



AirWarden™

Installation

Guidelines

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Introduction

This document provides guidelines for installing AirWarden Sensors.

There is also an **Installation Checklist** document found in the Installation Overview and Hardware online training modules.

For detailed sensor specifications and cable requirements, and which installation components need to be supplied by the installer, please see the online training materials.

Installation Locations

The installation locations will be provided in the Site Survey. The site survey will contain a description, aerial map, and photos of the installation location for each sensor.

You must review the Site Survey with an AeroDefense resource to design a final project.

AirWarden Server Requirements

AirWarden Command Console is hosted in AeroDefense's secure cloud. No premises servers are required.

Installation Schedule

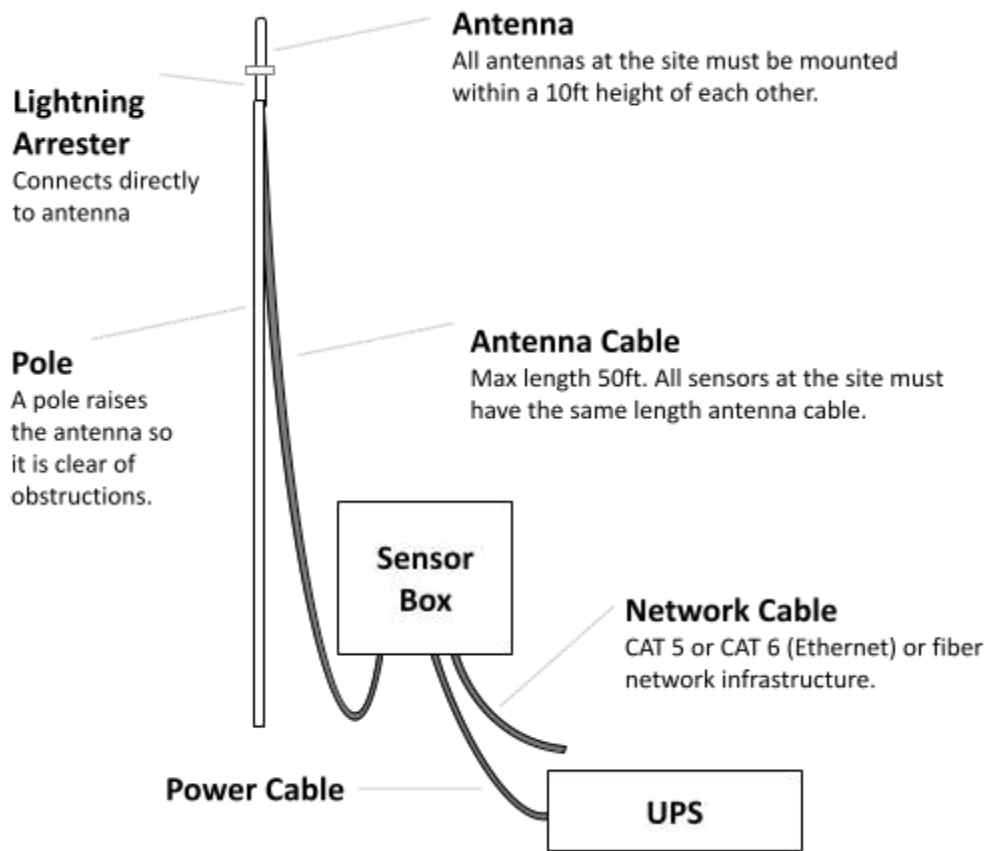
Once each sensor is installed and sealed it must be configured and tested. This process requires both the installer and an AeroDefense resource. If access to the sensors is limited (due to physical access restrictions e.g., if a bucket truck is required to access the sensor) configuration and testing should be conducted as soon as the sensor is installed and sealed. This reduces the likelihood that the installer will need to access the sensor again.

To facilitate configuration and testing at the time the installation is complete, AeroDefense must be notified the day before a sensor installation is completed so they can have a resource available. Installation schedule emails can be sent to help@aerodefense.tech.

The installer must also ensure they have a **fully charged drone and/or controller** with them at the time of installation. See [Test Considerations](#) in this document for details.

If DHCP and/or IP addresses are not available before the sensors are shipped, the installer will need to set them manually. To do this, they will need access to a VGA monitor and USB keyboard. See [How to a Set Sensor IP Address](#) in this document.

Installation Diagram



Antenna



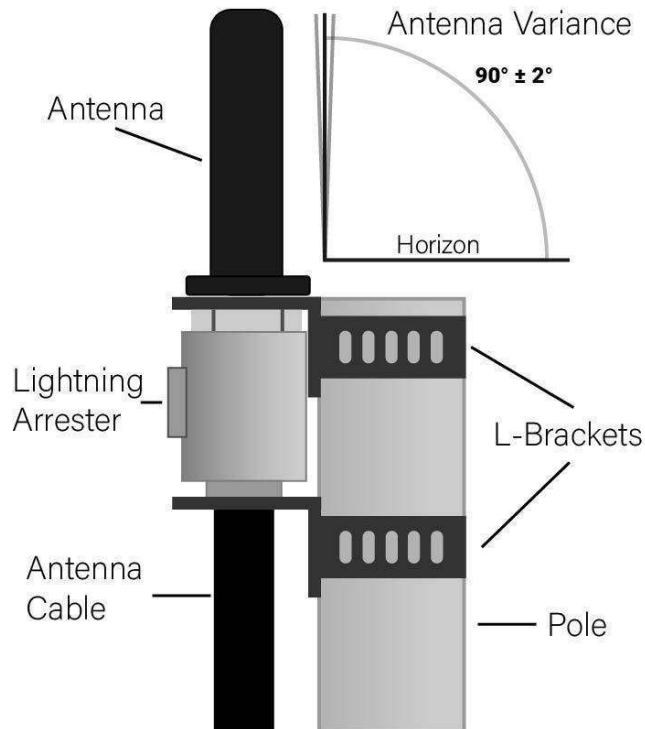
Antenna

- Mount antennas on a pole on a rooftop so they have a free unobstructed line of site to the environment/coverage area in as many directions as possible, including down (fiberglass is not an obstruction, only metal structures).
- All antennas at the site should be mounted at the same height +/- 5 ft. Antennas can be mounted on poles to achieve this.
- The maximum cable run between sensor box and antenna is 50ft (LMR-400).
- Antenna cable connects to Port 3 of the Splitter inside the sensor box. See *Sensor Wiring Diagram* in this document.
- **The antenna must be weather sealed in one of two ways:**
 - Mount the antenna through a weatherproof box (Hoffman box)
 - Seal antenna to lighting arrester, lightning arrester to coax cable, and cable to LCOM box connections with a combination of vinyl and rubber tape around the antenna connection and cable connection (a layer of rubber tape, then vinyl tape, then rubber tape).
- The antenna should be fully elevated above the pole or mast that the antenna is mounted on (no side blockage is allowed).
- The antenna should be vertical to the ground (use a level to make sure the antenna is within 2 degrees of vertical).
- The antenna should face outwards, e.g. if the antenna is mounted on a pole, the antenna side needs to face outside of the facility and the pole is inwards to minimize the pole's shadowing effect.





- Two L brackets will be provided by AeroDefense and used to secure the antenna. The antenna and L brackets should face away from the facility to have the best view of incoming sUAS and of the ground-based controller with little blocking the antenna's visibility of the air and ground facing away from the facility.



- The antenna needs to be installed at a location close to the outside of the facility elevated at least 9 feet above the surface it's on or elevated enough that the surface will not cause shading effect from the antenna to the ground 100 feet away, e.g. if the antenna is installed on the roof, the antenna needs to be installed close to the side that's facing outside and elevated enough to see the ground 100 feet away or as directed in the Google Earth project view.

Lightning Arrester



Lightning Arrester

Sensor Box



Sensor

- **Mounting:** Sensor Box should be mounted in a secure location with good air flow, if possible (e.g., in an access controlled area). The mounting flange allows it to be wall mounted on a flat surface or to a metal framing system as shown in Figure 1. **Cables should NEVER be connected by drilling a hole in the top of the box.**
- **Network:** Sensor boxes require network connectivity
- **Power:** Sensor boxes require a stable source of power (120V or 12-36V DC) plus ground, and a backup power source. Typically, a UPS is used both to stabilize the power and provide backup power. If LTE routers are deployed, also connect them to the UPS.

The survey Google Earth views provided by the installation team must be sufficient to identify the installation location of the sensors. Be sure to utilize the online Google Earth project view to allow you to zoom in on the specific sensor location.

After the sensor box is installed, note the FG number is written on the bottom of the sensor box as well as written on the inside of the sensor box on the **Sensor Physical Location Form**.

Cable Specs – Antenna to Sensor

It is critical the coax cable have solid pin connections of adequate length.

- LMR-240 cable (path loss=0.423/m@2.4GHz 0.669/m@5.8GHz) up to 20 ft
- LMR-400 cable (path loss=0.223/m@2.4GHz 0.354/m@5.8GHz) up to 40 ft
- N-male to SMA-male

Network Connectivity

Network connectivity can be achieved via one of 3 methods:

- **Ethernet/Fiber (preferred)**
Connection is via an organization's wired CAT 5 or CAT 6 (Ethernet) or fiber network infrastructure.
- **Peer to Peer (requires line of sight)**
Peer to Peer can be used to provide network connectivity to the sensors. For this solution, at least one sensor or the command computer must have Ethernet/Fiber access. If only one section has fiber the installer will need to figure out how to connect all sensors to the network. Example solutions include:
 - Ubiquity
 - IgniteNet
 - AirFiber
- **LTE**
AeroDefense support optional secure, encrypted LTE (cellular) wireless routers for locations that cannot offer existing networking for one or all sensors.

GPS Coordinates

AeroDefense will need to know the precise location of each sensor's antenna to ensure optimal performance of the system. While standing at the sensor, using a handheld GPS device, or Smart Phone (see ***How to get GPS coordinates on a Smart Phone*** in this document) record the GPS coordinates on the **Sensor Physical Location Form**.

Send Sensor Physical Location Form to AeroDefense

Once the installation is complete email the completed Sensor Physical Location Form to help@aerodefense.tech.

Post Installation Configuration and Testing

Once a sensor has been installed with power and network access and the RF connections are sealed, it needs to be configured and tested. **Please note that AeroDefense requires 48 hours advanced notice if sensors need to be tested as soon as the installation of each individual sensor is complete (due to physical access limitations, e.g., a bucket truck is required for access).**

Sensor Configuration and Testing

1. Installer calls AeroDefense
2. AeroDefense connects to the sensor and completes local configuration (approximately 15 minutes if there are no connectivity issues)
3. AeroDefense calls installer to notify them that configuration is complete and to walk them through reconnecting SDR cards (if required) and the detection tests.

Test Considerations

Detection Tests

Detection Tests will involve turning on a controller or a drone and controller, depending on the device used. Wi-Fi drones are not appropriate to use for this. Approved devices are as follows:

- DJI mavic series
- DJI phantom series
- **Drone and Controller Test** – Both drone and controller must be powered up and connected. It is important to remove the drone camera gimbal brace before powering up to avoid damage. The drone either needs to be placed on the same level where the antenna is installed or hovering at the same altitude as the antenna. The drone needs to be around 30 feet from the antenna.

Test Procedure

1. Contact AeroDefense support for guidance to test. AeroDefense support will conduct remote tests and instruct you on the following steps.
2. Turn on controller and drone,
3. Test on 2.4 GHz
 - a. Select bandwidth 10 MHz and confirm the channel lower range of 2437.5 MHz and the upper range of 2447.5 MHz is displayed.
 - b. Hover the drone at the same altitude as the antenna. The drone needs to be around 30 feet from the antenna. The pilot should stand directly underneath the drone.
4. Repeat Test on 5.8 GHz
 - a. Select bandwidth 10 MHz and confirm the channel lower range of 5730MHz and the upper range of 5740 MHz is displayed.

Onsite Troubleshooting Guide (LTE)

1. Verify LTE wireless router is powered
 - a. Lights visible
2. Check all SMA connections from antenna to wireless router
3. Check Ethernet cable from wireless router to computer
4. Continue to WIRED troubleshooting

Onsite Troubleshooting Guide (WIRED)

1. Confirm all components powered
 - a. Check computer power brick & connection to computer
 - b. Check the media converter is operating normally if applicable
2. Confirm all hard-wired connections are secure
3. Reboot computer
 - a. Unplug/re-plug power brick
 - b. Listen for “beep” to confirm re-powered
 - c. Check with NOC to verify sensor accessible

4. If not accessible, confirm computer functional
 - a. Plug in monitor/keyboard
 - b. Confirm login screen displays
5. Confirm network access
 - a. Escalate to AeroDefense team

Remote Troubleshooting Guide

Sensor Not Responding

1. Check power supply on sensor
2. Check power on networking component
3. Check networking component signal strength
4. Check if networking component detects client
5. If steps 1-4 check out, escalate to AeroDefense team

How to Reset an SDR Card

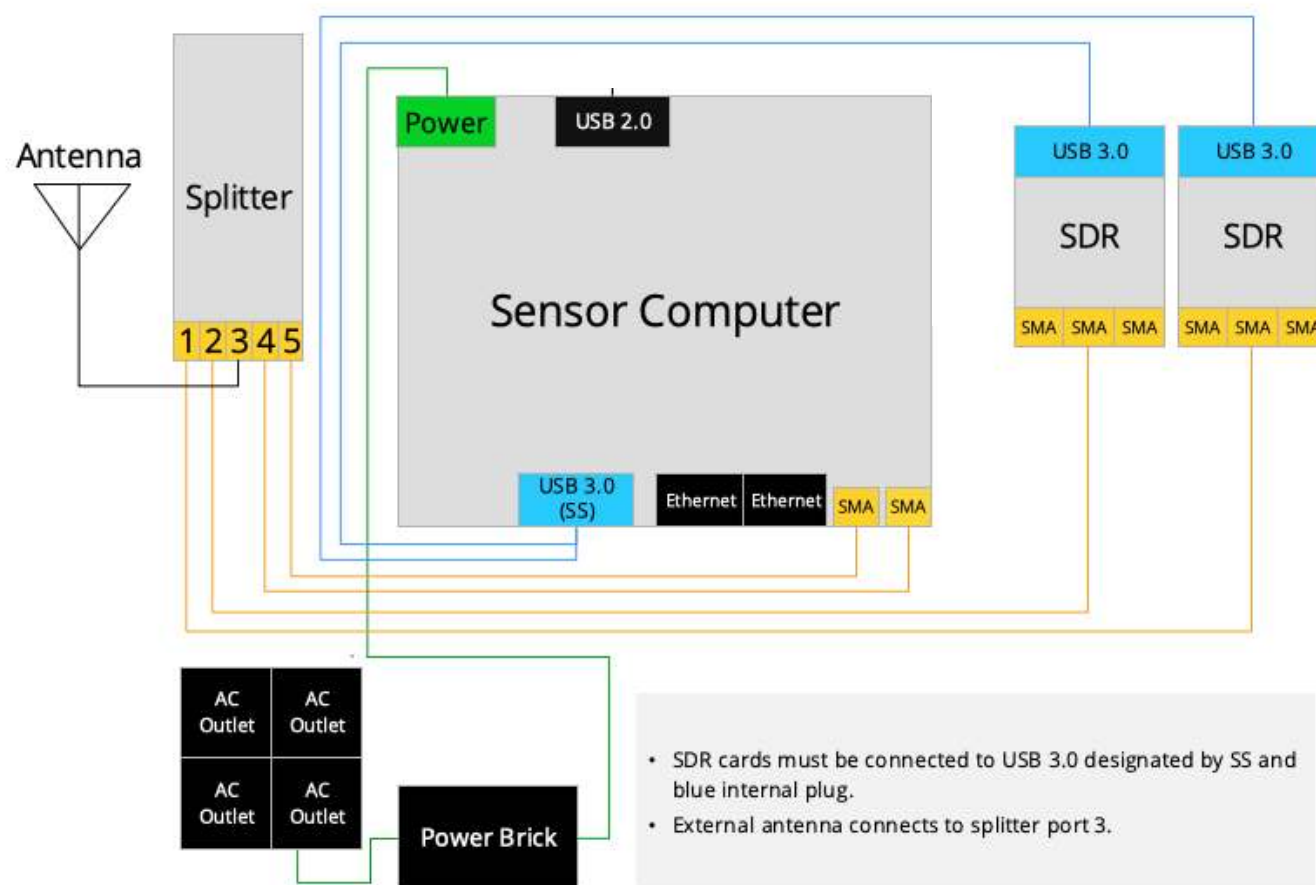
If a configuration fails, the installer will need to disconnect and reconnect the USB cables that connect the Computer to each of the SDR cards.

1. Locate the USB ports on the computer where the SDR card USB cables are connected
2. Disconnect the first USB cable from the computer and reconnect it
3. Disconnect the second USB cable from the computer and reconnect it

How to Replace an SDR Card

1. Disconnect the SMA Male Cable from the SDR Card.
2. Remove SDR Card from sleeve. This will require a 2.5mm Hex driver to fit in a small area to remove the screws holding SDR in the sleeve.
3. Insert new SDR Card into sleeve and replace screws to the new SDR/sleeve.
4. Reattach the SMA Male Cable to the middle RX2 port.

Sensor Wiring Diagram



How to get GPS coordinates on a Smart Phone

Android

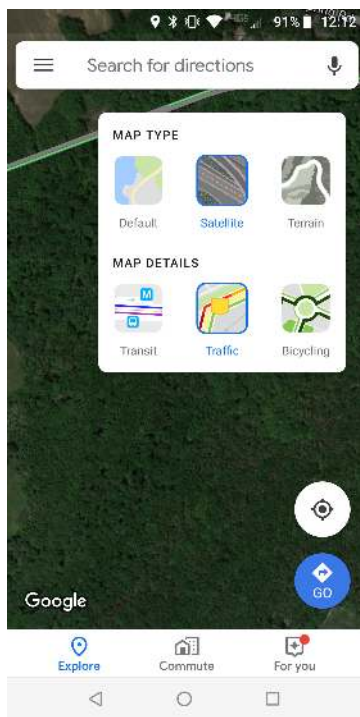
1. Tap the map icon



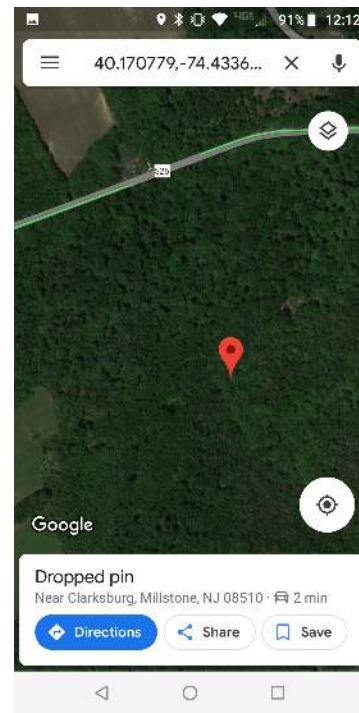
2. Tap the hamburger menu in the top left corner



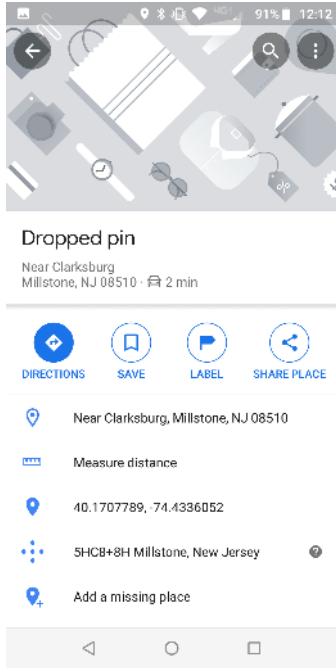
3. In the Map Type popup, select Satellite



4. Zoom in on the map and tap and hold on the exact location to mark it



5. The GPS coordinates will display in the search field at the top of the map, or you can tap the dropped pin on the map to view details, including the GPS coordinates



iPhone

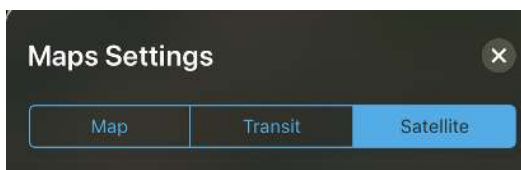
1. Tap the map icon



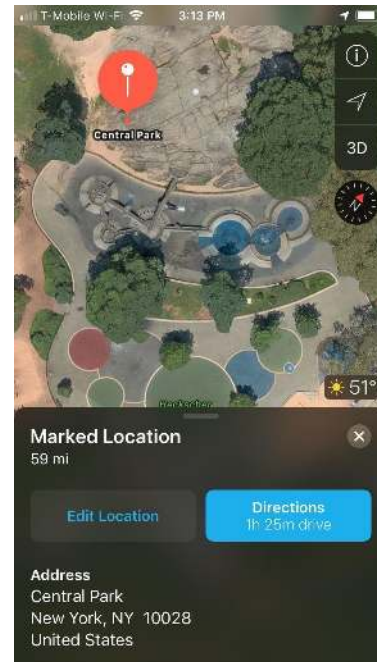
2. Tap the info icon in the top right corner of the screen



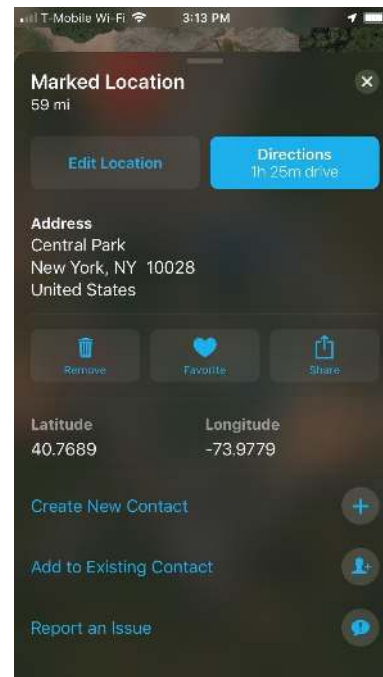
3. In the Map Settings popup, select Satellite



4. Zoom in on the map and tap and hold on the exact location to mark it



5. Scroll down to view the GPS coordinates (Latitude and Longitude)



Instruction to the User

This device complies with Part 15 of the FCC Rules and contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS standard(s).

Operation is subject to the following two conditions:

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

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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/TV technician for help.
- Changes or modifications made to this equipment not expressly approved by AeroDefense may void the FCC authorization to operate this equipment.