Datasheet

Ultrasonic Doppler Flow Meter

SUP-FSD300

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Ultrasonic Doppler Flow Meter
SUP-FSD300

This product is designed for measuring water velocity and flow in natural water bodies, open channels, or pipelines.

It utilizes ultrasonic technology to detect flow velocity, with the measurement point located in front of the instrument body, ensuring the flow field remains undisturbed.Featuring high measurement accuracy and linear flow response, it is capable of both instantaneous and average flow velocity measurements. With no rotating components, the instrument is resistant to clogging by sediment and entanglement by aquatic vegetation. The probe is rugged and durable, making it ideal for use in environments with high sediment concentrations, floating debris, and harsh conditions such as during freezing periods. It is especially suited for flow measurement in rivers with suspended solids and vegetation.

Features

- High measurement accuracy with a wide dynamic range, capable of detecting both low and high flow rates.
- Highly sensitive detection with excellent resolution, unaffected by minimum start-up velocity.
- Fast response time, capable of measuring both instantaneous and average flow velocities.
- Excellent linearity in measurement; no need for calibration constants such as K or C factors.

Ultrasonic Doppler Flow Meter

Principle

The measurement principle of the 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 perceived by the observer differs from the frequency emitted by the source. This frequency shift, caused by the relative motion, is directly proportional to the relative velocity between the two.

In the ultrasonic Doppler flow measurement method, the ultrasonic transmitter acts as a stationary sound source, while solid particles moving with the fluid serve as “observers” in relative motion. These particles reflect the incident ultrasonic waves back to the receiver. The frequency difference between the transmitted and received signals is the Doppler shift generated by the motion of solid particles within the fluid. Since this frequency shift is proportional to the fluid velocity, the flow velocity can be calculated from it, and consequently, the volumetric flow rate of the fluid can be determined.

Therefore, a necessary condition for ultrasonic Doppler flow measurement is that the measured fluid must contain a certain amount of sound-reflective particles or bubbles—i.e., it must be a two-phase medium. This working condition is actually a key advantage of this method: it is well-suited for measuring multiphase flows, which are often difficult to measure accurately using other types of flowmeters.

As a highly promising technology for multiphase flow measurement, ultrasonic Doppler flowmeters are increasingly being adopted in a wide range of industrial applications.

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

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

Where:

$\triangle Fd$ — Doppler frequency shift

F_0 — Transmitted ultrasonic frequency

C — Speed of sound in water

V — Flow velocity of water

θ — Angle between the ultrasonic beam path and the direction of water flow

Given that $C \gg V \cdot \cos\theta$

The ultrasonic transmission frequency F_0 is constant, and the transducer installation angle θ is fixed after setup, the coefficient K= $\frac{2F_0 \cdot \cos\theta}{C}$ becomes a constant.From the equation above, it is evident that the flow velocity V is directly proportional to the Doppler frequency shift $\triangle Fd$ and the speed of sound C in water. Therefore, once the Doppler frequency shift $\triangle Fd$ and sound velocity C are known, the flow velocity can be accurately calculated.

In this instrument, the speed of sound C is derived from the measured water temperature.

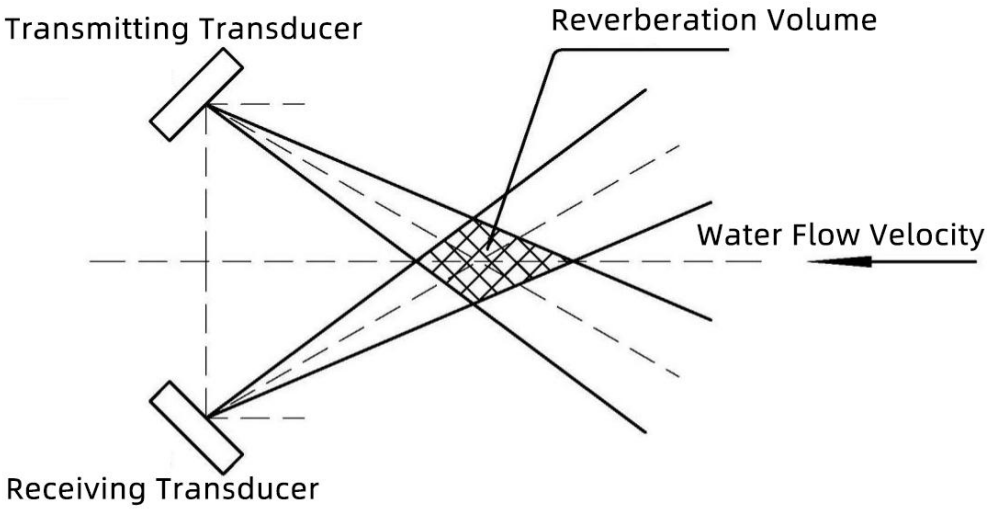

Figure 1 Illustration of Acoustic Field

Parameters		
Performance Parameters		
Measured Variables	Flow velocity, liquid level, temperature	
Measuring Range	Bidirectional flow (without direction recognition),displays absolute value of flow velocity and flow rate	flow velocity：（0~10）m/s liquid level：（0~10）m
	Bidirectional flow (with direction recognition) displays flow velocity and flow rate with positive or negative sign	flow velocity：（-10~10）m/s liquid level：（0~10）m
	temperature	（-5～60）℃
Accuracy	flow velocity：1.0%±0.01m/s liquid level：0.2%±0.01m temperature：±1℃	
Resolution	flow velocity：1mm/s liquid level：1mm	
Response Time	10s～60s Note: The smoothing coefficient can be configured via communication protocol. A higher value results in faster smoothing response of the flow velocity.	
Operating Frequency	2MHz	
Transmission Power	1W	
Protection Rating	IP68	
Output		
Transmitter Output	Output Type	（4~20）mA、（0~5）V
	Output Accuracy	%0.5 F.S
	Output Load	250Ω
Communication Output	Output Type	RS485
	Communication Protocol	MODBUS
Relay Output	Relay Type	Dual SPDT
Power Supply		
Power Supply Input	AC：220V DC：24V	
Power Consumption	≤4W	
Overvoltage Protection	36V	
Electrical Interface	M20*1.5 Cable Gland	

Process Conditions	
Measured Channel Type	Pipelines, open channels, natural streams and rivers
Measured Medium pH Range	Between 6 and 8, non-corrosive to the sensor
Medium Temperature	（0～60）℃
Environmental Conditions	
Ambient Temperature	（0～60）℃
Storage Temperature	（-20～60）℃

Wiring

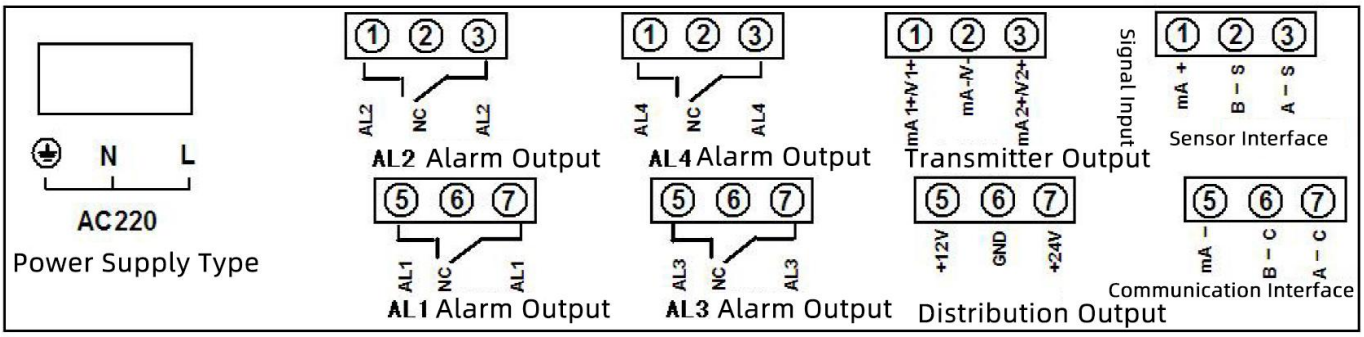

Figure 2 Main Unit Terminal Diagram

Dimension

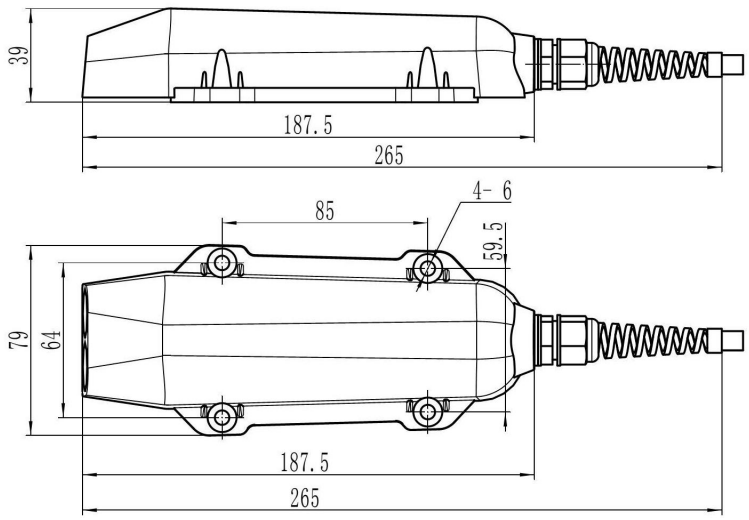

Figure 3 Sensor Dimensions (Unit: mm)

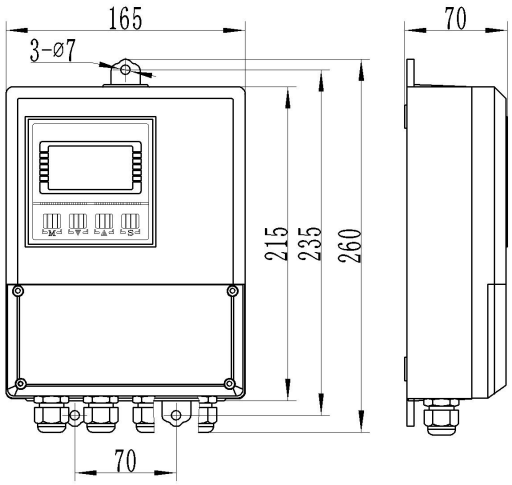

Figure 4 Main Unit Dimensions (Unit: mm)

Ordering code

SUP-FSD300 -1-D1-V-BJ-0-00-10								Description
SUP-FSD300	-	-	-	-	-	-	-	
Flow Velocity and Water Level Measurement Range	1							0-10.000 m/s，0-10m
	2							-10.000-+10.000 m/s，0-10m
	X							Others
Sensor Type		D1						Standard Type
		D2						Standard Type with Manhole Breather Valve Assembly
		XX						Others
Accuracy			V					1%±0.01m/s
Output and Power Supply				BJ				RS485，12VDC
				AJ				4-20mA+RS485，24VDC
				AS				0-5V+RS485，24VDC
				AW				4-20mA+RS485，220VAC
				AT				0-5V+RS485，220VAC
				XX				Others
Alarm					0			None
					4			Dual SPDT Contacts
					B			Dual SPDT Contacts +Dual SPST Contacts
					X			Others
Electrical Interface, Housing Material, and Protection Rating						00		None
						WH		M20*1.5Cable Gland，Aluminum Alloy，IP68
Remote Cable Length							10	10m
							20	20m
							XX	Others