HIKMICRO

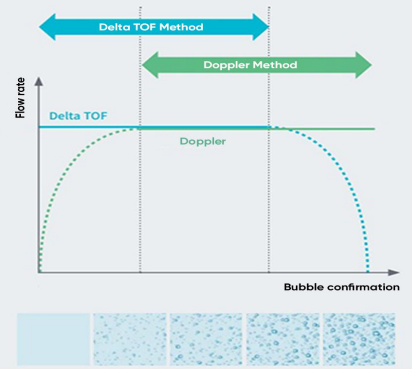
HIKMICRO

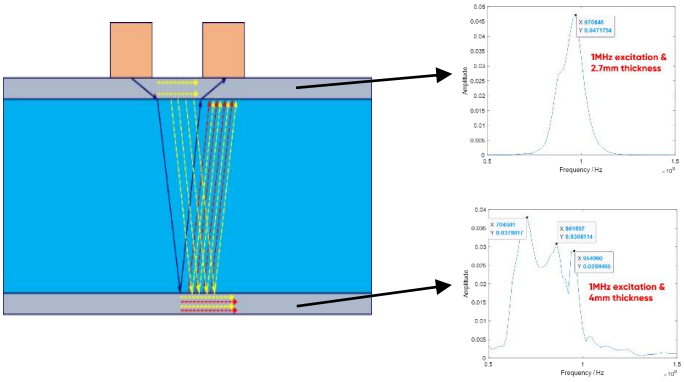
Clamp-on Ultrasonic Flow Meter

Features and Benefits

Strong measurement stability: 40db+ SNR index, high echo signal energy under large pipe diameter, stable measurement, strong penetration ability and easy measurement for rusted and scaled pipe sections.

High applicability to working conditions: automatic optimization of excitation frequency, selection of the most suitable excitation for pipe wall thickness, automatic switching of detection mode according to the amount of liquid bubbles





- High accuracy level, water medium achieves ±0.5% accuracy at a flow rate of 1m/s~10m/s, and repeatability ⩽0.1%
- Simple and safe menu-guided sensor installation method to ensure high-precision measurement results
- Installed outside the pipeline, no need to interrupt process operation, no pressure loss
- Supports bidirectional measurement of medium flow direction
- Supports Bluetooth remote debugging to achieve rapid device configuration, transmitter and sensor binding, sharing of website training materials and operation videos, which improves user operation efficiency and convenience of instrument use
- Sensor protection level up to IP68
- Rapid sensor self-test, automatically determine whether the sensor is working properly
- Automatic evaluation of installation position, automatically recommend installation locations based on signal quality
- Automatic selection of measurement frequency, automatically scan the optimal detection frequency to improve measurement accuracy

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Contents

1. Product Introduction

1.1. Application

HIKMICRO FU00 series clamp-on ultrasonic flow meter adopts a non-contact measurement method to measure various types of water medium (drinking water, raw water, and sewage). It is not affected by process pressure and medium conductivity. The measurement pipe diameter can cover a maximum of DN5000. It is an economical and efficient flow measurement solution.

1.2. Measuring Principle

HIKMICRO clamp-on ultrasonic flowmeter uses a measurement method that automatically switches between the time difference method (TOF) and the Doppler method. When the medium is relatively uniform, the time difference method is used for measurement, and when the medium contains particles or bubbles, the Doppler method is used for measurement.

1. Time Difference Method (TOF) to Measure Flow Velocity

   The flight time of the ultrasonic wave (TOF) is related to the flow velocity and sound velocity of the medium in the pipe section. By detecting the flight time, the flow velocity of the medium in the pipe section can be obtained, and finally the flow rate can be measured and calculated.

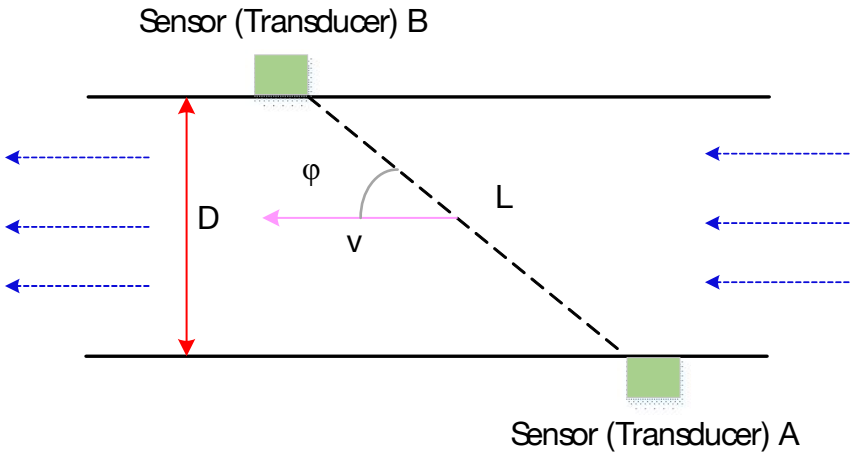


Figure 1. Schematic Diagram of TOF Method

Known:

L = Sound Wave Transmission Length

D = Pipe Diameter

φ = Angle between Sound Wave Transmission Path and Pipe

T_{AB} = Sound Wave Flight Time from Sensor A to Sensor B

T_{BA} = Sound Wave Flight Time from Sensor B to Sensor A

Unknown:

c = Sound Velocity in the Medium

v = Liquid Flow Rate in Pipe

Sound Wave Flight Time from Sensor A to Sensor B

$$T_{AB} = \frac{L}{c + v\cos\varphi}$$

Sound Wave Flight Time from Sensor B to Sensor A

$$T_{BA} = \frac{L}{c - v\cos\varphi}$$

Flow Velocity v:

$$v = \frac{L}{2\cos\varphi}\left(\frac{1}{T_{AB}} - \frac{1}{T_{BA}}\right) = \frac{L}{2\cos\varphi}\left(\frac{T_{BA} - T_{AB}}{T_{AB}T_{BA}}\right)$$

2. Doppler Method for Measuring Flow Velocity

The Doppler method uses the Doppler principle in acoustics. By detecting the frequency offset between the reflected sound wave and the transmitted sound wave, the flow velocity of the fluid can be determined, and then the fluid flow rate can be measured. The Doppler method actually measures the velocity of the particles in the fluid, which is used to replace the fluid velocity to calculate the fluid flow rate.

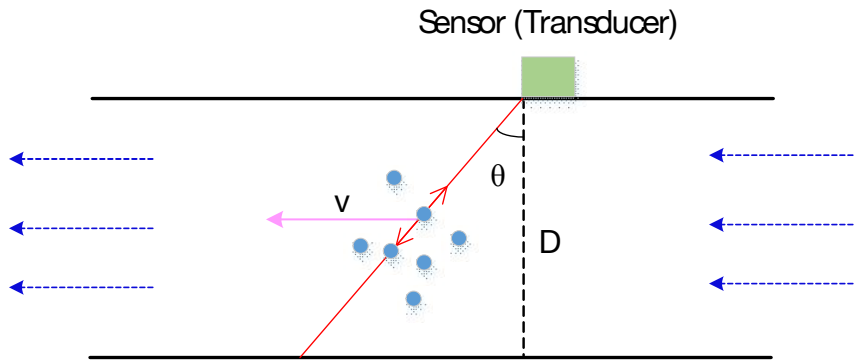


Figure 2. Schematic Diagram of Doppler Method

The sensor is first in the transmitting state, with a sound speed of c, and transmits an ultrasonic pulse with a frequency of f_T to the fluid containing particles. Then the transducer switches to the receiving state and receives the signal reflected by the particles. According to the Doppler Effect, the frequency of the ultrasonic wave reflected by the particles received by the receiver is f_R. When the particle flow velocity is v, there is the following relationship:

$$f_R = f_T(1-\frac{v\sin\theta}{c})^2 \approx f_T(1-\frac{2v\sin\theta}{c})$$

Then the Doppler frequency shift is:

$$\Delta f = f_T - f_R = f_T\frac{2v\sin\theta}{c}$$

Then the flow velocity v is:

$$v = \frac{c}{2f_T\sin\theta}\Delta f$$

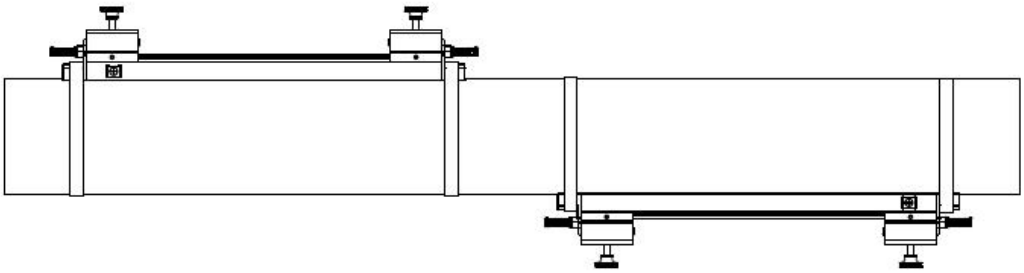
2. Technical Parameters

Measured Variables	Flow rate, volume flow
Accuracy and Repeatability (1 ~10 m /s)	Accuracy 0.5%, repeatability 0.1%(Time difference method) Accuracy 2.0%, repeatability 0.4 % (Doppler method)
Power Supply(Power Consumption≤10W)	AC: 85~265VAC, 50± 4Hz DC: 24V DC (12 ~36V DC)
Wire System	Four-wire
Output	4 ~ 20 mA HART Output range: 4 ~ 20 mA (NAMUR standard) Load capacity: 700 Ω Resolution : 0.4μA Mode: Active and Passive
	Pulse / function output Optional settings: ● Pulse output: Pulse width range 0.05~2,000ms , maximum pulse frequency 10 kHz ● Frequency output : Maximum frequency 10 kHz ● Function output: Switch value, which can be used to indicate status information, including: diagnostic response, limit value, flow direction check, and status.
Input	● 4 ~ 20 mA input: maximum input voltage ≤ 30V (passive), supports active and passive input. ● Switch input: Maximum input value 30V, response time 5 ~200ms configurable. Low level: -3 ~5VDC, High level: 12 ~30VDC
Temperature Compensation	Manual setting, or optional PT1000
Diagnostic Function	Sound velocity, signal amplitude, signal quality
Measuring Pipe Diameter Range	DN50~DN3500
Fixing Method	The transmitter supports wall-mounted installation and pipe installation The sensor supports fixture installation and clamp installation
Operating Conditions	Ambient temperature range: -40 ~+60 ℃ Medium temperature range: - 40~+120 ℃ Medium pressure range: static pressure is higher than saturated steam pressure to avoid medium gasification
Pressure Loss	No pressure loss
Protection Rating	IP67 for Transmitter, IP68 for Sensor

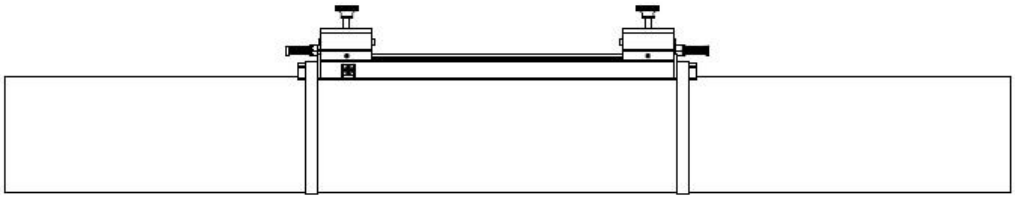
3. Installation Requirements

Select the corresponding installation method and installation distance according to the guidance settings.

The opposite installation method should ensure that the fixture is at both ends of the horizontal center of the pipeline



Opposite Side Installation



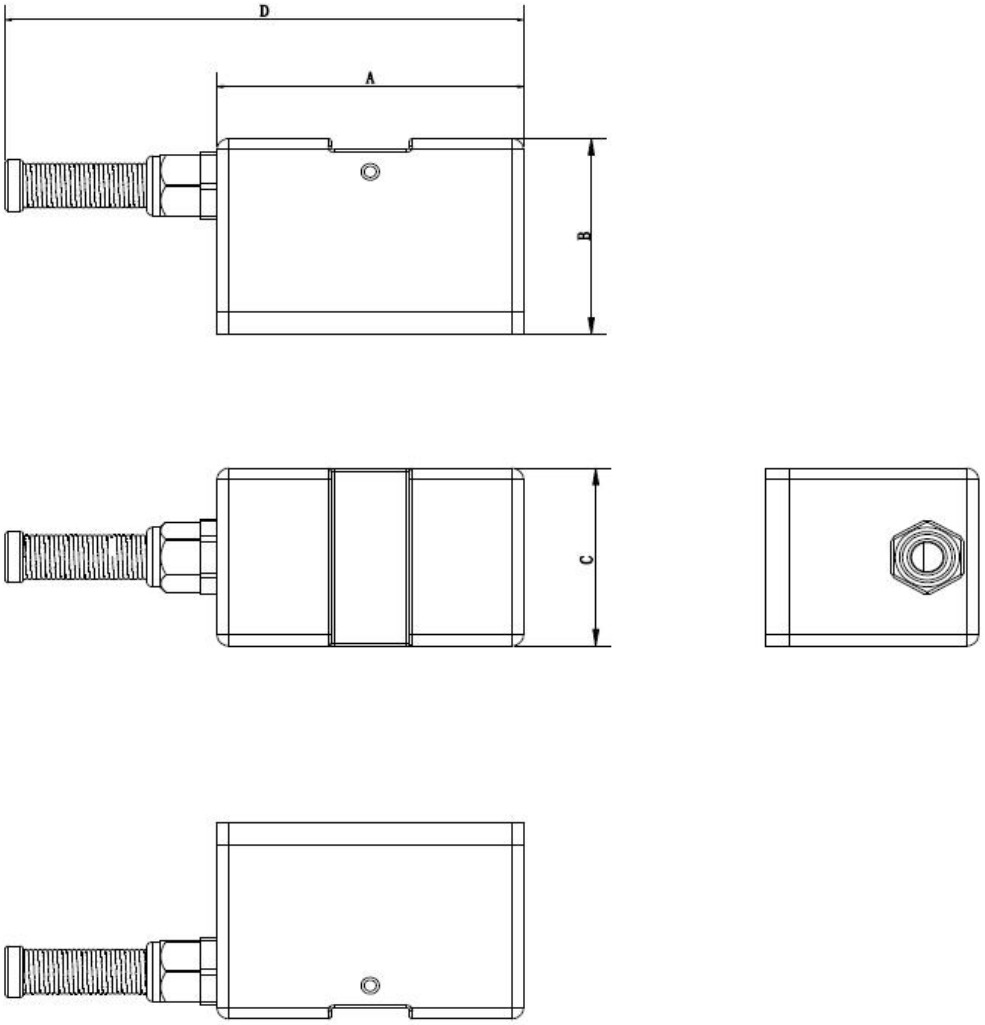
Same Side Installation

4. Mechanical Structure & Dimensional Drawing

Weight: 2.3 kg

Dimensions & structural parameters:

4.1. Sensor



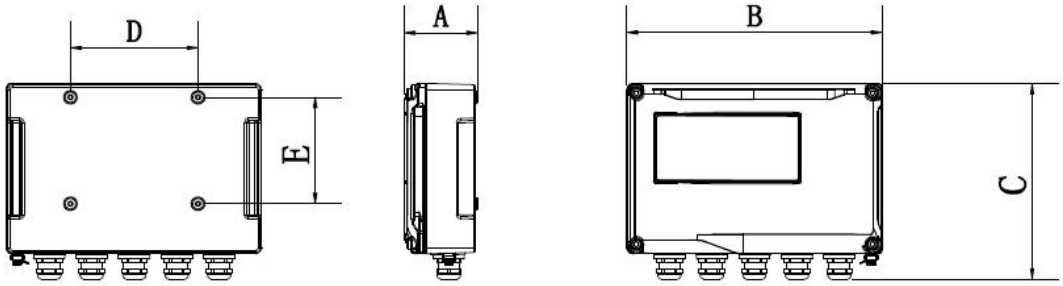
Material:

- Sensor body: SUS 316
- Anti-bending metal joint: SUS 316L

Size:

Unit	A	B	C	D
mm (inch)	50.8 (2)	35.3 (1.39)	32 (1.26)	88.3 (3.48)

4.2. Transmitter



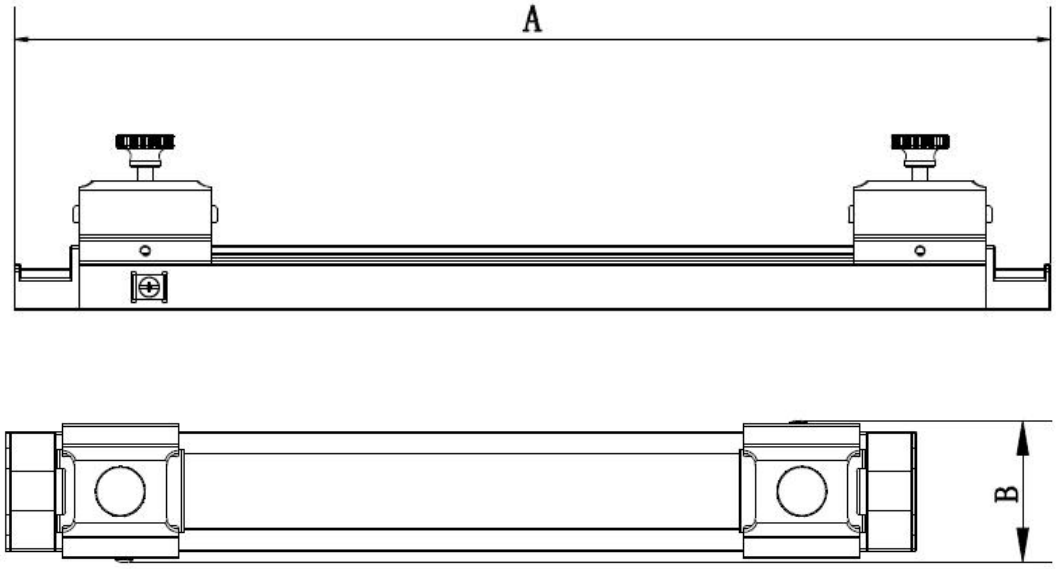
Material:

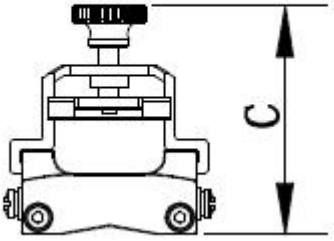
- Housing: Aluminum Silicon + Magnesium
- Cable gland: Nylon
- Gland seal: EPDM rubber

Size:

Unit	A	B	C	D	E
mm(inch)	66 (2.6)	240 (9.45)	188 (7.4)	120 (4.72)	100 (3.94)

4.3. Bracket





Material:

- Thumb screw: SUS304
- Bracket body: Aluminum Alloy

Size:

Unit	A	B	C
mm(inch)	400 (15.5)	62 (2.44)	67 (2.64)

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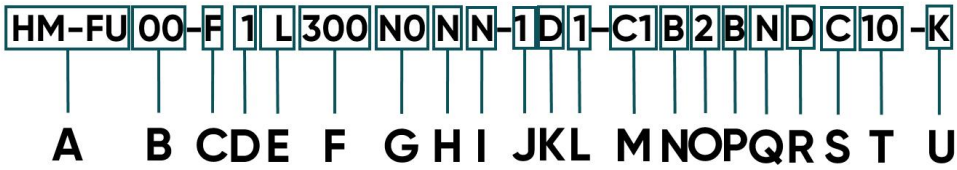
5. Ordering Information

The model code of HIKMICRO Ultrasonic Flow Meter is explained below. Each item from A to R must be specified at the time of ordering.



A. Base Model-Ultrasonic Flow Meter
B. Series
C. Accuracy
D. Number of Channels
E. Medium to be Measured
F. Nominal Diameter
G. Nominal Pressure
H. Process Connection
I. Sealing Surface
J. Housing
K. Power Supply
L. Output Signal
M. Sensor Type
N. Sensor Frequency
O. Temp. Range (Medium)
P. Sensor Material
Q. Explosion-proof
R. Sensor Protection Rating
S. Cable Type
T. Cable Length
U. Installation Method

5.1. Model Code Description

Model Code Position	Model Code	Description
Base Model- Ultrasonic Flow Meter		
A	HM-FU	Product Category
Series		
B	00	Product Series
Accuracy		
C	F	0.5%
C	G	1%
Number of Channels		
D	1	Single Channel
Medium to be Measured		
E	L	Liquid (water, raw water, demineralized water)
Nominal Diameter		
F	300	DN50~DN300
F	600	DN300~DN600
F	122	DN600~DN1200
F	302	DN1200~DN3000

Nominal Pressure		
G	N0	NA
Process Connection		
H	N	NA
Sealing Surface		
I	N	NA
Housing		
J	1	Square housing
Power Supply		
K	D	DC 24V
K	S	Adaptive power supply
Output Signal		
L	1	4 ~ 20 mA + pulse + MODBUS
Sensor Type		
M	C1	Standard A series
Sensor Frequency		
N	B	1MHz
Temp. Range (Medium)		
O	2	-40℃~120℃
Sensor Material		
P	B	Stainless steel
Explosion-proof		
Q	N	Non-explosion proof
Sensor Protection Rating		
R	D	IP68
Cable Type		
S	C	Standard cables
Cable Length		
T	10	10m
Installation Method		
U	K	Aluminum clamp + Holder
U	C	Aluminum clamp only

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5.2. Selection Table

Clamp-on Ultrasonic Flow Meter

X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X

Series
00 Series 00

Accuracy
0.5% F
1% G

Number of Channels
Single Channel 1

Medium to be Measured
Liquid L
(water, raw water, demineralized water)

Nominal Diameter
DN50~DN300 300
DN300~DN600 600
DN600~DN1200 122
DN1200~DN3000 302

Nominal Pressure
NA N0

Process Connection
NA N

Sealing Surface
NA N

Housing
Square housing 1

Power Supply
D DC 24V
S Adaptive power supply

Output Signal
1 4~20 mA + pulse + MODBUS

Sensor Type
C1 Standard A series

Sensor Frequency
B 1MHz

Temp. Range (Medium)
2 -40℃~120℃

Sensor Material
B Stainless steel

Explosion-proof
N: Non-explosion proof

Sensor Protection Rating
D: IP68

Cable Type
C: Standard cables

Cable Length
10: 10m

Installation Method
K: Aluminum clamp
C: Alilluminum clamp only

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HIKMICRO Thermography
HIKMICRO
hikmicro_industrial
www.hikmicrotech.com
hikmicro_industrial
info@hikmicrotech.com