FVA-60B
Variable Optical Attenuator

EXFO
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Units of Measurement

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

Version number: 1.0.0

Contents

Certification Information

F.C.C. Information

Electronic test equipment is exempt from Part 15 compliance (FCC) in the United States. However, compliance verification tests are systematically performed on most EXFO equipment.

$C\epsilon$ 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 undergone extensive testing according to the European Union Directive and Standards.

EXFO $C\epsilon$ <u>DECLARATION OF CONFORMITY</u>

Application of Council Directive(s):	73/23/EEC - The Low Voltage Directive
	89/336/EEC - The EMC Directive
	And their amendments
Manufacturer's Name:	EXFO Electro-Optical Engineering Inc.
Manufacturer's Address:	400 Godin Avenue
	Quebec, Quebec
	Canada, G1M 2K2
	(418) 683-0211
Equipment Type/Environment:	Test & Measurement / Industrial
Trade Name/Model No.:	FVA-60B, Variable Optical Attenuator

<u>Standard(s) to which Conformity is Declared:</u>

EN 61010-1:2001	**Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements.**
EN 61326:1997 +A1:1998 +A2:2001 + A3:2003	**Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements**
EN 55022: 1998 +A2: 2003	**Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment.**

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

<u>Manufacturer</u>

Signature:	
Full Name:	Stephen Bull, E. Eng
Position:	Vice-President Research and Development
Address:	400 Godin Avenue, Quebec (Quebec), Canada, G1M 2K2
Date:	April 17, 2008

1 Introducing the FVA-60B Variable Optical Attenuator

The FVA-60B is a variable optical attenuator used for bit error rate and system testing, optical margin analysis, calibration verifi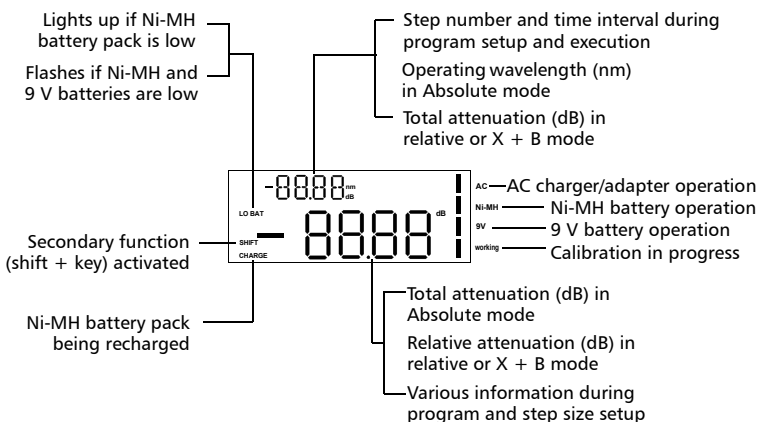cation and component testing. It can be configured for singlemode or multimode fibers. Calibrated wavelengths are either 1310/1550 nm or 850/1300 nm respectively.

The FVA-60B is powered by the built-in rechargeable Ni-MH battery pack, the 9 V alkaline battery, or the AC adapter/charger.

Display Description

Lights up if Ni-MH battery pack is low

Flashes if Ni-MH and 9 V batteries are low

Step number and time interval during program setup and execution

Operating wavelength (nm) in Absolute mode

Total attenuation (dB) in relative or X + B mode

AC — AC charger/adapter operation
Ni-MH — Ni-MH battery operation
9V — 9 V battery operation
working — Calibration in progress

Secondary function (shift + key) activated

Ni-MH battery pack being recharged

Total attenuation (dB) in Absolute mode

Relative attenuation (dB) in relative or X + B mode

Various information during program and step size setup

Keypad Description

Toggles between Absolute and Relative modes

Powers unit on or off

Decreases attenuation (hold for rapid scanning)

Decreases user-defined parameters during program setup

Increases attenuation (hold for rapid scanning)

Increases user-defined parameters during program setup

Executes program and activates program setup

Toggles between user-defined parameters

Accesses secondary keypad functions

Exits program execution or setup

Secondary Functions Keypad

Activates X + B mode

Toggles between programmed wavelengths

Activates Wavelength Programming mode

Repositions internal optics to minimum attenuation

Activates step size setup and toggles between available step sizes

Activates variable step size setup

x ! B *STEP SIZE*

λ SELECT *CALIBRATE*
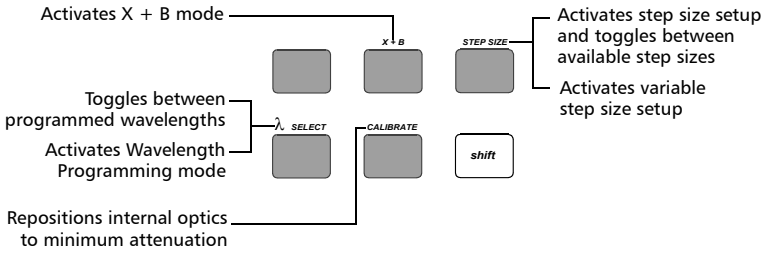
shift
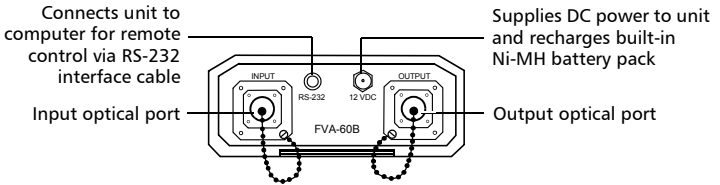
Note: *To access a secondary function, press **shift**, then the corresponding key.*

Connector Panel Description

Connects unit to computer for remote control via RS-232 interface cable

Input optical port

Supplies DC power to unit and recharges built-in Ni-MH battery pack

Output optical port

INPUT   RS-232   12 VDC   OUTPUT

FVA-60B

Conventions

Before using the product 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.

2 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.

3 Operating the FVA-60B Variable Optical Attenuator

Calibrating the Unit

For optimum performance, the unit should be calibrated before each test session.

To calibrate the unit:
1. Turn on the unit.
2. Press **shift/exit**, then **CALIBRATE**. The internal motor runs for a few seconds (adjusting attenuation to minimum) and the **working** marker is displayed.

To check the minimum insertion loss for a particular wavelength, select the wavelength and perform a calibration. The value displayed after calibration is the minimum insertion loss at the selected wavelength.

Note: *Performing a calibration sets the* FVA-60B *to Absolute mode.*

CAUTION

The specifications of the FVA-60B are based on a maximum input power of 15 dBm. Using a greater input power can result in severe component damage.

To ensure optimal performance from your unit, limit maximum input power to 15 dBm.

Using the Absolute Mode

The Absolute mode displays the current wavelength and attenuation settings. It is selected by default when turning on the FVA-60B. Scanning is used to set a new attenuation value. If you turn off the unit while a scan is in progress, it will be completed the next time you turn the unit on.

Note: *The attenuation value is the actual insertion loss between the input and output ports including connectors.*

Using the Relative Mode

The Relative mode allows you to establish a 0.00 dB reference attenuation at any value within the unit's attenuation range.

To establish a reference:

1. Ensure the unit is in Absolute mode. See *Using the Absolute Mode* on page 5.

2. Select the appropriate wavelength by pressing **shift/exit**, then λ **SELECT**. To program wavelengths, see *Programming Wavelengths* on page 7.

3. Set the desired attenuation level by using ⬆ or ⬇. For details about how to set attenuation, see *Setting Attenuation Step Sizes* on page 7.

4. Press **atten./rel.** The smaller digits display the total attenuation, while the larger digits display the attenuation with respect to the selected reference (that is, 00.00 dB).

If you now vary the attenuation, the smaller digits display the total attenuation introduced by the FVA-60B, while the larger digits display the relative loss (or gain) with respect to the selected reference.

Using the X + B Mode

The X + B mode displays the sum of X + B values, where X is the actual attenuation introduced by the unit, and B is some offset value, possibly a power level or a known system loss. The X + B mode allows you to display attenuation readings as any value between ─99.95 dB and 99.95 dB.

To use the X + B mode:

1. Ensure the unit is in Absolute mode. See *Using the Absolute Mode* on page 5.

2. Select the appropriate wavelength by pressing **shift/exit**, then λ **SELECT**. To program wavelengths, see *Programming Wavelengths* on page 7.

3. Set the initial attenuation value X by using ⬆ or ⬇. For details about how to set attenuation, see *Setting Attenuation Step Sizes* on page 7.

4. Press **shift/exit**, then **X + B**. The larger digits flash and the smaller digits display the initial attenuation.

5. Set the desired X + B value by using ⬆ or ⬇. The value displayed on the smaller digits (absolute attenuation) does not change, since setting the arbitrary X + B value has no influence on the actual attenuation.

6. Press **shift/exit** when the X + B value is set.

If you now vary the attenuation value X, both the absolute attenuation value and the X + B value increase or decrease accordingly.

Programming Wavelengths

The FVA-60B offers calibrated wavelength at ± 30 nm (in 10 nm steps) from the standard singlemode and multimode wavelengths.

To program wavelengths:

1. Press **shift/exit**, then λ **SELECT** for three seconds. The currently selected wavelength flashes.

2. Press ⬆ or ⬇ to toggle between available wavelengths.

3. Press **program** to confirm selection.

4. Repeat step 2 to select a second wavelength and press **program** to confirm selection. Upon confirmation of a second wavelength, the unit exits the Wavelength Programming mode.

Note: *To see the currently selected wavelength when you are in Relative or X + B mode, switch to the alternate wavelength and back. The new setting is briefly displayed.*

Setting Attenuation Step Sizes

The unit has four attenuation step sizes that permit different scanning speeds and resolutions:

➤ 0.05 dB step size and resolution (default when turning on the unit)

➤ 0.2 dB step size and resolution

➤ 1 dB step size and resolution

➤ User-defined step size with 0.05 dB resolution

Note: *Selecting a larger step size allows for faster attenuation scanning.*

Standard Step Sizes

To select a standard step size:

1. Press **shift/exit**, then **STEP SIZE**.

2. Press **STEP SIZE** again to toggle between step size options.

3. Press **shift/exit** to confirm selection.

4. Pressing ⬆ or ⬇ changes the attenuation by one step.

Note: *Selecting one of the three standard step sizes affects the resolution of the attenuation setting and may cause rounding off of the currently selected attenuation value.*

User-Defined Step Size

To set the user-defined step size:

1. Press **shift/exit**, then **STEP SIZE** for three seconds. The larger digits flash, indicating the current variable step size setting.

2. Set the desired step size using ▲ or ▼. The maximum step size value is 60.00 dB.

3. Press **shift/exit** to confirm selection. The variable step size is now programmed and is the currently selected step size.

Programming the Unit

The unit can be programmed for automatic operation. The program permits up to 60 attenuation steps with a time interval of up to 60 hours (minus one second) between each step. Attenuation changes between −0.05 B and −70 dB (minus the insertion loss) may be introduced. You can define program parameters for each of the available wavelengths.

To program the unit:

1. Select the appropriate wavelength by pressing **shift/exit**, then λ **SELECT**. To program wavelengths, see *Programming Wavelengths* on page 7.

2. Press **program** for three seconds to activate program setup. A flashing value, between 00 and 59, defines the number of attenuation steps in your program. Press ▲ or ▼ to select a number, then press **program** to confirm the selection.

3. A flashing value, between 00H and 59H, defines the number of hours in the time interval. Press ▲ or ▼ to select a number, then press **program** to confirm the selection.

4. A flashing value, between 00: and 59:, defines the number of minutes. Press ▲ or ▼ to select a number, then press **program** to confirm the selection.

5. A flashing value, between :00 and :59, defines the number of seconds. Press ▲ or ▼ to select a number, then press **program** to confirm the selection.

6. A flashing value, between −00.00 dB and −70.00 dB, defines the size of each attenuation step. Press ▲ or ▼ to select a number in 00.05 dB steps. The program parameters have now been defined. To cycle through the five parameters, press **program**.

7. Press **shift/exit** to exit the program setup. Your program parameters have been set.

Note: *If you turn off the unit before exiting the program definition, all changes made during the current programming session will be lost.*

Initiating the Program Execution

To initiate the program execution:

1. Set the unit to the appropriate initial attenuation value.

2. Press **program**. The FVA-60B will start at the initial attenuation value and automatically increase the attenuation in accordance with the program parameters. Upon completion of the last program step, the unit resets the initial attenuation value and the program loops.

3. Press **shift/exit** to end program execution.

Note: *If your program attempts to set a value beyond the maximum attenuation range, the program resets to the first step and loops using only the steps that fall within the range.*

4 Using the RS-232 Interface and Software

The RS-232 interface and application software allow remote control of the unit from a computer. A floppy disk, containing the programming source code (Borland C™), is delivered as part of the RS-232 kit. Refer to the README.DOC file for up-to-date information about the FVA-60B application software. To read the file, insert the disk in the floppy disk drive, then type A:README from the DOS command line.

Installing the Software

The root directory of the floppy disk contains the following files:

- ➤ DEMO60B.EXE   Remote control program
- ➤ DEMOBW1.BAT   Example batch file for non-standard configuration
- ➤ DISPLAY.EXE   Program for viewing source code files
- ➤ README.BAT   Batch file to read README.DOC
- ➤ README.DOC   File containing the latest release information

Copy the files to your computer's hard disk.

The LISTINGS directory contains the uncompiled source and header files that were used to create the interface application.

Note: *Make a copy of the RS-232 interface floppy disk and keep the original in a safe place.*

To install the application software on your hard disk, insert the floppy disk into drive A or B and type the following commands (no spaces) from the DOS command line:

- ➤ C:<enter>
- ➤ CD\<enter>
- ➤ MD FVA60B<enter>
- ➤ CD FVA60B<enter>
- ➤ MD LISTINGS<enter>
- ➤ CD LISTINGS<enter>
- ➤ COPY A:\LISTINGS*.* C:<enter>
- ➤ CD..<enter>
- ➤ COPY A:*.* C:<enter>

Connecting the RS-232 Interface Cable

To connect the RS-232 interface cable:

1. Turn off the unit and the computer.

2. Connect the cable to the FVA-60B appropriate port.

3. Connect the DB-25 or DB-9 connector to COM 1 or COM 2 on the computer.

Starting the Interface Application

The information within square brackets is optional and depends on the configuration of your personal computer.

From the DOS directory where the file DEMO60B.EXE is located, type
DEMO60B [com port] [display] < return>

com port	enter **1** for COM 1, **2** for COM 2 (default is COM 1)
display	enter **TRUE** for color, **FALSE** for monochrome (default is true)

Using the Interface Application

Once the RS-232 communication is established and the **PRINCIPAL MENU** screen is displayed, you can control the operation of your unit from your computer. The attenuation and wavelength settings are always displayed on the upper portion of the screen.
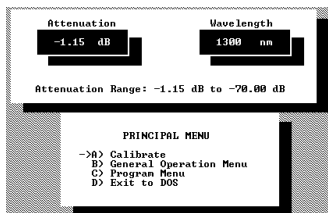
To activate a menu command, use the keyboard arrow keys (or type the corresponding letter) to highlight the line and press **Enter**.

Note: *Press **F1** to call up the help screen.*

Understanding the General Operation Menu
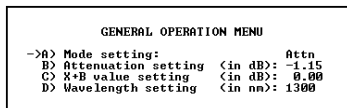
Note: *Changing the RS-232 interface software display mode does not change the unit's display mode.*

To change the software display mode:

1. Highlight **Mode setting**.

2. Press the space bar to switch through the three options. The data in the upper portion of the screen changes with the selected mode.

To change the attenuation setting:

1. Highlight **Attenuation setting**. The cursor appears under the attenuation value.

2. Enter the new value and press **Enter**.

Note: *Values outside the attenuation range will generate an error message.*

To change the relative value:

1. Highlight **X+B value setting**.

2. Enter a value between ─99.95 and 99.95 and press **Enter**.

To change the wavelength:

1. Highlight **Wavelength setting**.

2. Enter the new wavelength (4 digits) and press **Enter**. If a valid wavelength is entered, the unit switches to the new setting.

Understanding the Program Menu

```
                    PROGRAM MENU
->A) Number of steps    (0 to 59):        0
  B) Number of hours    (0 to 59):        0
  C) Number of minutes  (0 to 59):        0
  D) Number of seconds  (0 to 59):        0
  E) Attenuation value (0 to -70.00 dB):  0.00
```

To change program parameters:

1. Highlight the desired parameter.

2. Enter a value and press **Enter**. Values outside the allowable range will generate an error message.

3. Press tab to run the attenuation program.

4. Press any key to end the program execution.

Note: *The program you created does not modify the program that is stored in the unit.*

Viewing Source Files

The programming source and header files are included in the LISTINGS directory of the floppy disk. Refer to the README.DOC file for a description of the contents of each of these files.

View the files using any text editor, word processor, or via the Borland C programming environment. The floppy disk also includes a DISPLAY.EXE file that can display the contents of the files. To view a particular file, type

DISPLAY FILEPATH/FILENAME.EXT, where *filepath/filename.ext* is the full filename (including drive and directory) of the file you wish to view.

Using Interface Commands

The serial communication parameters for the RS-232 interface are as follows:

➤ 9600 baud

➤ no parity

➤ 8 data bits

➤ 1 stop bit

The following commands are recognized by the FVA-60B RS-232 interface:

Command	Description	Return Characters	
		Accepted	**Rejected**
>C<	Calibrate	0;	1;
>A-xx.xx<	Setting Attenuation	0;	1;
>Lxxxx<	Setting Wavelength	0;	1;
>?<	Attenuation Reading	-xx.xx;	1;
>1<	Wavelength Reading	xxxx;	1;
>i<	Minimum Insertion Loss	-xx.xx;	1;

Note: *Refer to the programming source files in the LISTINGS directory for examples demonstrating how the interface commands are used.*

The following applies to the RS-232 commands:

➤ All commands begin with the ASCII character ">" and terminate with "<".

➤ The unit returns a value in response to each command. The returned value indicates whether a given command has been accepted or rejected.

➤ Accepted values for attenuation must be divisible by 0.05 dB and be within the attenuation range of the unit.

➤ An "x" in the above table refers to an ASCII digit between 0 and 9.

➤ RS-232 commands do not disable the keypad operation of the unit. However, only one function is executed at a time. When the unit is in local programming mode (flashing display), only the last RS-232 command received will be executed once the unit returns to a normal operating condition.

5 Maintenance

To help ensure long, trouble-free operation:

➤ Always clean fiber-optic connectors before using them.

➤ Keep the unit free of dust.

➤ Clean the unit casing and front panel with a cloth slightly dampened with water.

➤ Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.

➤ Avoid high humidity or significant temperature fluctuations.

➤ Avoid unnecessary shocks and vibrations.

➤ If any liquids are spilled on or into the unit, turn off the power immediately and let the unit dry completely.

WARNING

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

Cleaning Fixed Connectors

Regular cleaning of connectors will help maintain optimum performance. *Do not try to disassemble the unit. Doing so would break the connector*.

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) 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).
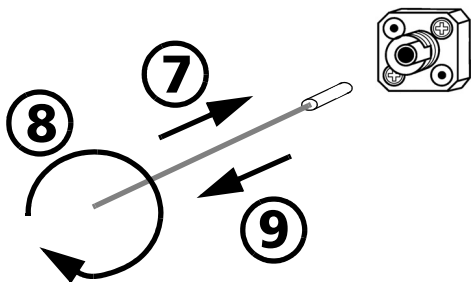
8. Gently turn the cleaning tip one full turn.

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

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

Note: *Make sure you don't 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 EUI Connectors

Regular cleaning of EUI connectors 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 EUI connectors:

1. Remove the EUI from the instrument to expose the connector baseplate and ferrule.
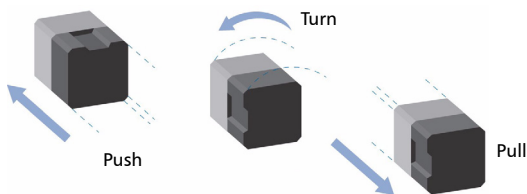
2. Moisten a 2.5 mm cleaning tip with *one drop* of isopropyl alcohol (alcohol may leave traces if used abundantly).

3. Slowly insert the cleaning tip into the EUI adapter until it comes out on the other side (a slow clockwise rotating movement may help).
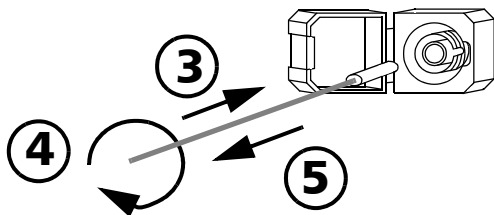
4. Gently turn the cleaning tip one full turn, then continue to turn as you withdraw it.

5. Repeat steps 3 to 4 with a dry cleaning tip.

Note: *Make sure you don't touch the soft end of the cleaning tip.*

6. Clean the ferrule in the connector port as follows:

    6a. Deposit *one drop* of isopropyl alcohol on a lint-free wiping cloth.

IMPORTANT

Since isopropyl alcohol is not absolutely pure, it may leave residues if used abundantly or left to evaporate (about 10 seconds).

Avoid contact between the tip of the bottle and the wiping cloth, dry the surface quickly, and use a bottle that distributes only a drop of alcohol at a time.

    6b. Gently wipe the connector and ferrule.

    6c. With a dry lint-free wiping cloth, gently wipe the same surfaces to ensure that the connector and ferrule are perfectly dry.

    6d. Verify connector surface with a portable fiber-optic microscope (for example, EXFO's FOMS) or fiber inspection probe (for example, EXFO's FIP).

WARNING

Verifying the surface of the connector WHILE THE UNIT IS ACTIVE WILL result in permanent eye damage.

7. Put the EUI back onto the instrument (push and turn clockwise).

8. Throw out cleaning tips and wiping cloths after one use.

Cleaning Detector Ports

Regular cleaning of detectors will help maintain measurement accuracy.

IMPORTANT
Always cover detectors with protective caps when unit is not in use.

To clean detector ports:
1. Remove the protective cap and adapter (FOA) from the detector.

2. If the detector is dusty, blow dry with compressed air.

3. Being careful not to touch the soft end of the swab, moisten a cleaning tip with *only one drop* of isopropyl alcohol.

IMPORTANT
Alcohol may leave traces if used abundantly. Do not use bottles that distribute too much alcohol at a time.

4. While applying light pressure (to avoid breaking the detector window), gently rotate the cleaning tip on the detector window.

5. Repeat step 4 with a dry cleaning tip or blow dry with compressed air.

6. Discard the cleaning tips after one use.

Recharging the Battery Pack

To recharge the battery pack, connect the AC adapter/charger. A full recharge takes approximately 20 hours. For maximum efficiency, recharge the battery at room temperature. To extend battery life, deplete the battery's charge completely before activating the AC adapter/charger.

Replacing the 9 V Alkaline Battery

To replace the battery:
1. Turn off the unit and remove it from the holster.

2. Open the battery compartment door located at the back of the unit.

3. Replace the 9 V alkaline battery (respecting polarity).

4. Close the battery compartment door and replace the unit in the holster.

Recycling and Disposal (Applies to European Union Only)

Recycle or dispose of your product (including electric and electronic accessories) properly, in accordance with local regulations. Do not dispose of it in ordinary garbage receptacles.

This equipment was sold after August 13, 2005 (as identified by the black rectangle).

➤ Unless otherwise noted in a separate agreement between EXFO and a customer, distributor or commercial partner, EXFO will cover costs related to the collection, treatment, recovery and disposal of end-of-lifecycle waste generated by electronic equipment introduced after August 13, 2005 to an European Union member state with legislation regarding Directive 2002/96/EC.

➤ Except for reasons of safety or environmental benefit, equipment manufactured by EXFO, under its brand name, is generally designed to facilitate dismantling and reclamation.

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

6 Troubleshooting

Solutions to Common Problems

Problem	Solution
Display is blank	➤ Press **on/off**. ➤ Verify and connect AC adapter/charger. ➤ Replace 9 V battery. ➤ Connect AC adapter/charger.
LO BAT is displayed	➤ Connect AC adapter/charger.
LO BAT is flashing	➤ Connect AC adapter/charger. ➤ Replace 9 V battery.
Display shows **-00.00**	➤ Press **atten./rel.**
Questionable attenuation	➤ Switch input and output power. ➤ Switch to the correct wavelength on all instruments being used.

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).

For detailed information about technical support, visit the EXFO Web site at www.exfo.com.

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

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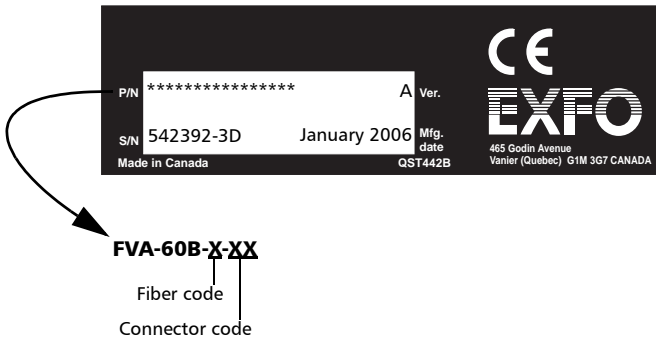
Transportation

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 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.

7 *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 verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.

IMPORTANT

The warranty can become null and void if:

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

➤ **warranty sticker has been removed.**

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

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

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

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

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

Liability

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

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

Exclusions

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

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 26). 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 26).

EXFO Service Centers Worldwide

If your product requires servicing, contact your 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
                                        quebec.service@exfo.com

EXFO Europe Service Center
Omega Enterprise Park, Electron Way   Tel.: +44 2380 246810
Chandlers Ford, Hampshire S053 4SE   Fax: +44 2380 246801
ENGLAND   europe.service@exfo.com

EXFO China Service Center/
Beijing OSIC
Beijing New Century Hotel   Tel.: +86 (10) 6849 2738
Office Tower, Room 1754-1755   Fax: +86 (10) 6849 2662
No. 6 Southern Capital Gym Road   beijing.service@exfo.com
Beijing 100044
P. R. CHINA

A Technical Specifications

IMPORTANT

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

SPECIFICATIONS [a]

Model		FVA-60B-B-XX	FVA-60B-C-XX	FVA-60B-D-XX	FVA-60B-E-XX
Fiber type (µm)		9/125	50/125	62.5/125	100/140
Calibration wavelengths (nm)		1310/1550	1300	1300	1300
Attenuation maximum (dB)		70	65	65	65
Insertion loss [b, c] (dB)	typical	2.5	2.5	2.5	2.5
	maximum	3.5	4.0	4.0	4.0
Resolution (dB)		0.05	0.05	0.05	0.05
Linearity [d] (dB)		± 0.15	± 0.15	± 0.15	± 0.15
Repeatability (dB)	typical	± 0.03	± 0.03	± 0.03	± 0.03
	maximum	± 0.10	± 0.10	± 0.10	± 0.10
Return loss [b] (dB)	typical	45	27	27	27
	minimum	40	20	20	20
Max. input power (dBm) [e]		15	15	15	15

GENERAL SPECIFICATIONS

Size		220 mm x 110 mm x 50 mm	(8 $^3/_4$ in x 4 $^1/_2$ in x 2 in)
Weight	unit	0.75 kg	(1 $^1/_2$ lb)
	shipping	2.5 kg	(5 $^1/_2$ lb)
Temperature	operating	−10 °C to 50 °C	(14 °F to 122 °F)
	storage	−30 °C to 70 °C	(−22 °F to 158 °F)
Relative humidity		0 % to 95 % non-condensing	
Power		AC charger (continuous operation), NiMH (5 to 25 hours depending on usage),	
		9 V alkaline batteries (3 to 10 extra hours depending on usage)	
Speed		0 to 70 dB in 10 seconds at maximum scan rate	

14 wavelengths available, of which two can be picked for quick toggling.

Multimode (nm)	820, 830, 840, 850, 860, 870, 880, 1270, 1280, 1290, 1300, 1310, 1320, 1330
Singlemode (nm)	1280, 1290, 1300, 1310, 1320, 1330, 1340, 1520, 1530, 1540, 1550, 1560, 1570, 1580

STANDARD ACCESSORIES

User guide, carrying case, protective holster, shoulder strap, RS-232 serial interface (comes with cable and application software), AC adapter/charger, 9 V alkaline battery, Certificate of Compliance

BELLCORE PRODUCT CODES

Model	CPR#	ECI#	CLEI#
FVA-60B	574669	661071	LGTDJ20AAA

NOTES

a. At 23 °C ± 2 °C unless otherwise specified.

b. At 1310 nm and 1550 nm for singlemode fiber; at 850 nm and 1300 nm for multimode fiber. The insertion loss is dependent on the input numerical aperture.

c. With FC/UPC connectors for singlemode fiber and FC/PC for multimode fiber.

d. At a calibrated wavelength, using a non-polarized light source with 0.002 dB stability (source accuracy of ± 0.5 nm) and up to 50 dB of attenuation.

e. Typical value. Prolonged exposure may damage the unit.

P/N: 1051992

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