FXK Series Clamp-On Ultrasonic Flow Meter

User Manual

Contents

1. Introduction

1.1 Product Overview

The product is a clamp-on ultrasonic flow meter with an integrated design, which is featured by small size, easy installation and operation, etc., and is suitable for the liquid media flow monitoring of a variety of small-diameter pipes.

1.2 Measurement Principle

When the ultrasonic beam propagates through a liquid, the flow of the liquid will cause a small change in the propagation time, which is proportional to the flow velocity of the liquid. At zero flow, the time required for both transducers to transmit and receive acoustic waves is exactly the same (the only technique that can actually measure zero flow). When the liquid flows, the acoustic transmission time in the upstream direction is greater than the acoustic transmission time in the downstream direction.

The relationship conforms to the following expression:

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} \bullet T_{down}}$$

Where
θ is the angle between the acoustic beam and the liquid flow direction
M is the number of times the acoustic beam propagates in a straight line through the liquid
D is the pipe diameter
T_{up} is the propagation time of the acoustic beam in the forward direction
T_{up} is the propagation time of the acoustic beam in the reverse direction
$\Delta T = T_{up} - T_{down}$

1.3 Features

◆ The measuring medium does not need to be electrically conductive;
◆ There is no need to break pipes during the installation process, and there is no need to stop work and production. There is no moving part and no pressure loss;
◆ No professional training is required for installation personnel, and they can complete the installation according to the installation video or the installation step diagram;
◆ Aviation aluminum alloy, stainless steel clamp, suitable for a variety of supply control environments.

1.4 Product Parameters

Items	Specifications
Housing material	Aluminium alloy, plastic
Mounting screw	Stainless steel
Protection grade	IP54
Flow velocity range	0.05-6m/s, > 0.2m/s to meet the accuracy
Calibration medium	Factory calibration medium: Water
Models	FXK-10, FXK-20, FXK-32, FXK-50
Measurement range	FXK-10: outer diameter Φ13-18mm FXK-20: outer diameter Φ18-28mm FXK-32: outer diameter Φ28-44mm FXK-50: outer diameter Φ44-64mm
Pipe materials	Stainless steel, carbon steel, copper, PVC, PP, PVDF and other dense pipes
Measurement media	Water, alcohol, gasoline, chemical solvents and other liquids with fixed composition (free of solid particles and impurities)

Media temperature	Standard transducer -10°C - 65°C (unfrozen) / Split transducer -20°C - 160°C
Measurement accuracy	Tolerance < 2%
Response time	1s - 5s
Power supply	12-24VDC
Power consumption	2W
Power supply/output interface	M12-Type A-6-core, 1 piece
Output	4-20mA
Communication	RS485 Modbus
Display screen	12864, LCD (black lettering on white background)
Keys	Light-touch mechanical keys, 4 pcs
Operating ambient temperature	-10°C - 60°C (unfrozen)
Storage temperature	-10°C- 60°C

1.5 Application Environments

1.5.1 Applicable Media (Common examples; if not listed, please contact the manufacturer for confirmation)

The product is suitable for the measurement of almost all single and clean liquids:

It is mainly used in the measurement and control of water (tap water, pure water, and ultrapure water). Due to the continuous expansion of application industries, it is also suitable for various acids, alkalis, organic liquids, chemical solvents, alcohols, beverages, etc.

Applicable fluids:
◆ Water
◆ Oil
◆ Chemicals

1.5.2 Pipe Materials

The product is suitable for the measurement of almost all pipes made of acoustic conductive materials, including metal pipes and plastic pipes.

With the options in the menu, one flow meter can measure both metal and plastic pipes.

Compatible pipe materials:
◆ Metal pipes: copper, iron, stainless steel
◆ Resin pipes: PVC, others

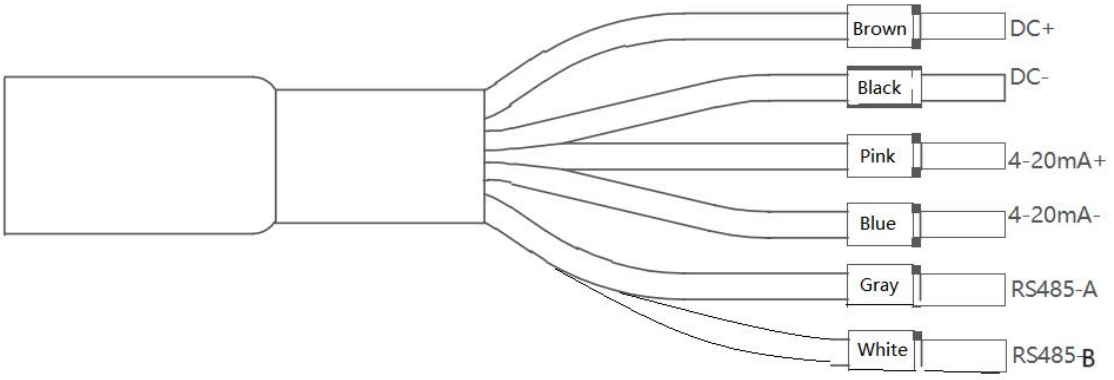
1.5.3 Pipe Diameter Range

For small-diameter pipes below DN40, the measurement data of other devices is not accurate, and this device is usually used for measurement.

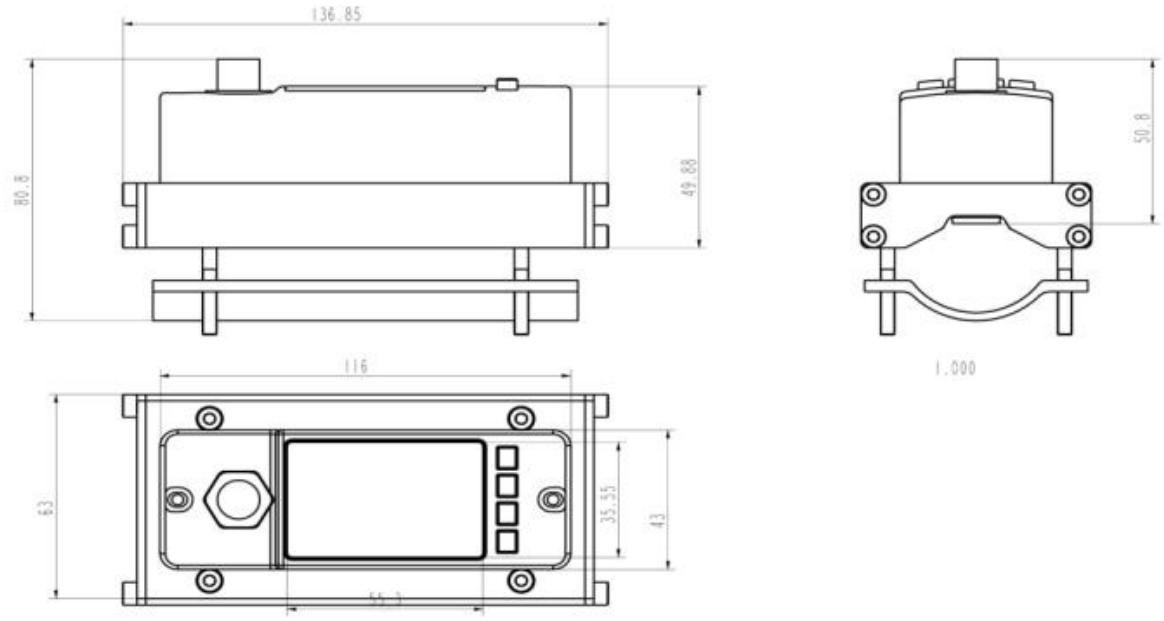
Compatible pipe sizes:
◆ DN10-DN63
◆ For For DN3~DN10, or above DN65, please contact the manufacturer for confirmation.

1.6 Cable

◆ Interface type: M12-Type A-6-core
◆ Wiring Diagram



1.7 Transducer Sizes



1.8 Outer Diameters for Different Models

Nominal diameter	Pipe outer diameter (mm)	Flow velocity range	Reference wall thickness range
FXK-10	Outer diameter Φ13-18mm	0.05-6m/s	1.0mm~2.5mm
FXK-20	Outer diameter Φ18-28mm	0.05-6m/s	1.0mm~3.5mm
FXK-32	Outer diameter Φ28-44mm	0.05-6m/s	1.0mm~4.0mm
FXK-50	Outer diameter Φ44-64mm	0.05-6m/s	1.0mm~5.5mm

1.9 Product Output Selection

	Output	
A	Default:	RS485, 4-20mA
B	Default:	RS485, OCT
C	Default:	RS485, solid-state relay
D	Default:	4-20mA, solid-state relay
E	Default:	4-20mA, OCT
F	Default:	OCT, solid-state relay

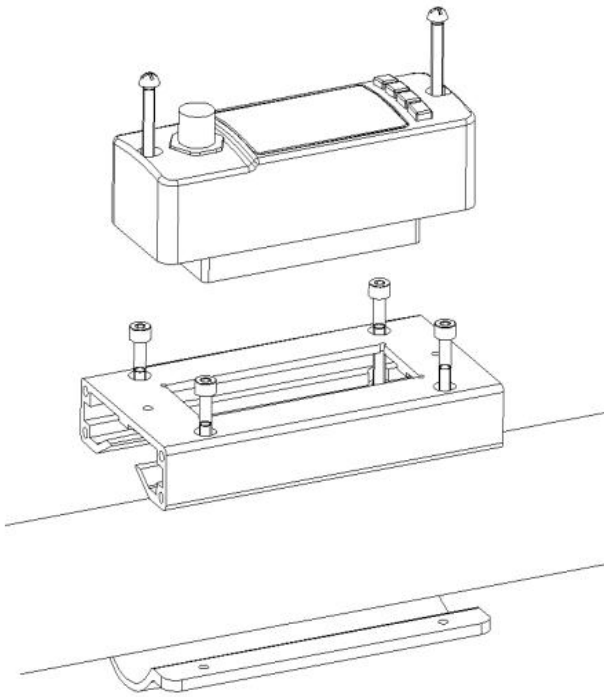
Example: FXK-20A
FXK clamp-on ultrasonic flow meter: applicable pipe diameter: DN15-DN25,Outer diameter Φ18-28mm, transducer temperature range: -10-65°C, 24V AC power supply, with 4-20mA current output and RS485 (Modbus) communication, standard cable length: 2m.

2. Installation and Commissioning

The installation of this meter is simple and convenient. Just select a suitable installation point, enter the pipe parameters at the installation point into the table, and then install the transducer on the pipe.

2.1 Installation

◆ Fix the pipe clamp to the pipe and tighten it;
◆ Install the transducer to the pipe clamp and fix the screws of the transducer;
◆ Note that the installation point shall be kept away from elbows, valves, tees and other positions that may affect the flow state. It shall be installed on a straight pipe, and the position shall be above 10 times the outside diameter of the pipe.

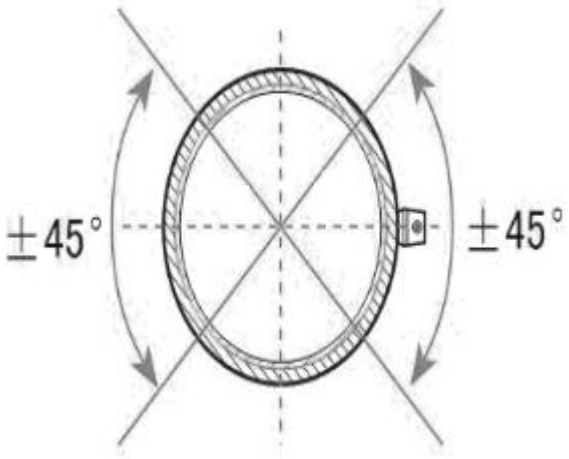


2.2 Selection of the Installation Point

The selection of the installation point is the key to correct measurement, and the following factors shall be considered in the selection of the installation point: full pipe, steady flow, scaling, temperature, and interference.

2.2.1 Full Pipe

To ensure the accuracy and stability of the measurement, the fluid at the measuring point shall fill the pipe section (otherwise the measured value will be too large or not measurable). Therefore, the following conditions shall be met:
The meter shall be installed in the horizontal direction of the axial surface of the pipe, and installed within the range shown in the figure, so as to prevent the upper part from being not filled with the pipe and air bubbles or the lower part from precipitation, which may affect the normal measurement of the transducer.



Full pipe	Possibly not full pipe
1. Select the installation point where the fluid flows vertically upwards 2. Select the installation point where the fluid flows obliquely upwards 3. Select the lowest point in the piping system to install	1. Pipes in which the fluid flows vertically downwards 2. Pipes in which the fluid flows obliquely downwards 3. The highest point of the piping system 4. The fluid is a natural flow 5. Fluid without pressure in the pipe

2.2.2 Steady Flow

A fluid with a steady flow helps to ensure measurement accuracy, while a fluid with a chaotic flow state makes it difficult to ensure measurement accuracy.

Standard requirements to meet steady flow conditions:
◆ The pipe section is away from the pump outlet or half-open valve, 10D for upstream and 5D for downstream (D: outer pipe diameter);
◆ 30D away from the pump outlet or half-open valve.

If the standard requirements of the steady flow conditions can not be met, the measurement can be tried in the following conditions:
◆ There is an elbow or buffer device between the pump outlet or half-open valve and the installation point;
◆ Upstream of the pump inlet or valve;
◆ The flow velocity of the fluid is medium or low.

(Low flow velocity: <1m/s; medium flow velocity: 1-2m/s; high flow velocity: ＞2m/s)

It is difficult to ensure a steady flow in the following cases, so please take care when installing.

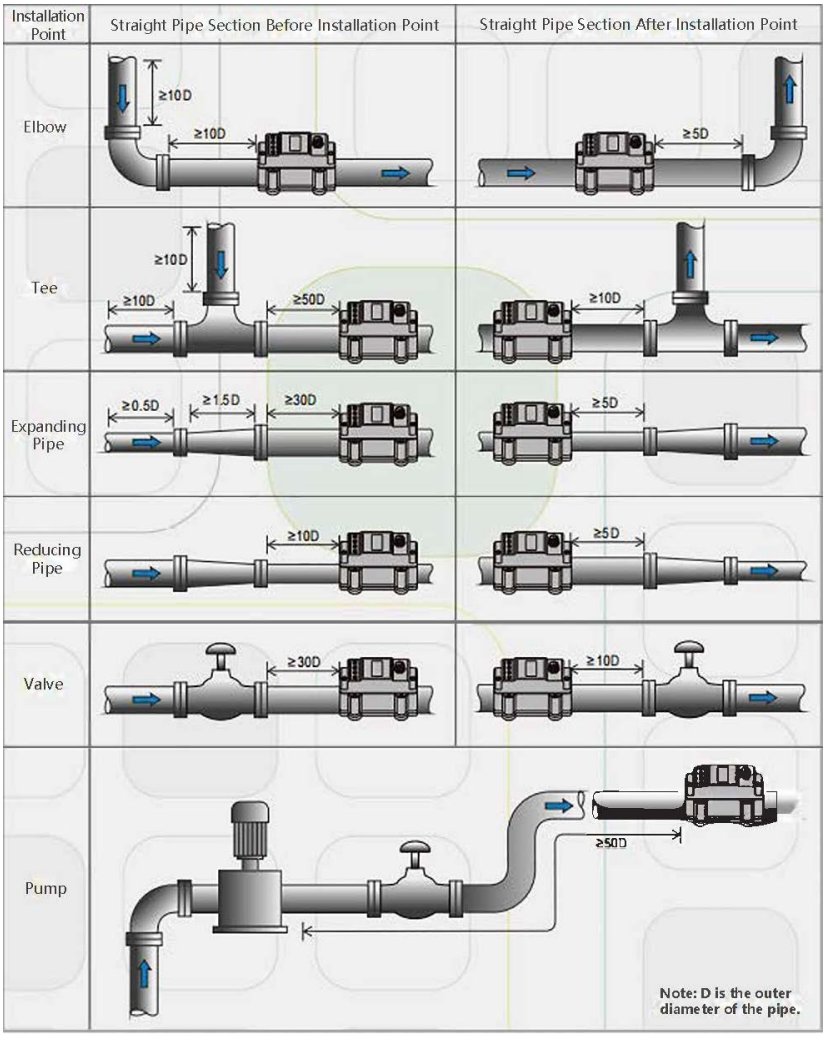
◆ The straight pipe section from the pump outlet or half-open valve is less than 10D, and there is no buffer device such as an elbow;

◆ The straight pipe section from the pump outlet or half-open valve is less than 10D, and the flow velocity is high;

◆ Vertical downward flow, oblique downward flow;

◆ Downstream: less than 10D away from the open outlet of the pipe.

Note: If it is difficult to determine the steady flow, you can use a portable ultrasonic flow meter to perform an actual measurement and observe the signal.



2.2.3 Scaling

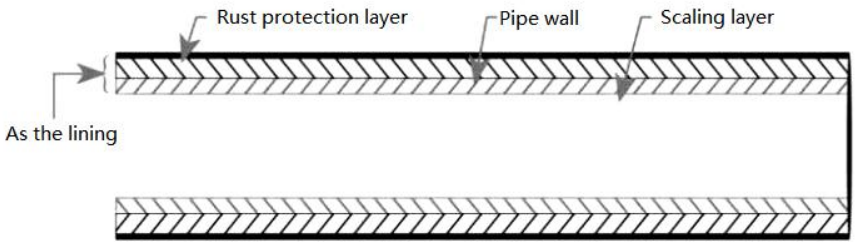
Scaling of the inner wall of the pipe will lead to attenuation of ultrasonic signal transmission and reduce the inner diameter of the pipe. Therefore, the scaling on the inner wall of the pipe will make the flow meter unable to measure normally or affect the measurement accuracy. Therefore, it is necessary to avoid selecting a position where the inner wall of the pipe is scaled as the installation point. If it is not possible to avoid the scaled installation point, the following measures can be taken to eliminate or reduce the effect of the scaling on the inner wall of the pipe on the measurement.

◆ Replace a pipe section at the measuring point.

◆ Hit the pipe of the measurement point with a hammer until the signal of the measurement point is

enhanced significantly.

◆Set the scaling as the lining to achieve higher measurement accuracy.



2.2.4 Temperature

Exceeding the transducer's operating temperature range may easily cause damage to the transducer or significantly shorten the service life of the transducer. Therefore, the fluid temperature at the installation point shall be within the operating temperature range of the transducer. Try to select an installation point with a lower temperature. Therefore, try to avoid installing it at the boiler water outlet and heat exchanger outlet of the same pipeline, and install it on the return pipe as much as possible (if possible, it is best to measure the temperature of the installation point with an infrared thermometer).

2.2.5 Interference

The main unit, transducer and cable of the ultrasonic flow meter are easily interfered by interference sources such as frequency converters, radio stations, television stations, microwave communication stations, mobile phone base stations, and high-voltage lines. Therefore, when selecting the installation points of the transducer and the main unit, try to stay away from these interference sources. The shielded layer of the main unit housing, transducer, and ultrasonic cable shall be grounded (for plug-in sensors, the grounding wire has been made into a binding post). Do not use the same power supply as the inverter, and use an isolated power supply to supply power to the main unit.

2.3 Enter Measurement Parameters

The initial setup is required before the measurement. Parameters in Menu 11 to Menu 25 need to be entered according to the on-site pipe conditions, and then the measurement can be started.

3. Menu List

3.1 Keypad

M (Used to access menus; type this key first, then type two digit keys, and you will enter the menu window corresponding to the digits)
▲ (Up key; move the menu up or select 0~9, +, or -)
▼ (Down key; move the menu down or move the cursor to the next digit)
↲ (Enter key; used to end menu input or enter a sub-menu)

Example: If you want to access Menu 11

Type [M], press [▲] once, select "1" for the first digit of the menu, type [▶] again, move the cursor to the second digit of the menu, type [▲] once, select "1" for the second digit of the menu, and then type [↲].

3.2 Details of Menu Windows

M00

Instantaneous flow, Water flow direction
Instantaneous flow velocity
Signal intensity, Signal quality, Operating state

+0.000$_{m3/h}$→
Flow velocity +0.0000m/s
S=000,000 Q=01+E

Signal intensity

M01 Positive cumulative flow

Positive cumulative flow +0.0000m3
Flow +0.0000m3/h
Flow velocity +0.0000m/s
S=000,000 Q=01+E

M02 Negative cumulative flow

Negative cumulative flow+0.0000m3
Flow +0.0000m3/h
Flow velocity +0.0000m/s
S=000,000 Q=01+E

M03 Net cumulative flow

Net cumulative flow +0.0000m3
Flow +0.0000m3/h
Flow velocity +0.0000m/s
S=000,000 Q=01+E

M04 Current time, Instantaneous flow

Date 25-01-01
Time 01:01:01
Flow +0.0000m3/h
S=000,000 Q=01+E

M05 Current time, Instantaneous flow velocity

Date 25-01-01
Time 01:01:01
Flow velocity +0.0000m/h
S=000,000 Q=01+E

M06

Model and size selection
Preset at factory

M06 Model FXK-10

M07

Manually locate the signal to remove interference

M07 ADC starting point offset 0000

M10

Enter the outer perimeter of the pipe; If the known condition is the outer diameter, enter it in Menu 11.

M10 Enter the outer perimeter of the pipe 00000.0mm

M11

Enter the outer diameter of the pipe directly, or you can enter the outer perimeter in the M10 window. The outer diameter range of the pipe shall be greater than 10mm and less than 6000mm.

M11 Enter the outer diameter of the pipe 00.0mm

M12

Enter the wall thickness of the pipe If the inner diameter of the pipe is known, you can skip this window and go to M13 to enter the inner diameter of the pipe

M12 Enter the wall thickness of the pipe 00.0mm

M13

Enter the inner diameter of the pipe; If the wall thickness has been entered, no parameters need to be entered in this menu.

M13 Enter the inner diameter of the pipe 00.0mm

M14

Material: carbon steel, stainless steel, cast iron, ductile iron, copper, PVC plastic, aluminum, asbestos, fiberglass, others

M14 Select the pipe material Carbon steel

M15 Acoustic velocity of the pipe material

M15
Enter the acoustic velocity of the pipe material
3185.0m/s

M16 Lining material: epoxy asphalt, rubber, mortar, polypropylene, polystyrene, polyester, polyethylene, bakelite, PTFE, others

M16
Select the lining material
No lining

M17 Acoustic velocity of the lining material

M17
Enter the acoustic velocity of the lining material
3185.0m/s

M18 Lining thickness

M18
Enter the lining thickness
000.0m

M19 Automatic, Low voltage, High voltage
The transmit power is automatic by default.

M19
Transmitting voltage setting
0-Automatic

M20 The fluid type in the pipe: water, seawater, kerosene, gasoline, fuel oil, crude oil, propane (-45℃), butane (0℃), others, diesel, castor oil, peanut oil, #90 gasoline, #93 gasoline, alcohol, high-temperature water (125℃)

M20
Select the fluid type
Water

M21 Acoustic velocity of the fluid

M21
Enter the acoustic velocity of the fluid
1473.0m/s

M22 Medium viscosity

M22
Medium viscosity

0.0000 cST

M23 Fixed high frequency, no modification is allowed

M23 Transmitting frequency setting 1-High frequency

M24 The reference distance is given after the parameters of Menu 11-23 are set.

M24 Transducer installation distance 00000.0mm

M25 The default direction of water flow is from left to right.

M25 Water flow direction setting 0->>>>

M26 If lower than this parameter, the on-site signal is determined to be abnormal, and the meter does not calculate the flow velocity.

M26 Minimum signal setting 10

M27 If lower than this parameter, the on-site meter displays a signal of 0.

M27 Signal removal 100

M28 The noise threshold is 0 by default.

M28 Signal-to-noise ratio threshold <= 0000

M29 The default is 50, and the pipe is determined to be empty when the signal is lower than 50.

M29 Empty pipe, signal intensity <= 050

M29A Default selection, normally not to be modified

M29A Signal capture algorithm X1024 (default)

M29B Default selection, normally not to be modified

M29B Set the number of excitations 001

M30 Metric and imperial unit selection

M30 Metric and imperial measurement units Metric

M31 Instantaneous flow unit: Cubic meter - m³ (Liter - L, US gallon - gal, Imperial gallon - igl, Mega gallon - mgl, cubic foot - cf, US barrel - ob, Imperial barrel - ib) /second - s (hour - h)

M31 Select the instantaneous flow unit Cubic meter - m³/h

M32 Cumulative flow unit: Cubic meter - m³, Liter - L, US gallon - gal, Imperial gallon - igl, Mega gallon - mgl, cubic foot - cf, US barrel - ob, Imperial barrel - ib

M32 Select the cumulative flow unit Cubic meter (m³)

M34 Net cumulative flow switch

M34 Net cumulative flow switch ON

M35 Positive cumulative flow switch

M35 Positive cumulative flow switch ON

M36 Negative cumulative flow switch

M36 Negative cumulative flow switch ON

M37 Accumulator clearing; it can clear: net cumulative flow, negative cumulative flow, positive cumulative flow, all accumulators, daily records, monthly records, yearly records, all

records, all cumulative flow, factory reset, custom records

M37 Accumulator clearing operation Not clearing

M38

The manual accumulator is a stand-alone accumulator that starts as you type and stops when you type again. It is used for the verification and estimation of flow measurement.

M38 Manual accumulator Type ENT when you're ready.

M39

Available in 2 languages: Chinese and English

M39 Language selection Simplified Chinese

M40

The damping coefficient ranges from 0 to 999 seconds. Damping acts to smooth out the displayed data. The damping coefficient value is equivalent to the time constant of the circuit, and the greater the damping coefficient, the greater the delay in the measurement results. Usually enter 5-10 in the application.

M40 Damping coefficient 10 Sec

M41

Remove the low-velocity flow so that the system displays "0" at low flow velocity to avoid ineffective accumulation.

M41 Low flow velocity removal 0.0000m/s

M41A

Remove the low-velocity flow. You can choose to remove forward, negative, or positive and negative.

M41A Low flow velocity removal direction Forward and negative removal

M41B

Disabled by default

M41B Direction recognition enabling Disabled

M42 After the fluid has completely stopped moving, is stationary and working properly, click 'Enter' to display a zero point, and click 'Enter' again to complete the static zeroing.

M42 Set the static zero point +0.0000m/s

M43 Select "Clear" to clear the zero point set by the user.

M43 Clear the static zero point Reserved

M44 Manual input offset time to superimpose to the measured value to obtain the true value

M44 Manual zero point setting +000.0m3/h

M45 This parameter is also known as the meter coefficient and is used to correct the measurement results. The meter coefficient refers to the ratio of the "true value" to the "indication value". For example, when the measured physical quantity is 2.00 and the meter shows 1.98, its instrument coefficient is 2/1.98.

M45 Scale factor meter coefficient 1.0000

M46 Enter the system identification code, which ranges from 1 to 99.

M46 Network identification address code 01

M47 Factory commissioned

M47 System lock, password protection Locked

M48 Segmental correction of on-site flow; coefficient after calibration of the <Flow Velocity Range>

M48 Flow correction curve coefficient <0.0-0.1>1.0000

M49 Serial port data

M49 View the input content of the serial port

The data is displayed in this line.

M50 Set the storage interval; timed storage of measurements at the set time, with 2,000 effective items

M50 Data storage interval 3600s

M54 It can be set from 6ms to 1s.

M54 OCT pulse width setting 200.000mS

M56 Output current calibration

M56 Current output verification 00

M57 The flow value corresponding to the set current loop output value of 20mA

M57 Current 20mA output value 010.0 m3

M58 Milliampere correction coefficient

M58 Current output correction value K 1.000

M59 If there is a slight deviation between the current value and the actual current output value, you can press +/- to correct and fine-tune the current value, and it is not recommended to correct if the deviation is too large (other reasons need to be checked).

M59 Current output correction value B 0.00 mA

M60 Modify the system date and time, and time is in 24-hour format.

M60 Date 25-01-01 Time 01-01-01

M61 Electronic serial number and software version number

M61 Basic information about the device SN:HU1E5FFFFFFF S250105_V7.1.01A

M62 Set the serial port. The serial port is used to interconnect with other devices. Devices connected with a serial port must have their serial port parameter settings matched.

M62 RS-232 serial port settings 9600, 8, N, 1

M63 Select the communication protocol

M63 Select the communication protocol MODBUS RTU

M67 Sets the upper limit frequency value of the frequency output signal. The upper limit frequency value shall be greater than the lower limit frequency value, and the value range is 0~9999Hz. Factory default value: 0~1000Hz

M67 Frequency output signal range 0000-1000Hz

M68 The flow value at the lower limit frequency point of the corresponding frequency signal

M68 Frequency output lower limit value 00000m3/h

M69 The flow value at the upper limit frequency point of the corresponding frequency signal

M69 Frequency output upper limit value 00010m3/h

M70 LCD backlight on time

M70 Display the backlight control options 00360 S

M71 Control the LCD display contrast, turning it up or down to get the proper contrast.

M71 Display contrast control

10

M72 Buzzer alarm switch setting

M72 Buzzer alarm setting ON

M73 Any measured flow below this lower limit value will result in an alarm output of the device.

M73 Flow alarm lower limit value +00.5 m3/h

M74 Any measured flow above this upper limit value will result in an alarm output of the device.

M74 Flow alarm upper limit value +99.9 m3/h

M75 When the flow is between the upper and lower limits, the indicator flashes, which is available in three colors.

M75 Normal state indicator 0-closed

M76 When the flow is below the lower flow limit, the indicator flashes, which is available in three colors.

M76 Low flow alarm indicator 0-closed

M77 When the flow is above the lower flow limit, the indicator flashes, which is available in three colors.

M77 High flow alarm indicator 0-closed

M78 Currently available options
1. Positive cumulative pulse output
2、2. Negative cumulative pulse output
3、3. Net cumulative pulse output
4、4. Flow signal output
5. Close the OCT output

M78 OCT output selection Close the OCT output

M81 Default parameter, no need to set normally

M81 Signal gain setting 200×Gain

M82 Thirty entries can be queried for daily, monthly, and yearly flow

M82 Yearly, monthly and daily flow query Daily

M88 Manufacturer's internal commissioning parameters

0000 0, 0, CD: 0900 000+0000, 000, 000 0000, 0000, 0000, D POS: 724 PV: 724.4

M90 Signal intensity, signal quality and transmission ratio

M90 000% Signal intensity, quality S=000,000 Q=01+E Signal reception anomaly

M91 Transmission time ratio

M91 Signal transmission time ratio 000%

M93 The measured average transmission time of ultrasonic waves

M93 Signal propagation time difference +0.00000

M94 The velocity correction coefficient value (or pipe factor) calculated by the current flow meter. This correction coefficient is generally the coefficient of the average linear flow velocity in the pipe.

M94 Reynolds coefficient pipe factor 0.4

M101 Default value

M101 ADC continuous acquisition times 0050 Times

4. Communication Protocols

3.1 MODBUS Protocol

Select to use MODBUS-RTU in the menu window M63.

The FXK series clamp-on ultrasonic flow meter only supports three MODBUS function codes: 03, 06 and 16, which are readout resistor, read-only register, and data block write function, respectively.

For example, to read the flow velocity of device 1 in RTU mode, that is, read registers 5 and 6, the command is as follows:
01 03 00 04 00 02 85 CA (hexadecimal digits)
Device Number Function Starting Register Number of Registers Checksum
Where 85 CA is a hexadecimal value, which is obtained according to the CRC-16 (BISYNCH, polynomial: x16 x15 x2 1, mask word: 0A001H) cyclic redundant algorithm. Please refer to the MODBUS related materials for further algorithms.
The returned data should be (set to simulated running state, flow velocity = 1.2345678m/s):
01 03 04 06 51 3F 9E 3B 32 (hexadecimal digits)
Device Number Function Number of Data Bytes Data=1.234567 Checksum

For another example, to read the net cumulative flow, the commands for two registers of REG25 and REG26 are as follows:
01 03 00 18 00 02 44 0C (hexadecimal digits)
The returned data should be (set the net accumulator = 802609 with a 4-byte hexadecimal expression of 00 0C 3F 31)
01 03 04 3F 31 00 0C A7 ED (hexadecimal digits, A7 ED is the checksum)
When the net cumulative flow = 0, the returned data is 01 03 04 00 00 00 00 FA 33, where FA 33 is the checksum.

Please note the order in which the data is stored in the example above. When using C language to interpret numerical values, you can use the pointer to directly put the required data into the corresponding variable address, and the general order of storage is to put the lowest bytes first. For example, in the above example of 1.23456m/s, the data of 3F 9E 06 51 is stored in the order of 51 06 9E 3F.

In ASCII mode, the command to read the 10 registers of device 1 starting from register 1 is as follows:
01030000000AF2 (carriage return)
The returned number is:
0103280000000000000000000000000000000000000000D4
Where ":" is the guide character in the ASCII mode, and "F2" and "D4" are double-byte checksums. The method is to add all characters except ":" and the carriage return at the end of the line in single-byte order, without counting carrying, and then seek the complement. Taking 01h+03h+00h+00h+00h+00h+0Ah=0Eh in the above command for example, its complement=0-0Eh=F2. The checksum of the returned data = 1 + 3 + 28h = 2Ch, and its complement = 0 - 2Ch = D4h.

In the MODBUS-RTU state, up to 125 registers can be read out at a time. While in the MODBUS-ASCII state, only 61 registers can be read out at a time. If more than these amounts, the flow meter will return an error message.

Please refer to the relevant materials for details of the MODBUS protocol.

When debugging the MODBUS protocol, it is recommended to use the free debugging software MODSCAN, which can be searched on the Internet. When there is a problem, if the correct data package of the checksum can be received, it means that there is no problem with the communication.

In the default state, the set rate of communication is generally 9600, without validation, and with 8 data

bits and 1 stop bit.
The four bytes of 3F 9E 06 51 are the single-accuracy floating-point form of 1.2345678 in IEEE754 format.

Register	Number of registers	Variable name	Data type	Notes
0001-0002	2	Instantaneous flow	REAL4	Unit: m³/h
0003-0004	2	Instantaneous heat flow	REAL4	Unit: GJ/h
0005-0006	2	Fluid velocity	REAL4	Unit: m/s
0007-0008	2	Measurement of the acoustic velocity of the fluid	REAL4	Unit: m/s
0009-0010	2	Positive cumulative flow	LONG	All flow accumulators that use long integers, whose measurement unit is controlled by M32 (i.e., REG1438).
0011-0012	2	Decimal part of positive cumulative flow	REAL4	REAL4 is a standard IEEE-754 format for single-precision floating-point numbers. This format is also commonly referred to as the FLOAT format.
0013-0014	2	Negative cumulative flow	LONG	LONG is a signed long integer preceded by a low character.
0015-0016	2	Decimal part of negative cumulative flow	REAL4	
0017-0018	2	Positive cumulative heat	LONG	All heat accumulators that use long integers, whose measurement unit is controlled by M84 (i.e., REG1441).
0019-0020	2	Decimal part of positive cumulative heat	REAL4	
0021-0022	2	Negative cumulative heat	LONG	
0023-0024	2	Decimal part of negative cumulative heat	REAL4	
0025-0026	2	Net cumulative flow	LONG	
0027-0028	2	Decimal part of net cumulative flow	REAL4	
0029-0030	2	Net cumulative heat	LONG	
0031-0032	2	Decimal part of net cumulative heat	REAL4	
0033-0034	2	Temperature1 / Water supply temperature	REAL4	Unit: ℃
0033-0034	2	Temperature1 / Water supply temperature	REAL4	Unit: ℃
0035-0036	2	Temperature 2 / Return water temperature	REAL4	Unit: ℃
0037-0038	2	Analog input AI3 quantity	REAL4	Converted dimensionless data
0039-0040	2	Analog input AI4 quantity	REAL4	Converted dimensionless data
0041-0042	2	Analog input AI5 quantity	REAL4	Converted dimensionless data
0043-0044	2	Analog input AI3 current value	REAL4	Unit: mA
0045-0046	2	Analog input AI4 current value	REAL4	Unit: mA
0047-0048	2	Analog input AI5 current	REAL4	Unit: mA

		value		
0049-0050	2	System setup password	BCD	Writable. 00H indicates canceling the password setting.
0051	1	Hardware setup password	BCD	Writable. "A55Ah" indicates on.
0053-0055	3	Date and time of the meter	BCD	Writable. The 6-byte BCD numbers indicate the second, minute, hour, day, month and year, respectively, with the lowest digit first.
0056	1	Day and hour of automatic data storage	BCD	Writable. The 2 bytes indicate the time and day of the start of scheduled data storage. For example, 0312H indicates that data is stored at 12 o'clock on the 3rd day of each month. 0012H indicates that the data is stored at 12 o'clock every day.
0059	1	Enter the key value (Analog keypad)	INTEGER	Writable. Refer to the key value table in the manual.
0060	1	Make the display show Menu X	INTEGER	Writable.
0061	1	Enter the backlight on time	INTEGER	Writable. Unit: s
0062	1	Remaining number of beeps of the buzzer	INTEGER	Writable. Maximum 255 times
0062	1	Number of remaining pulses of OCT	INTEGER	Writable. Maximum 65536
0072	1	Meter operating error code	BIT	See Note 4 for the meaning of each of the 16 bits.
0077-0078	2	Water supply resistance	REAL4	Unit: Ohm
0079-0080	2	Return water resistance	REAL4	Unit: Ohm
0081-0082	2	Total ultrasonic propagation time	REAL4	Unit: μs
0083-0084	2	Ultrasonic propagation time difference	REAL4	Unit: ns
0085-0086	2	Ultrasonic upstream propagation time	REAL4	Unit: μs
0087-0088	2	Ultrasonic downstream propagation time	REAL4	Unit: μs
0089-0090	2	Output current value of the current current loop	REAL4	Unit: mA
0092	1	Operating steps and signal quality	INTEGER	High bytes indicate signal tuning steps and low bytes indicate signal quality; Values range from 0-9, and large values indicate good signals.
0093	1	Upstream signal intensity	INTEGER	Range of value: 0- 4095
0094	1	Downstream signal intensity	INTEGER	Range of value: 0- 4095
0096	1	Operation interface language	INTEGER	0 for Chinese, 1 for English
0097-0098	2	Ultrasonic signal transmission ratio	REAL4	Normal range: 100+-3%
0099-0100	2	Current Reynolds number	REAL4	
0101-0102	2	Current Reynolds	REAL4	

		correction coefficient		
0103-0104	2	Time of the working timer	LONG	Unsigned, Unit: s
0105-0106	2	Total working time	LONG	Unsigned, Unit: s
0105-0106	2	Total number of power-ups	LONG	Unsigned
0113-0114	2	Net cumulative flow (in floating point form)	REAL4	Unit: cubic meter, 7 significant digits
0115-0116	2	Positive cumulative flow (in floating point form)	REAL4	Unit: cubic meter, 7 significant digits
0117-0118	2	Negative cumulative flow (in floating point form)	REAL4	Unit: cubic meter, 7 significant digits
0119-0120	2	Net cumulative heat (in floating point form)	REAL4	Unit: GJ, 7 significant digits
0121-0122	2	Positive cumulative heat (in floating point form)	REAL4	Unit: GJ, 7 significant digits
0123-0124	2	Negative cumulative heat (in floating point form)	REAL4	Unit: GJ, 7 significant digits
0125-0126	2	Today's cumulative flow (in floating point form)	REAL4	Unit: cubic meter, 7 significant digits
0127-0128	2	Cumulative flow for the month (in floating point form)	REAL4	Unit: cubic meter, 7 significant digits
0129-0130	2	Manual accumulator flow	LONG	
0131-0132	2	Decimal part of manual accumulator	REAL4	
0133-0134	2	Cumulative flow of batch controller	LONG	
0135-0136	2	Decimal part of batch controller	REAL4	
0137-0138	2	Today's cumulative flow	LONG	
0139-0140	2	Decimal part of today's cumulative flow	REAL4	
0141-0142	2	Cumulative flow for the month	LONG	
0143-0144	2	Decimal part of the cumulative flow for the month	REAL4	
0145-0146	2	Cumulative flow for the year	LONG	
0147-0148	2	Decimal part of the cumulative flow for the year	REAL4	