INSTALLATIONS
Manual

RF-300

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Content

1 Safety

1.1 Symbols

Symbol	Explanation
NOTICE	Indicates a situation which, if not avoided, can result in property damage
(i)	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-300 is a passive, network-attached sensor for the detection and direction finding of radio frequencies (RF) and Wi-Fi signals. In combination with two or more RF-300 it is able to determine the position of a drone by the RF signals. The RF sensor detects targeted radio signals, identifies their direction and sends the data, along with an alert to the DroneTracker System.

The RF-300 is intended for civil commercial and private use in conjunction with a DroneTracker System.
The RF-300 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-300 complies with Industry Canada licence-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 de-vice, 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 per-sonnel. 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 inst-ructions correctly

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

Despite careful construction, electrical devices can cause fires. Do not mount the RF-300 in areas containing highly flammable materials or gases. Do not mount the RF-300 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-300

The RF-300 is a passive, network-attached sensor for the detection and direction finding of radio frequencies (RF) and Wi-Fi signals. In combination with two or more RF-300 it is able to determine the position of a drone by the RF signals. The RF sensor detects targeted radio signals, identifies their direction and sends the data, along with an alert to the DroneTracker System.

Parts of the RF-300

A	Antenna cover		**E**	Power button
B	Knurled nut		**F**	Network socket
C	RF Mounting Plate		**G**	Wi-Fi-antenna
D	Knurled head screw with sealing washer			

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

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-300

1 x Wi-Fi antenna

1 x RF Mounting Plate (preassembled)

2 x Knurled head screw with sealing washer (preassembled)

2 x Knurled nut (preassembled)

1 x Pole Mount

2 x Strap

1 x Bag with 4x screws Torx M5, 8x flat washer, 4x nuts

1 x Bag with 1x environmentally sealed Ethernet crimp connector, 1x RJ45 plug

1 x Installation manual

1 x Safety information

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 Select the Mounting Place

5.1 Mounting Location

The position of the RF-300 has strong impact to the detection and direction finding range and accurancy. The RF-300 is intended for pole mounting. Make sure that a suitable pole is available (diameter between 1.2 in to 3.5 in (40 mm to 90 mm)) and the Antenna Cover extend beyond the pole.

The detection is the precondition for the direction finding.

5.1.1 Detection Conditions

For ideal results the location should fulfill the following conditions:

☐ **Clear view over the area**

☐ **Exposed, elevated position (minimum 10 ft (3 m))**

Do not install the device nearby the following objects:

- **Metal surfaces or vaporized glass**
  Disturbs the detection and prevents the localization

- **Walls**
  These share the detection area and prevent classification of signals behind the wall

- **Base station and other strong signale sources**
  The detected signals are getting interfered

- **Any excessive heat sources**

- **Any overhead power lines, power circuits, or electrical lights**
  electrical discharge can damage the device.

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

> (i) **Note the properties of each RF-300**. This is needed for the correct configuration and for service.
>
> We recommend the table below. The following information is important:
>
> - Serial Number
> - GPS position (longitude and latitude)
> - Horizontal angle

Serial number (see prouct plate)	GPS position (in degree, e.g. 52.516295, 13.377653)	Horizontal angle (azimuth) in degrees (0 = north, 90 = east, 180 = south, 270 = west)
	longitude: latitude:	
	longitude: latitude:	
	longitude: latitude:	

5.1.2   Direction Finding and Localization Conditions

For accurate localization results, follow the guidance below in addition to the Detection Conditions (see 5.1.1 Detection Conditions, page 7).

The position is determined by the intersection of at least two directions. Therefore minimum two RF-300 sensors are required for localization, but we recommend at least three RF-300 sensors as this significantly reduces localization errors.

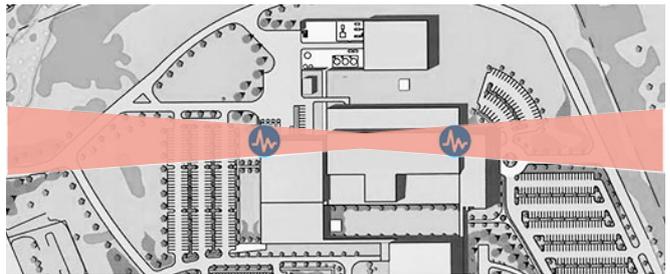For best localization results, all RF-300 sensor should be installed at the same height.

Position of the sensors to each other

To localize a drone an intersection of the directions from at least two sensors is needed.
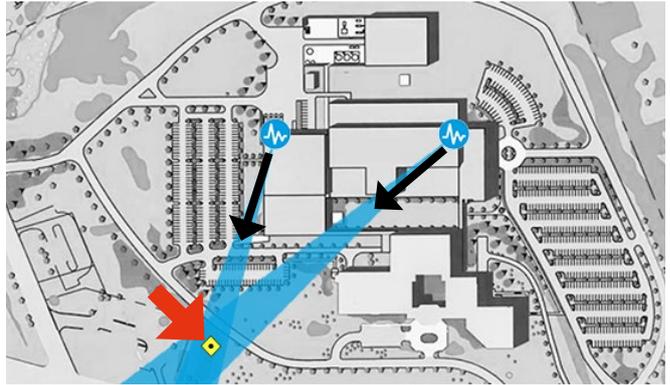

Localization is not possible in the case where two RF-300s are aligned.

This is the blind area of two sensors.

Both RF-300s detects a direction in alignment to the left. The over-lapping area covers the complete direction beam of the other RF-300. The position can't be determind.
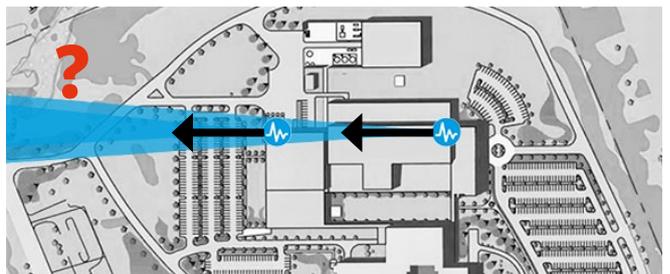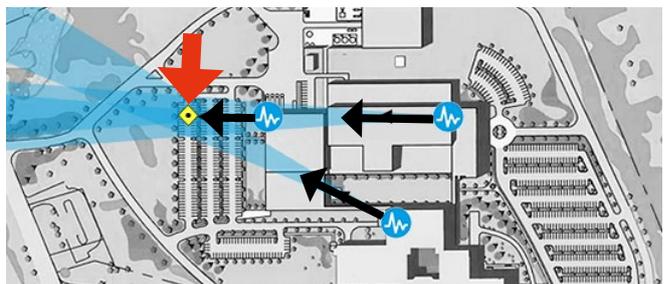

Both RF-300s detect a direction in alignment to the right. The over-lapping area covers the complete direction beam of the other RF-300. The position can't be determind.
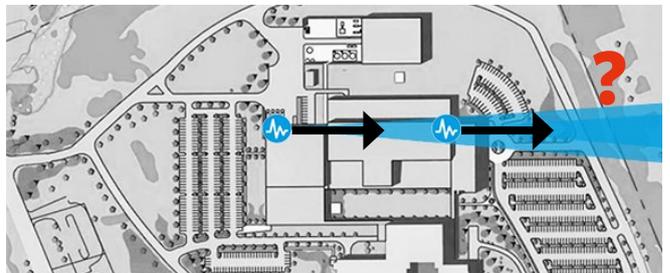
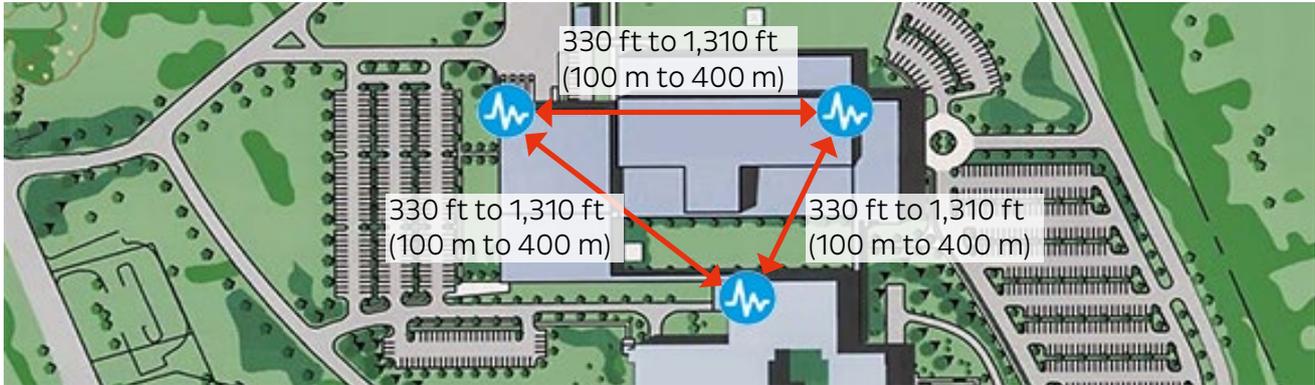Both RF-300s detect a direction against each other. No exact positi-on can be determined.
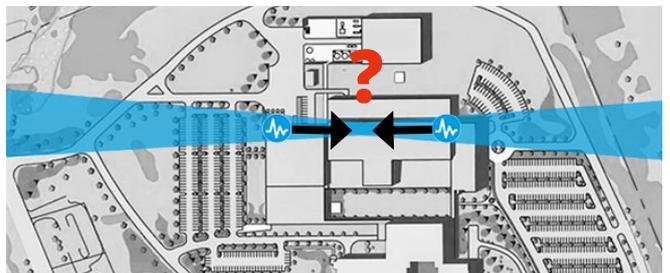
With three RF-300s there is no blind area. The third RF-300s can always varify the area of intersection.

Distances between the RF-300s

The distance between the RF-300 usually should be 330 ft to 1,310 ft (100 m to 400 m).

<div align="right">Distance between the RF-300s</div>

☐ Choose the postion depending on your monitoring focus. Increase the distance between the sensors to increase the accuracy at further distances.

☐ Localization accuracy increases as the drone gets closer to the sensors.

5.2 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-300 itself must not be grounded directly. The lightning conductor must be installed at least 1.5 m above the RF-300.

<div align="right">Lightning Protection Installation with RF-300s</div>

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).

5.3 Mounting Surface

Make sure the selected mounting surface is capable of supporting the combined weight of the RF–300 (6.8 lb (3.1 kg)) and mounting hardware under all expected conditions of load, vibration, and temperature.

5.4 Mounting Orientation

Important for a good result is the vertical alignment of the device and that the Antenna Cover extend beyond the pole.

Do not tilt the device.

The Wi-Fi antenna has to be orientated to the ground. Do not bend the Wi-Fi antenna.

5.5 Mounting Device

To mount the RF–300 with another mount as the supplied, note the following requirements for the mounting equipment:

- ☐ Licensed for outdoor use
- ☐ Safe and stiff load of 6.8 lb (3.1 kg)
- ☐ Matching for the holes of the RF Mounting Plate
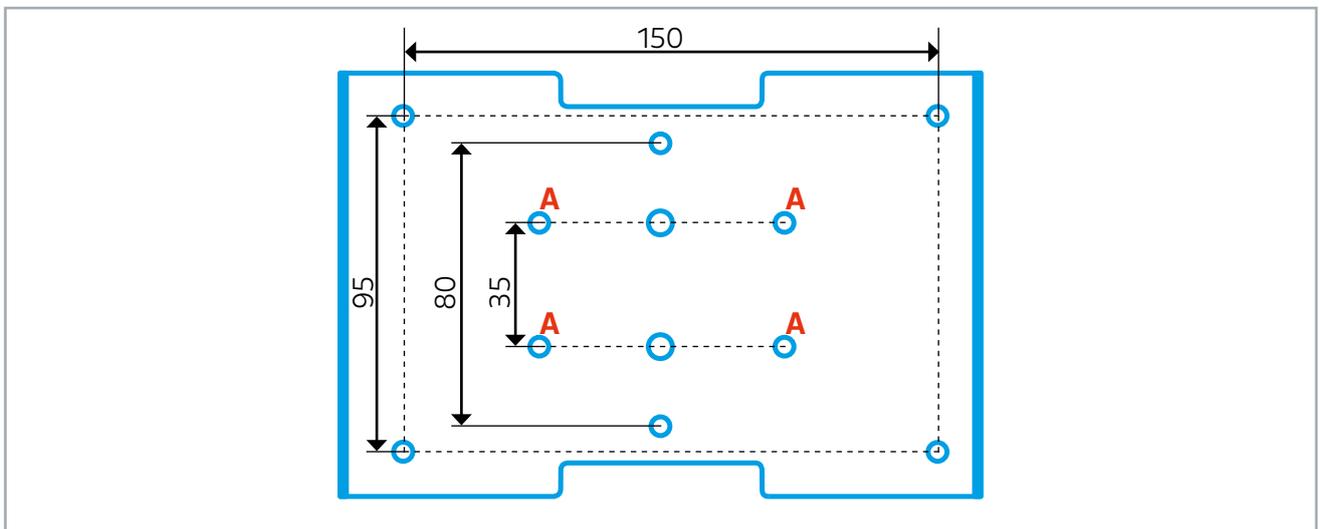
Dimensioning of the holes of the RF Mounting Plate

A   Holes for the pole mount

6 Installation

6.1 Power Supply

The RF-300 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.

6.2 Required Tools

☐ Screwdriver: Torx TX25

☐ Hex key: 4 mm

☐ Socket wrench: 8 mm ($^5/_{16}$") and 7 mm ($^9/_{32}$")

☐ Crimping tool
For an environmentally sealed connection to the RF-300, it's necessary to crimp the supplied connector to the laid patch cable (see 6.4 Cable Preparation, page 12).

☐ Ladder or lift truck, depending on the mounting location

☐ **Recommendation:** GPS device

6.3 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

6.4 Cable Preparation

For a weather resistant connection to the RF-300, 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.
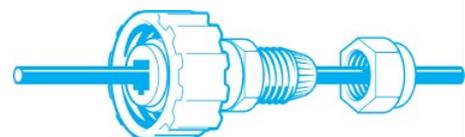
4	Remove the cable jacket carefully. Therefore take care not to damage the braid and foil.

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.

| 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

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.

6.5 Installation with Pole Mount

☐ Desired mounting place fulfills the requirements (see 5 Select the Mounting Place, page 7)

☐ Diameter of the pole: between 1.2 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-300 and unhook the RF-300 from the RF Mounting Plate.	
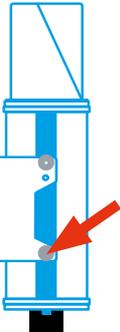
2	Screw the RF Mounting Plate onto the Pole Mount. Therefore note the following:
	
	• Use the shown holes.
	
	• The screw guidance of the RF Mounting Plate shows to the top.
	• Put a flat washer between
	   • screw head and RF Mounting Plate and
	   • nut and Pole Mount.
	• Screw down the nut with a 8 mm socket wrench.	
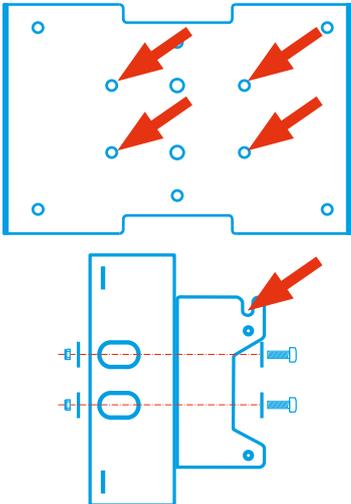
3	Run the straps through the slashes of the Pole Mount.
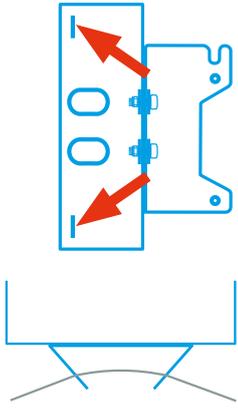
4	Mount the the Pole Mount to the pole: • Hold the Pole Mount with the RF Mounting Plate at the end of the pole. Thereby make sure, that the Antenna Cover will extend beyond the pole. • Lay the straps around the pole. • Put the strap in the slash under the screw and tighten it with the socket wrench (7 mm) appropriately.
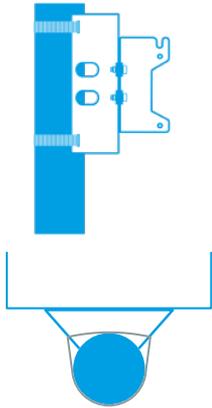
5	Hook the RF-300 in the screw guidance of the RF Mounting Plate.
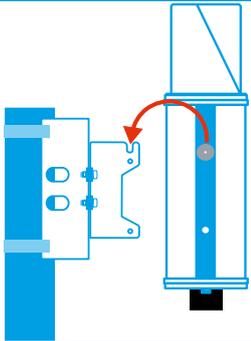
6	Screw down the 2 knurled head screws with the sealing washers at both sides in the lower holes. • Make sure that the soft side of the sealing washer is faced to the RF Mounting Plate. • Tighten the screws carefully. The RF Mounting Plate **should not be bent**.
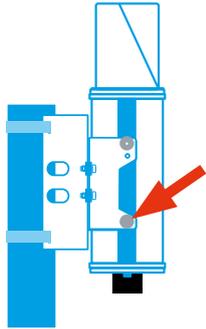
7	Screw the antenna on the screw thread at the bottom of the RF-300. Do not bend the antenna – it should be aligned to the ground.

8	ⓘ **An accurate alignment of the sensor is a prerequisite for a good direction finding result.** Most critical is the configuration of the GPS position and the horizontal angle of each RF-300. If the installation and configuration is not accurate, the direction finding could be strongly divergent. There are two ways to align the sensor accurately:

8a	Align the sensor by a landmark:
	• Choose a prominent landmark in the area which is visible (corner of a building, etc.).
	• Take a look over the pole and RF-300 and align the sensor to the prominent landmark. This is neccessary for the correct orientation of the sensor in the sitemap of the DroneTracker UI (see 7 Integrate the RF-300 in your DroneTracker, page 15).
8b	Align the sensor with a GPS device or compass:
	• Place the GPS device or compass on the RF-300 and check the orientation of the RF-300.
	• Read the GPS position in degrees (for example, "52.516295" and "13.377653").
	• Find the horizontal angle (azimuth) in degrees (0 = north, 90 = east, 180 = south, 270 = west).
	• Note the values in the table (see 5.1.1 Detection Conditions, page 7).
9	Make sure that the pole is grounded (see 5.2 Overvoltage Protection, page 10).
10	Connect the patch cable to the RF-300 and turn the connector gland until it is locked (for a correct cable preparation see 6.4 Cable Preparation, page 12).
	✔ If the patch cable is connected to the network, the RF-300 boots automatically and after approximately 1 second the blue button at the RF-300 illuminates, indicating that the hardware is ready.
	✖ The patch cable is connected to the network and the RF-300 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.
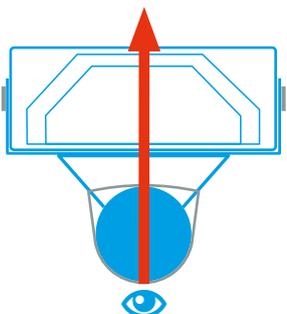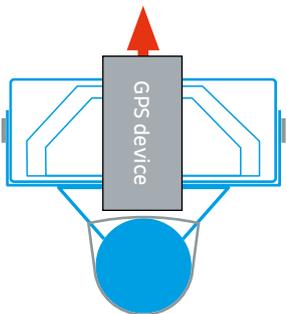
7   Integrate the RF-300 in your DroneTracker

The integration procedure of the RF-300 in your DroneTracker depends on the system type:

- On premises installations using your local DroneTracker Server (see 7.1 Integrate the RF-300 in your on prem DroneTracker Server, page 15).

- Dedrone Cloud installations do not require any additional infrastructur and are connected to the Dedrone Cloud (see 7.2 Integrate the RF-300 via Dedrone Cloud, page 17).

7.1 Integrate the RF-300 in your on prem DroneTracker Server

To connect to the RF-300 DHCP-Services are required that automatically assign an IP address to the RF-300. If the RF-300 and the DroneTracker Server are in the same Layer2 network they can be connected directly. If the RF-300 and the DroneTracker Server are in different networks refer to the Dedrone Planning Manual or consult your network administrator.

Requirements:

☐ RF-300 is installed

☐ The power supply is working and the button at the RF-300 illuminates blue

☐ RF-300 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 UI 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-300 and choose [**OK**]. ✔ The RF-300 appears in the Site Explorer.
6	To sort the RF-300 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-300.
9	ⓘ **An accurate alignment of the sensor and configuration in the DroneTracker are prerequisites for a good direction finding result.** If the sensor was aligned via a prominent landmark, drag and drop the sensor symbol to the installed position and move the arrow to the chosen prominent landmark. If the sensor was aligned via a GPS device, choose the element on the map and enter the noted values in the fields **Latitude**, **Longitude** and **Azimuth**.
10	To lock the settings, choose the option **Lock settings**.
11	Choose [**Save changes**]. ✔ The window **Map Editor** disappears.

> ⓘ For further information consult chapter "First Steps" of the integrated online help in the DroneTacker UI.

7.2 Integrate the RF-300 via Dedrone Cloud

Requirements:

☐ RF-300 is installed

☐ The power supply is working and the button at the RF-300 illuminates blue

☐ RF-300 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-300 appears in the Site Explorer.
6	To sort the RF-300 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-300.
9	ⓘ **An accurate alignment of the sensor and configuration in the DroneTracker are prerequisites for a good direction finding result.** If the sensor was aligned via a prominent landmark, drag and drop the sensor symbol to the installed position and move the arrow to the chosen prominent landmark. If the sensor was aligned via a GPS device, choose the element on the map and enter the noted values in the fields **Latitude**, **Longitude** and **Azimuth**.
10	To lock the settings, choose the option **Lock settings**.
11	Choose [**Save changes**]. ✔ The window **Map Editor** disappears.

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

8 Cleaning

| NOTICE | **Wrong cleaner damages the housing** |

The wrong cleaner can damage the housing or antenna of the RF-300. Never use glass cleaner or other solvent cleaner to clean the RF-300.

- Use solvent-free cleaner to clean the RF-300.

9 Decommissioning

9.1 Shut down the RF-300

| NOTICE | **RF-300 breaks** |

By disconnecting the cable without shut down the RF-300, the RF-300 could break.

- Always shut down the RF-300 before disconnecting the cable.

You have the possibility to shut down the RF-300 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-300.
4	Choose **System** > **Shutdown hardware.**

Shut down directly at the RF-300:

	Briefly press the Power button at the RF-300. ✔ The RF-300 shuts down and the blue light goes out.

9.2 Dismantling

Hot surface during operation

Depending on the evironment the surface of the RF-300 could get hot.

- Before dismantling the device wait 30 min after shut down the RF-300.

9.3 Disposal

Dispose the RF-300 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").

10 Technical Data

Range (line of sight)	Up to 0.65 mi (1.0 km) Up to 1.3 mi (1.5 km) in ideal conditions
Accurancy of Direction Finding *	±5° (mean error)
Geolocalization	With two or more RF-300, also through Wi-Fi signals
Device Type	Sensor
Radio Frequency	Omnidirectional passive detection, classification, and direction finding
L x W x H	7.7" x 3.7" x 14.4" (195 mm x 95 mm x 365 mm)
Weight	6.8 lb (3.1 kg)
Ingress Protection Rating	IP65 **
Operating Temperature	-4 °F to +131 °F (-20 °C to +55 °C)
Power Supply	PoE+ (IEEE 802.3at)
Power Consumption	18 W (typical)
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

*   in the 2.4 Ghz band

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

DRONE DETECTION TECHNOLOGY

Dedrone

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