Waterproof Portable Radar Flow Meter

User Manual

The LOW-SVR radio current meter is an advanced velocity measurement instrument that uses radar technology to achieve simple and fast non-contact surface velocity measurement. The instrument is compact, lightweight, and easy to carry, making it very suitable for on-site testing of difficult to use submerged measuring instruments such as floods or rapids.

The LOW-SVR radio current meter integrates many leading technologies. For example, using precision planar narrowband array radar sensors, FFT digital signal processing, flow velocity direction recognition, automatic correction of vertical and horizontal angles, etc; The maximum flow velocity that this instrument can measure is 20m/s, with high detection sensitivity. The flow meter is equipped with a large color LCD screen and embedded with guided menu software, which is very convenient for users to operate.

We sincerely hope that users can read this manual before using the LOW-SVR radio current meter, so that you will have a better understanding of how to use this advanced speed measuring instrument. This manual provides a detailed introduction to the usage, maintenance, and precautions of the LOW-SVR radio current meter.

Flow-SVR User Manual

☐ Precautions and Usage Restrictions

Attention: Our company's product design and manufacturing are safe and reliable. Please use them correctly (according to the text instructions shown) and fully comply with the following precautions to avoid harm to the instrument and human body.

pay attention to
The user of this manual must be aware of the potential hazards that this instrument and its accessories may pose.
All operators should be familiar with the safety instructions and warnings in this chapter before operating this instrument. If the operating instructions are not followed, the performance of the instrument may be reduced.

legend：

⚠ Explanation: Attention/Warning

Please read carefully the precautions related to transportation, use, and maintenance.

The following precautions should be taken：

Operating environment and precautions for electricity usage

⚠ Warning: Do not use the instrument in places where there are or may be flammable and explosive gases。

⚠ Caution: Do not place the instrument in contact with the water surface or in water。

⚠ Caution: Do not place the instrument in extreme temperatures to avoid static electricity.

Instrument operation

⚠ Attention: During the use, storage, or transportation of the instrument, it should be handled with care and not dropped or damaged.

BATTERY

⚠ Warning: Please use the lithium-ion rechargeable battery and charger specified in section 2.4.

⚠ Warning: Please charge the battery promptly when it is low.

⚠ Attention: The disposal of used batteries must comply with the regulations of your region.

Keyboard buttons

⚠ Caution: Do not press the instrument buttons too hard.

RS485 interface

⚠ Warning: Computer devices connected to RS485 interfaces must comply with BS EN60950/IEC950 standards.

Instrument components

⚠ Warning: This instrument is not equipped with spare parts and cannot be disassembled without authorization.

Hazardous substance management

Please comply with the regulations on hazardous substance management and dispose of FLOW-SVR as waste electronic/electrical

products.

⚠ Warning: Do not dispose of used instruments into classified waste or urban garbage。

Usage restriction regulations

FLOW-SVR Design to meet the requirements of regularity and safety。

Declaration

FLOW-SVR Design to meet and comply with the requirements of low voltage indicators.

CATALOGUE

Introduction

1.1 The LOW-SVR handheld radio current meter uses K-band radio waves for non-contact velocity measurement of rivers, sewage, mud, and oceans. The instrument is compact in size, handheld, powered by lithium-ion batteries, and easy to use. Not corroded by sewage or disturbed by sediment, the non-contact measurement ensures the safety of the measurer.

1.2 The instrument includes a highly sensitive planar narrowband radar probe and an angle meter, and is operated handheld. The embedded operating software is menu based and easy to operate.

1.3 This manual provides a detailed introduction to the usage and maintenance of the LOW-SVR radio current meter.

- **Instrument Features**
- For single use, weighing less than 1kg, can be measured handheld or placed on a tripod (optional);
- English interface, easy to operate;
- Non contact operation, not affected by sediment or water corrosion;
- Automatic correction of horizontal and vertical angles;
- Multiple measurement modes, able to measure quickly or continuously;
- Built in large capacity lithium-ion battery, capable of continuous use for more than 10 hours;
- Multiple charging methods are available, including AC, in car, and portable power banks for charging。

Operating principle

The waterproof portable radar flow meter can perform flow velocity detection in three modes: single, continuous, and flow. This instrument is based on the principle of

Doppler effect:

When the radar wave transmission source and the target are relatively stationary, the receiving frequency and transmission frequency are equal:

$$f_{Receive} = f_0 = \frac{c_0}{\lambda}$$

When the position of the transmitting wave source is fixed and the moving target moves towards the direction of the wave source at a speed relative to the transmitting wave source, the speed of the radar wave increases for the moving target $c_0 + v$, The number of wavelengths of radar waves that reach a moving target per unit time, i.e. the receiving frequency:

$$f'_{Receive} = \frac{c_0 + v}{\lambda}$$

doppler shift $f_D = f'_{Receive} - f_0$;

Movement speed of moving targets: $v = f_D \cdot \lambda = \frac{f_D}{f_0} \cdot c_0$

f_D When the value is positive, it indicates that the velocity is in the same direction as the transmitted wave, while when the value is negative, it is in the opposite direction; If the speed of the moving target is proportional to the frequency shift, then there is:

$$v = \left(\frac{f'_{Receive}}{f_0} - 1 \right) \cdot c$$

When measuring the speed of a flowing river surface, the LOW-SVR radar emits microwaves towards the water surface. When encountering waves, water bubbles, or floating objects (the measured moving target), the microwaves are absorbed and reflected. A part of the reflected wave is received by the probe and converted into an electrical signal, which is

processed by the measurement circuit to measure the Doppler frequency shift. Based on the above principle, the flow velocity of the water body can be calculated. Due to the fact that the direction of radar wave emission and the direction of water flow usually have a certain angle, and the distance required for transmission and reception to travel back and forth, it is necessary to correct the above results. The actual water flow velocity after correction is：

$$v = \frac{1}{2}\left(\frac{f'_{\text{Receive}}}{f_0} - 1\right) \cdot c_0 / \cos\alpha$$

1.4 Basic Operations

Instrument Structure

Appearance of the instrument： 1- Radio wave transmitter head 2- trigger 3- handle 4- operating button 5- LCD screen

1 - Radio Wave Transmitter

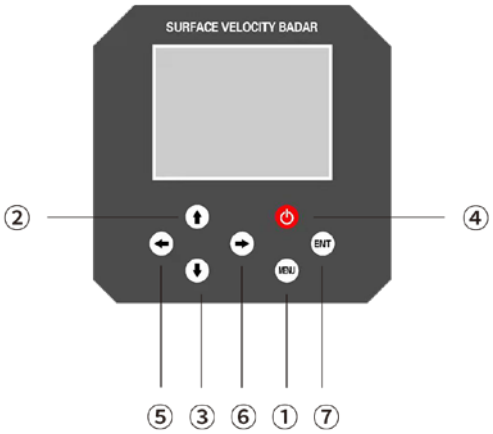
2 - Trigger

3 - Handle

4 - Operation buttons

5 - LCD Screen

1.5 Key Functions



Picture 2 Introduction to Key Functions

Serial Number	key	legend	describe
①	Menu key	M	Return to the higher-level menu, switch between operation/monitoring
②	Navigation keys (up)	▲	Move cursor up
③	Navigation keys (below)	▼	Move the cursor down
④	Power button	⏻	on/off
⑤	Navigation key (left)	◀	Move the cursor to the left
⑥	Navigation key (right)	▶	Move the cursor to the right
⑦	OK key	ENT	Enter the sub menu and confirm

1.6 Battery

This instrument uses lithium-ion rechargeable batteries.

Tip: To ensure better performance, please use our high-quality original lithium-ion batteries; When low battery is displayed, please charge the battery immediately.

⚠ Warning: Please use the charger provided by our company for charging; Using chargers without 3C certification may reduce battery life or pose safety hazards, please be sure to pay attention!

⚠ Attention: It is necessary to charge the battery regularly (every 3 months) to ensure the service life of lithium-ion batteries.

Power on

Long press (power button) to turn on the device 。Display the flow velocity measurement interface and wait for user operation.

1.7 Tip: If the battery is low, it will not turn on; Or it can automatically shut down after being turned on. If such a situation occurs, please charge the battery in a timely manner.

Battery level prompt

The battery label indicates the battery status: the higher the energy bar, the more green it is, indicating a higher battery level; the lower the energy bar, the more red it is, indicating a lower battery level. It is recommended to shut down and charge when the voltage is below 10V.

⚠ Attention: High temperatures can shorten battery life. Please store the instrument in a cool and dry place.

⚠ Attention: Recharging after the battery is completely depleted will damage the battery life.

Shutdown

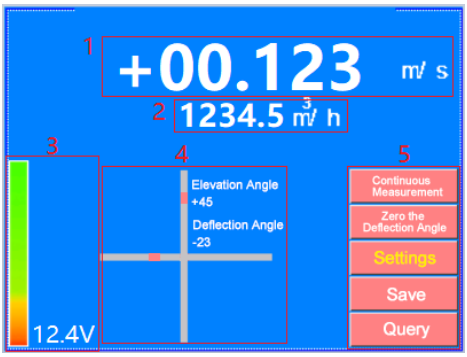
The device works in any state and can be shut down directly by pressing the button ⏻, After shutting down, the system power is completely disconnected without consuming battery power。

The instrument automatically shuts off the power when there is no operation within the specified time. The time can be set by the customer, with a default of 300 seconds.


SURFACE VELOCITY RADAR
+00. 000 m/s
0. 0m³/h
Elevation Angle -54
Deviation Angle +01
Continuous Measurement
Zero the deflection Angle
Settings
Save
Query
10. 6v
ENT
MENU

Menu Operations

After turning on the instrument, enter the default instrument operation interface. The five options on the right side of the screen are user operable。Press the "up" and "down" keys to move the cursor. Press the "left" and "right" keys to change the working status of the instrument, or press the "ENT" key to enter the secondary menu for more settings/query content.



Main operating interface

Region 1:

The real-time flow rate measured by the instrument. Unit meter per second.

Region 2:

The real-time water flow rate calculated based on the input river section size and real-time flow velocity. Unit meter per second.

Region 3:

Battery level. The reasonable range is 9V to 12.6V. It is recommended to charge quickly if it is below 10V.

Region 4:

The horizontal/vertical compensation angle measured by the internal gyroscope of the instrument

Elevation angle: the angle at which the instrument rotates vertically

Deviation angle: the angle at which the instrument rotates horizontally

Region 5:

This is the user's operable part

1. Switch measurement methods: single measurement/continuous measurement/average measurement

2. Whether to enable horizontal deviation angle correction: zero deviation angle/invalid deviation angle
3. Press the "ENT" key with the cursor to enter the settings page
4. Press the "ENT" key here to save the current real-time data
5. Press the "ENT" key here to enter the historical data query page

Operation of Three Measurement Methods

1. Single measurement

Press the trigger and the instrument will start working. After 3 to 6 seconds, the flow rate value will reach a stable level.

Release the trigger and the instrument stops working, and the flow rate value returns to zero.

2. Continuous measurement

In continuous measurement mode, users do not need to press the trigger. The instrument will maintain its measuring motion continuously. The flow rate value keeps refreshing.

3. Average measurement

In the average measurement mode, each time the trigger button is pressed, the instrument will continuously measure for 20 seconds without interruption. After the measurement is completed, the normally distributed values are taken from the flow rate value sequence obtained during the measurement period and averaged to obtain the final displayed value.

Operation: Press the "left" or "right" key to cycle through the three measurement modes。

1，The significance and operation of compensating angle 1.8

2. Coordinate axis graphics

The XY axis coordinate values are used as the elevation angle values and the visual display of the deflection angle values. Corresponding to two values one by one.

3. Elevation angle

Elevation angle is the angle between the normal of the instrument probe plane and the motion trajectory of the measured target in the vertical plane. Elevation angle does not require

calibration and cannot be operated.

4. Deviation angle

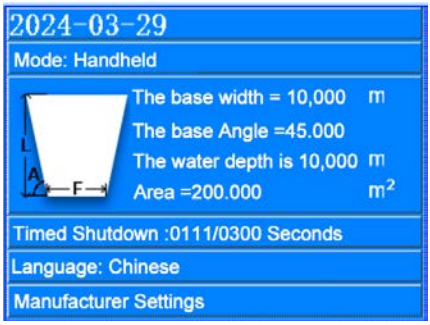
Deviation angle is the angle between the normal of the instrument probe plane and the motion trajectory of the measured target in the horizontal plane.

Example of deviation angle operation: For example, when a person stands on the bank to measure the flow velocity of a river, they first switch to the "zero deviation angle" state, then make the instrument parallel to the river, and then press "ENT". At this point, it is equivalent to calibrating the horizontal rotation angle of the instrument, and the deviation angle value becomes zero. Then, make the instrument face the center of the river, and the instrument will calculate the angle between itself and the flow direction of the river as a compensation basis for converting the original velocity to the actual flow velocity.

If angle compensation is not needed, press the "left" or "right" key to switch to the "angle invalid" state. At this point, the deviation angle value will remain at zero.

System Settings Interface

1. Move the cursor to the "Settings" option on the instrument operation interface and press the "ENT" key to enter the system settings page. Press the "up" and "down" keys to move the cursor.
2. Press the "ENT" key on the item that needs to be changed to enter the numerical input state.
3. In numerical input mode, press the "left" and "right" keys to move the cursor. Press the "up" and "down" keys to change the value. Press the "MENU" key to cancel the input or press the "ENT" key to save the input.



PICTURE 4 System settings interface

1. System time: Each saved data is distinguished and sorted based on decreasing system time.

2. Mode: Handheld/Fixed. Decided the behavior of the gyroscope inside the instrument. Handheld devices must be selected.

3. River section size: If accurate and realistic flow values are required on the instrument operation interface, the interface size must be set accordingly. Note that the base angle is the angle between the extension line of the trapezoidal base and the hypotenuse. The area is automatically calculated based on the input values of bottom width, bottom angle, and water depth.

4. Scheduled shutdown cycle: The denominator represents how many seconds the instrument will automatically shut down after no operation. The molecule is timed in a decreasing manner, and when the time drops to zero, it will immediately shut down. Press the "ENT" key to enter numerical input mode and change the denominator value, then press the "ENT" key to confirm.

2. Language of the menu: Press the "ENT" key here, then use the "up" and "down" keys to switch between Chinese and English. Press the 'ENT' key to confirm the changes.

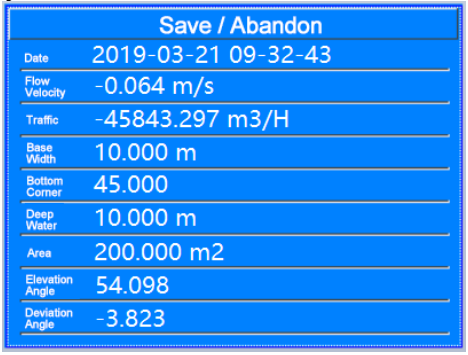
3.5 Manufacturer settings interface

1. Flow rate: The processed flow rate measured by the sensor divided by the original flow rate.
2. Signal strength: The amplitude of the echo received by the sensor.
3. Sensitivity: The sensitivity of the sensor. Strongest 1, weakest 10.
4. Intermediate frequency gain: The amplitude at which the original signal is amplified. Maximum 1, minimum 6, 0 are automatically adjusted by the program.
5. Transmission power: The power of electromagnetic waves emitted by the antenna. Maximum 0, minimum 7.
6. Filtering queue: The length of the data queue for buffering and filtering raw data. Maximum of 512, minimum of 8.
7. Sampling rate: The speed at which raw data is obtained per second. Maximum of 120 per second. At least 10 per second.
8. Restore to default. After customizing the parameters of the sensor, if the device is working abnormally, it can be restored.

Press the "up" and "down" keys to switch to the desired entry. Press the "ENT" key to enter the settings. Press the up, down, left, and right keys again to change the value. After making the changes, press the "ENT" key to confirm, or press the "MENU" key to cancel the changes.

3.6 Data saving interface

1. Move the cursor to the "Save" option on the instrument operation interface and press the "ENT" key to enter the data saving page. The displayed data is the current measurement data.
2. Press the "left" and "right" keys to move the cursor and switch between "save" and "discard".
Press the "ENT" key to select whether to save the current data or not.

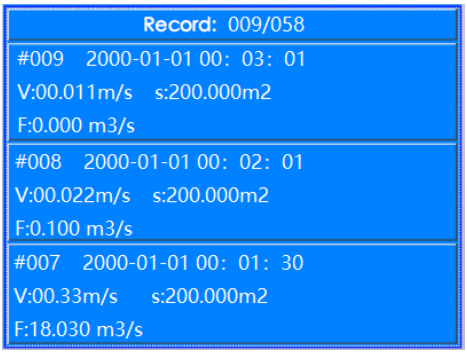


PICTURE 5 Data saving interface

3.7 Data query interface

1. Move the cursor to the "Query" option on the instrument operation interface and press the "ENT" key to enter the data
According to the search page.
2. Press the "left" and "right" keys to scroll through the page and view the records. Every ten records form one page. Press the "up" and "down" keys to scroll through the records one by one.

3. Press the "MENU" button to return to the instrument operation interface.



PICTURE 6 Data query interface

The score after the first line 'record', where the numerator represents the sequence number of the currently displayed record. The denominator represents the total number of records.

The screen displays three records simultaneously, with the first line of each record indicating the date it was saved. The second line shows the flow velocity (V) and river area (S) of the record. The third line is the traffic (F) of the record.

Use and maintenance

FLOW-SVR No special maintenance is required by operators or users。

Cleaning

Wipe with a dry or slightly damp soft cloth.

⚠ Warning: Do not wipe with a damp cloth or rinse the instrument with water.

⚠ Caution: Do not use solvents or strong cleaning agents to clean the instrument, as this may damage the plastic casing of the instrument and reduce its performance.

Battery Charging

To ensure accurate results, please charge the instrument immediately when the "low battery" sign appears.

Specification requirements for external chargers：12.6V⊛1A；

A complete charge takes about 6 hours. Please charge it promptly before use；

⚠ Warning: Please use the charger provided by our company for charging; Using chargers without 3C certification may reduce battery life or pose safety hazards. Please take precautions!

⚠ Attention: It is necessary to charge the battery regularly (every 3 months) to ensure the service life of lithium-ion batteries.

Warranty

4.1 The supplier guarantees that the LOW-SVR instrument has no defects in performance and quality at the time of sale. In case of any issues that arise during use, the instrument may be repaired or replaced according to different circumstances under correct usage conditions.

4.2 Please contact the supplier before repairing the instrument; The returned product must be packaged intact to ensure that the instrument is not damaged during transportation.

Warranty Period

4.3 The free warranty period enjoyed by users is one year (calculated from the date of purchase). For instruments that exceed the warranty period, the company will provide paid repairs.

Warranty Scope

During the warranty period, our company only provides free warranty for faults caused by product quality.

Malfunctions caused by the following situations are not covered by the warranty：

- Exceeding the warranty period；

- Damage caused by failure to follow the requirements of the product manual for use and maintenance；

- Damage caused by unauthorized repairers dismantling the machine (repairing without authorization)；

- Other non quality related failures caused by natural disasters, mechanical damage, etc。

5 Terminology and Abbreviations

m/s	Flow rate unit
LCD	display
Li	Lithium ion rechargeable battery
m^3/s	flow unit

5 Technical Parameters

convention：

Temperature range for use： -30~+70℃

Relative humidity range： 20%~80%

Storage temperature range： -30℃to70℃

Instrument details

measuring range： 0.05 ~ 20 m/s

measurement accuracy： ±3%±0.03m/s

Radio wave emission angle： 12°

Standard power for radio wave transmission： 10mW

Radio frequency： 24GHz

Angle compensation： Vertical angle automatic

Storage size： 1000 measurement results

battery

battery Type

Rechargeable lithium-ion battery

Battery capacity（2800mAh）

Standby state (at 25 ℃) for more than 6 months

Continuous work for more than 10 hours

6 AppendixA

1. Q: Why is my water surface velocity measurement reading much higher than the last reading?

Answer: If the water surface is smooth, not rough, or has very low roughness, the LOW-SVR may not receive enough return radar energy from the water surface. Attempt to measure near the water surface, or measure on water surfaces with turbulence, roughness, or even floating objects.

2. Question: I just completed a measurement and moved to another area of the river. The current measurement results seem to have significant differences.

Answer: Check and confirm if the horizontal (deviation) angle compensation has been adjusted. At high flow rates, incorrect or inappropriate angle input may result in significant differences in FLOW-SVR velocity readings.

3. Q: The water surface has good roughness and ripples, but the reading of LOW-SVR is still high and/or far below my expectations.

Answer: Make sure not to measure too far from the water surface. The specific distance is sometimes difficult to determine because the measurement result is a function of the signal quantity returned to LOW-SVR. The returned signal is directly related to the distance of the LOW-SVR from the water surface and the roughness of the water surface. The closer the position of LOW-SVR to the water surface, the better the measurement effect, even at low water flow speeds. You need to point to the same location in multiple measurements. Try to minimize the horizontal

(deviation) angle to the greatest extent possible during measurement. In addition, different vertical (downward) angles are adopted in multiple measurements to determine the consistency of readings. Ensure a stable grip on the LOW-SVR and maintain the same angle during measurement.

4. Question: I am measuring a water flow velocity that is visually below 0.60m/s, but the reading is higher than expected.

Answer: Check the impact of wind on the water surface. The measurement of low-speed water flow (such as water flow below 0.50m/s) may be affected by wind. If possible, measure in two directions, one towards the direction of the water flow towards the FLOW SVR and the other away from the FLOW SVR. Attempt to point the FLOW SVR towards the same location for measurement.

5. Q: I measure water surface velocity during floods. The water flow is very fast, the water is turbulent, the surface is rough, and there are many fragments and floating objects. Can accurate measurement results be obtained using LOW-SVR in this situation?

Answer: Sure. The turbulent water flow, combined with floating debris on the surface of the water, can provide a good return signal for the LOW-SVR. Please note that in this case, LOW-SVR will read multiple speeds of different sizes in different directions. Flow-SVR will measure these speeds and obtain the average speed.

6. Question: During measurement, the speed value changes every second.

Answer: Each measurement of LOW-SVR lasts for 60 seconds, and the display screen updates the test data every second during the measurement

process. This data is the result of multiple flow rate samples taken from the water surface velocity; After the 60 second measurement is completed, the screen displays the average speed within 1 minute.

7. Question: During measurement, there are issues such as high and low readings.

Answer: Ensure that the position of the LOW-SVR remains stable during measurement. The angle sensor that can compensate for vertical (downward deviation) and horizontal cosine velocity errors is highly sensitive. If the LOW-SVR vibrates or bounces, it will cause incorrect angle readings.

7 Appendix B

System Component Table

Product Name	Specifications	Quantity	Remarks
2 **FLOW-SVR** SURFACE VELOCITY RADAR	1	1	
FLOW-SVR chinese operation instructions (We will provide an electronic version of the English instructions, and the buyer will provide their email address)	1	1	
warranty card	1	1	
goniometer	1	1	built-in
rechargeable battery	1	1	built-in
charger	1	1	12V 1A
tripod	1	1	Optional