AeroDefense
RELIABLE DRONE DETECTION

AirWarden™ Installation Guidelines

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Introduction

This document provides guidelines for installing AirWarden Sensors.

For detailed sensor specifications and cable requirements, and which installation components need to be supplied by the installer, please see the *Sensor Spec Sheet*.

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.

Installation Schedule

Once each sensor is installed 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) ideally configuration and testing should be conducted as soon as the sensor is installed. 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 be completed so they can have a resource available. Installation schedule emails can be sent to installation@aerodefense.tech.

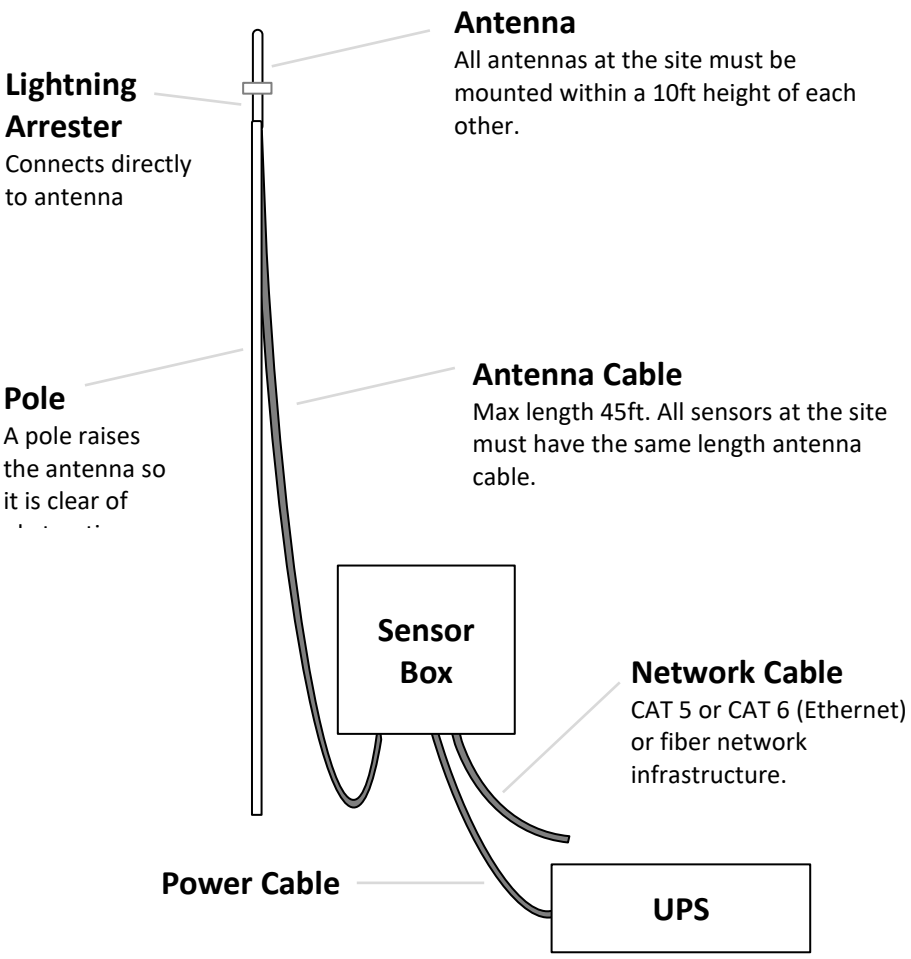
The installer must also ensure they have a **fully charged drone and/or controller** with them at the time of installation. See ***Test Considerations*** in this document for details.

Static Sensor IP Addresses

Static Sensor IP addresses should be pre-configured before the sensors are shipped to the site whenever possible. These should be entered into the **Sensor IP Form** and sent to installation@aerodefense.tech.

If 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



Antennas and Lightning Arresters

Antenna

Lightning Arrester

Figure 1 AirWarden Sensor Installation

- 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 45ft (LMR-400).
- The length of cable between the antenna and sensor box must be the same for all sensor installations (so that signal loss is consistent).
- Connect lightning arresters directly to the antenna and cables to the lightning arrester.
- Lightning arrester must be connected to the sensor box using an LMR-400 cable with N-Type Male to SMA Male connectors.
- Antenna cable connects to Port 3 of the Splitter inside the sensor box. See ***Sensor Wiring Diagram*** in this document.
- The antenna and lightning arrester connections must be weather sealed in one of two ways:
    - Mount the antenna through a weatherproof box (Hoffman box), and the lightning arrester inside the box.
    - Seal all connections with a combination of vinyl and rubber tape around the antenna to lightning arrester connection, and cable connection (a layer of rubber tape, then vinyl tape, than rubber tape).

Sensor Boxes

Sensor

- **Mounting:** Sensor Box should be mounted in a secure location, 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.
- **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.

After the sensor box is installed, note down the FG number (written on the inside of the sensor box) on the **Installation Form**.

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**

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 Installation Form.

Spare SDR Card with Velcro

SDR Card

SDR cards are located inside the sensor box. Each site will be shipped a spare SDR card and Velcro strip in case a card is broken. This card should not be installed unless instructed by AeroDefense. This card and Velcro should be accessible to the installer during sensor configuration and testing. For instructions on how to install a new SDR card see ***How to Replace SDR Card*** in this document.

Send Installation Form to AeroDefense

Once the installation is complete email the completed Installation Form to installation@aerodefense.tech.

Post Installation Configuration and Testing

Once a sensor has been installed and it has power and network access, it needs to be configured and tested. Please note that AeroDefense requires 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
- DJI inspire series
- Autel Xstar
- Flysky/Frysky transmitter
- 3DR IRIS controller

- **Controller Only Test** – Installer will need to use a controller that will transmit even when not connected to a drone, such as the Flysky FS-i6X 10CH 2.4GHz AFHDS RC Transmitter w/ FS-iA6B Receiver
- **Drone and Controller Test** – If the installer elects to use a drone that need to connect with its controller before the controller will transmit (such as a Mavic Pro), 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.

Position of Tester and Controller

10 yard distance from sensor

To conduct the test, the person operating the controller must be at least 10 yards from the sensor. This can be achieved in multiple ways:

- **From the Roof** – The test may be conducted by an installer on the roof as long as they can safely move to a position at least 10 yards from the sensor.
- **From a Lift** – The test may be conducted by an installer in a lift as long as it can be lowered to a position at least 10 yards from the sensor.
- **From the Ground** – The test may be conducted by a person on the ground.

Face away from the antenna

Once in position, the tester must face away from the antenna before turning on the controller.

Test Procedure

1. Move to a position 10 yards from the sensor
2. Turn on controller
3. Turn on drone (if required)
4. Advise AeroDefense when the controller is powered up or the drone and controller are connected.
5. AeroDefense indicates whether test is complete or if the installer needs to unplug and re-plugin the SDR cards.
6. Once advised by AeroDefense, power off the controller/drone.

Onsite Troubleshooting Guide (LTE)

1. Verify CradlePoint powered
    a. Blue/green lights visible
2. Check all SMA connections from antenna to CradlePoint
3. Check Ethernet cable from CradlePoint 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

Sensor SDR Error

If you’re prompted for [sudo] password for user, enter sensor password

1. Log into sensor CLI
2. Run ‘lsusb’
    a. Expected result should be
    user@user-Nuvo-5000:~$ lsusb
    Bus 002 Device 003: ID 2500:0021
    Bus 002 Device 002: ID 2500:0021
    b. If you see both SDR cards, skip to step 9
    c. After getting to step 8 three times, escalate to AeroDefense team
3. Make dummy change to /etc/default/grub
    a. Example - sudo nano /etc/default/grub
        i. Add any character
        ii. Delete that character

iii. Press ‘cnt+x’
iv. Press ‘y’
v. Press enter

4. Enter 'sudo update-grub'
5. Enter 'sudo reboot'
6. After computer responds to ping hard power cut for ≈3 minutes
7. Log into sensor
8. Go back to step 2
9. Start sensor via UI
10. Check UI for sensor error 10 minutes after completing step 9

How to Reconnect 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. Detach SDR card from sensor box (it’s attached with Velcro).
2. Disconnect the USB cable from the damaged SDR card and plug it into the USB slot in the new SDR card.
3. Disconnect the SMA Male connector from the middle port, port RX2, on the damaged SDR Card and connect it to the RX2 port on the new SDR card.
4. Attach the new strip of Velcro to the existing strip inside the sensor box.
5. Remove the sticky backing strip from the new strip of Velcro.
6. Stick the new SDR card to the sticky side of the Velcro.

How to Set a Sensor IP Address

Equipment Required

VGA Monitor with power cord and VGA Cable

Wireless USB Keyboard with Touchpad

To manually set the IP address of a sensor, an installer will need the following:

- VGA Monitor with power cord and VGA Cable
- Wireless USB Keyboard with Touchpad (or USB keyboard and USB mouse)
- List of IP addresses for each sensor

Set IP Address Procedure

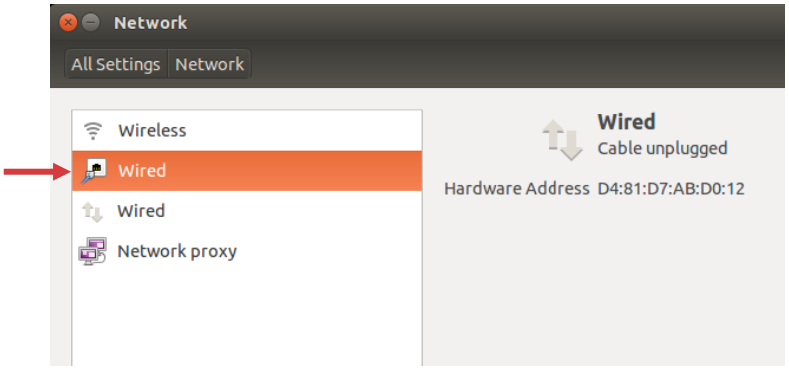
1. Log into the User Account (if you log into the temporary guest account all configuration changes will be erased upon logging out). Password will be provided by AeroDefense.

2. Click the **start icon** in top left corner of task bar

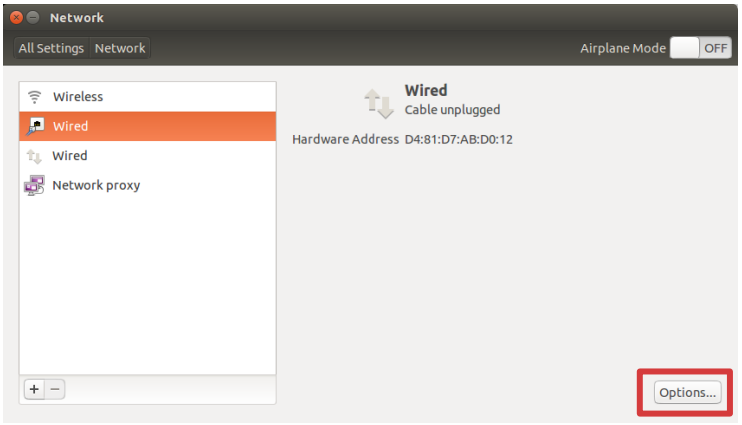
3. In search box, enter **'network'**

4. Single click the **Network folder**

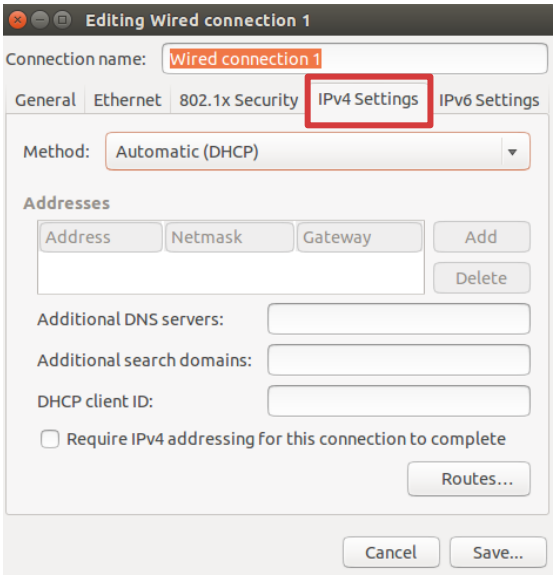
5. Select the first **Wired** (this will need to be repeated for both wired options)

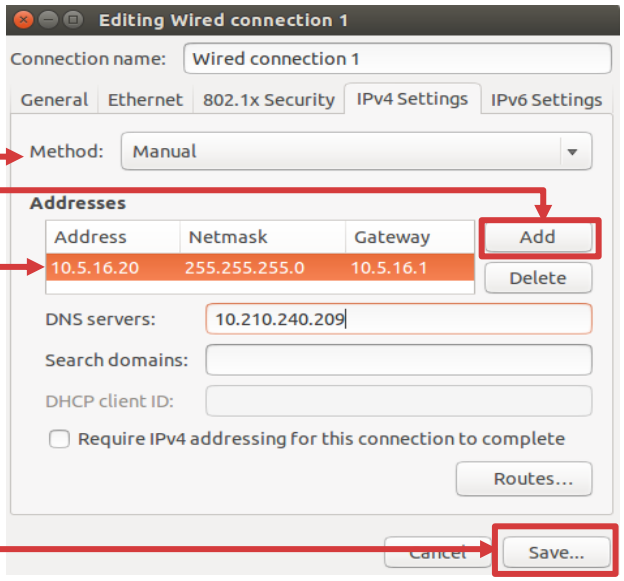


6. Click **Options**



7. Click **IPV4 Settings**





8. Change **Method** to **Manual**
9. Click **Add** to add a text box in the table
10. Enter the address details:
    a. Enter the **IP Address** value into **Address** column
    b. Enter **Subnet Mask** value into **Netmask** column
    c. Enter **Gateway** value into **Gateway** column
11. Click **Save**

Note: Save will be unavailable until you enter valid values for the fields. If it is not letting you click save double check Address/Netmask/Gateway.

12. Repeat steps 5 through 11 for the second wired option (port).

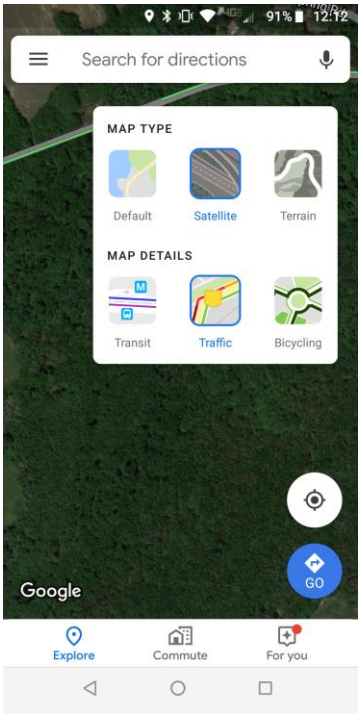
How to get GPS coordinates on a Smart Phone

Android

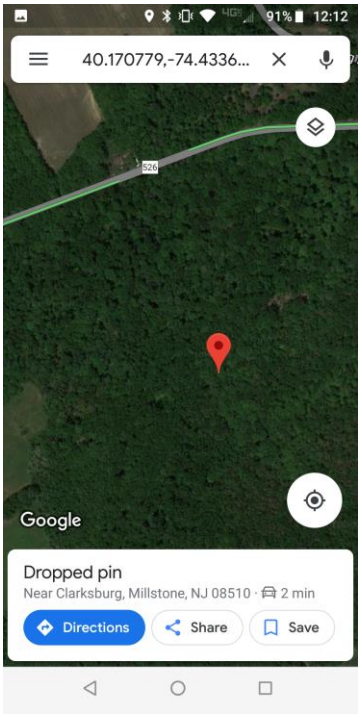
1. Tap the map icon

2. Tap the hamburger menu in the top left corner

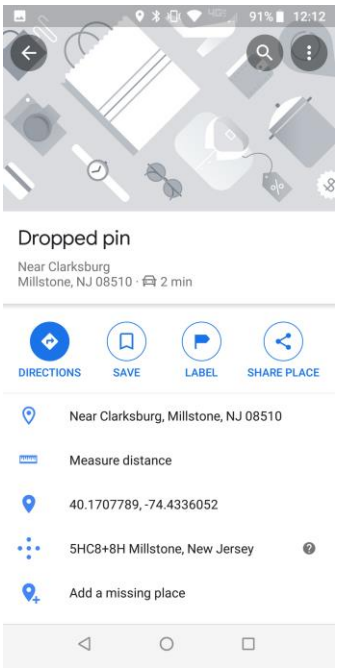
3. In the Map Type popup, select Satellite



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

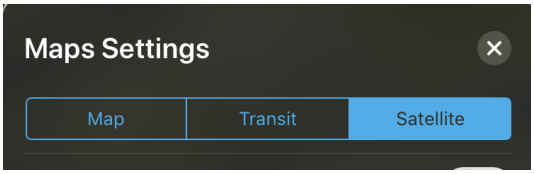


iPhone

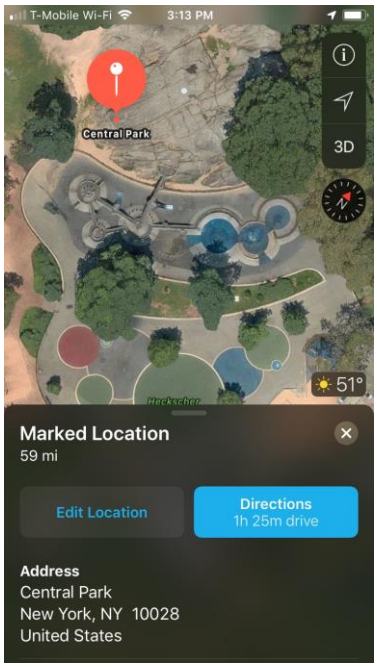
1. Tap the map icon

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

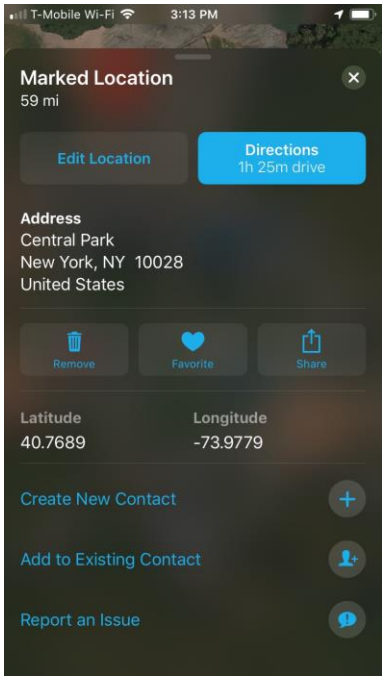
3. In the Map Settings popup, select Satellite



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 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.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.