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Variable Attenuator

FVA-3100



User Guide

EXFO

P/N: 1036215

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Variable Attenuator

FVA-3100



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Variable Attenuator

FVA-3100



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: 1036215
October 2002

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Certification Information

F.C.C. Information

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

CE Information

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

CSA Information

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

Independent Laboratory Testing

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

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IMPORTANT

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

IMPORTANT

The AC adapter provided with this product is equipped with a shielded three-wire power cord and plug. Use this power cord in conjunction with a properly grounded electrical outlet to avoid electrical shock and to reduce radio frequency interference that may emanate from the power cord.

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DECLARATION OF CONFORMITY

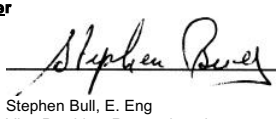
Application of Council Directive(s):	73/23/EEC - The Low Voltage Directive 89/336/EEC - The EMC Directive
Manufacturer's Name:	EXFO ELECTRO-OPTICAL ENG.
Manufacturer's Address:	465 Godin Avenue Vanier, Quebec Canada G1M 3G7 (418) 683-0211
Equipment Type/Environment:	Industrial Scientific Equipment
Trade Name/Model No.:	FVA-3100 Variable Attenuator
Year of Conformity Assessment:	2001

Standard(s) to which Conformity is Declared:

EN 55011:1993	**Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment.**
EN 61010-1:1990	**Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements.**
EN 61000-3-2:1995	**Electromagnetic Compatibility Part 3: Limits Section 2: Limits for Harmonic Current Emissions.**
EN 61000-3-3:1994	**Electromagnetic Compatibility Part 3: Limits Section 3: Limitation of Voltage fluctuations and Flicker in Low-Voltage Supply Systems.**
EN 50082-1:1992	**Generic Immunity for Residential, Commercial, and Light 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:	November 15, 2001

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1 Introducing the FVA-3100 Variable Attenuator

Main Features

The FVA-3100 Variable Attenuator is the instrument that allows you to perform several attenuation related tasks.

The FVA-3100 Variable Attenuator is configured for singlemode and multimode fibers. It is built to offer a high spectral uniformity, an important feature which allows you to maintain the attenuation value throughout the entire WDM spectrum. Its low insertion loss allows you to minimize your loss budget.

The FVA-3100 Variable Attenuator has a program function, which allows you to create custom programs such as automatic attenuation scan.

The variable attenuator has the versatility of three display modes:

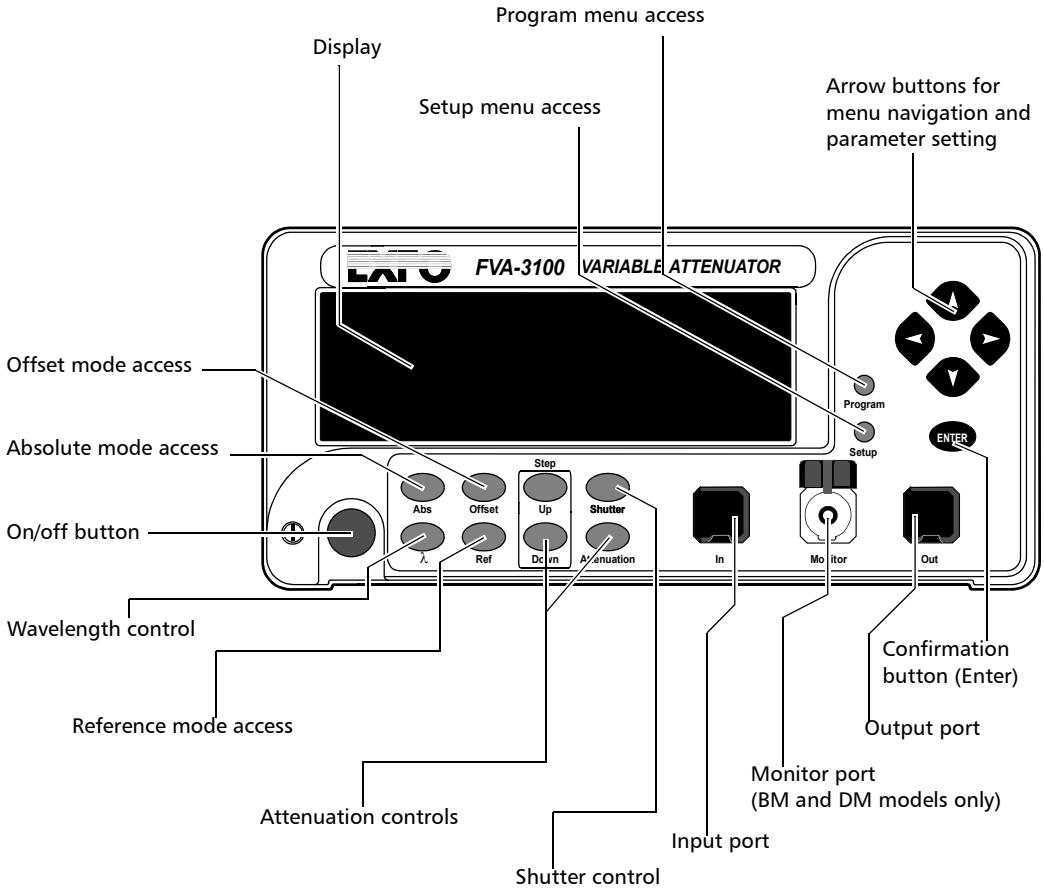
- Absolute, which includes the insertion loss.
- Reference, in reference to the 0.001 dB level.
- Offset, relative display to any selected reference value.

The FVA-3100 Variable Attenuator is controlled by easy-to-use software, enabling multiple-user configuration storage.

The FVA-3100 Variable Attenuator can be remotely controlled through a GPIB or RS-232 interface.

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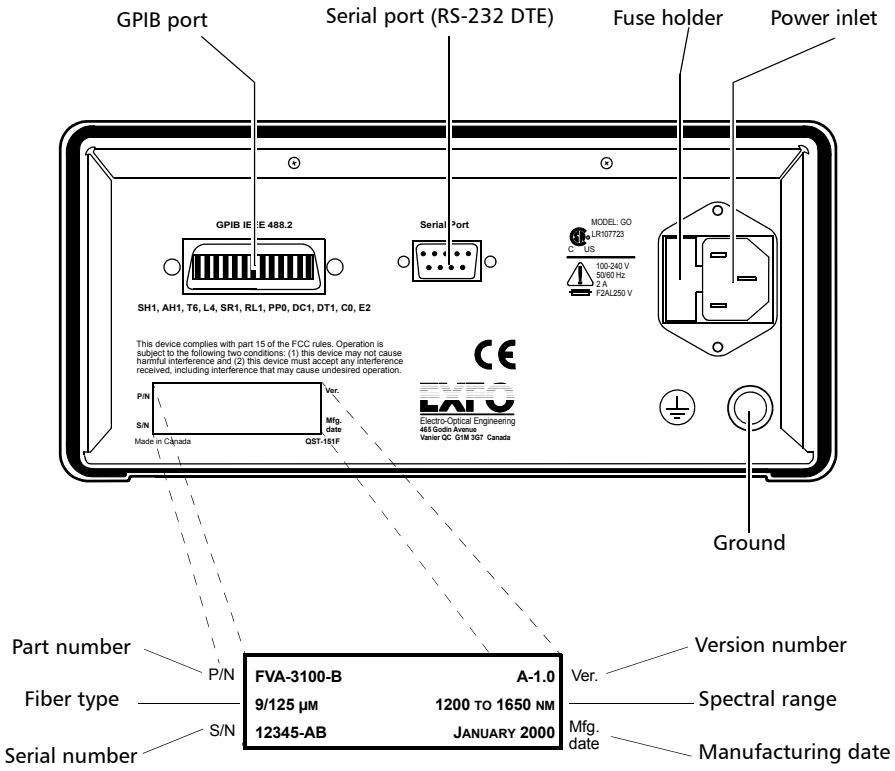
Front Panel



Note: *Your FVA-3100 Variable Attenuator may differ slightly from the illustration depending on the specific model of your unit.*

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Back Panel



Note: *Your FVA-3100 Variable Attenuator may differ slightly from the illustration depending on the specific model of your unit.*

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Available Models

According to the models you own, additional options are available. The FVA-3100-BM and FVA-3100-BMW offer spectral uniformity and maintain constant attenuation values.

The FVA-3100-BM, FVA-3100-BMW, FVA-3100-DM all come with a monitor output, which ensures accurate power-level monitoring.

Typical Applications

The FVA-3100 Variable Attenuator is ideal for

- manufacturing and laboratory applications such as system characterization
- EDFA
- component and system loss simulation
- instrument calibration
- power meter linearity measurement
- spectral tuning.

The FVA-3100 Variable Attenuator is particularly suitable to demanding laboratory and manufacturing qualification applications.

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Main Concept

The significance of the attenuation value displayed by an optical attenuator may differ from one manufacturer to another. At EXFO, for example, the attenuation displayed by the FVA-3100 Variable Attenuator is the actual loss or attenuation between the input and the output ports of the Variable Attenuator, including the loss of its own internal connectors, after performing a reference reading with a power meter.

IMPORTANT

The Variable Attenuator has been calibrated with a light source connected to the input port and a power meter connected to the output port. For optimum performance, do not interchange the input and output connections.

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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.

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Laser Safety Information

WARNING

Do not install or terminate fibers while a light 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.

Electrical Safety Information

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

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

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

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WARNING

To avoid electrical shock, do not operate the unit if there are signs of damage to any part of the outer surface (covers, panels, etc.). To avoid serious injury, observe the following precautions before powering on the unit.

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

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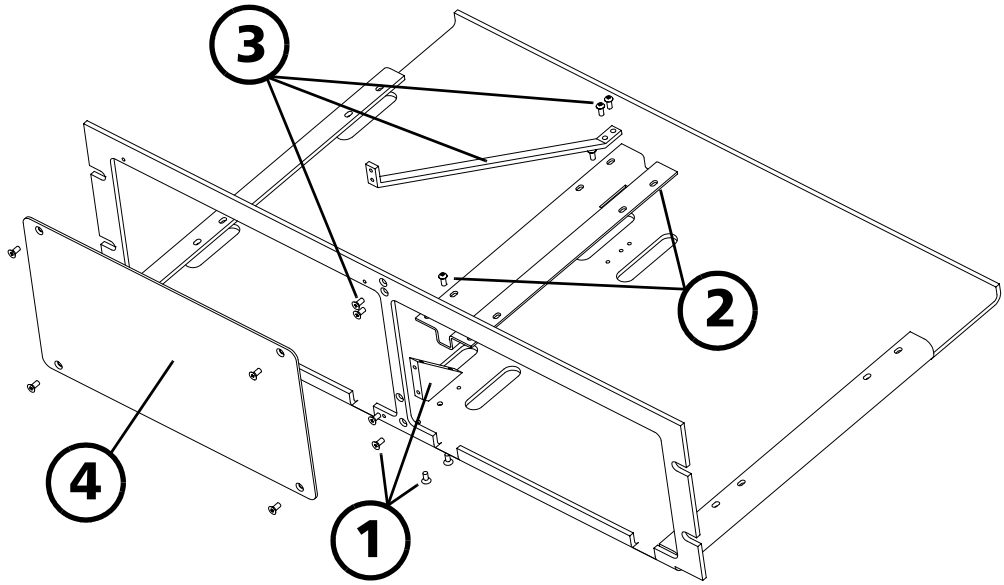
3 Getting Started With Your Variable Attenuator

Installing your FVA-3100 Variable Attenuator in a Rackmount

You can place your FVA-3100 Variable Attenuator in a rackmount in order to facilitate its usage.

To install the rackmount:

1. Fix the angle iron using four flat Phillips screws.



2. Fix the rackmount bracket to the frame using two round Phillips screws.

3. Fix the rackmount stiffener using two flat Phillips screws (for the front panel) and two round Phillips screws.

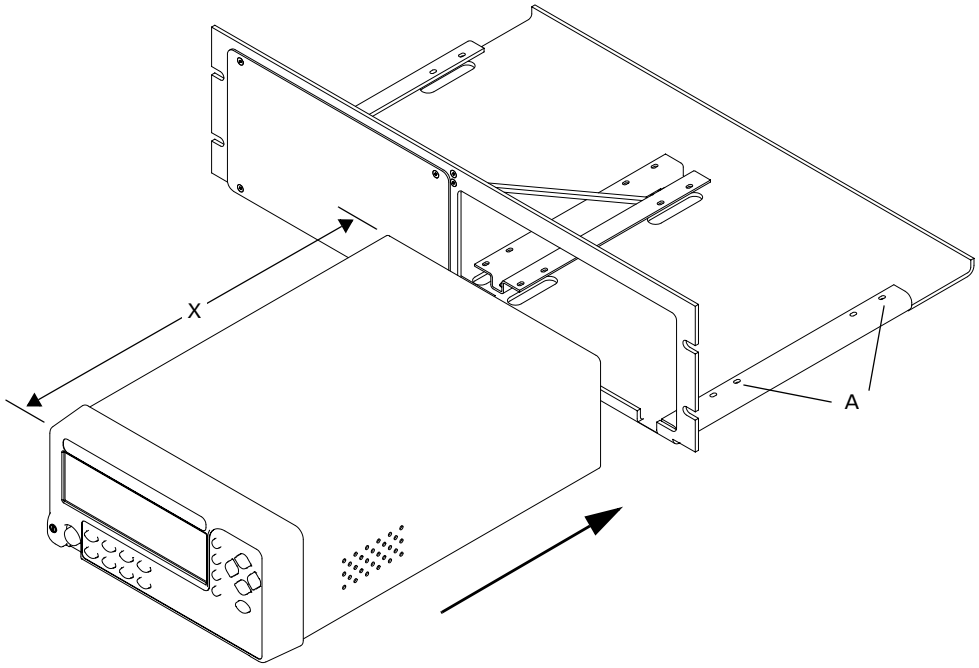
4. If your rackmount will have only one position, fix the rackmount cover plate to the frame using four flat Phillips screws.

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To install your FVA-3100 Variable Attenuator in a rackmount:

1. Slide the benchtop unit into the rackmount and tighten it from underneath using the four cover fixing screws.

If measurement X on the illustration exceeds 11.125 in., fix the unit into the four holes identified as A. Otherwise, use the other four holes.



2. If a second benchtop is to be installed, remove the cover plate and repeat step 1.

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Turning the Variable Attenuator On and Off

When you turn on your unit:

- it beeps twice
- it performs a self-test,
- it enters the mode that was active at the last power-off (Absolute, Offset, or Reference).

When you turn the unit off, the following items remain in read-only memory:

- current shutter state
- current display mode
- current attenuation setting
- current wavelength
- shortlisted wavelengths
- each wavelength offsets
- step size
- remote-control settings
- programmed attenuation routine settings
- saved configurations

Note: *The power cord is the most effective disconnecting device. To ensure that the power is completely turned off, disconnect the power cord.*

Before turning the Variable Attenuator on, please read *Safety Information* on page 7.

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To turn the unit on and off:

Use the red button in the lower left corner of the front panel.

IMPORTANT

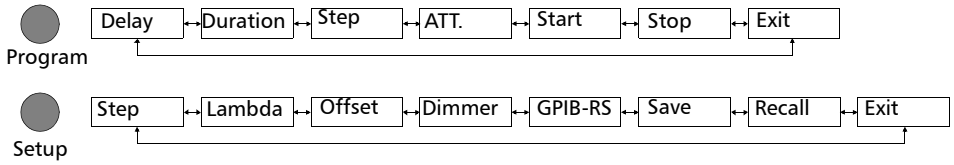
Some internal mechanisms can sometimes take a few seconds to adjust, depending on the operation performed. While the Variable Attenuator is performing internal adjustments (for example after having changed the wavelength or the attenuation setting), no buttons should be pressed while Program flashes on the display.

CAUTION

The Variable Attenuator should not be turned off while Program is flashing in the lower left corner of the display.

Accessing Menus

The blue buttons to the right of the display give access to single-level menus: Program and Setup. The following diagram shows the menus and their items.



To move (in a loop) between the menu items:

Use the left/right arrows.

To exit a menu:

Press the button that gave access to the menu;

OR

Use the left/right arrows to move until EXIT is displayed, then press ENTER.

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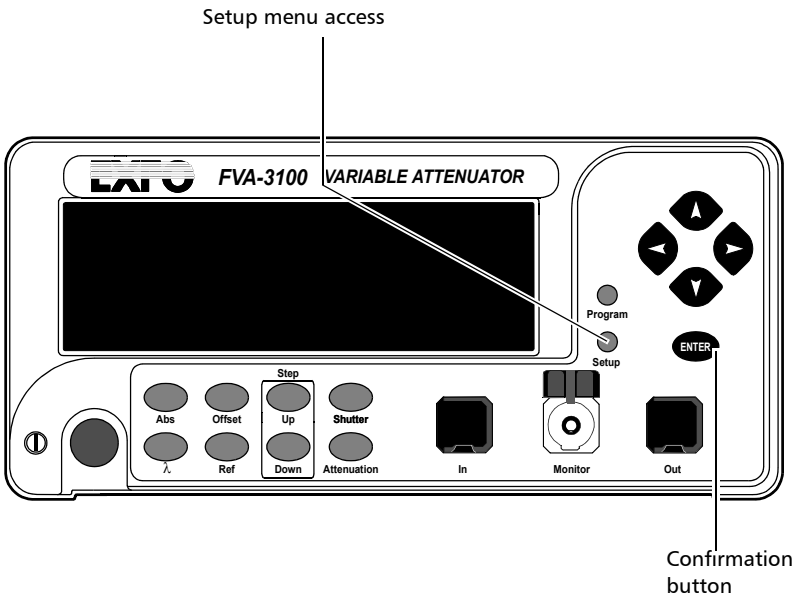
4 Setting Up Your Variable Attenuator

Selecting the Display Intensity

Display intensity may be set to high or low. You can also turn off the display without turning off the unit.

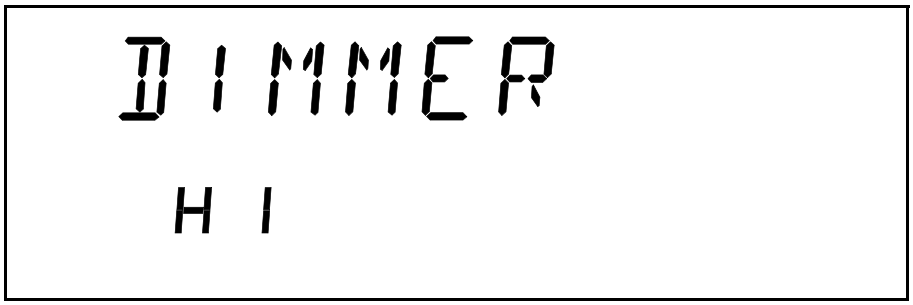
To select the display intensity:

1. Press on the Setup.



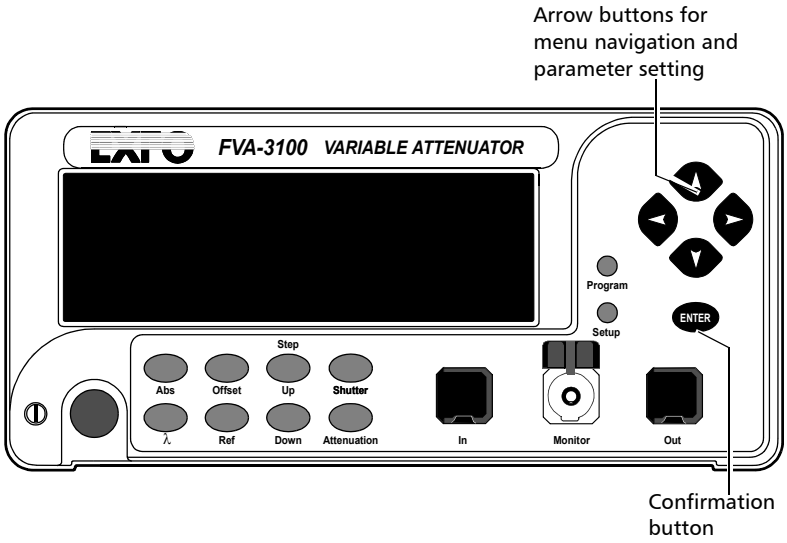
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2. Use the left/right arrows to move until it displays **DIMMER**.



3. Press ENTER. The current dimmer state will start flashing.

4. Use the up/down arrows to modify the dimmer status: LO, HI, or OFF.



5. Press ENTER.

Note: *Setting the dimmer to* OFF *turns off the display. Press any button to turn the display back on.*

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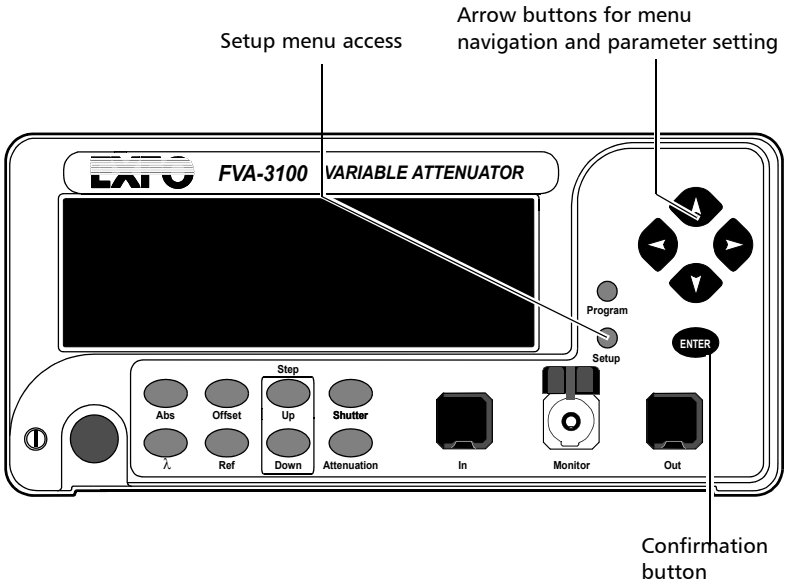
6. To exit the Setup menu, press on the Setup button.

Locking Control Key Access

To prevent unintended use of the FVA-3100 Variable Attenuator during operation, you can lock the control keys (the blue buttons on the front panel of the unit).

To lock the control key access:

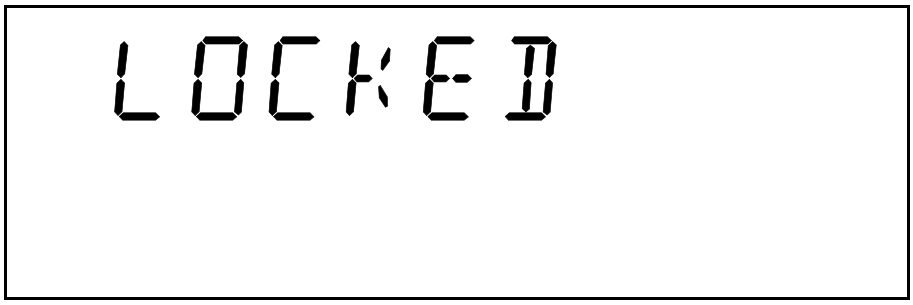
1. Press Setup.



2. Use the left/right arrows until **LOCKOUT** is displayed.

3. Press ENTER.

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The **LOCKED** message is briefly displayed, then the unit reverts to the settings that were active before you entered the Setup menu. All control keys are deactivated.

To unlock the keypad:

1. Press on the Setup button.
2. Press ENTER.

The UNLOCKED message is briefly displayed. All control keys are reactivated.

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Managing the Wavelength Shortlist

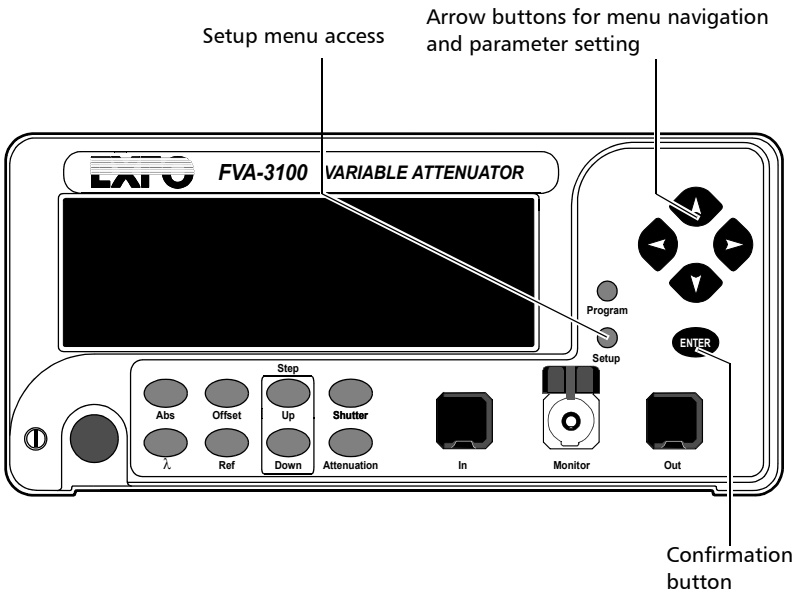
The FVA-3100 Variable Attenuator can test at many wavelengths. The accepted wavelengths depend on the configuration of your unit. You can store the wavelengths you use most often in a shortlist so you can quickly access them. The shortlist includes up to 20 wavelengths.

Note: *When switching to a new wavelength, the attenuator motor will reposition itself to keep the current attenuation value for the new wavelength.*

Refer to *Technical Specifications* on page 79 for more information on the wavelength ranges that you can enter.

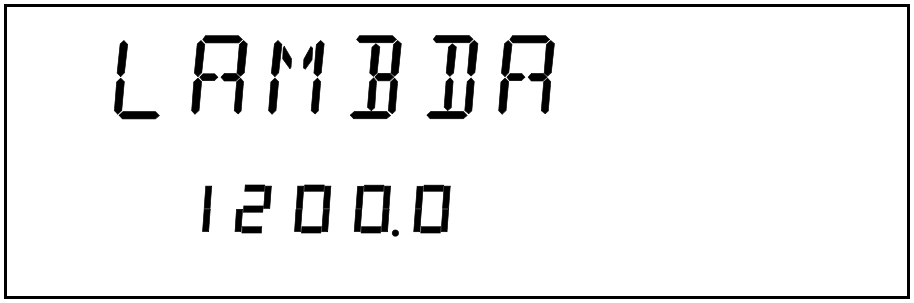
To add a wavelength to the shortlist:

1. Press Setup.



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2. Use the left/right arrows to move until **LAMBDA** is displayed.



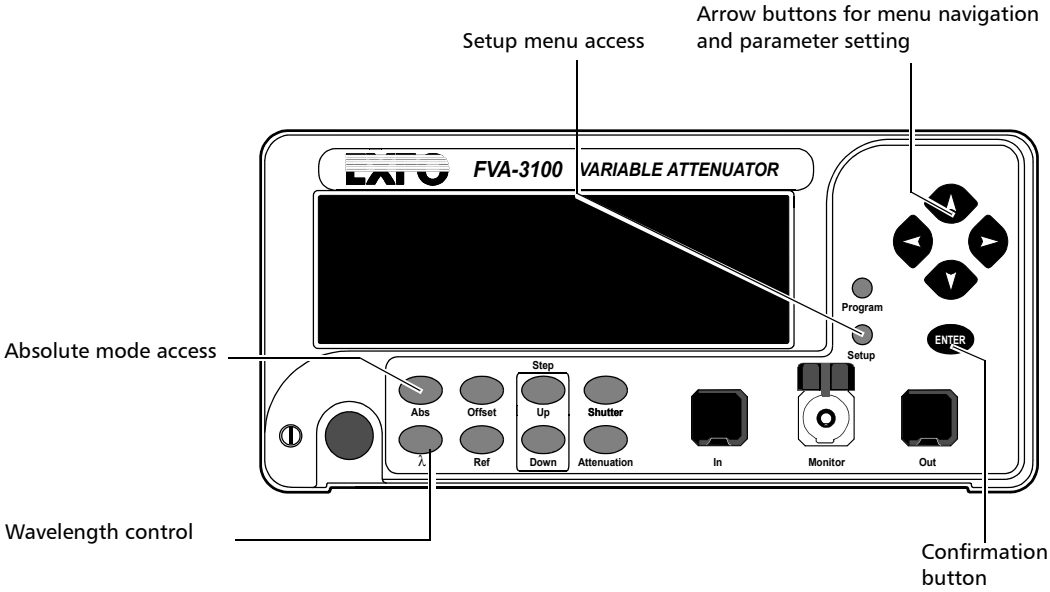
3. Use the up/down arrows to move until **Add** is displayed .
4. Press ENTER. A wavelength will be suggested and the first digit will flash.
5. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.
6. Once all digits are set, press ENTER.
7. To exit the Setup menu, press the Setup button.

Note: *If you are trying to enter a wavelength that is outside the wavelength range, the Variable Attenuator will beep and reject the wavelength.*

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To delete a wavelength from the shortlist:

1. Press the Setup button.



2. Press the left/right arrows until **LAMBDA** is displayed.

3. Use up/down arrows to move until the wavelength you want to delete appears in the lower portion of the display.

4. Press ENTER. The wavelength will start flashing.

5. Set all the wavelength digits to zero. To do so, use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

6. Press ENTER.

7. To exit the Setup menu, press the Setup button.

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To delete all wavelengths from the shortlist:

1. Press the Setup button.
2. Press the left/right arrows until **LAMBDA** is displayed.
3. Press the up/down arrows until **DEL ALL** appears in the lower portion of the display.
4. Press ENTER.

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Selecting the Attenuation

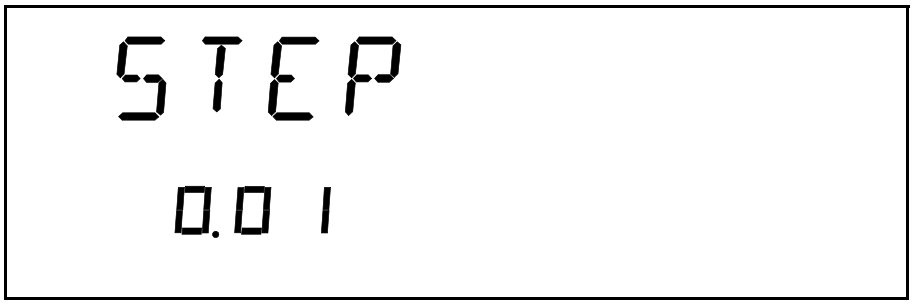
The attenuation can be set using two methods:

- By using the up and down arrows buttons, the attenuation is modified one step (up or down) at a time.
- By using the Attenuation button, you can quickly and precisely set the attenuation to a specific value
- The available step sizes are: 0.01, 0.02, 0.05, 0.1, 1, 2, 5, 10, 20, and 50 dB.

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

To change the step size:

1. Press Setup
2. Press the left/right arrows until **STEP is displayed.**

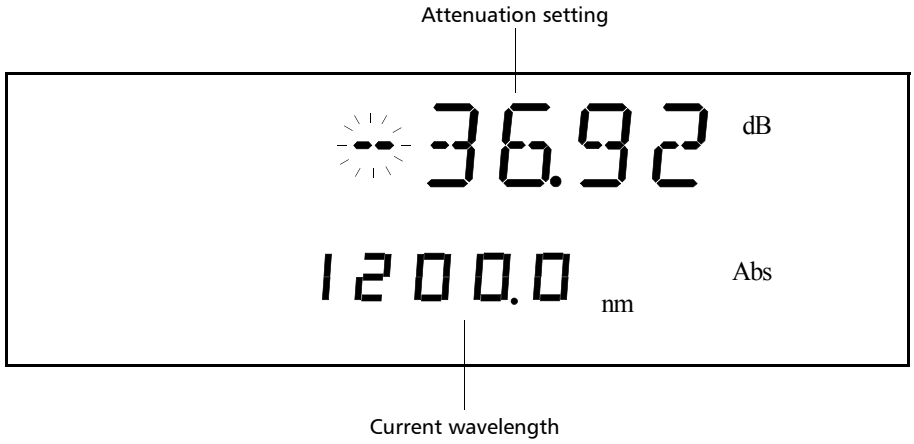


3. Press ENTER. The current step size will start flashing.
4. Using the up/down arrows, choose one of the available step sizes.
5. Press ENTER.
6. To exit the Setup menu, press Setup.

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To enter a specific attenuation value:

1. Press the Attenuation button. The first segment of the attenuation setting starts flashing.



2. Enter a new attenuation value. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

Note: *Since the optical resolution of the singlemode Variable Attenuator is 0.005 dB, the third digit after the decimal point must always be 5. The new attenuation setting will be rejected if its third digit is not 5. For more information on the variable attenuator optical resolution see* Technical Specifications *on page 79.*

3. Once you have entered all the segments, press ENTER.

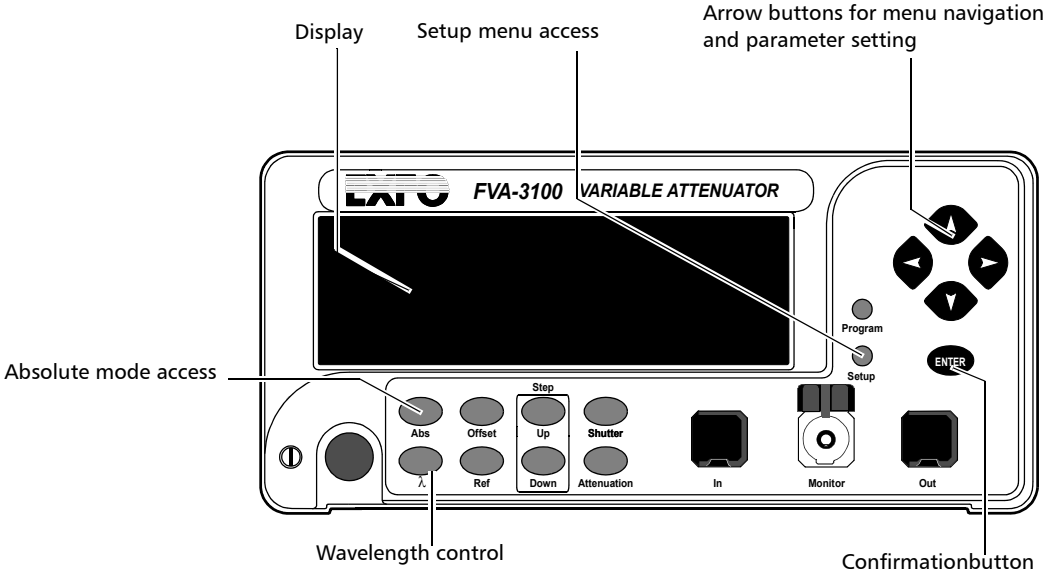
Note: *If you try to set an attenuation value that is outside the attenuation range, the Variable Attenuator will default to the minimum or maximum setting.*

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The attenuation range (minimum and maximum possible attenuation) of your FVA-3100 Variable Attenuator depends on the model you have at hand. Although EXFO guarantees that the minimum insertion loss is below a specified value, it may vary slightly from one wavelength to another and from one variable attenuator to another.

To set the minimum attenuation:

1. Select a wavelength, by clicking on the wavelength control until you reach the desired wavelength.

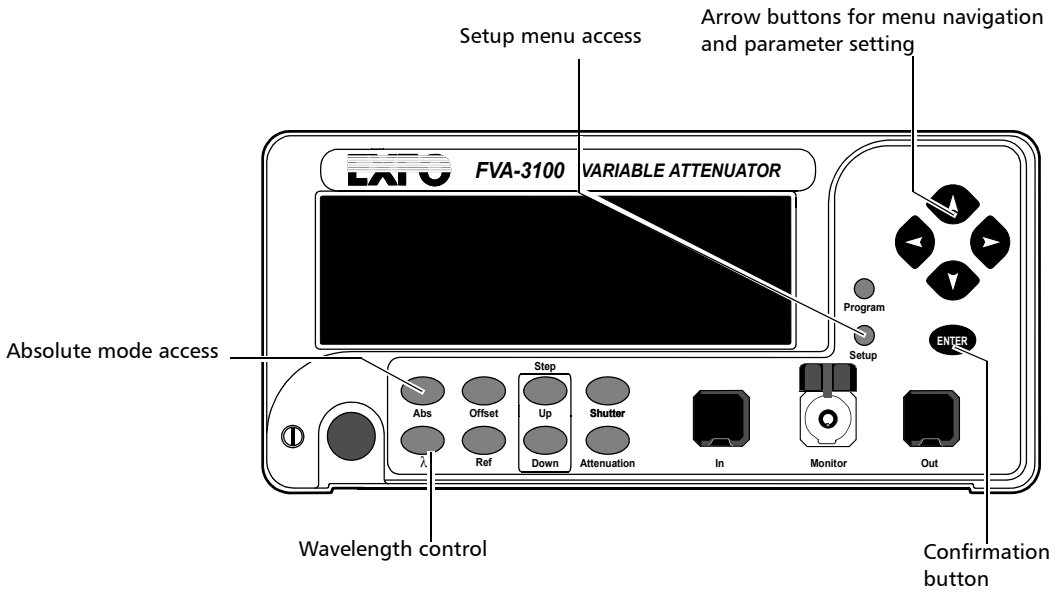


2. Press the Abs button.
3. Press the Attenuation button and set an attenuation of 000.00 dB.
4. Press ENTER. The Variable Attenuator will default to the minimum insertion loss.

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To set the maximum attenuation:

1. Select a wavelength by clicking on the wavelength control until you reach the desired wavelength.



2. Press the Abs button.

3. Press the Attenuation button and set an attenuation of -999.99 dB.

4. Press ENTER. The Variable Attenuator will default to the maximum attenuation.

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Selecting and Using an Attenuation Display Mode

Note: *The total or absolute attenuation referred to in this manual is the actual optical insertion loss between the input and output ports, including the connectors.*

The Variable Attenuator offers the following three attenuation display modes:

- Absolute attenuation mode
- Offset attenuation mode
- Reference attenuation mode

Display Mode	Description
Absolute	The displayed attenuation value takes into account both the absolute value and the offset value. Default mode upon initial activation.
Reference (relative)	The displayed attenuation value is the attenuation relative to a defined reference value, which can be any value within the unit's attenuation range and may be selected as the reference.

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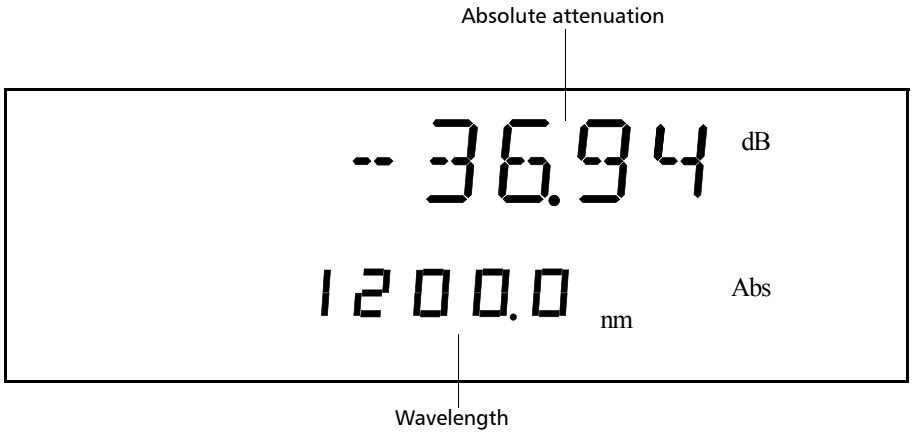
Display Mode	Description
Offset (X + B)	The displayed attenuation is the sum of two components: ➤ X = physical attenuation introduced by the unit. ➤ B = correction factor or offset; it may be used to compensate for losses along the connecting fibers or for losses displaying the attenuation as a power value. Offset mode can be best explained by the following example: ➤ An optical light source with a power output of -14 dBm at 1310 nm is connected to a variable attenuator. Because of internal losses, the minimum insertion loss at 1310 nm is approximately 2 dB. This means that the maximum optical power available at the output port of the attenuator is -16 dBm (-14 + -2). If we now set an offset value of -14 dBm, the (large digits) will display the optical power level at the output port of the attenuator. Using the above setup (i.e, light source, variable attenuator, and an accurately determined offset value), Exfo has created a precise variable light source with a dynamic range of nearly 100 dB. ***Note:*** *You must define the appropriate B value for the operating wavelength before enabling X+B mode. A different B value may be assigned to each wavelength in the wavelength box.*

Note: *The active display mode is always indicated on the display.*

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To set Absolute attenuation mode:

Press on the Abs button at any time to enable Absolute mode.



In Offset mode, the offset value is always displayed in the lower portion of the display while the upper portion (large digits) displays the sum of two values.

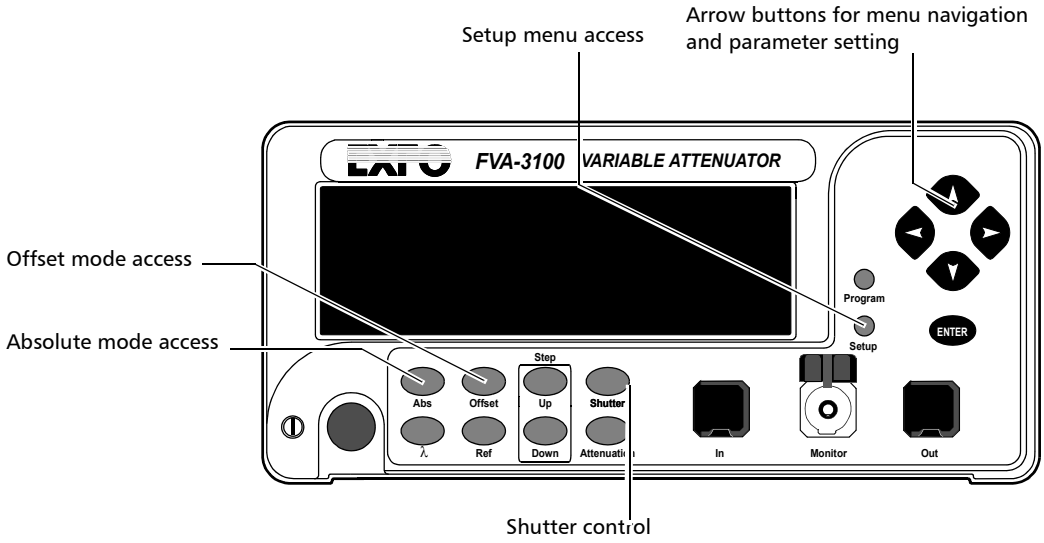
Before enabling the Offset mode, it is necessary to define the appropriate offset value for the operating wavelength. A different offset value can be associated with each wavelength in the shortlist.

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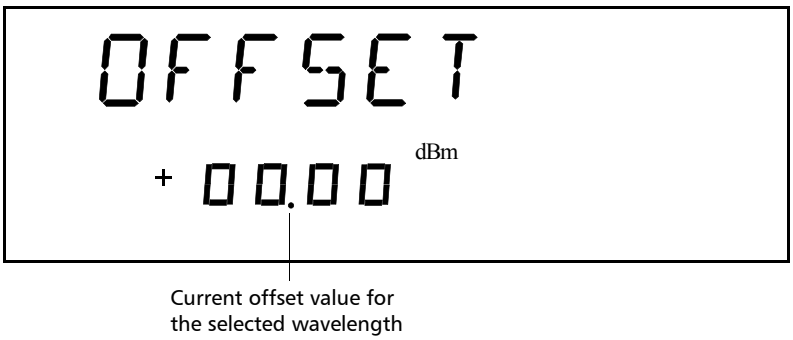
To define an offset value for a specific wavelength:

1. Set the Variable Attenuator to the appropriate wavelength.

2. Choose Setup.



3. Press the left/right until **OFFSET** is displayed.



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4. Press ENTER. The first segment of the current offset value will start flashing.
5. Enter a new offset. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

Note: *Offset values between -99.999 and 99.999 may be entered. Use dB when the offset represents loss and dBm when the offset represents power.*

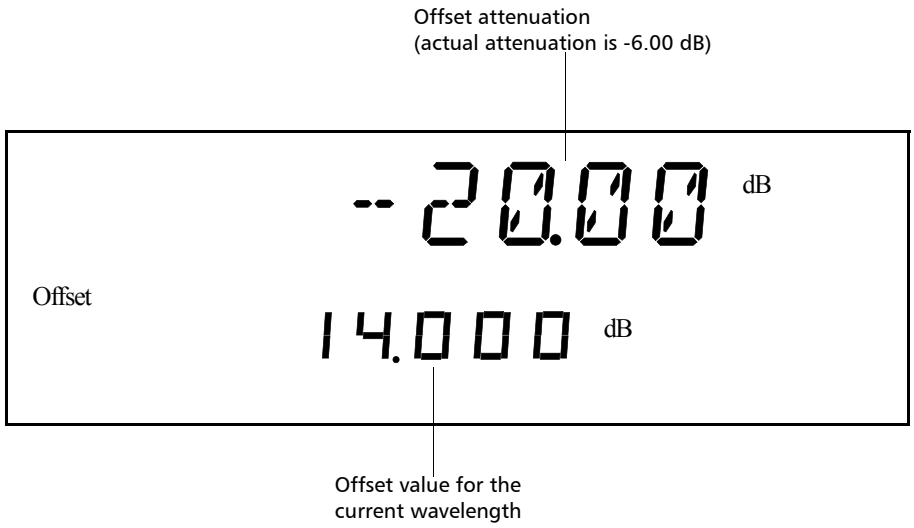
6. Once all the segments have been entered, press ENTER.
7. To exit the Setup menu, press the Setup button.

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To use the offset mode:

1. Ensure that the display is in Absolute mode (choose Abs).
2. Select the appropriate wavelength by pressing the wavelength control until you reach the desired wavelength.
3. If necessary, set an offset value.
4. Choose Offset. The display will switch to Offset mode.

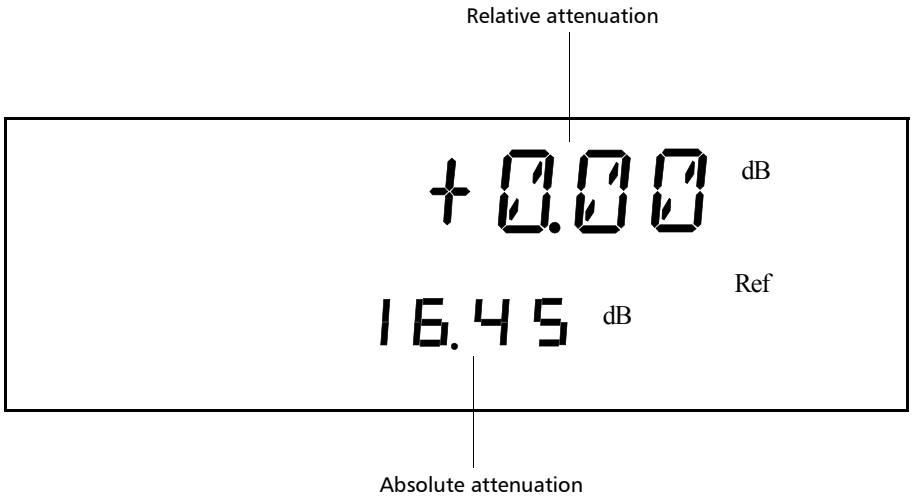
Note: *The offset value can be modified while Offset mode is active.*



Any value within the attenuation range may be selected as the reference. When Reference mode is enabled (by choosing Ref),

- the current absolute attenuation setting becomes the reference value and appears in the lower portion of the display; and
- **0.00 dB** (relative attenuation) is displayed in the upper portion of the display.

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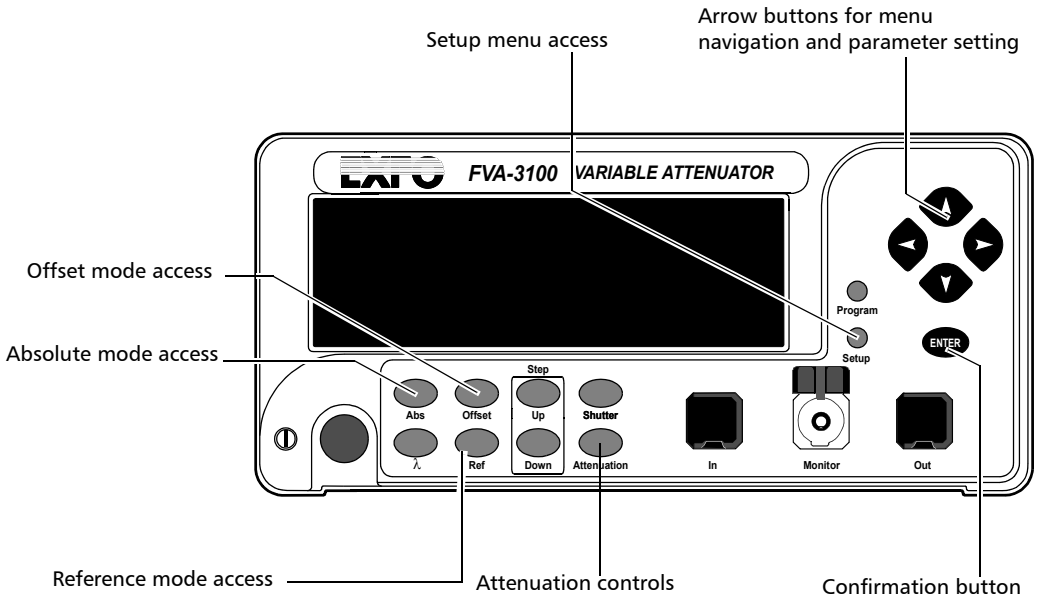


If the attenuation is increased by 1.0 dB, the upper digits (relative attenuation) will display **-1.00 dB** and the lower digits (absolute attenuation) will indicate **-17.45 dB**.

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To use the Reference mode:

1. Ensure that the display is in Absolute mode (choose Abs).



2. Select the appropriate wavelength.

3. Set the attenuation to the desired reference value.

4. Press Ref. The display will switch to Reference mode.

Note: *Pressing* Ref *with the Reference mode already active will reset the reference value to the current absolute attenuation setting.*

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Saving and Recalling a Configuration

Once the Variable Attenuator has been customized for a specific application or user, it is possible to save the configuration. Saved parameters are

- current wavelength and attenuation
- display mode
- step size
- shortlisted wavelengths
- each wavelength offset
- GPIB address
- programmed attenuation routine settings

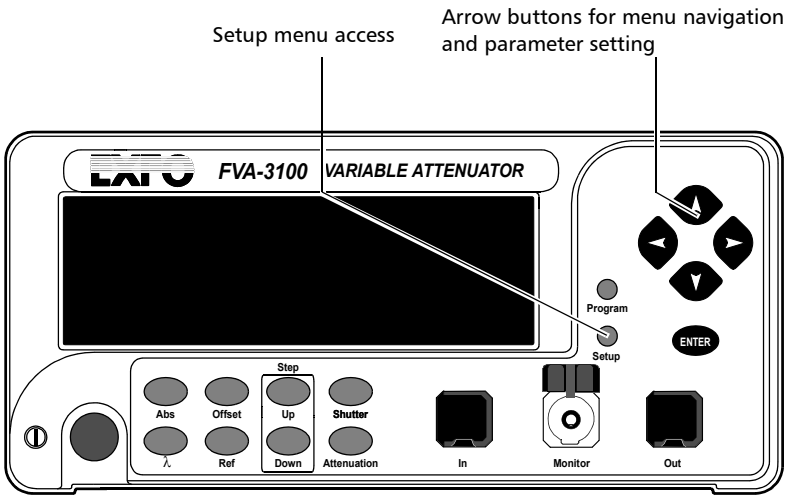
Up to ten configurations can be saved and recalled.

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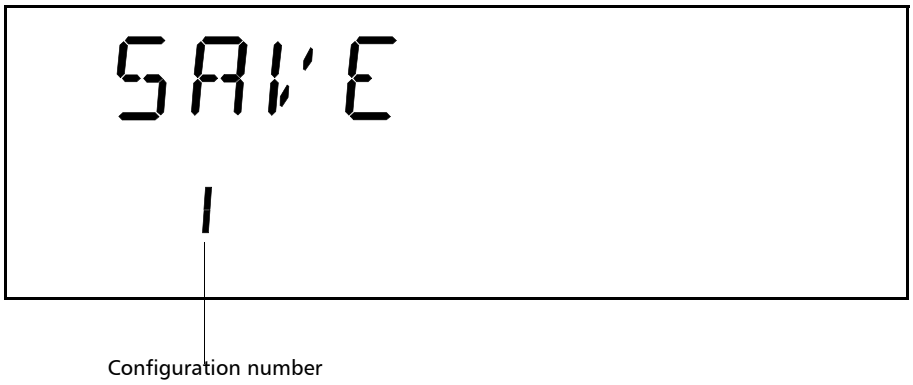
To save a configuration:

1. Customize the Variable Attenuator as required.

2. Press the Setup button.



3. Press the left/right arrows until **SAVE is displayed**.



4. Press ENTER. The configuration number will start flashing.

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5. Press the up/down arrows to modify the configuration number.

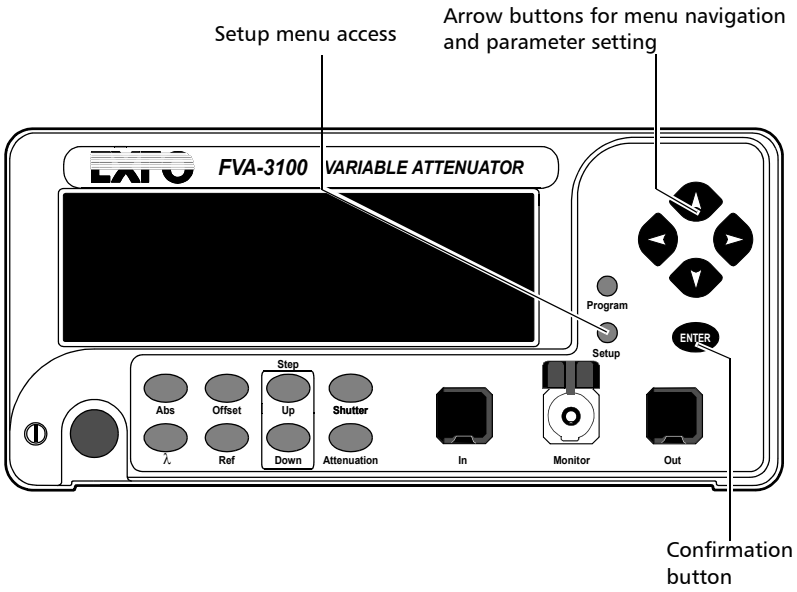
6. Press ENTER.

7. Press on the Setup button to exit the menu.

Once you have saved a configuration (see *Saving and Recalling a Configuration* on page 35), you can recall it at any time.

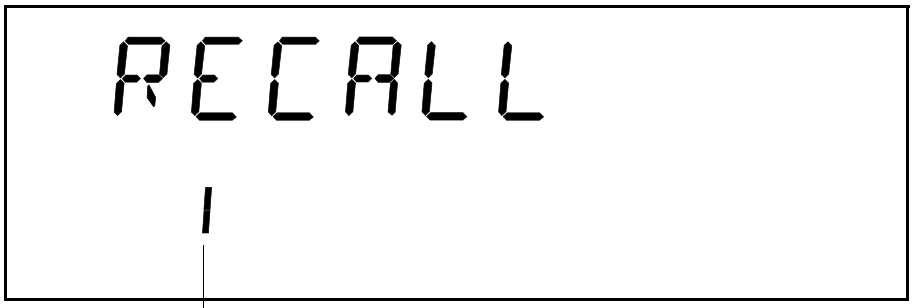
To recall a configuration:

1. Press on the Setup button.



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2. Press the left/right arrows until **RECALL** is displayed.



3. Press ENTER. The configuration number (bottom of the screen) will start flashing.
4. Use the up/down arrows to select the number of the configuration you want to recall.
5. Press ENTER.
6. To exit the Setup menu, press on the Setup button.

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5 Operating Your Variable Attenuator

Connecting Optical Fibers

IMPORTANT

To ensure maximum output power and to avoid erroneous readings, always clean fiber ends as explained below before inserting them into the port.

To connect the fiber-optic cable to the port:

1. Clean the fiber ends as follows:

   1a. Gently wipe the fiber end with a lint-free swab dipped in isopropyl alcohol.

   1b. Use compressed air to dry completely.

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

3. Push the connector in so that the fiber-optic cable is firmly in place, thus ensuring adequate contact.

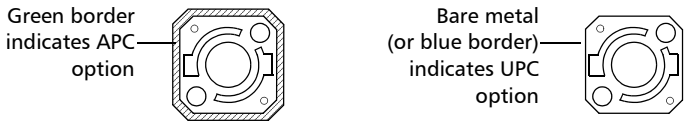
   If your connector features a screwsleeve, tighten the connector enough to firmly maintain the fiber in place. Do not overtighten, as this will damage the fiber and the port.

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

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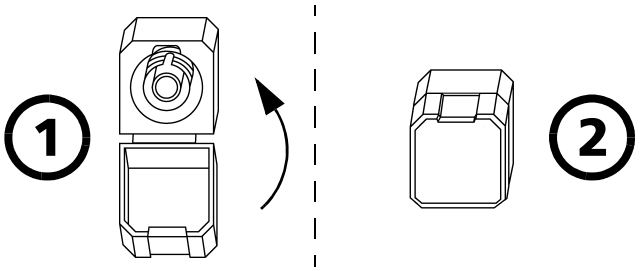
Installing the EXFO Universal Interface (EUI)

The EUI fixed baseplate is available for connectors with angled (APC) or non-angled (UPC) polishing. A green border around the baseplate indicates that it is for APC-type connectors, as shown below:



To install an EUI connector adapter onto the EUI baseplate:

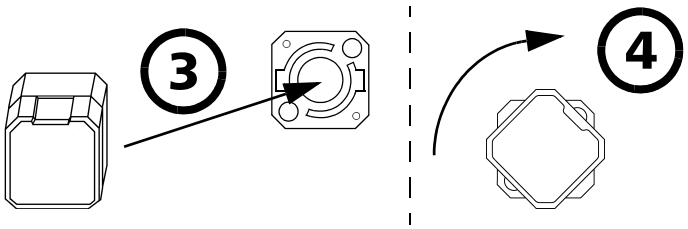
1. Hold the EUI connector adapter so the dust cap opens downwards.



2. Close the dust cap in order to hold the connector adapter more firmly.

3. Insert the connector adapter into the baseplate.

4. Turn the connector adapter clockwise on the baseplate to lock it in place.



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Performing an Attenuation Routine

You can program the FVA-3100 Variable Attenuator to perform an attenuation routine. Once the routine is started, the variable attenuator will automatically increase or decrease the inserted attenuation (by steps), return to the initial attenuation state, and perform the routine again until you stop it. The following parameters may be set:

- delay: the beginning of the attenuation routine may be delayed by up to 999 hours, 59 minutes and 59 seconds.
- duration: the variable attenuator can remain up to 999 hours, 59 minutes and 59 seconds at each attenuation step.
- number of steps: the attenuation routine may comprise up to 99 steps.
- attenuation difference between two steps: the difference in attenuation between two steps may be up to 99.999 dB.

Note: *Once set, the routine parameters remain in memory until new ones are entered.*

The following example shows how parameters are set up, as well as how an attenuation routine works.

If you start an attenuation routine with the following settings,

- Delay: 5 minutes,
- Duration: 10 seconds,
- Number of steps: 3,
- Attenuation difference between each step: –1 dB, and
- Initial attenuation state: –10 dB,

the Variable Attenuator will

- Wait five minutes before starting the routine,
- Remain at –10 dB attenuation for 10 seconds (step 0),

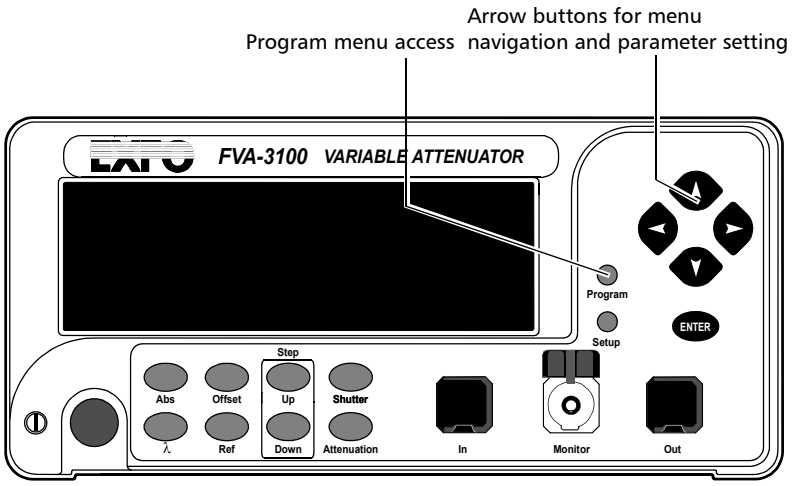
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- Switch to –11 dB attenuation for 10 seconds (step 1),
- Switch to –12 dB attenuation for 10 seconds (step 2),
- Switch to –13 dB attenuation for 10 seconds (step 3), and
- Return to the initial attenuation state (-10 dB) for 10 seconds (step 0) and repeat the routine until you stop it.

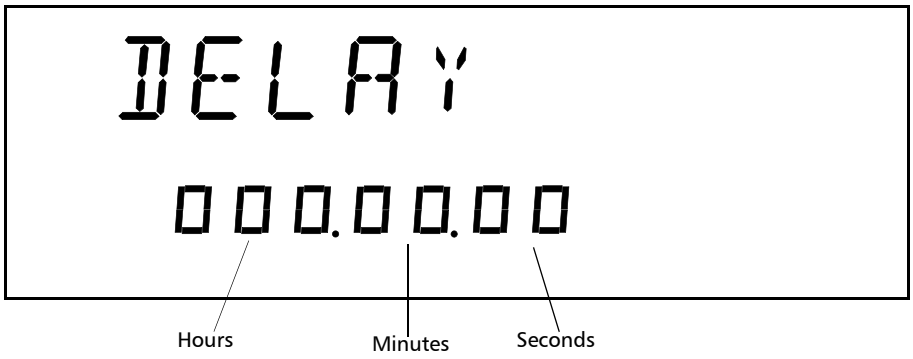
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To program the attenuation routine:

1. Press on the Program button.

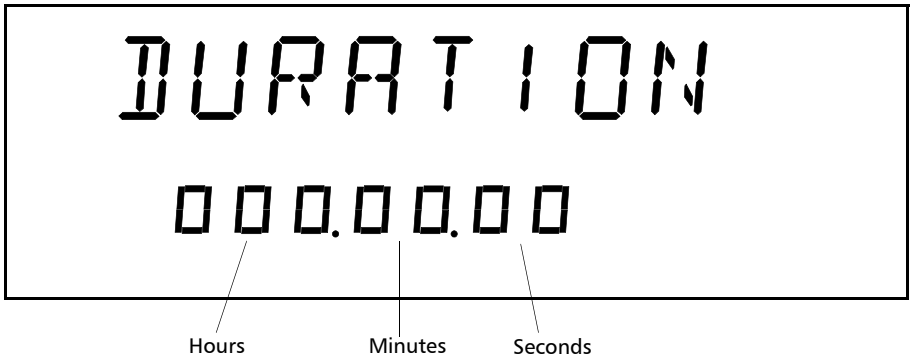


2. Press ENTER. The first digit will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

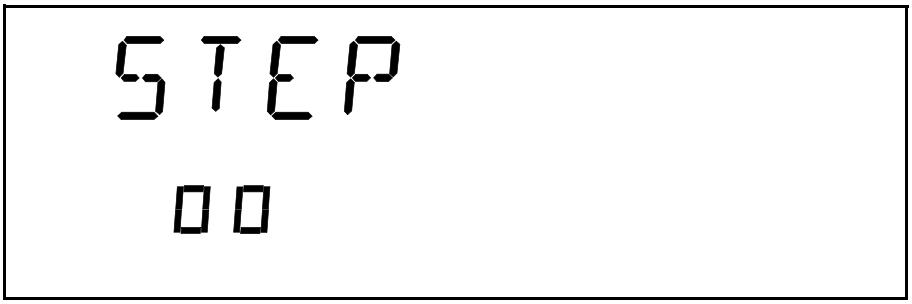


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3. If you do not want the routine to be delayed, leave the delay at 000.00.00.
4. Once the delay is set, press ENTER.



5. Select the duration (time for which the Variable Attenuator will remain at each step). Press the right arrow.
6. Press ENTER. The first digit will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.
7. Once the duration is set, press ENTER.
8. Press the right arrow. You will see the following display.

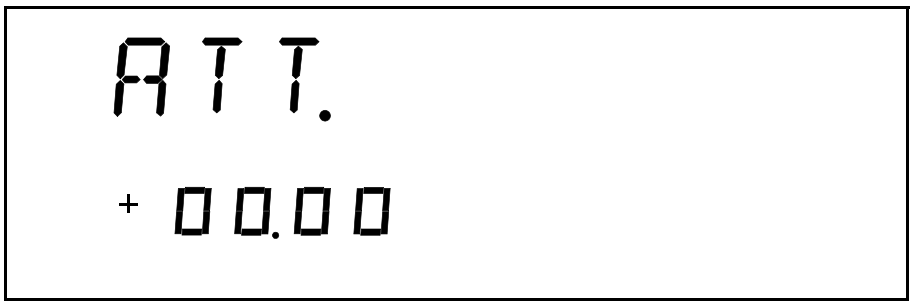


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9. Press ENTER. The first digit will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

10. Once the number of steps is set, press ENTER.

11. Press the right arrow. To set the attenuation difference between the steps.



12. Press ENTER. The first segment will start flashing. Use the up/down arrows to change the flashing digit and the left/right arrows to activate the next digit.

Note: *Entering a negative value will increase the attenuation (in absolute value) during the routine. Entering a positive value will decrease it.*

13. Once the step size is set, press ENTER.

Note: *The optical resolution of the singlemode Variable Attenuator is 0.005 dB. When you set the attenuation step size, the third digit after the decimal point must be 5; if not, the new attenuation step size will be rejected.*

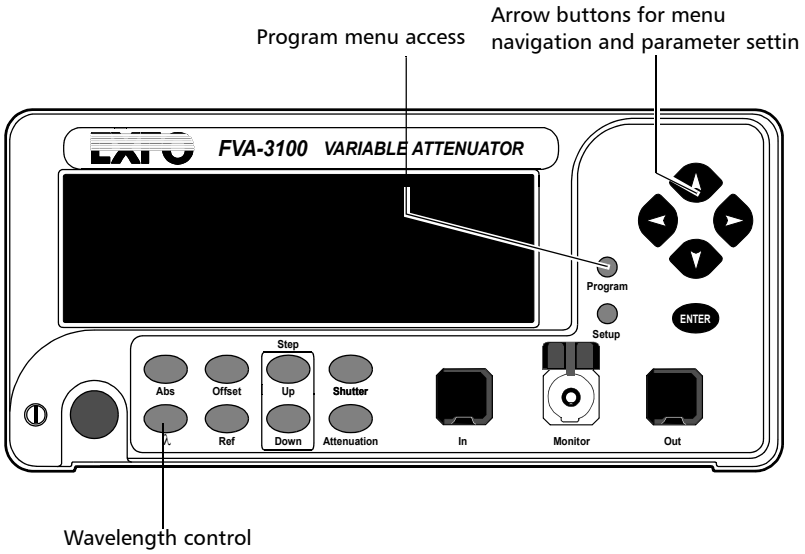
14. Press on the Program button to exit the menu.

Note: *The initial attenuation state counts as a step.*

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To start a routine:

1. Set the wavelength by pressing the wavelength control until you reach the desired wavelength.
2. Set the Variable Attenuator to the initial attenuation.
3. Press Program.



4. Press left/right arrows until **START** is displayed.
5. Press ENTER. **Program**, in the lower left portion of the display, indicates that an attenuation routine is in progress.

Note: *During a program, if the attenuation reaches the limit of the attenuation range, it will remain set at this value until the routine is completed.*

Once you have started the routine, the display goes back to the current attenuation mode display.

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To know...	perform the following steps
how much time is left in the delay	Press Program Press the left/right arrows until **DELAY** is displayed.
how much time is left in the current step	Press Program Press the left/rigth arrows until **DURATION** is displayed.
how many steps are left in the current routine	Press Program Press the left/rigth arrows until **STEP** is displayed.

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To stop the attenuation routine:

1. Press Program.
2. Press the left/right arrows until **STOP** is displayed.
3. Press ENTER.

The routine completes the current attenuation step, then stops (Program disappears from the display).

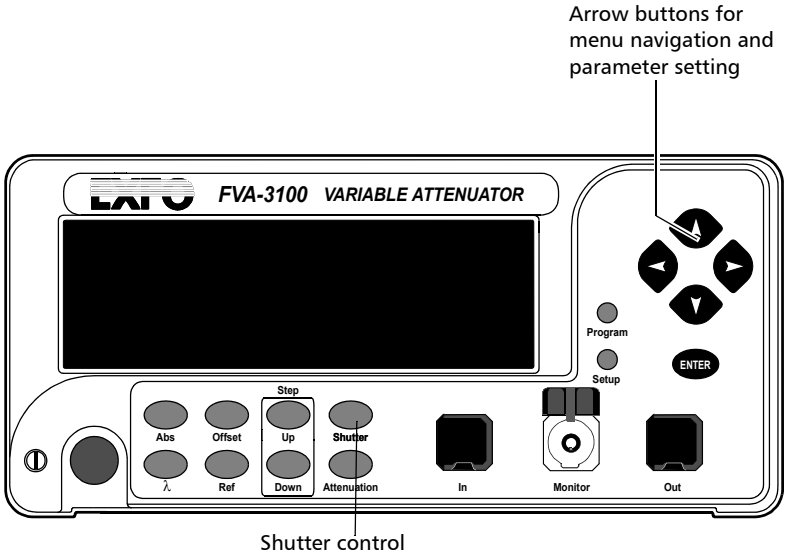
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Operating the Shutter

The optical shutter is an electro-mechanical device which, when activated, totally blocks light transmission.

To block light transmission:

Use the Shutter button to turn the shutter on or off. When the shutter is activated, **Shutter On** appears in the lower right portion of the display.



CAUTION

Using the shutter continuously at a rate of one cycle per three seconds may damage the instrument permanently or seriously reduce its life cycle.

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6 Controlling Your Variable Attenuator Remotely

The FVA-3100 Variable Attenuator can be remotely controlled either by

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

The commands used in both protocols are the same and are described in the following pages. When the Variable Attenuator is being remotely controlled, **Remote** appears in the lower left corner of the display.

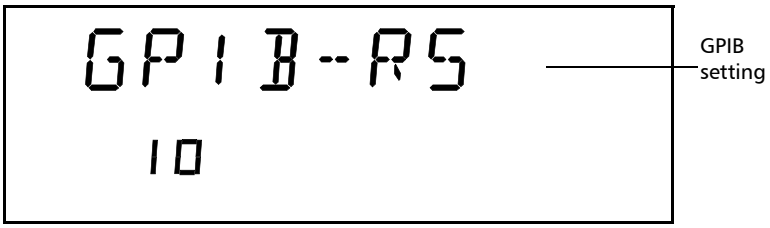
Note: *If you have already designed a GPIB program to control an attenuator from EXFO's IQ Series (IQS-3100), you can reuse sections for the FVA-3100.*

Setting Up the Variable Attenuator for Remote Control

To remotely control the Variable Attenuator, you need to set a GPIB address or activate the RS-232 port from the FVA-3100 front panel.

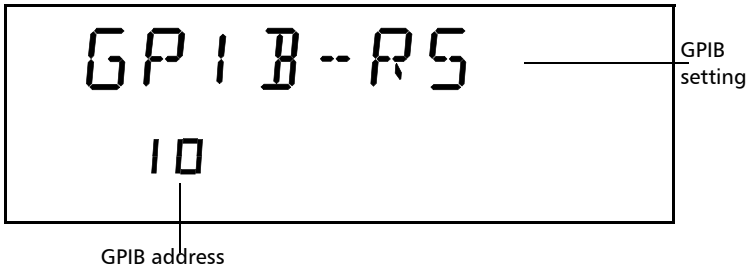
To set up the variable attenuator for remote:

1. Press Setup.
2. Use the left/right arrows to select **GPIB-RS**.

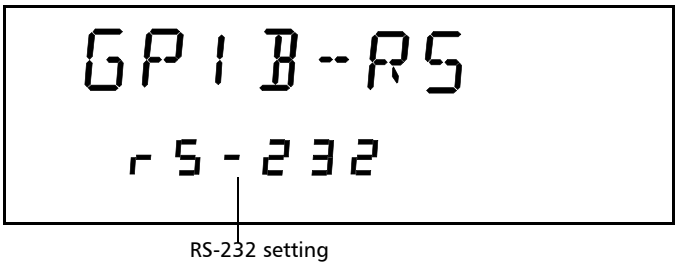


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To select remote command mode:



1. If you have select **GPIB-RS** as a command mode, you only need to set the address.
2. If you want to select the **RS-232** mode, press ENTER.

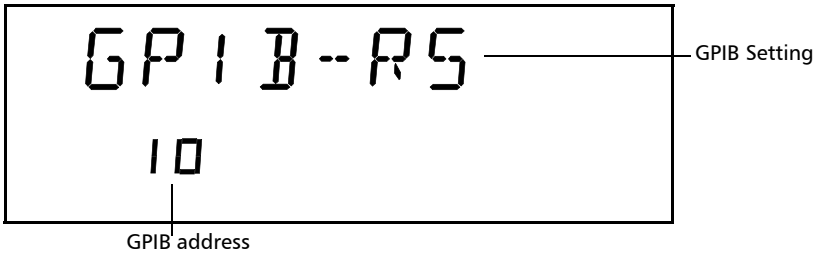


3. Use the up and down arrows to reach **RS-232** (before setting GPIB address 1 or GPIB address 30)
4. Press ENTER.
5. To exit the Setup menu, press the Setup button.

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To select a GPIB address:

1. Once you selected GPIB as a command mode, you can set the GPIB address you want.
2. Press ENTER. The bottom part of the displays will start flashing.
3. Using the up and down arrows, select the GPIB address you want.



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Communication Parameters

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

For GPIB Communication	
Terminate Read on EOS	Yes
Set EOI with EOS on Writes	Yes
Type of comparison on EOS	8-bits
EOS byte	0Ah
Sends EOI at end of Writes	Yes
GPIB primary address	10
GPIB secondary address	None

For RS-232 Communication	
EOS bytes	0Ah
Baud rate	9600 bps
Parity	None
Data bits	8 bits
Stop bits	1 bits
Flow control	None
Activation	see *Setting Up the Variable Attenuator for Remote Control* on page 51

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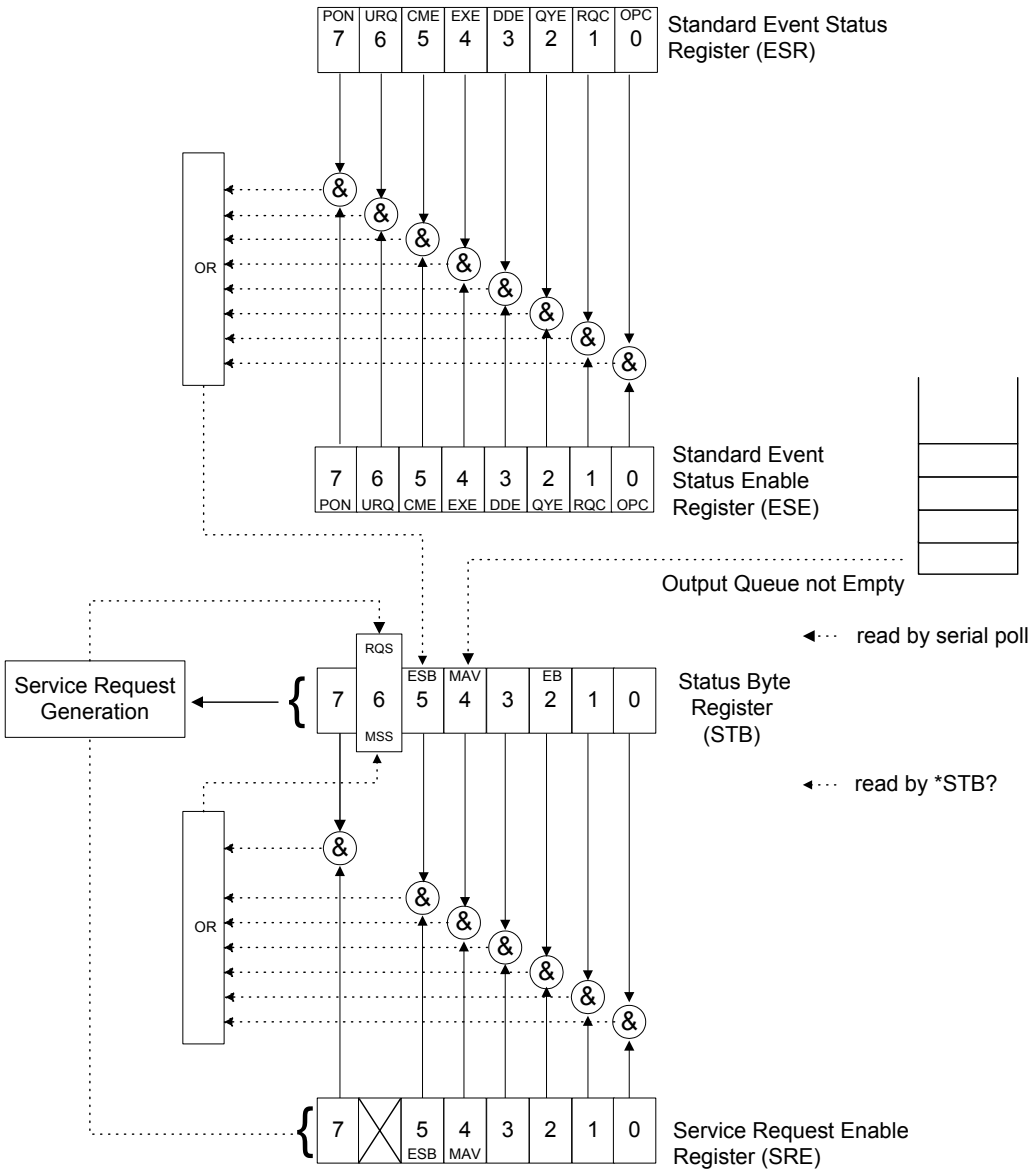
Standard Status Data Structure

The following page illustrates the four common status and enable registers as defined by IEEE 488.2. This diagram is a useful aid in understanding the general commands and how a service request (SRQ) is generated. The four registers are:

- Standard Event Status Register (ESR)
- Standard Event Status Enable Register (ESE)
- Status Byte Register (STB)
- Service Request Enable Register (SRE)

Bit	ESR	ESE	STB	SRE
0	Operation Complete	Operation Complete	Source Status	Source Status
1	Request Control	Request Control		
2	Query Error	Query Error	Error Bit	
3	Device-Dependent Error	Device-Dependent Error	Questionable Status	Questionable Status
4	Execution Error	Execution Error	Event Status Bit	Event Status Bit
5	Command Error	Command Error	Message Available	Message Available
6	User Request	User Request	Master Summary Status	Request Service/Master Summary Status
7	Power On	Power On	Operation Status	Operation Status

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An SRQ is forced when a bit is set in the STB and at the same time the corresponding SRE bit is set. When the SRQ is generated, the RQS bit is set to 1 and remains set until read by a serial poll. Once the RQS is read, it returns to 0.

Command Structure

The GPIB and RS-232 commands follow the guidelines determined by the Standard Commands for Programmable Interface (SCPI) consortium. For example, the command syntax

OUTP[:STAT]<wsp><boolean>

is used to control the FVA-3100 shutter.

In this particular example,

- OUTP identifies that the command is a part of the OUTPut subset of commands;
- STAT is a keyword that defines the function of the command;
- [ ] indicates that a keyword or a parameter is optional;
- <wsp> indicates that a space is required and
- <boolean> is the command parameter.

All keywords must be UPPERCASE characters separated by a colon. A typical command would be

OUTP:STAT 1

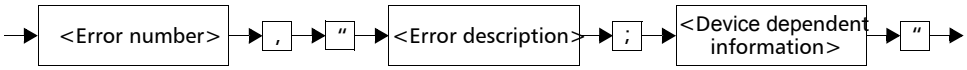
This command instructs the Variable Attenuator to optically open the shutter.

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

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Error Messages

System and device-specific errors are managed by the FVA-3100 Variable Attenuator. The generic format for error messages is illustrated in the following figure.



As shown in the above figure, the message contains three parts: the error number, error description, and device-dependent information. All error messages are stacked in a FIFO buffer. When there is at least one message in the buffer, bit 2 of the Status Byte Register is set to 1. Use the SYST:ERR?, ERR?, or LERR? command to read the most recent message. The error message buffer is initialized when starting the Variable Attenuator, when executing the *CLS command, or by reading the last message stored in the buffer.

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SCPI Management Errors (System Errors)

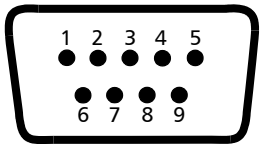
Error Number	Description	Probable Cause
–100	“Command Error.”	An error occurred while validating a command.
–101	“Undefined Header.”	Unknown command.
–102	“Missing Parameter.”	A command parameter is missing.
–103	“Parameter Not Allowed.”	An extra parameter is present.
–104	“Data Type Error.”	Invalid parameter format.
–200	“Execution Error.”	An error occurred while executing a command.
–300	“Device Dependent Error.”	A command has taken longer than expected to complete execution.
–300	“Invalid Attenuation.”	A command has attempted to set the internal attenuation to an invalid value.
–300	“Invalid Offset.”	The reference value parameter entered is out of range.
–300	“Program Running.”	A command that will halt the currently running program has been received, or an attempt has been made to override a program setting.
–300	“Invalid Wavelength.”	The entered wavelength parameter is out of range.
–300	“Invalid Delay Time.”	The entered delay parameter is out of range.
–300	“Invalid Duration Time.”	The entered duration time parameter is out of range.

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Error Number	Description	Probable Cause
–300	"Invalid Program Step."	The entered program step parameter is out of range.
–300	"Invalid Program Attenuation."	The entered program attenuation parameter is out of range.
–400	"Query Error."	An error occurred while accessing the output queue.
–500	"System Error."	System is out of memory.

RS-232 Connector Pinout

The RS-232 connector (serial port) at the back of the Variable Attenuator uses a DTE pinout configuration.



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

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7 Maintenance

To help ensure long, trouble-free operation:

- Keep the unit free of dust.
- Clean the unit casing with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately and let the unit dry completely.

WARNING

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

Cleaning the Front Panel

Clean the front panel of the FVA-3100 Variable Attenuator regularly to avoid buildup of dust, dirt, and other foreign substances.

To clean the front panel:

1. Gently wipe the front panel with a cloth dampened with soapy water.
2. Rinse the front panel with a cloth 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 Connectors Equipped with EUI/EUA Adapters

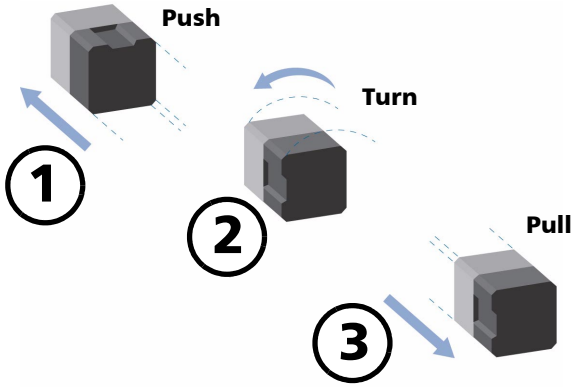
Regular cleaning of connectors equipped with EUI/EUA adapters will help maintain optimum performance. There is no need to disassemble the unit.

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.

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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.

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

5. Throw out the wiping cloths after one use.

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

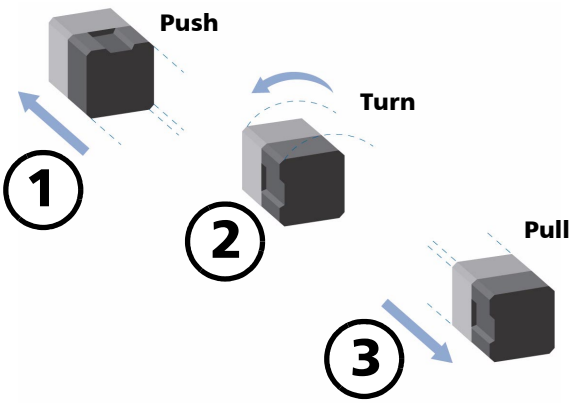
WARNING

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.

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To clean EUI/EUA adapters:

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



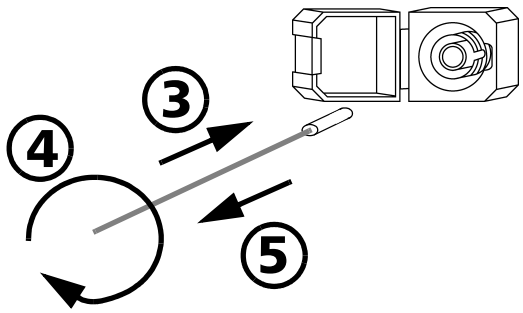
2. Moisten a cleaning tip (2.5 mm tip) provided by EXFO with *only one drop* of isopropyl alcohol.

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

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

7. Throw out the cleaning tips after one use.

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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.

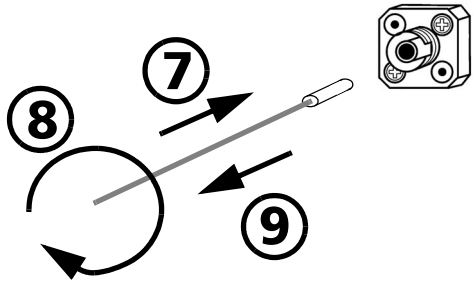
4. With a dry lint-free wiping cloth, gently wipe the same surfaces three times with a rotating movement.
5. Throw out the wiping cloths after one use.
6. Moisten a cleaning tip (2.5 mm tip) provided by EXFO with *only one drop* of isopropyl alcohol.

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IMPORTANT

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

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



8. Gently turn the cleaning tip one full turn.

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

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

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

11. Throw out the cleaning tips after one use.

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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 installing 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.

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Recalibrating the Unit

If a calibration due date was not indicated by EXFO on the calibration label, this means that the calibration certificate for your FVA-3100 Variable Attenuator has been modified in conformity with the ISO/IEC 17025 Standard.

EXFO recommends that an annual calibration be performed on your FVA-3100 Variable 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.

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8 Troubleshooting

Finding Information on the EXFO Web Site

The EXFO Web site provides answers to frequently asked questions (FAQs) regarding the use of your XX FTB-400 Universal Test System XX.

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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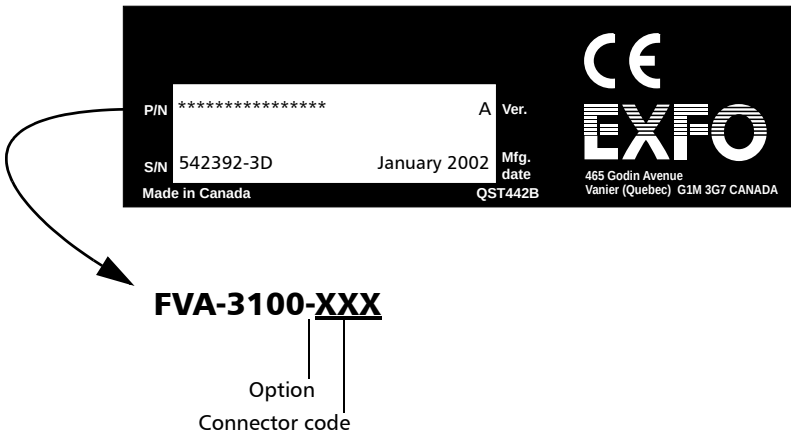
Contacting the Technical Support Group

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.



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Transportation

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

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

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9 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.

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Liability

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

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

Exclusions

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

Certification

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

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Service and Repairs

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

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 78). Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.
3. If the unit has an internal storage device, perform a data backup 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 to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, 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.

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EXFO Service Centers Worldwide

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

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

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

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

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

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

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

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

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

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

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

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A Technical Specifications

Electrical and Environmental Specifications	
Operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Relative humidity[a]	0 % to 80 % non-condensing
Maximum operation altitude	2000 m (6562 ft)
Pollution degree	2
Installation category	II
Power supply rating[b]	100 V to 240 V (50 Hz/60 Hz)
	maximum 2 A

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

Note: *The FVA-3100 Variable Attenuator is intended for indoor use only.*

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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*.

General Specifications[1]

Models	FVA-3100-B	FVA-3100-BM	FVA-3100-BW	FVA-3100-BWM
Fiber type (µm)	9/125	9/125	9/125	9/125
Wavelength range[2] (nm)	1200 to 1650	1270 to 1350 1510 to 1590	1200 to 1650	1270 to 1350 1510 to 1590
Wavelength resolution (nm)	0.1	0.1	0.1	0.1
Max. attenuation (dB)	≥ 100 (1200 nm to 1350 nm) ≥ 80 (1350 nm to 1600 nm) ≥70 (1600 nm to 1650 nm)	≥ 100 (1270 nm to 1350 nm) ≥ 80 (1510 nm to 1590 nm)	≥ 75 (1200 nm to 1400 nm) ≥ 70 (1400 nm to 1600 nm) ≥ 65 (1600 nm to 1650 nm)	≥ 75 (1270 nm to 1350 nm) ≥ 70 (1510 nm to 1590 nm)
Insertion loss[3,4] (dB)				
Typical	1.5	3.0	1.5	2.0
Maximum	1.8	3.3	1.8	3.0
Resolution (dB)	0.005	0.005	0.005	0.005
Linearity[5] (dB)	± 0.1	± 0.1	± 0.1	± 0.1
Spectral uniformity[6] (dB)				
≤ 20 dB	-	-	± 0.1	± 0.1
≤ 40 dB	-	-	± 0.25	± 0.25
≤ 50 dB	-	-	± 0.35	± 0.35
Max. repeatability (dB)	± 0.03	± 0.03	± 0.03	± 0.03
Typ. return loss[5,7] (dB)	≥ 55	≥ 50	≥ 50	≥ 50
Max. input power[8] (dBm)	25	25	25	25
Max. PDL[9] (dB)				
for a 20 dB attenuation	0.2	0.2	0.2	0.2
for a 50 dB attenuation	0.2	0.2	0.3	0.3
Shutter isolation (dB)	> 100	> 100	> 100	> 100
Typ. Monitor output (dB)	-	14.5	-	14.5

Models	FVA-3100-C	FVA-3100-D	FVA-3100-DM	FVA-3100-E
Fiber type (µm)	50/125	62.5/125	62.5/125	100/140
Wavelength range[2] (nm)	700 to 1350	700 to 1350	700 to 1350	700 to 1350
Wavelength resolution (nm)	0.1	0.1	0.1	0.1
Max. attenuation (dB)	≥ 100 (700 nm to 1000 nm) ≥ 65 (1000 nm to 1350 nm)	≥ 100 (700 nm to 1000 nm) ≥ 65 (1000 nm to 1350 nm)	≥ 100 (700 nm to 1000 nm) ≥ 65 (1000 nm to 1350 nm)	≥ 100 (700 nm to 1000 nm) ≥ 65 (1000 nm to 1350 nm)
Insertion loss[3,4] (dB)				
Typical	1.5	1.5	3.0	1.5
Maximum	2.0	2.0	4.5	2.0
Resolution (dB)	0.01	0.01	0.01	0.01
Linearity[5] (dB)	± 0.1	± 0.1	± 0.12	± 0.1
Max. repeatability (dB)	± 0.03	± 0.03	± 0.03	± 0.03
Typ. return loss[7] (dB)	≥ 25	≥ 25	≥ 25	≥ 25
Max. intput power[8] (dBm)	25	25	25	25
Shutter isolation (dB)	> 100	> 100	> 100	> 100
Typ. monitor output (dB)	-	-	13	-

Notes

1. At 23 ° C ± 2 °C.
2. Calibrated at 1310 nm and 1550 nm for singlemode fiber; calibrated at 1300 nm for multimode fiber.
3. Measured at 1310 nm and 1550 nm for singlemode fiber; measured at 1300 nm for multimode fiber. The insertion loss is dependent on the input numerical aperture.
4. Measured with FC/UPC connectors for singlemode fiber and FC/PC for multimode fiber.
5. Using a light source with 0.002 dB stability for a 15-minute period (source accuracy of ± 0.5 nm), non-polarized light, at a calibrated wavelength and an attenuation of up to 60 dB.
6. Measured between 1520 nm and 1570 nm.
7. The return loss is limited by the return loss of the connectors. The connectors used are FC/APC for the IQ-3100-B and IQ-3100-BM, FC/UPC for the IQ-3100-BW and the IQ-3100-BWM, and FC/PC for multimode fiber.
8. Input power above this limit may damage the unit. The linearity may be higher than specified.
9. Peak-to-peak value. Measured at 1550 nm.

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B Remote Control Commands

IEEE 488.2 Required Commands

The Variable Attenuator recognizes the main commands identified in IEEE-488.2. These commands are fully explained on the following pages.

Command	Function
*CLS	Clear status command
*ESE	Standard event status enable command
*ESE?	Standard event status enable query
*ESR?	Standard event status register query
*IDN?	Identification query
*OPC	Operation complete command
*OPC?	Operation complete query
*RST	Reset command
*SRE	Service request enable command
*SRE?	Service request enable query
*STB?	Read status byte query
*TRG	Trigger command
*TST?	Self-test query
*WAI	Wait to continue command

The commands are fully explained in the following pages.

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*CLS

Description	This command sets the contents of the Standard Event Register (ESR), the Status Byte Register (STB), and the Error Queue (ERR) to zero. This command is commonly used to clear the status registers before enabling SRQ. Note that the output queue, Standard Event Status Enable Register (ESE), and Service Request Enable Register (SRE) are not affected.
Syntax	*CLS
Note	The CLR command is equivalent to the *CLS command. Both give the same result.

*ESE

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

*ESE?

Description	This query reads the contents of the Event Status Register.
Syntax	*ESE?
Response	Binary integer with a value between 0 and 255.

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*ESR?

Description	This query reads the contents of the Standard Event Register.
Syntax	*ESR?
Response	Binary integer with a value between 0 and 255.

*IDN?

Description	This query reads the FVA-3100 identification string.
Syntax	*IDN?
Response	“EXFO E.O. Engineering FVA-3100 Vxx.xx”, where xx.xx is the current product version.
Note	The SYST:VERS? and IDN? commands are equivalent to the *IDN? command. They give the same result.

*OPC

Description	This command causes the FVA-3100 to generate the operation complete message in the Standard Event Status Register (ESR) when all pending selected FVA-3100 operations have been finished.
Syntax	*OPC
Example	*OPC,*IDN?

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*OPC?

Description	This query puts an ASCII 1 in the output queue when the contents of the input queue has been processed.
Syntax	*OPC?
Response	"1"
Note	The OPC? command is equivalent to the *OPC? command. Both give the same result.

*RST

Description	This command empties the step response list. It is only seen when it is part of another multiple command. In the example below, by adding this command after *IDN?, you will not be able to access the answer. The *RST, in this instance, erases the identification string. In addition, this command performs the following operations: ➤ Returns to initial state before command is sent, and not necessarily to previous settings. ➤ Forces the device to enter into an Operation Complete Command Idle State (OCIS). ➤ Forces the device to enter into an Operation Complete Query Active State (OQIS). ➤ Initializes previous responses unless there has been a program message terminator preceded by an *RST.
Syntax	*RST
Example	*IDN?,*RST<NL>

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*SRE

Description	This command sets bits in the Service Request Enable Register (default value is 255) and enables the corresponding bit in the Status Register. The command can be used to select which events can initiate a service request.
Syntax	*SRE<wsp><value>
Parameter	The <value> parameter must be between 0 and 255.

*SRE?

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

*STB?

Description	This query returns the contents of the Status Byte Register.
Syntax	*STB?
Response	A binary integer between 0 and 255.
Note	The STB? command is equivalent to the *STB? command. Both give the same result.

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*TRG

Description	This command will trigger any event that was suspended and is waiting for a trigger.
Syntax	*TRG
Parameters	None
Note	This command has no effect on the FVA-3100.

*TST?

Description	This query initiates an internal self-test and returns a binary value indicating the results of the test.
Syntax	*TST?
Response	A binary value “0” if the test is completed without error “1” if the test is completed with errors

*WAI

Description	This command prevents the FVA-3100 from processing any further commands until the No-Operation-Pending Flag is set. All pending operations must be complete before processing another command.
Syntax	*WAI
Parameters	None
Note	This command has no effect on the FVA-3100.

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The FVA-3100 Variable Attenuator also recognizes commands that can only be used with RS-232 communication. These commands are summarized below.

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

*LOK

Description This command is used to lock and unlock the FVA-3100 keypad. Once the FVA-3100 keypad is locked, no external input can interfere with the GPIB communication. The only way to unlock the keypad is to use the *LOK command again or turn off the unit.

Syntax *LOK <wsp><data>

Parameters The <data> parameter can be “1” to lock the keypad or “0” to unlock the keypad.

Example *LOK 1

Note When the keypad is locked, the unit will beep twice if any key is pressed on the keypad. The *Remote* indicator appears in the lower left corner of the display while the unit is being controlled remotely.

This command can only be used when working with RS-232 communication.

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	*LOK?
Description	This query reads the FVA-3100 keypad lock state.
Syntax	*LOK?
Response	“1” if the FVA-3100 keypad is locked “0” if the FVA-3100 keypad is unlocked
Example	*LOK?
Note	This command can only be used when working with RS-232 communication.

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Specific commands-Quick Reference Command Tree

Command	Parameter/ Response	Description
ATT[a, b]	<±99.99 [DB] | MIN|MAX>	set attenuation
ATT?	(± 999.99)	obtain attenuation
CAL[a, b]	<±99.99>	set offset
CAL?	(± 999.99)	obtain offset
D[b]	<0|1>	activate shutter
D?	(0|1)	obtain shutter state
DISP DIMM	<LO | HI | OFF>	adjust display intensity
DIMM ?	<LO | HI | OFF>	obtain display intensity
F[a, b]	<1|2>	set fiber type
F?	(1|2)	obtain fiber type
INP ATT[a]	<±99.99 [DB] | MIN|MAX>	set attenuation
ATT?	(± 999.99)	obtain attenuation
OFFS[a]	<±999.99 [DB]>	set a reference value
DISP		set ref. to display
OFFS?	(±999.99)	read reference value
STEP	0.01<step<50	set step
CATA ?	list of available steps	obtain step list

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Command			Parameter/ Response	Description
	STEP?		0.01<step<50	obtain current step
	WAVE [a]		<9999.9 [NM]>	set wavelength
	WAVE ?		(9999.9)	obtain wavelength
OUTP	APM		<OFF|ON|0|1>	set Absolute or Reference
	APM?		(0|1)	is it in Absolute mode?
	[STAT]		<OFF|ON|0|1>	activate shutter
	[STAT]?		(0|1)	obtain shutter state
PROG	SEL	ATT	±99.99	set atten. parameter
		DELA	<999,59,59	set delay parameter
		DURA	<999,59,59	set duration parameter
		STAT	<0 | 1 | START | STOP>	control the program
		STAT?	(0|1)	obtain program state
		STEP	<100	set step parameter
WVL[a] , b			<9999.9 [NM]>	set wavelength
WVL?			(9999.9)	obtain wavelength

a. Valid parameters are determined by the type of module.
b. This command is HPIB-compatible.

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ATTenuation

Description	This command sets the attenuation to a specific value. The valid range of values depends on the configuration of the FVA-3100 and on the current wavelength. The resolution of the value is 0.005 dB for singlemode models and 0.01 dB for multimode models.
Syntax	ATT<wsp><value>[<wsp>DB]

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Parameters The <value> parameter can be

- "MIN" (to set the FVA-3100 to the minimum setting for the current wavelength)
- "MAX" (to set the FVA-3100 to the maximum setting for the current wavelength)
- a valid attenuation value followed by the units [DB]. Note that, depending on the current measurement mode, the <value> parameter takes different values.

  In Absolute mode:

  value = actual attenuation

  In Reference mode:

  value = actual attenuation – reference value (INP:OFFS?)

  In Offset mode:

  value = actual attenuation + wavelength-specific offset

  Therefore, when in Reference or Offset mode, the range of the accepted values for the <value> parameter will change according to the current reference or offset value.

Example ATT –15.35 DB

Note This command cannot be issued while a program is running. The ATT command is equivalent to the INP:ATT command. Both give the same result.

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ATTenuation?

Description This query returns a value indicating the current attenuation setting OR the minimum/maximum attenuation setting.

Syntax ATT? [<wsp><value>]

Parameters The <value> parameter is optional and can be

"MIN" to obtain the minimum setting for the current wavelength

"MAX" to obtain the maximum setting for the current wavelength

Response The attenuation value in the format "999.99". The units are dB. Note that, depending on the current measurement mode, the response will include different parameters:

In Absolute mode:

$$\text{response} = \text{actual attenuator} + \text{general offset (CAL?)}$$

In Reference mode:

$$\text{response} = \text{actual attenuation} - \text{reference value (INP:OFFS?)} + \text{general offset (CAL?)}$$

In Offset mode:

$$\text{response} = \text{actual attenuation} + \text{wavelength-specific offset} + \text{general offset}$$

Example ATT? MIN

Note The ATT? command is equivalent to the INP:ATT? command. Both give the same result.

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CAL	
Description	This command stores an offset value that will be applied to all wavelengths in Absolute, Reference, and Offset modes. This offset value will be included in the measurement returned by ATT? but will not be taken into account on the FVA-3100 display. This offset value is deleted when the FVA-3100 is turned off.
Syntax	CAL<wsp><value>[<wsp><DB>]
Parameters	The <value> parameter must be a valid attenuation value in the format "±99.999". The units (DB) are optional.
Example	CAL 99.999 DB

CAL?	
Description	This query returns the offset value that is applied to all wavelengths in Absolute, Reference, and Offset modes.
Syntax	CAL?
Response	The offset value that is applied to all wavelengths in Absolute, Reference, and Offset modes in the format "±99.999". The units are dB.
Note	This offset value is included in the measurement returned by ATT? but is not taken into account on the FVA-3100 display.
Example	CAL?

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D	
Description	This command controls the shutter, which can block optical continuity.
Syntax	D<wsp><numeric>
Parameters	The <numeric> parameter can be “0” to open the shutter “1” to close the shutter
Example	D 1
Note	This command cannot be issued while a program is running. The D command is similar to the OUTP:STAT command.

D?	
Description	This query returns the current shutter state.
Syntax	D?
Response	The shutter state in the format “0” if the shutter is optically open “1” if the shutter is optically close
Example	D?
Note	The D? command is similar to the OUTP:STAT? command.

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DISPlay:DIMMer

Description	This command is used to adjust the intensity of the FVA-3100 display (high or low) or to turn off the display without turning off the unit.
Syntax	DISP:DIMM<wsp><data>
Parameters	The <data> parameter can be “HI”, “LO”, or “OFF”.
Example	DISP:DIMM OFF
Note	When the display is turned off by this command, any key pressed on the FVA-3100 keypad will return the display to high intensity. To prevent this, lock the FVA-3100 keypad with the *LOK command.
See also	DISP:DIMM?, *LOK, and *LOK?

DISPlay:DIMMer?

Description	This query returns the intensity of the FVA-3100 display (high, low, or off).
Syntax	DISP:DIMM?
Response	“HI” if the intensity is high “LO” if the intensity is low “OFF” if the display is off
Example	DISP:DIMM?

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Fiber

Description	This command specifies the type of fiber tested (singlemode or multimode).
Syntax	F<wsp><numeric>
Parameters	The <numeric> parameter can be “1” to specify singlemode fiber “2” to specify multimode fiber
Example	F 1
Note	This command has no effect on the FVA-3100. The FVA-3100 is designed to test either singlemode or multimode fiber but not both.

Fiber?

Description	This query returns the type of fiber (singlemode or multimode) that the FVA-3100 was designed to test (no matter what fiber type was entered with the F function).
Syntax	F?
Response	The appropriate fiber type in the format “1” for singlemode fiber (FVA-3100-B) “2” for multimode fiber (FVA-3100-C, FVA-3100-D, and FVA-3100-E)
Example	F?

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INPut:ATTenuation

Description	This command sets the attenuation to a specific value. The valid range of values depends on the configuration of the FVA-3100 and on the current wavelength. The resolution of the value is 0.005 dB for singlemode models and 0.01 dB for multimode models.
Syntax	INP:ATT<wsp><value>[<wsp>DB]

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Parameters The <value> parameter can be

- "MIN" (to set the FVA-3100 to the minimum setting for the current wavelength)
- "MAX" (to set the FVA-3100 to the maximum setting for the current wavelength)
- a valid attenuation value followed by the units [DB]. Note that, depending on the current measurement mode, the <value> parameter takes different values.

  In Absolute mode:

  $$\text{value} = \text{actual attenuation}$$

  In Reference mode:

  $$\text{value} = \text{actual attenuation} - \text{reference value(INP:OFFS?)}$$

  In Offset mode:

  $$\text{value} = \text{actual attenuation} + \text{wavelength-specific offset}$$

  Therefore, when in Reference or Offset mode, the range of the accepted values for the <value> parameter will change according to the current reference or offset value.

Example INP:ATT -15.35 DB

Note This command cannot be issued while a program is running. The ATT command is equivalent to the INP:ATT command. Both give the same result.

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INPut:ATTenuation?

Description This query returns a value indicating the current attenuation setting OR the minimum/maximum attenuation setting.

Syntax INP:ATT? [<wsp><value>]

Parameters The <value> parameter is optional and can be

"MIN" to obtain the minimum setting for the current wavelength

"MAX" to obtain the maximum setting for the current wavelength

Response The attenuation value in the format "999.99". The units are dB. Note that, depending on the current measurement mode, the response will include different parameters:

In Absolute mode:

response = actual attenuation

In Reference mode:

response = actual attenuation – reference value(INP:OFFS?)

In Offset mode:

response = actual attenuation + wavelength-specific offset

Example INP:ATT? MIN or

INP:ATT?

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INPut:OFFSet

Description	This command stores a reference value for the current wavelength and sets the FVA-3100 to Reference mode. In Reference mode, the displayed attenuation is relative to this reference value. A different reference value must be stored for every wavelength. The reference values remain in memory until they are overwritten.
Syntax	INP:OFFS<wsp><value>[<wsp>DB]
Parameters	The <value> parameter must be a valid attenuation value followed by the (optional) units (dB).
Example	INP:OFFS 99.99 DB
Note	This command cannot be issued while a program is running.

INPut:OFFSet:DISPlay

Description	This command sets the reference value (for the current wavelength) to the current absolute attenuation setting and sets the FVA-3100 to Reference mode. In Reference mode, the displayed attenuation is relative to the reference. A different reference value must be stored for every wavelength. The reference values remain in memory until they are overwritten.
Syntax	INP:OFFS:DISP
Parameters	N/A
Example	INP:OFFS:DISP
Note	This command cannot be issued while a program is running.

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INPut:OFFSet?

Description	This query returns the current reference value for the current wavelength.
Syntax	INP:OFFS?
Response	The current reference in the format “999.999”. The units are dB.
Example	INP:OFFS?

INPut:STEP

Description	This command is used to set the size of the step between two attenuation settings. Use the INP:STEP:CATA? query to obtain the list of available step sizes. If the requested step is not available, the FVA-3100 is set to the next available step. If the requested step is greater than the maximum available step, the FVA-3100 is set to the maximum available step.
Syntax	INP:STEP<wsp><step>[<wsp>dB]
Parameters	The <step> parameter is the requested step size. The unit of measurement (dB) is optional.
Example	INP:STEP 0.1
Note	This command cannot be issued while a program is running.

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INPut:STEP?

Description	This command is used to obtain the current step size between two attenuation settings.
Syntax	INP:STEP?
Response	The current step size in the format “0.02”.
Example	INP:STEP?

INPut:STEP:CATAlog?

Description	This query returns the list of available step sizes between two attenuation settings. Use this command to determine the maximum resolution of the attenuation or reflection setting.
Syntax	INP:STEP:CATA?
Response	The list of available steps. The steps are divided by “;” and the units are dB. For example: 0.01;0.02;0.05;0.1;1;2;5;10;20;50
Example	INP:STEP:CATA?

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INPut:WAVElength

Description	This command selects a specific calibrated wavelength. The wavelength range depends on the type and configuration of the FVA-3100.
Syntax	INP:WAVE<wsp><numeric_value>[<wsp><NM>]
Parameters	The <numeric_value> parameter is the actual wavelength in the format “9999.9 NM”. The units are optional.
Example	INP:WAVE 1310 NM
Note	This command cannot be issued while a program is running. The INP:WAVE command is equivalent to the WVL command. Both give the same result.

INPut:WAVElength?

Description	This query returns a value indicating the currently selected wavelength, the minimum available wavelength, or the maximum available wavelength.
Syntax	INP:WAVE?[<wsp><min_or_max>]
Parameters	The <min_or_max> parameter is optional and can be “MIN” to request the minimum wavelength “MAX” to request the maximum wavelength
Response	The wavelength in the format “9999.9”. The units are nm.
Example	INP:WAVE? MAX or INP:WAVE?
Note	The INP:WAVE? command is equivalent to the WVL? command. Both give the same result.

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OUTPut:APMode

Description	This command selects Absolute or Reference attenuation mode. When Absolute mode is selected, the Absolute attenuation introduced by the FVA-3100 is displayed. When Reference mode is selected, the current absolute attenuation is set as the reference value, and then the displayed attenuation is relative to the reference.
Syntax	OUTP:APM<wsp><boolean>
Parameters	The <boolean> parameter can be "0" or "OFF" to select Reference display mode "1" or "ON" to select Absolute display mode
Example	OUTP:APM ON
Note	This command cannot be issued while a program is running.

OUTPut:APMode?

Description	This query returns a value indicating whether or not Absolute display mode is selected.
Syntax	OUTP:APM?
Response	"0" if the unit is in Reference display mode "1" if the unit is in Absolute display mode
Example	OUTP:APM?

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OUTPut[:STATe]

Description	This command controls the shutter, which can block optical continuity.
Syntax	OUTP[:STAT]<wsp><boolean>
Parameters	The <boolean> parameter can be “0” or “OFF” to optically close the shutter “1” or “ON” to optically open the shutter
Example	OUTP:STAT ON
Note	This command cannot be issued while a program is running. The OUTP:STAT command is similar to the D command.

OUTPut[:STATe]?

Description	This query returns the state of the shutter.
Syntax	OUTP[:STAT]?
Response	“0” if the shutter is optically closed “1” if the shutter is optically open
Example	OUTP:STAT?
Note	The OUTP:STAT? command is similar to the D? command.

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PROGram:SELected:ATTenuation

Description	This command changes the attenuation parameter for the attenuation program.
Syntax	PROG:SEL:ATT<wsp><attenuation>[<wsp><DB>]
Parameters	The <attenuation> parameter is the difference in attenuation between each step in the program (maximum 99.99 dB). The units are optional.
Example	PROG:SEL:ATT 3
Note	This command cannot be issued while a program is running.

PROGram:SELected:DELAy

Description	This command changes the delay parameter for the attenuation program.
Syntax	PROG:SEL:DELA<wsp><delay>
Parameters	The <delay> parameter is the delay preceding the program start. This value has the following format: “999,59,59” (hours,minutes,seconds).
Example	PROG:SEL:DELA 000,05,30
Note	This command cannot be issued while a program is running.

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PROGram:SELected:DURAtion

Description	This command changes the duration parameter for the attenuation program.
Syntax	PROG:SEL:DURA<wsp><duration>
Parameters	The <duration> parameter is the time that the FVA-3100 remains at each attenuation step. This value has the following format: “999,59,59” (hours,minutes,seconds).
Example	PROG:SEL:DURA 000,10,00
Note	This command cannot be issued while a program is running.

PROGram:SELected:STATe

Description	This command controls the status of the currently loaded program.
Syntax	PROG:SEL:STAT<wsp><value>
Parameters	The <value> parameter can be “1” or “START” to start the program “0” or “STOP” to stop the program
Example	PROG:SEL:STAT START

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PROGram:SELected:STATe?

Description	This query returns a value indicating the status of the loaded program.
Syntax	PROG:SEL:STAT?
Response	“0”: the program is stopped “1”: the program is in progress
Example	PROG:SEL:STAT?

PROGram:SELected:STEP

Description	This command changes the number of steps parameter for the attenuation program.
Syntax	PROG:SEL:STEP<wsp><step>
Parameters	The <step> parameter is the number of attenuation steps in the program (maximum 99 steps). Entering a value above 99 sets the number of steps parameter to 99.
Example	PROG:SEL:STEP 50
Note	This command cannot be issued while a program is running.

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WaVeLength

Description This command selects a specific calibrated wavelength. The wavelength range depends on the type and configuration of the FVA-3100.

Syntax WVL<wsp><numeric>[<wsp><NM>]

Parameters The <numeric> parameter is the actual wavelength in the format “9999.9[NM]”. The units are optional.

Example WVL 1310 NM

Note This command cannot be issued while a program is running. The WVL command is equivalent to the INP:WAVE command. Both give the same result.

WaVeLength?

Description This query returns a value indicating the currently selected wavelength, the minimum available wavelength, or the maximum available wavelength.

Syntax WVL?[<wsp><min_or_max>]

Parameters The <min_or_max> parameter is optional and can be

“MIN” to request the minimum wavelength

“MAX” to request the maximum wavelength

Response The wavelength in the format “9999.9”. The units are nm.

Example WVL? MAX or

WVL?

Note The WVL? command is equivalent to the INP:WAVE? command. Both give the same result.

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SYSTem:ERRor?

Description	This command returns the next error on the list. The commands ERR? and LERR? give the same result. When an error is generated, an error number is sent to the error list. The error list can be accessed with the commands SYST:ERR?, ERR?, or LERR?.
Syntax	SYST:ERR?
Response	See error list and descriptions in *Error Messages* on page 58.

SYSTem:VERSion?

Description	This command returns the FVA-3100 identification string.
Syntax	SYST:VERS?
Response	“EXFO E.O. Engineering FVA-3100 Vxx.xx” where xx.xx is the current product version.
Note	The *IDN? and IDN? commands are equivalent to the SYST:VERS? command. They give the same result.

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