WOTECK
Fluid technology

2023
Selection
Manual

WTM-F

Electromagnetic
flow meter

WOTECK INSTRUMENT

CONTENTS

Overview

The electromagnetic flow meter is a kind of industrial process control instrument that is usually used to measure the volume flow of conducting liquids and slurries in the closed pipes. This product has been widely used in many industrial fields for its own advantages and has become a common flow meter for liquid flow measurement.

Working principle Figure 1

When the conductor moves in the magnetic field, an induced voltage will be generated. Electromagnetic measurement method is adopted. The induced voltage generated in the fluid is detected by two measuring electrodes mounted on opposite sides of the diameter of the tube. The signal voltage UE is proportional to the magnetic field intensity B, the electrode distance D and the average flow velocity v. Since a constant alternating magnetic field is generated by switching DC current with alternating polarity changes, the magnetic field strength and electrode distance are constant, then the signal voltage UE is proportional to the average velocity v. It can be seen from the formula for calculating the volume flow rate that the signal voltage UE is linearly proportional to the average flow rate v. In the signal converter, the voltage of the induced signal is amplified into analog signal and digital signal, and the flow rate of the fluid is calculated based on the diameter of the pipe.

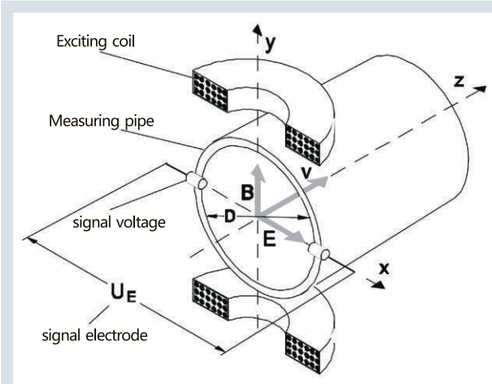


Figure 1 Working principle

$U_E \propto B * D * v$ $U_E \propto Qv$ $Qv = (\pi/4) * D^2 * v$

Where: U_E = signal voltage B = magnetic field intensity
D = electrode distance Qv = flow rate
v = flow velocity

Product categories

Electromagnetic flow meter consists of sensor and converter. When the sensor and converter are installed together, it's called integral electromagnetic flow meter (see Figure 2), When the sensor and converter are not installed together, it's called remote electromagnetic flow meter (see Figure 3).

Figure. 2 integrated

Figure. 3 Remote

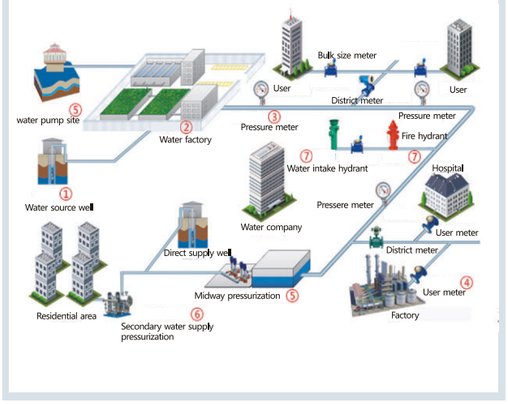
Product Characteristics

- Wide application range
- High accuracy
- Easy operation and maintenance
- Withstanding testing technology
- The design meets with the users' applications
- GB, DIN, ANSI, JIS standards flange connection, complying with ISO standards for installation length.
- A variety of liner materials for option.
- A variety of electrode materials for option.
- Electrodes can be fixed and replaced on-line)
- Enclosure IP65, IP67, Ip68
- Remote converter can be tube-mounted or wall-mounted
- A variety of programming for option
- A variety of output/input signals
- Multiple alarms, such as empty pipe, excitation break, flow over limit, upper/lower limit and other self-detection and self-diagnosis.
- A variety of digital communication for option.
- Workable for explosion-proof applications

Applications

With over 20 years of experience and technology, we has become the high-quality supplier for the field of industrial instrument in Vietnam Owning a professional team, we finish the design, R&D and manufacture of the water flow metering standard device and control system by ourselves. The company has won 100+ invention patents and honors in the field of instrument.

The electromagnetic flow meter is usually used to measure the volume flow of conducting liquids and slurries in the closed pipes. It' s widely used in pipe network zoning metering, large user trade and billing, independent metering area (DMA), secondary water supply, petroleum, electric power, chemicals, metallurgy, building materials, food, light industry, environmental protection, aerospace, drinking water, municipal, sewage treatment and other fields.



Water supply pipeline network

Thermal power plant

Chemicals

Petroleum

Food

Water treatment

Metallurgy

Pharmaceutical

Beverage

Paper industry

Aerospace

Main parameters

■ **Standard:** JB/T 9248-1999 Electromagnetic flow meter

■ **Nominal Diameter:** DN15～DN3000 (mm); 1/2" ～24" (Inches).

■ **Nominal Pressure:** 0.6 Mpa, 1.0 Mpa, 1.6 Mpa, 4.0 Mpa (GB、DIN); 150 lb, 300 lb, (ANSI); JIS10K、JIS20K (JIS).

Note 1: For special pressure requirements, please consult us

■ **Accuracy:** ± 0.5% (Optional ± 0.2%)

■ **Medium conductivity:** ⩾5 μS/cm

■ **Structure type:** Integral type DN15～DN1000 (mm); 1/2" ～24" (Inches); Remote type DN15～DN3000 (mm); 1/2" ～24" (Inches).

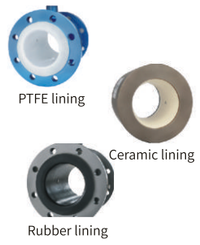
Note 2: In the case of remote type, the signal cable between the sensor and the converter is a kind of dedicated signal cable, the model is SMFE100
Note 3: The length of the signal cable between the sensor and converter should be: ⩽200m (650ft), >200m (650ft) Need special customization

■ **Maximum flow speed:** 15 m/s (49 ft/s)

■ **Ambient temperature:** -25℃～+55℃ (-13°F～+131°F)

■ **Relative temperature:** 5%～90%

■ **Liner material:**



Liner material	Suitable for size		Optional
	mm	Inches	
Soft rubber	DN50～DN3000	2" ～24"	
Hard rubber	DN50～DN3000	2" ～24"	
PTFE	DN15～DN1000	1/2" ～24"	
Polyurethane	DN15～DN300	1/2" ～12"	
PFA	DN15～DN250	1/2" ～10"	Metal Mesh Reinforcement
F46	DN15～DN250	1/2" ～10"	Metal Mesh Reinforcement
Ceramics	DN50～DN150	2" ～6"	

■ **Electrodes:**

Electrodes	Suitable for size	
	mm	Inches
316L Stainless Steel	DN15～DN3000	1/2" ～24"
Hastelloy C-22	DN15～DN1000	1/2" ～24"
Hastelloy B-10	DN15～DN1000	1/2" ～24"
Titanium	DN15～DN600	1/2" ～24"
Tantalum	DN15～DN600	1/2" ～24"
Platinum/Iridium Alloy	DN15～DN250	1/2" ～10"
Tungsten Coated Stainless Steel	DN15～DN1000	1/2" ～24"

■ **Grounding and liner protection method:**

Grounding and liner protection method	Suitable for size	
	mm	Inches
Wetted flange grounding	DN15～DN3000	1/2" ～24"
Liner protection, grounding rings	DN15～DN250	1/2" ～10"
Grounding electrode	DN15～DN1000	1/2" ～24"
Inlet protection flange	DN15～DN300	1/2" ～12"

■ **Medium maximum temperature (determined by liner materials and structure type)**

Liner material	Medium maximum temperature (determined by liner materials and structure type)					
	Normal (A)		Optional (B)		Optional (C)	
	℃	°F	℃	°F	℃	°F
Soft rubber	⩽80	⩽176	⩽120	⩽248		
Hard rubber						
PTFE					⩽180	⩽356
Polyurethane						
PFA			⩽120	⩽248		
F46						
Ceramics			⩽120	⩽248		

■ **Protection level:** IP65, IP67 (integral type only), IP68 (remote type only)

■ **Explosion-proof certification:** Ex d ib mb IIC T4 Gb

■ **Power supply (optional):**

Alternating current: 85 VAC～265 VAC/45 Hz～63 Hz, Power consumption⩽20VA

Direct current: 16 VDC～36 VDC

Power consumption⩽16VA

Battery: 3.6 VDC

Note 4: Only accuracy ±0.5%, pulse output, RS485 optional

■ **Display mode:** 3-line LCD with backlight display

■ **Programming method:** key programming, infrared remote control programming, Modbus programming.

■ **Output signal (programmable):**

1) Analog current output:

a) Current output signal: fully isolated 0-10mA / 4-20mA.

b) Load resistance: 0~1.5kΩ when 0~10mA; 0~750Ω when 4~20mA.

c) Basic error: add ±10μA to the basic error.

2) Frequency output:

The upper limit can be set within 1~5000Hz. The frequency output is a transistor collector open circuit output (OC gate) with photoelectric isolation, the external power supply is ⩽36V DC, and the maximum collector current is 50mA when it is turned on. Optional relay output, external power supply ⩽36VDC, maximum collector current ⩽250mA when turned on.

Main parameters

3) Pulse output:

The upper limit can reach 5000cp/s.Pulse equivalent is defined as the volume flow represented by each pulse. Pulse equivalent can be 0.0001L/p, 0.001L/p, 0.01L/p, 0.1L/p, 1.0L/p, 2L/p, 5L/p, 10L/p, 100L/p, 1m3/p, 10m3 /p, 100 m3/p and 1000 m3/p. Pulse width can be selected: automatic, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms. The pulse output is a transistor collector open circuit output with photoelectric isolation, the external power supply is ⩽36V DC, and the maximum collector current is 50mA when it is turned on. Optional relay output, external power supply ⩽36VDC, maximum collector current ⩽250mA when turned on.

4) Alarm output:

Two transistor open-collector alarm outputs with photoelectric isolation. The external power supply is ⩽36VDC, and the maximum collector current is 50mA when it is turned on. Optional relay output, external power supply ⩽36VDC, maximum collector current ⩽250mA when turned on.

5) Digital communication interface: optional RS232, RS485, MODBUS, HART, Profibus-DP.

■ **Galvanic isolation:**

- The insulation voltage between analog input and analog output is not less than 500V;
- The insulation voltage between the analog input and the alarm power supply is not less than 500V;
- The insulation voltage between the analog input and the AC power supply is not lower than 500V;
- The insulation voltage between the analog output and the AC power supply is not less than 500V;
- The insulation voltage between the analog output and the earth is not lower than 500V;
- The insulation voltage between the pulse output and the AC power supply is not lower than 500V;
- The insulation voltage between the pulse output and the earth is not less than 500V;
- The insulation voltage between the alarm output and the AC power supply is not less than 500V;
- The insulation voltage between the alarm output and the earth is not less than 500V.

Reference working conditions and error curve

According to JB/T 9248-1999:

- Ambient temperature：20℃（68°F）±2℃（±35.6°F）
- Relative humidity：60%～70%
- Power supply：220VAC±1%，50Hz±1%
- Installation conditions: upstream > 10×DN;
  downstream > 5×DN
  (Note 5: based on the center of the electrode)
- Preheating time: 30 minutes
- Analog output influence amount: pulse signal error plus ±0.1%

Error Curve: (Figure 4)

- Standard calibration (pulse output signal):
  ±0.5% of indicated value (flow speed > 0.6 m/s), or
  ±3mm/s (flow speed ⩽0.6 m/s), whichever is greater.
  [±0.5% of indicated value (flow speed > 1.97 ft/s), or
  ±0.01 ft/s (flow speed ⩽ 1.97 ft/s), whichever is greater.]
- Optional calibration (pulse output signal):
  ±0.2% of indicated value (flow speed > 1.0 m/s), or
  ±2mm/s (flow speed ⩽ 1.0 m/s), whichever is greater.
  [±0.2% of indicated value (for speed >3.28 ft/s), or
  ±0.006 ft/s (for speed ⩽3.28 ft/s), whichever is greater.]

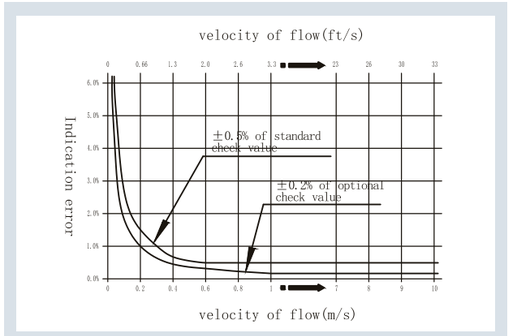


Figure 4　Flow meter error curve

Flow rate comparison table

Flow rate comparison table

Table 1

Nominal Diameter DN		Full scale (m^3/h)			Full scale (US Gal/min)		
mm	Inches	v=0.3 m/s (least)	V=1.0 m/s	V =15m/s (utmost)	v=1.0 ft/s (least)	v=3.0 ft/s	v=49 ft/s (utmost)
15	1/2	0.1909	0.6362	9.543	0.6120	1.836	29.99
20	3/4	0.3393	1.131	16.96	1.377	4.131	67.47
25	1	0.5301	1.767	26.51	2.448	7.344	120.0
32	1.25	0.8686	2.895	43.43	3.825	11.47	187.4
40	1.5	1.357	4.524	67.86	5.508	16.52	269.9
50	2	2.121	7.069	106.0	9.792	29.38	479.8
65	2.5	3.584	11.95	179.2	15.30	45.90	749.7
80	3	5.429	18.10	271.4	22.03	66.10	1080
100	4	8.482	28.27	424.1	39.17	117.5	1919
125	5	13.25	44.18	662.7	61.20	183.6	2999
150	6	19.09	63.62	954.3	88.13	264.4	4318
200	8	33.93	113.1	1696	156.7	470.0	7677
250	10	53.01	176.7	2651	244.8	734.4	11995
300	12	76.34	254.5	3817	352.5	1058	17273
350	14	103.9	346.4	5195	479.8	1439	23511
400	16	135.7	452.4	6786	626.7	1880	30708
450	18	171.8	572.6	8588	793.2	2379	38864
500	20	212.1	706.9	10603	979.2	2938	47981
600	24	305.4	1018	15268	1410	4230	69092
700	28	415.6	1385	20782	1919	5758	94042
800	32	542.9	1810	27143	2507	7520	122831
900	36	687.1	2290	34353	3173	9518	155457
1000	40	848.2	2827	42412	3917	11750	191923
1200	48	1221	4072	61073	5640	16921	276369
1400	56	1663	5542	83127	7677	23031	376169
1600	64	2171	7238	108574	10027	30081	491322
1800	72	2748	9161	137414	12690	38071	621830
2000	80	3393	11310	169646	15667	47001	767691
2200	88	4105	13685	205272	18957	56872	928906
2400	96	4886	16286	244291	22561	67682	1105475
2600	104	5734	19113	286702	26478	79433	1297398
2800	112	6650	22167	332507	30708	92123	1504674
3000	120	7634	25447	381704	35251	105753	1727305

Note 6: Flow calculation in metric units:

Q(m3/h) = 0.00282744 × D2 × V

D --- Nominal diameter, mm.

V --- Flow speed, m/s.

Note 7: Flow calculation in imperial units:

Q(US Gal/min) = 2.44799 × D2 × V

D ---Nominal diameter, inch

V ---flow speed, ft/s.

Dimensions

(See Figure 5, Figure 6, Figure 7, Figure 8, Table 2, Table 3, Table 4, Table 5)

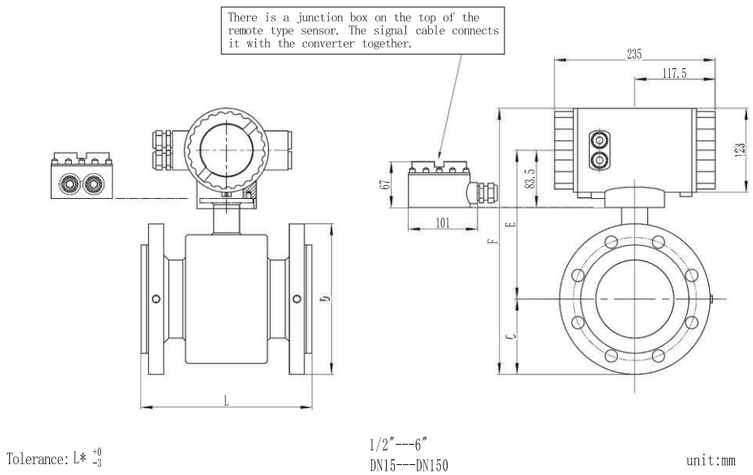


Figure 5 DN15~DN150 (1/2"~6") flow meter outline diagram

Table 2.1 DN15~DN150 Flow Meter Dimension Table(GB, DIN)

unit:mm

DN GBDIN	Nominal pressure Mpa	Dimension			Bolt information						(D) Outer diameter of flange		Net weight kg	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	PN1.6	PN4.0	PN1.6	PN4.0	PN1.6	PN4.0	PN1.6	PN4.0	PN1.6	PN4.0
15	PN1.6 or PN4.0	200	48	315	65	65	14	14	4	4	95	95	7	7
20		200	53	325	75	75	14	14	4	4	105	105	9	9
25		200	58	330	85	85	14	14	4	4	115	115	11	11
32		200	70	380	100	100	18	18	4	4	140	140	12	12
40		200	75	380	110	110	18	18	4	4	150	150	13	13
50		200	83	385	125	125	18	18	4	4	165	165	14	14
65		200	93	405	145	145	18	18	4	8	185	185	22	23
80		200	100	420	160	160	18	18	8	8	200	200	26	28
100		250	118	455	180	190	18	22	8	8	235	235	28	32
125		250	135	500	210	220	18	26	8	8	270	270	35	41
150		300	150	500	240	250	22	26	8	8	300	300	38	44

Table 2.2 1/2"~6" Flow Meter Dimension Table (ANSI, metric units)

unit:mm

DN ANSI	Nominal pressure lb	Dimension			Bolt information						(D) Outer diameter of flange		Net weight kg	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	150	300	150	300	150	300	150	300	150	300
1/2	150 or 300	200	48	315	60.5	66.5	15.7	15.7	4	4	89	95	8	8
3/4		200	59	325	69.9	82.6	15.7	19.1	4	4	99	117	10	10
1		200	62	330	79.2	88.9	15.7	19.1	4	4	108	124	11	13
1.25		200	67	380	88.9	98.6	15.7	19.1	4	4	117	133	11	13
1.5		200	78	380	98.6	114.3	15.7	22.4	4	4	127	155	12	16
2		200	83	385	120.7	127	19.1	22.4	4	8	152	165	14	16
2.5		200	96	405	139.7	149.4	19.1	22.4	4	8	178	191	24	27
3		200	105	420	152.4	168.1	19.1	22.4	4	8	191	210	28	33
4		250	127	455	190.5	200.2	19.1	22.4	8	8	229	254	32	40
5		250	140	500	215.9	235	22.4	22.4	8	8	254	279	38	51
6		300	159	500	241.3	269.7	22.4	22.4	8	8	279	318	41	60

Table 2.3 1/2"~6" Flow Meter Dimension Table (ANSI, Imperial Units)

unit:Inches

DN ANSI	Nominal pressure lb	Dimension			Bolt information						(D) Outer diameter of flange		Net weight lb	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	150	300	150	300	150	300	150	300	150	300
1/2	150 or 300	7.87	1.89	12.40	2.38	2.62	0.62	0.62	4	4	3.50	3.75	18	19
3/4		7.87	2.32	12.80	2.75	3.25	0.62	0.75	4	4	3.88	4.62	21	23
1		7.87	2.46	12.99	3.12	3.50	0.62	0.75	4	4	4.25	4.88	26	28
1.25		7.87	2.64	14.96	3.50	3.88	0.62	0.75	4	4	4.62	5.25	25	30
1.5		7.87	3.07	14.96	3.88	4.50	0.62	0.88	4	4	5.00	6.12	28	36
2		7.87	3.27	15.16	4.75	5.00	0.75	0.88	4	8	6.00	6.50	31	36
2.5		7.87	3.77	15.94	5.50	5.88	0.75	0.88	4	8	7.00	7.50	53	59
3		7.87	4.14	16.54	6.00	6.62	0.75	0.88	4	8	7.50	8.25	62	73
4		9.84	5.02	17.91	7.50	7.88	0.75	0.88	8	8	9.00	10.00	71	89
5		9.84	5.52	19.69	8.50	9.25	0.88	0.88	8	8	10.00	11.00	84	112
6		11.81	6.27	19.69	9.50	10.62	0.88	0.88	8	8	11.00	12.50	91	132

List 2 Note:

1) For other pressure classes, the flanges will be offered accordingly
2) L increases 3mm (0.12 ") with a pair of grounding rings
3) L increases 5mm (0.2 ") with an inlet protection flange
4) Please add 3.5kg (7.7LB) for the integral type converter

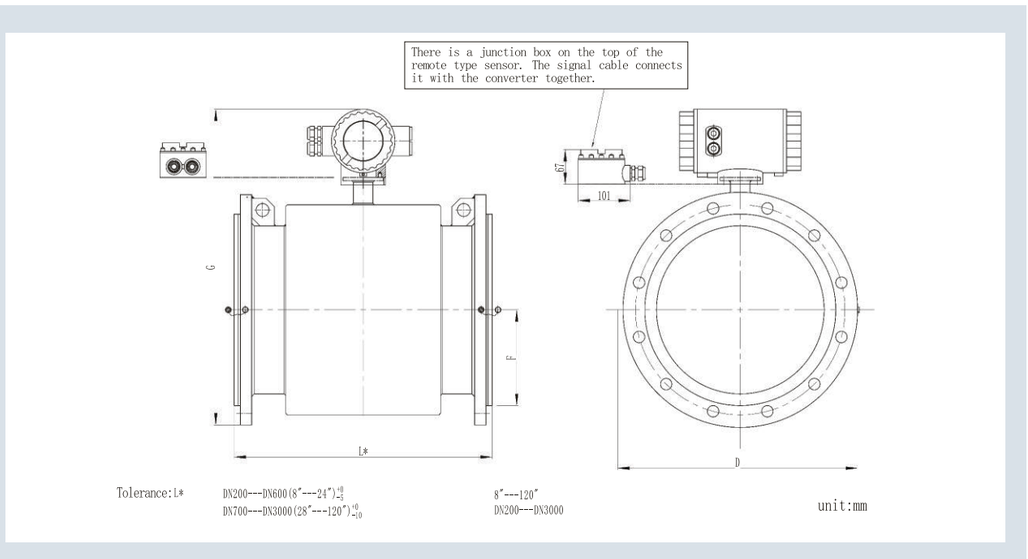


Figure 6 DN200-DN3000（8''-120'') dimension

Table 3.1 DN200~DN600 Flow meter dimension table (GB, DIN)

unit:mm

DN GBDIN	Nominal pressure Mpa	Dimension			Bolt information						(D) Outer diameter of flange		Net weight kg	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	PN1.0	PN1.6	PN1.0	PN1.6	PN1.0	PN1.6	PN1.0	PN1.6	PN1.0	PN1.6
200	PN1.0 or PN1.6	350	170	540	295	295	22	22	8	12	340	340	45	46
250		450	203	600	350	355	22	26	12	12	395	405	67	71
300		500	230	660	400	410	22	26	12	12	445	460	94	103
350		550	260	720	460	470	22	26	16	16	505	520	145	158
400		600	290	780	515	525	26	30	16	16	565	580	180	197
450		600	320	840	565	585	26	30	20	20	615	640	215	242
500		600	358	915	620	650	26	33	20	20	670	715	245	293
600		600	420	1040	725	770	30	36	20	20	780	840	335	418

Table 3.2 8"~24" Flow Meter Dimension Table (ANSI, metric units)

unit:mm

DN ANSI	Nominal pressure lb	Dimension			Bolt information						(D) Outer diameter of flange		Net weight kg	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	150	300	150	300	150	300	150	300	150	300
8	150 or 300	350	191	540	298.5	330.2	22.4	25.4	8	12	343	381	52	80
10		450	223	600	362	387.4	25.4	28.4	12	16	406	445	84	120
12		500	261	660	431.8	450.9	25.4	31.8	12	16	483	521	125	171
14		550	293	720	476.3	514.4	28.4	31.8	12	20	533	584	179	257
16		600	324	780	539.8	571.5	28.4	35.1	16	20	597	648	213	334
18		600	356	840	577.9	628.7	31.8	35.1	16	24	635	711	264	417
20		600	388	915	635	685.8	31.8	35.1	20	24	699	775	311	474
24		600	458	1040	749.3	812.8	35.1	41.1	20	24	813	914	423	690

Table 3.3 8"~24" Flow Meter Dimension Table (ANSI, Imperial Units)

unit:Inches

DN ANSI	Nominal pressure lb	Dimension			Bolt information						(D) Outer diameter of flange		Net weight lb	
					(K) Center distance		(A) Bolt hole diameter		(n) Bolt quantity					
		L	C	F	150	300	150	300	150	300	150	300	150	300
8	150 or 300	13.78	7.52	21.26	11.75	13.00	0.88	1.00	8	12	13.50	15.00	116	176
10		17.72	8.77	23.62	14.25	15.25	1.00	1.12	12	16	16.00	17.50	185	264
12		19.69	10.27	25.98	17.00	17.75	1.00	1.25	12	16	19.00	20.50	277	377
14		21.65	11.52	28.35	18.75	20.25	1.12	1.25	12	20	21.00	23.00	395	568
16		23.62	12.77	30.71	21.25	22.50	1.12	1.38	16	20	23.50	25.50	471	736
18		23.62	14.02	33.07	22.75	24.75	1.25	1.38	16	24	25.00	28.00	583	919
20		23.62	15.27	36.02	25.00	27.00	1.25	1.38	20	24	27.50	30.50	687	1045
24		23.62	18.02	40.94	29.50	32.00	1.38	1.62	20	24	32.00	36.00	934	1521

List 3 Note:

1) For other pressure classes, the flanges will be offered accordingly
2) L increases 4mm (0.16 ") with a pair of grounding rings
3) L increases 8mm (0.32 ") with an inlet protection flange
4) Please add 3.5kg (7.7LB) for the integral type converter

Figure 4 DN700～DN1400 dimension（GB、DIN）

unit:mm

DN GBDIN	Nominal pressure Mpa	Dimension			Bolt information (K) Center distance		Bolt information (A) Bolt hole diameter		Bolt information (n) Bolt quantity		(D) Outer diameter of flange		Net weight kg	
		L	C	F	PN0.6	PN1.0	PN0.6	PN1.0	PN0.6	PN1.0	PN0.6	PN1.0	PN0.6	PN1.0
700	PN0.6 or PN1.0	700	448	910	810	840	26	30	24	24	860	895	435	509
800		800	508	1215	920	950	30	33	24	24	975	1015	545	626
900		900	558	1315	1020	1050	30	33	24	28	1075	1115	655	756
1000		1000	615	1430	1120	1160	30	36	28	28	1175	1230	810	935
1200		1200	728	1605	1340	1380	33	39	32	32	1405	1455	875	1051
1400		1400	838	1830	1560	1590	36	42	36	36	1630	1675	1235	1453

Figure 5 DN1600～DN3000 dimension （GB、DIN）

unit:mm

DN GBDIN	Nominal pressure Mpa	Dimension			Bolt information (K) Center distance		Bolt information (A) Bolt hole diameter		Bolt information (n) Bolt quantity		(D) Outer diameter of flange		Net weight kg	
		L	C	F	PN0.25	PN0.6	PN0.25	PN0.6	PN0.25	PN0.6	PN0.25	PN0.6	PN0.25	PN0.6
1600	PN0.25 or PN0.6	1600	915	2180	1730	1760	30	36	40	40	1790	1830	1496	1555
1800		1800	1023	2380	1930	1970	30	39	44	44	1990	2045	1993	2085
2000		2000	1133	2580	2130	2180	30	42	48	48	2190	2265	2459	2610
2200		2200	1238	2680	2340	2390	33	42	52	52	2405	2475	2648	2830
2400		2400	1343	2890	2540	2600	33	42	56	56	2605	2685	3070	3310
2600		2600	1453	3110	2740	2810	33	48	60	60	2805	2905	3539	3875
2800		2800	1558	3320	2960	3020	36	48	64	64	3030	3115	4604	4930
3000		3000	1658	3480	31600	3220	36	48	68	68	3230	3315	5214	5580

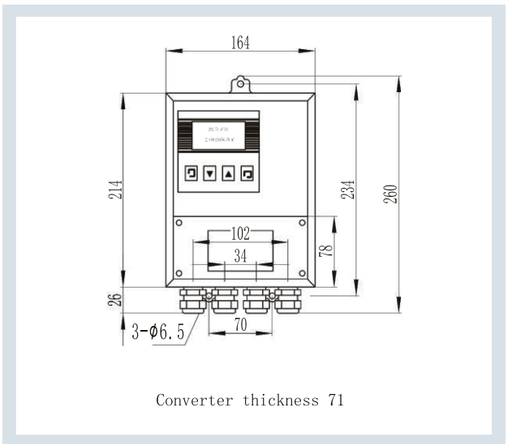


Figure 7 The dimension of the remote type converter

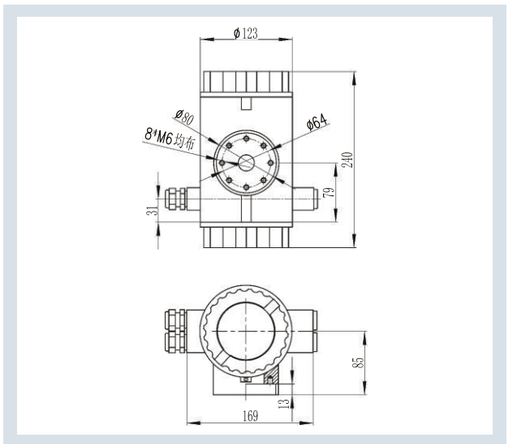


Figure 8 The dimension of the integral type converter

Points for selection and design

The necessary conditions to ensure the meter work with good accuracy

1] The conductivity of the medium must be larger than 5μs/cm;

2] The pipe line must be 100% filled with the medium;

3] The flow meter must be connected with the earth well to ensure no signal interference;

4] Please ensure straight distance for upstream 10DN and downstream 5DN for good accuracy and stability;

5] Please ensure no electric/magnetic field around the flow meter.

Size

Though the flow meter can work in a very wide flow range, such as the users can adjust the full scale in the scope of flow speed 15 m/s(1.6～49 ft/s), we recommend you to choose the same size for the flow meter to the pipe line size. In this way, easy installation and no pressure loss.

For more details, please see Figure 1.

1] At the same time, if there is precipitate in the sensor and the flow rate is very low, a pair of decrease pipe lines will be recommended at the upstream/downstream of the flow meter to increase the flow rate if pressure loss is acceptable.)

2] Second, if the flow rate is very low in the large pipe line, a pair of decrease pipe lines will be recommended at the upstream/downstream of the flow meter to increase the flow rate and save the cost.

3] Please ensure the cone angle of the decrease pipe lines is not larger than 15 degree, also the straight length of the upstream should be 5DV at least.

Recommended flow rate

1] In terms of accuracy, economy and durability, the recommended flow rate should be in the scope of 1 to 5m/s (3.3 to 16 ft/s). In this scope, the flow meter offers a good accuracy and linearity. Also the kinetic loss is less and abrasion of the medium is very small for the liner and electrodes.

2] If there is particles with the medium, flow speed 1 to 3m/s(3.3 to 10ft/s)is highly recommended to avoid abrasion for the liner and electrodes.

3] If there is precipitate in the sensor, flow speed 2 to 5m/s (6.5 to 16 ft/s) and vertical installation are highly recommended.

Wetted parts

Liner, electrodes, flanges and gaskets. The anti-corrosion, anti-corrosion and anti-temperature of these wetted parts lead to the flow meter ability to the medium. Due to these wetted parts can have different materials and simply shape, the flow meter has a strong ability to the medium.

1]Liner

a) Fluoro rubber, polyurethane rubber and rubber are the most common.

b) Rubber is usually used for the application of non-corrosion or weak corrosion, such as industrial water, sewage and weak acid/alkali. Rubber is low cost.

c) Fluorine plastic includes PTFE, PFA and F46.

d) PTFE has a better characteristic of anti-corrosion, but worse anti-abrasion and negative pressure.

e) PFA and F46 are not as good as PTFE for anti-corrosion, but they are better for anti-abrasion. At the same time, PFA and F46 (with metal mesh together) are better for negative pressure because they are fasten on the inner surface of the tube tightly.

f) Polyurethane rubber is better for anti-abrasion, but worse for anti-corrosion. Its anti-abrasion is 10 times of better than rubber, so it is suitable for coal slurry or pulp.

g) Hard rubber is suitable for HCl, acetic acid, oxalic acid, ammonia, H3PH4, 50% H2SO4, NAOH, KOH, so it is workable for general acid/alkali/saline. But not workable for strong oxidant.

2]Electrodes

When user chooses the electrodes, he should consider the anti-corrosion and anti-abrasion first.

Generally, we can see SS316L, HB, HC, Ti, Tan, Pt-Ir alloy. They are workable for the medium in most of the industry fields. Due to the corrosion of the medium differs from the temperature, flow rate and concentration, when the users choose the electrodes, they should consider the result of this medium in other applications and their own experience. If necessary, please get a bottle of medium sample and do the anti-corrosion test, that is the most closed to the real application in the site. Then the user can get a result that whether the electrodes are workable for the medium or not. By the way, the tungsten carbide is workable for strong anti-abrasion, but worse for anti-corrosion.

3] Grounding flange or grounding electrode

Grounding flange is needed for non-metallic pipe lines or non-metallic liner in the metallic pipe lines., in this way, the reference potential comes to 0V. Generally, the material of the grounding flange is SS304, small corrosion is acceptable, but regular replacement is needed. The dimension of grounding flange is big, so HB/HC/Tan/Ti are not suggested for economy factor. Then same material of grounding electrodes can be there to get 0V reference potential. Please ensure the grounding electrodes and grounding flange are same material so that there is no difference about corrosion and high reference potential.

Suggestions for installation

First of all, the safe load of the lifting equipment and protection should be conform to the related rules. Lifting the flow meter with the junction box or pakcing box through a rope are forbidden. See figure 9.

When welding or flame cutting adjacent to the pipe, isolation measures are required to prevent thermal damage to the lining (see Figure 10).

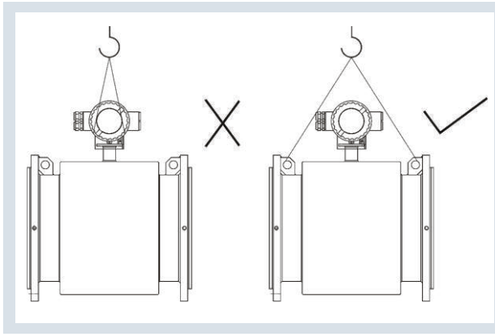


Figure 9 lifting

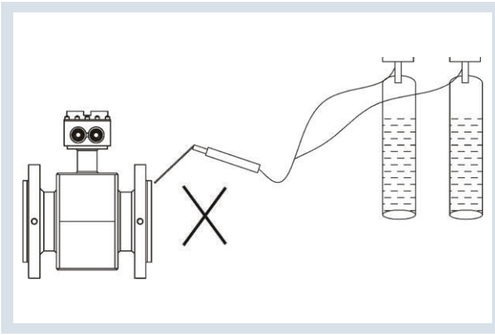


Figure 10 Take Isolation measures to protect lining from heat damage

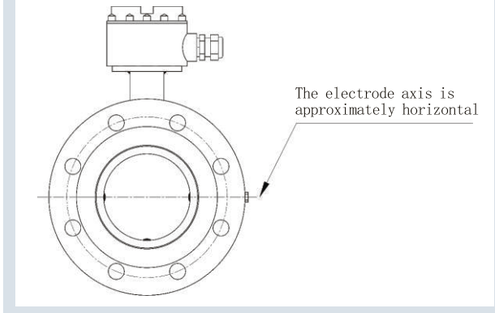


Figure11 Horizontal installation

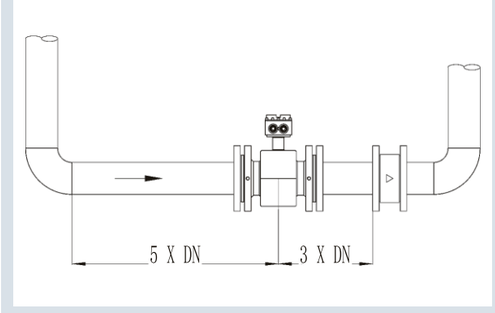


Figure12 Ensure pipe line 100% full and the straight length in the upstream\downstream

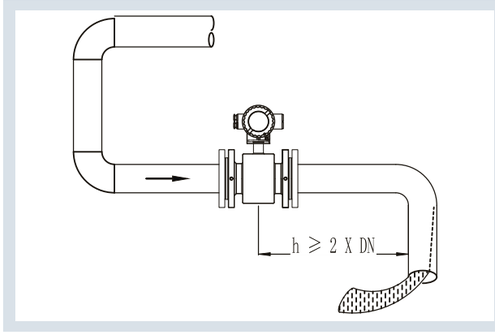


Figure13 Vertical installation

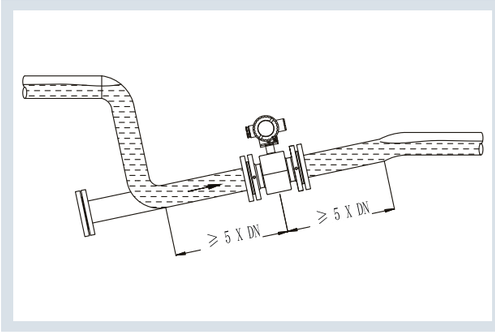


Figure 14 Recommended installation for precipitate

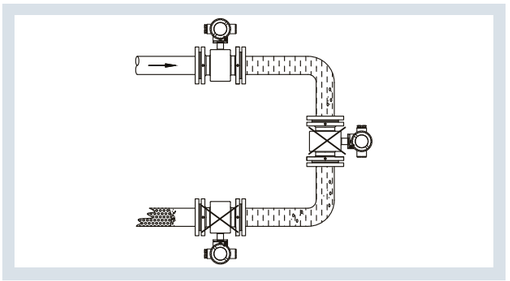


Figure 15 Avoid the bubbles, also do not install downward

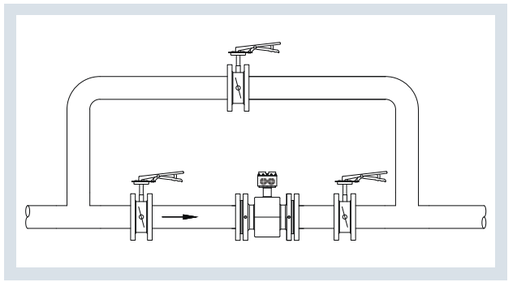


Figure 16 Install bypass pipe for easy maintenance

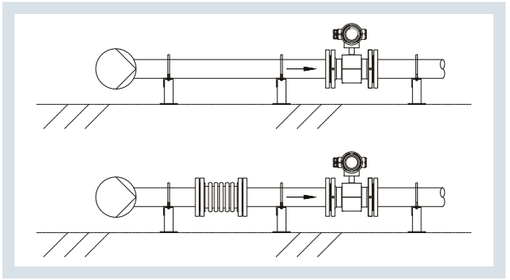


Figure 17 Avoid strong shock

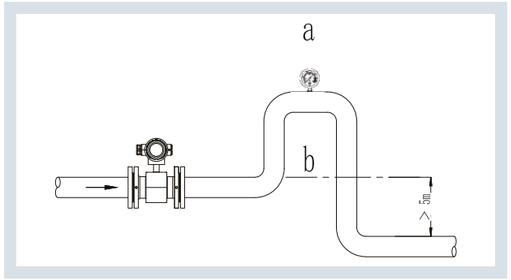


Figure 18 Avoid negative pressure and non-full pipe line

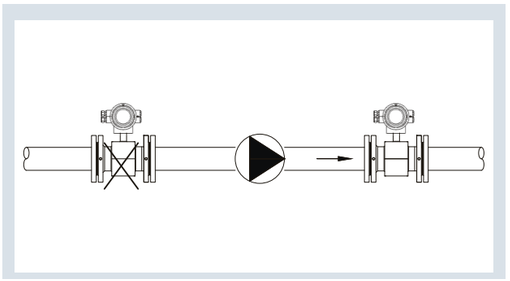


Figure 19 Avoid installation at the pump inlet

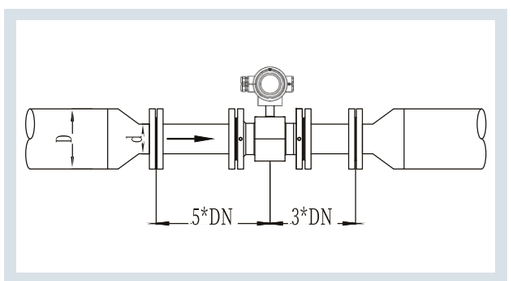


Figure 20 Ensure the straight length of the upstream/down stream for decrease pipe line installation

The flow meter can be installed horizontally, vertically and obliquely according to the demand, followings should be paid attention to for a good performance.

1] The pipe line must be 100% filled with medium. Empty or not full are forbidden.

2] The electrodes axis of the flow meter installed horizontally should be approximately horizontal.

3] There should be 5D straight length in upstream and 3D straight length in downstream, measuring from the axis of the electrodes.

4] The flow direction of the medium should be as same as the forward direction of the flow meter.

5] Enough space around the flow meter is recommended for easy installation and maintenance.

6] The decrease pipe lines with less than 15 degree of cone angle is recommended when the sizes of flow meter and pipe line is not same.

7] Please ensure no electric/magnetic field or shock around the flow meter, support the recommended if necessary.

8] The remote type converter should be installed in the ventilated and dry place, keep off rain or water.

Suggestions for grounding

In order to ensure the flow meter get 0V reference potential and work with good performance, the grounding work should be finished well to avoid the effect of the electric/magnetic. if the pipe line is non-metallic or there is non-metallic liner inside the pipe line, please add grounding rings or electrodes.

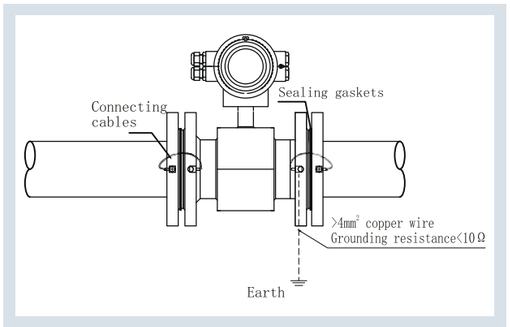


Figure 21 Metallic pipe line grounding

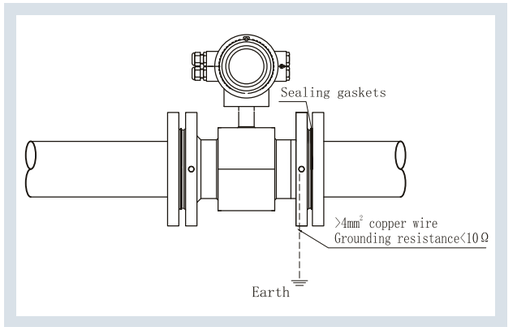


Figure 22 Non-metallic pipe line grounding, there is grounding electrodes inside the sensor

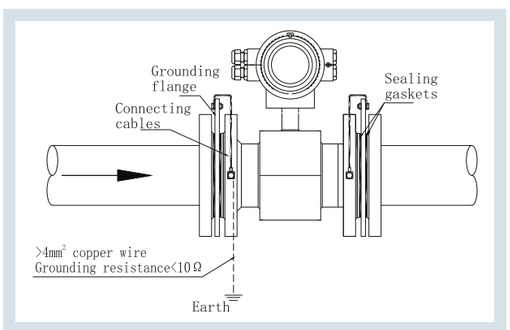


Figure 23 Non-metallic pipe line grounding, there is grounding flange with the sensor

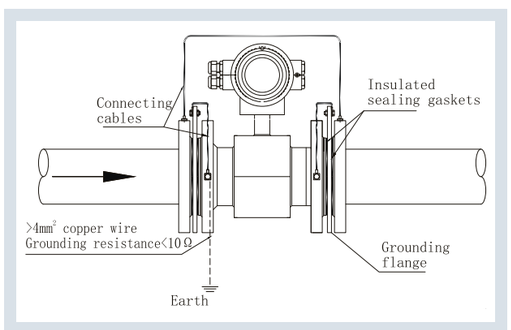


Figure 24 Cathodic protection grounding

Electrical connection

■ The connection between the flow meter (including the electrical connection between the sensor and converter) and the related electrical equipment must be completed by the professional technicians.

■ All electrical connections should be made after cutting off the power supply.

■ Connect correctly and securely as required.

■ Tighten the glands and the back cover to keep the flow meter well sealed.

■ Surge suppression devices should be installed on lines that may be subject to lightning surges.

■Double check that all electrical connections are correct before power is feed.

Electrical connection between sensor and converter(Figure 27)

The manufacturer has completed the electrical connection between the sensor and converter before the dispatch of integral type flow meter.

It requires the user to complete the electrical connection between the sensor and converter for the remote type flow meter.

Terminals and marking of the junction box of the remote type flow meter, Figure 25, Table 6.

Terminals and marking of the remote type converter, Figure 26, Table 7.

Figure 25 Terminals and marking of the junction box of the remote type flow meter

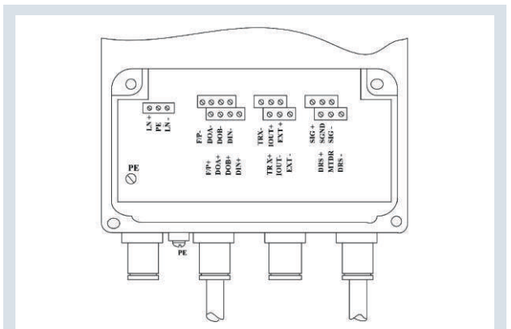


Figure 26 Terminals and marking of the remote type converter

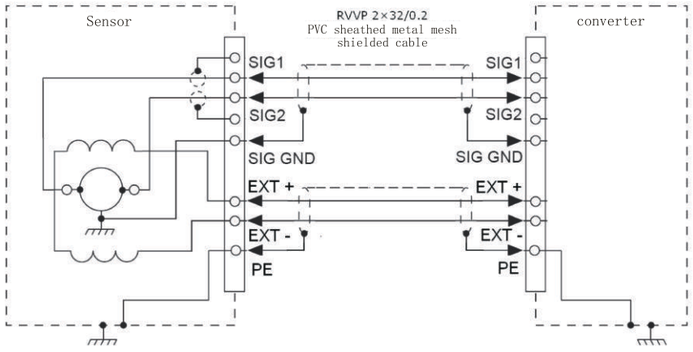


Figure 27 Electrical connection between sensor and converter

Table 6 Terminals and marking of the junction box of the remote type flow meter

No.	Terminal identification	Terminal name	Terminal category
1	SIG1	Signal 1	Signal input terminal
2	SIG2	Signal 2	
3	SIG GND	Signal ground	
4	EXT +	Excitation current output +	Excitation current output terminal
5	EXT -	Excitation current output -	

Table 7 Terminals and marking of the remote type converter

No.	Terminal identification	Terminal name	Terminal category
1	SIG+	Signal 1	Signal input terminal
2	SIG GND	Signal grounding	
3	SIG-	Signal 2	
4	EXT +	Excitation current output +	Excitation current output terminal
5	EXT -	Excitation current output -	
6	IOUT+	Active analog current output +	Current output terminal
7	IOUT-	Active analog current output -	
8	F/P+	Pulse/frequency output+	Pulse/frequency output terminal
9	F/P-	Pulse/frequency output-	
10	DOA+	Alarm output+	Alarm output terminal
11	DOA-	Alarm output-	
12	TRX+	Communication input (RS485 B)	Digital communication connection terminal RS485 model
13	TRX-	Communication input (RS485 A)	
14	DOB+	Reserve	Functional reservation
15	DOB-	Reserve	
16	DIN+	Reserve	
17	DIN-	Reserve	
18	DRS+	Excitation shielding+	Excitation signal terminal
19	MTDR	Excitation shielding grounding	
20	DRS-	Excitation shielding -	
21	LN+	220VAC or 24VDC+	Power supply
22	LN-	220VAC or 24VDC-	
23	PE	Housing grounding	

Terminals and marking of the integral type converter, figure 28 and table 8

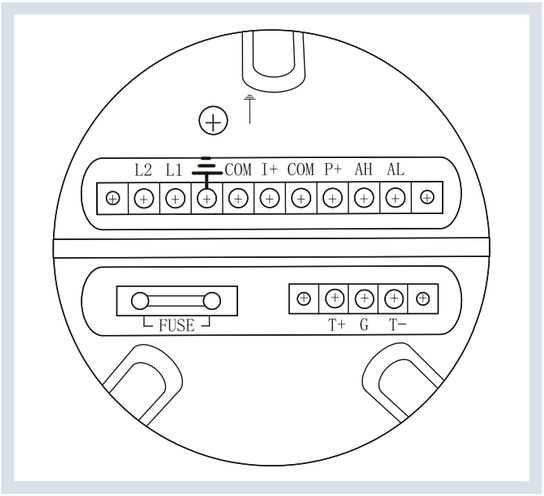


Figure 28 Terminals and marking of the integral type converter

Table 8 Terminals and marking of the integral type converter

Serial No.	Terminal identification	Terminal name	Terminal Type
1	TT +	Communication input（RS485-A）	connection terminal of Digital communication digital
2	T -	Communication input（RS485-B）	
3	G	RS232 communication ground	
4	I +	Flow current output	Current output terminal
5	COM	current output ground	
6	P+	Frequency (pulse) output	Frequency/pulse output terminal
7	COM	Frequency (pulse) output ground	
8	AH	High alarm output	Alarm output terminal
9	AL	Low alarm output	
10	L1 （+）	220V (24VDC+) power input	Power supply terminal
11	L2 （-）	220V (24VDC-) power input	

Cables for power supply and signal output

All these cables should be prepared by users as required. However, please ensure that the load current and strength requirements are met.

■ Power supply cable

Power supply cable can be a grounded two-core insulated rubber flexible cable. The recommended size is RVVP2*1MM.

For AC power supply converter, phase line should be connected to L1 terminal!

For DC supply converters, it should be noted that the wire resistance is related to the supply voltage, and generally the resistance of the 24VDC power supply cable should not be greater than 10 ohms. The resistance value of the power supply cable is determined by the length and section.

■ Current output cable (see Figure 29)

When using current output (for example, 4 to 20mA), note that the sum of the resistance of the loop conductor and the resistance of the load must not be greater than 750 ohms.

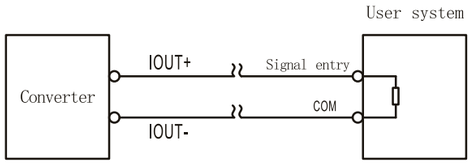


Figure 29 Current output connection (internal power supply)

■ Frequency (pulse)、Status output cable (see Figure 30a-c)

The output of frequency (pulse), upper and lower limit alarm, flow direction sign and so on are level output signals with open collector. They require external power supply and load, as shown in Figure 30a and Figure 30b. When the inductive load is used, the current diode should be added as shown in Figure 30a.

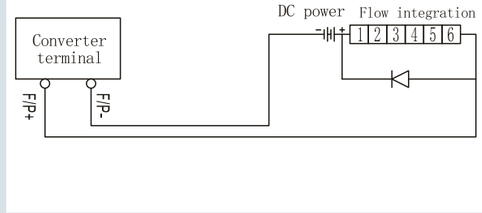


FIG. 30a External power supply connected to an electronic counter

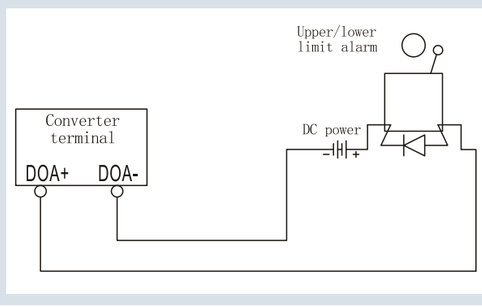


Figure 30b Alarm output wiring

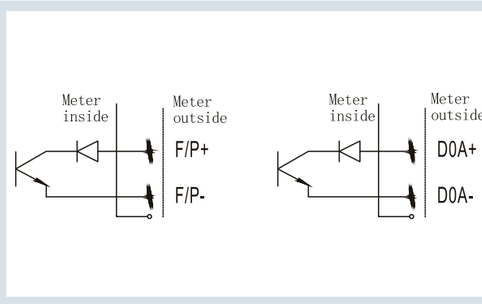


Figure 30c Connection mode of OC gate

Note 8: Frequency output (pulse output) use external power supply!

Digital communication interface and wiring

RS-485 interface: Designed according to IEERS-485 interface standards and supports MODBUS protocol RTU format.

■ **RS-485 wiring (see Figure 33)**

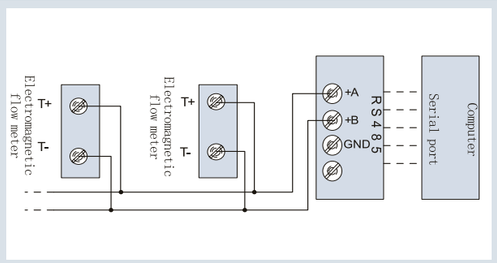


Figure 33 RS485 wiring

Converter grounding

Note 9: The converter housing must be grounded! The wiring terminal PE should be connected to the ground with a ground copper wire of no less than 1.6mm^2. The ground resistance value should not be greater than 10 ohms.

Digital output

Digital output is frequency output and pulse output. The frequency output and the pulse output are wired with the same set of output terminals. Therefore, the user can not choose the frequency output and the pulse output, but only one of them.

■ **Frequency output mode**

The frequency output corresponds to the percentage of flow:

f (Hz) = (Flow rate/Full scale) × Frequency output full scale = Flow percentage× Frequency output full scale

The upper limit of the frequency output is adjustable. The option is 0~1000HZ or 0~5000Hz.

The frequency output mode is generally used for control applications because it reflects the percentage. If the user is using it for billing, the pulse input mode should be selected.

Example: full scale = 100m^3/h，flow rate = 28.27 m^3/h，frequency output full scale = 2000Hz；

Then: Percentage flow= (flow rate/flow scale) ×100 = (28.27/100) ×100 = 28.27 %

f = (flow rate/flow scale) × frequency output full scale = (28.27/100) ×2000 = 565.4 Hz

f = percentage flow × frequency output full scale = 28.27% × 2000 = 565.4Hz

■ **Pulse output mode**

Pulse output mode is mainly used in metering mode. Appropriate pulse equivalent and pulse width should be selected during application. Pulse equivalent is defined in accordance with the custom of metering departments and other flow meters, i.e. how many units of volume (or mass) each pulse represents.

Under a certain flow rate, select a small pulse equivalent, the same time output pulse number, high measurement accuracy. However, in a short period of time, it is easy to count the counter full resulting in overflow. When the pulse equivalent is large, the output pulse number is small, the counting time of the same counter bit is long, and the corresponding frequency is low. Due to the use of electromagnetic counter at this time, the pulse current is large. Therefore, attention should be paid to select the appropriate pulse width to reduce the counter coil turn-on time, reduce power consumption. But also can not choose too small pulse width, otherwise, easy to lose the pulse number.

Also, it must be noted that the pulse output, unlike the frequency output, is not a very uniform pulse train. Generally measuring pulse output should choose counter meter, should not choose frequency meter.

Generally, the normal operation of the client optocoupler requires a current of about 1=10mA. If the power supply voltage of the client E=5-24VDC, calculate the load resistance R=E/I. Therefore, R=0.5-2.5k.

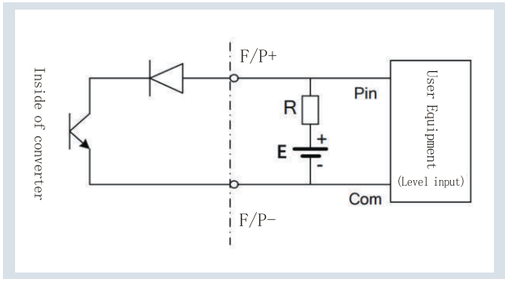


Figure 34 Schematic diagram of connection

Analog output

Note 10: The converter has active current output by default. If you want to use passive current output, must indicate when ordering!

Digital output

Analog output signal：4～20mA signal。

Analog current output for internal 24VCD power supply, in 4~20ma signal system, can drive 750 load resistance

Analog quantity Percentage of the current output corresponding to the flow rate, that is:

$$I_0 = \frac{\text{Measured value}}{\text{Full scale value}} \times \text{Current range} + \text{current zero}$$

For 4~20mA signal system, the current zero is 4mA. Therefore, in order to improve the output analog current resolution, users should choose the range of the flow meter appropriately. The converter can choose range automatic adjustment to achieve this requirement.

The maximum over range output of current is about 22mA.

When the converter leaves the factory, the manufacturer has calibrated the parameters of the analog output. In general, users do not need to adjust them. If there is an abnormal situation, the user needs to calibrate the analog output, just enter the current zero correction and current full degree correction two menus, according to the following operation procedures, No external signal source is required.

a) Ready for instrument adjustment

Connect a 0.1% ammeter at the current output end (or connect a 100 standard resistance and 0.1% digital voltmeter to become a 0.4-2V voltage measurement). Start the instrument and run for 15 minutes to make the inside of the instrument stable, ready to adjust the current output zero coefficient and range coefficient.

b) Current 0 point correction:

Set the converter to the parameter setting state, select the current zero correction item, in, adjust the correction coefficient value, so that the ammeter indicates exactly 4mA. Press the Confirm button.

c) Current full scale correction

Select the current full degree correction parameter, enter, adjust the converter positive coefficient, so that the ammeter is good indicating 20mA. Press the Confirm button.

After adjusting the zero point and full scale value of the current, the current output function of the converter can ensure the accuracy. The current output linearity of the converter is within 0.1%.

WTM-F series flange type electromagnetic flow meter selection design code

WTM-F	□□□	□□	□	□	□	□	□	□	□	□	□	□	□	□
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]

	Nominal diameter (mm)			
[1]	015	100	450	142
	020	125	500	162
	025	150	600	182
	032	200	700	202
	040	250	800	222
	050	300	900	242
	065	350	102	262
	080	400	122	302
	For example：050 = DN50; 150 = DN150; 122 = Dn1200			

	Nominal pressure and process connection	
[2]	02	0.25 MPa（DN700～DN3000）
	06	0.6 MPa （DN700～DN3000）
	10	1.0 MPa （DN200～DN1400）
	16	1.6 MPa （DN15～DN600）
	20	ANSI 150（DN15～DN600）
	40	4.0 MPa （DN15～DN150）
	50	ANSI 300（DN15～DN600）
	91	JIS 10K （DN15～DN1000）
	92	JIS 20K （DN15～DN600）
	XX	Special pressure requirement (according to special order)

	Liner material	
[3]	1	Soft rubber（DN50～DN3000）
	2	Hard rubber（DN50～DN3000）
	3	PTFE（⩽ DN1000）
	4	Polyurethane（⩽ DN300）
	5	PFA（⩽ DN250）
	6	F46（⩽ DN250）
	7	Ceramics（DN50～DN150）

	Electrodes material	
[4]	1	316Ti
	2	Alloy-C22
	3	Alloy-B10
	4	titanium
	5	tantalum
	6	platinum/iridium Alloy
	7	Stainless steel coated with tungsten carbide
	8	Special conductive ceramics (for ceramic linings only)
	X	Requirements for special electrode materials (according to special purchase order)

	Ground lining protection	
[5]	0	Local flange grounding (DN15～DN3000)
	1	Grounding rings (or liner protection flange)（DN15～DN300）
	2	Grounding electrode（DN25～DN1200）
	3	Inlet protection flange（DN50～DN300）
*	Example:[14]=2，and indicate 316SS flange, 304SS sensor housing.	
**	Example:[14]=3，and indicate 316SS flange, 316SS sensor housing.	

	Medium temperature	
[6]	A	⩽80 °C （All liners）
	B	⩽120 °C （Rubber, PTFE, PFA, ceramic liner only）
	C	⩽180 °C （PTFE liner only）

	Protection and explosion-proof requirements	
[7]	1	IP65
	2	IP67（Integral type only）
	3	IP68（Remote type only, need to indicate the length of connecting cable）
	4	IP65+Ex d ib mb IIC T4 Gb

	Sensor and transducer combination structure form	
[8]	C	Integral type(DN15----DN600 only)
	R	Remote type (with 10m signal cable, other lengths can be customized.)

	Power supply	
[9]	A	Alternating current 85～265 VAC /45～63Hz
	D	Direct current 16～36 VDC
	B	Battery 3.6VDC(Level 0.5 only, pulse output, RS485)

	Display and programming	
[10]	1	LCD display + key programming
	2	Wide temperature LCD display + key programming (ultra-low temperature converter)
	3	Liquid Crystal LCD display + photoelectric programming (Suitable for one type explosion-proof structure)
	4	No LCD display + communication programming

	Output and input signals	
[11]	0	Basic configuration (current output -- pulse output + alarm output)
	2	Basic configuration + RS232
	4	Basic configuration + RS485
	M	Basic configuration + MODBUS
	H	Basic configuration + HART
	P	Basic configuration + Profibus-DP

	Additional features			
[12]	0	No requirement	J	Relay output
	T	Power failure timing	F	Enhanced function
	Q	Quantitative control	S	High frequency grout
	R	Infrared remote control	G	GPRS communication
	H	Hourly accumulation	L	Ultra-low temperature converter

	Ex-factory test (accuracy level and flow rate point)			
[13]	1	0.5 grade, 3 point calibration	3	0.5 grade, 5 point calibration
	2	0.2 grade, 5 point calibration	X	Special requirement

	Supplementary coding	
[14]	0	No requirement
	1	Stainless Steel 304SS Sensor (304SS Flange)
	2	Special Requirements 1 (based on special Order + Remarks)
	3	Special Requirements 1 (based on special Order + Remarks) **

Selection example	Flange type, DN150, 4.0MPa, PTFE liner, HC electrodes, flange grounding, medium temperature ⩽120°C, IP65 non-explosion-proof, Integrated type, AC power supply, LCD display + key programming, basic configuration + RS485, no additional function requirements, 0.5 level, 3 point test, stainless steel sensor. Selection coding：[illegible]-F15040320B1CA14011

Consultation form

	Electromagnetic flow meter consulting form		Date: Total page Page
Customer name		Manufacture name	
TEL/FAX		TEL/FAX	
Procedure parameter			
Instrument name			
Device no.			
No.			
Pipe line specifications/materials			
Connection standards/grades			
Medium name			
Maximum flow rate m^3/h			
Normal flow rate m^3/h			
Minimum flow rate m^3/h			
Medium temperature ℃			
Working pressure MPa			
Measurement range m^3/h			
Accuracy class %	□ ±0.5 □ ±0.2	□ ±0.5 □ ±0.2	□ ±0.5 □ ±0.2
Design and selection data			
Nominal diameter mm			
Nominal pressure MPa			
Electrodes material			
Liner			
-Grounding and protection			
Medium temperature ℃	□ ⩽80 □ ⩽120 □ ⩽180	□ ⩽80 □ ⩽120 □ ⩽180	□ ⩽80 □ ⩽120 □ ⩽180
Protection grade	□ IP65 □ IP67 □ IP68	□ IP65 □ IP67 □ IP68	□ IP65 □ IP67 □ IP68
Explosion-proof requirement	□ No □ Ex d ib mb IIC T4 Gb	□ No □ Ex d ib mb IIC T4 Gb	□ No □ Ex d ib mb IIC T4 Gb
Instrument composition form	□ Integral □ Remote	□ Integral □ Remote	□ Integral □ Remote
Power supply	□ Alternating current 85 --- 265 VAC □ Direct current 16 --- 36 VDC □ 3.6 VDC	□ Alternating current 85 --- 265 VAC □ Direct current 16 --- 36 VDC □ 3.6 VDC	□ Alternating current 85 --- 265 VAC □ Direct current 16 --- 36 VDC □ 3.6 VDC
Show the programming mode			
Output input signal			
Factory calibration			
Instrument connection form			
Electrical connection			
Signal cable m			
Matching flanges and fasteners	□ Provide □ Not provide	□ Provide □ Not provide	□ Provide □ Not provide
Attachment 1			
Attachment 2			
Specification and model			
Remarks			