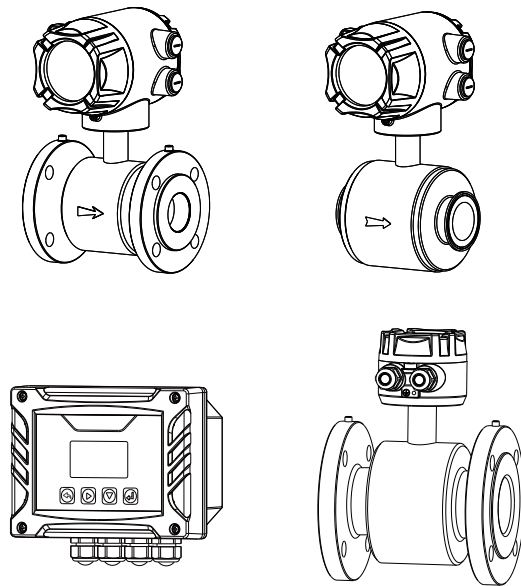


Electromagnetic Flowmeter



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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-SUP-LDG-SUP-A100-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, benzene

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.

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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

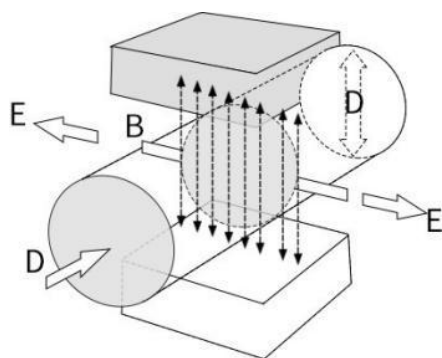


Fig.1

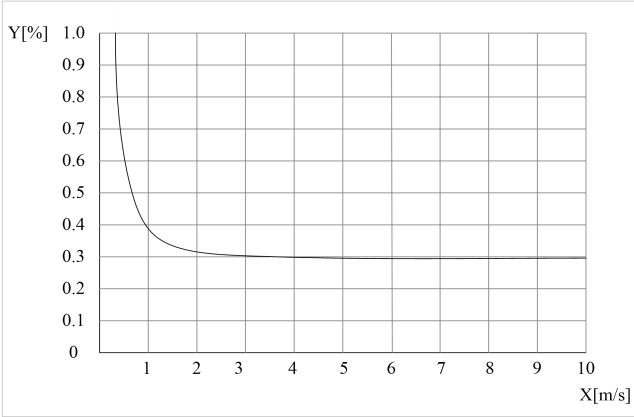
When measuring the flow, the fluid flows through a magnetic field which is perpendicular to the flow direction. The flow of conductive fluid induces a potential proportional to the average flow velocity, thus requiring the conductivity of the measured flowing liquid to be higher than the minimum conductivity. 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 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 (m³/h)	Max value (m³/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 (This value is lower than the maximum duty cycle, with a maximum duty cycle of 1:1) $F_{\max} \leq 5000 \text{ cp/s}$
		Pulse coefficient	0.001~100000/unit
	Passive	$U_{\text{Outer}} \leq 30\text{VDC}$	
	Active	$U_{\text{Internal}} \leq 24\text{VDC}$	
		$I \leq 4.52\text{mA}$	
Communications	RS485; MODBUS-RTU; Hart communication (optional)		
Relay (Remote type optional)	2 channels SPST; 250VAC; 3A		
Power supply			
Supply voltage	100VAC~240VAC, 50/60Hz; 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 Temperature: 20℃ Pressure: 0.1MPa Installation requirements: Inlet run≥10DN, Outlet run≥5DN																								
Accuracy	±0.5% of measured value; ±0.3% of measured value (available for selected pipe sizes) Note: Applicable to flow velocity range of 0.5 m/s to 5 m/s																								
Repetitiveness	0.16%																								
Maximum measured error	<div><table border="1"><caption>Data points for Maximum measured error graph</caption><thead><tr><th>Flow Velocity X [m/s]</th><th>Maximum measured error Y [%]</th></tr></thead><tbody><tr><td>0.5</td><td>1.0</td></tr><tr><td>1.0</td><td>0.35</td></tr><tr><td>2.0</td><td>0.32</td></tr><tr><td>3.0</td><td>0.31</td></tr><tr><td>4.0</td><td>0.30</td></tr><tr><td>5.0</td><td>0.30</td></tr><tr><td>6.0</td><td>0.30</td></tr><tr><td>7.0</td><td>0.30</td></tr><tr><td>8.0</td><td>0.30</td></tr><tr><td>9.0</td><td>0.30</td></tr><tr><td>10.0</td><td>0.30</td></tr></tbody></table><p>①X[m/s]: Flow Velocity ②Y[%]: Actual measured value deviation</p></div>	Flow Velocity X [m/s]	Maximum measured error Y [%]	0.5	1.0	1.0	0.35	2.0	0.32	3.0	0.31	4.0	0.30	5.0	0.30	6.0	0.30	7.0	0.30	8.0	0.30	9.0	0.30	10.0	0.30
Flow Velocity X [m/s]	Maximum measured error Y [%]																								
0.5	1.0																								
1.0	0.35																								
2.0	0.32																								
3.0	0.31																								
4.0	0.30																								
5.0	0.30																								
6.0	0.30																								
7.0	0.30																								
8.0	0.30																								
9.0	0.30																								
10.0	0.30																								
Process																									
Medium	CR liner: -10℃~70℃																								

temperature range	PU liner: -10℃~60℃ PTFE/F46 liner:-10℃~120℃	
Rated pressure (Customizable for high-pressure applications)	DN10~DN250: PN<1.6MPa DN300~DN1000: PN<1.0MPa 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℃ Sensor: -10℃~55℃
Storage temperature	-20℃~55℃	
Protection level	Integrated type	Standard: IP65
		High protection: IP66/IP67 (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 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.

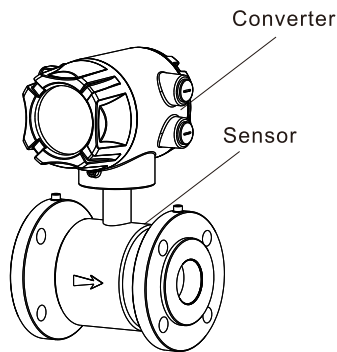


Fig.2 Structural diagram of the integrated version

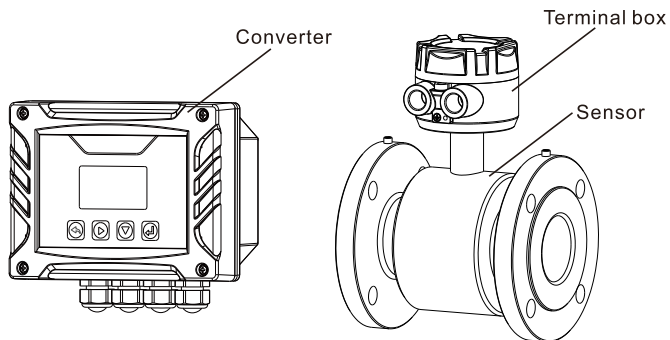


Fig.3 Structural diagram of the remote version

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.

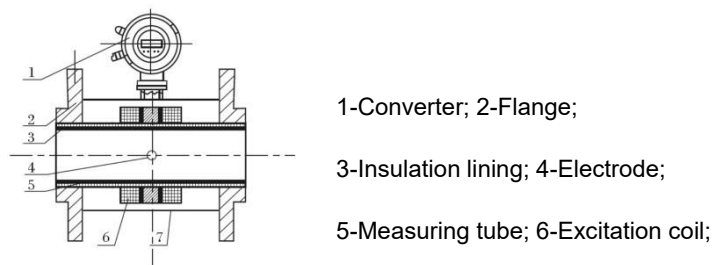


Fig.4

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

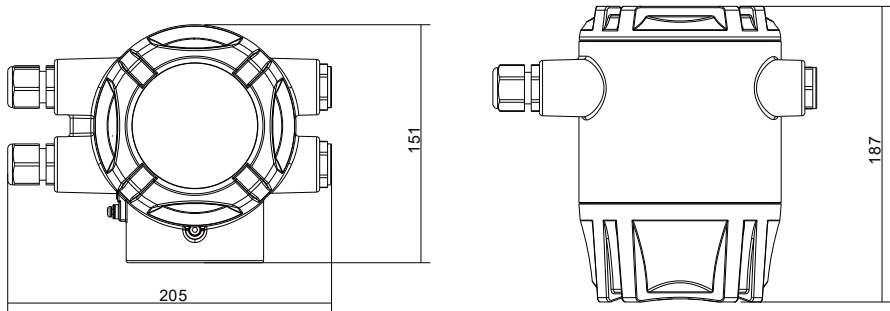


Fig.5 Integrated converter dimensions (Unit: mm)

2.2.2. Remote converter dimensions

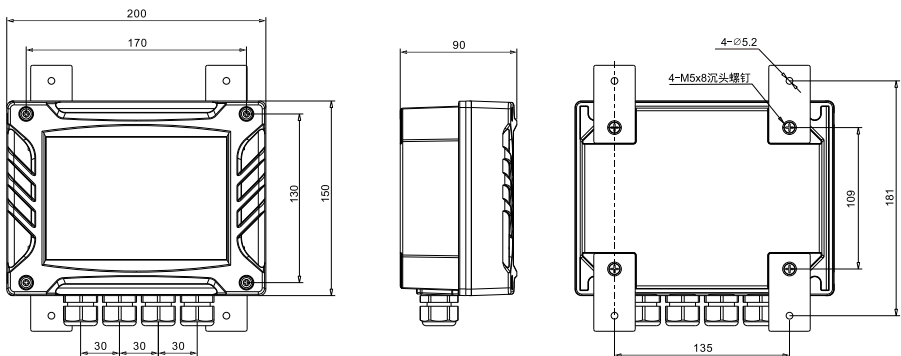


Fig.6 Remote converter dimensions (Unit: mm)

2.2.3. Sensor dimensions

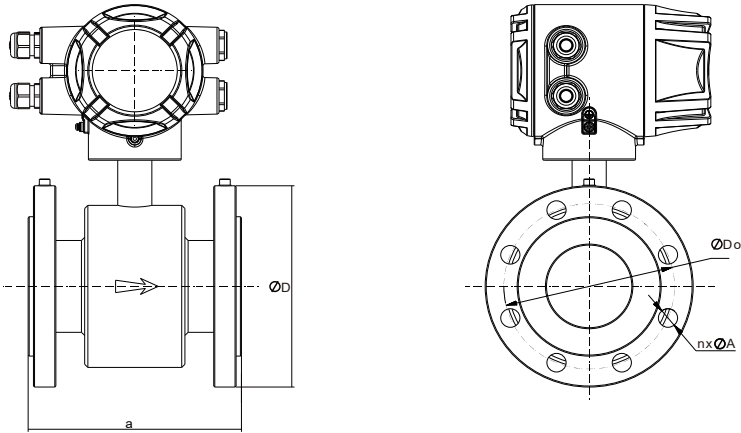


Fig.7 Structural diagram of the integrated sensor

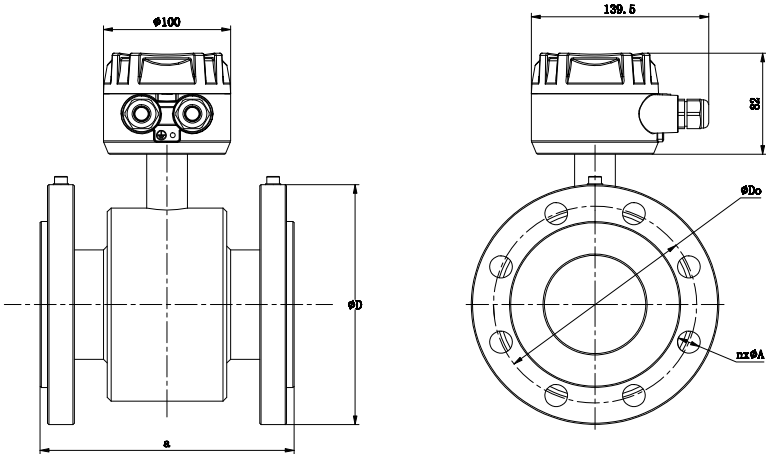


Fig.8 Structural diagram of the remote sensor

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.

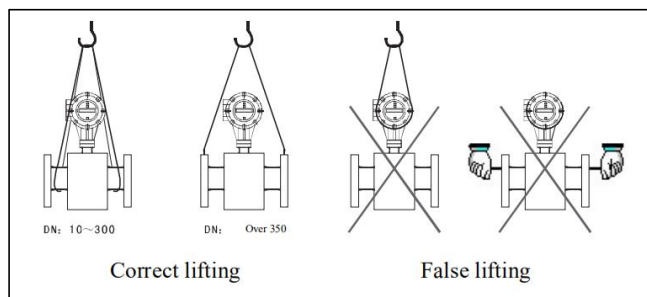


Fig.9

(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.

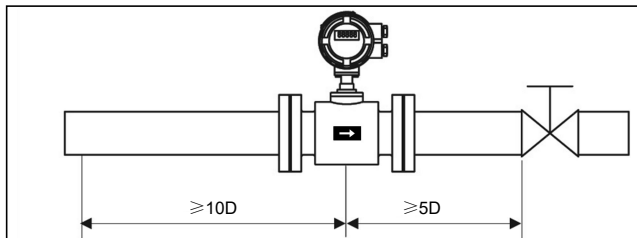


Fig.10

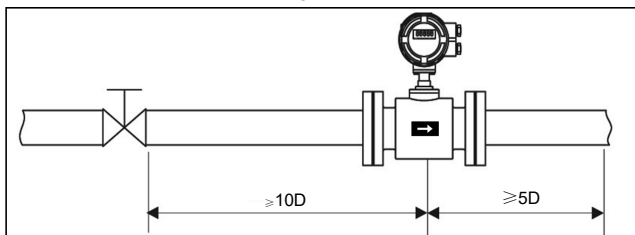


Fig.11

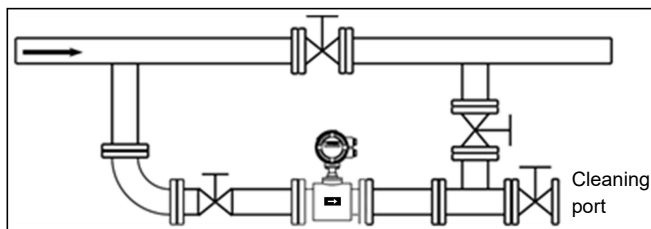


Fig.12

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.

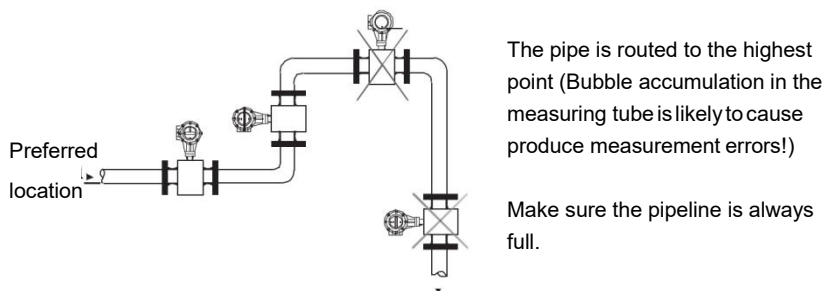


Fig.13

(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.

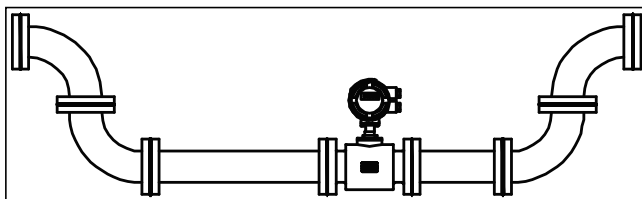


Fig.14

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.

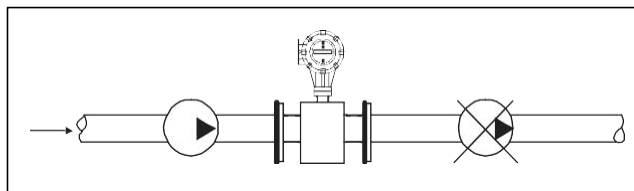


Fig.15

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

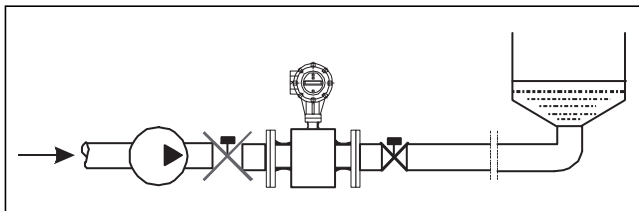


Fig.16

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

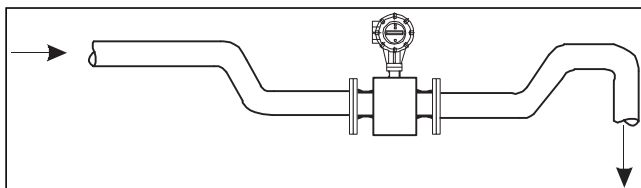


Fig.17

(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.

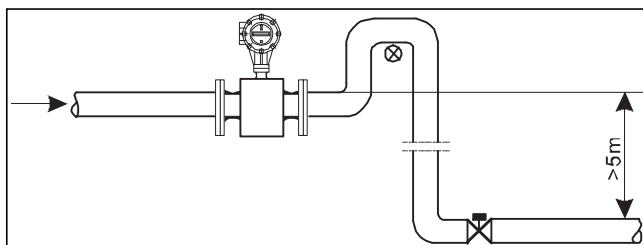


Fig.18

(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.

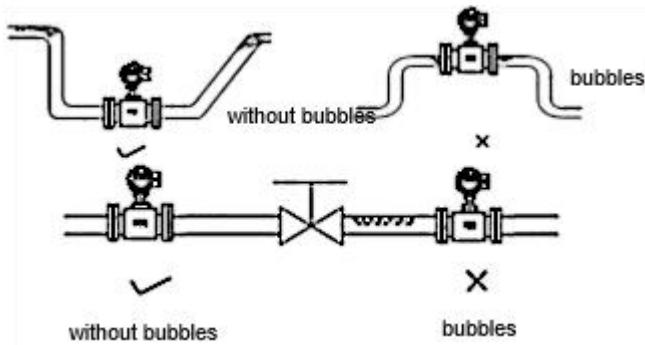


Fig.19

(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.

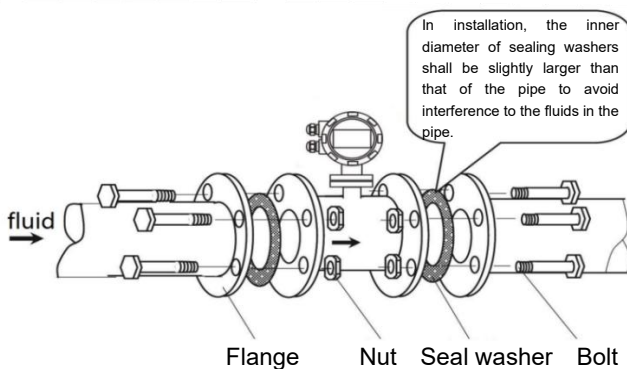


Fig.20

3.8 Post-Installation check

Table 4 Post-installation check

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

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

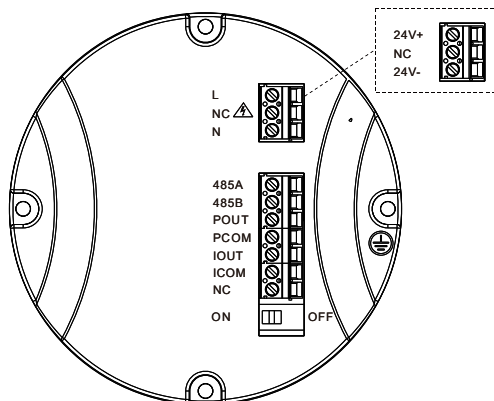



Fig.21 Terminal diagram

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. ON indicates active output; OFF indicates passive output.
POUT, PCOM	Pulse output
	Converter instrument protection grounding

4.3.2. Wiring terminal of the remote type

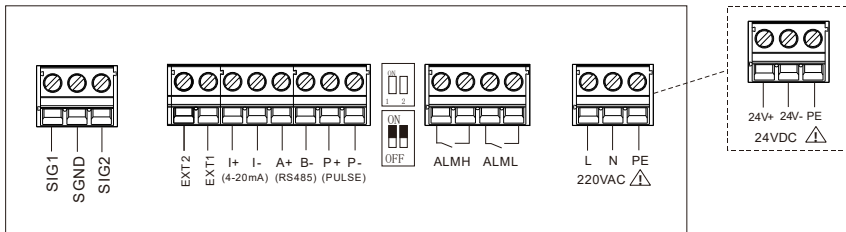


Fig.22 Terminal schematic diagram

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. ON indicates active output; 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 $RL \leq 750 \Omega$; $I_{max} \leq 24.5mA$.
- 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

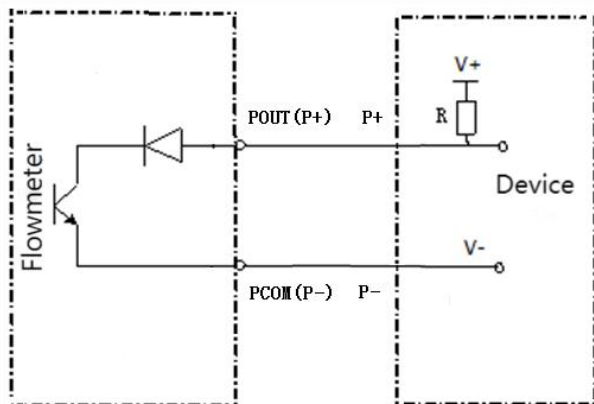


Fig.23

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

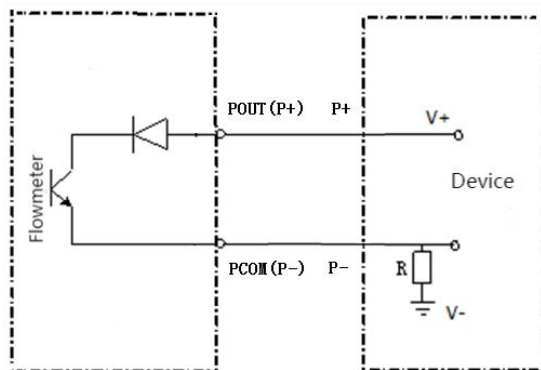


Fig.24

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

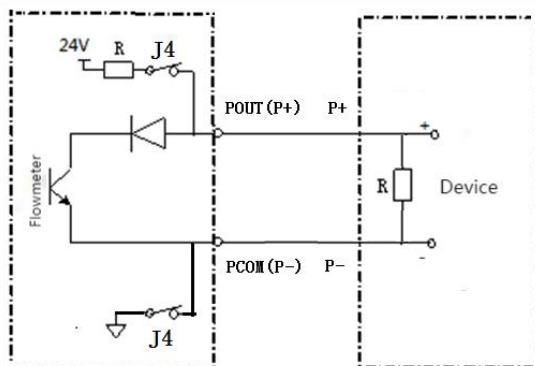


Fig.25

4.6 Post-Connection Check

Table 7 Post-connection Check

Inspection items	Result
Are the cables or instruments intact (visual inspection)?	<input type="checkbox"/>
Does the cable meet the requirements?	<input type="checkbox"/>
Is the cable completely free from external forces?	<input type="checkbox"/>
Is the terminal assignment correct?	<input type="checkbox"/>
Are all cable glands installed, securely tightened and sealed?	<input type="checkbox"/>
After power on, does the display show values?	<input type="checkbox"/>
Are all housings installed and tightened?	<input type="checkbox"/>

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

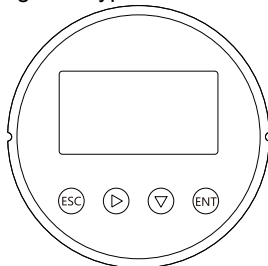
The measuring instrument consists of a measuring sensor and a signal converter; the delivery can be put into service. All parameters and hardware are configured according to your order.

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 :

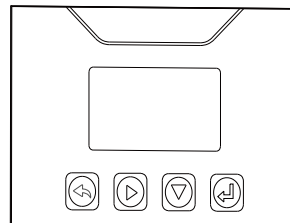


Fig.26 Display and operating elements









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

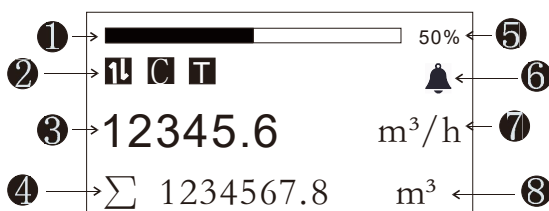





Fig.27 Main page

Table 10 Page description



No.	Description
1	Instantaneous flow in percent of flow
2	System status  : Reverse flow  : Low flow cutoff mode  : Simulation mode
3	Instantaneous flow
4	Cumulative amount and so on $\Sigma +$: Positive flow accumulation $\Sigma -$: Negative flow accumulation Σ : Net flow accumulation V : Current velocity 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:**  ; **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.

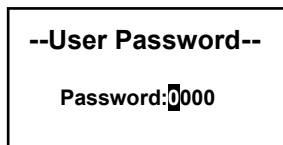


Fig.28 Password verification page

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.

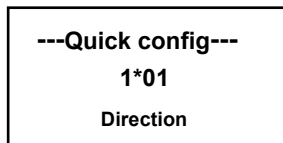


Fig.29 Configuration page

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. Choose volume unit ,such as L, m ³ , gal; the density will not calculated; 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; 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  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				
	Upper limit elimination conditions: real-time flow is less than the upper limit alarm value minus return difference.				
	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:

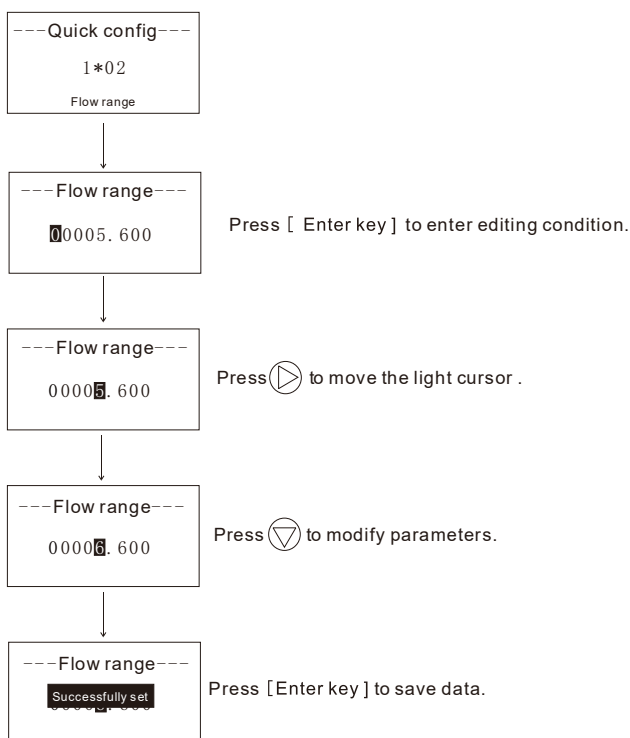


Fig.30 Example of operation

5.6.2. Display measurement

This page will display after start up.

$\Sigma +$: Positive flow accumulation $\Sigma -$: Negative flow accumulation
 Σ : Net flow accumulation V : Current velocity

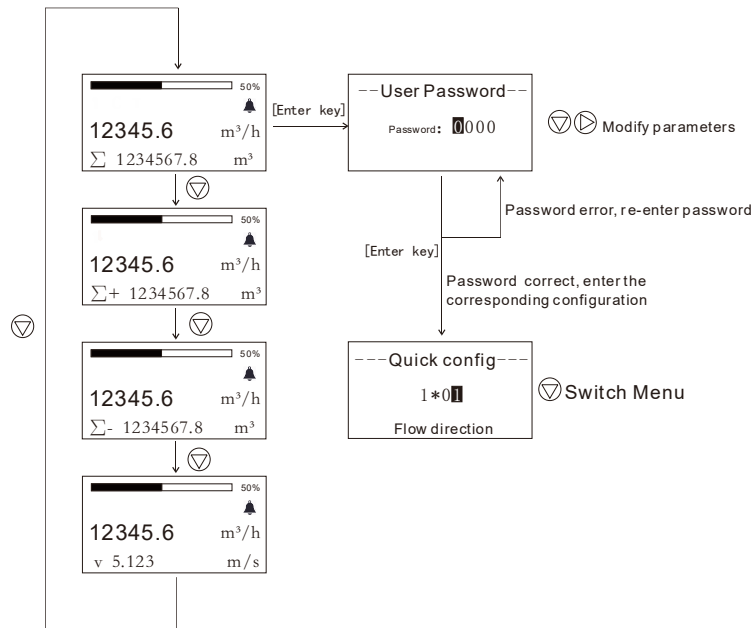


Fig.31 Display measurement

5.6.3. Flow setting

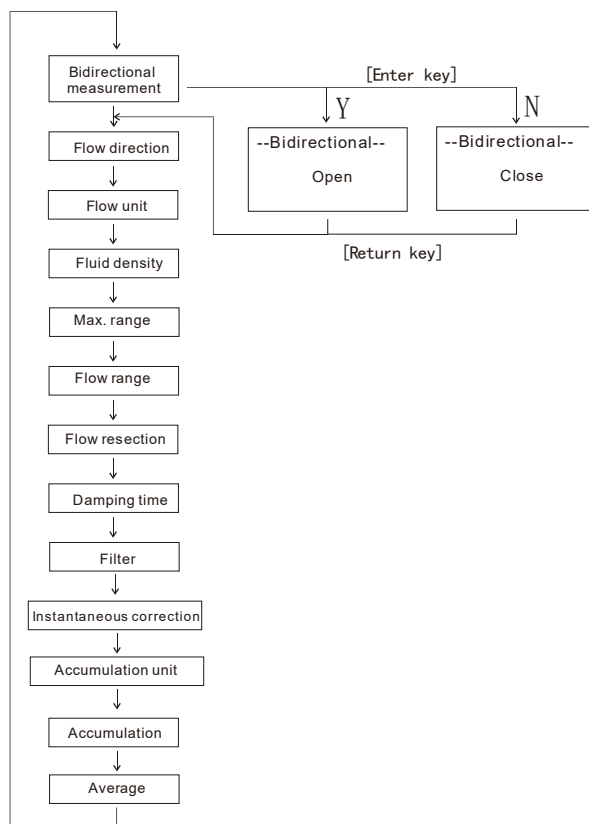


Fig.32 Flow setting

5.6.4. Output ,limit & error setting

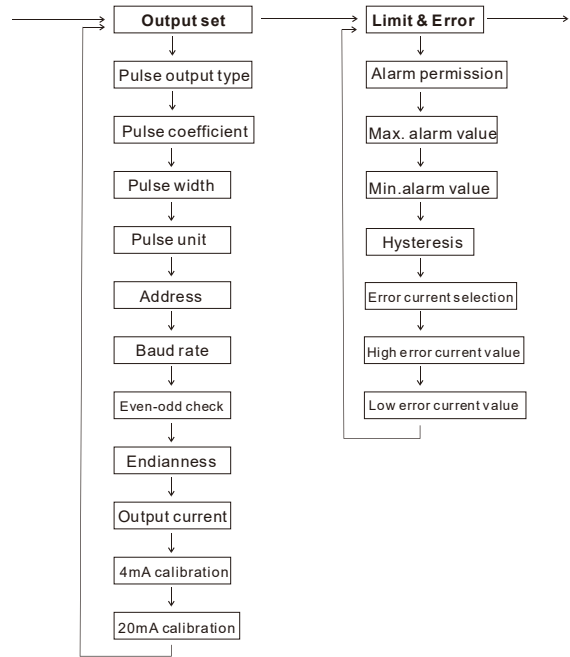


Fig.33 Output,limit & error setting

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

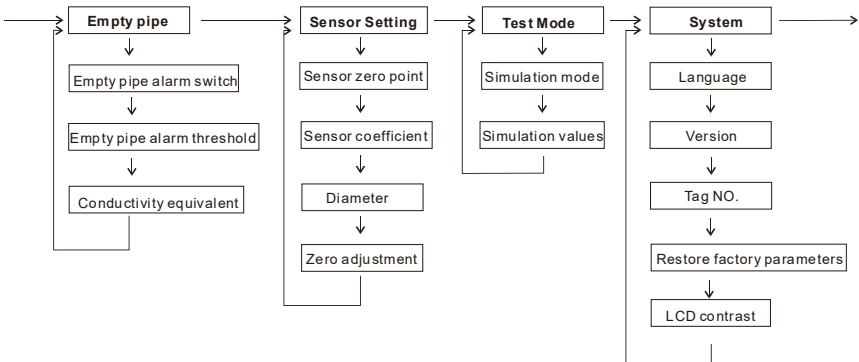


Fig.34 Empty pipe function, sensor function, test mode, system setting

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.

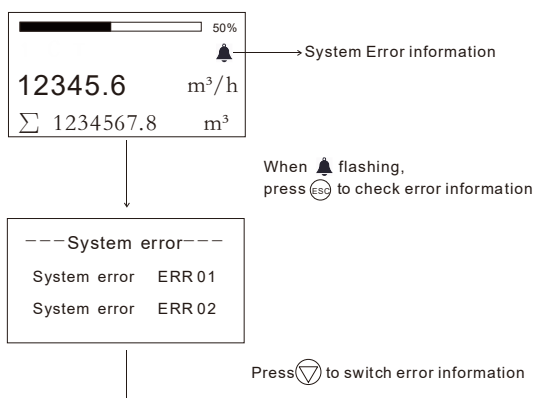





Fig.35 System information

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, m³). 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 value corresponds to the real-time flow rate, 20mA corresponds to the range limit, and 4mA corresponds to the range limit.

Conversion relationship

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

Notice:

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

Q_{Max} Indicate current instrument range

$I_{\text{real time}}$ 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)	<u>Applicable</u> : domestic water, industrial water, sewage, weak acid-base salt solutions, and normal temperature concentrated nitric acid. <u>Not applicable</u> : hydrofluoric acid, hydrochloric acid, chlorine, bromine, iodine, and other media.
Hastelloy B	<u>Applicable</u> : 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. <u>Not applicable</u> : nitric acid and other oxidizing acids.
Hastelloy C	<u>Applicable</u> : 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. <u>Not applicable</u> : reducing acids such as hydrochloric acid and chlorides.
Ti	<u>Applicable</u> : chloride, hypochlorite, seawater, and oxidizing acid. <u>Not applicable</u> : reducing acids such as hydrochloric acid, sulfuric acid, etc.
Ta	<u>Applicable</u> : 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°C. <u>Not applicable</u> : alkalis, hydrofluoric acid, sulfur trioxide.
Pt	<u>Applicable</u> : 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

<div> <div>Flow (m³/h)</div> <div>Velocity (m/s)</div> <div>DN (mm)</div> </div>	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)