Certified ISO 9001

SURFACE VELOCITY RADAR (SVR)™
USER'S MANUAL

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WELCOME TO DECATUR ELECTRONICS

Thank you for choosing this Decatur Electronics product—the *SVR*™, an advanced surface velocity radar (SVR) device for measuring water surface velocity. The *SVR* is extremely valuable for measuring water surface velocity during high-velocity flows and flood conditions where using contact measurement instruments poses a risk to safety.

The *SVR* incorporates many leading features such as cosine error correction for the vertical and horizontal angle positions of the gun to the target. The SVR also contains a configurable horizontal cosine able adjustment that may be used when the angle of the gun is not parallel to the flow of the target.

We urge you to study this manual before using the *SVR,* so you can maximize the benefits of this sophisticated radar device. If you are as pleased with its performance as we think you will be, ask your Decatur sales representative about our other products.

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

TABLE OF CONTENTS

SVR Features

The *SVR* is a hand-held surface velocity radar (SVR) gun specifically designed to measure the surface velocity of water—great for use in streams and rivers.

The standard package includes:

- radar gun with surface velocity measurement software
- communications port
- two rechargeable batteries
- Black & Decker® VersaPak™ 2-port battery charger
- user's manual
- hard case
- certification
- two-year full warranty.

The *SVR* operates using Black & Decker® VersaPak™ rechargeable batteries, which are available at hardware stores and Decatur Electronics.

The radar gun features a tilt sensor system, which internally compensates for the cosine error effect of the vertical (pitch-down) angle of the gun to the target. It is not necessary to manually set the tilt sensor.

Also, the software compensates for the horizontal (yaw) angle that is created when the gun is aimed at a target from an angle, which is greater than 10° from the parallel alignment of the gun to the target.

The *SVR* also features a data communications port, so it is possible to connect the gun to external devices such as a PC.

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

1.1 Initial Set Up

The *SVR* is easy to use. To operate, simply

- charge and insert the batteries
- power up
- aim at the target
- set the horizontal angle position of the gun to target
- pull the trigger, and record the velocity.

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.) Insert the batteries into the handle grip by pushing them into the receptacles in the bottom of the handle until you hear them snap into place.

Figure 1.1.1 Insert the batteries into the handle grip.

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

1.2 Power

Press and release the POWER button; the unit will immediately power up. Press and hold the button down for more than one second to turn off the unit.

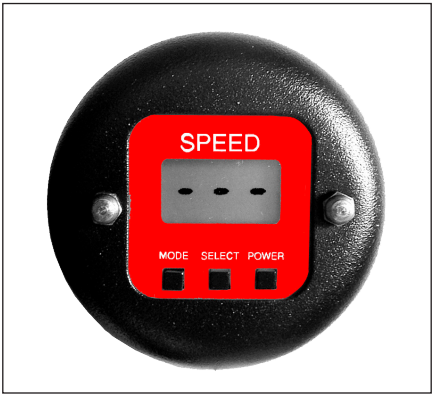

Figure 1.2 The *SVR* display after turning on the power

The SVR has a power save timeout of 5 minutes. If the gun is left ON for more than 5 minutes without any buttons pressed or the trigger pulled during that time, the gun will shut itself off.

1.3 Menu Options

To change a menu option, enter the Menu Mode by pressing the MODE button. To advance to the next option, press the MODE button again. To change an option value, press the SELECT button while the menu option is displaying. The current value, the value that was last set, is the first value to display the next time you enter the menu option. Repeat these steps until you display the desired value. The radar gun continues to operate in the background while it is in Menu Mode.

The *SVR* exits Menu Mode and returns to the main operating mode if, after 6 seconds, you do not press the MODE or SELECT button. The menu options are:

Display	Function
bL	Backlight (on/off)

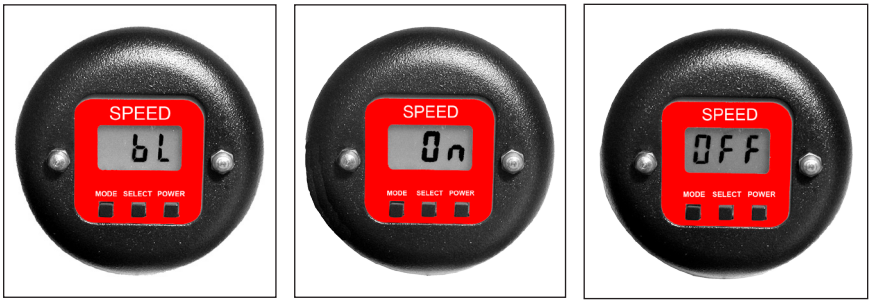

Figure 1.3a The mode for backlight, on, and off

Display	Function
COS	Cosine correction angle for the horizontal (yaw) angle (the valid range is 0° to 60° in increments of 5°)

Figure 1.3b The mode for selecting the horizontal (yaw) angle

Display	Function
U	"Eur" displayed for meters per second. "USA" displayed for feet per second.

Figure 1.3c The mode for selecting meters per second or feet per second

Display	Function
A	Vertical Angle Display. This is used to verify that the SVR is reading vertical angle correctly. The vertical angle may be calibrated first putting the gun in a level position, then pressing the Mode and Power buttons simultaneously for two seconds. (The Mode button must be pressed first to avoid shutting off the gun). The display will very briefly change to "CAL" when the self-calibration has been performed.

Display	Function
SEN	Sensitivity Display and Adjustment. Higher numbers tell the gun to pickup surface velocity from a further distance. Lower numbers reduce the distance. If the sensitivity is too high the indicated velocity may be unpredictable and erratic. The default value should work well in most situations.

1.4 Measuring Surface Velocity

To begin a velocity measurement, point the radar gun at the water and pull and release the trigger. The surface velocity can be measured flowing toward or away from the gun. The decimal point flashes while the SVR begins the measurement process. The decimal point stops flashing when the measurement is stable. The displayed velocity will continue to update as long as the trigger is in the Down position. When the trigger is pulled and released to bring it to the Up position the measurement will be locked and displayed.

WARNING

Do not put the radar gun in the water. This will damage it. The SVR *measures the water surface only from outside the water.*

Figure 1.4a The *SVR* displaying a 2.4 f/s water-surface velocity

When the trigger is in the ON position, the SVR begins measuring the surface velocity. The decimal point on the display will continue to flash until the velocity stabilizes. The decimal point will stop flashing when the SVR has performed enough measurements to display an averaged and reliable velocity. This velocity will continue to update as long as the trigger is in the ON position.

- The User pulls trigger ON. The display shows "- -.-". The leading "-" keeps flashing, indicting SVR is taking measurements. The velocity is updated once per second. This velocity may vary significantly while the SVR focuses its data processing. Towards the end of the first ten seconds, the displayed velocity will be accurate.
- After 10 seconds the display updates to "0 X.X". The leading "0" means 10 seconds have passed. The "X.X" is the average velocity over the last 10 seconds and then keeps unchanged. The leading "0" keeps flashing.
- After 15 seconds, the display updates to "1 X.X". The leading "1" means 10+5 seconds have passed. The "X.X" is the average velocity over the last 15 seconds and then keeps unchanged. The leading "1" keeps flashing.
- After 20 seconds, the display updates to "2 X.X". The leading "2" means (10+5+5) seconds have passed. The "X.X" is the average velocity over the last 20 seconds and then keeps unchanged. The leading "2" keeps flashing.
- After 60 seconds have passed, the SVR has completed ten separate 5-second batches of velocity measurements. The display will indicate the average of these measurements.

If the user pulls the trigger OFF at any time, the display reads the average of all measurements up to that point. For example, "52.3" means SVR calculated a velocity of 2.3m/s over a period of 35 seconds.

If there are fluctuations of more than 0.5 to 0.8 f/s (0.15 to 0.24 m/s) during a measurement interval, it is advised to review the final value. Consistent readings confirm the validity of the result, so we recommend taking the measurement more than once.

A hydraulics laboratory tested the *SVR* and discovered several factors to consider when making measurements outdoors. Because the *SVR* measures the Doppler effect from the water surface, the *SVR* requires a certain amount of return energy. (See section 3.1 How Radar Works.) Particulate material and/or floating debris (seeding) on the surface and surface water roughness provide this effect.

The *SVR* easily measures the velocity at which the particulate material moves in high-flow conditions. This provides the accuracy of the surface flow. For velocities of more than 1 to 2 f/s (0.30 to 0.60 m/s), floating debris and particulate material provide an ample return signal to the radar gun for measurement. Water roughness also gives a good signal return. Ripples and crosscurrents produce velocities in all directions. During a measurement, the *SVR* reads all the velocities and averages them into a resulting single value, based on the amount of signal return to the antenna.

1.5 Angle Compensation

The *SVR* compensates for the cosine error effect occurring when the position of the gun to the target creates an angle, because the gun is not directly in line (parallel) with the target. The tilt sensor automatically corrects the cosine error effect of a vertical angle. To compensate for the effect of the horizontal angle, set the software from the Menu Mode by pressing the MODE button to display A, then press SELECT to display the angle at which you will be aiming the gun. When the radar gun is not pointing directly in line (parallel) with a target, the position of the gun to the target creates a horizontal (yaw) angle. If this angle is greater than 10°, it creates the cosine error effect. This effect results in spurious (unusually low) velocity readings. (See section 3.2.1 Angular Interference for more about the cosine error effect.)

The vertical cosine angle will always be calibrated at the factory and should never need calibration in the field. However, a new application download may overwrite the locations where vertical cosine angle calibration parameters are stored.

The vertical angle of the SVR may be recalibrated at any time by leveling the gun and pressing the "mode" and "power" buttons at the same time for more than one second. Press the "mode" button slightly before the "power" button to make sure you don't power off the gun. The display will very briefly indicate "CAL". Run back to the Angle menu item and check the angle. It should read zero degrees when the gun is level. In actual use, a variance of a few degrees doesn't significantly affect the displayed velocity.

If the vertical angle of the gun exceeds 60 degrees, the display will indicate "—". The angle measurement is not accurate over 60 degrees, and we cannot gaurantee accuracy above a 60-degree angle.

1.5.1 Vertical Angle Compensation

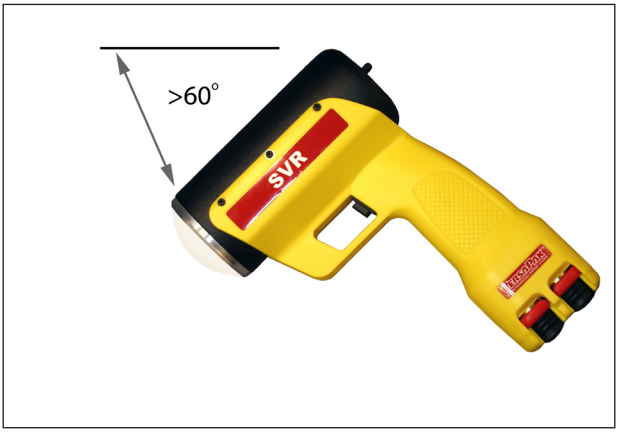

Figure 1.5.1a The *SVR* tilted pitch-down at a 60° vertical angle.

The tilt sensor automatically compensates for the vertical angle at which you aim the gun to the target. You do not need to manually set the tilt sensor. However, you must hold the gun still at a constant vertical angle while taking a velocity measurement.

The *SVR* indicates when the pitch-down angle exceeds 60° by displaying "– – –". While "– – –" appears in the display window, the radar gun does not record velocity measurements. To continue taking water surface velocity velocity measurements, tilt the gun to an angle less than 60° until the
"– – –" indicator no longer appears.

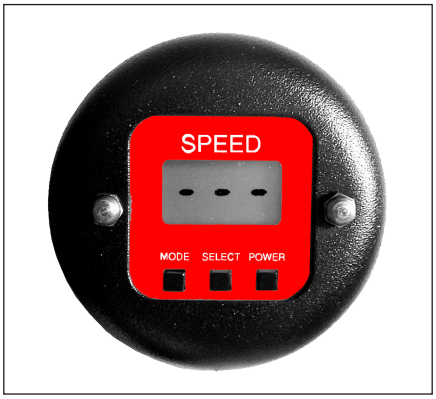

Figure 1.5.1b The display when the vertical (pitch-down) angle exceeds 60°

1.5.2 Horizontal Angle Compensation

Aiming the radar gun at the target at a horizontal angle greater than 10° creates a cosine error, which results in the radar displaying a spurious reading. To eliminate or greatly reduce this error, set the horizontal angle compensation option to the angle that you plan to aim the radar gun to the target. Then aim and hold the gun at this set angle during the entire velocity measurement.

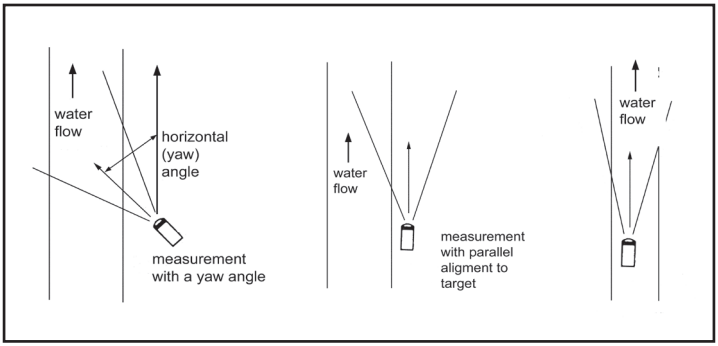

Figure 1.5.2a When the radar gun is not parallel with the target (the flow of the water) the positioning creates a horizontal (yaw) angle.

To set the horizontal angle compensation option, press the MODE button until an A appears in the display. Then press the SELECT button. Each time you press the SELECT button, a 0, 5, 10, 15, 20, 25, 30, 35, 40, or 75 appears, representing the horizontal angle degrees in which you plan to hold the gun. Select the angle by displaying the number until the radar gun times out. Now the gun is set at this angle selection and remains in this mode until you change it. This setting will appear the next time you enter this menu option.

Figure 1.5.2b The horizontal angle setting for 0°

2. Components

The *SVR* surface velocity measurement radar gun is extremely durable and has an easy-grip Black and Decker designed handle. The gun uses rechargeable Ni-Cad batteries, which are conveniently available at hardware stores and Decatur Electronics.

2.1 Display

The face panel includes a 3-digit velocity display and three buttons—MODE, SELECT, and POWER. Using the MODE and SELECT buttons, it is possible to control the backlighting of the display, cosine error correction of horizontal angle, and (if enabled) the serial communication output mode.

The display is logically divided into two portions. The left digit is a time indicator. The middle and right digits display the velocity.

2.2 Batteries

The *SVR* comes with a Black & Decker VersaPak™ Rechargeable Battery Starter Kit: 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, please use nickel metal hydride (NiMH), gold label, VersaPak™ batteries. 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 when storing or carrying them, so metal objects (keys, coins, etc.) do not come in contact with the exposed metal end. Remember to remove the caps before placing the batteries in the charger or *SVR*.

When the batteries are low, bAt appears in the display.

Figure 2.1 The display indicating low batteries

- *When the radar is transmitting, the* SVR *consumes roughly three times as much power from a battery than when it is not transmitting. Keep this in mind to maximize the battery life.*
- *The device draws a small amount of power from the batteries even when the power is off. When the device is not in use 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 in the same gun. It can damage the batteries.*
- *IMPORTANT: Using batteries that have mismatched voltages (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 at 800.428.4315, Black & Decker at 800.54. HOWTO, or a local Black & Decker service center. (See the Tools Electric section in the Yellow Pages.)

2.2.1 Removing Batteries

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

2.2.2 Battery Charger

Only charge the batteries with 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 battery charger to see if it is working or move it somewhere with a temperature between +40°F and +105°F (+4°C and +41°C). Unplug the charger when it is not in use.

2.3 Serial Communications Port

An activated serial communications port and 20-foot custom RS232 communications cable (part number S769-100) is available for ordering for recording and analyzing velocity data. With the port, connection of the *SVR* to external devices, such as a PC, is possible.

3. Performance Tips

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

3.1 How Radar Works

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

When the antenna transmits the beam of radio waves, the beam forms an elliptical pattern on the target area. The beam's size depends on the distance between the antenna and the target.

The horizontal beam width is 12°. The detection area becomes larger as it becomes farther away from the antenna.

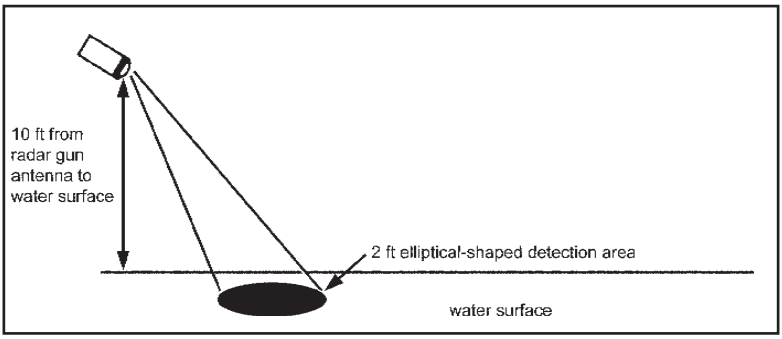

Figure 3.1 Radar beam detection area

When you point the *SVR* about 10 feet from the water surface, it measures an elliptical beam pattern of 2 feet in diameter. Keep this in mind when making measurements of a stream width. Take several readings to completely cover the full width of the stream.

3.2 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) velocities to display. Signs that a velocity is spurious can include the following characteristics:

- a reading appears when no target is in the operational range of the antenna
- a target entering the operational range overrides the interference signal, causing the display velocity to change suddenly
- interference is irregular and does not provide a valid target history.

3.2.1 Angular Interference (Cosine Error Effect)

The cosine effect causes the radar device to display a velocity, which is lower than the actual water surface velocity. This condition exists whenever the target's path (the water flow direction) is not parallel with the radar gun's antenna. As the horizontal (yaw) angle between the antenna and the water surface velocity target increases, the displayed velocity decreases. Ideally, an angle of zero (0°) is best.

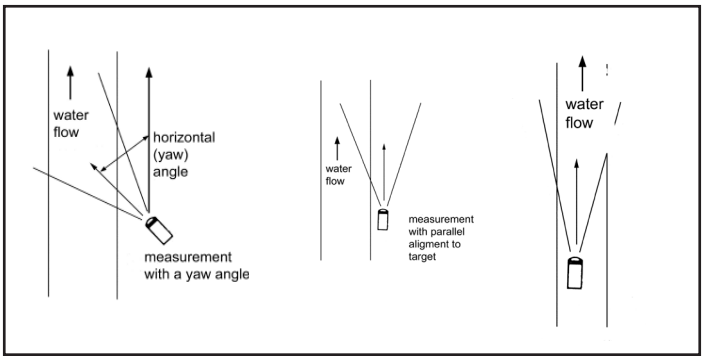

Figure 3.2.1 An angular error occurs when the target's path is not parallel to the radar antenna. The horizontal (yaw) angle creates the cosine error effect.

Small angles (less than 10°) have little effect on accuracy. As the angle increases, the displayed target velocity erroneously decreases, as the following table, Table 3.2.1, shows. At 90°, the target velocity is 0—grossly incorrect. You will see numbers such as these if you do not set the horizontal angle compensation option in the software menu. (For how, see Section 1.5.2 Horizontal Angle Compensation.)

Actual velocity in f/s	Horizontal angle degrees: 0°	1°	3°	5°	10°	15°	20°	30°	45°	60°	90°
	Displayed velocity:										
3	3.0	3.0	3.0	3.0	3.0	2.9	2.8	2.6	2.1	1.5	0.0
5	5.0	5.0	5.0	5.0	4.9	4.8	4.7	4.3	3.5	2.5	0.0
7	7.0	7.0	7.0	7.0	6.9	6.8	6.6	6.1	4.9	3.5	0.0
9	9.0	9.0	9.0	9.0	8.9	8.7	8.5	7.8	6.4	4.5	0.0
11	11.0	11.0	11.0	11.0	10.8	10.6	10.3	9.5	7.8	5.5	0.0
13	13.0	13.0	13.0	13.0	12.8	12.6	12.2	11.3	9.2	6.5	0.0
15	15.0	15.0	15.0	14.9	14.8	14.5	14.1	13.0	10.6	7.5	0.0
17	17.0	17.0	17.0	16.9	16.7	16.4	16.0	14.7	12.0	8.5	0.0
19	19.0	19.0	19.0	18.9	18.7	18.4	17.9	16.5	13.4	9.5	0.0
21	21.0	21.0	21.0	20.9	20.7	20.3	19.7	18.2	14.8	10.5	0.0
23	23.0	23.0	23.0	22.9	22.7	22.2	21.6	19.9	16.3	11.5	0.0
25	25.0	25.0	25.0	24.9	24.6	24.1	23.5	21.7	17.7	12.5	0.0

Table 3.2.1 Actual and displayed velocities at antenna-to-target angles

Table 3.2.1 shows the actual velocities (in the left column) and the velocity that displays (columns on the right) if you have not adjusted the radar gun for the horizontal (yaw) angle. Note that for angles less than 10°, the cosine error effect on the velocity is minimal.

Also, note that the table reflects only the cosine error from the horizontal angle. When you introduce a horizontal (yaw) angle and a vertical (pitch-down) angle into a measurement, both angles affect the final calculated display velocity. Note: The vertical (pitch-down) angles that are less than 45° are automatically compensated for by the tilt sensor.

3.2.2 Electromagnetic Interference (EMI)

While operating, electric motors can produce EMI. EMI can produce spurious (erratic and unusually low or high) target velocities. To correct the interference, simply turn off its source.

3.2.3 Feedback Interference

When you direct the radar beam at computer screens, streetlights, and other electronic devices, it can display spurious (erratic and unusually low or high) velocities. To correct the interference, move the radar gun's antenna away from the source of the interference.

3.2.4 Radio Frequency Interference (RFI)

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

3.2.5 Scanning

The *SVR* is designed for 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 velocity reading by scanning will not happen when you properly use the radar and is considered a deliberate misuse of the system.

3.2.6 Environmental Factors: Wind, Rain, & Snow

Wind moving across a water surface can produce waves, which result in movement differing from the main direction of the water flow. In high-velocity water flow, this effect is minimal or non-existent and does not affect the measurement. However, in low water surface flow, such as conditions below 1 to 2 f/s (0.30 to 0.60 m/s), the wind's effect is dominant, so the measurement might not reflect the actual velocity movement. In wind, position the *SVR* toward a target area where wind does not affect or minimally disturbs the water surface, such as under a bridge or in a sheltered area.

Rain and snow can influence the accuracy of measurements. In slow water flow conditions, the vertical velocity component of rain or snow is dominant. Rain droplets passing in front of the measuring plane of the antenna and water surface roughness produced by rain droplets contacting the water surface cause this effect. However, in conditions of rapid water flow, these effects are minimal. The dominant effect is the surface water flow following the direction of the main open channel. In these conditions, take measurements under a bridge, structure, or covered area where rain and snow do not dominate the measurement.

Take measurements where the main channel flow is dominant. This eliminates the potential for errors from environmental factors.

4. 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, use a soft clean cloth, which is free of cleaning solutions.

5. Specifications

5.1 Measurement Specifications

Units of measure are set by the factory in feet per second (f/s) or meters per second (m/s).

Minimum velocity	1 f/s (0.3 m/s)
Maximum velocity	30 f/s (9.1 m/s)
Measurement accuracy	5% of Reading
RS232 interface	115.2K baud 8:n:1

5.2 Factory Default Settings

Units	m/s
Horizontal Cosine	0 Degrees
Sensitivity	12

5.3 Antenna Parameters

K-Band

IACP Type III

Nominal transmission frequency	24.150 GHz ± 50 MHz
Nominal horizontal beamwidth	12°
Polarization	Linear
Nominal microwave power output	10 mW
Maximum aperture power density	1 mW / cm^2

Environment

Ambient operating temperatures	-22°F to +158°F -30°C to +70°C
Maximum humidity	90% relative humidity at 99°F (37°C) non-condensing

Water resistance meets International Robustness Standard IEC 529:1989 and European Community Standard EN 60529 Classification IP55. These set international standards for immunity from damage by solid protrusions and water.

5.4 Voltages

Supply voltage range	6.2VDC – 8.0VDC
Power supplied from replaceable Ni-Cad batteries	
Low voltage threshold	6.2VDC

5.5 Power Consumption Parameters

All currents measured at 7.2VDC with backlight on.

Standby (antenna off)	.180 ampres
Antenna ON (no targets displayed)	.370 ampres
Antenna ON (anything displayed)	.440 ampres
Antenna OFF (segment check "888")	.180 ampres
Antenna ON (segment check "888")	.370 ampres

All currents measured at 7.2VDC with backlight off.

Standby (antenna off)	.155 ampres
Antenna ON (no targets displayed)	.345 ampres
Antenna ON (anything displayed)	.415 ampres
Antenna OFF (segment check "888")	.155 ampres
Antenna ON (segment check "888")	.345 ampres

6. Legal Requirements

6.1 FCC Document

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Decatur Electronics Inc
715 Bright Street
Decatur, IL 62522
Attention: Randall Sanner

Date of Grant: 02/28/2000

Application Dated: 12/21/1999

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-1KD
Name of Grantee Decatur Electronics Inc

Equipment Class: Part 15 Field Disturbance Sensor
Notes: Traffic Safety Radar

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Watts	Output Frequency Tolerance	Emission Designator
15		24075 - 24175		%	

Mail To:

EA96328

7. Frequently Asked Questions (FAQ)

Q . My surface velocity measurement reading is much higher than the last time I took a reading.

A. If the water surface is smooth with very little or no roughness, the *SVR* is possibly not receiving enough returning radar energy from it. Try to make your measurement closer to the water or in a region where some water surface turbulence, roughness, or even floating material is on the water.

Q. I just completed making a measurement and moved to a different spot on the river. Now my measurements seem off.

A. Check to make sure you have adjusted the horizontal (yaw) angle compensation. In high flow conditions, an incorrect or improper angle input can yield a significant difference in velocity readings.

Q. The water has some good roughness and waves on the surface, but the radar gun still seems to give me a higher and/or much lower reading than I expect.

A. Make sure you are not too far away from the water surface when making a measurement. This distance is sometimes difficult to determine, because the measurement is a function of the amount of returning signal to the radar gun. The returning signal directly relates to the distance from the water surface and the water surface roughness. The radar gun makes the best measurements, even for very low velocities, when it is as close to the water surface as possible. You need to make several measurements pointing at the same spot. Try to minimize the horizontal (yaw) angle in the measurement. Also, make several measurements at different vertical (pitch-down) angles to determine a consistency in the readings. Make sure you hold the gun steady and at only one angle when making a measurement.

Q. I am trying to make a velocity measurement that appears to be lower than 2 f/s (.60 m/s), but my readings show a higher velocity.

A. Check for wind effect occurring on the water surface. Wind can affect the measurement of low velocities, for example below 2 f/s (.60 m/s). If possible, make the measurement in two directions, one of the water flowing toward the gun and one away from the gun. Try to make the measurement by pointing at the same spot.

Q. I'm making a measurement during a flooding condition. The water is flowing very fast and is very turbulent and rough with a lot of debris and floating material. Is the gun giving me a good measurement?

A. YES, turbulent water with floating material on the surface provides a good return signal to the radar. Note that in these conditions, the radar gun reads many different velocities occurring in numerous directions. The radar gun measures all these velocities and provides one averaged velocity value.

Q. While making a measurement, the value is changing every 5 seconds.

A. The radar gun measures the velocity in 60-second intervals. When the first measurement value appears on the display, it is a result of the radar gun sampling the surface velocity numerous times. (The radar gun puts the data values in a type of first-in, first-out memory buffer.) As the radar gun continues to take samples, it discards and replaces the older velocity values with newer samples then averages the values again. The sampling process takes place every 5 seconds within this 60-second period. This is because the hydraulics of the water can change. The radar samples the surface water and provides ten averaged values of surface velocity, each sampled in a 5-second period. After 60 seconds, the radar gun averages the ten values together to provide a final velocity value.

Q. When I make measurements, the readings seem to change from high to low velocities to high velocities, etc._

A. Make sure you hold the gun steady when you take a measurement. The tilt sensor that compensates for vertical (pitch-down) cosine error in velocity is very sensitive. Vibration or jerky movements of the gun cause incorrect angle readings.

Q. I am making a measurement of water that is moving fairly rapidly. It is beginning to drizzle. Will rain affect my readings?

A. In some cases the rain helps the measurement, because the small ripples it produces provide the radar with a reflective surface for a return signal back to the antenna. For rapid water flows, the outward movement of a ripple is much slower than the relative surface water movement, and the ripples that the rain generates move the same direction as the rapid flow of the water. he radar "sees" the higher velocity of the water surface. This is what dominates the water surface measurement. The effect of rain at higher surface water velocity is therefore minimal. Note that you should avoid making measurements in rain, because the amount of rain fall and its intensity can cancel its effect. Also, rain can influence the measurement, but it depends on how far away you are from the water surface. Falling rain, depending on the amount, can create a reflective barrier between the radar antenna and the water surface. The radar "sees" the velocity of the falling rain, not the water surface.

Q. I am making a surface water velocity measurement on a water surface that has a lot of bubbles. Will my measurement be valid?

A. Yes. Bubbles moving the direction of the flow provide a very good returning signal to the radar.

Q. The bubbles are moving in different directions but generally in the same direction of the water flow. Will my measurement still be valid?

A. Yes, the radar gun performs an excellent measurement by averaging the varying velocities of the bubbles that are moving in different directions but in the same general direction of the flow.

Q. From standing on a bridge, how do I measure an entire stream width?

A. To obtain an average velocity of the full width of a stream, you first need to estimate the distance between the radar gun and the water surface. Keep in mind that the detection area is larger the farther away the radar gun antenna is from the water surface. The radar produces an elliptical beam pattern of 2 feet in diameter for every 10 feet of straight-line distance. You will want to take several readings to completely cover the full width of the stream. You can determine how many individual measurements you need to make to cover this width. When moving across the bridge, separate each measurement point by the beam's diameter. For example, if the stream is 10-feet wide and you are approximately 10 feet from the stream, start your first measurement point about 1 foot from the edge of the stream bank. The radar gun measures from the edge of the stream to 2 feet across the stream. Next, position the gun 2 feet from where you made your previous measurement. Continue measuring the entire stream until you reach the opposite bank. Record all the measurement readings, then average them to determine the final surface velocity value. Note that the edge of a stream typically gives a reading that is a lower velocity than the center of the stream.

Q. My radar gun will not power up. What should I do?

A. First, make sure the batteries are locked in place. If the gun does not power up, try inserting new or recharged batteries. If it still does not power up, contact Decatur Electronics at 800.428.4315.

Q. My radar gun has poor range. How can I remedy this?

A. Make sure the antenna has no obstructions in its path. (See section 3 Performance Tips.) If the gun still has poor range, contact Decatur Electronics.

Q. How long will my batteries last?

A. The batteries have a minimum life of 300 charge cycles. Replacement batteries and chargers are conveniently available at hardware stores and from Decatur Electronics.

Q. Will my *SVR* work while it is moving?

A. No, the radar gun is a stationary-only model, so it does not operate correctly while moving. Hold it steady while you take a reading.

Q . What if I drop my gun?

A. The *SVR* is extremely durable, and the Black & Decker designed handle gives it a comfortable grip that is easy to grasp. If you drop it, simply reload the batteries, power up, and try it. If the gun does not appear to work properly, contact Decatur Electronics.

Q. What should I do if I drop my gun in the water?

A. Contact Decatur Electronics. The *SVR* is not waterproof, so dropping it in water will damage it. However, it is water-resistant, so you can operate it in rain.

Q. What other products does Decatur Electronics carry?

A. Decatur Electronics carries the *Genesis* series of radar guns for law enforcement, including a line of hand-held stationary guns and mobile radar products. Decatur's *Prospeed CR-1K*™ sports radar works well with most kinds of racing, including watercraft, snowmobile, motorcycle, and auto. Decatur also carries the *Galaxy*™ line of speed signs and radar trailers and a Hi8™ in-car video recording solution, the *Gemini*™—the *Gemini Headliner*™ for the Ford® Crown Victoria™ and Chevrolet® Impala™ that fits flush with a vehicle's interior headliner and a *Gemini*™ two-piece unit that fits in anywhere in the console area of any vehicle's interior. Contact Decatur for more information on these products.

Decatur also sells sports radar guns designed specifically for baseball and softball that are marketed exclusively through the JUGS Company. For more information, phone 800.547.6843, *www.thejugscompany.com*.

8. Service

8.1 Warranty

TWO-YEAR RADAR WARRANTY

Decatur Electronics, Inc. guarantees that the *SVR* is free of defects in workmanship and materials and that it will 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, that is found to be defective, without cost to the owner, providing you return the *SVR-VP* to the Decatur authorized warranty service center, Contract Assembly Service, Inc.

The VersaPak™ batteries and charger are warranted by Black & Decker. For warranty assistance on the batteries and chargers, call 800.762.6672.

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

For repairs, simply return the unit (transportation prepaid) directly to Contract Assembly Service (the repair facility) by following the instructions in section 9.2 Service Return Procedure.

8.2 Service Return Procedure

If your *SVR* has a problem, first see section 8 Frequently Asked Questions (FAQ). If the problem persists, contact our customer service hotline at 302.995.1976. 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 original 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 that you want it returned to. Send the package by UPS to:

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

The customer is responsible for the shipping charges to send the radar gun to Contract Assembly Service, the Decatur Electronics authorized service center.

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

Decatur Electronics authorized service center will pay the freight (up to $10.00 US) for shipping the system from the repair facility to the customer, providing the radar gun is still under warranty. We will charge the customer for any shipping charges above the initial $10.00. If you want to ship your package express mail or next day air, we will invoice you for these 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 we will perform, Contract Assembly Service would be happy to give you a repair estimate. To obtain an estimate, request it on the paperwork you submit with the radar gun when you send it in for service. Contract Assembly Service provides estimates only upon request.

8.3 Maintenance and Repair Record

Date of Maintenance or Repair	What Was Done	By Whom

9. How to Order Additional Products

You can purchase other Decatur Electronics radar products or additional parts for your *SVR,* such as a molded holster, a pole mount bracket, or a tripod-mounting adapter. For product descriptions and to 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
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
Custom RS232 communications cable	S769-100	$70.00
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

Index