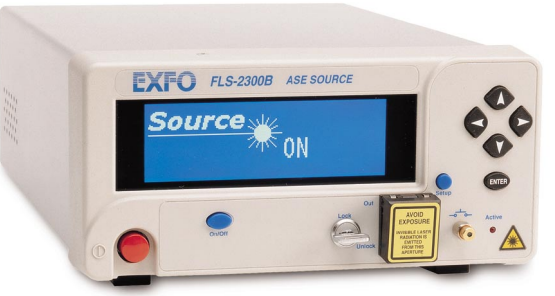
ASE Broadband Light Source

FLS-2300B



If the equipment described herein bears the CE symbol, the said equipment complies with the applicable European Union Directive and Standards mentioned in the Declaration of Conformity.

User Guide

P/N: 1034633
March 2002

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

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Certification Information

F.C.C. Information

Electronic test equipment is exempt from Part 15 compliance (FCC) in the United States, but EXFO makes reasonable efforts to ensure this compliance.

CE Information

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. This unit has been tested and found to comply with the limits for a Class A digital device. Please refer to the Declaration of Conformity.

CSA Information

This unit received CSA certification under the model name “GO”. The CSA Certificate Number is 162451. The “C-US” indicator adjacent to the CSA Mark signifies that the product has been evaluated to the applicable ANSI/UL and CSA Standards, for use in the United States and Canada.

Independent Laboratory Testing

This unit has undergone extensive testing according to the European Union Directive and Standards. All pre-qualification tests were performed internally, at EXFO, while all final tests were performed externally, at an independent, accredited laboratory. This guarantees the unerring objectivity and authoritative compliance of all test results.

IMPORTANT

Use of shielded remote I/O cables, with properly grounded shields and metal connectors, is recommended in order to reduce radio frequency interference that may emanate from these cables.

EXFO
Electro-Optical Engineering

DECLARATION OF CONFORMITY

Application of Council Directive(s):	73/23/EEC - The Low Voltage Directive 89/336/EEC - The EMC Directive
Manufacturer's Name:	EXFO ELECTRO-OPTICAL ENG.
Manufacturer's Address:	465 Godin Avenue Vanier, Quebec Canada G1M 3G7 (418) 683-0211
Equipment Type/Environment:	Industrial Scientific Equipment
Trade Name/Model No.:	FLS-2300B ASE Braodband Source
Year of Conformity Assessment:	2001

Standard(s) to which Conformity is Declared:

EN 61010-1:1993 A2: 1995	**Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements.**
EN 55022:1994/ A2: 1997	**Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment.**
EN 60825-1:1993/ A11: 1996	**Safety of laser products – Part 1: Equipment classifications, requirements, and user's guide**
EN 61326:1997/ A1: 1998	**Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards.

Manufacturer

Signature:

Full Name:	Stephen Bull, E. Eng
Position:	Vice-President Research and Development
Address:	465 Godin Avenue Vanier, Quebec, Canada
Date:	March 11, 2002

1 Introducing the FLS-2300B ASE Broadband Source

The FLS-2300B Broadband Source is a high-power, unpolarized fiber-optic source that comes with a standard FC-APC output connector.

By optically pumping an erbium-doped fiber, the C+L-band source emits a flattened amplified spontaneous emission (ASE) spectrum over the entire wavelength range.

With this source, there is no need to take a reference at every measurement. The high-power density of the FLS-2300B ASE Broadband Source results in a higher dynamic range when measuring a passive device with an optical spectrum analyzer.

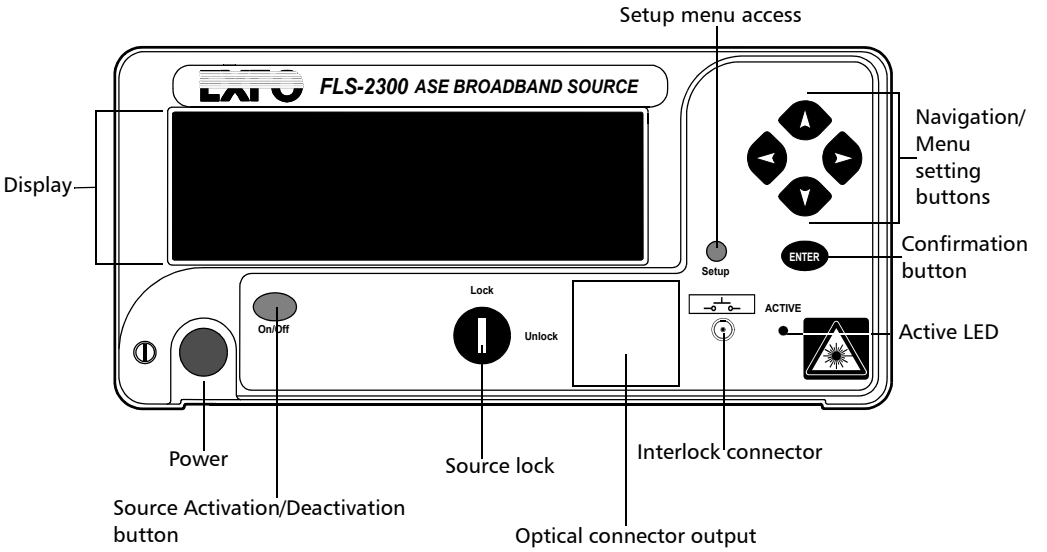
Its unpolarized output makes it particularly suitable for stable and average loss measurements. It is also ideal for component testing, high-sensitivity PMD measurements, communication link characterization and fiber sensing.

The excellent spectral stability of the FLS-2300B source as well as its high output power stability make this source useful for fast and reliable characterization of high-loss DWDM passive components such as thin film filters, arrayed waveguides and fiber Bragg gratings.

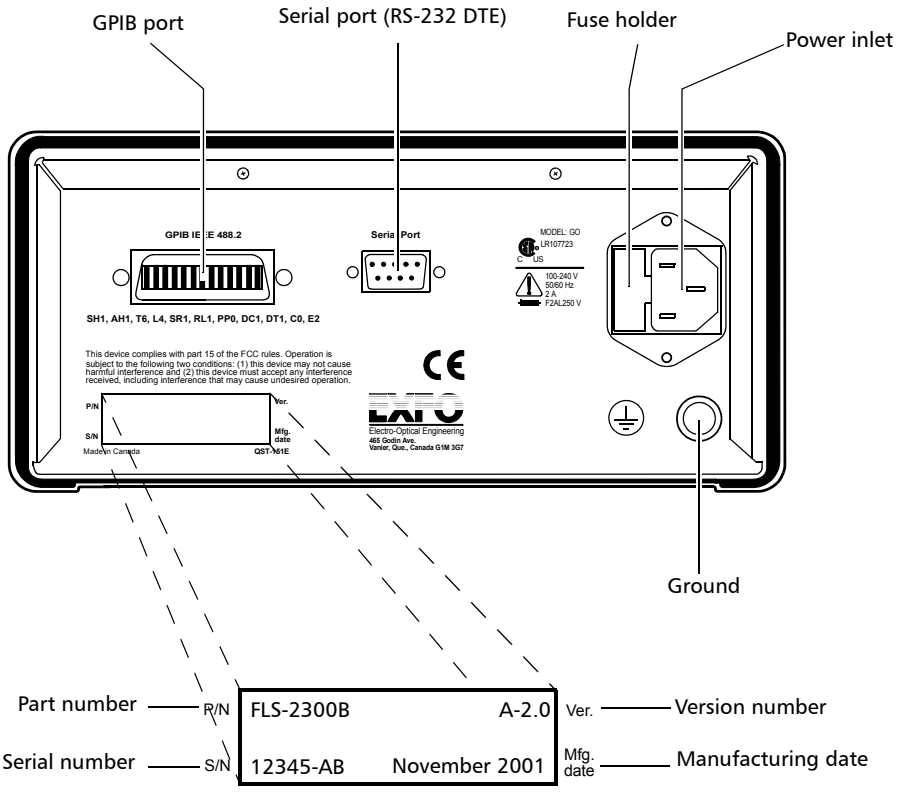
The high output power is stable and flat, making it suitable for simulating uniform noise in receiver bit error rate (BER) tests or testing the gain and the gain flatness of Raman amplifiers.

Depending on your needs, the FLS-2300B ASE Broadband Source can be purchased with the gain-flattening option (for applications requiring high flatness).

Front Panel


Setup menu access
FLS-2300 ASE BROADBAND SOURCE
Display
Navigation/
Menu
setting
buttons
Setup
ENTER
Confirmation
button
Lock
On/Off
Unlock
ACTIVE
Active LED
Power
Source lock
Interlock connector
Source Activation/Deactivation
button
Optical connector output

Back Panel


GPIB port
Serial port (RS-232 DTE)
Fuse holder
Power inlet
GPIB IEEE 488.2
Serial Port
MODEL: GO
LR107723
C US
100-240 V
50/60 Hz
2 A
F2AL250 V
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.
P/N
S/N
Ver.
Mfg. date
Made in Canada
QST-M1E
Electro-Optical Engineering
465 Godin Ave.
Vanier, Que., Canada G1M 3G7
Ground
Part number
R/N
FLS-2300B
A-2.0
Ver.
Version number
Serial number
S/N
12345-AB
November 2001
Mfg. date
Manufacturing date

2 Safety Information

Safety Conventions

You should understand the following conventions before using the product described in this manual:

WARNING

Refers to a potential *personal* hazard. It requires a procedure which, if not correctly followed, may result in bodily harm or injury. Do not proceed unless you understand and meet the required conditions.

CAUTION

Refers to a potential *product* hazard. It requires a procedure which, if not correctly followed, may result in component damage. Do not proceed unless you understand and meet the required conditions.

IMPORTANT

Refers to any information regarding the operation of the product which you should not overlook.

General Safety Information

The following safety precautions must be observed during the operation and servicing of the unit. Failure to comply with these precautions or with specific indications elsewhere in this manual violates safety standards of intended use of the unit. EXFO assumes no liability for the user's failure to comply with these requirements.

- This unit is intended for indoor use only.
- Unit covers cannot be removed during operation.

- Before powering on the unit, all grounding terminals, extension cords, and devices connected to it should be connected to a protective ground via a ground socket. Any interruption of the protective grounding is a potential shock hazard and may cause personal injury.
- Whenever the ground protection is impaired, the unit is not to be used and must be secured against any accidental or unintended operation.
- Only fuses with the required rated current and specified type (IEC, 250 V, 2 A, fast blow, 0.197 in. x 0.787 in. / 5 mm x 20 mm) may be used for replacement. Do not use repaired fuses or short-circuited fuse holders.
- The unit must be positioned so as not to block the ventilation holes located on each side of the unit.
- Any adjustments, maintenance and repair of opened units under voltage should be avoided and carried out only by skilled personnel aware of the hazards involved. Do not attempt internal service or adjustment unless another person qualified in first aid is present. Do not replace any components while power cable is connected.
- Operation of any electrical instrument around flammable gases or fumes constitutes a major safety hazard.
- Installation of replacement parts or modification of the unit should be carried out by authorized personnel only.
- Capacitors inside the unit may be charged even if the unit has been disconnected from its electrical supply.

Laser Safety Information

WARNING

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

WARNING

Use of controls, adjustments and procedures for operation and maintenance other than those specified herein may result in hazardous radiation exposure.

WARNING

Use of optical instruments with this product will increase eye hazard.

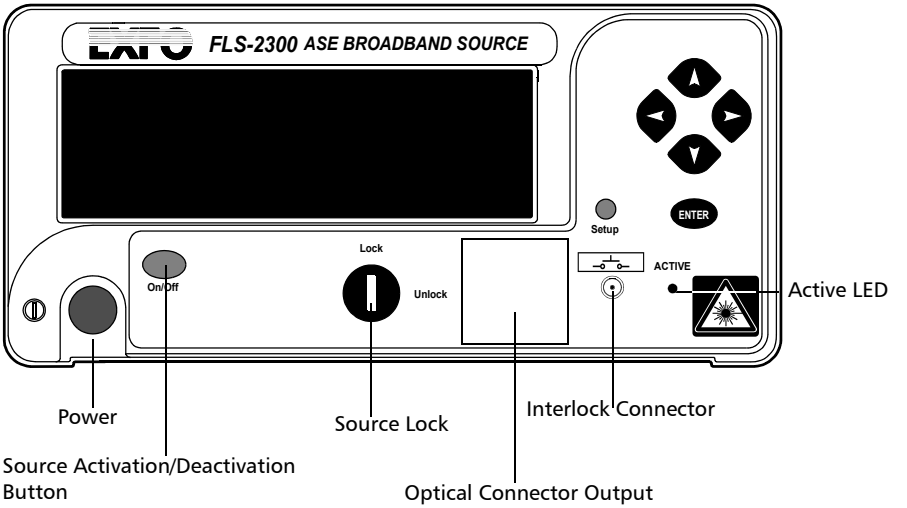
The Laser Radiation Warning Sticker below appears on the shutter of the optical output connector.

Your FLS-2300B ASE Broadband Source is a Class 3A laser product in compliance with standard IEC 60825-1: Edition 1.1 1998. It is also a Class IIIb laser product in compliance with standard 21 CFR 1040 10. It is potentially harmful if not used with extreme caution.

Light in the 1550 nm wavelength region is invisible to the human eye and can cause permanent eye damage. Use caution at all times when working with Class 3A or Class IIIb laser products. Wear appropriate eye protection and follow laser safety precautions.

The FLS-2300B ASE Broadband Source contains a Class 3A or Class IIIb laser source, as indicated on the following label(s):

Affixed on the top of the unit



Active LED

The unit has an active LED on its front panel. When lit, this LED indicates that an optical signal is being emitted from the source port.

On Class III B laser products, the active LED will turn on three seconds before the laser starts emitting above the Class 1 limit.

Source Port

The optical signal is emitted from the source port (labelled *Optical connector output* in figure on page 8). The Laser Radiation Hazard Sticker below appears on the front panel of the module.

Electrical Safety Information

AC Requirements

The FLS-2300B can operate from any single-phase AC power source between 100 V and 240 V (50 Hz/60 Hz). The maximum input current is 2 A.

Power Cable

The power cable of the FLS-2300B is its disconnect device (the only way to be sure the unit is completely powered off is to disconnect its power cable).

The FLS-2300B uses an international safety standard three-wire power cable. This cable serves as a ground when connected to an appropriate AC power receptacle. The type of power cable supplied with each unit is determined according to the country of destination.

Only qualified electricians should connect new plugs if needed. The color coding used in the electric cable depends on the cable. New plugs should meet local safety requirements and include:

- adequate load-carrying capacity
- ground connection
- cable clamp

WARNING

To avoid electrical shock, do not operate the unit if there are signs of damage to any part of the outer surface (covers, panels, etc.).

To avoid serious injury, the following precautions must be observed before powering on the unit:

- **If the unit is to be powered via an auto-transformer for voltage reduction, the common terminal must be connected to the grounded power source pole.**
- **Insert the plug into a power outlet with a protective ground contact. Do not use an extension cord without a protective conductor.**
- **Before powering on the unit, the protective ground terminal of the unit must be connected to a protective conductor using the unit power cord.**
- **Do not tamper with the protective ground terminal.**

3 Getting Started with Your Light Source

Turning the FLS-2300B On and Off

IMPORTANT

Before turning on the FLS-2300B, please read the *General Safety Information* on page 5.

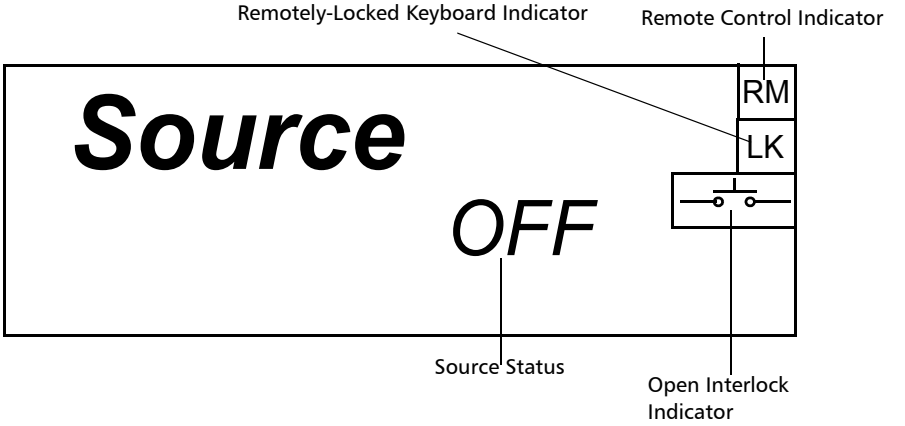
To turn the FLS-2300B on and off, press the red button located in the lower left-hand corner of the front panel (see front panel figure on page 2).

Upon startup, the unit beeps twice, performs a self-test and then displays the main window with the source deactivated.

When the unit is turned off, the current Setup menu settings remain in a storage device called non-volatile memory. These settings include display features and remote control.

FLS-2300B Display

The main window of your unit allows you to get important information on the source with just one glance.



- The *Source Status Indicator* shows whether the source is active or not (ON/OFF). In the case of an active source, a graphical element representing a light beam is also displayed.
- The *Remote Control Indicator* (**RM**) appears when the unit is currently controlled by remote commands (via GPIB or RS-232 communication mode).
- The *Locked Keyboard Indicator* (**LK**) shows that a remote application prevents you from using the keyboard of the unit.

Note: *The term "keyboard" refers to all front panel buttons –except the red button used to power the unit on or off.*

- The *Open Interlock Indicator* is displayed as soon as the source lock or the interlock connector (both located on front panel of the unit –see page 2) is open. For your safety, the source is automatically shut off.

Locking or Unlocking the Source

Description of Safety Measures

To comply with section 21 CFR 1040.10 of the *Radiation Control for Health and Safety Act* of 1968, various safety measures have been added to all Class IIIB laser sources. Your module is rated as a Class IIIB laser source. To comply with these regulations, each light source is supplied with

- an integrated remote interlock connector, which allows the introduction of external remote interlocks
- a source lock with a key and
- an emission indicator, which provides a visible signal sufficiently before emission to allow appropriate action to avoid exposure to the laser radiation.

Interlock Connector

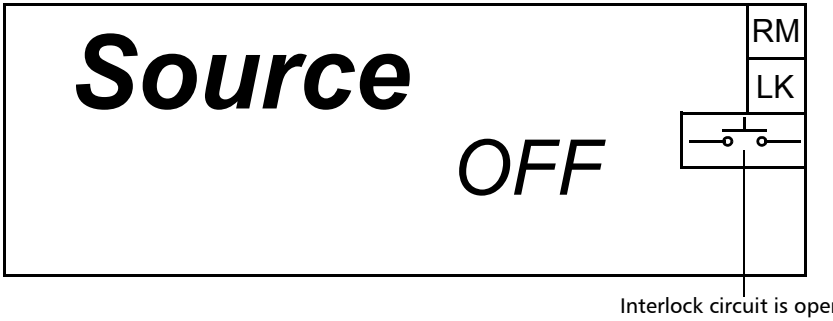
Your module is a Class IIIB laser source with an integrated remote interlock connector, which allows you to install a security switch or panic button. This module comes with an internally shorted interlock cap.

Note: *It is the user's responsibility to install external remote interlocks to ensure safe use of these sources.*

The interlock circuit has the following characteristics:

- When the interlock circuit is open, the light source cannot be activated.
- If the light source is active before the interlock circuit is opened, the light source becomes inactive. For your safety, the source won't automatically become active upon closing the interlock circuit. The source must be turned on by pressing the source *activation/deactivation* button (labeled *On/Off* on your unit, as shown in figure on page 2).

An icon is only displayed on the main window when the interlock circuit (interlock or key) is open.



Three-Second Safety Delay

The FLS-2300B provides a three-second safety delay between the source activation and actual light emission. During this three-second delay, you may cancel the activation of the laser by opening the interlock circuit.

Note: *Pressing the source* activation/deactivation *(*On/Off*) button won't have any effect, since the source initialization is already underway.*

Activating or Deactivating the Source

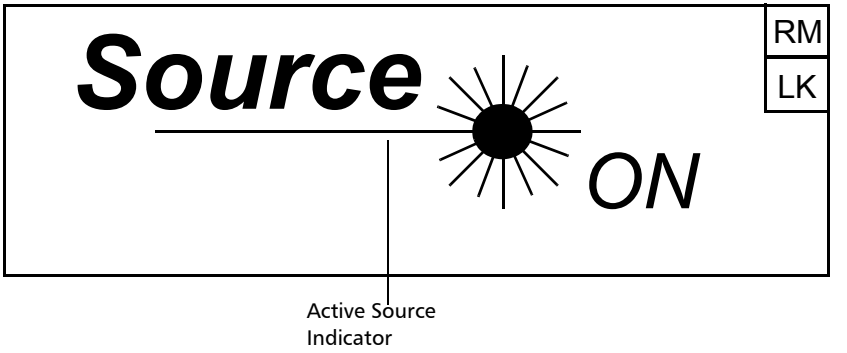
To activate the source:

1. Setup the source as explained in *Setting FLS-2300B Parameters* on page 19.
2. Make sure that the interlock circuit is closed by turning the source lock to the *Unlock* position.

   The *Open Interlock* indicator should not be displayed. If it is, simply close the interlock circuit. Source lock and interlock connector are located on the front of the unit.

3. To activate the source, press on the *On/Off* button . The active LED on the module front will light up, and the front display will read "*Source ON*", also showing a light beam icon.

The word "*ON*" will flash during the three-second safety delay.



4. To deactivate the source, press the *On/Off* button again. The active LED on the module front will then turn off and the display will read "*Source OFF.*"

Note: *To obtain optimum stability, a laser source should be allowed to warm up for 2 hours.*

4 Setting FLS-2300B Parameters

The blue button on the right side of the display provides access to the single-level *Setup* menu. You can access the Setup menu even while the source is active. The figure below shows *Setup* menu items.

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	STD	Flow Ctrl	N.A.
Exit			

To set a parameter:

1. Use arrows on the front panel of the unit to select the parameter you want to modify (see front panel figure on page 2). The current selection is displayed in reverse video.
2. Press *ENTER* to edit the parameter. The cell containing the value will then be displayed in reverse video, indicating you can modify its contents.
3. Use the *up/down* arrows to select the appropriate value.
4. Confirm your selection by pressing *ENTER*. The display wiil return to normal.

To exit the *Setup* menu, press the blue button providing access to the menu. You can also select the *Exit* item from the Setup menu (last item at the bottom of the window) and press *ENTER*. The FLS-2300B will revert to its state prior to entering the menu.

Note: *The unit will beep whenever the FLS-2300B does not allow an operation.*

Setting Refresh Rate

This function allows you to define the refresh rate of the display.

To set the refresh rate:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up/down* or *left/right* arrow keys to select **Refresh Rate** (the item will be displayed in reverse video).

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	STD	Flow Ctrl	N.A.
Exit			

3. Press *ENTER* to access the **Refresh Rate** edit box.
4. Use the *up/down* arrow keys to set the refresh rate between 1/2 Hz, 1 Hz, 2 Hz, 4 Hz, 8 Hz and 16 Hz.
5. Press *ENTER* to confirm the new refresh rate.

Setting Backlight

In certain circumstances, you might want to deactivate the display backlight.

To modify the backlight setting:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up*/*down* or *left*/*right* arrow keys to select **Backlight** (the item will be displayed in reverse video).
3. Press *ENTER* to access the **Backlight** edit box.
4. Use the *up*/*down* arrow keys until the backlight value changes to *OFF*.
5. Press *ENTER* to confirm the new backlight setting.

Note: *To reactivate the backlight, you must be very close to the unit screen to see the information displayed. Repeat steps 1 to 4 above –except backlight value must be set to ON.*

Setting Contrast

To modify the contrast:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up*/*down* or *left*/*right* arrow keys to select **Contrast** (item will appear in reverse video).
3. Press *ENTER* to access the **Contrast** edit box.
4. Use the *up*/*down* arrow keys to adjust the contrast as required.
5. Press *ENTER* to confirm the contrast adjustment.

Setting Video Mode

To change the video mode:

1. Press the *Setting* button to access the *Setting* menu.
2. Use the *up/down* or *left/right* arrow keys to select **Video Mode** (item will appear in reverse video).
3. Press *ENTER* to access the **Video Mode** edit box.
4. Use the *up/down* arrow keys to set the required video mode.

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	STD	Flow Ctrl	N.A.
Exit			

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	INV	Flow Ctrl	N.A.
Exit			

5. Press *ENTER* to confirm the video mode.

Resetting the FLS-2300B

You may want to reset the FLS-2300B parameters to their original values.

To reset parameters to values at time of purchase, while turning on the unit, press *ENTER* until the unit beeps three times.

All the user-defined parameters are automatically reset. The following table presents the parameters and their default values.

Parameters	Reset Value or State
Source	OFF
Backlight	ON
Video Mode	STD (standard)
Refresh Rate	4 Hz
RS232/GPIB (Remote control)[a]	GPIB
GPIB Address[a]	12
Baud Rate[a]	N.A.
Flow Ctrl[a]	N.A.

a. Parameter cannot be reset by a remote control command.

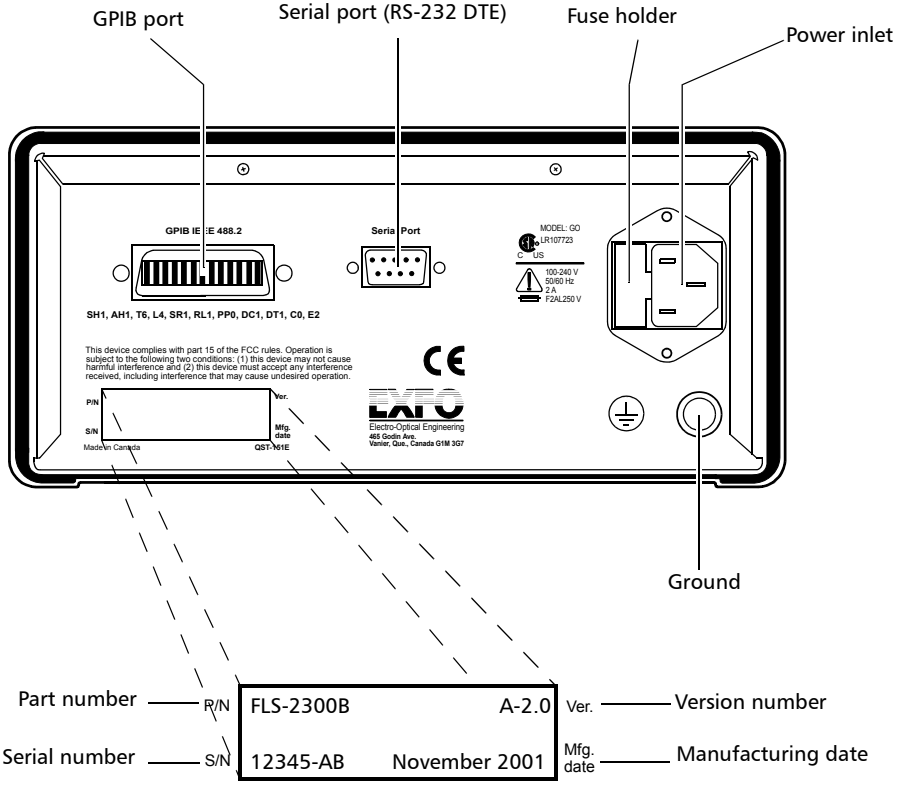
5 Controlling the Source Remotely

The FLS-2300B can be remotely controlled either by

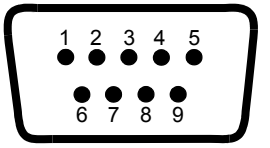
- a GPIB interface (through a GPIB cable connected to the GPIB port)

OR

- an RS-232 interface (through a serial cable connected to the serial port).



The RS-232 connector (serial port) at the back of the FLS-2300B uses a DTE pinout configuration.



Pin Number	Description	Direction
2	Receive (Rx)	Input
3	Transmit (Tx)	Output
5	Signal ground (Gnd)	—

The commands used in both protocols are the same and are summarized in two reference tables. Common GPIB commands are listed in *General Commands—Quick Reference* table on page 39. Specific commands for the FLS-2300B are shown in the *Specific Commands—Quick Reference* table on page 40. Detailed information about these commands can be found in the *Remote Control Commands* appendix.

When the FLS-2300B is remotely controlled, **RM** appears in the upper right-hand corner of the display.

Setting Remote Command Mode

To remotely control the FLS-2300B, you must set a GPIB address or activate the RS-232 port.

To set a remote command mode:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up/down* or *left/right* arrow keys to select **RS232 / GPIB**. The current setting is displayed.

Note: *If* GPIB *is currently selected and you want to specify a GPIB address, see Setting GPIB Address on page 28.*

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	STD	Flow Ctrl	N.A.
Exit			

3. Press *ENTER* to access the **RS232 / GPIB** edit box.
4. Use the *up/down* arrow keys to toggle between *GPIB* and *RS232*.
5. Press *ENTER* to confirm.

If you selected *RS232*, the **GPIB Addr.** menu option is deactivated ("*N.A.*" is displayed).

If you selected *GPIB*, the **Baud Rate** and **Flow Ctrl** menu options are disabled ("*N.A.*" is displayed). If the currently selected GPIB address doesn't suit your needs, you can change it.

Setting GPIB Address

If GPIB is selected as the remote command mode, you can select the GPIB address you want to use from 1 to 30 (default value is 12).

To set a GPIB address:

1. Press *Setup* to access the *Setup* menu.
2. Use the *up/down* or *left/right* arrow keys to select **GPIB Addr.** The current GPIB address is displayed.

Note: *If you are in RS-232 mode, the GPIB address cell will display* "N.A." *You must change the communication mode to* GPIB *before setting an address.*

Refresh Rate	8 Hz	RS232 / GPIB	GPIB
Backlight	ON	GPIB Addr.	12
Contrast	▼ ◐ ▲	Baud Rate	N.A.
Video Mode	STD	Flow Ctrl	N.A.
Exit			

3. Press *ENTER*, then use the *up/down* arrow keys to select a GPIB address between 1 and 30.
4. Press *ENTER* to confirm your choice.

Setting Baud Rate

The baud rate is a parameter related to RS-232 communication. It determines the speed at which data is sent between the unit and a computer, in bits per second (bps).

To change the baud rate for your remote communications:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up*/*down* or *left*/*right* arrow keys to select **Baud Rate**. The current setting is displayed.

Refresh Rate	8 Hz	RS232 / GPIB	RS232
Backlight	ON	GPIB Addr.	N.A.
Contrast	▼ ◐ ▲	Baud Rate	19200
Video Mode	STD	Flow Ctrl	Soft
Exit			

3. Press *ENTER*, then use the *up*/*down* arrow keys to select the baud rate. You can select 1200, 2400, 4800, 9600 or 19200 bps.
4. Press *ENTER* to confirm.

Setting Flow Control

The flow control parameter applies only to RS-232 communication. This parameter allows you to select the type of serial communication used.

Choose *Soft* if you want the rate of data transmission to match the rate at which it can be processed by the device. This enables the computer and the FLS-2300B ASE Source to stop each other from transmitting by sending a control character (Xoff). They will also be able to restart the transmission by sending another control character (Xon). This is known as a "*software handshake*", *a procedure* requiring a special cable.

To set a flow control:

1. Press the *Setup* button to access the *Setup* menu.
2. Use the *up/down* or *left/right* arrow keys to select **Flow Ctrl**. The current setting is displayed.

Refresh Rate	8 Hz	RS232 / GPIB	RS232
Backlight	ON	GPIB Addr.	N.A.
Contrast	▼◐▲	Baud Rate	19200
Video Mode	STD	Flow Ctrl	Soft
Exit			

3. Press *ENTER*, then use the *up/down* arrow keys to select the type of flow you want. "*None*" means no flow control. "*Soft*" allows the unit or computer controlling it, to turn the data transmission on or off.
4. Press *ENTER* to confirm.

Communication Parameters

Note: *EOS means "End of String." EOI means "End or Identify."*

For GPIB Communication	
Terminate Read on EOS	Yes
Set EOI with EOS on Writes	Yes
Type of compare on EOS	8 bits
EOS byte	0Ah
Send EOI at end of Writes	Yes
GPIB primary address	See *Setting GPIB Address* on page 28
GPIB secondary address	None

For RS-232 Communication	
EOS bytes	0Ah
Baud rate	1200/2400/4800/9600/ 19200 bps
Parity	None
Data bits	8 bits
Stop bits	1 bit
Flow control	Software (Xon/Xoff) or None
Activation	See *Setting Remote Command Mode* on page 27

Standard Status Data Structure

The four tables below give information on the common Status and Enable registers as defined by IEEE 488.2.

The diagram displayed on page 36 is a useful aid in understanding the general commands and how a service request (SRQ) is generated.

➤ Standard Event Status Register (ESR)

Bits	Mnemonics	Bit Value
7	Power On	128
6	Not used	0
5	Command Error	32
4	Execution Error	16
3	Device Dependent Error	8
2	Query Error	4
1	Not used	0
0	Operation Complete	1

➤ Standard Event Status Enable Register (ESE)

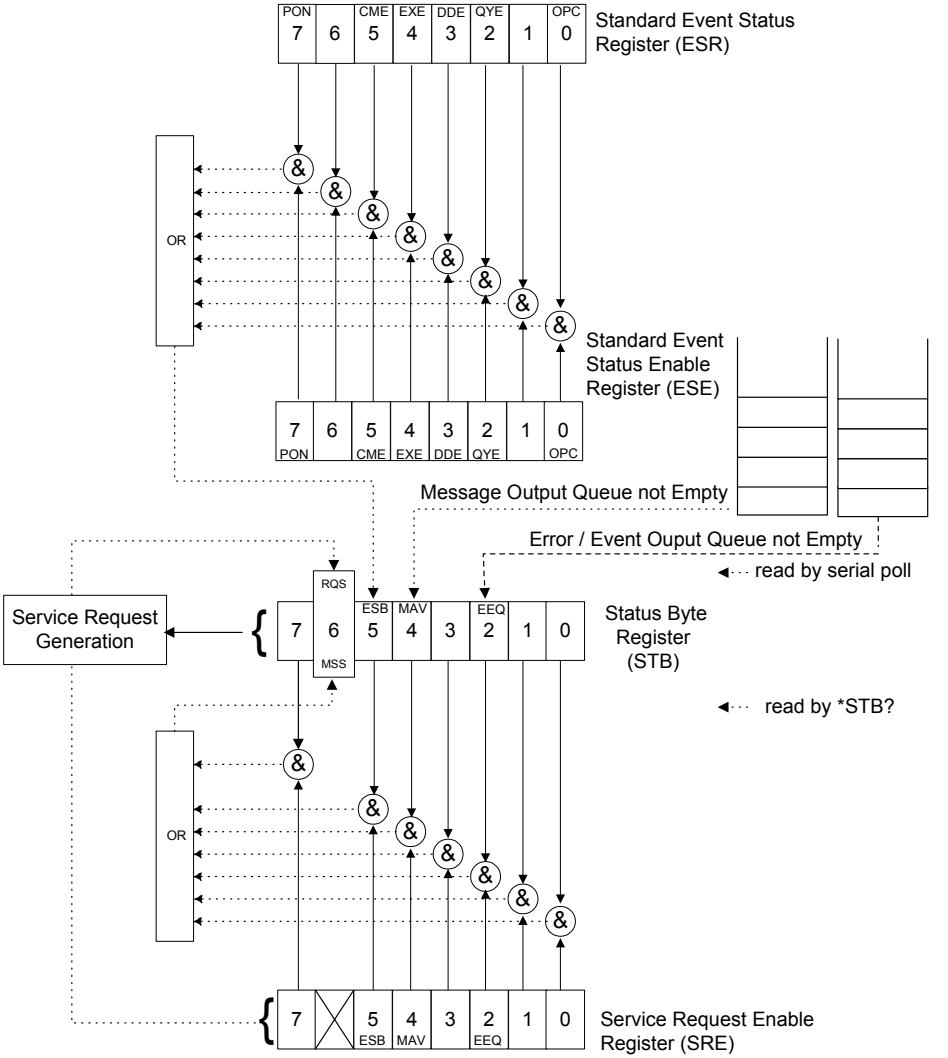
Bits	Mnemonics	Bit Value
7	Power on	128
6	Not used	0
5	Command error	32
4	Execution error	16
3	Device dependent error	8
2	Query error	4
1	Not used	0
0	Operation complete	1

➤ Status Byte Register (STB)

Bits	Mnemonics	Bit Value
7	Not used	0
6	Request service / Master summary status	64
5	Event summary bit	32
4	Message available	16
3	Not used	0
2	Error / Event queue	4
1	Not used	0
0	Not used	0

➤ Service Request Enable Register (SRE)

Bits	Mnemonics	Bit Value
7	Not used	0
6	Reserved	0
5	Event status byte	32
4	Message available	16
3	Not used	0
2	Error / Event queue	4
1	Not used	0
0	Not used	0


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

An SRQ is forced when a bit in the Status Byte register goes from 0 to 1 and the corresponding SRE mask bit is set. If an SRQ is forced, the RQS bit is set to 1 and will remain there until read by a serial poll –even if the reason or condition causing the service request no longer exists. Similarly, if a serial poll reads the RQS, it is reset to 0, whether or not the condition causing the service request still exists.

Command Structure

The GPIB and RS-232 commands follow the guidelines determined by the Standard Commands for Programmable Instruments (SCPI) consortium. For example, the following command syntax is used to activate or deactivate the source.

SOUR:POW[:STAT]<wsp><Boolean>

- SOUR, POW and STAT are keywords that define the function of the command.
- [ ] indicates that a keyword or parameter is optional.
- <wsp> indicates that a space is required ("wsp" stands for "white space").
- <Boolean> indicates the command parameter.
- Keywords must be separated by a colon.

To enter commands or queries you must use either the full word for the command, or the three- or four-letter shortcut. Commands are not case-sensitive, however spelling errors will cancel the command or query.

The command or query can be written using only shortcuts, only full words, or a combination of both.

Other command syntax elements are

- the comma, which is used to separate values in a command or query.
- the semi-colon, which is used to separate commands or queries, when you send more than one at a time.

Note: *It is recommended that you retrieve the response immediately after each query.*

General Commands—Quick Reference

The FLS-2300B recognizes the main commands identified in IEEE 488.2. The table below summarizes these commands. For more information about general commands, see *Remote Control Commands* on page 73.

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

The FLS-2300B also recognizes commands that can only be used with RS-232 communication. These commands are summarized below.

Command	Function
*LOK	Set Remote Lockout programming state
*LOK?	Remote Lockout programming state query
*REM	Set Remote programming state

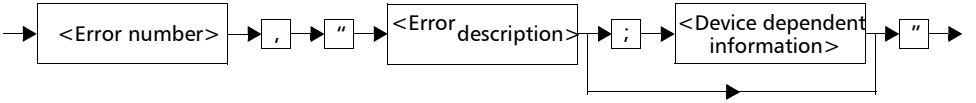
Specific Commands—Quick Reference

The table below contains a summary of the FLS-2300B specific commands. If you need more information about these specific commands, see *Specific Commands* on page 82.

Command				Parameter/ Response	Description
DISP	BRIG			<numeric_value> |MINimum| MAXimum	Turn backlight on or off
	BRIG?			(0|1)	Backlight on or off?
SOUR	POW	STAT		0|1 |ON|OFF	Turn source on or off
		STAT?		(0|1)	Source active?
		PROT	TRIP?	(0|1)	Interlock open?
SYST	ERR?			Error code	Next error from error queue?
	VERS?			Current version	Identification string?

Error Messages Format

System and device specific errors are managed by the FLS-2300B. 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

All error messages are stacked in a FIFO buffer. When there is at least one message in the buffer, bit 2 of the Status Byte Register is set to 1. Use the SYST:ERR? command to read the most recent message. The error message buffer is initialized when starting the FLS-2300B, when executing the *CLS command, or by reading the last message stored in the buffer.

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

SCPI Management Errors (System Errors)

Error Number	Description	Probable Cause
-100	“Command error”	A Command error has occurred. This is the generic syntax error for devices that cannot detect more specific errors.
-104	“Data type error”	The parser recognized a data element different than the one allowed.
-108	“Parameter not allowed”	More parameters were received than expected for the header.
-109	“Missing parameter”	Fewer parameters were received than expected for the header.
-113	“Undefined header”	The header is syntactically correct, but it is undefined for this specific device.
-130	“Suffix error”	An error occured while parsing a suffix.
-131	“Invalid suffix”	The suffix does not follow the appropriate syntax or it is inappropriate for this device.
-138	“Suffix not allowed”	A suffix was encountered after a numeric element which does not allow suffixes.
-200	“Execution error”	An execution error occurred. This is the generic syntax error for devices that cannot detect more specific errors.

Error Number	Description	Probable Cause
-222	“Data out of range”	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.
-224	“Illegal parameter value”	An exact value from a list of possibles was expected.
-300	“Device-specific error”	A device-dependent error occurred. This is the generic syntax error for devices that cannot detect more specific errors.
-321	“Out of memory”	An internal operation needed more memory than was available.
-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.
-365	“Time out error”	This is a generic device-dependent error.
-400	“Query error”	A query error occurred. This is the generic syntax error for devices that cannot detect more specific errors.

6 Maintenance

To help ensure long, trouble-free operation:

- Keep the unit free of dust.
- Clean the unit casing with a tissue that has been 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 and let the unit dry completely.

WARNING

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Cleaning the Front Panel

Clean the front panel of the FLS-2300B ASE Broadband Source regularly to avoid build-up of dust, dirt, and other foreign substances.

To clean the front panel:

1. Gently wipe the front panel with a cloth that has been dampened with soapy water.
2. Rinse the front panel with a cloth that has been dampened with water.
3. Dry with a clean wiping cloth.

IMPORTANT

To help keep the connectors and adapters clean, EXFO recommends that you install protective caps when the unit is not in use. You should also clean the fiber ends before every connection.

Cleaning Fixed Connectors

Regular cleaning of connectors will help maintain optimum performance. There is no need to disassemble the module.

To clean fixed connectors:

1. Fold a lint-free wiping cloth in four to form a square.
2. Moisten the center of the lint-free wiping cloth with *only one drop* of isopropyl alcohol.

IMPORTANT

Alcohol may leave traces if used abundantly. Avoid contact between the tip of the bottle and the wiping cloth, and do not use bottles that distribute too much alcohol at a time.

3. Gently wipe the connector threads three times with the folded and moistened section of the wiping cloth.

IMPORTANT

Isopropyl alcohol takes approximately ten seconds to evaporate. Since isopropyl alcohol is not absolutely pure, evaporation will leave microscopic residue. Make sure you dry the surfaces before evaporation occurs.

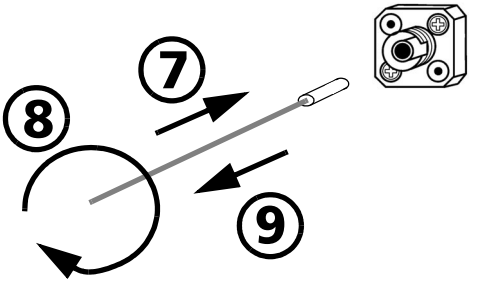
4. With a dry lint-free wiping cloth, gently wipe the same surfaces three times with a rotating movement.
5. Throw out the wiping cloths after one use.

6. Moisten a cleaning tip (2.5 mm tip) provided by EXFO with *only one drop* of isopropyl alcohol.

IMPORTANT

Alcohol may leave traces if used abundantly. Avoid contact between the tip of the bottle and the cleaning tip, and do not use bottles that distribute too much alcohol at a time.

7. Slowly insert the cleaning tip into the connector until it reaches the ferrule inside (a slow clockwise rotating movement may help).



8. Gently turn the cleaning tip one full turn.

9. Continue to turn as you withdraw the cleaning tip.

10. Perform steps 7 to 9 again, but this time with a dry cleaning tip (2.5 mm tip provided by EXFO).

Note: *Make sure that you do not touch the soft end of the cleaning tip, and verify the cleanliness of the cotton tip.*

11. Throw out the cleaning tips after one use.

Cleaning Connectors Equipped with EUI/EUA Adapters

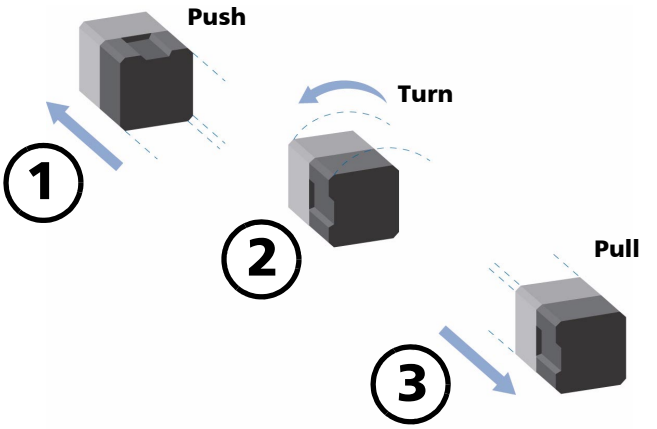
Regular cleaning of connectors equipped with EUI/EUA adapters will help maintain optimum performance. There is no need to disassemble the unit.

IMPORTANT

If any damage occurs to internal connectors, the module casing will have to be opened and a new calibration will be required.

To clean connectors:

1. Remove the EUI/EUA adapter from the module to expose the optical connector baseplate and ferrule.



2. Use a lint-free wiping cloth and deposit *only one drop* of isopropyl alcohol on it.

IMPORTANT

Alcohol may leave traces if used abundantly. Avoid contact between the tip of the bottle and the wiping cloth, and do not use bottles that distribute too much alcohol at a time.

3. Gently wipe the connector and ferrule.

IMPORTANT

Isopropyl alcohol takes approximately ten seconds to evaporate. Since isopropyl alcohol is not absolutely pure, evaporation will leave microscopic residues. Make sure you dry the surfaces before evaporation occurs.

4. With a dry lint-free wiping cloth, gently wipe the same surfaces in order to be sure that the connector and ferrule are perfectly dry.

5. Throw out the wiping cloths after one use.

WARNING

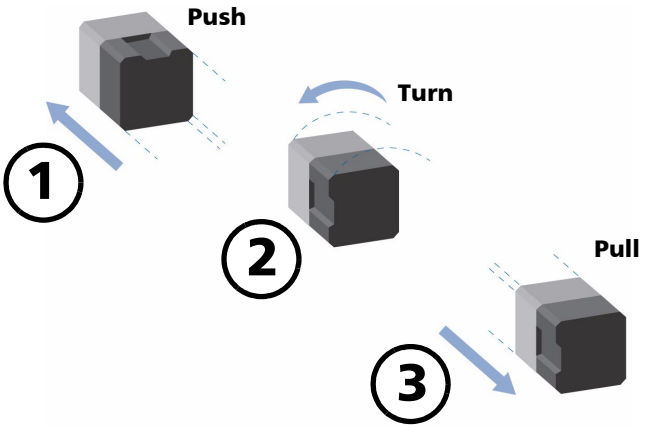
DO NOT verify the surface of the connector with a fiber-optic microscope WHILE THE UNIT IS ACTIVE. Doing so WILL result in permanent eye damage.

6. After having cleaned the connectors and having made sure that the unit is not active, verify the surface of the connector with a small, portable fiber-optic microscope.

Cleaning EUI/EUA Adapters

To clean EUI/EUA adapters:

1. Remove the EUI/EUA adapter from the module connector.

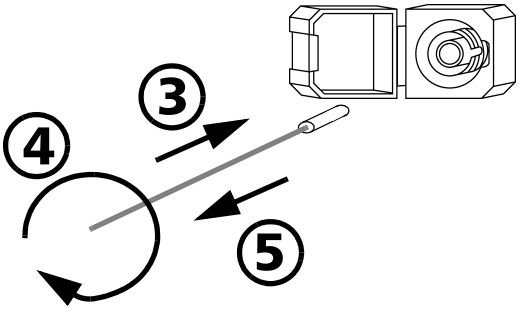


2. Moisten a cleaning tip (2.5 mm tip) provided by EXFO with *only one drop* of isopropyl alcohol.

IMPORTANT

Alcohol may leave traces if used abundantly. Avoid contact between the tip of the bottle and the cleaning tip, and do not use bottles that distribute too much alcohol at a time.

3. Slowly insert the cleaning tip into the adapter until it comes out on the other side (a slow clockwise rotating movement may help).



4. Gently turn the cleaning tip one full turn.

5. Continue to turn as you withdraw the cleaning tip.

6. Perform steps 3 to 5 again, but this time with a dry cleaning tip (2.5 mm tip provided by EXFO).

Note: *Make sure that you do not touch the soft end of the cleaning tip, and verify the cleanliness of the cotton tip.*

7. Throw out the cleaning tips after one use.

Cleaning Detector Ports

IMPORTANT

To help keep the detectors and adapters clean, EXFO recommends that you install protective caps when the unit is not in use. You should also clean the fiber ends before every connection.

Regular cleaning of connectors will help maintain optimum performance.

To clean detector ports:

1. Remove the detector protective cap and the connector adapter (FOA).
2. If the detector is dusty, remove dirt with compressed air.
3. Take a cleaning tip from the package (supplied with EXFO's power meters) being careful not to touch the soft end of the swab.
4. Moisten the cleaning tip with *only one drop* of isopropyl alcohol.

IMPORTANT

Alcohol may leave traces if used abundantly. Avoid contact between the tip of the bottle and the cleaning tip, and do not use bottles that distribute too much alcohol at a time.

5. While applying light pressure, gently rotate the cleaning tip on the detector window.

CAUTION

To avoid breaking the detector window during cleaning, be careful not to apply too much pressure on it.

6. Repeat step 5, but this time with a dry cleaning tip or blow dry with compressed air.
7. Discard the cleaning tips after one use.

Replacing the Fuse

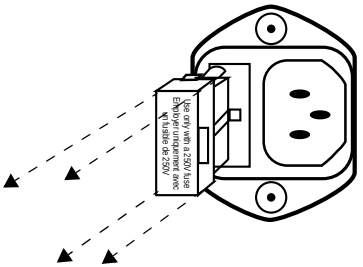
The FLS-2300B contains two fuses of type IEC, 250 V, 2 A, fast blow 5 mm x 20 mm (0.197 in x 0.787 in). The fuse holder is located at the back of the FLS-2300B, just beside the power inlet.

This symbol, found at the back of the FLS-2300B, indicates that the user should refer to the instruction manual for fuse replacement and power rating.

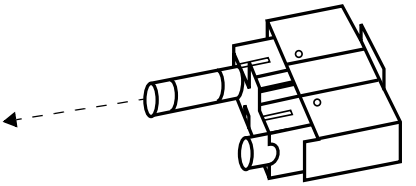
To replace the fuses:

1. Unplug the power cord from the FLS-2300B.

2. Pull the fuse holder out of the FLS-2300B.



3. Check and replace the fuses if necessary.



4. Make sure the fuses are firmly in the holder prior to reinsertion.
5. Firmly push the holder into place.

Recalibrating the Unit

If a calibration due date is not indicated on the calibration label, this means that the calibration certificate for your FLS-2300B ASE Broadband Source has been modified in conformity with the ISO/IEC 17025 Standard.

EXFO recommends that an annual calibration be performed on your FLS-2300B ASE Broadband Source to ensure that it remains within the published specifications. However, as prescribed by the ISO/IEC 17025 Standard, this date can only be set by you.

You should indicate the calibration due date in the space provided on the calibration label.

Software Upgrades

To upgrade the FLS-2300B embedded software using a diskette, you must connect your FLS-2300B to a computer through a null modem cable.

Note: *Software upgrades may be performed in DOS, Windows 3.1, Windows 95, Windows 98 or Windows 2000. If problems occur, please contact EXFO.*

IMPORTANT

When using a notebook computer to upgrade the FLS-2300B software, you should perform the upgrade in a DOS environment.

Proceed with the software upgrade only if the version indicated on the diskette is *greater* than the software version currently installed in your unit. To check the software version currently installed on your unit, see the information displayed at start-up.

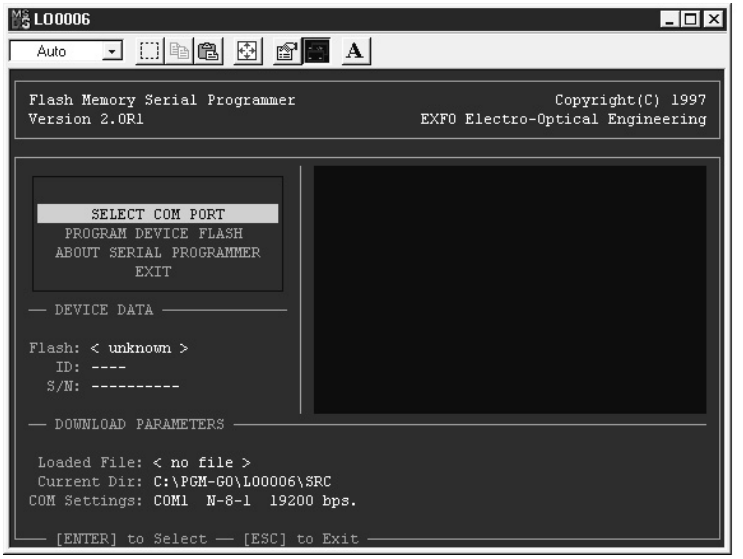
To perform a software upgrade:

1. Turn off the FLS-2300B.
2. If it is not already done, turn on the computer.
3. On the hard disk of your computer, create a directory named "*Test*" (*C:|Test*).
4. Insert the upgrade diskette into the computer floppy disk drive and copy the **.hex* file into the new directory (if necessary, unzip the file.).
5. Connect one end of a null modem cable to the FLS-2300B RS-232 serial port and the other end to an unused communication port on your computer (ex. COM2).
6. If the software upgrade is performed in Windows 98, you have to restart your computer in DOS mode before launching the upgrade program. In other cases, simply exit to DOS.

   From *C:\Test* directory, type
   LO0006.exe /c:2 /F:C:\Test*.hex, which can be decoded as follows:

   - "2" represents the serial port number. In this case, it means "COM2."
   - There is a space between "LO0006.exe" and "/".
   - There is a space between "c:2" and "/F".
   - "*" represents the name of the file. Do not type *.hex, but rather the actual name of the file you copied to your hard disk.

   Press *Enter*.



7. When the "*Waiting for device handshake*" message appears, turn on the FLS-2300B. The FLS-2300B screen will remain off; the unit will beep once and the update program will start automatically. A progress bar on the computer screen will indicate the status of the software upgrade.

8. Once the software upgrade is complete, the "Reboot device for self-test" message will appear. If the software upgrade was performed in Windows 2000, an error message will be displayed: "*LO0006 NTVDM has encountered a System Error. The parameter is incorrect. Choose 'Close' to terminate the application.*". Click on **Close** to hide the dialog box.

9. You must turn the FLS-2300B off, and then on again, to use the upgraded software. During self-test execution, the FLS-2300B should display the new software version number.

7 Troubleshooting

FLS-2300B Error Messages

Warning/Error Number	Description	Recommended Action
-11	Module reset error: The nulling was not performed correctly.	Restart your unit to solve the problem.
-12	Wrong module ID: The module returns the wrong ID.	Call EXFO for assistance.
-20	Module communication error: Communication error with the module.	Restart your unit to solve the problem.
-25	Checksum error: Checksum error while reading the module's FIFO.	Restart your unit to solve the problem.
-30	Command not accepted: The command that caused the warning will be lost. The unit may continue with the program even if the command was not performed.	If problem persists, call EXFO for assistance.
-31	Module setting error: One of the settings sent to the unit is wrong.	Review your command before sending it again.
-32	Action currently in progress: You cannot send a command while the unit is already active.	Wait until the unit is done before sending the command.

Warning/Error Number	Description	Recommended Action
-34	Command overflow: Too many commands were sent to the unit at a time.	Wait until the unit is done before sending more commands.
-40	FIFO not ready for reading: The unit's FIFO is not ready for reading. Commands sent will be ignored.	If problem persists, call EXFO for assistance.
-60	Laser over-current: A problem occured with the current going to the laser.	Call EXFO for assistance.
-64	EEPROM error: The EEPROM was not detected.	Call EXFO for assistance.
-65	EEPROM checksum error: A Checksum error was detected by the unit.	Call EXFO for assistance.
-68	Temperature error: The operating temperature of the unit is from 0 °C to 40 °C (32 °F to 104 °F).	Make sure the ambient temperature is comprised in the specified temperature range.
-69	FPGA problem: A FPGA problem was detected.	Call EXFO for assistance.
-73	Supply voltage error: Internal voltage values are out of the operation range.	Call EXFO for assistance.
-74	Laser pump failure: A problem occured in the output (optical) power of the laser pump.	Call EXFO for assistance.

Warning/Error Number	Description	Recommended Action
-75	Laser temperature problem: Laser temperature is out of the operation range.	Make sure the ambient temperature is comprised in the specified temperature range.
-76	Thermo-electric cooler over-current: A problem occured with the current going to the thermo-electric cooler.	Call EXFO for assistance.
-79	EEPROM access error: A problem occured when accessing the EEPROM memory (read or write).	Call EXFO for assistance.
100	No more room in the command pipe: A command could not be added to the command pipe.	If problem persists, call EXFO for assistance.
101	Timeout error: The command request was not performed in the set time amount.	Call EXFO for assistance.
102	Runtime error: The command was not performed by the unit due to a runtime error.	Call EXFO for assistance.
103	Invalid response: A command has triggered an invalid response from the unit.	Call EXFO for assistance.

Warning/Error Number	Description	Recommended Action
200	Decompression error: An error occurred while decompressing the software.	Call EXFO for assistance.
32244	Floating exception: There is an overflow while running a command.	Restart your unit to solve the problem.
32245	Stack overflow: Not enough RAM to run the command.	Restart your unit to solve the problem.
32246	Abort called in firmware: The unit used a command which it is not intended to.	Restart your unit to solve the problem.
32300	Heap overflow: Not enough space in the heap.	Restart your unit to solve the problem.
32301 32302	Malloc overflow: Not enough RAM to run the command.	Restart your unit to solve the problem.
32303	Divide by zero: The unit attempted to perform a division by zero, which gives an infinite answer.	Restart your unit to solve the problem.
32304	Array boundary error: A table index is outside the bounaries set by the array.	Restart your unit to solve the problem.
32305	Invalid Opcode: The unit did not recognized the binary code.	Restart your unit to solve the problem.

GPIB Troubleshooting

Problem	Probable Cause	Solution
Unable to communicate with FLS-2300B (no response from *IDN? command).	Incorrect communication type selected.	Select the correct communication type: RS-232 or GPIB.
	Incorrect communication parameters.	Check the communication parameters: bus address, baud rate, flow control, etc., as required.
	Incorrect termination characters.	Synchronize termination characters between the GPIB controller and the SCPI Manager.
	Poor bus connection.	Ensure the functionning of the controller card and make sure that the bus cable is properly connected.
	Improper configuration.	Verify that the GPIB interface is properly configured.
Receive “Undefined header” error.	Incorrect command syntax.	Verify and correct syntax.
Unstable communication.	Incorrect termination character.	Synchronize termination characters between the GPIB controller and the SCPI Manager.

Using the Online Help

Context-sensitive and interactive help is available to guide you through the use of your application.

To obtain online help:

1. Click on the **Help** button or press on F1. A question mark will appear next to your pointer.
2. Click on any element and a pop-up window will appear to display a description of the selected element.

Finding Information on the EXFO Web Site

The EXFO Web site provides answers to frequently asked questions (FAQs) regarding the use of your FLS-2300B ASE Broadband Source.

To access FAQs:

1. Type the following address in your Internet browser: **www.exfo.com**.
2. Click on the **Support** tab.
3. Click on **FAQs** and follow the on-screen instructions. You will be given a list of questions pertaining to your subject.

The EXFO Web site also provides the product's most recent technical specifications.

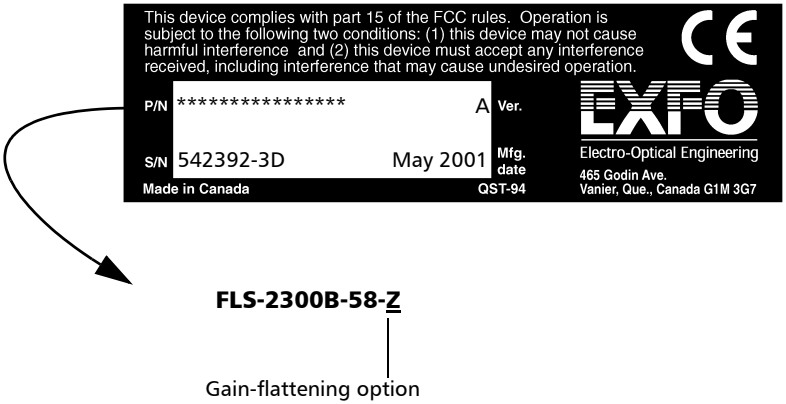
Contacting the Technical Support Group

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, 7:30 a.m. to 8:00 p.m. (Eastern Time in North America).

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

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

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



Transportation

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

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

8 Warranty

General Information

EXFO Electro-Optical Engineering 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 recalibrate the product free of charge should the equipment need to be repaired or if the original calibration is erroneous.

IMPORTANT

The warranty can become null and void if

- **the equipment has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**
- **the warranty sticker has been removed.**
- **case screws, other than those specified in this manual, have been removed.**
- **the case has been opened, other than as explained in this manual.**
- **the equipment serial number has been altered, erased, or removed.**
- **the equipment 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 purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the operation of any system of which the purchased 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, and batteries used with EXFO products are not covered by this warranty.

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 after 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 70). Support personnel will determine if the equipment requires service, repair, or calibration.

2. If the equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and an address for return.

IMPORTANT

Never send any unit or accessory back to EXFO without a Return Merchandise Authorization (RMA) number.

3. If the unit has an internal storage device, do a backup of your data before sending the unit for repairs.
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 by the 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, the customer will be invoiced for the cost appearing on this report. Return-to-customer shipping costs will be paid by EXFO for equipment under warranty. Shipping insurance is at the customer's expense.

EXFO Service Centers Worldwide

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

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

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

EXFO Europe Service Center
Le Dynasteur
10/12, rue Andras Beck
92366 Meudon la Forêt Cedex
FRANCE

Tel.: +33.1.40.83.85.85
Fax: +33.1.40.83.04.42
europe.service@exfo.com

Beijing OSIC EXFO Service Center
No. 1754-1755 Beijing New Century
Hotel Office Tower
No. 6 Southern Capital Gym Road
Beijing 100044
P.R. CHINA

Tel.: +86 (10) 6849 2738
Fax: +86 (10) 6849 2662
beijing.service@exfo.com

EXFO Asia-Pacific Service Center
151 Chin Swee Road
#03-29 Manhattan House
SINGAPORE 169876

Tel.: +65 333 8241
Fax: +65 333 8242
asiapacific.service@exfo.com

Burleigh Instruments Service Center
7647 Main Street Fishers
Victor, NY 14564
USA

Tel.: 1 585 924-9355
Fax: 1 585 924-9072
service@burleigh.com

A Technical Specifications

IMPORTANT

The technical specifications for this product 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*.

Specifications[1]

		Without gain-flattening option	With gain-flattening option
Spectral density (dBm/nm)		≥ -8 from 1530 nm to 1600 nm	≥ -10 from 1530 nm to 1600 nm
		≥ -14 from 1525 nm to 1610 nm	≥ -15 from 1525 nm to 1610 nm
		≥ -25 from 1520 nm to 1615 nm	≥ -26 from 1520 nm to 1615 nm
Total output power (dBm)		≥ 14	≥ 12
Spectral density stability (dB/nm)	15 min	± 0.04 (1520 nm to 1560 nm)	± 0.04 (1520 nm to 1560 nm)
Total power stability[2] (dB)	1 hour	± 0.01 (Δ = 0.02)	± 0.01 (Δ = 0.02)
Spectral flatness (dB)		Δ ≤ 3.5 typical (1537 nm to 1600 nm)	Δ ≤ 3 (1530 nm to 1600 nm)
DOP		< 2 % typical (1530 nm to 1600 nm) over 0.15 nm band	

General Specifications

Output connector	FC/APC
Dimensions (H x W x D)	11.7 cm x 22.2 cm x 33.3 cm (4 5/8 in x 8 3/4 in x 13 1/8 in)
Weight	3.2 kg (7 lb)
Operating temperature	10 °C to 40 °C
Storage temperature	–40 °C to 70 °C
Output fiber	SMF-28

Notes

1. At 23 °C ± 0.5 °C, after a two-hour warmup.
2. The total power stability is expressed as ± half the difference between the maximum and minimum values measured during the period.

Safety

21 CFR 1040.10	CLASS 3B LASER PRODUCT
IEC 60825-1: Ed.1.1 1998	CLASS 3A LASER PRODUCT

Standard Accessories

Instruction manual, hybrid patchcord, test report, Certificate of Compliance

Electrical and Environmental Specifications	
Operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Relative humidity	0 % to 80 % non-condensing.[a]
Maximum operation altitude	2000 m (6150 ft)
Pollution degree	2
Installation category	II
Power supply rating[b]	100 V to 240 V (50 Hz/60 Hz)
	maximum 2 A

a. Measured in 0 °C to 31 °C (32 °F to 87.8 °F) range decreasing linearly to 50 % at 40 °C (104 °F).
b. Not exceeding ± 10 % of the nominal voltage.

Note: *The FLS-2300B ASE Broadband Source is intended for indoor use only.*

B Remote Control Commands

Common Commands

The SCPI Manager recognizes all of the common commands identified as mandatory by IEEE-488.2. These commands are fully explained on the following pages.

Note: *The expression* <wsp> *stands for white space in certain GPIB commands syntax.*

*CLS	
Description	This command sets the contents of the Standard Event Status Register(ESR), the Status Byte Register (STB), as well as the Error and Input queues to zero. This command is commonly used to clear the status registers before enabling SRQ. Note that the following settings are not affected: Instrument interface address, Output queue, Service Request Enable Register (SRE), Standard Event Status Enable Register (ESE).
Syntax	*CLS

*ESE	
Description	This command is used to set bits in the Standard Event Status Enable Register (ESE) to a new value (initial value is 189). The contents of the ESE register are logically ANDed with the ESR register. A non-zero result will set the Event Summary Bit (ESB) of the Status Byte Register (STB). This command is useful for selecting which events may generate an SRQ.
Syntax	*ESE<wsp><value>
Parameter	The <value> parameter must be between 0 and 255.

*ESE?

Description	This query reads the contents of the Standard Event Status Enable Register (ESE).
Syntax	*ESE?
Response	A binary integer between 0 and 255

*ESR?

Description	This query reads the contents of the Standard Event Status Register (ESR) and clears it.
Syntax	*ESR?
Response	A binary integer between 0 and 255

*IDN?

Description	This query reads the FLS-2300B system identification string.
Syntax	*IDN?
Response	“EXFO E.-O. Engineering,FLS-2300B,xxxxxxxxxx,2.0r0”, where – xxxxxxxx is the serial number – 2.0r0 is the Firmware level.

	***OPC**
Description	This command will cause the FLS-2300B to generate the operation complete message in the Standard Event Status Register (ESR) when all pending selected FLS-2300B operations have been completed.
Syntax	*OPC
Example	*IDN?;*OPC
Note	The following actions cancel the *OPC command (and put the instrument into Operation Complete Command Idle state): Power On Device clear active state is asserted on the interface *CLS *RST

*OPC?	
Description	This query puts an ASCII 1 in the Output queue and generates the operation complete message in the Standard Event Status Register (ESR) when all pending selected FLS-2300B operations have been completed. This query is useful to prevent another command from processing until the current command is complete.
Syntax	*OPC?
Response	"1"
Note	The following actions cancel the *OPC command (and put the instrument into Operation Complete Command Idle state): ➤ Power On ➤ Device clear active state is asserted on the interface ➤ *CLS ➤ *RST

*RST

Description The *RST command sets the instrument to reset settings (factory settings stored in ROM). Pending *OPC and *OPC? actions are cancelled. The instrument is placed in idle state. The *RST command clears the Input and Error queues. The following settings are not changed:

- Instrument interface address
- Output queue
- Service Request Enable Register (SRE)
- Standard Event Status Enable Register (ESE)

Syntax *RST

Note For a complete list of default parameters, see *Resetting the FLS-2300B*, on page 23.

This command uses electronic parts with a limited life span (non-volatile memory). Use this command in moderation.

*SRE

Description This command sets bits in the Service Request Enable Register (SRE; initial value is 52), and enables the corresponding bit in the Status Byte Register (STB). The command can be used to select which events can initiate a service request.

Syntax *SRE<wsp><value>

Parameter The <value> parameter must be between 0 and 255.

*SRE?	
Description	This query returns the contents of the Service Request Enable Register (SRE).
Syntax	*SRE?
Response	A binary integer between 0 and 255

*STB?	
Description	This query returns the contents of the Status Byte Register (STB).
Syntax	*STB?
Response	A binary integer between 0 and 255

*TST?

Description	This query initiates an internal self-test and returns a binary value indicating the test results.
Syntax	*TST?
Response	A decimal value indicating the sum of all corresponding errors: “0”–No errors “1”–N/A “2”–Supply voltage error: “4”–Laser over-current: “8”–Laser pump failure: “16”–Laser temperature problem: “32”–Thermo-electric cooler over-current: “64”–N/A “128”–EEPROM access error: “256”–EEPROM checksum error: “512”–EEPROM error: “1024”–FPGA problem: “2048”–Temperature error: “4096”–N/A “8192”–N/A

*WAI	
Description	This command prevents the FLS-2300B from processing any further command until the No-Operation-Pending-Flag is set. All pending operations must be completed before processing another command.
Syntax	*WAI
Parameters	None

The supported RS-232 commands are fully explained hereafter.

*LOK	
Description	This command is used to set the Remote Lockout programming state.
Syntax	*LOK<wsp><value>
Parameters	The <value> parameter is a boolean value indicating if the FLS-2300B is "0" or "unlocking" "1" or "locking"
Note	This command can only be used when working with RS-232 communication.

*LOK?	
Description	This query returns the Remote Lockout programming state.
Syntax	*LOK?
Response	A boolean value indicating if the FLS-2300B is “0” unlocked “1” locked
Note	This command can only be used when working with RS-232 communication.

*REM	
Description	This command is used to set the Remote programming state.
Syntax	*REM<space><data>
Parameters	The <data> parameter can be “1” to set the Remote programming state to Remote or “0” to set the Remote progamming state to Local.
Note	This command can only be used with RS-232 communication.

Specific Commands

There are some commands specific to the FLS-2300B. These commands are fully explained on the following pages.

DISPlay:BRIGhtness	
Description	This command turns the backlight of the unit on or off.
Syntax	DISP:BRIG<wsp><numeric_value>|MINimum|MAXimum
Parameters	A numeric parameter: "1"–turns the backlight on "0"–turns the backlight off
Example	DISP:BRIG 1 DISPLAY:BRIGHTNESS 0

DISPlay:BRIGhtness?	
Description	This command returns the state of the backlight.
Syntax	DISP:BRIG?
Response	A numeric value: "1"-the backlight is on "0"-the backlight is off
Example	DISP:BRIG? 1

SOURce:POWer[:STATe]

Description	This command turns on or off the source. When the source is on, the red LED on the front of the module illuminates.
Syntax	SOUR:POW[:STAT]<wsp><boolean>|ON|OFF
Parameters	A boolean parameter: "1"–turns the source on "0"–turns the source off
Example	SOUR:POW:STAT 1 (turns the source on.) SOURCE:POWER 0 (turns the source off.)

SOURce:POWer:STATe?

Description	This query returns a value indicating the state of the optical source (on or off).
Syntax	SOUR:POW:STAT?
Response	A boolean value: "1"–the source is on "0"–the source is off
Example	SOUR:POW:STAT? 1

SOURce:POWer:PROTection:TRIPped?

Description	This query returns the state of the interlock circuit (including the interlock connector and the source key protection). As soon as it is opened, the protection circuit prevents the source from emitting (the source was on) or from being turned on (the source was off).
Syntax	SOUR:POW:PROT:TRIP?
Response	A boolean value: "1"–the protection is open (Source cannot be turned on without closing the protection.) "0"–the protection is closed (Normal operating state)
Example	SOUR:POW:PROT:TRIP? 0

SYSTem:ERRor?

Description	This command returns the next error in the error queue. When an error is generated, an error number is sent to the error queue. The error queue is accessed with the SYST:ERR? query.
Syntax	SYST:ERR?
Response	See error list and description in *SCPI Management Errors (System Errors)* on page 42.

SYSTem:VERSion?

Description	This query reads the FLS-2300B identification string.
Syntax	SYST:VERS?
Response	“EXFO E.-O. Eng. FLS-2300B vx.xx”xxxxxxxx xxxxxxx, where xxxxxxxx xxxxxxx is the serial number and vx.xx is the current product version.
Note	This query returns the same response as the *IDN? query.

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