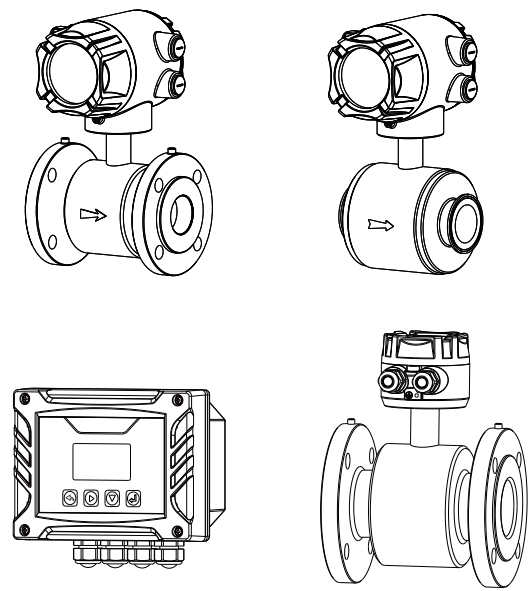
# User Manual

# Electromagnetic Flowmeter

U-001A-PUS-GDL-EN7



## Preface

Thank you for purchasing this electromagnetic flowmeter. To ensure proper operation and prevent potential losses due to improper use, please read this manual thoroughly before using the device.

**Note**

- The contents of this manual are subject to change without notice due to real-time factors such as function upgrades.
- We strive to ensure the accuracy of the manual. Nevertheless, if you identify any errors or inaccuracies, please contact us.
- Unauthorized reprinting or copying of this manual is strictly prohibited.

**Version**

U-001A-PUS-GDL-EN7

## Safety Precautions

In order to use this product safely, be sure to follow the safety precautions described.

**About this manual**

- Please submit this manual to the operator for reading.
- Please read the operation manual carefully before applying the instrument. On the precondition of full understanding.
- This manual only describes the functions of the product. The company does not guarantee that the product will be suitable for a particular use by the user.

**Precautions for protection, safety, and modification of this product**

- To ensure safe use of this product and the systems it controls, please read carefully the operation manual and understand the correct application methods before putting it into operation, to avoid unnecessary losses due to operational mistakes. If the instrument is operated in other ways not described in the manual, the protections that the instrument gives may be destroyed, and the failures and accidents incurred due to the violation of precautions shall not be borne by our company.
- When installing lightning protection devices for this product and its control system, or designing and installing separate safety protection circuits for this product and its control system, it needs to be implemented by other devices.
- If you need to replace parts of the product, please use the model specifications specified by the company.
- This product is not intended for use in systems that are directly related to personal safety. Such as nuclear power equipment, equipment using radioactivity, railway systems, aviation equipment, marine equipment, aviation equipment and medical equipment. If applied, it is the responsibility

of the user to use additional equipment or systems to ensure personal safety.

- Do not modify this product. The following safety signs are used in this manual:

Hazard: If not taken with appropriate precautions, it will result in serious personal injury, product damage, or major property damage.

Warning: Pay special attention to the important information linked to the product or particular part in the operation manual.

- Confirm if the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock, operational mistakes, good grounding protection must be made.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the electrical level, shielded, wires shall be located rationally, and SPD surge protectors shall be applied properly.
- Some inner parts may carry high voltage. Do not open the square panel in the front except for our company personnel or maintenance personnel acknowledged by our company, to avoid an electric shock.
- Cut off the electric power before making any checks to avoid an electric shock.
- Check the condition of the terminal screws regularly. If it is loose, please tighten it before use.
- It is not allowed to disassemble, process, modify, or repair the product without authorization, otherwise it may cause abnormal operation, electric shock or fire accident.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine

or other organic solvents. Prevent all kinds of liquid from splashing on the product. If the product falls into the water, please cut off the power immediately, otherwise, there will be leakage, electric shock or even a fire accident.

- Please check the grounding protection status regularly. Do not operate if you think that the protection measures, such as grounding protection and fuses, are not perfect.
- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life, and fire.
- Please strictly follow the instructions in this manual; otherwise, the product's protective device may be damaged.

- Do not use the instrument if it is found damaged or deformed upon opening of package.
- Prevent dust, wire ends, iron fines, or other objects from entering the instrument during installation; otherwise, it will cause abnormal movement or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Operational mistakes may lead to failure and even the destruction of the instrument and controlled equipment.
- Each part of the instrument has a certain lifetime, which must be maintained and repaired on a regular basis for long-term use.
- The product shall be scrapped as industrial waste to prevent environmental pollution.
- When not using this product, be sure to turn off the power switch.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

## Disclaimer

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

**Package contents**

| No. | Item Name | Quantity | |
|---|---|---|---|
| 1 | Electromagnetic flowmeter | 1 | |
| 2 | User manual | 1 | |
| 3 | Certificate | 1 | |
| 4 | Test report | 1 | |
| 5 | Installation kit | 1 | Comes with the remote type |

After opening the box, please confirm the package contents before starting the operation. If you find that the model and quantity are incorrect or there is physical damage to the appearance, please contact us.

# Contents

# 1 Introduction

## 1.1 Introduction

The electromagnetic flowmeter is designed based on the Faraday electromagnetic induction principle and is used to directly measure the flow rate of conductive liquids in closed pipelines. During on-site monitoring and display, standard current signals, pulse signals, and RS485 digital signals can be output for recording, adjustment, and control, achieving automatic detection and control. It can be widely used in industries such as tap water, chemical industry, coal, environmental protection, light textile, metallurgy, papermaking, etc.

## 1.2 Measuring principle

The operating principle of the electromagnetic flowmeter is based on Faraday's law of electromagnetic induction. The two electromagnetic coils at the upper and lower ends, as shown in Figure 1, generate a constant or alternating magnetic field. When the conductive medium flows through the electromagnetic flowmeter, the induced electromotive force can be detected between the left and right electrodes on the wall of the flowmeter tube. The magnitude of the induced electromotive force is proportional to the electrically conductive medium flow rate, the magnetic induction density of the magnetic field, and the width of the conductor (the inner diameter of the flowmeter measuring tube), and the flow rate of the medium can be obtained by calculation. The induced electromotive force equation is as follows:

$$E=K\times B\times V\times D$$

Where: E－Induced electromotive force

K－Meter constant

B－Magnetic induction density

V－Average flow speed in the cross-section of the measuring tube

D－Inner diameter of measuring tube

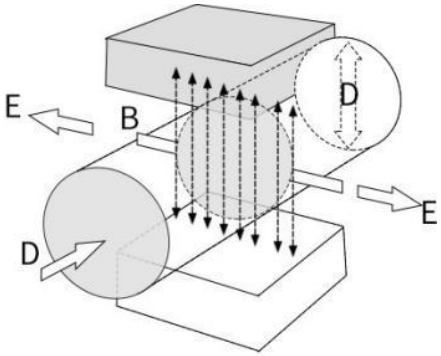



Fig.1

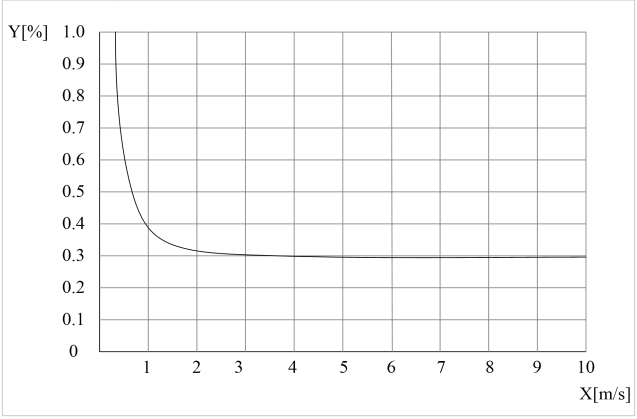
When measuring the flow, the fluid flows through a magnetic field which is perpendicular to the flow direction. The flow of conductive fluid induces a potential proportional to the average flow velocity, thus requiring the conductivity of the measured flowing liquid to be higher than the minimum conductivity. The induced voltage signal is detected by two electrodes and transmitted to the converter via a cable. After a series of analog and digital signal processing, the accumulated flow and real-time flow are displayed on the display of the converter.

## 1.3 Technical parameters

Table 1 Technical parameters

| Input | | | |
|---|---|---|---|
| Measured variable | Direct measured: Flow velocity<br>Calculated value: Volume flow, mass flow. | | |
| Flow velocity range | Typically range of flow velocity: 0.5m/s~5m/s | | |
| Nominal diameter | DN10~DN1000 | | |
| Flow range | Nominal diameter | Min value ($m^3/h$) | Max value ($m^3/h$) |
| | DN10 | 0.14 | 1.4 |
| | DN15 | 0.32 | 3.2 |
| | DN20 | 0.56 | 5.6 |
| | DN25 | 0.88 | 8.8 |
| | DN32 | 1.4 | 14 |
| | DN40 | 2.3 | 23 |
| | DN50 | 3.5 | 35 |
| | DN65 | 6 | 60 |
| | DN80 | 9 | 90 |
| | DN100 | 14 | 140 |
| | DN125 | 22 | 220 |
| | DN150 | 32 | 320 |
| | DN200 | 56 | 560 |
| | DN250 | 88 | 880 |
| | DN300 | 127 | 1270 |
| | DN350 | 173 | 1730 |
| | DN400 | 226 | 2260 |
| | DN450 | 286 | 2860 |
| | DN500 | 353 | 3530 |
| | DN600 | 509 | 5090 |
| | DN700 | 693 | 6930 |

| | | | |
|---|---|---|---|
| | DN800 | 905 | 9050 |
| | DN900 | 1150 | 11500 |
| | DN1000 | 1410 | 14100 |
| Range ratio | 10:1 | | |
| **Output** | | | |
| Current output | Function | Flow velocity, volumetric flow, or mass flow (Under the condition of constant medium density) | |
| | Range | Range | (4~20)mA |
| | | Upper range limit | 20mA |
| | | Lower range limit | 4mA |
| | Internal voltage | 24VDC | |
| | Loading | ≤750Ω | |
| Pulse output | Function | Set up pulse output | |
| | Pulse output | Basis | Output pulse width: 0.1ms ~2000ms<br>(This value is lower than the maximum duty cycle, with a maximum duty cycle of 1:1)<br>$F_{max}$ ≤ 5000 cp/s |
| | | Pulse coefficient | 0.001~100000/unit |
| | Passive | $U_{Outer}$≤ 30VDC | |
| | Active | $U_{Internal}$ ≤ 24VDC | |
| | | I≤ 4.52mA | |
| Communications | RS485; MODBUS-RTU; Hart communication (optional) | | |
| Relay (Remote type optional ) | 2 channels SPST; 250VAC; 3A | | |
| **Power supply** | | | |
| Supply voltage | 100VAC~240VAC, 50/60Hz;<br>20VDC~28VDC | | |

| | |
|---|---|
| Power consumption | ≤15W |
| Terminals | Screw type terminal block |
| Cable entries | M20*1.5 Cable gland |
| Signal cable | Applicable only to the remote version. Comes standard with a 10 m cable; other lengths customizable. |
| **Performance** | |
| Reference operating conditions | Medium: water<br>Temperature: 20℃<br>Pressure: 0.1MPa<br>Installation requirements: Inlet run≥10DN, Outlet run≥5DN |
| Accuracy | ±0.5% of measured value; ±0.3% of measured value (available for selected pipe sizes)<br>Note: Applicable to flow velocity range of 0.5 m/s to 5 m/s |
| Repetitiveness | 0.16% |
| Maximum measured error |  <br>①X[m/s]: Flow Velocity<br>②Y[%]: Actual measured value deviation |
| **Process** | |
| Medium | CR liner: -10℃~70℃ |

| | | |
|---|---|---|
| temperature range | PU liner: -10℃~60℃<br>PTFE/F46 liner-10℃~120℃ | |
| Rated pressure (Customizable for high-pressure applications) | DN10~DN250: PN<1.6MPa<br>DN300~DN1000: PN<1.0MPa<br>Note: For certain specifications, actual values may vary; refer to the nameplate for exact information. High-pressure versions are available upon request. | |
| Conductivity | ≥50μS/cm | |
| Buried depth | ＜5m (only for remote type sensors with IP68 protection) | |
| Immersion depth | ＜3m (only for remote type sensors with IP68 protection) | |
| **Environment condition** | | |
| Ambient temperature | Integrated type | -10℃~55℃ |
| | Remote type | Converter:-20℃~55℃<br>Sensor: -10℃~55℃ |
| Storage temperature | -20℃~55℃ | |
| Protection level | Integrated type | Standard: IP65 |
| | | High protection: IP66/IP67<br>(Cable requirements: armored shielded cable with twisted pairs; core configuration: 2 * 2 * 0.75 or 1.5 * 2/2.5 * 2; outer diameter 8mm~12mm) |
| | Remote type | Sensor: IP65<br>Converter: IP68 |

# 2 Structure and dimensions

## 2.1 Structure

The electromagnetic flow meters mainly consist of two parts: sensor and converter.

The integrated electromagnetic flow: sensor and converter are integrated in structure;

The remote type electromagnetic flowmeter: sensor and converter are installed separately and connected through signal cables.

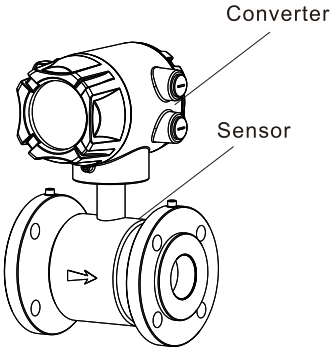



Fig.2 Structural diagram of the integrated version

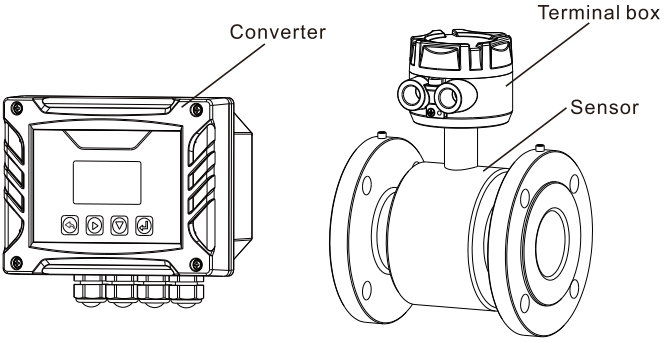
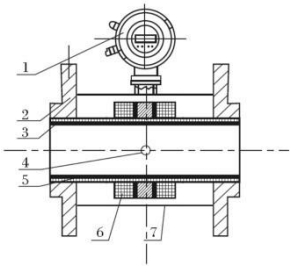



Fig.3 Structural diagram of the remote version

The sensor includes a flange, a lining, an electrode, a measuring tube, an excitation coil, and a sensor casing, etc; the converter includes an internal circuit board and a converter casing.

The electromagnetic flowmeter is mainly consisted of the following parts, see Fig.2.




1-Converter; 2-Flange;

3-Insulation lining; 4-Electrode;

5-Measuring tube; 6-Excitation coil;

Fig.4

The electromagnetic flowmeter mainly consists of a sensor and a converter. The sensor includes a flange, a lining, an electrode, a measuring tube, an excitation coil, and a sensor casing etc; the converter includes an internal circuit board and a converter casing.

(1) Converter: Provide stable excitation current for the sensor, meanwhile amplify the induced electromotive force obtained by the sensor and convert it to standard electrical signals or frequency signals; at the same time, it displays real-time flow and parameters for displaying, controlling, and adjusting thereof.

(2) Flange: for connecting process piping.

(3) Lining: Refer to a complete layer of electrically insulating corrosion-resistant material located at the inner side of the measuring tube and flange sealing surface.

(4) Electrode: A pair of electrodes is installed on the wall of the measuring tube, which is perpendicular to the magnetic line, to detect the flow signal. The material of the electrode can be selected according to the corrosion performance of the measured medium. It is also equipped with 1-2 grounding electrodes and anti-interference of flow signal measurement.

(5) Measuring tube: The measured medium flows through the measuring tube. It is made by welding non-magnetic stainless steel and the flange, and the

inner side is equipped with an insulation lining.

(6) Excitation coil: A group of coils is arranged on the upper and lower sides of the external side of the measuring tube, respectively, to generate a working magnetic field.

(7) Casing: Protect and seal the meter.

## 2.2 Converter dimensions

### 2.2.1. Integrated converter dimensions

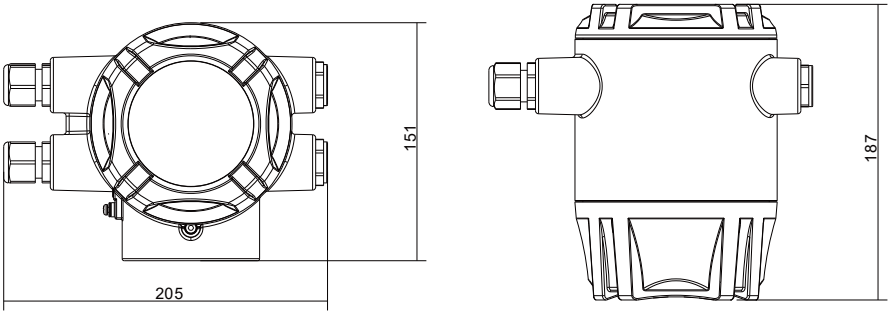



Fig.5 Integrated converter dimensions ( Unit: mm)

### 2.2.2. Remote converter dimensions

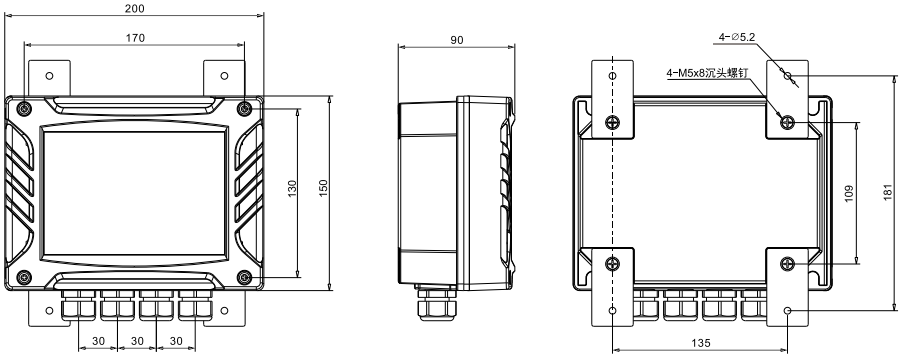



Fig.6 Remote converter dimensions ( Unit: mm)

### 2.2.3. Sensor dimensions

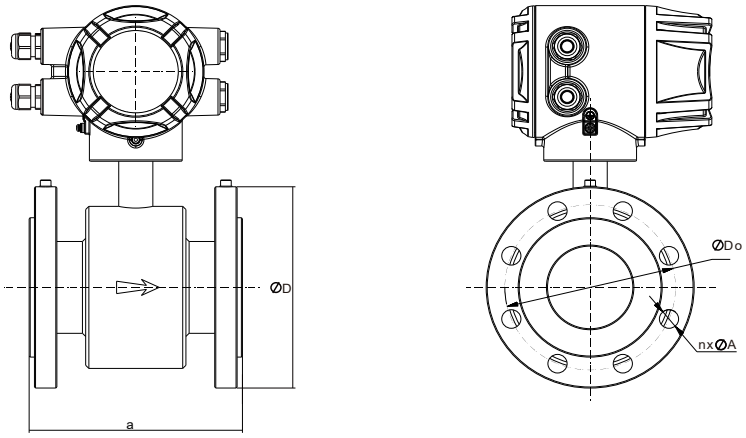



Fig.7 Structural diagram of the integrated sensor

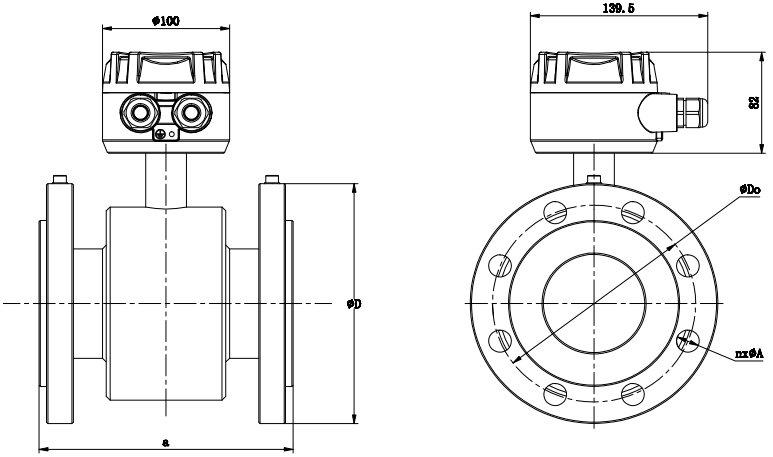



Fig.8 Structural diagram of the remote sensor

Table 2 Sensor dimensions (JB/T 81 Flange Connection)

Unit in mm

| DN | a | D | Do | n*A | Pressure resistance |
|---|---|---|---|---|---|
| 10 | 200 | 90 | 60 | 4*14 | 1.6MPa |
| 15 | 200 | 95 | 65 | 4*14 | 1.6MPa |
| 20 | 200 | 105 | 75 | 4*14 | 1.6MPa |
| 25 | 200 | 115 | 85 | 4*14 | 1.6MPa |
| 32 | 200 | 135 | 100 | 4*18 | 1.6MPa |
| 40 | 200 | 145 | 110 | 4*18 | 1.6MPa |
| 50 | 200 | 160 | 125 | 4*18 | 1.6MPa |
| 65 | 200 | 180 | 145 | 4*18 | 1.6MPa |
| 80 | 200 | 195 | 160 | 8*18 | 1.6MPa |
| 100 | 250 | 215 | 180 | 8*18 | 1.6MPa |
| 125 | 250 | 245 | 210 | 8*18 | 1.6MPa |
| 150 | 300 | 280 | 240 | 8*23 | 1.6MPa |
| 200 | 350 | 335 | 295 | 12*23 | 1.6MPa |
| 250 | 450 | 405 | 355 | 12*25 | 1.6MPa |
| 300 | 500 | 440 | 400 | 12*23 | 1.0MPa |
| 350 | 550 | 500 | 460 | 16*23 | 1.0MPa |
| 400 | 600 | 565 | 515 | 16*25 | 1.0MPa |
| 450 | 600 | 615 | 565 | 20*25 | 1.0MPa |
| 500 | 600 | 670 | 620 | 20*25 | 1.0MPa |
| 600 | 600 | 780 | 725 | 20*30 | 1.0MPa |
| 700 | 700 | 895 | 840 | 24*30 | 1.0MPa |
| 800 | 800 | 1015 | 950 | 24*33 | 1.0MPa |
| 900 | 900 | 1115 | 1050 | 28*33 | 1.0MPa |
| 1000 | 1000 | 1230 | 1160 | 28*36 | 1.0MPa |

Table 3 Sensor dimensions (GB/T 9124 Flange Connection)

Unit in mm

| DN | a | D | Do | n*A | Pressure resistance |
|---|---|---|---|---|---|
| 10 | 200 | 90 | 60 | 4*14 | 1.6MPa |
| 15 | 200 | 95 | 65 | 4*14 | 1.6MPa |
| 20 | 200 | 105 | 75 | 4*16 | 1.6MPa |
| 25 | 200 | 115 | 85 | 4*16 | 1.6MPa |
| 32 | 200 | 140 | 100 | 4*18 | 1.6MPa |
| 40 | 200 | 150 | 110 | 4*18 | 1.6MPa |
| 50 | 200 | 165 | 125 | 4*20 | 1.6MPa |
| 65 | 200 | 185 | 145 | 8*20 | 1.6MPa |
| 80 | 200 | 200 | 160 | 8*20 | 1.6MPa |
| 100 | 250 | 220 | 180 | 8*22 | 1.6MPa |
| 125 | 250 | 250 | 210 | 8*22 | 1.6MPa |
| 150 | 300 | 285 | 240 | 8*24 | 1.6MPa |
| 200 | 350 | 340 | 295 | 12*26 | 1.6MPa |
| 250 | 450 | 405 | 355 | 12*29 | 1.6MPa |
| 300 | 500 | 445 | 400 | 12*26 | 1.0MPa |
| 350 | 550 | 505 | 460 | 16*30 | 1.0MPa |
| 400 | 600 | 565 | 515 | 16*32 | 1.0MPa |
| 450 | 600 | 615 | 565 | 20*36 | 1.0MPa |
| 500 | 600 | 670 | 620 | 20*38 | 1.0MPa |
| 600 | 600 | 780 | 725 | 20*42 | 1.0MPa |
| 700 | 700 | 895 | 840 | 24*50 | 1.0MPa |
| 800 | 800 | 1015 | 950 | 24*56 | 1.0MPa |
| 900 | 900 | 1115 | 1050 | 28*62 | 1.0MPa |
| 1000 | 1000 | 1230 | 1160 | 28*70 | 1.0MPa |

### 2.2.4. Process connection

**Flange**: JB/T81 or GB/T 9124 flange; Other specifications can be customized.
**Clamp**: Compliant with ISO 2852 clamp standard, DN50 and above specifications can be customized after negotiation.

### 2.2.5. Materials

**Integrated converter housing:** standard die-cast aluminum
**Remote converter housing:** ABS + standard die-cast aluminum
**Sensor housing**: Carbon steel (optional stainless steel)
**Lining （optional)**: PTFE, CR, PU or F46.
**Sensor**: Optional stainless steel 316L, Hastelloy (HB and HC), titanium, tantalum, platinum iridium alloy.

# 3 Installation

## 3.1 Installation tips

**Note!**

Please check whether the boxes are damaged or not, and whether they have been handled roughly or not. Please report the damage to the courier service and the manufacturer.

**Note!**

Please check the packing list to make sure the batch of goods that you have received is complete.

**Note!**

Please check the instrument nameplate and confirm whether the delivered contents are consistent with your order. Check whether the power supply indicated on the nameplate is correct. If not
Correct, please contact the manufacturer.

**Note!**

The installation diagram is for reference only; please refer to the actual product.

## 3.2 Storage

(1) The instrument shall be stored in a dry and clean place.
(2) Avoid exposure to direct sunlight for long.
(3) The instrument shall be stored in the original package.

## 3.3 Unpacking

(1) Unpacking precautions

Take care to avoid damage to the meter when you are unpacking. It is suggested not to unpack the box before transporting it to the installation site to avoid damage to the meter. It's prohibited to use a stick or rope to lead through the measuring tube of the sensor. Instead, follow the correct lifting as shown in the figure below.

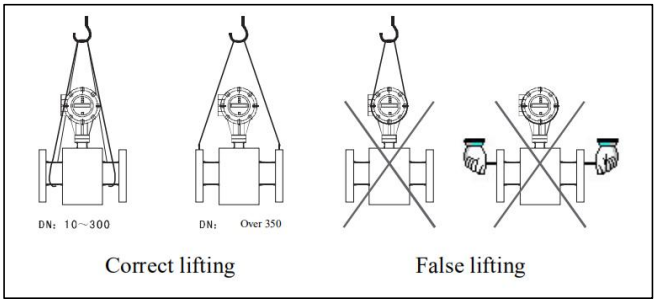



Fig.9

(2) Avoid vibration

Avoid heavy falling or pressing, especially on the flange surface, which cannot be stressed (otherwise, the lining may be damaged to disable the operation of the meter).

(3) Protection of the flange surface

After unpacking, pay attention to protect the flange. Do not place it on the unpadded floor or other uneven boards.

(4) Terminal box

It's not allowed to seal the terminal box cover before electrical wiring. After the wiring is completed, please apply the special sealant provided by our company to the terminal box as soon as possible. Then cover the terminal box and tighten the screws to ensure the tightness.

If the protection level of the electromagnetic flowmeter is IP68 at type selection, it has been subject to waterproof sealing.

## 3.4 Pipeline design

**The following items shall be considered when the pipes are designed.**

(1) Leave enough space on the side.

(2) Do not make the electromagnetic flowmeter subject to violent vibration.

## 3.5 Pipe design

**(1) Location**

① The electromagnetic flowmeter shall be installed in a dry and ventilated place. Places that could be flooded should be avoided.

② The electromagnetic flowmeter shall be kept away from the sunshine and rain. When it is installed outdoors, it shall be equipped with facilities against the sunlight and rain.

③ The electromagnetic flowmeter shall not be installed in places with large temperature variations, and avoid high temperature radiation from the equipment. If it must be installed therein, heat insulation and ventilation measures shall be taken.

④ The electromagnetic flowmeter shall not be installed in an environment containing corrosive gases. If it must be installed therein, ventilation and anti-corrosion measures shall be taken.

⑤ The electromagnetic flowmeter shall be installed to avoid as much strong vibration as possible, such as violent pipe vibration. In this case, brackets for fixing pipes on both sides of the electromagnetic flowmeter shall be provided.

⑥ Part of the sensor of electromagnetic flowmeters with IP68 (3 m underwater) protection level can be placed in the water. The electromagnetic flowmeter with an IP65 protection level cannot be immersed in water or installed outdoors.

**(2) Avoid interference with the magnetic field.**

Do not install electromagnetic flowmeters near motors, transformers, or other power sources that are prone to cause electromagnetic interference, near the frequency converter, or obtain power from the power distribution cabinet of the frequency converter to avoid interference.

**(3) Length of inlet and outlet runs**

To ensure the measurement accuracy, it is recommended to keep the length of

inlet runs of the sensor shall be at least 10 times of pipe diameter (10D), and the length of outlet runs at least 5 times of pipe diameter (5D)

**(4) Maintenance space**

For the convenience of installation and maintenance, enough installation space shall be reserved around the electromagnetic flowmeter.

**(5) For pipes that do not allow flow disruption in the process**

When installing the electromagnetic flowmeter, bypass pipes and cleaning ports shall be added. As shown in Fig.7, these devices can ensure the continuous operation of the equipment system when the flowmeter is out of service.

**(6) Support of electromagnetic flowmeter**

Do not install the electromagnetic flowmeter on a free-vibrating pipe without any support. Instead, a mounting base shall be used to secure the measuring tube. When the electromagnetic flowmeter is required to be installed underground, the pipes at both inlet and outlet ends shall be provided with support items, and a metal protection plate shall be installed above the flowmeter.

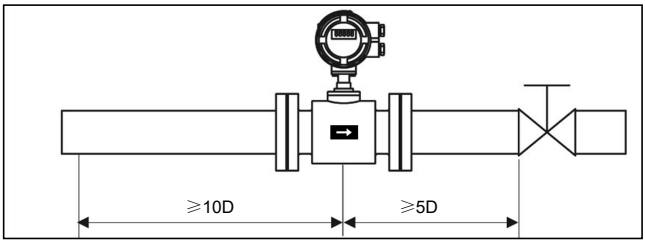



Fig.10

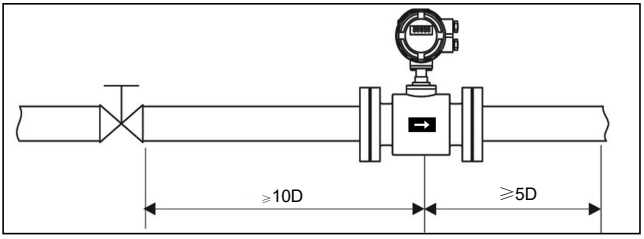



Fig.11

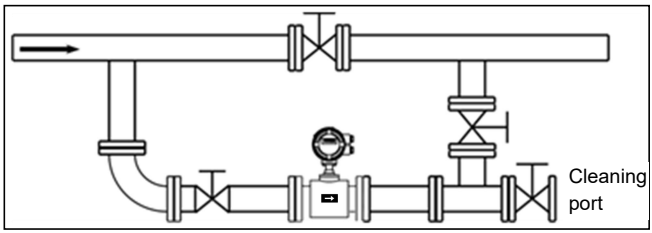


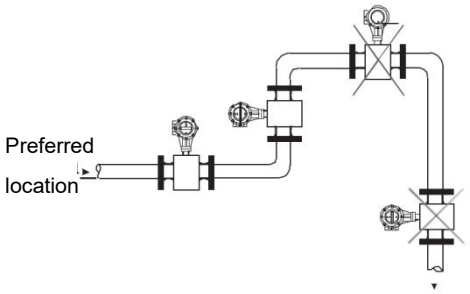

Fig.12

## 3.6 Installation conditions

**(1) Flow direction**

The flowmeter can be set to automatically detect the positive and negative flow direction. The flow direction arrow on the sensor casing indicates the positive flow direction specified by the manufacturer. Generally, when installing the meter, the user shall make the flow arrow consistent with the on-site process flow.

Fig.12 shows the preferred location for installing the electromagnetic flowmeter.




The pipe is routed to the highest point (Bubble accumulation in the measuring tube is likely to cause produce measurement errors!)

Make sure the pipeline is always full.

Fig.13

**(2) Installation direction of electromagnetic flowmeter and sensor electrodes**

The sensor allows horizontal and vertical installation. When it's installed horizontally, the electrode shall be horizontally placed such that bubbles will not be adsorbed near the electrode in case the medium is contained with bubbles or precipitates. Otherwise, this would cause converter signals to open and zero drift due to the fact that deposits are not covered by the electrode.

**(3) Liquids shall always be filled into pipes.**

Pipes shall be arranged to ensure that the electromagnetic flowmeter measuring tube is always filled with liquids.

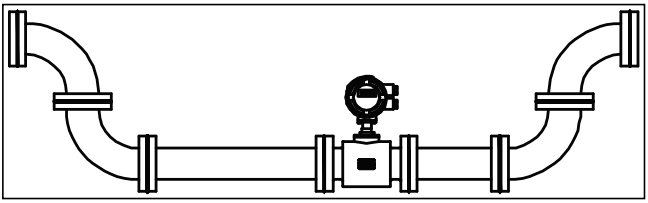


Fig.14

In case of liquids or suspensions containing solid particles, it is recommended to install electromagnetic flowmeters vertically. For one thing, the phase separation of the measured medium can be prevented; for another, the sensor lining is worn evenly. In addition, impurities will not precipitate at the bottom of the measuring tube.

It shall be guaranteed that liquids flow from bottom to top to ensure that the sensor measuring tube is always filled with medium.

**(4) The electromagnetic flowmeter cannot be installed on the suction side of the pump.**

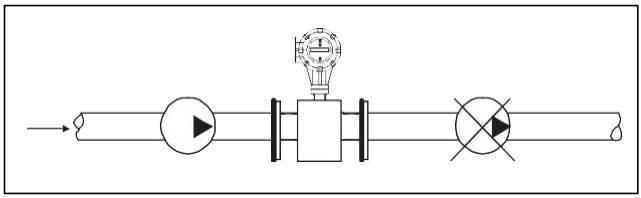


Fig.15

**(5) For long pipelines, control valves are generally installed downstream of the electromagnetic flowmeter.**

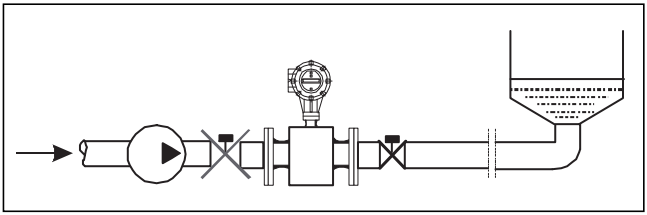


Fig.16

**(6) For pipes with open discharges, the electromagnetic flowmeter shall be installed at the bottom section (lower part of the pipe).**

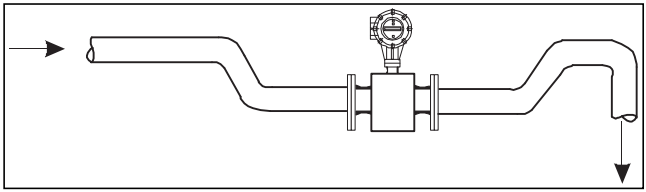


Fig.17

**(7) For places where the fall head of pipes is over 5 m, the air valve shall be installed on downstream of the electromagnetic flowmeter.**

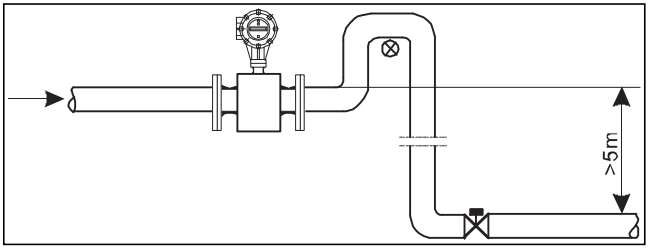



Fig.18

(8) **Measurement errors caused by the ingress of foreign gas and damage to the lining caused by vacuum should be avoided.**

**(9) No bubbles shall be observed in the pipes.**

Pipes shall be designed to prevent the air bubbles in the fluids from accumulating in the measurement pipe of a sensor. If a valve exists near the flowmeter, try to mount the flowmeter on the valve's upstream side to prevent a decrease in pressure inside the pipe, possibly, consequently avoiding the possibility of air bubbles.

Ensure that no gas can be separated from the liquid.

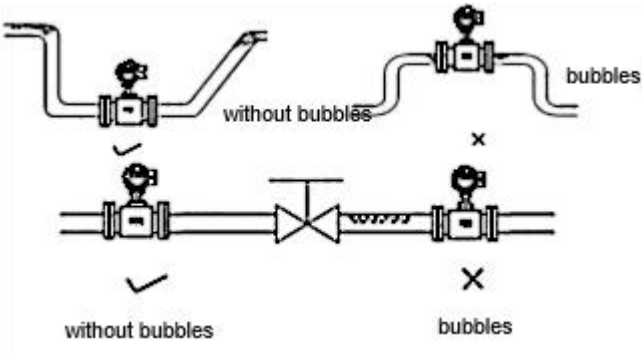



Fig.19

**(10) Liquid conductivity**

It's not allowed to install the electromagnetic flowmeter at a place where the liquid conductivity is extremely uneven. Injection of chemicals from the upstream of the meter can easily result in uneven liquid conductivity, which can cause serious interference to the meter flow indication. In this case, it is recommended to inject chemicals from the downstream of the meter; if chemicals must be injected from the upstream of the meter, it must be ensured that the straight pipe section on the upstream at least has 30 times of pipe diameter to ensure adequate mixing of liquids.

**(11) Grounding**

As the voltage of the induced signal of the electromagnetic flowmeter is small, it's more prone to being affected by noise or other electromagnetic signals. This is why the electromagnetic flowmeter needs to be grounded on many occasions. This functions to form an internal space for shielding external interference through the grounding of the flowmeter casing, thereby improving measurement accuracy.

## 3.7 Mechanical installation

### 3.7.1. Installation of the flowmeter pipeline

(1) Prior to installation, the pipeline shall be calibrated to ensure that the diameter

of the meter has good coaxiality with the user's pipeline. For sensors with a nominal diameter of no more than 50mm, the protrusion of their axis shall not exceed 1.5 mm; for sensors with a nominal diameter of 65~300 mm, it shall not exceed 2mm, and for sensors with a nominal diameter of no less than 350 mm, it shall not exceed 4 mm.

(2) In general, foreign particles (such as welding slag) may exist in newly installed pipelines. Before the flowmeter is installed, wash away the debris. It prevents not only the lining from being damaged but also measurement error caused by foreign particles that pass through the measuring tube during measurement.

### 3.7.2. Flowmeter Installation

(1) Installation direction

The flow direction of the measured fluid shall be consistent with the flow direction mark indicated on the flowmeter.

(2) Seal gaskets installed between flanges shall have good corrosion resistance and shall not protrude into the interior of the pipe.

(3) When welding or flame cutting is performed adjacent to the sensor pipe, isolation measures shall be taken to prevent the lining from being deformed due to heat.

(4) If it is installed in a well or immersed in water, apply sealant on the terminal box of the sensor after the system is installed and debugged. (If the protection level of the electromagnetic flowmeter is IP68 at type selection, it has been subject to waterproof sealing.)

(5) When the flowmeter is installed on the field, use bolts to connect the flange on the sensor to that on the pipe. Bolts, nuts, and their threads for securing meters shall be complete and free of damage and well lubricated. Use them with suitable flat washers and spring washers. A torque wrench shall be used to tighten the bolts according to the flange size and torque. Regularly tighten the bolts during daily use to prevent looseness of the bolts.

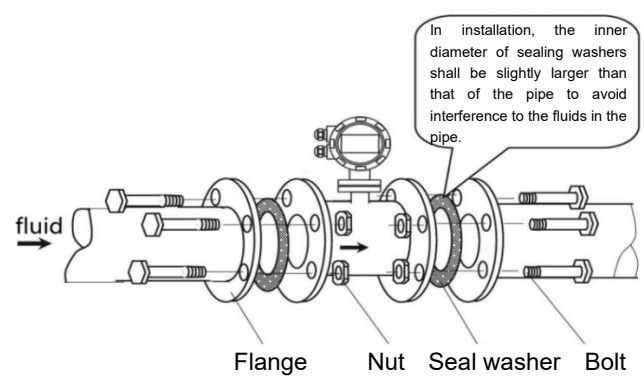



Fig.20

## 3.8 Post-Installation check

Table 4 Post-installation check

| Checking Items | Results |
|---|---|
| Is the device free from damage (visual inspection)? | □ |
| Does the meter meet the technical specifications of the measuring point, e.g., medium temperature, process pressure, ambient temperature, nominal diameter? | □ |
| Is the installation direction of the sensor correct? | □ |
| Is the flow direction indicated on the meter consistent with the actual flow of the medium? | □ |
| Is the label or mark at the measuring point correct (visual inspection)? | □ |
| Are sufficient protective measures in place to prevent the instrument from exposure to direct sunlight or rain? | □ |
| Is a suitable wrench used to securely tighten the mounting screws? | □ |

After installation, the meter should **Not** be left unused for long periods. If it is not used for an extended period, the following measures must be taken:

1. Check the sealing of the cable gland and entries to ensure that moisture and water do not penetrate the instrument.

2. Perform regular inspections. Check the conditions of the measures mentioned above at least once a year. In situations where water may enter the instrument (e.g., after heavy rainfall), the meter should be checked immediately.

# 4 Electrical connection

## 4.1 Safety tips

**Danger!**

Only when the power is switched off, can we do all the work on electrical connections. Please pay all attention to the power supply on the nameplate!

**Danger!**

Please observe national installation regulations.

**Warning!**

Please strictly observe local occupational health and safety regulations. Only those who have been properly trained are allowed to operate on the electrical equipment.

**Tips!**

Please check the nameplate of the equipment, and confirm whether the delivered contents are consistent with your order, and check whether the voltage indicated on the nameplate is
correct. Otherwise, please contact the manufacturer or supplier.

## 4.2 Potential equalization

**Danger!**

No potential difference is allowed between the measuring sensor and the casing or protective earth of the converter. The electromagnetic flowmeter must be grounded separately during operation. If it is grounded with other instruments or electrical devices, the leakage current may cause serial-mode interference to the measurement signal, or in a serious case, the electromagnetic flowmeter cannot work.

(1) The measurement sensor must be correctly grounded.

(2) The grounding conductor shall not transmit any interference voltage.

(3) It is not allowed to connect other electrical equipment to the grounding conductor at the same time.

## 4.3 Wiring terminals

### 4.3.1. Wiring terminal of the integrated type

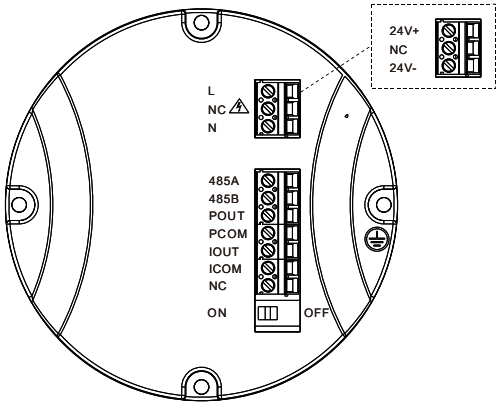



Fig.21 Terminal diagram

Table 5 Terminal Description

| Terminal | Description |
|---|---|
| L,N | 220V AC power supply |
| 24V+, 24V- | 24V DC power supply |
| 485A, 485B | RS485 serial communication |
| IOUT, ICOM | (4~20)mA output |
| NC | Not Defined |
| ON/OFF | DIP switch for pulse output type.<br>ON indicates active output;<br>OFF indicates passive output. |
| POUT, PCOM | Pulse output |
| ⏚ | Converter instrument protection grounding |

### 4.3.2. Wiring terminal of the remote type

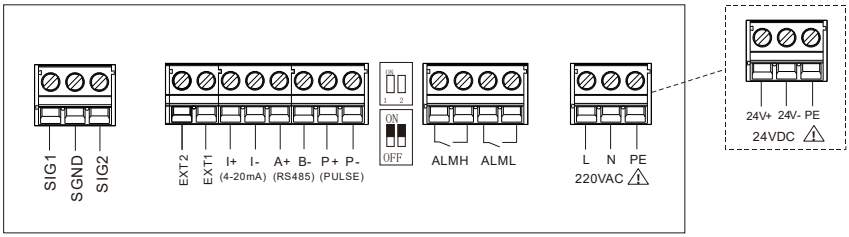



Fig.22 Terminal schematic diagram

Table 6 Terminal Description

| Terminal | Description |
|---|---|
| SIG1; SIG2; SGND | Sensor signal |
| EXT1; EXT2 | Excitation signal |
| I+; I- | (4~20)mA output |
| A+; B- | RS485 serial communication |
| P+; P- | Pulse output |
| ON/OFF | DIP switch for pulse output type.<br>ON indicates active output;<br>OFF indicates passive output. |
| ALMH; ALML | Relay output (Optional) |
| L; N | 220V AC |
| 24V+; 24V- | 24V DC |
| PE | Ground |

## 4.4 Power connection of the converter

**Warning!**

Regulation-compliant grounding is necessary to protect operators from electric shock.

**(1) 220VAC power supply**

Power supply range: 100 VAC ~240 VAC, 50Hz ~ 60Hz

① L: AC phase line;

② N: AC neutral wire.

③ Connect the ground wire to the copper pillar grounding screw marked with /PE symbol

**(2) 24VDC power supply**

Power supply range: 20VDC~28VDC

① 24V+ : 24VDC power positive pole

② 24V- : 24VDC power negative pole

## 4.5 Output Description

### 4.5.1. Current output

① IOUT, ICOM ( split I+, I- ) : (4~20)mA output (IOUT ( I+ ) is connected to the positive terminal of current input, ICOM ( I- ) is connected to the negative terminal of current input).

② Active mode: load RL ≤750Ω; Imax ≤24.5mA.

③ The percentage of the current corresponding to the flow rate.

### 4.5.2. Communication output

① 485A, 485B ( remote type: A+, B- ) : R 485 serial communication.

② Protocol: ModBus RTU.

### 4.5.3. Pulse output

The corresponding terminals are POUT, PCOM (Remote type P+, P−).

Pulse output supports three output modes:

**Output Mode 1**: **OC gate passive output with pull-up resistor on user side**

Set the DIP switch inside the wiring cavity to OFF

POUT (P+) outputs the pulse signal

External power supply V+ can be 5V/12V/24V

Pull-up resistor R range: (2 ~ 10)kΩ

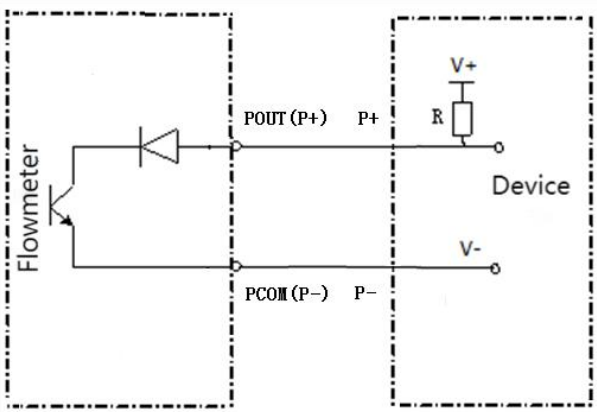



Fig.23

**Output Mode 2: OC gate passive output with pull-down resistor on user side**

Set the DIP switch inside the wiring cavity to OFF

PCOM (P−) outputs the frequency/pulse signal

POUT (P+) connects directly to the external power supply V+

This mode is commonly used in systems where flow meters are integrated with PLCs

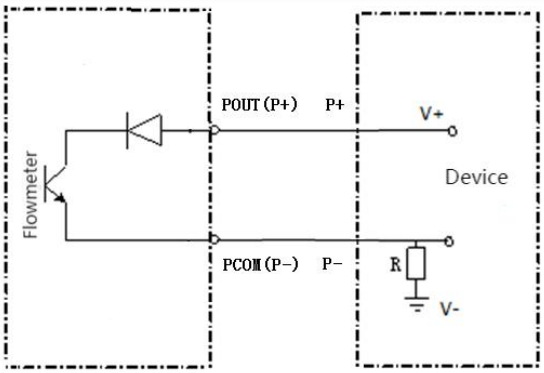



Fig.24

**Output Mode 3: Active output using level signal, capable of directly driving loads**

Set the DIP switch inside the wiring cavity to ON

POUT (P+) outputs frequency/pulse signal

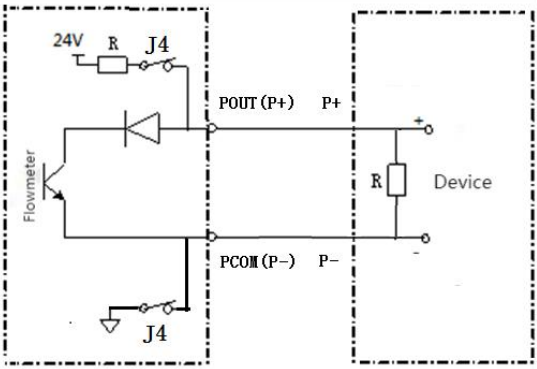



Fig.25

## 4.6 Post-Connection Check

Table 7 Post-connection Check

| Inspection items | Result |
|---|---|
| Are the cables or instruments intact (visual inspection)? | □ |
| Does the cable meet the requirements? | □ |
| Is the cable completely free from external forces? | □ |
| Is the terminal assignment correct? | □ |
| Are all cable glands installed, securely tightened and sealed? | □ |
| After power on, does the display show values? | □ |
| Are all housings installed and tightened? | □ |

# 5 Operation

## 5.1 Start up

### 5.1.1. Power on

Please check whether the installation is correct before powering on, including:

① The meter must be installed following safety compliance.

② Power supply connection must be performed in accordance with the regulations.

③ Please check that the electrical connection in the power supply is correct.

④ Tighten the converter shell back cover.

### 5.1.2. Converter's start-up

The measuring instrument consists of a measuring sensor and a signal converter; the delivery can be put into service. All parameters and hardware are configured according to your order.

After activation, the device will perform a self-check once. Then it will immediately begin to measure and display the current values.

## 5.2 Display and operating units

The integrated electromagnetic flowmeter display screen and operating unit (4 mechanical buttons) are located below the front cover of the converter, and the measured values can be read through the transparent housing cover. Open the front cover of the converter to operate the instrument. The display screen and operation unit (4 touch buttons) of the split electromagnetic flowmeter are located on the front panel of the converter and can be operated directly.

Integrated type : Remote type :

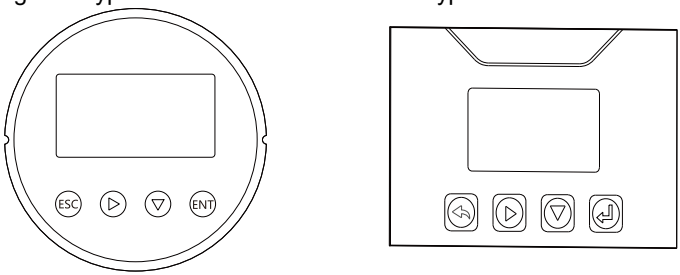



Fig.26 Display and operating elements

### 5.2.1. Display

Table 8

| | |
|---|---|
| Display | Monochrome LCD display, 128*64 pixels |
| Functions | Multiple measurement value screens (measurement, status, alarm status, etc.) |
| Language | Chinese, English, Korean, Spanish, and Russian. |
| unit | Units can be selected via the configuration menu. |

### 5.2.2. Operation Keys

Table 9 Operation keys

| Mark | | Name | Measuring mode | Menu mode | Modify mode |
|---|---|---|---|---|---|
| Integrated type | Remote type | | | | |
|  |  | Return | Check system alarm information | Return to the previous page | Return to the previous page |
|  |  | Right | / | Switch menu | Switch data |
|  |  | Down | Check the accumulative amount and so on | Modify | Modify data |
|  |  | Enter | Enter menu mode | Enter sub-menu | Confirm modification |

## 5.3 Page description

### 5.3.1. Main page

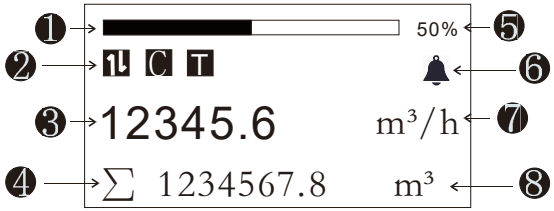



Fig.27 Main page

Table 10 Page description

| No. | Description |
|---|---|
| 1 | Instantaneous flow in percent of flow |
| 2 | System status<br>: Reverse flow : Low flow cutoff mode<br>: Simulation mode |
| 3 | Instantaneous flow |
| 4 | Cumulative amount and so on<br>Σ+:Positive flow accumulation Σ- : Negative flow accumulation<br>Σ : Net flow accumulation **V** : Current velocity<br>**MT**: Equivalent conductivity value |
| 5 | Instantaneous flow in percent of flow |
| 6 | System alarm information |
| 7 | Instantaneous flow unit |
| 8 | Accumulation flow unit |

**In the main page：**

Press **[ Down key ]** to display of page of net flow accumulation,positive flow accumulation,

negative flow accumulation,and current velocity

**System error:**

When a system error occurs, a bell icon will flash in the upper right corner. At this

time, pressing **[Return key] (Integrated version:** ESC **; Remote version:** ⏎ **)** to enter the alarm page to check specific error information

### 5.3.2. Password verification page

On the main page, press the **[Enter key ]**to enter the password verification page.


Fig.28 Password verification page

Quick configuration level password: **0000** (used to modify quick level parameters)

User configuration level password: **1000** (used to modify user level parameters.

### 5.3.3. Configuration page

Enter different user passwords to enter different configurations.

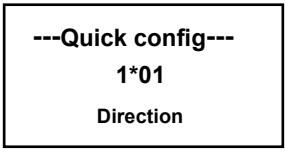



Fig.29 Configuration page

## 5.4 Quick configuration

Key parameters facilitate the manufacturer and user in quickly setting up the meter:

Press **[ Enter key ]** to enter the parameter setting page.

Enter quick configuration level password: **0000**(Used to modify the quick setup menu).

Table 11 Quick configuration

| NO. | Parameter | Setting mode | Parameter range | Default |
|---|---|---|---|---|
| 1*01 | Direction | Select | Forward / Reverse | Forward |
| 1*02 | Flow range | Digit | 0.1*Maximum ~1.2*Maximum | Maximum |
| 1*03 | Flow unit | Select | (L; kg; $m^3$; t; $ft^3$; US gal; US bbl; UK gal; UK bbl)/ (h; min; s) | $m^3/h$ |
| 1*04 | Cumulative reset | Select | Forward reset / Reverse reset | - |
| 1*05 | Communication address | Digit | 000~126 | 008 |
| 1*06 | Language | Select | 中文/English, Korean, Spanish, and Russian. | ENGLISH |

## 5.5 Detailed configuration

The configuration identification style is "X * XX".

For example, the system setting category is 8 * XX, and the built-in language sub-configuration is 8 * 01. Select the corresponding number and confirm to select the corresponding sub-configuration.

Table 12 Detailed Configuration

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| **1-Quick configuration** | | | | | |
| 1*01 | Flow Direction | Select | Quick | Forward / Reverse | Forward |
| | Used to change the direction of flow, when negative pole and positive pole signal cable are reversely connected, or the sensor is reversely installed, activate this function. | | | | |
| 1*02 | Flow range | Figure | Quick | 0.1*Maximum ~1.2*Maximum | Maximum |
| | Set the maximum flow limit value. Used to calculate the frequency, current output limit calculation and alarm threshold calculation, etc. | | | | |
| 1*03 | Flow unit | Select | Quick | (L; kg; $m^3$; t; $ft^3$; US gal; US bbl; UK gal; UK bbl)/(h; min; s) | $m^3/h$ |
| | When entering this menu configuration option, press ▷ to select time units/volume units.<br>Choose volume unit ,such as L, $m^3$, gal; the density will not calculated;<br>Choose mass unit such as kg, t; need 1-2 density parameter. | | | | |
| 1*04 | Accumulation reset | Select | Quick | Forward/Reverse reset | - |
| | Select the corresponding function, press **[ Enter key ]** ,and the corresponding cumulative amount will be reset;<br>Net cumulative value=positive cumulative value - negative cumulative value. Clearing the cumulative value in either direction will have an impact on the net cumulative value. | | | | |
| 1*05 | Address | Figure | Quick | 000~126 | 008 |
| | Communication Protocol instrument address based on the RS485 protocol Modbus RTU. | | | | |
| 1*06 | Language | Select | Quick | 中 文 /English, | ENGLISH |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| | | | | Korean, Spanish, and Russian. | |
| | Set system language, supporting five types of language. | | | | |
| **2-Flow set** | | | | | |
| 2*01 | Bidirectional measurement | Select | User | Open/Close | Open |
| | Allow measurement of flow from the reverse direction when open, only measure forward flow when close. | | | | |
| 2*02 | Flow direction | Select | User | Forward / Reverse | Forward |
| | Same as 1*01. | | | | |
| 2*03 | Flow unit | Select | User | (L; kg; $m^3$; t; $ft^3$; US gal; US bbl; UK gal; UK bbl)/(h; min; s) | $m^3/h$ |
| | Same as 1*03. | | | | |
| 2*04 | Fluid density | Figure | User | (0.01~5) $g/cm^3$ | 1 |
| | Set fluid density | | | | |
| 2*05 | Max.range | Read-only | User | -- | -- |
| | The maximum range that can be set, this configuration item is read-only. | | | | |
| 2*06 | Flow range | Figure | User | 0.1*Maximum ~1.2*Maximum | Maximum |
| | Same as 1*02. | | | | |
| 2*07 | Flow cutoff | Figure | User | 0~10% | 1% |
| | Flow volume is regarded as zero if it is below the setting value Zero means not removing. | | | | |
| 2*08 | Damping time | Figure | User | 0s~99s | -- |
| | Damping coefficient of the filter, select the average selected within the time parameter as the real-time flow. | | | | |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| 2*09 | Filter | Select | User | ON/OFF | OFF |
| | A digital filter is included in the converter specifically for pulsating or noisy flow signals. It smoothes the displayed indication value and current output. Turn on the filter, the damping value setting can be reduced, and the response time of the converter is not affected. The "filtering" mode is selected using the up or down keys and turned on by pressing **[ Enter key ]** | | | | |
| 2*11 | Instantaneous correction | Read-only | User | -- | -- |
| | Correction of instantaneous flow. | | | | |
| 2*12 | Accumulation unit | Read-only | User | L; kg; $m^3$; t; $ft^3$; US gal; US bbl; UK gal; UK bbl | -- |
| | This unit is read-only and related to the pulse output unit. | | | | |
| 2*13 | Accumulation reset | Select | User | Forward/Reverse reset | - |
| | Same as 1*04. | | | | |
| 2*14 | Average | Select | User | No calculated / Calculated | No calculated |
| | When you need to calculate the average value, select "Calculated" and press (ENT) After waiting for the calculation to complete, the calculated percentage average will be automatically displayed. | | | | |
| **3-Output set** | | | | | |
| 3*01 | Pulse output type | Select | User | High/Low power level | Low power level |
| | Choose active output or passive output. | | | | |
| 3*02 | Pulse coefficient | Figure | User | 0.001~9999.9 | -- |
| | The default value of 10.It is also influenced by the highest frequency, so that the frequency corresponding to the range does not exceed 5kHz. Settings that exceed the range will be restricted within the range. | | | | |
| 3*03 | Pulse width | Figure | User | 0.1~2000ms | -- |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| | The maximum pulse width is also limited by a proportion not exceeding 50%. | | | | |
| 3*04 | Pulse unit | Select | User | L; kg; $m^3$; t; $ft^3$; US gal; US bbl; UK gal; UK bbl | $m^3$ |
| | This unit will also affect the cumulative unit. | | | | |
| 3*05 | Address | Figure | User | 000~126 | 008 |
| | Same 1*05. | | | | |
| 3*06 | Baud rate | Select | User | 4800/9600/19200/ 38400/57600/ 115200 | 9600 |
| | Baud rate of serial communication. | | | | |
| 3*07 | Even-odd check | Select | User | None / Even check / Odd check | None |
| | Verification mode of serial communication. | | | | |
| 3*08 | Endianness | Select | User | 2143; 4321; 1234; 3412 | 2143 |
| | Byte exchange sequence of serial communication | | | | |
| 3*09 | Output current | Figure | User | 3.6mA~22.8mA | 0mA |
| | Converter fixed current output for calibrating (4-20) mA output, 0mA means normal output. | | | | |
| 3*11 | 4mA calibration | Figure | User | 3.6mA~4.4mA | |
| | 4mA calibration current value, written value is the measured value when the output current is 4mA. | | | | |
| 3*12 | 20mA calibration | Figure | User | 18mA~22.8mA | |
| | 20mA calibration current value, written value is the measured value when the output current is 20mA. | | | | |
| **4-Limit & Error** | | | | | |
| 4*01 | Alarm permission | Select | User | Open / Close | Close |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| | Open or close alarm function allows. | | | | |
| 4*02 | Max.alarm value | Figure | User | 0%~120% | 120% |
| | Set the max alarm value , range percentage. | | | | |
| 4*03 | Min.alarm value | Figure | User | 0%~120% | 0% |
| | Set the min alarm value , range percentage. | | | | |
| 4*04 | Hysteresis | Figure | User | 0%~5% | 0.5% |
| | Used to eliminate the alarm disturbance<br>Upper limit elimination conditions: real-time flow is less than the upper limit alarm value minus return difference.<br>Lower limit elimination conditions: real-time flow is greater than the lower limit alarm value plus return difference. | | | | |
| 4*05 | Error current selection | Select | User | 4mA / High / Low | 4mA |
| | When the system malfunctions, select the 4mA,high and low current output | | | | |
| 4*06 | High error current value | Figure | User | 23.5mA~24.5mA | 24mA |
| | When the system malfunctions,output current high value. | | | | |
| 4*07 | Low error current value | Figure | User | 3.2mA~3.9mA | 3.8mA |
| | When the system malfunctions,output current low value. | | | | |
| **5-Empty pipe** | | | | | |
| 5*01 | Empty pipe alarm | Select | User | Open / Close | Open |
| | Set whether to enable empty detection function. | | | | |
| 5*02 | Empty threshold | Figure | User | 0~16000 | -- |
| | Threshold for empty pipe alarm judgment. | | | | |
| 5*03 | Conductivity equivalent | Read-only | User | -- | -- |
| | This item is the conversion value of the internal reading code value of the | | | | |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| | system, not the actual conductivity value, and only serves as a reference for judging conductivity (or judging empty or full pipes). | | | | |
| **6-Sensor Setting** | | | | | |
| 6*01 | Sensor zero point | Read-only | User | -- | -- |
| | Sensor factory zero point, read-only. | | | | |
| 6*02 | Sensor coefficient | Read-only | User | 0.5~10 | -- |
| | Sensor coefficient. | | | | |
| 6*03 | Diameter | Select | User | 0~35 (Diameter code) | -- |
| | Diameter of sensor. | | | | |
| 6*04 | Zero adjustment | Figure | User | -100~100 | -- |
| | Zero adjustment of sensor. | | | | |
| **7-Test Mode** | | | | | |
| 7*01 | Simulation mode | Select | User | Not simulated / Percentage | Not simulated |
| | This setting disappears after power failure, and this function simulates a normal state, which is the function used during testing. | | | | |
| 7*02 | Simulation values | Figure | User | -- | -- |
| | This setting is effective after turning on simulation mode and disappears after power failure. | | | | |
| **8-System** | | | | | |
| 8*01 | Language | Select | User | Chinese/English, Korean, Spanish, and Russian. | ENGLISH |
| | Same as 1*06. | | | | |
| 8*02 | Version | Read-only | User | -- | -- |
| | Software version information. | | | | |

| NO. | Parameter | Setting mode | Password level | Parameter range | Default |
|---|---|---|---|---|---|
| 8*03 | Tag NO. | Read-only | User | -- | -- |
| | Decimal places. | | | | |
| 8*04 | Restore factory | Select | User | Yes / No | No |
| | Restore factory parameter settings. | | | | |
| 8*05 | LCD contrast | Select | User | 1~9 | 5 |
| | Display contrast settings | | | | |
| **HART Setting (optional)** | | | | | |
| 9*01 | Polling Address | Select | User | 00~63 | 00 |
| | Sets the polling address. | | | | |
| 9*02 | Loop Current | Select | User | ON/OFF | On |
| | Sets the loop current mode. When turned off, the output is fixed at 4 mA. | | | | |
| 9*03 | Tag No. | Select | User | 26 English letters | TAG |
| | Sets the tag. Up to 8 characters can be entered. | | | | |

## 5.6 Operating instruction

### 5.6.1. Parameter selection and adjustment

On the main page, press **[Enter key]**, press passwords to enter different configurations.

After entering the corresponding configuration page, the position indicated by the cursor is the menu level (element). Press **[Right key]** to move the cursor, press **[Down key]** to add data, and press **[Enter key]** to confirm selection and save.

Press **[Return key]** to return to the previous menu corresponding to the permission.

After modifying the password, you can directly enter the monitoring main interface.

To re-enter the configuration, you need to enter the permission password again.

**For example, if you need to modify the flow range, the specific menu operation is as follows:**

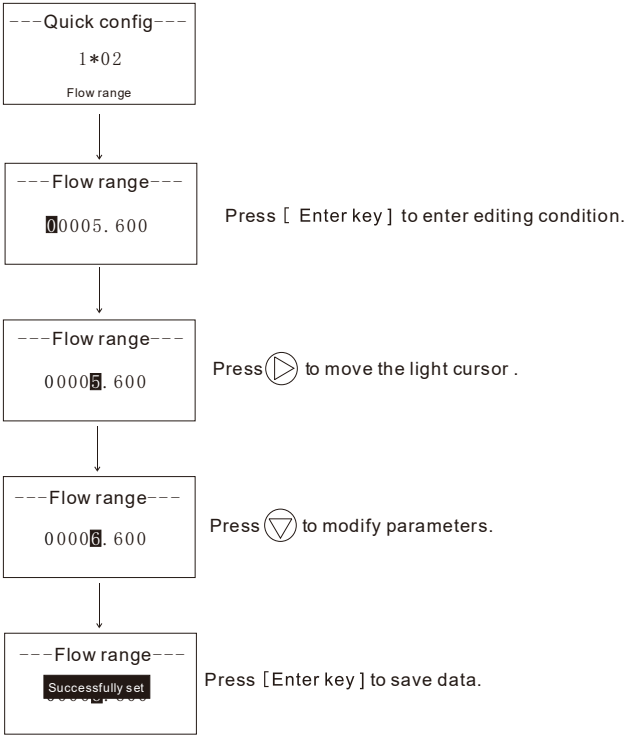



Fig.30 Example of operation

### 5.6.2. Display measurement

This page will display after start up.

∑+:Positive flow accumulation ∑- : Negative flow accumulation

∑ : Net flow accumulation V : Current velocity

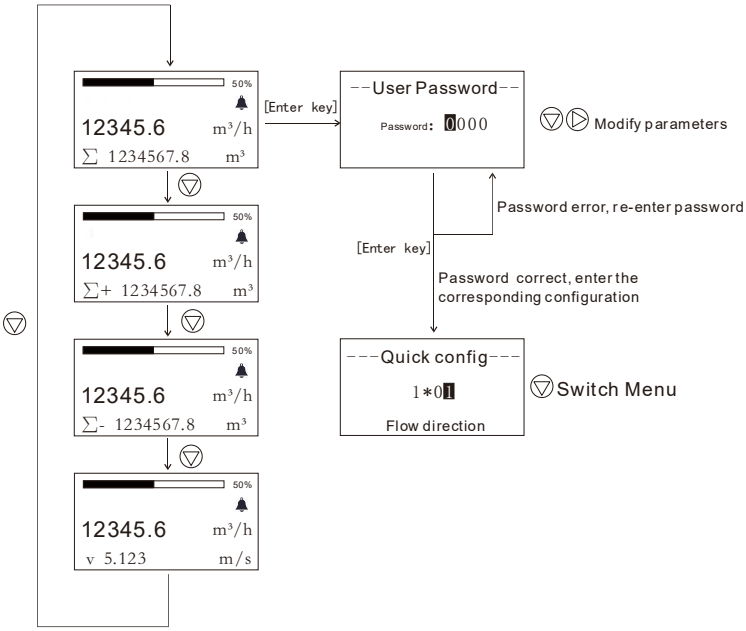



Fig.31 Display measurement

### 5.6.3. Flow setting

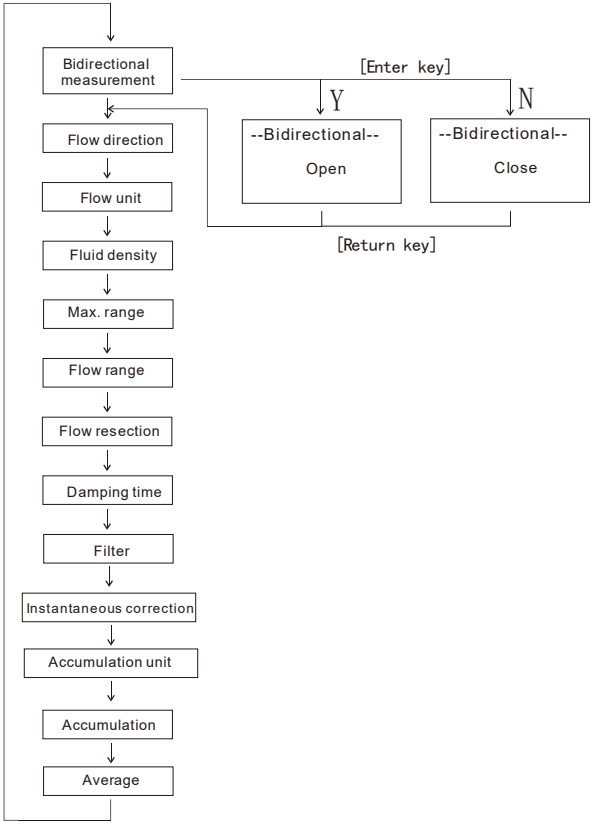



Fig.32 Flow setting

### 5.6.4. Output ,limit & error setting

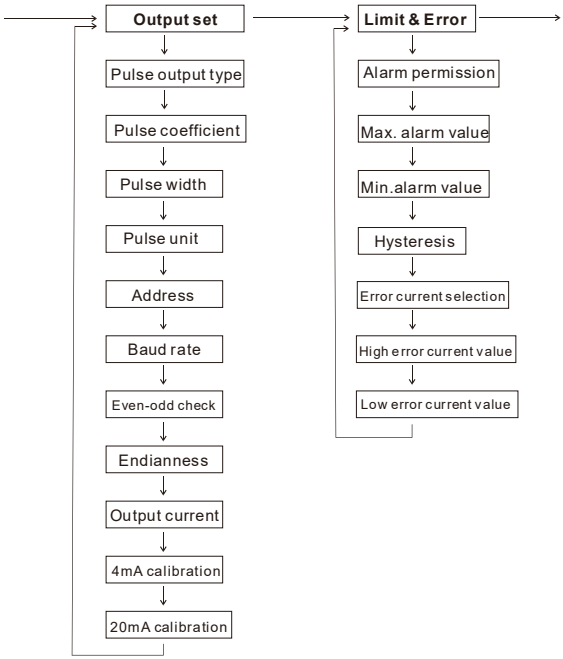



Fig.33 Output,limit & error setting

### 5.6.5. Empty pipe function, sensor function, test mode, system setting

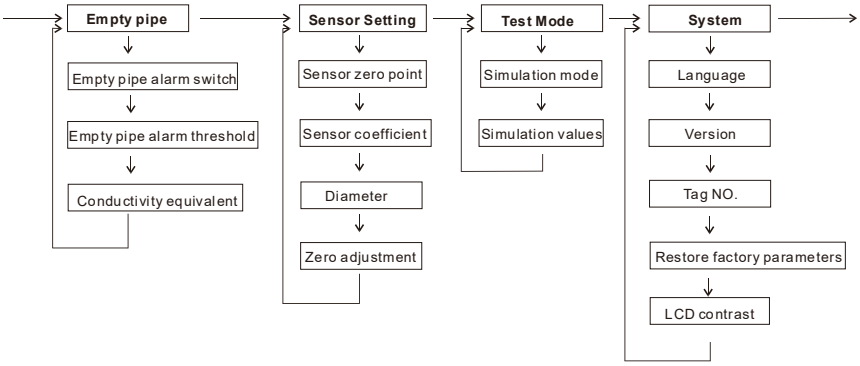



Fig.34 Empty pipe function, sensor function, test mode, system setting

# 6 Functions

## 6.1 System information

The flowmeter itself has a self-diagnosis function, in addition to the power supply and circuit board hardware failures; it can correctly provide the corresponding alarm message to the fault in a general application.

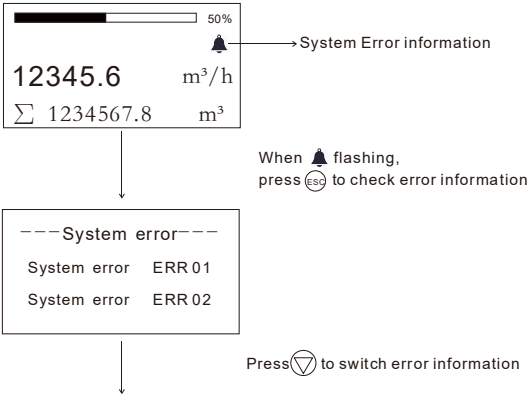



Fig.35 System information

Table 13 System information

| Display | Alarm content |
|---|---|
| 🔔 | On the main page, press **[ Return key ]** to check error information. |
| ERR01~04 | System error. |
| ADC error | Signal acquisition chip malfunction |
| Excitation current error | The excitation current output by the converter is incorrect. Check if the excitation wiring is disconnected. |
| Signal saturation | The signal exceeds the collection range. |
| Signal fluctuation exceeds | The sensor signal is unstable, greater than the AD sampling of the upper limit. |
| Empty pipe alarm | The pipeline is not fully filled with the liquid to be |

| Display | Alarm content |
|---|---|
| | tested, or the sensor is not grounded properly |
| Min. flow value alarm | Detected traffic exceeds the set lower limit alarm value |
| Max. flow value alarm | Detected traffic exceeding the set upper limit alarm value |
| The flow exceeds the range | The current real-time flow rate exceeds the setting flow limit |
| Output freq saturation | Output frequency exceeds the collection range |
| Units mismatch exceeds | Unit setting error |
|  | Reverse flow detected (not configured properly) |
|  | Low flow cutoff mode |
|  | Simulation mode |

## 6.2 Pulse/Current output

### 6.2.1. Pulse output

It is mainly used for sensor manufacturer coefficient calibration and user measurement applications. In the third way, configuration parameter settings:

The pulse coefficient corresponds to the number of pulses in a measured flow unit. If the pulse coefficient value changes, the cumulative value is maintained in the selected unit. The setting range of the pulse coefficient is from 0.001 to 100000 pulses per unit. Use the selected flow range, pulse width (0.1ms to 1000ms), and pulse units (such as L, $m^3$ ). Check the pulse coefficient of the passive input with a mass unit (such as g, kg) and a density correction coefficient. If any of these parameters change, the pulse width cannot exceed 50% of the output frequency cycle when the flow rate is at 100% (duty cycle 1:1). If the input pulse width is large, it will be automatically reduced to 50% of the cycle. Pulse output can only be achieved using counter instruments, not frequency meters.

### 6.2.2. Current output

Mainly used for transmitting output to other intelligent instruments, such as digital display table, recorder, PLC, DCS, etc.

The current output type: 4 - 20mA.

The current valve corresponds to the real-time flow rate, 20mA corresponds to the range limit, and 4mA corresponds to the range limit.

Conversion relationship

$$I_{(Real\ time)} = \frac{Q_{Real\ time}}{Q_{max}} 16.00 + 4.00$$

Notice:

$Q_{real\ time}$ Indicate real-time flow rate

$Q_{Max}$ Indicate current instrument range

$I_{real\ time}$ Indicate the real-time current value

# 7 Common troubleshooting

Table 14

| Phenomenon | Cause | Method |
|---|---|---|
| Converter flow is negative | The sensor direction indicator rod is opposite to the fluid flow direction | Rotate the sensor direction 180° |
| | There is a reverse connection between SIG1 and SIG2 or EXT1 and EXT- in the sensor junction box | Converter rewired |
| Converter output over range | The flowmeter range value is less than the actual measurement value | Expand the flowmeter range |
| | Fluid does not fill the pipe | Close the small flow control valve |
| | Exciter coil open circuit | Rewire |
| The output signal fluctuates too much | There is gas at the sensor electrode, resulting in poor contact between the electrode and the medium | Exclude the gas in the pipeline |
| | Deposits on the electrodes | Cleaning electrode |
| The output signal gradually drifts towards zero | The sensor enters the water | Replace the sensor |
| | Electrodes are covered | cleaning electrode |

# Appendix 1: Electrode selection and specification

Table 15 Corrosion Resistance of Electrode Material (Only for Reference)

| Material | Corrosion Resistance |
|---|---|
| Molybdenum-containing stainless steel (316L) | Applicable: domestic water, industrial water, sewage, weak acid-base salt solutions, and normal temperature concentrated nitric acid.<br>Not applicable: hydrofluoric acid, hydrochloric acid, chlorine, bromine, iodine, and other media. |
| Hastelloy B | Applicable: non-oxidizing acids, such as hydrochloric acid and hydrofluoric acid of certain concentration, alkaline solutions with a concentration of no less than 70% sodium hydroxide.<br>Not applicable: nitric acid and other oxidizing acids. |
| Hastelloy C | Applicable: oxidizing acids, such as nitric acid, mixed acid, or sulfuric acid mixed corrosive media, corrosive environments with oxidizing salts or other oxidizing agents such as hypochlorite solution above room temperature, seawater.<br>Not applicable: reducing acids such as hydrochloric acid and chlorides. |
| Ti | Applicable: chloride, hypochlorite, seawater, and oxidizing acid.<br>Not applicable: reducing acids such as hydrochloric acid, sulfuric acid, etc. |
| Ta | Applicable: most acids, such as concentrated hydrochloric acid, nitric acid, and sulfuric acid, including hydrochloric acid with a boiling point, nitric acid, and sulfuric acid below 175℃.<br>Not applicable: alkalis, hydrofluoric acid, sulfur trioxide. |
| Pt | Applicable: various acids (excluding aqua regia), alkalis and salts. |

**Notes:** Due to a wide variety of media, their corrosive substance is affected by complex factors such as temperature, concentration, and velocity.

So this table is only for reference. Users may make their own choices based on the actual situation. You may refer to the corrosion prevention manual for general media. But for media with complex compositions like mixed acid, you may need to conduct corrosion tests for materials to be selected.

# Appendix 2: Flow and velocity parallel table

Table 16 Flow and Velocity Parallel Table for Electromagnetic Flowmeter

| Velocity (m/s) / Flow (m³/h) / DN (mm) | 0.1 | 0.2 | 0.4 | 0.5 | 1 | 5 | 10 | 15 |
|---|---|---|---|---|---|---|---|---|
| DN10 | 0.0283 | 0.0565 | 0.1131 | 0.1414 | 0.2827 | 1.4137 | 2.8274 | 4.2411 |
| DN15 | 0.0636 | 0.127 | 0.254 | 0.318 | 0.636 | 3.1809 | 6.362 | 9.543 |
| DN20 | 0.113 | 0.226 | 0.452 | 0.565 | 1.131 | 5.6549 | 11.310 | 16.965 |
| DN25 | 0.176 | 0.353 | 0.707 | 0.884 | 1.767 | 8.8357 | 17.671 | 26.507 |
| DN32 | 0.290 | 0.579 | 1.158 | 1.448 | 2.895 | 14.476 | 28.953 | 43.429 |
| DN40 | 0.452 | 0.905 | 1.810 | 2.262 | 4.524 | 22.619 | 45.239 | 67.858 |
| DN50 | 0.707 | 1.414 | 2.827 | 3.534 | 7.069 | 35.343 | 70.690 | 106.03 |
| DN65 | 1.195 | 2.389 | 4.778 | 5.973 | 11.946 | 59.730 | 119.46 | 179.19 |
| DN80 | 1.810 | 3.619 | 7.238 | 9.048 | 18.100 | 90.478 | 181.00 | 271.43 |
| DN100 | 2.827 | 5.655 | 11.310 | 14.137 | 28.274 | 141.37 | 282.74 | 424.12 |
| DN125 | 4.418 | 8.836 | 17.671 | 22.090 | 44.179 | 220.89 | 441.79 | 662.68 |
| DN150 | 6.362 | 12.723 | 25.447 | 31.809 | 63.617 | 318.09 | 636.17 | 954.26 |
| DN200 | 11.310 | 22.619 | 45.239 | 56.549 | 113.10 | 565.49 | 1131.0 | 1696.5 |
| DN250 | 17.671 | 35.343 | 70.686 | 88.357 | 176.71 | 883.57 | 1767.1 | 2650.7 |
| DN300 | 25.447 | 50.893 | 101.79 | 127.23 | 254.47 | 1272.3 | 2544.7 | 3817.0 |
| DN350 | 34.636 | 69.272 | 138.54 | 173.18 | 356.36 | 1731.8 | 3463.6 | 5195.4 |
| DN400 | 45.239 | 90.478 | 180.96 | 226.19 | 452.39 | 2261.9 | 4523.9 | 6785.8 |
| DN450 | 57.256 | 114.51 | 229.02 | 286.28 | 572.56 | 2862.8 | 5725.6 | 8588.3 |
| DN500 | 70.686 | 141.37 | 282.74 | 353.43 | 706.86 | 3534.3 | 7060.6 | 10603 |
| DN600 | 101.79 | 203.58 | 407.15 | 508.94 | 1017.9 | 5089.4 | 10179 | 15268 |
| DN700 | 138.54 | 277.09 | 554.18 | 692.72 | 1385.4 | 6927.2 | 13854 | 20782 |
| DN800 | 181.00 | 361.91 | 723.82 | 904.78 | 1809.6 | 9047.8 | 18096 | 27143 |
| DN900 | 229.02 | 458.04 | 916.09 | 1145.1 | 2290.2 | 11451 | 22902 | 34353 |
| DN1000 | 282.74 | 565.49 | 1131.0 | 1413.7 | 2827.4 | 14137 | 28274 | 42412 |
| DN1200 | 407.15 | 814.30 | 1628.6 | 2035.8 | 4071.5 | 20357 | 40715 | 61072 |
| DN1400 | 554.18 | 1108.4 | 2216.7 | 2770.9 | 5541.8 | 27709 | 55418 | 83126 |
| DN1600 | 723.82 | 1447.7 | 2895.3 | 3619.1 | 7238.2 | 36191 | 72382 | 108573 |

# Appendix 3 Communication

This instrument provides a standard RS-485 communication interface, using the international standard MODBUS-RTU.

### C.1 ModBus protocol command encoding definition

The MODBUS function code definition is shown in the table below, and the electromagnetic flowmeter adopts the 04 function code.

Table 17 Function code

| Function code | Name | Definition |
|---|---|---|
| 01 | Using coil read and write commands | Reserve |
| 02 | Using discrete input commands | Reserve |
| 03 | Using the Hold Register read command | Reserve |
| 04 | Using the Input Register Read Command | Read dynamic variables |
| 06 | Using a single holding register write command | Reserve |
| 16 | Using multiple holding registers, write command | Reserve |

### C.2 Register address

Table 18 Register address (Function code 04)

| Register number | Address | Parameter | Data type | Access Type | Range |
|---|---|---|---|---|---|
| 3：0100 | 0x0063 | Instantaneous flow | Float | R | |
| 3：0102 | 0x0065 | Instantaneous flow velocity | Float | R | |
| 3：0104 | 0x0067 | Flow percentage | Float | R | |
| 3：0106 | 0x0069 | Conductivity | Float | R | |
| 3：0108 | 0x006B | Forward flow accumulation of | uint32 | R | |

| Register number | Address | Parameter | Data type | Access Type | Range |
|---|---|---|---|---|---|
| | | integer | | | |
| 3：0110 | 0x006D | Forward flow accumulation of decimal | uint32 | R | The decimal part magnifies by 100 times, 123 stands for 0.123 |
| 3：0112 | 0x006F | Reverse flow accumulation of integer | uint32 | R | |
| 3：0114 | 0x0071 | Reverse flow accumulation of decimal | uint32 | R | The decimal part magnifies by 100 times, 123 stands for 0.123 |
| … | … | Reserve | / | / | Reserve，do not operate |
| 3：1001 | 0x03E8 | Instantaneous flow | Float | R | 0~Maximum |
| 3：1003 | 0x03EA | Forward flow accumulation | Double | R | 0~99999999 |
| 3：1007 | 0x03EE | Reverse flow accumulation | Double | R | 0~99999999 |
| 3：1011 | 0x03F2 | Flow percentage | Float | R | 0~120 |
| 3：1013 | 0x03F4 | Instantaneous flow velocity | Float | R | 0~6 |

### C.3 Communication configuration

Mailing address: 0~126

Default address: 8

Baud rate: 4800; 9600; 19200; 38400; 57600;115200;

The default baud rate: 9600

Check: no check, odd parity, parity; Default no check;

For 32-bit data (long plastic or floating point) arranged in the communication frame;

Example: Long integer 16909060(01020304H): 03 04 01 02

Floating number 4.00(40800000H): 00 00 40 80

Double 10.24(40247AE147AE147B)：14 7B 47 AE 7A E1 40 24

### C.4 Communication examples

**Read instantaneous flow:**

Send message：08 04 03 E8 00 02 F1 22

Send message：08 04 04 22 6E 41 3F 79 61(Instantaneous flow：11.95)

**Read forward flow accumulation (Double)：**

Send message：08 04 03 EA 00 04 D0 E0

Send message：08 04 08 70 A4 0A 3D 53 D7 40 58 14 56 (Forward flow accumulation：97.31)

**Read reverse flow accumulation:**

Send message: 08 04 00 6F 00 04 C1 4D

Return message: 08 04 08 00 D2 00 00 03 66 00 00 18 C7 (Reverse flow accumulation：210.87( integer + (decimal/1000) ).

The integer part (210)：00 D2 00 00;

The decimal part (870)：03 66 00 00 )