

# **Vortex Flowmeter**



Installation and operation instruction

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## Catalogue

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#### Foreword

Thank you for purchasing vortex flowmeter independently developed and produced by our company.

The vortex flowmeter manual records how to use the product correctly and safely.Please read this manual carefully before installation and debugging in order to prevent the instrument from being damaged or unable to perform its best performance and ensure the stable operation of the instrument.

#### Step 1: open the box inspection must read

1. Check the packing list to see whether the accessories are complete.

2. Appearance inspection to see if the instrument is complete and damaged due to

transportation;

3. Power test. If the battery is powered up, turn on the switch to check the display state of the meter.

4. Check whether the installation accessories are complete and prepare for installation.

#### Step 2: read the installation steps

1. Choose an appropriate installation environment. The ambient temperature should be  $-25-55^{\circ}$ °C, and the ambient humidity should be within the range of 5%-90%. See 6.1 installation environment requirements for the instrument for details;

2. Welding the product accessories, instruments should not be online welding (flange clamping instrument),Online welding may cause sensor thermal damage;

3. Purge the pipeline to ensure that there is no residual welding slag in the pipeline;

4. Install the instrument, pay attention to the direction sign of the instrument, prohibit reverse installation, ensure that the front and rear straight pipe meet the requirements,See installation requirements of instrument pipelines in 6.2 for details;

5. Open the front valve slowly to prevent air hammer or water hammer phenomenon from hurting the instrument;

6. Pipeline pressure test and leak detection to ensure that the pipeline does not leak;

7. Air tightness test to ensure that the installation instrument meets the sealing requirements;

8. Slowly open the back end valve to ensure stable flow field of medium passing through;

9. Instrument for normal operation;

1



10. Intallation environment should avoid violent vibration, vibration environment will lead to unstable flow or static flow , In the case of slight vibration, pipe fastening device can be installed at the upstream and downstream 2D position, and soft connection can be installed at the connection place with the fan and other equipment.

11. The installation diagram of vortex flowmeter is as follows :



Note: the above installation drawings of high-end l-shaped vortex street products are for reference only.



#### I , Product description

Vortex flowmeter is a kind of velocity flowmeter, which is designed based on Karman vortex principle. It is mainly used for flow measurement of medium and fluid in industrial pipelines, such as flow control and measurement of gas, steam or liquid and other media.

Vortex street flowmeter can achieve the following functions according to the selection: measuring the temperature, pressure, instantaneous flow and cumulative flow of medium fluid in industrial pipelines, and has pulse output, 4-20ma analog signal output, RS485 communication (Modbus RTU protocol), Hart protocol, GPRS of Internet of things and other functions.

Vortex flowmeter is widely used in heat supply, gas supply, chemical industry, environmental protection, metallurgy, textile, steel, pharmaceutical, paper making, drainage and other corporations to superheated steam and saturated steam, compressed air and gas (oxygen, nitrogen, hydrogen, natural gas, coal gas, etc.), water and liquid (such as: water, gasoline, alcohol, stupid class, etc.) of the measurement and control.

#### II 、 Features

- The main body of the product has no moving parts, high reliability, long-term stability, simple structure and easy maintenance.
- The output of the sensor is pulse frequency, which is linear with the actual flow rate of the measured body, zero point no drift, and the performance is very stable.
- > The structure forms are various, including pipe type, plug type flow sensor and so on.
- The measurement accuracy of conventional liquid is ±1.0%. The accuracy of the gas measurement was ±1.5%;
- ➤ The pressure loss is small (about 1/4 to 1/2 of orifice flowmeter), which belongs to energy-saving flow meter
- Flexible installation mode, can be horizontal, vertical or inclined to different angles according to different process pipeline;
- Circuit adopts a variety of protection mode, anti-surge, strong adaptability;
- High precision probe, piezocrystalline vortex sensor, stable signal. The 316L stainless steel sensor shell has strong corrosion resistance and good intercrystalline corrosion resistance. It also has good corrosion resistance to alkali solutions and most organic and inorganic acids;
- Long life lithium battery: equipped with 3.6v high poly lithium battery, with high storage energy density, the service life of more than 1 year;



- > Products high and low temperature adaptability, environmental protection and other advantages;
- ▶ Wide measuring range, measuring range ratio up to 1:10-20;
- Within a certain Reynolds number range, the output signal frequency is not affected by the physical properties and component changes of the fluid, and the instrument coefficient is only related to the shape and size of the vortex generator, There is no need to compensate when measuring the volume flow rate of the fluid condition.

#### **III**、**Product structure and working principle**

#### **3.1 Product structure**

The basic structure of AFLO series vortex flowmeter is shown in figure 1. It is mainly composed of shell, vortex generator, flow sensor, temperature sensor, pressure sensor, shield bar, integrator and other main accessories.

Integrating instrument
Pressure transducer
Shielding rod
shell



Vortex flowmeter product structure drawing

#### 3.2 Working principle

Vortex flowmeter is a speed-type flowmeter produced according to karman's vortex principle, which can be used for the measurement and measurement of conventional gas, steam and liquid. Vortex flow sensor has high precision and wide range ratio, no moving parts in use, which can improve mechanical stability and reduce maintenance. Vortex flowmeter is almost not affected by the temperature, pressure and composition of medium when measuring the volume of working condition. Therefore, it is convenient to calibrate the instrument, so vortex street flow sensor is widely used in production and life.



When a trigonal column vortex generator is set in the fluid, regular vortices are generated alternately on both sides of the vortex generator, which is called Carmen vortex. The vortex columns are arranged asymmetrically downstream of the vortex generator. Vortex flowmeter is produced according to this principle. Vortexes are generated by generating bodies and the number of vortexes is detected by high-sensitivity sensors. In a certain range, the number of vortexes generated is proportional to the flow rate.



In vortex flowmeter, the relationship between flow rate and the number of vortexes generated can be expressed by the following formula:

$$Q = \frac{3600F}{K}$$

Q : Operating volume flow of the measured medium  $\ensuremath{\,,}$  The unit is m3/h  $\ensuremath{\,,}$ 

F: Frequency of the number of vortices produced by the generating body, The unit is Hz.

K : Refers to the calculated or calibrated flow coefficient, It represents how many frequency signals per cube, the coefficient is usually obtained by calibration.

The formula of standard table method calibration coefficient K:  $K = \frac{\text{CheckedmeterflowQ}_{S}}{\text{Standard meter flowQ}_{C}} \times K_{\text{Coefficient of the checked meter}} \qquad (\text{The formula can also be used for flow})$ 

correction).



### IV、 The main technical performance indicators

#### 4.1 Basic parameter

Executive	《JB/T9249-2015 Vortex flow meter industry standard》
standard	
Nominal	15、20、25, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, (300~1000plug-in)
diameter	
(mm)	
Nominal	DN15-DN200 4.0(>4.0 Supply agreement), DN250-DN300 1.6(>1.6Supply agreement)
Pressure	
(MPa)	
Use condition	Operational temperature: Std: $-40 \sim 100$ °C, KST-M: $-40 \sim 250$ °C,
	KST-HC: $-40 \sim 400$ °C; (max.30 minutes, working temperature can be 450 oC)
	Environmental temperature: -20°C $\sim$ 55°C, Relative humidity: 5% $\sim$ 90%, Atmospheric
	pressure: 86~106kPa
Material	Body: 304(Other materials are supplied by agreement) Integrator housing: aluminium die
	casting
Allowable	piezoelectric type:0.2g
vibration	
acceleration	
Accuracy	$\pm 1\%$ R, $\pm 1.5\%$ R; Plug-in: $\pm 2.5\%$ R,
Rangeability	1: 6~1: 30
Supply voltage	sensor: DC +24V; transducer: DC +24V; battery-powered; 3.6Vbattery
Output signal	Pluse output, $4 \sim 20$ mA current RS485 (modbus, RTU agreement) Internet of Things GPRS
Output signal	and so on
Pressure loss	IB/T9249 standard Cd<2.4
factor	
inclui	
Explosive-proo	The Ann model: Ex ia II CT4
f	
IP Grade	IP65
Counduit entry	Inside threadM20*1.5or other
Applicable	Gas,liquids ,steam
medium	
Transmission	Three-wire pulse output: $\leq 300$ m, Two-wire standard current output (4 $\sim 20$ mA) $\leq 1500$ m; load
distance	resistance $\leq$ 500 $\Omega$ ; RS485/HART $\leq$ 1200m.



#### Vortex flowmeter accuracy class

Accura	acy class	1	1.5	2	2.5	
Maximum impact $q_t \le q < q_{max}$		±1.0%	±1.5%	±2.0%	±2.5%	
error $q_{min} \leq q < q_t$		±2.0%	±3.0%	±4.0%	±5.0%	
Note: The bounded flow is 0.2qmax						

#### 4.2 Range of measurement

The measuring flow range of different calibre instrument will be different, the instrument selection process must be in accordance with the flow range to choose the instrument, the most taboo is to choose the instrument according to the thickness of the pipeline. The biggest disadvantage of selecting instrument according to pipeline is that it is easy to cause measurement error due to insufficient flow.

The determination of the flow range of vortex flowmeter is based on the flow rate in operating conditions. Therefore, the flow rate is converted into the flow rate in operating conditions and the flow range table is compared to make the commonly used flow rate in the middle range measured by the instrument as far as possible.

#### 4.2.1 reference condition

1.Gas :Normal pressure and temperature,air,t=20°C, P=0.1MPa (AP) ,  $\rho$ =1.205 kg/m3,  $\nu$ =15×10-6 m2/s.

2.Liquid:Normal temperature, water,  $t=20^{\circ}$ C,  $\rho=998.2$ kg/m3,  $\upsilon=1.006\times10$ -6m2/s.

	Liqu	ıid	gas		
Meter diameter (mm)	Range of measurement (m3/h)	Range of output frequency(Hz)	Range of flow(m3/h)	Range of output frequency(Hz)	
15	0.3~5	35~450	3~15	300~1600	
20	0.6~10	29~380	6~30	230~1200	
25	1.2~16	25~320	8~55	170~1100	
32	1.8~20	18~200	10~120	100~1180	
40	2~40	10~190	27~205	130~1040	

#### Reference range of vortex flow sensor under reference condition



50	3~60	8~150	35~380	94~920
65	4~85	6~120	60~640	90~910
80	6.5~130	4.1~82	86~1100	55~690
100	15~220	4.7~69	133~1700	42~536
125	20~350	3.2~57	150~2000	38~475
150	30~450	2.8~43	347~4000	33~380
200	45~800	2~31	560~8000	22~315
250	65~1250	1.5~25	890~11000	18~221
300	95~2000	1.2~24	1360~18000	16~213
(300)	100~1500	5.5~87	1560~15600	85~880
(400)	180~3000	$5.6{\sim}87$	2750~27000	85~880
(500)	300~4500	5.6~88	4300~43000	85~880
(600)	450~6500	5.7~89	6100~61000	85~880
(800)	750~10000	5.7~88	11000~110000	85~880
(1000)	1200~17000	5.8~88	17000~170000	85~880
>(1000)	agreement		agreement	

Note: In Chart(300)~(1000)diameter is plug-in.

Working condition of traffic:Refers to the measurement of the current volume of medium passing through the pipeline,Is the medium in the working state,For example, gas can be compressed. When there is pressure in the pipeline, the volume of compressed gas is the flow rate under the working condition.The flow rate will change as the working environment changes.

Standard of flow:Refers to the volume of the medium at standard atmospheric pressure and  $0^{\circ}$  (or 20 °) standard, when compressed gas is released into the standard environment..The flow rate will change as the working environment changes.

Vortex flowmeter measures the working volume, and only after temperature and pressure compensation can the standard volume be obtained. Generally, when it is used for trade measurement, the volume of gas shall prevail, and the quality of steam shall prevail.

 $Q_{\text{Workingconditionof the volume}} = Q_{\text{volume}} \times \frac{0.101325}{P_{\text{gagepressure}} + 0.101325} \times \frac{273.15 + T_{\text{temperature}}}{293.15} (\text{Operating condition and standard state conversion formula})$ 



#### V、 Product classification and size

#### **5.1Product classification**

#### 5.1.1 Classified by function:

1.Common on-site display vortex flowmeter integrates vortex flow sensor and flow integrator, and its main performance index reaches the leading level in China. It is an ideal instrument for petroleum, chemical, electrical, light industry, power heating and other industries.

2.Vortex flowmeter of temperature and pressure compensation type, which integrates vortex flow sensor and flow integrator, has the function of temperature and pressure compensation, and its main performance index reaches the leading level in China.

3. The split-type vortex flowmeter is installed separately from vortex flow sensor and flow integrator, with the function of split-type display, which can realize high-altitude installation and low-altitude display, providing convenience for meter reading in high-altitude installation.

#### 5.1.2 Classified by installation mode:

- 1. Flange clamp type (clamping type) vortex flow meter
- 2. Flange-connected vortex flowmeter
- 3.Simple insert vortex flowmeter
- 4.Ball valve insert vortex flowmeter

5. Other special structures can be customized through communication with suppliers

#### 5.2 Product size and pressure rating



![](_page_10_Picture_15.jpeg)

LUGB flange connection diagram

Simple insertion diagram

![](_page_10_Figure_18.jpeg)

![](_page_11_Picture_0.jpeg)

Flange mounting common field display dimensioTable 1										
Nominal diameter	Pressure rating MPa	L mm	Lı mm	D mm	D1 mm	H mm	H1 mm	d1 mm	d² mm	n hole count
DN15		70	95	55	100	393	420	78	14	3
DN20		70	95	55	100	393	420	78	14	3
DN25	1	70	95	55	100	393	420	78	14	3
DN32	4	70	95	55	100	393	420	78	14	3
DN40		85	108	80	140	405	440	106	18	4
DN50		85	108	90	145	414	445	112	18	4
DN65		85	108	105	165	429	465	130	18	4
DN80		85	108	120	180	444	480	145	18	6
DN100		85	108	140	210	464	505	175	18	6
DN125	1.0	85	115	165	235	489	530	200	18	8
DN150	1.0	100	128	194	270	516	560	230	22	8
DN200		100	128	248	325	568	615	285	22	8
DN250		115	142	300	375	619	665	330	22	10
DN300		130	158	350	425	669	715	380	22	10

Flange connection common field display dimensionTable 2							
Nominal diameter(mm)	Pressure rating (MPa)	L mm	d mm	H mm	k mm	d2 mm	n hole count
DN10		170	10	461	60	14	4
DN15		170	15	464	65	14	4
DN20		170	20	469	75	14	4
DN25	4.0	170	25	474	85	14	4
DN32		170	32	486	100	18	4
DN40		170	40	491	110	18	4
DN50		170	50	528	125	18	4
DN65		190	65	538	145	18	8
DN80	1.6	190	80	546	160	18	8
DN100		200	100	556	180	18	8

![](_page_12_Picture_0.jpeg)

DN125	200	125	570	210	18	8
DN150	200	150	588	240	22	8
DN200	200	200	616	295	22	12
DN250	240	250	648	355	26	12
DN300	240	300	676	410	26	12

Insert general field display dimension Table 3								
Nominal diameter	Dielectric strength level	Ball valve insert L	Simple insertion L					
mm	MPa	mm	mm					
DN250		680	255					
DN300	1.6	705	280					
DN400		755	330					
DN500		805	380					
DN600		855	430					
DN800-2000		905~1555	530~1130					

REMARK: The height H/H1 of table 1 and table 2 is the size below 250 degrees of common field display type, the height H/H1 of  $250 \sim 330$  degrees of temperature and pressure compensation type increases by  $60 \text{mm} \pm 0.5$ , and other special size agreements are customized.

![](_page_13_Picture_0.jpeg)

#### VI、 Product installation and use

#### **6.1Instrument installation environment requirements**

1.Flowmeter should be **installed in the indoor,** if installed in the outdoor, there should be cover above, in order to prevent rain invasion and the sun exposure and affect the service life of the flowmeter (flow meter wiring shielding wire to make a u-shaped, finally into the case when the line is from the bottom up, avoid rain along the road into the case);

2. The flow meter shall not be surrounded by strong external magnetic field interference, strong electrical equipment, high-frequency equipment, and avoid sharing power with these equipment;

3.Do not share power with inverter, welding machine and other polluting power equipment, and install purification power when necessary;

4. Avoid high temperature, cold, corrosive or extremely humid environment. If installation is necessary, protection of flow meter must be done;

5. The flowmeter should not be installed on the pipe with strong vibration. If it must be installed, pipe fastening device should be installed at 2D upstream and downstream, and anti-vibration pad should be added to enhance the anti-vibration effect.

6. Ample space should be left around the instrument installation point for installation wiring and regular maintenance.

#### 6.2 Installation requirements for instrument piping

Vortex flow meter has certain requirements on the upstream and downstream straight pipe section of the installation point, otherwise it will affect the flow field of medium in the pipeline and affect the measuring accuracy of the meter. The length of the upstream and downstream straight pipe section of the instrument is required as shown in FIG. DN is the nominal diameter unit of the instrument :mm

![](_page_14_Picture_0.jpeg)

![](_page_14_Figure_1.jpeg)

Note:

 $1_{x}$  As far as possible, the regulating valve should not be installed in the upstream of vortex street flow meter, but should be installed 10D beyond the downstream of vortex flow meter.

2. Inner diameters of upper and lower piping shall be the same. If there is any difference, the relationship between piping inner diameter Dp and vortex street meter inner diameter Db should meet the following requirements:0.98 Db Dp or less or less 1.05 Db;

3. The upstream and downstream piping should be concentric with the internal diameter of flow meter, and the coaxiality between them should be less than 0.05Db;

4. The sealing gasket between the meter and flange cannot be protruded into the pipe during installation, and its inner diameter should be 1-2mm larger than the inner diameter of the meter;

![](_page_15_Picture_0.jpeg)

5. Installation design of pressure hole and temperature hole. When temperature and pressure transmitters need to be installed in the measured pipeline, the pressure measuring hole should be set at the downstream 3-5d and the temperature measuring hole should be set at the downstream 6-8d. D is the nominal diameter of the instrument, unit: mm;

6. The meter may be installed horizontally, vertically, or diagonally on the pipe.

7. When measuring gas, install the instrument in the vertical pipe with unlimited gas flow direction. However, if the pipe contains a small amount of liquid, in order to prevent the liquid from entering the gauge pipe, the airflow should flow from the bottom up, as shown in FIG. (iv) a;

8. When measuring liquid, in order to ensure that the tube is filled with liquid, the direction of liquid flow should be ensured from the bottom up when installing the instrument in the vertical or inclined pipeline. If there is a small amount of gas in the pipe, the instrument should be installed at the lower part of the pipe to prevent the gas from entering the measuring pipe, As shown in FIG. (iv) b.

9. Heat preservation measures should be paid attention to when measuring high temperature and low temperature media. The high temperature inside the converter (inside the watch head shell) should not exceed 70°C generally; Low temperature may cause condensation inside the converter, reduce the insulation impedance of the circuit board, and affect the normal operation of the meter.

![](_page_15_Figure_6.jpeg)

draw (IV)

![](_page_16_Picture_0.jpeg)

#### 6.3 Installation procedure of plug - in vortex street flow meter

1. A circular hole slightly smaller than 100mm with gas welding on the pipe, And the round hole around the burr clean, to ensure that the probe rotating smoothly;

2. Weld the flange provided by the manufacturer at the round hole of the pipe. The flange axis is required to be perpendicular to the pipe axis.

3. Install the ball valve and sensor on the welded flange;

4. Adjust the lead screw to make the insertion depth meet the requirements(ensure that the central axis of the probe and the central axis of the pipeline coincide),the flow direction of the fluid must be consistent with the direction indicated by the arrow;

5. Tighten the screws on the gland evenly.(note: the tightness of the gland determines the sealing degree of the instrument and whether the lead screw can rotate);

6. Check whether all links are completed, slowly open the valve to observe whether there is leakage(Special attention should be paid to personal safety)Repeat steps 5 and 6 if there is keakage.

![](_page_17_Picture_0.jpeg)

#### 6.4 Operation instructions of integrator

1.Display interface description

![](_page_17_Figure_3.jpeg)

D1 is the SHIFT button, D2 is the SET button, D3 is CONFIRM button

2. Circuit wiring diagram

![](_page_17_Picture_6.jpeg)

![](_page_18_Picture_0.jpeg)

![](_page_18_Picture_1.jpeg)

![](_page_19_Picture_0.jpeg)

#### 3.Instructions

Display on the main page;

Total	0.00 Nm3
Flow	0.00 Nm3/h
Fre	0.00 HZ
0. 0℃	0.0 Kpa

Press D1 to Password input interface

![](_page_19_Figure_5.jpeg)

![](_page_19_Figure_6.jpeg)

![](_page_19_Figure_7.jpeg)

Conventional volume

![](_page_19_Figure_9.jpeg)

In the main interface, press the D1 to Password interface

In the Passwod input interface, Push D3to shift, and D2 to input the Password 2010

#### 0: Chinese

1: English

Press D3 after input the Password 2010, then enter into Language setting, Press D2 to choose English or Chinese

## 0. Volume 1.STPV 2.Mass 3.STPV 4. P compensate5. T compensate 6. T and P compensate

Under the language menu, press D3 to Alg interface, Press D1 to shift and D2 to choose

#### 0, L/s, 1. m3/h 2. Nm3/h 3. Nl/s 4. t/h 5. kg/m 6. m3/h

#### 7. L/h 8. Nm3/m 9. kg/h

Press D3 enter into Unit interface, D2 to choose unit

Under Unit interface, Press D3 enter into calibration low limit interface, Press D1 to shift and D2 revise

![](_page_20_Picture_0.jpeg)

![](_page_20_Figure_1.jpeg)

Under Fmin interface, Press D3 enter into calibration upper limit interface, Press D1 to shift and D2 revise

Under Fmax interface, press D3 enter into Coefficient menu, Press D1 to shift and D2 revise

Under Flow Coefficient menu, Press D3 enter into Span memu, Press D1 to shift and D2 to revise

Under Full flow interface, Press D3 to enter into Density interface, Press D1 to shift and D2 to revise the value

Under the density setting menu, press the D3 button to save and enter the temperature setting menu. Press the D3 button to save and go to the next menu.

Under the temperature setting menu, press D3 button to save, Press D2 to shift and press D2 again to input value

![](_page_21_Picture_0.jpeg)

![](_page_21_Figure_1.jpeg)

Backlight ↓ Rate Gain Under the gauge pressure setting menu, press D3 enter into Low cut menu, press D1 to shift and D2 to revise.

Under the lower cut menu, press the D3 button to save and enter the clear menu. Press the D2 buttom to clear the cumulative flow.

Under total flow clear menu, press D3 enter into password setting menu, press D1 to shift and D2 to revise the value.

From password menu, press D3 enter into caliber menu, press D1 to shift and D2 to input the OD of the flowmeter.

0: shut off back light 1: open back light Press D3 to enter into Backlight menu from caliber menu, press D2 to open or shut off the back light

Under the backlight menu, press the 3 button enter into rate menu, D1 to shift, D2 to choose 0 or 1.

Under the rate menu, press D3 to gain menu, Pressure D2 to damping time 0 or 1  $\,$ 

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