

QORTEX™ DTC 2.4 for Q-Track User Guide

Q-Track



Notices

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Revision History

Version	Date	What Changed	Change Location
A	08/09/18	Released to support QORTEX DTC 2.0 version Beta 1.	
B	03/28/19	Released to support QORTEX DTC 2.0 version Beta 2.	
		Changed title and software name of Q-Guard to QORTEX DTC 1.x.	Notices (2)
		ROS, RViz, Continuous Recording, and Terminating Processes.	Sections removed.
		Installation and licensing	LiDAR Sensor Prerequisites (29), Environment Prerequisites (28), Install QORTEX DTC Client Software (42), Managing the License (44), Download QORTEX DTC Server Software and Documents (35)
		Start, stop, and interface	Getting Started (20), Starting and Stopping QORTEX DTC (55), QORTEX DTC Client Interface (75)
		Using Qortex DTC	Visualizing Data (115), View Recorded (PLAYBACK) Data (155), Recording Data (152), and Troubleshooting (159)
		API	Error! Reference source not found. (19)
C	07/19/19	Released to support QORTEX DTC 2.0 version Beta 3.	
		QSPU mini	Content removed
		QPU	Content removed version N
		Zone import, Zone create	Establishing Zone and Counter Lines (107)
		gRPC API	Error! Reference source not found. (19)
D	02/20/20	Released to support QORTEX DTC 2.0, feature complete version.	
		Installation and licensing	Updated: Contact (2), LiDAR Sensor Prerequisites (29), Object and Capacity Specifications (24), Installing QORTEX DTC Server and Client (35), QORTEX DTC Client Host Computer (32), Download QORTEX DTC Server Software and Documents (35), Managing the License (44) New: Table 2. QORTEX DTC Server Specifications

Version	Date	What Changed	Change Location
		Start, stop, and interface, viewing controls	Getting Started (20), Start the Server Daemon Service the First Time (55), QORTEX DTC Client Interface (75)
		Using Qortex DTC, zones, zone widgets, sensor settings, playback, refresh tracks	View Recorded (PLAYBACK) Data (155), Establishing Zone and Counter Lines (107), Sensor Health Status Options (104), Visibility Menu (83), Visualize Playback Data in Loopback Mode (156), Refresh Tracks (157)
		Troubleshooting and status	Troubleshooting (159), Status and Error Messages (161), Error! Reference source not found. (179), Settings File Error (160)
		API, parameters, Cartesian reference	Error! Reference source not found. (174), and Error! Reference source not found. (183), Cartesian Coordinate System (189)
E	08/20/20	Released to support QORTEX DTC 2.0 with Q-Track sensors.	
		VMS plug-in, Essentials license, and primary sensor.	Content removed
		New feature reference	QORTEX DTC Fast Track (188), Automated Handover ID (173)
		API, parameters, Cartesian reference	Error! Reference source not found. (174), and Error! Reference source not found. (183), Cartesian Coordinate System (189)
F	10/07/20	Released to support QORTEX DTC 2.0 with client on Linux.	
		Install on Ubuntu	Install on Ubuntu (43), Install or Update QORTEX DTC with a Debian Package (39)
		Start, Stop client	Start the Client on an Ubuntu Host (58), Stop the Client (60)
		Client grid cell, object list	Grid Cell (121), Error! Reference source not found. (175)
G	12/29/20	Release to support QORTEX DTC 2.1 Beta.	
		Install, Ubuntu 20.04, license PTZ camera and rules, TCP publishing	Installing QORTEX DTC Server and Client (35), Managing the License (44), TCP Publishing Format (93), Environment Prerequisites (28), QORTEX DTC Client Host Computer (32)
		PTZ cameras	Adding PTZ Cameras (126)

Version	Date	What Changed	Change Location
		Rules recording, PTZ cameras, network actions	Adding Rules (142)
		Event zone sector options	Add a Zone (109)
		Recording in PTZ camera video	Recording Data (152)
		gRPC APIs for PTZ camera	Error! Reference source not found. (183)
		Guide restructure	Merged Prerequisites with Preparing chapter. Moved visualization tasks from Client to Visualization chapter. Created chapters for Configuration, Sensors, PTZ cameras, Recording, and Rules. Applied new template.
H	03/19/21	Release QORTEX DTC 2.1.	
		Added to gRPC API descriptions for PTZ camera and rules.	Error! Reference source not found. (183)
		Added Docker server installation.	Install QORTEX DTC in a Docker Container (40)
		Added to supported cameras: AXIS Q6115-E PTZ Network Camera	Supported PTZ Cameras (126), Prepare the PTZ Camera (127)
		Updated sections.	Calibrate a PTZ Camera (129), Set PTZ Camera Home Location (135), Sort Rule Priority (151)
I	4/20/21	Rolling update release QORTEX DTC 2.1	
		Add camera support: Hikvision DS-2DF8336IV-AEL, Bosch AUTODOME IP starlight 5000i.	Supported PTZ Cameras (126)
		Add visualization button: Grid Cell, Grid Area.	Visualizer Controls (82), Grid Cell (121), Grid Area (122)
		Updated section.	Start the Client on an Ubuntu Host (57)
I	5/12/21	Rolling update release QORTEX DTC 2.1	
		Add camera support: Hikvision DS-2DE5225IW-AE, Bosch MIC IP starlight 7100i.	Supported PTZ Cameras (126)
		Add camera following distance.	Add PTZ Camera Field of View (134)
J	5/24/21	Release QORTEX DTC 2.1.	
		Add Bosch firmware requirement.	Supported PTZ Cameras (126)
		Edited port number and added note for left vs right handed coordinates.	Error! Reference source not found. (175), Cartesian Coordinate System (171)
		QORTEX DTC 2.2 Beta.	

Version	Date	What Changed	Change Location
K Beta	06/12/21	Update overview	QORTEX DTC 2.4 Improvements (21)
		Added Basic Settings, a subset of Advanced Settings.	Adjust Sensor Settings (97), Error! Reference source not found. (189)
		PTZ time switching	Add Object Stitching Rule (145), Error! Reference source not found. (189)
		Tracking objects through PTZ cameras.	Add PTZ Camera (147)
		Object trail line in Visualizer.	Central Visualizer Window Elements (78)
		Vehicle subcategories.	Activate a License (46), Central Visualizer Window Elements (78), Object and Capacity Specifications (24), Error! Reference source not found. (175)
		Glass reflection. Exclusion zone by sensor.	Enable Exclusion Zones by Sensor (114)
		Recording folder labels use UTC.	Specify Recording Settings (152)
K Beta 2	09/11/21	QORTEX DTC 2.2 Beta 2.	
		Update overview	QORTEX DTC 2.4 Improvements (21), Process Setup Overview (24)
		Vehicle sub-class definitions.	Visualizer Sub-Vehicles (81)
		New object colors.	Central Visualizer Window Elements (78)
		Scheduling Rules.	Add Network Actions Rule (143), Add Recording Rule (146), Add PTZ Camera Automatic Tracking Rule (147)
		Cybersecurity.	Security Mode (63), Enter Configuration Mode (86), Process Setup Overview (24), Start the Client on a Windows Host (57), Start the Client on an Ubuntu Host (58), Configuration Mode Options (85), Add Network Action Rules (143), Automated Handover ID (188)
		secure.vault	Start the Server Daemon Service the First Time (55), Create User for Security Mode (63)
		Inclusion zones.	Establishing Zone and Counter Lines (107), Process Setup Overview (24), Visualizer Controls (82), Configuration Mode Options (85)

Version	Date	What Changed	Change Location
		TCP messages.	Encrypted TCP Port Messages (185)
		Settings with sensor calibration updates.	Add or Update Multiple Sensors at a Location (90)
		Zone widgets.	Common Zone/Counter Line Widgets (112)
		Zone editing.	Edit a Zone (110)
		Re-calibration keep existing zone and camera configuration.	Add or Update Multiple Sensors at a Location (90)
		Unknown PTZ camera custom settings.	Edit PTZ Camera Custom Settings (136)
		Automated ID Handling.	Working with Secure Mode Functionalities (196)
		Beta Only Configuration.	Download QORTEX DTC Server Software and Documents (35), Install QORTEX DTC Client Software (42)
K	11/05/21	QORTEX DTC 2.2 Release	
		Download and install QORTEX DTC	Download QORTEX DTC Server Software and Documents (35), Install QORTEX DTC Client Software (42)
		Cybersecurity API	Error! Reference source not found. (189), Error! Reference source not found. (189)
		TCP Listener update	Error! Reference source not found. (189)
		User log	Table 20. User Log Statements
		Edit zone options	Edit a Zone (110)
		Simultaneous objects	Object and Capacity Specifications (24)
		Automated Handover update	Automated Handover ID (188)
L	03/02/22	QORTEX DTC 2.2 update	
		Added product release updates	21QORTEX DTC 2.4 Improvements (21)
		Quanergy download links updated to https	Documentation (27), Installing QORTEX DTC Server and Client (35)
		Clarification Automated Handover ID compatibility	Port Versioning Parameter (194), Working with Secure Mode Functionalities (196)
M	07/05/22	QORTEX DTC 2.2.1 update	

Version	Date	What Changed	Change Location
		QORTEX DTC server IP address alias	Automated Handover ID > Configuration (191)
		AIDH server failure resilience	Automated Handover ID (188)
N	09/20/22	QORTEX DTC 2.3 update	
	10/27/22	IPv6 support	Environment Prerequisites (28), Locate IP Address of Linux Host (32), Locate IP Address for Windows Host (33), Start the Client on a Windows Host (57), Start the Client on an Ubuntu Host (58), Login to Client for the First Time (58), Connect the Client to the Server (60), Add Single-Sensor to a Location (89), Add or Update Multiple Sensors at a Location (90)
		Ubuntu 20.04 support	QORTEX DTC Server Host Computer , (31) Install on Ubuntu (43)
		HTTP API updates	Error! Reference source not found. (262)
		Removed support for QPU-L7 and QSPU servers.	Object and Capacity Specifications (24), QORTEX DTC Server Host Computer (31)
		Sensor anti-masking detection.	Advanced Setting: Anti-Masking Detector Settings (99), Server TCP Ports to Monitor (93), Error! Reference source not found.
		FLIR Systems Saros DQ-Track PTZ Camera support	Supported PTZ Cameras (126)
		Set world coordinate axis for system	Visualizer Controls (82), Figure 39. Client Bottom Bar, World Coordinate Point Cloud Alignment , (116)
		PointCloud grid view camera controls 3D.	Table 6. Visualizer Elements and Colors
		Trackable object updates.	
		CounterLine feature	Establishing Zone and Counter Lines (107), Error! Reference source not found. (201)
		Classification types in zones	Error! Reference source not found. (178)
		Object Stitching. Detect trackable IDs and merge duplicates.	Error! Reference source not found. (227), Add Object Stitching Rule (145)
		Advanced settings updates.	

Version	Date	What Changed	Change Location
		Movement threshold setting for trackable objects.	<u>Advanced Setting: Movement Threshold Filter</u> (100)
		ML SubVehicle classification method.	<u>Advanced Setting: SubVehicle Classification Method</u> (101)
		Vehicle forking/splitting.	<u>Advanced Setting: Object Forking and Splitting Parameters</u> (102)
		Stationary vehicles bouncing.	<u>Advanced Setting: Stabilize Stationary Vehicles Settings</u> (103)
		Fusing point clouds.	<u>Advanced Setting: Fuse Point Cloud Pipeline Settings</u> (103)
		TCP updates.	
		NDJSON support	TCP Publishing Format93(), Error! Reference source not found. (207)
		View TCP publishing settings	<u>Edit TCP Port Publishing Settings</u> (94), <u>Adjust Sensor Settings</u> (97)
		Security and user management.	
		Multiple user types: viewer, editor, admin, credentials formats	<u>User Management</u> (69)
		Add, Edit, Delete, Disable, Enable users and user credentials	<u>Login to Client for the First Time</u> (58), <u>Create New Users</u> (70), <u>Change Usernames and Roles</u> (73), <u>Disable and Enable Users</u> (73), <u>Delete Users</u> (74)
		Enable/Disable security user credentials	<u>Change User Credentials for Security Mode</u> (66), <u>Turn Security Mode On or Off</u> (64), <u>Set User Password Expiry</u> (70)
		Credential recovery	<u>Recover Admin Credentials with Security Mode Enabled</u> (74)
		Log file updates.	
		Log file access. User activity log retention.	User Activity Log (164), Logs and Configuration Files (164)
		Add timestamp to unique object ID.	Visibility: Zones/Lines and Object ID (118)
		Logging rotation, roll active log file to a new file.	Log File Rotation (166)
		Zip file used for downloading user access log files	<u>Download User Log Files</u> (164)
		Download log files through API	Error! Reference source not found. (242)

Version	Date	What Changed	Change Location
P	12/08/24	Rename QORTEX DTC to QORTEX Q-Track DTC	
		Moved API appendices to new book, <i>Qortex DTC API Reference</i> .	

Text Styles

In this guide certain fonts are applied to provide a visual means to interpret text. See [Table 1. Text Styles and Meanings](#).

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.
<i>Italic underline</i>	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.
<i>Italic</i>	Identifies book or section titles. Provides emphasis for terms or ideas. Also identifies options for selecting from a menu, entering in a field, or replacing in a command string.
<i>Code italic</i>	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.
<div style="border: 1px solid black; padding: 2px;">Text in box</div>	Notes and Tips. Useful related information. Format used to call attention to the content or to describe side-bar content.
<div style="border: 2px solid blue; padding: 5px; display: inline-block;">Text in box</div>	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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1. Getting Started

QORTEX DTC™ 2.4 for Q-Track is the software portion of a LiDAR-based solution that provides three-dimensional perception and volumetric sensing. This system detects, tracks, and classifies (DTC) person and vehicle objects to:

- Accurately locates objects to be tracked uniquely in real time.
- Customize Event zones with flexible commands.

With data intelligence and centimeter-level accuracy, QORTEX DTC provides a cost-effective solution enabling Internet of Things (IoT) applications in different sectors, such as security and smart cities and spaces with interests in monitoring traffic and crowd flow and perimeter intrusion.

QORTEX DTC 2.4 Improvements

QORTEX DTC 2.4 added and improved the following features:

- Support for Q-Track sensors: Q-Track LR, Q-Track HD, Q-Track Dome

Unique Features

Q-Track is a solution that includes both Quanergy LiDAR Q-Track sensors and QORTEX DTC software.

This solution accomplishes its demanding goals through the following features:

- **Extended Detection Range in Real-Time.** Q-Track sensors can continuously track static and moving objects accurately and in real time within a 20-meter, 40-meter, or 70-meter radius depending on the Q-Track sensor selected.
- **Classification of Shape Data.** The sensor produces surveillance data the host computer collects, records, visualizes, analyzes, classifies, and outputs to an Object List. This list provides a basis for further action outside of QORTEX DTC, such as the notification of external alarm systems via LAN, TCP, UDP, and HTTP GET.
- **Persistence in Tracking.** The commercial-grade, static LiDAR visualization system senses and displays the movement of objects over time, persisting even through blockages and crowd gaps. This gives users the ability to track and record the historical movements of potential threats.
- **Resilience in Suboptimal Conditions.** The sensor is designed for use indoors and outdoors and in bright or dark conditions, with no infrared signature needed. It also withstands extreme weather, from bitter cold to baking sun, with complete ingress protection from mist, rain, snow, and dust.

- **Fault Tolerance, with Automatic Reconnect.** Designed for persistence, the QORTEX DTC server recovers persistently, since it runs as a daemon service. If a sensor disconnects from a server, the server sends a notification of the event, continues to run with the remaining connected sensors, and auto-reconnects with the sensor without reboot. The QORTEX DTC client also automatically resumes in Monitor mode after restart, with 3D visualization restored.
- **Configurable.** The Q-Track LR sensor can be configured through the web server to adjust the frame rate from 5 to 20 hertz, with single or multiple (up to 3) returns. We strongly recommend that you set the sensor to single return mode when using it with QORTEX DTC. The field of view is adjustable when less than a full 360° and is preferred.

Configure sensors using the Sensor Settings Management application (webserver) built into the sensor. See *Managing the Sensor* in your sensor-specific user guide. Request the sensor user guide from support@quanergy.com.

The Q-Track HD and Q-Track Dome sensors do not have a web server and do not support multiple returns. Use Q-View to configure them.

- **Leverage Q-View Calibration.** Q-View™ is the Quanergy sensor discovery and management toolkit, which calibrates multiple sensors into the same space and outputs the resulting `transform_alignment.xml` file. QORTEX DTC takes the output file and aligns the overlapping vision of multiple sensors into an enriched Multi-LiDAR Fusion view.
- **Enhances Legacy Systems.** QORTEX DTC reduces or eliminates false positive threats and dramatically boosts the surveillance effectiveness of the Video Management Systems (VMS) by measuring and providing exact 3D coordinates of people.

System Architecture

The QORTEX DTC for Q-Track system architecture deploys in a simple distributed scenario that includes the QORTEX DTC server and a QORTEX DTC client or third-party application to consume the server output.

- The server software interfaces with statically installed LiDAR sensors and produces output to your own network infrastructure, including a real-time list of tracked objects accessed through the QORTEX API. See *QORTEX Q-Track API Reference*. Configuration and control of the server software are achieved through the client interface and/or the gRPC API. See *QORTEX Q-Track API Reference*. The gRPC API can be used to develop a customized client-user interface.
- The client software enables control and creation of a location (area of interest), with visualization of the corresponding server output point cloud, detected objects, tracks, classification, and zones. Any number of potential third-party host infrastructure applications may subscribe to published data stream outputs for surveillance or visualization. See *QORTEX Q-Track API Reference*.

The QORTEX DTC solution blocks of functionality are shown in *Figure 1. QORTEX DTC System Architecture Overview*. LiDAR sensors that integrate into an existing deployment might be able to leverage that existing power and communication infrastructure, if compatible.

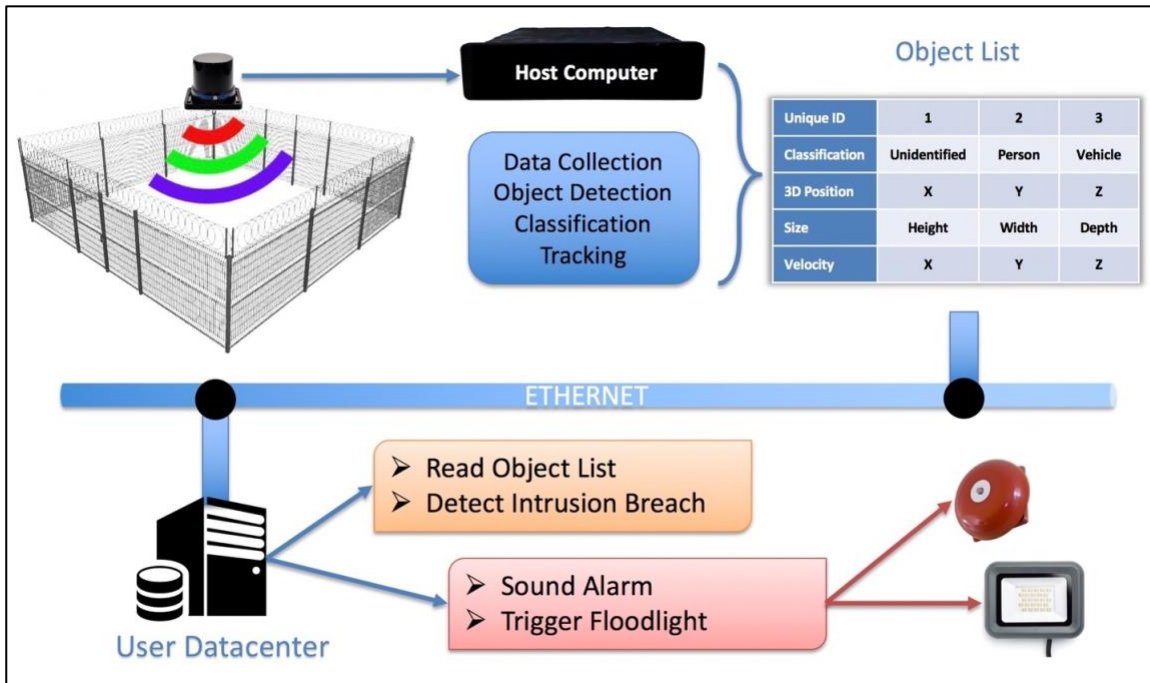


Figure 1. QORTEX DTC System Architecture Overview

System Components

To use Quanergy QORTEX DTC for monitoring objects in a location requires:

- Physical site installation of the sensors. See the sensor User Guides.
- Computers meeting defined requirements for software installation of QORTEX DTC server, and QORTEX DTC client. See *Preparing the Computing Environment* (page 28).
- Software configuration:
 - **License Manager.** See *Managing the License* (page 44).
 - **Sensor Settings Management** application (web server). See the sensor user guides. Request the sensor user guide from support@quanergy.com.
 - **Q-View.** See the *Q-View User Guide*. Download from <https://downloads.quanergy.com/>.
 - **QORTEX DTC Server.** See *Download QORTEX DTC Server Software and Documents* (page 35).
 - **QORTEX DTC Client.** See *Install QORTEX DTC Client Software* (page 42).
- All the sensors, PTZ cameras, and QORTEX DTC running on a single Ethernet network.

Supported Quanergy Sensors

- Q-Track sensor family: Q-Track LR, Q-Track HD, Q-Track Dome

Object and Capacity Specifications

Table 2. QORTEX DTC Server Specifications lists the scope and range specifications for QORTEX support.

Table 2. QORTEX DTC Server Specifications

Parameter	Specification
Object Information	Provides an object list with 3D direction and position, velocity, and classification in Protobuf, JSON, NDJSON, or XML formats
Classification Types	Human, Vehicle, Unknown Additional SubVehicle licensing adds: TWOWHEELER_VEHICLE, PASSENGER_VEHICLE, COMMERCIAL_VEHICLE
Continuous Tracking Range	Q-Track LR sensors: 140 meters (70-meter radius) Q-Track HD sensors: 80 meters (40-meter radius) Q-Track Dome sensors: 40 meters (20-meter radius)
Number of Simultaneous Objects	Depends on the QORTEX DTC server and sensors.
Video Management System (VMS) Compatibility	Most major VMSs such as Milestone XProtect®, and Genetec™ Security Center, Hanwha Wave, Network Optix, Mirasys, Flir Latitude, Salient, Digifort, Surveill, and many more.
Cameras	PTZ: no hard limit, up to 5 cameras tested

Process Setup Overview

To visualize and track objects in a space requires the following setup.

1. Complete installation of the sensors, QORTEX DTC server and QORTEX DTC client on a single Ethernet network. See *Preparing the Computing Environment* (page 28) and *Installing QORTEX DTC Server and Client* (page 35).
2. Verify licenses for PTZ camera and Rules.
 - To add PTZ cameras, check the licensing includes optional item: Number of **PTZ Cameras**: 1 or more.
 - To define Rules for PTZ Camera, Network Actions, or automatic Recording, check the license file includes optional item: **Add-Ons**: Rules

Check the licensing by logging into the license server or viewing the licensing details through the activated QORTEX DTC server. See *Managing the License* (page 44).

3. Start the QORTEX DTC server and the QORTEX DTC client. Then connect the client to the server. See *Starting and Stopping QORTEX DTC* (page 55).
4. Understand the QORTEX DTC client elements. See *QORTEX DTC Client Interface* (page 75).
5. On first time login to Qortex DTC client, create `Admin` user.
6. Enter **Configuration** mode. See *Entering Configuration Mode* (page 85).

Optionally, view and verify **TCP Publishing** file format and port settings for object lists, sensor health state, and zone lists, and optionally change **Add Data Size** or **Network Byte Order** settings.

7. Optionally, add users and enable **Security** mode. See *Security Mode* (63).
8. **Add sensors** to the QORTEX DTC server. See *Adding Sensors* (page 88).

The server can be configured to receive data from either a single sensor or multiple sensors for a single location. Sensors must be calibrated before they can be added to a server. Use Q-View to calibrate multiple sensors. Download the *Q-View User Guide* from <https://downloads.quanergy.com/>.

9. Optionally, add, calibrate, and configure **PTZ cameras** through the QORTEX DTC client. See *Adding PTZ Cameras* (page 126).

A specific PTZ camera license is required to add PTZ cameras. Calibrate PTZ cameras to align with the sensors to track objects. Configure PTZ camera Field of View (FOV) to help determine the camera coverage area. When idle, PTZ cameras can be used by other applications. Define the PTZ camera Home Location, to which it returns when idle.

Objects assigned an ID from sensors and in a PTZ Camera FOV at a location, can be tracked automatically using Rules or manually if selected through the PTZ camera icon in the Visualizer.

10. Optionally, add **Inclusion zones** with data displaying in the **Visualizer**. See *Establishing Zone* and Counter Lines (page 107).

If added, QORTEX DTC only monitors the area designated by the Inclusion zone, rather than the entire coverage area.

In the Visualizer create a polygon shape cover the area to track. Adjust the Z Height minimum (min Z) and maximum (Max Z) for vertical scanning.

11. Add **Event zones** with data displaying in the **Visualizer**. See *Establishing Zone* and Counter Lines (page 107).

In the Visualizer create a polygon shape cover the area to track. Adjust the Z Height minimum (min Z) and maximum (Max Z) for vertical scanning.

The sensors and PTZ camera follow objects per the rules set for the Event zone.

12. Add **Exclusion zones**, with data displaying in the **Visualizer**. See [Establishing Zone](#) and Counter Lines (page 107).

In the Visualizer create a polygon shape cover the area to exclude from tracking. Adjust the Z Height minimum (min Z) and maximum (Max Z) for vertical scanning.

The sensors and PTZ camera *do not* follow in the Exclusion zones. Objects in the Exclusion zone are ignored.

13. Add **Counter Lines**, with data displaying in the **Visualizer**. See [Establishing Zone](#) and Counter Lines (page 107).

In the Visualizer draw a line to cover a threshold. Set the direction to track objects crossing the counter line as left/right or in/out.

14. View the data in the QORTEX DTC client Visualizer. See [Visualizing Data](#) (page 115).

15. Add **Rules** to track objects. See [Adding Rules](#) (page 142).

If the Rules tab is grayed out, verify and update licenses. Licensing **Add-Ons** field must state **Rules**. See [Adding Rules](#) (page 142) to create a rule.

Event Rules – Types include:

- **PTZ Camera rule.** A PTZ camera rule causes the PTZ camera to follow a selected object. The PTZ camera time switching option enables the PTZ camera to switch between tracking of objects over time. These rules override Rule-based Zone priorities. See [Add PTZ Camera Automatic Tracking Rule](#) (page 147).
- **Network Action rule.** A network action rule sends a message each time a selected object class (Any, Human, Vehicle, Human and Vehicle, or Unknown) enters or exits the selected area. See [Add Network Actions Rule](#) (page 143).
- **Recording rule.** Automatically start recording the Visualizer raw sensor data per Rule settings. Stop recording per Rule settings, plus one (1) minute buffer. This step is for recording data when a rule is triggered. See [Add Recording Rule](#) (page 146).

16. Optionally, select **Recording** options. See [Recording Data](#) (page 152).

- **Automatic Recording.** In **Configuration** panel > **Rules** tab > **Record**, toggle to **ON** to enable event recording. Recordings are triggered only when QORTEX DTC client is in **LIVE** mode.
- **Manual Recording.** In **Configuration** panel > **Rules** tab > **Record**, toggle to **OFF**. Click **RECORD** button in top right Visualizer. Recording continues until you manually stop. Click the **RECORD** button again. While manually recording, the **Rules > Record** option remains disabled.
- **Playback a recording.** Toggle the **Sensor Connection** icon to **Disconnected**. Select **PLAYBACK** from the **LIVE/PLAYBACK** menu. Select a recording from the list of recordings. Click **Play** in the Player control panel.

Documentation

Table 3. Related Documents lists the latest versions of the relevant user documents and how to access them.

Table 3. Related Documents

Topic area	Guide	Access
QORTEX-specific guides	<i>QORTEX DTC 2.4 User Guide</i> <i>QORTEX DTC 2.4 Quick Start Card</i>	Download from https://downloads.quanergy.com/
Sensor management guides	<i>Q-View User Guide</i> <i>Q-View Quick Start Card</i>	Download from https://downloads.quanergy.com/
Sensor user guides for each LiDAR sensor model	<i>User Guide</i> <i>Quick Start Card</i>	Request from support@quanergy.com
Sensor datasheets	<i>Datasheets</i>	Download documents from https://quanergy.com/downloads/

2. Preparing the Computing Environment

This chapter describes the environment, sensor, and hardware requirements for installing and using QORTEX. Complete the steps described in the following sections before you install QORTEX.

Environment Prerequisites

Every location where detection, tracking, and classification needs to occur requires a QORTEX system operating with the following specifications:

- **Sensors.**

The number of sensors effectively used in the QORTEX system is affected by two variables:

- The selection of a computer for hosting the QORTEX server. See [QORTEX DTC Server Host Computer](#) (page 31).
- The scope of license purchased. See [Managing the License](#) (page 44).

- **Sensor Software.**

Sensor Web Server. For Q-Track LR only. Quanergy Sensor Settings Management application is a web server provided for each sensor that is accessed through a web browser using each sensor IP address. See your sensor specific user guide. Request the sensor user guide from support@quanergy.com.

Q-View™. Quanergy sensor management and visualization software. Provides information about the sensor network and is used to calibrate and align the sensors. Download the *Q-View User Guide* from <https://downloads.quanergy.com/>.

- **Computers.**

Host Computer. Each computer or virtual machine hosts one instance of the QORTEX DTC server software and accommodates a certain number of LiDAR sensors, depending on the host/VM specifications and capabilities. The QORTEX DTC client can be on the same computer as the QORTEX DTC server, but typically is on a separate computer.

There are a variety of options for the computer(s) hosting the server and client, as discussed in the following sections. For computer parameters and requirements see, [QORTEX DTC Server Host Computer](#) (page 32) and [QORTEX DTC Client Host Computer](#) (page 32).

Computer Accessories. A keyboard, mouse, and monitor are needed to use the client. Depending on how the server software is configured, these accessories may be required when first setting up the server. However, once the daemon service starts, the accessories will not be needed, since the server is designed to run headless.

Hard Drive. Recordings can quickly consume large amounts of memory. If recording, set up the system to prevent filling up the hard drive. If hard drive space becomes scarce, integrate an external hard drive, preferably one that easily exceeds the amount of expected data.

- **Operating System.**

QORTEX server is installed on a machine running either Windows® Server 22, Windows 10, Windows 11, or Linux® distribution of Ubuntu® 20.04. Docker images are available for additional Linux distributions.

QORTEX client is installed on typically, on a separate computer from the server, and is running either Microsoft Windows Server 22, Windows 10, Windows 11, or Ubuntu 20.04 (LTS Focal Fossa).

- **Network.**

All sensors must be on the same Ethernet subnet as the QORTEX server and client.

IPv4 and IPv6 addresses are supported.

LiDAR Sensor Prerequisites

For sensors deployed in areas where power outages occur, a backup power system is strongly advised. However, the QORTEX DTC server recovers and the client automatically resumes in Monitor mode after restart, with 3D visualization restored.

1. Understand, set up, and mount the LiDAR sensors.

- a. Ensure the sensors are on the appropriate network.

LiDAR sensors connect to the installation site local area network (LAN) via Transmission Control Protocol (TCP/IP) or User Datagram Protocol (UDP). The QORTEX DTC server and QORTEX DTC client connect to the same LAN to access the visualization and alert system.

- TCP/IP – Q-Track LR
- UDP – Q-Track HD and Q-Track Dome

- b. Set the values for **Frame Rate in Hz**, **Return Data Select**, **Scan Field** using the Sensor Settings Management application (web server).

Q-Track LR sensors run at a configurable frame rate (5-20 Hz) with a single or multiple (up to 3) returns, and their HFOV may be adjusted to less than 360° if preferred.

Q-Track HR and Q-Track Dome have a fixed frame rate and only support single returns.

See *Managing the Sensor* in your sensor-specific user guide. Request the sensor user guide from support@quanergy.com.

Note: For TCP connected sensors, Quanergy recommends selecting only one return to save on network bandwidth. When a single return is selected, a LiDAR sensor generates 20 megabits per second. When all three returns are selected, a LiDAR sensor generates close to 60 megabits per second. The single return option has no performance reduction because the object point cloud published by QORTEX DTC shows only a single return regardless.

- c. Configure object list output rate.

Adjust the parameter through the `settings.xml` file or client. See *QORTEX Q-Track API Reference*.

2. Download and install Quanergy Q-View application.

Download the Q-View executable to the planned QORTEX client host computer. Download both the Q-View executable and the *Q-View User Guide* from <https://downloads.quanergy.com/>. Choose the appropriate OS version of Q-View (Linux or Windows) for your system.

3. For a single LiDAR in the location, use the Q-View application Dashboard tab to discover and note the sensor IP address.
4. For multiple LiDARs in the location, combine the point clouds.

To set up a location from scratch, use Q-View Dashboard tab to connect to the sensors and the Calibrate tab to align their point clouds. The QORTEX client uses the calibration file (`transform_alignment.xml`) output by Q-View.

The following is a summary of the calibration task completed in Q-View. See the *Q-View User Guide*.

- a. In Q-View, select sensor to connect and calibrate.
- b. Click the (+). Initially, the **Connected** field shows 0. As Q-View completes connection, the **Connected** field shows 1 and the **Sensor** block turns **Green**.
- c. Click Q-View Calibration icon. Open folder, browse, new folder, select folder, click **Next**.
- d. Select sensor, click **Next**. Select the next sensor, click **Next**.
- e. Align sensor using +/- TRANSLATE and ROTATION panels. For example, moving **Green** to align over **White**. Click **Refine** for minor alignment. Click **Accept**.
- f. Repeat for each sensor. Click **Save** (floppy) icon.

When completed, the `transform_alignment.xml` file is created.

QORTEX DTC Server Host Computer

The QORTEX server machine can be an off-the-shelf computer can be set up and installed for use with the sensors.

- QORTEX server is installed on a machine running either Windows Server 22, Windows 10, Windows 11, or Linux® distribution of Ubuntu® 20.04. Docker images are available for additional Linux distributions.

A list of Linux Ubuntu desktops and laptops is at: <https://certification.ubuntu.com/>

- A Linux virtual machine (VM).

VMware ESXi 6.5 is the recommended VM. Other VM options are listed at:

<https://www.digitaltrends.com/computing/best-virtual-machine-apps-for-mac-linux-and-windows-pcs/>

- For Docker container, install the Docker engine on the Linux host machine.

<https://docs.docker.com/engine/install/ubuntu/>

The recommended maximum number of sensors the hardware can support. This is not a hard limit. The actual number depends on the number of objects being tracked and the overlap between sensors. Depends on the QORTEX DTC server and sensors. For example:

- Small server, 1-4 sensors
- Medium server, 6-10 sensors
- Larger server, 12-18 sensors

Table 4. Minimum Specifications for PC Desktop or Laptop Hosting Server lists specification recommendations for running a single instance of QORTEX DTC server on the PC.

Table 4. Minimum Specifications for PC Desktop or Laptop Hosting Server

System	Parameter	Specification
Hardware	Central Processing Unit (CPU)	Intel Core i3, Gigabit Ethernet. Must support AVX2. Q-Track LR sensor: 2 + 1 virtual core Q-Track HR sensor: 2 + 2 virtual cores Q-Track Dome sensor: 2 + 2 virtual cores
	Random Access Memory (RAM)	4 GB
	Storage Memory (no recording)	100 MB (QORTEX DTC needs < 1 GB drive space for installation.)
	Recording Storage Requirement	150 MB/sensor/min (single return mode)
Ethernet	Network Ports	Local Area Network (LAN) / Wide Area Network (WAN)
Software	Operating System	Windows Server 22 or Ubuntu 20.04 LTS

QORTEX DTC Client Host Computer

An off-the-shelf computing solution, such as a PC or laptop, can host the QORTEX DTC client software.

For best results, make sure the client host computer complies with the minimum PC specifications. See [Table 5. Minimum Specifications for PC Desktop or Laptop Hosting Client](#).

Table 5. Minimum Specifications for PC Desktop or Laptop Hosting Client

System	Parameter	Specification
Hardware	Central Processing Unit (CPU)	Intel Core i3, Gigabit Ethernet Must support AVX2.
	Random Access Memory (RAM)	4 GB
	Installation Drive Space	> 1 GB for the client Software
Ethernet	Network Ports	Local Area Network (LAN) / Wide Area Network (WAN)
Software	Operating System	Windows 10, Windows 11, or Ubuntu 20.04 LTS
Graphics	Graphics Card	OpenGL-compliant card such as GeForce 8800 or Radeon 4770
Display	Resolution Support	1024x768, 1280x800, 1280x1024, 1366x864, 1440x900, 1600x900, 1920x1080, 2048x1536, 2560x1440, 3840x2160, 4096x2160


Connect and Start the Host Computers

Before launching the software, all hardware components must be in place. Connect the computers hosting the QORTEX DTC server and the QORTEX DTC client to power, accessories, sensors, and the network, as follows:

1. Connect the host computer to a power source.
2. If it doesn't turn on automatically, turn on the power button for the host computer.
3. Connect user-supplied accessories (keyboard, mouse, monitor) to USB/HDMI/VGA inputs, or log in remotely.
4. Log or write down the IP address of the host computer for later use.

Locate IP Address of Linux Host

For the Linux computer hosting the server. See [Figure 2. Discover Linux Host Computer IP Address](#).

1. On the menu bar of the Ubuntu desktop, click the **Network Manager**  menu, and select **Wired Connection**.

2. Write down the host computer **IPv4 IP address** as listed in the pop-up **Wired** window here: _____ . QORTEX DTC supports both IPv4 and IPv6 IP addresses.
3. Click **Cancel**, as you are not making any changes.

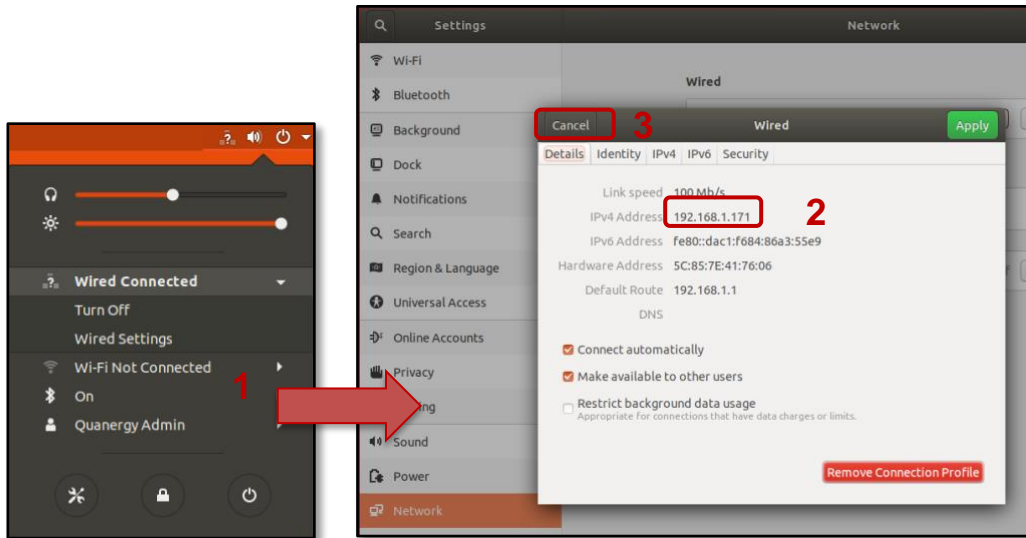




Figure 2. Discover Linux Host Computer IP Address

Locate IP Address for Windows Host

For the Windows computer hosting the client. See [Figure 3. Discover Windows Host Computer IP Address](#).

1. Click the **Internet Access** icon  in the bottom right task bar.
2. Select the **Properties** link from the pop-up.
3. In the window that appears, scroll down to **IPv4 address**.
4. Write down the host computer IPv4 address here: _____. QORTEX DTC supports both IPv4 and IPv6 IP addresses.
5. Click **Copy**, then exit the **Settings** page click the return  arrow. Close the network dialog.

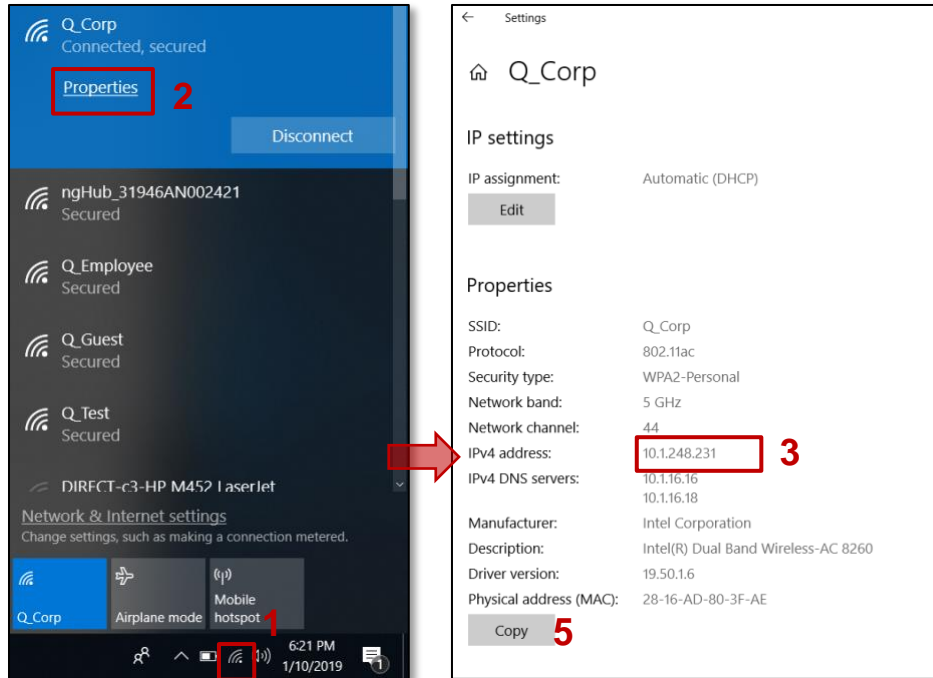


Figure 3. Discover Windows Host Computer IP Address


3. Installing QORTEX DTC Server and Client

After implementing the hardware and connecting it to the same Ethernet subnet, remove the old software (if necessary), download the latest software, and install the downloaded software through the Quanergy Download Center.

For user-supplied host computers, virtual machines, or Docker containers, acquire the QORTEX DTC server and client applications, as well as relevant documents, and follow the procedures in the following subsections.

Download QORTEX DTC Server Software and Documents

Download the QORTEX for Q-Track server software and documents.

1. Login to a machine to download the QORTEX DTC installer. This is typically the QORTEX DTC host machine.
2. In an Internet browser, navigate to the Quanergy Download Center (<https://downloads.quanergy.com/>), and click the QORTEX DTC icon  at the top of the page or scroll to the QORTEX DTC section. See *Figure 4. Quanergy Qortex DTC Server and Client Download Path*.

3. Download the documentation.

In the Quanergy Download Center, click links to the QORTEX user. For example, download the *QORTEX DTC 2.4 User Guide* and *QORTEX DTC 2.4 Quick Start Card*.

4. Enable the download links.
 - a. Click the **End User Software License Terms** link, read it, return to the Quanergy Download Center.
 - b. Check the **To download software, please agree to the End User Software License Term** box.
5. Open the QORTEX DTC server download page for your operating system.

From the QORTEX DTC 2.4 section of the Quanergy Download Center, click the **Qortex DTC 2.4 Server** link for your operating system. This opens the download page.

The QORTEX DTC `/linux` and `/windows` download pages lists the current QORTEX DTC 2.4 server software installation packages for both the QORTEX server and QORTEX client.

Ubuntu and Docker downloads are on the same page. Optionally read the `qortex_readme.txt` or `qortex_server_docker_readme.txt`.

downloads.quanergy.com

Quanergy Download Center

Welcome to the Quanergy Download Center where you can download software, technical documentation and support materials for Quanergy LiDAR sensors and smart sensing solutions.

Q-VIEW Q-TRACK QORTEX

QORTEX DTC™

QORTEX DTC is a LiDAR-based solution that provides 3D perception and volumetric sensing. This innovative technology enables detection, tracking and classification of 3D vehicles and human-sized objects in real-time.

Server: [Ubuntu](#) [Docker](#) [Windows](#) **5**

Client: [Ubuntu](#) [Windows](#)

4 To download software, please agree to the [End User Software License Terms](#)

3 [User Guide](#)
Quick Start Card: [Ubuntu](#) [Windows](#)
[Acknowledgments](#)

1 [Older Releases](#)

Index of /qortex/linux

Name	Last modified	Size	Description
Parent Directory	-	-	-
qortex-client_2.3.688_amd64.deb	2024-04-01 08:27	65M	
qortex-server_2.3.1129_amd64.deb	2024-04-01 08:27	41M	
qortex-server_2.3.1129_docker.tar.gz	2024-04-01 08:28	226M	
qortex_readme.txt	2024-04-01 08:28	2.9K	
qortex_server_docker_readme.txt	2024-04-01 08:28	2.9K	
settings.xml	2024-04-01 08:28	66K	

Index of /qortex/windows

Name	Last modified	Size	Description
Parent Directory	-	-	-
qortex-client-2.3.688-win64.exe	2024-04-01 08:28	49M	
qortex-server-2.3.1129-win64.exe	2024-04-01 08:28	17M	

Apache/2.4.41 (Ubuntu) Server at downloads.quanergy.com Port 443

Figure 4. Quanergy Qortex DTC Server and Client Download Path

Installing on Windows

Before starting the install package make sure you do not have QORTEX DTC Server running already as system service.

Windows Installation Wizard

1. From your Windows machine, click the **QORTEX DTC 2.4 server** executable.
2. If you did not select to run the installer as admin, elevate the installer execution to Admin level. At the **Do you want to allow this app to make changes to your device** prompt, click **Yes**.
3. On the Welcome page, read the note, then click **Next**.
4. On the License Agreement page, read the License Agreement, then click **I Agree**.
5. Choose Install Location page. Do not change the destination folder unless you have a reason. Click **Next**.
6. Select a Start Menu Folder. Optionally, click **Do not create shortcuts**. Click **Next**.
7. If the Choose Component page is displayed, select **bundle**. Click **Install**.
8. Monitor installation progress. Optionally, click **Show details**. No other action is needed.
9. At the Completing qortex-server Setup page, click **Finish**.

Allowing TCP ports

QORTEX DTC server uses a set of TCP ports. Make sure these ports are not taken on the Q-Track QORTEX DTC server host system:

- 8080 HTTP ALTERNATIVE
- 17172 QORTEX_ZONE_LIST
- 17168 SENSOR_HEALTH_STATE
- 17175 CONFIGURATION_CLIENT_DATA
- 17176 MONITOR_CLIENT_DATA

To list the programs that use ports in the Windows system. Open a command console and type:

```
netstat -a -b
```

Make sure none of the above ports used before you start Q-Track QORTEX DTC server. Contact your local system administrator, if needed to confirm, allow, or disallow port allocation.

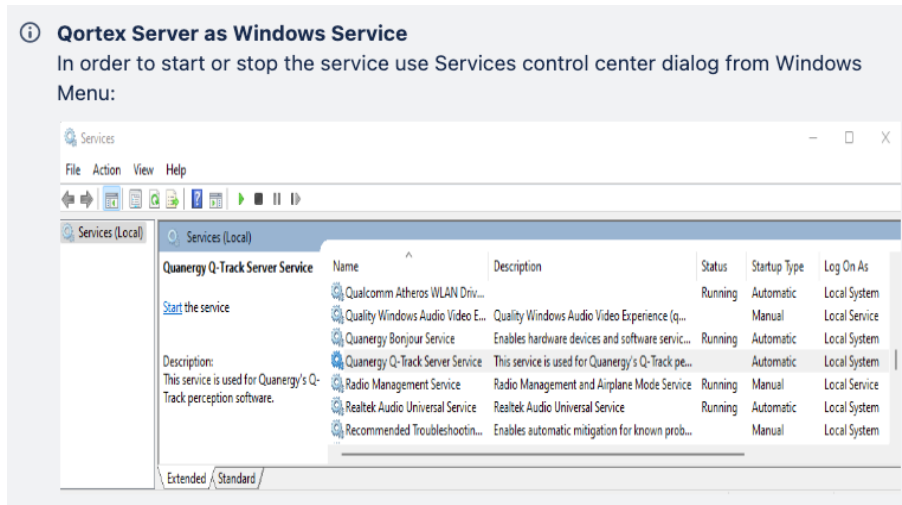


Figure 5. Windows Service list of QORTEX Server Services

Installing on Linux

1. From the QORTEX DTC server download page:
 - a. Select the QORTEX DTC 2.4 server installation bundle specific to your host machine.
 - Linux host (physical or virtual): `qortex-server_2.4.xxx_amd64.deb`
 - Docker container: `qortex-server_2.4.xxx.tar.gz` and `settings.xml`
 - b. Download the installation bundle to the Downloads folder or another destination.

2. Continue to the next section:

If you downloaded the QORTEX DTC installer on the QORTEX DTC host machine, skip the next section and proceed to:

- For Linux: [Install or Update QORTEX DTC with a Debian Package](#) (page 39)
- For Docker: [Install QORTEX DTC in a Docker Container](#) (page 40).

If you need to move the QORTEX DTC installer to the QORTEX DTC host machine, proceed to [Move QORTEX DTC Installer Package to the Host Computer](#) (page 37).

Move QORTEX DTC Installer Package to the Host Computer

If the QORTEX DTC server installation package is used on a different computer (such as an air-gapped computer) than the one it was downloaded to, do the following:

1. Search the download computer for the installer package that needs to be moved (where 2.4.xxx is the current release version) and note the filepath.

Linux file:

`qortex-server_2.4.xxx_amd64.deb`

Docker files:

```
qortex-server_2.4.xxx.tar.gz  
settings.xml
```

Windows file:

```
qortex-server_2.4.xxx_win64.exe
```

2. Transfer the files to an external USB or hard drive.
3. Connect the drive to the destination computer and transfer the relevant files to a filepath comparable to where the file had been placed during the original download.
4. Continue to the next section, [Install or Update QORTEX DTC with a Debian Package](#) (page 39) or [Install QORTEX DTC in a Docker Container](#) (page 40), or Installing on Windows (page 37).

Install or Update QORTEX DTC with a Debian Package

When the QORTEX DTC server installation package is in its final destination, install it as follows.

Note: If you are installing your QORTEX DTC software on a machine that is different than the machine you used to download the software, first complete the steps in [Move QORTEX DTC Installer Package to the Host Computer](#) (page 37).

1. Open a new terminal window (Ctrl+Alt+T) on the host computer.
2. Remove any old versions of QORTEX DTC.

```
$ sudo systemctl stop qortex-server.service  
$ sudo dpkg -r <qortex-server_old_version>
```

3. Install QORTEX DTC server.

- Execute the following command to install the QORTEX DTC server from the downloaded Debian package, where 2.4.xxx is the current release version.

```
$ cd ~/Downloads ###or the filepath of the download
```

- Execute the following command to install the required package only:

```
$ sudo dpkg -i qortex-server_2.4.xxx_amd64.deb
```

All programs and libraries are placed where they are needed. To use them, the license must be activated. See [Managing the License](#) (page 44).

If this is an update to existing software, reload the software. See [Restart the Server Daemon Service](#) (page 56) and [Figure 6. Post-Installation Commands for Refreshed Server](#).

If this is a fresh installation, skip to Step 4.

a. From a terminal window (Ctrl+Alt+T) on the host computer, execute the command:

```
$ sudo systemctl daemon-reload
```

b. In the **Authenticate** pop-up window, enter the password for the server host computer.

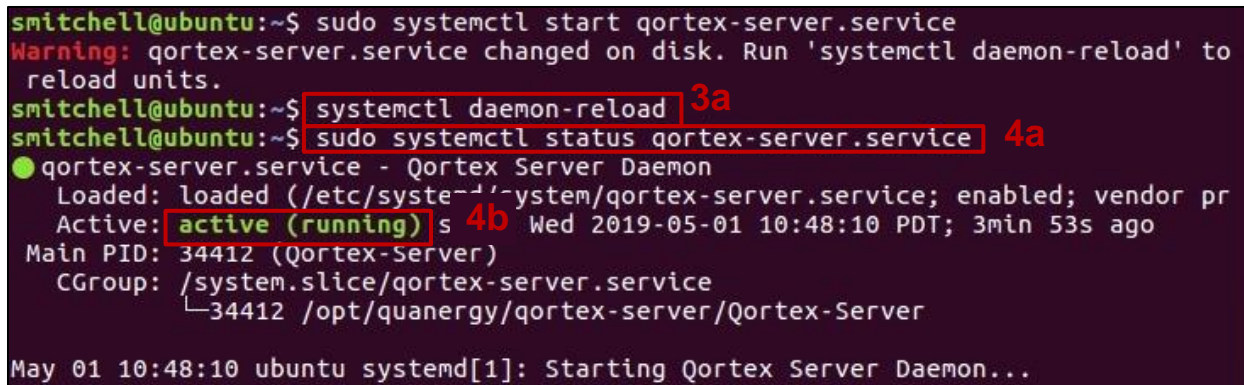
4. Optionally, verify the service is running.

a. Run the command.

```
$ sudo systemctl status qortex-server.service
```

b. Check the status **Active** field states: active (running).

This completes QORTEX DTC server installation using a Debian package.



```
smithell@ubuntu:~$ sudo systemctl start qortex-server.service
Warning: qortex-server.service changed on disk. Run 'systemctl daemon-reload' to
reload units.
smithell@ubuntu:~$ systemctl daemon-reload 3a
smithell@ubuntu:~$ sudo systemctl status qortex-server.service 4a
● qortex-server.service - Qortex Server Daemon
   Loaded: loaded (/etc/systemd/system/qortex-server.service; enabled; vendor pr
   Active: active (running) s 4b Wed 2019-05-01 10:48:10 PDT; 3min 53s ago
   Main PID: 34412 (Qortex-Server)
   CGroup: /system.slice/qortex-server.service
           └─34412 /opt/quanergy/qortex-server/Qortex-Server

May 01 10:48:10 ubuntu systemd[1]: Starting Qortex Server Daemon...
```

Figure 6. Post-Installation Commands for Refreshed Server

Install QORTEX DTC in a Docker Container

When the QORTEX DTC server Docker installation package is in its final destination, install it as follows:

1. Load the docker image on the host, from a terminal on the host, run:

```
$ docker load <qortex-server_2.4.xxx.tar.gz
```

2. Verify the docker image is deployed on the host, run:

```
$ docker images
```

Scan the result for `qortex-server` with tag `2.4.xxx`, part of the docker images command.

3. Add `quanergy` user and set permissions for the user. On the host machine, run:

```
$ sudo adduser --system quanergy --group
```

```
$ sudo mkdir -p /home/quanergy/quanergy/qortex/location
$ sudo chown -R quanergy:quanergy /home/quanergy
```

4. Copy the `settings.xml` file to the directory,
`/home/quanergy/quanergy/qortex/location`

```
$ cp settings.xml /home/quanergy/quanergy/qortex/location/
```

5. Open the `settings.xml` file, update the sensor IP address, and save the file.
6. Activate the QORTEX DTC Server license.

```
$ docker run --rm --net=host -v
/home/quanergy/quanergy/qortex:/home/quanergy/quanergy/qortex
-it qortex-server:2.4.xxx
--license activate <LICENSE_ID> <PASSWORD>
```

7. Run the container from the docker image. Provide the complete `/qortex` folder path on the host.

```
$ docker run --restart=always --net=host -v
/home/quanergy/quanergy/qortex:/home/quanergy/quanergy/qortex
-dit --name qortex-server qortex-server:2.4.xxx
```

8. Verify docker container is running.

```
$ docker ps -a
```

9. Verify the counter line output.

```
$ nc 127.0.0.1 17163
```

If you do not see the listed output then update `settings.xml`:

- a. Open for editing, the `settings.xml` file in the folder,
`/home/quanergy/quanergy/qortex/location`.
- b. Update the `<Publisher>` section.

```
<Publisher>
  <Name>QTRACK_COUNTER_LINE_TRACK_LIST</Name>
  <Format>json</Format>
  <Port>17163</Port>
  <AddDataSize>>false</AddDataSize>
  <NetworkByteOrder>>false</NetworkByteOrder>
</Publisher>
```

10. Optional commands:

- o To see the logs:

```
$ docker logs qortex-server
```

- o To stop and remove the container:

```
$ docker rm -f qortex-server
```

- o To deactivate the license:

```
$ docker run --rm --net=host -v  
/home/quanergy/quanergy/qortex:/home/quanergy/quanergy/qortex  
-it --name qortex-server qortex-server:2.4.xxx --license deactivate
```

This completes QORTEX DTC server installation using Docker.

Install QORTEX DTC Client Software

The QORTEX DTC client software can be installed on a Windows or Linux operating system.


Install on Windows

From the QORTEX DTC client Windows machine, install the QORTEX DTC client software, as follows:

1. Download the QORTEX 2.4 Windows client executable to the **Downloads** folder or another destination on the Windows QORTEX DTC 2.4 client host. See *Figure 4. Quanergy Qortex DTC Server and Client Download Path*.
 - a. Open an Internet browser and navigate to <https://downloads.quanergy.com/>.
 - b. Click the QORTEX Windows client.
 - c. From the <https://downloads.quanergy.com/qortex/client/windows/> page, select the QORTEX 2.3 Windows client executable.

qortex-client_2.4.xxx_win64.exe
 - d. Download the QORTEX Windows client to the **Downloads** folder or another destination.
2. From your Windows machine, click the **QORTEX client** executable.
3. Before the Wizard opens, a dialog box appears at the bottom of the window. Select the **Save** button to download the executable to the computer **Downloads** folder.
4. Open the **Downloads** folder, then double-click the **QORTEX client** file.
5. If a pop-up window interrupts the Wizard to ask, “**Do you want to allow this app to make changes...?**” click the **Yes** button to continue.
6. If a pop-up window suggests uninstalling a previous version of the software
 - a. Click **Yes**.
 - b. In the **Wizard Uninstall** window, click the **Uninstall** button to confirm.
 - c. In the **Wizard Uninstallation Complete** window, click the **Close** button to confirm.

7. For the Wizard setup sequence, agree to the terms of each step, then click the **Finish** button to dismiss the Wizard.

A shortcut QORTEX DTC client  icon is placed on the desktop as a quick way to start the client.

Install on Ubuntu

From the QORTEX DTC client Ubuntu machine, install the QORTEX DTC client software, as follows:

Note: Whenever you're prompted, type the password for your host computer.

1. Download the QORTEX DTC Linux client installation package to the **Downloads** folder or another destination on the Ubuntu QORTEX DTC 2.4 client host. See *Figure 4. Quanergy Qortex DTC Server and Client Download Path*.

- a. Open an Internet browser and navigate to <https://downloads.quanergy.com/>.
- b. Click the QORTEX 2.3 Ubuntu client.
- c. From the <https://downloads.quanergy.com/qortex/client/linux/> page, select the QORTEX 2.3 Ubuntu client executable.

```
qortex-client_2.4.xxx_amd64.deb.
```

- d. Download the QORTEX 2.3 Ubuntu client to the **Downloads** folder or another destination.

2. Open a terminal window on your client host computer and change directory to your download location. For example:

```
$ cd ~/Downloads
```

3. Execute the command:

```
$ sudo dpkg -i qortex-client_2.4.xxx_amd64.deb
```

4. The QORTEX DTC client installation starts, follow the prompts.

When prompts finish, you have completed installing the QORTEX DTC client.

4. Managing the License

The QORTEX DTC 2.4 server (not the client) requires a valid license tied to both its host machine and a version of the server software before the application is permitted to run.

License Parameters

Type. The Premium license enables the software to detect, track, and classify humans and vehicles.

Sensors. Each license is approved for use with a specified number of sensors. This number is based on your purchase history.

Duration. There are two durations of licenses:

- **Annual licenses.** These expire based on the issue date.
- **Perpetual licenses.** These never expire for a particular version of the software.

Tasks. The server includes a License Manager (command-line interface utility) which manages the licenses for the following tasks:

- *[Activate a License](#)* (page 46)
- *[Refresh a License](#)* (page 48)
- *[Deactivate a License](#)* (page 49)
- *[Renew a License](#)* (page 50)
- *[Check a License](#)* (page 50)
- *[Check a License Version](#)* (page 52)

Credentials. Before activating a license, an email from a support representative containing a License ID and Activation Password is sent to you. If you do not receive the email, contact a support at support@quanergy.com.

Offline. The simplest way to complete the licensing tasks is through the Internet. However, if Internet access is not available on the QORTEX DTC server air-gapped host machine, an Internet-connected third machine can be used to retrieve the file that manages the license on the air-gapped host machine. See *[Manage the License of an Air-Gapped Computer](#)* (page 52).

License Portal

After the software is downloaded and installed, acquire and activate the QORTEX DTC server license. The License Portal provides an organized place to access software, retrieve license keys, manage licenses, update contact information, and find support contact information.

Using the License Portal

A support representative creates a user account and emails the following items to the user:

- Link and credentials necessary for logging in to the License Portal.
- License ID and Activation Password necessary for using the License Manager. See *License Parameters* (page 44).

Use the emailed information to log in to the License Portal, as follows:

1. In a browser, enter the link supplied in the email to navigate to the **License Portal**.
<https://license.quanergyworks.com/solo/customers/Default.aspx>
2. Enter the **License Portal** credentials provided in the email.
3. Click the **Downloads** button to download the License Manager and check on the list of licenses. See *Figure 7. Customer License Portal*.



Figure 7. Customer License Portal

4. On the License Portal Downloads page, click the **Download** button for access to QORTEX DTC 2.4 software and documentation. See *Figure 8. Customer License Portal Downloads Page*.

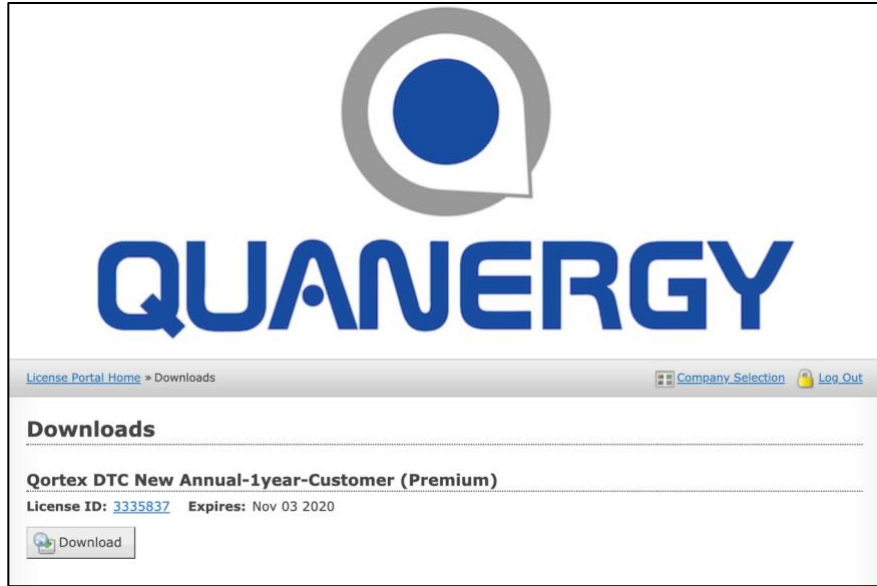


Figure 8. Customer License Portal Downloads Page

Activate a License

To activate the license, you need the credentials emailed from the support representative:

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.
2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the following command:

```
$ ./Qortex-Server --license activate
```

4. Respond to each prompt, and press **Enter**, as follows:

```
----- licensing -----
Do you want to process your request over the internet? (y/n) (Default: y) [type y]
Please enter your License ID:
    [type 8-digit license number, e.g., 12345678]
Please enter your Activation Password:
    [type 8-digit alphanumeric combination, e.g., A1B2C3D4]
Please enter your installation name (optional):
    [blank, or type site name, e.g., MyLab-2]
```

5. After pressing **Enter** for the last question, this message returns to confirm that the license is activated and provides a summary of options purchased and configured for your license.

```
qortex license has been successfully activated.
Status: Activated, registered to: [usernames configured for license]
```

License id:	[license number entered]
License type:	[purchased license option]
Add-ons: Rules SubVehicle	[If None is listed, then both Rules or SubVehicle features are not supported]
Number of licensed sensors:	[number of sensor connections to your QORTEX DTC server allowed.]
Number of licensed cameras:	[If value is 0, PTZ cameras are not supported. Value of 1 or more is number of PTZ camera connections to your QORTEX DTC server allowed.]
Expiration Date:	

Required items: Status, License id, License, type, and Number of licensed sensors.

Optional items are:

- **Add-ons:**
 - If **Rules** are not listed, then Rules configuration is not supported and the Rules tab is grayed out in the Configuration panel.
 - If **SubVehicle** is not listed, vehicle object subcategories are not identified or labeled. Without this license all vehicle types are labeled simply as `vehicle`.
- **Numbers of licensed PTZ cameras:** If the number is zero, then PTZ cameras are not supported and the PTZ tab is grayed out in the Configuration panel.

6. Start the server daemon service. See *Starting and Stopping QORTEX DTC* (page 55) and *Figure 9. License Activate from the Ubuntu Terminal*.

```

user:/opt/quanergy/qortex-server$ ./Qortex-Server -license activate
----- licensing -----
Do you want to process your request over the internet? (y/n) (Default y) Y
Please enter your License ID: #####
Please enter your Activation Password: #####
Please enter your installation name (optional):

Qortex license has been successfully activated.
Status: Activated, registered to:
USER-NAME
License id: #####
License type: Quanergy premium
Number of license sensors: 15
Expiration Date: 2020-05-20T00:00:00Z

```

Figure 9. License Activate from the Ubuntu Terminal

Refresh a License

As long as the QORTEX DTC server is connected to the Internet, the software refreshes the license every day automatically. However, if any of the following events occur:

- An annual license was renewed.
- The sensor allowance was changed.

The license must be manually refreshed as follows. See [Figure 10. License Refresh from the Ubuntu Terminal](#).

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.

Enter the username and password for the host machine, if required.

2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the refresh command

```
$ ./Qortex-server --license refresh
```

4. Respond to the prompt, and press the Enter key, as follows:

```
Do you want to process your request over the internet? (y/n) [type y]
```

5. This message returns to confirm the refresh:

```
qortex license has been successfully refreshed.
```

```
user:/opt/quanergy/qortex-server$ ./Qortex-Server --license refresh
----- licensing -----
Status: Activated, registered to:
USER-NAME
License id: #####
License type: Quanergy premium
Number of license sensors: 15
Expiration Date: 2020-05-20T00:00:00Z
Do you want to process your request over the internet? (y/n) (Default y)

Qortex license has been successfully refreshed.
Status: Activated, registered to:
USER-NAME
License id: #####
License type: Quanergy premium
Number of license sensors: 15
Expiration Date: 2020-05-20T00:00:00Z
```

Figure 10. License Refresh from the Ubuntu Terminal

Deactivate a License

Deactivating a license permits the transfer of the license from one QORTEX DTC server host machine to another.

Note: Even while deactivated, an annual license continues its expiration countdown without pausing.

Deactivate the license as follows:

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.

Enter the username and password for the host machine, if required.

2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the deactivate command. See [Figure 11. License Deactivate from the Ubuntu Terminal](#).

```
$ ./Qortex-server --license deactivate
```

4. Respond to the prompt, and press **Enter**, as follows:

```
Do you want to process your request over the internet? (y/n) [type y]
```

After pressing the **Enter** key, the License Manager deactivates the license.

This message returns to confirm that the process was successful:

```
qortex license has been successfully deactivated.
```

5. When ready to reactivate the license, see [Activate a License](#) (page 46).

```
user:/opt/quanergy/qortex-server$ ./Qortex-Server --license deactivate
----- licensing -----
Status: Activated, registered to:
USER-NAME
License id: #####
License type: Quanergy premium
Number of license sensors: 15
Expiration Date: 2020-05-20T00:00:00Z
Do you want to process your request over the internet? (y/n) (Default: y)

Qortex license has been successfully deactivated.
```

Figure 11. License Deactivate from the Ubuntu Terminal

Renew a License

You are responsible for renewing the annual license in a timely manner. If the license expires, then the QORTEX DTC server shuts down and the QORTEX DTC client stops functioning.

QORTEX DTC displays warning notifications concerning an expiring license in the **Status** panel. See *Figure 12. License Expiration Notification from the Status Panel*. Regarding the **Status** panel, see *Status Button* (page 83).

If the license expires, the QORTEX DTC application immediately terminates, logs a message in the server log, and sends a message to the client. To renew the license, contact your sales representative or support@quanergy.com and supply a new Purchase Order. Then activate the license. See *Activate a License* (page 46) or *Manage the License of an Air-Gapped Computer* (page 52).

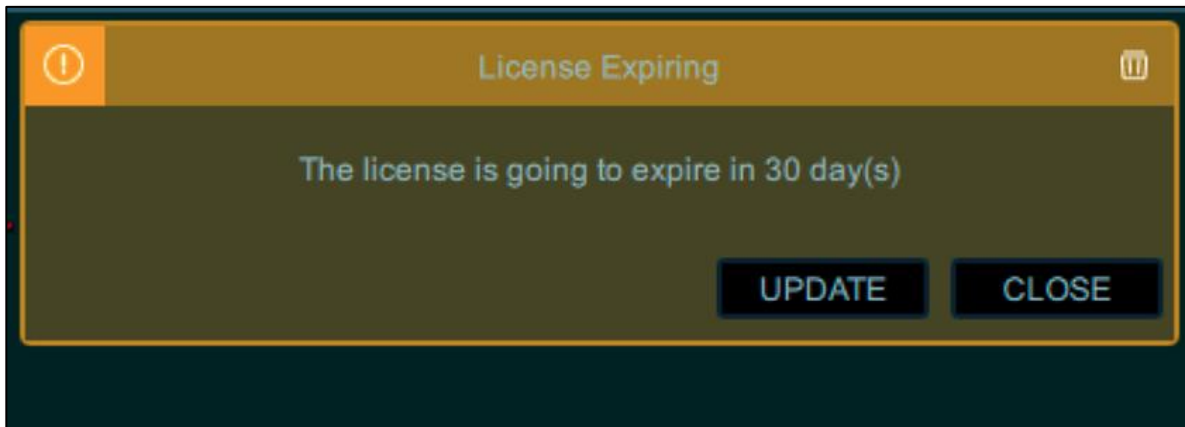


Figure 12. License Expiration Notification from the Status Panel

Check a License

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.

Enter the username and password for the host machine, if required.

2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the license info command to see a report of the license details. See *Figure 13. License Info Report from the Ubuntu Terminal*.

```
$ ./Qortex-server --license info
```

Details about the license can also be found in the following sections:

- List of licenses. See [Using the License Portal](#) (page 45).
- Starting the server daemon service. See [Start the Server Daemon Service the First Time](#) (page 55).

A valid license returns a report similar to [Figure 13. License Info Report from the Ubuntu Terminal](#).

An invalid license returns a report similar to [Figure 14. License Invalid Report from the Ubuntu Terminal](#).

```
user:/opt/quanergy/qortex-server$ ./Qortex-Server --license info
----- licensing -----
Status: Activated, registered to:
USER-NAME
License id: #####
License type: Quanergy premium
Number of license sensors: 15
Expiration Date: 2020-05-20T00:00:00Z
2020-02-14 00:11:16 [info] Log: Reload is called in license validation
```

Figure 13. License Info Report from the Ubuntu Terminal

```
user:/opt/quanergy/qortex-server$ ./Qortex-Server
Looks like software license is not valid.
Error 9203: The license has expired.
Please obtain a valid license and try again.
User the - license command line option to activate.
Contact Quanergy support for more information: support@quanergy.com

2020-02-14 00:11:16 (error) Log: Looks like software license is not valid.
Error 9203: The license has expired.
Please obtain a valid license and try again.
Use the -license command line option to activate.
Contact Quanergy support for more information: support@quanergy.com

2020-02-14 00:11:16 (error) Log: Qortex terminating because of license issue . . .
The license has a problem. Exiting . . .
2020-02-14 00:11:16 (error) Log: The License has a problem. Exiting . . .
```

Figure 14. License Invalid Report from the Ubuntu Terminal

Check a License Version

To check the version of the licensed software:

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.

Enter the username and password for the host machines, if required.

2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the version command, then check the return.

Windows

```
$ ./Qortex-server -version
```

Ubuntu

```
user:/opt/quanergy/qortex-server$ ./Qortex-Server -version 2.3.136
```

Manage the License of an Air-Gapped Computer

If the server host computer is air-gapped (no Internet access), use an offline process for managing the licenses. The offline license management process requires two separate computers:

- QORTEX DTC server air-gapped host computer
- Internet-connected computer

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in.

Enter the username and password for the host machine, if required.

2. Enter the proper directory:

```
$ cd /opt/quanergy/qortex-server
```

3. Execute the following command, and enter one of the options at the end:

```
$ ./Qortex-server --license [activate|refresh|deactivate]
```

4. Respond to each prompt, and press **Enter**, as follows:

```
Do you want to process your request over the internet? (y/n) [type n]
To proceed without an internet connection, you need a response.xml file
Do you already have a response file? (y/n) [type n]
No worries! We will walk you through obtaining your response.xml file.
For this, you'll first need to generate a request.xml file.
Please enter your License ID: [type 8-digit license number, e.g., 12345678]
```

```
Please enter your Activation Password: [type 8-digit alphanumeric combination, e.g., A1B2C3D4]
Please enter your installation name (optional): [type site name, e.g., MyLab-2]
Wrote License Request to request file at:
home/quanergy/quanergy/qortex/license/request.xml
```

5. Move the `request.xml` file to the Internet-connected computer.
6. In a browser, navigate to this page of the **Customer License Portal**. See *Figure 15. Customer License Portal Manual Request*.
<https://license.quanergyworks.com/solo/customers/ManualRequest.aspx>
7. In the **Upload Request File** area, click the **Choose File** button.
8. In the file browser that appears, select the `request.xml` file.
9. In the **License Portal Upload Request File** area, click the **Submit** button.
10. After the credentials are validated, a `response.xml` file is generated by the license server.

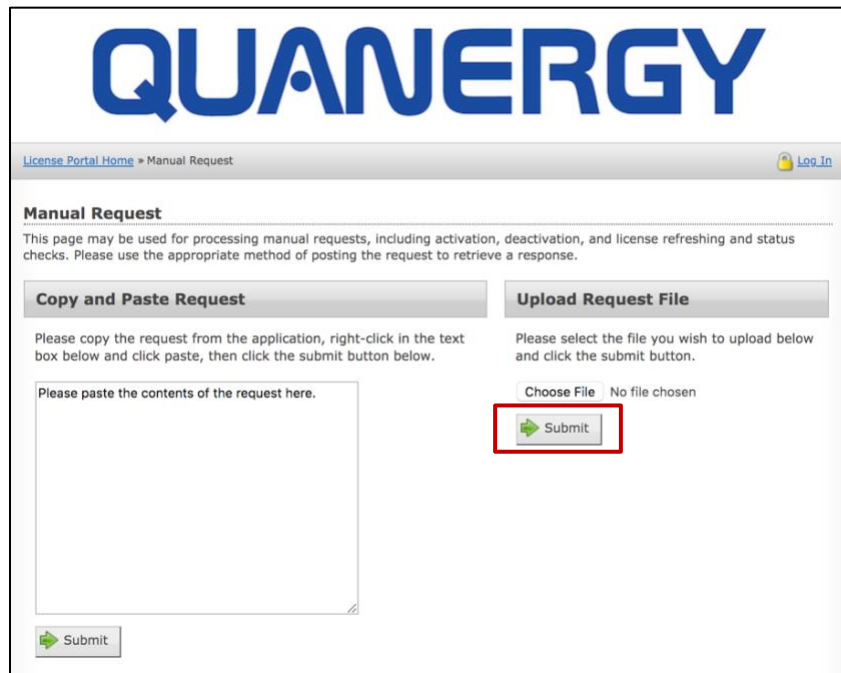


Figure 15. Customer License Portal Manual Request

11. Download the `response.xml` file.
12. Move the `response.xml` file to the target host computer in this filepath:
`/home/quanergy/quanergy/qortex/license/request.xml`
13. Process the `response.xml` file and select the option needed, as follows:

```
$ cd /opt/quanergy/qortex-server
$ ./Qortex-server --license [activate|deactivate|refresh] [Enter preferred option]
```

Respond to each prompt, and press **Enter**, as follows:

```
Do you want to process your request over the internet? (y/n) [Type n]
To proceed without an internet connection, you need a response.xml file
Do you already have a response file? (y/n) [Type y]
Default path to the response.xml file is:
/home/quanergy/quanergy/qortex/license/request.xml
If you wish to use a different path, enter the absolute path to the response.xml
file; otherwise just press enter: [Press the Enter key.]
```

This message returns to confirm that the process was successful:

```
Qortex license has been successfully [activated|deactivated|refreshed].
```

5. Starting and Stopping QORTEX DTC

After all licensing, hardware, and software components are in place, the QORTEX DTC 2.4 system is ready for operation.

The server host computer is designed to run persistently through a Linux daemon service, a non-interactive background program. Even if the server exits unexpectedly, it will immediately restart its processes. Therefore, the procedures in this user guide assume the server is running. The client is able to freely connect to and disconnect from the server at any time, while the server continues publishing surveillance data.

Start QORTEX DTC Summary

1. Login to the QORTEX DTC server host. Open a terminal to access and start the QORTEX DTC server.
2. Login to the QORTEX DTC client host. Open an Ubuntu terminal or click the Windows QORTEX DTC icon and start the QORTEX DTC client.
3. From the QORTEX DTC client, connect to the QORTEX DTC server.
4. If this is the first time any user logs into the QORTEX DTC client, they are prompted to create an admin user with a new password.

Start the Server Daemon Service the First Time

1. Logon to the server host machine using the host machine credentials and open a terminal window.
2. Start the QORTEX DTC daemon service by executing the following command. See [Figure 16. Server: Start, Stop, Status Commands to Control Daemon Service](#).

```
$ sudo systemctl start qortex-server.service
```

Although no messages are returned, the QORTEX DTC software is working behind the scenes to set up a new essential computer directory, `/home/quanergy/quanergy/qortex`, where the following important directories and files are placed:

- `datasets` directory stores each recording as a timestamped folder, which contains sequentially numbered index files (`*.i00`, `*.i01`, ...), sequentially numbered qlog recording files (`*.q00`, `*.q01`, ...), and a copy of the `settings.xml` file in force at the time of recording. See [Recording Data](#) (page 152).
- `license` directory stores the license files as `qortex_licenseAlias1.lfx`, `qortex_licenseAlias2.lfx`, `qortex_licenseFile.lfx`, and `secure.vault.lfx`. Leave these files as they are. See [Managing the License](#) (page 44).

- location directory stores the `settings.xml` file that is created and updated based on changes made in Configuration mode. See [Entering Configuration Mode](#) (page 85).
- `qortex.server.status.xml` file is used by the server to recover its status in the event of a crash. Leave this file as is. See [Restart the Server Daemon Service](#) (page 56).

Restart the Server Daemon Service

If the server-client interaction behaves in unexpected ways, it might help to restart the daemon service. See [Figure 16. Server: Start, Stop, Status Commands to Control Daemon Service](#).

1. Logon to the server host machine using host machine credentials and open a terminal window.
2. Execute the `restart` command:

```
$ sudo systemctl restart qortex-server.service
```

If the restart is successful, no messages are returned.

```
smitchell@ubuntu:/opt/quanergy/qortex-server$ sudo systemctl stop qortex-server.service
smitchell@ubuntu:/opt/quanergy/qortex-server$ sudo systemctl start qortex-server.service
smitchell@ubuntu:/opt/quanergy/qortex-server$ sudo systemctl status qortex-server.service
● qortex-server.service - Qortex Server Daemon
   Loaded: loaded (/etc/systemd/system/qortex-server.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2019-04-23 14:33:04 PDT; 55s ago
     Process: 5210 ExecStopPost=/bin/bash -c /bin/echo "[`date`] Qortex Server Daemon Stopping" >> /var/log/qortex_serverd.log
     Process: 5210 ExecStartPre=/bin/bash -c /bin/echo "[`date`] Qortex Server Daemon Starting" >> /var/log/qortex_serverd.log
    Main PID: 5215 (Qortex-Server)
      CGroup: /system.slice/qortex-server.service
              └─5215 /opt/quanergy/qortex-server/Qortex-Server

Apr 23 14:33:04 ubuntu systemd[1]: Starting Qortex Server Daemon...
Apr 23 14:33:04 ubuntu systemd[1]: Started Qortex Server Daemon.
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: Status: Activated, registered to:
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: SURABHI SARDA
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: QUANERGY_SURABHILicense type: Quanergy Premium
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: Number of licensed sensors: 10
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: Expiration Date: 2019-07-12T00:00:00Z
Apr 23 14:33:04 ubuntu Qortex-Server[5215]: 2019-04-23 21:33:04 [info] QortexServer.GRPCServer: Server listening on 0.0.0.0:
smitchell@ubuntu:/opt/quanergy/qortex-server$
```

Figure 16. Server: Start, Stop, Status Commands to Control Daemon Service

Control the Server Daemon Service

Once daemon service is active, the server runs persistently (and restarts automatically as necessary). It should never need to be manually started or stopped unless downloading a new version or dealing with the license server is necessary.

To restart the service (which both stops and starts the service), or discretely stop and then start the service:

1. Logon to the server host machine using host machine credentials and open a terminal window.
2. Execute the `restart`, `start`, or `stop` command, as needed.

```
$ sudo systemctl [restart|start|stop] qortex-server.service
```

If the command is successful, no messages are returned. See [Figure 16. Server: Start, Stop, Status Commands to Control Daemon Service](#).

Check the Status of the Server Daemon Service

To see the status of the daemon, including any error messages:

1. Logon to the server host machine using host machine credentials and open a terminal window.
2. Execute the commands:

```
$ sudo systemctl status qortex-server.service
```

If the daemon is running (server is operational), this return appears. See [Figure 16. Server: Start, Stop, Status Commands to Control Daemon Service](#).

```
qortex-server.service ... active (running) since <Date>  
Process: <number>
```

If the daemon is not running (server is not operational), this return appears.


```
qortex-server.service ... inactive (dead)
```

Start the Client on a Windows Host

1. On the QORTEX DTC server host, verify the Qortex DTC server is running. See [Check the Status of the Server Daemon Service \(page 57\)](#).

```
$ sudo systemctl status qortex-server.service
```

In the response, look for the phrase `Active: active (running) since <Date>`.

2. Logon to the client Windows host using host machine credentials.
3. Start the client. Double-click the QORTEX DTC client icon  on the Windows Desktop.

Additional Windows 10 methods to locate the QORTEX DTC client application include: file browser, **Search** field, or Windows key.

The QORTEX DTC client and client terminal open in their own window. See [Figure 33. Client Start Options and Initial Blank View](#).

By default, the QORTEX DTC client does not require a login. The initial display is a blank screen. To view any data requires you connect the client to a server. See [Connect the Client to the Server \(page 60\)](#).

4. If this is the first time anyone has logged into the Qortex DTC client, you are prompted to create an `Admin` user. See [Login to Client for the First Time](#) (page 58).
5. If **Security** mode is enabled, enter your credentials in the **Sign into your account** window.

Start the Client on an Ubuntu Host

1. On the QORTEX DTC server host, verify the Qortex DTC server is running. See [Check the Status of the Server Daemon Service](#) (page).

```
$ sudo systemctl status qortex-server.service
```

In the response, look for the phrase `Active: active (running) since <Date>`.

2. Logon to the client Ubuntu host and open a terminal window.
3. Execute the command:

```
$ /opt/quanergy/qortex-client/Qortex-Client
```

The QORTEX DTC client and client terminal open in their own window. See [Figure 33. Client Start Options and Initial Blank View](#).


By default, the QORTEX DTC client does not require a login. The initial display is a blank screen. To view any data requires you connect the client to a server. See [Connect the Client to the Server](#) (page 60).

4. If this is the first time anyone has logged into the Qortex DTC client, you are prompted to create an `Admin` user. See [Login to Client for the First Time](#) (page 58).
5. If **Security** mode is enabled, enter your credentials in the **Sign into your account** window.

Login to Client for the First Time

During the first-time login, you are directed to create a new user. This is an `Admin` user by default. See [Figure 21. Security: Setup Authentication Flow](#).

After the first-time login, Admin or Editor user type credentials are required to access the QORTEX DTC server through the QORTEX DTC client.

1. Start the QORTEX DTC client.
 - Windows: double-click the QORTEX DTC client  icon.
 - Ubuntu: from a terminal, run: `/opt/quanergy/qortex-client/Qortex-Client`
2. From the **Configuration** mode panel, click **CONFIRM**.
3. From the **Server** tab > **Security** panel, toggle the **Security Mode ON**.
4. In the **Sign into your account** panel, enter your **License ID** and **License password**.

If you do not know your license ID and license password:

- a. Click **Locate Server License**.
- b. Browse through to find your Quanergy license and locate the License ID and License Password.
- c. From the command line, retrieve the license number.

```
$ ./Qortex-Server -license info
```

- d. From the License Portal, enter your license number and retrieve the Activation Password.
5. In the **Setup Admin Account**, enter a username and password and click **Setup Account**. Credential requirements are:
- o **Username criteria:** Contains at least 6 characters and contain alphabetic, numeric, and special characters. It cannot contain a space.
 - o **Password criteria:** Contains at least 6 characters and must contain at least one upper case letter, 1 lowercase letter, 1 numeric, and 1 special character. It cannot contain a space. Do not include the username as part of the password.

These credentials are saved on the configured QORTEX DTC server. The next time the new user connects the QORTEX DTC client to the QORTEX DTC server, they are prompted to provide these login credentials for that QORTEX DTC server.

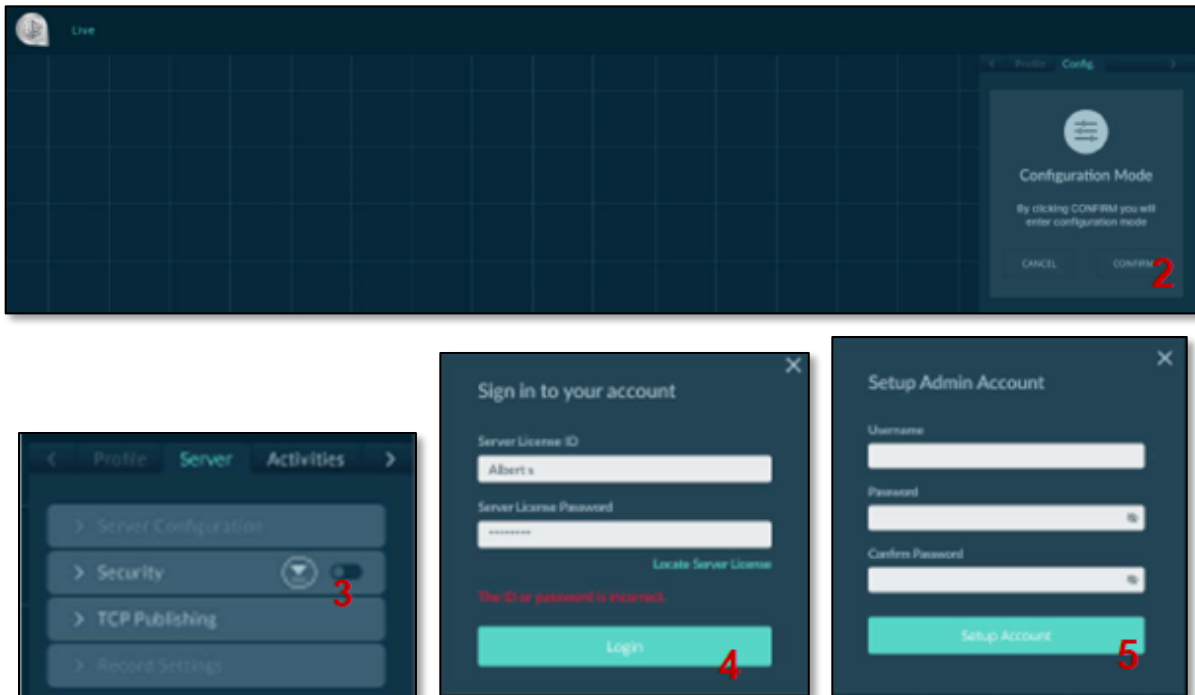


Figure 17. First Time Login – Create Admin User

6. Verify the new user credentials.

- a. From the **Profile** tab, verify the new user credentials. Click **Change** to alter them.
- b. Click **Logout**.
- c. In the **Login** panel, enter the credentials and click **Login**.

Stop the Client

On the client host, stop and dismiss the client software using any of these methods. See [Figure 18. Stop Client via Interface Window Close Menu or Close Button](#).

1. Click the red Close button at the right top corner.
2. Click the top left corner of the client window title bar to open the standard Windows menu, then select the **Close** item (or press the Alt+F4 keyboard equivalent).
3. Click the command / terminal window that launched the client, then press **Ctrl+C** (Windows) or **Ctrl-Q** (Ubuntu) on the keyboard.

You might need to resize or minimize the client to see the command / terminal window.

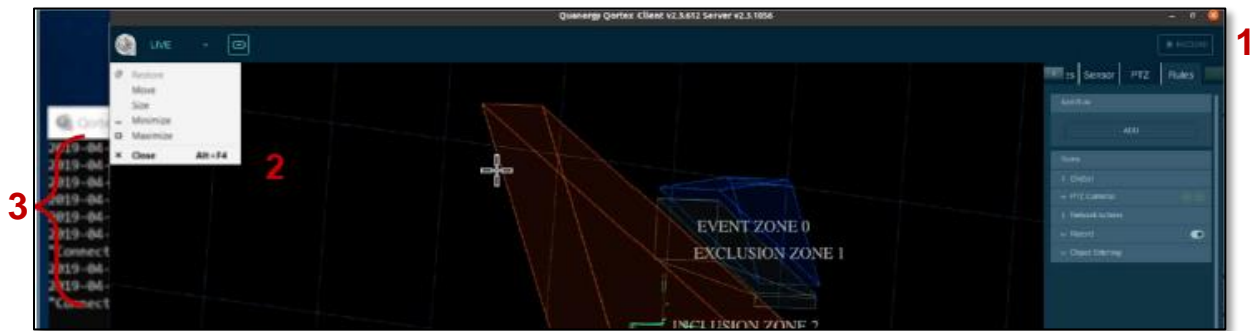


Figure 18. Stop Client via Interface Window Close Menu or Close Button

Connect the Client to the Server

If the client is on an Ubuntu system, you provide the server IP address when the client is started for the first time. If the client is on a Windows system, the server is connected after the client starts. See [Figure 19. Client Window First Time Start](#).

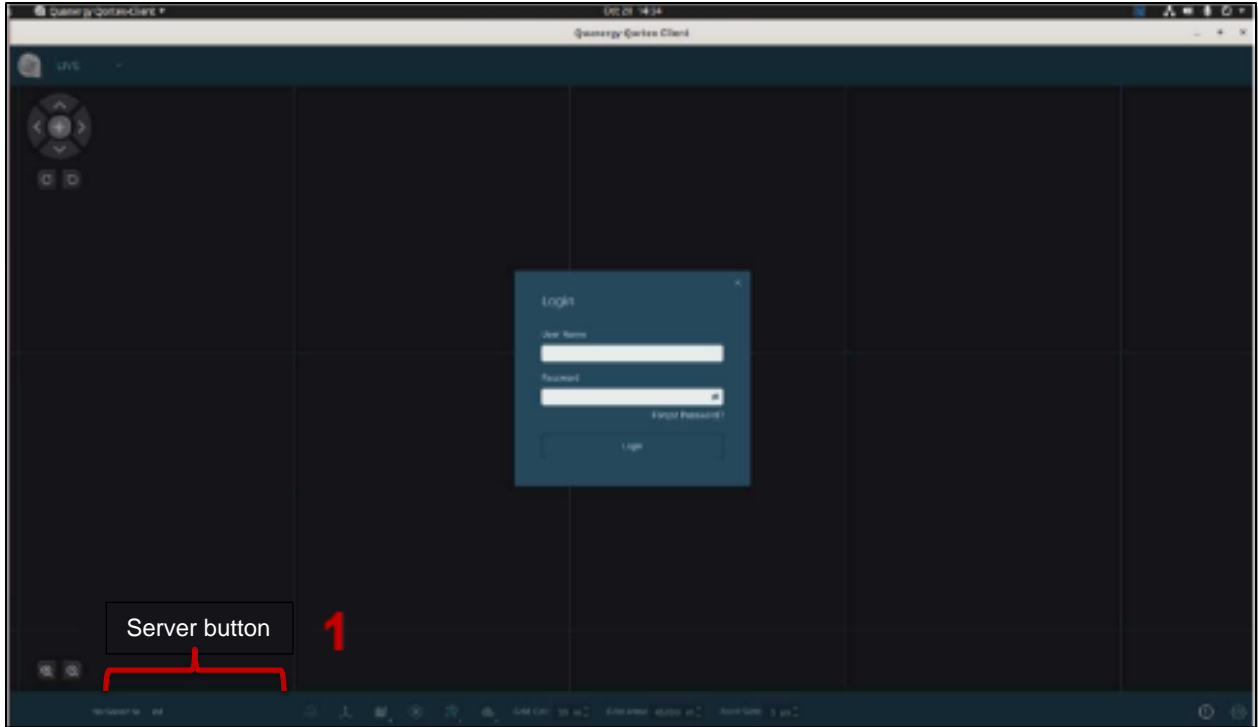


Figure 19. Client Window First Time Start

A client can list one or more servers to connect to, but the client can connect to only one server at a time. It receives data from the selected server only.

Specify a server the client can connect to:


1. From the QORTEX DTC client interface, click the **No Server Selected** button. See [Figure 19. Client Window First Time Start](#).

If servers were already added and configured, the button displays the list of servers previously added.

2. From the **Add Server** panel, click the **Add New Server** button. See [Figure 20. Add Server Sequence](#).
3. Specify the server information.


- a. In the **Server Name** field, type a nickname for the server.
- b. In the **Server IP address** field, type the server IP address.

For discovery of the IP address, see [Connect and Start the Host Computers](#) (page 32).

- c. Click **OK**. The client immediately tries to connect to the server. It displays a **Busy**  button until it connects or fails to connect.

If the message is **Connected**, click **OK**.

If the message is **Failed Connection**, choose a method:

- Click the **RETRY** button to try the same settings again.
 - Click **CANCEL** button > **Edit** icon  and correct the server IP address.
4. Click the **Esc** button on the keyboard to minimize a populated panel. The name of the connected server is the button that reopens the panel.

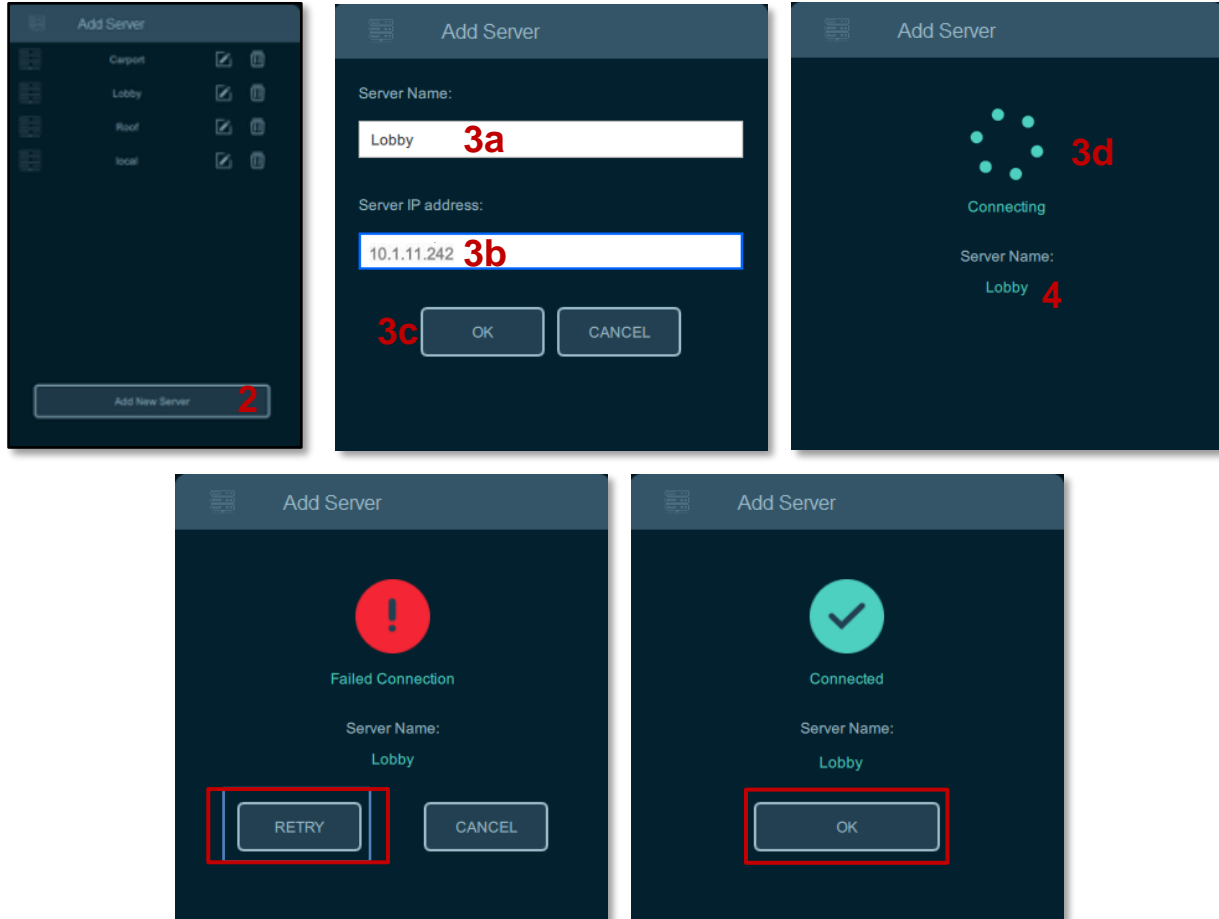


Figure 20. Add Server Sequence

6. Security Mode

QORTEX DTC 2.4 adds support for user authentication and data encryption. This is an optional mode for the QORTEX DTC server. By default, **Security** mode is `off`. Enable it through the QORTEX DTC client in **Configuration** mode.

- **HTTP Digest** authentication protocol—Internet access is not required. Certificate of Authority (CA) is not required. Authentication setting applies for the duration of the QORTEX DTC client session.
- **AES-256** encryption—The object list, zone list and sensor health APIs are encrypted.

When Security mode is enabled, user authentication is required for the following actions:

- Connecting the QORTEX DTC client to the QORTEX DTC server
- Connecting any third-party client to the QORTEX DTC server
- Sending and receiving gRPC API calls.
- Reading QORTEX DTC API (such as, object list, zone list, sensor health).
- Anytime an application is reading the QORTEX API TCP ports. The Quanergy TCP listener includes HTTP digest and AES-256 support. See [Server TCP Ports to Monitor](#) (page 93).

To enable the QORTEX DTC server **Security** feature, install QORTEX DTC server and Debian, and activate or refresh the Quanergy license.

Create User for Security Mode

This is the user whose credentials, username or password, are required through the **Security Login** panel. It is not used unless the **Security** mode is `ON`. See [Figure 26. Security: Change User Name or Password](#).

1. From the **Configuration** mode panel > **Server** tab, expand the **Security Login** panel.
2. Change the Username. Click **Change** in the **User Name** panel.
3. Change the Password. Click **Change** in the **Password** panel.
4. The Security Login panel expands to list the authentication methods. Select a method: **Password**.
5. If you choose **Password**. Enter current **Password**.
6. Enter new **User Name** or **New Password**
7. Click **Apply All** at the bottom of the **Server** tab.

After you change the username or password, you are returned to **Monitor** mode. Enter **Configuration** mode again, as needed. Restarting the QORTEX DTC client is not required.

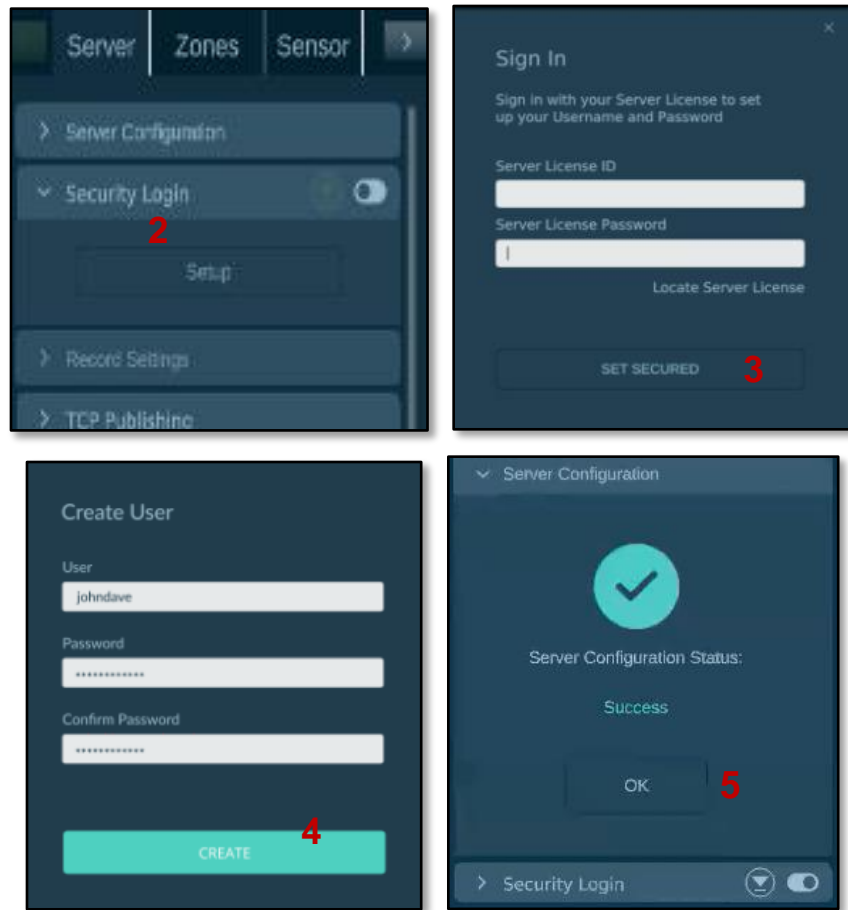


Figure 21. Security: Setup Authentication Flow

Turn Security Mode On or Off

1. From the **Configuration** mode panel > **Server** tab, in **Security** panel header, click the **Security** toggle. See [Figure 22. Security: Login Toggle On](#)

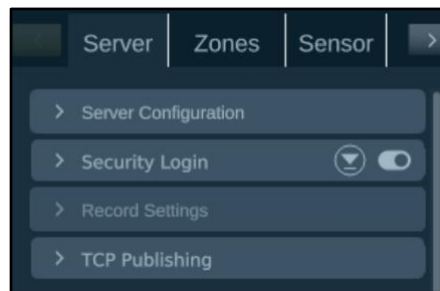


Figure 22. Security: Login Toggle On

2. You are prompted to Login as an Admin user.
3. Click to confirm the change.
 - If you toggle Security mode ON, click **SET SECURE**.



Figure 23. Security: Toggle On and Secure

- If you toggle Security mode OFF, click **UNSECURE**.



Figure 24. Security: Toggle Off and Unsecure

Sign In to QORTEX DTC Server with Security Mode Enabled

When **Security** mode is enabled, when you login to the QORTEX DTC client and want to connect to the QORTEX DTC server, you are prompted to provide your login credentials. See [Figure 25. Security: Sign-In.](#)

To sign in to the QORTEX DTC server, enter either the credentials you created in the **Create User** panel of the Security Setup flow or use your license ID and license password. See [Create User for Security Mode](#) (page 63).

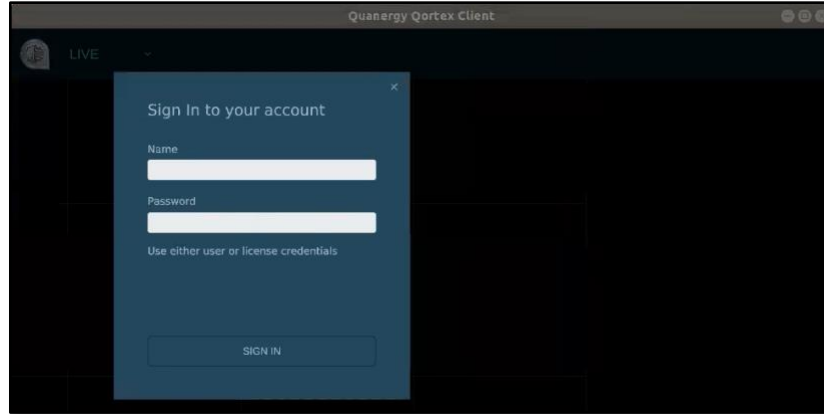



Figure 25. Security: Sign-In

Change User Credentials for Security Mode

You can change the username or password through the **Security Login** panel. It is not used unless the **Security** mode is ON . See [Figure 26. Security: Change User Name or Password](#).

1. From the **Configuration** mode panel > **Profile** tab.
2. Change the Username. Click **Change** in the **User Name** panel.
3. Change the Password. Click **Change** in the **Password** panel.
4. The Security Login panel expands to list the authentication methods.
5. Enter new **User Name** or **New Password**
6. Click **Apply All** at the bottom of the **Server** tab.

After you change the username or password, you are returned to **Monitor** mode. Enter **Configuration** mode again, as needed. Restarting the QORTEX DTC client is not required.

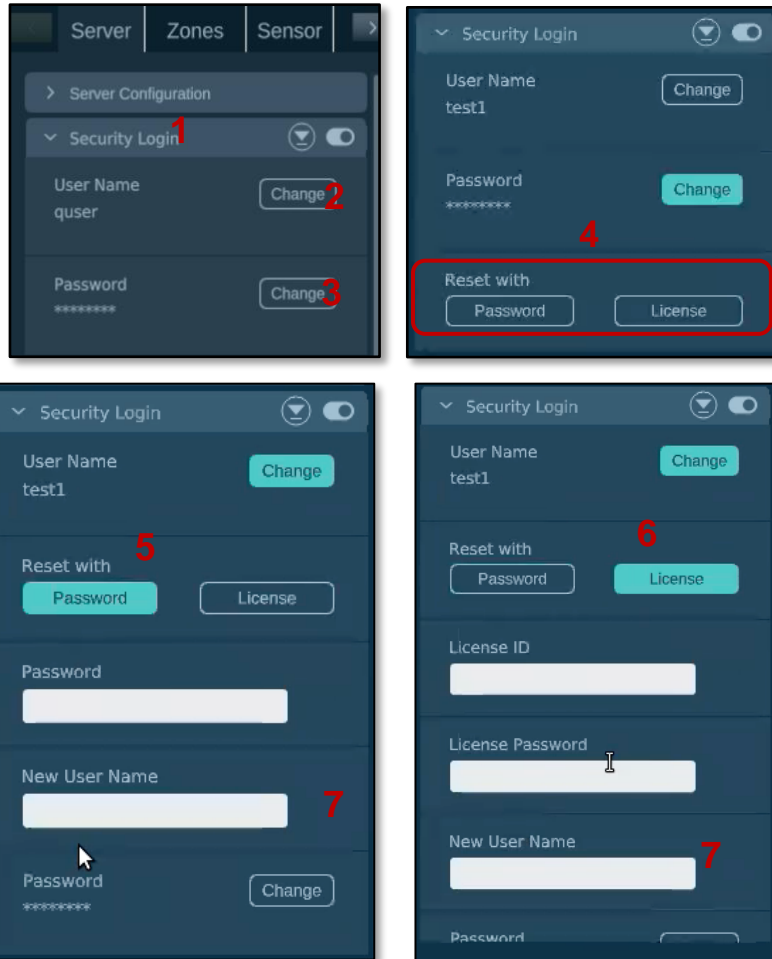



Figure 26. Security: Change User Name or Password

7. From the **Configuration** mode panel > **Server** tab, in **Security** panel header, click the **Security** toggle.



Figure 24. Security: Login Toggle On

8. You are prompted to **Login** as an Admin user.
Sign in using your Admin user credentials.
9. In the Configuration Mode panel, click **CONFIRM**.

10. Click the **Security** toggle again to turn Security mode ON .
11. Click to confirm the change.

If you toggle Security mode ON, click **SET SECURED**.



Figure 25. Security: Toggle On and SET SECURED

7. User Management

User management include creating, updating, enabling users with Secure mode and without Secure mode.

User Types and Permissions

QORTEX DTC client has to user types based on roles:

- Viewer—General user with permissions to:
 - Monitor QORTEX DTC.
 - Request a password change and complete their password change.
 - View the User Log.
- Editor—General user with permissions to:
 - Monitor QORTEX DTC.
 - Configure QORTEX DTC. Re-enter credentials to access Configuration Mode.
 - Request a password change and complete their password change.
 - View the User Log.
- Admin—Administrative user has permissions to:
 - Monitor QORTEX DTC.
 - Configure QORTEX DTC. Re-enter credentials to access Configuration Mode.
 - Manages QORTEX DTC users.
 - Add, delete users
 - Enable, disable users
 - Reset user passwords
 - Edit usernames and roles
 - Edit own username and password
 - Download, view, and edit the User Log.
 - Enable/disable Security mode.
 - Modify global QORTEX DTC Settings
 - Secure TCP ports
 - Password expiry

User Credential Requirements

Username criteria: Contains at least 6 characters and contain alphabetic, numeric, and special characters. It cannot contain a space.

Password criteria: Contains at least 6 characters and must contain at least one upper case letter, 1 lowercase letter, 1 numeric, and 1 special character. It cannot contain a space. Do not include the user name as part of the password.

When a user is created, these credentials are saved on the configured QORTEX DTC server. The next time the new user connects the QORTEX DTC client to the QORTEX DTC server, they are prompted to provide these login credentials for that QORTEX DTC server.

Create New Users

1. Login to Qortex DTC client as an `Admin` user.
2. Select **Server** tab > **Users** tab and click **Add User**.
3. In the **Create User** panel:
 - a. Enter a **Username** and **Password**.
 - b. From the menu select, **User Role** for the new user. The options are Viewer, Editor, or Admin.
 - c. Click **Add User**.

The new user is listed under the **Server > Users** panel.



Figure 27. Add User Button and Create User Panel

Set User Password Expiry

The timing for users to reset their passwords is applied globally.

Note: User passwords expires only when Security Mode is ON.

1. Login to Qortex DTC client as an `Admin` user.
2. Select **Server** tab > **Global Settings**.
3. Toggle **Password Expiry** to **On**.
4. Enter the how often passwords must be reset, in the **Password will expire after** field.

This is defined by number of days. For example, if you enter 90 days, then users must reset their password every 90 days.



Figure 28. User Password Expiration Global Settings Panel

Reset Your Own Password

When password expiry is on, when you login to the QORTEX DTC client, you receive a message in the Status panel that notifies you when your password is set to expire.

To change your unexpired password:

1. Login to Qortex DTC client with your username.
2. Select **Profile** tab and click **Change**.
3. In the expanded **Profile** panel, enter your current (old) password.
4. Enter your new password in both the **New Password** and **Confirm Password** fields.
5. Click **Logout**.
6. Relog back in with the new credentials.

To change your expired password, contact your administrator to reset your password for you.



Figure 29. User Profile Panel

Reset User Passwords

1. Login to Qortex DTC client as an `Admin` user.
2. Select **Server** tab > **Users** tab.
3. Expand the username panel, click **Reset Password**.
4. In the **New Password** field, enter a **Password**.
5. Click **Apply Changes**.

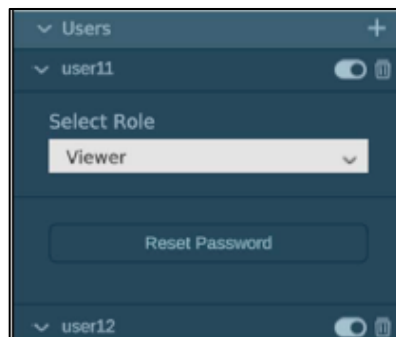


Figure 30. User Reset Password

Change Usernames and Roles

1. Login to Qortex DTC client as an Admin user.
2. Select **Server** tab > **Users** tab.
3. Expand the username panel to edit.
4. Click the username to open the username field. Enter the new username.
5. Open the **Select Role** menu and select an alternative role for the user.
6. Click **Apply Changes**.

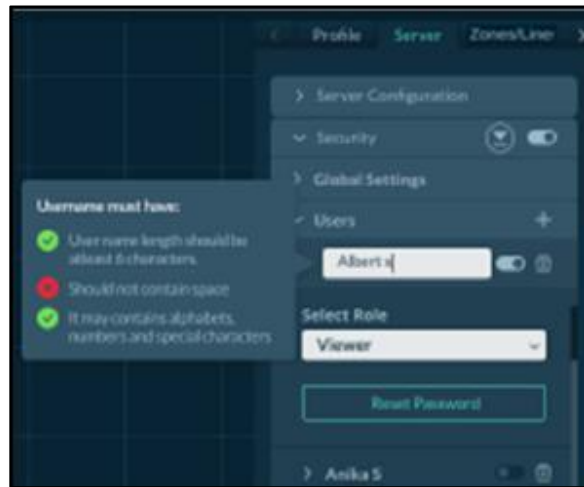




Figure 31. Edit Username and Role User Panel

Disable and Enable Users

1. Login to Qortex DTC client as an Admin user.
2. Select Server tab > Users tab.
3. Click the toggle icon On or Off next to the username.
 - Toggle On  enables the user.
 - Toggle Off  disables the user.

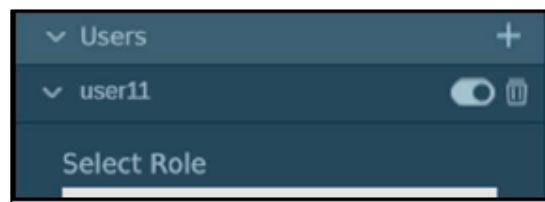


Figure 32. User Disable and Delete Options

Delete Users

1. Login to Qortex DTC client as an `Admin` user.
2. Select **Server** tab > **Users** tab.
3. Click the trashcan icon next to the username you are deleting.

The user is deleted from the system.

Recover Admin Credentials with Security Mode Enabled

From the QORTEX DTC server command line, enter:

```
./Qortex-Server --auth reset-admin --lic-id 7779898 --lic-pwd KXM39PFC  
--adm-id UserName563@ adm-pwd PwdPwd!!34
```

Entering the QORTEX DTC license ID and license password enables you to create a new Admin username and password.

8. QORTEX DTC Client Interface

Launching the QORTEX DTC client from the client starts the client processes and opens the QORTEX DTC client graphical user interface (GUI). It consists of several areas of functionality, which are described in this section.

Figure 33. Client Start Options and Initial Blank View shows one of the QORTEX DTC client start options and the initial QORTEX DTC client window. For starting the client, either through a terminal or the client icon, see *Start the Client on a Windows Host* (page 57) and *Start the Client on an Ubuntu Host* (page 57).

The first time the QORTEX DTC client starts, you need to add a QORTEX DTC server. When the QORTEX DTC client starts subsequently, the automatically connects to the last connected server.

Version information is stated in the title bar. When the client is started for the first time, it is in an unconnected and unconfigured state, only the client version is displayed. When the client is connected to a server, the server version is also displayed.



Figure 33. Client Start Options and Initial Blank View

Hover Tool Tips

Hovering over most interface widgets display a tool tip pop up that summarizes its purpose.

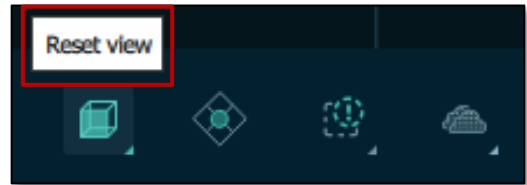


Figure 34. Client Tool Tip Example

Top Bar Options

The QORTEX DTC client top menu bar has both static decorations and interactive widgets.

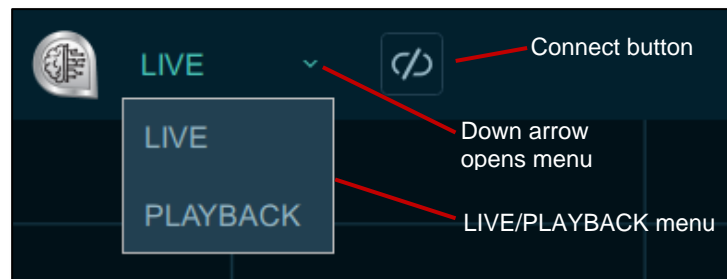


Figure 35. Client Top Bar, Data Selector: LIVE or PLAYBACK, Connect

Data Selector

Next to the QORTEX DTC icon is the **Data Selector** area. Select and view the type of data being visualized:

- **LIVE** (real-time data mode) is displayed by default. **LIVE** data is visualized according to the `settings` file generated in **CONFIGURATION** mode. See [Entering Configuration Mode](#) (page 85) and [Visualizing Data](#) (page 115).
- **PLAYBACK** (previously recorded data mode) provides a list of recordings. Recordings play according to their own `settings` file. See [View Recorded \(PLAYBACK\) Data](#) (page 155).

Connect Button

When a server is selected and the client is in **LIVE** data mode, the **Connect** button appears. The Connect button is a toggle that connects and disconnects the server from the sensors. It has three states:



Connected status indicates the server is connected to sensors. When connected, data is visualized from the sensor location. Click **Connected** button to disconnect from the sensors.



A **Busy** button appears while the server tries to connect to sensors, or when a sensor connection is busy.



Disconnected status indicates the server is disconnected from sensors. When disconnected, the server remains connected to the client, but live data from the sensors is not visualized. Configuration mode requires the server be disconnected from the sensors. Click **Disconnected** button to reconnect to sensors.

Record Button

The Record button indicates if the LIVE data is being recorded. It also indicates in you can manually record LIVE data. See [Recording Data](#) (page 152).

The Record button is gray when inactive. The Record button is red and has a time elapsed counter when active.

Manual recording requires the event recording option, under **Configuration** panel > **Rules** tab > **Record** toggle is OFF. See [Manually Start a Recording](#) (page 154).

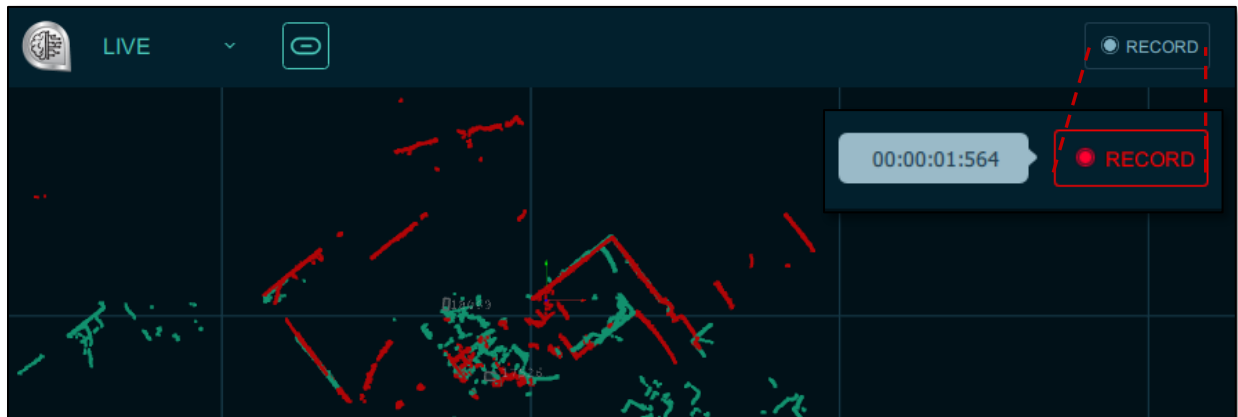
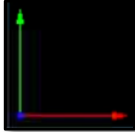
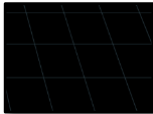

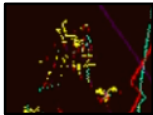

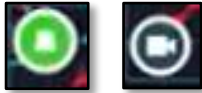
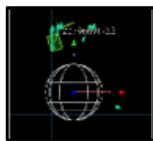


Figure 36. Client Record Active / Inactive Button

Central Visualizer Window Elements

The client Visualizer window is where data that is collected by the sensor and processed by the server is visualized. This Visualizer displayed data, whether displayed in real time or replayed from QLogs. See [Figure 37. Client Object Types and Zones](#), [Figure 38. Client Visualizer Window](#), and [Table 6. Visualizer Elements and Colors](#).

Table 6. Visualizer Elements and Colors

Element	Color	Description
Axes		Show position/orientation for each sensor when QORTEX DTC server is in disconnected state or Sensor Health is turned off.
Background grid		Indicates the scale for the visualized data. Blue lines on black background.
Object unique ID numbers		Assigned when a new object is detected
Point clouds		Collection of data points, displayed in CONFIGURATION mode only. One color assigned to each sensor.
Point cloud move 3D view controls.		Shift the point cloud view. Shift left, right, up, down. Set top front view.
Sensor and PTZ Camera icons		Indicate the position of sensors and PTZ cameras.
World coordinate axis		Display where the World Coordinate origin and axis are aligned relative to a physical location in the point cloud.

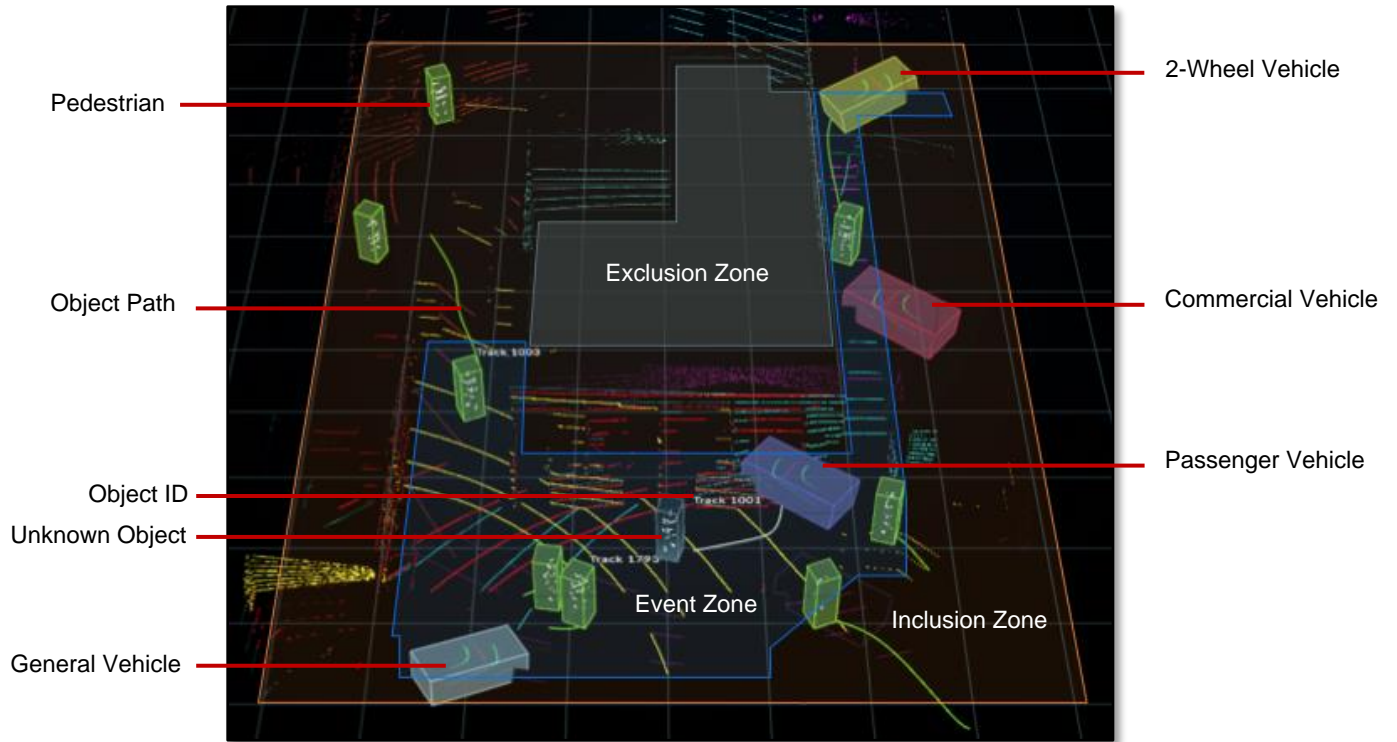


Figure 37. Client Object Types and Zones






Figure 38. Client Visualizer Window Elements

Visualizer Zones

Zones are areas for tracking or excluding tracking objects. See [Table 7. Visualizer Zone Types and Colors](#).

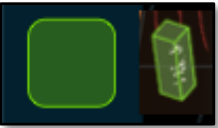
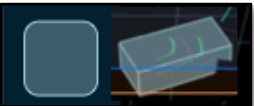

Table 7. Visualizer Zone Types and Colors

Element	Color	Description
Event zones		Areas for triggering actions (Events) based on Rules.
Exclusion zones		Areas where points and tracks are filtered out.
Inclusion zones		QORTEX DTC only monitors this area, areas outside of the Inclusion zone are filtered out. Event zones and Exclusion zones can be layered within Inclusion zones.

Visualizer Tracked Objects

Tracked objects are represented as cubes or rectangles with trailing tails to show movement. Objects are tracked as they pass from one LiDAR field of view (FOV) to another. They are classified by their bounding box as indicated. See [Table 8. Visualizer Tracked Objects and Colors](#).

Table 8. Visualizer Tracked Objects and Colors

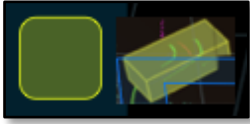



Element	Color	Description
Pedestrian		Green a person.
Vehicle		Gray a general vehicle if the subvehicle categories are not activated or is unknown.
Unknown		Blue an unknown object.

Visualizer Sub-Vehicles

Sub-vehicles use additional colors to identify them. The sub-vehicle classes supported are based on the United State Department of Transportation, Federal Highway Administration, [Traffic Monitoring Guide](#).

If the `SubVehicle` license is activated and the `useSubVehicleClassification` toggle is ON/True, QORTEX DTC sub-classifies vehicles, based on size, into three categories: **two-wheeler** vehicles, **passenger** vehicles, and **commercial** vehicles. If a proper subclassification cannot be determined, QORTEX DTC classifies a vehicle in the parent **general** vehicle class. See [Activate a License](#) (page 46) and [Table 9. Visualizer Sub-Vehicles and Colors](#).

Table 9. Visualizer Sub-Vehicles and Colors

Element	Color	Description
Two-wheel vehicle		Light Green, Class 1 Motorcycles
Passenger vehicles		Dark Blue, Class 2 and 3 Passenger Cars
Commercial vehicles		Magenta, Class 4 and above Buses and Trucks
General vehicle		Gray, if sub-class cannot be determined.

Bottom Bar Options

The bottom bar is loaded with important features and essential functionality to help make the most of the client interface.

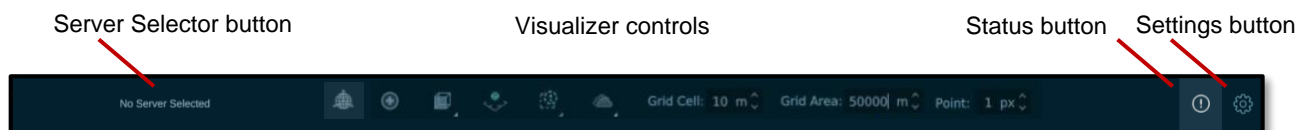


Figure 39. Client Bottom Bar

Server Selector

Use **Server Selector** to connect a QORTEX DTC server to the client. When a server is not connected to the client, the **Server Selector** label states **No Server Selected**. When a server is selected, the button label lists the name of the assigned server. See [Connect the Client to the Server](#) (page 60).



It is important to know that each server represents just one location, and that location includes either a single sensor or a set of multiple calibrated sensors observing the same contiguous geographic space representing the area of interest. When an PTZ camera is added, it is included in the same geographic space, defined by the sensors. See [Adding Sensors](#) (page 88) and [Adding PTZ Cameras](#) (page 126).

Visualizer Controls

In the bottom middle of the client interface are the viewing control buttons, toggles, and menus. These adjust the viewing options in the Visualizer window. See [Visualizing Data](#) (page 115) and [Table 10. Visualizer Buttons, Toggles, and Menus](#).


Table 10. Visualizer Buttons, Toggles, and Menus

Name	Image	Description
Grid Area Menu		Adjust the size of the monitored area. The measurement applies to all sides of the monitored area. See Grid Area (page 122).
Grid Cell Menu		Adjust the background grid spacing in the display. Measured in meters. See Grid Cell (page 121).
Orthographic Projection Toggle		Toggle between on and off mode. ON switches to 3D view. Off switches to 2D view. See Orthographic Projection Toggle (page 117).
Point Cloud/Color Picker Toggle		Toggle between multi-sensor viewing options: No Cloud , Color Picker , Split , and Combined/Fused . Requires LIVE data mode. See Point Cloud Display (page 120).
Point Size Menu		Adjust the size of the points in the display. Measured in pixels. See Point Size (page 122).
Reset View Toggle		Toggle the display between Top View or Side View perspective relative to the sensor. See Reset View Toggle (page 116).
Sensor Health Toggle		Check the status of each of the sensors. Requires LIVE data mode. See Sensor Health Status Options (page 100).

Name	Image	Description
Visibility Menu		Sets whether to include Inclusions, Exclusions, Events, and/or Track ID in the display. See Visibility: Zones/Lines and Object ID (page 118).
World Coordinate Toggle		Orient the point cloud to a physical coordinate. For example, the ground or a wall.

Settings Button




The **Settings** button  opens the **CONFIGURATION** panel on the right side of the client interface. If **Security** mode is enabled, provide credentials. Entering **Configuration** mode requires confirmation, to exit **Monitor** mode and enter **Configuration** mode.

This button is not available until a server is selected.



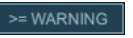


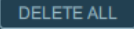
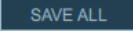
The **Settings** button differentiates between **Monitor** mode and **Configuration** mode. See [Visualizing Data](#) (page 115) and [Entering Configuration Mode](#) (page 85).

Status Button




The **Status**  button which provides informational (**colorless**), warning (**yellow**), and critical error (**red**) notifications about the licensing and operation of QORTEX DTC.

To use **Status** button:

1. Click the **Status**  button to open the **Status** panel.
Critical notifications pop up from the **Status** panel automatically.
2. Click one of the notifications to expand it to show more detail.
3. Click the bottom left button on the **Status** panel to cycle through three types of notifications:  ,  , and  .
4. Click  to delete a specific notification or click  to delete the entire list.
5. Click  to save the current list to the filepath and filename specified in the file browser. See [Figure 40. Status Button to Access Notifications \(top\), Saved Messages \(bottom\)](#).

The panel displays only the most recent five statuses, deleting old ones as new ones replace them. **Saved Messages** are saved as `.txt` files.

6. Click  to dismiss the **Status** panel.

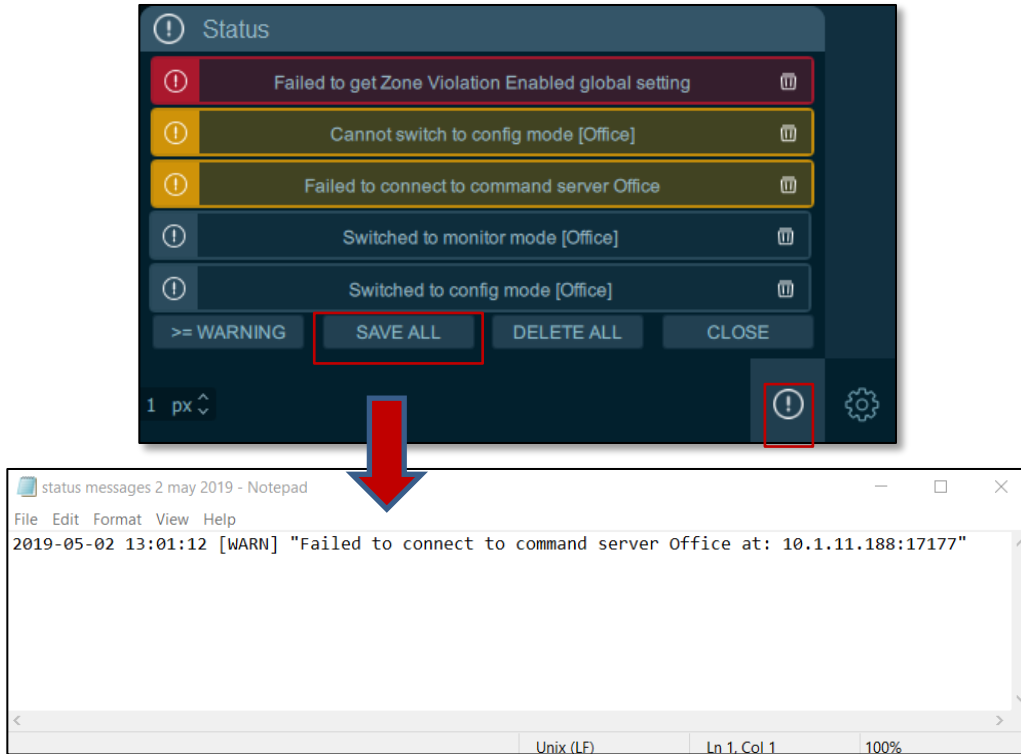


Figure 40. Status Button to Access Notifications (top), Saved Messages (bottom)

9. Entering Configuration Mode

Configuration mode supports only one client at a time in a first come, first served protocol. If a client is in **Configuration** mode, it becomes the controlling client, and no other client can configure the server, create or update zones, or view the point cloud until the controlling client has clicked the **EXIT CONFIGURATION** button.

Configuration Mode Options

The **Configuration** panel offers tabs with panels, fields, and options to configure the QORTEX DTC server

- **Server tab** has settings for:
 - **Server Configuration** panel, provides Sensor Setup, Import Calibration, and Location Template. See [Add Single-Sensor](#) (page 89) or [Add or Update Multiple Sensors at a Location](#) (page 90) (default).
 - **Security Configuration** panel, to setup security with username and password, enable or disable security mode, change security credentials (username and password), and download user log file.
 - **TCP Publishing** panel, provides options to change the TCP format for Object list and Zone list. See [TCP Publishing](#) (page 93).
 - **Record Settings** panel, provides a toggle to turn compression ON/OFF and identifies the folder where recordings are stored. By default `/home/quanergy/quanergy/qortex/dataset/Recordings` directory in the server is used. This directory is created automatically when the server software is first installed on the server host machine.
- **Zones tab** has panels for:
 - **Exclusions panel** to set up, enable, or disable Exclusion zones. The zone definition is saved to the `settings.xml` configuration file. See [Establishing Zone](#) and Counter Lines (page 107).
 - **Events panel** to set up, enable, or disable Event zones. The zone definition is saved to the `settings.xml` configuration file. See [Establishing Zone](#) and Counter Lines (page 107).
 - **Inclusion panel** to set up, enable, or disable Inclusion zones. The zone definition is saved to the `settings.xml` configuration file. See [Establishing Zone](#) and Counter Lines (page 107).
 - **Counter lines panel** to setup, enable, or disable Counter lines. The counter line definition is saved to the `settings.xml` configuration file. See [Establishing Zone](#) and Counter Lines (page 107).

- **Sensor tab** provides the **Refresh Tracker** and **Template Parameter** tabs.

Use **Refresh Tracker tab > Refresh** button to refresh all tracks to clear the noise of lagging artifacts. See [Refresh Tracks](#) (page 157).

Expand the **Sensor tab > Template Parameter** tabs: **ClusterPipeline**, **MultiLidarPipeline**, **OutputFilter**, **StaticCloudPipeline**, or **TrackerPipeline** to configure parameters for defining server setting values. See [QORTEX Q-Track API Reference](#).

- **PTZ tab** provides the panel for adding PTZ cameras to the configuration. See [Adding PTZ Cameras](#) (page 126).
- **Rules tab** provides access to create and edit Rules for **PTZ Camera**, **Network Action**, and **Recording**. See [Adding Rules](#) (page 142).
 - **Add Rule** tab for creating new rules.
 - **Rules** tab lists the existing PTZ Camera and Network Actions rules.
 - **Record** tab provides toggle to turn On/Off Rule-based Recordings. When **ON**, enables Rule based recording. When **OFF**, enables manual recording.



Enter Configuration Mode

Figure 41. Configuration Mode Sequence shows the steps listed below.


1. Connect the QORTEX DTC client to a QORTEX DTC server.
 - a. In the bottom of the client, click **Server Selector** to view a list of added servers or **Add New Server** button to add a server. See [Adding Sensors](#) (page 88).
 - b. To confirm connection between sensors and server, click **Server Selector**. Expand the **Servers** panel to view all available servers.
 - c. If you have not added any QORTEX DTC servers and if **Security** mode is enabled on the QORTEX DTC server, enter your credentials at the prompt to access the QORTEX DTC server.

Credentials can be either `username/user password` or `license name/license password`.

2. Disconnect the server from the sensors.

In the top left corner of the client, click the **Connected**  button. Wait until the status changes to **Disconnected** . If the server is already disconnected, no additional action is required.

Changing configuration can be in either LIVE vs PLAYBACK mode.


3. Click the **Settings** button .
4. Click the **CONFIRM** button.

5. The **Configuration** panel offers tabs with panels, fields, and options to configure the QORTEX DTC server.

- a. Scroll to and click a tab.
- b. Expand panels in a tab.
- c. Enter changes.
- d. Click **Apply Changes**.

Click **Apply Changes** button remains disabled until a change is made to one of the options.

6. When configuration efforts are complete:

- a. Click **APPLY ALL** to save the configuration changes to the selected Configuration tab.
- b. Click the **Settings** button . The **Configuration** panel is dismissed, the point cloud continues to be displayed, and other clients continue to remain locked out of **Configuration** mode.
- c. Click the **EXIT CONFIGURATION** button. The client relinquishes control of **Configuration** mode and enters **Monitor** mode, the point cloud is no longer displayed, other clients can enter configuration mode.

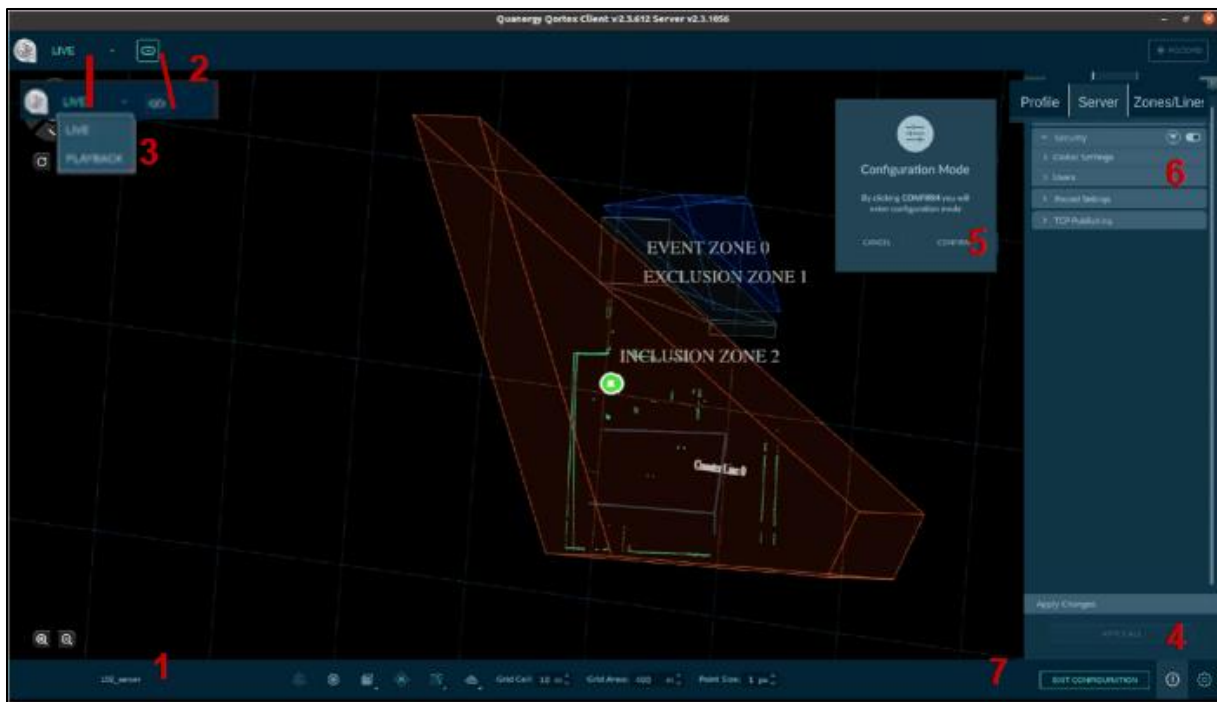




Figure 41. Configuration Mode Sequence

10. Adding Sensors

Each QORTEX DTC server supports one location at a time. The server can be configured to receive data from a single sensor or from multiple sensors, but not both. Even if a location has multiple sensors, you have the option to add a single sensor to the server.

The button indicating **Connected**  or **Disconnected**  status in the upper left corner of the interface window is a toggle mechanism that connects the server to, or disconnects the server from, the sensors and PTZ cameras.

Add Sensors Overview

1. Configure the sensors to add to the server.

Configure each Q-Track LR sensor through its web server (Sensor Settings Management). Configure multiple sensors through Q-View. When using multiple sensors, you need to calibrate them using Q-View. Q-View creates the calibration file, `transform_alignment.xml`.

See the sensor User Guide and the *Q-View User Guide*.

2. Enter **Configuration** mode. See *Entering Configuration Mode* (85).
3. Add sensors to the server through the client. From the **Configuration** panel, select **Server** tab > **Server Configuration** tab.

Choose to add a single sensor or multiple sensors.

4. To add one sensor, click **Single**.

Enter sensor IP address and a reference name for the sensor.

5. To add multiple sensors, click **Multiple**, then click **Browse**.
 - a. In Browse window, locate the folder containing the calibration file.
 - b. Select the `transform_alignment.xml` file. Click **Open**.
 - c. In **Server Configuration > Lidars To Use**: click checkbox for each sensor to add.

6. Select a **Location Template** from the pull-down.

7. Click **OK**. Click **Connect** button.


The data for each added sensor is displayed as a different color in the Visualizer.

Add Single-Sensor to a Location

Add a single sensor to a server. The sensor defines the location area that the server monitors. See [Figure 42. Single Sensor Configuration Sequence](#).

1. Prepare to add a single sensor to the server.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel, select the **Server** tab and click **Single**.
3. In the **Sensor IP Address** field, enter the address of the sensor whose data will be visualized.
4. In the **Sensor Name** field, enter a name for the sensor, such as a serial number or location.
5. In the **Location Template** section, click the drop-down menu and select whichever of the three templates optimizes for the type of object most likely to be encountered:
 - For an indoor setting, such as an airport baggage claim area, select the `person_tracking_settings.xml` file.
 - For an outdoor setting, such as at a congested stretch of freeway, select the `vehicle_tracking_settings.xml` file.
 - For mixed setting, such as the crosswalk at the entrance to an airport, select the `general_tracking_settings.xml` file.
6. At the bottom of the **Server Configuration** section, click the **OK** button.
7. After the **Server Configuration** panel displays a **Success**  message, the client remembers this single-sensor server configuration (until its `settings` are overwritten by repeating this procedure again) and automatically uses it to visualize LIVE data. See [Visualize Live Data](#) (page 123).

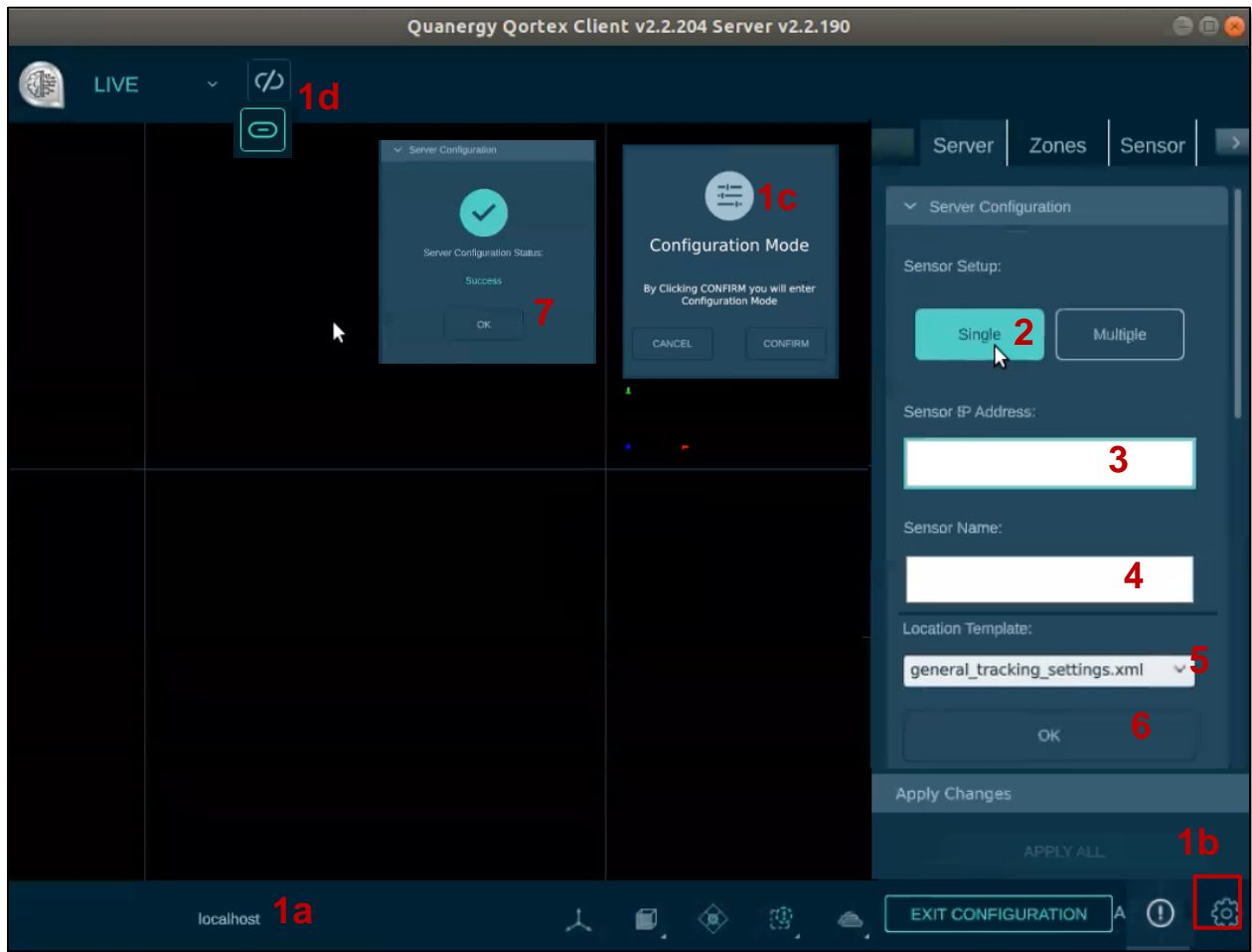


Figure 42. Single Sensor Configuration Sequence

Add or Update Multiple Sensors at a Location

Add multiple sensors to a server. The combined sensors define the location area that the server monitors.

Also, if you re-calibrated a sensor through Q-View or are replacing a sensor connected to the QORTEX DTC server, use the **Sensor** tab.

See [Figure 43. Multiple Sensor Configuration Using transform_alignment.xml File.](#)

1. Prepare to add multiple sensors to the server.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel, select the **Server** tab > **Multiple**.

3. Browse to import the calibration file created through Q-View. See [LiDAR Sensor Prerequisites](#) (page 29).

In the **Import Calibration** section, click the **Browse** button to open a file browser and select the calibration file for your sensors.

Use Q-View calibration `transform_alignment.xml` file to set up zones from scratch.

4. If you select `transform_alignment.xml` file, select LiDAR sensors.


These are the sensors whose data will be visualized. In the **Lidars To Use** section, click the checkboxes next to associated LiDAR sensors.

5. Optionally, if you are adding a sensor or recalibrating a sensor, Click the **Keep Location Settings** and/or **Keep LiDAR PTZ Calibration** toggles **ON** or **OFF**.

These toggles allow you to recalibrate the sensors without losing other information such as zones, rules, and algorithm parameters. This way only the Sensor and Transforms are updated.

6. In the **Location Template** section, click the drop-down menu and select the template that optimizes for your expected typical object type. See [QORTEX Q-Track API Reference](#).
 - o For an indoor setting, such as an airport baggage claim area, select the `person_tracking_settings.xml` file.
 - o For an outdoor setting, such as at a congested stretch of freeway, select the `vehicle_tracking_settings.xml` file.
 - o For mixed setting, such as the crosswalk at the entrance to an airport, select the `general_tracking_settings.xml` file.

7. At the bottom of the **Server Configuration** section, click **OK** (scroll down, if needed).

8. After the **Server Configuration** panel displays a **Success**  message, the client remembers this multi-sensor server configuration (until its `settings` are overwritten by repeating this procedure) and automatically uses it to visualize LIVE data. See [Visualize Live Data](#) (page 123).

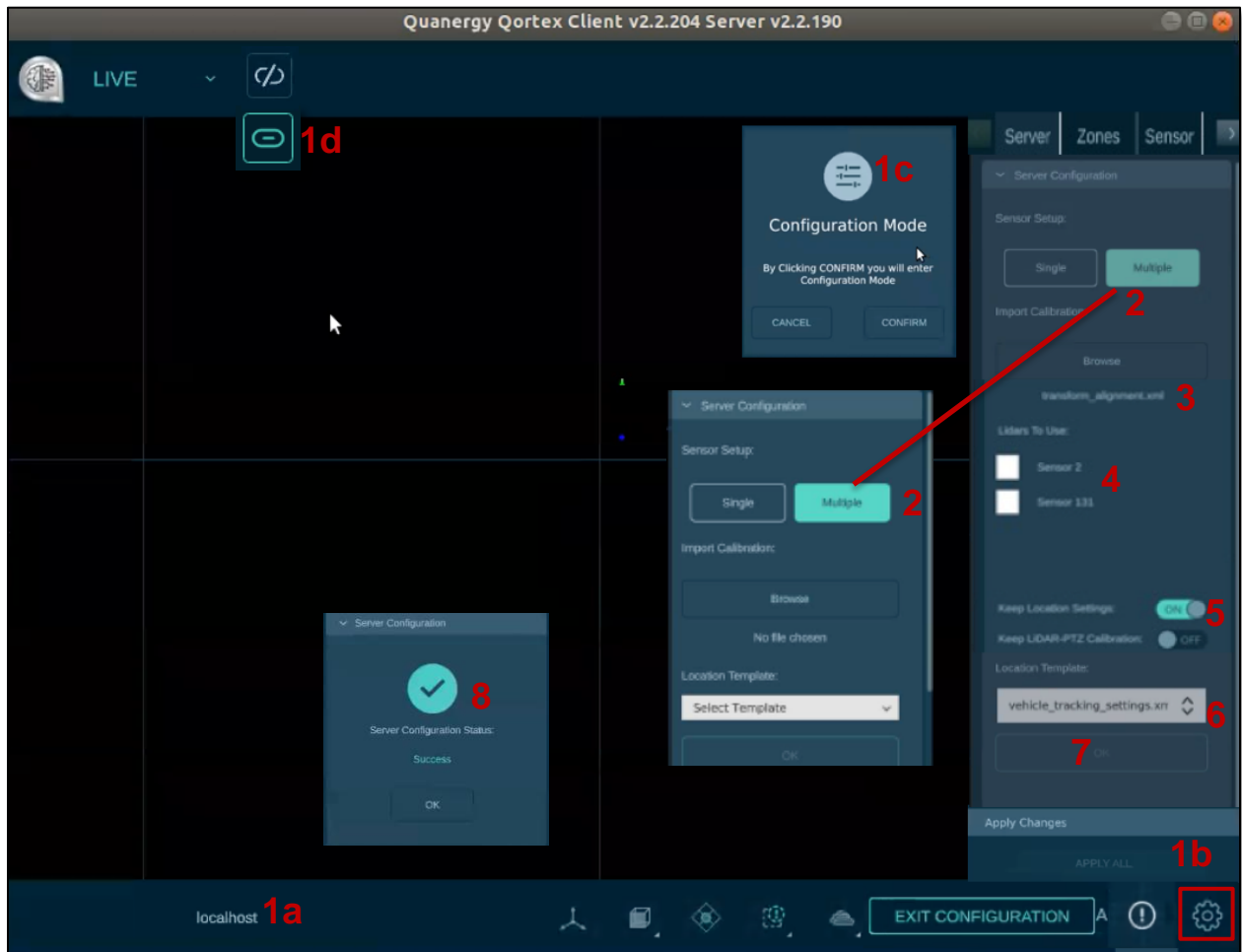


Figure 43. Multiple Sensor Configuration Using transform_alignment.xml File

11. QORTEX DTC and Sensor Configuration Options

Additional configuration settings include:

- [TCP Publishing Format](#) (page 93)
- [Adjust Sensor Settings](#) (page 97)
- [Sensor Health Status Options](#) (page 100)

TCP Publishing Format

As of QORTEX DTC 2.4 you have the option to change the TCP format. This includes port, data size, and network byte order through QORTEX DTC. See [Figure 45. TCP Publishing Settings](#).

Server TCP Ports to Monitor

Quanergy encourages the use of third-party applications that directly consume the server output, which can then be reappropriated in other ways. LiDAR sensors are identified by IP address in the `settings.xml` file connected to the server host computer. See [Figure 44. External Applications Access Output on Server Host Computer](#). The external applications can monitor specific TCP ports on the server and access the data published there directly.

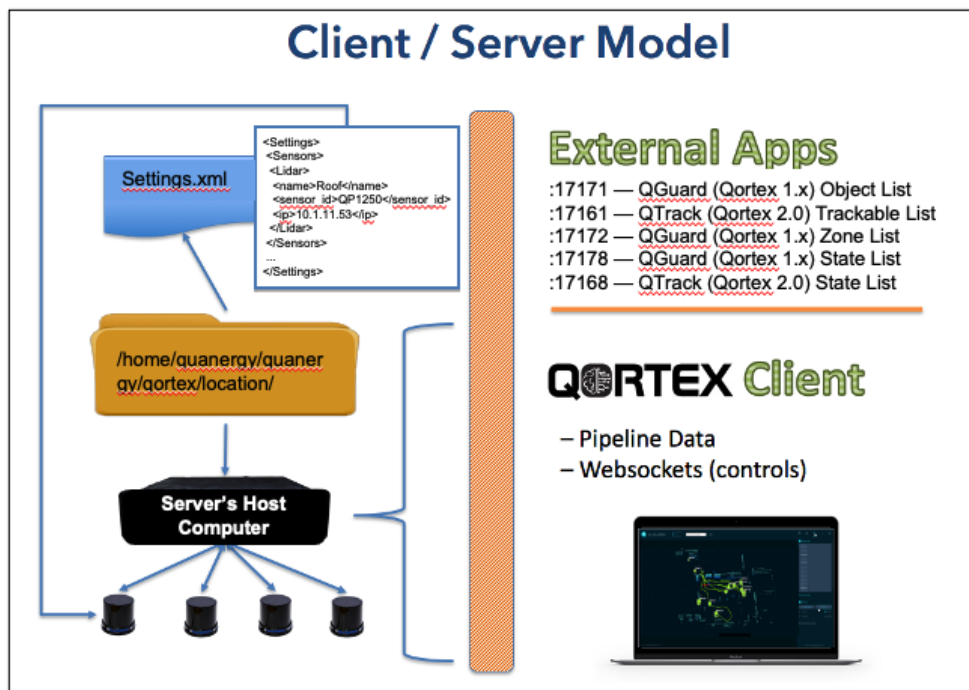


Figure 44. External Applications Access Output on Server Host Computer

To aid the user, Quanergy created a Port Monitoring Tool and identified a publication-confirmation utility.

Quanergy QORTEX DTC Application Programming Interface (API) is an Ethernet interface available on the local network where the server is running. This API delivers the needed data to the TCP port and in Protobuf, JSON, NDJSON, or XML format specified in the `settings.xml` file. These ports are configurable, but a typical scenario is outlined below:

- Port 17161 publishes Qortex DTC 2.x trackable list in Protobuf, JSON, NDJSON, or XML.
- Port 17168 publishes Qortex DTC 2.x state list in Protobuf, JSON, NDJSON, or XML. Qortex DTC 2.4 or greater includes sensor masking detection.
- Port 17172 publishes Qortex DTC 2.x zone list data in Protobuf, JSON, NDJSON, or XML.

Edit TCP Port Publishing Settings

1. Prepare to edit the TCP port publishing settings on the server.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel, select the **Server** tab and expand the **TCP Publishing** tab. Click the **v** arrow on the tab.
3. Expand the TCP publishing option to edit. The choices are separated by Qortex DTC version:
 - QORTEX 2.x Object List
 - QORTEX 2.x Sensor Health State
 - QORTEX Zone List
 - QORTEX 2.x Counter Line Object List
4. For each of the TCP option, the configurable items are:
 - **Format**— Default is None, which means QORTEX DTC server does not publish data. To enable publishing data for a particular list or state, select a file format: JSON, NDJSON, XML, and Protobuf.
 - **Port**—The port number assigned to the TCP item that is listening for this content: object lists, sensor health states, or zone lists.
 - **Add Data Size**—**True** adds the data packet size to the output, **False** does not include the data size. False is the default.
 - **Network Byte Order**— **True** transmits the data in Big Endian order. **False** transmits the data in Little Endian order. False is the default. This option applies when PTZ cameras are connected to the QORTEX DTC server.

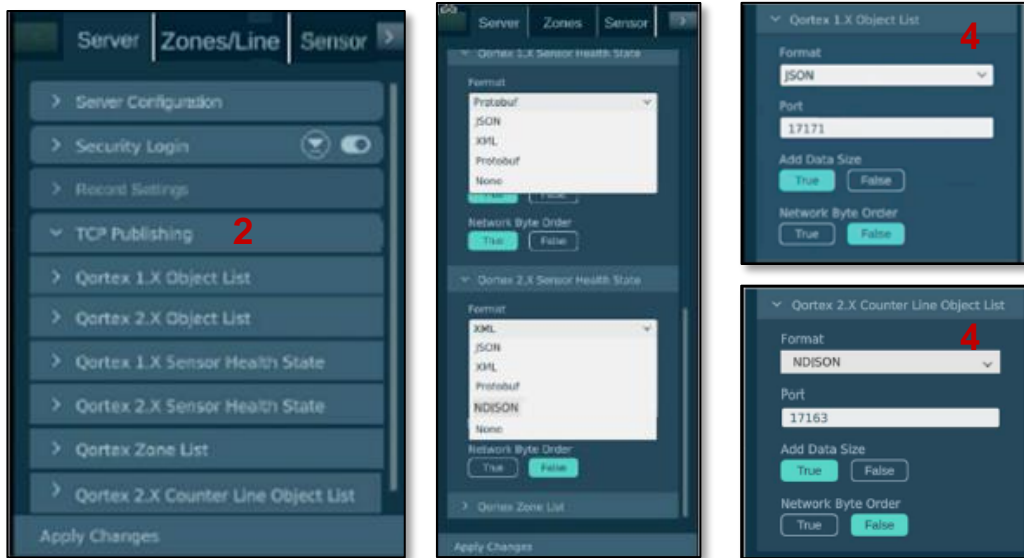


Figure 45. TCP Publishing Settings

These changes are applied to the settings.xml file.

```

<TCPPublishers>
  <!-- TCPPublishers section lists all publishing APIs, each publisher section has:
  - Fixed Name which is a string referenced in code to identify specific API, it
  could be :
      QORTEX_TRACK_LIST,
      QORTEX_ZONE_LIST, ...
  - Publishing Format which could be 'json', 'xml', 'protobuf', 'NDJson' or
  'none';
  Optional parameter in case of default is 'none'
  - Publishing TCP Port, Optional parameter in case of default uses a hard-coded
  default value for that
  -->
  <Publisher>
    <Name>QTRACK_COUNTER_LINE_TRACK_LIST</Name>
    <Format>json</Format>
    <Port>17163</Port>
    <AddDataSize>>false</AddDataSize>
    <NetworkByteOrder>>false</NetworkByteOrder>
  </Publisher>
  <Publisher>
    <Name>QORTEX_ZONE_LIST</Name>
    <Format>none</Format>
    <Port>17172</Port>
    <AddDataSize>>false</AddDataSize>
    <NetworkByteOrder>>false</NetworkByteOrder>
  </Publisher>
  <Publisher>

```




```

    <Name>QTRACK_TRACK_LIST</Name>
    <Format>none</Format>
    <Port>17161</Port>
    <AddDataSize>>false</AddDataSize>
    <NetworkByteOrder>>true</NetworkByteOrder>
  </Publisher>
  <Publisher>
    <Name>SENSOR_HEALTH_STATE</Name>
    <Port>17168</Port>
    <Format>none</Format>
    <AddDataSize>>false</AddDataSize>
    <NetworkByteOrder>>false</NetworkByteOrder>
  </Publisher>
  <Publisher>
    <Name>QORTEX_STATE</Name>
    <Port>17178</Port>
    <Format>none</Format>
    <AddDataSize>>false</AddDataSize>
    <NetworkByteOrder>>false</NetworkByteOrder>
  </Publisher>
  <!-- Data intended for Qortex Client -->
  <Publisher>
    <Name>CONFIGURATION_CLIENT_DATA</Name>
    <Port>17175</Port>
  </Publisher>
  <Publisher>
    <Name>MONITOR_CLIENT_DATA</Name>
    <Port>17176</Port>
  </Publisher>
</TCPPublishers>

```

Figure 46. Sample TCP Publishers portion of settings.xml

Secure TCP Port Data

1. Login as a secure user. See [Create New Users](#) (page 70).
2. From the Configuration panel, select the **Sensor** tab and expand **Advanced Settings > Global Settings**.
3. Enable **Secure TCP Ports**. Click the toggle to **ON** .

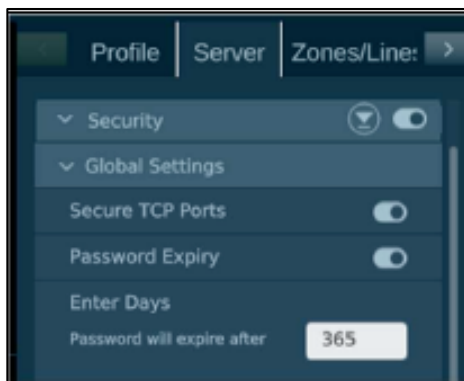


Figure 47. Global Settings > Secure TCP Ports

Adjust Sensor Settings

Use the Sensor tab to adjust the sensor settings. See [Figure 48. Basic and Advanced Sensor Settings in Sensor Tab](#).

Note: Though you can view the settings, the functionality is only available for a LIVE location.

1. Prepare to adjust sensor settings.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel, select the **Sensor** tab and expand **Basic Settings** or **Advanced Settings**.
3. Adjust the optimized values in a settings template (person, vehicle, or general). Expand the relevant panel and edit the fields listed.
 - **Basic Settings**, are designed for general users. They are a subset of the Advanced Settings. Editing Basic Settings is recommended for most use cases. See [Table 11. Basic Sensor Settings Descriptions](#).
 - **Advanced Settings**, the options include: ClusterPipeline, ClusterFilter, ClusterSplitter, MultiLidarPipeline, OutputFilter, StaticCloudPipeline, and TrackerPipeline. See [QORTEX Q-Track API Reference](#).

Editing Advanced Settings is recommended for advanced users who have a deeper knowledge of the QORTEX DTC parameter settings.
4. Click **APPLY ALL** at the bottom of the Sensor tab. Click **REFRESH** to return all values to default.

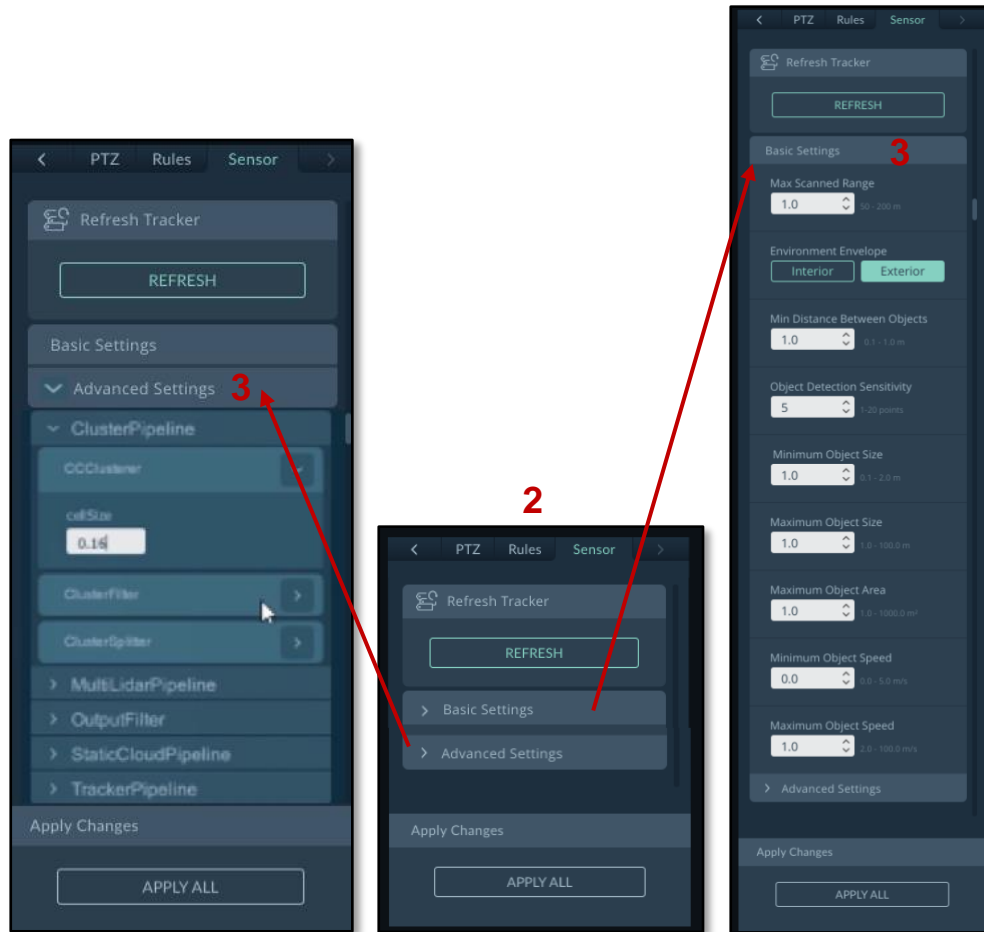


Figure 48. Basic and Advanced Sensor Settings in Sensor Tab

Table 11. Basic Sensor Settings Descriptions

Field	Range	Description	Advanced Setting Parallel
Max Scanned Range	50-200 m	The maximum distance the sensor can distinguish between background (static points) and foreground (moving points). Anything that exists beyond the setting is classified as background and is not tracked as an object.	BackgroundFilter > maxBinDistance
Environment Envelope	Interior or Exterior	Set to Exterior when there is open space beyond the maximum LiDAR range. Set to Interior when the environment is within (less than) the maximum LiDAR range.	BackgroundFilter > useNanAsUnobstructed
Min Distance Between Objects	0.1-1.0 m	Objects detected within this distance are merged together.	ClusterPipeline > CCCclusterer > cellSize

Field	Range	Description	Advanced Setting Parallel
Object Detection Sensitivity	1-20 points	Set the minimum number of points required to define a cluster as an object. Setting low values increases sensitivity and can return false positives. Setting high values increases the possibility of missing objects.	ClusterPipeline > ClusterFilter > minNumClusterPoint
Minimum Object Size	0.1-2.0 m	Objects smaller than this value are filtered out.	OutputFilter > minSize
Maximum Object Size	1.0-100.0 m	Objects larger than this value are filtered out.	OutputFilter > maxSize
Maximum Object Area	1.0-1000.0 m ²	Objects square area (length * width) is larger than this are filtered out.	OutputFilter > maxArea
Minimum Object Speed	0.0-5.0 m/s	Objects traveling at speeds (m/s) slower than this are filtered out.	OutputFilter > minSpeed
Maximum Object Speed	2.0-100.0 m/s	Objects traveling at speeds (m/s) faster than this are filtered out.	OutputFilter > maxSpeed

Advanced Setting: Anti-Masking Detector Settings

Anti-Masking detection sends an alert when the point cloud is compromised. For example, when the sensor cap is blocked. This feature is set to **False** (off) by default. See [Figure 49. Anti-Masking Detector Panel](#).

1. From the **Configuration** panel, select the **Server** tab and expand the **MaskingDetector** tab. Click the **v** arrow on the tab.
2. Turn on Masking Detection. Set **enable** to **TRUE**.
3. Set masking notification threshold.
 - **Masking ErrorPercent** – The percentage of point in the point cloud with no detected return must be greater than this threshold. When threshold reaches or exceed this value, notification is sent that the sensor is masked, masking is detected. Valid range 1.0 to 100%. Default is 80%.
 - **Masking ListedPercent** – The percentage of points in the point cloud with no detected return must be less than or fall below this threshold. When the threshold reaches or drops below this value, notification is sent that the sensor is no longer masked, masking is no longer detected. Valid range 1.0 to 100%. Default is 50%.

To prevent bouncing, set these values to so they have greater than a 10% difference.

4. Click **Apply Changes**.

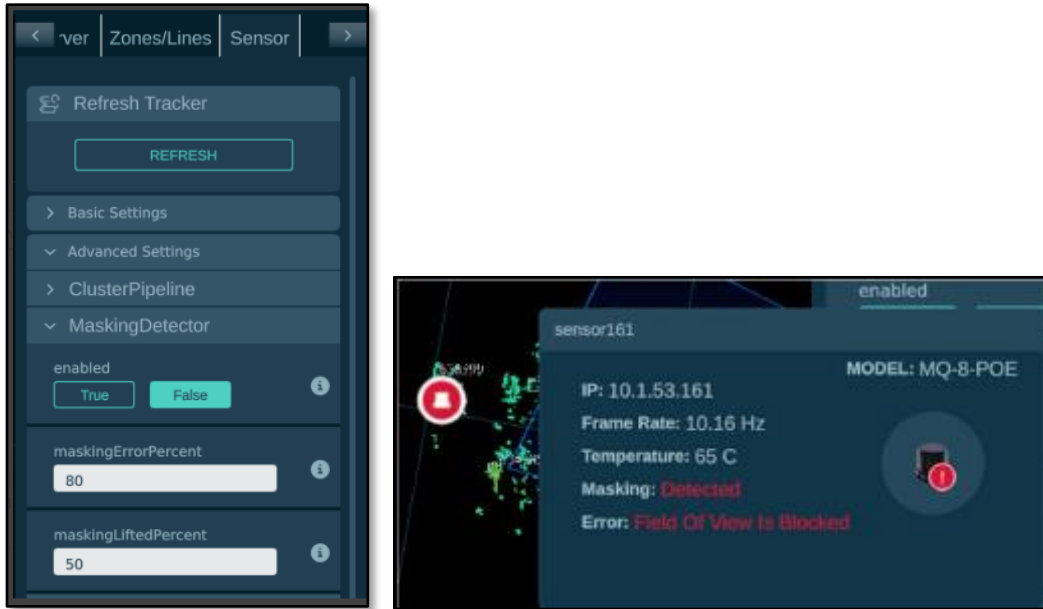


Figure 49. Anti-Masking Detector Panel, Masking Detected Sample

Advanced Setting: Movement Threshold Filter

Use the Movement Threshold to identify static objects, such as grass and foliage. The Movement Threshold is an object filter that keeps track of where each object was first seen and calculates the distance with its current position. When an object does not meet the threshold values, it is considered static and not assigned an object ID.

1. From the Configuration panel, select the **Sensor** tab > expand **Advanced Settings** > **Output Filter** > **Movement Threshold**.
2. Set **MovementThreshold** values to define and enable the threshold filter.
 - **minMovementThreshold** – distance of detected movement measured in meters.
 - **minSize** – Objects smaller than this value are filtered out.
 - **minSpeed** – Objects traveling at speeds (m/s) slower than this are filtered out.
 - **mustBeClassified** – Object classified as “unknown” are filtered out.
 - **useMovementThresholdFilter** – to enable Movement Threshold, set to **True**.
3. Click **Apply Changes**.



Figure 50. Minimum Threshold Filter Panel

Advanced Setting: SubVehicle Classification Method

QORTEX DTC 2.4 provides an option to use a machine learning based subvehicle classifier rather than the logic classifier of earlier QORTEX DTC versions. The ML model and the logic classifier both differentiate between the same three vehicle subclasses:

- Class 1 – Two-wheeler (motorcycle, bicycles, scooters)
- Class 2 and 3 – Passenger vehicles (passenger cars, trucks, and vans)
- Class 4 and above – Commercial vehicles (busses, commercial trucks)

1. From the **Configuration** panel, select the **Sensor** tab > expand **Advanced Settings** > **Output Filter** > **SubVehicle Classification**.
2. Set the subVehicle classifier mode. In the **subVehicleClassifier** field, select
 - `logic` – this uses the logic classifier
 - `logic_regression` – this uses the ML classifier
3. If using ML classifier, set learning script. In the **subVehicleClassifierCheckpoint** field, select from the options: `528ef191`, `ff902fb0`, `300ac7e6`.
4. If in a cluster configuration, set to use heuristics. In the **usePointBasedHeuristics** field select **True**.
5. Enable subVehicle classifier. This setting and a license for subVehicles is required to enable subVehicle classification. In the **useSubVehicleClassification** field, select **True**.



Figure 50. SubVehicle Classifier Panel

Advanced Setting: Object Forking and Splitting Parameters

Sometimes as objects approach each other, then move apart, they are assigned different object IDs. To keep consistent object IDs, adjust the parameters:

`min_vehicle_forking_merging_heading_diff` and `merged_vehicle_cluster_ratio`.

Decreasing `merged_vehicle_cluster_ratio` and increasing `min_vehicle_forking_merging_heading_diff` can cause false positives.

1. From the **Configuration** panel, select the **Sensor** tab > expand **Advanced Settings** > **Output Filter**.
2. Adjust the values in the fields.
 - `merged_vehicle_cluster_ratio` – set value to greater than 2.27
 - `min_vehicle_forking_merging_heading_diff` – set value to less than 1.5
3. Click **Apply Changes**.



Figure 51. Merged and Forking Object Panel

Advanced Setting: Stabilize Stationary Vehicles Settings

Sometimes the visualization of objects sitting still for a time, wobble. To reduce this bouncing of stationary object, enable `StabiitizeStationaryVehicles` and adjust the parameters: `velocityThreshold` and `windowSize`.

1. From the **Configuration** panel, select the **Sensor** tab > expand **Advanced Settings** > **MeasurementAdjuster** > **StabilizeStationaryVehicles**.
2. Lower the values in the fields when vehicles are showing as stationary when they are not.
 - `velocityThreshold` – example value 1.5
 - `min_vehicle_forking_merging_heading_diff` – example value 10
3. Enable the **StabilizeStationaryVehicles** feature. Select **True**.
4. Click **Apply Changes**.

Advanced Setting: Fuse Point Cloud Pipeline Settings

When there is a large number of objects, and you want to reduce processing time, enable `MultiCloudPipeline`. This feature uses a Deep Learning based perception pipeline that connects to raw data pipeline and merges the point cloud from multiple lidars into one merged point cloud.

1. From the **Configuration** panel, select the **Sensor** tab > expand **Advanced Settings** > **MultiCloudPipeline**.
2. Enable the **MultiCloudPipeline** feature. Select **True**.
3. If needed, specify the name of the **multiCloud** to **enable**. In the configuration file, the parameter is `<name>multiCloud</name>`.
4. Click **Apply Changes**.








Figure 52. Fuse MultiCloud Pipeline Panel

Sensor Health Status Options

When the QORTEX DTC client is displaying **LIVE** data, use **Sensor Health** to check the status of each sensor. See *Figure 53. Sensor Health: Axes (1), Disconnected (2), Healthy (3), Malfunctioning (4).*

Enable sensor health mode

Click the **Sensor health**  toggle to display or hide the health and diagnostics data for all sensors and PTZ cameras added to the QORTEX DTC server. In the Visualizer window, the colored axes  change to become **green** healthy , **red** malfunctioning , or grey disconnected  sensor icon.

Sensor health for the PTZ camera relays information about the PTZ camera connectivity states, including Disconnected, Connected, IP not reachable, Other error.

Display an informational tool tip

Hover over the **Sensor health**  button to see the list of options.

View the diagnostics panel



1. Hover over one of the **green** (or **red**) sensor icon to display a tooltip with instructions and the sensor or PTZ camera name.
2. Click one of the **green** (or **red**) sensor icon to select a sensor or PTZ camera.
3. Review the selected sensor health data as it appears in a single panel on the Visualizer window.

4. Click a different sensor icon to see another sensor data.

Dismiss the diagnostics panel

Click in the Visualizer window, not on the sensor icon.

Disable sensor health mode

Click the **Sensor health** button . In the Visualizer window, the now inactive sensor icons return to displaying as 3D-colored axes, and the **Sensor health** button resumes its disabled  appearance.

Sensor Health Diagnostics Panel

The **Diagnostics** panel reports these important data points pertaining to the selected sensor:

- **Sensor name**
Typically, this is the sensor serial number. See [View PTZ Camera Details](#) (page 140).
- **Sensor model and image.**
- **IP address**, such as 10.1.24.137.
- **Frame rate** is the rotational speed of the turret (stated as the number of cycles per second in hertz). This is adjustable through the Sensor Settings Management application (webserver) built into the sensor. See [Edit Settings](#) in your sensor-specific user guide. Request the sensor user guide from support@quanergy.com.
- **Temperature** reported in degrees Celsius.

Error reported as None or High Sensor Temperature, for example. The error message is in **red**, and the malfunctioning sensor icon appears in **red** in the client interface for identification.

If the Q-Track sensor Rev D4P and higher returns an error, a message printed in red describes the problem. If the Q-Track sensor Rev D4 and lower returns an error, it cannot report it in the **Diagnostics** panel.

Table 18. System Status and Error Messages lists the possible sensor state messages.

For possible causes and solutions for the reported error, see *Troubleshooting Issues* in your sensor-specific user guide. Request the sensor user guide from support@quanergy.com.

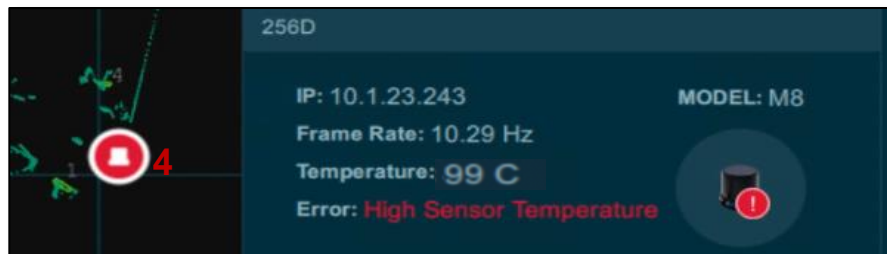
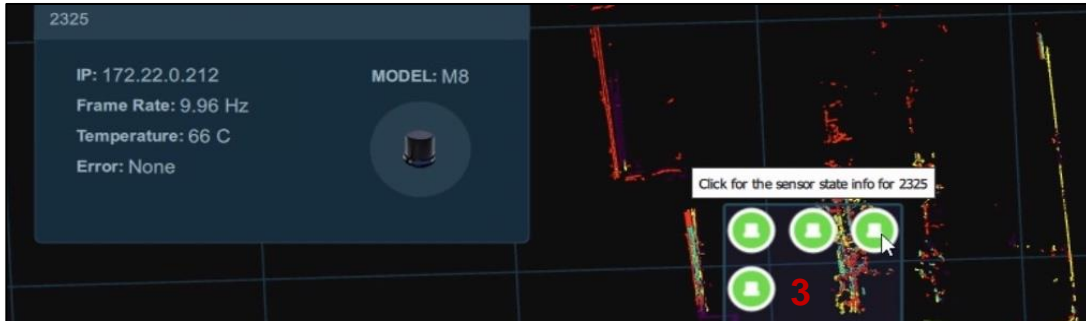


Figure 53. Sensor Health: Axes (1), Disconnected (2), Healthy (3), Malfunctioning (4)

12. Establishing Zone and Counter Lines

Typically, a site area of interest is not uniformly important. Secured sites have areas of minimal and maximal importance, and QORTEX DTC enables treating each of those spaces with appropriate consideration. See *Figure 54. Event, Exclusion, Inclusion Zones, and Counter Lines* in Visualization Pane.

- **Event zones** are special areas of importance for security and smart cities and spaces with interests in monitoring pedestrian flow, valuable resources, or sensitive equipment. QORTEX DTC Rules apply to Event zones only. Third party software can ingest the zone list output and define triggered actions — highlighting tracked objects or turning lights or alarms on and off through HTTP GET network command — to target suspicious activities before actual problems occur.
- **Exclusion zones** are visually noisy areas (flapping flags or swaying branches, for example) that pose zero threat and therefore no interest. These are areas that would be wasting bandwidth for detecting, visualizing, tracking, classifying, or recording the moving objects. Exclusion zones can be used in conjunction with other zones to exclude an area within another zone.
- **Inclusion zones** limit the QORTEX DTC processing area. Everything outside of the Inclusion is ignored. If 0 Inclusions zones are drawn, the QORTEX DTC server processes the entire area covered by the sensors except for Exclusion zone areas. If 1 or more Inclusion zones are drawn, the QORTEX DTC server only processes the point cloud in the Inclusion zones. Event zones and Exclusion zones can overlap Inclusion zones.
- **Counter Lines** track movement of objects across counter lines. Set direction for the count left/right, in/out. To count the number of people crossing into or out of an area, add a counter line. Set counter lines in doorways or metal detectors. This is useful for counting occupancy in bathrooms, conferences room, pedestrian occupancy crossing streets, or entering buildings such as stores and restaurants from the street. Counter Lines can overlap all other zones.

Edit zones and counter lines through the **Zones/Lines** tab in the **Configuration** panel. Zone and Counter Line definitions are stored in the `settings.xml` file. The `settings.xml` file is produced, managed, and updated based on actions performed in the **Configuration** panel.

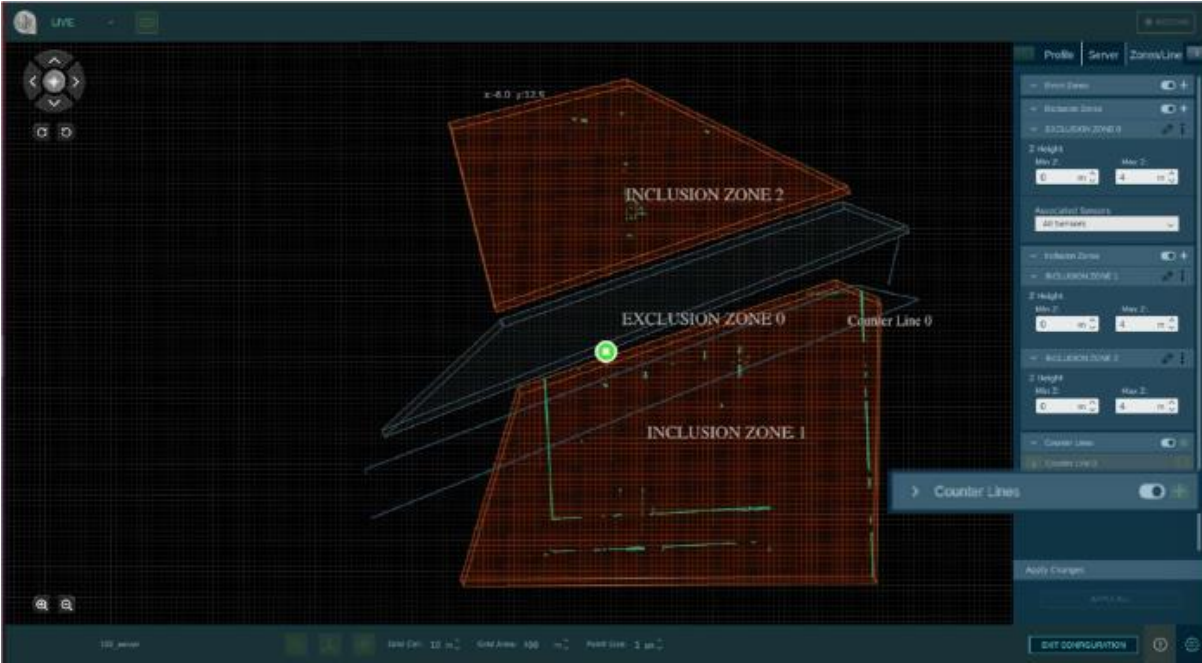


Figure 54. Event, Exclusion, Inclusion Zones, and Counter Lines in Visualization Pane

Create Zone/Counter Line Overview

1. Prepare to Define Zones (page 108).

From the QORTEX DTC client, enter **Configuration** mode.

2. Add a Zone (page 109).

- a. Select the tab for the zone to draw, either **Event**, **Exclusion**, **Inclusion**, or **Counter Line**.
- b. Click in the **Visualizer** to add connected points of the zone. Counter Lines do not need to be closed.

3. Adjust Vertical Distances (page 113).

Define the height (Z-axis) of the zone, up and down relative to the position of the sensors.

Prepare to Define Zones/Lines

After a server is selected and set up with a single-sensor or multi-sensors, define a zone/counter line.


1. From the **Configuration** panel, scroll to and click the **Zones/Lines** tab.
2. Expand the **Event**, **Exclusion**, **Inclusion**, or **Counter Line** panels. Click the expand panel  icon
3. Continue to [Add a Zone](#) (page 109)



Figure 55. Zone/Line Definition Initial Steps

Add a Zone/Line

Add one or more zones/counter lines to the sensor defined area.

1. From the **Configuration** panel, select **Zones/Lines** tab > **Event**, **Exclusion**, **Inclusion**, or **Counter Line** panel click the **Add (+)** button. Each new instance of the zone/counter line panel type increments the default name number.

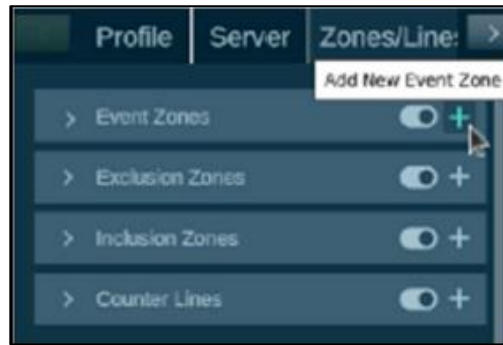



Figure 56. Add Zone/Lines Buttons

2. Draw the zone.

See [Figure 57. Three Zone Types and a Counter Line Created.](#)

- a. Click in the Visualizer window.
- b. Move and click a second point.
- c. Continue to move and click until the zone polygon or counter line is complete.
Right-click to deselect a previously placed point.
- d. When the shape is defined by at least three points, complete the zone/counter line. Choose a method:
 - Select Save/Exit from the right panel.
 - Left double-click the zone in the Visualizer window.
 - Click the green **Close** button in the Visualizer window.

3. For Counter Lines, toggle the direction that define 'In' and 'Out' across the Counter Line. Click the **Direction** icon to switch the direction.
4. Click **Apply Changes** to save the zone/counter line and update the configuration file on the QORTEX DTC server. This ensures the zone/counter line shows up persistently in each session.
5. Click **APPLY ALL**, when you are finished creating zones/counter lines
6. Toggle the zone/counter line to On .
7. For Zones, continue to the *Adjust Vertical Distances of the Zone* (page 113).

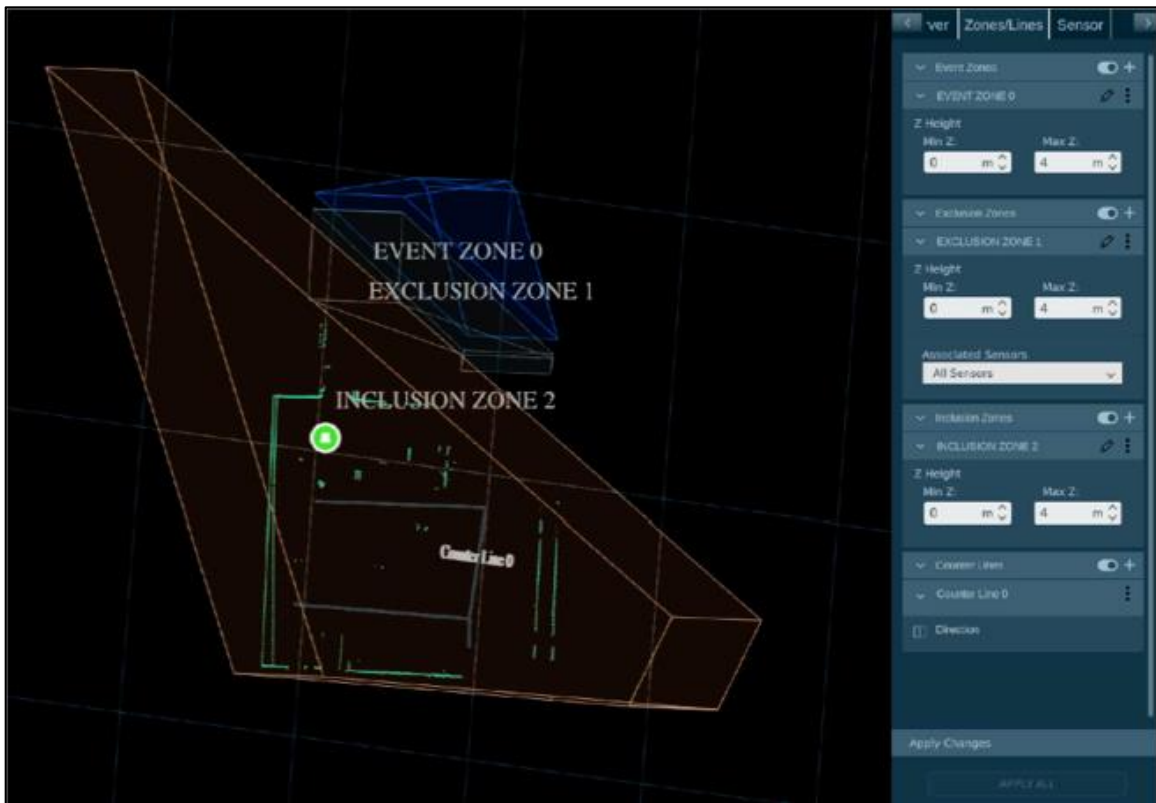


Figure 57. Three Zone Types and a Counter Line Created

Edit a Zone/Line

All zone types and counter lines can be edited.

To change the shape of an existing polygon zone/counter line:

1. Open the zone editor:

From the Visualizer, in **Configuration** mode, use your mouse and keyboard to manipulate the zone/counter line, and enter **Edit** mode. Choose a method:

- Left click in the zone.

- From the **Configuration > Zones** tab, click the edit (pencil)  icon.

The vertices of the zone display as points. See [Figure 58. Zone/Counter Line Edit Icon and Editing Vertex Points](#).

2. Apply changes to the zone/counter line:

- **Move an entire zone/counter line:** Single left-click and hold, then move the mouse to the new position and left-click. QORTEX DTC moves the entire zone/counter line.
- **Edit a zone vertex point:** Double right-click on an individual vertex point to select it. Move the mouse to the new location and single left-click.
- **Add a zone vertex point:** Single left-click at new vertex point location. Qortex DTC automatically adds the point into the zone/counter line, relative to the two nearest points in the zone/counter line.
- **Remove a selected vertex point:** Double right-click on an individual vertex point to select it. Single right-click.

3. Close zone/counter line editing: Double left-click.

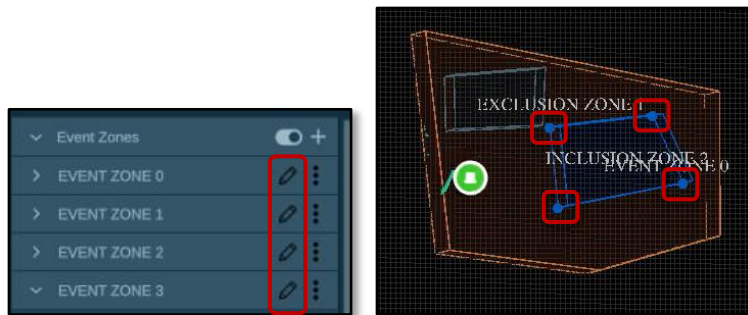


Figure 58. Zone/Counter Line Edit Icon and Editing Vertex Points

Save and Exit Editing a Zone/Counter Line

To save changes and exit zone/counter line Edit mode:

1. Close the zone area. Counter lines do not need to be closed.
2. Double left-click anywhere in the Visualizer.

Cancel and Exit Editing a Zone/Counter Line

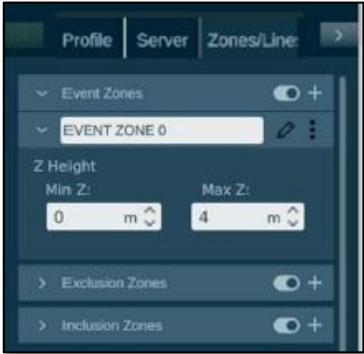










To cancel and exit zone/counter line Edit mode: Press **Escape** [esc] key.

Changes are not saved. All changes since you opened Edit mode, are lost.

Common Zone/Counter Line Widgets

The **Event**, **Exclusion**, **Inclusion**, and **Counter Line** panels enable the user to control creation, visibility, and ability of up to 1000 zones. Each zone type or counter line and individual zone/counter line has management options. See [Table 12. Zone/Counter Line Management Widgets](#).

Table 12. Zone/Counter Line Management Widgets

Management Option	Button	
	OFF/Collapse	ON/Expand
Change zone/counter line name: Click on name. Enter new name in field. Click out of field.		
Delete specific zone/counter line. Click trashcan icon, click Apply , and click Confirm .		
Expand/Collapse zone/counter line panel. Click arrow toggle.		
Enable/Disable all zones/counter lines. Click button toggle.		
Enable/Disable specific zone/counter line. Click button toggle. Default ON.		
View/Hide specific zone/counter line in Visualizer. Click eye icon.		

Adjust Vertical Distances of the Zone

In the **Event**, **Exclusion**, or **Inclusion** panels, **Min Z** is the minimum distance, defining the zone bottom plane relative to the world Origin. **Max Z** defines the zone top plane relative to Min Z and world origin. Between the Min Z and Max Z is the range where points are considered meaningful. Any points that are detected outside of that range are discarded.

Default values (Min Z at 0 meters and Max Z at 4 meters) are likely to need adjustment. For example, a sensor mounted on top of a fence or strapped to a pole, needs a negative number for the Min Z and possibly a higher number for Max Z. It can also be useful to adjust Min Z if excluding fluttering branches and leaves, for example, or tracking a person climbing up over a fence while ignoring a person standing next to the fence. See [Figure 59. Adjusting Vertical Height in Zones](#).

Adjust a zone Min Z and/or Max Z:

1. In the Visualizer, click the **Reset View** menu, then select **Side View** to more easily visualize relative zone heights within the scene.
2. In the Zone/Lines tab, select a zone.
3. In the **Z Height** panel, adjust the zone **Min Z** and/or **Max Z** height values in whole numbers by one of these methods:
 - Click the up / down arrows of the user interface or the keyboard to change a value.
 - Click the value, backspace, and type a new value.
4. Click **APPLY** to save the values, update the configuration file on the server, and visualize the results of the choices made.
5. Revise and re-APPLY as many times as needed.

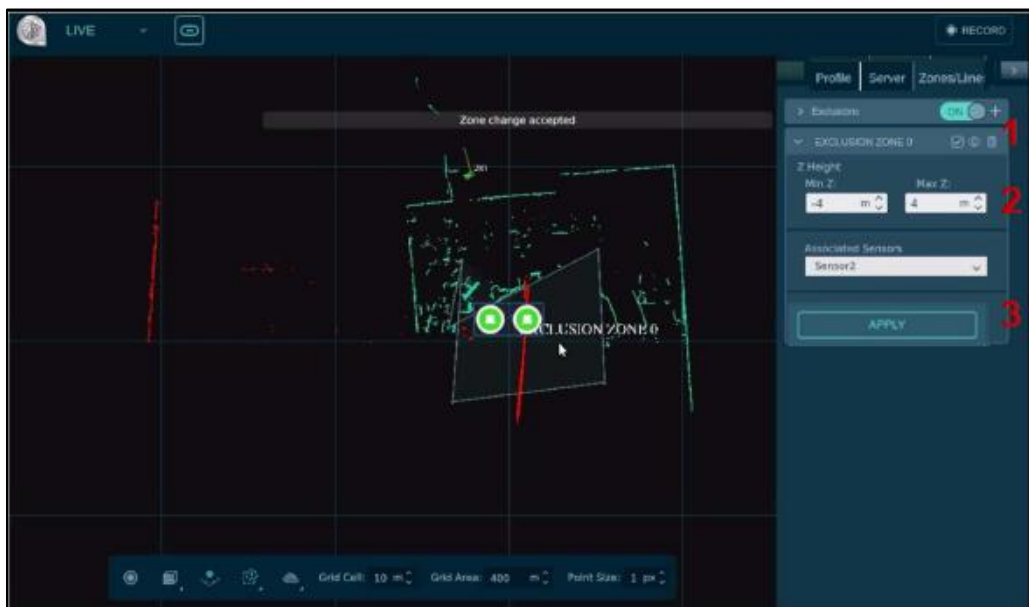


Figure 59. Adjusting Vertical Height in Zones

Enable Exclusion Zones by Sensor

Some monitored environments have areas that contain reflections, such as bodies of water or mirrored windows. Reflections of objects can sometimes be mistaken for actual objects. One approach to reducing reflections as objects is to create Exclusion zones around the reflecting area. Sometimes an area generates reflections only from a certain direction, in which case, the reflections only affect data collected from selected sensors.



Figure 60. Sample Reflections in Visualizer

For additional methods to adjust for reflections, such as intensity and noise-based settings.xml edits, contact support@quanergy.com.

Use the **Associated Sensor** option to enable Exclusion zones on specific sensors.

1. In the Visualizer, click the **Zones/Lines** tab, and expand the **Exclusions** panel.
2. To apply specific Exclusion zones to specific sensors:
 - a. Expand the **zone_name > Associated Sensor** menu.
 - b. Click the checkboxes to apply **zone_name** to each sensor.
 - c. Alternatively, check **All Sensors**.
 - d. Click outside the menu.

The selected *sensor_names* are listed in the **Associated Sensor** box.

3. Click **APPLY**.



Figure 61. Exclusion Zones by Sensor

13. Visualizing Data

The process of setting up data visualization involves both QORTEX DTC 2.4 server and client, as explained in the following sections.

Start the Operation

Both the server and client must be in operation to visualize LIVE or PLAYBACK (recorded) data:

1. On the Ubuntu machine hosting the QORTEX DTC 2.4 server, confirm the server is running by checking its status. See [Control the Server Daemon Service](#) (page 56).
2. On the Windows or Ubuntu machine hosting the QORTEX DTC 2.4 client, start the client. See [Start the Client on a Windows Host](#) (page 57) or [Start the Client on an Ubuntu Host](#) (page 57).

Monitor Mode

Monitor mode supports multiple monitoring sensors simultaneously. Multiple distributed clients can monitor the same server published data. See [Figure 62. Bottom Menu Bar](#).

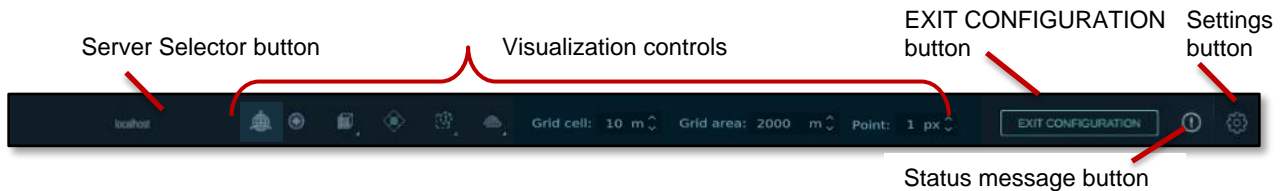


Figure 62. Bottom Menu Bar

To use monitor mode:

1. By default, the client interface is in **Monitor** mode when the following events occur.
 - o As soon as the client first starts running.
 - o Whenever the interface is not explicitly in **Configuration** mode.
 - o After the user has clicked the **EXIT CONFIGURATION** button to exit **Configuration** mode.
2. As soon as a server is selected and before the server has been configured, **Monitor** mode visualizes the server data output without the point cloud (for reduced bandwidth consumption).
3. Monitor objects as they move and interact with any zones that are defined.

Use the Visualizer controls to adjust the view. See the following sections for descriptions of each of the Visualizer control options.


Visualizer Controls

In the bottom of the client screen are the Visualizer controls. The following sections describe the actions for each of the options.

World Coordinate Point Cloud Alignment

The World Origin button toggles adding or removing the World Coordinate object in the visual display. When the World Coordinate object is displayed, you can align the point cloud to a physical plane. For example, the ground or a wall.

To use the World Coordinate object to align the point cloud:

1. Set the World Origin in Q-View for each sensor. See the *Q-View User Guide*.
2. Click the World Origin button to toggle on the World Coordinate object .


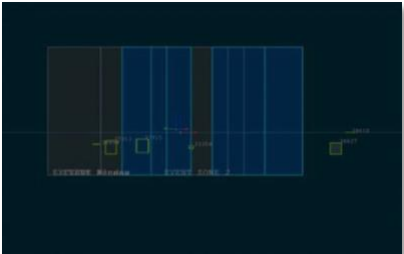

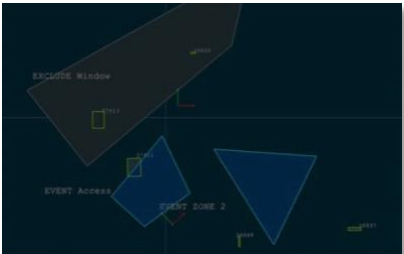
Reset View Toggle

The **Reset view** button toggles the display between Top View or Side View perspective relative to the sensor. See *Table 13. Viewing Controls: Reset View Snaps to a Flat View*.

To use reset view:

1. Click the button to open a pop-up menu to see options for snapping to Top View or Side View.
2. Hover over an icon in the menu to reveal its function.
3. Click the icon for a particular view. The Visualizer and background grid snaps to the selected view.

Table 13. Viewing Controls: Reset View Snaps to a Flat View

Name	Widget	Visual	Example
Side View		Grid and Visualizer snaps to the worms-eye-view as though looking straight into the side of the sensor, as shown on the right (with Orthographic projection toggled on).	
Top View		Grid and Visualizer snaps to the birds-eye-view as though looking straight down on the top of the sensor, as shown on the right (with Orthographic projection toggled on).	

Perspective View through 3D Controls

Use the following mouse (or trackball) controls to fine-tune the display perspective as. If multiple sensors are displayed, then instructions that refer to a specific axis pertain to the sensor specified to be the World Lidar. See [Add or Update Multiple Sensors at a Location](#) (page 90) and Appendix 1: [Cartesian Coordinate System](#) (page 171).

To zoom the display in and out, rotate the mouse wheel.

To reposition the display within the visible area:

1. Hold down the right mouse button and move the mouse or mouse ball until the area of interest is located.
2. Release the mouse button.

To spin the display around the red X-axis.

1. Reset the display to the top view.
2. Hold down the left mouse button, then move the mouse or mouse ball up or down along a vertical line.
3. Moving along the line, the view passes from the top view (looking down on the sensor) to a side view (looking at the side of the sensor) to an upside-down view of the sensor.
4. Release the mouse button.

To spin the display around the green Y-axis.

1. Reset the display to the top view.
2. Hold down the left mouse button, and Shift+Drag the mouse or mouse ball left-to-right or right-to-left along a horizontal line.
3. Release the mouse button.

To spin the display around the blue Z-axis.

1. Reset the display to the top view or side view.
2. Hold down the Control+Drag the mouse or mouse ball left-to-right or right-to-left along a horizontal line.
3. Release the mouse button.

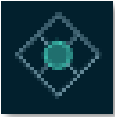
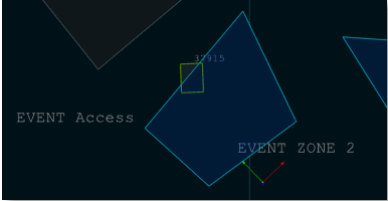
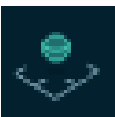
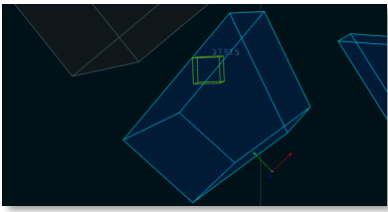
Orthographic Projection Toggle

The **Orthographic projection** toggles between on and off mode. ON switches to 3D view. Off switches to 2D view.

Orthographic projection is most useful in Top View and when trying to determine whether objects are in or near zones. See [Table 14. Viewing Controls: Orthographic Projection Toggles On and Off.](#)

Click the **Orthographic projection** button to toggle between on and off mode. When the Orthographic projection is on, the Visualizer and background grid snaps to the selected mode. This makes it easier to see whether an object is in or out of the zone boundary.

Table 14. Viewing Controls: Orthographic Projection Toggles On and Off

Name	Widget	Visual	Example
Orthographic Projection is ON (click to turn off)		ON represents 3D view in 2D, so the view of a location is along parallel lines that are perpendicular to the plane of the floor, which clarifies where an object is in relationship with a zone boundary, as shown in the example image.	
Orthographic Projection is OFF (click to turn on)		OFF makes it harder to determine whether an object is inside or outside of a zone boundary. In the example image, notice how the objects appear to be simultaneously inside and outside of the zone boundary.	

Visibility: Zones/Lines and Object ID

The **Visibility** menu sets whether to include Exclusions, Events, and/or Trackable Object (Track) IDs in the display. See [Table 15. Viewing Controls: Zones Hide and Show](#) and [Table 16. Viewing Controls: Track IDs Enabled and Disabled](#).

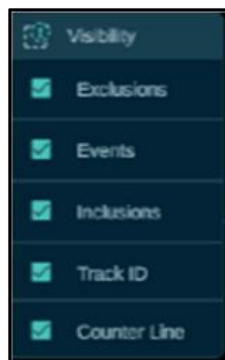


Figure 63. Visibility Menu for Zones and Counter Lines

To use visibility zones:

1. Click to open a pop-up menu, which displays options for hiding/unhiding zones and track ID.
2. Hover over an item in the menu to reveal its function.
3. Click the box for the preferred option.

When checked, the Visualizer displays the selected zones and/or track ID labels. When unchecked, the Visualizer hides the selected zone and/or track ID label.

If the `use_timestamp_in_id` option is set to `True`, then the object ID includes a timestamp. The setting for the option is listed in the `settings.xml` file.

Table 15. Viewing Controls: Zones Hide and Show


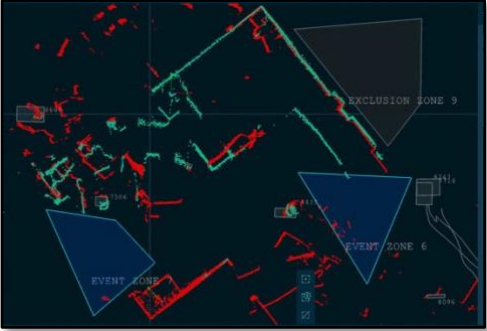
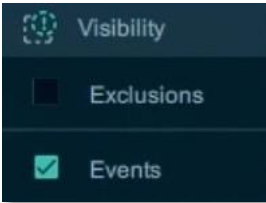
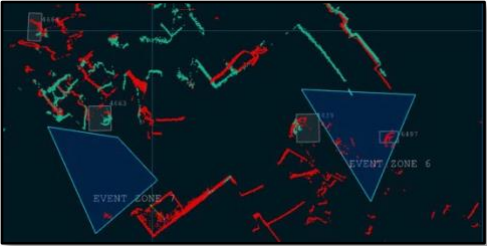
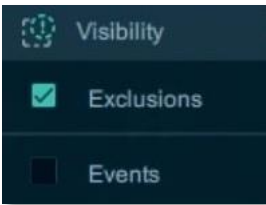
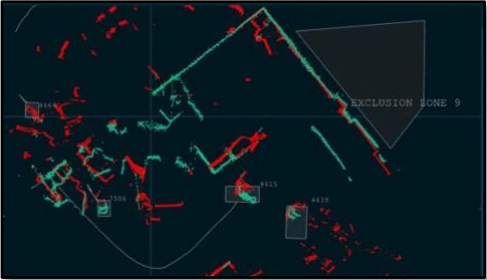
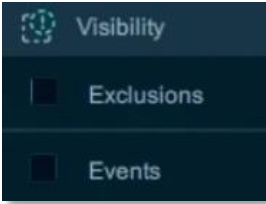
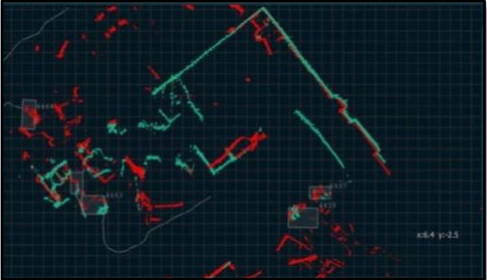
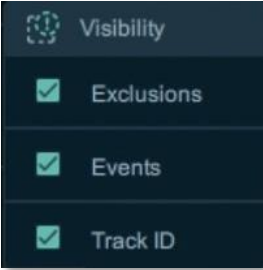
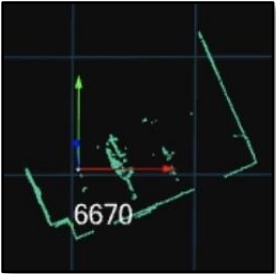
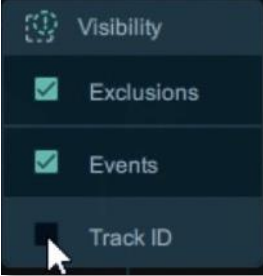
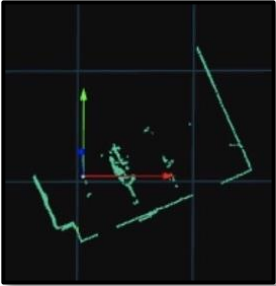
Status	Apply	Visual	Example
Checked Exclusions and Events		All Event zones and all Exclusion zones are shown in the Visualizer window.	
Checked Events Only		All Event zones are shown in the Visualizer window.	
Checked Exclusions Only		All Exclusion zones are shown in the Visualizer window.	
Unchecked Exclusions and Events		No zones are shown in the Visualizer window.	

Table 16. Viewing Controls: Track IDs Enabled and Disabled

Status	Apply	Visual	Example
Checked Track ID		All Track IDs are shown in the Visualizer window.	
Unchecked Track ID		All Track IDs are hidden in the Visualizer window.	


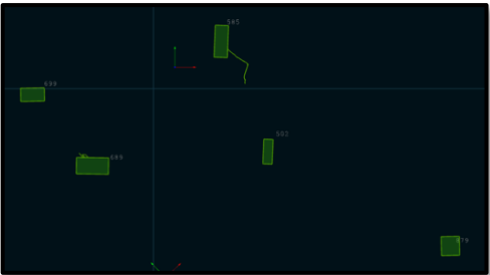
Point Cloud Display





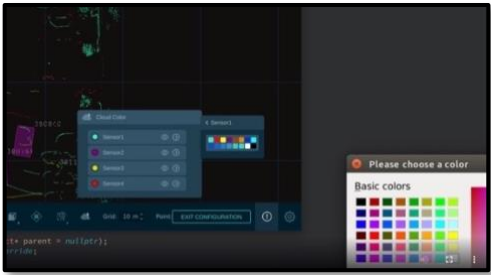

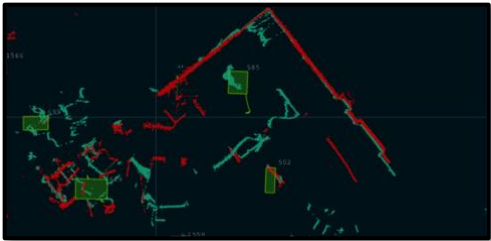


The **Point Cloud Display** toggles between multi-sensor viewing options: **No Cloud**, **Color Picker**, **Split**, and **Combined/Fused**. This menu has no effect in **Monitor** mode.

To use point cloud display:


1. Click it to open a pop-up menu of options for hiding/unhiding point clouds.
2. Hover over an icon in the menu to reveal its function.
3. Click the icon for the preferred option. The Visualizer conforms to the request.

Table 17. Viewing Controls: Point Cloud Visualization

Name	Widget	Visual	Example
No Cloud		The point clouds are not visualized in the Visualizer window.	

Name	Widget	Visual	Example
Color Picker		In the Cloud Color panel: Hide/show  a sensor point cloud. Click arrow  to select a different color swatch. Click black swatch  to pick/define new color.	
Split		Each sensor point cloud is visualized in a different color in the Visualizer window. This is useful for troubleshooting.	
Combined/ Fused		All sensors' point clouds are combined into a single fused point cloud that is visualized in a single color in the Visualizer window.	

Grid Cell

The **Grid Cell** menu  adjusts the background grid spacing in the display. Measured in meters. There are always at least 4 grid cells, each with the connecting point from the center of the area. Grid cell square minimum size is 1 meter, maximum is 100 meters.

To use grid cell settings:

Note: If the monitor resolution is 1440x900, 1280x800, 1024x768, or 1280x1024, exit **Configuration** mode before proceeding.

1. Click (or click and hold) an up or down arrow on Grid Cell selection menu to adjust the number increment.
2. Click the number and backspace to remove a digit, or type to add a digit. When the number is correct, click the **Enter** button.

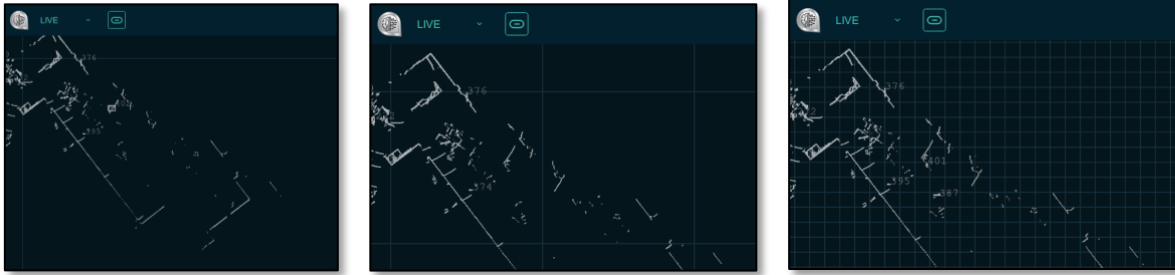


Figure 64. Viewing Controls: Grid Cell 50 m (left), 10 m (middle), 1 m (right) Grid Area

Grid Area

The **Grid Area** menu **Grid Area: 400 m** adjusts the size of the monitored area. The measurement applies to all sides of the monitored area. This option adjusts the viewable area that is displayed in the Visualizer. It does not change the view in the Visualizer. Grid Area along each side is minimum 10 meters, maximum 50,000 meters.

To use grid area settings:

Note: If the monitor resolution is 1440x900, 1280x800, 1024x768, or 1280x1024, exit **Configuration** mode before proceeding.

1. Click (or click and hold) an up or down arrow on Grid Area selection menu to adjust the number increment.
2. Click the number and backspace to remove a digit, or type to add a digit. When the number is correct, click the **Enter** button.

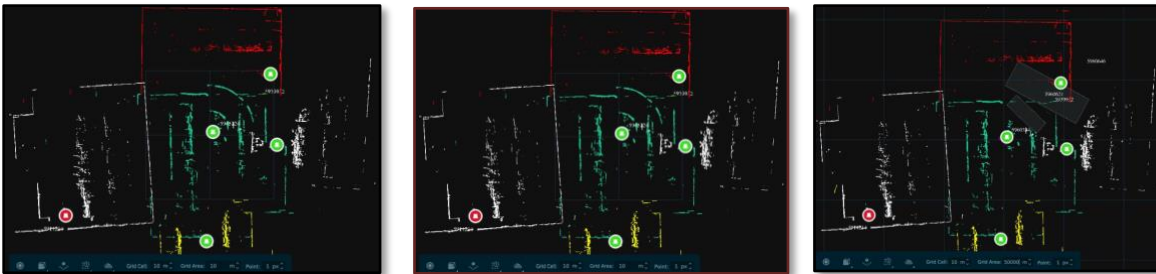


Figure 65. Viewing Controls: Grid Area 10 m (left), 25000 m (middle), 50000 m (right)

Point Size

The **Point** menu **Point: 1 px** adjusts the size of the points in the display. Measured in pixels, adjustable in increments of 1 pixel, within a range of 1 pixel for the finest size (default) to 5 pixels for the coarsest size.

Note: With client installations, depending upon the computer graphic card, the point cloud size might not change when the value is changed in the **Point Size** setting.

To use point size settings:

Note: If the monitor resolution is 1440x900, 1280x800, 1024x768, or 1280x1024, exit **Configuration** mode before proceeding.

1. Click (or click and hold) an up or down arrow to adjust the number increment.
2. Click the number and backspace to remove a digit, or type to add a digit, then click the **Enter** button when the number is satisfactory.

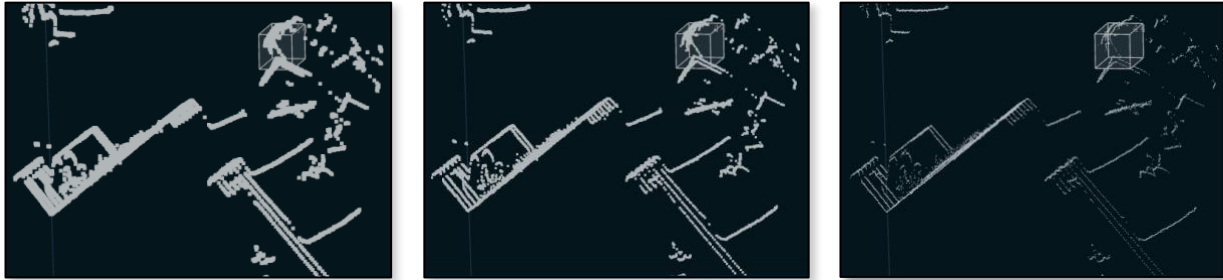





Figure 66. Viewing Controls: Point Size of 5 px (left), 3 px (middle), 1 px (right)

Visualize Live Data

LIVE data is visualized according to the configuration saved in the settings file. See [View PTZ Camera Details](#) (page 140).

1. If the top left corner of the interface indicates **Disconnected** status , click that button to reconnect sensor(s) to the server and visualize the collected data. When connected, the button status is 
 - For a sample visualization of single-sensor `settings.xml` file output, see [Figure 67. Visualize Single-Sensor LIVE Data](#).
 - For a sample visualization of multiple-sensor `transform_alignment.xml` file output (no zones) from Q-View, see [Figure 68. Visualization based on transform_alignment.xml File without Zones](#).
 - For a sample visualization of the `settings.ini` file output (with zones) from QORTEX DTC 1.x, see [Figure 69. Visualization based on settings.ini File with Preconfigured Zones](#).

It may take up to 30 seconds for the sensors to spin up and data to appear in the Visualizer window. By default, each sensor point cloud appears in a different color.

2. In the **Visualizer** window of the client interface, visually confirm the point cloud, objects, and tracks, if any are moving in the sensors' or PTZ camera area. See [Table 6. Visualizer Elements and Colors](#), [Table 7. Visualizer Zone Types and Colors](#), and [Table 8. Visualizer Tracked Objects and Colors](#).
3. In the bottom right corner of the client interface, click the **Settings** button  to close the **Configuration** panel and see more of the Visualizer window.

4. To select options for the point cloud view, click the icons in the visualizer bar,



5. To turn off the point cloud (to conserve bandwidth), click the **EXIT CONFIGURATION** button in the same corner of the window. Visualization of objects, tracks, zones, and so on continues without the point cloud.

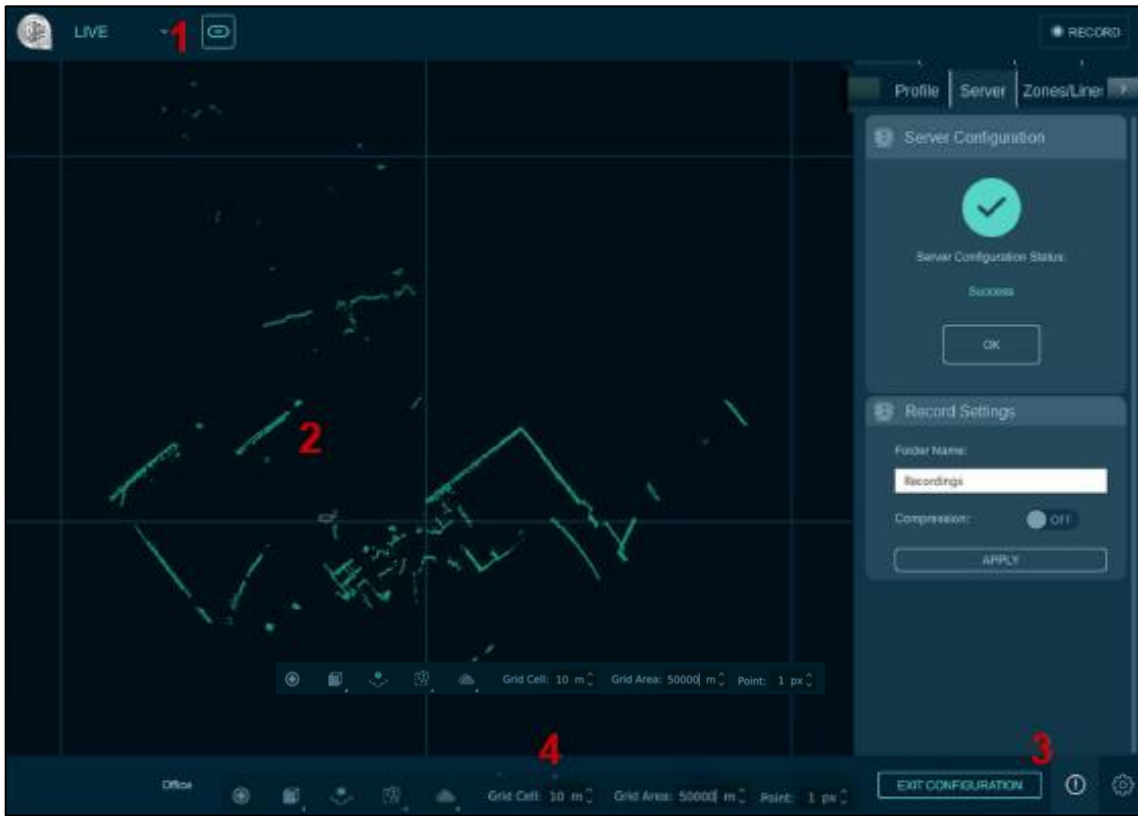


Figure 67. Visualize Single-Sensor LIVE Data

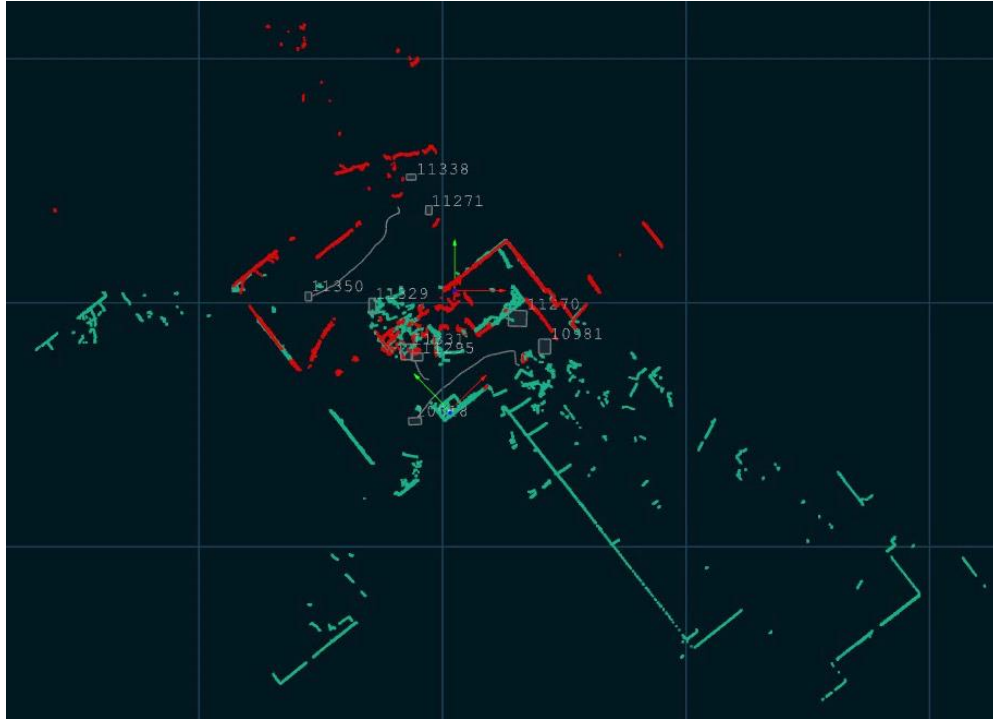




Figure 68. Visualization based on `transform_alignment.xml` File without Zones



Figure 69. Visualization based on `settings.ini` File with Preconfigured Zones

14. Adding PTZ Cameras

A server can be configured to control and visualize data from up to five PTZ cameras per server. Configure the PTZ camera, so QORTEX DTC server can collect data on location and objects. Adding PTZ cameras also enables optionally recording video.

The button indicating **Connected**  or **Disconnected**  status in the upper left corner of the interface window is a toggle mechanism that connects the server to, or disconnects the server from, the sensors and PTZ cameras.

Summary of steps to use PTZ cameras:

1. Verify the specific PTZ camera license.
2. Enter **Configuration** mode. See *[Entering Configuration Mode \(85\)](#)*.
3. Add PTZ camera to the QORTEX DTC server.
4. Calibrate PTZ cameras to align with the sensors to track objects.
5. Configure PTZ camera Field of View (FOV) to help QORTEX DTC determine which objects are within view of the PTZ camera.
6. Define the PTZ camera Home Location, to which it returns when idle. When idle, PTZ cameras can be used by other applications.
7. Track objects already detected by QORTEX DTC server that are in the PTZ Camera FOV. Automatically track objects using Rules. Manually track objects through the PTZ camera icon in the Visualizer.

Supported PTZ Cameras

Quanergy supports Pan-Tilt-Zoom (PTZ) cameras that are compliant with the global standards set by the Open Network Video Interface Forum (OnVIF), Profile S (streaming video). Such compliance ensures the effective interoperability of security products operating under the Internet Protocol (IP). The following PTZ cameras have been tested with QORTEX DTC:

- AXIS Q6115-E PTZ Network Camera
- Bosch AUTODOME IP starlight 5000i
- Bosch MIC IP starlight 7100i

Note: When using Bosch MIC IP starlight 7100i, ensure the camera is on the latest Bosch firmware update. See [Bosch Security and Safety Systems](#).

- FLIR Systems Saros DQ-Track
- GeoVision [beta]
- Hanwha / Samsung [beta]

- Hikvision DS-2DF8336IV-AEL
- Hikvision DS-2DE5225IW-AE

PTZ Camera Terms

- **Pan** — a sideways rotation to scan horizontally.
- **Tilt** — an up/down movement to scan vertically.
- **Zoom** — an in/out magnification of the observed frame.

Prepare the PTZ Camera

It is outside the scope of this user guide to explain exactly how to set up your camera, which is affected by the model's capabilities, specific environment, and intended usage.

The general steps involved in setting up any QORTEX DTC-compliant camera are:

1. **Understand.** Check the camera datasheet or published specifications to understand its particular abilities, limitations, and requirements.
2. **Define.** In the web settings, according to camera instructions, define an OnVIF user.
3. **Mount.** Securely mount the camera according to the camera's installation instructions. Some general, common sense mounting tips include placing the camera in a permanent, static location where:
 - The camera will not be moved or bumped.
 - Both camera and LiDAR sensors share common lines of sight.
 - The camera and LiDAR sensors don't block each other's view.
 - No other static objects block the camera's view.
4. **Network.** Connect the camera to the same subnet that the QORTEX DTC server host computer Ethernet is on.
5. **Stream.** Follow the camera's instructions for assigning an IP address, accessing the video stream through a web browser, and performing any other setup procedures.
6. **View.** Place the QORTEX DTC client window next to the web browser displaying the camera output for maximum situational awareness and interactivity.
7. **Routine.** Follow all of the camera's safety, cleaning, and maintenance instructions.

Add a PTZ Camera

Add a PTZ camera through the QORTEX DTC client Configuration panel. Alternatively, you can edit the settings file. The steps below describe the client option. See [Figure 70. Add PTZ Camera Steps](#).

You can add up to five PTZ cameras to your QORTEX DTC server. These provide object location for automated security.

1. Prepare to add a PTZ camera.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From **Configuration** panel, select the **PTZ** tab and **Unlock PTZ camera** configuration.

Click the lock icon on the PTZ camera tab to switch to the unlocked icon.


If the PTZ tab is grayed out, verify and update licenses. Licensing must state support for 1 or more PTZ cameras. There is no hard limit in terms of the number of PTZ cameras that can be supported per server, but Quanergy has tested and verified support for up to 5 PTZ cameras.

3. Click the **ADD CAMERA** button.

4. Add PTZ camera details, then click **Next**.

- **Name** field—assign a name for the PTZ camera.
- **User** and **Password** fields—enter the credentials required to access the PTZ camera.
- **IP** field—enter the IP address for access to the PTZ camera. Every PTZ camera must have its own IP address.
- **Model** menu—select the manufacturer for the PTZ camera displayed in the list. Select **UNKNOWN**, if your PTZ camera is not listed.
- **Activation URL**—is not required. Used for enabling the camera to handle positioning requests with OnVIF.
- **Video URL**—is automatically assigned. Used for the Real Time Streaming Protocol (RTSP) video stream.

If you select **UNKNOWN** for the **Model**, manually enter the URL for your PTZ camera.

When the activated PTZ camera is activated, the Visualizer displays the activated PTZ camera icon .

If the busy icon does not go away, the PTZ camera is not added. Correct the activation data and click **Apply**.

If the PTZ camera icon has a hash line across it, it means the PTZ camera is not activated. Correct the activation data and click **Apply**.

Each PTZ camera must have its own IP address and must be on the same network as the sensors and QORTEX DTC.

5. When the PTZ camera is added. Click **Apply Changes**.

While the server adds the PTZ camera, a busy icon is displayed in the PTZ panel. When completed:

- The settings file is updated with the PTZ camera settings.
 - The PTZ camera appears in the Visualizer.
6. Repeat these steps for each PTZ camera you want to connect. Provide a unique name and IP address for each PTZ camera.



Figure 70. Add PTZ Camera Steps

Calibrate a PTZ Camera

Calibrate PTZ cameras to align with the sensors to track objects.

Calibration is a semi-automatic process. Collect a minimum three pairs of sample points. Each of three pairs creates an association between the location of an object in the Visualizer (such as the LiDARs frame of reference) and the location of the object in the PTZ camera video.

When selecting locations for the point pairs, try to cover, as completely as possible, the physical area in which objects are expected to be tracked by QORTEX DTC. This ensures accurate camera tracking throughout the area.

1. Prepare to calibrate the PTZ camera.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From **Configuration** panel, go to the **PTZ** tab. Unlock PTZ camera configuration, if locked.
3. Expand the tabs: **PTZ camera name** > **Calibration** > **Calibrate Camera**. Click the **Start** button.

In the example, the PTZ camera name is `Axis_work`.



Figure 71. Start PTZ Camera Calibration

PTZ Camera video panel opens. Calibrate PTZ Camera wizard starts in Configuration panel.

4. Set first point of first pair. **Position A.**
 - a. While standing at least 2 meters in front of the camera, click on the track box you are associated with in the Visualizer.
 - b. In the Visualizer, place the cross-hair (+) on an object with a track ID and click. See [Figure 72. PTZ Camera Calibration: Position A.](#)
 - c. Adjust PTZ Camera. As slider shifts, values also change in top bar of PTZ camera video view.

In PTZ camera video view, adjust PTZ camera to locate object using:

- Click and drag the entire PTZ camera video window to move it around the Visualizer window.

- Select the PTZ camera video window, then using the keyboard up-down and left-right arrows to move the PTZ camera focus.
- Use the mouse wheel to move the PTZ camera focus in or out.
- Adjust the pan and tilt axis of the PTZ camera. At the bottom right of the PTZ camera video, click the ^/v toggle to expand/close the Pan and Tilt fields panel. Adjust the values using the sliders.

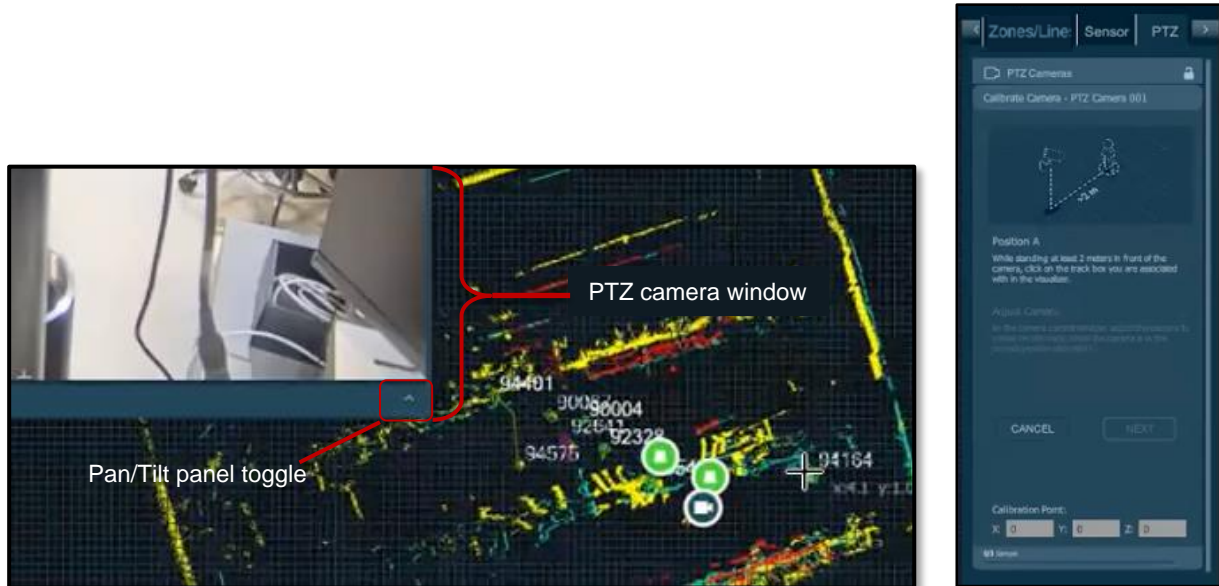


Figure 72. PTZ Camera Calibration: Position A

- d. In the PTZ camera video, center and place the cross hair (+) symbol to be centered on the object. For a human mid-chest height is good.
- e. In the PTZ camera tab, click **CONFIRM POSITION** button. See [Figure 73. PTZ Camera Calibration: Set Video Position](#).

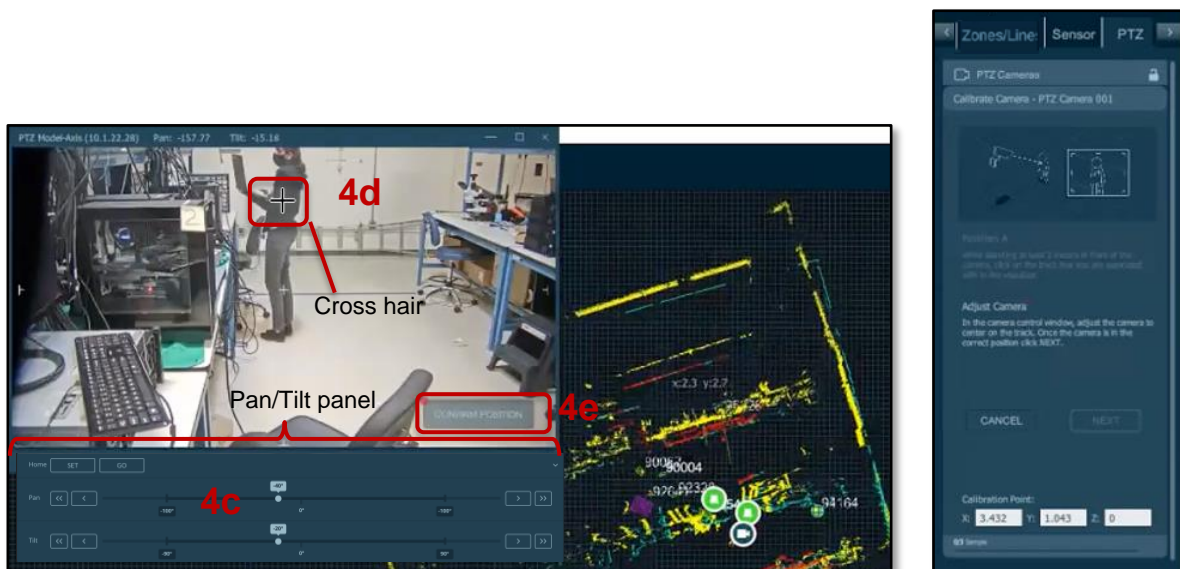


Figure 73. PTZ Camera Calibration: Set Video Position

- f. In the **Configuration** panel, click **Next**.

The cross-hair in the Visualizer changes to a colored sphere.

5. Set second point of first pair. **Position B**. See [Figure 74. PTZ Camera Calibration: Position B Visualizer and Video](#).
 - a. Physically move the object to a different place within the sensor defined location.
 - b. In Visualizer, click the cross-hair (+) on the object ID used in Position A. This can be a different object than was used for Position A.
 - c. In PTZ camera video, adjust PTZ Camera using keyboard, mouse, or expanded Pan/Tilt panel. See Step 4c.
 - d. In PTZ camera video, place cross-hair (+) on the object. The cross-hair in the Visualizer changes to a colored point.
 - e. In PTZ Camera tab, click **SAMPLE**.



Figure 74. PTZ Camera Calibration: Position B Visualizer and Video

Progress bar indicates, one pair is complete. In Visualizer a line is drawn between Position A and Adjusted PTZ Camera point.

Notice the Calibration Point values in the Configuration panel have changed from all zeros.

6. Set second and third pair. Repeat a Position A and Position B.

Click **Add** for more samples, if needed.

7. In Configuration panel, click **CALIBRATE** button. Click **COMPLETE**. See [Figure 75. PTZ Camera Calibration: Calibrate All Points](#).

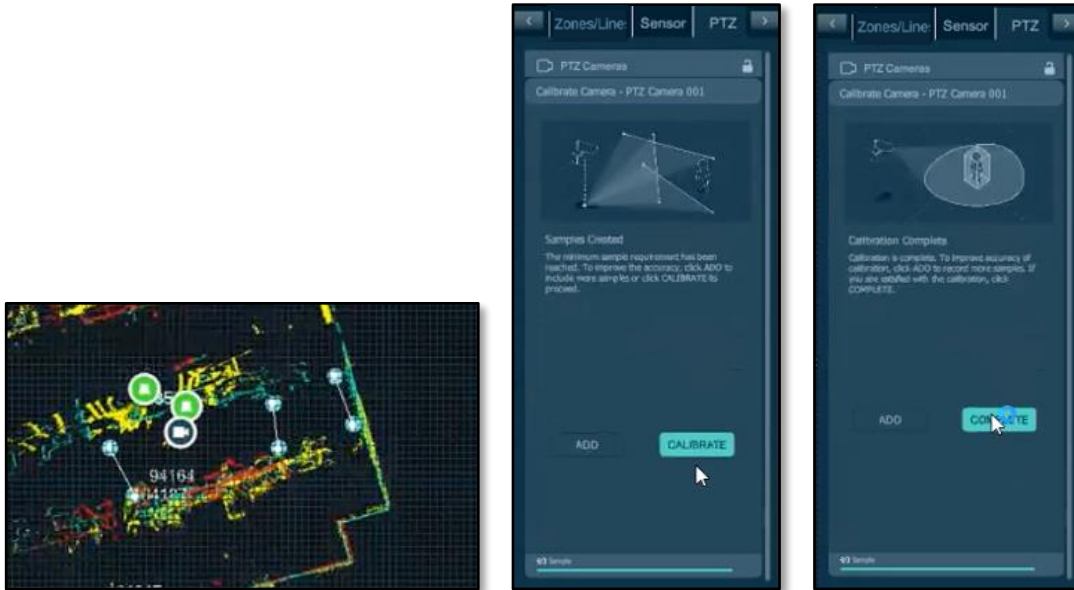


Figure 75. PTZ Camera Calibration: Calibrate All Points

8. View the PTZ calibrated values. Expand the **Camera Position** tab. See [Figure 76. PTZ Camera Calibration: Verify Camera Position](#).

If calibration fails, the calibration data is not populated, and an error message is displayed in the bottom status bar.

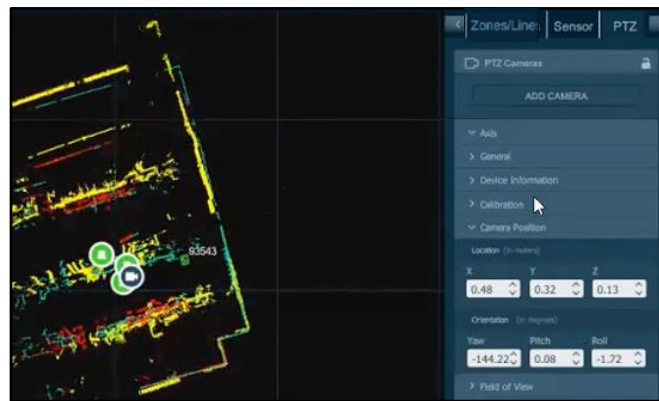


Figure 76. PTZ Camera Calibration: Verify Camera Position

9. Continue to edit the PTZ camera Field of View. See [Add PTZ Camera Field of View](#) (page 134).

Add PTZ Camera Field of View

Configure PTZ camera Field of View (FOV) to designate the camera coverage area and help determine which objects are visible to the camera. Camera following distance is 3 to 50 meters. Each PTZ camera has its own FOV.

Note that zones are the areas created within a sensor field of view. Zones can only be polygons. PTZ camera field of view can be circle, arc, or polygon, but they are not to be confused with zones.

1. Prepare to define the PTZ camera Field of View.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From **Configuration** panel, go to the **PTZ** tab. Unlock PTZ camera configuration, if locked.
3. Select **PTZ Camera > PTZ Camera name tab > Field of View: CIRCLE** or **POLYGON**.

Maximum distance away from the PTZ camera is 500 meters.

4. **Circle FOV.**

- a. Click **CIRCLE** button.
- b. In the **Field of View** panel, the values entered center around PTZ camera.
 - **Start**—measured in degrees from the center of the camera. Range is -180 to 180.
 - **Stop**—measured in degrees from the Start position, creates the width of the arc of the circle. Range is -180 to 180 degrees.
 - **Maximum Distance**—measured in meters, the length of radius from center point. Range is 0 to 200 meters.

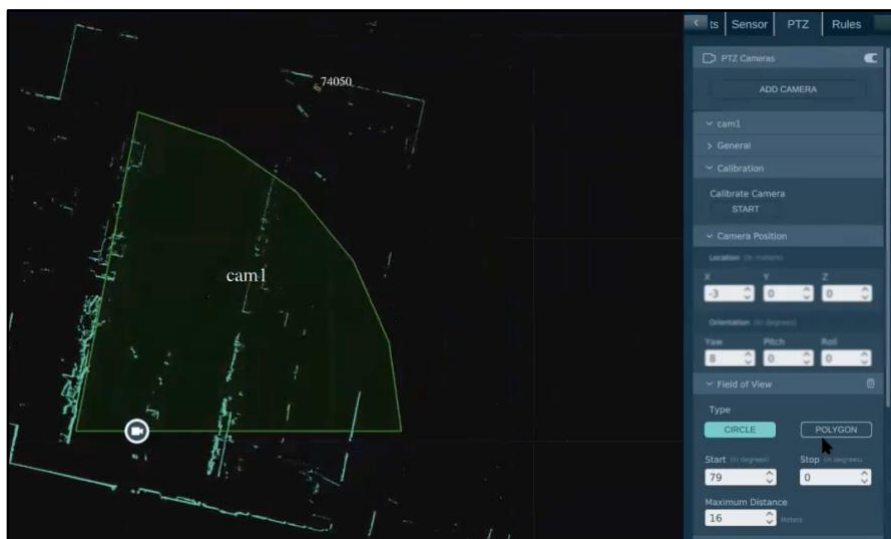


Figure 77. PTZ Camera Circle FOV

5. Polygon FOV.

- a. Click **POLYGON** button.
- b. Click in Visualizer minimum of three points to create a defined space.



Figure 78. PTZ Camera Polygon FOV

6. Click **APPLY ALL**.
7. Continue to add a Home Location. See [Set PTZ Camera Home Location](#) (page 135).

Set PTZ Camera Home Location

When idle, PTZ cameras can be used by other applications. This is where the PTZ camera returns its point of view location when in resting or idle state, and when in lock mode.

The Home Location is important to enable the PTZ camera to efficiently capture an intruder (person, vehicle) as reported by the QORTEX DTC system Home Location can help the camera readiness to turn the minimal angle for responsiveness. Use a position where you might expect a zone intrusion to occur.

Recommended use: Set the home location so that the PTZ camera can cover the most probable route of objects or provide an immediate view of objects entering an Event zone.



Define the PTZ camera Home Location. See [Figure 79. PTZ Camera Set Home Location](#).

1. Prepare to define the PTZ camera home location.

Connect your QORTEX DTC client to a QORTEX DTC server. See [Connect the Client to the Server](#) (page 60).

Setting the PTZ camera home location does not require **Configuration** mode.

2. Open either a PTZ camera Calibration window or PTZ camera video window. See [Calibrate a PTZ Camera](#) (page 129) or [View the PTZ Camera Video Feed](#) (page 137)

3. Click the toggle to open the **Pan and Tilt slider** panel. Optionally, use the keyboard directional arrows to shift the position.
4. Position the PTZ camera, adjusting the Pan and Tilt settings until the cross hair  is pointing to your preferred home location.
5. Click the **Set** button at the bottom of the PTZ camera window.
6. When PTZ camera calibration is complete, lock it. On the PTZ Camera tab, click the lock toggle to close the **Lock** .

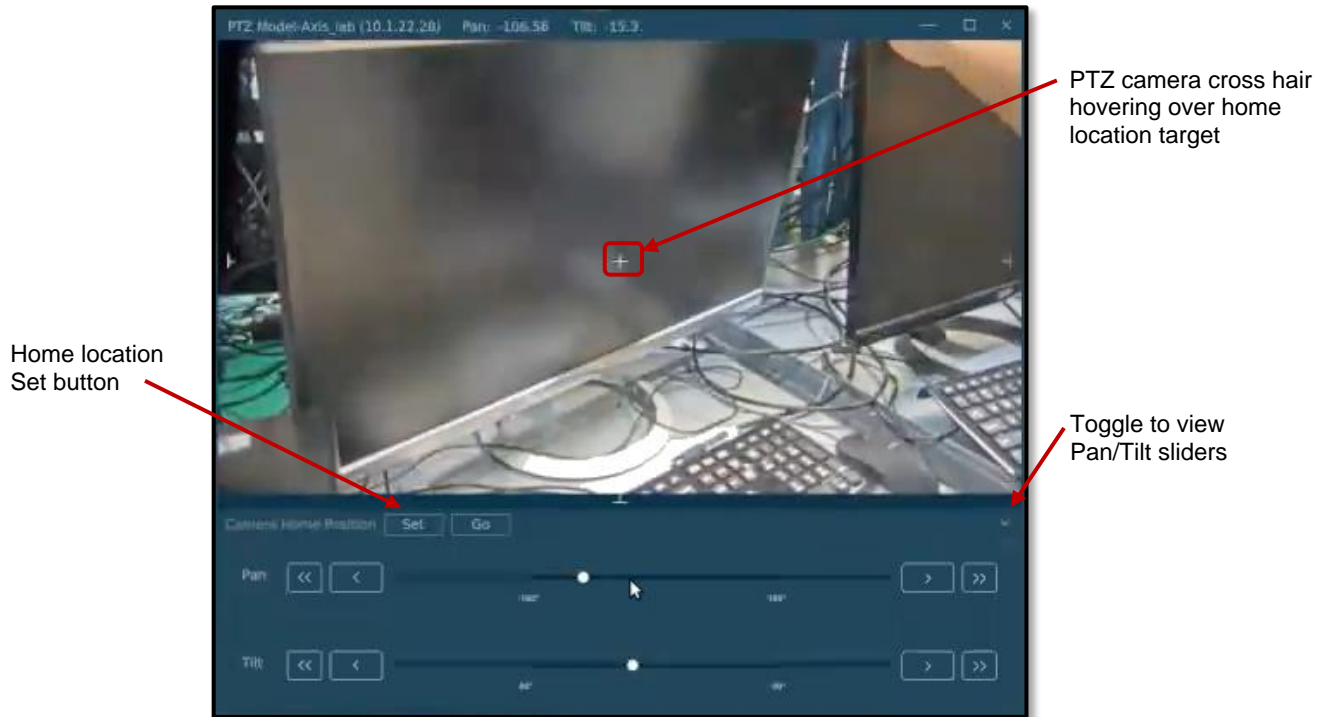


Figure 79. PTZ Camera Set Home Location

Edit PTZ Camera Custom Settings

Keep the default settings unless you are using a non-standard PTZ camera. If your PTZ camera has different values, as determined by the manufacturer, enter them here. The content updates the PTZ camera library file. See [Figure 80. PTZ Camera Custom Settings](#).

1. Prepare to edit the PTZ camera settings

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).
2. From **Configuration** panel, scroll to the **PTZ** tab. Unlock PTZ camera configuration, if locked.

3. From the **Configuration** panel, expand the tabs to **PTZ > PTZ Camera > PTZ Camera name > Custom Settings**.
4. Click the **^/v** arrows to increase or decrease the values for each field. Sets position space in degrees.

For example, these values are adjusted to the values reported by an Axis model PTZ camera. The specific fields that are display vary depending upon the PTZ camera model. If you selected **UNKNOWN** camera type, all the possible fields are listed for you to edit.

- **pan_gain**—defines the relative PTZ camera pan left-right move request during calibration. Default is 1.0.
reported_pan_range—defines the range before customizing. Default is [0, 360]. Use [360,0] to reverse the range.
- **tilt_pain**—defines the relative PTZ camera tilt up-down move request during calibration. Default is 1.0.
reported_tilt_range—defines the range before customizing. Default is [-90, 90]. Use [90, -90] to reverse the range.

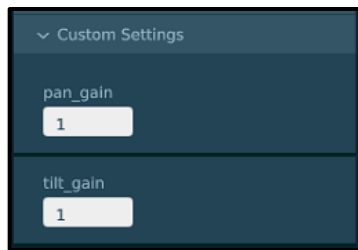


Figure 80. PTZ Camera Custom Settings

5. When your edits are complete, click **Apply Changes** or **APPLY ALL**, as highlighted.

View the PTZ Camera Video Feed

When a PTZ camera is added to a server, a PTZ camera icon and an option to view the live PTZ camera feed, is added to the Visualizer. The pop-out PTZ camera video uses the Video URL assigned when the PTZ camera is configured.

View the Nested PTZ Camera Feed

To view the PTZ camera video, from the Visualizer, click the camera icon.

Adjust the Nested PTZ Camera Feed

1. From the Visualizer, expand the **Sensor Health** icon in the Visualizer Controls bar and set PTZ camera to **Axis** mode.
2. Select the PTZ camera to view. Left-click the feed for a specific PTZ camera.

3. Select viewing options.

From the menu:

- **Minimize**—Shrinks the PTZ camera feed to a reference point.
- **Maximize**—Expands the PTZ camera feed to fill the space of the Visualizer.
- **Restore**—Returns the PTZ camera feed to the thumbnail size.

Using a mouse click and drag:

- **Close Focus**—Shifts PTZ camera focus closer in.
- **Distant Focus**—Shift PTZ camera focus further out.

Move the Nested PTZ Camera Feed

Click the PTZ camera video windows and drag it to any area on your monitor. This includes outside the Visualizer.

Track Objects through PTZ Camera

There are multiple setting options for tracking objects with your PTZ Cameras.

- **Rule based PTZ Camera** control configured for track type in a zone with specific start and stop actions. See [Add PTZ Camera Automatic Tracking Rule](#) (147).
- **Rule based PTZ Time Switching** configured to switch between tracking of objects over time. This rule overrides Rule-based Zone priorities. See [Add PTZ Camera Time Switching Rule](#) (149).
- **Manual tracking** – Only available in LIVE mode, allows you to select an object to monitor as long as it remains in the QORTEX DTC server coverage area. This overrides Rule-based tracking. See [Manually Track Objects through the PTZ Camera](#) (138).


Manually Track Objects through the PTZ Camera

Use supported PTZ cameras to identify and track manually-selected objects through a zone. See [Establishing Zone and Counter Lines](#) (page 107).

Manually tracking objects overrides the automatic object tracking. See [Add PTZ Camera](#) (page 147).

To manually track an object from the PTZ camera:

1. Before you can manually track objects using the PTZ camera:

- Switch to **LIVE** mode. See [Monitor Mode](#) (page 115)
- Ensure the PTZ camera configuration is **Locked** .

From **Configuration** panel > **PTZ** tab, click the unlocked icon in the **PTZ Camera** tab to toggle it to locked, if needed.

2. Select an object to track.

In the Visualizer, right-click the PTZ camera icon. A list of trackable objects is displayed. Select the checkbox for the track ID number of the object to track.



Figure 81. PTZ Camera Select Object

The PTZ camera video panel opens and displays the object. The Visualizer displays a line attached to the object that traces the movement of the numbered object.

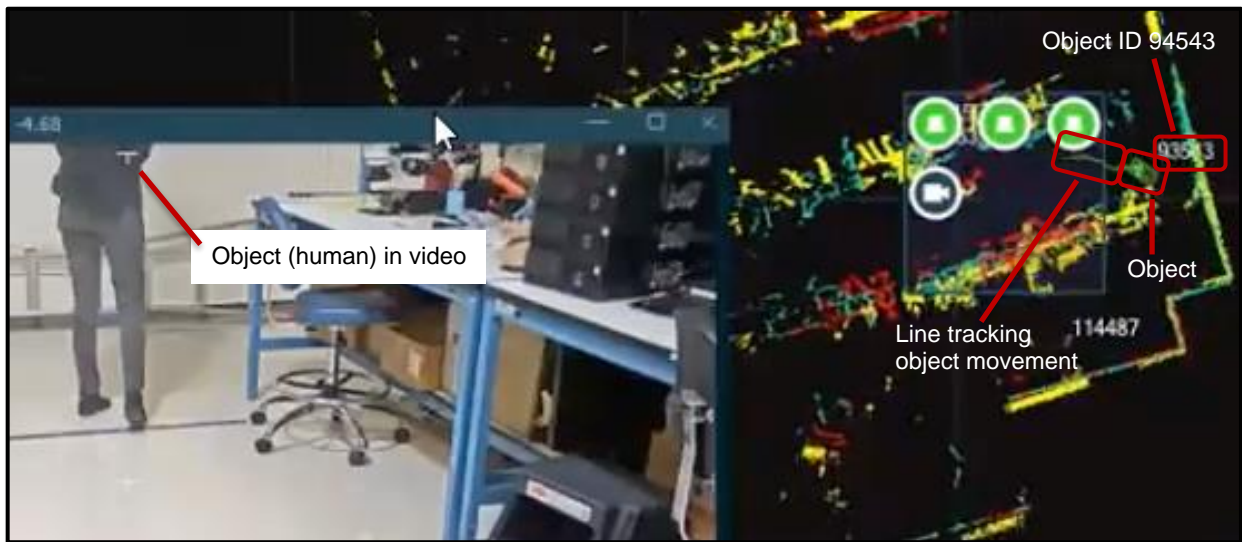


Figure 82. PTZ Camera Track Object

- The PTZ camera continuously tracks the object through the defined zone until the object disappears or the PTZ camera is manually released.
- When the object disappears, it loses its track ID number.
- If the object returns and becomes visible again, the QORTEX DTC server assigns it a new track ID. The PTZ camera does not continue to follow the object because it now has a different track ID.

3. Optionally, record the tracking of the object. See [Manually Start a Recording](#) (page 154).

Recordings do not include the PTZ camera video tracking.

View PTZ Camera Details

For each configured PTZ camera data through the **PTZ > camera_name > General** and **Device Information** tabs. See *Figure 83. PTZ Camera General and Device Information Panels*.

The **General** information panel lists the information provided when you added the PTZ camera to the QORTEX DTC server configuration. The fields can be edited. The fields are:

- **Name** field—assign a name for the PTZ camera.
- **User** and **Password** fields—enter the credentials required to access the PTZ camera.
- **IP** field—enter the IP address for access to the PTZ camera. Every PTZ camera must have its own IP address.
- **Model** menu—select the manufacturer for the PTZ camera displayed in the list. Select **UNKNOWN**, if your PTZ camera is not listed.
- **Activation URL**—is not required. Used for enabling the camera to handle positioning requests with OnVIF.
- **Video URL**—is automatically assigned. Used for the Real Time Streaming Protocol (RTSP) video stream. If the **Model** is listed as **UNKNOWN**, the URL is what you manually entered for your PTZ camera.

The **Device Information** is specific to the PTZ camera manufacturer. The **Device Information** panel is populated automatically when the PTZ camera is activated. To modify this data, use the gRPC API. See *QORTEX Q-Track API Reference*. The self-explanatory **Device Information** fields are:

- Manufacturer
- Model
- Firmware Version
- Serial Number
- Hardware ID

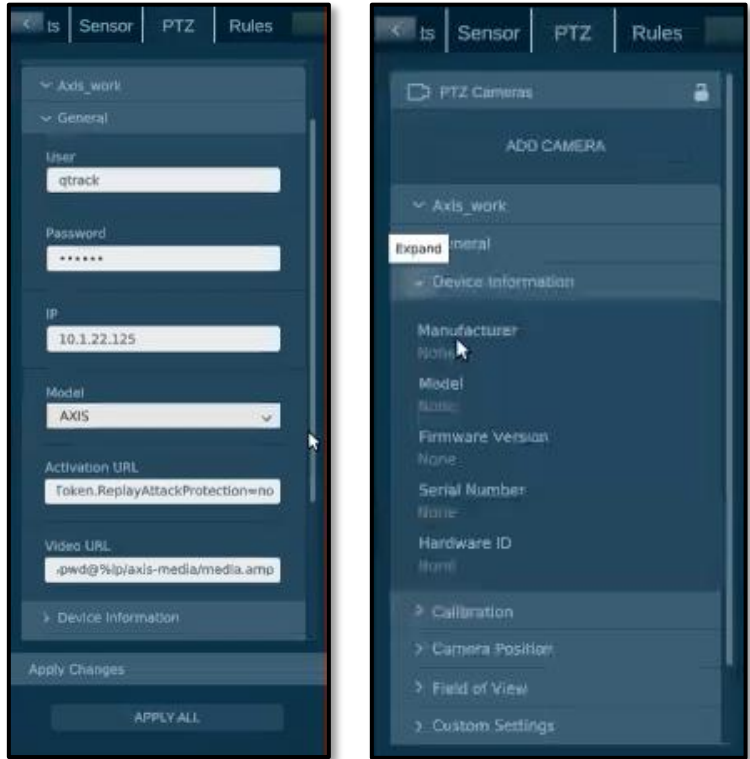


Figure 83. PTZ Camera General and Device Information Panels

15. Adding Rules for Event Zones

Rules are applied to Event zones. Rules are not applied to Exclusion or Inclusion zones. Rules are triggered by trackable objects (trackables) entering or leaving zones.

To create a rule, first create a zone. Each zone can have multiple rules with different rule types. See [Establishing Zone](#) and Counter Lines (page 107).

Event Zone Rules – Provide a method for processing objects in Event zones. Only one rule of each type can be applied to each Event zone. The Event Zone Rule Types are: **PTZ Camera**, **Network Action**, **Recording**, and **Object Stitching**. See [Figure 84. Add Rules Panel Options](#).

- **PTZ Camera rules** – For automatic rule-based tracking with the PTZ camera, define zone stop and start triggers. These include objects as they enter, leave, or currently exist in an Event zone. See [Add PTZ Camera Automatic Tracking Rule](#) (page 147).
- **Time Switching** – Enabling time switching between objects is an optional configuration. As of QORTEX DTC 2.4, PTZ Time Switching rules define how many objects to track, rotating tracked object every specified number of seconds. When this option is applied, the default PTZ camera assignment based on rules priority order is not followed. See [Add PTZ Camera Time Switching Rule](#) (page 149).
- **Network Action rules** – Define a network command to run when objects enter and exit a zone. See [Add Network Actions Rule](#) (page 143).
- **Recording rules** – Automatically record collected data on an object while it is in a zone. See [Add Recording Rule](#) (page 146).

Note: In QORTEX DTC 2.1 or later automatic recordings are configured through the **Rules** tab. In QORTEX DTC 2.0 or older, automatic recording is configured through the **Events** tab.

- **Object Stitching rules** – Detect and merge duplicate trackable IDs. See [Add Object Stitching Rule](#) (page).

If the **Rules** tab is grayed out, verify and update licenses. Licensing **Add-Ons** field must state **Rules**.

Start to Add Rules

1. From the QORTEX DTC Client, select the **Settings** button.
2. In the Configuration panel, scroll through the top tab to the **Rules** tab.
3. Click the **ADD** button and select a **Rule Type**.
4. Proceed to the section for the Rule Type: **PTZ Camera**, **Network Action**, or **Recording**.

Note: For any time-based rule, make sure the computer system clock is correctly configured. QORTEX DTC references the system clock for day and time information.

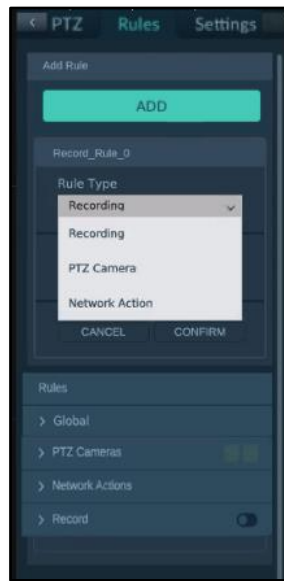


Figure 84. Add Rules Panel Options

Add Network Actions Rule

Network actions rules send notification messages to designated URL locations.

Prepare for Network Actions

To view the results of a Network Action, set up a server to listen for messages from QORTEX DTC. These messages can be simply displayed in a server terminal, or depending upon your server configuration, they can be added to a log or emailed.

Add Network Action Rules

1. From the **Configuration** mode panel > **Rules** tab, click **Add**. See [Figure 85. Network Action Add Rule Panel, Track Type, Schedule, and Log Response](#).

Rules trigger network commands when an object enters and exits a zone.

2. From the **Rule Type** menu, select **Network Action**.

Rules trigger messages sent to specified URL when objects enter or exit a zone.

3. From the **Track type** menu, select one:

- Any
- Human
- Vehicle

- Human and Vehicle
- Unknown

4. From the **Zone** menu, select from the list of Events zones you defined for this server.

Create Event zones before adding a rule.

5. Specify when to activate the rule.

For the Network Action, define an **Enter Trigger**, by typing one or more HTTP commands or HTTP command with digestive authentication in the text box. For example:

Turn a light switch on when an object enters. Type `http://` with the string:

```
<network-switch-ip>/outlet?<number>=ON
```

Send a `$TRACK-ID` to log when object enters. Type `http://` with the string:

```
<webserv-er-ip>:3000/$TRACK_ID-ENTRY
```

6. Specify when to stop the rule.

For the Network Action, define an **Exit Trigger**, by typing one or more HTTP commands in the text box. For example:

Turn a light switch off when an object enters. Type `http://` with the string:

```
<network-switch-ip>/outlet?<number>=OFF
```

Send a `$TRACK-ID` to log when object exits. Type `http://` with the string:

```
<webserv-er-ip>:3000/$TRACK_ID-EXIT
```

7. If **Security** mode is setup, add the following lines to your HTTP command to include the digestive authentication information.



Sample HTTP command with digestive authentication when Security mode is OFF/Disabled. Type `http://` with the string:



```
<user>:<pwd>@<ip>/rcp.xml?command=0x01c1&type=F_FLAG&direction=WRITE&num=1&payload=0x0
```

Sample HTTP command with digestive authentication when Security mode is ON/Enabled. Type `http://` with the string:

```
<user>:<pwd>@<ip>/rcp.xml?command=0x01c1&type=F_FLAG&direction=WRITE&num=1&payload=0x0
```

8. Optionally, set a rule activation schedule. By default, rules are always on. You have the option to set a rule to run at a specific time of day for selected days of the week.

- a. Enable **Rule Schedule**, click the toggle  to ON.
- b. Expand the **Schedule** panel, click the expand icon .

- c. Select a time range for each day the rule is active, click the expand icon  and scroll through to select a time. Select both a **Start** and **Stop** time.
- d. Select the days of the week the rule is active, click each day toggle , as needed.

9. Click **CONFIRM**.

The new rule is added to the **Rule** tab panel under its **Rule Type**.

10. Click **Apply Changes** and if done with CONFIGURATION mode, click **EXIT CONFIGURATION**.

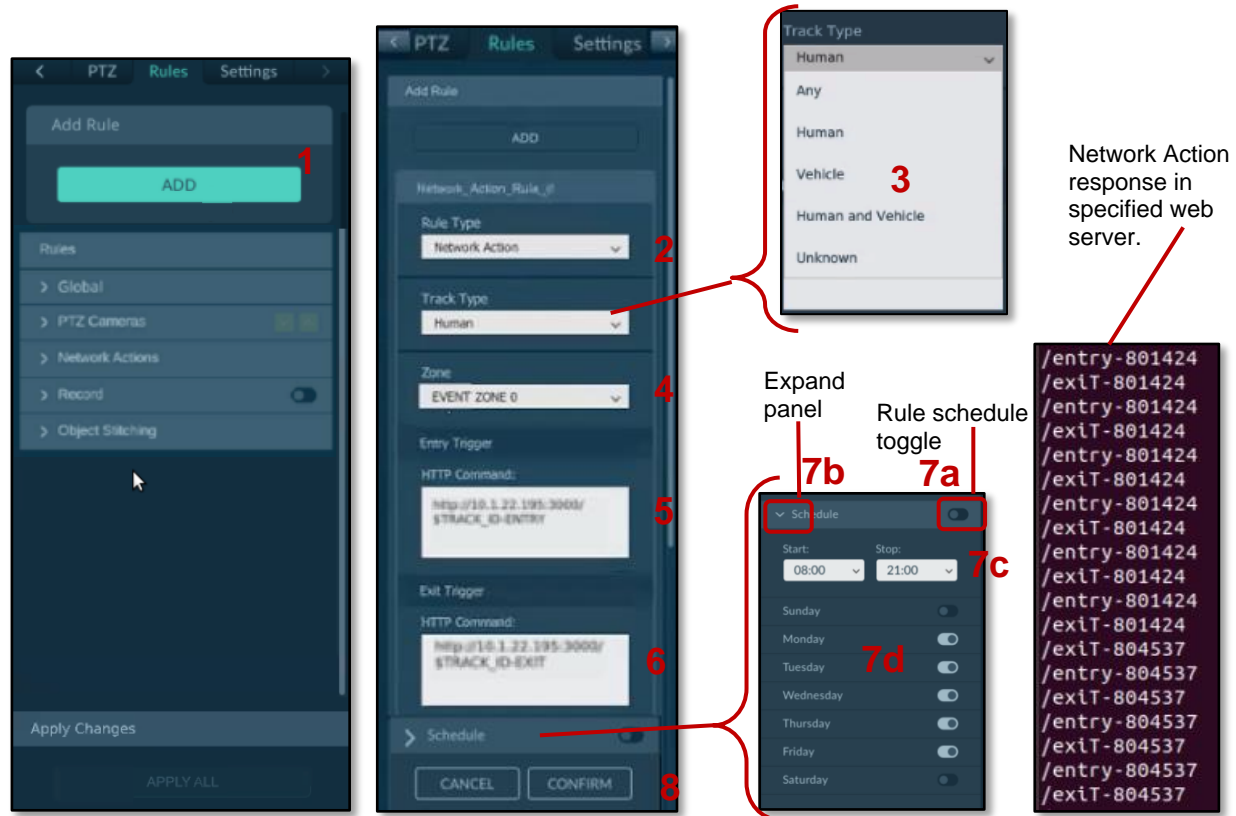


Figure 85. Network Action Add Rule Panel, Track Type, Schedule, and Log Response

Add Object Stitching Rule

Object stitching detects and merges duplicate trackable IDs (multiple IDs for the same object). When an object disappears from a zone, then reappears, it is evaluated to determine if it is the same object. If it is the same object, it is assigned the same object ID. Create a zone to apply object stitching.

1. From the **Configuration** panel > **Rules** tab. Expand **Global** > **Object Stitching Parameters** panel.
2. Select the parameters.

- **Distance Threshold** – Set the distance within which QORTEX DTC should search for the duplicate or disappeared object.
 - **Disappearing Time Threshold** – Set the time threshold to remember a duplicate or disappeared object.
 - **Classification Type** – Select the class of object to track and stitch. The options are Human, Auto, Truck, Bike (Motorcycle). If you have licensing for vehicle subcategories, those are selectable in the pull-down menu.
3. Turn on Object Stitching. Click **True** in the **Track Disappeared Objects** field.

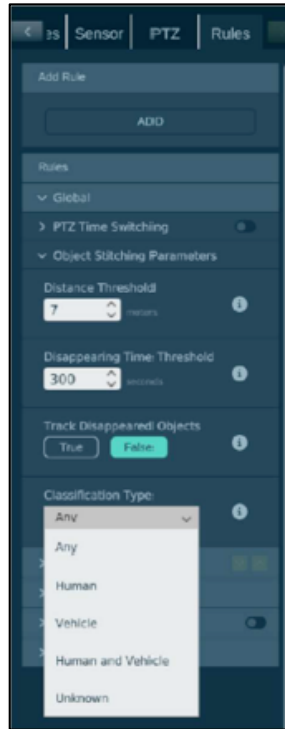


Figure 86. Rules > Global > Object Stitching Parameters Panel

Object Stitching Settings Parameters

Object Stitching parameters can be edited through the Qortex DTC client or through gRPC messaging.



Add Recording Rule

1. From the **Configuration** panel > **Rules** tab, click **Add**.

Rules trigger tracking objects when an object enters a zone.

2. From the **Rule Type** menu, select **Recording**.

Record is a toggle switch to enable automatically recoding the collected data per defined rules applied to zones.

3. From the **Zone** menu, select from the list of zones you defined for this server.
Create zones before adding a rule.
4. Optionally, set a rule activation schedule. By default, rules are always on. You have the option to set a rule to run at a specific time of day for selected days of the week.
 - a. Enable **Rule Schedule**, click the toggle to ON.
 - b. Expand the **Schedule** panel, click the expand icon .
 - c. Select a time range for each day the rule is active, click the expand icon  and scroll through to select a time. Select both a **Start** and **Stop** time.
 - d. Select the days of the week the rule is active, click each day toggle , as needed.
5. Click **CONFIRM**.
The new rule is added to the **Rule** tab panel under its **Rule Type**.
6. Click **Apply Changes**. If done with CONFIGURATION, click **EXIT CONFIGURATION**.

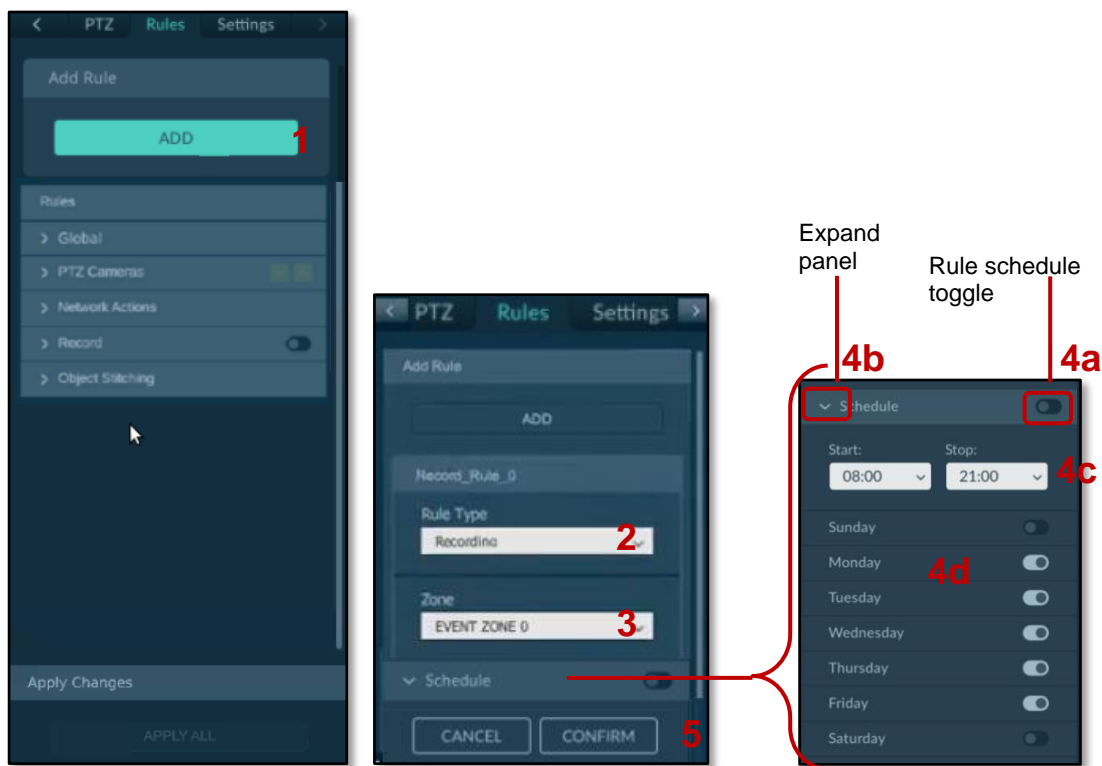


Figure 87. Record Add Rule Panel

Add PTZ Camera Automatic Tracking Rule

Use supported PTZ cameras to identify and track objects through a zone. See [Establishing Zone and Counter Lines](#) (page 107).

If there are multiple tracked objects QORTEX DTC defaults to automatic tracking, when the following criteria are met:

- PTZ Time Switching is OFF.
- Each tracked object is followed by one PTZ camera.
- PTZ cameras are assigned to track the objects based on:
 - **Rule priorities.** You can automatically track objects using Rules with your PTZ camera in a selected Event zone. Rules apply to all PTZ Cameras. See [Sort Rule Priority](#) (page 151).
 - **Proximity.** The PTZ camera with the FOV that is closest to each tracked object.

You can manually track an object during LIVE mode. See [Manually Track Objects through the PTZ Camera](#) (page 138).

To setup automatically tracking objects using Rules with your PTZ camera in a selected Event zone:

1. From the **Configuration** mode panel > **Rules** tab, click **Add**. See [Figure 88. PTZ Camera Add Rules Panel](#).

Rules trigger tracking objects when an object enters a zone.

2. From the **Rule Type** menu, select PTZ Camera.

PTZ rules do not apply for Playback mode, they only apply to Live mode.

3. From the **Track type** menu, select one:

- Any
- Human
- Vehicle
- Human and Vehicle
- Unknown

4. From the **Zone** menu, select from the list of Event zones you defined for this server.

Create Event zones before adding a rule.



5. Select when to activate the rule. Currently, there is only one option.

Enter/Occupied

6. Select when to stop the rule. Select from the **Stop** menu:

- **Object disappears**
- **Exits the zone**
- **Triggered by a new object**

7. Optionally, set a rule activation schedule. By default, rules are always on. You have the option to set a rule to run at a specific time of day for selected days of the week

- Enable **Rule Schedule**, click the toggle to ON.
- Expand the **Schedule** panel, click the expand icon .
- Select a time range for each day the rule is active, click the expand icon  and scroll through to select a time. Select both a **Start** and **Stop** time.
- Select the days of the week the rule is active, click each day toggle , as needed.

8. Click **CONFIRM**.

The new rule is added to the **Rule** tab panel under its **Rule Type**.

During LIVE mode, when an object of the selected type enters the designated Event zone, and if the PTZ camera is available, then QORTEX DTC automatically tracks the object. This tracking is included in the collected data.

When the object leaves the Event zone, and there are no other objects to track, the PTZ camera returns to the configured Home location. See [Set PTZ Camera Home Location](#) (page 135).

9. Click **Apply All** and if done with CONFIGURATION mode, click **EXIT CONFIGURATION**.

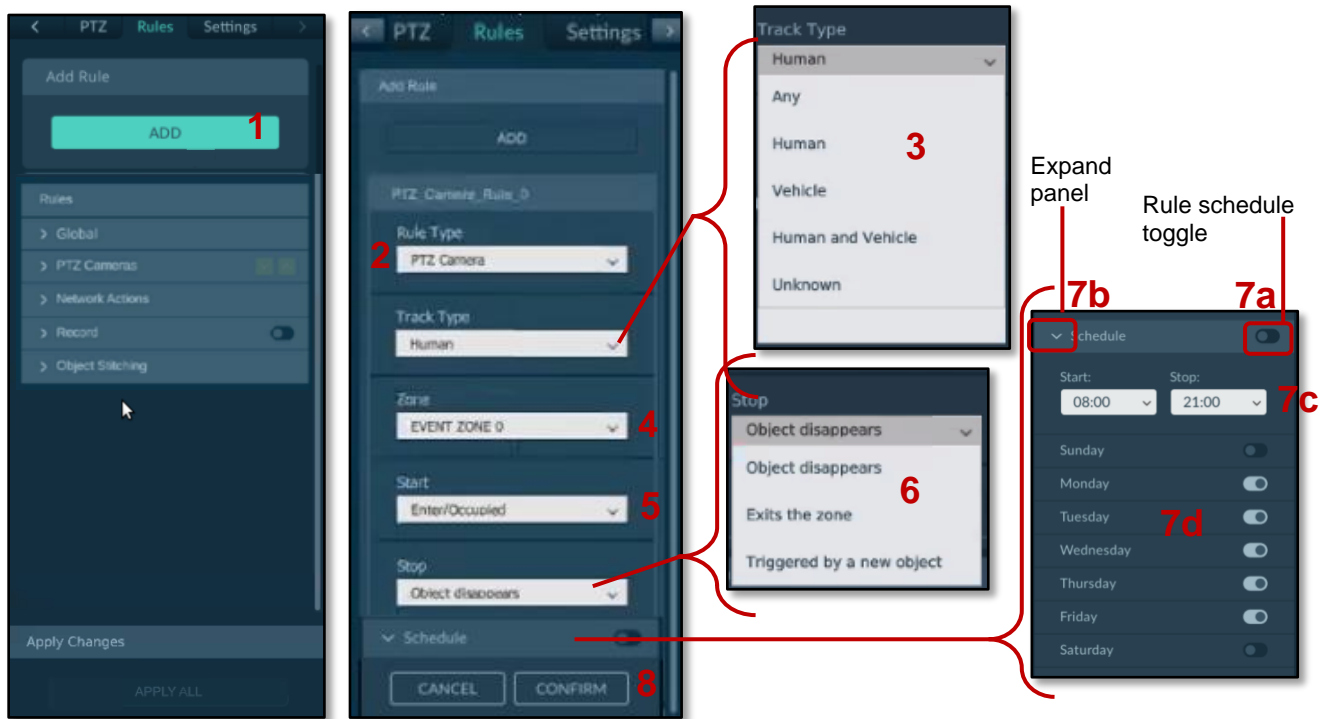


Figure 88. PTZ Camera Add Rules Panel

Add PTZ Camera Time Switching Rule

When more than one trackable object is in a PTZ camera view, the object being tracked is typically the most recent object. To continue tracking older objects, enable PTZ Time Switching

to alternate between tracking the Y number of triggered objects every few X number of seconds. These values are configurable, see the steps below.

For example. If **Alternate Between Last** (value Y) is 3 (Object 1, Object 2, Object 3) and **Follow Time Per Object** (value X) is 10. Then the PTZ camera video window tracks Object 3 for 10 seconds, switches and the tracks Object 2 for 10 seconds, switches and the tracks Object 1 for 10 seconds, and returns to Object 3 to start the cycle again. This repeats until one or more of the tracked objects leaves the monitored area or new trackable object enters the monitored area.

To set the number and frequency of switching between tracked objects.

1. Prepare to define the PTZ camera Field of View (FOV).

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel > **Rules** tab, expand the **Global** panel.
3. Enable the **PTZ Time Switching** toggle and expand the **PTZ Time Switching** panel.

OFF (black): PTZ camera tracking behavior is the same a QORTEX DTC 2.1, where the PTZ camera continues to track one object at a time.

ON (green): PTZ camera tracking switches between objects based on the settings in Step 4.

4. Select the field values:
 - **Alternate Between Last.** Sets the number of objects to track in alternating rotation. The default is one object minimum. The maximum is 10 objects.
 - **Follow Time Per Object.** Sets the length of time to track an object before switching to the next object in rotation. The default is 10 seconds minimum. The maximum is 120 seconds.

Click the ^/v arrows and make your selection.

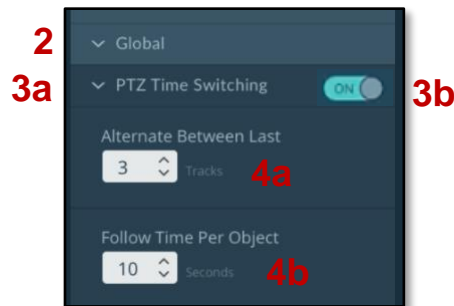



Figure 89. PTZ Time Switching Settings

Sort Rule Priority

When there are multiple PTZ Camera rules, the sort icon  is displayed on the PTZ Camera tab. Click the icon to sort the rules numerically, lowest to highest or highest to lowest. The numerical value is the incremented portion of the rule name.

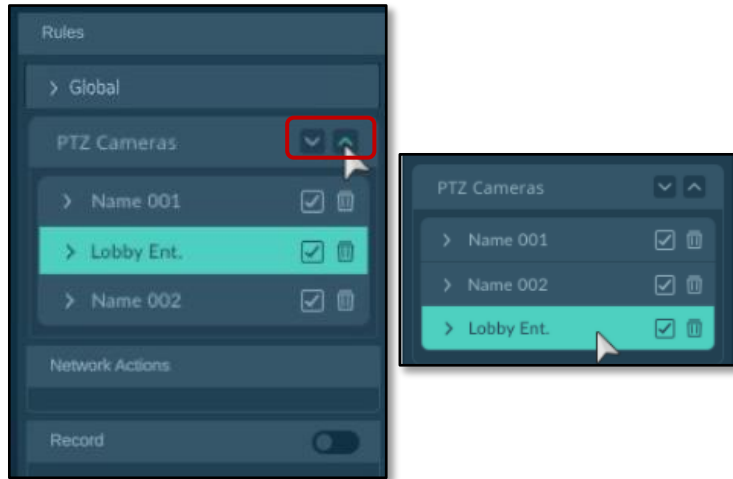







Figure 90. Sort Rule Priority

Disable a Rule

1. From the **Configuration** mode panel > **Rules** tab, expand  the **Rules** panel.
Rules are enabled by default, as indicated by the checkbox icon .
2. Click the **checkbox** icon off  for the rule you want to disable.
3. Click **Apply All**.
4. Click **Apply Changes** and if done with CONFIGURATION mode, click **EXIT CONFIGURATION**.

Delete a Rule

1. From the **Configuration** mode panel > **Rules** tab, expand  the **Rules** panel.
2. Click the **trashcan**  icon for the rule you want to delete.

Note: There is no confirmation for deleting a rule. If you click the trashcan icon, the rule is deleted.

16. Recording Data

There are two modes for recording the data collected at a location: manual and rule based. Both modes save recordings in Quanergy proprietary Qlog format. Recordings can be replayed in the QORTEX DTC client (or other Quanergy application). This section discusses how to record in both modes and play back the recording.

Stored Recording Data

Recordings are stored as follows:

- In the datasets directory. See [Start the Server Daemon Service the First Time](#) (page 55).
- In the specified directory. See [Specify Recording Settings](#) (page 152).

Specify Recording Settings

Recording settings have default values and do not need to be adjusted. However, you can make adjustments to optimize for a particular computing environment. There are two simple adjustment options, which affect both modes of recording.

- **Compression**—Used when either bandwidth or storage space is limited.
- **Folder Name**—Use to change the default recording folder name. The folder contains:
 - A Recordings folder name is created for each recording. To ensure a unique folder name a Universal Time Coordinated (UTC) time is part of the Recordings folder name. The time used aligns with when the logging it started.
 - At least one sequentially numbered index file, such as `SensorName.i00`, for every sensor at the location.
 - At least one sequentially numbered QLog file, such as `SensorName.q00`, for every sensor at the location.
 - A copy of the `settings.xml` file that was in force during the recording.

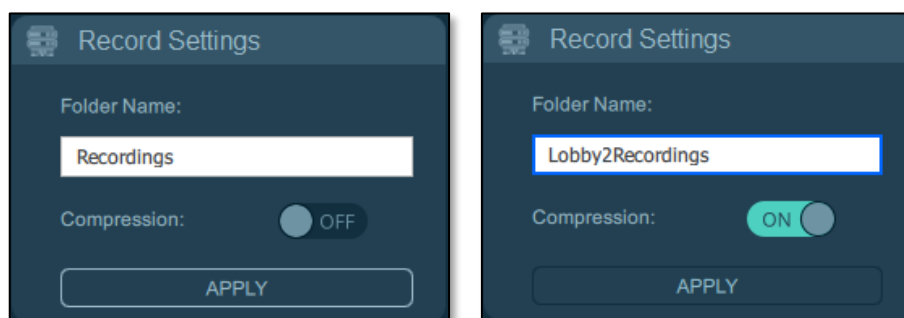


Figure 91. Client Record Settings Fields: Default (left), Optimized (right)

1. From the **Configuration** panel > **Server** tab, expand the **Record Settings** tab.

2. In the **Folder Name** field, the default name (**Recordings**) can be edited. See [Figure 91. Client Record Settings Fields: Default \(left\), Optimized \(right\)](#).

If you want to change the name, the new name must be made up of numbers, letters, and underscores.

Recordings are saved in the data sets directory. Recording folder names are automatically created for each recording. To ensure a unique folder name a UTC time is part of the Recordings folder name. The time used aligns with when the logging it started. See [Start the Server Daemon Service the First Time](#) (page 55).

3. The **Compression** switch (enabled only in **LIVE mode**) can be switched on or off, depending on how much bandwidth and storage space is available.
4. If any changes are made, click the **APPLY** button to save them, update the configuration file on the server, and implement them.
5. Continue the setup process with one or both of the following procedures:
 - [Manually Start a Recording](#) (page 154).
 - [Add Recording Rule](#) (page 146).

The recording is automatically saved in the server host computer directory created when the server software was first installed. The default path is:

```
/home/quanergy/quanergy/qortex/datasets/Recordings/YYYY-MM-DD_HH-MM-SS.xxx.
```

Add a Rule-Based Recording

Event zones (not Exclusion zones) have the option of triggering a recording event based on the actions of a moving object that is tracked, that is, a trackable. If preferred, take the following steps to enable rule-based recording. These options are not changeable when a recording or playback event is in progress.

1. Prepare to add a rule-based recording.

Connect your QORTEX DTC client to a QORTEX DTC server and enter **Configuration** mode. See [Connect the Client to the Server](#) (page 60) and [Enter Configuration Mode](#) (page 86).

2. From the **Configuration** panel > the **Rules** tab, expand the **Rules** panel to view the **Record** tab. Toggle the **Record** switch so that it is green and indicates **ON**.

ON disables the **Record** button in the top right corner of the client window. This allows **Event zone** rule-based recording settings to execute.

OFF disables the automatic recording function for all **Event zones** and enables the manual **Record** button. See [Manually Start a Recording](#) (page 154).

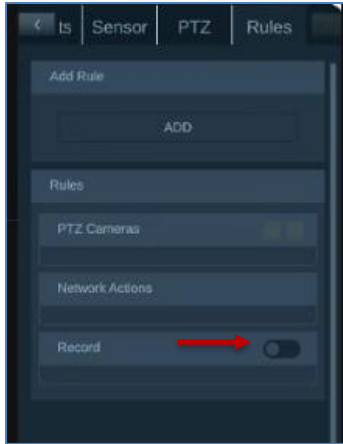


Figure 92. Record Toggle on Rules Tab

3. A trigger, defined by the rules created, start a recording.

During a rule-based recording event, the **Record** button (top right of the client) is disabled and the recording is complete.

When the recording event ends, the **Record** button returns to grayed out, the **timer** disappears, and the event is saved as a separate QLog.

By default, the recording has a buffer time of 60 seconds. This buffer is the amount of time that is retroactively recorded before a **start_record** action, as well as the amount of time that continues recording after a **stop_record** action. So, if a trackable object triggers a zone for 30 seconds, the recording will be 150 (60+30+60) seconds long.

4. To replay rule-based recorded data, see [View Recorded \(PLAYBACK\) Data](#) (page 155).

Manually Start a Recording

When LIVE data is visualized, a gray (inactive) **Record** button appears (top right of the client), enabling the start and stop of data recording with a mouse click.

Recordings do not include PTZ camera video tracking.

1. From the **Configuration** panel > **Rules** tab > **Rules** panel, select **Recording** switch.
2. Set the **Rules Recording** switch to OFF. See [Figure 92. Record Toggle on Rules Tab](#).

OFF disables the automatic recording function for all Event zones and enables the manual Record button in the top right corner of the client window

3. Click the **Record** button to start recording.

The Record button turns **red** and the time elapsed time counter appears. Leave the client open while recording is in progress if an accurate indication of elapsed time is needed. See [Figure 93. RECORD Button: Inactive and Active with Elapsed Time Counter](#).

Note: The elapsed time counter is accurate only if the client remains open while recording is in progress.

4. When satisfied with the data recording length, click the **Record** button to stop recording.

The **Record** button returns to the gray (inactive) state, and the recording is saved as a QLog file.

5. Play back or download the recordings. See [Visualize Live Data](#) (page 123).

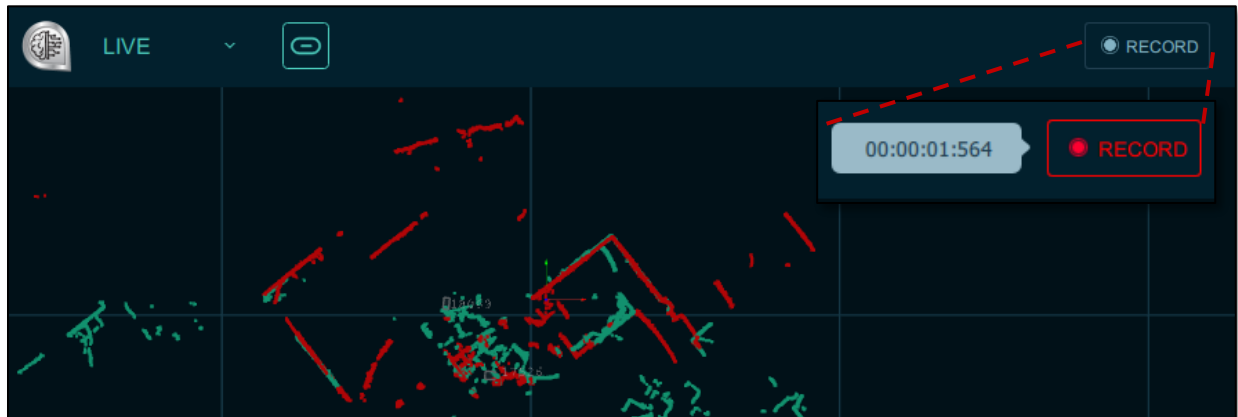



Figure 93. RECORD Button: Inactive and Active with Elapsed Time Counter



View Recorded (PLAYBACK) Data

All recording data is captured in recorded QLog files. To visualize (view) this data:






1. From **Configuration** mode, **Disconnect**  from the sensors.

Click **Connected**  button to disconnect the server from the sensors' streams of LIVE data, if needed.

PLAYBACK is available only when the sensors are disconnected.

2. In the same corner, click the **Data Selector**  arrow, and select the **PLAYBACK** item.
3. Click the **Select Recording**  button that appears, then select a recording from the menu.

The available options change, depending on what action is taken:

- Click the **Play**  arrow to see the recording. All the viewing controls still allow customization of the visualization.
- Click the **Replay**  arrow to see the same recording again. Viewing control choices made during the previous play persist upon replay.
- Click the **Download**  arrow to download the recording from the server to the local client host computer for sharing. An animated green circle  indicates a busy status, and red  indicates error status.
- Click the circling **Download** arrow to cancel the downloading process.

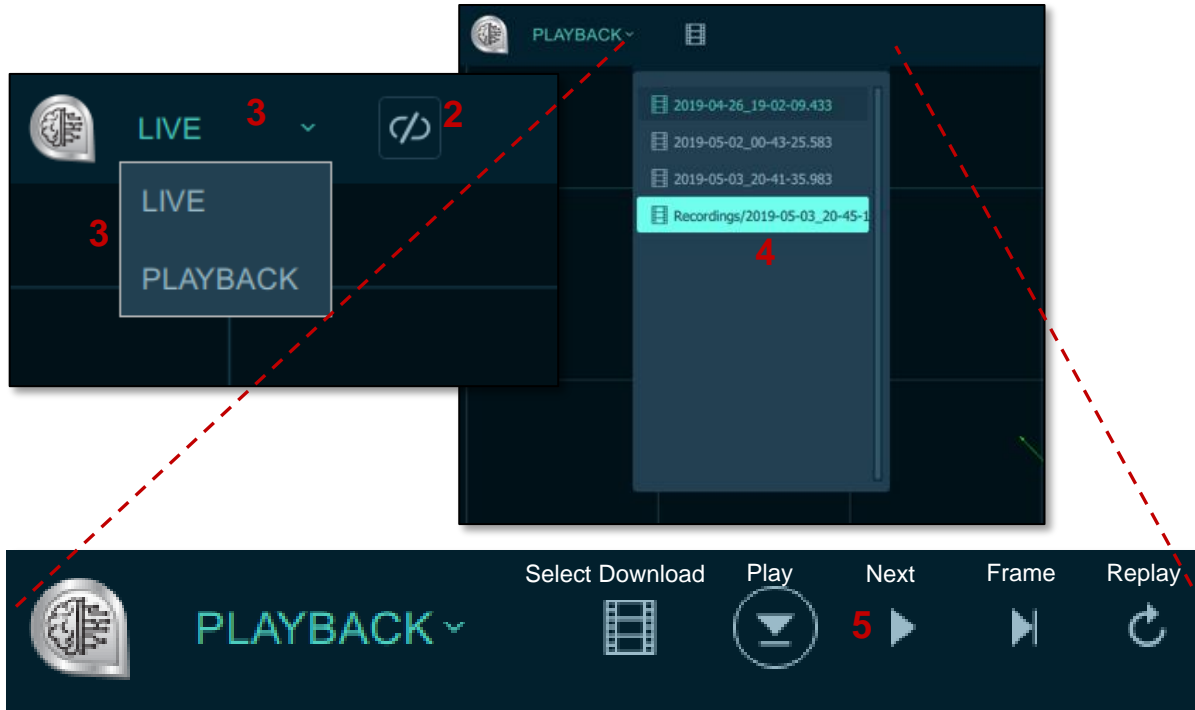


Figure 94. Top Navigation Bar: Selecting and Playing a Recorded Dataset

4. Click the **Play** button arrow.
 - The **Play** button turns blue.
 - The name of the selected dataset appears.
 - The elapsed time appears as a counter, which starts at 00:00:00:00 and increments up to the maximum time length of the recording.



Figure 95. Top Navigation Bar: During Play in Playback Mode

5. Optionally, click to Pause the recording.

When playback is paused, the Play arrow becomes a Pause symbol, and the Next Frame and Replay arrows disappear.

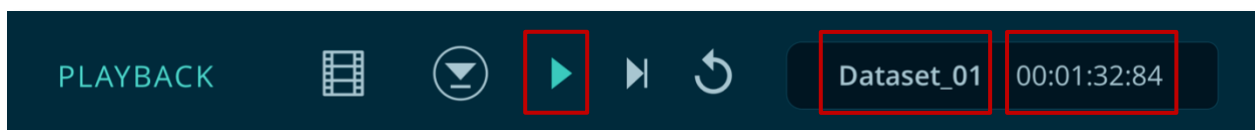


Figure 96. Top Navigation Bar: During Pause in Playback Mode

Visualize Playback Data in Loopback Mode

Loop the play of a dataset through the command line (not the user interface), as follows.

1. On the QORTEX DTC server host computer, open a terminal (or `ssh`) and log in. The username and password for the host machine may be required.
2. Execute the command to play a dataset in **Loopback** mode (continuous looping play), substituting the brown portions with the pathway and name of the settings file and recorded dataset:




```
$ cd /opt/quanergy/qortex-server
$ sudo ./Qortex-server -s /pathway/to/settings/file.xml
  --replay-path /pathway/to/dataset/folder -|
```

- Press the **spacebar** to pause the looping.
- Press the **Esc** key to stop the playback.

Note: Help is available at the terminal to recall commands and options, as follows: `./Qortex-server -h`

Refresh Tracks

Use the **Sensor** tab to refresh the tracks. Refresh tracks when a lag in the display of new tracks is detected, or continuing noise is displayed as old track artifacts. See [Figure 97. Refresh Tracks and Optimize Sensor Settings with Sensor Tab](#).

1. **Disconnect**  from the sensors. Click **Connected**  button to disconnect the server from the sensors' streams of LIVE data, if needed.
2. In the bottom right corner of the interface, click the **Settings** icon  to open the **Configuration** panel.
3. Enter **Configuration** mode. See [Entering Configuration Mode](#) (85).
4. From the **Configuration** panel, select the **Sensor** tab.
5. At the top of **Sensor** tab, click the **REFRESH** button.

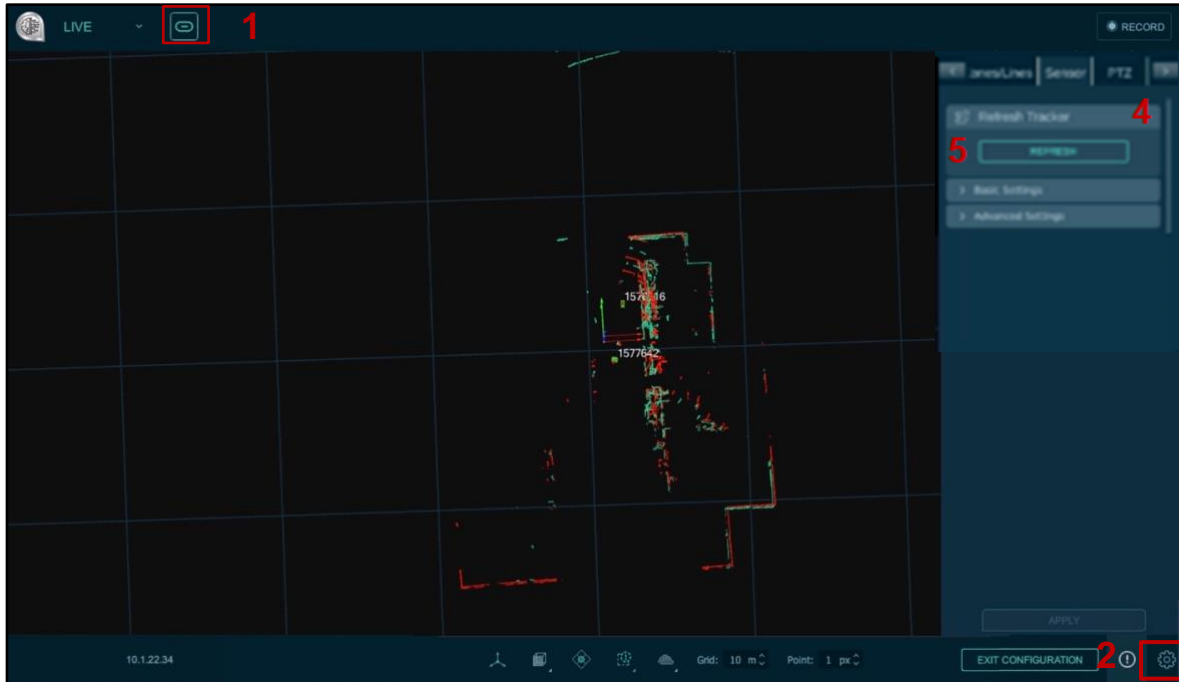


Figure 97. Refresh Tracks and Optimize Sensor Settings with Sensor Tab

Delete a Recording

When a dataset is recorded by running a daemon service, the owner of the recordings is Quanergy. When the user-based or trigger-based recordings on the hard drive are no longer needed, use `sudo` permission to overrule the restrictions and delete the files from the server host computer, as follows:

1. In a terminal, navigate to the directory enclosing the folder to be deleted.
2. Execute the data removal command, updating the folder name and providing the login password:

```
/home/quanergy/quanergy/qortex/datasets
$ sudo rm -rf Test_Recordings
```

17. Troubleshooting

Most problems have simple solutions that can be resolved as explained below.

General Help

For the server, the QORTEX DTC API provides some specific help commands and parameters that are useful. See **Error! Reference source not found.** (page 182) and *QORTEX Q-Track API Reference*.

Version Discovery


To identify which version of QORTEX DTC software is currently running:

For the server, on the Ubuntu terminal, look for the package by executing the following:

```
$ sudo dpkg -l qortex-server
```

Or, in the Ubuntu terminal, use the QORTEX DTC API command, as follows:

```
$ cd /opt/quanergy/qortex-server  
$ ./Qortex-Server --version
```

For the client, when the QORTEX DTC client icon  is double-clicked on the Windows desktop, the launch window and GUI window both list the version at the top of their respective windows.

Previous Software Removal

For the server, if previously installed software needs to be removed to install a new version or reinstall the same version:

1. Open a new Ubuntu terminal window on the computer hosting that software.
2. Execute the following command to remove the old software:

```
$ sudo systemctl stop qortex-server.service  
$ sudo dpkg -r qortex-server
```

For the client, if previously installed software needs to be removed, right-click it in a file browser, select the Uninstall item, and select Yes to “allow this app to make changes.”

Quanergy Folder

For the server, the QORTEX DTC server automatically creates a `~/quanergy/` folder the first time it starts up. If the folder is deleted and does not exist, all attempts to select a filepath or save settings returns errors. To fix, restore the missing folder on the computer hosting the QORTEX DTC server, as follows:

1. In the Ubuntu terminal window, execute the following:

```
$ sudo userdel quanergy
```

2. Reinstall the server. See [Install or Update QORTEX DTC with a Debian Package](#) (page 39).

Licensing Errors

For the server, the license management process may trigger errors, as discussed below.

Activation Error 5008

After logging in to the QORTEX DTC server and activating the license key. See [Managing the License](#) (page 44), the following appears:

```
Status: Activated
```

But if a wrong License ID or Activation Password is provided, the following appears:

```
Error 5008: Invalid Activation Data
```

This means that the License ID and/or Activation Password were not validated by the License Portal server. Make sure a valid License ID and Activation Password is available and are entered correctly for activation. See [Activate a License](#) (page 46).

Deactivation Error 9015

After deactivating a license, the following appears if a user tries to deactivate the previously deactivated license:

```
Return Code = 9015 Some (or all) of the arguments are invalid
```

Ignore the error; QORTEX DTC is already non-functional. When ready to reactivate the license and resume activity. See [Activate a License](#) (page 46).

Settings File Error

When you select an area (**LIVE** mode) or dataset (**PLAYBACK** mode), the QORTEX DTC server checks the relevant `settings.xml` file against the current license. The server stops and displays an error in the status bar if the number of sensor configuration sections in the `settings.xml` file is more than the number of sensors permitted by the license. If this error occurs, try the following:

- Refresh the license. See *Refresh a License* (page 48).
- Contact a support representative. See *Any Other Issue* (page 163).

Status and Error Messages

If the QORTEX DTC system has a suspected issue, check the following:

For the system **Status** panel, see *Status Button* (page 83). Status and error messages are listed below in *Table 18. System Status and Error Messages*.

For the sensor **Diagnostics** panel, see *Sensor Health Status Options* (page 100). A list of the sensor state messages is provided in *Table 19. Sensor State Messages*. For possible causes and solutions for the error reported, see *Troubleshooting Issues* in your sensor-specific user guide. Request the sensor user guide from support@quanergy.com.

The sensor health is also shown on the Q-View **Diagnostics** panel, discussed in the *Q-View User Guide* (available at <https://downloads.quanergy.com/>).

Table 18. System Status and Error Messages

Category	Severity	Error
Server State Error	Red	Request server state error
Sensor State Error	Red	Request sensor state error
Live Mode Error	Red	Stop live mode error
Playback Mode Error	Red	Start playback error
		Stop playback error
		Slow down playback error
		Step playback error
Replay playback error		
Zone Editing Error	Red	Cannot set existing name for the zone
QLog Error	Red	QLog download error
		QLog file list request error
Location Settings Error	Red	Sensor location settings request error
Location Error	Red	Start location error
Zone Error	Red	Adding a zone error
		Editing a zone error

Category	Severity	Error
		Removing a zone error
		Requesting the Event zone violation enabled state error
		Event zone violation enabled state error
		Changing specific zone violation trigger error
		While requesting specific zone violation trigger actions error
		While requesting specific zone violation trigger error
		While requesting zone enabled status for the zone type error
		While setting zone enabled status for the zone type error
		Changing specific zone violation trigger error
License Expiring	Yellow	Subscription license has 30 day(s) remaining
		Subscription license has 10 day(s) remaining
	Red	Subscription license has expired
		Subscription does not support the number of sensors connected
		Sensor disconnect info error

Table 19. Sensor State Messages

Severity	Error
Colorless	None
Red	Motor Initialization Error
Red	High Sensor Temperature
Red	Insufficient Motor Velocity
Red	Field Of View Is Blocked (Q-Track sensors only)
Red	Version Mismatch
Red	Watchdog Violation

Software Crash

The QORTEX DTC application is resilient by design, but software crashes can occur.

For the server, the client will detect the server crash and send a notification. The server is designed to run persistently, so it will restart its service automatically.

1. If it fails to restart, see *Control the Server Daemon Service* (page 56). Check the status of the service, and if a process number is not given, re-start the service. Check status again to confirm that the return includes a process number.
2. If necessary, notify a support representative.

For the client, do the following:

1. Update all of the available graphics drivers on the host machine to rule out that potential issue.
2. Restart the client. See *Start the Client on a Windows Host* (page 57) or *Start the Client on an Ubuntu Host* (page 57). The client remembers the previously saved configuration and resumes in **Monitor** mode.
3. If necessary, notify a support representative.

Any Other Issue

Contact a support representative to create an automatic support ticket to receive the specific help needed. Provide the sensor serial number, if required.

- If the hardware and software was purchased from Quanergy, send an email to support@quanergy.com with feedback, questions, or concerns.
- If the hardware and software was purchased from a value-added reseller (VAR) or system integrator (SI), contact them for support.

18. Logs and Configuration Files


User Activity Log

The user log file is useful for auditing purposes. The user log file contains QORTEX DTC client IP, username, and login and logout times. The login time is when the user is successfully authenticated with the QORTEX DTC server. Logout time is when the user disconnects from the QORTEX DTC server. See [Figure 98. Security: User Activity Log](#) and [Table 20. User Log Statements](#).

Data is stored in the user log whether the QORTEX DTC client is in LIVE or PLAYBACK mode. The option to download the log is only available in LIVE mode. The user log continues to grow as long as the QORTEX DTC server is running. Each time the QORTEX DTC server restarts, a new user log is created and the old user log is overwritten.

Log content includes: the user log file accessible from the QORTEX DTC client contains user's IP address, username, permission level, login and logout times. In addition, the file contains security configuration updates/changes such as adding new users, changing user permissions, resetting passwords, when password expiry is enabled/disabled, error when adding an existing user, and admin username change.

Download User Log Files

1. Select login option:
 - To modify the log, login as Admin or root user.
 - To only view the log, login as Viewer or Editor user.
2. Select the **Configuration** mode panel > **Server** tab > **Security Login** panel header.
3. Click the download  icon.

The current log is displayed in a new terminal and a copy of the current file is written to:
`/home/quanergy/quanergy/qortex/userLogs/user.activity.log.`



Figure 98. Security: User Activity Log

QORTEX DTC Server implements User Activity Log to track user-initiated actions explicitly related to security changes or approved/denied by Cyber Security. Download the security user activity log. This file is read only except for Quanergy or root users.

Table 20. User Log Statements

Log level	Log statement type	Text format example
Info	Security Token Created	2022-06-24 22:58:57 [info] Security: New session key token created
info	Client authenticated	2022-06-24 22:58:57 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 authenticated
info	Client authentication rejected	2022-06-24 23:12:24 [info] Security: ::ffff:127.0.0.1 @Alex434 auth rejected
info	Client session started	2022-06-24 22:58:57 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 started new session
info	Client session finished	2022-06-24 23:04:45 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 finished session
info	Set Credentials	2022-06-24 23:03:23 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 set user name @Alex435 and password new user type Viewer
info	TCP port connected	2022-06-24 23:17:54 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 ::ffff:127.0.0.1 connected to port 17175 secure mode
info	TCP port N unsecured	2022-06-24 23:17:54 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 TCP 17175 set unsecured
info	TCP port N secured	2022-06-24 23:17:54 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 TCP 17175 set secured: must reconnect all
info	Setting edited	2022-06-24 23:00:39 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 edited settings set expiryEnabled to false set secureTcp to true Message can list different settings changed.
info	Set user name/ password/ user type	2022-06-24 23:01:59 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 set user name @Alex434 and password new user type Viewer
info	Deleted user	2022-06-24 23:04:10 [info] Security: Admin user @Alex433 ::ffff:127.0.0.1 deleted user @Alex434

Log File Rotation

By default message logging is sent to the QORTEX DTC console when the QORTEX DTC server is unable to find a properties file, `qortex.server.logging.properties`. Default location for the properties file is `/home/quanergy/quanergy/qortex/`. The properties file provides multiple options for logging messages to a log file.

Log file rotation has two primary features:

- After a configured state is reached, the primary log file content is transferred to a new, incremented, file. The primary log file continues to receive messages.
- After a configured state is reached, the oldest log file is removed to make room for the newest incremented log file.

Define the log file rotation conditions through the properties file.

- The rolling log files directory is: `/home/quanergy/quanergy/qortex/userLogs/`
- Rotation time: every 24 hours
- Max log file count allowed: 100

```
root@ubuntu:/home/quanergy/quanergy/qortex/userLogs# ll
total 36
drwx----- 2 quanergy quanergy 4096 Sep 7 14:38 ./
drwxrwxrwx 6 quanergy quanergy 4096 Sep 21 21:16 ../
-rw----- 1 quanergy quanergy 2464 Aug 11 21:19 user.activity-0.log
-rw----- 1 quanergy quanergy 362 Aug 12 15:52 user.activity-1.log
-rw----- 1 quanergy quanergy 8700 Aug 17 17:09 user.activity-2.log
-rw----- 1 quanergy quanergy 215 Aug 31 21:42 user.activity-3.log
-rw----- 1 quanergy quanergy 144 Sep 7 14:39 user.activity-4.log
```

Figure 99. Sample Rolling Log File Directory

System File

The `settings.xml` file contains the list of configuration settings applied to each sensor. Select and change settings through the QORTEX DTC client options listed on tabs in the **CONFIGURATION** mode panel. Alternatively, you can edit the `settings.xml` file in a text editor.

Properties File

The properties file is a text file with the name `qortex.server.logging.properties`. The default location is in the `/home/quanergy/quanergy/qortex/` directory. If the file is not in this location when the QORTEX DTC server is launched, logging configuration is not uploaded.

Logging Properties File Parameters

logToFile

Set whether to log message to a file. This is a flag. Default is `False`.

- `True` Logs messages to a file and the Qortex DTC console.
- `False` Logs message only to the Qortex DTC console.

logFile

Define the path to the messages log file. Action is dependent on `logStrategy` setting. If the `logStrategy` setting is:

- `Rolling` The log file directory cannot contain any other files.
- `syslog` The `logFile` is redundant because messages are logged to `/var/log/syslog`.
- `logger` The `logFile` path already exists and that the QORTEX DTC server user has permission to edit the file.

fileLogLevel

Sets log levels for messages logged to the file. Default is `info`. Available log message types.

- `error`
- `warn`
- `info`
- `debug`
- `trace`
- `notset`

Only messages that are `>=` the log level defined here are logged to the file.

logToConsole

Set if message display in the QORTEX DTC console. This is a flag. Default value is `true`.

- `True` Messages display in the QORTEX DTC console.
- `False` Messages do not display in the QORTEX DTC console.

consoleLogLevel

Sets log levels for messages logged to the QORTEX DTC console. Default is `info`. Available log message types.

- `error`
- `warn`
- `info`
- `debug`
- `trace`

- notset

Only messages that are \geq the log level defined here are logged to the file.

logStrategy

Set the method for handling messages sent to the log file. Default is `logger`. Options:

- `logger` Default. Log messages to the file using `ostream`. No file rotation or rolling options available.
- `syslog` Log messages to the file using `syslog` handler, which provides its own log file rotation/rolling. These rotation properties are defined in `/etc/logrotate.d/rsyslog`.
- `rolling` Log messages using customized properties with `boost` library. This provides log file rotation/rolling. The properties are defined by the parameters in the `properties` file, as explained below.

default

Set the default logging level for both the console and the log file. Default is `info`. Available log message types.

- error
- warn
- info
- debug
- trace
- notset

<parent_name>.<child_name>

Optionally, set log levels for sub-loggers. Both parameters must have values. This is available for all loggers and sub-loggers.

- `parent_name` The main logger. The log level is defined.
- `child_name` The sub-logger. By default, the sub-logger uses the same log level as the main logger. Use this parameter to set a different log level.

For example: `QortexServer.GRPCServer = warn`

– where `QortexServer` is a main logger and `GRPCServer` is a sublogger

rotationTime

Set the time lapse, in hours, to role the current log file. Requires `logStrategy` set to `rolling`. Default is 24 hours.

When the log file roles:

- The content in the current log file is transferred to a file, with an incremented filename, `qortex.server--<file_index>.log`. This transferred file is saved in the `logFile` directory.
- New log content continues to be added to the current, now empty, log file.

maxFileCount

Set the maximum number of files created without rotation. Requires `logStrategy` set to `rolling`. Default is 100 files.

The next file created after `maxFileCount` is reached, triggers rotation. Rotation is removing and replacing the oldest log file with the new empty log file ready to receive messages.

For example: If this parameter is set to 10 and the rotation time is set to 24 hours. A new log file is created after every 24 hours. By the beginning of the 11th day, there are 10 logs files in the folder. One log for each of the last 10 days. At the end of the 11th day, the log file from day 1 is removed and replaced by the log file of the 11th day. The oldest log file is replaced when the `maxFileCount` parameter is reached.

maxLogFileSize

Set the maximum combined file size of the log files created without rotation. Requires `logStrategy` set to `rolling`. The value is in bytes. By default, this is not used to trigger rotation.

When the combined file size is reached, additional log entries trigger rotation. Rotation is removing and replacing the oldest log file with the new empty log file ready to receive messages. This is similar to `maxFileCount`, except file size is used to trigger rotation, rather than count.

minFolderSize

Set the minimum amount of free space left in the log file directory without rotation. Requires `logStrategy` set to `rolling`. The value is in bytes. By default, this is not used to trigger rotation.

When the log file directory total free space drops to this value, additional log entries trigger rotation. Rotation is removing and replacing the oldest log file with the new empty log file ready to receive messages. This is similar to `maxFileCount`, except total free space is used to trigger rotation, rather than count.

Sample `qortex.server.logging.properties` File

Stored in `/home/quanergy/quanergy/qortex/`

```
logToFile    = true
logFile      = /home/user/qortex_log/qortex.server.log
fileLogLevel= warn
logToConsole= true
consoleLogLevel = warn
```

```
logStrategy = rolling
default = warn
QortexServer.GRPCServer = warn
rotationTime = 24
maxFileCount = 100
minFolderSize = 1000000000 # 1Gb
```

Appendix 1. Cartesian Coordinate System

To properly configure QORTEX DTC 2.4, a basic mathematical understanding of the Cartesian coordinate system for defining 3D locations in space is needed. A quick way to remember the correct orientation of the axes defining the coordinate system is by the right-hand rule. See *Figure 100. Coordinate System: Right-Hand Rule.*

- The index finger points forward for the positive X-axis.
- The middle finger points to the side for positive Y-axis.
- The thumb points up for the positive Z-axis.
- The Origin point (0, 0, 0) is on the palm.

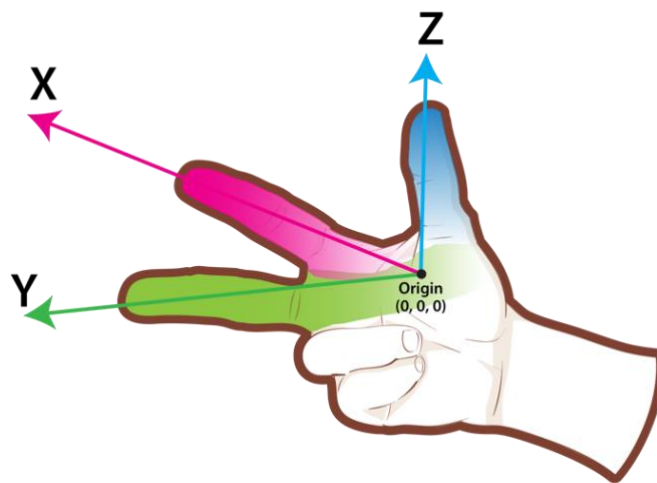


Figure 100. Coordinate System: Right-Hand Rule

Every DTC object must share the same frame of reference, that is, the same X-axis, Y-axis, Z-axis, and Origin so that a 3D description in meters (X, Y, Z) expresses precisely one location, such as (3.2, 1.9, -1.8).

In the sensor coordinate system (non-PoE+ version). See *Figure 101. Coordinate System: Two Versions of the Sensor.*

- The front area of the sensor points toward positive X.
The sensor cable in the back points toward negative X.
- Through the center of the center, perpendicular to the X-axis.
The right-side points toward positive Y.
The left side points toward negative Y.
- The top flat face of the sensor points toward positive Z.
The bottom face of the mounting base points toward negative Z.
- For each sensor, the three axes converge internally at the point of Origin (0, 0, 0).

In the sensor coordinate system (PoE+ version), See *Figure 101. Coordinate System: Two Versions of the Sensor.*

- The connector in the front of the sensor points toward positive X.
The back points toward negative X.
- Through the center of the center, perpendicular to the X-axis.
The right-side points toward positive Y.
The left side points toward negative Y.
- The top flat face of the sensor points toward positive Z.
The bottom face of the mounting base points toward negative Z.
- For each sensor, the three axes converge internally at the point of Origin (0, 0, 0).

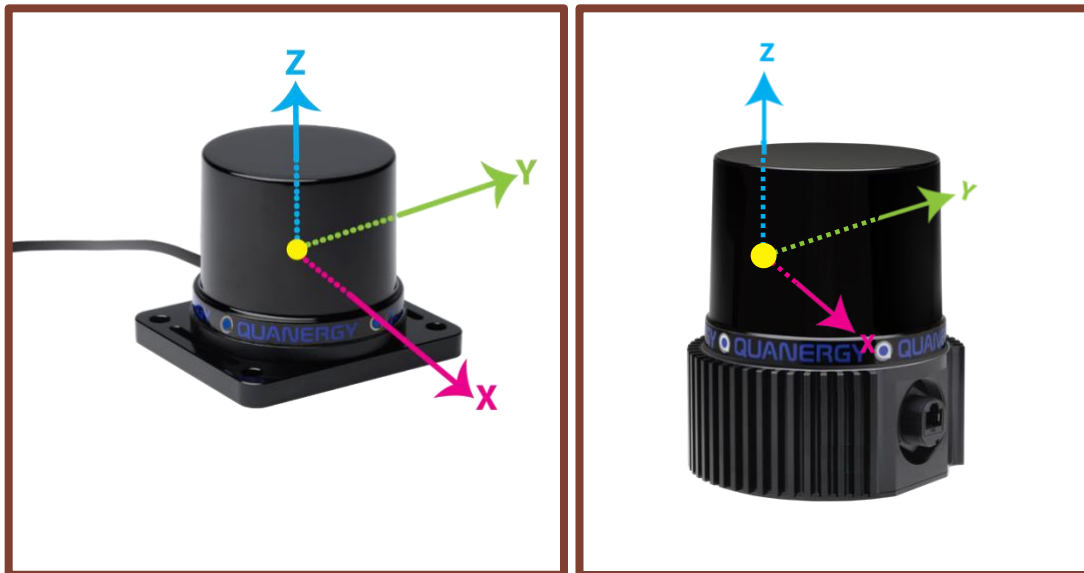


Figure 101. Coordinate System: Two Versions of the Sensor

Appendix 2. QORTEX DTC Fast Track

QORTEX DTC Fast Track is a set of tools that uses source code and business logic to help system integrators and value-added resellers accelerate software development for QORTEX DTC. The Fast Track bundle includes:

- **Geolocation Translator:** converts object location into latitude and longitude, as discussed in the next section.
- **Sensor Coverage Tool:** estimates a sensor coverage area depending on the sensor position.
- **Web Server and Google Maps Tool:** visualizes object location(s) on Google Maps.
- **Port Monitor:** listens and displays the real time output of a TCP port.
- **System Health Monitor:** monitors QORTEX DTC system health and sends an email alert if an abnormality is detected.

To purchase or obtain access to QORTEX DTC Fast Track, please contact Quanergy sales or support@quanergy.com.

Geolocation Translator

The Geolocation Translator provides the absolute latitude and longitude of an object. The script reads the object list and zone list from QORTEX DTC. It uses the location of the QORTEX DTC server World Origin to determine the latitude and longitude of objects in the object list.

The output is broadcast through sockets. Available output formats include XML and JSON.

The script, which currently supports a single QORTEX DTC server, provides the following information:

- Object ID and classification
- Object position in x, y, z locations, and in latitude and longitude
- Object velocity
- Object size
- Zones (contains all zones in which the object is present)
- Timestamp

Requirements

The Geolocation Translator script requires a computer with the following list of items installed or updated. See *Figure 102. Geolocation Translator: Required Updates to settings.xml File*.

Ubuntu 20.04 operating system

QORTEX DTC Server

Python 2.7 or above, installed as follows:

1. Acquire the pip for Python 2.7 package or the pip for Python 3 package:

For Python 2.7, install with this script:

```
-- sudo apt-get install python-pip
```

For Python 3, install with this script:

```
-- sudo apt-get install python3-pip
```

2. Acquire the lxml package, and install it with this script:

```
-- sudo pip install lxml
```

3. Acquire the configparser package, then install it with this script:

```
-- sudo pip install configparser==4.0.2
```

settings.xml **file is updated.**

4. Run the following to specify and open whichever settings.xml file is in use:

```
$ sudo gedit /home/quanergy/quanergy/  
qortex/location/<settings>.xml
```

5. In the text editor, update values where indicated.

- **Format:** json or xml
- **Port:** for Zone list is 17172
- **AddDataSize:** true

6. Save and close the file.

```
<Publisher>  
  <Name>QORTEX_ZONE_LIST</Name>  
  <Format>json</Format>  
  <Port>17172</Port>  
  <AddDataSize>>true</AddDataSize>  
  <NetworkByteOrder>>false</NetworkByteOrder>  
</Publisher>
```

Figure 102. Geolocation Translator: Required Updates to settings.xml File

Preparation

Before using the Geolocation Translator, make these preparations:

1. Download/clone the Geolocation Translator script folder from GitHub to the same host machine where the QORTEX DTC server is installed, or to a machine that is on the same network as the QORTEX DTC server machine.
2. Unzip the downloaded folder, navigate to the Geolocation Translator folder, and list the contents. See [Figure 103. Geolocation Translator: Folder](#).

```
user:~/Downloads/qguard_geolocation_translator$ ls
config qguard_geolocation_translator.py quanergy
```

Figure 103. Geolocation Translator: Folder

3. Navigate to the config folder, open the config.ini file in a text editor, update the following values if necessary, then save and close the file. See [Figure 104. Geolocation Translator: config.ini File Updates](#).
 - o **ip_address**: of the QORTEX DTC server
 - o **message_format**: json or xml
 - o **lat**: the latitude of the World Origin
 - o **long**: the longitude of the World Origin
 - o **heading**: current orientation (direction of the X-axis) of the sensor in degrees

```
[QGuard]
ip_address=127.0.0.1
zone_list_port=17172

[Broadcaster]
port=18181
send_packet_size=true
# file format can be in either xml or json
message_format=json

[Primary Sensor]
lat=37.768943
long=-122.389166
heading=0
```

Figure 104. Geolocation Translator: config.ini File Updates

Execution

Once the config parameters have been edited, execute the Geolocation Translator script. Run the `qguard_geolocation_translator.py` script in one of the following ways. See [Figure 105. Geolocation Translator: Connection and Output](#).

```
$ python qguard_geolocation_translator.py
```


or

```
$ ./qguard_geolocation_translator.py
```

The return is the same regardless.

Connect to port 18181 to stream output with this command.

```
$ nc 127.0.0.1 18181
```

An example of the output.

```
user:~/Downloads/qguard_geolocation_translator$ python
qguard_geolocation_translator.py
Attempting connection to 127.0.0.1 on port 17172
Connected to server at 127.0.0.1 on port 17172

user:~$ nc 127.0.0.1 18181

{
  "objectClass": "VEHICLE",
  "timestamp": "1586206199366",
  "zones": [
    "62"
  ]
  "position": {
    "y": -23.0818291,
    "x": 41.2743149,
    "z": 1.20757973,
    "lat": 37.76931430954076,
    "long": -122.38942868433801
  },
  "velocity": {
    "y": -0.144213989,
    "x": -4.59316397,
    "z": 0.224059537,
    "track": -178.2016450122697,
    "speed": 4.6008866393517026
  }
  "id": "3724805"
  "size": {
    "y": 2.04645191
    "x": 3.47772717
    "z": 1.02826643
  }
}
```

Figure 105. Geolocation Translator: Connection and Output

Sensor Coverage Tool

The Sensor Coverage tool simulates point clouds from multiple sensors to identify the coverage for an area. The tool considers no obstacles or objects in the area. It supports and simulates Q-Track sensors.

Requirements

The Sensor Coverage tool requires a computer running one of the following to operate:

- Python 2.7 (<https://www.python.org/downloads/release/python-2710/>)
- Python 3.7 (<https://www.python.org/downloads/release/python-370/>)

Preparation

Before using the Sensor Coverage tool, make these preparations:

1. Download/clone the `sensor_coverage` folder from GitHub to the same host machine where the QORTEX DTC server is installed, or to a machine that is on the same network as the QORTEX DTC server machine.
2. Unzip the downloaded folder, navigate to the `sensor_coverage` folder, and list the contents. See *Figure 106. Sensor Coverage Tool: Folder*.

```
user: sensor_coverage-master user$ ls
LICENSE      generate_lidar_rings.py
README.md    sensor_coverage.py
```

Figure 106. Sensor Coverage Tool: Folder

3. Edit the `sensor_coverage.py` script in that folder to update the following sensor parameters, if necessary. See *Figure 107. Sensor Coverage Tool: python Script Updates and Additions*.

Type: specify the sensor as Q-Track.

Range: effective sensor range, measured in meters, used for the simulation.

x, y, z: position of the sensor in space, measured in meters. See Appendix 1: *Cartesian Coordinate System* (page 171) for information about defining 3D locations in space.

yaw_angle: rotation around the Z-axis of the sensor, measured in degrees.

pitch_angle: pitch and tilt relative to the sensor, measured in degrees.

A positive (+) value refers to the measurement of tilt down.

A negative (–) value refers to the measurement of tilt up.

roll_angle: rotation around the X-axis of the sensor, measured in degrees.

min_angle: minimum angle of the sensor FOV (Field of View), in degrees.

max_angle: maximum angle of the sensor FOV, measured in degrees.

ground_offset: height off the ground at which points are differentiated from the ground, measured in meters.

target_height: maximum height of the target where points/returns are expected to be captured, measured in meters.

Other editable graphical parameters that may be included in the script, or that you could add are:

```
plt.axis ('equal')
plt.xlim (-100, 100)
plt.ylim (-70, 70)

{"type":"Q-Track","range":85,"x":0,"y":0,"z":4.2, "yaw_angel":385,
"pitch_angle":6.4, "roll_angle":0, "min_angle":-180, "max_angle":180,
"color":"green","alpha":0.5}

{"type":"Q-Track","range":85,"x":33,"y":3,"z":4.2, "yaw_angel":200, "pitch_angle":-
6.2, "roll_angle":0, "min_angle":-180, "max_angle":180,
"color":"green","alpha":0.5}

{"type":"Q-Track","range":85,"x":8,"y":-24,"z":4.2, "yaw_angel":80, "pitch_angle":-
6.0, "roll_angle":0, "min_angle":-180, "max_angle":180,
"color":"green","alpha":0.5}

{"type":"Q-Track","range":85,"x":33,"y":-24,"z":4.2,
"yaw_angel":170,"pitch_angle":6.4, "roll_angle":0, "min_angle":-180,
"max_angle":180, "color":"green","alpha":0.5}

plt.axis ('equal')
plt.xlim (-100, 100)
plt.ylim (-100, 100)
```

Figure 107. Sensor Coverage Tool: python Script Updates and Additions

Execution

Once the LiDAR and other parameters have been edited, execute the following script:

```
$ python sensor_coverage.py
```

Sensors are plotted on a graph in an image which includes the following elements.

- **Blue** dots indicate sensors.
- **Light green** areas indicate a single beam from a particular sensor.
- **Dark green** areas indicate the overlap of two or more beams from two or more sensors.
- **White** areas in between beams indicate no beam coverage from any sensor.

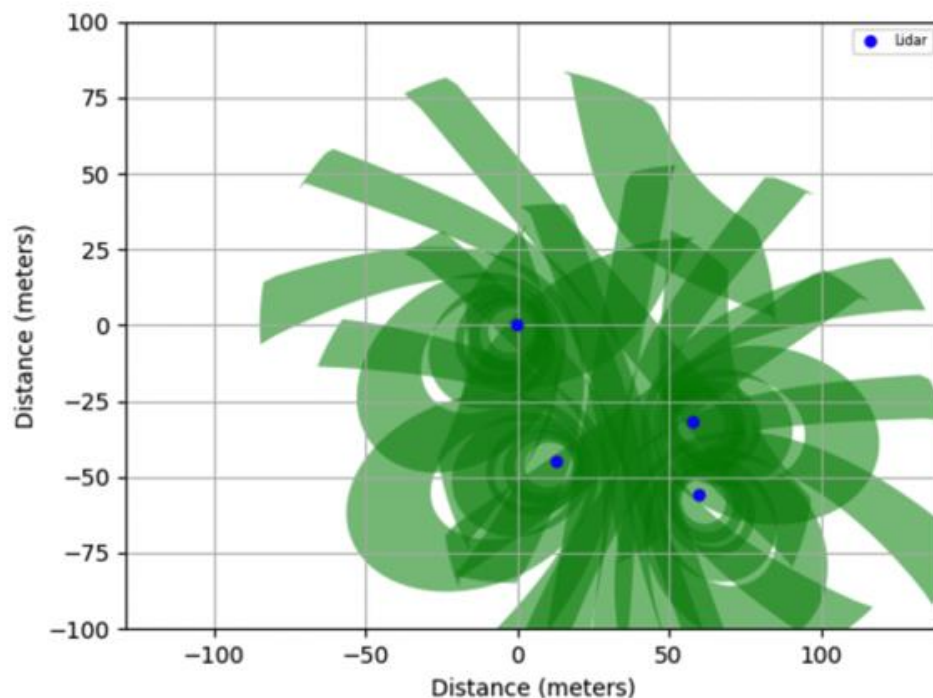


Figure 108. Sensor Coverage Tool: Graph

Web Server and Google Maps Tool

A Web Server serves the Object list streamed from one or more QORTEX DTC servers to a web client that visualizes the objects on Google Maps.

Requirements

The Web Server and Google Maps Tool requires a computer running the following:

- **Ubuntu 20.04** operating system
- **node.js**

To install `node.js`, go to <https://github.com/creationix/nvm>

To install `node.js` through NVM, go to the same web page

- **Google Maps API Key** installation instructions are at:

<https://developers.google.com/maps/documentation/javascript/get-api-key>

Preparation

Before using the Web Server and Google Maps Tool, make these preparations:

1. Download the `Qortex_DTC_WebClient`, then unzip the file.
2. Open a terminal window, and navigate to the following folder:

```
Qortex_DTC_WebClient-master/src/clients/google_maps
```

3. Run:

```
npm run build
```

4. Open `index.html` in a text editor, replace `<insert_your_key>` with the proper Google Maps API Key, save the file, and exit the editor.
5. Navigate to the `src/server` folder, then run:

```
npm install
```

Configuration

Configure the Web Server and Google Maps Tool as follows:

1. Go the folder `Qortex_DTC_WebClient-master/config`.
2. Open the `config.ini` file in a text editor, and update these values, as needed:

type: the name of the web client served by the Web Server.

ip_address: the QORTEX DTC server IP address. For multiple servers, add additional `[servers.<name>]` sections. Each section requires the information below:

track_port: the port on which the QORTEX DTC server publishes objects.

zone_port: The port on which the QORTEX DTC server publishes zones.

Optional geographic calibration of the QORTEX DTC installation against the world:

lat: The latitude of the QORTEX DTC installation in the world

lng: The longitude of the QORTEX DTC installation in the world

heading: The orientation of the QORTEX DTC installation in the world

Cartesian calibration of the QORTEX DTC installation against the world, if needed. These values depend on the map to display objects on, as follows:

x_position: The x position of the QORTEX DTC installation relative to some point

y_position: The y position of the QORTEX DTC installation relative to some point

z_position: The z position of the QORTEX DTC installation relative to some point

3. Save the file, then exit the text editor.

Execution

Visualization of objects requires the Web Server to start up and keep going, as follows:

1. Run the Web Server in one of the following two ways:

Execute the `server.sh` shell script, available in the bin folder.

or

Run the node on `src/server/src/main.js`.

2. Pass in any of the following options you prefer:

`-h` or `--help` to get a full list of options.

`-l` or `--log` to set whether the JSON data received from the QORTEX DTC servers is saved to file. Files are saved to the logs folder in the QORTEX DTC Web Client root folder.

`-p` or `--port` to specify which port the QORTEX DTC Web Client server uses for HTTP communications. It defaults to the port set in the environment, or 3000 if the port is not set.

`-c` or `--config` to pass in the location of the config file.

3. Open a web browser, and enter the following into the address bar: 127.0.0.1:3000
4. The message `Server Status: Connected` is displayed, and objects are seen moving on Google Maps. See [Figure 109. Web Server and Google Maps Tool: Example Site](#).
5. Press **Ctrl+C** when if you are ready to stop the Web Server.



Figure 109. Web Server and Google Maps Tool: Example Site

Port Monitor

The Port Monitor, also called the `qortex_listener` (Listener), is an example to use or adapt. The main routine where the code starts executing exhibits the process flow to create a customized human alert system using the object/trackable list data, for example. See [Figure 110. Port Monitor `qortex_listener` Main Routine](#). This tool uses standard sockets to connect to a port on the server host computer and processes messages that are published there.

```
/* Start here - THESE ARE JUST CODE SNIPS. PLEASE SEE SOURCE APPLICATION. */
int main(int argc, char **argv)
    /* socket: create the socket */
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    /* Get the server Internet address:port, then connect our socket to the port */
    connect(sockfd, (struct sockaddr *) &serveraddr, sizeof(serveraddr))

    /* Wait for messages and process them */
    processMessage( sockfd );
    /* Every message is preceded by a 4 byte message length, including JSON & XML */
    int bytcount = recv( theSocket, messageBuffer, 4, 0 );
    /* Process the 'protobuf' message, then wait for next */
    if (qobjarr.ParseFromArray( messageBuffer, bytcount )) {
        /* If the format is 'protobuf' use the built-in parser to display the data */
        std::cout << "Parsed QObjects: " << qobjarr.object_size() << " " <<
qobjarr.DebugString();
    }
    else {
        /* If the data is serial text data, just output the text */
        std::cout << "Parsed text object: " << messageBuffer << std::endl;
    }
}
```

Figure 110. Port Monitor `qortex_listener` Main Routine

Requirements

There are a few requirements before using the Port Monitor.

1. Have the following set up:
 - CMake >2.8.1
 - Boost >1.52
 - Protocol Buffers v3.5.0 Development Library
(<https://github.com/google/protobuf/releases/tag/v3.5.0>)
2. Install the new Protobuf 3.5.0 library by opening an Ubuntu terminal window, and execute the following commands:

```
$ ./configure
```



```
$ sudo make
$ sudo make install
```

3. Access the `source_code/build`, and execute the following command to refresh the system environment:

```
$ sudo ldconfig
```

Preparation

To build the tool, use the make file (included in the source code) on a machine with a C++ compiler.

1. Clone the repository into a directory.
2. Build the application in that directory by executing the following commands:

```
$ mkdir build && cd build
$ cmake ..
$ make
```

The tool runs on any PC, operating system, or any other node on the network so that any third-party machine can receive the data output from QORTEX DTC.

Execution

Start the Port Monitor as follows, providing the IP address and port number of the server host computer, and specifying the type of content expected. See [Server TCP Ports to Monitor](#) (page 93).

```
$ ./qortex_listener [--host ip] [--port port_number] [-t output_type]
```

If these parameters are not provided, the Port Monitor defaults by trying to connect to localhost (127.0.0.1) on port 17161, where the Trackable List is output. When the command is executed, the Port Monitor establishes a TCP socket connection and monitors the specified TCP port to directly consume the live (real-time) data and print it to the Ubuntu terminal window in whichever format is specified in the `settings.xml` file.

Use the following executable commands, with the variable (user-specified server host computer IP address) in *brown*:

For detected trackables:

```
$ ./qortex_listener -h x.x.x.x -p 17161 -t qtrack
```

For defined zones:

```
$ ./qortex_listener -h x.x.x.x -p 17172 -t qzone
```

For current sensor status:

```
$ ./qortex_listener -h x.x.x.x -p 17178 -t qstate
```

Press **Ctrl+C** to terminate the Port Monitor.

Encrypted TCP Port Messages

If **Security** mode is enabled, TCP port messages are encrypted. See *Figure 111. TCP Encrypted and Decrypt with Security Mode Enabled.*

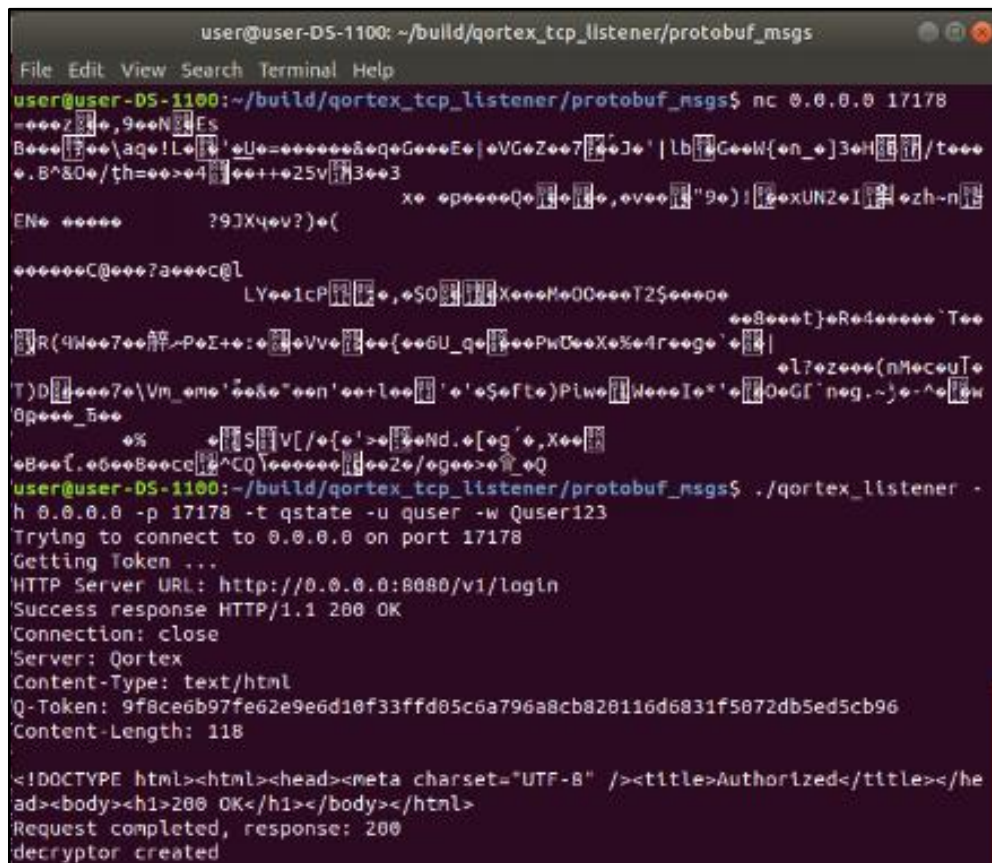
To view unencrypted TCP port messages using the Quanergy TCP listener, `qortex_listener`:

1. From the command line of your QORTEX DTC server, change to the `/Qortex_tcp_listener` directory for the message format selected in your TCP port settings. See *Edit TCP Port Publishing Settings* (page 93).
2. Enter the command to view the port messages.

```
$ nc <ip_address> <tcp_port>
```

3. If the output is encrypted, use the key from HTTP digests to decrypt the published message. This includes the TCP type reference and security credentials: username and password. For example:

```
$ ./Qortex_listener -h 0.0.0.0 -p 17161 -t qtrack -u <username> -w <password>
$ ./Qortex_listener -h 0.0.0.0 -p 17172 -t qzone -u <username> -w <password>
```



```
user@user-DS-1100: ~/build/qortex_tcp_listener/protobuf_msgs
File Edit View Search Terminal Help
user@user-DS-1100:~/build/qortex_tcp_listener/protobuf_msgs$ nc 0.0.0.0 17178
-+9N34Es
B+aq!L+U+8dqG+VG+Z+7+J+|Lb+C+W{on_}3+H/tee
.B^&O+th+4+++25v3+3
x+ p+Q+e+v+"9+):xUN2+I+zh-n
EN+ ?9JX4v?)+(
++++C@+?a+c@l
LY+1cP+,+SO+X+M+00+T2$+
R(4M+7+P+I+:+V+V+{+GU_q+P+U+X+4r+e+g+'+|
T)D+++7+V+m_om+'&e"+en'++l+e+'+'e+$+f(t)+Plw+W+e+e+'e'O+G['neg.-)+-^+P+w
0p+++_5+
+% S[V[/'>+Nd.[eg '+,X+
+B++l.+6++B+ec+Q\+e+e+e+e+Z+/+g+e+>+Q
user@user-DS-1100:~/build/qortex_tcp_listener/protobuf_msgs$ ./qortex_listener -
h 0.0.0.0 -p 17178 -t qstate -u quser -w Quser123
Trying to connect to 0.0.0.0 on port 17178
Getting Token ...
HTTP Server URL: http://0.0.0.0:8080/v1/login
Success response HTTP/1.1 200 OK
Connection: close
Server: Qortex
Content-Type: text/html
Q-Token: 9f8ce6b97fe62e9e6d10f33ffd05c6a796a8cb820116d6831f5072db5ed5cb96
Content-Length: 118
<!DOCTYPE html><html><head><meta charset="UTF-8" /><title>Authorized</title></he
ad><body><h1>200 OK</h1></body></html>
Request completed, response: 200
decryptor created
```

Figure 111. TCP Encrypted and Decrypt with Security Mode Enabled

System Health Monitor

The System Health Monitor checks the status of various sensor health parameters and sends email alerts about problems.

Requirements

The System Health Monitor requires a computer with the following:

- **Ubuntu 20.04** operating system on a native machine or virtual machine
- **Python 2.7**
- **pip install pyyaml**
- **Postfix** : `sudo apt-get install postfix`
- QORTEX DTC server publishing JSON data on ports 17161, 17172, 17168, and 18181 (for the Geolocation Translator)

Preparation

Before using the System Health Monitor, make these preparations:

1. Download/clone the System Health Monitor script folder from GitHub to the same host machine where the QORTEX DTC server is installed, or to a machine that is on the same network as the QORTEX DTC server machine.
2. Unzip the downloaded folder, then navigate to the System Health Monitor folder.
3. Open the `config.yaml` file in a text editor, update the following parameters if needed, then save and close the file.

Site > Streams > geo

- **host**: 10.36.141.131 (IP address of machine running Geolocation Translator)
- **port**: 18181 (if streaming port number changed, update this)
- **docker_image**: `qgeo_image`
- **docker_container**: `qgeo-server`

QORTEX

- **host**: 10.36.141.131 (IP of machine running the QORTEX DTC server)
- **port**: 17161 (if streaming port number changed, update this)
- **sensor_status**: 17168 (if streaming port number changed, update this)
- **docker_image**: `Qortex_server_image`
- **docker_container**: `qortex-server`

alert_email_sender: email address of the sender

alert_email_list: email address list of recipients

4. Open a terminal window, and give the `monitor_email_only` script executable rights:

```
$ sudo chmod 777 monitor_email_only.py
```

Execution

In a terminal window, run the System Health Monitor script in one of the following ways:

```
$ ./monitor_email_only.py
```

or

```
$ python monitor_email_only.py
```

The script checks parameters and completes tasks in the following order:

1. Checks QORTEX DTC object and health/status streams, Q-Track sensors, and the geolocation translator script. The script sends an email if any of the streams are unavailable or missing, or if the sensor(s) do not respond to ping requests.
2. Checks data on port 18181 of the geolocation translator script.

If data on port 18181 is missing, the script checks for data stream on port 17161 (Track List) from QORTEX DTC 2.0. If the stream is unavailable or missing on port 17161, the script sends an alert email stating: `Qortex was not sending out data at 17161 on $Server_IP. Manual Intervention needed.`

If the data stream is active and available on port 17161 but missing on ports 18181, the script sends an alert email stating: `Geo translator was not sending out data at 18181 on 10.36.141.131. Qortex seems to be running fine. Manual intervention needed!`

3. Checks data on port 17168 (State List) of QORTEX DTC 2.0.

If the State List is unavailable or missing, the script sends an alert email stating:

```
Sensor status is not being published by Qortex on port: 17168  
Manual intervention needed!
```

If the data stream is active on 17168, the script searches for sensor(s) with a status of “not connected.”

4. Pings sensor(s) connected to QORTEX DTC at defined time intervals.

Appendix 3. Automated Handover ID

Automated Handover ID™ is an application that unifies the output from multiple QORTEX DTC servers. The application connects to multiple QORTEX DTC servers and combines the individual results into a single output that is in a format identical to the QORTEX DTC output. The object IDs are consistent across the servers (that is, an object traveling from one server area to another server area preserves its object ID). Duplicate objects are suppressed.

As of Automated Handover ID version 2.3, server failure resilience is added. If one of the Qortex DTC servers fails, Automated Handover ID continues to seamlessly run.

This application is available from your support representative at support@quanergy.com.

Supported Versions

As of QORTEX DTC 2.4, Automated Handover 2.3 versioning is in sync with QORTEX DTC versioning.

Table 21. Automated Handover Version Compatibility

Automated Handover version	QORTEX DTC version	Features
2.3	2.x, 1.x	2.x trackables list
2.2.1	2.x, 1.x	Server resilience when a server is down. 2.x trackables list

Minimum Requirements

The application is packaged as a Docker image and therefore needs to run in a Docker container. At a minimum, the application also requires the following:

- Hardware: Desktop or laptop with i3 processor, 4GB Memory.
- Operating System: Ubuntu 20.04 LTS or VMware ESXi6.5.

System Architecture

For an example of the system architecture, which uses a Docker container.

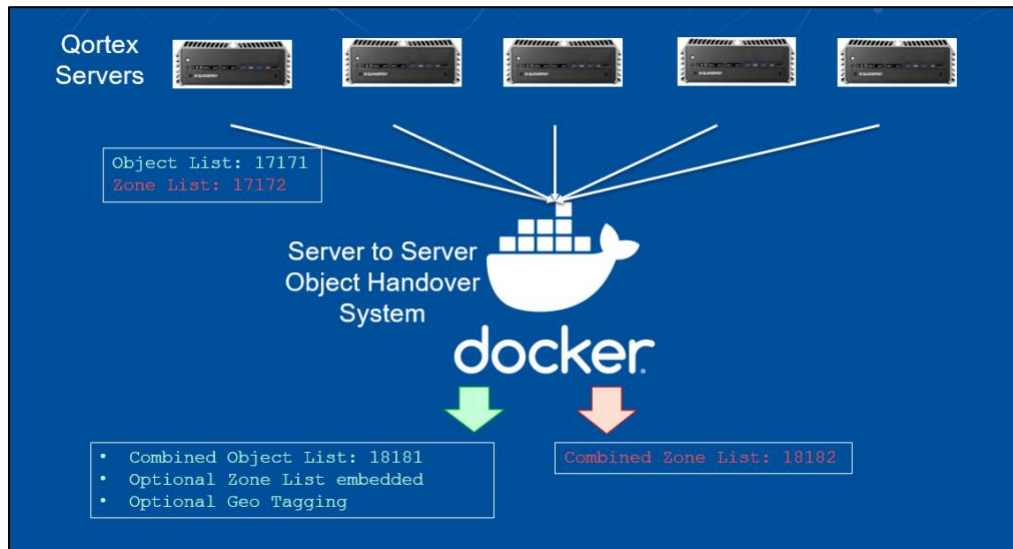


Figure 112. Automated Handover ID System Architecture

System Design

This application is designed for the following required minimum configuration:

- Multiple servers, with at least one sensor per server.
- At least one overlap area is between the servers.
- Sensors must be calibrated.

For an example with two servers, and each server has four sensors, see [Figure 113. Automated Handover ID System Design and Configuration](#). The servers have an overlap area (the exchange rectangle, shown in **orange**).

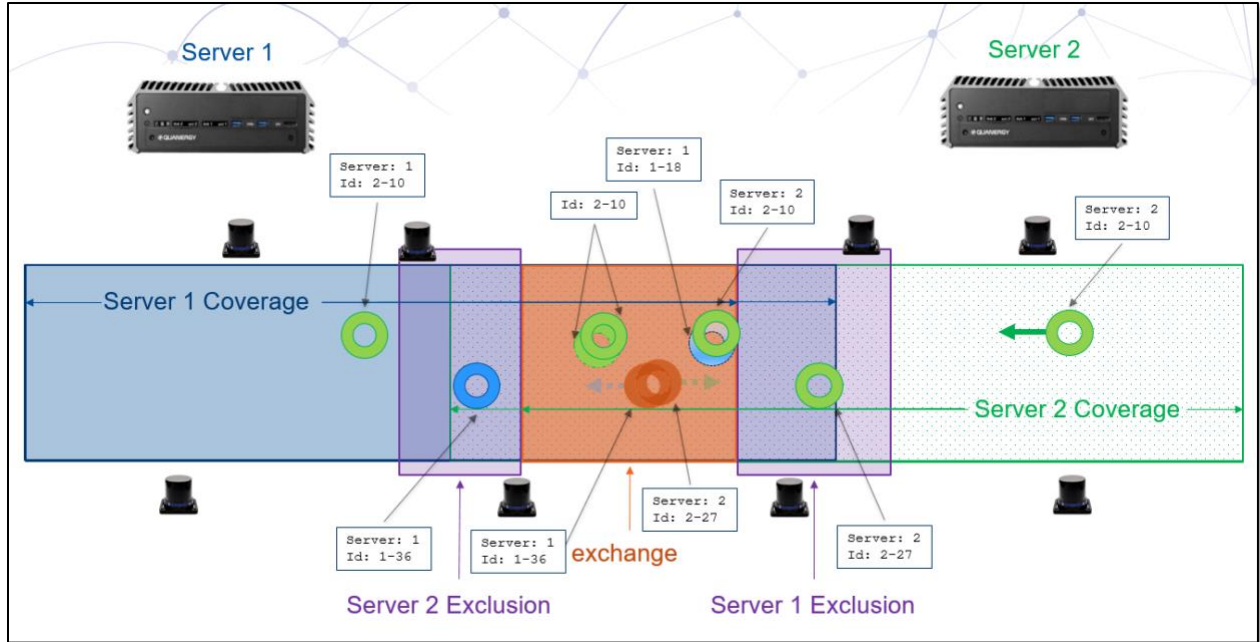


Figure 113. Automated Handover ID System Design and Configuration

Calibration

Prepare all the sensors that will be involved in the Automated Handover ID application and set up their location as follows. Refer to the *Q-View User Guide*, which is available at <https://downloads.quanergyworks.com/>.

1. In Q-View configure the sensors.
 - a. Connect all the sensors in Q-View to a single server. See *Using the Dashboard Tab* in the *Q-View User Guide*.
 - b. Calibrate all of the sensors in that group together. See *Using the Calibrate Tab* in the *Q-View User Guide*. This process creates the file:
 - `transform_alignment.xml` file, which is used by QORTEX DTC.

2. In QORTEX DTC client set up a multi-sensor location. Select **Configuration** panel > **Sensor** tab > **Multiple**.

See *Add or Update Multiple Sensors at a Location* (page 90).

- a. Connect to the first QORTEX DTC server. Select the `transform.alignment` file. Select a single sensor and create a location.
- b. Connect the second QORTEX DTC server. Select the same `transform.alignment` file. Select a different single sensor and create a location.

Configuration

In the `config.yaml` file of settings parameters that was provided with this application, fill in the server information with values for your setup. Explanations and example values are listed below. Other settings values can be customized by the user.

Note: The concept of primary sensor, which is used in this procedure for what QORTEX DTC 2.4 calls World Origin. The term refers to the centerpoint of the geolocation.

```
qortex_server_list:
  10.1.52.209:
    server_name: server1
    server_type: qortex
    port_list:
      track_port_2x: 17161
      zone_port: 17172
      state_port_2x: 17168
      line_port_2x: 17163
  10.1.52.126:
    Server_name: server2
    server_type: qortex
    port_list:
      track_port_2x: 17161
      zone_port: 17172
      state_port_2x: 17168
      line_port_2x: 17163

# Object Handover Details, active is always 1 for now. Please list the name(s) of
the exchange zone(s) .
# Just one name per overlap as the zone names are identical for the same overlap
area in different servers.
object_handover:
  active: 1
  exchange_zones:
    - exchange_zone

#Qortex encryption block. Be sure that the username and password is the same across
all qortex servers
authentication:
  secure_mode: 0
  username: user00
  password: Letmein433!
  uuid: 3debc6c9-08cc-7a02-9af0-1a082c39f4d2
  primary_server: '10.1.52.209'
```



```

#Port versioning. Set for respective types
port_version:
  ol_ver: 1
  zl_ver: 0
  sl_ver: 1
  ll_ver: 1

# Broadcaster details. Please leave the ports as is. Changing the ports will also
require a change in Docker run command.
# add_geo is 1 for adding geo location information in the object list
# add_zones is 1 for embedded zone list in the object list.
# broadcast_frequency is in Hz you want to receive the data output.
broadcaster:
  zl_port: 18182
  sl_port: 18168
  ll_port: 18163
  add_geo: 0
  add_zones: 0
  send_packet_size: 0
  message_format: json
  broadcast_frequency: 10
  nd_json: 0
  IPv6: 0

```

Figure 114. Sample Automated Handover ID config.yaml File

Broadcaster Parameter

These parameters relate to the format of the messages that are broadcast by the application.

- **Track list port** (ol_port): Port on which the track list is published.
- **Zone list port** (zl_port): Port on which the zone list is published.
- **State list port** (sl_port): Port on which state list is published.
- **Line list port** (ll_port): Port on which line list is published.
- **Add geolocation** (add_geo): 0-Disable, 1-Enable
When enabled, geo location details become part of the object data.
- **Add zones** (add_zones): 0-Disable, 1-Enable
When enabled, zones data is embedded in the object data.
- **Send packet size** (send_packet_size): 0-Disable, 1-Enable
When enabled, packet size is included in the message.
- **Broadcast frequency** (broadcast_frequency): Values (1-10) Hz

This is the object and zone list broadcasting frequency. It can be set from a low value to a high value that is equivalent to the highest data output frequency set in any one of the connected servers. Recommended value is same as QORTEX DTC frequency or lower.

- **nd_json**: When enabled switches broadcast format to NDJSON
- **ipv6**: When enabled, allows broadcasting on IPv6 system

```
broadcaster:  
  ol_port: 18181  
  zl_port: 18182  
  add_geo: 0  
  add_zones: 0  
  send_packet_size: 0  
  broadcast_frequency: 10
```

Exchange_zones Parameter

List the name(s) of the exchange zone(s). For best performance, all the servers should have an overlapping area, and an Event zone should be created in the overlap area to be used by the application as an exchange zone. In the example below, the exchange zone is named `exchange_zone`.

Copy the details of this exchange zone into the `settings.xml` file in use by the other QORTEX DTC servers to ensure that the exchange zones are identical for every server.

Any other overlapping area between the two servers outside of the exchange zone should be masked by Exclusion zones in at least one of the servers.

```
exchange_zones:  
  - exchange_zone
```

Primary_sensor geolocation Parameter

Use any accurate GPS device to discover and provide the primary sensor latitude, longitude, and heading. The heading value, in degrees, is the direction of the X-axis of the system as determined by the GPS or a compass. (This center point geolocation data provides accuracy for the objects, but it is only used if the `add_geo` parameter is enabled in the broadcaster section below. If the `add_geo` parameter is disabled, then this geolocation data is not added to the object list.)

```
primary_sensor:  
  lat: 37.767057  
  long: -122.389331  
  heading: 175
```

Object_handover Parameter

The `object_handover` active parameter is used to enable or disable the object handover functionality.

active: 0-Disable, 1-Enable

```
object_handover:  
  active: 1
```

Port Versioning Parameter

For AIDH 2.3 and above, all ports support port lists.

Note: QORTEX DTC defaults to line lists.

Example:

Use QORTEX DTC object trackables list

```
port_version:  
  ol_ver: 1  
  zl_ver: 0  
  sl_ver: 1  
  ll_ver: 1
```

Server_list Parameter

Provide the QORTEX DTC server IP addresses. Any server in the setup can be the primary server. QORTEX DTC supports both IPv4 and IPv6 IP addresses. Support for server aliases or server names is also included.

- **server_name:** Server Name allows for server aliases
- **server_type:** Server type options are: qortex, mock
- **port_list:** Port list sets the port for each type of QORTEX DTC list. Can be configurable.

```
qortex_server_list:  
  10.1.52.209:  
    server_name: server1  
    server_type: qortex  
    port_list:  
      track_port_2x: 17161  
      zone_port: 17172  
      state_port_2x: 17168  
      line_port_2x: 17163  
  10.1.52.126:  
    server_name: server2  
    server_type: qortex  
    port_list:  
      track_port_2x: 17161  
      zone_port: 17172  
      state_port_2x: 17168
```

```
line_port_2x: 17163
```

Deployment

Run the Automated Handover ID in a Docker container as follows:

1. Download the AIDH docker image, `aidh_2.3.1.tar.gz`, and the configuration file, `config.yaml`, to the host.
2. Load the docker image on the host.

```
$ docker load < aidh_2.3.1.tar.gz
```

3. Verify the docker image is deployed to the host.

```
$ docker images
```

Scan the return to see that `aidh` with tag `2.3.1` is part of the `docker images` command.

4. Update the `config.yaml` file with:
 - QORTEX DTC server information.
 - Set the `primary_server` under authentication to the host IP of the primary QORTEX DTC server.
5. Run the `memcached` docker container. The Memcached container is a prerequisite to running the AIDH container.

When you run the command for the first time, the Memcached image is pulled from the Docker hub.

```
$ docker run --net=host -dit --name memcached bitnami/memcached:latest
```

6. Verify Memcached container is running.

```
$ docker ps -a
```

7. Run the AIDH container from the docker image.

Make sure to provide the complete path for the `config.yaml` file on the host.

```
$ docker run --restart-always --net=host -v  
<path_to_config.yaml_file>:/opt/quanergy/aidh/config/config.yaml  
-dit --name aidh aidh:2.3.1
```

For example, if `config.yaml` is located at `/home/user/aidh/`.

```
$ docker run --restart-always --net=host -v  
/home/user/aidh/config.yaml:/opt/quanergy/aidh/config/config.yaml  
-dit --name aidh aidh:2.3.1
```

8. Verify docker container `aidh` is running.

```
$ docker ps -a
```

9. Verify the object data output.

```
$ netcat 127.0.0.1 18181
```

Common AIDH Docker Commands

View the AIDH logs.

```
$ docker logs aidh
```

Stop and remove the AIDH container.

```
$ docker rm -f aidh
```

Remove the AIDH docker image.

Stop and remove the AIDH container first.

```
$ docker rmi -f aidh:2.x.x
```

Stop and remove the Memcached container.

```
$ docker rm -f memcached.
```

Apply changes to `config.yaml`.

These commands start the AIDH container with the new configuration.

```
$ docker rm -f aidh
$ docker run --restart=always --net=host -v
<path_to_config.yaml_file>:/opt/quanergy/aidh/config/config.yaml
-dit --name aidh aidh:2.3.1
```

Stop Memcached service running on the host.

```
$sudo systemctl stop memcached.service
```

Working with Secure Mode Functionalities

Note: Currently the Security mode feature only supports multiple servers under one set of credentials.

The encryption feature is not available for version 2.1 of either AIDH or QORTEX DTC.

AIDH Security Mode Requirements

To use the Security mode (encryption) requires:

- Both the QORTEX DTC server 2.3 or later and AIDH 2.3 or later.

- Both QORTEX DTC server and AIDH must have **Secure** mode enabled. See [Turn Security Mode On or Off](#) (page 64) and [Secure TCP Port Data](#) (page 96).

Use Security mode features of QORTEX DTC

In Automated ID Handover, complete the following.

1. Add the following authentication section at the bottom of the existing `config.yaml` file.

The authentication, username and password vary based on user, but `uuid` is always the same.

```
authentication:
secure_mode: 0
username: user00
password: Letmein433!
uuid: 3debc6c9-08cc-7a02-9af0-1a082c39f4d2
primary_server: '10.1.52.209'
```

2. Apply the `config.yaml` changes to the AIDH container.

These commands start the AIDH container with the new configuration.

```
$ docker rm -f aidh
$ docker run --restart=always --net=host -v
<path_to_config.yaml_file>:/opt/quanergy/aidh/config/config.yaml
-dit --name aidh aidh:2.3.1
```

3. If **Security** mode is properly enabled, the QORTEX DTC **Sign-In** pop-up appears. Enter the credentials listed in the `config.yaml` file.

In Qortex DTC, complete the following.

1. Ensure the admin credentials are identical across all QORTEX DTC servers. This is required for AIDH support.
2. Set QORTEX DTC to **Security** mode.
 - If using API, set QORTEX DTC `secure_mode` to 1.
 - If using QORTEX DTC client, **Security** mode in **enabled**.
3. Ensure **Secure TCP Ports** is enabled.

When using the encryption feature, AIDH 2.3 gets the encryption key from port 8080 of the QORTEX DTC server, as listed in the Automated ID Handover (AIDH) configuration file, `config.yaml`.

- a. Select the **Configuration** panel > **Server** tab > **Security** tab > **Enabled** toggle.

This toggle switches between secure/unsecure modes.

- b. Select the **Configuration** panel > **Server** tab > **Security** tab > **Global Settings** panel > **Secure TCP Ports** toggle.

This toggle ensures data transmits through secure TCP ports.



Figure 129. Security mode and Secure TCP Ports Toggles

4. Ensure Qortex DTC is broadcasting encrypted data.
5. For decrypting data, ping the HTTPS server using the QORTEX DTC primary server IP address and acquire the `qtoken` for use with the `decryption` command.

```

quanergy@QPU309:~/Documents/Authentication$ nc 127.0.0.1 17171
{
  "header": {
    "timestamp": "1627408606771",
    "frameId": "quanergy",
    "sequence": 652905
  },
  "object": [
    {
      "id": "3946062",
      "timestamp": "1627408606771",
      "position": {
        "x": -0.854608238,
        "y": 1.05341458,
        "z": -0.369616777
      },
      "size": {

```

Figure 115. Sample of Unsecure Mode track_list

```

*****UeZeeh3a$Y ]*TN[[]]i+++sp"l[]j[]ue[][]h[<{+++!~e_+++>+0}f+++>[]]l
quanergy@QPU309:~/Documents/Authentication$ nc 127.0.0.1 17171
[+]9eS@F@eeYecot++++[]+++M`3 n9+++++=e[]XreeG@[]+++S@Vee\o?oSre}}f+++|
HE/[]+;+o[]n@Z[][]f+.eie++XB+S+++T3e[]EM:"e+z@Y@leaa[]n@[]e+?ed[]eV5@P@h[]@++++
k++++exen#[]p@ev[]o+++++z`PtQ@[]L@Ee+6?+u
e[]+5 j /;+[]+/@A(<e[]+[]eDuBe[]eaa++++{e[]+ 2#:-re>[]i+++3e+S@A|eUg+++
[]+O++~eXV@[]e+T+++e[]]e+++[] ec[]+[]e+;"RAs&++++[]e+^+++le++<B
e>e+?e+""eWS7w[]+eB@He|M@gY[]@[]+e4+++++>e]>+++qhe+nZ6LH@j+++J@)Jt[]+[]e++w[]+++7e+B

```

Figure 116. Sample of Secure Mode track_list



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