MFE600-E Electromagnetic Flowmeter

Features

- Accuracy unaffected by fluid density, viscosity, temperature, pressure, or conductivity
- No obstructing parts, no pressure loss
- Simple construction, easy installation, minimal straight pipe section required
- No mechanical inertia, fast response, good linearity, suitable for pulsating flow
- Sensor lining and electrodes contact the medium; proper materials ensure corrosion and wear resistance for long-term use
- Multi-electrode design for high accuracy, no grounding ring needed, reducing costs
- EEPROM stores specs and total flow data during power off
- The transmitter utilizes low-power consumption single-chip microcomputer, with reliable performance, high accuracy, and stable zero. Dot-matrix LCD displays total flow, instant flow, flow velocity, flow percentage
- Two-way measurement, supports positive and negative flow; low-frequency excitation improves stability and low-flow performance
- Integrated pressure measurement, simultaneous flow and pressure reading

Introduction

MFE600-E Electromagnetic Flowmeter (the electromagnetic flowmeter) is a smart metering instrument developed and manufactured using advanced international technology. It features high accuracy, reliability, stability, and long service life. MICROSENSOR emphasizes every process, including construction, materials, manufacturing, assembly, and testing. Utilizing the 37 m water tower as a stabilizing device for flow calibration and a specialized production line for mass flowmeter. Additionally, dedicated software and hardware were developed for the mass production, ensuring sustained high standards. It is widely used in oil, chemicals, metallurgy, water supply and drainage, steel, coal, papermaking, food, textiles, and environmental protection.

Operating Principle

Electromagnetic flowmeters operate based on Faraday's law of electromagnetic induction. A pair of electrodes is installed on the pipe wall, where the axis of the meter tube is perpendicular to the magnetic field lines. When the conductive fluid flows along the pipe axis, it cuts through the magnetic field lines, generating an induced electromotive force, which is detected by the electrodes. The induced electromotive force is given by the formula: $U = K \times B \times V \times D$, where:

U: Induced electromotive force K: Instrument constant
B: Magnetic flux density V: Average velocity
D: Inner diameter of the meter tube

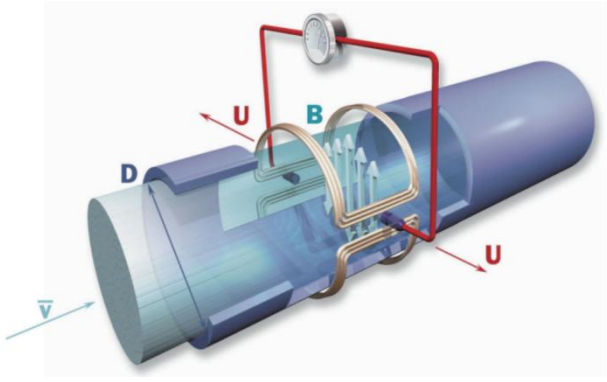


Figure 1 Operating Principle

Product Types

Flanged (Carbon Steel)

Flanged (Stainless Steel)

Clamp-on

Threaded

Wafer

Battery-powered (Carbon Steel)

Battery-powered (Stainless Steel)

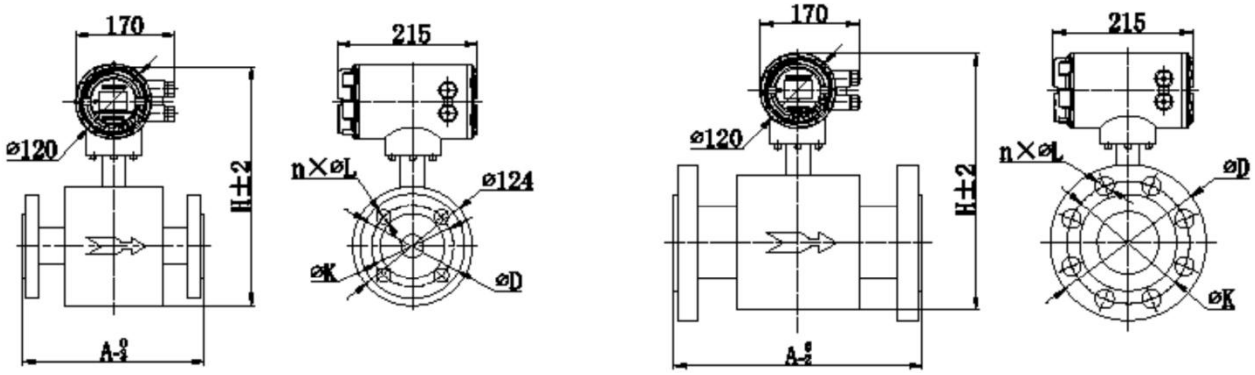
Specifications

Table 1 Specifications

Diameter	Flanged DN3 ~ DN2400
	Hygienic DN6 ~ DN50
	Threaded DN6 ~ DN50
	Wafer DN10 ~ DN300
Accuracy	Class 0.5, 0.2
Electrode types	Standard fixed electrode, anti-fouling electrode
	DN6 ~ DN20 one pair of measuring electrodes, no grounding electrode
	DN25 ~ DN500 one pair of measuring electrodes and one pair of grounding electrodes
	≥DN600 two pairs of measuring electrodes and one pair of grounding electrodes
Construction types	Integral, remote (remote cable length ≤ 99m)
Explosion-proof mark	Ex db ib mb IIC T6 Gb
Rated pressure	GB: PN2.5, PN6, PN16, PN25, PN40, PN63, PN100, PN160, PN250, PN320
	ANSI: CLASS 150, CLASS 300, CLASS 600, CLASS 900, CLASS 1500
	DIN: PN10, PN16, PN25, PN40, PN63, PN100
	JIS: 5K, 10K, 16K, 20K, 30K, 40K, 63K
	Others: Custom-made
Electrode	316L, Titanium (Ti), Hastelloy (HB, HC), Tantalum (Ta), Tungsten carbide (WC), Platinum -iridium (Pt), Ceramic
Lining	Chloroprene rubber (CR), Natural rubber (NR), Polyurethane rubber (PU)
	Polytetrafluoroethylene (PTFE), F46, PFA, Ceramic
Meter tube	304 SS
Flange and body	Carbon steel, 304 SS, 316L SS
Transmitter housing	Cast aluminum, 304 SS
Power supply	220VAC
	12V DC, 24V DC
	Battery-powered (with LCD display, RS485 output, wireless output, frequency/pulse output – frequency/pulse output for calibration only)
Output signal	4mA ~ 20mA DC (load resistance 0Ω ~ 750Ω, active output)
	HART output
	Frequency/pulse output (optional passive or active)
	Upper and lower limit alarm output
	RS485 output (ModBus protocol), RS232 output
	Profibus-DP, Profibus-PA
Electrical port	M20×1.5 (Female), NPT 1/2 (Female)
IP rating	IP65: Dust proof, protected against water jets IP67: Dust proof, protected against temporary immersion IP68: Protected against continuous immersion (sensor part only, transmitter IP65), suitable for installation in instrument wells
Ambient temperature	-20℃~ 60℃ (optional -40℃~ 60℃)
Storage temperature	-40℃~ 60℃
Relative humidity	5% ~ 90%

Outline Construction

Integral flanged dimensions



DN3 ~ DN20 DN25 ~ DN2400

Figure 2 Integral Outline Dimensions

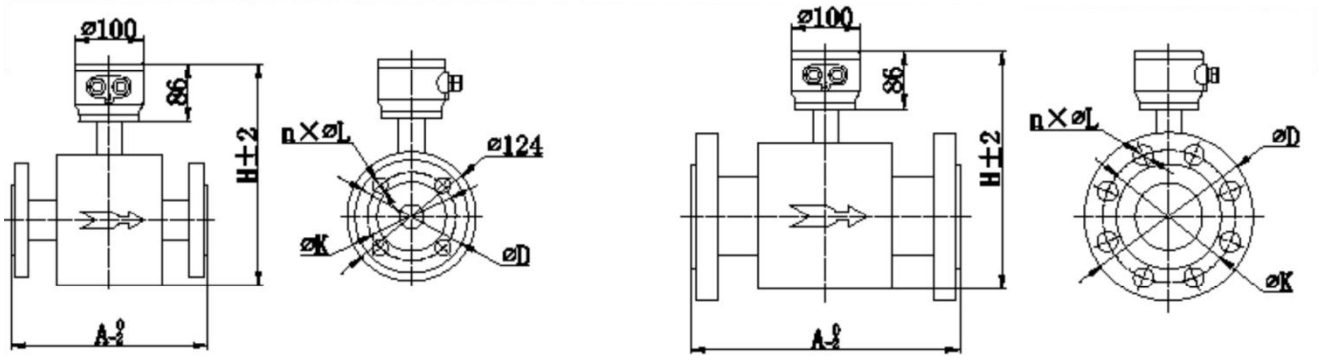
A : flowmeter tube length; H: flowmeter height; n: bolt holes QTY; L: bolt hole diameter; K: bolt hole center diameter; D: flange outer diameter.

Integral electromagnetic flowmeter dimensions

Table 2 Integral Electromagnetic Flowmeter Dimensions

DN	Rated Pressure (MPa)	Outline Dimension (mm)		Flanged Dimension (mm)		
		A	H	D	K	n×ΦL
3	4.0	150	304	90	60	4×Φ14
4		150	304	90	60	4×Φ14
6		150	304	90	60	4×Φ14
8		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	1.0	350	522	340	295	8×Φ23
250		400	574	395	350	12×Φ23
300		500	624	445	400	12×Φ23
350		500	698	505	460	16×Φ22
400		600	759	556	515	16×Φ26
450		600	812	615	565	20×Φ26
500		600	861	670	620	20×Φ26
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		1000	1376	1220	1160	28×Φ34
1200	0.6	1200	1578	1405	1340	32×Φ34
1400		1400	1840	1630	1560	36×Φ36
1600		1600	2078	1830	1760	40×Φ36
1800		1800	2262	2115	2020	44×Φ54
2000		2000	2472	2325	2230	48×Φ54
2200		≥DN2200, please consult with the MICROSENSOR				
2400						

Remote flanged dimensions



DN3 ~ DN20　　DN25 ~ DN2400

Figure 3 Remote Outline Dimensions

A : flowmeter tube length; H: flowmeter height; n: bolt holes QTY; L: bolt hole diameter; K: bolt hole center diameter; D: flange outer diameter.

Remote electromagnetic flowmeter dimensions

Table 3 Remote Electromagnetic Flowmeter Dimensions

DN	Rated Pressure (MPa)	Outline Dimension (mm)		Flanged Dimension (mm)		
		A	H	D	K	n×ΦL
3	4.0	150	245	90	60	4×Φ14
4		150	245	90	60	4×Φ14
6		150	245	90	60	4×Φ14
8		150	245	90	60	4×Φ14
10		150	245	90	60	4×Φ14
15		150	245	95	65	4×Φ14
20		150	245	105	75	4×Φ14
25		150	252	115	85	4×Φ14
32		150	270	140	100	4×Φ18
40		150	280	150	110	4×Φ18
50		200	280	165	125	4×Φ18
65		200	300	185	145	8×Φ18
80		200	314	200	160	8×Φ18
100	1.6	250	342	220	180	8×Φ18
125		250	366	250	210	8×Φ18
150		300	400	285	240	8×Φ23
200	1.0	350	464	340	295	8×Φ23
250		400	516	395	350	12×Φ23
300		500	566	445	400	12×Φ23
350		500	639	505	460	16×Φ22
400		600	700	565	515	16×Φ26
450		600	753	615	565	20×Φ26
500		600	950	780	725	20×Φ25
600		600	892	780	725	20×Φ25
700		700	998	895	840	24×Φ30
800		800	1106	1010	950	24×Φ34
900		900	1212	1110	1050	28×Φ34
1000		1000	1316	1220	1160	28×Φ34
1200	0.6	1200	1518	1405	1340	32×Φ34
1400		1400	1780	1630	1560	36×Φ36
1600		1600	2018	1830	1760	40×Φ36
1800		1800	2202	2115	2020	44×Φ54
2000		2000	2402	2325	2230	48×Φ54
2200		≥DN2200, please consult with the MICROSENSOR				
2400						

Remote transmitter dimensions

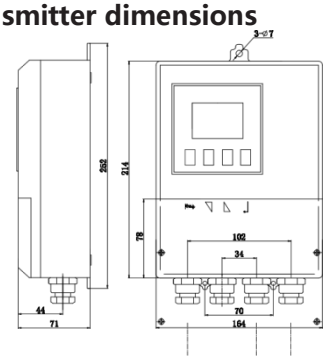


Figure 4 Remote Transmitter Dimensions

The remote type is ideal for challenging maintenance, debugging, and harsh conditions, such as high-temperature fluids or vibrations. In most cases, both remote and integral types meet the requirements.

For diameters ≥ 500mm, the remote type is recommended for easier maintenance. For underground installation, a remote type with IP68 should be chosen. For pump outlet installation, a remote type should also be chosen.

Electrical Connection

The electromagnetic flowmeter transmitter is available in integral and remote types. See Figures 5 and 6 for wiring diagrams.

Wiring precautions:

a) Use a two-wire twisted-pair shielded cable for RS485 communication;

b) Power and 4mA–20mA signal cables must be connected separately.

Integral wiring

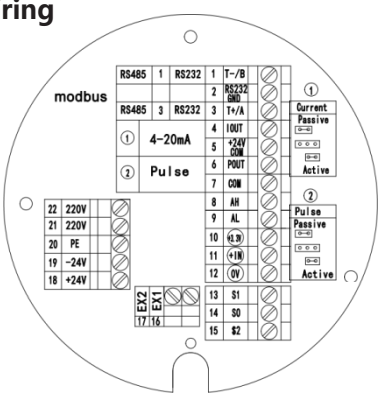


Figure 5 Integral Wiring

Select the correct power terminal per specs and connect the signal cable as needed. See Table 4 for terminal definitions.

Table 4 Integral Terminal Definitions

Terminal Symbol		Description
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 common ground/ HART (–)
6	POUT	Pulse/frequency output
7	COM	Pulse/frequency output common ground
8	AH	Alarm output for Upper Limit of flow
9	AL	Alarm output for Lower Limit of flow
10	+3.3V	Power supply for pressure transmitter (positive)
11	+IN	Pressure transmitter output
12	0V	Pressure transmitter common ground
13	S1	Electrode wire
14	S0	Signal grounding wire
15	S2	Electrode wire
16	EX1	Excitation current
17	EX2	
18	+24V	24V DC (12V DC) power supply input
19	-24V	
20	PE	Power grounding wire
21	220V	220VAC input
22	220V	
Jumper	Passive	Current① or pulse② output is passive
	Active	Current① or pulse② output is active

Remote wiring

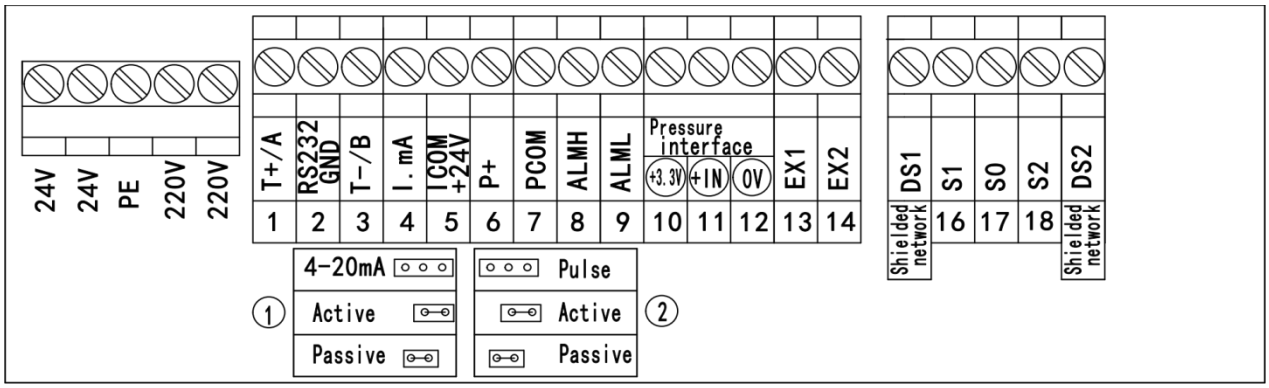


Figure 6 Remote Wiring

Select the correct power terminal per specs and connect the signal cable as needed. See Table 5 for terminal definitions.

Table 5 Remote Terminal Definitions

Terminal Symbol		Description
1	T+/A	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T-/B	RS485/RS232 communication output
4	I.mA	4mA ~ 20mA DC output/ HART (+)
5	Icom +24V	4mA ~ 20mA DC output common ground/ HART (–)
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	Power supply for pressure transmitter (positive)
11	+IN	Pressure transmitter output
12	0V	Pressure transmitter common ground
13	EX1	Excitation current
14	EX2	
Shielding network	DS1	
16	S1	Electrode wire
17	S0	Signal grounding wire
18	S2	Electrode wire
Shielding network	DS2	
220V	220V	220V AC power supply input
220V	220V	
24V	24V	24V DC power supply input
24V	24V	
Jumper	Passive	Current① or pulse② output is passive
	Active	Current① or pulse② output is active

Installation

The electromagnetic flowmeter must operate under full pipe conditions and cannot function if the pipe is not full or is empty.
To ensure the pipeline is filled with liquid, the flowmeter should not be installed at the high point of the pipeline, as shown in Figure 7.

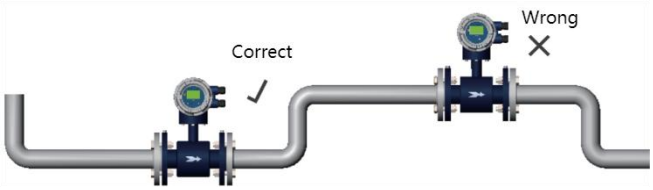


Figure 7

Upstream and downstream straight pipe

To ensure high accuracy for the flowmeter, the installation method shown below is recommended.
When valves are present upstream and downstream of the flowmeter, the minimum straight pipe sections must be 5D upstream and 2D downstream, with the valves fully opened, as shown in Figure 8.

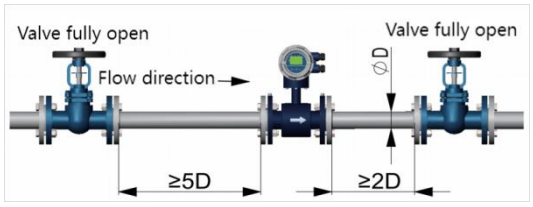


Figure 8

When installed at the downstream of a T-pipe, the flowmeter must have a minimum straight pipe section of 5D from the T-pipe, as shown in Figure 9.

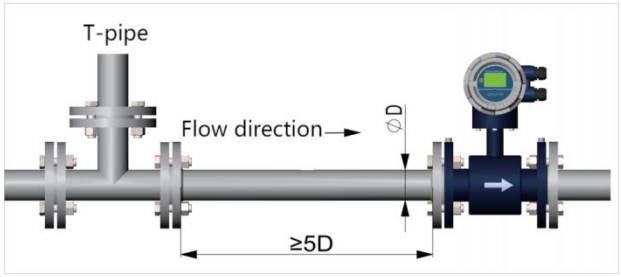


Figure 9

When installed at the downstream of a 90° elbow, the flowmeter must have a minimum straight pipe section of 5D from the elbow, as shown in Figure 10.

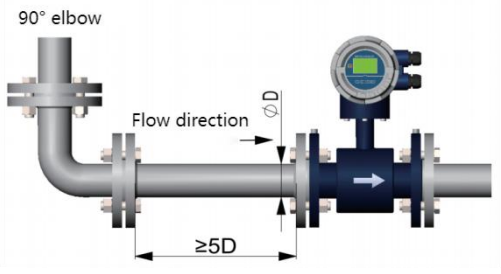


Figure 10

When installed at the downstream of a expander, the flowmeter must have a minimum straight pipe section of 10D from the expander, as shown in Figure 11.

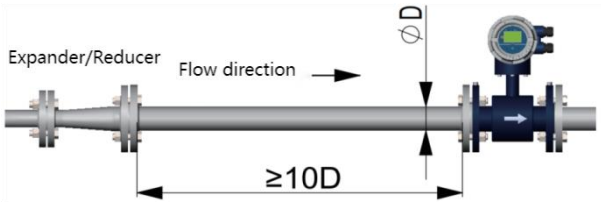


Figure 11

When installed at the downstream of a partially opened valve, the flowmeter must have a minimum straight pipe section of 10D from the valve, as shown in Figure 12.

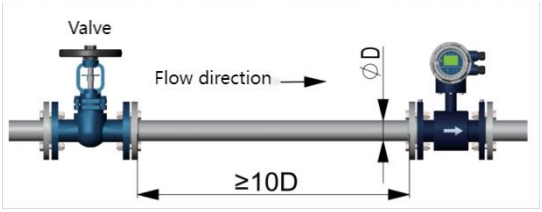


Figure 12

Installation direction

During installation, ensure the liquid flow direction aligns with the sensor arrow and provide adequate maintenance space near the flowmeter. Supports should be placed on both sides of the flowmeter to prevent stress from vibrations, shocks, and contractions.
For electromagnetic flowmeter installation, the measurement electrodes should be parallel to the ground. If vertical, bubbles may accumulate near the upper electrode, obstructing contact, and the lower electrode may be covered by mud or impurities. The transmitter should be installed above the pipeline to prevent water.

Figure 13 Flowmeter Installation Direction

When installing the electromagnetic flowmeter, ensure the pipeline axis is aligned with the flowmeter's meter tube axis. An angle between the two may cause sealing failures at the flange and can lead to fractures at the flange welds.

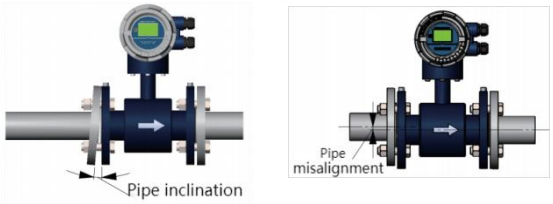


Figure 14 Flowmeter Installation Symmetrically with Pipe Axis

Precautions for Installing a Expander/Reducer

To minimize the impact on flow distribution and ensure accurate readings from the electromagnetic flowmeter, the expander/reducer should be treated as part of a straight pipe section. The conical angle (α) of the expander/reducer should not exceed 15°, with smaller angles preferred.

Installing a expander/reducer pipe introduces pressure loss, which can be divided into three components:

1. Pressure loss in the reducer section: $\Delta P1=\rho/2\xi1V2^2$
2. Pressure loss in the expander section: $\Delta P3=\rho/2\xi3V2^2$
3. Pressure loss in the sensor meter tube: $\Delta P2=\rho/2\xi3V2^2$

Total pressure loss: $\Delta P=0.01(\Delta P1+\Delta P2+\Delta P3)$ (mbar)

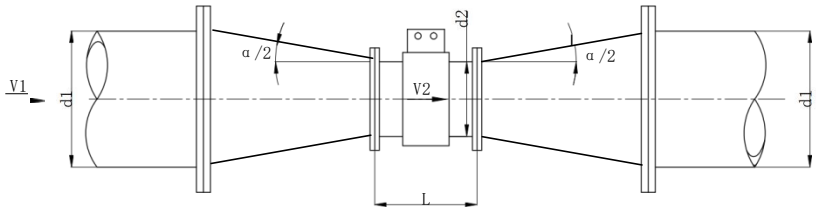
Where:

ρ is the medium density (kg/m³)

ξ_1, ξ_3 are loss coefficients for the reducer and expander sections, respectively, based on Reynolds number

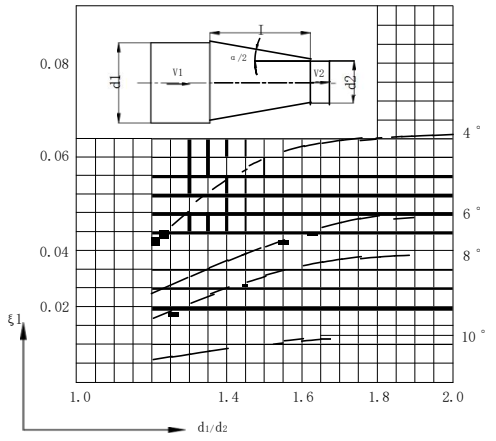
ξ_2 = 0.02 is the coefficient for the sensor meter tube

V_1 and V_2 are the flow velocities in the process pipe and sensor meter tube, respectively (m/s)

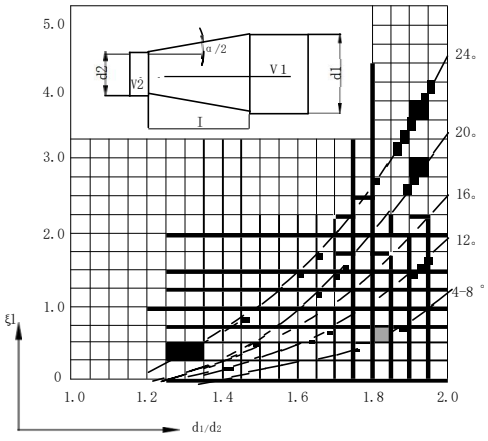


For example: The value of ξ when α=8°

d1/d2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
ξ1	0.018	0.023	0.0255	0.028	0.03	0.0308	0.0315	0.0323	0.0332
ξ3	0.01	0.02	0.07	0.15	0.26	0.43	0.64	0.9	1.25



Reducer



Expander

Order Guide

Types	Items	Code	Description
Composition		MFE600-E- Sensor Specifications - Construction Types - Transmitter Specifications - Options	
	Model	MFE600	Electromagnetic Flowmeter
	Series	E	E
Sensor specifications	Types	C	Standard
		P	With pressure port
		X	Explosion-proof
	Diameter	003	DN3
		004	DN4
		006	DN6
		008	DN8
		010	DN10
		015	DN15
		020	DN20
		025	DN25
		032	DN32
		040	DN40
		050	DN50
		065	DN65
		080	DN80
		100	DN100
		125	DN125
		150	DN150
		200	DN200
		250	DN250
		300	DN300
		350	DN350
		400	DN400
		450	DN450
		500	DN500
		600	DN600
		700	DN700
		800	DN800
		900	DN900
		10H	DN1000
		12H	DN1200
		14H	DN1400
		16H	DN1600
		18H	DN1800
		20H	DN2000
		22H	DN2200
		24H	DN2400
	Rated pressure	P0	0.6MPa
		P1	1.0MPa
		P2	1.6MPa
		P3	2.5MPa
		P4	4.0MPa
		P5	6.3MPa
		P6	10MPa
		C0	150LB
		C1	300LB
		J0	10K
		J1	16K
	Process connection ①	F	Flanged
		L	Threaded
		J	Wafer
		K	Clamp-on

Types	Items	Code	Description
Sensor specifications	Sensor materials	1	Carbon steel
		2	304 SS
		3	316L SS
	Electrode types	D	Standard fixed type (DN20≤2 electrodes ≥DN25 4 electrodes)
		T	Standard fixed type (DN20≤2 electrodes ≥DN25 3 electrodes)
	Electrode materials	1	316L SS
		2	Hastelloy C (HC)
		3	Hastelloy B (HB)
		4	Titanium (Ti)
		5	Tantalum (Ta)
		6	Tungsten carbide (WC)
		7	Platinum-iridium (Pt)
	Lining materials	C	Chloroprene Rubber (CR)
		N	Natural Rubber (NR)
		U	Polyurethane rubber (PU)
		T	Polytetrafluoroethylene (PTFE)
		F	Fluorinated ethylene propylene (F46)
		A	Polyfluoroalkoxy (PFA)
	Medium temperature range	1	≤ 60℃
		2	≤ 120℃
		3	≤ 180℃ ②
		4	≤150℃
		5	≤100℃
	Grounding	1	With Grounding electrode / no grounding ring ③
		2	304 SS grounding ring
		3	316L SS grounding ring
		4	Hastelloy C grounding ring
		5	Titanium (Ti) grounding ring
		6	Tantalum (Ta) grounding ring
	IP rating	1	IP65
		2	IP67 (Only for Integral)
		3	IP68 (Sensor IP68 / transmitter IP65)
Construction types		1	Integral
		2	Remote
Transmitter specifications	Accuracy	A	Class 0.2
		B	Class 0.5
	Transmitter housing	1	Cast aluminum
		2	304 SS
	Electrical connection	M	M20×1.5 Female
		T	NPT1/2
	Output signal	N	No output (Battery-powered)
		1	4-20mA/ frequency pulse
		2	4-20mA/ frequency pulse + relay output
		3	4-20mA/ frequency pulse +HART
		4	4-20mA/ frequency pulse +RS485 (MODBUS protocol)
		5	4-20mA/ frequency pulse +Profibus-DP
		6	4-20mA/ frequency pulse +Profibus-PA
		G	4G wireless output
	Power supply	1	220VAC
		2	12V DC
		3	24V DC
		4	3.6V DC (Battery-powered)
		5	3.6V lithium battery + 24V DC dual power supply
Options	Options (multiple available)	/N	None
		/C	CNAS calibration report
		/S	Third-party inspection report
		/TS	TS certificate
		/J1	Electrical connection: nickel-plated copper
		/J2	Electrical connection: 304 SS
		/F1	Carbon steel companion-flange
		/F2	304 SS companion-flange
		/F3	316L SS companion-flange

Types	Items	Code	Description
		/Y	With integral pressure transmitter
		/CS	CCS
		/E	Labels, Operation Manual, Certificate of Conformity
		/JY	Slurry type
		/KR	Interference-resistant (low conductivity transmitter)
		/A	ATEX explosion-proof certification
		/L10 ④	Cable Length: L10, with a default 10m remote cable (excitation & signal wires, 10m each), maximum 99m. If it exceeds 99 m, please contact the MICROSENSOR.

※ For items not covered in the order guide, please contact the MICROSENSOR.

Notes:

① Threaded (L): 1.6MPa, DN10-DN50
Wafer (J): 1.6MPa, DN3~DN300
Clamp-on (K): 1.6MPa, DN3-DN300

② Suitable for PFA lining, remote type

③ No grounding electrode for DN20 and below

④ Cable length is available in 5 m increments (L10, L15, L20...L99)

Example: MFE600-E-C050P4F11T111-1-B1M11-F1

Description: MFE600-E Electromagnetic Flowmeter, standard, DN50, rated pressure 4.0MPa, flanged, sensor material carbon steel, Standard fixed electrode (DN20≤2 electrodes ≥DN25 3 electrodes); 316L SS electrode, PTFE lining, medium temperature 0～60℃, no grounding ring, IP65, integral, accuracy class 0.5, transmitter housing cast aluminum, M20×1.5 Female electrical connection, 4mA-20mA/frequency pulse output, 220V AC power supply, with carbon steel companion-flange and bolts & nuts.

The selection of an electromagnetic flowmeter should be made by technical personnel familiar with on-site conditions, using the flow rate table to choose the appropriate diameter, lining material, and electrode. The end user familiar with the process should make the final choice.

Notes

According to statistics from leading authorities, one-third of flowmeter failures are due to product quality issues, while two-thirds are caused by improper selection and non-compliant installation. When selecting an electromagnetic flowmeter, consider the following specifications:

1) Process data
   a) Measured fluid and chemical composition
   b) Max, min, and typical flow rates
   c) Max operating pressure
   d) Max and min temperatures
2) Fluid conductivity: Must be >5 μS/cm.
3) Max and min flow rate must meet the specified range in Table 7.
4) For clean media: 1.5m/s ~3 m/s; For crystallizing solutions: 3m/s ~ 4m/s to prevent deposition; For abrasive fluids (e.g., slurry): 1m/s ~ 2m/s to reduce wear. Actually, velocities >7 m/s are rare, >10m/s is even rarer.
5) The operating pressure must not exceed the rated pressure.
6) Max and min temperatures must meet specifications.
7) Check for any negative pressure in the pipeline.

Precautions

1) Common pipe diameter and rated pressure

Table 6 Nominal Rated Pressure of the Pipe

Rated Pressure	Diameter
4.0MPa	DN3 ~ DN80
1.6MPa	DN100 ~ DN150
1.0MPa	DN200 ~ DN1000
0.6MPa	DN1200 ~ DN2400
Note: Custom-made is available. Flange standard for DN3-DN500 per GB/T 9124.1-2019 Flange standard for DN600-DN2400 per JB/T 81-2015	

2) Flow velocity-to-flow rate

Table 7 Flow Velocity-to-Flow Rate

Velocity m/s / Flow rate m³/h / Diameter mm	0.5	1	2	3	4	5	7	10
3	0.0127	0.0254	0.0508	0.0763	0.1017	0.1272	0.1781	0.2544
4	0.0226	0.0452	0.0904	0.1357	0.1809	0.2261	0.3166	0.4524
6	0.0509	0.1018	0.2036	0.3054	0.4072	0.5089	0.7125	1.0179
8	0.0904	0.1809	0.3619	0.5428	0.7238	0.9047	1.2666	1.8095
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
1800	4580.4420	9160.8840	18321.7680	27482.6520	36643.5360	45804.4201	64126.1881	91608.8402
2000	5654.8666	11309.7333	22619.4667	33929.20008	45238.9334	56548.6668	79168.1335	113097.3336
2200	6842.3886	13684.7773	27369.5547	41054.3320	54739.1094	68423.8868	95793.4415	136847.773
2400	8143.0080	16286.0160	32572.0320	48858.0481	65144.0641	81430.0801	114002.1122	162860.160

3) Electrode materials

Table 8 Electrode Material Properties

Material	Corrosion Resistance	Applicability
316L	Domestic water, industrial water, raw water, groundwater, municipal wastewater, treated neutral industrial wastewater	☑
	Acids, alkalis, salts	☒
Hastelloy B (HB)	Weak organic acids	☑
	Nitric acid (HNO_3), hydrochloric acid (HCl), phosphoric acid (H_3PO_4), hydrofluoric acid (HF), and other reducing acids	☒
Hastelloy C (HC)	Oxidizing salts such as Fe^{3+}, seawater	☑
	Nitric acid, hydrochloric acid, phosphoric acid, hydrofluoric acid, and other reducing acids	☒
Titanium (Ti)	Chlorides (chlorides / magnesium (Mg^{2+}) / aluminum (Al^{3+}) / calcium (Ca^{2+}) / ammonium (NH_4^+) / iron (Fe^{2+} / Fe^{3+}), etc.)	☑
	Ammonia solution (NH_3 (aq)), sodium salts, potassium salts, ammonium salts, hypochlorite, seawater	
	Alkaline solutions (concentration < 50%) such as sodium hydroxide (NaOH), potassium hydroxide (KOH), ammonium hydroxide (NH_4 OH), barium hydroxide ($Ba(OH)_2$), etc.	
	Nitric acid, hydrochloric acid, sulfuric acid (H_2SO_4), phosphoric acid, hydrofluoric acid, and other reducing acids	☒
Tantalum (Ta)	Hydrochloric acid (HCl, concentration <40%), dilute and concentrated sulfuric acid (H_2SO_4)	☑
	Chlorine dioxide (ClO_2), ferric chloride ($FeCl_3$), hypochlorous acid (HOCl), sodium cyanide (NaCN), lead acetate ($Pb(C_2H_3O_2)_2$), etc.	
	Oxidizing acids such as nitric acid (HNO_3), aqua regia (HNO_3 + HCl) < 80°C	
	Alkalis, hydrofluoric acid (HF)	☒
Platinum (Pt)	Nearly all acid, alkali, and salt solutions	☑
	Aqua regia (HNO_3 + HCl), ammonium salt (NH_4Cl)	☒
Tungsten carbide (WC)	Treated neutral industrial wastewater, domestic sewage, resistant to solid particle interference	☑
	Acids, alkalis, salts	☒

4) Lining materials

Table 9 Lining Material Properties

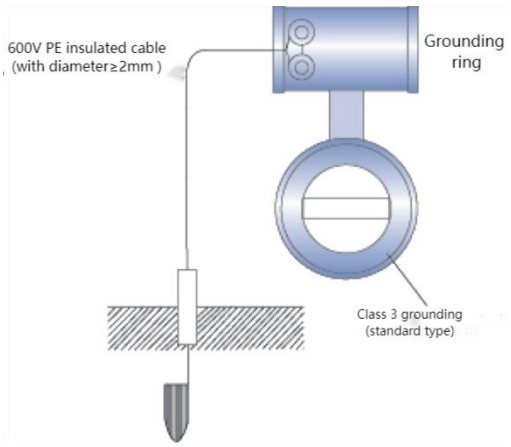
Material	Symbol	Property	Operating Temp.	Applicable Liquid	Diameter
Chloroprene rubber	CR	Moderate abrasion resistance, resistant to mild alkalis and salts	-10℃~ 60℃	Tap water, domestic sewage	DN50 ~ DN2400
Natural rubber	NR		-10℃~ 60℃		
Polyurethane rubber	PU	Excellent abrasion resistance, poor resistance to acids and alkalis	-10℃~ 60℃	Pulp, slurry, etc.	DN25 ~ DN600
Polytetrafluoroethylene	F4 (PTFE)	Chemically stable, resistant to boiling hydrochloric acid, sulfuric acid, aqua regia, and concentrated alkalis	-20℃~ 120℃	Corrosive acids, alkalis, and salt solutions	DN25 ~ DN2400
Perfluoroethylene propylene	F46 (FEP)	Chemically similar to F4, superior compressive and tensile strength to F4	-20℃~ 150℃	Corrosive acids, alkalis, and salt solutions	DN3 ~ DN600
Perfluoroalkoxy	PFA	Chemically equivalent to F46, superior compressive and tensile strength to F4	-20℃~ 180℃	Corrosive acids, alkalis, and salt solutions	DN3 ~ DN600

5 IP rating selection

According to GB/T 4208-2017 and IEC 529-76, the IP rating (degree of protection) of enclosure are as follows:
IP65: Protected against water jets (0.3bar, 12.5 L/min, 3 m distance).
IP67: Protected against temporary immersion (minimum depth 150 cm, for at least 30 min).
IP68: Protected against continuous immersion (maximum depth determined by MICROSENSOR and user).
Choose IP rating based on the operating conditions. For instruments frequently submerged underground, select IP68. For above-ground installation in dry environments, IP65 is sufficient.

6 Sensor grounding

Electromagnetic flowmeters have low induced signal voltage and are prone to noise, so the reference potential must match the fluid's. The sensor, transmitter, and amplifier should share the same reference potential (medium potential)as the fluid, which must also be grounded.
Grounding electrodes or rings are provided to establish grounding and protect the liner.
Instrument grounding:



7 Noise suppression

The electromagnetic flowmeter should not be installed near motors, transformers, or other strong sources of interference that may induce noise.