QUANTIFI PHOTONICS™

LASER

1000 SERIES
TUNABLE
LASER SOURCE

USER MANUAL

quantifiphotonics.com

Trademarks

Units of Measurement

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

Version: 4.02

Contents

1 Conventions

Before using the instrument described in this manual, take note of the following conventions:

WARNING

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

CAUTION

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

CAUTION

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

IMPORTANT

Refers to information about this product that you should not overlook.

NOTE

Indicates some information that requires your attention or some extra information for the current topic.

2 Safety information

Before using the Laser 1000 Series product, ensure that the following safety information has been read and understood.

2.1 Optical laser radiation precautions

WARNING

Do not install or terminate fibers while the light source is active. Care must be taken to ensure that the instrument has been **turned OFF before inspecting the end face(s) of the instrument, or any optical patch cords** connected to this instrument. Never look directly into a live fiber; ensure that your eyes are protected at all times.

CAUTION

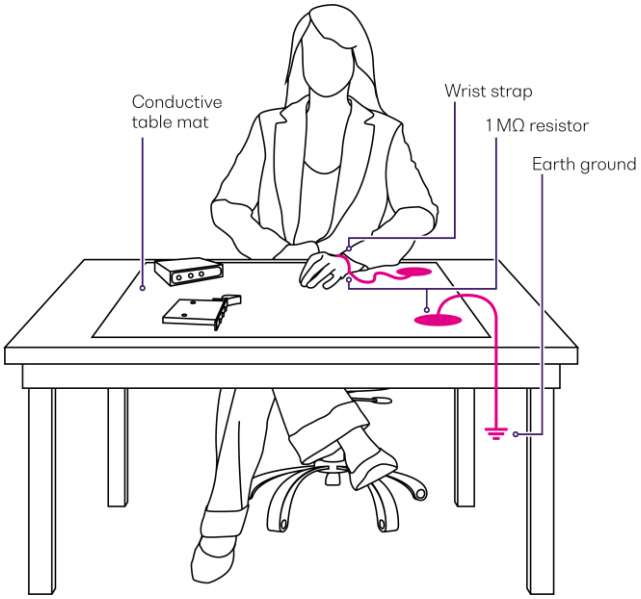
The use of controls, adjustments, and procedures other than those specified herein may result in exposure to hazardous situations involving optical radiation.

2.2 Electrostatic discharge precautions

CAUTION

The Laser 1000 Series products are sensitive to electrostatic discharge (ESD). Store the unused products in the original protective electrostatic packaging that the product was shipped in.

Ensure that a wrist strap and grounding table mat is used when unpacking or handling the Laser 1000 Series product. Proper grounding and ESD management practices should always be followed to ensure that no ESD damage is caused to the Laser 1000 Series product.



2.3 Electromagnetic compatibility

CAUTION

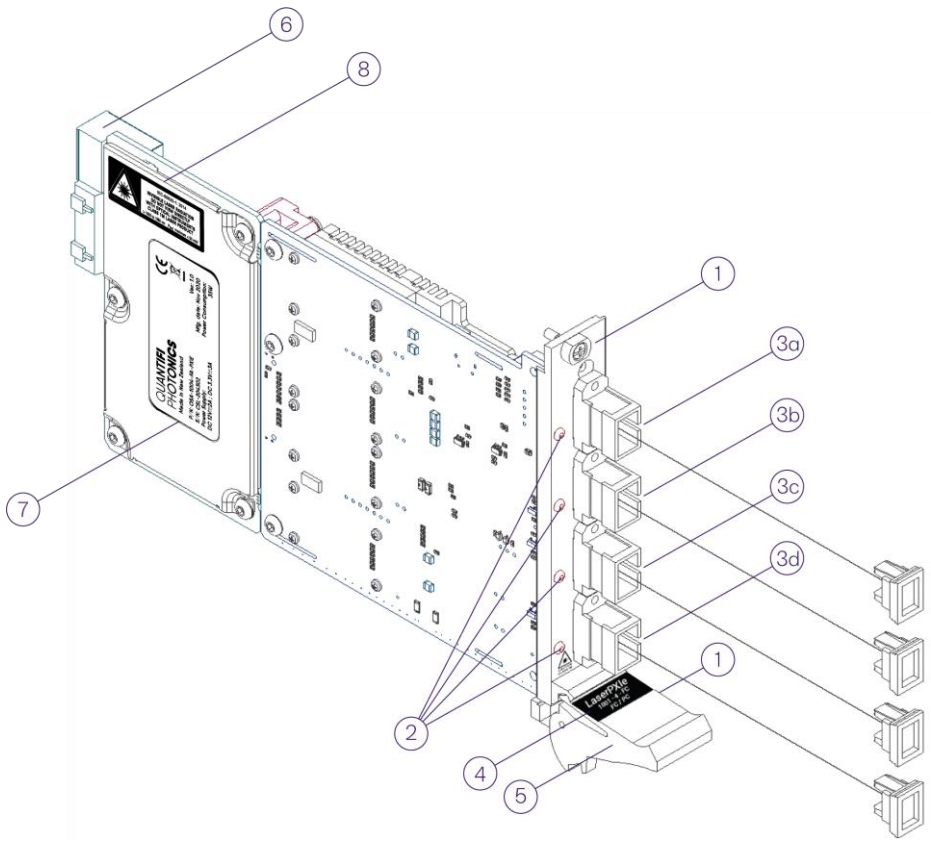
- For electromagnetic compatibility, this instrument is a Class A product. It is intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.
- Wherever the ⚠ symbol is printed on the unit, refer to the instructions provided in the device documentation for related safety information Ensure that the required conditions are met and understood before using the product.

3 Introducing the Laser 1000 Series – Tunable laser source

The Laser 1000 Series is a continuous wave (CW), tunable laser source offering high-power output, narrow 100kHz linewidth and 0.01pm resolution tunability. The Laser 1000 Series can be easily integrated into new or existing test setups to save space, lower costs, and improve testing efficiency.

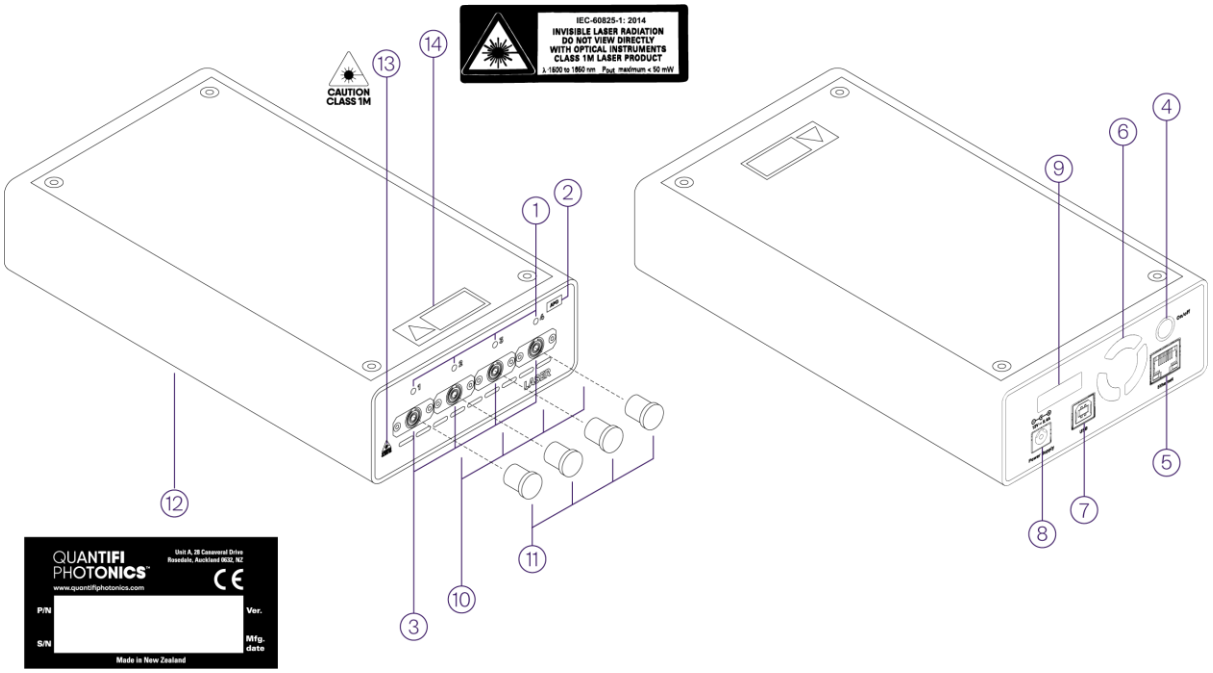
3.1 Laser 1000 PXIe modules overview & features

1 Fastening screws
2 Status LEDs
3a Channel 1 laser output port
3b Channel 2 laser output port
3c Channel 3 laser output port
3d Channel 4 laser output port
4 Optical connector information
5 Fastening clip
6 PXIe headers
7 Laser PXIe module information
8 IEC laser hazard warning



3.2 Laser 1000 MATRIQ instrument overview & features

1 Status LEDs
2 Optical connector type
3 Laser output ports
4 On/ Off push button
5 Ethernet port
6 Ventilation fan (DO NOT OBSTRUCT)
7 USB type B port
8 Power supply port
9 IP address LCD screen
10 Class 1M laser radiation paths
11 Protective caps
12 Laser MATRIQ instrument information
13 Class 1M laser warning symbol
14 IEC laser hazard safety label



3.3 Status LED

The Status LEDs are used to denote the operational state of the Laser 1000 Series product.

- **Off -** Indicates that the laser is **DISABLED**.
- **Solid red -** Indicates that the laser is **ENABLED**. Do not look into or inspect the fiber when the source is active.
- **Blinking red -** Indicates initialization of the Laser product during startup. If blinking persists for more than a few seconds, it indicates an error was registered.

4 Connecting optical fibers

CAUTION

To ensure maximal power transmission in fiber, and to avoid erroneous readings, always inspect fiber end faces. Make sure they are cleaned as detailed below before inserting into any port. **Quantifi Photonics is not responsible for damage or errors caused by bad fiber cleaning or handling**.

IMPORTANT

The type of optical connectors on the Laser 1000 Series can be found printed on the front plate of the product. **Joining mismatched connectors will damage the ferrules and fibre faces**.

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

Quantifi Photonics uses high quality connectors in compliance with EIA-455-21A standards.

4.1 Cleaning and connecting optical fibers

To connect the fiber-optic cable to the port:

1. Inspect the fiber using a fiber inspection microscope. If the fiber is clean, proceed to connect it to the desired port. If the fiber is dirty, clean it as detailed below.
2. Clean fiber ends as follows:
   a. Gently wipe the fiber end with a lint-free swab dipped in isopropyl alcohol.
   b. Use compressed air to dry completely.
   c. Visually inspect the fiber end to ensure its cleanliness.
3. Carefully align the connector and port to prevent the fiber end from touching the outside of the port or rubbing against other surfaces. If the connector features a key, ensure that it is correctly mated into the corresponding notch of the port bulkhead.
4. Push the connector in so that the fiber-optic cable is firmly in place, thus ensuring adequate contact. If your connector features a screw sleeve, tighten the connector enough to firmly maintain the fiber in place. **Do not over tighten, as this will damage the fiber and the port bulkhead.**

NOTE

If your fiber-optic cable is not properly aligned and/or connected, you will notice large signal loss and reflection.

5 Handling the Laser 1000 Series modules

CAUTION

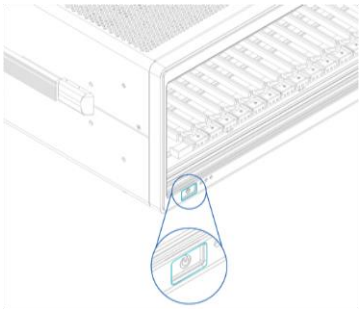
- Do not remove the Laser 1000 Series product from the antistatic packaging until instructed during the following installation procedure.
- **The Laser 1000 Series product is sensitive to ESD. Please be sure to wear a grounded wrist strap at all times when handling the Laser product to prevent such damage.**
- Take care not to handle the connectors on the Laser product, as once they are exposed to skin contact this may leave corrosive residue which can damage the connector.

5.1 Laser 1000 PXIe module installation

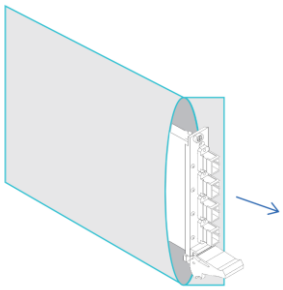
WARNING

DO NOT attempt to remove or adjust any component of the PXIe chassis while the power is on. **Ensure the chassis is powered OFF, and that the correct handling procedure detailed herein is followed when removing or installing any modules**.

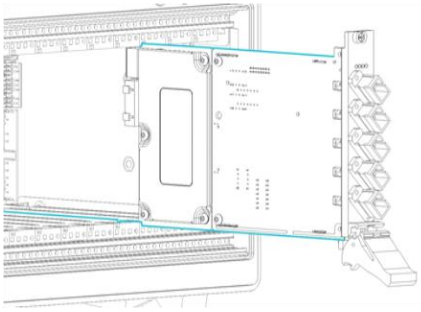
STEP 1: Power OFF the Chassis



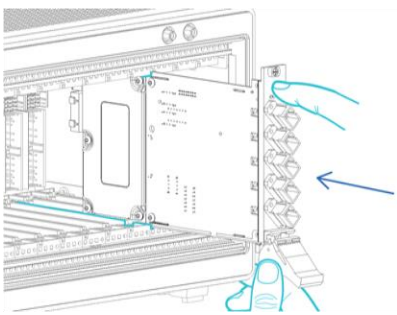
STEP 2: Remove the module from the antistatic bag. Retain bag



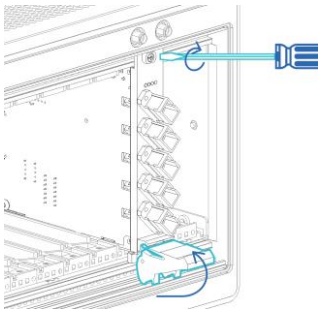
STEP 3: Align module with slot guide rails



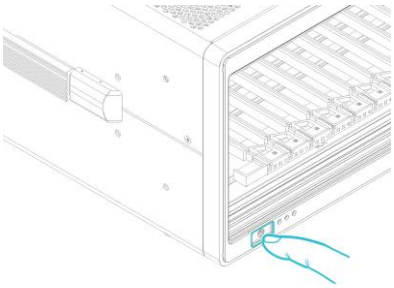
STEP 4: Push module into slot until resistance is felt from the backplane connection



STEP 5: Engage the fastening clip. Secure all fastening screws



STEP 6: Power ON the chassis

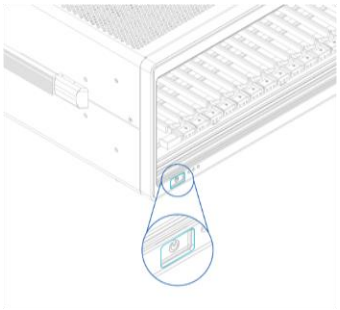


⚠ IMPORTANT

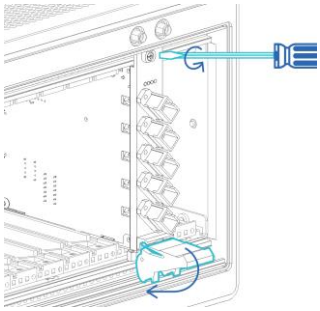
After powering on the PXIe chassis, please wait at least **2 minutes** before attempting to communicate with the instrument. This will allow the chassis enough time to finish boot procedures and initialize the communication server.

5.2 Laser 1000 PXIe module uninstallation

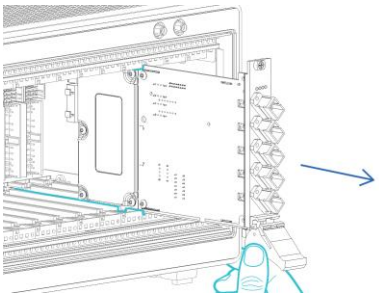
STEP 1: Power OFF the chassis.



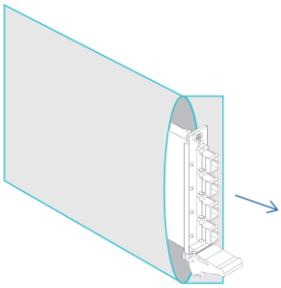
STEP 2: Unsecure the fastening screws and fastening clip



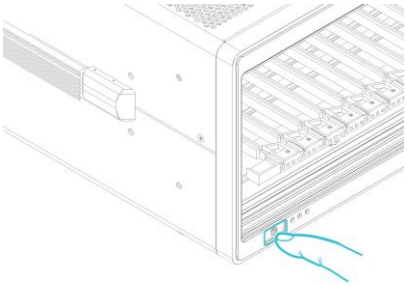
STEP 3: Pull out the module. USE THE FASTENING CLIP TO PULL. DO NOT PULL ON THE CONNECTORS



STEP 4: Store module in antistatic bag

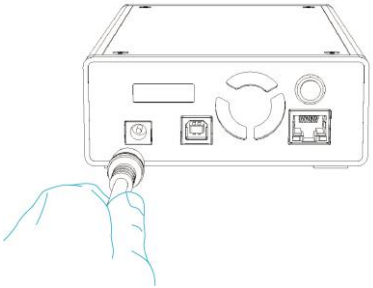


STEP 5: Power ON the chassis

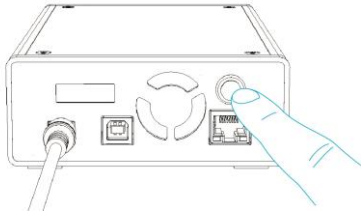


5.3 Laser 1000 MATRIQ instrument installation

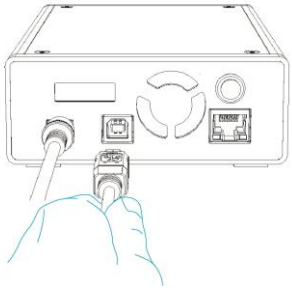
STEP 1:
Insert power cord



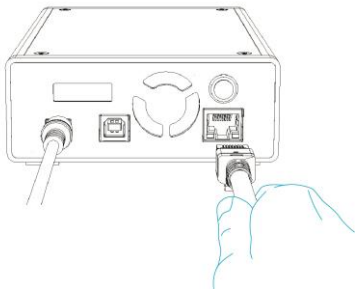
STEP 2:
Power ON the instrument



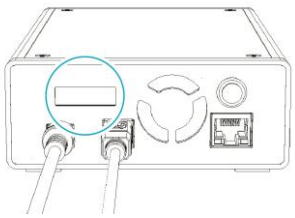
STEP 3:
via USB – Connect USB cable



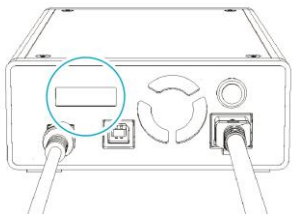
STEP 3:
via Ethernet – Connect Ethernet cable



STEP 4:
IP address will appear on the LCD screen



via USB



via Ethernet

6 Software installation information for Laser 1000 Series

⚠ IMPORTANT

The installation process varies between the PXIe Modules (6.1) and the MATRIQ Instrument (6.3). Refer to the relevant section according to the product type.

6.1 Cohesion Installer information for PXIe modules

⚠ IMPORTANT

The software must be installed on the PXIe Controller for the PXIe Chassis in which the Quantifi Photonics modules will be installed, or the controller PC in the case of a MXI setup.

Minimum System Requirements: 64bit OS, Windows 7 or above.
Recommended System Requirements: 64bit Windows 10.

The Cohesion Installer is a **single installation package** that contains all the required drivers and software, to support and control Quantifi Photonics modules on the PXIe Platform.

6.1.1 Installation overview

For the PXIe Controller to communicate with the Laser 1000 Series installed in the chassis, software and driver installations are necessary. This software is contained in the **Cohesion Installer** single installer package.

- CohesionDriver: Drivers for Quantifi Photonics PXIe Modules
- CohesionSCPI: VXI11 compliant server for remote SCPI communication
- CohesionUI: Web-based Graphical User Interface

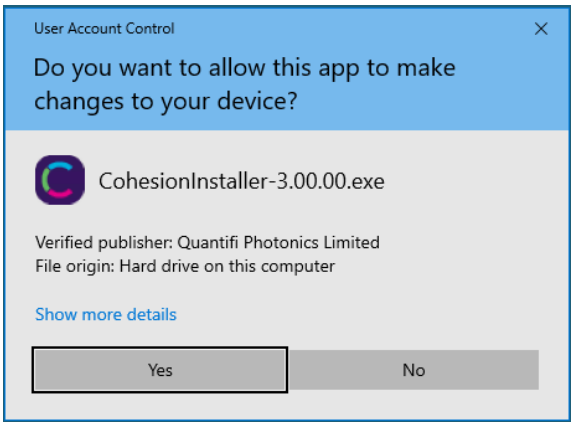
⚠ IMPORTANT

It recommended that you **save all work and close any open programs** before attempting to install the required software packages above.

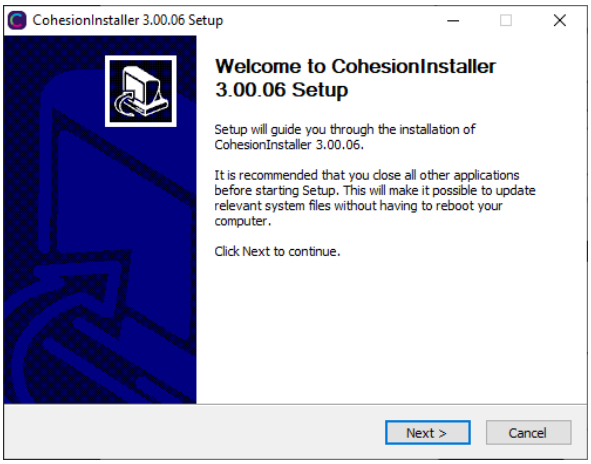
6.1.2 Installation process

Windows 10 64bit:

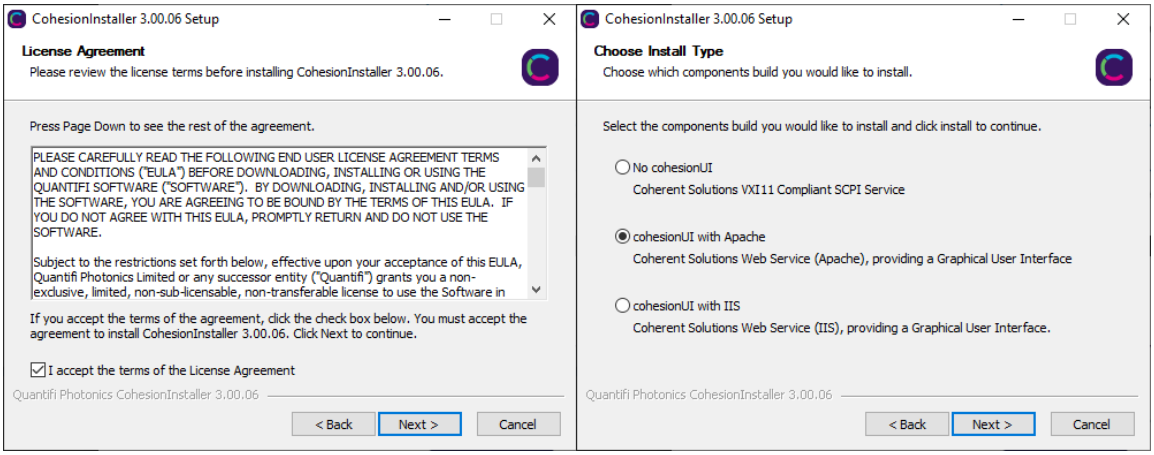
1. Locate and run the installer **CohesionInstaller-3.XX.XX.exe** from the provided USB media device (or download from the Quantifi Photonics website).



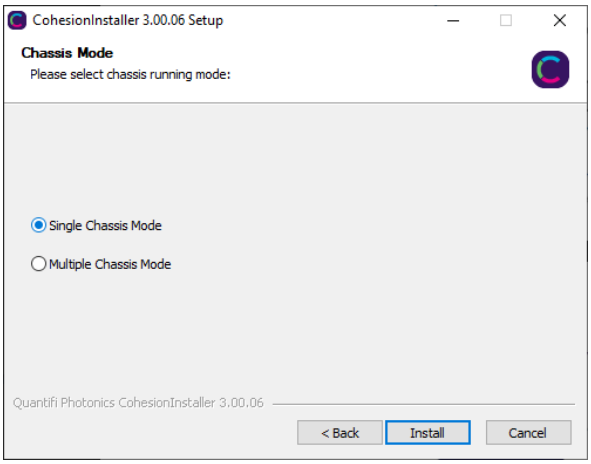
2. Follow the on-screen installation prompts.



3. Continue with the installation by following the on-screen installation prompts. Choose the default installation type – CohesionUI with Apache.



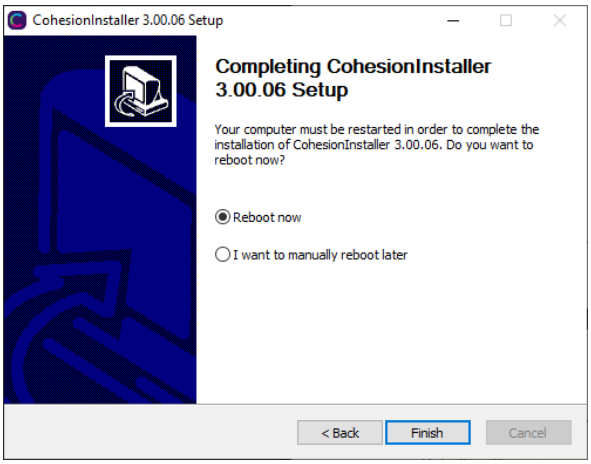
4. Installation will continue with the **Chassis Mode** selection. The default setting is **Single Chassis Mode**. If unsure, proceed with the default mode setting.



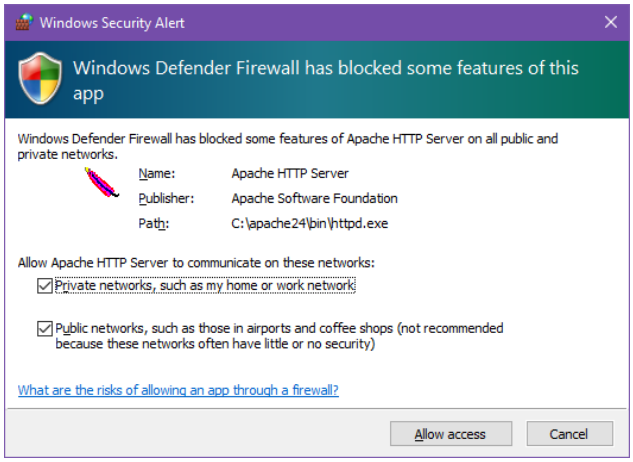
⚠ IMPORTANT

To operate in Multiple Chassis Mode, additional hardware modules are required. The Chassis Mode can be changed at any time, so it is recommended to select **Single Mode** until all other configuration requirements have been met.

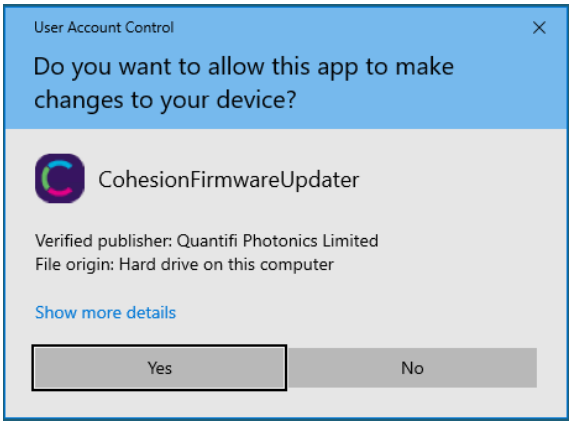
5. At the end of the installation, **it is recommended to select the Reboot now** option, and click **Finish** to complete the installation process.



6. Windows Security Alert may prompt the user for network access. It is **recommended that both options be ticked**, to allow any network configuration.



7. After rebooting the system, on startup a User Account Control prompt will be displayed to run the Cohesion Firmware Updater Utility. Click **Yes** and proceed with the application.



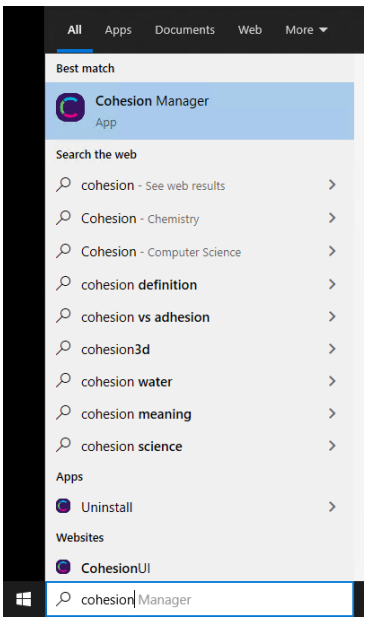
6.2 Quantifi Photonics PXIe system utility applications

Contained within the CohesionInstaller 3.XX.XX are two utility applications:

- Cohesion Manager
- Cohesion Firmware Updater

6.2.1 Cohesion Manager utility

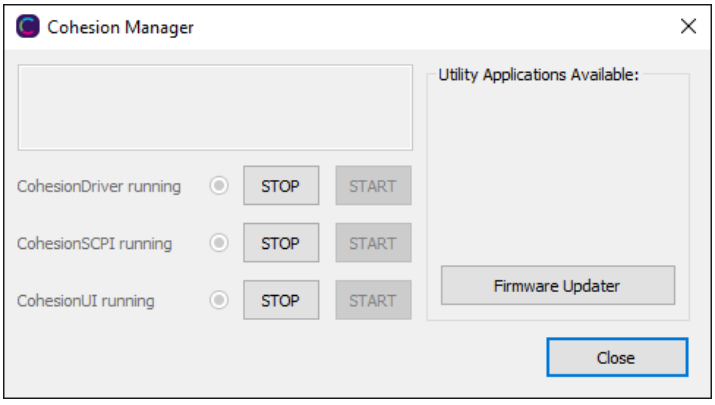
The Cohesion Manager utility serves as a single window application to give the user an overview of the status of all the Cohesion Software Services running on the system. The Cohesion Manager can be accessed via the Windows Start Menu.



Cohesion Manager is designed as a single reference source to check the status of all the running services in one contained window. The utility also allows the user to start or stop the **CohesionDriver service, CohesionSCPI service**, or **CohesionUI service** independently.

By default, all these Cohesion Software Services will start automatically on startup of the Windows OS and need to be running to facilitate proper communication with the Quantifi Photonics PXIe modules. If there is an issue in detecting or communicating with the modules, run the Cohesion Manager to check the status of the software services.

- **(Required) CohesionDriver** – The CohesionDriver service which directly manages the installed Quantifi Photonics modules.
- **(Required) CohesionSCPI** – The CohesionSCPI service which is the VXI11 compliant SCPI interface for TCP communication with the installed Quantifi Photonics modules.
- **(Optional) CohesionUI** – An optional web service providing a graphical interface for simplified operation of the installed Quantifi Photonics modules.



⚠ IMPORTANT

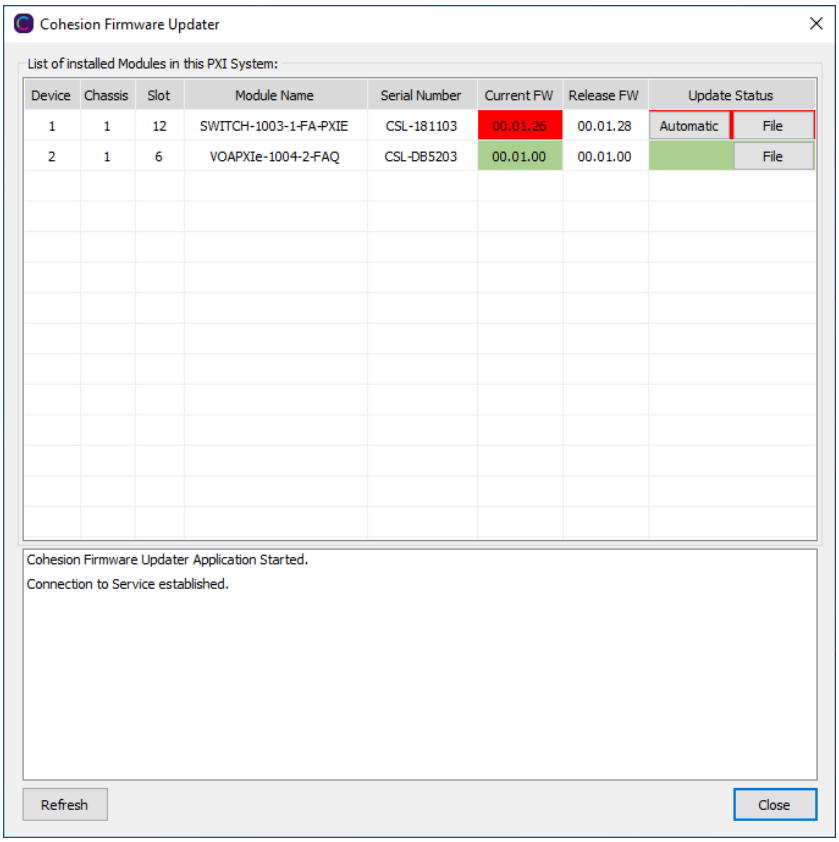
The **Driver and SCPI services** need to be running to facilitate communication with any installed Quantifi Photonics module, **therefore they are listed as REQUIRED**.

On the right side of the Cohesion Manager window a list of all the installed Quantifi Photonics system utilities is displayed.

6.2.2 Cohesion Firmware Updater utility

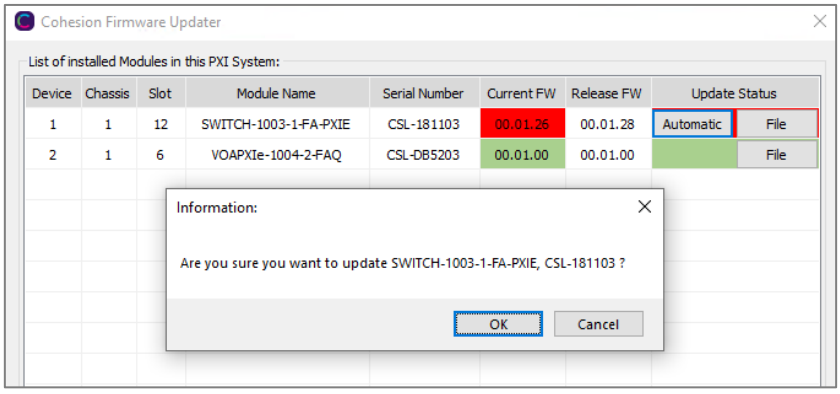
The Cohesion Firmware Updater utility serves as a single window summary application to display the current firmware status of all the Quantifi Photonics PXIe modules installed in the chassis.

The Cohesion Firmware Updater utility can be accessed via the Cohesion Manager application (see Section for more 6.2.1 information).

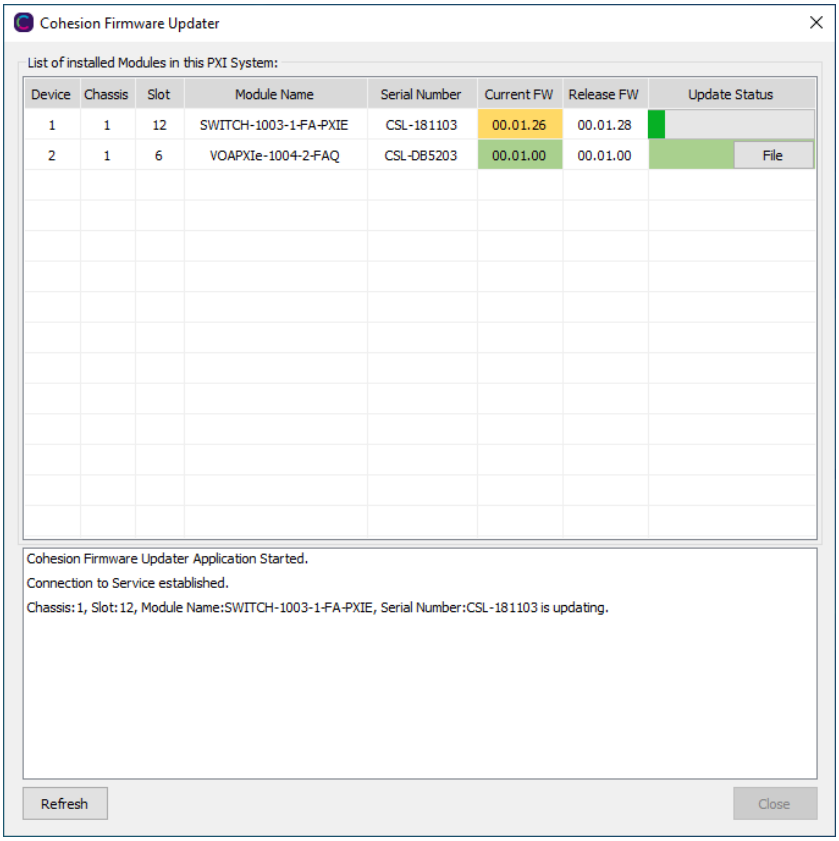


Whenever a new version of the CohesionInstaller is installed on the system, the Cohesion Firmware Updater utility will automatically launch after the system is rebooted. It will show the user the firmware status of all installed Quantifi Photonics modules and allow the user to update the firmware to a new version if applicable.

If a module's firmware is out of date, it is highly recommended to update the firmware to the new available version. Clicking the **Automatic** button will update the module(s) to the latest supported firmware for the installed packages on the system.



After clicking **OK**, the firmware update progress will be shown in the **Update Status** column.
The **File** button is reserved for updating a module to a specific firmware version if required.



6.3 MATRIQ Installer information for MATRIQ instruments

> **⚠ IMPORTANT**
> If **another MATRIQ instrument is already connected** to the client computer **over USB**, consult the **Network and Update settings** (7.5.6) section below on configuring the Ethernet / USB IP address for multi instrument control.

Communication with the Laser 1000 MATRIQ Series instrument can be realised over an **Ethernet** or **USB** connection. Both connection methods will allow control of the instrument through the CohesionUI graphical user interface and with SCPI commands. To control or communicate with the MATRIQ instrument, a USB driver needs to be installed onto the client computer.

The **MATRIQ Installer** (included on the provided USB drive as **MATRIQ-1.X.X.exe**) will install the driver and create a Desktop icon to help connect to the CohesionUI running on your MATRIQ instrument.

The MATRIQ Installer is also available for download from Quantifi Photonics website.

1. Run the MATRIQ Installer: Double click and run the **MATRIQ-1.X.X.exe** MATRIQ Installer from the provided USB drive.
2. Run the MATRIQ application: Double click and run the **MATRIQ** desktop application.
3. Follow the on-screen prompts from the MATRIQ application landing page to use CohesionUI to control the MATRIQ instrument.

7 CohesionUI application

CohesionUI is a web-based application that you can use to control any Laser 1000 Series product from Quantifi Photonics. Its cutting-edge design offers a sleek modern interface, cross-device compatibility, multi-instrument control, customizable views, and remote access.

7.1 Accessing CohesionUI for PXIe modules

To use CohesionUI, you need the IP address of the host chassis, with which you can access the chassis either locally or remotely. For local access, use the embedded PXIe controller operating system, and for remote access, use any compatible device that is connected to the PXIe chassis via an ethernet connection.

To obtain the IP address, open the **Command Prompt** window on the chassis controller and then run the `ipconfig` command. Note down the IPv4 address that is displayed. For the local IP address, you can use `127.0.0.1` instead.

To access CohesionUI locally or remotely, open a compatible browser (Google Chrome or Microsoft Edge) and use the IP address `127.0.0.1` as the URL. Alternatively, you can double-click the desktop icon for CohesionUI or select it from the **Start** menu.

7.2 Accessing CohesionUI for MATRIQ instruments

The IP address of the MATRIQ is displayed on the LCD screen on the back of the instrument. Irrespective on the operation mode of the MATRIQ (access over USB or Ethernet), the appropriate IP address will be displayed on the screen.

> **NOTE**
> When both Ethernet and USB cables are connected to the MATRIQ Instrument, the IP displayed on the LCD will alternate between the USB and Ethernet IP addresses.

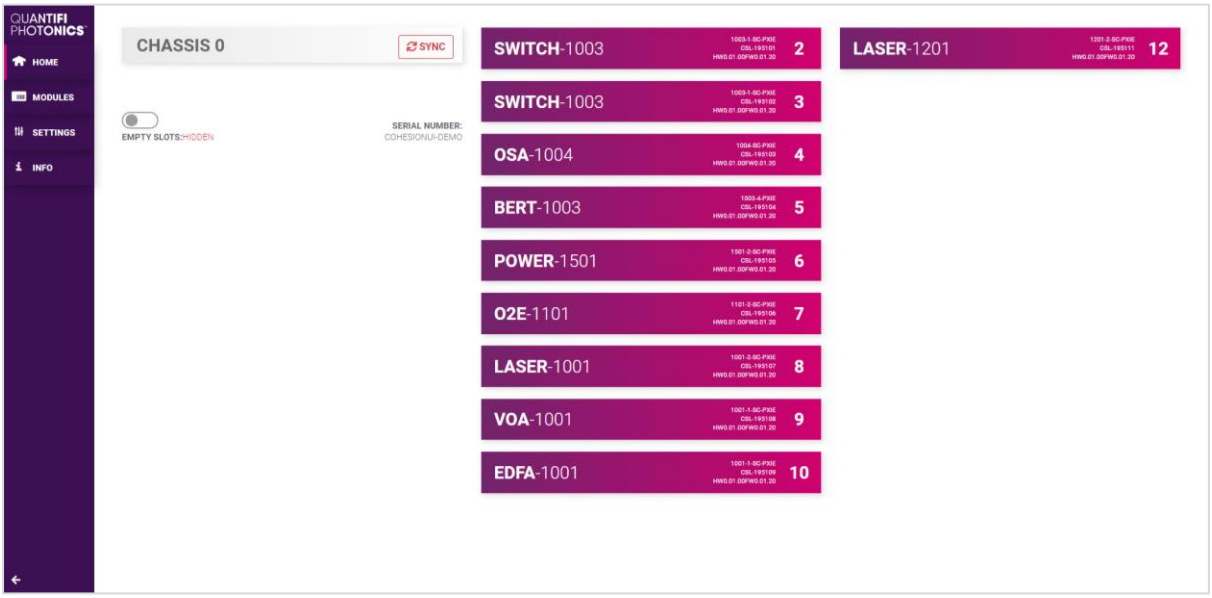
Launch Google Chrome or Microsoft Edge on a computer, and type in the MATRIQ instrument IP address into the address bar of the browser e.g. **10.10.10.89**.

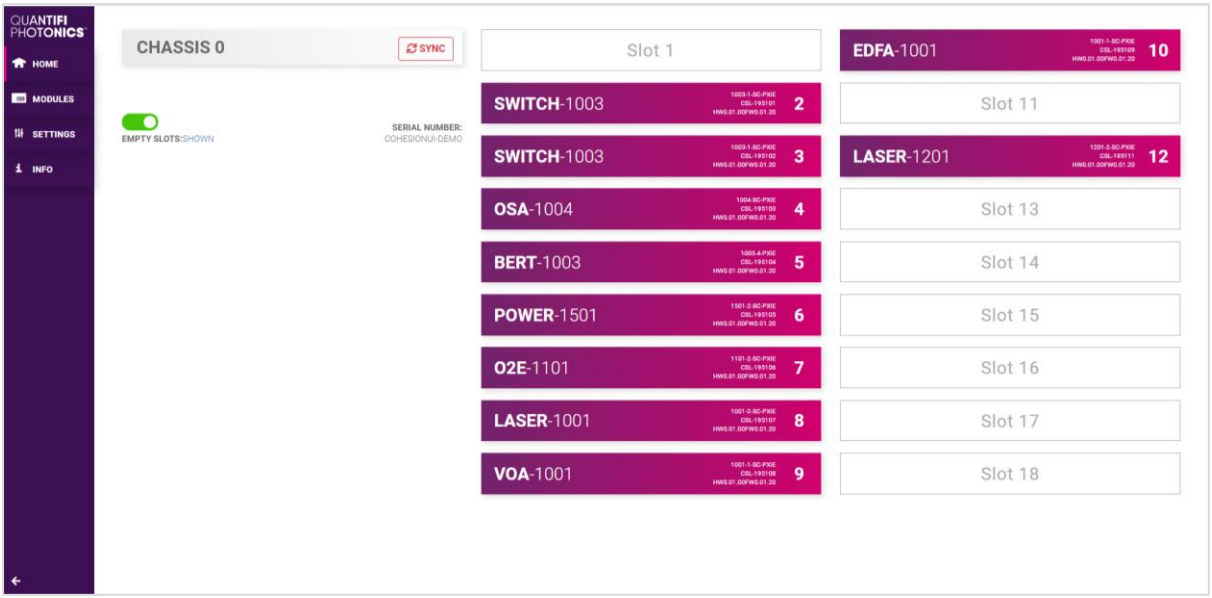
If needed, the IP address can be statically assigned to the Ethernet or USB connection (see 7.5.6).

7.3 Home page

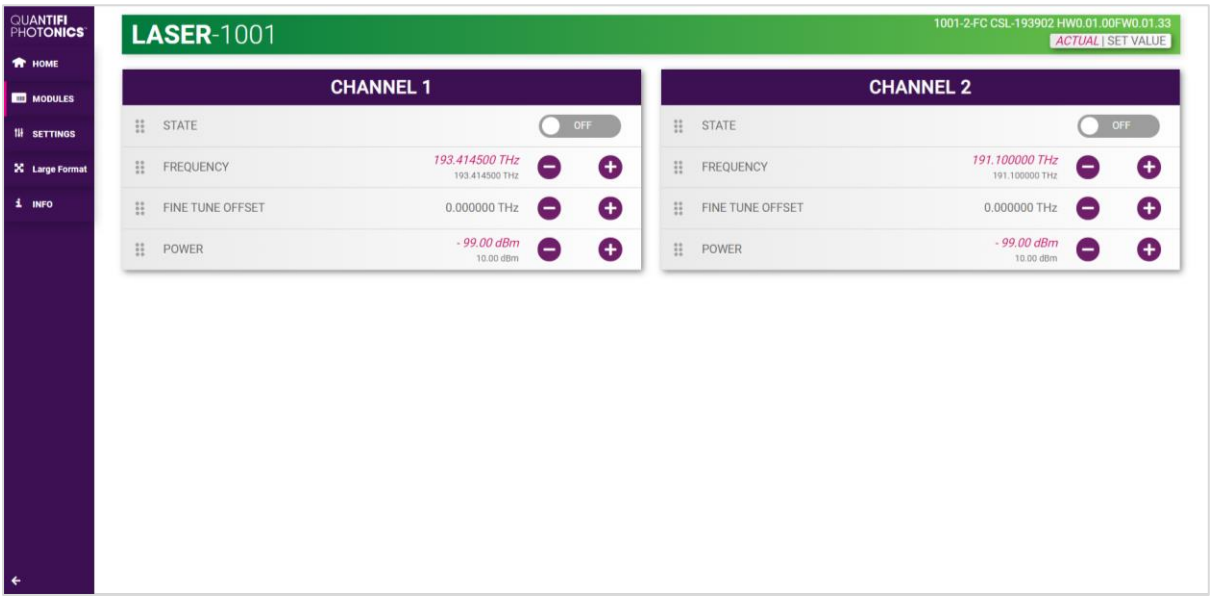
The main landing page in CohesionUI is called the **HOME** page. It displays a graphical representation of the module arrangement in the PXIe chassis or the MATRIQ instrument channels.

For PXIe modules, white numbers are displayed beside each module corresponding the slot in which they are installed. The EMPTY SLOTS button will toggle the page view to hide (HIDDEN), or to show (SHOWN) the empty slots in the PXIe chassis. The default setting is HIDDEN.



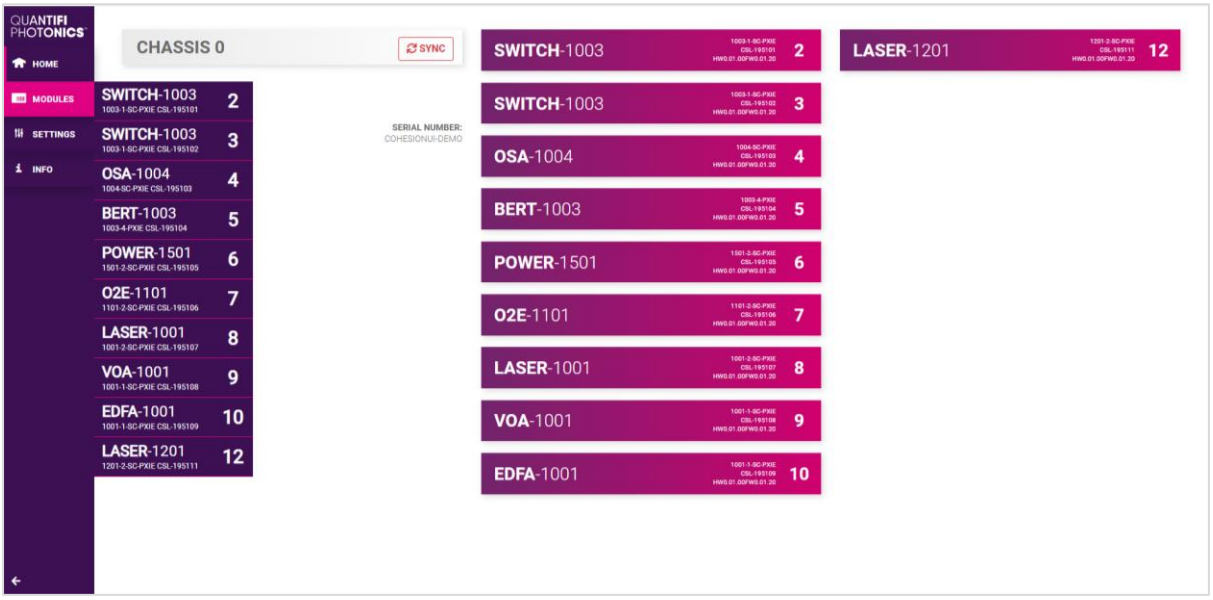


For MATRIQ instruments, all the information relating to the instrument such as the model number, serial number and firmware versions are displayed in the top right corner of the window.



7.4 Modules list

All the installed modules are displayed on the HOME page. To access the controls for a module, click the corresponding module name, or hover over the MODULES button and select a module from the displayed list. Controls for a specific module, or a channel in a module are then displayed.

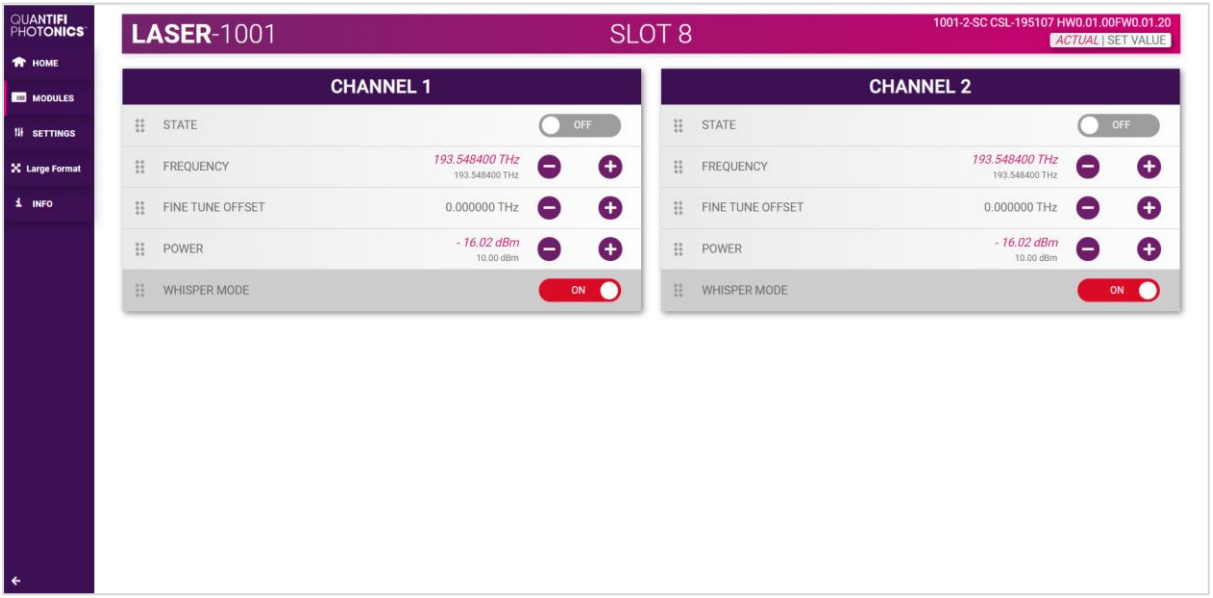


7.4.1 Set and Actual values

Some Quantifi Photonics products will allow the user to set a given parameter's value and then read that parameter (eg. Laser, VOA, O2E, etc). In order to help the user to distinguish between a set value and an actual read value, CohesionUI will format these values differently according to the legend in the top right corner of the window.

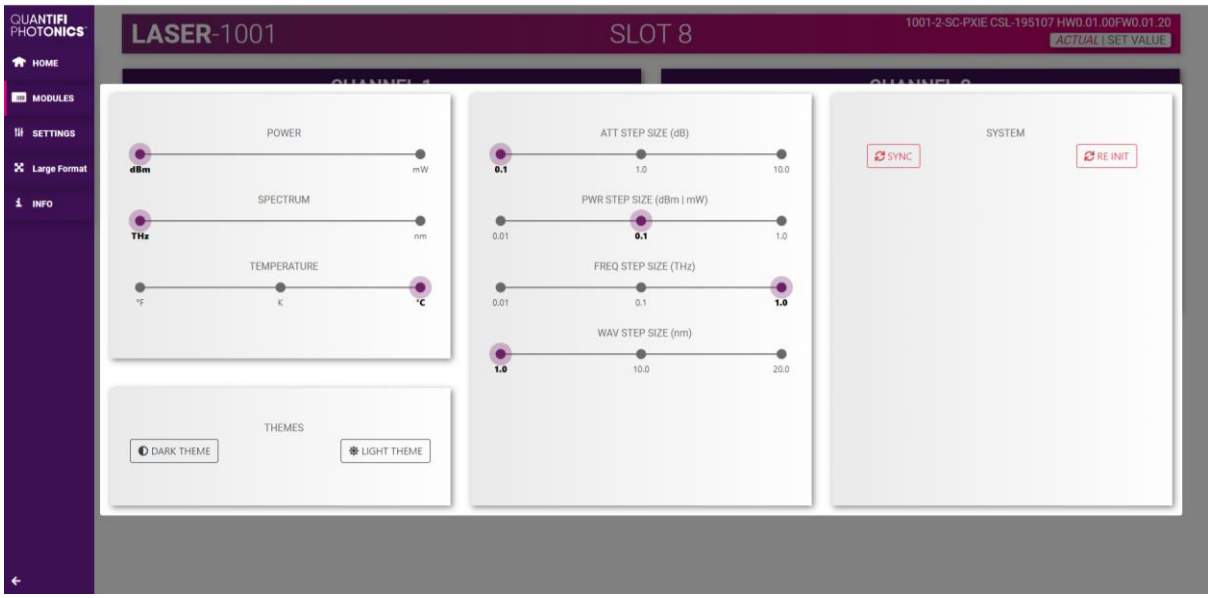
- *ACTUAL*: the actual value of the parameter, defined by querying the module
- SET: the intended value of a given parameter, defined by user input

In the following example, the POWER is SET to 10.00 dBm, but the *ACTUAL* value is *-16.02 dBm*. Thus, the user can see both the current and user defined value of a given parameter.
The SET and *ACTUAL* values are only displayed for appropriate parameters which require user input. For parameters that report a value and do not depend on user input, only an *ACTUAL* value is displayed.



7.5 Settings page

The SETTINGS page is used to configure the CohesionUI settings and unit preferences or to synchronize / reinitialize the system. These controls can be accessed by clicking the SETTINGS button. Step size refers to the amount by which the attenuation, frequency, or power increments / decrements when the + or - button is clicked.



NOTE

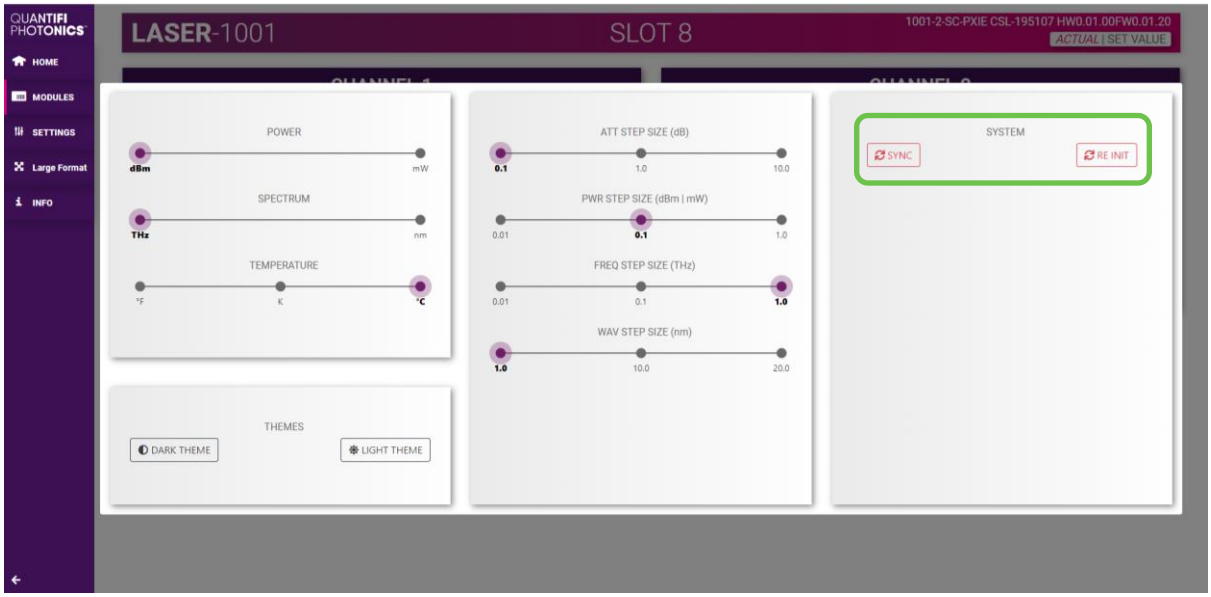
- The unit preferences and settings can be set by hovering over the SETTINGS button in the left side menu. This will bring up a dropdown menu that lists all settings for a quick access.
- Whenever the chassis is power cycled, CohesionUI reverts to default settings.

7.5.1 System controls for PXIe modules

On the SETTINGS window there is a SYSTEM controls section. These controls are to facilitate re-discovery of any Quantifi Photonics PXIe modules there may have been installed after initial startup, or if no modules are displayed in the CohesionUI window. This is useful for users who are operating in a multi-chassis MXI setup, instead of the standard PXIe embedded controller setup.
There are two actions in the SYSTEM controls section:

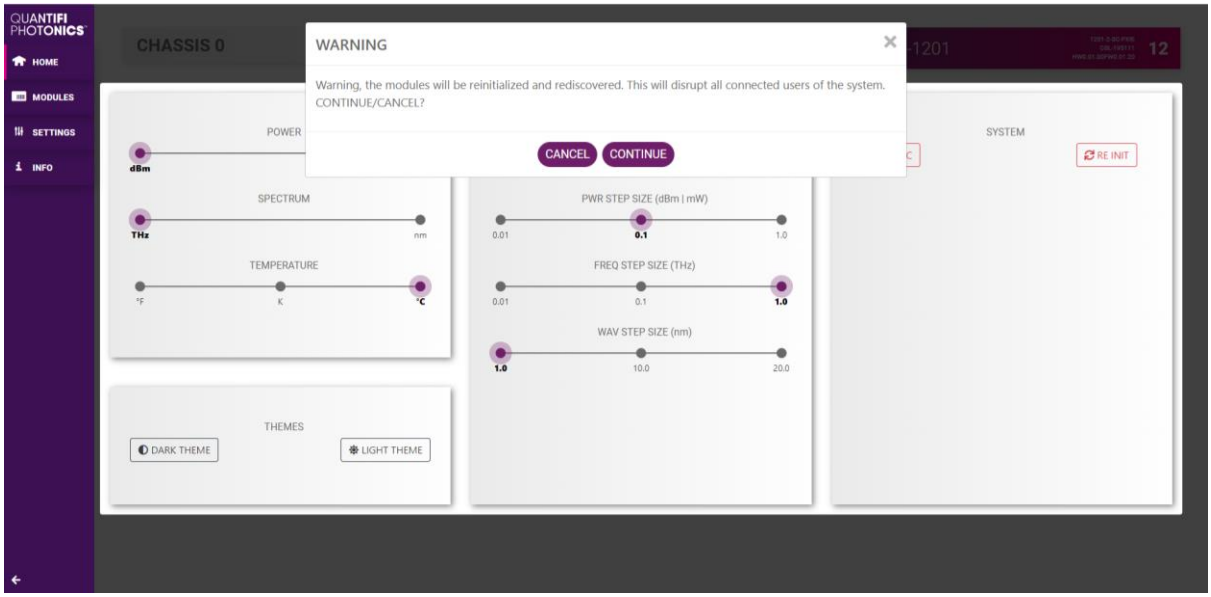
- SYNC: Synchronize CohesionUI with the latest information from the CohesionSCPI service.
- RE-INIT: Re-initialize CohesionUI by synchronizing the CohesionSCPI service with the CohesionDriver service.

The SYNC button is also displayed on the HOME page beside every chassis in the setup. This allows any chassis to be synchronized independently. After clicking the SYNC button, CohesionUI will disable the page while it is synchronizing with the CohesionSCPI service. Once completed, the page will be functional again.



Clicking the RE-INIT button will bring up a prompt to continue, since this action will temporarily disconnect all modules while the re-initialization with the CohesionDriver service is in progress. Once it is complete, the page will be functional again.

> **NOTE**
> The RE-INIT action will disconnect any connected users to the PXIe system while the action is being completed. All modules will be disabled during this time.



7.5.2 Network and Update settings controls for MATRIQ instruments

The network configuration control panel enables the user to set the preferred communication interface (Ethernet or USB).

> **NOTE**
>
> The Network interface controls are only available when connected over **USB.**

7.5.3 Updating firmware and CohesionUI for MATRIQ instruments

The Firmware or CohesionUI versions running on the MATRIQ instrument can be updated using the update utility on the **Settings** page.

For the latest firmware and CohesionUI version files email support@quantifiphotonics.com, along with the product serial and model numbers.

7.5.4 Resetting the MATRIQ instrument

If for any reason there is an issue with the MATRIQ instrument, it can be reverted to factory settings using the **FACTORY RESET** utility.

NOTE

Any IP address settings will be reverted to factory settings when the MATRIQ instrument is reset.

7.5.5 Configuring the Network Interface settings for MATRIQ instruments

The MATRIQ instruments can operate over either an Ethernet or USB connection. To communicate with the instrument, the IP address is required. In order to configure ANY network interface settings, the **MATRIQ instrument will have to be connected via a USB cable** to a computer.

NOTE

The Network interface controls are only available when connected over USB. When connected over Ethernet the settings will be locked, as highlighted as follows.

7.5.6 Setting the USB IP address for MATRIQ instruments

When connected via USB, the default IP address is **192.168.101.201**. This is a static address set during instrument calibration. If necessary, this address can be changed. Typing the default IP address in a supported web browser will open the cohesionUI page for the instrument. The Network Interface configuration controls are available in the **Settings** page.

The **value in the 3rd octet of the IP address can be changed** to any available value. It is important to make sure that any other instruments connected to the computer do not share this new IP address, as there will be an addressing conflict.

Clicking **APPLY** will write the new IP address to the instrument settings. Once set, the new IP address will be displayed on the LCD screen on the back of the instrument.

7.5.7 Setting the Ethernet IP address for MATRIQ instruments

The default Ethernet IP addressing method is dynamic, as the DHCP will automatically assign the instrument an IP address. This address can be found on the back of the instrument on the LCD screen.

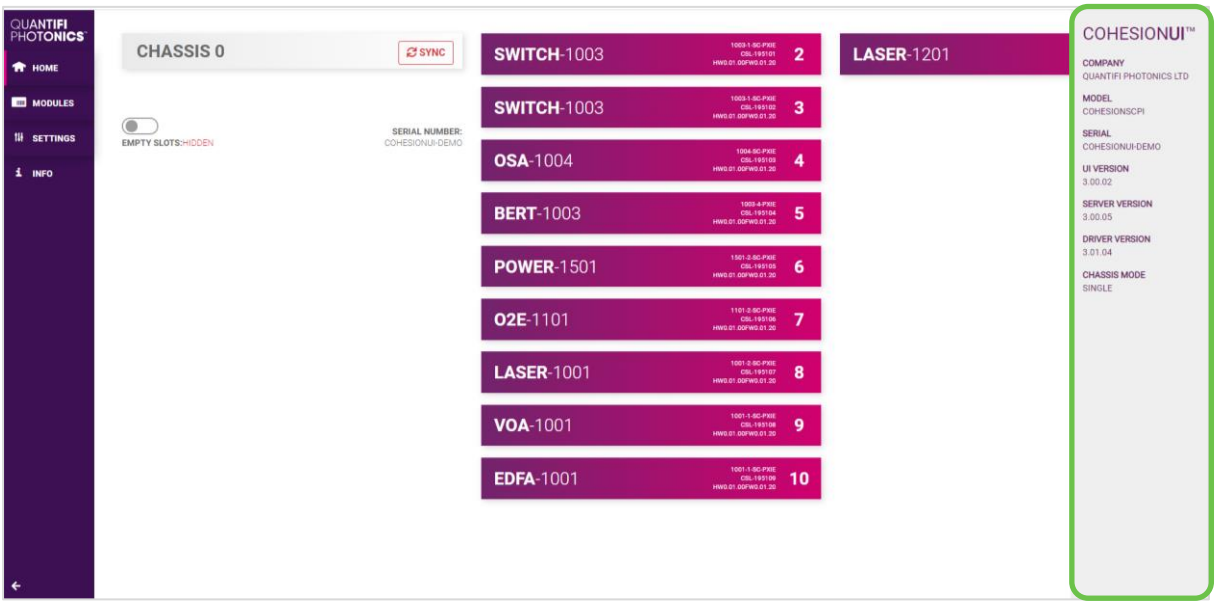
While connected over USB, typing in the assigned IP address in a supported web browser will open the cohesionUI page for the instrument.

The addressing method can be changed to a static method, where the MATRIQ instrument will always have the same IP address over Ethernet. Typing in a **valid IP address and Subnet mask**, and then clicking **APPLY** will save the IP address into the settings of the instrument.

To test if the IP addressing has worked, power OFF the instrument, and disconnect the USB cable. Turn the unit back **ON**, and once it has finished booting, check the IP address shown on the LCD screen.

7.6 Info panel

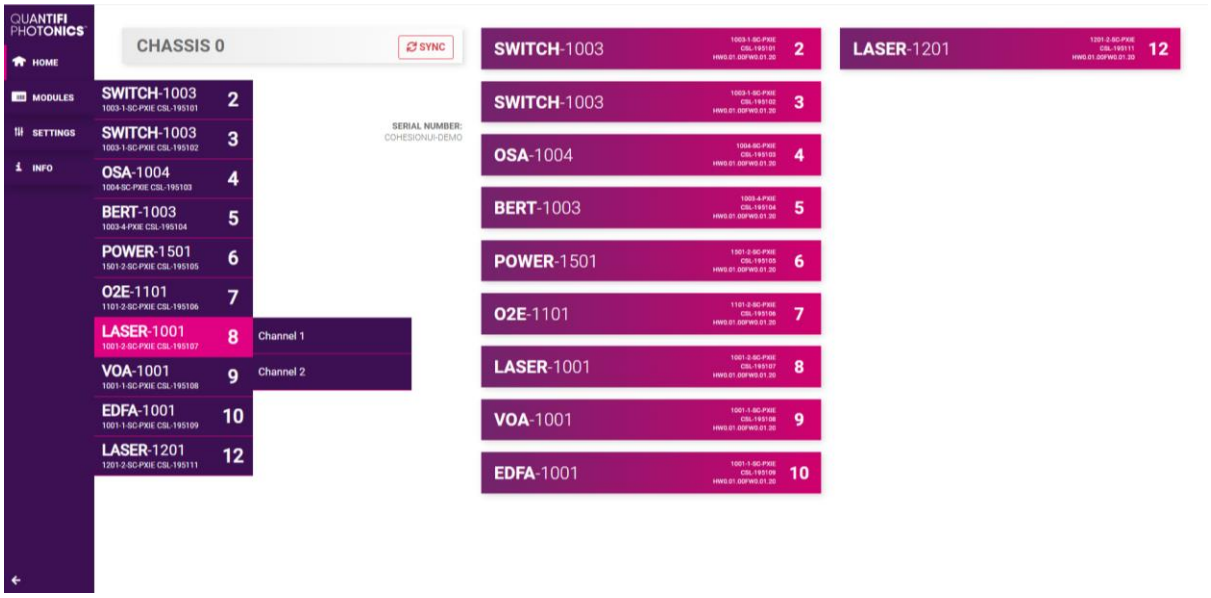
Clicking the **INFO** button will display an information panel on the right side of the page. Information such as the chassis operation mode, manufacturer, model, and serial number of the chassis, CohesionUI version number, and the version of CohesionSCPI service running on the chassis is displayed in this panel.



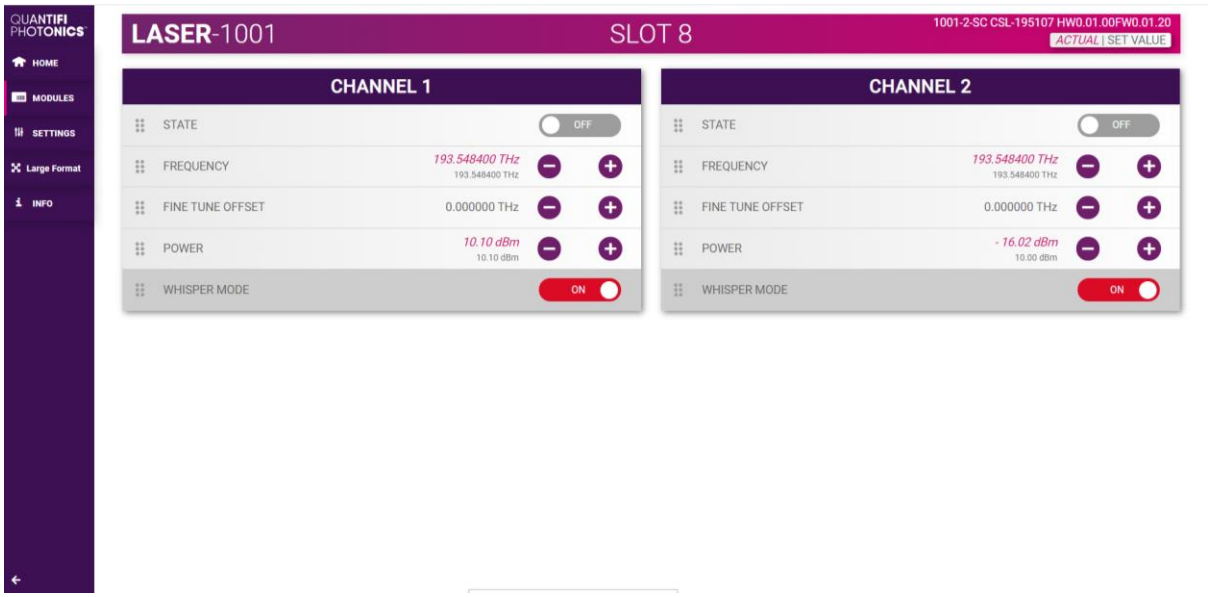
8 Laser 1000 Series control with CohesionUI

To control the Laser PXIe module through CohesionUI, click the desired module installed in the chassis or the desired channel. Alternatively, hovering over the MODULES menu button on the left will bring up a dropdown menu that the Laser module can also be selected from.

To control the Laser MATRIQ instrument, click HOME to display controls for all channels.



After clicking the desired Laser module, its control page is displayed. All information relating to the module such as model number, serial number and firmware versions are displayed in the top right corner of the window.

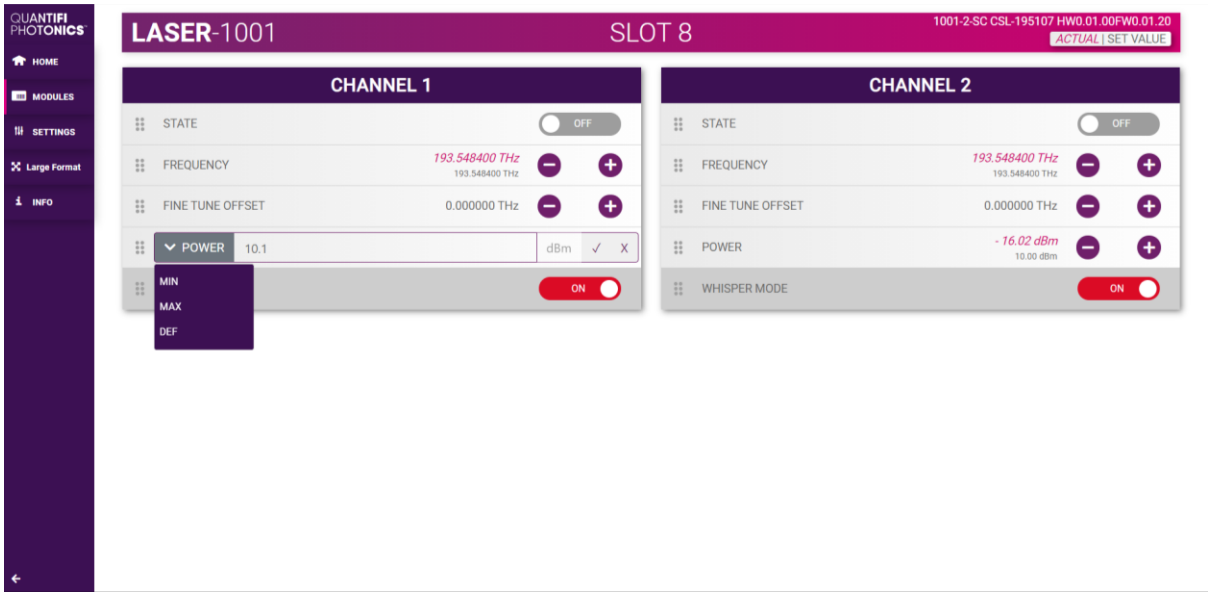


8.1 Setting channel parameter values

Specific control parameters for a given channel in the Laser product can be set, either by clicking the parameter button, or using the + and – control buttons to increment or decrement the value field by a set amount. This step size is set in the **Settings** menu. This applies to the following parameters:

- **FREQUENCY (WAVELENGTH):** The desired frequency (wavelength) of light that the Laser product should output. This corresponds to the spectral location of the central peak of the laser.
- **POWER:** The desired output power of the Laser product.

Alternatively, the parameter can also be set to the **MIN** and **MAX** value by clicking the dropdown in the name of the parameter.



In the above example, the POWER for CHANNEL 1 has been set to 10.1 dBm by manual input. Alternatively clicking the MIN button in the dropdown menu will set the power to the minimum value. To apply the changes, click the tick mark.

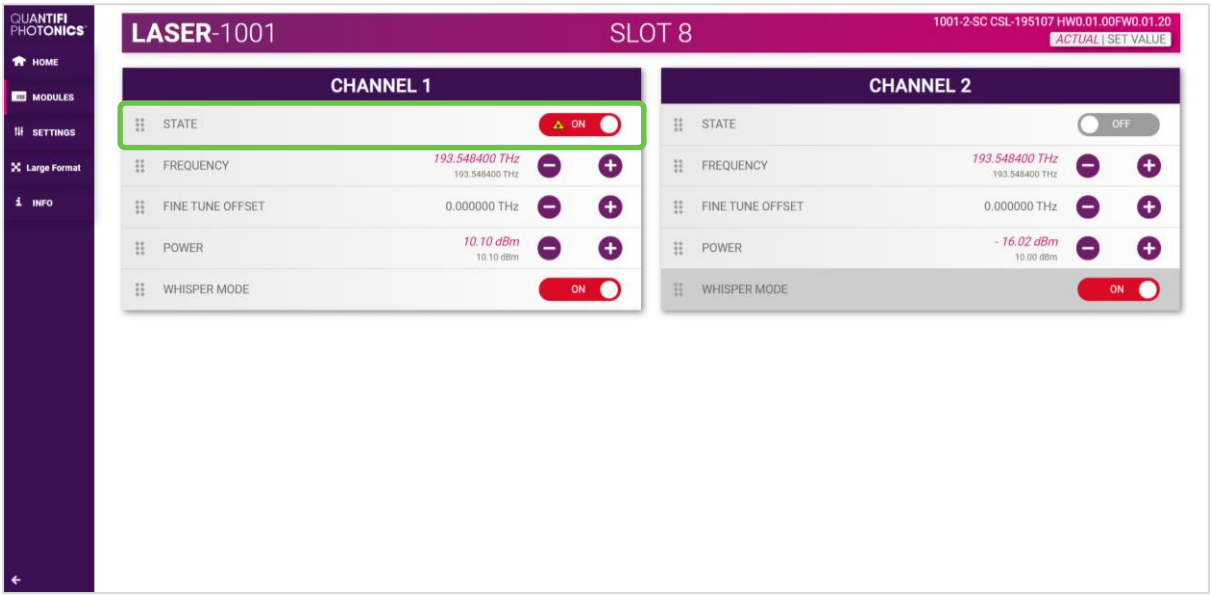
Note that after setting the desired output power and clicking the tick mark, the displayed POWER value will be the ACTUAL power value. The set value is stored in memory and is applied when the laser STATE is toggled ON.

> **⚠ IMPORTANT**
>
> The tick mark **MUST** be clicked in order for any changes or values that were entered to be applied successfully.

8.2 Toggling the Laser product on / off

To toggle the laser in a specific channel of the Laser product **ON** or **OFF**, click the **STATE** button.
In the example below, the laser in CHANNEL 1 has been set to 193.5484 THz, 10.1 dBm of output power and **STATE** has been toggled **ON**.

> **⚠ IMPORTANT**
> After toggling **the STATE button from OFF to ON**, the Laser product will take up to **30 seconds to stabilise** its power and frequency. CohesionUI will be unresponsive during this time.



8.3 Tuning the laser product

The Laser 1000 Series product allows the user to tune the laser to any spectral set point in the operational range of the laser. The user can operate in either FREQUENCY (Hz) or WAVELENGTH (nm) units.

Tuning can be realised through the following commands. See the Programming Guide (9) section of the User Manual for specific information about the listed commands.

Commands	Description
`SOURce<n>:CHANnel<m>:FREQuency/?`	- Set / query the laser output frequency value, with 1 MHz resolution.
`SOURce<n>:CHANnel<m>:FREQuency:FINE/?`	- Set / query the fine tune laser output frequency up to +/- 6 GHz around the closest GRID point, with 1 MHz resolution.
`SOURce<n>:CHANnel<m>:WAVelength/?`	- Set / query the laser output wavelength value, with 0.01 pm resolution.

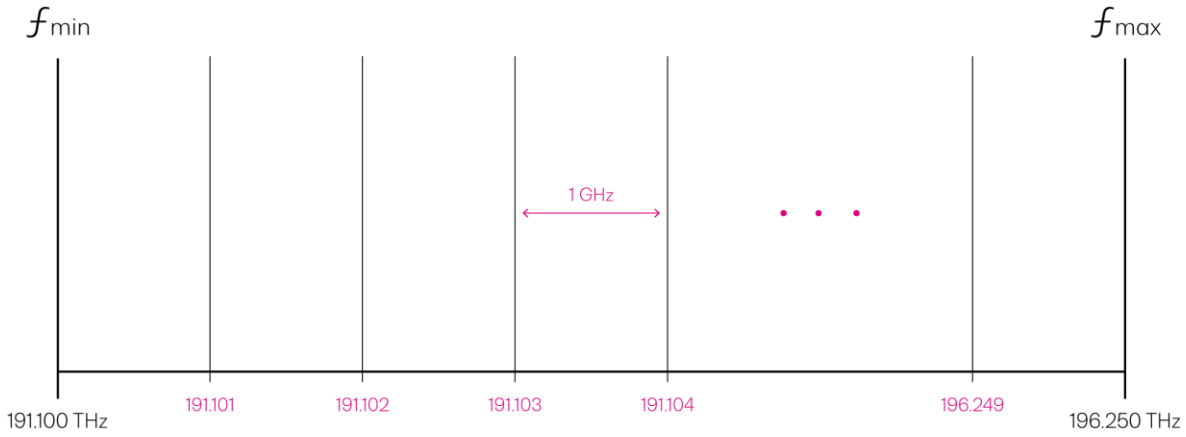
All lasers with firmware versions equal to or higher than 1.30 will support full spectral tunability down to the minimum resolution of 1 MHz/ 0.01 pm. Older versions only support full tuning down to the 1 MHz / 0.01 pm resolution with the separate FREQUENCY and FREQUENCY:FINE commands.

8.3.1 Grid setting and Min & Max frequency values

The default state of the laser is to operate in frequency (Hz) mode. The entire frequency operation range of the laser can be divided up into a **GRID**. Each **GRID point** is spaced apart by an equal amount, called the **GRID spacing**.

The user can set this GRID spacing using the `SOURce<n>:CHANnel<m>:GRID/?` command, between the values of 100 MHz and 50 GHz.

Each Laser 1000 Series model will have a MIN and MAX frequency value, which defines its operation range. For example, the Laser-1001 product has MIN and MAX frequency values of 191.1 THz (1527.605 nm) and 196.25 THz (1568.773 nm), respectively. If the user were then to set a GRID spacing of 1 GHz, then the frequency grid would be as shown in the below image.



The general rule for the set of valid frequency GRID points is:
F_MIN + [GRID x [N + 1]], where GRID = GRID spacing set by user, N >= 1

Whenever a user sets the frequency to an intended value, the instrument will use the defined GRID to first set the laser to the closest value (GRID point) on the frequency grid. If there is still an offset between the user intended frequency value and the GRID point, then a FINE TUNE OFFSET will be applied to move the laser to, or as close to the user intended value. This is due to the +/- 6 GHz tunability range of the FINE TUNE OFFSET, meaning that there could be regions where the laser is not able to tune to (see the **Frequency FINE tuning** (8.3.3) section for more information).

8.3.2 Frequency tuning

The user can directly set a frequency value down to 1 MHz precision using the `SOURce<n>:CHANnel<m>:FREQuency/?` command. If the intended value is above the minimum resolution of 1 MHz, then the value will be directly set. If the intended value is specified to below the minimum resolution, then the outstanding value will be truncated (highlighted below in red).

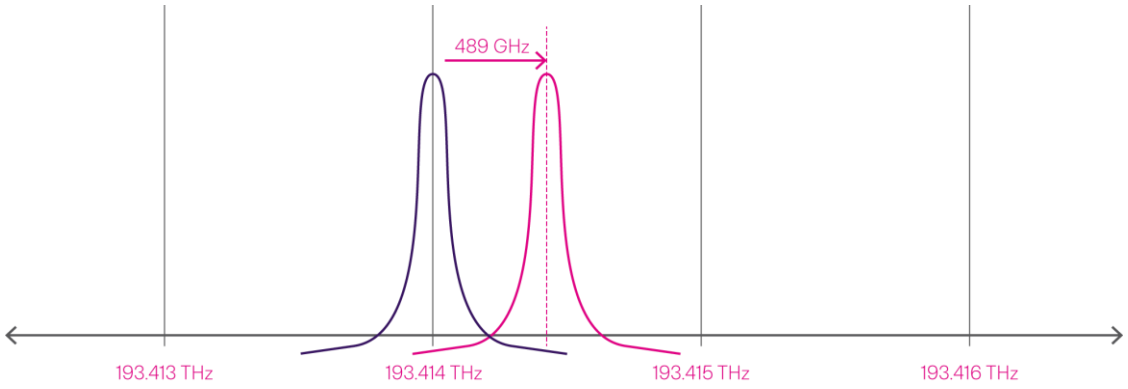
Intended user frequency value	Accepted frequency value	Applied frequency value
193.41448 THz	193.4144800 THz	193.414480 THz
193.4144890 THz	193.414489 THz	193.414489 THz
193.41448905 THz	193.414489 THz	193.414489 THz
193.000000055 THz	193.000000 THz	193.000000 THz

The table below details the intended vs. the actual set of values for a variety of these examples. Note that the GRID spacing is set to 1 GHz for the following examples.

Intended user frequency value	Command	Current GRID value	Actual set frequency value
193.414 THz	`SOUR1:CHAN1:FREQ 193.414 THz`	193.414 THz	193.414000 THz
193.42501 THz	`SOUR1:CHAN1:FREQ 193.42501 THz`	193.425 THz	193.425010 THz
193.414489 THz	`SOUR1:CHAN1:FREQ 193.414489 THz`	193.414 THz	193.414489 THz
193.4144895 THz	`SOUR1:CHAN1:FREQ 193.4144895 THz`	193.414 THz	193.414489 THz
193.4000001 THz	`SOUR1:CHAN1:FREQ 193.4000001 THz`	193.400 THz	193.400000 THz

An important point to note is that when a frequency value is specified by the user, if the value lies in between any two adjacent GRID points, and can be tuned to, it will tune up from the lower GRID point value. The laser will never tune down from a GRID point value to reach the final point.

In the example below, the user sets the output frequency to 193.414489 THz, with a GRID spacing of 1 GHz. The laser first tunes to the closest GRID point below the intended frequency value (193.414 THz), and then uses FINE TUNE OFFSET to fine tune by 489 MHz up to the final set point

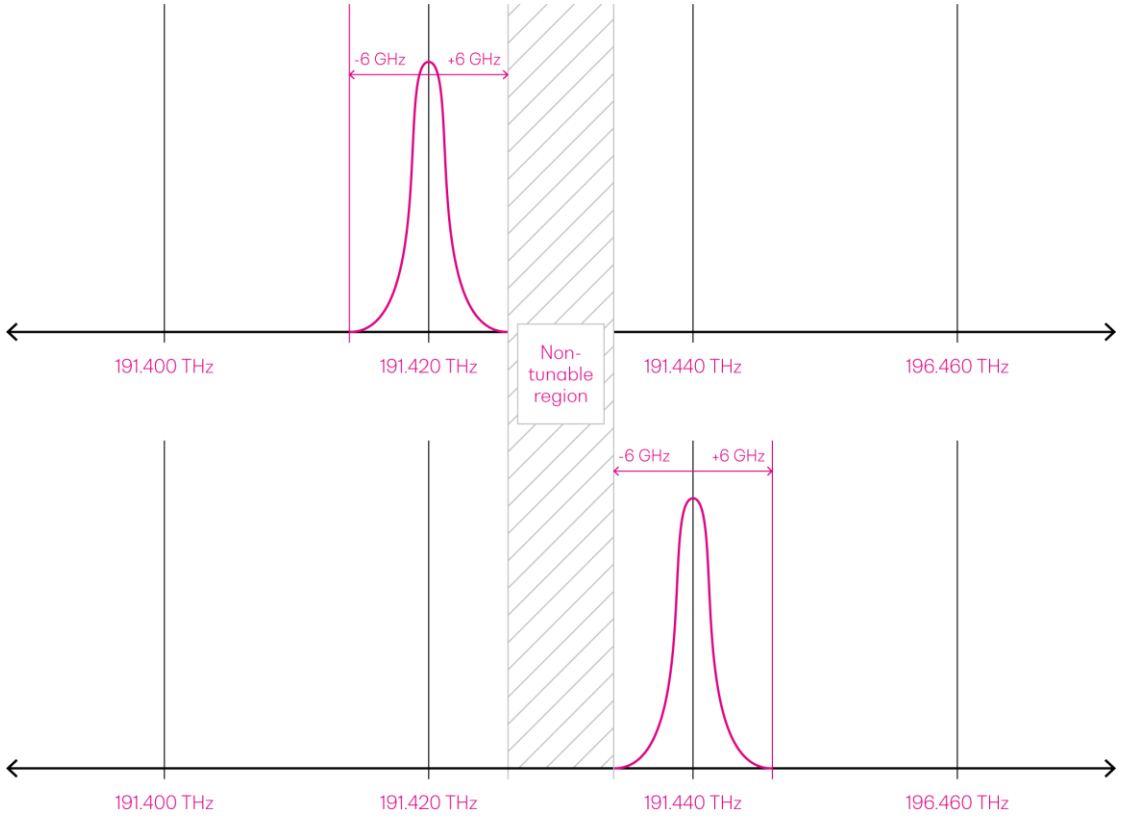


8.3.3 Frequency Fine tuning

Another option a user has is to use the FREQUENCY:FINE tuning functionality to tune the laser by +/- 6 GHz around the set GRID point value.

Commands	Description
`SOUR1:CHAN1:GRID` 1 GHz `SOUR1:CHAN1:FREQ` 193.414489 THz `SOUR1:CHAN1:FREQ:FINE?` -> 489 MHz `SOUR1:CHAN1:FREQ:FINE` 50 MHz `SOUR1:CHAN1:FREQ?` -> 193.414050 THz	- Query the frequency fine setting. - Fine tune the frequency by +50 MHz from the current GRID point (193.414 THz). - Query the current frequency setting

One thing to note is that if the GRID spacing has been set to a value larger than 6 GHz, then there will be a range of values that sit between adjacent frequency grid points which will be impossible to tune to, using the FINE tuning functionality. In the example below, the GRID spacing has been set to 20 GHz, meaning that between any two adjacent GRID points, there lies an 8 GHz region that is non-accessible. If tunability is a primary concern, it is suggested that the user set the GRID spacing to be <= 6 GHz.



8.4 Toggling Whisper mode on / off

The Laser 1000 Series product uses a frequency dither to allow the laser to tune the output frequency to the user set value. The Laser 1000 Series is able to tune and maintain the set frequency value by using a small frequency dither, which is part of the wavelength locking mechanism.

With the Laser-105X models, the user is able to turn off the frequency dither, with the Whisper mode functionality. Toggling the Whisper mode ON or OFF can be realised through CohesionUI or by the following command. See the Programming Guide (9) section of the User Manual for specific information about the listed command.

Commands	Description
`SOURce<n>:CHANnel<m>:WHISper/?`	- Set / query the whisper mode state of the laser.

8.4.1 Laser frequency dither and Whisper control

In order to tune to and lock on a specific frequency (wavelength), the laser uses a small frequency dither. The spectral magnitude of this dither is 48 MHz, at a dither rate of 888 Hz. With a laser that has Whisper mode functionality, a user has the ability to turn off this frequency dither after the set frequency has been tuned to and locked.

Even after a frequency set value has been tuned to, and locked onto, the frequency dither is still active, to ensure that the laser does not drift. If a customer wishes to use the laser without this frequency dither, it is recommended that the Whisper mode is only turned on for a few minutes, since the laser will drift with time, due to the environmental factors like ambient temperature.

It is important to note that the Whisper mode state is inversely mapped to the dither status of the laser.

Whisper mode state	Frequency dither status	Command
ON	Frequency dither is OFF	`SOURce<n>:CHANnel<m>:WHISper ON`
OFF	Frequency dither is ON	`SOURce<n>:CHANnel<m>:WHISper OFF`

In the following example, a user first sets an intended frequency value. After that, the user then turns on the Whisper mode to allow them to conduct their testing. Once the testing has been completed, the user can turn off the Whisper mode.

Commands	Description

`SOUR1:CHAN1:GRID 10 GHZ`
`SOUR1:CHAN1:FREQ 193.414489 THZ`
`SOUR1:CHAN1:WHIS? -> OFF`
`OUTP1:CHAN1:STATE ON`
`SLOT1:OPC?`
`SOUR1:CHAN1:FREQ:LOCK? -> TRUE`
`SOUR1:CHAN1:WHIS ON`
 	
`SOUR1:CHAN1:WHIS? -> ON`
	- Query the Whisper mode state of the laser.
	- Enable the laser.
	- Check that the laser OPC is returning 0, and that the laser frequency has been locked to the intended set value.
	- Now that the laser has been locked and is stable, turn on the Whisper mode.
	- Query the Whisper mode state of the laser.

Regardless of the laser output state, if any changes to the POWER, FREQUENCY or WAVELENGTH are made, the Whisper mode will be automatically turned OFF. This is because the laser requires the frequency dither to apply any of these changes, so it will automatically turn Whisper mode OFF, so that the user's changes can be applied.

9 Programming guide

Introduction

Remote communication with the CohesionSCPI service is achieved through the Standard Commands for Programmable Instruments (SCPI). Support for VISA I/O API over TCP/IP is provided by the VXI-11 compliant CohesionSCPI service. With VISA communication drivers installed on the client, the implementation of VISA programming within environments such as MATLAB becomes available.

This guide provides general information on the commands available to communicate with the CohesionSCPI service remotely using the VISA I/O.

> **⚠ IMPORTANT**
>
> In NI-MAX a RIO interface will show up, however there are no communication methods available or implemented on this interface. Quantifi Photonics products are **ONLY** accessible through the **VISA TCPIP INSTR** interface provided by the CohesionSCPI service installed on the system.

9.1 Programming conventions

This section details the programming and measurement conventions to follow while executing the commands for the CohesionSCPI service.

Parameter	Default Unit	Alternative Units
Power	DBM	DBM
Frequency	HZ	THZ, GHZ, MHZ, KHZ
Frequency Fine	HZ	THZ, GHZ, MHZ, KHZ
Wavelength	M	NM, PM

Argument	Data Format
`<wsp>`	Specifies whitespace character (01_{16} – 09_{16}, $0B_{16}$ – 20_{16}).
`<value>`	Is numerical data, an integer, a decimal, exponential (10e-9 or 5.8e6) or string
`[VALUE1|VALUE2]`	A parameter choice. The '|' separates the unique parameters available, only one of the choices can be used. In the example, either the input parameter `[VALUE1]` or `[VALUE2]` can be used, but not both. Some commands may have more than two choices available. This parameter can be omitted where the command has a default defined in the command description.

9.1.1 Index addressing of modules (slot, source) and units (channel)

When executing commands, it is almost always necessary to provide the index of a specific Laser module or an index of a specific installed unit.

For the commands that require index values:

- `<c>`: is the chassis index in which the specific blade module is installed; this is an integer, inclusive of 0.
- `<n>`: is the slot (or source) index of the specific blade module, this is an integer, <1 to 18>
- `<m>`: is the channel index of a specific unit in the module, this is an integer, <1 to 4>.

Message queues

Information is exchanged in the form of messages. These messages are held in input and output queues. The output queue stores responses to query commands. The CohesionSCPI service transmits any data in the output queue when a read request is received. Unless explicitly specified otherwise in the command description, all output response data is transmitted in ASCII format.

9.2 Common system command summary

Common Commands	Description
`*CLS`	-Clear Status command
`*IDN?`	-Query the chassis identification
`*OPC?`	-Query the Operation Complete Status
`*OPT?`	-Query the modules managed by the CohesionSCPI service
`*ESR?`	-Query the Standard Event Status Register

9.3 Common system command descriptions

Command	`*CLS`
Syntax	`*CLS`
Description	Clear Status command
Parameters	No parameters
Response	No response
Example	`*CLS`

Command	`*ESR?`
Syntax	`*ESR?`
Description	Query the Standard Event Status Register
Parameters	No parameters
Response	Unsigned integer 8 bit value for the register <0 to 255>, as a string. Bit — Description — Decimal Value 7 (MSB) — Not used — 0 6 — Not used — 0 5 — Command Error — 32 4 — Execution Error — 16 3 — Device dependent Error — 8 2 — Not used — 0 1 — Not used — 0 0 (LSB) — Not used — 0
Example	`*ESR? -> 8` `*ESR? -> 32`

⚠ IMPORTANT

It is recommended to use the `*ESR?` command query after every command that is sent to the device.

The `*ESR?` query will be able to catch:

- **Device dependent Error** – the device is reporting an error in operation
- **Execution Error** – SCPI was unable to execute the given command
- **Command Error** – SCPI was unable to parse the given command, likely due to an incorrect command.

Command	*IDN?
Syntax	*IDN?
Description	Query the chassis identification
Parameters	No parameters
Response	Comma separated string with the <manufacturer>,<server name>,<chassis controller name>,<server version>
Example	*IDN? -> Quantifi Photonics, CohesionSCPI service,PXIE-8133,FW2.0.15

Command	*OPC?
Syntax	*OPC?
Description	Query the Operation Complete Status
Parameters	No parameters
Response	1 is returned if all the modules installed in the chassis are ready to execute commands 0 is returned if any module installed in the chassis still has a command to execute in the input queue
Example	*OPC? -> 1

Command	*OPT?
Syntax	*OPT?
Description	Query the modules managed by the CohesionSCPI service
Parameters	No parameters
Response	Response will be a comma separated string of the installed modules in the chassis
Example	*OPT? -> ,LaserPXIe-1002-2-FA,SwitchPXIe-1003-1-FC,,VOAPXIe-1001-2-FA,,,,O2EPXIe-1001-1-FC,,,,,,,,,

9.4 Specific command summary

Slot commands	Description
:SLOT<n> :OPC? :OPTions? :IDN?	 -Query the status of the Operation Complete bit -Query the modules installed on the slot -Query the Identifier for the slot; returns the manufacturer, part number, serial number, hardware and firmware versions
Configuration commands	**Description**
:OUTPut<n> :CHANnel<m> :STATE/? :SOURce<n> :CHANnel<m> :POWer/? :WAVelength/? :FREQuency/? :FINE/? :GRID/? :WHISper/? :TEMPerature?	 -Set or query the optical output state of the laser -Set or query the laser output power -Set or query the laser output wavelength value, with 0.01 pm resolution -Set or query the laser output frequency value, with 1 MHz resolution -Set or query the fine tuning laser output frequency up to +/- 6 GHz around the closest GRID point, with 1 MHz resolution -Set or query the grid spacing -Set or query the Whisper mode state of the laser -Query the laser temperature

9.5 Specific command descriptions

9.5.1 Slot commands

Command	:SLOT<n>:OPC?
Syntax	:SLOT<n>:OPC?
Description	Query the status of the Operation Complete bit
Parameters	No parameters
Response	1 is returned if the module is ready to execute a new operation 0 is returned if the module is busy
Example	SLOT2:OPC? -> 1

Command	:SLOT<n>:OPTions?
Syntax	:SLOT<n>:OPTions?
Description	Query the modules installed on the slot
Parameters	No parameters
Response	The response will be a comma separated string of detectors installed in the Laser PXIe. If a module is not installed in a channel, it will not return any identification string
Example	SLOT2:OPT? -> 1,1,,

Command	:SLOT<n>:IDN?
Syntax	:SLOT<n>:IDN?
Description	Query the Identifier for the slot; returns the manufacturer, part number, serial number, hardware and firmware versions
Parameters	No parameters
Response	Comma separated string containing the <manufacturer>, <part number>, <serial number>,<hardware version><firmware version>
Example	SLOT2:IDN? -> Quantifi Photonics,LaserPXIe-1002-2-FA,QuantifiPhotonics-192001,HW1.0FW1.02 Hardware and firmware versions are not separated by a comma

9.5.2 Configuration commands

Command	:OUTPut<n>:CHANnel<m>:STATE
Syntax	:OUTPut<n>:CHANnel<m>:STATE<wsp>[ON|OFF]
Description	Set the optical output state of the laser
Parameters	ON: Enable the laser output OFF: Disable the laser output
Response	No response
Example	OUTP2:CHAN1:STATE ON

Command	:OUTPut<n>:CHANnel<m>:STATE?
Syntax	:OUTPut<n>:CHANnel<m>:STATE?
Description	Query the optical output state of the laser
Parameters	No parameters
Response	Returns the current output state of the laser
Example	OUTP2:CHAN1:STATE? -> ON

⚠ IMPORTANT

If the laser STATE is **ON** while setting POWer, WAVelength, FREQuency or FREQuency:FINE, there will be a minimal non-stable output generated during the transition to the new value when the configuration commands are executed.

It is recommended that the `:SLOT<n>:OPC?` command is run after setting any one of these parameters, to ensure the module is ready for the next operation.

Command	`:SOURce<n>:CHANnel<m>:POWer`
Syntax	`:SOURce<n>:CHANnel<m>:POWer<wsp><value>`
Description	Set the laser output power
Parameters	`<value>`: A valid numerical value which is in the range between the MIN and MAX power values
Response	No response
Example	`SOUR2:CHAN1:POW 13.00`

Command	`:SOURce<n>:CHANnel<m>:POWer?`
Syntax	`:SOURce<n>:CHANnel<m>:POWer?<wsp>[MIN|MAX|DEF|SET|ACT|ALL]`
Description	Query the laser output power
Parameters	`MIN`: Return the minimum programmable value `MAX`: Return the maximum programmable value `DEF`: Return the default value of power `SET`: Return the desired set value `ACT`: Return the current value (default) `ALL`: Returns all of the above parameters
Response	Depending on the parameters the response will be a single value, or a comma separated string of values
Example	`SOUR2:CHAN1:POW? -> 13.00` `SOUR2:CHAN1:POW? ALL -> 10.00,15.00,10.00,13.00,13.00`

Command	`:SOURce<n>:CHANnel<m>:WAVelength`
Syntax	`:SOURce<n>:CHANnel<m>:WAVelength<wsp><value>`
Description	Set the laser output wavelength value, with 0.01 pm resolution
Parameters	`<value>`: A valid numerical value which is in the range between the MIN and MAX wavelength values.
Response	No response
Example	`SOUR2:CHAN1:WAV 1.550000e-06`

Command	`:SOURce<n>:CHANnel<m>:WAVelength?`
Syntax	`:SOURce<n>:CHANnel<m>:WAVelength?<wsp><value>[MIN|MAX|DEF|SET|ACT|LOCK|ALL]`
Description	Query the laser output wavelength value, with 0.01 pm resolution
Parameters	`MIN`: Return the minimum programmable value `MAX`: Return the maximum programmable value `DEF`: Return the default value of wavelength `SET`: Return the set value (default) of the wavelength in the GRID `ACT`: Return the actual value of the SET wavelength `LOCK`: Query whether the laser is currently at the SET wavelength `ALL`: Returns all of the above parameters
Response	Depending on the parameters the response will be a single value, or a comma separated string of values. The lock parameter will return as `TRUE` or `FALSE`.

Example	`SOUR2:CHAN1:WAV? -> 1.550116e-06`
	`SOUR2:CHAN1:WAV? MAX -> 1.568773e-06`
	`SOUR2:CHAN1:WAV? ALL -> 1.527605e-06,1.568773e-06,`
	`1.548928e-06,1.550000e-06,1.550116e-06,FALSE`

Command	:SOURce<n>:CHANnel<m>:FREQuency
Syntax	:SOURce<n>:CHANnel<m>:FREQuency<wsp><value>
Description	Set the laser output frequency value, with 1 MHz resolution.
Parameters	<value>: A valid numerical value which is in the range between the MIN and MAX frequency values.
Response	No response
Example	SOUR2:CHAN1:FREQ 1.92e+14

Command	:SOURce<n>:CHANnel<m>:FREQuency?
Syntax	:SOURce<n>:CHANnel<m>:FREQuency?<wsp><value>[MIN|MAX|DEF|SET|ACT|LOCK|ALL]
Description	Query the laser output frequency value, with 1 MHz resolution.
Parameters	MIN: Return the minimum programmable value MAX: Return the maximum programmable value DEF: Return the default value of frequency SET: Return the set value (default) of the frequency in the GRID ACT: Return the actual value of the SET frequency LOCK: Query whether the laser is currently at the SET frequency ALL: Returns all of the above parameters
Response	Depending on the parameters the response will be a single value, or a comma separated string of values. The lock parameter will return as TRUE or FALSE
Example	SOUR2:CHAN1:FREQ? -> 1.92000000e+14

NOTE

You may use the **:SOURce<n>:CHANnel<m>:FREQuency? ACT** command to get the actual operating frequency of the laser, which includes the grid channel frequency as well as the fine-tuned frequency.

Command	:SOURce<n>:CHANnel<m>:FREQuency:FINE
Syntax	:SOURce<n>:CHANnel<m>:FREQuency:FINE<wsp><value>
Description	Set the fine tune laser output frequency up to +/- 6 GHz around the closest GRID point, with 1 MHz resolution.
Parameters	<value>: A valid numerical value in the frequency fine tuning range. Fine tuning can increase or decrease the frequency (positive or negative value). Valid range is from -6 GHz to 6 GHz in 1 MHz increments as detailed in the specifications.
Response	No response
Example	SOUR2:CHAN1:FREQ:FINE 2e+06

Command	:SOURce<n>:CHANnel<m>:FREQuency:FINE?
Syntax	:SOURce<n>:CHANnel<m>:FREQuency:FINE?<wsp>[MIN|MAX|DEF|SET|ALL]
Description	Query the fine tune laser output frequency up to +/- 6 GHz around the closest GRID point, with 1 MHz resolution.
Parameters	MIN: Return the minimum programmable value MAX: Return the maximum programmable value DEF: Return the default value of the fine-tuning frequency SET: Return the set value (default) of the fine-tuning frequency ALL: Returns all of the above parameters
Response	Depending on the parameters the response will be a single value, or a comma separated string of values
Example	SOUR2:CHAN1:FREQ:FINE? ALL -> -6.00000000e+09,6.00000000e+09,0.00000000e+00,2.00000000e+06

⚠ IMPORTANT

The Laser STATE must always be set to **OFF** before attempting to change the GRID spacing.

Command	:SOURce<n>:CHANnel<m>:GRID
Syntax	:SOURce<n>:CHANnel<m>:GRID<wsp><value>
Description	Set the grid spacing
Parameters	<value>: Is the channel grid spacing within the specification range given by the MIN and MAX grid values
Response	No response
Example	SOUR2:CHAN1:GRID 2.5e+09

Command	:SOURce<n>:CHANnel<m>:GRID?
Syntax	:SOURce<n>:CHANnel<m>:GRID?<wsp>[MIN|MAX|DEF|SET|ALL]
Description	Query the grid spacing
Parameters	MIN: Return the minimum programmable value MAX: Return the maximum programmable value DEF: Return the default value of the grid spacing SET: Return the set value of the grid spacing. ALL: Returns all of the above parameters
Response	Depending on the parameters the response will be a single value, or a comma separated string of values.
Example	SOUR2:CHAN1:GRID? SET -> 2.50000000e+09

⚠ IMPORTANT

- Whisper mode functionality is only available on the 105X models of the Laser 1000 Series.
- When a Whisper mode control command is issued, the module will be non-responsive for a short period of time (up to 5 seconds). Only the :SLOT<n>:OPC? command will execute during this period, all other commands will return an error, or time out. During this time, the front panel LED will blink rapidly, before returning to normal operation.
- When the Whisper mode state is set to ON, if either a POWer, FREQuency, or FREQuency:FINE adjustment is made, the Whisper mode control will automatically be switched OFF for these changes to take effect. The same timeout period as mentioned above will apply.
- Before turning Whisper mode control ON, ensure that the SOUR<n>:CHAN<m>:FREQ? LOCK or SOUR<n>:CHAN<m>:WAV? LOCK return True, and that the ACT power of the laser matches the SET power.

Command	: SOURce<n>CHANnel<m>:WHISper
Syntax	:SOURce<n>:CHANnel<m>:WHISper<wsp>[ON|OFF]
Description	Set the Whisper mode state of the laser
Parameters	ON: Enable the Whisper mode functionality on the laser OFF: Disable the Whisper mode functionality on the laser
Response	No response
Example	SOUR2:CHAN1:WHIS ON

Command	:SOURce<n>:CHANnel<m>: WHISper?
Syntax	:SOURce<n>:CHANnel<m>: WHISper?
Description	Query the Whisper mode state of the laser
Parameters	No parameters
Response	Current Whisper mode state of the laser
Example	SOUR2:CHAN1:WHIS? -> ON

Command	:SOURce<n>:CHANnel<m>:TEMPerature?
Syntax	:SOURce<n>:CHANnel<m>:TEMPerature?
Description	Query the laser temperature.
Parameters	No parameters
Response	Temperature in Celsius
Example	SOUR2:CHAN1:TEMP? -> 49.99000168

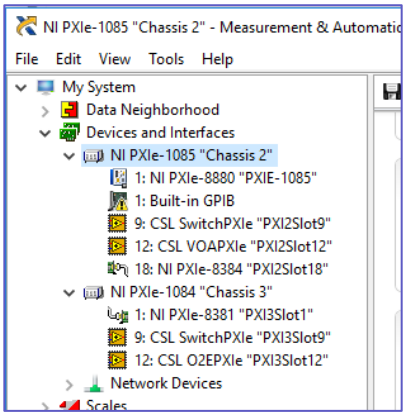
9.6 Laser 1000 PXIe Multi Chassis mode operation

Multiple chassis can be connected to operate in **Multi Chassis Mode.** To operate in Multi Chassis Mode, **CohesionSCPI service must be version 1.02.06** or later.

9.6.1 NI-MAX application Multi Chassis mode

> **⚠ IMPORTANT**
>
> The CohesionSCPI service does not manage the chassis numbers. These are controlled by the NI Platform Services (and through NI-MAX).
>
> Even if the CohesionSCPI service is in Multi Chassis mode, if a chassis is connected but has no installed modules, it will not show up when **`*OPT?`** is run.

In the example shown below, there are two chassis connected via the PXIe-8384 to PXIe-8381 connection. Chassis #2 has the controller running CohesionSCPI service, and Chassis #3 is the 'extended' chassis.



9.6.2 SCPI Multi Chassis commands

Command	:SYSTEM:CHASSIS?
Syntax	:SYSTEM:CHASSIS?<wsp>[LIST|MODE]
Description	Query the Chassis Mode configuration
Parameters	No parameters
Response	`LIST`: Returns a comma separated list of valid chassis index numbers discovered by the CohesionSCPI service. These are chassis that have modules installed `MODE`: Returns the current Chassis Mode the CohesionSCPI service is operating in (`SINGLE` or `MULTI`) `None`: Returns the number of chassis managed by the CohesionSCPI service. If operating in SINGLE mode, this will always return `1`
Example	In Single chassis mode: SYSTEM:CHASSIS? -> 1 SYSTEM:CHASSIS? LIST -> 0 SYSTEM:CHASSIS? MODE -> SINGLE In Multi chassis mode: SYSTEM:CHASSIS? -> 2 SYSTEM:CHASSIS? LIST -> 2,3 SYSTEM:CHASSIS? MODE -> MULTI

⚠ IMPORTANT

Changing the CohesionSCPI service Chassis Mode will rediscover all Chassis and installed modules.

Command	`:SYSTEM:CHASSIS`
Syntax	`:SYSTEM:CHASSIS<wsp>[SINGLE|MULTI]`
Description	Set the Chassis Mode configuration
Parameters	SINGLE: Set CohesionSCPI service to operate in SINGLE Chassis Mode MULTI: Set CohesionSCPI service to operate in MULTI Chassis Mode
Response	No response
Example	`SYSTEM:CHASSIS SINGLE`

In Multi chassis mode, all the commands given above in the Specific Command Summary will still work, but they must be prefixed with `:CHASSIS<c>`.

Common command example:

Single Chassis Mode	`SLOT2:IDN?`
Multi Chassis Mode	`CHASSIS1:SLOT2:IDN?`

Specific command example:

Single Chassis Mode	`SOUR2:CHAN2:POW? MAX`
Multi Chassis Mode	`CHASSIS1 SOUR2:CHAN2:POW? MAX`

10 Example: Control of a Laser 1000 Series with SCPI

The following is a simple example of how to control the Laser 1000 Series using SCPI commands. See the previous section for specific details and extra parameters that the listed commands accept.

After any command, it is recommended to query the `*ESR?` command. This will allow debugging of unreceived or incorrect commands that were sent to the Laser product.

Identifying the Laser product:

1. Query to confirm the correct instrument/PXIe chassis is setup
   `:*IDN?`
2. Query the available instrument module configuration
   `:*OPT?`
3. Query the identification information for a specific slot module
   `:SLOT3:IDN?`

Configuring the Laser product:

1. Set the Laser output power to 10 dBm
   `:SOURce2:CHANnel1:POWer 10 DBM`
2. Set the Laser frequency to 193.4145 THz (1550 nm)
   `:SOURce2:CHANnel1:FREQuency 193.4145 THZ`
3. Turn the Laser ON
   `:OUTPut2:CHANnel1:STATE ON`

> **⚠ IMPORTANT**
> After setting the Laser STATE to ON, **allow 30 seconds for the laser power and frequency to stabilize and reach the set point.** Any POWER or FREQUENCY (WAVELENGTH) queries during this time may return incorrect information.

Querying the Laser product configuration values:

1. Query the Laser actual power
   `:SOURce2:CHANnel1:POWer?`
2. Query the Laser set frequency
   `:SOURce2:CHANnel1:FREQuency?`

Using the FREQuency:FINE command to tune the Laser product:

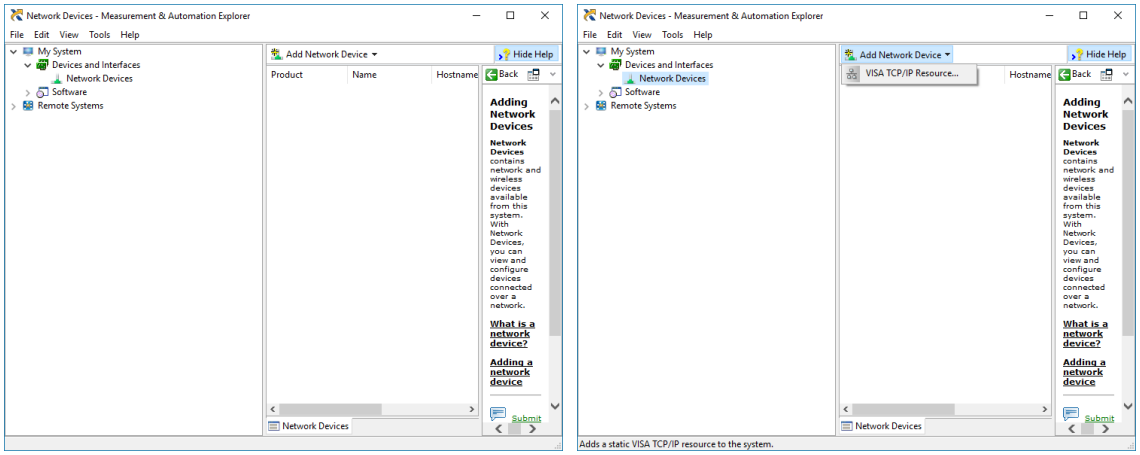
1. Fine tune the Laser by -1 MHz (-0.01 pm) around the set frequency
   `:SOURce2:CHANnel1:FREQuency:FINE +1.0 MHZ`
2. Query the Laser set fine tune frequency
   `:SOURce2:CHANnel1:FREQuency:FINE?`

The following section details the various methods that a user may send these commands to the **PXIe Module** via **SCPI** commands:

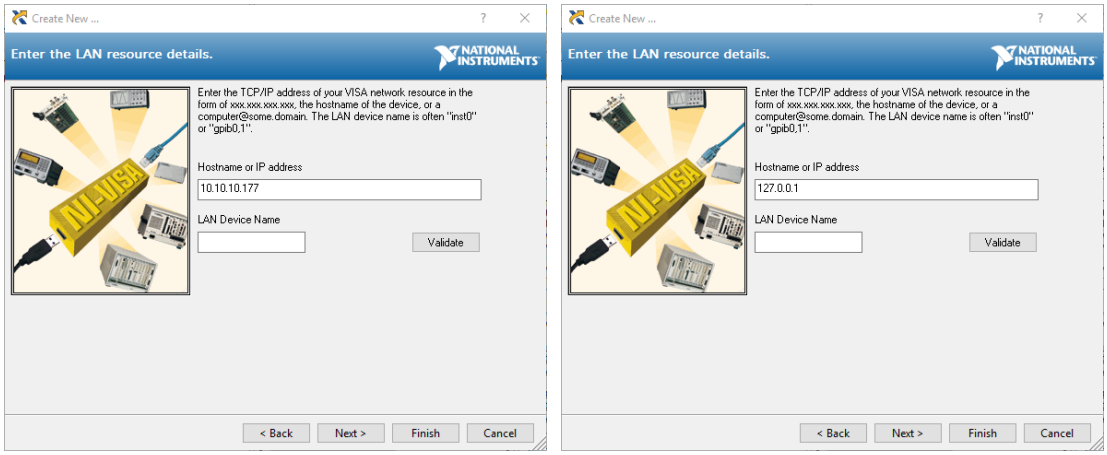
10.1 NI-MAX application

To communicate with any Quantifi Photonics PXIe module, the chassis must first be setup as a TCP/IP instrument.

1. After installing NI-MAX, launch the application. In the left side pane of the window, click the **Devices and Interfaces** option. A drop down of available instruments detected will show up.
2. Click on **Network Devices**, then click **Add Network Devices** and select **VISA TCP/IP Resource**.



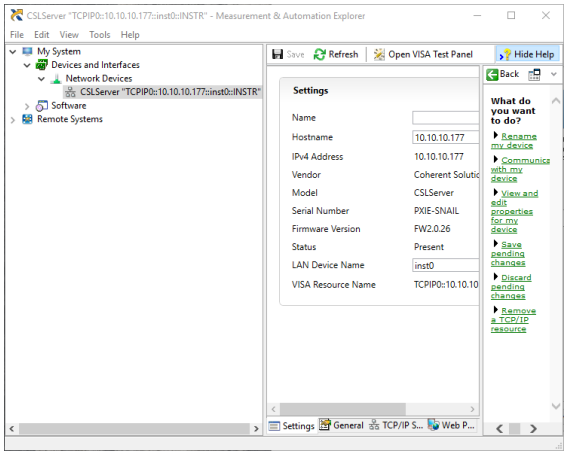
3. Select **Manual Entry of LAN Instrument**. Enter in the Hostname or IP Address. The top image is an example of operating remotely, the bottom image is an example of operating locally. Note when operating locally, enter in the localhost IP address of **127.0.0.1**. Click **Finish** to end the setup process.



10.2 NI-VISA application

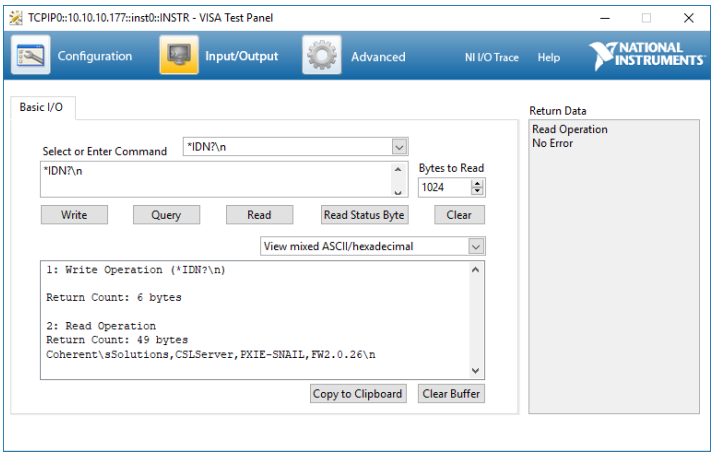
NI-VISA is used to communicate with the PXIe chassis or installed modules. The above steps must be completed before attempting to communicate using NI-VISA.

1. Launch NI-MAX. In the left-hand side menu, select an Instrument from the **Network Devices** list.



2. On the righthand side panel, select **Open VISA Test Panel**. A new window will popup. Click the **Input / Output** button from the window menu.

   Valid chassis and module commands can be entered in, and their returns queried.



10.3 Python® 2.7 code example

The following example shows how to communicate with a PXIe module using Python code. For a list of supported and valid SCPI commands, refer to the **Programming Guide**.

```
# You can get VXI11 from pip:
# pip install python-vxi11==0.9
import vxi11
from vxi11.vxi11 import Vxi11Exception
# replace this with the IP of your device
ip = "127.0.0.1"
try:
	print("connecting to " + ip + " ... ")
	instrument = vxi11.Instrument(ip)
	print("connected")
	print("checking IDN...")
	command = "*IDN?"
	data = instrument.ask(command)
	print("IDN: " + data)
	print("checking OPT...")
	command = "*OPT?"
	data = instrument.ask(command)
	print("OPT: " + data)
	# replace this with a valid command for your device (read # the programming
	guide section for examples)
	command = ""
	print("writing a specific command")
	instrument.write(command)
	print("checking ESR")
	command = "*ESR?"
	data = instrument.ask(command)
	print("*ESR?: " + data)
except Vxi11Exception as e:
	# pass
	print("ERROR" + str(e) + ", command: " + str(command))
```

10.4 MATLAB® code example

To communicate with PXIe module in MATLAB® the installation of a VISA IO driver is required. These drivers enable the creation of the Interface Object for instrument communication.

If developing locally on the PXI Platform, then these will already be installed. However, if development is on a remotely connected system the VISA Libraries, e.g. National Instruments NI-VISA will have to be installed.

> **⚠ IMPORTANT**
> MATLAB 2010x or later with the Instrument Control Toolbox is required to execute the code detailed in this section.

The following example shows how to communicate with a PXIe module using MATLAB code. For a list of supported and valid SCPI commands, refer to the **Programming Guide**.

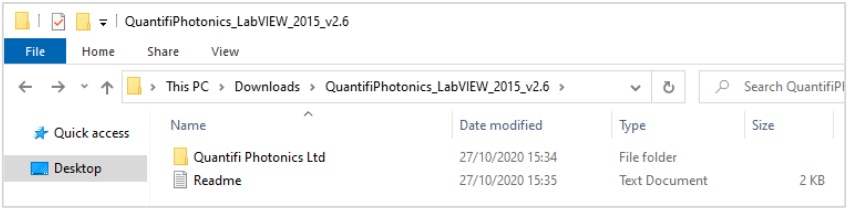
```
% Find a VISA-TCPIP object. This is if the VISA object has already been
% created with tmtool or has been removed from the workspace without
% first being closed (cleanly disconnected).
PXIE_Chassis = instrfind('Type', 'visa-tcpip', ...
       'RsrcName', 'TCPIP0::10.10.10.89::inst0::INSTR', 'Tag', '');
% Create the 'agilent' VISA-TCPIP object if it does not exist
% otherwise use the object that was found.
if isempty(PXIE_Chassis)
       PXIE_Chassis = visa('agilent', 'TCPIP0::10.10.10.89::inst0::INSTR');
else
       fclose(PXIE_Chassis);
       PXIE_Chassis = PXIE_Chassis (1);
end
% Open the connection to the VISA object.
fopen(PXIE_Chassis);
% Query the PXIE_Chassis.
response = query(PXIE_Chassis, '*IDN?');
disp('The *IDN query response:');
disp(response);
response = query(PXIE_Chassis, '*OPT?');
disp('The *OPT query response:');
disp(response);
% Replace this with a valid command for your device (read the programming
% guide section for examples)
command = ''
% Close the connection to the object.
fclose(PXIE_Chassis);
% Clean up all objects.
delete(PXIE_Chassis);
```

10.5 LabVIEW™ application

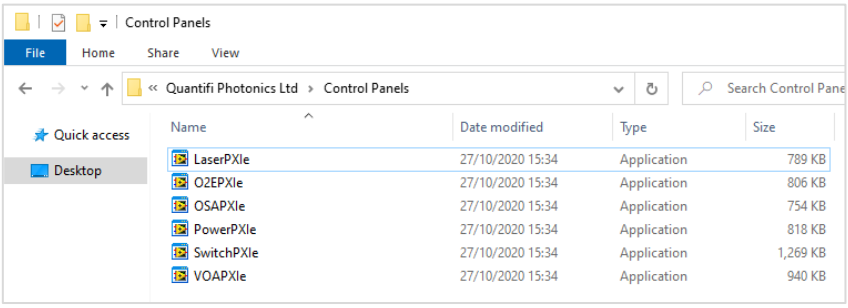
10.5.1 Soft Panels

To control the PXIe modules with a LabVIEW™ Soft Panel, you will need to have setup the chassis as a TCP/IP Resource as shown in Section 10.1.

1. Download the LabVIEW zip file from the Quantifi Photonics website. This contains all the Soft Panels and Virtual Instruments (VIs) for Quantifi Photonics PXIe modules.



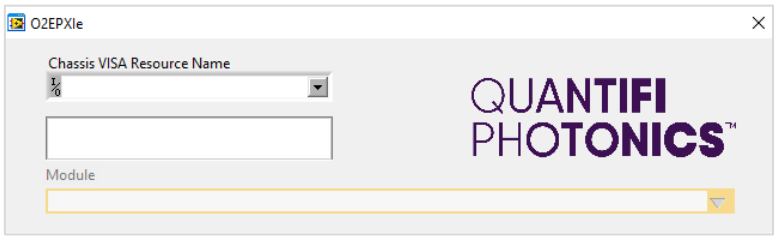
2. Open the Control Panels folder and select the corresponding Soft Panel for the desired PXIe module. Because these are executables, they will need LabVIEW Runtime Engine 2015 to run.



⚠ IMPORTANT

If LabVIEW Runtime Engine 2015 is not present, a system dialog will pop up. To proceed download the Runtime Engine (more information on LabVIEW website).

3. Once the desired executable has been run, select the VISA Resource corresponding to the intended instrument.



Note this step depends on the setup process shown in Section 10.1. If the instrument has not been setup, then the Soft Panel cannot be used.

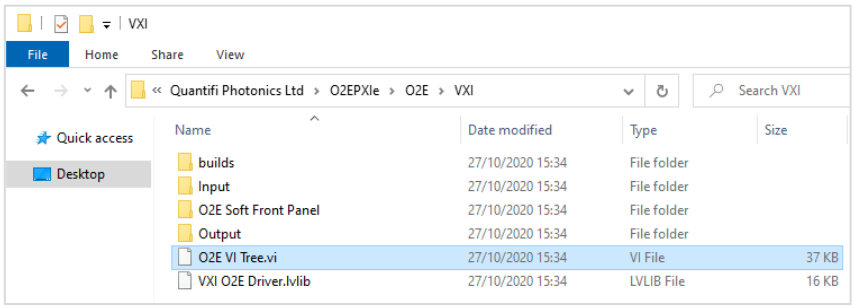
10.5.2 LabVIEW™ Virtual Instruments (VIs)

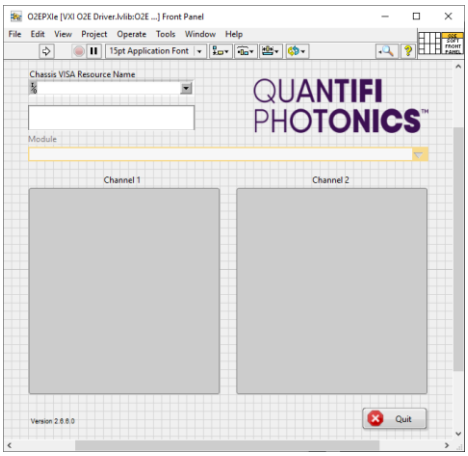
Instead of using the Soft Panels, the Virtual Instruments can also be used to control the PXIe module from within LabVIEW. These VIs are provided for customers who want to develop custom applications using the PXIe modules.

1. Copy the QuantifiPhotonics_LabVIEW_2015_v2.6 > **Quantifi Photonics Ltd** folder to the following path:
   C:\Program Files\National Instruments\LabVIEW 20XX\instr.lib\

2. Within the Quantifi Photonics Ltd folder, navigate to the intended module's sub folder.
   e.g. Quantifi Photonics Ltd > O2E > O2E > VXI

This VI Tree can then be added into the desired development project, therefor the Soft Panel can be rebuilt and used by other LabVIEW Runtime Engine.





11 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the product free of dust.
- Store product 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 product, power off the chassis or the MATRIQ instrument immediately. Remove the product and allow to dry completely.

WARNING

The use of controls, adjustments, and procedures other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.

11.1 Annual calibration schedule

To ensure that the Laser product is performing as expected, it is recommended that the product be sent in for annual re-calibration. As an optical product will naturally degrade over time, it is important to periodically re-test the product, to confirm that it is working as expected.

All Quantifi Photonics products are calibrated during manufacture, and each product is shipped to the customer with a Calibration Certificate. On this certificate, the calibration date, as well as the next calibration due date are mentioned.

It is recommended that the customer return their product for re-calibration before the listed due date, to ensure continued performance of their product. For re-calibration service information, or to send in a product for re-calibration service, customers can email service@quantifiphotonics.com.
If the Calibration Certificate has been misplaced, or the calibration due date is not known, the customer can email this address for support.

12 Technical support

12.1 Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact Quantifi Photonics. The Technical Support Group is available to take your calls from Monday to Friday, 9:00 a.m. to 5:00 p.m. (New Zealand Time).

Technical Support Group

Tel.: +64 9 478 4849

Fax: +64 9 478 4851

support@quantifiphotonics.com

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

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

13 Warranty

13.1 General information

Quantifi Photonics Ltd. (Quantifi Photonics) warrants from the date of the original shipment (the Warranty Period) that this product will conform to specifications and will be free from defects in material and workmanship for the applicable Warranty Period. Quantifi Photonics also warrants that the equipment will meet applicable specifications under normal use.

⚠ IMPORTANT

The warranty can become null and void if:

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

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL QUANTIFI PHOTONICS BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.
For full warranty terms and conditions, please visit www.quantifiphotonics.com.

13.2 Liability

Quantifi Photonics 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.

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

13.3 Exclusions

Quantifi Photonics 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 Quantifi Photonics products are not covered by this warranty.

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

13.4 Certification

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

13.5 Service and repairs

To send any equipment for service, repair or calibration please contact the Technical Support Group.

Test.
Measure.
Solve.

Quantifi Photonics is transforming the world of photonics test and measurement. Our portfolio of optical and electrical test instruments is rapidly expanding to meet the needs of engineers and scientists around the globe. From enabling ground-breaking experiments to driving highly efficient production testing, you'll find us working with customers to solve complex problems with optimal solutions.

To find out more, get in touch with us today.

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