

## PCL-T10 liquid turbine flowmeter

### Features:

- High precision, generally up to  $\pm 0.5\%R$ ,  $\pm 1.0\%R$  (R refers to reading error)
- Good repeatability, short-term repeatability can reach 0.05% ~ 0.2%. High accuracy can be obtained with frequent calibration or online calibration.
- Output pulse frequency signal and 4-20mA current signal, suitable for total measurement and connection with computer. No zero drift and strong anti-interference ability.
- Original pulse frequency range (10.0Hz~1.5kHz), strong signal resolution.
- Wide turndown ratio, generally 1:10, up to 1:15
- Compact structure, intuitive and clear reading, high reliability, and no interference from external power supply.
- Strong anti-electromagnetic interference and anti-vibration ability.
- Small pressure loss, saving power consumption.

### Applications and industries:

- Petroleum, chemical, metallurgy, heating, textile, paper, food, pharmaceutical and other industries.



### Product overviews:

PCL-T10 series liquid turbine flowmeter is based on the principle of torque balance. It is a velocity flow meter with high accuracy, convenient installation and maintenance, strong adaptability, good repeatability, no zero drift, high turndown ratio, and digital signal output. PCL-T10 series liquid turbine flowmeter has built-in high-quality bearings and specially designed guide vanes, which greatly reduces wear and is not sensitive to peak values. It can give reliable measurement variables even under harsh conditions. The output signal is Pulse, easy to digitize. PCL-T10 series liquid turbine flowmeter has small pressure loss and anti-corrosion vanes (dual-phase steel), which are suitable for measuring low-viscosity and low-corrosive liquid media.

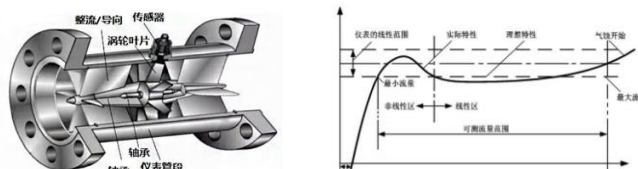
### Measurement principle:

When the fluid to be measured passes through the turbine flowmeter, the fluid impacts the impeller blades. Because there is a certain oblique angle between the impeller blades and the flow direction of the fluid, the impact force of the fluid produces a rotational torque on the impeller, so that the impeller rotates against the mechanical frictional resistance torque and the fluid resistance torque. The rotation speed is approximately proportional to the volume flow of the fluid being measured. Since the blade is in the magnetic field of the signal detector, when the turbine rotates, the rotating blade continuously cuts the magnetic field lines, periodically changing the magnetic flux of the coil, and generating a pulse frequency signal  $f$  proportional to the flow rate.

**Notes:**

- 1 Do not misuse the file.
- 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.

After the pulse signal is amplified, filtered and shaped, the volume flow  $Q_v$  is finally obtained through correlation calculation.  $Q_v = fK$ , where  $K$  is the meter factor. Figure 1 shows the structure of the turbine sensor.

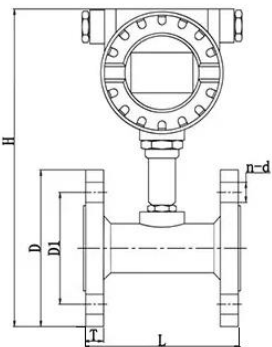


1 Turbine flowmeter structure    2 Turbine flowmeter characteristic curve

The relationship curve between the meter coefficient of the turbine flowmeter and the flow (or Reynolds number) is shown in Figure 2. It can be seen from the figure that the instrument coefficient is divided into two sections, namely the linear section and the nonlinear section. The linear segment is about two-thirds of its working segment, and its characteristics are related to the sensor structure size and fluid viscosity. The nonlinear segment characteristics are greatly affected by bearing friction and fluid viscous resistance. When the flow is below the lower limit of the sensor flow, the meter coefficient changes rapidly with the flow. When the flow exceeds the upper limit of flow, pay attention to prevent cavitation.

Performance parameters			
Measured medium	No impurities, low viscosity, no strong corrosive liquid		
Accuracy	±1%R (default), ±0.5%R (optional)		
Repeatability	±0.15%R		
Turndown ratio	1:10		
Pipe diameter Rated pressure	Connection method	Caliber range	Conventional withstand voltage level
	Flange	DN15~DN50	4.0MPa
		DN65~DN100 DN125~DN200	1.6MPa 1.6MPa
Calibration conditions	Calibration device	Standard table method liquid flow calibration device, static mass method liquid flow calibration device	
	Calibration environment	ambient temperature	25℃±5℃
		Relative humidity	65%±5%
Body material	SS304(conventional)		
Medium temperature	-20℃~80℃(default), -20℃~120℃(Customized)		
Protection	IP65		
Ambient temperature	-20℃~60℃		
Relative humidity	5%~90%		

## Dimensions

external structure	Dimensions	unit: mm
<b>PCL-T10 flange connection type liquid turbine flowmeter</b>		

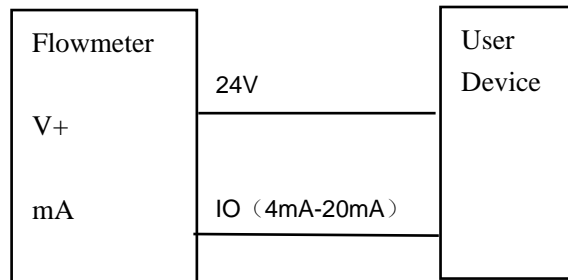
In the above figure, L represents the length of the measuring tube of the flowmeter; D1 represents the center distance between the bolt holes; D represents the flange diameter; T represents the flange thickness; n represents the number of bolt holes; d represents the diameter of the bolt; H represents the length between the top of the meter and the bottom of the pipe interface. The external dimension table of PCL-T10 liquid turbine flowmeter flange connection type is shown in Table 1 below.

**Table 1 Outline dimension table of flange connection type liquid turbine flowmeter**

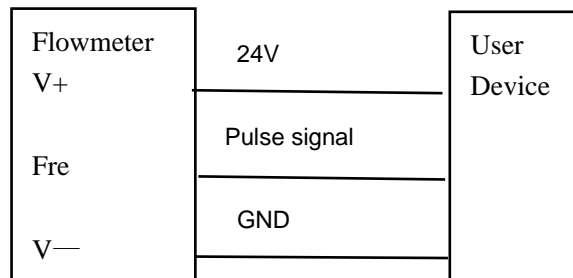
DN	preset pressure (MPa)	Dimensions (mm)		Flange connection size (mm)			
		L	H	D	D1	n-d	T
15	4.0	75	260	95	65	4-14	14
20		90	265	105	75	4-14	16
25		100	270	115	85	4-14	16
32		140	285	140	100	4-18	18
40		140	295	150	110	4-18	18
50		150	310	165	125	4-18	20
65	1.6	180	325	185	145	4-18	20
80		200	340	200	160	8-18	20
100		220	360	220	180	8-18	22
125		250	390	250	210	8-18	22
150		300	420	285	240	8-22	24
200		360	470	340	295	12-22	26

## Electrical connection

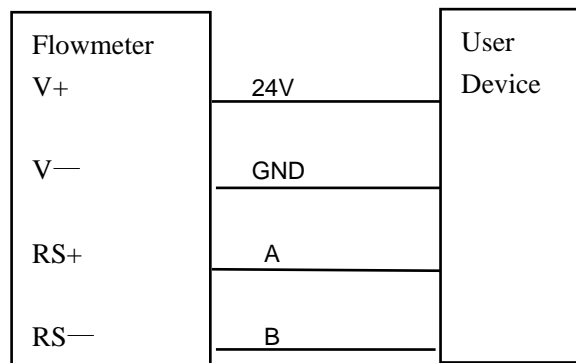
1、 The output signal is 4~20mA, turbine flowmeter wiring



2、 The output signal is the pulse signal, turbine flowmeter wiring



3、 The output signal is 4~20mA+RS485, turbine flowmeter wiring



## Installation

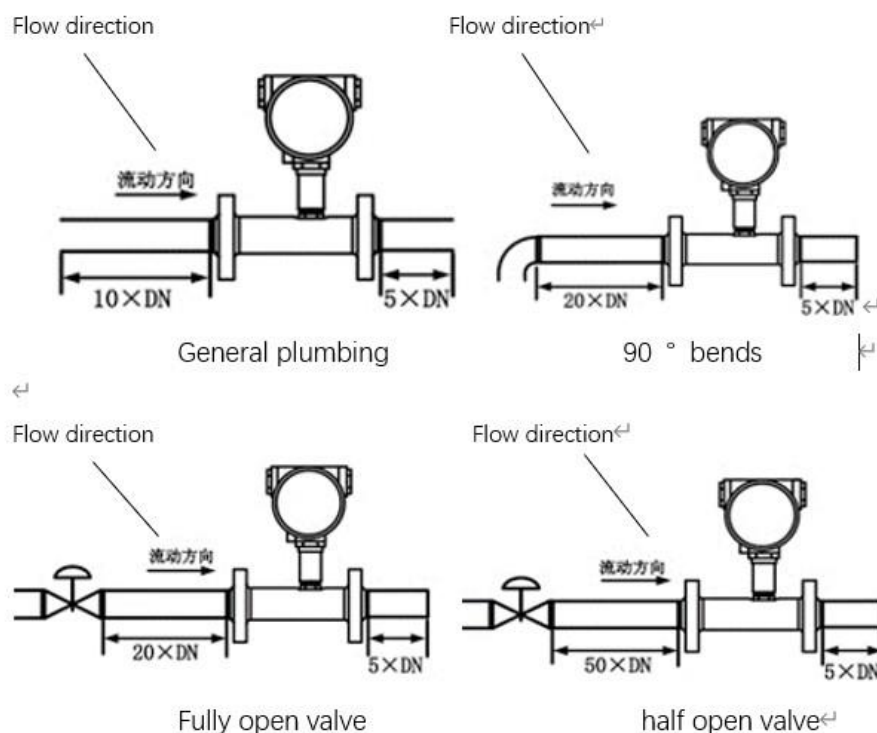
1. Precautions for installation

- (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 turbine 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 the upstream and downstream 5DN, 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 installed 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 Turbine flowmeters have 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 of the upstream and downstream straight pipe sections of the turbine flowmeter are as shown in the figure below.



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 turbine flowmeter as much as possible, but should be installed  $5DN$  downstream of the turbine 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 turbine 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 turbine flowmeter measuring pipe, and the misalignment between them should be less than  $0.05D_b$ .

### (3) The installation position of the turbine flowmeter on the pipeline

① Ensure that the tube is full.

In order to ensure that the pipe is filled with liquid, when installing a turbine flowmeter in a vertical or inclined pipe, the direction of liquid flow should be from bottom to top, as shown in Figure a below.

② Avoid air bubbles.

If the pipeline contains a small amount of gas, in order to prevent the gas from entering the measuring tube of the turbine flowmeter, the turbine flowmeter should be installed at the lower part of the pipeline, as shown in Figure b below.

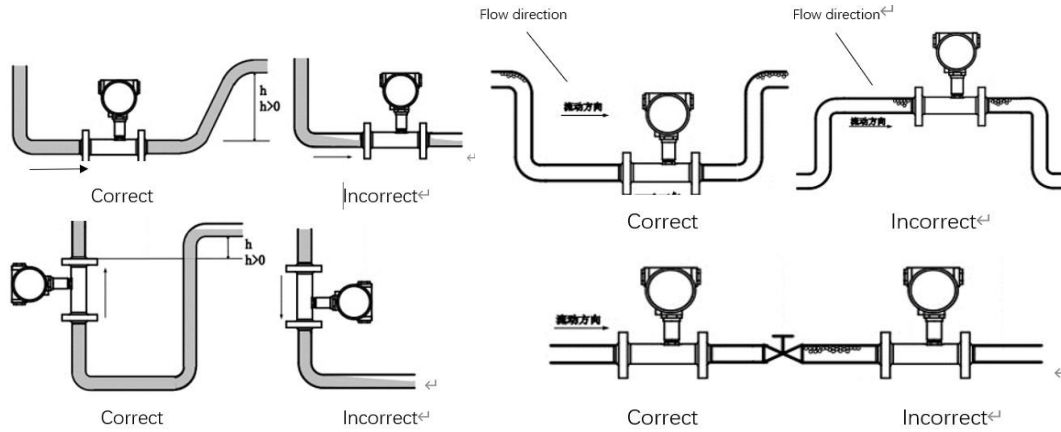


Figure a

Figure b

(4) When the ambient temperature involves high temperature and low temperature, attention should be paid to thermal insulation measures.

The high temperature inside the converter (in the meter housing) affects the performance of the circuit components and the normal measurement of the turbine 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 normal operation of the turbine flowmeter.

### How to order

PCL-T10- T1 DN100 P16 J8X V1B14 EX0

Code	Explosion-proof	Code	Power and output	Code	Power and output
EX0	No explosion proof	V1B14	24VDC, pulse +4~20mA	V5B16	3.6V lithium battery, no output
		V1B15	24VDC, pulse+RS485		
Code	Installation method				
J8X	all-in-one with display				
Code	preset pressure	Code	preset pressure		
P40	4.0MPa, DN15~DN50	P16	1.6MPa, DN65~DN200		
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	-20℃~80℃	T2	-20℃~120℃		
PCL-T10	Flanged Liquid Turbine Flowmeter				

Selection example: PCL-T10-T1DN100P16J8XV1B14EX0

Model Description:

PCL-T10 integrated liquid turbine flowmeter with display type flange connection, the medium temperature is -20℃~80℃, the measuring pipe diameter is DN100, the rated pressure is 1.6MPa, the installation method is integrated type with display, the power supply and output are 24VDC and pulse +4~20mA, no explosion-proof requirement.

According to the statistics of the world authoritative organization, 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 liquid turbine flowmeters 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. Turbine flowmeter caliber flow comparison table

Table 2 Turbine flowmeter bore flow comparison table

Pipe diameter mm	normal measurement range m <sup>3</sup> /h	Extended flow range m <sup>3</sup> /h	pressure loss MPa
15	0.6~6	0.4~8	0.035
20	0.8~8	0.45~9	
25	1~10	0.5~10	
32	1.5~15	0.8~15	0.025
40	2~20	1~20	
50	4~40	2~40	
65	7~70	4~70	
80	10~100	5~100	
100	20~200	10~200	
125	25~250	13~250	
150	30~300	15~300	
200	80~800	40~800	

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