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

INSTALLATION:

PREPARATION: The SPVD-2 is shipped without the battery installed in the detector. To install the battery, remove the four bolts from the underground housing cube. The top half has the detector already installed. Place the battery in the bottom half of the cube. Plug the battery into the white connector on the corner of the PC board and turn on the power switch SW8. Secure the cube by tightening the bolts, going around evenly, make certain the gasket is sealed firmly, but do not to crush the gasket. It is strongly suggested to use a small amount of anti-seize or grease on the bolts. Even though the bolts are stainless steel, several years underground can cause them to corrode.

Install the unit in the enclosed zip lock bag to keep mud and cold patch off the FCC label and the screw heads and threads.

To install the detector:

1. Install the pole-mounted antenna and the Receiver at the control cabinet (refer to a SPVDREC manual for specifics).

2. Use an 8 inch core drill or jackhammer to dig a hole for the yellow SPVD box. The unit should be buried about 3 inches below the road's surface, therefore your hole should be about 8-9 inches deep. The deeper you bury the unit, the greater the attenuation of the radio signal, which will shorten the device's transmitting range. At a depth of 3 inches below the road surface, the range of the unit will vary between 500 and 700 feet depending on soil composition and moisture. If greater range is desired, try burying the unit about an inch below the surface. For even longer range, a concrete enclosure with lid can be purchased from Signal Services. This allows the unit to be practically flush with the surface and simplifies changing the battery.

3. Remove all ferrous metal tools and vehicles from the detection area (10 – 15 feet away). This will prevent them from distorting the Earth's magnetic field around the burial site.

4. Turn the SPVD unit on its side for 2-3 seconds and then return the unit to the upright position. This action will cause the mercury tilt switch to put the SPVD-2 into test and calibration mode. The detector will transmit a long tone, followed by a series of test packets.
   NOTE: When the unit is tipped on its side to activate the transmitter's test mode it draws maximum continuous power. If the unit were tossed into the back of a vehicle and landed on its side it will only transmit for 10 seconds and then automatically shut off to conserve battery. This prevents a dead battery condition if the unit sits in the vehicle for a long period of time before being set upright. To reactivate, set the unit upright and tilt it for 2-3 seconds to activate test/calibration mode.

5. The tone and test packets can be monitored with a handheld FM scanner. You will need to program the scanner to the appropriate frequency shown on the FCC label. It may be necessary to turn off the squelch to hear the data packs. These packs are approximately 17/1000 of a second long. With a walkie talkie verify with another technician that the receiver in the control box is hearing the tone and turning on its arrival, departure, and low battery lights.

6. During this time, install the unit into the hole with the FCC label on top and the arrows pointing in the direction of traffic.

7. Pour sand around and on top of the detector, while making certain that the receiver is receiving the tone and data packs.

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8. After the last data pack is transmitted the SPVD instantly measures the Earth's magnetic field and saves it to memory. Once auto-calibration has occurred (last data pack was transmitted) the unit should not be rotated or tilted anymore. Doing so will require the need to tip the unit on its side and repeat the calibrating process. While passing a magnet over the SPVD, use the scanner and receiver at the controller and once again verify arrival and departure pulses.

9. Put cold patch or hot mix over the detector and wave a magnet over the detector to simulate a detection to verify again that the receiver is receiving the packets.

10. After these steps are completed, test the unit with a vehicle. You may also want to use the tire of the vehicle to pack the cold patch.

TECHNICAL NOTES:

1. The FCC has allocated 20 frequencies from 47.02 to 47.40 MHz for use by wireless vehicle detectors. The FCC does not regulate spurious emissions from traffic controllers; therefore many controllers will generate RF noise on the 47 MHz band (usually 1 or 2 of the 20 frequencies). Midian recommends using a handheld scanner to scan the cabinet for RF noise, to determine if there are any channels with birdies generated by the controller. Midian will also do an FCC database check for any licensed frequencies in the area. Midian will then avoid any licensed frequencies or those that have been determined to have birdies at that intersection.

2. The SPVD-2 PC board has a dipswitch in one corner to adjust the sensitivity of the detection zone. SW1 is closest to the corner. The first 3 positions on the switch adjust the sensitivity. With no switches selected the detection zone is comparable to a six by six loop. The sensitivity can be increased or decreased by adjusting the switch as indicated in the Sensitivity Table located on the next page.

   If the departure pulse is not required, turning SW4 on will activate pulse mode, eliminating the departure pulse. This will reduce battery consumption and add another year to the battery life. This is typically done if presence detection is not required. You must also turn on pulse mode at the receiver.

3. If the detector will be installed within approximately 100 feet of the antenna, the power can be lowered to extend the battery life. This is accomplished by adjusting switches 6 & 7 on the dipswitch. With pins 6 & 7 both in the on position the power output is 95mW, with 6 on and 7 off 45 mW, and with 6 off and 7 on 85mW.

4. Switch 8 works as a power on/off switch. No power will be supplied to the board with the switch in the off position.

SPVD OPERATION:

The SPVD-2 uses a dual-axis magnetometer to measure the Earth's magnetic field. IC-2 is a 12-bit AD converter that converts the analog information to digital data for use by the microprocessor IC-1. IC-1, IC-2 and the magnetometer receive their power from IC-3.

When the microprocessor determines a vehicle is present it turns on IC-4, a 6-volt regulator to power the transmitter. Transmission time is 20 msec. The micro also transmits a short data pack on Pin 12 during the last half of the 20 msec to tell the receiver that a vehicle has arrived.

R30 and C21 acts as a splatter filter before data hits the true FM varactor diode D8. D7AB, R31 and R32 set the bias point for D8 and provides temperature compensation for oscillator Q2.

Oscillator Q2 employs an 11.8 MHz crystal. L1 and C22 tune the oscillator Q2's output to the fourth harmonic. Q3 and Q4 amplify and buffer the 47 MHz signal from the oscillator and then drive the final amplifier IC-5.

Inductor L-5 and capacitor C36 tune the base circuit of IC-5.

L7 and C40 tune IC-5 to 47.XX MHz while C41, L8, C42 and C44 act as a low-pass filter and impedance matching to the spiral antenna. Switches 6 and 7 allow the user to select Hi or Low power options.

TUNING PROCEDURE:

Oscillator Q2's collector tank circuit (L2) is adjusted by C26. Tune for a peak level on TP9.

Buffer amp Q3's collector tank circuit (L3 & C28) is tuned using L3 and adjusting TP10 for a peak indication.

Buffer amp Q4's collector tank circuit (L4 & C31) is tuned using L4 and adjusting TP11 for a peak indication.

The input to IC-5 is adjusted using L5 and C36 and tuning for maximum output power on J1 antenna connector. IC-5's collector tank circuit is tuned using C40 and peaking for maximum RF power output. C44 helps match the low-pass filter to the antenna connector. Tune C44 for peak power on the antenna connector.

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Sensitivity Table								
Setting	**SW3**	**SW2**	**SW1**	**Vertical Acquire**	**Vertical Release**	**Horizontal Acquire**	**Horizontal Release**	**Explanation**
1	Out	Out	Out	250	200	No	200	Recommended for standard traffic lanes
2	Out	Out	In	250	200	No	150	Slightly more sensitive than setting 1
3	Out	In	Out	250	200	No	100	Clustering effect for left-turn lanes
4	Out	In	In	250	150	No	100	Slightly more sensitive than setting 3
5	In	Out	Out	200	100	No	100	Setting for use under bridges
6	In	Out	In	150	80	No	100	Slightly more sensitive than setting 5
7	In	In	Out	320	200	No	200	Narrow lane setting – less sensitive than setting 1
8	In	In	In	75	25	75	100	Highest sensitivity – for curb use

*****Lower number equals higher sensitivity***

The dipswitch has 8 positions. The end closest to the corner of the PCB is SW1. The ON condition exists when the switch is pressed down toward the edge of the PCB. See arrow on pictorial layout.

SW4 Puts the unit into pulse mode when turned on. Otherwise, unit is in presence mode and will transmit a departure pulse. Pulse mode reduces battery consumption and should provide another year or so of battery life.

SW5 Used by factory for testing and tuning.

SW6 Low power radio transmission (45 milliwatts)

SW7 Medium power radio transmission (85 milliwatts)

SW6 & SW7 High power radio transmission (95 milliwatts)

SW8 Power on/off switch

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