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 upgrading.
- 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-FMC800-EN1

Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

About this manual

- Please ensure the instrument operators have a careful reading of this manual.
- Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility as to the device 's suitability for any specific purpose lies solely in the operator.

Precautions for product protection, safety, and modification

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipped the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for use in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:

Hazard: Failure to take appropriate precautions may result in serious personal injury, product damage, or major property loss.

Warning: Pay special attention to critical information related to the product or specific sections of this user manual.

- Confirm whether 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 and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.

- Please check the grounding protection regularly. Do not operate the product if you think that the protection, such as grounding protection and fuses, is inadequate.
- 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; failure to do so may damage the product's protective devices.

- Do not use the instrument if it is found damaged or deformed upon opening the package.
- Prevent dust, wire end, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.
- Each part of the instrument has a certain service life, which must be maintained and repaired on a regular basis for long-term use.
- If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.
- Disconnect the instrument when it is not in use.
- 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 the terms beyond the scope of this product warranty.
- This company is not responsible for damage to the instrument, loss of parts or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Item	Quantity	Note
1	Wireless electromagnetic flowmeter	1	
2	Infrared remote controller	1	
3	User manual	1	
4	Certificate	1	
5	Test report	1	

After opening the box, please confirm the scope of delivery before starting the operation. If you find that the model and quantity are incorrect or there is physical damage to the product's appearance, please contact us.

Contents

1 Introduction

1.1 Overview

The wireless electromagnetic flowmeter consists of an electromagnetic flowmeter and a 4G wireless transmission module. It is used to measure the instantaneous and cumulative flow rates of conductive liquids in closed pipelines. Measurement data are transmitted via a 4G network to a remote receiving platform, allowing users to conveniently view data and remotely configure parameters through browsers, WeChat Official Accounts, and other channels, enabling smart IoT connectivity. It is widely used in industries such as municipal water supply, chemical engineering, coal, environmental protection, textiles, metallurgy, and papermaking, etc.

The flow converter, battery-powered, comes standard with a conventional lithium battery pack and can work continuously for 3-6 years. If equipped with a high-capacity lithium battery pack, the working time will be longer.

1.2 Measuring Principle

The operating principle of 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 cross-section of measuring tube

D—Inner diameter of measuring tube

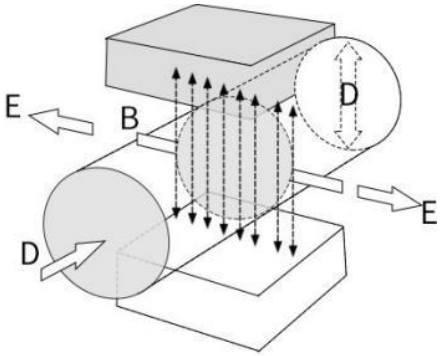


Fig.1

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 Features

- **Low power consumption:** no need for battery replacement throughout the product's service life.
- **Easy operation**: supports quick and easy parameter configuration via infrared remote control, magnetic pen, or LCD interface.
- **IP68 protection**: Fully waterproof, moisture-resistant, and submersion-proof.
- **Built-in SIM card:** no need to open the device during use, significantly

enhancing waterproof performance and installation convenience.

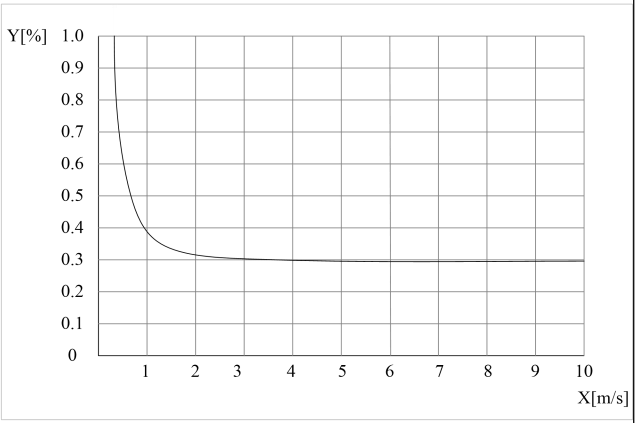
- **Remote configuration**: supports flexible and efficient remote configuration to meet various application needs.
- **Advanced server platform:** provides intuitive data queries, smart analysis, real-time alarm notifications, and SIM card renewal management, greatly improving system stability and connectivity.
- **Flexible access**: easily view data, configure parameters remotely, and update firmware through web browsers or WeChat official account.
- **Strong Technical Support:** Backed by a professional technical team offering fast and reliable support for integration with users' third-party service platforms.

2 Technical Parameters

Table 1 Technical parameters

Input			
Measured variable	Flow, pressure (optional)		
Velocity of flow	Typically velocity of flow: 0.5m/s~5m/s		
Nominal diameter	DN15~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

<table>
<tr><td rowspan="3"></td><td>DN800</td><td>905</td><td>9050</td></tr>
<tr><td>DN900</td><td>1150</td><td>11500</td></tr>
<tr><td>DN1000</td><td>1410</td><td>14100</td></tr>
<tr><td>Range ratio</td><td colspan="3">1:10</td></tr>
<tr><td colspan="4">Output</td></tr>
<tr><td rowspan="5">Pulse output</td><td>Pulse width (ms)</td><td colspan="2">Maximum output pulse 1second (p/s)</td></tr>
<tr><td>0.05</td><td colspan="2">10000</td></tr>
<tr><td>1</td><td colspan="2">500</td></tr>
<tr><td>10</td><td colspan="2">50</td></tr>
<tr><td>12.5</td><td colspan="2">40</td></tr>
<tr><td>Communications</td><td colspan="3">RS-485 serial, MODBUS-RTU communication protocol</td></tr>
<tr><td>Wireless communication (optional)</td><td colspan="3">4G</td></tr>
<tr><td colspan="4">Power supply</td></tr>
<tr><td>Supply voltage</td><td colspan="3">Built in 3.6V lithium battery;
Built in 3.6V lithium battery+24VDC dual power supply;
Built in 3.6V lithium battery+12VDC dual power supply;</td></tr>
<tr><td>Cable entries</td><td colspan="3">M20*1.5 Cable gland</td></tr>
<tr><td colspan="4">Process</td></tr>
<tr><td>Medium temperature range</td><td colspan="3">Chloroprene rubber (CR): -10℃~70℃
Polyurethane rubber (UR): -10℃~60℃
PTFE/FEP: -10℃~120℃
PFA: -10℃~120℃</td></tr>
<tr><td>Pressure rating (High pressure can be customized)</td><td colspan="3">DN10~DN250: PN<1.6MPa
DN300~DN1000: PN<1.0MPa
Note: (If there are differences in the selection of individual specifications, the label shall prevail, and high-voltage can be customized)</td></tr>
</table>

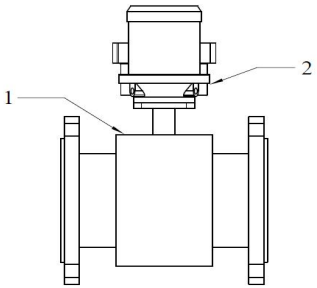
Conductivity	≥20μS/cm
Performance	
Accuracy	0.5%FS
Repeatability	0.16%
Maximum measured error	 ①X[m/s]：Velocity of flow ②Y[%]：Actual measured value deviation
Environment	
Ambient temperature	-20℃~50℃
Storage temperature	0℃~40℃
Ingress protection	IP68

3 Structure and Dimensions

3.1 Structure

The electromagnetic flowmeters mainly consist of the following components: sensor, converter and wireless transmission module.

- 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

2-Sensor

Fig.2

(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 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 electrode can be selected according to the corrosion performance of the measured medium. It is also equipped with 1-2 grounding electrodes for grounding 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 flange, and the inner side is equipped with insulation lining.

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

(7) Casing: Protect and seal the meter.

3.2 Dimensions

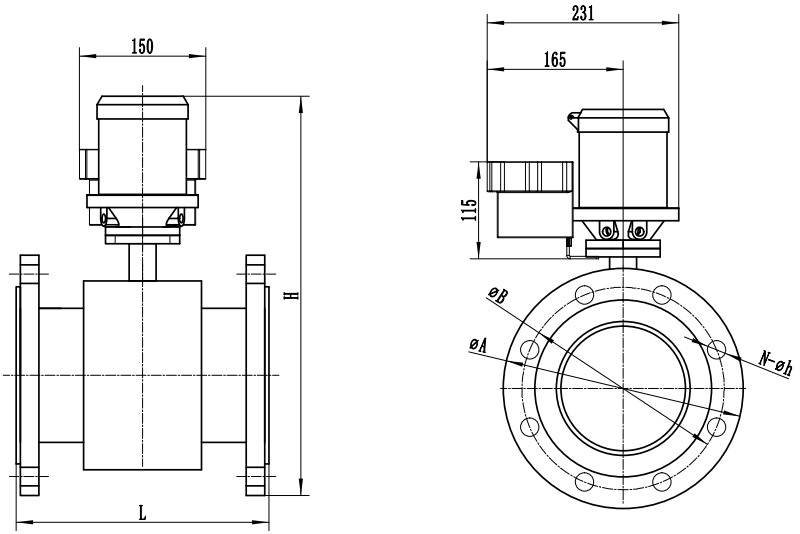


Fig.3 Dimensions (Unit: mm)

Flange standard: JB/T 81-2015.

Table 2 Sensor dimensions

DN	H (mm)	L (mm)	ΦA (mm)	ΦB (mm)	Φh (mm)	N	Rated Pressure
15	315	200	95	65	14	4	PN16
20	320	200	105	75	14	4	PN16
25	325	200	115	85	14	4	PN16
32	335	200	135	100	18	4	PN16
40	345	200	145	110	18	4	PN16
50	360	200	160	125	18	4	PN16
65	378	200	180	145	18	4	PN16
80	394	200	195	160	18	8	PN16
100	413	250	215	180	18	8	PN16
125	438	250	245	210	18	8	PN16
150	470	300	280	240	23	8	PN16
200	528	350	335	295	23	12	PN16
250	606	450	405	355	25	12	PN16
300	649	500	440	400	23	12	PN10
350	705	550	500	460	23	16	PN10
400	762	600	565	515	25	16	PN10
450	813	600	615	560	25	20	PN10
500	867	600	670	620	25	20	PN10
600	977	600	780	725	30	20	PN10
700	1086	700	895	840	30	24	PN10
800	1193	800	1010	950	34	24	PN10
900	1293	900	1110	1050	34	28	PN10
1000	1408	1000	1220	1160	34	28	PN10

3.3 Materials

Housing: stainless steel; carbon steel

Flange: Standard carbon steel (carbon steel optional)

Lining: CR, UR, PTFE (F4), FEP (F46), and PTFE (PFA)

Sensor: Optional stainless steel 316L, Hastelloy (HB and HC), titanium, tantalum, platinum iridium alloy.

4 Installation

4.1 Installation Tips

Note!

Please check whether the boxes are damaged, 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 to 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.

4.2 Precautions

To ensure reliable installation, the following measures must be taken:

(1) Leave sufficient clearance on the sides.

(2) Avoid subjecting the electromagnetic flowmeter to severe vibrations.

4.3 Pipeline Design

(1) The following items shall be considered when the pipes are designed.

① Mounting locations shall be dry and well-ventilated; avoid locations that are prone to water pooling.

② The flowmeter shall be protected from direct sunlight and rain. When installed outdoors, it shall be equipped with a weather protection cover.

③ Avoid mounting places with large temperature variation and high temperature radiation. If it must be installed therein, heat insulation and ventilation measures shall be taken.

④ Avoid mounting places with corrosive gas environment; if it is unavoidable, well-ventilated and explosion proof measures should be taken.

⑤ The mounting flowmeter should minimize strong vibrations. If the pipeline is subject to significant vibrations, pipe supports should be installed on both sides of the meter.

⑥ Parts of the flowmeter with IP68 protection (up to 3 meters underwater) can have their sensor components submerged in water. However, parts with IP65 protection must **Not** be submerged or installed outdoors.

(2) Avoid interference of magnetic field

Do not install electromagnetic flowmeters near motors, transformers, or other power sources which 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

In order to ensure the measurement accuracy of flowmeter, it is recommended to ensure that the length of inlet runsof the sensor shall be at least 10 times of pipe diameters (10D), and the length of outlet runs be at least 5 times of pipe diameters (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 equipment system when the flowmeter is out of service.

(6) Support of electromagnetic flowmeter

Do not install the electromagnetic flowmeter on a vibrating pipe without any support. Instead, a mounting base shall be used to secure the measuring tube. When the 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.

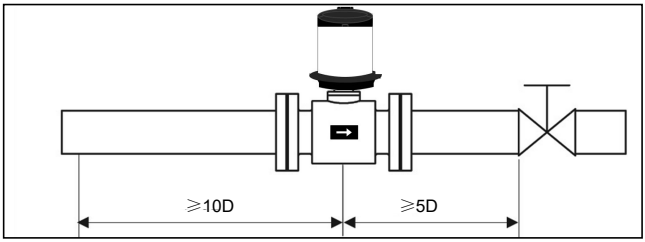


Fig.4

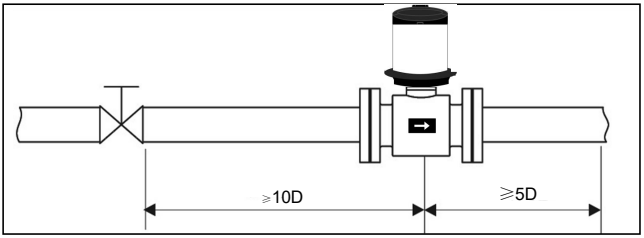


Fig.5

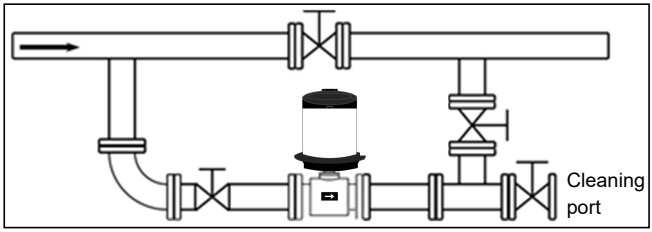


Fig.6

4.4 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.8 shows the preferred location for installing the electromagnetic flowmeter.

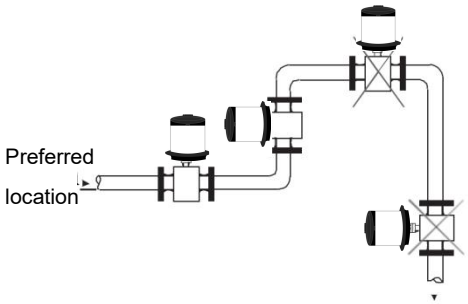


Fig.7

(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 that the medium is contained with bubbles or precipitates. Otherwise, this would cause converter signals opened and zero drift due to the fact that deposits are not covered by the electrode.

(3) Liquids shall always be filled with pipes.

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

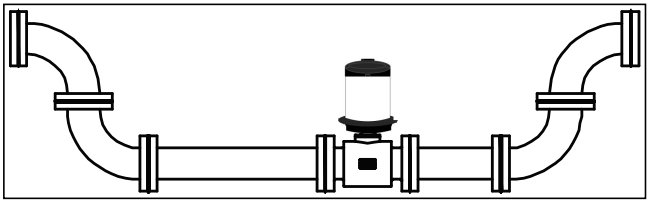


Fig.8

In case of liquids or suspensions containing solid particles, it is recommended to install electromagnetic flowmeters vertically. For one thing, the phase separation of 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.

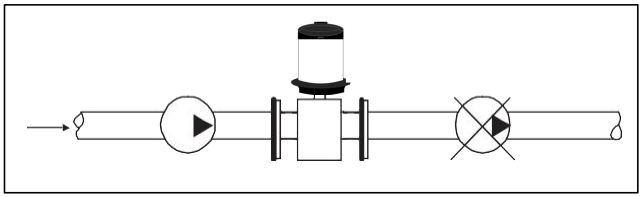


Fig.9

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

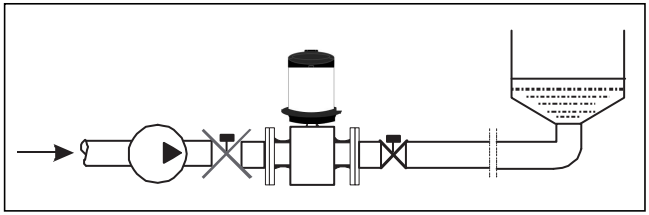


Fig.10

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

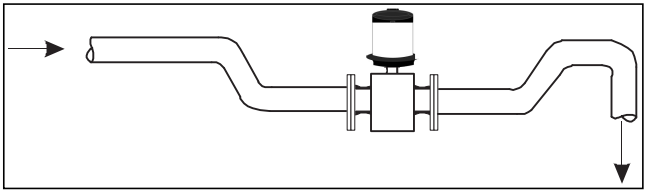


Fig.11

(7) For places where fall head of pipes is over 5 m, the air valve shall be

installed on the downstream of the electromagnetic flowmeter.

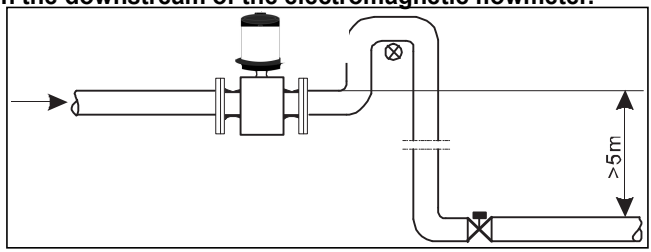


Fig.12

(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 the measurement pipe of a sensor. If a valve exists near the flowmeter, try to mount the flowmeter on the valve's upstream side for preventing a decrease of pressure inside the pipe possibly, consequently avoiding the possibility of air bubbles.

ensure that no gas can be separated from the liquid.

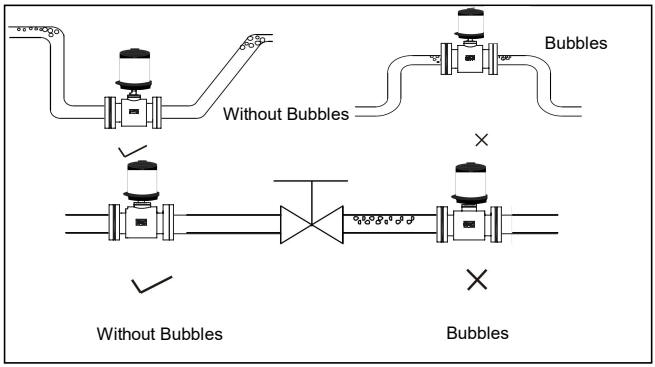


Fig.13

(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 diameters to ensure adequate mixing of liquids.

(11) Grounding

As the voltage of induced signal of electromagnetic flowmeter is small, it is susceptible to be affected by noises or other electromagnetic signals. Thus, the flowmeter need to be grounded in most cases to create an internal spaces shielded from interference and improving measurement accuracy, thereby improving measurement accuracy.

4.5 Mechanical Installation

4.5.1. Installation of Flowmeter Pipeline

(1) Prior to installation, the pipeline shall be calibrated to ensure that the diameter of the meter has a good coaxiality with the user's pipeline. For sensors with a nominal diameter of no more than 50mm, the protrusion of its 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 not only prevents the lining from being damaged but also measurement error caused by foreign particles which pass through the measuring tube during measurement.

4.5.2. Precautions

Operating introduction:

(1) 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 of meter. It's prohibited to use a stick or rope to lead through the measuring tube of sensor. Instead, follow the correct lifting as shown in the figure below.

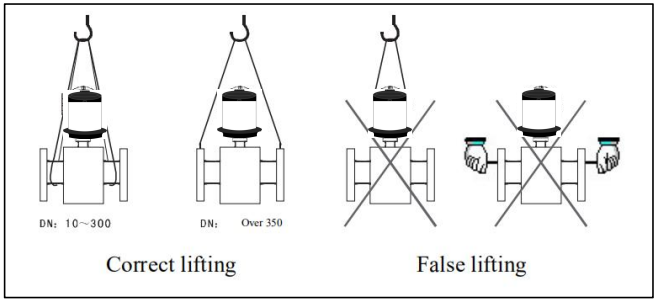


Fig.14

(2) Avoid vibration

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

(3) Protection of 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 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 water-proof sealing.

(5) No operation for a long duration

After the instrument is installed, long time out of use is not recommended. If it is unavoidable, please take the following measures:

A. Check the tightness of the covers and the wiring terminals to ensure that no moisture and water enters into the meter.

B. Conduct regular inspection. Check against the measures mentioned above and the terminal box for at least once a year. In the event of water entry into the meter (eg, after heavy rain, etc.), the meter shall be inspected immediately.

4.5.3. Flowmeter Installation

(1) Installation direction

The flow direction of the measured fluid shall be consistent with 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 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 water-proof 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 washer. 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.

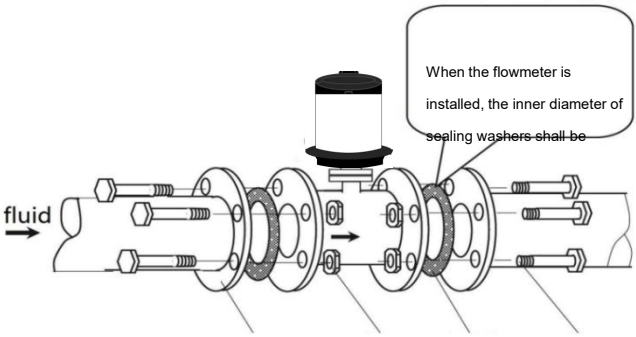


Fig.15

5 Electrical Connection

5.1 Converter Waterproof Interface Definition

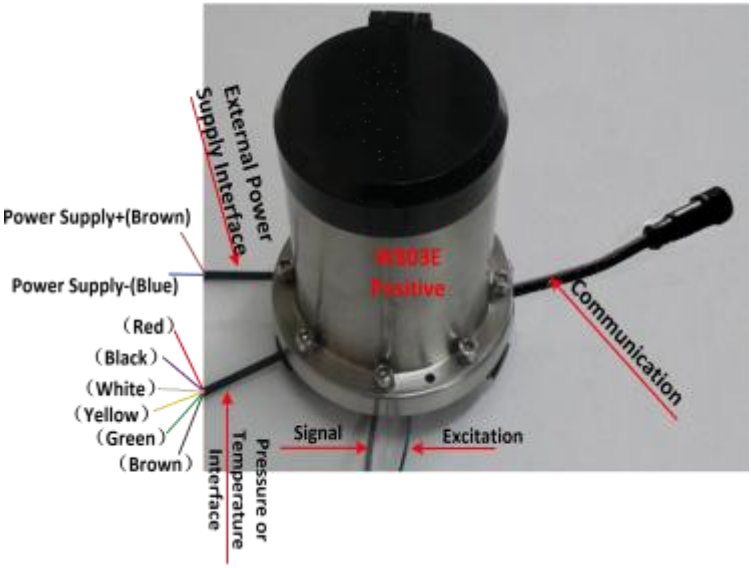


Fig.16

(1) Power Supply Interface (two core wire):

Brown Wire —External power supply+

Blue Wire—External power supply-

(2) Communication Interface

This port is a standard reserved port. Users can connect different accessories to realize different functions such as RS485 communication, 4-20mA + current loop communication etc.

(3) Pressure measurement Interface(optional):

Red Wire — Power Supply+

White, Black Wire — Suspension

Yellow Wire — Pressure signal+

Green Wire — Pressure signal-

Gray Wire — Power Supply-

Converter Pressure Measurement Interface and Pressure Sensor Wiring

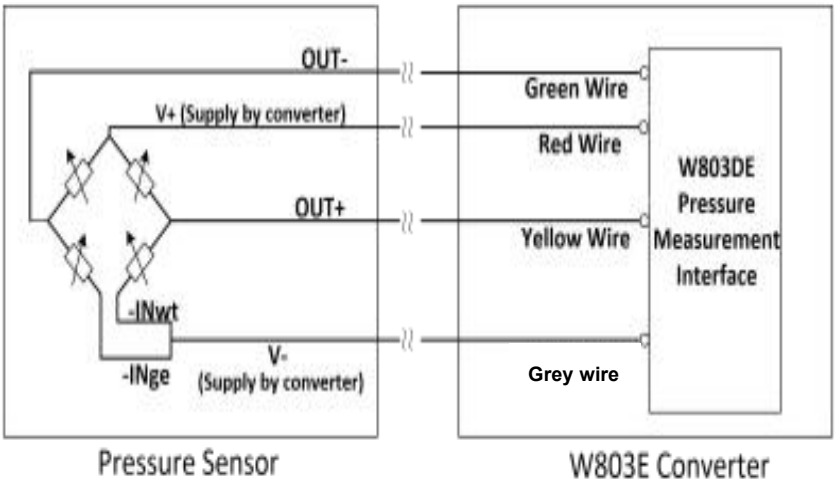


Fig.17

5.2 Converter Assembled Grounding Requirements

First, useΦ20 copper, cut to 1700mm long (can be extended if necessary) to make ground nail buried 1500mm (Note: When buried nails, nail tips in spreading a layer of wood chips carbon, then pour brine);

Second, solder 4mm2 copper wire to the ground nail, and finally ground to the sensor flange, grounding rings, pipe flanges, refer to Fig. 18.

Note: stainless steel is required to fixed ground screw, spring washer, and flat washer.

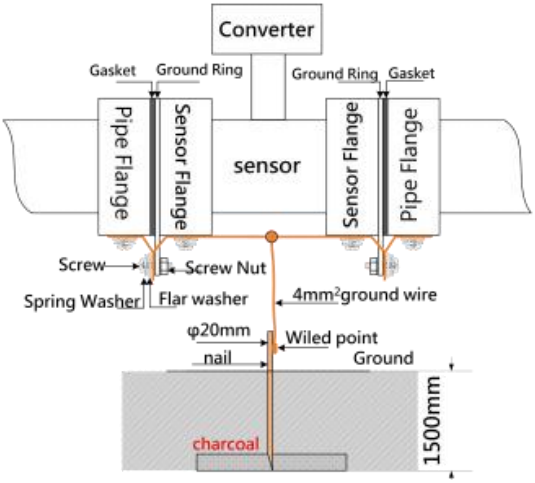


Fig.18 Converter Grounding Schematic

5.3 Flow Test

5.3.1. Pulse Output Wiring

Pulse output signal, designed for flow calibration needs, enables the converter to output pulse per unit volume. In order to ensure good seal, the pulse output interface is calibrated by infrared calibration box. When doing the user calibration, refer to the wiring diagram below.

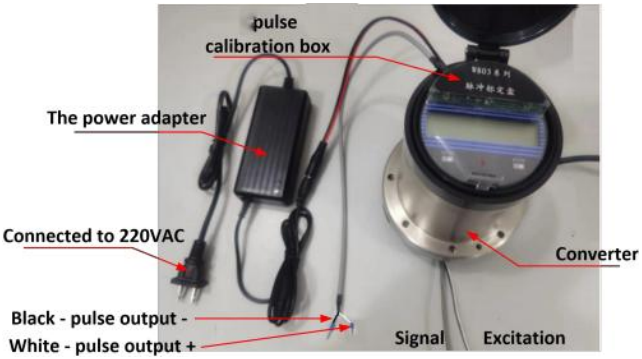


Fig.19 Connection between pulse output and other devices

5.3.2. Pulse Output and Calibration System Connection

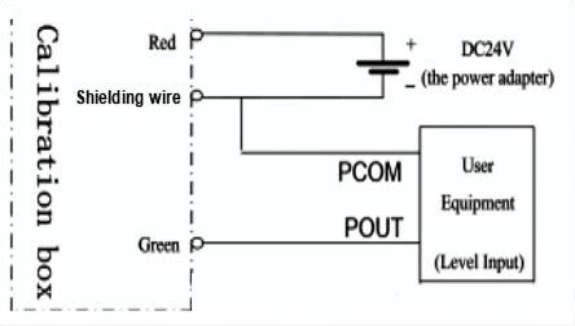


Fig.20 Pulse output and calibration system connection

5.3.3. Pulse Output Parameter Setting

- Users need to set pulse output rate in the sub menu " Pulse Factor"when calibrate. And when the pulse width is 0.05mS,the maximum pulse is 10000,so the pulse rate need low than the maximum pulse to result in calibration error.
- For example: use DN100 flowmeter, when the flow rate is 10m/s, the flow is 282.74m^3/h. If the pulse output equivalent is 0.01L, there are 7854 pulses output per second.
- Pulse output rate should not be selected too high to avoid approaching the upper limit of the output rate, causing the output pulse loss and affecting the accuracy of the instrument calibration.
- To avoid counting synchronization error between calibration system and calibrated meter, battery powered converter requires calibration count each time is longer than 4 minutes.

6 Operation

6.1 Operation of Infrared Remote Control

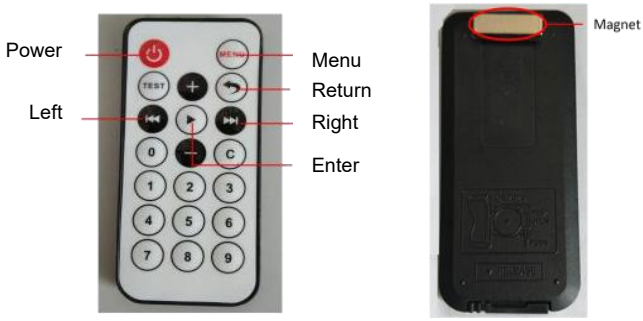


Fig.21 Operation of Infrared Remote Control

Power -test mode to measurement mode

Menu -test mode to parameter settings

Enter -parameter settings to all levels of the menu

Return -parameter settings back to the next higher level menu

Left -cursor moves left

Right -cursor moves right

6.2 Display

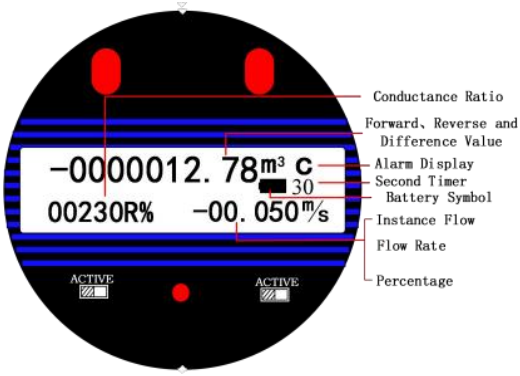


Fig.22 Converter LCD (Only Flow Mode)

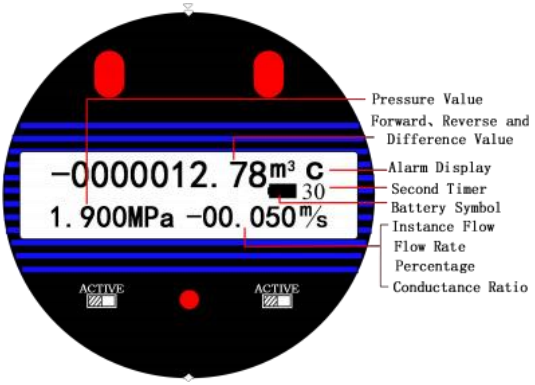


Fig.23 Converter LCD（Flow + Pressure Mode）

6.3 Meter Mode

Test mode: Supply power to the converter, the instrument get into the test mode (LCD middle row no battery symbol on the right side). The converter can output pulse signals to complete the machine calibration or change the converter parameters. After entering the meter calibration mode, without any operation, 3 minutes automatically transferred into the measurement model; If there are any operation, stop the operation to maintain after 3 hour examining mode, and then transferred into measuring instrument automatic mode.

The transition from the measurement mode to test mode is described below:

1) First trigger the right-down reed pipe with the magnet of the infrared remote control until the position of Percentage, move away the magnet;

2) Then trigger the left-down reed pipe until the LCD doesn't display, and then move away the magnet. Wait for a moment, the state has changed to test mode already.

Measurement mode: measurement mode is applied when the converter is in use(there is battery symbol on the right side of the LCD). Under measurement mode, converter can complete the measurement of flow, velocity and empty pipe parameter etc.It can also output pulse signal and RS485 or GRPR communication via infrared transmission.

Sleep mode: Because the meter is factory sealed, the converter is set sleep mode for power saving. The converter has no display, no output and little power consumption .

6.4 Meter Wake-up

To wake up the instrument, users can use our dedicated infrared remote controller (hereinafter referred to as the “remote controller”) to change the “Sleep Password” under the “Operate Mode” menu of the converter to “00000”, then return to the measurement mode. A battery icon will appear on the right side of the middle row of the LCD screen.

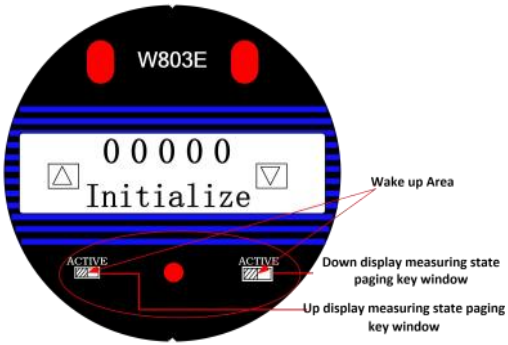


Fig.24

Note: The internal clock doesn't work during sleep mode. After waking up the meter, users must reset the time settings.

6.5 Sleep Mode Setting

If the user intends to set the meter into sleep mode, use the remote control to set the converter menu ‘Operate Mode’ sub menu ‘ Meter Dormancy’ password to 23130 and go back to test mode (On the right, it has battery symbol in middle row of LCD screen).

6.6 Transition between Measurement Mode and Test Mode

6.6.1. Measurement Mode into Test Mode

In the measure mode, use the magnet of the remote control to scan the state conversion window into the test mode (there is no battery symbol on LCD, and seconds timer accumulate once per second).

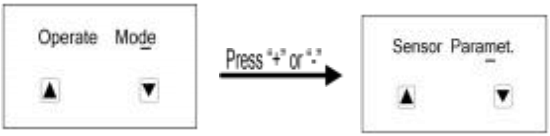
6.6.2. Test Mode into Measurement Mode

When need to enter measurement mode under test mode, just need to aim at the ‘remote control window’ and press ‘ power’ key(there is battery symbol in the middle of the LCD screen).

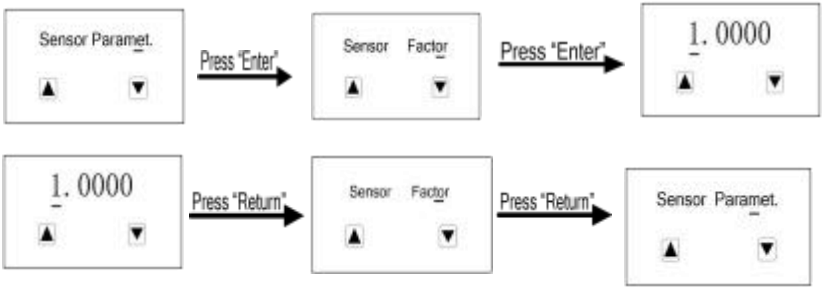
6.7 Parameter Setting

Parameters Setting and Remote Control Operation

To set or modify parameters, make sure the meter is under parameters setting mode. In the test mode, press “ Menu” to enter the password “00000”. After entering the password,press “ Enter ” to enter “ Parameters Set” function selection display, then press “ Enter ” again to enter the main operating menu. If intend to change the main menu, press “+” or “-”. Refer to the figure below:



To set sub menu parameter, move cursor to press “ Enter” and enters sub menu of the present main menu. If you want to return to the higher level menu or the calibration model, need to press the return key.



6.8 Function Selection Display

Press “ Menu” to enter the password “00000”. After enter the password, press “ Enter ” to enter the function selection display, and press “+” to select. There are five functions to select:

Table 3

No.	Parameters	Comments
1	Parameters Set	Select the function to enter parameters setting
2	Clr Total Rec	Select the function to clear total record
3	Flow Total Rec	Select the function to record the reverse flow total of 120 months. (Storage by month and the year’s end separately) (Number=Mantissa of the year×12+month) For example: year: 2019 month:10 Number=9×12+10=118
4	Heat Total Rec	Select the function to record heat total of 120 months. (Storage by month and the year’s end separately) (Number=Mantissa of the year×12+month) For example: year: 2019 month:10 Number=9×12+10=118
5	Error Record	Select the function to record error record of 24 month in “ Flow+Temperature” mode.

6.9 Clr Total Record

Step 1: According to then method of “3.5 Parameter Setting” to set “Clear Total Key”and back to test mode.

Step 2: In the test mode, press “Menu”key. (Meter version will be displayed for 5s,and then “ Parameters Set” is displayed.)

Step 3: After enter the password,press “+”, “Clr Total Rec ” is displayed.

Step 4: Press” Enter” key ,input the “Clear Total Key” set in step 1 and press “ Enter”key, the meter displays “00000”, Clear Total Record is done.

Step 5: Press the button “Return”, and then meter is back to test mode.

Remarks:

***Clr Total Rec* +1：clear heat or cold total under current mode.**

***Clr Total Rec* +3：clear work time.**

***Clr Total Rec* +4：clear 120 months flow and heat monthly record.**

***Clr Total Rec* +7：clear 24 error record.**

Note:

1. The factory set of the meter is sleep mode (the LCD is not lighted), users need to use remote control to wake up the meter for normal use (refer to 3.2); When using the meter, please set the time to affect the use.
2. When the meter is waked up, the meter is in test mode. Meter correction or parameters setting can be done in the test mode. Measurement or communication must be done under measurement mode.

6.10 Meter Parameter

The parameters of battery powered converter are: Operate Mode, Flow Parameters,Output Parameters, Sensor Parameter, Linearization, Temperature Parameters, Communication, Factory Adjust, Total parameter and Pressure Parameter. The definitions of the parameters are as below:

Table 4 Menu List

Code	Parameters	Set	Content	Password Level
Ⅰ Operate Mode				
1	Operate Mode S.	Select	Flow only Flow+Pressure Flow+Temperature	1
2	Interval Time	Select	2～30SEC	1
3	Meter Dormancy	Set	0～59999	1

Code	Parameters	Set	Content	Password Level
		Count		
4	Measure Mode	Select	Measure Heat 、Measure Cold	1
5	LCD Time Sleep	Select	Enable/Disable	1
6	Backups Enable	Select	Enable/Disable	1
7	SD_Card Enable	Select	Enable/Disable	1
8	Humidity Enable	Select	Enable/Disable	1
9	Bi_Direct Enable	Select	Enable/Disable	1
Ⅱ Flow Parameter				
1	Sensor Size	Select	3～2100mm	1
2	Flow Unit	Select	L/s 、L/m 、L/h 、m^3/s 、m^3/m 、m^3/h 、ukg/s 、ukg/m 、ukg/h 、usg/s、usg/m、usg/h、kg/h、kg/m、kg/s 、t/s 、t/m 、t/h	1
3	Flow Range	Set Count	0～65535	1
4	Flow Direction	Select	FORWARD、REVERSE、ALL FORWARD、 ALL REVERSE	1
5	Flow Zero CRC	Set Count	0~±9999	1
6	Flow Cutoff	Set Count	according to flow	1
7	Flow Filter Time	Select	3～30Sec	1
8	Reverse Flow En.	Select	Enable/Disable	1
9	Starting Value	Set Count	0～59.999m/s	1
10	Heat Display	Select	Reserved	1
11	High Alm. Limit	Set	0～65535	1

Code	Parameters	Set	Content	Password Level
		Count		
12	Low Alm. Limit	Set Count	0～65535	1
13	Fluid density	Set Count	0～1.9999	1
14	Zero Noise Reset.	Select	Enable/Disable	1
Ⅲ Output Parameters				
1	Pulse Output En.	Select	Enable/Disable	1
2	Pulse Unit	Select	m3 、Ltr 、ukg 、usg	1
3	Pulse Factor	Set Count	0.0000～ 5.9999	1
4	Pulse Width	Select	0.05～12.5ms	1
Ⅳ	Sensor Paramet.			
1	FWD. Sensor Fact	Set Count	0.0000～5.9999	1
2	REV. Sensor Fact	Set Count	0.0000～5.9999	1
3	Excitation Time	Select	TYPE1 、TYPE2	1
4	Sensor Coding	User set	Factory YAER 、MONTH（0～59999）	1
5	Empty Pipe Value	Set Count	0～59999	1
6	Empty. Zero CRC	Set Count	0～19999	1
7	Empty. Range CRC	Set Count	0～59999	1
8	System Alarm En.	Select	Enable/Disable	1

Code	Parameters	Set	Content	Password Level
9	Exit. Value Set （for version 47）	Select	Excit:1 、Excit:2 、Excit:3	1
Ⅴ FWD.Linearizati.				
1	Linearizat. Ena	Select	Enable 、Disable	1
2	FWD Correct Po.1	User set	According to Velocity	1
3	FWD Target Val.1	User set	According to Velocity	1
4	FWD Correct Po.2	User set	According to Velocity	1
5	FWD Target Val.2	User set	According to Velocity	1
6	FWD Correct Po.3	User set	According to Velocity	1
7	FWD Target Val.3	User set	According to Velocity	1
8	FWD Correct Po.4	User set	According to Velocity	1
9	FWD Target Val.4	User set	According to Velocity	1
10	FWD End Velocity	User set	According to Velocity	1
11	Speed Value 5	User set	According to Velocity	1
Ⅵ REV.Linearizati.				
1	REV Correct Po.1	User set	According to Velocity	1
2	REV Target Val.1	User set	According to Velocity	1
3	REV Correct Po.2	User set	According to Velocity	1
4	REV Target Val.2	User set	According to Velocity	1
5	REV Correct Po.3	User set	According to Velocity	1
6	REV Target Val.3	User set	According to Velocity	1
7	REV Correct Po.4	User set	According to Velocity	1
8	REV Target Val.4	User set	According to Velocity	1
9	REV End Velocity	User set	According to Velocity	1
Ⅶ Temperat. Param				
1	Heat Unit	Select	GJ 、MJ 、KWH 、MWH	1
2	Sensor Position	Select	Inlet/Export	1

Code	Parameters	Set	Content	Password Level
2	Temperat. Filter	Select	06～63Sec	1
3	Ent.T Zero CRC	Set Count	00000～ 59999	1
4	Ent.T Range CRC	Set Count	0.0000～1.9999	1
5	Out.T Zero CRC	Set Count	00000～ 59999	1
6	Out.T Range CRC	Set Count	0.0000～1.9999	1
7	Pressure Range	Select	0.6MPa/1.6MPa	1
8	Ent.Temp.Calic	Set Count	0.0000～1.9999	1
9	Out.Temp.Calic	Set Count	0.0000～1.9999	1
Ⅷ Communication				
1	CommAddres	Select	0～199	1
2	Communica.Rate	Select	1200～14400	1
3	Communica.check	Select	No Parity 、Odd Parity 、Even Parity	1
4	Communicat.Gap	Select	RESERVE	1
5	Communication	Select	MOD BUS	
6	IrDA Data Type	Select	IrDA Pulse Mode 、IrDA Total Mode	1
Ⅸ Factory Adjust				
1	Language	Select	简体中文、ENGLISH	1
2	Meter Correct	Set Count	0.0000～1.9999	1
3	Meter Code 1-4	Factory	Factory YAER 、MONTH（0～	2

Code	Parameters	Set	Content	Password Level
		set	59999）	
4	Multiplier	Set Count	0.0000～3.9999	1
5	Factory Logo	Select	Enable 、Disable	1
6	Meter Factor	Set Count	0.0000～3.9999	1
X Total Parameter				
1	Flow Total Unit	Select	0.001m3 ～ 1m3 、0.001L ～ 1L 、 0.001ukg～1ukg 、 0.001usg ～ 1usg 、0.001kg～1kg 、0.001t～1t	1
2	Heat Total Unit	Select	0.001GJ～1.000GJ、0.001MJ～1.000MJ、0.001KWH ～ 1.000KWH 、0.001MWH～1.000MWH	
3	Clear Total Key	User set	0～59999	2
4	FWD Total Low	User set	0～99999	1
5	FWD Total High	User set	0～39999	1
6	REV Total Low	User set	0～99999	1
7	REV Total High	User set	0～39999	1
8	Heat Total Low	User set	0～99999	1
9	Heat Total High	User set	0～39999	1
10	Total Display	Select	Flow+ 、 Flow+, Flow- 、Flow+, Flow-,FD 、 Heat Quantity、Flow+, Heat 、 Flow+, Flow-, LM、	1

Code	Parameters	Set	Content	Password Level
			F+, F-, FD, LM 、 Flow+, Heat, LM、	
Ⅺ Pressure Param.				
1	Pressure Unit	Select	1.000KPa～ 1.000MPa	1
2	P_Sensor Excit	Select	ID=100uA for 20K、ID=250uA For 8K、 ID=500uA For 4K 、ID=750uA For 2K5	1
3	Pressure Gain	Select	G=02 For 1000mV、G=04 For 500mV、 G=08 For 250mV 、G=16 For 125mV、 G=32 For 62.5mV、G=64 For 31.25mV	1
4	Press. Zero CRC	Set Count	0~±9999	1
5	Press. Range CRC	Set Count	0.0000～ 5.9999	1
6	Press. Hi. Alarm	Set Count	0000～ 9999	1
7	Press. Lo. Alarm	Set Count	0000～ 9999	1

7 Wireless Communication Operation

The wireless electromagnetic flowmeter comes with a pre-installed SIM card and is delivered in "activation" mode. Users can view data via web pages, WeChat official accounts, and other platforms.

7.1 Wireless Module Panel Description

Fig.25 Wireless module panel

Table 5 Panel Description

No.	Parts	Function
①	ACT/ Activate magnetic button	Device activation and immediate uploading
②	IR receiving port	Come into use with the remote control.
③	LCD display	Display basic system information.
④	SFT/ LCD interface magnetic toggling button	Toggle to the LCD interface for checking the device information

7.2 Activation

Scan the ACT/Activation magnetic button with a strong magnet. Upon hearing three beeps, the activation is successful. The activation operation can be performed repeatedly and is intended for use during field installation and commissioning.

7.3 Wireless Module Interface Description

The LCD display provides a visual reference for on-site commissioning, helping to identify issues and improve the efficiency of field installation and commissioning.

This terminal is an ultra-low-power device. Under normal conditions, the LCD remains off and will only be activated through the procedure described in section 7.2.

After activation, the LCD screen turns on.

You can scan the SFT/LCD Interface Switch magnetic button with a strong magnet to cycle through interfaces P01 to P05. After data transmission is completed, if there is no operation within 10 seconds, the LCD will automatically turn off and enter low-power standby mode.

The interface displays and their meanings are as follows:

Page P00: Startup Interface – displays during the device initialization process.

Page P01: Data Collection and Transmission Interface – dynamically displays process parameters during data acquisition and wireless transmission; this is the default screen of the device. The main information is shown in the table below.

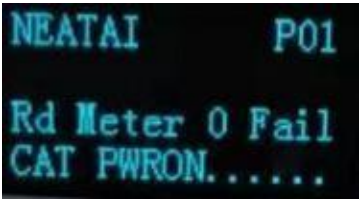
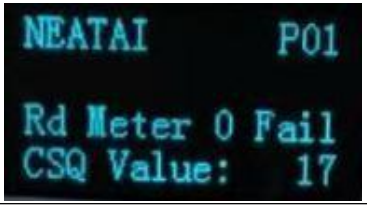
Page P02: Device Information Interface.

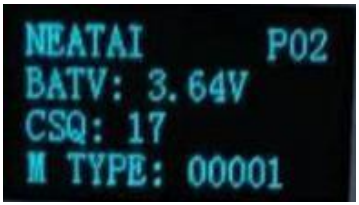
Page P03: Modbus Information Interface.

Page P04: Data Collection Day and Interval Interface.

Page P05: Wireless Terminal Device Identification Code Interface.

Table 6

Page	Display	Meaning
P01		Pre-reading base meter data
		Read result: Fail: Failed to read the base meter OK: Successfully read the base meter
		PWRON: Communication module is initializing CAT: CAT.1 NB: NB-IoT
		CSQ Value: read signal quality 1-31 succeed/(higher is better) Fail: failed

Page	Display	Meaning
P01		ATNET: attach to network OK: success Fail: failed
		SEND: send data OK: success Fail: failed
		Waiting to read meter or for SFT LCD operation
P02		BATV: built-in battery voltage of wireless data collector CSQ: communication signal M TYPE: meter type

8 Common Troubleshooting

8.1 Alarming Information

There are several kinds of alarming shown: S—system alarming, M—empty pipe alarming, C—small signal cut alarming, A/ B—temperature break alarm, P—pressure alarm, short—excitation short circuit to ground alarm, BAT. LOW—low battery alarm.

If S displays, it is possible that converter exciting breaks or converter excitation frequency mode selection inappropriate.

8.2 Common Troubleshooting

Table 7

Troubles	Solutions
No Display	* Check whether the power is on; * Check whether the power voltage meets the requirement
Excitation Mode Alarming	* Check whether excitation wiring EX1and EX2 is open circuit *Check whether the total resistance of the excitation coil of the sensor matches the excitation current of the converter; * If the items above are in normal, then the converter is malfunctioned
Empty Pipe Alarming	* Check whether the fluid is full of the senior pipe * Connect the signal3(white line, red line and the shield line) to short circuit, if the empty pipe alarming “ Empty Pipe” disappeared, the meter is in normal condition; otherwise, the error

Troubles	Solutions
	may caused by low fluid conductance, wrong setting of empty pipe threshold or range. * Check whether the signal wiring is correct * Check whether the senior pole is in normal condition If the flow is zero, the displayed conductance ratio shall be less than 100% If there is liquid in pipe, the resistance between white line and red line to shield line shall be less than 50kΩ. (If the medium is water, it is better to use pointer multi-meter to do the test and there is charge and discharge during the testing.)
Flow Measurement Inaccurate	* Check whether the liquid is full of sensor pipe * Check whether the signal cable is in normal condition * Check the sensor parameter and zero-point is set by sensor label or factory calibration
Remote Control Key Failure	If the buttons are unresponsive when aligned remote control to infrared tube, the power button battery insides the remote control may be low. The remote control can be detached to measure button battery voltage. If the value is lower than 2.7V, the remote control can’t work properly. Then button battery needs to be replaced.

Appendix 1 Electrode Selection and Specification

Table 8 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, normal temperature concentrated nitric acid. 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. 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. Not applicable: reducing acids such as hydrochloric acid and chlorides.
Ti	Applicable: chloride, hypochlorite, seawater, oxidizing acid. 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 boiling point, nitric acid and sulfuric acid below 175℃. 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 ownchoices based on actual situation. You may refer to 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 9 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	10	12	15
DN10	0.0283	0.0565	0.1131	0.1414	0.2827	2.8274	3.3929	4.2411
DN15	0.0636	0.127	0.254	0.318	0.636	6.362	7.634	9.543
DN20	0.113	0.226	0.452	0.565	1.131	11.310	13.572	16.965
DN25	0.176	0.353	0.707	0.884	1.767	17.671	21.206	26.507
DN32	0.290	0.579	1.158	1.448	2.895	28.953	34.744	43.429
DN40	0.452	0.905	1.810	2.262	4.524	45.239	54.287	67.858
DN50	0.707	1.414	2.827	3.534	7.069	70.690	84.823	106.03
DN65	1.195	2.389	4.778	5.973	11.946	119.46	143.35	179.19
DN80	1.810	3.619	7.238	9.048	18.100	181.00	217.15	271.43
DN100	2.827	5.655	11.310	14.137	28.274	282.74	339.29	424.12
DN125	4.418	8.836	17.671	22.090	44.179	441.79	530.14	662.68
DN150	6.362	12.723	25.447	31.809	63.617	636.17	763.41	954.26
DN200	11.310	22.619	45.239	56.549	113.10	1131.0	1357.2	1696.5
DN250	17.671	35.343	70.686	88.357	176.71	1767.1	2110.6	2650.7
DN300	25.447	50.893	101.79	127.23	254.47	2544.7	3053.6	3817.0
DN350	34.636	69.272	138.54	173.18	356.36	3463.6	4156.3	5195.4
DN400	45.239	90.478	180.96	226.19	452.39	4523.9	5428.7	6785.8
DN450	57.256	114.51	229.02	286.28	572.56	5725.6	6870.7	8588.3
DN500	70.686	141.37	282.74	353.43	706.86	7060.6	8482.3	10603
DN600	101.79	203.58	407.15	508.94	1017.9	10179	12215	15268
DN700	138.54	277.09	554.18	692.72	1385.4	13854	16625	20782
DN800	181.00	361.91	723.82	904.78	1809.6	18096	21715	27143
DN900	229.02	458.04	916.09	1145.1	2290.2	22902	27483	34353
DN1000	282.74	565.49	1131.0	1413.7	2827.4	28274	33929	42412
DN1200	407.15	814.30	1628.6	2035.8	4071.5	40715	48848	61072
DN1400	554.18	1108.4	2216.7	2770.9	5541.8	55418	66501	83126
DN1600	723.82	1447.7	2895.3	3619.1	7238.2	72382	86859	108573

Appendix 3 Installing and Connecting of Pressure Sensor

Fig.26 shows how to install the pressure sensor.

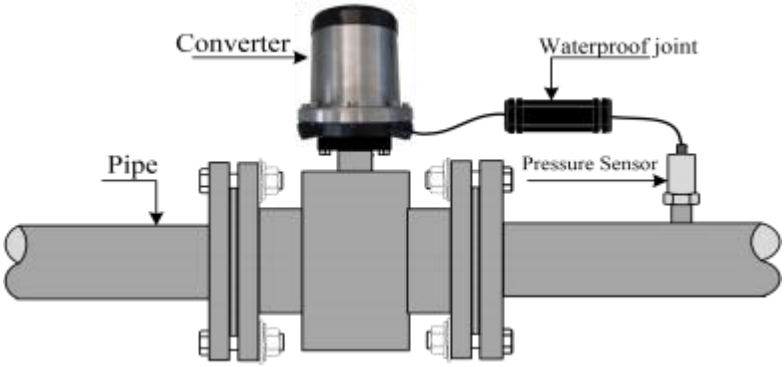


Fig.26