PCL-V10 Vortex Flowmeter

Features

- Advanced circuit design, with both low-power amplifier and current output signal functions on the circuit board
- The product measurement range is relatively wide
- Output signal 4mA~20mA two-wire current signal corresponding to flow rate
- Display both cumulative and instantaneous traffic simultaneously
- With five stage nonlinear correction, small signal removal, and free damping time setting function
- Fully universal design, small overall size, and compact structure. Suitable for flow measurement of liquid and gas media with different diameters
- New digital filtering and correction functions make flow measurement more accurate and reliable
- Advanced humanized design, easy to operate and use

Application

- The measurement and control of compressed air and general gases (such as oxygen, nitrogen, hydrogen, natural gas, coal gas, etc.), water, and liquids (such as water, gasoline, alcohol, benzene, etc.) in industries such as petroleum, chemical, metallurgy, heating, textile, and papermaking.

Product Overview

The PCL-V10 series vortex flowmeter is a fully intelligent flowmeter developed by combining advanced domestic and foreign technologies. It has the characteristics of simple structure, low power consumption, small resistance loss, stable operation, long durability, and easy installation.

The PCL-V10 series vortex flowmeter pays attention to every step in the process of design, material selection, process manufacturing, production assembly, and factory testing; The product has a variety of output signal forms, including standard analog signals and standard digital signal output signals, which are easy to use with digital systems such as computers and secondary instruments, achieving the intelligence,standardization, and universality of the product.

Measuring principle

The vortex flowmeter is based on the Karman vortex principle and is a vibration type flow meter. It utilizes the vibration frequency of the fluid to be proportional to the fluid flow rate, and achieves flow measurement by measuring the frequency generated by the vortex.

The Karman vortex street phenomenon is shown in the following figure. When a fluid passes through a vortex street flowmeter measuring device in a pipeline, two rows of vortices are alternately generated after the vortex generator, which are proportional to the flow rate. The release frequency of vortices is related to the average velocity of the fluid in the pipeline and the characteristic width of the vortex generator, and its relationship can be expressed as:

Note:

1.Do not misuse the file.

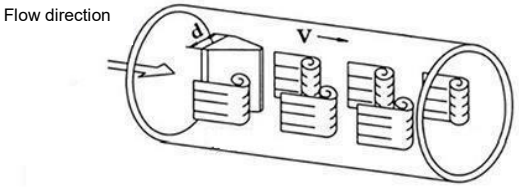
2.The information in this selection is for reference only and cannot be used as a product installation guide.

3.Complete installation, operation, and maintenance information is provided in the product manual

$$f = S_r \frac{V}{md} \quad (1)$$

Among them, is the Strouhal number and is the ratio of the flow area on both sides of the vortex generator to the cross-sectional area of the pipeline.

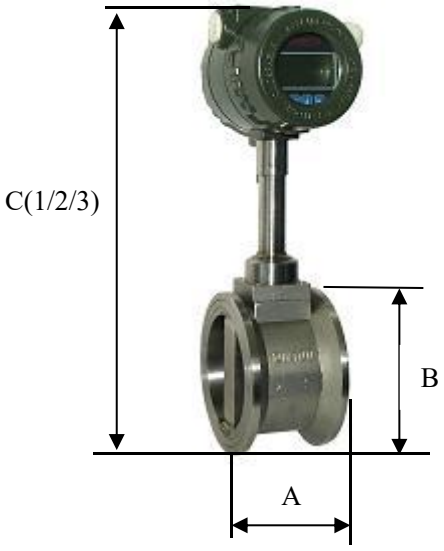
By measuring the frequency of vortex occurrence, the average velocity of the fluid in the pipeline can be calculated, and then the flow rate can be calculated, where is the cross-sectional area of the pipeline.



Performance parameter

Accuracy	Liquid; ±1.0% Gas; ±1.5%
Pipe diameter	DN15～DN300
Rated pressure	GB; PN2.5, PN6, PN16, PN25, PN40, PN63, PN100, PN160, PN250 ANSI; CLASS 150, CLASS 300, CLASS 600, CLASS 900 DIN; PN10, PN16, PN25, PN40, PN63 JIS; 5K,10K, 16K, 20K, 30K, 40K, 63K Special pressure: customizable
Medium temperature	Ordinary temperature: -40℃～80℃ Moderate temperature: -40℃～250℃ High temperature: -40℃～350℃
Body material	Stainless steel 304 (conventional)
Range ratio	1:10(Theoretical value)
Flow rate range	Liquid (water): 0.7m/s～7m/s Gas: 5m/s～70m/s Steam: 4m/s～70m/s
Reynolds number	1.5×10^4～4×10^6
Drag coefficient	Cd≤2.4
Power supply and output signal	24VDC: pulse output signal (without display), 4-20mA/pulse (with display), 4-20mA/pulse/485 (with display) Battery powered: No output signal (with display)
Protection grade	IP65
Ambient temperature	Non explosion-proof locations: -40 ℃~55 ℃; Explosion proof location: -20 ℃~55 ℃
Explosion proof	Explosion proof (24VDC) certificate number: CNEx22.4919X mark: Ex db IIC T6 Gb

Overall dimension

Outline structure	Dimension	Unit:mm
PCL-V10J Clamping Vortex Flowmeter		

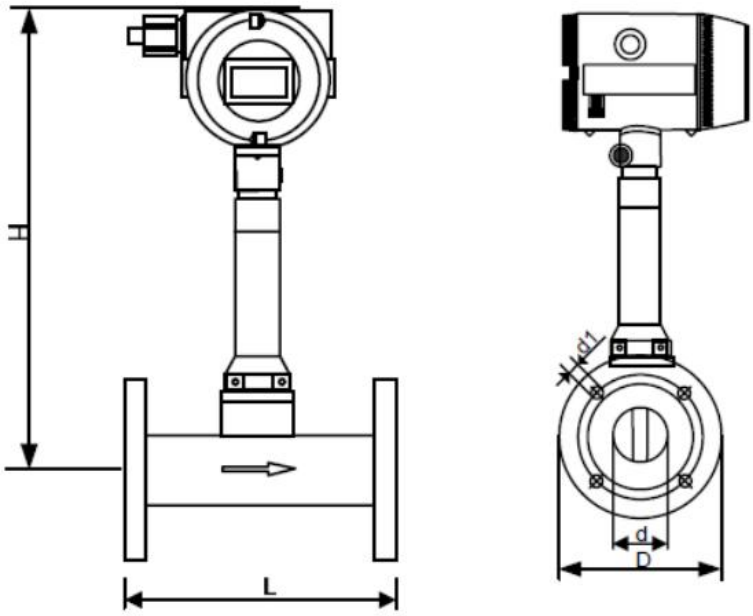
In the above figure, A represents the length of the flow meter measuring tube; B represents the diameter of the flowmeter interface; C represents the length between the top of the meter head and the bottom of the pipeline interface.

The outer dimensions of the flange clamped vortex flowmeter are shown in Table 1.

Table 1 Boundary Dimensions of Flange Clamping Vortex Flowmeter

Size(mm)	Nominal pressure	Overall dimensions(mm)		Height(mm)		
	PN	Length(A)	external diameter(B)	C1	C2	C3
15～25	16	70	Φ54	325	385	445
32	16	85	Φ69	325	385	445
40	16	85	Φ79	325	385	445
50	16	85	Φ89	330	390	450
65	16	85	Φ104	340	400	470
80	16	90	Φ119	360	420	480
100	16	90	Φ139	380	440	500
125	16	95	Φ168	405	465	530
150	16	100	Φ194	430	490	560
200	16	102	Φ248	485	545	610
250	16	115	Φ300	540	600	660
300	16	130	Φ350	590	650	710

Overall dimensions

Outline structure	Dimension	Unit:mm
PCL-V10F flange mounted vortex flowmeter		

In the figure, L represents the length of the flow meter measuring tube; D represents the diameter of the flowmeter flange; H represents the length between the top of the meter head and the center of the pipeline interface. The overall dimensions of flange mounted vortex flowmeter are shown in Table 1.

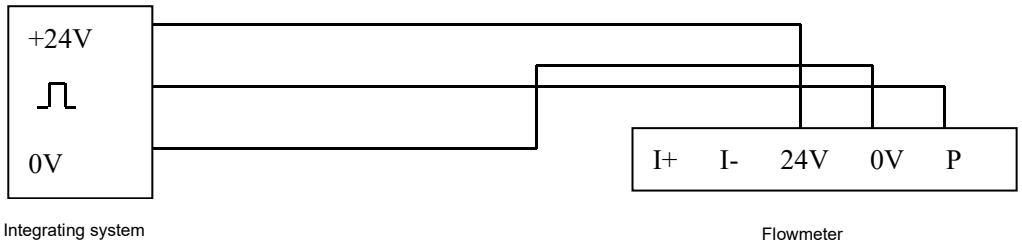
Table 1 Boundary Dimensions of Flange Mounted Vortex Flowmeter

Nominal Diameter	Nominal pressure	Inner diameter of gauge body	Flange dimensions						Instrument height
DN	PN	d	Measuring tube length L	Flange outer diameter D	Center pitch K	Number of bolts N	Bolt aperture DL	Flange thickness B	H
15	40	15	200	95	65	4	14	14	300
20	40	20	200	105	75	4	14	16	300
25	40	25	200	115	85	4	14	16	300
40	40	40	200	150	110	4	18	18	340
50	40	50	200	165	125	4	18	20	350
80	16	80	200	200	160	6	18	24	365
100	16	100	250	220/235	180/190	8	18/22	22/24	375
125	16	125	250	250/270	210/220	8	18/26	22/26	390
150	16	150	300	285/300	240/250	8	22/26	24/28	400
200	16	200	350	340/360	295/310	12	22/26	24/30	425
250	16	250	450	405/425	355/370	12	26/30	26/32	450
300	16	300	500	460/485	410/430	12/16	26/30	28/34	475

Electrical connection

1. Wiring of a three wire vortex flowmeter with output signal frequency signal

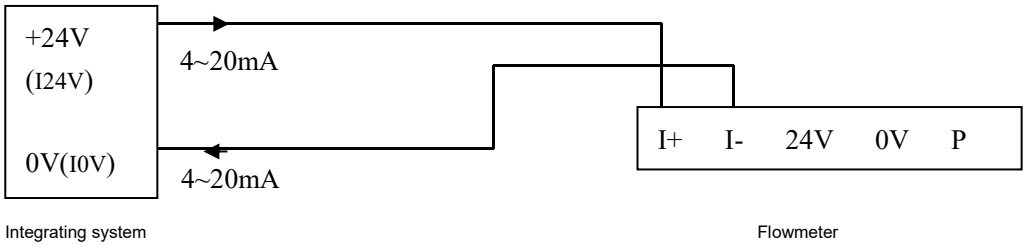
The three wire vortex flowmeter that output signals frequency signals is powered by a DC24V or DC12V power supply, and is generally connected to the display instrument or computer through a three core shielded cable. The shielding layer should be reliably connected to the grounding screw of the amplifier shell. The selection of shielded cables should be suitable for the on-site environmental requirements. In addition, shielded cables should be separated from other high-power power lines and cannot be run in parallel. The wiring of the flowmeter terminal is shown in the following figure.



2. Two wire vortex flowmeter wiring with standard 4-20mA current signal output signal

The two wire vortex flowmeter that output signals a standard 4-20mA current signal is powered by a DC24V power supply and is generally connected to the display instrument or computer through a two core shielded cable. The shielding layer should be reliably connected to the grounding screw of the

amplifier shell. The selection of shielded cables should be suitable for the on-site environmental requirements. In addition, shielded cables should be separated from other high-power power lines and cannot be run in parallel. The wiring of the flowmeter terminal is shown in the following figure.



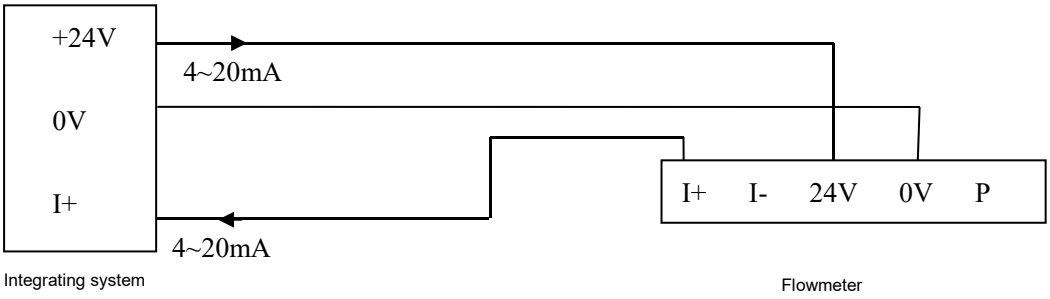
Note; ① The corresponding relationship between terminal blocks for models with and without battery power supply:

I24V(A) →I+ ; I0V(B) →;Fout P→

② When supplying power to the instrument, unscrew the back cover and turn the battery switch to the "on" position

3. Wiring for a three-wire vortex flowmeter with output signal standard 4-20mA current signal

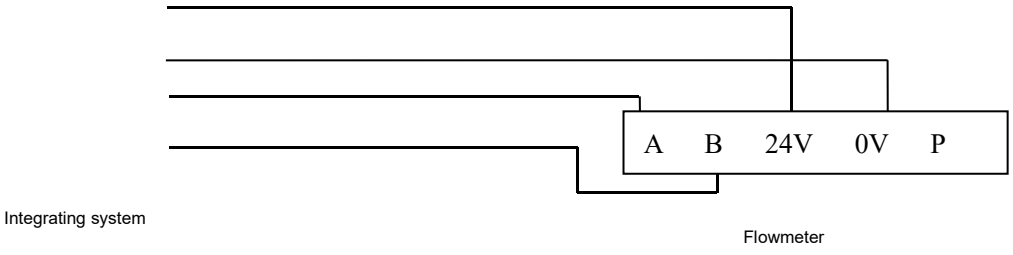
The wiring of a three wire vortex flowmeter with a standard 4-20mA current signal output signal is shown in the following figure



4. Vortex flowmeter wiring with RS485 communication interface function

The vortex flowmeter with RS485 communication function is powered by a DC24V power supply, and is transmitted to other devices using a four wire system. instrument

The terminal wiring is shown in the following figure.



Installation

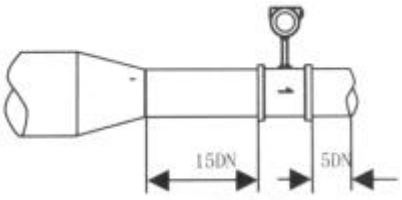
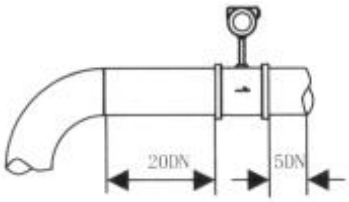
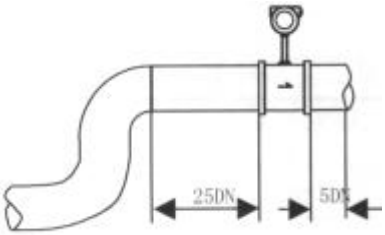
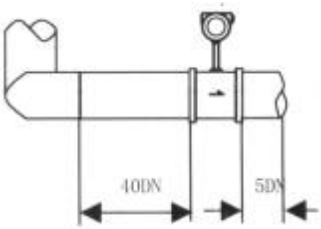
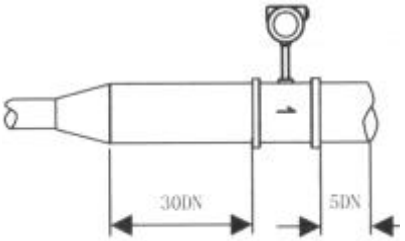
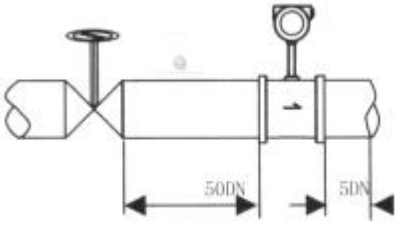
1. Installation precautions

Try to avoid strong current equipment, high-frequency equipment, and strong switching power supply equipment as much as possible. The power supply of the instrument should be separated from these devices as much as possible.

(2) Avoid the direct impact of high-temperature heat sources and radiation sources. If installation is necessary, insulation and ventilation measures must be taken.

(3) Avoid high humidity environments and strongly corrosive gas environments. If installation is necessary, ventilation measures must be taken.
(4) Vortex flow instruments should be installed on pipelines with strong vibrations as much as possible. If installation is necessary, pipeline fastening devices must be installed upstream and downstream 2D, and anti vibration pads must be added to enhance the anti vibration effect.
(5) It is best to install the instrument indoors, and when installed outdoors, attention should be paid to waterproofing. Special attention should be paid to bending the cable into a U-shaped shape at the electrical interface to prevent water from entering the amplifier shell along the cable.
There should be ample space left around the instrument installation point for installation, wiring, and regular maintenance.
2. Instrument pipeline installation requirements
(1) Requirements for straight pipe sections

Vortex flowmeter has certain requirements for the upstream and downstream straight pipe sections of the installation point, otherwise it will affect the flow field of the medium in the pipeline and affect the measurement accuracy of the flowmeter. The length requirements for the upstream and downstream straight pipe sections of the flow meter are shown in the table below.

Upstream pipeline form of sensor	Length of front and rear straight pipe sections	Upstream pipeline type of sensor	Length of front and rear straight pipe sections
Concentric contraction fully open valve		A 90 degree elbow	
Two 90 degree elbows in the same plane		Two 90 degree elbows in different planes	
Concentric expansion tube		Regulating valve half open valve (not recommended)	

Note: ① DN refers to the nominal diameter of the instrument, in mm; ② The regulating valve should not be installed upstream of the vortex flowmeter as much as possible, but should be installed 10D downstream of the vortex flowmeter, where D is the inner diameter of the pipeline measured by the flowmeter.

(2) Inner diameter of upstream and downstream piping

The inner diameter of the upstream and downstream piping should be the same. If there is a difference, the inner diameter of the piping and the inner diameter of the vortex flowmeter measuring

pipe should meet the following relationship:

$$0.98D_b \leq D_P \leq 1.05D_b$$

The upstream and downstream piping should be concentric with the inner diameter of the vortex flow meter measuring pipe, and the different axial degrees between them should be less than 0.05.

(3) Sealing gasket

The sealing gasket between the vortex flowmeter and the flange should not be recessed into the pipe during installation. The diameter of the sealing gasket should be 1-2mm larger than the inner diameter of the vortex flowmeter measurement pipe.

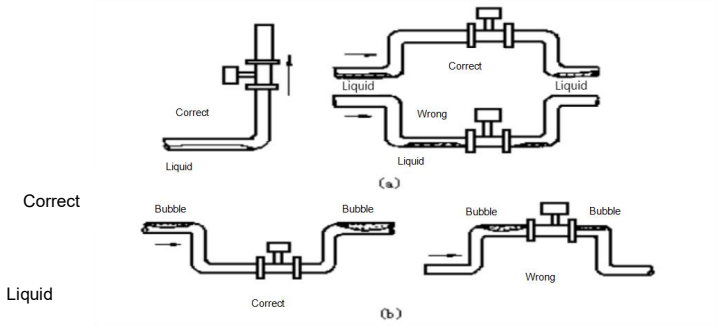
(4) Installation position of pressure and temperature measuring holes

When temperature and pressure transmitters need to be installed in the tested pipeline, the pressure measuring hole should be set at 3-5 D downstream of the vortex flowmeter. The temperature measurement hole should be set at 6-8D downstream of the vortex flowmeter.

Installation position of vortex flowmeter on pipeline

① When measuring gas, install a vortex flowmeter in a vertical pipeline, with unlimited gas flow direction. But if the pipeline contains a small amount of liquid, in order to prevent the liquid from entering the vortex flowmeter measurement tube, the airflow should flow from bottom to top, as shown in Figure a.

② When measuring liquid, in order to ensure that the pipe is filled with liquid, a vortex flowmeter should be installed in a vertical or inclined pipeline, ensuring that the liquid flow direction is from bottom to top. If the pipeline contains a small amount of gas, in order to prevent gas from entering the vortex flowmeter measurement pipe, the vortex flowmeter should be installed at the lower part of the pipeline as shown in Figure b.



(6) When measuring high-temperature and low-temperature media, attention should be paid to insulation measures. The high temperature inside the converter (inside the meter head housing) affects the performance of circuit components and affects the normal measurement of vortex flow meters; Low temperature can easily cause condensation inside the converter, reduce the insulation impedance of the printed circuit board, and affect the normal operation of the vortex flowmeter.

Selection code

PCL-V10F-M1 T1 DN100 P16 S1 CO1 I1 CG1B1 EX0

Code	Explosion-proof
EX	No explosion-proof
EX	Ex db IIC T6 Gb

Code	Power supply and output signal
CG1	24VDC, pulse output signal (without
CG1	24VDC，4-20mA+pulse (with display)
CG1	24VDC,4-20mA+pulse+RS485 (with
CG2	Battery powered, no output signal (with
CG1	24VDC, 4-20mA+pulse+hart (with display)

Code	Installation method	Code	Installation method
I1	Integrated with display	I2	Integrated without display

Code	Compensation method	Code	Compensation method
CO	No compensation	CO	Single temperature
CO2	Single pressure compensation	CO4	Temperature and pressure compensation

Code	Sensor material	Code	Sensor material
S1	304 stainless steel	S2	316l stainless steel

Code	Rated pressure	Code	Rated pressure
P4	4.0MPa	P1	1.6MPa
P2	2.5MPa		

Code	Measuring pipe diameter
DN	The code meaning of DNxx is that the inner diameter of the measuring pipe

Code	Medium temperature	Code	Medium temperature	Code	Medium temperature
T1	-40℃～80℃	T2	-40℃～250℃	T3	-40℃～350℃

Code	Measurement medium	Code	Measurement medium	Code	Measurement medium
M1	Liquid	M2	Gas	M3	Steam

PCL-V1	Integrated flange clamping vortex flowmeter (piezoelectric type)
PCL-V1	Integral flange mounted vortex flowmeter (piezoelectric type)

Example: PCL-V10J-M1T1DN100P16S1CO1I1CG1B1EX0

Model Description:

PCL-V10J flange clamped vortex flowmeter (piezoelectric type), measuring medium is liquid, medium temperature is -40 ℃~80 ℃, measuring pipe diameter is DN100, rated pressure is 1.6MPa, sensor material is 304 stainless steel, product does not have temperature and pressure compensation, installation method is integrated with display, power supply and output signal are 24VDC and 4-20mA, and there is no explosion-proof requirement.

Selection code

According to statistics from authoritative institutions around the world, two-thirds of instrument failures in practical applications are caused by incorrect selection and installation of instruments. Therefore, the selection of vortex flow meters is a very important work in practical applications. When selecting models, the following factors should be considered:

1. Collect process data
   a. The name of the tested fluid and the composition of the chemical substances contained;
   b. The maximum flow rate, minimum flow rate, and commonly used flow rate of the fluid;
   c. The maximum working pressure of the fluid;
   d. The highest and lowest temperature of the fluid.
2. The maximum and minimum flow rates must comply with the values in the flow rangetable.
3. The actual maximum working pressure must be less than the rated working pressure of the flow meter guide pipe.
4. The maximum and minimum operating temperatures of the fluid must meet the temperature requirements specified by the flowmeter.

Appendix

1. Vortex flow meter liquid and working gas flow range

Table 2 Flow Range of Vortex Flowmeter (Measurable Range)

Pipe diameter mm	Liquid	Gas
	Measuring range m^3/h	Measuring range m^3/h
25	1～12	10～80
32	1.5～23	15～150
40	2.4～32	23～230
50	4.0～50	35～350
65	6.3～84	60～600
80	10～130	90～900
100	20～200	140～1400
125	31～310	220～2200
150	45～450	300～3000
200	80～800	550～5500
250	150～1500	880～8800
300	200～2000	1300～13000

Wotian reserves the right to make any change in this publication without notice. The information provided is believed to be accurate and reliable as of this product sheet.

Contact Us

Nanjing Wotian Technology Co.,Ltd.

Website: www.wtsensor.com

Add: 5 Wenying Road, Binjiang Development Zone, Nanjing, 211161, China

E-mail:dr@wtsensor.com