IQS-2400

IQS-2400 for IQS Platforms

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Telecom Test and Measurement

EXPERTISE REACHING OUT

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Units of Measurement

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

Version number: 2.0.0

Contents

Certification Information

F.C.C. Information

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

CE Information

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. This unit has undergone extensive testing according to the European Union Directive and Standards.

IMPORTANT

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

EXFO CE DECLARATION OF CONFORMITY

Application of Council Directive(s):	73/23/EEC - The Low Voltage Directive 89/336/EEC - The EMC Directive And their amendments
Manufacturer's Name:	EXFO Electro-Optical Engineering Inc.
Manufacturer's Address:	400 Godin Avenue Quebec, Quebec Canada G1M 2K2 (418) 683-0211
Equipment Type/Environment:	Test & Measurement / Industrial
Trade Name/Model No.:	IQS-2400 WDM Laser Source

Standard(s) to which Conformity is Declared:

EN 61010-1:2001	**Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements.**
EN 60825-1:1994 +A11:1996 +A2: 2001 +A1: 2002	**Safety of laser products – Part 1: Equipment classifications, requirements, and user's guide**
EN 55022: 1998 +A2: 2003	**Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment.**
EN 61326:1997 +A1:1998 +A2:2001 + A3:2003	**Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards.

Manufacturer

Signature: 

Full Name:	Stephen Bull, E. Eng
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Date:	January 7, 2002

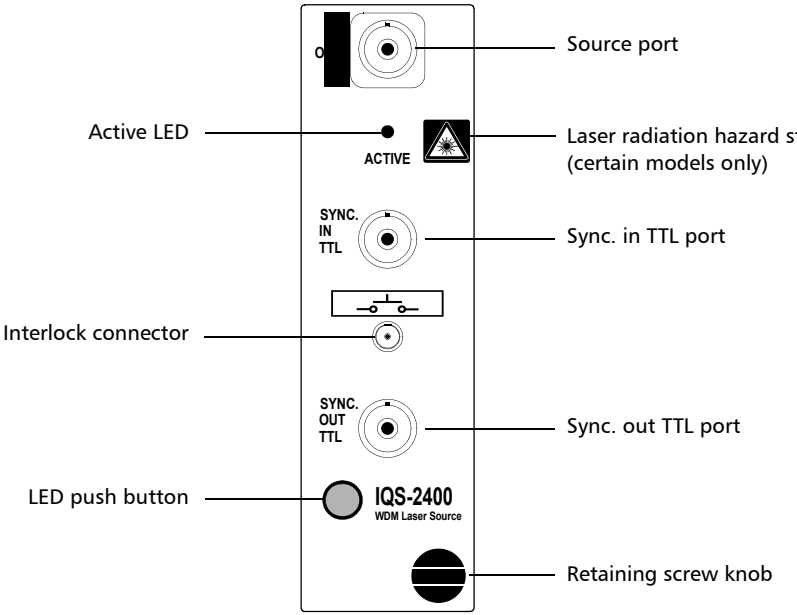
1 Introducing the IQS-2400 WDM Laser Source

Main Features

The IQS-2400 WDM Laser Source is a DFB laser source configured at a wavelength set at the time of purchase. However, you can adjust this wavelength within a ± 1 nm tuning range around the ITU-T wavelengths. This DFB laser source integrates an internal attenuation so you can vary the output power. The built-in optical isolator of the DFB laser increases power stability. All models, except the IQS-2402, can also come equipped with a built-in polarization-maintaining fiber (PMF) output.

The power and wavelength of each DFB laser are calibrated using a wavelength meter and a four-channel power meter traceable to NIST standards (for power) or to natural physical constants (for wavelengths). This calibration method ensures a fully referenced and automated calibration of the DFB's internal temperature and laser current to obtain a precise central wavelength at any power level.

The IQS-2400 WDM Laser Source features wavelength tuning capabilities for each of the ITU-T grid wavelengths, coherence control through a small signal, and direct current modulation with a triangular or square waveform. DFB laser diode manufacturers can also choose to integrate their own lasers into the IQS-2400 WDM Laser Source.



Note: *Actual connectors may differ from the ones shown above.*

The IQS-2400 WDM Laser Source can operate in the following modes:

- Normal mode provides access to total wavelength- and power-tuning ranges, maintaining full control of the output power (automatic power control).
- High Wavelength Stability mode enables you to set wavelength and power-tuning resolution with picometer accuracy through laser temperature and current steps.
- Dither Modulation mode adds a small waveform (triangular or square) to the central wavelength signal, reducing the signal coherence length. It provides modulation capabilities.
- On/Off Modulation mode ensures maximum optical extinction and make possible the synchronization of several sources from an external TTL signal generator or from any module synchronization output. It provides modulation capabilities.

Safety Features

To comply with laser safety regulations, each IQS-2400 WDM Laser Source is supplied with special security features.

Interlock Connector

The IQS-2400 WDM Laser Source is equipped with a remote interlock connector so you can install a security switch or panic button. The WDM Laser Source is shipped with an internally shorted interlock cap. It is your responsibility to install external remote interlocks to ensure safe use of your instrument.

The  sticker is affixed to the front panel, just above the interlock connector to identify it.

The interlock circuit has the following characteristics:

- When it is open, the WDM Laser Source cannot be activated.
- If the WDM Laser Source is active before the interlock circuit is opened, it becomes inactive. For your safety, the WDM Laser Source will not become active automatically upon closing the interlock circuit. You will have to turn it on again. Putting the application's switch to OFF will shut down the instrument at any time.

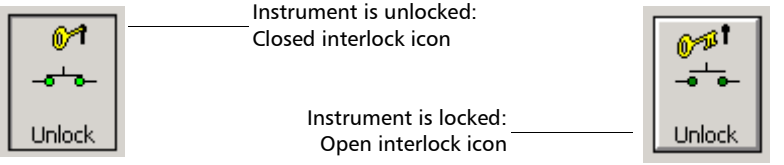
The state of the interlock circuit (open or closed) is indicated in the WDM Laser Source application.

Protection Software Key

For additional safety, you cannot activate the WDM Laser Source (with the application ON/OFF switch) without unlocking it by entering the security password “safekey”when prompted.

Note: *This password cannot be changed and is the same for all instruments requiring a software key.*

Once the instrument has been unlocked, the **Unlock** button remains pressed and the icon shows a closed interlock.



Five-Second Safety Delay

The IQS-2400 WDM Laser Source application provides a five-second safety delay between the instrument activation and actual light emission. During this five-second delay, you may cancel the activation of the laser by using the instrument activation/deactivation switch, by opening the interlock circuit or by using the software key button.

Note: *The source emits a weak signal during the five-second delay.*

Typical Applications

Because of its accuracy, you can use the IQS-2400 WDM Laser Source instead of a wavelength measurement system when testing components and subsystems.

The IQS-2400 WDM Laser Source emulates ITU-T channels in dense WDM applications such as multiwavelength network simulation, simultaneous multiple inputs for EDFA characterization, and insertion loss measurement of WDM passive components. It is ideal for production environments and offers unequaled long-term wavelength stability.

Place more than one IQS-2400 WDM Laser Source in an IQS Platforms and obtain the versatility and reliability you need for optical fiber amplifier testing and network qualification. In addition, with the IQS Platforms, you can set up and control all of your modules at the same time.

You can customize your own high-performance test station by adding one or several of the following modules to the WDM Laser Source: IQS-3100 Variable Attenuator, IQS-5100B Polarization Scrambler, IQS-5250B Optical Spectrum Analyzer, IQS-9100 Optical Switch.

The IQS-2400 WDM Laser Source 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.

Conventions

Before using the product described in this manual, 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.

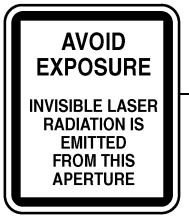
2 Safety Information

WARNING

Do not install or terminate fibers while a light source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

WARNING

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



Affixed to module's side panel

Your instrument is a Class 1M laser product in compliance with standards IEC 60825-1 Amendment 2: 2001 and 21 CFR 1040.10. Invisible laser radiation may be encountered at the output port.

The product is safe under reasonably foreseeable conditions of operation but it may be hazardous if you use optics within a diverging or collimated beam. *Do not view directly with optical instruments.*

Affixed to module's side panel

3 Getting Started with Your WDM Laser Source

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.

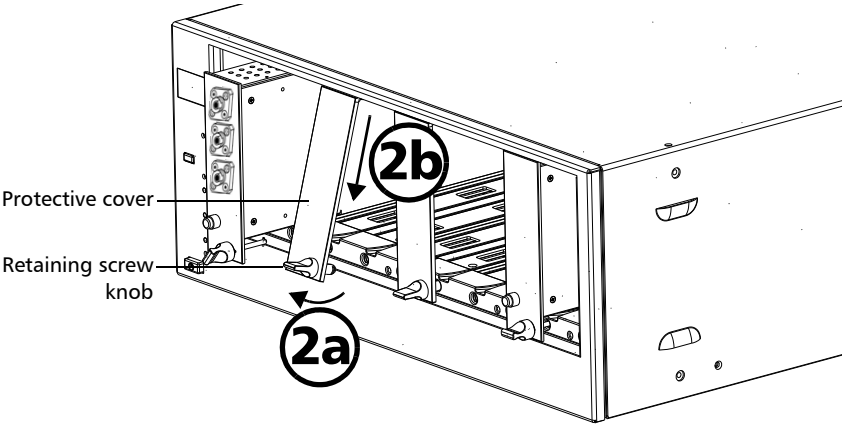
To insert a module into the controller or expansion unit:

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

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

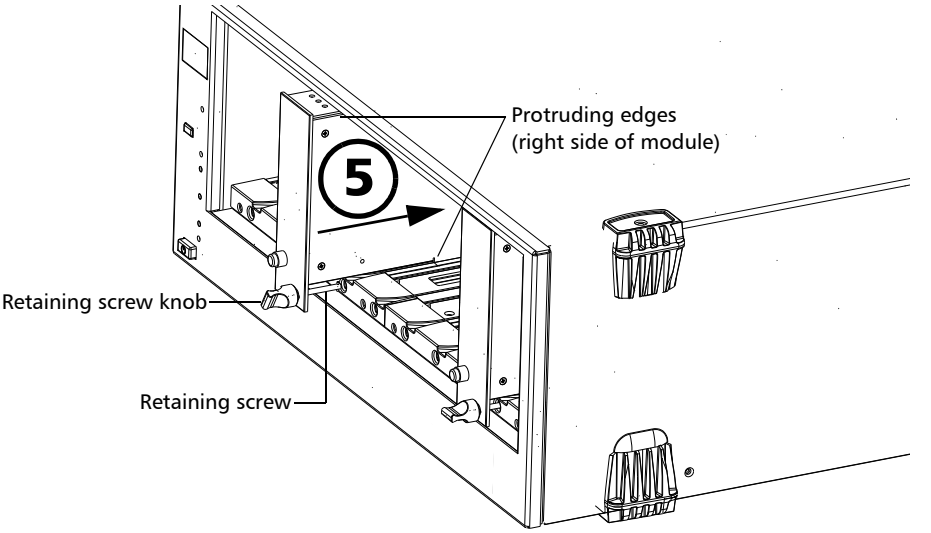
2a. Pull the retaining screw knob firmly towards you and release the bottom of the cover.

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.

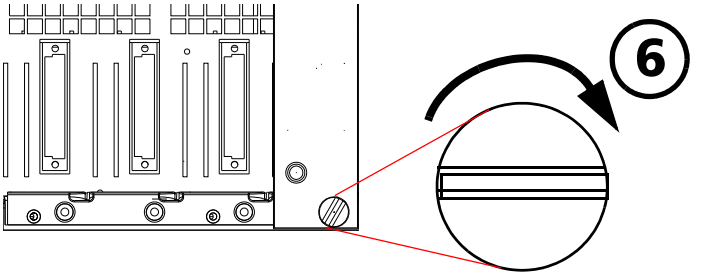
4. Insert the protruding edges of the module into the grooves of the unit's module slot.



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.

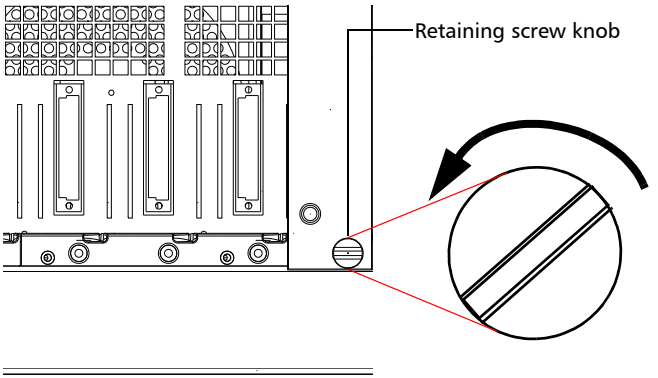
When you turn on the controller unit, the startup sequence will automatically detect your module.

Note: *You can insert IQ modules into your controller or expansion unit; the IQS Manager software will recognize them. However, the IQS-2400 locking mechanism (retaining screw) will not work for IQ modules.*

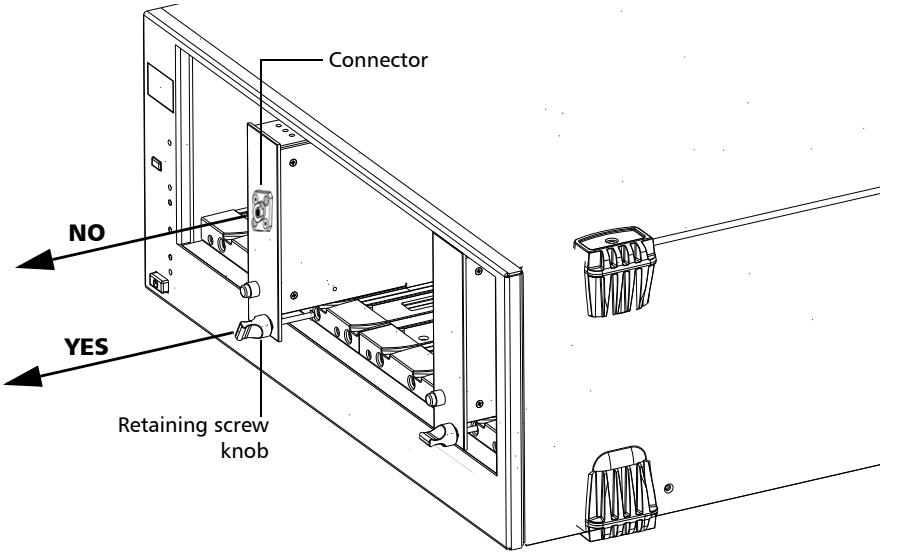
To remove a module from your controller or expansion unit:

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 WDM Laser Source Application

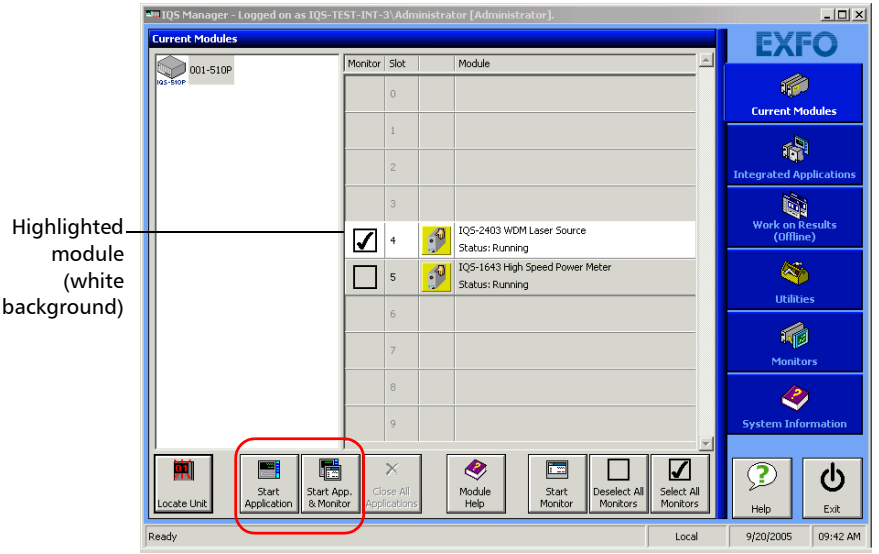
Your IQS-2400 WDM Laser Source module can be configured and controlled from its dedicated IQS Managerapplication.

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.



2. Click **Start Application**.

   OR

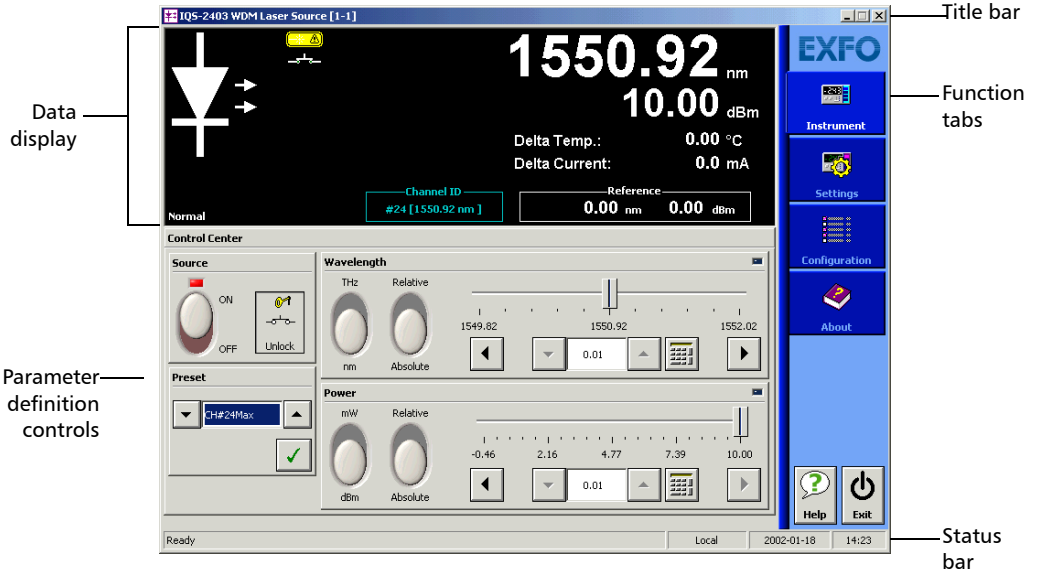
   Press the green LED push button on the front of the corresponding module.

   You can also double-click its row.

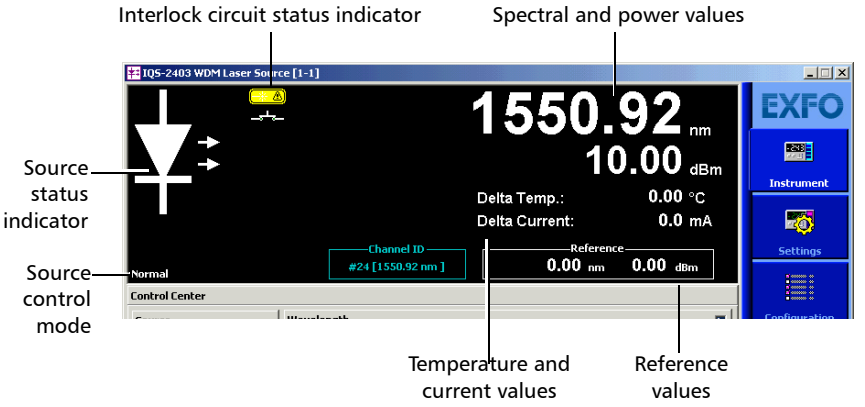
Note: *Pressing the LED push button will not activate or turn on the module.*

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 WDM Laser Source:



Data Display



Depending on the setup, the displayed units (nm/THz, dBm/mW) will change and some items may appear in bright colors or be grayed out.

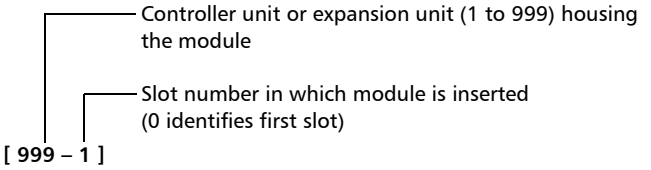
The state of the interlock circuit (open or closed) is indicated by an icon, as shown below:


Open interlock circuit


Closed interlock circuit

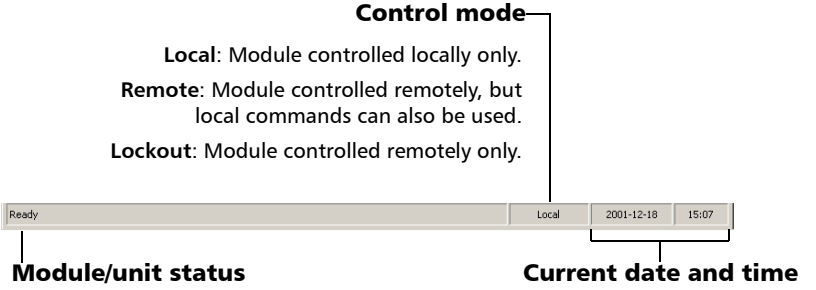
Title Bar

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

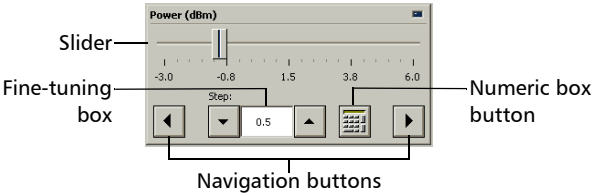
The status bar, located at the bottom of the main window, identifies the operational status of the IQS-2400 WDM Laser Source.



For more information about automating or remotely controlling the IQS-2400 WDM Laser Source, refer to your platform user guide.

Entering Values Using Sliders and Numeric Boxes

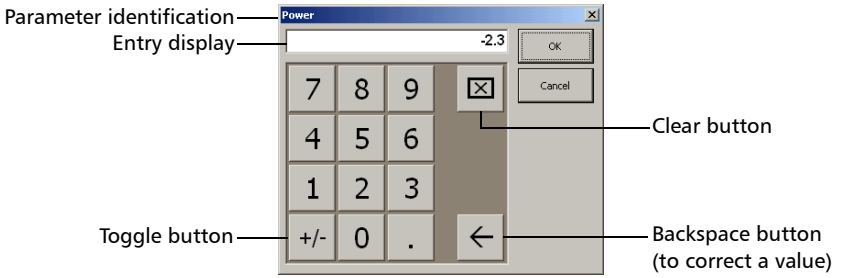
Many parameters in IQS Manager and module applications can be set using the following tools.



- 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 powe 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 is a good way to free 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**.

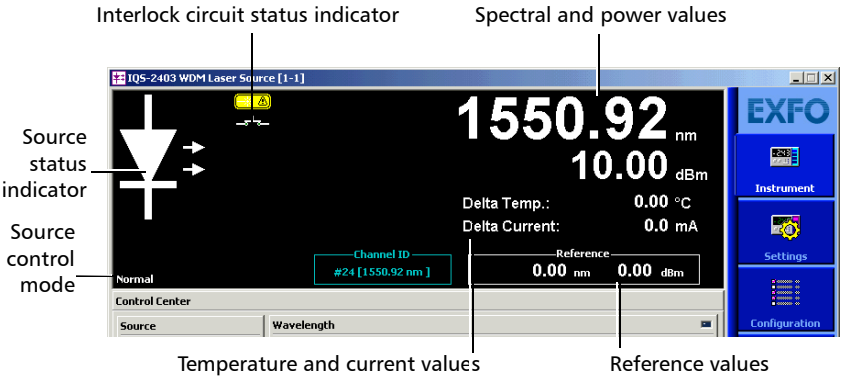
4 Setting Up the WDM Laser Source

Selecting a Control Mode

The IQS-2400 WDM Laser Source offers the following control modes:

Mode	Explanation	Display
Normal	➤ To maximize output power stability. ➤ Default mode used to tune wavelength and power throughout their respective ranges (2 nm for wavelength and 10 dB for power). ➤ To maintain power at the specified level, the monitor current at the back end of the laser will be held constant. Laser current intensity is adjusted in real time to produce a constant output power. Since peak wavelength varies with laser current intensity, the emission spectrum is slightly enlarged.	During laser stabilization, spectral value (wavelength or frequency) and power are displayed in dark green; however, adjustments can be made by using the control center buttons. After laser temperature stabilization, both values are displayed in light green. For Normal mode only: if you use Relative value, reference values appear at the bottom right-hand side of the display (see *Configuring Wavelength/Frequency or Delta Temperature* on page 29 and *Configuring Power or Delta Current* on page 33).
Dither Modulation	➤ Combination of Normal mode and dithering. ➤ In this mode, you can have a 1 mA to 5 mA tone (dithering), which can either be a square or triangular wave.	

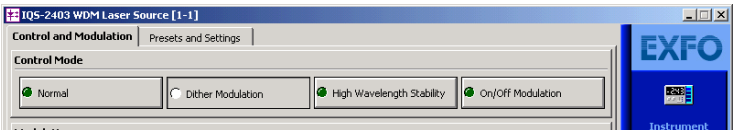
Mode	Explanation	Display
High Wavelength Stability	➤ Used when central wavelength stability is critical. ➤ Current is constant, thus maintaining wavelength stability. Once power and wavelength have been set to the required levels (in Normal mode), select High Wavelength Stability mode to enhance wavelength stability at the established value. A limited tuning range is permitted around this value (± 1 °C for wavelength or ± 1 mA for current). Power stability can be enhanced after a very long stabilization period (typically 2 days).	Even though wavelength and power are displayed in light green, they cannot be adjusted. Both modes are used for fine-tuning laser temperature and current on a limited range around nominal wavelength and power levels reached in Normal mode. Laser temperature and current are displayed just below the power value.
On/Off Modulation	➤ This mode (50 % duty cycle) uses half the average power available from the source module. It controls current during the “on” cycle of the signal. ➤ The tuning range for temperature and current are the same as in High Wavelength Stability mode.	



The spectral value shown on the data display is either the wavelength or the frequency of the signal emitted. The spectral value corresponds to the spectral unit you select in the main window. Wavelength values are given in nm and frequency values in THz.

To select a control mode:

1. From the main window, select the **Settings** function tab.
2. Select the **Control and Modulation** tab.
3. From the **Control Mode** panel, select the desired control mode.



Note: *You can modify the control mode while the laser is active. Changes to laser operation will take effect immediately.*

Setting Modulation (for Dither and On/Off Modulation)

Modulation can be synchronized with a TTL signal coming from the module itself (internal) or from another module (external). Default values are *Internal* for synchronization and *On/Off* for modulation.

The module determines minimum and maximum frequencies.

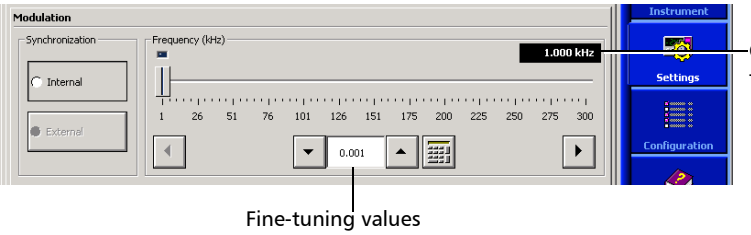
For a dither modulation signal, you can select the depth and waveform of the amplitude modulation signal added or overlapped over the CW signal. The module's differential efficiency determines minimum and maximum depths.

To set up the modulation:

1. From the main window, select the **Settings** function tab.
2. Select the **Control and Modulation** tab.
3. For the On/Off control mode, select the source synchronization mode: internal or external from the **Synchronization** section.

Note: *Synchronization can only be internal with Dither Modulation control mode.*

4. From the **Frequency** section, if you have selected internal synchronization, you can adjust the modulation frequency of the laser signal emitted by the source. For information on how to use the controls, see *Entering Values Using Sliders and Numeric Boxes* on page 19.



Note: *You cannot edit fine-tuning values or add new values.*

5. If you have selected the Dither Modulation control mode, you can configure depth and waveform of the modulation signal as follows:

5a. Select the desired waveform (square or triangular) from the **Waveform** panel.

5b. Specify the desired modulation signal depth with the **Depth** controls.

Note: *You cannot edit fine-tuning values or add new values.*

Configuring Wavelength/Frequency or Delta Temperature

Values appearing on the display correspond to:

- the actual value obtained in Normal or Dither Modulation modes at selected wavelength

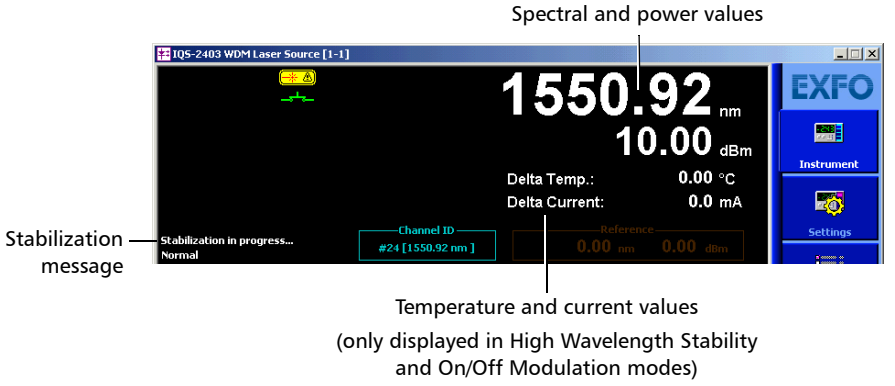
  OR

- the delta temperature (difference between the above value and the temperature obtained after switching to High Wavelength Stability or On/Off Modulation modes).

Adjustable parameters depend on the control mode:

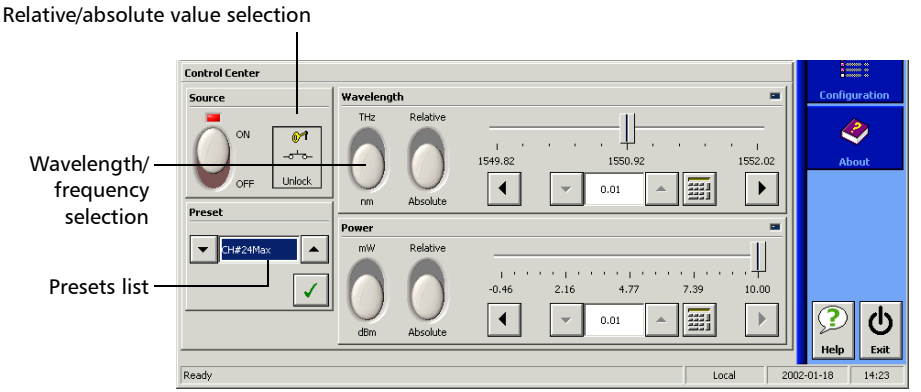
- Normal and Dither modes: to adjust the spectral value (wavelength or frequency). Relative value is only available for these modes.
- High Wavelength Stability and On/Off Modulation modes: once you have set the wavelength in Normal mode or Dither, you can use these modes to enhance wavelength stability at the established value (permitted tuning range: ±1 °C).
- In all modes, modifying the wavelength or frequency also modifies the internal laser temperature. The source will then take a few seconds to adjust to the new value.

The main window data display differs for each control mode.



To configure wavelength/frequency in (Normal or Dither Modulation modes only):

1. If you want to display the source wavelength, select **nm**. If you want to display the frequency, select **THz**.



2. Select between **Relative** and **Absolute** values.

Selecting the relative value will make the current wavelength or frequency the reference value. The new value shown on the data display corresponds to the difference between the reference value and the actual value.

3. Set the wavelength/frequency using one of the following methods:

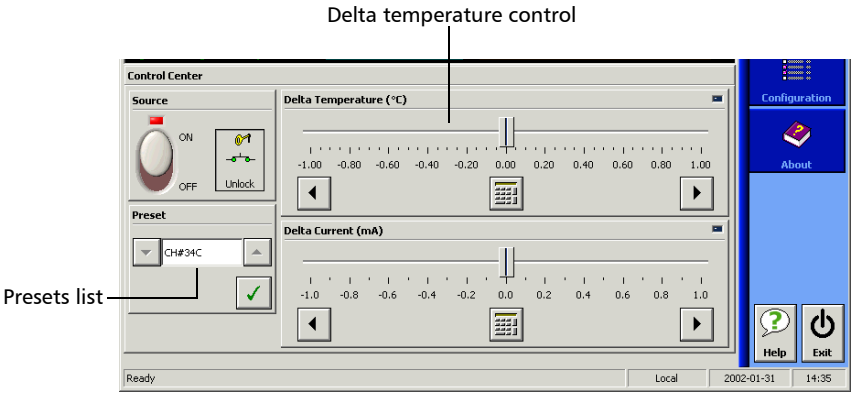
- Slider or navigation buttons
- Up/down arrows to select the predefined parameters from the **Presets** list and ✓ to confirm the selection. For more information, see *Managing Predefined Parameters (Presets)* on page 34.

The source takes a few seconds to adjust to the selected values; a message will be displayed on the left, just above the current source mode.

To configure the delta temperature (wavelength) in High Wavelength Stability or On/Off Modulation modes:

Set the delta temperature using one of the following methods:

- Slider or navigation buttons
- Up/down arrows to select the predefined parameters from the **Presets** list and ✓ to confirm the selection. For more information, see *Managing Predefined Parameters (Presets)* on page 34.



The source takes a few seconds to adjust to the selected values, a message will be displayed on the left, just above the current source mode.

Configuring Power or Delta Current

Values appearing on the display correspond to:

- the actual value on the source port obtained in Normal and Dither Modulation modes at selected wavelength

  OR

- the delta obtained after switching to High Wavelength Stability and On/Off modes).

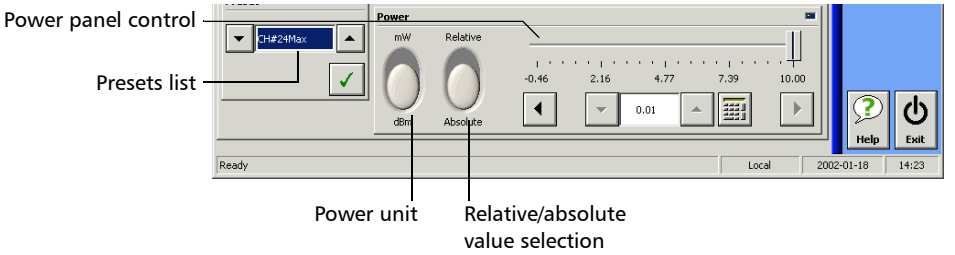
Adjustable parameters depend on the control mode:

- Normal and Dither modes: to adjust the source power. Relative value is only available for these modes.
- High Wavelength Stability and On/Off Modulation modes: once you have set the desired power in Normal mode, you can use these modes to enhance wavelength stability at the established value (permitted tuning range: ±1 mA for temperature/wavelength).
- In all modes, modifying the power current also modifies the internal laser temperature. The source then takes a few seconds to adjust to the new value and a message will be displayed.

The main window data display differs for each control mode.

To configure the source power in Normal or Dither Modulation mode:

1. Select **dBm** or **mW** to modify the power units used in the data display.



2. Select between **Relative** and **Absolute** values. Selecting Relative value will make the current power the reference value. The new value shown corresponds to the difference between the reference value and the actual value. For more information, see *Configuring Power or Delta Current* on page 30.

3. Set the power using one of the following methods:

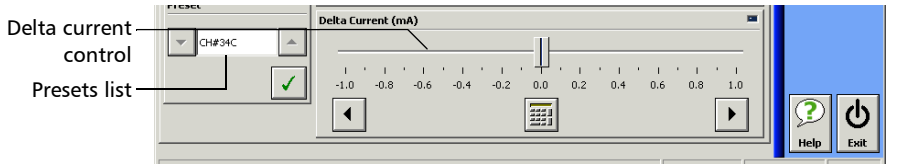
- Slider or navigation buttons
- Up/down arrows to select the predefined parameters from the **Presets** list and ✓ to confirm the selection. For more information, see *Managing Predefined Parameters (Presets)* on page 34.

The source will take a few seconds to adjust to the selected values, a message will be displayed on the left, just above the current source mode.

To configure the source delta current in High Wavelength Stability or On/Off Modulation mode:

Set the delta current using one of the following methods:

- Slider or navigation buttons
- Up/down arrows to select the predefined parameters from the **Presets** list and ✓ to confirm the selection. For more information, see *Managing Predefined Parameters (Presets)* on page 34.



The source takes a few seconds to adjust to the selected values, a message will be displayed on the left, just above the current source mode.

Managing Fine-Tuning Values

Fine-tuning values are the increments (steps) used in Normal and Dither Modulation modes to increase or decrease (with the navigation buttons or slider):

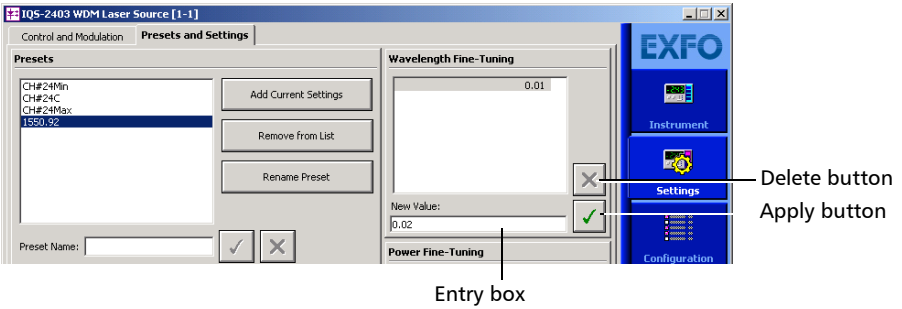
- signal wavelength or frequency in nm or THz.
- power emitted by the source in dB or mW (Values are not converted from one unit to the other).

Values can appear differently depending on the unit you select.

Note: *Fine-tuning values are not available in High Wavelength Stability or in On/Off Modulation modes since settings are made on delta temperature.*

To add a new increment value:

1. Select the **Settings** function tab.
2. In the **New Value** box, enter the desired value.



3. Use ✓ to transfer the new value to the list.

To delete a value from the list:

1. Select the item to delete.
2. Use ✗ to remove the value from the list.

Managing Predefined Parameters (Presets)

A preset is a set of parameters that you can use to configure the source in a single operation. Presets are especially useful when you often need to set the source to specific parameters.

Note: *In Dither Modulation or On/Off Modulation modes, the application will not retain any modulation information. Saved parameters are only related to wavelength and power (actual values or delta temperature/current).*

Control mode	Parameters defined by presets
Normal Dither Modulation	➤ power ➤ minimum, central and maximum wavelength
High Wavelength Stability On/Off Modulation	➤ power ➤ central wavelength ➤ relative laser temperature (difference between absolute temperature and actual value) ➤ relative drive current (difference between absolute current and actual value)

Presets list contains default values (defined by EXFO and calibrated at the wavelength specified at time of purchase) and user-defined values. Each preset is saved under a specific name. Presets appear on a list in the main window.

You can remove or rename any preset from the list, except the default ones.

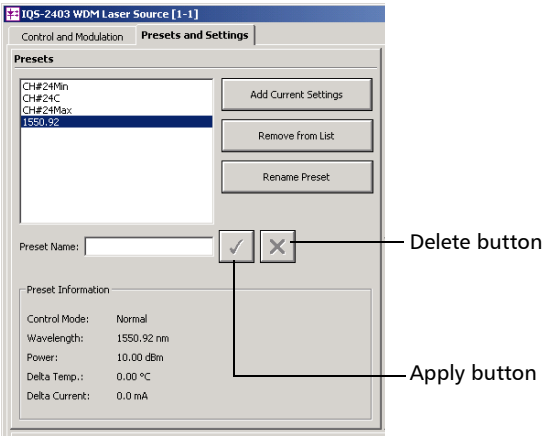
IMPORTANT

To create a preset, the laser must be on and stabilized.

To create a preset:

1. Select a control mode, as explained in *Selecting a Control Mode* on page 21.
2. Adjust source wavelength and power to the desired levels.

   For more information, see *Configuring Wavelength/Frequency or Delta Temperature* on page 26 and *Configuring Power or Delta Current* on page 30.
3. Select the **Presets and Settings** tab from the **Settings** function tab.



4. Use the Add Current Settings button to transfer the current source settings to a new preset.
5. Enter a name for the preset (max. 10 characters) and add it to the list with ✓. You can also discard the new preset with ✗.
6. The new set of values becomes the active preset and is displayed in the main window.

Note: *You should select a significant name to facilitate further usage of the preset. For example, identify the new preset by its wavelength (for example,1552.23) or give it the name of the signal destination (for example,Channel_1).*

To rename a preset:

1. Select the **Presets and Settings** tab from the **Settings** function tab.
2. Select the preset to be renamed and use the **Rename Preset** button to edit the name.
3. Enter the new name.
4. Confirm the modification by using ✓.

To delete a preset:

1. Select the **Presets and Settings** tab from the **Settings** function tab.
2. Select the preset to remove.
3. Use the **Remove From List** button to delete the item.

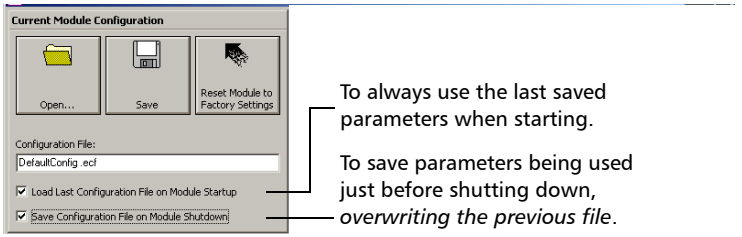
Saving and Recalling Configurations

Once you have set the IQS-2400 WDM Laser Source 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.

5 Operating the WDM Laser Source

Cleaning and Connecting Optical Fibers

IMPORTANT

To ensure maximum power and to avoid erroneous readings:

- **Always clean fiber ends 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. Clean the fiber ends as follows:

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

   1b. Use compressed air to dry completely.

   1c. Visually inspect the fiber end to ensure its cleanliness.

2. Carefully align the connector and port to prevent the fiber end from touching the outside of the port or rubbing against other surfaces.

   If your connector features a key, ensure that it is fully fitted into the port's corresponding notch.

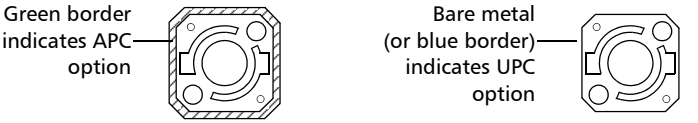
3. Push the connector in so that the fiber-optic cable is firmly in place, thus ensuring adequate contact.

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

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

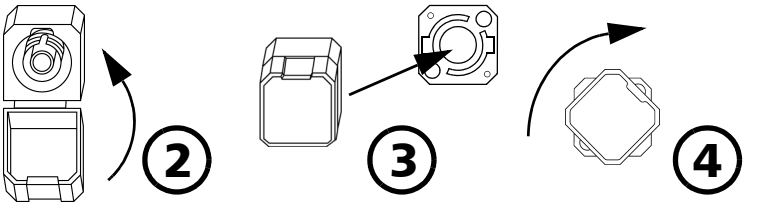
Installing the EXFO Universal Interface (EUI)

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 EU 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.

Activating and Deactivating the Source

This section gives you all the information required to activate and deactivate the source. For more information on the particular safety features, see *Safety Features* on page 4.

IMPORTANT

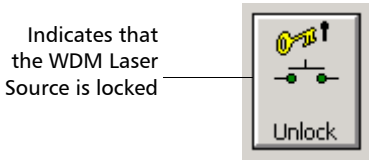
To obtain optimum stability, warm up your laser source for 60 minutes once it has been activated.

To activate the WDM Laser Source:

1. Make sure that the interlock connector (located on the instrument front panel) is closed.

Note: *Since the interlock circuit is a mechanical device, it cannot be opened or closed via the application.*

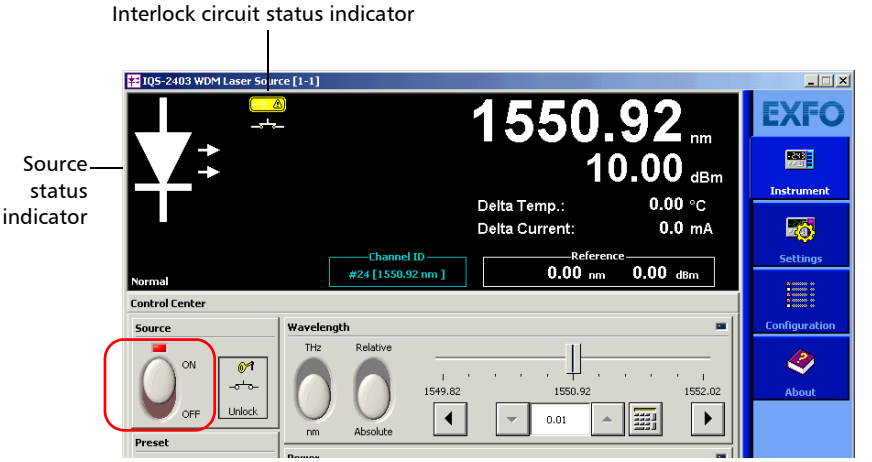
2. If the WDM Laser Source is locked, you will have to unlock it with the software key button (**Unlock** button). This button displays an open interlock when the instrument is locked.



If necessary, use the **Unlock** button. When prompted, enter the password “safekey”.

Note: *Using the **Unlock** button when the instrument is unlocked will automatically stop light emission.*

3. From the **Instrument** function tab, set the **Source** switch to ON.



The status indicator flashes during the five-second safety delay. When the source is active, the LED on the module front panel lights up and the status indicator appears in bright red with two right-pointing arrows.

To deactivate the WDM Laser Source:

➤ Put the activation/deactivation switch to **Off**.

OR

➤ Use the **Unlock** button. This ensures that you will need to enter a password again when you reactivate the instrument.

Once the source has been deactivated, the LED on the module front panel turns off, the status indicator appears in dark red and the arrows disappear.

Correcting the Output Power Level

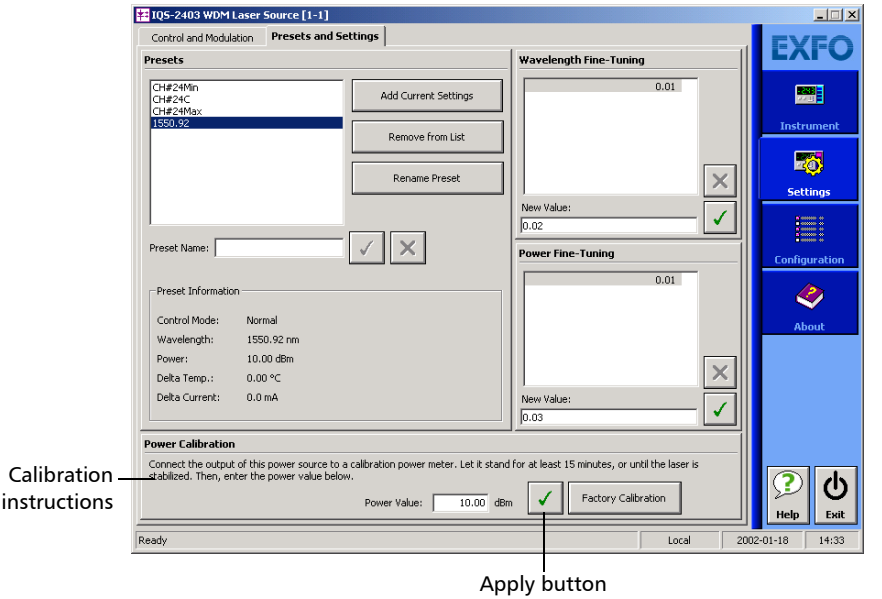
Although the module is precisely calibrated, the actual output power level may slightly drift over time due to connector usage and laser aging. When this occurs, you can use the *power calibration* option to adjust the output power level to its actual value, as measured using a calibrated power meter.

Correcting the source output power level is only possible in Normal mode. If you are controlling multiple IQS-2400 WDM Laser Source modules, you will have to adjust each source output power level individually (use the **Control Single Instrument** button to switch to the appropriate tab).

To correct the output power level:

1. Use a reference patchcord with a known insertion loss and make sure it has been properly cleaned at both ends.
2. Connect the patchcord between a calibrated power meter and the source port.
3. Make sure you activated the source at least one hour before correcting the output power level. For more information, see *Activating and Deactivating the Source* on page 41.

4. Select the **Settings** function tab, then select the **presets and settings** tab.



5. From the **Power Calibration** panel, follow the instructions displayed. Once you have entered the value, confirm with ✓. The "User Calibration" label will appear on the left side of the **Instrument** function tab data display.

The new power level is used as a reference to reestablish the correspondence between the output power level and the displayed values.

Use the **Factory Calibration** button to return to EXFO's original calibration at any time. The "User Calibration" label will disappear from the **Instrument** function tab display.

Synchronizing Sources

You can use synchronization to simultaneously perform operations (for example, wavelength adjustments) on many IQS-2400 WDM Laser Source modules. The sources can be synchronized with a signal coming from an external instrument or from an other IQS-2400 WDM Laser Source.

To synchronize your source module with another instrument:

1. Connect a BNC cable from

➤ the external device to the Sync. In TTL port of the first source module.

OR

➤ the Sync. Out port of the synchronizing IQS-2400 WDM Laser Source to the Sync. In TTL port of the sources to be synchronized.

2. Use a BNC-T connector between each Sync. In port if more than one source needs to be synchronized.

6 Controlling Multiple WDM Laser Source Modules

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.*

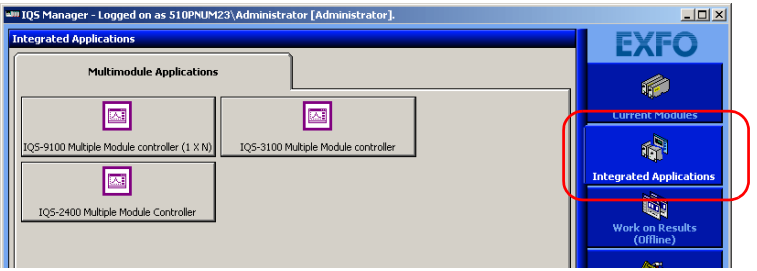
Starting a Multimodule Application

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.



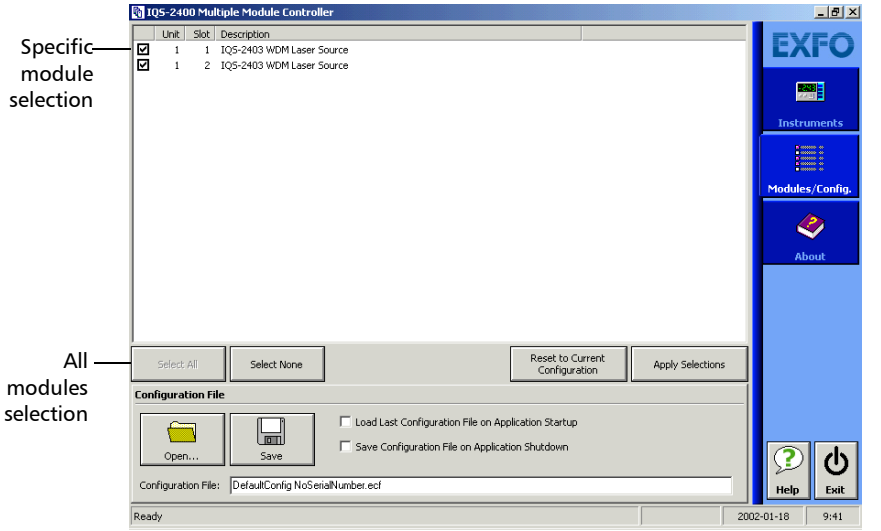
2. Click the appropriate **Multiple Module Controller** button.

   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-2400 WDM Laser Source modules:

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

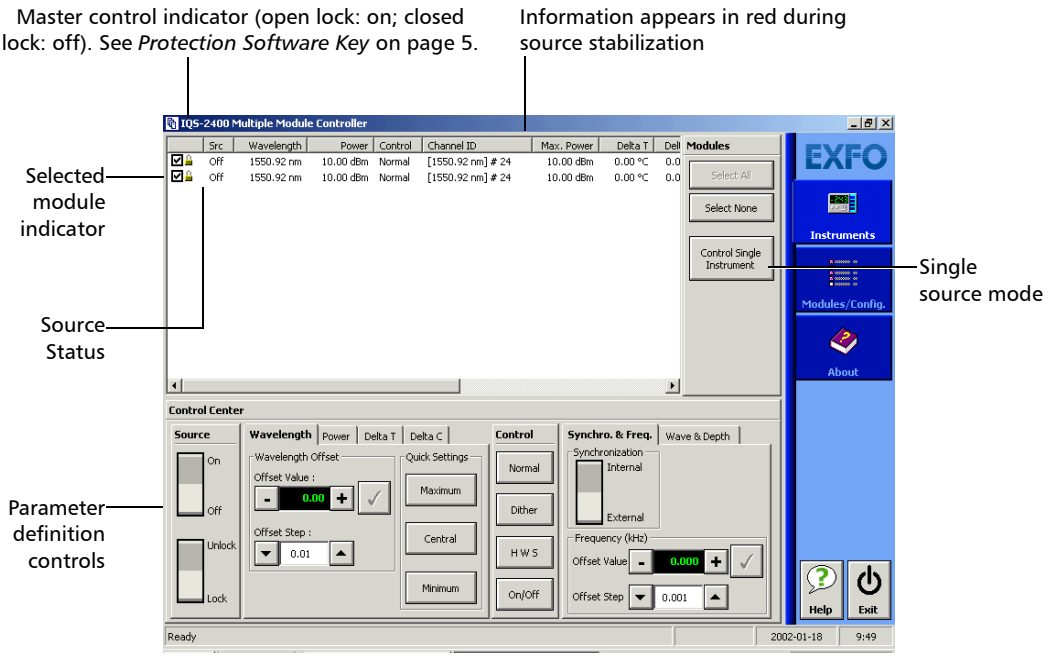
   OR

   Click **Select All** if you want to work with all IQS-2400 WDM Laser Source modules.

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

Setting Up Multiple IQS-2400 WDM Laser Source Modules

Principles that rule the performance of your IQS-2400 WDM Laser Source are the same whether you control one or many sources at the same time. For information, see *Wavelength and Power Control, General Principles* on page 183.



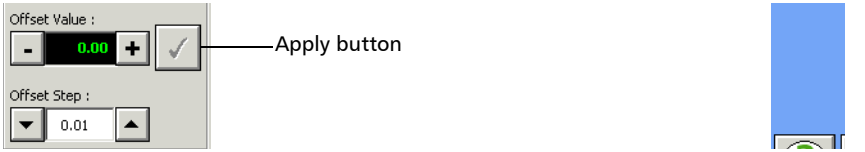
All parameters that can be set for a single module can also be set for multiple modules, except for preset values (because source characteristics may vary from one module to another). In fact, all the settings must be made with offset values.

IMPORTANT

Before setting parameters or turning sources on, make sure that their corresponding boxes are selected.

To modify a particular parameter (all are set the same way):

1. Select the tab associated with the parameter to be modified.
2. Use the and buttons to define the value that will be *added* to the parameter value. If you want to decrease the parameter value, make sure that the offset is negative.

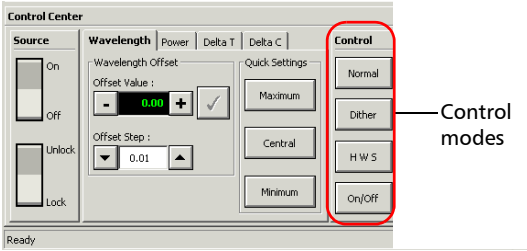


Note: *You can modify the step used when you increase or decrease the offset value. Use the* ***Offset Step*** *up/down arrows to modify the step.*

3. When you are satisfied with the offset value, use to confirm the new setting.

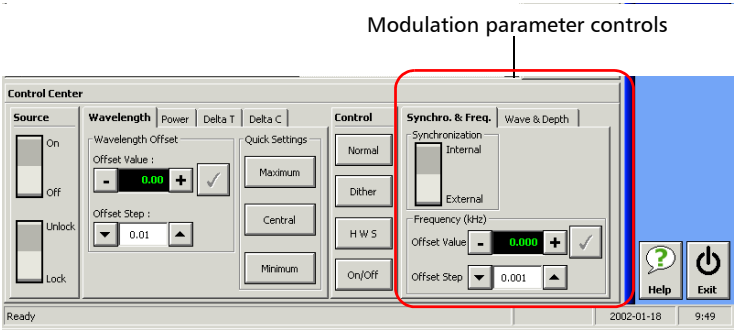
Note: *If the new offset value is out of the permitted range, the application displays an error message.*

To set the control mode:



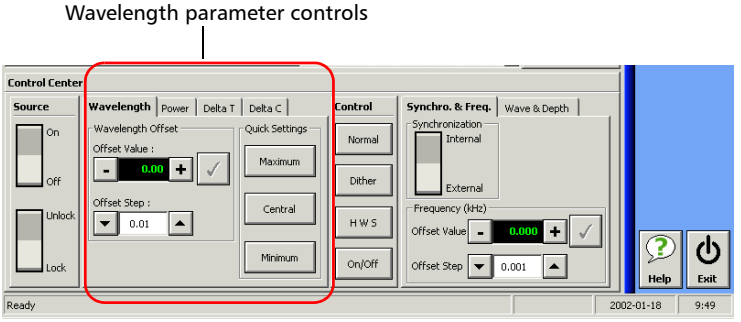
For information, see *Selecting a Control Mode* on page 21.

To set modulation:



For information, see *Setting Modulation (for Dither and On/Off Modulation)* on page 24.

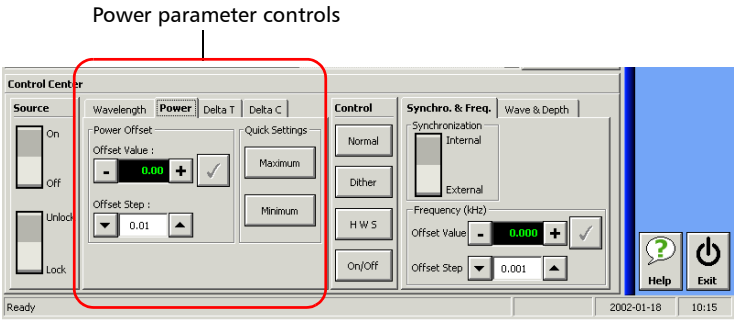
To set wavelength/frequency:



Wavelength or frequency will be used with Normal and Dither Modulation modes. With the **Quick Settings** buttons, you can directly set the source wavelength values to their intrinsic **Maximum**, **Central** or **Minimum** value.

For information, see *Configuring Wavelength/Frequency or Delta Temperature* on page 26.

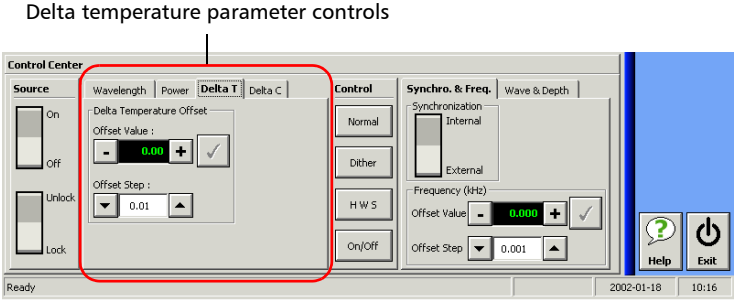
To set power:



Power will be used with Normal and Dither Modulation modes. With the Quick Settings buttons, you can directly set the source power value to their intrinsic **Maximum** or **Minimum** value.

For information, see *Configuring Power or Delta Current* on page 30.

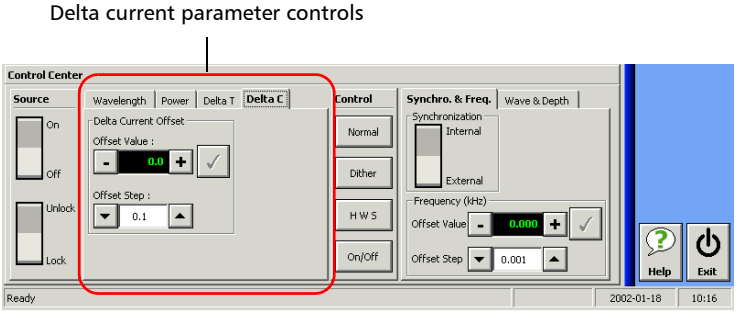
To set delta temperature:



Delta temperature will be used with High Wavelength Stability and On/Off Modulation modes.

For information, see *Configuring Wavelength/Frequency or Delta Temperature* on page 26.

To set delta current:



Delta current will be used with High Wavelength Stability and On/Off Modulation modes.

For information, see *Configuring Power or Delta Current* on page 30.

Controlling a Single IQS-2400 WDM Laser Source

You may want to control a specific module among all the IQS-2400 WDM Laser Source modules that you have in the system.

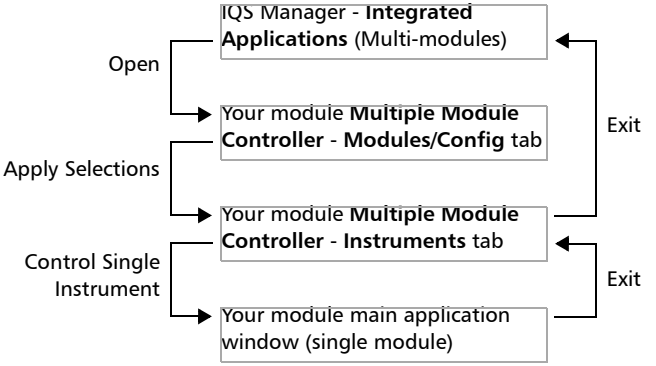
To control a specific IQS-2400 WDM Laser Source:

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-2400 WDM Laser Source 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:



7 Monitoring WDM Laser Source Modules

When using your IQS-2400 WDM Laser Source 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:

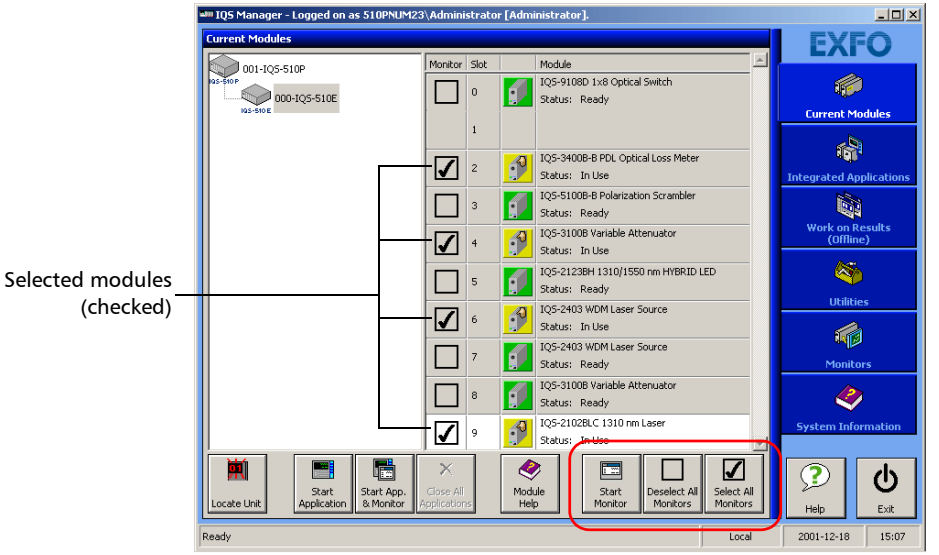
- opening the module application to access all the functions

  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.



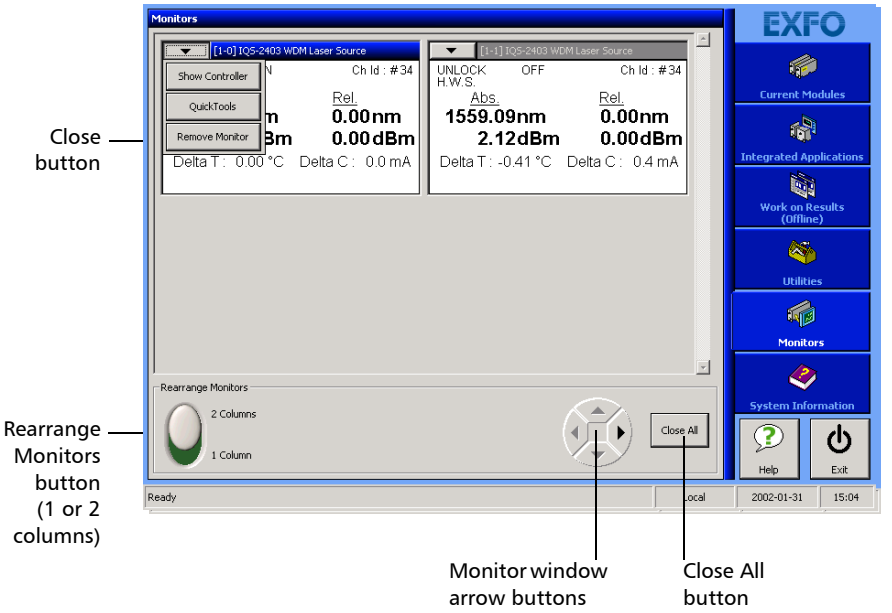
2. In the **Monitor** column, select the box next to each module you want to monitor.

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.

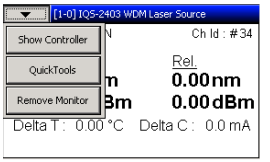
Note: *You can only access QuickTools if the module's monitor window is selected from the* ***Monitors*** *function tab and is currently active.*

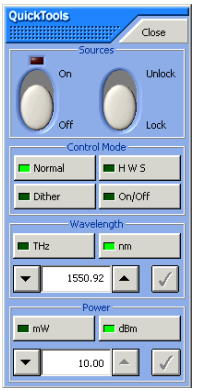
To start QuickTools:

1. From the **Monitors** function tab, elect 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****.*





To control a specific source with QuickTools:

1. Ensure that the source monitor window is selected.
2. Select the appropriate control mode. For a full explanation on control modes, see *Selecting a Control Mode* on page 21.
3. From the **Wavelength** section, adjust the wavelength as follows:
   - **3a.** If the control mode is Normal or Dither Modulation, select between frequency (THz) and wavelength (nm).
   - **3b.** Adjust the value and confirm your settings.
4. From the **Power** section, adjust the power as follows:
   - **4a.** If the control mode is Normal or Dither Modulation, select the unit in which you want the values to be expressed: mW or dBm.
   - **4b.** Adjust the value and confirm your settings.
5. Unlock the source and turn it on. For more information, see *Activating and Deactivating the Source* on page 41.

Note: *Preset values are not available from the QuickTools utility.*

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.

8 Maintenance

To help ensure long, trouble-free operation:

- Always clean fiber-optic connectors before using them.
- 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 and let the unit dry completely.

WARNING

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

Cleaning Fixed Connectors

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

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

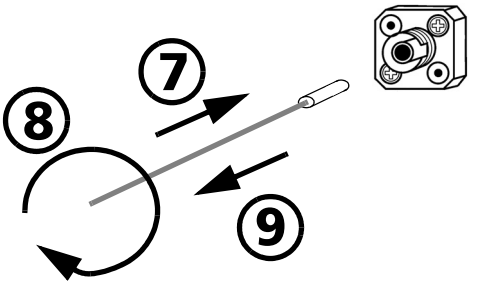
Isopropyl alcohol takes approximately ten seconds to evaporate. Since isopropyl alcohol is not absolutely pure, evaporation will leave microscopic residue. Make sure you dry the surfaces before evaporation occurs.

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

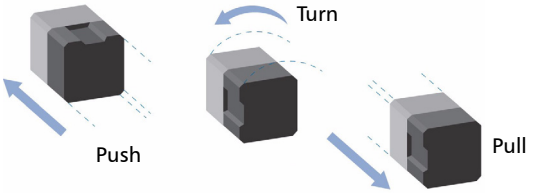
Regular cleaning of EUI connectors will help maintain optimum performance. There is no need to disassemble the unit.

IMPORTANT

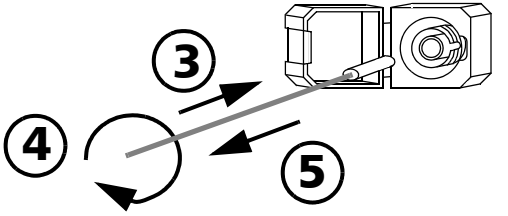
If any damage occurs to internal connectors, the module casing will have to be opened and a new calibration will be required.

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 inspection probe (for example, EXFO's FIP).

WARNING

Verifying the surface of the connector WHILE THE UNIT IS ACTIVE WILL result in permanent eye damage.

7. Put the EUI back onto the instrument (push and turn clockwise).

8. Throw out cleaning tips and wiping cloths after one use.

Recalibrating the Unit

Manufacturing and service center calibrations are based on the ISO/IEC 17025 Standard, which states that calibration documents must not contain a recommended calibration interval, unless this has been previously agreed upon with the customer.

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. You should determine the adequate calibration interval for your unit according to your accuracy requirements.

Under normal use, EXFO recommends calibrating your unit every year.

Recycling and Disposal (Applies to European Union Only)

Recycle or dispose of your product (including electric and electronic accessories) properly, in accordance with local regulations. Do not dispose of it in ordinary garbage receptacles.

This equipment was sold after August 13, 2005 (as identified by the black rectangle).

- Unless otherwise noted in a separate agreement between EXFO and a customer, distributor or commercial partner, EXFO will cover costs related to the collection, treatment, recovery and disposal of end-of-lifecycle waste generated by electronic equipment introduced after August 13, 2005 to an European Union member state with legislation regarding Directive 2002/96/EC.
- Except for reasons of safety or environmental benefit, equipment manufactured by EXFO, under its brand name, is generally designed to facilitate dismantling and reclamation.

For complete recycling/disposal procedures and contact information, visit the EXFO Web site at www.exfo.com/recycle.

9 Troubleshooting

Solving Common Problems

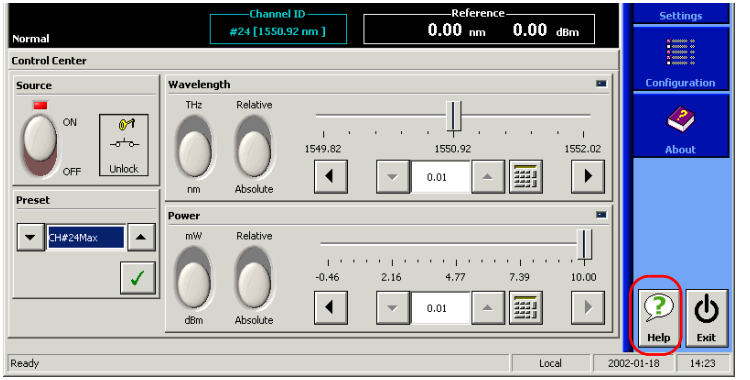
Problem	Probable Cause	Recommended Action
LED push button does not illuminate.	Power not on.	Check AC power cord and turn on the controller and expansion units.
	Module is not properly inserted.	Turn off the controller and expansion units, remove and reinsert the module.
	Computer is locked up.	Reboot the controller unit.
	LED is burnt.	Contact EXFO.
Pushing the LED push button does not open the module main window.	Computer is locked up.	Reboot the controller unit.
Source appears unstable.	Insufficient stabilization time.	Wait a minimum of 60 minutes for optimum stabilization.
	Reflection destabilizing the source.	Connect the source using an optical isolator.
	Ambient temperature varies.	Control ambient temperature.

Viewing Online Documentation

An online version of the IQS-2400 WDM Laser Source user guide is conveniently available at all times from the application.

To access the online user guide:

Click **Help** in the function bar.



Finding Information on the EXFO Web Site

The EXFO Web site provides answers to frequently asked questions (FAQs) regarding the use of your IQS-2400 WDM Laser Source.

To access FAQs:

1. Type http://www.exfo.com in your Internet browser.
2. Click the **Support** tab.
3. Click **FAQs** and follow the on-screen instructions. You will be given a list of questions pertaining to your subject.

The EXFO Web site also provides the product's most recent technical specifications.

Contacting the Technical Support Group

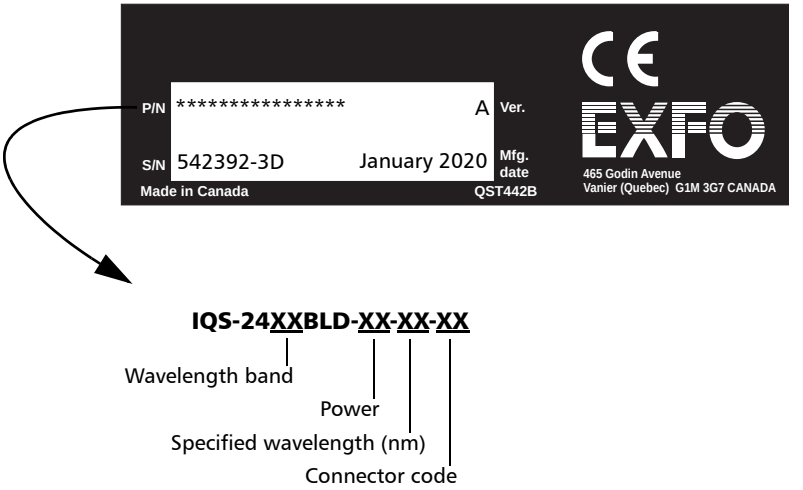
To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

For detailed information about technical support, visit the EXFO Web site at www.exfo.com.

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

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



Transportation

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

- Pack the unit in 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 Electro-Optical Engineering 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 EXFO's control.

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 76). 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 RMAnumber.*

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 76).

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
quebec.service@exfo.com

EXFO Europe Service Center
Omega Enterprise Park, Electron Way
Chandlers Ford, Hampshire S053 4SE
ENGLAND

Tel.: +44 2380 246810
Fax: +44 2380 246801
europe.service@exfo.com

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

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

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*.

IQS-2402 SPECIFICATIONS

Model		P4
Wavelength band (nm)		1308 ±5
Wavelength tuning range (nm)		±0.5 (typical)
Wavelength tuning resolution [b] (nm)		0.01
Wavelength accuracy [c, d] (nm)		±0.01
Wavelength stability [d, e] (nm)		±0.002
Output power [f] (dBm)		10
Output power attenuation range (dB)		>6
Sidemode suppression [g] (dB)		30 (40 typical)
Output power uncertainty [c] (dB)		±0.3
Power stability [c, d] (dB)	15 min	±0.005 (Δ= 0.01)
	8 h	±0.03 (Δ= 0.06)
Modulation frequency (internal or external sync.) (kHz)		0.010 to 300
Dithered modulation amplitude range [h] (mA)		1 to 5
Dithered modulation electrical waveform		Square/triangular

IQS-2403 SPECIFICATIONS

Model		P4/P5	P6/P7
Wavelength band		C-band 1528 nm to1565 nm	C-band 1528 nm to 1565 nm
Wavelength tuning range [a](nm)		±1	±1
Wavelength tuning resolution [b] (nm)		0.01	0.01
Wavelength accuracy [c, d] (nm)		±0.01	±0.02
Wavelength stability [d, e] (nm)		±0.002	±0.002
Output power [f] (dBm)		10	13
Output power attenuation range (dB)		10	10
Sidemode suppression [g] (dB)		30 (40 typical)	30 (40 typical)
Output power uncertainy [g] (dB)		±0.3	±0.3
Power stability [c, d] (dB)	15 min	±0.005 (Δ= 0.01)	±0.005 (Δ= 0.01)
	8 h	±0.03 (Δ= 0.06)	±0.03 (Δ= 0.06)
Modulation frequency (internal or external sync.) (kHz)		0.010 to 300	0.010 to 300
Dithered modulation amplitude range [h] (mA)		1 to 5	1 to 5
Dithered modulation electrical waveform		Square/triangular	Square/triangular

Technical Specifications

IQS-2404 SPECIFICATIONS

Model		P4/P5	P6/P7
Wavelength band		L-band 1566 nm to 1606 nm	L-band 1566 nm to 1606 nm
Wavelength tuning range [a] (nm)		±1	±1
Wavelength tuning resolution [b] (nm)		0.01	0.01
Wavelength accuracy [c, d] (nm)		±0.01	±0.02
Wavelength stability [d, e] (nm)		±0.002	±0.002
Output power [f] (dBm)		10	13
Output power attenuation range (dB)		10	10
Sidemode suppression [g] (dB)		30 (40 typical)	30 (40 typical)
Output power uncertainty [c] (dB)		±0.3	±0.3
Power stability [c, d] (dB)	15 min	±0.005 (Δ= 0.01)	±0.005 (Δ= 0.01)
	8 h	±0.03 (Δ= 0.06)	±0.03 (Δ= 0.06)
Modulation frequency (internal or external sync.) (kHz)		0.010 to 300	0.010 to 300
Dithered modulation amplitude range [h] (mA)		1 to 5	1 to 5
Dithered modulation electrical waveform		Square/triangular	Square/triangular

Notes

a. Guaranteed if the ambient temperature stays between 15 °C to 30 °C.

b. In high-wavelength stability mode, better resolution is possible, but on a limited range.

c. Specified at 23 °C ± 1 °C with 50 % relative humidity.

d. After a 1-hour warmup period.

e. For 8 hours at 23 °C ± 1 °C with 50 % relative humidity.

f. Output power is specified at connector output.

g. Guaranteed at maximum power level.

h. Dithered modulation is only available internally at a typical duty cycle of 50 % duty cycle.

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		0.580 kg	1.25 lb
Temperature			
	Operating	10 °C to 40 °C	50 °F to 104 °F
	Storage	−40 °C to 70 °C	−40 °F to 158 °F
Relative humidity		0 to 95 % non-condensing	

Instruments Drivers

LabVIEW™ drivers, SCPI commands and COM/DCOM libraries

Remote Control

With IQS-500: GPIB (IEEE-488.1, IEEE-488.2) Ethernet and RS-232.

Standard Accessories

User guide, test report and Certificate of Compliance.

B SCPI Command Reference

This appendix presents detailed information on the commands and queries supplied with your IQS-2400 WDM Laser Source.

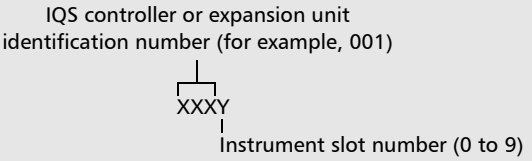
IMPORTANT

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 (except for IEEE 488.2 and platform commands):

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]	VALue					<CalibrationValue[<wsp>DBM|W]>	83
SNUMber?							85
SOURce[1..n]	ACCOutput					<DeltaTemp>,<DeltaCurrent>	86
	APCOutput					<Wavelength[<wsp>M|HZ]>,<Power[<wsp>DBM|W]>	89
	CURRent	ACCBase				<ACCBase>	92
		ACCBase?					94
		BASE?					96
		DELTa				<Delta>|MAXimum|MINimum|DEFault	97
		DELTa?				[MAXimum|MINimum|DEFault]	99
		LIMit	LOW?				100
			HIGH?				101
		RESolution?					102
		STEP?					103
	POWer	[LEVel]	[IMMediate]	[AMPLitude]		<Power[<wsp>DBM|W]>|MAXimum|MINimum|DEFault	104
				[AMPLitude]?		[MAXimum|MINimum|DEFault]	106
		LIMit	LOW?				108
			HIGH?				109
		RESolution?					110
		PROTection	[HARDware]	EXISt?			111
				STATe?			112
			RemovePassWorD				113
			SetPassWorD			<Password>	114
			SOFTware	EXISt?			115
				STATe?			116
		STATe				<PowerState>	117
		STATe?					118
		STEP?					119

Command						Parameter(s)	P.
	PULM	INTernal	DEPTh			<DepthModulation>	120
			DEPTh?				121
			SHAPe			SquareWave|TriangleWave	122
			SHAPe?				123
			FREQuency[1|2]			<Frequency>|MAXimum|MINimum|DEFault	124
			FREQuency[1|2]?			[MAXimum|MINimum|DEFault]	126
		LIMit	DEPTh	LOW?			129
				HIGH?			130
				STEP?			131
				DELTa?			132
			FREQuency	[RANGe]	LOW?	<RangeIndex>	133
					HIGH?	<RangeIndex>	136
					STEP?	<RangeIndex>	139
					RESolution?	<RangeIndex>	141
					COUNt?		143
				DMIN?			145
				DMAX?			146
				OMIN?			147
				OMAX?			148
		SOURce				INTernal|EXTernal	150
		SOURce?					151
		STATe				<ModulationState>	152
		STATe?					153
	SETPoint					<SetpointName>,APC|ACC	154
	STABle?						156

Command						Parameter(s)	P.
	TEMPerature	PROTection	LOW	[LEVel]?			157
			HIGH	[LEVel]?			158
			STEP?				159
			RESolution?				161
			DELTa?				163
			CHannel?				164
	WAVelength	[CW]				<Wavelength[<wsp>M|HZ]>| MAXimum|MINimum|DEFault	165
		[CW]?				[MAXimum|MINimum|DEFault]	167
		[CW]	RESolution?				169
		LIMit	LOW?				170
			HIGH?				171
			STEP?				172
		MODE				NORMal|HRESolution	173
		MODE?					174
STATus?							175
UNIT[1..n]	POWer					DBM|W	176
	POWer?						177
	SPECtrum					M|HZ	178
	SPECtrum?						179

Product-Specific Commands—Description

:CALibration[1..n]:VALue	
Description	This command is used to set the power calibration value of the instrument. This calibration value is used as a correction factor. At *RST, the calibrated power is set to the factory value.
Syntax	:CALibration[1..n]:VALue<wsp> <CalibrationValue[<wsp>DBM|W]>
Parameter(s)	*CalibrationValue:* The program data syntax for <CalibrationValue> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> elements are: DBM|W. The <CalibrationValue> parameter represents the new calibration value. If you do not specify a unit, the device will use the current power units (Watts or dBm). To select the current power units use the UNIT[1..n]:POWer command.
Example(s)	SOUR:PULM:STAT OFF SOUR:WAV:MODE NORMAL /* Under FDA jurisdiction, a password must be entered before turning the laser on. */ SOUR:POW:PROT:SPWD "safekey" SOUR:POW:STAT ON

:CALibration[1..n]:VALue

SOUR:STAB? (repeat until the returned value is not 1)
SOUR:POW 5.0 DBM
CAL:VAL 5.1DBM

Notes

This command must not be used when the instrument is in High Wavelength Stability. To determine the appropriate calibration value, connect the source output to a power meter. The power read by the power meter is the parameter that should be entered with the CALibration[1..n]:VALue command. To return the device to its original factory calibration, use the token DEFault.

The value used must not be more than 10 times greater or less than 10 times lower than the factory calibration value. An attempt to exceed these limits will raise a "Parameter out of range" error.

See Also

UNIT[1..n]:POWer
SOURce[1..n]:WAVelength:MODE
SOURce[1..n]:PULM:STATe
SOURce[1..n]:POWer:PROTection:SetPassWorD
SOURce[1..n]:POWer:[:LEVel][:IMMediate][:AMPLitude]

:SNUMber?

Description	This query returns the module's serial number.
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 is a string corresponding to the serial number of the module.
Example(s)	SNUM? Returns "123456-AB"

:SOURce[1..n]:ACCOutput

Description

This command sets the delta temperature and the delta current of the laser.

At *RST, the delta current and delta temperature are device-dependent.

Syntax

:SOURce[1..n]:ACCOutput<wsp><DeltaTemp>,<DeltaCurrent>

Parameter(s)

➤ *DeltaTemp:*

The program data syntax for <DeltaTemp> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <DeltaTemp> parameter represents the delta temperature of the laser in °C.

The value used must be equal to or between the values returned by SOURce[1..n]:TEMPerature:PROTection:LOW[:LEVel]? and SOURce[1..n]:TEMPerature:PROTection:HIGH[:LEVel]?. The query SOURce[1..n]:TEMPerature:PROTection:STEP? returns the instrument sensitivity.

:SOURce[1..n]:ACCOutput

➤ *DeltaCurrent:*

The program data syntax for <DeltaCurrent> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <DeltaCurrent> parameter represents the delta current of the laser in amperes.

The value used must be equal to or between the values returned by SOURce[1..n]:CURRent:LIMit:LOW? and SOURce[1..n]:CURRent:LIMit:HIGH?. The SOURce[1..n]:CURRent:STEP? query returns the instrument sensitivity.

Example(s)

```
SOUR:PULM:STAT ON
SOUR:WAV:MODE HRES
SOUR:ACCO 0.1,0.0001
```

:SOURce[1..n]:ACCOutput

Notes	This command must only be used when the instrument is either in High Wavelength Stability or On/Off modulation mode. If the instrument is not in one of these modes, the parameters will be read as a requested wavelength and a requested power. This will generate the error message: "Invalid instrument mode".
See Also	SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection: RESolution? SOURce[1..n]:CURRent:LIMit:LOW? SOURce[1..n]:CURRent:LIMit:HIGH? SOURce[1..n]:CURRent:STEP? SOURce[1..n]:CURRent:RESolution? SOURce[1..n]:WAVelength:MODE SOURce[1..n]:PULM:STATe

:SOURce[1..n]:APCOutput

Description

This command is used to set the wavelength or the frequency and the signal power.

At *RST, the power and the wavelength are device-dependent.

Syntax

:SOURce[1..n]:APCOutput<wsp><Wavelength [<wsp>M|HZ]>,<Power[<wsp>DBM|W]>

Parameter(s)

➤ *Wavelength:*

The program data syntax for <Wavelength> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> elements are: M|HZ.

The <Wavelength> parameter is a new wavelength (in meters) or the new frequency (in HZ). If you do not specify a unit, the device will use the current spectrum units. To select the current power units, use the UNIT[1..n]:SPECtrum command.

:SOURce[1..n]:APCOutput

The value used must be equal to or between the values returned by SOURce[1..n]:WAVelength:LIMit:LOW? and SOURce[1..n]:WAVelength:LIMit:HIGH?. The SOURce[1..n]:WAVelength:LIMit:STEP? query returns the instrument sensitivity.

➤ *Power:*

The program data syntax for <Power> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element followed by an optional <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> elements are: DBM|W.

The <Power> parameter represents a new power of the signal in watts or dBm. If you do not specify a unit, the device will use the current power unit. To select the current power unit, use the UNIT[1..n]:POWer command.

The value used must be equal to or between the values returned by SOURce[1..n]:POWer:LIMit:LOW? and SOURce[1..n]:POWer:LIMit:HIGH?. The SOURce[1..n]:POWer:STEP? query returns the instrument sensitivity.

Example(s)

```
SOUR:PULM:STAT ON
SOUR:WAV:MODE NORMAL
SOUR:APCO 1547nm ,7.39DBM
```

:SOURce[1..n]:APCOutput

Notes

This command must only be used when the instrument is either in Normal mode or Dither mode. If the instrument is not in one of these modes, the parameters will be read as a requested delta temperature and a requested delta current. This will generate the following error message: "Invalid instrument mode".

See Also

UNIT[1..n]:POWer
SOURce[1..n]:POWer:LIMit:LOW?
SOURce[1..n]:POWer:LIMit:HIGH?
SOURce[1..n]:POWer:STEP?
SOURce[1..n]:WAVelength:LIMit:LOW?
SOURce[1..n]:WAVelength:LIMit:HIGH?

SOURce[1..n]:WAVelength:LIMit:STEP?
SOURce[1..n]:WAVelength:MODE
SOURce[1..n]:PULM:STATe

:SOURce[1..n]:CURRent:ACCBase

Description

This command is used to set the ACC base current. The base current is the actual current of the laser. For this command to function properly, the instrument must be in High Wavelength Stability or On/Off modulation mode and the SOURce[1..n]:STABle? query must return 1 (stable). Normally, this command would rarely be used.

*RST has no effect on this command.

Syntax

:SOURce[1..n]:CURRent:ACCBase<wsp><ACCBase>

Parameter(s)

ACCBase:

The program data syntax for <ACCBase> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <ACCBase> parameter is the desired current of the instrument in amperes.

Example(s)

```
SOUR:PULM:STATE OFF
SOUR:WAV:MODE HRES
/* Under FDA jurisdiction, a password must be
entered before turning the laser on. */
SOUR:POW:PROT:SPWD "safekey"
SOUR:POW:STAT ON
```

:SOURce[1..n]:CURRent:ACCBase

SOUR:STAB? (repeat until the returned value is not 1)
SOUR:CURR:ACCB 0.0854

Notes

The current properties of the laser may change with time. For this reason, if a setpoint was defined in High Wavelength Stability or On/Off modulation mode, and you want to return to it at a later date, the wavelength and power may differ from those defined with the current step and temperature step when the setpoint was created. To cancel this effect, when creating a setpoint in these modes, the base current is recorded internally. This base current is sent to the instrument when returning to the mentioned setpoint. All this is done automatically and is transparent to the user.

See Also

SOURce[1..n]:CURRent:ACCBase?
SOURce[1..n]:STABle?
SOURce[1..n]:WAVelength:MODE
SOURce[1..n]:WAVelength:MODE?

:SOURce[1..n]:CURRent:ACCBase?

Description	This query returns the ACC base current. For this query to function properly, the instrument must be in High Wavelength Stability or On/Off modulation mode and the SOURce[1..n]:STABle? query must return 1 (stable). *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:ACCBase?
Parameter(s)	None
Response Syntax	<ACCBase>
Response(s)	*ACCBase:* The response data syntax for <ACCBase> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <ACCBase> response is a value representing the ACC base current in amperes.
Example(s)	SOUR:PULM:STATE OFF SOUR:WAV:MODE HRES /* Under FDA jurisdiction, a password must be entered before turning the laser on. */ SOUR:POW:PROT:SPWD "safekey" SOUR:POW:STAT ON

:SOURce[1..n]:CURRent:ACCBase?

SOUR:STAB? (repeat until the returned value is not 1)
SOUR:CURR:ACCB?

Notes

The source must be on.

See Also

SOURce[1..n]:CURRent:ACCBase
SOURce[1..n]:STABle?
SOURce[1..n]:POWer:STATe
SOURce[1..n]:PULM:STATe
SOURce[1..n]:WAVelength:MODE
SOURce[1..n]:POWer:PROTection:SetPassWorD

:SOURce[1..n]:CURRent:BASE?

Description	This query returns the channel's base current. *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:BASE?
Parameter(s)	None
Response Syntax	<CurrentBase>
Response(s)	*CurrentBase:* The response data syntax for <CurrentBase> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <CurrentBase> response is a value representing the current channel base current in amperes.
Example(s)	SOUR:CURR:BASE?
See Also	SOURce[1..n]:CURRent:DELTa? SOURce[1..n]:CURRent:DELTa

:SOURce[1..n]:CURRent:DELTa

Description

This command sets the delta current.

At *RST, the delta current is device-dependent.

Syntax

:SOURce[1..n]:CURRent:DELTa<wsp><Delta>|MAXimum|MINimum|DEFault

Parameter(s)

Delta:

The program data syntax for <Delta> is defined as a <numeric_value> element. The <Delta> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.
MAXimum allows to set the instrument to the greatest supported value.
DEFault allows the instrument to select a value for the <Delta> parameter.

The <Delta> parameter is a value representing the delta current in amperes.

Example(s)

```
SOUR:PULM:STAT ON
SOUR:WAV:MODE HRES
/* Under FDA jurisdiction, a password must be entered before turning the laser on. */
SOUR:POW:PROT:SPWD "safekey"
SOUR:POW:STAT ON
```

:SOURce[1..n]:CURRent:DELTa

SOUR:STAB? (repeat until the returned value is not 1)
SOUR:CURR:DELT -0.0006

Notes

The instrument must be in High Wavelength Stability mode or On/Off modulation.
The source must be on.

See Also

SOURce[1..n]:CURRent:DELTa?
SOURce[1..n]:PULM:STATe
SOURce[1..n]:WAVelength:MODE
SOURce[1..n]:POWer:PROTection:SetPassWorD
SOURce[1..n]:POWer:STATe
SOURce[1..n]:STABle?

:SOURce[1..n]:CURRent:DELTa?

Description	This query returns the delta current. At *RST, the delta current is device-dependent.
Syntax	:SOURce[1..n]:CURRent:DELTa?[<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 greatest supported value. DEFault is used to retrieve the instrument's default value.
Response Syntax	<Delta>
Response(s)	*Delta:* The response data syntax for <Delta> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Delta> response is a value representing the delta current in amperes.
Example(s)	SOUR:CURR:DELT? returns -6.000000E-004 SOUR:CURR:DELT? MAX returns 1.000000E-003 SOUR:CURR:DELT? MIN returns -1.000000E-003
See Also	SOURce[1..n]:CURRent:DELTa

:SOURce[1..n]:CURRent:LIMit:LOW?

Description	This query returns the minimum delta current used with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:LIMit:LOW?
Parameter(s)	None
Response Syntax	<LimitLow>
Response(s)	*LimitLow:* The response data syntax for <LimitLow> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitLow> response is a value representing the minimum delta current in amperes. The returned value will be negative.
Example(s)	SOUR:CURR:LIM:LOW? Returns -1.000000E-003
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:CURRent:LIMit:HIGH? SOURce[1..n]:CURRent:RESolution? SOURce[1..n]:CURRent:STEP?

:SOURce[1..n]:CURRent:LIMit:HIGH?

Description	This query returns the maximum delta current used with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:LIMit:HIGH?
Parameter(s)	None
Response Syntax	<LimitHigh>
Response(s)	*LimitHigh:* The response data syntax for <LimitHigh> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitHigh> response is a value representing the maximum delta current in amperes. The returned value will be positive.
Example(s)	SOUR:CURR:LIM:HIGH? Returns 1.000000E-003
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:CURRent:LIMit:LOW? SOURce[1..n]:CURRent:RESolution? SOURce[1..n]:CURRent:STEP?

:SOURce[1..n]:CURRent:RESolution?

Description	This query returns the minimum step available when changing the laser current with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:RESolution?
Parameter(s)	None
Response Syntax	<CurrentResolution>
Response(s)	*CurrentResolution:* The response data syntax for <CurrentResolution> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <CurrentResolution> response is a value representing the minimum step available in amperes.
Example(s)	SOUR:CURR:RES? Returns 1.000000E-004
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:CURRent:LIMit:HIGH? SOURce[1..n]:CURRent:LIMit:LOW? SOURce[1..n]:CURRent:STEP?

:SOURce[1..n]:CURRent:STEP?

Description	This query returns the minimum step available when changing the laser current with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:CURRent:STEP?
Parameter(s)	None
Response Syntax	<LimitStep>
Response(s)	*LimitStep:* The response data syntax for <LimitStep> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitStep> response is a value representing the minimum step available in amperes.
Example(s)	SOUR:CURR:STEP? Returns 1.000000E-004
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:CURRent:LIMit:HIGH? SOURce[1..n]:CURRent:LIMit:LOW? SOURce[1..n]:CURRent:RESolution?

:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

Description

This command sets the source output power level. This value can be set even if the source is off.

At *RST, the power level is device-dependent.

Syntax

:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]<wsp><Power[<wsp>DBM|W]>|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> elements are: DBM|W. The <Power> special forms MINimum, MAXimum and DEFault are accepted on input.

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

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

The <Power> parameter is the new source output in watts or in dBm. If you do not specify a unit, the device will use the current power unit. To select the current power unit, use the UNIT[1..n]:POWer command.

:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

Example(s)	SOUR:PULM:STAT OFF SOUR:WAV:MODE NORMAL UNIT:POW DBM SOUR:POW 3.5
Notes	This command must only be used when the instrument is either in Normal or Dither Modulation mode. If the instrument is not in one of these modes, the parameters will be read as a requested wavelength and a requested power. This will generate the following error message: “Invalid instrument mode”.
See Also	SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]? UNIT[1..n]:POWer

:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description	This query returns the current source output power level. At *RST, the output power level is device-dependent.
Syntax	:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]?[<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 greatest supported value. DEFault is used to retrieve the instrument's default value.
Response Syntax	<Power>

:SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]?

Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response is the current source output power in the current selected power unit. To select the currently spectrum unit, use the UNIT[1..n]:POWer command..
Example(s)	UNIT:POW DBM SOUR:POW 3.5 SOUR:POW? Returns 3.500000E+000
See Also	SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude] UNIT[1..n]:POWer

:SOURce[1..n]:POWer:LIMit:LOW?

Description	This query returns the minimum power that can be used with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:LIMit:LOW?
Parameter(s)	None
Response Syntax	<Power>
Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response is the minimum source output power in the currently selected power unit (watts or dBm). To select the current power unit, use the UNIT[1..n]:POWer command.
Example(s)	UNIT:POW DBM SOUR:POW:LIM:LOW? Returns -4.600000E-001
Notes	To set the signal output power, use the SOUR:APCO or SOUR:POW command.
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:POWer:LIMit:HIGH? SOURce[1..n]:POWer:STEP? SOURce[1..n]:POWer:RESolution? UNIT[1..n]:POWer SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

:SOURce[1..n]:POWer:LIMit:HIGH?

Description	This query returns the maximum power at which the output signal can be set with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:LIMit:HIGH?
Parameter(s)	None
Response Syntax	<Power>
Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response is the maximum source output power in the currently selected power unit (watts or dBm). To select the current power unit, use the UNIT[1..n]:POWer command.
Example(s)	UNIT:POW DBM SOUR:POW:LIM:HIGH? Returns 1.000000E+001
Notes	To set the signal output power, use the SOUR:APCO or SOUR:POWcommand.
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:POWer:LIMit:LOW? SOURce[1..n]:POWer:STEP? SOURce[1..n]:POWer:RESolution? UNIT[1..n]:POWer SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

:SOURce[1..n]:POWer:RESolution?

Description	This query returns the minimum resolution that can be used when changing the power with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:RESolution?
Parameter(s)	None
Response Syntax	<Power>
Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response is a value reprensenting the minimum power step in watts.
Example(s)	SOUR:POW:RES? Returns 1.000000E-005
Notes	An attempt to change the output power by a quantity less than the minumum step will be ignored.
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:POWer:LIMit:LOW? SOURce[1..n]:POWer:LIMit:HIGH? SOURce[1..n]:POWer:STEP? UNIT[1..n]:POWer SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

:SOURce[1..n]:POWer:PROTection[:HARDware]:EXISt?

Description	This query returns a response indicating whether the instrument contains an integrated remote interlock connector. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection[:HARDware]:EXISt?
Parameter(s)	None
Response Syntax	<InterlockConnector>
Response(s)	*InterlockConnector:* The response data syntax for <InterlockConnector> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <InterlockConnector> response indicates whether the instrument contains an integrated interlock connector. 0- The instrument does not contain an interlock connector 1- The instrument contains an interlock connector
Example(s)	SOUR:POW:PROT:EXIS? Returns 1 (the hardware power protection exists)
See Also	SOURce[1..n]:POWer:PROTection[:HARDware]:STATe?

:SOURce[1..n]:POWer:PROTection[:HARDware]:STATe?

Description	This query returns the integrated interlock connector status. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection[:HARDware]:STATe?
Parameter(s)	None
Response Syntax	<InterlockConnector>
Response(s)	*InterlockConnector:* The response data syntax for <InterlockConnector> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <InterlockConnector> response represents the current interlock status. 0- The interlock connector is closed. 1- The interlock connector is open.
Example(s)	SOUR:POW:PROT:STAT? Returns 1 (the hardware power protection is activated)
See Also	SOURce[1..n]:POWer:PROTection[:HARDware]:EXISt?

:SOURce[1..n]:POWer:PROTection: RemovePassWorD

Description	This command allows you to remove the software protection password. It activates the software lock and turns off the source if it was on. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection: RemovePassWorD
Parameter(s)	None
Example(s)	SOUR:POW:PROT:RPWD (remove the actual password)
See Also	SOURce[1..n]:POWer:PROTection:SOFTware: STATe? SOURce[1..n]:POWer:PROTection:SOFTware: EXISt?

:SOURce[1..n]:POWer:PROTection:SetPassWorD

Description	This command allows you to enter the software protection password. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection:SetPassWorD <wsp><Password>
Parameter(s)	*Password:* The program data syntax for <Password> is defined as a <STRING PROGRAM DATA> element. The <Password> parameter represents the password key to deactivate the protection key. The default password is safekey.
Example(s)	SOUR:POW:PROT:SPWD "safekey"
See Also	SOURce[1..n]:POWer:PROTection:SOFTware:STATe? SOURce[1..n]:POWer:PROTection:SOFTware:EXISt?

:SOURce[1..n]:POWer:PROTection:SOFTware:EXISt?

Description	This query returns a response indicating whether the instrument contains a software-key-activated master control. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection:SOFTware:EXISt?
Parameter(s)	None
Response Syntax	<SoftwareKey>
Response(s)	*SoftwareKey:* The response data syntax for <SoftwareKey> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <SoftwareKey> response indicates whether the instrument contains a software-key-activated master control. 0- The instrument does not contain a software key. 1- The instrument contains a software key.
Example(s)	SOUR:POW:PROT:SOFT:EXIS? Returns 1 (software protection exists)
See Also	SOURce[1..n]:POWer:PROTection:RemovePassWorD SOURce[1..n]:POWer:PROTection:SetPassWorD SOURce[1..n]:POWer:PROTection:SOFTware:STATe?

:SOURce[1..n]:POWer:PROTection:SOFTware:STATe?

Description	This query returns software-key-activated master control status. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:PROTection:SOFTware:STATe?
Parameter(s)	None
Response Syntax	<SoftwareKey>
Response(s)	*SoftwareKey:* The response data syntax for <SoftwareKey> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <SoftwareKey> response is the current software key status. 0- The software key is off. 1- The software key is on.
Example(s)	SOUR:POW:PROT:SOFT:STAT? Returns 1 (software protection is activated)
See Also	SOURce[1..n]:POWer:PROTection:RemovePassWorD SOURce[1..n]:POWer:PROTection:SetPassWorD SOURce[1..n]:POWer:PROTection:SOFTware:EXISt?

:SOURce[1..n]:POWer:STATe

Description	This command turns the optical source on or off. When source is on, the red LED (Active) on the front of the instrument lights up. *RST sets the optical source to OFF.
Syntax	:SOURce[1..n]:POWer:STATe<wsp> <PowerState>
Parameter(s)	*PowerState:* The program data syntax for <PowerState> is defined as a <Boolean Program Data> element. The <PowerState> special forms ON and OFF are accepted on input for increased readability. ON corresponds to 1 and OFF corresponds to 0. The <PowerState> parameter is the new power state of the source. 1 or ON, turns the optical source on. 0 or OFF, turns the optical source off.
Example(s)	SOUR:POW:STAT ON
Notes	When the user is under Food and Drug Administration (FDA) jurisdiction, a password must be entered before turning the laser on.
See Also	SOURce[1..n]:POWer:STATe?

:SOURce[1..n]:POWer:STATe?

Description	This query returns a value indicating the state of the optical source (on or off). *RST sets the optical source to OFF.
Syntax	:SOURce[1..n]:POWer:STATe?
Parameter(s)	None
Response Syntax	<PowerState>
Response(s)	*PowerState:* The response data syntax for <PowerState> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <PowerState> response is the state of the source power. 0- The optical source is off. 1- The optical source is on.
Example(s)	SOUR:POW:STAT OFF SOUR:POW:STAT?
See Also	SOURce[1..n]:POWer:STATe

:SOURce[1..n]:POWer:STEP?

Description	This query returns the minimum step that can be used when changing the power with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:POWer:STEP?
Parameter(s)	None
Response Syntax	<Power>
Response(s)	*Power:* The response data syntax for <Power> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <Power> response is a value reprensenting the minimum power step in watts.
Example(s)	SOUR:POW:LIM:STEP? Returns 1.000000E-005
Notes	An attempt to change the output power by a quantity less than the minumum step will be ignored.
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:POWer:LIMit:LOW? SOURce[1..n]:POWer:LIMit:HIGH? SOURce[1..n]:POWer:RESolution? UNIT[1..n]:POWer SOURce[1..n]:POWer[:LEVel][:IMMediate][:AMPLitude]

:SOURce[1..n]:PULM:INTernal:DEPTh

Description	This command is used to set the dither modulation signal depth. If the instrument is not in Dither modulation mode, this command will have no effect. At *RST, the dither depth is 0.005 amperes.
Syntax	:SOURce[1..n]:PULM:INTernal:DEPTh<wsp> <DepthModulation>
Parameter(s)	*DepthModulation:* The program data syntax for <DepthModulation> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element. The <DepthModulation> parameter represents the new dither modulation signal depth in amperes.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE NORMAL SOUR:PULM:INT:DEPT 0.00255
See Also	SOURce[1..n]:PULM:INTernal:DEPTh? SOURce[1..n]:PULM:LIMit:DEPTh:HIGH? SOURce[1..n]:PULM:LIMit:DEPTh:LOW? SOURce[1..n]:PULM:LIMit:DEPTh:STEP?

:SOURce[1..n]:PULM:INTernal:DEPTh?

Description	This query returns the dither modulation signal depth. If the instrument is not in Dither Modulation mode, the returned value is undefined. At *RST, the dither depth is 0.005 amperes.
Syntax	:SOURce[1..n]:PULM:INTernal:DEPTh?
Parameter(s)	None
Response Syntax	<DepthModulation>
Response(s)	*DepthModulation:* The response data syntax for <DepthModulation> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <DepthModulation> response is a value representing the current dither modulation signal depth in amperes.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE NORMAL SOUR:PULM:INT:DEPT 3.15E-3 SOUR:PULM:INT:DEPT? Returns 3.150000E-003
See Also	SOUR:PULM:INT:DEPT SOUR:PULM:LIM:DEPT:HIGH SOUR:PULM:LIM:DEPT:LOW? SOUR:PULM:LIM:DEPT:STEP?

:SOURce[1..n]:PULM:INTernal:SHAPe

Description	This command is used to set the shape of the internal dither modulation signal. If the instrument is not in Dither modulation mode, this command will have no effect. At *RST, the dither shape is square wave.
Syntax	:SOURce[1..n]:PULM:INTernal:SHAPe<wsp> SquareWave|TriangleWave
Parameter(s)	*DitherModulation:* 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: SquareWave|TriangleWave. This parameter is the desired shape of the internal dither modulation signal. TriangleWave selects a triangle wave shape. SquareWave selects a square wave shape.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE NORMAL SOUR:PULM:INT:SHAP SW
Notes	The instrument must be in Dither mode.
See Also	SOURce[1..n]:PULM:INTernal:SHAPe?

:SOURce[1..n]:PULM:INTernal:SHAPe?

Description	This query returns the shape of the internal dither modulation signal. If the instrument is not in Dither modulation mode, the returned value is undefined. At *RST, the dither shape is square wave.
Syntax	:SOURce[1..n]:PULM:INTernal:SHAPe?
Parameter(s)	None
Response Syntax	<Shape>
Response(s)	*Shape:* The response data syntax for <Shape> is defined as a <CHARACTER RESPONSE DATA> element. The <Shape> response is the current shape of the internal dither modulation signal. TRIANGLEWAVE, indicates a triangle wave shape. SQUAREWAVE, indicates a square wave shape.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE NORMAL SOUR:PULM:INT:SHAP SW SOUR:PULM:INT:SHAP? Returns SQUAREWAVE
See Also	SOURce[1..n]:PULM:INTernal:SHAPe

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]

Description

This command is used to set the frequency of the internal Dither or On/Off modulation signal. If the instrument is not in Dither or On/Off modulation mode, this command will have no effect.

To set the frequency of the dither mode, the FREQuency header suffix [1|2] must be 1.
To set the frequency of the On/Off mode, the FREQuency header suffix [1|2] must be 2.

At *RST, the dither frequency is 1000 Hz and the On/Off modulation is 10 Hz.

Syntax

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2] <wsp><Frequency>|MAXimum|MINimum|DEFault

Parameter(s)

Frequency:

The program data syntax for <Frequency> is defined as a <numeric_value> element. The <Frequency> special forms MINimum, MAXimum and DEFault are accepted on input.

MINimum allows to set the instrument to the smallest supported value.
MAXimum allows to set the instrument to the greatest supported value.
DEFault allows the instrument to select a value for the <Frequency> parameter.

The <Frequency> parameter represents the new frequency of the internal dither or On/Off modulation signal in hertz.

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]

Example(s)

```
/* Set the frequency of the dither mode */
SOUR:PULM:STAT ON
SOUR:WAV:MODE NORMAL
SOUR:PULM:INT:FREQ1 1000

/* Set the frequency of the On/Off mode */
SOUR:PULM:STAT ON
SOUR:WAV:MODE HRES
SOUR:PULM:INT:FREQ2 10kHz
```

Notes

The instrument must be in Dither or On/Off modulation mode.

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?

SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?

Description

This query returns the frequency of the internal dither or On/Off modulation signal. If the instrument is not in Dither or On/Off modulation mode, the returned value is undefined.

To get the frequency of the dither mode, the FREQuency header suffix [1|2] must be 1.
To get the frequency of the On/Off mode, the FREQuency header suffix [1|2] must be 2.

At *RST, the dither frequency is 1000 Hz and the On/Off modulation is 10 Hz.

Syntax

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? [<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 greatest supported value.
DEFault is used to retrieve the instrument's default value.

Response Syntax

<Frequency>

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?

Response(s)

Frequency:

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

The <Frequency> response is the current internal dither frequency or On/Off modulation frequency in hertz.

Example(s)

```
/* Get the frequency of the dither mode */
SOUR:PULM:STAT ON
SOUR:WAV:MODE NORMAL
SOUR:PULM:INT:FREQ1?

/* Get the frequency of the On/Off mode */
SOUR:PULM:STAT ON
SOUR:WAV:MODE HRES
SOUR:PULM:INT:FREQ2?
```

:SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?

Notes

The instrument must be in Dither or On/Off modulation mode.

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?

SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:DEPTh:LOW?

Description	This query returns the minimum depth at which the dither modulation signal can be set with the SOURce[1..n]:PULM:INTernal:DEPTh command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:DEPTh:LOW?
Parameter(s)	None
Response Syntax	<LowLimit>
Response(s)	*LowLimit:* The response data syntax for <LowLimit> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LowLimit> response is the minimum depth at which the dither modulation signal can be set in amperes.
Example(s)	SOUR:PULM:LIM:DEPT:LOW? Returns 1.000000E-003
Notes	To set the dither modulation signal depth, use the command SOURce[1..n]:PULM:INTernal:DEPTh.
See Also	SOURce[1..n]:PULM:INTernal:DEPTh SOURce[1..n]:PULM:INTernal:DEPTh? SOURce[1..n]:PULM:LIMit:DEPTh:HIGH? SOURce[1..n]:PULM:LIMit:DEPTh:STEP?

:SOURce[1..n]:PULM:LIMit:DEPTh:HIGH?

Description	This query returns the maximum depth at which the dither modulation signal can be set with the SOURce[1..n]:PULM:INTernal:DEPTh command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:DEPTh:HIGH?
Parameter(s)	None
Response Syntax	<HighLimit>
Response(s)	*HighLimit:* The response data syntax for <HighLimit> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <HighLimit> response is the maximum depth at which the dither modulation signal can be set in amperes.
Example(s)	SOUR:PULM:LIM:DEPT:HIGH? Returns 5.000000E-003
Notes	To set the dither modulation signal depth, use the command SOURce[1..n]:PULM:INTernal:DEPTh.
See Also	SOURce[1..n]:PULM:INTernal:DEPTh SOURce[1..n]:PULM:INTernal:DEPTh? SOURce[1..n]:PULM:LIMit:DEPTh:LOW? SOURce[1..n]:PULM:LIMit:DEPTh:STEP?

:SOURce[1..n]:PULM:LIMit:DEPTh:STEP?

Description	This query returns the minimum step available when changing the dither modulation signal depth with the SOURce[1..n]:PULM:INTernal:DEPTh command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:DEPTh:STEP?
Parameter(s)	None
Response Syntax	<StepLimit>
Response(s)	*StepLimit:* The response data syntax for <StepLimit> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <StepLimit> response is the minimum step available for the dither modulation signal depth in amperes.
Example(s)	SOUR:PULM:LIM:DEPT:STEP? Returns 1.000000E-004
Notes	The step is an indication of the instrument sensitivity. An attempt to change the dither modulation signal depth by a quantity less than the minimum step will be ignored.
See Also	SOURce[1..n]:PULM:INTernal:DEPTh SOURce[1..n]:PULM:INTernal:DEPTh? SOURce[1..n]:PULM:LIMit:DEPTh:HIGH? SOURce[1..n]:PULM:LIMit:DEPTh:LOW?

:SOURce[1..n]:PULM:LIMit:DEPTh:DELTa?

Description	This query returns the minimum step available when changing the dither modulation signal depth with the SOURce[1..n]:PULM:INTernal:DEPTh command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:DEPTh:DELTa?
Parameter(s)	None
Response Syntax	<DepthPrecision>
Response(s)	*DepthPrecision:* The response data syntax for <DepthPrecision> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <DepthPrecision> response is the minimum step available for the dither modulation signal depth in amperes.
Example(s)	SOUR:PULM:LIM:DEPT:DELT? Returns 1.000000E-004
Notes	The step is an indication of the instrument sensitivity. An attempt to change the dither modulation signal depth by a quantity less than the minimum step will be ignored.
See Also	SOURce[1..n]:PULM:INTernal:DEPTh SOURce[1..n]:PULM:INTernal:DEPTh? SOURce[1..n]:PULM:LIMit:DEPTh:HIGH? SOURce[1..n]:PULM:LIMit:DEPTh:LOW? SOURce[1..n]:PULM:LIMit:DEPTh:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?

Description

The available modulation frequencies may be divided into more than one range. Each range has a minimum frequency, a maximum and a step. This query returns the minimum frequency at which the internal dither or On/Off modulation signal can be set for the specified range with the SOURce[1..n]:PULM:INTernal:FREQuency[1|2] command.

*RST has no effect on this command.

Syntax

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?<wsp><RangeIndex>

Parameter(s)

RangeIndex:

The program data syntax for <RangeIndex> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element.

The <RangeIndex> parameter represents the index of the range. The range is from 0 to the value returned by the SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? query.

Response Syntax

<RangeLow>

:SOURce[1..n]:PULM:LIMit:FREQuency [:RANGe]:LOW?

Response(s)	*RangeLow:* The response data syntax for <RangeLow> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <RangeLow> response is the minimum frequency at which the internal dither or On/Off modulation signal can be set for the specified range in hertz.
Example(s)	SOUR:PULM:LIM:FREQ:LOW? 0 returns 1.000000E+001
Notes	In Dither modulation mode, make sure that this value is not lower than the value returned by SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?, which is the minimum dither modulation frequency.

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?

In On/Off modulation, make sure that this value is not lower than the value returned by SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?.

To set the frequency of the internal dither or On/Off modulation signal, use the SOURce[1..n]:PULM:INTernal:FREQuency[1|2] command.

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?
SOURce[1..n]:PULM:INTernal:FREQuency[1|2]
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?

SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?
SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?

Description	The available modulation frequencies may be divided into more than one range. Each range has a minimum frequency, a maximum and a step. This query returns the maximum frequency at which the internal dither or On/Off modulation signal can be set for the specified range with the SOURce[1..n]:PULM:INTernal:FREQuency[1|2] command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?<wsp><RangeIndex>
Parameter(s)	*RangeIndex:* The program data syntax for <RangeIndex> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element. The <Range index> parameter represents the index of the range. The range is from 0 to the value returned by the SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? query.
Response Syntax	<RangeHight>

:SOURce[1..n]:PULM:LIMit:FREQuency [:RANGe]:HIGH?

Response(s)	*RangeHight:* The response data syntax for <RangeHight> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <RangeHight> response is the maximum frequency at which the internal dither or On/Off modulation signal can be set for the specified range in hertz.
Example(s)	SOUR:PULM:LIM:FREQ:HIGH? 0 returns 3.000000E+002
Notes	In Dither modulation mode, make sure that this value does not exceed the value returned by SOURce[1..n]:PULM:LIMit:FREQuence:DMAX, which is the maximum dither modulation frequency.

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?

In On/Off modulation, make sure that this value does not exceed the value returned by SOURce[1..n]:PULM:LIMit:FREQuency:OMAX.

To set the the frequency of the internal dither or On/Off modulation signal, use the command SOURce[1..n]:PULM:INTernal:FREQuency[1|2].

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?
SOURce[1..n]:PULM:INTernal:FREQuency[1|2]
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?

SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?
SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

Description	The available modulation frequencies may be divided into more than one range. Each range has a minimum frequency, a maximum and a step. This query returns the minimum step available for the specified range when changing the frequency with the SOURce[1..n]:PULM:INTernal:FREQuency[1|2] command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?<wsp><RangeIndex>
Parameter(s)	*RangeIndex:* The program data syntax for <RangeIndex> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element. The <Range index> parameter represents the index of the range. The range is from 0 to the value returned by the SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? query.
Response Syntax	<RangeStep>

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

Response(s)

RangeStep:

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

The <RangeStep> response is the minimum step available for the specified range of frequency in hertz.

Example(s)

SOUR:PULM:LIM:FREQ:STEP? 2

Notes

An attempt to change the frequency by less than the minimum step will be ignored.

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?
SOURce[1..n]:PULM:INTernal:FREQuency[1|2]
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?
SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:RESolution?

Description	The available modulation frequencies may be divided into more than one range. Each range has a minimum frequency, a maximum and a step. This query returns the minimum step available for the specified range when changing the frequency with the SOURce[1..n]:PULM:INTernal:FREQuency[1|2] command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:RESolution?<wsp><RangeIndex>
Parameter(s)	*RangeIndex:* The program data syntax for <RangeIndex> is defined as a <DECIMAL NUMERIC PROGRAM DATA> element. The <RangeIndex> parameter represents the index of the range. The range is from 0 to the value returned by the SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? query.
Response Syntax	<FrequencyResolution>

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:RESolution?

Response(s)

FrequencyResolution:

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

The <FrequencyResolution> response is the minimum step available for the specified range of frequency in hertz.

Example(s)

SOUR:PULM:LIM:FREQ:RES? 1

Notes

An attempt to change the frequency by less than the minimum resolution will be ignored.

See Also

SOURce[1..n]:PULM:INTernal:FREQuency[1|2]?
SOURce[1..n]:PULM:INTernal:FREQuency[1|2]
SOURce[1..n]:PULM:STATe
SOURce[1..n]:PULM:STATe?
SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?
SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW?
SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?

Description	This query returns the number of modulation frequency ranges. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?
Parameter(s)	None
Response Syntax	<RangeCount>
Response(s)	*RangeCount:* The response data syntax for <RangeCount> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <RangeCount> response is the number of modulation frequency ranges. The smallest range is 0.

:SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt?

Example(s)	SOUR:PULM:LIM:FREQ:RANG:COUN? Returns 3
See Also	SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? SOURce[1..n]:PULM:INTernal:FREQuency[1|2] SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:PULM:LIMit:FREQuency:DMAX? SOURce[1..n]:PULM:LIMit:FREQuency:DMIN? SOURce[1..n]:PULM:LIMit:FREQuency:OMAX? SOURce[1..n]:PULM:LIMit:FREQuency:OMIN? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?

Description	This query returns the lowest possible modulation frequency in Dither mode. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency:DMIN?
Parameter(s)	None
Response Syntax	<LowLimit>
Response(s)	*LowLimit:* The response data syntax for <LowLimit> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LowLimit> response is the lowest possible modulation frequency in Dither mode in hertz.
Example(s)	SOUR:PULM:LIM:FREQ:DMIN? Returns 1.000000E+003
See Also	SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? SOURce[1..n]:PULM:INTernal:FREQuency[1|2] SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:PULM:LIMit:FREQuency:DMAX? SOURce[1..n]:PULM:LIMit:FREQuency:OMAX? SOURce[1..n]:PULM:LIMit:FREQuency:OMIN? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:LOW? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?

Description	This query returns the highest possible modulation frequency in Dither mode. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency:DMAX?
Parameter(s)	None
Response Syntax	<HighLimit>
Response(s)	*HighLimit:* The response data syntax for <HighLimit> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <RangeCount> response is the highest modulation frequency in Dither mode in hertz.
Example(s)	SOUR:PULM:LIM:FREQ:DMAX? Returns 3.000000E+005
See Also	SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? SOURce[1..n]:PULM:INTernal:FREQuency[1|2] SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:PULM:LIMit:FREQuency:DMIN? SOURce[1..n]:PULM:LIMit:FREQuency:OMAX? SOURce[1..n]:PULM:LIMit:FREQuency:OMIN? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?

Description	This query returns the lowest possble modulation frequency in On/Off mode. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency:OMIN?
Parameter(s)	None
Response Syntax	<LimitLow>
Response(s)	*LimitLow:* The response data syntax for <LimitLow> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitLow> response is the lowest possible modulation frequency in On/Off mode in hertz.
Example(s)	SOUR:PULM:LIM:FREQ:OMIN? Returns 1.000000E+001
See Also	SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? SOURce[1..n]:PULM:INTernal:FREQuency[1|2] SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:PULM:LIMit:FREQuency:DMAX? SOURce[1..n]:PULM:LIMit:FREQuency:DMIN? SOURce[1..n]:PULM:LIMit:FREQuency:OMAX? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?

Description	This query returns the highest possible modulation frequency in On/Off mode. *RST has no effect on this command.
Syntax	:SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?
Parameter(s)	None
Response Syntax	<LimitMax>
Response(s)	*LimitMax:* The response data syntax for <LimitMax> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitMax> response is the highest possible modulation frequency in On/Off mode in hertz.

:SOURce[1..n]:PULM:LIMit:FREQuency:OMAX?

Example(s)	SOUR:PULM:LIM:FREQ:OMAX? Returns 3.000000E+005
See Also	SOURce[1..n]:PULM:INTernal:FREQuency[1|2]? SOURce[1..n]:PULM:INTernal:FREQuency[1|2] SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:PULM:LIMit:FREQuency:DMAX? SOURce[1..n]:PULM:LIMit:FREQuency:DMIN? SOURce[1..n]:PULM:LIMit:FREQuency:OMIN? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:COUNt? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:HIGH? SOURce[1..n]:PULM:LIMit:FREQuency[:RANGe]:STEP?

:SOURce[1..n]:PULM:SOURce

Description	This command is used to set the source of the modulation signal (Internal or External). If the instrument is not in On/Off modulation mode, this command will have no effect. At *RST, the synchronization mode is internal.
Syntax	:SOURce[1..n]:PULM:SOURce<wsp>INTernal|EXTernal
Parameter(s)	*Modulation:* 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: INTernal|EXTernal. This parameter represents the new source of the modulation signal. EXTernal, for the external modulation. INTernal, for the internal modulation.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE HRES SOUR:PULM:SOUR EXT
See Also	SOURce[1..n]:PULM:SOURce? SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:WAVelength:MODE

:SOURce[1..n]:PULM:SOURce?

Description	This query returns the current source of the modulation signal (Internal or External). If the instrument is not in Dither or On/Off modulation mode, the returned value is undefined. If the instrument is in Dither modulation mode, the returned value will always be INTernal. At *RST, the synchronization mode is internal.
Syntax	:SOURce[1..n]:PULM:SOURce?
Parameter(s)	None
Response Syntax	<Source>
Response(s)	*Source:* The response data syntax for <Source> is defined as a <CHARACTER RESPONSE DATA> element. The <LimitMax> response is the current source of the modulation signal (Internal or External). EXTERNAL- Source set to External modulation. INTERNAL- Source set to Internal modulation.
Example(s)	SOUR:PULM:STAT ON SOUR:WAV:MODE HRES SOUR:PULM:SOUR EXT SOUR:PULM:SOUR? Returns EXTERNAL
See Also	SOURce[1..n]:PULM:SOURce SOURce[1..n]:PULM:STATe SOURce[1..n]:PULM:STATe? SOURce[1..n]:WAVelength:MODE

:SOURce[1..n]:PULM:STATe

Description	This command is used to set the modulation to on or off. At *RST, modulation is off.
Syntax	:SOURce[1..n]:PULM:STATe<wsp><ModulationState>
Parameter(s)	*ModulationState:* The program data syntax for <ModulationState> is defined as a <Boolean Program Data> element. The <ModulationState> special forms ON and OFF are accepted on input for increased readability. ON corresponds to 1 and OFF corresponds to 0. The <ModulationState> parameter is the desired modulation state. 0 or OFF, deactivates the modulation. 1 or ON, activates the modulation.
Example(s)	SOUR:PULM:STAT ON
Notes	This command is meant to be used in conjunction with SOURce[1..n]:WAVelength:MODE. When the modulation is on and the resolution mode is normal, then the dither modulation is selected. If the resolution mode is high resolution, then On/Off modulation is selected.
See Also	SOURce[1..n]:PULM:SOURce? SOURce[1..n]:PULM:SOURce SOURce[1..n]:PULM:STATe? SOURce[1..n]:WAVelength:MODE

:SOURce[1..n]:PULM:STATe?

Description	This command returns the state of the modulation. At *RST, modulation is off.
Syntax	:SOURce[1..n]:PULM:STATe?
Parameter(s)	None
Response Syntax	<ModulationState>
Response(s)	*ModulationState:* The response data syntax for <ModulationState> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <LimitMax> response is the current modulation state. 0- Modulation is inactive. 1- Modulation is active.
Example(s)	SOUR:PULM:STAT ON SOUR:PULM:STAT? Returns 1
See Also	SOURce[1..n]:PULM:SOURce? SOURce[1..n]:PULM:SOURce SOURce[1..n]:PULM:STATe SOURce[1..n]:WAVelength:MODE

:SOURce[1..n]:SETPoint

Description

This command sets the instrument to a predefined setpoint. No command is provided to create setpoints. Setpoints have to be created from within the IQS application.

At *RST, the resolution mode, the wavelength, the power, the delta temperature and the delta current are set to the default instrument values.

Syntax

:SOURce[1..n]:SETPoint<wsp> <SetpointName>,APC|ACC

Parameter(s)

➤ *SetpointName:*

The program data syntax for <SetpointName> is defined as a <STRING PROGRAM DATA> element.

The <SetpointName> parameter is the name of the setpoint. This name is not case-sensitive.

➤ *LaserMode:*

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

This parameter represents the mode of the setpoints.

APC sets Normal mode.
ACC sets High Wavelength Stability mode (HWS).

Example(s)

SOUR:SETP "CH38C", APC

:SOURce[1..n]:SETPoint

Notes

No modulation is associated with a setpoint. Therefore, a setpoint created in Normal or Normal with Dither modulation mode will be considered Normal (APC) mode. A setpoint created in either HWS or On/Off modulation mode will be in HWS (ACC) mode. In turn, a setpoint in Normal mode can be used in Normal or Normal with Dither mode. Also, a setpoint in HWS mode can be used as well in On/Off modulation mode. The mode must be supplied because setpoints in Normal and HWS modes may have the same name. Therefore, the application will search for the specified setpoint with the specified mode. If such a setpoint exists, the application will adjust the wavelength, power, current step, and temperature step according to the setpoint. If the setpoint does not exist, there will be no change.

Modes: If the instrument is in Normal or Normal with Dither modes and the setpoint is in Normal mode, there will be no change to the mode of the instrument. If the setpoint is in HWS mode, the application will go to HWS mode. If the instrument is in HWS or On/Off mode and the setpoint is in HWS mode, there will be no change in mode. If the setpoint is in Normal mode, the instrument will go to Normal mode.

See Also

SOURce[1..n]:CURRent:ACCBase
SOURce[1..n]:CURRent:ACCBase?

:SOURce[1..n]:STABle?

Description	This query indicates whether the source is stable or stabilizing. At *RST, the resolution mode, the wavelength, the power, the delta temperature and the delta current are set to the default instrument values.
Syntax	:SOURce[1..n]:STABle?
Parameter(s)	None
Response Syntax	<Stable>
Response(s)	*Stable:* The response data syntax for <Stable> is defined as a <NR1 NUMERIC RESPONSE DATA> element. The <LimitMax> response is the stabilization state. 0- The instrument is stabilizing. 1- The instrument has stabilized.
Example(s)	SOUR:STAB?
Notes	After the mode has been changed, the instrument needs some time to stabilize. It is very important not to change the mode while the instrument is stabilizing. This would cause the instrument to return to its central wavelength in Normal mode. Before changing the mode, you should poll SOUR:STAB? until it returns 1, indicating that the instrument has stabilized.
See Also	SOURce[1..n]:POWer:STATe?

:SOURce[1..n]:TEMPerature:PROTection:LOW[:LEVel]?

Description	This query returns the minimum value at which the delta temperature can be set with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]?
Parameter(s)	None
Response Syntax	<LowTemp>
Response(s)	*LowTemp:* The response data syntax for <LowTemp> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LowTemp> response is the minimum value at which the delta temperature can be set in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:LOW? Returns -1.000000E+000
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection: RESolution? SOURce[1..n]:TEMPerature:PROTection:DELTa? SOURce[1..n]:TEMPerature:PROTection: CHannel?

:SOURce[1..n]:TEMPerature:PROTection:HIGH[:LEVel]?

Description	This query returns the maximum value at which the delta temperature can be set with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]?
Parameter(s)	None
Response Syntax	<HighTemp>
Response(s)	*HighTemp:* The response data syntax for <HighTemp> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <HighTemp> response is the maximum value at which the delta temperature can be set in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:HIGH? Returns 1.000000E+000
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection: RESolution? SOURce[1..n]:TEMPerature:PROTection:DELTa? SOURce[1..n]:TEMPerature:PROTection: CHannel?

:SOURce[1..n]:TEMPerature:PROTection:STEP?

Description	This query returns the minimum step available when changing the temperature with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:STEP?
Parameter(s)	None
Response Syntax	<TempStep>
Response(s)	*TempStep:* The response data syntax for <TempStep> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <TempStep> response is the minimum step available for the temperature in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:STEP? Returns 1.000000E-002

:SOURce[1..n]:TEMPerature:PROTection:STEP?

Notes	An attempt to change the temperature by a quantity less than the minimum step will be ignored.
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:RESolution? SOURce[1..n]:TEMPerature:PROTection:DELTa? SOURce[1..n]:TEMPerature:PROTection:CHannel?

:SOURce[1..n]:TEMPerature:PROTection:RESolution?

Description	This query returns the minimum step available when changing the temperature with the SOURce[1..n]:ACCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:RESolution?
Parameter(s)	None
Response Syntax	<TempResolution>
Response(s)	*TempResolution:* The response data syntax for <TempResolution> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <TempResolution> response is the minimum resolution available for the temperature in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:RES? Returns 1.000000E-002

:SOURce[1..n]:TEMPerature:PROTection:RESolution?

Notes	An attempt to change the temperature by a value lower than the minimum resolution will be ignored.
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection:DELTa? SOURce[1..n]:TEMPerature:PROTection:CHannel?

:SOURce[1..n]:TEMPerature:PROTection:DELTa?

Description	This query returns the laser delta temperature. At *RST, the delta temperature is set to the instrument's default value.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:DELTa?
Parameter(s)	None
Response Syntax	<DeltaTemp>
Response(s)	*DeltaTemp:* The response data syntax for <DeltaTemp> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <DeltaTemp> response is the laser delta temperature in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:DELT? Returns 0.000000E+000
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection: RESolution? SOURce[1..n]:TEMPerature:PROTection: CHannel?

:SOURce[1..n]:TEMPerature:PROTection:CHannel?

Description	This query returns the channel (laser) delta temperature. At *RST, the delta temperature is set to the instrument's default value.
Syntax	:SOURce[1..n]:TEMPerature:PROTection:CHannel?
Parameter(s)	None
Response Syntax	<ChannelTemp>
Response(s)	*ChannelTemp:* The response data syntax for <ChannelTemp> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <ChannelTemp> response is the current channel delta temperature in °C. The returned value will be negative.
Example(s)	SOUR:TEMP:PROT:CH? Returns 0.000000E+000
See Also	SOURce[1..n]:ACCOutput SOURce[1..n]:TEMPerature:PROTection:LOW [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:HIGH [:LEVel]? SOURce[1..n]:TEMPerature:PROTection:STEP? SOURce[1..n]:TEMPerature:PROTection:RESolution? SOURce[1..n]:TEMPerature:PROTection:DELTa?

:SOURce[1..n]:WAVelength[:CW]

Description

This command selects a new source wavelength.

At *RST, the instrument is set to the central spectrum value.

Syntax

:SOURce[1..n]:WAVelength[:CW]<wsp><Wavelength[<wsp>M|HZ]>|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> elements are: M|HZ. The <Wavelength> special forms MINimum, MAXimum and DEFault are accepted on input.

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

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

This parameter represents the new wavelength in meters or in hertz. If you do not specify a unit, the device will use the current spectrum unit. To select the current spectrum unit, use the UNIT[1..n]:SPECtrum command.

:SOURce[1..n]:WAVelength[:CW]	
Example(s)	SOUR:PULM:STAT OFF SOUR:WAV:MODE NORMAL SOUR:WAV 1547.52nm
Notes	The instrument must be in Normal mode.
See Also	SOURce[1..n]:WAVelength[:CW]? SOURce[1..n]:WAVelength[:CW]RESolution?

:SOURce[1..n]:WAVelength[:CW]?

Description	This query returns the current source wavelength. At *RST, the instrument is set to the central spectrum value.
Syntax	:SOURce[1..n]:WAVelength[:CW]?[<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 greatest supported value. DEFault is used to retrieve the instrument's default value.
Response Syntax	<Wavelength>

:SOURce[1..n]:WAVelength[:CW]?

Response(s)	*Wavelength:* The response data syntax for <Wavelength> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <WavelengthResolution> response is the wavelength in the currently selected spectrum unit. To select the spectrum unit, use the UNIT[1..n]:SPECtrum command.
Example(s)	SOUR:PULM:STAT OFF SOUR:WAV:MODE NORMAL SOUR:WAV 1562.52nm SOUR:WAV?
See Also	SOURce[1..n]:WAVelength[:CW] SOURce[1..n]:WAVelength[:CW]RESolution?

:SOURce[1..n]:WAVelength[:CW]:RESolution?

Description	This query returns the minimum tuning resolution for the wavelength. *RST has no effect on this command.
Syntax	:SOURce[1..n]:WAVelength[:CW]:RESolution?
Parameter(s)	None
Response Syntax	<WavelengthResolution>
Response(s)	*WavelengthResolution:* The response data syntax for <WavelengthResolution> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <WavelengthResolution> response is the wavelength resolution in meters.
Example(s)	SOUR:WAVE:RES? Returns 1.000000E-011
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:WAVWAVelength:LIMit:HIGH? SOURce[1..n]:WAVWAVelength:LIMit:LOW? UNIT[1..n]:SPECtrum

:SOURce[1..n]:WAVelength:LIMit:LOW?

Description	Depending on the current spectral unit, this query returns the minimum wavelength or the maximum frequency at which the laser can be set with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:WAVelength:LIMit:LOW?
Parameter(s)	None
Response Syntax	<LimitLow>
Response(s)	*LimitLow:* The response data syntax for <LimitLow> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitLow> response is the lowest selectable wavelength in meters or the highest selectable frequency in Hz. To select the current spectrum unit, use the UNIT[1..n]:SPECtrum command.
Example(s)	SOUR:WAV:LIM:LOW?
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:WAVelength:LIMit:HIGH? SOURce[1..n]:WAVelength:LIMit:STEP? UNIT[1..n]:SPECtrum

:SOURce[1..n]:WAVelength:LIMit:HIGH?

Description	Depending on the current spectral units this query returns the maximum wavelength or the minimum frequency at which the laser can be set with the SOURce[1..n]:APCOutput command. *RST has no effect on this command.
Syntax	:SOURce[1..n]:WAVelength:LIMit:HIGH?
Parameter(s)	None
Response Syntax	<LimitHight>
Response(s)	*LimitHight:* The response data syntax for <LimitHight> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitHight> response is the highest selectable wavelength in meters or the lowest selectable frequency in Hz. To select the current spectrum unit, use the UNIT[1..n]:SPECtrum command.
Example(s)	SOUR:WAV:LIM:HIGH?
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:WAVelength:LIMit:LOW? SOURce[1..n]:WAVelength:LIMit:STEP? UNIT[1..n]:SPECtrum

:SOURce[1..n]:WAVelength:LIMit:STEP?

Description	This query returns the minimum tuning resolution for the wavelength. *RST has no effect on this command.
Syntax	:SOURce[1..n]:WAVelength:LIMit:STEP?
Parameter(s)	None
Response Syntax	<LimitStep>
Response(s)	*LimitStep:* The response data syntax for <LimitStep> is defined as a <NR3 NUMERIC RESPONSE DATA> element. The <LimitStep> response is the minimum step available for the wavelength in meters.
Example(s)	SOUR:WAV:LIM:STEP?
See Also	SOURce[1..n]:APCOutput SOURce[1..n]:WAVelength:LIMit:HIGH? SOURce[1..n]:WAVelength:LIMit:LOW? UNIT[1..n]:SPECtrum

:SOURce[1..n]:WAVelength:MODE

Description	This command is used to toggle between the Normal and High Wavelength Stability (High Resolution) modes. At *RST, the resolution mode is normal.
Syntax	:SOURce[1..n]:WAVelength:MODE<wsp> NORMal|HRESolution
Parameter(s)	*SourceMode:* 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: NORMal|HRESolution. This parameter represents the desired wavelength operation mode. NORMal sets the instrument to Normal mode. HRESolution sets the instrument to High Wavelength Stability mode.
Example(s)	SOUR:WAV:MODE HRES
Notes	This command meant to be used in conjunction with SOURce[1..n]:WAVelength:MODE. When the modulation is on and the resolution mode is normal, then the dither modulation is selected. If the resolution mode is high resolution, then the On/Off modulation is selected.
See Also	SOURce[1..n]:WAVelength:MODE? SOURce[1..n]:PULM:STATe?

:SOURce[1..n]:WAVelength:MODE?

Description	This query returns the current Wavelength source mode. At *RST, the resolution mode is normal.
Syntax	:SOURce[1..n]:WAVelength:MODE?
Parameter(s)	None
Response Syntax	<SourceMode>
Response(s)	*SourceMode:* The response data syntax for <SourceMode> is defined as a <CHARACTER RESPONSE DATA> element. The <SourceMode> response is the current wavelength operation mode. NORMAL- The instrument is in the normal wavelength mode. HRESOLUTION- The instrument is in the High wavelength stability mode.
Example(s)	SOUR:WAV:MODE HRES SOUR:WAV:MODE? Returns HRESOUTION
See Also	SOURce[1..n]:WAVelength:MODE SOURce[1..n]:PULM:STATe?

:STATus?

Description	This query returns a value indicating the status of the module (READY, BUSY, etc.).
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 module state, where: UNINITIALIZED, means the module is not initialized. INITINPROGRESS, means the module initialization is in progress, READY, means the module is ready, BUSY, means the module is busy, DISCONNECTED, means the module is disconnected, DEFECTIVE, means the module is defective, and UNCONFIGURED, means the module is not configured.
Example(s)	STAT? Returns READY (Module is ready.)

:UNIT[1..n]:POWer

Description	This command is used to select the instrument's current power unit. At *RST, the power unit is set to watts.
Syntax	:UNIT[1..n]:POWer<wsp>DBM|W
Parameter(s)	*Unit:* The program data syntax for the first parameter is defined as a <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> elements are: DBM|W. This parameter represents the desired power unit.
Example(s)	UNIT:POW DBM
See Also	UNIT[1..n]:POWer?

:UNIT[1..n]:POWer?

Description	This query returns the instrument's current power unit. At *RST, the power unit is set to watts.
Syntax	:UNIT[1..n]:POWer?
Parameter(s)	None
Response Syntax	<PowerUnit>
Response(s)	*PowerUnit:* The response data syntax for <PowerUnit> is defined as a <SUFFIX RESPONSE DATA> element. The <PowerUnit> response is the currently selected power unit.
Example(s)	UNIT:POW DBM UNIT:POW? Returns DBM
See Also	UNIT[1..n]:POWer

:UNIT[1..n]:SPECtrum

Description	This command allows you to set the spectrum unit. At *RST, the spectrum unit is set to meters.
Syntax	:UNIT[1..n]:SPECtrum<wsp>M|HZ
Parameter(s)	*Unit:* The program data syntax for the first parameter is defined as a <SUFFIX PROGRAM DATA> element. The allowed <SUFFIX PROGRAM DATA> elements are: M|HZ. This parameter represents the desired spectral unit.
Example(s)	UNIT:SPEC M
See Also	UNIT[1..n]:SPECtrum?

:UNIT[1..n]:SPECtrum?

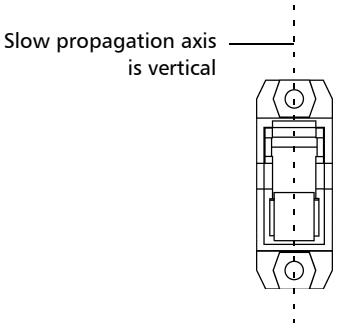
Description	This query returns the current spectrum unit. At *RST, the spectrum unit is set to meters.
Syntax	:UNIT[1..n]:SPECtrum?
Parameter(s)	None
Response Syntax	<SpectralUnit>
Response(s)	*SpectralUnit:* The response data syntax for <SpectralUnit> is defined as a <SUFFIX RESPONSE DATA> element. The <SpectralUnit> response is the current selected spectral unit.
Example(s)	UNIT:SPEC M UNIT:SPEC? returns M (meter)
See Also	UNIT[1..n]:SPECtrum

C Polarization-Maintaining Laser Connectorization

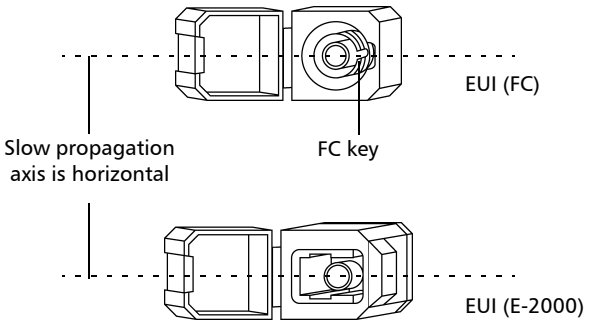
The DFB-LD integrated in the IQS-2400 WDM Laser Source comes with a polarization-maintaining pigtail. The slow propagation axis of this pigtail has been aligned in order to be parallel to the linear state of polarization (SOP) of the laser. Once connectorized and mounted on the IQS-2400 WDM Laser Source front panel, the slow propagation axis will be aligned with the FC key of the EUI (FC) connector on the inside.

Depending on the type of connector you have on the IQS-2400 WDM Laser Source front panel, the slow propagation axis will either be horizontal or vertical.

➤ E-2000/APC Connector Option



➤ EUI Connector Option



D Wavelength and Power Control, General Principles

Wavelength Control

The source wavelength is influenced mostly by laser temperature and, to a lesser extent, by laser current intensity. In the IQS-2400 WDM Laser Source, you can control and stabilize wavelength by modifying the laser temperature. The laser temperature can be set to any value between (T_{set}–1 °C) and (T_{set}+1 °C). T_{set} is the temperature that the laser must attain to generate the central wavelength. Wavelength variation corresponds to an average of 0.1 nm/°C for a total wavelength tuning range superior or equal to 2.0 nm.

Note: *The displayed wavelength does not take into account the temperature correction (0 °C correction).*

At module startup, the laser is warmed up to 24 °C in order to speed up stabilization when it is activated. When the laser is deactivated (but module is still on), the laser temperature is maintained.

Temperature stability and control are essential for wavelength adjustment. Therefore, the source module includes a thermistor that is placed inside the laser package and is used to measure internal laser temperature. The source module also drives the thermoelectric cooler (TEC) used to reach required temperatures and regulate specific values.

Power Control

To ensure more power stability, the source module is mounted with a back-facet photodiode measuring a monitor current coming from the rear facet of the laser. Since the output power is directly proportional to the monitor current, power is calculated using the monitor current in relation to the coupling efficiency.

You can control the source power through a change in laser drive current. A 10.0 dB attenuation range is possible. Wavelength precision will be maintained throughout the attenuation range.

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