SENSYS
Networks

VSN240 Sensor Installation and User Manual

Contents

1   Overview

Congratulations for purchasing your Wireless Magnetic Sensor. This manual will support the installation of both in-pavement and surface mount models of the sensor, VSN240-F and VSN240-S respectively. The sensors use deviations in the earth's magnetic field along three axes, to determine the presence or absence of a vehicle at the sensors location. Event information is then wirelessly transmitted back to an Access Point, AP240, which is responsible for analysis and further reporting.

RF Specifications

- IEEE 802.15.4 Standard Compliant Radio
- 2.4 GHZ ISM Band

Physical Specifications

Table 1   *VSN240-S*

Measure	Metric	US
Length (L)	13.9 cm	5.35 inches
Width (W)	9.2 cm	3.6 inches
Height (H)	2.2 cm	0.9 inches

Table 2   *VSN240-F*

Measure	Metric	US
Length (L)	7.4 cm	2.9 inches
Width (W)	7.4 cm	2.9 inches
Height (H)	4.9 cm	1.9 inches

Durability

- VSN240-F – Expected lifetime of 8 to 11 years, depending on traffic volumes.
- VSN240-S – Expected lifetime of 5 to 7 years, depending on traffic volumes.

Environmental

- Nema 6P / IP 68
- Temperature Range: -40°C to +80°C

2 Package Contents

Each VSN240 comes with the items found in the list below. If any of the contents is missing, contact customer service at support@sensysnworks.com.

- VSN240 Installation and Users manual.
- The sensor itself (sealed and ready for installation).
- An information sheet specifying the information below:
    - Senor ID (In hexadecimal format).
    - Operating Channel
    - Time Slot Assignment
    - Software Release Version
    - Board Rev Number
    - Battery Age
    - System Certification Checks.
    - Initials of System test Engineer.

NOTE: If the new sensor has an identical slot number as another sensor in the same location, see the section on *Changing Slot Numbers, in the VDS240 Wireless Vehicle Detection System Users Guide*.

3   Installation

NOTE: Sensys Networks is exempt from all responsibility of damage and injury caused by the installation or improper installation of either of the VSN240-F or VSN240-S sensors.

Sensys Networks can recommend a "best method" of installation based on lab testing and field experience. It is at the discretion of the customer to choose how the installation will proceed. The recommended installation of the flush mount sensors is very different from the recommended installation of the surface mount. One commonality is the recommended epoxy/adhesive, named SmartStud Adhesive©, which can be purchased directly from Sensys Networks. MSDS records can be found on our website at *www.sensysnetworks.com/msds*.

NOTE: Test basic sensor functionality before installation. Reference *Basic Functionality Tests, in the VDS240 Wireless Vehicle Detection System Users Guide*.

3.1   Label Location and Information

Each sensor will have a label attached on the top side. Use the label to determine sensor ID and proper installation orientation. The label contains the following information:

- Serial Number
- Bar Code
- **FC** Contains FCCID TDB-VSN240
- Sensys Networks Logo
- An arrow, parallel to the direction of traffic flow.

3.2   VSN240-F Install

Figure 1   VSN240-F Flush Mount Sensor

<u>Required Equipment:</u>

    i.   VSN240-F Sensor

    ii.   Gloves and safety glasses.

    iii.   At least 200ml or 2/3 of a SmartStud Adhesive tube.

    iv.   SmartStud applicator.

    v.   The "Grinding" and "Double" Coring Bits. See Coring Bit Section below.

    vi.   Chisel and hammer.

    vii.   Coring Drill and frame. (Milwaukee 510067 or comparable).

    viii. Shop Vacuum or brush.

    ix.   Heat gun or propane torch. * When installing in moist environments.

<u>Sensor Location and Orientation</u>

- Sensors should be installed in the middle of the lane.
- The arrow (⇐) sticker on the sensor should be parallel to the direction of traffic flow.

<u>Coring Bits</u>

The most time consuming function of the installation is the coring of the cylindrical hole in the pavement. Sensys Networks recommends two types of 4 inch drill bits, with 1.25" standard machine threaded sleeve. When used with a truck mounted drill, coring the hole can take less then a few minutes. See figure 2 for 3d images of the bits, and visit *www.sensysnetworks.com/coringbits* for full CAD drawings.

    NOTE: Because of the SmartStud Adhesive moisture constraints, all drilling should be of type "Dry" coring.

- Part number of "Double Cylinder" Coring Bit (PN BIT100)
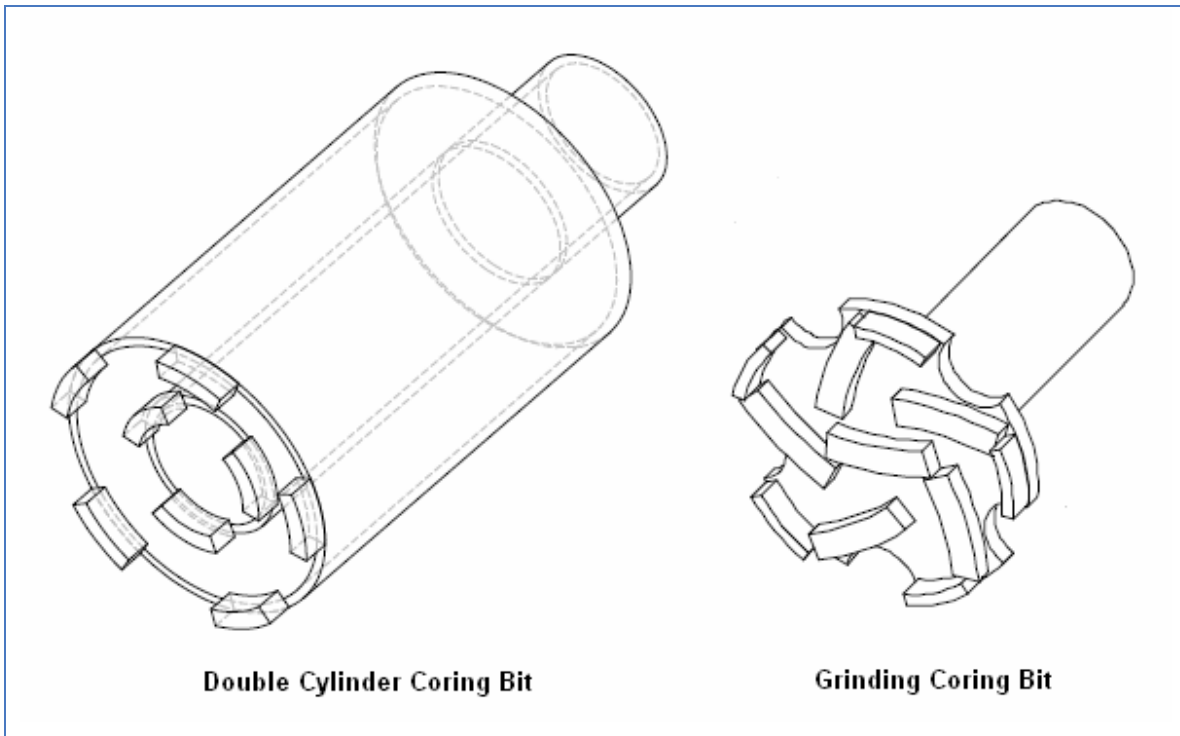- Part number of "Grinding" Coring Bit (PN BIT101)

Figure 2   *Coring Bits*

The 4" inch Double Cylinder Coring bit is recommend to be used in conjunction with the Grinding Coring bit. The Double Cylinder bit is used to drill the initial two inch hole, with the remaining asphalt chiseled away. Then the Grinding bit is used to make the bottom of the hole flat.

Installation Procedure

The SmartStud Adhesive and many other industrial epoxies and adhesives come in single use canisters. For this reason, it is recommended that all local holes be cored and cleaned prior to the preparation of the adhesive in step six.

> **NOTE:** Take all safety precautions necessary, with the use gloves and safety glasses as a minimum.

i.   Find the center of the lane, and leave a mark for coring location.

ii.   Mark a line 2 inches from the bottom of the Double Cylinder Coring bit. It is important not to dig to deep or shallow, as best performance is achieved when the dot is perfectly flush, or just slightly below the roads surface.

iii.   Start the coring process, checking depth and removing debris periodically. Once a two inch depth is reached with the Double Cylinder bit, and is cleaned of excess asphalt or cement, use the Grinding bit to make the holes bottom flat.

iv.   Once complete, vacuum or brush all dust and debris out of the cored hole. This will

assure proper adhesion.

    v.   If moisture is noticed, use heat-gun and or propane torch to dry the inside or the cored hole.

    vi.   Using Section 4, prepare SmartStud Adhesive for application. If another epoxy or adhesive is used, the preparation procedure should be completed.

    vii.   Fill the hole ¼ full of the adhesive.

    viii.   Determine Sensor orientation (See *Sensor Location and Orientation* section), and place sensor in the hole. The Epoxy should still have work time, so the sensor can be rotated for perfect alignment, and pushed down so it lays flat on the holes floor.

    ix.   Fill in the remaining empty space of the hole with the adhesive.

    x.   Depending on ambient temperature and humidity, the SmartStud adhesive can take from 5 to 25 minutes to harden. Verify hardness before completion.

3.3   VSN240-S Install

Figure 3   VSN240-S Surface Mount Sensor

Required Equipment

    i.   VSN240-S Sensor

    ii.   Gloves and safety glasses.

    iii.   At least 150ml or 1/2 of a SmartStud Adhesive tube.

    iv.   SmartStud applicator.

    v.   Chisel and hammer.

    vi.   Drill based metal wire brush, or any industrial grade metal wire brush for removing dirt, grime, and oil,

    vii.   Drill that supports metal brush.

    viii.   Shop Vacuum or brush.

    ix.   Heat gun or propane torch. * When installing in moist environments.

<u>Sensor Location and Orientation</u>

- Sensors should be installed in the middle of the lane.
- The arrow (⇐) sticker on the sensor should be parallel to the direction of traffic flow.

<u>Metal Brush</u>

It is imperative that the application surface is free of dirt, grime, and oil. Using a drill based metal brush has proved to be a very good solution for cleaning the pavement surface.

- Metal Brush Part Number (PN BIT103)

Drill Based Metal Brush

Figure 4   Metal Brush

<u>Installation Procedure</u>

The SmartStud Adhesive and many other industrial epoxies and adhesives come in single use canisters. For this reason, it is recommended that all sensor installation locations be cleaned prior to the preparation of the adhesive in step seven.

NOTE: Take all safety precautions necessary, with the use gloves and safety glasses as a minimum.

i.   Find the center of the lane, and leave a mark for cleaning location.

ii.   Attach the metal brush to the drill, and clean a 6 x 4 inch rectangular area, with the long side parallel to the flow of traffic.

iii.   Vacuum or brush away any dust or residue.

iv.   If time persists, use the chisel to give the application surface some texture.

v.   Again, vacuum or brush away any dust or residue.

vi.   If moisture is noticed, use heat-gun and or propane torch to dry mounting surface.

vii.   Using Section 4, prepare SmartStud Adhesive for application. If another epoxy or

adhesive is used, the preparation procedure should be completed

viii.   Apply between 20%-25% of the 300ml tube, to the center of the cleaned location.

ix.   Determine Sensor orientation (See *Sensor Location and Orientation* section), and drop the sensor into the "puddle" of adhesive. Wiggle the sensor from side to side, and apply pressure until it is correctly oriented and rests flat on the cleaned surface. Adhesive should have been forced out from under the sensor, and will be exposed on all four sides of the sensor.

x.   Using caution, apply a ring of adhesive that connects to the adhesive that flowed out the sides. This forms a lip around the sensor.

xi.   Depending on ambient temperature and humidity, the SmartStud Adhesive can take from 5 to 25 minutes to harden. Verify hardness before completion.

4 Using the SmartStud Adhesive

There are three major points or requirements that must be accounted for when using the SmartStud adhesive. Verify that the following criteria can be met before proceeding with the installation.

- WORK QUICKLY: After the first application, do not let it sit static for more then 30 seconds before the next application.
- NO MOISTURE: There must be absolutely no moisture on the applied surface.
- TEMPERATURE: For a 24 hour period after the installation, the temperature CANNOT drop below freezing.

Required Material

If items ii., iii, and iv, did not come with the SmartStud Adhesive package, contact customer service at support@sensysnetworks.com.

    i.   Safety glasses and gloves.
    ii.   Tube of SmartStud Adhesive (PN EPX100)
    iii.   Mixing Nozzle
    iv.   Small "D" shaped metering Nozzle
    v.   Adhesive applicator (PN EPX101)
    vi.   Bag or box for the initial dispensing of adhesive material.

Adhesive Tube Integrity Check

    i.   Remove adhesive from the packaging
    ii.   Rotate Adhesive tube back and forth, and verify that moving air bubbles signifying free flowing material
    iii.   Let adhesive stand upright for 5 to 10 minutes, to allow air bubbles to rise to the top.

Attach Mixing Nozzle and Flow Meter

    i.   Remove and retain black screw cap.
    ii.   Some versions have a steel seal washer, which should be discarded.
    iii.   Remove the two "D" shaped black plugs, and clean any debris from the exposed outlets.
    iv.   Insert the "D" shaped metering plug into the smaller of the two tubes (The tube that contains the brownish/yellowish solution). Verify that the metering plug is secure.
    v.   Take the mixing nozzle, and fit it over the end of the adhesive tube. (It will not stay without the black screw cap from step i.)
    vi.   Thread the black cap (from step i) though the mixing nozzle, and screw it back on.

This secures the mixing nozzle.

Adhesive Applicator

     i.   Fit Adhesive into applicator gun.

     ii.   Keeping the gun upright, purge material until it runs black. Dispense a small amount of adhesive in the bag/box to verify proper mixing.

     iii.   Start installation.

5   Configuration and Integration

This section does not supplement the *VDS240 Wireless Vehicle Detection System Users Guide* in anyway. It should be used as a brief introduction the VDS240 detection system, and provide the simplest mean of integrating the sensor with an Access Point.

Overview

The only way to communicate, and therefore configure the sensor, is via an Access Point (AP240-E/S). Sensor configuration commands can be issued through the access point using the VDS240 API (application programming interface), or the Sensys Traffic Dot application.

An Example

Three sensors where just installed, accompanied with an access point. The site has determined that the best channel for operation is 7, and the sensors will support a lane and speed count application. From the packing slip, the channel and sensor ID are known. Two of the sensors are already operating on channel 7, and one is configured for channel 0. Follow the steps below to configure the system.

i.   Take not of distances between sensors, and the order along the axis of traffic flow.

ii.   Set the AP240's channel to 7, and verify that the two sensors begin communication.

iii.   Change the channel of the access point to channel 0 and verify that the third sensor appears.

iv.   Issue a "Change RF Channel" to the sensor, and set the new channel to seven.

v.   Verify that the dot is no longer communication on channel 0.

vi.   Change the access points channel back to 7.

vii.   When the three dots appear, enter the distances and orientations of the sensors into the count and speed applications.

viii. Run the applications and enjoy.

6   Support and Warranty Information

Both VSN240-F and VSN240-S sensors come with a one year equipment replacement warranty. For more information, got to www.sensysnetworks.com/support, or contact customer service at:

TEL: 1-510-548-4620

support@sensysnetworks.com

Attention: Customer Service

Sensys Networks, Inc

2590 Ninth St, Suite 211

Berkeley, CA 94710

NOTE: Sensys Networks is not responsible for the costs associated with the replacement or removal or the sensors.

7 Communications Regulation Information

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, and (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, Inc., 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 20cm and between radiator and the user's body. Improper use or tampering with the device is prohibited, and may not ensure compliance with FCC exposure guidelines.