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FVA-80

OPERATION MANUAL

Revised June 1993

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INTRODUCTION

EXFO Electro-Optical Engineering is pleased to introduce the FVA-80 High Resolution Programmable Optical Attenuator. Our commitment to superior design in all our fiberoptic instrumentation is respected throughout the industry and is based on four goals: simplicity of operation, extensive features, reliable operation and a dedicated interest in the needs of our customers.

We would like to thank you for placing your confidence in EXFO Electro-Optical Engineering. We strongly believe that your FVA-80 will provide you with reliable operation for years to come. But before operating the instrument, please read the following operating instructions thoroughly to acquaint yourself with your Optical Attenuator.

Unpacking and Inspection

The standard FVA-80 Programmable Optical Attenuator package contains the following items:

(1) FVA-80 Optical Attenuator.
(2) Power cord.
(3) Operation manual.
(4) Certificate of calibration.

Some options may also be included in your unit:

(5) RS-232 interface, two software diskettes and cable.
(6) IEEE-488 interface and software diskettes.
(7) Low back-reflection option (LBR).
(8) Rack mounting plates and brackets.
(9) Extension IEEE-488 cable for rack mounted unit.

We recommend that you verify your invoice and make sure that your order is complete. If any damage has occurred during shipping or if any item is missing, notify EXFO Electro-Optical Engineering immediately.

Description

The FVA-80 High resolution Programmable Optical Attenuator of the FVA-80 offers outstanding performance and unique features to be used for the simulation of system loss, optical margin analysis or communication system acceptance. Its manual and program modes (through the RS-232 or IEEE-488 interface), together with its high resolution (0.01 dB) and singlemode and/or multimode capability make it perfectly suited for your most demanding field or lab requirements.

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Besides its *absolute loss* mode (featuring an insertion loss better than 3.0 dB), the unit offers two *relative attenuation* display modes. Moreover, the FVA-80 incorporates a user-friendly programmable mode. Using this feature, the FVA-80 will change the attenuation up to 60 times, wait for up to 23 hours, 59 minutes and 59 seconds between each change and increment the attenuation by an arbitrary value.

The FVA-80 High resolution Programmable Optical Attenuator is also extremely reliable and has been designed and tested to be field portable. It comes with a rechargeable battery and has the robustness which characterizes all EXFO instruments.

Optical Insertion Loss

The definition of optical "insertion loss" may differ from one manufacturer to another. As an example, at EXFO E.O. Engineering, an FVA-80-B12 insertion loss would be measured the following way.

(1) Two biconic singlemode cables would be used to connect the FVA-80-B12 to a power meter and a laser light source.

(2) Replacing the attenuator with a bulkhead adapter in the power meter/light source loop, we would store a reference value in the power meter.

(3) Finally the FVA-80-B12 (set for minimum attenuation) would be connected back into this loop and the new attenuation displayed on the power meter would be defined as the insertion loss of the optical attenuator.

Therefore, the minimum insertion loss of your FVA-80 is the actual loss or attenuation between the input and output ports of the FVA-80.

LCD and LED

At power up, the LCD displays the minimal insertion loss indicators (large digits) and the wavelength at which the unit is presently operating (small digits). Four markers indicate various statuses:

Û 1: Calibrated attenuation level on the display applies to multimode port (lower pair on the front panel of a monomode /multimode unit).
Û 2: Not in use

Û 3: Motor moving, attenuation currently setting, please wait.

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Û 4: "Interface program" is present in the memory. "Manual Program" execution is disabled.

Other indicators also light up when **SCAN** mode is activated, when battery is charging (**CHARGE**) and when batteries are low (**LO BAT**).

There are four LEDs on the front panel. When the instrument is powered up, **Local** is lit indicating that the FVA-80 is not communicating via a computer interface. The other three LEDs indicate computer interface statuses:

TALK is lit when the FVA-80 sends a message to a computer.

LISTEN is lit when the instrument receives a message.

REMOTE is lit when you lock the keyboard.

OPERATION AND KEYPAD FUNCTIONS

Nomenclature

Terms in *italics* refer to keys of the FVA-80. **Terms in bold** refer to indicators displayed on the LCD and to important operating procedures.

Note:

To fully understand the FVA-80's operation and capabilities, study the following procedures and illustrations together.

On/Off switch

This switch, placed to the left of *ref/dBm*, turns the FVA-80 Optical Attenuator on and off. At power up, the instrument will be in the *loss* mode. It will select 1300 nm as the calibrated operating wavelength and will display the minimum insertion loss (in **dB**) corresponding to this wavelength.

Note

You will hear the motor in motion for a certain time after power-up. During this time interval, the internal opto-mechanical system repositions itself for minimum insertion loss.

Note

A solid marker will appear to the right of the display whenever the motor driving the optical filter is in motion.

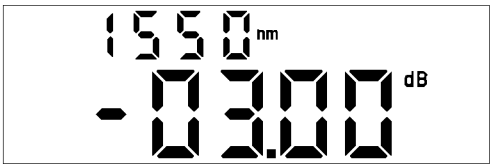
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λ select

This key switches the FVA-80 between two calibrated wavelengths. The singlemode version (FVA-80-BXX) offers wavelengths of 1300 nm and 1550 nm. The multimode versions (FVA-80-CXX, FVA-80-DXX or FVA-80-EXX) offer wavelengths of 850 nm and 1300 nm. Other calibration wavelengths may also be available as options.

When you change wavelength, the FVA-80 will move the filter to the minimal insertion loss position. A short delay is required for this.

Simply **depress** *λ select* to change wavelengths. The operating wavelength is displayed in small digits when you are using the *loss* mode.



If you are using the *ref* (reference) mode, the total loss value is displayed instead of the wavelength (refer to section *ref/dBm* for more information).

shutter

Pressing *shutter* instantly causes a total attenuation of the signal. In other words, the *shutter* prevents the signal from going past the attenuator. The output port is disconnected, the optical path is broken without having to power down your optical input. To indicate that the *shutter* is on, the display shows - - - -. Attenuation is greater than 100 dB.

Remote switching of the shutter

The FVA-80-C22-IE comes with a connector for the remote switching of the *shutter*. On the back panel of the unit, a BNC connector has been added. This is where the remote switch will be connected.

To contol the shutter, use a <u>normally open, temporarily closed</u> switch (similar to that of a telegraph...).

Warning: Do not connect either pole of the connector to a ground; doing so may result in permanent damage of the keyboard chip.

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To change the status of the shutter (go from open to closed and vice versa), depress the switch. Depressing the switch again will bring the shutter back to its original status.

increment arrow

This key increments different values displayed on the LCD:
- Attenuation in the *loss* or *ref/dBm* modes.
- In "prog." mode: (see *prog.* for details)
    - o Number of attenuation changes in the program.
    - o Size of the step between attenuation changes.
    - o Time interval between attenuation changes.

In the *loss* and *ref/dBm* modes it is possible to vary the size of the step between attenuation changes through the *fine/coarse* function. Refer to section *fine/coarse* for more information.
When the unit is in the "Scan" mode, *increment arrow* activates the scanning function which rapidly increases the attenuation.

The *increment arrow* key also enables you to execute a program step by step if it has been activated by the *start prog.* function. In this case, the step (or increment) between each value is the one set in the program. Scan mode must be off for step by step execution of a program.

decrement arrow

This key has the same characteristics as the *increment arrow* key but acts in the opposite direction. It decrements:
- Attenuation in the *loss* or *ref/dBm* mode.
- In program mode:
    - o Number of attenuation changes in the program.
    - o Size of the step between attenuation changes.
    - o Time interval between attenuation changes. (etc)

If you press *decrement arrow* after *start prog.* in the step mode, you can step backwards through a program, ie execute the previous instruction.

loss

Press *loss* to select the *loss* mode. The *loss* mode, activated by default at power up, displays the **total loss between the input and output ports, including insertion loss.** The small digits indicate the operating wavelength.

ref/dBm

This key selects two relative modes in sequence: first the *ref* mode and then the *dBm* mode.

1- The *ref* mode can also be called "relative reference". The "relative reference" mode gives a reading of the attenuation in relation to an arbitrary loss that the user inputs into the optical fiber system using the FVA-80. For example, try the following procedures.

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-Switch the wavelength to 1300 nm after power up. The LCD will display the minimum loss, for instance -3 dB, and the wavelength, in smaller digits. If you press *ref/dBm*, this loss of -3 dB becomes your reference attenuation. (This is why we call this mode "relative reference".) If you now change the attenuation, using *up or down arrow* keys (in combination with *step/scan* and *fine/coarse* if required), the small digits will display the total loss caused by the presence of the FVA-80 in your system. The large digits will show the difference between the reference attenuation (here -3 dB) and the total loss between the input and output ports. Now turn your unit off and try another example.

At power up, bring the attenuation to -5 dB. (Press fine/coarse twice until the LED on this key is lit, then *up arrow* twice). Now press *ref/dBm* to switch to the relative reference mode. The -5 dB is your new "zero", your reference attenuation. Press *up or down arrow* to change the attenuation and observe that again, the large digits indicate "how far you drifted" from your reference attenuation. The small digits still show the total loss caused by the FVA-80, including the insertion loss. Now note the small digits and exit the relative reference mode (depress *loss*). The small digits reading is now displayed on the large digits. **The FVA-80 always displays the total loss, either on the large digits, in the loss mode, or on the small ones, in the relative mode.**

EXFO's engineers also foresaw more complex situations where another mode of display would be more useful. Therefore a dBm (or x + B, or relative display) mode was developed.

2- The dBm mode involves two concepts: the reference attenuation, as described in part A, and an arbitrary reference **power reading**, which is not directly related to the attenuation, that we can call a reference **power value**. We already saw how to display readings in relation to an attenuation caused by the FVA-80 (using relative reference). Now the "relative display" mode lets you display readings in relation to **any arbitrary reference power value**. We call it "relative display" because, in fact, you make the FVA-80 display what you feel appropriate. A simple example follows:

Imagine a light source emitting laser light at -14 dBm. That light source can be hooked to the FVA-80 and the resulting attenuated signal fed into a system. At 1300 nm, the minimal loss of the FVA-80 is (for example) -2 dB, so the signal at the output port is attenuated to -16 dBm. The

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relative display mode allows you to set the FVA-80 so that it will display the combination of the "real" (-2 dB) insertion loss of the attenuator and the power being transmitted at the output port of the FVA-80 (-16 dB) **when no attenuation but the insertion loss has been added by the unit**. Here's how. Turn the FVA-80 on, select 1300 nm. Depress *ref/dBm* twice: the **dB** on the display starts flashing. The value which comes up was entered the last time this x + B mode was used. Now bring the value to -16 dB using the *up and down arrow* keys (*fine/coarse* also works while **dB** is flashing). Note that the actual attenuation (small digits) does not change while the large digits do. Press *ref/dBm* again to confirm your display value. In this example, you have a true loss of -2 dB, which is the "x" in x + B. The correction factor, or B, is -14. The total of x + B is -16. If you now change the attenuation using *up and down arrows*, the large digits will vary accordingly. In this example, **that reading corresponds to the actual power leaving the FVA-80**. (This explains why we also call this mode "dBm".) The small digits keep track of the total attenuation caused by the FVA-80 in your system.

Application for this feature:

Refer to the setup described in the previous example. If you now raise or lower the attenuation, the display will follow the changes and will indicate the absolute power of the light source/attenuator combination. You have transformed a stable light source into a variable loss set that can yield power output variations of up to 65 dB. Normal variable light sources such as EXFO's FLS-210 may have a range of 10 dB.

You could also try the following example.

After power up, press *fine/coarse* (the LED will blink), then press *up* 5 times (to add 0.5 dB to MIL (minimum insertion loss)), then *fine/coarse again*, followed by *up arrow* 6 times (display shows MIL + 6 + 0.5 dB, say
-9.5dB). Any signal that goes through the FVA-80 will therefore lose 9.5 dB. You might want to have the attenuator display something else for your particular application. Imagine that you want to make this loss of -9.5 dB correspond to a display of +10 dB. Press *ref/dBm* twice. Using *fine/coarse* and the *arrow keys*, change the value which comes up (probably -16) to 10 dB. Press *ref/dBm* again. Now your instrument, still causing a loss of -9.5 dB, reads (+)**10.00.** You can always make the FVA-80 display any value while attenuating the signal by a totally independant number of dBs.

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Step/Scan

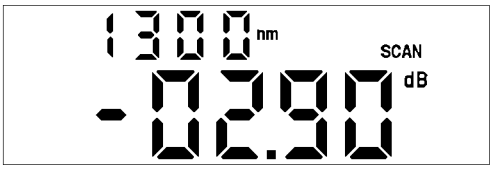
The FVA-80 offers two operation modes, the *step* and *scan* modes, which enable you to modify attenuation values in the *loss* and *ref/dBm* modes. The *step/scan* key lets you switch from one mode to the other.

On power-up, the *step* mode is selected. You can increase or decrease the displayed values, step by step, with the *increment* and *decrement arrow* keys. Refer to the *fine/coarse* section for information on the size of the step.

The *scan* operation mode, on the other hand, allows you to quickly scan through the range of attenuation values instead of changing them step by step. Switch from the *step* mode to the *scan* mode by **depressing** *step/scan*.

Note

When the *scan* mode is activated, a **SCAN** indicator appears above the fourth digit on the LCD.



To activate the scanning feature in one direction or the other, **press** the corresponding *increment or decrement arrow* key. Stop the scanning at any time by **depressing** one of the *arrows*.

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Note

The *scan* mode can be very useful when combined with the *fine/coarse* function. Together, these two features enable you to choose the size of the scanning step and then scan slowly or rapidly throughout the entire range of attenuations.

Note

Since the FVA-80 incorporates an opto-mechanical system (motor and filter) to change the attenuation, there is a delay between the time a loss value is inputted and the time the attenuator actually reaches that value.

During this short delay, a **marker** appears on the LCD, indicating that the attenuation inputted and displayed on the LCD has not been reached by the attenuator. When this value is reached, the **marker** disappears.



Note

The *step and scan* modes play a specific role when used in the *start prog.* mode. Please refer to the section *start prog.* for more information on the subject.

fine/coarse

This key can be used in the *loss and ref/dBm* modes to modify the size of the step when you change the attenuation by stepping or scanning. The LED on the *fine/coarse* key indicates which increment is selected.

- a step of **0.01dB** or scanning at 0.02 dB/sec: LED off.
- a step of **0.1dB** or scanning at 0.2 dB/sec: LED blinking
- a step of **1dB** or scanning at 2 dB/sec: LED on.

The different selections are activated by **depressing** *fine/coarse.* Repeat until the desired selection is displayed.

On power-up, the instrument will be in the finest mode (0.01 dB per step/.02 dB/sec).

If you need to scan throughout the whole dynamic range to get to the desired attenuation, select the largest step using *fine/coarse*.

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Then activate the *scan* mode by **depressing** *step/scan*. The **SCAN** indicator appears in the upper right portion of the LCD.
Finally, **use** the *Increment and Decrement Arrows* to rapidly scan through the range and find the desired attenuation. When you are getting close to that value, you may want to use a smaller step and slow down the scanning.

To choose a smaller step use the *fine/coarse* function once again: **depress** *fine/coarse*.

If the attenuation is still changing too quickly, activate the *step* mode by **depressing** the *step/scan* key so that the **SCAN** indicator disappears from the display. **Use** the *increment and decrement arrows* to select the right attenuation.

You can change the step while setting the "B" value in the dBm mode.

Fine/coarse may also be used after *prog* has been depressed to accelerate the programming of the size of the step. In this case, two choices are offered:

-increment of 0.01 dB: LED off.
-increment of 0.5 dB: LED on.

prog.

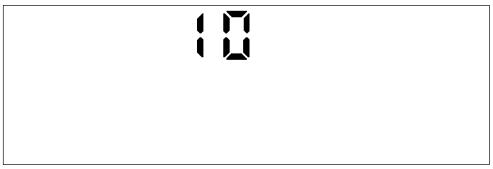
This key activates the "Program" mode of the FVA-80 in which up to 60 attenuation values can be programmed and executed automatically by the unit. The user chooses the step size and the time interval between the values. This time delay can also be manually controlled using step by step execution.

The programming of the FVA-80 is done in five steps where the user determines the following parameters:

1) The number of attenuation values.
2) The "hours" of the time interval between each value.
3) The "minutes" of the time interval between each value.
4) The "seconds" of the time interval between each value.
5) The size of the step between the values.

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The "Program" mode is activated by **depressing** *prog.*. Once the unit is in this mode, it displays a number between 00 and 59 which is the number of attenuation steps the FVA-80 will go through when the program is run.



Use the *increment and decrement arrows* to input the number of attenuation steps in your program. If you hold down one of these keys, the unit will scan through the possible values of that parameter. A quick way to reach 59 is to press *decrement arrow* if the display reads **00**. This also works for the next parameters.

Once this is done, you can move on to the next step where you will choose the time lapse between each attenuation value. You first select the number of hours in this time lapse, then the number of minutes and the seconds.

To do so, **depress** *prog.* The FVA-80 will display **xxH**, the prompt for the Hours part of the time interval (between 00 and 23).

Using the *increment and decrement arrows*, select the number of hours for the time interval. You can also scan through the range of hours by holding down one of the *arrows*. When the desired value is reached, confirm using *prog.*

The display changes to **00:**. You can now input the "minutes" of the time interval by using the *arrows.*

Once again, **depress** *step/scan* to confirm your value and the FVA-60A will display the "seconds" part (:00 to :59) of the time interval.

Use the *Increment and Decrement Arrows*, as you did for the minutes, to select the number of seconds for the time interval. Here again, you may scan through the range of values by holding down one of the *Arrows.*

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Finally, **depress** *step/scan* to display and choose the size of the step between the attenuation values.



Use *increment and decrement arrows* to select the size of the step and hold down one of these keys to scan through the possible values.

Note

It is possible to use *fine/coarse* in the "Program" mode. The finest resolution is the default one and is automatically displayed when the mode is activated.

The programming of the FVA-80 is now completed. You may keep on changing the values of the different parameters that we have just discussed, by **depressing** *prog.* as often as needed to display the parameter you want to modify.

Note

To exit the "Program" mode at all times, depress *prog* until you resume in the *loss or ref/dBm* mode. When you exit the "Program" mode, you also save all the changes you have just made in this programming session.

When you exit the "Program" mode, the unit will automatically go back to the mode it was in before the activation of the "Program" mode: either the *loss* or the *ref/dBm* mode.

If you have programmed your instrument and have saved your modifications by completing the cycle, the unit may be turned off and the modifications will remain in the memory.

Note

If you are in the "Program" mode and you turn off your unit before exiting from that mode, all changes to the different parameters that you have made will be lost. You must always exit the "Program" mode if you want to save your new parameter values.

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start prog

This function starts the program of which you have defined the parameters in the "Program" mode. To activate it, **depress** *start prog.* when in the *loss or ref/dBm* mode.

Note

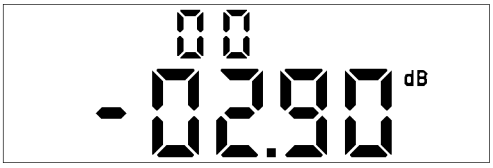
With this function, the *step and scan* modes play a particular role; take the time to read this section thoroughly.

To exit the "Start Program" mode at all times, depress *start prog.*

Note

Before running the program, **make sure that the attenuation value you want to start with is displayed on the LCD (either in the *loss or the ref/dBm* mode)**. Once the program has started, **the step you have specified in the "Program" mode will be added to that attenuation**.

With the unit in the *step* mode (no SCAN indicator), depress *start prog.* The FVA-80 then displays **00** in the upper part of the LCD, and the attenuation that was displayed just before the activation of the *start prog.* mode.



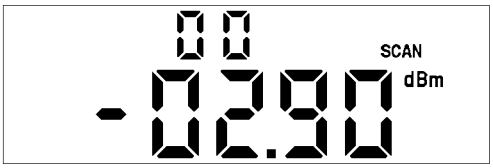
The digits **00** represents the number of attenuation values that the FVA-80 has displayed since the activation of the *start prog.* mode. However, although the program is currently running, the unit ignores the time interval that you have defined in the "Program" and waits for a command from one of the *arrow keys* (the *increment arrow* key if you want to add the programmed step to the current attenuation or the *decrement arrow* key if you want to subtract the step from the attenuation).

In the *step* mode, the time interval between each attenuation display is determined manually.

If you activate the *scan* mode (depress *step/scan* and observe a **SCAN** indicator**)** and **depress** the *start prog*, the FVA-80 will first display **00** in the upper part of the LCD, and the

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attenuation that was displayed just before the activation of the *start prog.* mode.



As soon as this is displayed, the FVA-80 increments the attenuation according to the step and time lapse you have programmed in the "Program" mode. The unit will keep on doing this until the two digits (**00** at first) in the upper part of the LCD reach the programmed number of attenuations.

When it reaches that number, the FVA-80 automatically resets itself to the starting attenuation value and runs the program over and over again as long as the user does not press *start prog.* again.

Note If you find the time lapse too long or if you want to skip some attenuation values, you can bypass this time interval using the *increment and decrement arrows* as you did in the "Step" mode. The FVA-80 will immediately execute the next step. It is always possible to manually control the time lapse.

Note When a program was transferred to the FVA-80 via RS-232 interface, pressing *start prog.* will start the execution of this RS-232 program, even if you have manually programmed the FVA-80 in the "Program" mode. When the memory contains a program which was transferred via interface, a **marker** is lit on the display to indicate that the execution of a manual program is impossible.

The *step and scan* modes have the same characteristics in the *start prog.* mode whether the FVA-80 was programmed through the "Program" mode or the RS-232 mode.

Note Refer to appendix A for more information on the RS-232 interface and the relevant commands.

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OPTICAL CONNECTIONS

CAUTION ! Do not install or terminate fibers while a laser source is operating at the other end of the fiber. Ensure that your eyes are protected at all times.

There are two optical connections on the front panel. The connector to the left is the optical input. This connection is used to input the optical signal to be attenuated. The connector to the right of the attenuator is the output. The FVA-80 is calibrated in this direction; this light path must be respected for all measurements for best results. Even though the instrument can operate in both directions, it is only calibrated for light propagating from input to output.

Dual Ports

If your FVA-80 Optical Test Set features the dual ports option, you will notice four optical connectors and a solid state switch on the front panel of the instrument.

The two upper connectors are Singlemode ports, with an optical input on the left and an optical output on the right. The other two connectors are Multimode and are placed in a similar manner.

The solid state switch in the centre of these four optical connectors allows you to decide to which set of connectors the attenuation is applied, or, in other words, which fiber is currently under test. A solid marker will appear on the LCD when the multimode connectors are "active".

ELECTRICAL CONNECTIONS

Power

Two connectors found on the back panel supply AC or DC to the FVA-80. The AC jack accepts the AC cord shipped with your instrument. This AC connector also features a 250 V/1.0 A fuse which must be replaced with a fuse of identical value. The other electrical outlet (a miniature jack) accepts 12 VDC to remotely power the FVA-80.

Note

This external 12 VDC powers the unit but does not recharge the internal battery pack.

Computer Interfaces

If your FVA-80 was shipped with an optional **IEEE-488** or **RS-232** interface, these data ports will also be housed on the rear panel of your instrument.

POWER REQUIREMENTS

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Your instrument is equipped with an AC electrical cord and rechargeable lead-acid battery pack which will power your instrument for 12 hours under normal use. The battery charger is incorporated in the FVA-80. Plugging the AC line powers the instrument and charges the battery pack.

If the battery pack needs recharging, a **LO BAT** indicator will appear on the LCD approximately 30 minutes before the instrument stops operating. A full battery charge requires 16 hours and charging will **automatically stop** if the AC line cord is left connected. This feature is meant to ensure maximum life expectancy for the internal battery pack.

MAINTENANCE AND REPAIR

Routine Inspection

There are no user-serviceable components in the FVA-80. Your instrument has been designed to require a minimum of maintenance and to provide you with accurate operation for many years. All optical ports found on the front of the FVA-80 must be kept clean at all times to ensure repeatability of readings.

Maintenance of fiber-optic connectors

With the end-cap removed from the optic cable, gently clean the exposed end with a cotton swab dipped in denatured alcohol. Blow-dry the connector afterwards with compressed air.

Recalibration

Although not imperative, EXFO Electro-Optical Engineering recommends an annual recalibration to ensure that the instrument remains within the specified calibration tolerances and within the N.I.S.T (National Institute of Standards and Technologies) standards. Furthermore, avoid shocks and vibrations whenever possible to protect the opto-mechanical system that is the heart of your FVA-80.

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Troubleshooting Procedures

Symptom	Possible Cause	Solution
LCD display blank	Power not on switch	Press Power
	AC cord not securely attached	Reattach AC cord
	AC power fuse blown	Change fuse, use one of the same value
LCD displays a null reading	Shutter activated	Depress shutter key
LCD displays zeros	FVA-80 in ref/dBm mode	Read section on ref/dBm in manual
Instrument in incorrect wavelength	Incorrect wavelength selected	Press Lambda select key
Charging Indicator and **LoBat** indicator both appear on the LCD	Battery is charging but level is very low	Wait until unit is charged

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Service and repairs

Instruments and accessories manufactured by EXFO Electro-Optical Engineering are designed, inspected, and tested to ensure product reliability and performance.

If you are having trouble with an instrument or accessory manufactured by EXFO Electro-Optical Engineering, we suggest that you first refer your problem to the troubleshooting section of this manual. If you need further assistance in determining the instrument's problem, call our service department for assistance. Our service personnel can usually solve the problem over the phone or determine if service or repairs are required.

Note

Never send any instrument or accessory back to EXFO Electro-Optical Engineering without a Return Authorization Number (RAN).

Certificate of Calibration

Your FVA-80 Optical Attenuator is shipped with a Certificate of Calibration. This document certifies that your instrument was calibrated and tested before shipment.

Warranty

EXFO E.O. Engineering warrants products manufactured by it to be free from defects in material and workmanship and to meet the applicable specifications under normal use and service for a period of 12 months from the date of original shipment. EXFO E.O. Engineering's obligation under this warranty is limited to the repair or replacement of such products which, after having been returned to the factory or a designated location, shall be examined and in the opinion of EXFO E.O. Engineering, found defective and that such defect was not induced by causes external to the product. This warranty does not cover recalibration for instruments whose calibration is specified on the calibration certificate to be less than one year.

Alternately, EXFO E.O. Engineering may elect to issue credit for any defective product. Products to be repaired or replaced shall be returned prepaid to the designated place of repair in accordance with authorization, packing and shipping instructions issued by EXFO E.O. Engineering. Return shall not be made until such authorization and instructions are issued. Each returned product shall be accompanied by a statement or report fully stating the claimed defects and any other relevant information concerning the failure.

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EXFO E.O. Engineering's responsibility under this warranty does not apply to any products which have been repaired, worked upon or altered by persons not authorized so as to in EXFO E.O. Engineering's sole judgement injure the stability or reliability of such product, or which have been subject to misuse, negligence or accident, or where applicable, the serial number has been altered, erased or removed.

CAUTION ! Under no circumstances should anyone, besides EXFO's trained personnel, open the case of an instrument since permanent damage to the unit could occur. The opening of a unit's case immediately **VOIDS** all warranties on EXFO E.O. Engineering behalf. Removal of the warranty sticker across the seam of the case will **NULLIFY** EXFO E.O. Engineering's warranty. Furthermore, removal of the case screws will also **VOID** the unit's warranty.

EXFO E.O. Engineering 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 functioning of an entire system of parts of any system of which the purchased product may be a part.

EXFO E.O. Engineering reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatever on units purchased. Accessories, including but not limited to fuses, pilot lamps and batteries used with EXFO E.O. Engineering's products are not covered by this warranty. A test set-up charge will apply to any returned instrument which, after test, is found to meet the applicable specifications.

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

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Repairs Under Warranty

Please feel free to call our service department for any suspected problem. If the instrument cannot be repaired by telephone assistance, our service personnel will provide you with a Return Authorization Number to return your instrument to EXFO E.O. Engineering for service or repair. Instrument freight charges must be prepaid to EXFO Electro-Optical Engineering. All repairs carried out under warranty are returned prepaid to the customer.

EXFO Electro-Optical Engineering will not be responsible for any product returned without a Return Authorization Number (R.A.N.).

If you have any questions concerning our policy, do not hesitate to contact our service department. It is also your responsibility to insure the instrument during shipment.

Repairs Out of Warranty

Out-of-warranty repairs are also provided on all of EXFO Electro-Optical Engineering's fiber optic instruments. This service is billable to the customer for both parts and labour. All instrument freight charges must be prepaid returned by the customer and an evaluation of costs involved will be provided on request.

All products manufactured by EXFO Electro-Optical Engineering, under warranty or out of warranty, are to be returned according to EXFO's return procedure. For any return, please contact our service department at:

Attention: Service Department
Tel: (800) 663-EXFO
Fax: (418) 683-2170

When you do, you will receive a Return Authorization Number along with all the necessary information on the return procedure.

Note:

The return of any instrument to EXFO has to be made according to EXFO's procedures. Any instrument sent back to EXFO not according to the standard company procedures, will be refused and returned to sender.

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Transportation and Storage

Although your EXFO Electro-Optical Engineering fiberoptic instrument is designed to be rugged and field portable, transportation damage can occur from improper handling. Therefore, we recommend that the following steps be taken to minimize the possibility of damage.

If the instrument is to be shipped, repack it in the original packing material for best protection.

When not in use, store instrument at room temperature in a clean and dry area. Avoid areas of high humidity, large temperature fluctuations, keep the instrument away from direct sunlight and avoid unnecessary mechanical shocks.

Accessories and Options

Available with the FVA-80 Variable Attenuator is the following list of options and accessories:

Bare Fiber Adaptors

BFTB-1	Bare fiber terminal block (temporary connection of two fibers).
BFA-9	High precision bare fiber adapter (125 µm) with push button.
BFA-10	Bare fiber adapter (125-140 µm).
BFA-11	Bare fiber adapter (140-250 µm).
BFA-12-MM	High precision Biconic adapter for multimode bare fibers with push button.
BFA-12-SM	High precision Biconic adapter for singlemode bare fibers with push button.
BFA-14	High precision NEC-D4 adapter for multimode or singlemode bare fibers (push button).
BFA-16	High precision SMA-905/906 adapter for multimode bare fibers with push button.
BFA-22-MM	High precision NTT-FC adapter for multimode bare fibers with push button.
BFA-22-SM	High precision NTT-FC adapter for singlemode bare fibers with push button.
BFA-32-MM	High precision AT&T adapter for multimode bare fibers with push button.
BFA-32-SM	High precision AT&T adapter for singlemode bare fibers with push button.

Miscellaneous:

GP-30A	Spare battery charger for North America.
GP-30E	Spare battery charger, European style.
GP-30U	Spare battery charger for United Kingdom.
GP-30I	Spare battery charger for India.
GP-30S	Spare battery charger for Australia.
GP-40	External battery pack.(1200mA-H)

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	GP-60	Supplementary RS-232C interface cable.
	GP-140	Package of 25 alcohol cleaning pads.
	GP-150	Power cable for vehicle cigarette lighter.
	MAN-FVA-80.3AN	Operation manual for this unit.
	REC-10	Optical/Electrical recalibration for the FVA-80.
	-RS	Bi-directional optional RS-232 type computer interface. Comes with software and cable.
	RS-FVA-80	Demonstration program for RS-232C interface.
Test Jumpers:	TJ-B12-12	Biconic to Biconic, 9/125µm.
	TJ-B12-14	Biconic to D4, 9/125µm.
	TJ-B14-14	D4 to D4, 9/125µm.
	TJ-B22-22	FC to FC, 9/125µm.
	TJ-B12-22	Biconic to FC, 9/125µm.
	TJ-B32-32	ST to ST, 9/125µm.
	TJ-B12-32	Biconic to ST, 9/125µm.
	TJ-B22-32	FC to ST, 9/125µm.
	TJ-C12-12	Biconic to Biconic, 50/125µm.
	TJ-C16-16	SMA 906 to SMA 906, 50/125µm.
	TJ-C32-32	AT&T-ST to AT&T-ST, 50/125µm.
	TJ-D32-32	ST to ST, 62.5/125µm.
	TJ-D32-56	ST to FDDI, 62.5/125µm.
	TJ-D56-56	FDDI to FDDI, 62.5/125µm.

A dual-fiber option is also available, please indicate both fibers during ordering. (ie. FVA-80-B12-C16). If the connector you need is not currently listed, feel free to consult our technical support department. Call factory for other available connectors.

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Appendix A

RS-232 Interface (FVA-80)

A standard RS-232 computer interface may be provided as an option with the FVA-80 model. The interface lets you perform all the functions of the attenuator remotely through a PC XT/AT IBM compatible computer equipped with a serial port.

Requirements

Hardware required to operate the FVA-80 with a computer:

1) A PC XT/AT compatible computer equipped with a DB 25 serial port connector.

Note: **Although the RS-232 type interface is common to many computers, only IBM compatible computers may be used with the FVA-80.**

2) A GP-60 RS-232C interface cable, supplied with your instrument.

3) A software diskette containing several programs and a read-me file that contains specific instructions on how to operate the application software.

Installation

These are step-by-step instructions in order to set up the FVA-80 with the RS-232C interface on a compatible PC XT/AT computer.

Step 1: Turn the FVA-80 OFF.

Step 2: Connect the cable with the stereo jack end (the smallest end) into the receptacle on the back panel of the FVA-80.

Step 3: Connect the cable's DB 25 connector end on either serial port 1 or 2 of your PC XT/AT IBM compatible computer.

Step 4: If you have both interfaces, set all the dip switches on the back of the FVA-80 to on (A1 to A6).

Step 5: Turn your FVA-80 ON.

Step 6: Boot up your computer with a DOS system and insert the software diskette #1 into drive A. (continued)

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Note: We assume that you are familiar with the DOS system and its commands. If you are not, you should refer to a specialized book on the subject (probably supplied with your computer).

Step 7: Type **A:** and hit the **ENTER/RETURN** key. You may survey the contents of the diskette by typing **DIR** and the **ENTER/RETURN** key.

Note: Before executing any of these programs or doing any programming, it is **highly recommended** that you read through or print the README.DOC file which contains information on the different programs and useful subroutines that you could include in many of your own programs. You may also find information on any software updates.

We also suggest that you print out a listing of the demo program.

Step 8: You access the information contained in the README.DOC file by typing **README** followed by the ENTER/RETURN key (this executes the README.BAT batch file which enables you to read the README.DOC file).

Programming The diskettes included with your RS-232C interface package contain a demo program and a "README" file to help you make your own programs. Remember that, with the RS interface, all commands used in your program must be sent with right and left arrows (> ... <.
Refer to Annex C for a complete listing of the commands.

Examples: To set the attenuation at -28 dB, send >A-28.00<.
To set the attenuation at +5 dB (in relative mode), send >A+05.00<. Upper and lower case characters are not interchangeable.

The FVA-80 unit then sends the ASCII character ";" which means that the unit is acknowledging the command. The unit will then bring the attenuation to the desired value.

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Communication Protocol

The software on the diskettes has been written using a PC compatible computer. The communication protocol is 9600 Baud, 8 bit, no parity, one stop bit using serial port 1 or 2.

A number of application examples are included on your software diskette. It is important to go through the entire Readme File before operating the unit.

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Appendix B

IEEE-488 (GPIB) Interface

General

The IEEE-488 or GPIB (General Purpose Interface Bus) was developed to provide a standard interface between instruments from diverse sources. For example, power meter, attenuator, computer. Please note that the IEEE-488 interface only operates using AC power. Ensure that the AC electrical cord is properly connected.

IEEE Interface Functions

The interface functions define the receiving, processing and sending operations of data by the FVA-80. The following codes define the IEEE-488 interface that has been implemented on the FVA-80. More details can be found in the IEEE-488 guidebook.

SH1:	Complete source handshake functions.
AH1:	Complete acceptor handshake functions.
L4:	Basic listener unaddressed to listen on TAG.
T6:	Basic talker functions, serial poll unaddressed to talk LAG.
SR1:	Service Request capability.
RL1:	Including the Remote/Local operation selecting function.
PPO:	Not including the parallel poll function.
DC1:	Including the device clear function.
DT1:	Including the device trigger function.
CO:	Not including the control function.
EO:	Tri-state bus.

Requirements

Hardware required to operate the FVA-80 on a computer:

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1) A PC XT/AT compatible computer equipped with a GPIB \ IEEE-488 card and connector.

Note: **Although the IEEE-488 interface is common to many computers, only IBM compatible computers may be used with the FVA-80.**

2) A GP-130 IEEE-488 interface cable, **not supplied** with your instrument.

3) A software diskette containing several programs and a read-me file that contains specific instructions on how to operate the application software.

Installation These are step-by-step instructions in order to set up the FVA-80 with the IEEE-488 interface on a compatible PC XT/AT computer.

Step 1: Turn the powermeter FVA-80 OFF.

Step 2: Connect one end of the GPIB cable into the receptacle on the back panel of the FVA-80 unit.

Step 3: Connect the other end of the cable on the GPIB port of your PC XT/AT IBM compatible computer.

Step 4: Set the A1-A6 dip switches on the back of the FVA-80 to select the desired address (decimal value between 0-30).

Step 5: Turn your FVA-80 ON.

Step 6: Boot up your computer with a DOS system and insert the software diskette #1 into drive A.

Note: We assume that you are familiar with the DOS system and its commands. If you are not, you should refer to a specialized book on the subject (probably supplied with your computer).

Step 7: Type "A:" and hit the "ENTER/RETURN" key. You may survey the contents of the diskette by typing "DIR:" and the "ENTER/RETURN" key.

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Note: Before executing any of these programs or doing any programming, it is **highly recommended** that you read through or print the README.DOC file which contains information on the different programs and useful subroutines that you could include in many of your own programs. You may also find information on any software updates.

We also suggest that you print out a listing of the demo program.

Step 8: You access the information contained in the README.DOC file by typing "README" followed by the "ENTER/RETURN" key (this executes the README.BAT batch file which enables you to read the README.DOC file).

Programming The list of commands is found in Appendix C.

Serial polling Each time a serial polling is conducted by the controller, the status byte is returned. (See status byte in appendix C.)

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Appendix C

IEEE-488 / RS-232 COMMANDS (FVA-80)

Note 1: "x" represents a number from 0 to 9, "E" represents scientific notation, and "_" indicates a blank space.

Note 2: Whenever the unit is displaying "- - - -" the unit will return a -99.99 to your computer for easier computation.

Commands	Description	RS-232 Response
)	Lock the keyboard.	;
(	Unlock the keyboard.	;
D	Select Loss mode (display shows total attenuation)	;
R	Select Relative reference mode	;
X ± xx.xx	Select X + B (or relative display) mode, Set value for B	;
LS	Display attenuation applied to singlemode connectors (same as toggling front panel switch)	;
LM	Display attenuation applied to multimode connectors (same as toggling front panel switch)	;
L0	Select lowest wavelength (850 multi, 1300 single)	;
L1	Select highest wavelength (1300 multi, 1550 single)	;
A±xx.xx	Attenuate input signal by xx.xx dB ;	
H0	Turn shutter off	;
H1	Turn shutter on	;

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Commands	Description	Response
S0	Read status byte 00110ME0 If E = 1 then there is an error in the command. If M = 1 then the attenuation is currently changing.	
S1	Get reading from FVA-80. Format of readings: -ATTEN: **-xx.xx;** -REL and X+B: **±xx.xx,±xx.xx;** **(±attenuation,±reference;)**	reading
LL	Get attenuation limits min = insertion loss, max = maximum attenuation	min, max
note:	These values apply to the λ selected and to the type of fiber selected with LS or LM.	
>PLxxxxhhmmss<	A single step in the interface program mode. Program up to 60 steps, each specifying a λ, an attenuation and the period during which the attenuation will be held before executing the next step.	;
NOTE	The FVA-80 offers two distinct program modes: o A manual program mode, entered directly on the unit using its keyboard. o An interface program mode which is inputted via the interface using your computer. While an interface program is present in the memory (marker #4 is on), manual programming becomes disabled: loading an interface program blocks the execution of a manual program.	

Where **L** = wavelength : If L=0 » Multimode: Lambda=850nm,
Singlemode: Lambda=1300nm.
If L=1 » Multimode: Lambda=1300nm,
Singlemode: Lambda=1550nm.

hh = the "hours" part of the time interval during which the attenuation remains stable. (value: 00 ≤ hh ≤ 23.

mm = the "minutes" part of the time interval during which the attenuation remains unchanged (value range: 00 ≤ mm ≤ 59).

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ss = the "seconds" part of the time interval.
(value range: 00 ≤ ss ≤ 59).

xxxx = attenuation value, in the high resolution format, that you want to program in the "Atten." mode.

>U<	Exits the interface program mode and resets "step count" to zero. Marker #4 is turned off.	**;**
Note	**This command must be executed prior to going in the field if you want to allow the execution of a program entered manually on the FVA-80.**	

Ex.: Let us program, for a wavelength of 1300nm (multimode fiber) and a time interval of 14 minutes and 30 seconds, an attenuation of -35.25 dB in the "Atten." mode:

1- Reset the "step count" to zero: send >U<

2- Send **>P3525001430<**

3- Unlock the keyboard: Send >(< (*LOCAL* replaces *REMOTE*)

4- To run the program, **depress** the "Shift" and "Increment Arrow" Keys.

The attenuator will then set the attenuation to -35.25 and hold this for 14 m 30 s before executing any subsequent step in the program. Up to 60 steps can be entered separately.

REMEMBER! After an interface program is transfered to the FVA-80, execution of a manual program is impossible. Send >U< to enable it before terminating RS-232 session.

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