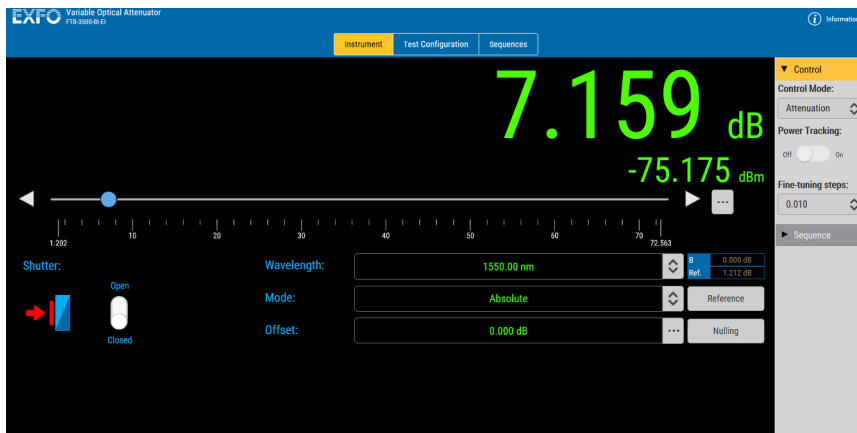


# VOA

## Variable Optical Attenuator



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### ***Units of Measurement***

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

### ***Patents***

EXFO's Universal Interface is protected by US patent 6,612,750.

Version number: 2.0.0.1

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## Certification Information

### North America Regulatory Statement

This unit was certified by an agency approved in both Canada and the United States of America. It has been evaluated according to applicable North American approved standards for product safety for use in Canada and the United States.

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America and from ICES-003 compliance in Canada. However, EXFO Inc. makes reasonable efforts to ensure compliance to the applicable standards.

The limits set by these standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

### European Community Declaration of Conformity

Warning: This is a class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

The full text of the EU declaration of conformity is available at the following Internet address: *www.exfo.com/library*.



# 1 **Introducing the Variable Optical Attenuator**

The VOA is a versatile variable attenuator. It can be used as a regular attenuator or it can be equipped with an integrated power meter, which allows you to work not only in attenuation but also in power level requirements. The following is a description of the VOA features and its typical applications.

## **Models and Options**

The VOA module is a high-performance attenuator available in different models:

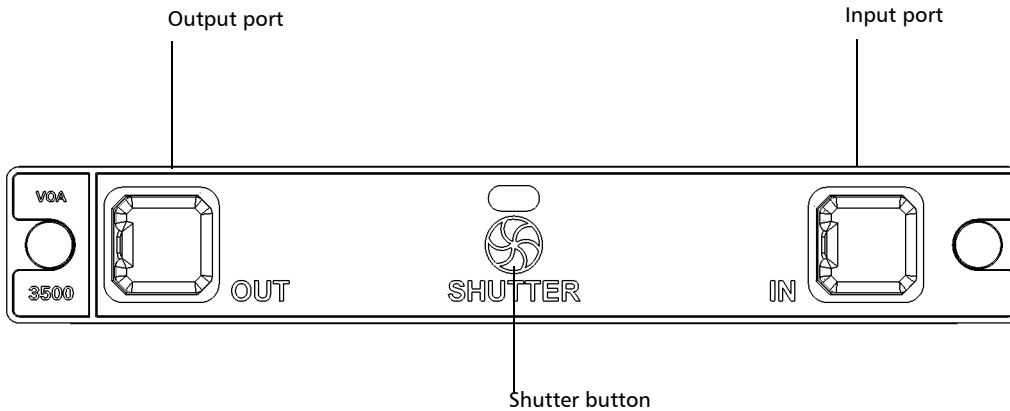
- FTB- and FTBx-3500-B: Singlemode.
- FTB- and FTBx-3500-C : Multimode (50  $\mu\text{m}$ ).
- FTB- and FTBx-3500-D: Multimode (62,6  $\mu\text{m}$ ).
- FTB- and FTBx-3500-BI: Self-adjusting singlemode (includes the Output Power control mode).
- FTB- and FTBx-3500-CI: Self-adjusting multimode (50  $\mu\text{m}$ , includes the Output Power control mode).
- FTB- and FTBx-3500-DI: Self-adjusting multimode (62.5  $\mu\text{m}$ , includes the Output Power control mode).

## Introducing the Variable Optical Attenuator

### *Models and Options*

---

The self-adjusting modules offer two operation modes: Attenuation and Power Output. The Attenuation mode allows you to work with a wide range of attenuation levels. The Output Power mode allows you to request a fixed output power value and the module automatically adjusts the attenuation according to that value.



The module is configured for singlemode or multimode fibers and complies with optical return loss measurement (ORL) standards on transmission equipment.



### Typical Applications

The Variable Optical Attenuator can be used in a number of test situations. It is ideal for manufacturing and laboratory applications:

- Bit-error-rate (BER) testing and system characterization
- Component and system loss simulation
- Optical margin analysis
- Instrument calibration
- Power meter linearity measurement
- Spectral tuning.

The VOA is perfectly suited for WDM applications by providing the same attenuation level on all channels simultaneously for a complete characterization of amplifiers or subsystems.

The Variable Optical Attenuator supports local control, or remote control using SCPI or REST commands.

You can also use the IVI drivers you can find on the EXFO Website at [www.exfo.com](http://www.exfo.com). The drivers have their own specific documentation to help you use them with your application.

## Introducing the Variable Optical Attenuator

### Technical Specifications

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### Control Modes (Self-Adjusting Modules)

With the self-adjusting modules, you can select between two control modes: Attenuation and Output Power.

Control Mode	Description
Attenuation	<p>The instrument applies the attenuation values you have selected.</p> <p>The value appearing at the top of the data display (dB) represents your attenuation setting whether it was entered in a test sequence or on the <b>Instrument</b> function tab.</p> <p>The value appearing underneath the attenuation value is the input power.</p>
Output Power	<p>The instrument produces the output power level you have selected.</p> <p>The value appearing at the top of the data display (dBm) represents your power level setting whether it was entered in a test sequence or on the <b>Instrument</b> function tab.</p> <p>The value appearing underneath the output power value is the input power.</p>

### Technical Specifications

To obtain this product's technical specifications, visit the EXFO Web site at [www.exfo.com](http://www.exfo.com).

## Conventions

Before using the product described in this guide, you should understand the following conventions:



### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.



### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.



### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.



### **IMPORTANT**

Refers to information about this product you should not overlook.

### Safety Information

Your VOA does not include laser components in itself. However, other modules or units you will use may do so. Make sure to follow all laser safety rules.



#### **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**

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.



#### **WARNING**

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.




#### **WARNING**

Use only accessories designed for your unit and approved by EXFO. For a complete list of accessories available for your unit, refer to its technical specifications or contact EXFO.



### **IMPORTANT**



When you see the following symbol on your unit , make sure that you refer to the instructions provided in your user documentation. Ensure that you understand and meet the required conditions before using your product.



### **IMPORTANT**

Other safety instructions relevant for your product are located throughout this documentation, depending on the action to perform. Make sure to read them carefully when they apply to your situation.

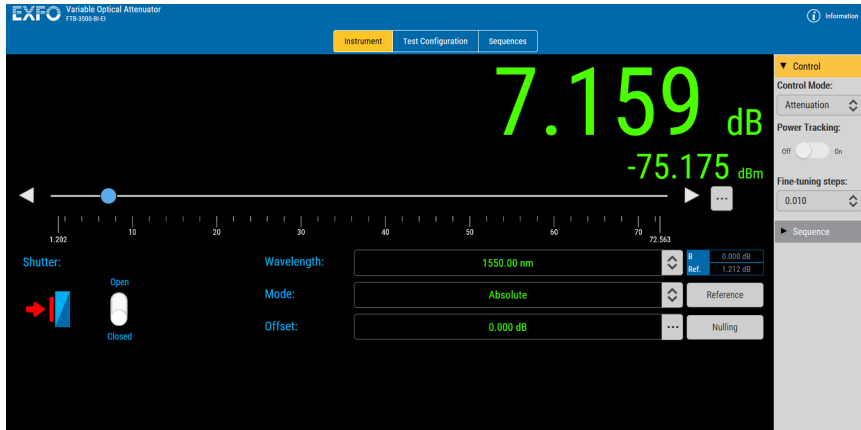
For more information on product safety and equipment ratings, refer to the user guide of your platform. The VOA consumption is 6 W.



## 2 *Setting Up and Using Your Variable Optical Attenuator*

The VOA comes with factory default settings; however, you can create custom settings and save them in configuration files.

When you start the Variable Optical Attenuator dedicated application, it opens the **Instrument** function tab. To start building your own test settings, click the **Test Configuration** function tab.



# Setting Up and Using Your Variable Optical Attenuator

## Selecting a Module from a Web Browser

If you are accessing your module from a Web browser, you can select which module or application you want to work with. Simply enter `http://[IP address of your unit]` in your browser address box.

To only view the VOA modules, enter `http://[IP address of your unit]/3500`

The screenshot shows the EXFO LTB-8 Module Selector web interface. At the top, there is a blue header with the EXFO logo, the text 'LTB-8', 'Module Selector', and a search filter box. Below the header, a list of modules is displayed, each with a location number, a model name, and a description. The modules are: 1. FTBx-1750-04-EI (High-Performance Optical Power Meter), 2. FTBx-3500 (Variable Optical Attenuator), 3. FTBx-1750-02-EI (High-Performance Optical Power Meter), 5. FTBx-3500-BI (Variable Optical Attenuator), and 8. FTBx-3500 (Variable Optical Attenuator). Each module entry has a play button icon on the right. Annotations with lines pointing to specific elements include: 'Search filter' pointing to the search box; 'Location of module on unit.' pointing to the number '8'; 'Module is ejecting.' pointing to a red triangle icon above the play button for module 5; 'Module was ejected.' pointing to a red triangle icon above the play button for module 8; and 'Click to start the application.' pointing to the play button for module 8.

Location	Module Name	Description	Status
1	FTBx-1750-04-EI	High-Performance Optical Power Meter (S.N.: 636990)	Available
2	FTBx-3500	Variable Optical Attenuator (S.N.: SIMFTB3500DEI)	Available
3	FTBx-1750-02-EI	High-Performance Optical Power Meter (S.N.: 614552)	Available
5	FTBx-3500-BI	Variable Optical Attenuator (S.N.: SIMFTB3500BEA)	Ejecting
8	FTBx-3500	Variable Optical Attenuator (S.N.: SIMFTB3500BIEA)	Ejected



### Setting the B Value

The B value settings are necessary for the X+B display mode. These settings apply to one or many wavelengths defined in the **Wavelength** list and are only enabled when using this display mode. The B value settings are available for both standard and self adjusting modules.

The B value is defined as a correction factor or defined as an input power value representing the attenuation in the equivalent output power in dBm.

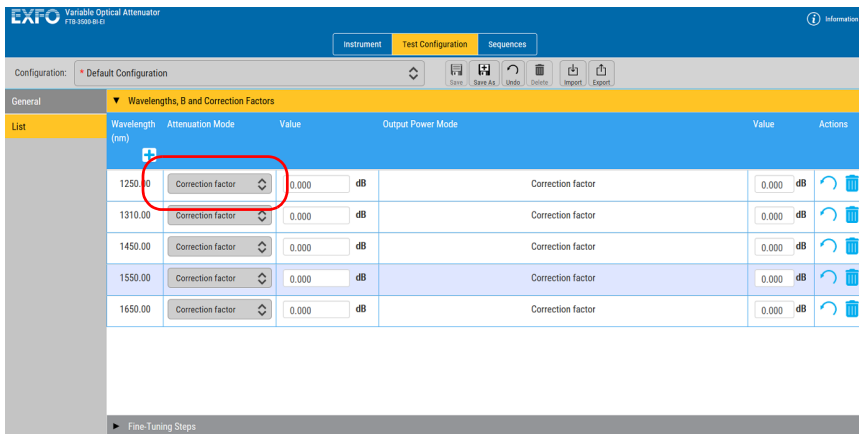
- The **Correction factor** can be used to correct a difference in attenuation or output power from the original specification due to some changes in the equipment, such as a connector replacement.
- The **Input Power** setting, only available in the Attenuation control mode, allows you to set the source power in dBm. This changes the attenuation scale values in the **Control Center** to the equivalent values of the output power in dBm. You can then use the slider to select an output power value rather than an attenuation value. It is not as precise as the Output Power control mode but it is still useful for certain test applications.

# Setting Up and Using Your Variable Optical Attenuator

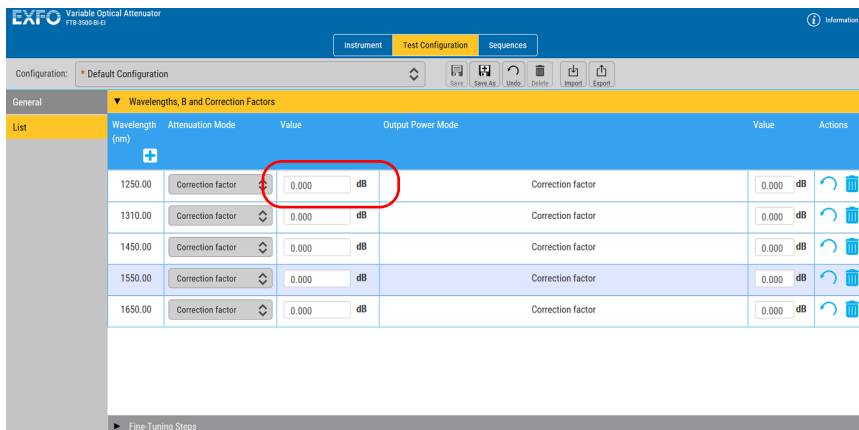
## Setting the B Value

### To set a correction factor for a wavelength:

1. On the **Test Configuration** function tab, click the **Lists** tab.
2. For the desired wavelength, select if you want to enter a correction factor or input power value in the list.



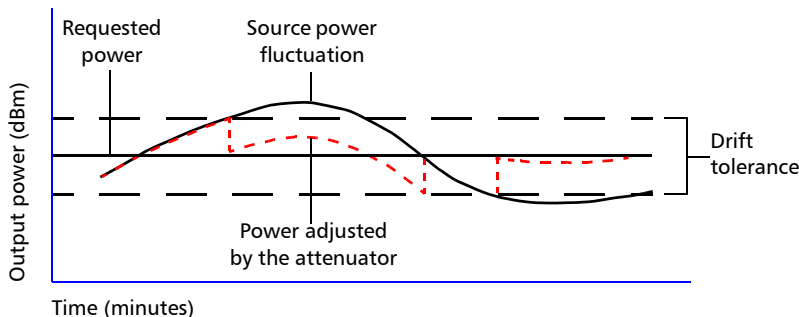
3. Enter the value for the attenuation.



## Setting the Drift Tolerance

The drift tolerance setting is only available for the self-adjusting modules and is only applicable for the **Power Tracking** function (see *Using the Power Tracking Mode (Self-Adjusting Modules)* on page 33).

When you use the power tracking function, the internal power meter monitors the output power level and constantly adjust the attenuation to ensure that the output power does not exceed the limits set (drift tolerance). For example, if the power of the source used for the test drifts over time, the attenuation is adjusted so that the output power remains within the preset limits.

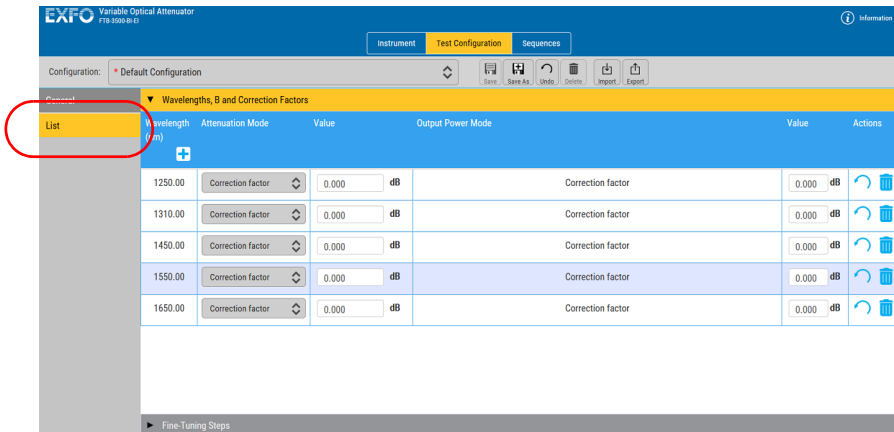


# Setting Up and Using Your Variable Optical Attenuator

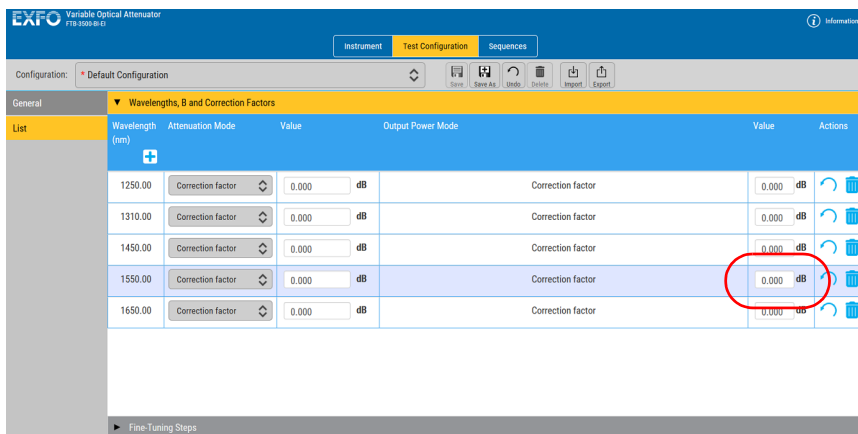
## Setting the Drift Tolerance

**To set the drift tolerance:**

1. On the **Test Configuration** function tab, click the **List** tab.



2. In the **Value** box of the wavelength you want to use, enter the tolerance value.

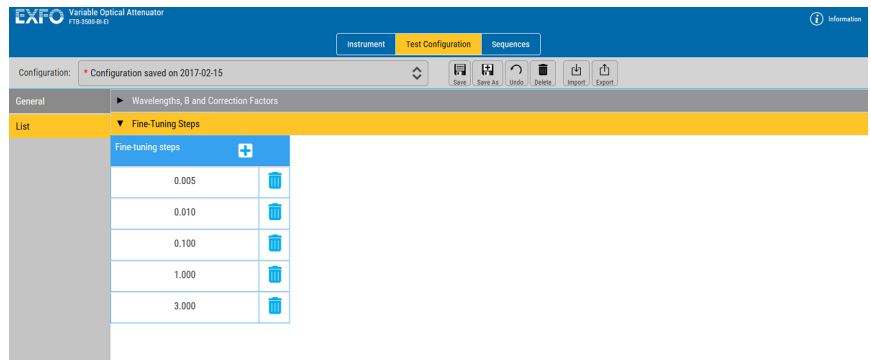


### Customizing the Wavelength and Fine-Tuning Step Lists

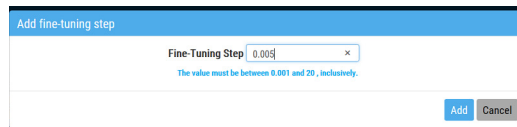
You can define lists of wavelengths and fine-tuning steps that will be available during operation.

#### To add a value to the lists:

1. On the **Test Configuration** function tab, click the **List** tab, then **Fine-Tuning Steps**.



2. Click the **+** button to add a value to the list.
3. Enter the desired step value, then click **Add** to confirm your choice.



#### To delete a value from the lists:

1. On the **Test Configuration** function tab, click the **List** tab, then **Fine-Tuning Steps**.
2. Click a value in the list to select it.
3. Click the **🗑️** button to delete the value.

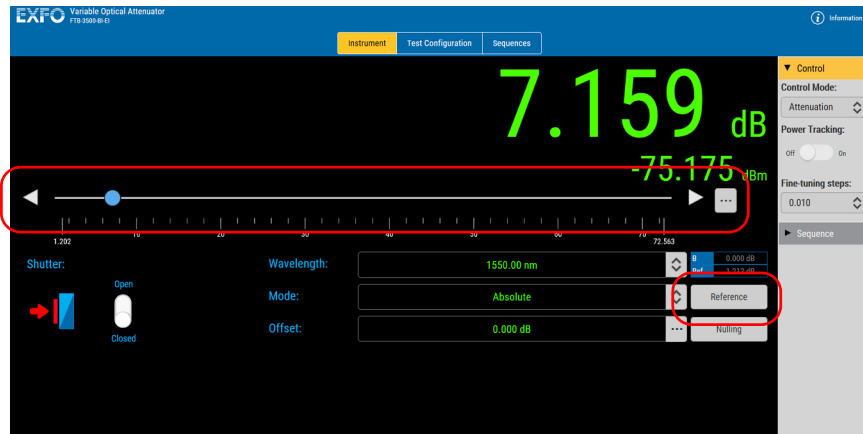
# Setting Up and Using Your Variable Optical Attenuator

## Selecting the Reference Value

Before clicking the **Reference** button, you must select the reference attenuation value to use.

### To select the reference value:

Use either the slider, the left/right arrows or the ... button to enter a value directly. Upon clicking the **Reference** button, the instrument uses the selected attenuation as reference.



### Creating a Test Sequence

The VOA allows you to create test sequences so that the attenuation or output power steps are performed automatically without your intervention.

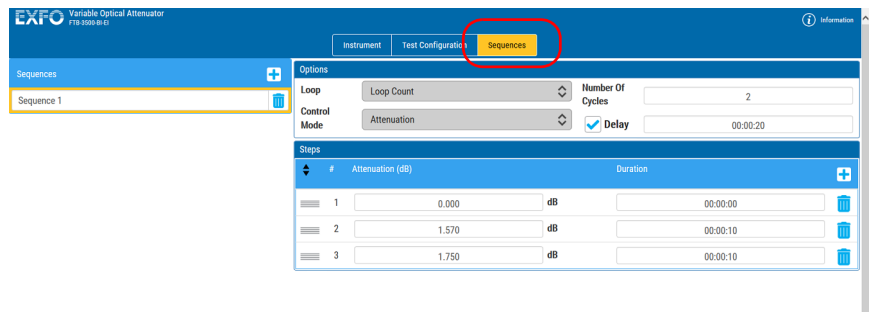
**Note:** *The sequences are kept on the current platform and can be used by other VOA modules running on it.*

Sequences can be created for both Attenuation and Output Power (self-adjusting modules) modes.

You can create new sequences, or modify existing ones. The changes are saved automatically as soon as they are done.

#### To create a sequence:

1. Select the **Sequence** function tab.



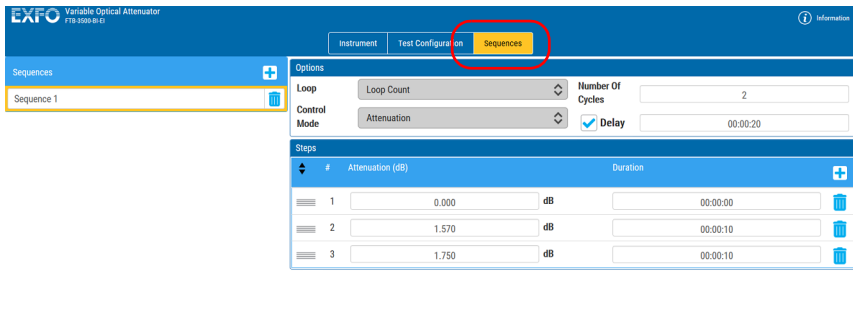
2. Click the **+** button.
3. Enter a name for your sequence.
4. Modify the settings as explained further in this section.

# Setting Up and Using Your Variable Optical Attenuator

## Creating a Test Sequence

### To modify a sequence:

1. Select the **Sequence** function tab.

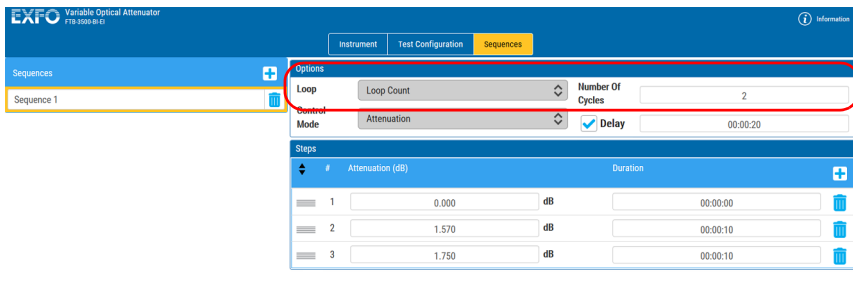


2. Click the existing sequence to modify.

**Note:** The sequence currently being modified is highlighted.

### To modify the sequence settings:

1. Create or select a sequence.
2. Under **Options**, select the repetition scheme, either continuous or a set number of loops. If you select the loop count option, enter the number of cycles to perform.



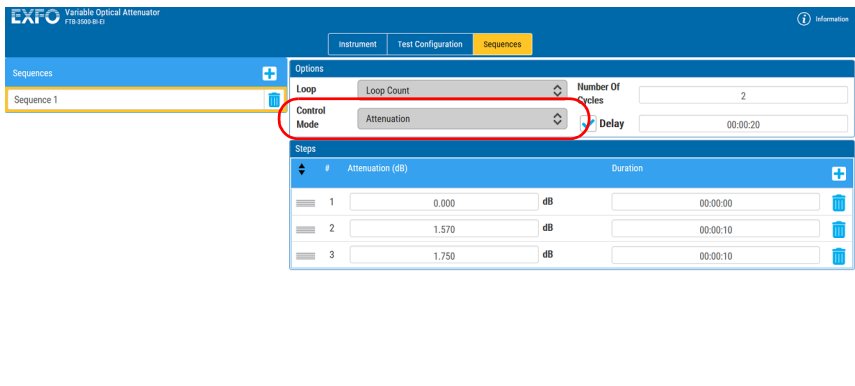
**Note:** If you are using a delay for the sequence start, the latter will only apply for the first sequence in the loop.



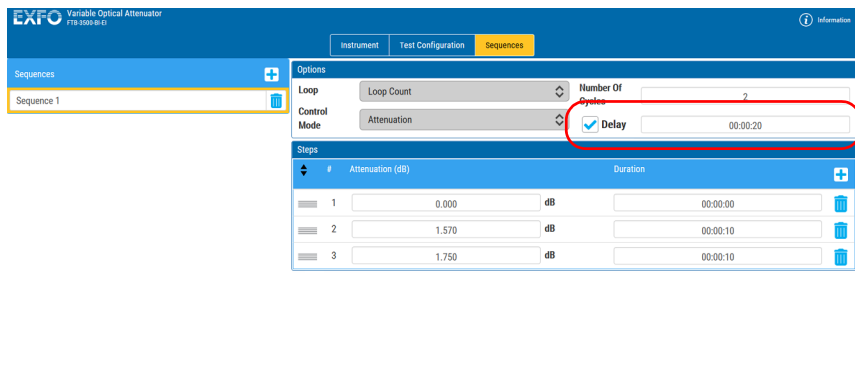
# Setting Up and Using Your Variable Optical Attenuator

## Creating a Test Sequence

3. Enter the control mode for the sequence, either attenuation or output power.






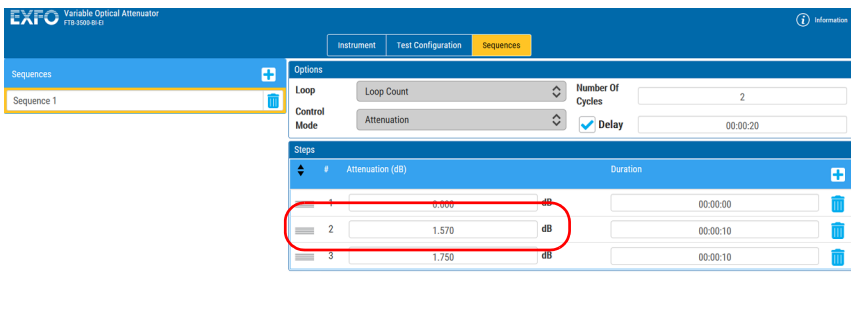
4. If you want to have a delay before starting the sequence, enable the option, then enter a duration.



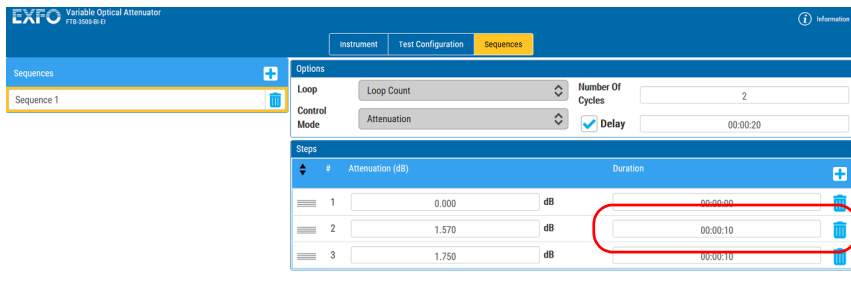
# Setting Up and Using Your Variable Optical Attenuator

## Creating a Test Sequence

- Under **Steps**, determine the sequence itself:
  - To add a step, use the  button.
  - To move a step and change its position in the sequence, click the  button, then drag the step to its desired position. You can also use the arrows next to the step number to move the step up or down.
  - To remove a step, use the  button
- For each step, in the **Attenuation** or the **Output Power** box (depending on the selected control mode) enter the attenuation or the output power level you need.



- In the **Duration** box, enter the length of time this level will be applied before the next step.



### Managing Configurations

You can create configurations that will keep your test settings. The actions made on the configuration (saving, deleting, etc.) affect all tabs of the unit at the same time.

The configuration will include the following items:

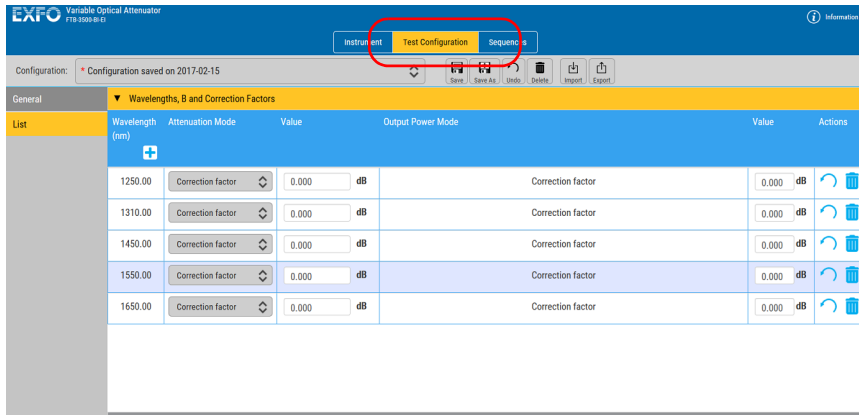
- Wavelengths
- Correction factors/Input power values
- Fine-tuning steps
- Attenuation value
- Current Wavelength
- Mode
- Offset
- Reference
- Shutter state (if not locked)

# Setting Up and Using Your Variable Optical Attenuator

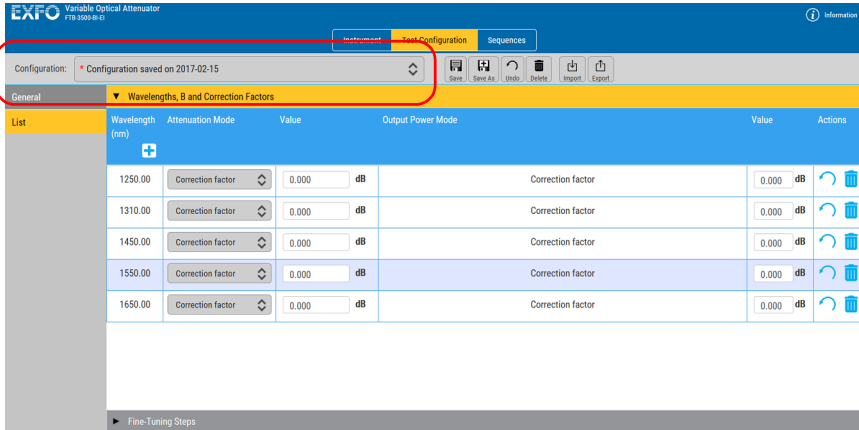
## Managing Configurations

**To save changes in an existing configuration:**

1. Select the **Test Configuration** tab.



2. Select a configuration in the list.



3. Change the configuration as needed.

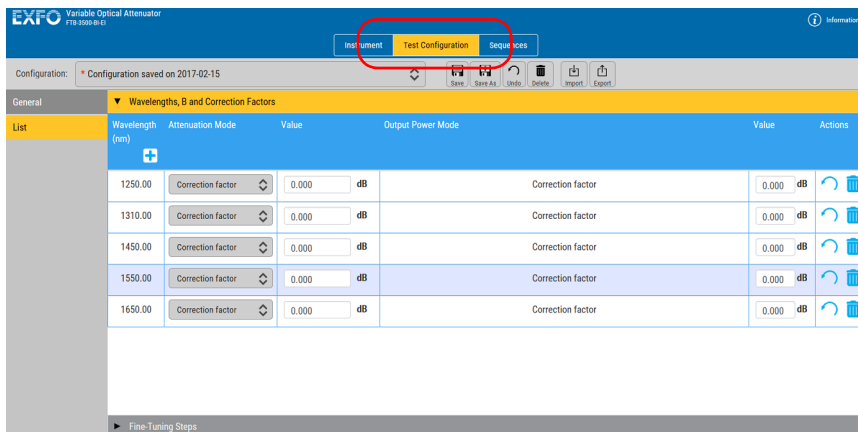
4. Click .


# Setting Up and Using Your Variable Optical Attenuator

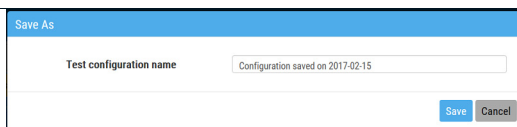
## Managing Configurations

**To create a configuration:**

1. Select the **Test Configuration** tab.



2. Change the configuration as needed.
3. Click .
4. Enter a name for the configuration.



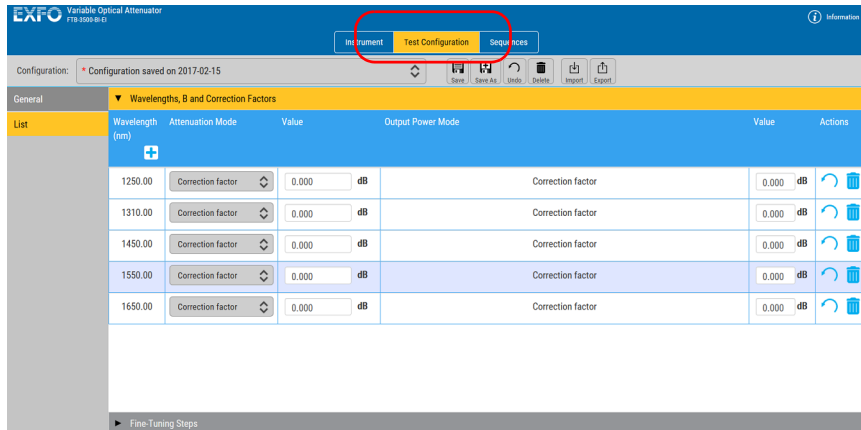
5. Confirm your choice.

# Setting Up and Using Your Variable Optical Attenuator

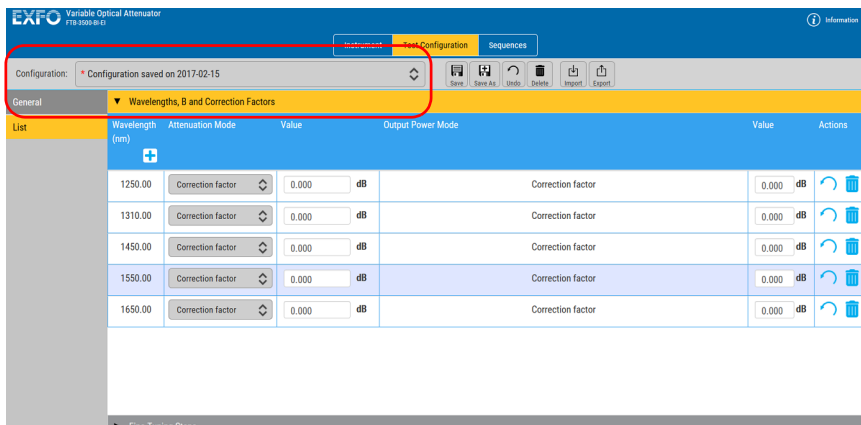
## Managing Configurations

### To delete a configuration:

1. Select the **Test Configuration** tab.



2. Select the configuration you want to delete.




3. Click .

4. Confirm your choice.

# Setting Up and Using Your Variable Optical Attenuator

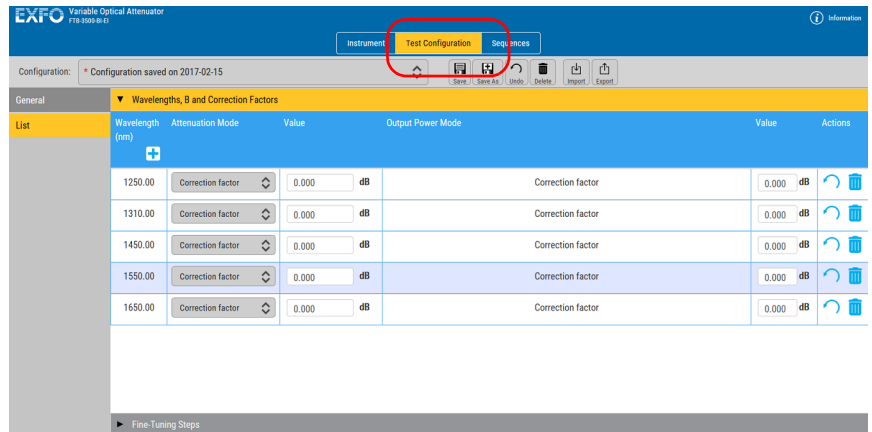
## Managing Configurations

**To revert to the current configuration and erase changes:**











1. While in the **Test Configuration** tab, click .
2. Confirm your choice.

**To export a configuration:**

1. Select the **Test Configuration** tab.



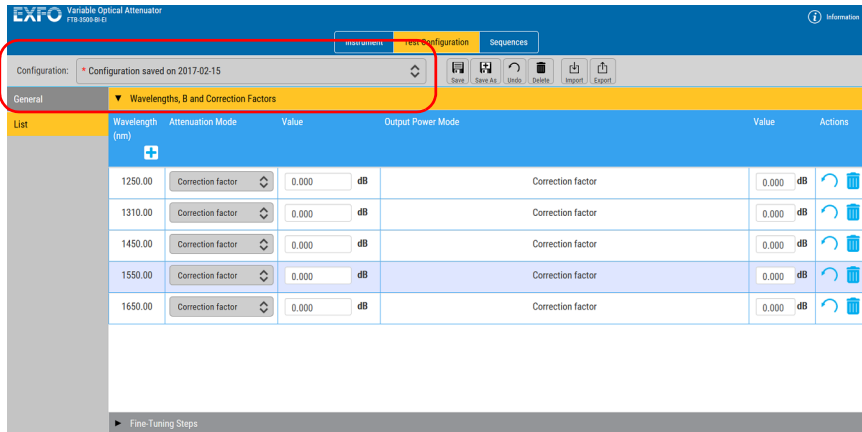
The screenshot shows the EXFO Variable Optical Attenuator software interface. The top navigation bar includes 'Instrument', 'Test Configuration' (highlighted), and 'Sequences'. Below the navigation bar, there are icons for 'Save', 'Save As', 'Undo', 'Delete', 'Import', and 'Export'. The 'Undo' button is circled in red. The main content area is titled 'Wavelengths, B and Correction Factors' and contains a table with the following data:

Wavelength (nm)	Attenuation Mode	Value	Output Power Mode	Value	Actions
1250.00	Correction factor	0.000 dB	Correction factor	0.000 dB	 
1310.00	Correction factor	0.000 dB	Correction factor	0.000 dB	 
1450.00	Correction factor	0.000 dB	Correction factor	0.000 dB	 
1550.00	Correction factor	0.000 dB	Correction factor	0.000 dB	 
1650.00	Correction factor	0.000 dB	Correction factor	0.000 dB	 

# Setting Up and Using Your Variable Optical Attenuator

## Managing Configurations

2. Select the configuration you want to export.



3. Click .
4. Select the location for the file and change the name if needed.
5. If you have changed the name or location, click **Save** to confirm your export.

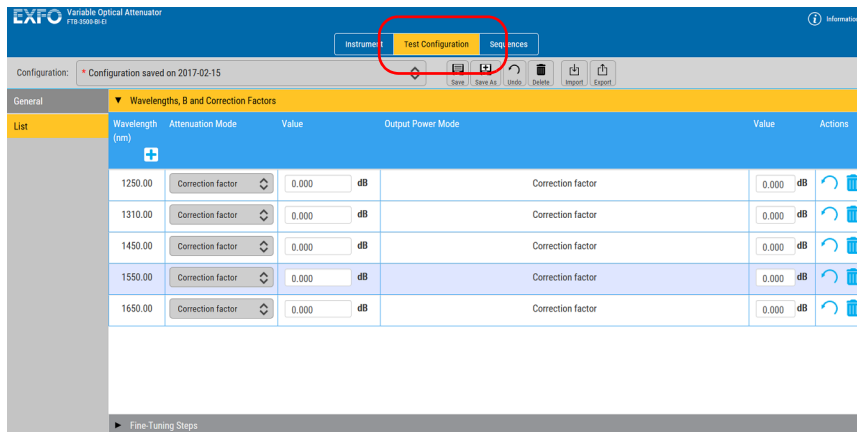



# Setting Up and Using Your Variable Optical Attenuator

## Managing Configurations

### To import a configuration:

1. Select the **Test Configuration** tab.



2. Click .
3. Locate the configuration files that you want to add and click **Open**.



# 3 **Operating the VOA**

This section presents basic operations using the Variable Optical Attenuator.

## **Cleaning and Connecting Optical Fibers**



### **IMPORTANT**

To ensure maximum power and to avoid erroneous readings:

- Always inspect fiber ends and make sure that they are clean as explained below before inserting them into the port. EXFO is not responsible for damage or errors caused by bad fiber cleaning or handling.
- Ensure that your patchcord has appropriate connectors. Joining mismatched connectors will damage the ferrules.

#### ***To connect the fiber-optic cable to the port:***

1. Inspect the fiber using a fiber inspection probe. If the fiber is clean, proceed to connecting it to the port. If the fiber is dirty, clean it as explained below.
2. Clean the fiber ends as follows:
  - 2a. Gently wipe the fiber end with a lint-free swab dipped in optical-grade liquid cleaner.
  - 2b. Use a dry swab to dry the connector completely.
  - 2c. Visually inspect the fiber end to ensure its cleanliness.
3. 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.
4. Push the connector in so that the fiber-optic cable is firmly in place, thus ensuring adequate contact.

## Operating the VOA

### *Cleaning and Connecting Optical Fibers*

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

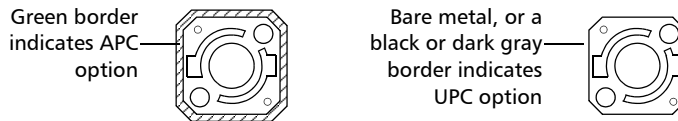
**Note:** *If your fiber-optic cable is not properly aligned and/or connected, you will notice heavy loss and reflection.*

EXFO uses good quality connectors in compliance with EIA-455-21A standards.

To keep connectors clean and in good condition, EXFO strongly recommends inspecting them with a fiber inspection probe before connecting them. Failure to do so will result in permanent damage to the connectors and degradation in measurements.

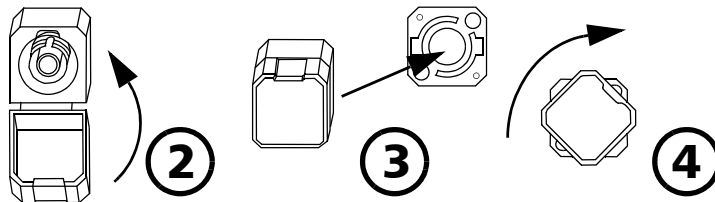
## Installing the EXFO Universal Interface (EUI)

The EUI fixed baseplate is available for connectors with angled (APC) or non-angled (UPC) polishing. The type of border around the baseplate indicates which type of connector it is designed for.



### ***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. While pushing firmly, turn the connector adapter clockwise on the baseplate to lock it in place.

## Operating the VOA

### Selecting a Control Mode

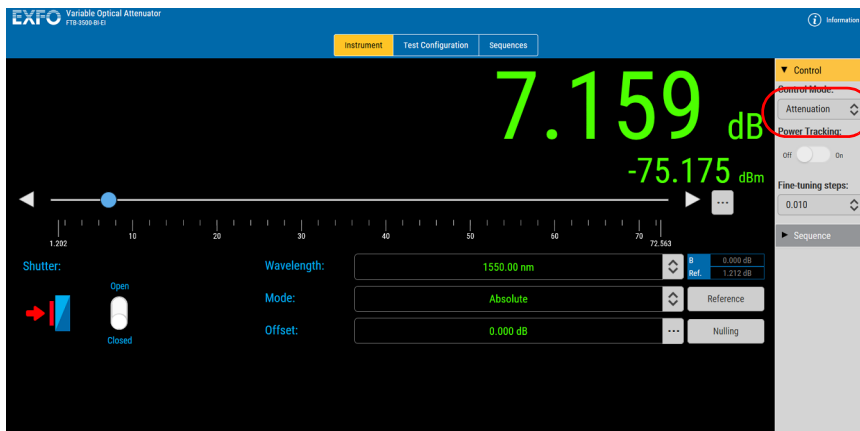
You can work with your module using two modes:

- Attenuation: to reduce the amplitude of the signal to fit your needs without a lot of distortion.
- Output Power: to ensure power stability and eliminate the need for an external power meter.

**Note:** The output power option is not available on all models.

#### To select the control mode:

1. From the **Instrument** function tab, select the **Control** tab.
2. Set the control mode as needed.

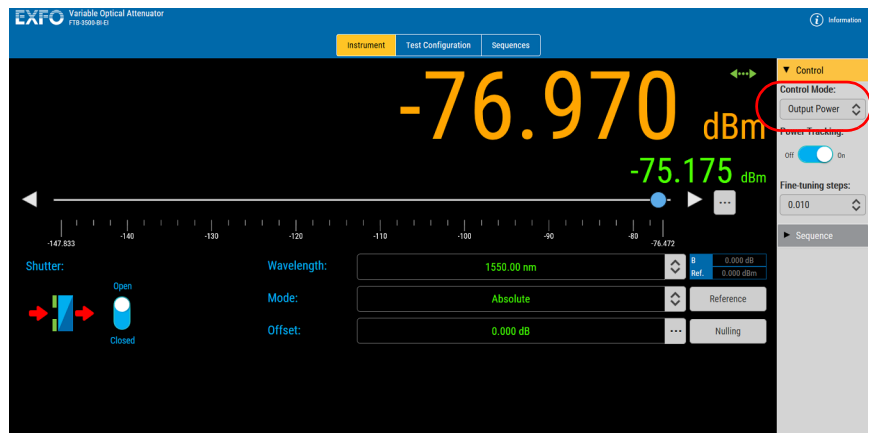


### Using the Power Tracking Mode (Self-Adjusting Modules)

The power tracking mode is used to monitor, when in the Output Power control mode, the output power level and automatically adjust the attenuation to keep the output power to the requested level.

**To activate the power tracking mode:**

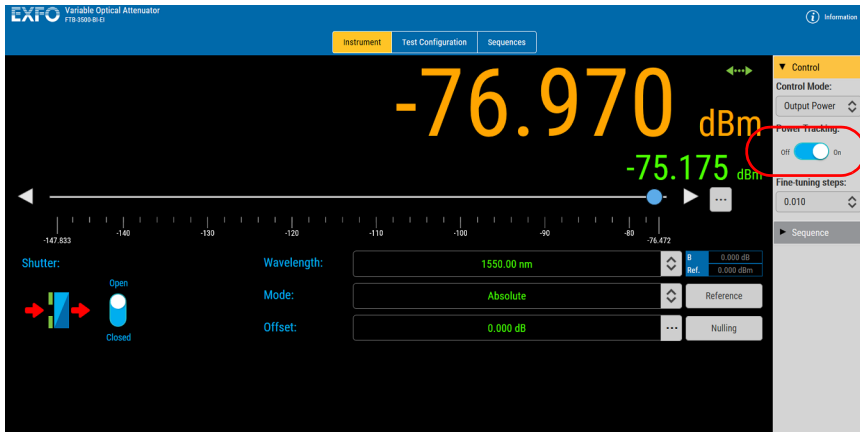
1. From the **Instrument** function tab, select the **Control** tab.
2. If it is not done already, set the control mode to output power.



## Operating the VOA

Using the Power Tracking Mode (Self-Adjusting Modules)

3. Switch the **Power Tracking** button to the ON position.





## Selecting a Display Mode

The active display mode determines the significance of the value appearing on the data display. Three modes are available: Absolute, Reference, and X+B.

### **Attenuation**

Display Mode	Description
Absolute (default mode)	The displayed attenuation takes into account both the absolute value and the offset value: Displayed att. = absolute att. + offset value
Reference	The displayed attenuation value is relative to a defined reference value: Displayed att. = absolute att. – reference value + offset value
X+B	The displayed attenuation is the sum of two elements: <ul style="list-style-type: none"> <li>➤ X = physical attenuation introduced by the unit.</li> <li>➤ B = correction factor (dB). You must define the correction factor for the test wavelength before enabling the X+B mode (see <i>Setting the B Value</i> on page 11):                              Displayed att. = absolute att. + correction factor<sup>a</sup> + offset value</li> <li>➤ B = input power value (dBm):                              Displayed att. = (absolute att. × – 1) + input power<sup>a</sup> + offset value</li> </ul>

a. The correction factor and the input power value are specific to the wavelength.

## Operating the VOA

### Selecting a Display Mode

---

#### Output power

Display Mode	Description
Absolute (default mode)	The displayed output power takes into account both the absolute output power value and the offset value.  Displayed power = absolute power + offset value
Reference	The displayed output power value is relative to a defined reference value (see <i>Selecting a Display Mode</i> on page 35).  Displayed power = absolute power – reference value + offset value
X+B	The displayed output power is the sum of two elements: <ul style="list-style-type: none"><li>➤ X = output power of the unit.</li><li>➤ B = correction factor. You must define the correction factor for the test wavelength before enabling the X+B mode (see <i>Setting the B Value</i> on page 11).</li></ul> Displayed power = absolute power + correction factor <sup>a</sup> + offset value

a. The correction factor value is specific to the wavelength.



### IMPORTANT

For the Variable Optical Attenuator, the absolute (or total) attenuation is the actual optical insertion loss between the input and output ports, including connector losses.

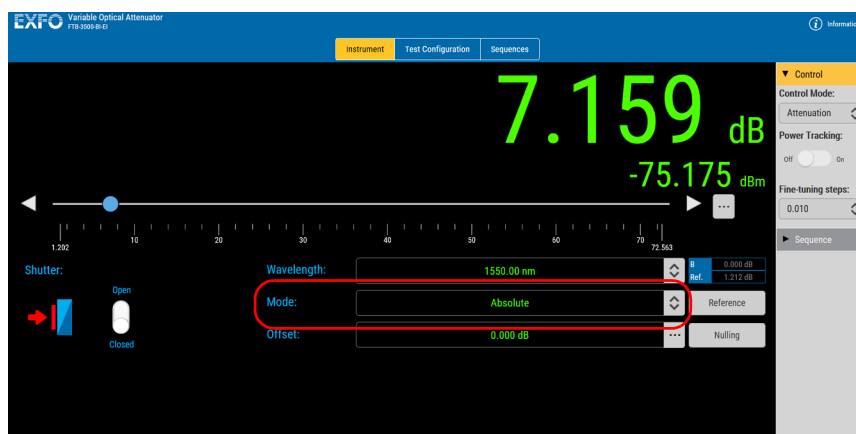
### To select a display mode:

1. If you want to work in reference mode, select your reference value as indicated in *Selecting the Reference Value* on page 16.

OR

If you want to work in X + B mode, set the value of B as explained in *Setting the B Value* on page 11.

2. From the **Instrument** function tab, select the desired mode in the list.



## Operating the VOA

### Selecting a Wavelength and a Fine-Tuning Step

## Selecting a Wavelength and a Fine-Tuning Step

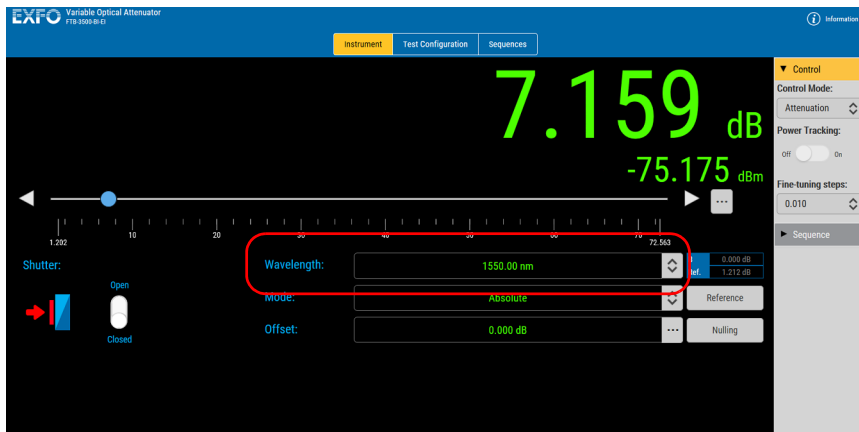
The attenuator wavelength must be set as closely as possible to the wavelength of the optical source. The Variable Optical Attenuator module provides a wide range of wavelengths: 1250 nm to 1650 nm for singlemode modules and 700 nm to 1350 nm for multimode modules.

The fine-tuning step can be as low as 0.002.

The lists of available values are built on the **Test Configuration** tab (see *Customizing the Wavelength and Fine-Tuning Step Lists* on page 15).

### To select a wavelength and a fine-tuning step:

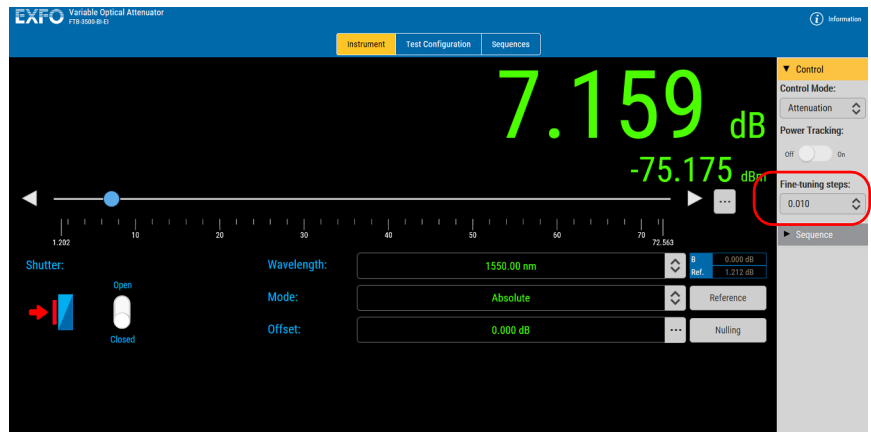
1. From the **Instrument** function tab, use the corresponding list to select the desired wavelength.



## Operating the VOA

### Selecting a Wavelength and a Fine-Tuning Step

2. Under the **Control** tab, use the list to select the fine-tuning value.



## Operating the VOA

*Changing the Attenuation or the Output Power*

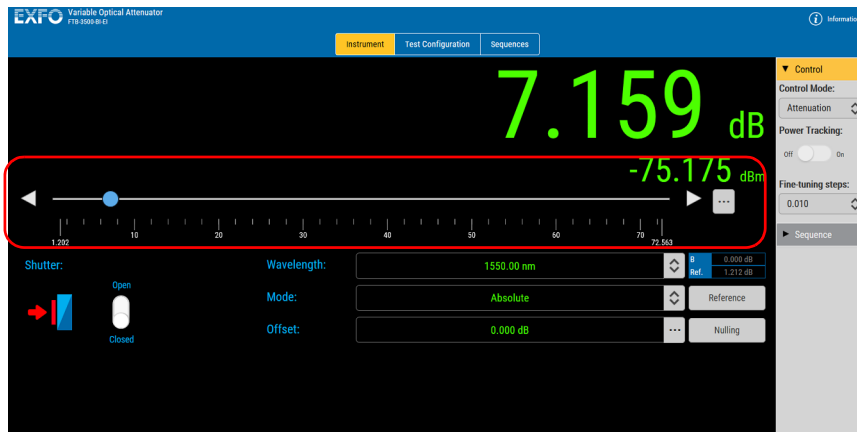
# Changing the Attenuation or the Output Power

You can change the attenuation or the output power (self-adjusting module only) value while performing your tests.

You can select any value between the minimum insertion loss and the maximum permitted by the module specifications. Although EXFO guarantees that the minimum insertion loss is below a specified value (see specification sheet), it may vary slightly from one wavelength to another and from one Variable Optical Attenuator to another.

### **To change the attenuation or output-power level:**

From the **Instrument** function tab, use either the slider, the left/right arrows, or the ... button to change the attenuation or output power value.

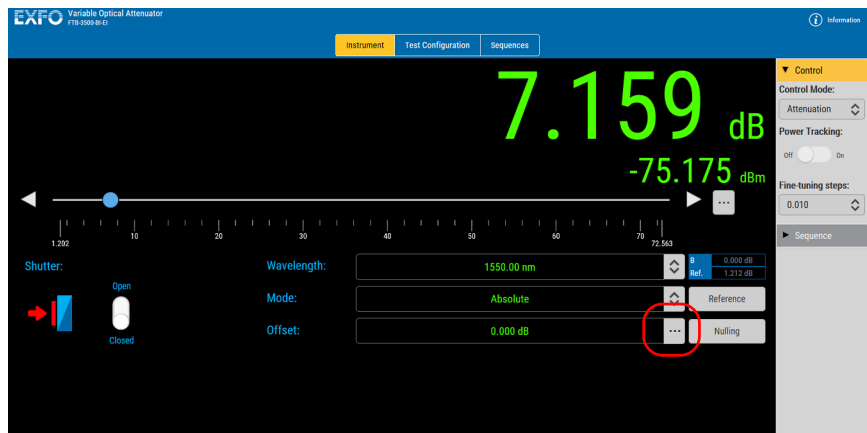


## Defining an Offset Value

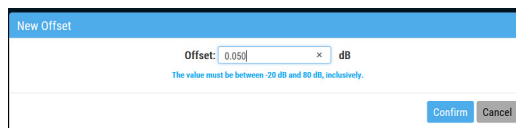
The offset value is not applied to a particular wavelength. It does not affect the filter attenuation. It can be used to compensate for the loss generated elsewhere in the system.

### To define an offset value:

1. From the **Instrument** function tab, click the ... button next to the offset value.



2. Enter the value you want to use, then click **Confirm** to accept it.



**Note:** The offset values must be between -20 dB and 80 dB, inclusively. The attenuation value is positive; therefore, when the offset value is positive, the displayed attenuation increases.

## Using the Shutter

The shutter is used to let light through the input or block it.

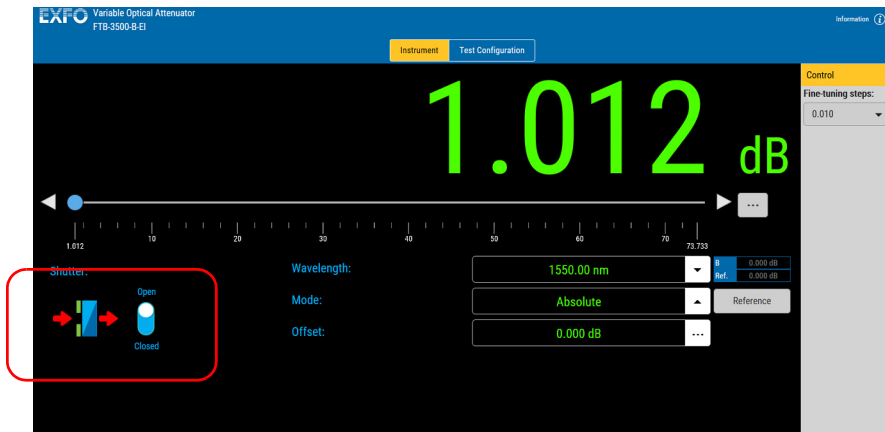


### CAUTION

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

#### To use the shutter:

1. Click the **Instrument** function tab.
2. Under **Shutter**, click the switch to open or close the shutter.







## IMPORTANT

Using the Shutter button on the module front panel to close the shutter disables the software shutter controls. You must press the button again to unlock the software controls. The lock status is indicated by a padlock on the data display.



## Shutter Status

The status of the shutter is shown on the left of the data display.

Open

Closed



The indicator on the module lights up to indicate that it is closed.

## High-Power Detection

The BI, CI and DI modules are equipped with a sensor that detects the presence of unusually high power at the input. When high power is detected, the shutter automatically closes and the high power status is indicated by a laser-radiation sign on the data display.

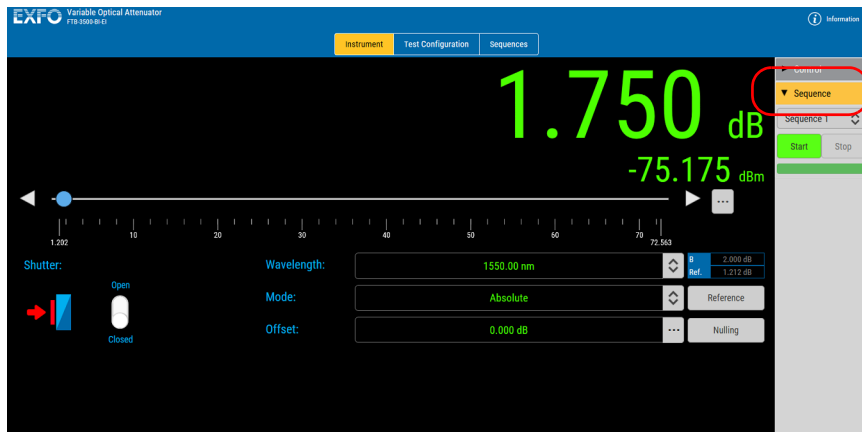


## Running an Attenuation Sequence

Attenuation sequences allow you to automate and ease your testing process. Prepare the test sequence as described in *Creating a Test Sequence* on page 17.

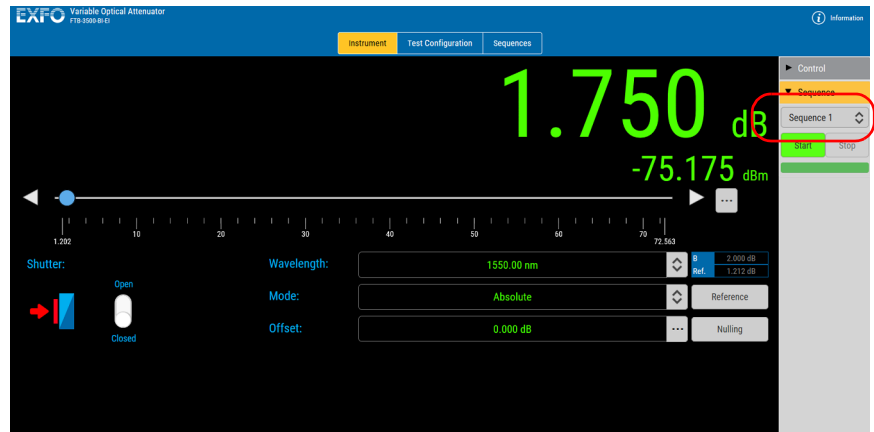
**To start an attenuation sequence:**

1. Click the **Instrument** function tab, then select the **Sequence** tab.

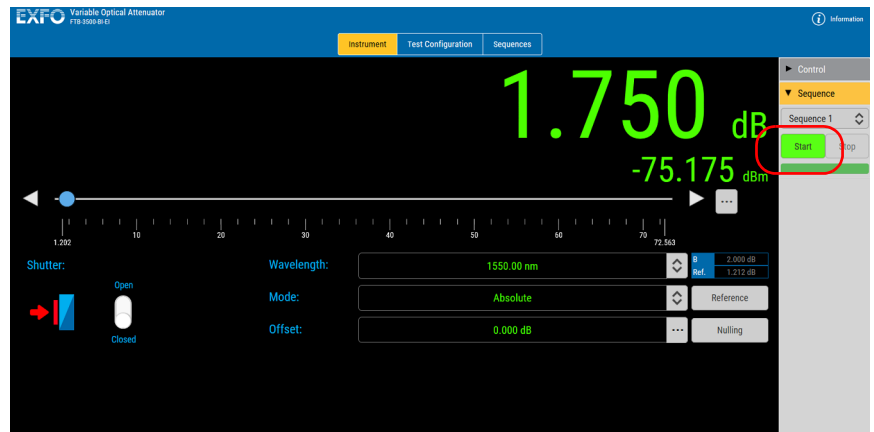


**Note:** Once a sequence is started, all controls in the **Instrument** function tab are disabled to avoid accidental interruptions.

2. Select which sequence you want to run from the list of available choices.



3. Click the **Start** button.



The **Stop** button becomes available should you need to interrupt the sequence.



## 4 **Maintenance**

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately, disconnect from any external power source, remove the batteries and let the unit dry completely.



### **WARNING**

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

## Cleaning Fixed Connectors

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



### WARNING

Looking into the optical connector while the light source is active **WILL** result in permanent eye damage. EXFO strongly recommends to **TURN OFF** the unit before proceeding with the cleaning procedure.

#### **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 optical-grade liquid cleaner.



### IMPORTANT

Some cleaners 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 liquid at a time.

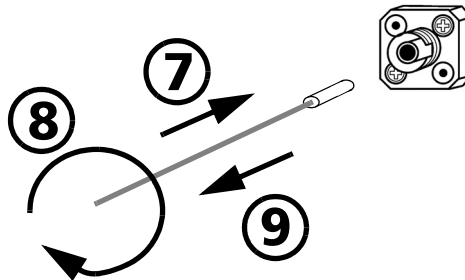
3. Gently wipe the connector threads three times with the folded and moistened section of the wiping cloth.
4. With a dry lint-free wiping cloth, gently wipe the same surfaces three times with a rotating movement.
5. Throw out the wiping cloths after one use.
6. Moisten a cleaning tip (2.5 mm tip) with *only one drop* of optical-grade liquid cleaner.



## IMPORTANT

Some cleaners 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 liquid at a time.

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



8. Gently turn the cleaning tip one full turn.
9. Continue to turn as you withdraw the cleaning tip.
10. Repeat steps 7 to 9, but this time with a dry cleaning tip (2.5 mm tip provided by EXFO).

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

11. Throw out the cleaning tips after one use.

## Cleaning EUI Connectors

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



### **IMPORTANT**

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

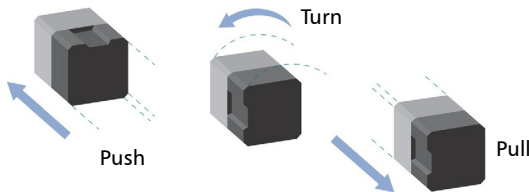


### **WARNING**

Looking into the optical connector while the light source is active **WILL** result in permanent eye damage. EXFO strongly recommends to **TURN OFF** the unit before proceeding with the cleaning procedure.

#### **To clean EUI connectors:**

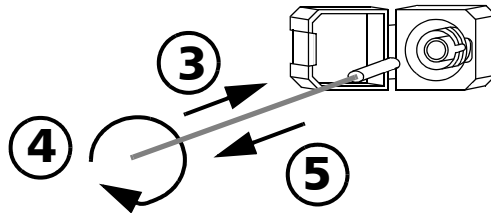
1. Remove the EUI from the instrument to expose the connector baseplate and ferrule.



2. Moisten a 2.5 mm cleaning tip with *one drop* of optical-grade liquid cleaner.



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



4. Gently turn the cleaning tip one full turn, then continue to turn as you withdraw it.
5. Repeat steps 3 to 4 with a dry cleaning tip.

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

6. Clean the ferrule in the connector port as follows:
  - 6a. Deposit *one drop* of optical-grade liquid cleaner on a lint-free wiping cloth.



## **IMPORTANT**

**Avoid contact between the tip of the bottle and the wiping cloth, and dry the surface quickly.**

- 6b. Gently wipe the connector and ferrule.
- 6c. With a dry lint-free wiping cloth, gently wipe the same surfaces to ensure that the connector and ferrule are perfectly dry.
- 6d. Verify connector surface with a fiber inspection probe (for example, EXFO's FIP).
7. Put the EUI back onto the instrument (push and turn clockwise).
8. Throw out cleaning tips and wiping cloths after one use.

## Maintenance

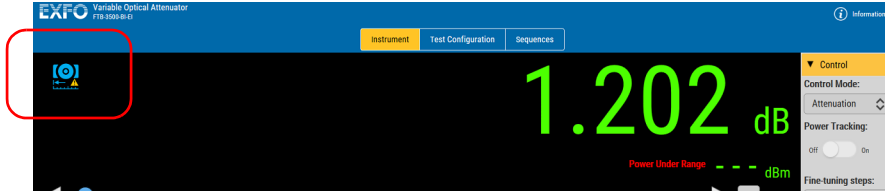
### *Homing the Variable Attenuator (User Calibration)*

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## Homing the Variable Attenuator (User Calibration)

The variable attenuator contains mechanical elements used to change attenuation or output power (self-adjusting modules) levels. It is a good practice to have the instrument mechanism return to the zero (home) position to reestablish its relative position on the range of attenuation or output power levels.

EXFO recommends that you perform the homing procedure when the homing icon appears on the data display.

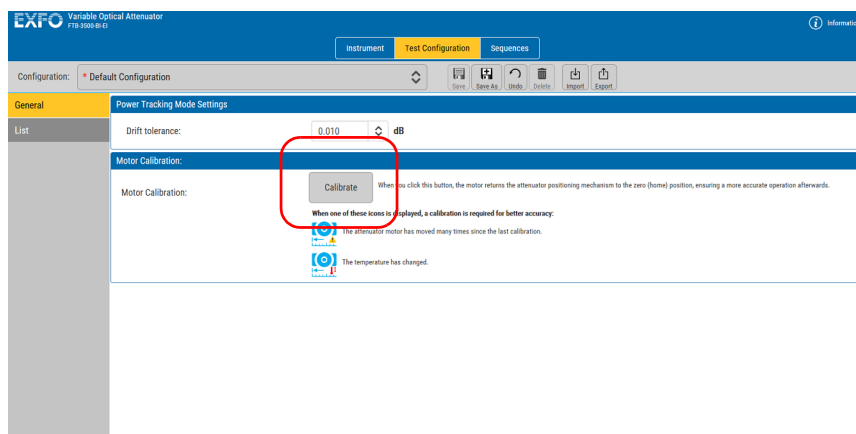


The icon will appear in the following circumstances:

- The attenuator was moved many times since the last calibration.
- The temperature has varied substantially since the last calibration.
- The minimum temperature was reached for the module.
- The maximum temperature was reached for the module.

**To calibrate the attenuator:**

1. On the **Test Configuration** function tab, click the **General** tab.
2. Click the **Calibrate** button.



The attenuator mechanism is moved to the zero (home) position.

## Recycling and Disposal (Applies to European Union Only)

For complete recycling/disposal information as per European Directive WEEE 2012/19/UE, visit the EXFO Web site at [www.exfo.com/recycle](http://www.exfo.com/recycle).



# 5 **Troubleshooting**

## **Solving Common Problems**

Here are possible solutions to common problems for your module.

<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
Cannot open the shutter	The shutter was closed using the button.	Unlock the shutter using the physical button on the module.
Cannot change the settings in the window	The application was locked using the corresponding SCPI command.	<ul style="list-style-type: none"><li>▶ Change the settings using SCPI commands.</li><li>▶ Unlock the unit through SCPI to enable direct interaction with the module.</li></ul>

## Troubleshooting

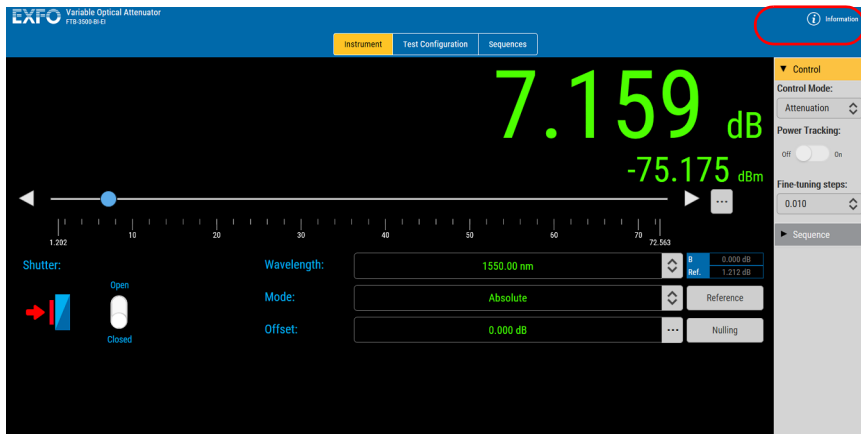
### Viewing Online Documentation

# Viewing Online Documentation

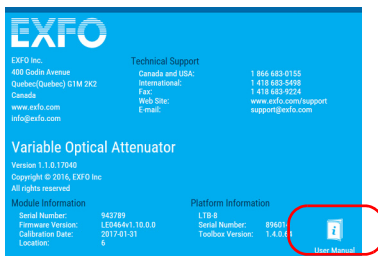
A PDF version of the user guide is available at all times for your Variable Optical Attenuator.

**To view the user guide:**

1. From the main window, click **Information**.



2. Select **User Manual**.



## **Contacting the Technical Support Group**

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

### **Technical Support Group**

400 Godin Avenue  
Quebec (Quebec) G1M 2K2  
CANADA

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

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at [www.exfo.com](http://www.exfo.com)

If you have comments or suggestions about this user documentation, you can send them to [customer.feedback.manual@exfo.com](mailto:customer.feedback.manual@exfo.com).

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

## Troubleshooting

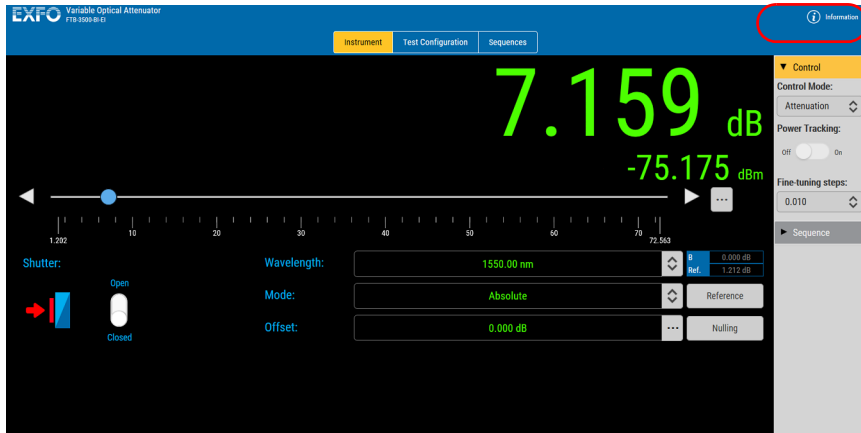
### Viewing Product Information

# Viewing Product Information

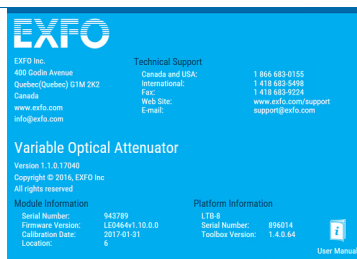
You can see information about your product, such as the serial and version numbers and contact information at all times.

**To view product information:**

1. From the main window, click **Information**.



2. Once you are done, click anywhere on the screen to close the window.





## **Transportation**

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

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



# 6 **Warranty**

## **General Information**

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of two years from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.



### **IMPORTANT**

The warranty can become null and void if:

- unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.
- warranty sticker has been removed.
- case screws, other than those specified in this guide, have been removed.
- case has been opened, other than as explained in this guide.
- unit serial number has been altered, erased, or removed.
- unit has been misused, neglected, or damaged by accident.

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

## Warranty

### Liability

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## Liability

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

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

## Exclusions

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

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.



## IMPORTANT

In the case of products equipped with optical connectors, EXFO will charge a fee for replacing connectors that were damaged due to misuse or bad cleaning.

## Certification

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

## Service and Repairs

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

***To send any equipment for service or repair:***

- 1.** Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 64). Support personnel will determine if the equipment requires service, repair, or calibration.
- 2.** If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.
- 3.** If possible, back up your data before sending the unit for repair.
- 4.** Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
- 5.** Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

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

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 64).

## Warranty

*EXFO Service Centers Worldwide*

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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  
Quebec (Quebec) G1M 2K2  
CANADA

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

### EXFO Europe Service Center

Winchester House, School Lane  
Chandlers Ford, Hampshire S053 4DG  
ENGLAND

Tel.: +44 2380 246800  
Fax: +44 2380 246801  
support.europe@exfo.com

### EXFO Telecom Equipment (Shenzhen) Ltd.

3rd Floor, Building C,  
FuNing Hi-Tech Industrial Park, No. 71-3,  
Xintian Avenue,  
Fuyong, Bao'An District,  
Shenzhen, China, 518103

Tel: +86 (755) 2955 3100  
Fax: +86 (755) 2955 3101  
support.asia@exfo.com

To view EXFO's network of partner-operated Certified Service Centers nearest you, please consult EXFO's corporate website for the complete list of service partners:

<http://www.exfo.com/support/services/instrument-services/exfo-service-centers>.

# A **SCPI Command Reference**

This appendix presents detailed information on the commands and queries supplied with your Variable Optical Attenuator.



## IMPORTANT

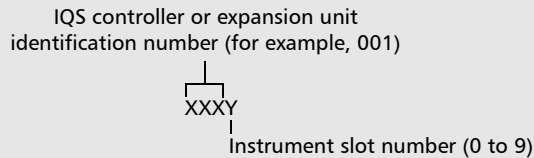
Since the platforms can house many instruments, you must explicitly specify which instrument you want to remotely control.

You must add the following mnemonic *at the beginning of any command or query* that you send to an instrument:

**LIN**Instrument<LogicalInstrumentPos>:

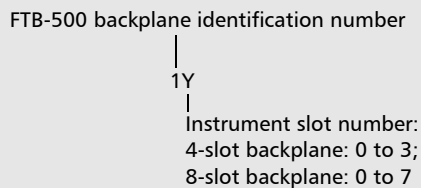
where <LogicalInstrumentPos> corresponds to the identification number of the instrument.

- For instruments usable with IQS-600 platforms:



For information on modifying unit identification, refer to your platform user guide.

- For instruments usable with FTB-500 platforms:



- For instruments usable with other platforms:

Use the LINS value defined in the Remote Control Configuration tool (accessible from System Settings). For information on modifying the LINS value, refer to your platform user guide.

## Quick Reference Command Tree

Command						Parameter(s)
CALibration	ZERO					
CONTrol	MODE					ATTenuation POWER
	MODE?					
	MODE	CATalog?				
INPut	ARESolution?					
	ATTenuation					<Attenuation[ <wsp>DB]>  MAXimum MINimum DEfault
	ATTenuation?					[MAXimum MINimum DEfault]
	OFFSet					<Offset[ <wsp>DB]>  MAXimum MINimum DEfault
	OFFSet?					[MAXimum MINimum DEfault]
	RATTenuation					<RelativeAttenuation[ <wsp>DB]>  MAXimum MINimum DEfault
	RATTenuation?					[MAXimum MINimum DEfault]
	REference					<Reference[ <wsp>DB]>  MAXimum MINimum DEfault
	REference?					[MAXimum MINimum DEfault]
	WAVelength					<Wavelength[ <wsp>M]>  MAXimum MINimum DEfault
	WAVelength?					[MAXimum MINimum DEfault]
	LOCK	[STATE]				
[STATE]?						
OUTPut	ALC	[STATE]				<State>



## SCPI Command Reference

### Quick Reference Command Tree

Command				Parameter(s)
		[STATE]?		
	APMode			ABSolute XB REference
	APMode?			
	DTolerance			<Drift[ <wsp>DB]>  MAXimum MINimum DEFAULT
	DTolerance?			[MAXimum MINimum DEFAULT]
	LOCK	[STATE]?		
	OFFSet			<Offset[ <wsp>DB]>  MAXimum MINimum DEFAULT
	OFFSet?			[MAXimum MINimum DEFAULT]
	POWer			<Power[ <wsp>DBM]>  MAXimum MINimum DEFAULT
	POWer?			[MAXimum MINimum DEFAULT]
	REference			<Reference[ <wsp>DBM]>  MAXimum MINimum DEFAULT
	REference?			[MAXimum MINimum DEFAULT]
	RPOWer			<RelativePower[ <wsp>DBM]>  MAXimum MINimum DEFAULT
	RPOWer?			[MAXimum MINimum DEFAULT]
	[STATE]			<ShutterState>
	[STATE]?			
READ	[SCALar]	POWer	DC?	
RST				
SENSe	CORRection	COLLect	ZERO	
SNUMBER?				

## SCPI Command Reference

### Quick Reference Command Tree

---

Command						Parameter(s)
STATus?						
STATus	OPERation	BIT<n>	CONDition?			
	QUEStionable	BIT<n>				

## Product-Specific Commands—Description

### :CALibration:ZERO

<b>Description</b>	Returns the mechanism of the instrument to its home position.  This command is an event and has no associated *RST condition or query form.
<b>Syntax</b>	:CALibration:ZERO
<b>Parameter(s)</b>	None
<b>Example(s)</b>	STAT:QUES:BIT9:COND? Returns 1 if the instrument's mechanism should be returned to its home position. STAT? Must return READY CAL:ZERO STAT:OPER:BIT9:COND? Keep resending the query as long as the operation is not complete (returned value is not 0).
<b>Notes</b>	This command will take at least 15 seconds to complete.
<b>See Also</b>	:SENSe:CORRection:COLLect:ZERO :STATus:OPERation:BIT<n>:CONDition? :STATus:QUEStionable:BIT<n>:CONDition?

## SCPI Command Reference

### Product-Specific Commands—Description

---

#### :CONTRol:MODE

<b>Description</b>	<p>This command selects the attenuator's control mode.</p> <p>At *RST, the control mode is ATTenuation.</p>
<b>Syntax</b>	:CONTRol:MODE<wsp>ATTenuation POWER
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: ATTenuation POWER.</p> <p>This parameter represents the newly selected control mode.</p> <p>ATTenuation: selects the attenuation control mode.</p> <p>POWER:selects the power control mode.</p>
<b>Example(s)</b>	CONT:MODE POW CONT:MODE ATTENUATION
<b>See Also</b>	:CONTRol:MODE? :INPut:ATTenuation :INPut:RATTenuation :OUTPut:POWER :OUTPut:RPOWER

---

**:CONTRol:MODE?**

<b>Description</b>	This query returns the attenuator's control mode.  At *RST, the control mode is ATTenuation.
<b>Syntax</b>	:CONTRol:MODE?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<Mode>
<b>Response(s)</b>	<i>Mode:</i>  The response data syntax for <Mode> is defined as a <CHARACTER RESPONSE DATA> element.  The <Mode> response corresponds to the selected control mode.  ATTENUATION: the attenuation control mode is selected. POWER: the power control mode is selected.
<b>Example(s)</b>	CONT:MODE POW CONT:MODE? Returns POWER
<b>See Also</b>	:CONTRol:MODE :INPut:ATTenuation :INPut:RATTenuation :OUTPut:POWer :OUTPut:RPOWer

### :CONTRol:MODE:CATalog?

<b>Description</b>	This query returns a comma-separated list of available control modes.
<b>Syntax</b>	:CONTRol:MODE:CATalog?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<Modes>
<b>Response(s)</b>	<i>Modes:</i> The response data syntax for <Modes> is defined as a <CHARACTER RESPONSE DATA> element.  The <Modes> response corresponds to the available control modes.  ATTENUATION: the attenuation control mode is available. POWER: the power control mode is available.
<b>Example(s)</b>	CONT:MODE:CAT? Returns ATTENUATION,POWER
<b>See Also</b>	:CONTRol:MODE :CONTRol:MODE?

---

## :INPut:ARESolution?

<b>Description</b>	<p>This query returns the smallest attenuation step available. Use this command to determine the maximum resolution of the attenuation.</p> <p>*RST has no effect on this command.</p>
<b>Syntax</b>	:INPut:ARESolution?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<Resolution>
<b>Response(s)</b>	<p><i>Resolution:</i></p> <p>The response data syntax for &lt;Resolution&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;Resolution&gt; response represents the smallest attenuation step available.</p>
<b>Example(s)</b>	INP:ARES? Returns: 2.000000E-003

---

### **:INPut:ATTenuation**

#### **Description**

This command sets the absolute attenuation to a specific value. The valid range of values depends on the type of instrument and the current wavelength. This value is used only when the ATTenuation control mode is active.

In POWer mode, the device adjusts the attenuation automatically to match the desired output power. For this reason, changes made to attenuation via the INPut:ATT command are not taken into account.

At \*RST, the absolute attenuation value that will be set depends on the instrument you have.

#### **Syntax**

:INPut:ATTenuation<wsp><Attenuation[<wsp>>DB]>|MAXimum|MINimum|DEFault

#### **Parameter(s)**

*Attenuation:*

The program data syntax for <Attenuation> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DB. The <Attenuation> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.  
MAXimum allows to set the instrument to the greatest supported value.



## :INPut:ATTenuation

DEfault allows the instrument to select a value for the <Attenuation> parameter.

The <Attenuation> parameter corresponds to a valid attenuation value. You can use the INPut:ATTenuation? MAX and INPut:ATTenuation? MIN queries to determine a valid attenuation range for the current wavelength.

### Example(s)

```
INP:WAV 1310 NM
CONT:MODE ATT
INP:ATT 5 DB
STAT:OPER:BIT8:COND? Keep sending the query
as long as attenuation is not reached. When
attenuation is reached, the returned value is 0.
INP:ATT MIN
STAT:OPER:BIT8:COND? Keep sending the query
as long as attenuation is not reached. When
attenuation is reached, the returned value is 0.
```

### See Also

```
:INPut:ATTenuation?
:INPut:RATTenuation
:OUTPut:POWer
:STATus:OPERation:BIT<n>:CONDition?
```

### **:INPut:ATTenuation?**

<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum absolute attenuation value.</p> <p>At *RST, the absolute attenuation value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	<p>:INPut:ATTenuation?[ &lt;wsp&gt;MAXimum   MINimum   DEFault]</p>
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum   MINimum   DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<p>&lt;Attenuation&gt;</p>

---

## **:INPut:ATTenuation?**

**Response(s)**

*Attenuation:*

The response data syntax for <Attenuation> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <Attenuation> response represents either the current or the MINimum/MAXimum absolute attenuation, in dB.

**Example(s)**

```
INP:WAV 1310 NM
CONT:MODE ATT
INP:ATT 25.30
INP:ATT? Returns: 2.530000E+001
```

**See Also**

```
:INPut:ATTenuation
:INPut:RATTenuation?
```

---

### :INPut:OFFSet

**Description** This command sets an offset value for the attenuation. This offset value will be added to the absolute attenuation. The same offset value will be used for all wavelengths. This value is used only when the ATTenuation control mode is active. The offset is only taken into account when the INPut:RATTenuation command is used.

At \*RST, the current value is set to 0 dB.

**Syntax** :INPut:OFFSet<wsp><Offset[<wsp>DB]>|MAXimum|MINimum|DEFault

**Parameter(s)** *Offset:*  
The program data syntax for <Offset> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DB. The <Offset> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.

MAXimum allows to set the instrument to the greatest supported value.

**:INPut:OFFSet**

DEfault allows the instrument to select a value for the <Offset> parameter.

The <Offset> parameter corresponds to a valid offset value. You can use the INPut:OFFSet? MAX and INPut:OFFSet? MIN queries to determine a valid range for the attenuation offset.

**Example(s)**

```

INP:WAV 1310 NM
CONt:MODE ATT
OUTP:APM ABS
INP:OFFS DEF
INP:ATT 20.50 DB
INP:ATT? Returns: 2.050000E+001
INP:RATT? Returns: 2.050000E+001
INP:OFFS -5.000 DB
INP:ATT? Returns: 2.050000E+001

INP:RATT? Returns: 1.550000E+001
INP:OFFS 4.000 DB
INP:ATT? Returns: 2.050000E+001
INP:RATT? Returns: 2.450000E+001
    
```

**See Also**

```

:INPut:OFFSet?
:INPut:RATTenuation
:OUTPut:OFFSet
    
```

## SCPI Command Reference

### Product-Specific Commands—Description

---

#### **:INPut:OFFSet?**

<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum attenuation offset value.</p> <p>At *RST, the current value is set to 0 dB.</p>
<b>Syntax</b>	<code>:INPut:OFFSet?[ &lt;wsp&gt;MAXimum MINimum DEFault]</code>
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<code>&lt;Offset&gt;</code>

---

**:INPut:OFFSet?**

**Response(s)**

*Offset:*

The response data syntax for <Offset> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <Offset> response represents either the current or the MINimum/MAXimum offset setting in dB.

**Example(s)**

CONT:MODE ATT

INP:OFFS 12.482

INP:OFFS? Returns: 1.248200E+001

**See Also**

:INPut:OFFSet

:INPut:RATTenuation

:OUTPut:OFFSet?

---

### :INPut:RATTenuation

**Description**

This command sets the relative attenuation to a specific value. The valid range of values depends on the type of instrument, the configuration, and the current wavelength. This value is used only when the ATTenuation control mode is active.

At \*RST, the relative attenuation value that will be set depends on the instrument you have.

**Syntax**

:INPut:RATTenuation<wsp> <RelativeAttenuation[ <wsp>DB]> | MAXimum | MINimum | DEFault

**Parameter(s)**

*RelativeAttenuation:*

The program data syntax for <RelativeAttenuation> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DB. The <RelativeAttenuation> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.

MAXimum allows to set the instrument to the greatest supported value.



## :INPut:RATTenuation

DEfault allows the instrument to select a value for the <RelativeAttenuation> parameter.

The <RelativeAttenuation> parameter is a valid relative attenuation value. You can use the INPut:RATTenuation? MAX and INPut:RATTenuation? MIN queries to determine a valid range for the attenuation.

a) In ABSolute mode, <RelativeAttenuation> = absolute attenuation + offset value.

b) In REFerence mode, <RelativeAttenuation> = absolute attenuation – reference value + offset value.

c) In XB mode (dB), <RelativeAttenuation> = absolute attenuation + correction factor (wavelength-specific) + offset value.

d) In XB mode (dBm), <RelativeAttenuation> = (absolute attenuation \*-1) + input power (wavelength-specific) + offset value.

### Example(s)

```
INP:WAV 1310 NM
CONT:MODE ATT
OUTP:APM ABS
INP:OFFS 1.000 DB
INP:RATT 15.355 DB
```

### :INPut:RATTenuation

STAT:OPER:BIT8:COND? Keep sending the query as long as attenuation is not reached. When attenuation is reached, the returned value is 0.

INP:ATT? Returns: 1.435500E+001

INP:RATT? Returns: 1.535500E+001

OUTP:APM REF

INP:ATT? Returns: 1.435500E+001

INP:RATT? Returns: 1.000000E+000

INP:RATT -2.000

STAT:OPER:BIT8:COND? Keep sending the query as long as attenuation is not reached. When attenuation is reached, the returned value is 0.

INP:ATT? Returns: 1.135500E+001

INP:RATT? Returns: -2.000000E+000

INP:RATT MIN

#### See Also

:CONTRol:MODE

:OUTPut:APMode

:INPut:ATTenuation

:INPut:OFFSet

:INPut:RATTenuation?

:INPut:REFerence

:STATus:OPERation:BIT<n>:CONDition?

:OUTPut:RPOWer

---

## :INPut:RATTenuation?

<b>Description</b>	<p>This query returns either the current or the minimum/maximum relative attenuation.</p> <p>At *RST, the relative attenuation value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	:INPut:RATTenuation?[ <wsp>MAXimum MINimum DEFault]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value.            MAXimum is used to retrieve the instrument's greatest supported value.            DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<RelativeAttenuation>
<b>Response(s)</b>	<p><i>RelativeAttenuation:</i></p> <p>The response data syntax for &lt;RelativeAttenuation&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p>

### **:INPut:RATTenuation?**

The <RelativeAttenuation> response represents either the current or the MINimum/MAXimum relative attenuation, in dB.

a) In ABSOLUTE mode, <RelativeAttenuation> = absolute attenuation + offset value.

b) In REFERENCE mode, <RelativeAttenuation> = absolute attenuation – reference value + offset value.

c) In XB mode (dB), <RelativeAttenuation> = absolute attenuation + correction factor (wavelength-specific) + offset value.

d) In XB mode (dBm), <RelativeAttenuation> = (absolute attenuation \* -1) + input power (wavelength-specific) + offset value.

#### **Example(s)**

INP:RATT 15.355 DB  
INP:RATT? Returns: 1.535500E+001

#### **See Also**

:CONTRol:MODE  
:OUTPut:APMode  
:INPut:ATTenuation?  
:INPut:OFFSet  
:INPut:RATTenuation  
:INPut:REFerence

---

## :INPut:REFErENCE

**Description** This command sets, for the current wavelength, a reference value for the attenuation. When the instrument is used in Reference mode, the attenuation configured with the INPut:RATTenuation command is relative to this reference value. This command will have no effect when the instrument is used in Absolute or X + B mode. This value is used only when the ATTenuation control mode is active.

At \*RST, the reference value that will be set depends on the instrument you have.

**Syntax** :INPut:REFErENCE<wsp><Reference[ <wsp>D B]> | MAXimum | MINimum | DEFault

**Parameter(s)** *Reference:*  
The program data syntax for <Reference> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DB. The <Reference> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.

MAXimum allows to set the instrument to the greatest supported value.

### :INPut:REFeRence

DEfault allows the instrument to select a value for the <Reference> parameter.

The <Reference> parameter represents the new reference value.

#### Example(s)

```
INP:WAV 1310 NM
CONT:MODE ATT
OUTP:APM ABS
INP:OFFS 0.000 DB
INP:RATT 33.865 DB
OUTP:APM REF
INP:RATT? Returns: 0.000000E+001
INP:REF? Returns: 3.386500E+001
INP:REF 12.345 DB
```

```
INP:RATT? Returns: 2.152000E+001
INP:REF MIN
```

#### See Also

```
:INPut:RATTenuation
:INPut:REFeRence?
:OUTPut:APMode
:OUTPut:APMode?
:OUTPut:REFeRence
```

---

**:INPut:REFeRence?**

<b>Description</b>	<p>This query returns either the current or the minimum/maximum reference value for the attenuation.</p> <p>At *RST, the reference value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	:INPut:REFeRence?[ <wsp>MAXimum MINimum DEFault]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value.          MAXimum is used to retrieve the instrument's greatest supported value.          DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<Reference>

---

## SCPI Command Reference

Product-Specific Commands—Description

---

### :INPut:REFeRence?

<b>Response(s)</b>	<p><i>Reference:</i></p> <p>The response data syntax for &lt;Reference&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;Reference&gt; response represents either the current or the MINimum/MAXimum reference value in dB.</p>
<b>Example(s)</b>	<pre>INP:WAV 1310 NM CONT:MODE ATT OUTP:APM REF INP:REF?</pre>
<b>See Also</b>	<pre>:INPut:RATTenuation? :INPut:REFeRence :OUTPut:APMode :OUTPut:APMode? :OUTPut:REFeRence</pre>

---



## :INPut:WAVelength

<b>Description</b>	<p>This command selects a specific wavelength.</p> <p>At *RST, the wavelength that will be selected depends on the instrument you have.</p>
<b>Syntax</b>	<p>:INPut:WAVelength&lt;wsp&gt;&lt;Wavelength[ &lt;wsp&gt;&gt;M]&gt;   MAXimum   MINimum   DEFault</p>
<b>Parameter(s)</b>	<p><i>Wavelength:</i></p> <p>The program data syntax for &lt;Wavelength&gt; is defined as a &lt;numeric_value&gt; element followed by an optional &lt;SUFFIX PROGRAM DATA&gt; element. The allowed &lt;SUFFIX PROGRAM DATA&gt; element is M. The &lt;Wavelength&gt; special forms MINimum, MAXimum and DEFault are accepted on input.</p> <p>MINimum allows to set the instrument to the smallest supported value.          MAXimum allows to set the instrument to the greatest supported value.</p>

### **:INPut:WAVelength**

DEfault allows the instrument to select a value for the <Wavelength> parameter.

The <Wavelength> parameter corresponds to the current wavelength. You can use the INPut:WAVelength? MAX and INPut:WAVelength? MIN queries to determine a valid range for the wavelength.

#### **Example(s)**

```
INP:WAV 1310 NM
STAT:OPER:BIT8:COND? Keep sending the query
as long as attenuation is not reached. When
attenuation is reached, the returned value is 0.
INP:WAV 0.000001550 M
STAT:OPER:BIT8:COND? Keep sending the query
as long as attenuation is not reached. When
attenuation is reached, the returned value is 0.
```

#### **See Also**

```
:INPut:WAVelength?
:STAT:OPER:BIT:COND?
```

---

---

**:INPut:WAVelength?**

<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum wavelength.</p> <p>At *RST, the wavelength that will be selected depends on the instrument you have.</p>
<b>Syntax</b>	:INPut:WAVelength?[ <wsp>MAXimum   MINimum   DEFault]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum   MINimum   DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value.            MAXimum is used to retrieve the instrument's greatest supported value.            DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<Wavelength>

---

### :INPut:WAVelength?

**Response(s)**

*Wavelength:*

The response data syntax for <Wavelength> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <Wavelength> response corresponds to either the current or the MINimum/MAXimum wavelength setting, in meters.

**Example(s)**

INP:WAV? MAX Returns: the maximum valid wavelength.

INP:WAV 1310 NM

INP:WAV? Returns: 1.310000E-006.

**See Also**

:INPut:WAVelength

---

**:LOCK[:STATe]**

**Description**

The :LOCK:STATe command controls the API write lock. When locked, only SCPI can change the instrument configuration.

At \*RST, the locked state of the instrument API remains unchanged.

**Syntax**

:LOCK[:STATe] <wsp> <State>

**Parameter(s)**

*State:*

The program data syntax for <State> is defined as a <Boolean Program Data> element. The <State> special forms ON and OFF are accepted on input for increased readability. ON corresponds to 1 and OFF corresponds to 0.

The program data syntax for <State> is defined as a <Boolean Program Data> element. The <State> special forms ON and OFF are accepted on input for increased readability. ON

corresponds to 1 and OFF corresponds to 0.

The <State> is rounded to an integer. A non-zero result is interpreted as 1.

**Example(s)**

:LOCK:STAT ON (api is locked)  
:LOCK:STAT 0 (api is unlocked)

**See Also**

:LOCK:STATe?

## SCPI Command Reference

Product-Specific Commands—Description

---

### **:LOCK[:STATe]?**

<b>Description</b>	The :LOCK:STATe? command return the locked state of the instrument API.
<b>Syntax</b>	:LOCK[:STATe]?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<State>
<b>Response(s)</b>	<i>State:</i> The response data syntax for <State> is defined as a <NR1 NUMERIC RESPONSE DATA> element.  The response data syntax for <State> is defined as a <NR1 NUMERIC RESPONSE DATA> element.  1 corresponds to ON and 0 corresponds to OFF.
<b>Example(s)</b>	:LOCK:STAT? returns 1 (api locked) :LOCK:STAT? returns 0 (api unlocked)
<b>See Also</b>	:LOCK:STATe

---

---

**:OUTPut:ALC[:STATe]**

**Description**

This command activates or deactivates the power tracking that controls the output power level. The power tracking is done via the ALC (Automatic Leveling Control) loop. The state of the ALC loop (on or off) is used only when the POWer control mode is active.

At \*RST, this value is set to off.

**Syntax**

:OUTPut:ALC[:STATe] <wsp> <State>

**Parameter(s)**

*State:*

The program data syntax for <State> is defined as a <Boolean Program Data> element. The <State> special forms ON and OFF are accepted on input for increased readability. ON corresponds to 1 and OFF corresponds to 0.

The <State> parameter corresponds to the new state of the ALC (Automatic Leveling Control) loop.

OFF: No power tracking will be performed.

ON: Power tracking is activated.

**See Also**

:OUTPut:ALC[:STATe]?  
 :CONTRol:MODE  
 :OUTPut:DTolerance  
 :OUTPut:POWer  
 :OUTPut:RPOWer

---

## SCPI Command Reference

Product-Specific Commands—Description

---

### **:OUTPut:ALC[:STATe]?**

<b>Description</b>	<p>This query indicates if the power tracking that controls the output power level has been activated or not. The power tracking is done via the ALC (Automatic Leveling Control) loop.</p> <p>At *RST, this value is set to off.</p>
<b>Syntax</b>	:OUTPut:ALC[:STATe]?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<State>
<b>Response(s)</b>	<p><i>State:</i></p> <p>The response data syntax for &lt;State&gt; is defined as a &lt;NR1 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;State&gt; response corresponds to the state of the ALC (Automatic Leveling Control) loop.</p> <p>0: No power tracking will be performed. 1: Power tracking is activated.</p>
<b>See Also</b>	:OUTPut:ALC[:STATe] :CONTRol:MODE :OUTPut:DTolerance :OUTPut:POWer :OUTPut:RPOWer

---



**:OUTPut:APMode**

<b>Description</b>	<p>This command selects the operation mode (ABSolute, REference or X+B ) for the active control mode (ATTenuation or POWer).</p> <p>At *RST, the operation mode is ABSolute for both control modes (ATTenuation and POWer).</p>
<b>Syntax</b>	:OUTPut:APMode<wsp>ABSolute XB REFere nce
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: ABSolute XB REFere nce.</p> <p>This parameter represents the desired mode.</p> <p>ABSolute selects Absolute mode. XB selects X+B mode. REFere nce selects Reference mode.</p>

---

## SCPI Command Reference

*Product-Specific Commands—Description*

---

### **:OUTPut:APMode**

<b>Example(s)</b>	INP:WAV 1310 NM CONT:MODE ATT OUTP:APM ABS INP:RATT 42.75 INP:RATT? Returns: 4.275000E+001 OUTP:APM XB CONT:MODE POW OUTP:APM REF CONT:MODE ATT OUTP:APM? Returns XB (corresponding to the X+B operation mode)
<b>Notes</b>	Since the operation mode applies to the active control mode, you must first define the control mode with the :CONTRol:MODE command.
<b>See Also</b>	:CONTRol:MODE :INPut:RATTenuation :OUTPut:APMode? :OUTPut:RPOWer

---

**:OUTPut:APMode?**

<b>Description</b>	<p>This query returns the current operation mode (ABSolute XB REFERENCE) for the active control mode (ATTenuation or POWer).</p> <p>At *RST, the operation mode is ABSolute for both control modes (ATTenuation and POWer).</p>
<b>Syntax</b>	:OUTPut:APMode?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<Mode>
<b>Response(s)</b>	<p><i>Mode:</i></p> <p>The response data syntax for &lt;Mode&gt; is defined as a &lt;CHARACTER RESPONSE DATA&gt; element.</p> <p>The &lt;Mode&gt; response corresponds to the operation mode that is currently selected.</p> <p>ABSOLUTE: the attenuator is in Absolute mode.            REFERENCE: the attenuator is in Reference mode.            XB: the attenuator is in X+B mode.</p>
<b>Example(s)</b>	<p>OUTP:APM XB            OUTP:APM? Returns XB (corresponding to the X+B operation mode)</p>
<b>See Also</b>	<p>:CONTRol:MODE            :INPut:RATTenuation            :OUTPut:APMode            :OUTPut:RPOWer</p>

### **:OUTPut:DTolerance**

**Description**

This command specifies the drift tolerance that will be used for power tracking via the ALC (Automatic Leveling Control) loop. This value is only taken into account when the ALC loop is active (OUTPut:ALC[:STATe] ON). This value is used only when the POWer control mode is active.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax**

:OUTPut:DTolerance<wsp><Drift[ <wsp>DB]> | MAXimum | MINimum | DEFault

**Parameter(s)**

*Drift:*

The program data syntax for <Drift> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DB. The <Drift> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.

MAXimum allows to set the instrument to the greatest supported value.

## **:OUTPut:DTolerance**

DEfault allows the instrument to select a value for the <Drift> parameter.

The <Drift> parameter corresponds to a valid drift tolerance for the power tracking via the ALC loop, in dB. You can use the OUTPut:DTolerance? MAX and OUTPut:DTolerance? MIN queries to determine a valid range for the drift tolerance.

### **Example(s)**

```
INP:WAV 1310 NM
CONT:MODE POW
OUTP:POW -25.00 DBM
OUTP:ALC:STAT ON
OUTP:DTO 0.005 DB
```

### **See Also**

```
:OUTPut:POWer
:OUTPut:DTolerance?
:OUTPut:ALC[:STATe]
```

---

### :OUTPut:DTolerance?

<b>Description</b>	<p>This query returns the drift tolerance that is used for power tracking via the ALC (Automatic Leveling Control) loop.</p> <p>At *RST, the value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	<p>:OUTPut:DTolerance?[&lt;wsp&gt;MAXimum MINimum DEFAULT]</p>
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFAULT.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFAULT is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<p>&lt;Drift&gt;</p>

---

**:OUTPut:DTolerance?**

**Response(s)**

*Drift:*

The response data syntax for <Drift> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <Drift> response corresponds to either the current or the MINimum/MAXimum drift tolerance that is used for power tracking via the ALC (Automatic Leveling Control) loop.

**Example(s)**

OUTP:DTO 5e-3 DB  
 OUTP:DTO? 5.000000E-003

**See Also**

:OUTPut:POWer  
 :OUTPut:DTolerance  
 :OUTPut:ALC[:STATe]?

### **:OUTPut:LOCK[:STATe]?**

**Description** This query returns the lock state of the instrument's shutter. If the shutter is closed using the push button (located on the front panel of the instrument), the shutter is automatically locked. Once the shutter is locked, it can only be unlocked by using the push button again.

At \*RST the lock state remains unchanged.

**Syntax** :OUTPut:LOCK[:STATe]?

**Parameter(s)** None

**Response Syntax** <ShutterLockState>

**Response(s)** *ShutterLockState:*

The response data syntax for <ShutterLockState> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

The <ShutterLockState> corresponds to the current lock state of the shutter.

---



**:OUTPut:LOCK[:STATe]?**

0: The shutter is unlocked and can be controlled using the OUTup[:STATe] command.

1: The shutter is locked and can not be controlled remotely. In this case, the shutter can only be unlocked by using the red push button (located on the instruments front panel).

**Example(s)**

OUTP:LOCK:STAT? Returns: 0 (The shutter is unlocked and can be controlled using the OUTup[:STATe] command.)

**See Also**

:OUTPut[:STATe]

---

### **:OUTPut:OFFSet**

**Description**

This command sets a power offset value. The power offset value will be added to the absolute output power. The same power offset value will be used for all wavelengths. The offset is only taken into account when the `OUTPut:RPOWer` command is used. This value is used only when the `POWer` control mode is active.

At `*RST`, this value is set to 0 dB.

**Syntax**

`:OUTPut:OFFSet<wsp><Offset[<wsp>DB]> | MAXimum | MINimum | DEFault`

**Parameter(s)**

*Offset:*

The program data syntax for `<Offset>` is defined as a `<numeric_value>` element followed by an optional `<SUFFIX PROGRAM DATA>` element. The allowed `<SUFFIX PROGRAM DATA>` element is `DB`. The `<Offset>` special forms `MINimum`, `MAXimum` and `DEFault` are accepted on input.

`MINimum` allows to set the instrument to the smallest supported value.

`MAXimum` allows to set the instrument to the greatest supported value.

---

**:OUTPut:OFFSet**

DEfault allows the instrument to select a value for the <Offset> parameter.

The <Offset> parameter corresponds to a valid power offset in dB. The offset value will be added to the absolute power. The same offset value will be used for all wavelengths. You can use the OUTPut:OFFSet? MAX and OUTPut:OFFSet? MIN queries to determine a valid range for the power offset.

**Example(s)**

```
INP:WAV 1310 NM
CONT:MODE POW
OUTP:ALC:STAT OFF
OUTP:APM ABS
OUTP:OFFS 0.000 DB
OUTP:POW -5.500 DBM
OUTP:POW? Returns: -5.500000E+000
OUTP:RPOW? Returns: -5.500000E+000
OUTP:OFFS -1.500 DB
```

```
OUTP:POW? Returns: -5.500000E+000
OUTP:RPOW? Returns: -7.000000E+000
OUTP:OFFS MAX
```

**See Also**

```
:INPut:OFFSet
:OUTPut:OFFSet?
:OUTPut:RPOWer
```

## SCPI Command Reference

### Product-Specific Commands—Description

---

<b>:OUTPut:OFFSet?</b>	
<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum power offset setting.</p> <p>At *RST, this value is set to 0 dB.</p>
<b>Syntax</b>	<code>:OUTPut:OFFSet?[&lt;wsp&gt;MAXimum MINimum DEFault]</code>
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<code>&lt;Offset&gt;</code>

---

**:OUTPut:OFFSet?**

<b>Response(s)</b>	<p><i>Offset:</i></p> <p>The response data syntax for &lt;Offset&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;Offset&gt; response corresponds to either the current or the MINimum/MAXimum power offset value in dB.</p>
<b>Example(s)</b>	<p>CONT:MODE POW          OUTP:OFFS -5.000 DB          OUTP:OFFS? Returns: -5.000000E+000</p>
<b>See Also</b>	<p>:INPut:OFFSet?          :OUTPut:OFFSet          :OUTPut:RPOWer</p>

### :OUTPut:POWer

**Description** This command sets the absolute output power to a specific value. The valid range of values depends on the type of instrument, the configuration, the current wavelength, and the input power. This value is used only when the POWer control mode is active.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax** :OUTPut:POWer<wsp><Power[ <wsp>DBM]>  
|MAXimum|MINimum|DEFault

**Parameter(s)** *Power:*  
The program data syntax for <Power> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DBM. The <Power> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.  
MAXimum allows to set the instrument to the greatest supported value.

---

---

**:OUTPut:POWer**

DEfault allows the instrument to select a value for the <Power> parameter.

The <Power> parameter is a valid output power in dBm. You can use the OUTPut:POWer? MAX and OUTPut:POWer? MIN queries to determine a valid range for the output power.

**Example(s)**

INP:WAV 1310 NM  
 CONT:MODE POW  
 OUTP:POW -15.000 DBM  
 STAT:OPER:BIT8:COND? Keep sending the query as long as the output power is not reached. When output power is reached, the returned value is 0.

OUTP:POW MAX  
 STAT:OPER:BIT8:COND? Keep sending the query as long as the output power is not reached. When output power is reached, the returned value is 0.

**See Also**

INPut:ATTenuation  
 OUTPut:ALC[:STATe]  
 OUTPut:DTolerance  
 OUTPut:POWer?  
 OUTPut:RPOWer?  
 :STATus:OPERation:BIT<n>:CONDition?

---

### :OUTPut:POWer?

<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum absolute power value.</p> <p>At *RST, the value that will be set is device-dependent.</p>
<b>Syntax</b>	:OUTPut:POWer?[ <wsp>MAXimum   MINimum   DEFault]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum   MINimum   DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<Power>

---



**:OUTPut:POWer?**

<b>Response(s)</b>	<p><i>Power:</i></p> <p>The response data syntax for &lt;Power&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;Power&gt; response represents either the current or the MINimum/MAXimum absolute power value, in dBm.</p>
<b>Example(s)</b>	<pre>INP:WAV 1310 NM CONT:MODE POW OUTP:POW -15.000 DBM OUTP:POW? Returns -1.500000E+001</pre>
<b>See Also</b>	<pre>:OUTPut:ALC[:STATe]? :OUTPut:DTolerance? :OUTPut:POWer :OUTPut:RPOWer?</pre>

### :OUTPut:REference

**Description** This command sets a power reference value for the current wavelength. When the instrument is used in REference mode, the power is relative to this reference value. This command will have no effect when the instrument is used in Absolute or X + B mode. This value is used only when the POWer control mode is active.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax** :OUTPut:REference<wsp><Reference[<wsp>DBM]>|MAXimum|MINimum|DEFault

**Parameter(s)** *Reference:*  
The program data syntax for <Reference> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DBM. The <Reference> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.  
MAXimum allows to set the instrument to the greatest supported value.

---

**:OUTPut:REference**

DEfault allows the instrument to select a value for the <Reference> parameter.

The <Reference> parameter represents the new power reference value.

**Example(s)**

```
INP:WAV 1310 NM
CONT:MODE POW
OUTP:ALC:STAT OFF
OUTP:APM ABS
OUTP:OFFS 0.000 DB
OUTP:RPOW -15.000 DBM
OUTP:APM REF
OUTP:RPOW? Returns: 0.000000E+000
OUTP:REF? Returns: -1.500000E+001
OUTP:REF -10.000
OUTP:RPOW? Returns: -5.000000E+000
```

**See Also**

```
:INPut:REference
:OUTPut:APMode
:OUTPut:OFFSet
:OUTPut:REference?
:OUTPut:RPOWer
```

## SCPI Command Reference

Product-Specific Commands—Description

---

### :OUTPut:REference?

<b>Description</b>	<p>This query returns either the current or the minimum/maximum output power reference value.</p> <p>At *RST, the value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	:OUTPut:REference?[<wsp>MAXimum MINimum DEFAULT]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFAULT.</p> <p>MINimum is used to retrieve the instrument's smallest supported value. MAXimum is used to retrieve the instrument's greatest supported value. DEFAULT is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<Reference>

---

**:OUTPut:REFeRence?**

**Response(s)**

*Reference:*

The response data syntax for <Reference> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <Reference> response represents either the current or the MINimum/MAXimum power reference value in dBm.

**Example(s)**

```
INP:WAV 1310 NM
CONT:MODE POW
OUTP:APM REF
OUTP:REF 12.345 DBM
OUTP:REF? Returns: 1.234500E+001
```

**See Also**

```
:INPut:REFeRence
:OUTPut:APMode
:OUTPut:OFFSet
:OUTPut:REFeRence
:OUTPut:RPOWer
```

---

## SCPI Command Reference

Product-Specific Commands—Description

---

### :OUTPut:RPOWer

**Description** This command sets the relative power to a specific value. The valid range of values depends on the type of instrument, the configuration, and the input power. This value is used only when the POWer control mode is active.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax** :OUTPut:RPOWer<wsp><RelativePower[<wsp>>DBM]>|MAXimum|MINimum|DEFault

**Parameter(s)** *RelativePower:*  
The program data syntax for <RelativePower> is defined as a <numeric\_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is DBM. The <RelativePower> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.

MAXimum allows to set the instrument to the greatest supported value.

**:OUTPut:RPOWER**

DEfault allows the instrument to select a value for the <RelativePower> parameter.

The <RelativePower> parameter corresponds to a valid relative power. You can use the OUTPut:RPOWER? MAX and OUTPut:RPOWER? MIN queries to determine a valid range for the power.

a) In ABSolute mode, <RelativePower> = absolute power + power offset value.

b) In Reference mode, <RelativePower> = absolute power – power reference value + power offset value.

c) In X+B mode (dBm), <RelativePower> = absolute power + correction factor (wavelength-specific) + power offset value.

---

## SCPI Command Reference

*Product-Specific Commands—Description*

---

### :OUTPut:RPOWer

#### Example(s)

```
INP:WAV 1310 NM
CONT:MODE POW
OUTP:APM ABS
OUTP:OFFS -10.500 DB
OUTP:RPOW -40.00 DBM
```

```
STAT:OPER:BIT8:COND? Keep sending the query
as long as the output power is not reached. When
output power is reached, the returned value is 0.
OUTP:RPOW? Returns -4.000000E+001
OUTP:POW? Returns -2.950000E+001
OUTP:APM REF
OUTP:RPOW? Returns 0.000000E+001
OUTP:RPOW 2.00
```

#### See Also

```
:CONTRol:MODE
:INPut:RATTenuation
:OUTPut:APMode
:OUTPut:OFFSet
:OUTPut:REFerence
:OUTPut:RPOWer?
:STATus:OPERation:BIT<n>:CONDition?
```

---



**:OUTPut:RPOWer?**

<b>Description</b>	<p>This query returns a value indicating either the current or the minimum/maximum relative power value.</p> <p>At *RST, the value that will be set depends on the instrument you have.</p>
<b>Syntax</b>	:OUTPut:RPOWer?[<wsp>MAXimum MINimum DEFault]
<b>Parameter(s)</b>	<p><i>Parameter 1:</i></p> <p>The program data syntax for the first parameter is defined as a &lt;CHARACTER PROGRAM DATA&gt; element. The allowed &lt;CHARACTER PROGRAM DATA&gt; elements for this parameter are: MAXimum MINimum DEFault.</p> <p>MINimum is used to retrieve the instrument's smallest supported value.          MAXimum is used to retrieve the instrument's greatest supported value.          DEFault is used to retrieve the instrument's default value.</p>
<b>Response Syntax</b>	<RelativePower>

---

### :OUTPut:RPOWer?

#### Response(s)

*RelativePower:*

The response data syntax for <RelativePower> is defined as a <NR3 NUMERIC RESPONSE DATA> element.

The <RelativePower> parameter corresponds to a valid relative power value.

a) In ABSOLUTE mode, <RelativePower> = absolute power + power offset value.

b) In REREFERENCE mode, <RelativePower> = absolute power – power reference value + power offset value.

c) In XB (X+B) mode, <RelativePower> = absolute power + correction factor (wavelength-specific) + power offset value.

#### Example(s)

```
CONT:MODE POW
OUTP:APM ABS
OUTP:RPOW -40.00 dBm
OUTP:OFFS 0.0
OUTP:RPOW? Returns -4.000000E+001
OUTP:OFFS 2.5
OUTP:RPOW? Returns -3.750000E+001
```

#### See Also

```
:CONTRolMODE
:OUTPut:APMode
:OUTPut:OFFSet
:OUTPut:REFerence
:OUTPut:RPOWer
```

---

**:OUTPut[:STATe]**

<b>Description</b>	<p>This command controls the state of the instrument's shutter (open or closed).</p> <p>At *RST, the state of the shutter is set to off (closed).</p>
<b>Syntax</b>	:OUTPut[:STATe]<wsp><ShutterState>
<b>Parameter(s)</b>	<p><i>ShutterState:</i></p> <p>The program data syntax for &lt;ShutterState&gt; is defined as a &lt;Boolean Program Data&gt; element. The &lt;ShutterState&gt; special forms ON and OFF are accepted on input for increased readability. ON corresponds to 1 and OFF corresponds to 0.</p> <p>The &lt;ShutterState&gt; parameter allows to set the state of the shutter.</p> <p>0 or OFF: closes the shutter (no light is transmitted).</p> <p>1 or ON: opens the shutter (allows light transmission).</p>
<b>Example(s)</b>	OUTP ON OUTP:STAT OFF OUTP:STAT 1 OUTP 0
<b>See Also</b>	:OUTPut[:STATe]? :OUTPut:LOCK[:STATe]?

---

## SCPI Command Reference

Product-Specific Commands—Description

---

<b>:OUTPut[:STATe]?</b>	
<b>Description</b>	<p>This query returns the state of the instrument's shutter.</p> <p>At *RST, the state of the shutter is set to off (closed).</p>
<b>Syntax</b>	:OUTPut[:STATe]?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<ShutterState>
<b>Response(s)</b>	<p><i>ShutterState:</i></p> <p>The response data syntax for &lt;ShutterState&gt; is defined as a &lt;NR1 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;ShutterState&gt; represents the current shutters state.</p> <p>0: the shutter is closed (no light is transmitted). 1: the shutter is open (allows light transmission).</p>
<b>Example(s)</b>	<p>OUTP:STAT ON OUTP:STAT? Returns: 1 (the shutter is open)</p>
<b>See Also</b>	<p>:OUTPut[:STATe] :OUTPut:LOCK[:STATe]?</p>

---

---

**:READ[:SCALar]:POWer:DC?**

<b>Description</b>	<p>This query returns the power measured at the instrument's input port.</p> <p>This command is an event and has no associated *RST condition or query form.</p>
<b>Syntax</b>	:READ[:SCALar]:POWer:DC?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<PowerMeasurement>
<b>Response(s)</b>	<p><i>PowerMeasurement:</i></p> <p>The response data syntax for &lt;PowerMeasurement&gt; is defined as a &lt;NR3 NUMERIC RESPONSE DATA&gt; element.</p> <p>The &lt;PowerMeasurement&gt; response represents the current input power.</p>
<b>Example(s)</b>	<p>READ:SCAL:POW:DC? Returns -1.254000E+001</p> <p>READ:SCAL:POW:DC? Returns 9221120237577961472 = (UNDERRANGE)</p> <p>READ:SCAL:POW:DC? Returns 9221120238114832384 = (OVERRANGE)</p>

---

## SCPI Command Reference

### Product-Specific Commands—Description

---

<b>:RST</b>	
<b>Description</b>	The command resets the attenuator to its default configuration.  This command is an event and has no associated *RST condition or query form.
<b>Syntax</b>	:RST
<b>Parameter(s)</b>	None
<b>Example(s)</b>	OUTP:STAT ON OUTP:STAT? Returns: 1 (the shutter is open) RST OUTP:STAT? Returns: 0 (the shutter is closed)

---

---

**:SENSe:CORRection:COLLect:ZERO**

<b>Description</b>	<p>This command performs an offset nulling on the internal power meter.</p> <p>This command is an event and has no associated *RST condition or query form.</p>
<b>Syntax</b>	:SENSe:CORRection:COLLect:ZERO
<b>Parameter(s)</b>	None
<b>Example(s)</b>	<p>STAT? Must return READY</p> <p>SENS:CORR:COLL:ZERO</p> <p>STAT:OPER:BIT10:COND? Keep resending the query as long as the operation is not complete (returned value is not 0).</p>
<b>Notes</b>	This command will take at least 3 seconds to complete.
<b>See Also</b>	<p>:CALibration:ZERO</p> <p>:STATus:OPERation:BIT&lt;n&gt;:CONDition?</p>

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## SCPI Command Reference

*Product-Specific Commands—Description*

---

<b>:SNUMber?</b>	
<b>Description</b>	<p>This query returns a value indicating the instrument's serial number</p> <p>This command is an event and has no associated *RST condition or query form.</p>
<b>Syntax</b>	:SNUMber?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<SerialNumber>
<b>Response(s)</b>	<p><i>SerialNumber:</i></p> <p>The response data syntax for &lt;SerialNumber&gt; is defined as a &lt;STRING RESPONSE DATA&gt; element.</p> <p>The &lt;SerialNumber&gt; response represents a string containing the instruments serial number.</p>
<b>Example(s)</b>	SNUM? Returns "123456-AB"

---



**:STATus?**

<b>Description</b>	<p>This query returns a value indicating the status of the attenuator.</p> <p>This command is an event and has no associated *RST condition or query form.</p>
<b>Syntax</b>	:STATus?
<b>Parameter(s)</b>	None
<b>Response Syntax</b>	<Status>
<b>Response(s)</b>	<p><i>Status:</i></p> <p>The response data syntax for &lt;Status&gt; is defined as a &lt;CHARACTER RESPONSE DATA&gt; element.</p> <p>The &lt;Status&gt; response represents the instrument state, where:</p>

---

## SCPI Command Reference

*Product-Specific Commands—Description*

---

### **:STATus?**

UNINITIALIZED means the instrument has not been initialized yet.

INITINPROGRESS means the instruments initialization is in progress.

READY means the instrument is ready.

BUSY means the instrument is busy.

DISCONNECTED means the instrument is disconnected.

DEFECTIVE means the instrument is defective.

#### **Example(s)**

STAT? Must return READY

SENS:CORR:COLL:ZERO

STAT? returns BUSY

STAT? Keep sending the query as long as the returned value is "BUSY". When the operation is complete, the returned value could be "READY".

#### **See Also**

:STATus:OPERation:BIT<n>:CONDition?

---

## **:STATus:OPERation:BIT<n>: CONDition?**

**Description**

This query returns the state of a specific bit in the OPERATION register set. The <n>, ("bit <n>") indicates for which bit the information must be retrieved in the :STATus:OPERation status register. The <n> value must be a number from 8 to 12.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax**

:STATus:OPERation:BIT<n>:CONDition?

**Parameter(s)**

None

**Response Syntax**

<OperationCondition>

**Response(s)**

*OperationCondition:*

The response data syntax for <OperationCondition> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

### **:STATus:OPERation:BIT<n>: CONDition?**

The <OperationCondition> represents the current operation condition of the instrument. The meaning of the response depends on the value returned for bit <n>.

Bit <8>: When the returned value is 1, the instrument is currently adjusting the attenuation to reach a new set point. When the returned value is 0, the new set point is reached and the attenuation is stable.

Bit <9>: When the returned value is 1, the instruments mechanism is being repositioned at its home position (CALibration:ZERO).

Bit <10>: When the returned value is 1, the nulling of the offsets on the internal power meter is in progress.

#### **Example(s)**

STAT:OPER:BIT8:COND?

#### **See Also**

CALibration:ZERO

SENSe:CORRection:COLLect:ZERO

STATus?

STATus:QUEStionable:BIT<n>:CONDition?

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## :STATus:QUEStionable:BIT<n>:CONDition?

**Description**

This query returns the state of a specific bit in the QUEStionable register set. The <n>, ("bit <n>") indicates for which bit the information must be retrieved in the :STATus:QUEStionable status register. The <n> value must be a number from 9 to 12.

At \*RST, the value that will be set depends on the instrument you have.

**Syntax**

:STATus:QUEStionable:BIT<n>:CONDition?

**Parameter(s)**

None

**Response Syntax**

<`uestionableCondition>

**Response(s)**

*QuestionableCondition:*

The response data syntax for <QuestionableCondition> is defined as a <NR1 NUMERIC RESPONSE DATA> element.

### **:STATus:QUESTionable:BIT<n>: CONDition?**

The <QuestionableCondition> corresponds to the current questionable condition of the instrument. The meaning of the response depends on the value returned for bit <n>.

Bit <9>: When the value is 1, EXFO recommends that the instruments mechanism be returned to its home position (CALibration:ZERO). This operation must be performed after many moves of the instruments mechanism or when variations in temperature occur.

Bit <10>: When the returned value is 1, the operation temperature is outside the recommended operation temperature range as indicated in the instruments specifications.

**Example(s)**

STAT:QUES:BIT9:COND?

**See Also**

:CALibration:ZERO

:STATus:OPERation:BIT<n>:CONDition?

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## **B** ***REST Command Reference***

A complete list of the REST commands for your unit is available at all times online. It details the commands with examples and appropriate syntax.

***To view the REST command documentation:***

From your internet browser, go to the following address:

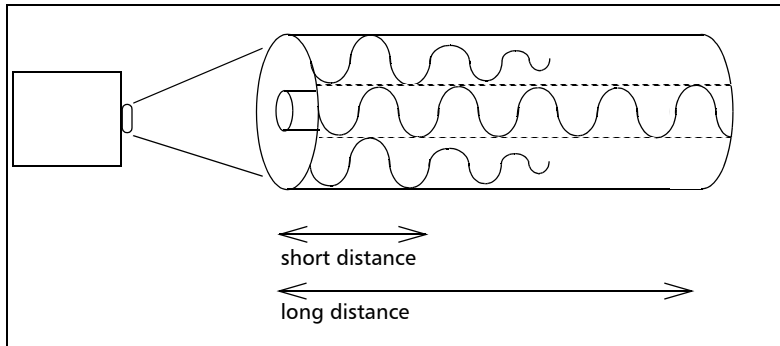
[http://\[IP address of your platform\]/3500/help](http://[IP address of your platform]/3500/help).





# C **Measuring Multimode Insertion Loss**

Often, when using a multimode source (mostly LED sources), part of the optical energy is transmitted into the fiber cladding. These cladding modes attenuate rapidly, but will affect power meter readings if the source is connected using only a short jumper, as would be the case when taking a reference before measuring insertion loss.



Due to the internal optics of the Variable Optical Attenuator (and the majority of attenuators), most of the cladding modes are filtered out. This means that, with the attenuator connected, the power meter will display a loss greater than the attenuation setting of the attenuator (cladding modes have been partially stripped).

Cladding modes are not used in communication systems and, therefore, should not have been part of the source power measurement in the first place.

## Measuring Multimode Insertion Loss

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There are several methods of eliminating these cladding modes:

- A cladding mode stripper (preferred method) is a material with a refractive index greater than that of the cladding. With the cladding exposed, the fiber is immersed in the mode stripper (glycerin, oil, or other suitable liquid). Due to the greater refractive index of the stripper, light energy is not reflected at the cladding-stripper interface and passes through the stripper.
- Cladding modes attenuate to insignificant levels over relatively short distances. Therefore, we recommend using a long fiber jumper.
- A mandrel wrap can be introduced by making a minimum of five turns around a 0.5 in. diameter mandrel. This method will introduce slight losses in the multimode core and remove some of the cladding modes. A mandrel wrap is not the preferred method of controlling cladding modes in multimode fibers.

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CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

中国关于有害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS  
CONTAINED IN THIS EXFO PRODUCT

包含在本 EXFO 产品中的有毒有害物质或元素的名称及含量

Part Name 部件名称	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr(VI))	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电气组件	X	O	X	O	X	X
Optical sub-assembly <sup>a</sup> 光学组件 <sup>a</sup>	X	O	O	O	O	O
Mechanical sub-assembly <sup>a</sup> 机械组件 <sup>a</sup>	O	O	O	O	O	O

Note:

注:

This table is prepared in accordance with the provisions of SJ/T 11364.

本表依据 SJ/T 11364 的规定编制。

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。

X: indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572. Due to the limitations in current technologies, parts with the "X" mark cannot eliminate hazardous substances.



X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 标准规定的限量要求。

标记 "X" 的部件, 皆因全球技术发展水平限制而无法实现有害物质的替代。

a. If applicable.

如果适用。

MARKING REQUIREMENTS  
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限 (年)	Logo 标志
This EXFO product 本 EXFO 产品	10	
Battery <sup>a</sup> 电池	5	

a. If applicable.  
如果适用。

P/N: 1071151

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