Electromagnetic Flowmeter

— user's Guide

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1. Product function description

1.1 Basic Functions

- Low frequency square wave excitation, excitation frequency: 1/8 power frequency, 1/16 power frequency, 1/20 power frequency;
- High frequency square wave excitation, excitation frequency: 1/2 power frequency (suitable for slurry measurement) (optional) ;
- The excitation current can be selected as 125mA, 187.5mA , 250mA ;
- Empty pipe measurement function without additional electrodes, continuous measurement, fixed value alarm;
- Flow rate measurement range: 0.1 --- 15 m/s, flow rate resolution: 0.5 mm/s;
- AC high frequency switching power supply, voltage range: 85VAC --- 250VAC;
- DC 24V switching power supply, voltage range: 20 VDC --- 36VDC;
- Network function: MODBUS, HART (optional) ;
- Chinese and English display modes (other languages can be customized);
- There are three totalizer totals inside, which can record respectively: forward total, reverse total, and difference total.

1.2 Special features

- Power-off time recording function, automatically recording the power interruption time of the instrument system and calculating the missed flow;
- Hourly total volume recording function, recording the total volume of flow in hours, suitable for time-sharing metering system;
- Infrared handheld operation keyboard, long-distance non-contact operation of all converter functions .

1.3 Normal working conditions

Ambient temperature: integrated type –10～+60℃;

Relative humidity: 5% to 90%;

Power supply: single-phase AC 85~250V, 45~63Hz and DC24V ;

Dissipated power: less than 20W (after connecting the sensor).

1.4 Connection type with sensor

Integrated: round housing, the housing is directly connected to the sensor flange.

1.5 Product Dimensions

1.5.1 Converter size

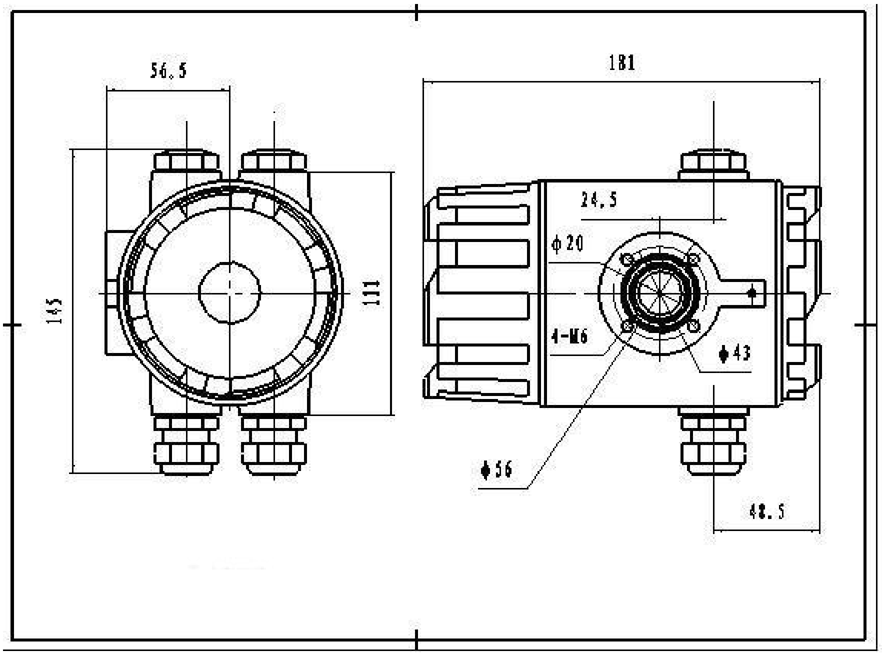


Figure 1.1 KFD9000A Series

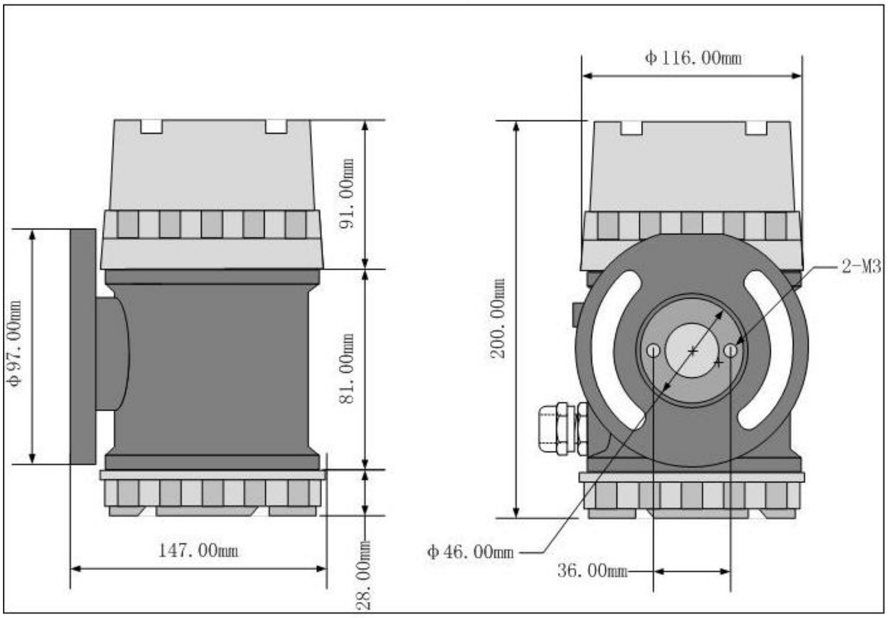
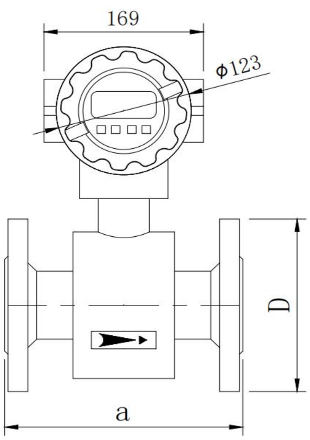
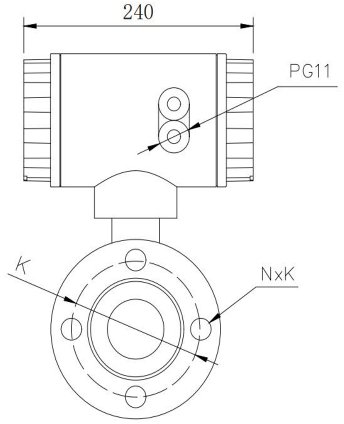


Figure 1.2 EMF Series

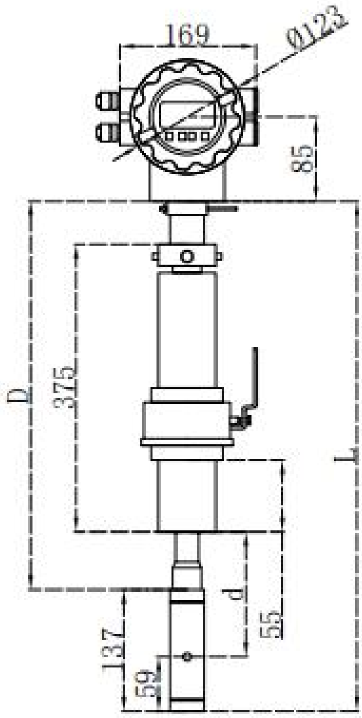
1.5.2 Sensor size



DN	a	D	K	N*k
10	200	90	60	4*14
15	200	9 5	6 5	4*14
20	200	105	75	4*14
25	200	115	85	4*14
32	200	140	100	4*18
40	200	150	110	4*18
50	200	165	125	4*18
65	200	185	145	4*18
80	250	200	160	8*18
100	250	220	180	8*18
125	250	250	210	8*18
150	300	285	240	8*22
200	350	340	295	8*22
250	450	395	350	12*22
300	500	445	400	12*22
350	550	505	460	16*22



400	600	565	515	16*26
450	600	615	565	20*26
500	600	670	620	20*26
600	600	780	725	20*30
700	700	895	840	24*30
800	800	1015	950	24*33
900	900	1115	1050	28*33
1000	1000	1230	1160	28*36
1200	1200	1405	1340	32*33
1400	1400	1630	1560	36*36
1600	1600	1830	1760	40*36
1800	1800	2045	1970	44*39
2000	2000	2265	2180	48*42
2200	2200	2405	2315	52*45



口径	d	D	L
DN100	1/2	550	690
DN150	1/2	550	690
DN200	1/2	550	690
DN250	1/2	550	690
DN300	1/2	550	690
DN350	1/2	550	690
DN400	1/4	550	690
DN450	1/4	550	690
DN500	1/4	550	690
DN600	1/4	550	690
DN700	1/4	700	840
DN800	1/4	700	840
DN900	1/4	700	840
DN1000	1/4	700	840
DN1100	1/4	700	840
DN1200	1/4	700	840
DN1300	1/4	700	840

1. Product Introduction

Insertion type electromagnetic flow sensor (referred to as sensor) and insertion type electromagnetic flow converter (referred to as converter) are matched into Insertion electromagnetic flowmeter (flowmeter for short) is used to measure the volume flow of various conductive liquids in the conveying pipeline.

2. Characteristics of Insertion Flow Meter

The main features are as follows:

◆ There are no moving parts in the sensor, the structure is simple and the operation is reliable.

◆The plug-in electromagnetic structure can be easily installed and disassembled under low pressure or with pressure without stopping water. Therefore, it is very suitable for the fluid measurement of existing pipelines and easy to maintain and repair instruments.

◆ The measurement accuracy is not affected by changes in physical parameters such as temperature, pressure, density, viscosity, and electrical conductivity (conductivity greater than 50μs/cm) of the measured medium.

◆ The sensor has almost no pressure loss and extremely low energy loss.

◆ The manufacturing and installation costs are lower than those of general flow meters. It is especially suitable for flow measurement in large and medium diameter pipelines.

◆ Adopt advanced low-frequency square wave excitation. Zero point stability, strong anti-interference ability and reliable operation.

◆ Large flow measurement range. The full-scale flow velocity in the measured pipeline can be set arbitrarily from 1m/s to 10m/s .
The flow rate is linear.

◆ The flow meter not only has 4~20mA/DC standard current output, but also 1~5kHz frequency output and standard RS485/MODBUS-RTU output, due to the flow meter (sensor) has the above series of advantages, therefore, has been widely used Used for chemical industry, chemical fiber, metallurgy, fertilizer, paper making, water supply and drainage, sewage treatment and other industrial sectors and agricultural irrigation water metering
Conductive liquid flow measurement and automatic control of production process .

3. Product type, dimension drawing and flow range

3.1 The product is of plug-in type and is connected to the pipeline through a mounting base, a ball valve, a compression nut and a positioning screw.

The measurement is divided into two structural types: measuring tube type and flat electrode type. The measuring tube type sensor is suitable for measuring clean media; the flat electrode

This type is suitable for measuring the flow of liquids containing other impurities in the measuring medium.

4. **Working Principle**

The sensor is actually a liquid flow rate measuring instrument

It is made by applying the principle of Faraday's law of induction.

Figure 1 is the basic diagram of the insertion flow meter .

Schematic diagram of the working principle.

A small electromagnetic flow sensor is connected to the

The sensor is inserted into the specified position of the measured pipeline, and the conductive

When the fluid flows vertically through the working magnetic field of the sensor (conversion

When the sensor provides excitation current, the excitation coil

The working magnetic field is generated in the excitation system composed of

It is equivalent to the conductor cutting the magnetic lines of force in the magnetic field. According to Faraday's law of induction, an induced current is generated at both ends of the conductor.

The induced electromotive force is detected by a pair of electrodes in contact with the fluid. The magnitude of the electromotive force is related to the magnetic induction intensity B and the distance between the two poles.

The distance L is proportional to the average flow velocity of the fluid.

$E=B \cdot L \cdot V$(V)

① Where: E—— induced electromotive force, volt;

B—— magnetic field strength, Tesla;

L—— the distance between the two electrodes, meters;

V ——Flow velocity through the flow velocity sensor (i.e., the particle velocity at the specified insertion point of the measured pipeline), m / s

K—— coefficient.

There are two ways to insert the electromagnetic flow sensor in our factory. One is to insert it into the central axis of the measured pipeline; the other is to insert it into the central axis of the measured pipeline.

Insert the pipe into the inner wall of the pipe at about 0.25D of the pipe, where D is the pipe diameter. Generally, pipes smaller than DN400 can be inserted into the pipe to be tested.

The flow rate measured by the flow velocity sensor is the maximum flow rate of the pipeline, and the average flow rate of the pipeline is

The velocity should be calculated by multiplying the maximum velocity by a coefficient K.

② Where: n is the Reynolds number index, which can be obtained by formula ③,

n=1.66lgRD

Where: RD—— Reynolds number of pipeline fluid.

③ Where, K is the equivalent absolute roughness, the average height of the protrusions on the inner wall of the pipe.

Pipes larger than DN400 can be inserted to a distance of about 0.25D from the inner wall of the pipe . At this time, the flow velocity measured by the flow velocity sensor is the average flow velocity.

The coefficient K = 1. The flow rate of the measured pipeline can be expressed by the following formula

Q=B・V・A（ **m^3/h** ）

④ In the formula, A is the cross-sectional area of the circular pipe, m2 .

Substituting formula ① into formula ②, we get ⑤

Since the working magnetic field strength of the insertion electromagnetic flow velocity sensor and the distance between the two electrodes are

It has been determined during manufacturing. At the same time, the cross-sectional area of the measured pipeline is also obtained, so

The output electromotive force of the electromagnetic flow sensor can represent the flow rate.

5.2 Structure

The sensor is shown in Figure 2 , which mainly consists of a measuring head (or measuring tube), an excitation

The system consists of an insertion rod, a junction box, a mounting base, a sealing positioning mechanism, etc.

Measuring head (or measuring tube): The measuring head (measuring tube) is located in the pipeline to be measured.

The flow velocity point is used to detect the flow velocity at that point.

A tip or conduit made of insulating material with a pair of electrodes mounted on it.

Except for the electrode tip or the inner wall of the measuring tube, the rest of the parts are insulated from the measured fluid.

Excitation system: The function of the excitation system is to generate a working magnetic field.

It consists of an excitation coil and an iron core, which is insulated and sealed into an insert.

Insertion rod: Made of stainless steel. The measuring head and measuring tube are fixed in the insertion rod. The excitation lead and electrode lead are connected through the

The insertion rod is sealed with the measured medium and connected to the junction box. Direction indicators are welded on the insertion rod to ensure that the direction is correct during installation.

It is verified that the working magnetic field, flow velocity and electrode connection are perpendicular to each other, which meets the requirements of Faraday's law of induction.

Junction box: The junction box is located on the upper part of the sensor, and the wiring terminals in the junction box serve to connect the sensor and the converter.

Mounting base: The mounting base is welded on the measured pipe and used to connect with the mounting ball valve and insert the flow meter sensor.

part.

Sealing mechanism: It is composed of a compression thread seat, a compression nut, a rubber gasket and a positioning screw made of stainless steel, which is used to seal the inserted sensor so that it can withstand a certain working pressure.

2. Basic circuit of converter

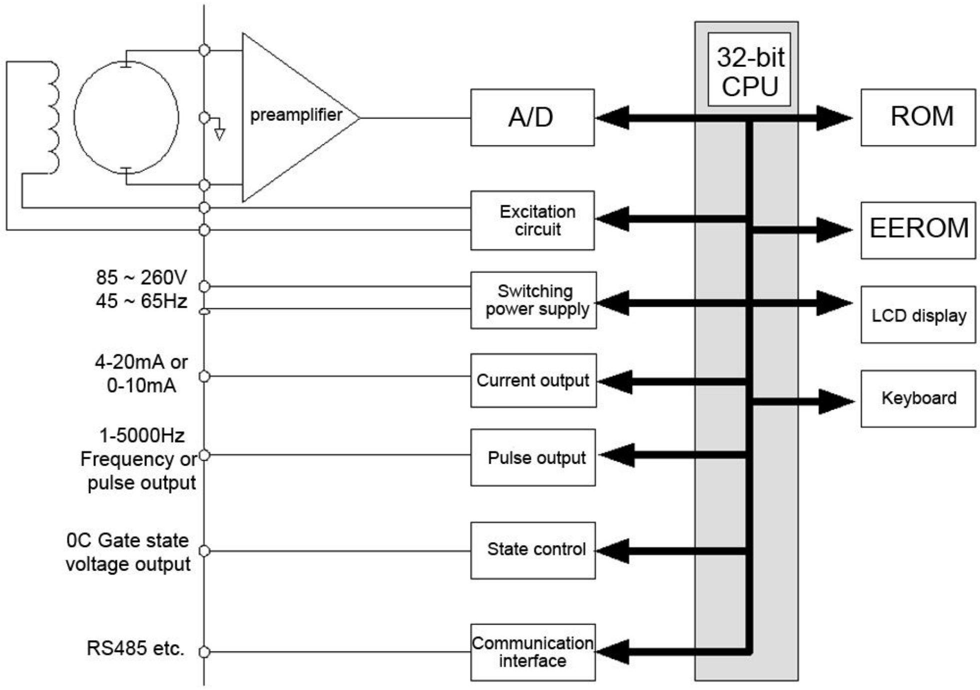


Figure 2.1 Converter circuit structure

The electromagnetic flowmeter converter provides a stable excitation current to the electromagnetic flow sensor excitation coil. The preamplifier amplifies the electromotive force induced by the sensor and converts it into a standard current signal or frequency signal, which is convenient for displaying, controlling and adjusting the flow. Figure 2.1 shows the converter circuit structure.

3. Technical performance indicators

3.1 Implementation Standards

of KFD9000 electromagnetic flowmeter are carried out in accordance with "JB/T 9248-2015 Electromagnetic Flowmeter".

3.2 Flow meter selection and parameter performance indicators

Correctly selecting the electromagnetic flowmeter is a prerequisite for ensuring good use of the electromagnetic flowmeter. The type of electromagnetic flowmeter to be selected should be determined based on the physical and chemical properties of the fluid being measured, so that the electromagnetic flowmeter's diameter, flow range, lining material, electrode material and output current can adapt to the properties and flow requirements of the fluid being measured.

From the working principle of electromagnetic flowmeter, we know that the fluid that can be measured by electromagnetic flowmeter must be conductive. Strictly speaking, except for high-temperature fluid, any fluid with conductivity greater than 30 μS/cm must use the corresponding electromagnetic flowmeter to measure the flow. Therefore, non-conductive gases, steam, oils, acetone and other substances cannot be measured by electromagnetic flowmeter.

3.2.1 Nominal diameter of the matching sensor (mm):

10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200;

3.2.2 Determination of sensor caliber

The flow meter should preferably be used at a flow rate within the range of 0.3 to 5 m/s. At this time, the flow meter diameter can be selected to be consistent with the user's pipeline diameter.

Use flow rate less than 0.3 m/s, it is best to increase the flow velocity locally at the instrument location by using a shrink tube method:

★ When the center cone angle of the reducer is no more than 15°C, the reducer can be regarded as part of the straight pipe section.

3.2.3 Choice of integrated or separated type

Integrated type: When the on-site environment is good, the integrated type is generally selected, that is, the sensor and converter are assembled into one.

Separate type: the sensor and converter are installed separately in different locations. Generally, the separate type is selected when the following situations occur.

(1) The ambient temperature or the radiated temperature of the flowmeter converter surface exceeds 60 °C .

(2) Where the pipeline vibrates greatly.

(3) This may cause severe corrosion to the aluminum shell of the sensor.

(4) Places where the site temperature is high or there is corrosive gas.

(5) The flow meter is installed at high altitude or in places where it is inconvenient to debug downward.

When ordering, the separation distance of the sensor and the converter should be specified, which generally cannot exceed 100 m. The converter is wall-mounted.

3.2.4 Selection of electrode and grounding ring materials

The material of the electrode should be selected according to the corrosiveness of the fluid being measured. Please check the relevant corrosion manual and conduct tests for special fluids.

Material	Corrosion resistance
Molybdenum-containing stainless steel (Ocr18Ni12Mo2Ti)	Nitric acid, sulfuric acid <5% at room temperature, boiling phosphoric acid, formic acid, alkaline solution, sulfurous acid under pressure, sea water, acetic acid
Hastelloy C Hastelloy B (HC, HB)	Resistant to oxidizing acids, oxidizing salts, seawater, non-oxidizing acids, non-oxidizing salts, alkalis, and sulfuric acid at room temperature
Titanium (Ti)	Seawater, various chlorides and hypochlorous acid, chlorinated acids (including fuming nitric acid), organic acids, alkalis
Tantalum (Ta)	Chemical media other than hydrofluoric acid, oleum, and alkali, including boiling hydrochloric acid. Nitric acid <175℃
Platinum (Pt)	Various acids, bases, salts, excluding aqua regia

3.2.5 Lining material selection instructions

The lining material should be selected according to the corrosiveness, abrasiveness and temperature of the measured medium.

Lining material	name	symbol	performance	temperature	Applicable liquid
rubber	Neoprene		Moderate wear resistance, resistant to general low concentration acid, alkali and salt corrosion	<80℃	Tap water, industrial water, sea water
	Polyurethane rubber		Excellent wear resistance, poor acid and alkali resistance	60<℃	Pulp, mineral pulp and other slurries
Fluoroplastic	Polytetrafluoroethylene	F4 or PTFE	The chemical properties are very stable, resistant to corrosion from boiling	120<℃	Strongly corrosive acid, alkali and salt liquids

			hydrochloric acid, sulfuric acid, aqua regia, and concentrated alkali		
	Tetrafluoroethylene and hexafluoropropylene translation: Teflon FEP	F46 or FEP	The chemical performance is slightly inferior to F4	<80℃	Corrosive acid, alkali and salt liquids
plastic	Tetrafluoroethylene and ethylene	F4 or ETFE	The chemical performance is slightly inferior to F4	<80℃	Corrosive acid, alkali and salt liquids
	Polyethylene	PO	Stable chemical properties	60<℃	Sewage
	Polyphenylene sulfide	PPS		150<℃	Hot water

3.2.6. Selection of flow range

Note: It is recommended to use the flow range value corresponding to the flow rate of 0.5~5m/S to ensure measurement accuracy.

Flow rate (m^3/h) / Flow rate (m/s) / Diameter(mm)	0.2	0.4	0.5	1	5	10
DN 10	0.0565	0.1131	0.1414	0.2827	1.414	2.827
DN15	0.127	0.25	0.318	0.636	3.181	6.362
DN20	0.226	0.45	0.566	1.131	5.655	11.31
DN25	0.35	0.71	0.8836	1.767	8.836	17.67
DN32	0.58	1.16	1.448	2.895	14.476	28.95
DN40	0.90	1.81	2.262	4.524	22.619	45.24
DN50	1.414	2.83	3.535	7.069	35.343	70.69
DN65	2.39	4.78	5.973	11.946	59.730	119.5
DN80	3.62	7.24	9.048	18.1	90.478	181
DN100	5.65	11.31	14.14	28.27	141.37	282.7
DN125	8.84	17.67	22.09	44.18	220.89	441.8

DN150	12.7	25.5	31.81	63.62	318.09	636.2
DN200	22.6	45.2	56.55	113.1	565.49	1131
DN250	35.4	70.7	88.36	176.7	883.57	1767
DN300	51	102	127.24	254.5	1272.35	2545
DN350	69	139	173.2	356.4	1731.8	3464
DN400	90	181	226.2	452.4	2261.9	4524
DN450	114	229	286.3	572.6	2862.8	5726
DN500	141	283	353.4	706.9	3534.3	7069
DN600	203	407	508.9	1018	5089.4	10179
DN700	277	554	692.7	1385	6927.2	13854
DN800	362	723	905	1810	9047.8	18096
DN900	458	916	1145	2290	11451	22902
DN1000	565	1131	1414	2827	14137	28274
DN1200	814	1628	2035.8	4069.4	20358	40694

3.2.7 Sensor Support Requirements

Sensor signal sensitivity: At a flow rate of 1 m/s, the sensor output is 150μV ~200μV;

For the KFD9000 electromagnetic flowmeter converter, three 83.33 mA currents are used in the excitation circuit to form 250 mA. Each 83.33 mA current is controlled by a 15 Ω precision resistor. Therefore, users can select different excitation currents by changing the number of precision resistors.

The converter is factory set to 250 mA current. Similarly, if there are two precision resistors, it corresponds to 125 mA.

Sensor excitation coil resistance : 250 mA excitation current: 40 ~ 60 Ω;

187.5 mA excitation current: 60 ~ 80Ω;

125mA excitation current: 100 ~ 120Ω;

3.2.8 Overall measurement accuracy

VS: Setting range (m/s) Table 3.1

Diameter	Range m/s	Accuracy

(mm)		
3～20	0.3 or less	±0.25%FS
	0.3～1	±1.0%R
	1～15	±0.5%R
25～600	0.1～0.3	±0.25%FS
	0.3～1	±0.5%R
	1～15	±0.3%R
700～3000	0.3 or less	±0.25%FS
	0.3～1	±1.0%R
	1～15	±0.5%R
%FS: relative to the measuring range; %R: relative to the measured value.		

3.2. 9 Analog current output

Load resistance: 0-1.5kΩ at 0-10mA;

0～750Ω at 4～20mA.

Basic error: 0.1%±10μA.

3.2. 10 digital frequency output

Frequency output range: 1～5000Hz;

Output electrical isolation: photoelectric isolation. Isolation voltage: > 1000VDC;

Frequency output drive: field effect tube output, maximum withstand voltage 36VDC, maximum load current 250mA.

3.2. 11 Digital pulse output

Output pulse equivalent: 0.001～1.000 m3 / cp,

0.001～1.000 Ltr/cp,

Output pulse width: 50 ms , automatically converted into square wave at high frequency;

Output electrical isolation: photoelectric isolation, isolation voltage: > 1000VDC;

Pulse output drive: field effect tube output, maximum withstand voltage 36VDC, maximum load current 250mA.

3.2. 12 Alarm output

Alarm output contact: FHL --- upper limit alarm; ALML --- lower limit alarm (optional) ;

Output electrical isolation: photoelectric isolation. Isolation voltage: > 1000VDC;

Alarm output drive: Darlington output, maximum withstand voltage 36VDC, maximum load current 250mA.

3.2.13 Digital communication interface and communication protocol

MODBUS interface: RTU format, physical interface RS-485, electrical isolation 1000V;

HART interface: supports standard HART protocol, equipped with HART handheld device, display measured values online ,And the instrument parameters can be modified ;

3.2.14 Electrical isolation

The insulation voltage between analog input and analog output is not less than 500V;

The insulation voltage between analog input and alarm power supply shall not be less than 500V;

The insulation voltage between analog input and AC power supply is not less than 500V;

The insulation voltage between analog output and AC power supply is not less than 500V;

The insulation voltage between analog output and ground is not less than 500V;

The insulation voltage between pulse output and AC power supply shall not be less than 500V;

The insulation voltage between the pulse output and the ground is not less than 500V;

The insulation voltage between the alarm output and the AC power supply is not less than 500V;

The insulation voltage between the alarm output and the ground is not less than 500V.

4. Converter wiring and operation

4.1 Keyboard Definition and Display

Four-button operation keyboard definition and LCD display

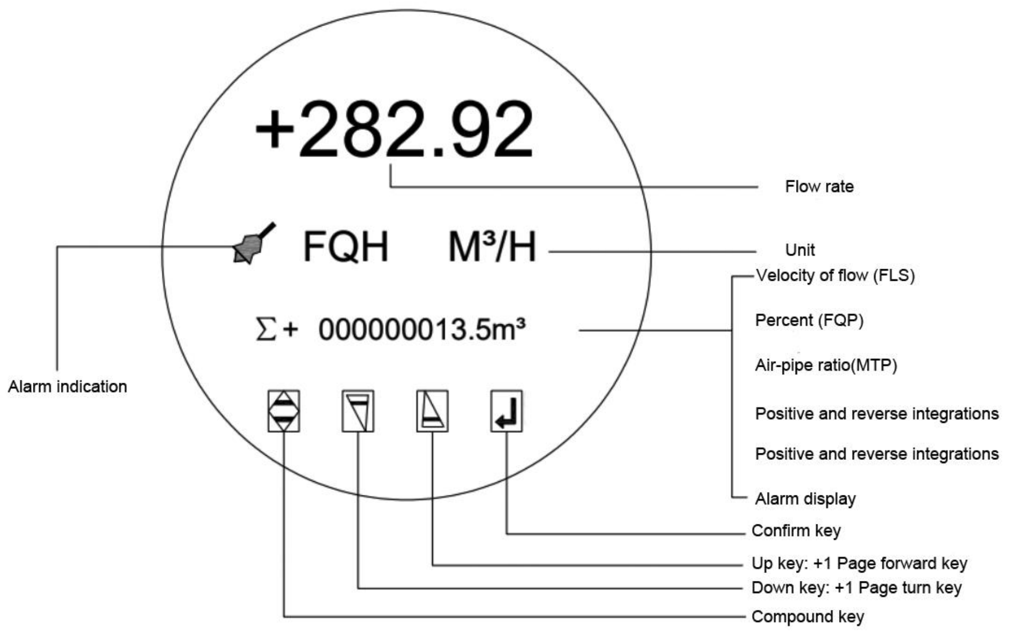


Figure 4.1 Integrated keyboard definition and LCD display

Note: In the measurement state, press the "composite key + confirmation key" to display the converter function selection screen "parameter setting". Press the confirmation key once and the meter will enter the password input state. According to the confidentiality level, modify the password provided by the factory. Press the "confirm key" again to enter the required parameter setting state. If you want to return to the running state, press and hold the confirmation key for a few seconds.

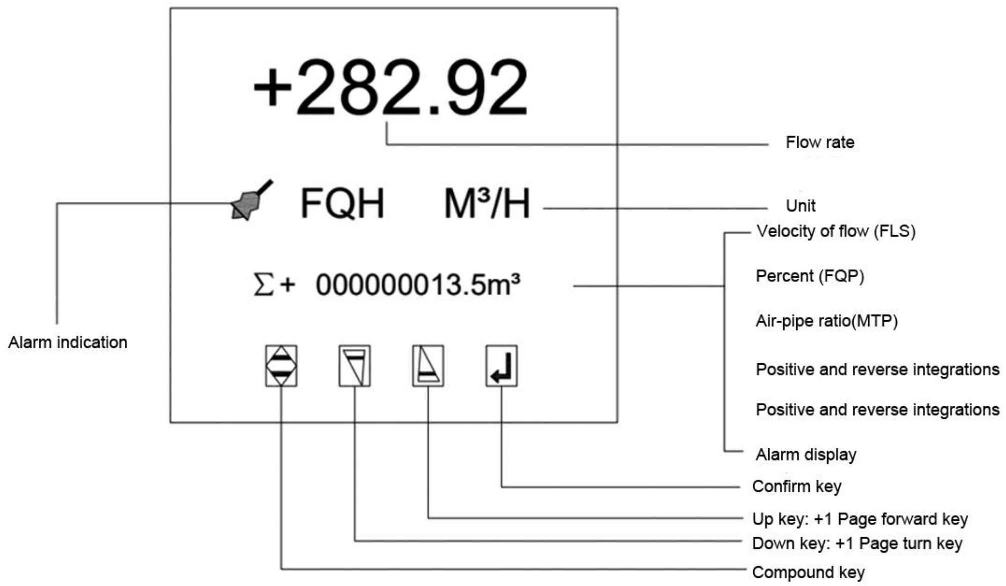


Figure 4. 2-part keyboard definition and LCD display

Note: In the measurement state, press the "composite key + confirmation key" to display the converter function selection screen "parameter setting". Press the confirmation key once and the meter will enter the password input state. According to the confidentiality level, modify the password provided by the factory. Press the "confirm key" again to enter the required parameter setting state. If you want to return to the running state, press and hold the confirmation key for a few seconds.

4. 2 Converter wiring diagram

The meanings of the terminal markings are as follows:

IOUT + :	Flow current output +
IOUT - :	Flow current output -
POUT + :	Flow pulse output +
POUT - :	Flow pulse output -
FQH+ :	Alarm output +
FQH- :	Alarm output -
FUSE:	Power fuse
485A :	Communication output
485B :	Communication output
EX1-Y	Excitation coil + input
EX2-X	Excitation coil-input
SIG-A	Electrode signal + input
SIG-B	Electrode signal-input
GND :	Sensor ground input
DC24V	Two-wire 24V voltage input
L:	220V power input
N:	220V power input

4.3 Characteristics and connection requirements of connecting wires and cables

4.3.1 Signal line processing

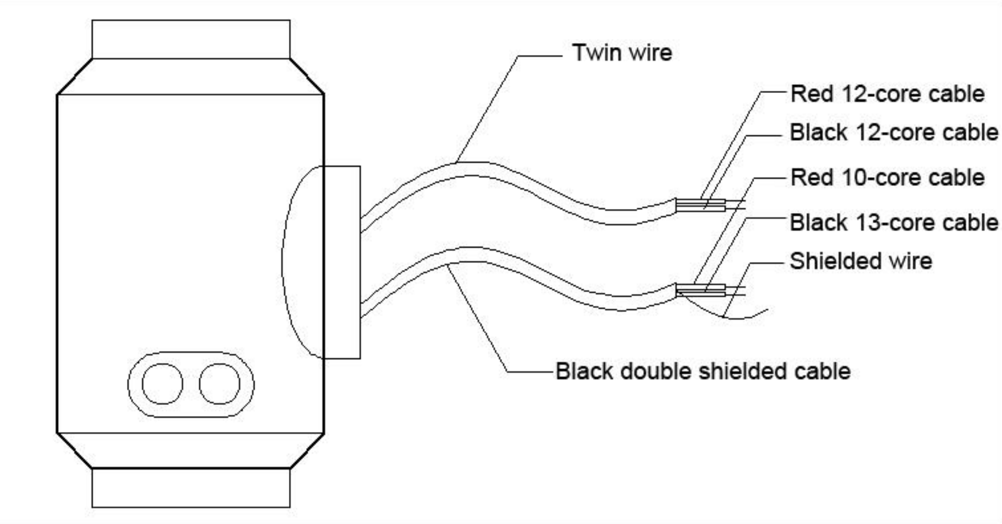


Figure 4.4.1 Signal line processing

The signal lines are marked as follows:

Double-strand wire: Red 12-core wire
Black 12-core wire
Connecting excitation current

Black double-strand shielded wire: Red 10-core wire connected to "Signal 1"

Black 13-core wire connects to "Signal 2"

Shielded wire connected to "signal ground"

4.3.2 Flow signal line

When the converter is used with the sensor, if the conductivity of the measured fluid is greater than 50μS/cm, the flow signal transmission cable can use the polyvinyl chloride sheathed metal mesh shielded signal cable of model RVVPB2*0.12*280 mm2 · The use length should not exceed 100m. The signal line is matched with the sensor when it leaves the factory. The signal line can be processed according to Figure 4.4.1. This converter provides an equipotential excitation shielded signal output voltage to reduce the influence of the distributed capacitance of the cable transmission on the flow signal measurement. When the measured conductivity is less than μ or for long-distance transmission, a double-core double-shielded signal cable with equipotential shielding can be used. For example, STT3200 special cable or BTS type triple-shielded signal cable.

4.3.3 Excitation current line

The excitation current line can be a two-core insulated rubber soft cable, and the recommended model is RVVP2*0.12*250mm2 · The length of the excitation current line is consistent with the length of the signal cable.

When using the STT3200 dedicated cable, the excitation cable and signal cable are combined into one.

4.3.4 Output and power cord

All output and power cables are prepared by the user according to the actual situation. But please pay attention to meet the load current requirements.

4.3.5 Grounding wire connection

The converter housing grounding terminal should be connected to the ground with a grounding copper wire no less than 1.6 mm2 · The grounding resistance from the converter housing to the ground should be less than 10Ω.

4.4 Digital output and calculation

Digital output refers to frequency output and pulse output . Frequency output and pulse output use the same output point in wiring , so users cannot select both frequency output and pulse output at the same time, but can only select one of them .

4.4.1 Frequency output :

The frequency output range is 0～5000HZ, and the frequency output corresponds to the flow percentage .

F = Measurement value / full scale value * frequency range

The upper limit of the frequency output is adjustable . Users can choose 0~5000HZ , or a lower frequency : such as 0~1000HZ or 0~5000HZ .

Frequency output is generally used for control applications because it reflects the percentage flow rate . If the user uses it for metering applications , the pulse output should be selected .

4.4.2 Pulse output mode :

The pulse output method is mainly used for metering. Outputting a pulse represents an equivalent amount of fluid flowing through the pipeline, such as one pulse represents 1L or 1M3，etc.

Pulse equivalent is divided into: 0.001L, 0.01L, 0.1L, 1L, 0.001 M^3, 0.01 M^3, 0.1 M^3, 1 M^3. When selecting pulse equivalent, users should pay attention to the matching of flow meter flow range and pulse equivalent. For volume flow, the calculation formula is as follows:

$$Q_L = 0.0007854 \times D^2 \times V \text{ (L/S)}$$

$$Q_M = 0.0007854 \times D^2 \times V \times 10^{-3} \text{ (M}^3\text{/S)}$$

Here: D-pipe diameter (mm)

V-flow rate (m/s)

If the pipeline flow is too large and the pulse equivalent is too small, the pulse output will exceed the upper limit, so the pulse output frequency should be limited to below 3000Hz . If the pipeline flow is small and the pulse equivalent is too large, the instrument will take a long time to A pulse can be output.

In addition, it must be pointed out that pulse output is different from frequency output. Pulse output is to output a pulse when a pulse equivalent is accumulated. Therefore, the pulse output is not very uniform. Generally, a counter instrument should be used to measure pulse output, not a frequency meter.

4.4.3 Wiring of digital output

Digital output has two contacts: digital output contact and digital ground contact. The symbols are as follows:

POUT + ———— Digital output contact;

P OUT - ———— Digital ground connection point;

4.5 Analog output and calculation

4.5.1 Analog output

Analog output is divided into two signal systems: 0-10mA and 4-20mA. When using, the user can select one of the two signal systems through parameter settings.

The analog current output is internally powered by 24V and can drive a load resistance of 750Ω under a 0-20mA signal system.

The analog current output corresponds to the percentage flow rate, that is:

$$I_0 = \frac{\text{Measured value}}{\text{Full scale value}} \bullet \text{Current range + current zero}$$

For the 0~10mA signal system, the current zero point is "0".

For the 4-20mA signal system, the current zero point is 4mA.

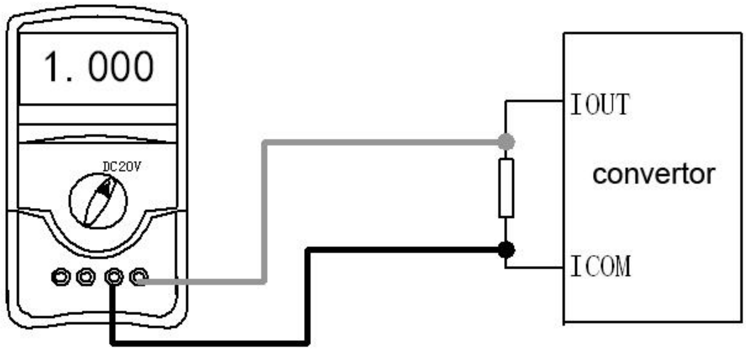
Therefore, in order to improve the resolution of the output analog current, the user should appropriately select the flow meter range.

When the flowmeter leaves the factory, the manufacturer has calibrated the parameters of the analog output. Generally, the user does not need to make any adjustments. If an abnormal situation occurs and the user needs to calibrate the analog output, the following operating procedures can be followed.

4.5.2 Analog output adjustment

(1) Instrument calibration preparation,

Turn on the meter and run it for 15 minutes to allow the internal part of the meter to reach thermal stability. Prepare a 0.1% level ammeter, or a 250Ω resistor and a 0.1% voltmeter, and connect them as shown below.



(2) Current “0” point correction:

Set the converter to parameter setting state, select the "current zero correction" item, enter, turn the standard signal source to the "0" position, and adjust the correction coefficient value so that the ammeter just indicates 4mA (±0.004mA).

(3) Current full scale correction

Select the "Current Full Scale Correction" parameter, enter, set the standard signal source to the full scale position, and adjust the converter correction factor so that the ammeter indicates exactly 20mA (±0.004mA).

After adjusting the current "0" point and full-scale value, the current function of the converter can guarantee accuracy. The linearity of the current output of the converter is within 0.1%.

(4) Current linearity check:

Set the standard signal source to 75%, 50%, and 25% to check the linearity of the output current.

5. Instrument parameter settings

the KFD9000 electromagnetic flowmeter converter and sensor are connected to the fluid pipeline (whether for calibration or use), the following work should be done first:

- Connect the pipes before and after the sensor with copper wires.
- Ground the sensor well.
- When adjusting the instrument zero point, ensure that the fluid in the pipeline is still.
- Ensure that the oxide film on the sensor electrode is stably formed (the electrode is in continuous contact with the fluid for 48 hours).

5.1 Parameter setting function and function key operation

To set or modify the instrument parameters, the instrument must be switched from the measurement state to the parameter setting state. In the measurement state, press the " Compound Key" + " Confirm Key" to enter the function selection screen "Parameter Setting", then press the " Confirm Key" to enter the password "00000" state, press the " Up Key " or "Down Key" to modify the password 0, press the " Compound Key" + " Up and Down Keys " to shift the cursor, and after entering the correct password , press the " Confirm Key " to enter the selection operation menu for parameter setting.

5.1.1 Function selection screen

Press the " Compound Key" + " Confirm Key" to enter the function selection screen, and then press the " Confirm Key" to select. There are 2 functions to choose from in this screen;

Parameter number	Functional content	illustrate
1	Parameter settings	Select this function to enter the parameter setting screen.
2	Total Clear	Select this function to reset the total amount of the instrument.

5.1.2 Parameter settings

Press the " Compound Key" + " Confirm Key" to display the "Parameter Setting" function. After entering the instrument password, press the " Confirm Key" to enter the parameter setting state.

5.1.3 Total amount cleared

Press the " Compound Key" + " Confirm Key" to display "Parameter Setting", then press the "Up Key" to turn the page to "Total Reset", enter the total reset password, press the " Confirm Key" , the instrument's reset function is completed, and the total amount inside the instrument is 0.

5.1.4 Parameter setting menu

KFD9000 series has a total of 50 parameters. When using the instrument, the user should set each parameter according to the specific situation. The parameter list is as follows: Parameter setting menu list

parameter serial number	Parameter text	Setting method	Parameter range	Password Level
1	language	choose	Chinese, English	1
2	Correspondence address	Number	0～99	1
3	Baud rate	choose	1200 ～ 38400	1
4	Parity	choose	No parity , odd parity, even parity	1
5	mouth path	choose	3～3000	1
6	Flow Unit	choose	L/h, L/m, L/s, m^3/h, m^3/m, m^3/s	1
7	Range setting	Number	0～99999	1
8	Damping time	choose	1～ 99	1
9	Direction selection	choose	Forward, Reverse	1
10	Flow zero correction	Number	0～±9999	2
11	Small signal cut-off point	Number	0～ 9 99.99%	2
1 2	Allow cutout display	choose	Allow/Disallow	2
1 3	Totalizing Unit	choose	0.001m^3 ~ 1m^3, 0.001L ~ 1L, 0. 00 1 T ~ 1 T	2
1 4	Reverse output enable	choose	Allow, prohibit	2
1 5	Current output type	choose	0～10mA /4～20mA	2
1 6	Pulse output	choose	Frequency/ Pulse	2

	mode			
1 7	Pulse equivalent	choose	$0.001m^3 \sim 1m^3$, 0.001L～1L,	2
1 8	Frequency range	choose	1～ 9 999 Hz	2
19	Sensor coefficient	Number	0.0000 ～ 9.9999	2
20	Empty pipe alarm value	Number	0-9 9999	2
twenty one	Air traffic control alarm allowed	choose	Allow/Disallow	3
twenty two	Upper limit alarm value	Number	000.0 0 ～ 9 99.99 %	3
twenty three	Upper limit alarm allowed	choose	Allow/Disallow	3
twenty four	Lower limit alarm value	Number	000.0 0 ～ 9 99.99 %	3
2 5	Lower limit alarm allowed	choose	Allow/Disallow	3
2 6	Wire break detection allows	choose	Allow/Disallow	3
2 7	Excitation alarm allowed	choose	Allow/Disallow	3
2 8	Total reset password	Number	0-99999	3
2 9	User password setting	User Settings	0-99999	3
30	Excitation mode selection	choose	Method 1, 2, 3	3
31	Flow correction point 1	Number	0.0000 ～ 9.9999	4
32	Flow correction factor 1	Number	00.0 0 ～ 99.99	4
33	Flow correction point 2	Number	00000～99999	4
34	Flow correction factor 2	Number	00000～99999	4
35	Flow correction point 3	Number	00000～99999	4
36	Flow correction factor 3	Number	00000～99999	4
37	Flow correction point 4	Number	00000～99999	4
38	Flow correction factor 4	Number	00000～99999	4
39	Flow correction point 5	Number	00000～99999	4
40	Flow correction factor 5	Number	00000～99999	4
41	Positive	Number	0～9999 99999	4

	cumulative setting			
42	Reverse cumulative setting	Number	0～9999 99999	4
43	Noise suppression	Number	0～999	4
44	Current zero correction	Number	0.0000～1.9999	5
45	Current full scale correction	Number	0.0000～3.9999	5
46	Factory calibration coefficient	Number	0.0000 ～ 9.9999	5
47	Density setting	User Settings	0.000 ～ 9.999	5
48	Remote transmission function enabled	Factory settings	Allow/Disallow	6
49	FarEasTone card number	Factory settings	0～9999 9999	6
50	Remote transmission interval	Factory settings	0 ～ 9999	6

The instrument parameters determine the operating status, calculation method, output mode and status of the instrument. Correctly selecting and setting the instrument parameters can make the instrument operate in the best state and obtain higher measurement display accuracy and measurement output accuracy.

The instrument parameter setting function has 6 levels of passwords. Levels 1 to 5 are user passwords, and level 6 is the manufacturer password. Users can use the level 5 password to reset the level 1 to 4 passwords.

Regardless of the password level, the user can view the instrument parameters. However, if the user wants to change the instrument parameters, a different level of password must be used.

Level 1 password (factory value *****): users can only view instrument parameters;

Level 2 password (factory value *****): users can change 1 to 20 instrument parameters;

Level 3 password (factory value *****): users can change 1 to 30 instrument parameters;

Level 4 password (factory value *****): users can change 1 to 43 instrument parameters;

Level 5 password (factory value 19818): The user can change 1 to 47 instrument parameters.

5.2 Four-key converter parameters and operation

When the meter is powered on, it automatically enters the measurement state. In the automatic measurement state, the meter automatically completes each measurement function and displays the corresponding measurement data. In the parameter setting state, the user uses the four panel keys to complete the meter parameter setting.

5.2.1 Button Functions

Key functions in automatic measurement state

Up key or down key : cycle through the contents displayed on the lower line of the screen;

Compound key + Confirm key: enter parameter setting state;

Press and hold the confirmation button for 5 seconds to return to automatic measurement status.

Long press the button for 10 seconds: enter the forward and reverse flow selection .

Functions of each key in parameter setting state

Down key: the number at the cursor decreases by 1;

Up key: add 1 to the number at the cursor;

Compound key + down key: Move the cursor to the left;

Compound key + up key: Move the cursor right;

Confirm key: Enter/exit submenu;

Confirm key: In any state, press and hold for 5 seconds to return to automatic measurement state.

Note: (1) When using the “compound key”, you should first press the compound key and then press and hold the “up key” or “down key” at the same time.

(2) In the parameter setting state, if no key operation is performed within 3 minutes, the instrument automatically returns to the measurement state.

(3) To select the flow direction for flow zero correction, move the cursor to the leftmost "+" or "-" and use the "up key" or "down key" to switch it to the opposite direction of the actual flow direction.

5.3 Detailed parameter description of the instrument

5.3.1 Language

The electromagnetic converter has two languages, Chinese and English, and users can choose to operate it.

5.3.2 Correspondence address

Refers to the communication address of this table when multiple machines are communicating. The optional range is: 01 ~ 254 addresses, and address 0 is reserved.

5.3.3 Baud rate

The converter communication baud rate selection range is: 1200, 2400, 4800, 9600 , 14400, 19200 , 38400.

5.3.4 Parity check

The converter has multiple communication check modes such as no check, odd check, even check, etc. , and users can choose the operation by themselves.

5.3.5 Pipeline diameter

The sensor diameter range of the electromagnetic flowmeter converter is 3 to 3000 mm.

5.3.6 Flow units

Select the flow display unit in the parameters. The flow display units of the instrument are: L/s, L/m, L/h, m^3/s, m^3/m, m^3/h. Users can select a suitable flow display unit according to process requirements and usage habits.

5.3.7 Range setting

The instrument range setting refers to determining the upper limit flow value, and the lower limit flow value of the instrument is automatically set to "0".

Therefore, the instrument range setting determines the instrument range, which also determines the corresponding relationship between the instrument percentage display, instrument frequency output, instrument current output and flow rate:

Instrument percentage display value = (flow value measurement / instrument range) * 100%;

Instrument frequency output value = (flow value measurement value/instrument range) * frequency full range value;

Instrument current output value = (flow value measurement value/instrument range) * current full scale value + base point;

The meter pulse output value is not affected by the meter range setting;

5.3.8 Damping time

Long measurement filter time can improve the stability of flow display and output signal of the instrument, and is suitable for measuring pulsating flow with total accumulation. Short measurement filter time shows fast measurement response speed, and is suitable for production process control. The setting of measurement filter time adopts selection mode.

5.3.9 Direction selection

If the user believes that the fluid direction during debugging is inconsistent with the design, the user does not need to change the connection method of the excitation line or signal line, but can change the flow direction setting parameter.

5.3.10 Flow rate zero point correction

When correcting the zero point, ensure that the sensor tube is filled with fluid and the fluid is in a static state. The flow zero point is expressed by the flow velocity in mm/s.

The converter flow zero correction is shown as follows:

FS = ○ ○ ○ ○ ○
± ○ ○ ○ ○ ○

The upper line shows in small characters: FS represents the zero point measurement value of the instrument;

The lower line shows in large characters: flow rate zero point correction value;

When FS is not displayed as "0", the correction value should be adjusted to make FS = 0. Note: If the downstream correction value is changed, the FS value increases, and the positive and negative signs of the downstream value need to be changed so that FS can be corrected to zero.

The correction value of flow zero point is the matching constant value of the sensor and should be recorded in the sensor record sheet and sensor label. When recorded, the sensor zero point value is the flow velocity value in mm/s, and its sign is opposite to the sign of the correction value.

5.3.11 Small signal cut - off point

The small signal cut-off point setting is expressed as a percentage of the range flow rate. When the small signal is cut off, the user can choose to cut off the display and signal output of the flow rate, flow velocity and percentage at the same time; or choose to cut off only the current output signal and frequency (pulse) output signal, and keep the display of flow rate, flow velocity and percentage.

5.3.12 Integration units

The converter display is a 9-digit counter with a maximum allowable count value of 999999999.

The calculation units used are L, m^3, T (liters, cubic meters).

Flow integration equivalent: 0.001 T , 0.010 T , 0.100 T , 1.000 T ;

0.001L, 0.010L, 0.100L, 1.000L;

0.001m^3, 0.010m^3, 0.100m^3, 1.000m^3;

5.3.13 Reverse output enable function

When the reverse output permission parameter is set to "allowed", as long as the fluid flows, the converter will output pulses and current according to the flow value. When the reverse output permission parameter is set to "prohibited", if the fluid flows in the reverse direction, the converter output pulse is "0" and the current output is signal " 4 " (4mA or 0mA).

5.3.14 Current output type

Users can select 0～10mA or 4～20mA current output in the current output type.

5.3.1 5 Pulse output mode

There are two pulse output modes: frequency output and pulse output.

- Frequency output mode: The frequency output is a continuous square wave, and the frequency value corresponds to the flow percentage.

Frequency output value = (flow measurement value/meter range) * frequency full range value;

- Pulse output mode: The pulse output is a rectangular wave pulse train. Each pulse represents a flow equivalent flowing through the pipeline. The pulse equivalent is selected by the "pulse equivalent unit" parameter below. The pulse output mode is mostly used for total accumulation and is generally connected to an integrator.

Frequency output and pulse output are generally in the form of OC gate. Therefore, external DC power supply and load should be connected.

Section 4.5 .

5.3.1 6 Pulse Equivalent

The pulse unit equivalent refers to the flow value represented by a pulse. The instrument pulse equivalent selection range is:

Pulse equivalent	Flow value	Pulse equivalent	Flow value
1	0.001L/cp	5	0.001 m^3 /cp
2	0.01L/cp	6	0.01 m^3 /cp
3	0.1L/cp	7	0.1 m^3 /cp
4	1L/cp	8	01 m^3 /cp

At the same flow rate, if the pulse equivalent is small, the frequency of the output pulse is high and the accumulated flow error is small.

5.3.17 Frequency range

100% of the percentage flow. The frequency output upper limit value can be set arbitrarily within the range of 1 to 5000 Hz.

5.3.18 Sensor coefficient value

Sensor coefficient: the calibration coefficient of the electromagnetic flowmeter. This coefficient is obtained from the actual calibration and printed on the sensor nameplate. The user must place this coefficient in the KFD9000 converter parameter table .

5.3.19 Empty pipe alarm value 1-2

There are two empty pipe alarm values for the converter, empty pipe alarm value 1 and empty pipe alarm value 2. The default value of value 1 is 500, and the default value of value 2 is 200. The technicians can set it according to the actual sensor situation , and it is generally set to the default .

5.3.20 Air traffic control alarm allowed

The converter has an empty pipe detection function, and no additional electrodes are required. If the user chooses to allow the empty pipe alarm , the instrument can detect an empty pipe state when the fluid in the pipeline is lower than the measuring electrode. After detecting the empty pipe state, the instrument analog output and digital output are set to signal zero, and the instrument flow display is zero . The user chooses to allow or prohibit.

5.3.21 Upper limit alarm value

The upper limit alarm value is calculated as a percentage of the range. This parameter is set numerically. The user sets a value between 0% and 999.99 % . If the alarm condition is met during the operation of the instrument, the instrument will output an alarm signal.

5.3.22 Upper limit alarm allowed

The user chooses to allow or prohibit.

5.3.23 Lower limit alarm value

The lower limit alarm value is calculated as a percentage of the range. This parameter is set numerically. The user sets a value between 0% and 999.99 % . When the alarm condition is met during the operation of the instrument, the instrument will output an alarm signal.

5.3.24 Lower limit alarm permission

The user can choose to allow or prohibit

5.3.25 Disconnection detection allowed

The converter has a line detection function , which can reflect the line condition of the instrument itself. The user can choose to allow or prohibit it according to the needs . The expression mode is: empty pipe alarm/ground fault, empty pipe alarm/signal fault, empty pipe alarm.

5.3.26 Excitation alarm

Select "allow" to enable the excitation alarm function, and select "disable" to cancel the excitation alarm function.

5.3.27 Total reset password

Users with passwords above level 5 can set this password, and then set this password within the total reset.

5.3.28 User password setting

Users with passwords above level 5 can set this password. Note: Please remember the set password and return it to the factory if lost.

5.3.29 Excitation mode selection

The electromagnetic converter provides three excitation frequency options: 1/10 power frequency (mode 1), 1/16 power frequency (mode 2), and 1/25 power frequency (mode 3). The excitation system of a small-diameter sensor has a small inductance, so 1/10 power frequency should be selected. The excitation system of a large-diameter sensor has a large inductance, so the user can only choose 1/16 power frequency or 1/25 power frequency. During use, first select excitation mode 1. If the zero point of the flow rate of the instrument is too high, then select mode 2 or mode 3 in turn. Note: The excitation mode in which the calibration is performed must be the same as the excitation mode in which the calibration is performed.

5. 3. 30 Flow correction points 1-5

For flow correction points and coefficients 31-41, please refer to Appendix 1 "Non-linear Correction Function Description" .

5.3.31 Positive cumulative setting

forward cumulative setting can change the value of the forward cumulative total, which is mainly used for instrument maintenance and instrument replacement.

The user enters with the Level 5 password and can modify the positive cumulative amount (Σ+). Generally, the cumulative amount cannot exceed the maximum value counted by the counter (9999999999) .

5.3.32 Reverse accumulation setting

reverse accumulation setting can change the value of the reverse accumulation total, which is mainly used for instrument maintenance and instrument replacement.

the cumulative amount cannot exceed the maximum value of the counter (999999999) .

5.3.33 Noise suppression

For measurements in interference environments , noise, magnetic fields or pulse groups will be generated to disrupt the normal measurement of the instrument . To overcome such interference, the converter adopts a rate-of-change suppression algorithm. The converter is designed with a reset counter. The smaller the value , the greater the interference suppression rate .

5.3.34 Current zero point correction

The converter is factory-adjusted for current output zero point, so that the current output is accurately 0mA or 4mA.

5.3.35 Current full scale correction

The converter is factory-adjusted to full scale current output, so that the current output is exactly 10mA or 20mA.

5.3.36 Factory calibration coefficient

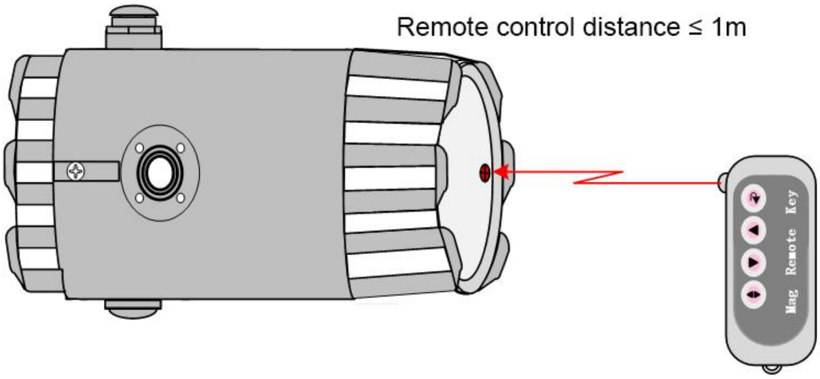
This coefficient is a special coefficient for the converter manufacturer. The converter manufacturer uses this coefficient to normalize the electromagnetic converter measurement circuit system to ensure that the interchangeability between all electromagnetic converters reaches 0.1%.

5.3.37 Density setting

It can be used when the integration unit is adjusted to mass unit.

6. Infrared handheld remote control keyboard

The operation of the infrared handheld remote control keyboard of the instrument is the same as the keyboard operation of the instrument. When operating, please place the infrared transmitting port of the infrared handheld remote control keyboard parallel to the infrared receiving port of the instrument, with a distance of about 1m. For specific operation, see the figure below:



7. Alarm information

The printed circuit board of the electromagnetic flow converter adopts surface welding technology, which is not repairable by the user. Therefore, the user cannot open the converter housing.

The intelligent converter has a self-diagnosis function. Except for power supply and hardware circuit failures, faults in general applications can correctly give alarm information. These information are prompted with "  " on the left side of the display. In the measurement state, the instrument automatically displays the fault content as follows:

FQH ---- flow upper limit alarm; FQL ---- flow lower limit alarm;

FGP ---- Fluid empty pipe alarm; SYS ---- System excitation alarm;

8. Troubleshooting

8.1 No display on the instrument

* Check whether the power is on;

* Check whether the power fuse is intact;

* Check whether the power supply voltage meets the requirements;

8.2 Excitation alarm

* Whether the excitation wiring EX1 and EX2 are open;

* Whether the total resistance of the sensor excitation coil is less than 150Ω;

* Is the resistance of excitation EX1 and EX2 to GND ⩾ 10MΩ ?

8.3 Air Traffic Control Alarm

* Whether the measuring fluid fills the sensor measuring tube;

* Use wires to short-circuit the three points of the converter signal input terminals SIG1, SIG2 and SIGGND. If the "empty pipe" prompt disappears, it means the converter is normal. It may be that the conductivity of the measured fluid is low or the empty pipe threshold and empty pipe range are set incorrectly.

* Check whether the signal connection is correct;

* Check whether the sensor electrode is normal:

  When there is flow, the resistance of terminals SIG1 and SIG2 to SIGGND should be less than 50kΩ (measured value for water medium. It is best to use a pointer multimeter to measure, and charging and discharging can be seen during the measurement process).

* The DC voltage between DS1 and DS2 measured with a multimeter should be less than 1V, otherwise it means that the sensor electrodes are contaminated and should be cleaned.

8.4 The measured flow rate is inaccurate

* Check whether the fluid fills the sensor measuring tube;

* Whether the signal line connection is normal;

* Check whether the sensor coefficient and sensor zero point are set according to the sensor nameplate or factory calibration sheet;

9. Packing and storage

9.1 Packing

The electromagnetic flowmeter is packed in foam or fixed wooden box before leaving the factory , which is drop-proof . After receiving the goods, check whether the outer packaging is intact. If there is any damage, please contact the salesperson or dealer for timely processing .

The random documents include: one copy each of installation and operation manual, product certificate and packing list.

9.2 Transportation and storage

To prevent the instrument from being damaged during operation, please keep the packaging state of the manufacturer before arriving at the installation site. When storing, the storage location should be indoors with the following conditions: rainproof, moisture-proof, small mechanical vibration, and avoid impact; temperature range -20～+60℃; humidity not more than 80% .

Appendix 1: Nonlinear Correction Function Description

The nonlinear correction function is, in principle, used for linear adjustment of small flow rates (0.5m/s or less). This function is designed with 5 correction levels, which are divided into 5 correction points and 5 correction coefficients. The flow rates corresponding to the correction points must meet the following conditions: **0 < correction point 1 (1.0m/s) < correction point 2 (2.0m/s) < correction point 3 (3.0m/s) < correction point 4 (4.0m/s) < correction point 4 (5.0m/s). Each correction point defaults to 0.00m/s and each correction coefficient defaults to 1.0000 when leaving the factory.**

The correction calculation is performed on the original sensor flow coefficient curve, so the sensor coefficient should be marked first. According to the marked sensor nonlinearity, set the correction point range and correction coefficient to perform segmented correction. If the coefficient is set appropriately, no recalibration is required. **Note: When correction point 1 is set to 0.00 m/s, the correction function is turned off, otherwise it is turned on.**

The original flow rate in the formula is the actual standard flow rate, and the corrected flow rate is called **the corrected flow rate**. The correction calculation formula is as follows:

When flow correction point 1 is set to 1.00m/s ;

Corrected flow rate = in the instrument flow rate range of 0-1m/s; flow correction coefficient 1 × original flow rate;

when flow correction point 2 is set to 2.00m/s ;

Corrected flow rate = in the instrument flow rate range of 1-2m/s; flow correction coefficient 2 × original flow rate;

When flow correction point 3 is set to 3.00m/s ;

Corrected flow rate = in the instrument flow rate range of 2-3m/s; flow correction coefficient 3 × original flow rate;

when flow correction point 4 is set to 4.00m/s ;

Corrected flow rate = in the instrument flow rate range of 3-4m/s; flow correction coefficient 4 × original flow rate;

when flow correction point 5 is set to 5.00m/s ;

Corrected flow rate = instrument flow rate in the range of 4-5m/s; flow correction coefficient 5 × original flow rate;

at this time, when the flow rate is greater than 5m/s = original flow rate;

in the formula, if the instrument only uses flow correction point 1 set to 1.00m/s for correction, and other correction points are set to the default setting of 0.00m/s , the converter will only correct in the range of 0-1m/s, and at this time, when the flow rate is greater than 1m/s = original flow rate .

Appendix 2: Excitation frequency selection (reference)

The electromagnetic converter provides three excitation frequency options: 1/8 power frequency (mode 1), 1/10 power frequency (mode 2), and 1/16 power frequency (mode 3). The excitation system of a small-diameter sensor has a small inductance, so 1/10 power frequency should be selected. The excitation system of a large-diameter sensor has a large inductance, so the user can only choose 1/16 power frequency or 1/25 power frequency. During use, first select excitation mode 1. If the zero point of the flow rate of the instrument is too high, then select mode 2 or mode 3 in turn.

When the electromagnetic converter is matched with the user sensor, it often happens that the resistance of the user sensor excitation coil does not meet the requirements of the electromagnetic converter. At this time, according to the specific situation, the following treatment can be done:

（1） Small excitation coil resistance

If the resistance of the excitation coil is less than the resistance required by the converter, you can use the method of connecting a series resistor in the excitation coil loop to make the total resistance meet the requirements of the converter. The power of the series resistor should be greater than twice the actual power consumption. For example, if a 10Ω resistor is connected in series at a current of 250 mA, its power should be 3W.

（2） The excitation coil resistance is large (change the excitation current)

If the resistance of the excitation coil is greater than the resistance required by the converter, you can choose to change the excitation current. For example, if the resistance of the excitation coil is 70Ω, the coil resistance is too large for an excitation current of 250 mA. In this case, the excitation current can be changed from 250 mA to 187 mA.

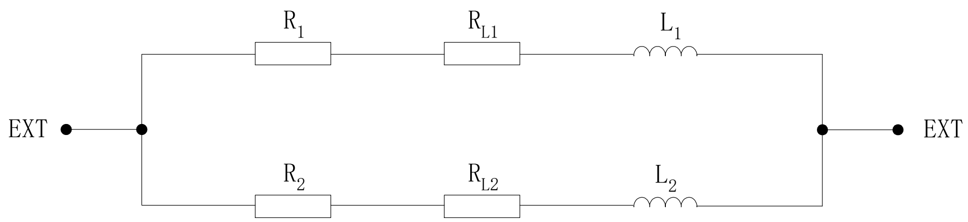
（3） The resistance of the excitation coil is large (change the coil connection method)

If the resistance of the excitation coil is greater than the resistance required by the converter, you can choose to change the coil connection method. For example, if the total resistance of the excitation coil is 200Ω, then the resistance of each excitation coil is 100Ω. By connecting the upper and lower excitation coils in parallel, the resistance of the coils in parallel can meet the requirements. If the resistance of the coils in parallel is too small, you can use the series resistor method to solve it.

According to the above analysis, change the excitation coil wiring method of the sensor and measure from both ends of the excitation coil.

Make total resistance = (R1 + RL1) in parallel (R2 + R_{L2} ） ≤ 120Ω;

(As shown in the figure: R1 , R2 - external resistors; RL1 , RL2 - excitation coil resistors)



(4) The sensor excitation current takes too long to stabilize (the inductance is too large)

For the problem of long stabilization time of excitation current, the first solution is to change the excitation mode, using 1/16 or 1/25 power frequency.

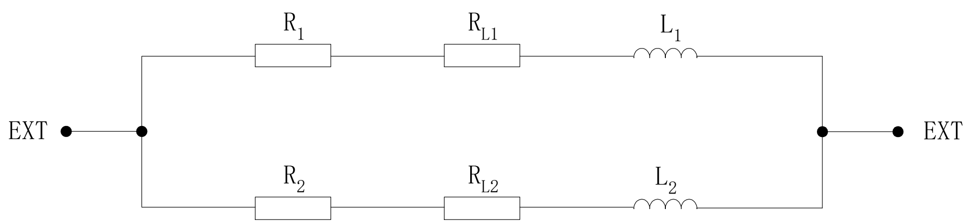
If changing the excitation method cannot meet the use requirements, the coil connection method can still be used to solve the problem.

Excitation current transit time $\tau = L / R$

Where: L is the inductance of the excitation coil; R is the resistance of the excitation coil.

Therefore, decreasing L or increasing R will decrease τ.

According to the above analysis, change the sensor's excitation coil wiring method, as shown below:



R_1, R_2 —— external resistors; R_{L1}, R_{L2} —— excitation coil resistance.

connecting resistors R1 and R2 in series , the total resistance (R1 + RL1) is connected in parallel $(R_2 + R_{L2}) \leq 120\Omega$;