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Электромагнитный расходомер MFE600Z. Технические характеристики.



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;
- 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.

MFE600Z

Electromagnetic Flowmeter

Introduction

MFE600Z 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. MFE600Z can be mainly used in environmental protection and heating fields, Building automation, flow monitoring.

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

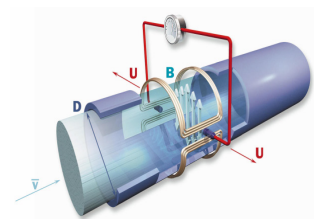


Figure 1 working principle diagram

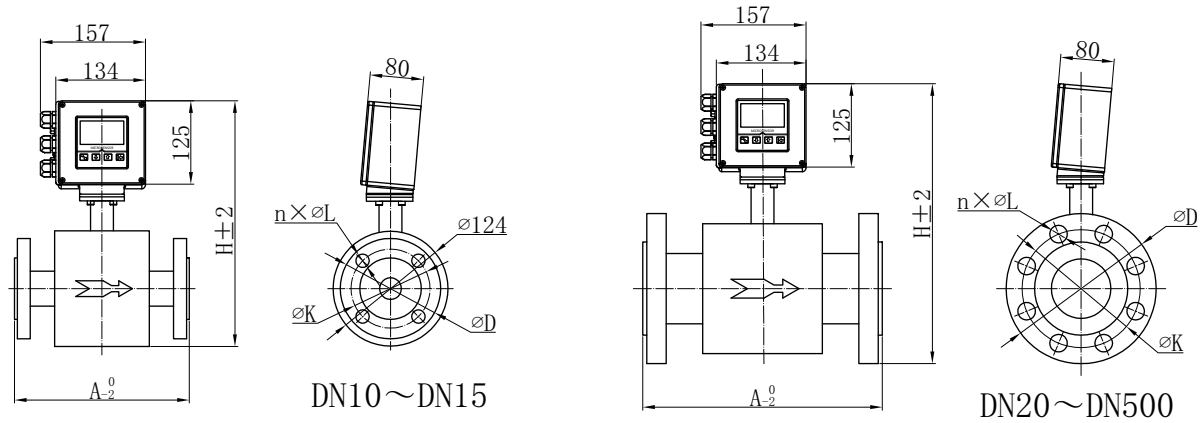
Specifications

Table 1 Specifications

Diameter	Flange type: DN10~DN500
Measurement accuracy	$\pm 0.5\%$, $\pm 1.0\%$
Pressure port	ANSI 1/2 NPT, JIS G1/2, ISO M20 ×1.5
Electrode type	Standard fixed electrode, antifouling electrode
	DN10~DN20: a pair of measuring electrodes, no grounding electrodes
	DN25~DN500: a pair of measuring electrodes and a pair of grounding electrodes
Structure type	Integrated type, separated type (cable length of separated type≤100m)
Rated pressure	GB: PN6, PN10, PN16, PN25, PN40, PN63
	ANSI: CLASS 150, CLASS 300, CLASS 600
	DIN: PN6, PN10, PN16, PN25, PN40, PN63
	JIS: 10K, 20K, 40K
	Others: customizable
Electrode material	316L, Ti, HB/HC, Ta, WC, Pt
Lining material	Neoprene (CR), Natural Rubber (NR), Polyurethane Rubber (PU)
	Polytetrafluoroethylene (PTFE), F46
Measured pipe	Stainless steel 06Cr19Ni10(304), 304 ASTM, SUS 304
Flange/body flange	Carbon steel (standard), stainless steel (optional) 06Cr19Ni10(304), 304 ASTM, SUS 304
Converter housing	Aluminum die-casting
Ground Ring Form	No Ground ring DN20 and below, Grounding ring material same as measuring electrode
Power supply	100 V AC~240V AC
	24V DC, 12V DC
Output signal	4mA~20mA DC (4mA to 0m ³ ; 20mA to full scale) (load resistance 0Ω~750Ω, active output)
	Frequency, pulse output (Passive, active output optional)
	Upper and lower limit alarm output
	RS485 (standard Modbus protocol), RS232
Electrical connection	ISO M20×1.5
IP protection	IP65, IP68 (separated type only)
Power consumption	≤5W
Environmental temp.	-20°C ~60°C
Storage temp.	-40°C ~60°C
Relative humidity	5%~90%

Outline Structure

Integrated flange connection dimensions

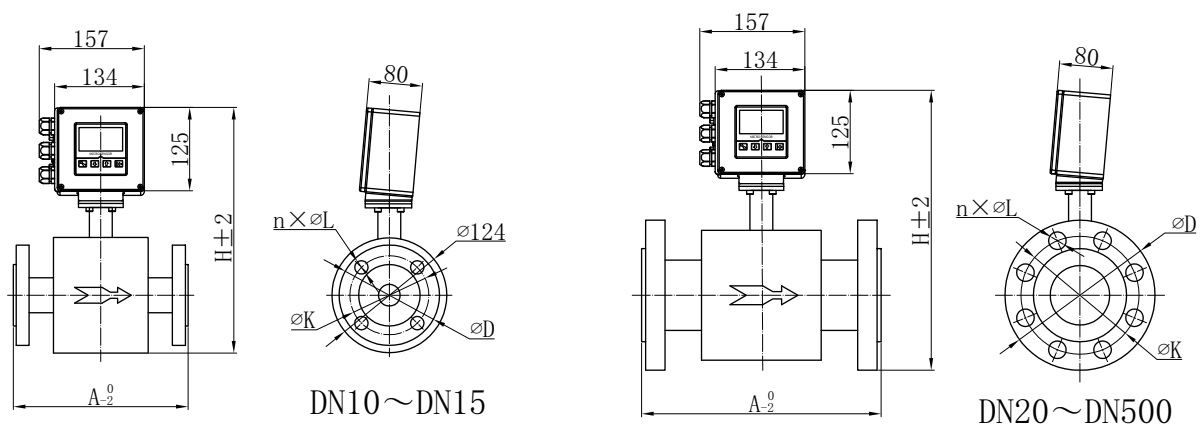


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n × ØL
10	0.6 (DIN)	200	296	75	50	4 × Ø11
15		200	296	80	55	4 × Ø11
20		200	299	90	65	4 × Ø11
25		200	311	100	75	4 × Ø11
32		200	315	120	90	4 × Ø14
40		200	328	130	100	4 × Ø14
50		200	341	140	110	4 × Ø14
65		250	366	160	130	4 × Ø14
80		250	373	190	150	4 × Ø18
100		250	396	210	170	4 × Ø18
125		250	426	240	200	8 × Ø18
150		300	463	265	225	8 × Ø18
200		350	506	320	280	8 × Ø18
250		450	559	375	335	12 × Ø18
300		500	596	440	395	12 × Ø23
350		550	676	490	445	12 × Ø23
400		600	746	540	495	16 × Ø23
450		600	786	595	550	20 × Ø23
500		600	809	645	600	20 × Ø23

Integrated flange connection dimensions

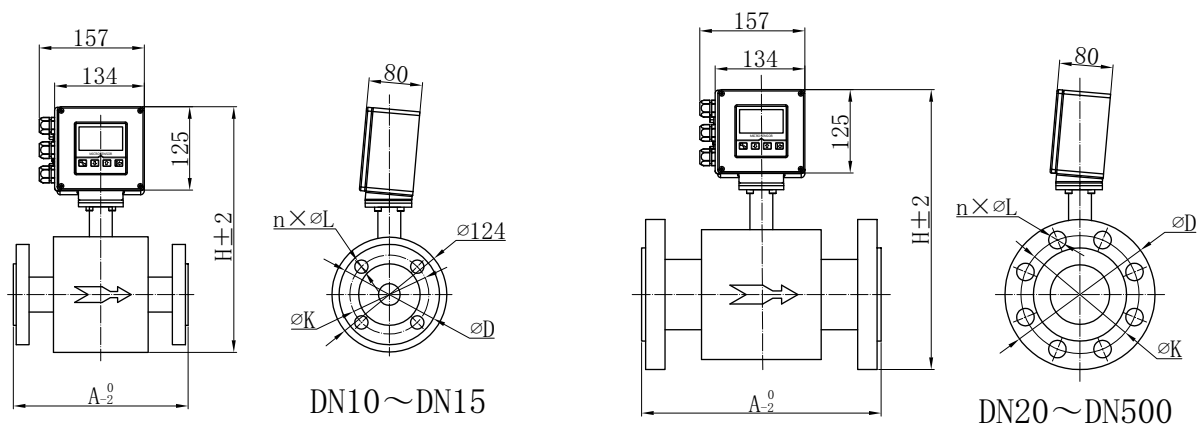


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	1.0 (DIN)	200	296	90	60	$4 \times \phi 14$
15		200	296	95	65	$4 \times \phi 14$
20		200	299	105	75	$4 \times \phi 14$
25		200	311	115	85	$4 \times \phi 14$
32		200	315	140	100	$4 \times \phi 18$
40		200	328	150	110	$4 \times \phi 18$
50		200	341	165	125	$4 \times \phi 18$
65		250	366	185	145	$8 \times \phi 18$
80		250	373	200	160	$8 \times \phi 18$
100		250	396	220	180	$8 \times \phi 18$
125		250	426	250	210	$8 \times \phi 18$
150		300	463	285	240	$8 \times \phi 23$
200		350	506	340	270	$8 \times \phi 23$
250		450	559	395	350	$12 \times \phi 23$
300		500	596	445	400	$12 \times \phi 23$
350		550	676	505	460	$16 \times \phi 23$
400		600	746	565	515	$16 \times \phi 25$
450		600	786	615	565	$20 \times \phi 25$
500		600	809	670	620	$20 \times \phi 25$

Integrated flange connection dimensions

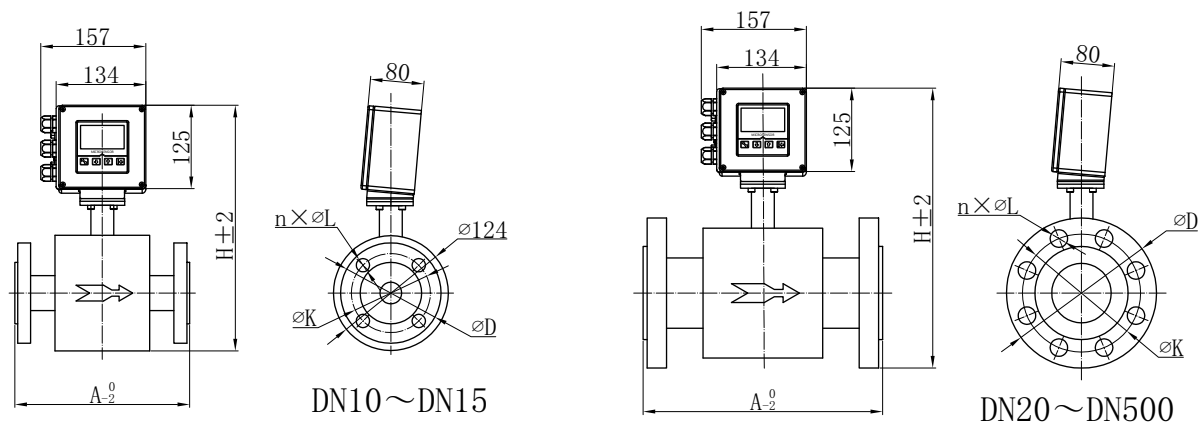


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	1.6 (DIN)	200	296	90	60	$4 \times \phi 14$
15		200	296	95	65	$4 \times \phi 14$
20		200	299	105	75	$4 \times \phi 14$
25		200	311	115	85	$4 \times \phi 14$
32		200	315	140	100	$4 \times \phi 18$
40		200	328	150	110	$4 \times \phi 18$
50		200	341	165	125	$4 \times \phi 18$
65		250	366	185	145	$8 \times \phi 18$
80		250	373	200	160	$8 \times \phi 18$
100		250	396	220	180	$8 \times \phi 18$
125		250	426	250	210	$8 \times \phi 18$
150		300	463	285	240	$8 \times \phi 23$
200		350	506	340	295	$12 \times \phi 23$
250		450	559	395	350	$12 \times \phi 25$
300		500	596	445	400	$12 \times \phi 25$
350		550	676	500	460	$16 \times \phi 25$
400		600	746	565	515	$16 \times \phi 30$
450		600	786	615	565	$20 \times \phi 30$
500		600	809	670	620	$20 \times \phi 33$

Integrated flange connection dimensions

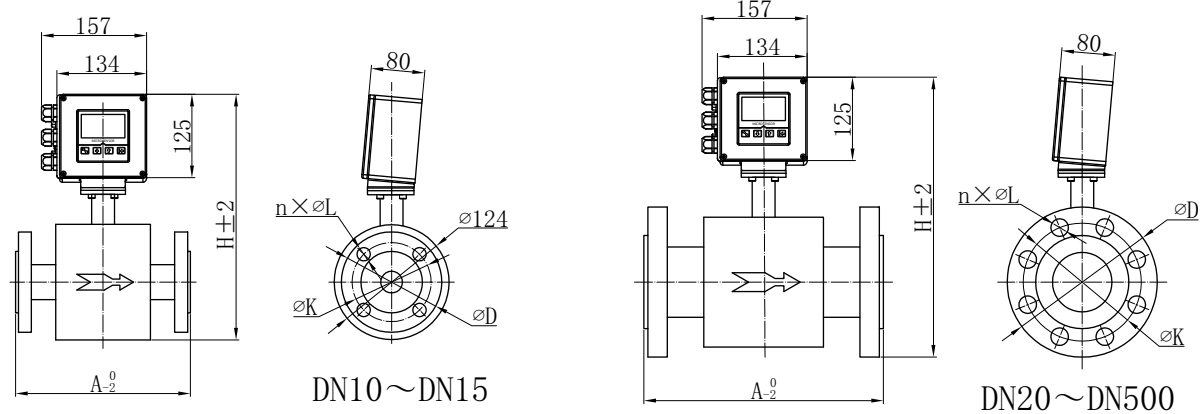


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×φL
10	2.5 (DIN)	200	296	90	60	4×φ14
15		200	296	95	65	4×φ14
20		200	299	105	75	4×φ14
25		200	311	115	85	4×φ14
32		200	315	140	100	4×φ18
40		200	328	150	110	4×φ18
50		200	341	165	125	4×φ18
65		250	366	185	145	8×φ18
80		250	373	200	160	8×φ18
100		250	396	235	180	8×φ22
125		250	426	270	220	8×φ26
150		300	463	300	250	8×φ26
200		350	506	360	310	12×φ26
250		450	559	425	370	12×φ25
300		500	596	485	430	12×φ30
350		550	676	555	490	16×φ33
400		600	746	620	550	16×φ36
450		600	786	670	600	20×φ36
500		600	809	730	660	20×φ36

Integrated flange connection dimensions

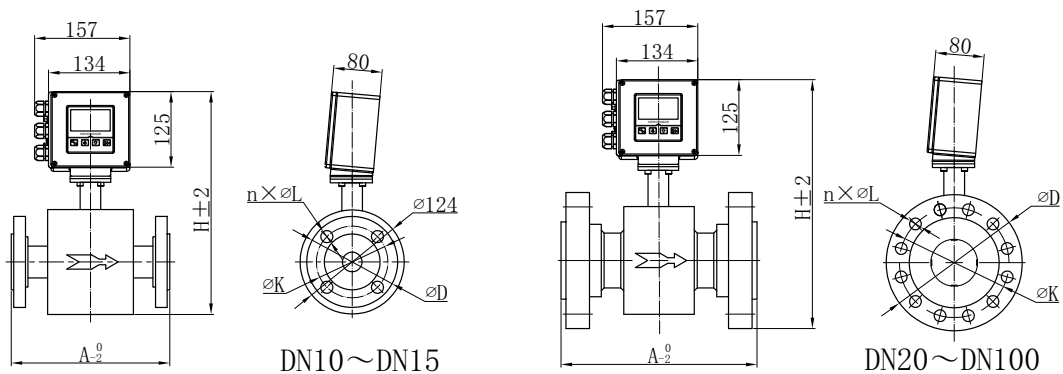


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	4.0 (DIN)	200	296	90	60	$4 \times \phi 14$
15		200	296	95	65	$4 \times \phi 14$
20		200	299	105	75	$4 \times \phi 14$
25		200	311	115	85	$4 \times \phi 14$
32		200	315	140	100	$4 \times \phi 18$
40		200	328	150	110	$4 \times \phi 18$
50		200	341	165	125	$4 \times \phi 18$
65		250	366	185	145	$8 \times \phi 18$
80		250	373	200	160	$8 \times \phi 18$
100		250	396	235	190	$8 \times \phi 22$
125		250	426	270	220	$8 \times \phi 26$
150		300	463	300	250	$8 \times \phi 26$
200		350	506	375	320	$12 \times \phi 23$
250		450	559	450	385	$12 \times \phi 30$
300		500	596	515	450	$16 \times \phi 33$
350		550	676	580	510	$16 \times \phi 36$
400		600	746	660	585	$16 \times \phi 39$
450		600	786	685	610	$20 \times \phi 39$
500		600	809	755	670	$20 \times \phi 42$

Integrated flange connection dimensions

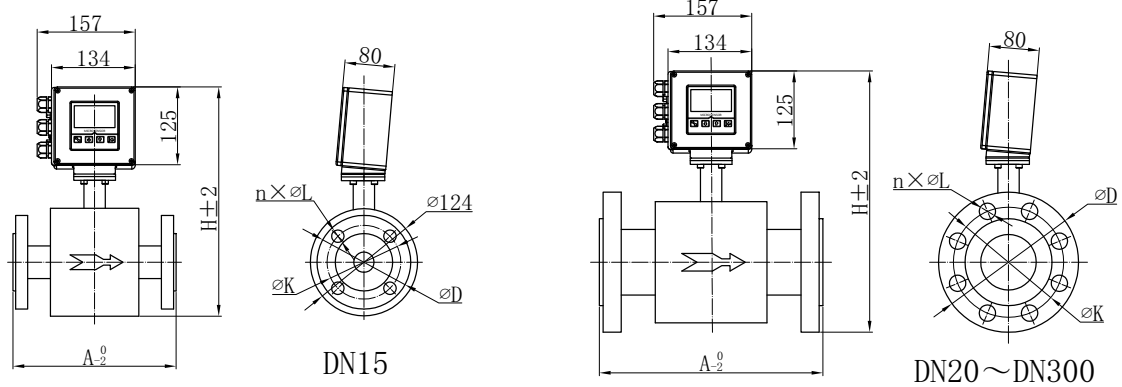


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	6.3 (DIN)	200	296	100	70	$4 \times \phi 14$
15		200	296	105	75	$4 \times \phi 14$
20		200	299	130	90	$4 \times \phi 18$
25		200	311	140	100	$4 \times \phi 18$
32		200	315	155	110	$4 \times \phi 22$
40		200	328	170	125	$4 \times \phi 22$
50		200	341	180	135	$4 \times \phi 22$
65		250	366	205	160	$8 \times \phi 22$
80		250	373	215	170	$8 \times \phi 22$
100		250	396	250	200	$8 \times \phi 26$

Integrated flange connection dimensions

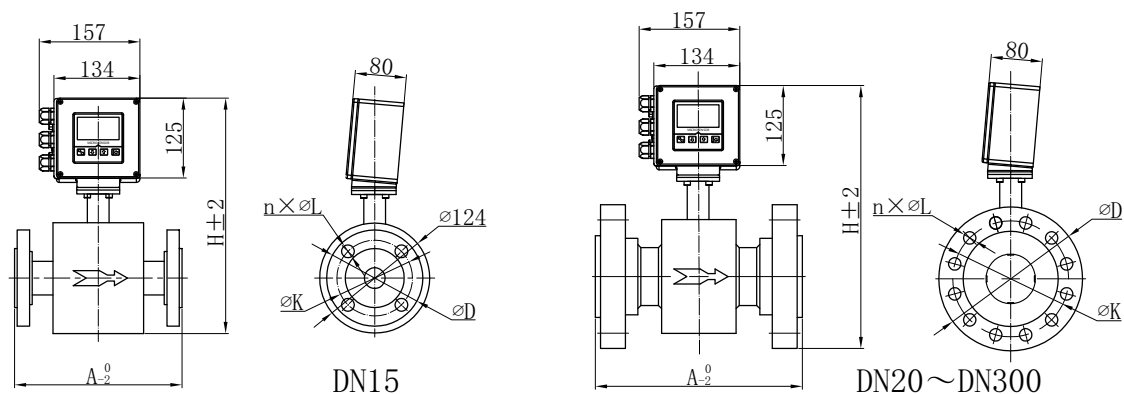


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×ΦL
15	ANSI 150LB	200	294	90	60.5	4×Φ16
20		200	297	100	70	4×Φ16
25		200	309	110	79.5	4×Φ16
32		200	305	120	89	4×Φ16
40		200	318	130	98.5	4×Φ16
50		200	334	150	120.5	4×Φ18
65		200	364	180	139.5	4×Φ18
80		250	368	190	152.5	4×Φ18
100		250	391	230	190.5	8×Φ18
125		250	424	255	216	8×Φ22
150		250	461	280	241.5	8×Φ22
200		300	504	345	298.5	8×Φ22
250		350	554	405	362	12×Φ26
300		450	576	485	432	12×Φ26

Integrated flange connection dimensions

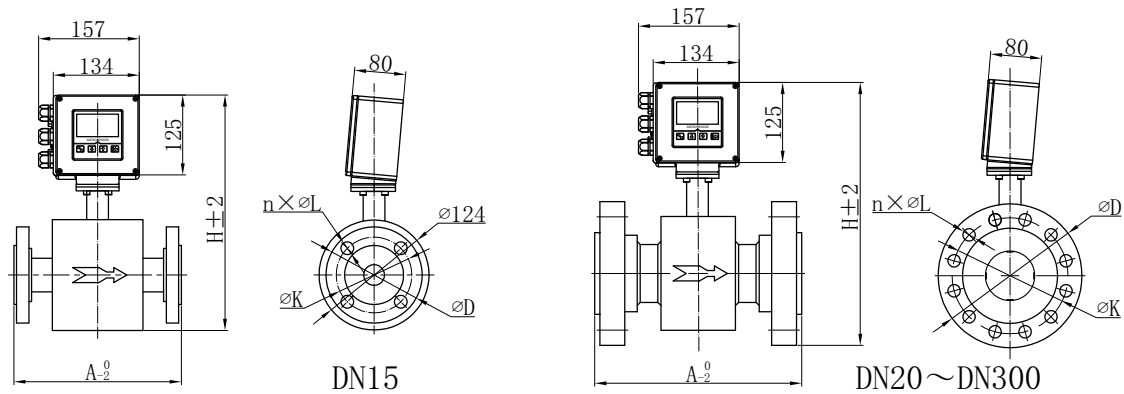


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×ΦL
15	ANSI 300LB	200	296	95	66.5	4×Φ16
20		200	299	115	82.5	4×Φ18
25		200	311	125	89	4×Φ18
32		200	315	135	98.5	4×Φ18
40		200	328	155	114.5	4×Φ18
50		200	341	165	127	8×Φ18
65		200	366	190	149	8×Φ22
80		250	373	210	168	8×Φ22
100		250	396	255	200	8×Φ22
125		250	426	280	235	8×Φ22
150		250	463	320	270	12×Φ22
200		300	506	380	330	12×Φ25
250		350	559	445	387	16×Φ30
300		450	596	520	451	16×Φ32

Integrated flange connection dimensions

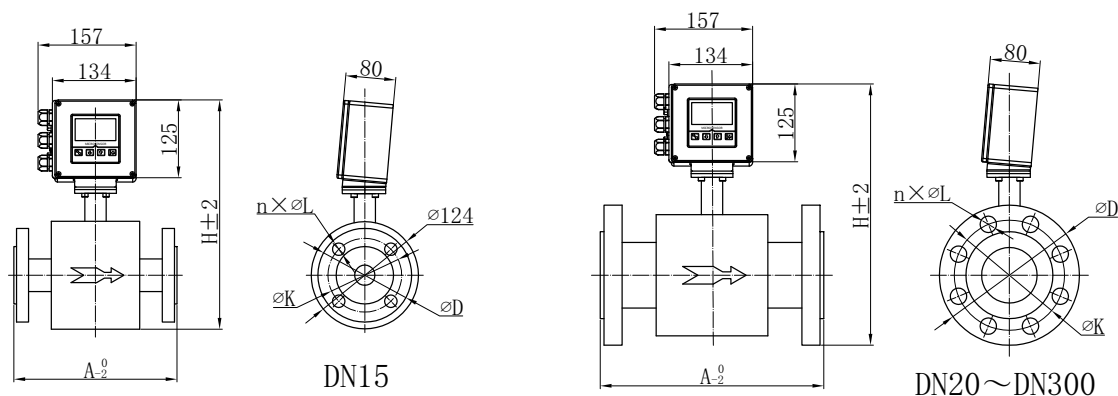


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	ANSI 600LB	200	296	95	66.5	$4 \times \phi 16$
20		200	299	115	82.5	$4 \times \phi 18$
25		200	311	125	89	$4 \times \phi 18$
32		200	315	135	98	$4 \times \phi 18$
40		200	328	155	114	$4 \times \phi 22$
50		200	341	165	127	$8 \times \phi 22$
65		200	366	190	149	$8 \times \phi 22$
80		250	373	210	168	$8 \times \phi 22$
100		250	396	275	216	$8 \times \phi 25$
125		250	426	330	267	$8 \times \phi 30$
150		250	463	355	292	$12 \times \phi 30$
200		300	506	420	349	$12 \times \phi 32$
250		350	559	510	432	$16 \times \phi 35$
300		450	596	560	489	$20 \times \phi 35$

Integrated flange connection dimensions

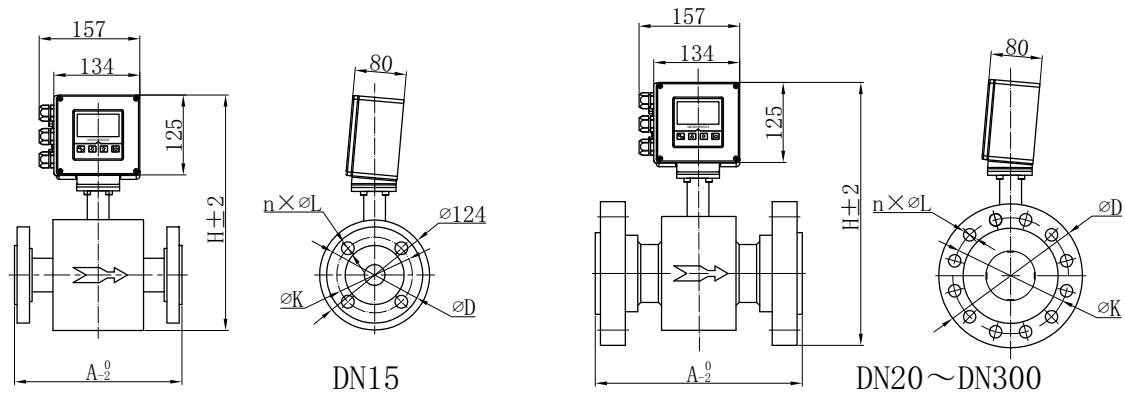


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	10K (JIS)	200	296	95	66.5	$4 \times \phi 12$
20		200	297	100	82.5	$4 \times \phi 12$
25		200	306	125	89	$4 \times \phi 12$
32		200	313	135	98	$4 \times \phi 16$
40		200	323	140	114	$4 \times \phi 16$
50		200	336	155	127	$4 \times \phi 16$
65		200	361	175	149	$4 \times \phi 16$
80		250	364	185	168	$8 \times \phi 16$
100		250	391	210	216	$8 \times \phi 16$
125		250	426	250	267	$8 \times \phi 20$
150		250	461	280	292	$8 \times \phi 20$
200		300	501	330	349	$12 \times \phi 20$
250		350	557	400	432	$12 \times \phi 22$
300		450	596	445	489	$16 \times \phi 22$

Integrated flange connection dimensions

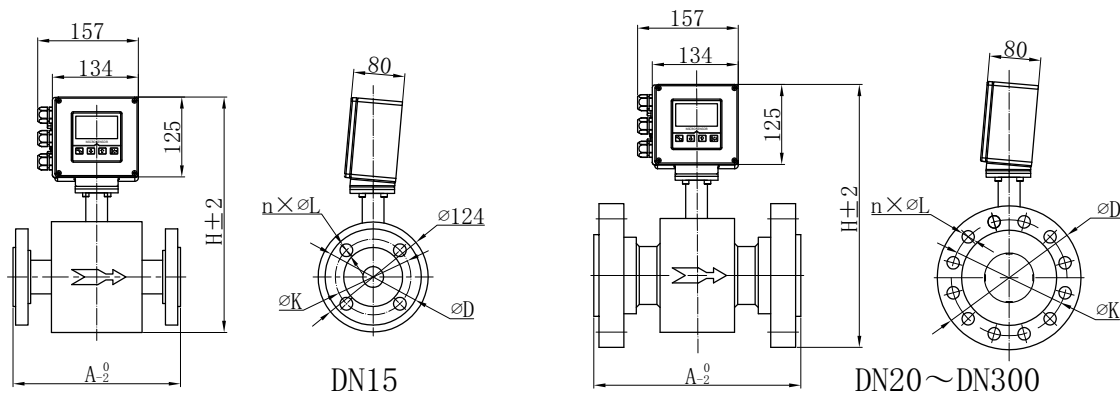


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	20K (JIS)	200	296	95	66.5	$4 \times \phi 16$
20		200	299	115	82.5	$4 \times \phi 18$
25		200	311	125	89	$4 \times \phi 18$
32		200	315	135	98.5	$4 \times \phi 18$
40		200	328	155	114.5	$4 \times \phi 18$
50		200	341	165	127	$8 \times \phi 18$
65		200	366	190	149	$8 \times \phi 22$
80		250	373	210	168	$8 \times \phi 22$
100		250	396	255	200	$8 \times \phi 22$
125		250	426	280	235	$8 \times \phi 22$
150		250	463	320	270	$12 \times \phi 22$
200		300	506	380	330	$12 \times \phi 25$
250		350	559	445	387	$16 \times \phi 30$
300		450	596	520	451	$16 \times \phi 32$

Integrated flange connection dimensions

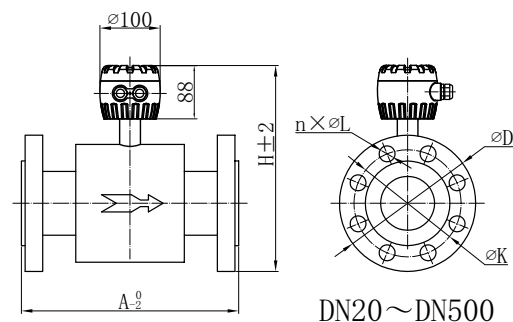
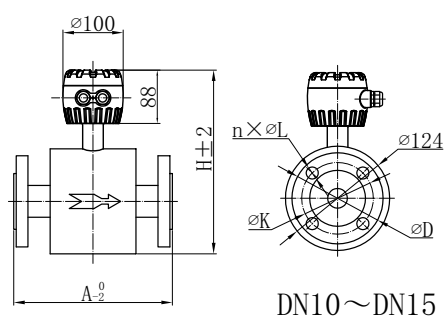


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Integrated flowmeter dimensions

DN	Rated Pressure	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	40K (JIS)	200	296	115	80	$4 \times \phi 19$
20		200	299	120	85	$4 \times \phi 19$
25		200	311	130	95	$4 \times \phi 19$
32		200	315	140	105	$4 \times \phi 19$
40		200	328	160	120	$4 \times \phi 23$
50		200	341	165	130	$8 \times \phi 19$
65		200	366	200	160	$8 \times \phi 23$
80		250	373	210	170	$8 \times \phi 23$
100		250	396	250	205	$8 \times \phi 23$
125		250	426	300	250	$8 \times \phi 27$
150		250	463	355	295	$12 \times \phi 33$
200		300	506	405	345	$12 \times \phi 33$
250		350	559	475	410	$12 \times \phi 33$
300		450	596	540	470	$16 \times \phi 39$

Separated flange connection dimensions

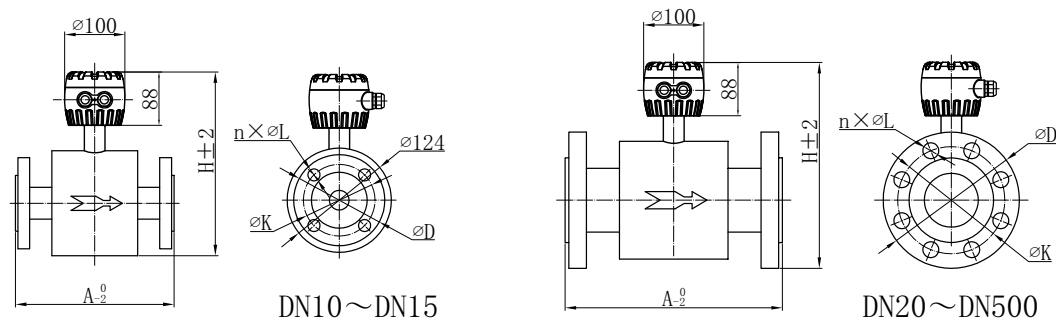


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	0.6 (DIN)	200	240	75	50	$4 \times \phi 11$
15		200	240	80	55	$4 \times \phi 11$
20		200	243	90	65	$4 \times \phi 11$
25		200	255	100	75	$4 \times \phi 11$
32		200	259	120	90	$4 \times \phi 14$
40		200	272	130	100	$4 \times \phi 14$
50		200	285	140	110	$4 \times \phi 14$
65		250	310	160	130	$4 \times \phi 14$
80		250	317	190	150	$4 \times \phi 18$
100		250	340	210	170	$4 \times \phi 18$
125		250	370	240	200	$8 \times \phi 18$
150		300	407	265	225	$8 \times \phi 18$
200		350	450	320	280	$8 \times \phi 18$
250		450	503	375	335	$12 \times \phi 18$
300		500	540	440	395	$12 \times \phi 23$
350		550	620	490	445	$12 \times \phi 23$
400		600	690	540	495	$16 \times \phi 23$
450		600	730	595	550	$20 \times \phi 23$
500		600	753	645	600	$20 \times \phi 23$

Separated flange connection dimensions

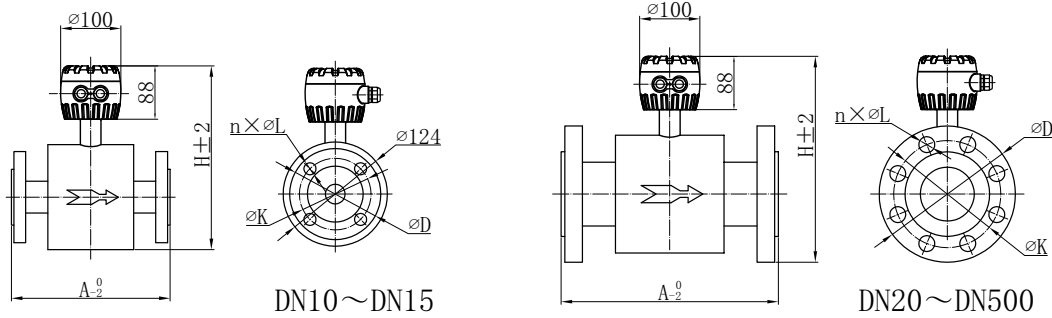


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	1.0 (DIN)	200	240	90	60	$4 \times \phi 14$
15		200	240	95	65	$4 \times \phi 14$
20		200	243	105	75	$4 \times \phi 14$
25		200	255	115	85	$4 \times \phi 14$
32		200	259	140	100	$4 \times \phi 18$
40		200	272	150	110	$4 \times \phi 18$
50		200	285	165	125	$4 \times \phi 18$
65		250	310	185	145	$8 \times \phi 18$
80		250	317	200	160	$8 \times \phi 18$
100		250	340	220	180	$8 \times \phi 18$
125		250	370	250	210	$8 \times \phi 18$
150		300	407	285	240	$8 \times \phi 23$
200		350	450	340	270	$8 \times \phi 23$
250		450	503	395	350	$12 \times \phi 23$
300		500	540	445	400	$12 \times \phi 23$
350		550	620	505	460	$16 \times \phi 23$
400		600	690	565	515	$16 \times \phi 25$
450		600	730	615	565	$20 \times \phi 25$
500		600	753	670	620	$20 \times \phi 25$

Separated flange connection dimensions



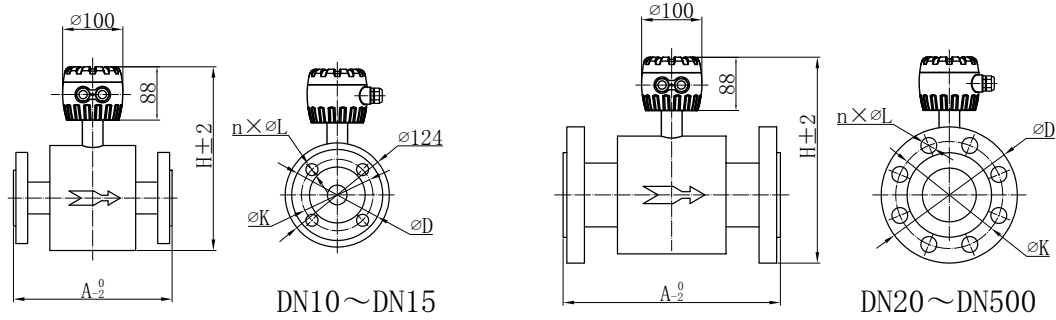
A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	1.6 (DIN)	200	240	90	60	$4 \times \phi 14$
15		200	240	95	65	$4 \times \phi 14$
20		200	243	105	75	$4 \times \phi 14$
25		200	255	115	85	$4 \times \phi 14$
32		200	259	140	100	$4 \times \phi 18$
40		200	272	150	110	$4 \times \phi 18$
50		200	285	165	125	$4 \times \phi 18$
65		250	310	185	145	$8 \times \phi 18$
80		250	317	200	160	$8 \times \phi 18$
100		250	340	220	180	$8 \times \phi 18$
125		250	370	250	210	$8 \times \phi 18$
150		300	407	285	240	$8 \times \phi 23$
200		350	450	340	295	$12 \times \phi 23$
250		450	503	395	350	$12 \times \phi 25$
300		500	540	445	400	$12 \times \phi 25$
350		550	620	500	460	$16 \times \phi 25$
400		600	690	565	515	$16 \times \phi 30$
450		600	730	615	565	$20 \times \phi 30$
500		600	753	670	620	$20 \times \phi 33$

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)			
		A	H	D	K	n×ΦL	
10	2.5 (DIN)	200	240	90	60	4×Φ14	
15		200	240	95	65	4×Φ14	
20		200	243	105	75	4×Φ14	
25		200	255	115	85	4×Φ14	
32		200	259	140	100	4×Φ18	
40		200	272	150	110	4×Φ18	
50		200	285	165	125	4×Φ18	
65		250	310	185	145	8×Φ18	
80		250	317	200	160	8×Φ18	
100		250	340	235	180	8×Φ22	
125		250	370	270	220	8×Φ26	
150		300	407	300	250	8×Φ26	
200		350	450	360	310	12×Φ26	
250		450	503	425	370	12×Φ25	
300		500	540	485	430	12×Φ30	
350		550	620	555	490	16×Φ33	
400		600	690	620	550	16×Φ36	
450		600	730	670	600	20×Φ36	
500		600	753	730	730	660	20×Φ36

Separated flange connection dimensions

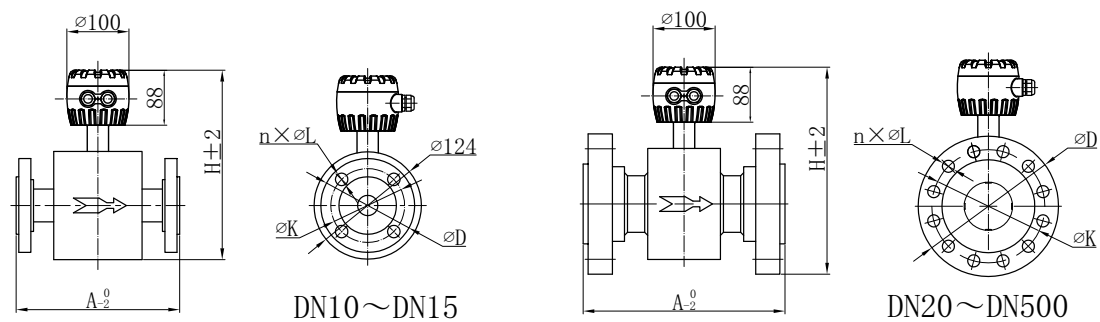


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n × ΦL
10	4.0 (DIN)	200	240	90	60	4 × Φ14
15		200	240	95	65	4 × Φ14
20		200	243	105	75	4 × Φ14
25		200	255	115	85	4 × Φ14
32		200	259	140	100	4 × Φ18
40		200	272	150	110	4 × Φ18
50		200	285	165	125	4 × Φ18
65		250	310	185	145	8 × Φ18
80		250	317	200	160	8 × Φ18
100		250	340	235	190	8 × Φ22
125		250	370	270	220	8 × Φ26
150		300	407	300	250	8 × Φ26
200		350	450	375	320	12 × Φ23
250		450	503	450	385	12 × Φ30
300		500	540	515	450	16 × Φ33
350		550	620	580	510	16 × Φ36
400		600	690	660	585	16 × Φ39
450		600	730	685	610	20 × Φ39
500		600	753	755	670	20 × Φ42

Separated flange connection dimensions

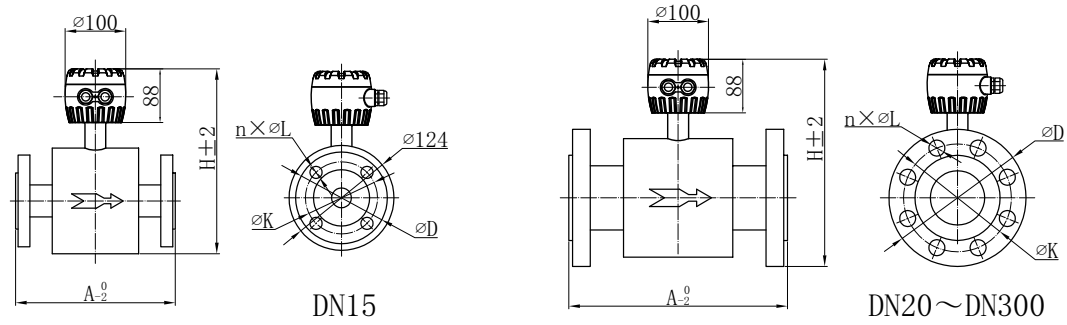


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
10	6.3 (DIN)	200	240	100	70	$4 \times \phi 14$
15		200	240	105	75	$4 \times \phi 14$
20		200	243	130	90	$4 \times \phi 18$
25		200	255	140	100	$4 \times \phi 18$
32		200	259	155	110	$4 \times \phi 22$
40		200	272	170	125	$4 \times \phi 22$
50		200	285	180	135	$4 \times \phi 22$
65		250	310	205	160	$8 \times \phi 22$
80		250	317	215	170	$8 \times \phi 22$
100		250	340	250	200	$8 \times \phi 26$

Separated flange connection dimensions

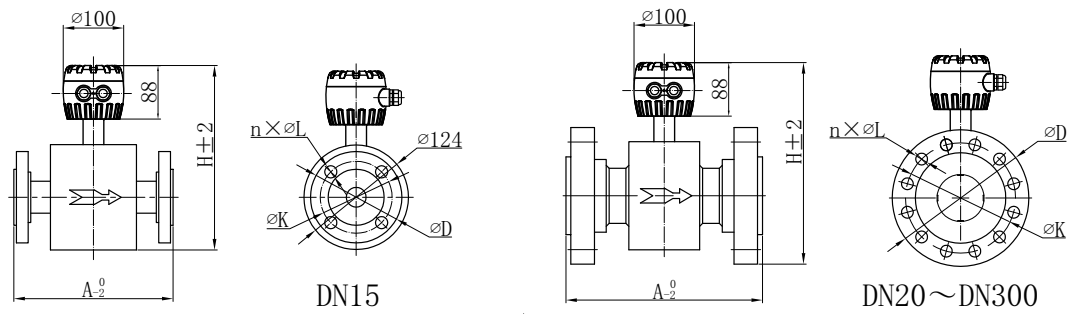


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	ANSI 150LB	200	242	90	60.5	$4 \times \phi 16$
20		200	242	100	70	$4 \times \phi 16$
25		200	250	110	79.5	$4 \times \phi 16$
32		200	260	120	89	$4 \times \phi 16$
40		200	260	130	98.5	$4 \times \phi 16$
50		200	272	150	120.5	$4 \times \phi 18$
65		200	298	180	139.5	$4 \times \phi 18$
80		250	309	190	152.5	$4 \times \phi 18$
100		250	337	230	190.5	$8 \times \phi 18$
125		250	364	255	216	$8 \times \phi 22$
150		250	398	280	241.5	$8 \times \phi 22$
200		300	465	345	298.5	$8 \times \phi 22$
250		350	510	405	362	$12 \times \phi 26$
300		600	546	485	432	$12 \times \phi 26$

Separated flange connection dimensions

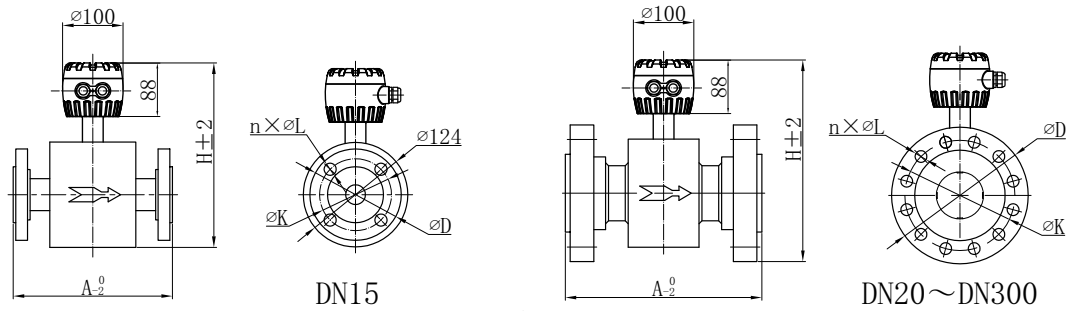


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×ΦL
15	ANSI 300LB	200	245	95	66.5	4×Φ16
20		200	245	115	82.5	4×Φ18
25		200	252	125	89	4×Φ18
32		200	270	135	98.5	4×Φ18
40		200	280	155	114.5	4×Φ18
50		200	280	165	127	8×Φ18
65		200	300	190	149	8×Φ22
80		250	314	210	168	8×Φ22
100		250	342	255	200	8×Φ22
125		250	366	280	235	8×Φ22
150		250	400	320	270	12×Φ22
200		300	464	380	330	12×Φ25
250		350	516	445	387	16×Φ30
300		600	566	520	451	16×Φ32

Separated flange connection dimensions

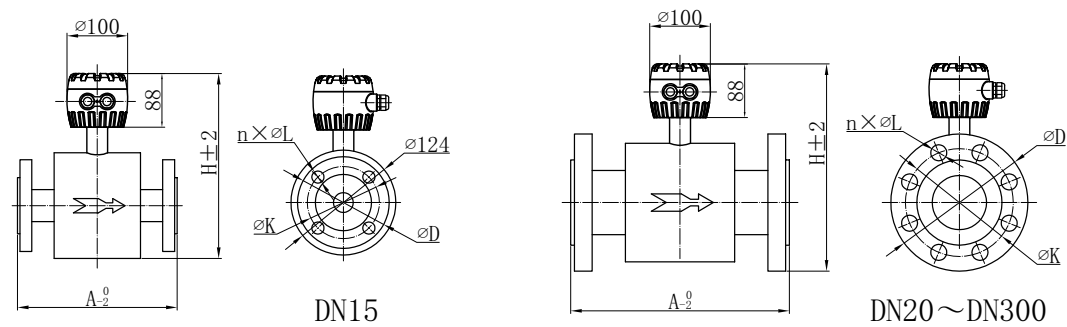


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×ΦL
15	ANSI 600LB	200	245	95	66.5	4×Φ16
20		200	245	115	82.5	4×Φ18
25		200	252	125	89	4×Φ18
32		200	270	135	98	4×Φ18
40		200	280	155	114	4×Φ22
50		200	280	165	127	8×Φ22
65		200	300	190	149	8×Φ22
80		250	314	210	168	8×Φ22
100		250	342	275	216	8×Φ25
125		250	366	330	267	8×Φ30
150		250	400	355	292	12×Φ30
200		300	464	420	349	12×Φ32
250		350	516	510	432	16×Φ35
300		600	566	560	489	20×Φ35

Separated flange connection dimensions

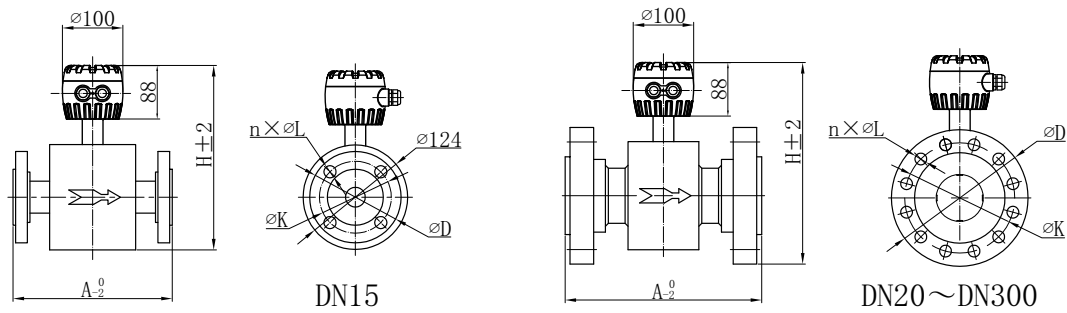


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \Phi L$
15	10K (JIS)	200	245	95	66.5	$4 \times \Phi 12$
20		200	245	100	82.5	$4 \times \Phi 12$
25		200	247	125	89	$4 \times \Phi 12$
32		200	267	135	98	$4 \times \Phi 16$
40		200	275	140	114	$4 \times \Phi 16$
50		200	270	155	127	$4 \times \Phi 16$
65		200	295	175	149	$4 \times \Phi 16$
80		250	307	185	168	$8 \times \Phi 16$
100		250	337	210	216	$8 \times \Phi 16$
125		250	366	250	267	$8 \times \Phi 20$
150		250	398	280	292	$8 \times \Phi 20$
200		300	460	330	349	$12 \times \Phi 20$
250		350	514	400	432	$12 \times \Phi 22$
300		600	566	445	489	$16 \times \Phi 22$

Separated flange connection dimensions

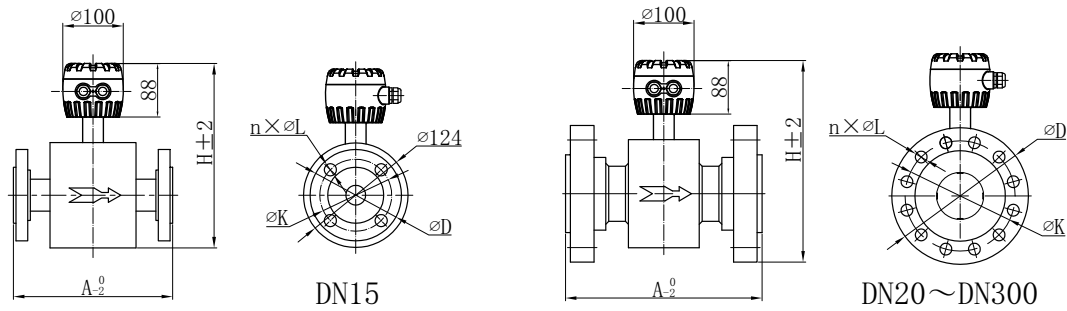


A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	20K (JIS)	200	245	95	70	$4 \times \phi 15$
20		200	245	100	75	$4 \times \phi 15$
25		200	252	125	90	$4 \times \phi 19$
32		200	270	135	100	$8 \times \phi 19$
40		200	280	140	105	$8 \times \phi 19$
50		200	280	155	120	$8 \times \phi 19$
65		200	300	175	140	$8 \times \phi 19$
80		250	314	200	160	$8 \times \phi 23$
100		250	342	225	185	$8 \times \phi 23$
125		250	366	270	225	$8 \times \phi 25$
150		250	400	305	260	$12 \times \phi 25$
200		300	464	350	305	$12 \times \phi 25$
250		350	516	430	380	$12 \times \phi 27$
300		600	566	480	430	$16 \times \phi 27$

Separated flange connection dimensions



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

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	$n \times \phi L$
15	40K (JIS)	200	245	115	80	$4 \times \phi 19$
20		200	245	120	85	$4 \times \phi 19$
25		200	252	130	95	$4 \times \phi 19$
32		200	270	140	105	$4 \times \phi 19$
40		200	280	160	120	$4 \times \phi 23$
50		200	280	165	130	$8 \times \phi 19$
65		200	300	200	160	$8 \times \phi 23$
80		250	314	210	170	$8 \times \phi 23$
100		250	342	250	205	$8 \times \phi 23$
125		250	366	300	250	$8 \times \phi 27$
150		250	400	355	295	$12 \times \phi 33$
200		300	464	405	345	$12 \times \phi 33$
250		350	516	475	410	$12 \times \phi 33$
300		600	566	540	470	$16 \times \phi 39$

Separated converter dimensions

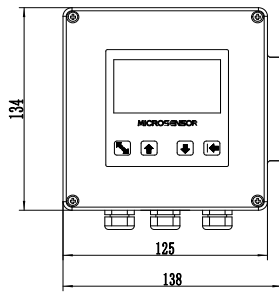


Figure 2 Separated converter dimensions

The Separated type is generally used in occasions where the reading is inconvenient during on-site maintenance and debugging, and is also used in harsher applications, such as high temperature fluids and vibration sources. Integrated and Separated type models can meet the requirements for most occasions. When the instrument is installed below the ground, it is recommended to choose the Separated type, IP68 protection hierarchical structure.

Electrical Connection

The electromagnetic flowmeter converter can be divided into integrated converter and separated converter, and the wiring diagram is shown in Figure 3.

When wiring, please note:

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

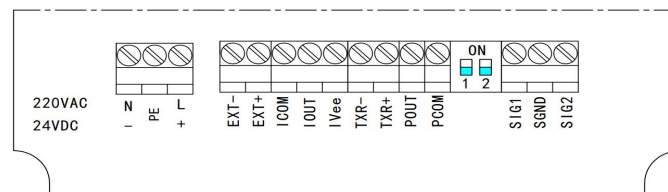


Figure 3 Integrated wiring diagram

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

Table 2 Terminal definition of integrated type

Terminal Symbol	Function
SIG 1	Electrode wire
SGND	Signal grounding wire
SIG 2	Electrode wire
EXT +	Exciting current +
EXT -	Exciting current -
I Vee	Current output power supply (voltage access port when current is passive output)
IOUT	Current output (active output port)
ICOM	Current output ground
POUT	Pulse/frequency output
PCOM	Pulse/frequency output grounding wire
TXR+	RS485+
TXR-	RS485-
- (N)	24VDC- (220VAC)
PE	Power grounding wire
+ (L)	24VDC+ (220VAC)

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 4.

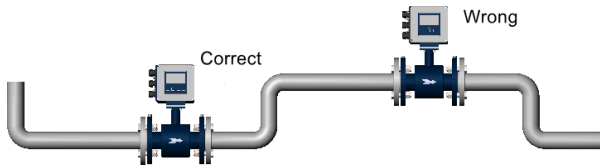


Figure 4

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 5.

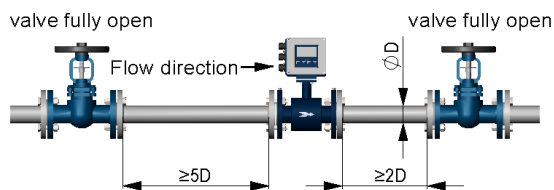


Figure 5

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 6.

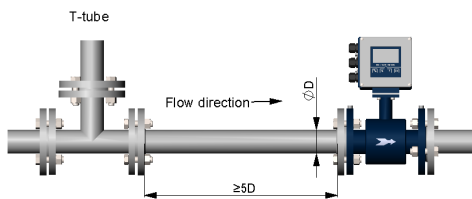


Figure 6

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 7.

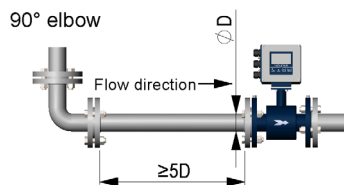


Figure 7

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 8.

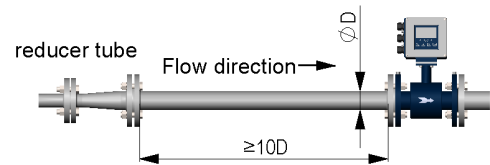


Figure 8

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 9.

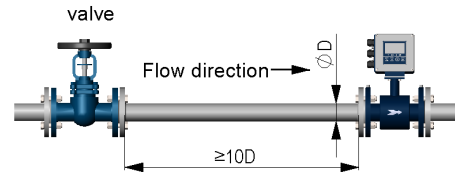


Figure 9

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.

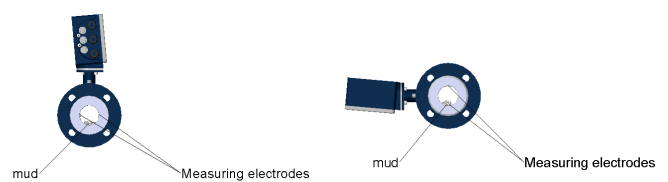


Figure 10 Flowmeter installation direction

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.

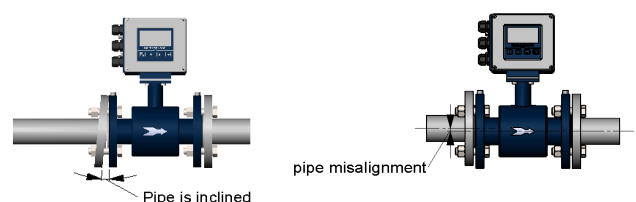


Figure 11 Flowmeter installation symmetrically with the pipe axis

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:

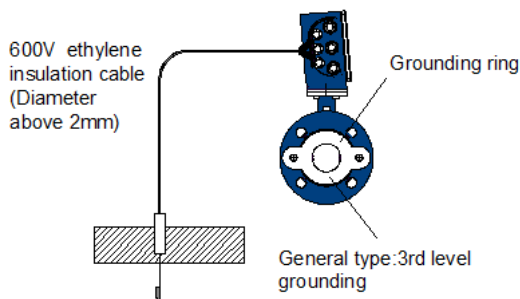


Figure 12

Noise Suppression

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

Electromagnetic Flowmeter Product Manufacturing Standard

- JB/T 9248-2015 Electromagnetic Flowmeter
- JJG 1033-2007 Verification Regulations
- GB/T 9124.1-2019 Steel Pipe Flange
- GB/T 17626.2-2018 EMC Electrostatic discharge test
- GB/T 17626.3-2016 EMC Radio frequency electromagnetic field radiation
- GB/T 17626.4-2008 EMC Burst disturbance
- GB/T 17626.5-2019 EMC Measurement Techniques Surge (Shock) Immunity Test
- GB/T 17626.8-2006 EMC Power frequency magnetic field disturbance
- GB/T 4208-2017 Protection class

Order Guide

MFE600Z - AS0 - 100 - 105 - 1.6E2 - 0001 -0110

MFE600Z	Electromagnetic Flowmeter		
AS0	Code	Sensor type	
	AS0	Standard	
	AS1	With pressure port	
100	Code	Pipe diameter	
	xxx	For example: 100 represents DN100	
	10	DN 10 3/8"	0.31 4.45 m³/h
	15	DN 15 1/2"	0.56 7.92 m³/h
	20	DN 20 3/4"	0.88 12.37 m³/h
	25	DN 25 1"	1.45 20.27 m³/h
	32	DN 32 1 1/4"	2.26 31.67 m³/h
	40	DN 40 1 1/2"	3.53 49.48 m³/h
	50	DN 50 2"	5.97 83.62 m³/h
	65	DN 65 2"	9.04 126.67 m³/h
	80	DN 80 3"	14.14 197.92 m³/h
	100	DN 100 4"	22.08 309.25 m³/h
	125	DN 125 5"	31.80 445.32 m³/h
	150	DN 150 6"	56.55 791.68 m³/h
	200	DN 200 8"	88.35 1237.00 m³/h
	250	DN 250 10"	127.18 1781.28 m³/h
	300	DN 300 12"	173.18 2424.52 m³/h
	350	DN 350 14"	226.19 3166.73 m³/h
	400	DN 400 16"	286.28 4007.89 m³/h
	450	DN 450 18"	353.43 4948.01 m³/h
	500	DN 500 20"	508.93 7125.13 m³/h
1	Code	Electrode Type	
	1	Standard	
0	Code	Electrode Material	
	0	SS316L	
	1	Platinum (Pt)	
	2	Hastelloy BB(HB)	
	3	Tantalum (Ta)	
	4	Titanium (Ti)	
	5	HastelloyC (HC)	
	6	Wolfram carbide (WC)	
5	Code	Lining material	
	2	NR DN25-DN1600 Max medium Temp. 60°C	
	3	CR DN50-DN1600 Max medium Temp. 60°C	
	4	PU DN25-DN500 Max medium Temp. 60°C	
	5	PTFE DN25-DN1600 Max medium Temp. 120°C	
	6	F46 DN6-DN600 Max medium Temp. 150°C	
	9	Others	

1.6	Code	Rated pressure	
	6.3	PN63 DIN2501, EN 1092-1 DN10-DN100	
	4.0	PN40 DIN2501, EN 1092-1 DN10-DN500	
	2.5	PN25 DIN2501, EN 1092-1 DN10-DN500	
	1.6	PN16 DIN2501, EN 1092-1 DN10-DN500	
	1.0	PN10 DIN2501, EN 1092-1 DN10-DN500	
	0.6	PN6 DIN2501, EN 1092-1 DN10-DN500	
	150LB	Class 150 ASME B16.5 DN10-DN300	
	300LB	Class 300 ASME B16.5 DN10-DN300	
	600LB	Class 600 ASME B16.5 DN10-DN300	
	10K	JIS 10K DN10-DN300	
	20K	JIS 20K DN10-DN300	
	40K	JIS 40K DN10-DN300	
	9	Others	
E	Code	Measuring medium temperature	
	E	≤60°C	
	H	≤120°C	
2	Code	Ground mode	
	*	Without electrode DN10-DN20	
	1	With electrode	
	2	304 Ground ring	
	9	Others	
00	Code	Converter mode	
	00	Integrated IP65	
	11	Separated IP65 (Converter IP65, Sensor IP65)	
	20	Separated IP68 (Converter IP65, Sensor IP68)	
	90	Others	
0	Code	Analog output	
	0	4mA-20mA	
	9	Others	
1	Code	Digital output	
	0	Without	
	1	RS485 MODBUS RTU	
	9	Others	
0	Code	Sensor material	
	0	Carbon Steel	
	1	304 Stainless steel	
	9	Others	
1	Code	Connection mod	
	1	Flange	
	9	Others	
1	Code	Accessories	
	0	Without	
	1	Carbon steel companion flange	
	2	304 Stainless steel companion flange	
0	Code	Power supply	
	0	220V AC 100-240V	
	1	24V DC 18V-28V	
	2	12V DC	
	9	Others	

Note:

1. The power supply is 24V or 220V, with 4~20mA output and frequency/pulse output by default.
2. When the temperature is higher than 80°C , recommended to choose Separated converter.
3. DN-DN20 without ground electrode.

Example:

MFE600Z-AS0-100-105-1.6E2-0001-0110(200)

Explanation: MFE600Z Electromagnetic flowmeter; DN100 diameter; fixed stainless steel 316L electrodes; PTFE lining; rated pressure 1.6MPa; media temp. 0 °C ~ 60 °C ; 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 6.

- 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.

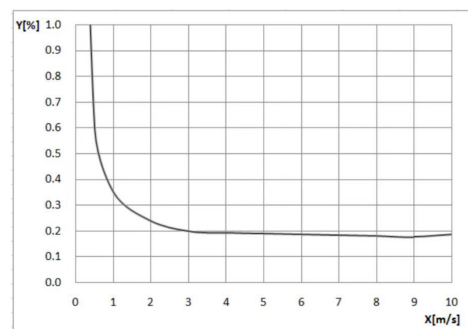
Attentions**1) Measurement accuracy**

Figure 13

X[m / s]: flow rate

Y[m / s]: Deviation of actual measurement

DN10-DN500 0.5% of measured value + 1 mm/s

3) Electrode material

Table 4 Electrode material property

Material	Corrosion resistance	Applicability
316L	Domestic water, industrial water, raw water, groundwater, urban sewage, treated neutral industrial sewage	☑
	Acid, alkali, salt	☒
Hastelloy B (HB)	Weak organic acid	☑
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	☒
Hastelloy C (HC)	Oxidizing salts such as Fe ³⁺ , sea water	☑
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	☒
Titanium (Ti)	Chloride (chloride/magnesium/aluminum/calcium/ammonium/iron, etc.)	☑
	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%	
	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	☑
	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	☒
Platinum (Pt)	Almost all acid, alkali, salt solutions	☑
	Aqua regia, ammonium salt	☒
Wolfram carbide (WC)	Treated neutral industrial sewage, domestic sewage, can resist the interference of solid particles	☑
	Acid, alkali, salt	☒

4) Lining material

Table 5 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 ~ DN500
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 ~ DN500
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 ~ DN500
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	DN10 ~ DN500

2) Flow range

Table 3 Flow range

Velocity m/s Flow m³/h DN mm	0.5	1	2	3	4	5	7
10	0.1414	0.2827	0.5655	0.8482	1.1310	1.4137	1.9792
15	0.3181	0.6362	1.2723	1.9085	2.5447	3.1809	4.4532
20	0.5655	1.1310	2.2619	3.3929	4.5239	5.6549	7.9168
25	0.8836	1.7671	3.5343	5.3014	7.0686	8.8357	12.3700
32	1.4476	2.8953	5.7906	8.6859	11.5812	14.4765	20.2670
40	2.2619	4.5239	9.0478	13.5717	18.0956	22.6195	31.6673
50	3.5343	7.0686	14.1372	21.2058	28.2743	35.3429	49.4800
65	5.9730	11.9459	23.8918	35.8377	47.7836	59.7295	83.6213
80	9.0478	18.0956	36.1911	54.2867	72.3823	90.4779	126.6690
100	14.1372	28.2743	56.5487	84.8230	113.0973	141.3717	197.9203
125	22.0893	44.1786	88.3573	132.5359	176.7146	220.8932	309.2505
150	31.8086	63.6173	127.2345	190.8518	254.4690	318.0863	445.3208
200	56.5487	113.0973	226.1947	339.2920	452.3893	565.4867	791.6813
250	88.3573	176.7146	353.4292	530.1438	706.8583	883.5729	1237.0021
300	127.2345	254.4690	508.9380	763.4070	1017.8760	1272.3450	1781.2830
350	173.1803	346.3606	692.7212	1039.0818	1385.4424	1731.8030	2424.5241
400	226.1947	452.3893	904.7787	1357.1680	1809.5574	2261.9467	3166.7253
450	286.2776	572.5553	1145.1105	1717.6658	2290.2210	2862.7763	4007.8868
500	353.4292	706.8583	1413.7167	2120.5750	2827.4334	3534.2917	4948.0083

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