MFE600E

Operation Manual

V2.0

MICROSENSOR

Contents

Our company reserves the right to modify this manual due to product technology and process updates. If there are changes, no further notice will be given.
Please note the latest version of this manual.
The company reserves the right of final interpretation of this manual.

Thank you very much for choosing our products. In order to better use the product, it is recommended that you read the instructions carefully before using the product.

1 Introduction

MFE600E Electromagnetic Flowmeter (hereinafter called Electromagnetic Flowmeter) is designed and manufactured with the most advanced domestic and abroad technology, featuring high accuracy, reliability, good stability and long service life.

We pay our attention to every detail in the process of the product structure design, material selection, manufacturing, assembly and factory testing etc. With a water tower up to 37m as pressure stabilizer for actual flow calibration, we have a professional production line for electromagnetic flowmeter, also we design and develop a series of software and hardware for electromagnetic flowmeter for mass production to ensure high quality in long term use. The product has backlight and wide temperature-ranged LCD display. With fully practical function, visual display, easy operation, it saves troubles for on-site installation operation and maintenance. MFE600 can be widely used in industrial fields such as petroleum, chemical, metallurgy, water supply and drainage, steel, coal, paper, food, textile, environmental protection and other municipal administration, water conservancy construction field etc.

2 Features

- The measurement accuracy will not be influenced by the fluid density, viscosity, temperature, pressure and electrical conductivity changes;
- Open flow without moving parts in measuring pipe, no pressure loss;
- Simple structure, easy installation, no high requirements for straight pipe section;
- No mechanical inertia, with good sensitivity, it can measure the transient pulsating flux, and has good linearity;
- Only the lining and electrodes contact with the media, as long as the selection of electrode and lining materials is proper, they can be corrosion resistance and abrasive resistance, and are able to ensure long-term use;
- Multi-electrode structure ensures high accuracy. With the grounding electrode, it doesn't need grounding ring which saves the cost;
- When power off , EEPROM can protect parameter setting and cumulative values；
- The converter uses a low-power consumption single-chip for processing data which ensure the reliable performance, high accuracy, low power consumption and zero stability. Dot matrix LCD can display the integrated flux, transient flux, velocity, flow percentage and other parameters;
- Two-way measuring system can be used for measuring forward flux and reverse flux; low frequency rectangular wave excitation improves the stability of flow, low power loss and superior low velocity characteristic.

3 Working Principle

The working principle of Electromagnetic Flowmeter is based on Faraday's Law of Electromagnetic Induction, that is, when the conductive liquid flows through the electromagnetic flowmeter, the induced electromotive force will be produced in the liquid conductor, and the induced electromotive force is

directly proportional to the velocity of conductive liquid, magnetic flux density and width of conductor (interior diameter of flowmeter). Such induced electromotive force is detected by a pair of electrodes on the tube wall of the flowmeter, and the equation of induced electromotive force is as follows:

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

U: Induced electromotive force

K: Instrument Constant

B: Magnetic flux density

V: Velocity

D: Interior diameter of measuring pipe

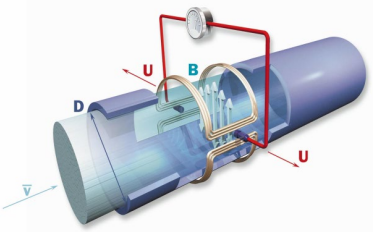


Figure 1 working principle diagram

4 Product Category

Flange Type (carbon steel)

Flange Type (stainless steel)

Threaded Type (stainless steel)

Threaded Type

Clamping Type

Battery Supplied Type (carbon steel)

Battery Supplied Type (stainless steel)

5 Outline Structure

IIntegrated flange connection dimensions

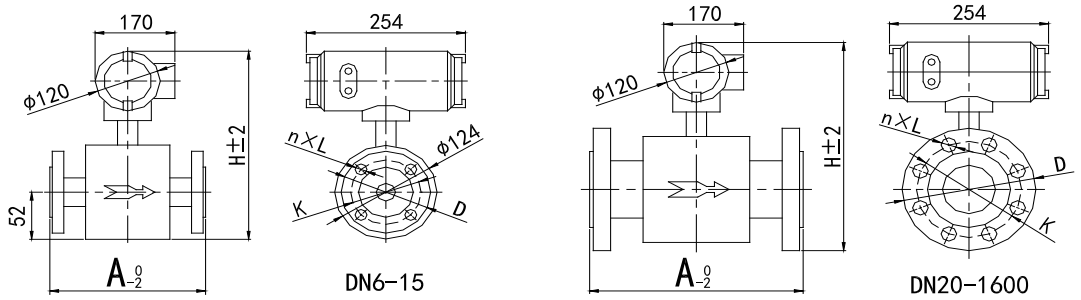


Figure 2 Integrated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

Table 2 Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×L
6	4.0	150	304	Φ90	Φ60	4×Φ14
10		150	304	Φ90	Φ60	4×Φ14
15		150	304	Φ95	Φ65	4×Φ14
20		150	304	Φ105	Φ75	4×Φ14
25		150	312	Φ115	Φ85	4×Φ14
32		150	330	Φ140	Φ100	4×Φ18
40		150	340	Φ150	Φ110	4×Φ18
50		200	338	Φ165	Φ125	4×Φ18
65		200	358	Φ185	Φ145	8×Φ18
80		200	374	Φ200	Φ160	8×Φ18
100	1.6	250	402	Φ220	Φ180	8×Φ18
125		250	425	Φ250	Φ210	8×Φ18
150		300	458	Φ285	Φ240	8×Φ23
200	1.0	350	522	Φ340	Φ295	8×Φ23
250		400	574	Φ395	Φ350	12×Φ23
300		500	624	Φ445	Φ400	12×Φ23
350		500	678	Φ500	Φ460	16×Φ23
400		600	742	Φ656	Φ515	16×Φ25
450		600	794	Φ615	Φ565	20×Φ25
500		600	862	Φ670	Φ620	20×Φ25
600		600	950	Φ780	Φ725	20×Φ25
700		700	1058	Φ895	Φ840	24×Φ30
800		800	1166	Φ1010	Φ950	24×Φ34
900		900	1272	Φ1110	Φ1050	28×Φ34
1000		1000	1376	Φ1220	Φ1160	28×Φ34
1200	0.6	1200	1578	Φ1405	Φ1340	32×Φ34
1400		1400	1840	Φ1630	Φ1560	36×Φ36
1600		1600	2078	Φ1830	Φ1760	40×Φ36

Separated flange connection dimensions

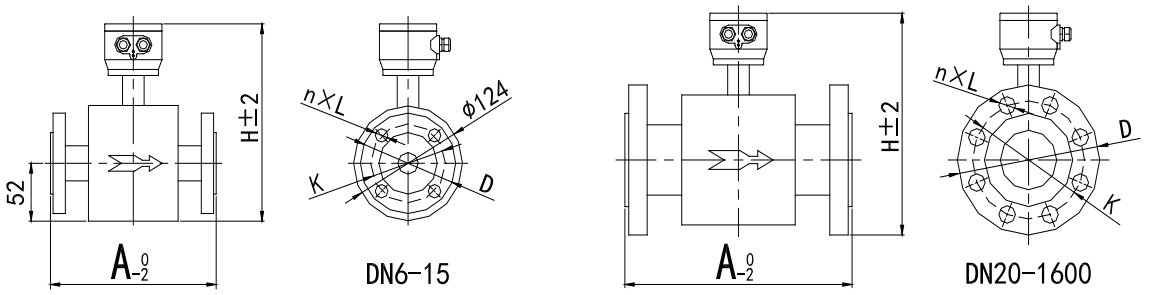


Figure 3 Separated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

Table 3 Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×L
6	4.0	150	245	Φ90	Φ60	4×Φ14
10		150	245	Φ90	Φ60	4×Φ14
15		150	245	Φ95	Φ65	4×Φ14
20		150	245	Φ105	Φ75	4×Φ14
25		150	252	Φ115	Φ85	4×Φ14
32		150	270	Φ140	Φ100	4×Φ18
40		150	280	Φ150	Φ110	4×Φ18
50		200	280	Φ165	Φ125	4×Φ18
65		200	300	Φ185	Φ145	8×Φ18
80		200	314	Φ200	Φ160	8×Φ18
100	1.6	250	342	Φ220	Φ180	8×Φ18
125		250	366	Φ250	Φ210	8×Φ18
150		300	400	Φ285	Φ240	8×Φ23
200	1.0	350	464	Φ340	Φ295	8×Φ23
250		400	516	Φ395	Φ350	12×Φ23
300		500	566	Φ445	Φ400	12×Φ23
350		500	618	Φ500	Φ460	16×Φ23
400		600	682	Φ656	Φ515	16×Φ25
450		600	734	Φ615	Φ565	20×Φ25
500		600	802	Φ670	Φ620	20×Φ25
600		600	892	Φ780	Φ725	20×Φ25
700		700	998	Φ895	Φ840	24×Φ30
800		800	1106	Φ1010	Φ950	24×Φ34
900		900	1212	Φ1110	Φ1050	28×Φ34
1000		1000	1316	Φ1220	Φ1160	28×Φ34
1200	0.6	1200	1518	Φ1405	Φ1340	32×Φ34
1400		1400	1780	Φ1630	Φ1560	36×Φ36
1600		1600	2018	Φ1830	Φ1760	40×Φ36

Separated converter dimensions

The separated type is generally used in on-site maintenance and debugging reading inconvenient occasions, but also used in more severe applications, such as high-temperature fluids and vibration sources. On most occasions, the integrated and separated types can both meet the requirements.

is ≥500mm, the separated type is recommended for easy maintenance; when the meter is installed below the ground, the separated type, IP68 protection level structure must be selected; when the meter is unavoidably installed at the pump outlet, please choose a separated structure meter

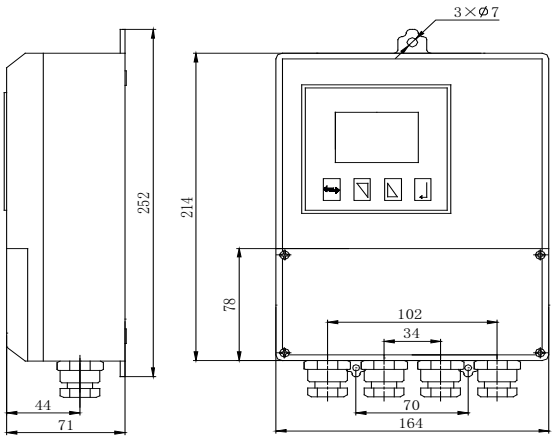


Figure 4 Separated converter dimensions

6 Specifications

Table4

Diameter	Flange type: DN6~DN1600, ≥DN20 with built-in grounding electrode
	Sanitary type: DN6~DN50
	Threaded type: DN6~DN50
	Clamping type: DN10~DN300
Measurement accuracy	0.2%，0.5%
Electrode type	Standard fixed electrode, antifouling electrode
	DN6~DN20: a pair of measuring electrodes, no grounding electrodes
	DN25~DN500: a pair of measuring electrodes and a pair of grounding electrodes
	≥DN600: 2 pairs of measuring electrodes and a pair of grounding electrodes
Structure type	Integrated type, separated type (cable length of separated type≤100m)
Rated pressure	GB: PN2.5, PN6, PN16, PN25, PN40, PN63, PN100, PN160, PN250
	ANSI: CLASS 150, CLASS 300, CLASS 600, CLASS 900
	DIN: PN10, PN16, PN25, PN40, PN63
	JIS: 5K,10K,16K,20K,30K,40K,63K
	Others: customizable
Electrode material	316L, Ti, HB/HC, Ta, WC, Pt
Lining material	Neoprene (CR), Natural Rubber (NR), Polyurethane Rubber (PU)
	Polytetrafluoroethylene (PTFE), F46, PFA
Measured pipe	Stainless steel
flange/body flange	Carbon steel (standard), stainless steel (optional)
converter housing	Aluminum die-casting
Power supply	100 V AC~240V AC
	12V DC,24V DC
	Battery supply (LCD display, RS485 output, wireless output, frequency/pulse output, and the frequency/pulse output is used only for calibration or calibration purposes.)
	Solar power with storage battery

Output signal	4mA~20mA DC (load resistance 0Ω~750Ω, active output)
	Hart
	Frequency, pulse output (Passive, active output optional)
	Upper and lower limit alarm output
	RS485(Modbus protocol), RS232
	Profibus-DP, Profibus-PA
	2G,4G, NB, LoRa wireless transmission
Electrical connection	M20×1.5
IP protection	IP65, IP68: submersible, long-term working in water, suitable for instrument installation in instrument well.
Environmental temp.	Working temp.: -20℃~60℃
Storage temp.	-40℃~60℃
Relative humidity	5%~90%

7 Electrical Connection

The electromagnetic flowmeter converter can be divided into integrated converter and separated converter, and the wiring diagram is shown in Figure 5 and Figure 6.
When wiring, please note:

a) RS485 communication cable needs to use two-core twisted pair shielded wire;
b) The same cable shall not be used for the power line and 4mA~20mA DC signal line. Two cables shall be connected separately.

7.1 Integrated wiring

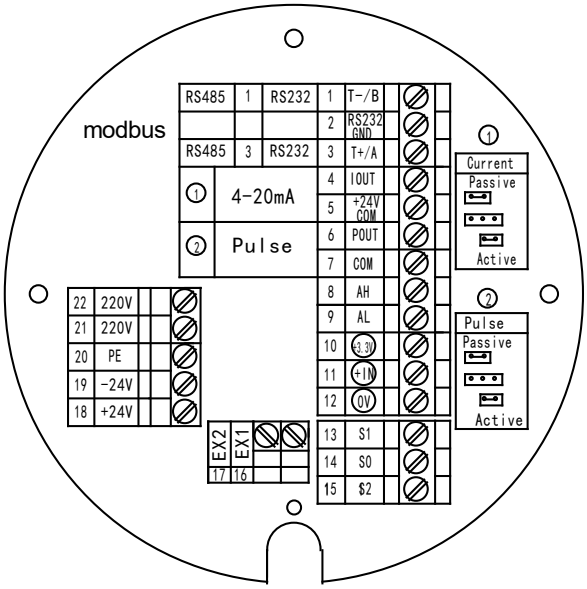


Figure 5 Integrated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output signal. See Table 2 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 5

Terminal Symbol		Function
1	T-/B	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T+/A	RS485/RS232 communication input
4	IOUT	4mA~20mA DC output;
5	+24V DC COM	4mA~20mA DC output grounding wire;
6	POUT	Pulse/frequency output
7	COM	Pulse/frequency output grounding wire
8	AH	Alarm output for Upper Limit of flow
9	AL	Alarm output for Lower Limit of flow
10	+3.3V	Pressure transmitter +IN
11	+IN	Pressure transmitter output terminal
12	0V	Pressure transmitter GND
13	S1	Electrode wire
14	S0	Signal grounding wire
15	S2	Electrode wire
20	PE	Power grounding wire
21	220V	220V AC power supply access
22	220V	
19	-24V	24V DC (12V DC) power supply access
18	+24V	
16	EX1	Exciting current
17	EX2	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current① or pulse ② will output an active signal.
	Active	When lugs are connected to Active, the current① or pulse② will output a passive signal.

7.2 Separated wiring

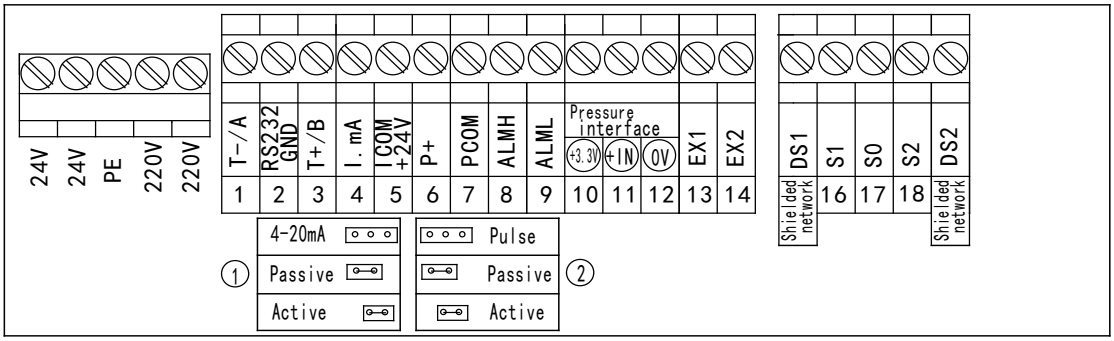


Figure 6 Separated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output form. See Table 3 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 6 Terminal definition of separated type

Terminal Symbol		Function
1	T-/A	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T+/B	RS485/RS232 communication input
4	I.mA	4mA~20mA DC output;
5	Icom +24V	Current output grounding wire
6	P+	2-way flow pulse output/frequency output
7	Pcom	Pulse output grounding wire
8	ALMH	Alarm output for Upper Limit of flow
9	ALML	Alarm output for Lower Limit of flow
10	+3.3V	Pressure transmitter +IN
11	+IN	Pressure transmitter output terminal
12	0V	Pressure transmitter GND
13	EX1	Exciting current
14	EX2	
Shielding network	DS1	
16	S1	Electrode wire
17	S0	Signal grounding wire
18	S2	Electrode wire
Shielding network	DS2	
220V	220V	220V AC power supply access
220V	220V	
24V	24V	24V DC power supply access
24V	24V	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current① or pulse② will output an active signal.
	Active	When lugs are connected to Active, the current① or pulse② will output a passive signal.

8 Installation

The electromagnetic flowmeter must work under the condition of full pipe, and the flowmeter cannot work normally when the pipe is not full or empty.

The correct installation method of the electromagnetic flowmeter should ensure that the pipe is filled with liquid and should not be installed high on the pipe, as shown in Figure 6.

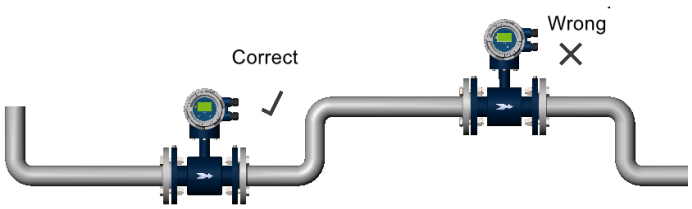


Figure6

Front and rear straight pipe installation

In order to ensure the upstream piping conditions required for high accuracy measurement of the flowmeter, the piping installation as shown in the figure below is recommended.

When there are valves at the front and rear of the flowmeter, the front and rear straight pipe must meet the front 5D and rear 2D installation methods at least, and the valve must be fully open, as shown in Figure 7.

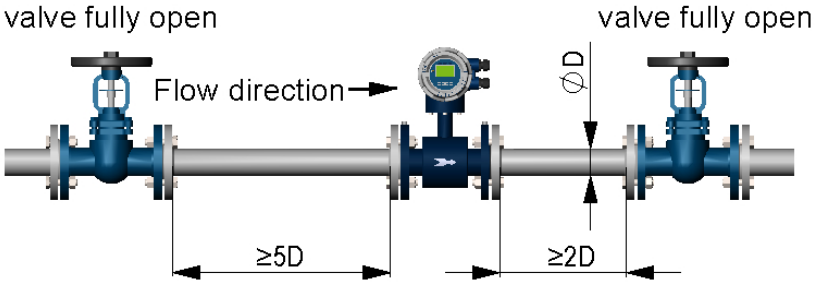


Figure 7

When flowmeter is installed at the back end of T-tube, the flowmeter and T-tube shall have a minimum of 5D straight pipe segments, as shown in Figure 8

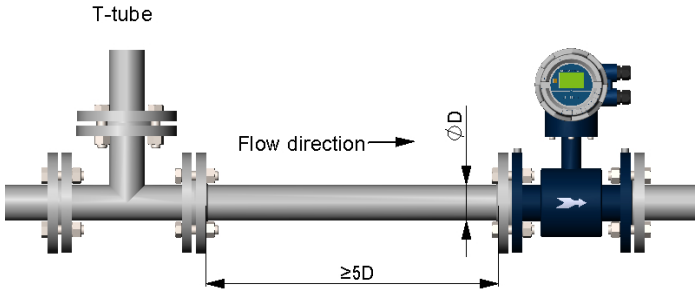


Figure 8

When the flowmeter is installed at the back end of 90°elbow pipe, at least 5D straight pipe are needed between the flowmeter and the tail end of the elbow, as shown in Figure 9.

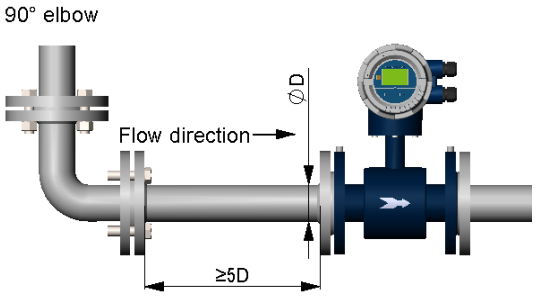


Figure 9

When the flowmeter is installed at the back end of the expanded diameter pipe, the flowmeter and the back end of the expanded diameter pipe need to ensure a minimum of 10D straight pipe, as shown in

Figure 10.

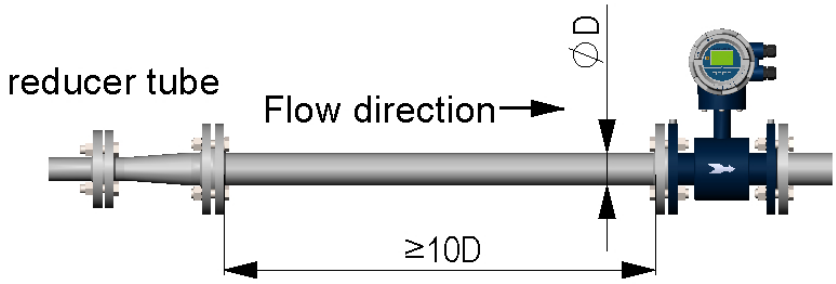


Figure 10

When the flowmeter is installed at the back end of the valve and the valve is not fully open, the flowmeter and the back end of the valve need to ensure a straight pipe section of at least 10D, as shown in Figure 11.

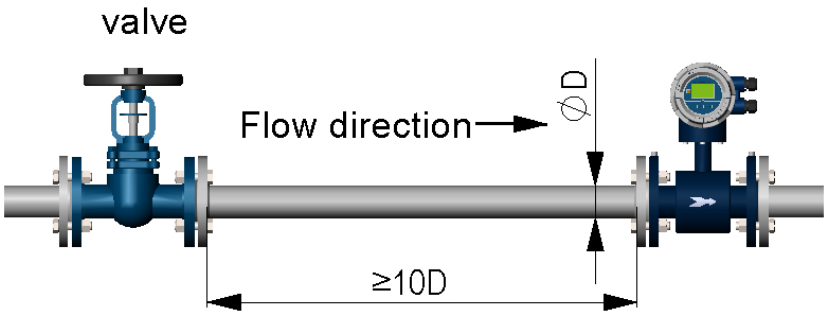


Figure 11

Installation Direction

When installing, the positive direction of liquid flow should generally be the same with the direction of the arrow on the sensor, and there must be sufficient space for installation and maintenance near the flowmeter. During installation, the flowmeter should be equipped with supports on both sides of the pipeline to prevent the flowmeter from being stressed due to pipeline vibration, impact and contraction.
When installing the flowmeter, in general, with horizontal installation, please ensure the axis of the measuring electrode is approximately horizontal; if the axis of the measuring electrode is perpendicular to the ground, bubbles can easily build up near the upper electrode which is easy to block the liquid from contacting the electrode below that is easily covered by mud or impurities. The converter is generally installed above the pipeline to prevent water from entering the converter.

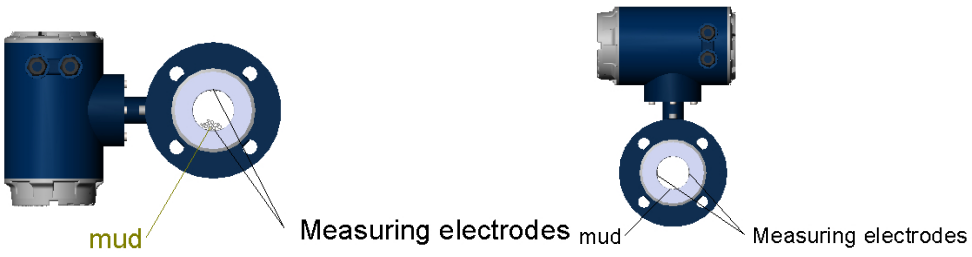


Figure 12 Flowmeter installation direction

When installing the flowmeter, please ensure the axis of the pipeline and the flowmeter measuring tube are in the same straight line. If there is an angle between the two axes, the flange connection will not be sealed well, and even the flange welding part will break

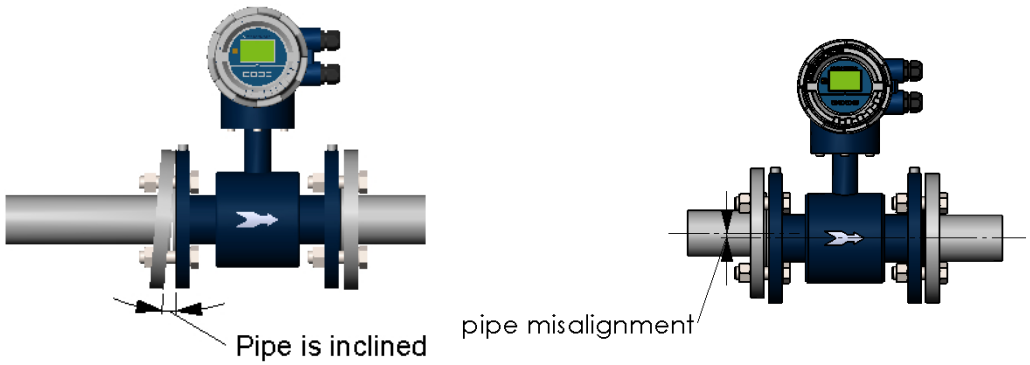
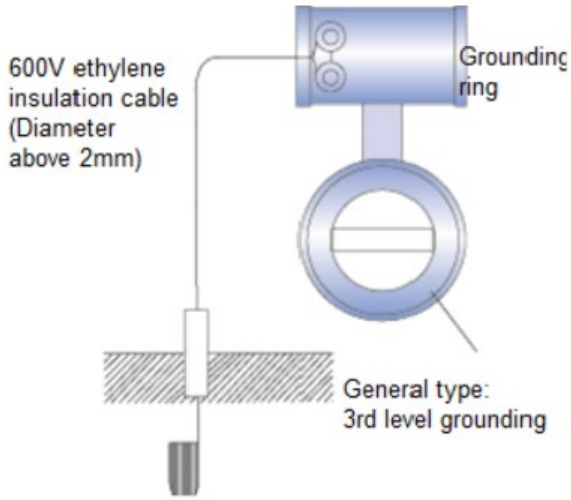


Figure 13 Flowmeter installation symmetrically with the pipe axis

Sensor Grounding

Since the voltage of inductive signal of electromagnetic flowmeter is small, it is easily affected by noise. Its reference potential must be the same to the measured liquid potential. Therefore, the reference potential of the sensor (terminal potential), the reference potential of converters and amplifiers are also the same to measured liquid potential, and the liquid potential have to be the same as the ground potential. The electromagnetic flowmeter is equipped with a ground loop, which is for establishing a liquid ground via contact with liquid, and for protecting lining meanwhile.

The instrument grounding is shown as below:



Noise Suppression

Do not install Electromagnetic Flowmeter near motors, transformers or power device which is easy to cause induction interference.

9 Start up Start up

9.1 Switch on

Before turning on the power, please check that the system has been properly installed as required, including:

a) The instrument shall be mechanically safe and shall be installed in accordance with regulations;
b) The power supply shall be connected according to regulations;
c) The electrical connection wire of the cavity shall be protected, and the cap shall be tightened;
d) Please check whether the running data of the power supply is correct.

9.2 Converter start-up

The measuring instrument is composed of a sensor and a converter and is ready for immediate use when it is supplied. All operating data is factory set according to your order, please refer to the provided inspection report for details.

After turning on the power, the flowmeter performs a self-check first. After the self-check, the flow meter directly starts flow measurement and displays the current measured value.

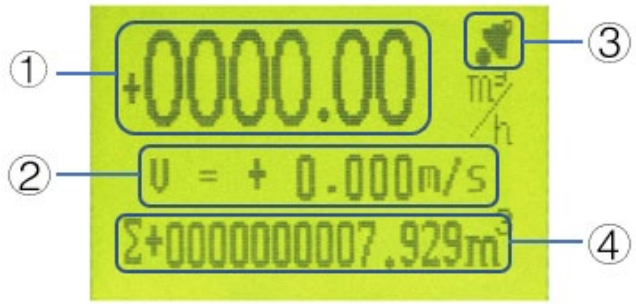


Figure 14 Main interface of flow meter

The detailed information of the flowmeter interface status after startup is shown in Table 7.

Table 7

Display	Description	Reuse content
①	Real-time flow value and unit	Null
②	Real-time flow rate and unit	Click down key to switch display: %, resistance value
③	Alarm mark	System alarm, you can check the alarm content by up key
④	Cumulative flow and unit	Positive cumulant, negative cumulant, cumulant algebraic sum, and check the specific alarm content by up key

The "bell" sign at the upper right of the meter is an alarm sign. You can view the alarm message by the key. The possible causes for the alarm are shown in Table 8.

Table 8

Item	Alarm content	Possible causes
1	Excitation impassability	The excitation part is not working normally. The excitation line may be loose or misconnected
2	Empty pipe	The fluid is not filled with pipe; the media conductivity is less than 5us; the electrode is misconnected
3	Electrode	The fluid is not filled with pipe; the media conductivity is less than 5us; the electrode is misconnected
4	Upper flow limit	The real-time flow value is higher than the set upper limit of alarm value
5	Lower flow limit	The real-time flow value is lower than the set lower limit of alarm value

10 Operation

10.1 key instruction

The electromagnetic flowmeter display and operation interface are shown in Figure 15. There is a key on the left side of the screen and 4 keys on the bottom side of the display screen.

Figure 15 Operation interface

The meaning of the keys and operation methods are shown in Table 6. The composite key needs to press two keys at the same time. If there is no key operation within 10 minutes, it will automatically return to the main screen. This version does not provide touch keys or infrared remote-control keys. If you need to set up, you must open the front cover.

Table 9

Key	Sign	Function
Shift		1. Use in combination with the confirm key to enter the password interface; 2. Cursor movement during password input
Down		Number minus 1 or page down
Up		Number plus 1 or page up
Enter		Enter or exit
Function		Enter key for report, data reset and other functions

10.2 Key operation

The meter can enter the menu setting interface by simultaneously pressing the "shift" and "enter". Customers can choose the corresponding password to enter the menu for operation according to different needs. The meter password has two levels: level 1 password is 19818 and the level 2 password is 29818. The authority of level 1 password is different from that of level 2 password. Level 2 password has higher authority and more parameters can be changed. If customers need to modify level 1 or 2 password, it can be done in the secondary menu password modification item.

Note: If you modify level 1 or level 2 password, please remember the modified password!

11 Parameter setting and method

11.1 Report query

In the main interface state (Figure 15), press  (Function key) to enter the report query interface (Figure 16), and then select the corresponding function to view the data according to actual needs.

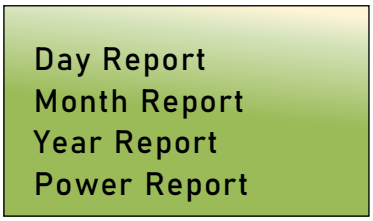


Figure 16 Report query interface

Users can query 4 types of reports: daily, monthly, annual, and power outage reports. The meter can save up to 90 daily reports, 36 monthly reports, 3 annual reports and 20 power outage reports.

11.2 Parameters setting

In the main interface state (Figure 8), press + "shift" + "enter") to enter the password input interface (Figure 10). The user enters the corresponding password by entering different levels of passwords. The menu sets the parameters related to the use of the flowmeter.

Special tips: Please operate carefully when setting, so as to avoid the failure of the flowmeter due to the parameter setting!

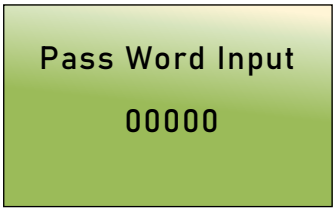
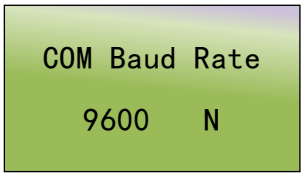


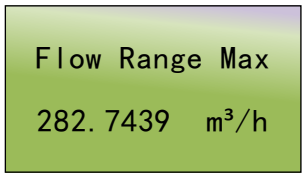
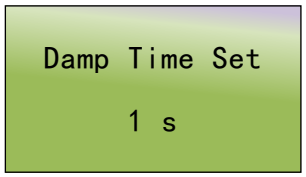
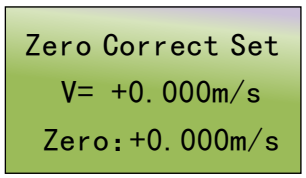
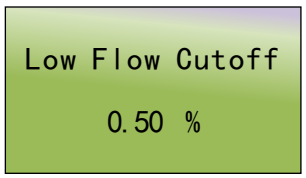
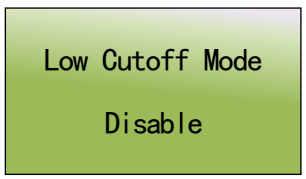
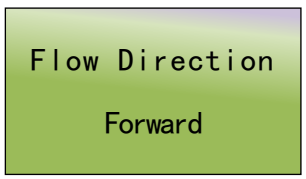
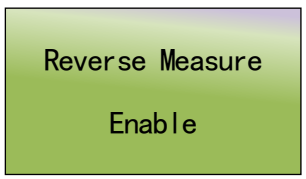
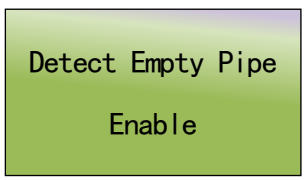
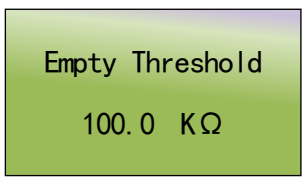
Figure 17 Password input interface

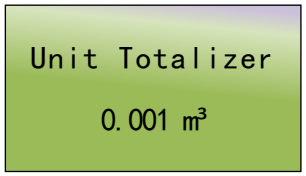
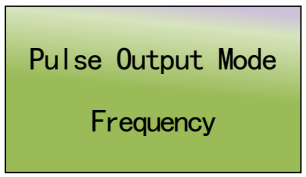
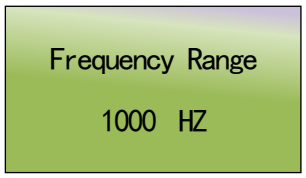
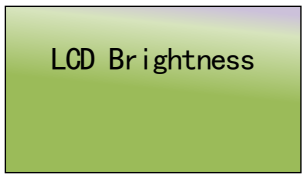
11.3 Level 1 password menu

Users enter the menu through level 1 password "19818" and can set the parameters in the menu. The specific parameter information and data type are shown in Table 10.

Table 10

Items	Functions	Setting/Instructions	Parameter Range
1	Communication address		Range:0~255
2	Communication rate		Rate:1200,2400,4800,9600,14400 Check: no check, odd parity Check, even parity check

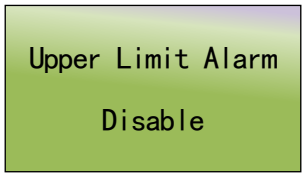
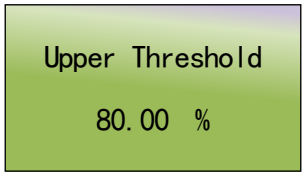
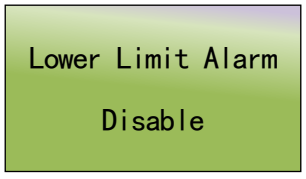
3	Range setting		m³/h,L/s,L/m,L/h,Ukg/s,Ukg/m,Ukg/h,Usg/s,Usg/m,Usg/h,T/s,T/m,T/h,kg/s,kg/m,kg/h,m³/s,m³/m
4	Damping time		0.5S,0.8S,1.0S,2S,3S,4S,5S,6S,8S,10S,20S,30S,50S,100S
5	Zero velocity correction		
6	Small signal excision		Data type: integer Range:0~100%
7	Remove display		Yes, NO
8	Flow direction		Positive, reverse
9	Reverse measurement		Yes, No
10	Empty pipe alarm		Yes, No
11	Empty pipe alarm threshold value		As customers' request

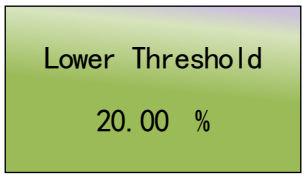
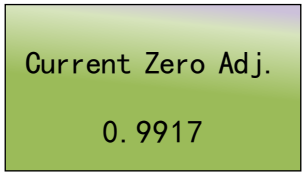
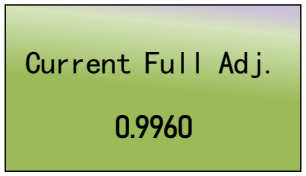
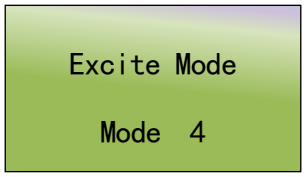
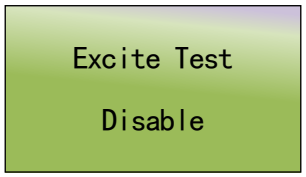
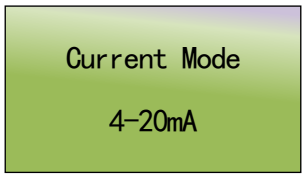
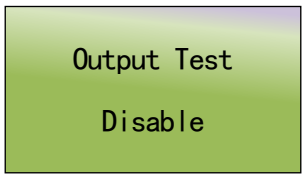
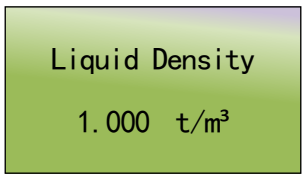
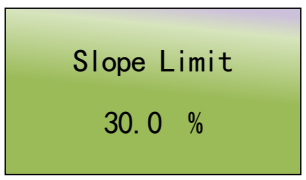
12	Flow integration unit		1m³,0.1m³,0.01m³,0.001m³,1L,0.1L,0.01L,0.001L,1t,0.1t,0.01t,0.001t,1kg,0.1kg,0.01kg,0.001kg,1gal,0.1gal,0.01gal,0.001gal,1ig,0.1ig,0.01ig,0.001ig,
13	Pulse output method		Frequency output, pulse output
14	Frequency output range		1~5000
15	LCD screen brightness		1~5 adjustable

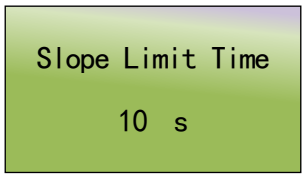
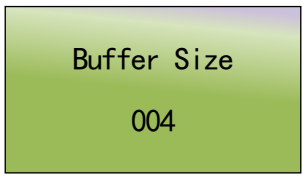
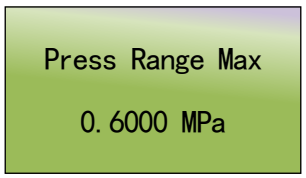
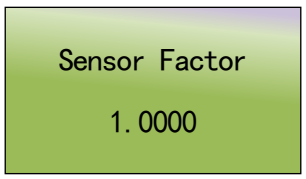
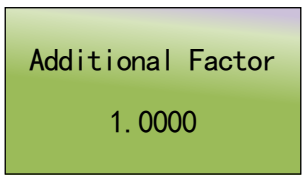
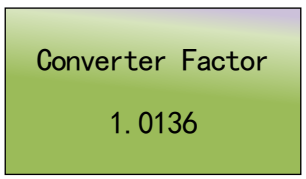
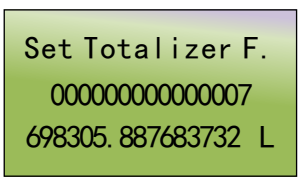
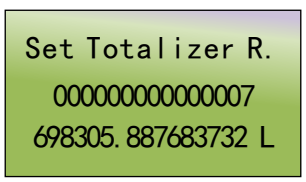
11.4 Level 2 menu

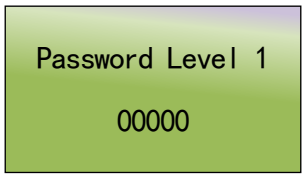
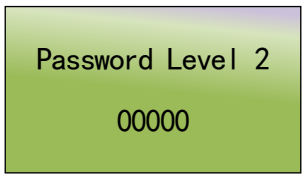
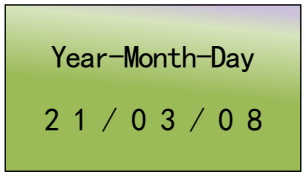
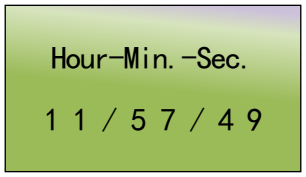
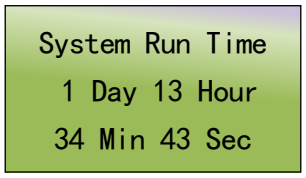
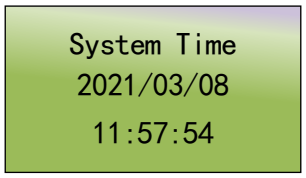
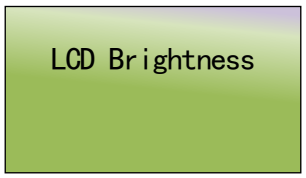
Users enter the menu through level 2 password "29818" and can set the parameters in the menu. The specific parameter information and data type are shown in Table 11.

Table 11

Items	Functions	Setting/Instructions	Parameter Range
1	Upper limit alarm		Yes, No
2	Upper limit alarm value		Full scale percentage setting
3	Lower limit alarm		Yes, No

4	Lower limit alarm value		Full scale percentage setting
5	Current zero point correction		adjustable
6	Current full-scale correction		adjustable
7	Excitation method		4 types: 50 Hz,25 Hz,12.5 Hz,6.25 Hz
8	Excitation current test		
9	Current output		0mA~10mA,4mA~20mA
10	Output test		20mA/2000Hz,10mA/1000Hz,4.16mA/20Hz,4mA/1Hz
11	Density of measured fluid		As customers' request
12	Change rate limit value		0~100% adjustable

13	Insensitive time		0~99S adjustable
14	Acquisition buffer depth		0~199 adjustable
15	Pressure sensor full scale		0.6MPa,1.0MPa,1.6MPa
16	Sensor coefficient value		Factory set, unchangeable
17	Additional coefficient		Factory set, unchangeable
18	Converter coefficient		Factory set, unchangeable
19	Converter code value		Factory set, unchangeable
20	Positive total preset		adjustable
21	Reverse total preset		adjustable

22	Level 1 password modification		adjustable
23	Level 2 password modification		adjustable
24	Date-YY/MM/ DD		adjustable
25	Time-HH/MM/ SS		adjustable
26	System running time		
27	System time		adjustable
28	LCD screen brightness		1~5 adjustable

12 Modbus RTU communication

Communication connection RS485 or RS232, Baud rate range 600-9600, communication parameter: Baud rate, N, 8, 1.

Instrument terminal T+（A）, T-（B）and COM.

Communication protocol conforms to MODBUS RTU protocol. In instruction table register number is register address.

Composition of communication information: Address code - Function code - Data segment - CRC, A message is sent and received continuously, and the character interval cannot be greater than one character, otherwise it is regarded as the beginning of a new message or the end of the previous

message. The message body consists of hexadecimal numbers.

Data definition: The cumulative amount is a 16-byte hexadecimal fixed point number, and the instantaneous amount (including flow, velocity, etc.) is a 4-byte IEEE 754 single-precision floating point number.

Communication command: Function code 03（or 04）- reading display data

Table 12

Send		Receive	
01	Address	01	Address
03	Function code	03	Function code
00	Register address high	04	Byte numbers
00	Register address low (display address)	80	Data 1
00	Register numbers high	04	Data 2
02	Register numbers low	80	Data 3
CRCH	CRC Check code is high	80	Data 4
CRCL	CRC Check code is low	CRCH	CRC Check code is high
		CRCL	CRC Check code is low

For a multi-byte number transmission, use the BIG-ENDIAN format, that is, use the format with high-weight bytes first and low-weight bytes after transmission. For example, a four-byte number ABCDEF12H, the transfer order is: D0= ABH, D1=CDH, D2=EFH, D3=12H。

For a two-byte number such as 12ABH, then D0=12H, D1=ABH。

For floating-point numbers, the format is IEEE 754 single-precision, and the transmission order is the high byte first and then the low byte. The high byte is the byte where the sign bit and exponent bit in the floating-point number are located, and the low byte is the byte where the mantissa is located.

Above D0, D1, D2, and D3 respectively correspond to D0, D1, D2, and D3 in the transmission data sequence described later.

According to the MODBUS RTU protocol specification, the maximum number of data bytes allowed to be transmitted in one communication is 250 (125 × 2).

Table 13

Parameter storage TPTR	Explanation	Data type	Data length
00	Instantaneous flow information	FLOAT	4
02	Instantaneous flow unit information	SHORT	2
03	Positive total integer low	LONG	4
05	Positive total decimal place	FLOAT	4
07	Positive total unit	SHORT	2
08	Reverse total integer low	LONG	4
0A	Reverse total decimal places	SHORT	4
0C	Reverse total unit	LONG	2
0D	Excitation alarm	FLOAT	2
0E	Electrode alarm	SHORT	2

0F	Empty pipe alarm	SHORT	2
10	Upper limit alarm	SHORT	2
11	Lower limit alarm	SHORT	2
12	Flow rate information	FLOAT	4
14	Flow percentage	FLOAT	4
16	Electrode resistance	FLOAT	4
18	Instrument diameter	FLOAT	4
1A	Positive total integer high	LONG	4
1C	Reverse total integer high	LONG	4
1E	Two-way total cumulative algebra and integers	LONG LONG	8
22	Two-way total cumulative algebra and decimal numbers	FLOAT	4
24	Two-way cumulative algebra and symbols	INT	2

For a multi-byte number transmission, use the BIG-ENDIAN format, that is, use the format with high-weight bytes first and low-weight bytes after transmission. For example, a four-byte number ABCDEF12H, the transfer order is: D0= ABH, D1=CDH, D2=EFH, D3=12H. Above D0, D1, D2, and D3 respectively correspond to D0, D1, D2, and D3 in the transmission data sequence described later.

For a two-byte number such as 12ABH, then D0=12H, D1=ABH.

For floating-point numbers, the format is IEEE 754 single-precision, and the transmission order is the high byte first and then the low byte. The high byte is the byte where the sign bit and exponent bit in the floating-point number are located, and the low byte is the byte where the mantissa is located.

According to the MODBUS protocol specification, the maximum number of data bytes allowed to be transmitted in one communication is 250 (125 × 2).

For example:

a) Definition of instantaneous flow information（FLOAT）
   Host sends: 01 03 00 00 00 02 C4 0B
   Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

b) Definition of unit instantaneous flow information （SHORT/ List type）
   Host sends: 01 03 00 02 00 01 25 CA
   Slave response: 01 03 02 00 **D0** CRCL CRCH
   D0 Definition:

D0	0	1	2	3	4	5	6	7
unit	m^3/s	m^3/min	m^3/h	L/s	L/min	L/h	g/m	g/h
D0	8	9	10	11	12	13	14	15
unit	ig/m	ig/h	t/s	t/min	t/h	kg/s	kg/min	kg/h
D0	16	17						
unit	g/s	ig/s						

c) Positive total integer low 4 bit message definition （LONG）
   Host sends: 01 03 00 03 00 02 34 0B
   Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

d) Positive total decimal place message definition （FLOAT）
Host sends: 01 03 00 05 00 02 D4 0A
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

e) Positive total unit message definition（SHORT/ List type，same as reverse unit message）
Host sends: 01 03 00 07 00 01 35 CB
Slave response: 01 03 04 **D0** CRCL CRCH
D0 Definition**:**

D0	0	1	2	3	4	5
unit	L	m^3	gal	igal	kg	t

f) Reverse total integer low 4 bit message definition （LONG）
Host sends: 01 03 00 08 00 02 45 C9
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

g) Reverse total decimal places message definition （FLOAT）
Host sends: 01 03 00 0A 00 02 E4 09
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

h) Reverse total unit message definition （SHORT/ List type）
Host sends: 01 03 00 0C 00 01 44 09
Slave response: 01 03 04 **D0** CRCL CRCH
D0 Definition**:**

D0	0	1	2	3	4	5
unit	m^3	L	t	kg	gal	igal

i) Excitation alarm （SHORT）
Host sends: 01 03 00 0D 00 01 15 C9
Slave response: 01 03 02 **00 T/F** CRCL CRCH

j) Electrode alarm （SHORT）
Host sends: 01 03 00 0E 00 01 E5 C9
Slave response: 01 03 02 **00 T/F** CRCL CRCH

k) Empty pipe alarm （SHORT）
Host sends: 01 03 00 0F 00 01 B4 09
Slave response: 01 03 02 **00 T/F** CRCL CRCH

l) Upper limit alarm （SHORT）
Host sends: 01 03 00 10 00 01 85 CF
Slave response: 01 03 02 **00 T/F** CRCL CRCH

m) Lower limit alarm （SHORT）
Host sends: 01 03 00 11 00 01 D4 0F
Slave response: 01 03 02 **00 T/F** CRCL CRCH

n) Flow rate message definition （FLOAT）
Host sends: 01 03 00 12 00 02 64 0E
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH
unit defult as **m/s**

o) Flow percentage message definition （FLOAT）
Host sends: 01 03 00 14 00 02 84 0F
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH
The data are percentages, such as 100 for 100% and 1 for 1%

p) Electrode resistance message definition （FLOAT）
Host sends: 01 03 00 16 00 02 25 CF
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH
Electrode resistance unit defult as kΩ

q) Instrument diameter message definition（FLOAT）
Host sends: 01 03 00 18 00 02 44 C0
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

r) read total data
Host sends: 01 03 00 00 00 1A C4 01

s) Positive total integer high message definition （LONG）
Host sends: 01 03 00 1A 00 02 E5 CC
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

t) Reverse total integer high message definition （LONG）
Host sends: 01 03 00 1C 00 02 05 CD
Slave response: 01 03 04 **D0 D1 D2 D3** CRCL CRCH

Total cumulative value calculation method:
The integer part is a binary number, divided into two parts, the upper four bytes and the lower four bytes. Set the upper four bytes as X, the lower four bytes as Y, and the fractional part as Z, then the accumulated value SUM: SUM = X * 1E9 + Y + Z.
For example: the high part of the data is CD00EFH, the low part is 1234AB67H, and the decimal part is 0.567f, then
1234AB67H =305,441,639
CD00EFH =13,435,119
For the cumulative value result SUM, there are:
SUM = CD00EFH * 1E9 + 1234AB67H + 0.567f = 13,435,119,305,441,639.567
If only the low bits of the integer are used, the maximum value of the integer is 999,999,999H
Instrument diameter unit defult as mm.
D0，D1，D2，D3 data rule：
eg：0x44,0xc8,0x00,0x00---------（FLOAT）number repressent 1600
0x00,0x00,0x06,0x40---------（LONG）number repressent 1600
0x06,0x40----------（SHORT）number repressent 1600
eg：（FLOAT）（number：-0.25）
Host sends: 01 03 00 02 00 02 65 CB
Slave response: 01 03 04 BE 80 00 00 DF F3
0xBE,0x80,0x00,0x00---------（FLOAT）number repressent（-0.25）

13 Flow range

Velocity m/s Flow m³/h DN mm	0.5	1	2	3	4	5	7	10
6	0.0509	0.1018	0.2036	0.3054	0.4072	0.5089	0.7125	1.0179
10	0.1414	0.2827	0.5655	0.8482	1.1310	1.4137	1.9792	2.8274
15	0.3181	0.6362	1.2723	1.9085	2.5447	3.1809	4.4532	6.3617
20	0.5655	1.1310	2.2619	3.3929	4.5239	5.6549	7.9168	11.3097
25	0.8836	1.7671	3.5343	5.3014	7.0686	8.8357	12.3700	17.6715
32	1.4476	2.8953	5.7906	8.6859	11.5812	14.4765	20.2670	28.9529
40	2.2619	4.5239	9.0478	13.5717	18.0956	22.6195	31.6673	45.2389
50	3.5343	7.0686	14.1372	21.2058	28.2743	35.3429	49.4801	70.6858
65	5.9730	11.9459	23.8918	35.8377	47.7836	59.7295	83.6213	119.4591
80	9.0478	18.0956	36.1911	54.2867	72.3823	90.4779	126.6690	180.9557
100	14.1372	28.2743	56.5487	84.8230	113.0973	141.3717	197.9203	282.7433
125	22.0893	44.1786	88.3573	132.5359	176.7146	220.8932	309.2505	441.7865
150	31.8086	63.6173	127.2345	190.8518	254.4690	318.0863	445.3208	636.1725
200	56.5487	113.0973	226.1947	339.2920	452.3893	565.4867	791.6813	1130.9734
250	88.3573	176.7146	353.4292	530.1438	706.8583	883.5729	1237.0021	1767.1459
300	127.2345	254.4690	508.9380	763.4070	1017.8760	1272.3450	1781.2830	2544.6900
350	173.1803	346.3606	692.7212	1039.0818	1385.4424	1731.8030	2424.5241	3463.6059
400	226.1947	452.3893	904.7787	1357.1680	1809.5574	2261.9467	3166.7254	4523.8934
450	286.2776	572.5553	1145.1105	1717.6658	2290.2210	2862.7763	4007.8868	5725.5526
500	353.4292	706.8583	1413.7167	2120.5750	2827.4334	3534.2917	4948.0084	7068.5835
600	508.9380	1017.8760	2035.7520	3053.6281	4071.5041	5089.3801	7125.1321	10178.7602
700	692.7212	1385.4424	2770.8847	4156.3271	5541.7694	6927.2118	9698.0965	13854.4236
800	904.7787	1809.5574	3619.1147	5428.6721	7238.2295	9047.7868	12666.9016	18095.5737
900	1145.1105	2290.2210	4580.4421	6870.6631	9160.8842	11451.1052	16031.5473	22902.2104
1000	1413.7167	2827.4334	5654.8668	8482.3002	11309.7336	14137.1669	19792.0337	28274.3339
1200	2035.7520	4071.5041	8143.0082	12214.5122	16286.0163	20357.5204	28500.5286	40715.0408
1400	2770.8847	5541.7694	11083.5389	16625.3083	22167.0778	27708.8472	38792.3861	55417.6944
1600	3619.1147	7238.2295	14476.4589	21714.6884	28952.9179	36191.1474	50667.6063	72382.2947

14 Responsibility

Within one year from the delivery date, we shall repair or replace the instrument with any quality fault caused by material parts or our manufacturing technique free of charge. For non-quality malfunction during user's operation, we are in charge of repair. But the material cost and the shuttle transportation fees should be borne by users.

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