PCL-E10 Integrated Electromagnetic Flowmeter

Features

- No mechanical transmission components, sturdy and vibration resistant
- Simple structure, convenient installation, and low requirements for straight pipe sections
- The measurement accuracy is not affected by factors such as fluid density, viscosity, temperature, pressure, etc
- There are no intercepting or blocking components in the measuring pipeline, which will not cause pressure loss or blockage
- Adopting a multi electrode structure, stable measurement and high accuracy
- Bidirectional measurement system, capable of measuring forward and reverse flow rates
- Low frequency rectangular wave excitation improves flow stability, reduces power loss, and has superior low flow rate characteristics
- The converter uses a low-power microcontroller for data processing, with reliable performance, high accuracy, and low power consumption. The LCD meter can display parameters such as cumulative flow rate, instantaneous flow rate, flow rate, and flow percentage
- When power is off, EEPROM can save set parameters and accumulated flow values

Application

- Process control fields in industries such as water supply, heating, environmental protection, food, water conservancy, metallurgy, and pharmaceuticals.

Product Overview

The PCL-E10 series electromagnetic flowmeter is a fully intelligent flowmeter developed using advanced technology both domestically and internationally. It has the characteristics of high measurement accuracy, high reliability, good stability, and long durability.

The PCL-E10 series strictly controls and pays attention to every step in the process of design, material selection, process manufacturing, production assembly, and factory testing; Equipped with calibration devices compatible with different calibers, each electromagnetic flowmeter manufactured has undergone real flow calibration. We have designed and developed specialized large-scale production software and hardware for electromagnetic flow meters, effectively ensuring the long-term high quality and high quality of our products. The product adopts a wide temperature range LCD display and a simple display interface, with complete and practical menu functions, simple and co nvenient button operation, and convenient on-site operation.

Measuring Principle

The electromagnetic flowmeter works based on the Faraday electromagnetic induction principle. Two detection electrodes are installed on the wall of the non magnetic measuring tube that is perpendicular to the magnetic field lines. When the conductive liquid moves along the axis of the measuring tube, it cuts the magnetic field lines and generates an induced potential. This induced potential is detected by the two detection

Notes:

1. Do not misuse the file.

The information in this selection is for reference only and cannot be used as a product installation guide.

3. Complete installation, operation, and maintenance information is provided in the product manual

electrodes on the measuring tube.

The magnitude of the induced electromotive force is, and the physical quantities represented by each parameter in the formula have the following meanings:

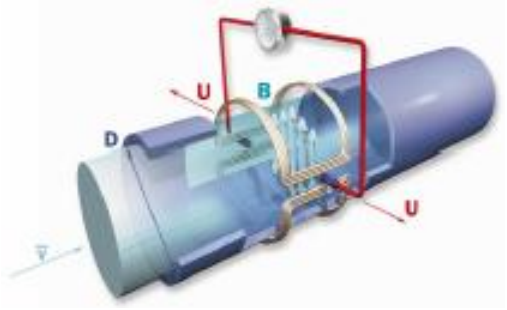
U: Induced electromotive force

K: Instrument constant

B: Magnetic induction intensity

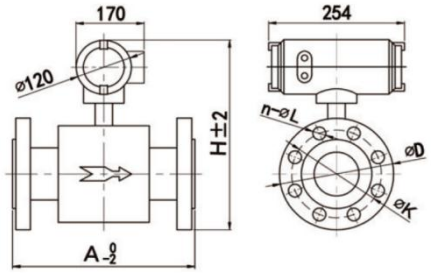
D: Measure the inner diameter of the tube

V: Measure the average flow velocity within the cross-section of the tube



Performance parameters	
Pipe diameter	Flange type DN10~DN1600
Accuracy	± 0.2% FSoptional), ± 0.5% FS (default)
Electrode form	Standard fixed electrode
Present pressure	GB:PN2.5、PN6、PN16、PN25、PN40 ANSI:CLASS 150、CLASS 300 DIN:PN10、PN16、PN25、PN40 JIS:5K、10K、16K、20K Special pressure: can be customized
Electrode material	316L, Titanium (Ti), Hastelloy (HB, HC), Tantalum (Ta), Tungsten Carbide (WC), Platinum Iridium (Pt)
Lining material	Neoprene (CR), Natural Rubber (NR), Urethane Rubber (PU), Polytetrafluoroethylene (PTFE), F46, PFA
Measuring catheter	stainless steel
Flange and body	Carbon steel (regular), stainless steel (optional)
Converter housing	aluminum alloy die casting
Power supply	85V～264V AC,47Hz～63Hz(220V AC);18V～30V DC(24V DC)
Output signal	4mA~20mA DC (load resistance 0 Ω~750 Ω, active output signal) Hart output signal Frequency and pulse output signal (optional for passive and active output signals) Upper and lower limit alarm output signal, air traffic control alarm RS485 output signal (standard ModBus protocol) Profibus-DP (customized), Profibus-PA (customized)
Wire connector	M20 × 1.5 Waterproof connector
Protection	IP65
Ambient temperature	-20℃～60℃
Storage temperature	-40℃～60℃
Relative humidity	5%～90%
Medium temperature	-15℃～80℃(Neoprene rubber);-10℃～120℃ PTFE) -10℃～80℃(polyurethane);-10℃～150℃(F46)
Dielectric conductivity	>5μS/cm
Explosion proof	Explosion proof (24VDC) certificate number: CNEx22.1736X logo: Exd ia mb IIC T6 Gb

Dimensions

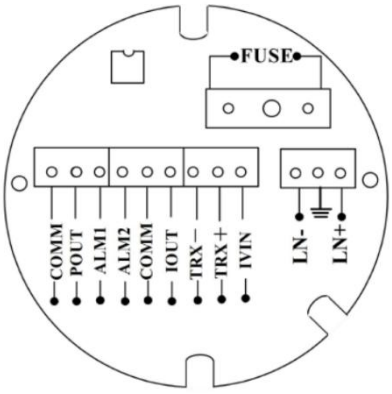
External structure	Dimension	Unit: mm
PCL-E10 integrated electromagnetic flowmeter		

In the above figure, A represents the length of the flow meter guide pipe; H represents the height of the flow meter; N represents the number of bolt holes; L represents the diameter of the bolt hole; K represents the diameter of the bolt hole center circle; D represents the outer diameter of the flange. The overall dimensions of the integrated electromagnetic flowmeter are shown in Table 1.

Table 1 Overall Dimensions of Integrated Electromagnetic Flowmeter

DN	present pressure (MPa)	Dimensions (mm)		Flange connection size (mm)		
		A	H	D	K	n-ΦL
10	4.0	200	304	90	60	4-Φ14
15	4.0	200	304	95	65	4-Φ14
20	4.0	200	304	105	75	4-Φ14
25	4.0	200	312	115	85	4-Φ14
32	4.0	200	330	140	100	4-Φ18
40	4.0	200	340	150	110	4-Φ18
50	4.0	200	338	165	125	4-Φ18
65	1.6	200	358	185	145	8-Φ18
80	1.6	200	374	200	160	8-Φ18
100	1.6	250	402	220	180	8-Φ18
125	1.6	250	425	250	210	8-Φ18
150	1.6	300	458	285	240	8-Φ23
200	1.6	350	522	340	295	8-Φ23
250	1.6	450	574	405	355	12-Φ26
300	1.6	500	624	460	410	12-Φ26
350	1.6	550	678	520	470	16-Φ26
400	1.6	600	742	580	252	16-Φ30
450	1.0	600	794	615	565	20-Φ26
500	1.0	600	862	670	620	20-Φ26
600	1.0	600	950	780	725	20-Φ30
700	0.6	700	1058	860	810	24-Φ26
800	0.6	800	1166	975	920	24-Φ30
900	0.6	900	1272	1075	1020	24-Φ30
1000	0.6	1000	1376	1175	1120	28-Φ30
1200	0.6	1200	1578	1405	1340	32-Φ33
1400	0.6	1400	1840	1630	1560	36-Φ36
1600	0.6	1600	2078	1830	1760	40-Φ36

Electrical connection

External structure	Wiring diagram	Precautions
PCL-E10 Integrated electromagnetic flowmeter		1. RS485 communication cable, need to use two-core twisted pair shielded cable; 2. The power cable and the 4-20mA DC signal cable cannot use the same cable, and the two cables need to be wired separately.

When wiring, select the corresponding power terminal according to the product specifications to connect to the power line, and then connect to the signal line according to the required output signal signal. The meaning of the PCL-E10 integrated electromagnetic flowmeter terminal markings is shown in Table 2.

Table 2 Integrated electromagnetic flowmeter wiring terminal table

Terminal symbol	Function Description	Terminal symbols	Function Description
COMM	Frequency, pulse, current common terminal (ground wire)	TRX-	Communication input (RS485-B)
POUT	Bidirectional flow frequency/pulse output signal	TRX+	Communication input (RS485-A)
ALM1	Upper limit alarm output signal	IVIN	Two-wire 24V voltage input
ALM2	Lower limit alarm output signal	LN-	220V power output signal
COMM	Frequency, pulse, current common terminal (ground wire)	LN+	220V power input
IOUT	Flow current output signal/two wire current output signal	FUSE	fuse

Installation

1. Installation precautions

(1) When installing electromagnetic flow meters, they should avoid direct sunlight or areas with high ambient temperature to prevent insulation performance damage caused by unacceptable temperature rise of the excitation coil due to high ambient temperature.

(2) Electromagnetic flow meters should be kept away from magnetic fields, such as large motors, transformers, and welding machines

(3) During installation, electromagnetic flow meters should avoid vibration.

(4) The direction of fluid flow should be consistent with the direction indicated by the flow meter.

(5) Electromagnetic flow meters are generally installed upstream of the valve.

(6) The electromagnetic flowmeter must operate under full pipe conditions and cannot be empty or empty. It is necessary to ensure that the measuring pipeline is always filled with the measured medium. When installing, attention should be paid to the installation position, as shown in Figure 1.

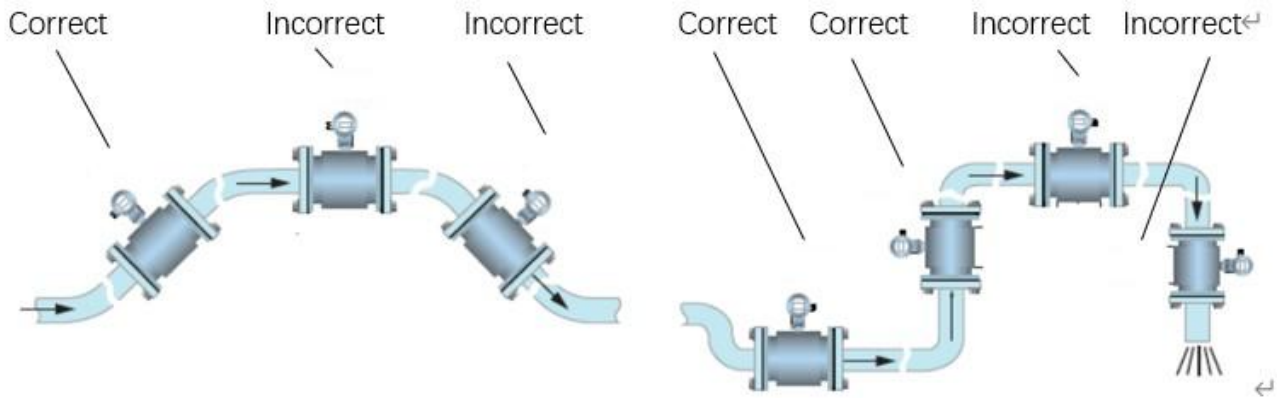


Figure 1 Installation position

2. Installation direction

The positive direction of fluid flow during installation should be consistent with the arrow direction marked on the sensor, and there must be sufficient installation and maintenance space near the flowmeter. During installation, supports for the pipeline should be installed on both sides of the flowmeter to prevent stress on the flowmeter due to pipeline vibration, impact, and contraction.

When installing an electromagnetic flow meter, it is generally necessary to ensure that the axis of the measuring electrode is approximately horizontal when installing horizontally; If the axis of the measuring electrode is perpendicular to the ground, bubbles tend to accumulate near the electrode above, blocking fluid contact with it, while the electrode below is prone to being covered by mud or impurities. The converter is generally installed above the pipeline to prevent water from entering the converter.

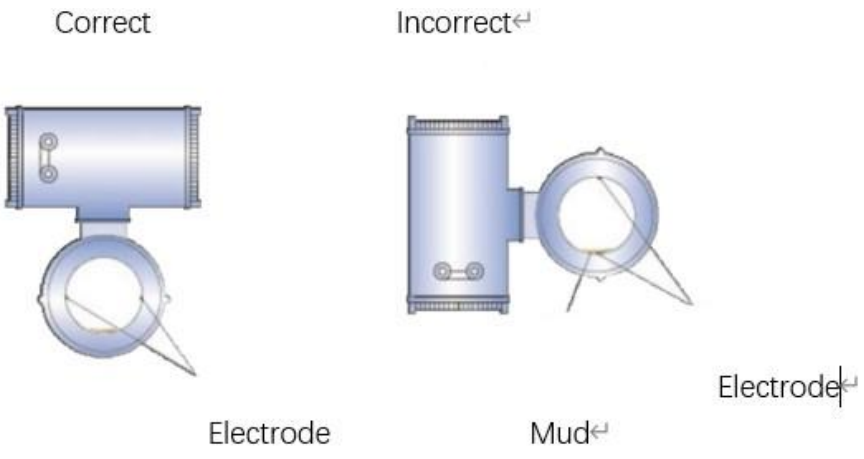


Figure 2 Installation direction

3. Flowmeter piping

The misalignment between the pipeline axis and the electromagnetic flow meter axis, or the deviation between the pipeline flange and the electromagnetic flow meter flange, is the cause of the

pipeline flange jumping and fracture. Therefore, when installing the flow meter, it is necessary to first correct the misalignment or inclination of the pipeline, as well as the installation distance deviation between the two flanges.

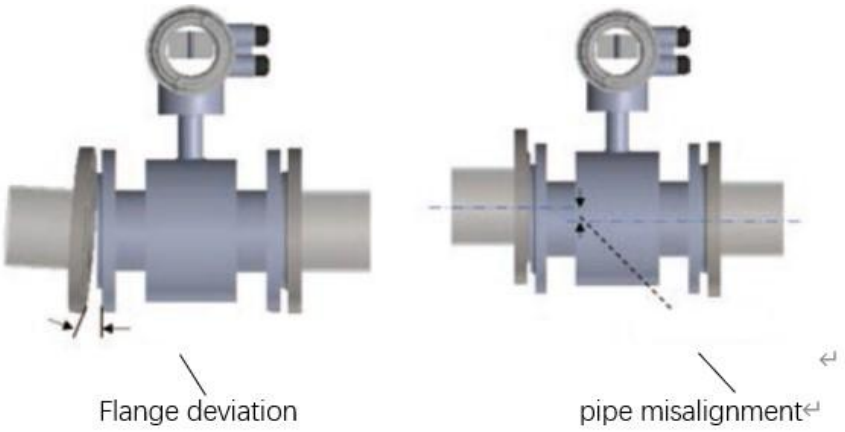


Figure 3 Flowmeter Piping

4.Front and rear straight pipe sections installation

In order to ensure the measurement accuracy of the electromagnetic flowmeter, a certain length of straight pipe sections should be left before and after it.

When installing the electromagnetic flow meter at the location where there are valves in the front and rear, the straight pipe sections in the front and rear should at least meet the length of the first 5D and then 2D (D is the inner diameter of the flow meter guide pipe), and the front and rear valves need to be fully opened, as shown in Figure 4.

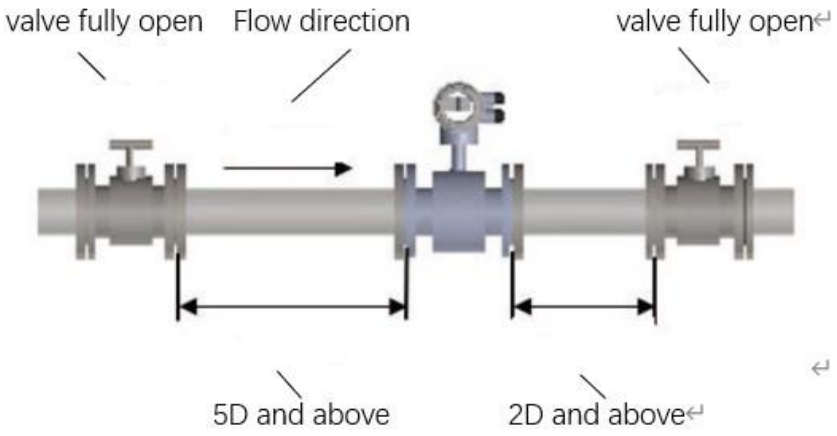


Figure 4 Straight pipe section with front and rear valves

When the electromagnetic flow meter is installed at the rear end of the T-tube, it is necessary to ensure a minimum straight pipe section of 5D or more between the electromagnetic flow meter and the T-tube, as shown in Figure 5.

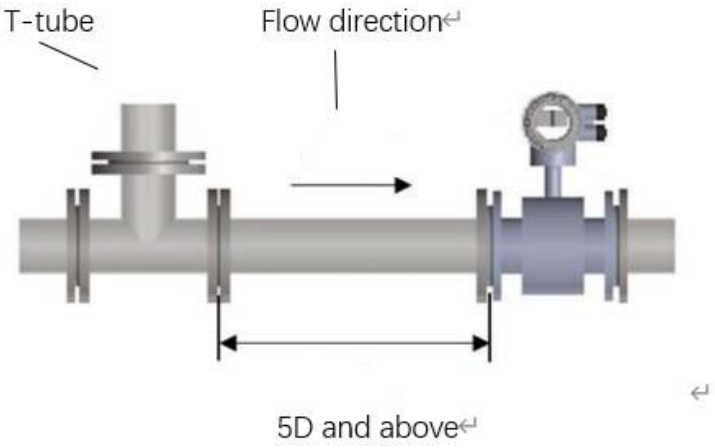


Figure 5 Straight pipe section with T-shaped pipe at the front end of the flowmeter

When the electromagnetic flow meter is installed at the rear end of a 90 ° bend, it is necessary to ensure a minimum straight pipe section of 5D between the electromagnetic flow meter and the end of the bend, as shown in Figure 6.

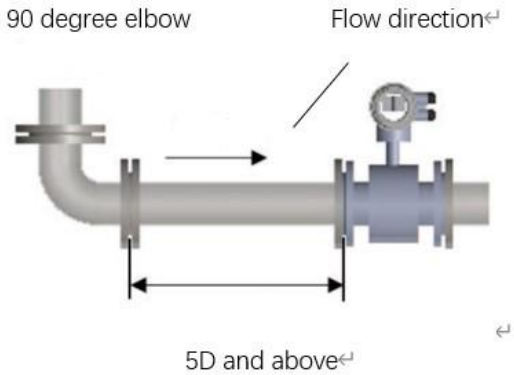


Figure 6: Straight pipe section with a 90 ° bend at the front end of the flowmeter

When the electromagnetic flow meter is installed at the back end of the valve and the valve is not fully open, a minimum of 10D straight pipe section needs to be ensured between the electromagnetic flow meter and the back end of the valve, as shown in Figure 7.

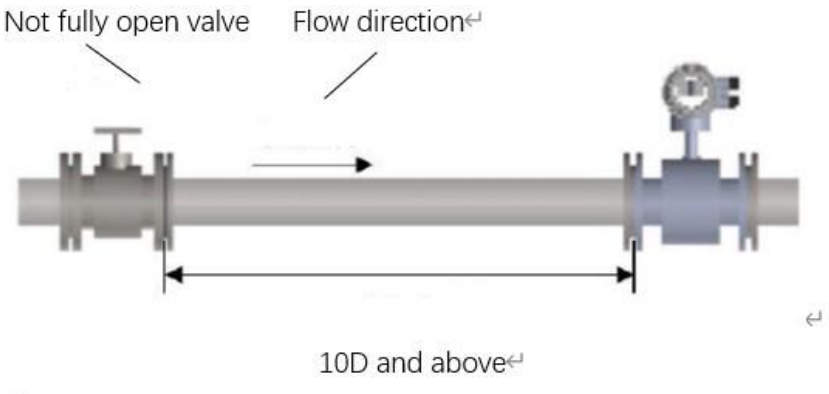


Figure 7: Straight pipe section with partially opened valve at the front end of the flow meter

When the electromagnetic flow meter is installed at the rear end of the expanding pipe, a minimum

of 10D straight pipe section needs to be ensured between the electromagnetic flow meter and the rear end of the expanding pipe, as shown in Figure 8.

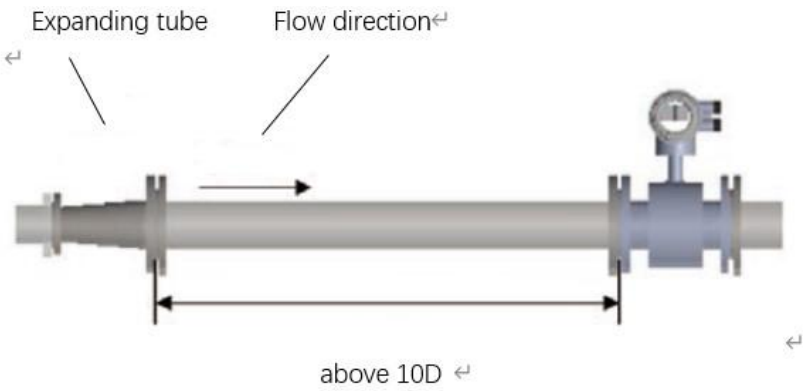


Figure 8: Straight pipe section with partially opened valve at the front end of the flow meter

4. Grounding requirements for converter installation

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

Firstly Φ 20 copper pipes, cut into a length of 1700mm (can be extended as needed) to make ground nails buried 1500mm (note: when burying ground nails, sprinkle a layer of crushed wood charcoal on the tip of the nails, and then pour salt water).

Next, weld 4mm2 copper wire onto the ground stud, and finally connect the ground wire to the sensor flange, grounding ring, and pipeline flange, as shown in Figure 9.

Note: Stainless steel material is required for fixing ground wire screws, spring washers, and flat washers.

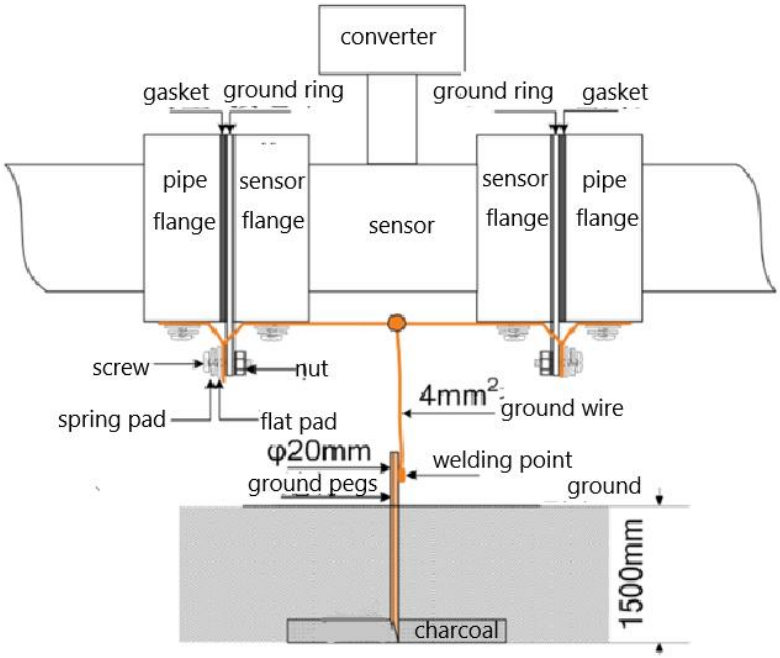


Figure 9 Schematic diagram of converter grounding

How to order

PCL-E10-DN100 P16 T0 N5 E0 EE1 C0 F0 G0 S0 B0 A0 EX0

Co	Explosion-proof
EX	No explosion
EX	Ex d ia mb IIC

Co	Pairing accessories
A0	No pairing accessories
A1	Carbon steel flange G/T20592-2009
A2	Carbon steel flange HG/T20615-2009
A3	304 flange
A4	304 flange
A5	316 flange
A6	316L flange HG/T20615-2009

Code	Digital output signal
B0	RS485(Modbus)
B1	Hart

Co	Analog output signal
S0	4～20mA(with pulse/frequency)

Co	Power supply	Co	Power supply
G0	24V DC	G1	220V AC

Co	Flange material	Co	Flange material
F0	Carbon steel	F2	316LStainless
F1	304 Stainless steel		

Co	Excitation housing material	Code	Excitation housing
C	Carbon steel	C2	316L Stainless
C	304 Stainless steel		

Co	Grounding method	Co	Grounding method
EE	Without ground	EE	Built-in ground electrode

Co	Electrode material	Co	Electrode material
E0	Stainless steel 316L	E4	Tin (Ti)
E1	Platinum Iridium (Pt)	E5	HastelloyC(HC)
E2	Hastelloy B(HB)	E6	Tungsten Carbide (WC)
E3	Tantalum (Ta)		

Co	lining material	Co	lining material
N1	PFA	N4	Polyurethane rubber
N2	natural rubber	N5	Teflon (PTFE)
N3	Neoprene	N6	F46

Co	Medium temperature	Co	medium temperature
T0	≤60℃	T1	≤120℃

Co	Present pressure	Co	Present pressure
P4	4.0MPa,DN10～DN80	P1	1.0MPa,DN200～DN1000
P1	1.6MPa,DN100～DN150	P0	0.6MPa,DN1200～DN1600

Co	Measuring pipe diameter

	DN xx	The code of DNxx means that the inner diameter of the measuring tube is xx. See Table 1 for the selection of pipe diameters. The material of the measuring tube is 304 stainless
PCL-E1	Integrated electromagnetic flowmeter (flange connection method)	

Selection example:PCL-E10-DN100P16T0N5E0EE1C0F0G0S0B0A0EX0

Model Description:

PCL-E10 integrated electromagnetic flowmeter, with a pipeline diameter of DN100, present pressure of 1.6MPa, medium temperature ≤ 60 ℃, lining material of polytetrafluoroethylene (PTFE), electrode material of 316L, built-in grounding electrode, excitation coil shell of carbon steel, connecting flange material of carbon steel, power supply of 24VDC, analog signal of 4-20mA (with pulse/frequency), RS485 digital signal output signal, no accessories, and no explosion-proof requirements.

How to order

According to the statistics of the world's authoritative organizations, two-thirds of the failures of the instrument in practical applications are caused by the wrong selection and incorrect installation of the instrument. Therefore, the selection of the flowmeter is a very important work in practical applications. When selecting models, please note:

1. Collect process data

a. The name of the fluid to be tested, and the composition of the chemical substances contained;

b. The maximum flow, minimum flow and common flow of the fluid;

c. The highest working pressure of the fluid;

d. The maximum temperature and minimum temperature of the fluid.

2. The fluid to be tested must have a certain conductivity, with a conductivity of ≥ 5μS/cm.

3. The maximum flow and minimum flow must conform to the values in the flow range table.

4. The actual maximum working pressure must be less than the rated working pressure of the flowmeter diversion pipe.

5. The maximum working temperature and minimum working temperature of the fluid must meet the temperature requirements specified by the flowmeter.

6. Determine whether there is negative pressure in the process pipeline.

7. When measuring clean medium, the economic flow rate is 1.5m/s~3m/s; when measuring easy-to-crystallize solution, the flow rate should be appropriately increased to 3m/s~4m/s, which plays the role of automatic cleaning to prevent adhesion and deposition; When using abrasive-resistant fluids such as ore pulp, the flow rate should be appropriately reduced to 1m/s to 2m/s to reduce the wear on the lining and electrodes. In practice, velocities exceeding 7m/s are rarely seen, and 10m/s is even rarer.

8. You can choose a suitable electromagnetic flowmeter according to the actual situation. If the inner diameter of the selected electromagnetic flowmeter does not match the inner diameter of the on-site process pipeline, the tube should be reduced or expanded.

a. If the pipeline is shrinked, it should be considered whether the pressure loss caused by the shrinkage will affect the process flow.

b. Considering the improvement of measurement accuracy and product price, a smaller diameter electromagnetic flowmeter can be selected to reduce economic investment.

Appendix

1. Common pipeline caliber and present pressure

Table 3 General Pressure Ratings of Flanges

Pipe diameter	Present pressure
DN10～DN80	4.0MPa
DN100～DN150	1.6MPa
DN200～DN1000	1.0MPa
DN1200～DN1600	0.6MPa

2、Electrode material suitability

Table 4 Applicability of electrode materials

Electrode material	Corrosion resistance	applicability
316L	Domestic water, industrial water, raw water, groundwater, urban sewage, weakly corrosive acid, alkali, salt solution	P
	Inorganic acids, organic acids, chlorides	O
Hastelloy B(HB)	Non-oxidizing acids such as hydrochloric acid with a concentration of less than 10%, sodium hydroxide with a concentration of less than 50%, ammonium hydroxide alkali solution of all concentrations, phosphoric acid, organic acids	P
	Nitric acid	O
Hastelloy C(HC)	Mixed acid (such as mixed solution of chromic acid and sulfuric acid), oxidizing salts (such as: Fe++++, Cu++, seawater)	P
	Hydrochloric acid	O
Tin (Ti)	Salts (such as chlorides, sodium salts, potassium salts, ammonium salts, hypochlorites, sea water), potassium hydroxide, ammonium hydroxide, barium hydroxide alkali solutions with a concentration of less than 50%	P
	Reducing acids such as hydrochloric acid, sulfuric acid, phosphoric acid, and hydrofluoric acid	O
Tantalum (Ta)	Hydrochloric acid, dilute sulfuric acid and concentrated sulfuric acid (excluding oleum) with a concentration of less than 40%; Chlorine dioxide, ferric chloride, hypochlorous acid, sodium cyanide, lead acetate, etc.; nitric acid (including oxidizing acids such as fuming nitric acid), aqua regia with temperature below 80°C	P
	Alkali, hydrofluoric acid	O
Platinum (Pt)	Almost all acid, base, salt solutions (including fuming nitric acid and oleum)	P
	aqua regia, ammonium salt	O
Tungsten Carbide (WC)	Treated neutral industrial sewage, domestic sewage, resistant to solid particle interference; slurries, such as mud, mortar.	P
	Acids, bases, salts	O

3、lining material

Table 5 Scope of application of lining materials

Lining material	Symbol	Performance	Operating temperature	Applicable liquid	Applicable diameter
Teflon	F4(PTFE)	1. Stable chemical properties, resistant to boiling hydrochloric acid, sulfuric acid, aqua regia, nitric acid, concentrated alkali and various organic solvents 2. Poor wear resistance and adhesion	-10℃~120℃	Strong corrosive acid, alkali, salt liquid	DN25～DN1600
Copolymers of tetrafluoroethy-lene and perfluoroalkyl vinyl ethers	PFA	The corrosion resistance is the same as that of PTFE, and there is a stainless steel wire mesh in the measuring tube, which has the characteristics of negative pressure resistance.	-20℃~15℃	Strong corrosive acid, alkali, salt liquid	DN10～DN500
Polyperfluoroethylene propylene	F46(FEP)	The corrosion resistance is the same as that of PTFE, and there is a stainless steel wire mesh in the measuring tube, which has the characteristics of negative pressure resistance.	-20℃~150℃	Strong corrosive acid, alkali, salt liquid	DN10~DN500
Neoprene	CR	Medium wear resistance, corrosion resistance to low concentrations of acid, alkali and sal	-15℃~80℃	Measure general water, sewage, mud, ore pulp	DN50~DN1600
Polyurethane rubber	PU	Excellent wear resistance, poor acid and alkali resistance	-10℃~80℃	Neutral and strong abrasive slurry, coal slurry, mud	DN25~DN300

4. Diameter and flow measurement range

Table 6 Bore size and flow measurement range

Diameter (mm)	Minimum flow rate (m/s)	Maximum flow rate (m/s)
	0.5	10
	Minimum flow (m3/h)	Maximum flow (m3/h)
10	0.1414	2.8274
15	0.3181	6.3615
20	0.5655	11.3094
25	0.8836	17.6709
32	1.4476	28.9521
40	2.2619	45.2376
50	3.5343	70.6838
65	5.9730	119.4555
80	9.0478	180.9504
100	14.1372	282.7350
125	22.0893	441.7734
150	31.8086	636.1538
200	56.5487	1130.9400
250	88.3573	1767.0938
300	127.2345	2544.6150
350	173.1803	3463.5038
400	226.1947	4523.7600
500	353.4292	7068.3750
600	508.9380	10178.4600
700	692.7212	13854.0150
800	904.7787	18095.0400
900	1145.1105	22901.5350
1000	1413.7617	28273.5000
1100	1710.5972	34210.9350
1200	2035.7520	40713.8400
1400	2770.8847	55416.0600
1500	3186.8625	63615.3750
1600	3619.1147	72380.1600

Note: The values in this table are rounded for reference only.

Please calculate the exact value according to the following formula:

Q=9π×d^2×v/10000

In the formula,

Q: flow rate, unit m^3/h; d: flowmeter diameter, unit mm; π: pi 3.14; v: flow rate, unit m/s.

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