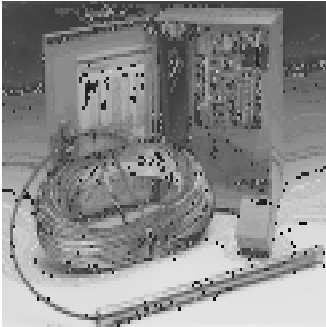


VEHICLE SENSOR SYSTEMS

INSTALLATION/OPERATION

MODEL D-373



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. A remote annunciator or buzzer can be connected to the Sensor System to provide audible indication of sensor activation. It is important to remember that 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 cable attached. If additional cable is required, order a Custom Sensor. Splices in the cable should be avoided if at all possible. If a splice is absolutely necessary, 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 about 8 feet of power lines, mercury lights, electric motors or intermittent pumps. It is important to stay 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 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

conduit 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

1. Determine the optimum placement by laying the sensor on the ground, turning the Signal Processor sensitivity ("GAIN") all the way down, and driving past the sensor at the probable vehicle speed and line of travel (See Figure 3). 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.

2. If the sensor is put in conduit (1½ inch ID), keep the sensor stationary within the conduit with foam, sponge or tape.

C. Installation In a Driveway

1. The sensor can be placed in the middle of the driveway, perpendicular to the line of travel of the vehicles. It should be about 1 inch under the surface of cement, 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. Again, ensure the sensor is stationary within the pipe.

3. If the driveway is a two-car driveway, two sensors wired in series, on each side of the driveway, may be necessary for complete coverage. (Figure 2)

D. Other Applications

The Vehicle Sensor System can be used for other applications and in other physical configurations. Contact **MFM sensors, Inc.** for advice.

II. Installation Instructions

A. Bench Testing

1. Connect AC Power to the Processor using the step-down transformer (120VAC to 12VAC) provided. 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 K1 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 moving a metal object (screwdriver, wrench, etc.) down its length and about two inches away. Verify relay closure with the ohmmeter.

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 Figure 2.

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. Be sure the sensor is not allowed to roll or move during the vehicle tests; slight movement of the sensor may cause false trips. Figure 3 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 farthest 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 2). 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/enclosure in an inside dry location close to a 120VAC outlet and 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, strong physical vibrations, etc.

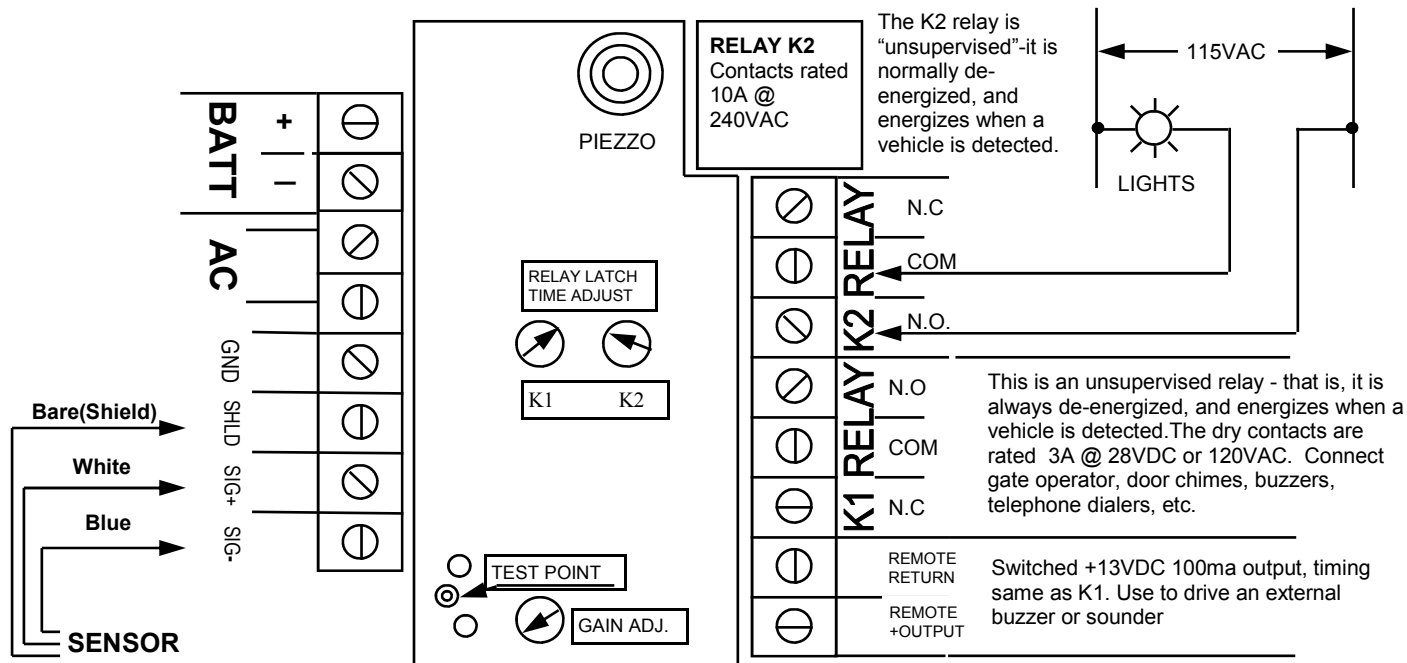


Figure 1 - Model D-373

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. Be careful not to damage the sensor cable during installation and burial. If the ground is rocky, put the cable in ½" PVC.

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

5. Adjust the latch time of the K1 and K2 relays as required, using the "MAX TIME" adjustment (see Figure 1). The adjustment of the K1 latch time also controls the duration of the on-board buzzer as well as the "REMOTE OUTPUT-REMOTE RETURN" voltage.

6. If a standby battery is required, connect a 12 volt 1.9AH or 2.6AH sealed lead-acid or gell cell battery to the "BATT+" and "BATT-" terminals. *Do not connect a dead battery to these terminals.*

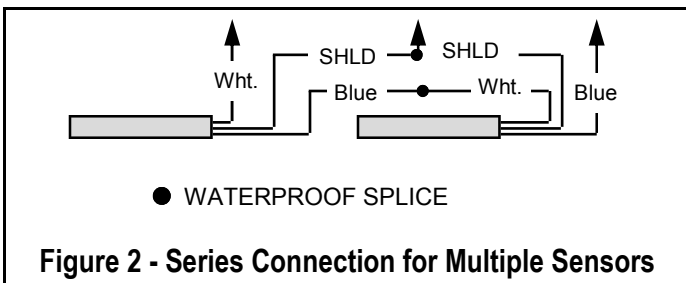


Figure 2 - Series Connection for Multiple Sensors

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. Carefully check these possibilities before assuming sensor or processor malfunction.

2. Most false tripping that is caused by the Sensor System is caused by moisture in the sensor or cable. The moisture can enter the sensor from a small nick in the cable during installation or during grounds maintenance. This problem is sometimes difficult to verify. Check the sensors and processor by performing the steps in paragraph B. If the problem is not apparent from these tests, then it is usually safe to assume that the sensor and/or cable has moisture in it.

3. Separate sensor problems from processor problems by disconnecting all three sensor wires from the processor. Turn the "GAIN" control to maximum gain. If the processor trips with the

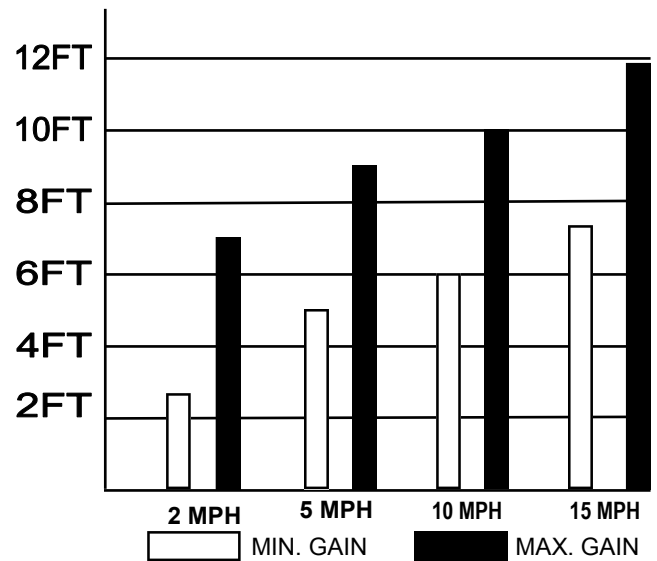


Figure 3 - Approximate Detection Radius

sensor disconnected, the problem is with the processor, input power, or standby battery. **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 20Megohms or higher), 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 \pm 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 from the processor, and slide the "BUZZ" switch to the "ON" position. Be sure the center board is firmly seated on the two terminal boards.
2. Check to be sure the input voltage is either 12VAC ("AC" input) or 12VDC ("BATT + and -").
3. Turn the "GAIN" control about mid position. Momentarily short "SIG +" (terminal 7) to "SHLD" (terminal 6). The buzzer should sound for the latch time of the K1 relay and both relays should click. If neither or only one happens the processor is faulty.

4. Use a high input impedance DC voltmeter (a digital voltmeter is preferred) to measure the DC voltage between the terminals marked "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. Connect the DC voltmeter between "REMOTE+ OUTPUT" and "REMOTE RETURN" terminals. When the processor is tripped, this voltage is about 13VDC. If there is no voltage, the board is faulty.

6. Check the DC voltage between the silver spot just above and to the left of the "GAIN" control, and the terminal marked "GND". With the sensor disconnected and the "GAIN" control fully clockwise (maximum sensitivity) this voltage should be between 2.4 and 2.6 VDC 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.

7. Measure the voltage on both ends of the fuse - it should be about 13VDC. If the voltage is present on one end and not the other, the fuse is blown. Replace it with a ½A fuse, and try again. If the fuse blows, you may be trying to charge a dead battery. Disconnect the battery and try again. If there is no voltage on either end of the fuse, recheck the input voltage (12VAC or 12VDC). If the input voltage is good, the processor is faulty.

8. If the processor K1 relay cycles every second or so with the sensor connected, the problem may be an open sensor cable shield wire. 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.

REPLACEMENT ASSEMBLIES

| | |
|-----------------|---|
| D915PRO | Processor (center pull-out) board |
| D915 | Complete Electronic Assembly, including both terminal boards and large relay. |
| R373 | Relay, K2, 10A@240VAC |
| D200-XXX | Replacement Sensor with XXX feet of direct burial cable attached. |

SPECIFICATIONS

| | | | |
|------------------------------|------------------------|--------------------------|--------------------------|
| Input Power_____ | 12VAC or 12VDC | Operating Current_____ | 50ma (140ma alarm) |
| Relay K1 Contact Rating_____ | 3A @28VDC | Relay K1 Latch Time_____ | 2 seconds to 10 seconds |
| Relay K2 Contact Rating_____ | 10A @ 240VAC | Relay K2 Latch Time_____ | 45 seconds to 10 minutes |
| Processor Temp Range_____ | 0 to 120F (-18 to 49C) | Sensor Temp Range_____ | -30 to 150F (-34 to 66C) |
| Remote + Output_____ | 13.5VDC, 100ma, Reg. | Sensor Size_____ | 18" x 1" Diameter |
| Enclosure Size_____ | 12" x 9" x 4.6" | | |

LIMITED WARRANTY

All MFMsensor units are warranted against defective materials and workmanship for a period of one (1) year from the date of shipment from MFMsensors factory provided the installation, adjustment and operation are in accordance with MFMsensors instructions. During this period, MFMsensors will repair or replace the equipment returned to the factory which is determined by MFMsensors to be defective. MFMsensors assumes no responsibility for costs incurred in removing, installing or shipping new or defective units. Customer repairs, disassembly, alterations or abusive treatment will void this warranty. MFMsensors does not warrant fuses or batteries. No allowance will be given for repairs or alterations made by others unless made with MFMsensors prior written consent. MFMsensors shall not be held responsible for the work done, apparatus furnished or repairs made by others. MFMsensors reserves the right to make changes in design and additions or improvements in its equipment as shall in the sole judgment of MFMsensors constitute an improvement over former practice, but MFMsensors shall not be obligated to install such designs, additions or improvements in equipment previously manufactured.

LIMITATION OF WARRANTY AND REMEDY

Except as stated above, there are no other warranties, expressed or implied, including the warranties of merchantability or fitness for a particular purpose, applicable to this transaction and Purchasers sole and exclusive remedy against MFMsensors shall be for the repair or replacement of defective parts as provided for herein and the limited warranty as stated above is in lieu of any other warranty or remedy. In no event, whether due to a breach of any warranty or any other cause arising from the performance or non-performance of the goods sold hereunder, shall MFMsensors be obligated or liable to Purchaser in any manner for consequential or incidental damages, including, but not limited to, lost profits, loss of property due to theft, plant downtime, delays or suits by third parties. If Purchaser resells the product, such sales shall be subject only to the terms of the Seller's Limited Warranty and Purchaser shall make no representations with respect to such products in addition to Seller's Limited Warranty.