Ultrasonic Doppler Flowmeter



Supmea®

Headquarters

5th floor,Building 4,Singapore Hangzhou Science Technology Park,No. 6 street,
Hangzhou Economic Development Area,Hangzhou 310018,China

Singapore

2 Venture Drive #11-30 Vision Exchange Singapore

info@supmea.com
www.supmea.com
Supmea Automation Co.,Ltd.

Foreword

- Thank you for purchasing our products.
- This manual is an instruction manual for the product's various functions, wiring methods, setup methods, operation methods, troubleshooting methods, etc.
- Please read this manual carefully before operation and use this product correctly to avoid unnecessary losses due to incorrect operation.
- After you have finished reading, please keep it in an accessible place for your reference during operation.

Note

- The contents of this manual are subject to change without notice due to feature upgrades or other reasons.
- We strive to ensure the accuracy of the information in this manual. If you find any errors, please contact us.
- The contents of this manual are strictly prohibited from being reproduced or copied.
- This product is prohibited from application in explosion-proof environments.

Version

U-SUP-FSD300-EN1

Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

About this manual

- Please ensure the instrument operators have a careful reading of this manual.
- Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility for the device's suitability for any special or personalized purpose lies solely with the operator.

Precautions for product protection, safety, and modification

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipping the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for use in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:



Hazard: Failure to take appropriate precautions may result in serious personal injury, product damage, or major property loss.



Warning: Pay special attention to critical information related to the product or specific sections of this user manual.



- Confirm whether the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.
- Please check the grounding protection regularly. Do not operate the

product if you think that the protection, such as grounding protection and fuses, is inadequate.

- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life, and fire.
- Please strictly follow the instructions in this manual; failure to do so may damage the product's protective devices.



- Do not use the instrument if it is found damaged or deformed upon opening the package.
- Prevent dust, wire ends, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.
- Each part of the instrument has a certain service life, which must be maintained and repaired regularly for long-term use.
- If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.
- Disconnect the instrument when it is not in use.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

Disclaimer

- The company does not make any guarantees for terms beyond the scope of this product warranty.
- This company is not responsible for damage to the instrument, loss of parts, or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Items	Quantity	Note
1	Ultrasonic Doppler Flowmeter	1	
2	User Manual	1	
3	Test Certificate	1	

After opening the box, please confirm the scope of delivery before starting the operation. If you find that the model and quantity are incorrect or there is physical damage to the product's appearance, please contact us.

Contents

1 Overview 1
1.1 Introduction 1
1.2 Measuring Principle 1
1.3 Features 3
2 Technical Parameters 4
3 Structure and Dimensions 6
3.1 Sensor size 6
3.2 Main Unit Dimensions 7
3.3 Weight 7
3.4 Material 7
4 Installation 8
4.1 Installation of Main Unit 8
4.2 Installation conditions and locations of the Sensor 8
4.3 On-site Installation of Brackets and Wiring 13
4.4 Installation Notes 14
4.5 Installation Steps 15
5 Electrical Connection 16
5.1 Wiring Precautions 16
5.2 Sensor Cables 16
5.3 Main Unit Wiring Terminals 16
6 Operation 18
6.1 Display and Operation Unit 18
6.2 Main Menu 19
6.3 Setup Instructions 19
7 Fault Analysis and Troubleshooting 23
8 Maintenance 24
8.1 Cleaning 24
8.2 Maintainance 24
8.3 Repair 24
9 Warranty and After-Sales Service 25
Appendix A Communication Protocol 26
A.1 Communication Protocol 26
A.2 Register Address 26
A.3 Examples of Communication 30

1 Overview

1.1 Introduction

This ultrasonic Doppler flowmeter is designed to measure the flow velocity and flow rate in natural water bodies, channels, or pipelines.

Adopting the ultrasonic technology to detect flow velocity, the flowmeter locates the measuring point in front of the flowmeter without disrupting the flow field. It offers high accuracy and linearity of flow measurement. It can measure not only instantaneous but also average flow velocities. No rotary components, the instrument is immune to blockage by sediment or entanglement by aquatic plants. The probe is robust and durable, ensuring reliable operation without issues such as sediment deposition or entanglement by weeds and debris. It is particularly suitable for rivers with high suspended sediment content, abundant floating vegetation, or extremely harsh ice-season conditions.

1.2 Measuring Principle

The measuring principle of an ultrasonic Doppler flowmeter is based on the Doppler effect in physics. According to the acoustic Doppler effect, when there is relative motion between a sound source and an observer, the frequency of the sound perceived by the observer will differ from the frequency emitted by the sound source. This frequency change caused by relative motion is proportional to the relative velocity of the two objects. In the ultrasonic Doppler flow measurement method, the ultrasonic transmitter is a fixed sound source, and the solid particles moving with the fluid act as the "observer" with relative motion to the sound source; they simply reflect the ultrasonic waves incident on the solid particles back to the receiver. The frequency difference between the emitted and received sound waves is the Doppler frequency shift caused by the movement of solid particles in the fluid. Since this frequency difference is proportional to the fluid velocity, the flow velocity can be determined by measuring the frequency difference, and thus the flow rate can be obtained. Therefore, a necessary condition for ultrasonic Doppler flow measurement is that the fluid medium being measured should be a two-phase medium containing a certain number of solid particles or bubbles that can reflect sound waves. This working condition is also a

major advantage, as this flow measurement method is suitable for measuring two-phase flows, a problem that other flowmeters struggle to solve. Therefore, as a highly promising two-phase flow measurement method and flowmeter, ultrasonic Doppler flow measurement is currently being increasingly applied.

According to the Doppler frequency shift equation, the magnitude of the frequency shift is:

$$\triangle F_d = \frac{2F_0 \bullet V \bullet \cos\theta}{C - V \bullet \cos\theta}$$

Formula :

△Fd — Doppler frequency shift

F0 — Frequency of emitted ultrasonic waves

C — Speed of sound in water

V — water flow velocity

θ — The angle between the transmitted and received beams relative to the direction of the river flow.

C >> V·cosθ

The ultrasonic emission frequency is constant, and the transducer angle remains fixed after installation, so K is also constant. As shown in equation <3>, the flow velocity V is directly proportional to the Doppler frequency shift △Fd and the sound velocity C of water. Therefore, the flow velocity can be calculated by detecting the Doppler frequency shift △Fd and the sound velocity C of water. In this instrument, C is derived from the temperature value.

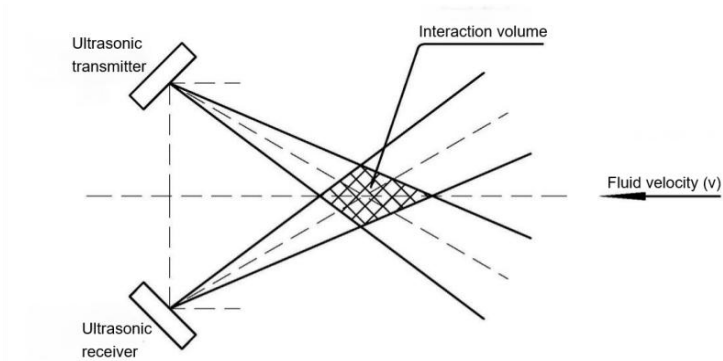

Fig.1 Sound field diagram

1.3 Features

- High measurement accuracy with a wide measuring range; capable of detecting both weak and strong flows.
- High sensitivity and resolution; not limited by minimum start-up flow velocity.
- Fast response time; capable of measuring both instantaneous and average flow velocity.
- Excellent measurement linearity with no K or C calibration coefficients required.

2 Technical Parameters

Table 1 Technical parameters

Performance parameters		
Measured variables	Flow velocity, liquid level, temperature	
Measuring range	directional flow **without** flow direction recognition; absolute values of flow velocity and flow rate.	Flow velocity: (0~10) m/s Liquid level: (0~10) m
	Bidirectional flow **with** flow direction recognition; flow velocity and flow rate displayed with polarity.	Flow velocity: (-10~10) m/s Liquid level: (0~10) m
	temperature	(-5～60) ℃
Accuracy	Flow velocity: 1.0% ± 0.01 m/s Liquid level: 0.2% ± 0.01m Temperature: ±1℃	
Resolution	Flow velocity: 1 mm/s Liquid level: 1mm	
Response time	10s～60s Note: The smoothing coefficient is set through the communication protocol. The larger the value, the faster the smoothing flow rate responds.	
Operating frequency	2MHz	
Transmit power	1W	
Protection level	IP68	
Output		
Transmitter output	Output type	(4~20) mA, (0~5) V
	Output accuracy	%0.5 FS
	Output load	250Ω

Communication output	Output type	RS485
	Communication	MODBUS
Relay output	Relay type	Dual SPDT/Dual SPDT + Dual SPST
Power supply		
Power supply	AC: 220V DC: 24V	
Power consumption	≤4W	
Overvoltage protection	36V	
Electrical interface	M20*1.5 cable gland	
Process conditions		
Measured waterway	Pipes, channels, natural streams, and rivers	
pH of the measured medium	The pH value is between 6 and 8, and it is non-corrosive to the sensor.	
Medium temperature	(0～60)℃	
Environmental conditions		
Ambient temperature	(0～60)℃	
Storage temperature	(-20～60)℃	

3 Structure and Dimensions

The flowmeter consists of two parts: the sensor and the main unit, which are connected by a cable.

3.1 Sensor size

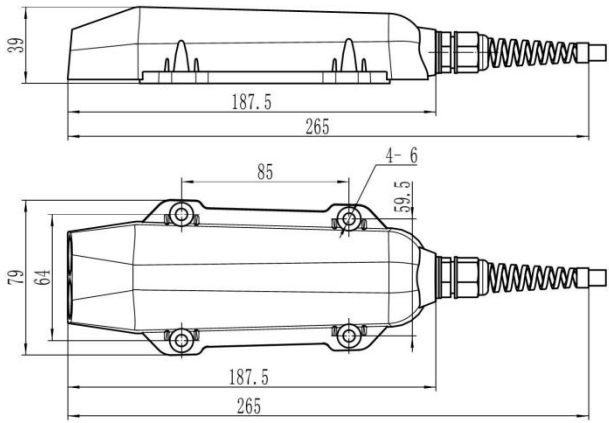

Fig.2 Sensor dimensions (unit: mm)

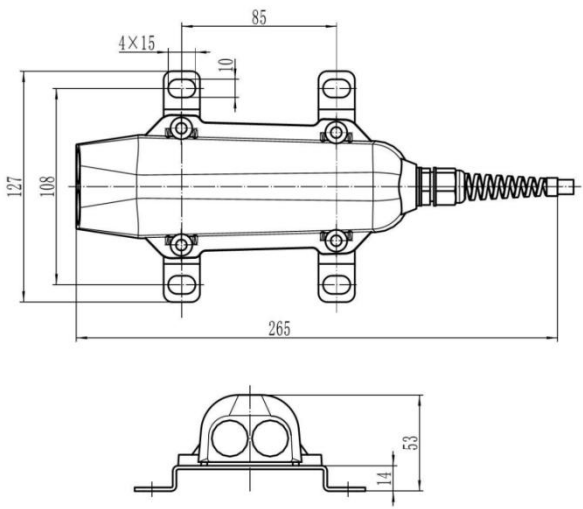

Fig.3 Sensor mounting dimensions (unit: mm)

3.2 Main Unit Dimensions

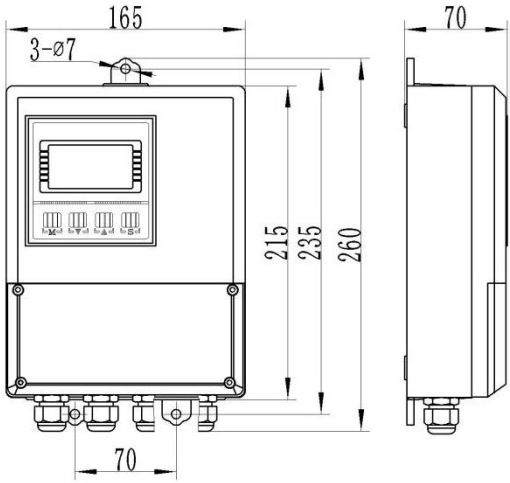

Fig.4 Main unit dimensions (unit: mm)

3.3 Weight

Sensor: 1050g

Main unit: 1800g

3.4 Material

Sensor: ABS

Main unit: Cast aluminum

4 Installation

4.1 Installation of Main Unit

The main unit is installed via three fixing screw holes on the casing, allowing it to be fixed to a wall or inside an electrical box.

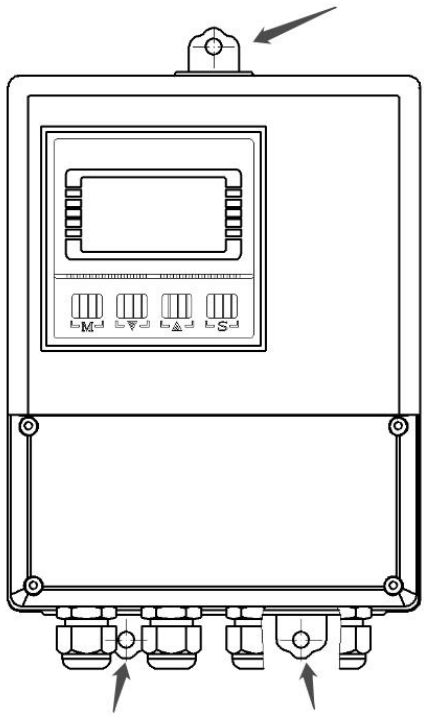

Fig.5 Fixing hole

4.2 Installation conditions and locations of the Sensor

4.2.1. Installation within the channel

（1）Measurements can be taken on rivers and canals as long as the minimum water level is at least 20 cm above the sensor.

（2）The standard pressure resistance of the flowmeter sensor is 100 kPa, equivalent to a 10-meter water depth. Please specify before ordering. If you need a higher pressure resistance. The maximum pressure resistance can be 1000 kPa

(100-meter water depth).

（3）Ultrasonic Doppler flowmeters are suitable for water with a solid concentration not exceeding 20 kg/m³ and a flow velocity ≤ 5.0 m/s.

（4）Ultrasonic Doppler flowmeters should be installed in locations with stable and uniform flow. In areas with unstable water flow, typically turbulent flow, the measured flow velocity will fluctuate, resulting in instability and significant measurement errors.

（5）The installation site of the ultrasonic Doppler flowmeter should have a straight upstream section at least 10 times the channel width and a straight downstream section at least 5 times the channel width.

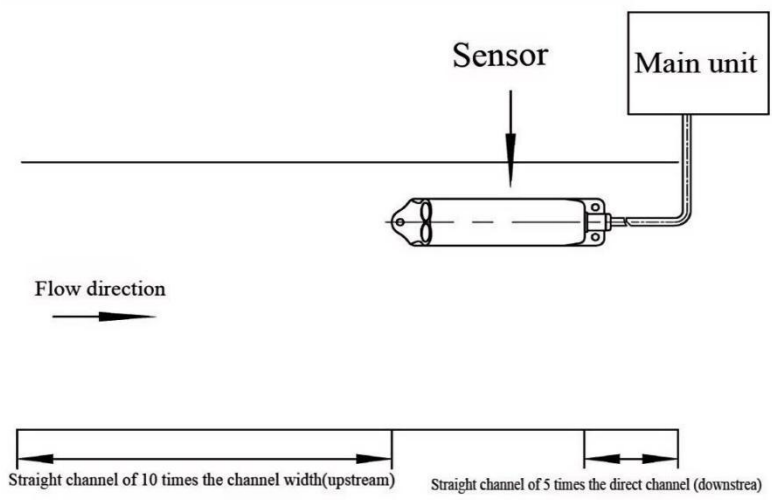

Fig.6 Requirements for upstream and downstream direct channels for sensor installation points

In some on-sites, due to actual channel conditions, the installation location may not have an upstream straight section meeting the 10×channel width requirement, nor a downstream straight section meeting the 5×channel width requirement.

The minimum requirement is 5 times the upstream straight channel length and 3 times the downstream straight channel length. Under these circumstances, measurement errors tend to increase, with their exact magnitude depending on the specific site conditions and various sites. For example, the bends of the flow

path in the mountainous areas fail to meet the standard upstream straight section requirement. Thus, the actual flow velocity at the installation point is 0.90–0.95 m/s, while the measured value ranges from 0.65–0.80 m/s.

（6）If the installation site is downstream of the sluice gate (a straight channel section of at least 30 times the channel width is generally required), please observe the water surface conditions to ensure stable flow. If the installation location is already 30 channel widths away from the gate but the water surface remains turbulent, the sensor should be positioned further downstream until the flow stabilizes. There is no fixed limit for this distance; it may be 60, 80, or more times the channel width, depending on where the flow becomes steady. In practice, the sensor should be installed at the point where the water flow is stable, for example, if stability occurs 50 channel widths downstream, that is the suitable installation location.

（7）Determining the installation height

The ideal height of the probe from the bottom of the channel is 100mm-250mm, depending on the lowest water level in the channel.

The sensor should be installed as close to the bottom of the channel as possible. However, if the channel bottom contains a lot of sediment, silt, aquatic vegetation, or loose rocks, the sensor should be raised to prevent coverage by debris or damage from moving stones.

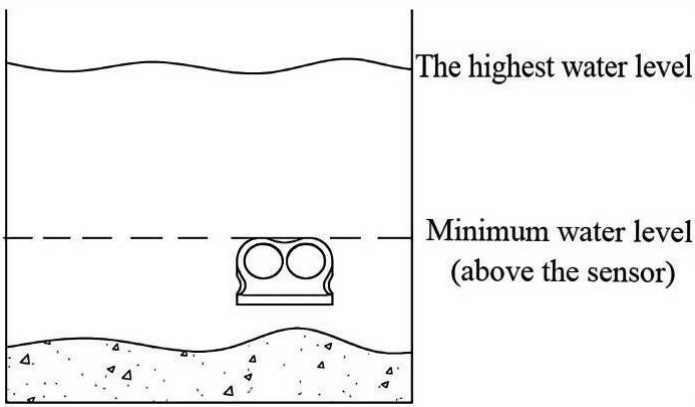

Fig.7 The lowest water level is above the sensor.

（8）Selection of horizontal installation location

- For channels less than 20 meters wide, if it is a rectangular channel, the pipe should be installed at 15 % to 20% of the total channel width. This is because the installation position can best capture the average flow velocity in the horizontal direction of the entire channel.

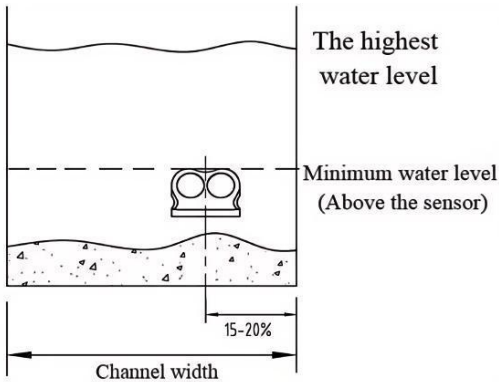

Fig.8 Rectangular channel installation location requirements

- Trapezoidal channel installation: The sensor is installed at the junction of the slope and the bottom edge, also “slope foot”. Simultaneously, the minimum water level must be above the sensor.

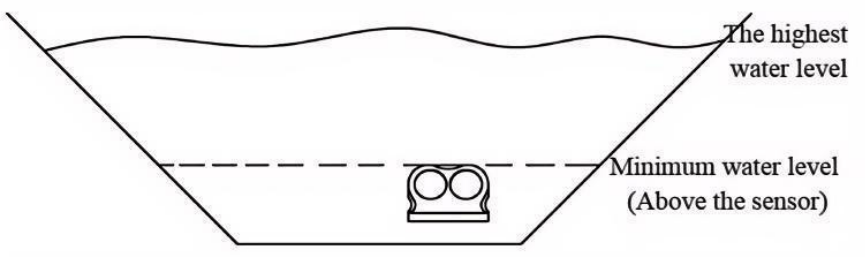

Fig.9 Trapezoidal channel installation location requirements

（9）The sensor should be facing the direction of the water flow.

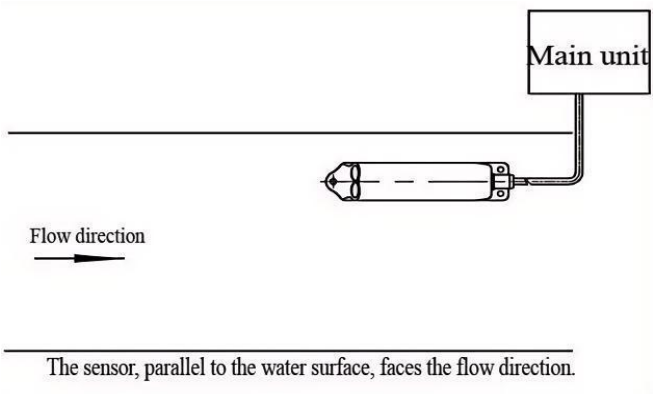

Fig.10 Sensor horizontal installation requirements

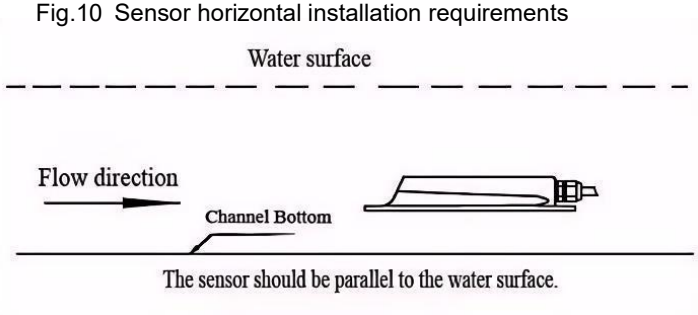

Fig.11 Sensor horizontal installation requirements

（10）For garbage or floating debris coming from upstream, a grate should be installed in the upstream channel to filter it. The distance between the grate and the sensor should be more than 5 times the distance of the channel.

4.2.2. Installed inside pipes or culverts

（1）For installation inside a pipe, measurements can be taken as long as the minimum water level does not exceed the sensor and the pipe's inner diameter is greater than 500 mm. Full-pipe conditions are not required; partially filled pipes can also be measured. The sensor should be installed in a section with stable flow. Ideally, the upstream straight section should be at least 10 times the pipe diameter, and the downstream straight section at least 5 times the pipe diameter.

（2）The sensor must be installed where the flow is stable. In areas with turbulent or unstable flow, measurements may fluctuate significantly or underestimate

actual flow. Two typical issues may occur:

- Large oscillations in the recorded data.
- Measured values are consistently lower than the true flow.

（3）The presence of sediment or silt in the pipe should be taken into account. The sensor should be positioned to avoid contact with sediment. For upstream debris or floating material, a screen or grate should be installed in the upstream section, at a distance of at least five times the pipe diameter from the sensor.

4.3 On-site Installation of Brackets and Wiring

4.3.1. Installation inside the Channel

Note: Based on a flow velocity of 0.20 m /s, doubling the water flow velocity will increase the destructive force on surrounding objects by 50 to 64 times.

（1）The sensor should be securely mounted inside the channel. The sensor lead must be enclosed in PVC, PE, or galvanized conduit to protect it from water impact or entanglement with debris. If the flow can be temporarily stopped, the sensor can also be mounted on the channel bottom.

（2）In channels with sediment, silt, or other accumulated material, the mounting base should be elevated so that the sensor sits above the debris, minimizing the risk of blockage or damage.

（3）For channels up to 5 meters wide, the flowmeter can be installed with stainless steel brackets.

4.3.2. Installation inside the Pipeline

For installations inside pipelines, it is not necessary to stop the flow; the bracket can be lowered from the top of the pipe for fixation. For typical pipes up to 2000 mm in diameter, the sensor can be installed at the center. The sensor should be mounted on a bracket fixed to the pipe bottom. The bracket should be L-shaped, with the sensor attached at the bottom of the L, extending into the pipe and oriented directly into the flow.

4.3.3. Installation in Rivers

When installed in the river channel, it is also installed using side supports.

4.3.4. Installation inside Wells or Manholes

Sensors installed in wells or manholes should be fixed using appropriate brackets or support structures to keep the sensor stable and correctly oriented. Special

attention should be paid to flow direction, water turbulence, and access for maintenance or cable routing.

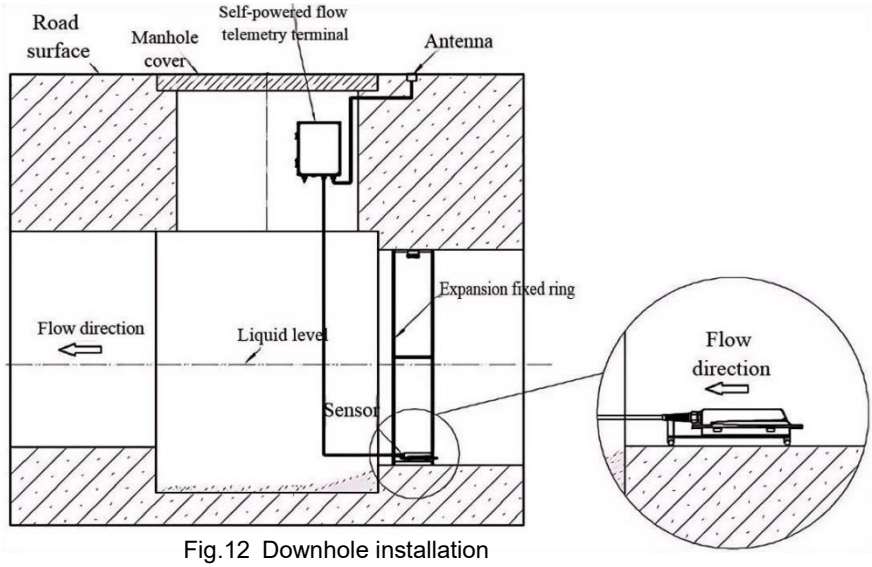

Fig.12 Downhole installation

4.4 Installation Notes

During installation, the sensor side must be installed facing down. The side with the small hole contains the pressure sensor and must face downward; it should never face upward.

- The communication cable coming with the sensor has a vent tube, so be careful not to bend it. After the communication cable is brought out of the water, it can be connected to a regular cable. In this case, the vent tube opening should face downwards to prevent water and foreign objects from entering or blocking it.

Cables connecting the sensor's 485 interface or power supply must be separated, using two independent 2-core shielded cables.

- Do not pull or swing the cable, and do not strike the sensor housing. The connection cables must never be used to bear weight or suspend objects. All cables should be securely fastened to the concrete walls of the channel to prevent movement or vibration.
- For sites with flow velocities > 1.0 m/s, the mounting bracket must be

reinforced to at least three times the strength of the standard bracket to prevent it from being dislodged or damaged by strong currents. Additional diagonal bracing should be provided to stabilize the sensor horizontally and prevent movement, vibration, or drift caused by the flow.

- When the cable extension is required, the vent tube should be protected from water ingress, bending, or blockage. Consideration should be given to environmental conditions such as high humidity or condensation in low temperatures. The RS-485 output cable can be extended up to 200 meters, requiring a 0.75 square mm^2 2-core shielded cable.

4.5 Installation Steps

(1) Fixing the brackets securely to check their fastening even at twice the maximum flow rate.

(2) The sensor is secured to the mounting base.

(3) The sensor cable must be run through conduit, and all protective conduits must be securely fixed. For protective conduits submerged in water, there must be at least one clamp every 0.5 meters. The sensor wiring outlet should be specially protected and secured so that any impact from the water is absorbed by the protective conduit, preventing stress on the sensor cable itself. Otherwise, prolonged exposure may lead to cable breakage.

(4) Remove debris upstream of the sensor to ensure unobstructed flow.

5 Electrical Connection

5.1 Wiring Precautions

（1）To minimize electrical noise, route input signal cables away from instrument power cables, power distribution lines, and load wiring. Shielded signal cables are recommended, with independent routing and grounding of the shield.

（2）Avoid sourcing the instrument's power from circuits that also supply heavy electrical loads, as this may introduce interference. A dedicated power supply is recommended-preferably a conditioned or filtered supply.

（3）All wiring should comply with applicable electrical equipment regulations. For instrument grounding, use conductors with a nominal cross-sectional area of approximately 1.25 mm^2 -2.0mm^2 , and ground over the shortest possible distance.

（4）The company reserves the right to upgrade the product without prior notice. In case of any discrepancy, follow the wiring diagram attached to the rear cover of the instrument.

5.2 Sensor Cables

Table 2 Sensor cable definition

Power supply	DC12V+	DC12V terminal
	DC12V-	DC12V terminal
Output	RS485A	RS-485 interface A
	RS485B	RS-485 interface B

5.3 Main Unit Wiring Terminals

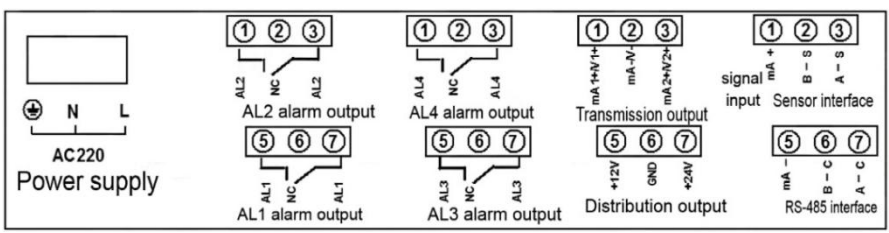

Fig.13 Main unit terminal diagram

Table 3 Terminal definition

Type	Mark	Definition
Power		Grounding
	N	220V terminal
	L	220V terminal
Alarm output	AL1, AL2, AL3, AL4	alarm relay
	NC	Public terminal
Transmitter output	mA1+/V1+	First current output + / First voltage output +
	mA2+/V2+	Second current output + / Second voltage output +
	mA+/V+	Current/voltage output -
Power distribution output	+12V	DC12V power output
	GND	DC12V and DC24V common GND terminal
	+24V	DC24V power output
Sensor Interface	mA+	(4~20)mA input positive terminal
	B-S	Sensor RS485 interface B
	A-S	Sensor RS485 interface A end
Communication	mA-	(4~20)mA input negative terminal
	B-C	RS485-B
	A-C	RS485-A

6 Operation

6.1 Display and Operation Unit

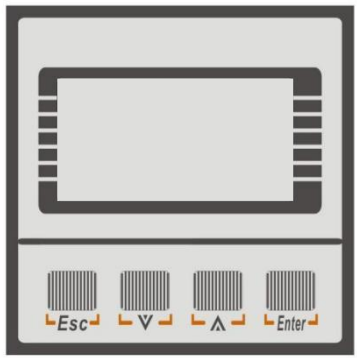

Fig.14 Display and operation unit

Table 4 Display and operation unit description

Panel Information		Description
Display	LCD screen	Under normal operating conditions, the input quantity or input signal is displayed. Displays the parameter being set or its value during parameter setting.
Operation keys	Esc (Back button)	In parameter setting mode, this is used to return to the previous menu level. In the value setting menu, press the Esc key to cancel the value modification and return to the previous menu.
	▽	In parameter setting mode, this is used for selecting from the drop-down menu. When changing parameter settings, press the button continuously to decrease the parameter value automatically and rapidly.
	△	In parameter setting mode, this is used for selecting from the top menu. When changing parameter settings, press the button

Panel Information		Description
		continuously to increase the parameter value; the value will automatically and rapidly increase.
	Enter (Confirm button)	In normal operating conditions, it is used to access the parameter setting menu. In parameter setting mode, this is used to confirm the modified parameters.

6.2 Main Menu

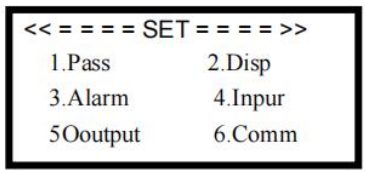

Fig.15 Main menu interface

Press △/▽ to select the menu you want to operate on, and press Enter to enter.

6.3 Setup Instructions

6.3.1. Password settings

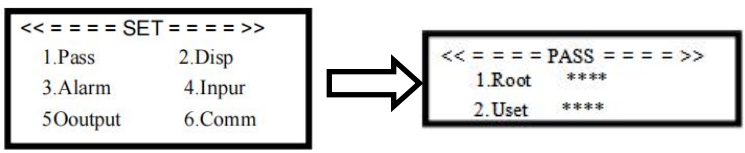

Fig.16 Password setting interface

Level 1 password: Menu partially locked, only display settings are accessible (users can set freely).

Secondary password: All menus are locked; only the password-protected menu remains accessible.

6.3.2. Display settings

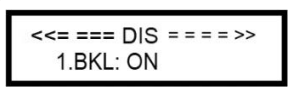

Fig.17 Display settings interface

Backlight: Selectable on/off/60 seconds.

6.3.3. Alarm settings

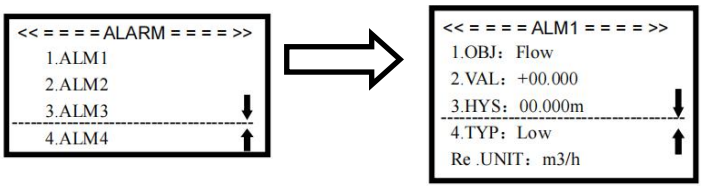

Fig.18 Alarm settings interface

Alarm settings:

Object: Selectable instantaneous flow rate/flow velocity/water level.

Value: Sets the value of the corresponding object.

Hysteresis value: Set the corresponding hysteresis value.

Type: You can choose between underreporting and overreporting.

6.3.4. Input settings

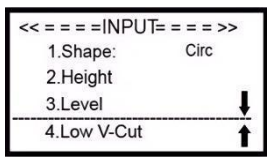

Fig.19 Input settings interface

Pipe section shape: Rectangular/trapezoidal/circular/elliptical/U-shaped are available.

Installation height: Sets the installation height value.

Water level threshold: Sets the value for the water level threshold.

Low-flow-rate cutoff: Set the value for low-flow-rate cutoff.

6.3.5. Output settings

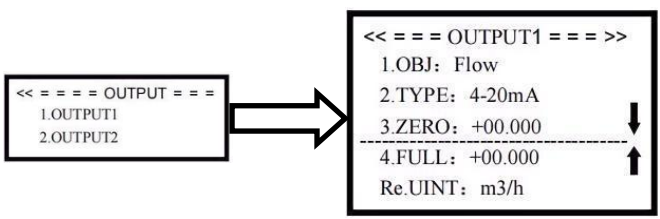

Fig.20 Output settings interface

Object: Select instantaneous flow rate/flow velocity/water level.

Type: 4-20mA selectable.

Zero point: Set the corresponding zero point value.

Full scale: Set the corresponding full scale value.

6.3.6. Communication settings

Select the settings menu based on the order.

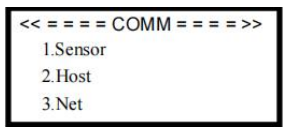

Fig.21 Communication settings interface

（1）Sensor

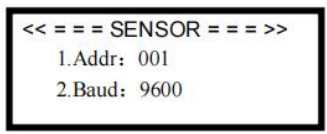

Fig.22 Sensor communication settings

Address: communication address range 1-254;

Baud Rate: Sets the instrument's communication baud rate: 1200/2400/4800/9600/19200/38400/57600.

（2）Host computer settings

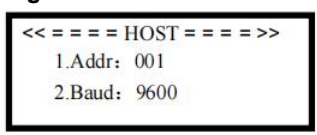

Fig.23 Host computer communication settings

Address: communication address range 1-254;

Baud Rate: Sets the instrument's communication baud rate: 1200/2400/4800/9600/19200/38400/57600.

（3）Network settings

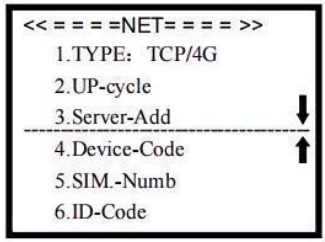

Fig.24 Network settings

Communication type: TCP/4G.

Upload cycle: You can select the upload interval time. Available upload interval times are 10 s and 20 s30 s/40 s/50 s/60 s/70 s/80 s/90 s

Server address: Optional IP address/port.

Device code: Optional time/customer/type/number.

SIM Number: Displays the SIM card number.

ID-Code: Displays the IMEI number.

7 Fault Analysis and Troubleshooting

The table below lists potential problems with ultrasonic Doppler flowmeters and their solutions. If your problem is not listed or the solution does not address your issue, please contact us.

Table 5 Troubleshooting

Troubles	Troubleshooting	Solution
No communication	Loose RS485A and RS485B terminals	Check whether the voltage between the RS-485A and RS-485 B terminals is around 3.1V.
	Loose power connector	Verify whether the supply voltage is between (8~14) VDC.
Low flow velocity reading	Sensor covered by debris or fouling	Signal strength is less than 80%
Abnormal water level reading	Water level sensor blockage	Check if the water level sensor is blocked.
	Water ingress in the vent tube	Check if water has entered the vent tube.

8 Maintenance

8.1 Cleaning

If the sensor cannot communicate with the host computer software, check if the sensor is entangled in aquatic plants or blocked by cement, and clean it in time.

8.2 Maintainance

Regularly check whether the sensors are entangled in aquatic plants or blocked by cement, and perform timely maintenance.

8.3 Repair

If this flowmeter malfunctions, please report it our support team or may return it for repair if necessary.

9 Warranty and After-Sales Service

Our company guarantees that any product quality issues arising during the warranty period will be covered under our unconditional "Three Guarantees" policy, which includes free repair, replacement, or return. All non-customized products are eligible for return or exchange within 7 days (excluding products damaged due to misuse). For customized products, the warranty terms specified in the contract shall apply.

Disclaimer

The following situations are not covered under the "Three Guarantees" policy, even during the warranty period:

(1) Product malfunctions caused by improper use by the customer.

(2) Product malfunctions resulting from unauthorized disassembly, repair, or modification by the customer.

Appendix A Communication Protocol

A.1 Communication Protocol

The RTU mode using the MODBUS protocol enables master-slave half-duplex communication.

A.2 Register Address

Table 6 Register address

Name	Register address	Data length	Data type	R/W	Function Description
Instrument Address	0x5E	0x 02	Float	RW	Values: 1~254
Baud rate	0x60	0x 02	Float	RW	1 = 2400, 2 = 4800 3 = 9600, 4 = 19200 5 = 38400, 6 = 576000 7 = 115200
Intermittent velocity	0x26	0x 02	Float	OR	Unit: m/s; Average flow velocity during intermittent operation; suitable for ADV intermittent power-off operation mode; Intermittent time is adjustable.
Intermittent flow rate	0x28	0x 02	Float	OR	Unit m^3 /h
Interval time setting	0xF4	0x 02	Float	RW	(0-300000) ms. For example, if the interval time is set to 10,000 ms, the intermittent flow rate will be the real-time value within 10,000 ms after the ADV is powered on, and the intermittent flow rate

Name	Register address	Data length	Data type	R/W	Function Description
					will be the average value within 10,000 ms after 10,000 ms.
Inverted flow velocity	0x10	0x 02	Float	OR	The unit is m/s. The flow rate is calculated in real time. In full performance mode, it is updated once every 0.2 seconds, and in low power mode, it is updated once every 1 second.
Inverted flow rate	0x12	0x 02	Float	OR	Unit m^3 / h
Totalized flow setting	0x48	0x 02	Float	RW	Total cumulative flow setting: Write to this register if you need to clear the totalized flow to zero.
Totalized flow of the signed integer	0x0600	0x 02	Int	OR	0-999999999 m^3
Smoothed flow velocity	0x00	0x 02	Float	OR	The unit is m/s. It is a smoothed filter flow rate with a relatively slow response. It is suitable for ADV uninterrupted operation mode. The smoothing coefficient can be set.
Water level	0x02	0x 02	Float	OR	Unit m
Water	0x04	0x 02	Float	OR	Unit ℃

Name	Register address	Data length	Data type	R/W	Function Description
temperature					
Smoothed flow rate	0x06	0x 02	Float	OR	Unit m^3 /h
Low totalizer	0x08	0x 02	Float	OR	Cumulative value of the totalized flow = High value of totalized flow * 10000 + Low value of totalized flow
High totalizer	0x0A	0x 02	Float	OR	Cumulative value of the totalized flow = High value of totalized flow * 10000 + Low value of totalized flow
Water cross-sectional area	0x0C	0x 02	Float	OR	Unit m^2
Signal strength	0x0E	0x 02	Float	OR	
Smoothing coefficient	0x54	0x 02	Float	RW	Value (0.001-1) The larger the value, the faster the response of the smoothed flow rate.
Installation height	0x46	0x 02	Float	RW	Unit m
Channel shape selection	0x2C	0x 02	Float	RW	0: Rectangle 1: Trapezoid 2: Circle 3: Oval 4:U shape
Rectangle channel width	0x2E	0x 02	Float	RW	Unit m
Top width of trapezoidal channel	0x30	0x 02	Float	RW	Unit m

Name	Register address	Data length	Data type	R/W	Function Description
Bottom width of trapezoidal channel	0x32	0x 02	Float	RW	Unit m
Trapezoidal height	0x34	0x 02	Float	RW	Unit m
Radius of circular channel	0x36	0x 02	Float	RW	Unit m
Horizontal semi-axis of elliptical channel	0x38	0x 02	Float	RW	Unit m
Vertical semi-axis of elliptical channel	0x3A	0x 02	Float	RW	Unit m
Bottom radius of u-shaped channel	0x3C	0x 02	Float	RW	Unit m

Table 7 Host register address

Address	Number of registers	Function Description
0x00	0x02	Instantaneous flow rate, unit m/s (float, read-only)
0x02	0x02	Water level, unit: meters (float, read-only)
0x04	0x02	Water temperature, unit ℃(float, read-only).
0x06	0x02	Instantaneous flow rate, unit m^3/h (float, read-only)
0x08	0x02	Positive cumulative integer bits, unit m^3 (u32 read-only)
0x0a	0x02	Positive cumulative decimal places, unit m^3 (float is read-only)
0x0c	0x02	Reverse cumulative integer bits, unit m^3 (u32 read-only)
0x0e	0x02	Accumulates decimal places in reverse order, unit m^3 (float is read-only).
0x10	0x02	Cross-sectional area of water flow, unit m^2 (float, read-only)
0x12	0x02	Sensor installation height, in meters (float read/write).
0x14	0x02	Water level threshold, unit m (float read/write)
0x16	0x02	Low-velocity resection, unit m/s (float read/write)
0x18	0x02	Flow rate is linear, default value is 1 (float read/write).

A.3 Examples of Communication

Host Request

1	2	3	4	5	6	7	8
Address	03H	High byte of the start register address	Low byte of start register address	Number of registers read (high byte)	Read register count (low bytes)	CRC low byte	CRC high byte

Response from the slave

1	2	3	4	5	…	…	N+4	N+5
Address	03H	Total number of bytes N	Data high byte	Data low byte	…	…	CRC low byte	CRC high byte

For example

Host: 0x010x030x000x000x000x020xC40x0B

Slave device: 0x01 0x03 0x04 0x42 0x48 0x000 0x000 6E 0x5D

Note: Slave address 01, measurement display 50.0