Dedrone

Declaration Of Conformity
According to ETSI

Manufacturer / Supplier's Name:	Dedrone GmbH
Manufacturer / Supplier's Address:	Miramstraße 87, 34123 Kassel, Germany
Product Name / Model:	DroneTracker RF Sensor / RF-100

The product herewith complies with the following relevant Union harmonisation legislations:

- Radio Equiment Directive 2014/53/EU (RED)
- Low Voltage Directive 2014/35/EU
- Restriction of certain Hazardous Substances Directive 2011/65/EU (RoHs)

Conformity to the essential requirments of the legislations have been demonstrated by using the following standards:

- Spectrum
  - EN 300 440 V2.1.1 (2017-01)
    spuriusous emmissions
- EMC and ERM
  - EN 301489-3 V1.6.1
- Health and Safety
  - EN60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013
- RoHs
  - EN50581:2012

The product bears the CE marking **CE** accordingly.

Additional Information:

This product has been assigned to a Regulatory Model Number which is pursuant to the regulatory aspects of the design. The Regulatory Model Number is the main product identifier in the regulatory documentation and test reports, this number should not be mistaken with the marketing name or product numbers.

For further questions please contact the undersigned.

Kassel, November 26, 2018

Name/ Title: Dr. Ingo Seebach
(CEO)

Dedrone

Name / Title:

Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

Fon +49(0)561 861799-00
Fax +49(0)561 861799-11
E-Mail info@dedrone.com
www.dedrone.com

Change History

Version	Date	Change
1.0	01/31/2017	-
2.0	11/26/2018	Updated standard **EN 300 440-2 V1.4.1** to **EN 300 440 V2.1.1 (2017-01)**

Release Notes 4.1

This document describes all relevant changes in Dedrone's DroneTracker version 4.1.

User interface:

- Enhanced home screen user experience
    - Added quick action buttons to show or hide sitemap elements e.g. sensors, bearings or target path.
    - Rearranged view options for an easy to use and clear interface.
    - Added brightness option for the map.
- Added classification of targets as friend, foe or ignored
    - Display classified targets in different colors on site map
    - Manually classified detections are labeled with the according alert type in the alert list
    - Classified alerts can be filtered in the alert list and reporting.
- Added picture in picture to video live views showing a closeup image of the target. You can switch between closeup and overall view for the live view window.
- Improved drone path accuracy and smoothness on the map during the alert and in the alert recording.
- Improved alert screen
    - The selected target is now highlighted with a rectangle around the different target icons on the map.
    - Only selected target shows its tooltip and target details.
    - The distance line to the point of interest is only displayed for the selected target.

  - Increased target size on the map.
  - Changed pilot-marker color.

- Improved Site Configuration
  - Sensor list replaces sensor tree. The list is clear structured and all relevant sensor information can be perceived quickly and easily.
  - Sensor details dialog is structured tab based.
  - Removed Save-button from the option Site Configurating. All changes are saved immediately.

- Added all new PTZ dashboard as an external live view
  - All integrated PTZ cameras are listed in the dashboard and you can switch between the live views directly.
  - Control the PTZ cameras in the big live screen by moving the camera using the displayed PTZ controls, clicking directly in the picture or using a connected joystick.
  - Displays all target details like ID, location, speed.
  - Classify target directly in the PTZ dashboard (see “Classify target as friend foe or ignored” above).
  - See a closeup view of the detection
  - Save thumbnails of detections into the alert. The thumbnails can be viewed in the alert recording.
  - Added button "Track" which allows to force-track a drone in the center area of the image.
  - If a dual PTZ camera with thermal and HD view is connected, you can switch between the different live streams.

- Enhanced Alert recording
    - Added heatmap overlay to alert recording
    - Added playback speed option to alert recording replay
    - Saved thumbnails from video or PTZ sensors are shown in the identification details.
    - Added display option to the alert timeline - switch between the alert duration and real time and date of the alert.
- Enhanced heatmap algorithm for a more accurate heatmap.
- Consolidated RF and Wi-Fi live views
    - RF and Wi-Fi detections are displayed in the same live view.
    - Detections are displayed in a list with all relevant information.
    - Added option to freeze the current RF sensor live view.
    - Added expert mode for additional information.
- Added date and time selection for scheduled reports.
- Extend search options
    - Added more search terms, e.g. search for alerts with bearings or alerts with locations.
    - Add serial number and UUID to full text search.
- Alert export
    - Separated RSSI statistics of drones and remotes.
    - Alerts in Excel and CSV exports are ordered to newest first.
- Added PTZ joystick control via joysticks connected to the browser.
- Implement muting option for audio notification (alert siren sound)

- Scanning duration is shown in the RF sensor details.
- Updated integrated online help.
- Email addresses in the notifications are case insensitive.
- General minor fixes.

Core platform components:

- Remote and drone detections are split into distinct alerts. This allows a quick and easy subsequent assessment of the alarm situation.
- New feature “Sensor configuration profiles”
    - Sensor configuration can be easily uploaded as configuration profile to the DroneTracker and assigned to a sensor in the sensor details dialog.
    - Dedrone provides a set of configuration profiles. With these profiles, different sensors can be adapted to specific and difficult environments or to special customer needs.
    - Configuration profiles are managed in a centralized menu.
    - Current assigned sensor configuration profiles are displayed in the Site Configuration.
    - As an administrator you can create your own configurations profiles by combining existing profiles.
- Improved track merging for multiple video sensors.
- Improved handling of tracks at different heights.
- Improved reliability of drone positions.
- DroneTracker backup and restore now effects all relevant data of the system.
- Muted PTZ cameras will not be involved in any alerts anymore.

- PushAPI
    - Added status channel containing current sensor status, sensor coordinates and sensor orientation.
    - Removed debug bearings (displayOnlyCones) from PushAPI.
- General stability improvements and minor bug fixes.

RF Sensor:

- Improved drone and remote localization with LTE operated sensors.
- Improve robustness against failures on the internal hard drive and notify customer in case of hard drive failures.
- Improved detection time due to adding more RF sensors.
- Improved directional finding and scanning algorithms.
- Optimized directional finding configuration.
- Improved Parrot drone's localization.
- General stability improvements.

Video:

- PTZ
    - Implemented dynamic searching strategy.
    - Improved PTZ search for targets at large distances.
    - Refined control of PTZ cameras.
    - Improved pan and tilt algorithm.
- Integrated tracking on thermal video streams.
- Stability improvements.

3rd party integration:

- New PTZ cameras:
    - Ascent Vision CM202U PTZ
    - Axis Q6215-LE PTZ camera
    - FLIR HDC Ranger 1200 PTZ camera
- New 3D radar systems:
    - FLIR Ranger R8SS-3D including track classification.
    - Updated Echodyne integration to their new firmware including track classification.

Radar:

- Radar are generating unverified targets in the DroneTracker software. Those are not treated as alerts until they get verified in one of the following ways:
    - Verified by other sensors (e.g. PTZ camera or RF sensor).
    - Manually raised to an alert by an operator (mark as Foe).
    - Get promoted to a drone detection by a radars built-in classificator.
- Verified tracks will be saved and recorded in total and treated as normal alerts.

General Information:

- Consolidated the Wi-Fi and RF sensor to one RF device. The sensor information for the single sensors are displayed in the sensor details of the RF device.

Data Sheet RF-100

The RF-100 is a passive, network-attached sensor for the detection of radio frequencies (RF) and Wi-Fi signals. It supplements the DroneTracker System with another level of detection. The RF sensor detects targeted radio signals and sends the data, along with an alert, to the DroneTracker System.

Features

Range	0.65 mi (1.0 km) in ideal conditions up to 1.3 mi (2 km)
Device Type	sensor
Radio Frequency	omnidirectional passive detection and classification
L x W x H	7.7” x 3.7” x 17.3” (195 mm x 95 mm x 440 mm) height without antenna: 9.8” (250 mm)
Weight	6.8 lb (3.1 kg)
Ingress Protection Rating	IP65
Operating Temperature	-4 °F to +122 °F (-20 °C to +50 °C)
Power Supply	active PoE+ (IEEE802.3at)
Power Consumption	15 W (typ.)
Connectivity	via LAN in existing IT infrastructure
Software Configuration	via DroneTracker User Interface
Operation	via DroneTracker User Interface
Software Updates	firmware and DroneDNA updates via cloud-based database connection
Alarm Notifications	via DroneTracker User Interface

Dedrone

INSTALLATIONS

Manual

RF-100

Legal Provisions

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The declaration of conformity is available on request at support@dedrone.com.

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Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

Fon +49 561 861799-0
Fax +49 561 861799-111
Email info@dedrone.com

Dedrone Holding, Inc.
220 Sansome Street
San Francisco, CA 94104
USA

Fon +1 4145 913-6116
Email info@dedrone.com

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1 Safety

1.1 Symbols

Symbol	Explanation
NOTICE	Indicates a situation which, if not avoided, can result in property damage
	Information that is important for a specific goal, but is not safety-relevant
	Indicates a requirement for meeting a specific goal
	Desired result
	A problem that might occur
	Action to resolve a problem

1.2 Intended Use

The RF-100 is a passive, network-attached sensor for the detection of radio frequencies (RF). It supplements the DroneTracker System with another level of detection. The RF-100 detects targeted radio signals of different drones and remote controllers and sends the data, along with an alert, to the DroneTracker System.

The RF-100 is intended for civil commercial and private use in conjunction with a DroneTracker System.

The RF-100 is suitable for outdoor use.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable legal standards and directives. Any other application may cause personal injury or property damage.
Any use of the product other than that described in the intended use section does not qualify as appropriate. The enclosed documentation is an integral part of this product. Keep the documentation in a convenient place for future reference and observe all instructions contained therein.
The type label must remain permanently attached to the product.

Compliance Information Statement FCC and IC
The RF-Sensor RF-100 complies with Industry Canada license-exempt RSS standard(s) and complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protecti-

on against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications: Any modifications made to this device that are not approved by Dedrone GmbH may void the authority granted to the user by the FCC to operate this equipment.

Caution!
To prevent permanent exposure, the device should be installed and operated with a minimum distance of 20 cm (7.87 in) between the device and your body.

1.3 Safety Information

Read, follow and retain all of the following safety instructions. Heed all warnings on the unit and in the operating instructions before operation.

Warning! Setup should be carried out by trained personnel only, in accordance with the national electric code, ANSI/NSPA, and all local country codes.

Do not attempt to service this device yourself. Refer all servicing to qualified service personnel. This device has no user-serviceable internal parts.
Whenever any damage to the device has occurred, unplug the devices from the power source by disconnecting the patch cable and refer servicing to qualified service personnel. Such damages can be:

- the patch cable is damaged
- an object has fallen on the device
- the device has been dropped, or its enclosure has been damaged
- the device does not operate normally when the user follows the operating instructions correctly

Adjust only those controls specified in the operating instructions. Improper adjustment of other controls may cause damage to the unit.

Despite careful construction, electrical devices can cause fires. Do not mount the RF-100 in areas containing highly flammable materials or gases. Do not mount the RF-100 in a potentially explosive atmosphere.

Do not install product near any heat sources such as radiators, heaters, exhaust air systems or other equipment (including amplifiers) that produce heat.

2 The RF-100

The RF-100 is a passive, network-attached sensor for the detection of radio frequencies (RF). The RF-100 detects targeted radio signals of different drones and remote controllers and sends the data, along with an alert, to the DroneTracker System.

Parts of the RF-100

A	Activation button	D	RF pole mount
B	RF-100	E	Network socket (covered)
C	Antenna		

It scans a wide frequency band for radio frequencies and classifies them. The data is recorded and available on the DroneTracker user interface.

3 Unpacking

This equipment should be unpacked and handled with care. Check the exterior of the packaging for visible damage. If an item appears to have been damaged in shipment, notify the shipper immediately.

4 Scope of Delivery

Verify that all the parts listed in the scope of delivery are included. If any items are missing, notify your Dedrone Partner.

Do not use this product if any component appears to be damaged. Please contact Dedrone in the event of damaged goods.

- **1 x** RF-100
- **4 x** Antenna (2x short, 2x long)
- **1 x** RF pole mount (preassembled)
- **2 x** Knurled head screw with sealing washer (preassembled)
- **2 x** Knurled nut (preassembled)
- **2 x** Strap
- **1 x** Bag with 1x environmentally sealed Ethernet crimp connector, 1x RJ45 plug
- **1 x** Installation manual
- **1 x** Safety information (only US and Canada)
- **1 x** Product registration document (this information is only needed for a cloud based sensor operation and is provided by an enclosed document or online by the Dedrone Service)

The original packing carton is the safest container in which to transport the unit and must be used if returning the unit for service. Save it for possible future use.

5 Installation

5.1 Select the Mounting Place

5.1.1 Mounting Location

The position of the RF-100 has strong impact to the detection range. The RF-100 is designed for a pole mounting. Make sure that a suitable pole is available (diameter between 1.6 in to 3.5 in (40 mm to 90 mm)).

For ideal results the location should fulfill the following conditions:

- ☐ **Clear view over the area**
- ☐ **elevated position: 10 ft (3 m) minimum, 33 ft (10 m) recommended**

Select a secure installation location and mounting position for the RF-100. Ideally, this is a location where the device cannot be interfered with, either intentionally or accidentally.

Do not install the device near the following objects:

- Walls because these shades the detection area and prevent classification of signals behind the wall
- Any excessive heat sources
- Any overhead power lines, power circuits, high-voltage lines or electrical lights, or where there is a chance of electrical discharge
- Behind metal surfaces or vaporized glass because this could reduce the detection range

Note the properties of each RF-100. This is needed for the correct configuration and for service.

We recommend the table below. The following information is important:

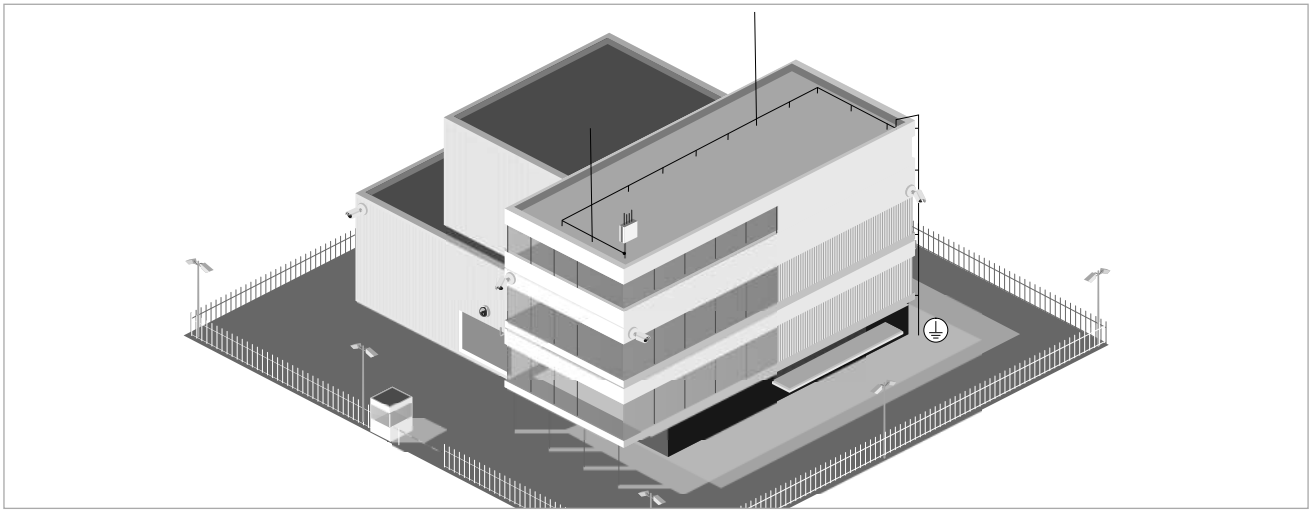
- Serial Number (see product plate)
- GPS-position in degree (longitude and latitude)

Serial number (see prouct plate)	**GPS position** (in degree, e.g. 52.516295, 13.377653)
	longitude: latitude:
	longitude: latitude:

Overvoltage Protection

For safe mounting in an exposed position overvoltage protection must be observed.

Ensure that the pole is connected to the lightning conductor of the building. The RF-100 itself must not be grounded directly. The lightning conductor must be installed at least 5 ft (1.5 m) above the RF-100.



Lightning Protection Installation with RF-100s

Ensure that the location has the appropriate clearance from power and lightning conductors, in accordance with NEC725 and NEC800 (CEC Rule 16-224 and CEC Section 60).

5.1.2 Mounting Surface

Make sure the selected mounting surface is capable of supporting the combined weight of the RF-100 (8 lb (3.6 kg)) and pole under all expected conditions of load, vibration, and temperature.

5.1.3 Mounting Orientation

The orientation of the device itself does not have any effect for the performance. Important for a good result is the orientation of the antenna. Both **antennas** must orientated **skywards**.

5.2 Power Supply and Required Tools

Power Supply

The RF-100 does not need any additional power supply connection. The power supply is provided by the connected switch with activated active PoE+ (802.3at).

- ☐ Make sure, that your network has activated **active PoE+ (802.3at**).

Note: Data transfer is only possible with a suitable PoE switch.

Required Tools

- ☐ Socket wrench: 7 mm ($^{9}/_{32}$")
- ☐ Crimping tool
  For an environmentally sealed connection to the RF-100, it's necessary to crimp the supplied connector to the laid patch cable (see Cable Preparation, page 10).
- ☐ Ladder or lift truck, depending on the mounting location
- ☐ **Recommendation:** GPS device

5.3 Cable Requirements and Preparation (Crimp)

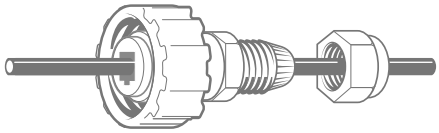
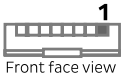
Cable Requirements

Type	Cat-6 Patch Cable Recommendation: Cat-7 Patch Cable
Maximum Length	328 ft (100 m) For longer distances a PoE extender is required
External Diameter	3.5 mm – 7.5 mm

Cable Preparation

For a weather resistant connection to the RF-100, it is necessary to crimp the supplied environmentally sealed Ethernet connector to the patch cable.

Procdure:

1	Cut the RJ45 plug off the laid cable. Keep the cut off plug, to check the wiring standard later.
2	Screw the gland off the connector body.
3	Thread the gland nut and the connector body onto the cable. 
4	Remove the cable jacket carefully. Therefore, take care not to damage the braid and foil.
5	Fold back the braid and foil over the cable jacket. Note: 25 mm (1”) of free conductors are needed.
6	Unravel the conductors, sort the conductors in the required wiring standard (568-A or 568-B), and push the conductors all the way in the plug. The required wiring standard can be checked on the previous cut-off RJ45 plug.  Front face view
7	Crimp the RJ45 plug with the crimping tool.
8	Push down the latching clip of the plug and press the connector body all the way to the stop over the RJ45 plug.
9	Put the gland nut over the connector body and screw down the gland nut on the connector body.

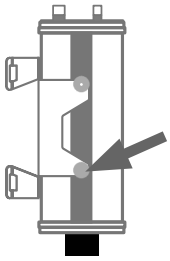
Position	568-A	568-B
1	White/Green	White/Orange
2	Green	Orange
3	White/Orange	White/Green
4	Blue	Blue
5	White/Blue	White/Blue
6	Orange	Green
7	White/Brown	White/Brown
8	Brown	Brown

5.4 Install the sensor

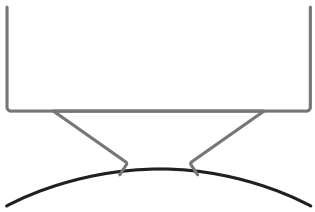
Requirements:

- ☐ Desired mounting place fulfills the requirements (see 5.1 Select the Mounting Place, page 7)
- ☐ Diameter of the pole: between 1.6 in to 3.5 in (40 mm to 90 mm)

Procdure:

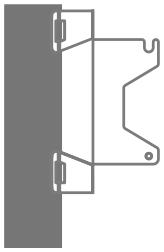
1	Loosen the knurled head screws with the sealing washers on both sides of the RF-100 and unhook the RF-100 from the RF pole mount. 

2 Run the straps through the slashes of the RF pole mount.

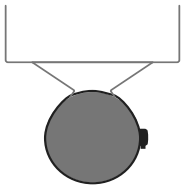


3 Mount the the Pole Mount to the pole:

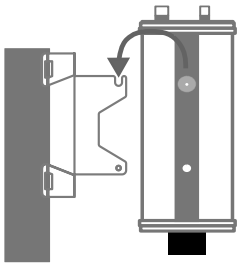
- Hold the RF pole mount at the desired height of the pole.



- Lay the straps around the pole.
- Put the strap in the slash under the screw and tighten it with the socket wrench 7 mm ($^{9}/_{32}$") appropriately.

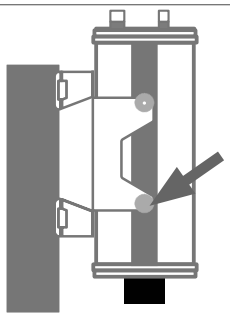


4 Hook the RF-100 in the screw guidance of the RF pole mount.

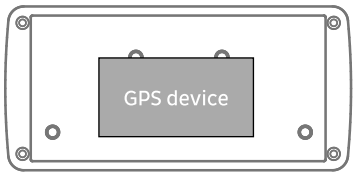


5 Screw down the 2 knurled head screws with the sealing washers at both sides in the lower holes.

- Make sure that the soft side of the sealing washer is faced to the RF pole mount.
- Tighten the screws **carefully**. The RF pole mount **should not be bent**.

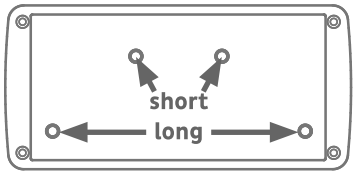


6 If a GPS device is available, place it on top of the RF-100 and note the longitude and latitude in the table (see 5.1.1 Mounting Location, page 7).



7 Screw the antennas on the screw threads at the top of the RF-100.

Therefore, note the correct positioning of the short and long antenna.



8 Adjust the antenna of the RF-100 **skywards**.

9 Make sure that the pole is grounded (see Overvoltage Protection, page 8).

10	Connect the patch cable to the RF-100 and turn the connector gland until it is locked (for a correct cable preparation see 5.3 Cable Requirements and Preparation (Crimp), page 9). ✔ If the patch cable is connected to the network, the RF-100 boots automatically and after approximately 1 second the activation button at the RF-100 illuminates, indicating that the hardware is ready. ✖ The patch cable is connected to the network and the RF-100 does not boot automatically after approximately 1 second? 🔧 Push the blue button and wait for it to illuminate. 🔧 Make sure that **active PoE+ (802.3at)** is activated in your network.

6 Integrate the RF-100 in your DroneTracker

The integration procedure of the RF-100 in your DroneTracker depends on the system type:

- On premises installations use your local DroneTracker Server (see 6.1 Integrate the RF-100 in your on premises DroneTracker Server, page 12).
- Dedrone Cloud installations do not require any additional infrastructure and are connected to the Dedrone Cloud (see 6.2 Integrate the RF-100 via Dedrone Cloud, page 13).

6.1 Integrate the RF-100 in your on premises DroneTracker Server

To connect to the RF-100 DHCP-Services are required that automatically assign an IP address to the RF-100. If the RF-100 and the DroneTracker Server are in the same Layer2 network they can be connected directly. If the RF-100 and the DroneTracker Server are in different networks refer to the Dedrone Planning Manual or consult your network administrator.

Requirements:

- ☐ RF-100 is installed.
- ☐ The power supply is working and the button at the RF-100 illuminates blue.
- ☐ RF-100 is connected to the network.
- ☐ The IP address of the DroneTracker Server is known.

Procedure:

1	Start your web-browser and enter the address of your DroneTracker Server. For an optimal use, Dedrone recommends Chrome or Firefox.
2	Log in the DroneTracker user interface as an administrator or configurator. The default login credentials are: User: **admin** Password: **dedrone** ✔ The DroneTracker user interface appears.
3	Choose **OPTIONS** > **Site Configuration**.

4	Choose [**Add**] > **Dedrone RF Sensor**. ✔ The window **Discovered Sensors** appears.
5	Select the desired RF-100 and choose [**OK**]. ✔ The RF-100 appears in the Site Explorer.
6	To sort the RF-100 in the Site Explorer, drag and drop the element to the desired position.
7	Choose [**Save changes**]. ✔ The window **Site Configuration** disappears.
8	Choose **OPTIONS** > **Map Editor**.
9	Choose **[Add]** > **Sensor**. Choose the desired RF-100 in the window **Select sensor**. Choose **[OK]**. ✔ The RF symbol appears on the map.
10	Move the RF symbol per drag and drop on the installation position on the map. If the sensor was installed and aligned with a GPS device enter the noted values in the fields **Longitude** and **Longitude**.
11	To lock the settings activate the option **Lock settings**.
12	Choose [**Save changes**]. ✔ The window **Map Editor** disappears.

For further information consult chapter “First Steps” of the integrated online help in the DroneTacker UI.

6.2 Integrate the RF-100 via Dedrone Cloud

Requirements:

- ☐ RF-100 is installed.
- ☐ The power supply is working and the button at the RF-100 illuminates blue.
- ☐ RF-100 is connected to the Dedrone Cloud.
- ☐ The address of your Dedrone Cloud access is known (provided by Dedrone).
- ☐ The registration key of the sensor is available (provided by Dedrone).

Procedure:

1	Start your web-browser and enter the address of your Dedrone Cloud. For an optimal use, Dedrone recommends Chrome or Firefox.
2	Log in the DroneTracker UI as an administrator or configurator.
3	Choose **OPTIONS** > **Site Configuration**.
4	Choose [**Add**] > **Register device.** ✔ The window **Register device** appears. 
5	Enter the registration key of your sensor and choose [**OK**]. ✔ The RF-100 appears in the Site Explorer.
6	To sort the RF-100 in the Site Explorer, drag and drop the element to the desired position.
7	Choose [**Save changes**]. ✔ The window **Site Configuration** disappears.
8	Choose **OPTIONS** > **Map Editor** and choose the RF-100.
9	Choose **[Add]** > **Sensor**. Choose the desired RF-100 in the window **Select sensor**. Choose **[OK]**. ✔ The RF symbol appears on the map.
10	Move the RF symbol per drag and drop on the installation position on the map. If the sensor was installed and aligned with a GPS device enter the noted values in the fields **Longitude** and **Longitude**.
11	To lock the settings, choose the option **Lock settings**.
12	Choose [**Save changes**]. ✔ The window **Map Editor** disappears.

For further information consult chapter “First Steps” of the integrated online help in the DroneTacker UI.

7 Cleaning

NOTICE **Wrong cleaner damages the housing**

The wrong cleaner can damage the housing or antenna of the RF-100. Never use glass cleaner or other solvent cleaner to clean the RF-100.

- Use solvent-free cleaner to clean the RF-100.

8 Decommissioning

8.1 Shut down the RF-100

NOTICE **RF-100 breaks**

By disconnecting the cable without shut down the RF-100, the RF-100 could break.

- Always shut down the RF-100 before disconnecting the cable.

You have the option to shut down the RF-100 via the DroneTracker user interface or directly on the sensor.

Shut down via DroneTracker user interface:

1	Log in to the DroneTracker UI.
2	Choose **OPTIONS** > **Site Configuration**.
3	Right-click on the desired RF-100.
4	Choose **System** > **Shutdown hardware.**

Shut down directly at the RF-100:

	Briefly press the activation button at the RF-100. ✔ The RF-100 shuts down and the blue light goes out.

8.2 Dismantling

Hot surface during operation

Depending on the evironment the surface of the RF-100 could get hot.

- Before dismantling the device wait 30 min after shut down the RF-100.

8.3 Disposal

Dispose the RF-100 at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to Dedrone GmbH with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("FOR DISPOSAL").

9 Technical Data

Range (line of sight)	0.65 mi (1.0 km) In ideal conditions up to 1.3 mi (2 km)
Radio Frequency	Omnidirectional passive detection and classification
L x W x H	7.7” x 3.7” x 17.3” (195 mm x 95 mm x 440 mm) height without antenna: 9.8” (250 mm)
Weight (including mounting)	8 lb (3.6 kg)
Ingress Protection Rating	IP65 *
Operating Temperature	-4 °F to +122 °F (-20 °C to +50 °C)
Power Supply	Active PoE+ (IEEE 802.3at)
Power Consumption	15 W (typ.)
Connectivity	Via LAN to existing IT infrastructure or via the Dedrone Cloud
Configuration, Operation, and Alarms	Via DroneTracker software (software version >= 3.1 and valid license)
Software Updates	Firmware and DroneDNA updates via cloud-based connection

* No ingress of dust; complete protection against contact (dust tight). Water projected by a nozzle (6.3 mm) against enclosure from any direction shall have no harmful effects.

AIRSPACE SECURITY SOLUTION

Dedrone

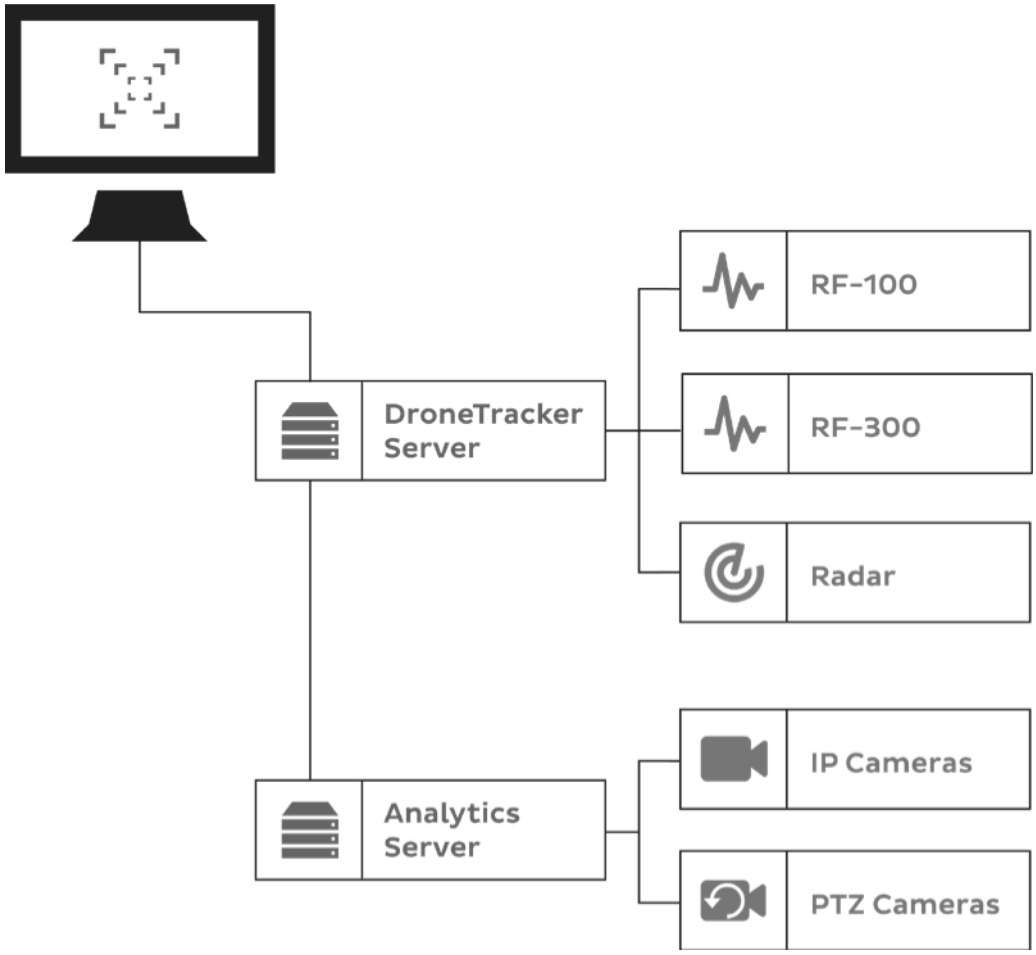
Dedrone Holding, Inc.
220 Sansome Street
San Francisco, CA 94104
USA

Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

+1 415 8136116
+49 561 8617990
info@dedrone.com
www.dedrone.com

Planning Manual

Deploying DroneTracker System 4.1 on premises



This document gives you a overview of what the requirements for the system are and which steps have to be done to setup the system on premises.

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1 List of Network Components

The following components are necessary to setup a DroneTracker System:

- Servers, see requirements here.
- Cables, see requirements here.
- Switches, see requirements here.

2 Server Requirements

An on premises DroneTracker System always needs a DroneTracker Server as a physical or virtual machine.

For a system **with** external IP cameras (static or PTZ), additional to the DroneTracker Server, one or more DroneTracker Analytics Servers are required. The number of Analytic Servers depends on the number and type of cameras and on the used graphic board.

DroneTracker Analytics Servers must be physical machines. The DroneTracker Server may also run on the same machine as the DroneTracker Analytics Servers.

2.1 DroneTracker Server minimum requirements

☐ Exclusive use of the server resources in this OS, physical or virtual machine

☐ 500 GB Hard Disc recommended, divided in System and Recordings:
  - **System**: 50 GB (required)
  - **Recordings**: depending on the number of sensors and system configuration; minimum 50 GB number of recordings severely limited, recommended 450 GB; additional storage for long term archiving

☐ Processor: Dual Core CPU (can be virtualized if exclusive)

☐ Working memory: 8 GB

☐ OS: Ubuntu 16.04 LTS – 64 bit

☐ Deactivated encryption of home directory

2.2 Analytics Server minimum requirements

- ☐ Cuda 10 compatible Nvidia graphics card with Nvidia Pascal microarchitecure or newer (preferably the most recent one like Volta or Turing).
- ☐ Each camera or PTZ may consume up to 1.2 GB of GPU memory on the Analytics Server. For example, a Nvidia RTX 2070 with 8192 MB of VRAM supports up to 6 PTZs and/or cameras.
- ☐ Physical machine, with exclusive use of the server resources in this OS
- ☐ Hard Disc: 500 GB SSD with good I/O, divided in System and Recordings:
  - **System**: 50 GB SSD (required)
  - **Recordings**: depending on the number of sensors and system configuration; minimum 50 GB number of recordings severely limited, recommended 450 GB; additional storage for long term archiving
- ☐ Processor: Intel Xeon E5 CPU with at least 12 Cores; 2,2Ghz and >25MB Cache
- ☐ Working memory: 64 GB
  We recommend distributing the 64 GB of RAM to all available channels, for example 4 x 16 GB multi-channel RAM is better than 1 x 64 GB RAM single-channel.
- ☐ OS: Ubuntu 16.04 LTS (Desktop) – 64 bit, installed **without** secure boot option.
- ☐ Kernel version: from v4.15.0
- ☐ Deactivated encryption of home directory

3 Network Requirements

3.1 General Network Connectivity

Sensors and server must be able to reach each other via a L3 IP Network: Firewall or other Security measures must allow communication between sensors and server. The sensors do not have to communicate directly with each other.

- ☐ IP addresses must be dynamically assigned via DHCP. If sensor and server are in different subnets, DHCP server must send configuration option with IP address of server to sensor (see “Configure Communication Between Server and Sensor”, page 9).
- ☐ The server-sensor-connection does not support NAT traversal.
- ☐ If a virtual machine is used, the network type must be “bridged”.

3.2 RF Sensor connectivity requirements

Ethernet connection with IEEE802.3**at** Power over Ethernet (30 W at PoE Power Sourcing Equipment (PSE) / 25,5 W at powered device). Some Power Sourcing PoE**+** Switches might need specific configuration to provide full power.

3.3 Distance

Maximum distance from Ethernet device to next PoE Power Sourcing Equipment (PSE) / PoE switch: **100 m (328 ft), max 70 m (230 ft) recommended.**

3.4 Overview ports

3.4.1 DroneTracker Server

Incoming

Protocol	Service	Function	Port
TCP	SSH	Dedrone Service access	22
TCP	HTTP / HTTPS	Web interface	Configurable Default HTTP: 8080 Default HTTPS:443
TCP	MQTT TLS	Sensor connection	8883
UDP	SNMP	SNMP notifications	Configurable Default: 161
Optional:			
TCP	APT Server	Half-offline update	3142
TCP	Websocket	Sensor connection (optional)	8090

Outgoing

Protocol	Service	Function	Address	Port
TCP	HTTP/HTTPS	Download of updates, communication with cloud	trackerapi.dedrone.com	HTTP: 8080 HTTPS: 443
TCP	HTTP/HTTPS	Check license	license.dedrone.com	HTTP: 8080 HTTPS: 443
TCP	Configurable	Notifications	configurable	configurable
TCP + UDP	DNS	DNS	via DHCP	53
UDP	NTP	Time sync	ntp.dedrone.com	123
UDP	SNMP (traps)	SNMP notifications	configurable	162
TCP	MQTT TLS	Sensor communication		8883
Optional:				
TCP	OpenVPN	Dedrone Service access	supportconnection.dedrone.com	1194

3.4.2 Analytics Server

Incoming

Protocol	Service	Function	Port
TCP	Discovery	Sensor discovery	Random Default: 8888
TCP	SSH	Dedrone Service access	22

Outgoing

Protocol	Service	Function	Address	Port
TCP	MQTT TLS	Sensor communication		8883
TCP	RTSP	Real time streaming protocol		configurable default: 554
Optional:				
TCP	OpenVPN	Dedrone Service access	supportconnection.dedrone.com	1194
TCP	Websocket	Fallback for server communication (software version ≤ 2.6.9)	given via discovery or DHCP option	8090
TCP	APT cacher	Half-offline updates		3142

3.4.3 RF Sensor

Incoming

Protocol	Service	Function	Port
TCP	Discovery	Sensor discovery	Random Default: 8888
TCP	SSH	Dedrone Service access	22

Outgoing

Protocol	Service	Function	Address	Port
TCP	MQTT TLS	Sensor communication		8883
TCP	Discovery	External sensor discovery	With ddmt file	8080, 443

Optional:				
TCP	OpenVPN	Dedrone Service access	supportconnection.dedrone.com	1194
TCP	Websocket	Fallback for server communication (software version ≤ 2.6.9)	given via discovery or DHCP option	8090
TCP	APT cacher	Half-offline updates		3142

3.4.4 IP camera and PTZ camera

Incoming

Protocol	Service	Function	Port
TCP	HTTP	Camera management user interface (vendor specific)	Configurable on camera Default: 80

Outgoing

Protocol	Service	Function	Port
TCP	RTSP	Real time streaming protocol	Configurable on camera Default: 554

4 Cable Requirements

Maximum Distance	100 m (328 ft) maximum distance from Ethernet device to next PoE Power Sourcing Equipment (PSE) / PoE switch, **Recommendation**: less than 70 m (230 ft) For longer distances a PoE extender is required
Cable-Type	Cat-6 Cable recommended (For Cat-5e max 50 m (165 ft) distance recommended)
External Cable Diameter	3.5 mm – 7.5 mm
Connector	For a weather resistant connection to the Sensors it is necessary to crimp the supplied environmentally sealed Ethernet connector to the patch cable.

5 PTZ Camera Requirements

☐ The following PTZ cameras are recommended for the DroneTracker System:

- **Axis Q6215-LE**
  - Drone detection range: up to 0.6 mi (1 km)
  - Night view due integrated IR LED up to 1,300 ft (400 m)
  - Zoom: 30x optical
  - Resolution: 1080p
- **Flir HDC1200**
  - Drone detection range day and night: 1.25 mi (2 km), under ideal conditions up to 2.5 mi (4 km)
  - Night view due thermal optic
  - Zoom: 120x optical (with extender), 22x thermal
  - Resolution: 1080p optical, 720p thermal
- Others on request

☐ **PTZ camera is mounted on a leveled horizontal plate** (no tilted foundations).
If the PTZ camera is mounted tilted, the positioning result and camera controls of the PTZ camera won't be accurate either.

☐ **An accurate positioning and alignment of the PTZ camera is a prerequisite for good tracking**.
The configuration of the GPS position and height of the PTZ camera is critical. If the installation and configuration is not accurate, the tracking won't be accurate either.
- Note the GPS position and height of the PTZ camera during the installation.

☐ **An appropriate Analytics Server is installed.**
To operate a PTZ camera in a DroneTracker system an Analytics Server is required.
The Analytics Server requirements are documented in chapter 2.2 Analytics Server minimum requirements page 4 and the Online Help of the DroneTracker.

The correct configuration, alignment and calibration of a PTZ camera is described in Dedrone's quick guide "Configure a PTZ camera".

6 IP Camera Requirements

The DroneTracker System supports cameras with the interface **Onvif Profil S**.

Depending of the desired range, a full HD or 4K camera is recommended (note the appropriate Analytics Server requirements).

Recommended IP cameras:

☐ Axis P1425E (full HD)

☐ Axis P1428E (4K)

7 Radar Requirements

The following radar systems are supported with the DroneTracker System:

- FLIR Ranger R8SS-3D
- Echodyne ECOGUARD

Radar systems are subject to certain legal restrictions and require separate computer hardware. Please contact Dedrone or a Dedrone Partner for the integration of a radar.

8 Steps to Set Up a DroneTracker System

8.1 Set Up the DroneTracker Server

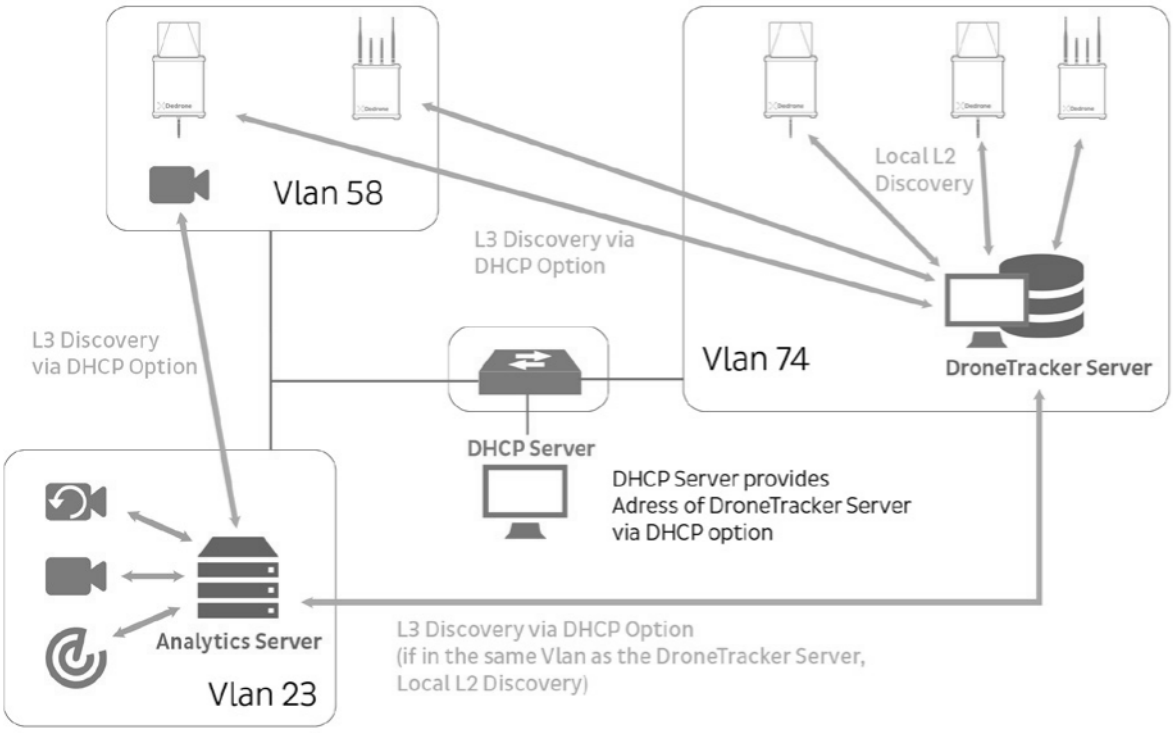
- Get IP for the desired environment.
- Configure the server (follow enclosed Readme).
- Log in to the DroneTracker user interface.
- Upload license key.
- Change login password for the DroneTracker user interface.
- Before a connection between sensor and server can be established, the sensor needs to be configured in the server. The "Add devices" list contains all sensors from which a discovery package was received (discovery mode) OR a connection request was made (DHCP option mode).

8.2 Configure Communication Between Server and Sensor

In a DroneTracker System several sensors connect to a central DroneTracker Server.

The DroneTracker Server and sensors can be on different Layer3/Routed Networks. In this Scenario, which will be common for most enterprise deployments, the sensors need to discover the address of the DroneTracker Server. This discovery happens through a DHCP Option configured on the enterprise DHCP server much like the option provided for IP-Phones to find their call manager.

If the DroneTracker Server and the sensors are on the same Layer2 Network (aka Vlan) there is a Layer2-discovery method available as well.

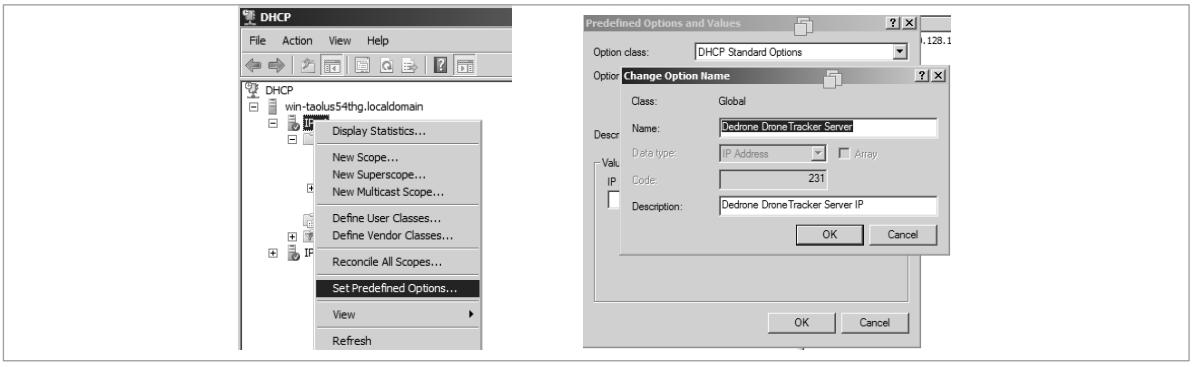


Network Communication in a DroneTracker System

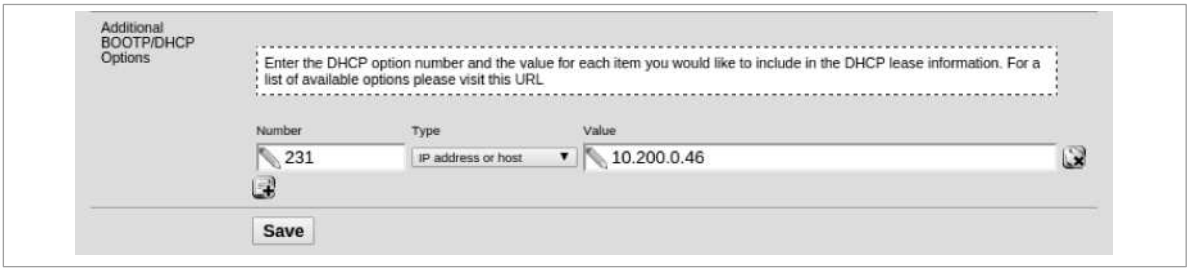
8.2.1 Forced Connection via DHCP Option

If the DroneTracker Server receives DHCP option 231 containing an IP address, the sensors will try to connect to a server instance on this IP address listening on port 8000. You can use DHCP option 232 as unsigned 16-bit integer to change the port.

If the connection to the specified server fails after 10 tries, the sensors will fall back to discovery mode for some seconds before they try to connect to the specified IP address again.



Windows 2008 DHCP Server



FreeBSD PfSense

After adding the DHCP option to your DHCP server, please make sure the DroneTracker renews or acquires a new DHCP lease. The safest way to ensure this is to reboot the DroneTracker.

8.2.2 UDP Broadcast Discovery

If DHCP option 231 is unset, the sensors will send UDP broadcast packets on port 9876 to their broadcast address as configured via DHCP. These packages publish a TCP port (default 8888, random if occupied) where the sensor is reachable for connection requests. The server will answer discovery packages for which it has a paired sensor on that port. The sensor then connects to the server that first answered the discovery package.

8.3 Install and Connect Sensors to the Network (see Installation Manual)

8.4 Add Sensors in the UI (Site Configuration and Map Editor)

AIRSPACE SECURITY SOLUTION

Dedrone

Dedrone Holding, Inc.
220 Sansome Street
San Francisco, CA 94104
USA

Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

+1 415 813-6116
+49 561 8617990
info@dedrone.com
www.dedrone.com

Quick Guide: How to Install the Analytics Server

This quick guide describes the requirements and a simplified instruction for the installation of the Analytics Server.

Following the instructions requires basic knowledge about Linux and servers.

Server Requirements

- ☐ Cuda 10 compatible Nvidia graphics card with Nvidia Pascal microarchitecure or newer (preferably the most recent one like Volta or Turing).
- ☐ Each camera or PTZ may consume up to 1.2 GB of GPU memory on the Analytics Server. For example, a Nvidia RTX 2070 with 8192 MB of VRAM supports up to 6 PTZs and/or cameras.
- ☐ Physical machine, with exclusive use of the server resources in this OS
- ☐ Hard Disc: 500 GB SSD with good I/O, divided in System and Recordings:
  - **System**: 50 GB SSD (required)
  - **Recordings**: depending on the number of sensors and system configuration; minimum 50 GB number of recordings severely limited, recommended 450 GB; additional storage for long term archiving
- ☐ Processor: Intel Xeon E5 CPU with at least 12 Cores; 2,2Ghz and >25MB Cache
- ☐ Working memory: 64 GBWe recommend distributing the 64 GB of RAM to all available channels, for example 4 x 16 GB multi-channel RAM is better than 1 x 64 GB RAM single-channel.
- ☐ OS: Ubuntu 16.04 LTS (Desktop) - 64 bit, installed without secure boot option.
- ☐ Deactivated encryption of home directory

Procedure:

1 If available, change the default graphic board in server BIOS from **onboard** to **offboard**.

2 Go to address https://downloads.dedrone.com and log in with your credentials.

3 Download the current analytics server package to your server.
"`dedrone_analyticsserver_pack-v[version].tgz`"

4 On the server, unpack the file as root user with the command:
```
root$> tar xzf dedrone_analyticsserver_pack-v[version].tgz
```

5 Do not run the following script from inside your graphical environment, as it might be required to stop and restart it in order to install video drivers.

As root user, run `setup.sh` from the installation package:

```
root$> dedrone_analyticsserver_pack-v[version]/setup.sh
```

Confirm the questions with y/n.

Quick Guide: How to Install the DroneTracker Server

This quick guide describes requirements and a simplified instruction for the installation of the DroneTracker Server.

Following the instructions requires basic knowledge about Linux and servers. For a more detailed description, follow the planning manual “Deploying DroneTracker System on premises”.

Requirements

- ☐ Exclusive use of the server resources in this OS, physical or virtual machine
- ☐ 500 GB Hard Disc recommended, divided in System and Recordings:
  - **System**: 50 GB (required)
  - **Recordings**: depending on the number of sensors and system configuration; minimum 50 GB number of recordings severely limited, recommended 450 GB; additional storage for long term archiving
- ☐ Processor: Dual Core CPU (can be virtualized if exclusive)
- ☐ Working memory: 8 GB
- ☐ OS: Ubuntu 16.04 LTS – 64 bit
- ☐ Deactivated encryption of home directory

Overview ports DroneTracker Server

Incoming

Protocol	Service	Function	Port
TCP	SSH	Dedrone Service access	22
TCP	HTTP / HTTPS	Web interface	Configurable Default HTTP: 8080 Default HTTPS:443
TCP	MQTT TLS	Sensor connection	8883
UDP	SNMP	SNMP notifications	Configurable Default: 161

Outgoing

Protocol	Service	Function	Address	Port
TCP	HTTP/HTTPS	Download of updates, communication with cloud	trackerapi.dedrone.com	HTTP: 8080 HTTPS: 443
TCP	HTTP/HTTPS	Check license	license.dedrone.com	HTTP: 8080 HTTPS: 443
TCP	Configurable	Notifications	configurable	configurable
TCP + UDP	DNS	DNS	via DHCP	53
UDP	NTP	Time sync	ntp.dedrone.com	123
UDP	SNMP (traps)	SNMP notifications	configurable	162
TCP	MQTT TLS	Sensor communication		8883

Procedure:

1	Go to address https://downloads.dedrone.com and log in with your credentials.
2	Download the desired DroneTracker Server version to your server.
3	On the server, unpack the file as dedrone user with the command: `tar xzf dedrone_server-v[version].tgz`
4	Follow the included Readme file **README.txt**.

Quick Guide: How to Update an Offline DroneTracker System

This Quick Guide describes the update process of a DroneTracker System (from version 3.0) with limited or no connection to the Internet.

Requirements:

- ☐ Access to the DroneTracker Server as system administrator (root access)
- ☐ Basic Linux knowledge

Depending on the system type, the update procedure differs:

Updating a complete offline system 1
Updating a system with offline sensors only 3

Updating a complete offline system

1	Contact the Dedrone Support (support@dedrone.com) and request for update package for an offline system. Dedrone Support team will verify license status and send you a portable storage containing all relevant data. The following components will be updated. Updates must be applied to all systems in which one or more of these components are installed: • DroneTracker Server • Analytics Server • Offline Cacher (apt-cacher-ng)
2	Connect the media to your offline system and mount the storage appropriately. Example: `$> sudo mount -t ext4 /dev/[your_device] /mnt/dedrone_drive`
3	Navigate to mounted directory as root. Example: `$> cd /mnt/dedrone_drive/dedrone_offline_update`
4	If you are performing the update in a system where Analytics Server component is installed (either with DroneTracker, or as standalone), make sure to execute the installation script **in a non-graphical user environment.** DO NOT run the update script from a terminal window in a graphical desktop environment. Tip: Connect to the server via SSH from another system, or press [Ctrl]+[Alt]+[F1] to switch to CLI screen when performing the update directly in the server.

5

Execute `offlineupdate.sh` as root and answer the questions corresponding to the desired server component.

Example:

```
$> sudo ./offlineupdate.sh
```

✔ Update routine is running.

Note: DroneTracker Server, Analytics Server, and offline cacher (apt-cacher-ng) must be updated before sensors can be updated.

6

Open a web browser, navigate to the DroneTracker user interface and login as administrator.

Note: DroneTracker Server is accessible only via **https** (port 443)

7

Update the sensors:

a. Choose menu **OPTIONS** > **Software Version**.

b. Choose **[Update all]**.

✔ The button will become inactive as the sensors are updated in the background. During this process, the sensors will temporarily disconnect from DroneTracker server before re-establishing the connection. A short system message regarding sensor connection status may appear on screen during.

Updating a system with offline sensors only

1

Contact Dedrone Support (support@dedrone.com) and request for update package for a system with offline sensors.

Dedrone Support team will verify the license status and send you a download link to the relevant package.

2

Download the update package to your DroneTracker Server or to your offline cacher (apt-cacher-ng) server.

Example:

```
$> wget [download-link] -O dedrone_offline_sensor_cache.tgz
```

3

Unpack the offline package.

Example:

```
$> tar xf dedrone_offline_sensor_cache.tgz
```

4

Run `setup.sh` as root user.

Example:

```
$> sudo dedrone_offline_sensor_cache_[version]/setup.sh
```

5

Open a web browser, navigate to the DroneTracker user interface and login as administrator.

Note: DroneTracker Server is accessible only via **https** (port 443)

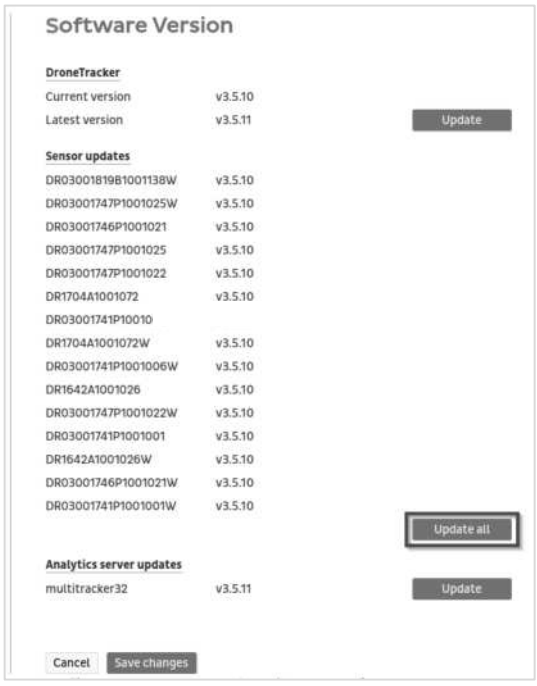
6

Update the sensors:

a. Choose menu OPTIONS > **Software Version**.

b. Choose **[Update all]**.

✔ The button will become inactive as the sensors are updated in the background. During this process, the sensors will temporarily disconnect from DroneTracker server before re-establishing the connection. A short system message regarding sensor connection status may appear on screen during.



Enjoy the Improvements!

RF-100

RF Classification Sensor

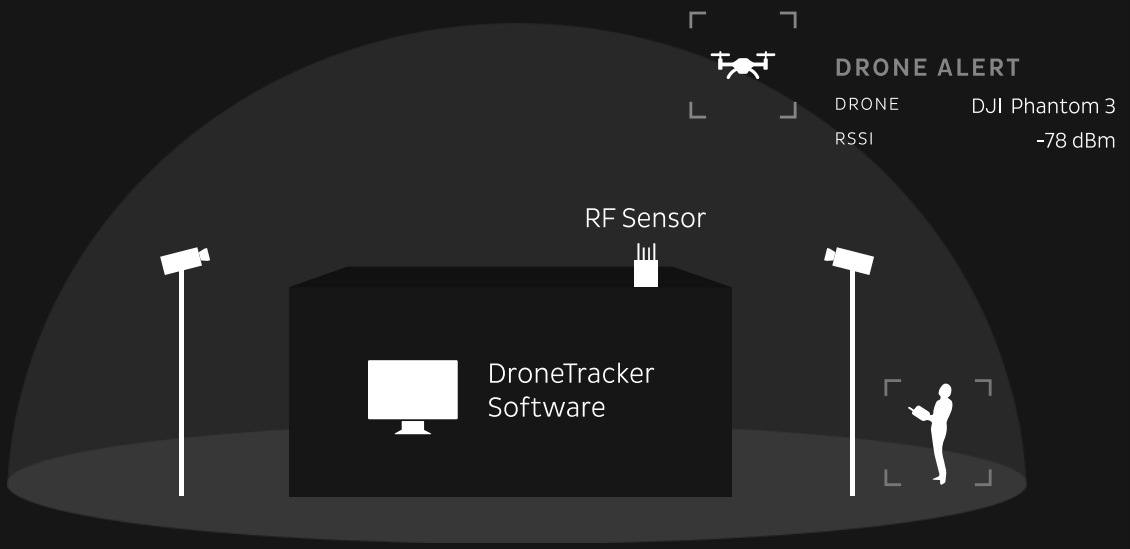
OVERVIEW

Detection and Classification of Drone-Based Threats

The RF-100 is a passive, network-attached radio sensor for the detection and classification of drones and their remote controls. The RF Sensor detects consumer, commercial, and hobbyist drones, and with its extended range gives early warning alerts on potential drone intrusions.

HIGHLIGHTS

- Detects RF, WiFi, and non-WiFi drones
- Classifies drones by manufacturer and model
- Detects intruders and tracks repeat offender drones
- Broad frequency range with dual-radio design
- Approximate coverage range 1 mile (depends on terrain)
- Ruggedized form factor for extreme environments
- IP65 rating
- Single connection Ethernet and power (PoE+)
- Connects to DroneTracker software (cloud-hosted or on-premise)
- Mounting hardware included



Complete Airspace Security

FEATURES

Drone Detection and Classification

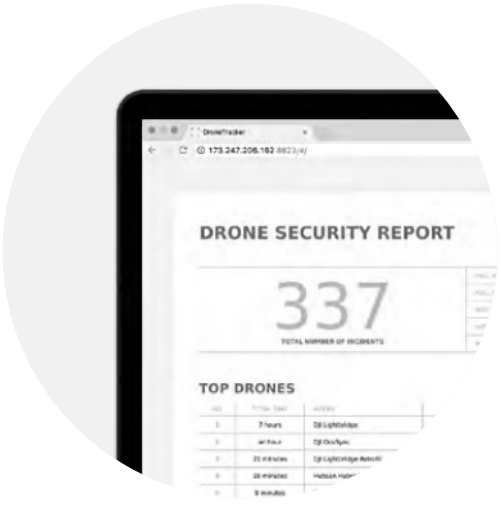
Leveraging Dedrone's DroneDNA signature library, a frequently-updated database of drone signatures that protects against the latest drone threats, the RF-100 detects, classifies, and alerts on drones and remote controls.

Early Warning with Extended Range

The RF-100 dual-radio design enables early warning detection with extended range. By detecting signals from drones and remote controls, users can be alerted to potential threats even before drone take off in the air.

Cornerstone of Airspace Security

The RF-100 collects essential data on drone activity, including the frequency and time of incidents, and records classifications such as manufacturer and model. By continuously monitoring the airspace, it generates data-driven reports that help assess the threats presented by unauthorized drones in the airspace.



Works with DroneTracker Software

The RF-100 connects to Dedrone's DroneTracker, a software platform that analyzes data from multiple sensors, sends alerts, generates reports, and triggers countermeasures. DroneTracker includes Dedrone's DroneDNA, a library of drone signatures that is frequently updated to detect the latest drones.

SPECIFICATIONS

RANGE (LINE OF SIGHT)	Up to 0.65 mi (1.0 km) In ideal conditions up to 1.3 mi (2.0 km)
DEVICE TYPE	Sensor
RADIO FREQUENCY	Omnidirectional passive detection and classification
DIMENSIONS (L X W X H)	7.7" x 3.7" x 17.3" (195 mm x 95 mm x 440 mm) height without antenna: 9.8" (250 mm)
WEIGHT	6.8 lb (3.1 kg)
INGRESS PROTECTION RATING	IP65
OPERATING TEMPERATURE	-4 °F to +122 °F (-20 °C to +50 °C)
POWER SUPPLY	PoE+ (IEEE 802.3at)
POWER CONSUMPTION	15 W (typical)
CONNECTIVITY	Via LAN to existing IT infrastructure
CONFIGURATION, OPERATION, AND ALARMS	Via DroneTracker software
SOFTWARE UPDATES	Firmware and DroneDNA updates via cloud-based connection

ORDERING INFORMATION

RF-100 RF SENSOR	RF-100-HW	RF-100 RF and WiFi classification sensor with direction finding
RF SENSOR LICENSE (1YR), RF-100	RF-100-1YR-SW	Includes DroneTracker software, on-going feature enhancements, DroneDNA updates, and support for 1 RF-100 RF Sensor
RF SENSOR LICENSE (3YR), RF-100	RF-100-3YR-SW	Includes DroneTracker software, on-going feature enhancements, DroneDNA updates, and support for 1 RF-100 RF Sensor
RF SENSOR LICENSE (5YR), RF-100	RF-100-5YR-SW	Includes DroneTracker software, on-going feature enhancements, DroneDNA updates, and support for 1 RF-100 RF Sensor

RF-100

RF Classification Sensor

OVERVIEW

Detection and Classification of Drone-Based Threats

The RF-100 is a passive, network-attached radio sensor for the detection and classification of drones and their remote controls. The RF Sensor detects consumer, commercial, and hobbyist drones, and with its extended range gives early warning alerts on potential drone intrusions.

BASIC INSTALLATION REQUIREMENTS

- Sensor installed outdoors, with optimal vantage point of environment
- A provided 10-15' pole, minimum of 2'' diameter
- Mounting hardware is included

CONNECTIVITY OPTIONS

Cloud

Dedrone provides 4G/LTE hardware to connect sensors to Dedrone Cloud. This minimizes the need to connect to existing internal IT infrastructure. In this setup, Dedrone requires access to standard 110V power.

On-Premise

On-premise deployments can run two ways — with internet access, and without. In the former option, the client will supply internet access via their existing IT infrastructure. For many a closed system is desired, which Dedrone also accommodates.

SPECIFICATIONS

RANGE (LINE OF SIGHT)
Up to 0.65 mi (1.0 km). In ideal conditions up to 1.3 mi (2.0 km)

RADIO FREQUENCY
Omnidirectional passive detection and classification

DIMENSIONS (L X W X H)
7.7" x 3.7" x 17.3" (195 mm x 95 mm x 440 mm)

WEIGHT
6.8 lb (3.1 kg)

INGRESS PROTECTION RATING
IP65

OPERATING TEMPERATURE
-4 °F to +122 °F (-20 °C to +50 °C)

POWER SUPPLY
PoE+ (IEEE 802.3at), 15W (typical consumption)

EXAMPLE INSTALLATION

AIRSPACE SECURITY ANALYTICS

Automated Drone Reports

- Single click summaries of drone incidents
- Displays frequency of activity with both daily and hourly breakdowns, type of drones and critical data for longer drone flights
- Easily apply filters to focus on particular data

Learn more at dedrone.com

Dedrone

PROJECT	
Number	025
Code	SCE 0100
Title	Electronic Counter Measure System
Process	P43 – Project Description

DOCUMENT	
Code	DTPS
Type	Technical Description of Products and Systems
Complementary	00 – Main body
Subject	SCE 0100
Purpose	DroneBlocker System Technical Specification

Review History

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1. INTRODUCTION

1.1. Document Purpose

This document is intended to present the preliminary technical specifications for the SCE 0100 DroneBlocker system. The reference values considered were derived from design requirements and technical and market analysis.

1.2. Scope

Below is the scope of this document:

- Description of the SCE 0100 DroneBlocker system.
- Presentation of the main features of the SCE 0100 DroneBlocker system.
- Presentation of the preliminary technical specifications for the SCE 0100 DroneBlocker system.

1.3. Acronyms

The following acronyms are used in this document:

Acronyms and Abbreviations	DESCRIPTION
BIT	Built-In-Test (Auto Teste)
AC	Alternating Current
CC	Continuous Current
CW	Continuous Wave
DTPS	Technical Description of Products and System
GPS	Global Positioning System
HMI	Man-Machine Interface
ISM	Industrial, Scientific and Medical Radio bands
MTBF	Mean Time Between Faults
RCIED	Radio Controlled Improvised Explosive Device
RF	Radio Frequency
SCE	Counter Measures System
VSWR	Voltage Standing Wave Ratio
WIFI	Wireless network LAN based on IEEE 802.11

2. APPLIED DOCUMENTATION

The following documents are applied to this DTPS:

2.1. Project Documentation

NUMBER	TYPE	TITLE

3. SCE 0100 DRONEBLOCKER SYSTEM

3.1. Introduction to the SCE 0100 DroneBlocker System

The SCE 0100 DroneBlocker System is composed of two (2) subsystems: The Drone Jamming subsystem and the Drone Detection subsystem. A Command & Control (C&C) application is used for controlling and monitoring the integrated SCE 0100 DroneBlocker system.

3.1.1. *The Jamming Sub-System*

The Drone Jamming subsystem is a sophisticated electronic counter-measure system. Embedded in a ruggedized case (Figure 1) that allows its installation on either a fixed or a mobile platform, the Jammer system can operate in almost any location and platform type, as well as under severe weather conditions, in order to jam / block different RF signals.

The Jammer system features several configurations, which allow for the jamming / interfering: Drones (micro e mini) communication means, cellular phones and RCIED. The configuration of the system is linked with the output power and operation frequency, as required in the specific mission that will be executed.

The Jammer system features up to six (6) fully independent channels, capable of operating simultaneously without the need to "jump" between bands. Each channel has the ability to sweep rapidly over a predefined bandwidth, in order to ensure the maximum power in each frequency used in this band.

The Jammer system is able to jam / interfere with different communication means over the frequency ranges listed below (the popular bands of use for Drones):

a) 27 - 75MHz: versions of <1W, 10W and100W;
b) 433 - 470MHz (ISM): versions of <1W, 10W and 100W;
c) 902 - 928MHz (ISM): versions of <1W, 10W and 50W;
d) 2400 - 2500MHz (WIFI): versions of <1W, 10W and 50W;
e) 5700 - 5900MHz (WIFI): versions of <1W and 15W;
f) GPS L1/L2/L5: versions of <1W and 10W.

(a) **(b)**

Figure 1 - Illustrative image of the Jammer system case: (a) Front side view; (b) Backside view

3.1.2. *The Detection Sub-System*

The Drone Detection & Tracking subsystem (Figure 2), allows for effective detection of drones during day and night, and under any weather conditions (snow, rain, fog, clouds, extreme temperatures). The unique combination of four sensors – a radar, an acoustic array, cameras and RF Receiver – is not to be found in any other competing solution globally, and enables minimized alarm rates in the detection of small drones in ranges of up to 1000m.

Figure 2 - Illustrative image of the Drone Detection & Tracking subsystem

The Drone Detection & Tracking subsystem is composed of the following sensors:

a) Radar sensor (Figure 3):

   A miniaturized and affordable FMCW Radar sensor, operating in the unlicensed, permit-free 10.5-10.6GHz band, according to EN 300-440 harmonized standard, emitting below 500mW of power (safe operation for humans).
   There are three versions of the radar developed - with antenna beam widths of 30/60/90 degrees in azimuth, and 30/60/90 degrees in elevation. Other radar solutions on the market are much more expensive, and also feature much smaller antenna beam widths in elevation, or use moving mechanical parts; hence, their scanning capability is very limited and they are prone to defects/faults. Moreover, sophisticated signals processing is implemented in this Radar, which minimizes false alarm rates and differentiates between birds and drones.

Figure 3 - Illustrative image of the Radar sensor

b) Acoustic Array (Figure 4):

The Acoustic sensor technology is unique. It is based on a multi-microphone array distributed in space. Advanced signal processing algorithms, including beam-forming as well as machine learning based classification, have been developed and implemented.
The microphone-array, composed of eight (8) microphones allows detecting and tracking precisely the azimuth and elevation angle of unmanned aircraft. Distance to the target is estimated based on spectral characteristic of the signal.
The implemented algorithms includes GCC-PHAT, which allows the measurement of the amplitude of the sound coming from different angles. In addition, the classifier applies noise events based on NMF (nonnegative matrix factorization) and MMFC (Mel Frequency Cepstral coefficients) with the support of SVM (support vector machine).The classification algorithms, based on a large database of sound samples, allow to reliably differentiate a drone from a car, a drill, a lawn mower, human speech, etc.

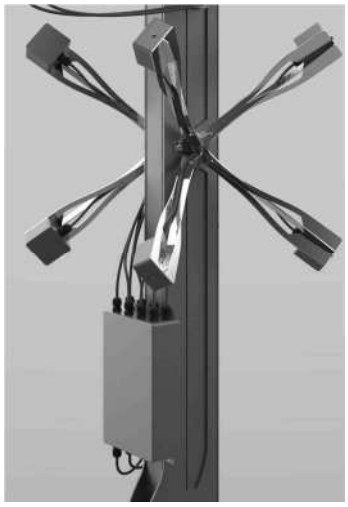


Figure 4 - Illustrative image of the Acoustic sensor

c) Cameras (Figure 5):

The Detection subsystem consists of a set of cameras. They are used to visualize the monitored scenery and take video footage of the invading drone for post-incident action.
Both a simple/fixed camera and a PTZ camera are available. PTZ (pan-tilt-zoom) camera allows for precise tracking in space of the drone with the use of proprietary image analysis algorithms designed to detect drones. Slew-to-cue with radar is implemented in order to focus the PTZ camera in the right point in space for object classification and identification. Without a radar, the PTZ camera will not serve, because it has to be precisely pointed in space, especially for the detection of small objects, which are far away from the detection unit.

Figure 5 - Illustrative image of the available cameras

d) RF Receiver (Figure 6):

Nearly all commercially available drones use radio signals, whether it is to receive control commands from the remote control (uplink), or to transmit video or telemetry data (downlink). The RF Receiver sensor role is to detect these radio signals.
The greatest benefits from using a RF Receiver are:

- Increased detection range (up to 1000m, in an omni-directional coverage)
- Early detection of switched-on remote controls (in some cases, the Drone might be detected when still on ground)
- Highly reliable detection and identification of drones

Figure 6 - Illustrative image of the RF Receiver

3.1.3. *The Command & Control (C&C) SW Application*

A user-friendly, dedicated C&C application (Figure 7) has been developed, which allows an authorized access for a defined group of users, whether it is from a PC, laptop or a tablet.

The C&C application provides the following features:

a) Monitoring of a defined airspace
b) Definition of the protected area
c) Easy deployment of Detection Sensors and Jammers
d) Radar, Acoustic Array, Camera and Receiver sensors integration
e) Visualization of the scene on maps and Google maps
f) Multi-target Tracking
g) Archiving incident data
h) SMS, email and system alerts
i) Easy interfacing to common security systems

Figure 7 - Illustrative image of the C&C SW Application

4. TECHNICAL PRELIMINARY SPECIFICATION

4.1. SCE 0100 DroneBlocker Jamming Subsystem

4.1.1. *Operating modes and types of users*

Operating modes supported ..... Via HMI / “Manual” using front panel switches

Types of users supported ..... “Basic”: able to activate and deactivate only a pre-defined configuration

..... “Advanced”: able to create, activate and deactivate new configurations

Number of users supported ..... unlimited, with authorization/credentials for users

4.1.2. *Dimensions*

10W version:

Height..... 260 mm
Width..... 500 mm
Length ..... 500 mm
Weight..... 35 kg (50 kg with transportation case)

50-100W version:

Height..... 340 mm
Width..... 475 mm
Length ..... 680 mm
Weight..... 50 kg (70 kg with transportation case)

4.1.3. *Transmission Section*

Frequency Band

Channel #1..... 27 MHz - 75 MHz
Channel #2..... 433 MHz - 470 MHz
Channel #3..... 902 MHz - 928 MHz
Channel #4..... 1575 ± 10MHz (GPS L1), and
..... 1227 ± 10MHz (GPS L2), and
..... 1176 ± 10MHz (GPS L5)
Channel #5..... 2400 MHz - 2500 MHz
Channel #6..... 5700 MHz - 5900 MHz

Output power (± 3 dB)

Medium power version..... Up to 10 W per channel (for GPS: < 1 W only)
High power version ..... Channel #1: 50 dBm (100 W)
..... Channel #2: 50 dBm (100 W)
..... Channel #3: 47 dBm (50 W)
..... Channel #4: 40 dBm (10 W)
..... Channel #5: 47 dBm (50 W)
..... Channel #6: 41.5 dBm (15 W)

4.1.4. *General*

Environmental Conditions ..... Temperature: -5°C to 50°C
..... Humidity: 90% at 45ºC, falling linearly to 80% at 50ºC
Reliability..... MTBF > 13.000 horas (~1.5 anos, para operação 24/7/365)

Configuration and Monitoring..... Via Ethernet (LAN)

Maintenance ..... Digital Control of the transmission output power
Digital Control of the sweeping parameters
Capability of auto tests (BIT - *Built In Test*)

Alarm / indications ..... High temperature (per channel)
..... High reflected power (per channel)
..... Monitoring of internal power supplies 12 VDC / 28 VDC

Installation ..... Modular equipment intended for easy installation and adjustment

4.1.5. *Feeding*

Primary supply voltage ..... 90 to 136 (115VAC / 127VAC) and 181 to 251 (220VAC)
Frequency..... 60 ± 4 Hz
DC Supply (optional) ..... 12 VDC / 24 VDC (using an external inverter)
Power consumption (AC) ..... 10W version: <250 W
..... 50W/100W version: <1500 W

4.1.6. *Antennas*

Antenna #1 (Omni-directional, channel #1):
Type ..... Monopole
Frequency band ..... 30 - 90 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 0 dBi (min) / 2 dBi (max)
VSWR ..... < 2.5:1

Radiation pattern ..... Omni-directional in azimuth
Power handling ..... 100W (CW)

Antenna #2 (Omni-directional, channels #2, #3, #4, #5):
Type ..... Monopole
Frequency band ..... 400 - 2700 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 3 dBi (min) / 6 dBi (max)
VSWR ..... < 2.5:1
Radiation pattern ..... Omni-directional in azimuth
Power handling ..... 100W (CW)

Antenna #3 (Omni-directional, channel #6):
Type ..... Monopole
Frequency band ..... 5700 - 5900 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 6 dBi (typical)
VSWR ..... < 1.5:1
Radiation pattern ..... Omni-directional in azimuth
Power handling ..... 100W (CW)

Antenna #4 (Directional, channel #1):
Type ..... Log Periodic
Frequency band ..... 27 - 100 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 3 dBi (min) / 9 dBi (max)
VSWR ..... < 3:1
Radiation pattern ..... Directional in azimuth & elevation (100 x 80 degrees)
Power handling ..... 1000W (CW)

Antenna #5 (Directional, channel #2):
Type ..... Log Periodic
Frequency band ..... 406 - 470 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 7 dBi (typical)
VSWR ..... < 1.3:1
Radiation pattern ..... Directional in azimuth & elevation (65 x 115 degrees)
Power handling ..... 150W (CW)

Antenna #6 (Directional, channels #3, #4):

Type ..... Log Periodic
Frequency band ..... 690 - 2700 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 8 dBi (min) / 10 dBi (max)
VSWR ..... < 1.5:1
Radiation pattern ..... Directional in azimuth & elevation (70 x 70 degrees)
Power handling ..... 100W (CW)

Antenna #7 (Directional, channels #5, #6):

Type ..... Panel (MIMO, dual band)
Frequency band ..... 2400 - 2500 MHz / 5150 - 5850 MHz
Input impedance ..... 50 Ω
Polarization ..... Vertical
Gain ..... 10.5 dBi / 13 dBi (typical)
VSWR ..... < 1.8:1
Radiation pattern ..... Directional in azimuth & elevation (65 x 30 deg. / 55 x 25 deg.)
Power handling ..... 100W (CW)

4.1.7. *Environmental conditions (min, for all antennas)*

Normal operation temperature ..... -5°C to +50°C
Relative humidity ..... Up to 95%
Wind resistance ..... 100 m/h

4.2. SCE 0100 DroneBlocker Detection Subsystem

4.2.1. *Detection sensors ranges*

Radar ..... up to 1000m (for DJI Phantom Standard). Larger drones are detected from longer distances
Radar minimum range 40m

RF Receiver ..... up to 1000m (Omnidirectional coverage)

Camera ..... 150m-700m (depending on the model used)

Acoustic Array ..... 50m-180m (depending on the surrounding noise levels)
Acoustic Array minimum range ..... 0m (spherical protection, 360° in both azimuth and elevation)

4.2.2. *Detection sensors features*

Radar ..... allows for Detection and Classification of Drones

RF Receiver ..... allows for Detection, Classification and Identification of Drones

Camera ..... allows for Detection, Classification and Identification of Drones (depepnding on the model used)

Acoustic Array ..... allows for Detection, Classification and Identification of Drones

4.2.3. *Radar characteristics*

Frequency ..... FMCW, 10.5 – 10.6 GHz (frequency can be adjusted if needed, between 9.5 – 11 GHz)

Output power ..... 500mW (can be adjusted up to 5W)

Aperture angle ..... 30° / 60° / 90° in both azimuth and elevation (depending on the model used)

4.2.4. *Camera models*

Regular / fixed ..... Camera HIKVISION DS-2CD2022WD; 2M pixel CMOS, 1920x1080, lens 4mm, 6mm @ F2.0, Angle of view: 90°(4mm) , 53.9°(6mm)

Rotating (enslaved to Radar) ..... PTZ camera HIKVISION DS-2DF6223-AEL; 2M pixel CMOS, 1920x1080, f5.9-135.7mm / F1.5-F3.4, 23x optical zoom

4.2.5. *Weight*

Mobile configuration ..... 40kg including battery

Stationary / fixed configuration ..... 85kg; 180kg with dedicated tripod; can be easily fixed to the ground

4.2.6. *Feeding*

Primary supply voltage ..... 220VAC or Battery

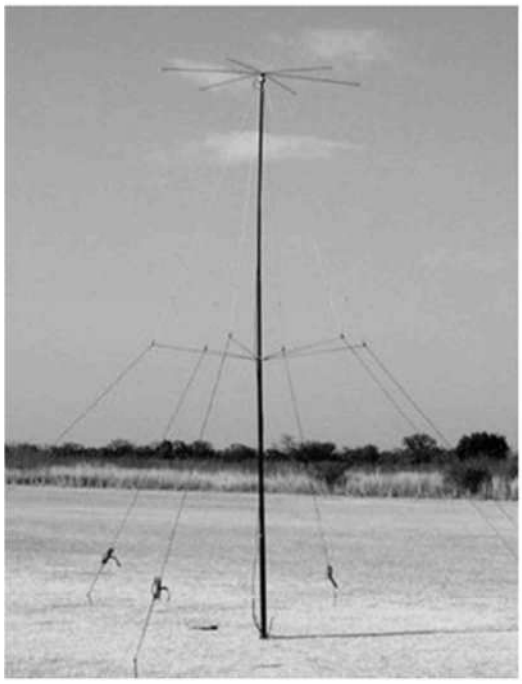
Autonomic operation ..... ~2 hours on external battery pack (delivered with the system)

4.2.7. *Environmental conditions*

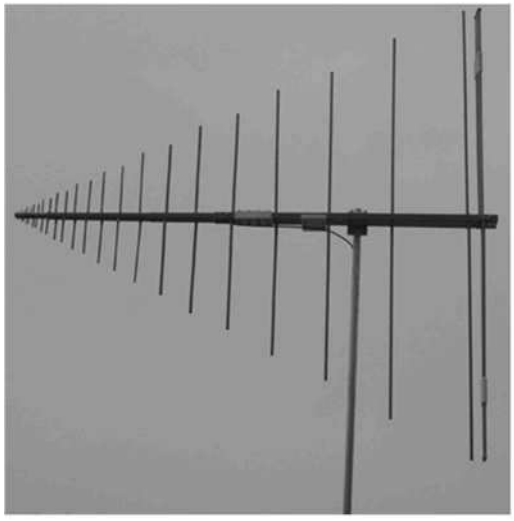
Stationary and Mobile configurations ..... IP67 compliance

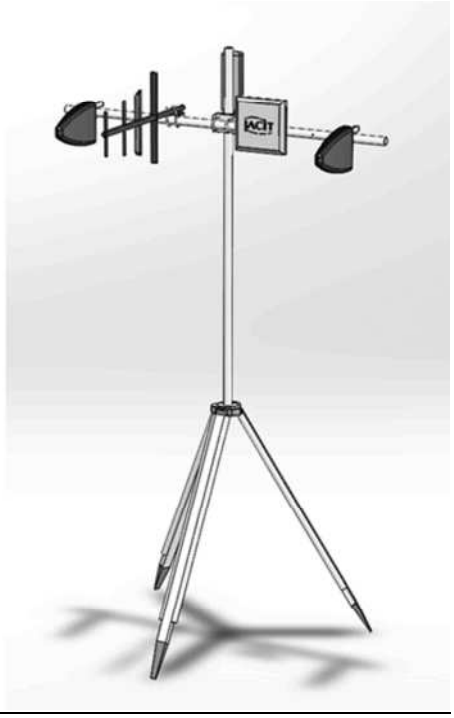
5. ANNEX A – JAMMING SUBSYSTEM – ANTENNAS & DEPLOYMENT

Deployment / installation of the omni-directional antennas:



Deployment / installation of the directional antennas:





Dedrone

USER
Manual

DroneTracker User Interface 4.1
Cloud System

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1 The DroneTracker UI

The browser-based, user-friendly DroneTracker UI allows you to easily configure the DroneTracker System or retrieve data such as videos or the history of previous drone alerts. The monitored airspace can also be viewed in real time. When a drone is detected, you will be notified immediately via SMS, email or a variety of network messages.

2 Overview

2.1 HOME

The Home screen is the main window for the DroneTracker System. Here you can monitor the airspace with the installed sensors.

The monitoring section on the left provides all relevant status and alert information and a list of the latest alerts within the last 6 hours.

The DroneTracker System shows the following status:

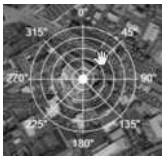
- **SAFE**
  no drone detected
- **WARNING**
  drone or remote is detected or localized in an interest zone. Whether a non-localized drone triggers a warning or not can be configured in Alerting Configuration.
- **ALERT**
  drone or remote is detected or localized in an Alert Zone. Whether a non-localized drone triggers an alert or not can be configured in Alerting Configuration.

A live view of each individual sensor can be shown in the sensor list by selecting a sensor. To enlarge and undock the live view, double-click on the shown live view.

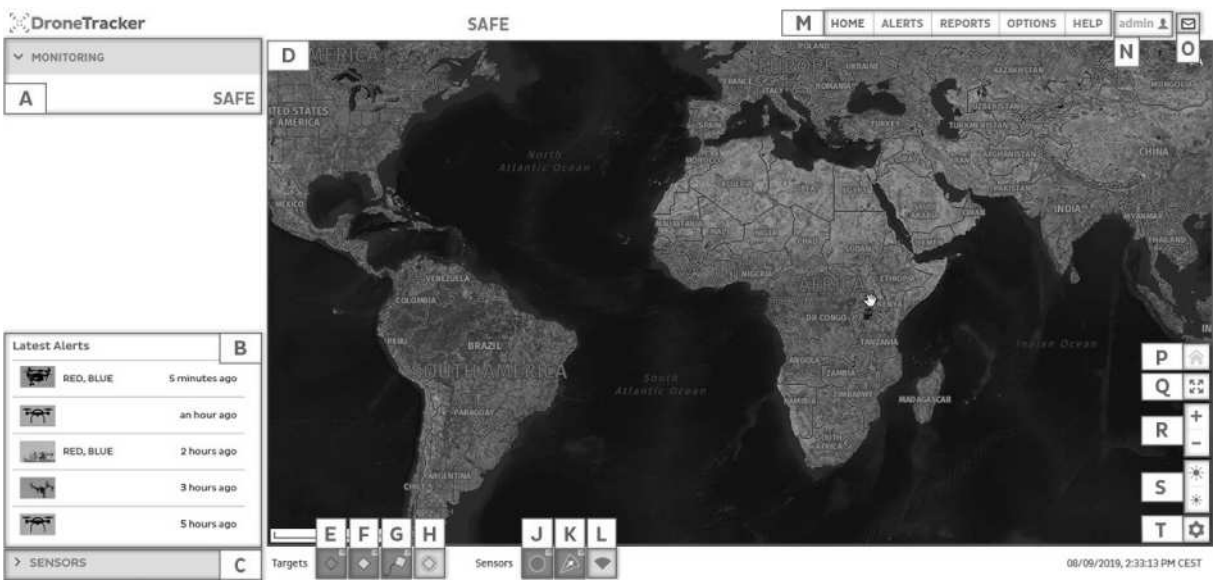
The menu is shown in the header.

2.1.1 Map symbols

	Target position detected by one sensor
	Target position detected by more than one sensor
	Target position of the selected alert detected by one sensor
	Target position of the selected alert detected by more than one sensor
	Friendly target position detected by one sensor
	Friendly target position detected by more than one sensor
	Detected remote position

	Detected remote position of the selected alert
	Drone position with uncertainty circle The size of the uncertainty circle displays how accurate the shown drone position is. The smaller the circle, the more accurate the position.
	Movement direction from or to the Point of Interest of the drone or remote
	Flight path of the drone
	Connection between two positions, if the positioning was interrupted
	Tactical overlay
	Alerting zone
	Warning zone
	RF sensor

2.1.2 Safe screen

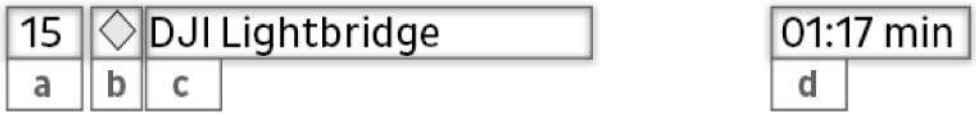


POSITION	EXPLANATION
A	**Monitoring status** In case of an alert or warning, the related live view and all relevant information are displayed here, e.g. duration, drone speed, heading of the drone and drone type.
B	**Latest Alerts** List of up to five latest alerts during the last six hours. The list shows the thumbnail of the alert, the labels of the triggered zones and the time since the alert has happened.
C	**Site Explorer** Shows the configured Sensor Tree with all integrated sensors By choosing a sensor, the respective live view is shown below.
D	**Site map** Displays the configured map of the protected site. In case of an alert or warning the estimated direction or position of detected drones or remote controls is shown on the Site map. If configured, alert and interest zones are shown. If popup notifications are activated, the popup messages are shown in the lower right corner.
E	**Friendly targets** Show or hide all friendly targets on the map (see also Classify target)
F	**Hostile targets** Show or hide all hostile targets on the map (see also Classify target)
G	**Path** Show or hide the drawn path of the selected target. The path shows the movement of the last few seconds.
H	**Uncertainty** Show or hide the uncertainty circle of the selected target.
J	**Sensor icon configuration** Configure when sensor icons shall be shown. • **Show sensors** Always show all sensor icons on the map • **Show sensors on alert** Show sensor icons only if it is triggering an alert • **Hide sensors** Hide all sensor icons on the map
K	**Bearings**

	Show or hide the bearings of RF-300 sensors
L	**Sensor ranges** Show the sensor range of all shown sensors.  Depending on the range display configuration of each sensor single ranges can still be hidden.
M	**Menu** Open alert recordings, reports, configuration options or the online help of the DroneTracker System.
N	**User Role** The logged in user is shown here. You can configure your profile page and logout from the DroneTracker UI.
O	**System messages** Shows current news to the system status
P	**Home position** Center the map on the configured home position
Q	**Fit to content** Centers and zooms the map to all elements placed on the map
R	**Zoom** Zoom the site map
S	**Brightness** Increase or decrease the map brightness
T	**Map options** Configure some display options for the map: • **Map scheme** Select the desired map scheme • **Map scale** Display or hide the scale bar on the map • **Tactical Overlay** If at least one Point of Interest with a tactical overlay is configured a layer with all tactical overlays can be displayed. • **Sensor states** In case of an error the icon is shown on the related sensor icon. By hovering the mouse on the icon, a status message is shown. The sensor state is just shown, if the sensor is displayed. • **Auto track** If **Auto track** is activated and a detection is selected by the user, the map will center on this activity.

2.1.3 Alerting screen

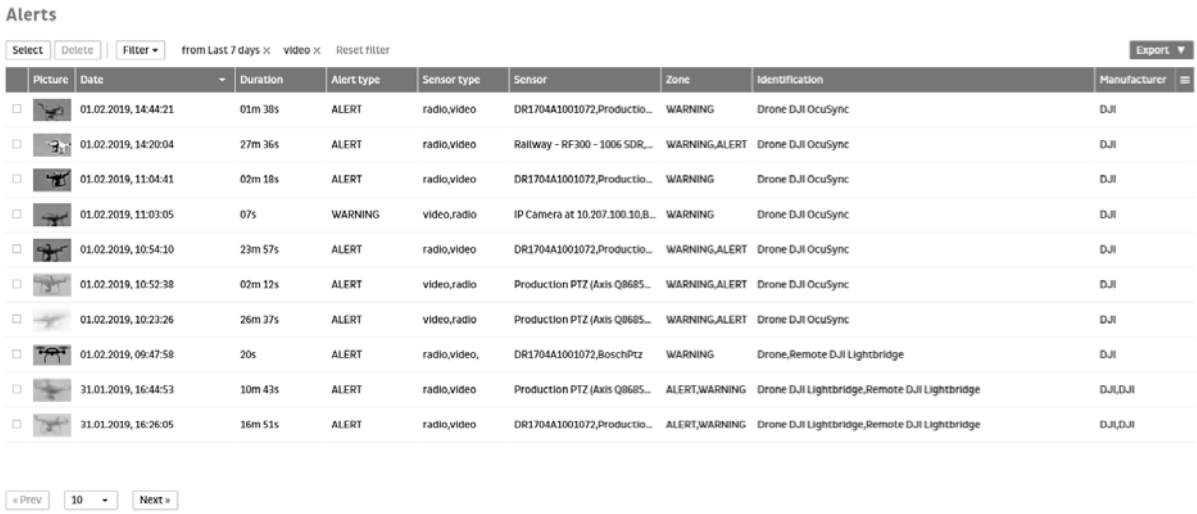
During an alert, all relevant information is displayed on the home screen.

POSITION	EXPLANATION
A	**Current detections**  a. Random Id for references b. Identifies the detection as a drone or remote controller. c. Classification of the detection d. Duration of appearance
B	**Detection details** Displays the GPS position, movement speed of the drone or remote depending on which sensor type detected the target.
C	**Classify target** as Friend, Foe or ignore the detection by choosing one of these buttons
D	**Activate jammer** (only if a jammer is connected)
E	**Focus PTZ camera to the selected detection**. Only available, if the system has a PTZ camera. **Not available** for user role **Viewer**.
F	**Sensor live view**

2.2 ALERTS

View history of all drone alerts.

Alerts can be sorted by the various columns, **filtered**, or **exported to Excel or CSV file**.



Picture	If a video detection is involved in the alert, a thumbnail of the drone is shown.
Date	Date and Time when the alert began
Duration	Duration of the alert in minutes and seconds
Alert Type	Category of the alert
Sensor type	Which kind of sensors are involved
Sensor	Which sensors are involved
Zone	Names of the zones which have been triggered (see Add and Configure Zones)
Flag	Category which has been added manually (see Categorize an alert recording)
Identification*	Identification of the detection
Manufacturer*	Manufacturer of the classified drones
Model*	Model of the classified drones
Comment	Comment which has been added manually (see Comment an alert recording)
Protocol*	Protocol of the detected RF communication
SSID*	SSID of the classified drones

*optional if information available

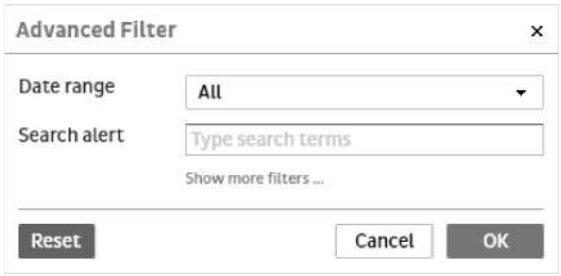
BUTTON	DESCRIPTION
[Select]	Choose one or more entries of the table
[Delete]	Deletes the selected entries
[Filter]	Filters the table by the chosen options
Reset filter	Resets the filter and selections of the table **Note**: Only available if a filter is set.
[Export]	Export the current list to the desired format **Note:** The set filter effects the content of the export. If no period of time is set, the past 31 days are issued.
☰	Show or hide the columns of the table
[<< Prev] [10] [Next >>]	Page navigation Choose the number of entries shown on one page.

2.2.1 Filter the list

You have the option to filter the content.

1. Choose **[Filter]**.

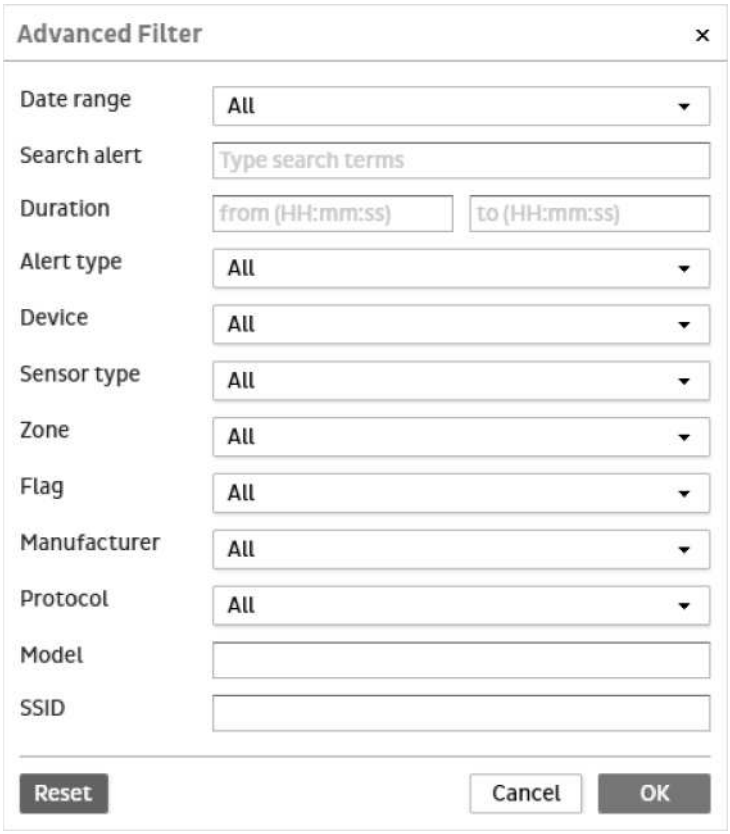
   ▶ The window **Advanced Filter** appears.



2. Choose the desired date range from the preselection in the list and the desired search term such as a sensor name, comment, manufacturer etc.
   The field **Search alert** searches most alert fields:

   - Combine terms, e.g. **"remote" "parrot"**: Shows all alerts with remote **and** parrot identifications
   - Exclude terms, e.g. **remote -drone**: Shows all alerts only with remote identifications and no drone identifications.
   - Search for alerts with locations: **locations** or without locations: **-locations**
   - Search for alerts with bearings: **bearings** or without bearings: **-bearings**
   - **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.

3. Choose **Show more filters ...** to enlarge the advanced filter.



Field	Format	Description
Date range	date	Time frame for the data. Choose **Custom** to define a specific time span
Search alert	text	Search alerts by writing a search term like a sensor name, comment, manufacturer etc. Searches most alert fields. Combine terms e.g. **"remote" "parrot"**: shows all alerts with remote **and** parrot identifications Exclude terms, e.g. **remote -drone**: shows all alerts only with remote identifications and no drone identifications. Search for alerts with locations: **locations** or without locations: **-locations** Search for alerts with bearings: **bearings** or without bearings: **-bearings** **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.
Duration	hh:mm:ss	Period of time the alert was present
Alert type	list	Type of alert If a target was classified during the alert the alert type changes. Additionally, the zone (e.g. Warning zone) can have an effect on the alert type.

Device	list	Device involved in the alert
Sensor type	list	Type of sensor involved in the alert
Zone	list	Name of the zones which were triggered (see Add and configure zones)
Flag	list	Flag of the alert
Manufacturer	list	Manufacturer of the classified drone
Protocol	list	Protocol of the detected RF communication
Model	text	Model of the classified drone
SSID	text	SSID of the classified drone
[Reset]	button	Reset the filter
[Cancel]	button	Close the filter window without changing the filter settings
[OK]	button	Apply the configured filter

All text fields are case sensitive.

4. Choose **[OK]**.

2.3 REPORTS

The report gives a comprehensive overview of the drone activities in the protected area. The given key figures, maps, diagrams and statistics provides a deep insight into the threatsituation and enables you to develop the right counter measures to minimize your risks.

You have the option to configure and filter the report to your needs, export it and configure a scheduled report, which is sent at the selected frequency.

- Report Settings
- Choose report content
- Filter report data by region
- Filter the report data
- Create a scheduled report
- Export a report

2.3.1 Available figures and diagrams

SUMMARY

- TOTAL NUMBER OF ALERTS: Count of alerts
- ALERTS PER DAY: Average count of alerts per day in the report time span
- AVG. DURATION PER ALERT: Average duration per alert in minutes
- DAYS WITH ALERTS: Count of days with alerts
- MAX ALERTS PER DAY: Maximum count of alerts in one day

ALERT HEATMAP
Heatmap colors indicate the duration of drone detections. Red indicates the longest durations of detection.

When the map is zoomed out, selectable clusters show the percentage of activity within the cluster compared to the entire map's activity in the chosen timespan.

TOP DRONES
Shows the distribution and a list of the most frequently detected drones.

TOP DRONE PROTOCOLS
Shows the distribution and a list of the most frequently detected drone protocols.

ALERTS BY SENSOR
Shows the distribution and a list of the sensors with the most detections.

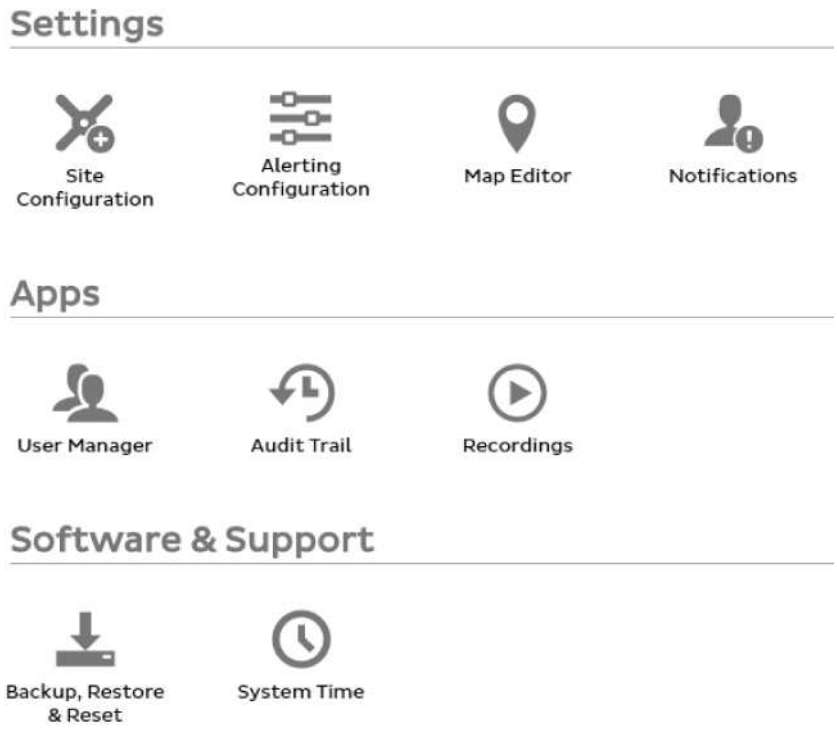
IMPORTANT DRONE ALERTS
Most important drone alerts depending on the involved zone and minimum duration.

ALERTS BY DATE
Represents a count of triggered alerts by date.

ALERTS BY HOUR AND DAY OF WEEK
Represents a count of triggered alerts by time of day.

2.4 OPTIONS

Configuration and settings of the DroneTracker.



2.5 System messages

The System messages shows current news to the system status. The following information will be shown:

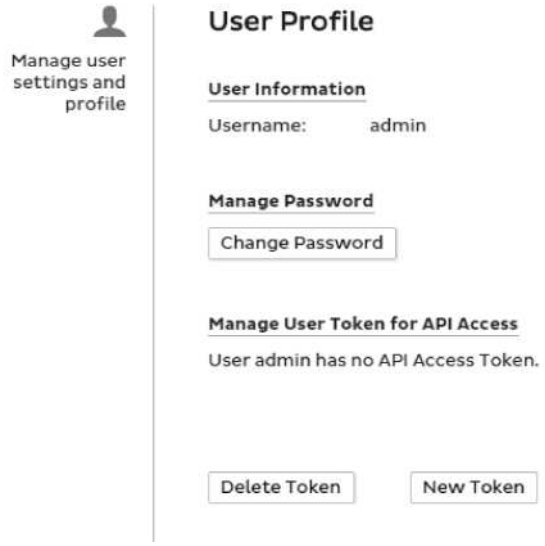
[X] connectable sensors available:...	Sensors are available to get integrated in the system.
Dedrone Cloud: ...	Information to the connection status to Dedrone Cloud
Network error, reconnecting...	Connection to the DroneTracker Server failed. The browser is trying to reconnect.
No space left for alerts/recordings. Will be silently discarded!	The disk space for alerts or recordings on your server or DroneTracker Multi-Sensor is full. New alerts or recordings will be discarded without any further message. To check the space status, go to **OPTIONS > Server Status**.
Only [X] MB left for alerts/recordings	Early warning, that disk space for alerts or recordings is less than 500 MB.

	To check the space status, go to **OPTIONS > Server Status**.
Sensor connection error	A connection between the DroneTracker Server and the sensor failed.
Sensor restricted	The software version of the sensor is too old.

System messages disappear when they are no longer relevant.

2.6 User Profile

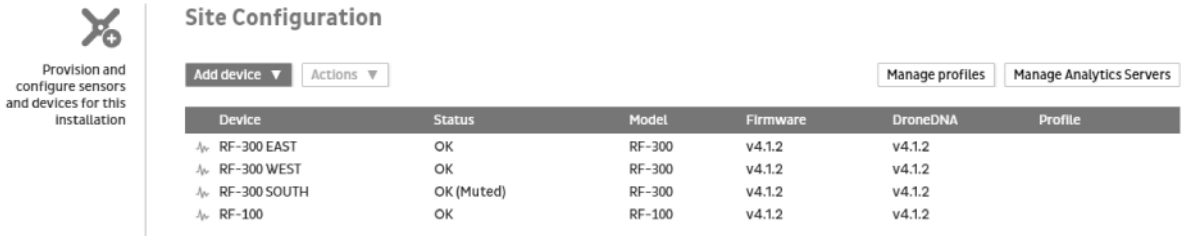
Manage your user password and token for API access.



As an administrator you have the option to create a token. With this token you can give API access for external programs.

2.7 Site Configuration

The Site Configuration is the central menu to organize and configure all sensors of the DroneTracker System. You can structure sensors in a site hierarchy, label them and configure each sensor individually.



Depending on the chosen type of element in the Site Explorer you have different kind of possible actions.

- Add Sensor
- Rename Sensor
- Mute Sensor
- Edit Wi-Fi or radio sensor
- Shut down aRF sensor
- Reboot aRF sensor

Symbols of the Site Explorer

	RF sensor
	Point of Interest with tactical overlay
	Sensor is muted
	Sensor is alerting and recording
	Sensor is disrupted or in calibration. The sensor does not detect and does not trigger any alarms. The pop-up window of the sensor, the system messages and the menu **Site Configuration** gives more detailed information.

2.8 Map Editor

Choose an address, position or a custom map of your area or property in the DroneTracker UI and configure the position, orientation and range of each sensor.

Wrong drone positions will be a result of inaccurate sensor positions.

Accurate positioning and alignment of the sensors on the sitemap has a significant impact on the drone detecting and positioning result of the system.

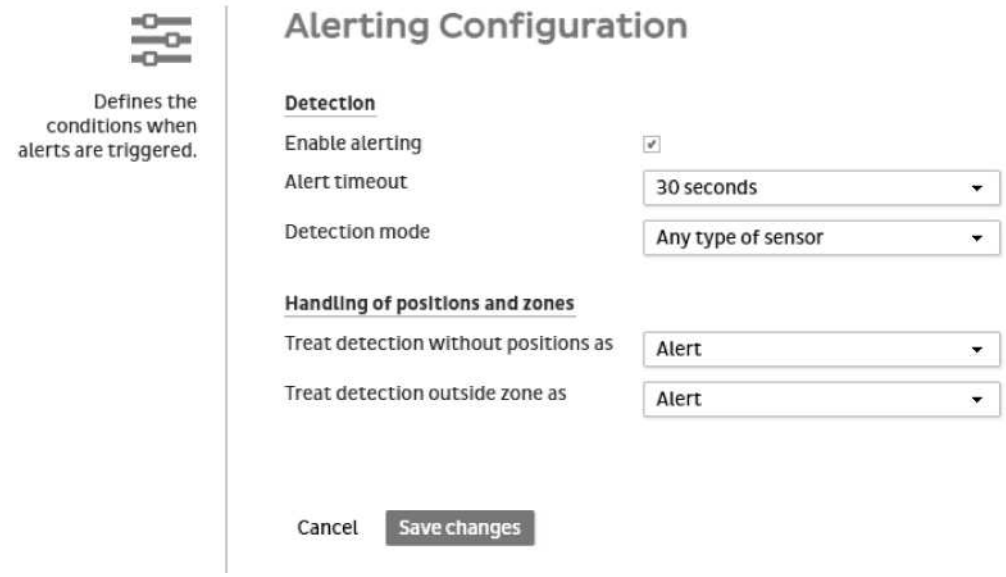
- If you use a custom sitemap image, make sure that the sitemap is calibrated with location markers.
- Position and align the sensors as accurately as possible.

Search bar

Navigate to a desired address, region or geo-location (latitude, longitude in degree decimal). It is also possible to search for site-elements on the map, like sensors or zones. Therefore write ":" in the search bar and choose a shown element.

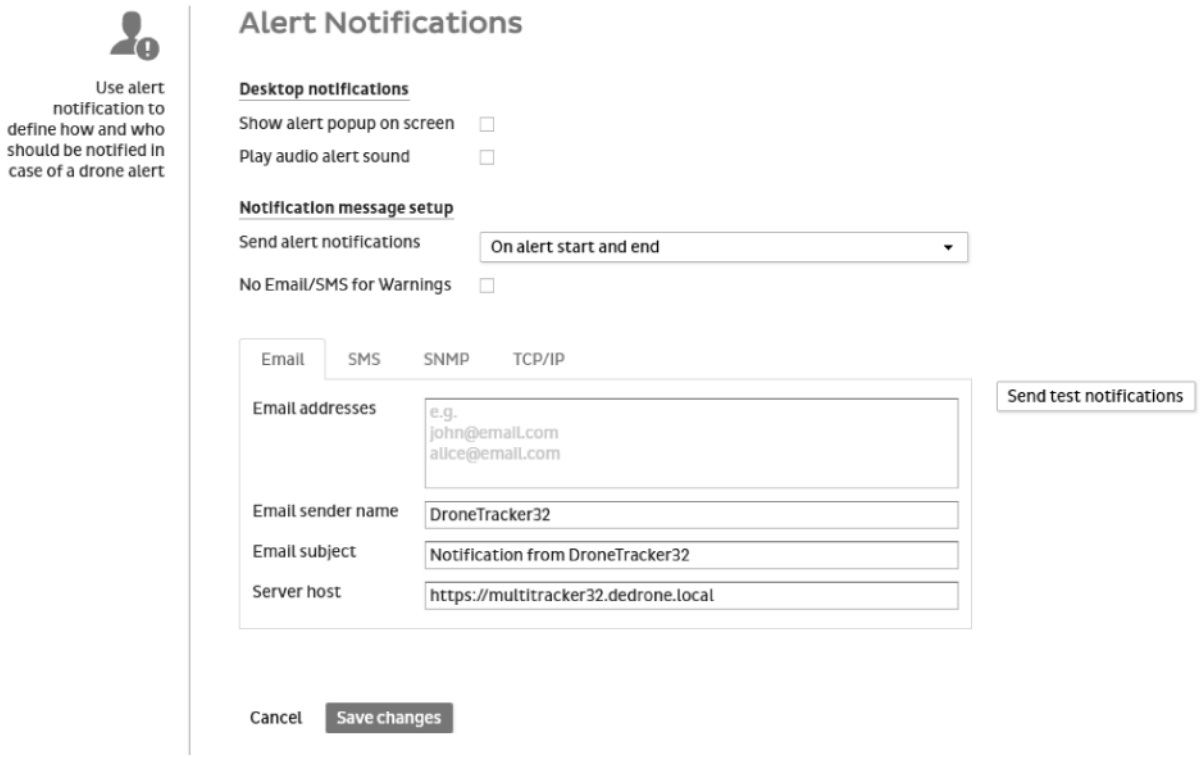
2.9 Alerting Configuration

Depending of the deployed sensors, the alerting behavior of the system can be configured. This allows to set up the alerting to all needs and can reduce false alerts.



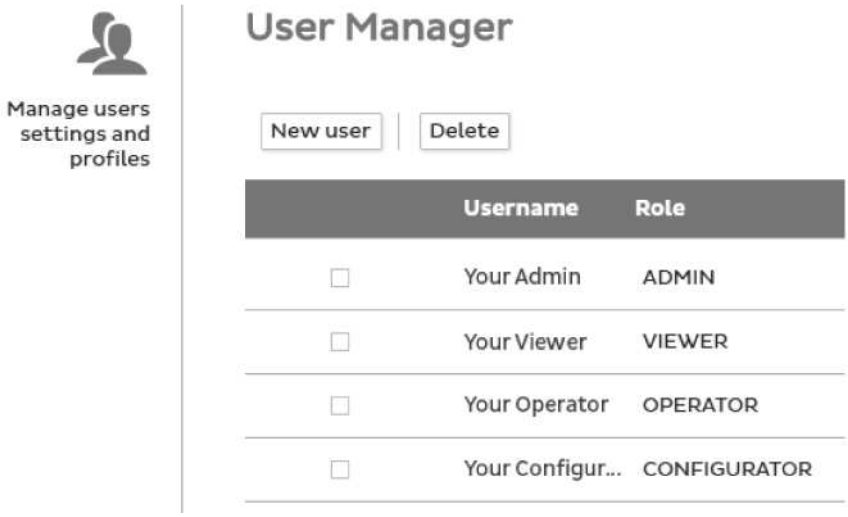
2.10 Alert Notifications

Define how and who should be alerted and notified in case of a drone alert.



2.11 User Manager

Manage all users, passwords and roles in this menu.



According to your role, the content in the DroneTracker UI is shown.

The user **dedrone_support** is predefined and cannot be deleted or changed. This user is necessary to ensure the support of Dedrone for your system.

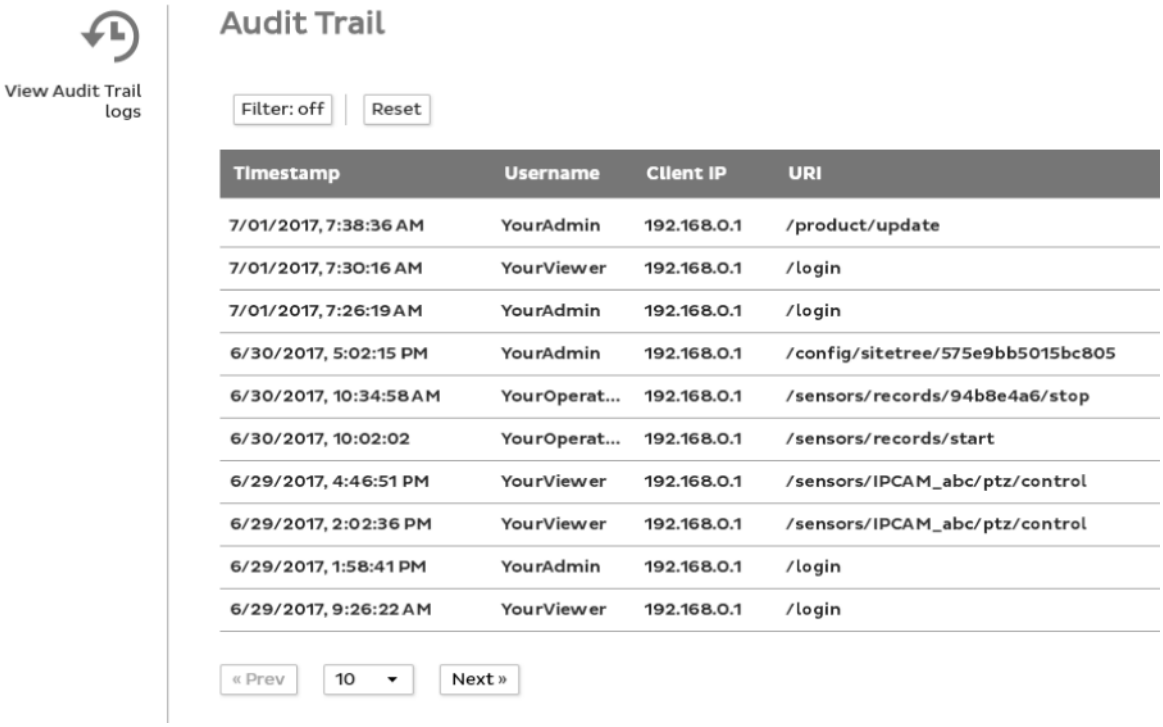
2.11.1 Role permissions

Each role has different permissions. Only the role ADMIN has the permission to create or change users.

Permission	VIEWER	OPERATOR	CONFI-GURATOR	ADMIN
View home screen and monitoring state	x	x	x	x
View sensor live views	x	x	x	x
View alert recordings	x	x	x	x
Change display options of the map	x	x	x	x
Navigate on the map	x	x	x	x
Mute alert sound	x	x	x	x
Download alert recordings	x	x	x	x
Create and export reports	x	x	x	x
View Help content	x	x	x	x
Control PTZ camera	-	x	x	x
Flag and comment alert recordings	-	x	x	x
Discard alert	-	x	x	x
Create scheduled reports	-	-	x	x
Delete alert recordings	-	-	x	x
Add, organize, configure or delete sensors	-	-	x	x
Shutdown or reboot sensors	-	-	x	x
Perform sensor and RF spectrum diagnosis	-	-	x	x
Change alerting configuration	-	-	x	x
Change map image and position sensors	-	-	x	x
Change notification options	-	-	-	x
Create and manage user accounts	-	-	-	x
View audit trail	-	-	-	x
Update sensors	-	-	-	x
Reset, backup and restore the system	-	-	-	x
Set system time zone	-	-	-	x

2.12 Audit Trail

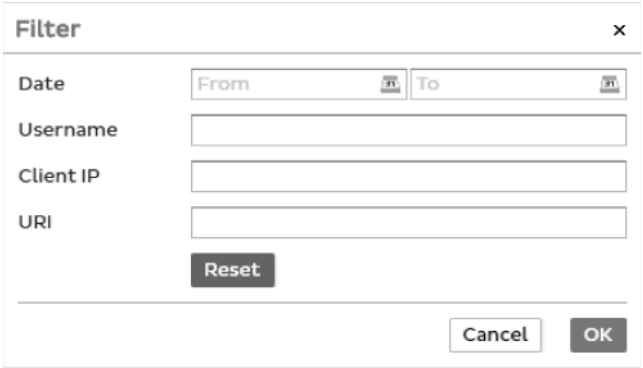
Check the activities of the users in the Audit Trail.



BUTTONS	DESCRIPTION
[Filter]	Filters the table by the chosen options
[Reset]	Resets the filter of table
[<< Prev] [10] [Next >>]	Page navigation Choose the number of entries shown on one side.

2.12.1 Filter the list

You have the option to filter the list:

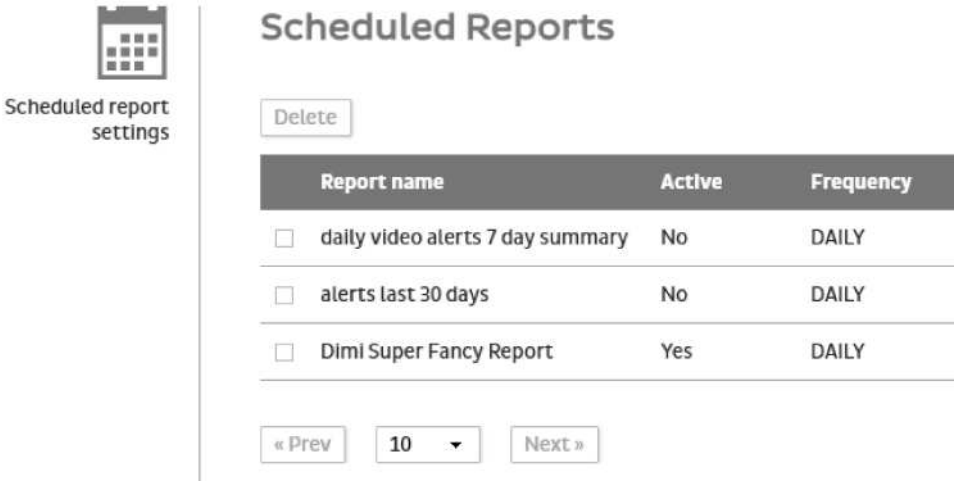


Field	Format	Description
Date	date	Time frame for the alert list

Username	text	Name of the user
Client IP	text	Client IP of the executive user
URI	text	Action of the user

2.13 Scheduled Reports

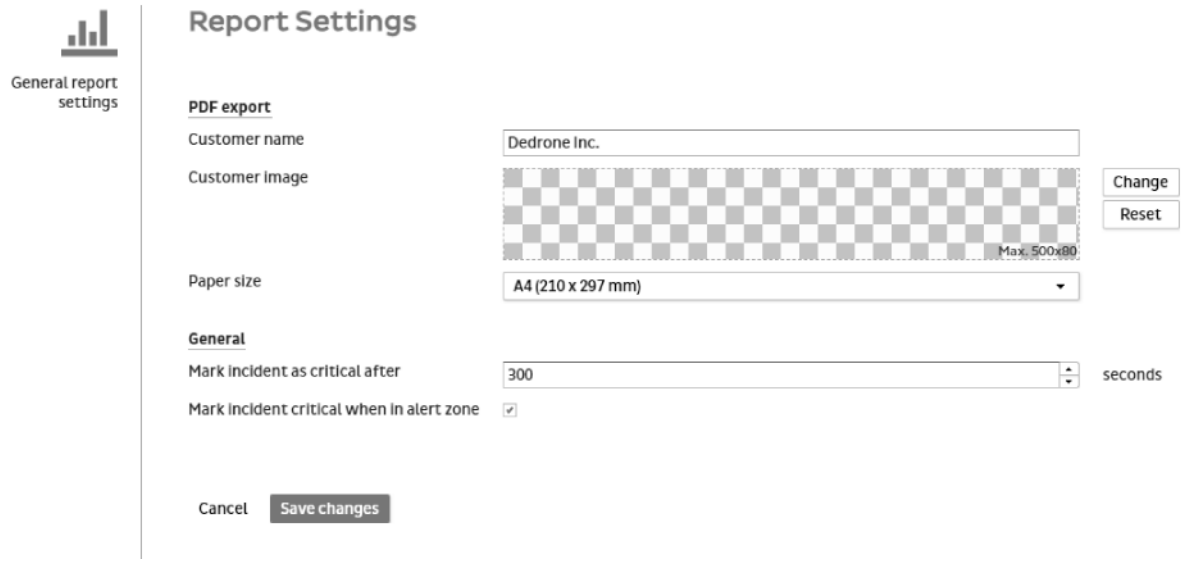
Manage, configure or deactivate your created scheduled reports in this menu.



2.14 Report Settings

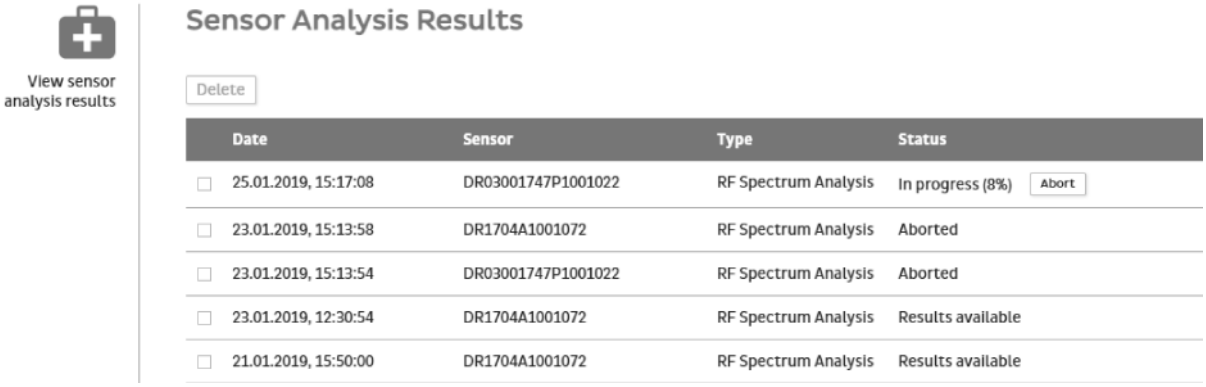
You have the option to customize the exported report pdf to your needs by adding your company name, a logo and the paper format.

Further you can define when an incident is classified as critical.



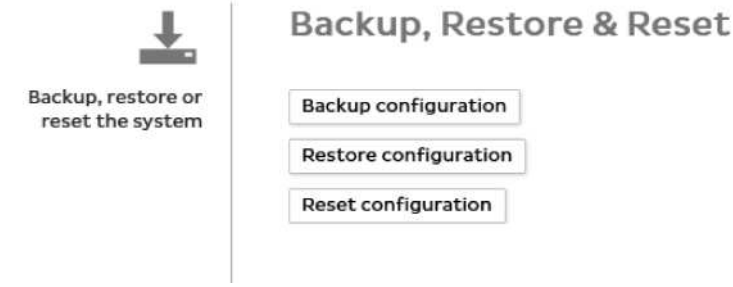
2.15 Sensor Analysis Results

To check the conditions of the RF environment, you have the option to perform a RF spectrum analysis. The results of these analyses are available in this menu.



2.16 Backup, Restore & Reset

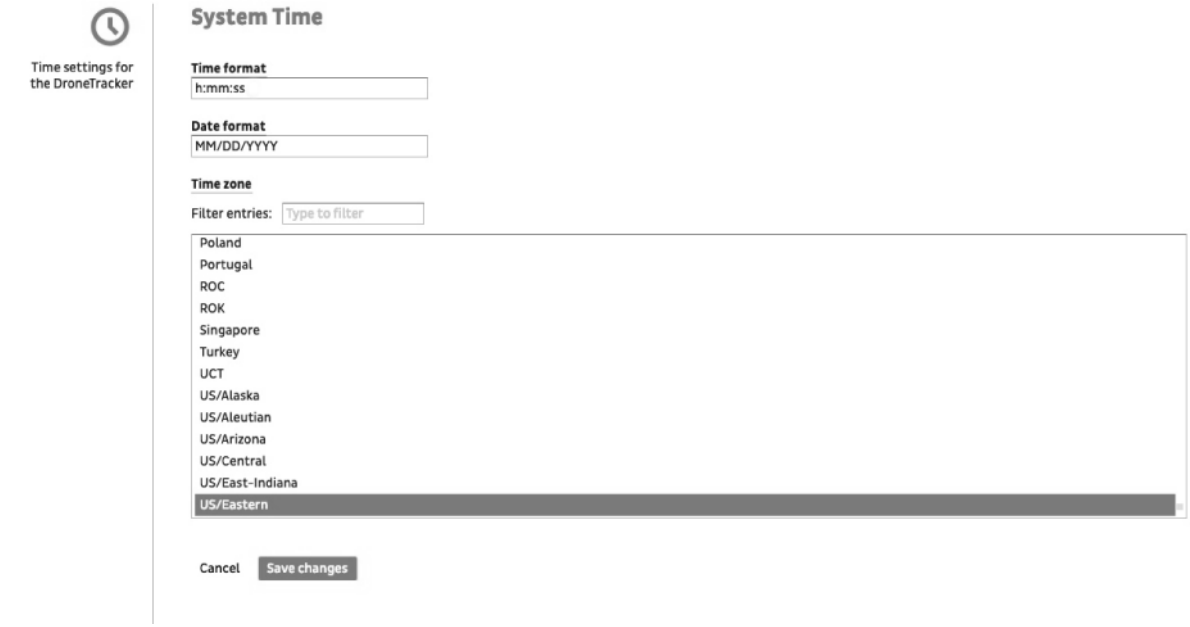
Save a backup, restore from a backup or reset the system.



2.17 System Time

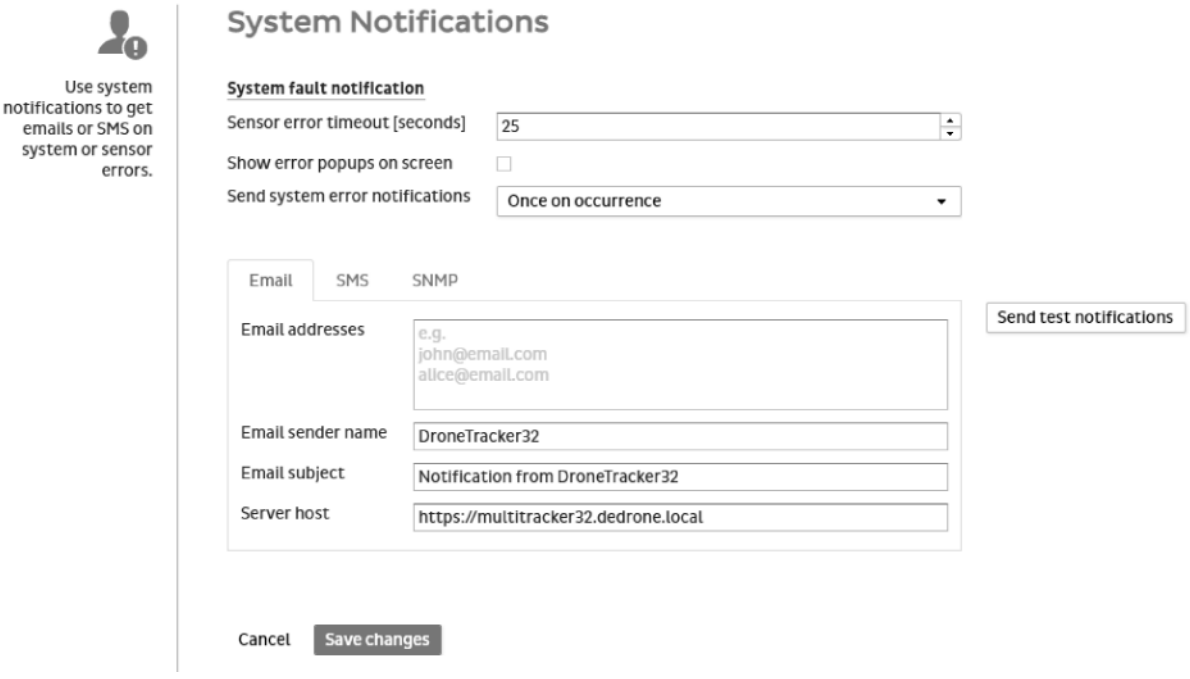
Set the time settings for DroneTracker.

By default, the browser time zone is used to display the server time. If a time zone is selected, it is used for all users of the system.



2.18 System Notifications

Define how and who should be notified in case of a system or sensor errors.



3 Configuration

3.1 Change login password

1. Choose menu admin > **Profile page**.
2. Choose **[Change password]**.
   ► The window **Change Password** appears.

3. Enter the old password and two times the new password.
4. Choose **[OK]**.

3.2 Site Configuration

3.2.1 Add sensor

3.2.1.1 Add a sensor to the Site Configuration

- Register device
- Add Dedrone RF sensor

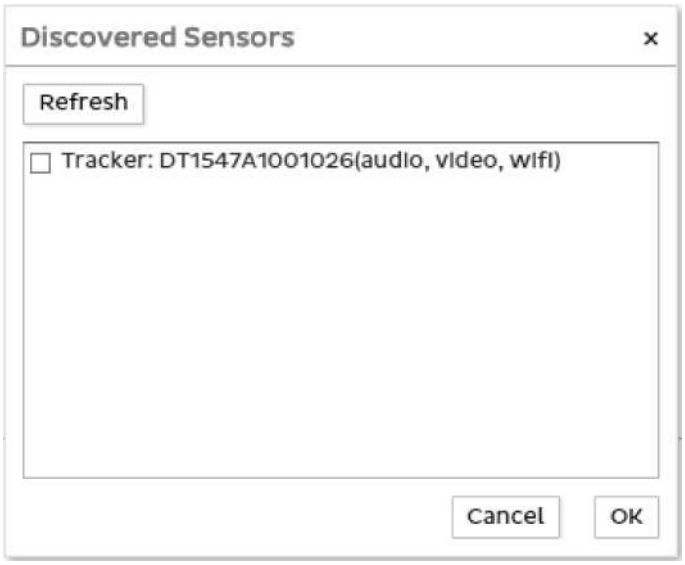
Register device

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > Register device**.
   ► The window **Register device** appears.

3. Enter the registration key of your sensor.
4. The sensor appears in the Site Explorer.
5. To sort the devices and sensors in the Site Explorer, drag and drop the element to the desired position.
6. Choose **[Save changes].**

Add Dedrone RF sensor

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > Dedrone RF Sensor**.
   ► The window **Discovered sensors** appears.



3. Select the desired device and choose **[OK]**.
   ► The selected elements appear in the Site Explorer.
4. To sort the devices and sensors in the Site Explorer, drag and drop the element to the desired position.
5. Choose **[Save changes]**.

3.2.2 Rename sensor

1. Choose menu **OPTIONS > Site Configuration**.
2. Double-click on the desired sensor**.**

▶ The window **Sensor details** appears.

3. Write the desired name in the field **Label**.
4. Choose **[OK]**.

3.2.3 Remove a sensor from the Site Configuration

All sensor information is lost

By deleting a sensor from the Site Configuration, all information about the sensor (e.g. IP address, configuration) will be lost.

- Consider muting the sensor instead of deleting.
- If you want to reconnect the sensor in the future, note the IP configuration, longitude, latitude, azimuth etc. of the sensor.
  (**OPTIONS >** Site Configuration **>** right-click on desired sensor > IP configuration and
  OPTIONS > Map Editor **>** choose desired sensor in drop-down-list or on the map)

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Right-click on the desired sensor.
3. Choose **Remove**.
   ▶ Behind the chosen element appears **(removing)**.
4. Choose **[Save changes]**.

3.2.4 Advanced sensor settings

3.2.4.1 Upload configuration profile

A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

Procedure:

1. Choose **OPTIONS > Site Configuration > [Manage profiles]**.
   ▶ The menu **Sensor configuration profiles** appears.
2. Choose **[Install]** and choose the profile file (format: *.json).
3. To overwrite an existing profile select the option **Overwrite existing?**
4. Choose **[OK]**.

3.2.4.2 Assign configuration profile to a sensor

A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Double-click on the desired sensor.
   ▶ The window **Sensor details** appears.

3. Choose the desired profile in the drop-down-list **Profile**.
4. Choose **[OK]**.

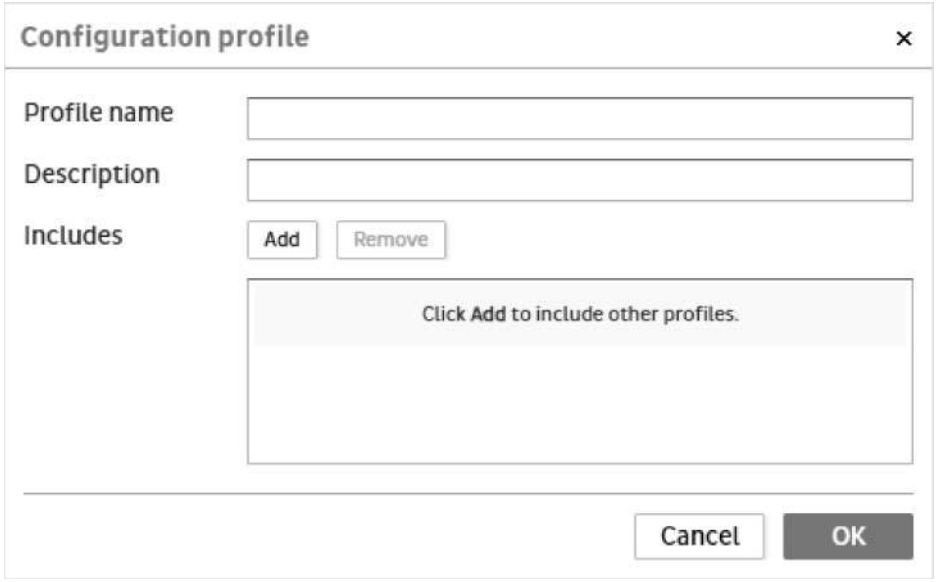
3.2.4.3 Create custom configuration profile

A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

You have the option to create your own custom configuration profile by combining existing profiles.

Procedure:

1. Choose **OPTIONS > Site Configuration > [Manage profiles]**.
   - ▶ The menu **Sensor configuration profiles** appears.
2. Choose **[New]**.
   - ▶ The window **Configuration profile** appears.



3. Enter a profile name and description.
4. Choose **[Add]** .
   - ▶ A list of the existing profiles appears.
5. Choose the desired profile and choose **[OK]**.
6. Add more profiles if needed.
7. Sort the profiles in the order of execution by drag and drop. The profile at the top of the list will be executed first.

3.2.4.4 Edit radio sensor configuration

The radio sensor configuration helps in some special cases to improve the radio frequency detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done with an understanding of the effects the changes will make and carefully. Monitor the effects of your changes in the following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.
3. Choose **Configuration**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
General		
Reduce sensitivity by	dB	Reduces the sensitivity of the radio sensor. This could result in reduced range of the sensor. default: 0

3.2.4.5 Edit Wi-Fi sensor configuration

The Wi-Fi sensor configuration helps to improve the Wi-Fi detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done knowingly and carefully. Monitor the effects of your changes in following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.

3. Choose **Configration (Wifi)**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
Detection		
Detection Threshold	%	Wi-Fi signal threshold for triggering an alert min.: 0 % max.: 100 % default: 20 %
Livestream device limit	number of devices	Limits the number of devices displayed in the Wi-Fi live view default: 20
Localization	true/false	Enables Wi-Fi trilateration For localization via Wi-Fi signal, at least 3 enabled Wi-Fi sensors are required. default: false
Treat cameras as drone	true/false	Treat Wi-Fi cameras (e. g. GoPro) as if a drone were detected.

3.3 Map Editor

3.3.1 Load map

3.3.1.1 Load online map

1. Choose menu **OPTIONS > Map Editor**.
2. Choose menu **[More] > Map settings > Use global map**.
   ► A map is shown. If the location information of your browser is available, the map is centered on this position.

3. By dragging & dropping or using the search bar you can navigate to the desired address, location, region or geo-position.
4. To define the chosen position as home position, right-click on that position and choose **Use as home position**.
5. To change the map scheme, map scale and other map options, choose the desired options in the map options in the lower right corner.
6. For an optimal contrast between the elements of the DroneTracker System and the map, configure the brightness of the map .
7. Choose **[Save changes]**.

3.3.1.2 Load and configure a custom map

If you prefer to use your own map image or your system does not have an internet connection, you have the option to upload an image (.jpg, .jpeg, .png, .bmp, .tiff, .tif, .gif).

To enable the system to visualize the position of a detection, the image has to be equipped with GPS coordinates. Therefore, it is necessary to set at least **2 location markers.** The more location markers are set, the better the accuracy of the GPS calculation will be.

Tip: Measure the GPS coordinates of at least 2 prominent positions on your site before configuring the sitemap image.

By using the format GeoTIFF the included position information will be recognized automatically after the upload.

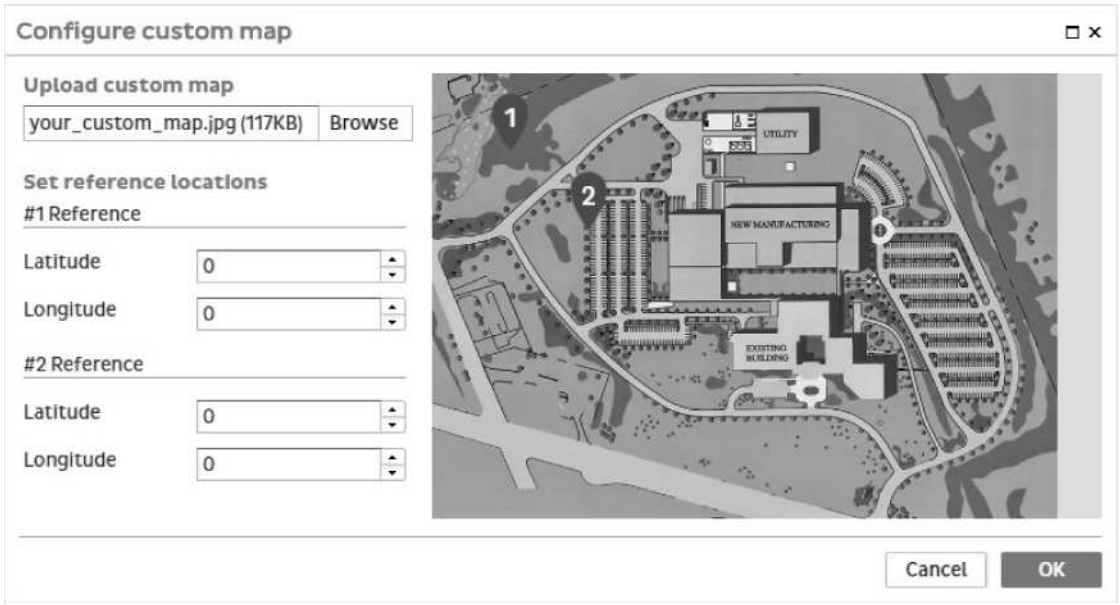
Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. Choose menu **[More] > Map settings > Use custom map**.

▶ The wizard **Configure custom map** appears.

3. Choose **Browse** and select your graphic. Therefore, the format has to be .jpg, .jpeg, .png, .bmp, .tiff, .tif or .gif.
4. Choose **[OK]**.

▶ The graphic appears in the map preview.



▶ Two location markers are set by default on the map.

5. To move a location marker, drag and drop it on the image.
6. Enter the according latitude and longitude values on the left.

1 To set additional location markers on the map, double-click on the image and enter the according latitude and longitude values on the left.

7. To delete a location marker, right-click on the location marker and choose **Delete location marker**.

8. Choose **[OK]**.
9. Choose **[Save changes]**.

3.3.2 Add and configure zones

It is possible to configure zones on the sitemap. There are two kinds of zones:

- Alert zone - triggers an alert if a drone is detected inside of it.
- Interest zone - triggers a warning if a drone is detected inside of it.

The recording starts regardless of the triggered zone type automatically in case of an alert or warning.

The alerting behavior of detections without position can be configured globally.

Procedure:

1. Choose **OPTIONS > Map Editor.**
2. Choose button **[Add] > Alerting zone**.
   ▶ An alert zone appears on the map and in the sidebar the according options are shown.
3. Write a zone name in the field **Label**.
4. To change the type of zone, choose the desired entry in the field **Zone type**.
   ▶ The color of the zone changes depending on the type of zone.
5. To form or move the zone, click and hold the nodes on the zone.
6. To add a node to the form, right-click on a node and choose **Insert node**.
   ▶ The new node appears clockwise next to the chosen node.
7. To delete a node from the form, right-click on the desired node and choose **Delete node**.
8. To lock the settings, activate the option **Lock settings**.
9. Choose **[Save changes]**.

3.3.3 Position and align a sensor

Wrong drone positions will be a result of inaccurate sensor positions.

Accurate positioning and alignment of the sensors on the sitemap has a significant impact on the drone detecting and positioning result of the system.

- If you use a custom sitemap image, make sure that the sitemap is calibrated with location markers.

- Position and align the sensors as accurately as possible.

Depending on the map type and the sensor types, there are different ways to calibrate the map and the sensors. The basis of the positions and alignments in DroneTracker are GPS coordinates. By using an online map, the calibration of the map is handled automatically. Uploaded sitemap images need to be calibrated by manually setting location markers.

Precondition:

- Sensors have been added in the site configuration.
- Calibrated sitemap is configured (see Load online map or Load and configure sitemap image)

Depending on the type of sensor, you have different options for the positioning and alignment:

- Position and align a sensor manually
- Position and align a Pan-Tilt-Zoom Camera (PTZ)

3.3.3.1 Position and align a sensor manually

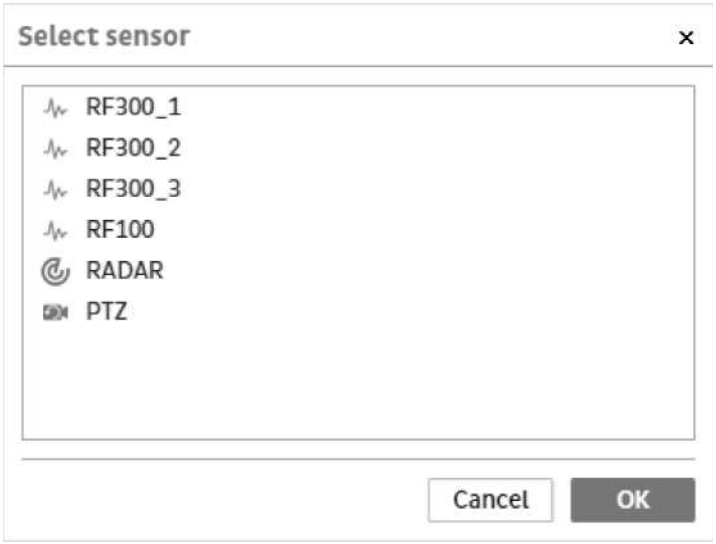
Precondition:

- Sensors have been added in the site configuration.

Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. If a senor is added in the Site Configuration and is not positioned on the sitemap a notification is shown in the lower left corner.
   Add the sensor by clicking on the notification.
   - A symbol of the device or sensor is shown on the map.
3. To choose a sensor from a list:
   - Choose **[Add] > Sensor**.

► The window **Select sensor** appears.



- Choose the desired sensor.

► A symbol of the sensor is shown on the map.

1. For approximate positioning and alignment of the sensor, drag and drop the symbol to move it to the desired position and drag and drop the range display to align it (azimuth).
2. For numeric positioning and alignment of the sensor, choose the element on the map and enter the following values:

Lock settings	Locks all settings of this sensor
Latitude	Latitude GPS coordinate in decimal degrees (e. g. 51.312349)
Longitude	Longitude GPS coordinate in decimal degrees (e. g. 9.492333)
Azimuth	Horizontal alignment in degree 0 = north 90 = east 180 = south 270 = west
Range	Range of the sensor in meters For IP cameras and RF-300s the configuration of the option **Range** determines where detected drones are drawn on the map. To show or hide the range displays of the elements, activate or deactivate the option  . This option affects the display of the range displays on the home screen and the Map Editor.

	To hide the range indicator of a single element constantly, choose the desired element in the sensor list or on the map and deactivate the option **Show range**.
Angle of view	Horizontal angle of the camera lens in degree In case of a wrongly entered value, a detected drone will be incorrectly drawn on the sitemap.
Height	Height of the installed DroneTracker or sensor in meters The height values should be entered relative to each other. You may for example use the GPS height or any locally available height measurement reference system
Elevation	Vertical alignment in degrees (maximum 90, minimum -90) 0 = straight ahead Positive values = alignment skywards Negative values = alignment to the ground
Show range	Deactivate this option to hide the range display. This effects the Home screen and Map Editor.

3. Choose **[Save changes]**.

3.3.4 Configure a Point of Interest

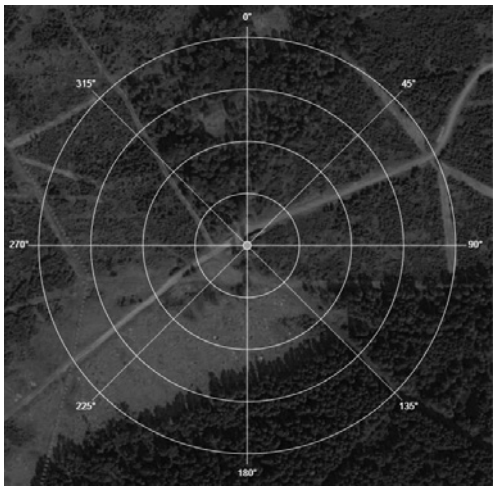
For better assessment of a drone threat, Point of Interests can be positioned on the map. When a drone position has been detected, the drone's direction of movement to the defined point of interest is displayed on the map.

Additionally, a tactical overlay can be enabled around every Point of Interest. The sector of the tactical overlay in which the drone is located is highlighted. The scaling of the tactical overlay is configurable.

Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. Choose **[Add] > Point of Interest**.

▶ The Point of Interest with the tactical overlay is shown.



3. For approximate positioning drag and drop the Point of Interest to the desired position.
4. For a numeric positioning fill in the fields **Latitude** and **Longitude**.
5. To rename the Point of Interest, enter the desired name in the field **Label**.
6. To configure the tactical overlay enter the following values:

Enabled	Display or hide the tactical overlay of the Point of Interest
Draw axes	Display or hide the axes of the tactical overlay
Axis labels	Choose the label of the axes: • **None**: No labels are displayed • **Degrees**: Axes are labeled in degree • **Mils**: Axes are labeled in mils
Number of axes	Configures how many axes the tactical overlay uses (4 to 64).
Range	Configures the radius of the tactical overlay in meters (50 to 1000).
Sub-Range	Configures the subdivision size in meters of the tactical overlays ring (25 to 250).
Azimuth	Configures the angle of the tactical overlay relative to the site maps north (0 to 359).

7. Choose **[Save changes].**

3.3.5 Add planning sensor

It is possible to add planning sensors on the sitemap. Planning Sensors are virtual sensors to plan a site. Planning Sensors are just shown in the Map Editor and do not appear in the Site Explorer on the home screen.

A Planning Sensor can be configured as any kind of sensor.

Procedure:

1. Choose **OPTIONS > Map Editor.**

1 Choose button **[Add] > Planning sensor**.

   ▶ The window **Add Planning Sensor** appears.

2. Write a name in the field **Label.**
3. Choose the type of sensor in the drop-down list **Type**.

   ▶ Depending on the sensor type, the sensor appears on the sitemap. The label of the planning sensor is marked with "(Planning)".

4. Position and align the sensor on the map.
5. Choose **[Save changes]**.

3.3.6 Lock/unlock elements on the sitemap

All elements on the sitemap can be locked or unlocked centrally. You have the option to secure your configuration from unintended changes.

It is also possible to lock and unlock the settings of single elements (see Position and align a sensor and Add and configure zones). When using the central option, all single lock settings will be overwritten.

Lock all elements:

1. Choose **OPTIONS > Map Editor.**
2. Choose **[More] > Lock all elements**.

   ▶ The window **Warning** appears.

3. Confirm with **[Yes]**.

   ▶ The option **Lock settings** of all elements is activated.

Unlock all elements:

1. Choose **OPTIONS > Map Editor.**
2. Choose **[More] > Unlock all elements**.

► The window **Warning** appears.

3. Confirm with **[Yes]**.

► The option **Lock settings** of all elements is deactivated.

3.3.7 Delete a sensor or zone from the sitemap

1. Choose menu **OPTIONS> Map Editor**.
2. Choose the desired sensor or zone on the map or in the drop-down list in the upper left corner.
3. Choose **[Delete]** in the menu bar.

► The sensor or zone disappears of the map. The removed sensor is still active part of the system and can trigger an alert.

4. Choose **[Save changes]**.

3.4 Configure alerting

Depending on the deployed sensors, the alerting behavior of the system should be configured differently. Whether alert or warning, the recording starts automatically.

Procedure:

1. Choose **OPTIONS > Alerting Configuration**.
2. Set desired configuration:

Detection	
Enable alerting*	Activates any kind of alerting **Security gap!** By deactivating this option, the system cancels the current alert and does not create any further alerts.
Alert timeout	Time after the last detection until an alert end **30 sec** is default and recommended.

Detection mode	Configures the global alerting behavior **RF or Wi-Fi required*** An RF sensor or Wi-Fi sensor has to trigger to create an alert. For an absolutely sensitive system configuration, this option is not recommended. If the RF detection does not trigger, the system never creates an alert. This could be misleading for example during product demonstrations. **Any type of sensor** Any type of sensor can trigger an alert. This increases the sensitivity of the system but could also lead to more false positives.
Handling of positions and zones	
Treat detection without position as	Configures the alerting behavior of detections without any position information (e.g. Wi-Fi or Audio alerts) **Ignored** Detections without position information will be ignored **Warning** Detections without position information will trigger a warning **Alert** * Detections without position information will trigger an alert
Treat detection outside zone as	Configures the alerting behavior of detections outside of zones (position required) **Ignored** Detections outside any zone will be ignored **Warning** Detections outside any zone will trigger a warning **Alert** * Detections outside any zone will trigger an alert

* Default setting

3. Choose **[Save changes]**.

3.5 Notifications

3.5.1 Set alert notifications

Precondition:

- For Email and SMS an existing internet connection is necessary.

Procedure:

1. Choose menu **OPTIONS > Alert Notifications.**
2. To set the popup notification for drone alerts on the DroneTracker UI, activate or deactivate the checkbox **Show alert popup on screen**.
3. To set the audio alert on the DroneTracker UI, activate or deactivate the checkbox **Play audio alert sound**.
   Note for Safari: When using the web-browser Safari, make sure that the Safari option **Auto-Play** is enabled.
4. Choose the desired entry in the drop-down list **Send alert notifications**:

Never	All alert notifications will be deactivated.
On alert start	If the system triggers an alert, a message will be sent.
On alert end	If a triggered alert ended, a message will be sent.
On alert start and end	If the system triggers an alert, a message will be sent and if a triggered alert ended, a message will be sent.

5. To restrict the Email and SMS notification to alerts in alert zones, choose the option **No Email/SMS for Warnings**.
6. Choose one or more desired notification channels and enter the desired recipients in the fields:

Email	
Email addresses	Email address of the recipient. Separate multiple addresses by a comma and a space.
Email sender name	Sender name which is shown in the email
Email subject	Email subject of the notification. You can use the following placeholder: **<type>**: shows the type of incident. This could be "Warning" or "Alert".

	<sensors>: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.
Server host	Host name to use for links in Emails
SMS	
Phone numbers	Phone number of the recipient. Use the international notation i.e. +12345678901. Separate more phone numbers with a line break [↵].
SNMP	
SNMP trap server IP and port	SNMP Trap address with port Enter the port separated by a colon directly behind the address.
TCP/IP	
TCP/IP server and port	TCP/IP address with port Enter the port separated by a colon directly behind the address. If a TCP/IP address is set, you have to create your own message by entering something in the field TCP/IP message format.
TCP/IP message format	Any string which will be sent in case of an alert. You can use the following placeholder: **<type>**: shows the type of incident. This could be "\Warning" or "Alert". **<sensors>**: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.

7. To test the configuration choose **[Send test notifications]**.

   ▶ The window Send test notifications appears.

   • Choose **[OK]** to save the changes and send the test notification.

- A test message will be sent to all recipients, except SNMP Trap messages.

8. Choose **[Save changes]**.

3.5.2 Set system notifications

Precondition:

- For Email and SMS an existing internet connection is necessary.

Procedure:

1. Choose menu **OPTIONS > System Notifications.**
2. To set an error timeout before a notification is sent, set a value in seconds in the field **Sensor error timeout [seconds]**. The value can be set between 0 to 300.
3. To set popup notifications for system errors on the DroneTracker UI, activate or deactivate the checkbox **Show error popups on screen**.
4. Choose the desired entry in the drop-down list **Send system error notifications**:

Never	All system fault notifications will be deactivated.
Once on occurrence	A system fault notification will be sent once on occurrence
On occurrence and every hour	A system fault notification will be sent once on occurrence and every hour
On occurrence and every 6 hours	A system fault notification will be sent once on occurrence and every six hours
On occurrence and every 12 hours	A system fault notification will be sent once on occurrence and every twelve hours
On occurrence and every 24 hours	A system fault notification will be sent once on occurrence and every 24 hours

5. Choose one or more desired notification channels and enter the desired recipients in the fields:

Email	
Email addresses	Email address of the recipient. Separate multiple addresses with a comma and a space.
Email sender name	Sender name which is shown in the email
Email subject	Email subject of the notification.

	You can use the following placeholder: **<type>**: shows the type of incident. This could be "Warning" or "Alert". **<sensors>**: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.
Server host	Host name to use for links in Emails
SMS	
Phone numbers	Phone number of the recipient. Use the international notation i.e. +12345678901. Separate more phone numbers with a line break [↵].
SNMP	
SNMP trap server IP and port	SNMP Trap address with port Enter the port separated by a colon directly behind the address.

6. To test the configuration choose **[Send test notifications]**.
   ▶ The window Send test notifications appears.
   - Choose **[OK]** to save the changes and send the test notification.
   - A test message will be sent to all recipients, except SNMP Trap messages.
7. Choose **[Save changes]**.

3.5.3 Deactivate alert notifications

1. Choose menu **OPTIONS > Alert Notifications.**
2. In the drop-down list **Send alert notifications** choose the entry **Never**.
3. Choose **[Save changes]**.

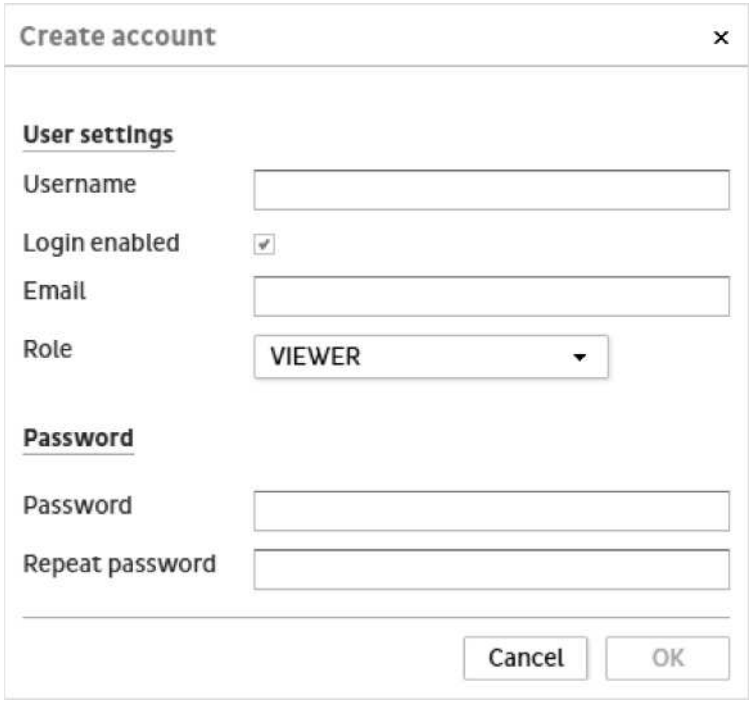
3.5.4 Deactivate system notifications

1. Choose menu **OPTIONS > System Notifications.**
2. In the drop-down list **Send system error notifications** choose the entry **Never**.
3. Choose **[Save changes]**.

3.6 User Management

3.6.1 Create a new user

1. Choose **OPTIONS > User Manager**.
2. Choose **[New user]**.
   ▶ The window **Create account** appears.



3. Enter a user name. Note the following user name policy:
   - At least one character long
   - Only lowercase letters
   - Consists only of letters, numbers and "@ _ - . "
   - No umlauts allowed
4. Enter an email address. This email address is used for the password reset and can be used as login as well.
5. Choose the desired role.
6. Enter a password. Therefore, note the following password policy:
   - At least eight characters long
   - Upper and/or lowercase letters (A-Z / a-z)
   - At least one digit
   - At least one special character

7. Choose **[OK]**.

   ▶ The created user appears in the user list and can be used.

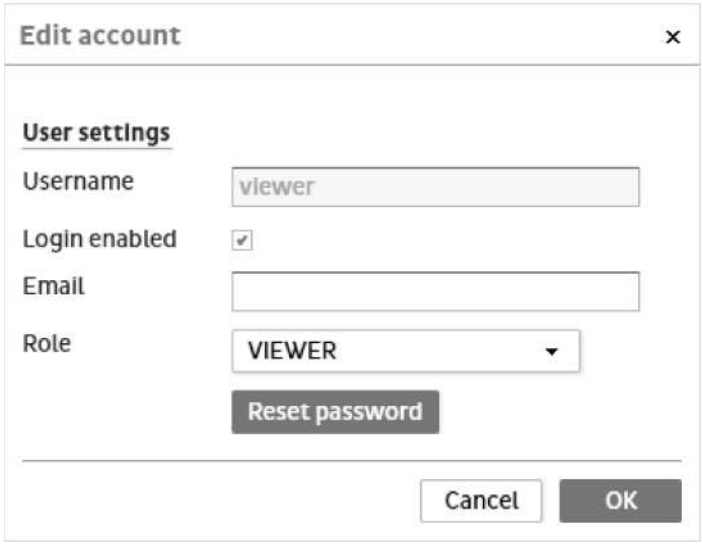
3.6.2 Reset user password

Each user has the option to change his own login password. As an administrator you can reset the password of each user.

Procedure:

1. Choose **OPTIONS > User Manager**.
2. Choose the desired user.

   ▶ The window **Edit account** appears.

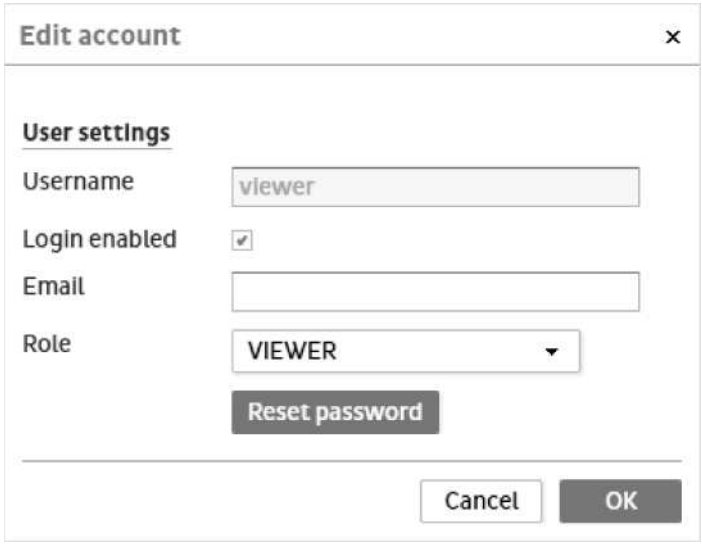


3. Choose **[Reset password]** and enter the new password for the chosen user.
4. Choose **[OK]**.

3.6.3 Change user role or user name

1. Choose **OPTIONS > User Manager**.
2. Choose the desired user.

▶ The window **Edit account** appears.



3. To change the username write the new name in the field **Username**.
4. To change the email address write the changed address in the field **Email**.
5. To change the user role choose the desired role in the field **Role**.
6. Choose **[OK]**.

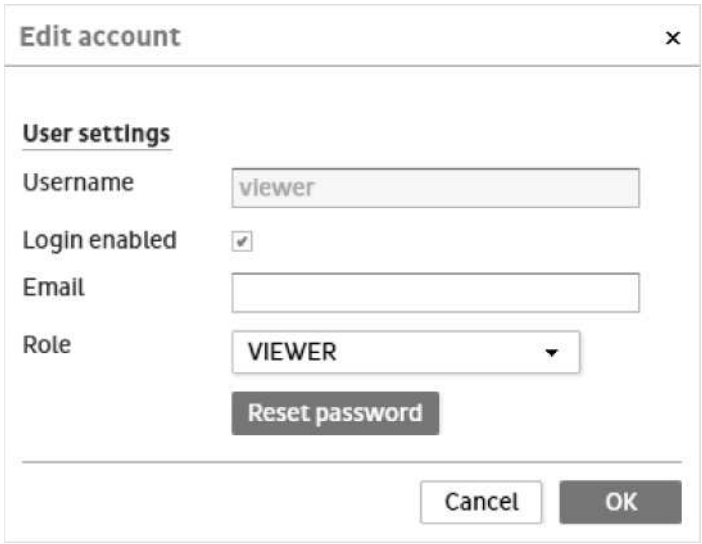
3.6.4 Disable user login

You have the option to disable a user login. Afterwards the user is not able to log into DroneTracker.

Procedure:

1. Choose menu **OPTIONS > User Manager**.
2. Choose the desired user.

▶ The window **Edit account** appears.



3. Deactivate the option **Login enabled**.
4. Choose **[OK]**.

3.7 Set up external access

It is possible to allow external access to the DroneTracker. Thus, you can integrate the DroneTracker into the existing security network.

Precondition:

- Login role as administrator

Procedure:

1. Log in as administrator.
2. Choose menu admin **> Profile page**.
3. Choose **[New token]**.
   ► A generated Token appears above the button.
4. Use this token to authorize your external access to the DroneTracker System.

3.8 Set time zone

This option configures the shown time in the DroneTracker UI.

By default, the browser time zone is used to display the server time. If a time zone is selected, it is used for all users of the system.

Procedure:

1. Choose menu **OPTIONS > System Time**.
2. To change the format of the shown time and date change the entries in the fields **Time format** and **Date format**.
3. Choose the desired time zone. To filter the list, write a continent, region or city in the field **Filter entries**.
4. Choose **[Save changes]**.

4 Monitoring

4.1 Classify target

During an alert you have the option to classify individual detections as **[Friend]** or **[Foe]**, as well as, to **[Ignore]** a detection in the details section.

- **[Friend]**
  The drone symbol on the map is colored green, in the header a banner shows FRIENDLY, and in the alert list the alert will have the alert type "FRIEND".
- **[Ignore]**
  By ignoring a detection the target symbol will disappear from the map. A message is shown for a few seconds above the map you can undo the ignoring. If no other detections are active, the alert ends immediately. The detection is saved in the alert list as alert type "IGNORED". You can filter the list by alert type.
- **[Foe]**
  Drones and remote controls are automatically classified as foe. You can manually classify unverified targets, e.g. from a radar or friend targets as foe. This will trigger an alarm and an alert recording.

4.2 Use PTZ camera (PTZ dashboard)

You can control the PTZ camera manually and watch the PTZ camera view directly in the DroneTracker UI. To see all relevant information on one display a PTZ dashboard is available.

4.2.1 PTZ Modes

A PTZ camera in a DroneTracker System has two operation modes: automatic and manual.

Automatic Mode

In automatic mode the camera searches autonomously for drones. This search includes an active video analysis, as well as, an automated alignment and zooming. For a faster and more accurate search, other sensors of the DroneTracker System like RF-300 or radar can deliver a direction, distance and height for the search.

Manual Mode

When the PTZ camera is moved manually the PTZ camera automatically switches to the manual mode. In manual mode the automatic drone detection is disabled. If the PTZ camera is not moved for 60 seconds it automatically switches back to automatic mode. During the manual mode a message in the PTZ live view is shown where you can switch directly to the automatic mode.

4.2.2 Open PTZ dashboard

- In the sensor list right-click on a PTZ camera and choose **Live view (new tab)**.
    - The PTZ dashboard opens in a new tab.

4.2.3 Dashboard overview

POSITION	EXPLANATION
A	**List of PTZ cameras** Choose the desired PTZ camera to view the live view and control it.
B	**Detection details** Displays the GPS position and movement speed of the drone or remote depending on which sensor type detected the target.

C	**Classify target** as Friend, Foe or ignore the detection by choosing one of these buttons
D	**Activate jammer** (only if a jammer is connected)
E	**Focus PTZ camera** to the selected detection. Focuses a PTZ camera permanently to the detection. The system chooses the best fitting PTZ camera for the tracking. **Not available** for user role **Viewer**.
F	**Site Map** Shows the camera orientation on the map.
G	**PTZ camera live view** Shows the live stream of the PTZ camera. By clicking and dragging you can pan and tilt the PTZ camera. You can zoom in and out with the mouse wheel.
H	**PTZ controls** Pan, tilt and zoom the camera with these controls. Alternatively, you can click and drag in the live view to pan and tilt the PTZ camera.
J	**Pause video** Pause the video streams on the dashboard for deeper investigation. The detection and tracking will continue in the background. By clicking again on the button, the live video stream is shown again.
K	**Take picture of current view** Save the current video image in the alert. When the alert ends the image is stored in the alert recording.
L	**Activate Track** Manually trigger a focused search in the region in the middle of the view. The video detector analyzes the middle of the frame with high sensitivity to search for drones and movements.
M	**Pan angle** Shows the current pan angle in degrees.
N	**Detected video region** In case of a drone detection the identified image section is shown live here. You can swap the image and the live view with the button  in the upper right corner of that window.
O	**Images** During a detection every second an image is updated here. You can save that image in the alert by choosing **Save** on the image. The last 30 images are shown.

4.3 Mute alert sound temporarily

You have the option to mute the alert sound for the current alert.

During an alert the status bar displays an alert banner. If the alert sound is activated, a button is displayed here.

- Choose the button **[Mute sound]** in the alert banner.

► The sound will be turned off for the current alert.

- To turn the sound on again, choose the button **[Sound muted]** at the same position.

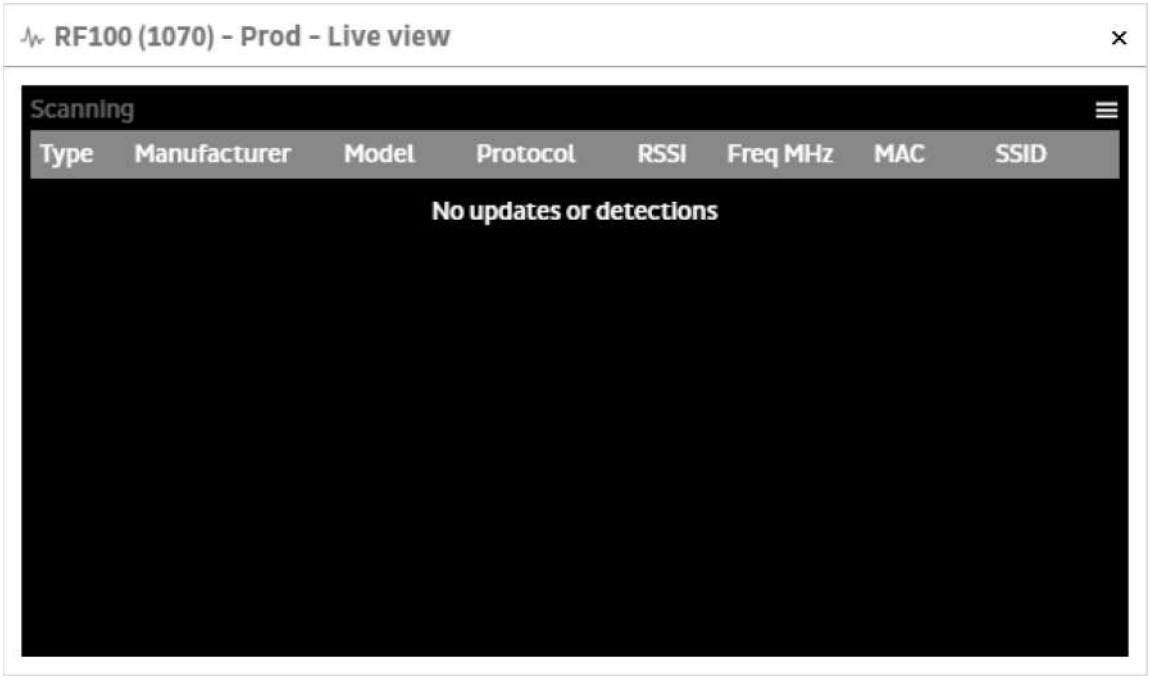
4.4 Display options

4.4.1 Use and organize live views

Enlarge a live view

1. Choose the desired sensor in the menu **SENSORS** on the home screen.
   ► The single live view is shown below the Site Explorer.
2. To enlarge the live view double-click on the live view or right-click on the sensor or live view and choose **Live view**.
3. To open the live view in a new browser tab right-click on the sensor or live view and choose **Open in new tab**.

RF Sensor live view



In the first line of the live view the current status of the sensor is shown (e.g. Scanning).

In case of a detected signal all relevant information is shown in the list.

The button provides some more view options:

- **Pause update**
  Freezes the current live view
- **Expert mode**
  Enables more display options for the live view and displays more detailed information in the list, e.g. RSSI and frequency
- **Show Wi-Fi clients** (only in expert mode)
  Displays the detected Wi-Fi clients
- **Show unknown Wi-Fi devices** (only in expert mode)
  Displays all detected Wi-Fi devices, including routers with Wi-Fi networks etc.

4.4.2 Configure home position

To center the map to a defined position in the home screen you can use the home position button .

Set home position

1. Right-click on the desired position on the map.
2. Choose **Use as home position**.
   ► The map is getting centered at the selected position and the view of the map with its zoom level is saved as home position.

Reset home position

1. Right-click on the map.
2. Choose **Reset home position**.
   ► The home position symbol becomes grey .

5 Analyzing

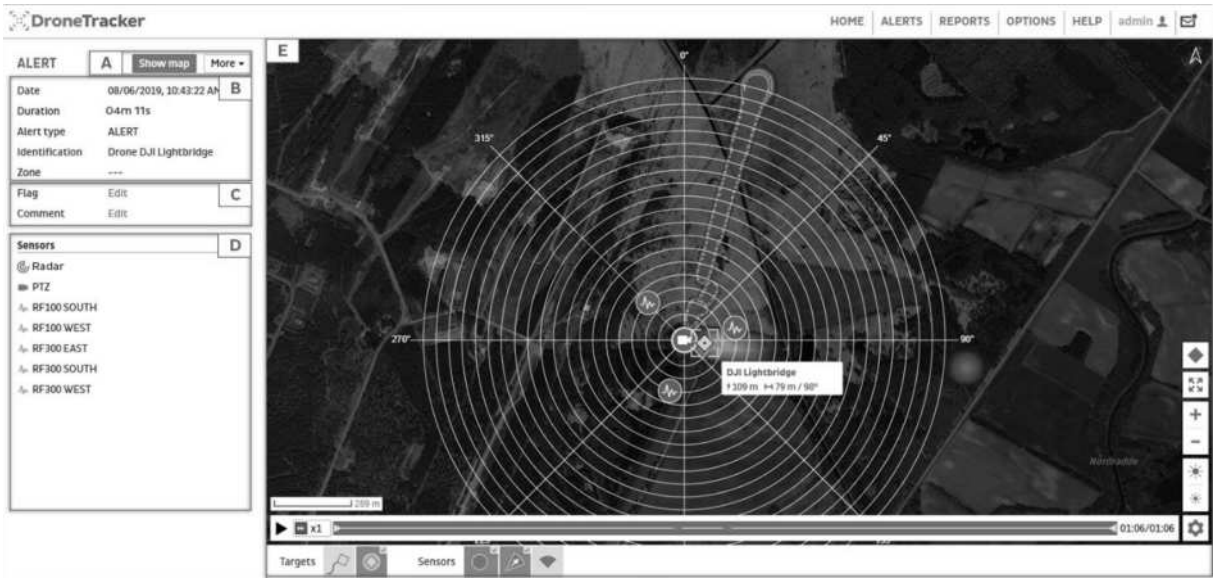
5.1 Alert Recordings

5.1.1 View an alert recording

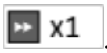
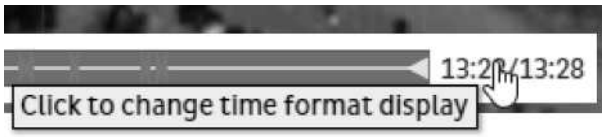
Procedure:

1. Choose menu **ALERTS**.
2. To filter the alert list, choose **[Filter]** and set a filter.
3. Choose the desired alert entry in the list.
   ▶ The window **Alert** will open.

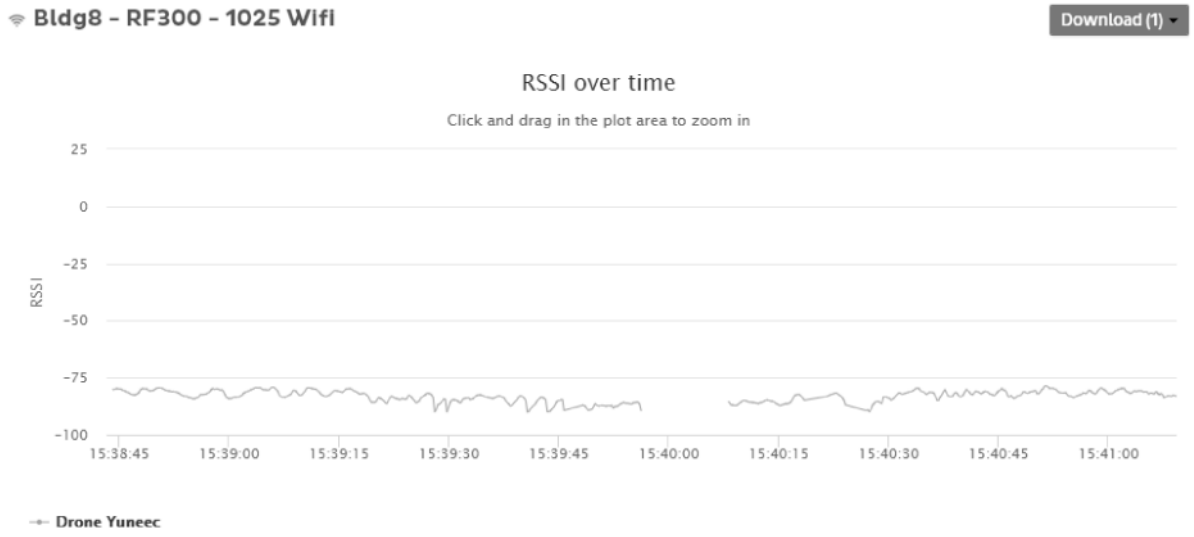
5.1.1.1 Overview of alert recording



POSITION	EXPLANATION
A	**Alert Options** **[Show map]** Here you can display the map with all relevant information on it. In the menu **[More]** you have more options: • **Refresh** Refreshes the alert. This could be helpful if an alert is viewed immediately after the alert happened. The source data may need some time to be uploaded and the sensors recordings are not available yet. • **Show identification details** Shows information about the drone identification. If an RF Sensor is

	involved the RF identifications are shown. If a camera is involved a thumbnail of the drone is shown. • **Download tracks as GPX** Download the fly path as a GPX file.
B	**Alert Details** General information about the alert
C	**Alert Categorization** To organize the alerts in the alert list you can flag and comment each alert. In the alert list and reports you can filter by flags and comments (via the filter **Search alert**).
D	**Alert sources** List of all sensors that were involved in the alert. By choosing a sensor you can watch or download the alert recording of each sensor.
E	**Map, alert playback and sensor view** Here you can playback the alert and find all information about the position of the drone. You can see the heatmap and flight path on the map and use the view options for the desired shown details (flight path, uncertainty, sensors etc.). In front of the timeline you have the option to change the replay speed  . Timeline symbols: In this time span a sensor detected a direction. In this time span a sensor detected a position. You can switch between the alert duration and real time and date of the alert by clicking on the duration.  If a source is chosen the live view recording of the chosen sensor is shown and you can download the raw data. In the timeline of the video playback you can see different information:

5.1.1.2 RF sensor playback



Shows the RSSI values of each detection over time.

Choose **[Download (x)] > Wi-Fi evidence** to download the Wi-Fi alert information in format *.json.

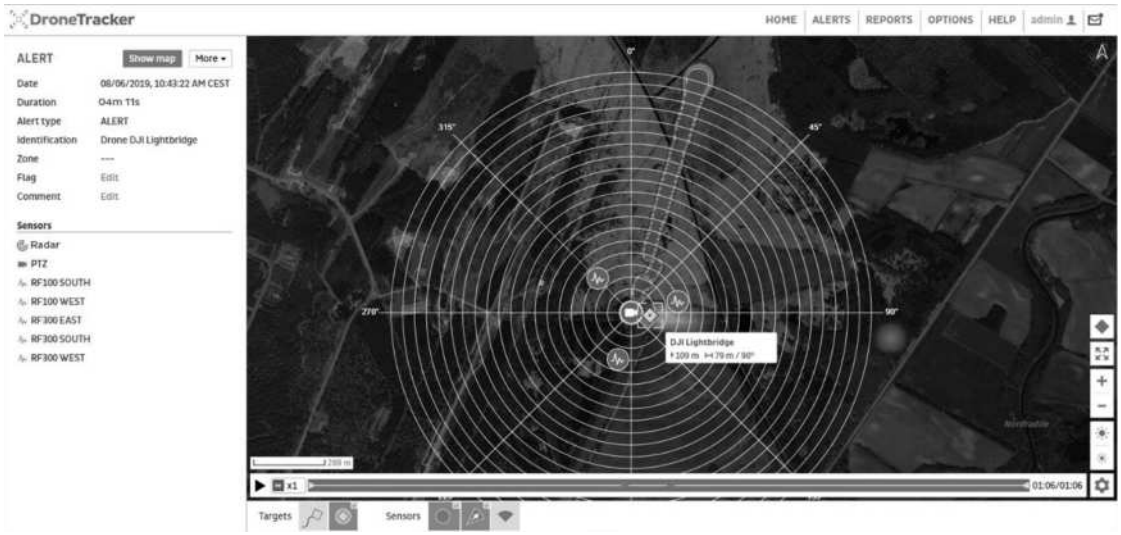
5.1.2 Delete an alert recording

1. Choose menu **ALERTS**.
2. Mark one or more check boxes at the alert.
3. Choose **[Delete]**.
   - ► The window **Confirm Delete** appears.
4. Choose **[OK]**.

5.1.3 Categorize or comment an alert recording

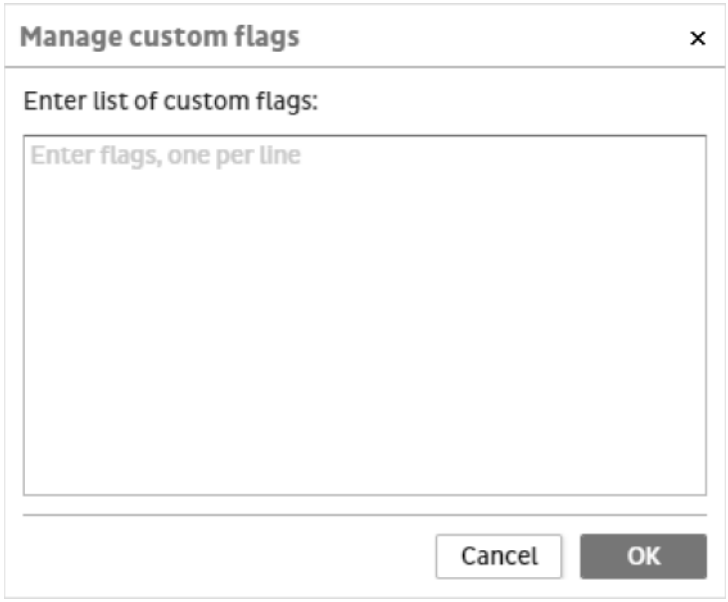
1. Choose menu **ALERTS**.
2. Choose the desired alert entry.

► The window **Alert** will open.



3. To categorize the alert choose **Edit** next to the field **Flag** and choose the desired entry.
4. To create a new flag:
   - Choose **Edit > Manage flags** next to the field **Flag**

   ► The window **Manage custom flags** appears.



   - Write one or more flag names in the field. Separate the flags with a new line (**[Enter]**).
   - Choose **[OK]**.
5. To add a comment to the alert:
   - Choose **Edit** next to the field **Comment**
   - Write your comment in the field.
6. Choose **[Save changes]**.

5.1.4 Export Alert list

You have the option to export the alert list to Microsoft Excel and CSV.

Note: The export is limited to 1000 Alerts.

Procedure:

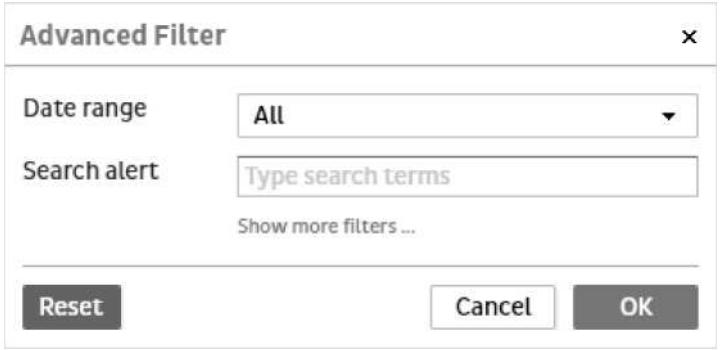
1. Choose menu **ALERTS**.
2. To define which alerts should be exported choose **[Filter]** and set the desired values.
3. Choose **[Export]** and choose the desired export format.
   ► The export file is stored in the default download folder.

5.2 Reporting

5.2.1 Filter the report data

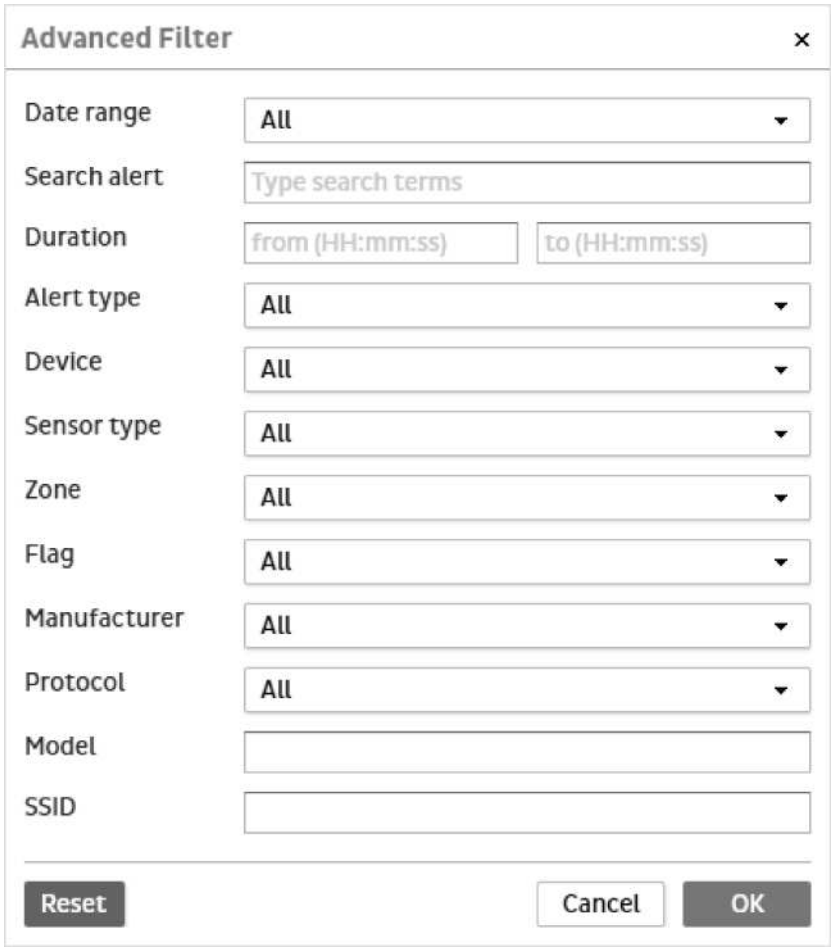
You have the option to filter the content.

1. Choose **[Filter]**.
   ► The window **Advanced Filter** appears.



2. Choose the desired date range from the preselection in the list and the desired search term such as a sensor name, comment, manufacturer etc.
   The field **Search alert** searches most alert fields:
   - Combine terms, e.g. **"remote" "parrot"**: Shows all alerts with remote **and** parrot identifications
   - Exclude terms, e.g. **remote -drone**: Shows all alerts only with remote identifications and no drone identifications.
   - Search for alerts with locations: **locations** or without locations: **-locations**
   - Search for alerts with bearings: **bearings** or without bearings: **-bearings**
   - **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.

3. Choose **Show more filters ...** to enlarge the advanced filter.



Field	Format	Description
Date range	date	Time frame for the data. Choose **Custom** to define a specific time span
Search alert	text	Search alerts by writing a search term like a sensor name, comment, manufacturer etc. Searches most alert fields. Combine terms e.g. **"remote" "parrot"**: shows all alerts with remote **and** parrot identifications Exclude terms, e.g. **remote -drone**: shows all alerts only with remote identifications and no drone identifications. Search for alerts with locations: **locations** or without locations: **-locations** Search for alerts with bearings: **bearings** or without bearings: **-bearings** **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.
Duration	hh:mm:ss	Period of time the alert was present

Alert type	list	Type of alert If a target was classified during the alert the alert type changes. Additionally, the zone (e.g. Warning zone) can have an effect on the alert type.
Device	list	Device involved in the alert
Sensor type	list	Type of sensor involved in the alert
Zone	list	Name of the zones which were triggered (see Add and configure zones)
Flag	list	Flag of the alert
Manufacturer	list	Manufacturer of the classified drone
Protocol	list	Protocol of the detected RF communication
Model	text	Model of the classified drone
SSID	text	SSID of the classified drone
[Reset]	button	Reset the filter
[Cancel]	button	Close the filter window without changing the filter settings
[OK]	button	Apply the configured filter

All text fields are case sensitive.

1. Choose **[OK]**.

5.2.2 Filter report data by region

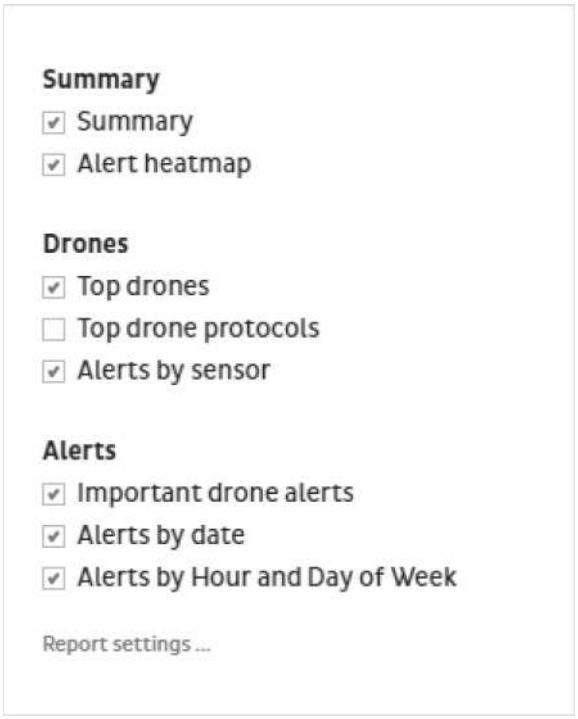
You have the option to filter the data by the shown map section:

1. Choose menu **REPORTS** and scroll to the **ALERT HEATMAP**.
2. Use [**Shift**]**+mouse left** and span a frame over the desired region.
   - ▶ The Report gets reloaded and the filter was added to the set filters.
   - ▶ The report contains only the alerts located within the chosen region.

5.2.3 Choose report content

To configure the report content to your needs, you have the option to show or hide each statistic and diagram.

1. Choose menu **REPORTS** and the menu **Customize**.



2. Activate or deactivate the desired option.

5.2.4 Open alert list according to a report

You have the option to open the alert list within all related alerts of the current report:

1. Choose menu **REPORTS.**
2. Choose the desired filters or region for the report.
3. Use [**Ctrl**] + click on the figure **Total number of alerts**.
   ► The alert list with all alerts, which are used for the report, opens.

5.2.5 Export a report

You have the option to create a scheduled report of your drone incidents.

Procedure:

1. Choose menu **REPORTS**.
2. To define the data content of the report choose **[Filter]** and set the desired values.
3. To define which key figures, diagrams and statistics are shown in the report choose **Customize** and hide or show the desired options.
4. Choose **[Export]** > **Download PDF now**.

► The report will be downloaded on your default download folder.

Customize the report style

You can customize the exported report to your need, e.g. with your company logo and page size (see Report Settings).

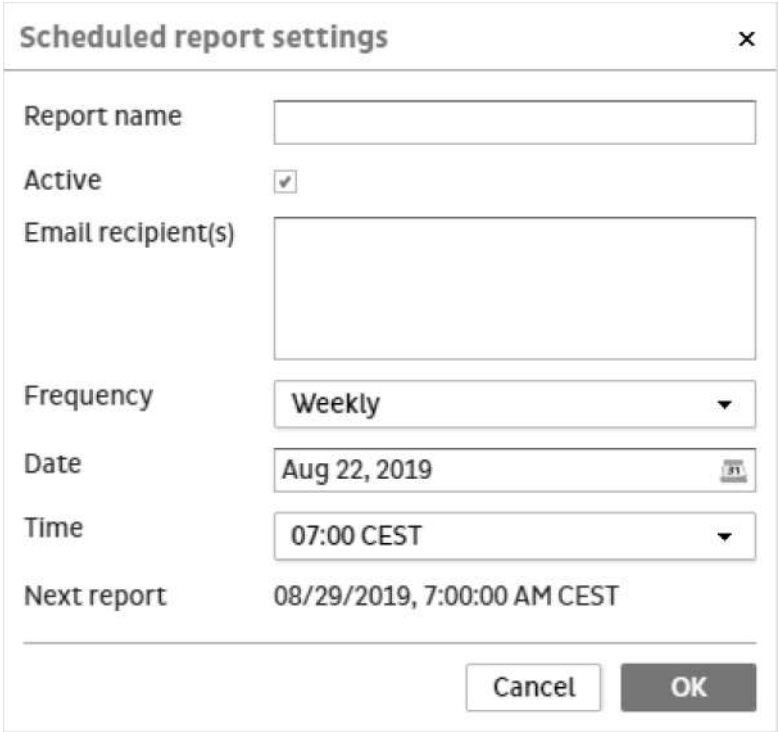
5.2.6 Create a scheduled report

You have the option to create a scheduled report of your drone incidents.

Procedure:

1. Choose menu **REPORTS**.
2. To define the data content of the report, choose **[Filter]** and set the desired values.
3. To define which key figures, diagrams and statistics are shown in the report, choose **Customize** and hide or show the desired options.
4. Choose **[Export]** > **Create new scheduled report**.

   ► The window **Scheduled report settings** appears.



5. Fill in the form. Separate the email recipients with a comma.
6. Choose **[OK]**.

▶ The window **Info** appears.

7. Choose **[OK]**.

▶ The scheduled report is created and listed in the menu **OPTIONS** > **Scheduled Reports.**

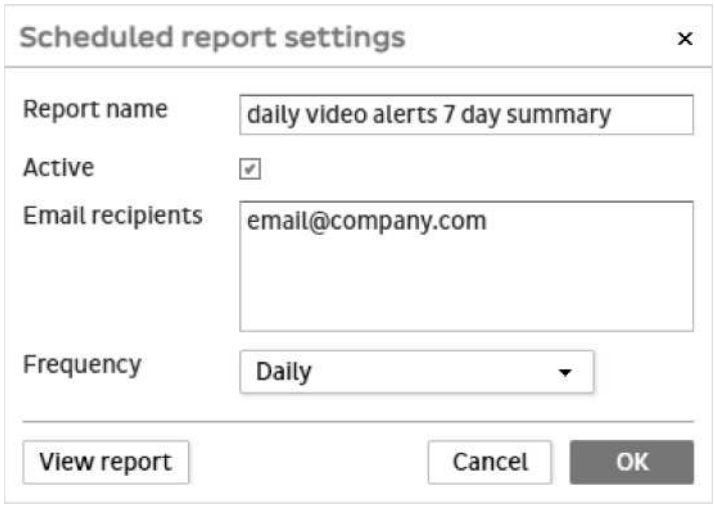
5.2.7 Deactivate a scheduled report

You have the option to deactivate a scheduled report.

Procedure:

1. Choose menu **Scheduled Reports**.
2. Choose the desired scheduled report.

▶ The window **Scheduled report settings** appears.



3. Deselect the option **Active** and choose **[OK]**.

▶ The window **Scheduled report settings** disappears and in the shown list the status of the report has changed to **Active** = **No**.

6 Troubleshooting

6.1 Mute sensor

In case of errors or other unwanted effects of a sensor, it is possible to mute each single sensor.

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Double-click on the desired sensor.
   - ▶ The window **Sensor details** appear.

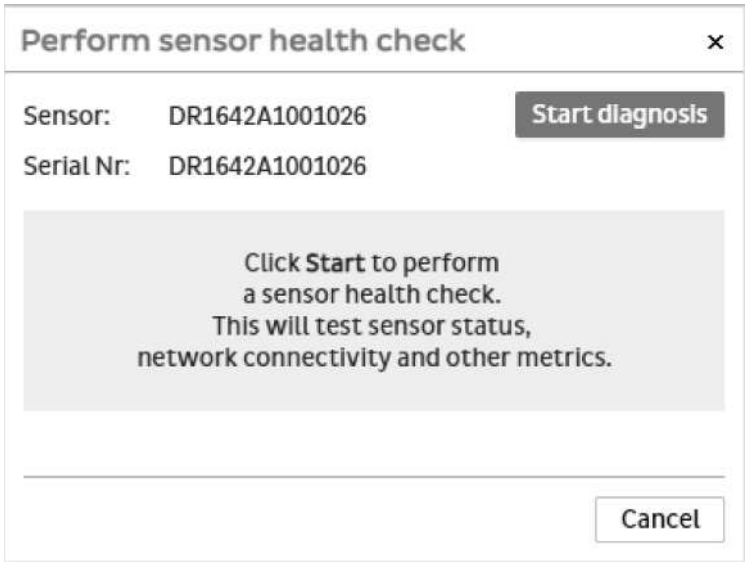
3. Activate the checkbox **Muted**.
4. Choose **[OK]**.
   - ▶ The sensor state in the sensor list changes to **OK (Muted)**.
   - ▶ In the sensor tree of the home screen, the sensor is marked with ⊗.

6.2 Perform sensor health check

In case of connection problems with a RF sensor you have the option to perform a diagnosis for each RF sensor, get an immediate result and a comprehensive log file.

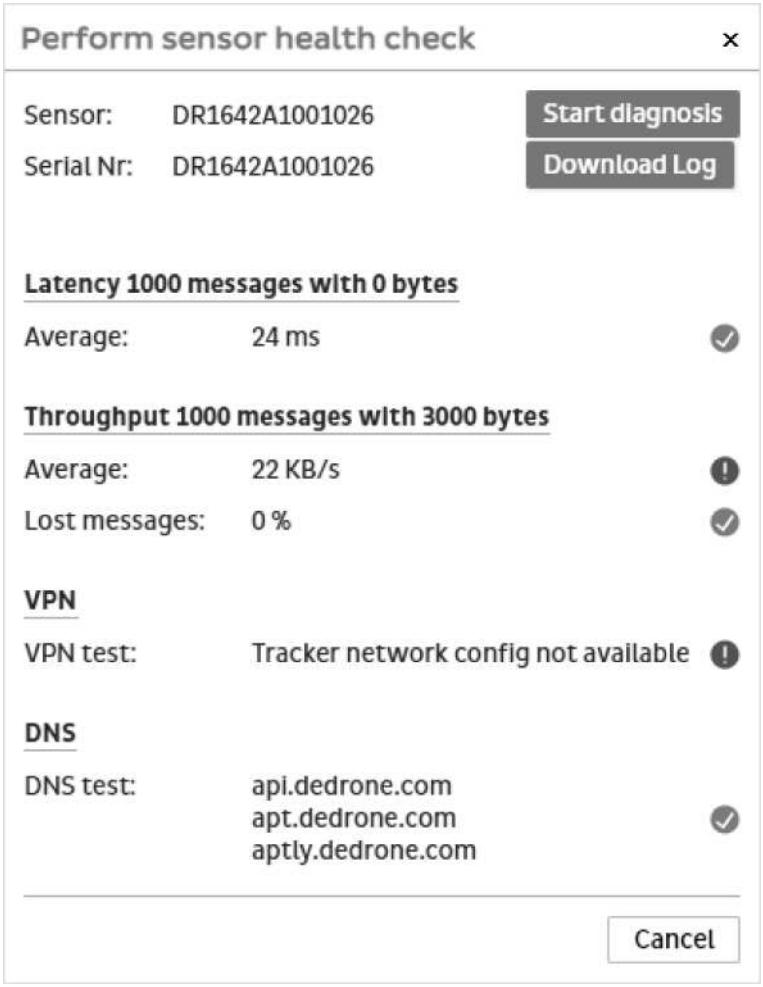
Procedure:

1. Choose menu **OPTIONS** > **Site Configuration**.
2. Right-click on the desired RF devise .
3. Choose **System** > **Perform sensor health check**.
   - The window **Perform sensor health check** appears.



4. Choose **[Start diagnosis]**.
   - The diagnosis starts.

- When the diagnosis has run through, an overview with status information is shown.



5. To download the comprehensive log file of the diagnosis choose **[Download Log]**.
   - The log file is stored in the default download folder and the results can be opened in the menu Diagnosis Results.

6.3 Perform RF spectrum analysis

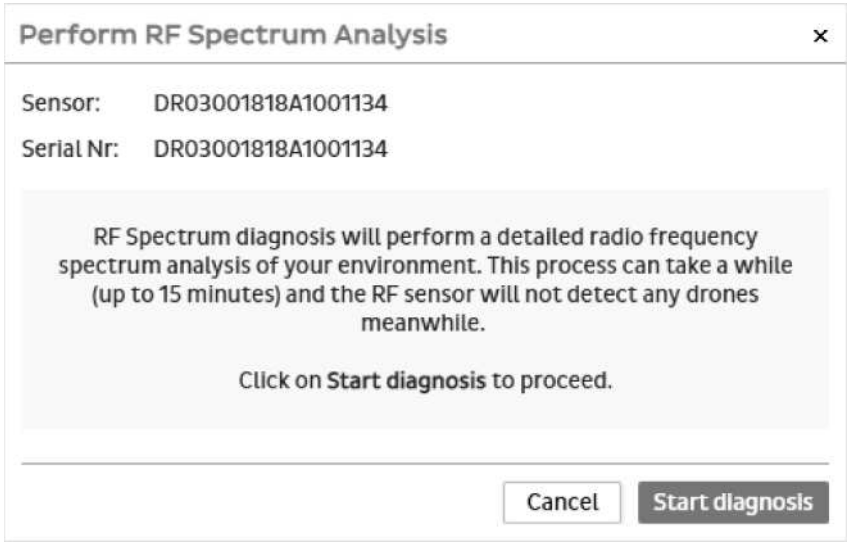
To proof and compare the RF environment you have the option to perform an RF spectrum diagnosis for each RF sensor.

During the diagnosis, the sensor does not detect!

Procedure:

1. Choose menu **OPTIONS** > **Site Configuration**.
2. Right-click on the desired RF sensor .
3. Choose **System** > **RF Spectrum diagnosis**.

▶ The window **Perform RF spectrum analysis** appears.



4. Choose **[Start diagnosis]**.

▶ The message is shown, and the diagnosis starts.

5. Choose menu **OPTIONS** > **Diagnosis Results**.

- All diagnoses results are listed.

6. Choose the desired entry and choose the desired frequency band.

6.4 Backup configuration

The following configurations and settings will be saved in the backup:

- Cloud settings (user, update channels)
- DroneDNA auto update setting
- Site Configuration and IP Whitelist
- Sitemap
- Site configuration (deletes sensors)
  - Sensor configuration
  - Configuration profiles
- Alerting configuration
- Alert and system notifications
- Scheduled reports
- Report settings
- Connector settings
- Dedrone account

Procedure:

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Backup configuration]**.
   ▶ The file **dedrone-tracker-config-[yyyy]-[mm]-[dd]-[hh]-[mm]-[ss].bak** is downloaded in your default download folder.

6.5 Reset configuration

The following configurations and settings will be reset:

- Cloud settings (user, update channels)
- DroneDNA auto update setting
- Site Configuration and IP Whitelist
- Sitemap
- Site configuration (deletes sensors)
  - Sensor configuration
  - Configuration profiles
- Alerting configuration
- Alert and system notifications
- Scheduled reports
- Report settings
- Dedrone account

Procedure:

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Reset configuration]**.

6.6 Restore configuration

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Restore Configuration]**.
   ▶ The window **Upload file** appears.
3. Choose a ***.bak-File** and choose **[OK]**.

6.7 Reboot RF sensor

1 Choose menu **OPTIONS > Site Configuration**.

2 Right-click on the desired RF sensor  .

3 Choose **System > Reboot hardware**.

6.8 Shut down a RF sensor

NOTICE Hardware broken

By disconnecting the cable without shutting down the hardware a sensor could undergo an irreparable software error.

- Always shut down the hardware before disconnecting the cable.

Third-party sensors cannot be shut down in the DroneTracker UI. You can remove the sensors from the system. The hardware of the third-party sensors should be powered down based on the vendor's instructions.

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Right-click on the desired RF sensor  .
3. Choose **System > Shutdown hardware**.

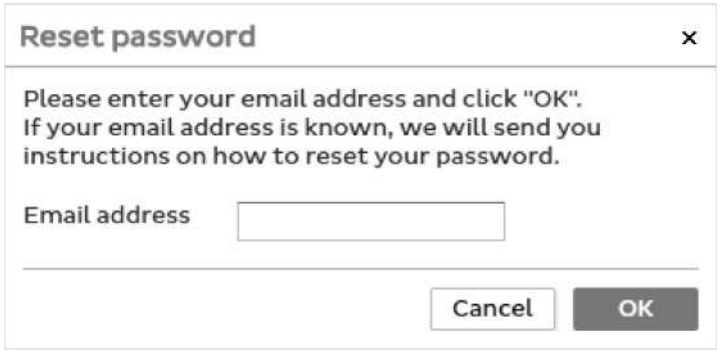
6.9 Forgotten password

If you have forgotten your password, you can reset the password using the stored email address.

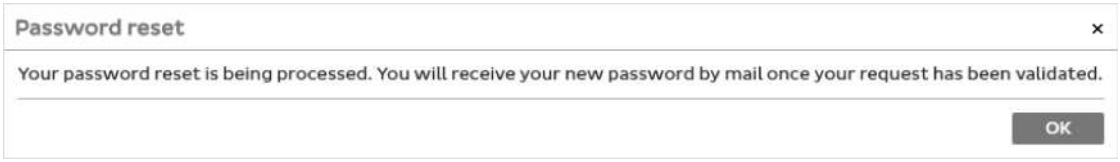
Procedure:

1. Navigate to the login of your DroneTracker System.
2. Choose **[Forgot]**.

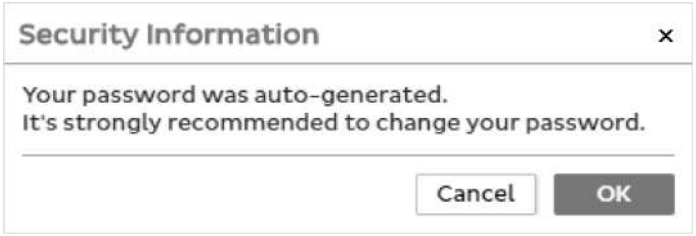
- ▶ The window **Reset password** appears.



3. Enter the email address which you have stored in your profile.
4. Choose **[OK]**.
   - ▶ An email is sent to your inbox.
5. Click on the link in the email.
   - ▶ The window **Password reset** appears.



6. Choose **[OK]**.
   - ▶ An email with your new password is send to your inbox.
7. Navigate to the login of your DroneTracker System and enter your new login credentials.
   - ▶ The window **Security Information** appears.



8. To change your password immediately choose **[OK]** and on the **User profile** choose **[Change password]**.

7 Additional documents

For a properly operating drone detection system the correct and accurate installation and alignment of the sensors is very important.

When installing the sensors pay attention to all advice and information in the installation manuals:

- Installation Manual RF-100
- Installation Manual RF-300

AIRSPACE SECURITY SOLUTION

Dedrone

Dedrone Holding, Inc.
220 Sansome Street
San Francisco, CA 94104
USA

Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

+1 415 813-6116
+49 561 8617990
info@dedrone.com
www.dedrone.com

Dedrone

USER
Manual

DroneTracker User Interface 4.1
On Premises System

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1 The DroneTracker UI

The browser-based, user-friendly DroneTracker UI allows you to easily configure the DroneTracker System or retrieve data such as videos or the history of previous drone alerts. The monitored airspace can also be viewed in real time. When a drone is detected, you will be notified immediately via SMS, email or a variety of network messages.

2 Overview

2.1 HOME

The Home screen is the main window for the DroneTracker System. Here you can monitor the airspace with the installed sensors.

The monitoring section on the left provides all relevant status and alert information and a list of the latest alerts within the last 6 hours.

The DroneTracker System shows the following status:

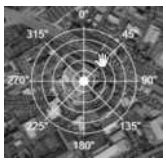
- **SAFE**
  no drone detected
- **WARNING**
  drone or remote is detected or localized in an interest zone. Whether a non-localized drone triggers a warning or not can be configured in Alerting Configuration.
- **ALERT**
  drone or remote is detected or localized in an Alert Zone. Whether a non-localized drone triggers an alert or not can be configured in Alerting Configuration.

A live view of each individual sensor can be shown in the sensor list by selecting a sensor. To enlarge and undock the live view, double-click on the shown live view.

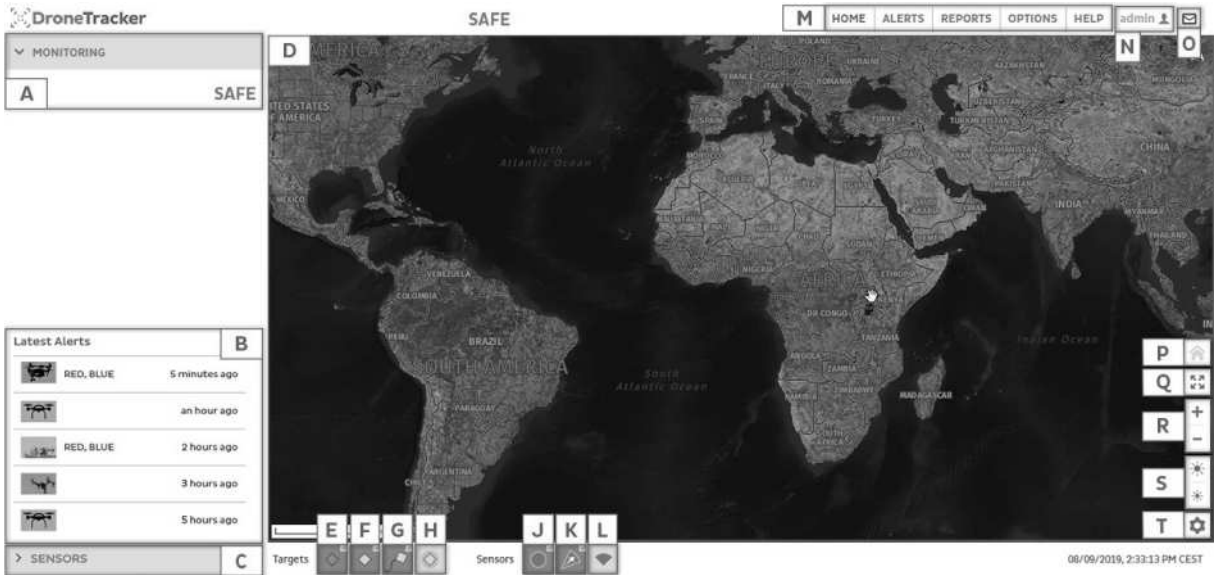
The menu is shown in the header.

2.1.1 Map symbols

	Target position detected by one sensor
	Target position detected by more than one sensor
	Target position of the selected alert detected by one sensor
	Target position of the selected alert detected by more than one sensor
	Friendly target position detected by one sensor
	Friendly target position detected by more than one sensor
	Unverified target position (only with radar sensors)

	Detected remote position
	Detected remote position of the selected alert
	Drone position with uncertainty circle The size of the uncertainty circle displays how accurate the shown drone position is. The smaller the circle, the more accurate the position.
	Movement direction from or to the Point of Interest of the drone or remote
	Flight path of the drone
	Connection between two positions, if the positioning was interrupted
	Tactical overlay
	Alerting zone
	Warning zone
	RF sensor
	Video sensor
	Pan-Tilt-Zoom camera
	Radar sensor

2.1.2 Safe screen



POSITION	EXPLANATION
A	**Monitoring status** In case of an alert or warning, the related live view and all relevant information are displayed here, e.g. duration, drone speed, heading of the drone and drone type.
B	**Latest Alerts** List of up to five latest alerts during the last six hours. The list shows the thumbnail of the alert, the labels of the triggered zones and the time since the alert has happened.
C	**Site Explorer** Shows the configured Sensor Tree with all integrated sensors By choosing a sensor, the respective live view is shown below.
D	**Site map** Displays the configured map of the protected site. In case of an alert or warning the estimated direction or position of detected drones or remote controls is shown on the Site map. If configured, alert and interest zones are shown. If popup notifications are activated, the popup messages are shown in the lower right corner.
E	**Friendly targets** Show or hide all friendly targets on the map (see also Classify target)
F	**Hostile targets** Show or hide all hostile targets on the map (see also Classify target)

G	**Path** Show or hide the drawn path of the selected target. The path shows the movement of the last few seconds.
H	**Uncertainty** Show or hide the uncertainty circle of the selected target.
J	**Sensor icon configuration** Configure when sensor icons shall be shown. • **Show sensors** Always show all sensor icons on the map • **Show sensors on alert** Show sensor icons only if it is triggering an alert • **Hide sensors** Hide all sensor icons on the map
K	**Bearings** Show or hide the bearings of RF-300 sensors
L	**Sensor ranges** Show the sensor range of all shown sensors. Depending on the range display configuration of each sensor single ranges can still be hidden.
M	**Menu** Open alert recordings, reports, configuration options or the online help of the DroneTracker System.
N	**User Role** The logged in user is shown here. You can configure your profile page and logout from the DroneTracker UI.
O	**System messages** Shows current news to the system status
P	**Home position** Center the map on the configured home position
Q	**Fit to content** Centers and zooms the map to all elements placed on the map
R	**Zoom** Zoom the site map
S	**Brightness** Increase or decrease the map brightness

T

Map options

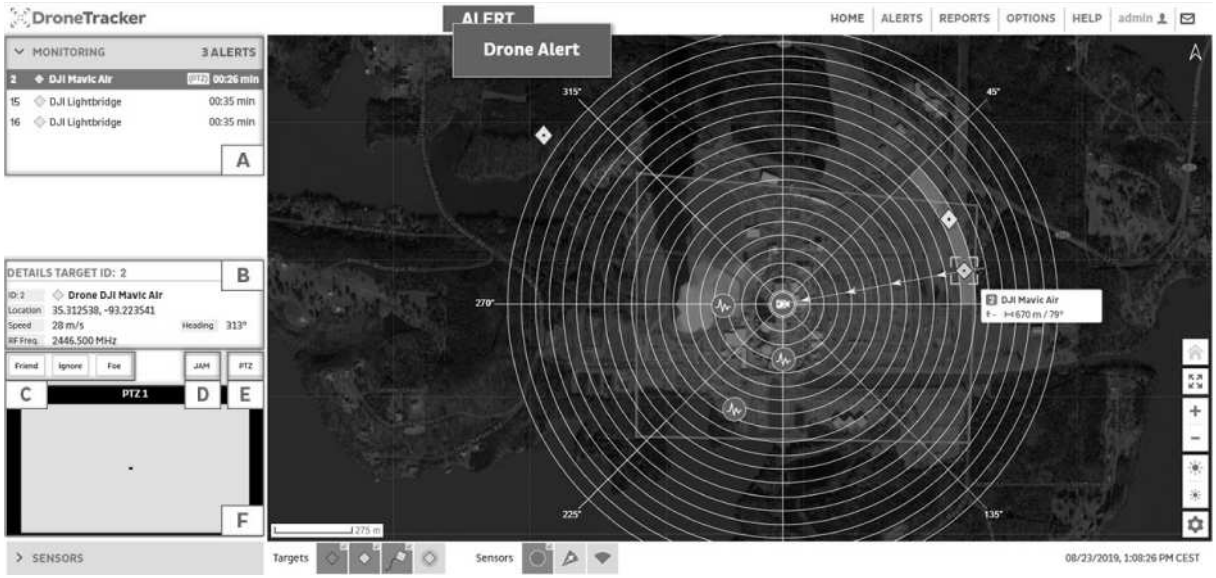
Configure some display options for the map:

- **Map scheme**
  Select the desired map scheme
- **Map scale**
  Display or hide the scale bar on the map
- **Tactical Overlay**
  If at least one Point of Interest with a tactical overlay is configured a layer with all tactical overlays can be displayed.
- **Sensor states**

  In case of an error the icon is shown on the related sensor icon. By hovering the mouse on the icon, a status message is shown. The sensor state is just shown, if the sensor is displayed.
- **Auto track**
  If **Auto track** is activated and a detection is selected by the user, the map will center on this activity.

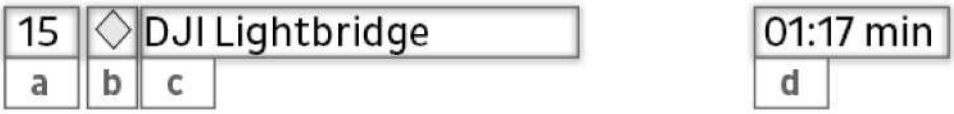
2.1.3 Alerting screen

During an alert, all relevant information is displayed on the home screen.



POSITION	EXPLANATION

Current detections



A

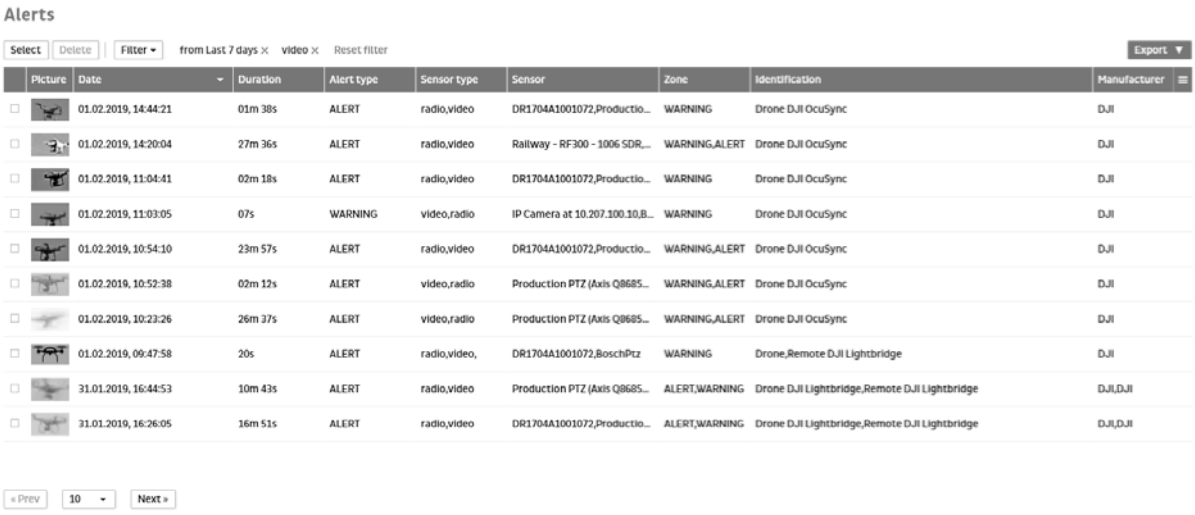
a. Random Id for references
b. Identifies the detection as a drone or remote controller.
c. Classification of the detection

	d. Duration of appearance
B	**Detection details** Displays the GPS position, movement speed of the drone or remote depending on which sensor type detected the target.
C	**Classify target** as Friend, Foe or ignore the detection by choosing one of these buttons
D	**Activate jammer** (only if a jammer is connected)
E	**Focus PTZ camera to the selected detection**. Only available, if the system has a PTZ camera. **Not available** for user role **Viewer**.
F	**Sensor live view**

2.2 ALERTS

View history of all drone alerts.

Alerts can be sorted by the various columns, **filtered**, or **exported to Excel or CSV file**.



Picture	If a video detection is involved in the alert, a thumbnail of the drone is shown.
Date	Date and Time when the alert began
Duration	Duration of the alert in minutes and seconds
Alert Type	Category of the alert
Sensor type	Which kind of sensors are involved
Sensor	Which sensors are involved

Zone	Names of the zones which have been triggered (see Add and Configure Zones)
Flag	Category which has been added manually (see Categorize an alert recording)
Identification*	Identification of the detection
Manufacturer*	Manufacturer of the classified drones
Model*	Model of the classified drones
Comment	Comment which has been added manually (see Comment an alert recording)
Protocol*	Protocol of the detected RF communication
SSID*	SSID of the classified drones

*optional if information available

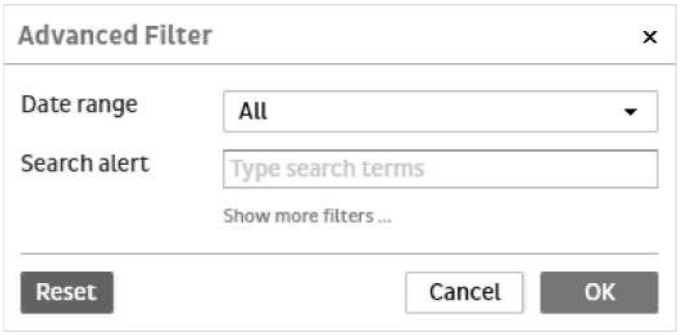
BUTTON	DESCRIPTION
[Select]	Choose one or more entries of the table
[Delete]	Deletes the selected entries
[Filter]	Filters the table by the chosen options
Reset filter	Resets the filter and selections of the table **Note**: Only available if a filter is set.
[Export]	Export the current list to the desired format **Note:** The set filter effects the content of the export. If no period of time is set, the past 31 days are issued.
☰	Show or hide the columns of the table
[<< Prev] [10] [Next >>]	Page navigation Choose the number of entries shown on one page.

2.2.1 Filter the list

You have the option to filter the content.

1. Choose **[Filter]**.

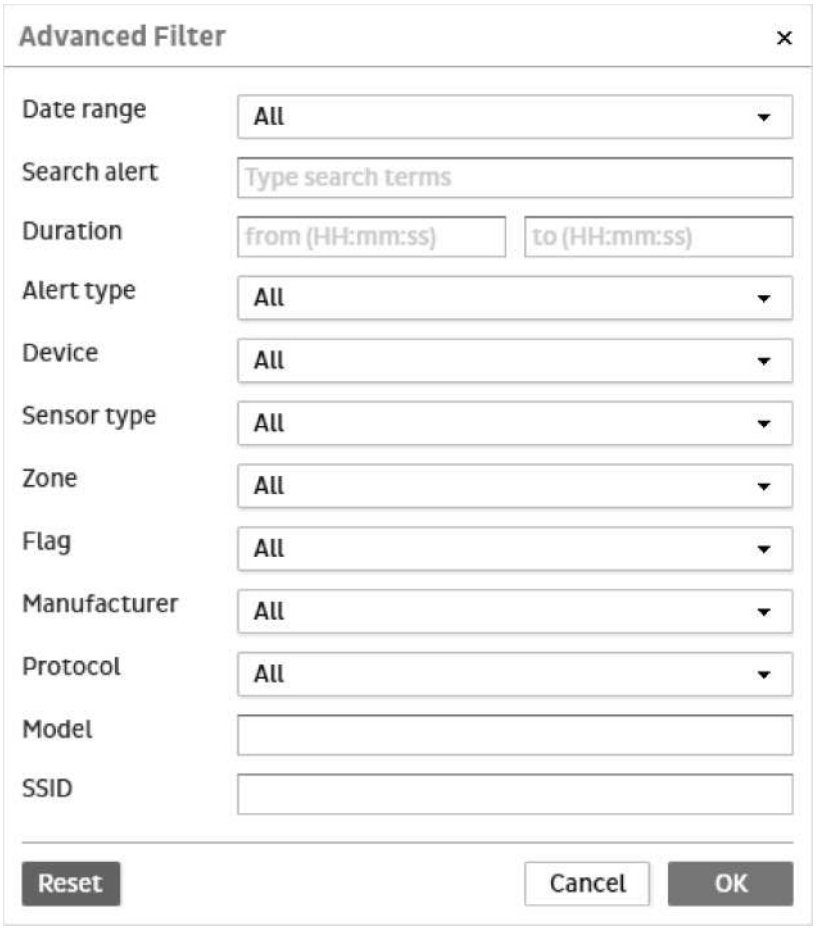
▶ The window **Advanced Filter** appears.



2. Choose the desired date range from the preselection in the list and the desired search term such as a sensor name, comment, manufacturer etc.
   The field **Search alert** searches most alert fields:

   - Combine terms, e.g. **"remote" "parrot"**: Shows all alerts with remote **and** parrot identifications
   - Exclude terms, e.g. **remote -drone**: Shows all alerts only with remote identifications and no drone identifications.
   - Search for alerts with locations: **locations** or without locations: **-locations**
   - Search for alerts with bearings: **bearings** or without bearings: **-bearings**
   - **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.

3. Choose **Show more filters ...** to enlarge the advanced filter.



Field	Format	Description
Date range	date	Time frame for the data. Choose **Custom** to define a specific time span
Search alert	text	Search alerts by writing a search term like a sensor name, comment, manufacturer etc. Searches most alert fields. Combine terms e.g. **"remote" "parrot"**: shows all alerts with remote **and** parrot identifications Exclude terms, e.g. **remote -drone**: shows all alerts only with remote identifications and no drone identifications. Search for alerts with locations: **locations** or without locations: **-locations** Search for alerts with bearings: **bearings** or without bearings: **-bearings** **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.
Duration	hh:mm:ss	Period of time the alert was present

Alert type	list	Type of alert If a target was classified during the alert the alert type changes. Additionally, the zone (e.g. Warning zone) can have an effect on the alert type.
Device	list	Device involved in the alert
Sensor type	list	Type of sensor involved in the alert
Zone	list	Name of the zones which were triggered (see Add and configure zones)
Flag	list	Flag of the alert
Manufacturer	list	Manufacturer of the classified drone
Protocol	list	Protocol of the detected RF communication
Model	text	Model of the classified drone
SSID	text	SSID of the classified drone
[Reset]	button	Reset the filter
[Cancel]	button	Close the filter window without changing the filter settings
[OK]	button	Apply the configured filter

All text fields are case sensitive.

4. Choose **[OK]**.

2.3 REPORTS

The report gives a comprehensive overview of the drone activities in the protected area. The given key figures, maps, diagrams and statistics provides a deep insight into the threatsituation and enables you to develop the right counter measures to minimize your risks.

You have the option to configure and filter the report to your needs, export it and configure a scheduled report, which is sent at the selected frequency.

- Report Settings
- Choose report content
- Filter report data by region
- Filter the report data
- Create a scheduled report
- Export a report

2.3.1 Available figures and diagrams

SUMMARY

- TOTAL NUMBER OF ALERTS: Count of alerts
- ALERTS PER DAY: Average count of alerts per day in the report time span
- AVG. DURATION PER ALERT: Average duration per alert in minutes
- DAYS WITH ALERTS: Count of days with alerts
- MAX ALERTS PER DAY: Maximum count of alerts in one day

ALERT HEATMAP

Heatmap colors indicate the duration of drone detections. Red indicates the longest durations of detection.

When the map is zoomed out, selectable clusters show the percentage of activity within the cluster compared to the entire map's activity in the chosen timespan.

TOP DRONES

Shows the distribution and a list of the most frequently detected drones.

TOP DRONE PROTOCOLS

Shows the distribution and a list of the most frequently detected drone protocols.

ALERTS BY SENSOR

Shows the distribution and a list of the sensors with the most detections.

IMPORTANT DRONE ALERTS

Most important drone alerts depending on the involved zone and minimum duration.

ALERTS BY DATE

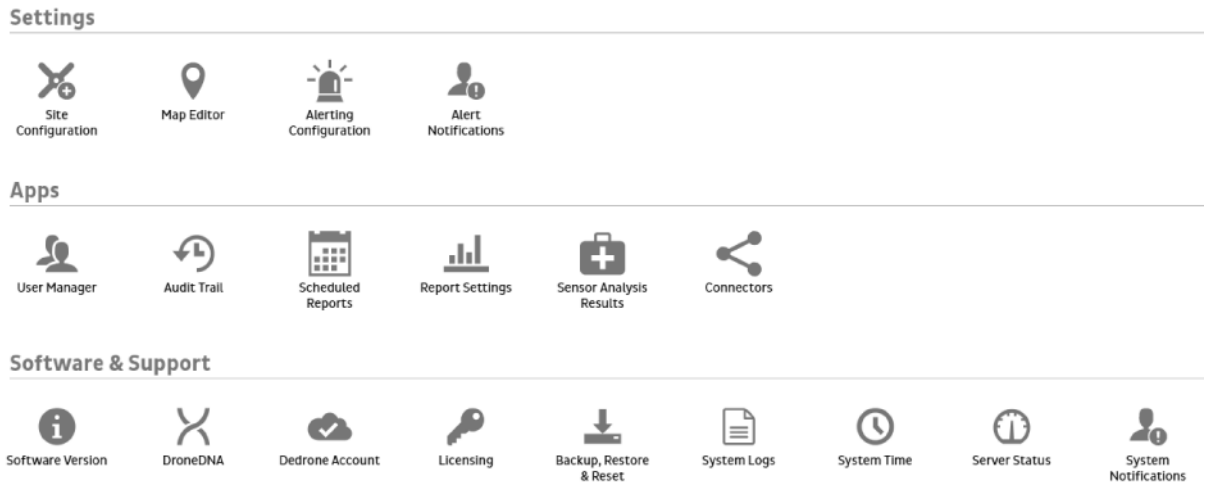
Represents a count of triggered alerts by date.

ALERTS BY HOUR AND DAY OF WEEK

Represents a count of triggered alerts by time of day.

2.4 OPTIONS

Configuration and settings of the DroneTracker.



2.5 System messages

The System messages shows current news to the system status. The following information will be shown:

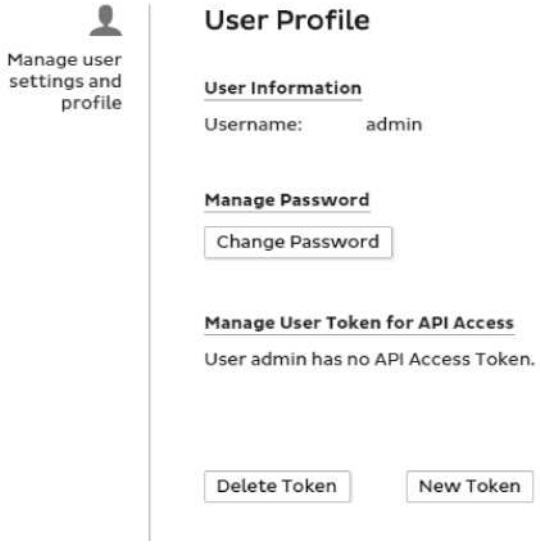
[X] connectable sensors available:...	Sensors are available to get integrated in the system.
Dedrone Cloud: ...	Information to the connection status to Dedrone Cloud
DNA update available: ...	A new version of DroneDNA is available (see Update DroneDNA).
DNA update: ...	During the process of the DNA update, the status is shown here.
Network error, reconnecting...	Connection to the DroneTracker Server failed. The browser is trying to reconnect.
No space left for alerts/recordings. Will be silently discarded!	The disk space for alerts or recordings on your server or DroneTracker Multi-Sensor is full. New alerts or recordings will be discarded without any further message. To check the space status, go to **OPTIONS > Server Status**.
Only [X] MB left for alerts/recordings	Early warning, that disk space for alerts or recordings is less than 500 MB. To check the space status, go to **OPTIONS > Server Status**.
Sensor connection error	A connection between the DroneTracker Server and the sensor failed.

Sensor restricted	The software version of the sensor is too old.
Software update available: ...	A new software version is available (see Update DroneDNA).
Software update: ...	During the process of the Software update, the status is shown here.

System messages disappear when they are no longer relevant.

2.6 User Profile

Manage your user password and token for API access.

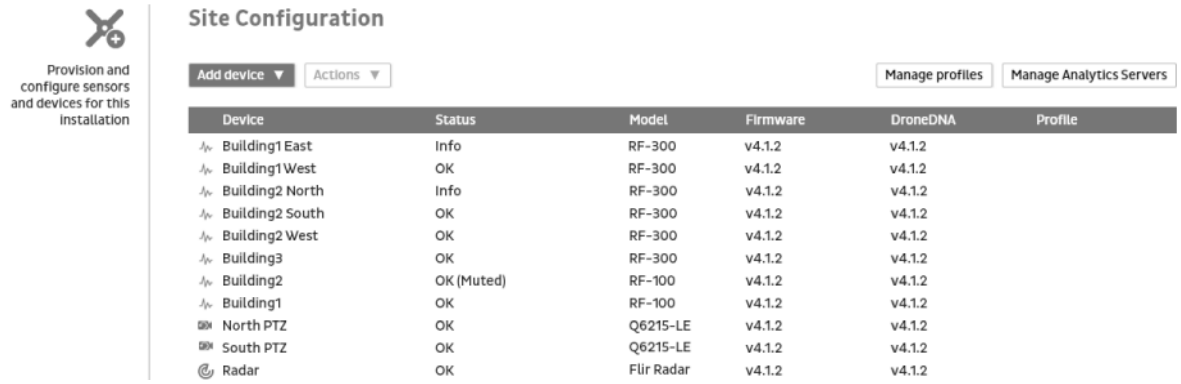


As an administrator you have the option to create a token. With this token you can give API access for external programs.

2.7 Site Configuration

The Site Configuration is the central menu to organize and configure all sensors of the DroneTracker System. You can structure sensors in a site hierarchy, label them and configure each sensor individually.

To integrate third party sensors in the DroneTracker System, an Analytics Server is required and can be managed in the menu **[Manage Analytics Servers]**.



Depending on the chosen type of element in the Site Explorer you have different kind of possible actions.

- Add Sensor
- Rename Sensor
- Mute Sensor
- Configure Camera Regions
- Edit video, audio, Wi-Fi or radio sensor
- Shut down a RF sensor
- Reboot a RF sensor

Symbols of the Site Explorer

	RF sensor
	Video sensor
	Audio sensor
	Pan-Tilt-Zoom camera
	Radar sensor
	Jammer
	Point of Interest with tactical overlay
	Sensor is muted
	Sensor is alerting and recording

⚠	Sensor is disrupted or in calibration. The sensor does not detect and does not trigger any alarms. The pop-up window of the sensor, the system messages and the menu **Site Configuration** gives more detailed information.

2.8 Map Editor

Choose an address, position or a custom map of your area or property in the DroneTracker UI and configure the position, orientation and range of each sensor.

Wrong drone positions will be a result of inaccurate sensor positions.

Accurate positioning and alignment of the sensors on the sitemap has a significant impact on the drone detecting and positioning result of the system.

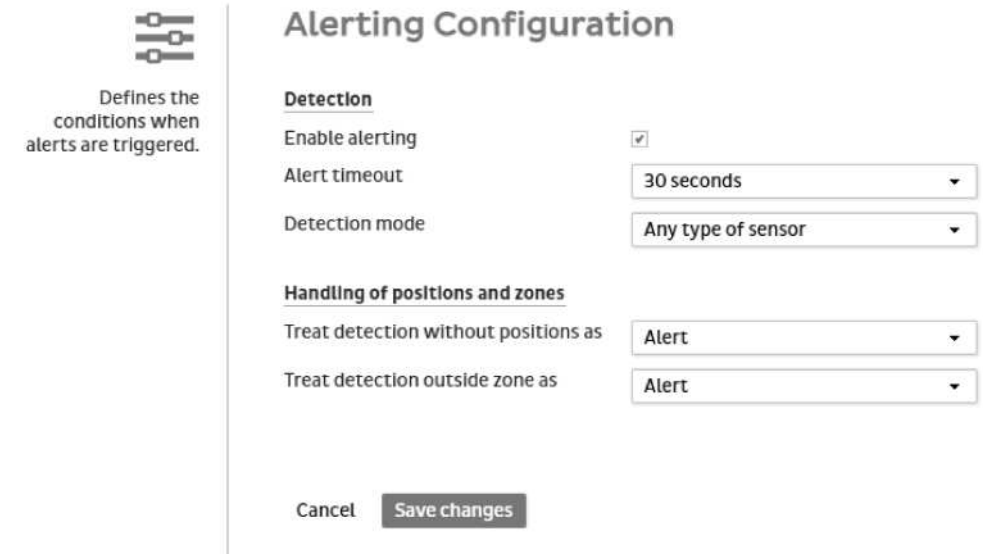
- If you use a custom sitemap image, make sure that the sitemap is calibrated with location markers.
- Position and align the sensors as accurately as possible.

Search bar

Navigate to a desired address, region or geo-location (latitude, longitude in degree decimal).
It is also possible to search for site-elements on the map, like sensors or zones. Therefore write "**:**" in the search bar and choose a shown element.

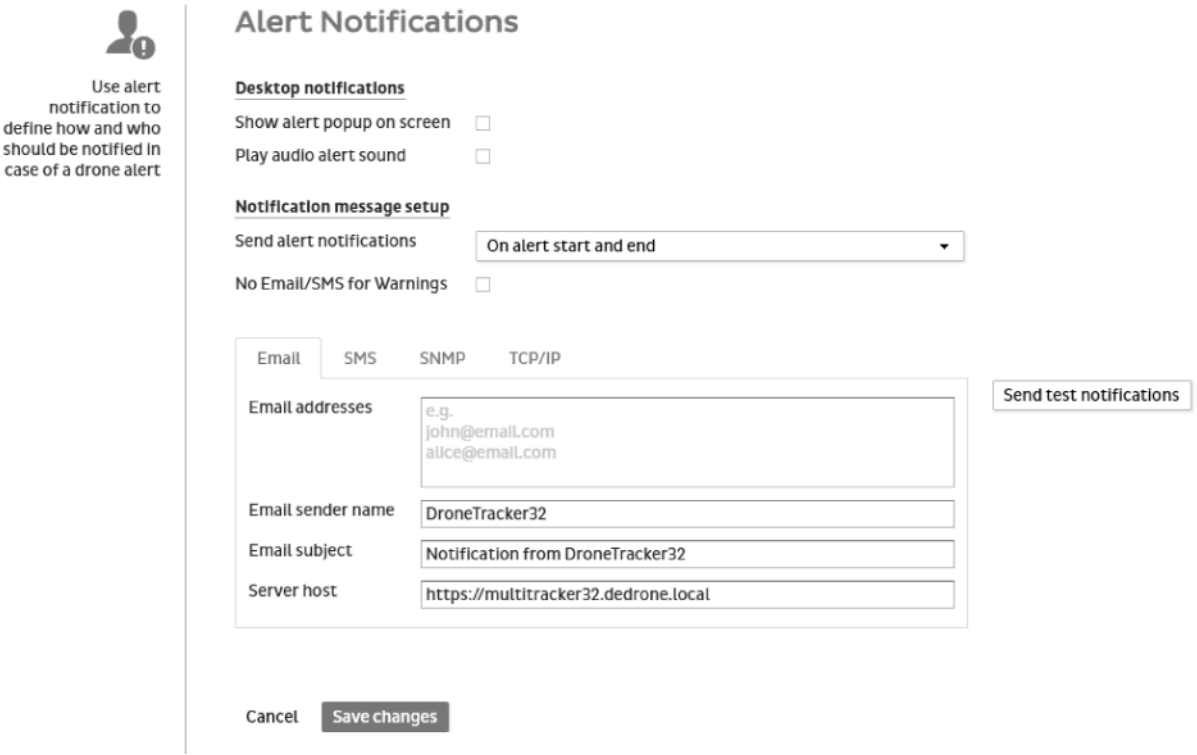
2.9 Alerting Configuration

Depending of the deployed sensors, the alerting behavior of the system can be configured. This allows to set up the alerting to all needs and can reduce false alerts.



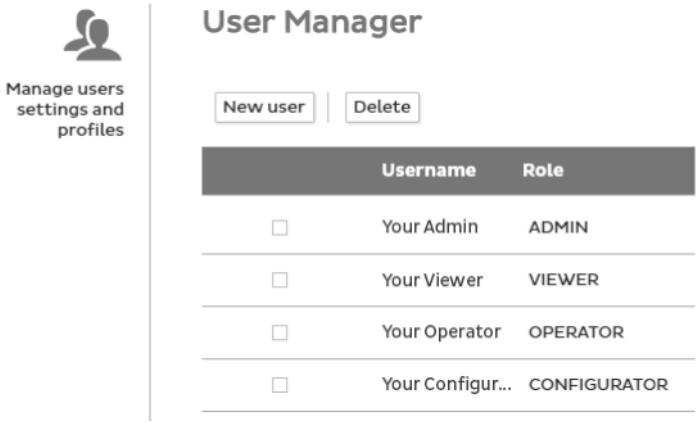
2.10 Alert Notifications

Define how and who should be alerted and notified in case of a drone alert.



2.11 User Manager

Manage all users, passwords and roles in this menu.



According to your role, the content in the DroneTracker UI is shown.

2.11.1 Role permissions

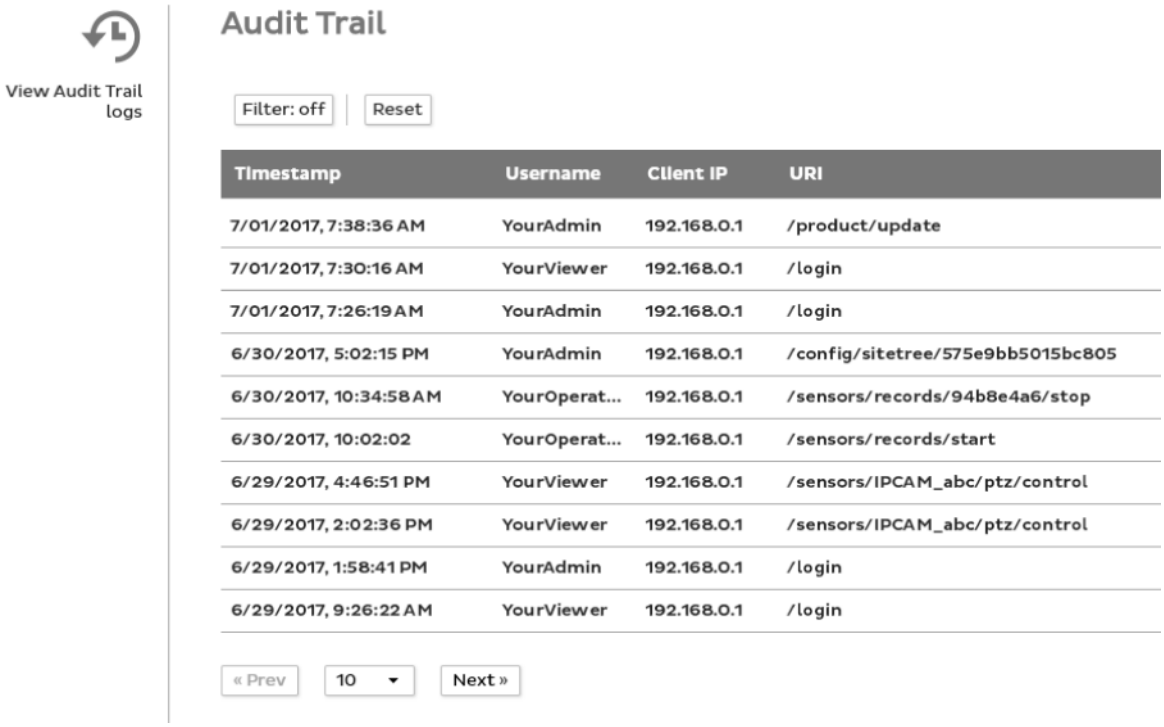
Each role has different permissions. Only the role ADMIN has the permission to create or change users.

Permission	VIEWER	OPERATOR	CONFI-GURATOR	ADMIN
View home screen and monitoring state	x	x	x	x
View sensor live views	x	x	x	x
View alert recordings	x	x	x	x
Change display options of the map	x	x	x	x
Navigate on the map	x	x	x	x
Mute alert sound	x	x	x	x
Download alert recordings	x	x	x	x
Create and export reports	x	x	x	x
View Help content	x	x	x	x
Control PTZ camera	-	x	x	x
Flag and comment alert recordings	-	x	x	x
Discard alert	-	x	x	x
Create scheduled reports	-	-	x	x

Delete alert recordings	-	-	x	x
Add, organize, configure or delete sensors	-	-	x	x
Shutdown or reboot sensors	-	-	x	x
Perform sensor and RF spectrum diagnosis	-	-	x	x
Change alerting configuration	-	-	x	x
Change map image and position sensors	-	-	x	x
Change notification options	-	-	-	x
Manage Analytics Server	-	-	-	x
Create and manage user accounts	-	-	-	x
View audit trail	-	-	-	x
Update software	-	-	-	x
View software version	-	-	-	x
Update sensors	-	-	-	x
Update DroneDNA	-	-	-	x
View DroneDNA version	-	-	-	x
View and download log files	-	-	-	x
Reset, backup and restore the system	-	-	-	x
Configure Dedrone Account	-	-	-	x
Set system time zone	-	-	-	x
View system state	-	-	-	x
Handle licenses	-	-	-	x

2.12 Audit Trail

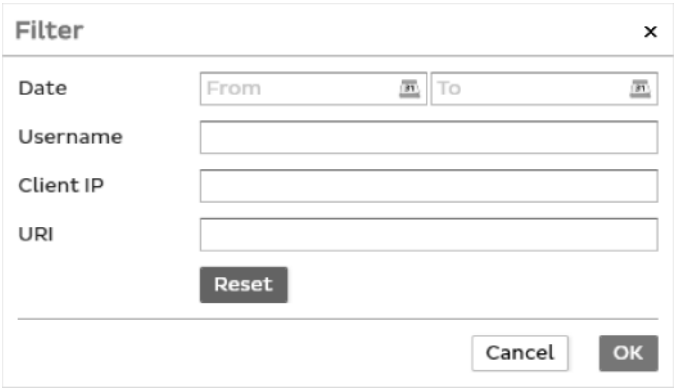
Check the activities of the users in the Audit Trail.



BUTTONS	DESCRIPTION
[Filter]	Filters the table by the chosen options
[Reset]	Resets the filter of table
[<< Prev] [10] [Next >>]	Page navigation Choose the number of entries shown on one side.

2.12.1 Filter the list

You have the option to filter the list:

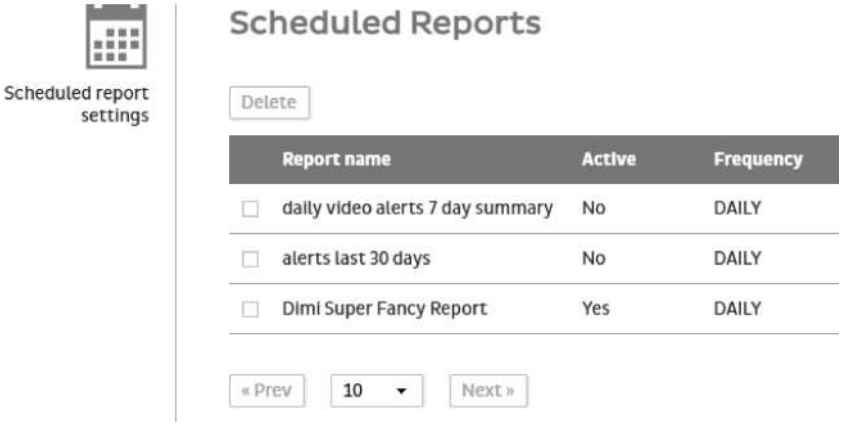


Field	Format	Description
Date	date	Time frame for the alert list
Username	text	Name of the user

Client IP	text	Client IP of the executive user
URI	text	Action of the user

2.13 Scheduled Reports

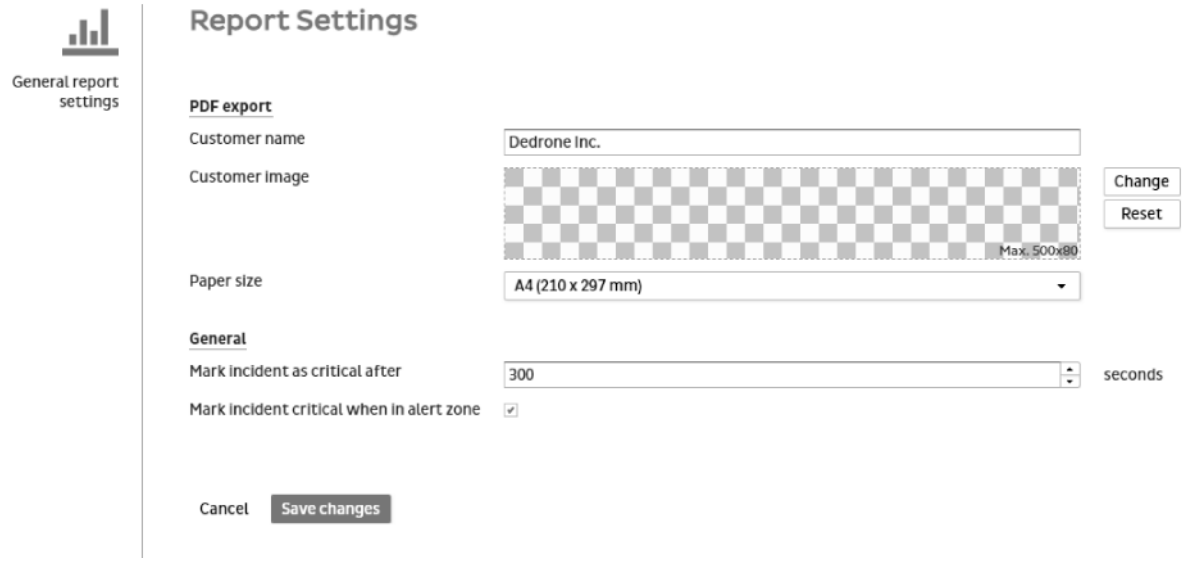
Manage, configure or deactivate your created scheduled reports in this menu.



2.14 Report Settings

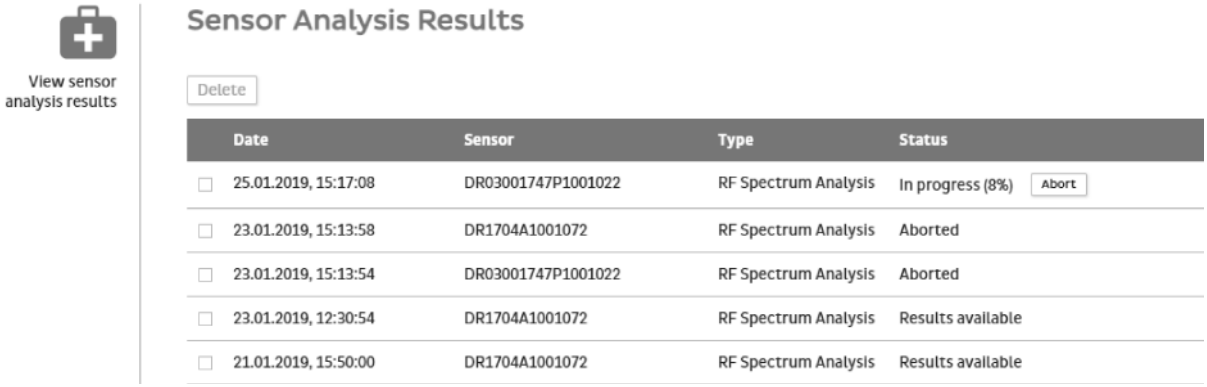
You have the option to customize the exported report pdf to your needs by adding your company name, a logo and the paper format.

Further you can define when an incident is classified as critical.



2.15 Sensor Analysis Results

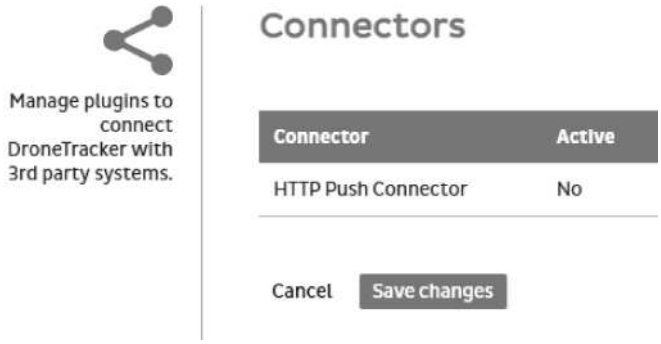
To check the conditions of the RF environment, you have the option to perform a RF spectrum analysis. The results of these analyses are available in this menu.



2.16 Connectors

Note: The availability of this menu depends on your license.

Manage plugins to connect the DroneTracker with third party systems via an API interface.



2.17 Software Version

Check for latest software versions and install updates.

Current Version shows the currently installed software version on the DroneTracker Server.

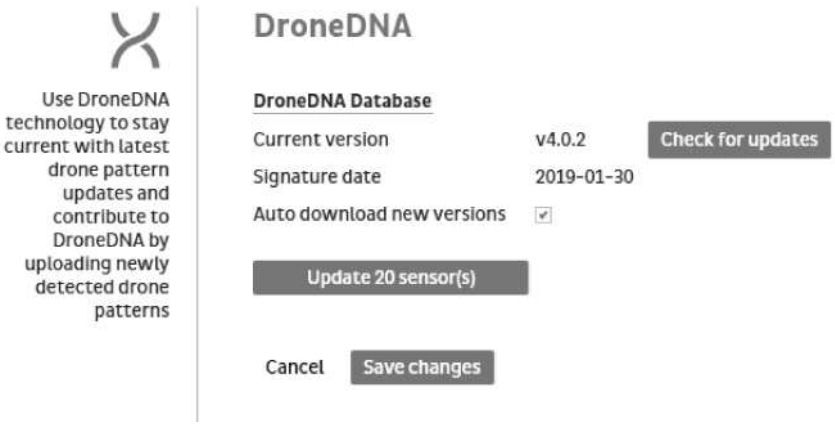
Latest version shows the latest available software version provided from Dedrone.

The setting APT Server is necessary for the update process without internet connection (offline update). Furthermore, by using an APT server as a proxy, the performance for updates with internet connection (online update) increases. The address must be notated in the following format: "**IP:Port**", e.g. 192.168.0.46:3142. The default port is "**8080**".

In the list **Sensor updates** the currently installed versions of each sensor is shown. The currently installed version of the currently connected Analytics Server is listed in the section **Analytics Server updates**.

2.18 DroneDNA

Stay current with latest drone pattern updates. You can view the currently installed version of the DroneDNA database and check for updates here.

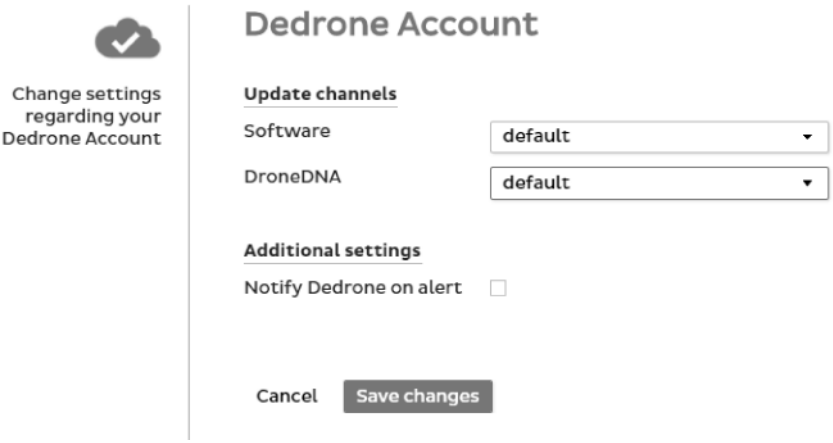


2.19 Dedrone Account

The Dedrone Account is the connection to the Dedrone Cloud. This access allows you to get the new releases of the software and the DroneDNA via an internet connection.

The update channels helps Dedrone to manage the versions of the software and DroneDNA. Please change the channels only on instruction by Dedrone.

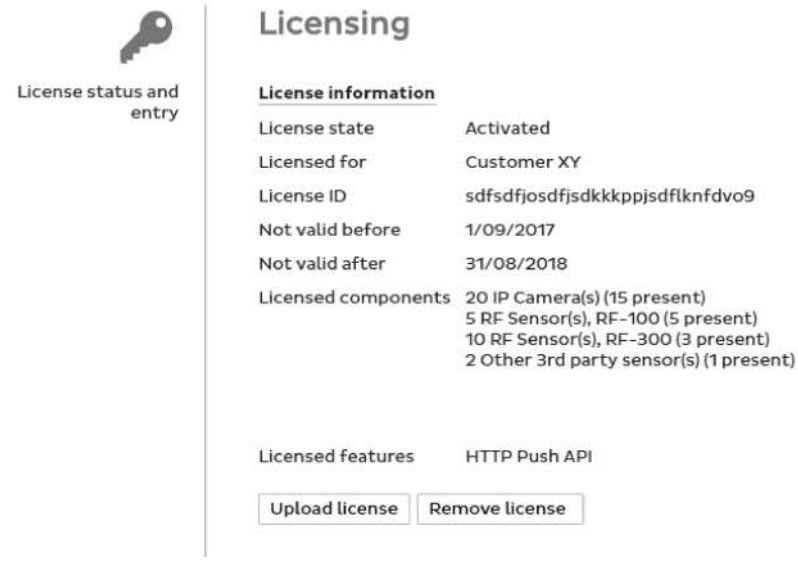
For a statistic review, you can send a trigger to the Dedrone Cloud, in case of an alert.



2.20 Licensing

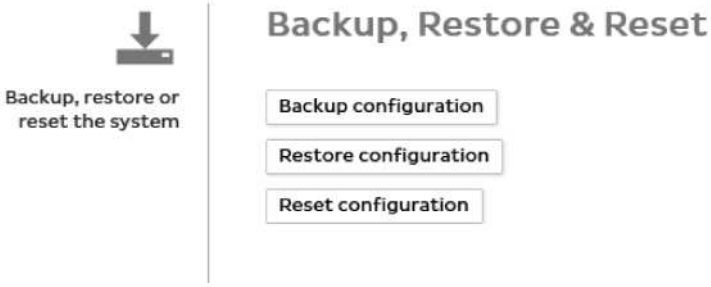
To run the DroneTracker System, a license is required. The license defines how many and which kind of sensors can be integrated and which licensed features are available.

Your license has to be activated, before you can use the system. For systems with an internet connection, this take place automatically. For offline systems, you have to activate the license manually.



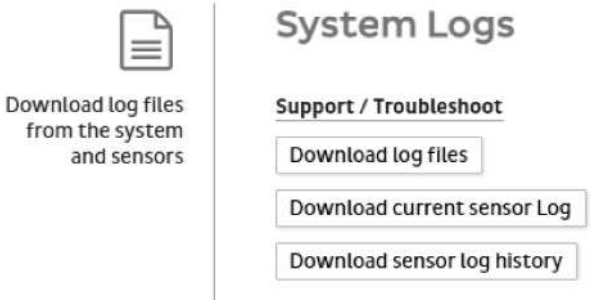
2.21 Backup, Restore & Reset

Save a backup, restore from a backup or reset the system.



2.22 System Logs

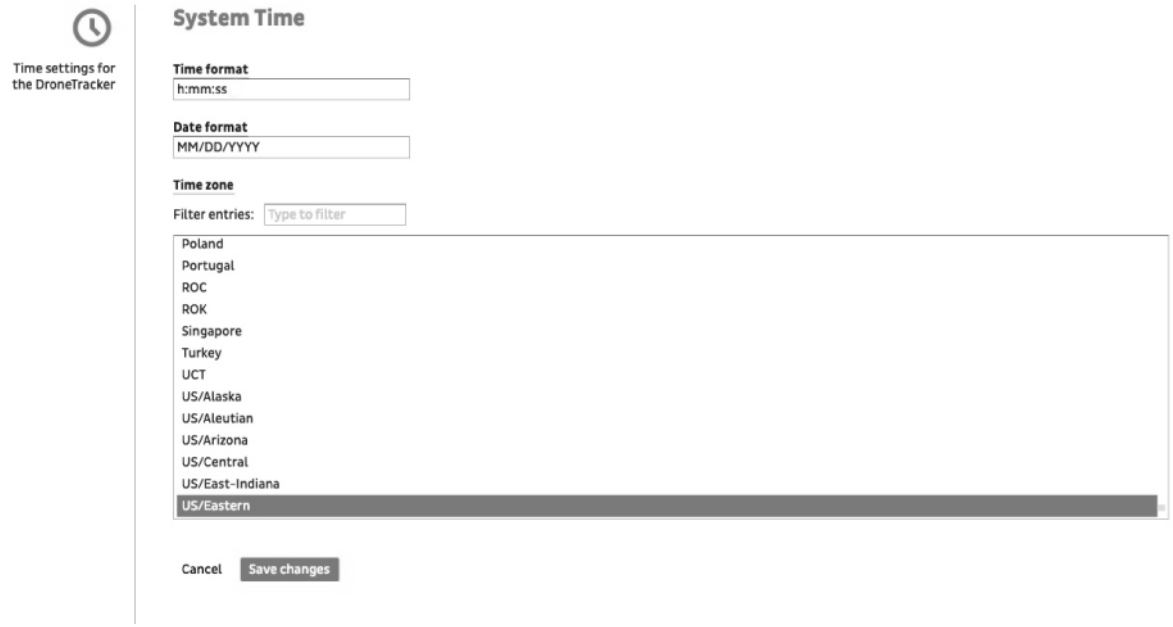
Log files are an important tool for troubleshooting and working support. You can download the log files of the system, the sensors as well as the entire sensor log history.



2.23 System Time

Set the time settings for DroneTracker.

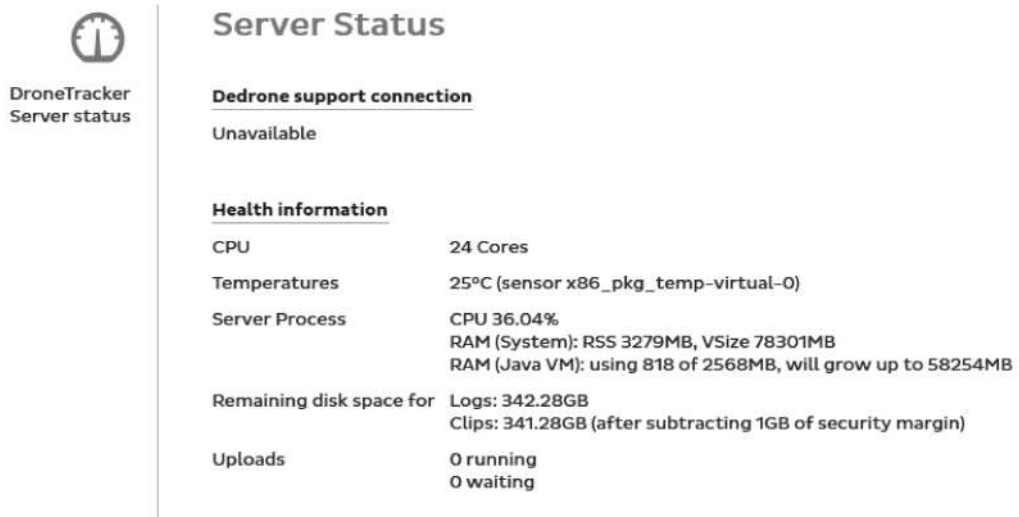
By default, the browser time zone is used to display the server time. If a time zone is selected, it is used for all users of the system.



2.24 Server Status

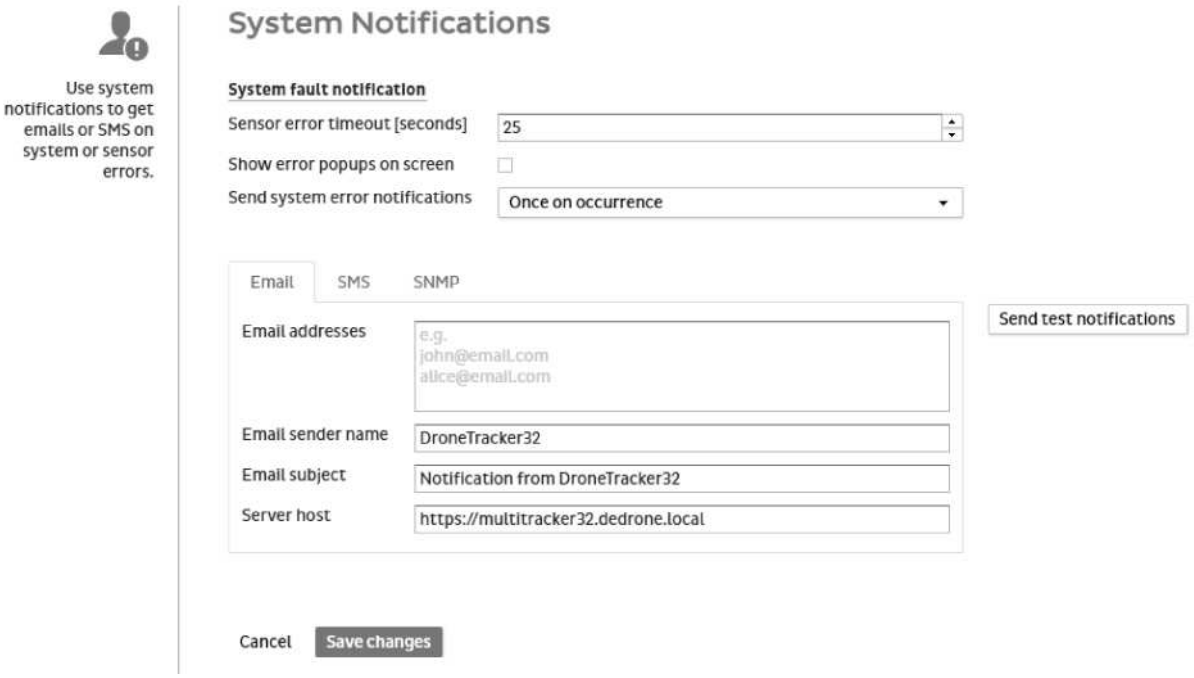
In case of a VPN connection the relevant VPN information is shown here.

In the section **Health Information**, some server attributes are given.



2.25 System Notifications

Define how and who should be notified in case of a system or sensor errors.



3 Configuration

3.1 Change login password

1. Choose menu admin > **Profile page**.
2. Choose **[Change password]**.
   ► The window **Change Password** appears.

3. Enter the old password and two times the new password.
4. Choose **[OK]**.

3.2 Licensing

3.2.1 Upload a license key

To run the DroneTracker System, a license is required. The license defines how many and which kind of sensors can be integrated and which licensed features are available.

Procedure:

1. Choose **OPTIONS > Licensing**.
2. Choose **[Upload license]** and choose the *.lic-file from your system.

3.2.2 Activate license manually

Your license has to be activated, before you can use the system. For systems with an internet connection, this take place automatically. For offline systems, you have to activate the license manually.

Procedure:

1. Choose **OPTIONS > Licensing**.
2. Choose **[Activate license]**.

► The window **Information** appears.

3. Choose one of the following options, to activate your license:
   - Scan the shown code with a mobile phone with internet connection and follow the link.
   - Choose the shown link "**click here**"
   - Choose the email address, insert your contact information and send the email.

   ► A response key is shown.

4. Enter the received code in the field **Activation key**. Therefore, note the format of the key **000-000-000**.
5. Choose **[OK]**.

3.2.3 Remove license

1. Choose **OPTIONS > Licensing**.
2. Choose **[Remove license]**.

   ► A warning is shown.

3. To confirm the removing, choose **[Yes]**.

   ► The license is removed from the system and it is deactivated. To use the system again, enter a license key.

3.3 Site Configuration

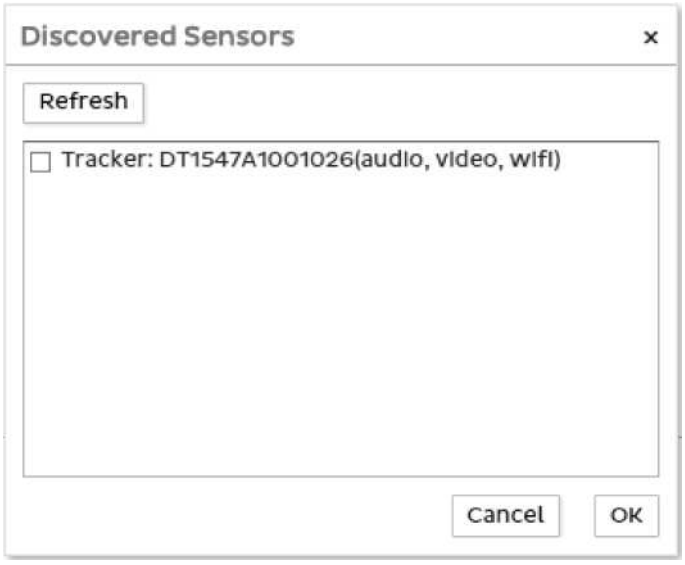
3.3.1 Add sensor

3.3.1.1 Add a sensor to the Site Configuration

- Register device
- Add Dedrone RF sensor
- Add IP camera
- Add Pan-Tilt-Zoom-Camera (PTZ)
- Add radar

Add Dedrone RF sensor

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > Dedrone RF Sensor**.
   ► The window **Discovered sensors** appears.



3. Select the desired device and choose **[OK]**.
   ► The selected elements appear in the Site Explorer.
4. To sort the devices and sensors in the Site Explorer, drag and drop the element to the desired position.
5. Choose **[Save changes]**.

Add IP camera

Precondition:

- An Analytics Server has to be connected and active in the system (see Analytics Servers).

Procedure:

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > IP camera**.
   ▶ The window **Add an IP camera** appears.

3. Fill in the form:

Analytics Server	Desired Analytics Server which manages the camera.
Cam hostname/IP	Network address of the camera
Username	Username to log in the camera (ONVIF user)
Password	Password according to the camera username
ONVIF Profile	Device specific ONVIF Profile name

3. Choose **[OK]**.
   ▶ The IP camera appears in the Site Explorer.
4. To sort the camera in the Site Explorer, drag and drop the element to the desired position.
5. Choose **[Save changes]**.

Add Pan-Tilt-Zoom camera (PTZ)

Requirements:

- The following PTZ cameras are supported by the DroneTracker System:
  - Axis Q8665-E
  - **Axis Q8685-E** (recommended)
  - **Axis Q8685-LE** (recommended)
  - Bosch MIC IP dynamic 7000 HD (Firmware version: 6.44.0020 (20500644))
  - AscentVision CM202U

- Flir HDC1200

- **PTZ camera is mounted on a level horizontal plate** (no tilted foundations).
  If the PTZ camera is mounted at an angle, the positioning and camera controls of the PTZ camera won't be accurate.

- **An accurate positioning and alignment of the PTZ camera is a requirement for good tracking.**
  The configuration of the GPS position and height of the PTZ camera is critical. If the installation and configuration is not accurate, the tracking won't be accurate either.

  - Note the GPS position and height of the PTZ camera during the installation.

- **An appropriate Analytics Server is installed.**
  To operate a PTZ camera in a DroneTracker System an Analytics Server is required.
  The Analytics Server requirements are documented here.

Procedure:

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > IP camera**.

   ▶ The window **Add an IP camera** appears.

3. Fill in the form:

Analytics Server	Desired Analytics Server which manages the camera.
Cam hostname/IP	Network address of the camera
Username	Username to log in the camera (ONVIF user)
Password	Password according to the camera username
ONVIF Profile	Device specific ONVIF Profile name

3. Choose the option **PTZ**.

   ▶ More options are shown.

4. Fill in the PTZ options:

Manufacturer	Manufacturer of your PTZ camera
Device model	Device Model of your PTZ camera
Mounting mode	Type of camera mounting For some PTZ cameras this mode has influence on the camera's degree of freedom.

5. Choose **[OK]**.
   - ▶ The PTZ camera appears in the Site Explorer.
   - ▶ If a wrong manufacturer or model has been chosen, after a few seconds the symbol is shown at the sensor.
     Double-click on the sensor to see more details.
6. To sort the camera in the Site Explorer, drag and drop the element to the desired position.
7. Choose **[Save changes]**.

Add radar

Procedure:

1. Choose **OPTIONS > Site Configuration**.
2. Choose **[Add] > Radar**.
   - ▶ The window **Add a Radar** appears.

3. Select the desired Radar Type.
4. Fill in the hostname or IP address and port.
5. Choose **[OK]**.
   - ▶ The radar appears in the Site Explorer.
6. To sort the devices and sensors in the Site Explorer, drag and drop the element to the desired position.
7. Choose **[Save changes]**.

3.3.2 Analytics Servers

To integrate third party sensors in the DroneTracker System an Analytics Server is required. The Analytics Server provides the interface between the sensors and the DroneTracker Server. Depending on the number of sensors, several Analytics Servers may be necessary.

The option **[Manage Analytics Servers]** is only available in installations with separate server hardware.

The menu **Analytics Servers** manages the connection between the Analytics Servers and the DroneTracker Server.

A configured Analytics Server is automatically connected to the DroneTracker Server.

To disconnect an Analytics Server, choose **[Deactivate]** beside the desired Analytics Server.

3.3.2.1 Analytics Server minimum requirements

- Cuda 10 compatible Nvidia graphics card with Nvidia Pascal microarchitecure or newer (preferably the most recent one like Volta or Turing).
- Each camera or PTZ may consume up to 1.2 GB of GPU memory on the Analytics Server. For example, a Nvidia RTX 2070 with 8192 MB of VRAM supports up to 6 PTZs and/or cameras.
- Physical machine with exclusive use of the server resources in this OS
- Hard Disk: 500 GB SSD with good I/O, divided in System and Recordings:
    - System: 50 GB SSD (required)
    - Recordings: depending on the number of sensors and system configuration; minimum 50 GB number of recordings severely limited, recommended 450 GB;
- additional storage for long term archiving
- Processor: Intel Xeon E5 CPU with at least 12 Cores; 2.2Ghz and >25MB Cache
- Working memory: 64 GB
  We recommend distributing the 64 GB of RAM to all available channels. For example 4 x 16 GB multi-channel RAM is better than 1 x 64 GB RAM single-channel.
- OS: Ubuntu 16.04 LTS (Desktop) – 64 bit installed without secure boot option.
- Deactivated encryption of home directory

3.3.3 Rename sensor

1. Choose menu **OPTIONS > Site Configuration**.
2. Double-click on the desired sensor**.**
   ▶ The window **Sensor details** appears.

3. Write the desired name in the field **Label**.
4. Choose **[OK]**.

3.3.4 Remove a sensor from the Site Configuration

All sensor information is lost

By deleting a sensor from the Site Configuration, all information about the sensor (e.g. IP address, configuration) will be lost.

- Consider muting the sensor instead of deleting.
- If you want to reconnect the sensor in the future, note the IP configuration, longitude, latitude, azimuth etc. of the sensor.
  (**OPTIONS >** Site Configuration **>** right-click on desired sensor > IP configuration and
  OPTIONS > Map Editor **>** choose desired sensor in drop-down-list or on the map)

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Right-click on the desired sensor.
3. Choose **Remove**.
   - ► Behind the chosen element appears **(removing)**.
4. Choose **[Save changes]**.

3.3.5 Video Sensors

3.3.5.1 Configure camera regions

To optimize the drone detection, you can add Camera Regions. There are two types of Camera Regions: **Maskout Region** and **Sky Region**.

The Maskout Region will be ignored by the video and infrared sensor.

The Sky Region optimize the drone detection in the sky.

Mask out areas

1. Choose menu **Site Configuration** and select the desired video sensor by right-click.
2. Choose **Maskout** in the context-menu.
   - ► The Menu **Camera Regions** appears.
3. Choose **[Add maskout region]**.

- ▶ On the image appears a semitransparent red area. The red area shows the area, which won't be monitored.

4. By dragging the circles at the corners you can move and form the area.
5. To add a corner click on the edge of the area.
6. To move the whole area click in the area and drag it.
7. Choose **[Save changes]**.

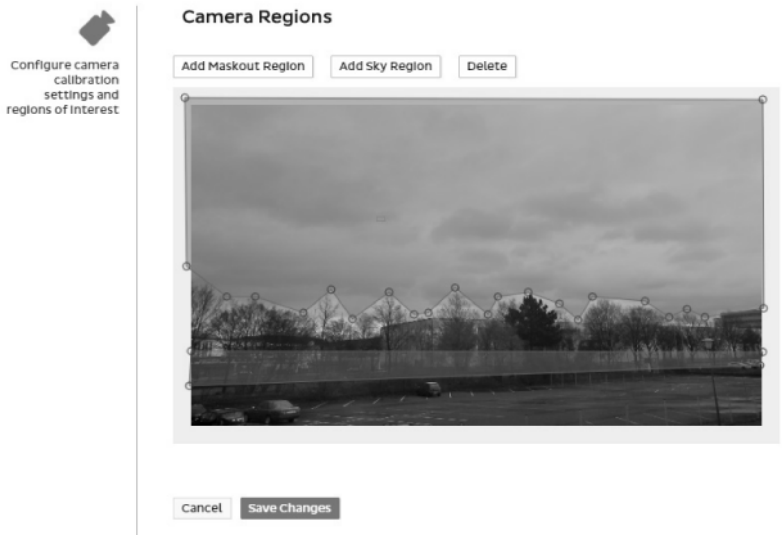
Add sky regions

1. Choose menu **Site Configuration** and select the desired video sensor by right-click.
2. Choose **Maskout**.
   - ▶ The Menu **Camera Regions** appears.
3. Choose **[Add sky region]**.
   - ▶ On the image appears a semitransparent blue area. The blue area shows the area, which should be monitored with parameters for drone detection in front of the sky.

4. By dragging the circles at the corners you can move and form the area.
5. To add a corner click on the edge of the area.
6. To move the whole area click in the area and drag it.
7. Choose **[Save changes]**.

3.3.5.2 Delete camera region

1. Choose menu **Site Configuration** and right-click on the desired video sensor.
2. Choose **Maskout** in the context-menu.
   ▶ The Menu **Camera Regions** appears.



3. Choose **[Delete]**.
   ▶ The button **[Delete]** stay's grey shaded.
4. Click on the desired red area.
   ▶ The red area disappears.
5. Choose **[Save changes]**.

3.3.6 Advanced sensor settings

3.3.6.1 Upload configuration profile

A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

Procedure:

1. Choose **OPTIONS > Site Configuration > [Manage profiles]**.
   ▶ The menu **Sensor configuration profiles** appears.
2. Choose **[Install]** and choose the profile file (format: *.json).
3. To overwrite an existing profile select the option **Overwrite existing?**
4. Choose **[OK]**.

3.3.6.2 Assign configuration profile to a sensor

A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Double-click on the desired sensor.
   ▶ The window **Sensor details** appears.

3. Choose the desired profile in the drop-down-list **Profile**.
4. Choose **[OK]**.

3.3.6.3 Create custom configuration profile

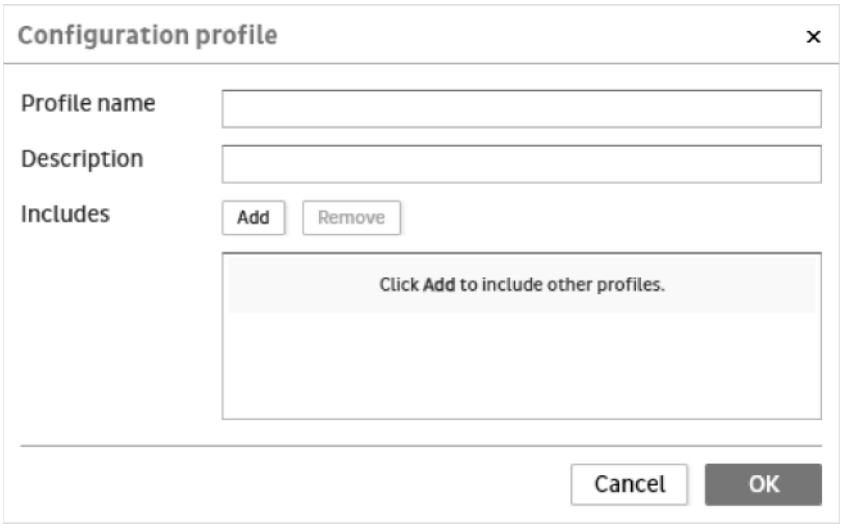
A configuration profile is a set of sensor configurations. These configurations are needed to manage difficult environments or the special needs of a customer. The configurations can only be created and provided by Dedrone.

You have the option to create your own custom configuration profile by combining existing profiles.

Procedure:

1. Choose **OPTIONS > Site Configuration > [Manage profiles]**.
   ▶ The menu **Sensor configuration profiles** appears.

2. Choose **[New]**.
   ▶ The window **Configuration profile** appears.



3. Enter a profile name and description.
4. Choose **[Add]** .
   ▶ A list of the existing profiles appears.
5. Choose the desired profile and choose **[OK]**.
6. Add more profiles if needed.
7. Sort the profiles in the order of execution by drag and drop. The profile at the top of the list will be executed first.

3.3.6.4 Edit radio sensor configuration

The radio sensor configuration helps in some special cases to improve the radio frequency detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done with an understanding of the effects the changes will make and carefully. Monitor the effects of your changes in the following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ▶ A context menu appears.
3. Choose **Configuration**.
   ▶ The window **Configuration** appears.

4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
General		
Reduce sensitivity by	dB	Reduces the sensitivity of the radio sensor. This could result in reduced range of the sensor. default: 0

3.3.6.5 Edit Wi-Fi sensor configuration

The Wi-Fi sensor configuration helps to improve the Wi-Fi detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done knowingly and carefully. Monitor the effects of your changes in following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.
3. Choose **Configration (Wifi)**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
Detection		
Detection Threshold	%	Wi-Fi signal threshold for triggering an alert min.: 0 % max.: 100 %

			default: 20 %
	Livestream device limit	number of devices	Limits the number of devices displayed in the Wi-Fi live view default: 20
	Localization	true/false	Enables Wi-Fi trilateration For localization via Wi-Fi signal, at least 3 enabled Wi-Fi sensors are required. default: false
	Treat cameras as drone	true/false	Treat Wi-Fi cameras (e. g. GoPro) as if a drone were detected.

3.3.6.6 Edit video sensor configuration

The video sensor configuration helps to improve the optical detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done with an understanding of the effects the changes will make and carefully. Monitor the effects of your changes in the following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.
3. Choose **Configuration**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
Background		
Background learning rate		Duration how long it takes until a detected object belongs to the background.

			Min. value: 10 Max. value: 500 Default: 70 A higher value decrease the detection speed. Use higher values for faster changing background.
	Background sensitivity		Threshold for the result of the background subtractor, which is committed to the next process steps. Min. value: 20 Max. value: 80 Default: 40 Decreasing this value will detect more objects and movements.
	Enable scene change detection	true/false	Enables scene change detection Default: true The scene change detection proofs the changing of the whole view. If the camera view is changing too much (e.g. moving the camera), the scene change detection notices this. During a scene changing, the drone detection is deactivated.
	Scene change threshold		Threshold for triggering a scene change Value range: 0 ... 1 Default: 0.2
Detection			
	Detection sensitivity		Option set for the sensitivity of the video detection

			Low: Decreased sensitivity of video sensor. Will lead to less false alerts at the cost of slightly lower detection capabilities. **Regular**: Balanced sensitivity and detection rate. Shall be appropriate for most installations. **High**: High sensitivity of video sensor. Can lead to a higher rate of false alerts but may detect difficult to spot drones. Default: Low
	Enable trajectory analyzer	true/false	Use trajectory information to classify objects. Help to reduce false classifications of detections like planes or helicopters based on their movement characteristics. Default: true
	Max. movement	multiplier	[ROI Width] x [Max. Movement] = searching radius for a track. Min. value: 1 Max. value: 5 Default: 1.25 Increasing this value will track and classify more moving objects which may not rely on each other. Increasing this value allows tracking of faster drones. **Hint**: High value: higher risk for false alerts Low value: higher risk not detecting drone
	Min. object height	pixels	Defines the minimal height of a detected object to start the classification. Min. value: 5 Max. value: 200

		Default: 5
Min. object width	pixels	Defines the minimal width of a detected object to start the classification. Min. value: 5 Max. value: 200 Default: 10
Min. tracking frames	frames	Number of frames an object should be tracked before starting to classify the object Min. value: 1 Max. value: 30 Default: 5 10 frames is approx. 1 second. **Hint**: Low value: higher risk for false alerts High value: drone gets detected later or maybe no alert is triggered - could cause very short alerts
Number of positive classifications for drones	frames	Number of positive drone classifications before object is considered a drone Defines how early the classifier triggers. Minimum count of positive classified frames before triggering an alert. Min. value: 1 Max. value: 25 Default: 15 **Hint**: Low value: higher risk for false alerts

		High value: drone gets detected later or maybe no alert is triggered - could cause very short alerts
Recording		
Record pre-roll	second	Defines the time of pre-recording in case of a recording. Min. value: 0 Max. value: 5 Default: 5
Scene learning		
Enable scene learning	true/false	Learn scene model Default: true
Source		
Display timestamp	true/false	Display the current date and UTC time in the video feed and in recordings. Default: false
Pixelate video feeds	true/false	Pixelates the video live view of the camera until an alert is triggered. This is a privacy measure for sensible or public views. During an alert, the live view is clear until approx. 30 seconds after the end of the alert. Default: false
Show drone as picture in picture	true/false	Display a close-up of the drone as a picture in picture in the live view. Default: true

3.3.6.7 Edit PTZ camera configuration

The video sensor configuration helps to improve the optical detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done with an understanding of the effects the changes will make and carefully. Monitor the effects of your changes in the following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.
3. Choose **Configuration**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

The following values can be set:

Value	Unit	Explanation
Background		
Background learning rate		Duration how long it takes until a detected object belongs to the background. Min. value: 10 Max. value: 500 Default: 70 A higher value decrease the detection speed. Use higher values for faster changing background.
Background sensitivity		Threshold for the result of the background subtractor, which is committed to the next process steps. Min. value: 20 Max. value: 80 Default: 40

		Decreasing this value will detect more objects and movements.
Enable scene change detection	true/false	Enables scene change detection Default: true The scene change detection proofs the changing of the whole view. If the camera view is changing too much (e.g. moving the camera), the scene change detection notices this. During a scene changing, the drone detection is deactivated.
Scene change threshold		Threshold for triggering a scene change Value range: 0 ... 1 Default: 0.2
Detection		
Detection sensitivity		Option set for the sensitivity of the video detection **Low**: Decreased sensitivity of video sensor. Will lead to less false alerts at the cost of slightly lower detection capabilities. **Regular**: Balanced sensitivity and detection rate. Shall be appropriate for most installations. **High**: High sensitivity of video sensor. Can lead to a higher rate of false alerts but may detect difficult to spot drones. Default: Low
Enable trajectory analyzer	true/false	Use trajectory information to classify objects. Help to reduce false classifications of detections like planes or helicopters based on their movement characteristics. Default: true

Max. movement	multiplier	[ROI Width] x [Max. Movement] = searching radius for a track. Min. value: 1 Max. value: 5 Default: 1.25 Increasing this value will track and classify more moving objects which may not rely on each other. Increasing this value allows tracking of faster drones. **Hint**: High value: higher risk for false alerts Low value: higher risk not detecting drone
Min. object height	pixels	Defines the minimal height of a detected object to start the classification. Min. value: 5 Max. value: 200 Default: 5
Min. object width	pixels	Defines the minimal width of a detected object to start the classification. Min. value: 5 Max. value: 200 Default: 10
Min. tracking frames	frames	Number of frames an object should be tracked before starting to classify the object Min. value: 1 Max. value: 30 Default: 5

		10 frames is approx. 1 second. **Hint**: Low value: higher risk for false alerts High value: drone gets detected later or maybe no alert is triggered - could cause very short alerts
Number of positive classifications for drones	frames	Number of positive drone classifications before object is considered a drone Defines how early the classifier triggers. Minimum count of positive classified frames before triggering an alert. Min. value: 1 Max. value: 25 Default: 15 **Hint**: Low value: higher risk for false alerts High value: drone gets detected later or maybe no alert is triggered - could cause very short alerts
PTZ		
Display PTZ mode in recordings	true/false	Displays the current PTZ mode in recordings. Default: false
Max. search height	m	Maximum search altitude for drones over ground Min. value: 0 Max. value: 1000 Default: 100
Min. search height	m	Minimum search altitude for drones over ground Min. value: 0

		Max. value: 1000 Default: 0
PTZ mode		Operation mode of the PTZ camera • **Passive**: Camera records when DroneTracker has a drone alert. Camera can be manually controlled. No video detection, tracking or repositioning of the camera. • **Detection**: Camera detects drones but does not pan and tilt to follow. Behavior similar to a normal IP camera - no repositioning of the camera. Camera can be manually controlled. • **Tracking**: Camera reacts on positions from other sensors and automatically tracks the drones by panning, tilting and zooming. Camera can be manually controlled. Default: Tracking
Recording		
Record pre-roll	second	Defines the time of pre-recording in case of a recording. Min. value: 0 Max. value: 5 Default: 5
Scene learning		
Enable scene learning	true/false	Learn scene model Default: true
Source		
Display timestamp	true/false	Display the current date and UTC time in the video feed and in recordings. Default: false

Pixelate video feeds	true/false	Pixelates the video live view of the camera until an alert is triggered. This is a privacy measure for sensible or public views. During an alert, the live view is clear until approx. 30 seconds after the end of the alert. Default: false
Show drone as picture in picture	true/false	Display a close-up of the drone as a picture in picture in the live view. Default: true

3.3.6.8 Edit audio sensor configuration

The audio sensor configuration helps to improve the acoustical detection.

Disadvantageous settings make the detection worse or can lead to increased false alarms.

Changes to the configuration should always be done with an understanding of the effects the changes will make and carefully. Monitor the effects of your changes in the following days and, if necessary, make corrections.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired sensor.
   ► A context menu appears.
3. Choose **Configuration**.
   ► The window **Configuration** appears.
4. Change the desired value.
5. Choose **[Save changes]**.

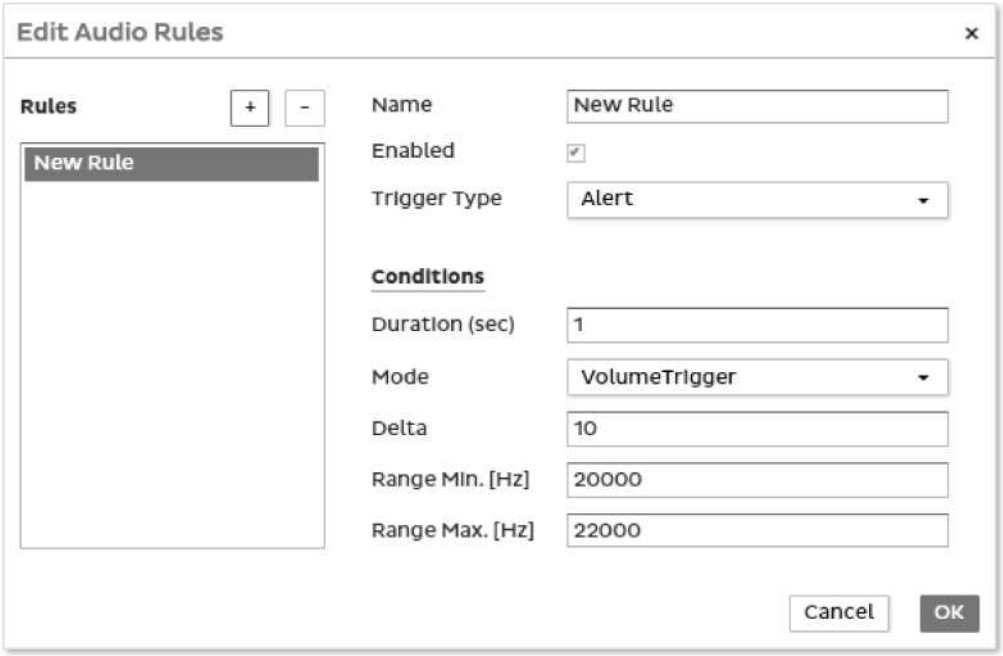
The following values can be set:

Value	Unit	Explanation

Background learning		
Enable background learning	true/false	Enables the learning of background noise. default: true
Learning time	minutes	Noises, which appears in the learning time, will be categorized as known for the system. min. value: 5 max. value: 120 default: 24
Noise level	%	The noise level defines, which noises are interpreted as background. For example, 100 means, everything is background, 50 means, everything below the average volume is background. Larger value means learning only loud signals as background noise. min. value: 0 max. value: 100 default: 75
Signal threshold		Threshold defines the delta value between the noise level and an alarm min. value: 0 max. value: 10 default: 0
General		
User audio rules		You can configure your individual audio rules. In this way you can customize the audio sensors for your environment.

Create audio rules

To adjust the acoustic detection, you have the option to define specific rules.



+ -	Add or remove a rule
Name	Name of the rule
Enabled	Activate the option to enable the chosen rule
Trigger type	**Alert** triggers an alert **No alert** blocks an alert
Duration (sec)	Duration, for how long the below specified condition has to persist
Mode	**VolumeTrigger** Analyzes a specified frequency range and in case of a deviation of the entered delta to the learned default value, the rule triggers **MeanComparisonTrigger** Analyzes a specified frequency range and compares the specified delta to a reference frequency range
Delta	Value in dB, which has to be louder to trigger
Range min. [Hz]	Lower bound for the analyzed range
Range max. [Hz]	Upper bound for the analyzed range

Ref range min. [Hz]	Lower bound for the analyzed reference range (just for **MeanComparisonTrigger**)
Ref range max. [Hz]	Upper bound for the analyzed reference range (just for **MeanComparisonTrigger**)

Tip: To find out the critical frequencies, you can use the Audio Overlay. To open the Audio Overlay, right-click on an Audio Live View and choose **Audio Settings > Overlay**.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired audio sensor.
   ► A context menu appears.
3. Choose **Configuration**.
4. The window **Configuration** appears.
5. Choose the field besides the option **User audio rules**.

6. Create your rule (see above).
7. Choose **[OK]**.
8. Choose **[Save changes]**.

3.4 Map Editor

3.4.1 Load map

3.4.1.1 Load online map

1. Choose menu **OPTIONS > Map Editor**.
2. Choose menu **[More] > Map settings > Use global map**.
   ► A map is shown. If the location information of your browser is available, the map is centered on this position.
3. By dragging & dropping or using the search bar you can navigate to the desired address, location, region or geo-position.

4. To define the chosen position as home position, right-click on that position and choose **Use as home position**.
5. To change the map scheme, map scale and other map options, choose the desired options in the map options in the lower right corner.
6. For an optimal contrast between the elements of the DroneTracker System and the map, configure the brightness of the map .
7. Choose **[Save changes]**.

3.4.1.2 Load and configure a custom map

If you prefer to use your own map image or your system does not have an internet connection, you have the option to upload an image (.jpg, .jpeg, .png, .bmp, .tiff, .tif, .gif).

To enable the system to visualize the position of a detection, the image has to be equipped with GPS coordinates. Therefore, it is necessary to set at least **2 location markers.** The more location markers are set, the better the accuracy of the GPS calculation will be.

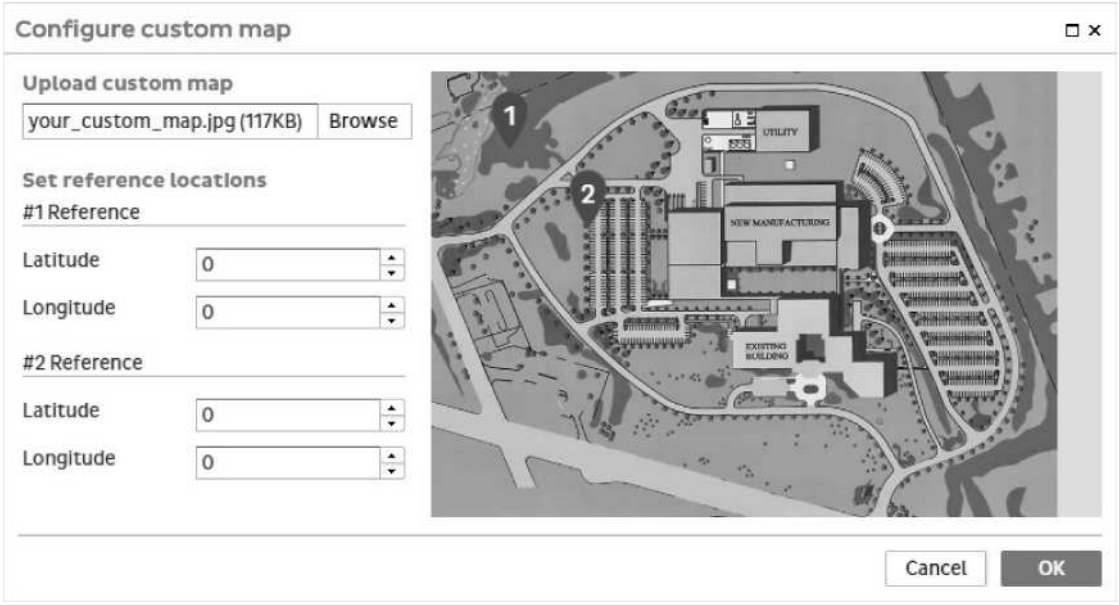
Tip: Measure the GPS coordinates of at least 2 prominent positions on your site before configuring the sitemap image.

By using the format GeoTIFF the included position information will be recognized automatically after the upload.

Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. Choose menu **[More] > Map settings > Use custom map**.
   ▶ The wizard **Configure custom map** appears.

3. Choose **Browse** and select your graphic. Therefore, the format has to be .jpg, .jpeg, .png, .bmp, .tiff, .tif or .gif.
4. Choose **[OK]**.
   ► The graphic appears in the map preview.



   ► Two location markers are set by default on the map.
5. To move a location marker, drag and drop it on the image.
6. Enter the according latitude and longitude values on the left.

1 To set additional location markers on the map, double-click on the image and enter the according latitude and longitude values on the left.

7. To delete a location marker, right-click on the location marker and choose **Delete location marker**.
8. Choose **[OK]**.
9. Choose **[Save changes]**.

3.4.2 Add and configure zones

It is possible to configure zones on the sitemap. There are two kinds of zones:

- Alert zone - triggers an alert if a drone is detected inside of it.
- Interest zone - triggers a warning if a drone is detected inside of it.

The recording starts regardless of the triggered zone type automatically in case of an alert or warning.

The alerting behavior of detections without position can be configured globally.

Procedure:

1. Choose **OPTIONS > Map Editor.**
2. Choose button **[Add] > Alerting zone**.
   ▶ An alert zone appears on the map and in the sidebar the according options are shown.
3. Write a zone name in the field **Label**.
4. To change the type of zone, choose the desired entry in the field **Zone type**.
   ▶ The color of the zone changes depending on the type of zone.
5. To form or move the zone, click and hold the nodes on the zone.
6. To add a node to the form, right-click on a node and choose **Insert node**.
   ▶ The new node appears clockwise next to the chosen node.
7. To delete a node from the form, right-click on the desired node and choose **Delete node**.
8. To lock the settings, activate the option **Lock settings**.
9. Choose **[Save changes]**.

3.4.3 Position and align a sensor

Wrong drone positions will be a result of inaccurate sensor positions.

Accurate positioning and alignment of the sensors on the sitemap has a significant impact on the drone detecting and positioning result of the system.

- If you use a custom sitemap image, make sure that the sitemap is calibrated with location markers.
- Position and align the sensors as accurately as possible.

Depending on the map type and the sensor types, there are different ways to calibrate the map and the sensors. The basis of the positions and alignments in DroneTracker are GPS coordinates. By using an online map, the calibration of the map is handled automatically. Uploaded sitemap images need to be calibrated by manually setting location markers.

Precondition:

- Sensors have been added in the site configuration.
- Calibrated sitemap is configured (see Load online map or Load and configure sitemap image)

Depending on the type of sensor, you have different options for the positioning and alignment:

- Position and align a sensor manually
- Position and align a Pan-Tilt-Zoom Camera (PTZ)

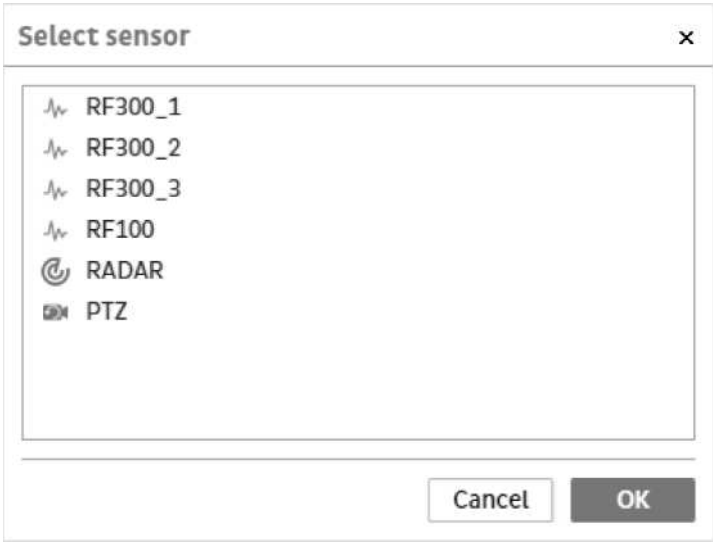
3.4.3.1 Position and align a sensor manually

Precondition:

- Sensors have been added in the site configuration.

Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. If a senor is added in the Site Configuration and is not positioned on the sitemap a notification is shown in the lower left corner.
   Add the sensor by clicking on the notification.
   - A symbol of the device or sensor is shown on the map.
3. To choose a sensor from a list:
   - Choose **[Add] > Sensor**.
   - ► The window **Select sensor** appears.



   - Choose the desired sensor.
   - ► A symbol of the sensor is shown on the map.
1. For approximate positioning and alignment of the sensor, drag and drop the symbol to move it to the desired position and drag and drop the range display to align it (azimuth).
2. For numeric positioning and alignment of the sensor, choose the element on the map and enter the following values:

Lock settings	Locks all settings of this sensor
Latitude	Latitude GPS coordinate in decimal degrees (e. g. 51.312349)
Longitude	Longitude GPS coordinate in decimal degrees (e. g. 9.492333)
Azimuth	Horizontal alignment in degree 0 = north 90 = east 180 = south 270 = west
Range	Range of the sensor in meters For IP cameras and RF-300s the configuration of the option **Range** determines where detected drones are drawn on the map. To show or hide the range displays of the elements, activate or deactivate the option  . This option affects the display of the range displays on the home screen and the Map Editor. To hide the range indicator of a single element constantly, choose the desired element in the sensor list or on the map and deactivate the option **Show range**.
Angle of view	Horizontal angle of the camera lens in degree In case of a wrongly entered value, a detected drone will be incorrectly drawn on the sitemap.
Height	Height of the installed DroneTracker or sensor in meters The height values should be entered relative to each other. You may for example use the GPS height or any locally available height measurement reference system
Elevation	Vertical alignment in degrees (maximum 90, minimum -90) 0 = straight ahead Positive values = alignment skywards Negative values = alignment to the ground
Show range	Deactivate this option to hide the range display. This effects the Home screen and Map Editor.

3. Choose **[Save changes]**.

3.4.3.2 Position and align a Pan-Tilt-Zoom camera (PTZ)

Requirements:

- The following PTZ cameras are supported by the DroneTracker System:
    - Axis Q8665-E
    - **Axis Q8685-E** (recommended)
    - **Axis Q8685-LE** (recommended)
    - Bosch MIC IP dynamic 7000 HD (Firmware version: 6.44.0020 (20500644))
    - AscentVision CM202U
    - Flir HDC1200
- **PTZ camera is mounted on a level horizontal plate** (no tilted foundations).
  If the PTZ camera is mounted at an angle, the positioning and camera controls of the PTZ camera won't be accurate.
- **An accurate positioning and alignment of the PTZ camera is a requirement for good tracking.**
  The configuration of the GPS position and height of the PTZ camera is critical. If the installation and configuration is not accurate, the tracking won't be accurate either.
    - Note the GPS position and height of the PTZ camera during the installation.
- **An appropriate Analytics Server is installed.**
  To operate a PTZ camera in a DroneTracker System an Analytics Server is required.
  The Analytics Server requirements are documented here.

Procedure:

1. Add the PTZ camera to the Site Configuration.
2. Temporarily change the PTZ mode for the configuration steps:
    - Choose **OPTIONS > Site Configuration.**
    - Right-Click on the desired PTZ camera .
    - ▶ A context menu appears.
    - Choose **Configuration**.
    - ▶ The window **Configuration** appears.
    - Change the field **PTZ mode** to the value **Passive**.
    - Choose **[Save changes]**.
3. Choose **OPTIONS > Map Editor**.

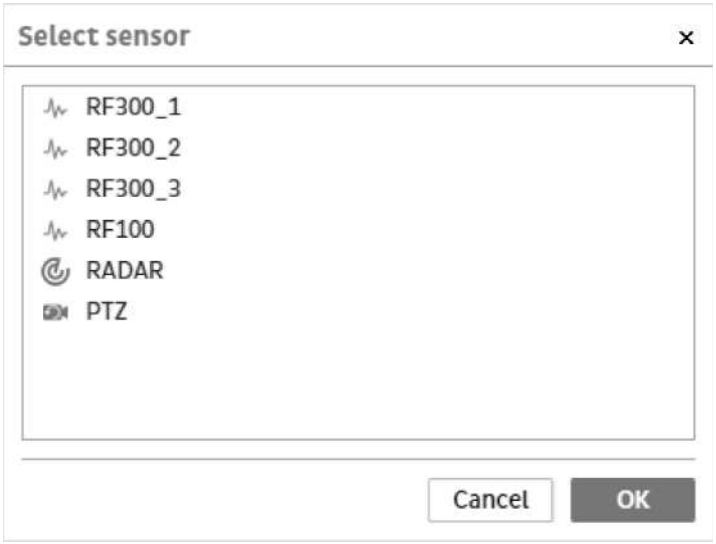
4. If a senor is added in the Site Configuration and is not positioned on the sitemap, a notification is shown in the lower left corner.
   Add the sensor by clicking on the notification.

   ► The symbol of the sensor is shown on the map .

5. To choose a sensor from a list:

   • Choose **[Add] > Sensor**.

   ► The window **Select sensor** appears.



   • Choose the desired PTZ Camera and **[OK]**.

   ► A symbol of the PTZ Camera is shown on the map .

6. Choose the element on the map and enter the noted values in the fields **Latitude** and **Longitude** in decimal degrees (e. g. 51.312349 and 9.492333).

7. Enter the value **Height** of the installed sensor in meters off the ground.

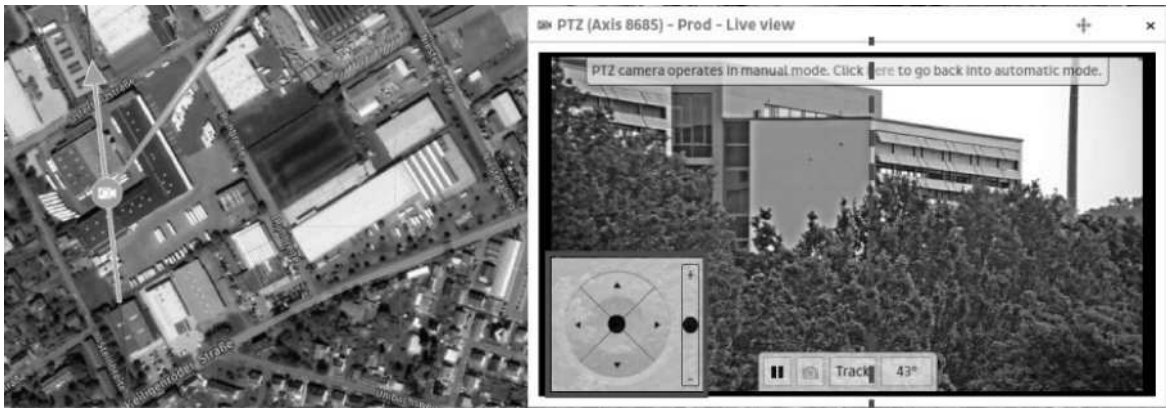
8. Right-Click on the desired PTZ camera and choose **Live view**.

   ► The live view of the PTZ camera is shown.

9. Choose a prominent landmark, which can be identified on the map, e.g. a corner of a building.
   Tip: If another sensor is already installed and visible for the PTZ camera, use this as a

landmark.

10. Use the PTZ controls in the live view to control and zoom in to a prominent landmark.



   ► According to the zoom factor, the shown range will become more narrow and longer.

11. Click on the range and align it over the chosen prominent landmark as accurately as possible.

12. To hide the range, deactivate the option **Show range**. To lock the settings, choose **Lock settings**.

13. Choose **[Save changes]**.

14. Activate the PTZ mode for drone tracking:
    - Choose **OPTIONS > Site Configuration.**
    - Right-Click on the desired PTZ camera .
    ▶ A context menu appears.
    - Choose **Configuration**.
    ▶ The window **Configuration** appears.
    - Change the field **PTZ mode** to the value **Tracking**.
    - Choose **[Save changes]**.

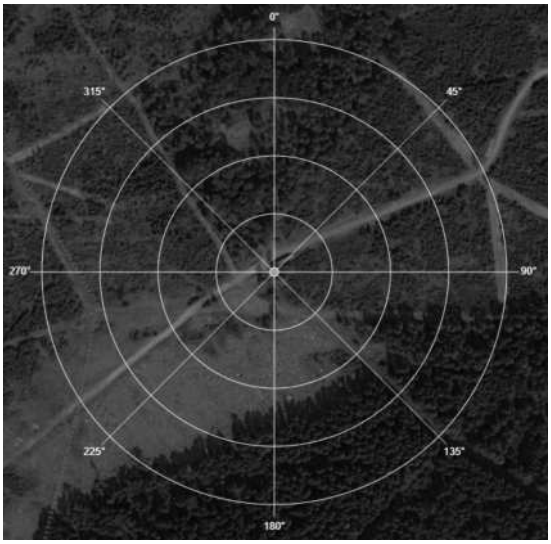
3.4.4 Configure a Point of Interest

For better assessment of a drone threat, Point of Interests can be positioned on the map. When a drone position has been detected, the drone's direction of movement to the defined point of interest is displayed on the map.

Additionally, a tactical overlay can be enabled around every Point of Interest. The sector of the tactical overlay in which the drone is located is highlighted. The scaling of the tactical overlay is configurable.

Procedure:

1. Choose menu **OPTIONS > Map Editor**.
2. Choose **[Add] > Point of Interest**.
    ▶ The Point of Interest with the tactical overlay is shown.



3. For approximate positioning drag and drop the Point of Interest to the desired position.
4. For a numeric positioning fill in the fields **Latitude** and **Longitude**.

5. To rename the Point of Interest, enter the desired name in the field **Label**.
6. To configure the tactical overlay enter the following values:

Enabled	Display or hide the tactical overlay of the Point of Interest
Draw axes	Display or hide the axes of the tactical overlay
Axis labels	Choose the label of the axes: • **None**: No labels are displayed • **Degrees**: Axes are labeled in degree • **Mils**: Axes are labeled in mils
Number of axes	Configures how many axes the tactical overlay uses (4 to 64).
Range	Configures the radius of the tactical overlay in meters (50 to 1000).
Sub-Range	Configures the subdivision size in meters of the tactical overlays ring (25 to 250).
Azimuth	Configures the angle of the tactical overlay relative to the site maps north (0 to 359).

7. Choose **[Save changes].**

3.4.5 Add planning sensor

It is possible to add planning sensors on the sitemap. Planning Sensors are virtual sensors to plan a site. Planning Sensors are just shown in the Map Editor and do not appear in the Site Explorer on the home screen.

A Planning Sensor can be configured as any kind of sensor.

Procedure:

1. Choose **OPTIONS > Map Editor.**

1 Choose button **[Add] > Planning sensor**.

   ▶ The window **Add Planning Sensor** appears.

2. Write a name in the field **Label.**
3. Choose the type of sensor in the drop-down list **Type**.

   ▶ Depending on the sensor type, the sensor appears on the sitemap. The label of the planning sensor is marked with "(Planning)".

4. Position and align the sensor on the map.
5. Choose **[Save changes]**.

3.4.6 Lock/unlock elements on the sitemap

All elements on the sitemap can be locked or unlocked centrally. You have the option to secure your configuration from unintended changes.

It is also possible to lock and unlock the settings of single elements (see Position and align a sensor and Add and configure zones). When using the central option, all single lock settings will be overwritten.

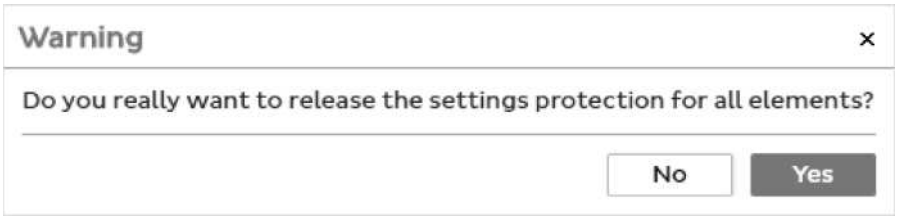
Lock all elements:

1. Choose **OPTIONS > Map Editor.**
2. Choose **[More] > Lock all elements**.
   - ▶ The window **Warning** appears.

3. Confirm with **[Yes]**.
   - ▶ The option **Lock settings** of all elements is activated.

Unlock all elements:

1. Choose **OPTIONS > Map Editor.**
2. Choose **[More] > Unlock all elements**.
   - ▶ The window **Warning** appears.



3. Confirm with **[Yes]**.
   - ▶ The option **Lock settings** of all elements is deactivated.

3.4.7 Delete a sensor or zone from the sitemap

1. Choose menu **OPTIONS> Map Editor**.
2. Choose the desired sensor or zone on the map or in the drop-down list in the upper left corner.
3. Choose **[Delete]** in the menu bar.

- ▶ The sensor or zone disappears of the map. The removed sensor is still active part of the system and can trigger an alert.

4. Choose **[Save changes]**.

3.5 Configure alerting

Depending on the deployed sensors, the alerting behavior of the system should be configured differently. Whether alert or warning, the recording starts automatically.

Procedure:

1. Choose **OPTIONS > Alerting Configuration**.
2. Set desired configuration:

Detection	
Enable alerting*	Activates any kind of alerting **Security gap!** By deactivating this option, the system cancels the current alert and does not create any further alerts.
Alert timeout	Time after the last detection until an alert end **30 sec** is default and recommended.
Detection mode	Configures the global alerting behavior **RF or Wi-Fi required*** An RF sensor or Wi-Fi sensor has to trigger to create an alert. For an absolutely sensitive system configuration, this option is not recommended. If the RF detection does not trigger, the system never creates an alert. This could be misleading for example during product demonstrations. **Any type of sensor** Any type of sensor can trigger an alert. This increases the sensitivity of the system but could also lead to more false positives.
Handling of positions and zones	

Treat detection without position as	Configures the alerting behavior of detections without any position information (e.g. Wi-Fi or Audio alerts) **Ignored** Detections without position information will be ignored **Warning** Detections without position information will trigger a warning **Alert** * Detections without position information will trigger an alert
Treat detection outside zone as	Configures the alerting behavior of detections outside of zones (position required) **Ignored** Detections outside any zone will be ignored **Warning** Detections outside any zone will trigger a warning **Alert** * Detections outside any zone will trigger an alert

* Default setting

3. Choose **[Save changes]**.

3.6 Notifications

3.6.1 Set alert notifications

Precondition:

- For Email and SMS an existing internet connection is necessary.

Procedure:

1. Choose menu **OPTIONS > Alert Notifications.**
2. To set the popup notification for drone alerts on the DroneTracker UI, activate or deactivate the checkbox **Show alert popup on screen**.
3. To set the audio alert on the DroneTracker UI, activate or deactivate the checkbox **Play audio alert sound**.
   Note for Safari: When using the web-browser Safari, make sure that the Safari option **Auto-Play** is enabled.
4. Choose the desired entry in the drop-down list **Send alert notifications**:

Never	All alert notifications will be deactivated.
On alert start	If the system triggers an alert, a message will be sent.
On alert end	If a triggered alert ended, a message will be sent.
On alert start and end	If the system triggers an alert, a message will be sent and if a triggered alert ended, a message will be sent.

5. To restrict the Email and SMS notification to alerts in alert zones, choose the option **No Email/SMS for Warnings**.
6. Choose one or more desired notification channels and enter the desired recipients in the fields:

Email	
Email addresses	Email address of the recipient. Separate multiple addresses by a comma and a space.
Email sender name	Sender name which is shown in the email
Email subject	Email subject of the notification. You can use the following placeholder: **<type>**: shows the type of incident. This could be "\Warning" or "Alert". **<sensors>**: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.
Server host	Host name to use for links in Emails
SMS	
Phone numbers	Phone number of the recipient. Use the international notation i.e. +12345678901. Separate more phone numbers with a line break [↵].
SNMP	
SNMP trap server IP and port	SNMP Trap address with port Enter the port separated by a colon directly behind the address.

TCP/IP	
TCP/IP server and port	TCP/IP address with port Enter the port separated by a colon directly behind the address. If a TCP/IP address is set, you have to create your own message by entering something in the field TCP/IP message format.
TCP/IP message format	Any string which will be sent in case of an alert. You can use the following placeholder: **<type>**: shows the type of incident. This could be "Warning" or "Alert". **<sensors>**: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.

7. To test the configuration choose **[Send test notifications]**.
   ► The window Send test notifications appears.
   - Choose **[OK]** to save the changes and send the test notification.
   - A test message will be sent to all recipients, except SNMP Trap messages.
8. Choose **[Save changes]**.

3.6.2 Set system notifications

Precondition:

- For Email and SMS an existing internet connection is necessary.

Procedure:

1. Choose menu **OPTIONS > System Notifications.**
2. To set an error timeout before a notification is sent, set a value in seconds in the field **Sensor error timeout [seconds]**. The value can be set between 0 to 300.
3. To set popup notifications for system errors on the DroneTracker UI, activate or deactivate the checkbox **Show error popups on screen**.
4. Choose the desired entry in the drop-down list **Send system error notifications**:

Never	All system fault notifications will be deactivated.
Once on occurrence	A system fault notification will be sent once on occurrence
On occurrence and every hour	A system fault notification will be sent once on occurrence and every hour
On occurrence and every 6 hours	A system fault notification will be sent once on occurrence and every six hours
On occurrence and every 12 hours	A system fault notification will be sent once on occurrence and every twelve hours
On occurrence and every 24 hours	A system fault notification will be sent once on occurrence and every 24 hours

5. Choose one or more desired notification channels and enter the desired recipients in the fields:

Email	
Email addresses	Email address of the recipient. Separate multiple addresses with a comma and a space.
Email sender name	Sender name which is shown in the email
Email subject	Email subject of the notification. You can use the following placeholder: **<type>**: shows the type of incident. This could be "Warning" or "Alert". **<sensors>**: contains a list of the sensors participating in the triggered alert. **<alertId>**: internal ID of the alert to be able to match the notification to alert. **<timestamp>**: UTC UNIX timestamp of the event. **<notificationType>**: classifies the notification e.g. alert begin or test notification.
Server host	Host name to use for links in Emails
SMS	
Phone numbers	Phone number of the recipient. Use the international notation i.e. +12345678901. Separate more phone numbers with a line break [↵].
SNMP	

SNMP trap server IP and port	SNMP Trap address with port Enter the port separated by a colon directly behind the address.

6. To test the configuration choose **[Send test notifications]**.
   ► The window Send test notifications appears.
   - Choose **[OK]** to save the changes and send the test notification.
   - A test message will be sent to all recipients, except SNMP Trap messages.
7. Choose **[Save changes]**.

3.6.3 Deactivate alert notifications

1. Choose menu **OPTIONS > Alert Notifications.**
2. In the drop-down list **Send alert notifications** choose the entry **Never**.
3. Choose **[Save changes]**.

3.6.4 Deactivate system notifications

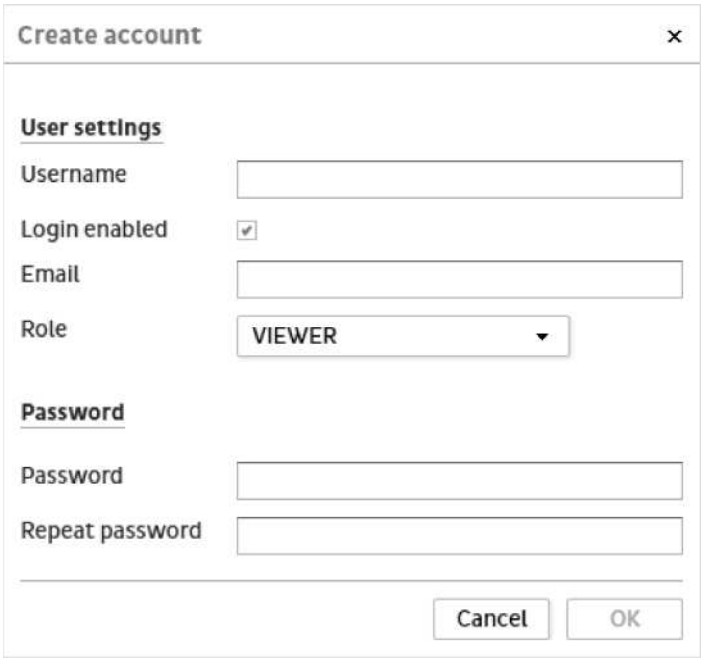
1. Choose menu **OPTIONS > System Notifications.**
2. In the drop-down list **Send system error notifications** choose the entry **Never**.
3. Choose **[Save changes]**.

3.7 User Management

3.7.1 Create a new user

1. Choose **OPTIONS > User Manager**.
2. Choose **[New user]**.

► The window **Create account** appears.



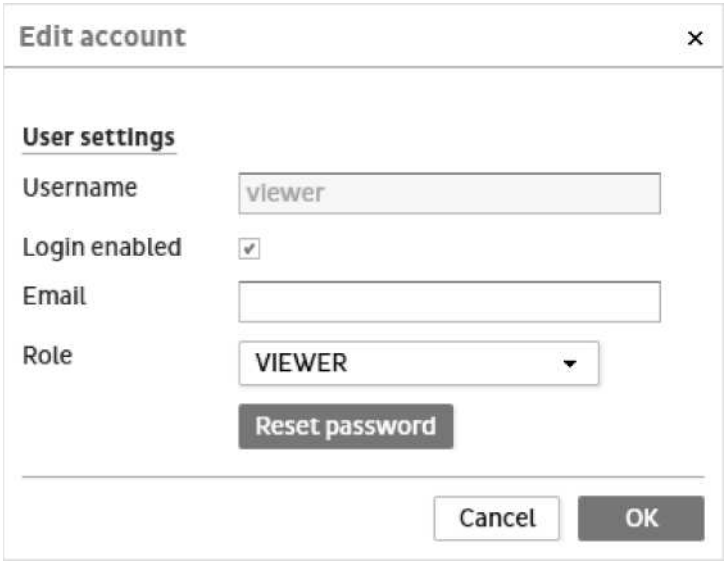
3. Enter a user name. Note the following user name policy:
   - At least one character long
   - Only lowercase letters
   - Consists only of letters, numbers and "@ _ - . "
   - No umlauts allowed
4. Enter an email address. This email address is used for the password reset and can be used as login as well.
5. Choose the desired role.
6. Enter a password. Therefore, note the following password policy:
   - At least eight characters long
   - Upper and/or lowercase letters (A-Z / a-z)
   - At least one digit
   - At least one special character
7. Choose **[OK]**.
   ► The created user appears in the user list and can be used.

3.7.2 Reset user password

Each user has the option to change his own login password. As an administrator you can reset the password of each user.

Procedure:

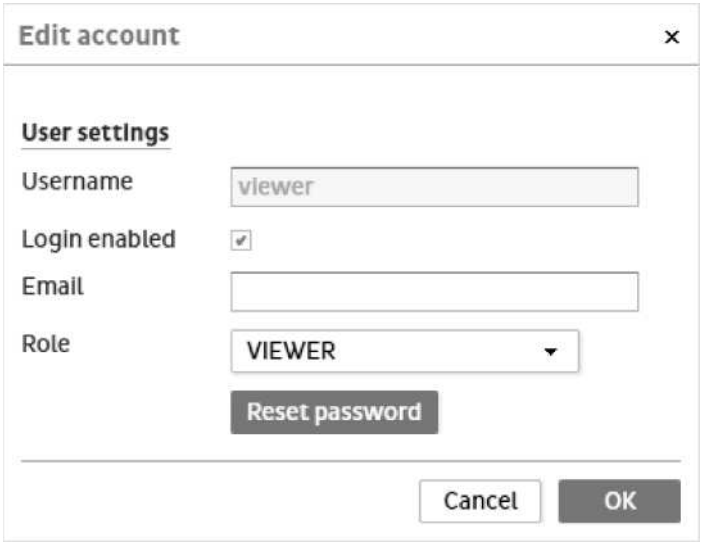
1. Choose **OPTIONS > User Manager**.
2. Choose the desired user.
   ▶ The window **Edit account** appears.



3. Choose **[Reset password]** and enter the new password for the chosen user.
4. Choose **[OK]**.

3.7.3 Change user role or user name

1. Choose **OPTIONS > User Manager**.
2. Choose the desired user.
   ▶ The window **Edit account** appears.



3. To change the username write the new name in the field **Username**.
4. To change the email address write the changed address in the field **Email**.

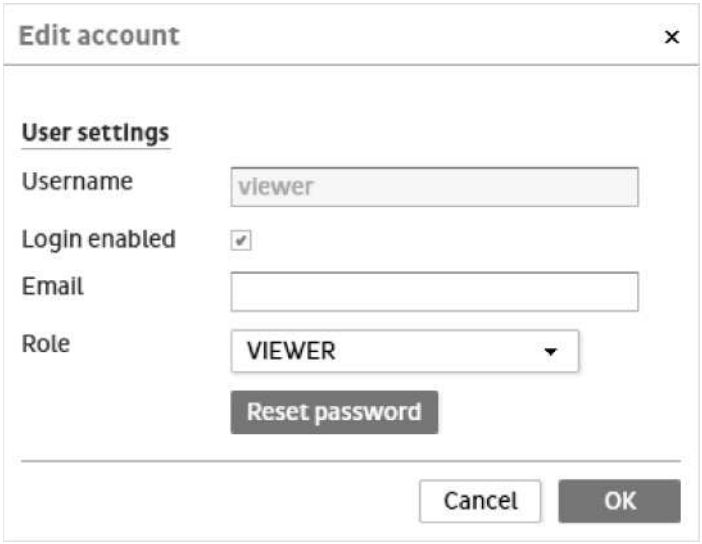
5. To change the user role choose the desired role in the field **Role**.
6. Choose **[OK]**.

3.7.4 Disable user login

You have the option to disable a user login. Afterwards the user is not able to log into DroneTracker.

Procedure:

1. Choose menu **OPTIONS > User Manager**.
2. Choose the desired user.
   ▶ The window **Edit account** appears.



3. Deactivate the option **Login enabled**.
4. Choose **[OK]**.

3.8 Configure a PTZ camera

For the operation and accurate drone tracking with a PTZ camera some requirements have to be fulfilled and configurations have to be set.

Requirements:

- The following PTZ cameras are supported by the DroneTracker System:
  - Axis Q8665-E
  - **Axis Q8685-E** (recommended)
  - **Axis Q8685-LE** (recommended)

  - **Axis Q6215-LE** (recommended)
  - Bosch MIC IP dynamic 7000 HD (Firmware version: 6.44.0020 (20500644))
  - AscentVision CM202U
  - Flir HDC1200
- **PTZ camera is mounted on a level horizontal plate** (no tilted foundations).
  If the PTZ camera is mounted at an angle, the positioning and camera controls of the PTZ camera won't be accurate.
- **An accurate positioning and alignment of the PTZ camera is a requirement for good tracking.**
  The configuration of the GPS position and height of the PTZ camera is critical. If the installation and configuration is not accurate, the tracking won't be accurate either.
  - Note the GPS position and height of the PTZ camera during the installation.
- **An appropriate Analytics Server is installed.**
  To operate a PTZ camera in a DroneTracker System an Analytics Server is required. The Analytics Server requirements are documented here.

Configuration

The configuration is carried out in three main steps:

3.8.1 Configuration of the PTZ camera in the web user interface

- Open the browser, enter the IP address of the PTZ camera and login with your credentials.

Depending on the PTZ camera model used and the firmware version of the PTZ camera, the user interface differs.

Configuration for Axis cameras with firmware version 6.5 or smaller:

- Setup > Video > ONVIF Media Profiles > profile_1_h264 > [Modify…] > Video Encoder Configuration > [Edit configuration] > **GOV length: 16**
- Setup > PTZ > Advanced > Device > Zoom limits > **Zoom tele: 9999**
- Setup > PTZ > Advanced > Device > **Proportional speed: disabled**
- *If the camera is installed inverted* - so it can tilt directly upwards - set the following setting:
  Setup > PTZ > Advanced > Device > **Camera housing configuration: Inverted**
- *Only Axis Q8685-E and Q8685-LE*:
  Setup > Video > Camera Settings > Normal Light > Priority: Controller to "Low motion

blur” •Only Axis Q8665-E: Setup > Video > Camera Settings > **Wide Dynamic Range: Enable Dynamic Contrast**

Configuration for Axis camera Q8685-E and Q8685-LE with firmware version 8.4 or higher:

- Settings > System > ONVIF > ONVIF media profiles > profile_1 h264 > [Modify...] > Video Encoder Configuration > [Edit configuration] > **GOV length: 16**
- Settings > PTZ > Limits > Zoom limit > **360x D**
- Settings > PTZ > Motion > **Proportional speed: disabled**
- *If the camera is installed inverted* - so it can tilt directly upwards - set the following setting:
  Settings > System > Plain Config > PTZ > UserAdv U1 > **Camera housing configuration: Inverted**
- Settings > Images > Exposure > **Blur-noise trad-off: Controller to “Low motion blur”**

Configuration for Axis camera Q6215-LE with firmware version 8.50

- System > ONVIF > New Media Profile > Video encoder > Select a configuration > **default_1 h264**
- Image > Appearance > set all four values to **100**

Configurations for Bosch MIC IP dynamic 7000 HD:

- Configuration > Camera > Lens Settings > **Day near limit: 10 m**
- Configuration > Camera > Lens Settings > **Night near limit: 10m**

3.8.2 Position and align a PTZ camera on the DroneTracker map

1. Add the PTZ camera to the Site Configuration.
2. Temporarily change the PTZ mode for the configuration steps:
   - Choose **OPTIONS > Site Configuration.**
   - Right-Click on the desired PTZ camera  .
   ► A context menu appears.
   - Choose **Configuration**.
   ► The window **Configuration** appears.
   - Change the field **PTZ mode** to the value **Passive**.

- Choose **[Save changes]**.

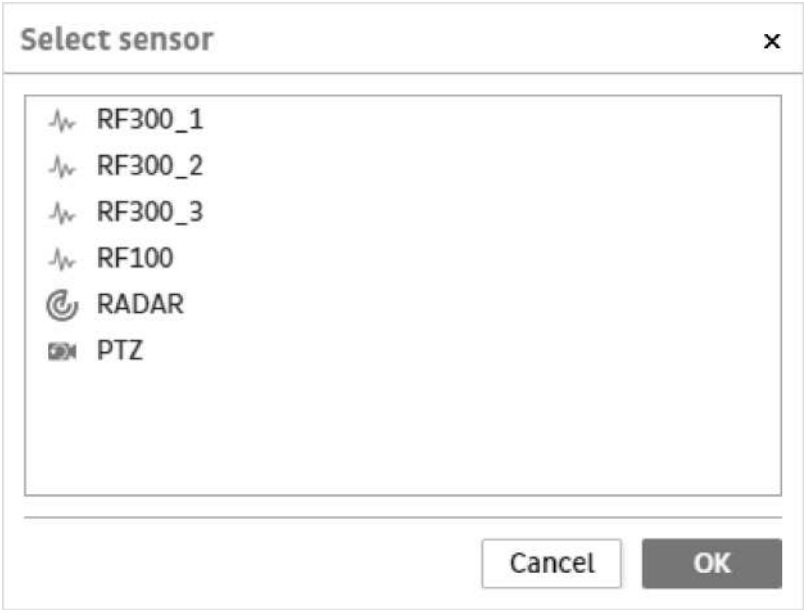
3. Choose **OPTIONS > Map Editor**.
4. If a senor is added in the Site Configuration and is not positioned on the sitemap, a notification is shown in the lower left corner.
   Add the sensor by clicking on the notification.

   ► The symbol of the sensor is shown on the map .

5. To choose a sensor from a list:

   - Choose **[Add] > Sensor**.

   ► The window **Select sensor** appears.



   - Choose the desired PTZ Camera and **[OK]**.

   ► A symbol of the PTZ Camera is shown on the map .

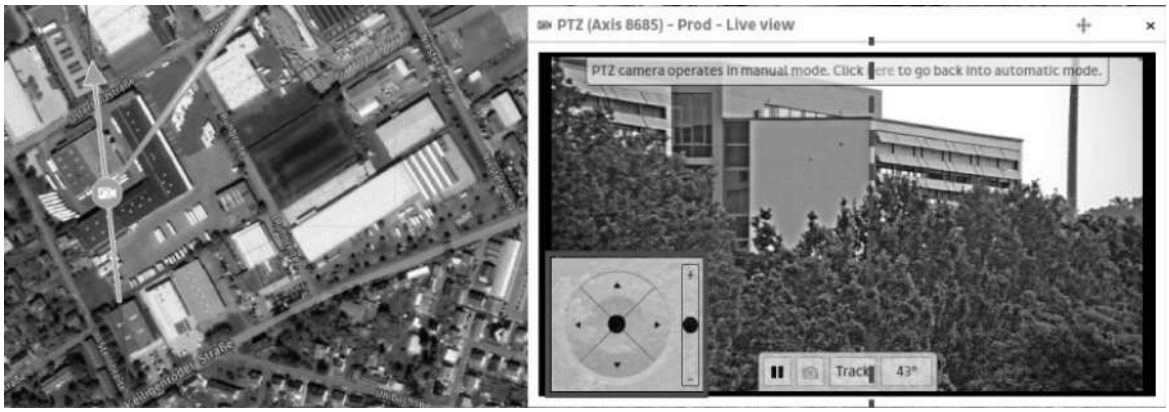
6. Choose the element on the map and enter the noted values in the fields **Latitude** and **Longitude** in decimal degrees (e. g. 51.312349 and 9.492333).
7. Enter the value **Height** of the installed sensor in meters off the ground.
8. Right-Click on the desired PTZ camera and choose **Live view**.

   ► The live view of the PTZ camera is shown.

9. Choose a prominent landmark, which can be identified on the map, e.g. a corner of a building.
   Tip: If another sensor is already installed and visible for the PTZ camera, use this as a

landmark.

10. Use the PTZ controls in the live view to control and zoom in to a prominent landmark.



   ► According to the zoom factor, the shown range will become more narrow and longer.

11. Click on the range and align it over the chosen prominent landmark as accurately as possible.

12. To hide the range, deactivate the option **Show range**. To lock the settings, choose **Lock settings**.

13. Choose **[Save changes]**.

14. Activate the PTZ mode for drone tracking:
    - Choose **OPTIONS > Site Configuration.**
    - Right-Click on the desired PTZ camera  .
    ▶ A context menu appears.
    - Choose **Configuration**.
    ▶ The window **Configuration** appears.
    - Change the field **PTZ mode** to the value **Tracking**.
    - Choose **[Save changes]**.

3.8.3 Configure PTZ search area

If a sensor in DroneTracker detects a drone position without height information (e.g. RF sensor or radar), the PTZ camera pans to that direction and searches at different heights, analyzes the video picture for the drone for about 2 seconds and pans randomly to another height position. To speed up this search, you can define an appropriate minimum and maximum height over ground for that search.

Procedure:

1. Choose **OPTIONS > Site Configuration.**
2. Right-Click on the desired PTZ camera  .
    ▶ A context menu appears.
3. Choose **Configuration**.
    ▶ The window **Configuration** appears.
4. Change the field **Max. search height** and **Min. search height** to realistic values in meter.
5. Choose **[Save changes].**

3.9 Updates

3.9.1 Update Process

The update process differs depending on the system type: stand-alone system or a DroneTracker System with separate server.

The update process of a DroneTracker System with separate Server must take place in two to three steps:

1. Update DroneTracker Server.
2. Update sensors.
3. If used, update Analytics Servers.

3.9.2 Update DroneTracker Server

If the system has an internet connection or not the preconditions and procedure may vary.

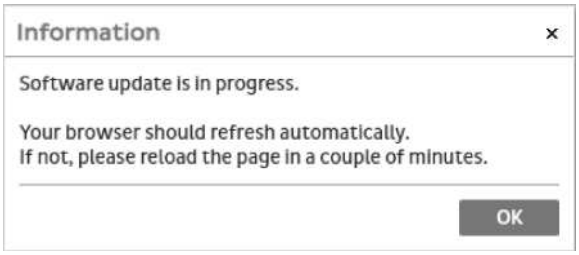
Update an Online System

Precondition:

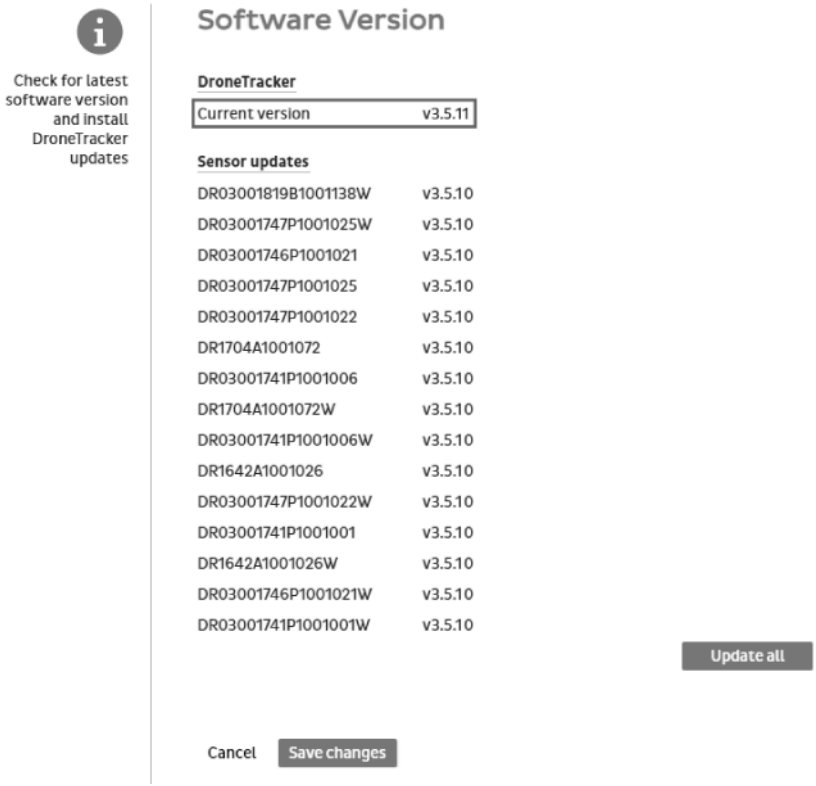
- Existing access to Dedrone Cloud
- Configured Dedrone Account

Procedure:

1. Choose menu **OPTIONS > Software Version**.
   ▶ The current and the latest software version is shown.
2. If a newer version is available, choose **[Update]** besides the latest version.
   ▶ The download and installation starts immediately.
   ▶ The window **Information** appears.



   ▶ If the new software version is shown at **Current Version** the download and installation of the DroneTracker Server update was successful.



Update an Offline System

Precondition:

- Basic Linux knowledge
- Update files on an external media ([apt-cacher].tgz and [DT Server Update].tgz)
- Access to the DroneTracker Server as system administrator
- Running and configured APT caching proxy (**apt-cacher-ng**) on the DroneTracker Server (for detailed information see **Readme Server Installation** for the DroneTracker Server).

Procedure:

1. Copy the tgz-files to your DroneTracker Server.
2. Verify that the string '**Offlinemode 1**' is included in file

   ```
   /etc/apt-cacher-ng/acng.conf
   ```
3. Stop the service **apt-cacher-ng**:

   ```
   root$> service apt-cacher-ng stop
   ```
4. Clean actual software repository:

   ```
   root$> rm -r /var/cache/apt-cacher-ng/*
   ```
5. Unpack the tarball as user root and set correct permissions:

   ```
   root$> tar xzf the_update_repository.tgz -C /var/cache/apt-cacher-ng/
   root$> chown -R apt-cacher-ng:apt-cacher-ng /var/cache/apt-cacher-ng/
   ```
6. Start the service **apt-cacher-ng**:

   ```
   root$> service apt-cacher-ng start
   ```
7. On the server, unpack the file as dedrone user with the command:

   ```
   tar xzf dedrone_server-v[version].tgz
   ```
8. Run update.sh from the tgz-file as dedrone user (adjust directory as required)

   ```
   dedrone$> dedrone_server-vXXXX/update.sh
   ```

3.9.3 Update Sensors

Precondition:

- Newer software version has to be downloaded on the DroneTracker Server.

You have the option to update all sensors at once or update every single sensor individually.

Update All Sensors at Once

1. Choose menu **OPTIONS > Software Version**.
2. Choose **[Update all]**.

   ► The button becomes grey and the sensors get updated in the background. During the update, the sensors get disconnected and reconnected. Some short system messages show the connection process.

Update a Single Sensor

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Double-click on the desired sensor.

   ► The window **Sensor details** appears. If an update is available for that sensor, a message is shown on top of the window.

3. Choose **[Update]**.
4. Choose **[OK]**.
5. Choose **[Save changes]**.

3.9.4 Update Analytics Server

Precondition:

- Newer software version has to be downloaded on the DroneTracker Server.

You have the option to update all Analytics Servers at once or update a single server individually.

Update all servers at once

1. Choose menu **OPTIONS > Software Version**.
2. Choose **[Update]**.

▶ The button becomes grey and the sensors get updated in the background. During the update, the sensors get disconnected and reconnected. Some short system messages show the connection process.

Update a single Analytics Server

1. Choose menu **OPTIONS > Analytics Servers**.
2. Choose **[Update]** besides the desired server.
3. Choose **[OK]**.

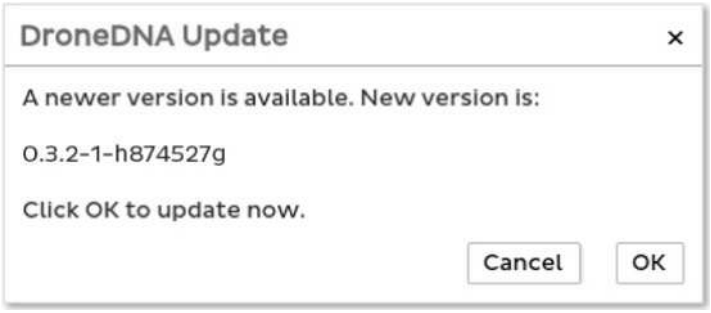
3.9.5 Update DroneDNA

Precondition:

- Existing access to Dedrone Cloud by a valid license.

Procedure:

1. Choose menu **OPTIONS > DroneDNA.**
2. Choose **[Check for updates]**.
   - ▶ The window DroneDNA Update appears, where you can download the newest version or get the confirmation, that your version is up-to-date.



3. To start the update choose **[OK]**.
   - ▶ The update is starting in the background.
   - ▶ The window **DroneDNA Update** appears.
4. Confirm with **[OK]**

3.9.6 Set automatically update of DroneDNA

Precondition:

- Existing access to Dedrone Cloud by a valid license.

Procedure:

1. Choose menu **OPTIONS > DroneDNA.**
2. Activate or deactivate the checkbox **Auto download new versions**.
3. Choose **[Save changes]**.

3.10 Configure Dedrone Account

Procedure:

1. Choose **OPTIONS > Dedrone Account.**
2. To change the update channel for a software update or DroneDNA update, select the desired channel in the fields **Software** or **DroneDNA**.
   The shown entries in these drop-down lists are dependent on your enabled channels. Only after consulting by Dedrone, it is perhaps necessary to change this channel.
3. To set the notification on alert in the Dedrone Cloud, activate or deactivate the check box **Notify Dedrone on alert**.
4. Choose **[Save changes]**.

3.11 Set up external access

It is possible to allow external access to the DroneTracker. Thus, you can integrate the DroneTracker into the existing security network.

Precondition:

- Login role as administrator

Procedure:

1. Log in as administrator.
2. Choose menu admin **> Profile page**.
3. Choose **[New token]**.
   ► A generated Token appears above the button.
4. Use this token to authorize your external access to the DroneTracker System.

3.12 Set time zone

This option configures the shown time in the DroneTracker UI.

By default, the browser time zone is used to display the server time. If a time zone is selected, it is used for all users of the system.

Procedure:

1. Choose menu **OPTIONS > System Time**.

2. To change the format of the shown time and date change the entries in the fields **Time format** and **Date format**.
3. Choose the desired time zone. To filter the list, write a continent, region or city in the field **Filter entries**.
4. Choose **[Save changes]**.

4 Monitoring

4.1 Classify target

During an alert you have the option to classify individual detections as **[Friend]** or **[Foe]**, as well as, to **[Ignore]** a detection in the details section.

- **[Friend]**
  The drone symbol on the map is colored green, in the header a banner shows FRIENDLY, and in the alert list the alert will have the alert type "FRIEND".
- **[Ignore]**
  By ignoring a detection the target symbol will disappear from the map. A message is shown for a few seconds above the map you can undo the ignoring. If no other detections are active, the alert ends immediately. The detection is saved in the alert list as alert type "IGNORED". You can filter the list by alert type.
- **[Foe]**
  Drones and remote controls are automatically classified as foe. You can manually classify unverified targets, e.g. from a radar or friend targets as foe. This will trigger an alarm and an alert recording.

4.2 Focus PTZ camera on a selected detection

Only available for system with a connected PTZ camera.

4.2.1 PTZ camera behavior

Depending on the system state (safe or alert/warning) the behavior of PTZ cameras differs.

Target tracking

If DroneTracker has a drone detection with a direction or position, the PTZ camera will automatically search in that direction or focus on that position. In the case of more than one detection, the PTZ camera will focus on the best fitting position. In case of more than one integrated PTZ cameras, the system chooses automatically the most suitable PTZ camera for the tracking.

Verify detections

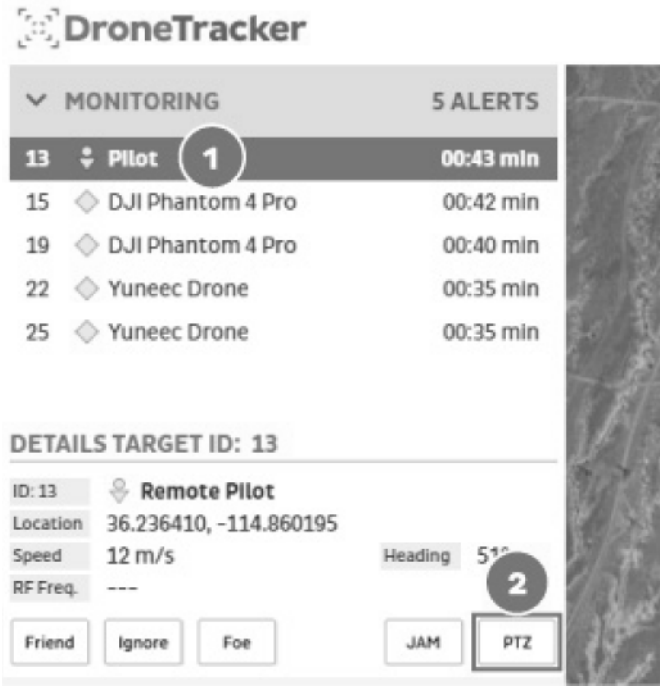
In case of unverified targets, e.g. detected by an integrated radar, the PTZ camera aligns and focuses on that position and analyzes it. If the PTZ camera verifies the target as a drone, an alert will be triggered and the PTZ camera tracks the target. If the PTZ camera does not detect a drone, it switches to the next unverified target.

4.2.2 Focus PTZ cameras on a selected detection

You can choose a detection manually and tell the PTZ camera to track this target. There are two ways to pin PTZ tracking on a detection:

- Choose a detection from the detection list.
- Choose a detection on the map.

Choose a detection from the detection list



1. Choose the desired entry in the alert list.
2. Choose the PTZ button in the alert details.

Choose a detection on the map

- Right-click on the drone icon on the map and choose **Lock PTZ**.

4.3 Use PTZ camera (PTZ dashboard)

You can control the PTZ camera manually and watch the PTZ camera view directly in the DroneTracker UI. To see all relevant information on one display a PTZ dashboard is available.

4.3.1 PTZ Modes

A PTZ camera in a DroneTracker System has two operation modes: automatic and manual.

Automatic Mode

In automatic mode the camera searches autonomously for drones. This search includes an active video analysis, as well as, an automated alignment and zooming. For a faster and more accurate search, other sensors of the DroneTracker System like RF-300 or radar can deliver a direction, distance and height for the search.

Manual Mode

When the PTZ camera is moved manually the PTZ camera automatically switches to the manual mode. In manual mode the automatic drone detection is disabled. If the PTZ camera is not moved for 60 seconds it automatically switches back to automatic mode. During the manual mode a message in the PTZ live view is shown where you can switch directly to the automatic mode.

4.3.2 Open PTZ dashboard

- In the sensor list right-click on a PTZ camera and choose **Live view (new tab)**.
    - The PTZ dashboard opens in a new tab.

4.3.3 Dashboard overview

POSITION	EXPLANATION
A	**List of PTZ cameras** Choose the desired PTZ camera to view the live view and control it.
B	**Detection details** Displays the GPS position and movement speed of the drone or remote depending on which sensor type detected the target.
C	**Classify target** as Friend, Foe or ignore the detection by choosing one of these buttons
D	**Activate jammer** (only if a jammer is connected)
E	**Focus PTZ camera** to the selected detection. Focuses a PTZ camera permanently to the detection. The system chooses the best fitting PTZ camera for the tracking. **Not available** for user role **Viewer**.
F	**Site Map** Shows the camera orientation on the map.
G	**PTZ camera live view** Shows the live stream of the PTZ camera. By clicking and dragging you can pan and tilt the PTZ camera. You can zoom in and out with the mouse wheel.
H	**PTZ controls** Pan, tilt and zoom the camera with these controls. Alternatively, you can click and drag in the live view to pan and tilt the PTZ camera.
J	**Pause video**

	Pause the video streams on the dashboard for deeper investigation. The detection and tracking will continue in the background. By clicking again on the button, the live video stream is shown again.
K	**Take picture of current view** Save the current video image in the alert. When the alert ends the image is stored in the alert recording.
L	**Activate Track** Manually trigger a focused search in the region in the middle of the view. The video detector analyzes the middle of the frame with high sensitivity to search for drones and movements.
M	**Pan angle** Shows the current pan angle in degrees.
N	**Detected video region** In case of a drone detection the identified image section is shown live here. You can swap the image and the live view with the button  in the upper right corner of that window.
O	**Images** During a detection every second an image is updated here. You can save that image in the alert by choosing **Save** on the image. The last 30 images are shown.

4.4 Mute alert sound temporarily

You have the option to mute the alert sound for the current alert.

During an alert the status bar displays an alert banner. If the alert sound is activated, a button is displayed here.

- Choose the button **[Mute sound]** in the alert banner.

► The sound will be turned off for the current alert.

- To turn the sound on again, choose the button **[Sound muted]** at the same position.

4.5 Display options

4.5.1 Use and organize live views

Enlarge a live view

1. Choose the desired sensor in the menu **SENSORS** on the home screen.
   ► The single live view is shown below the Site Explorer.
2. To enlarge the live view double-click on the live view or right-click on the sensor or live view and choose **Live view**.
3. To open the live view in a new browser tab right-click on the sensor or live view and choose **Open in new tab**.

Video live view

The video live view marks all detected objects with a frame.

The color of the frame indicates the classification of the object.

PTZ live view

Shows the live stream of the PTZ camera. By clicking and dragging you can pan and tilt the PTZ camera. You can zoom in and out with the mouse wheel.

With the menu bar you have some further options:

- 
  Pause the video stream for further investigations
- 

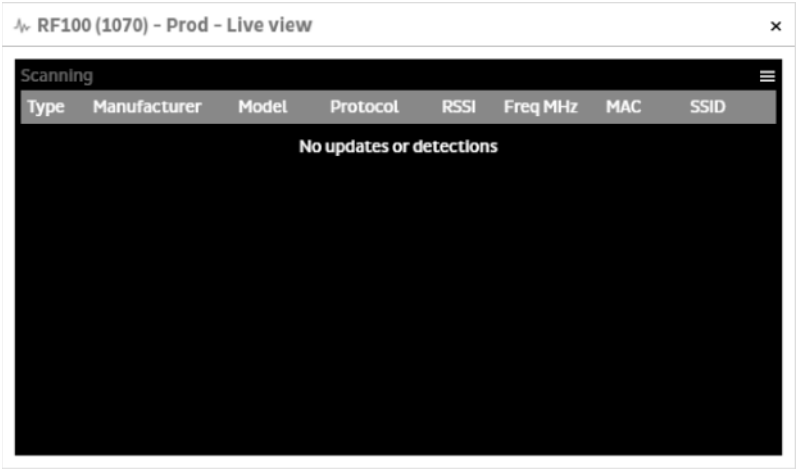
  Save the current video image in the alert. When the alert ends the image is stored in the alert recording.

- **[Track]**
  Trigger a new attention region in the middle of the view to start a highly sensitive video detector.
- **[103°]**

  Shows the current pan angle in degrees.

For more detailed information and PTZ options, we recommend using the PTZ dashboard.

RF Sensor live view



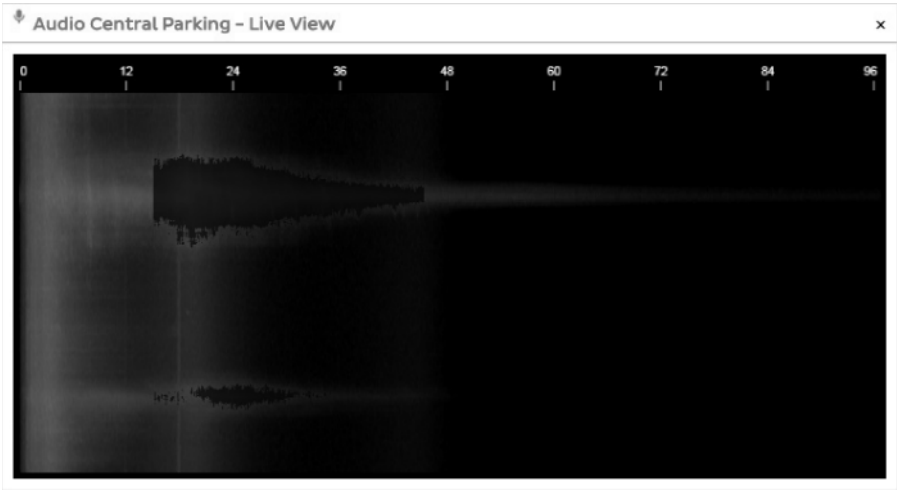
In the first line of the live view the current status of the sensor is shown (e.g. Scanning).

In case of a detected signal all relevant information is shown in the list.

The button  provides some more view options:

- **Pause update**
  Freezes the current live view
- **Expert mode**
  Enables more display options for the live view and displays more detailed information in the list, e.g. RSSI and frequency
- **Show Wi-Fi clients** (only in expert mode)
  Displays the detected Wi-Fi clients
- **Show unknown Wi-Fi devices** (only in expert mode)
  Displays all detected Wi-Fi devices, including routers with Wi-Fi networks etc.

Audio live view



The X-axis shows the frequency band of the audio sensors. The brightness in a certain frequency band represents the loudness of the signal. The louder the signal, the brighter the color. The red color represents a stronger than average acoustical signal level which will be further processed for drone detection and includes user defined rules.

Frequencies that trigger an alert are shown in red.

4.5.2 Configure home position

To center the map to a defined position in the home screen you can use the home position button .

Set home position

1. Right-click on the desired position on the map.
2. Choose **Use as home position**.
   - ▶ The map is getting centered at the selected position and the view of the map with its zoom level is saved as home position.

Reset home position

1. Right-click on the map.
2. Choose **Reset home position**.
   - ▶ The home position symbol becomes grey .

5 Analyzing

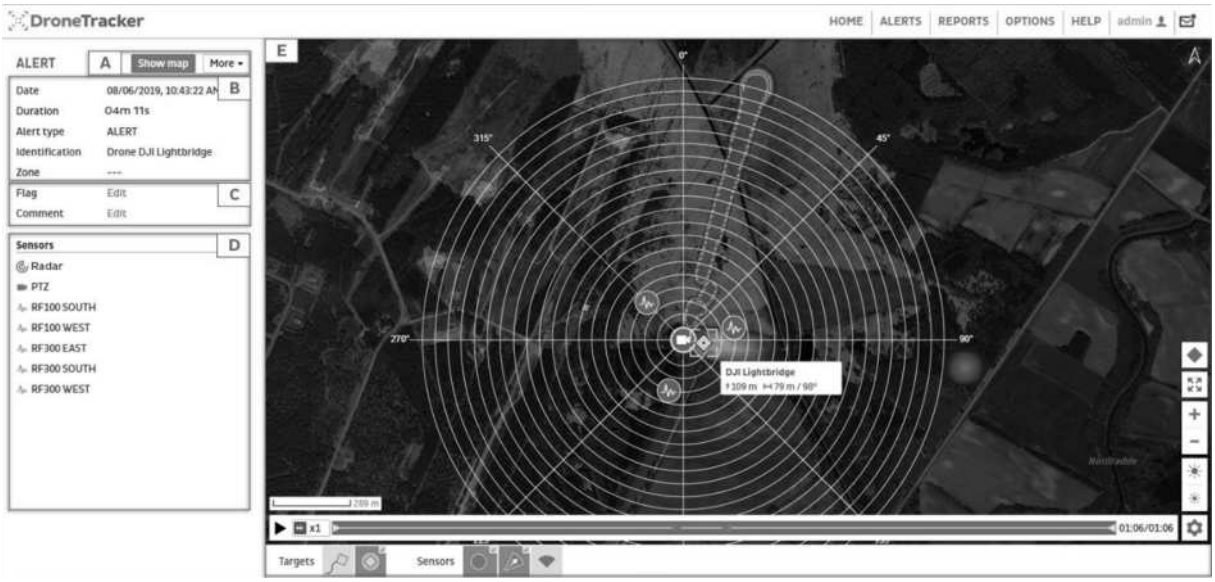
5.1 Alert Recordings

5.1.1 View an alert recording

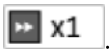
Procedure:

1. Choose menu **ALERTS**.
2. To filter the alert list, choose **[Filter]** and set a filter.
3. Choose the desired alert entry in the list.
   ▶ The window **Alert** will open.

5.1.1.1 Overview of alert recording



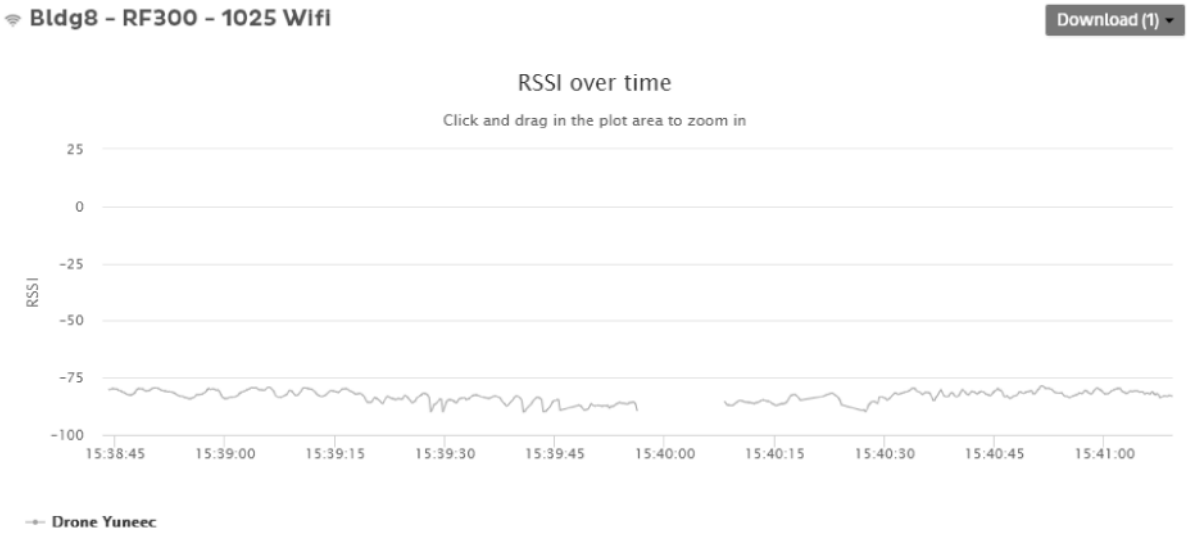
POSITION	EXPLANATION
	Alert Options
A	**[Show map]** Here you can display the map with all relevant information on it. In the menu **[More]** you have more options: • **Refresh** Refreshes the alert. This could be helpful if an alert is viewed immediately after the alert happened. The source data may need some time to be uploaded and the sensors recordings are not available yet. • **Show identification details** Shows information about the drone identification. If an RF Sensor is

	involved the RF identifications are shown. If a camera is involved a thumbnail of the drone is shown. • **Download tracks as GPX** Download the fly path as a GPX file.
B	**Alert Details** General information about the alert
C	**Alert Categorization** To organize the alerts in the alert list you can flag and comment each alert. In the alert list and reports you can filter by flags and comments (via the filter **Search alert**).
D	**Alert sources** List of all sensors that were involved in the alert. By choosing a sensor you can watch or download the alert recording of each sensor.
E	**Map, alert playback and sensor view** Here you can playback the alert and find all information about the position of the drone. You can see the heatmap and flight path on the map and use the view options for the desired shown details (flight path, uncertainty, sensors etc.). In front of the timeline you have the option to change the replay speed  . Timeline symbols: In this time span a sensor detected a direction. In this time span a sensor detected a position. You can switch between the alert duration and real time and date of the alert by clicking on the duration.  If a source is chosen the live view recording of the chosen sensor is shown and you can download the raw data. In the timeline of the video playback you can see different information:

5.1.1.2 Video and PTZ playback

[Download (x)]	**Video evidence** [*.mp4] Video file in full resolution **Video timing information** [*.json] Timing information of the video as reference for the PTZ orientation and drone position information to this video **PTZ orientation information** [*.json] (Only for PTZ cameras) Information about the orientation of the PTZ camera to retrace the movement and the field of view **Drone position information** [*.json] Information of the position of a detected drone in the video image
[Paths]	Hide the path of the detected drone
[Marker]	Hide the marker around the detected drone
	The red underlining of the timeline shows that there is a drone classification in this moment.

5.1.1.3 RF sensor playback



Shows the RSSI values of each detection over time.

Choose **[Download (x)] > Wi-Fi evidence** to download the Wi-Fi alert information in format *.json.

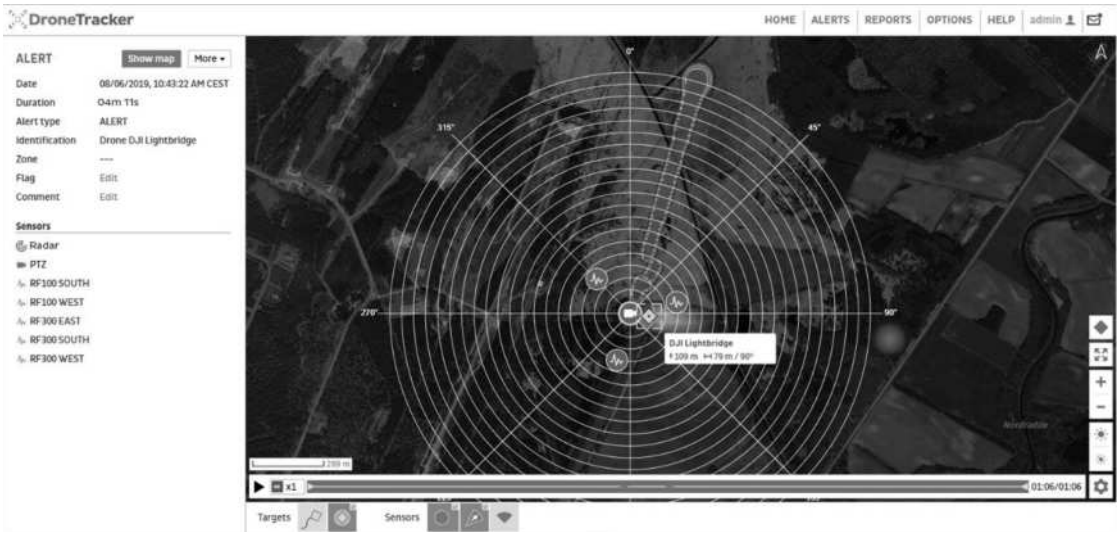
5.1.2 Delete an alert recording

1. Choose menu **ALERTS**.
2. Mark one or more check boxes at the alert.
3. Choose **[Delete]**.
   - ► The window **Confirm Delete** appears.
4. Choose **[OK]**.

5.1.3 Categorize or comment an alert recording

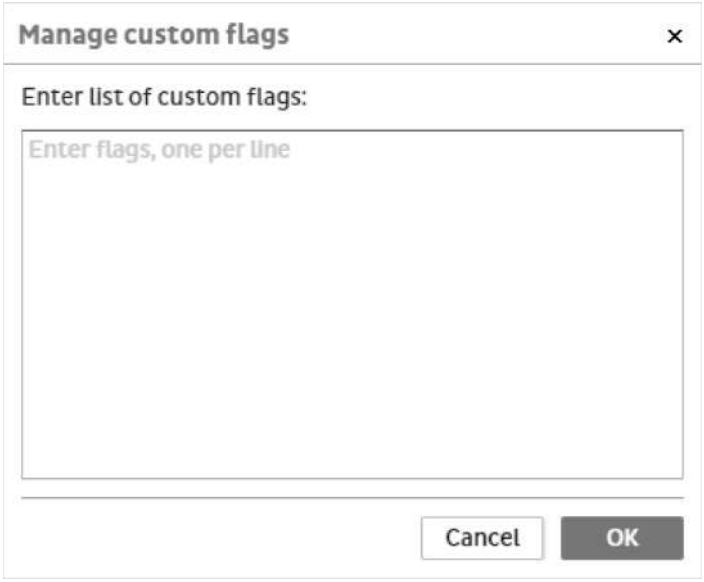
1. Choose menu **ALERTS**.
2. Choose the desired alert entry.

► The window **Alert** will open.



3. To categorize the alert choose **Edit** next to the field **Flag** and choose the desired entry.
4. To create a new flag:
   - Choose **Edit > Manage flags** next to the field **Flag**

   ► The window **Manage custom flags** appears.



   - Write one or more flag names in the field. Separate the flags with a new line (**[Enter]**).
   - Choose **[OK]**.
5. To add a comment to the alert:
   - Choose **Edit** next to the field **Comment**
   - Write your comment in the field.
6. Choose **[Save changes]**.

5.1.4 Export Alert list

You have the option to export the alert list to Microsoft Excel and CSV.

Note: The export is limited to 1000 Alerts.

Procedure:

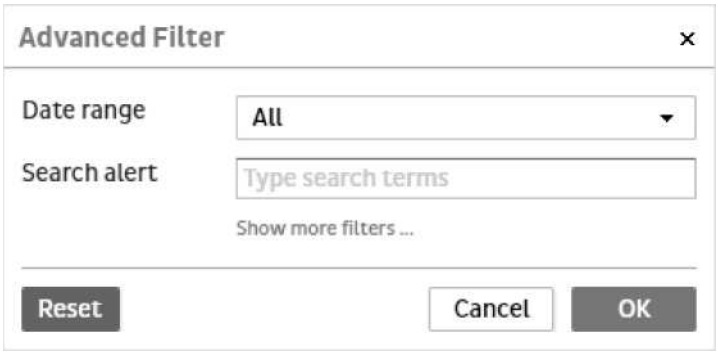
1. Choose menu **ALERTS**.
2. To define which alerts should be exported choose **[Filter]** and set the desired values.
3. Choose **[Export]** and choose the desired export format.
   ▶ The export file is stored in the default download folder.

5.2 Reporting

5.2.1 Filter the report data

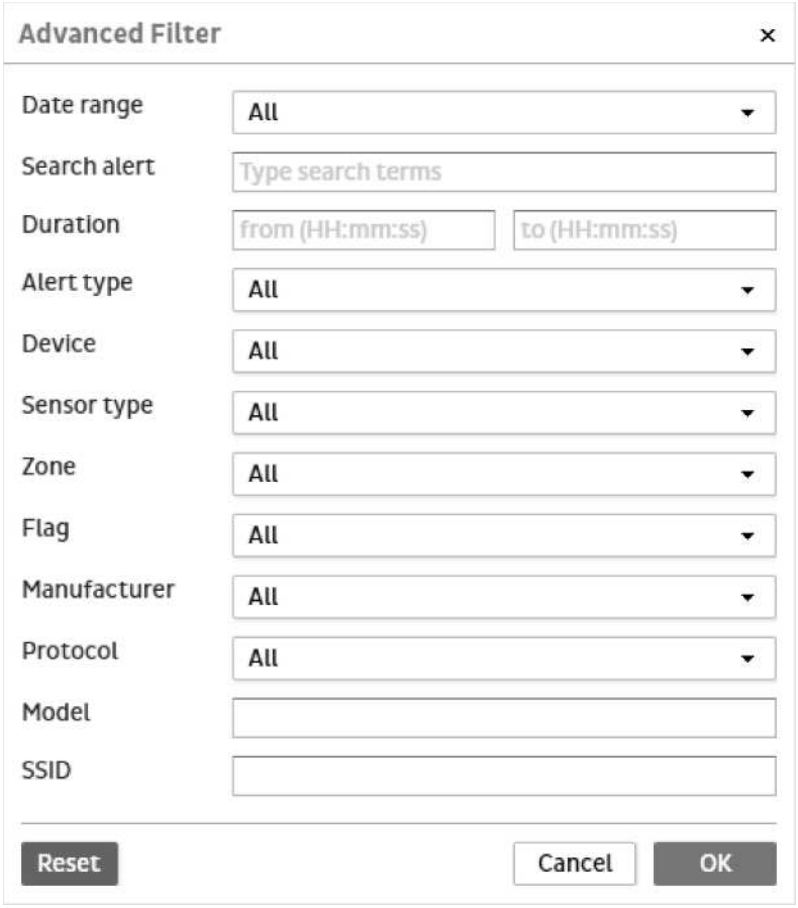
You have the option to filter the content.

1. Choose **[Filter]**.
   ▶ The window **Advanced Filter** appears.



2. Choose the desired date range from the preselection in the list and the desired search term such as a sensor name, comment, manufacturer etc.
   The field **Search alert** searches most alert fields:
   - Combine terms, e.g. **"remote" "parrot"**: Shows all alerts with remote **and** parrot identifications
   - Exclude terms, e.g. **remote -drone**: Shows all alerts only with remote identifications and no drone identifications.
   - Search for alerts with locations: **locations** or without locations: **-locations**
   - Search for alerts with bearings: **bearings** or without bearings: **-bearings**
   - **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.

3. Choose **Show more filters ...** to enlarge the advanced filter.



Field	Format	Description
Date range	date	Time frame for the data. Choose **Custom** to define a specific time span
Search alert	text	Search alerts by writing a search term like a sensor name, comment, manufacturer etc. Searches most alert fields. Combine terms e.g. **"remote" "parrot"**: shows all alerts with remote **and** parrot identifications Exclude terms, e.g. **remote -drone**: shows all alerts only with remote identifications and no drone identifications. Search for alerts with locations: **locations** or without locations: **-locations** Search for alerts with bearings: **bearings** or without bearings: **-bearings** **Note**: Use **" "** (quotation marks) for each search term to name the search content exactly.
Duration	hh:mm:ss	Period of time the alert was present

Alert type	list	Type of alert If a target was classified during the alert the alert type changes. Additionally, the zone (e.g. Warning zone) can have an effect on the alert type.
Device	list	Device involved in the alert
Sensor type	list	Type of sensor involved in the alert
Zone	list	Name of the zones which were triggered (see Add and configure zones)
Flag	list	Flag of the alert
Manufacturer	list	Manufacturer of the classified drone
Protocol	list	Protocol of the detected RF communication
Model	text	Model of the classified drone
SSID	text	SSID of the classified drone
[Reset]	button	Reset the filter
[Cancel]	button	Close the filter window without changing the filter settings
[OK]	button	Apply the configured filter

All text fields are case sensitive.

1. Choose **[OK]**.

5.2.2 Filter report data by region

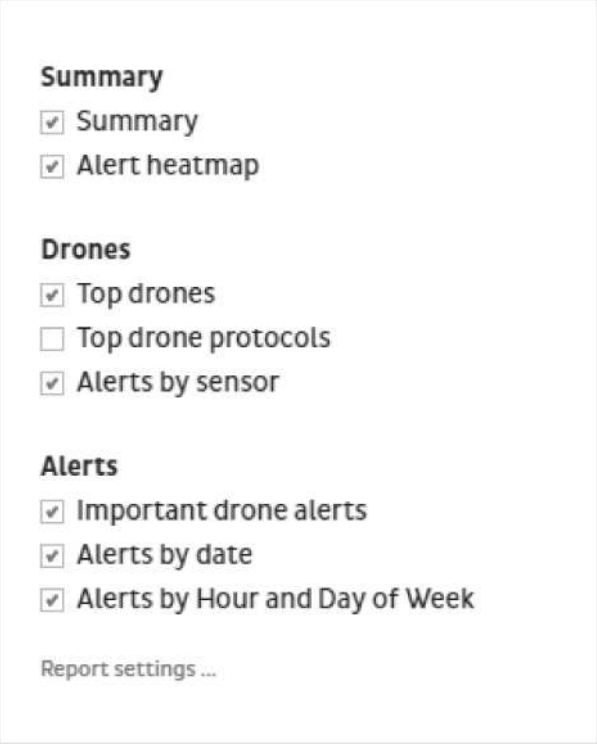
You have the option to filter the data by the shown map section:

1. Choose menu **REPORTS** and scroll to the **ALERT HEATMAP**.
2. Use [**Shift**]**+mouse left** and span a frame over the desired region.
   - ▶ The Report gets reloaded and the filter was added to the set filters.
   - ▶ The report contains only the alerts located within the chosen region.

5.2.3 Choose report content

To configure the report content to your needs, you have the option to show or hide each statistic and diagram.

1. Choose menu **REPORTS** and the menu **Customize**.



2. Activate or deactivate the desired option.

5.2.4 Open alert list according to a report

You have the option to open the alert list within all related alerts of the current report:

1. Choose menu **REPORTS.**
2. Choose the desired filters or region for the report.
3. Use [**Ctrl**] + click on the figure **Total number of alerts**.
   - ► The alert list with all alerts, which are used for the report, opens.

5.2.5 Export a report

You have the option to create a scheduled report of your drone incidents.

Procedure:

1. Choose menu **REPORTS**.
2. To define the data content of the report choose **[Filter]** and set the desired values.
3. To define which key figures, diagrams and statistics are shown in the report choose **Customize** and hide or show the desired options.

4. Choose **[Export]** > **Download PDF now**.
   ▶ The report will be downloaded on your default download folder.

Customize the report style

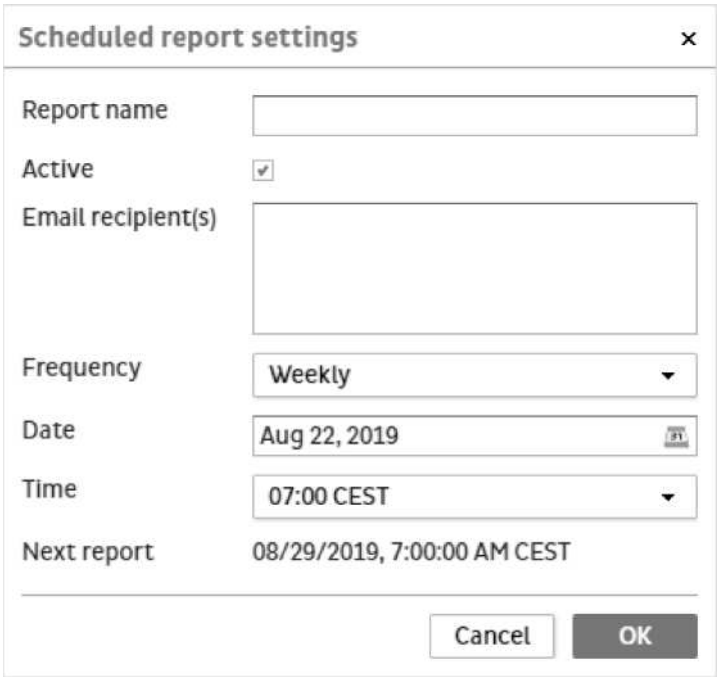
You can customize the exported report to your need, e.g. with your company logo and page size (see Report Settings).

5.2.6 Create a scheduled report

You have the option to create a scheduled report of your drone incidents.

Procedure:

1. Choose menu **REPORTS**.
2. To define the data content of the report, choose **[Filter]** and set the desired values.
3. To define which key figures, diagrams and statistics are shown in the report, choose **Customize** and hide or show the desired options.
4. Choose **[Export]** > **Create new scheduled report**.
   ▶ The window **Scheduled report settings** appears.



5. Fill in the form. Separate the email recipients with a comma.
6. Choose **[OK]**.

▶ The window **Info** appears.

7. Choose **[OK]**.

▶ The scheduled report is created and listed in the menu **OPTIONS** > **Scheduled Reports.**

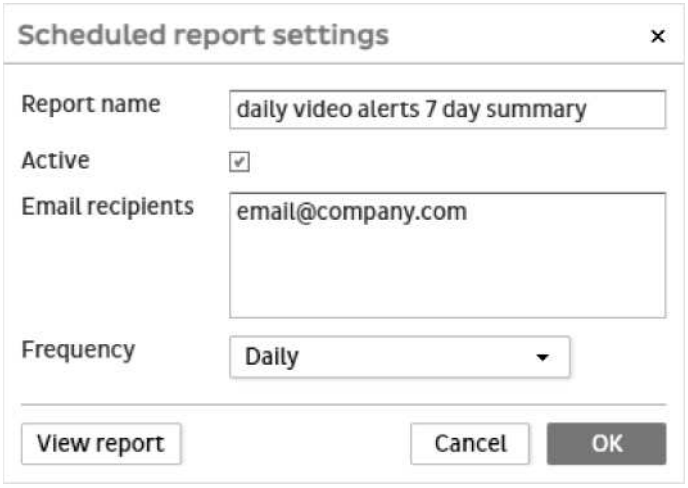
5.2.7 Deactivate a scheduled report

You have the option to deactivate a scheduled report.

Procedure:

1. Choose menu **Scheduled Reports**.
2. Choose the desired scheduled report.

▶ The window **Scheduled report settings** appears.



3. Deselect the option **Active** and choose **[OK]**.

▶ The window **Scheduled report settings** disappears and in the shown list the status of the report has changed to **Active** = **No**.

6 Troubleshooting

6.1 Mute sensor

In case of errors or other unwanted effects of a sensor, it is possible to mute each single sensor.

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Double-click on the desired sensor.
   - ▶ The window **Sensor details** appear.

3. Activate the checkbox **Muted**.
4. Choose **[OK]**.
   - ▶ The sensor state in the sensor list changes to **OK (Muted)**.
   - ▶ In the sensor tree of the home screen, the sensor is marked with ⊗.

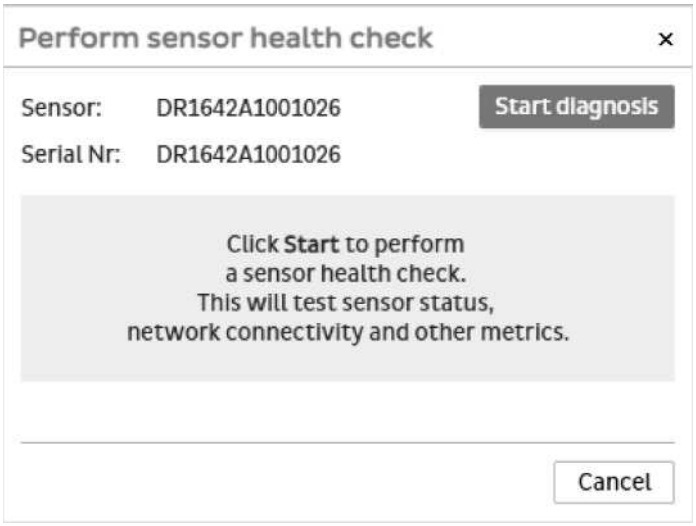
6.2 Perform sensor health check

In case of connection problems with a RF sensor you have the option to perform a diagnosis for each RF sensor, get an immediate result and a comprehensive log file.

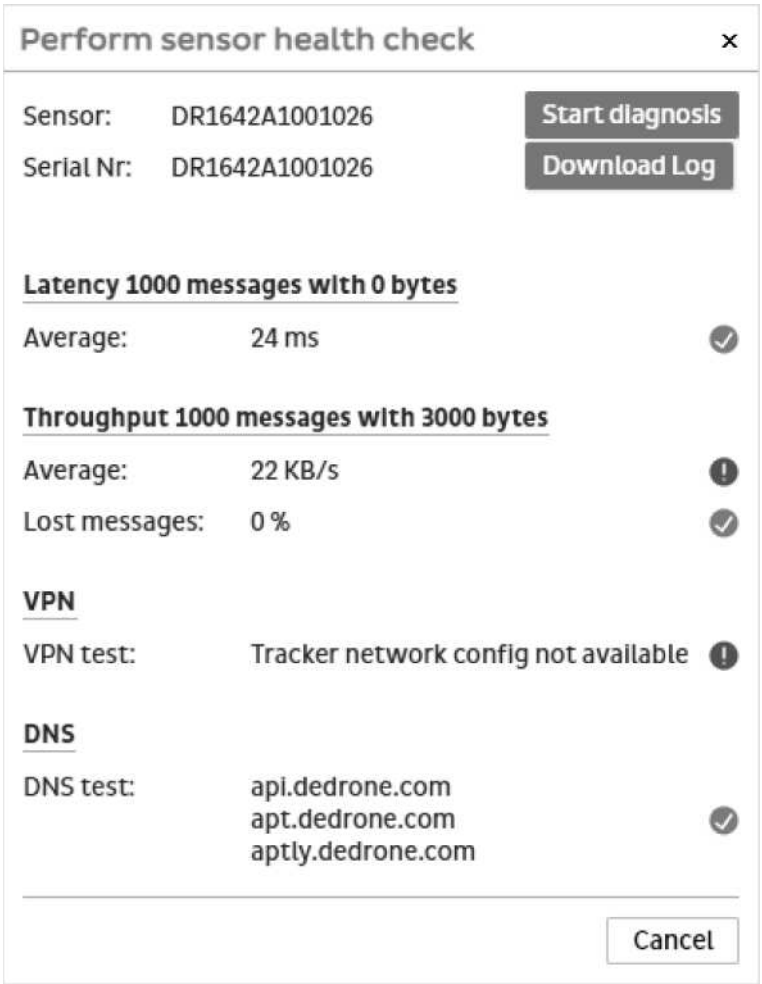
Procedure:

1. Choose menu **OPTIONS** > **Site Configuration**.

2. Right-click on the desired RF devise .
3. Choose **System** > **Perform sensor health check**.
   - The window **Perform sensor health check** appears.



4. Choose **[Start diagnosis]**.
   - The diagnosis starts.
   - When the diagnosis has run through, an overview with status information is shown.



5. To download the comprehensive log file of the diagnosis choose **[Download Log]**.
   ▶ The log file is stored in the default download folder and the results can be opened in the menu Diagnosis Results.

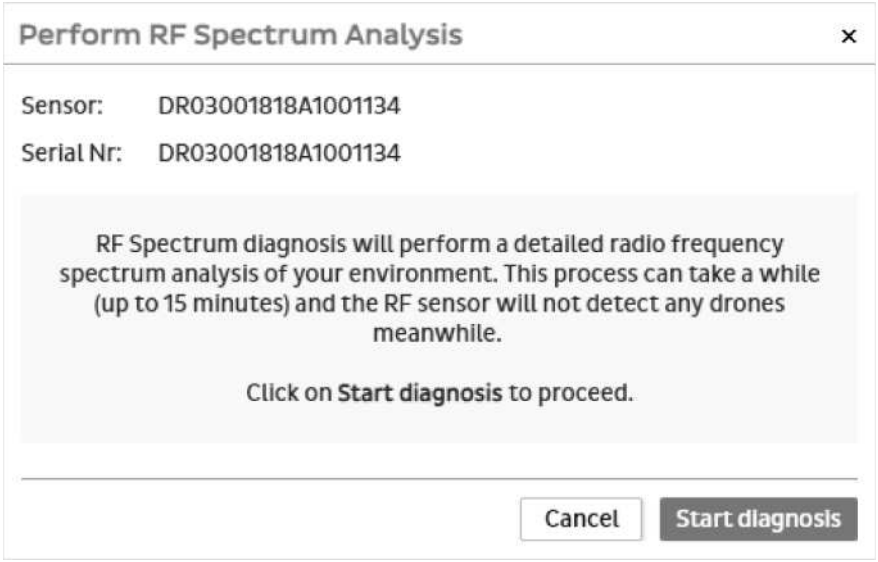
6.3 Perform RF spectrum analysis

To proof and compare the RF environment you have the option to perform an RF spectrum diagnosis for each RF sensor.

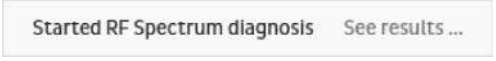
During the diagnosis, the sensor does not detect!

Procedure:

1. Choose menu **OPTIONS** > **Site Configuration**.
2. Right-click on the desired RF sensor .
3. Choose **System** > **RF Spectrum diagnosis**.
   ▶ The window **Perform RF spectrum analysis** appears.



4. Choose **[Start diagnosis]**.
   ▶ The message is shown, and the diagnosis starts.



5. Choose menu **OPTIONS** > **Diagnosis Results**.
   - All diagnoses results are listed.
6. Choose the desired entry and choose the desired frequency band.

6.4 Download log files

If your DroneTracker isn't connected to the internet the Log files are necessary for Dedrone to troubleshoot the DroneTracker. The log files contain important information for our Tech Support team.

1. Choose menu **OPTIONS > System Logs**.
2. Choose the desired download option:

[Download log files]	contains all log files of the DroneTracker Server
[Download current sensor log]	contains the log file of all sensors since the last system boot
[Download sensor log history]	contains all log files of all sensors

► Depending on your browser settings the download is starting automatically, or you can choose the download folder.

6.5 Backup configuration

The following configurations and settings will be saved in the backup:

- DroneDNA auto update setting
- Site Configuration and IP Whitelist
- Sitemap
- Site configuration (deletes sensors)
    - Sensor configuration
    - Configuration profiles
- Alerting configuration
- Alert and system notifications
- Scheduled reports
- Report settings
- Connector settings
- Dedrone account
- System time

Procedure:

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Backup configuration]**.

► The file **dedrone-tracker-config-[yyyy]-[mm]-[dd]-[hh]-[mm]-[ss].bak** is downloaded in your default download folder.

6.6 Reset configuration

The following configurations and settings will be reset:

- DroneDNA auto update setting
- Site Configuration and IP Whitelist
- Sitemap
- Site configuration (deletes sensors)
    - Sensor configuration
    - Configuration profiles
- Alerting configuration
- Alert and system notifications
- Scheduled reports
- Report settings
- Dedrone account
- System time

Procedure:

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Reset configuration]**.

6.7 Restore configuration

1. Choose menu **OPTIONS > Backup, Restore & Reset**.
2. Choose **[Restore Configuration]**.
    ► The window **Upload file** appears.
3. Choose a ***.bak-File** and choose **[OK]**.

6.8 Reboot RF sensor

1 Choose menu **OPTIONS > Site Configuration**.

2 Right-click on the desired RF sensor  .

3 Choose **System > Reboot hardware**.

6.9 Shut down a RF sensor

NOTICE **Hardware broken**

By disconnecting the cable without shutting down the hardware a sensor could undergo an irreparable software error.

- Always shut down the hardware before disconnecting the cable.

Third-party sensors cannot be shut down in the DroneTracker UI. You can remove the sensors from the system. The hardware of the third-party sensors should be powered down based on the vendor's instructions.

Procedure:

1. Choose menu **OPTIONS > Site Configuration**.
2. Right-click on the desired RF sensor  .
3. Choose **System > Shutdown hardware**.

6.10 Failed Sensor update

If the update process does not work, make sure that the address for the APT server is correct and the server is running.

Depending on the update content it is possible that prior update processes were working properly. Not every update needs the APT server.

7 Additional documents

For a properly operating drone detection system the correct and accurate installation and alignment of the sensors is very important.

When installing the sensors pay attention to all advice and information in the installation manuals:

- Installation Manual RF-100
- Installation Manual RF-300

AIRSPACE SECURITY SOLUTION

Dedrone

Dedrone Holding, Inc.
220 Sansome Street
San Francisco, CA 94104
USA

Dedrone GmbH
Miramstraße 87
34123 Kassel
Germany

+1 415 813-6116
+49 561 8617990
info@dedrone.com
www.dedrone.com