

# PCL-V10 Integrated Wafer Vortex Flowmeter

## Features:

- Advanced circuit design, the circuit board has both micro-power amplifying board and current output function
- Product measurement range is relatively wide
- Output 4mA ~ 20mA two-wire current signal corresponding to flow
- Simultaneous display of cumulative flow and instantaneous flow
- With five-segment nonlinear correction, small signal cut-off, free setting of damping time
- All-purpose design, small overall size and compact structure. Suitable for flow measurement of liquid and gaseous media of different calibers
- New digital filtering and correction functions make flow measurement more accurate and reliable
- Advanced humanized design, easy to use

## Application and industry:

■ Petroleum, chemical industry, metallurgy, heating, textile, papermaking and other industries are suitable for superheated steam, saturated steam, compressed air and general gases (oxygen, nitrogen, hydrogen, natural gas, coal gas, etc.), water and liquids (such as water, gasoline, alcohol, etc.) , benzene, etc.) measurement and control.



## Product overviews:

PCL-V10 series integrated wafer vortex flowmeter is a fully intelligent flowmeter developed by combining domestic and foreign advanced technologies. It has the characteristics of simple structure, low power consumption, small resistance loss, stable operation, long service life and easy installation. . PCL-V10 series integrated wafer vortex flowmeter pays attention to every link in the process of design, material selection, process manufacturing, production assembly and factory testing; product output forms are various, including standard analog signal and standard digital signal output , which is convenient to be used with digital systems such as computers and secondary instruments, and realizes the product's intelligence, standardization and generalization.

## Measurement principle:

Vortex flowmeter is based on the principle of Karman vortex street. It is a vibrating flow meter. It uses the vibration frequency of the fluid to be proportional to the fluid flow rate and realizes the flow measurement by measuring the frequency generated by the vortex. The Karman vortex phenomenon is shown in the figure below. When the fluid passes through the measuring device of the vortex flowmeter in the pipeline, two rows of vortices proportional to the flow rate are alternately generated after the

**Notes**

- 1 file do not misuse.
- 2 The information in this selection is for reference only, and this document cannot be used as a product installation guide.
- 3 Complete installation, operation and maintenance information is provided in the product manual

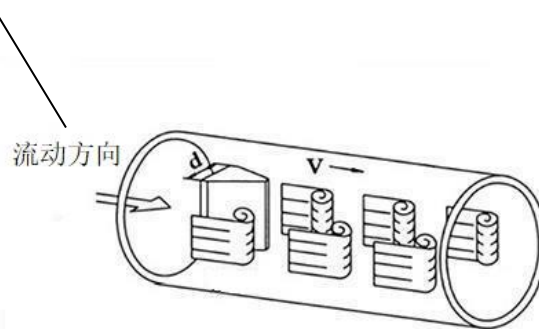
vortex generator. The characteristic width  $d$  of the vortex generator is related, and its relationship can be expressed as:

$$f = S_r \frac{v}{md}$$

(1) Among them,  $S_r$  is the Strouhal number, and  $m$  is the ratio of the flow area on both sides of the vortex generator to the cross-sectional area of the pipe.

The average velocity of the fluid in the pipeline can be calculated by measuring the frequency of vortex occurrence, and then the flow rate  $Q_v$  can be obtained by  $Q_v = SV$ , where  $S$  is the cross-sectional area of the pipeline.

Flow direction



**Performance parameters**

Accuracy	Liquid: $\pm 1.0\%$
	Gas: $\pm 1.5\%$
Pipe diameter	DN15~DN300
Preset 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: can be customized
medium temperature	normal temperature: $-40^{\circ}\text{C} \sim 80^{\circ}\text{C}$
	medium temperature: $-40^{\circ}\text{C} \sim 250^{\circ}\text{C}$
	high temperature: $-40^{\circ}\text{C} \sim 350^{\circ}\text{C}$
Body material	Stainless Steel 304 (conventional)
Turndown ratio	1:10(theoretical value)
Velocity range	Liquid (water): 0.7m/s~7m/s
	Gas: 5m/s~70m/s
	Steam: 4m/s~70m/s
Reynolds number	$1.5 \times 10^4 \sim 4 \times 10^6$
Resistance coefficient	$C_d \leq 2.4$

Power output (without temperature and pressure compensation)	24V DC: 4~20mA、4~20mA+pulse、4~20mA+pulse +RS485
	3.6V lithium battery power supply: RS485, RS485+pulse
Power output (With temperature and pressure compensation)	24V DC power supply: 4~20mA+ pulse
	3.6VLithium battery power supply: RS485+pulse, RS485+pulse+current (three-wire system)
Protection class	IP65
Ambient temperature	Non-explosion-proof place: -40℃~55℃; Explosion-proof place: -20℃~55℃

### Dimensions

External structure	Dimensions	Unit: mm
PCL-V10 Wafer Vortex Flowmeter		

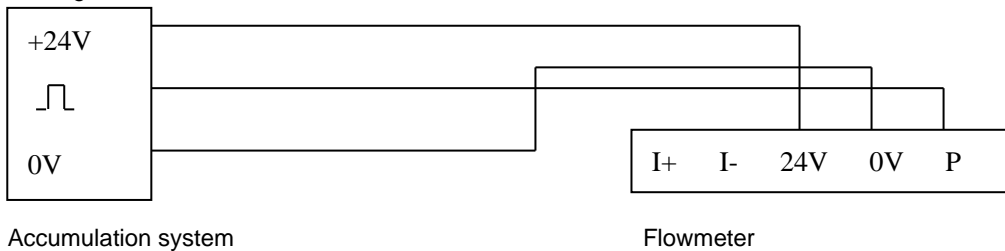
In the above figure, A represents the length of the measuring tube of the flowmeter; B represents the diameter of the flowmeter interface; C represents the length between the top of the meter and the bottom of the pipe interface. The dimensions of the flange- clamped vortex flowmeter are shown in Table 1 below.

Table 1 Dimensions of flange- clamped vortex flowmeter

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

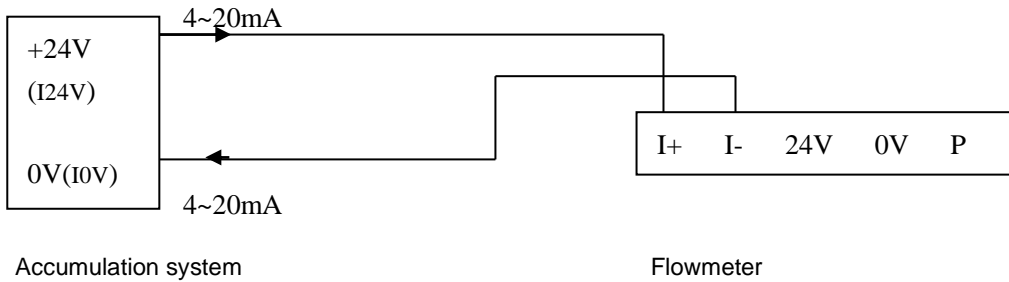
1. Wiring of the three-wire vortex flowmeter that outputs the frequency signal

The three-wire vortex flowmeter that outputs the frequency signal adopts DC24V or DC12V power supply, and is generally connected to the display instrument or computer through a three-core shielded cable, and the shielding layer should be connected reliably. onto the ground screw on the amplifier case. The selection of shielded cables should be suitable for the requirements of the on-site environment. In addition, the shielded cables should be separated from other high-power power lines and cannot be routed in parallel. The flowmeter terminal wiring is shown in the figure below.



2. Wiring of two-wire vortex flowmeter outputting standard 4-20mA current signal

The two-wire vortex flowmeter that outputs a standard 4-20mA current signal is powered by a DC24V power supply. Generally, it is connected to a display instrument or a 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 requirements of the on-site environment. In addition, the shielded cables should be separated from other high-power power lines and cannot be routed in parallel. The flowmeter terminal wiring is shown in the figure below.

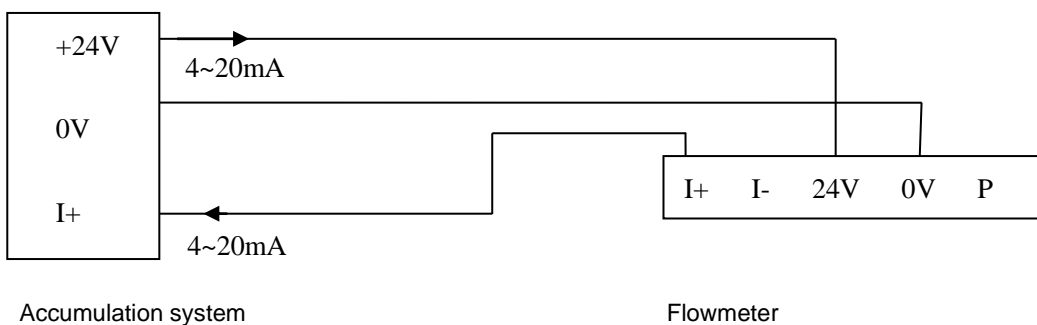


Note:

- ① Correspondence between the terminals of the battery-powered model and the battery-free model:  
I24V(A) → I+ ; I0V(B) → I- ; Fout → P
- ② Unscrew the back cover when the meter is powered, and turn the battery switch to the "on" state

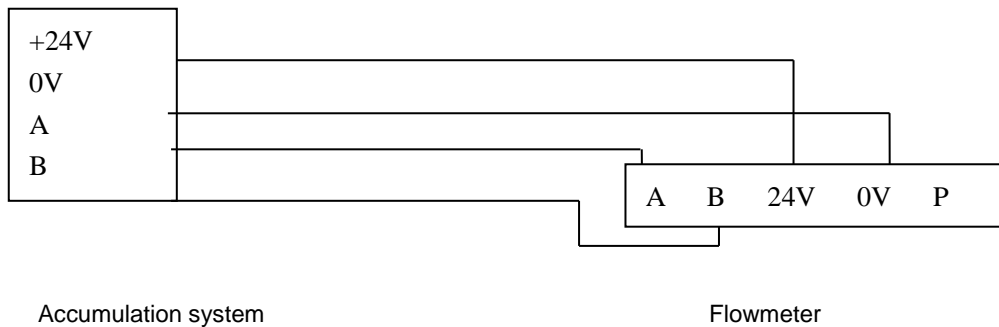
3. Wiring of three-wire vortex flowmeter outputting standard 4-20mA current signal

The wiring of the three-wire vortex flowmeter that outputs standard 4-20mA current signal is shown in the figure below.



#### 4、Wiring of Vortex Flowmeter with RS485 Communication Interface

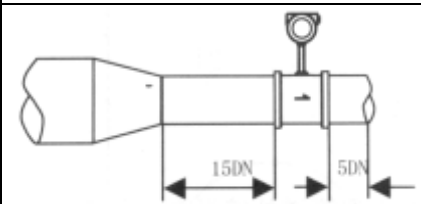
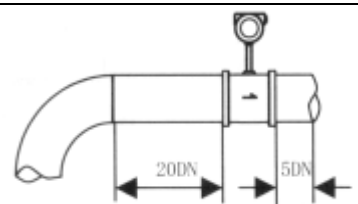
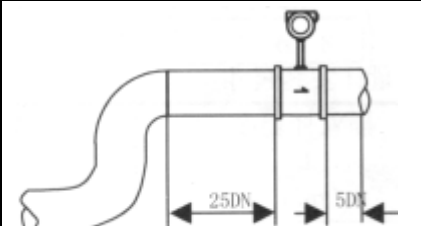
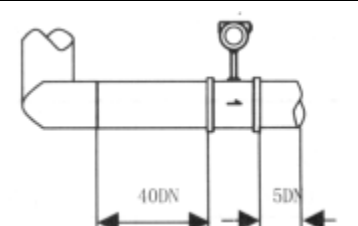
Vortex flowmeter with RS485 communication function adopts DC24V power supply, and adopts four-wire transmission mode with other equipment. The wiring of the instrument terminals is shown in the figure below.

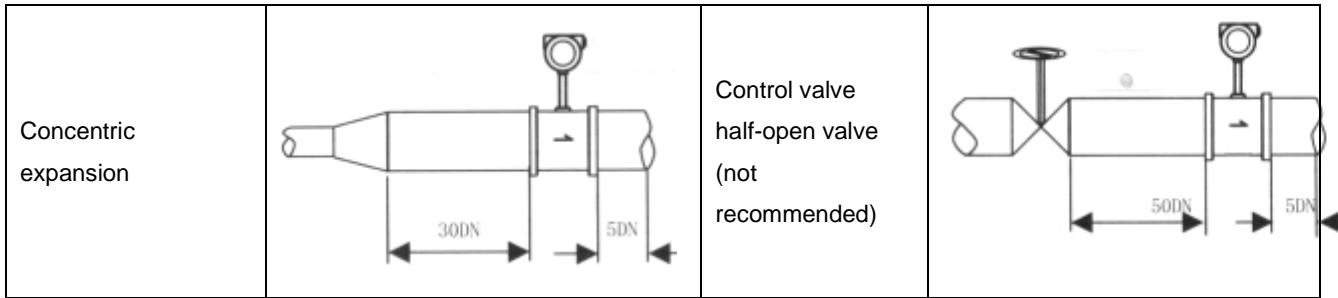


### Installation

1. Precautions for installation (1) Avoid strong electrical equipment, high frequency equipment and strong switching power supply equipment as much as possible. The power supply for the instrument is separated from these devices as much as possible. (2) Avoid the direct influence of high temperature heat sources and radiation sources. If it must be installed, heat insulation and ventilation measures must be provided. (3) Avoid high humidity environment and strong corrosive gas environment. If it must be installed, there must be ventilation measures. (4) The vortex flow meter should be installed on the pipeline with strong vibration as far as possible. If it must be installed, pipe fastening devices must be installed at 2D upstream and downstream, and anti-vibration pads must be added to enhance the anti-vibration effect. (5) It is best to install the instrument indoors, and pay attention to waterproofing when installing it outdoors. Special attention should be paid to bending the cable into a U shape at the electrical interface to prevent water from entering the amplifier housing along the cable. (6) Ample space should be reserved around the installation point of the instrument for wiring installation and regular maintenance. 2. Installation requirements for instrument pipelines (1) Requirements for straight pipe sections

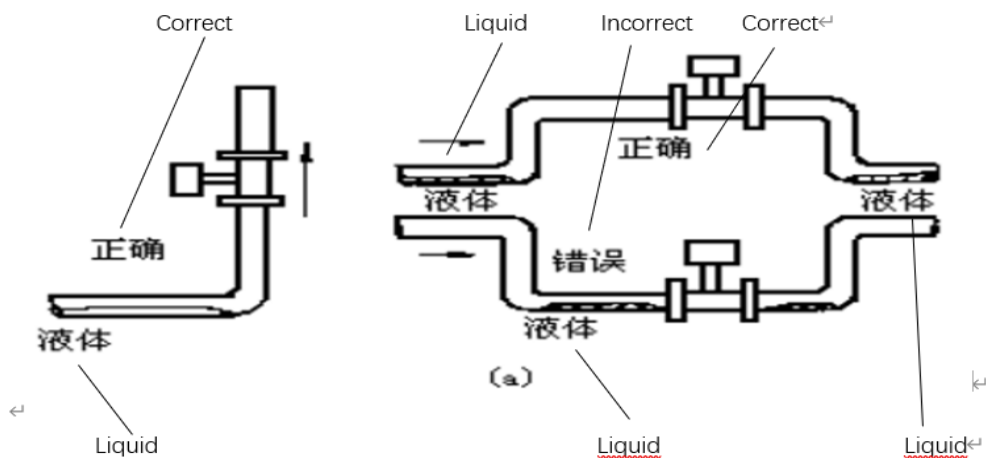
The vortex flowmeter has certain requirements on the upstream and downstream straight pipe sections of the installation point, otherwise it will affect the flow field of the medium in the pipeline and affect the measurement accuracy of the flowmeter. The length requirements of the upstream and downstream straight pipe sections of the flowmeter are as follows.

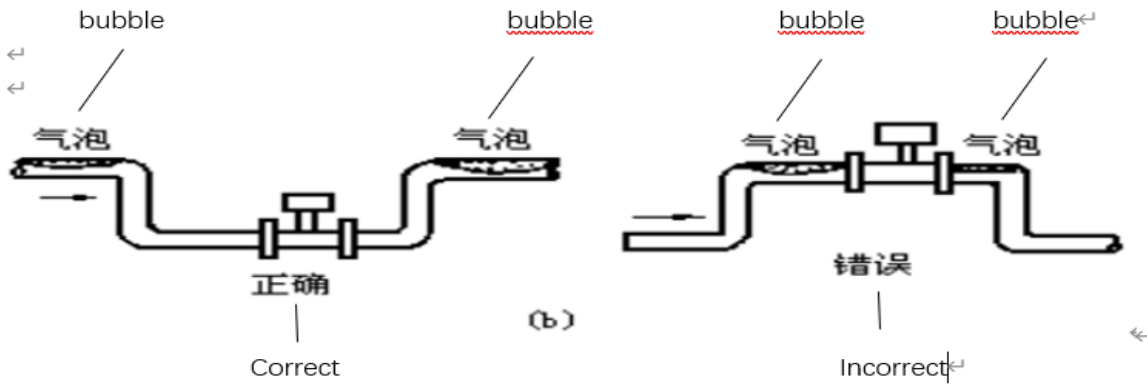
Sensor upstream pipeline form	Front and rear straight pipe length	Sensor upstream piping type	Front and rear straight pipe length
Concentric contraction full open valve		A 90 degree elbow	
Two 90 degree elbows on the same plane		Two 90 degree elbows on different planes	



Note:

- ① DN is the nominal diameter of the instrument, the unit is mm;
- ② The regulating valve should not be installed upstream of the vortex flowmeter as much as possible, but should be installed at 10D downstream of the vortex flowmeter, D is the inner diameter of the measuring pipe by the flowmeter.
- (2) Inner diameter of upstream and downstream piping The inner diameter of upstream and downstream piping should be the same. If there is a difference, the inner diameter  $D_P$  of the piping and the inner diameter  $D_b$  of the measuring tube of the vortex flowmeter should satisfy 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 measuring tube of the vortex flowmeter, and the difference between them Concentricity should be less than  $0.05D_b$ .
- (3) Gasket The gasket between the vortex flowmeter and the flange should not be recessed into the pipe during installation, and the diameter of the gasket should be 1-2mm larger than the inner diameter of the measuring pipe of the vortex flowmeter.
- (4) Installation position of pressure measuring hole and temperature measuring hole When the pipeline under test needs to be installed with temperature and pressure transmitter, the pressure measuring hole should be set at 3-5D downstream of the vortex flowmeter. The temperature measuring hole should be set at 6-8D downstream of the vortex flowmeter.
- (5) Installation position of the vortex flowmeter on the pipeline
  - ① When measuring gas, install the vortex flowmeter in the vertical pipeline, and the gas flow direction is not limited. However, if the pipe contains a small amount of liquid, in order to prevent the liquid from entering the measuring tube of the vortex flowmeter, the airflow should flow from bottom to top, as shown in Figure a below.
  - ② When measuring liquid, in order to ensure that the pipe is filled with liquid, when installing a vortex flowmeter in a vertical or inclined pipe, the flow direction of the liquid should be from bottom to top. If the pipeline contains a small amount of gas, in order to prevent the gas from entering the measuring tube of the vortex flowmeter, the vortex flowmeter should be installed at the lower part of the pipeline, as shown in Figure b below.





(6) When measuring high temperature and low temperature medium, attention should be paid to heat preservation measures. The high temperature inside the converter (in the case of the meter head) affects the performance of the circuit components and the normal measurement of the vortex flowmeter; the low temperature is easy to cause condensation inside the converter, which reduces the insulation resistance of the printed circuit board and affects the vortex flowmeter. normal work.

### How to order

PCL-V10- M1 T1 DN100 P16 CO1 I1 CG1B1 EX0

PCL-V10	code	Explosion-proof					
		EX0	No explosion proof				
		EX1	flameproof				
	Code	Power supply and output (without compensation)		Code	Power supply and output(with compensation)		
	CG1B1	24VDC, 4~20mA		DG1B9	24VDC, 4~20mA+ pulse		
	CG1B9	24VDC, 4~20mA+ pulse		DG2B12	3.6V lithium battery, RS485+pulse		
	CG1B10	24VDC, 4~20mA+ pulse +RS485		DG2B13	3.6V lithium battery power supply		
	CG2B11	3.6V lithium battery, RS485			RS485+ pulse + current (three-wire system)		
	CG2B12	3.6V lithium battery, RS485+					
	Code	Installation method		Code	Installation method		
	I1	all-in-one with display		I2	All-in-one without display		
	Code	Compensation method			Code	Compensation method	
	CO1	No compensation			CO3	Single temperature compensation	
	CO2	Single pressure compensation			CO4	Temperature and pressure compensation	
	Code	preset pressure			Code	preset pressure	
P40	4.0MPa			P16	1.6MPa		
P25	2.5MPa						
Code	Measuring pipe diameter						
DNxx	The code of DNxx means that the inner diameter of the measuring tube is xx						
Code	medium temperature		Code	medium temperature			
T1	-40℃~80℃		T2	-40℃~250℃			
			T3	-40℃~350℃			
Code	Measuring medium		Code	Measuring medium			
M1	Liquid		M2	Gas			
			M3	Steam			
PCL-V10	Integrated flange- clamped vortex flowmeter (piezoelectric)						



Selection example: PCL-V10-M1T1DN100P16CO111CG1B1EX0

Model Description:

PCL-V10 integrated flange clamped vortex flowmeter (piezoelectric), the measuring medium is liquid, the medium temperature is -40°C~80°C, the measuring pipe diameter is DN100, the rated pressure is 1.6MPa, the product does not have Temperature and pressure compensation, the installation method is integrated with display, the power supply and output are 24VDC and 4 ~ 20mA, no explosion-proof requirements.

Ordering Tips

According to the statistics of the world's authoritative organizations, two-thirds of the failures of the instrument in practical applications are caused by the wrong selection and incorrect installation of the instrument. Therefore, the selection of the vortex flowmeter 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 fluid to be tested, and the composition of the chemical substances contained;
  - b. The maximum flow, minimum flow and common flow of the fluid;
  - c. The highest working pressure of the fluid;
  - d. The maximum temperature and minimum temperature of the fluid.
2. The maximum flow and minimum flow must conform to the values in the flow range table.
3. The actual maximum working pressure must be less than the rated working pressure of the flowmeter diversion

pipe.

4. The maximum working temperature and minimum working temperature of the fluid must meet the temperature requirements specified by the flowmeter.

Appendix:

1、Vortex flowmeter flow range

Table 2 Vortex flowmeter flow range table (measurable range)

Pipe diameter mm	liquid	gas (steam)
	Measuring range m3/h	Measuring range m3/h
15	0.3~3	2.8~12
20	1~7	6~30
25	1.6~10	9~55
32	2.1~15	18~130
40	2.5~25	22~200
50	3.5~35	36~320
65	6.5~68	50~480
80	10~100	75~628
100	15~150	130~1100
125	27~275	200~1700
150	40~350	280~2240
200	80~650	580~4200
250	120~950	970~5500
300	180~1800	1460~8000

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