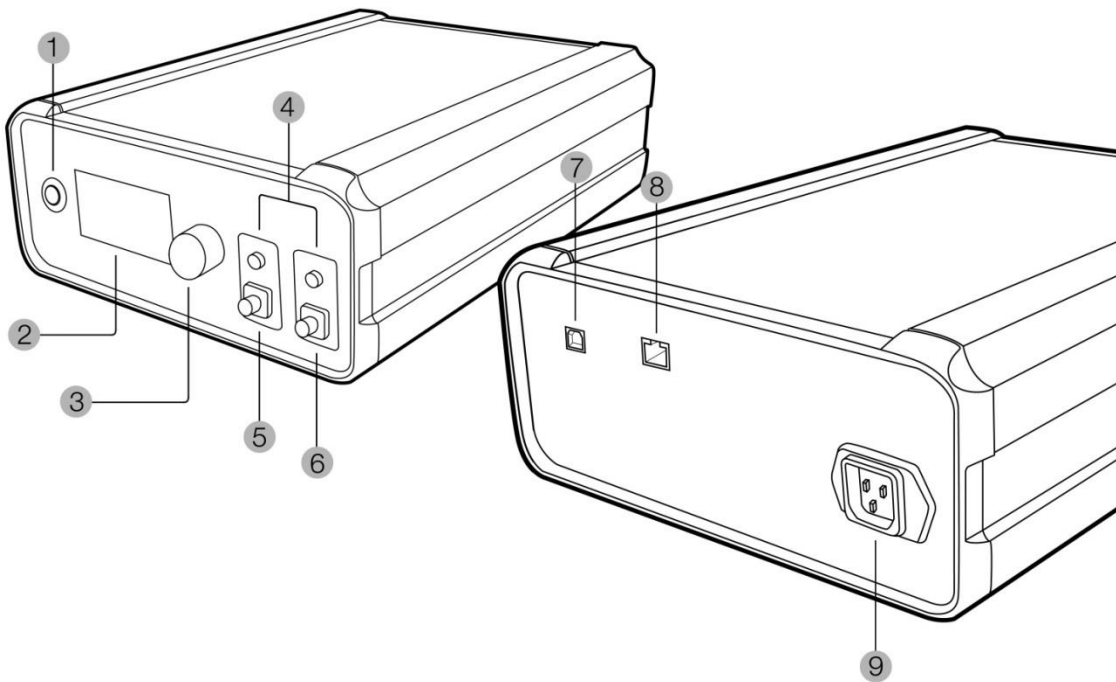
NOTE: The number of laser sources depends on the FLS-2800 model. See

> ### IMPORTANT
>
> These technical specifications can change without notice. The information presented in this section is provided as a reference only. To obtain this product's most recent technical specifications, visit the EXFO Web site at *www.exfo.com*.

Table 1 - FLS-2800 Specifications *for details.*

4. Technical Specifications

IMPORTANT

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

Table 1 - FLS-2800 Specifications

FLS-2800 Part Number	Optical connector Type	Number of lasers	Optical Power (dBm)	Band	Operating frequency range (THz)	Operating wavelength range (nm)
FLS-2800-1-1-C-H-89	PM FC/UPC	1		C	191.500 – 196.250	1527.605 – 1565.496
FLS-2800-1-1-C-H-91	PM SC/UPC					
FLS-2800-1-2-CC-H-89	PM FC/UPC	2				
FLS-2800-1-2-CC-H-91	PM SC/UPC					
FLS-2800-1-1-L-H-89	PM FC/UPC	1		L	186.350 – 191.100	1568.773 – 1608.760
FLS-2800-1-1-L-H-91	PM SC/UPC		7.0 – 15.0			
FLS-2800-1-2-LL-H-89	PM FC/UPC	2				
FLS-2800-1-2-LL-H-91	PM SC/UPC					
FLS-2800-1-2-CL-H-89	PM FC/UPC	2		C	191.500 – 196.250	1527.605 – 1565.496
				L	186.350 – 191.100	1568.773 – 1608.760
FLS-2800-1-2-CL-H-91	PM SC/UPC			C	191.500 – 196.250	1527.605 – 1565.496
				L	186.350 – 191.100	1568.773 – 1608.760

Specification (23°C± 3°C)	Units	All FLS-2800 models
Laser type		CW ECDL[1]
Frequency tuning resolution	MHz	100
Wavelength tuning resolution [2]	pm	~ 1
Frequency tuning repeatability	GHz	± 0.3
Maximum time to tune and power lock (warm start)[3]	sec	< 25
Spectral Characteristics		
Linewidth [FWHM (-3dB), instantaneous][4]	kHz	< 100
Side mode suppression ratio	dB	55 typical (40 min)
Frequency uncertainty	GHz	± 2.5
Frequency stability, over 24 hours	GHz	± 0.3
RIN for 13dBm output power[5]	dB/Hz	-145
Optical Power		
Maximum optical output power	dBm	≥ 15.0
Minimum optical output power	dBm	≤ 8.0
Output power uncertainty, after calibration	dB	± 0.6
Output power step size	dB	0.01
Power stability, 24 hours	dB	± 0.1
Power flatness over frequency (BOL)	dB	< 0.5
Power monitoring		Built-in

General Characteristics

Dimensions	230(W) x 260(D) x 100(H) mm
Weight	3.5 kg
PC interface method	USB 2.0, Ethernet
Minimum PC requirements	Windows XP SP3 or later
Power supply	~100 - 240 V; 50/60 Hz; 60W Max
Operating temperature range	- 5°C to +45 °C
Storage temperature range	- 40°C to +70 °C

Equipment Rating	
Temperature ➢ Operation ➢ Storage	➢ 5 °C to 45 °C (41 °F to113 °F) ➢ -40 °C to 70 °C (-40 °F to 158 °F)
Relative humidity	≤ 93 % non-condensing
Maximum operation altitude	2 000 m (6562 ft)
Pollution degree	2
Overvoltage category	II
Measurement category	Not rated for measurement categories II, III or IV
Power supply rating	⏦ 100 - 240 V; 50/60 Hz; 60W

1. Continuous Wave (CW) thermally tuned External-Cavity Diode Laser (ECDL).
2. Varies slightly depending on the wavelength
3. Laser operation time of at least 30 minutes
4. The laser uses a small FM dithering as part of its wavelength locking mechanism. The instantaneous Linewidth is measured over a 1 ms integration time
5. RIN is specified for 10Mhz to 40GHz

5. Hardware Connections

This section details the hardware connections required to setup the FLS-2800 instrument. Depending on the hardware setup you are using, not all of the following connections may be required.

Connections for Remote Operation
The recommended form of communication between any client PC and the FLS-2800 is via TCP/IP over the Ethernet. By default the FLS-2800 is set to obtain an IP address automatically from a DHCP server. If there is no DHCP server on your network, you will have to configure a static IP for the FLS-2800 using the USB connection web interface.

If an Ethernet network is not available a dedicated client PC can be used. This dedicated client PC will require an available USB 2.0 port.

Connecting the Ethernet (recommended)
Connect the FLS-2800 Ethernet port to either:

1. The Ethernet Hub of your network to allow any network client the ability to connect remotely

2. The Ethernet port of a dedicated client PC (this PC being the only client to have remote access) using:

    2a. an Ethernet cross-over cable

    2b. Ethernet patch cables and a small network hub

Connecting the USB (optional)
To perform administrative tasks such as configuration of the network settings, updating firmware and downloading log files, the USB connection is required. You may also require use of the USB as a TCP/IP connection if no alternative Ethernet connection is available.

IMPORTANT

➤ You may only have one FLS-2800 connected via the USB at any time. If connections to more than one FLS-2800 are required, an Ethernet network must be used.
➤ The IP Addressing described below is for the USB network connection.

Windows 7

1. Connect a USB cable (type male A to male B) between the USB 2.0 port at the back of the FLS-2800 and any available USB 2.0 port on the client PC.

2. Once connected, Windows will automatically install the drivers for the USB Ethernet connection. If the drivers do not automatically install, please refer to the *Windows XP SP3* installation instructions steps 3 to 9 below to install the USB driver.

3. Go to the *Control Panel* and open *Network and Sharing Center*. Then select *Change adapter settings* from the left-hand menu.

4. Locate the USB Ethernet/RNDIS Gadget connection. Right-click and select rename and type 'FLS-2800' for the new connection name.

5. Right-click again and select properties to bring up the network settings window. Select '*Internet Protocol Version 4 (TCP/IPv4)*' and click '*Properties*'.

6. Within the 'Internet Protocol Version 4 (TCP/IPv4)' properties window. Enter the IP address '192.168.97.2'. Set the Subnet mask to '255.255.255.0'. The USB connection of the FLS-2800 has a static 192.168.97.201 adress. The IP adress set for the client PC must be different than 192.168.97.2.

7. Click 'OK' to close the properties windows and close the *Control Panel*.

8. The USB Ethernet is now configured.

Windows XP SP3

1. Connect a USB cable (type male A to male B) between the USB 2.0 port at the back of the FLS-2800 and any available USB 2.0 port on the client PC.

2. Windows XP will automatically detect the device and it will bring up the *'Found New Hardware Wizard'*.

3. In response to the *'Can Windows connect to Windows Update to search for software?'* select *'No, not this time'* and click *Next*.

4. Select *'Install from a list or specific location (Advanced)'* and click *Next*.

5. Select *'Don't search. I will choose the driver to install'* and click *Next*.

6. Click the *'Have Disk'* button.

7. Click the *'Browse'* button and locate the **oem31.inf** file, which can be found in the **drivers** folder within the supplied installation media. Click *Next* to continue.

8. Click *'Continue Anyway'* when prompted that the driver has not verified its compatibility with Windows XP.

9. If prompted that *'The file '***usb8023x.sys***' on Windows driver cabinet is needed'*, click the *'Browse'* button and locate the file inside the **drivers** folder within the supplied installation media and click *OK* to continue.

10. Go to the *Control Panel* and open *Network Connections*. Right-click the new connection (labelled Linux USB Ethernet/RNDIS Gadget) and select rename and type in 'FLS-2800' to update the connection name.

11. Right-click on the newly labelled icon, and select properties. Under the properties *General* tab, select the item labelled *Internet Protocol (TCP/IP).*

12. Select *'Use the following IP Address'* and enter '192.168.97.2'.

13. Click *OK* to close the properties windows and close the *Control Panel*.

14. The USB Ethernet is now configured.

Note: Refer to section 11 USB Connection Web Interface for details on the administrative tasks available over the USB network connection.

6. Connecting Optical Output

IMPORTANT

To ensure maximum power and to avoid erroneous readings always inspect fiber ends and make sure that they are clean as explained below before inserting them into the port. EXFO is not responsible for damage or errors caused by bad fiber cleaning or handling.

CAUTION

The type of optical connectors on the FLS-2800 is specific to the model. The connectors will be of type PM FC/UPC or PM SC/UPC. This information can be found in

IMPORTANT

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

Table 1 - FLS-2800 Specifications. Joining mismatched connectors will damage the ferrules.

Cleaning and Connecting Optical Fibers

To connect the fiber-optic cable to the port:

1. Inspect the fiber using a fiber inspection microscope. If the fiber is clean, proceed to connecting it to the port. If the fiber is dirty, clean it as explained below.

2. Clean the fiber ends as follows:

    2a. Gently wipe the fiber end with a lint-free swab dipped in isopropyl alcohol.

    2b. Use compressed air to dry completely.

    2c. Visually inspect the fiber end to ensure its cleanliness.

3. Carefully align the connector and port to prevent the fiber end from touching the outside of the port or rubbing against other surfaces. If your connector features a key, ensure that it is fully fitted into the port's corresponding notch.

4. Push the connector in so that the fiber-optic cable is firmly in place, thus ensuring adequate contact. If your connector features a screw sleeve, tighten the connector enough to firmly maintain the fiber in place. Do not over tighten, as this will damage the fiber and the port.

Note: *If your fiber-optic cable is not properly aligned and/or connected, you will notice heavy loss and reflection.*

EXFO uses good quality connectors in compliance with EIA-455-21A standards.

To keep connectors clean and in good condition, EXFO strongly recommends inspecting them with a fiber inspection probe before connecting them. Failure to do so will result in permanent damage to the connectors and degradation in measurements.

7. Operating the FLS-2800

Output Enable/Disable

The *Laser on/off* button for each laser source, when OFF, sets and maintains the output state of that laser source to disabled. When the *Laser on/off* button is then switched to ON, any previous output state of the laser before the button was switched OFF is restored.

Powering On/Off the FLS-2800

To power on the FLS-2800 simply press the *Power On/Off* switch; the switch will become illuminated to verify the instrument is powered on.

IMPORTANT

After powering on the FLS-2800, please wait at least 1 minutes before attempting to communicate with the instrument. This will allow the FLS-2800 enough time to finish boot procedures and initialize the communication server.

To power off the FLS-2800 press the *Power On/Off* switch. The switch will no longer be illuminated indicating the instrument is off.

Remote Operation of the FLS-2800

Management and operation of the FLS-2800 is all performed remotely (TCP/IP over Ethernet or USB) from a client PC, either using the provided Tunable Laser Manager software or VISA programming environments.

Tunable Laser Manager Software

The Tunable Laser Manager software provides an easy to use graphical interface for configuration and management of the installed laser sources. See section *9 Tunable Laser Manager Software* for details of the use and functionality of this software.

Programming using Virtual Instrument Software Architecture (VISA)

Programming of the FLS-2800 can be achieved using programming environments that support VISA such as MATLAB. Please read section *10 Programming Guide* for detailed information.

The LCD Control Interface

The *LCD Control Interface* provides an accessible menu system that is used to set and configure the optical characteristics of the FLS-2800 laser sources.

Navigating within the LCD Control Interface

Navigation of the system menu is achieved by turning the control knob clockwise (up) or counter clockwise (down). The arrow cursor identifies the current menu location. Once this arrow is at the desired menu item, pressing in the control knob once will activate this menu item.

Figure 5 – LCD Control Interface Arrow Cursor

IMPORTANT

To cancel the changing of any selected menu item, let the menu sit idle for 10 seconds (do not move or press in the control knob) and the LCD will revert back to the main display discarding any changes made during the selection.

Changing Numerical Values

To change numerical values, use the control knob to move the arrow to the line of the value that you desire to change. Press the control knob in once and the arrow cursor will change to an asterisk (*) and you are then able to increment and decrement the value by turning the control knob clockwise and counter clockwise respectively. Once the desired value is reached, press the control knob to set this value. If the value is a frequency or wavelength, then the asterisk will remain while the new value is being locked.

Changing Numerical Units

To change between numerical units, navigate to the '*Settings'* menu and select '*Units'*. Within this menu you can change between THz or nm (for frequency and wavelength) and dBm or mW (for optical power output). Navigate to the desired unit and press the control knob, once selected turn the control knob to toggle between the two options for the selected unit. Press the control knob to set the unit when finished. To exit the '*Units'* menu, navigate to '*Done'* and press the control knob or let the menu timeout and return to the main display.

Changing Step Size

To change the step size for a laser source, navigate to the '*Settings'* menu and select '*Step Size'*. The step size can be changed between 50 GHz, 25 GHz or 100 MHz. Navigate to the desired laser source and press the control knob, once selected turn the control knob to cycle up and down through these values. Press the control knob in to set the desired step size. To exit the 'Step Size' menu, navigate to 'Done' and press the control knob or let the menu timeout and return to the main display.

Viewing Network Settings

To view the current network configuration of the instrument, navigate to the '*Settings'* menu and select '*Networking'*. Next, select the networking interface to view '*Ethernet'* or '*USB'*. Once selected the configuration of the interface including the IP address i.e. '*Address'*, subnet mask i.e. '*Netmask'*,

and *'Method'* i.e. *'dhcp'* or static will be displayed (scroll to see all).

Note: *If the network interface is not present, the 'Address' and 'Netmask' will display the invalid value '000.000.000.000'. If network access is required check the network cables are correctly connected and the network configured is correct (see 'Changing Network Settings'). For more help contact your network administrator.*

To return, either select *'Done'* or wait for the menu to timeout (30s)

Changing Network Settings

For Ethernet only, the menu used to view the network configuration above can also be used to configure the Ethernet interface. Other interface configurations cannot be modified.

First, navigate to the network configuration for the Ethernet (see '*Viewing Network Settings'*). Next navigate to *'Method'*, and by pressing then turning the control knob select either *'dhcp'* (i.e. auto) or *'static'* (i.e. manual) setups. Once a new method (or any other option) is selected, the menu will enter configuration mode and display the new network configuration to be saved and not the current network configuration.

If a *'dhcp'* method is selected the *'Address'* and *'Netmask'* fields will show '---.---.---.---'. These should be automatically assigned by the dhcp server (for configuration details please contact your network administrator). For *'dhcp'* no further configuration is required.

If instead a *'static'* method is selected the *'Address'* and *'Netmask'* fields must be configured manually (for configuration details please contact your network administrator). To change the IP address, navigate to the line below *'ADDRESS'* and press the control knob. This will allow the first octet of the address to be set by turning the control knob. Once set to the correct value press the control knob again to move to the next octet, continue like this until after the final octet is set and you are returned to the menu. Next, the subnet mask should be set in a similar way by selecting the line below *'Netmask'* and changing those octets to the desired value. These configurations can be changed again if needed before applying the new configuration below.

Once the display shows the new desired configuration for the network select *'Done'*. If the network configuration has been changed, you will be asked to *'Save Changes'*. To commit the changes made select *'Yes'*. To discard these changes either select *'Done'* followed by *'No'* or wait for the menu to timeout (30s).

8. Installing the Software

> ### IMPORTANT
>
> Make sure the client PC is connected to the same network as the FLS-2800 and the FLS-2800 is also powered on before proceeding with software installation.

Client System Minimum Requirements

- ➤ Operating System   Windows XP SP3 or later
- ➤ Screen Resolution   800x600
- ➤ Free Hard Disk Space   1GB
- ➤ Communication Port   USB 2.0 (Ethernet and USB 2.0 recommended)

Tunable Laser Manager Software Installation

Begin the installation by running the '**EXFO TLM_setup_[version].exe**' file located on the supplied media. This will start the installation of the Tunable Laser Manager software package.

1. When the installation begins, you will see the Welcome screen. Click on Next to begin the installation.

2. Please read the license agreement. If you choose to accept the agreement, click on the "*I accept the terms of the License Agreement*" check box and then click "*Install*". If you do not wish to accept the terms of the agreement, click on "*Cancel*" to terminate the software installation.

3. Once the license agreement has been accepted the installation will begin and the file progress will be displayed throughout the installation.

4. When the installation has completed you can click on "*Finish*" with the check box ticked (by default) to immediately start the Tunable Laser Manager software.

5. The installer will also place a Tunable Laser Manager application shortcut on your desktop

9. Tunable Laser Manager Software

Start-up
When the Tunable Laser Manager software is run, the start-up screen will be displayed. Click anywhere within the window to initiate the *Device Discovery*.

Click and drag the desired FLS-2800 device from the '*Discovered devices*' to the '*Selected devices*' list to enable management of this device.

Once you have selected the FLS-2800 device you wish to manage, click '*Apply*' to open the main Tunable Laser Manager interface.

Figure 6 - Tunable Laser Manager Start-up Device Selection

Note: *If there are no devices listed in the 'Discovered devices' list, refer to the Discover section on page 22 for instructions on how to detect your FLS-2800.*

Tunable Laser Manager Interface

1. Viewing Mode Selection
2. Content Selection
3. Main Display
4. Laser Selection Control
5. Laser Output Control
6. Laser Parameter Control
7. Tool Buttons

Note: *The Laser Selection Control (4) and Laser Parameter Control (6) are not populated until a selection of laser sources has been made, see below.*
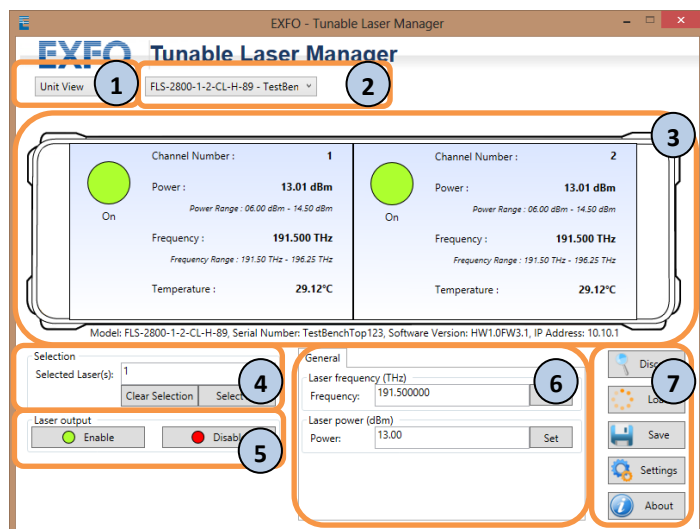

Figure 7 - Tunable Laser Manager Interface (Unit View)

Viewing Mode Selection
To select between *Unit View* and *Chart View* modes, click this drop-down menu and select the desired mode.

Once selected the *Main Display* will update. Details on these view modes can be found in section *Main Display*.
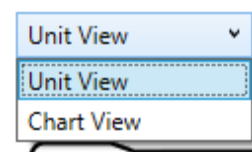

Figure 8 - View Selection Drop-down List

Content Selection

The *Content Selection* changes depending on the *Viewing Mode Selection* that is currently active.

Unit View

While in *Unit View*, the *Content Selection* menu lists all the devices that were selected for management in the *Device Discovery* interface.
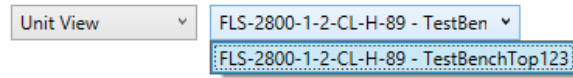

Figure 9 - Content Selection Drop-down List, Unit View

Click the drop-down box and select the desired device to be the currently managed unit. This unit will now be shown in the *Main Display*.

Chart View

While in *Chart View*, the *Content Selection* menu lists all the parameters that can be displayed within the *Main Display* chart.
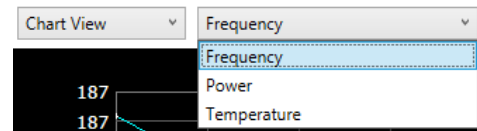

Figure 10 - Content Selection Drop-down List, Chart View

Main Display

The *Main Display* is the primary information panel of the software interface. The type of information shown is controlled by both the current *Viewing Mode Selection* and the *Content Selection*.

Unit View

The *Unit View* is used to display the FLS-2800 device in a format that provides characteristic information for the laser sources.

Laser source information:

➤   Channel number
➤   Optical Power (dBm or mW)
➤   Frequency or Wavelength
➤   Temperature
➤   State Symbol (Output 🟢 : on, 🔴 :off, ⚠ : malfunction)

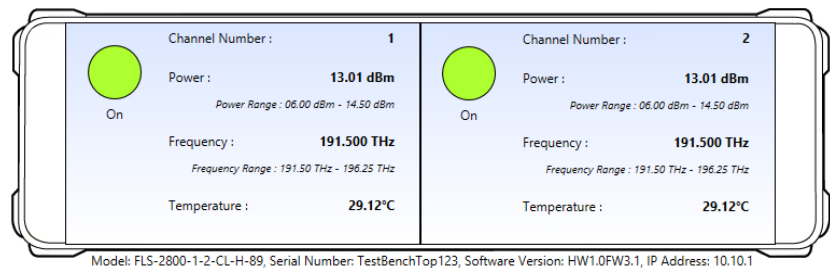**Figure 11 - Unit View Main Display**

Chart View

The *Chart View* displays information from all laser sources in a chart format.

The channel number is represented along the x-axis and the *Content Selection* represented on the y-axis.

The *Content Selection* is used to change between displaying *Frequency*, *Power* or *Temperature*
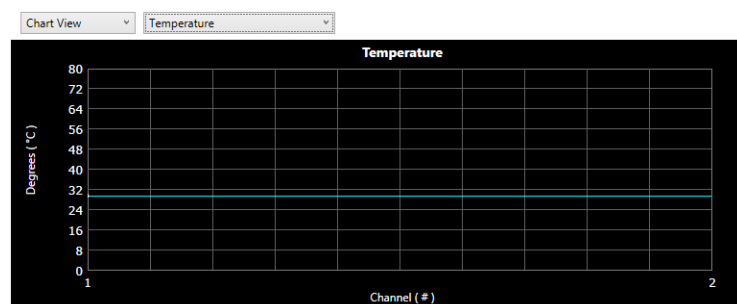

Figure 12 - Chart View Main Display, Temperature

Laser Selection Control

The *Laser Selection Control* allows you to specify the selected lasers by entering a valid range into the '*Selected Laser(s)*' edit box manually, or by clicking '*Select All*' to select all installed laser sources. You can also click '*Clear Selection*' to deselect all lasers.
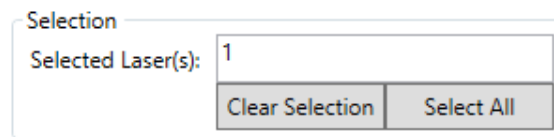

Figure 13 - Laser Selection Control

When you click to select and deselect lasers in the *Main Display* while in *Unit View*, you will see this '*Selected Laser(s)*' edit box content change accordingly.

Laser Output Control

IMPORTANT

The *Laser on/off* button for each laser source, when OFF, sets and maintains the output state of that laser source to disabled. When *the Laser on/off* button is switched to ON, the laser will turn on and the output state of the laser can be set using the *Laser Output Control.*

As seen previously, within the *Main Display* of the interface, the laser source information is graphically represented. Each laser source (or channel) will have a *State Symbol* which shows the output state by color (: on or : off).

Figure 14 - Laser Output Control

To change the output state of the selected laser source(s), simply click *Enable* or *Disable*. The *State Symbol* outline will change to show that the laser source is updating and when complete the appropriate state color will be shown.

Laser Parameter Control

When you click to select lasers in the *Main Display* while in *Unit View*, you will see the controls for changing the laser parameters become available according to the number of selected laser sources.

, : The *State Symbol* not only shows the output state of the laser source, but will also show command progress as well.

, : If the *State Symbol* changes to have a rotating animated dashed outline then this laser source is currently undergoing parameter changes.

General Parameters (changing frequency or wavelength)

Using the general tab in the Laser Parameter Control panel, the power and frequency or wavelength (depending on the *Environment Settings*) can be set for the selected laser sources.

Figure 15 - Laser Parameters Single Laser

Figure 16 - Laser Parameters Multiple Laser Selection

When a single laser source is selected you can enter the desired values and click '*Set*'. The laser source *Status Symbol* will reflect the progress of the '*Set*' request.

If both laser sources are selected, a *Start* value for the power, frequency or wavelength can be entered along with a *Step* size value. When you click 'Set' to apply parameter changes, the first selected laser source will be set at the *Start* value. The remaining laser source will be set to value *Start + (Step)*.

Note: *The software will provide a warning when you attempt to 'Set' values that are not valid or out of the operating range of the laser sources.*

Tool buttons

Discover
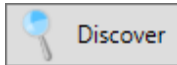
To change the current FLS-2800 unit to manage, click the '*Discover*' button.

The *Device Discovery* interface will open and scan the network for FLS-2800 devices. Scanned devices will show up in the '*Discovered devices*' list.

Click and drag the desired FLS-2800 device to the '*Selected device*' list to enable management of this device.

Once you have selected the FLS-2800 device you wish to manage, click '*Apply*' to open the main Tunable Laser Manager interface.

Note: *Make sure you save the configuration for the current FLS-2800 device before starting the Device Discovery interface.*
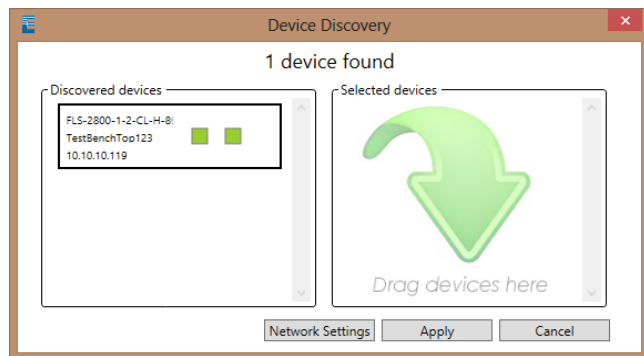
Figure 17 - FLS-2800 Device Discovery
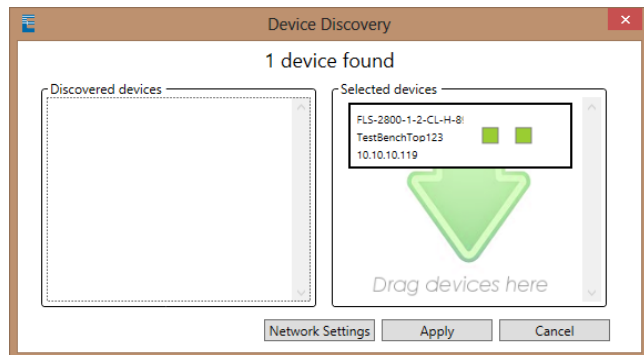
Figure 18 - FLS-2800 Selected Device

If no devices are displayed in the '*Discovered devices*' list then click the *'Network Settings'* button to manually enter an IP address search range. Once you click *'Ok'* The Tunable Laser Manager will search through this IP address range for all FLS-2800 devices and add them to the '*Discovered devices*' list.

Note: *If your device is still not shown in the 'Discovered devices' list; please ensure both your PC and the FLS-2800 devices are connected to the network correctly.*
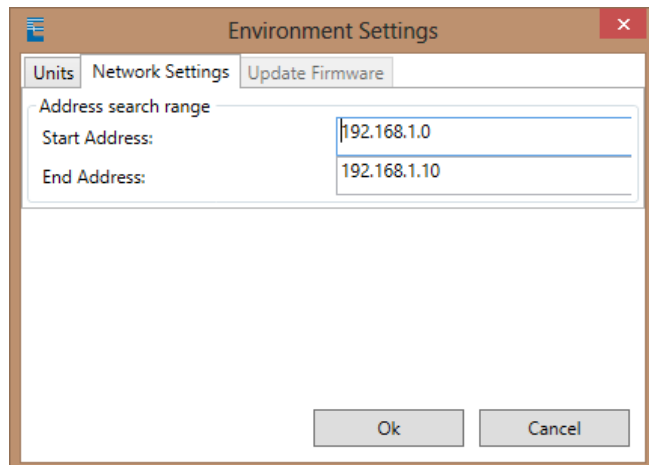
Figure 19 - Network Settings

Load

To change to a previous configuration for the current FLS-2800. Click '*Load*' and the '*Open*' dialog will appear.

Navigate to the desired configuration folder and select the desired configuration file then click '*Open*'.

Loading configuration files will change the parameters for all the laser sources defined when the file was created.

Save

The configuration of the current FLS-2800 can be saved to an '.xml' configuration file. When you click the '*Save*' button a '*Save As*' dialog will open.

Navigate to the desired location to save the configuration file. Click '*Save*' to accept the default, or type in the desired *File name* and then click '*Save*'.

Configuration files will store the current parameters for all the laser sources installed in the unit.

Settings

To change the *Environment Settings* of the Tunable Laser Manager software click the '*Settings*' button.

The *Environment Settings* window will appear providing tabs to configure *'Units'* and *'Network Settings'*.

While in the *'Units'* tab, radio buttons allow the selection of the different units. Selections can be made between displaying frequency or wavelength and optical power in mW or dBm by clicking the relevant radio buttons.

While the *'Network Settings'* tab is open (

Figure 19), you are able to enter the IP address search range for device discovery.
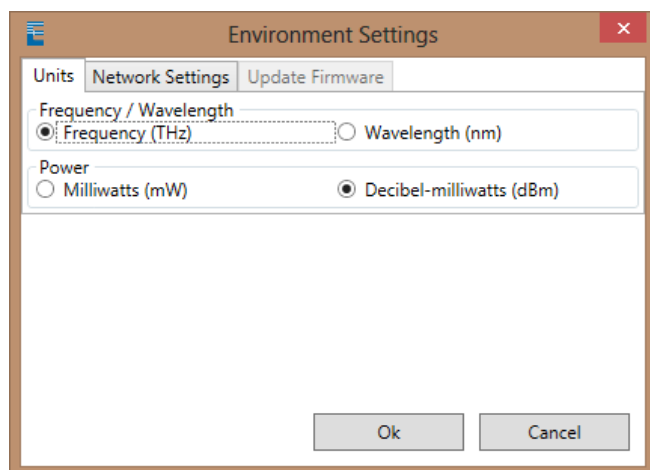
Figure 20 - Environment Settings

If a firmware update is required. The 'Update Firmware' tab can be used to upload the new firmware to the instrument.

The current versions of the firmware of both the selected system and module are listed within the 'Current Version' panel.
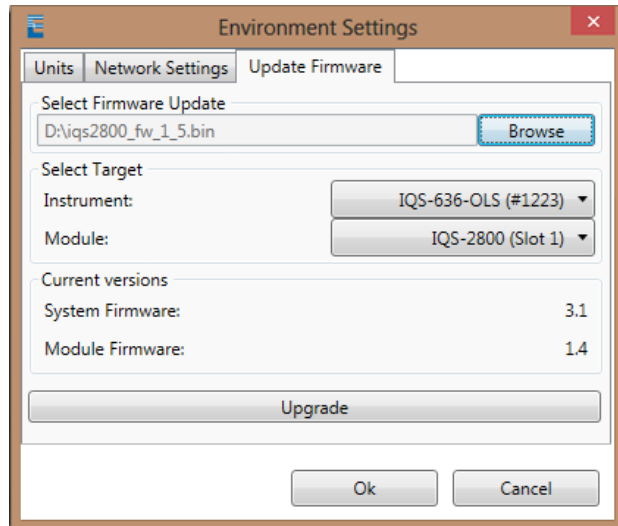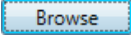
Figure 21 - Update Firmware Settings
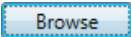
System Update

To perform an update of an FLS-2800 system:

1. Use the browse button Browse , to locate the firmware update file.
2. Select the target instrument from the dropdown box.
3. Select *'System Firmware'* from the module select dropdown box.
4. Click upgrade to perform the update procedure.
5. Wait for the update to finish, this can take up to two minutes. Do not power off the instrument during the firmware upgrade.

Module Update

To perform an update of an FLS-2800 laser module:

1. Use the browse button Browse , to locate the firmware update file.
2. Select the target instrument from the dropdown box.
3. Select 'Laser Module' from the module select dropdown box.
4. Click upgrade to perform the update procedure.
5. Wait for the update to finish, this can take up to two minutes. Do not power off the instrument during the firmware upgrade.

About

About

To view EXFO company information, click the '*About*' button.

10. Programming Guide

Introduction

Remote communication with the FLS-2800 is achieved through the Standard Commands for Programmable Instruments (SCPI). Support for VISA I/O API over TCP/IP is provided by a VXI-11 server running internally on the FLS-2800. With VISA communication drivers installed on the client, the implementation of VISA programming within environments such as MATLAB becomes available. This guide provides general information on the commands available to communicate with the FLS-2800 remotely using the VISA I/O.

Programming Conventions

This section details the programming and measurement conventions to follow while executing the commands for the FLS-2800.

Table 2 - Valid Units and Data Formats

Parameter	Default Unit	Alternative Units
Power	dBm	mdBm
Frequency	Hz	THz, GHz, MHz, kHz
Frequency (Fine)	Hz	THz, GHz, MHz, kHz
Wavelength	m	nm, pm
Grid size	Hz	THz, GHz, MHz, kHz
SBS Dither Rate	Hz	THz, GHz, MHz, kHz
SBS Dither Frequency	Hz	THz, GHz, MHz, kHz

Argument	Data Format
`<wsp>`	Specifies whitespace character ($01_{16} - 09_{16}$, $0B_{16} - 20_{16}$).
`<value>`	Is numerical data, an integer, a decimal, exponential (10e-9 or 5.8e6) or string
`[VALUE1|VALUE2]`	This is a parameter choice. The '|' separates the unique parameters available, only one of the choices can be used. In the example you can use the input parameter [VALUE1] or [VALUE2] not both. Some commands may have more than two choices available. This parameter can be omitted where the command has a default defined in the command description.

Index Addressing of Lasers (channel)

When executing commands, it is almost always necessary to provide the index of a specific laser source.

For the commands that require index values:

➤ `[m]`: is the channel index of a specific laser, this is an integer, <1 or 2>

Message Queues

Information is exchanged in the form of messages. These messages are held in input and output queues.

The output queue stores responses to query commands. The FLS-2800 transmits any data in the output queue when a read request is received.

Unless explicitly specified otherwise in the command description, all output response data is transmitted in ASCII format.

Common Command Summary

To comply with Standard Commands for Programmable Instruments (SCPI) 1999 standards, the FLS-2800 provides the following common commands.

Table 3 - FLS-2800 GPIB Common Commands

Command	Name
*CLS	Clear Status Command
*IDN?	Identification Query
*OPC?	Operation Complete Query
*OPT?	Option Identification Query

Common Command Descriptions

Command	***CLS**
Syntax	*CLS
Description	Clears status data structures in the Message Queues (Output and Error)
Parameters	None
Response	None
Example	`*CLS`

Command	***IDN?**
Syntax	*IDN?
Description	Query the device for manufacturer information strings
Parameters	None
Response	Comma separated string containing the \<manufacturer\>, \<part number\>, \<serial number\>,\<hardware version\>\<firmware version\>
Example	`*IDN? -> "EXFO,FLS-2800-1-1-C-H-89,CSL-1170,HW1.0FW2.2"` **Note**: Hardware and firmware versions are combined and not separated by a comma

Command	***OPC?**
Syntax	*OPC?
Description	Query the Operation Complete bit
Parameters	None
Response	`1`: If the FLS-2800 command queues are empty and the devices are ready to execute a command. `0`: If the FLS-2800 still has commands in the input queue to be executed.
Example	`*OPC? -> 0`

Command	***OPT?**
Syntax	*OPT?
Description	Query the FLS-2800 laser configuration (Specification part number)
Parameters	None
Response	The response will be part number of the FLS-2800
Example	`*OPT? -> "FLS-2800-1-1-C-H-89"`

Specific Command Summary

Table 4 - FLS-2800 SCPI Specific Commands

Slot commands	Description
:SLOT	
:OPC?	-Query the status of the Operation Complete bit
:OPTions?	-Query the modules installed on the slot
:IDN?	-Query the Identifier for the slot; returns the manufacturer, part number, serial number, hardware and firmware versions

Configuration commands	Description
:OUTPut:CHANnel[m]	
:POWer:UNIT?	-Query the power measurement unit used
:STATE/?	-Set or query the optical output state of the laser
:SOURce:CHANnel[m]	
:POWer/?	-Set or query the laser power
:WAVelength/?	-Set or query the laser wavelength
:FREQuency/?	-Set or query the laser frequency
:FINE/?	-Set or query the laser frequency fine tuning
:GRID/?	-Set or query the grid spacing
:SBS/?	
[:STATE/?]	-Set or query the state of the SBS dither
:RATE?	-Query the dither rate intended for SBS suppression
:FREQuency/?	-Set or query the SBS dither frequency modulation
:TEMPerature?	-Query the laser temperature

Specific Command Descriptions

Slot Commands

Command	:SLOT:OPC?
Syntax	:SLOT:OPC?
Description	Get the status of the Operation Complete bit for the device
Parameters	None
Response	1 is returned if the device is ready to execute a new operation 0 is returned if the device is busy
Example	`SLOT:OPC? -> 1`

Command	:SLOT:OPTions?
Syntax	:SLOT:OPTions?
Description	Get the laser sources installed on the slot
Parameters	None
Response	The response will be a comma separated string of lasers installed in the FLS-2800. If a laser is not installed in a channel, it will not return any identification string.
Example	`SLOT:OPT? -> "1,1,,"`

Command	:SLOT:IDN?
Syntax	:SLOT:IDN?
Description	Get the Identifier for the device
Parameters	None
Response	Comma separated string containing the <manufacturer>, <model number>, <serial number>,<hardware version><firmware version>
Example	`SLOT:IDN? -> "EXFO,FLS-2800-1-1-C-H-89,CSL-1186,HW1.0FW0.8"` **Note**: Hardware and firmware versions are combined and not separated by a comma

Configuration Commands

Command	:OUTPut:CHANnel[m]:POWer:UNIT?
Syntax	:OUTPut:CHANnel[m]:POWer:UNIT?
Description	Query the power unit of measurement currently set for the specified laser
Parameters	None
Response	Returns the string for the power unit of measurement of the specified laser
Example	`OUTP:CHAN1:POW:UNIT? -> dBm`

Command	:OUTPut:CHANnel[m]:STATE
Syntax	:OUTPut:CHANnel[m]:STATE<wsp>[ON|OFF]
Description	Set the laser output state
Parameters	ON|OFF: To set the output state on or off
Response	None
Example	`OUTP:CHAN1:STATE ON`

Command	:OUTPut:CHANnel[m]:STATE?
Syntax	:OUTPut:CHANnel[m]:STATE?
Description	Query the laser output state
Parameters	None
Response	Returns the current output state of the laser
Example	`OUTP:CHAN1:STATE? -> ON`
Command	:SOURce:CHANnel[m]:POWer

Syntax	:SOURce:CHANnel[m]:POWer<wsp><value>
Description	Set the power of the laser
Parameters	<value>: A valid numerical value which is in the range between the MIN and MAX response queried with the POWer? command seen below, or found in the FLS-2800 specifications
Response	None
Example	SOUR:CHAN1:POW 10.5

Command	:SOURce:CHANnel[m]:POWer?
Syntax	:SOURce:CHANnel[m]:POWer?<wsp>[MIN|MAX|SET|ACT|ALL]
Description	Query the power of the selected laser
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value SET: Get the desired set value ACT: Get the current value (default). ALL: Returns all of the above parameters
Response	Returns the minimum, maximum, set or actual (current) power for the laser as specified by parameters
Example	SOUR:CHAN1:POW? SET -> 14.5

IMPORTANT

If the laser STATE is ON while setting WAVelength, FREQuency or FREQuency:FINE. Please note that there will be a minimal non-stable output generated during the transition to the new value as the configuration commands are executed.

Command	:SOURce:CHANnel[m]:WAVelength
Syntax	:SOURce:CHANnel[m]:WAVelength<wsp><value>
Description	Set the laser wavelength
Parameters	<value>: A valid numerical value which is in the range between the MIN and MAX response queried with the WAVelength? command seen below, or found in the FLS-2800 specifications
Response	None
Example	SOUR:CHAN1:WAV 1.561419e-06

Command	:SOURce:CHANnel[m]:WAVelength?
Syntax	:SOURce:CHANnel[m]:WAVelength?<wsp>[MIN|MAX|SET|LOCK|ALL]
Description	Get the laser wavelength
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value SET: Get the set value (default) LOCK: Query whether the laser is currently at the SET wavelength ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set value for the laser wavelength as specified by parameters. The lock parameter will return as TRUE or FALSE
Example	SOUR:CHAN1:WAV? MAX -> 1.561419e-06

Command	:SOURce:CHANnel[m]:FREQuency
Syntax	:SOURce:CHANnel[m]:FREQuency\<wsp>\<value>
Description	Set the laser frequency
Parameters	\<value> is a valid numerical value which is in the range between the MIN and MAX response queried with the FREQuency? command seen below, or found in the FLS-2800 specifications
Response	None
Example	SOUR:CHAN1:FREQ 1.92e+14

Command	:SOURce:CHANnel[m]:FREQuency?
Syntax	:SOURce:CHANnel[m]:FREQuency?\<wsp>[MIN|MAX|SET|LOCK|ALL]
Description	Get the laser frequency
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value SET: Get the desired set value (default) LOCK: Query whether the laser is currently at the SET frequency ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set frequency for the laser as specified by parameters. The lock parameter will return as `true` or `false`
Example	SOUR:CHAN1:FREQ? MAX -> 1.92000000e+14

Command	:SOURce:CHANnel[m]:FREQuency:FINE
Syntax	:SOURce:CHANnel[m]:FREQuency:FINE\<wsp>\<value>
Description	Set or the laser frequency fine tuning
Parameters	\<value>: A valid numerical value in the frequency fine tuning range. Fine tuning can increase or decrease the frequency (positive or negative value). Valid range is from -6 GHz to 6 GHz in 1 MHz increments as detailed in the specifications.
Response	None
Example	SOUR:CHAN1:FREQ:FINE 2e+06

Command	:SOURce:CHANnel[m]:FREQuency:FINE?
Syntax	:SOURce:CHANnel[m]:FREQuency:FINE?\<wsp>[MIN|MAX|ACT|ALL]
Description	Get the laser frequency fine tuning
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value ACT: Get the current value (default) ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set fine tuning frequency for the laser as specified by parameters.
Example	SOUR:CHAN1:FREQ:FINE? -> 2.00000000e+06

IMPORTANT

The Laser STATE must always be set to OFF before attempting to change the GRID spacing.

Command	**:SOURce:CHANnel[m]:GRID**
Syntax	:SOURce:CHANnel[m]:GRID<wsp><value>
Description	Set the channel grid spacing
Parameters	<value>: Is the channel grid spacing within the specification range given by the MIN and MAX response queried with the GRID? command below.
Response	None
Example	SOUR:CHAN1:GRID 5e+10

Command	**:SOURce:CHANnel[m]:GRID?**
Syntax	:SOURce:CHANnel[m]:GRID?<wsp>[MIN|MAX|ACT|ALL]
Description	Query the grid spacing
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value ACT: Get the current value (default) ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set grid spacing for the laser as specified by parameters.
Example	SOUR:CHAN1:GRID? ACT -> 5.000000e+10

Command	**:SOURce:CHANnel[m]:SBS**
Syntax	:SOURce:CHANnel[m]:SBS<wsp>[ON|OFF]
Description	Set the state of the SBS dither
Parameters	ON|OFF: Set the SBS dither state to on or off
Response	None
Example	SOUR:CHAN1:SBS ON

Command	**:SOURce:CHANnel[m]:SBS?**
Syntax	:SOURce:CHANnel[m]:SBS?
Description	Query the state of the SBS dither
Parameters	None
Response	Returns the current state of the SBS dither
Example	SOUR:CHAN1:SBS? -> ON

Command	**:SOURce:CHANnel[m]:SBS:STATE**
Syntax	:SOURce:CHANnel[m]:SBS[:STATE]<wsp>[ON|OFF]
Description	Set the state of the SBS dither
Parameters	ON|OFF: Set the SBS dither state to on or off
Response	None
Example	SOUR:CHAN1:SBS:STATE ON

Command	:SOURce:CHANnel[m]:SBS:STATE?
Syntax	:SOURce:CHANnel[m]:SBS:STATE?
Description	Query the state of the SBS dither
Parameters	None
Response	Returns the current state of the SBS dither
Example	`SOUR:CHAN1:SBS:STATE? -> ON`

Command	:SOURce:CHANnel[m]:SBS:RATE?
Syntax	:SOURce:CHANnel[m]:SBS:RATE?<wsp>[MIN|MAX|ACT|ALL]
Description	Queries the dither rate intended for SBS suppression
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value ACT: Get the current value (default) ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set SBS dither rate for the laser as specified by parameters
Example	`SOUR:CHAN1:SBS:RATE? -> 2.000e+04`

IMPORTANT

SBS Dither STATE must always be set to OFF before attempting to change the SBS frequency.

Command	:SOURce:CHANnel[m]:SBS:FREQuency
Syntax	:SOURce:CHANnel[m]:SBS:FREQuency<wsp><value>
Description	Set the SBS dither frequency modulation.
Parameters	<value>: The desired frequency value within the range MIN and MAX given by the FREQ? query command below.
Response	None
Example	`SOUR:CHAN1:SBS:FREQ 1e+08`

Command	:SOURce:CHANnel[m]:SBS:FREQuency?
Syntax	:SOURce:CHANnel[m]:SBS:FREQuency?<wsp>[MIN|MAX|ACT|ALL]
Description	Query the SBS dither frequency
Parameters	MIN: Get the minimum programmable value MAX: Get the maximum programmable value ACT: Get the actual set value (default) ALL: Returns all of the above parameters
Response	Returns the minimum, maximum or currently set SBS dither frequency for the laser as specified by parameters
Example	`SOUR:CHAN1:SBS:FREQ? -> 1.00000000e+08`

Command	:SOURce:CHANnel[m]:TEMPerature?
Syntax	:SOURce:CHANnel[m]:TEMPerature?
Description	Get the laser temperature
Parameters	None
Response	Numerical temperature in degrees Celsius
Example	`SOUR:CHAN1:TEMP? -> 26.88`

VISA Programming Example: MATLAB

<table>
<tr>
<td>**!**</td>
<td>**IMPORTANT**

MATLAB R2010x or later with the *Instrument Control Toolbox* is required to execute the code detailed in this section.</td>
</tr>
</table>

VISA IO Driver Installation

To communicate with the FLS-2800 in MATLAB the installation of a VISA IO driver is required. These drivers enable the creation of the *Interface Object* for instrument communication.

Optional links to download third party VISA drivers:
➤ Agilent IO Suite - http://www.agilent.com/find/iosuite
➤ National Instruments NI-VISA - http://joule.ni.com/nidu/cds/view/p/id/3823/lang/en

MATLAB Test and Measurement Tool (`tmtool`)

The *Test and Measurement tool* is part of the *Instrument Control Toolbox*.

Note: To easily verify you have this feature installed type `tmtool` at the command line. The Test and Measurement tool will open in a new window if it is installed.

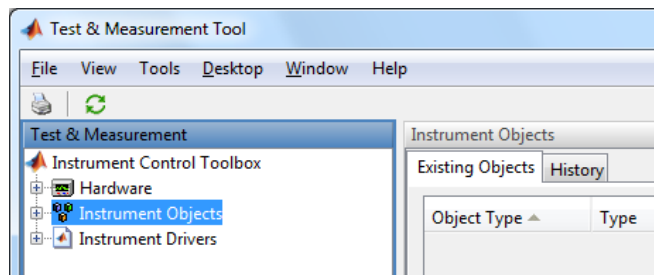1. Type `tmtool` at the command line and the *Test and Measurement tool* will open in a new window.

2. Double click on the '*Instrument Objects*' entry in the '*Instrument Control Toolbox*'.

Figure 22 - MATLAB Test and Measurement Tool

3. Right click on '*Interface Objects*' to bring up the context menu. Now select '*Create New Interface Object…*'
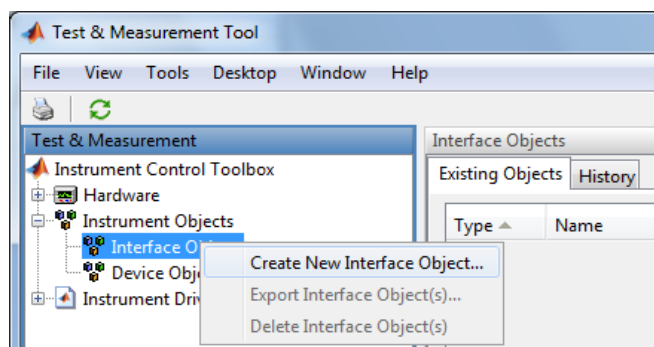

Figure 23 - MATLAB Create New Interface Object

4. Modify the options within the '*New Object Creation*' window to the following:
Interface object type:
VISA
Vendor:
<the VISA IO driver vendor>
Resource name:
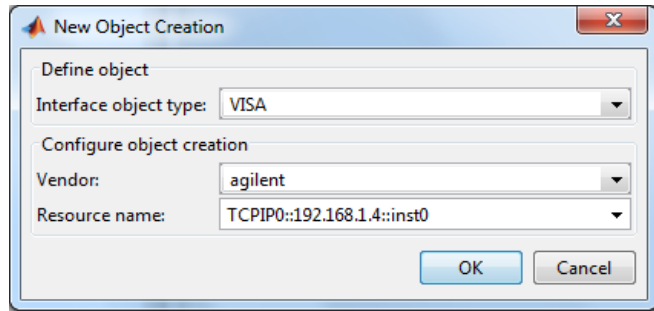TCPIP::<IP address of the FLS-2800>::inst0
Then click '*OK*'

Figure 24 - MATLAB New Object Creation Window

5. Once the VISA object is created you can click '*Connect*' which will open the connection to the FLS-2800 ready for communication.
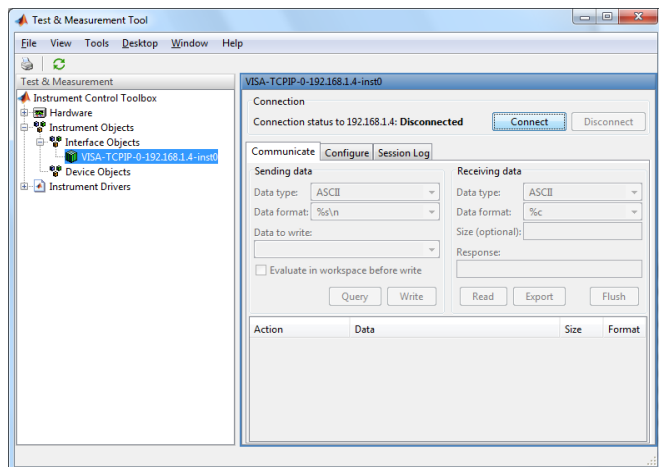

Figure 25 - MATLAB VISA Object Connect

6. While connected, using the '*Communicate*' tab, commands can be entered into the '*Data to write*' edit box (which also keeps a command history). Then clicking '*Query*' or '*Write*', depending on the type of command you are attempting to execute, '*Action*' entries will be added to the window giving the relative information about the command execution. For example response data will be listed here.
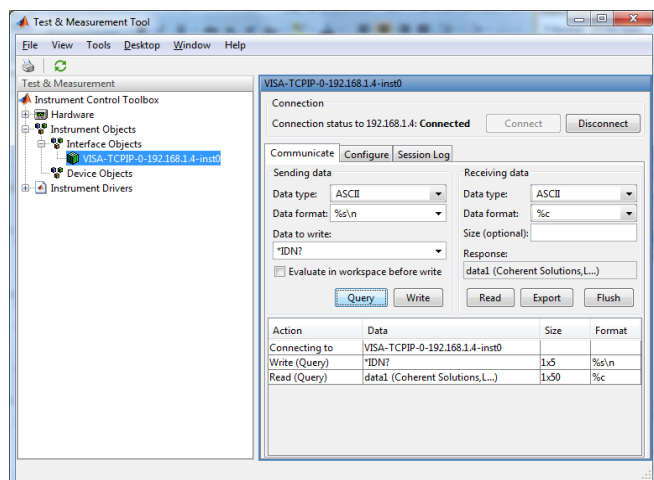

Figure 26 - MATLAB VISA Object Query

7. Once commands have been executed in the '*Communicate*' tab, clicking on the '*Session Log*' tab now shows MATLAB script code that will perform all the commands that were executed in the '*Communicate*' tab.

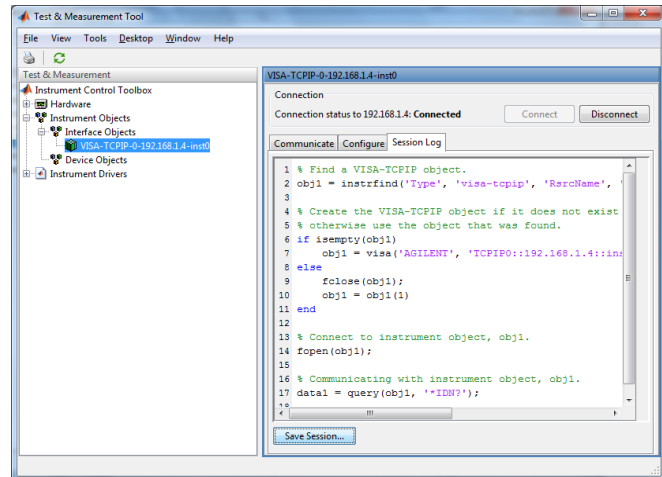8. By clicking '*Save Session…*' you are able to save the MATLAB .m file of these executed commands.

Figure 27 - MATLAB VISA Session Log

MATLAB Example Code: Query the FLS-2800

```matlab
% Find a VISA-TCPIP object. This is if the VISA object has already be
% created with tmtool etc, or has been removed from the workspace without
% first being closed (cleanly disconnected)
FLS_2800 = instrfind('Type', 'visa-tcpip', ...
    'RsrcName', 'TCPIP0::192.168.1.4::inst0::INSTR', 'Tag', '');

% Create the 'agilent' VISA-TCPIP object if it does not exist
% otherwise use the object that was found.
if isempty(FLS_2800)
    FLS_2800 = visa('agilent', 'TCPIP0::192.168.1.4::inst0::INSTR');
else
    fclose(FLS_2800);
    FLS_2800 = FLS_2800(1);
end

% Open the connection to the VISA object
fopen(FLS_2800);

% Query the FLS-2800.
response = query(FLS_2800, '*IDN?');
disp('The *IDN query response:');
disp(response);

response = query(FLS_2800, '*OPT?');
disp('The *OPT query response:');
disp(response);

% Close the connection to the object
fclose(FLS_2800);

% Clean up all objects.
delete(FLS_2800);
```

Note: *The IP address (`192.168.1.4`) used in the code is an example only. You will need to substitute in the IP address of your FLS-2800.*

11.USB Connection Web Interface

The USB web interface provides network configuration and log retrieval tools. This web interface is only available when connected by USB.

To access the USB web interface, open your internet browser and enter the address '`http://192.168.97.201`'. This will connect to the USB web interface welcome screen.

Note: *The IP address 192.168.97.201 is a factory set IP for the FLS-2800 USB connection.*

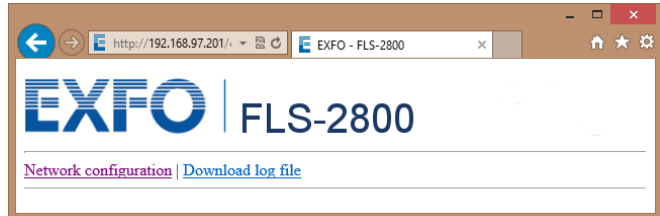From this web page you can click on the links to the available administration tasks.

Figure 28 - USB Web Interface, Welcome Screen

IMPORTANT

The IP Addressing described below is specifically used for Ethernet interface network connectivity. Please ensure this is never configured to 192.168.97.201 which will conflict with the USB web interface.

Network Configuration (Ethernet)

The Ethernet IP address for the FLS-2800 is requested from a DHCP server by default (*Obtain an IP address automatically*), however if no DHCP server is available, the configuration of the FLS-2800 Ethernet networking must be performed using this USB web interface.

To change the Ethernet IP address of the FLS-2800 to a static IP, select '*Use the following IP address:*' and the edit boxes will become active allowing you to enter the desired *IP address* and *Subnet mask*.

To set the Ethernet IP address to DHCP, select '*Obtain an IP address automatically*'.

Always confirm the *IP address* and *Subnet mask* with your network administrator before updating any network configuration settings.

Once entered, click '*Update Network Settings*' to apply the network configuration.

Figure 29 - USB Web Interface, Network Configuration
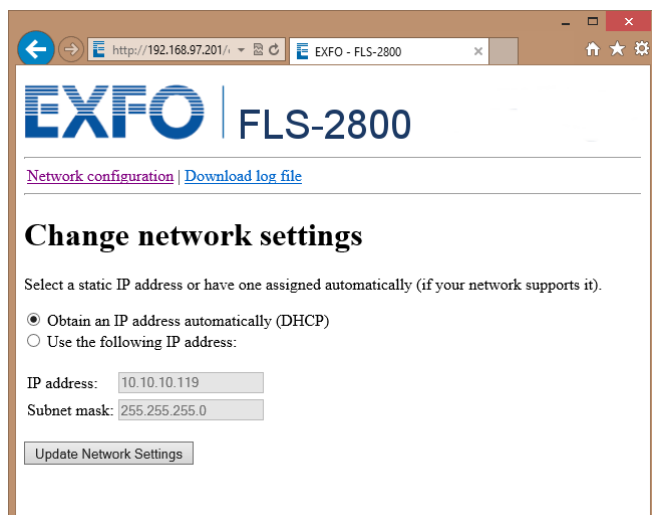
Download Log File

If a copy of the FLS-2800 system log files is required, the *Download log file* link can be used to retrieve this data.

Clicking this link will initiate a download of the **logfile.zip**. Click '*Save as*' and then navigate to the desired location to save this zip file and click '*Save*' again.
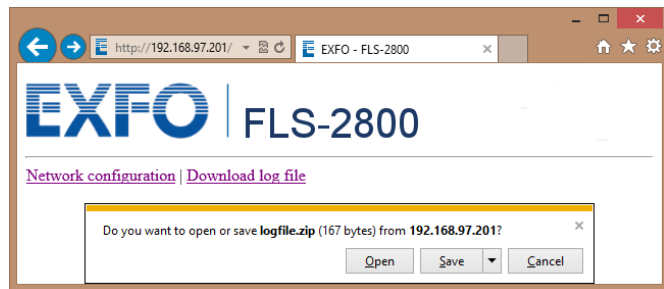

Figure 30 - USB Web Interface, Download Log Files

12.Maintenance

To help ensure long, trouble-free operation:

➤ Always inspect fiber-optic connectors before using them and clean them if necessary.

➤ Keep the unit free of dust.

➤ Always use blanking modules in slots that do not have an IQS-2800 laser module.

➤ 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 other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.

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

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 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr VI)	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电子组件	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

MARKING REQUIREMENTS
标注要求

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

a.   If applicable.
        如果适用

13.Technical Support

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	1 866 683-0155 (USA and Canada)
Quebec (Quebec) G1M 2K2	Tel.: 1 418 683-5498
CANADA	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.

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.

You may also be requested to provide software and module version numbers. This information, as well as technical support contact information, can be found in the '*About'* window.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The IQS-636 should be moved, lifted or otherwise transported without any IQS-2800 modules in the expansion slots.

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.

IMPORTANT

Keep this manual close at hand as it contains important details about your product.

14.Warranty

General Information

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

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

IMPORTANT

The warranty can become null and void if:

➤ The unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.

➤ The warranty sticker has been removed.

➤ The case screws, other than those specified in this guide, have been removed.

➤ The case has been opened, other than as explained in this guide.

➤ The unit serial number has been altered, erased, or removed.

➤ The unit has been misused, neglected, or damaged by accident.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL 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, transportation or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

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

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

> **IMPORTANT**
>
> EXFO will charge a fee for replacing optical connectors that were damaged due to misuse or bad cleaning.

Certification

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

Service and Repairs

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

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see EXFO Service Centers Worldwide on page 40). 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 40).

15.EXFO Service Centers Worldwide

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

EXFO Headquarters Service Center

400 Godin Avenue	1 866 683-0155 (USA and Canada)
Quebec (Quebec) G1M 2K2	Tel.: 1 418 683-5498
CANADA	Fax: 1 418 683-9224
	support@exfo.com

EXFO Europe Service Center

Winchester House, School Lane	Tel.: +44 2380 246800
Chandlers Ford, Hampshire S053 4DG	Fax: +44 2380 246801
ENGLAND	support.europe@exfo.com

EXFO Telecom Equipment (Shenzhen) Ltd.

3rd Floor, Building 10,	Tel: +86 (755) 2955 3100
Yu Sheng Industrial Park (Gu Shu Crossing), No. 467,	Fax: +86 (755) 2955 3101
National Highway 107,	support.asia@exfo.com
Xixiang, Bao An District,	
Shenzhen, China, 518126	

CORPORATE HEADQUARTERS	400 Godin Avenue	Quebec (Quebec) G1M 2K2 CANADA Tel.: 1 418 683-0211 · Fax: 1 418 683-2170
EXFO AMERICA	3400 Waterview Parkway Suite 100	Richardson, TX 75080 USA Tel.: 1 972-761-927 · Fax: 1 972-761-9067
EXFO EUROPE	Winchester House, School Lane	Chandlers Ford, Hampshire S053 4DG ENGLAND Tel.: +44 2380 246 800 · Fax: +44 2380 246 801
EXFO ASIA-PACIFIC	100 Beach Road, #25-01/03 Shaw Tower	SINGAPORE 189702 Tel.: +65 6333 8241 · Fax: +65 6333 8242
EXFO CHINA	Beijing Global Trade Center, Tower C, Room 1207, 36 North Third Ring Road East, Dongcheng District	Beijing 100013 P. R. CHINA Tel.: +86 (10) 5825 7755 · Fax: +86 (10) 5825 7722
EXFO SERVICE ASSURANCE	270 Billerica Road	Chelmsford MA, 01824 USA Tel.: 1 978 367-5600 · Fax: 1 978 367-5700
EXFO FINLAND	Elektroniikkatie 2	FI-90590 Oulu, FINLAND Tel.: +358 (0) 403 010 300 · Fax: +358 (0) 8 564 5203
TOLL-FREE	(USA and Canada)	1 800 663-3936

www.EXFO.com   info@exfo.com

EXFO | Telecom Test and Service Assurance