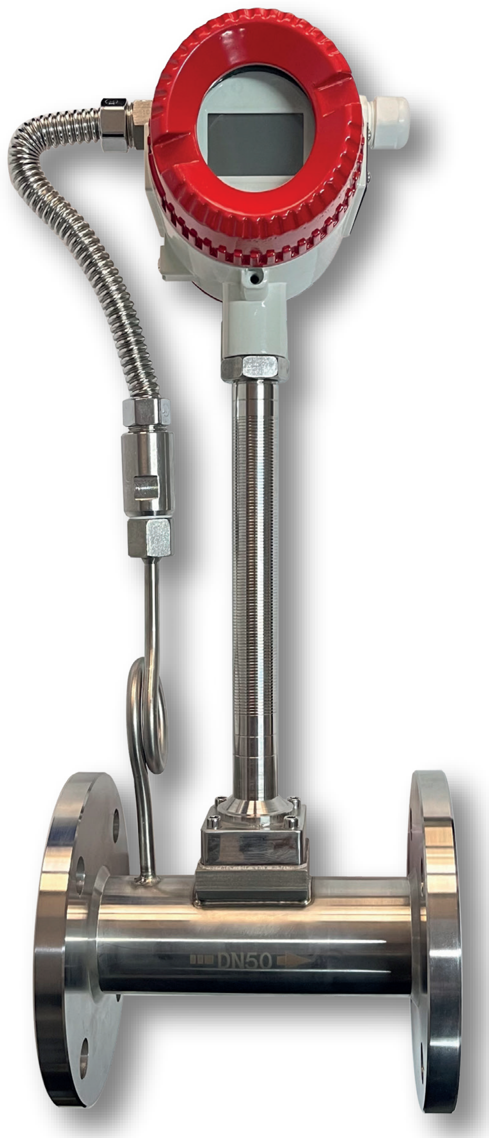
VORTEX FLOWMETER

PKS-VOR

User's Manual



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1. The Product Introduction

1.1 Types Of Products And Scope Of Application

(1) PKS-VOR series full-tube vortex flowmeter

(2) PKS-VOR series plug-in vortex flowmeter

PKS-VOR vortex flow meters are widely used in the measurement and control of superheated steam, saturated steam, compressed air and general gases (oxygen, nitrogen, hydrogen, natural gas, gas, etc.), water and liquids (such as water, gasoline, alcohol, benzene, etc.) in petroleum, chemical, metallurgy, heat, textile, paper and other industries.

1.2 Working Principle

If a non-streamline vortex generator (blocking fluid) is set in the fluid, then two regular vortexes will be generated alternately from both sides of the vortex generator. Such vortexes are called karman vortexes, as shown in FIG. (1).

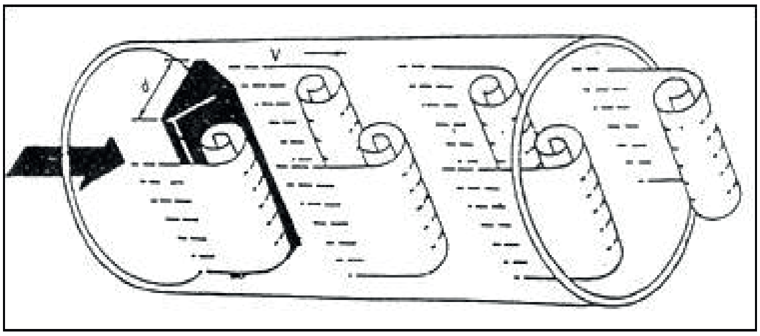


FIG. (1)

An alternate and regular vortex row is formed at the downstream of the vortex body.Let the occurrence frequency of the vortex be f, the average velocity of the incoming flow of the measured medium be V, and the width of the flow surface of the vortex generating body be d. According to the karman vortex street principle, the following equation can be obtained:

$$F = StV/d \qquad \text{Formula (1)}$$

Type:

F—Karman Vortex Frequency Generated On One Side of Sounding Body HZ

St—Strouhal Number (Dimensionless Number)

V- Average Velocity Of Fluid (m/s)

D - Width Of Vortex Generator (m)

Thus, the instantaneous flow rate can be calculated by measuring the karman vortex street separation frequency.Among them, strouhal number (St) is a dimensionless unknown,

FIG.（2）shows the relationship between strouhal number (St) and reynolds number (Re).

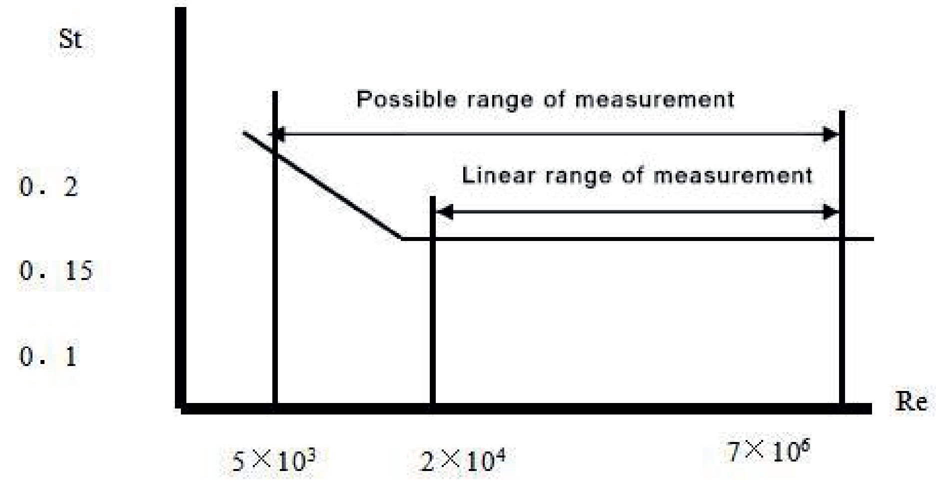


FIG.（2）

In the flat part of St = 0.17 in the curve table, the release frequency of the vortex is proportional to the flow rate, that is, the range of the vortex street flow sensor.As long as the frequency f is detected, the velocity of the fluid in the pipe can be obtained, and the volume flow rate can be calculated from the velocity V.The ratio of the number of measured pulses to volume is called the instrument constant (K), as shown in formula (2).

K = 3600 f/Q (1 / m3)　　Formula (2)

Type:
K = Instrument Constant (m-3).
F =The Number Of Pulses
Q = Volume Flow Rate (m3)

1.3 Main Technical Indicators

Nominal diameter(mm)	15、20、25，40，50，65，80，100，125，150，200，250，300，(150～1000 plug-in)
Nominal press (MPa)	DN15-DN200 4.0(>4.0 supply agreement)， DN250-DN300 1.6(>1.6 supply agreement)
Medium temperature (℃)	Piezoelectric type：-40～150，-40～250，-40～350； Capacitive type： -40～400（supply agreement）
Body material	1Cr18Ni9Ti，(Other materials supply agreement)
Allowable vibration acceleration	Piezoelectric type:0.2g　　Capacitive type:1.0～2.0g

Accuracy	±1%R，±1.5%R；plug-in：±2.5%R，
Range	1：8～1：30
Power	Sensor：DC +12V~DC +24V；transmitter：DC +12V~ DC +24V； Battery-powered：3.6V battery
Output single	Square wave pulse (excluding battery powered) : high level≥5V，low level≤1V； Current: 4 ~ 20mA
Pressure loss coefficient	Comply with JB/T9249 standard　Cd≤2.4
Explosion-proof marks	Intrinsic safety type：ExdⅡia CT2-T6 , Flameproof type：ExdⅡCT2-T6
Protection grade	Standard type: IP65　　Diving type: IP68
Environmental conditions	Temperature: -20℃～55℃，Relative humidity: 5%～90%，Atmospheric pressure: 86～106kPa
Medium	Gas, liquid, steam
Transmission distance	Three-wire system pulse output type：≤300m， Two-wire system standard current output type (4～20mA) ≤1500m； Load resistance ≤750Ω；　RS485/HART≤1200m.

2. Diameter Determination And Installation Design

Instrument selection is very important work in instrumentation, instrument selection, whether correctly or not will directly affect the instrument can normal operation. So the user when choosing the company's products and design unit, please read this section data, the process parameters of fluid should be carefully checked and can at any time to contact my company's sales or technical support department, to ensure that the correct selection.

2.1 Determination Of Flow Range And Diameter

The choice of instrument diameter is determined according to the flow range.The measuring range of vortex flowmeter with different caliber is different.Even if the same calibre flowmeter is used for different media, its measuring range is not the same.The actual measurable flow range needs to be determined by calculation.

2.1.1 The range of air and water flow under reference conditions is as follows

Gas: atmospheric pressure air, t=20℃，P=0.1MPa（Absolute pressure），ρ=1.205 kg/m3，υ=15×10-6 m2/s。

Liquid: under normal temperature water, t=20℃，ρ=998.2kg/m3，υ=1.006×10-6m2/s。

2.1.2 Basic steps for determining flow range and instrument diameter:

1.Define the following working parameters.

(1) The name and component of the test medium

(2) The minimum, common and maximum flow of medium in working state

(3)The minimum, common and maximum pressure and temperature of the medium

(4) The viscosity of medium under working condition

2.Vortex flow meter measures the volume flow of the medium in its working state, so the volume flow of the medium in its working state should be calculated first according to the process parameters. The relevant formula is as follows:

(1) Known the standard state volumetric flow rate of gas, the working condition volumetric flow rate can be obtained by the following formula

$$Q_O \quad \frac{0.131025 \quad Q}{0.101325 \quad P} \quad \frac{273.15 \quad t}{293.15}$$ Formula (3)

(2) Known gas standard state density ρ, the working condition density can be obtained by the following formula

$$_o \quad \frac{0.1`01325 \quad P}{0.101325} \quad \frac{293.15}{273.15 \quad t}$$ Formula (4)

(3) Known mass flow Qm is converted into volume flow Qv

$$Q_m \quad 10^3 /Q$$ Formula (5)

Type:

Qv: volume flow rate of medium under working conditions (m3/h)

(Qv=3600f/K: instrument coefficient)

Qo: volume flow rate of medium in standard state (Nm3/h)

Qm: mass flow rate (t/h)

ρ : the density of the medium under the working condition (kg/m3)

ρo: medium in the standard state of the density (kg/m3), the standard state density of gas medium commonly used, see table (3)

P: working condition gauge pressure (MPa)

T: working state temperature (℃)

3.Determination of instrument lower limit flow. The upper limit of vortex street flow meter can not be calculated generally. The diameter of vortex street flow meter is mainly calculated for the lower limit of flow. The calculation of the lower limit flow should meet two conditions: the minimum Reynolds number should not be lower than the limit Reynolds number (Re = 2× 104); For the stress vortex flowmeter, the vortex intensity generated at the lower limit flow rate should be greater than the allowable value of the vortex intensity of the sensor (the vortex intensity is

proportional to the lift ρv2). These conditions can be expressed as follows:

The measurable lower limit flow rate under working conditions determined by density:

$$Q_O \quad \sqrt{\quad Q} \qquad \text{Formula (6)}$$

Linear lower limit flow determined by kinematic viscosity:

$$Q_O \quad / \ Q \qquad \text{Formula (7)}$$

Type:

Qρ: the minimum volume flow rate (m3/h) meeting the vortex strength requirements.

ρ0: Density of Medium under Reference Condition

Q φ: Minimum linear volumetric flow rate (m3/h) meeting the minimum Reynolds number requirement

ρ: working condition density of measured medium (kg/m3)

Q0: Minimum Volume Flow Rate of Instrument under Reference Condition (m3/h)

υ: Kinematic viscosity of medium under working condition (m2/s)

υo: kinematic viscosity of the medium under the reference condition (m2/s)

Qρ and Qv are calculated by formulas (6) and (7). Compare Qρ and Qv to determine the measurable lower limit flow and linear lower limit flow of the flow meter:

Qυ≥Qρ：the measurable flow range is Qρ～Qmax , and the linear flow range is Qυ～Qmax

Qυ<Qρ：the measurable flow range and linear flow range are Qρ～Qmax

Qmax：The upper limit volume vlow of vortex flowmeter (m3/h)

4. The upper limit flow rate of the instrument shall be subject to the upper limit flow rate in Table (2). The upper limit flow rate of gas shall be less than 70m/s, and the upper limit flow rate of liquid shall be less than 7m/s.

5.When the medium measured by the user is steam, the unit of measurement usually used is mass flow, i.e. t/h or kg/h. Since the density of steam (superheated steam and saturated steam) is different at different temperatures and pressures, the determination of the steam flow range can be calculated from Formula (8)

$$Q\text{steam} \quad 1.5Q\text{gas} \quad 10^3 \quad \sqrt{\ _o /\ } \qquad \text{Formula (8)}$$

Type:

ρ: density of steam (kg/m3)

ρ0：1.205kg/m3

Q steam: steam mass flow rate (t/h)

6. Calculate the pressure loss and check whether the pressure loss has influence on the process pipeline. Formula (unit: Pa)

Δp= CdρV2/2 Formula (9)

Type

ρ: working condition medium density (kg/m3)
V: average flow rate (m/s)
Δp: pressure loss（Pa）
Cd: pressure loss coefficient（m/s）

7. When the measured medium is liquid, in order to prevent gasification and cavitation, the pipeline pressure shall meet the following requirements:

$$p \geq 2.7\Delta p + 1.3p_0 \qquad \text{Formula (10)}$$

Type:
Δp: pressure loss (Pa)
P0: saturated vapor pressure of liquid at working temperature (Pa absolute pressure)
Po: vapor pressure of fluid (Pa absolute pressure)

8.Vortex flowmeter is not suitable for measuring high viscosity liquid. When the calculated lower limit of measurable flow does not meet the design process requirements, other types of flow meters should be considered.

9. Through calculation, if there are two calibers that can meet the requirements, in order to improve the measurement effect and reduce the cost, the smaller calibers should be selected. It should be noted that, as far as possible, the common amount is 1/2 ~ 2/3 of the upper limit of the flow range.

Table (2) Working Flow Range of Vortex Flow Sensor under Reference Conditions

Type	Diameter (mm)	Liquid	Gas
		Measuring range (m3/h)	Measuring range (m3/h)
Pipeline type	15	0.5～5	3～20
	20	0.6～8	5～40
	25	1～10	8～60
	32	1.8～18	20～120
	40	5～30	25～180
	50	6～50	35～350
	65	7～70	65～650
	80	10～100	90～900
	100	18～180	150～1500
	125	20～200	220～2200
	150	35～350	350～3500
	200	60～600	600～6000
	250	10～1000	800～8000
	300	110～1500	1200～12000

Insertion type	150	35～350	350～3500
	200	60～600	600～6000
	250	10～1000	800～8000
	300	100～1800	1200～12000
	400	200～2500	2000～20000
	500	300～4000	3500～40000
	600	500～5000	4500～55000
	800	750～9000	9000～100000
	1000	1200～17000	12000～150000
	>(1000)	negotiation	negotiation

Table (3) Standard State Density of Commonly Used Gas Media (0 ℃, Absolute Pressure P=0.1MPa)

Gas name	Density （kg/m3）	Gas name	Density （kg/m3）
Air (dry)	1.2928	Acetylene	1.1717
Nitrogen	1.2506	Ethylene	1.2604
Oxygen	1.4289	Propylene	1.9140
Argon	1.7840	Methane	0.7167
Neon	0.9000	Ethane	1.3567
Ammonia	0.7710	Propane	2.0050
Hydrogen	0.08988	Butane	2.7030
Carbon monoxide	1.97704	Natrual gas	0.8280
Carbon dioxide	1.3401	Coal to gas	0.8020

2.2 Installation Design Of Flowmeter

The correct installation of the instrument is an important link to ensure the normal operation of the instrument. If it is not properly installed, it will affect the use accuracy of the instrument, and if it is not, it will affect the service life of the instrument and even damage the instrument.

2.2.1 Installation environment requirements:

.● Avoid strong electrical equipment, high frequency equipment and strong switching power supply equipment as much as possible. The power supply of the instrument shall be separated from these devices as far as possible.

● Avoid the direct influence of high temperature heat source and radiation source. If installation is necessary, there must be heat insulation and ventilation measures.

● Avoid high humidity environment and strong corrosive gas environment. If installation is necessary, ventilation measures must be taken.

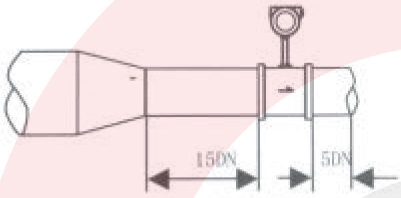
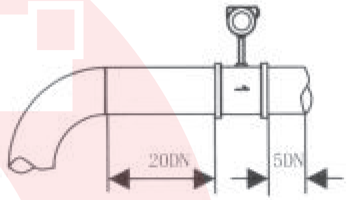
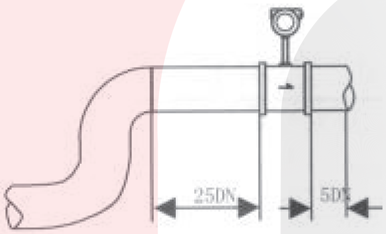
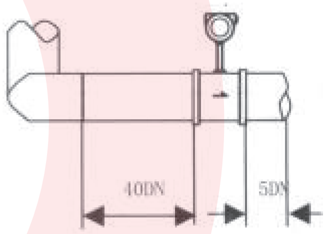
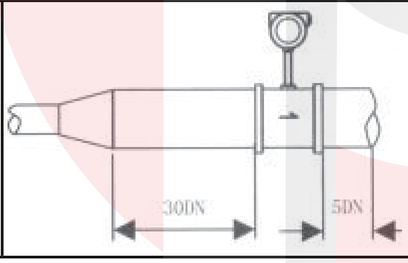
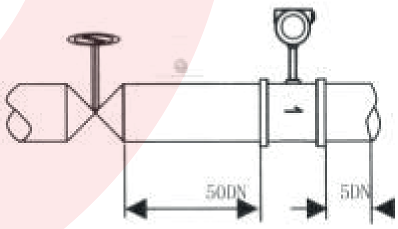
● Vortex street flow meters should be installed on pipes with strong vibration as far as possible. If installation is necessary, pipe fastening devices and anti-vibration pads shall be installed on the upstream and downstream 2D to enhance the anti-vibration effect.

● It is better to install the instrument indoors, and waterproof should be paid attention to when installing outdoors. Special attention should be paid to bending the cable into U-shape at the electrical interface to prevent water from entering the amplifier housing along the cable.

- Sufficient space should be left around the instrument installation point for installation and regular maintenance.

2.2.2 Installation requirements for instrument pipelines:

Vortex street flow meter has certain requirements for the straight pipe section upstream and downstream of the installation point, otherwise it will affect the flow field of medium in the pipe and affect the measuring accuracy of the meter. See Figure (3) for the length requirements of the upstream and downstream straight pipe sections of the instrument. DN is the nominal caliber unit of the instrument: mm.

Pipeline type upstream of sensor	Length of front and rear straight pipe sections	Pipeline type upstream of sensor	Length of front and rear straight pipe sections
Concentric contraction full open valve		A 90 degree bend	
Two 90-degree bends on the same plane		Two 90-degree bends in different planes	
Concentric expanding pipe		Regulating valve half open Valves (not recommended)	

Note:

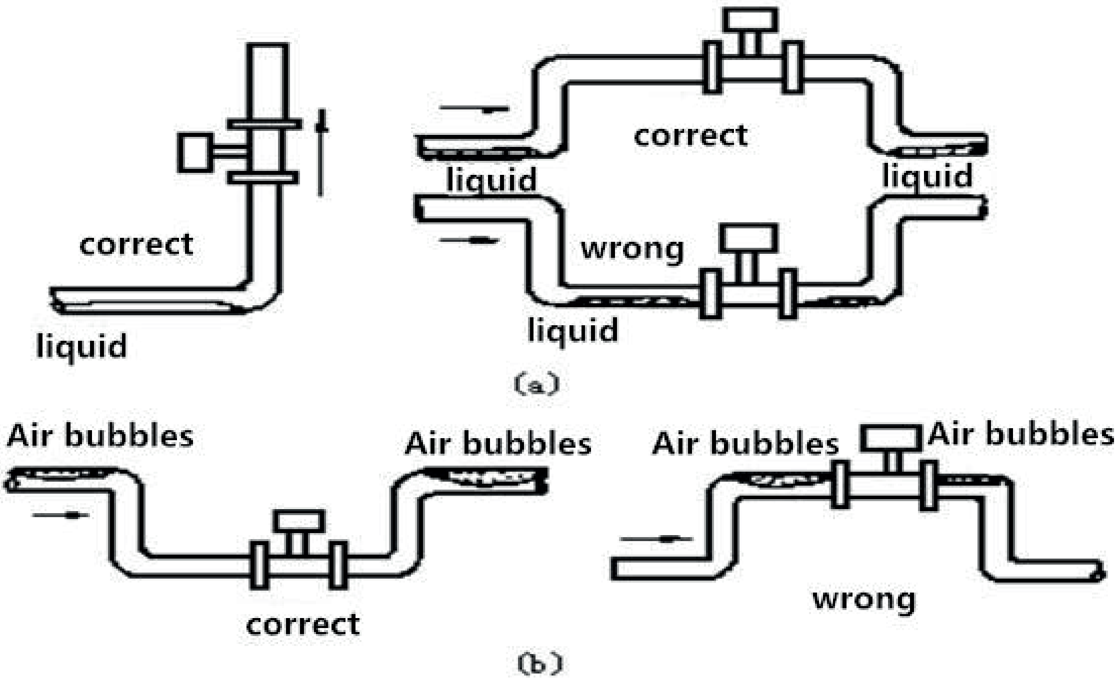
- The regulating valve shall be installed 10D downstream of the vortex flow meter instead of upstream of the vortex flow meter.
- The inner diameter of upstream and downstream piping shall be the same. If there is any difference, the inner diameter Dp of the pipe and the inner diameter Db of the vortex street meter shall meet the following relationship

$$0.98Db \leq Dp \leq 1.05Db$$

The upstream and downstream piping shall be concentric with the inner diameter of the meter body of the flow meter, and the misalignment between them shall be less than 0.05Db

- The sealing gasket between the instrument and the flange shall not protrude into the pipe during installation, and its inner diameter shall be 1-2mm larger than the inner diameter of the meter body.
- Installation design of pressure measuring holes and temperature measuring holes. When temperature and pressure transmitters need to be installed in the pipeline to be tested, the pressure measuring holes should be set at 3-5D downstream and the temperature measuring holes should be set at 6-8D downstream, as shown in Figure (7). D is nominal diameter of instrument, unit: mm
- The instrument can be installed horizontally, vertically or obliquely on the pipeline.
- When measuring gas, install instruments in vertical pipes, and the gas flow direction is not limited. However, if the pipeline contains a small amount of liquid, in order to prevent the liquid from entering the instrument measuring tube, the airflow should flow from bottom to top, as shown in figure (4) a.
- When measuring liquid, in order to ensure that the pipe is filled with liquid, so when installing instruments in vertical or inclined pipes, the direction of liquid flow should be ensured from bottom to top. If the pipeline contains a small amount of gas, in order to prevent gas from entering the instrument measuring tube, the instrument should be installed at the lower part of the pipeline.

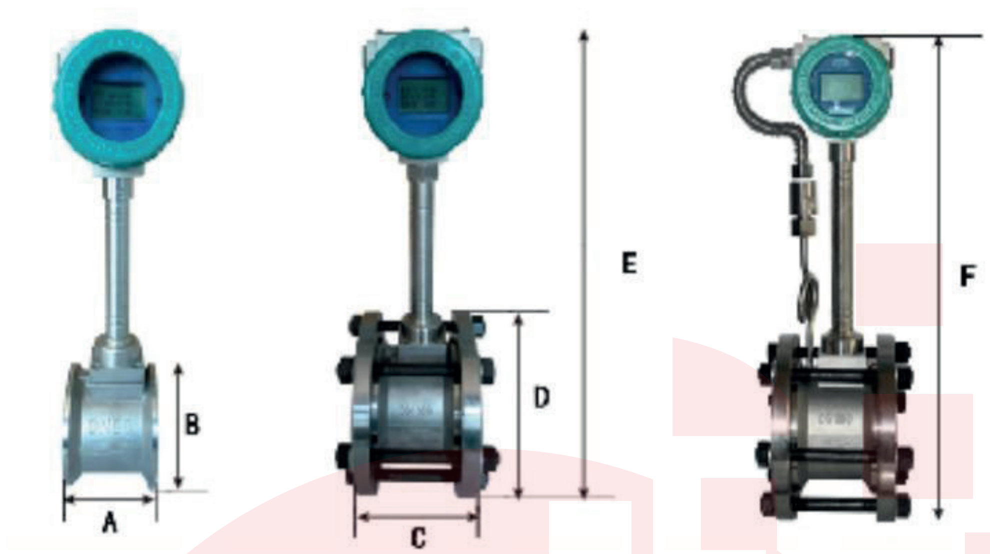
As shown in figure (4) b



Figure(4)

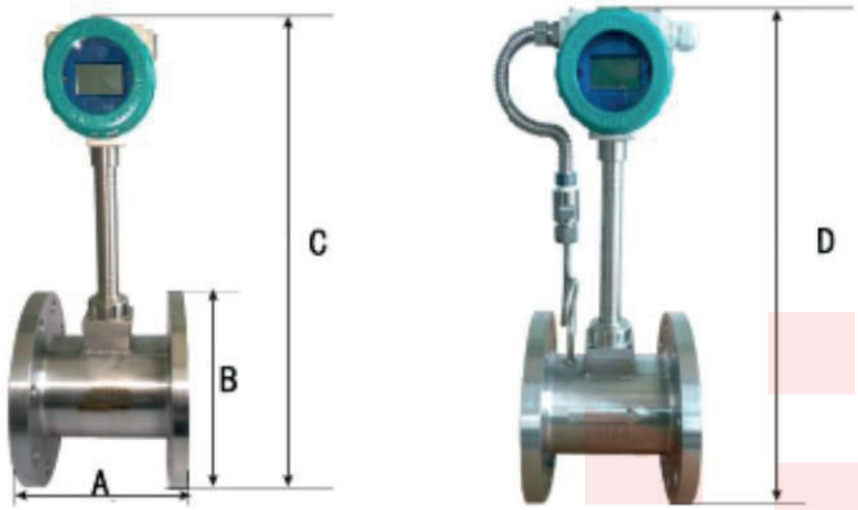
- When measuring high-temperature and low-temperature media, attention should be paid to heat preservation measures. The high temperature inside the converter (inside the meter housing) shall not exceed 70 ℃; Low temperature easily causes condensation inside the converter, reduces the insulation impedance of the printed circuit board, and affects the normal operation of the instrument.

2.2.3 Overall dimensions of instrument installation:



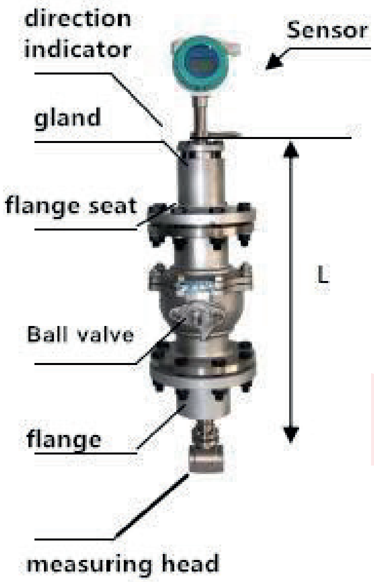
Wafer type flow meter

diameter（mm）	A	B	C	D	E	F
15、20、25、32	68	54	96	100	440	470
40	82	78	110	140	460	490
50	85	87	110	145	490	520
65	84	105	112	165	510	540
80	88	120	116	176	540	570
100	91	140	120	200	560	590
125	92	168	126	230	580	610
150	96	194	130	265	600	630
200	101	248	140	320	630	660
250	114	300	160	370	660	690
300	128	350	170	445	690	720



Flange type flow meter

diameter（mm）	A	B	C	D
15	170	95	430	460
20	170	105	430	460
25	170	115	440	470
32	170	132	450	480
40	160	150	480	510
50	160	160	480	510
65	160	180	530	560
80	180	195	530	560
100	180	215	550	580
125	180	245	560	590
150	180	280	590	620
200	200	340	620	680
250	200	405	710	740
300	350	400	750	780



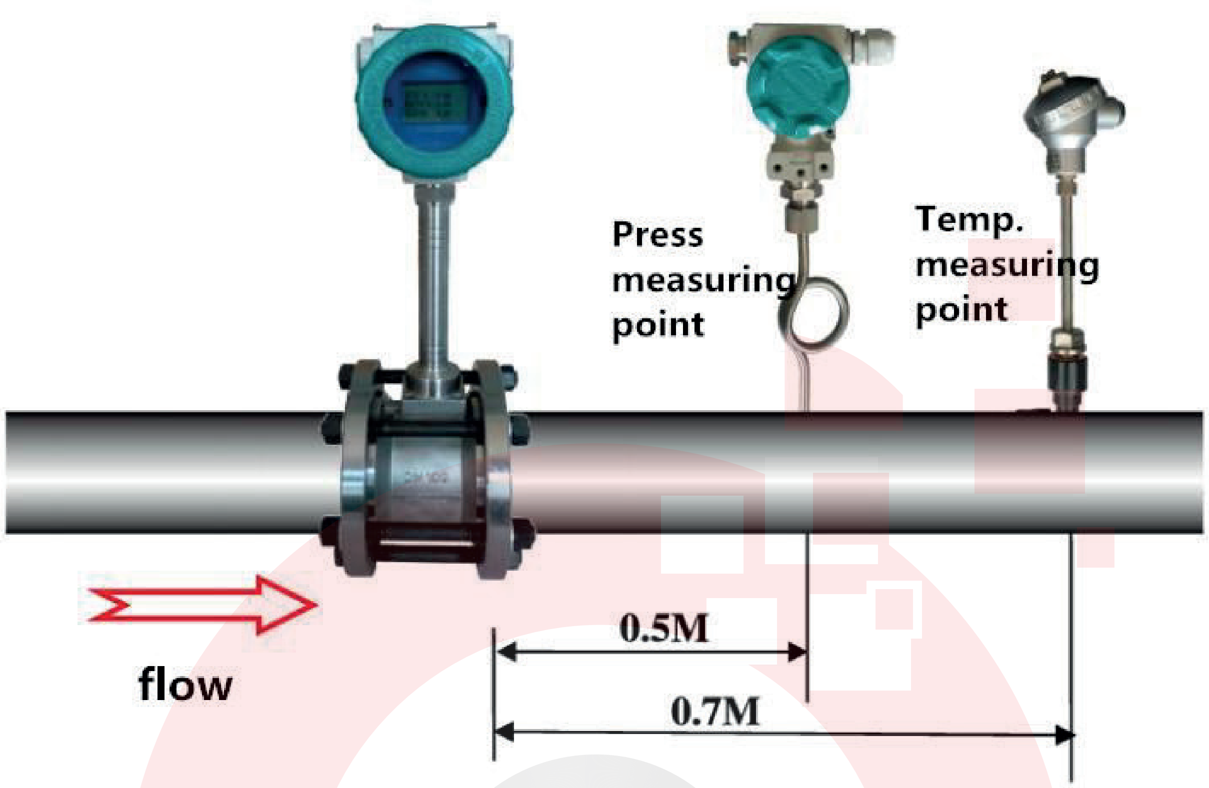
Insertion type flow meter

Diameter （mm）	DN150	DN200	DN250	DN300	DN400	DN500	DN600	DN800--2000
L	850	850	900	925	975	1075	1125	1175-1775

2.2.4 Installation Steps of Plug-in Vortex Flowmeter:

- Use gas welding to open a circular hole slightly smaller than Φ φ100mm on the pipeline, and remove burrs around the circular hole to ensure smooth rotation of the probe.
- Weld the flange provided by the manufacturer on the circular hole of the pipeline, and require the flange axis to be perpendicular to the pipeline axis.
- Install ball valve and sensor on welded flange.
- Adjust the lead screw so that the insertion depth meets the requirements (ensure that the central axis of the probe coincides with the central axis of the pipeline), and the fluid flow direction must be consistent with the indicating arrow on the direction mark.
- Tighten the screws on the gland evenly. (Note: The tightness of the gland determines the sealing degree of the instrument and whether the screw can rotate)
- Check whether all links are completed well, slowly open the valve to observe whether there is leakage (special attention should be paid to personal safety). If there is leakage, please repeat steps 5 and 6.

2.2.5 Schematic diagram of installation of pressure transmitter and Pt100



3.The operation of flow meter

See the attached table for the selection of different diameter and media switches. According to the actual signal, K2 and K3 expand the frequency band are first adjusted, and K1 charge amplifier gain is adjusted if necessary.

Vortex Flowmeter Amplifier Parameter Setting Reference Table (Liquid)

口径	K1								K2								K3								GB				SB			
mm	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	1	2	3	4
20	↑		↑		↑		↑		↑								↑										↑			↑		
25	↑		↑		↑		↑		↑								↑										↑			↑		
32	↑			↑	↑			↑				↑								↑		↑					↑			↑		
40	↑			↑	↑			↑				↑								↑		↑					↑			↑		
50	↑			↑	↑			↑						↑						↑		↑			↑		↑				↑	
65	↑			↑	↑			↑						↑							↑	↑	↑				↑				↑	
80	↑			↑	↑			↑							↑					↑	↑	↑			↑		↑				↑	
100	↑			↑	↑			↑							↑					↑	↑	↑				↑	↑				↑	
125	↑			↑	↑			↑							↑								↑			↑	↑		↑		↑	
150	↑			↑	↑			↑							↑							↑	↑		↑			↑		↑	↑	
200	↑			↑	↑			↑							↑							↑	↑		↑			↑		↑	↑	
250			↑	↑			↑	↑							↑	↑						↑	↑		↑			↑		↑	↑	
300			↑	↑			↑	↑							↑	↑						↑	↑		↑			↑		↑	↑	

Vortex Flowmeter Amplifier Parameter Setting Reference Table (Gas)

口径	K1								K2								K3								GB				SB			
mm	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	1	2	3	4
20	↑	↑			↑	↑			↑								↑										↑				↑	
25	↑	↑			↑	↑			↑								↑										↑				↑	
32	↑		↑		↑		↑			↑								↑									↑				↑	
40	↑		↑		↑		↑			↑								↑									↑				↑	
50	↑		↑		↑		↑			↑									↑								↑				↑	
65	↑		↑		↑		↑			↑									↑								↑				↑	
80	↑		↑		↑		↑				↑						↑		↑								↑				↑	
100	↑		↑		↑		↑				↑						↑	↑	↑								↑				↑	
125	↑		↑		↑		↑					↑					↑	↑	↑								↑				↑	
150	↑		↑		↑		↑				↑								↑								↑				↑	
200	↑			↑	↑			↑				↑					↑	↑	↑								↑				↑	
250	↑			↑	↑			↑					↑				↑	↑	↑								↑				↑	
300	↑			↑	↑			↑					↑				↑	↑	↑								↑				↑	

Vortex Flowmeter Amplifier Parameter Setting Reference Table (Steam)

口径	K1								K2								K3								GB				SB			
mm	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	1	2	3	4
20	↑	↑			↑	↑			↑								↑										↑				↑	
25	↑	↑			↑	↑			↑								↑										↑				↑	
32	↑		↑		↑		↑			↑								↑									↑				↑	
40	↑		↑		↑		↑			↑								↑									↑				↑	
50	↑		↑		↑		↑			↑									↑								↑				↑	
65	↑		↑		↑		↑			↑									↑								↑				↑	
80	↑		↑		↑		↑				↑						↑		↑								↑				↑	
100	↑		↑		↑		↑				↑						↑	↑	↑								↑				↑	
125	↑		↑		↑		↑					↑					↑	↑	↑								↑				↑	
150	↑		↑		↑		↑				↑								↑								↑				↑	
200	↑			↑	↑			↑				↑					↑	↑	↑								↑				↑	
250	↑			↑	↑			↑					↑				↑	↑	↑								↑				↑	
300	↑			↑	↑			↑					↑				↑	↑	↑								↑				↑	

Note:

A. The arrow head upward indicates that the switch position is ON and the switch without arrow is OFF.

B. When measuring gas and steam, SB is generally 3 and GB is 2; For larger diameter, GB can be appropriately adjusted to 3 according to sensitivity. When external interference is large, GB/ SB can be adjusted to 2 respectively; when frequency is low, K3 can be adjusted to 1st to 3rd gear in the direction of large diameter.

The above table values are for reference only. In actual use, due to different liquid viscosity and gas density, it should be adjusted around this value. When the frequency is low, K2/ K3 can be adjusted to one to three gears in the direction of large diameter. When the frequency is high, K2/ K3 can be adjusted to 1st to 3rd gear in the direction of small diameter.

Amplification gain and trigger sensitivity are adjusted by 4-bit switches, and 1/2/3/4 bits on and off represent 1/2/4/8 respectively. The sum of ON numbers is 1-15.

GB=l-15 amplifier gain (commonly 4- 8) corresponds to resistance ratio of 300 K/CL OOK-- 4K7), and 1 _ 15 amplification ratio increases.

SB=l-15 trigger threshold (commonly 4- 8) corresponds to a resistance ratio of 300 K/CL OOK-- 4K7), and the sensitivity of 1 _ 15 increases.

Key operation guide:

From left to right:

First key: shift key and return key

Second key: add key

Third key: confirm key

Menu number	Menu display	Meaning	Selections or range of values
1	Media	Algorithm selection	0:Qv Volume in working condition 1:Qm Mass in working condition 2:Nv Volume in standard condition 3:Nm Mass in standard condition 4:St Saturated steam 5:ST Superheated steam
2	Unit	Flow unit selection	0: Nm3/h 1: m3/h 2: m3/m 3: l/h 4: l/m 5: kg/h 6: kg/m 7: t/h 8: t/m
3	K.	Flow coefficient (1/m3)	Setting flow coefficient
4	Max	20mA current corresponding range	This value must be set and cannot be 0. The unit is consistent with the flow unit. Output full-scale flow when instantaneous flow exceeds full-scale flow.
5	ρ.	Density setting kg/m3	This must be set for both algorithms 1 and 3 The unit is kg/m3 and cannot be 0
6	P.	Pressure setting Ka	The meter displays this value, which is used in conjunction with the media setting
7	T.	Temperature setting ℃	The meter displays this value, which is used in conjunction with the media setting
8	damp	Set damping S	1-120 s damping is arbitrary setting
9	Cut	HZ	Cut the interference value of field environmental factors
10	485 ad	485 address	Address 0-225
11	4mA	Modify 4mA current value	Adjust the current by 10-200. The larger the value, the larger the current

12	reset	Cumulative zeroing	To accumulate zeroes, press the right key
13	Light	0-3	0： Aut （Default） 1： On 2： Off
14	Code	Password settings	Piksel Otomasyon +905447457350

I. Wiring Design of Three-wire Vortex Flowmeter for Output Frequency Signal

The three-wire flow sensor that outputs frequency signals uses DC24V or DC12 V power source for power supply, and generally passes through the three-core screen drain cable (RWP3x0.5mm) is connected to the display instrument or computer, and the shielding layer should be reliably connected to the grounding screw of the amplifier housing. The selection of shielded electric cables shall be suitable for the requirements of the site environment. In addition, shielded electric cables shall be separated from other high-power power lines and cannot be routed in parallel. The wiring of sensor terminals is shown in figure (8)

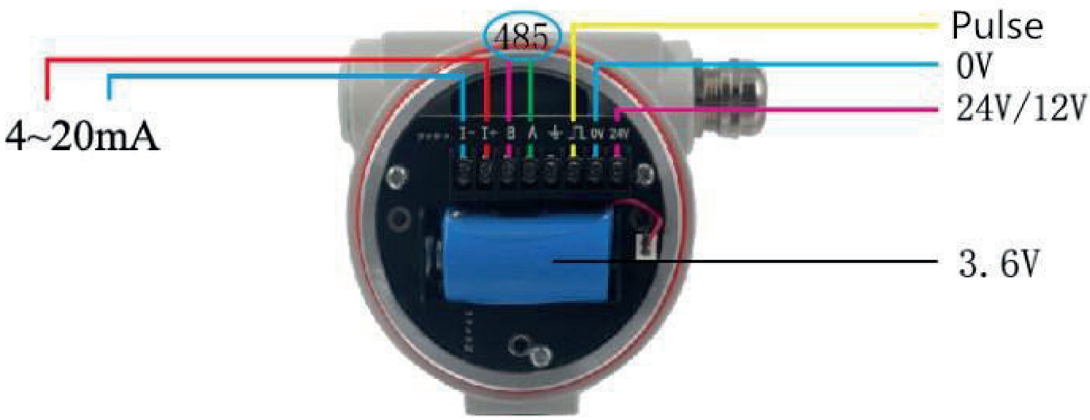
Figure (8)

II. Wiring Design of Two-wire Vortex Flowmeter Output Standard 4-20mA Current Signal

The two-wire transformer delivering the standard 4~ 20rnA electric current signal uses DC24V power source for power supply, and is connected to the display meter or the calculator through two-core shielded electric cable (RWP2 X 0. 5mm). The shielding layer should be connected to the grounding screw of the amplifier housing. The selection of shielded electric cables shall meet the requirements of the site environment. In addition, shielded electric cables shall be separated from other high-power electric cables and cannot be routed in parallel. See Figure (9) for terminal wiring of transformer.

Figure (9)

III. RS485/4-20mA/pulse/12-24VDC/3.6V battery



4. Analysis And Elimination Of Common Faults Of Instruments

LUGB/E B1 Type

4.1 When the frequency fluctuation of field instruments is large, the following is the elimination method:

4.1.1 First, check whether the straight pipe section meets the requirements. For gas or liquid, the straight pipe section is 15D before and 5D after. If the straight pipe section is not long enough, it is recommended to change the installation position.

4.1.2 There may be electromagnetic interference on site. Methods: Strengthen the filtering function, reduce the sensitivity and realize it by hitting dip switch.

4.1.3 The field flow rate is too small to be lower than the lower limit of the instrument. for example, the lower limit is 1500m3/h for 300 caliber plug-in gas, but the field indicates the instantaneous flow rate of about 500 m3. since the flow rate is at the lower limit, the value does not change linearly, and the flow rate can be increased by changing the instrument coefficient (not recommended).

4.1.4 Similar situations will occur when the liquid is measured to have pulsating flow.

4.2 There is 50HZ interference at the site, generally the shielded wire is not grounded.

4.3 There is no flow signal on site.

4.3.1 if the small signal of the instrument is cut off too much, it can be modified in the parameter setting;

4.3.2. the power supply is not connected properly and is not electrified;

4.3.3 the flow rate is very low and cannot reach the signal trigger point;

4.3.4.4-20mA output meter has not set measuring range before leaving the factory.

4.4 When the actual flow rate increases, the instrument display can be reduced, and the causes of site working conditions (such as pipeline technology, etc.) can be checked.

4.5 The actual flow rate decreases, but the instrument display increases. Most of it is due to pipeline vibration (such as when large fans are near) or the gasket is not at the center of the pipeline during installation. The instrument should be reinstalled.

4.6 The instrument displays under the same working conditions are inconsistent and differ greatly. A. The customer's experience value is wrong, or the working conditions are different, such as the problems of pipeline direction, straight pipe section, vibration, etc. B. the parameter has been modified by the customer; C. the operating flow is too low and the lower limit is not linear; D. temperature and pressure integrated compensation flowmeter, temperature and pressure failure.

4.7 The display of 4-20mA output instrument is inconsistent with that of the system. A. the units set by the parameters are inconsistent or the measuring ranges are not consistent; B.4-20mA output cable is too long (over 1000m) with large loss.

4.8 The flow rate displayed by the meter is quite different from the actual one, mostly due to the problem of parameter setting unit.