Catalog & Instruction Manual

Patton

ELS16 Electromagnetic flowmeter

Application areas

Aerospace, semiconductor processing, medical biology, electronic automobiles, steel metallurgy, ship electronics, industrial gas production and other industries, server water cooling system

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Safety Tips

Please read this operating manual and obtain applicable national standards, safety requirements and accident handling procedures. The installation and operation of the measuring instrument may only be carried out by qualified personnel.

Ex	**Instruments used in explosion-proof situations are equipped with special explosion-proof signs!**	Warning! There are special regulations for instruments used in explosion-proof environments. To ensure safe use in such environments, please be sure to comply with the following regulations: wiring, installation, operation and maintenance can only be carried out by qualified personnel who have received explosion-proof training.
警告	**Warning!**	Warning! If you do not pay attention to the display or appearance, it may cause personal injury, dangerous scenes, malfunction or damage to the instrument.
注意	**Notice!**	Caution! If you do not pay attention to the display or appearance, it may cause personal injury or instrument malfunction.

This product has a built-in lightning protection device, which has a certain protection function for the power terminals and input/output terminals.
Test standard: IEC 61000

Notes for Use

01	The electromagnetic flowmeters we offer are specifically designed for flow measurement of conductive fluids.
02	The responsibility for the applicability and proper use of the electromagnetic flowmeter lies with the user.
03	Improper installation and operation may void the warranty.
04	Other matters shall be handled in accordance with the “General Terms of Sale” in the sales contract signed by both parties.

Precautions for use

Your flowmeter is delivered configured and delivered according to your operating requirements, with the operating data set according to your order. The signal converter comes standard with a display, handheld remote control, and communication interface.

1. Product Overview

1.1 Product Scope

The ELS16 electromagnetic flowmeter integrates the traditional electromagnetic flowmeter sensor, PT100 temperature sensor, polysilicon pressure sensor and converter into one, with a compact appearance and flexible installation. It uses an infrared remote control and Bluetooth connection on the mobile phone APP for operation, and is easy to install and set up. It is widely used in various industries to measure the volume flow of liquids with conductivity greater than 2uS/cm. It is an integrated instrument for measuring the volume flow, temperature and pressure of conductive fluids. Using ARM Cortex-M4 32-bit processor and 24-bit ADC data acquisition system, the sensor adopts adaptive variable frequency excitation technology, which has fast computing speed and high accuracy. The instrument has self-diagnostic functions such as empty pipe detection, excitation circuit failure, and flow alarm. Our unique technology has applied for invention patents. The sensor is lined with imported PEEK material, and the electrodes and PEEK lining adopt a one-time injection molding process to ensure the consistency and reliability of product production. The overall assembly process has also applied for a number of patents.

1.2 Instrument Features

Professional description of instrument features:

- The display can automatically rotate 90 degrees according to the pipe installation direction to ensure that the user's viewing angle is always consistent.
- The sensor adopts adaptive variable frequency excitation technology, which has fast computing speed, high accuracy and lower power consumption.
- The instantaneous flow rate, temperature and pressure specifications of the fluid in the pipeline can be measured simultaneously.
- Using multiple ARM Cortex-M4 32-bit processors and 24-bit ADC data acquisition system, it runs faster.
- Adopting a unique fluid mechanics structure design, there is no installation requirement for straight pipe sections.
- A variety of output modes are available, including: RS-485 (MODBUS-RTU), IO-Link, (4-20) mA, frequency, pulse, 2-way switch input and output, etc.
- Measurements are unaffected by changes in fluid density, viscosity, temperature, pressure and conductivity.
- The electrode and lining materials are formed at one time and can still work normally under negative pressure, with good stability and reliability.
- Full digital processing, strong anti-interference ability, reliable measurement, high precision, and wide flow measurement range.
- Ultra-low EMI power supply, suitable for a wide range of power supply voltage changes, and good anti-EMI performance.
- Using soft and hard bonded board (FPCB) and surface mount (SMT) technology, the circuit has high reliability.
- Online changes to instrument specifications can be made in a variety of ways (Bluetooth, RS-485, IO-Link, infrared handheld remote control).
- It has self-test and self-diagnosis functions.
- Adopts a color LCD display that can display a variety of specifications (flow, flow rate, cumulative flow, temperature, pressure, output percentage, etc.)
- Intelligent maintenance function: The converter has a built-in self-check and self-diagnosis system that can diagnose information such as instrument empty pipe, excitation failure, electrode contamination, flow alarm, etc. (see page 12 for detailed alarm codes).
- Configurable main interface: The main interface of the converter can be displayed in a variety of specifications through the display settings (see page 20 for detailed display content)

1.3 Working Principle

Electromagnetic flowmeters are designed based on Faraday's law of electromagnetic induction, which states that a conductor moving in a magnetic field will induce a voltage. The conductive liquid acts as the conductor, and the magnetic field is generated by a coil of electricity flowing outside the flow tube. The magnitude of the induced voltage is directly proportional to the speed of the conductor, the diameter of the tube, and the strength of the magnetic field. Its value is:

E = B•V•D•K

Where:

E - induced electromotive force;

B - magnetic induction intensity;

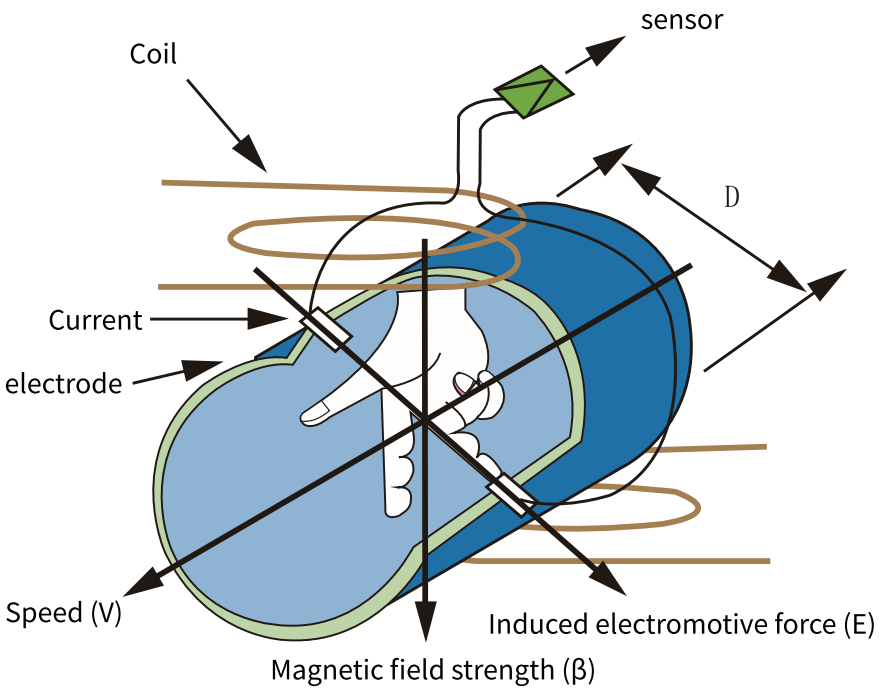
V - velocity of the conductive liquid;

D - electrode distance; (measuring tube inner diameter);

K - factor related to magnetic field distribution and axial length (instrument factor);

Where: B, D and K can be fixed values or can be calibrated, so the equation simplifies to: E ∝ V (E is proportional to V).

The sensor transmits the induced potential E as a flow signal to the converter. After amplification, filtering, conversion and other signal processing, the LCD screen displays the instantaneous flow rate, accumulated flow rate and other related specifications and outputs the required information specifications.



Measurement principle diagram of pipeline electromagnetic flowmeter

1.4 Ordering Instructions

Please read this document or our electromagnetic flowmeter selection catalog before placing an order to understand the model and numbering regulations of this product and determine the model specifications according to your needs. If necessary, please also indicate the following requirements:

01 Specifications that require products to be set before leaving the factory, such as the upper limit of the flow range or the corresponding upper limit of the flow rate;

02 Whether the provision of mating connectors for installation is required;

03 The default connection cable length is 2 meters (users can request other cable lengths);

04 Other special working conditions require separate instructions, etc.

2. Technical Specifications

2.1 Technical Specifications

Logo	Meaning	
Implementation Standards	Electromagnetic flow sensor (IEC 61869)	
Verification procedures	Electromagnetic flowmeter (OIML R 49)	
Measured fluid	Conductive liquid (conductivity not less than 2.0uS/cm)	
Flow meter lining	Polyetheretherketone (PEEK) lining	
Flow meter diameter	DN6～DN65	
pressure	-0.1MPa～4.0MPa (without pressure sensor)	
Electrode material	HC, 316L	
Body material	304, 316L	
Pipeline interface	Thread, sanitary joint, flange; other interfaces can be customized as required	
Measurement accuracy	Flow rate: ±0.5%, temperature: ±0.5°C, pressure: ±8kPa	
Pressure and temperature range	(0～1.6)MPa, (-40～+120)°C (range can be set)	
Output signal	(4～20)mA (maximum load 500Ω)	
Communication Protocol	IO-Link, RS-485(MODBUS-RTU)	
Turndown ratio	1:150	
Power supply	DC(18～36)V	
Electrical connections	M12-4 core connector	
Power consumption	<5W	
Environmental conditions	Ambient temperature	-25°C～ 75°C
	Fluid temperature	Ordinary type: -40°C～ 90°C
		High temperature type: -40°C～125°C
	Protection level	IP67, IP68

2.1 Technical Specifications

Model	Code
ELS16	
Caliber	
DN6	06
DN10	10
DN15	15
DN20	20
DN25	25
DN32	32
DN40	40
DN50	50
DN65	65
Lining material	
Polyetheretherketone (PEEK)	A
Electrode materials	
Hastalloy'C	C
316L S.S	L
Body material	
304 S.S	AA
316 S.S	AS
Connection type	
Thread	M
Clamp connection	C
flange	F
Voltage rating	
-1~40 kg/cm2 (without pressure sensor)	N
0~16 kg/cm^2	O
Voltage	
DC(18～36)V	A
Output signal	
RS-485 (MODBUS-RTU)	R
IO-Link(4～20mA)	I
Weather resistance grade	
IP67	7
IP68	8
Operating temperature	
Normal type: -40°C～ 90°C	A
High temperature type: -40°C～125°C	H
Cable length	
2M	2M
Customization (10M = -10M)	M

2.2 Measurement range

DN6
(0.01～0.75) m^3/h
(0.17～13) L/min

DN10
(0.02～1.5) m^3/h
(0.33～25) L/min

DN15
(0.035～5) m^3/h
(0.58～83) L/min

DN20
(0.04～6) m^3/h
(0.67～100) L/min

DN25
(0.1～15) m^3/h
(1.67～250) L/min

DN32
(0.15～20) m^3/h
(2.50～333) L/min

DN40
(0.25～38) m^3/h
(4.17～633) L/min

DN50
(0.4～60) m^3/h
(6.67～1000) L/min

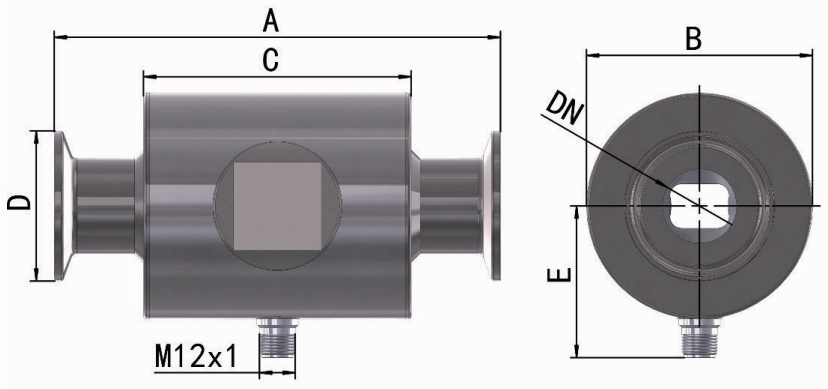
DN65
(0.5～75) m^3/h
(8.33～1250) L/min

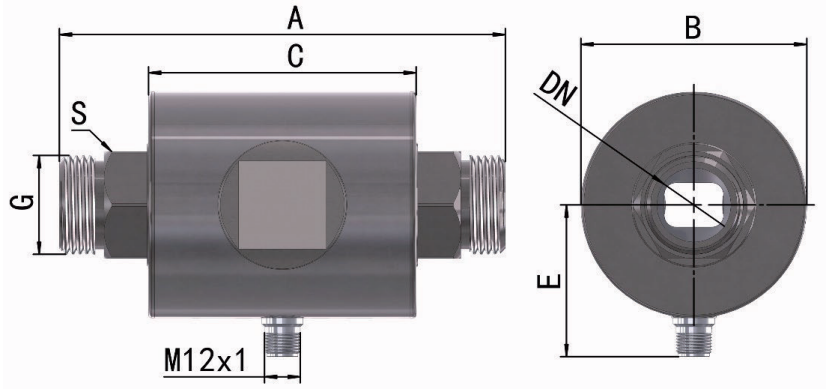
2.3 Caliber-Flow-Velocity Comparison Table

Flow rate L/h / Flow rate m/s / Caliber mm	0.05	0.1	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10
6	5.09	10.18	101.8	203.5	305.3	407.1	508.9	610.6	712.4	814.2	915.9	1018
10	14.14	28.27	282.7	565.4	848.1	1130.8	1413.5	1696.2	1978.9	2261.6	2544.3	2827
15	31.80	63.61	636.1	1272.2	1908.2	2544.3	3180.4	3816.5	4452.5	5088.6	5724.7	6361
20	56.54	113.08	1130.8	2261.6	3392.4	4523.2	5654.0	6784.8	7915.6	9046.4	10177.2	11308
25	88.34	176.69	1766.9	3533.8	5300.6	7067.5	8834.4	10601.3	12368.1	14135.0	15901.9	17669
32	144.74	289.48	2894.8	5789.7	8684.5	11579.4	14474.2	17369.1	20263.9	23158.8	26053.6	28948
40	226.16	452.32	4523.2	9046.4	13569.6	18092.8	22616.0	27139.2	31662.4	36185.6	40708.8	45232
50	353.38	706.75	7067.5	14135.0	21202.5	28270.0	35337.5	42405.0	49472.5	56540.0	63607.5	70675
65	597.20	1194.41	11944.1	23888.2	35832.2	47776.3	59720.4	71664.5	83608.5	95552.6	107497	119441

3. Dimensions

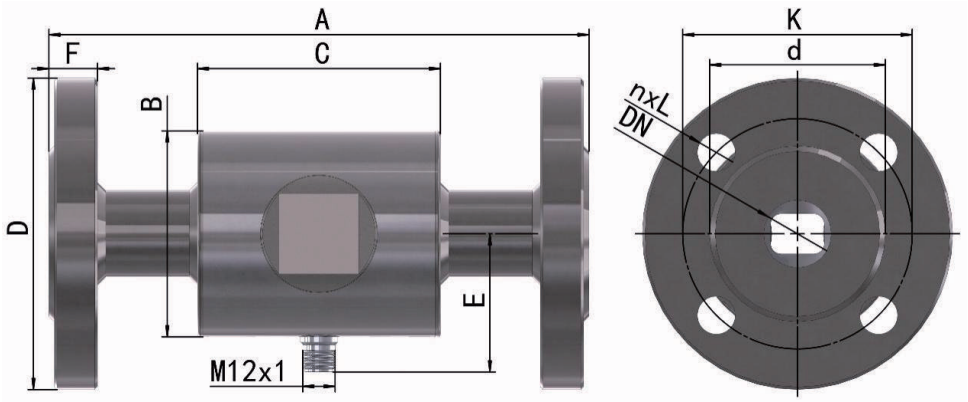
3.1 Clamp and threaded connection type dimensional drawing





DN	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	G (mm)	S (mm)
6	150	70	90	50.5	48	G1/2"	22
10	150	70	90	50.5	48	G1/2"	22
15	150	70	90	50.5	48	G3/4"	27
20	150	70	90	50.5	48	G3/4"	27
25	150	76	90	50.5	51	G1"	36
32	150	76	100	50.5	51	G 1-1/4"	42
40	200	89	100	64	57.5	G 1-3/4"	56
50	200	95	100	77.5	60.5	G2"	60
65	200	95	100	91	60.5	G2-3/4"	80

3.2 Flange connection type dimensional drawing

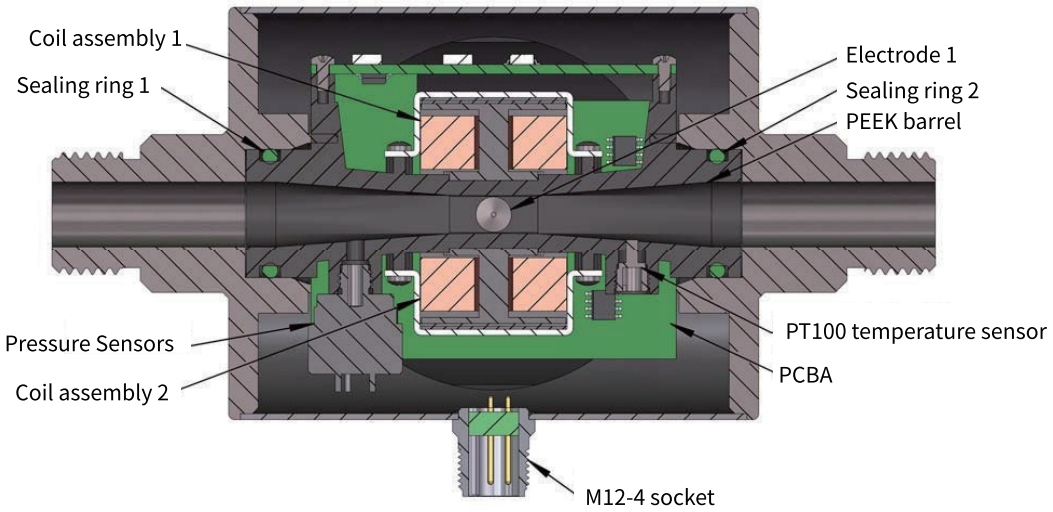


DN	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	K (mm)	d (mm)	n (mm)	L (mm)
6	200	70	90	90	48	16	60	41	4	14
10	200	70	90	90	48	16	60	41	4	14
15	200	70	90	95	48	16	65	46	4	14
20	200	70	90	105	48	18	75	56	4	14
25	200	76	90	115	51	18	85	65	4	14
32	200	76	100	140	51	18	100	76	4	18
40	200	89	100	150	57.5	18	110	84	4	18
50	200	95	100	165	60.5	18	125	99	4	18
65	200	95	100	185	60.5	18	145	118	8	18

Note: The dimensions and connection structures are default values. Users can customize them according to the special conditions on site. Please feel free to consult us.

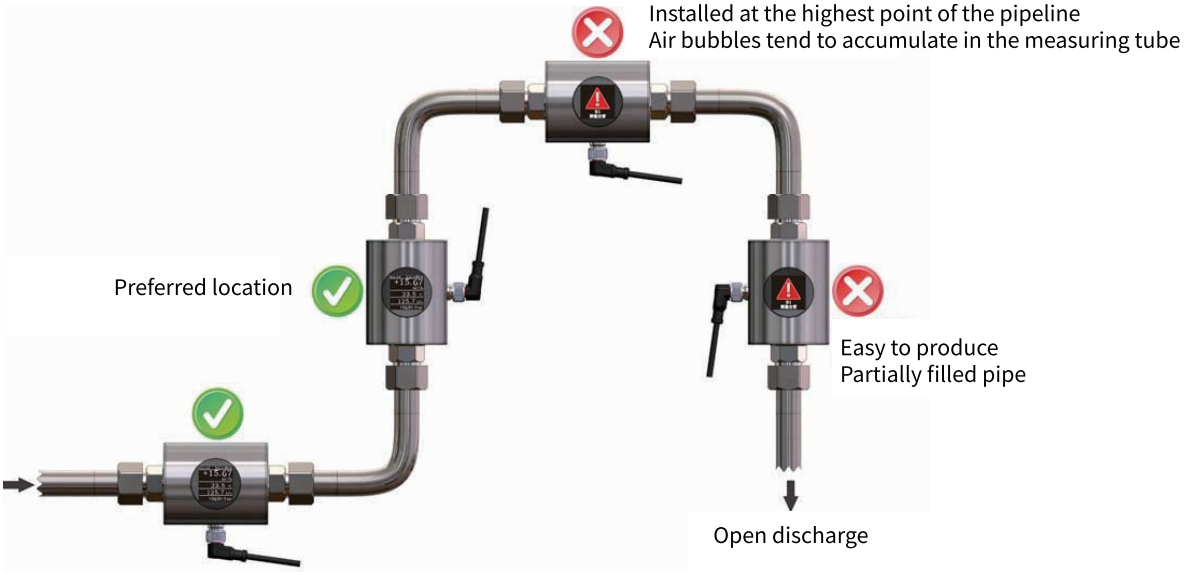
4. Structure and Installation

4.1 Internal structure diagram

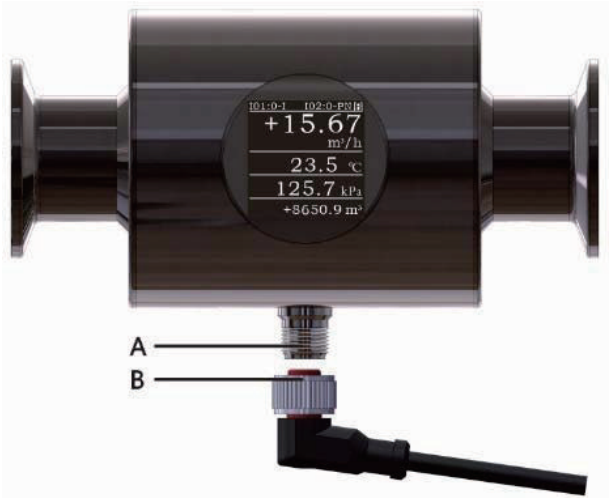


4.2 Installation Recommendations

To avoid measurement errors caused by trapped gas, please install the flow meter in the following position:

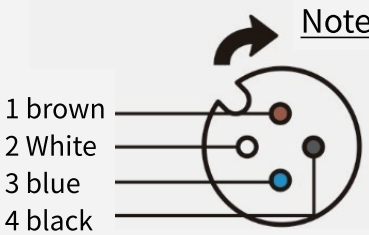


5. Electrical connection



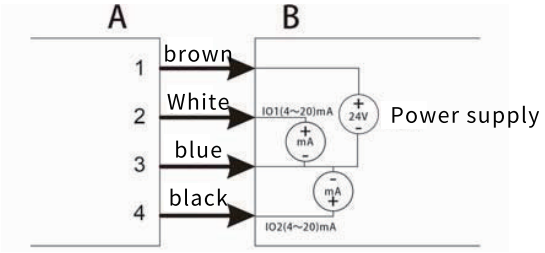
A. M12 electrical connector

B. User end (M12 cable connector)



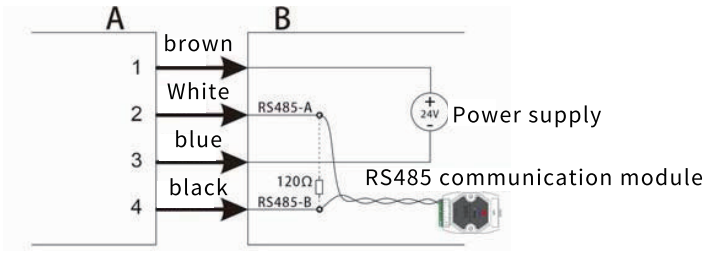
5.1 (4-20) mA output wiring method

Foot number	Lead color	Illustrate
1	brown	Connect to positive voltage 24V
2	White	IO1: output (4~20)mA
3	blue	GND/connect to negative voltage 24V
4	black	IO2: output (4~20)mA
Outer shield		(Ground)



5.2 RS-485 (MODBUS-RTU) communication wiring method

Foot number	Lead color	Illustrate
1	brown	Connect to positive voltage 24V
2	White	IO1: output (4~20)mA
3	blue	GND/connect to negative voltage 24V
4	black	IO2: output (4~20)mA
		(Ground)



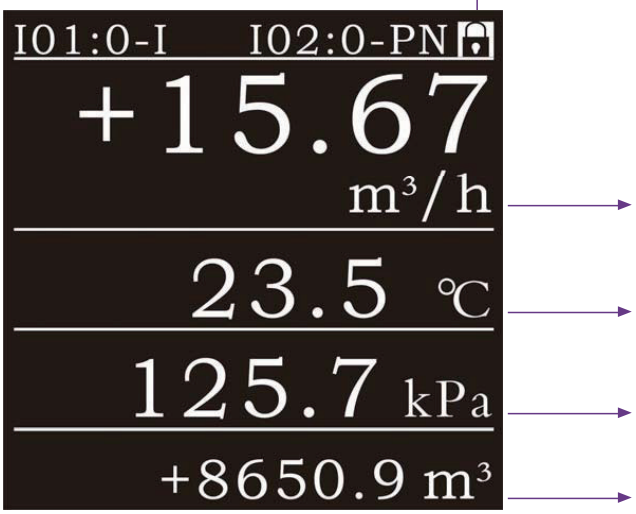
5.3 IO-Link, frequency, pulse, switching output and output

Foot number	Lead color	Illustrate
1	brown	Connect to positive voltage 24V
2	White	IO1: can be configured as frequency output, pulse output, switch input or output, IO1 output (4~20)mA
3	blue	GND/connect to negative voltage 24V/common terminal for all signal outputs
4	black	IO2: can be configured as IO-Link communication terminal, frequency output, pulse output, switch input or output, IO2 (4 ~ 20) mA
Outer shield		(Ground)

Note: The signal output pins 2 and 4 can be set to the required function pins through the menu.
1. After setting to MODBUS communication protocol, it can only be output as this communication method;
2. After setting to IO-Link communication protocol, pin 4 is the communication port, and pin 2 can be configured as other function output;
3. Pins 2 and 4 can be arbitrarily set as analog signals of flow, temperature, pressure, frequency, pulse signal output and switch input and output.

6. Signal Converter Operation

6.1 Main screen interface description



Status bar:
1. Display IO1 and IO2 setting status
2. Display Bluetooth information
3. Status lock

The menu cannot be operated in the locked screen state

Hold the remote control facing the screen and press then to unlock.

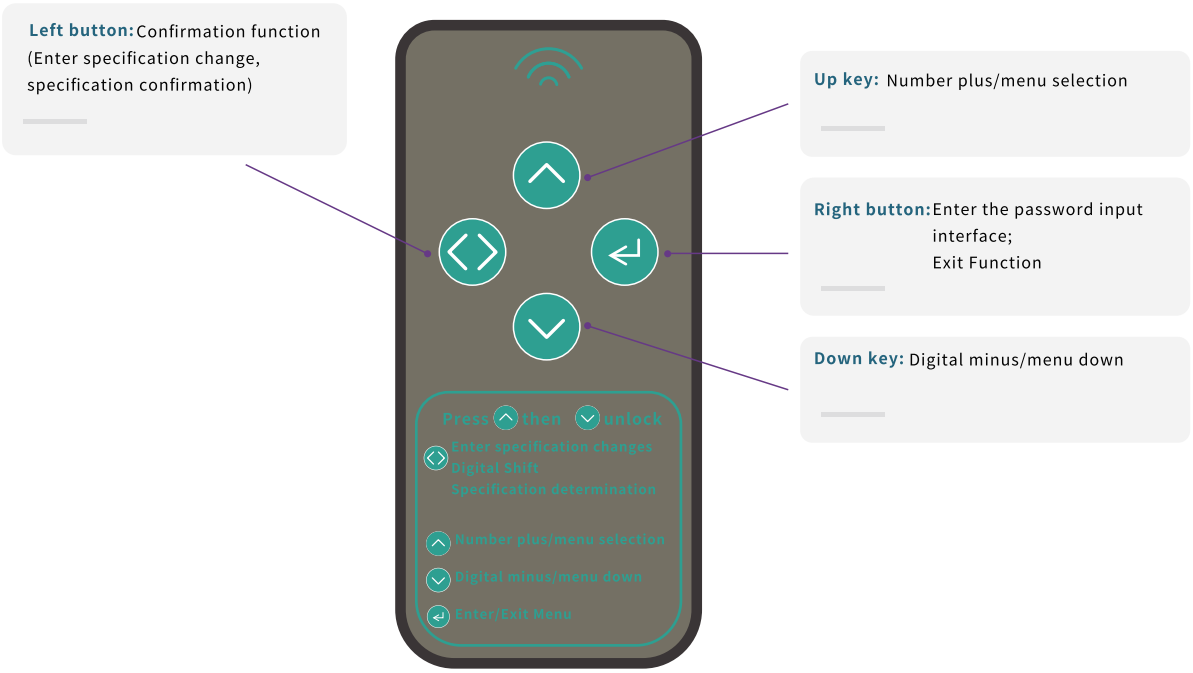
Traffic information display

Temperature information display

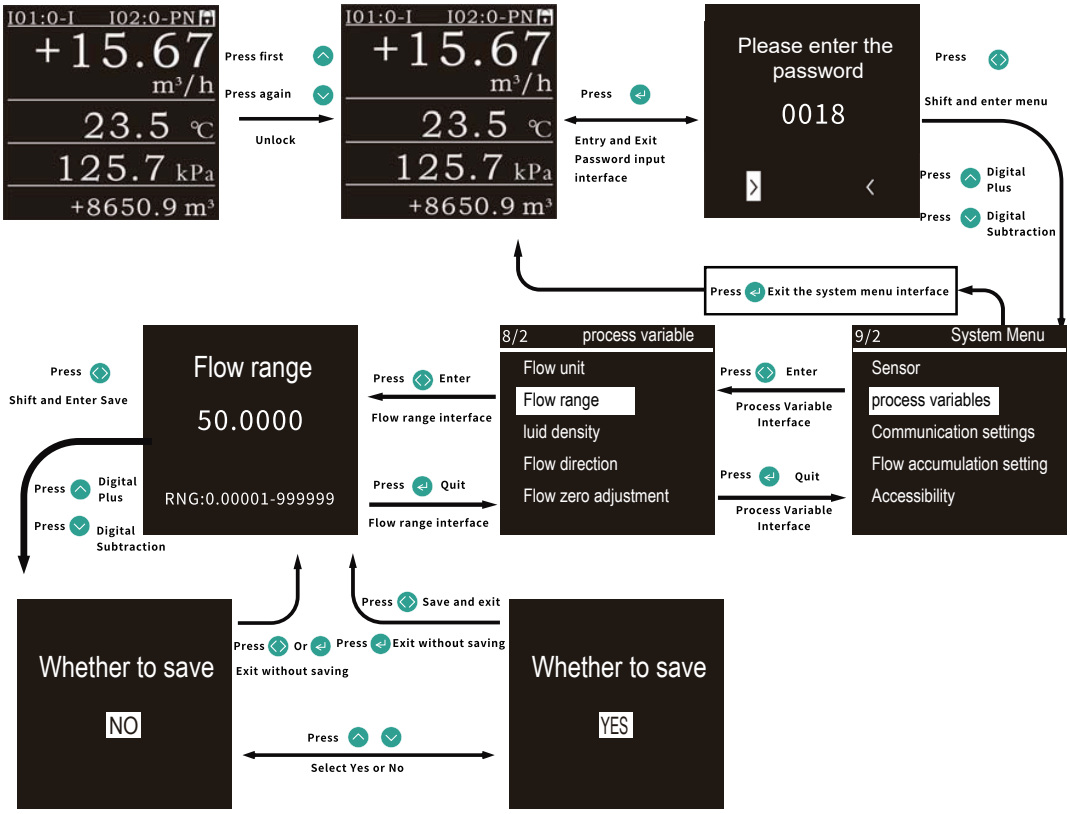
Pressure information display can be set

Accumulated flow display

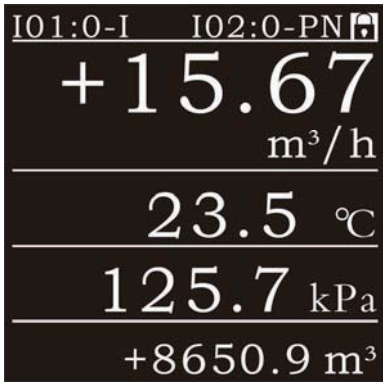
6.2 Handheld Remote Control Operation Instructions



The following example shows how to change the flow range using a handheld remote controller. Other menu operations are similar.



6.3 Alarm Code Description



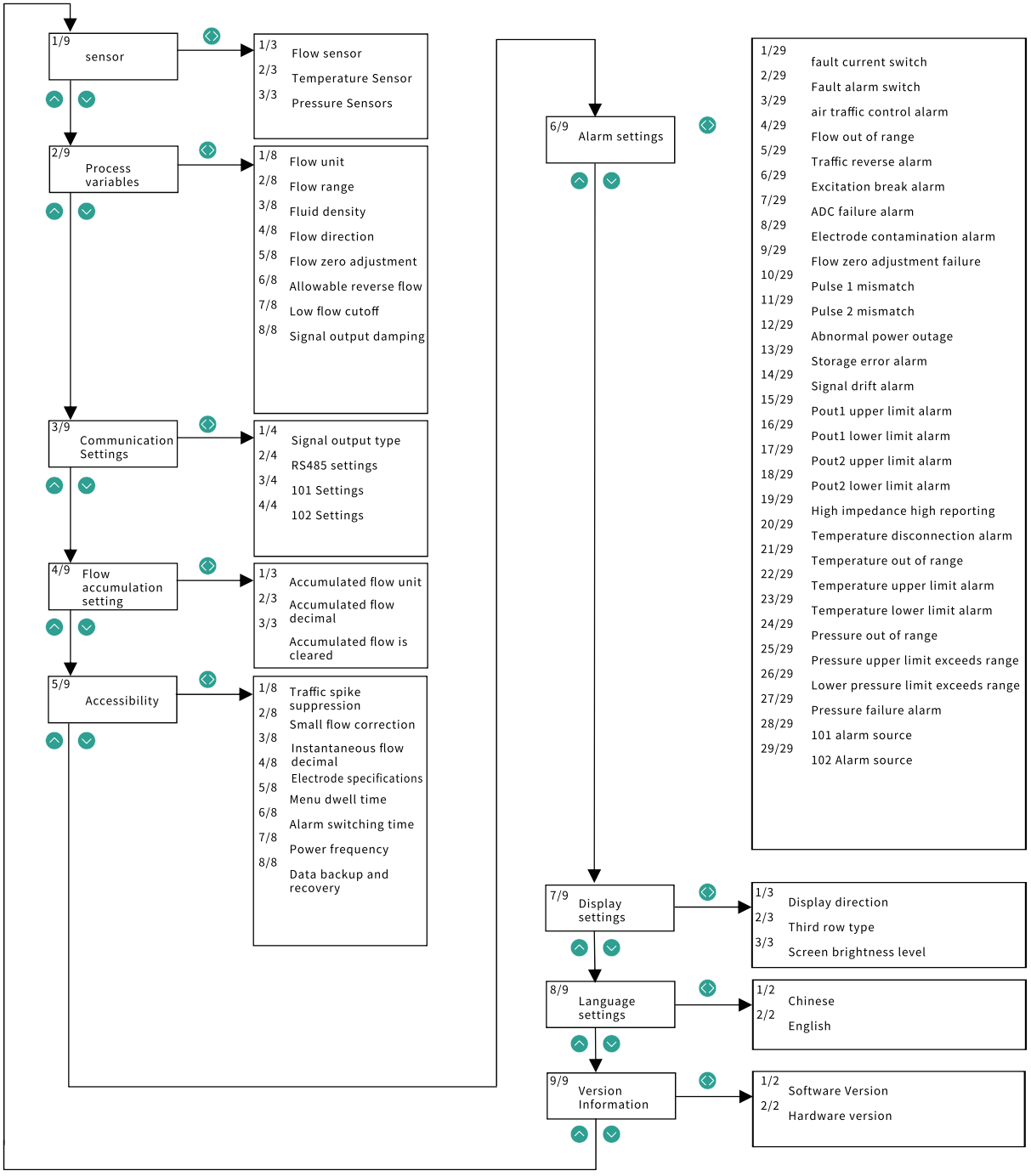
No alarm main interface

With alarm main interface

Alarm indication code description:

E1	Measuring empty pipes
E2	Flow rate exceeds range
E3	Flow Reverse
E4	Excitation circuit breaker
E5	ADC failure
E6	Electrode contamination
E7	Withering Glitch
E8	Pulse 1 Mismatch
E9	Pulse 2 Mismatch
E10	Power supply abnormality
E11	Storage Error
E12	Signal drift
E13	Pout1 exceeds upper limit
E14	Pout1 exceeds the lower limit
E15	Pout2 exceeds upper limit
E16	Pout2 exceeds the lower limit
E17	Electrode high impedance
E18	Temperature measurement circuit breaker
E19	Temperature out of range
E20	Temperature exceeds upper limit
E21	Temperature exceeds lower limit
E22	Pressure over range
E23	Pressure exceeds upper limit
E24	Pressure exceeds lower limit
E25	Pressure measurement failure

6.4 Menu Operation Flowchart



6.5 Specification Setting

Detailed menu items: (The following menus are described in code order)

1: Sensor

1.1: Flow sensor

1.1.1: Low frequency sensor coefficient (setting range: 0.1000～9.9999)
1.1.2: High frequency sensor coefficient (setting range: 0.1000～9.9999)
1.1.3: Sensor diameter (adjustable range: 0.00001～300000mm)

1.2: Temperature sensor

1.2.1: Temperature coefficient (settable range: 0.1000~9.9999)
1.2.2: Zero point of temperature range (settable range: －40.0～+120.0)
1.2.3: Lower limit of temperature alarm at full point of temperature range (settable range: －40.0～+120.0)
1.2.4: Temperature alarm lower limit (settable range: －40.0～+120.0)
1.2.5: Temperature alarm upper limit (settable range: －40.0～+120.0)
1.2.6: Temperature alarm hysteresis (settable range: 0.0~50.00)

1.3: Pressure sensor

1.3.1: Pressure switch (optional: on, off)
1.3.2: Pressure zero adjustment (optional: yes, no)
1.3.3: Zero point of pressure range (settable range: 30.00~1600.00)
1.3.4: Full point of pressure range (settable range: 30.00~1600.00)
1.3.5: Pressure alarm lower limit (settable range: 30.00~1600.00)
1.3.6: Pressure alarm upper limit (settable range: 30.00~1600.00)
1.3.7: Pressure alarm hysteresis (settable range: 0.0~50.00)

2: Process variables

2.1: Flow unit (optional range: L/h, L/min, L/s, t/h, t/min, t/s, kg/h, kg/min, kg/s, m^3/h, m^3/min, m^3/s)
2.2: Flow range (settable range: 0.00001~999999 flow units) decimal point position adjustable
2.3: Fluid density (settable range: 0.00001~999999g/cm^3) decimal point position is adjustable
2.4: Traffic direction (optional: forward, reverse) Default: forward
2.5: Flow zero adjustment

2.5.1: Automatic zero adjustment point (optional: yes, no) (Note: When selecting the automatic zero adjustment point, it must be determined that the liquid level in the pipeline is in a static state, it cannot be an empty pipe, and the fluid cannot flow.)

2.5.2: Manual zero adjustment (settable range: L-300.00mm/s ~ H +300.00mm/s) Default: +000.00mm/s, (the top of the screen displays the current flow rate)

2.6: Traffic reverse permission (optional: allow, prohibit) Default: allow
2.7: Low flow cutoff (settable range: 00.000~99.999%) Default: 01.000%
2.8: Signal output damping (settable range: 0.1~99s) Default: 3.0s

3: Communication settings

3.1: Signal output type (optional: RS-485 signal, other signals)

3.2: RS-485 Settings

3.2.1: Bus address (setting range: 000~255) default: 001

3.2.2: Baud rate (setting range: 1200 ~ 115200) default: 9600

3.3: IO1 settings

3.3.1: Port mode (optional: current, input, switch, frequency, pulse)

❖ If port mode is selected: Current (optional: Yes, No)

Analog output

1) Output specifications (optional: flow, pressure)
2) Current zero point (setting range: 0~31300)
3) Current full point (setting range: 0 ~ 31300)
4) Fault alarm switch (optional: on, off)
5) Fault alarm point 1 (setting range: 1.000～24.000)

❖ If port mode is selected: Input (optional: Yes, No)

Status Input

1) Control specifications (optional: forward accumulation, total accumulation, start accumulation, pause accumulation, clear accumulation)
2) Trigger type (optional: rising edge, falling edge, double edge)
3) Trigger event (optional: clear accumulation, start accumulation, pause accumulation)

❖ If port mode is selected: switch (optional: yes, no)

Output specifications (optional: flow, pressure, temperature)

Switch output

1) OC normal door output (optional: normally open, normally closed)
2) Alarm mode (optional: upper limit, lower limit)
3) Alarm value (setting range: 0.0～120.0)
4) Alarm hysteresis (setting range: 0.00～50.00)

❖ If port mode is selected: Frequency (optional: Yes, No)

Output type (optional: NPN, PNP)

Frequency output

1) Output specifications (optional: flow, pressure, temperature)
2) Lower limit output frequency (setting range: 0~10000)
3) Upper limit output frequency (setting range: 0~10000)

❖ If the port mode is selected: Pulse (optional: Yes, No)

Output type (optional: NPN, PNP)

Pulse output

1) Pulse equivalent setting (optional: 1L, 0.1L, 0.01L, 0.001L, $1m^3$, $0.1m^3$, $0.01m^3$, $0.001m^3$, 1kg, 0.1kg, 0.01kg, 0.001kg, 1t, 0.1t, 0.01t, 0.001t)
2) Pulse width (optional: 1ms, 0.05ms, 0.1ms, 0.5ms, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms)

3.4: IO2 Settings

3.4.1: Port mode (optional: current, input, switch, frequency, pulse)

❖ **If port mode is selected: Current (optional: Yes, No)**

Analog output
1) Output specifications (optional: flow, pressure)
2) Current zero point (setting range: 0~31300)
3) Current full point (setting range: 0 ~ 31300)
4) Fault alarm switch (optional: on, off)
5) Fault alarm point 1 (setting range: 1.000～24.000)

❖ **If port mode is selected: Input (optional: Yes, No)**

Status Input
1) Control specifications (optional: forward accumulation, total accumulation, start accumulation, pause accumulation, clear accumulation)
2) Trigger type (optional: rising edge, falling edge, double edge)
3) Trigger event (optional: clear accumulation, start accumulation, pause accumulation)

❖ **If port mode is selected: Input (optional: Yes, No)**

Output specifications (optional: flow, pressure, temperature)
Switch output
1) OC normal door output (optional: normally open, normally closed)
2) Alarm mode (optional: upper limit, lower limit)
3) Alarm value (setting range: 0.0～120.0)
4) Alarm hysteresis (setting range: 0.00～50.00)

❖ **If port mode is selected: Frequency (optional: Yes, No)**

Output type (optional: NPN, PNP)
Frequency output
1) Output specifications (optional: flow, pressure, temperature)
2) Lower limit output frequency (setting range: 0~10000)
3) Upper limit output frequency (setting range: 0~10000)

❖ **If the port mode is selected: Pulse (optional: Yes, No)**

Output type (optional: NPN, PNP)
Pulse output
1) Pulse equivalent setting (optional: 1L, 0.1L, 0.01L, 0.001L, 1m^3, 0.1m^3, 0.01m^3, 0.001m^3, 1kg, 0.1kg, 0.01kg, 0.001kg, 1t, 0.1t, 0.01t, 0.001t)
2) Pulse width (optional: 1ms, 0.05ms, 0.1ms, 0.5ms, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms)

4: Flow accumulation setting

4.1: Accumulated flow unit (optional: m^3, L, t, kg)
4.2: Accumulated flow decimal (optional: 0, 1, 2, 3)
4.3: Accumulated flow reset

4.3.1: Forward flow reset (optional: Yes, No)
4.3.2: Reverse flow reset (optional: Yes, No)
4.3.3: Mixed flow reset (optional: Yes, No)
4.3.4: Clear all (optional: Yes, No)

5: Accessibility

5.1: Traffic spike suppression

5.1.1: Peak suppression switch (optional: on, off) Default: off

5.1.2: Peak suppression time (setting range: 00.000～10.000s) Default: 00.000s

5.1.3: Peak suppression flow rate (setting range: 00.000～10.000m/s) Default: 00.000s

5.2: Small flow correction

5.2.1: Correction switch (optional: on, off) Default: off

5.2.2: Corrected flow rate (setting range: 00.000～10.000m/s) Default: 03.000m/s

5.2.3: Correction coefficient (setting range: 0.1000～9.9999) Default: 1.0000

5.3: Instantaneous flow decimals

5.3.1: Fixed decimal places (optional: 0, 1, 2, 3)

5.3.2: Automatic decimal places (optional: on, off)

5.4: Electrode specifications

5.4.1: Electrode Impedance (View Only)

5.4.2: Electrode contamination:

5.4.2.1: Threshold level 1 (settable range: 00.00~100.00MΩ) Default: 0.2MΩ

5.4.2.2: Threshold level 2 (settable range: 00.00~100.00MΩ) Default: 0.2MΩ

5.4.2.3: Threshold level 3 (settable range: 00.00~100.00MΩ) Default: 10MΩ

5.4.2.4: Dirt alarm level (selectable: level 1, level 2, level 3, level 4) Default: level 3

5.4.2.5: Measurement cycle (optional: 30s, 1min, 5min, 10min) Default: 1min (Note: This measurement cycle is the electrode viscosity measurement cycle, not the flow measurement cycle.)

5.4.3: Empty pipe threshold (setting range: 00000～9999) Default: 2300

5.4.4: High impedance threshold (setting range: 00.00～100.00) Default: 2

5.5: Menu stay time (setting range: 00~60min) Default: 30min (Note: when set to "00min", it will not automatically exit the menu)

5.6: Alarm switching time (setting range: 1~60)

5.7: Power frequency (setting range: 46.00Hz～63.00Hz) Default: 50Hz

5.8: Data backup and recovery (optional: backup, recovery)

6: Alarm setting

6.1: Fault current switch (optional: fully open, fully closed)

6.2: Fault alarm switch (optional: fully open, fully closed)

6.3: Air Traffic Control Alarm

6.3.1: Alarm switch (optional: on, off) Default: on

6.3.2: Clear alarm (optional: Yes, No)

6.3.3: Fault current alarm (optional: on, off)

6.3.4: Fault output port (optional: IO1, IO2)

6.4: Flow rate exceeds range

6.4.1: Alarm switch (optional: on, off) Default: on

6.4.2: Clear alarm (optional: Yes, No)

6.4.3: Fault current alarm (optional: on, off)

6.4.4: Fault output port (optional: IO1, IO2)

6.5: Flow reverse alarm

6.5.1: Alarm Switch (Options: On, Off) Default: On
6.5.2: Clear Alarm (Options: Yes, No)
6.5.3: Fault Current Alarm (Options: On, Off)
6.5.4: Fault Output Port (Options: IO1, IO2)

6.6: Excitation Circuit Breaker Alarm

6.6.1: Alarm Switch (Options: On, Off) Default: On
6.6.2: Clear Alarm (Options: Yes, No)
6.6.3: Fault Current Alarm (Options: On, Off)
6.6.4: Fault Output Port (Options: IO1, IO2)

6.7: ADC fault alarm

6.6.1: Alarm switch (optional: on, off) Default: on
6.6.2: Clear alarm (optional: Yes, No)
6.6.3: Fault current alarm (optional: on, off)

6.8: Electrode contamination alarm

6.8.1: Alarm switch (optional: on, off) Default: on
6.8.2: Clear alarm (optional: Yes, No)
6.8.3: Fault current alarm (optional: on, off)
6.8.4: Fault output port (optional: IO1, IO2)

6.9: Flow zeroing failure

6.9.1: Alarm switch (optional: on, off) Default: on
6.9.2: Clear alarm (optional: Yes, No)
6.9.3: Fault current alarm (optional: on, off)
6.9.4: Fault output port (optional: IO1, IO2)

6.10: Pulse 1 mismatch

6.10.1: Alarm switch (optional: on, off) Default: on
6.10.2: Clear alarm (optional: Yes, No)
6.10.3: Fault current alarm (optional: on, off)
6.10.4: Fault output port (optional: IO1, IO2)

6.11: Pulse 2 mismatch

6.11.1: Alarm switch (optional: on, off) Default: on
6.11.2: Clear alarm (optional: Yes, No)
6.11.3: Fault current alarm (optional: on, off)
6.11.4: Fault output port (optional: IO1, IO2)

6.12: Abnormal power outage

6.11.1: Alarm switch (optional: on, off) Default: on
6.11.2: Clear alarm (optional: Yes, No)
6.11.3: Fault current alarm (optional: on, off)
6.11.4: Fault output port (optional: IO1, IO2)

6.13: Storage error alarm

6.13.1: Alarm switch (optional: on, off) Default: on
6.13.2: Clear alarm (optional: Yes, No)
6.13.3: Fault current alarm (optional: on, off)
6.13.4: Fault output port (optional: IO1, IO2)

6.14: Signal drift alarm

6.14.1: Alarm switch (optional: on, off) Default: on
6.14.2: Clear alarm (optional: Yes, No)
6.14.3: Fault current alarm (optional: on, off)
6.14.4: Fault output port (optional: IO1, IO2)

6.15: Pout1 upper limit alarm

6.15.1: Alarm switch (optional: on, off) Default: on
6.15.2: Clear alarm (optional: Yes, No)
6.15.3: Fault current alarm (optional: on, off)
6.15.4: Fault output port (optional: IO1, IO2)

6.16: Pout1 lower limit alarm

6.16.1: Alarm switch (optional: on, off) Default: on
6.16.2: Clear alarm (optional: Yes, No)
6.16.3: Fault current alarm (optional: on, off)
6.16.4: Fault output port (optional: IO1, IO2)

6.17: Pout2 upper limit alarm

6.17.1: Alarm switch (optional: on, off) Default: on
6.17.2: Clear alarm (optional: Yes, No)
6.17.3: Fault current alarm (optional: on, off)
6.17.4: Fault output port (optional: IO1, IO2)

6.18: Pout2 lower limit alarm

6.18.1: Alarm switch (optional: on, off) Default: on
6.18.2: Clear alarm (optional: Yes, No)
6.18.3: Fault current alarm (optional: on, off)
6.18.4: Fault output port (optional: IO1, IO2)

6.19: High impedance alarm

6.19.1: Alarm switch (optional: on, off) Default: on
6.19.2: Clear alarm (optional: Yes, No)
6.19.3: Fault current alarm (optional: on, off)
6.19.4: Fault output port (optional: IO1, IO2)

6.20: Temperature disconnection alarm

6.20.1: Alarm switch (optional: on, off) Default: on
6.20.2: Clear alarm (optional: Yes, No)
6.20.3: Fault current alarm (optional: on, off)
6.20.4: Fault output port (optional: IO1, IO2)

6.21: Temperature out of range

6.21.1: Alarm switch (optional: on, off) Default: on
6.21.2: Clear alarm (optional: Yes, No)
6.21.3: Fault current alarm (optional: on, off)
6.21.4: Fault output port (optional: IO1, IO2)

6.22: Temperature upper limit alarm

6.22.1: Alarm switch (optional: on, off) Default: on
6.22.2: Clear alarm (optional: Yes, No)
6.22.3: Fault current alarm (optional: on, off)
6.22.4: Fault output port (optional: IO1, IO2)

6.23: Temperature lower limit alarm

6.23.1: Alarm switch (optional: on, off) Default: on
6.23.2: Clear alarm (optional: Yes, No)
6.23.3: Fault current alarm (optional: on, off)
6.23.4: Fault output port (optional: IO1, IO2)

6.24: Pressure out of range

6.24.1: Alarm switch (optional: on, off) Default: on
6.24.2: Clear alarm (optional: Yes, No)
6.24.3: Fault current alarm (optional: on, off)
6.24.4: Fault output port (optional: IO1, IO2)

6.25: Pressure upper limit alarm

6.25.1: Alarm switch (optional: on, off) Default: on
6.25.2: Clear alarm (optional: Yes, No)
6.25.3: Fault current alarm (optional: on, off)
6.25.4: Fault output port (optional: IO1, IO2)

6.26: Pressure lower limit alarm

6.26.1: Alarm switch (optional: on, off) Default: on
6.26.2: Clear alarm (optional: Yes, No)
6.26.3: Fault current alarm (optional: on, off)
6.26.4: Fault output port (optional: IO1, IO2)

6.27: Pressure fault alarm

6.27.1: Alarm switch (optional: on, off) Default: on
6.27.2: Clear alarm (optional: Yes, No)
6.27.3: Fault current alarm (optional: on, off)
6.27.4: Fault output port (optional: IO1, IO2)

6.28: IO1 alarm source (view only)

6.29: IO2 alarm source (view only)

7: Display settings

7.1: Display Direction

7.1.1: Fixed direction (optional: 0, 90, 180, 270)
7.1.2: Automatic direction (optional: on, off)

7.2: Third-party type (optional: forward accumulation, current flow rate, percentage value, mixed accumulation, reverse accumulation)

7.3: Screen brightness level (optional: 1, 2, 3, 4, 5)

8: Language settings (Available: Chinese, English) Default: Chinese

9: Device Information (Check the serial number and version information of the flow meter)

9.1: Software Version (View Only)

9.2: Hardware version (view only)

6.6 RS-485 Communication Protocol

Address (decimal)	Function code (decimal)	Name	Data Type	Illustrate
1000	4	transient flow	float	
1001				
1002	4	Transient flow rate (after filtering)	float	
1003				
1004	4	Traffic percentage	float	
1005				
1006	4	temperature	float	Unit: Celsius
1007				
1008	4	pressure	float	Unit: kPa
1009				
1010	4	Forward flow accumulation (integer bit)	uint32_t	
1011				
1012	4	Forward flow accumulation (decimal places)	float	
1013				
1014	4	Reverse flow accumulation (integer bit)	uint32_t	
1015				
1016	4	Reverse flow accumulation (decimal places)	float	
1017				
1018	4	Mixed flow accumulation (integer digit)	uint32_t	
1019				
1020	4	Mixed flow accumulation (decimal places)	float	
1021				
1022	4	Alarm status	uint32_t	See Table 1
1023				

Address (decimal)	Function code (decimal)	Name	Data Type	Data Scope
2000	3、6、16	Flow range	float	0.00001~999999
2001	3、6、16			
2002	3、6、16	Fluid density	float	0.00001~999999
2003	3、6、16			
2004	3、6、16	Signal output damping	float	0.1s~99.0s
2005	3、6、16			
2006	3、6、16	Transient flow unit	uint16_t	0~17, See Table 2
2007	3、6、16	Cumulative flow unit	uint16_t	0~5, See Table 3

Note: float data format is big endian (ABCD);
For example, to read the temperature using the preset address: 0A 04 03 EE 00 02 10 C1; the received value is: 0A 04 04 41 E2 66 66 5E C4;
"41 E2 66 66" represents the temperature value, which is converted to a floating point number of 28.3.

Table 1: Alarm status bits corresponding to alarm status	
bit 0	air traffic control alarm
bit 1	Over range alarm
bit 2	Traffic reverse alarm
bit 3	Excitation break alarm
bit 4	ADC failure alarm
bit 5	Electrode contamination alarm
bit 6	Flow zero adjustment fault alarm
bit 7	IO1 pulse mismatch alarm
bit 8	IO2 pulse mismatch alarm
bit 9	Abnormal power outage alarm
bit 10	Storage error alarm
bit 11	Signal drift timeout
bit 12	POUT1 upper limit alarm
bit 13	POUT1 lower limit alarm
bit 14	POUT2 upper limit alarm
bit 15	POUT2 lower limit alarm
bit 16	Electrode high impedance alarm
bit 17	Temperature sensor failure alarm
bit 18	Temperature over range alarm
bit 19	Temperature exceeds upper limit alarm
bit 20	Temperature exceeds lower limit alarm
bit 21	Pressure over range alarm
bit 22	Pressure exceeds upper limit alarm
bit 23	Pressure exceeds lower limit alarm
bit 24	Pressure sensor failure alarm
bit 25	
bit 26	
bit 27	
bit 28	
bit 29	
bit 30	
bit 31	

Table 2: Transient flow unit/number comparison table	
Serial Number	Unit
0	L/s
1	L/min
2	L/h
3	m3/s
4	m3/min
5	m3/h
6	NL/s
7	NL/min
8	NL/h
9	Nm3/s
10	Nm3/min
11	Nm3/h
12	kg/s
13	kg/min
14	kg/h
15	T/s
16	T/min
17	T/h

Table 3: Cumulative flow unit/number comparison table	
Serial Number	Unit
0	L
1	m3
2	NL
3	Nm3
4	kg
5	T