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Variable Optical Attenuator

FVA-60B



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: 1011968
April 2002

EXFO

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FVA-60B



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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.

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.

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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.:	FVA-60B, Variable Optical Attenuator
Year of Conformity Assessment:	1997

Standard(s) to which Conformity is Declared:

EN 61010-1:1990 **Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements**

EN 55011:1993 **Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical equipment**

EN 50082-2:1995 **Electromagnetic Compatibility Generic immunity standard - Part 2: Industrial Environment**

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: avril 4, 2002

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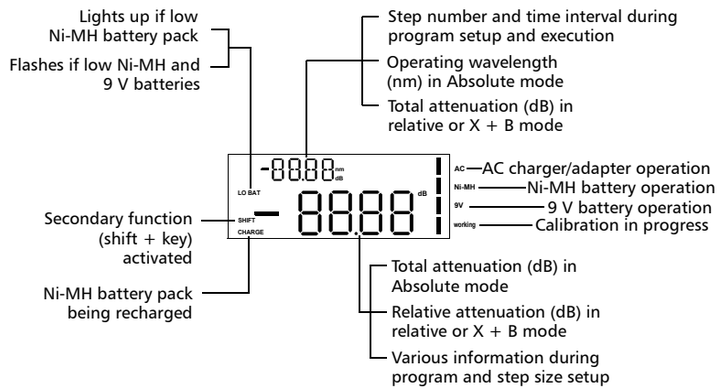
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1 Introducing the FVA-60B Variable Optical Attenuator

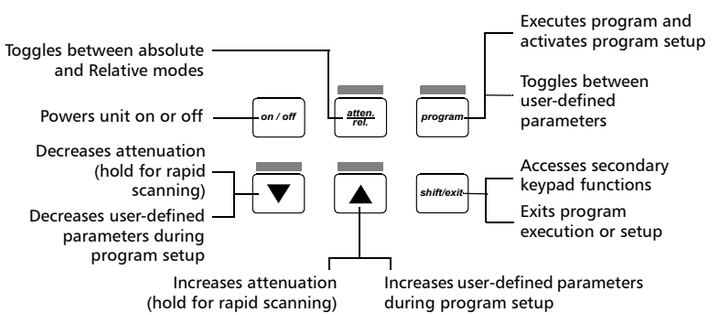
The FVA-60B is a variable optical attenuator used for bit error rate and system testing, optical margin analysis, calibration verification and component testing. It can be configured for singlemode or multimode fibers; calibrated wavelengths are either 1310/1550 nm or 850/1300 nm respectively.

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



Keypad Description

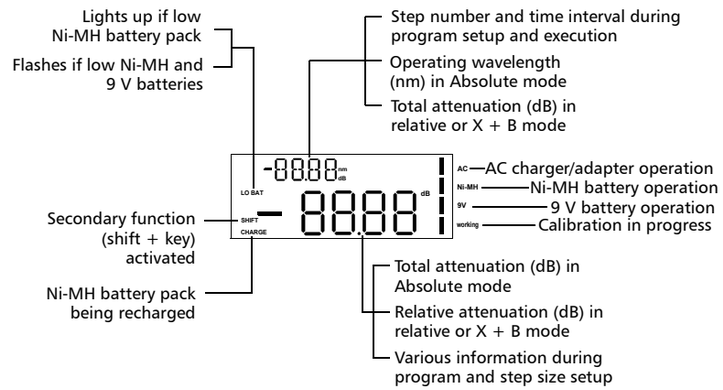


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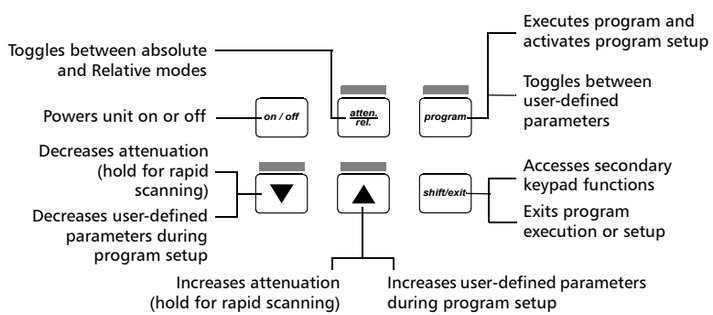
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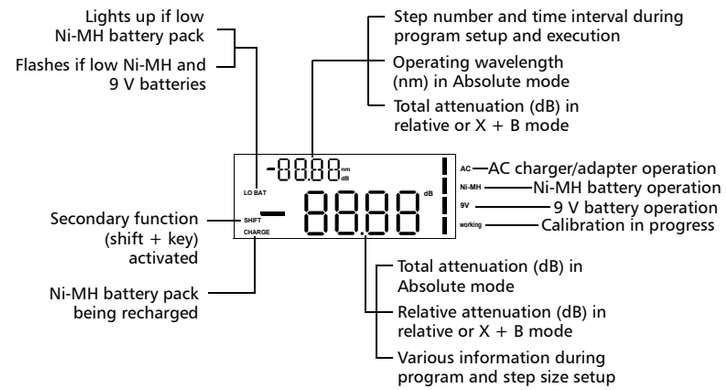


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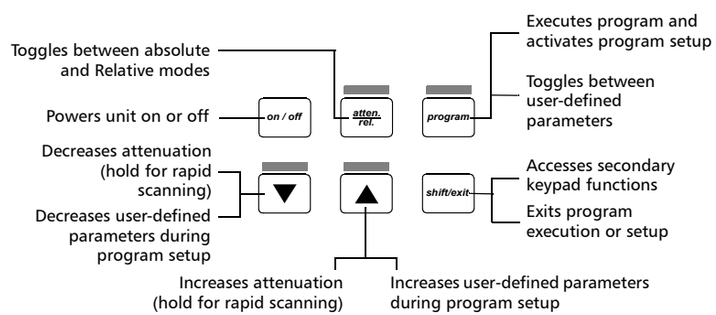
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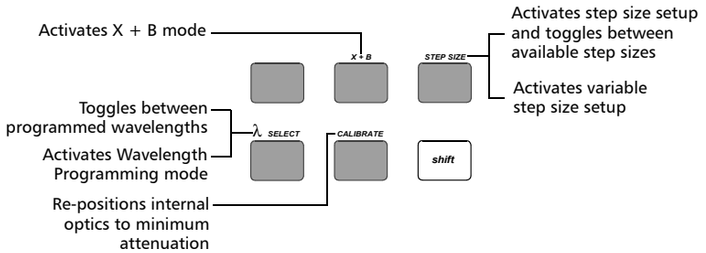


Keypad Description



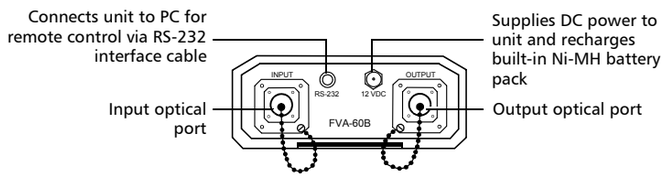
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Secondary Keypad Functions



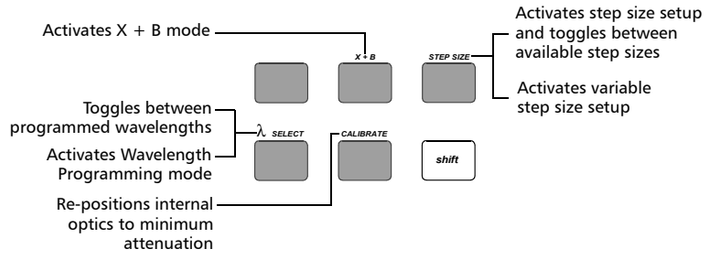
Note: *To access a secondary function, press **shift**, then the corresponding key.*

Connector Panel Description



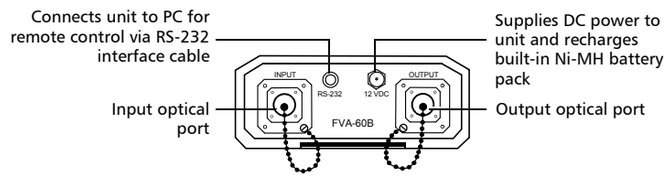
Introducing the FVA-60B Variable Optical Attenuator 2

Secondary Keypad Functions



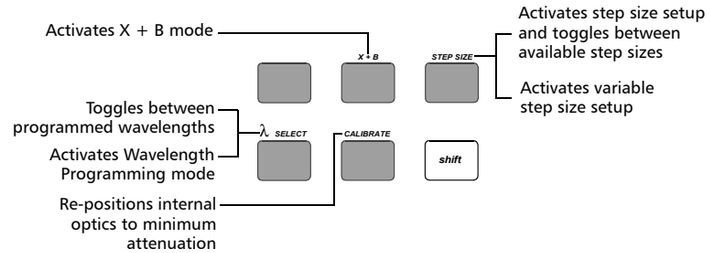
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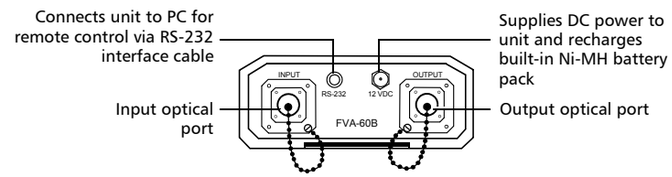
Introducing the FVA-60B Variable Optical Attenuator 2

Secondary Keypad Functions



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

Connector Panel Description



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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.

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.

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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. Power 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.*

Using the Absolute Mode

The Absolute mode displays the current wavelength and attenuation settings. It is selected by default when powering on the FVA-60B. If the unit was scanning (setting a new attenuation value) when it was powered off, the scan will be completed at power-up.



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

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Using the Relative Mode

The Relative mode allows the user 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 (i.e., 00.00 dB).
5. If you now change 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 the user 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.

Operating the FVA-60B Variable Optical Attenuator 6

Using the Relative Mode

The Relative mode allows the user 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 (i.e., 00.00 dB).
5. If you now change 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 the user 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.
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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 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 powering on the unit)
- 0.2 dB step size and resolution
- 1 dB step size and resolution
- User-definable 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 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.*

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User-Definable Step Size

To set the user-definable 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 dB 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 power off the unit before exiting the program definition, all changes made during the current programming session will be lost.*

Operating the FVA-60B Variable Optical Attenuator 8

User-Definable Step Size

To set the user-definable 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.

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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 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.*

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4 Using the RS-232 Interface and Software

The RS-232 interface and application software allow remote control of the unit from a PC. 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, type A:README from the DOS command line with the floppy disk inserted in your floppy drive.

Installing the Software

The following files are included in the root directory of the floppy disk:

- 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 PC'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>

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Connecting the RS-232 Interface Cable

To connect the RS-232 interface cable:

1. Power off the unit and the PC.
2. Connect the cable to the FVA-60B appropriate jack.
3. Connect the DB-25 or DB-9 connector to COM 1 or COM 2 on the PC.

Starting the Interface Application

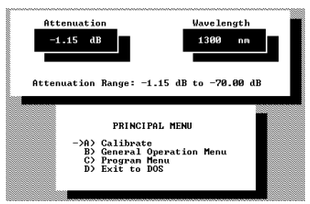
The information within square brackets is optional and depends on the configuration of your personal computer.

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

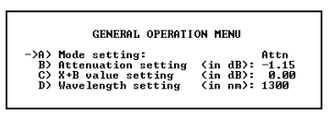
Once the RS-232 communication is established and the **PRINCIPAL MENU** screen is displayed, you can control the operation of your unit from your PC. The attenuation and wavelength settings are always displayed on the upper portion of the screen.



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.*

Using the RS-232 Interface and Software 12

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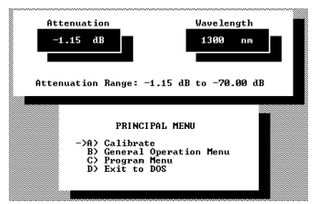
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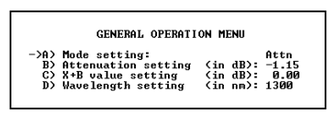
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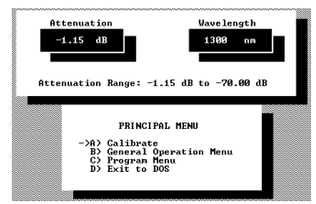
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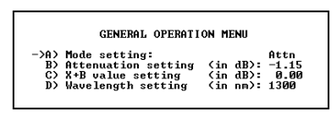
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Understanding the General Operation Menu



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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.*

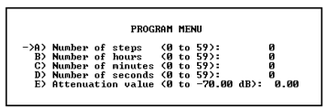
To change the relative value:

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



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 the 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 files' contents. 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.

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.*

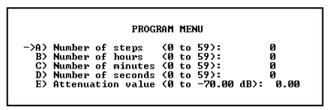
To change the relative value:

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



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 the 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 files' contents. 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.

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.*

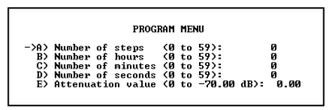
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Using Interface Commands

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 unit’s attenuation range.
- An “x” in the above table refers to an ASCII digit between 0 and 9.
- RS-232 commands do not disable the unit’s keypad operation. 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.

Using the RS-232 Interface and Software 14

Using Interface Commands

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5 Maintenance

To help ensure long, trouble-free operation:

- Keep the unit free of dust.
- Clean the unit casing with a cloth 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, adjustments and procedures for operation and maintenance other than those specified herein may result in hazardous radiation exposure.

Cleaning the Front Panel

Clean the front panel of the FVA-60B Variable Optical Attenuator 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.

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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

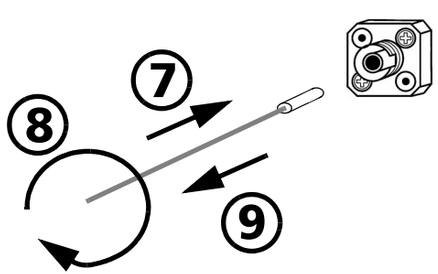
Isopropyl alcohol takes approximately ten seconds to evaporate. Since isopropyl alcohol is not absolutely pure, evaporation will leave microscopic residue. Make sure you dry the surfaces before evaporation occurs.

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).



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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

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

IMPORTANT

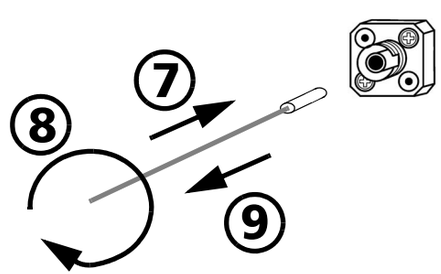
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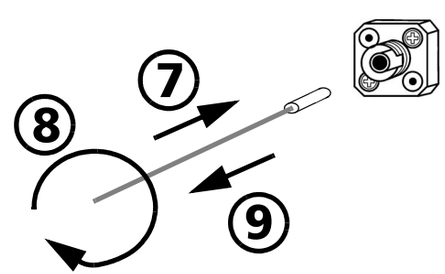
Isopropyl alcohol takes approximately ten seconds to evaporate. Since isopropyl alcohol is not absolutely pure, evaporation will leave microscopic residue. Make sure you dry the surfaces before evaporation occurs.

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).



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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.

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).

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FVA-60B 17

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Cleaning Connectors Equipped with EUI/EUA Adapters

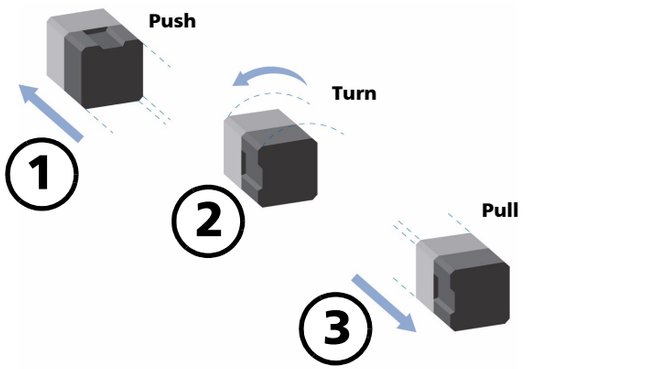
Regular cleaning of connectors equipped with EUI/EUA adapters will help maintain optimum performance. There is no need to disassemble the unit.

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 residue. Make sure you dry the surfaces before evaporation occurs.

Maintenance 18

Cleaning Connectors Equipped with EUI/EUA Adapters

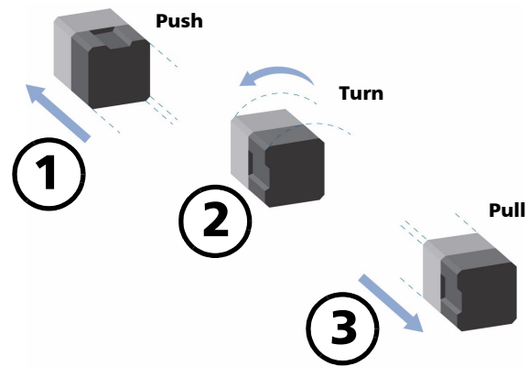
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IMPORTANT

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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 residue. Make sure you dry the surfaces before evaporation occurs.

Maintenance 18

Cleaning Connectors Equipped with EUI/EUA Adapters

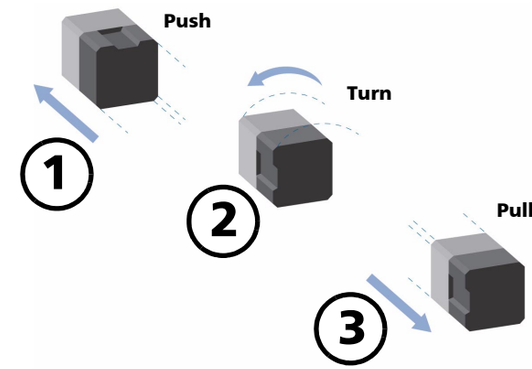
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IMPORTANT

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 residue. Make sure you dry the surfaces before evaporation occurs.

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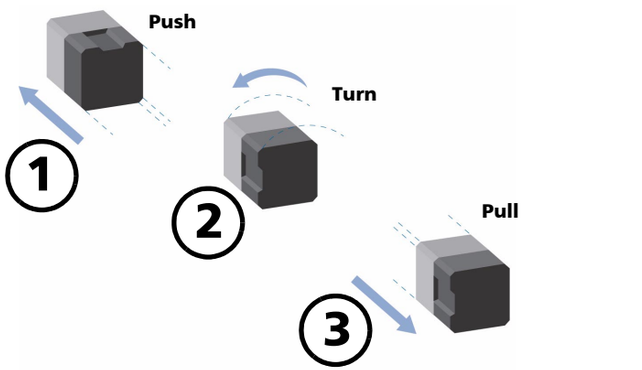
4. With a dry lint-free wiping cloth, gently wipe the same surfaces in order to be sure that the connector and ferrule are perfectly dry.
5. Throw out the wiping cloths after one use.
6. After having cleaned the connectors and having made sure that the unit is not active, verify the surface of the connector with a small, portable fiber-optic microscope.

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.

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).

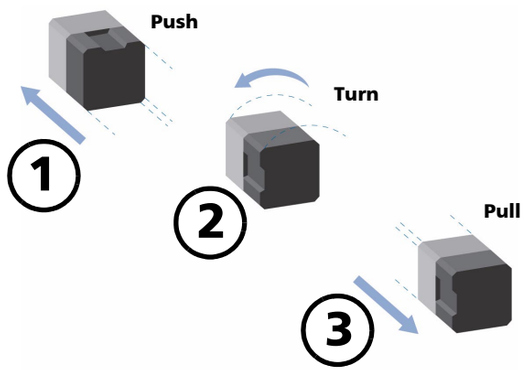
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WARNING

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.

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).

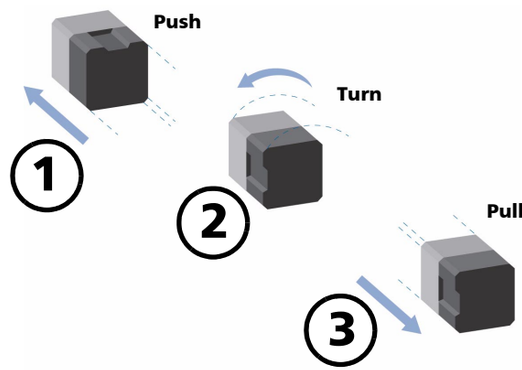
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To clean EUI/EUA adapters:

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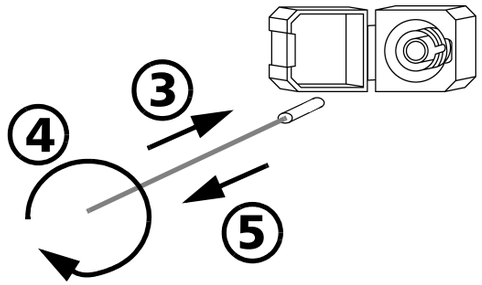
2. Moisten a cleaning tip (2.5 mm tip) provided by EXFO with *only one drop* of isopropyl alcohol.

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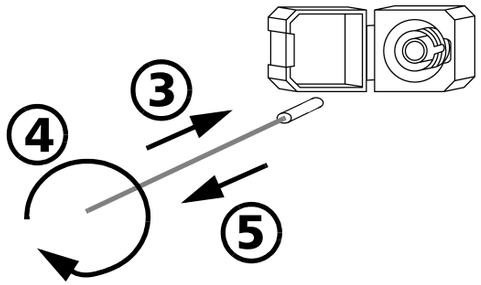


4. Gently turn the cleaning tip one full turn.
5. Continue to turn as you withdraw the cleaning tip.
6. Perform steps 3 to 5 again, but this time with a dry cleaning tip (2.5 mm tip provided by EXFO).

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.

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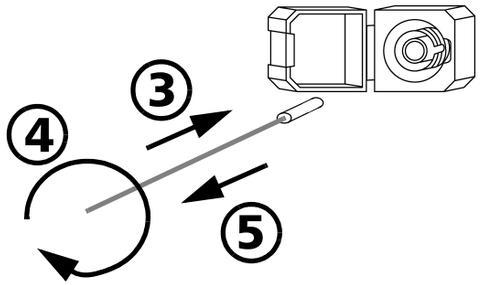


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Maintenance 20



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7. Throw out the cleaning tips after one use.

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Cleaning Detector Ports

Regular cleaning of connectors will help maintain optimum performance.

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.

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

Cleaning Detector Ports

Regular cleaning of connectors will help maintain optimum performance.

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.

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.
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Recharging the Battery Pack

To recharge the battery pack, plug in 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. Power 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 holster.

Recalibrating the Unit

If a calibration due date is not indicated on the calibration label, this means that the calibration certificate for your FVA-60B Variable Optical Attenuator has been modified in conformity with the ISO/IEC 17025 Standard.

EXFO recommends that an annual calibration be performed on your FVA-60B Variable Optical Attenuator 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.

Maintenance 22

Recharging the Battery Pack

To recharge the battery pack, plug in 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.

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6 Troubleshooting

Solutions to Common Problems

Problem	Solution
Display is blank	➤ Press **on/off**. ➤ Verify and connect AC adapter/charger. ➤ Replace 9 V battery. ➤ Plug in AC adapter/charger.
LO BAT is displayed	➤ Plug in AC adapter/charger.
LO BAT is flashing	➤ Plug in 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.

Finding Information on the EXFO Web Site

The EXFO Web site provides answers to frequently asked questions (FAQs) regarding the use of your FVA-60B Variable Optical Attenuator.

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.

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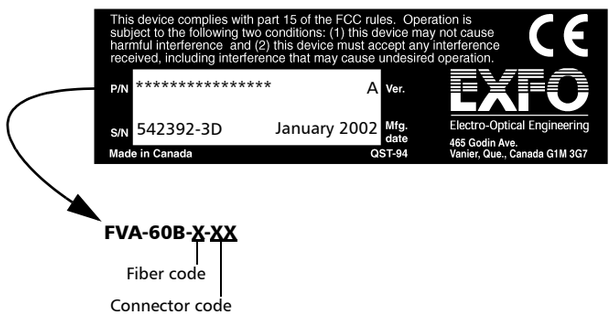
Contacting the Technical Support Group

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.

Troubleshooting 24

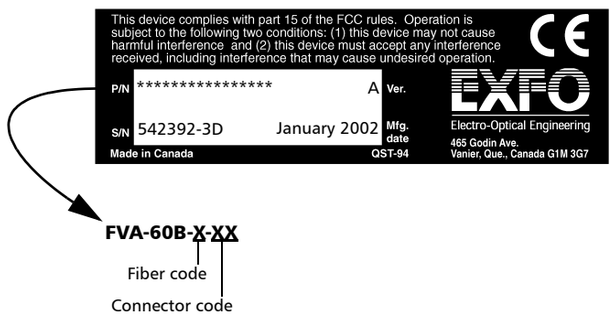
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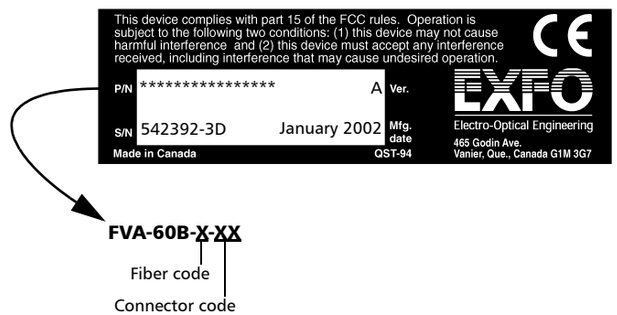
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7 Warranty

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 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.

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FVA-60B 25

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FVA-60B 25

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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*). 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.
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.

Warranty 26

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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[1]

Model		FVA-60B-BXX	FVA-60B-CXX	FVA-60B-DXX	FVA-60B-EXX
Fiber type (µm)		9/125	50/125	62.5/125	100/140
Calibration wavelengths (nm)		1310/1550	850/1300	850/1300	850/1300
Attenuation maximum (dB)		70	65	65	65
Insertion loss[2,3] (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[4] (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[2] (dB)	typical	45	27	27	27
	minimum	40	20	20	20

General Specifications

Size		22 cm x 11 cm x 5 cm	(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	

NOTES

1. At 23 °C ± 2 °C unless otherwise specified.
2. At 1310 nm and 1510 nm for singlemode fiber; at 850 nm and 1300 nm for multimode fiber. The insertion loss is dependent on the input numerical aperture.
3. With FC/UPC connectors for singlemode fiber and FC/PC for multimode fiber.
4. 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.
5. For multimode fiber only.
6. For singlemode fiber only.

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

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[1]

Model		FVA-60B-BXX	FVA-60B-CXX	FVA-60B-DXX	FVA-60B-EXX
Fiber type (µm)		9/125	50/125	62.5/125	100/140
Calibration wavelengths (nm)		1310/1550	850/1300	850/1300	850/1300
Attenuation maximum (dB)		70	65	65	65
Insertion loss[2,3] (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[4] (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[2] (dB)	typical	45	27	27	27
	minimum	40	20	20	20

General Specifications

Size		22 cm x 11 cm x 5 cm	(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	

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