QUANERGY®

Q-View
User Guide

Notices

See also:

- Acknowledgments of copyrighted material: http://downloads.quanergy.com/License.txt
- End User Software License Terms that apply to all platforms hosting the Q-View software: http://downloads.quanergy.com/quanergy_end_user_software_license_terms.pdf

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- For purchases made directly from Quanergy: contact support@quanergy.com
- For purchases from a third party such as value-added reseller/system integrator: **contact** the third party for support

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Revision History

Version	Date	What Changed	Change Location
A	02/24/17	Released to support the Q-View 1.0 release.	
B	10/26/17	Released to support the Q-View 1.2 release and S3-1 Rev 1 sensor.	
		Installs on user-supplied Linux 14.04 certified PC, or Windows 7 or 10 system.	*Install Q-View on an Ubuntu System* (24), *Install Q-View on a Windows System* (25)
		Removed Mac OS support.	
		Added Calibrate tab, daisy chaining files.	*Calibrating Sensors — Calibrate Tab* (76)
		Added Record tab, with export of QLog data files to PCD or LAS formats.	*Recording Sensor Data — Record Tab* (69), *Export Recorded QLog File to Another Format* (74)
C	11/21/17	Added details to install Q-View on Windows 7/10. Use English-only characters.	*Install Q-View on a Windows System* (25)
D	01/02/18	Released to support the Q-View 1.2.84 patch release and S3-2 Rev 1 sensor.	
		Added host computer minimum requirements.	*Required Functionality* (19)
		Updated installation steps	*Installing Q-View* (22)
E	06/26/18	Released to support Q-View 1.3 release, Ubuntu 16.04, and M8 Rev D4P & D5.	
		Added social media, updated legal notices	*Follow Us!* (2), *Notices* (2)
		Updated installation instructions to refer to http://downloads.quanergy.com.	*Download Q-View and Documents* (22)
		Added new ID and status information on sensor tiles.	*View the Sensor Diagnostics* (53)
		Added menus in Visualize tab and Calibrate tab for selecting LIVE or PLAYBACK mode, a color scheme (Intensity, Ring Based, or Return), and Point size.	*Viewing Point Clouds — Visualize Tab* (58), *Calibrating Sensors — Calibrate Tab* (76)
F	08/17/20	Released to support Q-View 1.4 release, M-Series (M8 PoE+, MQ-8 PoE+) and S-Series (S3-2NSI, S3-2NSO, S3-8) sensors.	
		Omitted Windows 7 support, Dashboard network port buttons, English-only characters requirement for sensor labels, requirement to disconnect sensors before engaging PLAYBACK mode, daisy chaining concept, and the QLog export issue that no longer requires troubleshooting.	

Version	Date	What Changed	Change Location
		Changed terms for display area and point cloud area to visualization window, and defined terms for name versus label	*Viewing Point Clouds — Visualize Tab* (58)
		Updated	*Contact* (2), *Documents* (21), *Installing Q-View* (22), *back cover*
		Tab icon, selectability rules	*Calibrating Sensors — Calibrate Tab* (76)
		Large scale performance specifications	*Unique Features* (18), *Using the Q-View Interface* (37), *Search for Sensors on the Network* (44)
		Recorder duration limiter	*Recording Sensor Data — Record Tab* (69)
		Added sensor compatibility, minimum network bandwidth, display resolution support,	*Required Functionality* (19)
		Populated timestamp in QLog exported to LAS	*Adjust the Grid Size* (67), *Use the World Calibration Controls* (79), *Create and Update a Fused Point Cloud* (80)
G	11/12/20	Released to support Q-View 1.5 Beta release, M8-PRIME sensor, M1 sensor, and Ubuntu 18.04 support.	
		Added M1 and M8-PRIME sensor content.	*Getting Started* (18), *Required Functionality* (19), *Documents* (21), *Filter the Sensor List* (49), *Select a Color Scheme* (65), *Detect Sensors Using Router-Assigned Dynamic IP Address* (28)
		Updated dynamic sensor list	*Filter the Sensor List* (49)
		Updated sensor minimum bandwidth	*Required Functionality* (19)
		Updated Dashboard Tab field descriptions. Added FOV field.	*View the Sensor Diagnostics* (53)
		Changed Ubuntu from 16.04 to 18.04	*Connect to an Online Sensor* (49), *Required Functionality* (19)
		Updated Ubuntu command	*Detect Sensors Using Port-Assigned Dynamic IP Address* (29)
		Changed listing of S3-2NSI and S3-2NSO to S3-2	*Getting Started* (18), *Filter the Sensor List* (49)
		Clarified text for Refine auto-alignment option	*Calibrating Sensors — Calibrate Tab* (76)
		Changed reference source	*Documents* (21)

Version	Date	What Changed	Change Location
H	05/14/21	Release Q-View 1.5. Support for M8-PRIME sensor, M1 sensor, and Ubuntu 18.04 support.	
		Added dynamic sensor list	*Make a Sensor Detectable to the Host Computer* (28)
		Added updating calibration XY offset range	*Make Changes to a Calibrated Group of Sensors* (91), *Use the Results* (93), *Edit quanergy.qview.calibration* File (95)
		Added S3-2WSO sensor minimum network bandwidth	*Table 3. Sensor Minimum Network Bandwidth*
		Updated NMEA/PPS/GPS messages.	*Table 10. NMEA/PPS GPS Status Messages*
		Updated sensors.	*Figure 5. Host Computer: Connect Sensor to Network via Router (Example Addresses)*
		Applied new template.	*Text Styles* (7)
J, Beta 1	07/13/21	Beta 1 Release Q-View 1.6 with QORTEX Aware.	
		Added QORTEX Aware chapter:	*Object Detection — QORTEX Aware™ Tab* (97)
		Updated	*Unique Features* (18), *Sensor Diagnostics Panel Details* (55)
		Networking	*Table 3. Sensor Minimum Network Bandwidth*, *Figure 5. Host Computer: Connect Sensor to Network via Router (Example Addresses)*, *Figure 13. Q-View Interface*, *Table 5. Q-View Tabs Summary*
		Q-View client interface	*Figure 15. Dashboard Tab: Interface*, *Table 8. Dashboard Tab: Sensor Filter Menu*, *Figure 31. Visualize Tab: Interface*
		NMEA/PPS GPS status	*Table 10. NMEA/PPS GPS Status Messages*
J, Beta 2	09/17/21	Beta 2 Release Q-View 1.6 with QORTEX Aware.	
		Moved QORTEX Aware API content to *M1 Edge Sensor User Guide*.	
		Qortex Aware overview	*Object Detection — QORTEX Aware™ Tab* (97)
		Clarify setting Evaluation Field through either sensor hardware pins (GPIO) or QORTEX Aware API.	*Set Active Evaluation Field* (114)
		Clarify Qortex Aware web server Settings	*Modify Default Non-Zone Settings* (113)
		Connected status. Settings file in Qortex Aware	*Connect to a QORTEX Aware Enabled Sensor* (101)

Version	Date	What Changed	Change Location
		Upload/download/save options.	*Select Settings File* (103) *Select Settings File* (103)
		Object detection	*Unique Features* (18)
		Requirements	*Required Functionality* (19)
		Update	*Documents* (21)
		Download for Beta	*Download Q-View and Documents* (22)
		Client interface tabs, add Qortex Aware	*Tabs* (38)
		Qortex Aware Monitor vs Configure mode	QORTEX Aware Process Overview (98), QORTEX Aware Configuration in Q-View (99)
J	11/16/21	Release Q-View 1.6 to support QORTEX Aware 1.0	
		Debounce time updated	*Set Debounce Time* (114)
		Polygon and Arc usage update	*Create Evaluation Field Zones* (108)
K beta	08/3/22	Release Q-View 1.7 and QORTEX Aware 2.0	
		Settings file in QORTEX Aware	*Network File Actions* (105)
		Support new sensors: M1 Edge PoE+, M8 PoE+	*Table 2. Q-View Sensor Compatibility*, *Table 8. Dashboard Tab: Sensor Filter Menu*, *Required Functionality (19)*
		Ubuntu version 20.04	*Required Functionality* (19), *Operating System Platform Requirements* (20)
		Evaluation field QORTEX Aware 2.0	*Create Evaluation Field Zones* (108), *Figure 66. QORTEX Aware: Configuration Panel and Visualizer Elements*, *Figure 72. QORTEX Aware: 360° Field of View*, *Figure 78. QORTEX Aware: Visualizer with Evaluation Field Zones*
K	09/27/22 11/04/22	Add IPv6 address support	*Make a Sensor Detectable to the Host Computer* (28), *Detect Sensors Using Router-Assigned Dynamic IP Address* (28), *Detect Sensors Using Port-Assigned Dynamic IP Address* (29), *IPv6 Address Toggle* (42)
		Add Ubuntu 20.04 support	*Operating System Platform Requirements* (20)
		Add M1 Edge PoE, M8-Prime (PetaLinux) support	*Sensor Compatibility* (19), *Operating System Platform Requirements* (20)
		Qortex Aware updates: • M1 Edge PoE	*QORTEX Aware Q-View Version Compatibility* (98),

Version	Date	What Changed	Change Location
		• 128 Zones • API content moved	*QORTEX Aware Evaluation Fields and Zones* (101), *Create Evaluation Field Zones* (108) Appendix 1. *QORTEX Aware APIs and Settings Commands* (129)
		Combined Sensor QLog Export	*Export Recorded QLog File to Another Format* (74)
M	12/08/24	Q-Track LR, HD, Dome sensor support.	

Text Styles

In this guide certain fonts are applied to provide a visual means to interpret text.

Table 1. Text Styles and Meanings

Font Style	Meaning
Blue underline	Hyperlink that opens a file outside of this document. Typically, this is a web page.
Italic underline	Hyperlink that moves you to a location within the document. Typically, this is a section, table, or figure.
Bold	General term for emphasis. Typically, this introduces a definition or description.
Bold	An item in a Graphical User Interface (GUI). This includes page, window, or panel labels, fields where you enter or select information, or checkboxes and buttons you click.
Bold colors	Examples of colors used in GUIs.
Italic	Identifies book or section titles. Provides emphasis for terms or ideas. Used to identify options for selecting from a menu, entering in a field, or replacing in a command string.
`Code italic`	Identifies a variable, where the intent is you provide a literal value in place of the variable. Used in paragraphs and code strings.
`Code`	Examples of commands you enter in a field or terminal, or responses from the system.
`Code on gray`	Examples of commands you enter into a command line interface (CLI) terminal or responses from the system.
Text in box	Notes and Tips. Useful related information. Format used to call attention to the content or to describe side-bar content.

Font Style	Meaning
Text in box	Cautions and Warnings. Read these and comply with the information provided. Comply with Cautions or Warnings to prevent equipment damage or injury to humans and other living things.

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Contents

Figures

Tables

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1. Getting Started

Quanergy is pleased to offer Q-View™, a user-friendly sensor management and visualization software-based toolkit for the following Quanergy LiDAR sensors:

~~M-Series, depending on the Q-View version: M1™, M1 Edge, M1 Edge PoE, M8™, M8-PRIME, M8 PoE+, MQ™-8 PoE+.~~ See *Sensor Compatibility* (page 19).

This automated discovery system unleashes the full functionality of Quanergy artificial-intelligence-powered LiDAR-based sensing systems. Q-View provides robust information about a sensor network and its performance along with intuitive tools used to calibrate and align the sensors.

Unique Features

Q-View design incorporates new and exciting Quanergy products to provide improved safety, efficiency, and performance for the security, 3D mapping and surveying, transportation, and industrial automation markets. Such breakthroughs are made possible through Q-View's unique features:

- **Informational Display**. A sleek and automatic sensor discovery engine driven by the multicast Domain Name System (mDNS) protocol discloses a wealth of specific data about the network, the sensors on it, and their performance, while a manual search mode enables the discovery of a particular sensor on the network.
- **Intuitive Operation.** Digital machinery operating in the background offers both automatic and manual modes for exploiting the full functionality of sensor query and diagnosis, visualization, recording, and calibration. The highly visual interface implements proven user patterns to enable users to grasp the consistent, intuitive controls right away.
- **Simple Calibration.** Multiple sensors acting in concert provide an enriched perspective of a shared area of interest through a calibration tool that allows the user to quickly enable Multi-LiDAR Fusion™ by aligning connected sensors' views, even for sensors that are not always within sight of each other.
- **Data Recording and Export.** Controls simultaneous recordings of data collected by one or more LiDAR sensors. The recorder saves point cloud output in the QLog format, which can be exported to PCD or LAS formats.
- **Object Detection.** Using ~~M1 Edge and M1 Edge PoE+~~ sensors and QORTEX Aware™, notifies mobile and/or stationary listening devices when objects enter defined Evaluation Field zones. This enables programmatic responses to the detected objects, such as collision avoidance.

Required Functionality

Functionality includes Q-View to Quanergy sensor compatibility, performance, communication, language, network bandwidth, display resolution, and platforms.

Sensor Compatibility

Q-View is fully compatible with the Quanergy LiDAR sensors. See *Table 2. Q-View Sensor Compatibility*. The model and revision level are stated on the sensor manufacturing label.

Table 2. Q-View Sensor Compatibility

Series	Sensor	Q-View	Qortex Aware	Notes
M-Series	M8	1.6, 1.7	1.0, 2.0	M8 sensor requires Rev D5 or later to report errors in the sensor diagnostics panel. See *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.
	M8-Prime	1.6, 1.7	1.0, 2.0	
	M8-Prime	1.7	1.0, 2.0	PetaLinux
	M8 PoE+	1.6, 1.7	1.0, 2.0	
	MQ-8 PoE+	1.6, 1.7	1.0, 2.0	
	M1	1.6, 1.7	1.0, 2.0	
	M1 Edge	1.6	1.0	Qortex Aware pre-installed. Only supported in Q-View 1.6.
	M1 Edge PoE+	1.7	2.0	Qortex Aware pre-installed.
Q-Track	LR	1.7	2.0	
	HD	1.7	2.0	
	Dome	1.7	2.0	

Performance Requirements

For best results in running the software, make sure the host computer meets these minimum specifications:

- i3 processor
- 4 GB memory
- GeForce 8800, Radeon 4770, or other OpenGL compliant graphics

Communication Requirements

Quanergy LiDAR sensors are Ethernet devices that must have an IP address before they can interact on the network. The system on which the Q-View application is installed must allow mDNS multicast traffic and HTTP

traffic between sensors and host computer in both directions. Make sure you have proper communication between the LiDAR sensors, the Q-View host computer, and the Q-View application.

Language Requirements

To ensure that recording and exporting functions behave as expected, only English alphanumeric characters are allowed for file directory names and file paths.

Network Bandwidth Requirements

Must be able to support the minimum bandwidth requirements when streaming live point cloud data from the sensor. See *Table 3. Sensor Minimum Network Bandwidth*.

Table 3. Sensor Minimum Network Bandwidth

Sensor Type	Minimum Bandwidth
~~M8, M8-PRIME, M8 PoE+, MQ-8-PoE~~	~~20 Mbps per sensor in 1 return mode.~~
	~~60 Mbps per sensor in 3 return mode.~~
~~M1, M1 Edge, M1 Edge PoE+~~	~~6 Mbps per sensor in 1 return mode.~~
	~~9 Mbps per sensor in 3 return mode.~~
Q-Track LR	
Q-Track HD, Q-Track Dome	

Display Resolution Supported

Q-View scales up from a minimum width of 1024 and a minimum height of 768. Q-View supports the following display resolutions:

1920x1080	1440x900	1280x1024
1024x768	1600x900	1536x864
1366x768	1280x800	1680x1050

Operating System Platform Requirements

For this version of the Q-View application, use the following Linux® and Windows® platforms. Some of the differences in common commands are listed below. Also see *Table 4. Q-View Version for Supported Operating Systems*.

- Linux® —Use a certified Linux Ubuntu 20.04 LTS (Focal Fossa) or 18.04 LTS (Bionic Beaver) operating system. A helpful list of desktops/laptops can be found at https://certification.ubuntu.com/.

- Windows® 10 System
- Host machine CPU must support AVX2.

Table 4. Q-View Version for Supported Operating Systems

OS Platform	Windows 10	Ubuntu 20.04 LTS	Ubuntu 18.04
~~M8~~	~~Q-View 1.6~~	~~n/a~~	~~Q-View 1.6~~
~~M8-Prime~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.6, 1.7~~
~~M8-Prime PetaLinux~~	~~Q-View 1.7~~	~~Q-View 1.7~~	~~Q-View 1.7~~
~~M8 PoE+~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.7~~	~~Q-View 1.6, 1.7~~
~~MQ-8 PoE+ (MQ-8)~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.7~~	~~Q-View 1.6, 1.7~~
~~M1~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.6~~	~~Q-View 1.6, 1.7~~
~~M1 Edge~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.6~~	~~Q-View 1.6, 1.7~~
~~M1 Edge PoE+~~	~~Q-View 1.6, 1.7~~	~~Q-View 1.6~~	~~Q-View 1.6, 1.7~~
Q-Track LR			
Q-Track HD			
Q-Track Dome			

Documents

Q-View assumes familiarity and proper setup of your Quanergy LiDAR sensors. To access the latest versions of the essential Q-View documents:

- *Datasheets: Q-Track Sensor Datasheet* list the specifications defining the sensor. This document can be downloaded from http://quanergy.com/downloads/
- *User Guides and Quick Start Cards: Q-Track Sensor User Guides* and *Sensor Quick Start Cards* explain the specifications, setup, and management of the LiDAR sensors. These documents are available upon request from support@quanergy.com
- *Q-View User Guide* (this guide) and *Q-View Quick Start Card* explain how to manage single sensors and groups of sensors. Download these documents from http://downloads.quanergy.com/.

2. Installing Q-View

This section describes how to install Q-View on a host computer that is on the same network as Quanergy LiDAR sensors and how to make those sensors detectable to the host.

Download Q-View and Documents

Access documents explaining the installation process, as follows. See *Figure 1. Quanergy Download Center*.

1. Open a browser and enter the Quanergy Download Center URL, http://downloads.quanergy.com.
2. Download the legal and user documents.
   a. Click the link. This opens a PDF or text file of the document in a browser.
   b. Save the file from the browser, as needed.

   The documents are:

   - *End User Software License Terms*—You must agree to these terms before downloading Q-View.
   - *Acknowledgments*—This provides acknowledgment for copyrighted and open-source material Quanergy Software might use.
   - *Q-View User Guide*—This guide.
   - *Q-View Quick Start Card*—A summary card for Q-View requirements, installation, and usage.
3. Enable the Q-View software download links. Click the checkbox: **To download software, please agree to the End User Software License Terms**
4. To download Q-View installer on Linux—
   a. Click the Linux link. It opens the `qview_readme.txt`.
   b. Locate the download page URL in the `qview_readme.txt`.
   c. Open a browser on your Ubuntu machine and enter the Linux download page URL. http://downloads.quanergy.com/qview/linux/
   d. Click the Q-View Debian package, `quanergy-qview_1.5.xxx_amd64.deb`.

      Where *xxx* is the release number.

      The link downloads the installer to your local `/Downloads` directory.
   e. Proceed to *Install Q-View on an Ubuntu System* (page 24).

5. To download Q-View installer on Windows—

   a. Click the Windows link.

      The link downloads the installation executable, `Q-View-1.5.xxx-win64.exe`, to your local `/Downloads` directory.

      Where *xxx* is the release number.

   b. Proceed to *Install Q-View on a Windows System* (page 25).

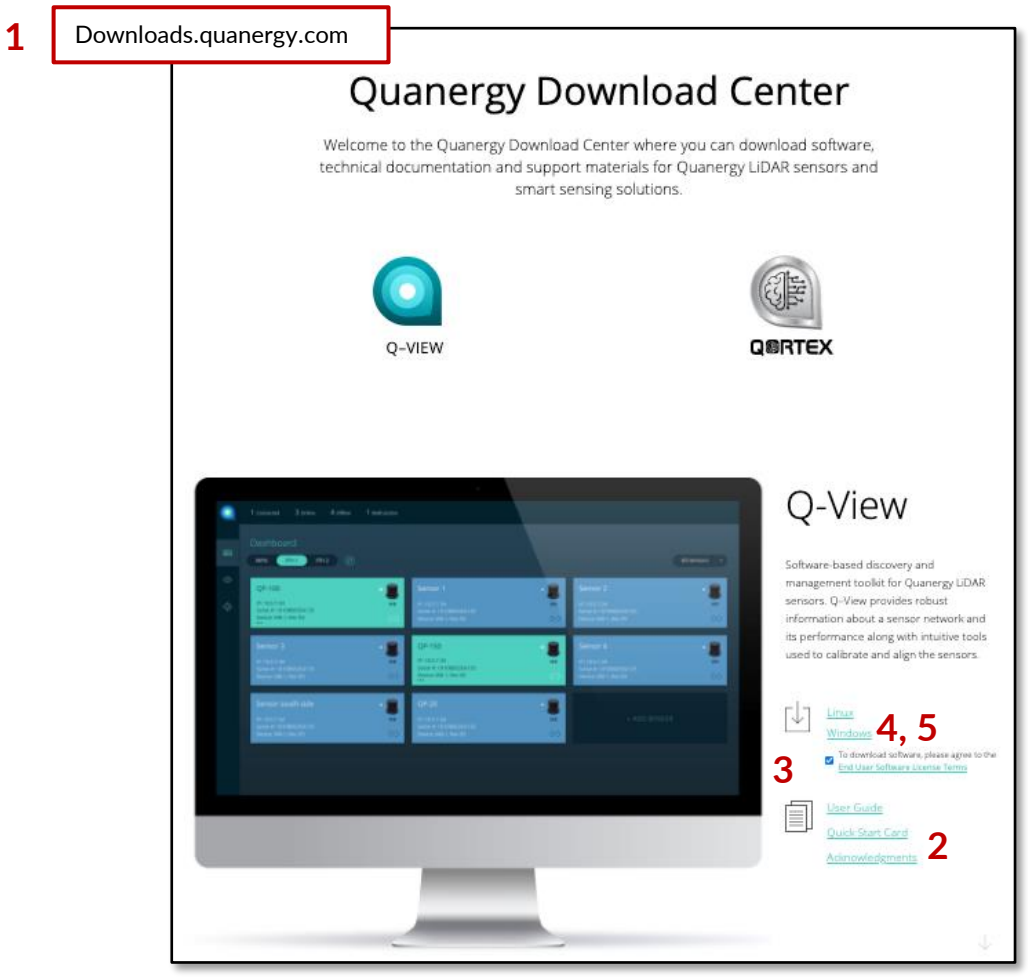


Figure 1. Quanergy Download Center

Install Q-View on an Ubuntu System

Install Q-View on an Ubuntu machine, as follows:

1. Ensure your environment meets the network, sensor, and installation machine requirements. See *Required Functionality* (page 19).
2. If you have a previous version of Q-View, uninstall it.
   a. From your Ubuntu machine, open a terminal.
   b. Run the command.

```
$ sudo dpkg -r <package-name>
```

3. If you prefer to use Q-View in isolation from unsecured networks:
   a. Locate the installer package in the `/Downloads` directory.
   b. Transfer that package to an external USB or hard drive.
   c. Connect that hard drive to the preferred "air-gapped" computer.
   d. Transfer the package to whichever directory you prefer, such as `~/Downloads`.
4. Open a terminal window on your Ubuntu host computer.

   Note: The Ubuntu host machine must be on the same network as the sensors.

5. Run the installation commands.

```
$ cd ~/Downloads
$ sudo dpkg -i quanergy-qview_1.6.xxx_amd64.deb
```

   Where *xxx* is the release number.

   All programs and libraries are placed where they are needed.

6. Proceed to detecting sensors. See *Make a Sensor Detectable to the Host Computer* (page 28).

Install Q-View on a Windows System

Install Q-View for the Windows platform, as follows:

1. Ensure your environment meets the network, sensor, and installation machine requirements. See *Required Functionality* (page 19).
2. If you prefer to use Q-View in isolation from unsecured networks:
   a. Locate the installer executable in the `/Downloads` directory.
   b. Transfer that package to an external USB or hard drive.
   c. Connect that hard drive to the preferred "air-gapped" computer.
   d. Transfer the package to whichever directory you prefer, such as `~/Downloads`.
3. Start the Windows installation wizard.

   From the `/Downloads` folder, double-click the executable, `Q-View-1.6.xxx-win64.exe` file.

   Where *xxx* is the release number.
4. Confirm making changes to your system, if prompted.

   In the prompt: `Do you want to allow this app to make changes...?` click **Yes**. The Wizard then continues.

5. Uninstall previous version of Q-View, if prompted. See *Figure 2. Windows Computer: Uninstall Old Q-View*.

   a. In the prompt: `Q-View is already installed. Do you want to uninstall the previous version before installing the new one?` click **OK**.

   b. In the wizard **Uninstall Q-View** panel, click **Uninstall** to confirm.

   c. In the wizard **Uninstallation Complete** panel, click **Close**.

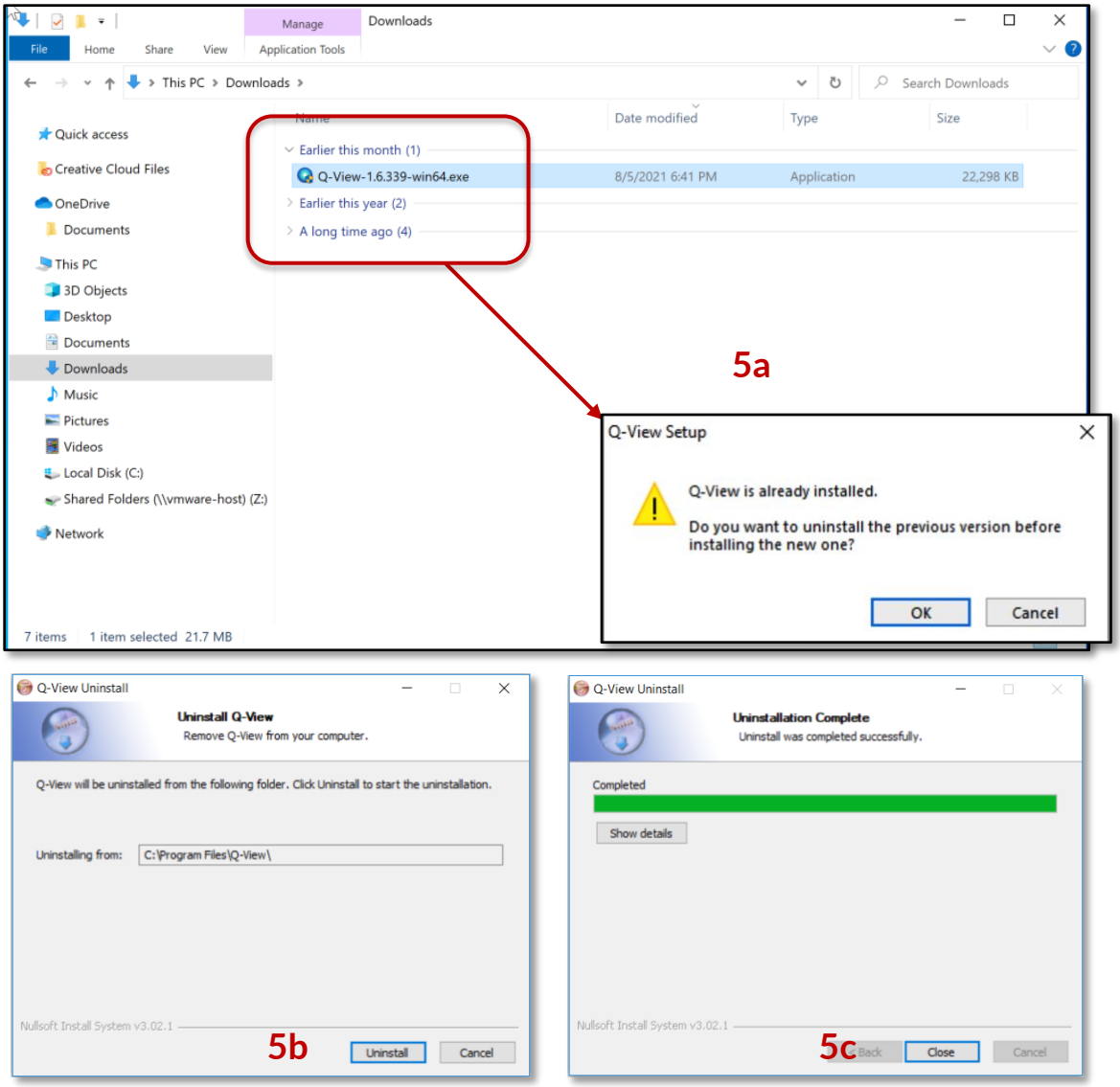


Figure 2. Windows Computer: Uninstall Old Q-View

6. Accept the defaults and prompts from the installation **Q-View Setup** wizard panels. See *Figure 3. Windows Computer: Step Through the Q-View Installation Wizard*.

   a. Agree to continue the **Q-View Setup** wizard, click **Next**.

   b. Accept the **License Agreement**, click **I Agree**.

   c. Accept the default `C:\Program Files\Q-View` destination or navigate to a different location folder, click **Next**.

   d. Accept the default **Start Menu** folder name, `Q-View` or enter a new name. Click **Next**. This is the folder where short-cuts are stored.

   e. Select components to install. Select the `bundle` checkbox. Then click **Install**.

   f. Wait while installation completes. Optionally, monitor the status bar.

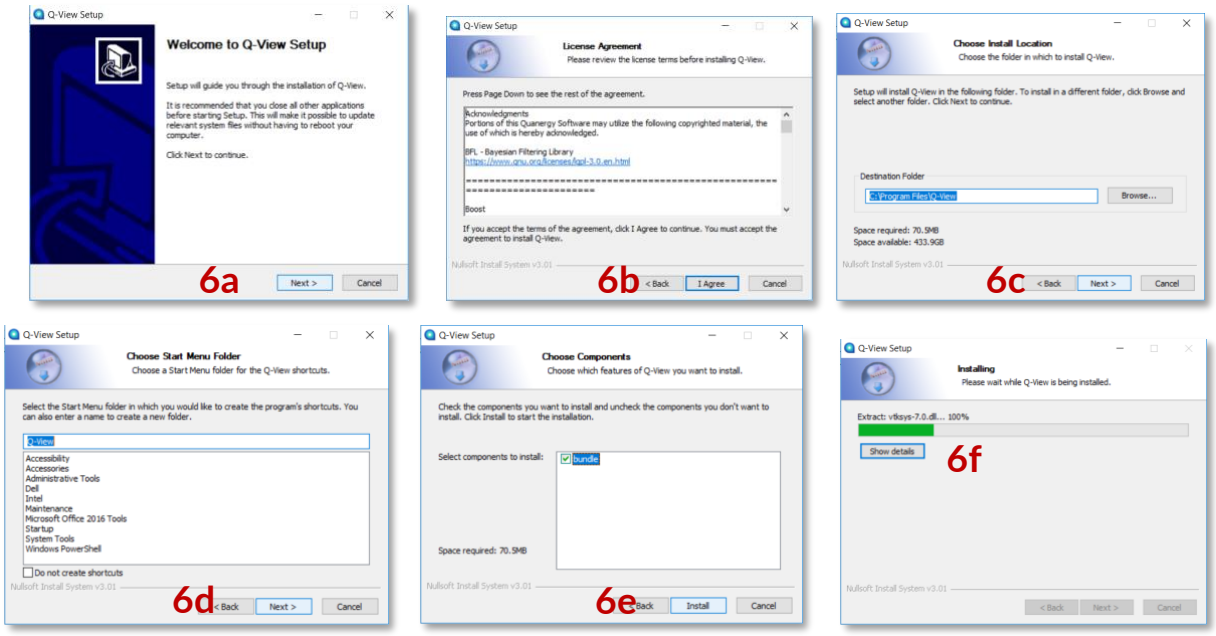


Figure 3. Windows Computer: Step Through the Q-View Installation Wizard

7. Dismiss the wizard when complete, click **Finish**. See *Figure 4. Windows Computer: Finish the Q-View Installation*.

   Notice that a shortcut Q-View icon is now on the desktop as a quick way to start the Q-View application. All programs and libraries are stored where they are needed.

8. Proceed to detecting sensors. See *Make a Sensor Detectable to the Host Computer* (page 28).

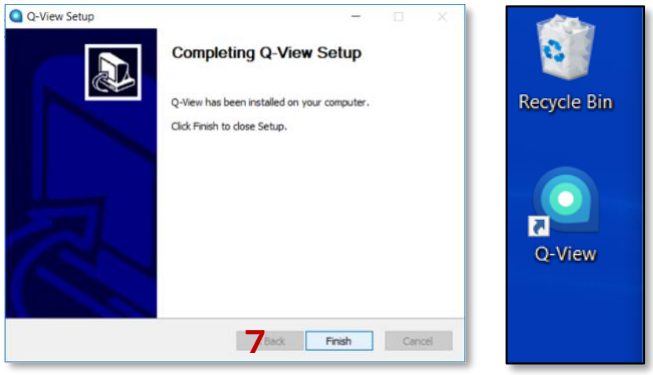


Figure 4. Windows Computer: Finish the Q-View Installation

Make a Sensor Detectable to the Host Computer

Q-View can easily detect a Quanergy LiDAR sensor when it is connected to the host computer through the network that can assign a dynamic IP address. Q-View supports IPv4 and IPv6 addresses.

- Using a router-assigned dynamic IP address method is the simplest and most resilient way for sensors to interact with the you on either Ubuntu or Windows computing environments. This is the recommended method. See *Detect Sensors Using Router-Assigned Dynamic IP Address* (page 28).
- Using a port-assigned dynamic IP address, is an alternative that connects directly to the host computer network port when Q-View is installed on an Ubuntu system. See *Detect Sensors Using Port-Assigned Dynamic IP Address* (page 29).

> **Note:** If you choose to connect using a different method than described here, call your support representative, if needed.

Detect Sensors Using Router-Assigned Dynamic IP Address

For the all-around best approach to making a sensor detectable by the Ubuntu or Windows host computer. See *Figure 5. Host Computer: Connect Sensor to Network via Router (Example Addresses)*.

1. Connect a dynamically set sensor to a router that is on the same network as the host computer.

> **Note:** For this method, the sensor cannot be configured to have a static IP address.

2. Connect the sensor to power.

3. The router DHCP server automatically assigns the sensor a dynamic IP address that has the same network address as the computer.

   This enables the computer and sensor to communicate. Example dynamic IP address: `10.1.11.x`. Where the *x* indicates a specific value assigned to each sensor and the computer.

   Q-View supports IPv4 and IPv6 addresses. If your sensor supports it, and you want to only show the IPv6 address, turn the IPv6 Address toggle to ON.

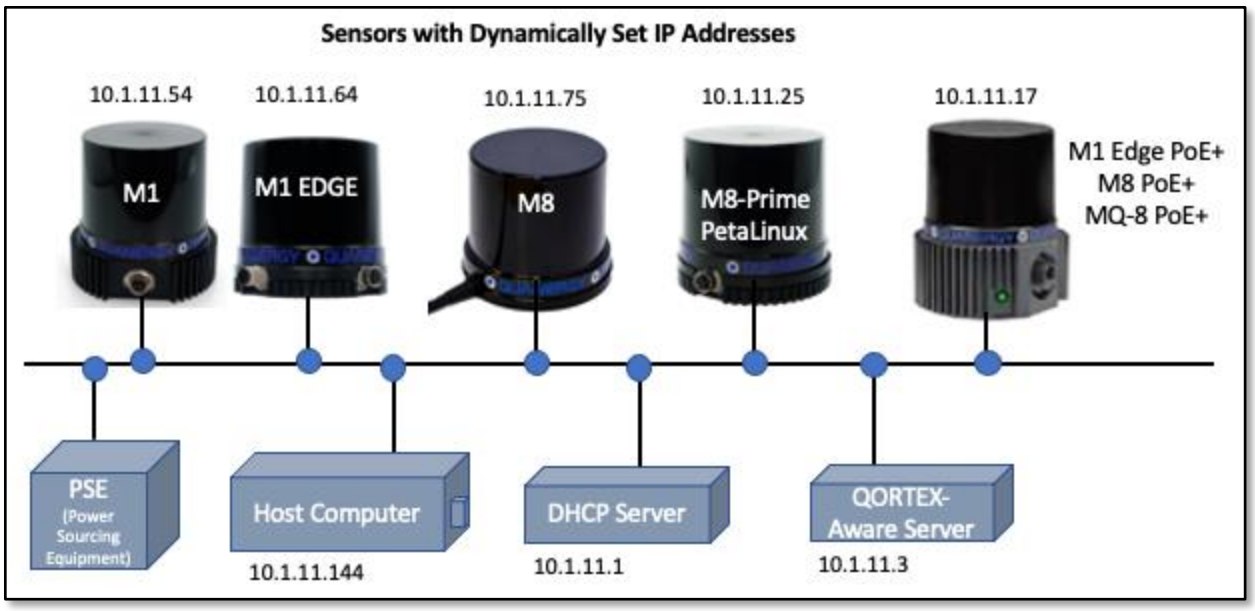


Figure 5. Host Computer: Connect Sensor to Network via Router (Example Addresses)

Detect Sensors Using Port-Assigned Dynamic IP Address

Alternatively, for Ubuntu-only environments, to avoid using a router, you can instead connect a single M-Series or S-Series Q-Track sensor (via the ethernet port) directly to the host computer. You'll need to set up a DHCP server that can assign IP addresses on the network port, as shown in *Figure 6. Ubuntu Computer: Connect Sensor to Network Port (Example Addresses)* with the ~~M8~~ Q-Track LR sensor as an example and instructed below.

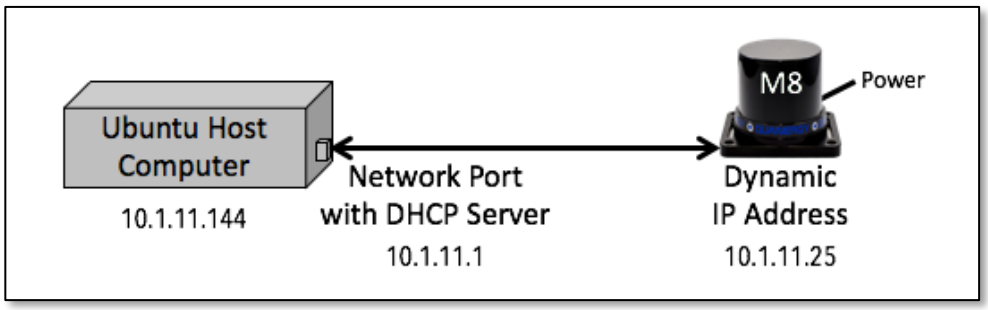


Figure 6. Ubuntu Computer: Connect Sensor to Network Port (Example Addresses)

1. Email your support representative at support@quanergy.com to request the `quanergy_net_install` installation script.
2. Download the `quanergy_net_install` installation script to your Ubuntu host computer.
3. From the `Downloads` directory, or wherever it was placed in the host computer, double-click the `quanergy_net_install.zip` file.
4. In the `quanergy_net_install.zip` window that appears, click the **Extract** button. See *Figure 7. Ubuntu Computer: Extract DHCP Server Installation Script*.

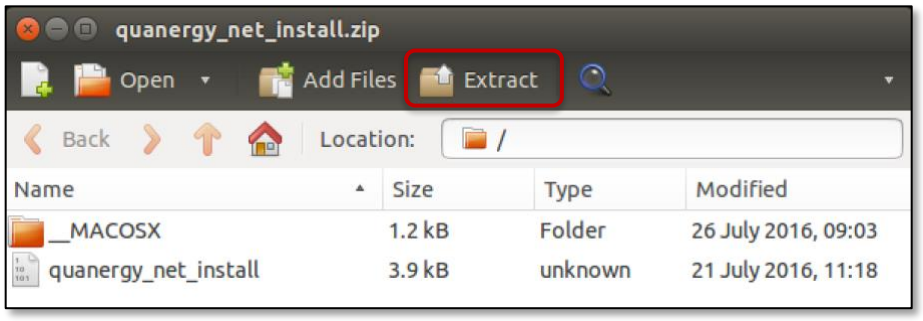


Figure 7. Ubuntu Computer: Extract DHCP Server Installation Script

5. Select the directory to extract the files.

   In the Extract window that appears. See *Figure 8. Ubuntu Computer: Assign Location for the Extracted Files*.

   - To leave the extracted file in the `Downloads` directory, click **Extract**.
   - To select a different location for the extracted file to reside, navigate to the preferred directory, and click **Extract**.

6. In the **Archive Manager** window confirmation, `Extraction completed successfully`, choose and option:
   - **Quit** to dismiss the Archive Manager.
   - **Show the Files** to check files that were extracted.

   See *Figure 8. Ubuntu Computer: Assign Location for the Extracted Files*.

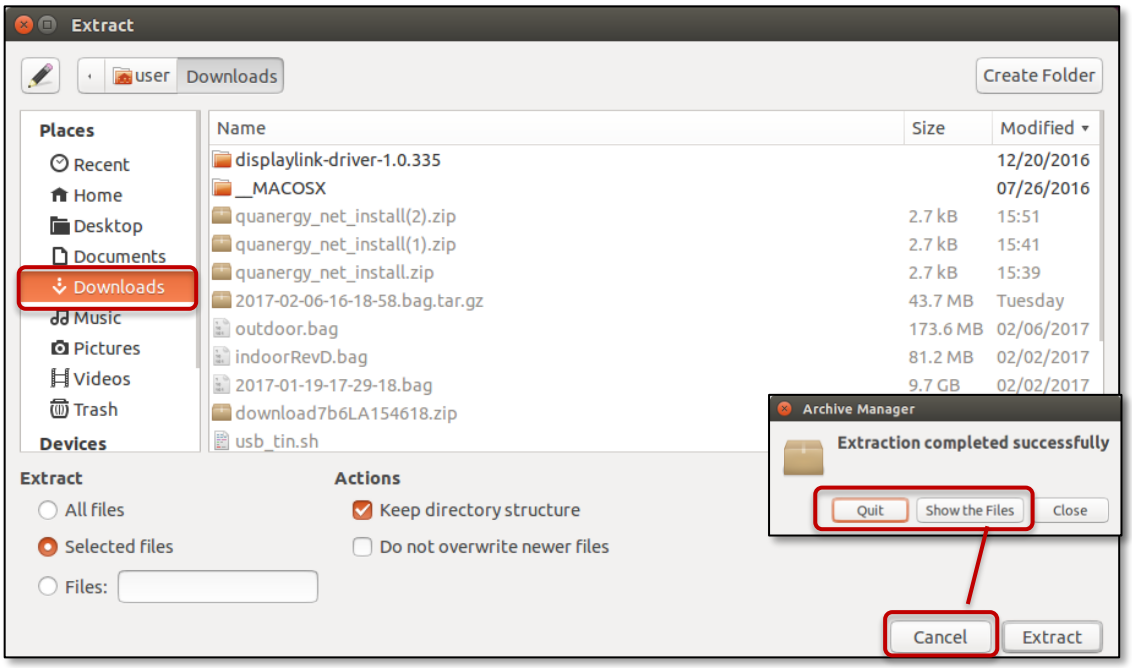


Figure 8. Ubuntu Computer: Assign Location for the Extracted Files

7. Open a terminal window (Ctrl+Alt+T), then take the following actions in it to set up the DHCP server.
   a. Navigate to the directory where the installation script was extracted into.
   b. At the prompt, execute this command to update all required packages:

```
$ sudo apt update
```

   c. At the prompt, execute this command to configure the network to be able to run the DHCP installation script:

```
$ sudo bash quanergy_net_install
```

   d. When prompted for a password, enter your usual password.
   e. When prompted for "`Configure dhcp server? [y/n],`" type `y`, and press the **Enter** key. (If your DHCP server is already set up, this prompt doesn't occur.)

f. When prompted for "`Ethernet interface`," type `0` to make `eth0` the network port the sensor connects to, then press the **Enter** key. (This is an example, which depends on your specific host computer setup.)

g. When prompted to create an "`IP address`" for the **Ethernet port**, type an **IP address** that matches the subnet, and whose host address is 1, such as 10.0.0.1), then press the **Enter** key.

   Q-View supports IPv4 and IPv6 addresses. If your sensor supports it, and you want to only show the IPv6 address, turn the IPv6 Address toggle to ON.

8. Reboot the computer to apply the changes, making the Ethernet port a DHCP server that assigns IP addresses of 2-255 on its subnet to any device that plugs into it.
9. Connect the sensor to the newly activated port, then connect the sensor to power.
10. Label the hardware for this port "`DHCP`" to prevent accidental connection to a LAN/internet cable.

CAUTION:

If you connect the sensor to a router or change to a different network, a new IP address may be dynamically assigned to the sensor this overwrites the current IP address.

3. Starting and Stopping Q-View

The Q-View application offers simple mechanisms for starting, restarting, and refreshing the Q-View network search.

Start Q-View

1. Login to your Q-View machine.
2. Depending on your computing environment, perform the action:

   For Ubuntu: Open a terminal window, and execute the following command:

```
$ /opt/quanergy/Q-View/Q-View
```

   For Windows: In the GUI, click the icon that appears on the desktop, or search for and select the Q-View application. See *Figure 9. Q-View Launch Icon: Ubuntu (left), Windows (right)*.

Figure 9. Q-View Launch Icon: Ubuntu (left), Windows (right)

   In Windows, to open a new terminal window, press **Win+X**, and select **Command Prompt**.

   Q-View welcome window appears very briefly with a LOADING timer. See *Figure 10. Q-View Welcome Window*.

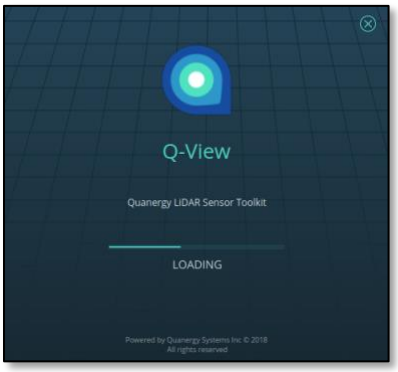


Figure 10. Q-View Welcome Window

3. Wait while Q-View performs a 30-40 second initial network search and several background operations:
   - Q-View scans all of the host computer network adapters to discover and display all sensors found.

     Note: Quanergy highly recommends the use of Ethernet rather than WiFi. The WiFi network adapter requires a stable connection and a high bandwidth sufficient to support the minimum requirements. If WiFi is necessary, a dedicated WiFi network for the sensors is recommended. See *Required Functionality* (page 19).

   - Q-View recalls all sensors that were found during previous work sessions. During the search, previously labeled sensors are represented briefly as tiles in the **Empty** (transparent) state. If they respond to Q-View query, they quickly change into the **Online** (blue) state, but if they never respond to the query, they change into the **Offline** (gray) state. Newly discovered sensors appear in the **Online** (blue) state. See *Figure 11. Q-View Scan Returns List of Sensors Found* and *Table 9. Dashboard Tab: Sensor States*.

     Note: The Q-View host computer and all discovered sensors share the same subnet, that is, have the same first three octets in the IP address (e.g., 10.1.11.x) UNLESS your network installation supports publishing mDNS traffic over routers, causing a Q-View scan of each network to yield similar or identical results that include multiple subnets.

   - Q-View scans for Q-View included applications and displays each in a separate tab.

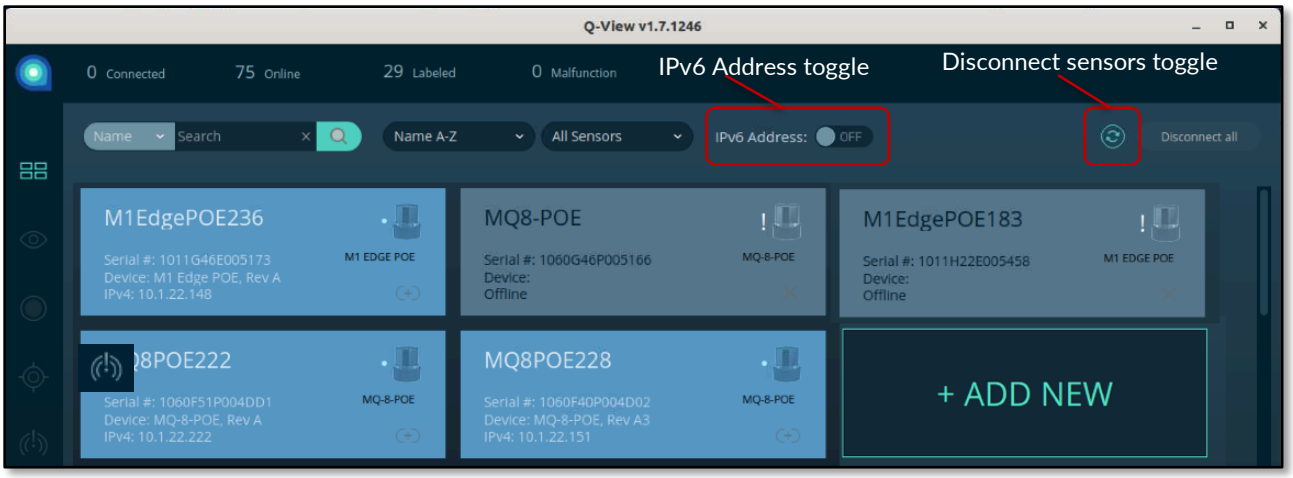


Figure 11. Q-View Scan Returns List of Sensors Found

4. If Q-View does not find a network connection:
    - The refresh button does not appear, and the network search is not available.
    - Previously labeled sensors might appear in an **Offline** (gray) state. See *Figure 12. Q-View Scan Displays Offline Sensors Even Without Network Connection*.
    - Quit Q-View, fix the network connection, and start Q-View again. See *Starting and Stopping Q-View* (page 33).

Figure 12. Q-View Scan Displays Offline Sensors Even Without Network Connection

Refresh Network Search

Refresh the network search when:

- You want to discover whether new sensors have been added.
- You expected to see a particular sensor show up (because you know it is plugged in and powered on), but it does not appear in the list of sensor tiles.
- You thought there would be more sensors in the list than actually appeared.
- You see some other unexpected, undesirable sensor or network behavior.

Anomalies and errors can occur for many reasons, including network configuration and traffic issues. To give Q-View the opportunity to resolve any of these issues:

1. Click the **Search** network button to refresh the list. See *Figure 11. Q-View Scan Returns List of Sensors Found*.
2. If the situation is not yet resolved, wait until the previous search concludes, then click the **Search** network button again.
3. Repeat until the search results meet your expectations.
4. If necessary, restart the Q-View application.

If Q-View found a network connection but did not detect any sensors on the network, the lack of sensors is reported. If necessary, you can manually add the IP address of sensors you know are on the network. See *Figure 22. Dashboard Tab: No Network Found (right), No Sensors Found (left)*, *Search for Sensors on the Network* (44) and *Sort the Sensor List* (page 48).

Stop Q-View

Select the method for your computing environment.

For Ubuntu:

1. Open a terminal window, press **Ctrl+Alt+T**.
2. Quit/close an application or window, select a method:
   - Click the red **Close** button in the upper left corner of the window.
   - Press **Ctrl+C** on the keyboard.

For Windows:

To quit/close the current Q-View window, select a method:

- Click the red **Close** button in the upper right corner.
- Press **Win+Ctrl+F4**.
- Click the Q-View menu **Close** item.

4. Using the Q-View Interface

After initial scanning operations are complete, the Q-View application interface enables the user to access tools for taking actions related to the LiDAR sensors and the data they gather. Q-View scales proportionally when the screen is set to a common display resolution. See *Figure 13. Q-View Interface* and *Required Functionality* (page 19).

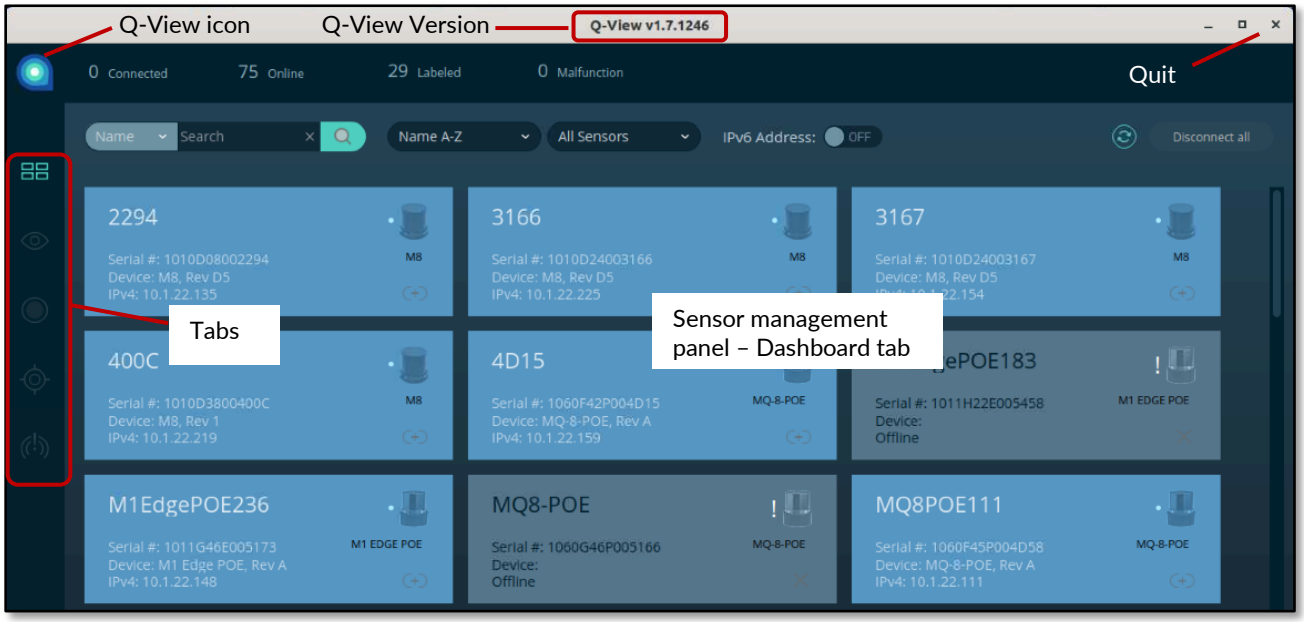


Figure 13. Q-View Interface

Quit Button

The Quit button style and location varies depending on which platform is hosting the Q-View application. See *Figure 13. Q-View Interface* and *Starting and Stopping Q-View* (page 33).

Version

Q-View states its version in the upper window frame. See *Figure 13. Q-View Interface*.

Tabs

Q-View offers specific sets of tools accessed through the Dashboard, Visualize, Record, Calibrate, and QORTEX Aware tabs. In the tab list, the active tab is green, . See *Figure 13. Q-View Interface* and *Table 5. Q-View Tabs Summary*.

Table 5. Q-View Tabs Summary

Icon	Name	Purpose
	Dashboard tab	Sensor management tools to help discover, label, use, and diagnose available sensors on the network. Q-View starts with this tab open. See *Managing Sensors — Dashboard Tab* (page41).
	Visualize tab	Visualization tools to verify that a particular sensor is operational by displaying its point cloud and manipulating its perspective. See *Viewing Point Clouds — Visualize Tab* (page 58).
	Record tab	Data tools to save the direct point cloud output of one or more connected sensors in Quanergy proprietary QLog format for export to PCD or LAS formats. See *Recording Sensor Data — Record Tab* (page 69).
	Calibrate tab	Calibration tools to transform the body frame of a second sensor into the fixed body frame of the first sensor so that they share the same Origin on the XYZ axes. See *Calibrating Sensors — Calibrate Tab* (page 76).
	QORTEX Aware tab	Object detection tools to notify mobile and stationary listening devices when an object has crossed into Evaluation Field zones. See *Object Detection — QORTEX Aware™ Tab* (page 97)

Tooltips

Hovering over a widget in any tab often reveals an explanatory tooltip. See *Figure 14. Q-View Interface: Hovering Reveals Tooltip*.

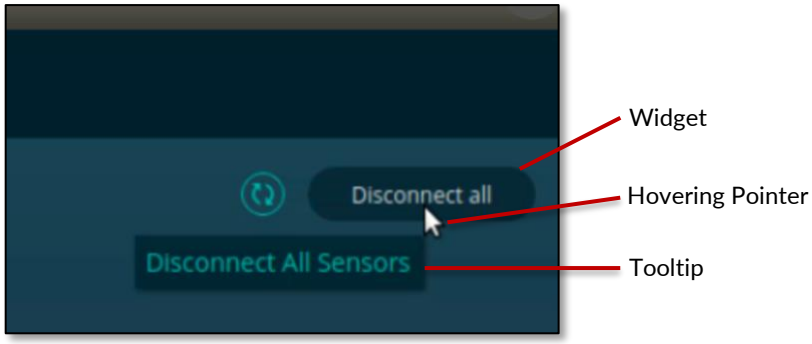


Figure 14. Q-View Interface: Hovering Reveals Tooltip

Files

A variety of files are available to support the Q-View application and are produced through the Q-View application. Those files and their default locations *Table 6. Q-View Default File Locations*.

> **Note:** To ensure that recording and exporting functions behave as expected, only English alphanumeric characters are allowed for file directory names/filepaths.

Table 6. Q-View Default File Locations

Platform	File	Figure	Default Location
Ubuntu	Record tab data output:		
	Sensor Settings	*Figure 48. Record Tab: Output Directory: Settings & Exported Files, QLog, PCD Format*	`~/YYYY-MM-DD_HH-MM-SS.TTT/sensor_settings.xml`
	QLog data		`~/YYYY-MM-DD_HH-MM-SS.TTT/sensorname.q00`
	Record tab data export:		
	cloud000000.pcd	*Figure 48. Record Tab: Output Directory: Settings & Exported Files, QLog, PCD Format*	`~/cloud000000.pcd`
	cloud000000.las		`~/cloud000000.las`
	Calibrate tab data output:		
	Transform Alignment	*Figure 62. Calibrate Tab: transform_alignment.xml File*	`~/UserDefinedFolder/transform_alignment.xml`
	Calibration	*Figure 52. Calibrate Tab: Where to Store Calibration Files*	`~/UserDefinedFolder/calibration.ini`
Windows	Record tab data output:		
	Sensor Settings		`C:\Users\username\YYYY-MM-DD_HH-MM-SS.TTT\sensor_settings.xml`
	QLog data		`C:\Users\username\YYYY-MM-DD_HH-MM-SS.TTT\sensorname.q00`
	Record tab data export:		
	cloud000000.pcd		`C:\Users\username\cloud000000.pcd`

Platform	File	Figure	Default Location
	cloud000000.las		`C:\Users\username\cloud000000.las`
	Calibrate tab data output:		
	Transform Alignment		`C:\UserDefinedFolder\transform_alignment.xml`
	Calibration		`C:\UserDefinedFolder\calibration.ini`

To keep your exported files from being overwritten by the subsequent export from a different set of data output, make sure your file path leads to the YYYY-MM-DD_HH-MM-SS.TTT folder of the original QLog file being exported. This does not happen by default.

5. Managing Sensors — Dashboard Tab

From the **Dashboard** tab, manage the available sensors on the network. This involves discovering sensors on the network, connecting to them, labeling them, checking their vital statistics, and disconnecting from them. Up to 50 sensors can be included on the dashboard. See *Figure 15. Dashboard Tab: Interface*.

View the Dashboard Panel

Click the **Dashboard** tab. Q-View opens the **Dashboard** panel. See *Figure 15. Dashboard Tab: Interface*.

Figure 15. Dashboard Tab: Interface

Add New Sensor by IP Address

If you know a sensor is on the network, but the search mechanisms have not listed it, the **+ ADD NEW** sensor tile allows you to search the network by the sensor specific IP address to find and display it. See *Search Manually for Sensors using IP Address* (page 46).

IPv6 Address Toggle

To list sensor IPv6 addresses, toggle the IPv6 address ON.

- By default, all sensors with IPv4 addresses are included.
- If sensors have both and IPv4 and IPv6 addresses, and the IPv6 address toggle is OFF, both the IPv4 and IPv6 addresses are listed.
- If the IPv6 address toggle is ON, all sensors with IPv6 addresses are listed, however due to the length of IPv6 addresses, the full address is not listed in the sensor tile. Hover over the IPv6 address to view the entire address or view the sensor Diagnostics panel.

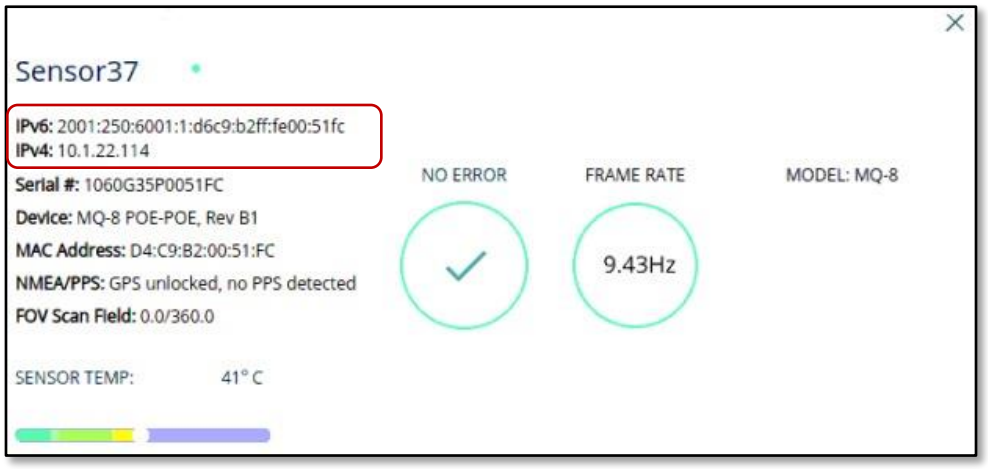


Figure 16. Sample Sensor Diagnostic Panel - IPv6 Toggle OFF

Figure 17. Sample Sensor Diagnostics Panel - IPv6 Toggle ON

Search Network Button

After the initial scan, you can refresh the search results by clicking the **Search** network button. The search takes a few seconds, then updates the list of sensors. See *Figure 15. Dashboard Tab: Interface*, *Search for Sensors on the Network* (page 44), and *Sort the Sensor List* (page 48).

Disconnect All Button

If many sensors are in a **Connected** (**green**) state, you can disconnect them all at once by clicking the **Disconnect All** button. This is handy when you are done calibrating a group of sensors, and you need to connect and calibrate a new group of sensors. See *Figure 15. Dashboard Tab: Interface*.

Scroll Bar

The tiles of all the sensors on your network may not fit on a single page view. Use the scroll bar along the right side of the Dashboard tab to scroll up and down through all of them.

Add a Sensor to Q-View

1. From Q-View, select the **Dashboard** tab. See *View the Dashboard Panel* (page 41) and *Figure 18. Q-View Dashboard Tab: Initial*.

   Q-View discovers sensors on the same network as Q-View and displays them in the list of tiles on the Dashboard panel.

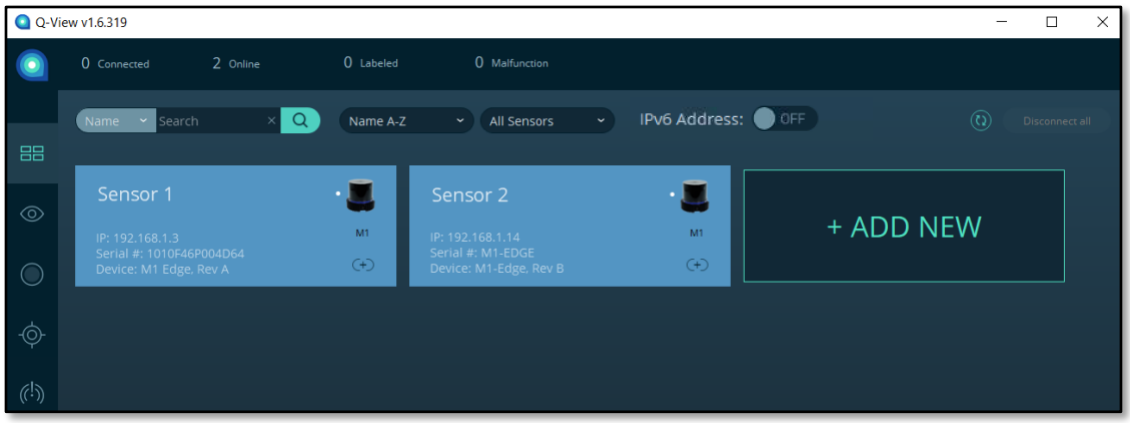


Figure 18. Q-View Dashboard Tab: Initial

2. Search for a sensor. See *Sort the Sensor List* (page 48) and *Figure 19. Sort Sensor Menus*.

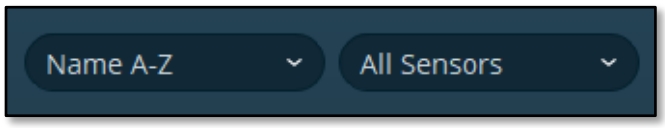


Figure 19. Sort Sensor Menus

3. If the sensor you are looking for is not listed, select a method to search for a sensor. See *Search for Sensors on the Network* (page 44) and *Figure 20. Search for Sensors Buttons*.

Figure 20. Search for Sensors Buttons

4. Connect a sensor. See *Connect to an Online Sensor* (page 49) and *Figure 21. Connect Sensor Button*.

Figure 21. Connect Sensor Button

Search for Sensors on the Network

After the initial startup scan is conducted, you can discover added sensors by automatic search through the **Search** network button. Both the initial startup scan and the **Search** network button perform a broad automatic mDNS search process according to network search rules.

Q-View also offers several ways to manually search for and sort all sensors on the network.

- By typing an IP address into a **+ADD NEW** tile, then pressing the **Enter** key. See *Search Manually for Sensors using IP Address* (page 46).
- By selecting search criteria (`Name`, `IP`, or `MAC`), typing the specific string in the data field, and clicking the **Search** button. See *Search Manually for Sensors* (page 47).
- By sorting the sensors alphabetically (**Name A-Z** or **Name Z-A**) or by **MAC address**, **IP address**, or **Model Number**. See *Sort the Sensor List* (page 48).
- By selecting a category (**All Sensors**, **Connected**, **Online**, **Offline**, **Labeled**, **Malfunctioning**, or each **model name**) of sensors. See *Filter the Sensor List* (page 49).

Network Search Rules

An automatic search follows specific network search rules:

- If a sensor is in a **Connected** state, it becomes persistent and is unaffected by subsequent searches.
- If you click the **Search** network button again, the list is cleared (except for the persistent **Connected** sensors) and refreshed by the results of the new search.
- While a search is in progress, the interface is locked, preventing the user from initiating any other activity until the search process completes. The spinner rotates to indicate that it is in search mode. You can click the spinning **Search** network button again to stop the search.

Any new sensors that are discovered appear as tiles in the list, along with the persistent **Connected** sensors.

Search Automatically for Sensors via mDNS

To search for available sensors via automatic mDNS broadcast:

1. Click the **Search** network button to immediately refresh a previous network search or activate a new search. The list of available sensors changes to reflect the current network.
2. If a previously labeled sensor is not discovered, it displays as an **Offline** (gray) tile, which can be deleted from the list by clicking its **Delete** button. See *Figure 12. Q-View Scan Displays Offline Sensors Even Without Network Connection*.
3. If you don't get the results you want. See *Figure 22. Dashboard Tab: No Network Found (right), No Sensors Found (left)*.
    - When the current network is available, but no sensors are found, a **NO SENSORS FOUND** message appears.
    - When the current network is not available, and no **Offline** tiles are listed, a **NO NETWORK FOUND** message appears.

    Additional options:

    - Quit Q-View.
    - Fix the network connections.
    - Restart Q-View.

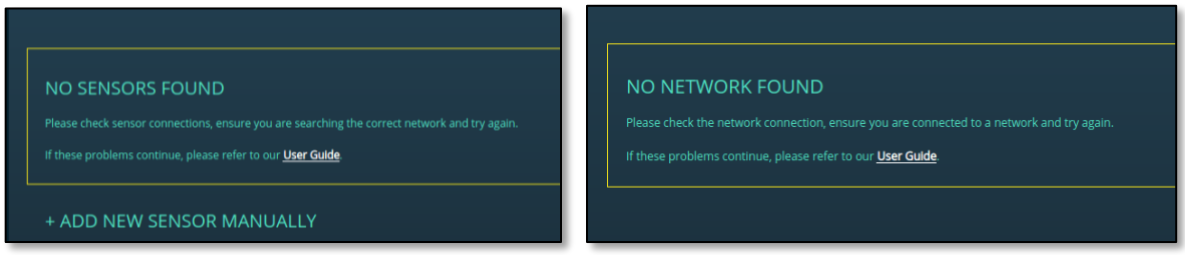


Figure 22. Dashboard Tab: No Network Found (right), No Sensors Found (left)

Search Manually for Sensors using IP Address

The manual search is a useful shortcut for new sensors that were just added or are on a sub-network that is not directly discoverable.

To search for a sensor whose IP address you know:

1. If there is an automatic search in progress, wait for it to end.
2. Click the **+ADD NEW** tile. That tile transitions to include four numeric fields separated by periods, and a blinking cursor prompts the user to type. See *Figure 23. Dashboard Tab: Add New Sensor Sequence.*

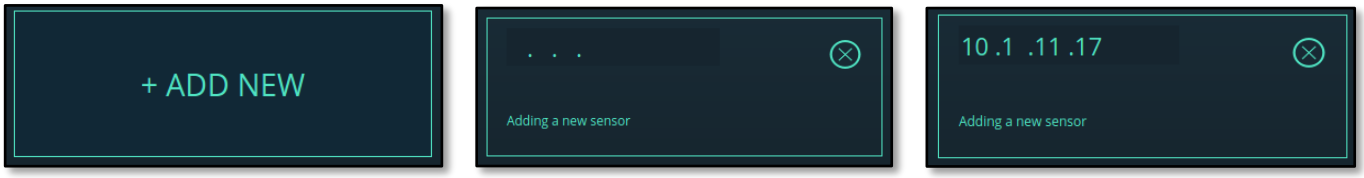


Figure 23. Dashboard Tab: Add New Sensor Sequence

3. Type the sensor known IP address in the octet fields.
   - Include the **dot** (.) to automatically move to the next field in the IP address.
   - Press the **Tab** key or period to complete the current field and skip to the next.
   - Press arrow keys to move forward or backward through three digits in each **octet**.
   - Press the **Backspace** key to delete a digit.
4. Press the **Enter** key or click in the **Adding a new sensor** panel, to activate the search for the sensor with that IP address. See *Figure 24. Dashboard Tab: Manual Search Results: Online (left) or Not Found (right)*.
   - If Q-View instantly reverts to the original empty **+ADD NEW** tile, then that sensor is already in the list of sensor tiles, that is, you searched for an already found sensor.
   - If the **IP address** appears valid by being in the standard format, Q-View does this:
     - Locks the **IP address** fields to prevent changes mid-scan.
     - Pings the **IP address** to determine that it is live on the network.
     - Issues the **HTTP** request for sensor information.
     - Displays a spinner while awaiting response. (For a healthy, available sensor, this should take five seconds at most.)
     - Creates a new **Sensor #** tile in an Online (blue) state when the sensor responds with the information as expected.
   - If the address appears invalid by being in the wrong format (for example, use of alpha characters, octet greater than 255, or not all fields completed), Q-View changes the sensor tile message to **Sensor** not found and allows the following.
     1) Click in an **octet** field and edit the **IP address**.
     2) Press the **Esc** (Escape) key while editing to display previously entered values.

- If an apparently valid IP address is not found or the search times out, Q-View changes the tile text to yellow and displays a **Sensor** not found message with a warning icon, then allows you to take one of the following actions.

  1) Click the **IP add**ress and press the **Enter** key to search the same IP address. Sensors can take up to a minute to restart and be recognized on the network.
  2) Click the **IP address** and edit it, then press the **Enter** key to search again.
  3) Delete the **Not Found** tile by clicking its **Delete** button.

Figure 24. Dashboard Tab: Manual Search Results: Online (left) or Not Found (right)

Search Manually for Sensors

If you know a **sensor name** (or label), **MAC address**, or **IP address**, you can search for it directly using the **Search** menu and field, as follows:

1. Select the item (**Name**, **MAC**, or **IP**) you prefer to search for from the **Search** menu on the far left of the **Search** mechanism. Searching by **Name** is the default option. See *Figure 25. Dashboard Tab: Sensor Search Menu and Field*.
2. In the **Search** field, type the name or label for the sensor(s) you wish to find.
3. Click the **Search** button (or press the **Enter** key) to activate the search. All sensor tiles that match the search criteria will appear on the **Dashboard** tab, in the order assigned by the **Sort** menu and filtered by the **Filter** menu. See *Table 7. Dashboard Tab: Sensor Sort Menu* and *Table 8. Dashboard Tab: Sensor Filter Menu*.

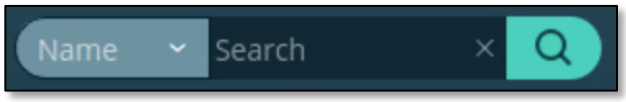
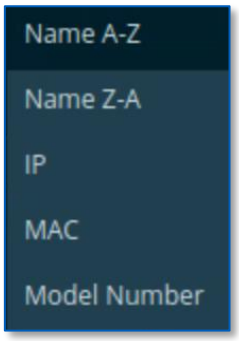


Figure 25. Dashboard Tab: Sensor Search Menu and Field

Sort the Sensor List

If you have a large number of sensor tiles on display, you may sort them by using the drop-down **Sort** menu in the upper-left area of the **Dashboard** tab. Each item in the **Sort** menu. See *Figure 15. Dashboard Tab: Interface* and *Table 7. Dashboard Tab: Sensor Sort Menu*.

Table 7. Dashboard Tab: Sensor Sort Menu

Drop-Down Menu	Select Sort	Result
	**Name A-Z** (default)	Sorts sensors alphabetically in ascending order by original names and updated labels.
	Name Z-A	Sorts sensors alphabetically in descending order by original names and updated labels.
	IP	Sorts sensors numerically in ascending order by each octet (1-999) of the IP address.
	MAC	Sorts sensors numerically in ascending order (1-9) by the last six digits of the sensor MAC address (identical to the last six digits of the sensor serial number). The MAC address is stated on the diagnostics panel, and the serial number is stated on the sensor tile and diagnostics panel. See *Figure 28. Dashboard Tab: Diagnostics (...) Button*.
	Model Number	Sorts sensors alphanumerically in ascending order by the model number.

Filter the Sensor List

As the complete list of discovered sensors overflows beyond the visualization window, you can adjust which sensors remain in view with these mechanisms. See *Figure 15. Dashboard Tab: Interface*.

- Drag the right-hand scroll bar.
- Resize the window to change the size of the visualization window.
- Filter the listed sensors to display only certain categories of sensors:
  - Click the drop-down filter menu in the upper-left area of the window.
  - Select which category you want to display. See *Table 8. Dashboard Tab: Sensor Filter Menu*.

The sensor filter list selection lists the sensors model numbers that are in the dashboard. This list dynamically updates to show only available sensors according to the sensors in dashboard.

Table 8. Dashboard Tab: Sensor Filter Menu

Drop-Down Menu	Select Filter	Display Tile States	Tile Colors
	**All Sensors**	**Empty, Online, Connected, Malfunctioning, Offline, Not Found**	Transparent, Blue, Green, Red, Gray, **Black**
	Connected	**Connected**	**Green**
	Online	**Online, Connected, Malfunctioning**	Blue, **Green**, **Red**
	Offline	**Offline**	Gray
	Labeled	Any tile assigned a nickname	Blue, **Green**, **Red**, Gray
	Malfunctioning	**Malfunctioning**	**Red**
	~~M1 (M1-PLUS, M1-CORE, M1-ULTRA)~~	**Empty, Online, Connected, Malfunctioning, Offline, Not Found** The list of sensors dynamically changes as sensors are detected on or removed from the network.	Transparent, Blue, Green, Red, Gray, **Black**
	~~M1 Edge, M1 Edge PoE+~~		
	~~M8, M8-Prime, M8-PoE+~~		
	~~MQ8-PoE+~~		
	Q-Track LR, Q-Track DM, Q-Track Dome		

Connect to an Online Sensor

You can only visualize, record, and calibrate sensors that are in a **Connected** state. To connect to a sensor that is in an **Online** (blue) state:

1. Click the **Connect** (**+**) button on the sensor tile. The button is replaced by a spinner that indicates the connection process is occurring.
   - If the sensor is determined to be healthy by achieving a persistent TCP connection, the sensor achieves a **Connected** state, displaying a **green** tile.
   - If the sensor is determined to be unusable by refusing to connect (perhaps because it is already connected to another user), the sensor is assigned the **Offline** state, displaying a **gray** tile.
   - If the sensor is determined to be unhealthy because it is experiencing non-fatal errors related to temperature, motor velocity, or other operational parameter, the sensor is assumed to be in a state of **Malfunction**, displaying a **red** tile.

     Although the tile appears **red**, these sensors are in a **Connected** state and capable of collecting data that can be visualized, recorded, and calibrated. The diagnostics panel lists which non-fatal errors the sensor is experiencing.

     If a sensor experiences a fatal error while trying to connect, it immediately goes **Offline** (**gray**).

     An Ubuntu host terminal may display the error message, which would be something similar to, `Terminating after catching exception: Firmware watchdog violation / Firmware version mismatch.`
2. Connect to one or more **Online** sensors. Be aware that connecting to a sensor secures ownership, which prevents any other users from connecting to it and using it. See *Viewing Point Clouds — Visualize Tab* (page 58).
   - At least one sensor must be **Connected** to visualize or record **LIVE** data.
   - At least two sensors must be **Connected** to perform **LIVE** calibration.
   - At least two sensors must be included in a recording to perform **PLAYBACK** calibration.

View Sensor Tiles and States

When the list of sensors is refreshed sensors are either. See *Figure 15. Dashboard Tab: Interface*.

- **Found** and are auto-assigned a number that starts from one and increments for each new discovery: Sensor 1, Sensor 2, and so on.
- **Remembered** from previous searches, retaining previous user-edited labels, such as West Roof. See *Managing Sensors — Dashboard Tab* (page 41).

Each sensor is represented by a tile that offers an image and data that indicates its state and enables additional actions. See *Table 9. Dashboard Tab: Sensor States* and *Figure 26. Dashboard Tab: Example Sensor Tile*.

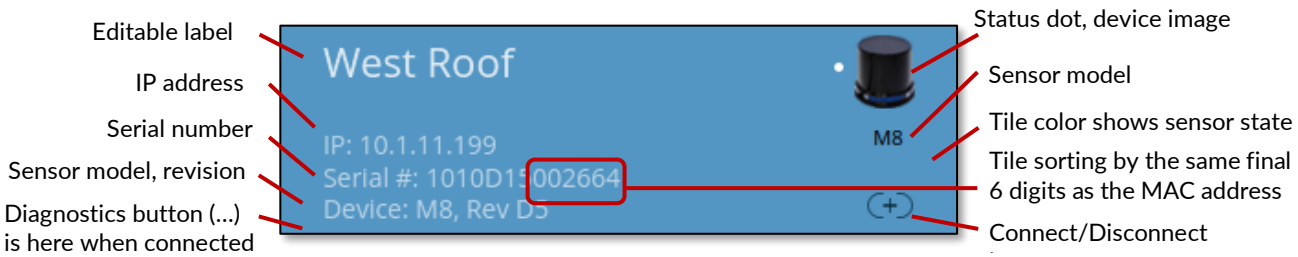
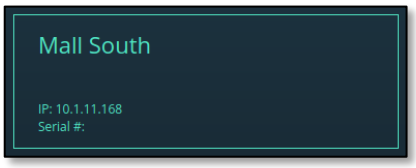
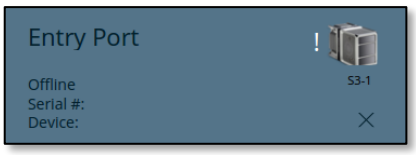
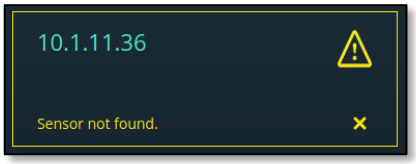


Figure 26. Dashboard Tab: Example Sensor Tile

Table 9. Dashboard Tab: Sensor States

Sensor State	Visual Data	Textual Data 1	Example Tile
EMPTY. Previously labeled sensor displays upon startup, waiting briefly for auto-search to find the sensor and reflect its state.	Uncolored tile, green text	Label, uneditable IP blank Serial # blank	
ONLINE. Auto-search or IP address search finds a valid sensor that appears to be active.	Blue tile, white text Sensor image, model White online dot icon **Connect** (+) button	Label, editable IP address Serial # Device, revision	
CONNECTED. When you click the Online sensor's Connect (+) button, a persistent TCP connection to the sensor is achieved, so you now "own" it.	Green tile, black text Sensor image, model White broadcast dot icon **Disconnect** (–) button **Diagnostics** (...) button's large active area is bolder when hovering over it	Label, editable IP address Serial # Device, revision	
MALFUNCTIONING. 2 When connect attempt is made, the sensor does not produce any data, or connected sensor returns an error during operation.	Red tile, white text Sensor image, model **Exclamation** (!) icon **Disconnect** (–) button may or may not appear **Diagnostics** (...) button	Label, uneditable IP address Serial # Device, revision	
OFFLINE. (Unusable.) Auto-search does not find previously labeled sensor, or Online sensor won't connect. Deletable by clicking **X** button.	Gray tile, black text Sensor image **Exclamation** (!) icon **Delete** (X) button	Label, uneditable Offline Serial # Device, revision	

Sensor State	Visual Data	Textual Data 1	Example Tile
NOT FOUND. Manual search by IP address does not find sensor if it does not exist, is off the network or refuses TCP connection. Delete by clicking **X** button.	**Black** tile, mixed colors **Warning** (Δ) icon **Delete** (X) button	Label is IP address, editable as octets Sensor not found.	

~~Table Notes:~~

~~1. M8 sensors Rev D4 and below do not report device revision level.~~

~~2. S-Series sensors do not display a Malfunctioning (red) state.~~

View Sensor Tallies

As you exercise options available on the **Dashboard** tab, Q-View keeps a visible running tally of sensors for the following categories of sensors. See *Figure 15. Dashboard Tab: Interface* and *Figure 27. Dashboard Tab: Sensor Tallies*.

- **Connected**: Number of sensors that have achieved a persistent TCP connection with Q-View. This includes all sensors in a **Connected** (**green**) state and a **Malfunctioning** (**red**) state. See *Table 9. Dashboard Tab: Sensor States*.
- **Online**: Number of sensors that are (or were previously) detected on the network.
- **Labeled**: Number of sensors that have been given nicknames by the user. These labels are tightly coupled to the sensor. Even when the sensor goes **Offline** and later comes **Online** again, the last known user-defined label appears with it. Unless, the **Offline** sensor is deleted, through the **Delete** button, then the label is forgotten.
- **Malfunction**: Number of sensors that are in a **Connected** state, but are experiencing non-fatal errors related to temperature, motor velocity, or other operational parameters. The sensors, whose tiles appear **red**, are capable of connecting and collecting data that can be visualized, recorded, and calibrated. The diagnostics panel shows which non-fatal errors the sensor is experiencing. See *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.

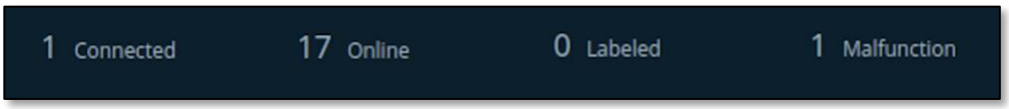


Figure 27. Dashboard Tab: Sensor Tallies

Edit Sensor Names and Labels

Sensors are assigned generic default names, but you can redefine those names with more meaningful labels, which are a handy way to identify specific sensors. Q-View has the following behaviors related to labels:

- During automatic sensor discovery, Q-View names sensors in numeric order as they are found: Sensor 1, Sensor 2, and so on.

- Names and labels of sensors in the **Offline** (gray) state and **Malfunctioning** (red) state are not editable.
- Names and labels are recognized locally per host computer and per user. In other words, two users on two separate host computers can relabel the same sensor without impacting each other experience.
- If you type a label that is already in use, Q-View reverts to the previous label.

To change a default **Sensor X** label to something more meaningful (place, owner, group...):

1. From the **Dashboard** tab > **Sensor** tile, click the label of a sensor.
2. Delete the old label by backspacing, or by double-clicking to highlight entire label.
3. Type the new label, up to 12 characters.
4. Press the **Enter** key, or click away from the field, to apply it.

Handle a Malfunctioning Sensor

Understand the specifics of a **Malfunctioning** (red) sensor when deciding how to handle it:

1. Upon attempting to connect to an **Online** (blue) sensor, a sensor that achieves a persistent TCP connection is in a **Connected** state. However, if the sensor also returns an error code, it remains **Connected**, but in a **Malfunctioning** (red) state.

   A **Malfunctioning** sensor continues to produce useful data, except for in the case of a **Motor Initialization Error**, which stops the spinning mechanism, but could recover.
2. Use the sensor as normal in the Q-View tabs.
3. Click the connected **Malfunctioning** sensor tile **Diagnostics** (...) button to view the diagnostics panel, which reveals any error codes reported by the sensor. See *Figure 28. Dashboard Tab: Diagnostics (...) Button* and *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.
4. For strategies for resolving minor anomalies. See *Sensor is Malfunctioning* (page 128).
5. For explanations of the error codes, see the “Troubleshooting Issues” section of each *Sensor User Guide*.

View the Sensor Diagnostics

For sensors in the **Connected** (green) or **Malfunctioning** (red) state, you can view a diagnostics panel that reveals a variety of information about the sensor.

How to View and Dismiss

To view a particular sensor diagnostics data. See *Figure 28. Dashboard Tab: Diagnostics (...) Button* and *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.

1. Click the **Diagnostics (...)** button active area on the sensor tile to reveal the diagnostics panel overlay.
2. Click the **Close** (X) button in the upper-right corner of the diagnostics panel to dismiss the panel and restore the regular **Dashboard** view.

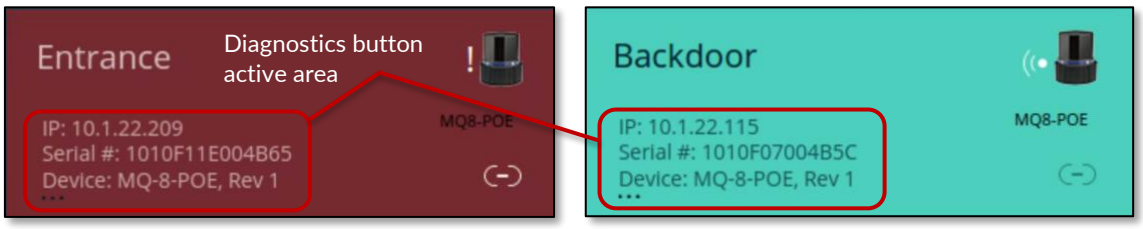


Figure 28. Dashboard Tab: Diagnostics (...) Button

Sensor Diagnostics Panel Details

Only one diagnostics panel appears at a time, overlaid on the list of sensor tiles. Compare the panels for sensors in good health and panels displaying non-fatal errors. See *Figure 29. Dashboard Tab: Diagnostics Panel Healthy Sensor* and *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.

Note: M8 sensors (Rev D4 and earlier) sensors do not display errors.

Figure 29. Dashboard Tab: Diagnostics Panel Healthy Sensor

Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error

For both healthy and malfunctioning sensors, the diagnostics panel provides several important data points.

To make any of the adjustments suggested in the descriptions below, see each *Sensor User Guide*.

- **Identification**: Reveals the sensor label.

  The label includes the title assigned to the sensor. For example: `FrontParkLot` and `Entrance`. The colored dot next to the sensor type title indicates status: **green** dot is online and healthy, **red** dot is malfunctioning.

  The **IP address**, **Serial #** (number), and **MAC Address** are specific to the sensor.

The **Device** field lists the **device model** and **firmware version**. For example: M8, Rev D4P and MQ-8-POE, Rev 1. If the sensor diagnostics panel does not list the sensor Revision (Rev) number, check the physical label on the sensor or log into the sensor web server interface.

- **FOV Scan Field**: Field of View Scan Field settings configured for the sensor. Where the first value is the FOV start angle and the second value is the FOV end angle. These are measured in degrees from 0.0 to 360.0.
  - For setting the FOV, see the *Sensor User Guide* and the Sensor Web Server.
  - For viewing the FOV in a QORTEX Aware visualizer, see *Connect to a QORTEX Aware Enabled Sensor* (page 101).
  - This field is not displayed for M8 Rev D4P and earlier, or S3-2 sensors.
- **Sensor Temperature**: States the numerical temperature, such as 41°C, and shows a colorful visual gauge ranging through **green** (cool), **yellow**, **orange**, and **red** (hot).
- **Frame Rate**: States the number of cycles per second in hertz.
  - For M-Series sensors, this is the rotational speed of the turret, which is adjustable through the web server. See the "Edit Settings" section in the *Sensor User Guide*.
  - For S-Series sensors, this is the scanning speed (reaction time).
- **Model**: States the **model name** and shows the **sensor image**.
- **NMEA/PPS**: National Marine Electronics Association (NMEA)/Precise Positioning Service (PPS) reveals the GPS status. This is adjustable through the web server. See "Edit Settings" (GPS section) in the *Q-Track Sensor User Guide*. See *Table 10. NMEA/PPS GPS Status Messages*.

  GPS supported sensors: Q-Track ??

Table 10. NMEA/PPS GPS Status Messages

Sensors	NMEA/PPS Status Messages	Notes
M1 M1 Edge M8 M8-PRIME	*GPS locked*	A locked status requires the following criteria: • Sensor is attached to the NMEA/PPS inputs. • Internal clock is successfully trained to the GPS external reference (satellite). • Internal timebase is properly adjusted to GPS time so that the PPS input always arrives within 4 µs of the internally expected time. **Note**: M8 Rev D5 or lower
M8	*GPS unlocked*	**Note**: M8 Rev D5 or lower
M1 M1 Edge M8-PRIME	*GPS unlocked, no PPS detected*	
M8-PRIME	*GPS lock in progress*	

Sensors	NMEA/PPS Status Messages	Notes
~~M8-PRIME~~	~~*GPS locked but suboptimal PPS*~~	
~~M8-PRIME~~	~~*GPS unlocked, noisy PPS*~~	
~~M8-PRIME~~	~~*GPS unlocked, PPS has been lost*~~	~~Possible reasons include:~~ ~~• Lost a successful lock to GPS on stable/ specified PPS signal.~~ ~~• Lost a suboptimal lock to GPS on unstable/ short PPS signal.~~
Q-Track LR		
Q-Track HD		
Q-Track Dome		

~~**GPS unsupported sensors:** M8 PoE, MQ-8 PoE, S3-2~~

~~The GPS field for sensors that do not support GPS show the following message.~~

- ~~M8-PoE message: *GPS unlocked.*~~
- ~~MQ-8 PoE message: GPS *unlocked, no PPS detected.*~~
- ~~S3-2 message: *Blank field.*~~

- **No Error**: If the sensor is not returning an error, a large green checkmark appears.
  - If the Q-Track ~~M1, M1 Edge, M8 (Rev D4P and higher), M8-PRIME, M8 PoE+, or MQ-8 PoE+~~ sensor returns an error, a message printed in **red** describes the problem. Refresh the display of sensors by selecting the **Search** network button to clear up any minor anomalies. See "Troubleshooting Issues" in each *Sensor User Guide* for possible causes and solutions for each code. See *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.
  - ~~M8 sensor Rev D4 and lower can return an error but cannot report it in the diagnostics panel.~~
  - ~~S-Series sensors do not return errors.~~

Disconnect from a Sensor

To disconnect from a **Connected** (**green**) sensor or a **Malfunctioning** (**red**) sensor, click the sensor tile **Disconnect** (**–**) button, and the sensor reverts to an **Online** (**blue**) state.

Delete a Sensor

To remove a sensor in the **Offline** (**gray**) or **Not Found** (**black**) state from the sensor list, click the sensor tile **Delete** (**X**) button, and the sensor is removed from the list.

6. Viewing Point Clouds — Visualize Tab

The Visualize tab allows the user to verify that a particular sensor is producing a point cloud. The point cloud is displayed to confirm that the sensor is perceiving what you expected it to perceive. If there are any problems, the point cloud can help you diagnose and address the root cause. For optimal results in visualizing point clouds, Quanergy recommends connecting to up to 18 sensors in single return mode. See *Figure 32. Visualize Tab: Connect to Sensors Message*.

View the Visualize Panel

Click the **Visualize** tab,  . Q-View opens the visualization panel.

If any sensors are in a **Connected** (**green**) state, Q-View displays sensor point cloud in the visualization window. See *Figure 31. Visualize Tab: Interface*.

Figure 31. Visualize Tab: Interface

If the panel is a blank grid with an advisory message, then zero sensors are Connected. See *Figure 32. Visualize Tab: Connect to Sensors Message*.

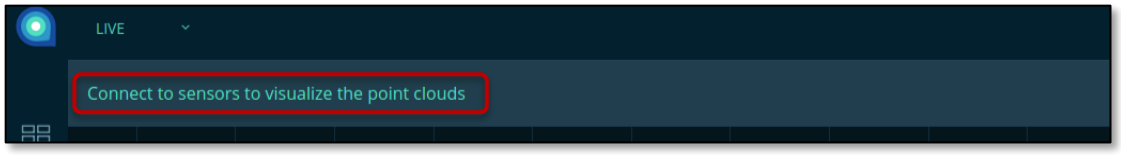


Figure 32. Visualize Tab: Connect to Sensors Message

Visualization Panel Components

The **Visualize** tab features several interface options. See *Figure 31. Visualize Tab: Interface*.

Mode Selector

A mode selector offers a choice of displaying. See *Choose LIVE or PLAYBACK Mode* (page 81).

- **LIVE** data that is visualized in real time. This is the default mode.
- **PLAYBACK** data that was previously recorded.

Connected Sensor Buttons

All sensors in a **Connected** state appear as buttons above the visualization window. See *Figure 31. Visualize Tab: Interface*.

- If no sensors are **Connected**, a message appears instead of sensor buttons: "`Connect to sensors to visualize the point clouds`". See *Figure 32. Visualize Tab: Connect to Sensors Message*.
- If one or more sensors are **Connected**, the first sensor button that is listed is selected by default, and its point cloud appears.
- If there are more sensors than can appear in a single row, arrow heads appear at the beginning and end of the row to enable left and right scrolling.

XYZ Axes

Most of the space in the **Visualize** tab is devoted to displaying the point cloud of the selected sensor, and this space always includes **XYZ** axes to help orient the point cloud. See *Figure 31. Visualize Tab: Interface*.

Display Selector

The display selector offers a choice of displaying points by specific color scheme: **Ring Based** (default), **Intensity**, or **Return**. See *Select a Color Scheme* (page 65).

Grid Size Selector

The **Grid size** selector offers a choice of what each side of a square grid cell represents in meters, from 1 meter minimum to a maximum of the sensor point cloud range. By default, the grid is set to 5 meters. The setting is adjustable in 1-meter increments. See *Adjust the Grid Size* (page 67).

Point Size Selector

The **Point size** selector adjusts each point to display as 1, 2, 3, 4, or 5 pixels (px). The larger point sizes make it easier to see, but at the expense of precision. See *Select a Point Size* (page 68).

View Reset Buttons

It possible to get disoriented when manipulating a point cloud. In the upper-right corner of the window, **View Reset** buttons allow you to force the point cloud to snap into easily understood **Top**, **Side**, and **Perspective Views**. See *Figure 31. Visualize Tab: Interface* and *Reset the View* (page 64).

3D Controls

Mouse and keyboard devices enable more precise manipulation of the point cloud. See *Apply the 3D Controls* (page 65).

Visualize a Point Cloud

The **Visualize** tab can display data collected in real time (**LIVE** mode) or data that was previously recorded (**PLAYBACK** mode).

LIVE Mode

By default, the **Visualize** tab displays in **LIVE** mode. See *Figure 31. Visualize Tab: Interface*.

- If no sensors are **Connected**, the visualization window is empty. To populate the visualization window, click the **Dashboard** tab, connect to one or more sensors, then click the **Visualize** tab.
- If one sensor is **Connected**, it appears as a button above the visualization window. If the button is selected (**green**), its point cloud is visualized in **Top View** orientation. Click the **Sensor** button to toggle its visualization on and off.
- If multiple sensors are **Connected**, they appear as buttons above the visualization window, and the point cloud of the first sensor listed is selected (**green**) and visualized in **Top Vie**w orientation.
    - Click the selected sensor button to toggle its visualization on and off.
    - Click the button of a different sensor to visualize its point cloud instead. The newly selected sensor button turns **green**.
- If you notice anything odd in the point cloud, or no points are displayed, see *Troubleshooting Issues* (page 127).

- To switch between **PLAYBACK** mode and **LIVE** mode, click the mode selector arrow in the top right corner to open the drop-down menu, and select `LIVE` or `PLAYBACK`. See *Figure 33. Visualize Tab: Mode Selector Menu (left), Items (middle), File Icon (right).*

PLAYBACK Mode

If data in the form of Quanergy proprietary QLog format has been shared with you or recorded through the **Record Tab**, you can select **PLAYBACK** mode to visualize up to 5 minutes of the recorded point cloud. See *Recording Sensor Data — Record Tab* (page 69).

PLAYBACK mode is available in both the **Visualize** tab and **Calibrate** tab. Both tabs are synchronized to visualize the point cloud at the same place in the recording. See *Figure 33. Visualize Tab: Mode Selector Menu (left), Items (middle), File Icon (right)*.

Figure 33. Visualize Tab: Mode Selector Menu (left), Items (middle), File Icon (right)

1. In the **Visualize** tab, click the mode selector arrow to open the drop-down menu, and select the **PLAYBACK** item.
2. Click the file icon that appears.
3. Navigate to the directory containing the QLog data you wish to visualize.
4. Select the directory, then click the **Choose** button. See *Figure 34. Visualize Tab: Select Playback Data Directory*.

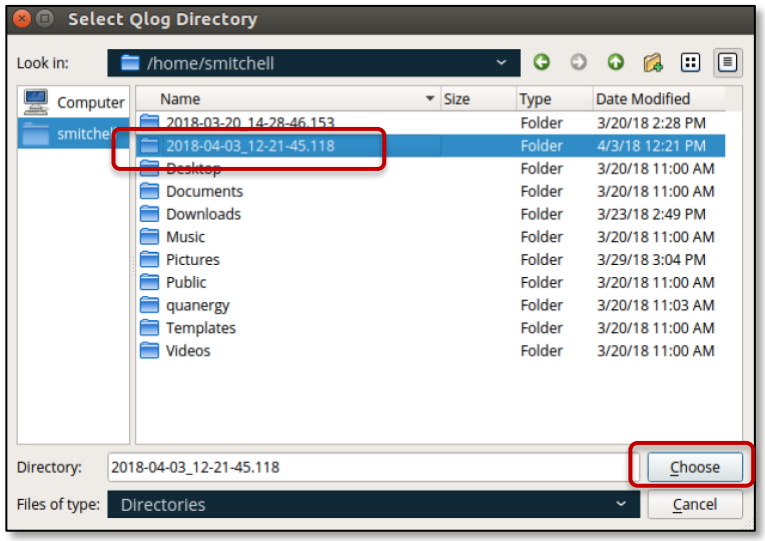


Figure 34. Visualize Tab: Select Playback Data Directory

5. If you select a directory that doesn't have any QLog files in it, a pop up appears. See *Figure 35. Visualize Tab: Invalid Directory Selected*.

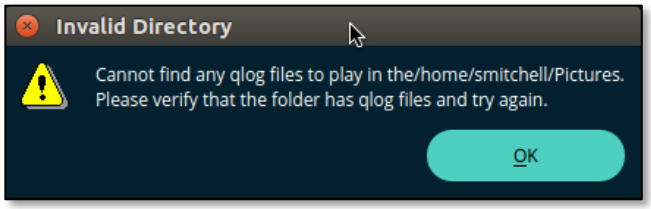


Figure 35. Visualize Tab: Invalid Directory Selected

6. When the files from a valid directory begin to download, a pop-up appears with a progress indicator and a button by which you can cancel the process. If you cancel the process, a confirmation window appears. See *Figure 36. Visualize Tab: Uploading Files (left), Canceling the Upload (right)*.

Figure 36. Visualize Tab: Uploading Files (left), Canceling the Upload (right)

7. If you prefer to adjust the speed of the visualized recording, click the up/down arrows to cycle through the options — .5 (slowest), 1.0 (default), 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, and 5.0 (fastest) — and select the speed you prefer. See *Figure 37. Visualize Tab: PLAYBACK Play (top), Pause, Step Forward, Replay (bottom)*.

> **Note:** This Speed selector disappears after the data is visualized. It reappears if you select pause during replay or select a different recording to visualize.

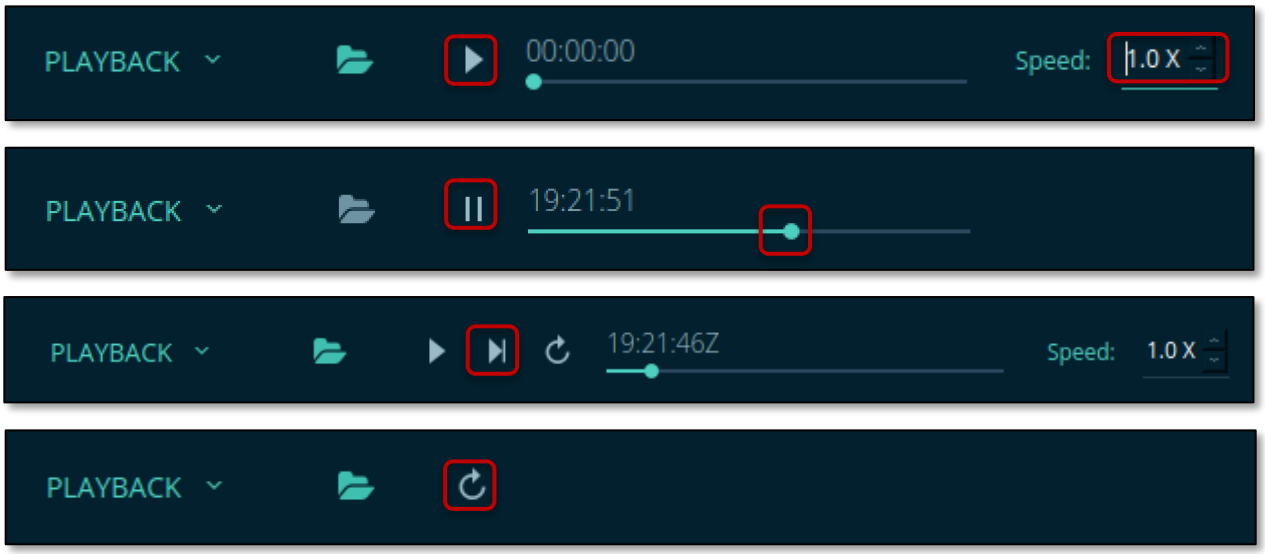


Figure 37. Visualize Tab: PLAYBACK Play (top), Pause, Step Forward, Replay (bottom)

8. To visualize the data, click the **Play** arrow, then click one or more sensor buttons. See *Figure 37. Visualize Tab: PLAYBACK Play (top), Pause, Step Forward, Replay (bottom)*.
   - The selected sensor button turns green, and the point cloud appears.

     If two or more sensor buttons are selected, the **Calibrate** tab becomes enabled, and you can pause the recording while you open the tab to calibrate a pair of recorded sensors.
   - The time indicator increments up and the ball indicator slides forward until the visualized recording ends.
   - The time displays with a concluding **Z** to indicate Coordinated Universal Time (UTC).
9. During play, you have two options for jumping to the approximate time you prefer to visualize. Select the **Pause** button during play, then choose a method. See *Figure 37. Visualize Tab: PLAYBACK Play (top), Pause, Step Forward, Replay (bottom)*.
   - Select and drag the **ball indicator**, which jumps in intervals of 100-ms. Playback pauses visualization at the place you select in the timeline. You can drag the ball indicator in both play and pause modes.
   - Click the **Step Forward** button to jump ahead in intervals of 100-ms.
10. To replay the recording after it ends, click the **Replay** arrow. See *Figure 37. Visualize Tab: PLAYBACK Play (top), Pause, Step Forward, Replay (bottom)*.

Reset the View

The **View Reset** buttons change the point cloud display in either **LIVE** or **PLAYBACK** mode. See *Figure 38. Visualize Tab: Top View (left), Side View (middle), Perspective View (right)*.

1. Visualize real-time or recorded data.
2. Hover over a **View Reset** button to highlight it and reveal its name, then click a **View Reset** button to instantly snap back to that view:
    - The **Top View** (default) button displays a two-dimensional "birds-eye-view" as though looking straight down on the top of the sensor.
    - The **Side View** button displays a two-dimensional "worms-eye-view" as though looking straight out at the side of the sensor.
    - The **Perspective View** button displays a three-dimensional view as though looking from above and to the side of the sensor.

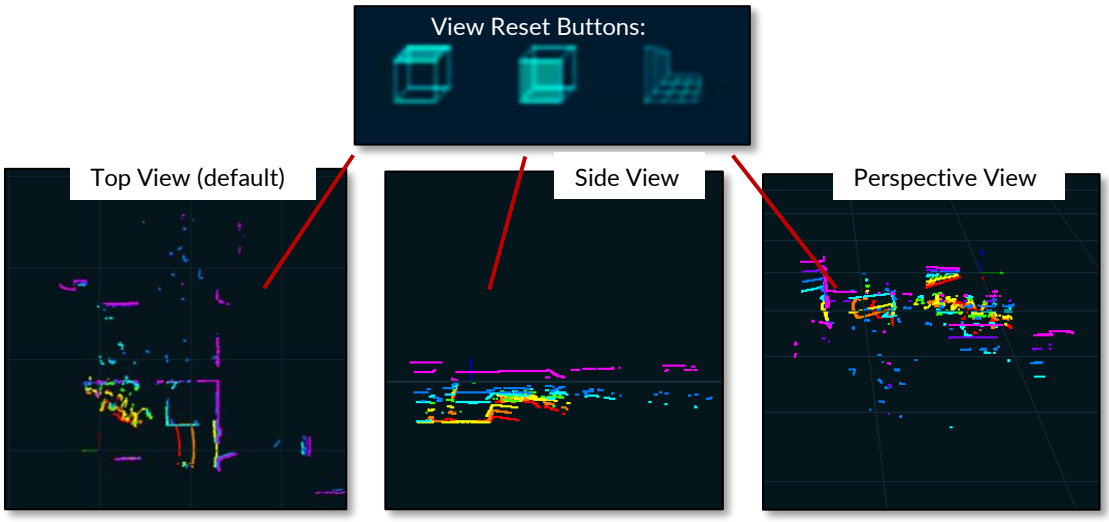


Figure 38. Visualize Tab: Top View (left), Side View (middle), Perspective View (right)

Apply the 3D Controls

No matter which view you start with or reset to, you can always apply the 3D controls via mouse and keyboard to fine-tune the point cloud perspective according to your needs and preferences.

- To rotate the **point cloud around the Z-axis**, hold down the **left mouse** button and drag left or right along a horizontal line. (Diagonal dragging is fine, too, but it yields results that are not as neatly explained.)
- To move the **perspective from birds-eye-view to worms-eye-view** (subterranean view), hold down the **left mouse** button and drag up or down along a vertical line. (Diagonal dragging is fine, too, but it yields results that are not as neatly explained.)
- To **zoom in and out** from the center of the point cloud, rotate the **mouse wheel**.
- To **reposition the point cloud** within the visible area, press the keyboard **Shift** key and the **left mouse** button, then drag until the area of interest is where you want it to be.

> **Note:** Touchpads are not fully supported at this time.

Select a Color Scheme

Select one of three color schemes listed in the display selector to highlight features in the visualized data that are important to you. See *Figure 39. Visualize Tab: Menu for Intensity, Ring Based, and Return Color Schemes*.

Ring Based color scheme (default) helps troubleshoot issues related to a particular ring.

- ~~M-Series~~ sensor points appear in a major color that represents each ring in the stacked layer: **red**, **orange**, **yellow**, **green**, **blue**, **indigo**, **violet**, **magenta**.
- ~~S-Series~~ sensor points appear in **red** and cyan.

Intensity color scheme displays points in a spectrum, as follows:

- ~~M1, M8 (Rev D5 and up), M8-Prime, M8 PoE+, and MQ-8 PoE+~~ sensor points appear in a spectrum of **red** (least reflective), **orange**, **yellow**, **green**, **blue**, **indigo** (most reflective) to indicate levels of retroreflectivity.
- ~~M8 sensor~~ Rev D4P and below do not detect intensity properly.
- ~~S-Series~~ sensor points appear in a spectrum of **red** to **indigo**.

Return color scheme varies depending on the sensor capabilities and options. See *Table 11. Visualize Tab: Color Scheme for Point Cloud* and *Figure 39. Visualize Tab: Menu for Intensity, Ring Based, and Return Color Schemes*.

- ~~M-Series~~ sensor points are affected by selections in the **Edit Settings > Return Data Select** section of the Sensor Settings Management (web server) application:
  - If you selected All 3 returns, an RGB (**red**, **green**, **blue**) scheme is used, where:

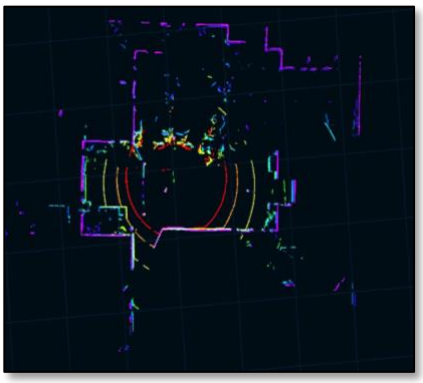
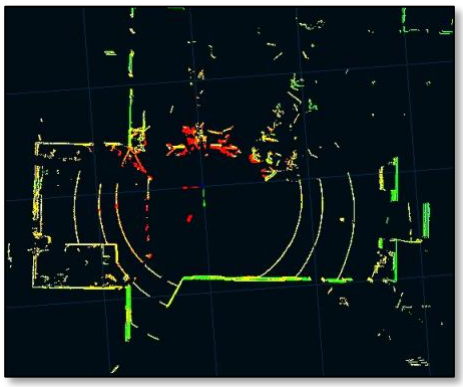
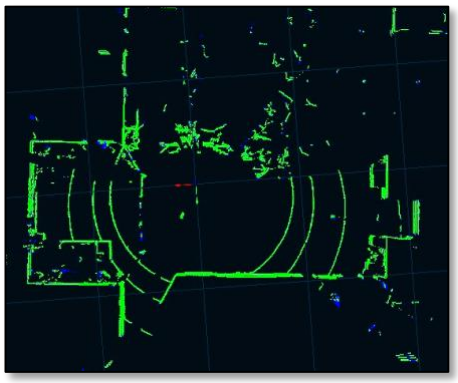
    `Return 0` (Maximum) points are **green**.

    `Return 1` (Second Strongest) points are **blue**.

    `Return 2` (Last) points are **red**.
  - If you selected any other option (`Return 0`, `Return 1`, or `Return 2`), all points are **red**.

Figure 39. Visualize Tab: Menu for Intensity, Ring Based, and Return Color Schemes

Table 11. Visualize Tab: Color Scheme for Point Cloud

Ring Based (default)	Intensity	Return
		

Adjust the Grid Size

The point cloud is displayed on a background grid of 10x10 squares (grid cells). The grid area size is double the sensor total range, so if a sensor range is 50 meters, then the grid area size is 100 x 100 meters. Q-View accommodates sensors whose ranges vary from 10 to 200 meters. By default, the point cloud appears in **Top View**, auto-scaled to display the entire point cloud within the visualization window.

Click the selector up and down arrows to adjust the distance represented by a square in 1-meter increments. 1 meter is the minimum size, 5 meters is the default size, and 50 meters is the maximum size. See *Figure 40. Visualize Tab: Grid Size Selection*.

Note: M-Series sensors do not report their ranges to Q-View, so the application uses a default range of 50 meters to draw the grid for those sensors. Contact support@quanergy.com if you need more specific configuration.

Figure 40. Visualize Tab: Grid Size Selection

Select a Point Size

Adjust the size of the visualized points, where each point is 1-5 pixels. Larger point sizes make it easier to see (especially outdoors in bright ambient light) but sacrifice precision. See *Figure 41. Visualize Tab: Point Size Selection*.

1. Click the up or down **Point size** arrows to display each point in the point cloud in the preferred pixel size, where 1 pixel is the default.
2. Readjust the **Point size** selector at any time until the display is satisfactory.

Figure 41. Visualize Tab: Point Size Selection

7. Recording Sensor Data — Record Tab

A data recorder allows you to control simultaneous recordings of data collected by up to 18 LiDAR sensors. This Q-View recorder saves direct point cloud output in Quanergy proprietary QLog format, which is easily exported to other formats, including PCD and LAS.

View the Record Panel

Click the **Record** tab, . Q-View displays the **Recorder** panel. See *Figure 42. Record Tab: Recorder Interface*.

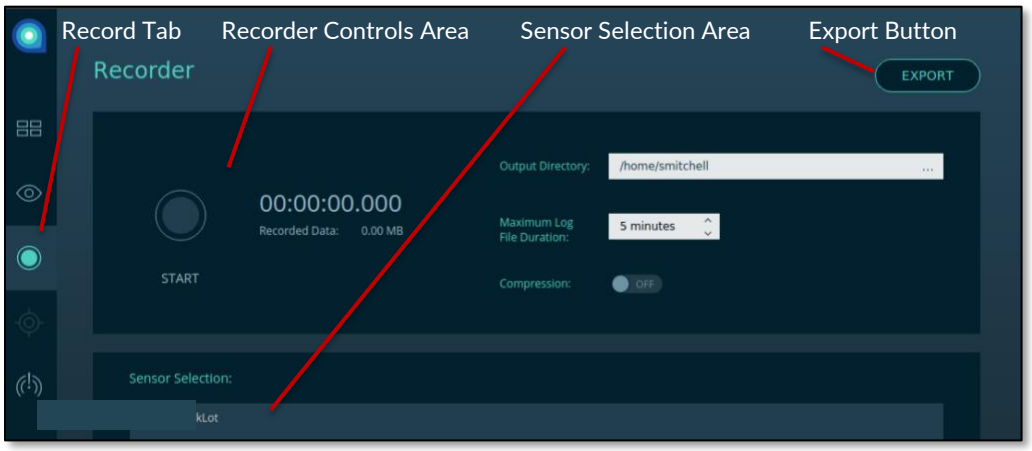


Figure 42. Record Tab: Recorder Interface

In addition to the active/inactive color options for Q-View tabs, the Recorder tab also indicates when Q-View is in **PLAYBACK** mode (for the **Visualize** tab and **Calibrate** tab). The **Record** tab is disabled, and its icon changes to a dim gray color.

Figure 43. Record Tab: Appearance and Status

Record Panel Components

The Record tab divides into three main areas. See *Figure 42. Record Tab: Recorder Interface*.

- **Recorder Controls.** See *Figure 44. Record Tab: Recorder Controls: Sensor Selected (top), Recording (bottom)*.
- **Sensor Selection.** See *Figure 46. Record Tab: Sensor Selection Area: Connected, Selected, Recorded*.
- **EXPORT Button.** See *Figure 47. Record Tab: QLog Export with Combined Sensors Option*.

Recorder Controls

The recorder controls area includes several interface components. See *Figure 44. Record Tab: Recorder Controls: Sensor Selected (top), Recording (bottom)*.

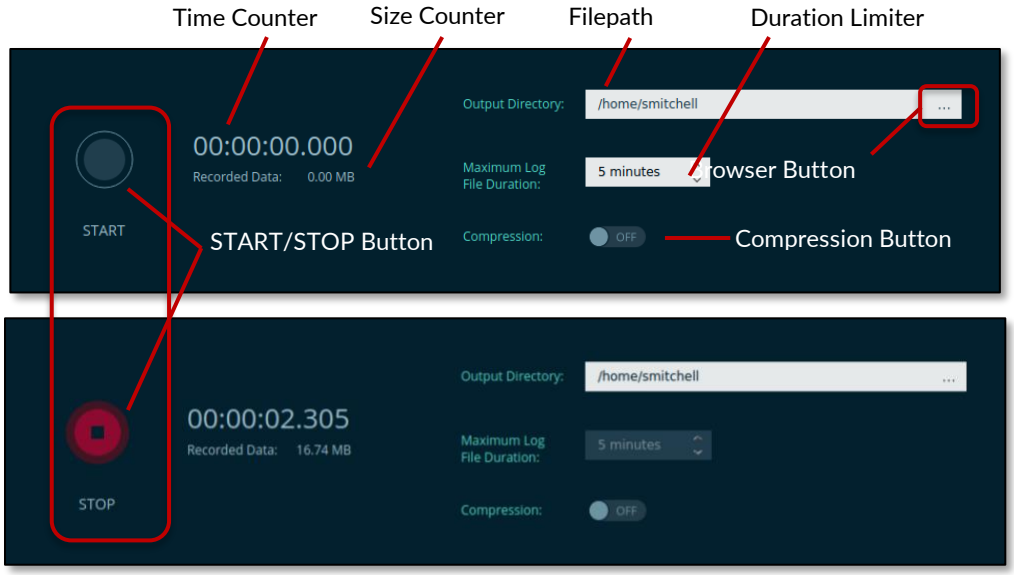


Figure 44. Record Tab: Recorder Controls: Sensor Selected (top), Recording (bottom)

- **START/STOP** Button. A toggle button waits, initiates, or ends recording activity:
  - At first, the **START** button is gray to indicate no sensors are available to record.
  - After sensor(s) have been selected through the **Dashboard** tab and **Sensor Selection** area, the **START** button inner dot becomes red to indicate readiness.
  - After the **START** button is clicked, it becomes a **red** **STOP** button by which to end the recording activity.
  - Once the **STOP** button is selected, the recording process stops, and the button is ready to **START** again.
- **Time Counter**. While a recording is active, a counter indicates how long a recording has continued, using the format `HH:MM:SS.TTT` to represent incrementing hours, minutes, seconds, and microseconds (T=1/1000 seconds).
- **Size Counter**. While a recording is active, a **Recorded Data** counter indicates the increasing size of the recording in megabytes (MB) of data.

- **Filepath** and **Browser Button**. Specify where the data recording is stored.
  a. Enter the filepath in the **Output Directory** field. Use English alphanumeric characters only!
  b. Click the ellipsis **... icon** to open a browser, then navigate to the preferred directory (or create a new directory). Default filepaths:

     For Ubuntu: `~/ home directory`

     For Windows: `C:\Users\<username> directory`

- **Duration Limiter**. A numeric **Maximum Log File Duration** control allows you to select and type or to click the up/down arrows to limit the duration of the individual log files, from a `1`-minute minimum to a `999`-minute maximum. Each time the duration limit is reached, a new file is saved as `q00`, then `q01`, `q02`.... `5` minutes is the default length.
- **Compression Button**. The data **Compression** button allows you to click **ON** to make file sizes as small as possible (lossless compression) or **OFF** to record files of regular size.

As a result of your interaction with these recorder controls, during a recording event, a new directory is created with a unique name based on a timestamp: `YYYY-MM-DD_HH-MM-SS.TTT` (`year-month-day_hour-minute-second.microsecond`).

The actual QLog data files and a `sensor_settings.xml` file are placed in the output directory. Each QLog data file is named `<sensorname>.q00`, where `q00` increments for each sensor (`q01`, `q02`, and so on). See *Figure 45. Record Tab: Produces sensor_settings.xml File*.

```
-<Settings>
   -<Sensors>
      -<Lidar>
         <name>Garage</name>
         <ip>10.1.11.142</ip>
         <port>4141</port>
       </Lidar>
    </Sensors>
   -<Transforms>
      -<Transform>
         <fromFrameName>Garage</fromFrameName>
         <toFrameName>Body</toFrameName>
      -<Position>
         <x>1.0309906/x>
         <y>3.05418968</y>
         <z>8.458936735</z>
       </Position>
       <orientationMethod>quaternion</orientationMethod>
      -<Quaternion>
         <w>0.140181616</w>
         <x>0.021026712</x>
```

```
          <y>0.0542631559</y>
          <z>0.988414168</x>
        </Quaternion>
       -<EulerYPR>
          <units<degrees</units>
          <yaw>164.02146911621094</yaw>
          <pitch>3.2549090385437012</pitch>
          <roll>-5.82773311325073242</roll>
        </EulerYPR>
       </Transform>
     </Transforms>
</Settings>
```

Figure 45. Record Tab: Produces sensor_settings.xml File

Select Sensors for a Recording Event

For optimal results when recording visualized point clouds, Quanergy recommends connecting to up to 18 sensors in single return mode. The **Sensor Selection** area lists a checkbox for each of those connected sensors. Check up to four of the listed sensors for inclusion in the recording event. See *Figure 46. Record Tab: Sensor Selection Area: Connected, Selected, Recorded*.

> **Note:** The sensors do not have to be calibrated because the data streams are completely independent and unfused.

The **Sensor Selection** area varies in appearance depending on whether the listed sensors are connected, selected, or recorded.

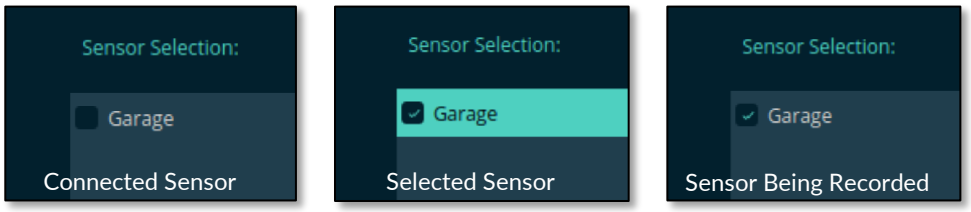


Figure 46. Record Tab: Sensor Selection Area: Connected, Selected, Recorded

Select EXPORT Parameters

1. From the **Recorder** panel, click the **EXPORT** button.
2. Select options in the **Export** panel. Then click **Start**.

   This panel provides various fields and menus for specifying the export parameters. See *Table 12. Export Button Parameters*, *Figure 42. Record Tab: Recorder Interface* and *Figure 47. Record Tab: QLog Export with Combined Sensors Option*.

Table 12. Export Button Parameters

Parameter	Description
QLog File:	Filepath to where the recorded file was placed.
Output Directory:	Filepath to where the exported file will be placed.
Filename Prefix:	cloud (default) or type any preferred prefix.
File Format:	Options are PCD (default) and LAS.
Precision:	Enabled is available only for LAS: decimeter, centimeter, millimeter, micrometer.
Compress:	Enabled (lossless compression) is available only for LAS, but the default is unchecked (uncompressed).

Record Data File in QLog Format

If one or more sensors are in a **Connected** state, then you can record their point cloud data from the **Record** tab **Recorder** interface. See *Figure 42. Record Tab: Recorder Interface*, *Figure 44. Record Tab: Recorder Controls: Sensor Selected (top), Recording (bottom)*, *Figure 46. Record Tab: Sensor Selection Area: Connected, Selected, Recorded*, and *Figure 48. Record Tab: Output Directory: Settings & Exported Files, QLog, PCD Format*.

1. In the **Sensor Selection** area, check the box for each sensor (up to four) that you wish to record.
2. In the **Output Directory** field, specify a local filepath to where data will be stored.
3. In the **Maximum Log File Duration** field, type or click the increment buttons to specify the maximum length of the recording in whole minutes.
4. Toggle the **Compression** button **ON** or **OFF** for data compression.
5. Click the **START** button to begin the recording.
6. Monitor the time and size counters, if you wish to make an informed decision about whether and when to click the **STOP** button to end the recording before it reaches the maximum duration.
7. Find the QLog file where it is placed in the output directory along with a `sensor_settings.xml` file.

Export Recorded QLog File to Another Format

Recorded QLog data can be exported to Point Cloud Data (PCD) and LASer (LAS) format. QLog data can be from a single sensor or multiple sensors. Multiple sensor data stored in a single folder is combined and exported into a single file of the selected type.

1. From Q-View left panel, select **Record**, click **EXPORT**.
2. Complete the **QLog Export** form. See *Figure 47. Record Tab: QLog Export with Combined Sensors Option*.
   a. Select the sensor to source. In the **PCD Output Type** field, select either `Single Sensor` or `Combined Sensor`.

      If Combined Sensor is selected, enter a path and filename or browse (ellipsis **(...)** icon) to a **Calibration File**. This can be QLog data from either Q-View or QORTEX DTC. For example:

```
datasets/Recordings_M8/2019-11-11_09-44-35.799/settings.orig.xml
```

   b. Select the QLog content for exporting. In the **QLog File/Folder** field, enter or browse (ellipsis **(...)** icon) to locate the data.

      - For a Single Sensor, select a single QLog.
      - For Combined Sensor export, select the directory that contains the QLog files of all the sensors in your environment. For example.

```
datasets/Recordings_M8/2019-11-11_09-44-35.799/
```

   c. Select the directory to save the exported file. In the **Output Directory** field, enter or browse (ellipsis **(...)** icon) to specify the target location. For example.

```
/home/username/pcd/
```

   d. Optionally, edit the **Filename Prefix** field. The default is `cloud`.

   e. Select the file format. From the **File Format** drop-down menu, select either `PCD` or `LAS`.

      If exporting to LAS format:

      - Select a metric unit from the **Precision** drop-down menu.
      - For compressed data, check the **Compress** box.

3. Click the **START** button to begin exporting the designated file into the output directory.
   - The **START** button changes to a **STOP** button and a message appears at the bottom of the dialog box, such as: "`Exporting Point Cloud Data 79% Complete`."
   - The message updates to "`Export completed successfully!`" when the process ends.

4. Find the exported files in the output directory. See *Figure 48. Record Tab: Output Directory: Settings & Exported Files, QLog, PCD Format*.

> **Note:** LAS files include a timestamp that is in GPS time whether the sensor is connected to GPS or not.

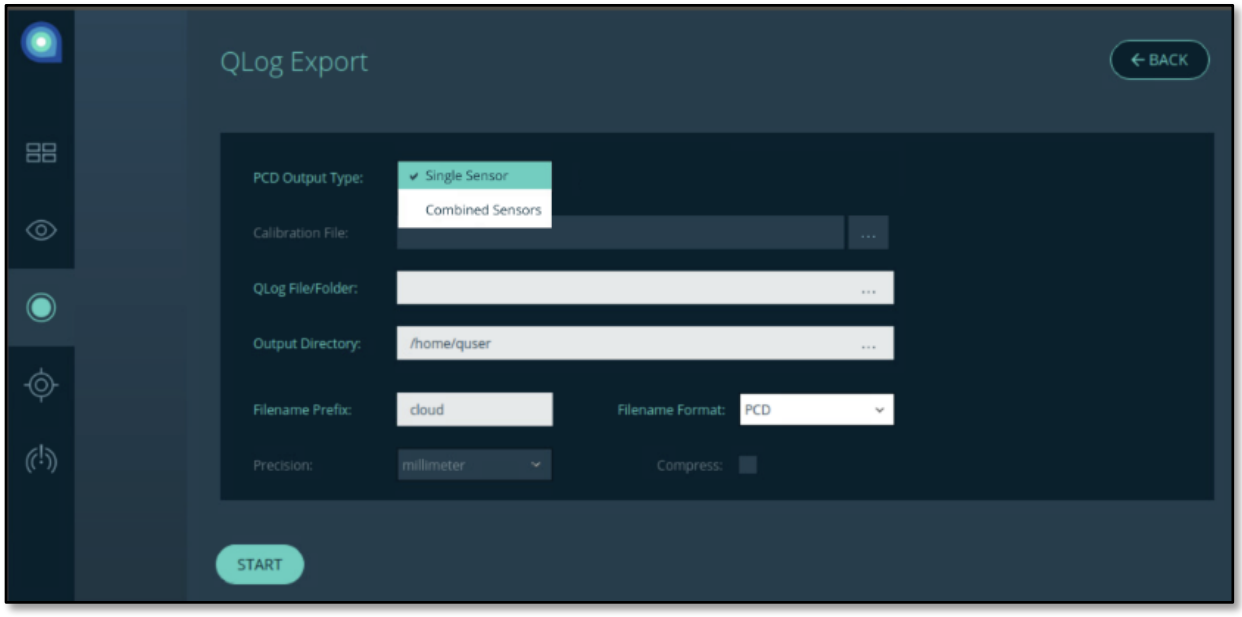


Figure 47. Record Tab: QLog Export with Combined Sensors Option

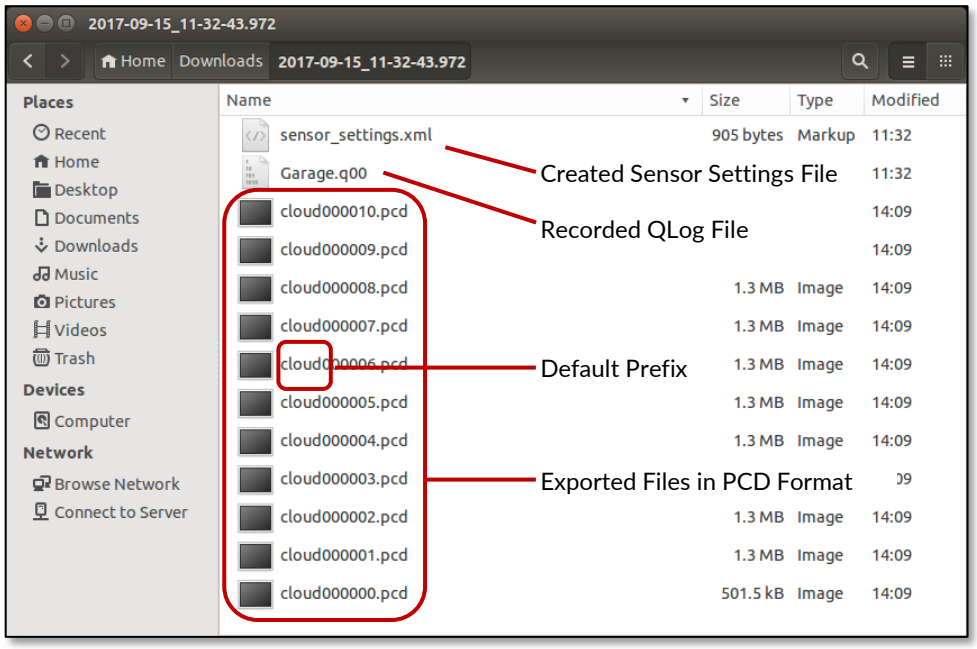


Figure 48. Record Tab: Output Directory: Settings & Exported Files, QLog, PCD Format

8. Calibrating Sensors — Calibrate Tab

The Calibrate tab enables production of a file containing sensor calibration parameters that can be used by other applications. Through this tab, the user aligns multiple sensors in LIVE or PLAYBACK mode so they share the same QORTEX "world frame," that is, have the same XYZ orientation and (0, 0, 0) point of World Origin from which to calculate an object location. In this way, point clouds (and tracked objects) overlap to provide a richer and broader view of the shared physical space called the area of interest. See *Figure 49. Calibrate Tab: Interface*.

Often, the Origin of one sensor in a group will serve as the QORTEX World Origin. For example, in an area of interest that includes contiguous surveilled spaces (front parking lot, lobby, research lab, snack room, rear exit, and back lot), the Origin could be a sensor in the middle (research lab, for example). However, it is not necessary for a sensor to serve as the World Origin because any location in the coverage area of the QORTEX server will do.

Such calibration is therefore possible between sensors that are:

- In a common area of interest, where their point clouds overlap at least partially.
- ~~M-Series~~ models, so you can mix and match them. The **Refine auto-alignment** option is only supported for calibration between two of the same type of sensors. For example, calibration between two M8 sensors or two MQ-8 sensors. For any other combination of sensors, users can only make manual refinement adjustments.
- Either in **LIVE** mode in a **Connected** (**green**) state or a **Malfunctioning** (**red**) state, or in **PLAYBACK** mode. For optimal results in visualizing point clouds, Quanergy recommends connecting to up to 18 sensors in single return mode.

View the Calibrate Panel

Click the **Calibrate** tab, . Q-View displays the calibrate a sensor panel. See *Figure 49. Calibrate Tab: Interface*, *Figure 50. Calibrate Tab: Context Controls*, and *Table 13. Calibrate Tab: Interface Components*.

For descriptions of the **Mode Selector** menu (**LIVE**, **PLAYBACK**), **Grid size** arrows, **Point size** arrows, **View Reset** buttons, and **XYZ axes** are also part of the **Visualize** tab. See *Visualization Panel Components* (page 59).

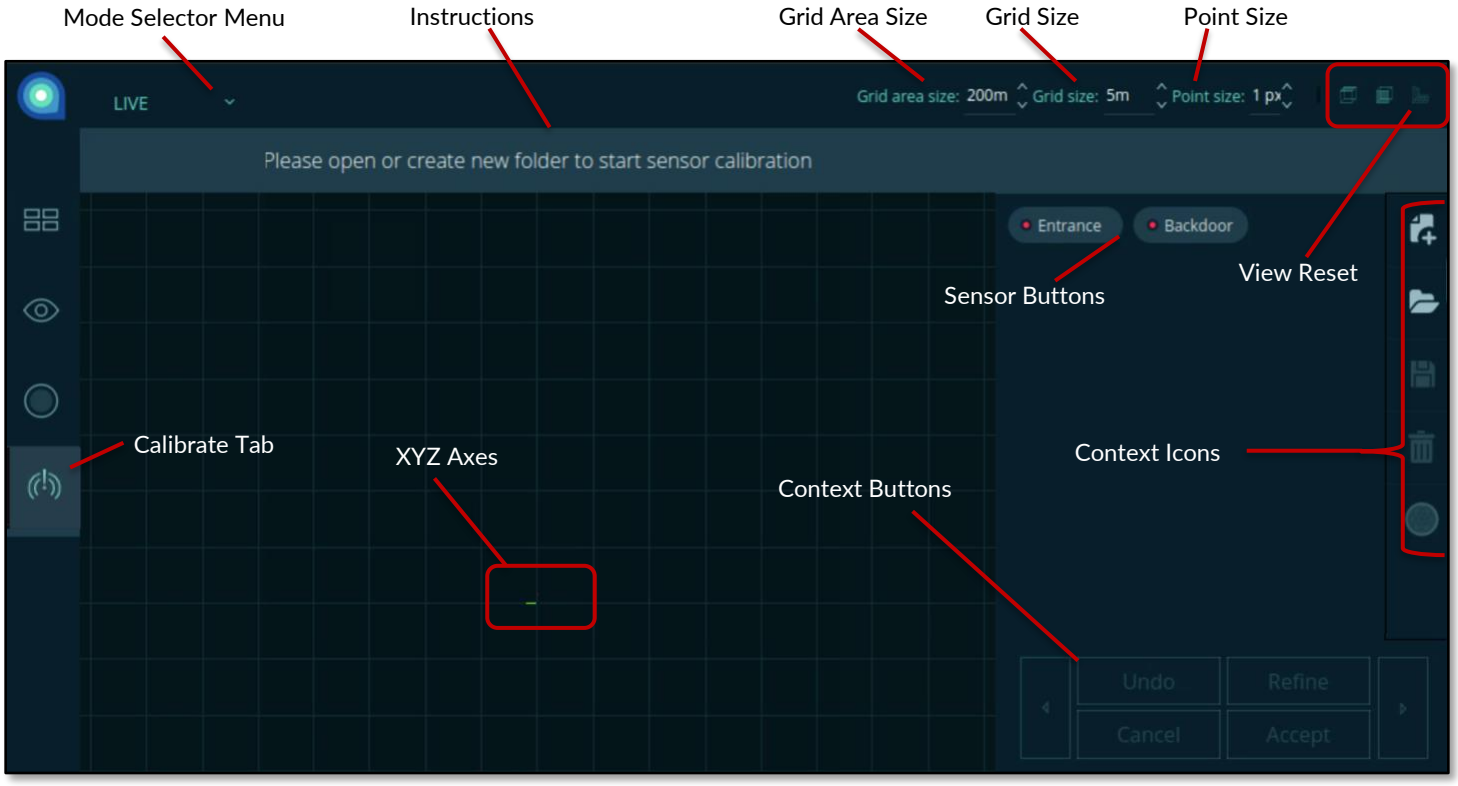


Figure 49. Calibrate Tab: Interface

Calibration Panel Components

For descriptions of the **Calibrate** tab interface components, see *Figure 50. Calibrate Tab: Context Controls*, *Table 13. Calibrate Tab: Interface Components*.

Table 13. Calibrate Tab: Interface Components

Component	Location	Purpose
Mode Selector Menu	Top left corner	Click the menu arrow and select a mode: **LIVE**: Mode for calibrating according to real-time data (default). See *LIVE Mode* (page 60). **PLAYBACK**: Mode for calibrating according to recorded data. See *PLAYBACK Mode* (page 61).
Instructions	Upper side ribbon	Simple commands guide you through each step of the process.
Sensor Buttons	Top of right-side navigation bar	Individual sensors appear as selectable buttons, arranged in rows. Each button has a colored dot to indicate its status: selected (**green**), non-selected (**red**), or calibrated (**white**) status. Disconnected calibrated sensors have a gray button.
Grid Area Size	Top right corner	Adjust the grid area (canvas) size arrows to match the size of the area of interest (1m-50m).
Grid Size	Top right corner	Adjust the grid size (density) arrows so that grid lines are closer together or farther apart. The meters indicate the distance represented by the side of a grid square (1m-50m). See *Adjust the Grid Size* (page 67).
Point Size	Top right corner	Click the incrementing up/down arrows to select the pixel size (1-5) of each point in the visualized cloud. See *Select a Point Size* (page 68).
View Reset Buttons	Top right corner	Snap the point cloud into easily understood top, side, and perspective views. See *Reset the View* (page 64).
XYZ Axes	Central grid	Represents the sensor origin in the area where point clouds are visualized. Select a sensor to visualize its point cloud.
Context Buttons	Bottom of right-side navigation bar	Buttons brighten to prompt you to make decisions during calibration: **Next arrow**: Click when satisfied to proceed to the next step. **Back arrow**: Click to revert to a previous step. **Undo**: Click to revert a process. **Cancel**: Click to stop a process. **Refine**: Click to start auto-alignment. This process is only supported for calibrating two M8 model sensors to each other. **Accept**: Click when satisfied with alignment to complete/save calibration data.

Component	Location	Purpose
Context Icons	Right of right-side navigation bar	Icons brighten to prompt you to make decisions about the calibration: **World Calibration**: Click when ready to calibrate selected sensor. See *Use the World Calibration Controls* (page 79). **Play/Pause**: Toggles between a dynamic versus static point cloud. **New**: Click to identify the base directory for a new calibration file. **Open**: Click to open the enclosing folder of an existing calibration file. **Save**: Click to save current calibration and continue calibration. **Remove**: Click if you want to abort the current calibration file and restart. **Fused Cloud**: Toggle to fuse point clouds. Toggle to distinguish sensor points.
TRANSLATE Controls	Right-side navigation bar	See *Use the World Calibration Controls* (page 79).
ROTATION Controls	Right-side navigation bar	These controls rotate the point cloud around the X, Y, and Z axes. See *Use the World Calibration Controls* (page 79).
3D Controls	Offline accessories	Mouse and keyboard devices enable manipulation of the point cloud. See *Apply the 3D Controls* (page 65).

Use the World Calibration Controls

World calibration refers to the world of a sensor or calibrating a sensor to the fused point cloud of a calibrated group of sensors. In this context, **Blue Z axis is Yaw**. **Green Y axis is Pitch**. **Red X axis is Roll**.

During the manual adjustment phases of the calibration process you might need to use **TRANSLATE** and **ROTATION** controls. See *Figure 50. Calibrate Tab: Context Controls*.

- The **TRANSLATE** controls adjust the movement along each axis with respect to the Origin point in coarse (1 meter) or fine (1 centimeter) movements.
- The **ROTATION** controls adjust the rotational movement around each axis in coarse (1 degree) or fine (0.1 degree) increments and decrements.

There are two ways to adjust the settings:

- Click the + or – (increment and decrement) buttons to scroll through numbers slowly.
- Hover the mouse pointer over a number field and spin the mouse wheel to scroll through the numbers quickly.

Point clouds are visualized in active mode. Pause the frame using the **Play/Pause** context icon while you apply adjustments to the calibration. When you toggle back to active mode, the visualization jumps to current real time instead of playing the frames you missed.

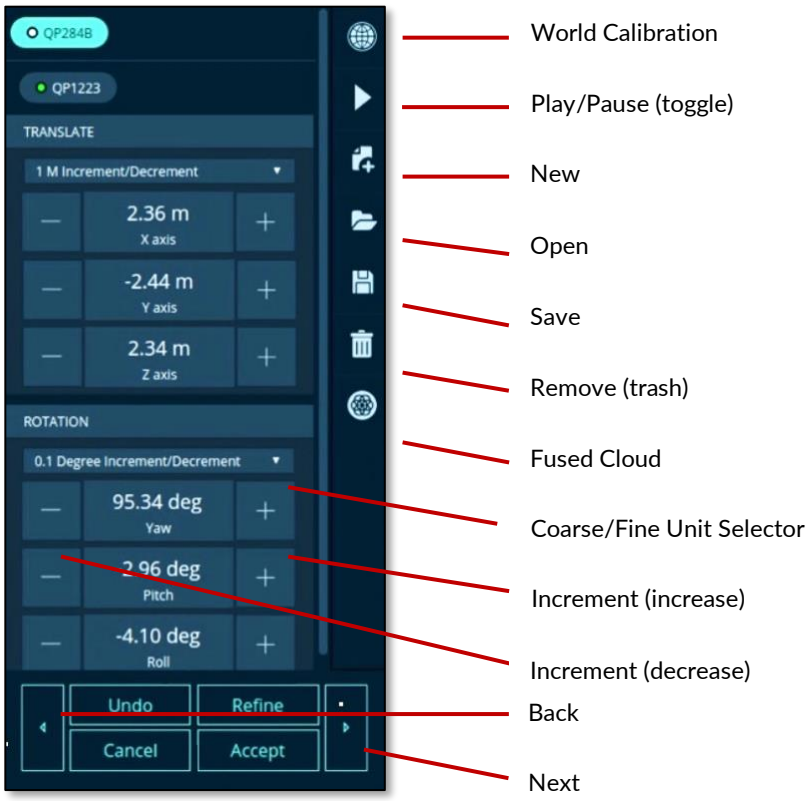


Figure 50. Calibrate Tab: Context Controls

Create and Update a Fused Point Cloud

Multiple sensors that are out of sight and distance range of each other can be aligned together as long as an individual sensor point cloud overlaps with the point cloud of at least one other sensor in that group or with the fused point cloud. The process for calibration of multi-sensor complex installations has been simplified to make it easier to create and update a fused point cloud.

Calibration occurs through a combination of automated and manual steps to map the relationship of each sensor in a group to every other sensor in that group. Alignment of a single sensor to another single sensor is a necessary first step. After that first step, the resulting point cloud can then be calibrated to a new sensor. The main procedures are summarized below and overviewed in the calibration flow chart. See *Figure 51. Calibrate Tab: Calibration Flow Chart*.

1. *Choose LIVE or PLAYBACK Mode* (page 81).
2. *Assign or Identify Location of Calibration Data Files* (page 82).
3. *Calibrate the World of the First Sensor* (page 83).
4. *Calibrate a Second Sensor to the First Sensor World* (page 86).
5. *Make Changes to a Calibrated Group of Sensors* (page 91).

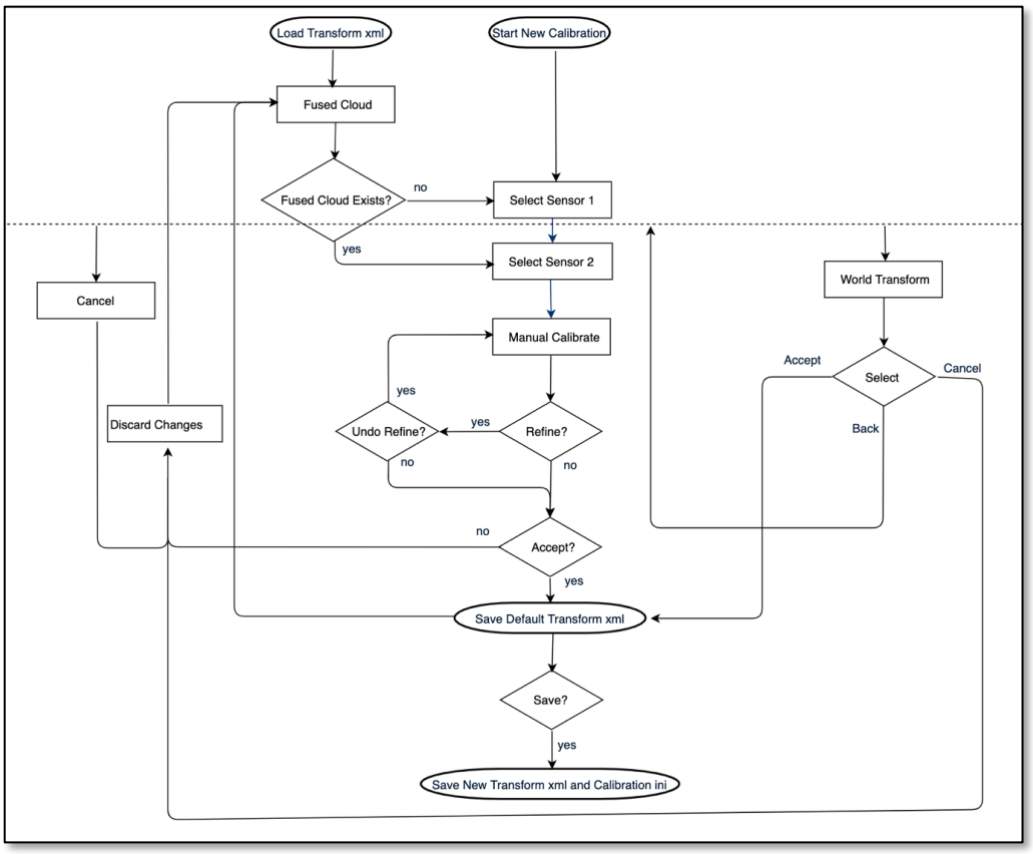


Figure 51. Calibrate Tab: Calibration Flow Chart

Choose LIVE or PLAYBACK Mode

Calibration can occur with sensors that are collecting points **LIVE** or have already collected points in a recording for **PLAYBACK**.

In the **Calibrate** tab, use the **Mode Selector** menu and select **LIVE** or **PLAYBACK**. See *Figure 49. Calibrate Tab: Interface*.

- **LIVE mode**: Connect at least two sensors in the **Dashboard** tab.
- **PLAYBACK mode**: If the recording is brief, start the playback point cloud then pause it while you continue with the calibration. See *PLAYBACK Mode* (page 61).

Assign or Identify Location of Calibration Data Files

Q-View needs a clear understanding of where to find and place calibration data files, as follows:

1. Determine where to save the calibration data files, including `transform_alignment.xml` and `calibration.ini`. See *transform_alignment.xml File* (page 93), *calibration.ini File* (page 95), and *Figure 52. Calibrate Tab: Where to Store Calibration Files*.

   To create a new calibration folder:

   a. Click the **File** icon on the right-side ribbon to open a dialog.

   b. In the **Directory Path** field, type the base directory filepath.

      Alternatively, click the ellipsis **... icon** to open a file browser, navigate to the base directory, and click **Choose**.

   c. In the **Input Name** field, type a meaningful name for the new calibration folder.

   d. Click **OK** in the dialog.

      The dialog disappears, the file path now appears above the sensor buttons, and the instruction ribbon states the next instruction.

   To add calibration data to a previously created folder:

   a. Click the **Folder** icon on the right-side ribbon to open a file browser.

   b. Navigate to the enclosing folder.

   c. Select the file browser **Choose** button.

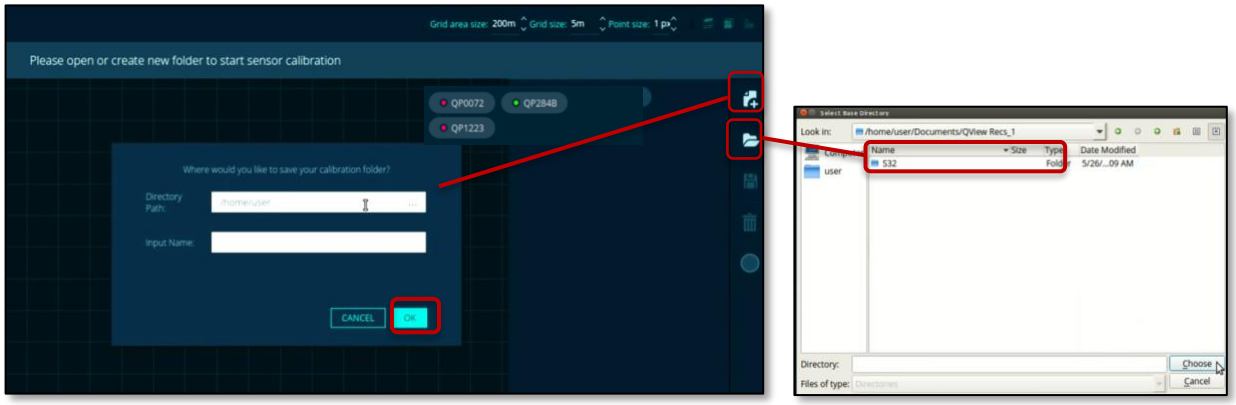


Figure 52. Calibrate Tab: Where to Store Calibration Files

2. Click the **Next** button (right arrow) to start the calibration process.

   Context buttons are in the bottom right corner of the Q-View window.

Calibrate the World of the First Sensor

The first sensor is important in that it determines the **World Origin** point. It may be easier to start with whichever sensor is most complicated, that is, not level. The steps for selecting and aligning the first sensor to the grid are as follows:

1. Choose **LIVE** or **PLAYBACK** Mode. See *Choose LIVE or PLAYBACK Mode* (page 81).
2. Assign or identify **Location of Calibration Data Files**. See *Assign or Identify Location of Calibration Data Files* (page 82).
3. Click a sensor button to select the first sensor.

   The **red** dot on the selected sensor button turns **green** and the point cloud for the sensor appears in **white**. See *Figure 53. Calibrate Tab: First Sensor White Point Cloud*.

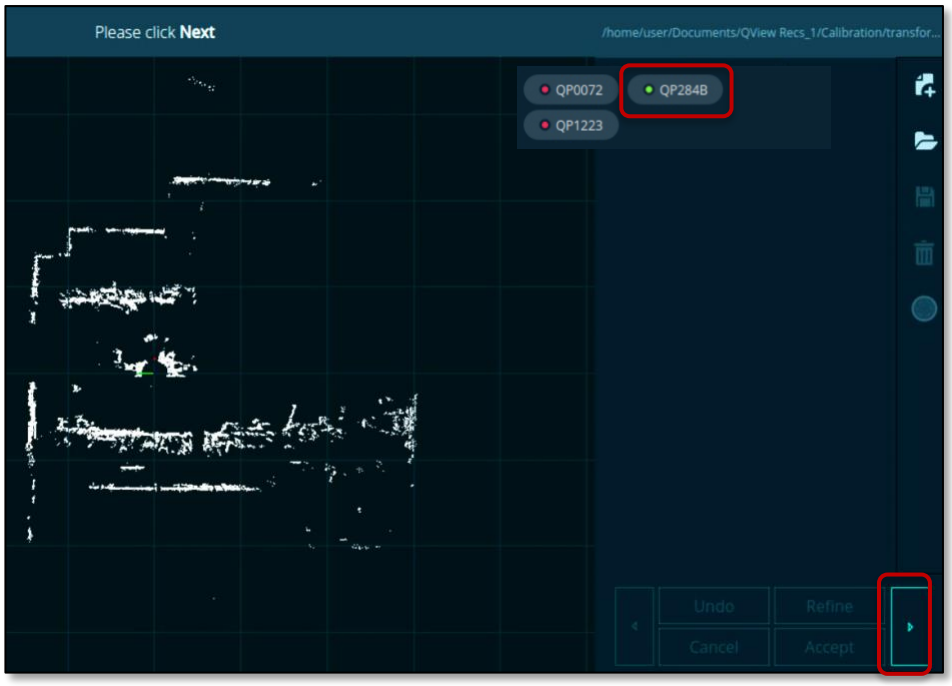


Figure 53. Calibrate Tab: First Sensor White Point Cloud

4. Click the **Next** button (right arrow).

   The context icons change to a subset of the **Calibration** tab **Context Controls**. See *Figure 50. Calibrate Tab: Context Controls*.

5. Click the **World Calibration** icon to enter **World Calibration mode.**

   See *Figure 50. Calibrate Tab: Context Controls* and *Use the World Calibration Controls* (page 79).

   Calibration is an iterative process that varies from situation to situation. Continue with the recommended sequence below, customizing as needed for your specific setup.

6. Examine the point cloud of your selected sensor. Notice where ground points show up in concentric rings. See *Figure 54. Calibrate Tab: First Sensor Align XY to Grid, Before (top), After (bottom)*.
    - The goal is for **Origin** and all ground points to be on/above the ground plane.
    - The ground plane is the single gray horizontal grid line in the **Side View**.
7. Click the **Top View** button to see how **XY axes** align with respect to the grid. See *Figure 54. Calibrate Tab: First Sensor Align XY to Grid, Before (top), After (bottom)*.
8. Adjust the point cloud **Yaw** values so that the perpendicular walls in the location square up to the grid.

Figure 54. Calibrate Tab: First Sensor Align XY to Grid, Before (top), After (bottom)

9. Click the **Side View** button to assess the point cloud **Y axis** alignment with respect to the ground plane. See *Figure 55. Calibrate Tab: Align Z to Ground Plane, Before (top), After (bottom)*.

- Adjust the **Z Axis** to raise/lower the entire point cloud until the concentric ring ground points are on or just above the ground plane.
- Adjust the **Pitch** to square up the entire point cloud to the ground plane.

10. Stay in the **Side View** but use your mouse to spin the view around the **Z axis** to see how the ground points touch the ground when seen from various angles. Make any additional adjustments.
11. Click **Accept** to lock in the results. See *Figure 55. Calibrate Tab: Align Z to Ground Plane, Before (top), After (bottom)*.

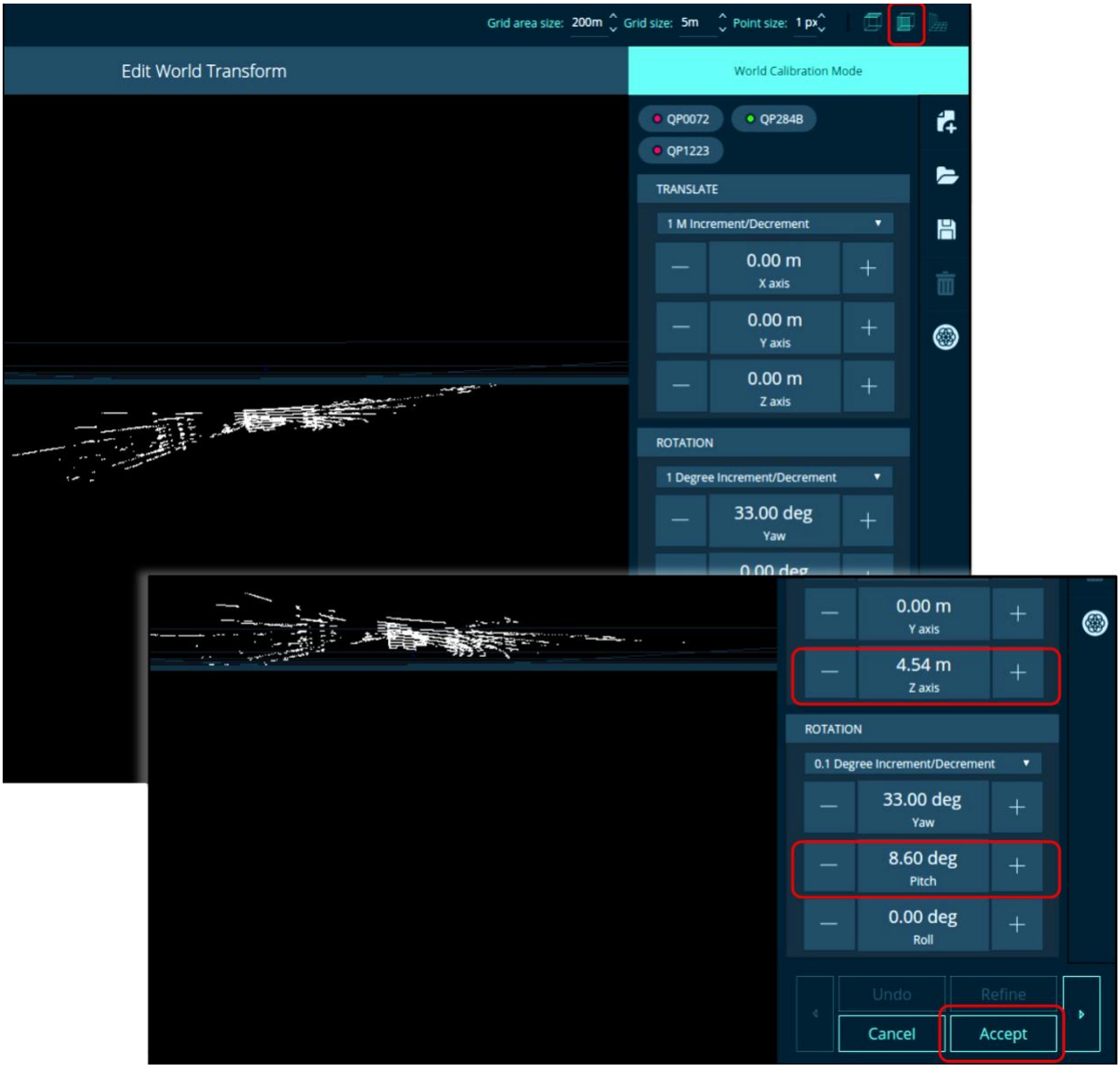


Figure 55. Calibrate Tab: Align Z to Ground Plane, Before (top), After (bottom)

Calibrate a Second Sensor to the First Sensor World

The first sensor world is now calibrated. To achieve a fused point cloud, at least one more sensor needs to be calibrated to the first sensor world, as follows:

1. Click a **Second Sensor** button to calibrate it to the first sensor. The second sensor has a **green** point cloud, which is overlaid on the **First Sensor** white point cloud. See *Figure 56. Calibrate Tab: Second Sensor (green) Calibrate to First Sensor (white)*.
2. Examine the visualized image of the two-**point clouds** to make sure the sensors you selected to calibrate share the same area of interest.
   - If the sensors do not reflect the same area of interest, and do not track the same moving objects, click a different sensor.

     Click multiple sensors to compare them, then re-click the sensors you don't want to calibrate. Continue this procedure with one sensor selected.
   - If the point clouds have at least a section that has the same shape and contours, and they track the same moving objects, then this confirms that they share the same area of interest.
3. Focus on some points of reference that represent the same artifact in physical reality, such as the right-angled corners.

   The goal is for the two-point clouds to align so precisely that the overlapping portions look like a single point cloud when viewed from every perspective. See *Figure 53. Calibrate Tab: First Sensor White Point Cloud*.
4. Click the **Next** button (right arrow).

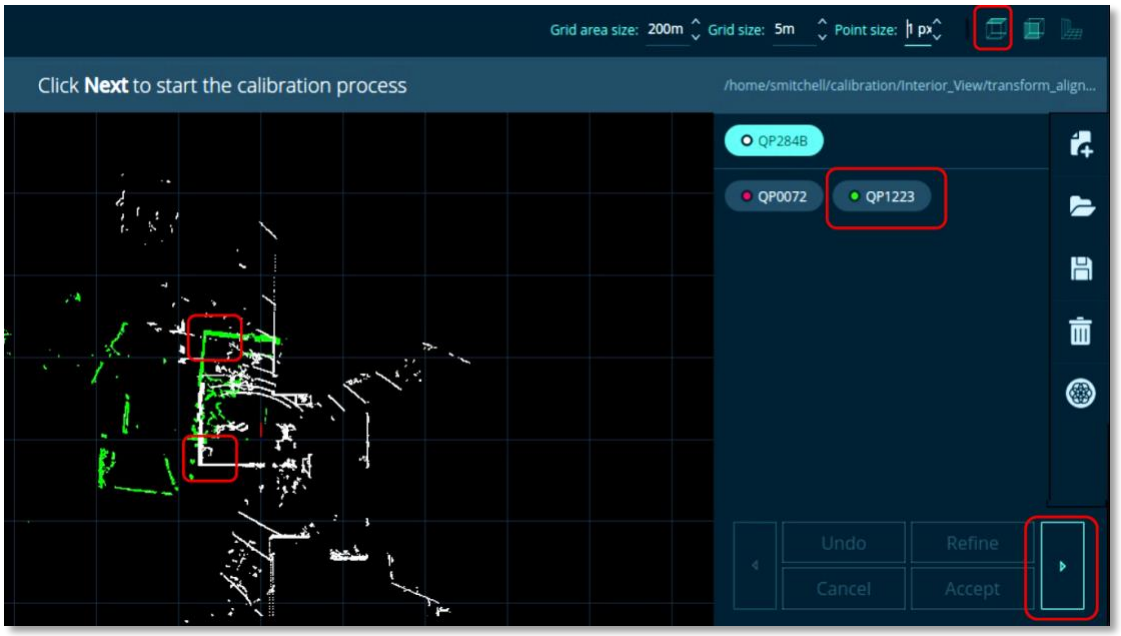


Figure 56. Calibrate Tab: Second Sensor (green) Calibrate to First Sensor (white)

5. Click the **Top View** button to see how the point cloud **XY axes** align with respect to the grid. See *Figure 57. Calibrate Tab: Second Sensor Align XY to Grid, Before (top), After (bottom)*.

   a. Adjust the point cloud **Yaw** to rotate the second sensor green point cloud to align with the primary sensor point cloud, that is, be oriented in the same direction, even if it is still offset.

   b. Adjust the **X axis** to move the entire point cloud forward or back, and the **Y axis** to move the entire point cloud left or right until the point clouds look perfectly overlapped, with no offset.

Figure 57. Calibrate Tab: Second Sensor Align XY to Grid, Before (top), After (bottom)

6. Click the **Side View** button to see how the point cloud **Y axis** aligns with respect to the gray line of the ground plane. See *Figure 58. Calibrate Tab: Second Sensor Align Z with Ground Plane*.
   - Adjust the **Z axis** to raise/lower the entire **green** point cloud until the **concentric ring ground points** are on or just above the ground plane.
   - Adjust the **Pitch** and **Roll** to square up the entire point cloud to the primary sensor and the **ground plane**.
7. When you are satisfied that the ground points are touching the ground plane, stay in **Side-View**, but spin the point cloud around the **Z axis** to see how the ground points touch the ground when seen from various angles.

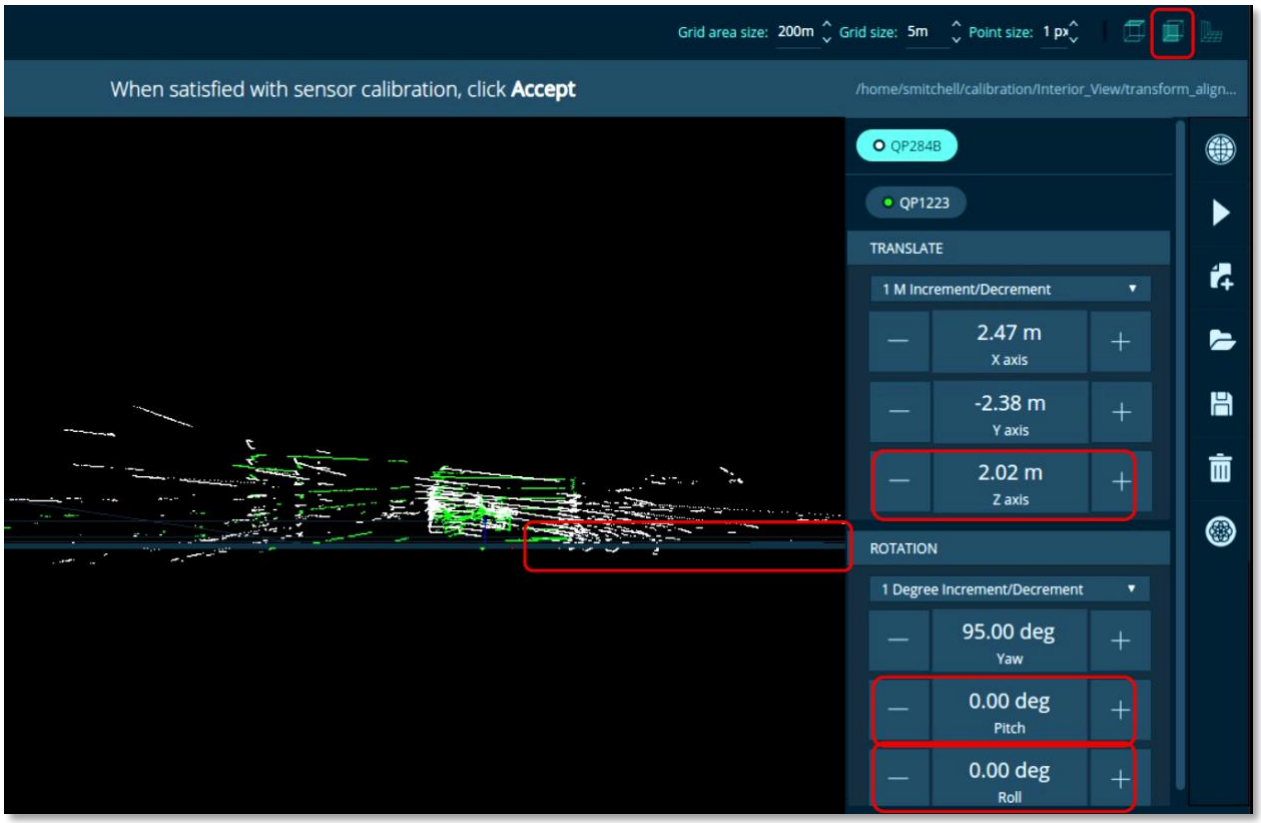


Figure 58. Calibrate Tab: Second Sensor Align Z with Ground Plane

8. Click **Perspective View**, check more angles, and make more adjustments. See *Figure 59. Calibrate Tab: Final Check in Perspective View*.
9. Optionally, for M8-to-M8 calibration: click the **Refine** button for final algorithmic refinement. See *Figure 59. Calibrate Tab: Final Check in Perspective View*.

   A spinner indicates auto-alignment is occurring.

   Click **Undo** if you don't like the refinement results.

10. Click the **Accept** button to lock in the results. See *Figure 59. Calibrate Tab: Final Check in Perspective View*.

    The **entire point cloud** turns white in the fused cloud, no longer differentiating which points belong to which sensor. The **sensor button** colored dot is now white to indicate its calibrated state.

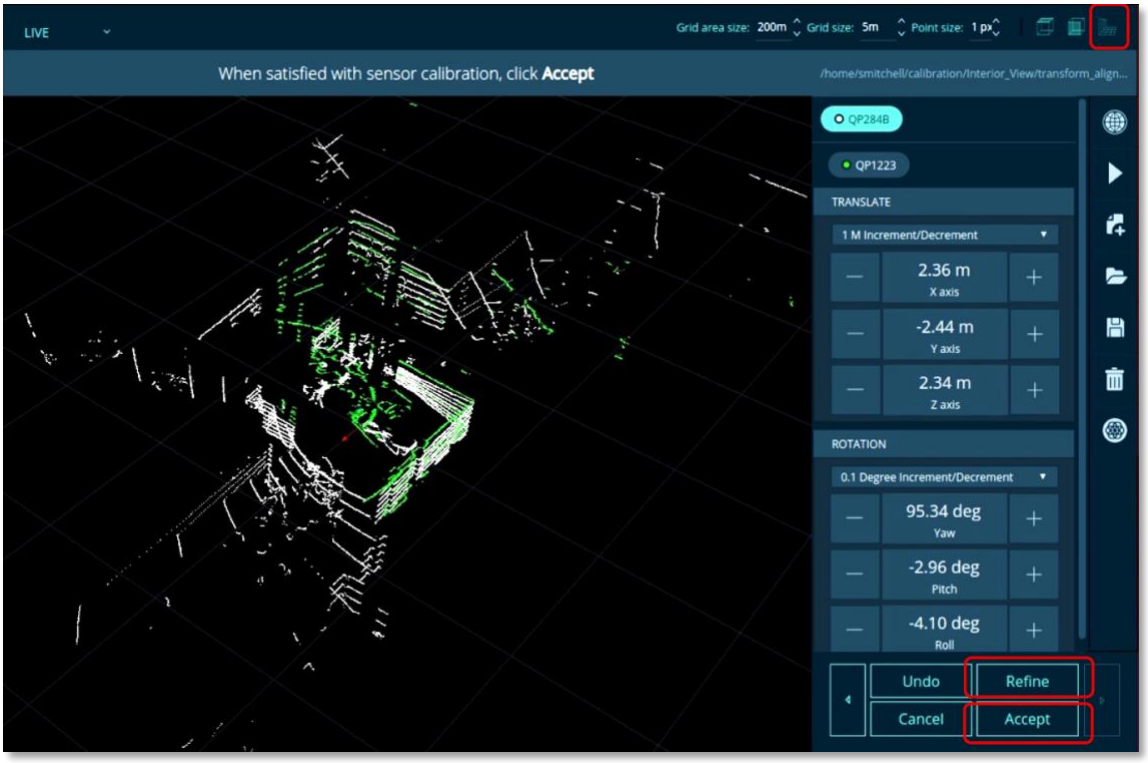


Figure 59. Calibrate Tab: Final Check in Perspective View

11. Click the **Save** icon to save the calibration data in the folder that was identified previously. See *Figure 60. Calibrate Tab: Fused Cloud Icon Consolidates into Single White Point Cloud*.

Figure 60. Calibrate Tab: Fused Cloud Icon Consolidates into Single White Point Cloud

12. Click the **Fused Cloud** icon to toggle the sensor view as you prefer:
    - A fused cloud, where all points turn white. See *Figure 60. Calibrate Tab: Fused Cloud Icon Consolidates into Single White Point Cloud*.
    - A differentiated cloud, where sensor buttons are outlined in the color of their visualized points, making it easier to spot an incorrectly calibrated sensor. See *Figure 61. Calibrate Tab: Fused Cloud Icon Colors Points for Each Sensor*.

13. To add another sensor to the calibrated group right away.
    a. Click the **Calibrate Another Sensor** button. See *Figure 61. Calibrate Tab: Fused Cloud Icon Colors Points for Each Sensor*.
    b. Repeat the steps in this procedure.

From now on the fused cloud appears in a dynamically assigned random color.

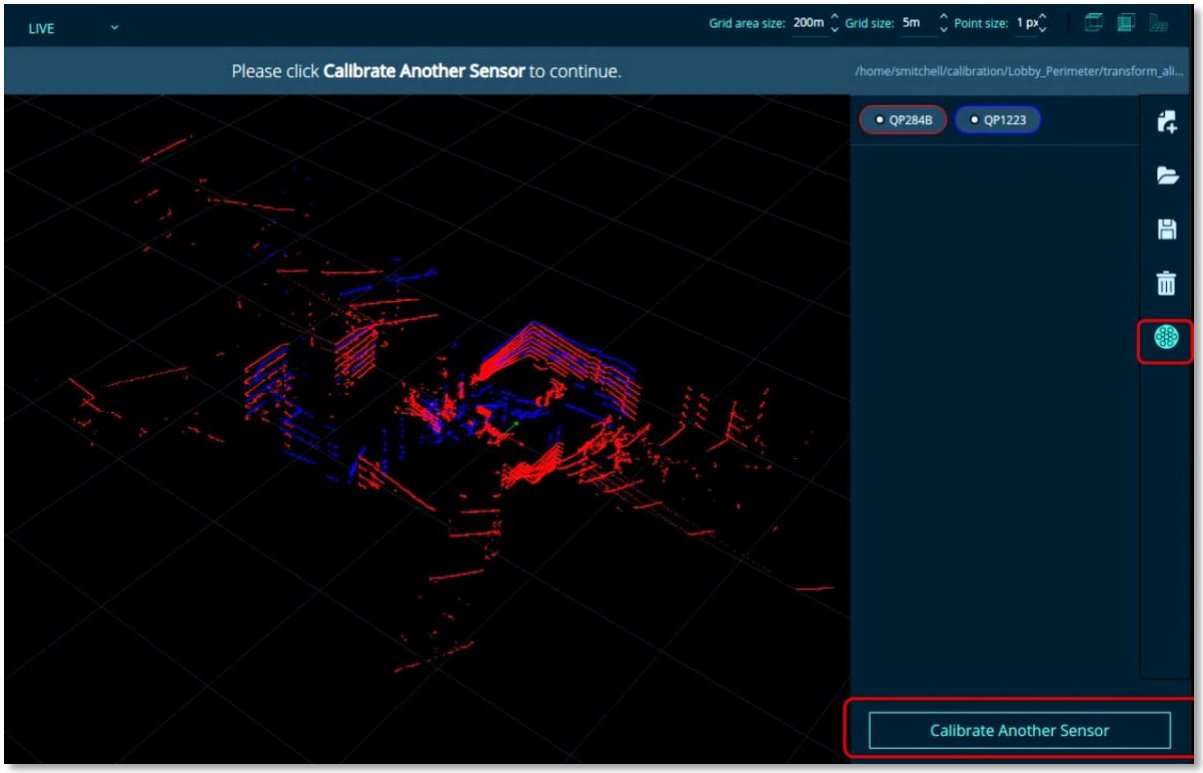


Figure 61. Calibrate Tab: Fused Cloud Icon Colors Points for Each Sensor

Make Changes to a Calibrated Group of Sensors

After calibration is completed, and the calibration data is saved. You can make various modifications for the entire group of sensors represented in the multi-sensor fused point cloud (the calibrated group). See *Use the Results* (page 93).

1. Choose LIVE or PLAYBACK mode. See *Choose LIVE or PLAYBACK Mode* (page 81).
   - For **LIVE** mode, you will need to open the **Dashboard** tab and connect to all of the sensors known to be in the calibrated group.
   - For **PLAYBACK** mode, select a recorded QLog that includes all of the sensors known to be in the calibrated group.
2. Click the **Open Calibration** button that activated as soon as at least two of the group sensors were selected and navigate to the location of the target calibrated group saved calibration data. See *Assign or Identify Location of Calibration Data Files* (page 82).
3. In the **Calibrate** tab, select the **Sensor** button of each sensor in the calibrated group.

   Q-View automatically selects and connects to the remaining sensors in the calibrated group. But if it is not possible to select one or more sensors in the calibrated group, a warning message displays to let you know that not all the sensors are selected.

4. Click the **Fused Cloud** icon to toggle the single combined color versus each sensor showing points in a different color.

   By default, the fused point cloud appears in a single dynamically assigned random color in the visualization window.

5. From here, you can take a variety of actions:

   - **Delete a sensor** from the calibrated group:

     1) Select the **Edit a Calibration** button.
     2) Select the **Remove** icon, which deletes the sensor from the group.
     3) Leave the sensor deleted or recalibrate it to re-add it to the group.

   - **Refine the calibration** of a sensor:

     1) Select the **Edit a Calibration** button.
     2) Select the **Refine** button, which shows the current fused point cloud overlaid with the current point cloud for that sensor.
     3) Adjust the **X, Y, Z, Yaw, Pitch**, and **Roll** values. See *Use the World Calibration Controls* (page 79).

   - **Add the deleted sensors** or additional new sensors to the calibrated group one at a time according to the steps of the "Calibrate a Second Sensor to the First Sensor World" procedure, starting on page 76, for each sensor you want to add.

   - **Adjust the world transform** for the calibrated group of sensors.

     1) Select the **World Calibration** icon to open controls.
     2) Adjust the **X, Y, Z, Yaw, Pitch**, and **Roll** values. See *Use the World Calibration Controls* (page 79).

6. Click **Accept** to lock in the results. See *Figure 59. Calibrate Tab: Final Check in Perspective View*.

   The entire point cloud turns the solid color of the fused cloud, no longer differentiating which points belong to which sensor. Toggle the **Fused Cloud** icon to split the sensor point clouds.

7. Click **Save** to save the calibration data.

   The data is saved in the folder that was previously defined. See *Assign or Identify Location of Calibration Data Files* (page 82).

Use the Results

Each time you **Accept** the calibration adjustments, the resulting calibration data is output into a few files: `transform_alignment.xml` and `calibration.ini`. Both the files reside in the folder that was previously defined. See *Assign or Identify Location of Calibration Data Files* (page 82).

Another file, `quanergy.qview.calibration`, provides a list of the Q-View configuration settings for each sensor. This file resides in:

- For Windows: `C:\Users\<quser>\AppData\Roaming`
- For Ubuntu: `\home\<user>\.config`

transform_alignment.xml File

Q-View creates an alignment map and saves it in a `transform_alignment.xml` file. Q-View uses this map to persist the alignment data in between sessions. See *Figure 62. Calibrate Tab: transform_alignment.xml File*.

In this file, each mapping relationship is recorded only once:

- For 2 sensors, only 1 mapping is needed. (2 --> 1)
- For 3 sensors, 3 mappings are needed. (3 --> 2+1)
- For 4 sensors, 6 mappings are needed. (4 --> 3+2+1)
- For 5 sensors, 10 mappings are needed. (5 --> 4+3+2+1)

The XML file consists of:

- The `Transform` list, which defines the spatial relationship between two sensors.
- The `Lidar` list, which defines the IP and MAC addresses of the two sensors.

```
-<Settings>
   -<Transforms>
      -<Transform>
         <fromFrameName>Sensor 15</fromFrameName>
         <toFrameName>Sensor 16</toFrameName>
      -<Position>
         <x>1.0309906/x>
         <y>3.05418968</y>
         <z>8.458936735</z>
       </Position>
       <orientationMethod>quaternion</orientationMethod>
      -<Quaternion>
         <w>0.140181616</w>
         <x>0.021026712</x>
         <y>0.0542631559</y>
         <z>0.988414168</x>
       </Quaternion>
      -<EulerYPR>
         <units<degrees</units>
         <yaw>164.02146911621094</yaw>
         <pitch>3.2549090385437012</pitch>
         <roll>-5.82773311325073242</roll>
       </EulerYPR>
      </Transform>
    </Transforms>
   -<LidarInfo>
      -<Lidar>
         <frameName>Sensor 16</frameName>
         <ip>10.1.10.128</ip>
         <mac>D4:C9:B2:00:08:67</mac>
       </Lidar>
      -<Lidar>
         <frameName>Sensor 15</frameName>
         <ip>10.1.10.96</ip>
         <mac>D4:C9:B2:00:11:65</mac>
       </Lidar>
   </LidarInfo>
</Settings>
```

Figure 62. Calibrate Tab: transform_alignment.xml File

calibration.ini File

Q-View creates a calibration map and saves it in a `calibration.ini` file. This file is useful only to a particular Quanergy application, and we show it here only because it is Q-View output. See *Figure 63. Calibrate Tab: calibration.ini File*.

```
[D4:C9:B2:00:11:65/D4:C9:B2:00:08:67]
primary_ip_address=10.1.10.96
primary_mac_address=D4:C9:B2:00:11:65
secondary_ip_address=10.1.10.128
secondary_mac_address=D4:C9:B2:00:08:67
qguard_yaw=163.689453
qguard_pitch=5.81829834
qguard_roll=3.27178264
qguard_x=-3.58999991
qguard_y=1.61999929
qguard_z=-8.14999962
[D4:C9:B2:00:08:67/D4:C9:B2:00:11:65]
primary_ip_address=10.1.10.128
primary_mac_address=D4:C9:B2:00:08:67
secondary_ip_address=10.1.10.96
secondary_mac_address=D4:C9:B2:00:11:65
qguard_yaw=163.942032
qguard_pitch=-6.49773264
qguard_roll=1.5197717
qguard_x=-3.05418968
qguard_y=1.0309906
qguard_z=8.45836735
```

Figure 63. Calibrate Tab: calibration.ini File

Edit quanergy.qview.calibration File

Edit the calibration file to modify the **XY offset** maximum value.

1. Locate the directory for the calibration file. Default locations are:

   For Windows: `C:\Users\<quser>\AppData\Roaming`

   For Ubuntu: `\home\<user>\.config`

2. Open the `quanergy.qview.calibration` file for editing.

3. Change the value for the parameter, `calibration_xy_offset_range`.

   The default value is `500`. The maximum range is `5000`.

```
…
[calibration]
```

```
Calibration_directory=C:/Users/quser/Quanergy
Calibration_xy_offset_range=500
…
```

4. Save the file.
5. Restart Q-View to apply the changes.

9. Object Detection — QORTEX Aware™ Tab

QORTEX Aware is an object detection and notification component of the QORTEX suite for selected sensors. QORTEX Aware provides a means to define zones, detect objects in those zones, and send messages to listening devices. See *Figure 64. QORTEX Aware: Components and their Function*.

Listening devices are typically controllers on mobile platforms such as Automated Guided Vehicles (AGVs) or Autonomous Mobile Robot (AMR), but they can also be stationary devices. The information received allows the devices to respond appropriately when an object has entered the defined zone.

QORTEX Aware is pre-installed on the sensor. The sensors provide the point cloud data for QORTEX Aware to interpret and identify objects in the defined zones.

QORTEX Aware always uses a single return from each laser pulse, regardless of sensor webserver setting.

- If a single return is selected, QORTEX Aware uses that return
- If all returns are selected QORTEX aware uses the max return (return 0). Q-View shows all returns.

QORTEX Aware elements are configured through the Q-View user interface. Configuration is uploaded to the sensors. Q-View is a graphical interface tool for configuration and visualization. Q-View is installed on a networked laptop. QORTEX Aware messages travel through the Ethernet on the sensor.

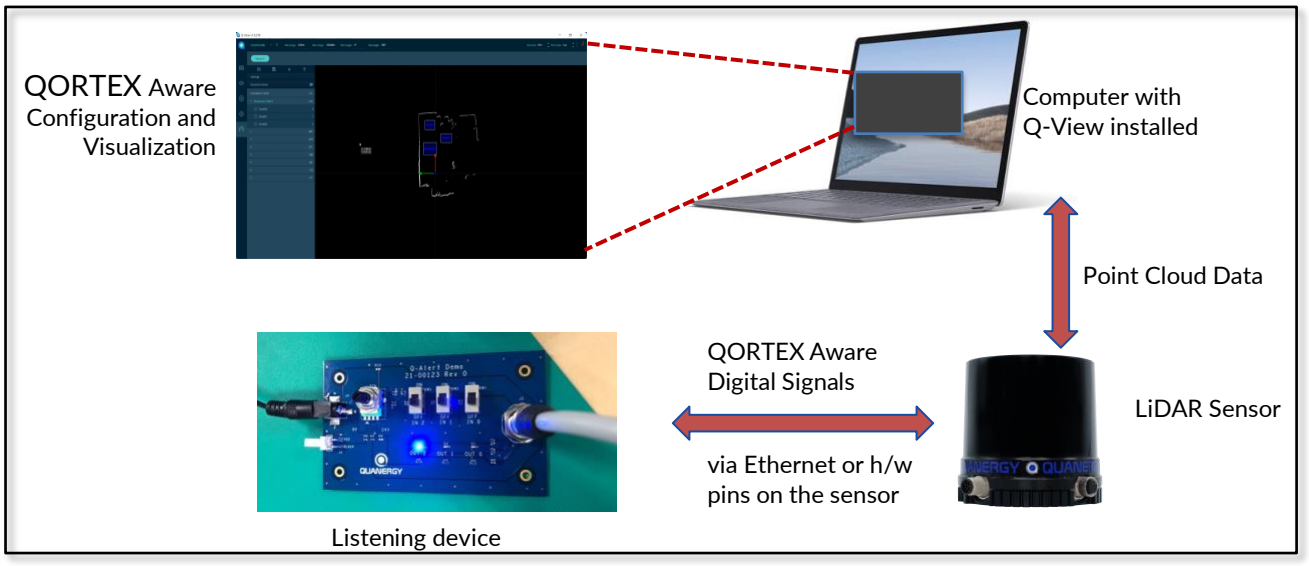


Figure 64. QORTEX Aware: Components and their Function

QORTEX Aware Q-View Version Compatibility

~~Q-View 1.7 is NOT backwards-compatible with sensors running Qortex Aware 1.0 (M1 Edge sensors).~~

Table 14. QORTEX Aware to Q-View Version Compatibility

Q-View Version	Qortex Aware Version
1.6	1.0
1.7	2.0

QORTEX Aware Process Overview

1. *Connect to a QORTEX Aware Enabled Sensor* (101).
   a. Add the sensor to the network.

      Note: QORTEX Aware sensors spin up immediately upon power-on. So, when connecting to the sensor in Q-View, there is no delay in Q-View between clicking connect and the sensor showing as connected, because the sensor is already spinning.

   b. Install Q-View on a laptop that is connected to the network.
   c. Add the listening device.
   d. Start Q-View and add sensors.
2. Click the QORTEX Aware tab and configure the zones to monitor through Q-View.
   - *Create Evaluation Field Zones* (page 108)—Areas to assess for objects.
   - *Create Exclusion Zones* (page 111)—Areas to ignore.
3. *Upload an Edited Settings File to the Sensor* (page 115) —Apply configuration to the sensor.
4. *View Sensor settings: QORTEX Aware Monitor Mode* (page 106)—View sensor activity through from sensor. See *Figure 65. QORTEX Aware Modes and settings Files*.

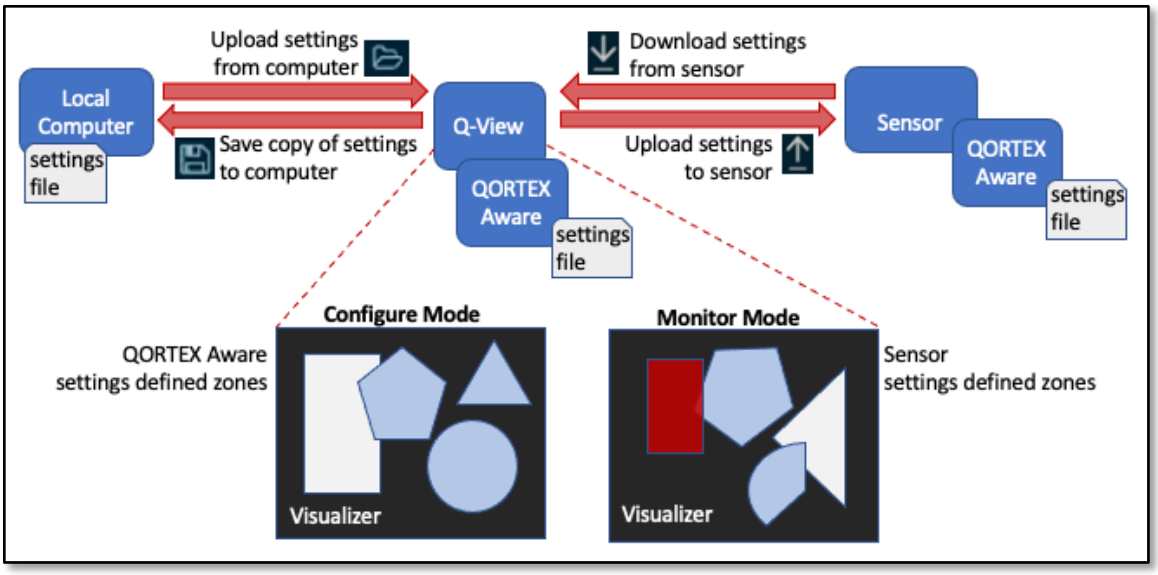


Figure 65. QORTEX Aware Modes and settings Files

QORTEX Aware Configuration in Q-View

QORTEX Aware panel has modes, configuration tabs, and panels:

- **Monitor Mode**—Shows what is happening on the sensor including Evaluation field switches from listening device (DIO). It shows the active Evaluation field from the sensor and alarms the sensor is showing. This includes the active evaluation field (set either via switches from the digital input or via the software API), the associated evaluation zones, and any alarms.
- **Configure Mode**—Allows for configuring zones and fields and other parameters. QORTEX Aware runs inside Q-View and the display does not depend on what is going on with the sensor. The upload/download functions allow for synchronizing with the sensor but when in Configure mode, you only see what is calculated locally. Allows for zone and other settings configuration. Q-Alert processing runs from within Q-View. This mode does not show the configuration that is on the sensor. The **Upload/Download** functions allow for synchronizing with the sensor
- **Settings**—Modify default settings for: output response – the desired interpretation of high/low voltage on the output line, debounce time to clear zone response, and sensitivity – the number of points required to indicate a zone is violated.
- **Exclusion Zones**— Define the areas to ignore. Data points gathered within exclusion zones are not included in detection actions. Exclusion zones display as gray in Q-View.
- **Evaluation Field Zones**—Define the areas to include for identification and notification of objects. Evaluation Field zones are **blue** when no objects are detected. Evaluation Field zones are **red** when one or more objects are detected.

To view QORTEX Aware panel, from Q-View, click the QORTEX Aware tab, . See *Figure 66. QORTEX Aware: Configuration Panel and Visualizer Elements*.

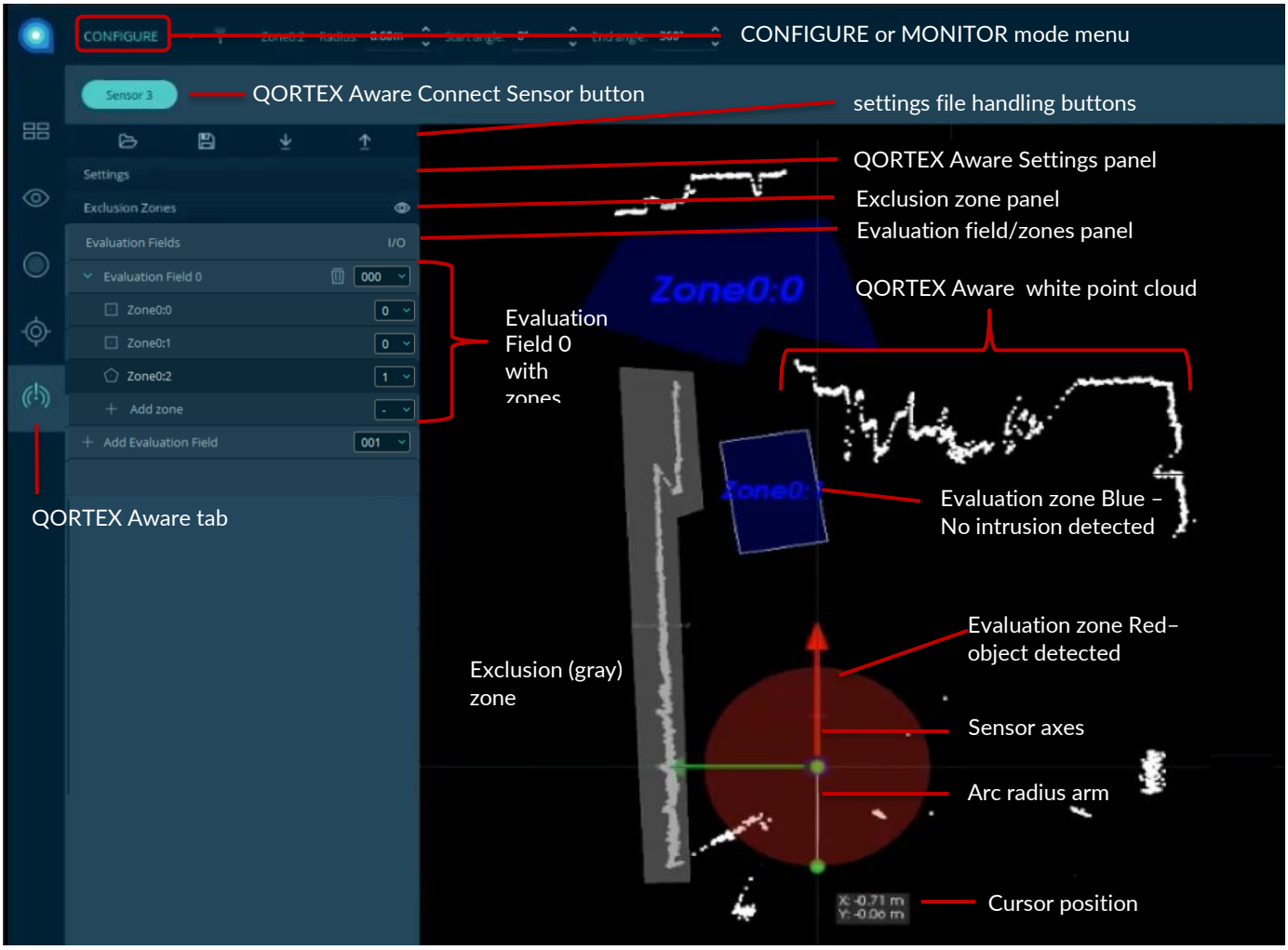


Figure 66. QORTEX Aware: Configuration Panel and Visualizer Elements

QORTEX Aware Evaluation Fields and Zones

Use QORTEX Aware to create different Evaluation fields to suit varying scenarios. QORTEX Aware flags impingements in Evaluation Field zones through the software API. Create up to 8 Evaluation Fields, each with up to 128 2D zones. Only one Evaluation Field is active at a time.

Response time for the Q-Aware is dependent on the number of zones and the number of points in or near the zones. To guarantee the best possible response time, see *Table 15. Maximum Number of QORTEX Aware Supported Zones*.

Table 15. Maximum Number of QORTEX Aware Supported Zones

Zone Type	Full FOV	Active FOV reduced to 90°
Polygons	8	32
Squares	20	80
Sectors	36	128

~~**For Q-View 1.6 ONLY, M1 Edge sensors:** Qortex Aware can also flag impingements in the Evaluation Field zones through the sensor hardware pins.~~

Connect the QORTEX Aware Components

Ensure all the QORTEX Aware components are on the same network.

1. Install Q-View, see *Q-View Users Guide*. Ensure it is on the same network as the sensor.
2. Install and configure a QORTEX Aware supported sensor, see *Sensor Users Guide*.
3. Connect listening device. See the manufacturer's documentation. Ensure it is on the same network as the sensor.

Connect to a QORTEX Aware Enabled Sensor

From within the Q-View interface, connect Q-View to a QORTEX Aware enabled sensor.

1. Start Q-View. Wait for the sensor tiles to appear in the Dashboard panel. See *Figure 67. Q-View Dashboard Tab, Green Connected Sensor*.
2. Connect Q-View to a located sensor. Click the sensor connect button.

   The **Sensor** tile changes from blue to **green**. The sensor button changes to sensor disconnect button. See *Figure 67. Q-View Dashboard Tab, Green Connected Sensor*.

QORTEX Aware sensors spin up immediately upon power-on. So, when connecting to the sensor in Q-View, there is no delay in Q-View between clicking connect and the sensor showing as connected, because the sensor is already spinning.

Figure 67. Q-View Dashboard Tab, Green Connected Sensor

3. Verify the connection, view live data from the connected senor. See *Figure 68. Q-View Visualizer Live Point Cloud, Sensor Connected*.

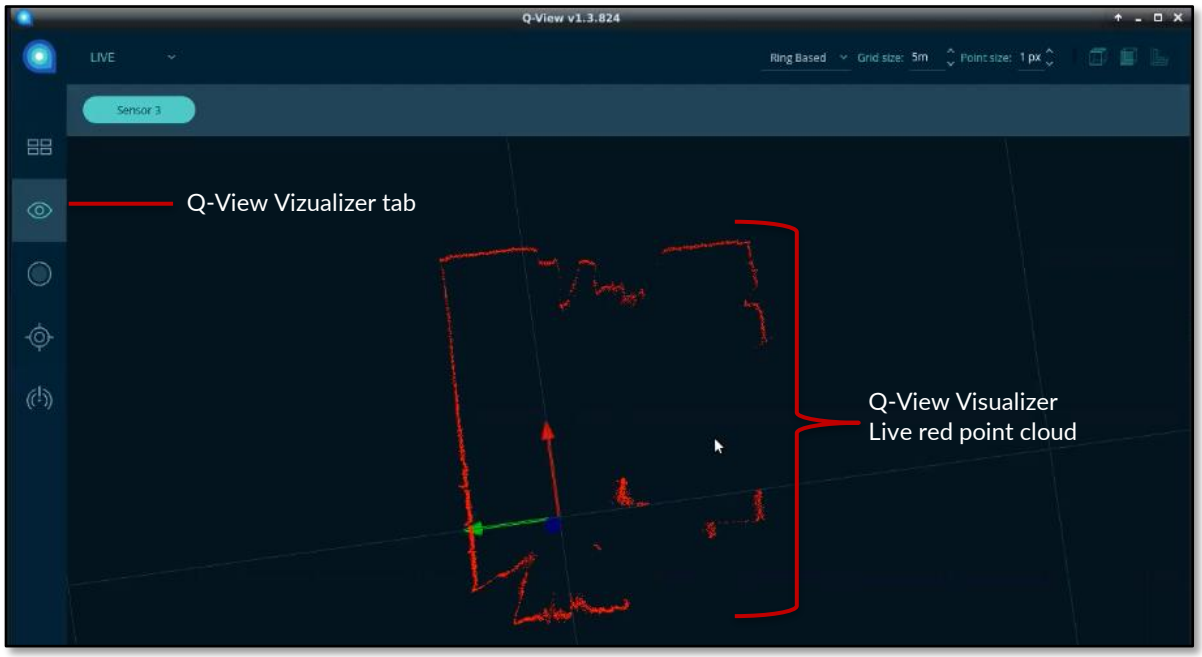


Figure 68. Q-View Visualizer Live Point Cloud, Sensor Connected

4. Select the **Qortex Aware** tab and click the **Sensor Connect** button.

   When you click the QORTEX Aware tab:

   - **If a sensor is not connected**, the visualization panel is blank. The Q-View attached sensors are listed. Click a sensor to select and display the sensor point cloud.
   - **If a sensor is not listed**, return to the Q-View Dashboard and add a sensor. See *Connect to an Online Sensor* (page 49).

- **If a sensor is connected**, the point cloud for the sensor is displayed.
  - The point cloud color is white. This distinguishes it from the Q-View point cloud visualization.
  - Default opening is in QORTEX Aware **Configure** mode with no zones configured.

> **Note:** In QORTEX Aware Configure mode, you configure zones. QORTEX Aware zones function from within Q-View. When creating zones is complete, upload this configuration to the sensor.

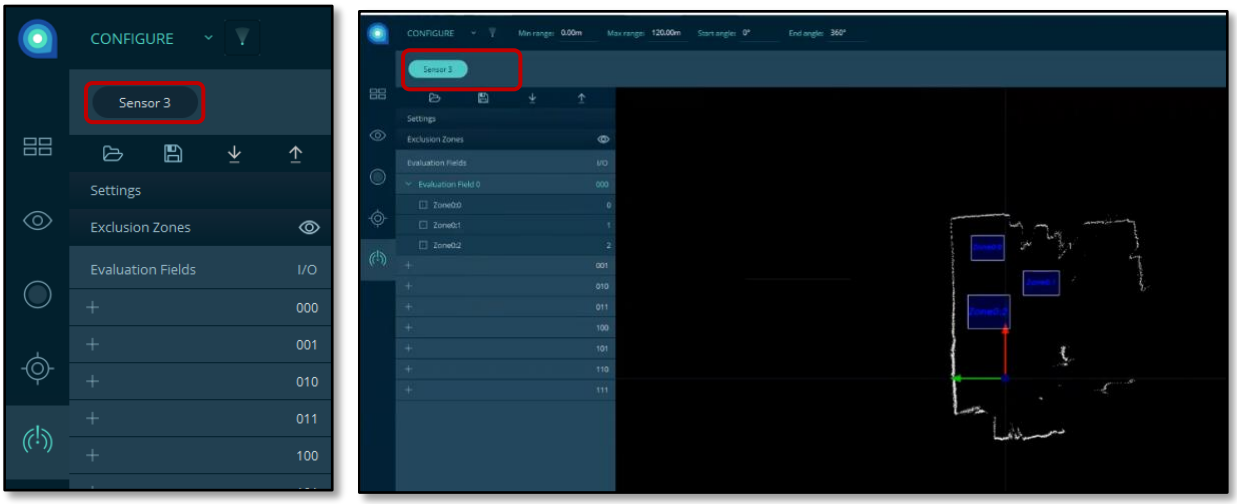


Figure 69. QORTEX Aware Sensor Not Connect (left) Connected (right)

Select Settings File

The QORTEX Aware `settings` file defines the values for all settings (debounce time, sensitivity, etc.) and definition of all the Exclusion Zones and Evaluation Field zones.

The QORTEX Aware mode determines which `settings` configuration you are viewing through the QORTEX Aware Visualizer.

- **Monitor** mode—displays the sensor `settings` configuration. It does not display what is QORTEX Aware defined in Q-View.
- **Configure** mode—displays the Q-View `settings` configuration. It does not display what's on the sensor.

`settings` files are stored to and accessible from three locations: Q-View, Network, and Sensor.

Important Settings File Notes

- When you upload / save or download / browse a `settings` file, it overwrites the `settings` file in target location.
- When the sensor is connected, to display any zones that are configured in the sensor, switch to **Monitor** mode or download the sensor's `settings` file to Q-View.

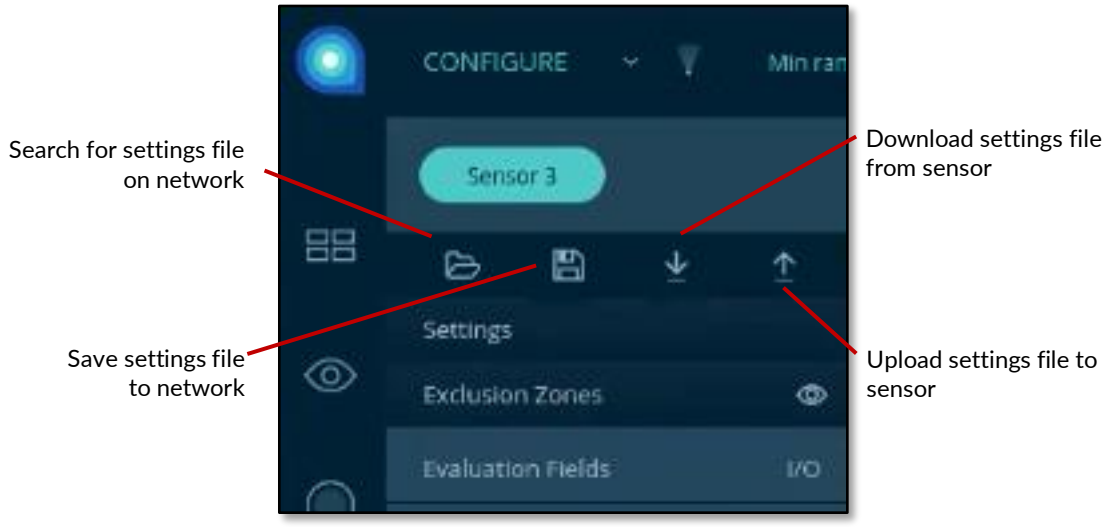


Figure 70. QORTEX Aware: Settings File Toolbar

Q-View settings File

> **Note:** The only `settings` file that is edited from QORTEX Aware, is the file open in the **Q-View > QORTEX Aware** tab.

When Qortex Aware is initially opened in Q-View, the `settings` file does not have any zones or configuration other than default `settings`.

The **Q-View > QORTEX Aware** `settings` is the file that you edit when you create or modify the QORTEX Aware configuration. This is the file whose configuration you see when QORTEX Aware is in **Configure** mode. This file can be **Saved** to a networked location or **Uploaded** to a sensor. When you upload this file to a sensor, it overwrites the sensor's existing settings file.

To get a `settings` file other than the default in the **Q-View > QORTEX Aware** tab, select the action from the QORTEX Aware settings bar. See *Figure 70. QORTEX Aware: Settings File Toolbar*.

Sensor settings File

Each sensor has its own `settings` file. QORTEX Aware on the sensor processes the point cloud data per the configuration defined in the sensor resident settings file.

Sensor `settings` is the file whose configuration you see when QORTEX Aware is in **Monitor** mode.

Sensor `settings` files can be Downloaded to Q-View or Uploaded to the sensor. Downloading a `settings` file, overwrites the `settings` file in Q-View. Downloading the sensor's `settings` file, allows Q-View to display the sensor configuration in **Configure** mode. Uploading a `settings` file, overwrites the `settings` file on the sensor.

> **Note:** As you make changes to a downloaded `settings` file, they are applied to the Q-View `settings` file only. They are not applied to the sensor's `settings`. Modified settings files must be **Uploaded** to the sensor to modify the sensor's behavior.

Sensor file actions:

- To modify the sensor's `settings` file, click **Download** .

  Download uses the sensor's `settings` file and replaces the QORTEX Aware `settings` file in Q-View.

  This allows Q-View to display the sensor configuration in **Configure** mode. It also overwrites any configuration you created through the QORTEX Aware visualizer.

- To apply the Q-View `settings` to the sensor, click **Upload** .

  Upload uses the QORTEX Aware `settings` file in Q-View and replaces the file on the sensor.

Network settings File

Network `settings` files can be opened into QORTEX Aware. When you browse to and open a networked `settings` file, it overwrites the `settings` file in QORTEX Aware. Network stored `settings` file can be saved from QORTEX Aware to a networked location. The only way to view saved network `settings` files is to open them, one at a time, in QORTEX Aware.

Saved `settings` files store a copy on the network and do not affect the sensor behavior.

Network File Actions

- To load a configuration from a networked `settings` file to QORTEX Aware in Q-View, click **Browse** , locate the networked `settings` file, and click **Open**.

  Browse uses the network stored `settings` file and replaces the QORTEX Aware `settings` file in Q-View.

  This replaces the configuration in QORTEX Aware in Q-view, including zones and settings, with the configuration from the `settings` file. It does not change the `settings` files on the sensor.

- To save the Q-View `settings` file to the network, click **Save** the file and browse to the network location.

  Save copies the QORTEX Aware `settings` file in Q-View and saves the file on the network. The Q-View version remains active in the Q-View visualizer.

View Sensor settings: QORTEX Aware Monitor Mode

In **MONITOR** mode, the object detection algorithm runs on the sensor and is displayed in the QORTEX Aware Visualization panel. Also, the CONFIGURE panel is removed from view in the Visualization panel. You can see the sensor point cloud updates, active Evaluation Zones and Exclusion Field zones, and zone violations.

1. Open Q-View, connect to sensors, select **QORTEX Aware** button.

   QORTEX Aware starts automatically when the sensor is powered on.

2. Select **MONITOR** mode from the pull-down menu.

Figure 71. QORTEX Aware: Monitor Mode

View Q-View settings: QORTEX Aware Configure Mode

While in configure mode, the visualization panel displays the visualization data and object detection, just the same as with MONITOR mode. The difference with CONFIGURE mode, is that the processing is performed in the Q-View application, rather than the sensor. This allows you to change settings and create zones without uploading / downloading `settings` from and to the sensor. See *Figure 66. QORTEX Aware: Configuration Panel and Visualizer Elements*.

1. Open Q-View, connect to sensors, select QORTEX Aware button.
2. Connect a sensor to QORTEX Aware if one is not connected. See *Connect to an Online Sensor* (page 49) and *Connect to a QORTEX Aware Enabled Sensor* (page 101).

   QORTEX Aware starts automatically when the sensor is powered on.

3. Select **CONFIGURE** mode from the pull-down menu, if it is not selected. Default after connecting to a sensor is CONFIGURE mode.

   The QORTEX Aware Configuration panel is displayed. See Figure 66. QORTEX Aware: Configuration Panel and Visualizer Elements.

View Sensor Field of View

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Optionally, check the field of view (FOV), click the FOV icon, . See the *Sensor User Guide* and the Sensor Web Server for setting the FOV. See *Figure 72. QORTEX Aware: 360° Field of View*.

> **Note:** If you limit the sensor field of view, use this FOV toggle to confirm the zones you defined are within the sensor FOV.

If you click from adding the sensor to QORTEX Aware to FOV too quickly, the visualizer panel might display a full 360° circle for the FOV, even if the FOV is set to be smaller than this. Give the sensor time to spin up, then re-click (toggle on/off) the FOV icon to allow it to receive the SNMP data from the sensor configuration.

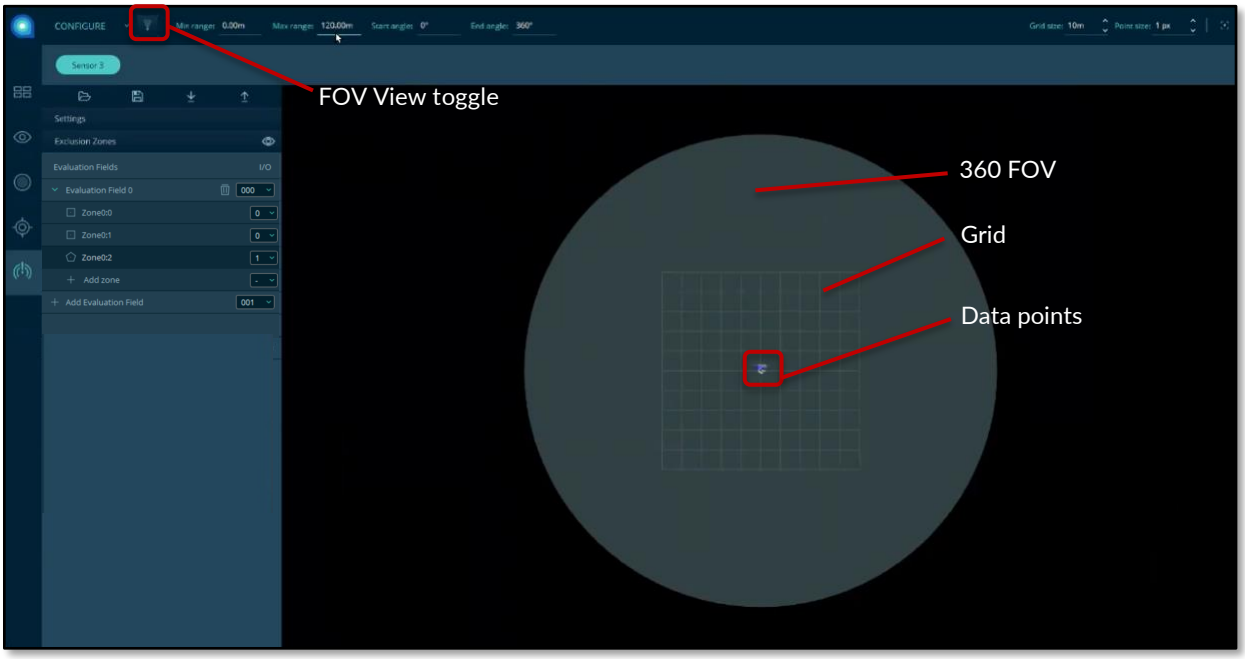


Figure 72. QORTEX Aware: 360° Field of View

Create Evaluation Field Zones

Evaluation Field zones have the same zone types as Exclusion Zones. See *Figure 78. QORTEX Aware: Visualizer with Evaluation Field Zones*.

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Expand the **Evaluation Fields** panel.

   There are 8 possible Evaluation fields. Each Evaluation field can have up to 128 zones.

   Define zones appropriate for different evaluation scenarios.

   Evaluation Field zone color indicates activity in zones. See *Figure 78. QORTEX Aware: Visualizer with Evaluation Field Zones*.

   - The **blue** zones indicate no objects have been detected in the defined areas.
   - The **red** zone indicates an object has been detected the arc defined area.

~~**For Q-View 1.6 ONLY, M1 Edge sensors:** One Evaluation Field is active at a time. Select the active Evaluation Field through either the device hardware pins or the Qortex Aware API. For example:~~

- ~~If your robot has different modes, such as fast mode, slow mode, or careful mode, then each individual mode could use a different evaluation field.~~
- ~~A stationary device monitors a safety area or secure access area. Depending upon the time-of-day different Evaluation Fields might be appropriate.~~

3. **Add Evaluation Field**, click the plus (**+**).

   Zone identification —The zone number in the data point panel have two parts, `N:N`. The first number indicates the Evaluation or Exclusion field. The second number indicates the specific zone within the evaluation field. The list panel shows the zones in binary. The point cloud panel shows the zone in decimal. For example, an Evaluation field `0000` in the list panel is Zone0 in the point cloud panel.

Figure 73. QORTEX Aware Evaluation Field ID Selection

~~**For Q-View 1.6 ONLY, M1 Edge sensors:** the drop down is enabled to assign a binary number to control the input pins associated with the evaluation field. The default value is the lowest available pin combination. For example, `0001`, if `0000` is already in use.~~

4. Expand the Evaluation, click the plus (+) in the list panel, and select a zone ID number.

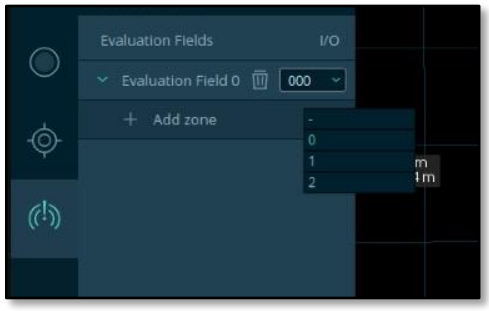


Figure 74. QORTEX Aware Evaluation Field Zone ID Selection

5. Draw the zone in the point cloud panel. See *Figure 78. QORTEX Aware: Visualizer with Evaluation Field Zones*.

   There are three zone types. These are defined by the shape of the zone.

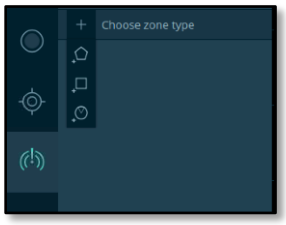


Figure 75. QORTEX Aware Zone Type Selection

Polygon —Click in the visualizer field. Continue to click until you define a closed area. Left-click to add a new point to the polygon and right-click to close the polygon.

Rectangle —Click in the visualizer field to define one vertex of the rectangle and click again to define the opposite vertex. This defines the shape. Make adjustments in the **Configure bar fields** as needed. Adjustment options: Width, Height, Rotate, Pos X, Pos Y. See *Figure 76. QORTEX Aware: Rectangle Zone Configure Bar*.

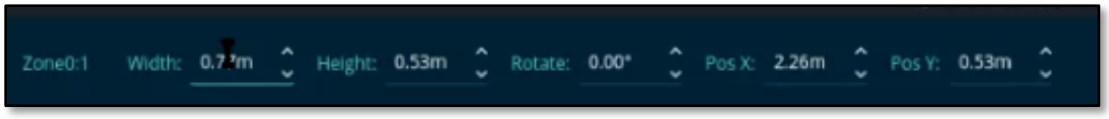


Figure 76. QORTEX Aware: Rectangle Zone Configure Bar

Arc —The center of the arc is positioned at the sensor. Default is a full circle around the sensor. The center of the arc originates at the sensor origin. Make adjustments in the **Configure bar fields** as needed. Adjustment options: Radius, Start angle, End angle. The Start angle must be a value less than the End angle. Left-click to set the radius and drag the end of the radius to change it. See *Figure 77. QORTEX Aware: Arc Zone Configure Bar*.

Figure 77. QORTEX Aware: Arc Zone Configure Bar

~~**For Q-View 1.6 ONLY, M1 Edge sensors:** the drop down is enabled. Select a value that corresponds to an output pin on the sensor. The default value is a hyphen (-) which means that the zone is not mapped to any pin.~~

6. To edit an existing zone. Select the zone from the list panel. Then click the Configure Bar field's ^/v to reposition or alter the size of the zone. See *Figure 76. QORTEX Aware: Rectangle Zone Configure Bar* and *Figure 77. QORTEX Aware: Arc Zone Configure Bar*.

   To change a Polygon zone, delete the zone. Click the trashcan icon by the zone name. Then create a new zone.

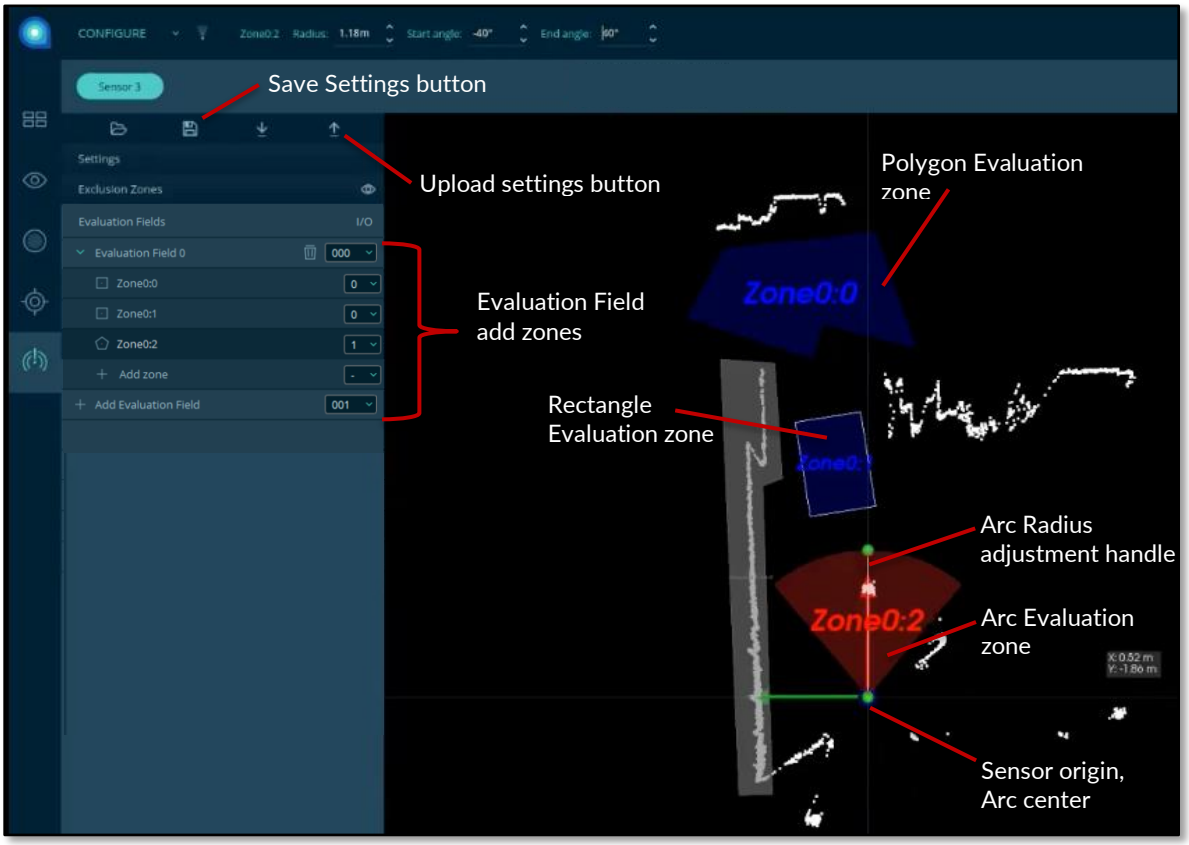


Figure 78. QORTEX Aware: Visualizer with Evaluation Field Zones

7. **Save** or **Upload** the zone configuration.
   - Click **Save** to save the local `settings` file. This does not change the sensor behavior.
   - Click **Upload** to replace the `settings` file on the sensor and run the detection from the sensor.

> **Note:** When you upload the changes, it overwrites any current `settings` file on the sensor.

Create Exclusion Zones

Creating Exclusion zones has the same zone types as Evaluation Fields. Exclusion zones apply across all Evaluation Fields. Exclusion zones display as gray areas. Objects in the gray zone are not detected. See *Figure 80. QORTEX Aware: Visualizer with Exclusion Zone*.

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Expand the **Exclusion Zones** tab.
3. Click the plus (**+**) to select a zone type and define the zone. There are three zone types. These are defined by the shape of the zone.

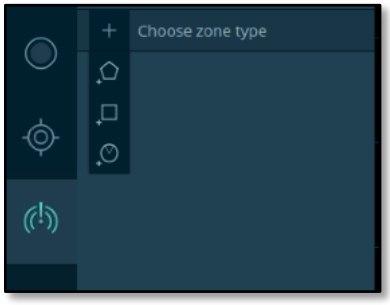


Figure 79. QORTEX Aware Zone Type Selection

Polygon —Click in the visualizer field. Continue to click until you define a closed area.

Rectangle —Click in the visualizer field to define one vertex of the rectangle and click again to define the opposite vertex. This defines the shape. Make adjustments in the **Configure bar fields** as needed. Adjustments options: Width, Height, Rotate, Pos X, Pos Y

Arc —Center of the arc is positioned at the sensor. Default is a full circle around the sensor. The center of the arc originates at the sensor origin. Make adjustments in the **Configure bar fields** as needed. Adjustments options: Radius, Start angle, End angle. The Start angle must be a value less than the End angle.

4. **Save** or **Upload** the zone configuration.
   - Click **Save** to save the local `settings` file. This does not change the sensor behavior.
   - Click **Upload** to replace the `settings` file on the sensor and run the detection from the sensor.

> **Note:** When you upload the changes, it overwrites any current `settings` file on the sensor.

Toggle Viewing Exclusion Zones

Exclusion zones can be hidden from the display using the Exclusion zone panel eye toggle.

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Click the eye icon on the Exclusion Zone tab. See *Figure 80. QORTEX Aware: Visualizer with Exclusion Zone*.

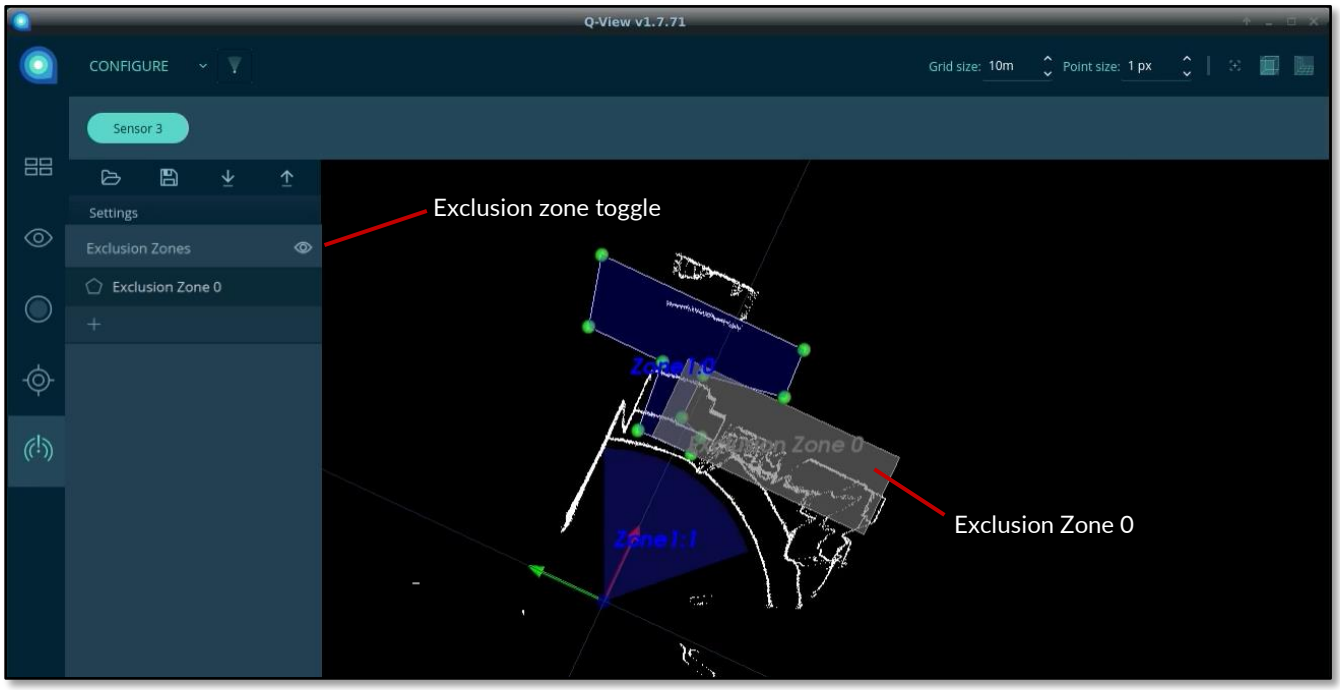


Figure 80. QORTEX Aware: Visualizer with Exclusion Zone

Delete a Zone

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Expand the **Evaluation Fields** or **Exclusion Zones** panel.
3. Select a zone to delete. Hover over the zone to delete and click the **Trashcan** icon.

   The zone is deleted. There is no confirmation prompt. When you delete a zone, the existing zones do not change their assigned ID number.

   - For example, if you have 4 Exclusion zones, 0, 1, 2, 3, and you delete Exclusion zone 1, the existing Exclusion zones keep their ID numbers 0, 2, and 3. The same applies to Evaluation Field zones.
   - However, you can create a new zone in the deleted ID space. For example, if you have 3 Evaluation Field zones, 1.0, 1.1, and 1.2. You delete 1.1. You can click the plus (+) in zone list entry for 1.1 to add a new zone, of any type: polygon, rectangle, or arc.

Modify Default Non-Zone Settings

Additional settings for detecting objects in zones can be modified. These are saved to the settings file, as part of the QORTEX Aware configuration for the sensor.

1. Open Q-View, connect to sensors, select **QORTEX Aware** button > **CONFIGURE** mode.
2. Expand the **Settings** panel. See *Figure 81. QORTEX Aware: Settings Panel Options*.

Figure 81. QORTEX Aware: Settings Panel Options

Set Output Active Level

This option only available for Q-View 1.6 ONLY, M1 Edge sensors.

1. From Q-View, select **QORTEX Aware** button > **CONFIGURE** > **Settings** panel. See *Figure 81. QORTEX Aware: Settings Panel Options*.
2. Select the output signal level for trigger action when a zone is impinged.

   Select from the **Settings** tab > **Output** menu. Options are:

   - **Active High**—When this is selected, a high voltage means a zone is occupied.
   - **Active Low**—When this is selected, a 0 voltage means a zone is occupied.

   Output Active level sets the value of the output pin on the listening device when a zone is occupied. This is used to decide the type of response for a detection. Examples:

   - If you select **Active High**, a light could turn on when an object is detected.
   - If you select **Active Low**, the wheels on a mobile device could stop when an object is detected.

Set Debounce Time

1. From Q-View, select **QORTEX Aware** button > **CONFIGURE** > **Settings** panel. See *Figure 81. QORTEX Aware: Settings Panel Options*.
2. Select the amount of time allowed before a zone status changes from **OCCUPIED** to **CLEAR**.

   In the **Settings** tab **>** **Debounce** field, click the **^/v** arrows or type a number change the delay in seconds.

   Debounce is the time to wait for changing a zone from occupied to unoccupied. Debounce valid values are 0.00 to 1000.00 seconds with 2-decimal precision. Adjust the debounce time to reduce rapid alarm cycling with objects at the edge of zones. Higher values keep the **red** zone indication on longer. The prevents rapid flipping between **red** and **blue**.

   Debounce time does not affect the time to detect objects but extends the alert beyond the point when the object is no longer in the zone.

Set Object Detection Sensitivity

1. From Q-View, select **QORTEX Aware** button > **CONFIGURE** > **Settings** panel. See *Figure 81. QORTEX Aware: Settings Panel Options*.
2. Select the sensitivity value for triggering object detection in a zone.

   In the **Settings** tab **>** **Sensitivity** field, click the **^/v** arrows or type a number between 1 and 10 to change the sensitivity.

   Sensitivity is the relative number of points in the point cloud required to indicate the zone is occupied. The highest sensitivity is 10. This setting requires only a single (1) point in the zone to indicate an OCCUPIED zone status.

   The least sensitivity is 1, this requires more points to trigger an OCCUPIED zone status.

   For example, adjust the setting so a very small object would not trigger a zone violation, but an animal or a person could trigger a zone violation.

Set Active Evaluation Field

Use the QORTEX Aware API to set the active Evaluation Field.

To enable using the QORTEX Aware API to set the active Evaluation Field:

1. From Q-View, select **QORTEX Aware** button > **CONFIGURE** > **Settings** panel. See *Figure 81. QORTEX Aware: Settings Panel Options*.
2. To use the Qortex Aware API to set the active Evaluation Field, select the **Set Evaluation Field via S/W API** checkbox. The default active Evaluation Field is 0.

~~**For Q-View 1.6 ONLY, M1 Edge sensors:** set the active Evaluation Field by adjusting the hardware pins on the sensor. See the *M1 Edge User Guide > Appendix: QORTEX Aware APIs and Settings Commands*.~~

Save an Edited Settings File to the Network

When you save a `settings` file, you store a copy of the QORTEX Aware `settings` to a networked location. The Save action does not overwrite the `settings` on the sensor.

1. Open Q-View, connect to sensors, select **QORTEX Aware** tab. QORTEX Aware is in **CONFIGURE** mode by default.
2. Make edits as needed to the QORTEX Aware **Settings**, **Evaluation Fields**, and/or **Evaluation Field Zones**. See *Create Evaluation Field Zones* (page 108), *Create Exclusion Zones* (page 111), and *Modify Default Non-Zone Settings* (page 113).
3. Click the **Save** button to store a copy of the `settings` file locally on the Q-View laptop.

   Give the settings file a useful name, such as `lobby_zones`, or `weekend_zones`. The `settings` files are in JSON format. Ensure the filename ends with the `.json` extension, manually add the `.json` if needed.
4. Browse to a location on the Q-View machine and click **Save**.

   This saves a file on the local Q-View machine. It does not overwrite the settings file on the sensor.

   > **Note:** If you do not **upload** your configuration changes in the `settings` file, your changes are overwritten in QORTEX Aware visualizer when the `settings` file is next downloaded from the sensor.

   Edit the Q-View displayed configuration through QORTEX Aware to create zones. Then choose:

   - **Save** to make a copy of the QORTEX Aware `settings` file and store it locally.
   - **Upload** the modified QORTEX Aware `settings` file and overwrite the existing file on the sensor.

Upload an Edited Settings File to the Sensor

Upload the QORTEX Aware `settings` file, with any changes you have made, and overwrite the `settings` file on the sensor.

1. Open Q-View, connect to sensors, select **QORTEX Aware** tab. QORTEX Aware is in **CONFIGURE** mode by default.
2. Make edits as needed to the QORTEX Aware **Settings**, **Evaluation Fields**, and/or **Evaluation Field Zones**. See *Create Evaluation Field Zones* (page 108), *Create Exclusion Zones* (page 111), and *Modify Default Non-Zone Settings* (page 113).
3. Click the **Upload** button to push and overwrite the settings file to the sensor.

   > ~~**Note:** If you upload a Q-View 1.0 `settings` file, it is converted to a Q-View 2.0 `settings` file.~~

Sample Settings File


```
{
  "Settings": {
    "ZoneDetector": {
      "version": "2.0",
      "debounceTimeMs": "3000",
      "sensitivity": "9",
      "triggerActiveLevel": "low",
      "useSoftwareAPICommand":"true",
      "ExclusionZone": {
        "name": "tiny_circle",
        "shape": "sector",
        "Sector": {
          "minAngle": "0",
          "maxAngle": "6.283185307179586",
          "radius": "0.01"
        },
        "zMin": "-1.0",
        "zMax": "1.0"
      },
      "ExclusionZone": {
        "name": "tiny_circle_2",
        "shape": "sector",
        "Sector": {
          "minAngle": "0.5",
          "maxAngle": "6.283185307179586",
          "radius": "0.05"
        },
        "zMin": "1.0",
        "zMax": "2.0"
      },
      "ExclusionZone": {
        "name":"Exclusion Zone 1",
        "shape":"rectangle",
        "Rectangle":{
          "rotation":"0",
          "Point": {
            "x":"3.6292960643768311",
            "y":"-0.17496338486671448"
          },
          "Point": {
            "x":"4.275385856628418",
```

```
            "y":"1.2150298357009888"
          }
        },
        "zMin": "4.0",
        "zMax": "8.0"
      },
      "EvaluationField": {
        "name": "square_diamond",
        "index": "2",
        "Zone": {
          "name": "square",
          "index": "0",
          "pin": "-1",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "-1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "-1"
            },
            "Point": {
              "x": "-1",
              "y": "-1"
            }
          },
          "zMin": "0.0",
          "zMax": "5.0"
        },
        "Zone": {
          "name": "diamond",
          "index": "1",
          "pin": "-1",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "5",
              "y": "6"
```

```
          },
          "Point": {
            "x": "6",
            "y": "5"
          },
          "Point": {
            "x": "5",
            "y": "4"
          },
          "Point": {
            "x": "4",
            "y": "5"
          }
        },
        "zMin": "-2.0",
        "zMax": "2.0"
      },
      "Zone": {
        "name": "triangle",
        "index": "2",
        "pin": "-1",
        "shape": "polygon",
        "Polygon": {
          "Point": {
            "x": "5",
            "y": "0"
          },
          "Point": {
            "x": "5",
            "y": "1"
          },
          "Point": {
            "x": "6",
            "y": "0"
          }
        }
      }
    },
    "EvaluationField": {
      "name": "rectan_tiny_circle",
      "index": "4",
      "Zone": {
        "name": "rectangle",
        "index": "1",
```

```
      "pin": "-1",
      "shape": "polygon",
      "Polygon": {
        "Point": {
          "x": "-6",
          "y": "1"
        },
        "Point": {
          "x": "-4",
          "y": "1"
        },
        "Point": {
          "x": "-4",
          "y": "-1"
        },
        "Point": {
          "x": "-6",
          "y": "-1"
        }
      },
      "zMin": "0.0",
      "zMax": "20.0"
    },
    "Zone": {
      "name": "tiny_circle",
      "index": "2",
      "pin": "-1",
      "shape": "sector",
      "Sector": {
        "minAngle": "0",
        "maxAngle": "6.283185307179586",
        "radius": "0.01"
      },
      "zMin": "0.0",
      "zMax": "20.0"
    },
    "Zone": {
      "name": "rotated_rectangle",
      "index": "0",
      "pin": "-1",
      "shape": "rectangle",
      "Rectangle": {
        "rotation": "90",
        "Point": {
```

```
            "x": "2",
            "y": "-1"
          },
          "Point": {
            "x": "-2",
            "y": "1"
          }
        },
        "zMin": "0.0",
        "zMax": "20.0"
      }
    },
    "EvaluationField": {
      "name": "square_in_sectors",
      "index": "7",
      "Zone": {
        "name": "square_inner",
        "index": "0",
        "pin": "-1",
        "shape": "polygon",
        "Polygon": {
          "Point": {
            "x": "-6",
            "y": "1"
          },
          "Point": {
            "x": "-5",
            "y": "1"
          },
          "Point": {
            "x": "-5",
            "y": "-1"
          },
          "Point": {
            "x": "-6",
            "y": "-1"
          }
        },
        "zMin": "0.0",
        "zMax": "20.0"
      },
      "Zone": {
        "name": "sector_large",
        "index": "1",
```

```
          "pin": "-1",
          "shape": "sector",
          "Sector": {
            "minAngle": "-1.570796326794897",
            "maxAngle": "1.570796326794897",
            "radius": "1"
          },
          "zMin": "0.0",
          "zMax": "20.0"
        },
        "Zone": {
          "name": "sector_small",
          "index": "2",
          "pin": "-1",
          "shape": "sector",
          "Sector": {
            "minAngle": "-0.7853981633974483",
            "maxAngle": "0.7853981633974483",
            "radius": "0.5"
          },
          "zMin": "0.0",
          "zMax": "20.0"
        }
      }
    }
  }
}}
```

Figure 82. Sample Q-View 2.0 settings.xml File

```
{
  "Settings": {
    "ZoneDetector2D": {
      "version": "0",
      "debounceTimeMs": "3000",
      "sensitivity": "9",
      "triggerActiveLevel": "low",
      "useSoftwareAPICommand":"true",
      "ExclusionZone": {
        "name": "tiny_circle",
        "shape": "sector",
        "Sector": {
          "minAngle": "0",
          "maxAngle": "6.283185307179586",
          "radius": "0.01"
```

```
      }
    },
    "ExclusionZone": {
      "name": "tiny_circle_2",
      "shape": "sector",
      "Sector": {
        "minAngle": "0.5",
        "maxAngle": "6.283185307179586",
        "radius": "0.05"
      }
    },
    "ExclusionZone": {
      "name":"Exclusion Zone 1",
      "shape":"rectangle",
      "Rectangle":{
        "rotation":"0",
        "Point": {
          "x":"3.6292960643768311",
          "y":"-0.17496338486671448"
        },
        "Point": {
          "x":"4.275385856628418",
          "y":"1.2150298357009888"
        }
      }
    },
    "EvaluationField": {
      "name": "square_diamond",
      "index": "2",
      "Zone": {
        "name": "square",
        "index": "0",
        "shape": "polygon",
        "Polygon": {
          "Point": {
            "x": "-1",
            "y": "1"
          },
          "Point": {
            "x": "1",
            "y": "1"
          },
          "Point": {
            "x": "1",
```

```
            "y": "-1"
          },
          "Point": {
            "x": "-1",
            "y": "-1"
          }
        }
      },
      "Zone": {
        "name": "diamond",
        "index": "1",
        "shape": "polygon",
        "Polygon": {
          "Point": {
            "x": "5",
            "y": "6"
          },
          "Point": {
            "x": "6",
            "y": "5"
          },
          "Point": {
            "x": "5",
            "y": "4"
          },
          "Point": {
            "x": "4",
            "y": "5"
          }
        }
      },
      "Zone": {
        "name": "triangle",
        "index": "2",
        "shape": "polygon",
        "Polygon": {
          "Point": {
            "x": "5",
            "y": "0"
          },
          "Point": {
            "x": "5",
            "y": "1"
          },
```

```
            "Point": {
              "x": "6",
              "y": "0"
            }
          }
        }
      },
      "EvaluationField": {
        "name": "rectan_tiny_circle",
        "index": "4",
        "Zone": {
          "name": "rectangle",
          "index": "1",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "-6",
              "y": "1"
            },
            "Point": {
              "x": "-4",
              "y": "1"
            },
            "Point": {
              "x": "-4",
              "y": "-1"
            },
            "Point": {
              "x": "-6",
              "y": "-1"
            }
          }
        },
        "Zone": {
          "name": "tiny_circle",
          "index": "2",
          "shape": "sector",
          "Sector": {
            "minAngle": "0",
            "maxAngle": "6.283185307179586",
            "radius": "0.01"
          }
        },
        "Zone": {
```

```
          "name": "rotated_rectangle",
          "index": "0",
          "shape": "rectangle",
          "Rectangle": {
            "rotation": "90",
            "Point": {
              "x": "2",
              "y": "-1"
            },
            "Point": {
              "x": "-2",
              "y": "1"
            }
          }
        }
      },
      "EvaluationField": {
        "name": "square_in_sectors",
        "index": "7",
        "Zone": {
          "name": "square_inner",
          "index": "0",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "-6",
              "y": "1"
            },
            "Point": {
              "x": "-5",
              "y": "1"
            },
            "Point": {
              "x": "-5",
              "y": "-1"
            },
            "Point": {
              "x": "-6",
              "y": "-1"
            }
          }
        },
        "Zone": {
          "name": "sector_large",
```

```
          "index": "1",
          "shape": "sector",
          "Sector": {
            "minAngle": "-1.570796326794897",
            "maxAngle": "1.570796326794897",
            "radius": "1"
          }
        },
        "Zone": {
          "name": "sector_small",
          "index": "2",
          "shape": "sector",
          "Sector": {
            "minAngle": "-0.7853981633974483",
            "maxAngle": "0.7853981633974483",
            "radius": "0.5"
          }
        }
      }
    }
  }
}
```

Figure 83. Sample Q-View 1.0 settings.xml File

10. Troubleshooting Issues

Most problems have fairly simple solutions that can be resolved by following the suggestions provided below.

Get Help of Any Kind

Contact your support representative to create an automatic support ticket and get the specific help you need. Provide the sensor serial number if appropriate.

- If you purchased your hardware and software from Quanergy, send email to support@quanergy.com with your feedback, question, or concern.
- If you purchased your hardware and software from a value-added reseller (VAR) or system integrator (SI), contact them for support.

Can't Find My Sensors

If you are not seeing the sensors you expect, verify the following:

- The sensors are plugged into the same subnet as the machine running Q-View.
- The sensors are plugged into suitable power sources, as specified in the relevant *Sensor User Guide*.
- Be patient and refresh the search for sensors again by selecting the **Search** network button. Sometimes, a sensor may take as long as a minute to come fully online.
- If the host computer went into sleep mode, the sensors can be in unpredictable states. If this occurs, refresh the search for sensors by selecting the **Search** network button. After the first search concludes, you might need to refresh again. Repeat the refresh sequence until the sensors return to the individual states you expected them in.

Q-View Crashed

Q-View is a highly reliable application, but network conditions are hard to predict.

- If Q-View crashes a time or two, just restart it again. It remembers everything you've done, so you can pick up where you left off.
- If Q-View continuously crashes every time you open it, please contact your customer support representative, and explain what happened.

Point Cloud Has Missing Portions

If the visualization of the point cloud omits some portions of the display, too many sensors might be in a **Connected** (**green**) or **Malfunctioning** (**red**) state. For optimal results in visualizing point clouds, Quanergy recommends connecting to up to 18 sensors in single return mode.

Sensor is Malfunctioning

If a sensor enters a **Malfunctioning** (**red**) state, refresh the display of sensors by selecting the **Search** network button to clear up any minor anomalies. If Q-View persists in displaying the connected sensor in a **Malfunctioning** (**red**) state, check the diagnostics panel to see which error code is reported. See *Figure 30. Dashboard Tab: Diagnostics Panel Sensor Error*.

- For sensor error codes causes and possible solutions, see "Troubleshooting Issues" in the *Sensor User Guide*.

Qortex Aware Output Rate is Decreasing

A reduction in Qortex Aware output rate, could be due to sensor processors being overly taxed which might result in sensor frames being dropped. Check if too many zones are defined in a certain way.

Appendix 1. QORTEX Aware APIs and Settings Commands

Using Q-View to configure QORTEX Aware, is strongly recommended.

For advanced users who do not want to use Q-View for QORTEX Aware configuration or who wish to configure QORTEX Aware with their own custom GUI, the following JSON based API can be used to configure QORTEX Aware.

THE QORTEX Aware API is accessed through port 4143. This port allows you to dynamically select the active Evaluation Field, provides information on zone violations, and allows for uploading / downloading settings.

All commands to the server must be newline-delimited JSON (NDJSON) strings. A NDJSON message is produced by removing all instances of \r (carriage return), \n (line feed), a \t (tab) from the original JSON message and appending a single \n (newline) at the end of the message. Pretty JSON is shown for example here for readability, but all new lines (except at the end of the message) should be removed.

This guide uses 'pretty' JSON in the examples, however, when you create JSON files or API content be sure to use the NDJSON format. See *Figure 84. Settings API: Sample JSON Formats*.

Example pretty JSON

```
{
   "command" : "select_evaluation_field",
   "evaluationFieldIndex" : "0"
}
```

Example NDJSON

```
"{\"command\":\"select_evaluation_field\",\"evaluationFieldIndex\":\"0\"}\n"
```

Figure 84. Settings API: Sample JSON Formats

The `Qortex` Aware API contains:

- Control messages (sent to server)
  - Set current evaluation field
  - Request settings from server
  - Settings upload
- Information messages (received from server)
  - Zone violations
  - Command acknowledgement
  - Settings

Command Message Sent to QORTEX Aware Server

The QORTEX Aware server accepts:

- A command to select the active evaluation field.
- A request to get the settings from the sensor
- A message to upload the settings.

command Object

The `select_evaluation_field` and `get_settings` commands use the command object described here. See *Set Active Evaluation Field* (page 130) and *Request Settings* (page 130).

Definitions: See *Table 16. QORTEX Aware API: command Object*.

Table 16. QORTEX Aware API: command Object

Key	Type	Values	Description
`command`	string	`select_evaluation_field` or `get_settings`	Use to issue a command to QORTEX Aware server.
`evaluationFieldIndex`	string	Zero-based index of the evaluation field to activate. (`0-7`)	This field is required for the `select_evaluation_field` command.

Set Active Evaluation Field

Example: See *Figure 85. QORTEX Aware API: Select Evaluation Field*.

Command Format

```
{
   "command" : "select_evaluation_field", "evaluationFieldIndex" : "0"
}
```

Figure 85. QORTEX Aware API: Select Evaluation Field

Request Settings

Example: See *Figure 86. QORTEX Aware API: Request Settings*.

Command Format

```
{
   "command" : "get_settings"
}
```

Figure 86. QORTEX Aware API: Request Settings

Upload Settings

Upload settings by passing the updated whole `settings` file as **Newline delimited JSON** string to server. Notice that there's no command in this message.

Example: See *Figure 87. QORTEX Aware 1.0 API: Upload Settings*.

```
{
  "Settings": {
    "ZoneDetector2D": {
      "version": "1.0",
      "debounceTimeMs": "3000",
      "sensitivity": "9",
      "triggerActiveLevel": "low",
      "useSoftwareAPICommand": "true",
      "ExclusionZone": {
        "name": "tiny_circle",
        "shape": "sector",
        "Sector": {
          "minAngle": "0",
          "maxAngle": "6.283185307179586",
          "radius": "0.01",
        }
      },
      "EvaluationField": {
        "name": "square_diamond",
        "index": "2",
        "Zone": {
          "name": "square",
          "index": "0",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "-1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "-1"
            },
            "Point": {
```

```
                "x": "-1",
                "y": "-1"
              }
            }
          }
        }
      }
    }
}
```

Figure 87. QORTEX Aware 1.0 API: Upload Settings

Example: See *Figure 88. QORTEX Aware 2.0 API: Upload Settings*. A summary of the changes between version 1.0 and 2.0:

- "version" 1.0 > 2.0
- "ZoneDetector2D" > "ZoneDetector"
- "zMin" and "zMax" (new settings for each shape)
- "pin" (new setting for each evaluation field)

```
{
  {
  "Settings": {
    "ZoneDetector": {
      "version": "2.0",
      "debounceTimeMs": "3000",
      "sensitivity": "9",
      "triggerActiveLevel": "low",
      "useSoftwareAPICommand": "true",
      "ExclusionZone": {
        "name": "tiny_circle",
        "shape": "sector",
        "Sector": {
          "minAngle": "0",
          "maxAngle": "6.283185307179586",
          "radius": "0.01",
          "zMin": "-1.0",
          "zMax": "0.5"
        }
      },
      "EvaluationField": {
        "name": "square_diamond",
        "index": "2",
        "Zone": {
```

```
          "name": "square",
          "index": "0",
          "pin":"-1",
          "shape": "polygon",
          "Polygon": {
            "Point": {
              "x": "-1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "1"
            },
            "Point": {
              "x": "1",
              "y": "-1"
            },
            "Point": {
              "x": "-1",
              "y": "-1"
            }
          },
          "zMin": "0.0",
          "zMax": "5.0"
        }
      }
    }
  }
}
```

Figure 88. QORTEX Aware 2.0 API: Upload Settings

Messages Sent from QORTEX Aware Server

The QORTEX Aware server outputs:

- A recurring zone violation message
- An acknowledgement message that is sent upon receipt of a `command` message
- The settings, when requested by a `get_settings` command.

ZoneViolations

These messages are sent with every frame of sensor data (at the same frequency of the sensor) to indicate the current zone violation status. See *Table 17. QORTEX Aware API: zoneViolations Object Definitions*.

Table 17. QORTEX Aware API: zoneViolations Object Definitions

Key	Type	Values	Description
`EvaluationField`	number	`0-7`	Index of currently active evaluation field.
`ZoneStatus`	array	`One of: -1, 0, 1`	Array containing three integer values, one for each zone. `-1`, zone does not exist `0`, zone is unoccupied `1`, zone is occupied

Example: See *Figure 89. QORTEX Aware 1.0 API: zoneViolations Object*.

zoneViolation Message

```
{
   "zoneViolations" : {
      "EvaluationField" : 0,
      "ZoneStatus" : [0, 1, -1]
   }
}
```

Figure 89. QORTEX Aware 1.0 API: zoneViolations Object

Example: See *Figure 90. QORTEX Aware 2.0 API: zoneViolations Object*.

zoneViolation Message

```
{
   "zoneViolations" : {
      "EvaluationField" : 0,
      "ZoneStatus" : [ 0,1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-
1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-
1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-
1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-
1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1 ]
   }
}
```

Figure 90. QORTEX Aware 2.0 API: zoneViolations Object

Settings File Content

A message containing the QORTEX Aware `settings` file content is sent after a `get_settings` command is received and acknowledged. Note: the entire QORTEX Aware `settings` file is included in the message. See *Figure 87. QORTEX Aware 1.0 API: Upload Settings*.

~~If you have a QORTEX Aware 1.0 settings file and open it in Q-View, the file is converted to QORTEX Aware 2.0 version.~~

Command Acknowledgement

The following message is sent to acknowledge receipt of a `Command` message, provide feedback on whether the command was valid, whether the command was performed successfully. If the command was a request for information (currently just the `get_settings` command falls in this category), the data is sent in a separate message. See *Table 18. QORTEX Aware API: commandAck Object Definitions*.

Table 18. QORTEX Aware API: commandAck Object Definitions

Key	Type	Values	Description
`command`	String		Echo of the command that is being acknowledged
`success`	Boolean		True, if the command was successful
`error_message`	String		Any errors encountered or empty if the command was successful

Example: See *Figure 91. QORTEX Aware API: commandAck Message*.

commandAck Message

```
{
   "commandAck" : {
   "command" : "get_settings",
   "success" : true,
   "error_message" : ""
   }
}
```

Figure 91. QORTEX Aware API: commandAck Message

QORTEX Aware Configuration API — JSON Object Definitions

The QORTEX Aware settings file description includes: the JSON structure, a description of each item, and the validation that is done by the QORTEX Aware server.

Settings Object

The `Settings` object is contained in the QORTEX Aware `settings.json` file. See *Table 19. QORTEX Aware API: Settings Object JSON Definitions*.

Table 19. QORTEX Aware API: Settings Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`ZoneDetector2D`	Object	`See ZoneDetector2D description`	Required	

ZoneDetector2D Object

Definitions: See *Table 20. QORTEX Aware API: zoneDetector2D Object JSON Definitions*.

Table 20. QORTEX Aware API: zoneDetector2D Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`version`	String	n/a	Required, value is checked to be in format x.y and specifically 1.y or 0.y	Used to track settings version.
`debounceTimeMs`	String	Integer >= -	Required. Non-integers or integers outside of the valid range are rejected.	Time (in milliseconds) to debounce for changing from OCCUPIED to CLEAR.
`sensitivity`	String	Integer between 1 and 10	Required. Non-integers or integers outside of the valid range are rejected.	Sensitivity to a zone being flagged as occupied. Higher sensitivity values require fewer points in the zone.
`triggerActiveLevel`	String	One of: High Low	Required. Must be one of: "high" or "low"	Specifies the value of the output pin when a zone is occupied (violated).
`useSoftwareAPICommand`	String	True or false	Optional. Must be one of: "true" or "false" Default is false	Boolean indicating whether to allow updating evaluation field via s/w API command (true) or h/w (false).
`ExclusionZones`	Array	Between 0 and 32 Zone objects	Required, but the array can be empty.	

Key	Type	Values	JSON Validation	Description
`EvaluationFields`	Array	Between 0 and 7 EvaluationField objects	Required, but the array can be empty.	

EvaluationField Object

Definitions: See *Table 21. QORTEX Aware API: EvaluationField Object JSON Definitions*.

Table 21. QORTEX Aware API: EvaluationField Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`name`	String	Not empty and maximum of 18 characters	Strings that are empty or contain more than the maximum number of characters are rejected.	Descriptive name for this Evaluation Field.
`index`	String	Integer between 0 and 7	Required. Non-integers or integers outside of the valid range are rejected. Must not be the same as any other EvaluationField index.	Index number for this Evaluation Field.
`Zones`	Array	Between 1 and 3 Zone objects.	Required. Array containing less than one or more than 3 entries is rejected.	The zones associated with this Evaluation Field

Zone Object

Definitions: See *Table 22. QORTEX Aware API: zoneDetector2D Object JSON Definitions*.

Table 22. QORTEX Aware API: zoneDetector2D Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`Name`	String	Not empty and maximum of 18 characters	Strings that are empty or contain more than the maximum number of characters are rejected.	Descriptive name for this object.
`Index`	String	Integer between 0 and 2	Required for Evaluation Field zones. Not required for Exclusion Zones.	Index number for this zone.

Key	Type	Values	JSON Validation	Description
			Non-integers or integers outside of the valid range are rejected. Must not be the same as any other Zone index.	
`Shape`	String	One of Sector Rectangle polygon	Required. Must be one of: "sector", "rectangle" or "polygon". There must be a corresponding Sector, Rectangle or Polygon object for the zone.	The shape of this zone.
`Sector`	Object	See sector object description.	Required, when shape is "sector"	Details of this zone's sector shape. This object is only required or present if "shape" is set to "sector".
`Rectangle`	Object	See rectangle object description.	Required, when shape is "rectangle"	Details of this zone's rectangle shape. This object is only required or present if "shape" is set to "rectangle".
`Polygon`	Object	See polygon object description.	Required, when shape is "polygon"	Details of this zone's polygon shape. This object is only required or present if "shape" is set to "polygon".
`zMin`	String	Floating point value	Points with a Z value less than zMin are always excluded from the zone. This value is ignored for single beam sensors.	Requires QORTEX Aware 2.0 or later. Optional. Default 0.0m. Value added to JSON object.
`zMac`	String	Floating point value	Points with a Z value greater than zMax are always excluded from the zone. This value is ignored for single beam sensors.	Requires Qortex Aware 2.0 or later. Optional. Default 20.0m. Value added to JSON object.

Sector

Definitions: See *Table 23. QORTEX Aware API: Sector Object JSON Definitions*.

Table 23. QORTEX Aware API: Sector Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`minAngle`	String	Angle (radians) between -2π and +2π	Required. Must be a numeric value.	Sector minimum angle.
`maxAngle`	String	Angle (radians) between -2π and +2π	Required. Must be a numeric value.	Sector maximum angle.
`Radius`	String	Positive floating point value (meters)	Required. Must be a numeric value greater than zero.	Sector radius.

Rectangle

Definitions: See *Table 24. QORTEX Aware API: Rectangle Object JSON Definitions*.

Table 24. QORTEX Aware API: Rectangle Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`Rotation`	String	Floating point angle	Required. Must be a numeric value.	Rectangle rotation angle (degrees).
`Points`	Array	Exactly two Point objects	Required. Array containing anything other than 2 entries is rejected.	The opposite corners of the rectangle.

Polygon

Definitions: See *Table 25. QORTEX Aware API: Polygon Object JSON Definitions*.

Table 25. QORTEX Aware API: Polygon Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`Points`	Array	Between 3 and 16 Point objects.	Required. Array containing less than three or more than 16 entries is rejected.	The vertices representing a closed loop polygon.

Point

Definitions: See *Table 26. QORTEX Aware API: Point Object JSON Definitions*.

Table 26. QORTEX Aware API: Point Object JSON Definitions

Key	Type	Values	JSON Validation	Description
`X`	String	floating point number	Required. Must be a numeric value.	X coordinate of this point
`Y`	String	floating point number	Required. Must be a numeric value.	Y coordinate of this point

Additional Settings Validation

The following validations are applied to the settings file:

- maximum file size: 100k
- maximum number of evaluation field: Qortex Aware version and sensor specific. See *Table 27. QORTEX Aware API: Versions, Evaluation Zones, and Mapping*.

Table 27. QORTEX Aware API: Versions, Evaluation Zones, and Mapping

Q-View version / Qortex Aware version / Sensor	Maximum Evaluation Fields	Maximum Number of Zones per Field	Zone to output pin mapping
1.6, 1.0, M1 Edge	8	3	Zone mapped to output pin
1.7, 2.0, M1 Edge PoE	8	128	No zone mapping, sensor does not have pins.

- name length (evaluation field, zone, exclusion zone): not empty and maximum is 20
- number of zones in evaluation field: not empty and maximum is 128
- maximum number of exclusion zones: 32
- maximum number of vertices in polygon exclusion zone: 16

Setting Active Evaluation Field Example

The following examples shows:

- Running the API command in one terminal, selecting a zone.
- In another terminal, the continuous zone status.
- In the Visualization panel, the changing and monitored zones.

Example: See *Figure 92. QORTEX Aware API: Set Active Evaluation Field*.

Command Format

```
{
   "command" : "select_evaluation_field", "evaluationFieldIndex":"1"
}
```

Figure 92. QORTEX Aware API: Set Active Evaluation Field

The next set of figures provide an example of changing the Evaluation Field through the Qortex Aware API and status changes.

- Change to Evaluation Zone 1 using Qortex Aware JSON command. See *Figure 93. QORTEX Aware: JSON Command Setting Zone 1*.
- Selected Evaluation Zone Status from Evaluation Zone 1 to Evaluation Zone 2. Both Q-View > QORTEX Aware tab view and CLI view. See *Figure 94. QORTEX Aware: Evaluation Field from Evaluation Field 0 to Evaluation Field 1*.

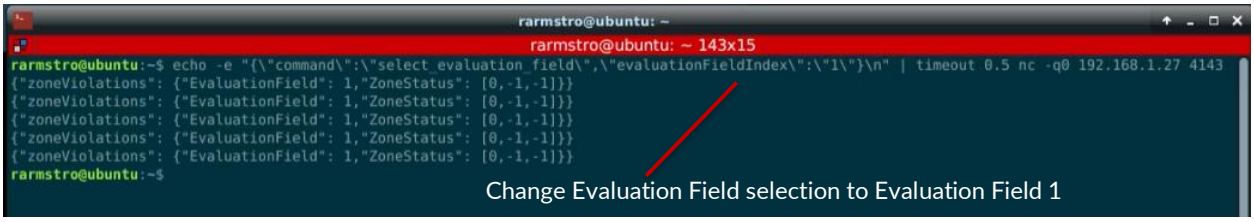


Figure 93. QORTEX Aware: JSON Command Setting Zone 1

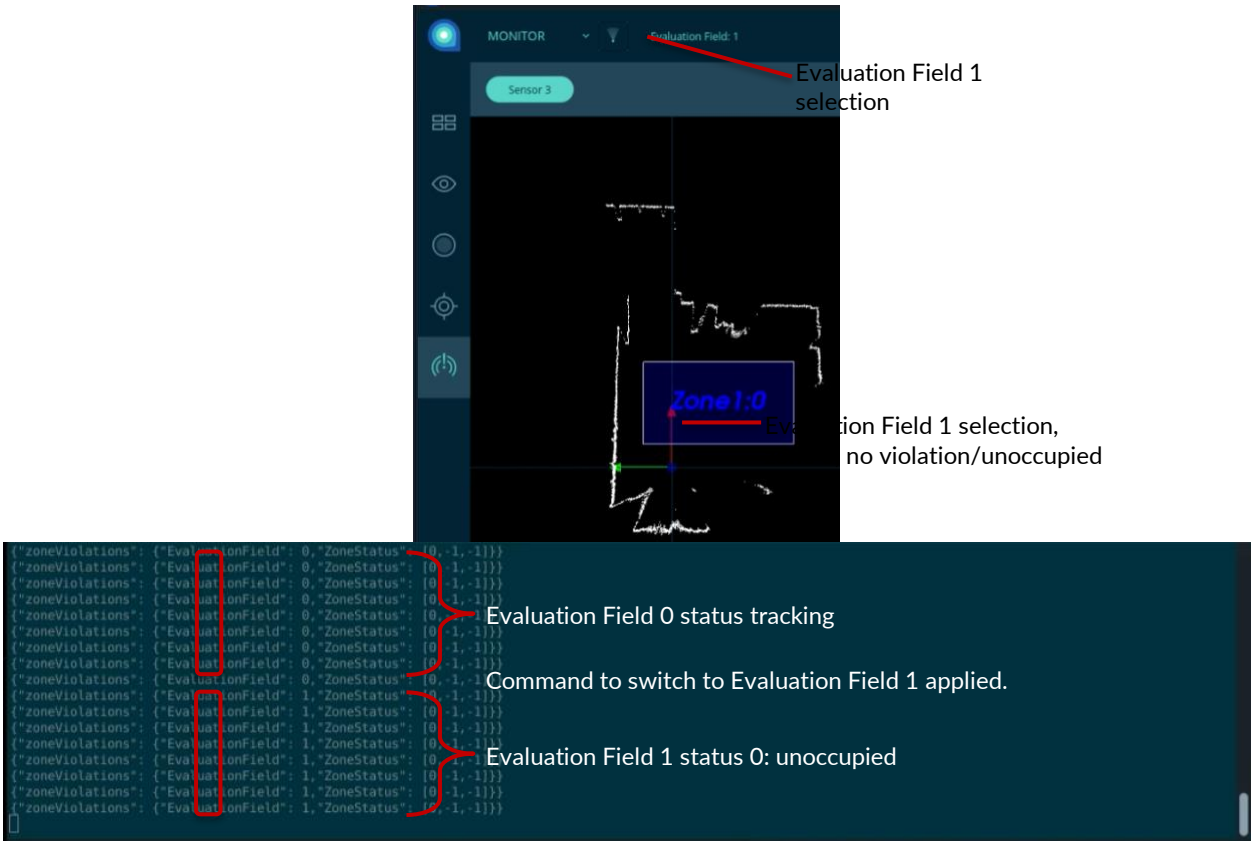


Figure 94. QORTEX Aware: Evaluation Field from Evaluation Field 0 to Evaluation Field 1

- Change to Evaluation Zone 2 using Qortex Aware JSON command. See *Figure 95. QORTEX Aware: JSON Command Setting Zone 2*.
- Selected Evaluation Zone Status from unoccupied to occupied. Both Q-View > QORTEX Aware tab view and CLI view. See *Figure 96. QORTEX Aware: Zone 2 Status Change from Unoccupied to Occupied*.

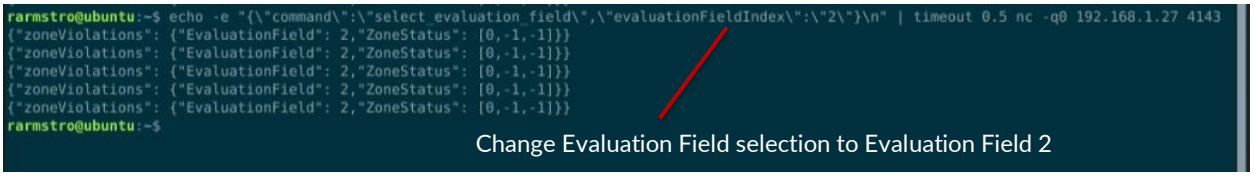
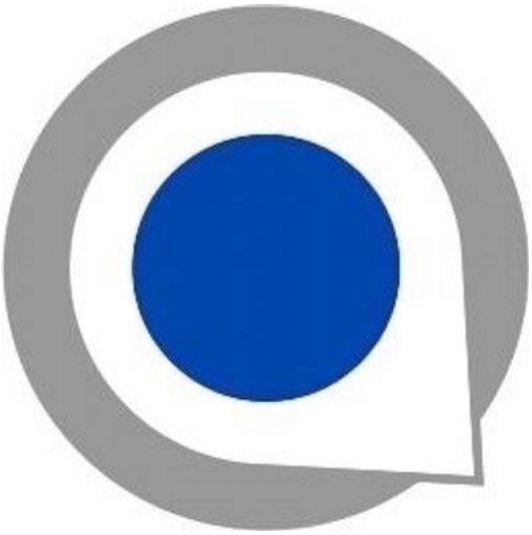


Figure 95. QORTEX Aware: JSON Command Setting Zone 2

Figure 96. QORTEX Aware: Zone 2 Status Change from Unoccupied to Occupied

Q-View User Guide



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