

# INSTALLATION

**Manual**

**RF-360**



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# 1 Safety

## 1.1 Symbols

Symbol	Explanation
<b>NOTICE</b>	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-360 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-360 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 via mobile data or local network connection, along with an alert to the DroneTracker System.

The RF-360 is intended for civil commercial and private use in conjunction with a DroneTracker System.

The RF-360 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-360 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 B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can

radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

**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.

**! DANGER****Danger of life due to electric shock.**

Whenever any damage to the device has occurred live components could be touched, which can lead to lethal electric shocks. Such damages can be:


- the AC cable is damaged
- 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


When the RF-360 is plugged into an AC power source, there is always voltage applied to the internal electronics. Unplug the devices from the power source by disconnecting the AC cable and patch cable immediately. Make sure, that the power socket is always accessible.

Refer all servicing to qualified service personnel. This device has no user-serviceable internal parts. Do not attempt to service this device yourself.



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-360 in areas containing highly flammable materials or gases. Do not mount the RF-360 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-360

The RF-360 is a passive, network-attached or cloud connected sensor for the detection and direction finding of radio frequencies (RF) and Wi-Fi signals. In combination with two or more RF-360 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 via LAN or mobile data to the DroneTracker System.



Parts of the RF-360

<b>A</b>	RF-360	<b>C</b>	Cover screw
<b>B</b>	Cover	<b>D</b>	Grip recess and activation button

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-360

**1 x** Screwdriver

**1 x** AC cable with outdoor plug, 16 ft. (5 m)

**1 x** Outdoor ethernet cable, 32 ft. (10 m)

**1 x** Bag with the 5 parts of the outdoor housing for prewired RJ45 cordset and a quick manual

**1 x** Fall protection ring

**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

The position of the RF-360 has strong impact to the detection and direction finding range and accuracy. The RF-360 is intended for an installation **on top of a pole**. Make sure that a suitable pole is available (diameter between 1.2 in to 3.1 in (40 mm to 80 mm)).

The detection is the precondition for the direction finding.

### 5.1 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 of the drone or controller.
- **Walls**  
These share the detection area and prevent classification of signals behind the wall.

- **Base station and other strong signal 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.

## 5.2 Direction Finding and Localization Conditions

For accurate localization results, follow the guidance below in addition to the Mounting Surface (see chapter Mounting Surface, page 9).

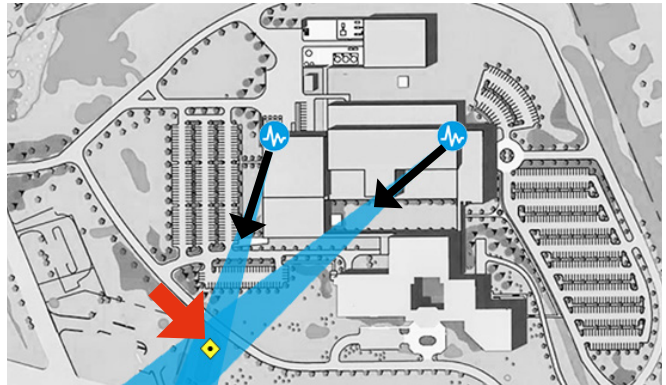
The position is determined by the intersection of at least two bearings. Therefore minimum two RF-360 sensors are required for localization, but we recommend at least three RF-360 sensors as this significantly reduces localization errors.

For best localization results, all RF-360 sensor should be installed at the same height.

### Position of the sensors to each other



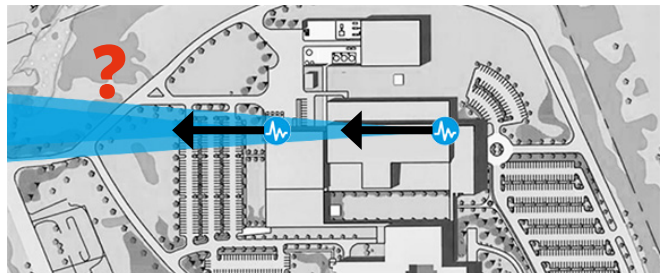
To localize a drone an intersection of the bearings from at least two sensors is needed.



Localization is not possible in the case where two RF-360s are aligned. This is the blind area of two sensors.



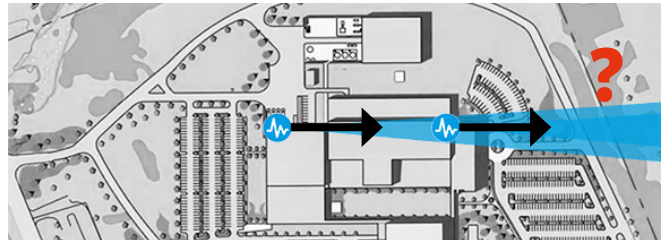
Both RF-360s detect a direction in alignment to the left. The overlapping area covers the complete bearing of the other RF-360. The position can't be determined.



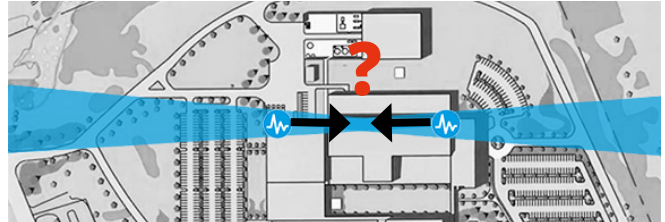




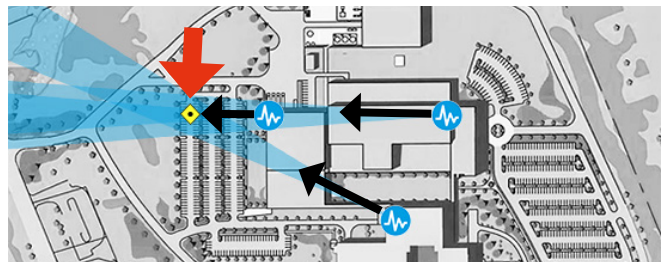
Both RF-360s detect a direction in alignment to the right. The overlapping area covers the complete bearing of the other RF-360. The position can't be determined.



Both RF-360s detect a direction against each other. No exact position can be determined.

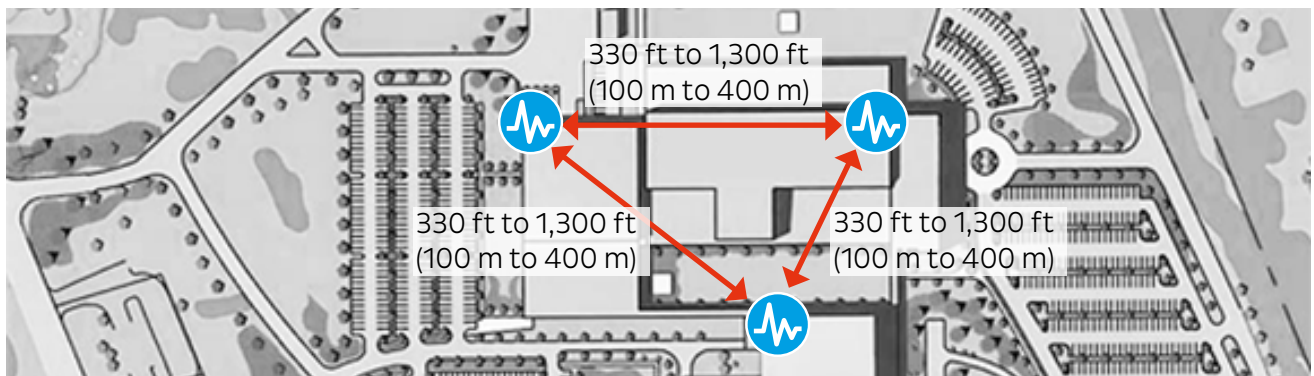


With three RF-360s there is no blind area. The third RF-360s can always verify the area of intersection.



## Distances between the RF-360s

The distance between the RF-360 usually should be 330 ft to 1,300 ft (100 m to 400 m).



Distance between the RF-360s

- ☐ For the best result, Dedrone strongly recommends a distance of **1,000 ft to 1,300 ft (300 m to 400 m)**.
- ☐ Choose the position 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.

## 5.3 Mounting Location

### Mounting Surface

- Make sure the selected mounting surface is capable of supporting the combined weight of the RF-360 (12.2 lb (5.5 kg)) and the pole under all expected conditions of load, vibration, and temperature.

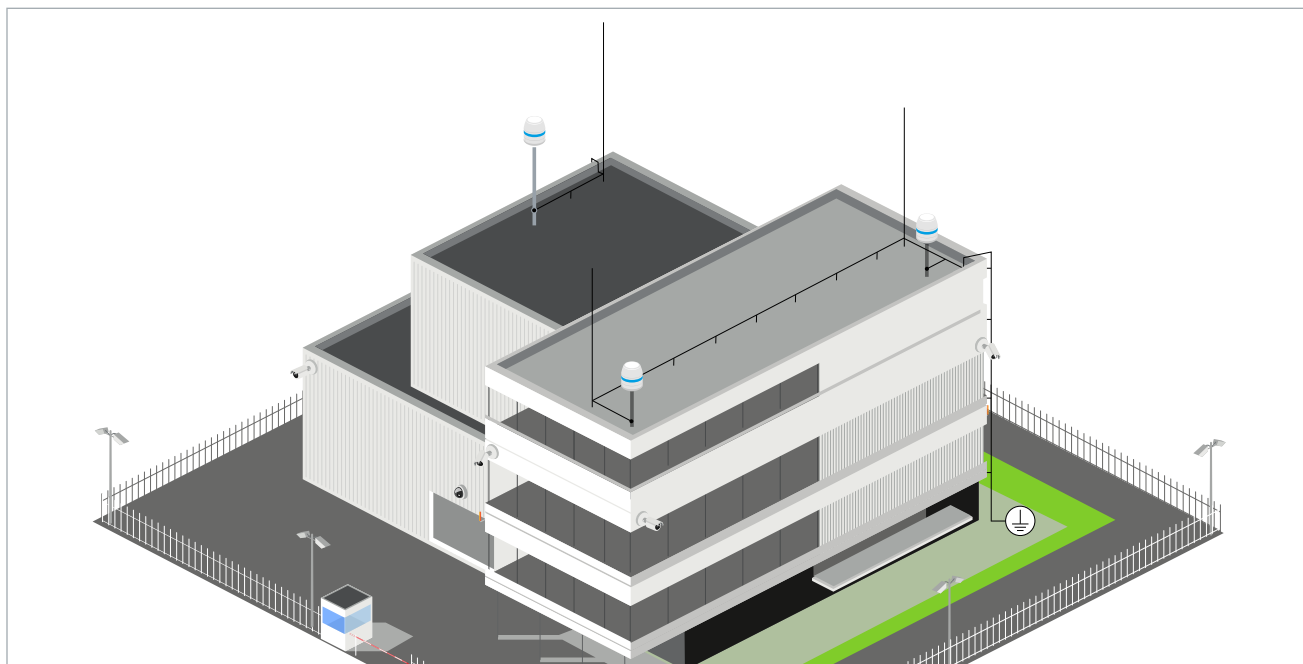
## Mounting Orientation

- Important for a good result is the vertical alignment of the device. Do not tilt the device.

## 5.4 Overvoltage Protection

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

Ensure that the mast is connected to the lightning conductor of the building and there is a metallic contact between the mast mount and the mast. The lightning conductor must be installed at least 1.5 m above the RF-360.



Lightning Protection Installation with RF-360s

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 and Section 810 of the National Electrical Code, ANSI/NFPA No.70).

## 6 Installation

### 6.1 Power Supply

The RF-360 can use two kinds of power supplies:

- AC power supply with the supplied power plug via a socket (AC 100-240V 50/60 Hz).
  - ☐ Make sure that the power socket is grounded.
  - ☐ In Denmark: Apparatets stikprop skal tilsluttes en stikkontakt med jord som giver forbindelse til stikproppens jord.
  - ☐ In Finland: Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan.
  - ☐ In Norway: Apparatet må tilkoples jordet stikkontakt.
  - ☐ In Sweden: Apparatens skall anslutas till jordat uttag

- Power over Ethernet via the supplied patch cable.
- ☐ Make sure, that your network has activated active PoE+ (802.3at).

## 6.2 Cable Requirements

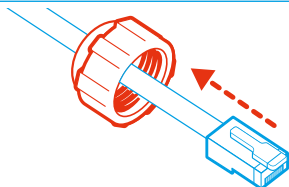
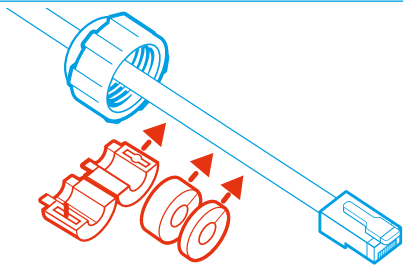
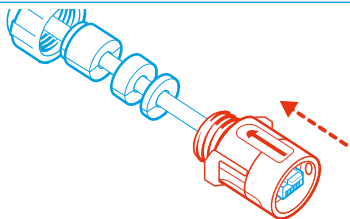
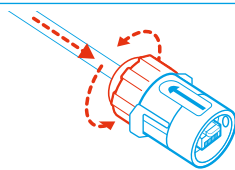
To connect the sensor with another cable as the supplied, note the following requirements.

Type	Cat-6 patch cable, shielded, suitable for outdoor use <i>Recommendation:</i> Cat-7 patch cable, shielded, suitable for outdoor use
Maximum Length	328 ft (100 m) For longer distances a PoE extender is required
External Diameter	3.5 mm – 7.5 mm

## 6.3 Cable Preparation for LAN connection

For a weather resistant connection to the RF-360, it is necessary to put on the supplied outdoor housing to the prewired RJ45 cordset.

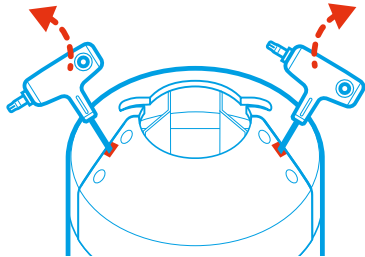
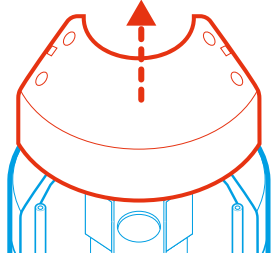

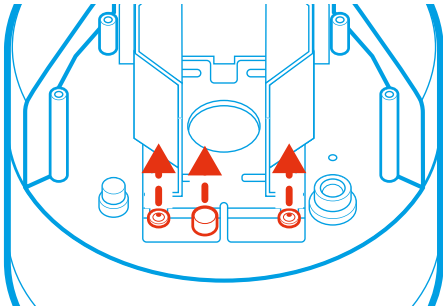
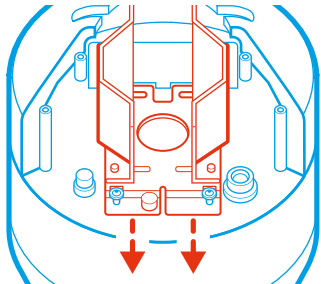
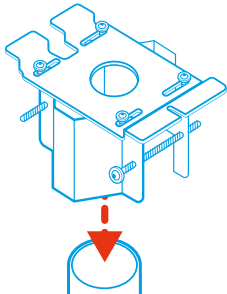
### Procedure:

1	Put the gland nut onto the cable. Thereby make sure that the thread shows to the plug.	
2	<ul style="list-style-type: none"> <li>• Open the sleeve and close it around the cable. Thereby make sure that the closer ring shows to the gland.</li> <li>• Put the sealing ring and the plastic ring over the cable. Thereby make sure that the sequence of the elements is correct.</li> </ul>	
3	Thread the connector body over the plug. <input checked="" type="checkbox"/> The plug clicks in and gets fixed in the connector body.	
4	Slide the gland to the connector body and screw down the gland nut on the connector body.	

## 6.4 Install the Sensor

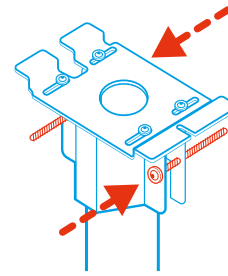
- ☐ Desired mounting place fulfills the requirements (see chapter 5 Select the Mounting Place, page 7).
- ☐ Diameter of the pole: between 1.2 in to 3.1 in (40 mm to 80 mm)

### Procedure:

1	Open the carton, remove the upper foam.	
2	Open the cover: <ul style="list-style-type: none"><li>• Stuck the supplied tool in the slot between the cover screws.</li><li>• Gently pry the cover on both sides.</li><li>✓ The cover comes up a little bit.</li></ul>	
3	Remove the cover and put it aside.	
4	Loosen both fixing screws and the security screw.  You do not need to unscrew the screws completely.	
5	Take out the pole mount.	
6	Put the pole mount on the pole. <ul style="list-style-type: none"><li>• To open up the pole mount unscrew the pole fixing screws.</li></ul>	

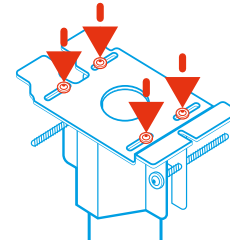
7

Adjust the pole mount in the desired direction and tighten the pole fixing screws appropriately. Only use the supplied screws.



8

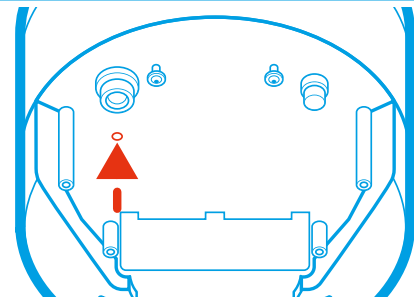
Center the pole mount plate over the pole and tighten the aligning screws appropriately. Only use the supplied screws.



9

If fall protection according to the installation regulations is required screw down the supplied fall protection ring and connect your suitable fall protection to the ring.

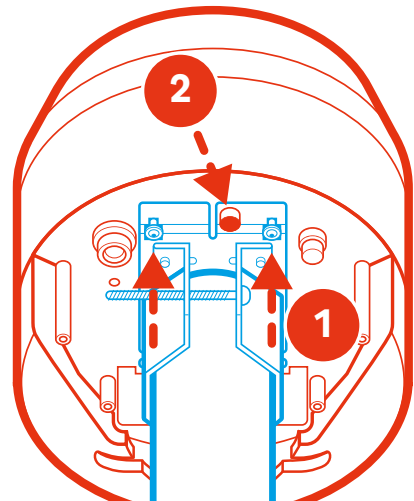
The fall protection must be dimensioned according to installation height in terms of thickness and length.



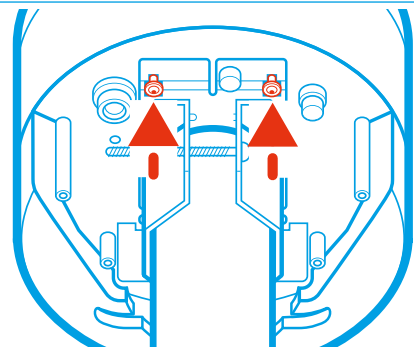
10

Place the RF-360 on the pole mount

- Slide the fixing screws in the screw guides of the mounting plate (1). Thereby make sure that the two flaps of the pole mount slides in the slot of the RF-360.
- Tighten the security screw by hand (2). Thereby the sensor is secured from falling down.



- Tighten the fixing screws appropriately. Only use the supplied screws.



**11** To connect the RF-360 to your local network, connect the patch cable with the outdoor housing to the network socket:

- Remove the protective cap from the plug.
- Plug the Ethernet cable with the outdoor housing into the plug (1). Make sure that the plug orientation fits the socket.
- Rotate the housing until it is locked (2).
- Lay the cable in the cable guide (3).

**i** If you want to operate the RF-360 via PoE+, make sure that PoE+ (802.3at) is enabled on the connected switch.

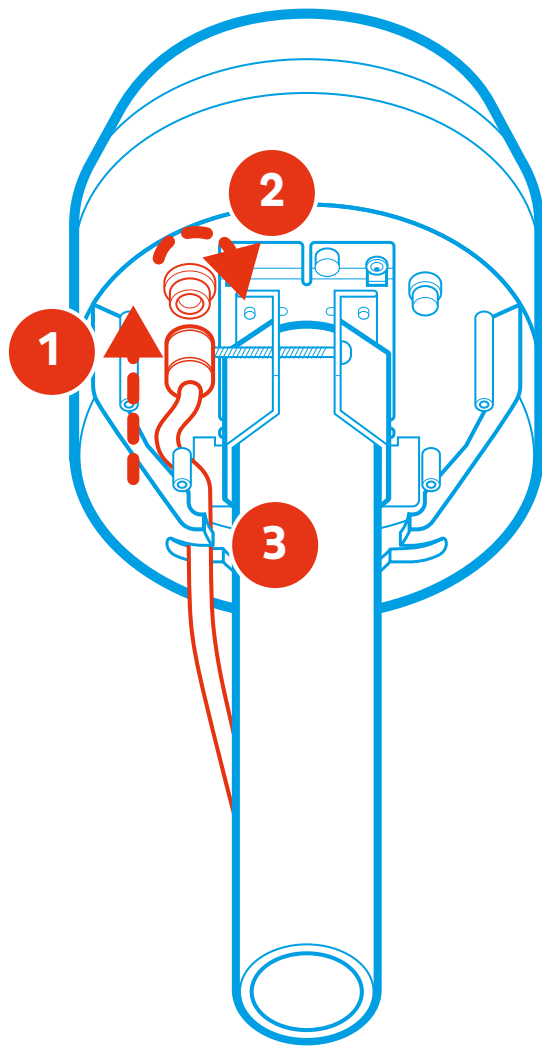
✓ If the patch cable is connected to the network and PoE+ is activated, the RF-360 boots automatically and after approximately 1 second the blue button at the RF-360 illuminates, indicating that the hardware is ready.

✗ The patch cable is connected to the network with activated PoE+ and the RF-360 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.

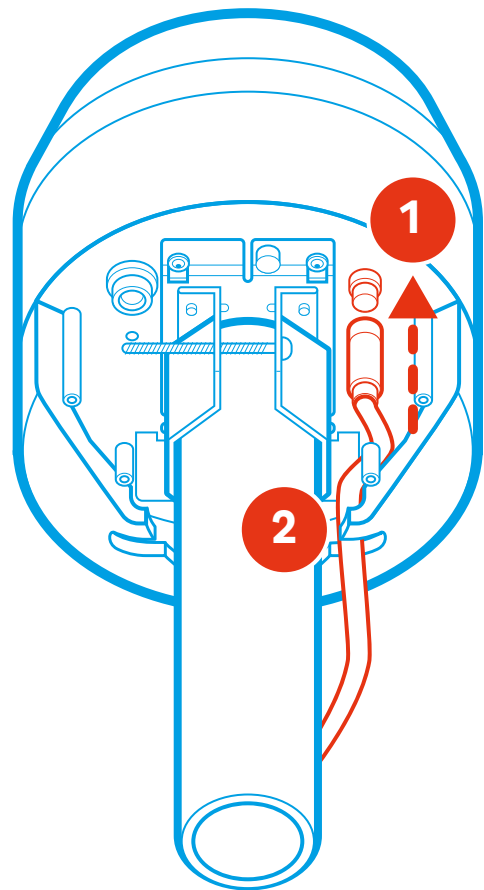
🔧 If you do not want to operate the RF-360 via PoE+, connect the AC cable as described in the next step.



## 12

To operate the RF-360 via the supplied AC cable, connect the AC cable to the AC socket:

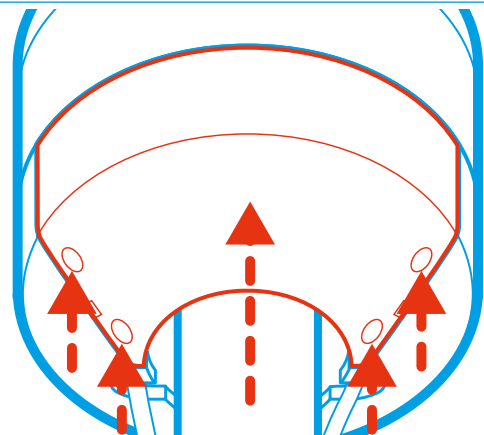
- Remove the protective cap from the AC plug.
- Plug the AC cable into the plug (1).
- ✓ The plug clicks into place and the arrow  on the plug points to the lock symbol  on the socket.
- Lay the cable in the cable guide (2).
- Plug the AC plug into the socket.
- ✓ If the AC cable carry current, the RF-360 boots automatically and after approximately 1 second the blue button at the RF-360 illuminates, indicating that the hardware is ready.
- ✗ The AC cable is connected to the socket and the RF-360 does not boot automatically after approximately 1 second?
  -  Push the blue button and wait for it to illuminate.
  -  Make sure that the power connection carry current.



## 13

Close the RF-360 cover:

- Put the cover on the RF-360.
- ✓ The cover locks in place.
- Screw down all cover screws.



## 7 Integrate the RF-360 in your DroneTracker

The integration procedure of the RF-360 in your DroneTracker depends on the system type:

- On premises installations using your local DroneTracker Server (see chapter 7.1 Integrate the RF-360 in your on prem DroneTracker Server, page 15).
- Dedrone Cloud installations do not require any additional infrastructure and are connected to the Dedrone Cloud (see chapter 7.2 Integrate the RF-360 via Dedrone Cloud, page 17).

### 7.1 Integrate the RF-360 in your on prem DroneTracker Server



To connect to the RF-360 DHCP-Services are required that automatically assign an IP address to the RF-360. If the RF-360 and the DroneTracker Server are in the same Layer2 network they can be connected directly. If the RF-360 and the DroneTracker Server are in different networks refer to the Dedrone Planning Manual or consult your network administrator.



**Requirements:**

- ☐ RF-360 is installed
- ☐ The power supply is working and the button at the RF-360 illuminates blue
- ☐ RF-360 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-360 and choose **[OK]**.  
✓ The RF-360 appears in the Site Explorer.
  - 6** To sort the RF-360 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-360.
  - 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 DroneTracker user interface.

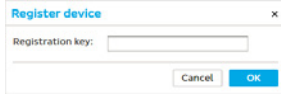




## 7.2 Integrate the RF-360 via Dedrone Cloud

### Requirements:

- ☐ RF-360 is installed
- ☐ The power supply is working and the LED at the RF-360 illuminates blue
- ☐ RF-360 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-360 appears in the Site Explorer.
  - 6 To sort the RF-360 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-360.
  - 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 DroneTracker user interface.

## 8 Cleaning

### **NOTICE** Wrong cleaner damages the housing

The wrong cleaner can damage the housing or antenna of the RF-360. Never use glass cleaner or other solvent cleaner to clean the RF-360.

- Use solvent-free cleaner to clean the RF-360.

## 9 Decommissioning

### 9.1 Shut down the RF-360

#### **NOTICE** RF-360 breaks

By disconnecting the cable of the power supply without shut down the RF-360, the RF-360 could break.

- Always shut down the RF-360 before disconnecting the cable.

You have the possibility to shut down the RF-360 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-360.
- 4 Choose **System** > **Shutdown hardware**.

#### Shut down directly at the RF-360:

- Briefly press the activation button at the RF-360 in the grip recess.
- ✓ The RF-360 shuts down and the blue light goes out.

### 9.2 Dismantling



#### Hot surface due to permanent sunlight

The surface of the RF-360 may become hot from permanent strong sunlight.

- Wear safety gloves when dismantling the device.

### 9.3 Disposal



Dispose the RF-360 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
Accuracy of Direction Finding	±5° (mean error)
Geolocalization	With two or more RF-360, also through Wi-Fi signals
Device Type	Sensor
Radio Frequency	Omnidirectional passive detection, classification, and direction finding
L x W x H	1 ft x 1 ft x 1.3ft (300 mm x 300 mm x 395 mm)
Weight	12.2 lb (5.5 kg)
Ingress Protection Rating	IP65 *
Operating Temperature	-4 °F to +131 °F (-20 °C to +55 °C)
Power Supply	AC 100-240V 50/60 Hz max. 1 A or PoE+ IEEE 802.3at (25 W)
Connectivity	Via LAN to existing IT infrastructure or via the integrated mobile connection in the Dedrone Cloud
Configuration, Operation, and Alarms	Via DroneTracker software (software version >= 4.1 and valid license)
Software Updates	Firmware and DroneDNA updates via cloud-based connection

\* 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.



# AIRSPACE SECURITY SOLUTION



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