PCL-E20 Divided Electromagnetic Flowmeter

Features

- 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 measurement pipeline, which will not cause pressure loss or blockage
- Simple structure, convenient installation, and low requirements for straight pipe sections
- No mechanical transmission components, sturdy and vibration resistant
- Adopting a multi electrode structure, stable measurement, high accuracy, equipped with a grounding electrode, without the need for a grounding ring, saving costs
- When power is off, EEPROM c an save set parameters and ac cumulated flow values
- 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
- 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

Product overview

The PCL-E20 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-E20 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 convenient button operation, and convenient on-site operation.

Measuring principle

The electromagnetic flow meter operates based on the Faraday electromagnetic induction principle, and two detection electrodes are installed on the wall of the non magnetic measuring tube where the axis and magnetic field field lines are perpendicular to each other. When the conductive liquid moves along the measuring tube axis, the conductive liquid cuts the magnetic field line to generate an induction potential, which is detected by two detection electrodes on the measuring tube.

The magnitude of the induced electromotive force and the physical quantities represented by each parameter in the formula are: $U = K \times B \times D \times \overline{V}$

Application

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

Note:

1. Do not misuse the file.
2.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

U: Induced electromotive force

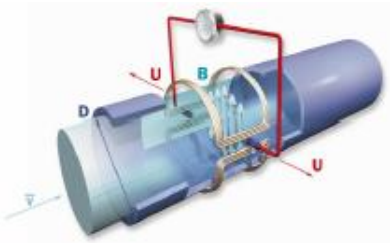
K: Instrument constant

B: Magnetic induction intensity

D: Measure the inner diameter of the tube

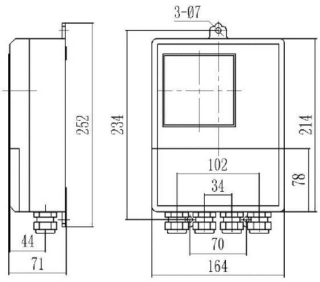
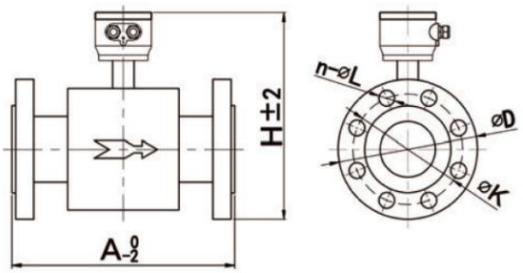
: Measure the average flow velocity within the cross-section of the tube

$\overline{V}$：Measure the average flow velocity within the cross-section of the tube



Performance parameters	
Pipe diameter	Flange type DN10～DN1600
Accuracy	± 0.2% FS (optional), ± 0.5% FS (default)
Electrode form	Standard fixed electrode
Rated pressure	GB (National Standard)：PN2.5、PN6、PN16、PN25、PN40 ANSI (American Standard)：CLASS 150、CLASS 300 DIN(German standard)：PN10, PN1, PN25, PN40 JIS (Japanese Standard):5K, 10K, 16K, 20K Special pressure: customizable
Electrode material	316L, Titanium (Ti), Hastelloy (HB, HC), Tantalum (Ta), Tungsten Carbide (WC), Platinum Iridium (Pt)
Lining	Neoprene rubber (CR), natural rubber (NR), polyurethane rubber (PU), polytetrafluoroethylene (PTFE), F46, PFA
Measuring catheter	Stainless steel
Flange and gauge body	Carbon steel (conventional), 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 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 connection	M20 × 1.5 Waterproof joint
Protection grade	IP68 (sensor part)
Ambient temperature	-20℃～60℃
Storage temperature	-40℃～60℃
Relative humidity	5%～90%
Medium temperature	-10 ℃~80 ℃ (chloroprene rubber)- 10 ℃~120 ℃ (PTFE); -10 ℃~80 ℃ (polyurethane rubber)- 10 ℃~150 ℃ (F46)
Dielectric conductivity	>5μS/cm
Explosion proof	Explosion proof (24VDC) certificate number: CNEx22.1736X logo: Exd ia mb IIC T6 Gb
Connecting cables	10 meters (default), the cable length between the meter head and the sensor is of other lengths and needs to be customized separately

Overall dimension

Structure	Dimension	Unit: mm
PCL-E20 split electromagnetic flowmeter	 Converter size  Sensor Size	

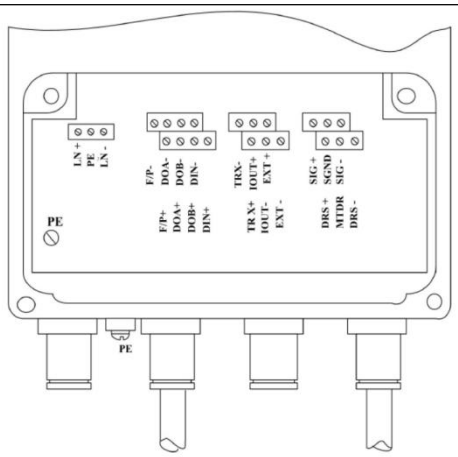
In the above figure, A represents the length of the flow meter guide pipe; H represents the height of the flow meter; N represents the number of bolt holes; L represents the diameter of the bolt hole; K represents the diameter of the bolt hole center circle; D represents the outer diameter of the flange.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

Table 1 External Dimensions of Split Electromagnetic Flowmeter

DN	Rated pressure (MPa)	Overall 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

Structure	Wiring diagram	Note
PCL-E20 split electromagnetic flowmeter		1. RS485 communication cable requires the use of two core twisted pair shielded wire; 2. The power line and 4-20mA DC signal line cannot use the same cable, and 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-E20 split type electromagnetic flowmeter terminal markings is shown in Table 2.

Table 2 Wiring Terminals of Split Electromagnetic Flowmeter

Terminal symbols	Function Description	Terminal symbols	Function Description
LN+	Power input positive	TRX+	Communication input (RS485 A)
LN-	Power input negative	IOUT-	Current output signal ground
F/P-	Pulse/frequency output signal ground	IOUT+	Current output signal positive
F/P+	Pulse/frequency output signal positive	EXT+	Excitation current positive
DOA-	Alarm output signal ground	EXT-	Excitation current negative
DOA+	Alarm output signal positive	SIG+	Signal 1
DOB-	Reserve	SGND	Signal ground
DOB+	Reserve	SIG-	Signal 2
DIN-	Reserve	DRS+	Positive excitation shielding
DIN+	Reserve	MTDR	Excitation shielding ground
TRX-	Communication input (RS485-B)	DRS-	Excitation shielding negative

Install

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.

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.

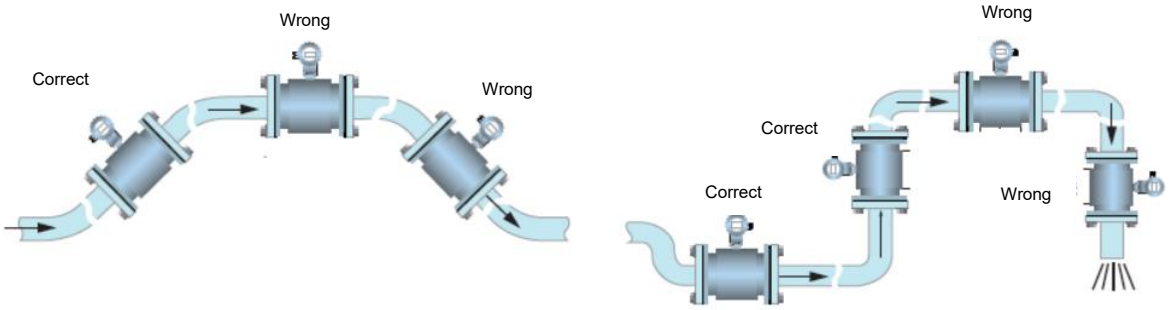


Figure 1 Installation Location

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.

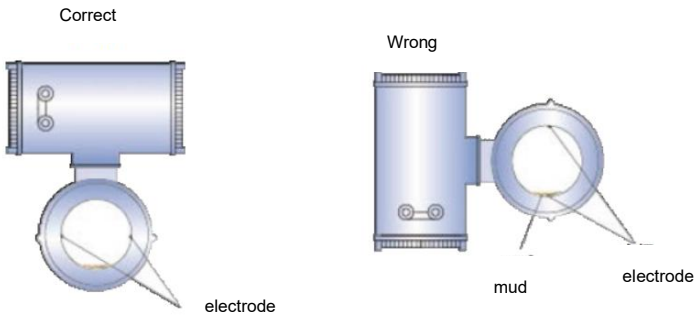
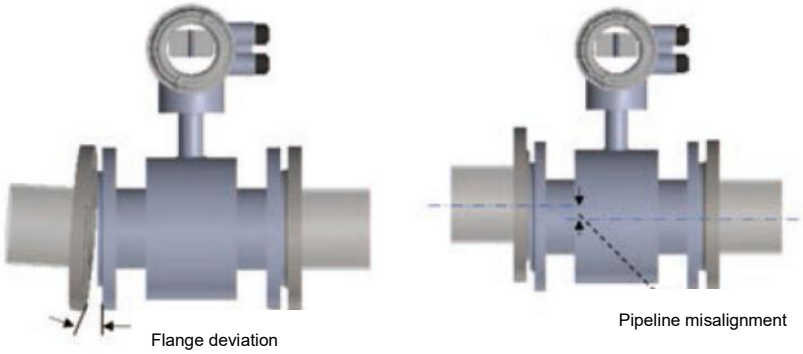


Figure 2 Installation Direction

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.



4. Install front and rear straight pipe sections

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.

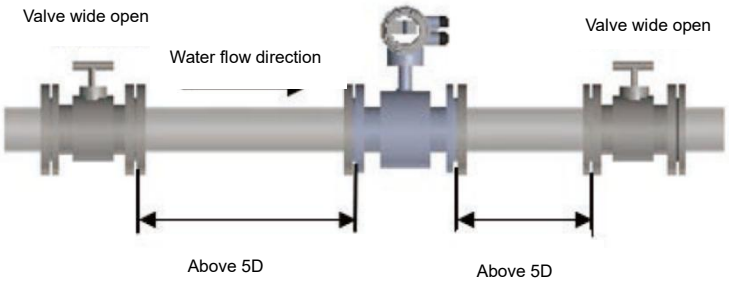


Figure 4 Straight pipe section with front and rear valves

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.

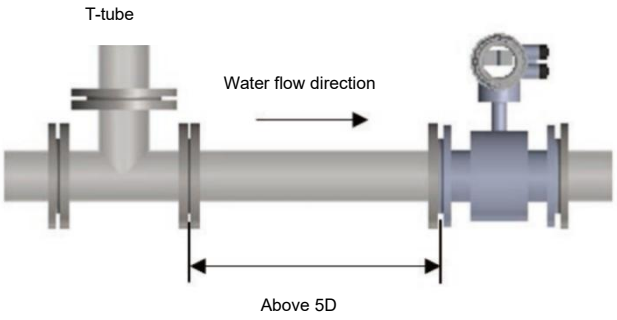


Figure 5 Straight pipe section with T-shaped pipe at the front end of the flowmeter

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.

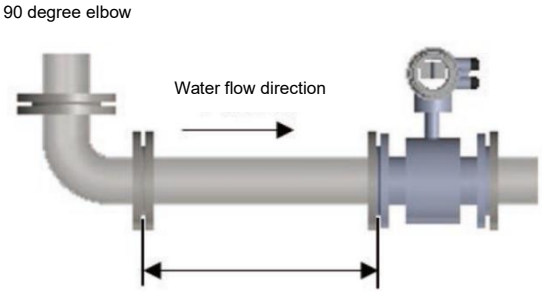


Figure 6: Straight pipe section with a 90 ° bend at the front end of the flowmeter

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.

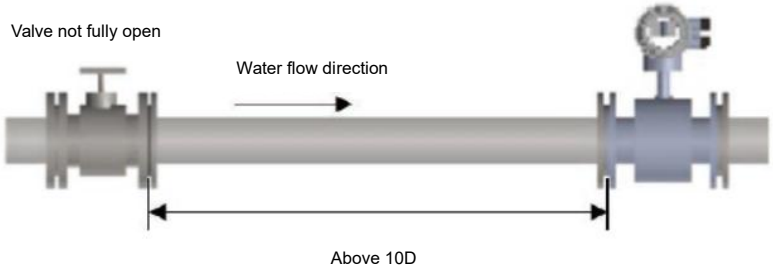


Figure 7: Straight pipe section with partially opened valve at the front end of the flow mete

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.

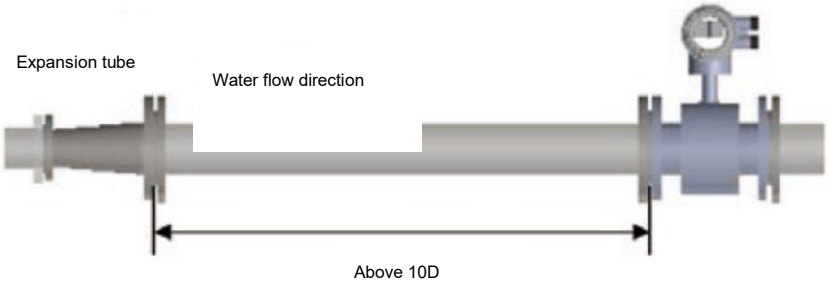


Figure 8: Straight pipe section with partially opened valve at the front end of the flow meter

5. 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.

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

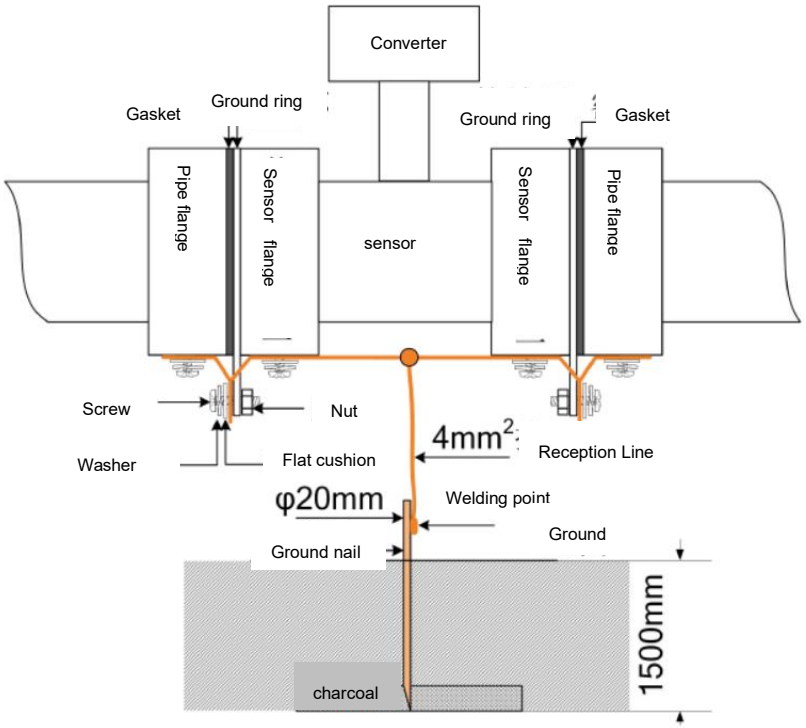


Figure 9 Schematic diagram of converter grounding

Selection code

PCL-E20-DN100 P16 T0 N5 E0 EE1 C0 F0 G0 S0 B0 A0 EX0

Code	Explosion-pro
EX0	No
EX1	Ex d ia mb IIC

Code	Paired attachments
A0	No paired attachments
A1	Carbon steel companion
A2	304 companion flange
A3	316L companion flange

Code	Digital output signal
B0	RS485(Modbus)
B1	Hart

Code	Analog output signal
S0	4-20mA (with pulse/frequency)

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

Code	Flange material	Code	flange material
F0	Carbon steel	F2	316L stainless
F1	304 stainless steel		

Code	Excitation shell material	Code	Excitation shell material
C0	Carbon steel	C2	316L stainless
C1	304l stainless steel		

Code	Grounding method	Code	Grounding method
EE	No grounding	E	Built-in grounding electrode

Code	Electrode material	Code	Electrode material
E0	316L stainless steel	E4	Titanium (Ti)
E1	Platinum iridium (Pt)	E5	Hastelloy C (HC)
E2	Hastelloy B (HB)	E6	Tungsten carbide (WC)
E3	Tantalum (Ta)		

Code	Lining	Code	Lining
N1	PFA	N4	polyurethane
N2	Natural rubber	N5	Polytetrafluoroethylene
N3	Neoprene rubber	N6	F46

Code	Medium temperature	Cod	Medium temperature
T0	≤60℃	T1	≤120℃

Code	Rated pressure	Code	Rated pressure
P4	4.0MPa,DN10～DN80	P1	1.0MPa，DN200～DN1000
P16	1.6MPa,DN100～DN150	P06	0.6MPa，DN1200～DN1600

C	Measuring pipe diameter

DN xx	The code meaning of DNxx is to measure the inner diameter of the pipe as xx. The selection of pipe diameter is shown in Table 1. The default material for the measuring tube is 304 stainless steel.
PCL-E20	Divided type electromagnetic flowmeter (flange connection method)

Example: PCL-E20-DN100P16T0N5E0EE1C0F0G0S0B0A0EX0

Model Description:

PCL-E20 split type electromagnetic flowmeter, with a pipeline diameter of DN100, rated 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.

Selection tips

According to statistics from authoritative institutions around the world, two-thirds of instrument failures in practical applications are caused by incorrect selection and installation of instruments. Therefore, the selection of flow meters is a very important task in practical applications. When selecting models, please note:

1. Collect process data

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

b. The maximum flow rate, minimum flow rate, and commonly used flow rate of the fluid;

c. The maximum working pressure of the fluid;

d. The highest and lowest temperature of the fluid.

2. The measured fluid must have a certain degree of conductivity, with a conductivity of ≥ 5 μ S/cm.

3. The maximum and minimum flow rates must comply with the values in the flow range table.

4. The actual maximum working pressure must be less than the rated working pressure of the flow meter guide pipe.

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

6. Determine if there is a negative pressure in the process pipeline.

7. When measuring clean media, the economic flow rate is 1.5m/s-3m/s; When measuring the easy crystallization solution, the flow rate should be appropriately increased to 3m/s~4m/s to automatically clean and prevent adhesion and deposition; When measuring wear-resistant fluids such as mineral slurry, the flow rate should be appropriately reduced to 1m/s~2m/s to reduce wear on the lining and electrodes. In practical applications, there are few flow velocities exceeding 7m/s, and those exceeding 10m/s are even rarer.

8. You can choose a suitable electromagnetic flow meter based on the actual situation. If the inner diameter of the selected electromagnetic flow meter does not match the inner diameter of the on-site process pipeline, it should be shrunk or expanded.

a. If the pipeline undergoes shrinkage, consideration should be given to whether the pressure loss caused by shrinkage will affect the process flow.

b. Considering improving measurement accuracy and product price, smaller caliber electromagnetic flow meters can be chosen to reduce economic investment.

Appendix

1. Common pipeline caliber and rated pressure

Table 3 Conventional Rated Pressure of Flange

Pipe diameter	Rated pressure
DN10～DN50	4.0MPa
DN100～DN400	1.6MPa
DN450～DN600	1.0MPa
DN700～DN1600	0.6MPa

2. Applicability of electrode material

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 alkaline solution with all concentrations, phosphoric acid, organic acids	P
	Nitric acid	O
Hastelloy C (HC)	Mixed acids (such as a mixed solution of chromic acid and sulfuric acid), oxidizing salts (such as Fe+++, Cu++, seawater)	P
	Hydrochloric acid	O
Titanium (Ti)	Salt (such as chloride, sodium salt, potassium salt, ammonium salt, hypochlorite, seawater), potassium hydroxide, ammonia hydroxide, barium hydroxide alkaline solution with a concentration less than 50%	P
	Reducing acids such as hydrochloric acid, sulfuric acid, phosphoric acid, hydrofluoric acid, etc	O
Tantalum (Ta)	Hydrochloric acid, dilute sulfuric acid, and concentrated sulfuric acid with a concentration less than 40% (excluding fuming sulfuric acid); Chlorine dioxide, iron chloride, hypochlorous acid, sodium cyanide, lead acetate, etc; Nitric acid (including oxidizing acids such as fuming nitric acid), aqua regia with a temperature below 80 ℃.	P
	Alkali, hydrofluoric acid	O
Platinum (Pt)	Almost all acid, alkali, and salt solutions (including fuming nitric acid and fuming sulfuric acid)	P
	Aqua regia, ammonium salts	O
Tungsten carbide (WC)	Processed neutral industrial wastewater, domestic wastewater, and resistant to solid particle interference; Slurry, such as mud and mortar.	P
	Acid, alkali, salt	O

3.Lining

Table 5 Applicable Scope of Lining Material

Lining	Symbol	performance	Operation temperature	Applicable liquid	Applicable caliber
Teflon	F4(PTFE)	1. Stable chemical performance, 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℃	Highly corrosive acid, alkali, and salt liquids	DN25～DN1600
Copolymer of tetrafluoroethylene and perfluoroalkyl vinyl ether	PFA	The corrosion resistance is the same as PTFE, with stainless steel wire mesh inside the measuring tube, which has negative pressure resistance characteristics	-20℃～150℃	Highly corrosive acid, alkali, and salt liquids	DN10～DN500
FEP	F46(FEP)	The corrosion resistance is the same as PTFE, with stainless steel wire mesh inside the measuring tube, which has negative pressure resistance characteristics	-20℃～150℃	Highly corrosive acid, alkali, and salt liquids	DN10～DN500
Neoprene rubber	CR	Moderate wear resistance, resistant to corrosion from generally low concentrations of acids, alkalis, and salts	-15℃～80℃	Measure general water, sewage, mud, and mineral slurry	DN50～DN1600

Polyurethane	PU	Excellent wear resistance, poor acid and alkaline resistance	-10℃～80℃	Neutral and strongly worn mineral slurry, coal slurry, slurry	DN25～DN300

4. Caliber and flow measurement range

Table 6 Caliber and Flow Measurement Range

Caliber (mm)	Minimum flow velocity (m/s)	Maximum flow velocity (m/s)
	0.5	10
	Minimum flow rate (m3/h)	Maximum flow rate (m3/h)
10	0.1414	2.8274 (1.414@5 m/s)
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 off for reference only.

Please calculate the exact value according to the following formula:

In the equation of $Q = 9\pi \times d^2 \times v/10000$, Q: Flow rate, unit;m^3/h；d：Flowmeter diameter,unit mm；π：Pi3.14；v: Flow rate, in units m/s。

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Contact Us

Nanjing Wotian Technology Co.,Ltd.
Website: www.wtsensor.com
Add: 5 Wenying Road, Binjiang Development Zone, Nanjing, 211161, China
Email: dr@wtsensor.com