Certified ISO 9001

RAILMASTER-VP™
USER'S MANUAL

Decatur Electronics, Inc.
715 Bright Street
Decatur, IL 62522
USA/Canada 800.428.4315
Intl 217.428.4315
Fax 217.428.5302
www.decaturradar.com

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WELCOME TO DECATUR ELECTRONICS

Thank you for choosing this Decatur Electronics product—a highly advanced radar system that will reward your department with years of dependable service. The *railmaster-VP*™ design incorporates high performance and long range, with many leading features.

We urge you to study this manual before using the *railmaster-VP*, so you can maximize the benefits of this sophisticated radar device. Its digital signal processor (DSP) gives the device advanced capabilities unseen by many users. If you are as pleased with its performance as we think you will be, ask your Decatur sales representative about other Decatur products. Try any one of our products and see if you don't agree that it is best-in-class!

—The management and staff at Decatur Electronics,
the nation's oldest radar company

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Introduction to the *Railmaster-VP*™

The *Railmaster-VP*™ is a cordless, hand-held radar gun that comes with a Black & Decker® interchangeable battery system. The radar gun contains an antenna and transceiver for transmitting and receiving K-band frequencies. The exclusive Digital Signal Processing (DSP) algorithms in the *Railmaster-VP* use these frequencies to obtain target vehicle speeds, which appear in the display window.

About This Manual

Note the following symbols in this manual.

indicates a warning message about safety precautions. Please read it carefully.

indicates a helpful tip or precaution to note.

1. Quick Start

If you are already familiar with radar tracking devices, you will probably want to follow the quick start instructions.

1.1 Initial Set Up

1.1.1 Insert the Batteries

Remove the Black & Decker® VersaPak™* batteries from their package and charge them according to the VersaPak™ instruction sheet (see Section 2.1.2, Battery Charger, for more about using the battery charger). After charging the batteries, insert them into the handle grip, as Figure 1.1.1 shows.

* VersaPak™ is a registered trademark of the Black & Decker® Company.

Figure 1.1.1 Insert the batteries into the handle grip.

Push the batteries into the receptacles in the bottom of the handle until you hear them snap into place.

After you insert the batteries, press the POWER button. The *Railmaster-VP* will run a display test, show the results (8.8.8), flash the backlight in the speed display window, then the display will blank.

1.1.2 Control Panel Functions

The faceplate control panel consists of three buttons, MODE, SELECT, and POWER for controlling the settings in two menus, the primary and secondary. Pressing the MODE button displays the primary menu options. Press SELECT after you press MODE to select a primary menu option.

MODE

When you first press MODE after powering up, the backlight (bL) setting appears. Press SELECT to turn the backlight setting on or off.

SELECT

Press MODE again, SEn displays. Then press the SELECT button to select a sensitivity level (1 through 5, one is the least sensitive and five is the most sensitive, for tracking distant objects.)

POWER

The POWER button turns the device on and off.

If the SELECT *button is pressed during power up, the system will reset to factory default.*

1.1.3 Trigger Operation

The spring-loaded trigger controls the radar signal transmission and speed-lock feature. To transmit the radar signal to begin speed measurements, pull the trigger once. When released, the trigger button remains in the pressed position. To stop transmitting the radar signal and receiving speed measurements, pull and release the trigger. This locks the speed in the display window and flashes it every 1/2 second. The locked speed flashes until you pull the trigger to clear the display.

1.1.4 Measuring a Target Speed

Aim the *Railmaster-VP* at a moving target, then pull the trigger. The *Railmaster-VP* transmits a signal, then you will see the speed of the vehicle in the display window that is returning the strongest signal. To lock the speed, pull and release the trigger. The current speed will blink on and off, and the system will no longer track the target. To clear the locked speed, pull and release the trigger again.

2. Components

2.1 Batteries

The *Railmaster-VP* comes with a Black & Decker® interchangeable battery system: two nickel-cadmium (NiCd), silver label, 3.6-volt VersaPak™ batteries and a two-port AC auto charger (part number P702-VP135). For increased runtime, you can use nickel metal hydride (NiMH), gold label, VersaPak™ batteries. For increased runtime, you can also use nickel metal hydride (NiMH), gold lavel, VersaPak™ batteries with the radar gun. Please read all the instructions and warnings on the VersaPak™ instruction sheet to ensure proper use and storage of your batteries.

Use the battery caps provided with the batteries to store or carry them, so metal objects can not contact the exposed metal end (keys, coins, etc.) Remember to remove the caps before placing the batteries in the charger or the *Railmaster-VP*.

If the device is idle for 30 minutes, it automatically powers down to save the batteries. The batteries have a minimum life of 300 charge cycles. You can purchase additional batteries at hardware stores and from Decatur Electronics.

- *When the device is transmitting, it consumes roughly three times as much power from the battery than when it is not transmitting. Keep this in mind to maximize the time until you need to recharge the batteries.*

- *The device draws power from the batteries even when the power is off. When you are not using the device for extended periods, remove the batteries to save the charge.*

WARNINGS

- *IMPORTANT: Do not combine a NiCd (silver label) battery with a NiMH (gold label) battery pack in the same gun. It can damage the batteries.*

- *IMPORTANT: Using batteries that have mismatched voltages, such as one battery fully charged and another with low voltage can cause the device to incorrectly power up.*

- *Never attempt to open a battery. If the housing breaks or cracks, immediately discontinue its use, and do not recharge it.*

- *Do not incinerate the batteries. They can explode.*

If you have problems or questions about your batteries, contact Decatur Electronics, 800.428.4315, Black & Decker® at 800.54.HOWTO.

2.1.1 Removing Batteries

To remove the batteries, press the red button with your thumb while pulling on the battery with your fingers.

2.1.2 Battery Charger

Charge the batteries with only the VersaPak™ battery charger. It is normal for the charger to hum and for the batteries and charger to become warm while charging. If a battery does not charge properly, check the receptacle to see if it is working or move it somewhere with an air temperature between +40°F and +105°F. Unplug the charger when it is not in use.

2.2 Controls

The faceplate control panel consists of three buttons MODE, SELECT, and POWER for navigating in two menus, the primary and secondary.

Figure 2.2 The control panel

2.2.1 Mode and Select

The MODE and SELECT buttons let you select options in a primary and secondary menu. To access the primary menu press MODE to see each option, then press SELECT to see the setting choices for the option. To access secondary menu options, press and hold the SELECT button, then press MODE to see each option. When you see the option you want to change, press the SELECT button until you see the setting for the option that you want. To select the setting, display it in the window until the system times out. (See section 3 Operating Modes for more on the menus and available options.)

2.2.2 Power

The POWER button turns the device on and off.

If the select button is pressed on during power up, the system will reset to the factory default settings.

2.3 Display

The *Railmaster-VP* speed window (status indicator) displays the target speed readings, error messages, and mode indictors such as sensitivity levels.

2.4 Trigger Operation

The spring-loaded trigger controls the radar signal transmission and speed-lock feature. To transmit the radar signal to begin speed measurements, pull the trigger once. When released, the trigger button remains in the pressed position. To stop transmitting the radar signal and receiving speed measurements, pull and release the trigger. This locks the speed in the display window. The display window will show the locked speed and flash it every 1/2 second. The locked speed flashes until you pull the trigger to clear the display.

2.5 Mounting Configurations

The *Railmaster-VP* is compatible with large display signs, which display vehicle target speeds. Also, you can mount it to a standard tripod. To order tripods, see section 12 How to Order Additional Products.

3. Operating Modes

The control panel on the *Railmaster-VP* has two menus, the primary and secondary. The primary menu is the main operating mode, which you will work in most of the time. The secondary menu is for adjusting settings to save as a new default.

3.1 Primary Menu

To select options in the primary menu, press the MODE button to see each option, then press the SELECT button to view the choices for the option. To select an option setting, simply display it in the display window until the system times out.

3.1.1 Backlight (bL)

The *Railmaster-VP* has a backlight LCD is for use at night. Press the MODE button. When bL is in the display window, press the SELECT button to turn the backlight on or off.

3.1.2 Speed Sensitivity Level (SEn)

When you press MODE again, SEn displays. While SEn is displaying, press the SELECT button to choose a sensitivity level, from 1 to 5. One is the least sensitive, and five is the most sensitive for the most distant objects.

3.2 Secondary Menu

To access secondary mode options, press and hold the SELECT button, then press MODE to see each option. When you see the option you want to change, press the SELECT button until you see the setting that you want for that option. To select the setting, display it in the window until the system times out.

3.2.1 Speed Range (Sr)

To set the speed range, select Sr. You can set the speed range to 0, 1, or 2, which are

Speed Range	MPH	KPH	KNOTS
0: Tenths Display	1.0 -> 75.9	1.5 -> 99.9	1.0 -> 65.9
1: Whole Display	1 -> 75	1 -> 120	1 -> 65
2: Whole Display	3 -> 320	5 -> 500	3 -> 275

3.2.2 Speed Units (Su)

The *Railmaster-VP* records speeds in mph or kph. Select the speed units (Su). The options are 0, 1, or 5, which represent

0: MPH
1: KPH
5: KNOTS

3.2.3 Serial Output Mode (Prt)

Prt is the serial output mode option. You can set the mode to the one of the following options (0, 2, or 3):

0: No serial output
2: Unitec Sign Protocol
3: 9600 baud 8:n:1 [hundreds][tens][ones][.][tenths]

3.2.4 Speed Hold Time (ht)

The speed hold time (ht) options are 0 through 10, which represent the number of seconds that the device will hold a target speed if no new speed is recorded to replace it.

4. Serial Output Mode

The *Railmaster-VP* enables RS232 communications through the port located on the side panel of the device. The communication port lets you connect and transmit data to Decatur's large display signs, in-car video, and PC where you can report and analyze speed data. To connect to a PC, plug a Decatur Electronics custom RS232 communications cable (part number S769-100) into the device and the serial communications port on your PC. (You can purchase this cable from Decatur Electronics, see section 12 How to Order Additional Products.)

5. Performance Tips

Understanding potential radar interference and what to do when it occurs can greatly increase the radar's performance.

5.1 How Radar Works

Determining a vehicle's speed, begins with the radar antenna transmitting and directing a beam of microwave energy (radio waves) at an approaching (or departing) target vehicle. When energy from this beam strikes a moving vehicle, a small amount of the beam is reflected back to the antenna. The reflected signal frequency shifts by an amount proportional to the speed of the target vehicle. This is known as the Doppler effect. The radar device then determines the target vehicle's speed from the difference in frequency between the reflected and transmitted signal.

5.2 Interference Sources and Remedies

When properly installed and operated, Doppler radar technology is extremely accurate and reliable. However, variations in the environment can cause situations and circumstances, which can cause spurious (erratic and unusually low or high) speeds to display. Signs that a speed is spurious can include the following characteristics:

- A reading appears when no target vehicle is in the operational range of the antenna.
- A target vehicle enters the operational range overrides the interference signal, causing the displayed speed to change suddenly to the vehicle's speed.
- Speeds are irregular and do not provide a valid traffic history.

5.2.1 Angular Interference (Cosine Error Effect)

The cosine effect causes the system to display a speed, which is lower than the actual vehicle speed. This condition exists when the target vehicle's path is not parallel to the antenna, including conditions such as the vehicle traveling on a curve or a hill.

As the angle between the beam of the antenna and the target vehicle increases, the displayed speed decreases. Ideally, an angle of 0° is preferable, because the displayed speed is the actual target vehicle speed. However, in all uses of police radar, the radar device is always at a slight angle to the target vehicle to avoid collisions.

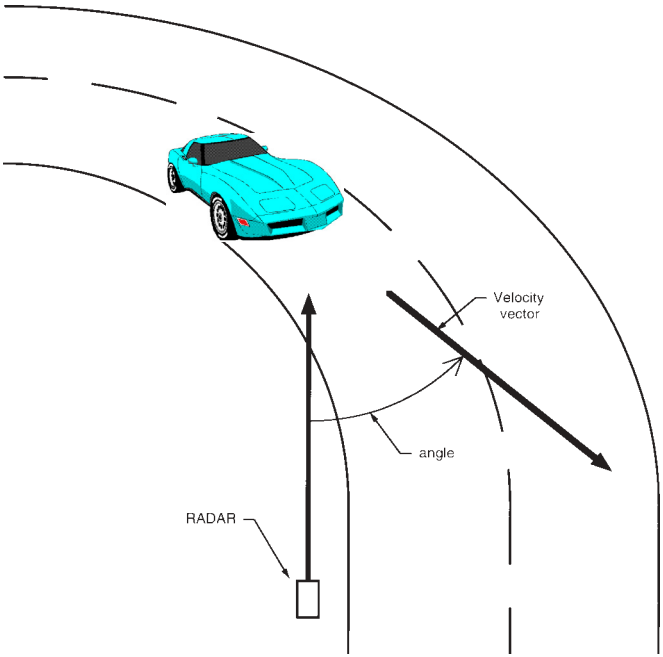

Figure 5.2.1 An angle between the antenna and the target vehicle causes the cosine effect.

The following table shows the effect that an increasing angle has on a displayed speed.

	Horizontal angle degrees:										
	0°	**1°**	**3°**	**5°**	**10°**	15°	20°	30°	45°	60°	90°
Actual speed:	Displayed speeds:										
30 mph	**30**	**29**	**29**	**29**	**29**	28	28	26	21	15	0
40 mph	**40**	**39**	**39**	**39**	**39**	38	37	34	28	20	0
50 mph	**50**	**49**	**49**	**49**	**49**	48	46	43	35	25	0
60 mph	**60**	**59**	**59**	**59**	**59**	57	56	51	31	30	0
70 mph	**70**	**69**	**69**	**69**	**68**	67	65	60	49	35	0
80 mph	**80**	**79**	**79**	**79**	**78**	77	75	69	57	40	0

Table 5.2.1 Actual and displayed speeds at different antenna-to-target angles

Small angles (less than 10°) have little effect on accuracy. As the angle increases, the displayed speed decreases. At 90°, the target speed is 0 mph—grossly incorrect.

5.2.2 Electromagnetic Interference (EMI)

Operating motors can produce EMI. EMI from power seats or windshield wipers can also produce spurious target speeds. To correct this type of interference, simply turn off its source.

5.2.3 Feedback Interference

When you direct the radar beam at laptop computer screens, streetlights, and other electronic devices, the radar gun can display spurious speeds. To correct this type of interference, relocate the radar antenna.

5.2.4 Large Objects

The *Railmaster-VP* detects a wide range of objects. When an object is large, it is easy for the system to "see" it as the target. However, when a large target, such as a moving train, is not present, the *Railmaster-VP* will "see" smaller objects. The *Railmaster-VP* low sensitivity level can detect light, rain, insects, birds, and walking people. (See section 3.1 Primary Menu, for how to adjust sensitivity levels). When the system is "seeing" a small object, the displayed speeds will be erratic. Then when a large target moves in front of the radar, the system will display the speed of it instead of the smaller targets. If the system displays speeds for no obvious target, direct the radar at a large moving object or perform one of the tests described in section 6 Field Tests to verify that the device is working properly.

5.2.5 Multi-Path Beam Cancellation

If multi-path beam cancellation occurs, the target vehicle speed sporadically blinks and reappears at semi-random intervals. This type of interference occurs when the radar loses track of a target vehicle, because the target is reflecting two or more signals, which are interfering with each other. The *Railmaster-VP* is immune to multi-path cancellation.

5.2.6 Radio Frequency Interference (RFI)

The system can inadvertently process radio energy as Doppler speeds, including that from airport radar, microwave transmission towers, CB radio transmitters, and AM/FM transmission towers. For this type of interference to occur, the radar unit must be operating very close to the radio transmitter.

The *Railmaster-VP* contains an RFI detection circuit that detects excess radio frequency energy. When stray radio frequency energy reaches an excessive level, the system displays an RFI message and stops processing and displaying speeds. The system resumes normal operation when the RFI condition no longer exists. At that time, any locked speeds will display again.

5.2.7 Scanning

The *Railmaster-VP* is designed to use while attached to a solid mount or hand-held in a steady position. Moving or "scanning" the antenna past stationary objects can cause the system to detect motion. Obtaining a speed reading from scanning will not happen when you properly use the radar and is considered deliberate misuse of the system.

6. Field Tests

6.1 Tuning Fork Test

In addition to the system test, you can verify signal processing accuracy by using a tuning fork, which comes with the *Railmaster-VP*.

To begin the test, tap the tines of the fork on a surface that is firm and non-metal. The tuning fork will ring audibly. Then place the side of the tuning fork that you tapped with the narrow side facing about 3 inches directly in front of the antenna. Pull the trigger and compare the speed in the display window to the speed stamped on the fork. If the difference is within ± 0.1 display unit, the radar gun is working properly.

Figure 6.1 Place the vibrating tuning fork about 3 inches in front of the antenna.

- *Keep the trigger pressed during the entire test.*

- *Only tap the tuning fork against hard plastic, wood, and materials that are softer than metal. Tapping the tines on hard surfaces, such as metal and concrete, can damage the tines and invalidate the fork for future tests. Also, using the fork in extreme temperatures can affect the readings.*

If the device does not display the expected speed, contact Decatur Electronics at 800.428.4315 to arrange for service.

To order tuning forks, see section 12 How to Order Additional Products.

7. Care, Cleaning, and Storage

- Avoid spilling food, beverages, and other liquids and substances on the radar device.

- When you are not using or transporting the device, store it in its original packaging.

- To clean the radar device, dust it with a soft clean cloth, which is free of cleaning solutions.

- The *Railmaster-VP* can withstand temperature variations, however, only the antenna is weather resistant.

8. Specifications

8.1 Power Consumption Parameters

Supply Voltage Rating 6.6 to 8 VDC

(All currents measured at 7.2 VDC with backlight on.)

Standby (antenna off)	.180 amperes
Antenna ON (no targets displayed)	.370 amperes
Antenna ON ("55" target displayed)	.440 amperes
Antenna OFF (segment check "888 888")	.180 amperes
Antenna ON (segment check "888 888")	.370 amperes

9. Legal Requirements

9.1 FCC Document

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION

Certification

Date of Grant
July 14, 1997

Decatur Electronics Inc
715 Bright Street
Decatur, IL 62522

File No.
31010/EQU 4-3-3

Application dated
May 6, 1997

Attention: Randall Craig Sanner, President

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER **HTRCR-1K**

Name of Grantee **Decatur Electronics Inc**

FCC Rule Part(s): 15

Frequency (MHz) : 24107

Equipment Class : Field Disturbance Sensor

Sports Radar Gun

This device has shown compliance with new rules adopted under Docket 87-389 and is not affected by Section 15.37, transition rule.

In correspondence concerning this grant, please refer to the FCC IDENTIFIER, File No., and date of grant

FCC 731A
October 1991

jg 8315200009

10. Troubleshooting

10.1 Device Will Not Power Up

Make sure the batteries are locked in place.

10.2 Radar Has Poor Range

Make sure the settings are adjusted properly and verify that no obstructions are in front of the antenna.

10.3 Low Battery (BAT)

When the voltage is low, the status indicator displays BAT, so you will know when to replace or recharge the batteries.

10.4 Error (Err)

The status indicator displays Err if an internal processor error occurs. Contact Decatur Electronics at 800.428.4315 for what to do when you see this error.

11. Service

11.1 Warranty

TWO-YEAR RADAR WARRANTY

Decatur Electronics, Inc. guarantees the *Railmaster-VP* to be free from defects in workmanship and material and to operate within specifications for a period of two years. During this period, Decatur Electronics will repair or replace, at its option, any component (except batteries or chargers) found to be defective without cost to the owner, provided the unit is returned to the factory or to a Dectur authorized warranty service center.

(Note: The VersaPak™ batteries and charger are warranted by Black & Decker®. For warranty assistance on batteries and chargers phone 800.762.6672.)

The full warranty on parts and workmanship does not include normal wear and tear, crushing, dropping, fire, impact, immersion, or damage from attempted repair or modifications by unauthorized service agents.

For repairs, simply return the unit (transportation prepaid) directly to the factory or to a Decatur authorized warranty service center near you by following the instructions in section 11.2 Service Return Procedure.

11.2 Service Return Procedure

If your *Railmaster-VP* gun has a problem, first see section 10 Troubleshooting. If the problem persists, contact our customer service hotline at 302.325.3254. Our customer service staff will try to solve the problem over the phone. If we can not, you need to return your radar package in the origial box if possible (no need to include the batteries and charger). Please include a short note describing the

problem, your name, phone number, and the address you want it returned to. Send the package by UPS to:

Contract Assembly Service, Inc.
75 Christiana Rd.
New Castle, DE 19720

The customer is responsible for the shipping charges to send the system to Contract Assembly Service, the authorized service center.

Contract Assembly Service does not accept COD shipments and will return ALL COD shipments to the sender, unpaid.

Contract Assembly Service will pay the freight (up to $10.00 US) for shipping the radar gun from the repair facility to the customer, providing the radar gun is still under warranty. The customer is charged any shipping charges above the initial $10.00. If you want to ship your package express mail or next day air, you will be invoiced for the freight charges, even if the gun is still under warranty.

If your radar is out of warranty and you would like to know the repair cost prior to the actual repair work being performed, Contract Assembly Service would be happy to give you an estimate. To obtain an estimate, request it either on the paperwork you submit with the radar when you send it in for service. Contract Assembly Service provides estimates only upon request.

11.3 Maintenance and Repair Record

Date of Maintenance or Repair	What was Done	By Whom

12. How to Order Additional Products

You can order upgrades (when available) to the *Railmaster-VP* from Decatur Electronics as well as cases, power supplies, tripods, and tuning forks. To see product descriptions or order products, see the Decatur Electronics Web site at www.decaturradar.com or call the sales office at 800.428.4315.

Product Description	Part Number	Price
Black & Decker® VersaPak™ batteries and chargers		
Two nickel-cadmium (NiCd), silver label, 3.6-volt batteries and AC 2-port charger	P702-VP135	$29.95*
Nickel metal hydride (NiMH) gold label battery	P702-VP110-BULK	$22.25
Nickel cadmium (NiCd) silver label battery	P702-VP100-BULK	$14.95
Custom RS232 communications cable	S769-100	$70.00
Test Forks (for testing the accuracy of your radar)		
77.6 and 33.2 MPH test fork set	S900-11	$40.00
100.6 and 45.3 KPH test fork set	S900-12	$40.00
Molded Holster	S780-400-0	$79.99
Pole Mount Bracket	S758-75-0	$29.95
Tripod	P761-1	$70.00
Tripod Adapter	S761-6	$ 4.70
Carrying Cases		
Cardboard packing box/carrying case	P1025-37	$15.00
Hard case with cut-out foam (recommended)	P801-GVP	$75.00
Soft case (black)	P801-22BLK	$34.95

*Prices are subject to change.

User Notes

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