MIDIAN ELECTRONICS INC.

THE ROAD RUNNER SYSTEM
SPVD-2 – DETECTOR/TRANSMITTER
QUICK INSTALLATION GUIDE

SPECIFICATIONS:

U.S. Patent #	5880682
FCC ID #	NOWSPVD-2
NEMA Certification	TS-1 & TS-2
Frequency Range	47.02 to 47.40 MHz
# of channels available	20
Channel Spacing	20 kHz
Operating Temperature	-34° to +74° C
Relative Humidity	95% or less @ 40° C
RF Output	50 – 100 mw
RF Output FCC Legal Limit	100 mw
Spurious & Harmonic	-55 dB
Frequency Stability	.005% -34° to +74°C
Modulation	±3.3 kHz FM
Modulation FCC Legal Limit	±5.0 kHz FM
Data	2000 baud NRZ w/ error correction
TX power consumption	36 mA for 17 msec at 85 mW
Battery	13.5 V, 15 Ah alkaline D-cell pack
Battery safety fuse	200 mA auto-resettable poly switch
Magnetometer circuit voltage	3 V DC regulated
TX & final amplifier voltage	6 V DC regulated
Low Voltage Alarm Level	7.5 V

THEORY OF OPERATION:

The SPVD-2 utilizes a dual axis flux-gate magnetometer to measure the Earth's magnetic field. When a vehicle approaches the detector, the vehicle distorts the magnetic field around the detector and the SPVD-2 detects this change. The SPVD-2 transmits an arrival pulse upon detection, which is transmitted in the 47 MHz range and the signal is picked up by the antenna located at the traffic control cabinet. The signal is then fed into the receiver in the cabinet, which uses an optical isolator to give a contact closure as an output to the controller. In presence mode, the detector will maintain the detection until the vehicle departs (up to 15 minutes). Once the vehicle departs, the SPVD-2 sends a departure data packet, which is again picked up by the antenna and fed to the receiver which then removes the contact closure to the controller. The SPVD-2 can be programmed to transmit only the arrival pulse (see SW4 in the sensitivity table on page 4).

The SPVD receiver at the traffic control cabinet has a green LED that glows continuously in the presence mode and gives a 120 msec flash in the pulse mode. It also has a red LED which glows continuously when the battery is low. The LED will flash red if the buried SPVD has not made a transmission within 24 hours. This could be caused by a failure of the unit or by a depleted battery.

The SPVD-2 has several features that set it apart from other magnetometers:

1. The dual axis magnetometer triggers only on the vertical axis. Depending on the mass & height of the vehicle, the vertical axis will detect 2-4 feet before the vehicle. Prior to this time the horizontal axis is disabled and will not detect vehicles in a horizontal direction (i.e. adjacent lanes). Once the vertical axis detects a vehicle, the vertical sensitivity is raised even higher and the horizontal axis is activated. This allows the magnetometer to follow through the empty cavity of the vehicle, producing one arrival pulse at the front of the car and one departure pulse at the back of the car. This prevents double axles and gives only one count per vehicle in about 97% of all cases. On the departure, due to the heightened sensitivity, the drop out range from the end of the vehicle will be approximately 3-6 feet. This is based on the standard sensitivity as shown in the sensitivity table located on page 4 of the manual. When higher sensitivity is selected, the drop out range may be 5 – 9 feet. This can be used for clustering so that each individual vehicle looks like one long vehicle. This feature is frequently used for left-turn lanes.

2. The SPVD-2 self-calibrates at the time of burial and constantly does a minor recalibration every 7 seconds to adjust for any slight changes in the Earth's magnetic field. Previous single axis magnetometer technology required frequent manual recalibration due to temperature changes and tilt caused by shifting of the pavement. This auto-calibration feature of the SPVD-2 eliminates the hassle of manually recalibrating the detector.

Because each vehicle contains a different mass of ferrous metal, the area of detection for each vehicle is different. However, on the standard sensitivity setting, the area of detection is comparable to a six by six loop for regular vehicles. For a motorcycle the area of detection is reduced to about half of the standard due to the reduced amount of ferrous metal. The calibration tables have been carefully adjusted to eliminate falsing on vehicles in the adjacent lane. However, a vehicle with an unusually large amount of ferrous metal, such as a Mack truck loaded with automobiles or a Bulldozer, could possibly trigger the SPVD-2 from an adjacent lane, especially if the lanes are narrow.

The SPVD-2 is powered by an alkaline battery pack. Based on an average of 10,000 arrival pulses and 10,000 departure pulses (presence mode) sent per day, the battery will last for approximately 4-5 years. Based on an average of 10,000 arrival pulses (pulse mode) the battery will last for approximately 6 years. The battery contains an internal poly switch, which will blow when short-circuited. Unplugging the battery from the SPVD for 1 second will reset the polyswitch.

Battery life is also dependent upon soil temperatures. In hotter climates the battery tends to self-discharge, so colder climates generally provide longer battery life. When the battery reaches a voltage level of 7.5 V, the unit will transmit a low battery

packet along with the arrival and departure packets. The battery should last for another 9 months at this point. A low battery output is then sent to the controller and a low battery light is displayed on the receiver.

The SPVD-2 may be equipped with an optional battery connector for using a lithium battery for longer life. Lithium's battery life can approach 10 years. The cost of Lithium is 6 to 8 times the alkaline battery. DOT requires special shipping and handling procedures and the EPA requires hazardous waste disposal. There is also a safety risk for personnel handling these types of batteries. When a lithium cell is dropped or damaged it may short-circuit and cause heating. This will eventually lead to bursting or explosion as well as venting of toxic gases. Therefore, personnel should be properly trained in the safe handling of Lithium batteries.