# Electromagnetic Flowmeter FM260

KATU卡图


## Product overview

According to Faraday's principle of electromagnetic induction, when a conductor passes vertically through magnetic field B, it will induce a voltage. U In the measurement of the flowmeter, the moving conductor is a flowing conductive medium, the magnetic field B is emitted from the direction perpendicular to the flowing medium, and the induced electro-motive force U on the two electrodes E1 and E2 is directly proportional to the flow rate V of the medium.

U=K×B×V×D
K- Meter constant
D- Internal probe spacing
After further processing, the induced electromotive force U is converted into a standard electrical signal output or display

## Functional characteristics

- Compact design saves installation space
- Anti-corrosion sensor technology
- All electronic design without viscosity of moving parts
- Automatic temperature compensation
- Pulse output/analog output /RS485 communication optional
- Low pressure loss
- Strong anti-fouling ability

## Technical parameter

| | |
|---|---|
| ◇ Measuring range: See range table | ◇ Ambient temperature: -25... 85 ℃ |
| ◇ Suitable pipe diameter: DN4... DN25(see selection table) | ◇ Medium temperature: -40... 120 No thermal shock |
| ◇ Measuring medium: conductive liquid (conductivity >20uS/cm) | (optional high temperature 140℃) |
| ◇ Accuracy: ≤±0.5% range | ◇ Materials |
| ◇ Repeatability: ≤±0.2% range | Electrode: HC |
| ◇ Pressure resistance: 16 bar | Process connection: stainless steel 316TI |
| ◇ Supply voltage: 24±10%Vdc | Measuring tube: PEEK |
| ◇ Current consumption: ≤80mA | Seal: EPDM |
| ◇ Electrical protection: reverse polarity protection, short circuit protection | Housing: stainless steel 304 |
| ◇ Output | ◇ Electrical connection: M12×1 connector |
| Pulse output: NPN output, pull-up resistor 2K | ◇ Process connection: external thread/internal thread |
| Analog output: 4... 20mA, current limit 26mA, load resistance < 250Ω | /sanitary chuck can be selected |
| ◇ Response time: < 100ms | |

## Wiring diagram

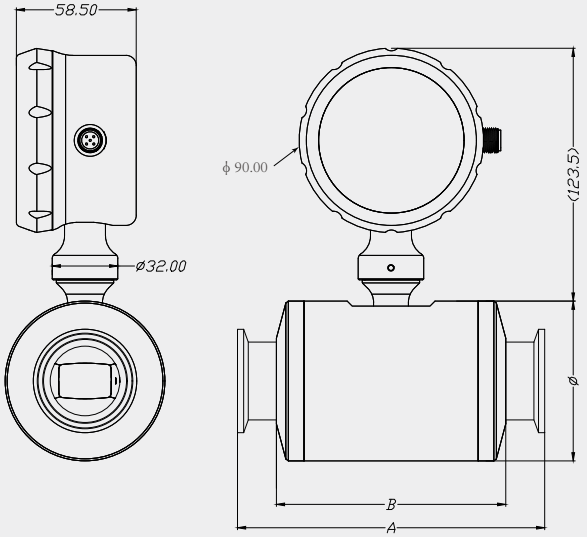
### 8-core wire

| line | color | Feature |
|---|---|---|
| 2 | BN | power supply(+) |
| 7 | BU | power supply(-) |
| 8 | RD | RS485(A) |
| 4 | YE | RS485(B) |
| 6 | PK | pulse (+) |
| 1 | WH | pulse (-) |
| 3 | GN | electric current (-) |
| 5 | GY | electric current (+) |

### 5-core wire

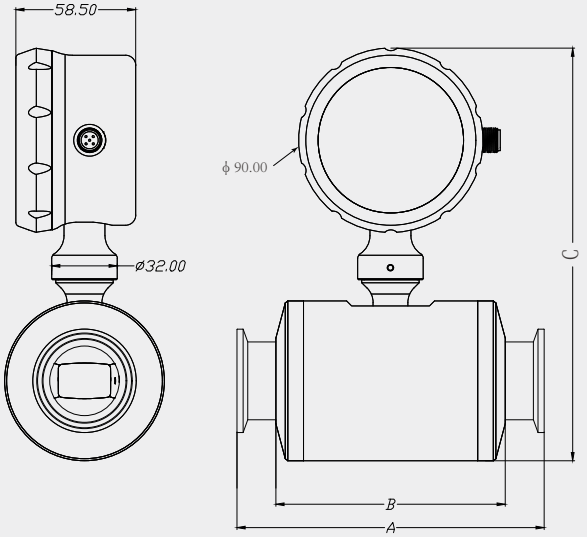
| line | color | Feature |
|---|---|---|
| 1 | BN | power supply(+) |
| 3 | BU | power supply(-) |
| 5 | GY | Analog signal (mA) |
| 2 | WH | RS485 (A) |
| 4 | BK | RS485 (B) |

## Dimensional Drawing (mm) — Clamp Connection




### ■ ≤25 Diameter

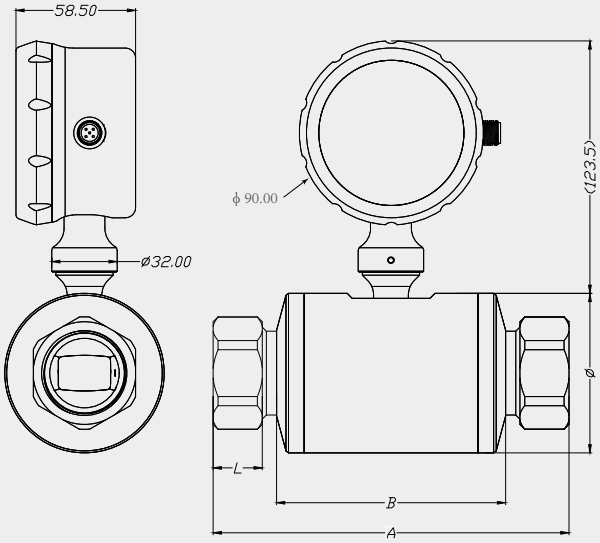
| Model | Chuck Connection | Pipe diameter | A | B | ϕ | Measurement range |
|---|---|---|---|---|---|---|
| FM260-H04 | 25.4 | DN4 | 90 | 60 | 45 | 0.1-10 L/min |
| FM260-H08 | 25.4 | DN8 | 104 | 74 | 60 | 0.5-25 L/min |
| FM260-H12 | 50.5 | DN12 | 120 | 90 | 70 | 1-60 L/min |
| FM260-H15 | 50.5 | DN15 | 120 | 90 | 70 | 3-100 L/min |
| FM260-H25 | 50.5 | DN25 | 150 | 112 | 78 | 4-200 L/min |




### ■ >25 Diameter

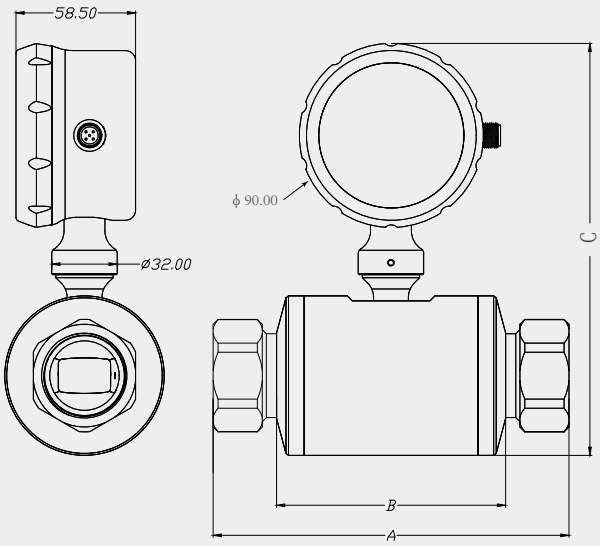
| Model | Chuck Connection | Pipe diameter | A | B | C | Measurement range |
|---|---|---|---|---|---|---|
| FM260-H32 | 50.5 | DN32 | 210 | 150 | 220 | 20-300 L/min |
| FM260-H40 | 64 | DN40 | 210 | 150 | 250 | 4-30³/h |
| FM260-H50 | 77.5 | DN50 | 210 | 150 | 300 | 7-45³/h |

## Dimensional Drawing (mm) — Internal Thread Connection




### ■ ≤25 Diameter

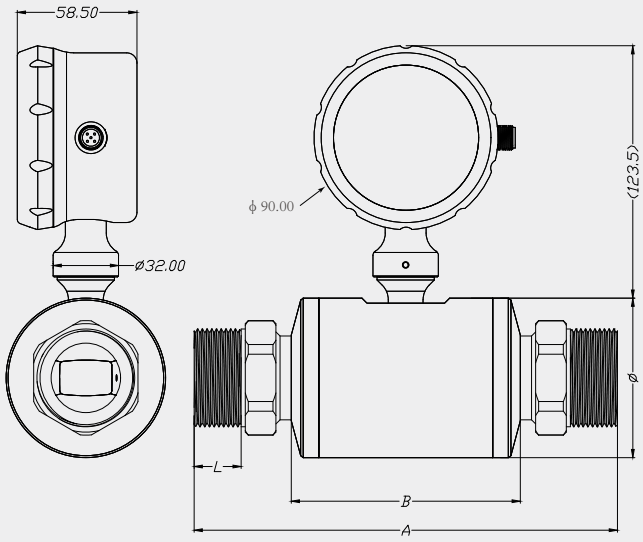
| Model | Internal thread | Pipe diameter | A | B | ϕ | Effective screw thread(L) | Measurement range |
|---|---|---|---|---|---|---|---|
| FM260-GK04 | GI/4" | DN4 | 90 | 60 | 45 | 13 | 0.1-10 L/min |
| FM260-GK08 | G1/2" | DN8 | 122 | 74 | 60 | 13 | 0.5-25 L/min |
| FM260-GK12 | G3/4" | DN12 | 142 | 90 | 70 | 15 | 1-60 L/min |
| FM260-GK15 | G3/4" | DN15 | 142 | 90 | 70 | 15 | 3-100 L/min |
| FM260-GK25 | G1-1/4" | DN25 | 174 | 112 | 78 | 20 | 4-200 L/min |




### ■ >25 Diameter

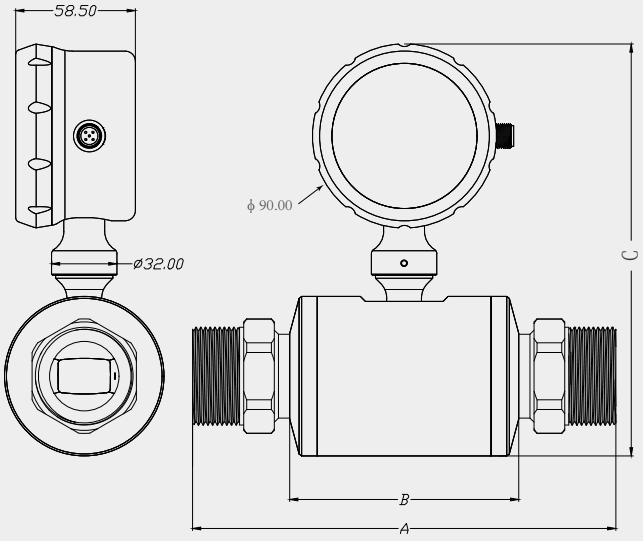
| Model | Internal thread | Pipe diameter | A | B | C | Measurement range |
|---|---|---|---|---|---|---|
| FM260-GK32 | 1-1/2" | DN32 | 210 | 150 | 220 | 20-300 L/min |
| FM260-GK40 | G2" | DN40 | 270 | 150 | 250 | 4-30³/h |
| FM260-GK50 | G2" | DN50 | 270 | 150 | 300 | 7-45³/h |

## Dimensional Drawing (mm) — External Thread Connection




### ■ ≤25 Diameter

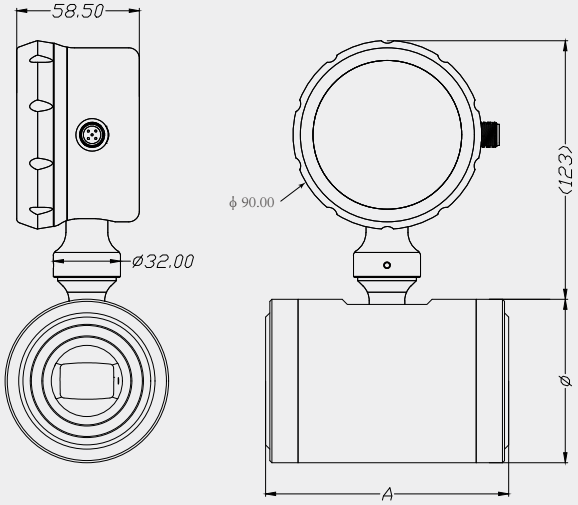
| Model | External thread | Pipe diameter | A | B | ϕ | Effective screw thread(L) | Measurement range |
|---|---|---|---|---|---|---|---|
| FM260-GM04 | Gl/4" | DN4 | 110 | 60 | 45 | 12 | 0.1-10 L/min |
| FM260-GM08 | G1/2" | DN8 | 141 | 74 | 60 | 18 | 0.5-25 L/min |
| FM260-GM12 | G1" | DN12 | 170 | 90 | 70 | 20 | 1-60 L/min |
| FM260-GM15 | G1" | DN15 | 170 | 90 | 70 | 20 | 3-100 L/min |
| FM260-GM25 | G1-1/2" | DN25 | 207 | 112 | 78 | 25 | 4-200 L/min |




### ■ >25 Diameter

| Model | External thread | Pipe diameter | A | B | C | Measurement range |
|---|---|---|---|---|---|---|
| FM260-GM32 | G1-1/2 | DN32 | 210 | 150 | 220 | 20-300 L/min |
| FM260-GM40 | G2" | DN40 | 270 | 150 | 250 | 4-30³/h |
| FM260-GM50 | G2-1/2 | DN50 | 270 | 150 | 300 | 7-45³/h |

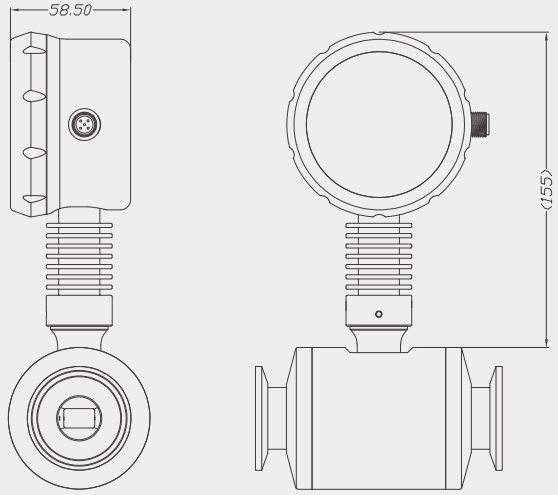
## Dimension drawing (mm) - Flange clamp assembly connection




■ **Flange clamp assembly connection**

| Model | Flange clamp | Pipe diameter | A | ϕ | Measurement range |
|---|---|---|---|---|---|
| FM260-F04 | DN15 | DN4 | 63 | 45 | 0.1-10 L/min |
| FM260-F08 | DN25 | DN8 | 80 | 60 | 0.5-25 L/min |
| FM260-F12 | DN32 | DN12 | 92 | 70 | 1-60 L/min |
| FM260-F15 | DN32 | DN15 | 92 | 70 | 3-100 L/min |
| FM260-F25 | DN32 | DN25 | 116 | 78 | 4-200 L/min |

## Dimension drawing (mm) - High-temperature type



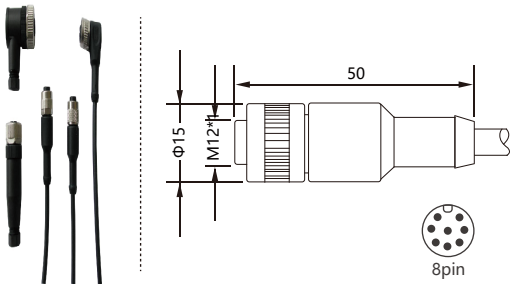

■ **High-temperature type（>120°）**

## Selection Table

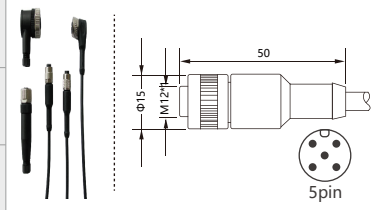
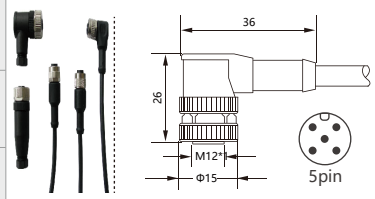
| FM260- | H | 04 | PR | - | - | Explanation |
|---|---|---|---|---|---|---|
| FM260- | | | | | | FM260 Electromagnetic Flowmeter |
| | H | | | | | Process connection: Clamp connection |
| | GK | | | | | Process connection: G thread internal teeth |
| | GM | | | | | Process connection: G thread external teeth |
| | F | | | | | Process connection: Flange mounting |
| | | 04 | | | | Measurement diameter: DN4 |
| | | 08 | | | | Measurement diameter: DN8 |
| | | 12 | | | | Measurement diameter: DN12 |
| | | 15 | | | | Measurement diameter: DN15 |
| | | 25 | | | | Measurement diameter: DN25 |
| | | 32 | | | | Measurement diameter: DN32 |
| | | 40 | | | | Measurement diameter: DN40 |
| | | 50 | | | | Measurement diameter: DN50 |
| | | | PR | | | Output signal: Pulse/Current/RS485 (8-wire) |
| | | | RA | | | Output signal: RS485/Analog mA (5-wire) |
| | | | | - | | Medium temperature: -20...120℃ |
| | | | | H1 | | Medium temperature: -20...140℃ |
| | | | | H2 | | Medium temperature: -40...120℃ |
| | | | | H3 | | Medium temperature: -40...140℃ |
| | | | | | - | Sealing material: Silicone (-40...120℃ coolant use) |
| | | | | | K | Sealing material: Perfluoroether |
| | | | | | E | Sealing material: Ethylene propylene diene monomer (EPDM) |
| | | | | | F | Sealing material: Fluoroceramic (0...120℃ use) |
| | | | | | N | Sealing material: Nitrile |

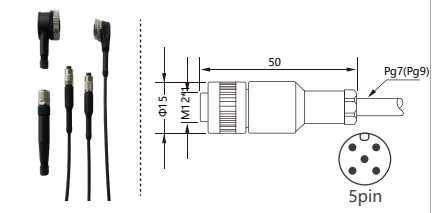
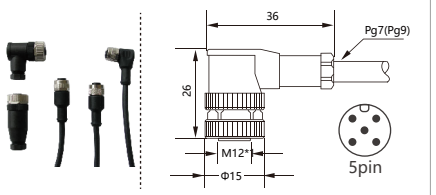
*Support customization of non-standard sizes

**Optional accessories - Electrical accessories (M12*1-8Pin) :PR output signal wiring (Factory standard: ZL08-PC02G)**

| name | Outline drawing/dimension drawing (unit :mm) | material | Model number |
|---|---|---|---|
| M12*1-8Pin (2m cable) |  | PVC | ZL08-PC02G |
| M12*1-8Pin (5m cable) | | | ZL08-PC05G |
| M12*1-8Pin (10m cable) | | | ZL08-PC010G |
| M12*1-8Pin (2m cable) | | PUR | ZL08-PU02G |
| M12*1-8Pin (5m cable) | | | ZL08-PU05G |
| M12*1-8Pin (10m cable) | | | ZL08-PU010G |

**Optional accessories - Electrical accessories (M12*1-5Pin) :RA output signal wiring (Factory standard: ZL05-PC02G)**

| name | Outline drawing/dimension drawing（mm） | material | model |
|---|---|---|---|
| M12*1-5Pin (2m cable) |  | PUR | ZL05-PU02G |
| M12*1-5Pin (5m cable) | | | ZL05-PU05G |
| M12*1-5Pin (10m cable) | | | ZL05-PU010G |
| | | PVC | ZL05-PC02G |
| | | | ZL05-PC05G |
| | | | ZL05-PC010G |
| M12*1-5Pin (2m cable) |  | PUR | ZL05-PU02W |
| M12*1-5Pin (5m cable) | | | ZL05-PU05W |
| M12*1-5Pin (10m cable) | | | ZL05-PU010W |
| | | PVC | ZL05-PC02W |
| | | | ZL05-PC05W |
| | | | ZL05-PC010W |

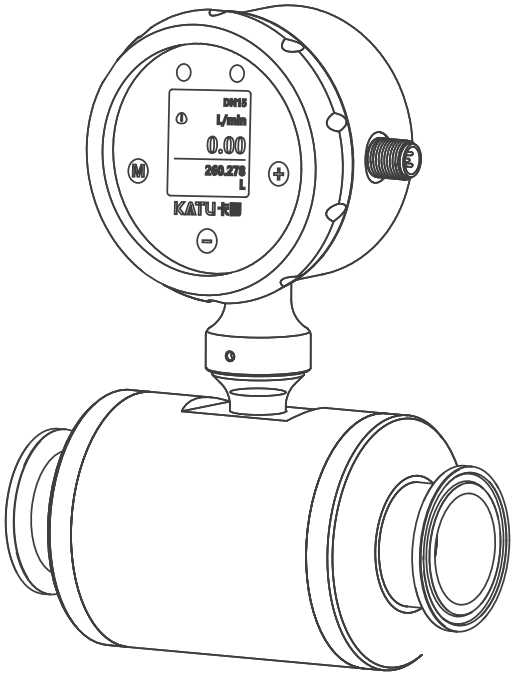
| M12* 1-5Pin self-connector/size drawing（mm） | model |
|---|---|
|  | GL05 (5Pin joint) |
|  | WL05 (5Pin joint) |

Sensor and controller

■ Flow ■ pressure ■ temperature ■ level ■ position

KATU 卡图

# Operation instruction
# Electromagnetic flowmeter
# FM260 Series



## *Safety statement*

- Before installing this device, please read this document to ensure that the product is suitable for your application and is not limited in any way;
- Failure to follow the operating instructions or technical data may result in personal injury or property damage;
- Check the compatibility of the product material with the medium to be tested in all applications;
- The equipment is only used as the medium to be tested, and it must only be ensured that the equipment is used correctly for long-term stable operation.

Ensure that the tested medium will not cause damage to the tested part of the product;

! The responsibility for determining whether the measurement sensor is suitable for the application lies with the operator, and the manufacturer accepts no responsibility for the consequences of improper use by the operator. Improper installation and use of the sensor results in invalid claims under warranty.

Flow sensors monitor the medium flow of fluids

Precautions: Beware of personal injury, overpressure danger!

# catalogue

## 1.1 Product Overview

According to Faraday's electromagnetic induction principle, when a conductive body passes perpendicularly through a magnetic field B, an electromotive force (EMF) will be induced. In this flowmeter, the moving conductor is the flowing conductive medium, and the magnetic field B is emitted perpendicular to the direction of the flowing medium, with the induced electromotive forces U at E1 and E2 proportional directly to the flow velocity V of the medium. U=K×B×V×D

K-factor of K-type flowmeter

D- internal probe spacing

The induced electromotive force U, after further processing, is converted into a standard electrical signal output or displayed.

## 1.2 Functional characteristics

- Compact design saves installation space
- Anti-corrosion sensor technology
- All electronic design without viscosity of moving parts
- Automatic temperature compensation
- Pulse output/analog output /RS485 communication optional
- Low pressure loss
- Strong anti-fouling ability

## 1.3 Technical parameter

◇ Measuring range: See range table

◇ Suitable pipe diameter: DN4... DN25(see selection table)

◇ Measuring medium: conductive liquid (conductivity >20uS/cm)

◇ Accuracy: ≤±0.5% range

◇ Repeatability: ≤±0.2% range

◇ Pressure resistance: 16 bar

◇ Supply voltage: 24±10%Vdc

◇ Current consumption: ≤80mA

◇ Electrical protection: reverse polarity protection, short circuit protection

◇ Output

Pulse output: NPN output, pull-up resistor 2K

Analog output: 4... 20mA, current limit 26mA, load resistance < 250Ω

◇ Response time: < 100ms

◇ Ambient temperature: -25... 85 ℃

◇ Medium temperature: -40... 120 No thermal shock (optional high temperature 160℃)

◇ Materials

Electrode: stainless steel 316TI

Process connection: stainless steel 316TI

Measuring tube: PEEK

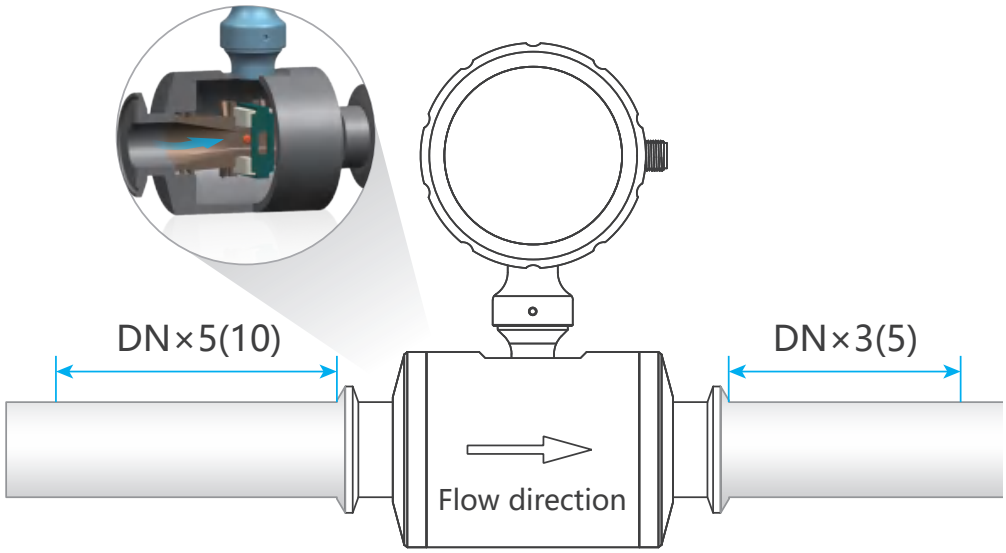
Seal: EPDM

Housing: stainless steel 304

◇ Electrical connection: M12×1 connector

◇ Process connection: external thread/internal thread/sanitary chuck can be selected

## 2.1 Installation precautions




**Electromagnetic flowmeter installation method:**

1. Select an installation position

The straight pipe section where the fluid flow is stable in the piping system should be selected. Generally, the length of the upstream straight pipe section is 5 to 10 times the pipe diameter, and the length of the downstream straight pipe section is 3 to 5 times the pipe diameter. Stay away from strong magnetic fields and strong electric field interference sources, such as large motors, transformers, high-voltage lines, etc. If it is not possible to stay away, shielding measures should be taken. The installation position should be easy to maintain and repair, and have enough operation space.

2. Installation method

Horizontal installation: The electromagnetic flowmeter can be installed horizontally, but it is necessary to ensure that the electrode axis is parallel to the ground, and the pipes at both ends of the flowmeter should be on the same horizontal plane to avoid high and low drop.

Vertical installation: can also be installed vertically, this time should ensure that the electrode axis and the ground vertical.

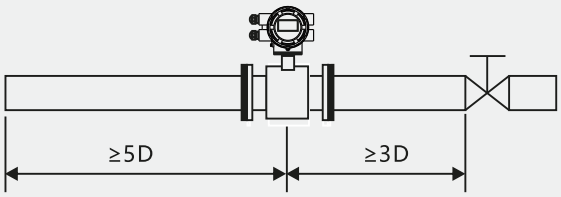
**Electromagnetic flowmeter installation precautions:**

Handle the flowmeter gently during installation to avoid collision and falling.

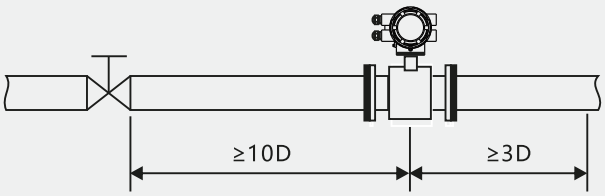
Install in strict accordance with the product instructions, and do not arbitrarily change the installation method and connection line.

After the installation is complete, check whether the connection parts are secure and the cables are correctly connected.

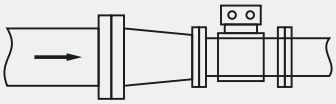
**Straight pipe length requirements**



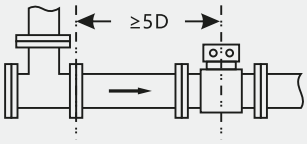

Valve is installed downstream of the sensor



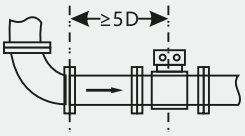

Valve is installed upstream of the sensor



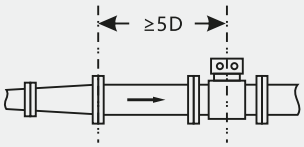
A tapered tube can be considered a straight tube



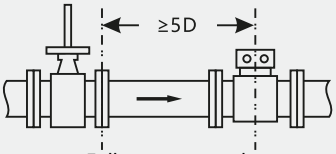

Tee joint



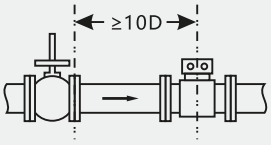

90°elbow




Expansion tube

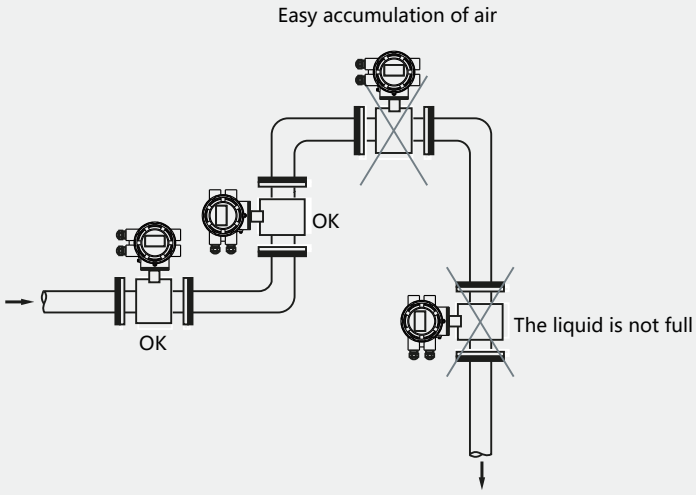


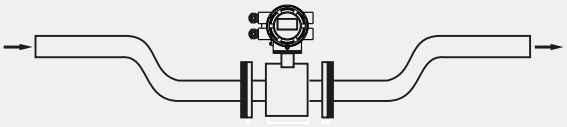

Full open gate valve



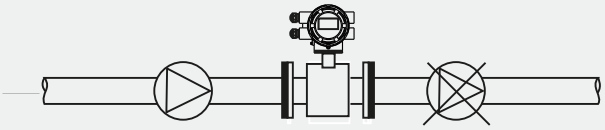

Various Kinds of Valves

**Recommended installation location**

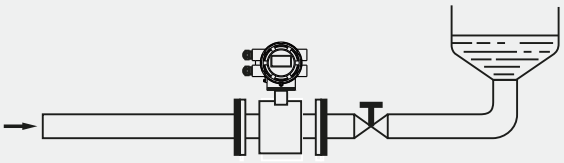


The sensor is lower than the installation of the pipe

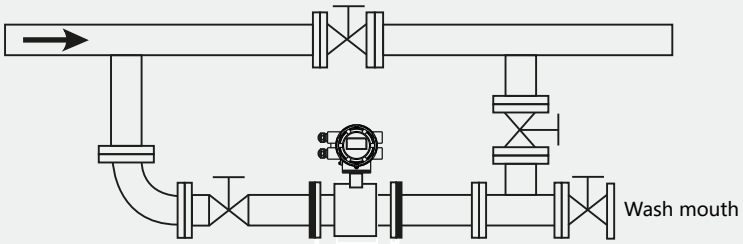


No electromagnetic flowmeter can be installed on the suction side of the pump to prevent negative pressure generated by vacuum



Downstream of the sensor there is back pressure installation

**Easy to clean pipe connections**




If the pipeline to be cleaned cannot be stopped, the side channel must be installed. To keep the system running while the equipment is being cleaned.

## 3.1 Wiring diagram

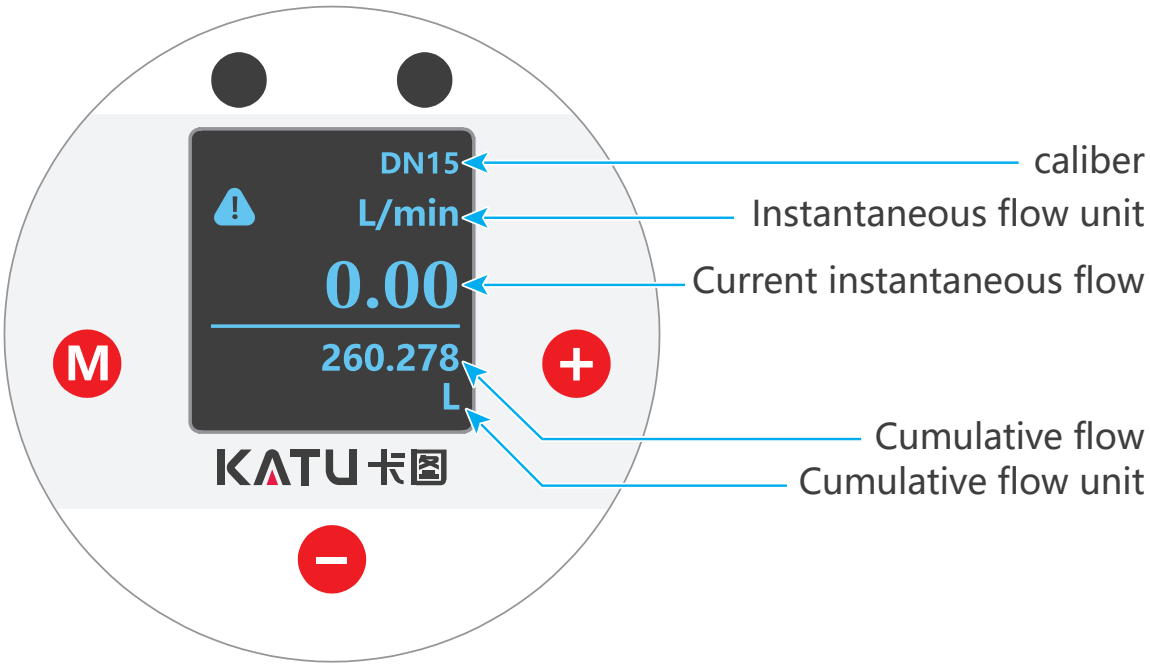
**RS485/analog mA**

| stitch | color | function |
|---|---|---|
| 1 | BN | power supply(+) |
| 3 | BU | power supply(-) |
| 5 | GY | Analog quantity（mA） |
| 2 | WH | RS485(A) |
| 4 | BK | RS485(B) |

**Pulse/current /RS485**

| stitch | color | function |
|---|---|---|
| 2 | BN | power supply(+) |
| 7 | BU | power supply(-) |
| 8 | RD | RS485(A) |
| 4 | RU | RS485(B) |
| 6 | PK | pulse（+） |
| 1 | WH | pulse（-） |
| 3 | GN | Electric current（-） |
| 5 | GY | Electric current（+） |

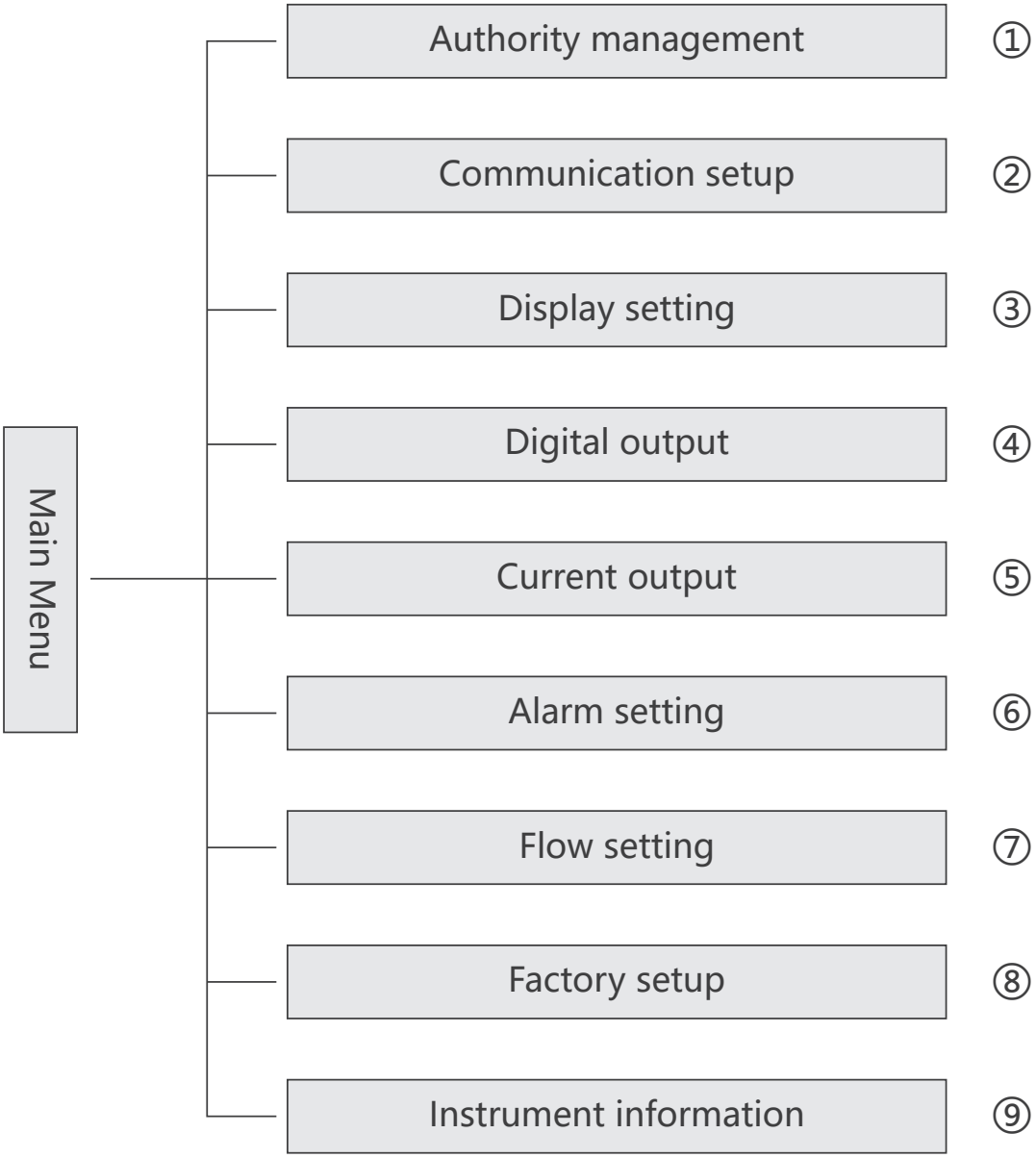
## 4.1 Description of panels and keys




**Key description**

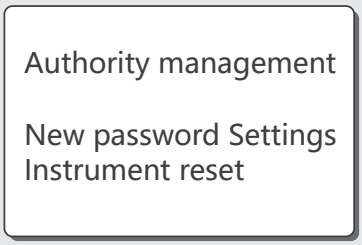
1. Long press the "M " key, the first time traffic related data appears, press again to display alarm information
2. Press M and - at the same time to enter the password menu. The maximum permission is 4, and the password is 000000
3. Press the + key to flip up, and the - key to flip down. Press the M and + keys at the same time to shift.
4. When the menu is displayed, press M and - to return to the previous menu, and hold down M to enter the current menu
5. Hold down the - and + keys at the same time, and hold down for 5 seconds to rotate the display screen 90 degrees. This operation is limited to the main screen.

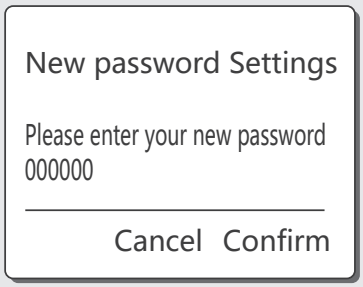
## *5.1 Main Menu*

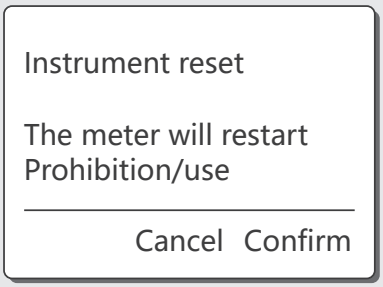

Main Menu
Authority management
①
Communication setup
②
Display setting
③
Digital output
④
Current output
⑤
Alarm setting
⑥
Flow setting
⑦
Factory setup
⑧
Instrument information
⑨

## 5.2 Menu introduction and operation

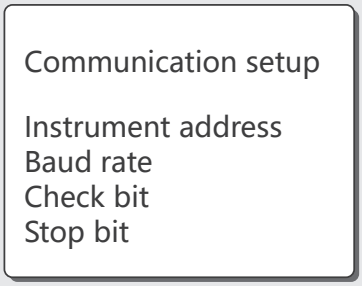
### ① Rights Management

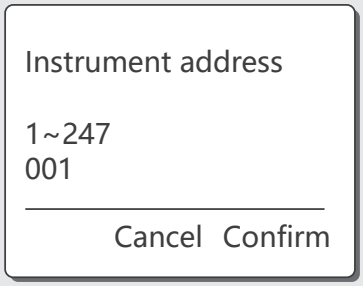


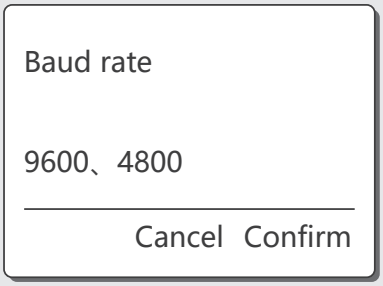



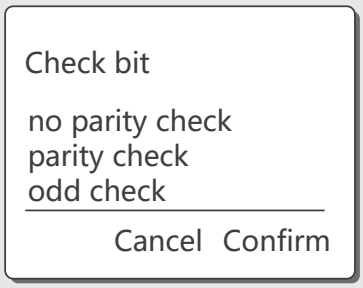



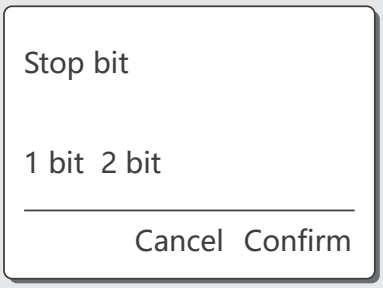

### ② Communication setup



## ③ Display setting

Display setting

Accumulator selection
Accumulator decimal place
Accumulator integer bit
Instantaneous quantity selection
User coding
Instantaneous decimal place
Language
rotate

Accumulator selection

Accumulator 1 Accumulator 2

Cancel Confirm

Accumulator decimal place

3 bit / 2 bit / 1 bit

Cancel Confirm

Accumulator integer bit

5~15
08

Cancel Confirm

Instantaneous quantity selection

Flow rate/Flow rate
/percentage of traffic

Cancel Confirm

User coding

Maximum 10 characters
EMF 0001

Cancel Confirm

Instantaneous decimal place

2 bit /3 bit /4 bit /1 bit/None

Cancel Confirm

Language

Chinese English

Cancel Confirm

rotate

0" 90 " 180" 270 "

Cancel Confirm

## ④ Digital output

Digital output

Output enable
Output polarity selection
Function selection
Pulse measurement polarity
Pulse equivalent
Pulse width
Frequency measurement polarity
Frequency range
Frequency duty cycle

Output enable

Enable/disable

Cancel Confirm

Output polarity selection

Low/high level

Cancel Confirm

Function selection

Frequency/pulse

Cancel Confirm

Pulse measurement polarity

Forward/reverse/bidirectional

Cancel Confirm

Pulse equivalent

0.0~100000000.0
1.0 L/P

Cancel Confirm

Pulse width

0.05~1000
1.00 ms

Cancel Confirm

Frequency measurement polarity

Forward/reverse/bidirectional
/ absolute value

Cancel Confirm

Frequency range

1~2000
1000 Hz

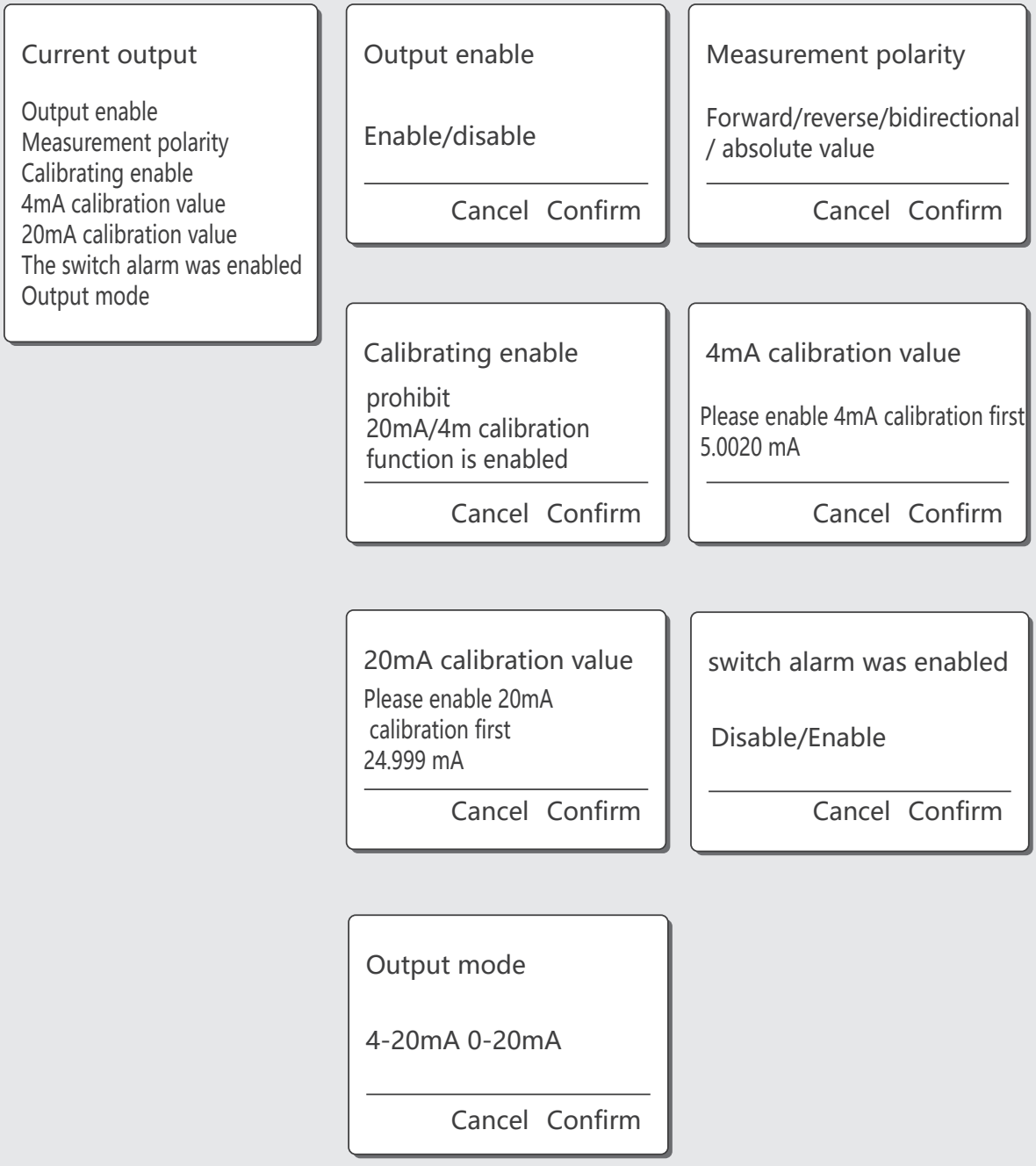
Cancel Confirm

Frequency duty cycle

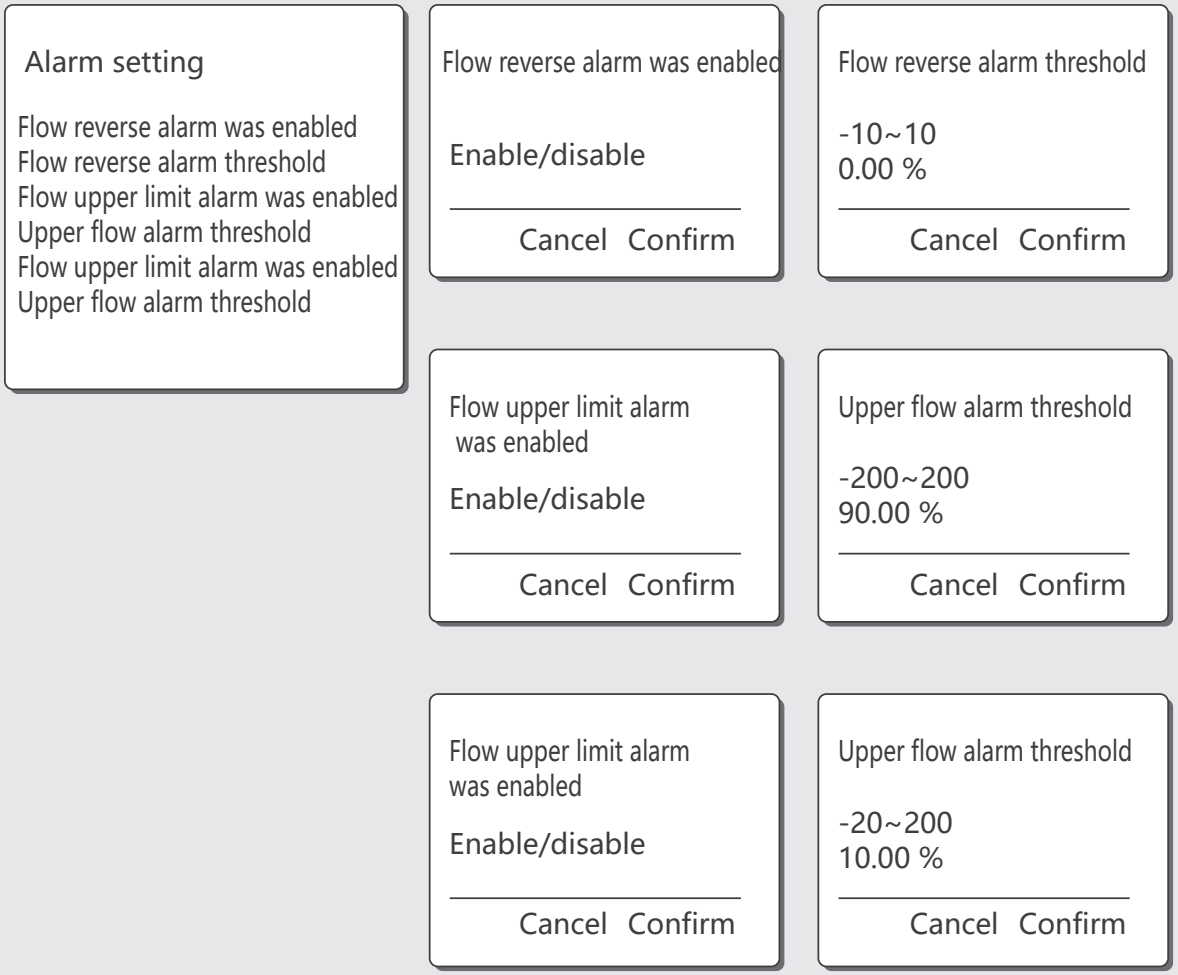
10~90
50 %

Cancel Confirm

## ⑤ Current output



## ⑥ Alarm setting



## ⑦ Flow setting

Flow setting

Flow
Accumulator 1 unit
Accumulator 1 Unit coefficient
Accumulator 1 function
Accumulator 1 Set
Accumulator 2 unit
Accumulator 2 Unit coefficient
Accumulator 2 function
Accumulator 2 Settings
Flow unit
Unit coefficient of discharge
Flow range
Low-flow excision
Flow direction setting
Flow reverse measurement was enabled
Filter constant
Subscriber instrument factor
User zero
The ATC detection was enabled. Procedure
Atc detection threshold
Excitation alarm enabled

Accumulator 1 unit

Max 5 characters
L

Cancel Confirm

Accumulator 1 Unit coefficient

0.000001~1000000
1000.00

Cancel Confirm

Accumulator 1 function

Forward cumulative
/reverse cumulative
/Total/net cumulative disabled

Cancel Confirm

Accumulator 1 Set

0.001~999999999
0.000 L

Cancel Confirm

Flow lower limit alarm
was enabled

Max 5 characters
L

Cancel Confirm

Accumulator 2 Unit coefficient

0.000001~1000000
1000.00

Cancel Confirm

Accumulator 2 function

Disable
/Forward accumulation/reverse
Cumulative to/total/net

Cancel Confirm

Accumulator 2 Set

0.001~999999999
0.000 L

Cancel Confirm

Flow unit

Max 8 characters
L/min

Cancel Confirm

Coefficient of flow unit

0.000001~1000000
16.6667

Cancel Confirm

Flow range

0.0001~999999
100.000 L/min

Cancel Confirm

Small signal excision

0.0001~1.0000
0.0050 m/s

Cancel Confirm

Flow direction setting

Forward/reverse

Cancel Confirm

Flow reverse measurement was enabled

Enable/disable

Cancel Confirm

Filter constant

0~10
00

Cancel Confirm

Subscriber instrument factor

0.5~1.5
1.0000

Cancel Confirm

User zero

-0.01~0.01
0.00000 m/s

Cancel Confirm

ATC detection was enabled . Procedure

Enable/disable

Cancel Confirm

Atc detection threshold

2.0~200.0
40.0 KΩ

Cancel Confirm

Excitation alarm enabled

Enable/disable

Cancel Confirm

## ⑧ Factory setup

Factory setup

caliber
Converter coefficient
Sensor coefficient
Sensor zero correction
Electrode impedance 200KΩ calibration value
Electrode impedance 0KΩ calibration value
system forward accumulator is set
System reverse accumulator Settings
Temperature 0 Resistor calibration value
Temperature 1K resistance calibration value
Nonlinear corrected flow rate 1
Nonlinear corrected flow rate 1 coefficient
Nonlinear corrected flow rate 2
Nonlinear corrected velocity 2 coefficient
Nonlinear corrected flow rate 3
Nonlinear corrected flow rate 3 coefficient
Nonlinear corrected flow rate 4
Nonlinear corrected velocity 4 coefficient
Nonlinear corrected flow rate 5
Non-linear correction velocity 5 coefficient

caliber

8~300
015 mm

Cancel Confirm

Converter coefficient

0.01~10.0
1.0000

Cancel Confirm

Sensor coefficient

0.01~10.0
1.0000

Cancel Confirm

Sensor zero correction

-0.2~0.2
0.00000 m/s

Cancel Confirm

Electrode impedance 200KΩ calibration value

Please separate the two signal electrodes to the ground
Don't connect the 200KΩ resistor
021.6 KΩ

Cancel Confirm

Electrode impedance 0KΩ calibration value

Please put the two signal electrodes
Short connect to ground

Cancel Confirm

system forward accumulator is set

0.001~999999999
00000000.000 m3

Cancel Confirm

System reverse accumulator Settings

0.001~999999999
00000000.000 m3

Cancel Confirm

Temperature 0 Resistor calibration value

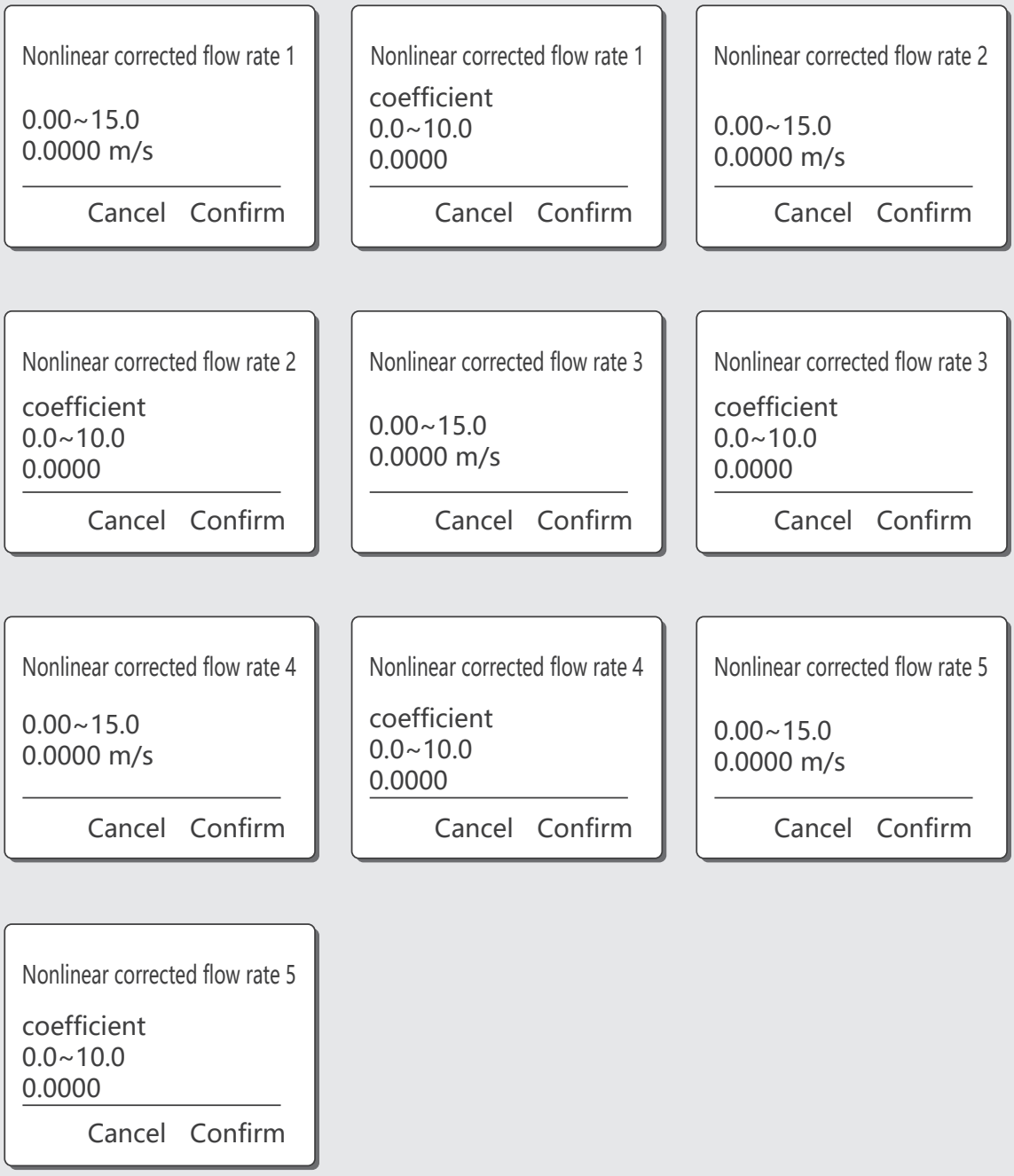
-50.0~50.0
0.00 Ω

Cancel Confirm

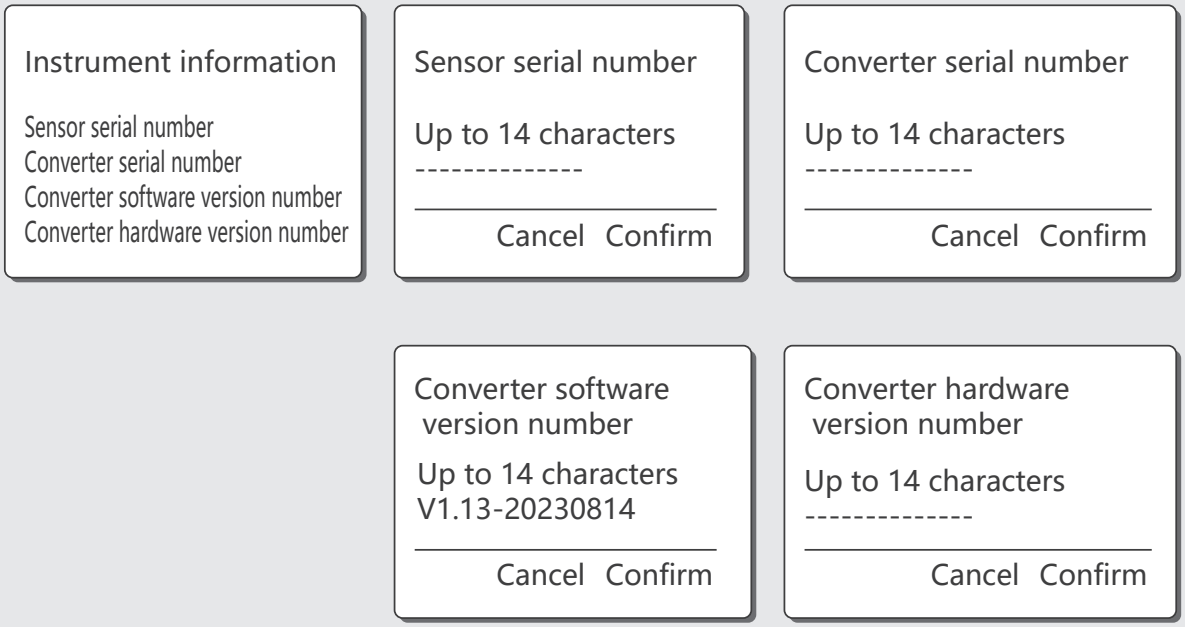
Temperature 1K resistance calibration value

950.0~1050.0
1000.00 Ω

Cancel Confirm


Nonlinear corrected flow rate 1
0.00~15.0
0.0000 m/s
Cancel Confirm
Nonlinear corrected flow rate 1
coefficient
0.0~10.0
0.0000
Cancel Confirm
Nonlinear corrected flow rate 2
0.00~15.0
0.0000 m/s
Cancel Confirm
Nonlinear corrected flow rate 2
coefficient
0.0~10.0
0.0000
Cancel Confirm
Nonlinear corrected flow rate 3
0.00~15.0
0.0000 m/s
Cancel Confirm
Nonlinear corrected flow rate 3
coefficient
0.0~10.0
0.0000
Cancel Confirm
Nonlinear corrected flow rate 4
0.00~15.0
0.0000 m/s
Cancel Confirm
Nonlinear corrected flow rate 4
coefficient
0.0~10.0
0.0000
Cancel Confirm
Nonlinear corrected flow rate 5
0.00~15.0
0.0000 m/s
Cancel Confirm
Nonlinear corrected flow rate 5
coefficient
0.0~10.0
0.0000
Cancel Confirm

## ⑨ Instrument information



## 6.1、Modbus Register address table

| MODBUS register | Number of registers | data type | Chinese name | unit | Access authority | Description |
|---|---|---|---|---|---|---|
| 0 | 2 | float | Velocity of flow | m/s | R | Update once per measurement cycle |
| 2 | 2 | float | Volume flow | Same user unit | R | |
| 4 | 2 | float | Percentage of flow | % | R | Volume flow as a percentage of full scale |
| 6 | 4 | double | User accumulator 1 | Same user unit | R/W | Changes can be made with the multi-register write command |
| 10 | 4 | double | User accumulator 2 | Same user unit | R/W | |
| 14 | 4 | double | System forward accumulator | m3 | R | - |
| 18 | 4 | double | System reverse accumulator | m3 | R | - |
| 22 | 2 | float | temperature | ℃ | R | - |
| 24 | 2 | uint32_t | Give an alarm | - | R | 0x0000: None<br>0x0001: Air flow control alarm<br>0x0002: flow reverse alarm<br>0x0004: flow upper limit alarm<br>0x0008: flow lower limit alarm<br>0x0010: Excitation coil alarm<br>0x0020: Storage exception alarm<br>0x0040: Low electrode resistance alarm<br>0x0080: Temperature upper limit alarm<br>0x0100: Temperature lower limit alarm<br>0x0200: Current open circuit alarm |
| 26 | 1 | uint16_t | Flow direction | - | R | 0：forward<br>1： reverse |
| 27 | 2 | float | Electrode | ohm | R | - |
| 29 | 2 | float | PT1000 resistance value | ohm | R | |

**Katu Electronic （Kunshan）Co.,Ltd.**

telephone：400-150-8815

Website: www.katusensor.com

Factory: Building 27B, Jingdong Intelligent Industrial Park,
No.9 Jinjie Road, Huaqiao Economic Development Zone,
Kunshan City, Suzhou

# MODBUS Protocol User Manual

Catalogue

# 1 Data Transmission Mode

MODBUS supports data transmission via two modes: RTU and ASCII. In RTU mode, 8-bit binary characters are used; in ASCII mode, 7-bit ASCII characters are employed. By splitting the high 4 bits and low 4 bits of each byte in RTU mode into separate fields, a byte is converted into two bytes—this constitutes the transmitted data in ASCII mode. For example, the data 0x1A in RTU mode corresponds to the two bytes 0x31 and 0x41 in ASCII mode, resulting in a frame length twice that of RTU mode.

**Note: Based on their transmission characteristics, the ASCII mode offers stronger anti-interference performance and is recommended. For RTU mode, a baud rate greater than 9600 bps is advised. Additionally, ASCII mode requires 8 data bits without parity check.**

Data frames in RTU transmission mode use CRC verification, while those in ASCII mode use LRC verification.

The table below summarizes the differences between the two transmission modes:

| **Transmission mode** | ASCII (7 bit) | RTU (8 bit) |
|---|---|---|
| Coded format | ASCII Code ('0' – '9', 'A' – 'F') | 8-bit binary (0x00 – 0xff) |
| Start bit | 1 | 1 |
| Data bit | 7，8 | 8 |
| Check bit | Odd, Even | Odd, Even |
| Stop bit | 1、2 | 1、2 |
| Frame Check | LRC | CRC16 |

# 2 Registers and Data Types

The table below lists several registers and data types.

| Register Type | DL | Number of Registers | Description |
|---|---|---|---|
| COIL | 1 bit | - | Boolean Variable (ON/OFF) |
| FLOAT | 32 bit | 2 | 32 Floating-point number (IEEE 754 format) |
| INT | 16 bit | 1 | Unsigned integer (0x0 – 0xFFFF) |
| DOUBLE | 64 bit | 4 | 64 Floating-point number (IEEE 754 format) |

## 2.1 COIL

Boolean variable: 0xFF00-> ON; 0x0000-> OFF

## 2.2 FLOAT

Use two registers to store single-precision IEEE754 floating-point numbers.

Each floating-point number consists of 4 bytes, defined as follows:

SEEEEEEE EMMMMMMM MMMMMMMM MMMMMMMM

S: Symbol bit 0 → positive, 1 → negative (1-bit)

E: Step Size (8 digits)

M: The decimal part of the last digit (23 digits)

For example: 0xC1480000 = -12.5

## 2.3 DOUBLE

Use four registers to store single-precision floating-point numbers in the IEEE754 format.

Each floating-point number consists of 8 bytes, defined as follows:

S: Symbol bit 0 → Positive 1 → Negative (1st position)

E: Step Size (11 digits)

M: The decimal part of the last digit (52 bits)

## 2.4 INT

Use one register to store an unsigned integer.

For example: 0x0025 = 37 0x1234 = 4660

# 3 Data Frame Verification Algorithm

## 3.1 LRC Verification

**// LRC verification range: from the "Instrument Address" to the byte preceding the LRC frame checksum**

```
void LRC(unsigned char *buf, unsigned int len)
{
    unsigned int i;
    LRC = 0;
    for (i=0; i<len; i++)
    {
        LRC += buf[i];
    }
    LRC = 0xff - LRC;
    LRC++;
}
```

## 3.2 CRC16 Check

```
const unsigned char  TAB_CRC_H[] = {
    0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0
    x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x
    01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x
    00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x
    01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x
    00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x
    00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x
    01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x
    01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x
    00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x
    00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x
    01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
```

```
    0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
    0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
    0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
    0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40};

const unsigned char  TAB_CRC_L[] = {
    0x00,0xC0,0xC1,0x01,0xC3,0x03,0x02,0xC2,0xC6,0x06,0x07,0xC7,0x05,0xC5,0xC4,0x04,
    0xCC,0x0C,0x0D,0xCD,0x0F,0xCF,0xCE,0x0E,0x0A,0xCA,0xCB,0x0B,0xC9,0x09,0x08,0xC8,
    0xD8,0x18,0x19,0xD9,0x1B,0xDB,0xDA,0x1A,0x1E,0xDE,0xDF,0x1F,0xDD,0x1D,0x1C,0xDC,
    0x14,0xD4,0xD5,0x15,0xD7,0x17,0x16,0xD6,0xD2,0x12,0x13,0xD3,0x11,0xD1,0xD0,0x10,
    0xF0,0x30,0x31,0xF1,0x33,0xF3,0xF2,0x32,0x36,0xF6,0xF7,0x37,0xF5,0x35,0x34,0xF4,
    0x3C,0xFC,0xFD,0x3D,0xFF,0x3F,0x3E,0xFE,0xFA,0x3A,0x3B,0xFB,0x39,0xF9,0xF8,0x38,
    0x28,0xE8,0xE9,0x29,0xEB,0x2B,0x2A,0xEA,0xEE,0x2E,0x2F,0xEF,0x2D,0xED,0xEC,0x2C,
    0xE4,0x24,0x25,0xE5,0x27,0xE7,0xE6,0x26,0x22,0xE2,0xE3,0x23,0xE1,0x21,0x20,0xE0,
    0xA0,0x60,0x61,0xA1,0x63,0xA3,0xA2,0x62,0x66,0xA6,0xA7,0x67,0xA5,0x65,0x64,0xA4,
    0x6C,0xAC,0xAD,0x6D,0xAF,0x6F,0x6E,0xAE,0xAA,0x6A,0x6B,0xAB,0x69,0xA9,0xA8,0x68,
    0x78,0xB8,0xB9,0x79,0xBB,0x7B,0x7A,0xBA,0xBE,0x7E,0x7F,0xBF,0x7D,0xBD,0xBC,0x7C,
    0xB4,0x74,0x75,0xB5,0x77,0xB7,0xB6,0x76,0x72,0xB2,0xB3,0x73,0xB1,0x71,0x70,0xB0,
    0x50,0x90,0x91,0x51,0x93,0x53,0x52,0x92,0x96,0x56,0x57,0x97,0x55,0x95,0x94,0x54,
    0x9C,0x5C,0x5D,0x9D,0x5F,0x9F,0x9E,0x5E,0x5A,0x9A,0x9B,0x5B,0x99,0x59,0x58,0x98,
    0x88,0x48,0x49,0x89,0x4B,0x8B,0x8A,0x4A,0x4E,0x8E,0x8F,0x4F,0x8D,0x4D,0x4C,0x8C,
    0x44,0x84,0x85,0x45,0x87,0x47,0x46,0x86,0x82,0x42,0x43,0x83,0x41,0x81,0x80,0x40
};

// CRC verification range: from the "instrument address" to the byte preceding the CRC frame check sum
void CRC(unsigned char *buf, unsigned int len)
{
    unsigned int i;
```

```
    unsigned char CRC_H , CRC_L , index, ch;
    CRC_H = 0xff;
    CRC_L = 0xff;
    for (i=0; i<len; i++)
    {
        ch = buf[i];
        index = CRC_H   ch;
        CRC_H = CRC_L   TAB_CRC_H[index];
        CRC_L = TAB_CRC_L[index];
    }
}
```

## 4 Instrument Variable Address Definition

All read instructions are 03, write instructions are 06 and 16, and data formats include unsigned short, long, float, and double.


1. Addresses that can use linking readings

| MODBUS register | Register Number of Items measure | data class mould | Chinese name | unit | access authority | description |
|---|---|---|---|---|---|---|
| 0000 | 2 | float | velocity of flow | m/s | R | Update once per measurement cycle |
| 0002 | 2 | float | volume flow | simultaneous use Household Statement Position | R | |
| 0004 | 2 | float | Traffic Percentage | % | R | Volume flow rate as a percentage of the full range |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0006 | 4 | double | User Counter 1 | Simultaneous use Household Statement Position | R/W | You can make changes using a multi-register write command. |
| 0010 | 4 | double | User Counter 2 | Simultaneous use Household Statement Position | R/W | |
| 0014 | 4 | double | The system is accumulating data in the forward direction. Gauge | m3 | R | — |
| 0018 | 4 | double | System Reverse Acc-umulation Gauge | m3 | R | — |
| 0022 | 2 | float | Temperature | ℃ | R | — |
| 0024 | 2 | uint32_t | Report to the police | — | R | 0x0000: None<br>0x0001: Air traffic control alarm<br>0x0002: Traffic Reverse Alarm<br>0x0004: Traffic limit alarm<br>0x0008: Traffic lower limit alarm<br>0x0010: Excitation coil alarm<br>0x0020: Storage error alarm<br>0x0040: Low resistance alarm for electrode<br>0x0080: Temperature Upper Limit Alarm<br>0x0100: Temperature lower limit alarm<br>0x0200: Open-circuit current alarm |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0026 | 1 | uint16_t | Traffic Direction | — | R | 0：forward<br>1：reverse |
| 0027 | 2 | float | Electrode imped-ance | ohm | R | — |
| 0029 | 2 | float | PT1000 Electric<br>Resistance | ohm | R | |

## 5 Specific Case Description

5.1 Default communication parameters for the flow meter: baud rate 9600, no parity, device address 1, RTU mode

5.2 Read the instantaneous flow rate and cumulative flow rate

| Read the instantaneous flow rate: register address 2, number of registers 2, data type single-precision floating-point (per IEEE 754 standard). | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ask | 01 | 03 | 00 | 02 | 00 | 02 | 65 | CB | | | | |
| | Address of the Meter | FC | Start address | | Number of Registers | | CRC | | | | | |
| Reply | 01 | 03 | 04 | 3B | BB | 5C | 79 | 7F | D0 | | | |
| | Address of the Meter | FC | DL | Data: 0.0057178 | | | | CRC | | | | |
| Read from reader accumulator 1: register address 6, number of registers 4, data type double precision floating-point (per IEEE 754 standard). | | | | | | | | | | | | |
| Ask | 01 | 03 | 00 | 06 | 00 | 04 | A4 | 08 | | | | |
| | Address of the Meter | FC | Start address | | Number of Registers | | CRC | | | | | |
| Reply | 01 | 03 | 08 | 3F | E2 | 64 | 9F | 27 | FB | B8 | 9A | 01 | 9B |
| | Address of the Meter | FC | DL | Data: 0.5747829228328272 | | | | | | | | CRC | |

## Cumulator Clear Command:

Clear User Accumulator 1:

Command 1: 01 10 03 E9 00 05 0A 00 04 30 30 30 30 30 30 00 00 E 1 FC Command 2: 01 10 0B BF 00 04 08 00 00 00 00 00 00 00 00 FA DB

System reset the accumulator:

Command 1: 01 10 03 E9 00 05 0A 00 04 30 30 30 30 30 30 00 00 E1 FC

Command 2: 01 10 13 99 00 04 08 00 00 00 00 00 00 00 00 52 B4

Clear the system's reverse accumulator:

Command 1: 01 10 03 E9 00 05 0A 00 04 30 30 30 30 30 30 00 00 E1

FC Command 2: 01 10 13 9D 00 04 08 00 00 00 00 00 00 00 00 A3 7B