

Electromagnetic Flow Meter Manual

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I Flowmeter

1. To users

1.1 Statement

This user manual introduce MF Series Electromagnetic Flowmeter of performance, technical parameters, performance index, model and specification, installation and use instructions, but not include special technical specification.

If user result in the Flowmeter damage by repairing or replacing parts without written approval or guidance from Kaifeng Kaichuang Flowmeter Technology Co.,Ltd, Kaifeng Kaichuang will assumes no responsibility.

1.2 Items in package

Below items should be in the package, if no, please contact kaifeng Kaichuang Flowmeter Technology Co., Ltd or local sales agent.

No.	Item	Qty.	Note
1	MF Series Electromagnetic Flowmeter sensor (remote type)	1 set/pc	Alternative
2	MF Series Electromagnetic Flowmeter converter (remote type)	1 pc	Only remote type
3	Special Cable	5m	Only remote type
4	User manual	1	
5	Product Quality Certification	1	
6	Calibration Report	1	

2. Overview

2.1 Application Field

MF Series Electromagnetic Flowmeter converter, together with magnetic-inductive sensor, forms a microprocessor-controlled accurate measurement unit. MF Series Electromagnetic flowmeter can be used for fluid flow speeds up to 15 m/s for a minimum conductivity of 5 S/cm. The main application range of MF Series widely covers a variety of fields:

- Chemical and petroleum industry
- Metallurgy industry
- Water and waste water
- Agriculture and irrigation

- Food and beverage industry
- Pharmaceutical industry

2.2 Working theory

The measuring principle of electromagnetic Flowmeter is based on the electromagnetic induction law of Farady. Measuring tube is a non-magnetic alloy tube with lining material inside. Two electrodes are fixed inside the tube at the diameter line of the tube, and the electrode head is even with lining material. When excitation coil crate bi-directional square wave pulse, it will result in a working magnetic field B vertically to measuring tube. Generated voltage E is proportional to product of the magnetic flux density B , inner diameter d , and flow velocity \bar{V} . And E can be detected by electrode and transit to converter by cable, which can be amplified and display flow rate, output pulse, and analog current for further controlling and adjustment.

$$E = KBd\bar{V}$$

Where:

E -----Voltage between electrodes (v)

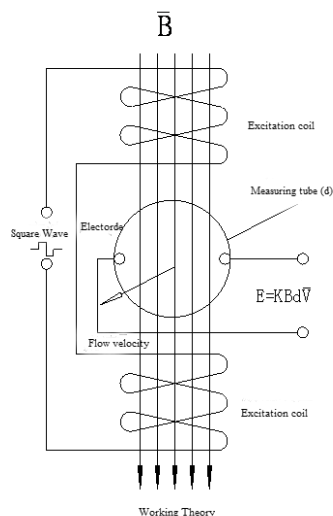
B ----- Magnetic flux density (T)

d -----Inner diameter (m)

\bar{V} -----Flow velocity (m/s)

K -----constant

As K is constant, and excitation current is also constant, then B is constant. By the formula, flow Q is proportional to E , i.e., they are linear relationship. So you can get Q by E , which is the basic working theory of electromagnetic Flowmeter.



rate

In the formula, we can know that the measuring result is not influenced by temperature, density, pressure, conductivity or liquid-solid ratio of two phase flow. As long as the flow complies with axial symmetry, then the result is correct, which indicates that electromagnetic Flowmeter belongs to volumetric Flowmeter.

MF Series uses the most advance technology around the world. It use rectangular wave with constant current and low frequency, which has the advantages of rectangular wave magnetic field and avoiding disadvantages of square wave magnetic field, eliminating the difference by fluctuating voltage and frequency of power supply and also resistance of excitation coil, deleting the problem of coil heating by large power transistors. MF Series also has excellent zero stability and high reliability resulting from no influence by flow noise. What's more, the coil of MF Series is also designed to generate uneven magnetic field that makes sensor smaller and more delight, and also made up for the difference by non-axisymmetric of flow.

2.3 Features

- Various liner can be selected that satisfies most industrial applications.

- Flow Velocity range:0-12 m/s, with good results for low flow applications
- It comes any flanges such as ,ANSI, DIN, JIS ...etc.
- It excellent for high pressure application.
- Protection class: IP68 is available,and the sensor can sink into the water.
- FEP Liner suitable in vacuum tube.
- High accuracy of +/-0.5% of reading(or+/-0.2% of reading)
- With Forward/Reverse flowrate measure function.

2.4 Specification

- DN (mm): 3,6,10,15,20, 25, 32, 40, 50, 65, 80, 100,125,
150,200,250,300,350,400,450,500,600,700,
800,900,1000,1200,1400,1600,1800,2000
- Measuring Range: Velocity 0 - 0.25 m/s min. and 0 - 12 m/s max.
- Conductivity: more than 5 uS/cm
- Accuracy: +/-0.5% of reading (Velocity \geq 0.5 m/s), +/-0.0025 m/s (Velocity < 0.5 m/s), +/-0.2% of Reading
- Max. Pressure: 350 Kg/cm²
- Temperature: -10 ~ +60 C (Polyurethane), -20 ~ +70 C (Neoprene), -40 ~ +180 C (FEP), -40 ~ +180 C (PTFE)
- Electrode & Grounding: Stainless Steel 316L, Hastelloy B, Hastelloy C, Titanium, Tantalum, Platinum, Tungsten Carbide, Monel
- Lining Material: Polyurethane(25-600 mm), Neoprene(50-2000 mm), FEP(6-300 mm), PTFE(25-800 mm)
- Measuring Tube: Stainless Steel 304
- Coil Housing: Carbon Steel (standard), Stainless Steel 304(Optional), Stainless Steel 316(Optional)
- Flange: Carbon Steel (standard), Stainless Steel 304(Optional), Stainless Steel 316(Optional)
- Flanges Type: JIS, DIN, ANSI and others as option
- Ambient Temperature: -25 to +60 Deg. C

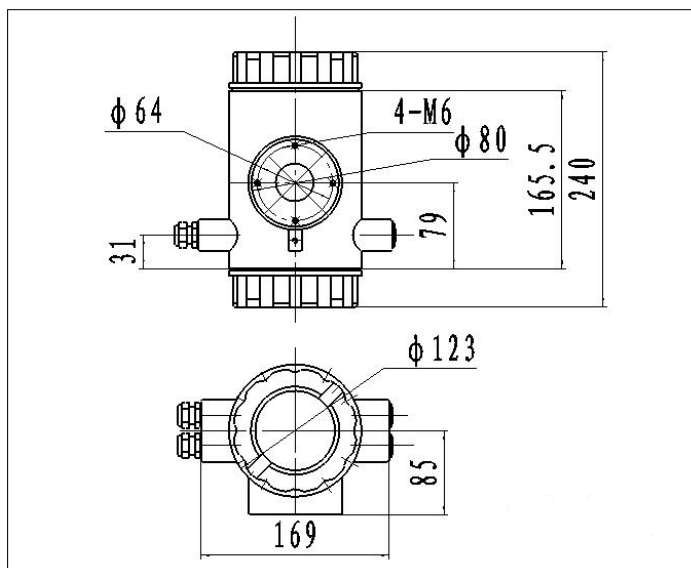
- Cable Entry: 2 M20x1.5
- Grounding Resistance: Must be less then 10 Ω
- Protection: IP 65, IP67 and IP68

3. Outline dimension

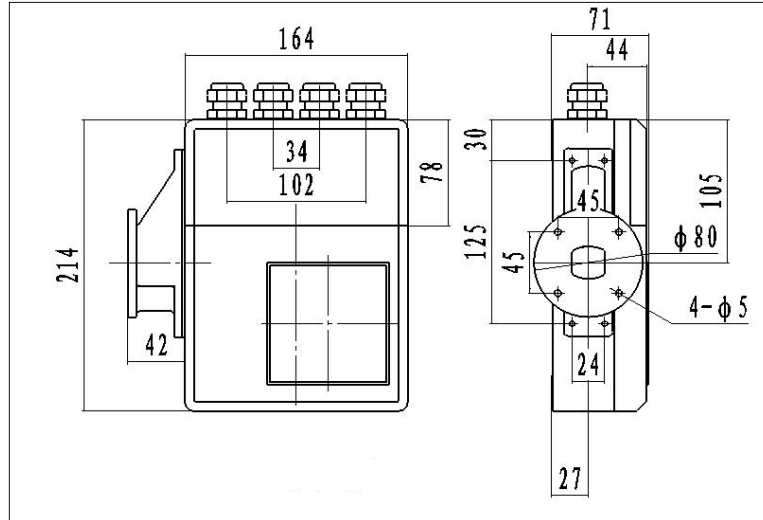
Note: Except below standard connection dimension and nominal pressure, customizing for installation location dimension and pipe nominal pressure is available for customer.

3.1 Converter Structure Dimension

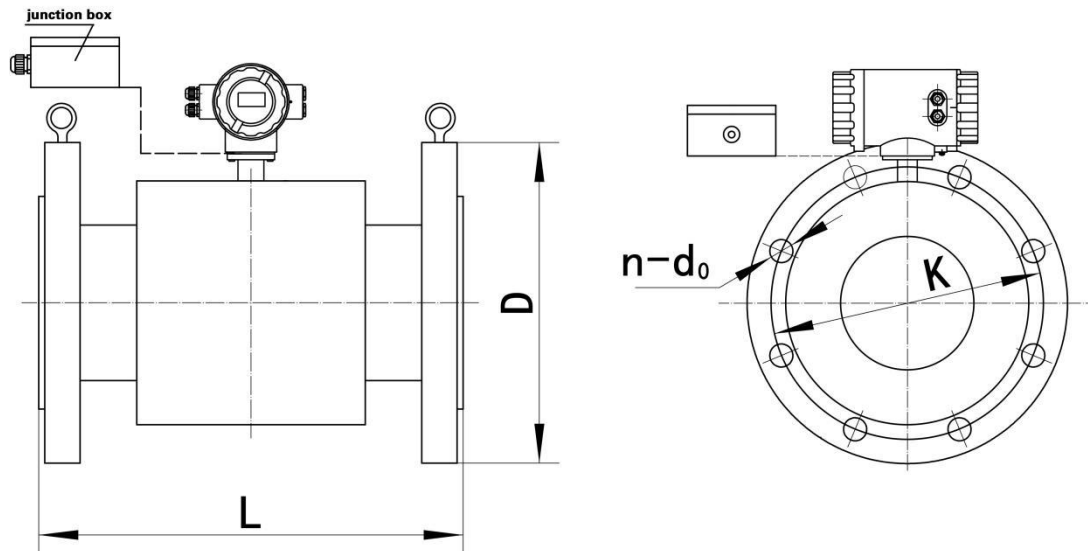
3.1.1 Round converter for integrate type



3.1.2 Square-converter for remote type



3.2 Outline Dimension for normal pressure



DN	PN (MPa)	Dimension					Weight (kg)
		L	D	K	n	d	
3	4.0	150	90	60	4	14	8
6		150	90	60	4	14	8

10		200	90	60	4	14	9.5
15		200	95	65	4	14	15
20		200	105	75	4	14	15
25		200	115	85	4	14	15
32		200	140	100	4	18	18
40		200	150	110	4	18	20
50		200	165	125	4	18	22
65		200	185	145	8	18	26
80		200	200	160	8	18	26
100	1.6	250	220	180	8	18	29
125		250	250	210	8	18	31
150		300	285	240	8	22	39
200	1.0	350	340	295	8	22	48
250		450	395	350	12	22	65
300		500	445	400	12	22	88
350		550	505	460	16	22	110
400		600	565	515	16	26	130
450		600	615	565	20	26	140
500		600	670	620	20	26	160
600		600	780	725	20	30	270
700		700	895	840	24	30	435
800		800	1015	950	24	33	545
900	900	1115	1050	28	33	655	
1000		1000	1230	1160	28	36	810
1200	0.6	1200	1405	1340	32	33	875
1400		1400	1630	1560	36	36	1235
1600		1600	1830	1760	40	36	1555
1800		1800	2045	1970	44	39	2085
2000		2000	2265	2180	48	42	2610

4. Model Selection

MF										xxx	xx	x	x	x	x	x	x	x	xx		
A	Caliber: the first two digits are the caliber's first and second digits. the third digit is the number of the zero																				
	No.	Caliber	No.	Caliber	No.	Caliber	No.	Caliber	No.	Caliber											
	003	3	400	40	201	200	601	600	162	1600											
	006	6	500	50	251	250	701	700	182	1800											

	No.	Structure		No.	Structure	10m cable is freely offered to the separated type.out of			
	1	Integrated		2	Split	10 meter,willb be charged extra			
I	Ex Mark								
	No.	Ex Mark		No.	Ex Mark		No.	Ex Mark	
	0	No		1	Integrated exolosion-proof		2	Seperated exolosion-proof	
J	Power supply								
	No.	Power supply		No.	Power supply		No.	Power supply	
	0	220V A.C		1	24V D.C		2	3.6V Li-ion battery	
K	Convertor type and output								
	B、C、D				E type Convertor				
	B1/C1/D1	standard output			E1	button+3 line display+standard output			
	B1/C1/D2	standard output+RS485			E2	magnetic button+2 line display+standerd output			
	B1/C1/D3	standard output+HART			standard output:unidirectional current+double pulse+double alarm+RS232				

Model selection is important for instrument working. As it shown in relative data, improper model selection and incorrec installation result in two third of instrument trouble. Please pay attention to this chapter.

4.1 Required Data

- a. Medium name and chemical properties;
- b. Maximum, minimum and normal flow rate;
- c. Suggestion: Normal flow rate should be within the flowrange of velocity 1~3m/s. d. If there is inconsistent, user should change the nominal diameter.
- e. Maximum working pressure
- f. Maximum and minimum working temperature
 - The medium shall be conductive liquid and conductivity should be no less than 5μs/cm.
 - The max. Working pressure shall be no more than the rated working pressure of Flowmeter. (See nameplate on sensor)
 - The max. and min. working temperature shall meet the temperature requirements of Flowmeter. (See nameplate on sensor)
 - Check if there is negative pressure.
 - Materials of electrode and lining should be suitable for measuring medium

4.2 Nominal Diameter and Flow range:

Unit: m³/h

DN (mm)	Flow Velocity (m/s)							
	0.01	1	2	3	4	5	10	15
3	0.0003	0.0254	0.0509	0.0763	0.1018	0.1272	0.2545	0.3817
6	0.0010	0.1018	0.2036	0.3054	0.4071	0.5089	1.0178	1.5268
10	0.0028	0.2827	0.5655	0.8482	1.1310	1.4137	2.8274	4.2412
15	0.0064	0.6362	1.2723	1.9085	2.5447	3.1809	6.3617	9.5426
20	0.0113	1.131	2.2619	3.3929	4.5524	5.6549	11.3097	16.9646
25	0.0177	1.7671	3.5343	5.3014	7.0686	8.8357	17.6715	26.5072
40	0.0452	4.5239	9.0478	13.5717	18.0956	22.6195	45.2389	67.8584
50	0.0707	7.0686	14.1372	21.2058	28.2743	35.3429	70.6858	106.0290
65	0.1195	11.946	23.8918	35.8377	47.7836	59.7295	119.4590	179.1890
80	0.181	18.0956	36.1911	54.2867	72.3823	90.4779	180.9560	271.434
100	0.2827	28.274	56.5487	84.8230	113.0973	141.3720	282.7430	424.115
150	0.6362	63.617	127.2350	190.8520	254.4690	318.0860	636.173	954.259
200	1.131	113.097	226.1950	339.2920	452.3893	565.4870	1130.973	1696.46
250	1.7671	176.715	353.4290	530.1440	706.8583	883.5730	1767.146	2650.719
300	2.5447	254.469	508.9380	763.4070	1017.876	1272.3450	2544.690	3817.035
350	3.4636	346.361	692.7210	1039.0820	1385.442	1731.8030	3463.606	5195.409
400	4.5239	452.389	904.7790	1357.1680	1809.557	2261.9470	4523.893	6785.84
450	5.7256	572.555	1145.1110	1717.6660	2290.221	2862.7760	5725.553	8588.329
500	7.0686	706.858	1413.7170	2120.575	2827.433	3543.292	7068.584	10602.88
600	10.079	1017.876	2035.7520	3053.628	4071.504	5089.38	10178.76	15268.14
700	13.854	1385.442	2035.752	4156.327	5541.769	6927.212	13854.42	20781.64
800	18.096	189.557	2770.885	5428.672	7238.23	9047.787	18095.57	27143.36
900	22.902	2290.221	3619.115	6870.663	9160.884	11451.11	22902.21	34353.32
1000	28.274	2827.433	4580.442	8482.30	11309.73	17137.17	28274.33	42411.5
1200	40.715	4071.504	5654.867	12214.51	16286.02	20357.52	40715.04	61072.56
1400	55.418	5541.769	8143.008	16625.30	22167.08	27708.85	55417.69	83126.54
1600	72.382	7238.23	11083.54	21714.69	28952.92	36191.15	72382.3	108573.4
1800	91.609	9160.884	14476.46	27482.65	36643.54	45804.42	91608.84	137413.3
2000	113.1	11309.73	18321.77	33929.20	45238.93	56548.67	113097.3	169646.0

4.3 Electrode Material Selection

Electrode Material Selection

Electrode	Corrosion Resisting Property
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Material	
Stainless Steel	Used for measuring water, waste water, inorganic acid, organic acid or other corrosive medium.
Hastelloy B	Good corrosion resistance of different concentration of hydrochloric acid under boiling point, resist the corrosion of non-oxidizing acid, alkali, non-oxidizing salt solution, such as sulfuric acid, phosphoric acid, organic acid, etc..
Hastelloy C	Resist the corrosion of oxidizing acid, such as nitric acid, mixed acid, the mixture of chromic acid and sulfuric acid, oxidizing salt like Fe ⁺⁺⁺ , Cu ⁺⁺ or other oxidants such as hypochlorite solution above ordinary temperature and seawater.
Tungsten Carbide	Used for measuring non-corrosiveness or strong abrasive liquid.
Titanium	Used for measuring seawater, kinds of chloride, pyochloride, oxidizing acid (including nitrosonitric acid) and organic acid-base. Not suitable for measuring pure reducibility acid (e.g. vitriol, hydrochloric acid). Note: if there is oxidizing agent in acid, corrosion resistance will be greatly decreased.
Tantalum	Have excellent corrosion resistance, as much as glass. can be used for measuring every chemical medium including boiling hydrochloric acid and vitriol below 175 °C , but there is exception of hydrofluoric acid, fuming acid and alkali.
Platinum	For measuring kinds of acid, alkali and salt, except aqua regia.
Monel	A kind of Nickel-copper alloy, suitable for every alkaline liquid.

4.4 Lining Material Selection

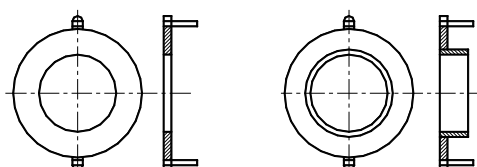
Liner material	Main performances	Applicability
Polytetrafluoroethylene (PTFE)	1.It is a plastic material with the stablest Chemical properties, resist the corrosion of Boiling Hydrochloric acid, sulfuric acid, nitric acid, aqua regia, Concentrated alkali and many kinds of organic solvent, unable to resist the corrosion of chlorine trifluoride, high Temperature vanadyltrifluoride, high flow-rate Liquid fluorine, liquid oxygen and ozon;	1.100°C, 150°C (special order required); 2.Strong corrosive medium like concentrated acid, alkali, etc.; 3.Sanitary medium.

	2.Poor abrasion resistance; 3.Poor ability of anti-negative pressure.	
polychloropree rubber (Neoprene)	1.Excellent elasticity, high degree of tensile strength,good wear resistance; 2.Able to resist the corrosion of generally low concentration acid, alkali and salt, unable to resist that of the oxidative medium.	1.80°C,120°C (special order required); 2.General water, polluted water, weak wear ability mud and ore pulp.
Polyurethane rubber (PU)	1.Excellent wear resistance (ten times of the natural rubber's); 2.Poor abrasion resistance of acid and alkali; 3.Not able to work with water mixed with organic solvent.	1.<80°C; 2.Middle and strong wear ability ore pulp, coal pulp, mud, etc..
PFA	Having the same abrasion resistance with PTFE.Having strong ability of load pressure resistance.	1.Below 220 deg C 2.Applicable in state of load pressure.
F46	1.Have the same abrasion resistance with PTFE. 2.Resistable for low abrasion. 3.Having strong resistance to load pressure.	1.Below 220 deg C 2.The same as PTFE. 3.Applicable in mediums of low abrasion.

4.5 Grounding Ring (Protecting Ring) Selection

If the pipe which connect with Flowmeter sensor is insulativity, grounding ring will be need; if medium is abrasive, grounding ring with neck should be chosen for protecting lining.

All of Flowmeter sensor with PTFE lining has grounding ring before leaving factory, one function is protecting lining surface, and another is for well grounding.



Grounding Ring with Neck

5. Instrument Installation

5.1 Installation Notice

There is safety requirement for Flowmeter design, test and power supply. User shall strictly comply with this manual to make sure the safe operation and run of Flowmeter.

Requirements for ensuring Flowmeter accuracy:

- Medium shall be conductive;
- Medium shall be full of pipe;
- Medium conductivity shall be homogeneous to avoid severe disruption. If chemical substances need be injected on pipe, the injection should be operated at down upstream of Flowmeter.
- Magnetic Flowmeter system shall connect ground well.
- There shall be straight pipe no less than five times DN at Flowmeter upstream and two times DN at Flowmeter downstream. (DN is internal diameter of the pipeline)
- Nearby Flowmeter, shall avoid strong electromagnetic interference, please do not install Flowmeter near large electrical machine or transformer.

5.2 Safety Precautions

For person and equipment safety, please observe below provision:

- Before installation, please read this manual seriously, think about the safety requirements for Flowmeter, relevant equipment and environment.
- Install and maintain Flowmeter by person who has the knowledge of Flowmeter.
- Install Flowmeter sensor and its pipe correctly, make sure the seal and safety, liquid pressure shall be no more than the max. working pressure on nameplate.
- Prevent electric shock accident.
- Lifting equipment for Flowmeter should conform to safety provision.

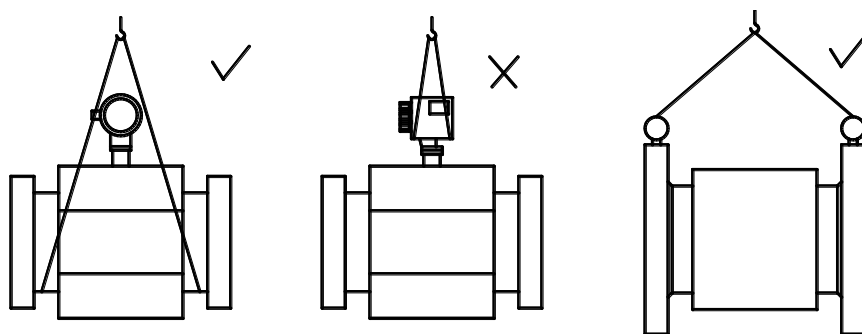
5.3 Inspection before installation

- Inspect if there is damage for flange, lining, body and lead collar;
- Open box cover, inspect if there is loose or damage for wiring and printed circuit board.
- Inspect if model coding on nameplate is the same with that in order.

5.4 Lifting

Lifting Flowmeter in right way, the safe load and safeguard procedures of lifting equipment should conform to relevant provision. Forbid craning Flowmeter on converter box (integrated type) or

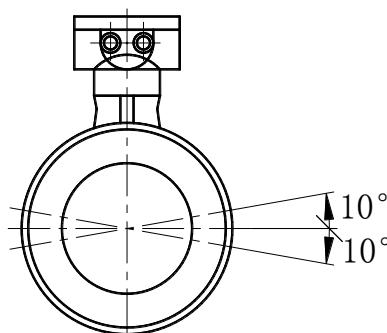
junction box (remote type).



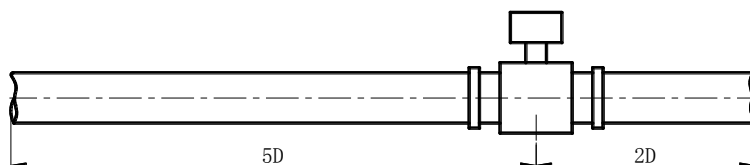
5.5 Correct Mounting Point

Correct mounting point is important to Flowmeter use. Wrong point may influence on measuring accuracy or Flowmeter service life, even damage Flowmeter.

- The axis for measuring electrode shall be approximate to horizontal direction.(included angle with horizontal line shall be no more than 10°)



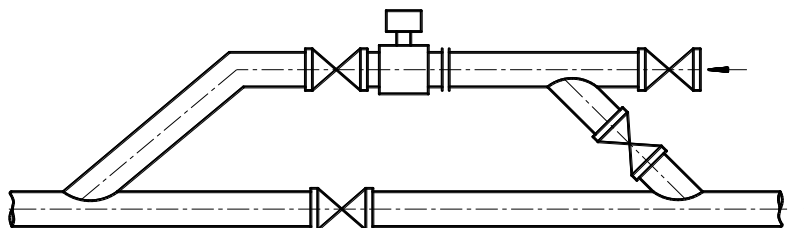
- Fluid shall be full of measuring pipeline;
- At Flowmeter upstream, there should be straight pipe no less than $5D$ and no less than $2D$ at Flowmeter downstream. (D is Flowmeter inner diameter);



- Flow direction of fluid shall be accordant with arrow direction of Flowmeter;
- Note: the vacuum in pipeline will damage Flowmeter lining.
- No strong electromagnetic field should be exist around the Flowmeter, the magnetic field intensity of installation place should be less than $400A/m$. Avoid installing Flowmeter near to large electrical machine or transformer.
- Enough space should be reserved for Flowmeter installation and maintenance
- If there is vibration on measuring pipe, the fixed support should be provided on Flowmeter two sides.
- For measuring mixed liquid, the distance between mixed point and Flowmeter should be no

less than 30D.(D is Flowmeter inner diameter)

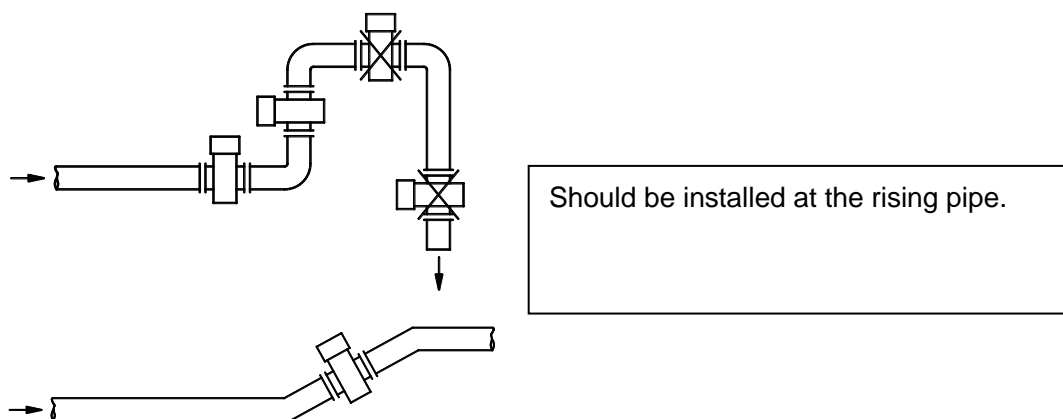
- For Flowmeter clean and maintain, the by-pass line should be installed.

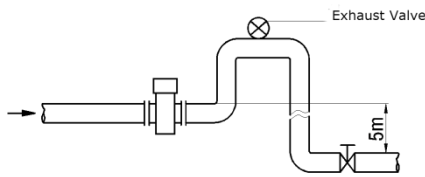


- Install the Flowmeter which has PTFE lining, connecting bolt should be screw down by torque spanner, or else it may damage PTFE lining.
- Avoid strong vibration and exaggerated change of temperature; prevent the damage to instrument from corrosive liquid leaking through.
- Do not expose to sun, please install shield to avoid.
- Make sure the coaxial of measuring tube and process pipeline. For sensor DN50mm and under DN50mm, axis deviation should be no more than 2mm; for sensor DN65mm to DN150mm, axis deviation should be no more than 3mm, for sensor above DN200mm, axis deviation should be no more than 4mm.
- Flange gasket between flanges should have well corrosion resistance and should not stretch into pipeline.
- Fasten instrument bolt and nut. The thread should be in good shape and lubricated. Please refer to flange dimension and moment to fasten bolt by torque spanner.
- When welding or flame cutting pipeline which is near to sensor, please adopt quarantine measures to avoid lining heated, meanwhile, make sure the Flowmeter is not power on to prevent the damage to instrument.

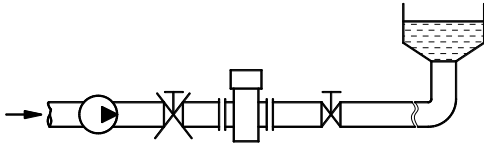
5.6 Installation

Flowmeter shall be installed at relative low of horizontal pipe or upward vertical, not highest point of pipe and downward vertical.

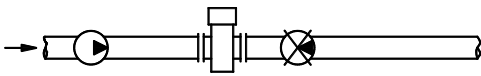




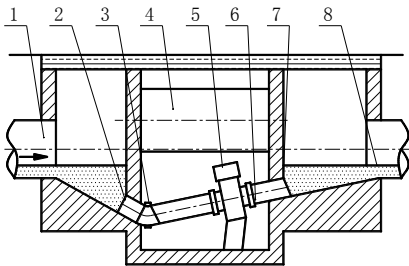
For installing at open pipe, Flowmeter should be installed at relative low. If pipe fall is more than 5m, vent valve should be installed at sensor downstream where should have backpressure.



Control valve and stop valve shall be installed at downstream of sensor not upstream.



Sensor shall be installed at outlet of pump not inlet.



Installation way in measure well:
 1. Inlet; 2. Entrance gate; 3. Cleaning hole;
 4. Overflow pipe; 5. Flow Meter; 6. Nozzle stub;
 7. Outlet; 8. Drain valve.

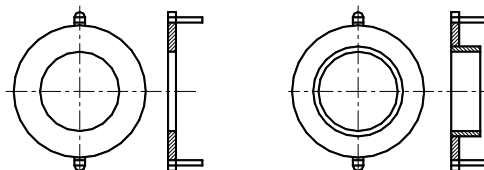
5.7 Grounding requirement

Magnetic Flowmeter grounding is very important, bad grounding will result in disorder operation. Flowmeter sensor part should have well and separate grounding cable (whose sectional area of copper core should be 1.6mm^2), ground resistance should be $<10\Omega$.

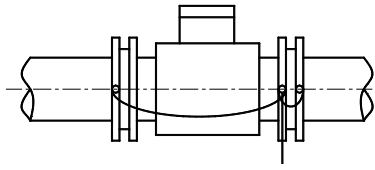
5.7.1 Grounding ring

If the pipeline connected with sensor is insulation, grounding ring will be needed, the material should be same as electrode material; if the medium is abrasive, and grounding ring with neck should be selected.

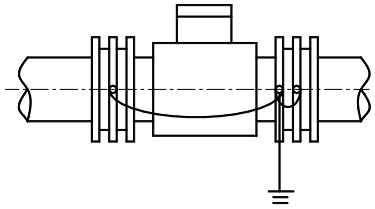
General grounding ring



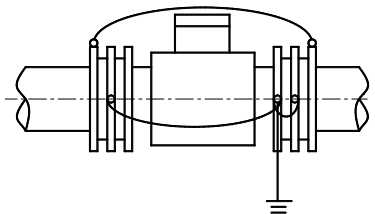
5.7.2 Grounding mode



If Flow Meter is installed in metal pipeline, there should be no insulating coating on pipeline inwall.



If Flow Meter is installed in the pipeline with insulating paint, paint, repaired inner, grounding ring should be need on sensor both sides.



If Flow Meter is installed in the pipeline with cathodic protection, which inner and outer is insulative, the grounding ring and flange should be insulative too.

5.8 Direction Change of Converter

Converter direction has four selections as required.

1. Direction change for converter of integrated type Flowmeter

- Take down four hexagonal screws which fix the converter.
- Turn converter to the required direction; please pay attention to the connecting wire.
- Retighten converter

2. Direction change for junction box of remote type Flowmeter

- Take down four hexagonal screws which fix the junction box.
- Turn junction box to the required direction; please pay attention to the connecting wire.
- Retighten junction box

6. Electric Connection

For reliable seal of lead collar, circular section cable should be used.

6.1 Connection requirement

Please cut off power supply before connecting.

- Check cable model, then connect cable in correct and reliable way.
- Follow procedure for cable into lead collar: at first, loose gland nut on lead collar and take off blind; secondly, put gland nut and rubber ring on cable, make the cable through lead collar; finally, straighten out cable, screw gland nut tight to make rubber ring press cable.
- When wire stripping, do not damage insulating layer which should be reserved. For signal core wire, do not strip shielding layer as much as possible.
- For STT3200 cable, after twist the inner shield line of two coaxial-cables, insulating bush should be use, then connect with SGND port. The black semiconductor layer should be removal from root to avoid influence other wire connecting.

6.2 Cable

Cable length between sensor and convertor is related with flow conductivity and electrical disturbance. The formula for required cable length is as below:

$$L \leq \sigma \times 4$$

L—Cable length (m)

σ - flow conductivity ($\mu\text{S}/\text{cm}$)

Cable should be no more than 100m to prevent accuracy and interference. Convertor should be installed closely to sensor as much as possible.

- Exciting current wire.
Exciting current wire could adopt soft insulation rubber cable with two cores, the model could be YHZ-2 \times 1 mm² or RVVP2 \times 32/0.2;
The length of Exciting current wire should be same as the length of signal cable. When use special cable STT3200, exciting wire and signal cable should be combined into one.
- Flow signal cable
For remote type Flowmeter, when flow conductivity is more than 50 $\mu\text{S}/\text{cm}$, flow signal cable could be shield signal cable with polyvinyl chloride jacket and metal net whose model is RVVP2 \times 32/0.2. The length should be no more than 100m. The signal cable will be provided with the sensor.
This convertor provides output voltage stimulated by equipotential shield signal to decrease distributed capacitance influence to flow signal measurement.
when flow conductivity is less than 50 $\mu\text{S}/\text{cm}$ or transmit for long distance, double shield signal cable with equipotential double cores will be needed, e.g. STT3200 special cable or BTS type trebling shield signal cable.

6.3 Grounding

The amphenol connector PE of Convertor shell should connect with ground by grounding copper

wire which no less than 1.6 mm² and ground resistance is no more than 10Ω.

7. Operation

7.1 Inspection

Inspection as below before Flowmeter put into operation:

- No damage for Flowmeter on transport way and installation.
- The supply voltage on site is same as the voltage on nameplate
- Use right fuse corresponding to flow rate
- Correct grounding
- Correct range setting (see Convertor part)

After inspect, open valve and make fluid full in pipeline system (note: eliminate leaked gas or residual gas in system); turn on power supply, in general, preheat ten minutes is OK for Flowmeter normal working.

7.2 flow direction adjustment

Flowmeter and flow direction regulation see 5.5.

For remote Flowmeter, although flow direction can be consistent between Flowmeter sensor and practical field flow direction, below problem may occur due to user wrong wiring:

- If convertor only has unidirectional output, when there is forward flow, the output display may be zero or negative value; (e.g. 0mA in 0~10mA or 4mA in 4~20mA.);
- If convertor has bi-directional display, when there is forward flow, the output display is negative value. The solution is : cut off power supply, replace two excitation line of any side, output direction, practical forward flow and sensor flow direction (arrow direction) will be same.

8. Maintenance

Before maintaining, safety provision Chapter 5.1& 5.2 chapter shall be read.

If trouble is confirmed, please contact with manufacturer.

8.1 Routine maintenance

Visually inspect if electrical connection is damage or instrument is working.

8.2 Failure checking

If the Flowmeter is not working as required, please inspect as below procedure:

- Inspect if all valves of Flowmeter pipeline are open; if pipeline is full with fluid; If flow rate is near to upper limit flow rate of Flowmeter;
- Inspect if instrument power supply facility such as power, switch, fuse is normal;
- Inspect if the trouble is in cable or received instrument.
- Inspect if the convertor factory No. and instrument coefficient is accordance with sensor.
- Inspect if range setting is correct;
- Inspect if Flowmeter output connection is correct and grounding is well;
- Inspect convertor follows converter manual.

9. Transport and storage

Please keep the packaging form of leaving-factory to avoid damage from transshipment. Storage requirement:

- Rain-proof and damp-proof;
- Low mechanical vibration and avoid shock;
- Temperature range: -20~60°C;
- Humidity ≤80%, 50% is better;
- Storage the used sensor should clean medium which attach to lining and electrode.
- Instrument performance may be influenced by storage in open system.

