User Guide

IQS-3150

Variable Attenuator for IQS Platforms

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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: 3.0.0.1

Contents

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.

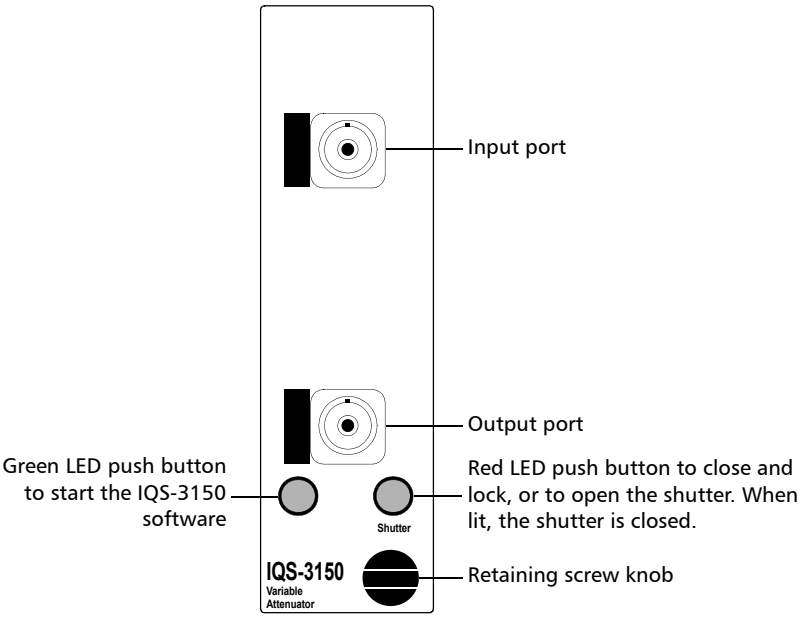
Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

1 Introducing the IQS-3150 Variable Attenuator

The IQS-3150 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 IQS-3150 features and its typical applications.

Models and Options

The IQS-3150 module is a high-performance attenuator, part of the IQS product line.



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

The IQS-3150 Variable Attenuator is available in four models:

- Standard singlemode
- Standard multimode
- Self-adjusting singlemode (added Output Power control mode)
- Self-adjusting multimode (added Output Power control mode)

  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.

Compatibility with various fiber cores is an option that you can add to your IQS-3150.

Local and Remote Control

The IQS-3150 Variable Attenuator supports local control (via the IQS Manager software) and remote control (through GPIB, RS-232, or Ethernet TCP/IP using SCPI commands or the provided LabVIEW drivers). For more information, refer to the *IQS platform* user guide.

Note: *With IQS-3100 modules, you can use the LabVIEW drivers created for the IQS-3150 module. However, the documentation and especially the examples provided with the drivers are focused on the new functionalities of the IQS-3150.*

Typical Applications

The IQS-3150 Variable Attenuator can be used in a number of test situations. It is ideal for manufacturing and laboratory applications:

- Erbium-doped-fiber amplifier (EDFA) and system characterization
- Component and system loss simulation
- Optical margin analysis
- Instrument calibration
- Power meter linearity measurement
- Spectral tuning.

The IQS-3150 is perfectly suited for WDM applications by providing the same attenuation level on all channels simultaneously for a complete characterization of amplifiers or subsystems.

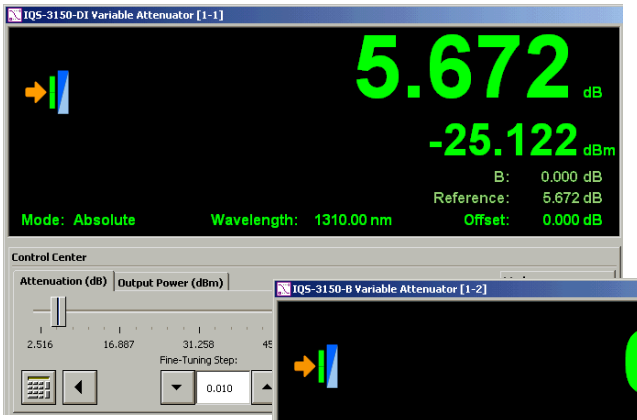
Main Software Features

The dedicated software functions are very similar whether you are using a self-adjusting or standard module. The following is an overview of the main features.

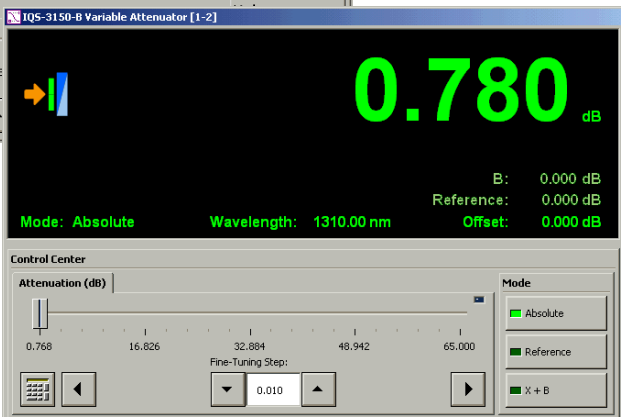
Control Center

For the standard module, the output power value does not appear on the data display and there is no **Output Power** tab in the **Control Center**.

Self-adjusting module



Standard module



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	The instrument applies the attenuation values you have selected. 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 **Instrument** function tab. The value appearing underneath the attenuation value is the output power.
Output Power	The instrument produces the output power level you have selected. 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 **Instrument** function tab. The value appearing underneath the attenuation value is the output power.

Display Modes

Both standard and self-adjusting modules give you a choice of three display modes: 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 (see *Selecting a Display Mode* on page 32). Displayed att. = absolute att. – reference value + offset value
X+B	The displayed attenuation is the sum of two elements: ➤ X = physical attenuation introduced by the unit. ➤ B = correction factor (dB). You must define the correction factor for the test wavelength before enabling the X+B mode (refer to *Setting the B Value* on page 25). Displayed att. = absolute att. + correction factor[a] + offset value ➤ B = input power value (dBm) Displayed att. = (absolute att. × –1) + input power[a] + offset value

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

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 *Selecting a Display Mode* on page 32). Displayed power = absolute power – reference value + offset value
X+B	The displayed output power is the sum of two elements: ➤ X = output power of the unit. ➤ B = correction factor. You must define the correction factor for the test wavelength before enabling the X+B mode (refer to *Setting the B Value* on page 25). Displayed power = absolute power + correction factor[a] + offset value

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

Multiple Module Control

The multimodule application is used to control and monitor several IQS-3150 variable attenuators at the same time.

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 IQS-3150 Variable Attenuator does not include laser components in itself. However, other modules or units you will use may do so. Please, 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.

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 Variable Attenuator consumption is 5 W.

2 Getting Started with Your Variable Attenuator

Inserting and Removing Test Modules

CAUTION

Never insert or remove a module while the controller unit and its expansion units are turned on. This will result in immediate and irreparable damage to both the module and unit.

CAUTION

To avoid damaging your unit, use it only with modules approved by EXFO.

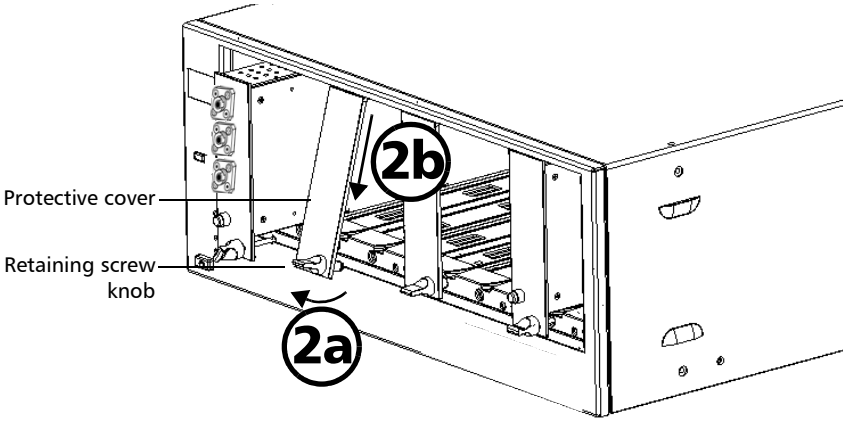
To insert a module into the controller or expansion unit:

1. Exit IQS Manager and turn off all your units.

2. Remove the protective cover from the desired unused module slot.

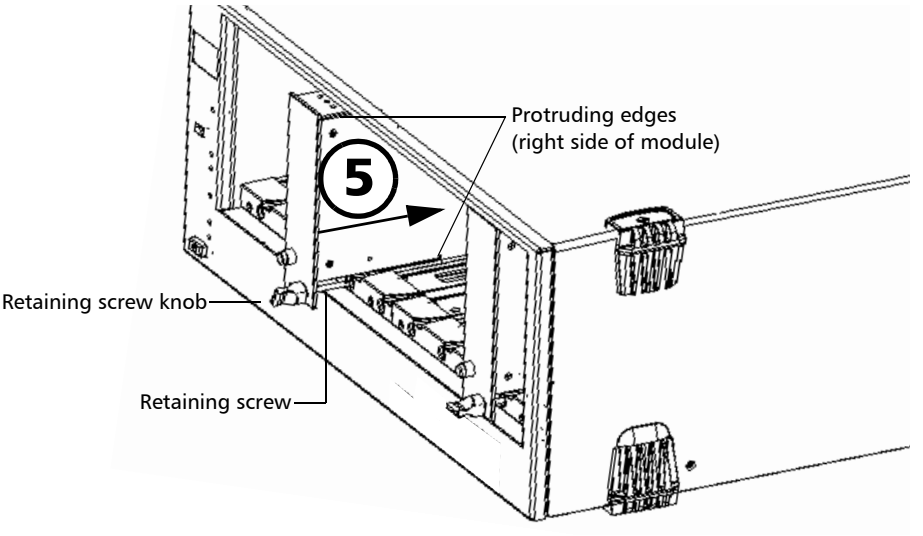
2a. Pull the retaining screw knob firmly towards you and release the bottom of the cover.

2b. Gently pull the top of the protective cover downwards, to remove it from the unit grooves.



3. Position the module so that its front panel is facing you and the top and bottom protruding edges are to your right.

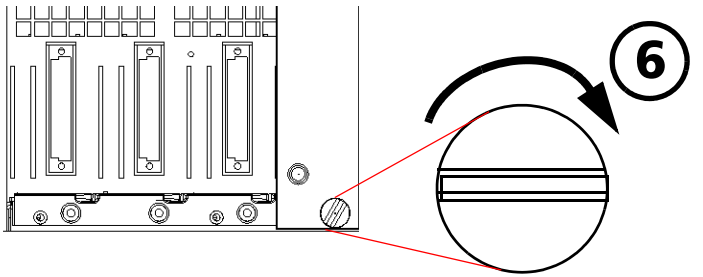
4. Insert the protruding edges of the module into the grooves of the unit's module slot.



5. Push the module all the way to the back of the slot, until the retaining screw makes contact with the unit casing.

6. While applying slight pressure to the module, turn the retaining screw knob (located at the bottom of the panel) clockwise until the knob is horizontal.

This will secure the module into its "seated" position.



The module is correctly inserted when its front panel is flush with the front panel of the controller or expansion unit.

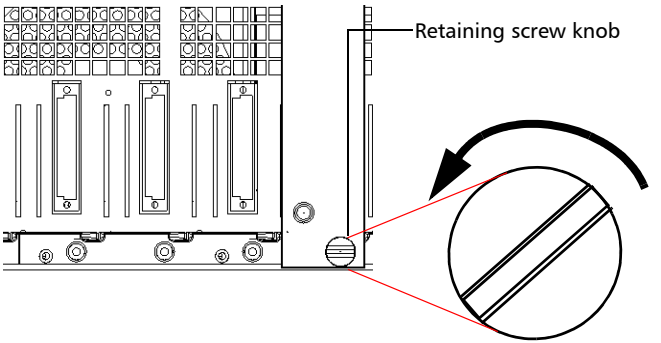
When you turn on the controller unit, the startup sequence will automatically detect your module.

Note: *You can insert IQ modules into your controller or expansion unit; the IQS Manager software will recognize them. However, the IQS-600 locking mechanism (retaining screw) will not work for IQ modules.*

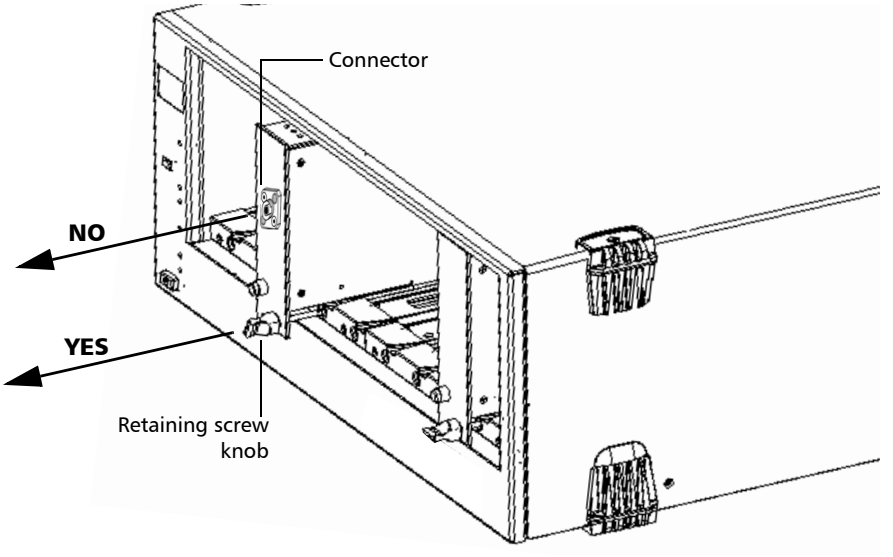
To remove a module from your controller or expansion unit:

1. While pulling gently on the knob, turn it counterclockwise until it stops.

The module will slowly be released from the slot.



2. Place your fingers underneath the module or hold it by the retaining screw knob *(NOT by the connector)* and pull it out.



CAUTION

Pulling out a module by a connector could seriously damage both the module and connector. Always pull out a module by the retaining screw knob.

3. Cover empty slots with the supplied protective covers.

3a. Slide the top of the protective cover into the upper grooves of the unit.

3b. Snap the cover into place by pushing the retaining screw knob.

CAUTION

Failure to reinstall protective covers over empty slots will result in ventilation problems.

Starting the Variable Attenuator Application

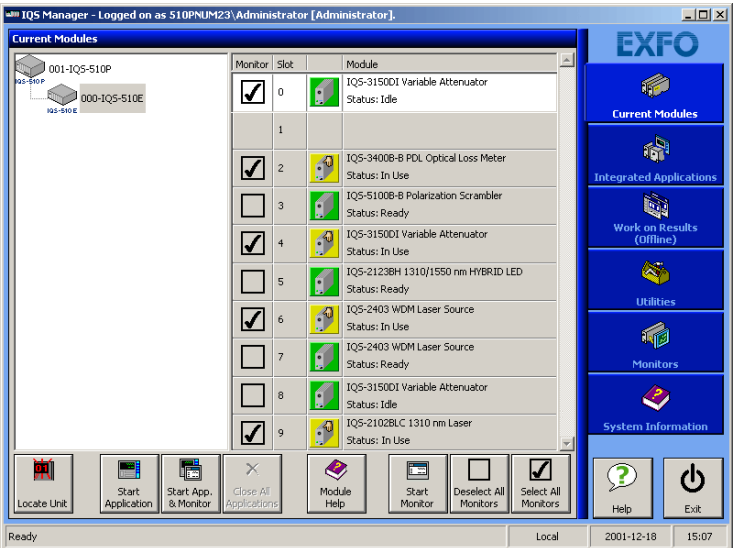
Your IQS-3150 Variable Attenuator module can be configured and controlled from its dedicated IQS Manager application.

Note: *For details about IQS Manager, refer to the* IQS platform *user guide.*

To start the application:

1. From the **Current Modules** function tab select the module to use.

   It will turn white to indicate that it is highlighted.



Note: *When starting the application for the first time after a firmware update, it is possible that the wait period extends over two minutes. Please wait until the application start is finished before using other commands.*

2. Click **Start Application**.

   OR

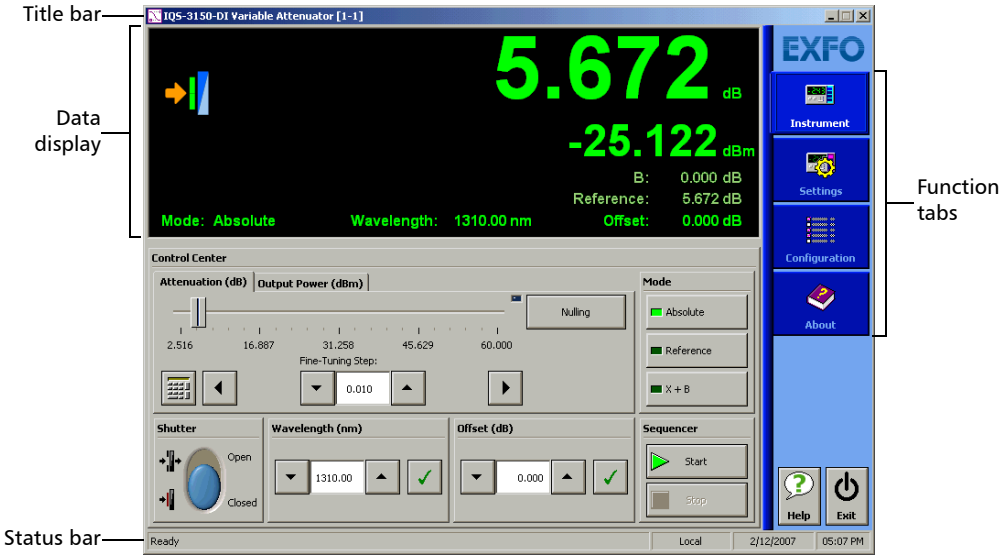
Press the green LED push button on the front of the corresponding module.

You can also double-click its row.

Note: *Pressing the LED push button will only enable you to switch to the module application. No action will be performed on the module automatically.*

Note: *To start the corresponding monitor window at the same time, click* ***Start App. & Monitor****. The window opens on the* ***Monitors*** *function tab.*

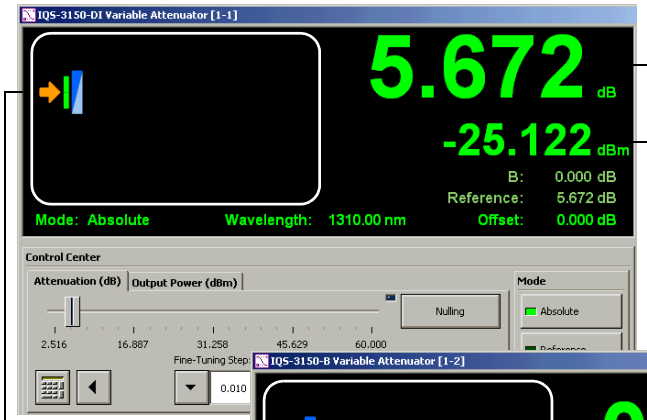
The main window (shown below) contains all the commands required to control the Variable Attenuator:



Data Display

Some elements of the data display differ depending on the type of module you are using (standard or self-adjusting).

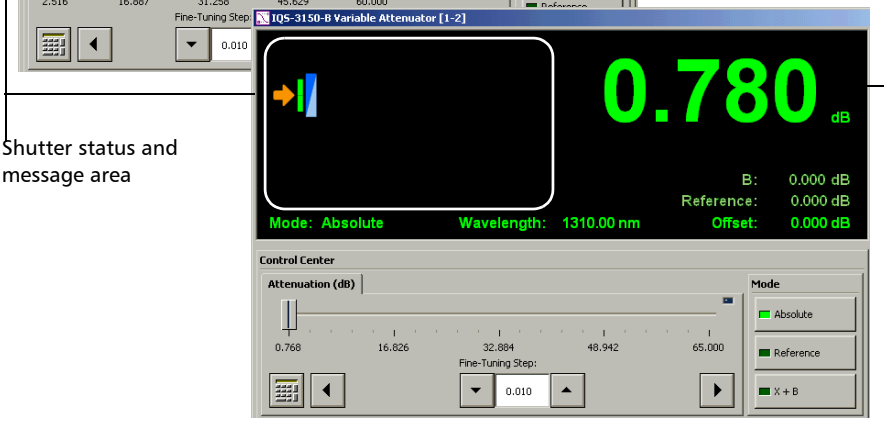
Self-adjusting module



Current attenuation (Attenuation control mode) or selected output power (Output Power control mode)

Output power

Standard module

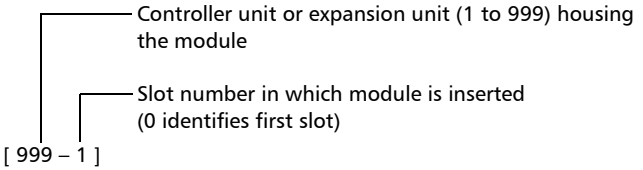


Current attenuation

Shutter status and message area

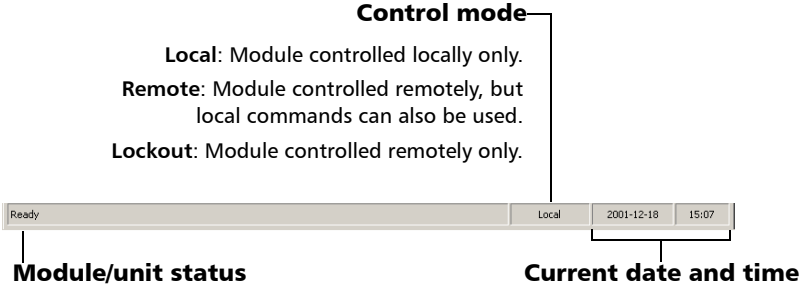
Title Bar

The title bar is located at the top of the main window. It displays the module name and its position in the controller or expansion unit. The module position is identified as follows:



Status Bar

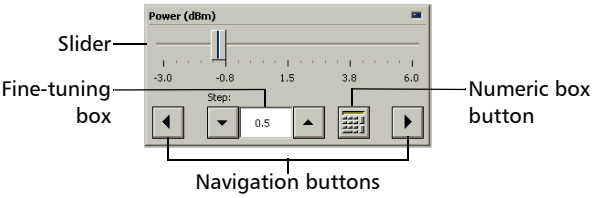
The status bar, located at the bottom of the main window, identifies the operational status of the IQS-3150 Variable Attenuator.



For more information about automating or remotely controlling the IQS-3150 Variable Attenuator, refer to your platform user guide.

Entering Values Using Sliders and Numeric Boxes

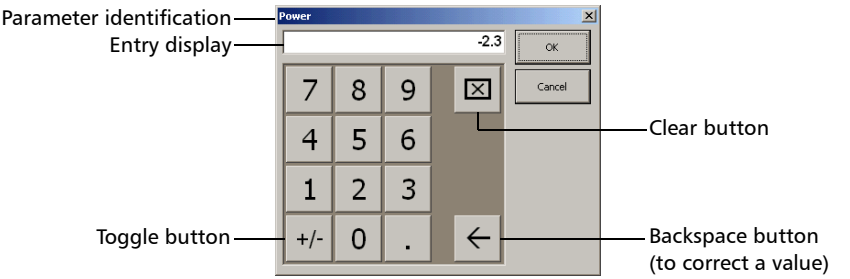
Many parameters in IQS Manager and module applications can be set using the following tools.



- Slider: Drag it to the desired value on the scale below.
- Navigation buttons: Click either buttons to move the slider. The slider moves by steps corresponding to the number in the fine-tuning box, which you can change by using the up and down arrow buttons next to the box. You cannot change the list of fine-tuning values from here.
- Numeric box: Click it to display the on-screen numeric pad, which you can use to enter a power value.

To enter a value using the numeric box:

1. Use the ⊠ button to clear the entry display.



2. Enter the value.

3. Click **OK** to confirm the value.

Exiting the Application

Closing any application that is not currently being used helps freeing system memory.

To close the application from the main window:

Click  in the top right corner of the main window.

OR

Click the **Exit** button located at the bottom of the function bar.

To close all currently running applications:

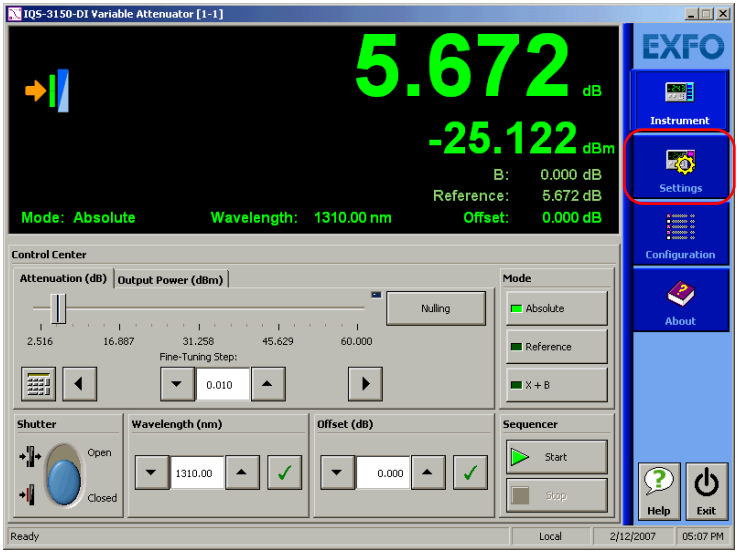
From IQS Manager, click **Close All Applications**.

3 Setting Up Your Variable Attenuator

The IQS-3150 comes with factory default settings; however, you can create custom settings and save them in configuration files.

Basic Settings

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

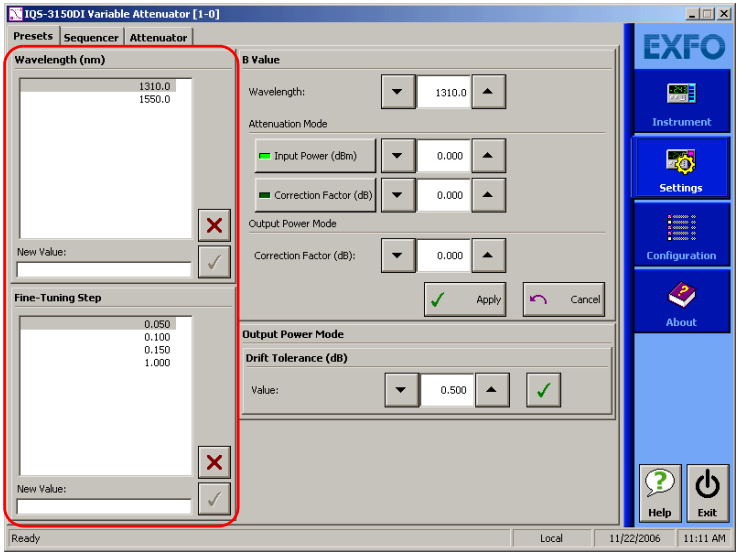


Customizing the Wavelength and Fine-Tuning Step Lists

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 **Settings** function tab, click the **Presets** tab and, under **Wavelength** or **Fine-Tuning Step**, enter the value in the **New Value** box.



2. Click the ✓ button to add the value to the list.

To delete a value from the lists:

1. On the **Settings** function tab, click the **Presets** tab and, under **Wavelength** or **Fine-Tuning Step**, click a value in the list to select it.
2. Click the ✕ button to delete the value.

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.

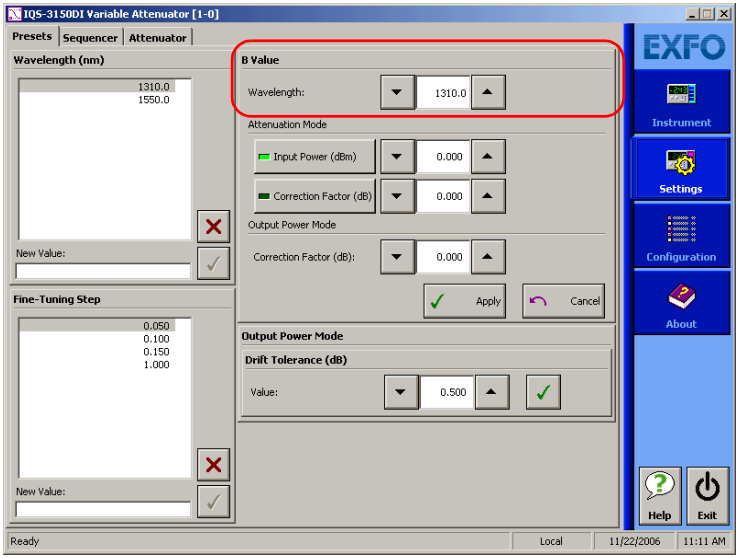
The B value is defined as a correction factor or defined as an input power value representing the attenuation in the equivalent output power in dBm.

Correction Factor

The **Correction factor** is available for both Attenuation and Output Power control modes. This feature 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.

To set a correction factor for a wavelength:

1. On the **Settings** function tab, click the **Presets** tab.
2. Under **B Value**, in the **Wavelength** list, use the up/down arrows to select the wavelength for which you want to add a correction factor.

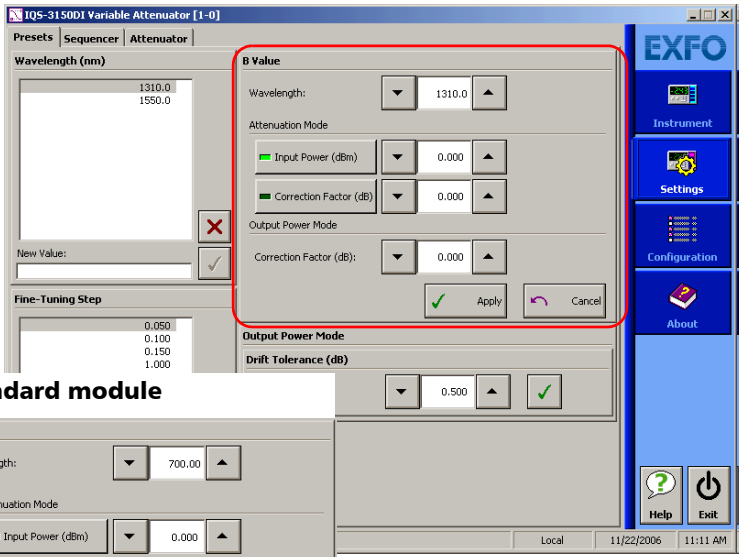


3. According to the control mode used, select the correction factor as follows:

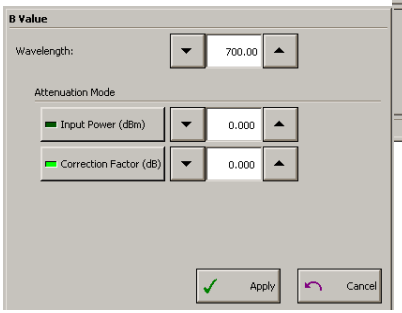
➤ For the Attenuation mode, under **Attenuation Mode**, click the **Correction Factor** button, and enter the correction value in the box next to it.

➤ For the Output power mode, under **Output Power Mode**, enter the correction value in the **Correction Factor** box.

Self-adjusting module



Standard module



4. Click **Apply**.

Input Power

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.

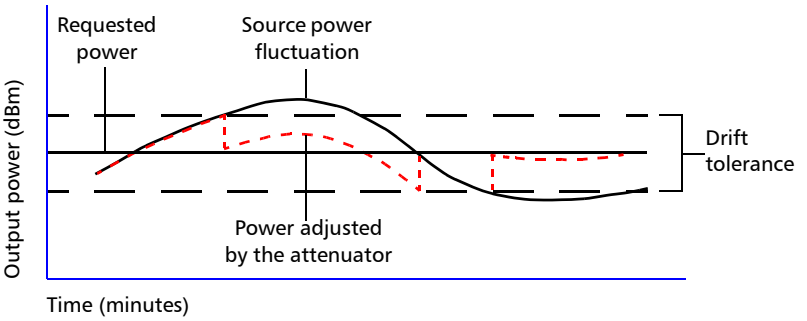
To select an input in dBm:

1. On the **Settings** function tab, click the **Presets** tab.
2. Under **B Value**, under **Attenuation Mode**, click the **Input Power** button.
3. In the box next to **Input Power**, enter the source power in dBm.
4. Click **Apply**.

Setting the Drift Tolerance

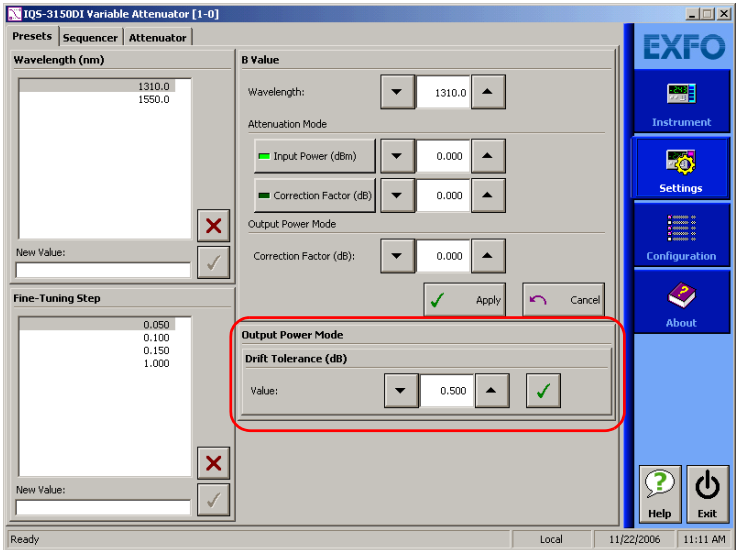
The drift tolerance setting is only available for the self-adjusting modules and is only applicable for the **Power Tracking** function (see *Using the Power Tracking Function (Self-Adjusting Modules)* on page 56).

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.



To set the drift tolerance:

1. On the **Settings** function tab, click the **Presets** tab.



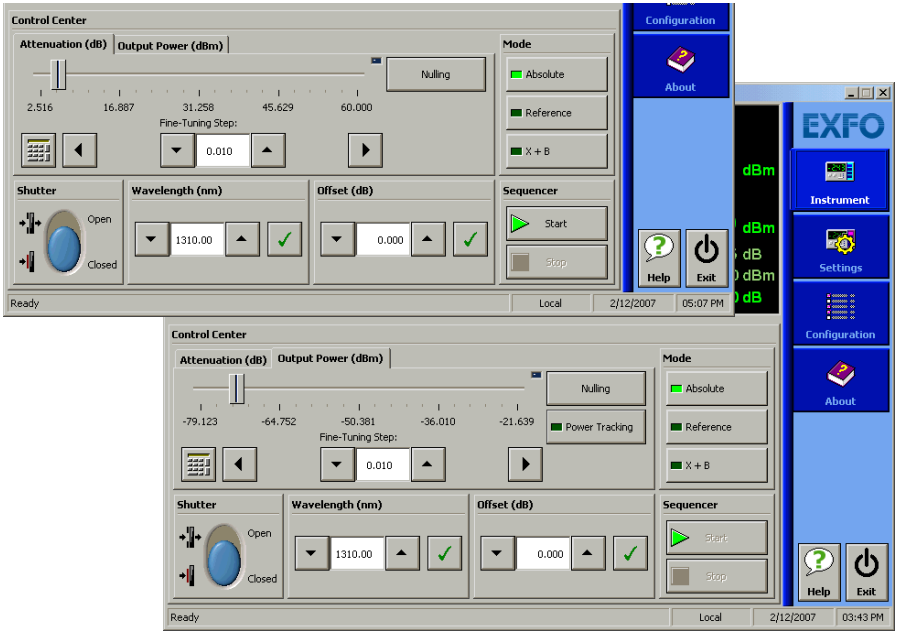
2. Under **Output Power Mode**, in the **Value** box, enter the tolerance value.

3. Click the ✓ button to accept the value.

Control Center Settings and Controls

Once the basic settings are entered, you can set parameters in the **Control Center** to create your test configuration.

Start creating your configuration by selecting a control mode (self-adjusting modules only).



Selecting a Display Mode

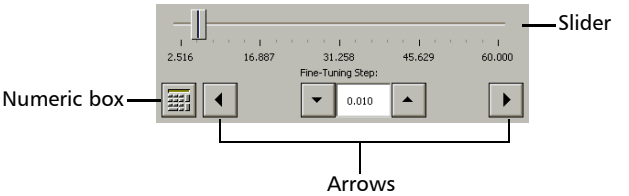
The active display mode determines the significance of the value appearing on the data display. For a description of each display mode, refer to *Display Modes* on page 6.

IMPORTANT

For the IQS-3150 Variable Attenuator, the absolute (or total) attenuation is the actual optical insertion loss between the input and output ports, including connector losses.

Reference

Before clicking the **Reference** button, select the reference attenuation or output power (Output Power control mode) value using either the slider, the left/right arrows, or the numeric box. Upon clicking the **Reference** button, the instrument uses the selected attenuation as reference.



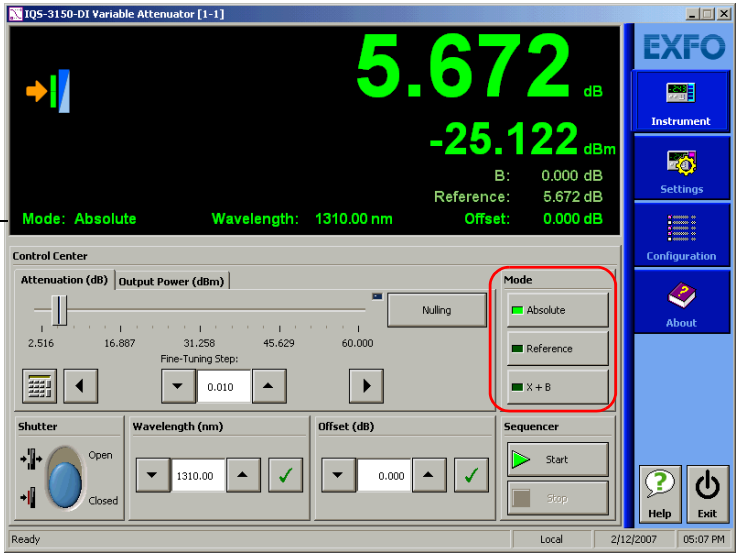
X+B

Before clicking the **X+B** button, make sure that the B value is correctly set (refer to *Setting the B Value* on page 25).

To select a display mode:

1. Click the **Instrument** function tab.

The selected display mode



2. Under **Control Center**, enter the appropriate settings.

3. Under **Mode** click the appropriate button.

The selected display mode appears next to **Mode** on the data display.

Selecting a Wavelength and a Fine-Tuning Step

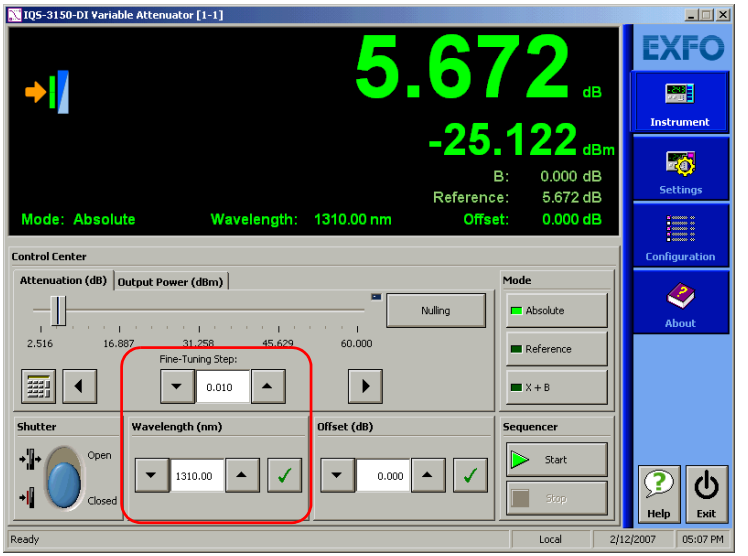
The attenuator wavelength must be set as closely as possible to the wavelength of the optical source. The IQS-3150 Variable Attenuator module provides a wide range of wavelengths: 1250 nm to 1650 nm for singlemode modules and 700 nm to 1350 nm for multimode modules.

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

The lists of available values are built on the **Settings** tab (refer to *Customizing the Wavelength and Fine-Tuning Step Lists* on page 24).

To select a wavelength and a fine-tuning step:

1. Click the **Instrument** function tab.



2. Under **Wavelength**, use the up/down arrows to select the wavelength, and click ✓.

3. Under **Fine-Tuning Step**, use the up/down arrows to select the fine-tuning value.

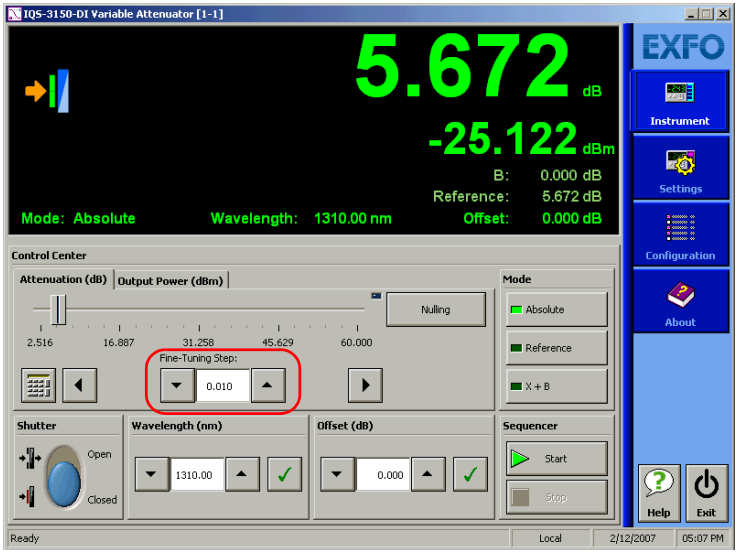
Changing the Attenuation or the Output Power

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

In the Attenuation control mode, 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 (refer to specification sheet), it may vary slightly from one wavelength to another and from one IQS-3150 Variable Attenuator to another.

To change the attenuation or output-power level:

1. Click the **Instrument** function tab.



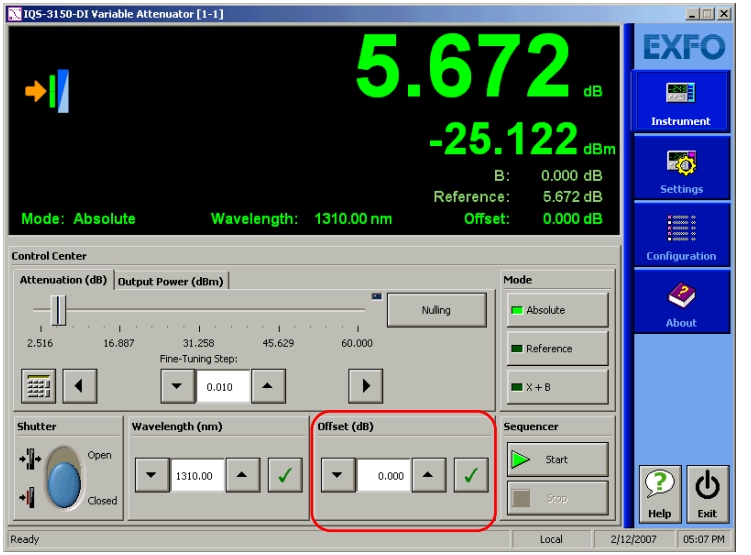
2. Click the **Attenuation** or the **Output Power** tab.
3. In the **Fine-Tuning Step** box, enter the step value.
4. Using either the slider, the left/right arrows, or the numeric box, change the attenuation or output power value.

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. Click the **Instrument** function tab.



2. Under **Offset**, enter de desired value in the box and click ✓ to accept the value.

Note: *The offset values must be between -99.999 dB and 99.999 dB. The attenuation value is positive; therefore, when the offset value is positive, the displayed attenuation increases.*

Creating a Test Sequence

The IQS-3150 allows you to create test sequences so that the attenuation or output power steps are performed automatically without your intervention.

The sequences can be saved and retrieved to be used as is or to be used as a template in which you can insert or remove steps. To build a new sequence starting with an old one, under **Sequence File**, click the **Open** button.

To create a completely new sequence, under **Sequence File**, click the **New** button.

IMPORTANT

When you click the New button, all parameters previously set on the Sequencer tab are erased. Make sure you save the sequence parameters you want to keep before clicking this button.

A duration can be applied to each step individually, the duration value must be between 0:00:00 and 999:59:59.

You can also set the time at which the sequence will start using one of the following starting time modes:

- Absolute: allows you to select a precise time (for example, 10:30:30 am) at which the sequence starts.
- Relative: allows you to select a countdown between the moment you start the sequence and the moment it actually starts.

In both modes, you cannot enter a value greater than 23:59:59.

You can also have the sequence repeated for a fixed number of times (between 1 and 99999) or continuously.

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

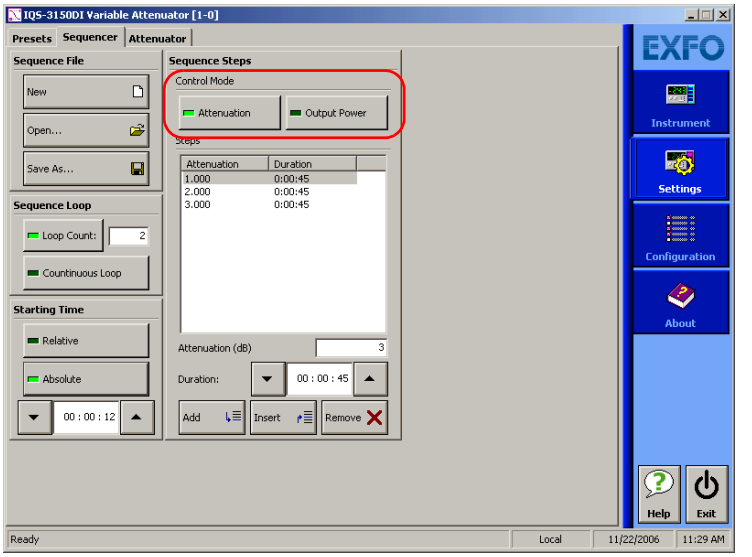
Adding, Inserting, and Removing Steps

You can customize test sequences:

- by adding steps, either to a new sequence or an existing one
- by inserting steps to an existing sequence.

To add, insert, and remove steps:

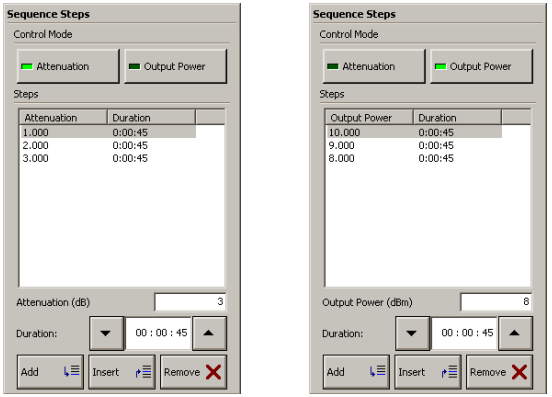
1. On the **Settings** function tab, click the **Sequencer** tab.



2. Under **Sequence Steps**, select the control mode.

3. 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 Attenuation mode **In Output Power mode**



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

5. Click **Add** (the new step is added at the end of the step list).

OR

Click a step in the **Steps** list to select it and click **Insert** (the step is added before the selected step).

6. To remove a step from the list, click a step in the **Steps** list to select it and click **Remove**.

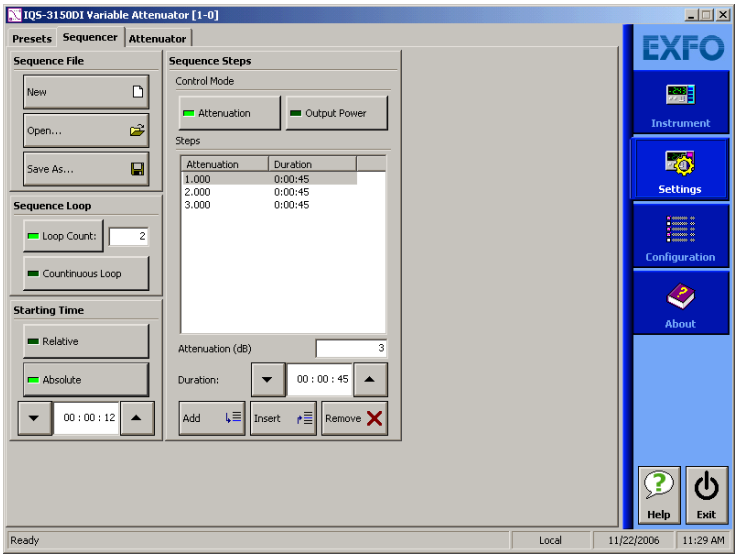
7. Under **Sequence File**, click **Save As** if you want to save that sequence.

Setting a Starting Time

The start of a test sequence can be set to a definite time of day (**Absolute**) or be delayed by a countdown (**Relative**).

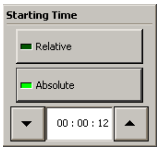
To set a sequence starting time:

1. On the **Settings** function tab, click the **Sequencer** tab.



2. Under **Sequence File**, open a test sequence or create one (refer to *Adding, Inserting, and Removing Steps* on page 38).

3. Under **Starting Time**, click the **Relative** or the **Absolute** button.



4. In the box below the buttons, enter one of the following value:

- The amount of time you need between the moment you click the **Start** button and the moment the sequence starts (**Relative**).
- The time (in the next 24 hours) at which you want the sequence to start (**Absolute**).

IMPORTANT

When using the Absolute start time mode, make sure that the clock of your IQS Platforms is correctly set. The IQS-3150 dedicated hardware uses that clock setting as time reference.

5. Under **Sequence File**, click **Save As** if you want to save that sequence.

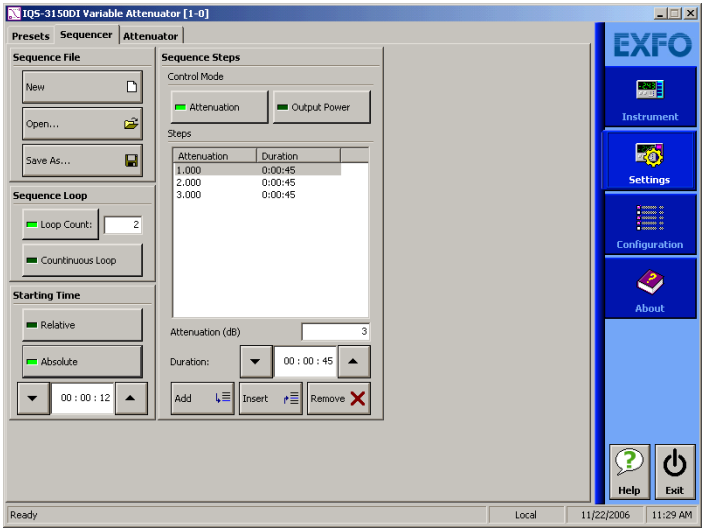
Setting Repetition Scheme

The test sequence can be set to repeat itself for a certain number of times or on a continuous basis.

Note: *If you have entered a setting for the sequence start, the delay or start time will only apply for the first sequence in the loop.*

To set the sequence repetition scheme:

1. On the **Settings** function tab, click the **Sequencer** tab.



2. Under **Sequence File**, open a test sequence.

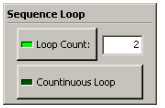
OR

Create a sequence (refer to *Adding, Inserting, and Removing Steps* on page 38).

3. Under **Sequence Loop**, click **Loop Count** and, in the text box, enter the number of times the sequence must be repeated.

OR

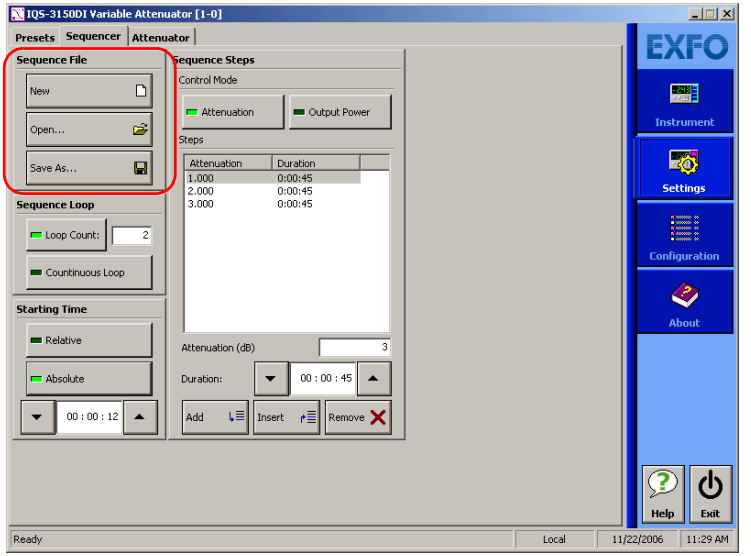
Click the **Continuous Loop** button.



4. Under **Sequence File**, click **Save As** if you want to save that sequence.

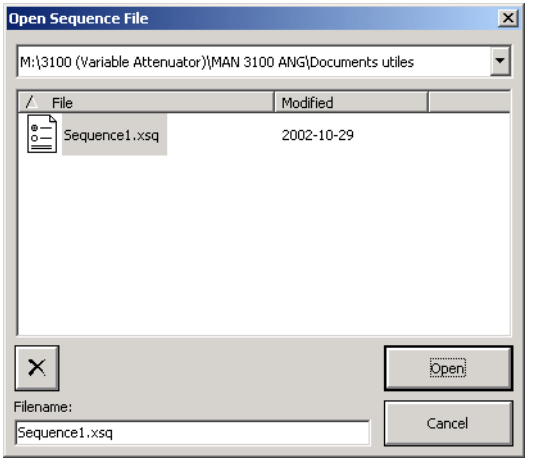
Managing Sequence Files

The commands to open new or existing sequence files and to save them are located on the **Sequencer** tab of the **Settings** function tab.

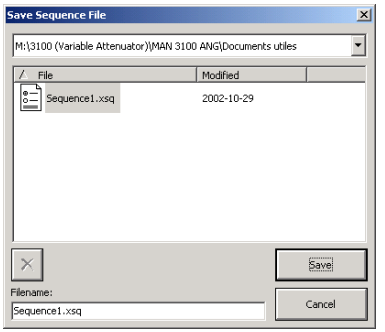


➤ Clicking the **New** button clears all previous settings allowing you to build a completely new sequence.

➤ Clicking the **Open** button opens the **Open Sequence File** dialog box from which you can select a sequence file.



➤ Clicking the **Save As** button opens the **Save Sequence File** dialog box from which you can select a directory to save your sequence file.



Note: *To facilitate the search of sequence files, EXFO recommends that you use the following elements in the file name: step attenuation or output power level, step duration, and sequence repetition scheme.*

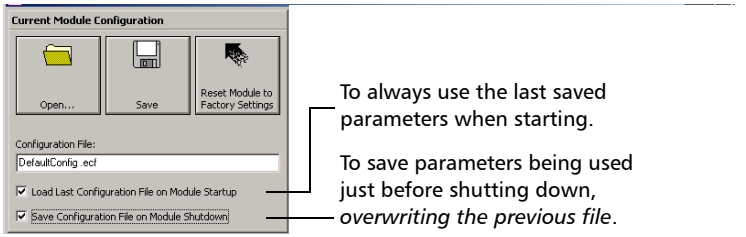
Saving and Recalling Configurations

Once you have set the IQS-3150 Variable Attenuator parameters, you can save your custom configuration and recall it at any time. You can also recall the factory-defined settings.

Saved configurations include all parameters set in the **Control Center** (**Instrument** function tab) and in the **Settings** function tab (if present).

To save a configuration:

1. Select the **Configuration** function tab.



2. In the **Current Module Configuration** panel, enter the name you wish to use for your configuration file.

It will be saved in
D:\IQS Manager\Configuration Files\(your_module)\.

3. Click **Save**.

To recall a configuration:

1. Select the **Configuration** function tab.
2. Click **Open**.
3. Select the configuration file you wish to recall and confirm your action.

   You are returned to the application and the new parameters are set.

To revert to factory settings:

1. Select the **Configuration** function tab.
2. Click the **Reset Module to Factory Settings** button.

IMPORTANT

Reverting to the factory settings will interrupt any module operation in progress.

IMPORTANT

The operation may take a few seconds to complete.

Note: *The sequence parameters that you could have set are not part of the data saved when you click the **Save** button for the configuration. You must save your sequence settings by clicking the **Save As** button under **Sequence File** on the **Sequencer** tab of the **Settings** function tab. This way your test configuration and your sequence settings are all saved.*

Note: *When recalling a saved configuration, the fine-tuning step appearing in the **Control Center** reverts to the default value.*

4 Operating the IQS-3150

This section presents basic operations using the Variable 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 microscope. 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 isopropyl alcohol.
   - **2b.** Use compressed air to dry 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.

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

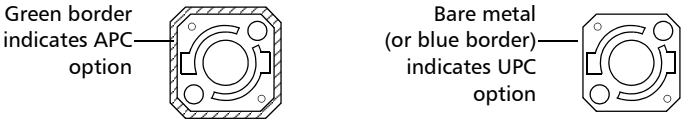
Note: *If your fiber-optic cable is not properly aligned and/or connected, you will notice heavy loss and reflection.*

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.

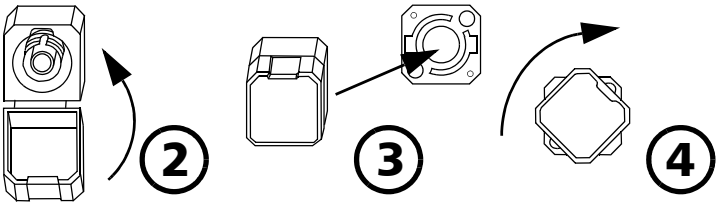
Installing the EXFO Universal Interface (EUI)

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



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.

Nulling Electrical Offsets

Temperature and humidity variations affect the performance of electronic circuits and optical detectors, which can offset measurement results. To compensate for this offset, the IQS-3150 is equipped with an offset nulling function.

EXFO recommends performing a nulling of the electrical offsets whenever environmental conditions change.

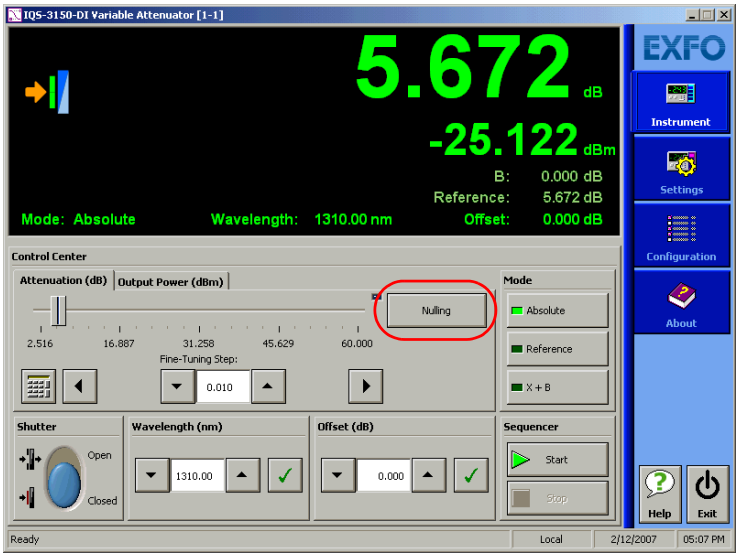
IMPORTANT

Light must not reach the detector when nulling offsets.

The nulling function is only available for the self-adjusting modules.

To perform the power meter nulling:

1. Click the **Instrument** function tab.
2. Click the **Nulling** button.

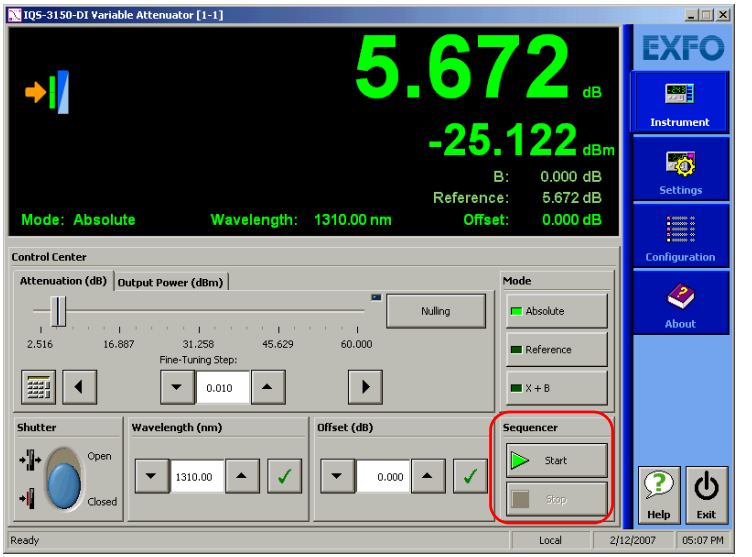


Running an Attenuation Sequence

Attenuation sequences allow you to automate and ease your testing process. Prepare the test sequence as described in *Creating a Test Sequence* on page 37.

To start an attenuation sequence:

1. Click the **Instrument** function tab.



Note: *Once a sequence is started, all controls in the **Instrument** function tab are disabled to avoid accidental interruptions. However, the monitor and multimodule applications are not disabled, so you can make changes in these applications while a sequence is running.*

2. Under **Sequencer**, click the **Start** button.

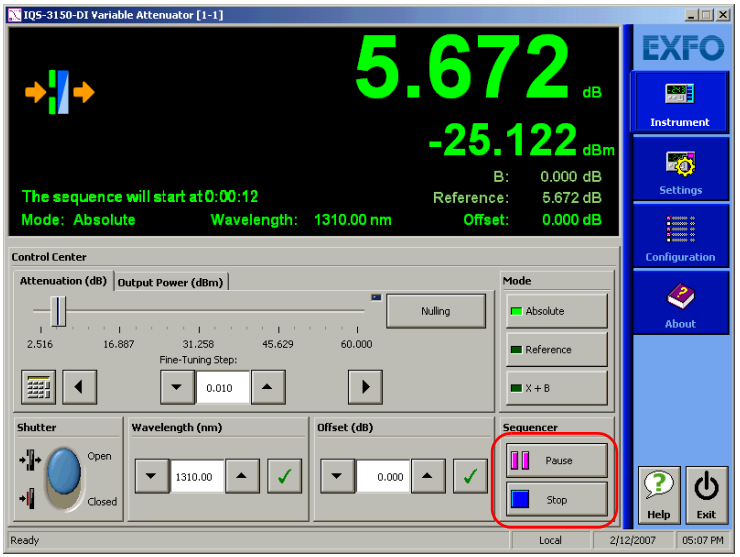
The **Start** button changes to **Pause**.

You can interrupt a sequence at any time by clicking **Pause**; click **Resume** when you are ready to continue.

Note: *When you click the **Pause** button, the sequence will not be restarted at the point you paused it. Upon clicking the **Resume** button, the acquisition will start with the next step in the sequence.*

If you click **Pause** between two steps, when you click **Resume** the system will go directly to the next step.

When you have programmed a start time or a start delay, upon clicking the **Start** button, a message appears on the data display.



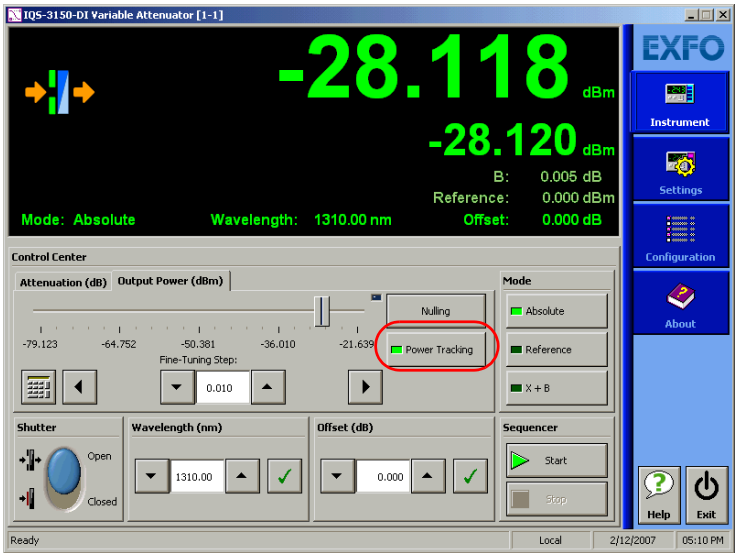
Using the Power Tracking Function (Self-Adjusting Modules)

The power tracking function 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.

In order to use the power tracking function, you must define a range of power levels (see *Setting the Drift Tolerance* on page 29).

To activate the power tracking function:

From the **Instrument** function tab, click the **Power Tracking** button.



Using the Shutter

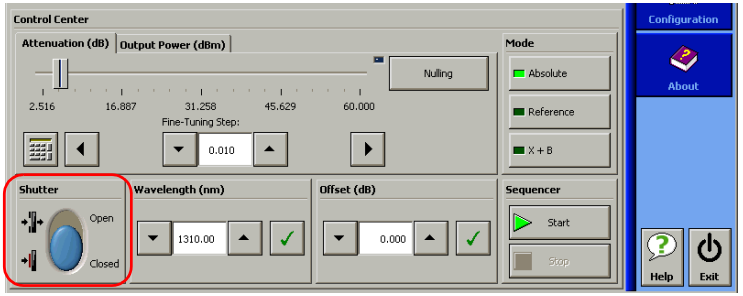
The shutter is used to let light through the input or block it.

CAUTION

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

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 LED push button on the module front panel to close the shutter disables the software shutter controls. You must press the push 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

It is also shown on the Shutter (red) LED push button on the front panel of the module; when lit, the shutter is closed.

High-Power Detection

The module is 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.

The red LED push button on the front panel of the module lights up.

5 Controlling Multiple Variable Attenuators

With your platform, you can set common parameters and simultaneously operate several modules *of the same kind* in a single interface, which is particularly useful in larger systems.

Note: *You should be familiar with the configuration and operation of a single module before controlling multiple modules simultaneously.*

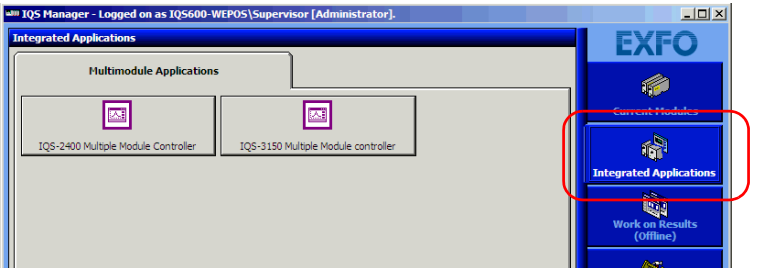
Starting a Multimodule Application

The multimodule applications available will change according to your module configuration (model, type, etc.).

Note: *When you start a multimodule application, you cannot open a monitor window at the same time, as it is possible with a single-module application. You must open the monitor window independently.*

To start a multimodule application:

1. In IQS Manager, select the **Integrated Applications** function tab.



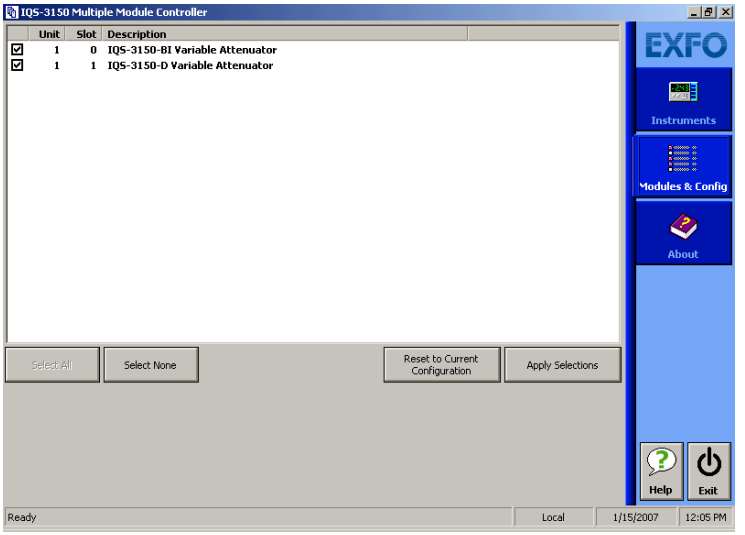
2. Click the appropriate **Multiple Module Controller** button.

   The multimodule application appears in a new window.

Note: *More than one **Multiple Module Controller** button may be displayed if different models are present in your platform.*

Selecting Modules to Control

Before you can modify the module parameters, you must specify which modules you intend to use.



To select IQS-3150 Variable Attenuator modules:

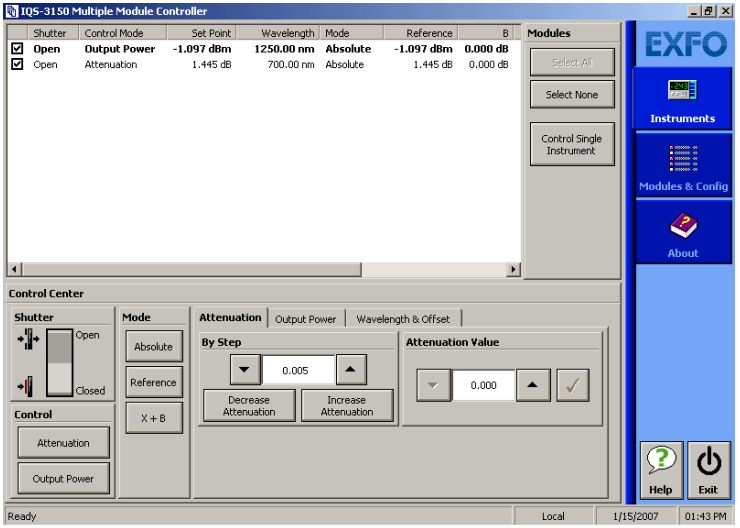
1. On the **Modules/Config** function tab, select the boxes corresponding to the modules you want to control.

   OR

   Click **Select All** if you want to work with all IQS-3150 Variable Attenuator modules.

2. Click **Apply Selections** and click the **Instruments** function tab.

On the **Instruments** function tab, you can set parameters for any number of modules at a time. Select the modules for which you want to set the parameters and use the functions in the control center. (For more information on settings and controls, refer to *Control Center Settings and Controls* on page 31.)



Controlling a Single IQS-3150 Variable Attenuator

You may want to control a specific module among all the IQS-3150 Variable Attenuator modules that you have in the system.

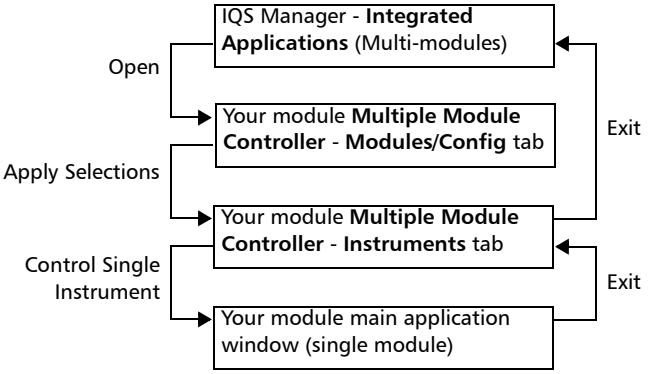
To control a specific IQS-3150 Variable Attenuator:

1. Make sure that the row corresponding to the module you want to control appears in bold or that it is highlighted.
2. Use the **Control Single Instrument** button to open the IQS-3150 Variable Attenuator application.

Navigating and Closing Multiple Module Windows

When controlling multiple modules, a number of windows are open at the same time. To close a window, use the **Exit** button located under the function tabs. You will return to the preceding window.

The following diagram illustrates the navigation between windows:



6 Monitoring Variable Attenuator Modules

When using your IQS-3150 Variable Attenuator module, either alone or with other modules in a test setup, you can view module data and status using its monitor window in IQS Manager.

Using Monitor Windows

Monitor windows display basic data about modules. A combination of resizable windows allows you to create an integrated data display (refer to the platform user guide).

From the monitor window, you can change module parameters either by:

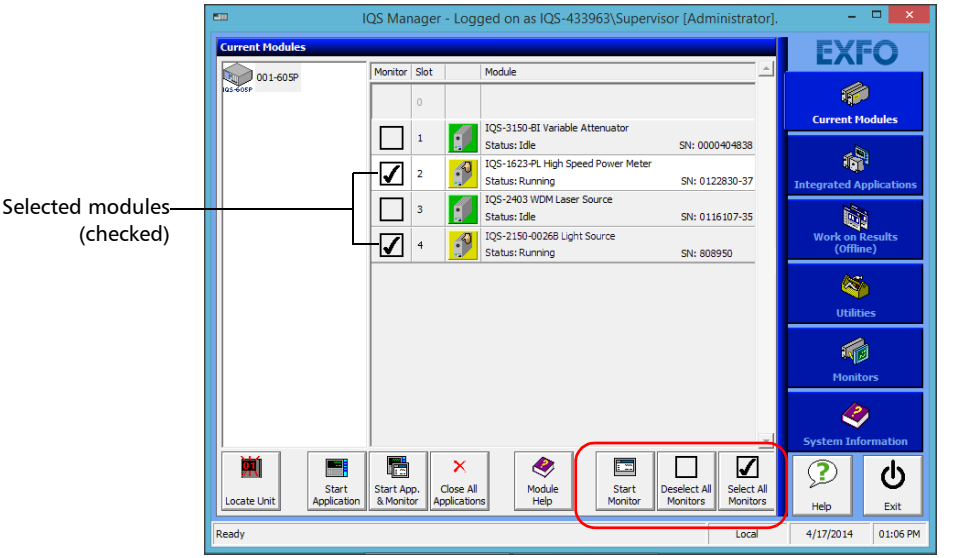
- opening the module application to access all the functions

  OR

- using the QuickTools utility, which provides frequently used functions from the application.

To select modules and display their monitor windows:

1. On the **Current Modules** function tab, select the controller or expansion unit containing the modules you want to monitor.



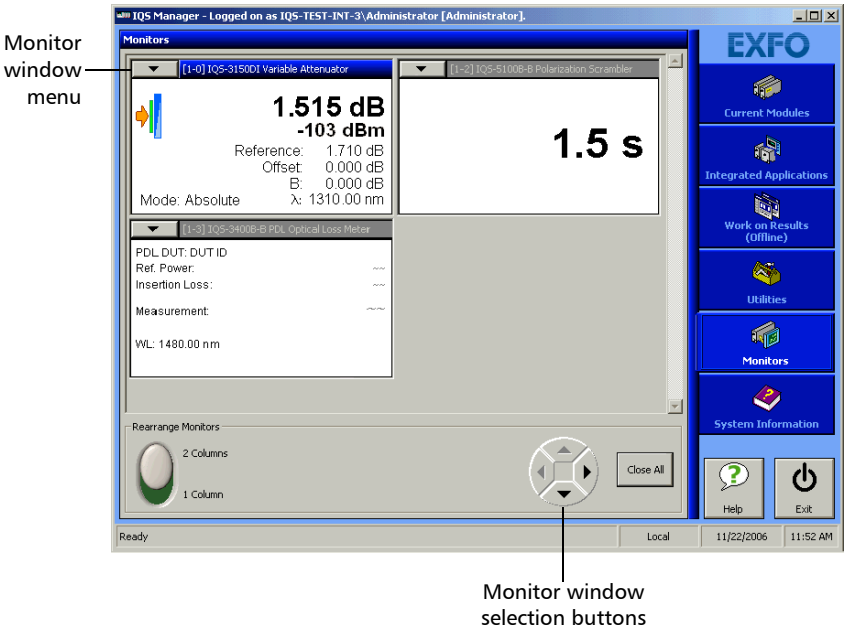
2. In the **Monitor** column, select the box next to each module you want to monitor.

If you want to monitor all the modules *in the current unit*, click **Select All Monitors**. If you want to clear your choices, click **Deselect All Monitors**.

3. Click **Start Monitor** to apply your selection.

IQS Manager will display the selected monitor windows on the **Monitors** function tab.

Note: *To start the* highlighted *module's corresponding application at the same time, click* ***Start App. & Monitor****. The application will appear in a different window.*



Using QuickTools

With QuickTools, you can fine-tune your module directly, while keeping an eye on your entire test setup.

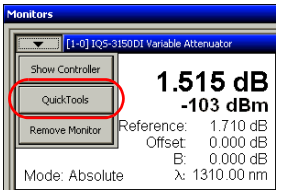
Note: *You can only access QuickTools if the module's monitor window is selected from the* ***Monitors*** *function tab and is currently active.*

To start QuickTools:

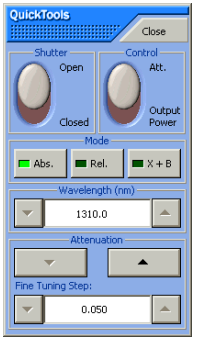
1. From the **Monitors** function tab, select the monitor window of the module you wish to control.
2. Using the arrow button in the upper left corner, select **QuickTools**.

   The corresponding monitor window flashes when QuickTools is activated.

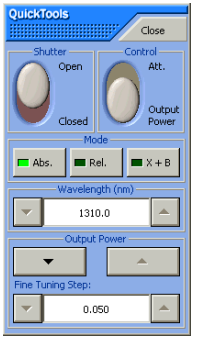
Note: *If you want to open the actual application for your module rather than QuickTools, click* ***Show Controller****.*



Attenuation control mode



Output Power control mode



For more information on settings and controls, refer to *Control Center Settings and Controls* on page 31.

To close QuickTools:

Click the **Close** button located at the top of the window.

OR

Click outside the QuickTools window.

To close a monitor window:

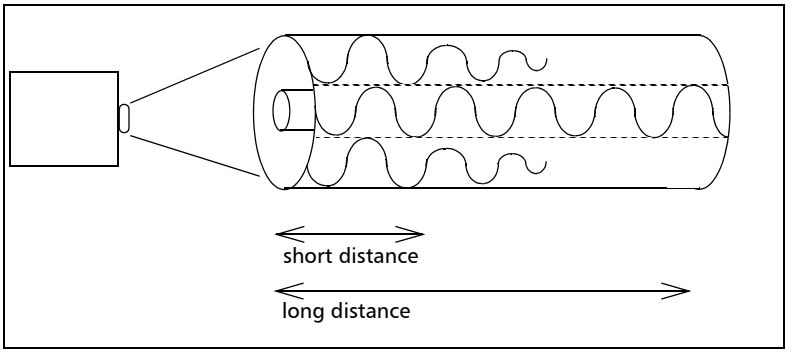
Click the button on the upper left of the monitor window and select **Remove Monitor**.

OR

Click the **Close All** button at the bottom of the window.

7 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 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.

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.

8 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 isopropyl alcohol.

IMPORTANT

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

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

IMPORTANT

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

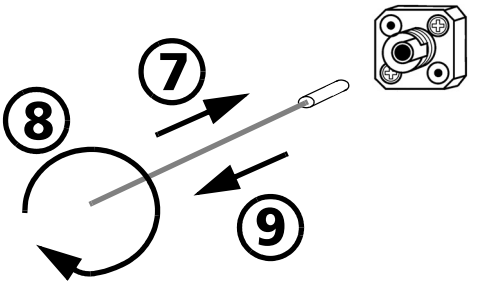
4. With a dry lint-free wiping cloth, gently wipe the same surfaces three times with a rotating movement.

5. Throw out the wiping cloths after one use.
6. Moisten a cleaning tip (2.5 mm tip) with *only one drop* of isopropyl alcohol.

IMPORTANT

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

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



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

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

11. Throw out the cleaning tips after one use.

Cleaning EUI Connectors

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

IMPORTANT

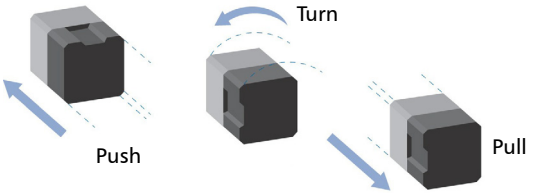
If any damage occurs to internal connectors, the module casing will have to be opened and a new calibration will be required.

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.

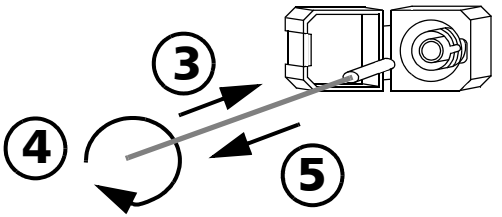
To clean EUI connectors:

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 isopropyl alcohol (alcohol may leave traces if used abundantly).

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



4. Gently turn the cleaning tip one full turn, then continue to turn as you withdraw it.

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

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

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

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

IMPORTANT

Isopropyl alcohol may leave residues if used abundantly or left to evaporate (about 10 seconds).

Avoid contact between the tip of the bottle and the wiping cloth, 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 portable fiber-optic microscope (for example, EXFO's FOMS) or 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.

Cleaning Detector Ports

Regular cleaning of detectors will help maintain measurement accuracy.

IMPORTANT

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

To clean detector ports:

1. Remove the protective cap and adapter (FOA) from the detector.
2. If the detector is dusty, blow dry with compressed air.
3. Being careful not to touch the soft end of the swab, moisten a cleaning tip with *only one drop* of isopropyl alcohol.

IMPORTANT

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

4. While applying light pressure (to avoid breaking the detector window), gently rotate the cleaning tip on the detector window.
5. Repeat step 4 with a dry cleaning tip or blow dry with compressed air.
6. Discard the cleaning tips after one use.

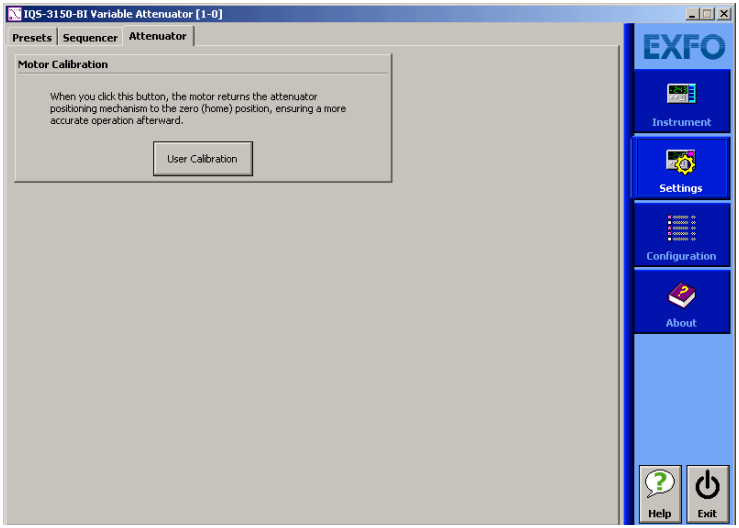
Homing the Variable Attenuator (User Calibration)

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.

To home the attenuator:

1. On the **Settings** function tab, click the **Attenuator** tab.
2. Click the **User Calibration** button.



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

Recalibrating the Unit

EXFO manufacturing and service center calibrations are based on the ISO/IEC 17025 standard (*General Requirements for the Competence of Testing and Calibration Laboratories*). This standard states that calibration documents must not contain a calibration interval and that the user is responsible for determining the re-calibration date according to the actual use of the instrument.

The validity of specifications depends on operating conditions. For example, the calibration validity period can be longer or shorter depending on the intensity of use, environmental conditions and unit maintenance, as well as the specific requirements for your application. All of these elements must be taken into consideration when determining the appropriate calibration interval of this particular EXFO unit.

Under normal use, the recommended interval for your IQS-3150 Variable Attenuator is: one year.

For newly delivered units, EXFO has determined that the storage of this product for up to six months between calibration and shipment does not affect its performance (EXFO Policy PL-03).

To help you with calibration follow-up, EXFO provides a special calibration label that complies with the ISO/IEC 17025 standard and indicates the unit calibration date and provides space to indicate the due date. Unless you have already established a specific calibration interval based on your own empirical data and requirements, EXFO would recommend that the next calibration date be established according to the following equation:

Next calibration date = Date of first usage (if less than six months after the calibration date) + Recommended calibration period (one year)

To ensure that your unit conforms to the published specifications, calibration may be carried out at an EXFO service center or, depending on the product, at one of EXFO's certified service centers. Calibrations at EXFO are performed using standards traceable to national metrology institutes.

Note: *You may have purchased a FlexCare plan that covers calibrations. See the Service and Repairs section of this user documentation for more information on how to contact the service centers and to see if your plan qualifies.*

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.

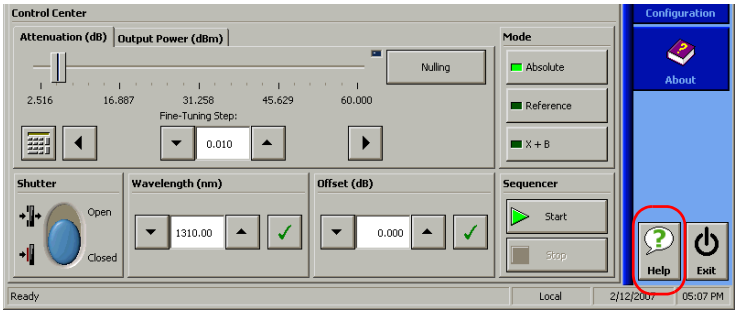
9 Troubleshooting

Viewing Online Documentation

An online version of the IQS-3150 Variable Attenuator user guide is available at all times from the application.

To access the online user guide:

Click **Help** in the function bar.



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

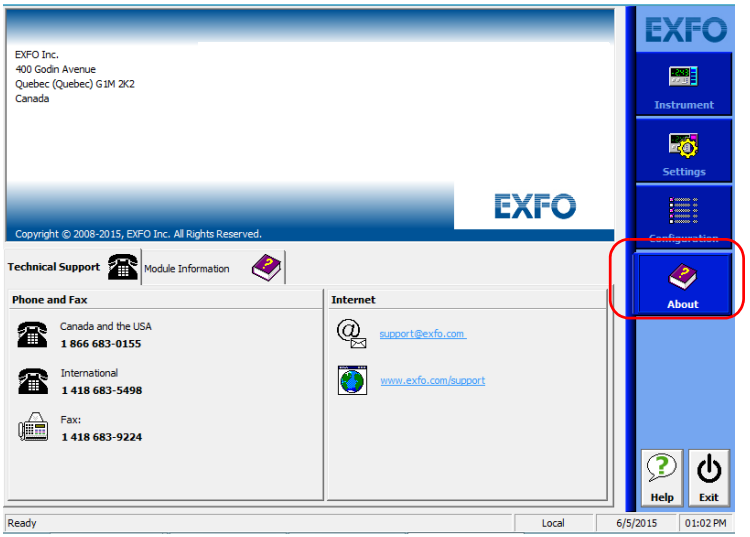
1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at www.exfo.com.

If you have comments or suggestions about this user documentation, you can send them to 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.

You may also be requested to provide software and module version numbers.This information, as well as technical support contact information, can be found in the **About** function tab.



- Select the **Technical Support** tab to view phone numbers and active Internet links to EXFO's Technical Support Group. Use these links to send an information request by e-mail or to access EXFO's web site.
- Select the **Module Information** tab to view the module identification, serial number and firmware version.

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.

10 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.

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

Liability

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

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

Exclusions

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

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

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 88). 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 88).

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 10,
Yu Sheng Industrial Park (Gu Shu Crossing), No. 467,
National Highway 107,
Xixiang, Bao An District,
Shenzhen, China, 518126

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 Technical Specifications

IMPORTANT

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

SPECIFICATIONS [a]

Singlemode configurations		
Description	**Without power monitoring**	**With power monitoring**
Models	IQS-3150-B	IQS-3150-BI
Fiber type (µm)	9/125	9/125
Wavelength range (nm)	1250 to 1650	1250 to 1650
Max. attenuation [b] (dB)	≥ 65	≥ 65
Insertion loss [c,d] (dB) Typical Max.	 1.0 1.5	 1.5 2.2
Attenuation setting resolution (dB), typical	0.002	0.002
Attenuation linearity [e] (dB)	±0.1	±0.1
Attenuation repeatability [f] (dB), 2σ	±0.01	±0.01
Spectral uniformity, 1510 nm to 1605 nm [g] (dB)	±0.05	±0.05
Spectral uniformity, 1450 nm to 1630 nm [g] (dB), typical	±0.09	±0.09
Power meter linearity [h] (dB)	N/A	±0.03
Power setting repeatability [f] (dB), 2σ	N/A	±0.015
PDL [i] (dB) peak-to-peak	0.15	0.2
Return loss [c,j] (dB), typical	60	60
Max. input power (dBm)	23	23
Transition speed (dB/s), typical	up to 23	up to 23
Shutter isolation (dB)	> 100	> 100

Technical Specifications

Multimode configurations		
Description	**Without power monitoring**	**With power monitoring**
Models	IQS-3150-C; D	IQS-3150-CI; DI
Fiber type (µm)	50/125, 62.5/125	50/125, 62.5/125
Wavelength range (nm)	700 to 1350	700 to 1350
Max. attenuation (dB)	≥ 60	≥ 60
Insertion loss [c,d] (dB) Typical Max.	 1.3 2.0	 1.5 3.0
Attenuation setting resolution (dB), typical	0.002	0.002
Attenuation linearity [e] (dB)	±0.1	±0.1
Attenuation repeatability [f] (dB), 2σ	±0.01	±0.01
Power meter linearity [k] (dB)	N/A	±0.03
Power setting repeatability [f] (dB), 2σ	N/A	±0.015
Return loss [c, d] (dB), typical	40	40
Max. input power (dBm)	20	20
Transition speed (dB/s), typical	up to 23	up to 23
Shutter isolation (dB), typical	> 90	> 90

Notes

a. At 23 °C ± 1 °C.

b. At 1550 nm and below.

c. Measured at 1310 nm and 1550 nm for singlemode units, measured at 850 nm for multimode units.

d. Excluding connectors.

e. Measured at 1310 nm and 1550 nm (up to 60 dB) for singlemode units and at 850 nm and 1300 nm (up to 50 dB) for multimode units, with non-polarized light.

f. Up to 45 dB attenuation.

g. For 20 dB attenuation relative to 0 dB attenuation.

h. At 1550 nm, after a 30-minute warm-up and an offset nulling, for an input power between 15 dBm and –45 dBm.

i. Up to 20 dB attenuation. At 1550 nm.

j. For FC/APC connectors.

k. At 1300 nm, after a 30-minute warm-up and an offset nulling, for an input power between 15 dBm and –50 dBm.

GENERAL SPECIFICATIONS

Size (H X W X D)	125 mm X 36 mm X 282 mm	(4 15/16 in X 1 7/16 in X 11 1/8 in)
Weight	0.7 kg	(1.6 lb)
Temperature Operating Storage	 0 °C to 40 °C –40 °C to 70 °C	 (32 °F to 104 °F) (–40 °F to 158 °F)
Relative humidity	0 % to 80 % noncondensing	
Instrument drivers	LabVIEW™ drivers and SCPI commands	
Remote control	With IQS-600: GPIB (IEEE 488.1, IEEE488.2), Ethernet and RS-232	
Standard accessories	User guide, Certificate of Compliance and Certificate of Calibration	

B SCPI Command Reference

This appendix presents detailed information on the commands and queries supplied with your IQS-3150 Variable Attenuator.

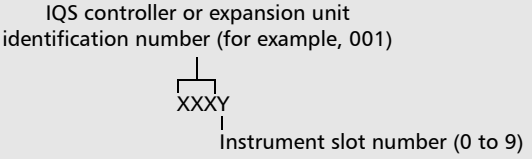
IMPORTANT

Since the IQS controllers and expansion units 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:

LINStrument<LogicalInstrumentPos>:

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



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

Quick Reference Command Tree

Command						Parameter(s)	P.
CALibration [1..n]	ZERO						94
CONTrol[1..n]	MODE					ATTenuation|POWer	95
	MODE?						96
INPut[1..n]	ARESolution?						97
	ATTenuation					<Attenuation[<wsp>DB]>| MAXimum|MINimum|DEFault	98
	ATTenuation?					[MAXimum|MINimum|DEFault]	100
	OFFSet					<Offset[<wsp>DB]>|MAXimum| MINimum|DEFault	102
	OFFSet?					[MAXimum|MINimum|DEFault]	104
	RATTenuation					<RelativeAttenuation[<wsp>DB]> |MAXimum|MINimum|DEFault	106
	RATTenuation?					[MAXimum|MINimum|DEFault]	109
	REFerence					<Reference[<wsp>DB]> |MAXimum|MINimum|DEFault	111
	REFerence?					[MAXimum|MINimum|DEFault]	113
	WAVelength					<Wavelength[<wsp>M]> |MAXimum|MINimum|DEFault	115
	WAVelength?					[MAXimum|MINimum|DEFault]	117
OUTPut[1..n]	ALC	[STATe]				<State>	119
		[STATe]?					120
	APMode					ABSolute|XB|REFerence	121
	APMode?						123
	DTOlerance					<Drift[<wsp>DB]>|MAXimum| MINimum|DEFault	124
	DTOlerance?					[MAXimum|MINimum|DEFault]	126
	LOCK	[STATe]?					128
	OFFSet					<Offset[<wsp>DB]>|MAXimum| MINimum|DEFault	129
	OFFSet?					[MAXimum|MINimum|DEFault]	131
	POWer					<Power[<wsp>DBM]>|MAXimum |MINimum|DEFault	133
	POWer?					[MAXimum|MINimum|DEFault]	135

Command						Parameter(s)	P.
	REFerence					<Reference[<wsp>DBM]> |MAXimum|MINimum|DEFault	137
	REFerence?					[MAXimum|MINimum|DEFault]	139
	RPOWer					<RelativePower[<wsp>DBM]> |MAXimum|MINimum|DEFault	141
	RPOWer?					[MAXimum|MINimum|DEFault]	143
	[STATe]					<ShutterState>	145
	[STATe]?						146
READ[1..n]	[SCALar]	POWer	DC?				147
SENSe[1..n]	CORRection	COLLect	ZERO				148
SNUMber?							149
STATus?							150
STATus	OPERation	BIT<n>	CONDition?				151
	QUEStionable	BIT<n>	CONDition?				153

Product-Specific Commands—Description

:CALibration[1..n]:ZERO	
Description	Returns the mechanism of the instrument to its home position. This command is an event and has no associated *RST condition or query form.
Syntax	:CALibration[1..n]:ZERO
Parameter(s)	None
Example(s)	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).
Notes	This command will take at least 15 seconds to complete.
See Also	:SENSe[1..n]:CORRection:COLLect:ZERO :STATus:OPERation:BIT<n>:CONDition? :STATus:QUEStionable:BIT<n>:CONDition?

:CONTrol[1..n]:MODE

Description

This command selects the attenuator's control mode.

At *RST, the control mode is ATTenuation.

Syntax

:CONTrol[1..n]:MODE<wsp>ATTenuation|POWer

Parameter(s)

Parameter 1:

The program data syntax for the first parameter is defined as a <CHARACTER PROGRAM DATA> element. The allowed <CHARACTER PROGRAM DATA> elements for this parameter are: ATTenuation|POWer.

This parameter represents the newly selected control mode.
ATTenuation: selects the attenuation control mode.
POWer:selects the power control mode.

Example(s)

CONT:MODE POW
CONT:MODE ATTENUATION

See Also

:CONTrol[1..n]:MODE?
:INPut[1..n]:ATTenuation
:INPut[1..n]:RATTenuation
:OUTPut[1..n]:POWer
:OUTPut[1..n]:RPOWer

:CONTrol[1..n]:MODE?

Description	This query returns the attenuator's control mode. At *RST, the control mode is ATTenuation.
Syntax	:CONTrol[1..n]:MODE?
Parameter(s)	None
Response Syntax	<Mode>
Response(s)	*Mode:* 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.
Example(s)	CONT:MODE POW CONT:MODE? Returns POWER
See Also	:CONTrol[1..n]:MODE :INPut[1..n]:ATTenuation :INPut[1..n]:RATTenuation :OUTPut[1..n]:POWer :OUTPut[1..n]:RPOWer

:INPut[1..n]:ARESolution?

Description	This query returns the smallest attenuation step available. Use this command to determine the maximum resolution of the attenuation. *RST has no effect on this command.
Syntax	:INPut[1..n]:ARESolution?
Parameter(s)	None
Response Syntax	<Resolution>
Response(s)	*Resolution:* The response data syntax for <Resolution> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Resolution> response represents the smallest attenuation step available.
Example(s)	INP:ARES? Returns: 2.000000E–003

:INPut[1..n]: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[1..n]: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[1..n]: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 highest supported value.

:INPut[1..n]: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[1..n]:ATTenuation? MAX and INPut[1..n]: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[1..n]:ATTenuation?
:INPut[1..n]:RATTenuation
:OUTPut[1..n]:POWer
:STATus:OPERation:BIT<n>:CONDition?

:INPut[1..n]:ATTenuation?

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

:INPut[1..n]: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[1..n]:ATTenuation :INPut[1..n]:RATTenuation?

:INPut[1..n]: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[1..n]:RATTenuation command is used.

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

Syntax

:INPut[1..n]: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 highest supported value.

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[1..n]:OFFSet? MAX and INPut[1..n]:OFFSet? MIN queries to determine a valid range for the attenuation offset.

:INPut[1..n]: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[1..n]:OFFSet?
:INPut[1..n]:RATTenuation
:OUTPut[1..n]:OFFSet

:INPut[1..n]:OFFSet?

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

:INPut[1..n]: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[1..n]:OFFSet :INPut[1..n]:RATTenuation :OUTPut[1..n]:OFFSet?

:INPut[1..n]: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[1..n]: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 lowest supported value. MAXimum allows to set the instrument to the highest supported value.

:INPut[1..n]: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[1..n]:RATTenuation? MAX and INPut[1..n]: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[1..n]: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[1..n]:MODE
:OUTPut[1..n]:APMode
:INPut[1..n]:ATTenuation
:INPut[1..n]:OFFSet
:INPut[1..n]:RATTenuation?
:INPut[1..n]:REFerence
:STATus:OPERation:BIT<n>:CONDition?
:OUTPut[1..n]:RPOWer

:INPut[1..n]:RATTenuation?

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

:INPut[1..n]: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[1..n]:MODE
:OUTPut[1..n]:APMode
:INPut[1..n]:ATTenuation?
:INPut[1..n]:OFFSet
:INPut[1..n]:RATTenuation
:INPut[1..n]:REFerence

:INPut[1..n]: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[1..n]: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 it 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[1..n]:REFerence<wsp><Reference [<wsp>DB]>|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 lowest supported value.
MAXimum allows to set the instrument to the highest supported value.

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

The <Reference> parameter represents the new reference value.

:INPut[1..n]:REFerence

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[1..n]:RATTenuation
:INPut[1..n]:REFerence?
:OUTPut[1..n]:APMode
:OUTPut[1..n]:APMode?
:OUTPut[1..n]:REFerence

:INPut[1..n]:REFerence?

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

:INPut[1..n]: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 reference value in dB.

Example(s)

```
INP:WAV 1310 NM
CONT:MODE ATT
OUTP:APM REF
INP:REF?
```

See Also

:INPut[1..n]:RATTenuation?
:INPut[1..n]:REFerence
:OUTPut[1..n]:APMode
:OUTPut[1..n]:APMode?
:OUTPut[1..n]:REFerence

:INPut[1..n]:WAVelength

Description	This command selects a specific wavelength. At *RST, the wavelength that will be selected depends on the instrument you have.
Syntax	:INPut[1..n]:WAVelength<wsp><Wavelength[<wsp>M]>|MAXimum|MINimum|DEFault
Parameter(s)	*Wavelength:* The program data syntax for <Wavelength> is defined as a <numeric_value> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> element is M. The <Wavelength> special forms MINimum, MAXimum and DEFault are accepted on input. MINimum allows to set the instrument to the lowest supported value. MAXimum allows to set the instrument to the highest supported value.

:INPut[1..n]: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[1..n]:WAVelength? MAX and INPut[1..n]: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[1..n]:WAVelength? :STAT:OPER:BIT:COND?

:INPut[1..n]:WAVelength?

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

:INPut[1..n]: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[1..n]:WAVelength

:OUTPut[1..n]: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[1..n]: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[1..n]:ALC[:STATe]?
:CONTrol[1..n]:MODE
:OUTPut[1..n]:DTOlerance
:OUTPut[1..n]:POWer
:OUTPut[1..n]:RPOWer

:OUTPut[1..n]:ALC[:STATe]?

Description	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. At *RST, this value is set to off.
Syntax	:OUTPut[1..n]:ALC[:STATe]?
Parameter(s)	None
Response Syntax	<State>
Response(s)	*State:* The response data syntax for <State> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <State> response corresponds to the state of the ALC (Automatic Leveling Control) loop. 0: No power tracking will be performed. 1: Power tracking is activated.
See Also	:OUTPut[1..n]:ALC[:STATe] :CONTrol[1..n]:MODE :OUTPut[1..n]:DTOlerance :OUTPut[1..n]:POWer :OUTPut[1..n]:RPOWer

:OUTPut[1..n]:APMode

Description

This command selects, for the active control mode (ATTenuation or POWer), the operation mode (ABSolute, REFerence or X+B).

At *RST, the operation mode is ABSolute for both control modes (ATTenuation and POWer).

Syntax

:OUTPut[1..n]:APMode<wsp>ABSolute|XB|REFerence

Parameter(s)

Parameter 1:

The program data syntax for the first parameter is defined as a <CHARACTER PROGRAM DATA> element. The allowed <CHARACTER PROGRAM DATA> elements for this parameter are: ABSolute|XB|REFerence.

This parameter represents the desired mode.

ABSolute selects Absolute mode.
XB selects X+B mode.
REFerence selects Reference mode.

:OUTPut[1..n]:APMode

Example(s)	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)
Notes	Since the operation mode applies to the active control mode, you must first define the control mode with the :CONTrol[1..n]:MODE command.
See Also	:CONTrol[1..n]:MODE :INPut[1..n]:RATTenuation :OUTPut[1..n]:APMode? :OUTPut[1..n]:RPOWer

:OUTPut[1..n]:APMode?

Description	This query returns, for active control mode (ATTenuation or POWer), the current operation mode (ABSolute|XB|REFerence). At *RST, the operation mode is ABSolute for both control modes (ATTenuation and POWer).
Syntax	:OUTPut[1..n]:APMode?
Parameter(s)	None
Response Syntax	<Mode>
Response(s)	*Mode:* The response data syntax for <Mode> is defined as a <CHARACTER RESPONSE DATA> element. The <Mode> response corresponds to the operation mode that is currently selected. ABSOLUTE: the attenuator is in Absolute mode. REFERENCE: the attenuator is in Reference mode. XB: the attenuator is in X+B mode.
Example(s)	OUTP:APM XB OUTP:APM? Returns XB (corresponding to the X+B operation mode)
See Also	:CONTrol[1..n]:MODE :INPut[1..n]:RATTenuation :OUTPut[1..n]:APMode :OUTPut[1..n]:RPOWer

:OUTPut[1..n]: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[1..n]: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[1..n]: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 lowest supported value.
MAXimum allows to set the instrument to the highest supported value.

:OUTPut[1..n]: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[1..n]:DTOlerance? MAX and OUTPut[1..n]: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[1..n]:POWer
:OUTPut[1..n]:DTOlerance?
:OUTPut[1..n]:ALC[:STATe]

:OUTPut[1..n]:DTOlerance?

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

:OUTPut[1..n]: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[1..n]:POWer
:OUTPut[1..n]:DTOlerance
:OUTPut[1..n]:ALC[:STATe]?

:OUTPut[1..n]:LOCK[:STATe]?

Description	This query returns the lock state of the instrument's shutter. If the shutter is closed using the red 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 red push button again. At *RST the lock state remains unchanged.
Syntax	:OUTPut[1..n]: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. 0: The shutter is unlocked and can be controlled using the OUTup[1..n][: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 instrument's front panel).
Example(s)	OUTP:LOCK:STAT? Returns: 0 (The shutter is unlocked and can be controlled using the OUTup[1..n][:STATe] command.)
See Also	:OUTPut[1..n][:STATe]

:OUTPut[1..n]: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 OUTut[1..n]:RPOWer command is used. This value it used only when the POWer control mode is active. At *RST, this value is set to 0 dB.
Syntax	:OUTPut[1..n]: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 lowest supported value. MAXimum allows to set the instrument to the highest supported value.

:OUTPut[1..n]: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[1..n]:OFFSet? MAX and OUTPut[1..n]: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[1..n]:OFFSet
:OUTPut[1..n]:OFFSet?
:OUTPut[1..n]:RPOWer

:OUTPut[1..n]:OFFSet?

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

:OUTPut[1..n]:OFFSet?

Response(s)

Offset:

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

The <Offset> response corresponds to either the current or the MINimum/MAXimum power offset value in dB.

Example(s)

CONT:MODE POW
OUTP:OFFS -5.000 DB
OUTP:OFFS? Returns: -5.000000E+000

See Also

:INPut[1..n]:OFFSet?
:OUTPut[1..n]:OFFSet
:OUTPut[1..n]:RPOWer

:OUTPut[1..n]: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[1..n]: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 lowest supported value.
MAXimum allows to set the instrument to the highest supported value.

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[1..n]:POWer? MAX and OUTPut[1..n]:POWer? MIN queries to determine a valid range for the output power.

:OUTPut[1..n]: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 ouput 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 ouput power is not reached. When output power is reached, the returned value is 0.

See Also

INPut[1..n]:ATTenuation
OUTPut[1..n]:ALC[:STATe]
OUTPut[1..n]:DTOlerance
OUTPut[1..n]:POWer?
OUTPut[1..n]:RPOWer?
:STATus:OPERation:BIT<n>:CONDition?

:OUTPut[1..n]:POWer?

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

:OUTPut[1..n]:POWer?

Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response represents either the current or the MINimum/MAXimum absolute power value, in dBm.
Example(s)	INP:WAV 1310 NM CONT:MODE POW OUTP:POW -15.000 DBM OUTP:POW? Returns -1.500000E+001
See Also	:OUTPut[1..n]:ALC[:STATe]? :OUTPut[1..n]:DTOlerance? :OUTPut[1..n]:POWer :OUTPut[1..n]:RPOWer?

:OUTPut[1..n]: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[1..n]: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 lowest supported value.
MAXimum allows to set the instrument to the highest supported value.

:OUTPut[1..n]: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[1..n]:REFerence :OUTPut[1..n]:APMode :OUTPut[1..n]:OFFSet :OUTPut[1..n]:REFerence? :OUTPut[1..n]:RPOWer

:OUTPut[1..n]:REFerence?

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

:OUTPut[1..n]: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[1..n]:REFerence
:OUTPut[1..n]:APMode
:OUTPut[1..n]:OFFSet
:OUTPut[1..n]:REFerence
:OUTPut[1..n]:RPOWer

:OUTPut[1..n]: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[1..n]: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 lowest supported value.
MAXimum allows to set the instrument to the highest supported value.

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[1..n]:RPOWer? MAX and OUTPut[1..n]:RPOWer? MIN queries to determine a valid range for the power.

:OUTPut[1..n]:RPOWer

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.

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 ouput 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[1..n]:MODE
:INPut[1..n]:RATTenuation
:OUTPut[1..n]:APMode
:OUTPut[1..n]:OFFSet
:OUTPut[1..n]:REFerence
:OUTPut[1..n]:RPOWer?
:STATus:OPERation:BIT<n>:CONDition?

:OUTPut[1..n]:RPOWer?

Description

This query returns a value indicating either the current or the minimum/maximum relative power value.

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

Syntax

:OUTPut[1..n]:RPOWer?[<wsp>MAXimum|MINimum|DEFault]

Parameter(s)

Parameter 1:

The program data syntax for the first parameter is defined as a <CHARACTER PROGRAM DATA> element. The allowed <CHARACTER PROGRAM DATA> elements for this parameter are: MAXimum|MINimum|DEFault.

MINimum is used to retrieve the instrument's lowest supported value.
MAXimum is used to retrieve the instrument's highest supported value.
DEFault is used to retrieve the instrument's default value.

Response Syntax

<RelativePower>

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.

:OUTPut[1..n]:RPOWer?

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

b) In REREFENCE 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

:CONTrol[1..n]MODE
:OUTPut[1..n]:APMode
:OUTPut[1..n]:OFFSet
:OUTPut[1..n]:REFerence
:OUTPut[1..n]:RPOWer

:OUTPut[1..n][:STATe]

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

:OUTPut[1..n][:STATe]?

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

:READ[1..n][:SCALar]:POWer:DC?

Description	This query returns the power measured at the instrument's input port. This command is an event and has no associated *RST condition or query form.
Syntax	:READ[1..n][:SCALar]:POWer:DC?
Parameter(s)	None
Response Syntax	<PowerMeasurement>
Response(s)	*PowerMeasurement:* The response data syntax for <PowerMeasurement> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <PowerMeasurement> response represents the current input power.
Example(s)	READ:SCAL:POW:DC? Returns -1.254000E+001 READ:SCAL:POW:DC? Returns 9221120237577961472 = (UNDERRANGE) READ:SCAL:POW:DC? Returns 9221120238114832384 = (OVERRANGE)

:SENSe[1..n]:CORRection:COLLect:ZERO

Description	This command performs an offset nulling on the internal power meter. This command is an event and has no associated *RST condition or query form.
Syntax	:SENSe[1..n]:CORRection:COLLect:ZERO
Parameter(s)	None
Example(s)	STAT? Must return READY SENS:CORR:COLL:ZERO STAT:OPER:BIT10:COND? Keep resending the query as long as the operation is not complete (returned value is not 0).
Notes	This command will take at least 3 seconds to complete.
See Also	:CALibration[1..n]:ZERO :STATus:OPERation:BIT<n>:CONDition?

:SNUMber?

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

:STATus?

Description	This query returns a value indicating the status of the attenuator. This command is an event and has no associated *RST condition or query form.
Syntax	:STATus?
Parameter(s)	None
Response Syntax	<Status>
Response(s)	*Status:* The response data syntax for <Status> is defined as a <CHARACTER RESPONSE DATA> element. The <Status> response represents the instrument state, where: UNINITIALIZED means the instrument has not been initialized yet. INITINPROGRESS means the instrument's 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 sould 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. 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.

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

	Bit <9>: When the returned value is 1, the instrument's mechanism is being repositioned at its home position (CALibration[1..n]: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[1..n]:ZERO SENSe[1..n]:CORRection:COLLect:ZERO STATus? STATus:QUEStionable:BIT<n>:CONDition?

: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	<QuestionableCondition>
Response(s)	*QuestionableCondition:* The response data syntax for <QuestionableCondition> is defined as a <NR1 NUMERIC RESPONSE DATA> element. 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 instrument's mechanism be returned to its home position (CALibration[1..n]:ZERO). This operation must be performed after many moves of the instrument's mechanism or when variations in temperature occur.

:STATus:QUEStionable:BIT<n>:CONDition?	
	Bit <10>: When the returned value is 1, the operation temperature is outside the recommended operation temperature range as indicated in the instrument's specifications.
Example(s)	STAT:QUES:BIT9:COND?
See Also	:CALibration[1..n]:ZERO :STATus:OPERation:BIT<n>:CONDition?

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NOTICE

通告

CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES

中国关于危害物质限制的规定

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和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (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 电子和电子组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

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[a] 电池 [a]	5	

a. If applicable.
如果适用。

P/N: 1068350

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