SVR3D™

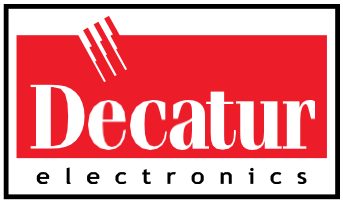
Surface Velocity Radar SVR3D

User's Manual

Rev 10-6-21

Table of Contents

Table of Contents



Welcome to Decatur Electronics, Inc.

Thank you for choosing this Decatur Electronics product—the SVR3D™, an advanced surface velocity radar (SVR) device for measuring water surface velocity. The SVR3D 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 SVR3D incorporates many leading features such as cosine error correction for the vertical and horizontal angle positions of the gun to the target. The SVR3D also contains a configurable horizontal cosine adjustment that may be used when the angle of the gun is not parallel to the flow of the target.

If you are as pleased with its performance as we think you will be, ask your Decatur sales representative about other Decatur products including the Genesis™ line of radars, the Onsite™ line of speed trailers, dollies, and pole signs.

Try any one of our products and see if you don't agree that it is the best-in-class!

—The Management and Staff at Decatur Electronics

About This Manual

This manual contains valuable information to help you set up, use and maintain your radar, so you can optimize its life and keep it at peak performance. Please take a moment to read through it, and keep it handy for future reference.

Note the following symbols in this manual:

Indicates a warning message about safety precautions. Please read carefully.

Indicates a helpful tip or precaution to note.

1. Safety Information

All service needs should be referred back to the manufacturer.

WARNINGS

- The internal battery pack is not user serviceable.

WARNING

Do not put the radar gun in the water. This will damage it. The SVR3D measures the water surface only from outside the water.

- Opening the SVR3D automatically voids any warranty still in effect. There are no user serviceable parts inside.
- Do not expose the SVR3D to excessive moisture. Never submerge the device. If the SVR3D should accidentally get submerged, remove from the water immediately, wipe off and let dry.
- Do not drop the SVR3D on hard surfaces since damage could occur. Units damaged by dropping or abuse are not covered for warranty repair.

Violation of these guidelines may void the warranty.

2. Receiving Inspection

- When you receive your radar, inspect all components for freight damage that might have happened during shipping orunloading. Take pictures to document any damage.
- Notify the freight company immediately of any damage, preferably while the driver is present. Record the damage on thebill of lading and keep a record of the problems or damage.
- The package should include the following pictured items along with this User's Manual.

SVR3D™

Detachable power and data USB cable

3. Getting Started

3.1 Introduction

The SVR3D is a hand-held surface velocity radar (SVR™) gun specificallydesigned to measure the surface velocity of water—great for use in streams and rivers. Features such as Recall allows you to review the previous measurement. Other features are selectable through the menu option.

Figure 3.1
SVR3D overview

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

3.2 Battery Charging

The SVR3D contains an internal Lithium rechargeable battery pack. When you first receive your radar, the batteries will need to be charged for the first time before using. Once batteries have been charged if you do not use the SVR3D for 3-4 weeks, you will want to recharge the batteries before use in order to get the full run time. To charge batteries for the first time, follow steps in 3.3.

3.3 Charging the Batteries

The USB power cable that comes with the SVR3D is used to charge the internal battery. Plug the USB cable into the USB connector located near the front of the trigger. The USB connector can be inserted in either orientation. If the SVR3D is powered off and charging, a green charging status light will illuminate the center power button. Once fully charged, the green light will stop lighting. If the SVR3D is powered on, battery charge and charging status will be shown in the upper right hand corner of the display.

Figure 3.3a
Inserting the USB Cable

Figure 3.3b
Power button illuminated when SVR3D is OFF and charging

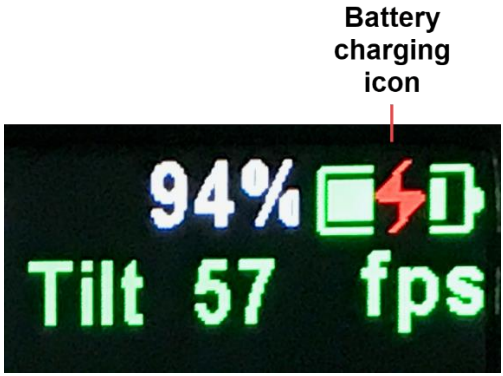


Figure 3.3c
Battery and charging status while SVR3D is ON and charging

- Best performance from your batteries is obtained when recharged at temperature between 50ºF (10ºC) and 113ºF (45ºC) . Recharging outside of that temperature range may result in reduced battery life or incomplete charging.

3.4 Battery Run Time

How long the SVR3D can operate between recharges depends upon several factors, age of the battery pack, and how the SVR3D is used. Generally, a fully charged SVR3D should run for approximately 1 week between recharges given normal use.

3.4.1 Auto Power Off

If enabled and If no trigger or key press is detected the SVR3D will automatically power off after 5, 10 or 15 minutes (depending on setting) in order to conserve battery life.

3.5 Replacing the Internal Battery Pack

The internal battery pack is not user serviceable or replaceable. Only a factory authorized service center can perform this service or replacement.

3.6 Connecting the USB Cable

The USB cable plugged into the SVR3D provides power to charge the internal batteries and for serial communication. The USB port on the SVR3D is located on the housing just in front and to the side of the trigger switch. With the USB cable plugged into the SVR3D and also plugged into a suitable power source (laptop, computer, usb charging device, etc) the SVR3D will attempt to charge the batteries even while operating.

3.7 Control Panel Functions

The operation of the SVR3D is controlled by the three-button key pad and the trigger.

4. Components

4.1 Control Buttons

Figure 4.1a
Faceplate (Display and Control Buttons)

Looking at the control buttons from left to right the buttons have thefollowing functions:

RCL
When the recall button (RCL) is pressed the unit enters recall mode whereby the operator can review a list of previous measured speeds. The recall mode is entered if the following is true:

- The unit is not transmitting
- A measurement is not currently taking place.

The recall mode allows the operator to recall the last measured speeds that the SVR3D calculated. After pressing the RCL button, a list containing the 8 most recent measured speeds will be displayed with the most recent speed displayed at the bottom and 8th most recent at the top. In addition to the speed, the time and date is also saved. Each press of the trigger brings an older sample in at the top and shifts the list down one level. Additional trigger pulls will continue shifting older saved data into view. Press the RCL button again to exit the recall screen.

PWR

The PWR button (center button) turns the radar on and off. When powered on the SVR3D will enter a power up cycle displaying a test screen, recalling the last saved operating parameters, placing the SVR3D radar into the last operating mode prior to being turned off and finally preparing the radar to take a measurement. The power up test screen is shown in Figure 4.1a and allows the user to check screen and backlight functionality. To power down the unit, the user must press and hold the power button down for a least 2 seconds. When you see the word “Powering Down” and “Release Power Button”, you must now release the power button and the unit will power down. If any settings or operating parameters were changed during operation, the SVR3D will save those settings into non-volatile memory.

MENU

Pressing the MENU button brings up the menu screen which allows the user to change certain operating settings. Repeatedly pressing the MENU button advances through the programmable features. Pressing the trigger button while a feature is selected (green color) allows the user to change parameters in a sub-menu under that particular feature.

Figure 4.1b
Menu screen after pressing the MENU button.

4.2 Display

4.2.1 SVR3D display

The SVR3D uses a large color sunlight readable display. Depending on the mode, the screen can show a variety of information from discrete digital values to spectrum and spectrogram displays. The brightness of the screen is automatically controlled but can be set to manual brightness levels as needed via the menu. (see LCD brightness menu settings)

4.2.2 SVR3D display after power on

When first turned on, the SVR3D performs a display check to allow the user to verify proper screen function. Figure 4.1a

4.2.3 SVR3D Common display icons for all modes

The SVR3D has several operating modes to give the operator a wide variety of water surface velocity information during a measurement cycle. The common display icons used for all modes of operation are:

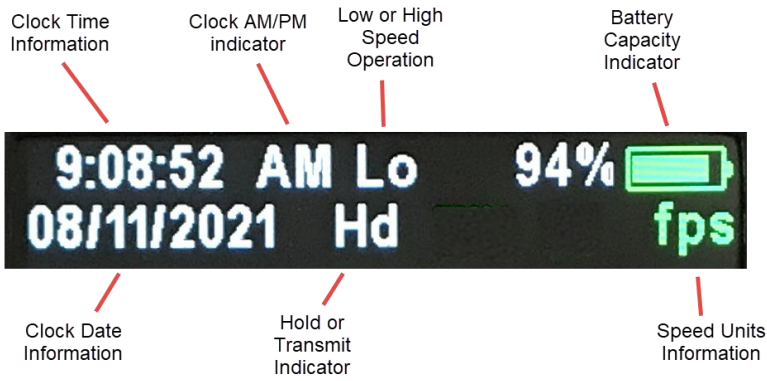


Figure 4.2.3
Common Icons for all SVR3D operating modes

Clock Time Information

SVR3D shows current time (if enabled)

Clock AM/PM indicator

SVR3D shows current AM or PM indicator. (If clock enabled and only applies if 12 hour mode is set)

Low or High Speed operation

SVR3D shows displays “Lo” if radar is set for Low Speed Operation.

SVR3D shows displays “Hi” if radar is set for High Speed Operation.

Battery Capacity Indicator

SVR3D shows current battery charge state as a percentage and as a graphic battery icon. The battery and percentage will change in color (going from Green to Red) as the battery loses capacity. When the battery voltage reaches 0%, the message “Low Bat” will display.

Clock Date Information

SVR3D shows current date (if enabled)

Hold or Transmit Indicator

SVR3D shows “Hd” for transmitter on hold (not transmitting).

SVR3D shows “Xt” for transmitter on.

Speed Units

SVR3D shows fps for “Feet per Second” standard units.

SVR3D shows m/s for “Meters per Second” standard units.

4.2.4

If the SVR3D is set for digital speed display operation (digital display of instantaneous and averaged speeds), the screen will appear as such:

Figure 4.2.4
Digital display operation with status indicator icons.

Standard Deviation Value

SVR3D shows the current standard deviation value.

Vertical Cosine Angle

SVR3D shows the current tilt angle (Cosine angle to water)

Instant Speed Value

SVR3D shows the current instant speed value (non-averaged).

Water Velocity Direction Arrows

SVR3D shows the current direction of instant and averaged speed value.

Average Speed Value

SVR3D shows the current averaged speed value.

4.2.5

If the SVR3D is set for spectrum operation (Spectrum display), the screen will appear as such:

Figure 4.2.5
Mode 1 Spectrum display with status indicator icons.

Speed Direction Indicator

SVR3D will show a direction indicator depending on the direction of the water flow. A downward pointing arrow (as shown) indicates the detected water flow is in the approaching direction. An upward pointing arrow indicates detected water flow is in the receding direction.

Water Signal Tracking Marker

The SVR3D will highlight the detected peak water velocity with a marker that will track the strongest signal located within the measurement area of the radar. The marker will track the strongest water flow return in real-time.

Water Velocity Spectrum Display Area

The SVR3D will show the spectrum of the water return by displaying all Doppler return frequencies from the water flow. The display shows increasing water velocities from left to right and increasing signal strengths from bottom to top. The signal strengths are color coded with blue being the weakest Doppler return with red color denoting a large return.

Average Speed Value

SVR3D shows the current averaged speed value.

4.2.6

If the SVR3D is set for spectrogram operation (Spectrogram display), the screen will appear as such:

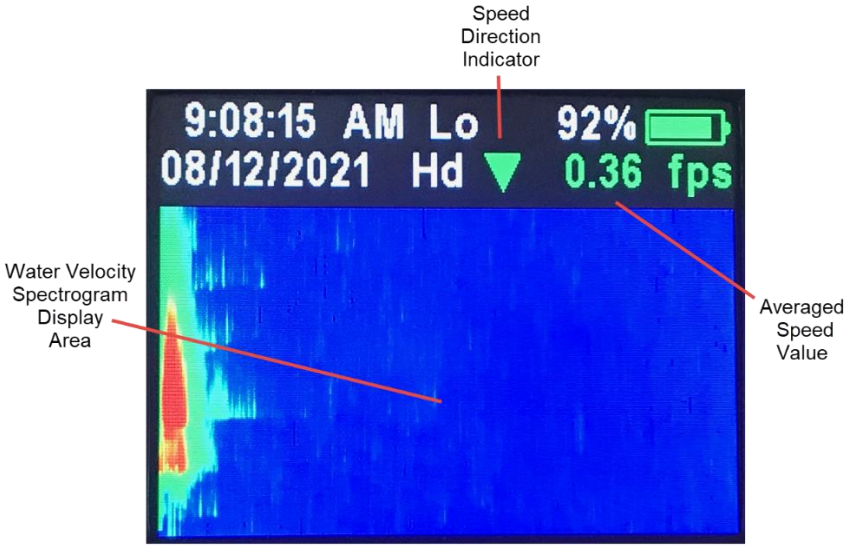


Figure 4.2.6
Mode 2 Spectrogram display with status indicator icons.

Speed Direction Indicator

SVR3D will show a direction indicator depending on the direction of the water flow. A downward pointing arrow (as shown) indicates the detected water flow is in the approaching direction. An upward pointing arrow indicates detected water flow is in the receding direction.

Water Velocity Spectrogram Display Area

The SVR3D will show the spectrogram display of the water return by displaying all Doppler return frequencies from the water flow over time. This display is similar to the spectrum display however, instead of the showing the signal strength in the vertical direction, the display now shows the spectrum over time in that direction. If the detected water flow is in the approach direction, the display will fill from the top to the bottom and alternately, if the detected water flow is in the receding direction, the display will fill from the bottom to the top. Like the spectrum display, the signal strengths are color coded with blue being the weakest Doppler return and red color denoting a

large return.

Average Speed Value

SVR3D shows the current averaged speed value.

4.3 Trigger

The radar transmits and receives microwave energy when you pull the trigger. To measure the flow velocity, pull and release the trigger. The radar will continue to transmit even though the trigger is now released. See Section 6.2 - Taking a Measurement.

4.4 Mounting Configurations

The radar is designed for hand-held operation. Optionally with an adapter attached to the integrated rail, you can mount it to a standard camera tripod.

5. Operating Modes

The MENU and SEL buttons on the SVR3D control panel lets you review and change settings. The radar gun will remember the settings you last set when it is turned off and will power up with them.

5.1 Main Menu

You can use the factory default settings that your SVR3D came with or you can select your own settings. To select a setting, repeatedly press the MENU button while looking at the main menu screen until the setting you want to change appears highlighted by the color green. Press the trigger switch to enter the sub-menu. Depending on the item, press the trigger switch or the MENU button to advance through the sub-menu selections for that setting (see detailed operation below). Pressing the trigger switch again on a sub-menu item allows you to adjust that setting.

Main Menu Settings: (use MENU key to cycle through)

(1) **MODE** (use trigger switch to move through settings)

a. Sub-menu Settings:

i. Approach only

ii. Recede only

iii. All

All

Approach

Recede

(2) **SENSITIVITY** (use trigger switch to move through settings)

a. Sub-menu Settings:

i. Min 1 setting

ii. 2 setting

iii. 3 setting

iv. 4 setting

v. 5 max sensitivity setting

Min Sens

Max Sens

(3) **DISPLAY MODES** digital display mode (use trigger switch to move through settings)

a. Sub-menu Settings

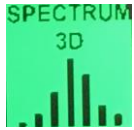
i. INST/AVG

ii. Spectrum

iii. Spectrum 3D or Spectrogram

Digital Display

Spectrum



Spectrum 3D

(4) **GENERAL** Settings (use trigger switch to enter sub-menu)

a. Sub-menu Settings (use MENU key to move through sub-menu options and then use trigger switch to select new setting)

i. Low/High speed operation

ii. Horizontal cosine setting. HCOS (0 to 60 degrees in 5 degree increments)

iii. Dimmer Auto, 1 – 8 (8 = Maximum brightness)

iv. Beep (On or Off)
v. Units (fps or m/s)
vi. Serial communication (COM X)
vii. Auto shutdown, Off, 5min, 10min, 15min
viii. Exit

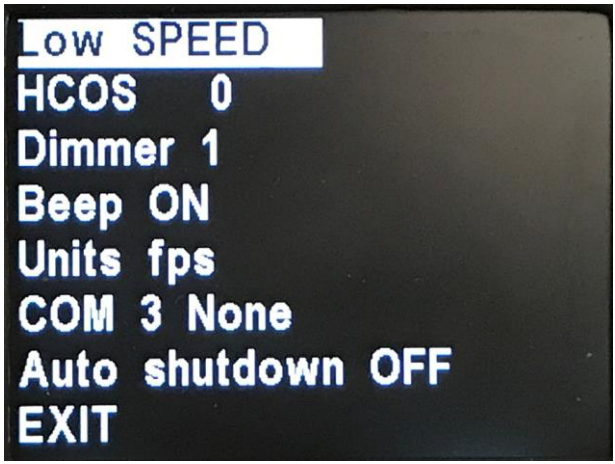


Figure 5.1a
General settings sub-menu selections.

(5) **CLOCK** settings (use trigger switch to enter sub-menu)

a. Sub-menu Settings
    i. Clock display On or Off
    ii. Year selection
    iii. Month selection, Jan to Dec
    iv. Date selection, 1 to 31
    v. 12 or 24 hour format
    vi. Hour selection, 1 to 12 or 1 to 24
    vii. Minute selection, 0 to 59
    viii. Exit

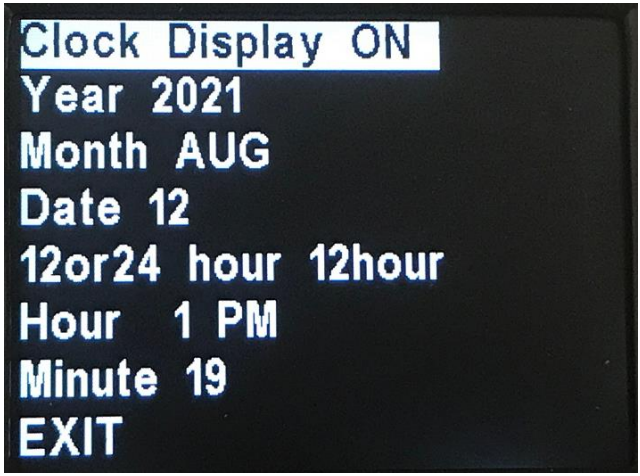


Figure 5.1b
Clock settings sub-menu selections.

(6) EXIT

Press trigger switch to exit main menu

6. Measuring Surface Velocity

6.1 Introduction

The SVR3D can detect water velocities approaching and receding from the radar and has a built in directional filter to help filter out random noise and sources of interference. It is important to place the SVR3D into the proper direction sensing mode matching the flowing water direction. If the water is flowing toward the radar than make sure the radar is in approach direction sensing mode. Conversely, if water is receding away from the SVR3D then place the radar into recede mode. If it is preferred to have the SVR3D automatically detect the direction then set the radar for ALL direction mode where the radar will automatically detect the flowing water direction and illuminate the proper direction arrows on the display.

To begin a velocity measurement, point the SVR3D radar gun at the water and pull and release the trigger (there is no need to continually press the trigger). Depending on the operational mode, the SVR3D will start taking samples of the moving Doppler shifted surface water. Samples are saved, averaged and the standard deviation calculated to determine when the velocity has converted to a stable reading.

6.2 Taking a Measurement

- Turn the SVR3D on by pressing the Power button. Once the displaysegment check is completed the gun is ready to use.
- Set the SVR3D for approach or recede mode as discussed or set to ALL directions if the user wants the radar to automatically detect the direction.
- Set the SVR3D for maximum sensitivity.
- Set the proper high/low speed range for the current water conditions.
- Pull and release the trigger. The SVR3D will start the measurement process. Initially the velocity calculated will vary but will start to converge to a stable value. If

the radar is in the digital display (Instantaneous and average mode) the SD (standard deviation) value will be displayed on the display. The SD value will start out at a high value and then start to drop towards zero. This indicates that the radar is converging to a nominal or mean velocity. The radar will continue to display the averaged value in the green display area. Once the SD value reaches a certain threshold, the radar will stop measuring and complete the measurement cycle. Once complete, the SVR3D will turn off the radar transmitter and hold the final measured speed in the green averaged display window. The SVR3D will also save this measurement reading to non-volatile memory for later recall. If the SVR3D is in spectrum or spectrum 3d mode, the measurement process remains the same but the SD value is not displayed on screen.

NOTE

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.

Because the SVR3D measures the Doppler Effect from the water surface, the SVR3D requires a certain amount of return energy. (See section 9.1 How Radar Works.) Particulate material and/or floating debris (seeding) on the surface and surface water roughness provide this effect.

The SVR3D 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 SVR3D reads all the velocities and averages them into a resulting single value, based on the amount of signal return to the antenna.

6.3 Recalling Previous Readings

The SVR3D can store up to a maximum of 32K readings. To recall a previously measured velocity, press and release the RCL button. A screen will display showing the last 8 measured readings with the most recent at the bottom (oldest at the top). Figure 6.3a shows an example.

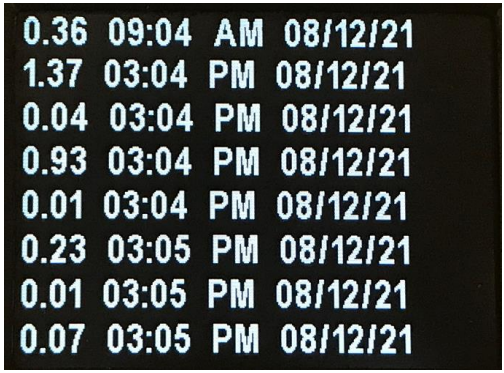


Figure 6.3a
Screen showing recalled speeds
with most recent at bottom.

To recall additional readings, press the trigger switch. Each trigger press will cycle in an older saved value at the top of the screen shifting all values down. Pressing the RCL button will exit the recall screen.

See section 11 for downloading and saving stored readings.

NOTE
The SVR3D will save the time and date along with each velocity immediately to non-volatile ram. Section 11 has information for downloading and saving stored readings.

7. Angle Compensation

Because surface velocity readings must be taken from a stationary, dry position, often a river bank or bridge, readings are necessarily affected by angle between the radar's beam and direction of water flow (see the section on Angular Interference).

The SVR3D compensates for this effect, referred to as cosine angle, both horizontally with user-programmable yaw correction and vertically with an automatic internal tilt sensor.

7.1 Vertical Angle Compensation

Figure 7.1
The SVR3D tilted pitch-down at 60º vertical angle

The SVR3D internal tilt sensor automatically compensates for the vertical angle at which you aim the gun to the target, up to 60°. 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 SVR3D indicates when the pitch-down angle exceeds 60° by displaying "tilt". While "tilt" appears in the display window, the radar gun does not record velocity measurements. To continue taking water surface velocity measurements, tilt the gun to an angle less than 60° until the "tilt" indicator no longer appears.

Only the digital display (Instantaneous and averaged speeds) shows the vertical cosine angle. The other modes, Spectrum and Spectrogram do not.

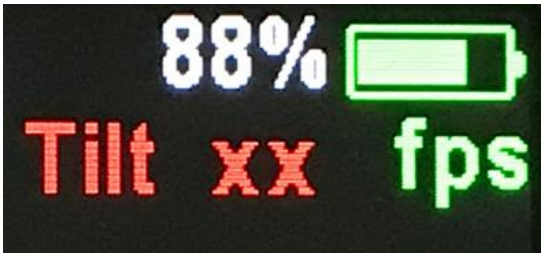


Figure 7.1
The display when the vertical (pitch-down) angle exceeds 60º

The vertical cosine angle will never need to be calibrated.

7.2 Horizontal Angle Compensation

Aiming the radar gun at the target at a horizontal angle greater than 0° creates a cosine error, which results in the radar displaying a spurious reading (Angles less than 9° impart an error of less than 1%). 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.

To set the horizontal angle compensation option, press the MENU button and then press the MENU button again until settings is highlighted (Gear wheel icon is highlighted). Pull the trigger and enter the settings sub menu. Press MENU again to move down the settings list until the HCOS line is highlighted. Press the trigger button to scroll through the available degrees.

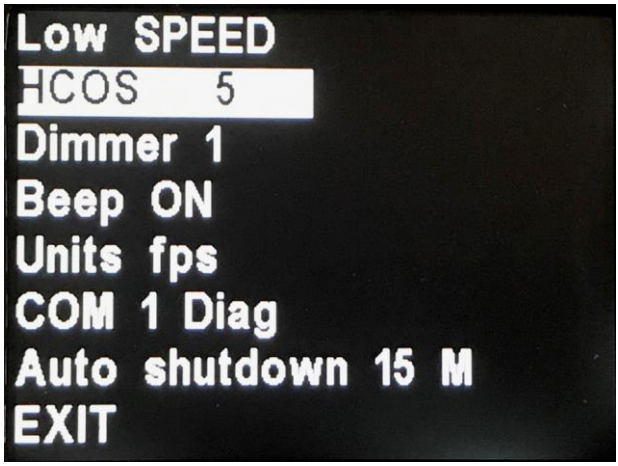


Figure 7.2
The horizontal angle setting for 5º

Each time you press the TRIGGER button 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60 appears, (resetting back to 0 when exceeding 60 degrees) representing the horizontal angle degrees in which you plan to hold the gun.

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.

Once set, use the MENU button again to scroll down to EXIT and press the trigger button.

8. Communications Port

The SVR3D has a USB communications port on the bottom of the radar next to the trigger switch. Use this port to upgrade the software as new releases become available and to receive serial speed data.

Figure 8 illustrates the port's location.

Figure 8
Port location.

The communications port sends serial data and has the following characteristics (8:n:1):

One (1) start bit, eight (8) data bits, No parity, One (1) stop bit. Transmission at 19200 baud and transmits data as ASCII symbols.

The Sr1 protocol is SSS.S<cr> (sent once every second during measurement cycle).

9. Performance Tips

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

9.1 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.

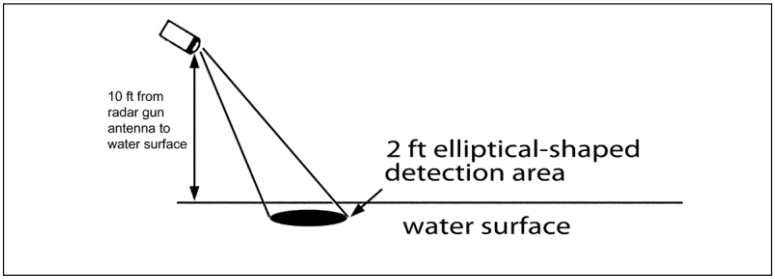


Figure 9.1
Radar beam detection area

When you point the SVR3D about 10 feet (3 meters) from the water surface, it measures an elliptical beam pattern of 2 feet (61 cm) 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.

9.2 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

9.2.1 Angular Interference (Cosine 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 target's directions of travel increases, the displayed velocity decreases. Ideally, an angle of zero (0°) is best.

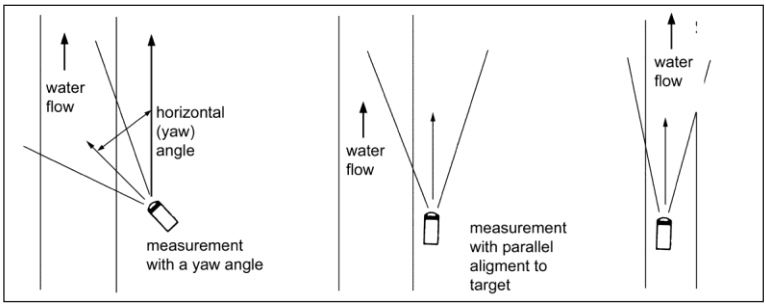


Figure 9.2.1
An angular error occurs when the target's path is not parallel to the radar antenna.

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 9.2.1, 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 7.2 Horizontal Angle Compensation.)

Actual velocity in f/s	Horizontal Angle Degrees										
	0	1º	3º	5º	10º	15º	20º	30º	45º	60º	90º
	Displayed speed:										
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 9.2.1
Actual and displayed velocities at antenna-to-target angles

Table 9.2.1 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 60° are automatically compensated for by the tilt sensor.

9.2.2 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 the source of interference.

9.2.3 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.

9.2.4 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.

9.2.5 Scanning

The SVR3D is designed for use while attached to a solid mount or handheld 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.

9.2.6 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 SVR3D 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.

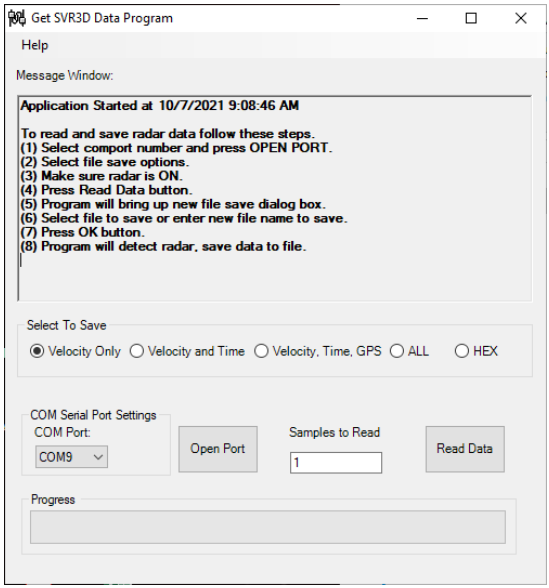
In these conditions, take measurements under a bridge, structure, or covered area where rain and snow do not dominate the measurement. Take measurements where the main channel flow is dominant. This eliminates the potential for errors from environmental factors.

10. 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

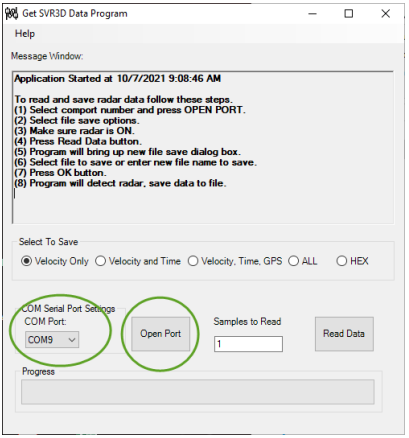
11. Data download

- SVR3D saved velocity information can be downloaded and saved using a special program called “Get Radar Data”
- Please contact your local Decatur Representative for this software.
- After running the program, you will see the following screen.



- Follow these steps to download data.

11.1 Select available comport # and press “open port”



11.2 Select required output data.

Selections include.

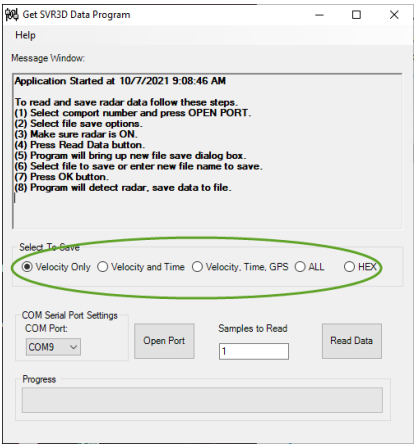
11.2.1 Velocity only

11.2.2 Velocity and time/date values

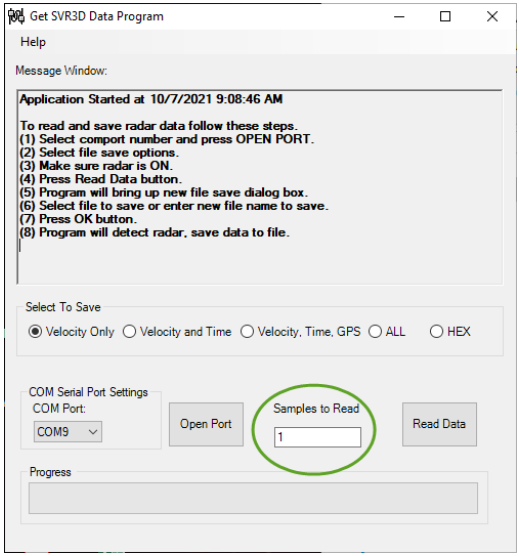
11.2.3 Velocity, time/date and GPS data

11.2.4 All radar meta data

11.2.5 Hex output for engineering/validation use.



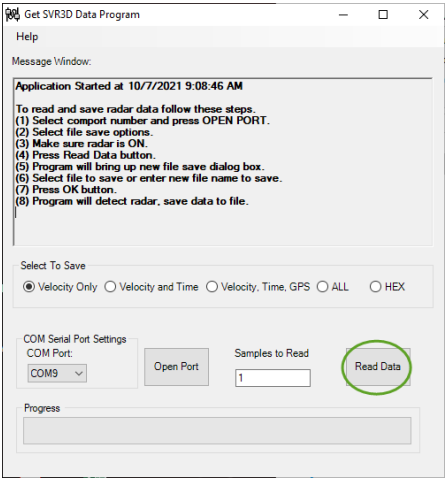
11.3 Select required number of samples to retrieve and store. Note, minimum value is 1, maximum value is 32,000.



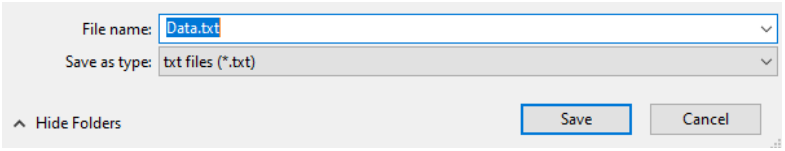
NOTE
Program will retrieve the last number of samples recorded by the radar starting at the most recent and moving backwards in time

11.4 Make sure the SVR3D radar is already on. (Powered up and running)

11.5 Press the Read Data button.

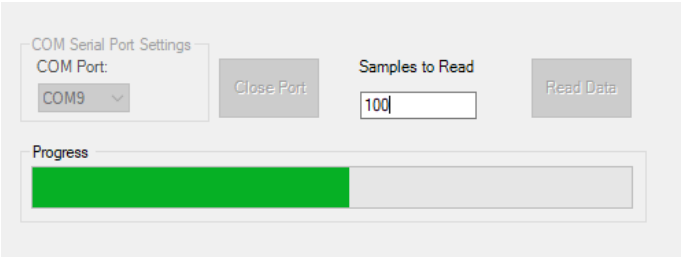


11.6 The following save data screen appears. Enter a file name to save data to and then press Save. Program will save data as a text file.



]

Program will now communicate with the SVR3D, showing data retrieval and saving progress.



11.7 Data save file structure.

11.7.1 **Velocity only save.** File consists of velocity data in text format with each sample on one line.

DD.DD (LF) DD.DD is saved velocity only data. Maximum data saved is 99.99
Example: 0.17

11.7.2 Velocity and Time/date

DD.DD , TIME DATE (LF) DD.DD is saved velocity data. TIME DATE is saved time/date stamp. Maximum data saved is 99.99. A comma is used to separate the data fields.
Example: 0.17, 01:23PM 10/06/2021

11.7.3 Velocity, Time/date, GPS

DD.DD , TIME DATE (LF), GPS DATA (LF) DD.DD is saved velocity data. TIME DATE is saved time/date stamp. Maximum data saved is 99.99. GPS latitude data saved as NEMA ddmm.mmmm format, GPS longitude data saved as NEMA dddmm.mmmm format. A comma is used to separate the data fields.
Example: 0.17, 01:23PM 10/06/2021, 0.0,S 0.0,W

11.7.4 All data

All SVR3D meta data saved during the sample.

Example: B, 0, 1, 0.17, 0, 54, 01:23PM 10/06/2021, 1.0, 0.0,S 0.0,W, 248, F8C22850

A comma is used to separate the data fields. Please contact Decatur for further information.

11.7.5 Hex format

All SVR3D data saved during the sample. Data is represented in Hex format.

Example: 0xB4011036 0x23C11810 0x2100000A 0x00000000 0x00000000 0x00000000 0x00000000 0xF8C22850

A blank space is used to separate the data fields. Please contact Decatur for further information.

12. Specifications

12.1 Measurement Specifications	
Lo Minimum Velocity	0.3 fps (0.1 m/s)
Lo Maximum Velocity	27 fps (8.5 m/s)
Hi Minimum Velocity	0.65 fps (0.2 m/s)
Hi Maximum Velocity	108 fps (33 m/s)
Measurement Accuracy	1% of Reading

Units of measure can be set to read in feet per second (fps) or meters per second (m/s).

12.2 Factory Default Settings	
Units	m/s (meters-per-second)
Horizontal Cosine	0°
Sensitivity	Max

12.3 Antenna Parameters	
Type	Ka-Band
Nominal Transmission Frequency	35.5 GHz
Nominal Horizontal Beamwidth	12°
Polarization	Circular
Nominal Microwave Power Output	12 mW
Maximum Aperture Power Density	<1 mW/cm^2

12.4 Environment	
Ambient 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 12°

12.5 Voltages	
Supply Voltage Range	6.4 to 8.4 VDC
Power Supply	Li-ion 4700 mAh battery
Low Voltage Threshold	6.4 VDC (battery)

12.6 Power Consumption	
Run time	10 hours continuous up to 26 hours intermittent usage.
Charge time	5 hours
USB Requirements:	BC1.2 compatible

a. Legal Requirements

13 Documents

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

b. 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 SV3D 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 fps (.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, as example below 2 fps (.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.

c. Warranty

TWO-YEAR RADAR WARRANTY

Decatur Electronics guarantees the radar 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 (excluding batteries) found to be defective, without cost to the owner, providing you return the unit to a Decatur authorized warranty service center.

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

For repairs, simply return the unit (transportation prepaid) directly to a Decatur authorized warranty service center. Refer to section 15 Service Return Procedure.

TWO-YEAR WARRANTY EXCEPTION

If you purchased the unit under a special buying program, such as a state purchase contract, etc., the above warranty may not apply. Please refer to the buying program contract for the appropriate warranty terms or contact Decatur Electronics.

If you are interested in an extended warranty contact your sales representative to discuss options.

d. Service Return Procedure

If you have questions, want a quick problem diagnosis, or need to return your unit or a component from your unit:

- Call Decatur Electronics by phoning 800.428.4315 and ask to speak with a Customer Service Representative.
- Explain to the Customer Service Representative the problem you are experiencing.
- Based on the information that you provide; the Customer Service Representative may be able to assist you or you may need to be referred to one of our Service Providers.

On warranty items Decatur Electronics will pay the freight (up to $10 U.S.) for shipping the system from the Service Provider to the customer. Please note that for any shipping charges above the initial
$10 (if you want the package shipped express or next day air) there will be an additional charge.

If you are referred to a Service Provider and your product is under warranty then once your product has been received, the Service Provider will investigate the problem. Once they have diagnosed the problem, they will repair the product and return it to you.

If you are referred to a Service Provider and your unit is not under warranty, then we recommend that you discuss the problem you are experiencing with the Service Provider and determine if an estimate is needed. Once your product has been received, the Service Provider will investigate the problem and you will be sent an estimate of cost, prior to any repair work being performed. After receiving the estimate, you can choose from the following options:

1. Approve the estimate and proceed with repair.
2. Decline the estimate and pay an estimate fee and return shipping.

3. Discuss other options with the Service Provider.

If your product is under warranty, it will automatically be repaired and sent back to you.

e. How to Order Additional Products

You can order upgrades to the SVR3D (when available) as well as cases and tripods. To see product descriptions or order products, see the Decatur Electronics Web site at www.DecaturElectronics.com or call the sales office at 800.428.4315.

www.DecaturElectronics.com

800.428.4315