QUANTIFI PHOTONICS®
A Teradyne Company

SWITCH

1000 SERIES

Optical switch

MATRIQ User Manual



quantifiphotonics.com

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EU Authorized Representative
Certification Company
Veluwezoom 42
1327 AH ALMERE
The Netherlands
+31 (0)36 202 40 37
info@certification-company.com

Manufacturer information

Quantifi Photonics Limited
12-14 Parkway Drive
Rosedale, Auckland 0632
New Zealand

User manual version: 5.10

Table of contents

1 What's in this user manual? 6

2 Conventions 7

3 Safety information 8

3.1 Optical laser radiation precautions 8

3.2 Electromagnetic compatibility 8

3.3 Electrostatic discharge precautions 9

4 Introducing the SWITCH Series 10

4.1 Hardware description 11

4.1.1 1x4 SWITCH instrument 11

4.1.2 Crossover SWITCH instrument 12

4.1.3 1x12 SWITCH instrument 13

4.2 Port mappings 14

4.2.1 MTP-12 connectors 14

4.3 Status LEDs 15

4.3.1 1x1 & 1x4 SWITCH 15

4.3.2 1x2 SWITCH 15

4.3.3 Crossover SWITCH 15

4.3.4 Duplex SWITCH 16

4.3.5 1xN SWITCH 16

4.3.6 NxN SWITCH 16

4.4 Environmental conditions 17

5 Setting up hardware 18

5.1 Set up your SWITCH product and power ON 19

5.2 Instrument IP address 20

6 Managing your product with Cohesion Operator 21

6.1 Install the Cohesion Operator software package 23

6.2 Connect with an instrument and retrieve instrument information 24
6.3 Set a hostname 25
6.4 Upgrade firmware 26
6.5 Restore factory settings 28
7 CohesionUI - Overview 29
7.1 Access instruments with CohesionUI 30
7.2 Change the instrument IP address 32
7.3 View system information 34
8 Controlling your SWITCH with CohesionUI 35
8.1 SWITCH 1000 / 1100 / 1300 / 1400 Series 35
9 Controlling your SWITCH with SCPI commands 36
9.1 Overview 36
9.2 Programming conventions 36
9.2.1 Index addressing of modules (slot, source) and units (channel) 37
9.3 Status and event registers 37
9.3.1 Standard Event Status Register 37
9.3.2 Standard Event Status Enable Register (Mask) 37
9.3.3 Status Byte Register 38
9.3.4 Service Request Enable Register (Mask) 38
9.3.5 Status and event registers diagram 39
9.4 Command summary 40
9.4.1 Common commands 40
9.4.2 System commands 40
9.4.3 Slot commands 40
9.4.4 Configuration commands 41
9.5 Command descriptions 42
9.5.1 Common commands 42

9.5.2 System commands ... 43
9.5.3 Slot commands ... 44
9.5.4 Configuration Commands ... 45
9.6 Programming example: Control of the SWITCH with SCPI ... 47
9.7 SCPI Command Console ... 48
10 Programming applications ... 51
10.1 Setting up NI-MAX application ... 52
10.2 Setting up NI-VISA application ... 53
10.3 Python® code example ... 54
10.4 MATLAB® code example ... 55
11 Working with optical fibers ... 56
12 System requirements ... 58
13 Maintenance ... 59
13.1 Annual calibration schedule ... 59
14 Technical Support ... 60
14.1 Contacting the Technical Support Group ... 60
14.2 Transportation ... 60
15 Warranty Information ... 61
15.1 General information ... 61
15.2 Liability ... 61
15.3 Exclusions ... 62
15.4 Certification ... 62
15.5 Service and repairs ... 62

1 What's in this user manual?

You can find the following information in this document:

Before you begin	Conventions Safety information Working with optical fibers System requirements
Getting started	Introducing the SWITCH Series Setting up hardware Managing your product with Cohesion Operator Instrument IP address
Working with your device	**CohesionUI GUI:** CohesionUI - Overview Controlling your SWITCH with CohesionUI **SCPI commands:** Controlling your SWITCH with SCPI commands Programming applications
Maintenance	Upgrade firmware Restore factory settings

2 Conventions

Please make yourself familiar with these conventions; we use them throughout this user manual:

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** or **component damage**.

Do not proceed unless the required conditions are met and understood.

NOTE

Indicates relevant information that requires your attention.

3 Safety information

Carefully read all safety information before using your Quantifi Photonics product.

3.1 Optical laser radiation precautions

The laser class of the end product is determined by the external laser source connected to the system and the final system configuration.

WARNING

To protect yourself from harm caused by optical radiation:

- Do not install or terminate fibers while the light source is active.
- Turn the Quantifi Photonics product OFF before inspecting the end face(s) of the product, or any optical patch cords connected to it.
- Never look directly into a live fiber; ensure that your eyes are protected at all times.
- Equip all unused ports with protective caps or blanking covers.

CAUTION

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

3.2 Electromagnetic compatibility

CAUTION

For electromagnetic compatibility, this product 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.

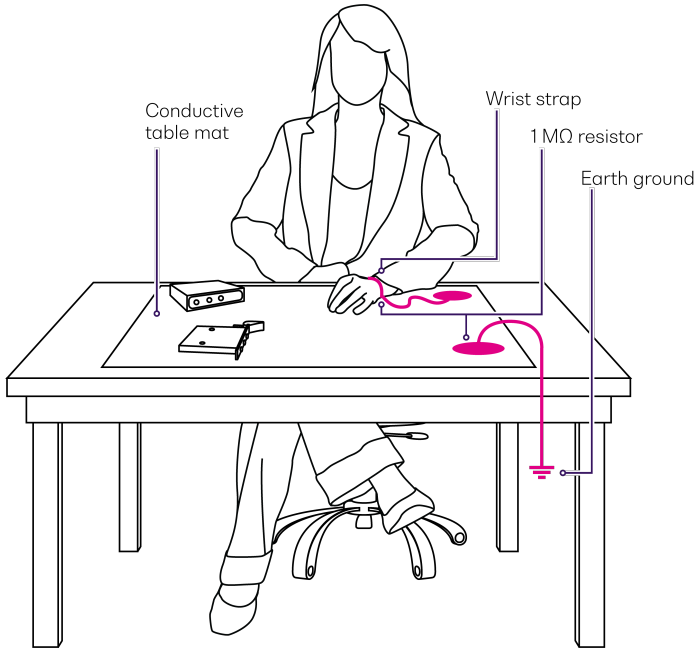

This symbol on the unit refers to documentation provided with the product for related safety information. Ensure that the required conditions are met and understood before using the product.

3.3 Electrostatic discharge precautions

CAUTION

The product is sensitive to electrostatic discharge (ESD). To ensure that you do not cause ESD damage to the product:

- Always follow proper grounding and ESD management practices.
- Store the unused product in the original protective electrostatic packaging that it was shipped in.
- Use a wrist strap and grounding table mat when unpacking or handling the product.



4 Introducing the SWITCH Series

The SWITCH Series is an efficient solution for test procedure automation. The MEMS based optical switch ensures repeatable and low-loss switching to various test set-ups while taking advantage of the flexible connectivity and high channel density form-factor.

NOTE

All Crossover and Duplex Switch instruments DO NOT HAVE A PARK STATE. When plugging optical fibres into the ports or inspecting fibres, ensure that the optical source is OFF to prevent user injury.



Programming interfaces

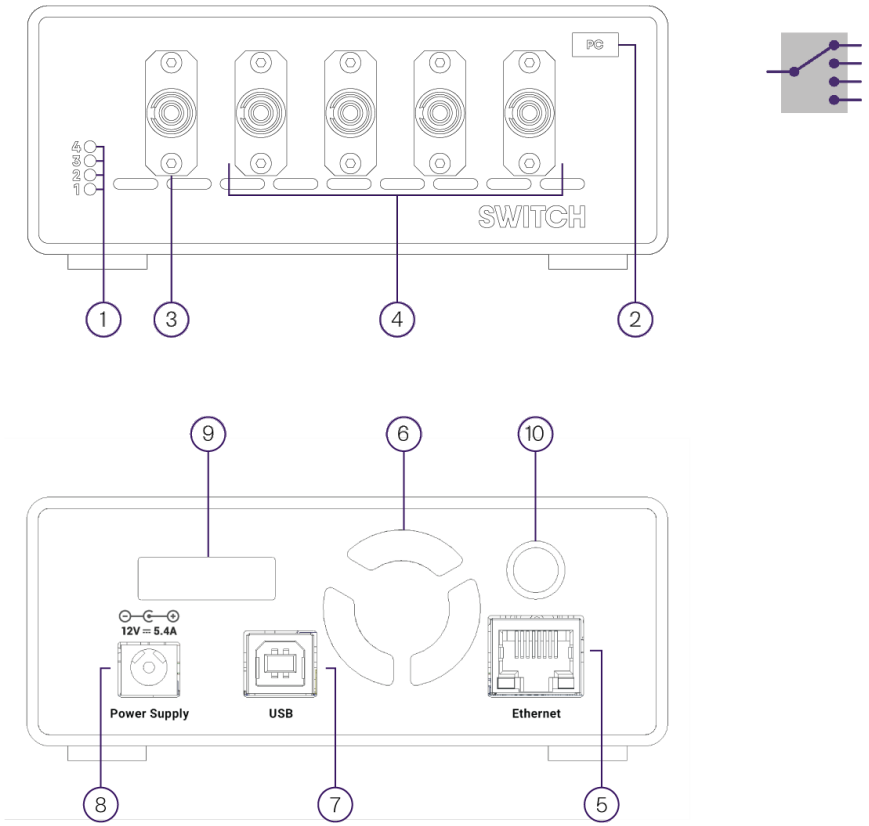
Through its programming interfaces you can take advantage of the SCPI-compliant command language and choose from programming tools such as LabView, C++, Python, or any of the other popular programming languages used to control automatic test equipment (ATE).

CohesionUI™

Quantifi Photonics' web-based graphical user interface CohesionUI is hosted on Microsoft Windows® and enables you to control your device from any supported web browser.

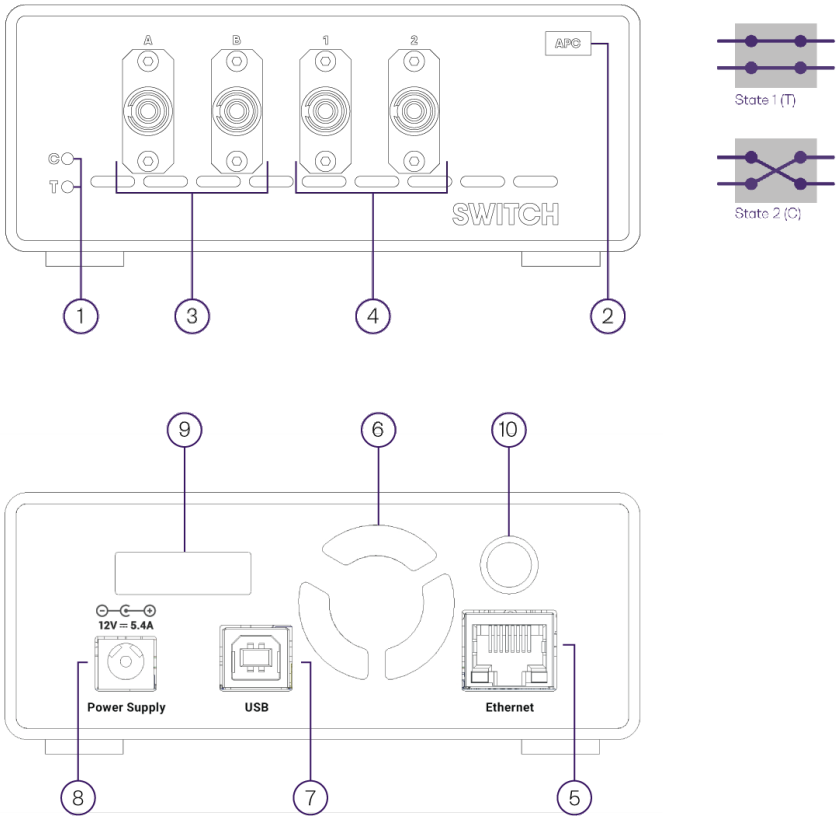
4.1 Hardware description

4.1.1 1x4 SWITCH instrument



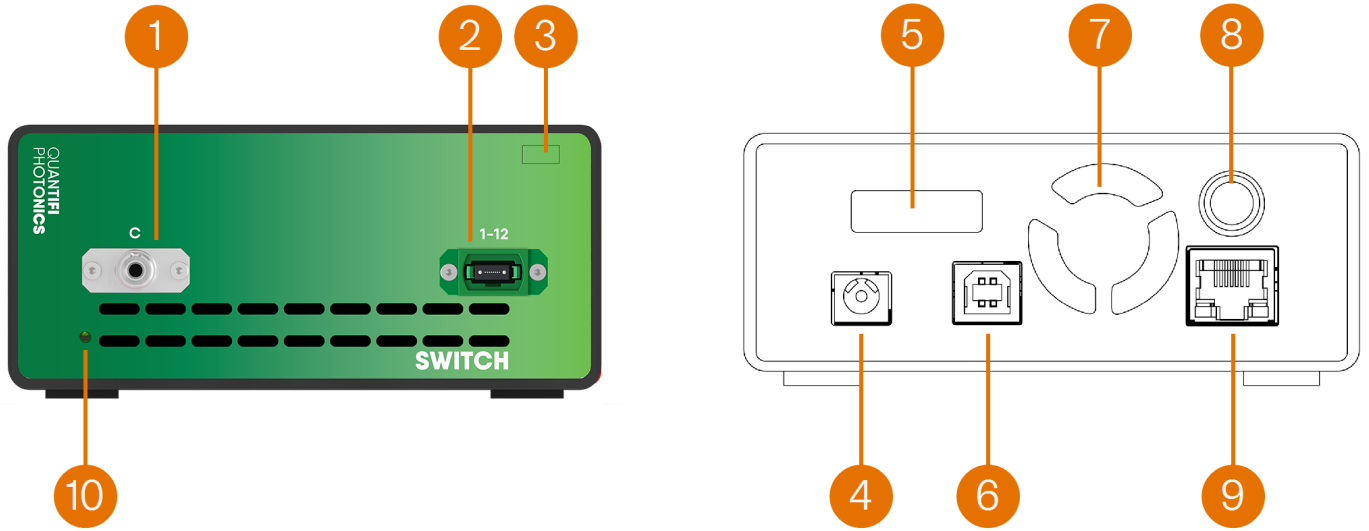
1	Status LEDs	6	Ventilation fan (DO NOT OBSTRUCT)
2	Optical connector type	7	USB type B port
3	Common optical port	8	Power supply port
4	Routing optical ports	9	IP address LCD screen
5	Ethernet port	10	On / Off push button

4.1.2 Crossover SWITCH instrument



1	Status LEDs	6	Ventilation fan (DO NOT OBSTRUCT)
2	Optical connector type	7	USB type B port
3	A & B optical ports	8	Power supply port
4	1 & 2 optical ports	9	IP address LCD screen
5	Ethernet port	10	On / Off push button

4.1.3 1x12 SWITCH instrument

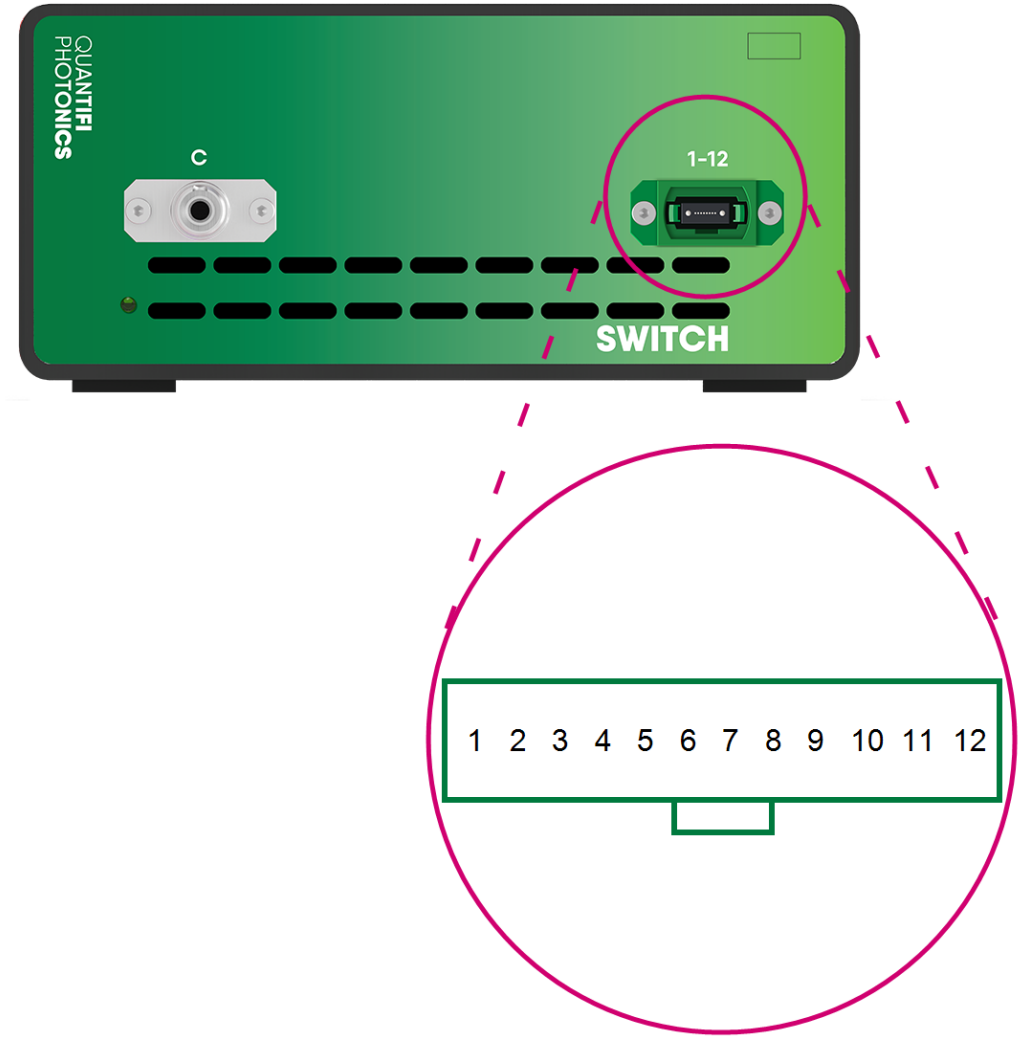


1	Common optical port	6	USB type B port
2	Routing optical port	7	Ventilation fan (DO NOT OBSTRUCT)
3	Optical connector type	8	On / Off push button
4	Power supply port	9	Ethernet port
5	IP address LCD screen	10	Status LED

4.2 Port mappings

4.2.1 MTP-12 connectors

MTP-12 connectors on SWITCH MATRIQ modules are mapped as follows:



4.3 Status LEDs

The Status LEDs denote the operation state of the SWITCH products. The definition of LED states varies between switch models as shown below.

4.3.1 1x1 & 1x4 SWITCH

LED	Meaning
OFF	The SWITCH is powered OFF, or The SWITCH is in the PARK state (State 0).
flashing YELLOW	Indicates initialization on startup.
solid RED	Indicates a SWITCH error. Most often this means an invalid route position.
solid GREEN	Indicates which state the SWITCH is routed to.

4.3.2 1x2 SWITCH

LED	Meaning
OFF	The SWITCH is powered OFF
solid GREEN	Indicates successful initialization and communication.
solid RED	Indicates a SWITCH error. Most likely an initialization error at startup.

4.3.3 Crossover SWITCH

The SWITCH xx04 is a 2x2 crossover switch. This means that it has only 2 valid states: **Transmit (T)** and **Cross (C)**.

LED	Meaning
OFF	The SWITCH is powered OFF
solid GREEN	Indicates which state the SWITCH is in (default is **T**).
solid RED	Indicates there was an error in switching states. Only 1 LED will light up.

4.3.4 Duplex SWITCH

The SWITCH xx05 is a duplex switch. This means that it has only 2 valid states: **1** and **2**.

LED	Meaning
OFF	The SWITCH is powered OFF
solid GREEN	Indicates which state the SWITCH is in (default is **1**).
flashing RED	Indicates there was an error in switching states. Only 1 LED will light up.

4.3.5 1xN SWITCH

LED	Meaning
OFF	The SWITCH is powered OFF
flashing YELLOW	Indicates initialization on startup.
solid GREEN	Indicates successful initialization and communication.
solid RED	Indicates a SWITCH error. Most likely an initialization error at startup.

4.3.6 NxN SWITCH

LED	Meaning
OFF	The SWITCH is powered OFF
flashing YELLOW	Indicates initialization on startup.
solid GREEN	Indicates successful initialization and communication.
solid RED	Indicates a SWITCH error. Most likely an initialization error at startup.

4.4 Environmental conditions

Range of environmental conditions:

Indoor or outdoor use	Indoor only
Altitude	Max. 2000m
Operating temperature range	5°C to 40°C | 41°F to 104°F
Storage temperature range	-40°C to 70°C | -40°F to 158°F
Relative humidity range	20% to 80%
DC voltage supply	12V DC, 5.41A
Pollution degree	2

5 Setting up hardware

Follow the instructions in this section when setting up your instrument.

CAUTION

The product is sensitive to electrostatic discharge (ESD). To prevent damage from ESD:

- Do not remove the product from the antistatic packaging until required to do so.
- Wear a grounded wrist strap at all times when handling the product.

CAUTION

Skin contact may leave corrosive residue and damage a connector:

- Always clean optical end faces before mating.

NOTE

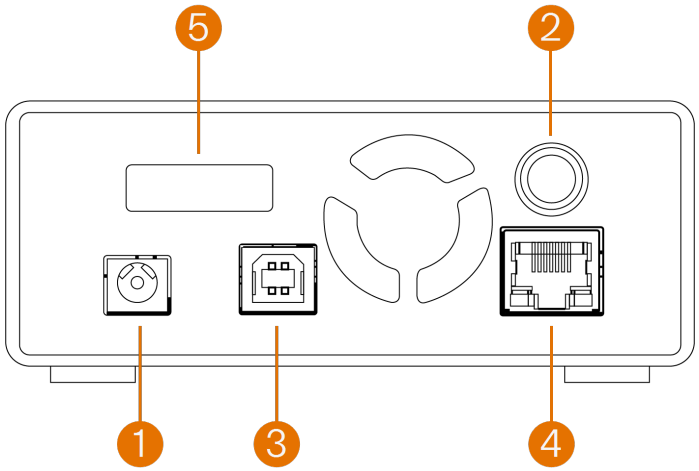
- You must use the external power supply that has been supplied by Quantifi Photonics with the unit. Any attempt to use a different external power supply may cause product damage and will void your warranty.
- The external power supply that has been supplied with the unit can only be used with that unit. Do not use it with any other product.
- DO NOT attempt to remove or adjust any component of the product while the power is on. Ensure the product is powered OFF, and that the correct handling procedure detailed herein is followed when you remove or install any products.

NOTE

Please check for the fiber end-face type of the optical ports, such as PC or APC, and only use the same type optical connector to avoid damaging the end-face.

For advice on connector and fiber care, please refer to Working with optical fibers.

5.1 Set up your SWITCH product and power ON



▶ To set up your instrument and power ON:

To allow for optimal air flow and avoid thermal issues, do not block the ventilation fans in the front and back of the instrument and set up your instrument with a minimum clearance of 2 inches (50.8mm) around it.

1. Insert the power cord - you must use the IEC cable supplied with the unit.
2. Power the instrument ON by pushing the ON button.
3. Connect to a client computer using a USB cable,

   OR
4. Connect to your network or client computer using an Ethernet cable.
5. The instrument IP address will appear on the LCD screen. When the unit is connected via both Ethernet and USB cable, both the Ethernet and USB IP addresses are displayed.

After powering ON, please wait at least **1 minute** before attempting to communicate with the unit. This gives the unit time to finish boot procedures and initialize the communication server.

5.2 Instrument IP address

To access your Quantifi Photonics instrument from a client computer, you need the IP address of the instrument.

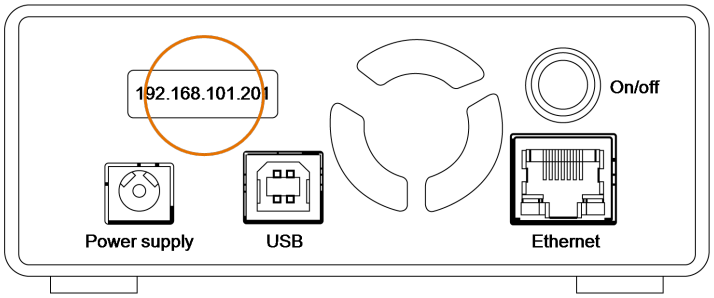
Your instrument can have two different IP addresses depending on your chosen connection method (USB or Ethernet):

- The default **USB IP address** is **192.168.101.201**. This is a static address set during instrument calibration.
- The default **Ethernet IP address** is dynamically assigned by the DHCP.

▶ To view an instrument's IP address:

With your instrument powered ON, you can view the current IP address on the LCD display.

If your instrument is connected with both, Ethernet and USB cables, both the USB and Ethernet IP address are displayed.



▶ To change an instrument's IP address:

You can change the instrument's static USB IP address and you can assign a static Ethernet IP address using CohesionUI.

Multi-instrument control

If you have several Quantifi Photonics instruments with static IP addresses on your network, make sure to assign a unique IP address to each instrument before connecting.

For details, refer to Change the instrument IP address.

6 Managing your product with Cohesion Operator

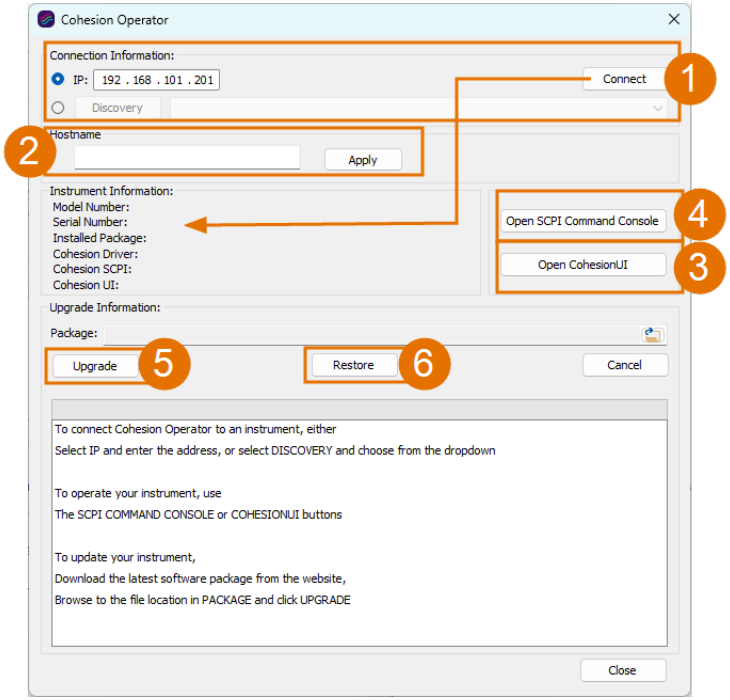
(Cohesion Operator 3.2.6)

To work with Quantifi Photonics instruments, you need to install the latest version of the **Cohesion Operator** software package on any computer that you use to connect with your instrument (client computer).

The software package is included on the USB media device that we provide with your instrument, or you can download it from quantifiphotonics.com (go to Resources > Drivers, software and manuals > MATRIQ Series).

Cohesion Operator enables you to:

1. **Connect** with instruments that are available on your network to retrieve instrument information and validate the instrument's IP address.
2. View and modify the **hostname** of the instrument.
3. Access an instrument using **CohesionUI**, a web-based graphical user interface.
4. Work with an instrument using the **SCPI Command Console**.
5. Upgrade instrument **firmware**.
6. Restore an instrument to **factory settings**.



Static vs dynamic IP address

Use one of the following methods to connect Cohesion Operator to the instrument:

- **Static IP Address** (recommended, USB cable required)

  Connect using the instrument's static IP address as shown on the instrument screen (for example, **192.168.101.201**). A USB cable is typically required for the initial connection.

- **Dynamic IP Address** (USB cable not required)

  Connect using a dynamic IP address.To enable automatic IP detection, ensure the computer running Cohesion Operator has at least one IP address on the same subnet as the instrument. For example, if the instrument IP address is **10.198.177.xxx**, the computer must also have an IP address in the **10.198.177.xxx** subnet.

  This allows Cohesion Operator to automatically detect IP address changes after an instrument reboot and maintain communication.

6.1 Install the Cohesion Operator software package

▶ To install the software package on a client computer:

1. (recommended) Save your work and close all programs.
2. Download the Cohesion Operator software package from the website, or insert the **USB media device** that includes the software package in the computer.
3. Double-click **CohesionOperator-<version>.exe** and follow the prompts.

   A Windows Security Alert may prompt you to allow network access. We recommend that you allow access to both, private and public networks, to enable any network configuration.

   The installation wizard will install required drivers, applications, and desktop icons on the computer.

Multi-instrument control

If another Quantifi Photonics instrument is already connected to the client computer via USB, make sure each instrument has a unique USB IP address to avoid any addressing conflicts.

▶ To open the Cohesion Operator application:

- Double-click the **Cohesion Operator** desktop icon or open **Cohesion Operator** from the Start menu.

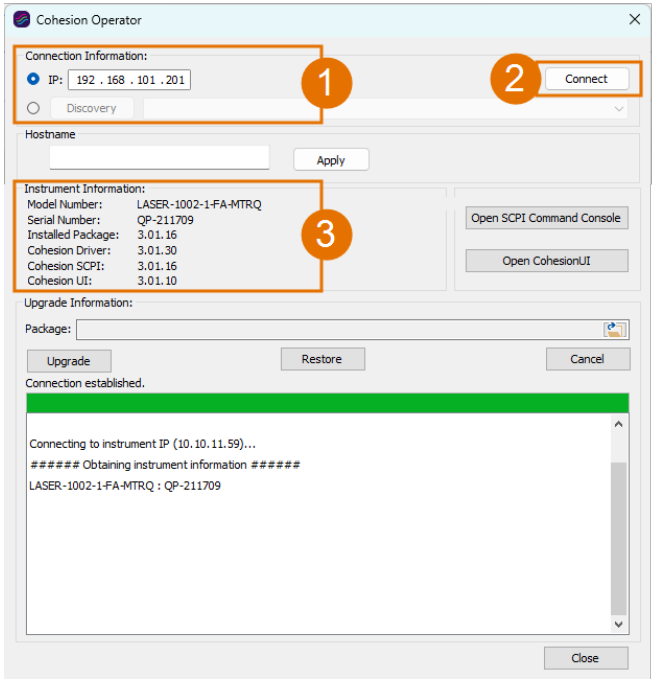
6.2 Connect with an instrument and retrieve instrument information

Using Cohesion Operator, you can check the firmware version and other details of Quantifi Photonics instruments that are available on your network.

▶ To check details in Cohesion Operator:

1. Select the instrument.
2. Click **Connect**.
3. Current instrument information will be displayed.

   Installed Package refers to the currently loaded firmware version.



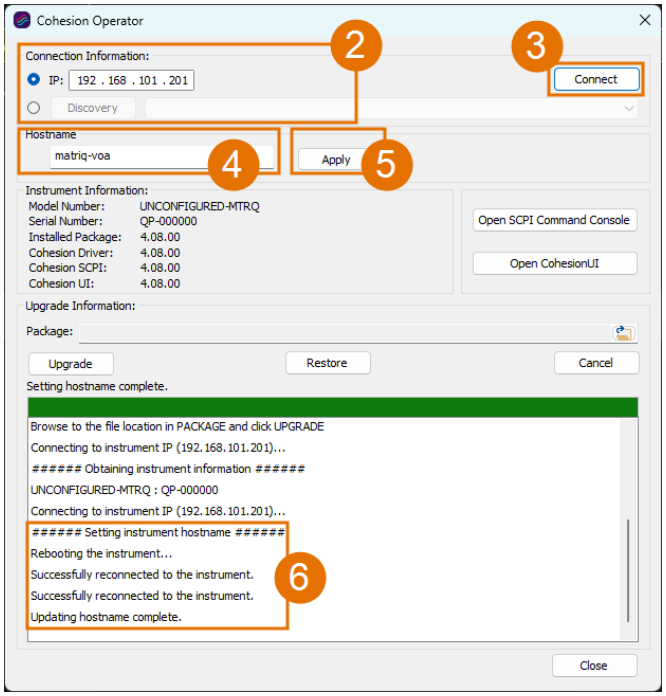
6.3 Set a hostname

Using Cohesion Operator, you can view and modify the hostnames of connected instruments.

> We recommend that you assign a hostname via a USB connection to prevent possible connection loss when using an Ethernet connection.

▶ To assign a hostname:

1. Open the Cohesion Operator, for example by double-clicking the **Cohesion Operator** desktop icon.



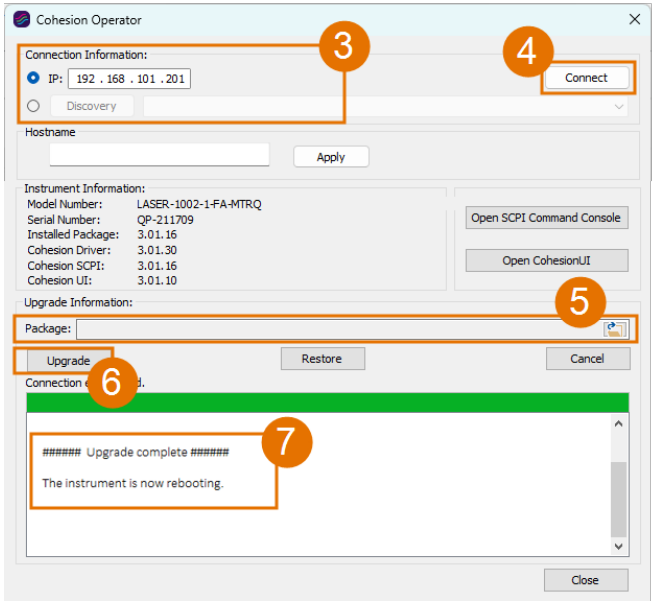
2. Select the instrument by entering its **IP address** or by selecting it from the **Discovery** drop down list.
3. To confirm that you have selected the correct instrument, click **Connect**. This will retrieve instrument information.
4. Enter a hostname.
5. Click **Apply**. Cohesion Operator will assign the hostname to the instrument. This can take a few minutes and the instrument might reboot several times in the process.
6. A message shows when setting the hostname was successful.

6.4 Upgrade firmware

We recommend that you upgrade firmware via a USB connection to prevent possible connection loss when using an Ethernet connection.

▶ To upgrade an instrument with the latest firmware:

1. Get the latest MATRIQ firmware package **CohesionMATRIQ-<version>.qfw**, for example by downloading it from quantifiphotonics.com (go to **Resources > Drivers, software and manuals > MATRIQ Series**), and save it to your network.
2. Open the Cohesion Operator, for example by double-clicking the **Cohesion Operator** desktop icon.



3. Select the instrument by entering its **IP address** or by selecting it from the **Discovery** drop down list.
4. To confirm that you have selected the correct instrument, click **Connect**.
   This will retrieve instrument information, with **Installed Package** showing the current firmware version.
5. In **Package**, click the Browse button, navigate to the previously downloaded firmware package and select it.
6. Click **Upgrade**. The instrument will be upgraded to the selected firmware package. This can take a few minutes and the instrument might reboot several times in the process.
7. A message shows when the upgrade is complete.

To verify the new firmware version, click **Connect** (4) to retrieve the latest instrument information.

NOTE

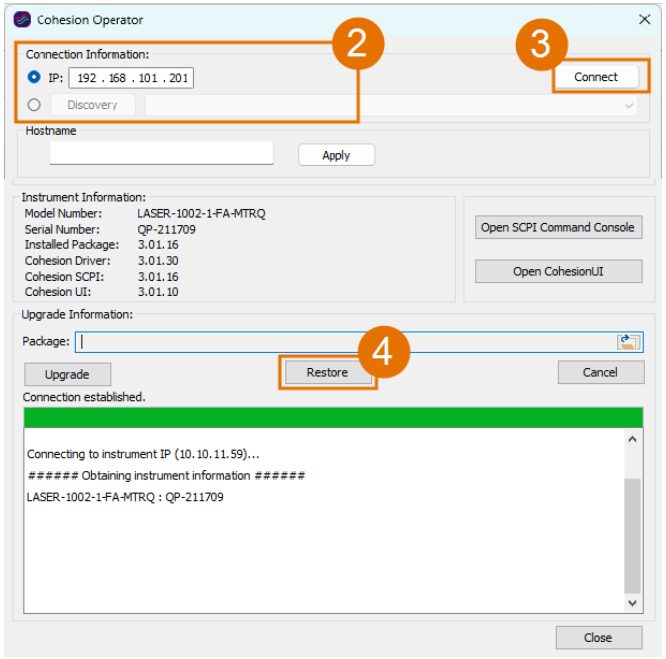
If an upgrade attempt is unsuccessful, the Cohesion Operator will stop the upgrade process and restore the instrument to its previous firmware version. Messages will be displayed accordingly.

6.5 Restore factory settings

We recommend that you restore factory settings via a USB connection to prevent possible connection loss when using an Ethernet connection.

▶ To restore factory settings:

1. Open the Cohesion Operator, for example by double-clicking the **Cohesion Operator** desktop icon.



2. Select the instrument by entering its **IP address** or by selecting it from the **Discovery** drop down list.
3. To confirm that you have selected the correct instrument, click **Connect**.
   This will retrieve instrument information, with **Installed Package** showing the current firmware version.
4. Click **Restore**.
   The instrument will be returned to factory settings, including IP address settings.

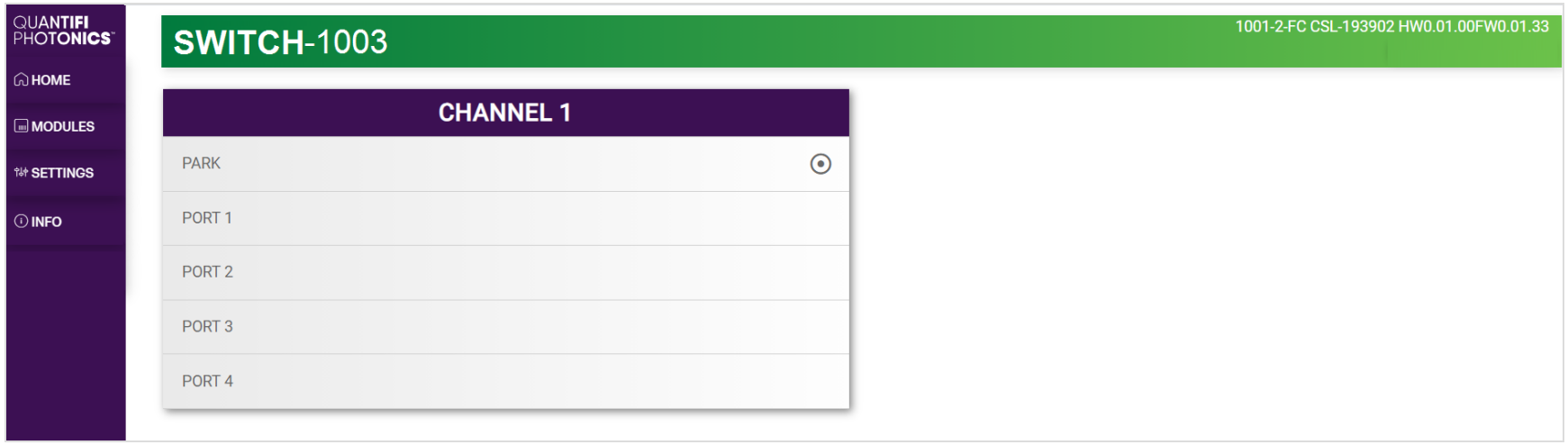
7 CohesionUI - Overview

CohesionUI is a web-based graphical interface that you can use to work with your Quantifi Photonics product.

> CohesionUI is part of the MATRIQ firmware package running on your Quantifi Photonics instrument.

From the menu on the left you can navigate to the following pages:

1. **HOME**: This is your main page. From here you can access all controls for your instrument
2. **SETTINGS**: Here you can change CohesionUI settings and/or instrument IP address
3. **INFO**: Here you can display instrument information, e.g. model number and firmware version



7.1 Access instruments with CohesionUI

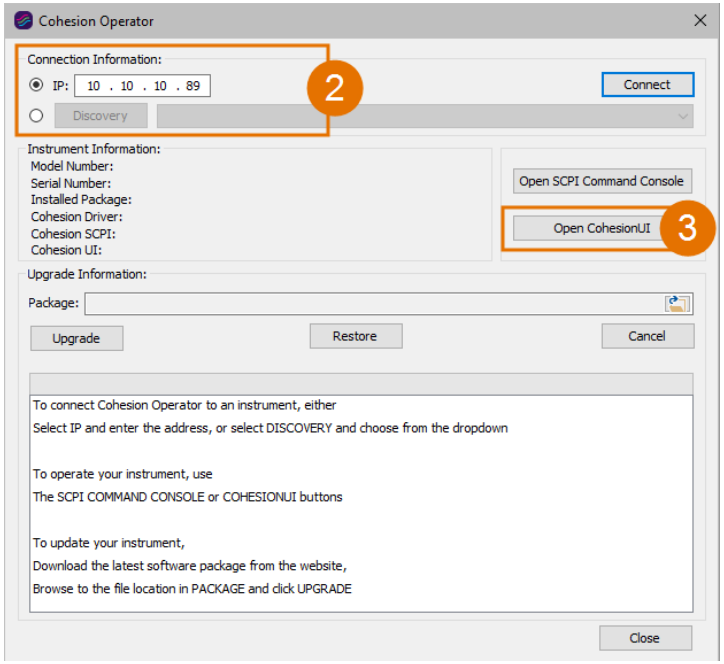
You can open CohesionUI for Quantifi Photonics MATRIQ and EPIQ instruments:

- from Cohesion Operator, or
- in a supported browser by entering the instrument IP in the address bar.

To open CohesionUI, you need the IP address of the instrument. For details, refer to the Instrument IP address section.

▶ To open CohesionUI from Cohesion Operator:

1. Open **Cohesion Operator** on a client computer, for example by double-clicking the Cohesion Operator desktop icon
2. Select the instrument by entering its **IP address** or by selecting it from the **Discovery** dropdown.
3. Click **Open CohesionUI**.
   CohesionUI will open in your standard browser.



To open CohesionUI in a browser:

1. Launch a supported **browser**.
2. Enter the instrument **IP address** in the address bar.
   CohesionUI will launch in the browser.



7.2 Change the instrument IP address

Your instrument can have two different IP addresses depending on your chosen connection method (USB or Ethernet):

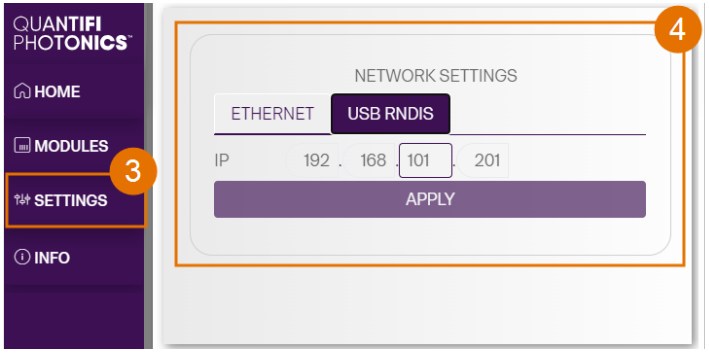
- The default **USB IP address** is **192.168.101.201**. This is a static address set during instrument calibration.
- The default **Ethernet IP address** is dynamically assigned by the DHCP.

You can change the instrument's static USB IP address, and assign a static Ethernet IP address if required.

> **Multi-instrument control**
>
> If you have several Quantifi Photonics instruments with static IP addresses on your network, make sure to assign a unique IP address to each instrument before connecting.

▶ To change the **USB IP address**:

1. Connect with the instrument from a client computer via USB. Ensure that this is the only Quantifi Photonics instrument currently connected via USB.
2. Open CohesionUI using the currently assigned USB IP address.
3. Go to **SETTINGS**.
4. In **NETWORK SETTINGS > USB RNDIS** tab:
   - The currently assigned IP address is displayed. Enter the new IP address by changing the **3rd octet** of the IP address.
     To avoid any addressing conflicts, make sure that this is a unique IP address that is not shared with any other instrument on the network.
   - Click **APPLY**. The new IP address will show in CohesionUI and on the display.



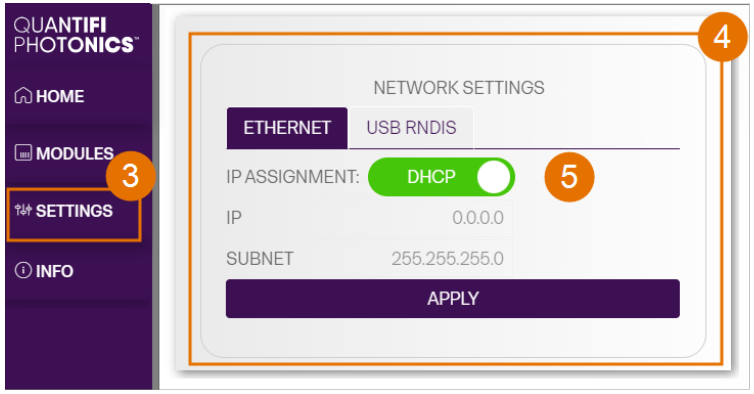
To change the **Ethernet IP address**:

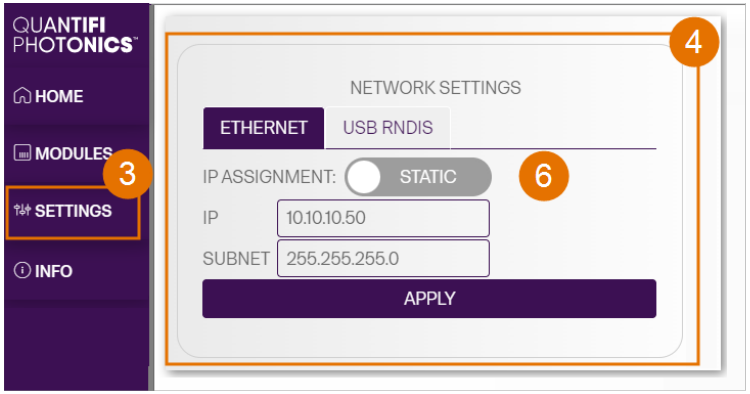
1. Connect with the instrument from a client computer via USB. Ensure that this the only Quantifi Photonics instrument currently connected via USB.
2. Open CohesionUI using the currently assigned USB IP address.
3. Go to **SETTINGS**.
4. In **NETWORK SETTINGS > ETHERNET** tab:
5. Toggle **IP ASSIGNMENT** to **DHCP** to enable the DHCP to automatically assign the Ethernet IP address (this is the default setting) and click **APPLY**.

   OR

6. Toggle **IP ASSIGNMENT** to **STATIC** to assign a static Ethernet IP address.
   Enter the new **IP address** and **SUBNET mask** and click **APPLY**.
   To avoid any addressing conflicts, make sure that this is a unique IP address that is not shared with any other instruments on the network.

   The new IP address will show in CohesionUI and on the display.



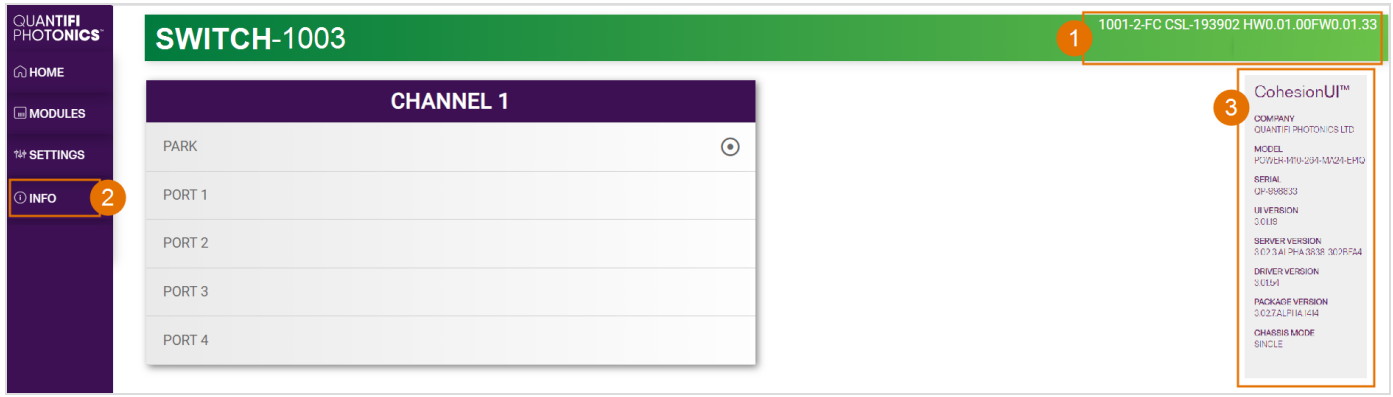


7.3 View system information

You can easily access instrument information, for example the model number and firmware version.

- To display instrument information in CohesionUI:

1. Refer to the top right corner in CohesionUI.
2. For more details, click **INFO** to display the information panel.
3. The information panel lists the instrument's serial number, and software and firmware versions.

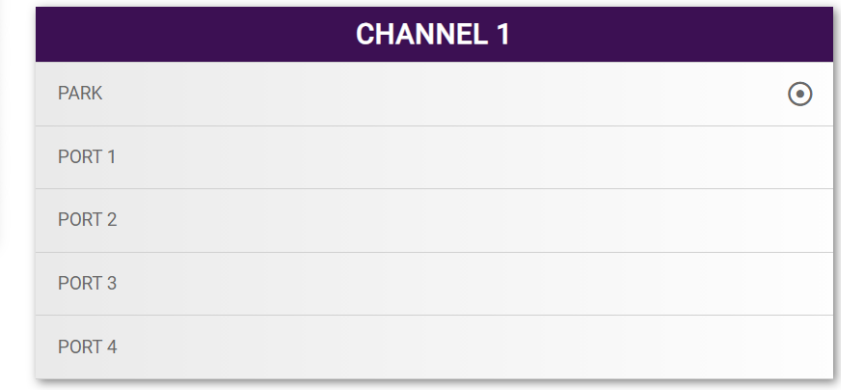


8 Controlling your SWITCH with CohesionUI

You can use Quantifi Photonics' graphical user interface CohesionUI to work with your module. For details on how to get started with CohesionUI, refer to CohesionUI - Overview.

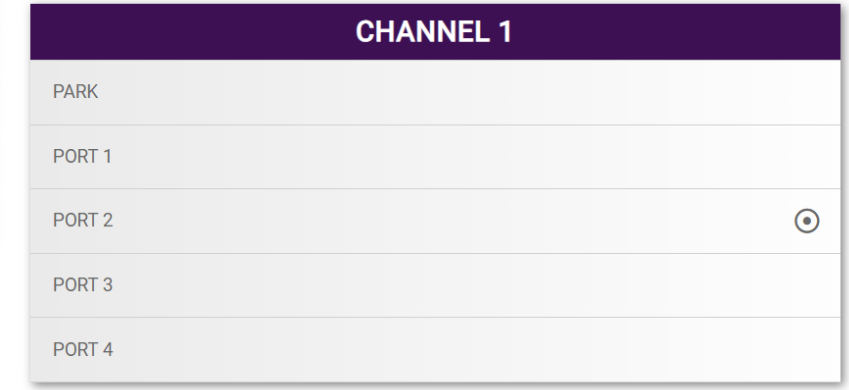
8.1 SWITCH 1000 / 1100 / 1300 / 1400 Series

The SWITCH is always in a **PARK** state by default. When in **PARK**, the SWITCH will act like an optical terminator.



To route the SWITCH to the desired port, click the port number (e.g. **PORT 2**). A grey circle will be displayed beside the current routed port.

The SWITCH can route the light very quickly, however there is a slight delay between re-routing the SWITCH and the UI updating the window.



9 Controlling your SWITCH with SCPI commands

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

NOTE

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 Overview

You can operate your Quantifi Photonics module using SCPI commands.

For details on available SCPI commands, refer to:

- Command summary
- Command descriptions

9.2 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.

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

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

For the commands that require index values:

Index	Description	Value
<n>		integer 1
<m>	the channel index of a specific unit in the module	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 specified, all output response data is transmitted in ASCII format.

9.3 Status and event registers

9.3.1 Standard Event Status Register

The Standard Event Status Register (SESR) is modified by the Quantifi Photonics product with the results of the command operations.

Bit	Description
7 (MSB), 6	Not used
5	Is set when a Command Error event has been detected
4	Is set when a command Execution Error has been detected
3	Is set when a Device Dependent Error event has been detected
2	Is set when there a Query Error event has been detected
1	Not used
0 (LSB)	Is set when an Operation Complete event has been generated

9.3.2 Standard Event Status Enable Register (Mask)

The Standard Event Status Enable Register (SESR Mask) is used to build the Event Status Bit (ESB) within the Status Byte Register (STB). To ignore any of the events detected and set in the SESR, set the corresponding bit within the SESR Mask to 0. The STB can then be queried and the value of the ESB can be used to determine service request requirements based on the SESR Mask applied.

NOTE

The 0 (LSB) value within the SESR Mask is 0.

9.3.3 Status Byte Register

The Status Byte Register (STB) is built from all other status registers and masks. This register can be used in queries to determine if an event has been detected and where that event has been detected.

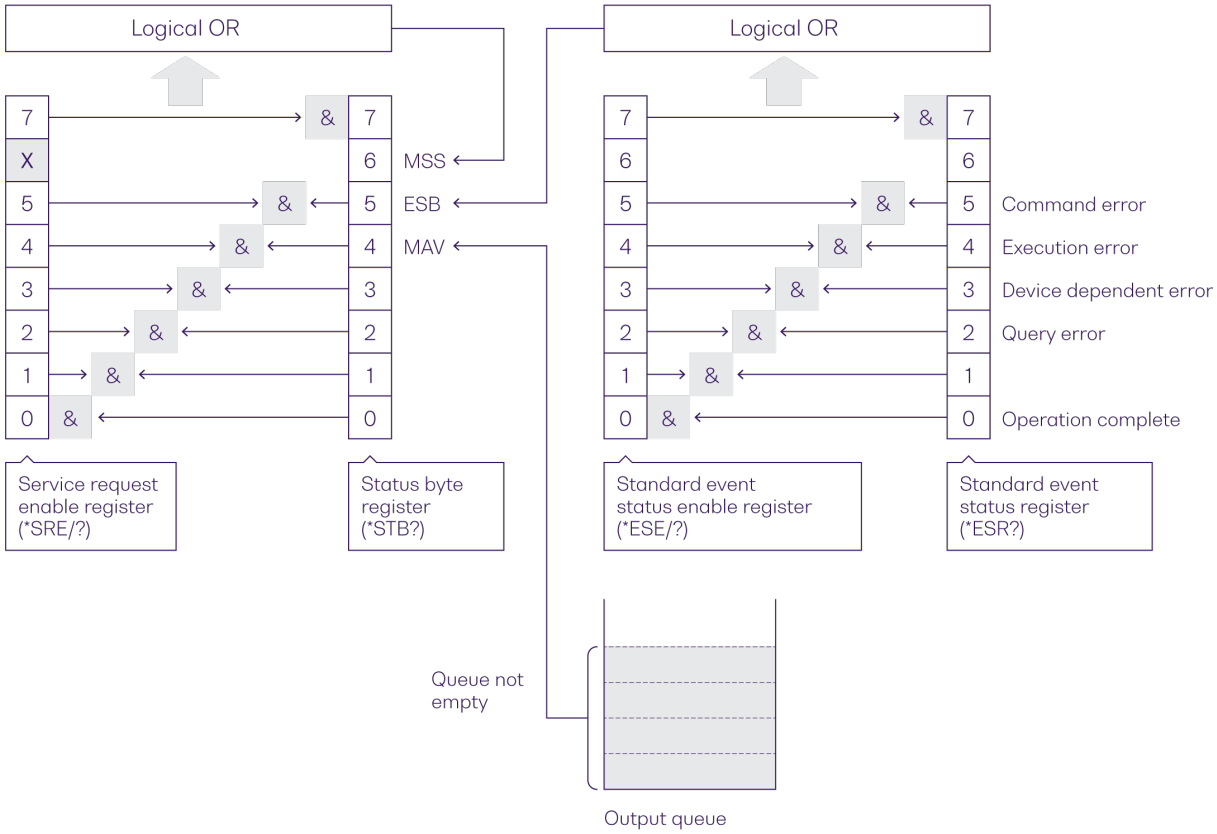
Bit	Description
7 (MSB)	Not used
6	The Master Summary Status (MSS) bit is set from the STB and SRE Mask
5	The Event Status Bit (ESB) is set from the SESR and the SESR Mask
4	Message Available (MAV) is set when there is data in the output queue
3, 2, 1, 0 (LSB)	Not used

9.3.4 Service Request Enable Register (Mask)

The Standard Request Enable Register (SRE Mask) is used to build the Master Summary Status Bit (MSS) within the Status Byte Register (STB). To ignore any of the events detected and set in the STB register itself, set the corresponding bit within the SRE Mask to 0. The STB can then be queried and the value of the MSS can be used to determine the type of service request required based on the SRE Mask applied.

Bit	Description
7 (MSB)	Not used
6	The Master Summary Status (MSS) bit is set from the STB and SRE Mask
5	The Event Status Bit (ESB) is set from the SESR and the SESR Mask
4	Message Available (MAV) is set when there is data in the output queue
3, 2, 1, 0 (LSB)	Not used

9.3.5 Status and event registers diagram



9.4 Command summary

9.4.1 Common commands

Command	Description
*CLS	Clear session message queues >>
*IDN?	Query the CohesionSCPI service identification >>
*OPC?	Query the Operation Complete Status >>
*OPT?	Query the modules managed by the CohesionSCPI service >>
*ESR?	Query the Standard Event Status Register >>

9.4.2 System commands

Command	Description
:SYSTEM	
:PRESet	Restore instrument settings to power-on default values >>

9.4.3 Slot commands

Slot commands	Description
:SLOT<n>	
:OPC?	Query the Operation Complete Status of the module >>
:OPTions?	Query the modules managed by the CohesionSCPI service >>
:IDN?	Query the slot identification >>
:PRESet	Restore instrument settings to power-on default values >>

9.4.4 Configuration commands

Configuration commands	Description
:ROUTe<n>	
:ERROR?	Query the error status of the SWITCH >>
:CHANnel<m>	
:ERROR?	Query the error status of the specified channel of the SWITCH >>
:STATE?	Query the routing state of the SWITCH >>
:STATE	Set the routing state of the SWITCH >>

9.5 Command descriptions

9.5.1 Common commands

Command	***CLS**	Summary >>
Syntax	`*CLS`	
Description	Clear session message queues	
Parameters	N/A	
Response	N/A	
Example	`*CLS`	

Command	***IDN?**	Summary >>
Syntax	`*IDN?`	
Description	Query the instrument identification	
Parameters	N/A	
Response	Comma separated string with the <manufacturer>,<server name>,<chassis controller name>,<server version>	
Example	`*IDN? -> Quantifi Photonics, CohesionSCPIService,PXIE-8133,FW2.0.15`	

Command	***OPC?**	Summary >>
Syntax	`*OPC?`	
Description	Query the Operation Complete Status	
Parameters		
Response	**1**: all modules installed in the chassis are ready to execute commands	
	0: modules installed in the chassis still have commands to execute in the input queue	
	NOTE: Any commands sent to the module when `:MODUle:OPC?` is NOT equal `1`, may not execute or return an error.	
Example	`*OPC? -> 1`	

Command	***OPT?**	Summary >>
Syntax	`*OPT?`	
Description	Query the modules installed in the instrument	
Parameters	N/A	
Response	Comma separated string of the installed modules in the chassis	
Example	`*OPT?`	

Command	***ESR?**		Summary >>
Syntax	`*ESR?`		
Description	Query the Standard Event Status Register		
Parameters	N/A		
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	Command Execution Error	16
	3	Device Dependent Error	8
	2	Not used	0
	1	Not used	0
	0 (LSB)	Operation Complete	1
Example	`*ESR? -> 8` `*ESR? -> 32`		

NOTE

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.

9.5.2 System commands

Command	**:SYSTEM:PRESet**	Summary >>
Syntax	`:SYSTEM:PRESet`	
Description	Restore instrument settings to power-on default values	
Parameters	N/A	
Response	N/A	
Example	`:SYSTEM:PRES`	

9.5.3 Slot commands

Command	**:SLOT<n>:OPC?**	Summary >>
Syntax	:SLOT<n>:OPC?	
Description	Query the Operation Complete Status of the module	
Parameters	N/A	
Response	**1**: the module is ready to accept a new command	
	0: the module is busy performing a previous operation	
	NOTE: Any commands sent to the module when :SLOT:OPC? is NOT 1, may not execute or return an error.	
Description	:SLOT1:OPC? -> 1	

Command	**:SLOT<n>:OPTions?**	Summary >>
Syntax	:SLOT<n>:OPTions?	
Description	Query installed modules	
Parameters	N/A	
Response	A comma separated array, or a single integer value based on the arguments given. If a module is not installed in a channel, it will not return any identification string.	
Example	:SLOT1:OPT? -> 1,1,,	

Command	**:SLOT<n>:IDN?**	Summary >>
Syntax	:SLOT<n>:IDN?	
Description	Query the module identification	
Parameters	N/A	
Response	A comma-separated string containing "<manufacturer>,<part number>,<serial number>,<hardware version><firmware version>". Note that the hardware and firmware versions are not comma separated.	
Example	:SLOT1:IDN? -> Quantifi Photonics, POWER-1500-2-FC-PXIE, QP-192001, HW1.0FW1.02	

Command	**:SLOT<n>:PRESet**	Summary >>
Syntax	:SLOT<n>:PRESet	
Description	Restore instrument settings to power-on default values	
Parameters	N/A	
Response	N/A	
Example	:SLOT1:PRES	

9.5.4 Configuration Commands

Command	**:ROUTe<n>:ERROR?** Summary >>
Syntax	`:ROUTe<n>:ERROR?`
Description	Query the error status of the SWITCH
Parameters	N/A
Response	The response of an integer value representing a bitmask of switch errors.
	8: Switch D(4) reports an error
	4: Switch C(3) reports an error
	2: Switch B(2) reports an error
	1: Switch A(1) reports an error
	0: There are no reported errors
Example	`:ROUT1:ERROR? -> 1`

Command	**:ROUTe<n>:CHANnel<m>:ERROR?** Summary >>
Syntax	`:ROUTe<n>:CHANnel<m>:ERROR?`
Description	Query the error status of the specified channel of the SWITCH
Parameters	N/A
Response	**1**: SWITCH reporting an error
	0: No error on SWITCH
Example	`:ROUT1:CHAN1:ERROR? -> 0`

Command	**:ROUTe<n>:CHANnel<m>:STATE?** Summary >>
Syntax	`:ROUTe<n>:CHANnel<m>:STATE?<wsp>[SET|ACT|ACTUAL|ALL]`
Description	Query the routing state of the SWITCH
Parameters	**SET**: Returns the set routing state
	ACT|ACTUAL: Returns the current position of the SWITCH routing state
	ALL: Returns all the above values in a comma separated string
Response	
Example	`:ROUT1:CHAN1:STATE? -> 1`

Command	**:ROUTe<n>:CHANnel<m>:STATE**	Summary >>
Syntax	:ROUTe<n>:CHANnel<m>:STATE<wsp><value>	
Description	Set the routing state of the SWITCH	
Parameters	**<value>**: A valid number representing the routing state of the SWITCH	
Response	N/A	
Example	:ROUT1:CHAN1:STATE 1	

9.6 Programming example: Control of the SWITCH with SCPI

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

We recommend that you use the `*ESR?` query after every command that is sent to the device. This enables you to debug unreceived or incorrect commands sent to the product.

```
#Identifying the SWITCH
:*IDN?                                  #Query to confirm the correct instrument is setup
:*OPT?                                  #Query the available instrument module configuration
:SLOT3:IDN?                             #Query the identification information for a specific module

#Setting the state of the SWITCH
:ROUTe3:CHANnel1:STATE 3                #Set the output route of the 1x4 Switch to port 3.
                                        #Default routing of a Switch is PARK (port 0).
:ROUTe3:CHANnel1:STATE 1                #Change the output route of the 1x4 Switch to port 1

#Querying the state of the SWITCH
:ROUTe3:CHANnel1:STATE?                 #Query the current route of the 1x4 Switch.
```

9.7 SCPI Command Console

The SCPI Command Console enables you to communicate with Quantifi Photonics product via SCPI commands. You can easily test commands and verify their syntax.

For available SCPI commands, refer to the user manual of the Quantifi Photonics product you are communicating with.

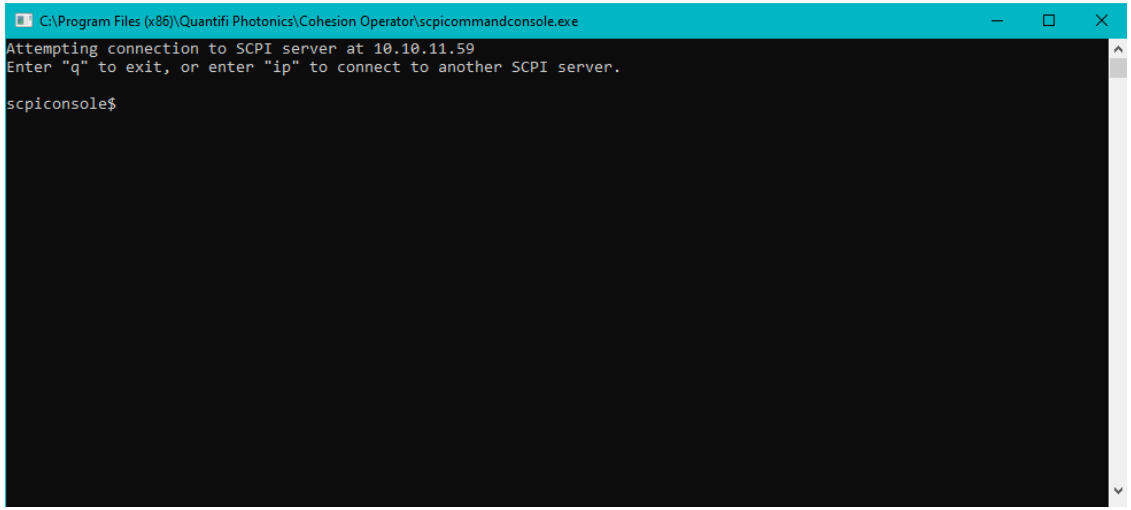
The two most common error codes are:

17: IO writer error: The command was invalid or not accepted by the instrument.

15: IO timeout: there was no response available before expiry of the reading wait time.

▶ To open the SCPI Command Console:

- Open the Cohesion Operator, for example by double-clicking the **Cohesion Operator** desktop icon.
- Select the instrument by entering its **IP address** or by selecting it from the **Discovery** drop down list.
- Click **Open SCPI Command Console**.



1. To verify that you are communicating with the right device:

- Enter `*idn?` and press **<ENTER>**.
- The device will return identification details.

2. To switch to another Quantifi Photonics device:

- Enter `ip` and press **<ENTER>**.
- Enter the IP address of the Quantifi Photonics product you would like to switch to and press **<ENTER>**.
- Confirm that you are communicating with the right product: Enter `*idn?` and press **<ENTER>**.

  The device will return identification details

3. To send a command or query to a Quantifi Photonics device:

- Enter a command and press **<ENTER>**.
- The device will execute the command and return an action response to the console if applicable.

4. To exit the SCPI Command Console:

- Enter `q` and press **<ENTER>**.



Example: Send instrument identification query *idn?

5. Enter the command: `*idn?`

   The instrument returns the requested information.

6. If you enter the command incorrectly, for example: `*ind?`

   The instrument returns **error code 32**.

   For details on error codes, please refer to the `*ESR?`command.



Example: Send a WRITE only command

7. If you enter a command correctly, for example: `*cls`

   The instrument executes the command, there will be no action response.

8. If you enter a command incorrectly, for example: `*csl`

   The instrument returns **error code 17: IO write error**.



10 Programming applications

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

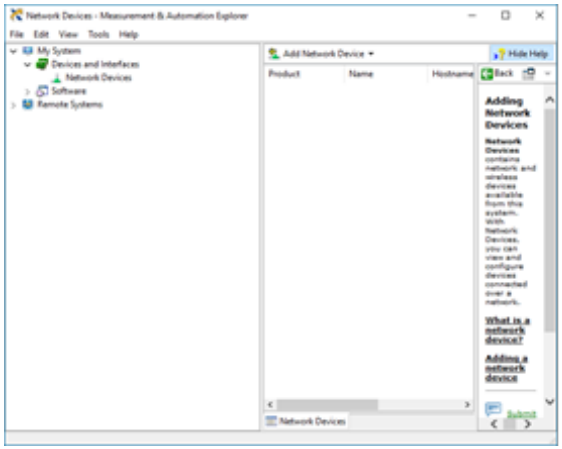
NOTE

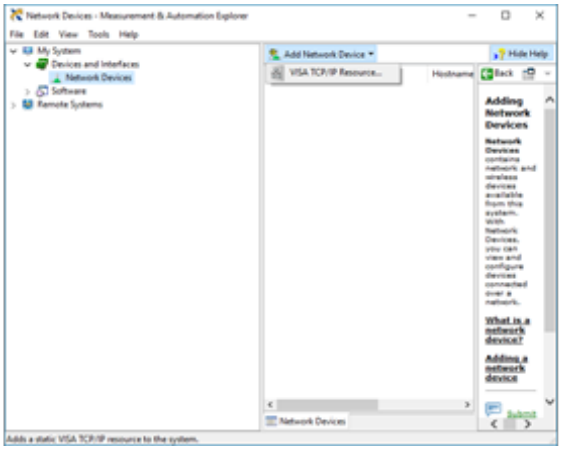
In NI-MAX a RIO interface will show up, however there are no communication methods available or implemented on this interface. Quantifi Photonics products are **ONLY** accessible through the **VISA TCPIP INSTR** interface provided by the CohesionSCPI service installed on the system.

10.1 Setting up NI-MAX application

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

1. After installing NI-MAX, launch the application. In the left side panel 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.
   Note when operating locally, enter in the localhost IP address of **127.0.0.1**. Click **Finish** to end the setup process.

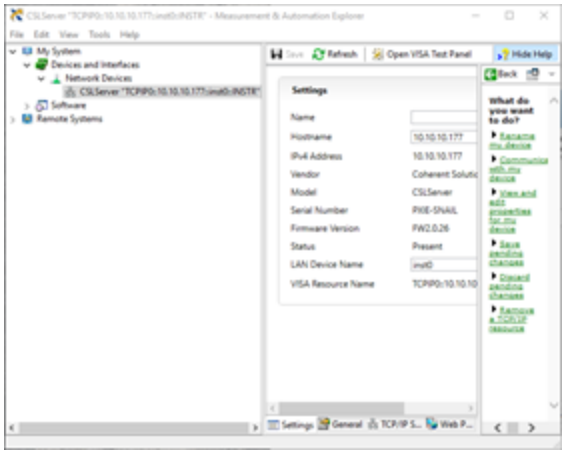




10.2 Setting up NI-VISA application

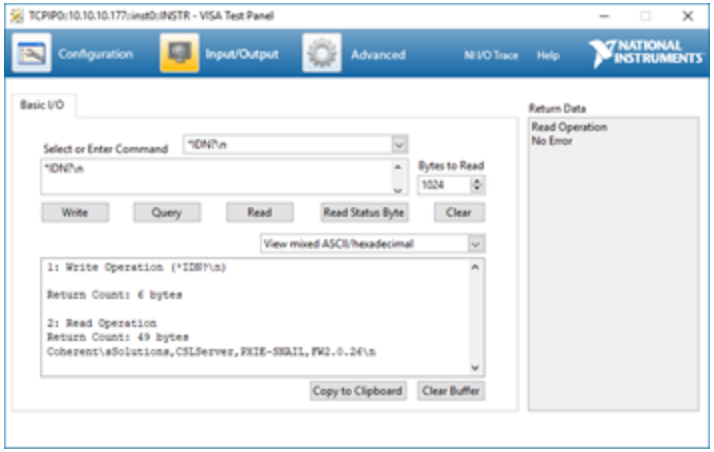
NI-VISA is used to communicate with the PXIe chassis or installed modules / instruments. The above steps must be completed before attempting to communicate using NI-VISA.

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



2. On the right-hand 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® code example

The following example shows how to communicate with the Quantifi Photonics product using Python code.

```
# 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 the Quantifi Photonics product 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 PXIE 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.

NOTE

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 Quantifi Photonics product using MATLAB code.

```
% 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.
```

11 Working with optical fibers

Quantifi Photonics products are equipped with high quality optical connectors in compliance with EIA-455-21A standards.

CAUTION

Keep connectors clean and in good condition to ensure maximum power and to avoid erroneous readings. Quantifi Photonics is not responsible for damage or errors caused by bad fiber cleaning or handling.

- Always inspect fiber end faces for cleanliness using a fiber inspection probe before inserting them into a port..
- If required, clean fibers and faces as detailed below.

NOTE

- To avoid damaging ferrules or fiber faces due to mismatched connectors, always check ports and connector type information before inserting a connector. All Quantifi Photonics units are labeled with connector type information.
- Failing to align and/or connect fiber-optic cables properly will result in significant signal loss and reflection.

▶ When connecting a fiber-optic cable to a port:

1. Visually inspect the fiber end face using a fiber inspection microscope.
2. If a **connector end face** is dirty:
    - Wipe the connector end face using a reel-type cleaner and inspect again.
    - For stubborn hard to clean connectors:
        - Use lint-free fiber-cleaning wipes soaked in a fiber optic cleaning solution.
        - Wipe the connector on the soaked part.
        - Dry the connector by wiping on the dry part of the wipe, or by using a reel-type cleaner.
    - Repeat the process until connector inspection shows a clean fiber face.
3. If a **bulkhead inner connector face** is dirty:
    - Use a pen-type dry cleaner, align the cleaning tip with the port and push the cleaner until you hear the characteristic click. Inspect again.
    - For stubborn hard to clean bulkhead connectors:
        - Use a stick-type cleaner dipped in a fiber optic cleaning solution.
        - Carefully align and insert the stick into the connector and gently rotate the stick for several seconds applying light pressure.
        - Use a pen-type cleaner to dry the connector.
    - Repeat the process until connector inspection shows a clean fiber face.
4. If the fiber end face is clean:
    - Carefully align the connector and port to prevent the fiber end from touching the outside of the port or other surfaces. If the connector features a key, mate it correctly into the corresponding notch of the port bulkhead.

- Push the connector in so that the fiber-optic cable is firmly in place with adequate contact. If your connector features a screw sleeve, tighten the connector to firmly maintain the fiber in place. Do not over-tighten, as this will dam-age the fiber and the port bulkhead.

12 System requirements

Quantifi Photonics PXIe modules

Supported browsers for working with CohesionUI	Google Chrome™ Microsoft Edge®
Chassis	PXIe-compatible chassis that • supports PXIe, or • contains PXI hybrid compatible slots
Recommended PXIe controller operating system	Microsoft Windows® 10 (64-bit)

Quantifi Photonics MATRIQ / EPIQ instruments

Supported browsers for working with CohesionUI	Google Chrome™ Microsoft Edge®
Recommended client computer operating system	Microsoft Windows® 10 (64-bit)

13 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Store the 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, power off the chassis immediately. Remove the unit and allow to dry completely.
- To allow for sufficient air flow and avoid thermal issues, set up your instrument with a minimum clearance of 2 inches (50.8mm) around it and do not block any ventilation fans.

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.

13.1 Annual calibration schedule

To ensure that the unit is performing within specification, we recommend it is re-calibrated every 12 months.

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.

We recommend your product is returned for re-calibration before the listed due date, to ensure continued performance of the product. For re-calibration service information, or to send in a product for re-calibration service, email support@quantifiphotonics.com.

If the Calibration Certificate has been misplaced, or the calibration due date is not known, email support@quantifiphotonics.com.

14 Technical Support

14.1 Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact Quantifi Photonics:

support@quantifiphotonics.com

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

14.2 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. If the original packaging is unavailable, use appropriate foam packaging to provide shock absorption and avoid displacement of the product inside the shipping box. Please keep all input connectors covered with the supplied anti-static plastic covers during transport and avoid any shipping material making contact with the sensitive connectors of the product.
- Avoid high humidity or large temperature fluctuations.
- Keep the product out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

15 Warranty Information

15.1 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.

NOTE

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.
- The unit has been used with an external power supply not supplied by Quantifi Photonics with the unit.

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 quantifiphotonics.com.

15.2 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.

The external power supply that has been supplied by Quantifi Photonics with the unit can only be used with that unit, do not use it with any other product.

15.3 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.

15.4 Certification

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

15.5 Service and repairs

To send any equipment for service, repair or calibration please contact the Technical Support Group: support@quantifiphotonics.com.

QUANTIFI PHOTONICS®
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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.

General Enquiries	sales@quantifiphotonics.com
Technical Support	support@quantifiphotonics.com
Phone	+64 9 478 4849
North America	+1-800-803-8872

quantifiphotonics.com