

IQFM-EX Series Electromagnetic Flowmeter



Features

- The measurement accuracy will not be influenced by the fluid density, viscosity, temperature, pressure and electrical conductivity changes;
- Open flow without moving parts in measuring pipe, no pressure loss;
- Simple structure, easy installation, no high requirements for straight pipe section;
- No mechanical inertia, with good sensitivity, it can measure the transient pulsating flux, and has good linearity;
- Only the lining and electrodes contact with the media, as long as the selection of electrode and lining materials is proper, they can be corrosion resistance and abrasive resistance, and are able to ensure long-term use;
- Multi-electrode structure ensures high accuracy. With the grounding electrode, it doesn't need grounding ring which saves the cost;
- When power off, EEPROM can protect parameter setting and cumulative values;
- The converter uses a low-power consumption single-chip for processing data which ensure the reliable performance, high accuracy, low power consumption and zero stability. Dot matrix LCD can display the integrated flux, transient flux, velocity, flow percentage and other parameters;
- Two-way measuring system can be used for measuring forward flux and reverse flux; low frequency rectangular wave excitation improves the stability of flow, low power loss and superior low velocity characteristic.

Introduction

IQFM-EX Series Electromagnetic Flowmeter (hereinafter called Electromagnetic Flowmeter) is designed and manufactured with the most advanced domestic and abroad technology, featuring high accuracy, reliability, good stability and long service life.

We pay our attention to every detail in the process of the product structure design, material selection, manufacturing, assembly and factory testing etc. With a water tower up to 37m as pressure stabilizer for actual flow calibration, we have a professional production line for electromagnetic flowmeter, also we design and develop a series of software and hardware for electromagnetic flowmeter for mass production to ensure high quality in long term use. The product has backlight and wide temperature-ranged LCD display. With fully practical function, visual display, easy operation, it saves troubles for on-site installation operation and maintenance. IQFM-EX can be widely used in industrial fields such as petroleum, chemical, metallurgy, water supply and drainage, steel, coal, paper, food, textile, environmental protection and other municipal administration, water conservancy construction field etc.

Working Principle

The working principle of Electromagnetic Flowmeter is based on Faraday's Law of Electromagnetic Induction, that is, when the conductive liquid flows through the electromagnetic flowmeter, the induced electromotive force will be produced in the liquid conductor, and the induced electromotive force is directly proportional to the velocity of conductive liquid, magnetic flux density and width of conductor (interior diameter of flowmeter). Such induced electromotive force is detected by a pair of electrodes on the tube wall of the flowmeter, and the equation of induced electromotive force is as follows:

$$U = K \times B \times V \times D$$

U: Induced electromotive force

K: Instrument Constant

B: Magnetic flux density

V: Velocity

D: Interior diameter
of measuring pipe

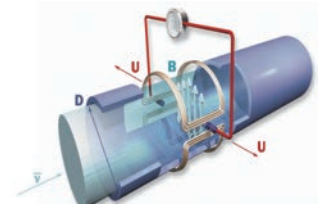


Figure 1 working principle diagram

Product Category



Flange Type (carbon steel)



Flange Type (stainless steel)



Threaded Type (stainless steel)



Threaded Type (carbon steel)



Clamping Type (carbon steel)



Battery Supplied Type (carbon steel)



Battery Supplied Type (stainless steel)

Specifications

Table 1 Specifications

Diameter	Flange type: DN6~DN1600, ≥DN20 with built-in grounding electrode
	Sanitary type: DN6~DN50
	Threaded type: DN6~DN50
	Clamping type: DN10~DN300
Measurement accuracy	±0.2%FS, ±0.5%FS
Electrode type	Standard fixed electrode, antifouling electrode
	DN6~DN20: a pair of measuring electrodes, no grounding electrodes
	DN25~DN500: a pair of measuring electrodes and a pair of grounding electrodes
	≥DN600: 2 pairs of measuring electrodes and a pair of grounding electrodes
Structure type	Integrated type, separated type (cable length of separated type≤100m)
Rated pressure	GB: PN2.5, PN6, PN16, PN25, PN40, PN63, PN100, PN160, PN250
	ANSI: CLASS 150, CLASS 300, CLASS 600, CLASS 900
	DIN: PN10, PN16, PN25, PN40, PN63
	JIS: 5K, 10K, 16K, 20K, 30K, 40K, 63K
	Others: customizable
Electrode material	316L, Ti, HB/HC, Ta, WC, Pt
Lining material	Neoprene (CR), Natural Rubber (NR), Polyurethane Rubber (PU)
	Polytetrafluoroethylene (PTFE), F46, PFA
Measured pipe	Stainless steel
Flange/body flange	Carbon steel (standard), stainless steel (optional)
Converter housing	Aluminum die-casting
Power supply	100 V AC~240V AC
	12V DC, 24V DC
	Battery supply (LCD display, RS485 output, wireless output, frequency/pulse output, and the frequency/pulse output is used only for calibration or calibration purposes.)
	Solar power with storage battery
Output signal	4mA~20mA DC (load resistance 0Ω~750Ω, active output)
	Hart
	Frequency, pulse output (Passive, active output optional)
	Upper and lower limit alarm output
	RS485 (standard Modbus protocol), RS232
	Profibus-DP, Profibus-PA
	2G, 4G, NB, LoRa wireless transmission
Electrical connection	M20×1.5
IP protection	IP65, IP68 (separated type only)
Environmental temp.	-20℃ ~60℃
Storage temp.	-40℃ ~60℃
Relative humidity	5%~90%

Outline Structure

Integrated flange connection dimensions

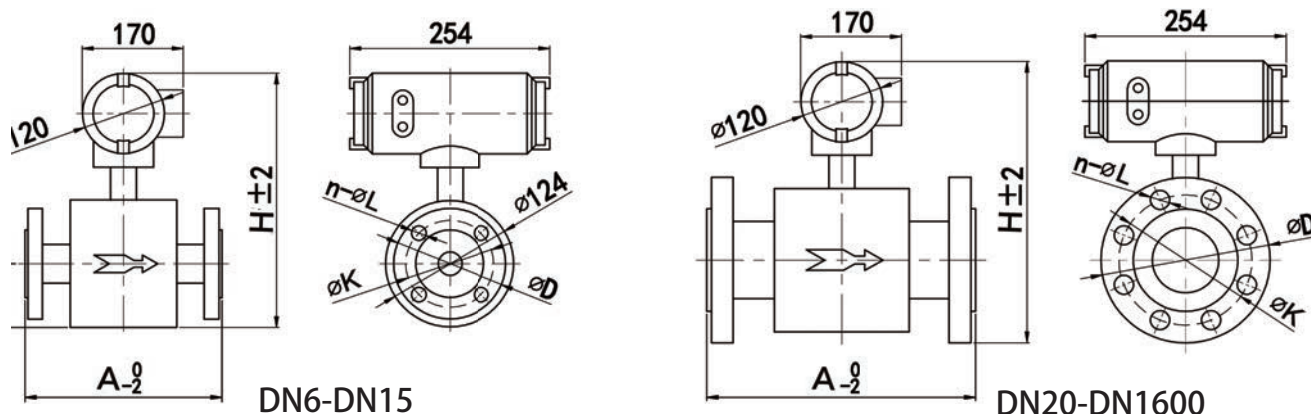


Figure 2 Integrated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

Table 2 Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n-φL
6	4.0	150	304	90	60	4-φ14
10		150	304	90	60	4-φ14
15		150	304	95	65	4-φ14
20		150	304	105	75	4-φ14
25		150	312	115	85	4-φ14
32		150	330	140	100	4-φ18
40		150	340	150	110	4-φ18
50		200	338	165	125	4-φ18
65		200	358	185	145	8-φ18
80		200	374	200	160	8-φ18
100	1.6	250	402	220	180	8-φ18
125		250	425	250	210	8-φ18
150		300	458	285	240	8-φ23
200		350	522	340	295	8-φ23
250		400	574	395	350	12-φ23
300		500	624	445	400	12-φ23
350		500	678	500	460	16-φ23
400		600	742	656	515	16-φ25
450	1.0	600	794	615	565	20-φ25
500		600	862	670	620	20-φ25
600		600	950	780	725	20-φ25
700		700	1058	895	840	24-φ30
800		800	1166	1010	950	24-φ34
900		900	1272	1110	1050	28-φ34
1000	0.6	1000	1376	1220	1160	28-φ34
1200		1200	1578	1405	1340	32-φ34
1400		1400	1840	1630	1560	36-φ36
1600		1600	2078	1830	1760	40-φ36

Separated flange connection dimensions

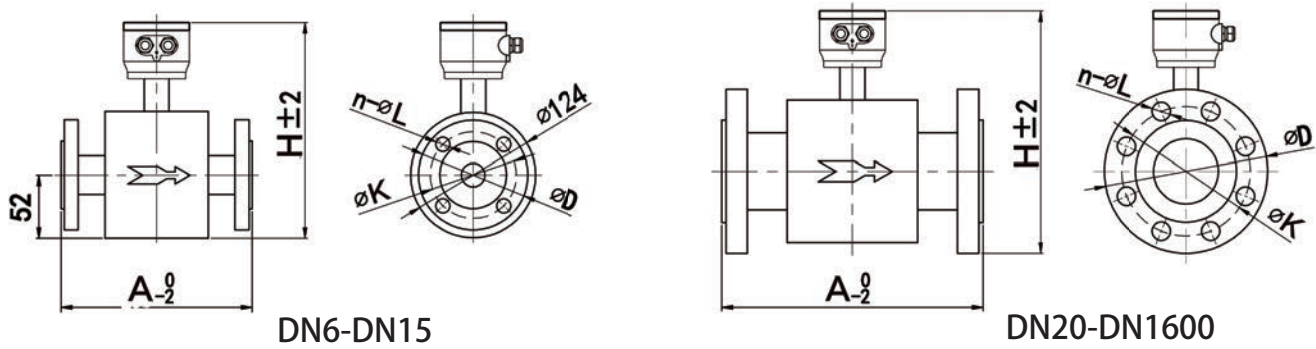


Figure 3 Separated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

Table 3 Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n-φL
6	4.0	150	245	Φ90	Φ60	4-Φ14
10		150	245	Φ90	Φ60	4-Φ14
15		150	245	Φ95	φ65	4-Φ14
20		150	245	Φ105	Φ75	4-Φ14
25		150	252	Φ115	Φ85	4-Φ14
32		150	270	Φ140	100φ	4-Φ18
40		150	280	Φ150	Φ110	4-Φ18
50		200	280	Φ165	Φ125	4-Φ18
65		200	300	Φ185	Φ145	8-Φ18
80		200	314	Φ200	Φ160	8-Φ18
100	1.6	250	342	Φ220	Φ180	8-Φ18
125		250	366	Φ250	Φ210	8-Φ18
150		300	400	Φ285	Φ240	8-Φ23
200	1.0	350	464	Φ340	Φ295	8-Φ23
250		400	516	Φ395	Φ350	12-Φ23
300		500	566	Φ445	Φ400	12-Φ23
350		500	618	φ500	Φ460	16-Φ23
400		600	682	Φ656	Φ515	16-Φ25
450		600	734	Φ615	Φ565	20-Φ25
500		600	802	Φ670	Φ620	20-Φ25
600		600	892	Φ780	Φ725	20-Φ25
700		700	998	Φ895	Φ840	24-Φ30
800		800	1106	Φ1010	Φ950	24-Φ34
900	900	1212	Φ1110	Φ1050	28-Φ34	
1000	1000	1316	Φ1220	Φ1160	28-Φ34	
1200	0.6	1200	1518	Φ1405	Φ1340	32-Φ34
1400		1400	1780	Φ1630	Φ1560	36-Φ36
1600		1600	2018	Φ1830	Φ1760	40-Φ36

Separated converter dimensions

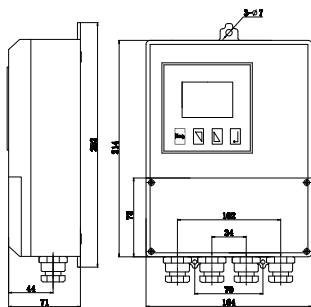


Figure 4 Separated converter dimensions

The separated type is generally used in on-site maintenance and debugging reading inconvenient occasions, but also used in more severe applications, such as high-temperature fluids and vibration sources. On most occasions, the integrated and separated types can both meet the requirements. is $\geq 500\text{mm}$, the separated type is recommended or easy maintenance; when the meter is installed below the ground, the separated type, IP68 protection level structure must be selected; when the meter is unavoidably installed at the pump outlet, please choose a separated structure meter

Electrical Connection

The electromagnetic flowmeter converter can be divided into integrated converter and separated converter, and the wiring diagram is shown in Figure 5 and Figure 6.

When wiring, please note:

- a) RS485 communication cable needs to use two-core twisted pair shielded wire;
- b) The same cable shall not be used for the power line and 4mA~20mA DC signal line. Two cables shall be connected separately.

Integrated wiring

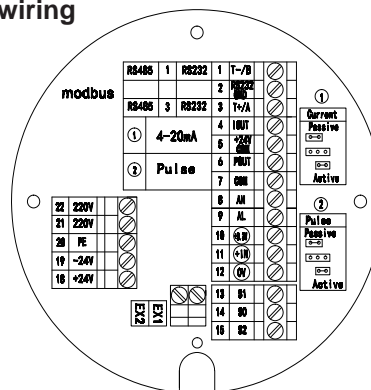


Figure 5 Integrated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output signal. See Table 4 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 4 Terminal definition of integrated type

Terminal	Symbol	Function
1	T-/B	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T+/A	RS485/RS232 communication input
4	IOUT	4mA~20mA DC output;
5	+24V DC COM	4mA~20mA DC output grounding wire;
6	POUT	Pulse/frequency output
7	COM	Pulse/frequency output grounding wire
8	AH	Alarm output for Upper Limit of flow
9	AL	Alarm output for Lower Limit of flow
10	(+3.3V)	Pressure transmitter +IN
11	(+IN)	Pressure transmitter output terminal
12	(0V)	Pressure transmitter GND
13	S1	Electrode wire
14	S0	Signal grounding wire
15	S2	Electrode wire
18	+24V	24V DC (12V DC) power supply access
19	-24V	
20	PE	Power grounding wire
21	220V	220V AC power supply access
22	220V	
	EX1	Exciting current
	EX2	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current ① or pulse ② will output an active signal.
	Active	When lugs are connected to Active, the current ① or pulse ② will output a passive signal.

Separated wiring

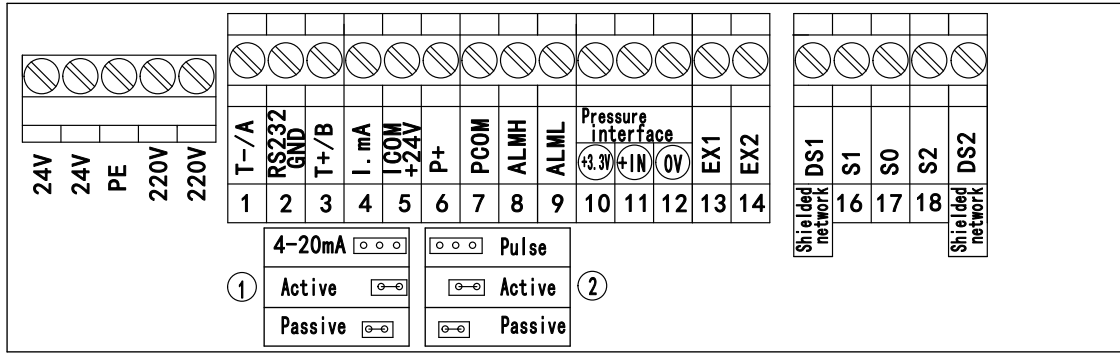


Figure 6 Separated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output form. See Table 5 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 5 Terminal definition of separated type

Terminal Symbol		Function
1	T+/A	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T-/B	RS485/RS232 communication input
4	I.mA	4mA~20mA DC output
5	Icom +24V	Current output grounding wire
6	P+	2-way flow pulse output/frequency output
7	Pcom	Pulse output grounding wire
8	ALMH	Alarm output for Upper Limit of flow
9	ALML	Alarm output for Lower Limit of flow
10	+3.3V	Pressure transmitter +IN
11	+IN	Pressure transmitter output terminal
12	0V	Pressure transmitter GND
13	EX1	Exciting current
14	EX2	
Shielding network	DS1	
	S1	Electrode wire
	S0	Signal grounding wire
	S2	Electrode wire
Shielding network	DS2	
220V	220V	220V AC power supply access
220V	220V	
24V	24V	24V DC power supply access
24V	24V	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current ① or pulse ② will output an active signal.
	Active	When lugs are connected to Active, the current ① or pulse ② will output a passive signal.

Installation

The electromagnetic flowmeter must work under the condition of full pipe, and the flowmeter cannot work normally when the pipe is not full or empty.

The correct installation method of the electromagnetic flowmeter should ensure that the pipe is filled with liquid and should not be installed high on the pipe, as shown in Figure 7.

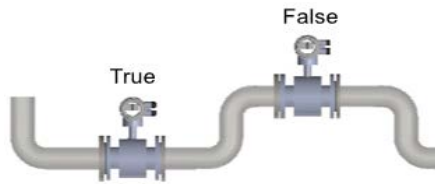


Figure 7

Front and rear straight pipe installation

In order to ensure the upstream piping conditions required for high accuracy measurement of the flowmeter, the piping installation as shown in the figure below is recommended.

When there are valves at the front and rear of the flowmeter, the front and rear straight pipe must meet the front 5D and rear 2D installation methods at least, and the valve must be fully open, as shown in Figure 8.

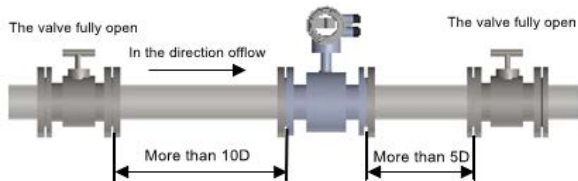


Figure 8

When flowmeter is installed at the back end of T-tube, the flowmeter and T-tube shall have a minimum of 5D straight pipe segments, as shown in Figure 9.

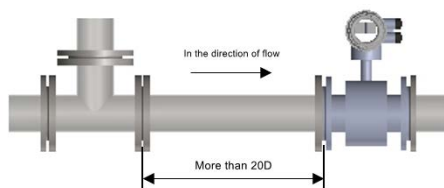


Figure 9

When the flowmeter is installed at the back end of 90° elbow pipe, at least 5D straight pipe are needed between the flowmeter and the tail end of the elbow, as shown in Figure 10.

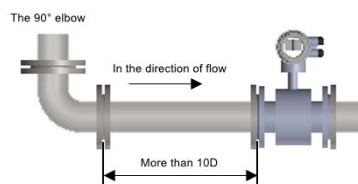


Figure 10

When the flowmeter is installed at the back end of the expanded diameter pipe, the flowmeter and the back end of the expanded diameter pipe need to ensure a minimum of 10D straight pipe, as shown in Figure 11.

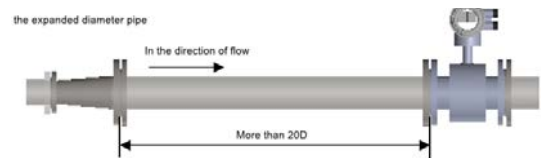


Figure 11

When the flowmeter is installed at the back end of the valve and the valve is not fully open, the flowmeter and the back end of the valve need to ensure a straight pipe section of at least 10D, as shown in Figure 12.

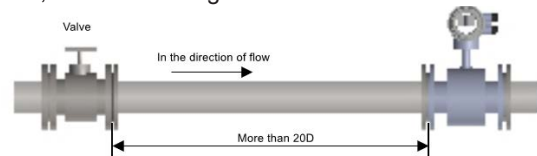


Figure 12

Installation Direction

When installing, the positive direction of liquid flow should generally be the same with the direction of the arrow on the sensor, and there must be sufficient space for installation and maintenance near the flowmeter. During installation, the flowmeter should be equipped with supports on both sides of the pipeline to prevent the flowmeter from being stressed due to pipeline vibration, impact and contraction.

When installing the flowmeter, in general, with horizontal installation, please ensure the axis of the measuring electrode is approximately horizontal; if the axis of the measuring electrode is perpendicular to the ground, bubbles can easily build up near the upper electrode which is easy to block the liquid from contacting the electrode below that is easily covered by mud or impurities. The converter is generally installed above the pipeline to prevent water from entering the converter.

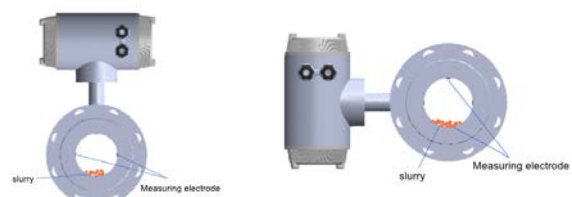


Figure 13 Flowmeter installation direction

When installing the flowmeter, please ensure the axis of the pipeline and the flowmeter measuring tube are in the same straight line. If there is an angle between the two axes, the flange connection will not be sealed well, and even the flange welding part will break.

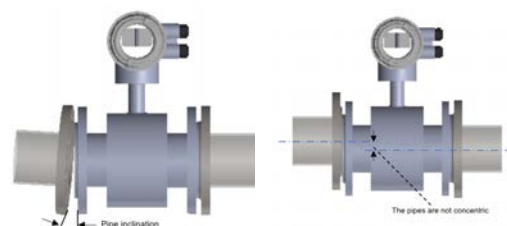
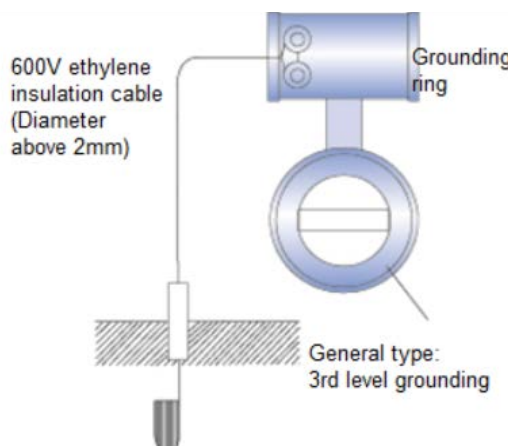


Figure 14 Flowmeter installation symmetrically with the pipe axis

Sensor Grounding

Since the voltage of inductive signal of electromagnetic flowmeter is small, it is easily affected by noise. Its reference potential must be the same to the measured liquid potential. Therefore, the reference potential of the sensor (terminal potential), the reference potential of converters and amplifiers are also the same to measured liquid potential, and the liquid potential have to be the same as the ground potential. The electromagnetic flowmeter is equipped with a ground loop, which is for establishing a liquid ground via contact with liquid, and for protecting lining meanwhile.

The instrument grounding is shown as below:



Noise Suppression

Do not install Electromagnetic Flowmeter near motors, transformers or power device which is easy to cause induction interference.

Order Guide

IQFM-EX		Electromagnetic Flowmete									
Code	Sensor type		Code	Sensor type		Code	Sensor type				
AS0	Standard		AS1	With pressure port		AS2	Explosion-proof (CT4)				
Code	Pipe diameter										
xxx	For example: 100 represents DN100										
Code	Electrode Type										
1	Standard Mount										
Code	Electrode Material		Code	Electrode Material		Code	Electrode Material		Code	Electrode Material	
0	SS316L		2	Hastelloy BB(HB)		4	Titanium (Ti)		6	wolfram carbide (WC)	
1	Platinum (Pt)		3	Tantalum (Ta)		5	HastelloyC (HC)				
Code	Lining material			Code	Lining material			Code	Lining material		
1	PFA			3	Neoprene			5	Polytetrafluoroethylene		
2	Natural rubber			4	vPolyurethane Rubber			6	F46		
Code	Rated pressure				Code	Rated pressure					
4.0	4.0MPa, DN10 ~ DN80				1.0	1.0MPa, DN200 ~ DN1000					
1.6	1.6MPa, DN100 ~ DN150				0.6	0.6MPa, DN1200 ~ DN1600					
Code	Media working temp.				Code	Media working temp.					
E	≤60°C				H	≤120°C					
Code	Ground mode		Code	Ground mode		Code	Ground mode				
*	Without electrode		1	With electrode		2	Ground ring				
Code	Protection			Code	Protection						
0	IP65			1	IP68 (separated type only)						
Code	Converter mode			Code	Converter mode						
0	Integrated			1	Separated						
Code	Analog		Code	Analog		Code	Analog				
*	without		0	4 ~ 20mA		1	4 ~ 20mA+Hart				
Code	Digital		Code	Digital		Code	Digital				
0	without		2	Profibus-DP		4	others				
1	RS485		3	Wireless ransmission(2G/4G/Lora							
Code	Sensor material			Code	Sensor material						
0	Carbon Steel			1	Stainless steel						
Code	Connection mode		Code	Connection mode							
1	Flange		3	Clamping type							
2	Thread		4	Clamp							
Code	Accessories			Code	Accessories						
0	Without			3	Pressure transmitter						
1	Carbon steel companion lange		4	others							
2	Stainless steel companion flange										
Code	Power supply		Code	Power supply							
0	100V ~ 240V AC										
1	24V DC		3	12V DC							
2	Battery Power supply		4	Others							
(xxx)	Instrument full range										

IQFM-EX - AS1 - 100 - 1 0 5 - 1.6 E 2 - 0 0 0 1 - 0 1 1 0 (200) the whole spec.

Example:

IQFM-EX-AS1-100-105-1.6E2-0001-0110(200)

Explanation: IQFM-EX Electromagnetic flowmeter; DN100 diameter; with pressure measurement interface; fixed stainless steel 316L electrodes; PTFE lining; rated pressure 1.6MPa; media temp. 0 °C ~60 °C ; ground electrode and ground ring; IP65 protection, integrated, with 4mADC~20mADC and RS485 digital signal; carbon steel sensor; flange connection; with companion mounting flange (including bolts and nuts), 100VAC~240VAC power supply; full range 200m³/h .

The selection of electromagnetic flowmeter should be carried out by technicians who are familiar with the on-site process conditions. The appropriate diameter, lining material, electrode, etc. should be selected according to the order guide, and determined by the end users who are familiar with the on-site process conditions.

Order Notes

According to statistics from authoritative organizations in the world, one-third of the cases of flow meter failure are caused by the quality of the product itself, and two-thirds of the cases are caused by product selection and on-site installation that do not meet the requirements. The selection of electromagnetic flowmeter requires the implementation of the following parameters.

1. Collect process data
 - a) The name of the measured fluid, and the composition of the chemical substance contained;
 - b) Max. flow, min. flow, common flow;
 - c) Max. Working pressure;
 - d) Max. Temp., min. Temp.
2. The measured fluid must be conductive, conductivity > 5μS/cm.
3. The maximum flow and the minimum flow must conform to the values of the flow range in table 7.
4. When measuring cleaning media, the economic low rate is 1.5m/s~3m/s; When measuring easy crystallization solution, the flow rate should be appropriately increased to 3m/s~4m/s to automatically clean and prevent adhesion deposition; for measuring ore slurry, etc. For wear-resistant fluids, the flow rate

should be appropriately reduced to 1m/s~2m/s to reduce the wear on the lining and electrodes. In practical applications, there is rarely a flow velocity exceeding 7m/s, and it is even rarer to exceed 10m/s.

5. The actual maximum working pressure must be less than the rated working pressure of the flowmeter.
6. The maximum and minimum working temperature must meet the requirements specified in the flowmeter.
7. Confirm whether there is negative pressure in process pipeline.

Attentions**1. Common pipe diameters and rated pressure****Table 6 Pipeline normal rated pressure**

Rated pressure	Diameter
4.0MPa	DN10~DN80
1.6MPa	DN100~DN150
1.0MPa	DN200~DN1000
0.6MPa	DN1200~DN1600
Notes: Other pressures can be customized	

2.Flow range

Table 7 Flow range

Velocity m/s Flow m³/h DN mm								
	0.5	1	2	3	4	5	7	10
6	0.0509	0.1018	0.2036	0.3054	0.4072	0.5089	0.7125	1.0179
10	0.1414	0.2827	0.5655	0.8482	1.1310	1.4137	1.9792	2.8274
15	0.3181	0.6362	1.2723	1.9085	2.5447	3.1809	4.4532	6.3617
20	0.5655	1.1310	2.2619	3.3929	4.5239	5.6549	7.9168	11.3097
25	0.8836	1.7671	3.5343	5.3014	7.0686	8.8357	12.3700	17.6715
32	1.4476	2.8953	5.7906	8.6859	11.5812	14.4765	20.2670	28.9529
40	2.2619	4.5239	9.0478	13.5717	18.0956	22.6195	31.6673	45.2389
50	3.5343	7.0686	14.1372	21.2058	28.2743	35.3429	49.4800	70.6858
65	5.9730	11.9459	23.8918	35.8377	47.7836	59.7295	83.6213	119.4591
80	9.0478	18.0956	36.1911	54.2867	72.3823	90.4779	126.6690	180.9557
100	14.1372	28.2743	56.5487	84.8230	113.0973	141.3717	197.9203	282.7433
125	22.0893	44.1786	88.3573	132.5359	176.7146	220.8932	309.2505	441.7865
150	31.8086	63.6173	127.2345	190.8518	254.4690	318.0863	445.3208	636.1725
200	56.5487	113.0973	226.1947	339.2920	452.3893	565.4867	791.6813	1130.9734
250	88.3573	176.7146	353.4292	530.1438	706.8583	883.5729	1237.0021	1767.1459
300	127.2345	254.4690	508.9380	763.4070	1017.8760	1272.3450	1781.2830	2544.6900
350	173.1803	346.3606	692.7212	1039.0818	1385.4424	1731.8030	2424.5241	3463.6059
400	226.1947	452.3893	904.7787	1357.1680	1809.5574	2261.9467	3166.7253	4523.8934
450	286.2776	572.5553	1145.1105	1717.6658	2290.2210	2862.7763	4007.8868	5725.5526
500	353.4292	706.8583	1413.7167	2120.5750	2827.4334	3534.2917	4948.0083	7068.5835
600	508.9380	1017.8760	2035.7520	3053.6281	4071.5041	5089.3801	7125.1320	10178.7602
700	692.7212	1385.4424	2770.8847	4156.3271	5541.7694	6927.2118	9698.0964	13854.4236
800	904.7787	1809.5574	3619.1147	5428.6721	7238.2295	9047.7868	12666.9014	18095.5737
900	1145.1105	2290.2210	4580.4421	6870.6631	9160.8842	11451.1052	16031.5470	22902.2104
1000	1413.7167	2827.4334	5654.8668	8482.3002	11309.7336	14137.1669	19792.0334	28274.3339
1200	2035.7520	4071.5041	8143.0082	12214.512	16286.0163	20357.5204	28500.5281	40715.0408
1400	2770.8847	5541.7694	11083.538	16625.308	22167.0778	27708.8472	38792.3854	55417.6944
1600	3619.1147	7238.2295	14476.458	21714.459	28952.9179	36191.1474	50667.6055	72382.2947

3. Electrode material

Table 8 Electrode material property

Material	Corrosion resistance	Applicability
316L	Domestic water, industrial water, raw water, groundwater, urban sewage, treated neutral industrial sewage	<input checked="" type="checkbox"/>
	Acid, alkali, salt	<input type="checkbox"/>
Hastelloy B (HB)	Weak organic acid	<input checked="" type="checkbox"/>
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	<input type="checkbox"/>
Hastelloy C (HC)	Oxidizing salts such as Fe ³⁺ , sea water	<input checked="" type="checkbox"/>
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	<input type="checkbox"/>
Titanium (Ti)	Chloride (chloride/magnesium/aluminum/calcium/ammonium/iron, etc.)	<input checked="" type="checkbox"/>
	Ammonia, sodium salt, potassium salt, ammonium salt, hypochlorite, sea water	
	Sodium hydroxide, potassium hydroxide, ammonium hydroxide, barium hydroxide and other alkaline solutions with a concentration of less than 50%	<input type="checkbox"/>
	Nitric acid, hydrochloric acid, sulfuric acid, phosphoric acid, hydrofluoric acid and other reducing acids	
Tantalum (Ta)	Hydrochloric acid (concentration less than 40%), dilute sulfuric acid and concentrated sulfuric acid	<input checked="" type="checkbox"/>
	Chlorine dioxide, ferric chloride, hypochlorous acid, sodium cyanide, lead acetate, etc.	
	Oxidizing acid such as nitric acid, aqua regia with temperature lower than 80°C	
	Alkali, hydrofluoric acid	<input type="checkbox"/>
Platinum (Pt)	Almost all acid, alkali, salt solutions	<input checked="" type="checkbox"/>
	Aqua regia, ammonium salt	<input type="checkbox"/>
Wolfram carbide (WC)	Treated neutral industrial sewage, domestic sewage, can resist the interference of solid particles	<input checked="" type="checkbox"/>
	Acid, alkali, salt	<input type="checkbox"/>

4. Lining material

Table 9 Lining material property

Lining Material	Symbol	Property	Working temp.	Applicable liquid	Applicable diameter
Neoprene	CR	Medium abrasion resistance, resistant to corrosion by low-concentration alkali and salt	-10°C ~ 60°C	Tap water, domestic sewage	DN50 ~ DN1600
Natural rubber	NR		-10°C ~ 60°C		
Polyurethane rubber	PU	Excellent abrasion resistance, poor acid and alkali resistance	-10°C ~ 60°C	Pulp, mineral pulp and other slurries	DN25 ~ DN600
Polytetrafluoro ethylene	F4 (PTFE)	The chemical performance is very stable, resistant to the corrosion of boiling hydrochloric acid, sulfuric acid, aqua regia and concentrated alkali	-20°C ~ 120°C	Corrosive acid, alkali, salt liquid	DN25 ~ DN1600
Polyperfluoro ethylene propylene	F46 (FEP)	The chemical performance is equivalent to F4, and the compressive and tensile strength is better than F4	-20°C ~ 150°C	Corrosive acid, alkali, salt liquid	DN6 ~ DN500
Copolymer of tetrafluoroethylene and perfluorinated hydrocarbon vinyl ether	PFA	The chemical properties are equivalent to F46, and the compressive and tensile strength is better than F4	-20°C ~ 150°C	Corrosive acid, alkali, salt liquid	DN6 ~ DN500