

## FlexMag Mini Sensor

### The Sensys Networks VDS240 Wireless Vehicle Detection System

uses wireless magneto-resistive sensors to detect the presence and movement of vehicles. The sensors – installed in holes drilled in the roadway and covered with epoxy – transmit detection data in real-time via low-power radio technology to a nearby Sensys Networks gateway. Vehicle detections are further relayed to a traffic signal controller, remote traffic management center, or other system.

The FlexMag Mini sensor provides the same functionality and range as the FlexMag Flush and Deep sensors but in a much smaller package. This sensor is even easier to install in just two to five minutes with minimal epoxy and only rolling road closures. The FlexMag Mini sensor has a diameter of 2.5" (63.5 mm) and is installed flush with the roadway surface. The sensor comes encased in an epoxy plug for ease of installation. The sensor is not removable. It can be deployed together with the FlexMag Flush and Deep sensors. The FlexMag Mini provides unmatched detection accuracy in a robust package design reflecting expertise from millions of hours of sensor operations in punishing real-world operations around the world.

In typical traffic management applications, a sensor is placed in the middle of a traffic lane to detect the presence and passage of vehicles. Vehicle speeds and length are measured by two sensors installed in the same lane with the exact distance between them configured in software. The recommended distance between sensors depends on the range of expected speeds to be measured: for typical freeway applications, a separation of 20 to 24 feet (6.1 to 7.3 meters) is recommended; for typical arterial applications, a separation of 10 to 12 feet (3.1 to 3.7 meters) is preferred.

### Advanced Magnetometer-Based Vehicle Detection.

The state-of-the-art magneto-resistive sensing devices in each wireless sensor measure the x-, y-, and z-axis components of the Earth's magnetic field at a 128 Hz sampling rate. As vehicles come within range, changes in the x, y, or z axes of the measured magnetic field become apparent. When no vehicles are present, sensors continually measure the background magnetic field to estimate a reference. Each sensor automatically self-calibrates to the local environment, and to any long-term variations of the local magnetic field, by allowing this reference value to change over time.

### Types of FlexMag Mini Sensors:

#### VSN240-F-3

- Flush-mount wireless sensor for in-pavement installation
- For all freeway, arterial, and signal control applications

#### VSN240-T-3

- Flush-mount wireless sensor for in-pavement installation
- For signal control applications only



## Functions / Features

### Lower power consumption

### 3-axis magnetometer for vehicle detection

- 128 Hz sampling rate
- Count and presence detection modes
- Modes for bicycle and motorcycle detection

### Flush mount in-pavement installation with no wires or lead-in cabling

### Fast and simple installation

- Installs in 2-5 minutes in small hole using a standard (non-core) drill
  - Hole 2-5/8 inch (68 mm) diameter and 3.5" (89 mm)
  - Adhered to hole with fast-curing adhesive supplied in burst-packs
- Minimal lane closure time
- No saw cuts

### Expected 10 year battery life

- Rugged mechanical design
- Auto-calibration

### Reliable 2-way radio communications with gateway

- Uniquely addressable and configurable
- Firmware can be upgraded over-the-air

### Readily deployed where other systems cannot be used

- Split roadways
- High water tables
- Damaged pavement

### Ability to enable temperature reporting

## Functional Specifications

<b>detection technique</b>	3-axis magnetic field sensing
<b>sampling rate</b>	128 Hz
<b>programmable vehicle detection parameters (mode B only)</b>	<ul style="list-style-type: none"> <li>Z-axis detect threshold (mG)</li> <li>Z-axis undetect threshold (mG)</li> <li>X-axis undetect threshold (mG)</li> <li>onset filter (ms)</li> <li>holdover (ms)</li> <li>auto-recalibration timeout (secs)</li> </ul>
<b>over-the-air protocol</b>	Enhanced Sensys Networks NanoPower (SNP) protocol (TDMA)
<b>physical layer protocol</b>	IEEE 802.15.4 PHY
<b>modulation</b>	Direct Sequence Spread Spectrum Offset Quadrature Phase-Shift Keying (DSSS O-QPSK)
<b>transmit/receive bit rate</b>	250 kbps
<b>frequency band</b>	2405 to 2480 MHz (ISM unlicensed band)
<b>frequency channels</b>	16
<b>channel bandwidth</b>	2 MHz
<b>antenna type</b>	microstrip patch antenna (mounted below top surface of sensor)
<b>antenna field of view</b>	±60° (azimuth & elevation)
<b>nominal output power</b>	+3 dBm
<b>spurious emissions</b>	<ul style="list-style-type: none"> <li>30 - 1000 MHz: &lt; -36 dBm</li> <li>1 - 12.75 GHz: &lt; -30 dBm</li> <li>1.8 - 1.9 GHz: &lt; -47 dBm</li> <li>5.15 - 5.3 GHz: &lt; -47 dBm</li> </ul>
<b>typical receive sensitivity</b>	-101 dBm (PER = 1%)
<b>saturation (max input level)</b>	≥ 10 dBm

## Sensor Modes

mode	application	description
<b>B (event)</b>	count stations; advance detection	<ul style="list-style-type: none"> <li>sends timestamped ON and OFF detection events using configurable detection parameters</li> <li>not supported by VSN240-T-3</li> </ul>
<b>E (idle)</b>	status reporting	disables magnetometer and sends sensor hardware and software version information
<b>STOPBAR-# (presence detection)</b>	stop bar detection; ramp management	sends timestamped ON and OFF detection events using pre-configured detection parameters
<ul style="list-style-type: none"> <li>16 different stop bar detection modes can be selected</li> <li>recommended stop bar detection modes for specific applications:</li> </ul>		
	STOPBAR-0	bicycles/scooters
	STOPBAR-2	motorcycles
	STOPBAR-5	passenger vehicles (normal recalibration)
	STOPBAR-7	passenger vehicles (fast recalibration)
	STOPBAR-14	light rail

## Power, Physical, & Environment

<b>power supply</b>	<ul style="list-style-type: none"> <li>non-replaceable primary Li-SOCl<sub>2</sub> 3.6v battery</li> <li>8.5 Ah (nominal capacity)</li> </ul>
<b>dimensions</b>	<ul style="list-style-type: none"> <li>Sensor: 2.22" x 3.06" (56.4 mm x 77.7 mm H)</li> <li>Plug: Ø 2.5" x 3.06" H (Ø 63.5 mm x 82.5 mm H)</li> </ul>
<b>weight</b>	<ul style="list-style-type: none"> <li>Sensor: 0.41 lb (0.187 kg)</li> <li>Plug: 0.55 lb (0.250 kg)</li> </ul>
<b>environmental</b>	<ul style="list-style-type: none"> <li>designed for in-pavement installation</li> <li>NEMA Type 6P enclosure</li> <li>IP68 ingress protection</li> </ul>
<b>operating temp</b>	-40°F to 176°F / -40°C to +85°C

## Compliance

<b>safety</b>	2006/95/EC
<b>EMC</b>	<ul style="list-style-type: none"> <li>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.</li> <li>CE0678</li> <li>2004/108/EC</li> <li>IC: This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.</li> <li>IC: Le présent appareil est conforme aux CNR d'Industrie 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'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.</li> </ul>

## Local Distributor