MFMsensors, Inc. **Tacoma, WA 98498 TEL: 800-500-6367 FAX: 253-589-1340**

VEHICLE SENSOR SYSTEMS INSTALLATION/OPERATION

MODEL D-376LC

System Description

The Vehicle Sensor Systems use a passive sensor that detects changes in the natural magnetic field caused by moving ferrous metal objects such as cars, trucks or buses. The sensor can be buried in dirt adjacent to a paved roadway or placed in concrete or asphalt directly under the path of the vehicle. The roughly circular detection area depends on the size and speed of the vehicle - larger vehicles and faster speeds result in a larger detection area. Up to five sensors can be connected to one Signal Processor to expand the detection area. A sensor can be located up to 5,000 feet (1,520M) from the Signal Processor. Power Line Carrier devices can be connected to the Sensor System to provide audible and visual indication of sensor activation. The system will not detect the presence of a vehicle or object, and should never be used as a "safety" device.

I. Installation Considerations

A. General

1. The standard sensor is furnished with 50, 100, or 150 feet of direct burial cable attached. If additional cable is required, order a Custom Length Sensor, Splices in the cable should be avoided if at all possible. If a splice is absolutely essential, solder the wires to be spliced, then use a good quality direct burial waterproof splice.

2. In order to avoid possible nuisance tripping of the Sensor System, do not install the sensor or sensor cable within 8 feet of power lines, mercury lights, electric motors or intermittent pumps. It is important to keep the sensor as far away as possible from utility lines, transformers or electrical transients.

3. Remember that the mass and speed of vehicles results in a relatively large diameter detection area (See Figure 4). The sensor should not be installed closer than about 30 feet from a busy residential road, about 40 feet from truck traffic, and about 100 feet from railroad tracks.

4. It is essential that the waterproof integrity of the sensor/direct burial cable assembly is maintained. A nicked or crushed cable jacket may allow moisture to enter the cable or sensor, resulting in intermittent and unreliable operation. Damaged wire can be cut out and spliced - ohm the remaining cable first to ensure it is moisture free (see par IIIB).

5. In order to protect the cable from burrowing critters (moles, etc.), we recommend you run the cable in ½" thick-wall plastic conduit about 18" deep. This will also offer some protection from rototillers and irrigation line trenchers. If the sensor or cable is to be buried in dirt or gravel, the use of plastic pipe will prevent sharp stones from puncturing the cable jacket.

6. The Signal Processor must have a good earth ground in order to provide reliable operation. A metal cold water pipe (street side) or a 5 foot copper rod will provide the best results.

B. Installation Adjacent to a Driveway (Fig .2)

Determine the optimum placement by laying the sensor on the ground, turning the Signal Processor sensitivity ("GAIN") all the way down (CCW), and driving past the sensor at the probable vehicle speed and line of travel (See Figure 4). Gradually increase the sensitivity and/or adjust the sensor location for desired results. Keep the sensitivity as low as possible to avoid nuisance tripping. Bury the sensor about 6 inches (15cm) deep, parallel to the line of travel of the vehicle. If the sensor is put in conduit (1½ inch ID), keep it stationary within the conduit with foam, sponge or tape.

C. Installation In a Driveway

1. Place the sensor in the middle of the driveway, perpendicular to the line of travel of the vehicles. It should be at least 1 inch under the surface of cement (and on the vehicle side of any rebar or metal mesh), and about 2 inches under asphalt. It can be positioned properly before the driveway is poured or paved, or an existing driveway can be cut to accommodate the sensor and cable.

2. The sensor and cable should be enclosed in plastic pipe to facilitate replacement if required. Ensure the sensor is stationary within the pipe.

3. If the driveway is a two-car driveway, two sensors wired in series may be necessary for complete coverage; see Figure 3.

D. Other Applications
The Vehicle Sensor System can be used for other applications and in other physical configurations. Contact ***MFMsensors, Inc.*** for advice.

II. Installation Instructions
A. Bench Testing
1. Connect DC power (11 to 14VDC) to the processor. See Figure 1 for connection points.

2. Connect the sensor to the processor, and adjust the "GAIN" control CCW (minimum gain).

3. Connect an ohmmeter between the "N/O" and "COM" terminals of the relay. The ohmmeter will read an open until the sensor is activated, at which time it will read less than 10 ohms.

4. After power has been applied for at least three minutes, move the sensor at least 4 feet away from the processor. Activate the sensor by waving a metal object (screwdriver, wrench, etc.) down its length and about two inches away. Verify relay contact closure with the ohmmeter, and note that the red LED illuminates.

B. Field Testing
1. Connect the sensor(s) to the processor. If more than one sensor is to be used (up to 5 sensors can be supported by one processor), connect them as shown in Fig 3.

2. Connect power to the processor, and allow at least three minutes before proceeding.

3. Place the sensor(s) on the ground in the desired location. Figure 4 shows the approximate coverage pattern for a single sensor.

4. Set the "GAIN" control fully counter-clockwise to minimum gain. Drive past the sensor(s) at the slowest probable vehicle speed. Gradually increase sensitivity ("GAIN") until the sensor(s) consistently detects vehicle movement as indicated by relay closure. Be sure the detection range extends to the furthest edge of the desired protected area. **Do not use more sensitivity than is necessary to insure reliable vehicle detection.** If the detection area is too small, enlarge it by adding one or more sensors in series (see Figure 3). If the detection area is too large, move the sensor farther from the vehicle path.

C. Installation
1. Review the **Installation Considerations** on the first page of this manual before final installation.

2. Install the processor in an inside location close to a good earth ground. Use at least #16 copper wire for the ground connection. Avoid areas close to large motors, electrical machinery, RF garage door openers, etc.

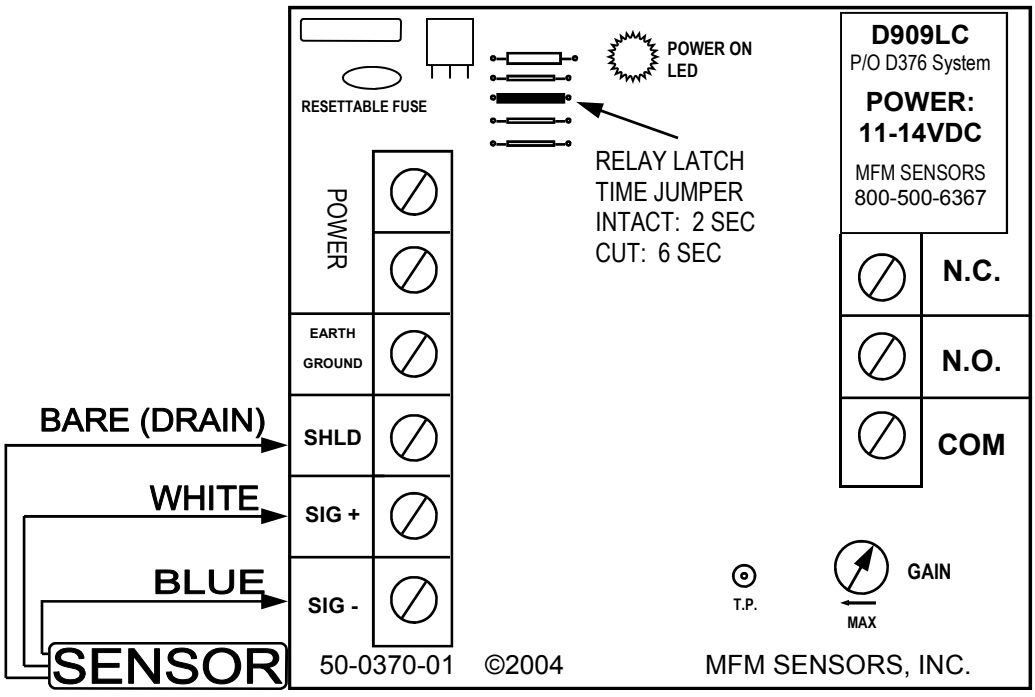

Figure 1 - Model D376LC, D909LC

3. Prepare the trench, and lay the sensor and cable in the trench. Do not run the sensor cable in the same trench with electrical service cable (low voltage/low current cable is OK). Be careful not to damage the sensor cable during installation and burial.

4. Field test the system (Par IIB) again to ensure proper operation, then carefully backfill the trench.

5. Set the latch time of the relay as required - see Figure 1. The latch time also controls the duration of the 10VDC output between the "+DC OUTPUT" and "REMOTE RETURN" terminals.

III. Troubleshooting

A. False Tripping

1. There are two basic causes for false tripping in the Vehicle Sensor System - those related to the operating environment, and those related to failure of the sensor or processor. False tripping related to the operating environment is usually caused by faulty grounding, power lines or transformers too close to the sensor or cable, or detection of fast moving vehicles outside the intended sensing area of the sensor (see Figure 4). Carefully check these possibilities before assuming sensor or processor malfunction.

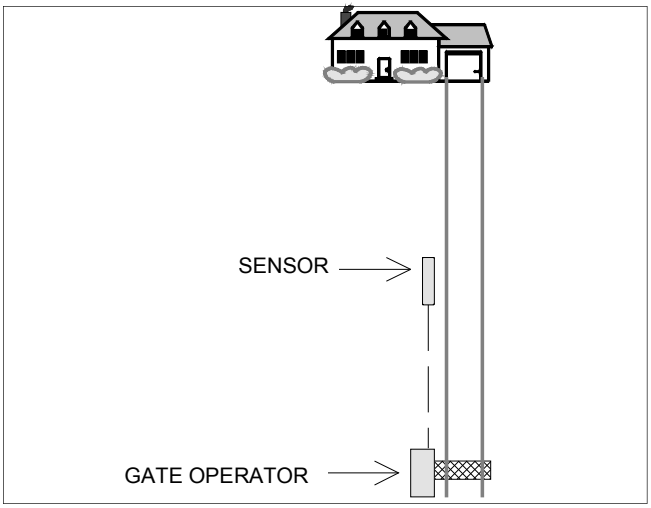

Figure 2. Typical Free Exit Layout

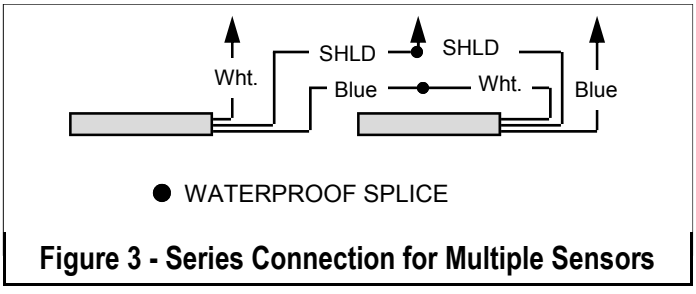

Figure 3 - Series Connection for Multiple Sensors

2. Most false tripping attributable to the Sensor System is caused by moisture in the sensor or cable. This moisture can enter the cable from a small nick in the outer jacket during installation or during grounds maintenance. This problem may be difficult to verify with an ohmmeter. Check the

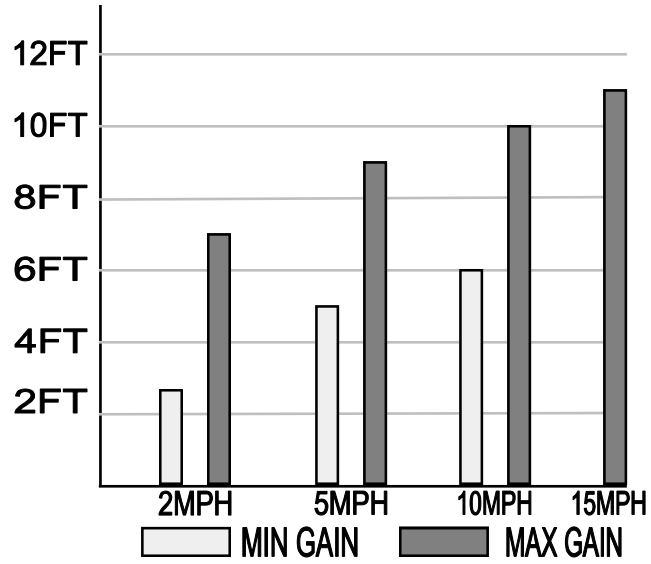

Figure 4 - Approximate Detection Radius

sensors and processor by performing the steps below. If the problem is not apparent from these tests, then it is usually safe to assume that the cable has moisture in it.

3. Separate sensor problems from processor problems by disconnecting all three sensor wires from the processor. If the processor trips with the sensor disconnected, the problem is with the processor or input power. **Note: It is normal for the unit to trip when the sensor terminals are touched.**

B. Testing the Sensors

1. Disconnect the sensor leads from the processor.

2. Using a good quality ohmmeter on the highest ohms scale (must be at least 20 Megohms full scale for a valid test), measure the resistance between the sensor shield (bare) wire, and first the sensor white wire and then the sensor blue wire. The ohmmeter indication should be infinity (totally open) for both measurements. If it is not, the cable either contains moisture or has been partially crushed.

3. Measure the resistance between the sensor white wire and the sensor blue wire. It should be 750 ohms ± 10%. If it is not, the sensor is defective.

If there are multiple sensors wired in series, the resistance at the processor end should be the number of sensors times 750, plus or minus 10%.

C. Testing the Processor

1. Disconnect the sensor (white and blue wires) from the processor. **NOTE:** It is normal for the processor to activate when the wires are being disconnected.

2. **Verify that the input DC voltage is from 11 to 14VDC at the "POWER" terminals. Voltages outside these limits will result in unsatisfactory operation.**

3. Turn the "GAIN" control about mid position. Connect an ohmmeter between the COM and N.O. terminals. Momentarily short "SIG +" to "SHLD". The relay should click, and the ohmmeter should indicate continuity. If neither happens (and the input power is within specifications), the processor is faulty.

4. Use a high input impedance DC voltmeter (a digital voltmeter is preferred) to measure the DC voltage between the "SHLD" (-) and "SIG +" (+), and between "SHLD" and "SIG -". This voltage should be between about 2.4 and 2.6VDC. If this voltage is very low, or if there is no voltage reading, the processor is faulty.

5. Check the DC voltage between the silver spot marked "T.P." (just above and to the right of the "GAIN" control) and "GND". With the sensor disconnected and the "GAIN" control fully clockwise (maximum sensitivity) this voltage should be between about 2.4 to 2.6VDC and steady (allow about 30 seconds for the voltage to settle out). If the voltage is not within these limits, or is not steady, the processor is faulty.

6. If the processor relay cycles every second or so with the sensor connected, the problem may be an open sensor cable shield wire or moisture in the cable. To test this, disconnect all three wires of the sensor. If the cycling stops, look for an open in the shield at a splice or at the processor end. Be sure to ohm out the sensor (par B).

Call MFMsensors, 800-500-6367, for further assistance. Please do not return equipment without a Return Authorization Number and shipping instructions.

SPECIFICATIONS

Input Power	12 - 14VDC ONLY	Operating Current	less than 15ma standby, 35ma detect.
Relay Contact Rating	3A @28VDC	Relay Latch Time	approx 1 second or 6 seconds
Proccessor Temp Range	0 to 120F (-18 to 49C)	Sensor Temp Range	-30 to 150F (-34 to 66C)
+ DC Output	10VDC, 100ma, Unreg.	Sensor Size	17" x 1 " Diameter

Manufactured, sold and serviced by MFM Sensors Inc. Made in the USA.

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