1 ## Connect Battery
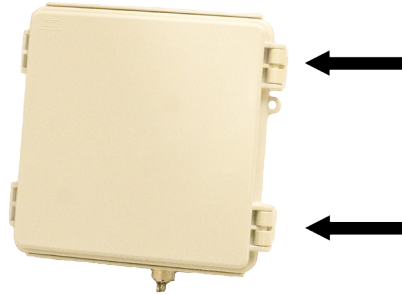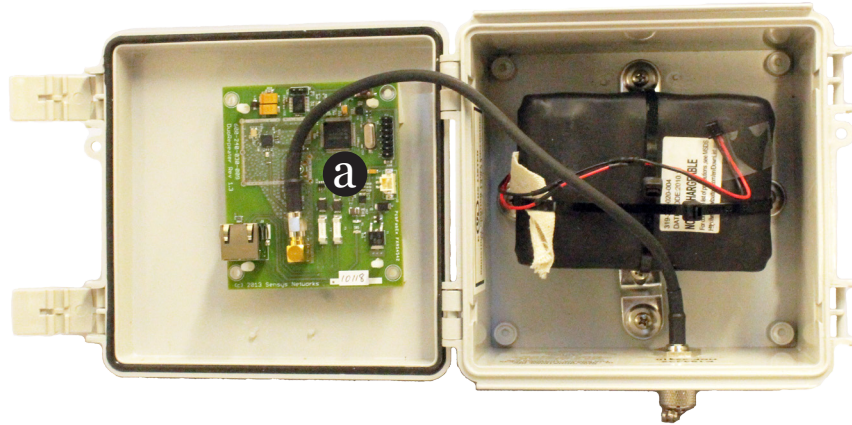

Open repeater
Unlatch the two hinges. Open the repeater cover.

Connect Battery

Connect battery cable to circuit-board connector (a). DO NOT PINCH OR STRESS CABLES. Wait approximately five seconds for LED lights to blink.

Close cover; ensure wires are not caught in edges. Latch the two hinges securely.

Warnings

Lithium Thionyl Chloride Batteries

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

- **SENSORS (VSN240-F, VSN240-T, VSN240-S, VSN240-M, VSN240-F-2, VSN240-T-2)**
- **REPEATERS (RP240-B, RP240-B-LL, RP240-BH, RP240-BH-LL, FLEX-RP-B, FLEX-RP-B-LL)**

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 (BATTERIES 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**

Sensys Networks 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://ultralifecorporation.com/download/308/

Repeater battery cell: www.ewtbattery.com/en/DownView.asp?ID=9

2 Connect to Access Point

Run TrafficDOT

Click the icon to start TrafficDOT2.

Select IP address

Select an access point from the automated list and click **Connect**.

Note: Ensure the box for *Load map data* is checked before clicking **Connect**.

Main Window

The *Main* window displays. The map on the *Main* window populates and configured equipment appears on the map and in the sensor tray at the bottom of the window.

Note: Before configuring or reconfiguring a repeater, ensure the correct repeater is displayed on the map by hovering over the repeater icon with the mouse to view repeater information.
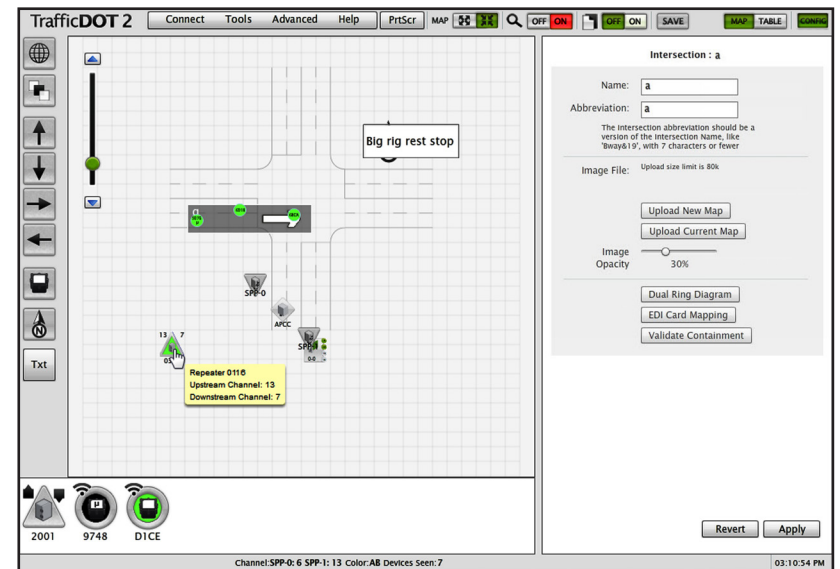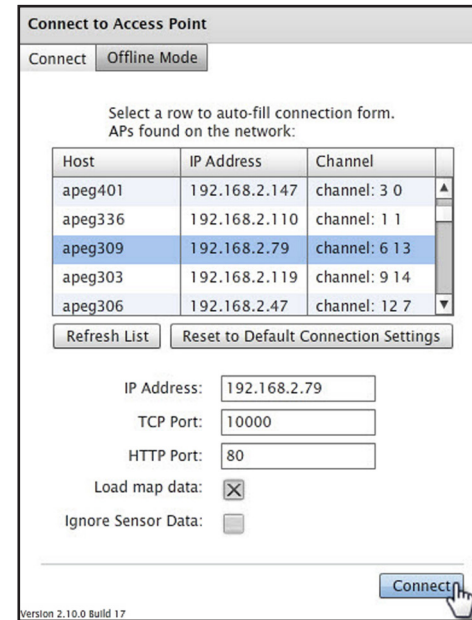
③ Configure Repeater

Repeater Configuration Window

Select a repeater from the image map to access the *Repeater Configuration* window with the *Position* tab open. The *Name* field allows the repeater's name to be user-defined.

Note: Repeater's firmware version is displayed for reference only.

Specifying Upstream Channel

Select an upstream channel by clicking the **Config** tab. Select an entry for the *Current Upstream Ch* field by clicking on the *Change to* drop-down list.

Specifying Downstream Channel

Select a entry for the *Current Downstream Ch* field by clicking the *Change to* drop-down list.

Channel Notes

- The default radio channel for access point to repeater communications is 0 (zero).
- The default radio channel for repeater to sensor communications is 1 (one).
- Never use the same channel for both access point and sensor communications.
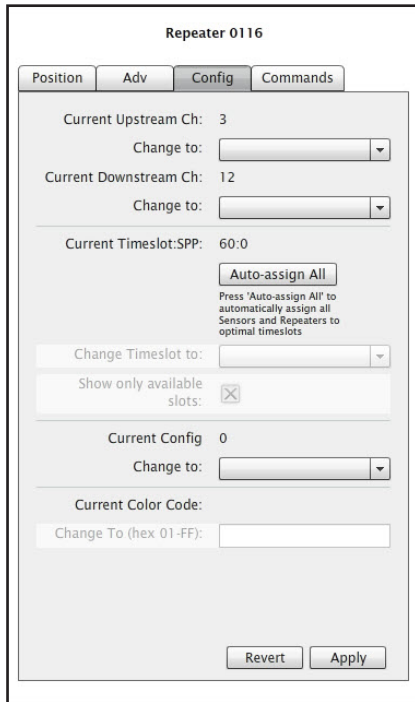
Refer to *Sensys Network VDS240 Wireless Vehicle Detection System TrafficDOT v2.10 Set Up and Operating Guide* for more information.

Config Notes

- When an installation contains multiple repeaters with more than ten sensors, changing one or more repeaters from *Current Config 0* to *Current Config 1* allows the repeater to communicate with up to 20 sensors.

Refer to *Sensys Network VDS240 Wireless Vehicle Detection System TrafficDOT v2.10 Set Up and Operating Guide* for more information.

Configure Repeater (cont.)
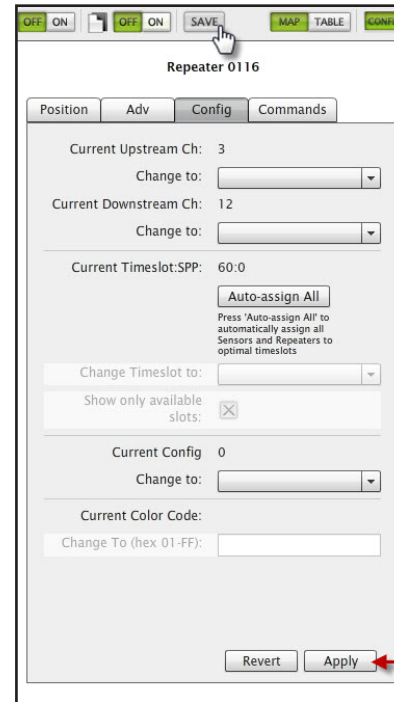
Set Time Slot

By default, TrafficDOT filters the contents of the drop-down list so that only available time slots are displayed. Click an entry from the *Change Timeslot to* drop-drop list.

Note: The grayed out options can be made accessible by enabling *Advanced Mode* using the *Advanced* drop-down menu.

To change the drop-down list to include all time slots in the network (both assigned and unassigned), remove the check in the *Show only available slots*.
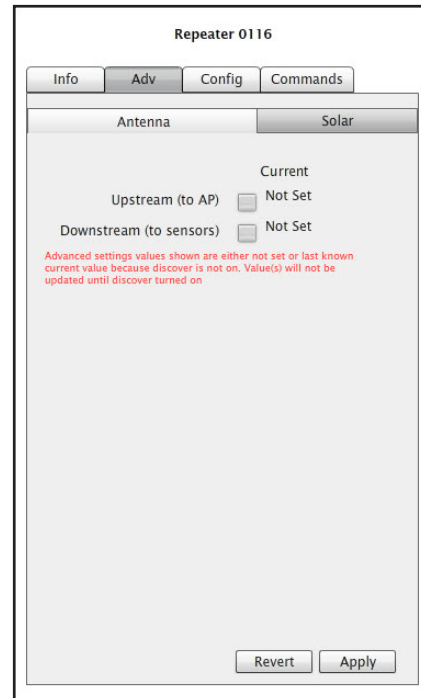
Save Configuration

Click **Apply** to accept configuration changes. Click **SAVE** to save changes made to the access point.

Configure Repeater (cont.)

Repeater 0116

| Info | Adv | Config | Commands |

| Antenna | Solar |

Current

Upstream (to AP) ☐ Not Set

Downstream (to sensors) ☐ Not Set

Advanced settings values shown are either not set or last known current value because discover is not on. Value(s) will not be updated until discover turned on

Revert   Apply

Adv Tab Notes

- Internal antenna is not listed on the panel, but will automatically be assigned to the unchecked option.

- A failsafe error message will occur should you choose both options.

- If FLEX-RP-B/FLEX-RP-B-LL is installed with or without the external antenna, and the *Adv* tab options are left unchecked, the internal antenna will be used for both *Upstream* and *Downstream* channels.

- If *Discover Mode* is not on the following warning will display: *Advanced setting values are either not set or last known current value because discover not on. Value(s) will not be updated until discover on.*

- If *Discover Mode* is off at connection time for TrafficDOT the *Adv* tab will display *Not Set* values. Turn on *Discover Mode* for true values to display.

Refer to *Sensys Network VDS240 Wireless Vehicle Detection System TrafficDOT v2.10 Set Up and Operating Guide* for more information.

Adv Tab

If the repeater is connected to an external antenna, then it can be configured via the *Adv* tab. From the *Antenna* window, select either *Upstream (to AP)* or *Downstream (to sensors)* to configure the external antenna.

Note: Recommended setting for external antenna is *Downstream (to sensors)*.

Save Configuration

Click **Apply** to accept configuration changes. Click **SAVE** at the top of the screen to save changes made to the access point.

Local Distributor

FLEX-RP-B & FLEX-RP-B-LL Repeater

The Sensys Networks Repeater. In cases where installed Sensys Networks wireless sensors are out of range of the nearest access point, one or more Sensys Networks repeaters can be used to provide a two-way relay between the out-of-range sensors and the access point. A repeater is mounted by the roadside on a pole or other structure. The repeater is positioned so that both the sensors and the tandem repeater or access point are within view and within range.

FLEX Repeaters are second generation repeaters from Sensys Networks that provide antenna options that extends the range of the repeaters and eliminates the need for additional repeaters operating in tandem. The FLEX-RP-B Repeater is powered with a replaceable battery pack located within the unit; however the FLEX-RP-B-LL Repeater does not have a replaceable battery. Both FLEX Repeaters utilize enhanced RF chipsets and circuitry that improves RF robustness and reduces energy consumption. FLEX Repeaters have an internal antenna and connect with the FLEX External Antenna.

Antenna Options. The FLEX External Antenna connects to FLEX Repeaters via a coaxial cable. The antenna, which works in conjunction with a repeater, allows the repeater to be aimed in two directions simultaneously utilizing a pole located between the sensor and access point.

Two types of FLEX External Antennas are supported: (i) the FLEX-ANT-1 with the same RF coverage as the internal antenna and (ii) the FLEX-ANT-2 with Long Range RF coverage.

The FLEX family of repeaters work with the standard repeaters RP240-BH and RP240-BH-LL.

| FLEX Repeater with Standard External Antenna | FLEX Repeater with Long Range External Antenna |

FLEX Repeater Configurations
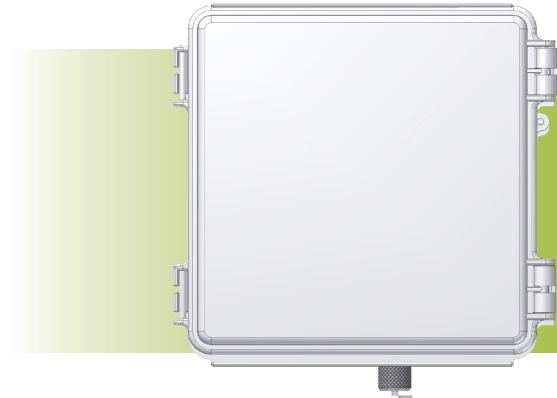
Functions / Features

Relay of radio communications

- To/from wireless sensors
- To/from access point
- To/from another repeater (FLEX or RP240)

Extension of range and coverage of the access point

- Supports operating in two directions with one repeater; its supported sensors communicate with the access point
- Maximum single-hop range of ~2000 feet (610 meters) from supporting access point or repeater
- Maximum single-hop range of ~300 feet (91 meters) from sensors with Long Range External Antenna

Fully wireless operation – no cable connections

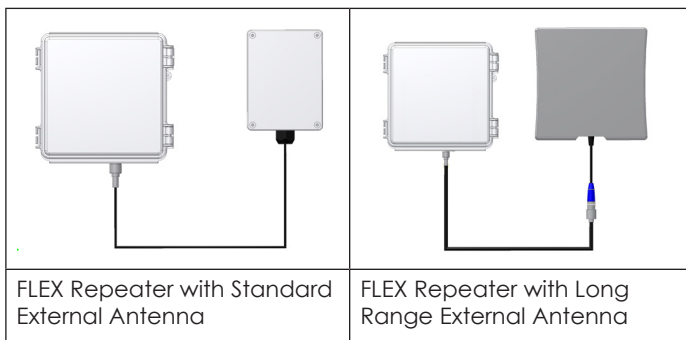### Radio signal quality measurements (of each link to wireless sensor)

- Receive Signal Strength Indicator (RSSI, in dBm)
- Link Quality Index (LQI, figure of merit 40-99)

Firmware upgrades over-the-air from access point

Simple installation

- Any roadside location that provides adequate signal coverage to sensors and the access point or repeater
- No special requirements regarding setback, relative angle of the sun or mounting stability

No calibration or adjustment required

Functional Specifications

interfaces	• to/from sensors via 802.15.4 PHY radio • to/from repeaters via 802.15.4 PHY radio • to/from access point via 802.15.4 PHY radio
over-the-air protocol	Sensys Networks NanoPower (SNP) protocol (TDMA)
physical layer protocol	IEEE 802.15.4 PHY
modulation	Direct Sequence Spread Spectrum Offset Quadrature Phase-Shift Keying (DSSS O-QPSK)
transmit/receive bit rate	250 kbps
frequency band	2400 to 2483.5 MHz (ISM unlicensed band)
frequency channels	16
channel bandwidth	2 MHz
internal antenna type	microstrip patch antenna (behind front face panel)
antenna field of view	±60° (azimuth & elevation)
nominal output power	3 dBm
spurious emissions	• 30 - 1000 MHz: < -36 dBm • 1 - 12.75 GHz: < -30 dBm • 1.8 - 1.9 GHz: < -44 dBm • 5.15 - 5.3 GHz: < -47 dBm
typical receive sensitivity	-101 dBm (PER ≤ 1%)
saturation (max input level)	≥ 10 dBm

Power, Physical, & Environmental

power supply	• FLEX-RP-B:
	  – Li-SOCl2 3.6V battery pack
	    ◦ nominal capacity: 57 Ah
	• FLEX-RP-B-LL:
	  – Li-SOCl2 3.6V battery pack
	    ◦ nominal capacity: 171 Ah

recommended battery/unit replacement	• FLEX-RP-B: battery replacement every 2 years • FLEX-RP-B-LL: unit replacement every 7 years
dimensions	• FLEX-RP-B: 6.50" x 6.55" x 6" (16.5 cm x 16.6 cm x 15.2 cm) • FLEX-RP-B-LL: 6.50" x 6.55" x 6" (16.5 cm x 16.6 cm x 15.2 cm) • FLEX-ANT-1: 5.65" x 3.54" x 4.80" (14.4 cm x 9 cm x 12.2 cm) • FLEX-ANT-2: 9.5" x 9.5" x 4.38" (24.10 cm x 24.10 cm x 11.10 cm)
weight	• FLEX-RP-B: 2.31 lb (1.05 kg) • FLEX-RP-B-LL: 2.62 lb (1.19 kg) • FLEX-ANT-1: 0.94 lb (0.43 kg) • FLEX-ANT 2: 2.2 lb (1 kg)
environmental	• designed for weatherproof, outdoor operation • NEMA Type 4x enclosure • IP65 ingress protection
operating temp	-40°F to 176°F / -40°C to +80°C

Available Products

Products	Descriptions
FLEX-RP-B	FLEX Repeater with internal battery pack
FLEX-RP-B-LL	FLEX Repeater with long-life battery pack
FLEX-ANT-1	FLEX Standard External Antenna
FLEX-ANT-2	FLEX Long Range External Antenna

Compliance

safety	2006/95/EC
EMC	• FCC: 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, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. • CE0678 • 2004/108/EC