

IQTX

Coherent Modulation Transmitter

EPIQ User Manual



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User manual version: 2.08

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1 What's in this user manual?

You can find the following information in this document:

Before you begin	<u>Conventions</u> <u>Safety information</u> <u>Working with optical fibers</u> <u>Working with electrical connectors</u> <u>System requirements</u>
Getting started	<u>Introducing the IQTX</u> <u>Setting up hardware</u> <u>Managing your product with Cohesion Operator</u>
Working with your device	CohesionUI GUI: <u>CohesionUI - Overview</u> <u>Controlling your IQTX with CohesionUI</u> SCPI commands: <u>Controlling your IQTX with SCPI commands</u> <u>Programming examples and applications</u> Touchscreen: <u>Operating the IQTX from the LCD interface</u>
Maintenance	<u>Upgrade firmware</u> <u>Restore factory settings</u>

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

Quantifi Photonics IQTX products are Class 1M laser products.



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 FDA certification

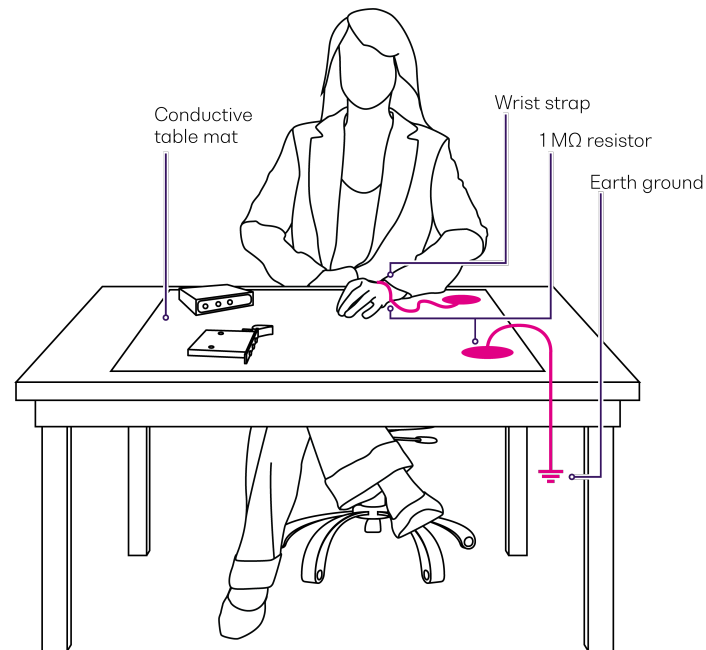
This IQTX complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no.50, dated June 24, 2007.

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.



3.4 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.

NOTE

If the LCD display is unavailable due to electromagnetic interference, please use the web-based graphical user interface CohesionUI to control, set or monitor the IQTX instrument.

4 Introducing the IQTX

The IQTX enables quick and simple generation of phase modulated optical signals in one, simple to use, bench-top package.

The IQTX is available in two configurations - single-polarization with dual-polarization emulator and full dual-polarization, allowing the customer flexibility from the outset. Its high bandwidth of up to 40 GHz (typical) ensures high quality optical signal generation, even at Baud rates exceeding 80 Gbaud, making it the ideal 'Golden' optical signal source for coherent communications applications. It uses the highest quality, high bandwidth, linear RF amplifiers to enable generation of any multi-level optical modulation formats when used with an RF Arbitrary Waveform Generator (AWG).

IQTX's emulated dual-polarization capability uses optical multiplexing technique to generate a dual-polarization signal from a single-polarization modulated signal. It enables the use of only two channels of RF signal source to generate a dual-polarization coherent modulation format, leading to a significant system cost reduction. This approach is widely used in R&D environments where there is no need to have independent data pattern on all four tributaries.

The IQTX comes with a narrow linewidth, high-power, tunable internal laser, which can conveniently be controlled remotely from a PC using the web-based graphical user interface CohesionUI.

The internal laser is externally connectorized on the front panel for maximum flexibility. Users simply connect its output to the modulator input using a short PMF patch cord supplied with the instrument. This external connection allows you to use your own laser if preferred.



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™

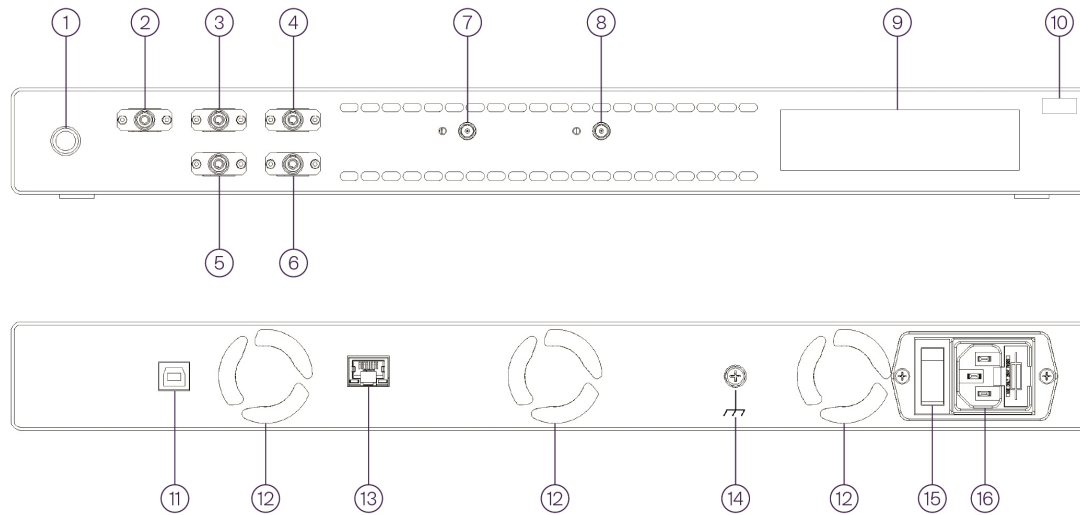
Quantifi Photonics' web-based graphical user interface CohesionUI is hosted on Microsoft Windows® and enables you to control your device from any supported web browser.

Touchscreen display

The touchscreen display makes it easy to quickly view and change a number of relevant settings.

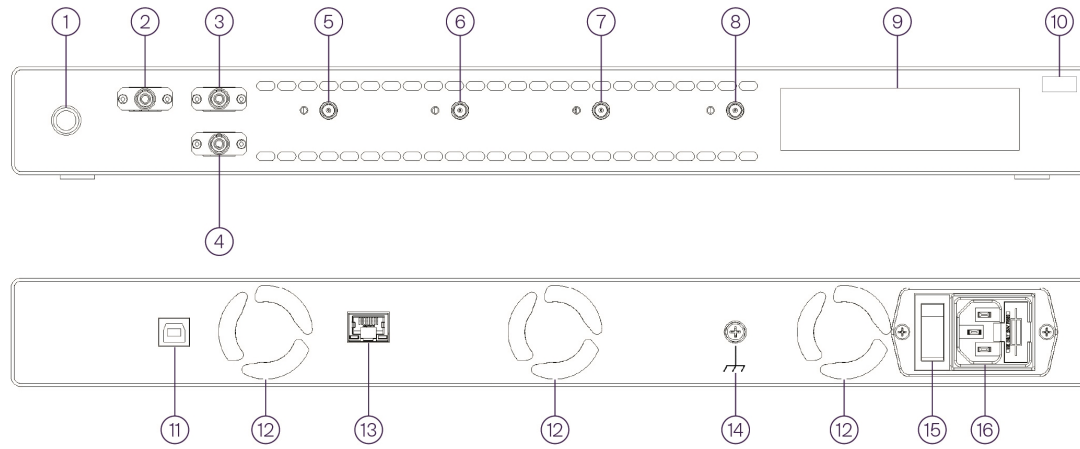
4.1 Hardware description

4.1.1 IQTX 1100 Series



Front		Rear	
1	Power ON/OFF	11	USB connection to PC
2	Built-in laser output PM FC/PM	12	Ventilation fans (DO NOT OBSTRUCT)
3	Modulator laser input PM FC/PC	13	Ethernet port
4	Modulated single-Pol signal output PM	14	Chassis grounding screw
5	Dual-Pol emulator input PM	15	Mains power on / off isolation switch
6	Dual-Pol emulator output PM	16	AC power ~100-240V; 50/60Hz; 85W Max
7	RF signal In-Phase input		
8	RF signal Quadrature input		
9	LCD touchscreen		
10	Connector type information		

4.1.2 IQTX 1200 Series



Front		Rear	
1	Power ON/OFF	11	USB connection to PC
2	Built-in laser output PM	12	Ventilation fans (DO NOT OBSTRUCT)
3	Modulator laser input PM	13	Ethernet port
4	Modulated Dual-Pol signal output	14	Chassis grounding screw
5	RF signal X-Pol-I input	15	Mains power on / off isolation switch
6	RF signal X-Pol-Q input	16	AC power ~100-240V; 50/60Hz; 85W Max
7	RF signal Y-Pol-I input		
8	RF signal Y-Pol-Q input		
9	LCD touchscreen		
10	Connector type information		

NOTE

You must use the IEC cable that has been supplied by Quantifi Photonics with the unit.

4.2 Environmental conditions

Range of environmental conditions:

Indoor or outdoor use	Indoor only
Altitude	Max. 2000m
Operating temperature range	5°C to 45°C 41°F to 113°F
Storage temperature range	-40°C to 70°C -40°F to 158°F
Relative humidity range	20% to 80%
Main supply voltage	100-240V~, 50/60Hz, 85W Max
Main supply voltage fluctuations	±10%
Fuse specification	3.15A, 250VAC
Overvoltage category	OVC II
Pollution degree	2

For fuse replacement, please adhere to the specifications provided in the table above.

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 IEC cable that Quantifi Photonics supplies with the unit.
- 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.
- 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 IQTX product and power ON

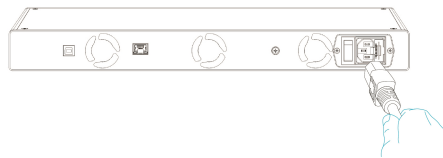
The RF signal connectors are used to input an RF generated pattern for optical transmission. Depending on the IQTX model, a single or dual polarization optical signal can be generated from the RF input signals.

NOTE

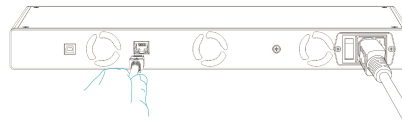
- Ensure that the IQTX is ON before applying any RF signals to the RF signal inputs.
- Ensure the input RF signal voltage remains below the specified 500 mV pk-pk.
- For advice on connector care, refer to section [Working with electrical connectors](#).
- To allow for optimal air flow and avoid thermal 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.

► To set up your IQTX:

1. Connect AC mains power to the instrument to provide ground connection.



2. Via USB – Connect a USB. Via Ethernet – Connect an Ethernet cable.



3. Make all required electrical and optical connections. For details refer to section [Set up your IQTX for single polarization \(IQTX 1100 Series models only\)](#) or [Set up your IQTX for dual polarization](#).



4. Once all connections are completed, turn ON the isolation switch located next to the mains socket.
The switch will illuminate indicating that the AC power supply is live and the IQTX is ready to be powered ON.
5. Power ON the instrument.



6. The IP address will appear on the LCD screen and in the web-based graphical user interface CohesionUI. If IQTX is connected via Ethernet and USB, both the USB and Ethernet IP address will be displayed. For details refer to section [LCD control touch-screen Graphical User Interface \(GUI\)](#) or [CohesionUI - Overview](#).



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 Set up your IQTX for single polarization (IQTX 1100 Series models only)

NOTE

- Ensure that the IQTX is ON before applying any RF signals to the RF signal inputs.
- Ensure the input RF signal voltage remains below the specified 500 mV pk-pk.
- For advice on connector care, refer to section [Working with electrical connectors](#).

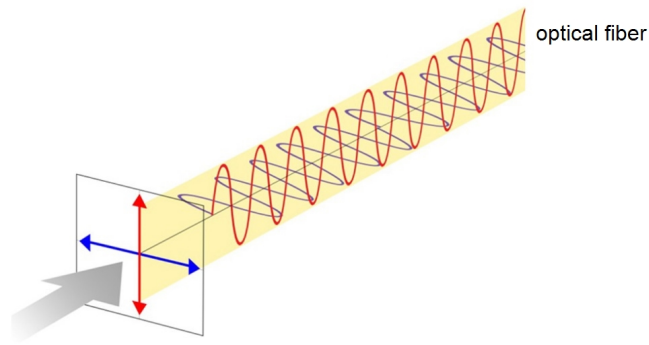
- To generate a single polarization signal (QPSK) aligned to a single state of polarization:
1. Connect the data channels from the RF source to the In-phase and Quadrature RF signal inputs.
 2. Connect the Internal Laser Output to the Modulator Laser Input using the short (20 cm) blue PM patch cord supplied with the instrument. Alternatively, you can connect your own narrow-linewidth Laser with a PM output using a PM patch cord (linewidth needs to be less than 500 kHz).
 3. Use the output port of the modulator for a linearly polarized single polarization signal.

NOTE

The power level going into the modulator Laser input port must not exceed the Max Input power specified for the model.

5.3 Set up your IQTX for dual polarization

IQTX models enable to generate dual polarization signals where the optical signal can be transmitted along two orthogonal polar planes in the optical fiber. However, the IQTX 1100 Series will only duplicate and delay modulated signals along both polarizations.



NOTE

- Ensure that the IQTX is ON before applying any RF signals to the RF signal inputs.
- Ensure the input RF signal voltage remains below the specified 500 mV pk-pk.
- For advice on connector care, refer to section [Working with electrical connectors](#).

5.3.1 IQTX 1100 Series (Emulated Dual Polarization)

► To generate a dual polarization signal:

1. Follow the instructions in section [Set up your IQTX for single polarization \(IQTX 1100 Series models only\)](#) to establish a single polarization modulation signal.
2. Connect the Single Polarization SIGNAL OUT to the Dual Polarization SIGNAL IN using a PMF patch-cord, to generate the Y-pol modulation signal.
3. The dual polarization modulated signal generated from the input RF pattern is then output from the optical port labelled Dual Polarization SIGNAL OUT.

5.3.2 IQTX 1200 Series (Full Dual Polarization)

The IQTX 1200 Series instrument can generate optical signals from up to four independent RF channel sources. One channel pair from the RF input signals is modulated on the X-pol, the second pair is modulated on the Y-pol.

▶ To generate a dual polarization signal:

1. Connect the data channels from the RF source to the RF Signal Inputs IN-PHASE electrical and RF Signal Inputs QUADRATURE connectors.
2. Connect the internal Laser output to the Modulator Input. If using your own narrow-linewidth Laser, the linewidth needs to be less than 500kHz.

NOTE

Please make sure the Laser power connected to the modulator input does not exceed the maximum optical power specification.

3. The dual polarization modulated signal is output from the modulator output port.

5.4 Instrument IP address

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

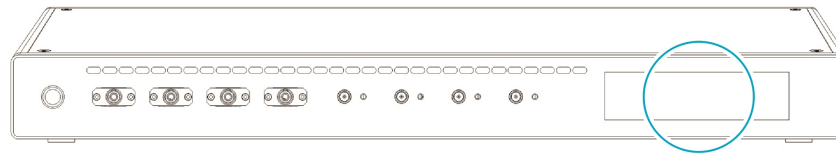
Your instrument can have two different IP addresses depending on your chosen connection method (USB or Ethernet):

- 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 the touchscreen display
- 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 [CohesionUI - Overview](#) or [Operating the IQTX from the LCD interface](#).

6 Managing your product with Cohesion Operator

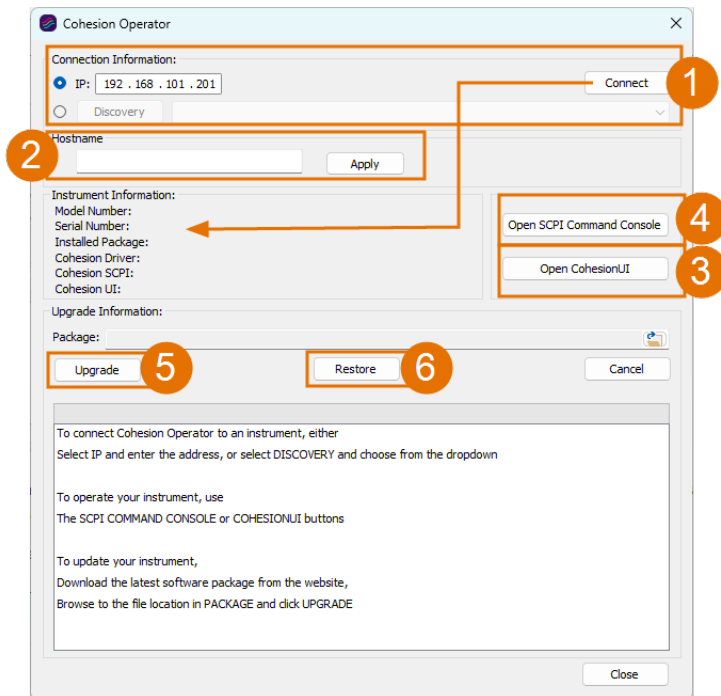
(Cohesion Operator 3.2.6)

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 > EPIQ 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.

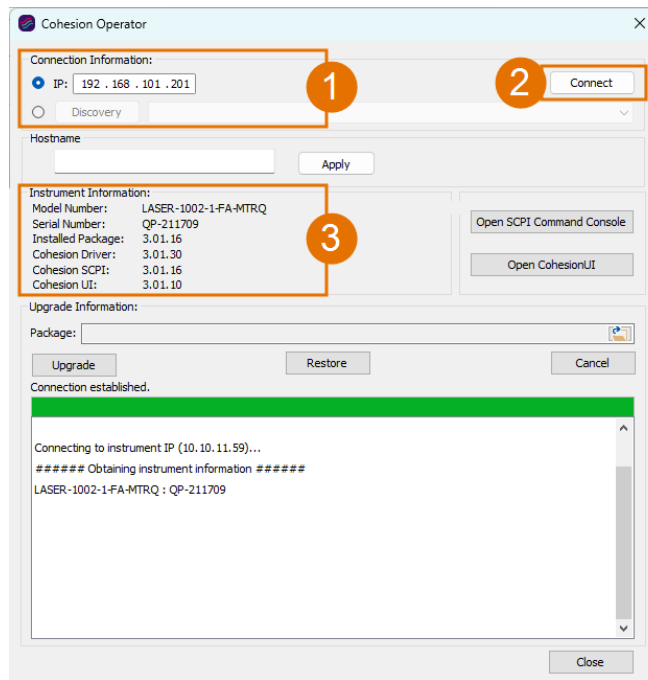
6.2 Connect with an instrument and retrieve instrument information

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.



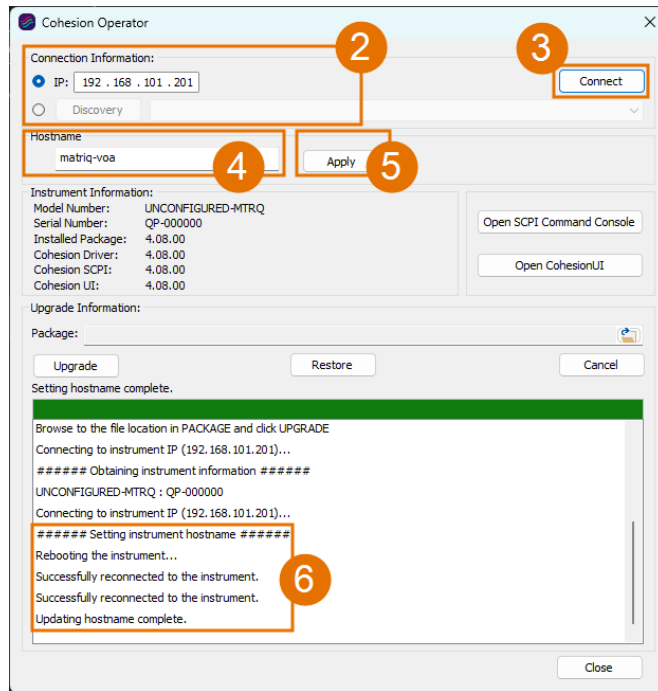
6.3 Set a hostname

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.



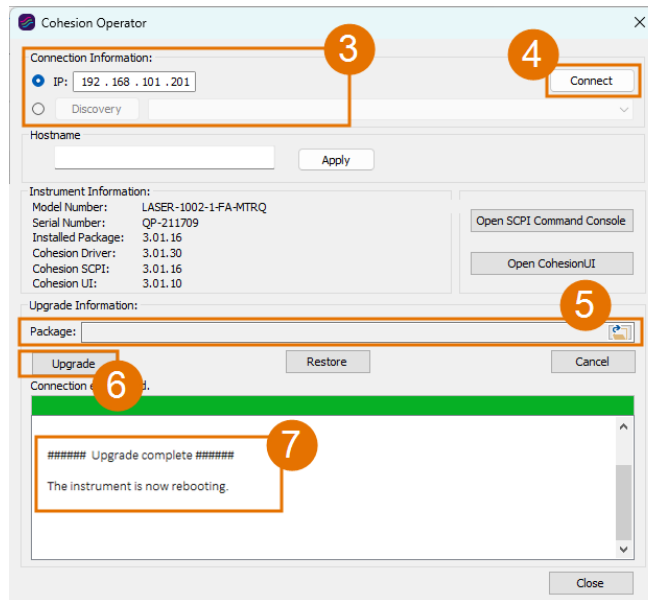
2. Select the instrument by entering its **IP address** or by selecting it from the **Discovery** drop down list.
3. To confirm that you have selected the correct instrument, click **Connect**. This will retrieve instrument information.
4. Enter a hostname.
5. Click **Apply**. Cohesion Operator will 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 EPIQ firmware package **CohesionEPIQ-<version>.qfw**, for example by downloading it from [quantifiphotonics.com](https://www.quantifiphotonics.com) (go to **Resources > Drivers, software and manuals > EPIQ 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

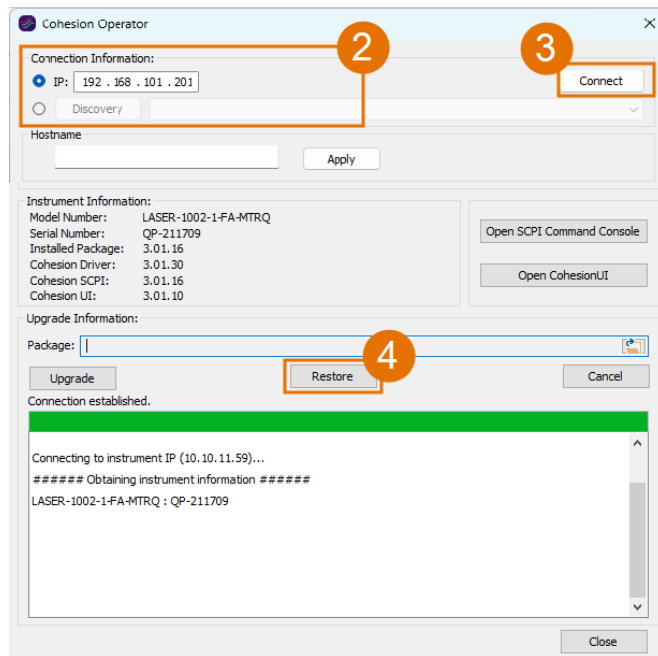
If an upgrade attempt is unsuccessful, the Cohesion Operator will stop the upgrade process and restore the instrument to its previous firmware version. Messages will be displayed accordingly.

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 EPIQ 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

The screenshot displays the CohesionUI interface for the IQTX-1203 instrument. The top header shows the instrument name "IQTX-1203" and the firmware version "IQTX-1203-FA-EPIQ CSL-204102 3.01.18". A left sidebar contains navigation links for HOME, SETTINGS, and INFO. The main area is divided into sections for CONTROL, ADVANCED, HISTORY, and SCANS. The CONTROL section displays various parameters and controls:

- GLOBAL MODE:** AUTO >
- OUTPUT POWER:** NaN (with - and + buttons)
- FORCE CALIBRATE:** Button
- Sub-sections (XI, XQ, XP, YI, YQ, YP):** Each section displays BIAS (e.g., -11.664 V, 0.253 V, -7.918 V, -6.032 V, -2.374 V, -6.118 V) and MODE (AUTO >) with - and + buttons.
- LASER 1:** A section with controls for STATE (OFF), FREQUENCY (193.414400 THz), FINE TUNE OFFSET (0.000000 THz), and POWER (-99.00 dBm).

7.1 Access instruments with CohesionUI

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

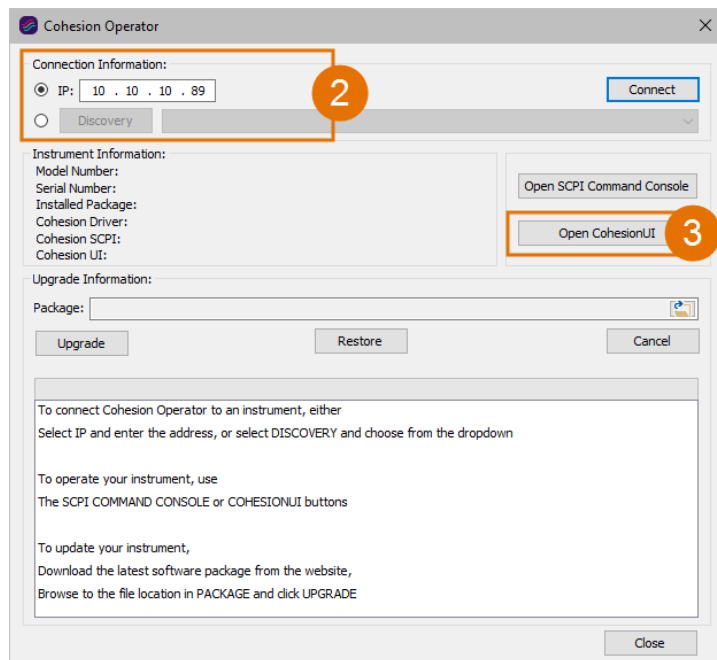
- from Cohesion Operator, or
- in a supported browser by entering the instrument IP in the address bar.

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 Set values

In CohesionUI you can set values for parameters where applicable.

- ▶ To set a value:
 1. Click on a parameter and enter a value.
 2. Confirm the value.
 3. Alternatively, you can use + and - to increase or decrease the value. You can edit the step size in the **SETTINGS** menu.
- ▶ To set a pre-defined value, for example **MIN**, **MAX** or **DEF**:
 4. Click on a parameter and select a value from the dropdown menu.
 5. Confirm the value.

The screenshot displays the CohesionUI interface with four channel configuration panels. The left sidebar contains navigation links: HOME, MODULES, SETTINGS, Large Format, CONSOLE, and INFO. The main area displays CHANNEL 1, CHANNEL 2, CHANNEL 3, and CHANNEL 4. CHANNEL 1 and 3 show the 'FINE TUNE OFFSET' parameter with a numeric input field (0.00009 THz) and a confirmation button (checkmark). CHANNEL 2 shows the same parameter with a confirmation button (checkmark) and a dropdown menu (plus/minus) for pre-defined values. CHANNEL 4 shows the 'STATE' parameter with a confirmation button (checkmark) and a dropdown menu (plus/minus) for pre-defined values. The 'WHISPER MODE' parameter is shown as a toggle switch (OFF) in all channels.

For details on how to change the step size, refer to [Manage CohesionUI settings](#).

7.3 SET values and ACTUAL values

In some cases you can manually set a value that will be displayed alongside the actual value as follows:

- **ACTUAL:** The actual value of the parameter as queried by the product.
- **SET:** The intended value of a given parameter as set by the user.

CHANNEL 1			
STATE		☐ OFF	
FREQUENCY	193.414400 THz 193.414489 THz	-	+
FINE TUNE OFFSET	0.000000 THz	-	+
POWER	- 99.00 dBm 10.00 dBm	-	+

7.4 Manage CohesionUI settings

On the **SETTINGS** page you can configure CohesionUI settings and unit preferences.

► To view all settings and unit preferences and adjust as required:

1. Click **SETTINGS**.
2. Change settings or unit preferences as required, for example temperature units.
Please note that the units displayed on this page are not always relevant for each product.
3. **Step size** refers to the amount by which a value is increased or decreased when clicking the + or - button.

The screenshot displays the 'SETTINGS' page of the Quantifi Photonics interface. The left sidebar contains navigation links: 'HOME' and 'SETTINGS' (highlighted with an orange circle 1), and 'INFO'. The main content area is divided into three sections:

- POWER**: A slider for 'POWER' with units 'dBm' and 'mW'.
- SPECTRUM**: A slider for 'SPECTRUM' with units 'THz' and 'nm'.
- TEMPERATURE**: A slider for 'TEMPERATURE' with units '°F', 'K', and '°C' (highlighted with an orange circle 2).

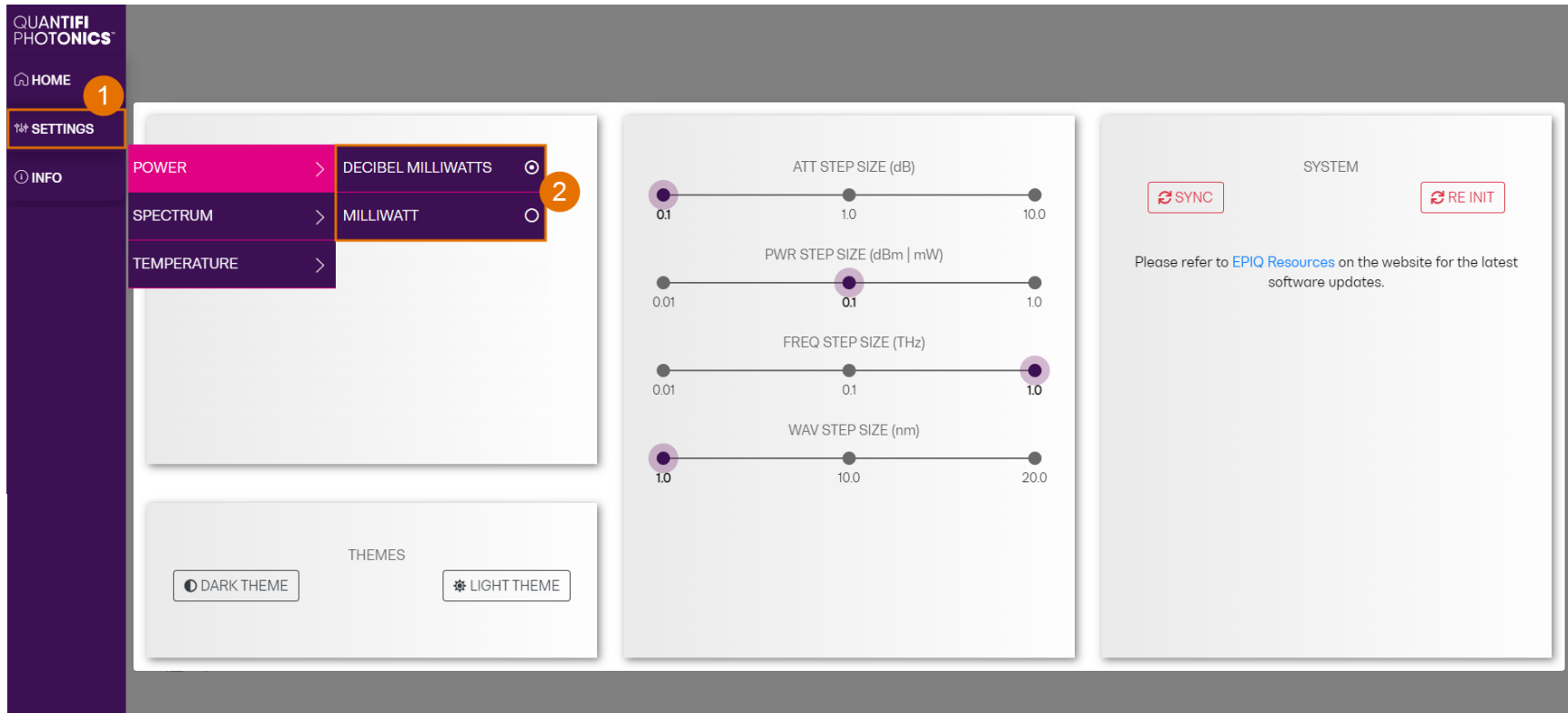
Below these sliders is a 'THEMES' section with buttons for 'DARK THEME' and 'LIGHT THEME'.

The right section, highlighted with an orange circle 3, contains four sliders for step sizes:

- ATT STEP SIZE (dB)**: Values 0.1, 1.0, 10.0.
- PWR STEP SIZE (dBm | mW)**: Values 0.01, 0.1, 1.0.
- FREQ STEP SIZE (THz)**: Values 0.01, 0.1, 1.0.
- WAV STEP SIZE (nm)**: Values 1.0, 10.0, 20.0.

The far right section, labeled 'SYSTEM', contains 'SYNC' and 'RE INIT' buttons, and a note: 'Please refer to [EPIQ Resources](#) on the website for the latest software updates.'

- To adjust unit preferences one at a time:
1. Hover over **SETTINGS**.
 2. Select a unit from the dropdown, for example the power unit.



7.5 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.

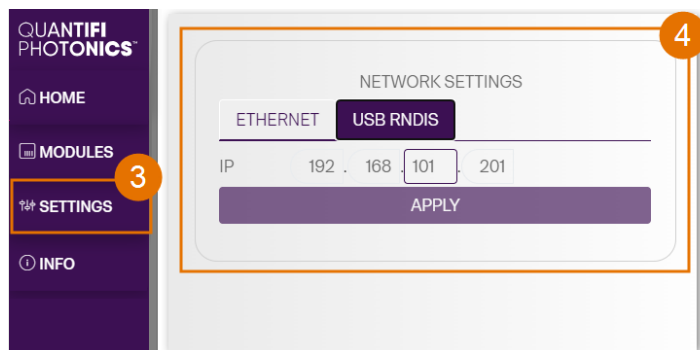
You can change the instrument's static USB IP address, and assign a static Ethernet IP address if required.

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.



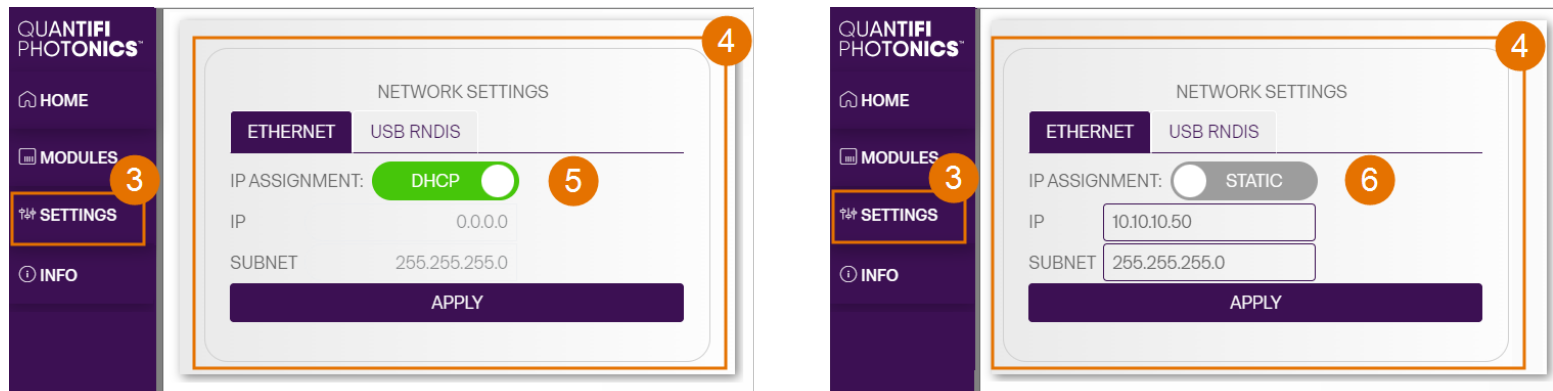
► To change the **Ethernet IP address**:

1. Connect with the instrument from a client computer via USB. Ensure that this 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 > 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.



7.6 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.

The screenshot displays the CohesionUI interface for the IQTX-1203 instrument. The interface is divided into several sections:

- Top Bar:** Displays the instrument model "IQTX-1203" and the serial number/firmware version "IQTX-1203-FA-EPIQ CSL-204102 3.01.18". A button labeled "ACTUAL | SET VALUE | REFRESH" is visible.
- Left Sidebar:** Contains navigation options: "HOME", "SETTINGS", and "INFO". The "INFO" option is highlighted with a red circle and a red "2".
- Control Panels:** The main area contains several control panels for different laser channels (XI, XQ, XP, YI, YQ, YP) and a "LASER 1" panel. Each panel shows parameters like BIAS, MODE, and output power. The "LASER 1" panel shows STATE, FREQUENCY, FINE TUNE OFFSET, and POWER.
- Right Panel:** Displays system information under the heading "CohesionUI™". It lists the company (QUANTIFI PHOTONICS LTD), model (IQTX-1203-FA-EPIQ), serial number (CSL-204102), UI version (3.01.14), server version (3.01.18), driver version (3.01.32), and chassis mode (SINGLE). This panel is highlighted with a red circle and a red "3".

8 Controlling your IQTX with CohesionUI

You can use Quantifi Photonics' graphical user interface CohesionUI to work with your product. For details on how to get started with CohesionUI, refer to [CohesionUI - Overview](#).

The CohesionUI IQTX HOME screen displays the following:

1. Modulation channels, including the following tabs:
 - CONTROL:** Control mode and bias values of the modulation channels, and laser settings.
 - ADVANCED:** Control modulator dither size values and interval.
 - HISTORY:** Review modulator bias values vs time error history plots.
 - SCANS:** Review modulator biases power vs biases voltage plots
2. Laser controls.

The screenshot displays the CohesionUI IQTX HOME screen. At the top, a blue header bar shows 'IQTX-1203' on the left and 'IQTX-1203-FA-EPIQ CSL-204102 3.01:18' on the right, with buttons for 'ACTUAL', 'SET VALUE', and 'REFRESH'. Below the header, there are four tabs: 'CONTROL', 'ADVANCED', 'HISTORY', and 'SCANS'. The 'CONTROL' tab is selected and highlighted with an orange circle labeled '1'. The main area is divided into two sections. The top section, labeled '1', contains six modulation channel controls (XI, XQ, XP, YI, YQ, YP) and a 'FORCE CALIBRATE' button. Each channel has a 'BIAS' value and a 'MODE' dropdown menu. The bottom section, labeled '2', is titled 'LASER 1' and contains a 'STATE' toggle switch (currently OFF), 'FREQUENCY' (193.414400 THz), 'FINE TUNE OFFSET' (0.000000 THz), and 'POWER' (-99.00 dBm). The 'LASER 1' section is also highlighted with an orange circle labeled '2'.

Channel	Bias	Mode
XI	- 3.689 V	MANUAL >
XQ	12.005 V	MANUAL >
XP	- 7.857 V	MANUAL >
YI	- 6.957 V	MANUAL >
YQ	- 3.238 V	MANUAL >
YP	- 3.088 V	MANUAL >

Parameter	Value
STATE	OFF
FREQUENCY	193.414400 THz
FINE TUNE OFFSET	0.000000 THz
POWER	- 99.00 dBm

8.1 Setting the modulation channels mode

The IQTX modulation channels can operate in AUTO mode (default) or MANUAL mode.

► To set the mode for all modulation channels:

1. In the **CONTROL** tab, click **GLOBAL MODE** and select a mode.

The screenshot shows the CONTROL tab interface. At the top, there are tabs: CONTROL, ADVANCED, HISTORY, and SCANS. Below the tabs, there is a GLOBAL MODE dropdown menu, which is highlighted with an orange box and a circled '1'. The dropdown menu shows 'AUTO' selected and 'MANUAL' as an option. To the right of the dropdown is the OUTPUT POWER display, which shows 'NaN' and two buttons: '-' and '+'. Further right is a button labeled 'FORCE CALIBRATE'. Below these are six modulation channel sections: XI, XQ, XP, YI, YQ, and YP. Each section has a BIAS value and a MODE dropdown menu. The BIAS values are: XI (-8.269 V), XQ (2.626 V), XP (-11.802 V), YI (-6.289 V), YQ (2.162 V), and YP (-6.088 V). The MODE dropdowns are all set to 'AUTO'.

► To set the mode for a selected modulation channel:

2. In the **CONTROL** tab, click **MODE** for a modulation channel and select a mode.
3. **GLOBAL MODE** will change to **CUSTOM**.

The screenshot shows the CONTROL tab interface after the first step. The GLOBAL MODE dropdown is now set to 'CUSTOM' and is highlighted with an orange box and a circled '3'. The MODE dropdown for the XI channel is highlighted with an orange box and a circled '2', showing 'MANUAL' selected. The BIAS values for the channels are: XI (-11.200 V), XQ (-1.146 V), XP (-9.164 V), YI (0.747 V), YQ (-6.343 V), and YP (-5.992 V). The MODE dropdowns for XQ, XP, YI, YQ, and YP are still set to 'AUTO'.

8.2 Setting the modulation channels bias values

In the **CONTROL** tab, you can set the BIAS value for each modulation channel.

The screenshot shows the **CONTROL** tab interface. At the top, there are tabs for **CONTROL**, **ADVANCED**, **HISTORY**, and **SCANS**. Below these, the **GLOBAL MODE** is set to **CUSTOM**. The **OUTPUT POWER** is displayed as **NaN**. A **FORCE CALIBRATE** button is present. The interface is divided into six sections for modulation channels: **XI**, **XQ**, **XP**, **YI**, **YQ**, and **YP**. Each section has a **BIAS** field and a **MODE** dropdown. The **BIAS** values are: **XI** (-11.2 V), **XQ** (-1.402 V), **XP** (-9.505 V), **YI** (1.036 V), **YQ** (-6.312 V), and **YP** (-5.331 V). The **MODE** for **XI** is **MANUAL**, while for all other channels it is **AUTO**.

For details on how to set a value, refer to [SET values and ACTUAL values](#)

8.3 Output power value

The global **OUTPUT POWER** of the IQTX instrument is displayed in the **CONTROL** tab on the top-middle ribbon of the screen.

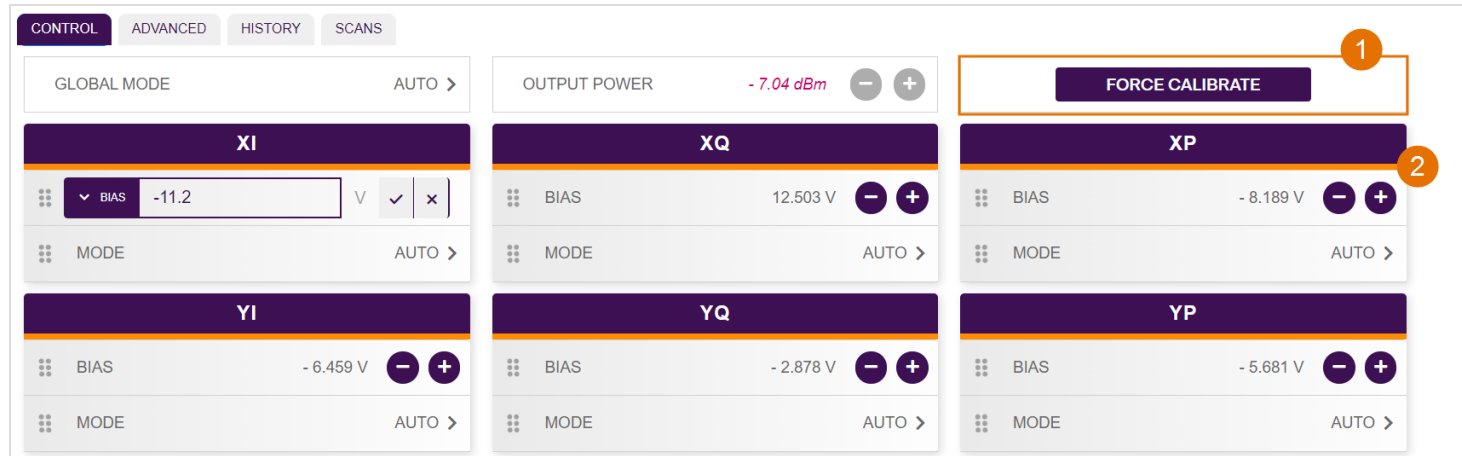
The screenshot shows the **CONTROL** tab interface. At the top, there are tabs for **CONTROL**, **ADVANCED**, **HISTORY**, and **SCANS**. Below these, the **GLOBAL MODE** is set to **AUTO**. The **OUTPUT POWER** is displayed as **-7.04 dBm**. A **FORCE CALIBRATE** button is present. The interface is divided into six sections for modulation channels: **XI**, **XQ**, **XP**, **YI**, **YQ**, and **YP**. Each section has a **BIAS** field and a **MODE** dropdown. The **BIAS** values are: **XI** (-11.2 V), **XQ** (12.503 V), **XP** (-8.189 V), **YI** (-6.459 V), **YQ** (-2.878 V), and **YP** (-5.681 V). The **MODE** for all channels is **AUTO**.

8.4 Initiating a DC-bias scan

You can initiate a new DC-bias scan after the initial power-up of the unit and when you require a new scan of the current Min-Min-Quad bias points.

► To initiate the scan:

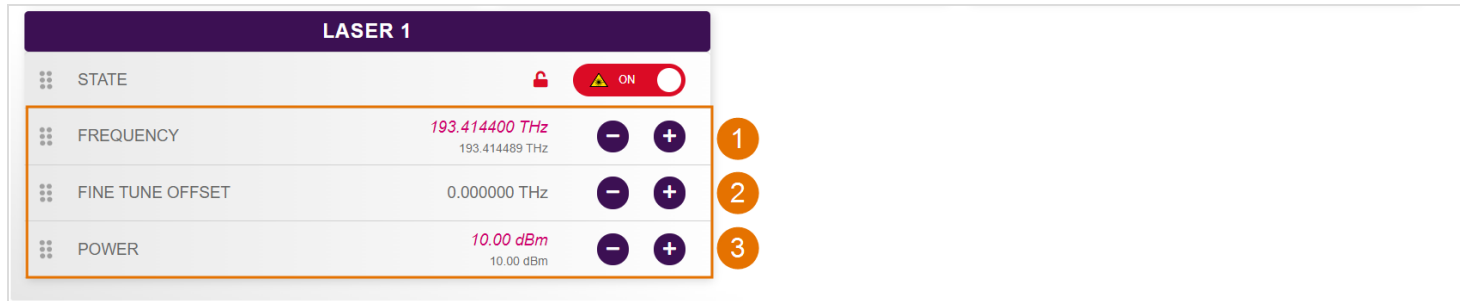
1. Click **FORCE CALIBRATE** in the **CONTROL** tab or in the **HISTORY** tab.
2. During the re-calibration process, the color strip under the bias label will turn orange. Once the unit has found the correct bias point, the color strip will turn green.



8.5 Setting the laser source parameters

In the CONTROL tab, you can set the following laser source parameters for a laser channel:

1. **FREQUENCY (WAVELENGTH):** The frequency (wavelength) of light for the IQTX to output. This corresponds to the spectral location of the central peak of the laser.
2. **FINE TUNE OFFSET:** See section [Tuning the laser source](#).
3. **POWER:** IQTX output power.



For details on how to set a value, refer to [SET values and ACTUAL values](#)

8.6 Tuning the laser source

The 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.

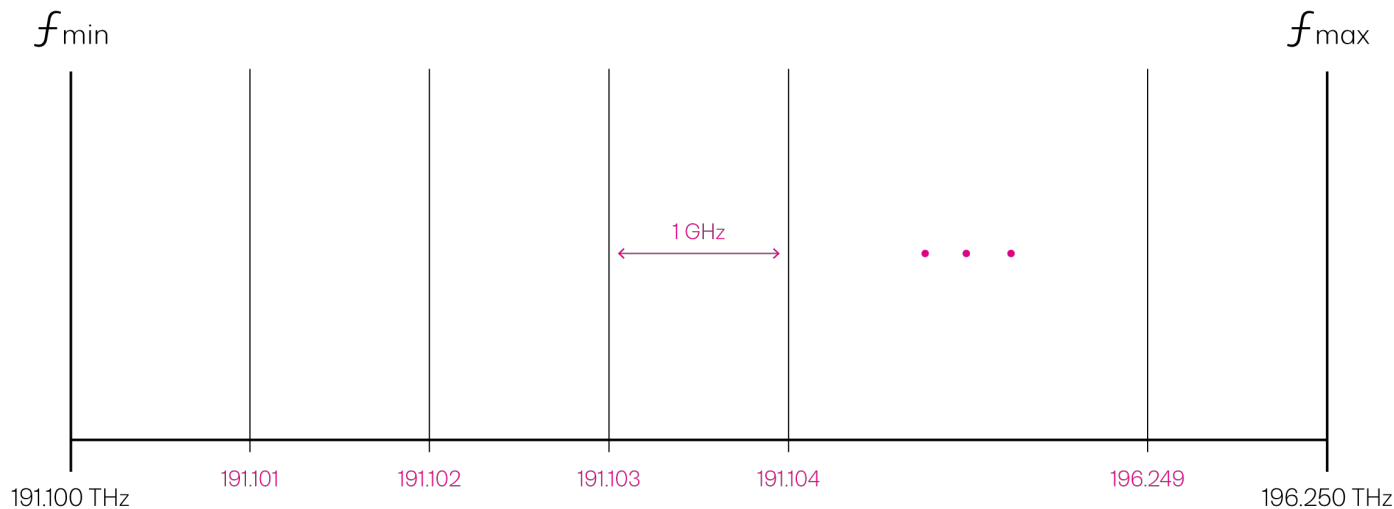
Tuning can be realized through the following commands. Refer to the SCPI command section for specific information about the listed commands.

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.

8.6.1 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 model will have a MIN and MAX frequency value, which defines its operation range. For example 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: $F_MIN + [GRID \times [N + 1]]$, where GRID = GRID spacing set by user, $N \geq 1$

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 (refer to [Frequency Fine tuning](#) for more information).

8.6.2 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).

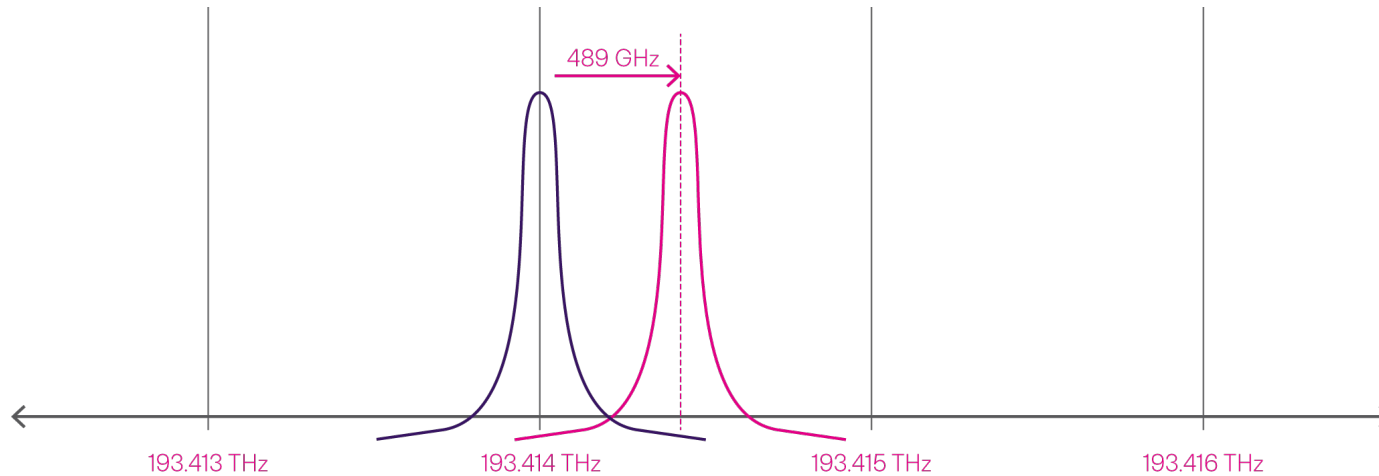
Intended user frequency value	Accepted frequency value	Applied frequency value
193.41448 THz	193.4144800 THz	193.414480 THz
193.4144890 THz	193.414489 THz	193.414489 THz
193.41448905 THz	193.414489 THz	193.414489 THz
193.000000055 THz	193.000000 THz	193.000000 THz

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	:SOUR2:CHAN1:FREQ 193.414 THz	193.414 THz	193.414000 THz
193.42501 THz	:SOUR2:CHAN1:FREQ 193.42501 THz	193.425 THz	193.425010 THz
193.414489 THz	:SOUR2:CHAN1:FREQ 193.414489 THz	193.414 THz	193.414489 THz
193.4144895 THz	:SOUR2:CHAN1:FREQ 193.4144895 THz	193.414 THz	193.414489 THz
193.4000001 THz	:SOUR2: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.

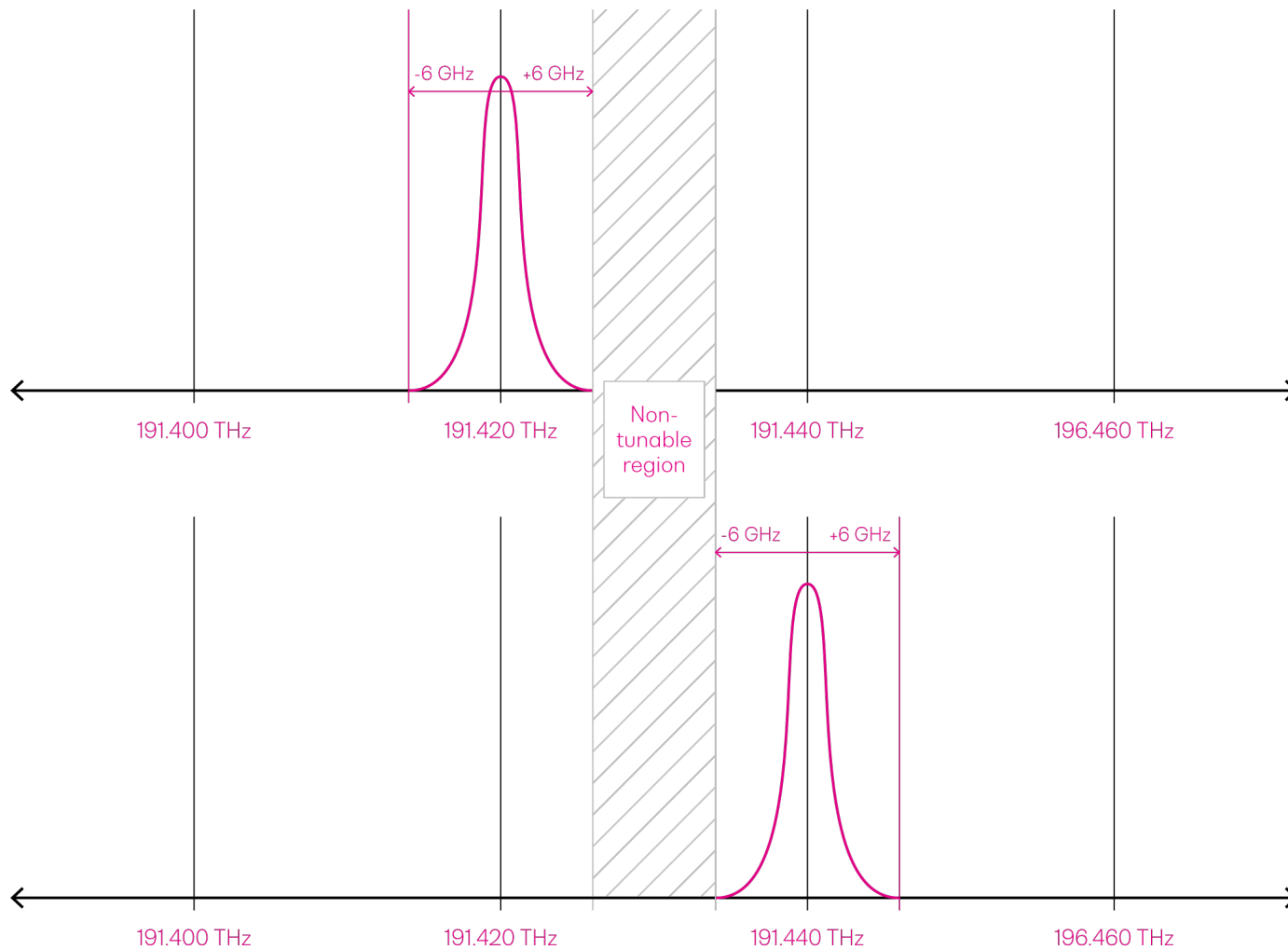


8.6.3 Frequency Fine tuning

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.

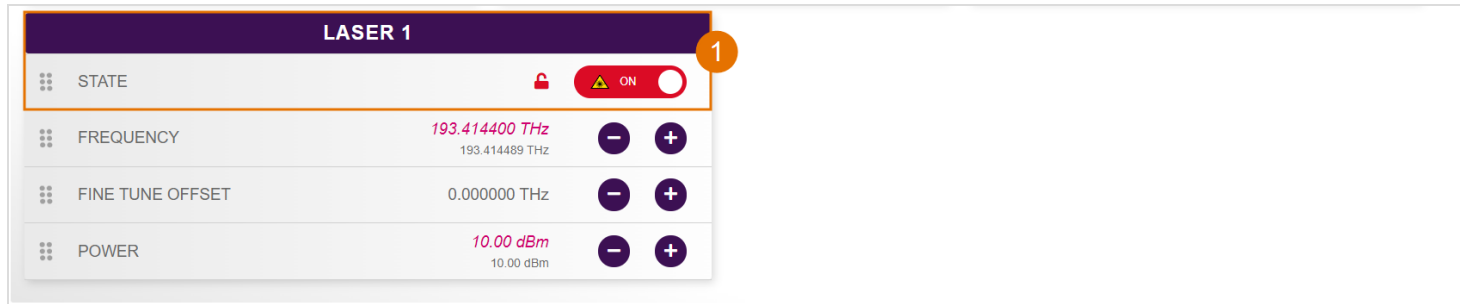
Commands	Description
<code>:SOUR2:CHAN1:GRID 1 GHz</code>	
<code>:SOUR2:CHAN1:FREQ 193.414489 THz</code>	
<code>:SOUR2:CHAN1:FREQ:FINE? -> 489 MHz</code>	Query the frequency fine setting.
<code>:SOUR2:CHAN1:FREQ:FINE 50 MHz</code>	Fine tune the frequency by +50 MHz from the current GRID point (193.414 THz).
<code>:SOUR2:CHAN1:FREQ? -> 193.414050 THz</code>	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.



8.7 Toggling the laser on/off

In the **CONTROL** tab, you can toggle the laser in a specific channel of the IQTX ON or OFF by clicking the **STATE** button.



8.8 Setting the dither size

The **DITHER SIZE** value (percentage of VPI) for each modulator bias can be set in the **ADVANCED** tab by clicking the parameter field, or by using the + and – control buttons to increase or decrease the value by a set amount. The step size is set to 2%. Alternatively, the **DITHER SIZE** can also be set to the MIN and MAX value by clicking the dropdown in the name of the parameter.

Increasing the dither size will lead to a more accurate bias optimization, but a larger dither will show up as an occasional perturbation to the bias voltage.

It is recommended to use the default dither size unless a residual bias error is constantly observed. In such cases, increasing the step size can improve the bias convergence accuracy.

The screenshot shows the 'ADVANCED' tab of a software interface. At the top, there are tabs for 'CONTROL', 'ADVANCED', 'HISTORY', and 'SCANS'. Below these, there is a 'DITHER INTERVAL' field set to 24.000 with minus and plus buttons. To the right is a 'RESET ALL DITHERS' button. The main area is divided into three columns of modulator settings: XI, XQ, and XP in the top row, and YI, YQ, and YP in the bottom row. Each modulator has a 'DITHER SIZE (% of VPI)' field with minus and plus buttons. The XI modulator's settings are highlighted with an orange box, showing a dropdown menu with 'MIN', 'MAX', and 'DEF' options. The current value for XI is 1.000 %.

Modulator	DITHER SIZE (% of VPI)
XI	1.000 %
XQ	2.700 %
XP	1.350 %
YI	2.700 %
YQ	2.700 %
YP	1.350 %

8.9 Setting the dither interval

The **DITHER INTERVAL** value for each modulator can be set in the **ADVANCED** tab by clicking the parameter field, or by using the + and – control buttons to increase or decrease the value by a set amount. Alternatively, the **DITHER INTERVAL** can also be set to the MIN and MAX value by clicking the dropdown in the name of the parameter.

The dither interval determines how frequently the bias control dither is applied. Lower dither interval will result in a faster convergence, while a higher dither interval will result in a more stable bias control.

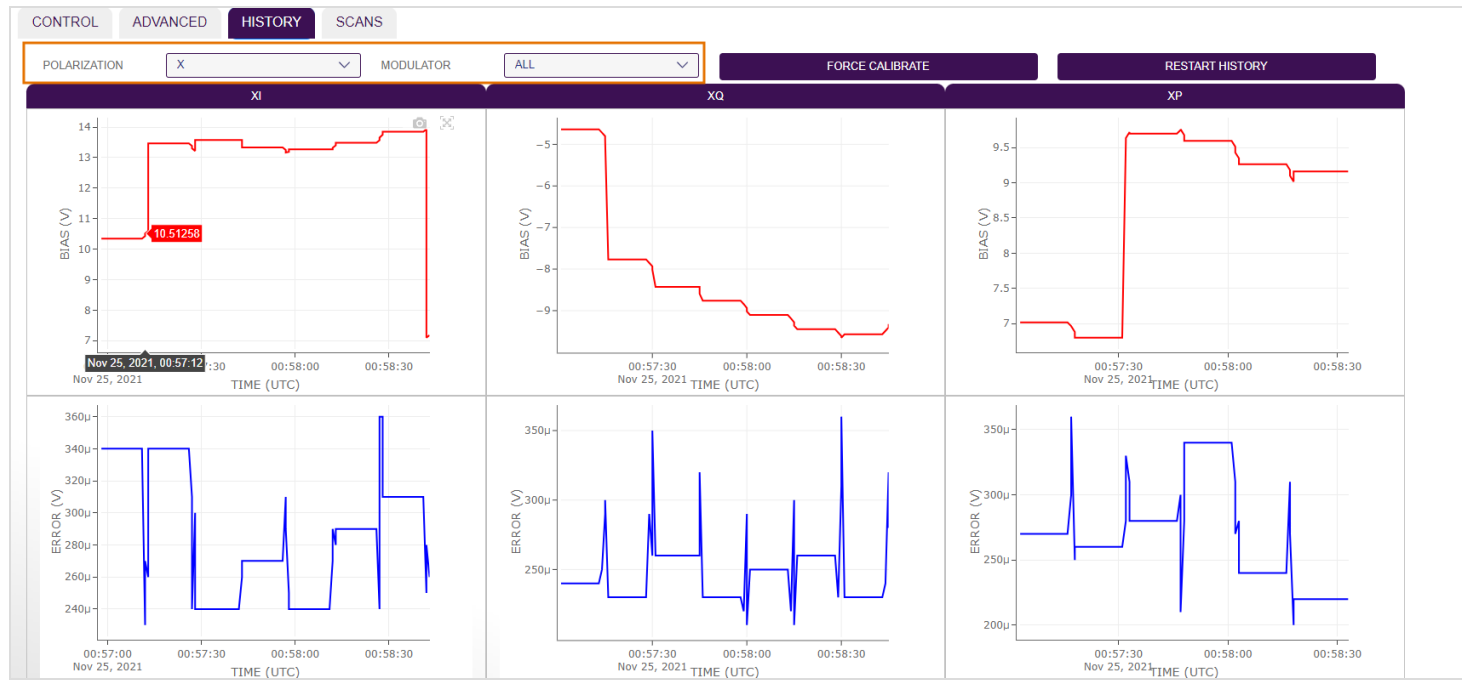
The screenshot shows the 'ADVANCED' tab of the software interface. The 'DITHER INTERVAL' field is highlighted with an orange box and set to 24. Below it, the 'DITHER SIZE (% of VPI)' settings for the XI, XQ, and XP modulators are visible. The XI modulator's settings are also highlighted with an orange box, showing a dropdown menu with 'MIN', 'MAX', and 'DEF' options. The current value for XI is 2.700 %.

Modulator	DITHER SIZE (% of VPI)
XI	2.700 %
XQ	2.700 %
XP	1.350 %

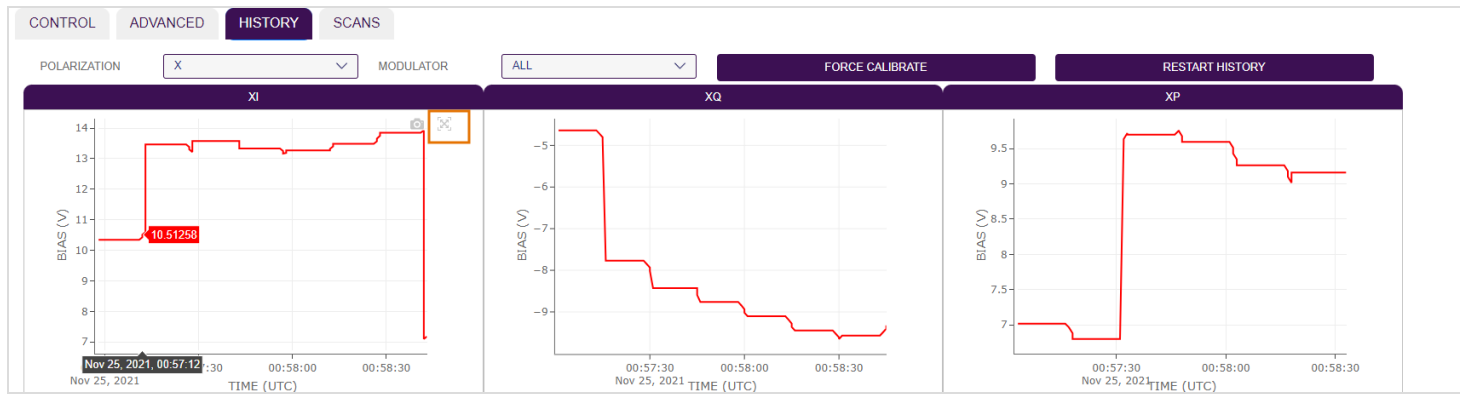
8.10 Reviewing modulator bias values vs time error history plots

To review modulator bias value vs. time error history plots, click the **HISTORY** tab.

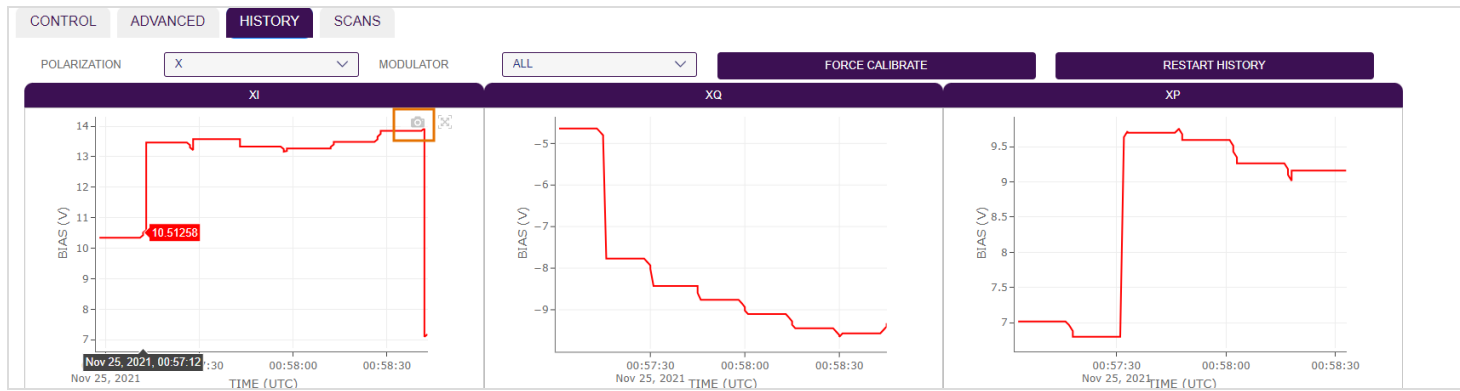
The polarization (X or Y) and the modulator biases (All, I, Q, P) can be selected and filtered by clicking the drop down lists above the plots area.



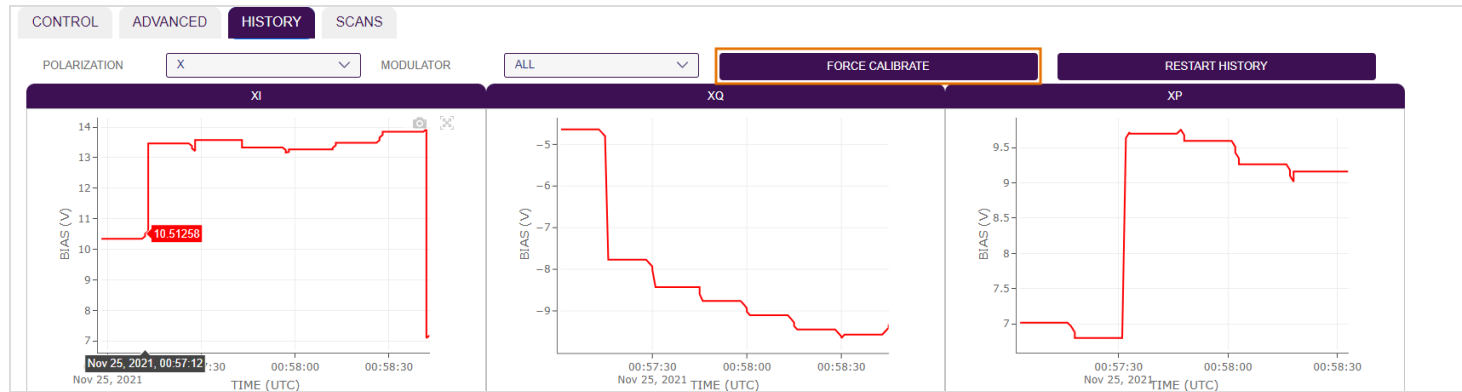
The plots can be zoomed to show a specific section of the analysis by clicking and dragging the desired area with the cursor. To reset the zoom, click the **Autoscale** button or double-click on the plot area.



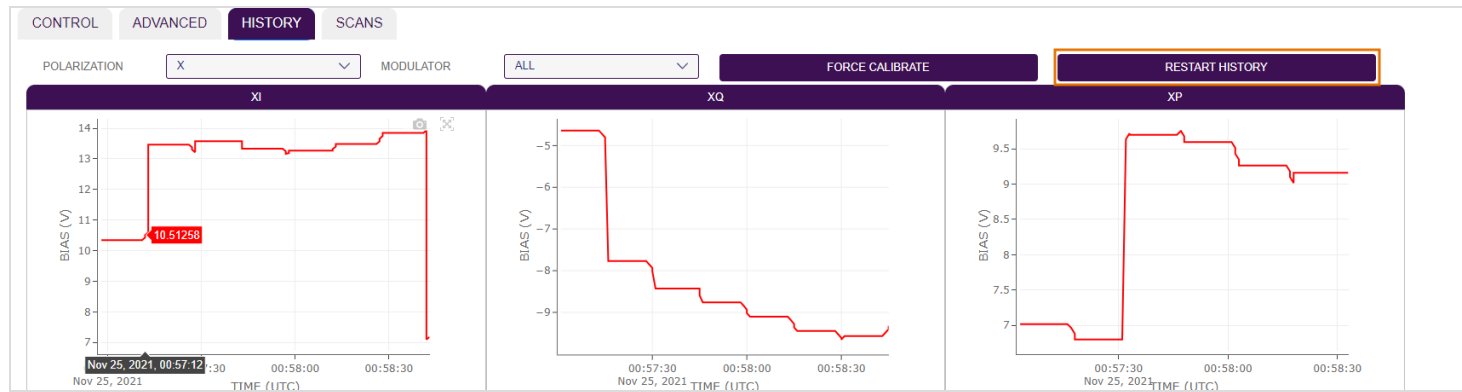
To download a plot as a PNG file, click the **Download plot as a png** button.



Clicking the **FORCE CALIBRATE** button will initiate a new DC bias scan.



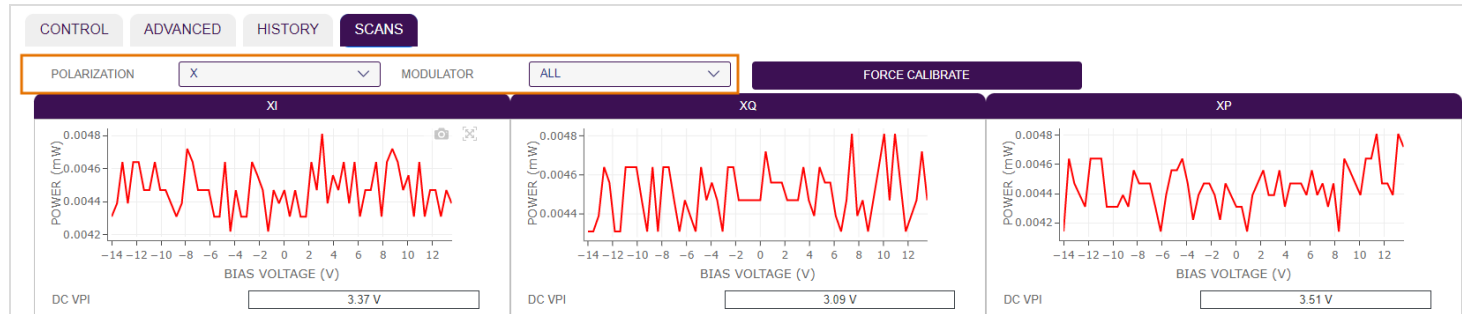
To clear the modulator's error plots history, click the **RESTART HISTORY** button.



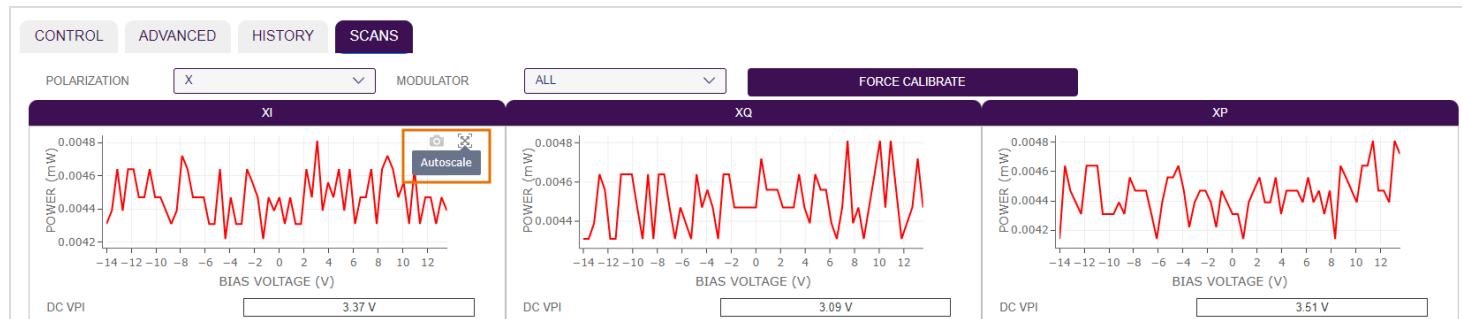
8.11 Reviewing modulator biases power vs biases voltage plots

To review modulator biases power vs. biases voltage plots, click the **SCANS** tab.

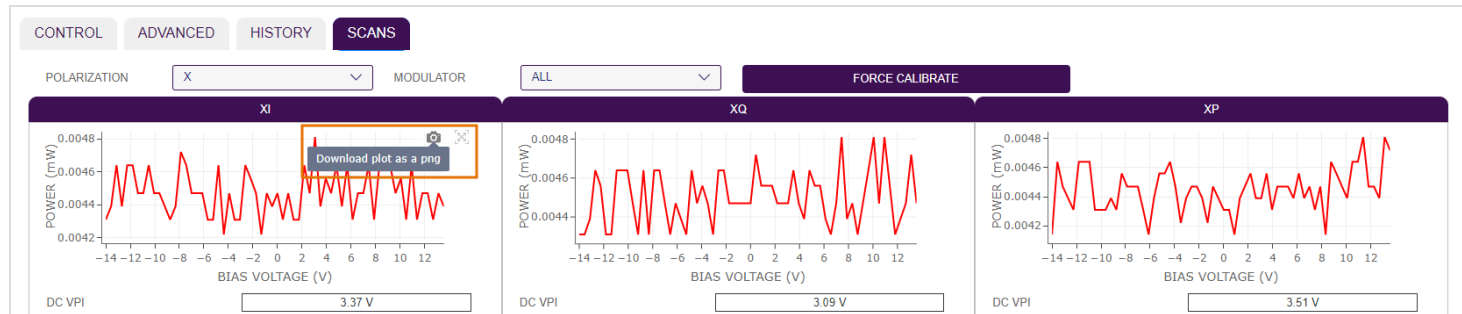
The polarization (X or Y) and the modulator biases (All, I, Q, P) can be selected and filtered by clicking the drop down lists above the plots area.



The plots can be zoomed to show a specific section of the analysis by clicking and dragging the desired area with the cursor. To reset the zoom, click the **Autoscale** button or double-click on the plot area.



To download a plot as a PNG file, click the 'Download plot as a png' button.



9 Operating the IQTX from the LCD interface

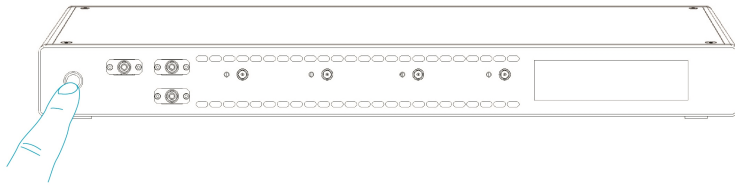
9.1 Powering the IQTX ON / OFF

To power on the IQTX press the On / Off button; the button will become illuminated to verify the instrument is powered on.

NOTE

After powering on the IQTX, please wait at least 1 minute before attempting to communicate with the instrument. This will allow the IQTX enough time to finish boot procedures and initialize the communication server.

To power Off the IQTX press the On / Off button. The button will no longer be illuminated, indicating the instrument is Off.

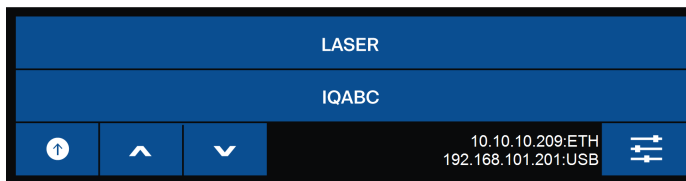


9.2 LCD control touch-screen Graphical User Interface (GUI)

9.2.1 Main display

The main display shows the available laser channels and their frequency and power values, along with the option to power on / off a specific laser channel and to adjust the settings of the instrument.

The IQTX IP address is displayed irrespective of the operation mode (access over USB or Ethernet). When both USB and Ethernet cables are connected to the instrument, the IP displayed on the LCD will alternate between USB and Ethernet IP addresses.



The LCD display is for indicative purposes only. The main user interface for monitoring the unit status is the web-based graphical user interface CohesionUI. Due to the characteristics of the LCD, the display may be unavailable under extreme working conditions, including changes in supply voltage, electromagnetic interference, temperature, and humidity.

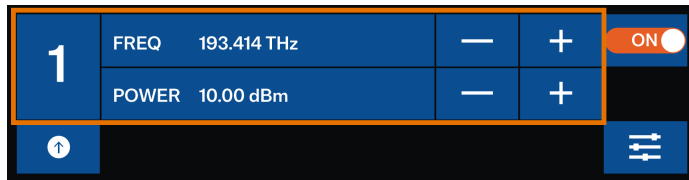
9.2.2 Setting laser channel parameter values

Clicking the laser channel row in the main display will open the configuration panel of the laser channel.

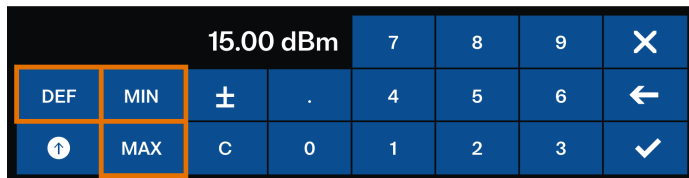
Specific parameters of the laser channel can be set either by clicking the parameter name, or by using the + and – control buttons to increase or decrease the value field by a set amount. This step size is set in the STEP SIZE tab in the menu.

This applies to the following parameters:

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



Alternatively, the parameter can also be set to the MIN, MAX or DEF value by clicking the buttons in the parameter settings panel. In the example below, the POWER has been set to the MAX value of 15 dBm. To apply the changes, click the tick mark.



NOTE

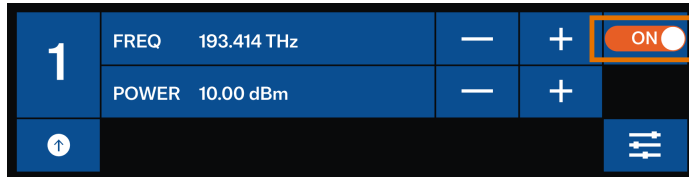
The tick mark **MUST** be clicked in order for any changes or values that were entered to be applied successfully.

9.2.3 Toggling the laser channel on / off

To toggle the laser in a specific channel ON or OFF, click the ON / OFF toggle button.

NOTE

After toggling the laser channel **from OFF to ON**, the IQTX instrument will take up to **30 seconds to stabilize** its power and frequency.



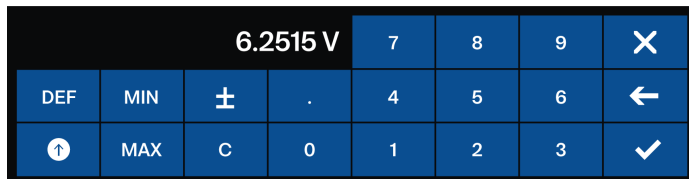
9.2.4 Setting modulation channel parameters

Clicking the IQABC row in the main display will open the configuration panel of the modulation channels.

Select a channel and set the mode to **AUTO** or **MANUAL**.



In manual mode you can set the BIAS value for the channel.



9.2.5 Settings menu

The settings menu is used to configure the IQTX instrument settings and unit preferences.

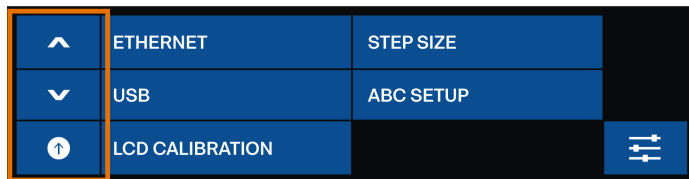
These controls can be accessed by clicking the settings button on the right-hand bottom corner.



9.2.6 Navigation within the settings menu

The up and down arrows are used to scroll the selections of the menu when there are more options than can be displayed.

The bottom button is used to take a step 'back' one level in the menu system. This will return you to the previous menu page.



9.2.7 Device information

To access the information about the IQTX instrument, click on the DEVICE INFO tab in the menu. IQTX's model name and serial number will be displayed along with the software version number.



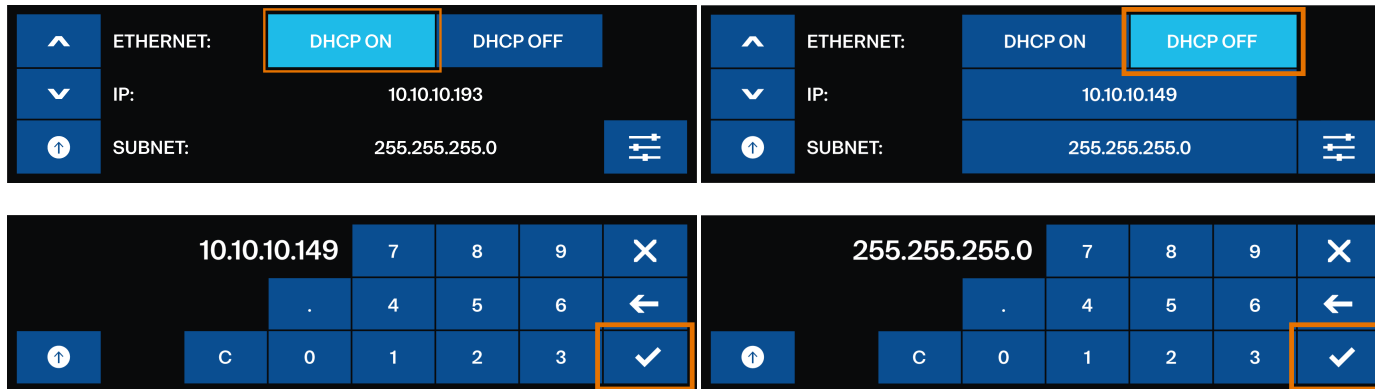
9.2.8 Ethernet connectivity configuration

To access the Ethernet connectivity configuration, click on the **ETHERNET** tab in the menu.

To set a dynamic IP addressing method, select the **DHCP ON** button. The DHCP will automatically assign the instrument an IP address.

To set a static IP address over the Ethernet, select the **DHCP OFF** button and set the IP address and the Subnet mask by clicking on the **IP / SUBNET** field and typing in a valid value. To save and apply the changes click the tick mark.

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 main LCD display.

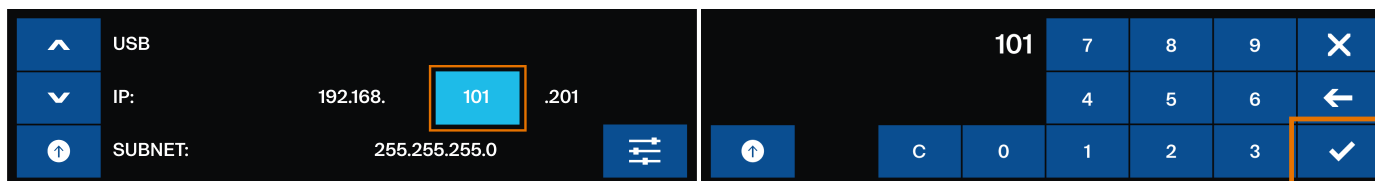


9.2.9 USB connectivity configuration

To access the USB connectivity configuration, click on the **USB** tab in the menu.

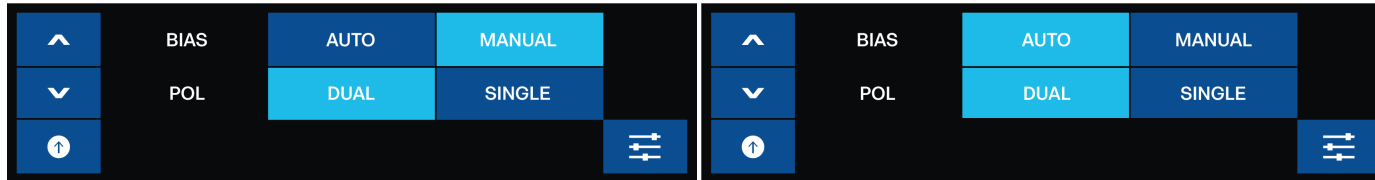
When connected via USB, the default IP address is **192.168.101.201**. This is a static address set during instrument calibration. If necessary, this address can be changed. Typing the default IP address in a supported web browser will open the CohesionUI page for the instrument.

To change the USB IP address, click on the **3rd octet** of the IP address and set 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. To save and apply the changes click the tick mark.



9.2.10 ABC setup settings

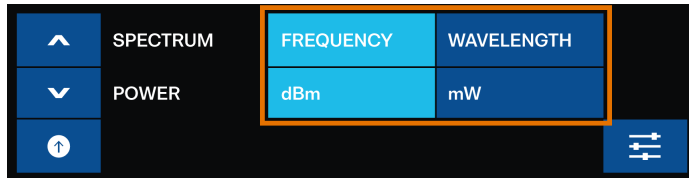
To access the ABC setup settings, click on **ABC SETUP** in the Settings menu.



9.2.11 Unit settings

To access the unit settings, click on the **UNITS** tab in the menu.

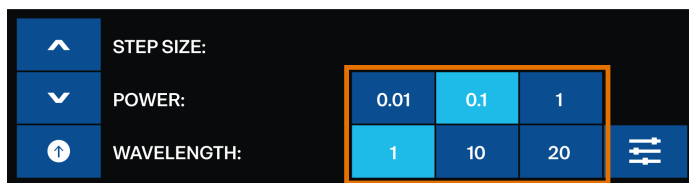
Set the preferred measuring unit of the spectrum and the power by selecting the desired unit type next to the value.



9.2.12 Step size settings

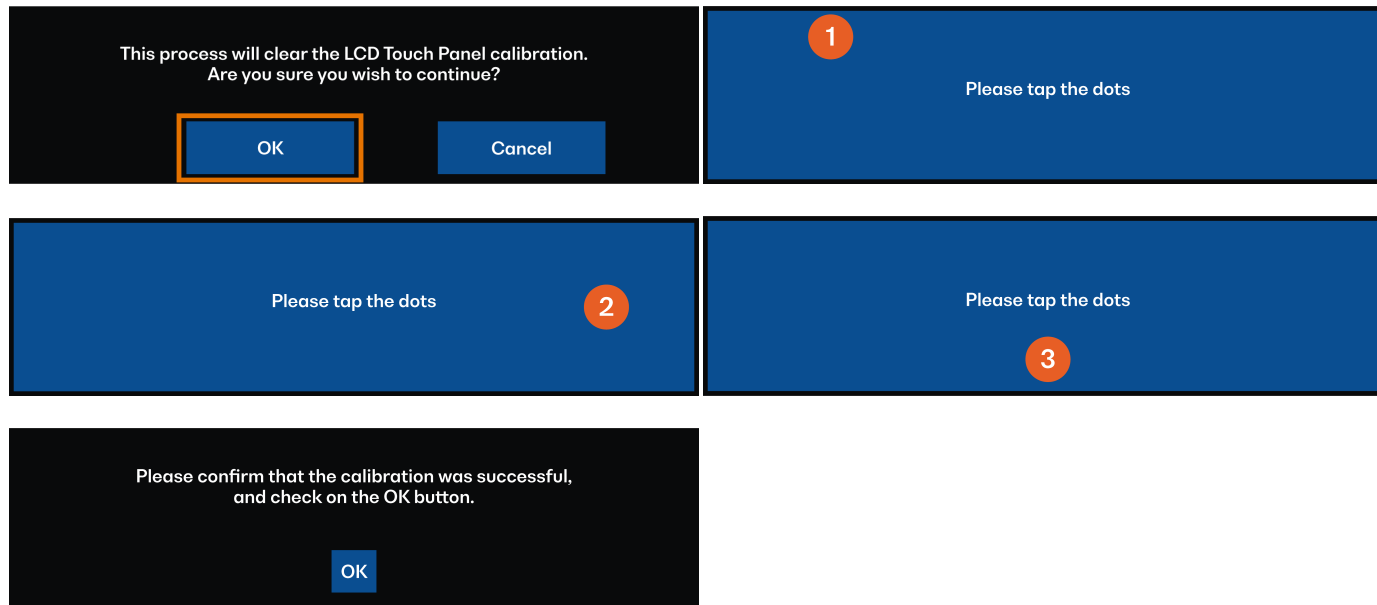
To access the step size settings, click on the **STEP SIZE** tab in the menu.

Step size refers to the amount by which the wavelength, power and additional values increase or decrease when the + or - button are clicked.



9.2.13 LCD calibration reset

To reset the LCD interface settings and calibration, click on the **LCD CALIBRATION** tab in the menu and select **OK**. Follow the instructions on the display to calibrate the LCD interface.



10 Controlling your IQTX 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.

10.1 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	MDBM, UDBM, W, MW, UW
Frequency	HZ	THZ, GHZ, MHZ, KHZ
Frequency Fine	HZ	THZ, GHZ, MHZ, KHZ
Wavelength	NM	M, MM, UM, PM
Bias	V	MV
Offset	UI	
Grid size	HZ	THZ, GHZ, MHZ, KHZ
Time	S	MS, US, NS

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.

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

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

For the commands that require index values:

<n> is the module index of the specific module within the IQTX instrument, this is an integer > 0.

<m> is the channel index of a specific channel, this is an integer, <1 to 6>.

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.

10.2 Status and event registers

10.2.1 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

10.2.2 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.

10.2.3 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.

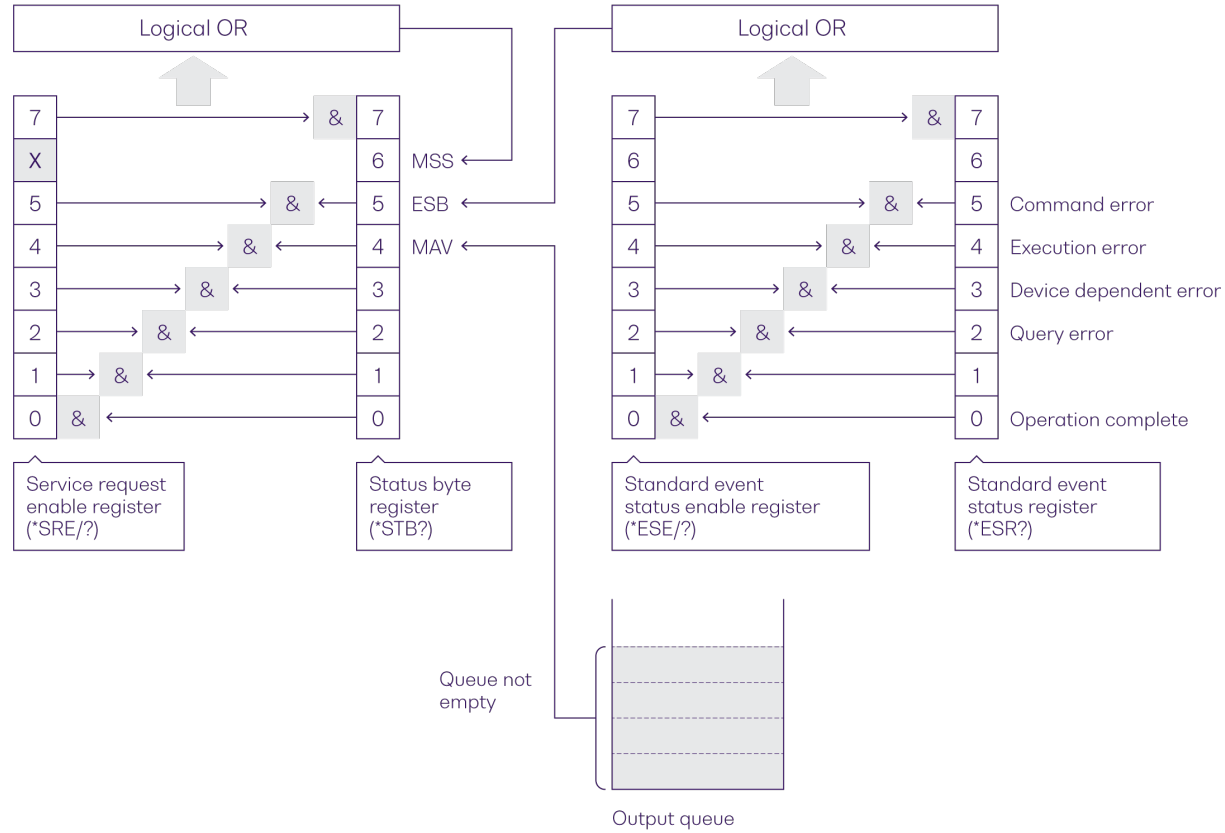
Bit	Description
7 (MSB)	Not used
6	The Master Summary Status (MSS) bit is set from the STB and SRE Mask
5	The Event Status Bit (ESB) is set from the SESR and the SESR Mask
4	Message Available (MAV) is set when there is data in the output queue
3, 2, 1, 0 (LSB)	Not used

10.2.4 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

10.2.5 Status and event registers diagram



10.3 Command summary

10.3.1 Common commands

Command	Description
*IDN?	Query the instrument identification >>
*OPT?	Query the modules installed in the instrument >>
*OPC?	Query the Operation Complete Status >>
*ESR?	Query the Standard Event Status Register >>
*ESE?	Query the Standard Event Status Enable Register (Mask) >>
*TST?	Query the instrument self-test status >>
*RST	Reset instrument to default power-on settings >>

10.3.2 System commands

Command	Description
:SYSTem	
:INFO?	Query the version of services >>
:MODULEs?	Query the number of modules installed in the instrument >>
:PRESet	Restore instrument settings to power-on default values >>

10.3.3 Module commands

Command	Description
:MODULE<n>	
:IDN?	Query the module identification >>
:OPC?	Query the Operation Complete Status of the module >>
:OPTions?	Query the channels installed in the module >>
:PRESet	Restore instrument settings to power-on default values >>

10.3.4 Configuration commands - ABC module

Command	Description
:ABC<n>	
:XI XQ XP YI YQ YP	
:PILOT?	Query the modulator channel auto-bias state >>
:PILOT	Set the modulator channel auto-bias state >>
:BIAS?	Query the modulator channel bias voltage >>
:BIAS	Set the modulator channel bias voltage >>
:LOCK?	Query whether the bias is locked to its optimal position >>
:HISTory?	Query the error history timeframe and reason >>
:SCAN?	Query the ABC modulator scan results >>
:GAIN?	Query the gain VPi percentage (dither size) >>
:GAIN	Set the gain VPi percentage (dither size) >>
:PDPower?	Query the output power of the unit in mW >>
:PDPower	Set the output power of the unit to NULL >>
:TIMEnulling?	Query the dark nulling time remained to complete >>
:NULLing	Perform dark current nulling on the specified channel >>
:CALibrate?	Queries the recalibration status of the auto-bias control system >>
:CALibrate	Forces recalibration of the auto-bias control system >>
:HISTory	
:START	Set a reset of the error history >>
:VPI?	Query the DC scan VPi >>
:SLOWfactor?	Query the optimizer timing factor >>
:SLOWfactor	Set the optimizer timing factor >>

10.3.5 Configuration commands - laser module

Command	Description
:OUTPut<n>	
:CHANnel [m]	
:STATE?	Query the optical output state of the laser >>
:STATE	Set the optical output state of the laser >>
:SOURce<n>	
:CHANnel [m]	
:POWer?	Query the laser output power >>
:POWer	Set the laser output power >>
:WAVelength?	Query the laser wavelength >>
:WAVelength	Set the laser wavelength >>
:FREQuency?	Query the laser frequency >>
:FREQuency	Set the laser frequency >>
:FINE?	Query the fine tune laser output frequency >>
:FINE	Set the fine tune laser output frequency >>
:GRID?	Query the grid spacing >>
:GRID	Set the grid spacing >>
:TEMPerature?	Query the laser temperature >>

10.4 Command descriptions

10.4.1 Common commands

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 Ltd, IQTX-1203-FA-EPIQ, CSL-204102, HW0.00.00SW3.00.02	

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? -> LASER, IQABC	

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<slot>:OPC? is NOT equal 1, may not execute or return an error.	
Example	*OPC? -> 1	

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.

Command	*ESE?	Summary >>																											
Syntax	*ESE?																												
Description	Query the Standard Event Status Enable Register (Mask)																												
Parameters	N/A																												
Response	Unsigned integer 8 bit value for the register <0 to 255>, as a string.																												
	<table> <tr> <th>Bit</th><th>Description</th><th>Decimal Value</th></tr> <tr> <td>7 (MSB)</td><td>Not used</td><td>0</td></tr> <tr> <td>6</td><td>Not used</td><td>0</td></tr> <tr> <td>5</td><td>Command error</td><td>32</td></tr> <tr> <td>4</td><td>Command Execution Error</td><td>16</td></tr> <tr> <td>3</td><td>Device Dependent Error</td><td>8</td></tr> <tr> <td>2</td><td>Not used</td><td>0</td></tr> <tr> <td>1</td><td>Not used</td><td>0</td></tr> <tr> <td>0 (LSB)</td><td>Operation Complete</td><td>1</td></tr> </table>	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	
Bit	Description	Decimal Value																											
7 (MSB)	Not used	0																											
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4	Command Execution Error	16																											
3	Device Dependent Error	8																											
2	Not used	0																											
1	Not used	0																											
0 (LSB)	Operation Complete	1																											
Example	*ESE? -> 61																												

Command	*TST?	Summary >>																					
Syntax	*TST?																						
Description	Query the instrument self-test status																						
Parameters	N/A																						
Response	Integer bit value <0 to 65535>																						
	<table> <tr> <th>Bit</th><th>Description</th><th>Decimal Value</th></tr> <tr> <td>5-15 (MSB)</td><td>Not used</td><td></td></tr> <tr> <td>4</td><td>Module 4</td><td></td></tr> <tr> <td>3</td><td>Module 3</td><td></td></tr> <tr> <td>2</td><td>Module 2</td><td></td></tr> <tr> <td>1</td><td>Module 1</td><td></td></tr> <tr> <td>0</td><td>IQTX</td><td></td></tr> </table>	Bit	Description	Decimal Value	5-15 (MSB)	Not used		4	Module 4		3	Module 3		2	Module 2		1	Module 1		0	IQTX		
Bit	Description	Decimal Value																					
5-15 (MSB)	Not used																						
4	Module 4																						
3	Module 3																						
2	Module 2																						
1	Module 1																						
0	IQTX																						
	Any bits set to 1 indicate an error in that component. This command will return "0" if all components are working correctly.																						
Command	*TST? -> 18																						

Command	*RST	Summary >>
Syntax	*RST	
Description	Reset instrument to default power-on settings	
Parameters	N/A	
Response	N/A	
Example	*RST	

10.4.2 System commands

Command	:SYSTem:INFO?	Summary >>
Syntax	:SYSTem:INFO?<wsp>[ALL SERVER DRIVER]	
Description	Query the version of services	
Parameters	SERVER : Returns CohesionSCPI version DRIVER : Returns CohesionDriver version ALL : Returns all of the above	
Response	Comma separated string containing the <parameter>,<version number>	
Example	:SYSTEM:INFO? -> IQTX-1203-XX-EPIQ :SYSTEM:INFO? ALL -> DRIVER,3.01.04 SERVER,3.00.02	

Command	:SYSTem:MODUles?	Summary >>
Syntax	:SYSTem:MODUles?	
Description	Query the number of modules installed in the instrument	
Parameters	N/A	
Response	Returns the number of modules installed in the IQTX	
Example	:SYSTem:MODU? -> 2	

Command	:SYSTEM:PRESet	Summary >>
Syntax	:SYSTEM:PRESet	
Description	Restore instrument settings to power-on default values Sets laser output/state to OFF.	
Parameters	N/A	
Response	N/A	
Example	:SYSTEM:PRES	

10.4.3 Module commands

Command	:MODULE<n>:IDN?	Summary >>
Syntax	:MODULE<n>:IDN?	
Description	Query the module identification	
Parameters	N/A	
Response	A comma-separated string containing "<manufacturer>,<model name>,<serial number>,<hardware version><firmware version>". Note that the hardware and firmware versions are not comma separated.	
Example	:MODULE1:IDN? -> Quantifi Photonics Ltd, IQABC-1001-FA, CSL-000000, HW0.01.06FW0.00.05	

Command	:MODULE<n>:OPC?	Summary >>
Syntax	:MODULE<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 :MODULE<slot>:OPC? is NOT 1, may not execute or return an error.	
Syntax	:MODU1:OPC? -> 1	

Command	:MODULE<n>:OPTions?	Summary >>
Syntax	:MODULE<n>:OPTions?	
Description	Query the channels installed in the module	
Parameters	N/A	
Response	A comma separated array, or a single integer value based on the arguments given	
Example	:MODU1:OPT? -> 1,1,1,1,1,1	

Command	:MODULE<n>:PRESet	Summary >>
Syntax	:MODULE<n>:PRESet	
Description	Restore instrument settings to power-on default values Sets laser output/state to OFF.	
Parameters	N/A	
Response	N/A	
Example	:MODU1:PRESet	

10.4.4 Configuration commands - ABC module

Command	:ABC<n>: [XI XQ XP YI YQ YP] : PILOT?	Summary >>
Syntax	:ABC<n>: [XI XQ XP YI YQ YP] : PILOT?<wsp> [DEF ALL SET INFO]	
Description	Query the modulator channel auto-bias state	
Parameters	DEF : Query the default programmable modulator channel auto-bias state	
	SET : Query the set programmable modulator channel auto-bias state	
	ALL : Returns all the modulator channel auto-bias states in a comma separated string	
	INFO : Returns the string for the specified channel auto-bias state	
Response	1 is returned if the modulator channel auto-bias state is AUTO	
	0 is returned if the modulator channel auto-bias state is MANUAL	
Example	:ABC1:XI:PILOT? ALL -> 0,1	

Command	:ABC<n>: [XI XQ XP YI YQ YP] : PILOT	Summary >>
Syntax	:ABC<n>: [XI XQ XP YI YQ YP] : PILOT<wsp> [1 ON 0 OFF DEF]	
Description	Set the modulator channel auto-bias state	
Parameters	1 ON : Set to the modulation auto-bias state to on	
	0 OFF : Set to the modulation auto-bias state to off	
	DEF : Set the default programmable modulator channel auto-bias state	
Response	No response	
Example	:ABC1:XI:PILOT ON	

Command	:ABC<n>: [XI XQ XP YI YQ YP] :BIAS?	Summary >>
Syntax	:ABC<n>: [XI XQ XP YI YQ YP] :BIAS?<wsp> [MIN MAX DEF SET ALL STEP UNIT]	
Description	Query the modulator channel bias voltage	
Parameters	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
	SET : Get the desired set value	
	ALL : Returns all of the above parameters in a comma separated string	
	STEP : Returns the step size value	
	UNIT : Returns the BIAS measurement unit	
Response	Returns the string for the modulator DC bias voltage for the specified channel	
Example	:ABC1:XI:BIAS? ALL -> -14.0000,14.0000,6.0000,-3.932	

Command	:ABC<n>: [XI XQ XP YI YQ YP] :BIAS	Summary >>
Syntax	:ABC<n>: [XI XQ XP YI YQ YP] :BIAS<wsp> [MIN MAX DEF <value>]	
Description	Set the modulator channel bias voltage	
Parameters	MIN : Set to the minimum programmable value	
	MAX : Set to the maximum programmable value	
	DEF : Set to the default programmable value	
	<value> : Sets to the user value (V is default). The valid range is <-14.0 to 24.0>	
Response	No response	
Example	:ABC1:XI:BIAS 1	

Command	:ABC<n>: [XI XQ XP YI YQ YP] :LOCK?	Summary >>
Syntax	:ABC<n>: [XI XQ XP YI YQ YP] :LOCK?<wsp> [INFO]	
Description	Query whether the bias is locked to its optimal position	
Parameters	INFO: Returns the string for the specified channel LOCK states	
Response	1 is returned if the modulator channel is LOCKED	
	0 is returned if the modulator channel is UNLOCKED	
Example	:ABC1:XI:LOCK? INFO -> 0:FALSE 1:TRUE	

Command	:ABC<n>:<XI XQ XP YI YQ YP>:HISTory?	Summary >>
Syntax	:ABC<n>:<XI XQ XP YI YQ YP>:HISTory?<wsp>[<start_time>,<end_time> <BIAS ERROR FULL]	
Description	Query the error history timeframe and reason	
Parameters	<wsp> : The start and end time of the error history BIAS : The bias voltage value and time when the error occurred ERROR : The error number and time when the error occurred FULL : Returns all of the above parameters in a comma separated string	
Response	<wsp> : <starttime>,<endtime> BIAS : <timestamp[1]+startTime>:<vbias[1]> ERROR : <timestamp[1]+startTime>:<error[1]> FULL : <timestamp[1]+startTime>:<vbias[1]>,<error[1]>	
Example	:ABC1:XI:HISTory? FULL -> 41000203.456:2.54,4.55	

Command	:ABC<n>:<XI XQ XP YI YQ YP>:SCAN?	Summary >>
Syntax	:ABC<n>:<XI XQ XP YI YQ YP>:SCAN?<wsp>[POWER ERROR PHASE FULL UNIT]	
Description	Query the ABC modulator scan results	
Parameters	POWER : The measured power values at the time of the scan for the current bias value ERROR : The error numbers at the time of the scan for the current bias value PHASE : The phase values at the time of the scan for the current bias value FULL : Returns all of the above parameters in a comma separated string UNIT : Get the scan measurement unit	
Response	POWER : <number of points N>:<dcbias x-axis for all>:<power1,...,powerN> ERROR : <number of points N>:<dcbias x-axis for all>:<error1,...,errorN> PHASE : <number of points N>:<dcbias x-axis for all>:<phase1,...,phaseN> FULL : <number of points N>:<dcbias x-axis for all>:<power1,...,powerN>:<error1,...,errorN>:<phase1,...,phaseN> UNIT : The scan measurement unit	
Example	:ABC1:XI:SCAN? POWER -> 32:-14.000000,-13.125000,-12.250000,-11.375000,-10.500000,-9.625000,-8.750000,- 7.875000,-7.000000,-6.125000,-5.250000,-4.375000,-3.500000,-2.625000,-1.750000,- 0.875000,0.000000,0.875000,1.750000,2.625000,3.500000,4.375000,5.250000,6.125000,7. 000000,7.875000,8.750000,9.625000,10.500000,11.375000,12.250000,13.125000:0.000987, 0.000926,0.000987,0.001094,0.000865,0.001048,0.000865,0.000926,0.000835,0.000987,0. 000774,0.001018,0.000850,0.001109,0.000896,0.000896,0.000957,0.000926,0.000822,0.00 1021,0.143313,0.143236,0.143236,0.143236,0.143267,0.143145,0.143221,0.143236,0.1431 75,0.143099,0.143221,0.143130	

Command	:ABC<n>:<XI XQ XP YI YQ YP>:GAIN?	Summary >>
Syntax	:ABC<n>:<XI XQ XP YI YQ YP>:GAIN?<wsp>[MIN MAX DEF SET ALL UNIT]	
Description	Query the gain VPi percentage (dither size)	
Parameters	MIN : Get the minimum gain VPi percentage value of the modulation channel	
	MAX : Get the maximum gain VPi percentage value of the modulation channel	
	DEF : Get the default gain VPi percentage value of the modulation channel	
	SET : Get the default gain VPi percentage value of the modulation channel	
	ALL : Returns all of the above parameters in a comma separated string	
	UNIT : Get the modulation channel gain VPi percentage measurement unit	
Response	Depending on the parameters the response will be a single value or a comma separated string of values.	
Example	:ABC1:XI:GAIN? SET -> 20.75	

Command	:ABC<n>:<XI XQ XP YI YQ YP>:GAIN	Summary >>
Syntax	:ABC<n>:<XI XQ XP YI YQ YP>:GAIN<wsp><value MIN MAX DEF>	
Description	Set the gain VPi percentage (dither size)	
Parameters	value : Set the gain VPi percentage value of the modulation channel	
	MIN : Set the minimum gain VPi percentage value of the modulation channel	
	MAX : Set the maximum gain VPi percentage value of the modulation channel	
	DEF : Set the default gain VPi percentage value of the modulation channel	
Response	No response	
Example	:ABC1:XI:GAIN SET 20.75	

Command	:ABC<n>:PDPower?	Summary >>
Syntax	:ABC<n>:PDPower?<wsp>[MIN MAX ALL UNIT TIME? TIME?UNIT]	
Description	Query the output power of the unit in mW	
Parameters	MIN : Get the minimum output power value of the unit	
	MAX : Get the maximum output power value of the unit	
	ALL : Returns all of the above parameters in a comma separated string	
	UNIT : Get the output power measurement unit	
	TIME? : Get the	
	TIME?UNIT : Get the time measurement unit	
Response	Returns the current output power of the unit in mW	
Example	:ABC1:PDP? ALL -> 0.000, 10.000, 0.142	

Command	:ABC<n>:PDPower	Summary >>
Syntax	:ABC<n>:PDPower [NULL]	
Description	Set the output power of the unit to NULL	
Parameters	NULL : Set output power value of the unit to NULL	
Response	No response	
Example	:ABC1:PDP:NULL	

Command	:ABC<n>:PDPower:TIMEnulling?	Summary >>
Syntax	:ABC<n>:PDPower:TIMEnulling?<wsp>[UNIT]	
Description	Query the dark nulling time remained to complete	
Parameters	UNIT: Get the dark nulling time remained to complete measurement unit	
Response	No response	
Example	:ABC1:PDP:TIME? UNIT -> s	

Command	:ABC<n>:PDPower:NULLing	Summary >>
Syntax	:ABC<n>:PDPower:NULLing	
Description	Perform dark current nulling on the specified channel	
Parameters	N/A	
Response	N/A	
Example	:ABC1:PDP:NULL	

Command	:ABC<n>:CALibrate?	Summary >>
Syntax	:ABC<n>:CALibrate<wsp> [COM REQ INFO]	
Description	Queries the recalibration status of the auto-bias control system	
Parameters	COMPLETED: Get the recalibration status of the auto-bias control system	
	REQUESTED: Query if the recalibration of the auto-bias control system was requested	
	INFO: Returns a string of the auto-bias control system recalibration states	
Response	1: Returned if the recalibration status is REQUESTED	
	0: Returned if the recalibration status is COMPLETED	
	TRUE / FALSE: Returned depending on the REQ / COM state	
Example	:ABC1:CAL? REQ -> FALSE	

Command	:ABC<n>:CALibrate	Summary >>
Syntax	:ABC<n>:CALibrate [COMPLETED]	
Description	Forces recalibration of the auto-bias control system	
Parameters	N/A	
Response	N/A	
Example	:ABC1:CAL COM	

Command	:ABC<n>:HISTory:STARt	Summary >>
Syntax	:ABC<n>:HISTory:STARt	
Description	Set a reset of the error history	
Parameters	N/A	
Response	N/A	
Example	:ABC1:HIST:STAR	

Command	:ABC<n>:VPI?	Summary >>
Syntax	:ABC<n>:MODulator<m>:VPI?<wsp> [POWER ERROR PHASE UNIT]	
Description	Query the DC scan VPi	
Parameters	POWER: Get the Vpi value as measured from the Output power vs DC Voltage scan	
	ERROR: Get the Vpi value as measured from the bias control error signal vs DC Voltage scan	
	PHASE: Get the Vpi value as measured from the Phase vs DC Voltage scan	
	UNIT: Get the unit of the Vpi value	
Response	Depending on the parameters the response will be a single value or a comma separated string of values.	
Example	:ABC1:MODulator1:VPI? POWER -> 3.073177,3.030208,3.753062,NAN,NAN,NAN	

Command	:ABC<n>:SLOWfactor?	Summary >>
Syntax	:ABC<n>:SLOWfactor?<wsp>[MIN MAX DEF SET ALL]	
Description	Query the optimizer timing factor	
Parameters	MIN : Get the minimum optimizer timing factor value of the modulation channel	
	MAX : Get the maximum optimizer timing factor value of the modulation channel	
	DEF : Get the default optimizer timing factor value of the modulation channel	
	SET : Get the default optimizer timing factor value of the modulation channel	
	ALL : Returns all of the above parameters in a comma separated string	
Response	Depending on the parameters the response will be a single value or a comma separated string of values.	
Example	:ABC1:SLOW? MAX -> 250	

Command	:ABC<n>:SLOWfactor	Summary >>
Syntax	:ABC<n>:SLOWfactor<wsp><value MIN MAX DEF>	
Description	Set the optimizer timing factor	
Parameters	<value> : Set the optimizer timing factor value of the modulation channel	
	MIN : Set the minimum optimizer timing factor value of the modulation channel	
	MAX : Set the maximum optimizer timing factor value of the modulation channel	
	DEF : Set the default optimizer timing factor value of the modulation channel	
Response	N/A	
Example	:ABC1:SLOWfactor MAX	

10.4.5 Configuration commands - laser module

Command	:OUTPut<n>:CHANnel [m] :STATE?	Summary >>
Syntax	:OUTPut<n>:CHANnel [m] :STATE?	
Description	Query the optical output state of the laser	
Parameters	N/A	
Response	Returns the current output state of the laser ON / OFF	
Example	:OUTP2:CHAN1:STATE? -> ON	

Command	:OUTPut<n>:CHANnel [m] :STATE	Summary >>
Syntax	:OUTPut<n>:CHANnel [m] :STATE<wsp>[ON OFF]	
Description	Set the optical output state of the laser	
Parameters	ON OFF : Sets the output state on or off	
Response	N/A	
Example	:OUTP2:CHAN1:STATE ON	

Command	:SOURce<n>:CHANnel [m] :POWer?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :POWer?<wsp> [MIN MAX DEF SET UNIT STEP ACT ALL]	
Description	Query the laser output power	
Parameters	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
	SET : Get the desired set value	
	UNIT : Get the measurement unit	
	STEP : Get the step size value	
	ACT : Get the current value (default)	
	ALL : Returns all of the above parameters	
Response	Returns the min, max, set or actual (current) power for the laser by parameters	
Example	:SOUR2:CHAN1:POW? SET -> 10.0	

Command	:SOURce<n>:CHANnel [m] :POWer	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :POWer<wsp> [<value> MIN MAX DEF]	
Description	Set the laser output power	
Parameters	<value> : A valid numerical value which is in the range between the MIN and MAX response queried with the <code>power?</code> command, or seen in the IQTX specifications	
	MIN : Set the laser power to the minimum value	
	MAX : Set the laser power to the maximum value	
	DEF : Set the laser power to the default value	
Response	N/A	
Example	:SOUR2:CHAN1:POW 7.0	

NOTE

If the laser STATE is ON while setting `Wavelength`, `FREQUENCY` or `FREQUENCY:FINE`, there will be a minimal non-stable output generated during the transition to the new value, as the configuration commands are executed.

Command	:SOURce<n>:CHANnel [m] :WAVelength?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :WAVelength?<wsp>[MIN MAX DEF SET UNIT STEP ACT LOCK ALL]	
Description	Query the laser wavelength	
Parameters	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
	SET : Get the desired set value	
	UNIT : Get the measurement unit	
	STEP : Get the step size value	
	ACT : Get the current value (default)	
	LOCK : Query whether the laser is currently at the SET wavelength	
	ALL : Returns all of the above parameters	
Response	Returns the minimum, maximum or currently set value for the laser wavelength as specified by parameters. The lock parameter will return as TRUE or FALSE	
Example	:SOUR2:CHAN1:WAV? MAX -> 1.56877267e-06	

Command	:SOURce<n>:CHANnel [m] :WAVelength	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :WAVelength<wsp>[<value> MIN MAX DEF]	
Description	Set the laser output wavelength value	
Parameters	<value> : A valid numerical value which is in the range between the MIN and MAX response queried with the WAVelength? command, or found in the IQTX specifications	
	MIN : Set the minimum programmable value	
	MAX : Set the maximum programmable value	
	DEF : Set the default programmable value	
Response	N/A	
Example	:SOUR2:CHAN1:WAV MIN	

Command	:SOURce<n>:CHANnel [m] :FREQuency?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :FREQuency?<wsp>[MIN MAX DEF SET UNIT STEP ACT LOCK ALL]	
Description	Query the laser frequency	
Parameters	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
	SET : Get the desired set value	
	UNIT : Get the measurement unit	
	STEP : Get the step size value	
	ACT : Get the current value (default)	
	LOCK : Query whether the laser is currently at the SET frequency	
	ALL : Returns all of the above parameters	
Response	Returns the minimum, maximum or currently set frequency for the laser as specified by parameters. The lock parameter will return as <code>true</code> or <code>false</code>	
Example	:SOUR2:CHAN1:FREQ? MAX -> 1.96250000e+14	

Command	:SOURce<n>:CHANnel [m] :FREQuency	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :FREQuency<wsp>[<value and unit> MIN MAX DEF]	
Description	Set the laser frequency	
Parameters	<value and unit> is a valid numerical value which is in the range between the MIN and MAX response queried with the <code>FREQuency?</code> command, or found in the IQTX specifications, along with the measurement unit	
	MIN : Set the minimum programmable value	
	MAX : Set the maximum programmable value	
	DEF : Set the default programmable value	
Response	N/A	
Example	:SOUR2:CHAN1:FREQ 1.92 THZ	

Command	:SOURce<n>:CHANnel [m] :FREQuency:FINE?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :FREQuency:FINE?<wsp>[MIN MAX DEF SET UNIT STEP ALL]	
Description	Query the fine tune laser output frequency	
Parameters	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
	SET : Get the desired set value	
	UNIT : Get the measurement unit	
	STEP : Get the step size value	
	ALL : Returns all of the above parameters	
Response	Returns the min, max or currently set fine tuning frequency as set by parameters.	
Example	:SOUR2:CHAN1:FREQ:FINE? -> 8.90000000e+07	

Command	:SOURce<n>:CHANnel [m] :FREQuency:FINE	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :FREQuency:FINE<wsp>[<value&unit> MIN MAX DEF]	
Description	Set the fine tune laser output frequency	
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.	
	MIN : Get the minimum programmable value	
	MAX : Get the maximum programmable value	
	DEF : Get the default programmable value	
Response	N/A	
Example	:SOUR2:CHAN1:FREQ:FINE MAX	

NOTE

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

Command	:SOURce<n>:CHANnel [m] :GRID?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :GRID?<wsp> [MIN MAX DEF SET ALL]	
Description	Query the grid spacing	
Parameters	MIN : Get the minimum programmable value MAX : Get the maximum programmable value DEF : Get the default programmable value SET : Get the desired set value ALL : Returns all of the above parameters	
Response	Returns the min, max or currently set grid spacing for the laser as set by parameters.	
Example	:SOUR2:CHAN1:GRID? MIN -> 1.000000e+08	

Command	:SOURce<n>:CHANnel [m] :GRID	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :GRID<wsp> [<value&unit> MIN MAX DEF]	
Description	Set the grid spacing	
Parameters	value : Is the channel grid spacing within the specification range given by the MIN and MAX response queried with the GRID? command. MIN : Set the minimum programmable value MAX : Set the maximum programmable value DEF : Set the default programmable value	
Response	N/A	
Example	:SOUR2:CHAN1:GRID 2 GHZ	

Command	:SOURce<n>:CHANnel [m] :WHISper?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :WHISper?	
Description	Query the Whisper mode state of the laser	
Parameters	N/A	
Response	Current Whisper mode state of the laser	
Example	:SOUR2:CHAN1:WHIS? -> ON	

Command	:SOURce<n>:CHANnel [m] :WHISper	Summary >>
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	N/A	
Example	:SOUR2:CHAN1:WHIS ON	

Command	:SOURce<n>:CHANnel [m] :TEMPerature?	Summary >>
Syntax	:SOURce<n>:CHANnel [m] :TEMPerature?	
Description	Query the laser temperature	
Parameters	N/A	
Response	Numerical temperature in degrees Celsius	
Example	:SOUR2:CHAN1:TEMP? -> 26.88	

10.5 Programming examples

The following is a simple example of how to control the IQTX instrument by 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 IQTX instrument and installed modules

```
*IDN?                #Query to confirm the correct instrument is setup
# -> Quantifi Photonics Ltd,IQTX-1102-FA-EPIQ,QP-998877,HW0.00.01SW3.01.18
*OPT?               #Query the available instrument module configuration
# -> IQABC,LASER
:MODULE2:IDN?       #Query the identification information for a specific module
# -> Quantifi Photonics Ltd,LASER-1002-2-SC,QP-987654,HW0.01.02FW0.01.32
```

#Configuring the Laser module on the IQTX instrument

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

#Force calibrate of the IQABC

```
:ABC1:CALibrate          #Force the recalibration of the auto-bias control system
:ABC1:CALibrate? COMPLETED #Query the completion status of the auto-bias control system calibration
# -> TRUE
```

#Querying the status of the IQABC module

```
:ABC1:XI:LOCK?          #Query whether the XI bias is locked in the optimal position
# -> 1
```

10.6 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.

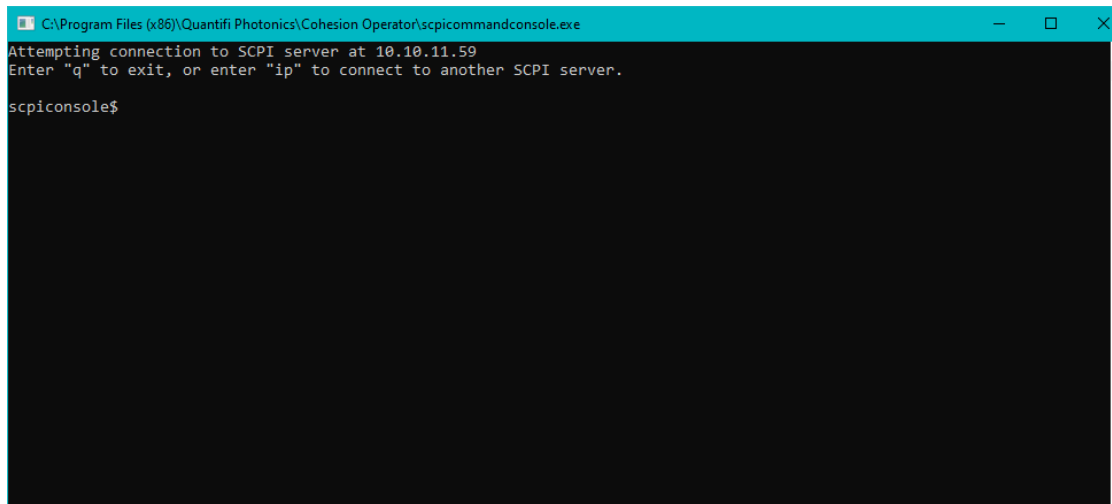
The two most common error codes are:

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**.



```
C:\Program Files (x86)\Quantifi Photonics\Cohesion Operator\scpicommandconsole.exe
Attempting connection to SCPI server at 10.10.11.59
Enter "q" to exit, or enter "ip" to connect to another SCPI server.
scpicomconsole$
```

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>**.

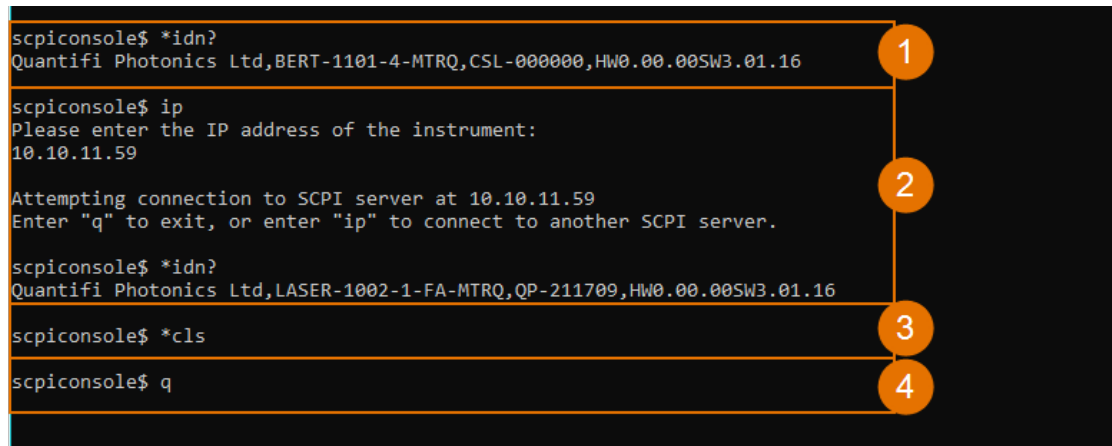
The device will return identification details

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>**.



The screenshot displays a terminal window with a black background and orange text. Four orange circles with white numbers 1 through 4 are positioned on the right side of the terminal, each corresponding to a specific command or action. Step 1 shows the command `*idn?` being entered, followed by the device's identification string. Step 2 shows the command `ip` being entered, followed by a prompt for the IP address and the user inputting `10.10.11.59`. Step 3 shows the command `*idn?` being entered again, followed by the device's identification string. Step 4 shows the command `q` being entered.

```
scpicomsole$ *idn?  
Quantifi Photonics Ltd,BERT-1101-4-MTRQ,CSL-000000,HW0.00.00SW3.01.16  
  
scpicomsole$ ip  
Please enter the IP address of the instrument:  
10.10.11.59  
Attempting connection to SCPI server at 10.10.11.59  
Enter "q" to exit, or enter "ip" to connect to another SCPI server.  
  
scpicomsole$ *idn?  
Quantifi Photonics Ltd,LASER-1002-1-FA-MTRQ,QP-211709,HW0.00.00SW3.01.16  
  
scpicomsole$ *cls  
  
scpicomsole$ q
```

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.

```
scpicontrol$ *idn?  
Quantifi Photonics Ltd,BERT-1101-4-MTRQ,CSL-000000,HW0.00.00SW3.01.16  
  
scpicontrol$ *ind?  
*ESR? -> 32  
  
scpicontrol$
```

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**.

```
scpicontrol$ *cls  
  
scpicontrol$ *csl  
17: IO write error  
  
scpicontrol$
```

11 Programming examples and 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.

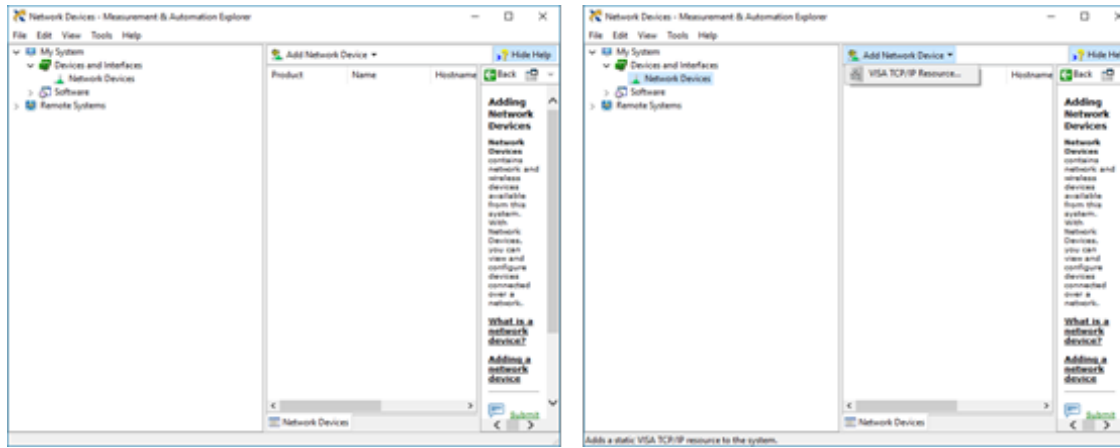
NOTE

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.

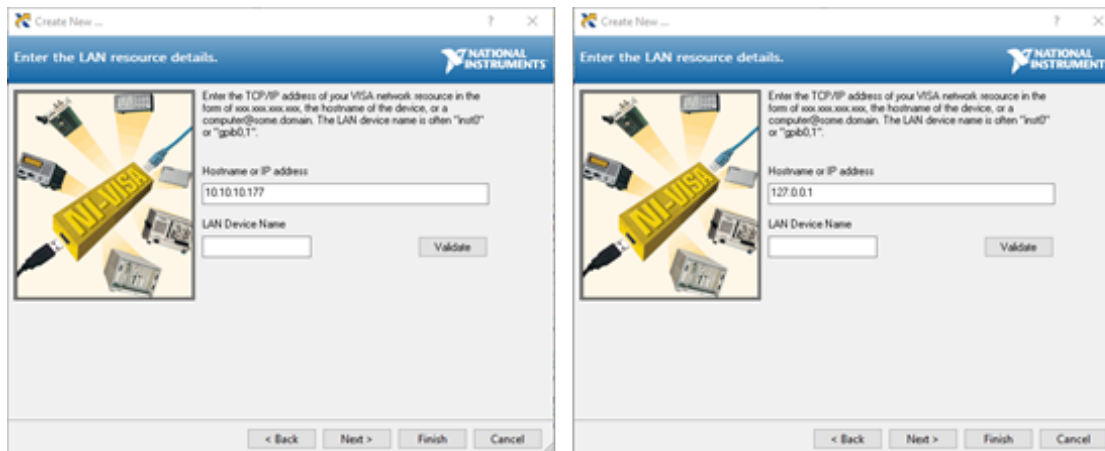
11.1 Setting up NI-MAX application

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**.



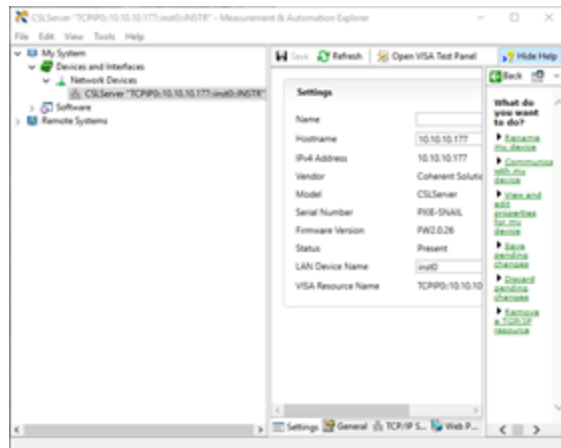
3. Select **Manual Entry of LAN Instrument**. Enter in the Hostname or IP Address.
Note when operating locally, enter in the localhost IP address of **127.0.0.1**. Click **Finish** to end the setup process.



11.2 Setting up NI-VISA application

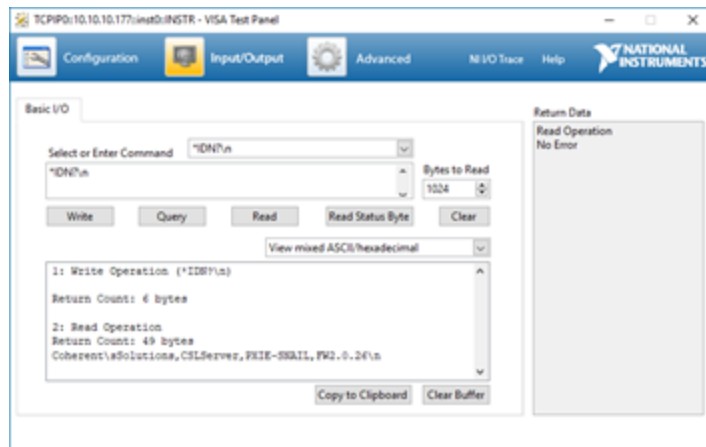
NI-VISA is used to communicate with the PXIe chassis or installed modules / instruments. The above steps must be completed before attempting to communicate using NI-VISA.

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



11.3 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))
```

11.4 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.
```

12 Example: QPSK configuration procedures

The various modulation adjustments on certain models of the IQTX are used to calibrate and configure the optical signal. This section provides detail on the calibration for the example QPSK hardware setups.

12.1 Set the laser frequency and power

Make sure the laser frequency and power are set to the desired values. This is displayed within the LCD display and CohesionUI for easy reference.

For calibration purposes it may be convenient to set the laser to maximum power providing you are transmitting within the specifications of the coherent receiver you are using.

12.2 Setting RF delay for IQ Skew (optional, certain models only)

12.2.1 I & Q RF delay adjustment

The I & Q RF delay adjustment is used to set the correct delay between the In-phase (I) and Quadrature (Q) RF input signals, hence reducing the IQ skew (see definition below).

The delay will have to be calibrated to the particular hardware configuration in operation, due to the internal connections combined with the lengths of the RF cables connecting the RF pattern generator to the IQTX.

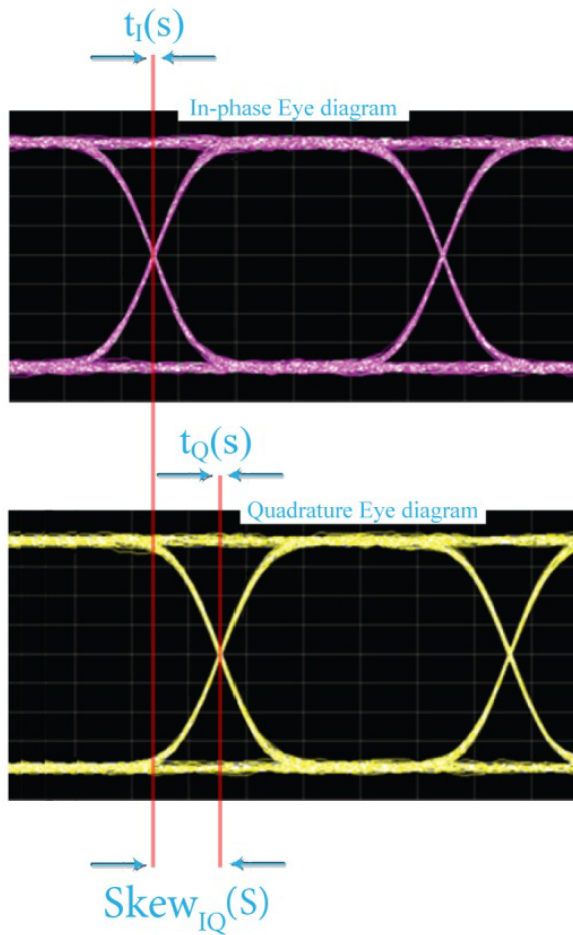
If the IQTX is connected to an IQ PPG, the I & Q RF delay can be configured and adjusted within that instrument.

12.2.2 IQ skew

To adjust the IQ skew within the IQTX modulator, the 'I & Q RF delay dial is adjusted to increase or decrease the delay of the RF quadrature input signal. Very small adjustments should be made.

The IQ skew is a measure of the time difference between the In-phase (I) and Quadrature (Q) crossing points in the eye diagrams as shown in section [Modulator bias-I and bias-Q](#).

$$Skew_{IQ}(s) = t_I(s) - t_Q(s)$$

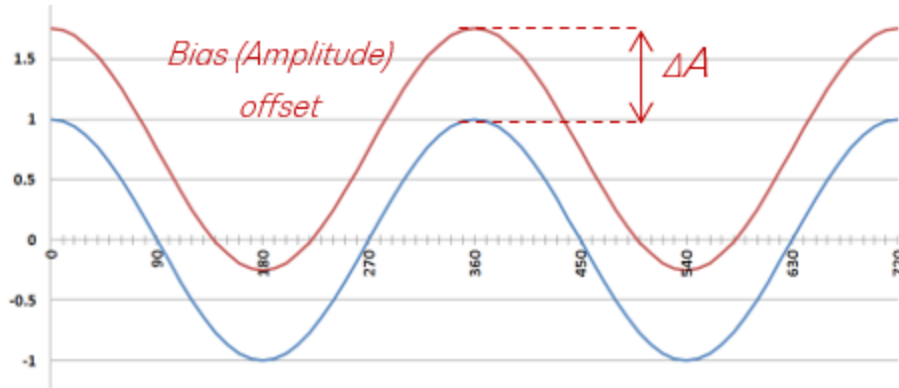


12.3 Modulator adjustments

The modulator adjustments provide manual adjustment of the In-phase (I), Quadrature (Q) and optical output signals. With the auto-bias control option, these biases will be automatically varied to compensate for the errors below and if the user wishes to manually control the bias voltages, they can do so with CohesionUI.

12.3.1 Modulator bias-I and bias-Q

The bias-I and bias-Q dials are used to set the bias offset (ΔA) for either the In-phase (I) or Quadrature (Q) components of the optical signal.



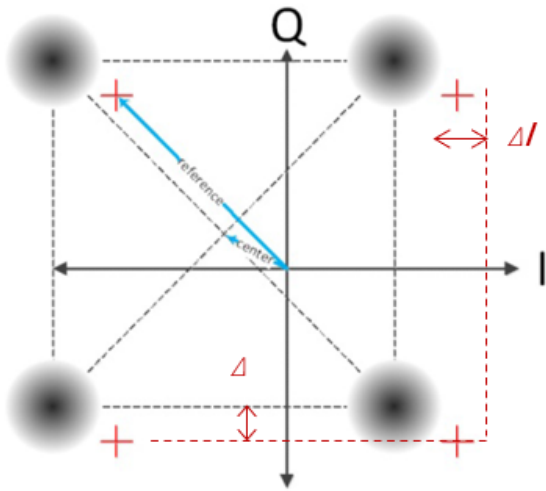
Changing the bias offset for a given component (I, Q) is related to reducing bias error within the constellation, represented by ΔI and ΔQ in section [I & Q optical phase offset](#).

The bias offset is a measure of how far the center of the constellation is with respect to the ideal center point. For QPSK and QAM modulation formats, the ideal center point is [0, 0] (I, Q). It is more convenient to represent the bias errors in percentages to make it independent of the average optical power.

Additionally, the bias error can be separated into orthogonal components (I and Q) as shown in the equation below, to help identify the origin of the bias error. Since the electrical to optical transfer function of optical modulators is typically non-linear, a 5% bias offset as measured in the optical domain may not necessarily correspond to a 5% error in bias voltage.

$$I_{bias_Error}\% = \frac{\Re(\text{centre})}{\Re(\text{reference})} \times 100$$

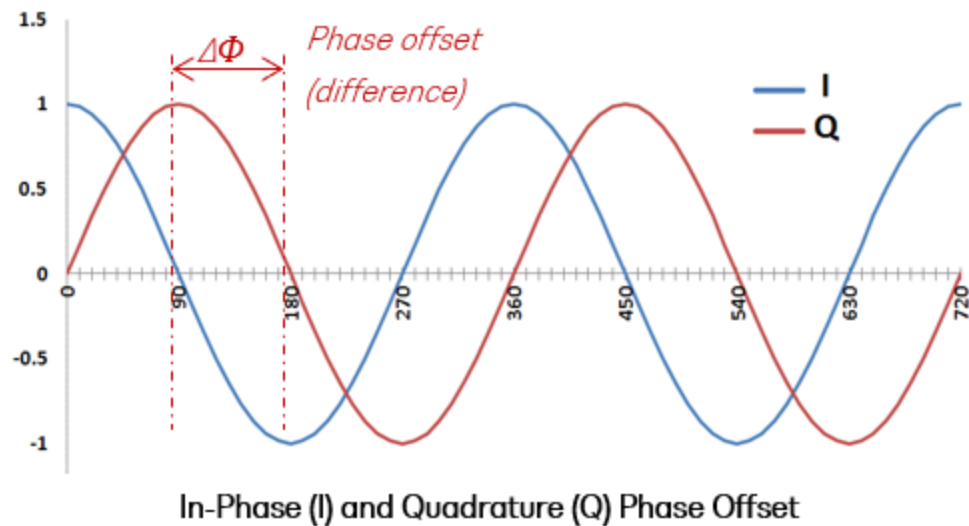
$$Q_{bias_Error}\% = \frac{\Im(\text{centre})}{\Im(\text{reference})} \times 100$$



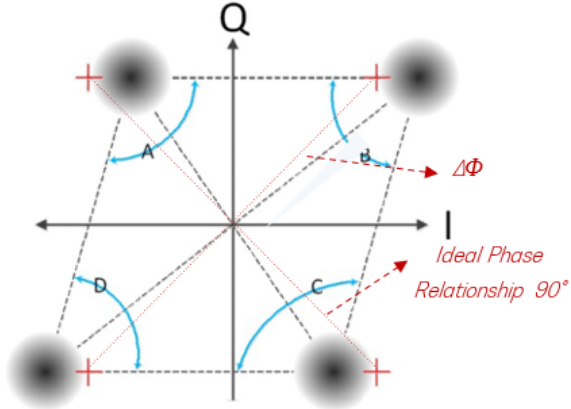
12.3.2 I & Q optical phase offset

The I & Q optical phase offset dial is used to set the phase offset, or phase difference ($\Delta\Phi$ as seen in the figures below), between the in-phase and quadrature phase components of the optical output signal generated by the IQTX.

The I & Q optical phase offset dial should be adjusted to align the clusters to the ideal phase relationship of 90° which is shown in this figure:



The quadrature error is a measure of the phase error of the constellation points with respect to the ideal phase relationship between the constellation points.



For QPSK and QAM modulation formats, the ideal phase between the constellation points is 90°.

The quadrature error is an average measurement taken over all the constellation points as shown in this equation:

$$Quad_{Error} = \frac{\angle A - \angle B + \angle C - \angle D}{4}$$

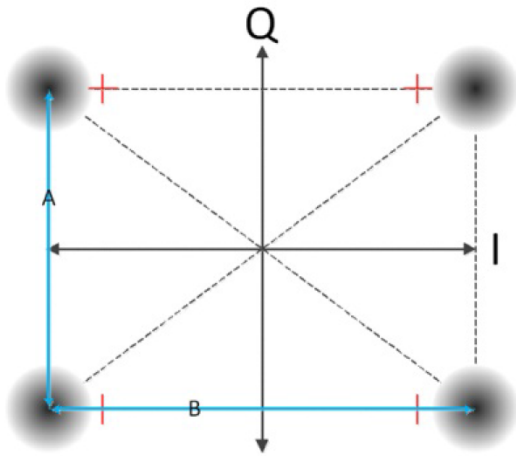
13 Measurement definitions

13.1 IQ RF imbalance

The IQ RF imbalance is the ratio of the in-phase component versus the quadrature component of the constellation points.

The ratio is represented as a percentage, so 10% IQ RF imbalance would mean that the in-phase component is 10% larger than the quadrature component.

$$IQ_{\text{Imbalance}} \% = \left(\frac{|B|}{|A|} - 1 \right) \times 100$$



13.2 Error vector

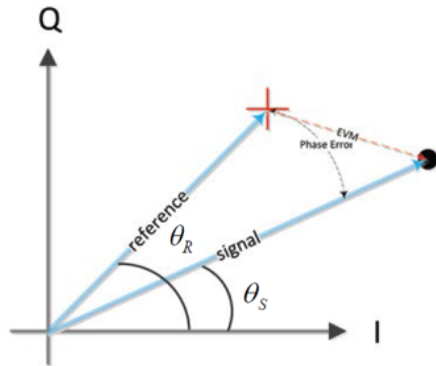
The error vector can be separated into its two primary components: Error Vector Magnitude (EVM) and Phase Error (PE).

The error vector magnitude is the magnitude of the error vector, which is the difference between the signal vector and the ideal reference vector. It is more convenient to represent the EVM as a percentage to make it independent of the average signal power, as shown in this equation:

$$EVM\% = \frac{|signal-reference|}{|reference|} \times 100$$

The phase error is the phase difference between the signal vector and the ideal reference vector, as shown here:

$$Phase\ Error = \theta_R - \theta_S$$



Error Vector, Single Sample Point

14 Working with electrical connectors

Quantifi Photonics products are designed with high quality connectors.

NOTE

Use electrostatic discharge (ESD) protection at all times, especially when handling RF input/output connectors.

14.1 Connector care

Although all connectors eventually wear, with proper technique you can maximize accuracy and repeatability of measurements, and the lifetime of connectors.

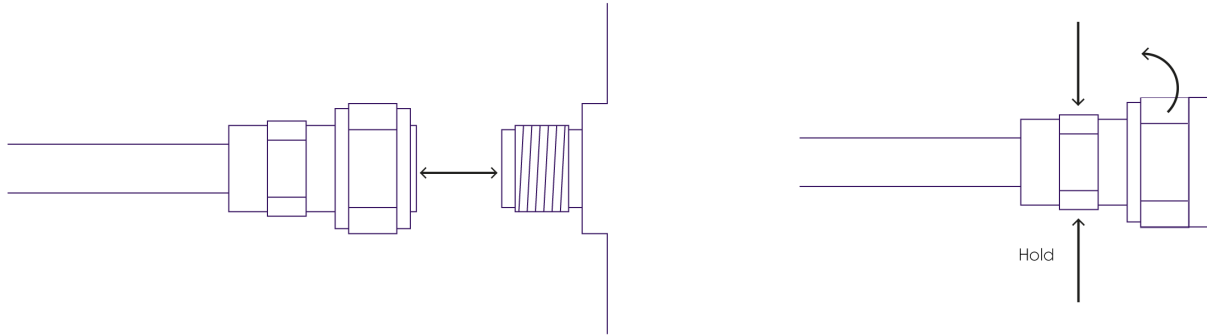
Make sure to follow these recommendations:

- Use high quality cables, connectors and adapters to avoid damaging the unit. Mating of low quality SMA components to female connectors may damage or degrade the female center pin.
- Handle connectors in the high-frequency range with precision dimensions properly to avoid inadvertent damage.
- Avoid bad connections due to malfunctioning connectors as they are the most common cause of measurement errors.
- Where possible, avoid frequent connections/disconnections as components will gradually wear.

14.2 Making a connection

When making a connection:

- Wear a grounded wrist strap.
- Inspect, clean, and gauge connectors. All connectors must be undamaged, clean, and within mechanical specification.
- Carefully align the center axis of both devices. Push the connectors straight together so they can engage smoothly. The male center conductor pin must slip concentrically into the contact finger of the female connector.



- Rotate only the connector nut — NOT THE DEVICE OR CONNECTOR BODY — until finger-tight. Be careful not to cross the threads. Damage to both connectors will occur if the male center pin is allowed to rotate in the female contact fingers!
- Apply the correct torqueing force, refer to [Using a torque wrench](#) and [Torque settings](#).

14.3 Separating a connection

When separating a connection:

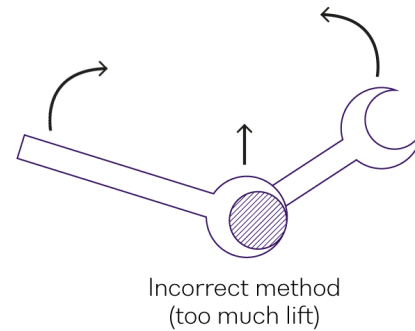
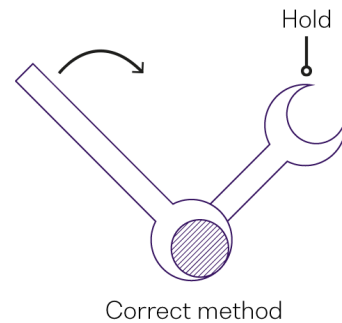
- Wear a grounded wrist strap.
- Support the devices to avoid any twisting, rocking, or bending force on either connector.
- Use an open-end wrench to prevent the device body from turning.
- Use another open-end wrench to loosen the connector nut.
- Complete the disconnection by hand, turning only the connector nut.
- Pull the connectors straight apart.

14.4 Using a torque wrench

Applying the correct torquing force by using a calibrated torque wrench avoids damage due to over or under tightening connections. It significantly improves measurement accuracy and repeatability at mm-wave frequencies, avoids signal failure and extends connector life.

When using a torque wrench:

- Make sure the torque wrench is set to the correct torque setting (refer to [Torque settings](#)).
- Position the torque wrench, and a second wrench to hold the device or cable, within 90° of each other before applying force. Make sure to support the devices to avoid putting stress on the connectors.
- Hold the torque wrench lightly at the end of the handle, then apply force perpendicular to the torque wrench handle. Tighten until the “break” point of the torque wrench is reached. Do not push beyond initial break point



14.5 Torque settings

Wrench type	Torque settings
1.0 mm	4 in-lb (45 N-cm)
1.85 mm	8 in-lb (90 N-cm)
2.4 mm	8 in-lb (90 N-cm)
NMD 2.4 mm	8 in-lb (90 N-cm)
2.92 mm	8 in-lb (90 N-cm)
3.5 mm	8 in-lb (90 N-cm)
NMD 3.5 mm	8 in-lb (90 N-cm)
SMA	5 in-lb (56 N-cm)

15 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 damage the fiber and the port bulkhead.

16 System requirements

Quantifi Photonics PXle modules

Supported browsers for working with CohesionUI	Google Chrome™ Microsoft Edge®
Chassis	PXle-compatible chassis that • supports PXle, or • contains PXI hybrid compatible slots
Recommended PXle 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)

17 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.

17.1 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.

18 Technical Support

18.1 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.

18.2 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.

19 Warranty Information

19.1 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.

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.

19.2 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.

19.3 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.

19.4 Certification

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

19.5 Service and repairs

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

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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