Intelligent Electromagnetic Flow Converter Manual FTEMF30-36

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I. Overview, characteristics and uses of electromagnetic flowmeter products

1.1 Product Overview

Electromagnetic flowmeters (EMF) are new types of flow measuring instruments that developed rapidly with the development of electronic technology in the 1950s and 1960s. The electromagnetic flowmeter is a meter that applies the principle of electromagnetic induction to measure the flow of conductive fluid according to the electromotive force induced by the conductive fluid passing through the external magnetic field.

1.2 Product feature

★Unaffected by changes in fluid density, viscosity, temperature, pressure and conductivity, the linear measurement principle enables high-precision measurements;

★The measuring tube has no obstruction and moving parts, and the pressure loss is small, so it will not cause additional energy loss and will not cause clogging. The energy saving effect is remarkable, especially suitable for liquid-solid two-phase flow medium Measurement., such as sewage, mud, pulp, pulp, etc.

★ Low installation requirements, only 5D length is required for the front straight pipe section and 3D length for the rear straight pipe section (D is the inner diameter of the selected instrument)

★ Nominal diameter DN3-DN3000 has a wide coverage range, and there are many options for lining and electrodes, which can meet the requirements of measuring various conductive flows.

★ With MODBUS-RS485, HART, GPRS and PROFIBUS and other communication signal output (optional)

★ Converter adopts 32-bit embedded microprocessor, full digital processing, fast calculation speed, strong anti-interference ability, reliable measurement, high precision, measuring range up to 150:1

★High-definition back-lit LCD display, full English menu operation, easy to use, easy to operate, easy to learn and understand;

★ With conductivity measurement function, it can judge whether the sensor is empty or not, and has self-test and self-diagnosis function;

★ The internal calculator can display positive cumulative flow, reverse cumulative flow and instantaneous flow respectively.

★Plug-in electromagnetic flowmeter, easy to install, can continuously flow the field with pressure opening, has absolute installation advantages and price advantages.

1.3 Product application

An electromagnetic flow meter can be used to measure the volumetric flow of a conductive fluid in a closed conduit. It is widely used in the measurement and control of flow in industrial and agricultural production processes such as petroleum, chemical, steel and metallurgy, water supply and drainage, water conservancy irrigation, water treatment, environmental sewage measurement and control, paper making, medicine, food, etc.

★Use environmental conditions

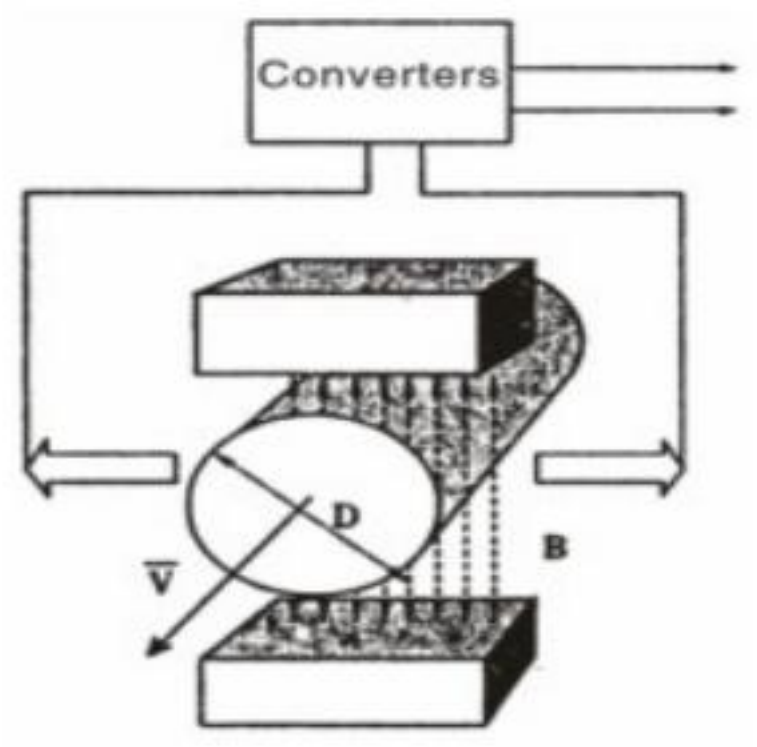
Ambient temperature: sensor -25°C～+60°C converter -10°C～+60°C

Relative humidity: 5% to 95%

★ working conditions

Fluid conductivity: higher than 20μS/cm (electrical conductivity of tap water and raw water is about 100~5005μS/cm)

II, The working principle



(1)Working principle diagram

2.1 Mathematical physics model

The measuring principle of the electromagnetic flowmeter sensor is based on Faraday's law of electromagnetic induction. A pair of detecting electrodes are mounted on the wall of the tube perpendicular to the axis of the measuring tube and the magnetic field lines of the magnetic field. When the conductive liquid moves along the axis of the measuring tube, the conductive liquid acts as cutting magnetic

line. An induced potential is generated, which is detected by two electrodes on the measuring tube, and the magnitude is: E=K·B·V·D

Where: E - induced potential

K — meter constant

B - magnetic induction

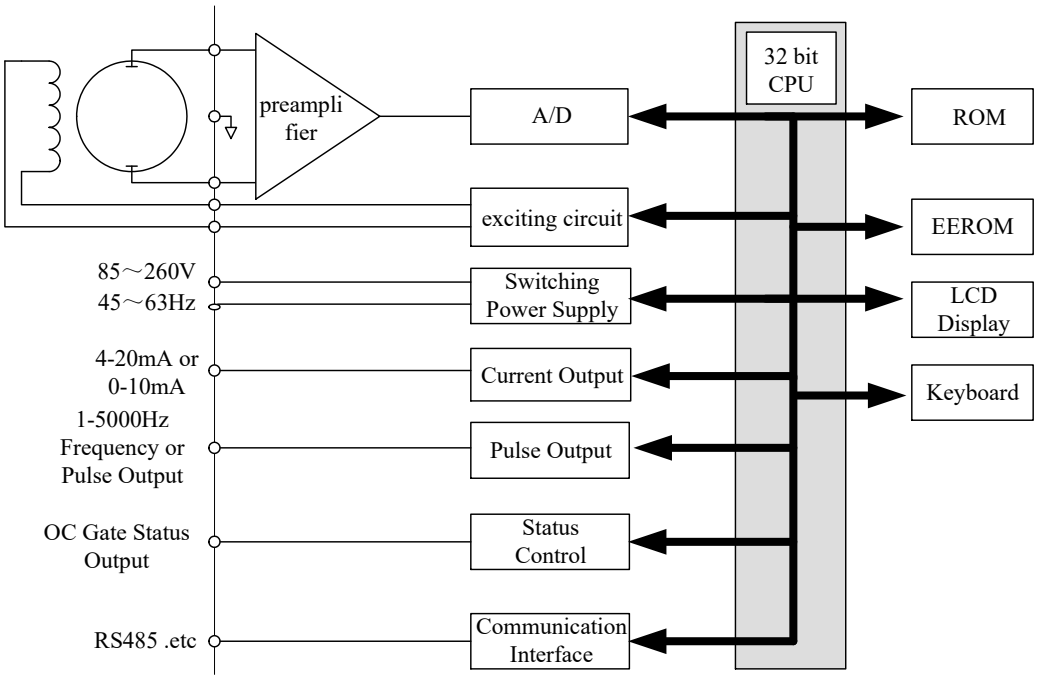
V—measuring the average flow velocity in the cross section of the tube

D—the inner diameter of the measuring tube

When measuring the fluid, the fluid flows through a magnetic field perpendicular to the direction of flow. The flow of the conductive fluid induces a potential proportional to the average flow rate, thus requiring that the conductivity of the flowing liquid being measured be above the minimum conductivity. The induced voltage signal is detected by two electrodes and transmitted to the converter through the cable. After signal processing and correlation calculation, the accumulated flow rate and instantaneous flow rate are displayed on the display screen of the converter.

2.2 converter circuit structure

The electromagnetic flowmeter converter provides a stable excitation current to the excitation coil of the electromagnetic flow sensor. The preamplifier amplifies and converts the electromotive force induced by the sensor into a standard current signal or a frequency signal, which facilitates the display, control and adjustment of the flow. The following figure shows the converter circuit structure:



(2)Converter circuit structure

III, Product structure and product form

3.1 Product structure

The structure of the electromagnetic flowmeter is mainly composed of a magnetic circuit system, measuring conduit, electrodes, housing and converter. The components of the magnetic circuit system, measuring conduit electrodes and housing are called electromagnetic sensors.

★ Magnetic circuit system: its role is to produce a uniform DC or AC magnetic field

★Measuring conduit: its function is to pass the conductive medium to be tested. In order to prevent the magnetic flux from being shunted or short-circuited when the magnetic flux passes through the measuring conduit, the measuring conduit must adopt non-magnetic permeability, low electrical conductivity, low thermal conductivity and certain mechanical strength. Made of materials, stainless steel, glass reinforced plastic, high-strength plastic, etc., which are non-magnetic.

★ Electrode: Its function is to draw and measure the induced potential signal proportional to it. The electrodes are typically made of non-magnetically conductive stainless steel and are required to be flush with the liner so that the fluid passes unimpeded.

★ Lining: There is a complete electrical insulation lining on the inside of the measuring tube and on the flange sealing surface. It directly contacts the medium to be measured, and its function is to increase the corrosion resistance of the measuring conduit and prevent the induced potential from being short-circuited by the metal measuring tube wall. Lining materials are mostly corrosion-resistant, high-temperature resistant, wear-resistant rubber, fluoroplastics, ceramics, etc.

★Converter: The induced potential signal generated by the flow of the medium is very weak and is greatly affected by various interference factors. The function of the converter is to amplify and convert the induced potential signal into a unified standard signal and suppress the main interference signal. Its task is to amplify and convert the induced potential Ex signal detected by the electrode into a unified standard DC signal.

3.2 Product composition

The electromagnetic flowmeter is divided into two types: an integrated electromagnetic flowmeter and a split type electromagnetic flowmeter according to different display modes. Split-type electromagnetic flowmeters require dedicated cables to connect converters and sensors. Both can be used in the specified explosion-proof places.

3.3 selection of Electrode and lining

The electromagnetic flowmeter is available in 7 different electrodes and a lining of 7 different materials.

Table 1: Electrode material and scope of application

No.	Electrode material	Scope of application
1	316L	For the measurement of water, sewage or slightly corrosive media of inorganic and organic acids.
2	B（HB）	It has good corrosion resistance to hydrochloric acid at all concentrations below the boiling point, and is also resistant to corrosion by non-oxidizing acids, alkalis, and non-oxidized salt liquids such as sulfuric acid, phosphoric acid, hydrofluoric acid, and organic acids.
3	C（HC）	Resistant to oxidizing acids such as nitric acid, mixed acid, or corrosion of mixed media of chromic acid and sulfuric acid; also resistant to oxidizing salts such as Fe+++, Cu++ or other oxidizing agents, such as hypochlorite solutions above normal temperature, Corrosion of sea water.
4	Ti	It is resistant to seawater, various chlorides and hypochlorites, oxidizing acids (including fuming nitric acid), organic acids, alkalis, etc.; it is not resistant to corrosion by purer reducing acids (such as sulfuric acid and hydrochloric acid), but is like acid. When oxidants (such as nitric acid, Fe+++, Cu++) are contained, the corrosion resistance is greatly reduced.。
5	Ta	It has excellent corrosion resistance and is very similar to glass. In addition to hydrofluoric acid, fuming sulfuric acid, fuming nitric acid, alkali, it is almost resistant to corrosion by all chemical media including boiling point hydrochloric acid, nitric acid, and sulfuric acid. Not resistant to corrosion in alkali.
6	Platinum rhodium alloy	It is suitable for almost all chemicals, but not for aqua regia and ammonium salts.
7	Tungsten carbide	Good wear resistance, can be used for the measurement of high-abrasion medium, such as pulp, slurry and so on.

Table 2: Lining material, performance and scope of application

NO.	Lining material	Main performance	Scope of application
1	Neoprene (CR)	Oil resistant, solvent resistant, oxidation resistant, resistant to general acid and alkali salts and other media corrosion. 2. Excellent elasticity and wear resistance, but poor cold resistance.	1. Non-strong acid, strong alkali, strong oxidizing medium from 0 °C to 80 °C 2. It can measure sewage and mud.
2	Silicone rubber (FVMQ)	1. Good low temperature resistance, can still work normally at -55 °C 2. Excellent heat resistance, long-term work at 180 ° C	1. Non-wearing non-corrosive medium from -25 ° C to 150 °C 2. Suitable for high temperature fluid conditions
3	Polyurethane rubber (PU)	1. Excellent wear resistance and elasticity. 2. Poor acid and alkaline.	1. -25°C～60°C 2. Neutral strong wear of pulp, coal slurry, mud
4	PFA	1. Hydrophobic and non-tacky, strong high temperature resistance. 2. Excellent corrosion resistance, strong acid, alkali, organic solvent and various salt solutions. 3. The anti-negative pressure ability is better, and the metal mesh can be added to further improve the negative pressure resistance performance. 4. The wear resistance is poor.	1. Non-strong abrasive media from -25 ° C to 140 ° C 2. Hygienic media
5	Polyperfluoroethylene propylene （F46）	1. It is hydrophobic and non-sticky. 2. Corrosion resistance is second only to PFA. 3. Metal mesh can be added to improve the negative pressure resistance. 4. Poor wear resistance.	1. Non-strong abrasive media from -25 ° C to 100 ° C 2. Hygienic media
6	PTFE	1. The most stable chemical material in plastics, resistant to boiling hydrochloric acid, sulfuric acid, nitric acid and aqua regia, also resistant to concentrated alkali and various organic solvents, not resistant to chlorine trifluoride, high temperature trifluorooxidation, high flow rate Corrosion of liquid fluorine, liquid oxygen, and ozone. 2. Poor wear resistance. 3. Poor anti-negative pressure, easy to appear deformation or breakage of the lining, resulting in electrode leakage.	1. -25℃～140℃ 2. Strong corrosive medium such as concentrated acid and alkali 3. Hygienic media
7	Ceramics （AL2O3）	1. High wear resistance, high negative pressure resistance 2. Long-term stability is excellent and accuracy is high 3. Excellent corrosion resistance, can measure mixed acid, aqua regia 4. Excellent heat resistance and thermal shock resistance	1. Chemical industry 2. Mining 3. Food industry

IV. Product technical performance indicators

4.1 Overall unit and sensor

Executive standard	《JJG1003-2007 Electromagnetic Flowmeter》			
Maximum flow rate	15m/s			
Fluid conductivity	≥5μS/cm			
Precise rating	±0.2% of the indicated value, ±0.5% of the indicated value			
Nominal diameter（mm）	3、6、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、1400、1600、1800、2000、2200、2400、2600、2800、3000			
Nominal pressure	10.0MPa、6.3MPa、4.0MPa、2.5MPa、1.6MPa、1.0MPa、0.6MPa			
Ambient temperature	Sensor	-25℃～+60℃		
	Converter and integrated type	-10℃～+60℃		
Lining material	Neoprene, polytetrafluoroethylene(PTFE), urethane rubber, polyperfluoroethylene propylene (F46), PFA, ceramics, etc.			
Signal electrode type	Fixed, scraper, detachable			
Signal electrode and ground electrode material	316L, Hastelloy B, Hastelloy C, titanium, tantalum, platinum-rhodium alloy, tungsten carbide			
Connecting flange material	Carbon steel, stainless steel (304, 316, 316L)			
Connection flange standard	GB, Ministry of Machinery Standard, Ministry of Chemical Industry Standard, ANSI, Japanese Standard			
Grounding ring material	Stainless steel1Cr18Ni9Ti			
Electrical Interface	M18*1.5、M20*1.5, 1/2NPT			
Transmission distance	Split-type electromagnetic flowmeter, the signal cable is connected between the sensor and the converter. The cable length should be less than 100m.			
Shell protection	EntireIP65	Sensor IP68 Converter IP65	Sensor IP67 Converter IP65	Entire IP68
Supply voltage	220VAC、24VDC、3.6VBattery powered, 24VDC and battery powered			
Power consumption	<20W			
Display function	Display in English and Chinese, can display instantaneous flow, accumulated flow and alarm display (excitation alarm, air traffic alarm, flow over limit alarm)			

4.2 Flow range

4.2 Flow range

Flow rate and flow velocity comparison table

	0.3	0.4	0.5	1	2	3	4	5	6	7	8	9	10
10	0.09	0.11	**0.14**	0.28	0.57	0.85	1.1	**1.4**	1.7	2	2.3	2.5	2.8
15	0.2	0.3	**0.3**	0.6	1.3	1.9	2.5	**3**	3.8	4.5	5.1	5.7	6.3
20	0.4	0.5	**0.6**	1.1	2.3	3.4	4.5	**6**	6.8	7.9	9	10	11
25	0.6	0.7	**0.9**	1.8	3.5	5.3	7.1	**9**	11	12	14	16	17
32	0.9	1.2	**1.5**	2.9	5.8	8.7	12	**15**	17	20	23	26	28
40	1.4	1.8	**2.3**	4.5	9	14	18	**23**	27	32	36	41	45
50	2.2	2.8	**3.5**	7.1	14	21	28	**35**	42	49	57	64	70
65	3.6	4.8	**6**	12	24	36	48	**60**	72	84	96	100	110
80	5.4	7.2	**9**	18	36	54	72	**90**	100	120	140	160	180
100	8.4	11	**14**	28	57	85	110	**140**	170	190	220	250	280
125	14	17	**22**	44	80	130	170	**220**	260	300	350	390	440
150	20	25	**31**	64	120	190	250	**310**	380	440	500	570	630
200	34	45	**57**	110	220	340	450	**560**	670	790	900	1000	1100
250	54	71	**88**	180	350	530	700	**880**	1000	1200	1400	1500	1700
300	77	100	**120**	250	500	760	1000	**1200**	1500	1700	2000	2200	2500
350	110	140	**170**	350	690	1000	1300	**1700**	2000	2400	2700	3100	3400
400	140	180	**230**	450	900	1300	1800	**2200**	2700	3100	3600	4000	4500
450	180	230	**290**	570	1100	1700	2300	**2800**	3400	4000	4500	5100	5700
500	220	280	**350**	710	1400	2100	2800	**3500**	4200	4900	5600	6300	7000
600	310	410	**500**	1000	2000	3000	4000	**5000**	6100	7100	8100	9100	10000
700	420	550	**700**	1400	2700	4100	5500	**7000**	8300	9600	11000	12000	13000
800	550	720	**900**	1800	3100	5400	7200	**9000**	10000	12000	14000	16000	18000
900	690	920	**1100**	2300	4500	6800	9100	**11000**	13000	16000	18000	20000	22000
1000	850	1100	**1400**	2800	5600	8500	11000	**14000**	16000	19000	22000	25000	28000
1200	1300	1600	**2000**	4100	8100	12000	16000	**20000**	24000	28000	32000	30000	40000
1400	1700	2200	**2800**	5500	11000	16000	22000	**28000**	33000	38000	44000	50000	55000
1600	2200	2900	**3600**	7200	14000	21000	29000	**36000**	43000	50000	57000	65000	72000
1800	2800	3700	**4600**	9200	18000	27000	36000	**46000**	54000	64000	73000	82000	91000
2000	3400	4500	**5600**	11000	22000	34000	45000	**56000**	67000	79000	90000	100000	110000
2200	4200	5500	**6800**	14000	27000	41000	56000	**68000**	82000	95000	110000	120000	130000
2400	4900	6500	**8100**	16000	32000	48000	68000	**81000**	97000	110000	130000	140000	160000
2600	5800	7600	**9500**	19000	38000	57000	76000	**95000**	110000	130000	150000	170000	190000
2800	6700	8900	**11000**	22000	44000	66000	88000	**110000**	130000	150000	170000	190000	220000
3000	7700	10000	**12000**	25000	50000	76000	100000	**120000**	150000	170000	200000	220000	250000

4.3 Protection level description

The protection level of the electromagnetic flowmeter casing can be divided into the following according to the national standard GB4208:

★IP65: Water spray type It is allowed to spray water from the instrument in any direction with water spray. The spray pressure is 30kPa, the water output is 12.5L/Min, and the spray nozzle is 3m away from the meter.

★IP67: Immersion type The instrument can be fully immersed in water (1m underwater) for a short time, 30min.

★IP68: Submersible type It can negotiate with the manufacturer for the long-term work under water (5m underwater).

Note: The protection level should be selected according to the above requirements and the actual conditions of the instrument. If the instrument is installed under the ground and is often flooded or the instrument is installed on the ground, the air humidity is high. The split type should be selected. The sensor IP68 should be placed in the protection. Inside the box or indoors.

4.4 Explosion protection instructions

★ Explosion-proof mark: Ex d ib IIC T6 GB

★ Product standard: Q/FT001-2019

★ Assembly drawing no.: FTEMF-50-000

Explosion-proof grade: EX ia IIc T5

EX ———— Explosion-proof electrical signs

Ia ———— Intrinsically safe

IIc———— Gas Group IIC Level

T5———— Temperature Group

4.5 Main performance of the converter:

■ Low-frequency square-wave exciting，exciting frequency：1/16 power frequency、1/20power frequency、1/25 power frequency;

■ High-frequency square-wave exciting，exciting frequency：1/2 power frequency（for grouting liquid measure）(This function is selectable);

■ No need to add empty pipeline measurement, and can measure continuously, alarm by fixed value;

■ Speed range：0.1 --- 15m/s，Speed resolution：0.5mm/s;

■ AC high-frequency switching power，range of voltage：85VAC --- 250VAC;

■ DC 24V switching power，range of voltage：20VDC --- 36VDC；

■ Network function：MODBUS、HART、GPRS、PROFIBUS 、Analog Loop Communication interface(This function is optional.)；

- Chinese or English displaying mode, (other languages can be customized);
- Three integrator gross inside, respective register: Forward gross, reverse gross and minus value gross.
- 4.5.1 Especial function
- Record the time when the power is turned off. This function can record the power interrupted time of instrument system automatically and recruit to count the missing flux；
- Record the hour gross. This function can record the flux gross in hours and fit for timed measure;
- The infrared handing keyboard can far-untouched operate all functions of converter.

4.5.2 Normal operating conditions

Ambient Temperature Ranges： –10～+60℃;

Relative Humidity：5%～90%;

Power Supply: 85～250V，45～63Hz (single-phase AC).

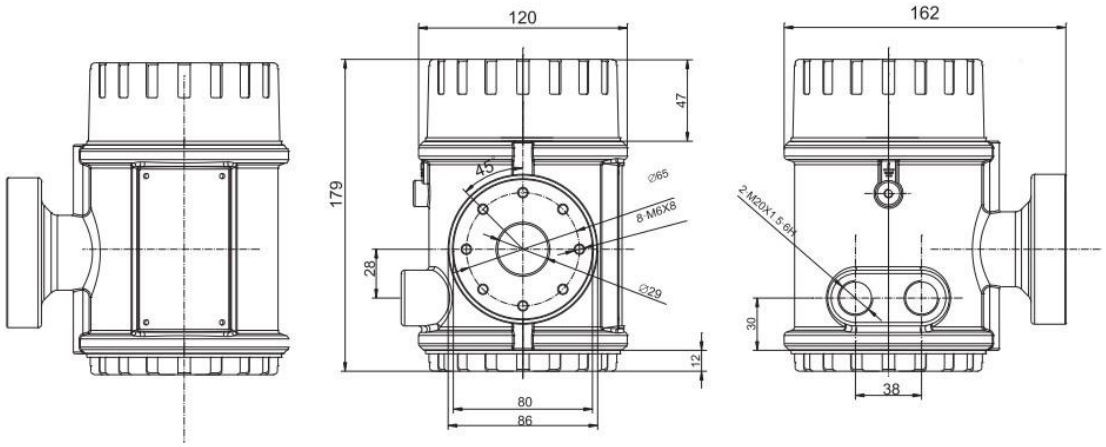
Dissipation Power: <20W（ After connecting sensor）.

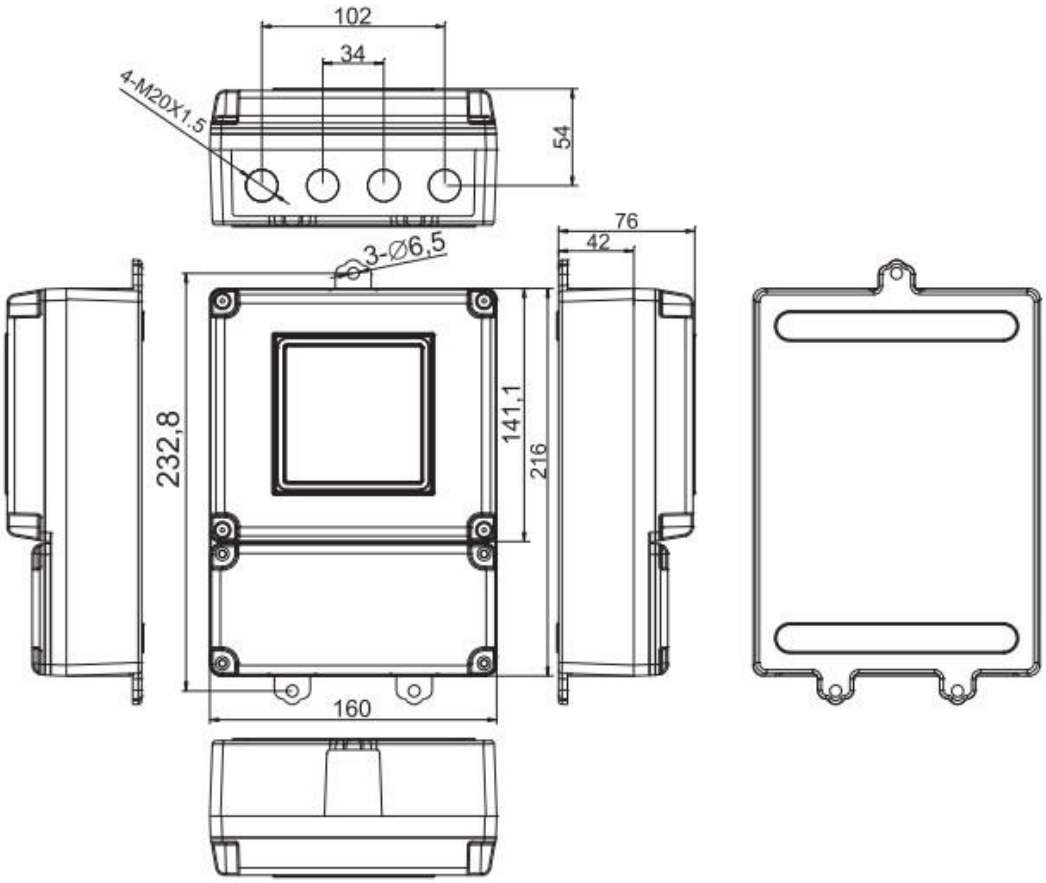
4.5.3 Type of connecting with sensors

- The integrated circinal shells: circinal shells, shells connect with the flange directly, explosion-proof;
- The integrated squared shells: squared shells, shells connect with the flange directly；
- The split squared shells: squared shells (hang on the wall), Signal converters connect with cable of sensor；

V, Product dimensions and installation dimensions

5.1 Converter appearance size

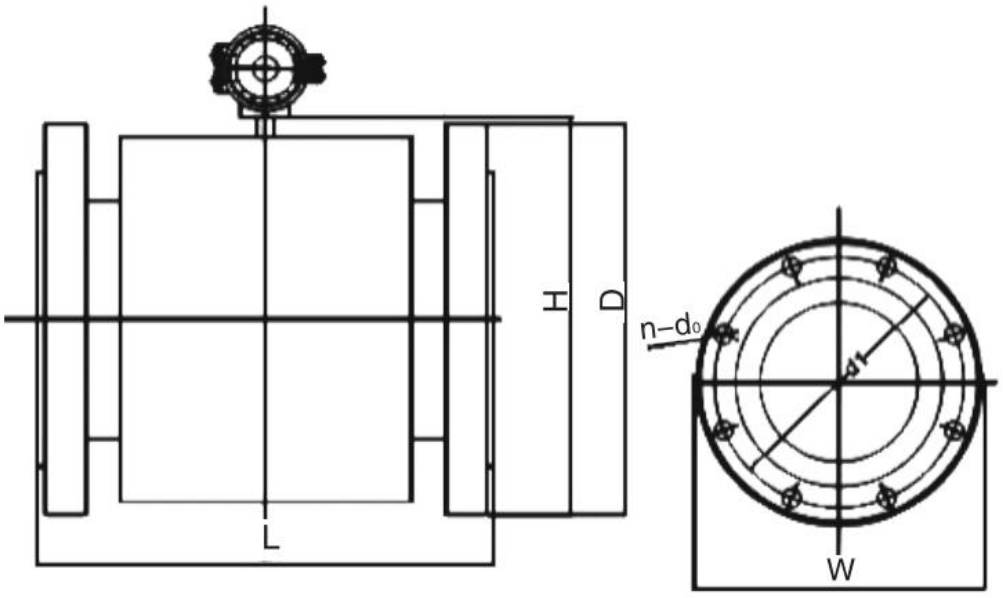




5.2 Sensor shape and installation dimensions are shown below

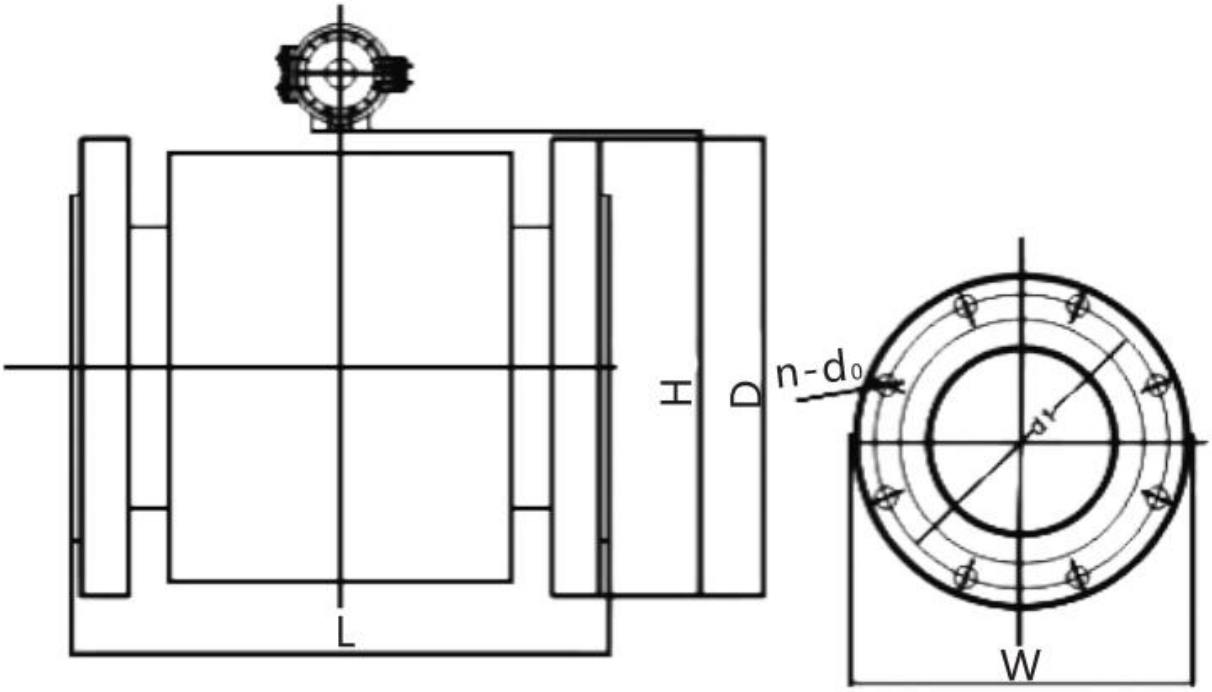
◆DN3～DN150, 1.6, 4.0MPa sensor and integrated outline drawing

◆Flange size (standard: GB/T9119-2010)



DN	L	H		DN	1.6MPa					4.0MPa				
					D	d_1	d_0	n	b	D	d_1	d_0	n	b
3	200	142		3	90	60	14	4	14	90	60	14	4	14
6	200	142		6	90	60	14	4	14	90	60	14	4	14
10	200	142		10	90	60	14	4	14	90	60	14	4	14
15	200	147		15	95	65	14	4	16	95	65	14	4	16
20	200	154		20	105	75	14	4	18	105	75	14	4	18
25	200	156		25	115	85	14	4	18	115	85	14	4	18
32	200	166		32	140	100	18	4	18	140	100	18	4	18
40	200	172		40	150	110	18	4	20	150	110	18	4	20
50	200	191		50	165	125	18	4	20	165	125	18	4	20
65	250	200		65	185	145	18	8	20	185	145	18	8	22
80	250	218		80	200	160	18	8	22	200	160	18	8	22
100	250	242		100	220	180	18	8	22	235	190	22	8	26
125	250	277		125	250	210	18	8	22	270	220	26	8	26
150	300	302		150	285	240	22	8	24	300	250	26	8	28

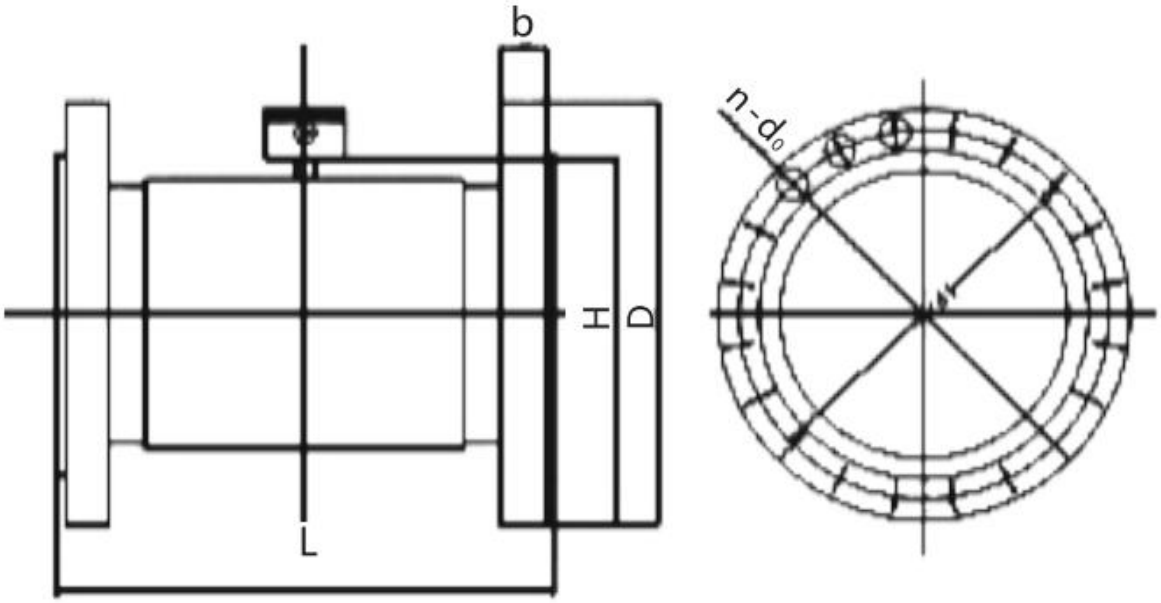
◆DN200～DN600, 1.0/1.6MPa sensor outline drawing



◆Dimensions ◆Flange size (standard GB/T9119-2010)

DN	L	H		DN	1.6MPa					1.0MPa				
					D	d_1	d_0	n	b	D	d_1	d_0	n	b
200	350	362		200	340	295	22	12	26	340	295	22	8	24
250	450	412		250	405	355	26	12	28	395	350	22	12	26
300	500	472		300	460	410	26	12	32	445	400	22	12	28
350	550	522		350	520	470	26	16	35	505	460	22	16	30
400	600	572		400	580	525	30	16	38	565	515	26	16	32
450	600	626		450	640	585	30	20	42	615	565	26	20	35
500	600	676		500	715	650	33	20	46	670	620	26	20	38
600	600	776		600	840	770	36	20	52	780	725	30	20	42

◆DN700～DN3000, 0.6/1.0MPa sensor outline drawing

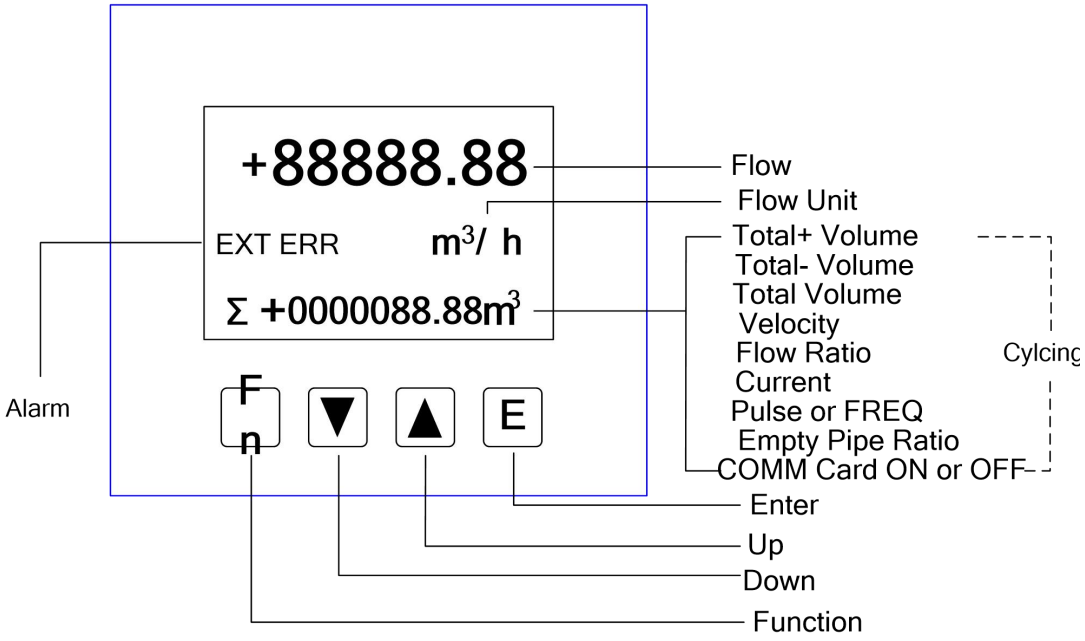


◆Dimensions ◆Flange size (standard GB/T9119-2010)

DN	L	H		DN	MPa	D	d_1	d_0	n	b
700	700	866		700	1.0	895	840	30	24	30
800	800	966		800		1015	950	33	24	32
900	900	1076		900		1115	1050	33	28	34
1000	1000	1200		1000		1230	1160	36	28	34
1200	1200	1406		700	0.6	860	810	26	24	26
1400	1400	1632		800		975	920	30	24	26
1600	1600	1832		900		1075	1020	30	24	26
1800	1800	2036		1000		1175	1120	30	28	26
2000	2000	2236		1200		1405	1340	33	32	28
2200	2200	2436		1400		1630	1560	36	36	32
2400	2400	2636		1600		1830	1760	36	40	34
2600	2600	2836		1800		2045	1970	39	44	36
2800	2800	3036		2000		2265	2180	42	48	38
3000	3000	3236		2200		2475	2390	42	52	42
				2400		2685	2600	42	56	44
				2600		2905	2810	48	60	46
				2800		3115	3020	48	64	48
				3000		3315	3220	48	68	50

VI Converter

6.1 Display



The electromagnetic flow converter enters into the automatic measurement status after power on. All of measurement functions are ready and measurement data is displayed.

6.2 Keyboard

The transmitter enters the automatic flow measurement mode after power on. All of measurement functions are ready and measurement data are displayed. The parameters can be setup and displayed by pressing four keys: Up key, Down key, Function key, and Enter key.

Up key	Plus 1 for the selected digit, or go back to the previous item
Down key	Minus 1 for the selected digit, or enter the next item
Function key + Up key	Move cursor to right
Function key + Down key	Move cursor to left
Function key + Enter key	Select the password menu, enter the password, then go to the lower submenu, and save parameters
Enter key	Go back to upper submenu. Pressing and holding for more than two seconds, then releasing it at Level One menu can activate the flow meter automatically go to the measurement mode

Note: Actually pressing and holding the Enter Key for more than two seconds, then releasing it at any time, can activate the flowmeter automatically go to the measurement mode.

6.3 Password

The converter has three level passwords.

The level one password : only can modify the password of level one；

The level two passwords: can modify the password of level one and level two, also have authority to view password of the level one;

The level three password: can modify the password of level one, level two and level three; also have authority to view password of the level one and level two;

The level one default password is “10000”, and the level two default password is “09000”.

6.4 Menu List

The menu list is using structured design. It has reasonable classification, and has very clear hierarchy, also convenient to operate.

The menu list is shown below.

Tab.1 Converter description abbreviation

Abbreviation	Description	Abbreviation	Description
BLKT	Back Light	**FREQ**	Frequency
NEGF	Negative Flow	**ALMH**	High Limit Alarm
CAL	Calibration	**INIT**	Initialization
COEF	Coefficient	**ALML**	Low Limit Alarm
COD	Code of Production	**MAINT**	Maintenance
DEC	decimal	**PF**	Power Frequency
DIR	Direction	**THD**	Threshold
DOD	Date of Production		
EPD	Empty Pipe Detection		
EXT	Excitation		
POSF	Positive Flow		

Tab.2 Converter LCD menu list

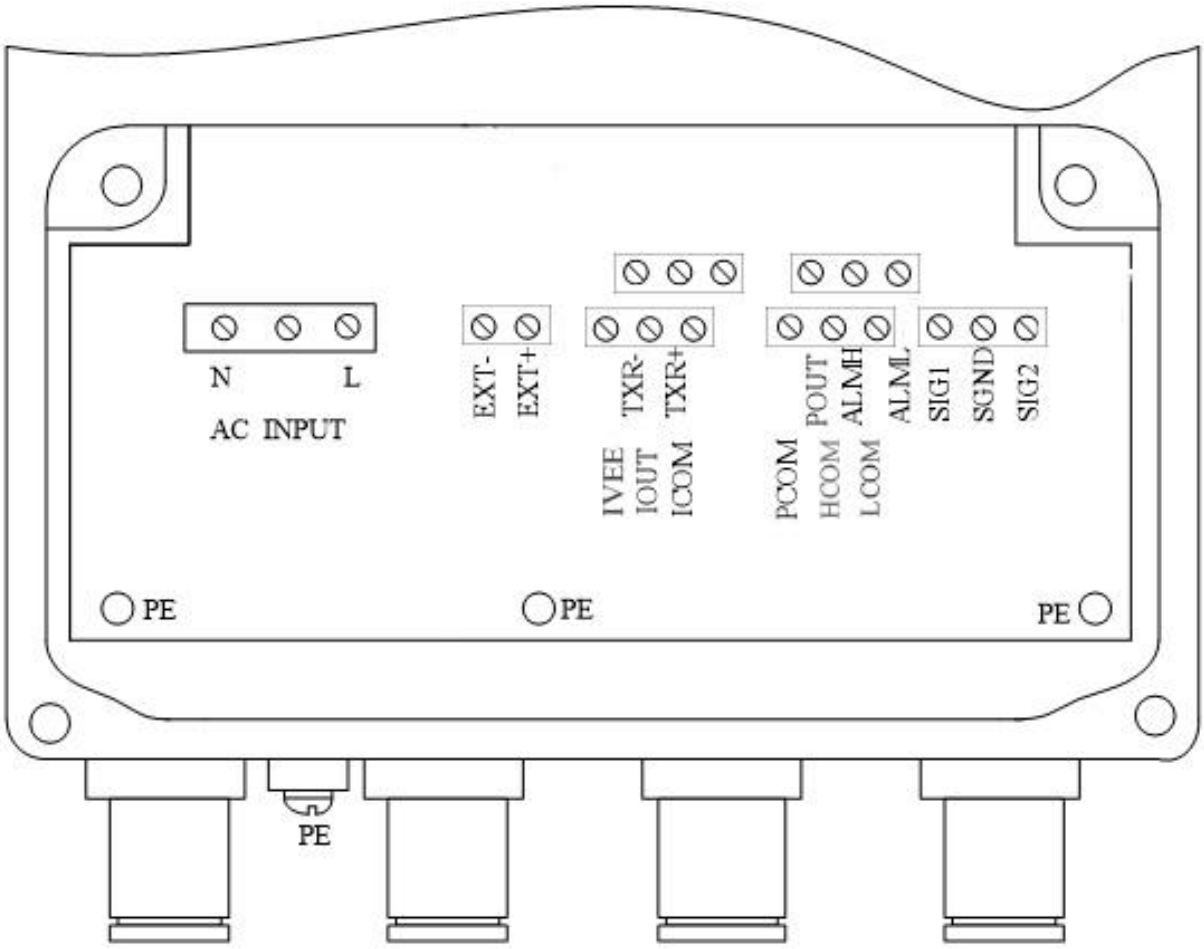
First Level Menu	Second Level Menu	Third Level Menu
PARAMETER SETTING	DIAMETER	3mm~3000mm
	DAMPING TIME	0~50 Sec.
	FLOW UNIT	L/h、L/m、L/s、m^3/h、m^3/m、m^3/s
	FLOW DEC SET	Auto Manu
	VOLUME UNIT	0.001m^3、0.01m^3、0.1m^3、1m^3、0.001L、0.01L、0.1L、1L

PARAMETER SETTING	MEASURE RANGE	Setting	
	EXT FREQ	1/2、1/4、1/8、1/16、1/20(PF)	
	EXT CURRENT	20%、50%、80%、100%	
	LIQUID DENSITY	Setting	
FUNCTION SETTING	MEASURE DIR	FORWARD/BACKWARD	
	NEGF MEASURE	ON/OFF	
	NEGF OUTPUT	ON/OFF	
	LOW FLOW CUTOFF	ON/OFF	
	LOW FLOW VALUE	Setting	
	SMART FILTER	ON/OFF	
	PEAK LIMIT THD	Setting	
	METER ALARM	ON/OFF	
	EXT ALARM	ON/OFF	
	EPD ALARM	ON/OFF	
	EPD ALARM THD	Setting	
	ALMH ALARM	ON/OFF	
	ALMH ALARM THD	Setting	
	ALML ALARM	ON/OFF	
	ALML ALARM THD	Setting	
	BAT ALARM	ON/OFF	
	BAT VALUE	Value	
COMMUNICATION SETTING	MODBUS	BUS ADDRESS	
		BAUDRATE	300,600,1200,2400, 4800,9600,19200, 38400
OUTPUT SETTING	OUTPUT MODE	FREQ/PULSE	
	PULSE UNIT	0.001m3、0.01m3、0.1m3、1m3、0.001L、0.01L、0.1L、1L	
	PULSE WIDTH	Setting	
	FREQ RANGE	1~10000Hz	
DIAGNOSTIC TEST	4-20mA TEST	Setting	
	FREQ TEST	Setting	
	PULSE TEST	Setting	
SYSTEM SETTING	LANGUAGE	CHN/ENG	
	LCD CONTRAST	Setting	

	LCD BKLT	Open/Close	
	LCD BKLT TIME	1\5\10\30\60 min	
	POSF SUM PRESET	Setting	
	NEGF SUM PRESET	Setting	
	FLOW SUM RESET	Total Cumulative Flow to be Cleared	
	SHOW PASSWORD	Including three level Password	
	PASSWORD SET	Including three level Password	
	SYSTEM DATE	Display Date (Adjustable)	
	SYSTEM TIME	Display Time (Adjustable)	
	SENSOR DATE	Display Sensor Production Date (Adjustable)	
	SENSOR CODE	Display Sensor Production Code (Adjustable)	
	METER DATE	Display Meter Production Date (Adjustable)	
	METER CODE	Display Meter Production Code(Adjustable)	
	LAST CAL DATE	Display the Last Calibration Date(Adjustable)	
	LAST MAINT DATE	Display the Last Maintenance Date(Adjustable)	
CALIBRATIOM SETTING	ZERO CORRECT	Setting	
	SENSOR COEF	Setting	
	FLOW CORRECT	FLOW CORRECT UNIT	m/s、m^3/h
		CORRECT POINT 1	Setting
		CORRECT COEF 1	Setting
		CORRECT POINT 2	Setting
		CORRECT COEF 2	Setting
		CORRECT POINT 3	Setting
		CORRECT COEF 3	Setting
		CORRECT POINT 4	Setting
		CORRECT COEF 4	Setting
		CORRECT POINT 5	Setting
		CORRECT COEF 5	Setting
	CORRECT SET	ON/OFF	
	NORMALIZED COEF	Setting	

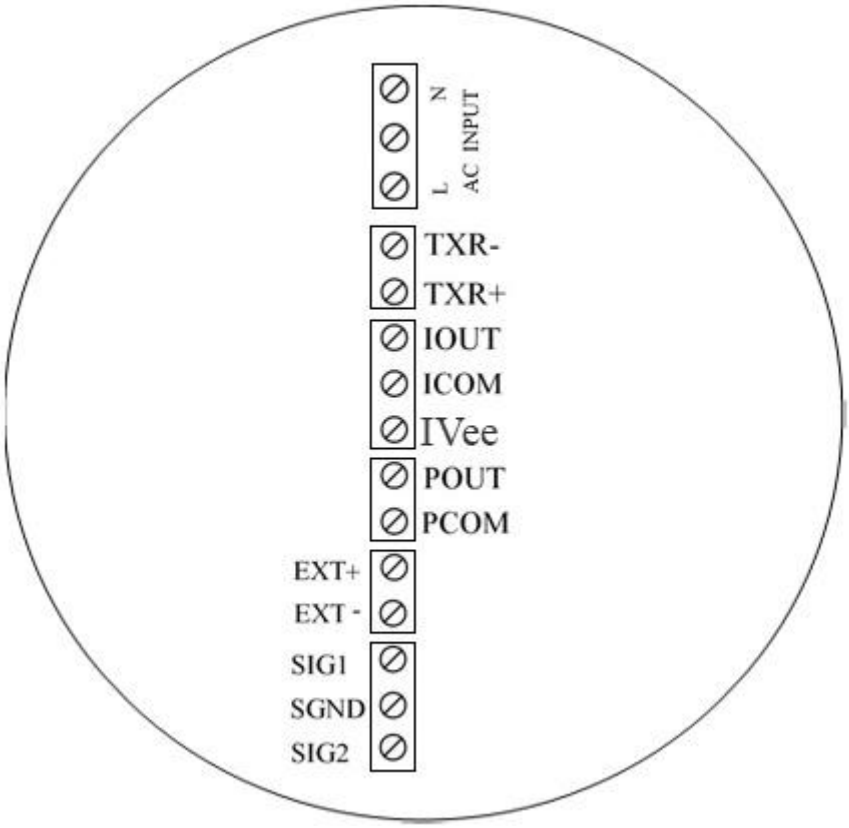
VII Connection and wiring diagram.

7.1Squad model wiring diagram and signal definitions



SIG 1	Signal 1	To Sensor
SGND	Signal Ground	
SIG 2	Signal 2	
EXT +	Excitation Current +	
EXT −	Excitation Current −	
IOUT	Current Output(4~20mA)	Analog Current Output
ICOM	Current Ground	
POUT	Frequency/Pulse Output	Frequency/Pulse Output
PCOM	Frequency/Pulse Ground	
TXR +	COM+(RS485+)	Communication Interface
TXR −	COM-(RS485-)	
ALMH	High Limit Alarm Output	High/Low Limit Alarm Output
ALML	Low Limit Alarm Output	

7.2 Circle-Shaped model wiring diagram and signal definitions

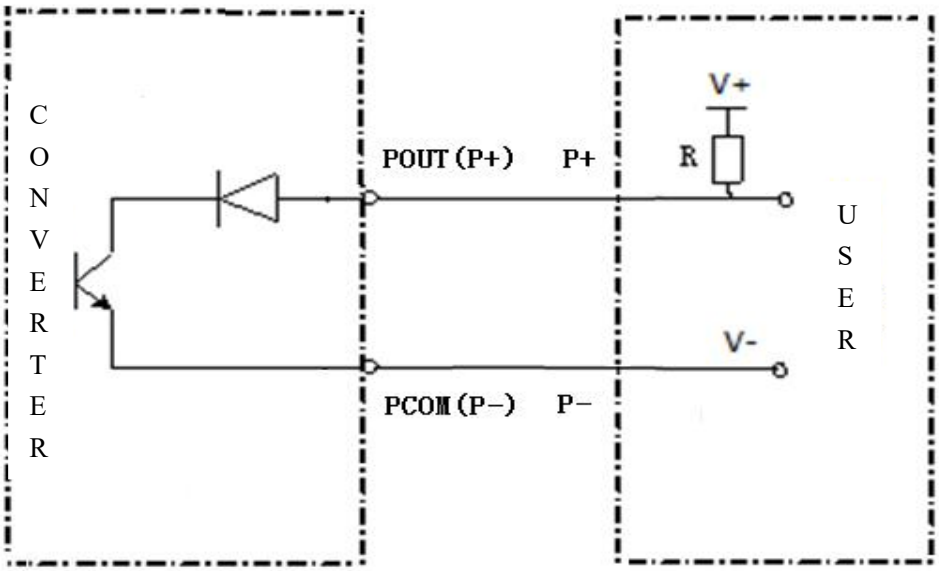


N	Naught wire	24VDC/220VAC
PE	Ground wire	
L	Live wire	
TX-	Communication Input(RS485-B)	Communication Input
TX+	Communication Input(RS485-A)	
IOUT	Analog Current Output	Analog Current Output
ICOM	Analog Current Output Ground	
IVEE	Emitter Voltage	
POUT	Flow Frequency (pulse) Output	Frequency(pulse) Output
PCOM	Flow Frequency (pulse) Output Ground	

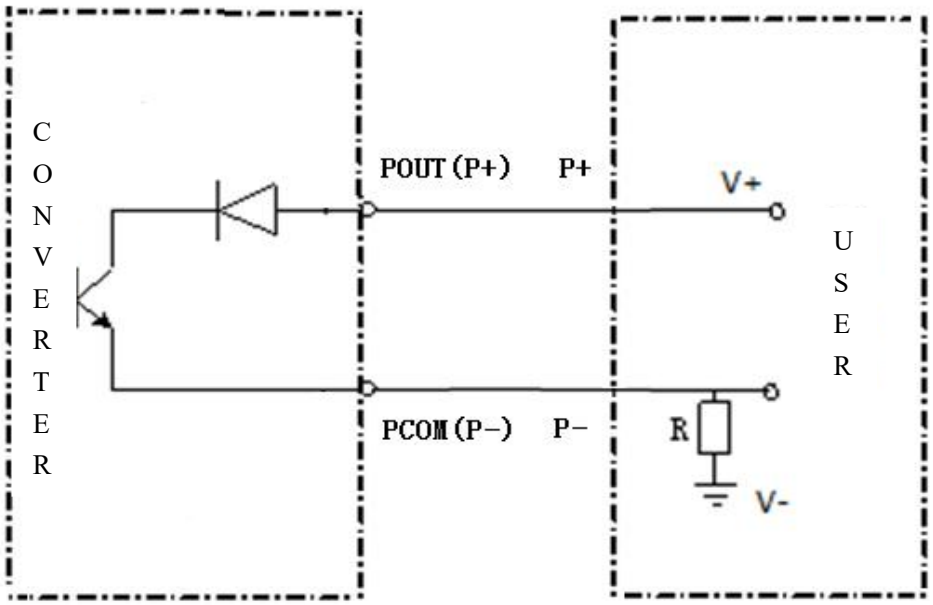
7.3 Frequency/Pulse Output

The Frequency and Pulse are using the same output interfaces: POUT（P+）and PCOM（P-）, and user can select the output mode via the menu. The Frequency/Pulse support 3 connection mode:

Connection Mode 1：External Power Supply with OC Gate

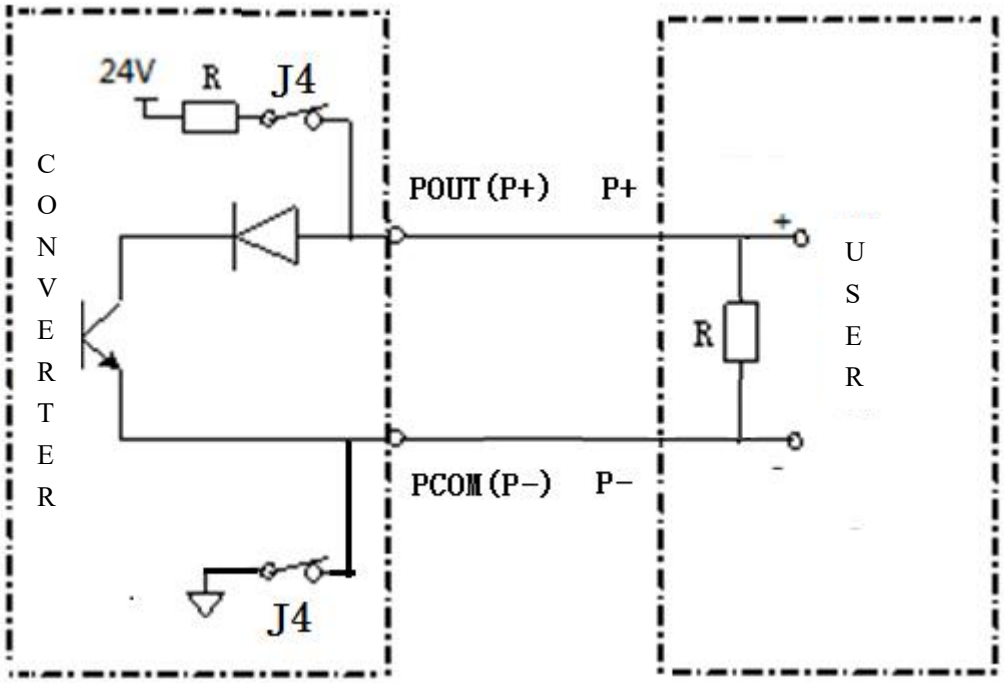


Connection Mode 2：External Power Supply with OC Gate。



Connection Mode 3：Internal Power Supply with OC Gate。

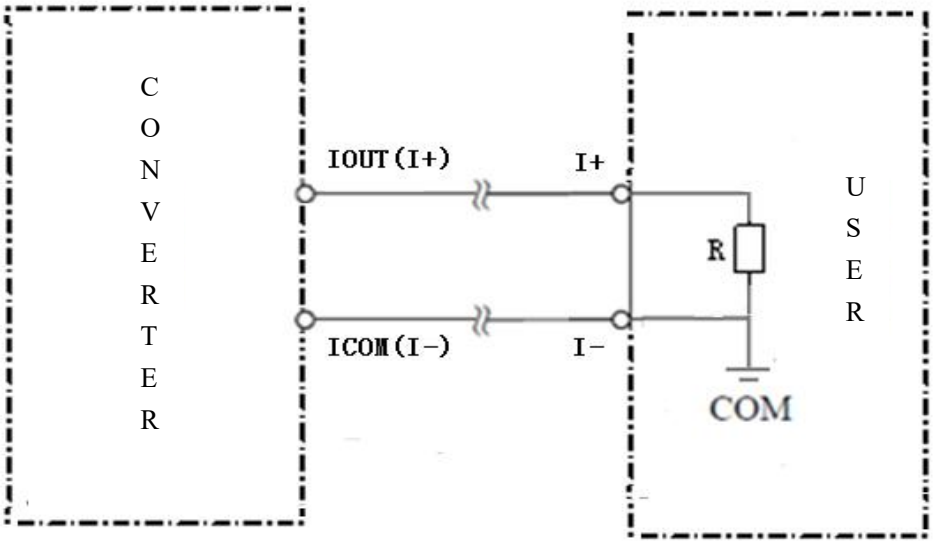
In this mode, user should plug in the jumper of internal power supply inside the converter.



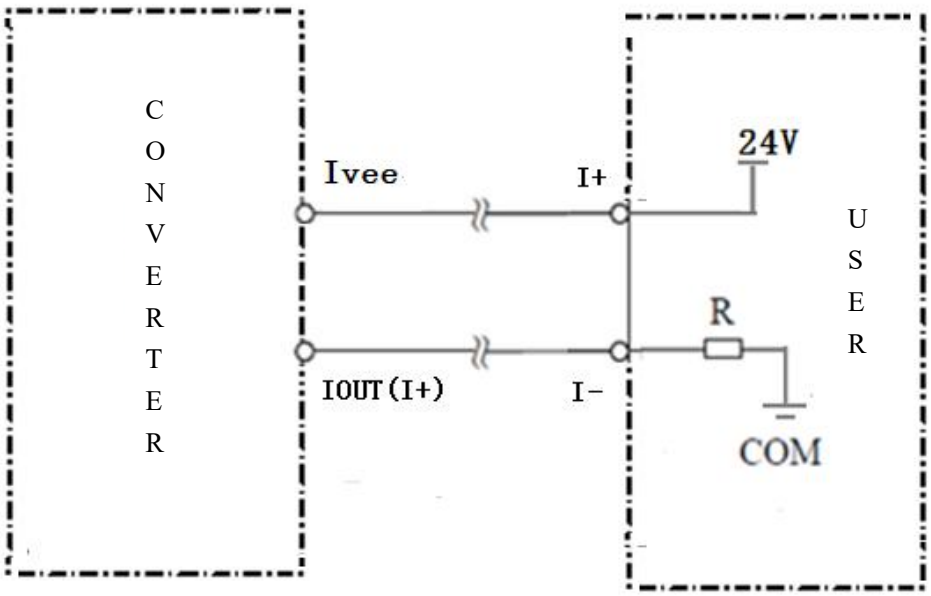
7.4 4~20mA Current Output

There are 3 interfaces of the current output: IOUT(I+)、ICOM（I-）and IVee (External Power), which can support 2 connection modes: Internal Power Supply and External Power Supply.

Connection Mode 1： Internal Power Supply Mode



Connection Mode 2：External Power Supply Mode



Appendix 1 Basic Parameters

PARAMETER SETTING:

- DIAMETER：

The converter can be equipped with different sensors that have different diameter of measuring pipes from 3mm to 3000.

- DAMPING TIME:

It means time of filter measure value. The long one can enhance the stability of flow display and output digital, and fits for gross add up of pulse flow; the short one means fast respond rate, and fits for production control.

- FLOW UNIT:

The flow unit can choose from the parameters (L/s、L/m、L/h、m3/s、m3/m、m3/h),and the user can choose the proper unit according to the technological requirement and using habit.

- VOLUME UNIT:

Converter display is counter with 9 bits, and the max is 999999999.

Integrator units are L, m3(liter, stere). It is accordant with flow unit and is set automatically.

This is the same to flow unit. When the flow unit is L/h， L/m and L/s the integrator unit is liter，when the flow unit is m3/h,m3/m and m3/s the integrator unit is stere.

Flow integrator value: 0.001L、 0.010L、 0.100L、 1.000L
0.001m3、 0.010m3、 0.100m3、 1.000m3 ;

- MEASURE RANGE:

Flow range means upper limit value, and lower limit value is set "0" automatically. So, it makes the range, and makes the relation of percent display, frequency output and current output with flow:
percent display = (flow measure / measure range) * 100 %;
frequency output = (flow measure / measure range) * frequency full;
current output = (flow measure / measure range) * current full + base point;
pulse output will not affect.

- EXT FREQ

This function enables customer to select the frequency for the excitation coil.
Normally 1/8 or 1/16 (of power frequency) is selected.

- EXT CURRENT

This function enables customer to select the current for the excitation coil.

FUNCTION SETTING:

- MEASURE DIR:

If users think the direct and design are differ, just change the direct parameter is OK, but not change exciting or signal.

- LOW FLOW CUTOFF:

This function is selectable: ON/OFF
In "ON" mode, when flow ratio is less than the low flow cut-off value, it will be cut off and the LCD display indicates "0";
In "OFF" mode, no matter what the flow ratio is, no any flow value is cut off.

- LOW FLOW VALUE:

This function serves user to set the minimum flow that the flowmeter will react on.
It is expressed in percentage, such as 0.5%, 2%, 5%, etc.

- SMART FILTER:

This function is selectable: ON/OFF
In "ON" mode, the flowmeter automatically starts the built-in smart judgment algorithm, making the flow measurement with better stability. We recommend set it up under the guidance of the manufacturer.

- METER ALARM:

This function is selectable: ON/OFF
In "ON" mode, the flowmeter works according to all alarm setting status;

In “OFF” mode, the flowmeter turns off all alarm status.

- EPD ALARM THD:

In “ON” mode, the user should setup the threshold value so that the flowmeter can detect the empty pipe status.

Keep liquid full of the pipe

Keep liquid with no movement

Based on the record of previous settings

Setup a new threshold value

COMMUNICATION SETTING:

- **MODBUS**

- **BUS ADDRESS:**

It means this instrument’s address when communicates with many, and has 01~99, holding the 0.

- **BAUDRATE:**

Baudrate: 300、600、1200、2400、4800、9600、19200、38400。

OUTPUT SETTING:

- OUTPUT MODE:

Two kinds of Outputs are can be chosen: Frequency Output and Pulse Output. Frequency Output is continuous square waveform and Pulse output is a serial wave of square wave. Frequency output is mainly used for instant flow and total integrated flow in short time measurement. Frequency output can be chosen in equivalent frequency unit and volume of integrated flow can be displayed. Frequency Output can be used in long time measurement for total integrated flow with volume units.

Frequency output and pulse output are usually from OC gates so that DC power supplies and load resistors have to be required.

- **PULSE UNIT:**

Pulse Unit is referred to one pulse for value of flow.

Under the same flow, the smaller pulse, the higher frequency output, and the smaller error will be.

- **PULSE WIDTH:**

Set the Pulse width from0.1ms to 100ms.

- FREQ RANGE:

Frequency output range is as the upper limit of flow measure, just the percent flow 100%. Frequency output upper limit can be selected between 1～10000Hz.

DIAGNOSTIC TEST：

- **4-20mA TEST**
- **FREQ TEST**
- **PULSE TEST**
- **SPEED TEST**

SYSTEM SETTING：

- LANGUAGE：

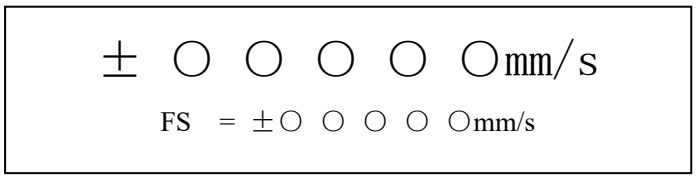
There are 2 languages for converter operation. They can be set by users according to the users' needs.

CALIBRATION SETTING：

- ZERO CORRECT：

Make sure the sensor is full of flow, and the flow is stillness. Flow zero is shown as velocity of flow, mm/s.

Converter's zero-flow correction displays like this:



* Upper large words: correction value of zero;

* Lower small words: FS means measure value of zero;

* Note：Just make the Upper words equal to the lower words with different direction. Flow zero is the compound value of the sensor, and should be recorded in sensor list and band. The unit will be mm/s, and the sign will be opposite with correction value.

- SENSOR COEF：

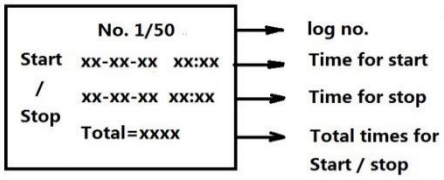
"Sensor Coefficient" is printed on the Label of the sensor when it is made in factory. The "sensor coefficient" has to be set into Sensor Coefficient Parameter when it runs with converter.

Appendix 2 Flow data-logging

A. Start/stop data logging

The transmitter can store the latest 50 history records for "Start/stop data-logging". It's convenient for users to view. The specific methods of operation are as follows:

In the measurement mode, go to the Enquiry menu first and then go to the "start/stop settings" sub-menu, you'll browse the "Start/stop" records.

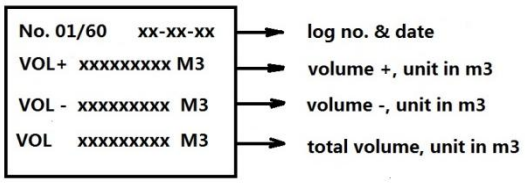


Note: The data logging number displays up to 50 records from No. 1 to No. 50. The user can browse through the arrow keys. The time format is "YY - MM - DD hr: mi". The total “start/stop” records are up to 9999.

B. **Daily data logging for volume**

The transmitter can store the latest 60 history records for “Daily data logging for volume”. It’s convenient for users to view. The specific methods of operation are as follows:

In the measurement mode, go to the Enquiry menu first and then go to the "Daily data logging for volume" sub-menu, you’ll browse the “Daily data logging for volume” records.

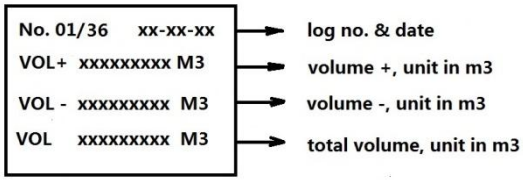


Note: The data logging number displays up to 60 records from No. 1 to No. 60. The user can browse through the arrow keys. The time format is "YY - MM - DD".

C. Monthly data logging for volume

The transmitter can store the latest 36 history records for “Monthly data logging for volume”. It’s convenient for users to view. The specific methods of operation are as follows:

In the measurement mode, go to the Enquiry menu first and then go to the "Monthly data logging for volume" sub-menu, you’ll browse the “Monthly data logging for volume” records.



Note: The data logging number displays up to 36 records from No. 1 to No. 36. The user can browse through the arrow keys. The time format is "YY - MM - DD".

Appendix 3 Notes to flow correction

Flow rate correction is mainly suitable for different flow segments for non-linear correction. The measurement range is divided into five correction points and five correction factors.

Flow correction factor is setup based on the original meter coefficient. Therefore, turn off the correction function first, and then turn it on to enable the correction function. According to the nonlinear flow segment, user should set up the flow correction point and its factor. If the setting values are appropriate, the flowmeter won't need to be re-calibrated.

The original velocity comes from the meter coefficient calculation. The corrected velocity forms from the flow rate correction. The corrected velocity corresponds to the followings:

- ✓ **correction point 1 <** original velocity **< correction point 2**
  Corrected velocity = correction factor 1* original velocity

- ✓ **correction point 2 <** original velocity **< correction point 3**
  Corrected velocity = correction factor 1*correction point 1+ correction point 2*(original velocity - correction point 1)

- ✓ **correction point 3 <** original velocity **< correction point 4**
  Corrected velocity = correction factor 1*correction point 1+ correction point 2* (correction point 2 - correction point 1) + correction point 3*(original velocity - correction point 3)

- ✓ **correction point 4 <** original velocity **< correction point 5**
  Corrected velocity = correction factor 1*correction point 1+ correction point 2* (correction point 2 - correction point 1) + correction point 3*(correction point 3 - correction point 2) + correction point 4*(original velocity - correction point 4)

- ✓ **correction point 5 <** original velocity
  Corrected velocity = correction factor 1*correction point 1+ correction point 2* (correction point 2 - correction point 1) + correction point 3*(correction point 3 - correction point 2+ correction point 4* (correction point 4 - correction point 3) +correction point 5*(original velocity - correction point 5)

Note: When setup correction point, user should keep the following relationship:
Correction point 1< correction point 2< correction point 3< correction point 4< correction point 5

The median value of the correction factor is 1.0000. If the correction factor is greater than the median value it is a positive factor; if the correction factor is less than the median value, it is a negative correction factor