

Sensys Networks VDS240 Wireless Vehicle Detection System

SensID Installation Guide

P/N 152-240-001-080, Rev D

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Document Properties

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Regulatory Statements

FCC Compliance Statement

This device 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.

Any changes or modifications to this product not authorized by Sensys Networks could void the EMC compliance and negate the authority to operate the product.

RF Exposure Statement

This device has been tested and meets the FCC RF exposure guidelines. It should be installed and operated with a minimum distance of 20 cm between the radiator of RF energy and the body of users, operators or others.

Improper use or tampering with the device is prohibited and may not ensure compliance with FCC exposure guidelines.

Warnings

No Safety Switching

Sensys Networks **does not** allow its equipment to be used for safety applications such as controlling a mechanical gate or switching a train to avoid a collision.

Lithium Thionyl Chloride Batteries

Sensys Networks uses Lithium Thionyl Chloride batteries in the following products:

- Sensors (VSN240-F/M/MP/T series)
- Repeaters (RP240 and FLEX-RP series)

Lithium batteries are widely used in electronic products because they contain more energy per unit -weight than conventional batteries. However, the same properties that deliver high energy density also contribute to potential hazards if the batteries are damaged. Improper use or handling of the batteries may result in leakage or release of battery contents, explosion or fire.

Following are the recommendations of the battery manufacturer for proper use and handling of batteries in the Sensys Networks devices mentioned above:

- DO NOT charge or attempt to recharge the batteries (they are NOT rechargeable)
- DO NOT crush or puncture batteries
- DO NOT short-circuit the batteries
- DO NOT force over-discharge of the batteries
- DO NOT incinerate or expose batteries to excessive heating
- DO NOT expose battery contents to water
- DO dispose of batteries and devices containing batteries in accordance with local regulations

NOTE:

Sensys Networks wireless sensors contain no serviceable parts and should never be disassembled. Installation and removal of sensors from pavement should only be done by trained personnel and care should be taken to insure that the sensor casing is not punctured or crushed.

Additional safety information is available from the battery's manufacturer:

- Sensor battery cell: <http://sensysnetworks.com/sensorbattery>
- Repeater battery cell: <http://sensysnetworks.com/repeaterbattery>

Document Control

Sensys Networks continually reviews and revises its technical publications. Please email address questions, suggestions or corrections to support@sensysnetworks.com.

Sensys Networks Technical Publications

For additional information regarding Sensys Networks products and applications, design guides, configuration guides, and best practices, refer to the Sensys Networks technical documents library available at http://www.sensysnetworks.com/resources.php?tech_docs.

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Introduction

This guide provides information and procedures for installing and configuring the Sensys Networks SensID¹ in conjunction with the Sensys Networks VDS240 wireless vehicle detection system. This document is intended to be used by Sensys Networks customers, consultants, partners, dealers, and those who are interested in the application of wireless communication technology to the challenges of traffic detection, management and control.

What's Inside

This guide includes the following information:

- *Chapter 1: Introduction*, defines the purpose and scope of the guide.
- *Chapter 2: Overview*, reviews the operations of SensID and describes the contents of a product shipment.
- *Chapter 3: Installation Considerations*, notes key points for installing SensID.
- *Chapter 4: Installation Procedures*, provides step-by-step instructions for installation.
- *Chapter 5: Configuration*, explains how to configure SensID via TrafficDOT.

1. This was previously known as VIMS Analyzer



Overview

This chapter provides a short overview of SensID and describes the contents of an SensID shipment.

SensID

SensID is a cloud hosted software solution that provides web-based access to travel time analytics, signal timing tools, and performance metrics based on anonymized Bluetooth[®] and Wi-Fi MAC records collected by FlexControl Card (i.e., APCC) or FlexControl Module devices at traffic intersections or other data collection points. The FlexControl Card or FlexControl Module forwards the anonymized MAC records to a remote SensID server via SNAPS. SensID manages the collection, processing, and storage of the anonymized MAC records as well as the creation of the FlexControl Card or FlexControl Module devices and vehicle routes.

The devices that support Wi-Fi and Bluetooth (BT) MAC data collection are the APCC-R and the FLEX-CTRL-M (and their variants).

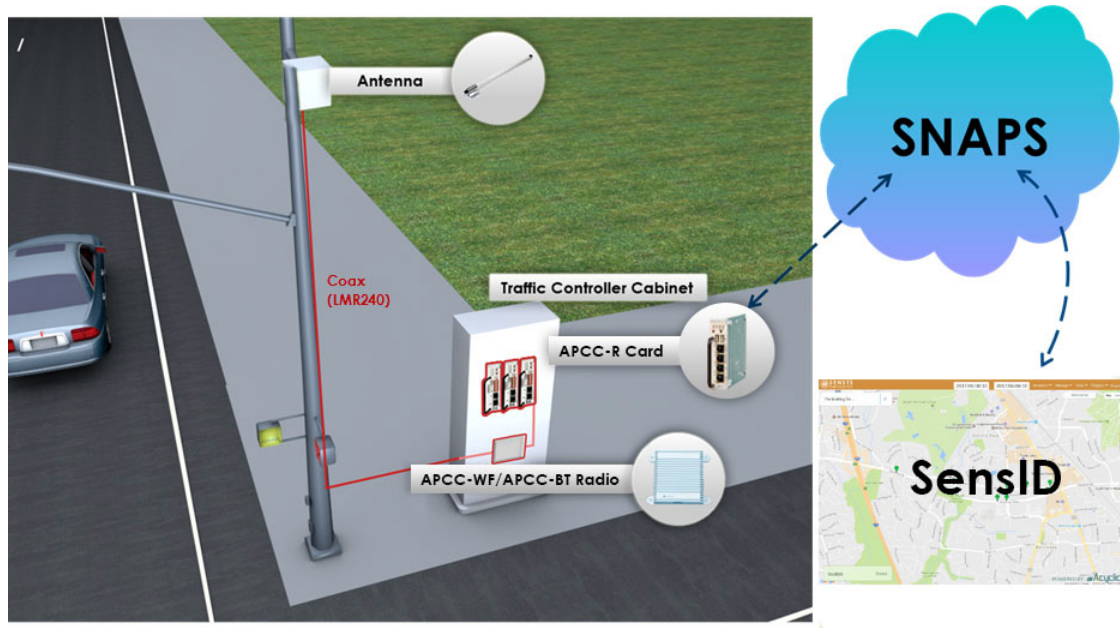


Figure 1. SensID System Configuration - APCC-R Card

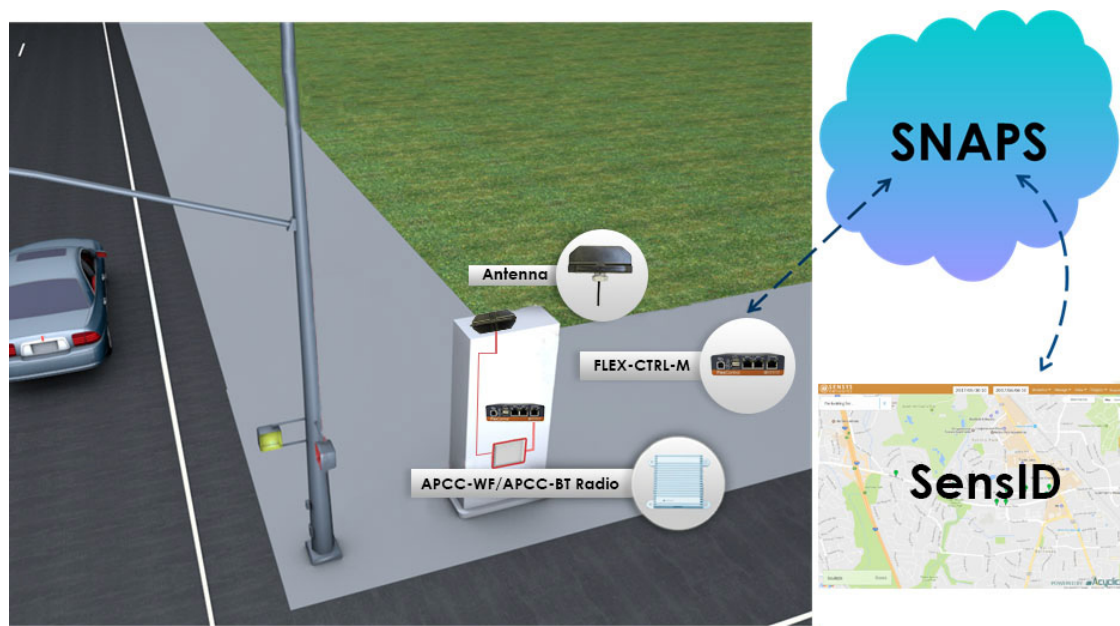


Figure 2. SensID System Configuration - FLEX-CTRL-M

System Installation

In a typical SensID installation, the omni-directional antenna is either mounted on pole at an intersection or mounted on top of the traffic cabinet and is connected by low-loss coaxial cable to the APCC-WF/APCC-BT radio in the controller cabinet. The APCC-WF/APCC-BT radio is connected by a USB cable to the APCC-R or FLEX-CTRL-M. The APCC-R or FLEX-CTRL-M has a 10/100Base-T Ethernet port to connect to a wired network or wireless cellular modem.

Required Equipment

A complete SensID installation consists of the following: an APCC-R or FLEX-CTRL-M, a APCC-WF/APCC-BT radio, antenna (with mounting plate and mounting kit), and antenna cable.

APCC-R

The APCC-R is a controller card that maintains low power consumption, supports multiple radios, and allows for additional communication and processing power. The APCC-R receives mobile device MAC addresses captured by the APCC-WF/APCC-BT radios. The APCC-R anonymizes the MAC addresses and forwards them to the SensID server via SNAPS.



Figure 3. APCC-R

FLEX-CTRL-M

The FlexControl Module provides equivalent functionality as the Access Point Controller Card (APCC) except for the internal contact closures. It maintains two-way wireless links to the sensors and repeaters, establishes overall time synchronization, transmits configuration commands and message acknowledgments, and receives and processes data from the sensors.



Figure 4. FLEX-CTRL-M (front and back)

APCC-WF/APCC-BT Radio

The APCC-WF radio is an industrial grade Wi-Fi radio that conforms to the IEEE 802.11b/g standard for wireless devices in the 2.4 GHz frequency range. The APCC-WF radio connects to the APCC-R or FLEX-CTRL-M via a USB interface.

The APCC-BT radio is a commercial grade radio that conforms to the Bluetooth 4.0 standard for wireless devices in the 2.4 GHz frequency range. The APCC-BT radio also connects to the APCC-R or FLEX-CTRL-M via a USB2.0 interface.



Figure 5. APCC-WF and APCC-BT Radios

Antenna

Depending on whether the configuration calls for a pole mounted antenna or a cabinet mounted antenna set up, there are two omni directional antennas available. Both antennas are compatible with the APCC-R or the FLEX-CTRL-M. The omni directional antenna used for a pole mount set up has 9 dBi gain.

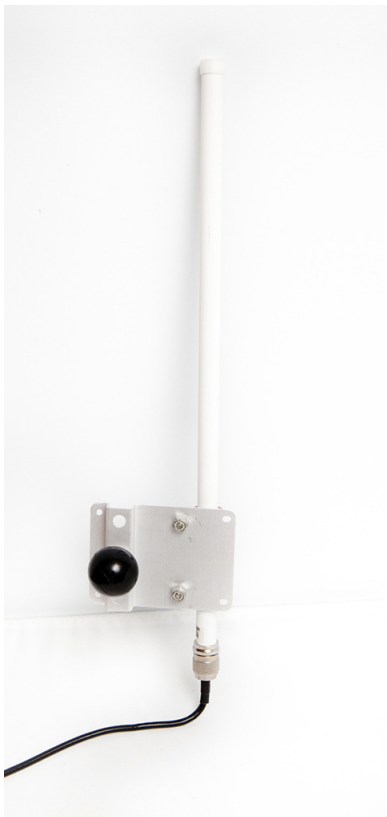


Figure 6. Pole Mounted Omni Directional Antenna

The omni directional antenna ANT-CM-W used for a cabinet mount set up has 4.5 dBi gain. A dual cellular/wifi combo antenna ANT-CM-CW is also available.



Figure 7. Cabinet Mounted Omni Directional Antenna

System Communication

A communication infrastructure is a requirement for data collection and device management. The following are the basic options for establishing communication with the APCC-R or FLEX-CTRL-M in the field:

- An Ethernet connection to a gateway with wired access to the Internet.
- An Ethernet connection to a gateway with wireless modem access to the Internet.

NOTE:

The communications setup for your devices should be planned out and any preliminary setup steps completed prior to going out to the field.

Installation Considerations

This chapter provides information to consider before installing SensID.

Identifying the APCC-WF/APCC-BT Radio and Antenna

APCC-WF/APCC-BT Radio

The APCC-R or FLEX-CTRL-M connects to a APCC-WF or APCC-BT radio via a 6' USB cable. The APCC-WF/APCC-BT radios sense MAC addresses from APCC-WF/APCC-BT units. The APCC-WF/APCC-BT radios have an N-Type (RP-SMA) connector for connecting a variety of omni-directional antennas, and a USB port for connecting to a controller.

Antenna and Cable

Each APCC-WF/APCC-BT radio must connect to an antenna. Determine the location of the antenna relative to the cabinet that will hold the APCC-R or FLEX-CTRL-M. The coax cable that connects to the antenna to the APCC-WF/APCC-BT radio should be a LMR-240 grade (or better). The LMR-240 coax cable will have an N-type connector that connects to the antenna and an N-Type (or RP-SMA) connector that connects to the APCC-WF (APCC-BT) radio.



Figure 1. N-Type Connector for APCC-WF



Figure 2. RP-SMA Connector for APCC-BT

Determining the Location of the Antenna

The physical location of the antenna is the primary determinant of the wireless radio communications quality and the network's overall usefulness and reliability. Selecting a location involves several factors (including other local RF transmissions) that may make pre-assigned locations problematic.

Optimal Location Criteria for Pole Mounted Antenna

Optimal locations for a pole mounted antenna should meet the following criteria:

- are high enough (at least 16 ft) to promote high quality RF communications on a sustained basis
- allow the antenna to be mounted with its bulkhead connector pointed toward the ground
- are within specified (maximum 200 ft) coax cable length limits
- do not subject the antenna to vibration, shaking or movement
- are reasonably accessible to field support personnel

Optimal Location Criteria for Cabinet Mounted Antenna

Optimal locations for a cabinet mounted antenna should meet the following criteria:

- a horizontal surface
- should be dry and clean of debris before installing
- the cabinet is at the intersection and not set back from the intersection
- antenna has clear view of the vehicles at the intersection

Installation Procedures

This chapter provides the instructions for installing and mounting the antenna and APCC-WF/APCC-BT radios into the controller cabinet.

Tools Required for Pole Mounted Antenna Installation

The following tools are required for installing an antenna:

- *Lift truck* – to install the antenna above the road surface
- *Screwdriver* – combination flat and Phillips head ends
- *Universal mounting kit* – double-socket arm holds the antenna. (Kit can be purchased from Sensys Networks.)

NOTE:

Mounting hardware is included in the universal mounting kit.

- *Clamp band kit* – for attaching double-socket arm to mounting pole. (Kit supplied by Sensys Networks.)
- *Pliers* – used to work the clamp band
- *Wire cutters* – used to cut the clamp band
- *Coax cable stripper* – used to prep the LMR coax cable
- *Crimp tool* – used to crimp the N-type or RP-SMA connector onto the LMR-240 coax cable
- *N-type (or RP-SMA) crimp connector* – for connecting the LMR-240 coax cable to the antenna and APCC-WF/APCC-BT radios

Installing the Mounting Plate on Poles

When attaching the square surface mounting ball plate to a pole, the clamp band is used to secure the ball plate to the pole.

Follow these steps to perform the installation:

1. Use the measuring tape to determine the circumference of the pole that will hold the ball plate.
2. Subtract four inches from the measured circumference and cut the band to that length. Cut the band through the center of the nearest round hole.
3. Feed the clamp band through the square ball plate using the custom clamp holes until the square ball plate is at the center of the band. Attach the fastener to *one end* of the band by diagonally inserting the end.
4. Use the cloth to clean the area of the pole that will meet the ball plate. Remove the double stick tape cover from the back of the plate, wrap the clamp band around the pole, and attach the second (non-engaged) end of the fastener. Tighten the clamp to secure it.
5. Attach the double socket arm to the square ball plate.
6. Attach the antenna ball plate to the other end of the double socket arm.
7. Position the antenna to be vertical and facing the center of the intersection and tighten the double socket arm to secure the antenna's position.



Figure 1. Completed Antenna Installation

IMPORTANT:

The antenna should be mounted a minimum of 16' above roadway surface.

Tools Required for Cabinet Mounted Antenna Installation

The following tools are required for installing an antenna:

- *#2 Phillips bit screwdriver* – combination flat and Phillips head ends
- *7/8 in (2.22 cm) hole saw or step drill bit with power drill* – used to drill a hole on top of the flat surface of the traffic cabinet where the omni directional antenna will be installed
- *Hand wrench* – used to tighten the antenna nut on the ferrule

Installing the Antenna on a Traffic Cabinet

When installing the omni directional antenna on top of the traffic cabinet, the surface area must be clean and dry.

Follow these steps to perform the installation:

1. Drill a 7/8 in (2.22 cm) diameter hole on top of the flat surface of the traffic cabinet with a hole saw or a step drill bit where the omni directional antenna will be installed. Ensure the hole is deburred.

NOTE:

Ensure the antenna hole location will not interfere with the internal components of the traffic cabinet. Ensure that there is sufficient ground plane for the antenna. Orient the antenna fin in the general direction of the repeaters.

2. Pass the connectors through the hole. Pull the cable until the threaded end of the antenna ferrule appears in the hole. Do not pull on connectors. Pulling on the connectors may cause them to detach or may cause internal damage to the cable connection.
3. Install the slotted nut onto the threaded ferrule. Ensure the side of the nut is flush against the top of the inside surface.
4. Hand tighten the nut two more turns to secure the antenna and to compress the antenna's gasket. If the gasket is not seated, continue tightening the nut until a seal is formed.

Connecting the APCC-WF/APCC-BT Radio

Once you have installed the antenna, perform the following steps to connect the antenna to the APCC-WF/APCC-BT radio.

For Pole Mounted Antenna Configurations:

1. Install the APCC-R or FLEX-CTRL-M in the cabinet or in an enclosure.
2. Mount the APCC-WF/APCC-BT radio in the controller cabinet using the provided screws. Only one screw needed.

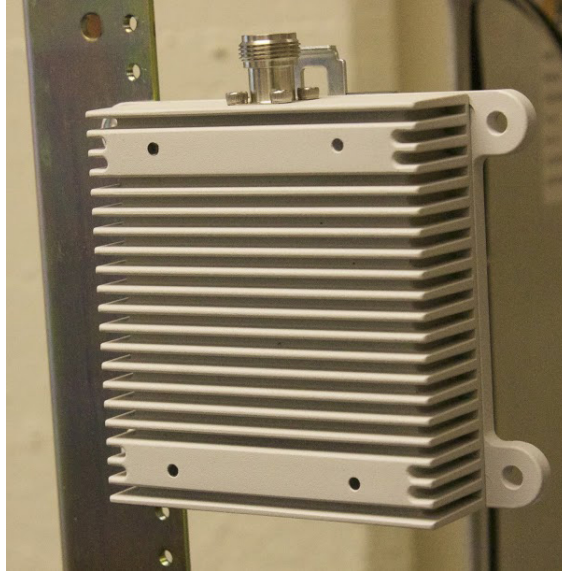


Figure 2. APCC-WF Radio Mounted in Cabinet



Figure 3. APCC-BT Radio Mounted in Cabinet

3. Run the LMR-240 antenna cable from the cabinet to and up the signal pole.

NOTE:

Bending radius for the LMR-240 cable is 0.75". Do not exceed this bend.

4. Cut the LMR-240 antenna cable to the appropriate length.
5. Take the coax strip tool and remove the cable jacket and dielectric from the antenna cable end.

6. Fold the braid over the jacket.
7. Slide on the ferrule.
8. Insert the pin in the center conductor.
9. Slide the connector housing onto the conductor.
10. Push the housing all the way down so the pin goes through.
11. Slide up the braid and the ferrule.
12. Using adequate pressure, crimp the ferrule onto the jacket using the crimp tool.
13. Give a gentle tug to ensure the connector is properly seated.
14. Connect the antenna to the LMR-240 antenna cable on the signal pole.
15. Repeat steps 5-13 with a N-type connector for APCC-WF or a RP-SMA connector for APCC-BT radio.
16. Connect the antenna cable to the APCC-WF/APCC-BT radio in the cabinet.
Additional step for the Bluetooth radio:
 - Use the cable tie to tighten the coax cable securely to the cable clamp to provide strain relief.
17. Connect the APCC-WF/APCC-BT radio to the APCC-R or FLEX-CTRL-M using the provided USB cable.

NOTE:

The USB cable is approximately 6' in length.

18. Connect the Ethernet port of the APCC-R or FLEX-CTRL-M to a wired network or wireless modem.
19. Dress and secure all cables in the cabinet.

For Cabinet Mounted Antenna Configurations:

1. Install the APCC-R or FLEX-CTRL-M in the cabinet or in an enclosure.
2. Mount the APCC-WF/APCC-BT radio in the controller cabinet using the provided screws. Only one screw needed.
3. Connect the antenna cable to the APCC-WF/APCC-BT radio in the cabinet.
Additional step for the Bluetooth radio:
 - Use the cable tie to tighten the coax cable securely to the cable clamp to provide strain relief.
4. Connect the APCC-WF/APCC-BT radio to the APCC-R or FLEX-CTRL-M using the provided USB cable.

NOTE:

The USB cable is approximately 6' in length.

5. Connect the Ethernet port of the APCC-R or FLEX-CTRL-M to a wired network or wireless modem.
6. Dress and secure all cables in the cabinet.

Configuration

This chapter describes the tasks required to configure and test the SensID installation. The configuration process consists of the following:

- *Starting TrafficDOT and Connecting to an APCC-R or FLEX-CTRL-M*
- *Configuring APCC-R or FLEX-CTRL-M*
- *Configuring TrafficDOT Addons*
- *Exiting TrafficDOT*
- *Testing the Installation*

Starting TrafficDOT and Connecting to an APCC-R or FLEX-CTRL-M

TrafficDOT is a configuration manager and monitoring tool for an access point and all its associated devices (sensors, repeaters, and contact closure cards). TrafficDOT provides a graphical user interface (GUI) to the network's devices, settings, and operations. The GUI simplifies both configuration and management of installations.

TrafficDOT requires an IP network connection to the APCC-R or FLEX-CTRL-M. The connection is made by cabling a laptop to an APCC-R or FLEX-CTRL-M.

NOTE:

Refer to the *TrafficDOT v2.12 Set Up and Operating Guide* for a more information on using TrafficDOT with the Sensys Networks Wireless Vehicle Detection System.

Connect to the APCC-R or FLEX-CTRL-M with TrafficDOT by performing the following steps:

1. On a Windows laptop or PC, start TrafficDOT by clicking its icon. TrafficDOT's *Main* window opens with the *Connect* window open in front of it.

2. Type the IP address of the APCC-R or FLEX-CTRL-M into the *IP Address* field and accept the default value in the *TCP Port* and *HTTP* field. Click **Connect**.
3. After clicking **Connect**, wait a moment for the *Main* window.

Configuring APCC-R or FLEX-CTRL-M

Configuring IP Mode

After connecting to the APCC-R or FLEX-CTRL-M, use TrafficDOT to configure the access point's *IP Mode*. Changes to the default IP address settings are necessary to communicate with the SNAPS server. To configure the *IP Mode*, perform the following steps:

1. Click on the access point, wait a moment for the *Configuration* window.
2. Click on the **Sys Config** tab. The *IP Mode* tab will appear as default.

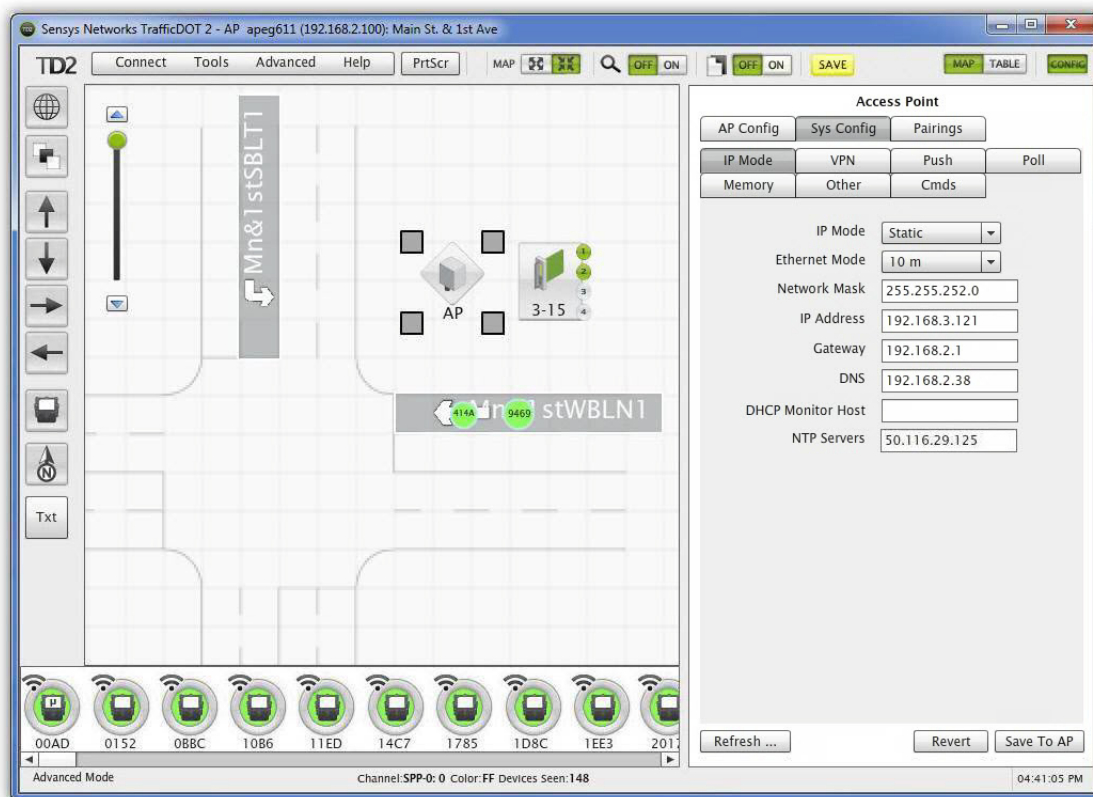


Figure 1. IP Mode Window

3. Select *Static* from the *IP Mode* drop-down list.
4. Select *10 m* from the *Ethernet Mode* drop-down list.
5. Enter the addresses for the following information:

NOTE:

Refer to your local IT department to receive the following information.

- *Network Mask* field
- *IP Address* field
- *Gateway* field
- *NTP Servers* field

NOTE:

All APCC-Rs or FLEX-CTRL-M in a SensID network must use the same NTP server.

- *DNS* field (optional)

6. Click **Save To AP**.

NOTE:

If you are using a cell modem with the APCC-R or FLEX-CTRL-M refer to *Appendix C* in *TrafficDOT v2.12 Set Up and Operating Guide* for configuration information.

Configuring Timezone

To enable correct data collecting and analysis, setting a timezone is required. To configure the *Timezone*, perform the following steps:

1. Click on **Other** tab. The *Time Settings* display as default.

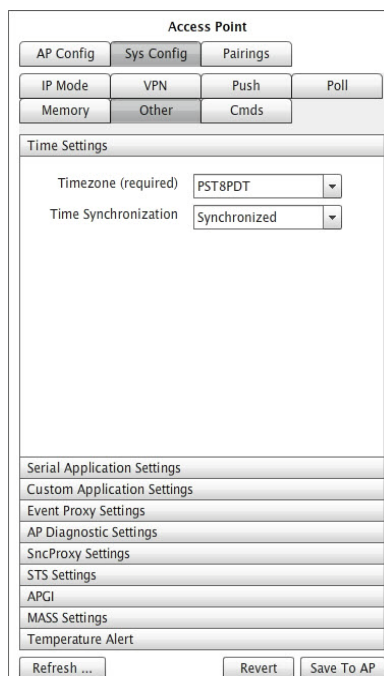


Figure 2. Time Settings window

2. Select a *Timezone* from the drop-down list.
3. Click **Save To AP**.

Configuring TrafficDOT Addons

Use TrafficDOT to configure the APCC-WF/APCC-BT addon. To enable the APCC-WF/APCC-BT radio addon, perform the following steps:

1. From the *Map* view, select **Addons** from the *Tools* menu.

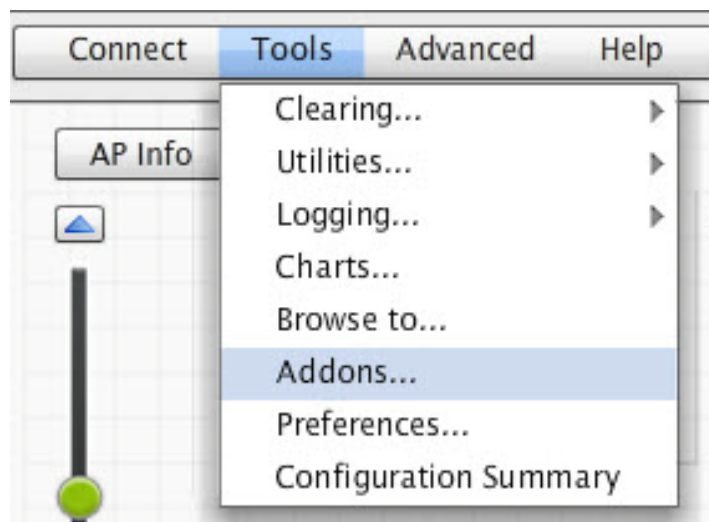


Figure 3. Addons

2. From the *Configure Addons* screen select **VIMS**.

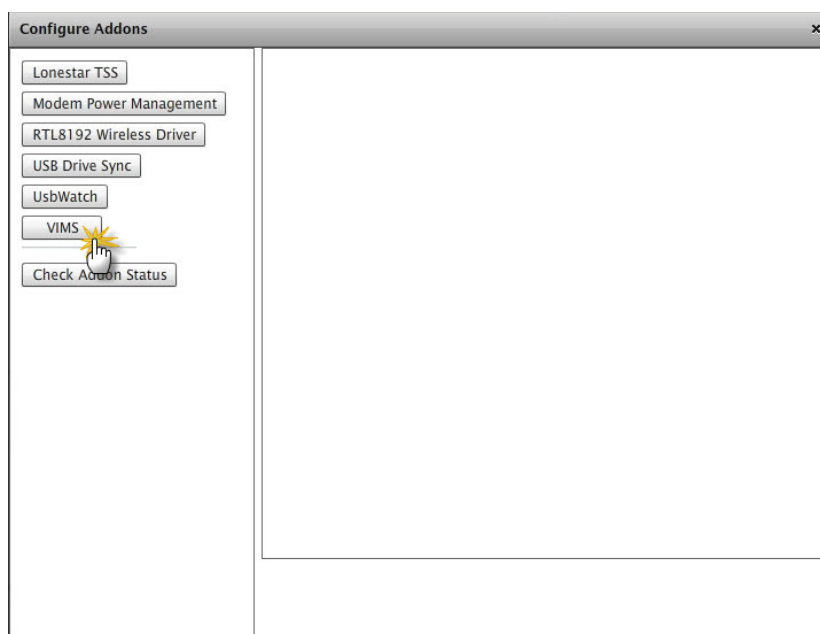


Figure 4. Configure Addons Screen

3. Select **Enable** (the *Disable* option is picked by default).

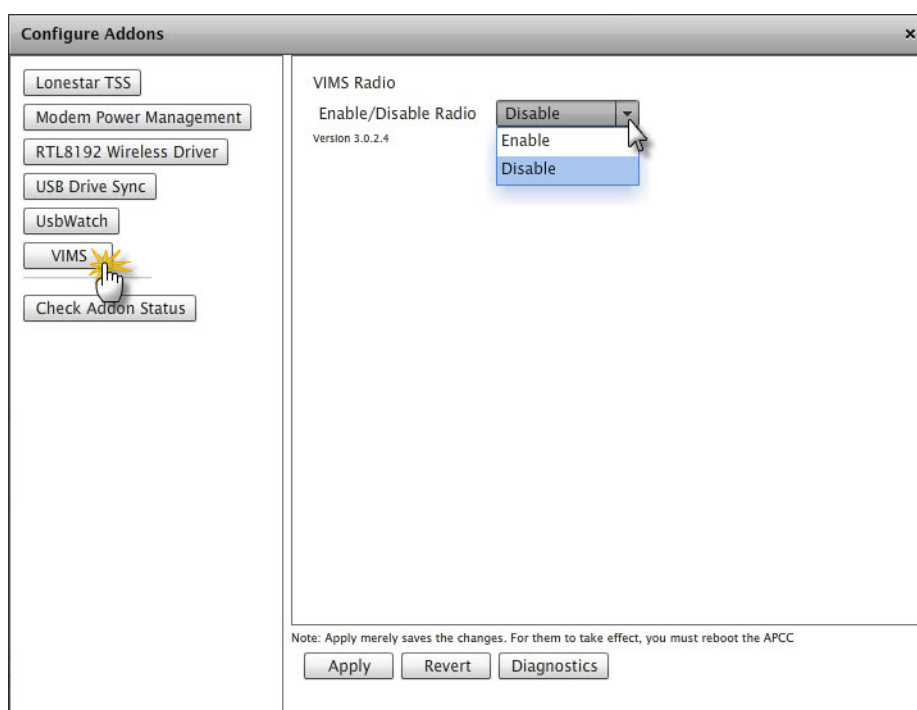


Figure 5. Enabling APCC-WF/APCC-BT Radio

4. Click **Apply** and reboot the APCC-R or FLEX-CTRL-M.

Exiting TrafficDOT

End the TrafficDOT session by selecting *Disconnect* from the *Connect* menu.

Testing the Installation

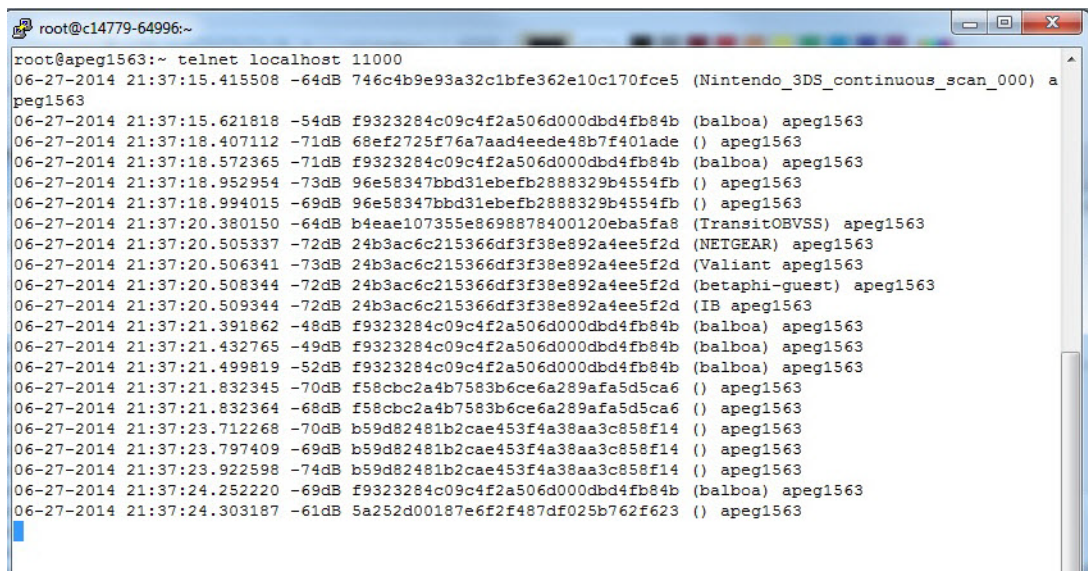
Once each device has been fully installed and configured, the system should be tested to ensure that it is collecting data and, where appropriate, posting to the remote servers. It is important to check that each device is functioning properly before leaving its deployment location.

Testing Locally

Functionality can be verified by connecting a PC to the Ethernet port on the APCC-R or FLEX-CTRL-M and running the following command:

```
telnet localhost 11000
```

After the connection is established, data should begin appearing on the PC screen in a few moments.



```

root@c14779-64996:~
root@apeg1563:~ telnet localhost 11000
06-27-2014 21:37:15.415508 -64dB 746c4b9e93a32c1bfe362e10c170fce5 (Nintendo_3DS_continuous_scan_000) a
peg1563
06-27-2014 21:37:15.621818 -54dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:18.407112 -71dB 68ef2725f76a7aad4eede48b7f401ade () apeg1563
06-27-2014 21:37:18.572365 -71dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:18.952954 -73dB 96e58347bbd31ebefb2888329b4554fb () apeg1563
06-27-2014 21:37:18.994015 -69dB 96e58347bbd31ebefb2888329b4554fb () apeg1563
06-27-2014 21:37:20.380150 -64dB b4eae107355e8698878400120eba5fa8 (TransitOBVSS) apeg1563
06-27-2014 21:37:20.505337 -72dB 24b3ac6c215366df3f38e892a4ee5f2d (NETGEAR) apeg1563
06-27-2014 21:37:20.506341 -73dB 24b3ac6c215366df3f38e892a4ee5f2d (Valiant apeg1563
06-27-2014 21:37:20.508344 -72dB 24b3ac6c215366df3f38e892a4ee5f2d (betaphi-guest) apeg1563
06-27-2014 21:37:20.509344 -72dB 24b3ac6c215366df3f38e892a4ee5f2d (IB apeg1563
06-27-2014 21:37:21.391862 -48dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:21.432765 -49dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:21.499819 -52dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:21.832345 -70dB f58cbc2a4b7583b6ce6a289afa5d5ca6 () apeg1563
06-27-2014 21:37:21.832364 -68dB f58cbc2a4b7583b6ce6a289afa5d5ca6 () apeg1563
06-27-2014 21:37:23.712268 -70dB b59d82481b2cae453f4a38aa3c858f14 () apeg1563
06-27-2014 21:37:23.797409 -69dB b59d82481b2cae453f4a38aa3c858f14 () apeg1563
06-27-2014 21:37:23.922598 -74dB b59d82481b2cae453f4a38aa3c858f14 () apeg1563
06-27-2014 21:37:24.252220 -69dB f9323284c09c4f2a506d000dbd4fb84b (balboa) apeg1563
06-27-2014 21:37:24.303187 -61dB 5a252d00187e6f2f487df025b762f623 () apeg1563

```

Figure 6. Testing Locally

NOTE:

Telnet may need to be enabled on the PC.

Testing the Acyclica Server

1. Log in to the Acyclica server using a web browser.
2. Access the project being defined.
3. In *Map* view, select the APCC-R or FLEX-CTRL-M being installed.

4. Look for *Last Data* in the pop-up window.
5. Look for a graph in the pop-up window.
6. Run the **Records / Hour** report.

NOTE:

This may take some time if real-time reporting is not set up on the Acyclica server.

