



## FM11

### Vortex flow meter

Vortex flowmeter to measure liquid, gas or steam volume flow, standard condition volume flow or mass flow based on the principle of Karman vortex street, and as a flow transmitter application automation and control systems.

Our vortex flow meter uses advanced differential technology, with isolation, shielding, filtering and other measures, we overcome the shock of similar products is poor, small- signal data disorders and other problems, and uses a unique sensor packaging technology and protective measures, ensure the reliability of the product. Each form has a whole sub- structure, according to the measurement of different diameters, there are pipeline, two plug-in installation, to adapt to different installation environment.

The instrument can be widely used in large, medium and small variety of pipes and drainage, metering industrial recycling, waste water treatment, oil and chemical reagents as well as compressed air, saturated and superheated steam, gas and a variety of media traffic.

#### Product series



## FM11 Vortex Flow meter Measuring Principle

Vortex Street Flow Indicator is to measure flow rate through using Karman vortex street principle. When inserting vertically a column into the measuring tube, fluid flows through both sides of column to naturally and alternately produce regular swirl ( shown in the following figure ) , this swirl is called Karman vortex street. When  $d/D=0.281$ , the releasing swirl is the most stable. ( D is tube diameter ) The releasing frequency of Karman vortex street is relating with fluid rate of flow and the width of the column. Representing in the formula below:

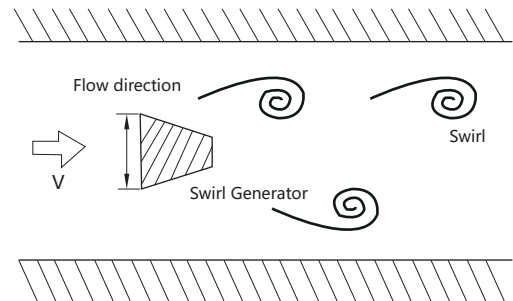
$$f = St \cdot v / d$$

f-releasing frequency of Karman vortex

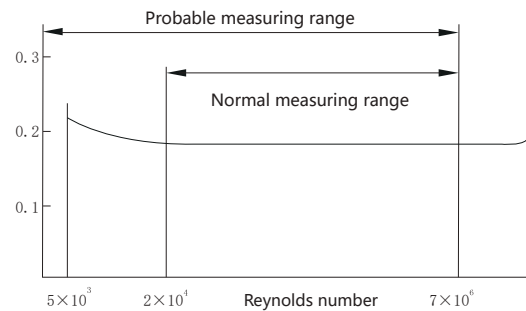
St-coefficient ( called Strouhal Number)

v-flow rate

d-column width



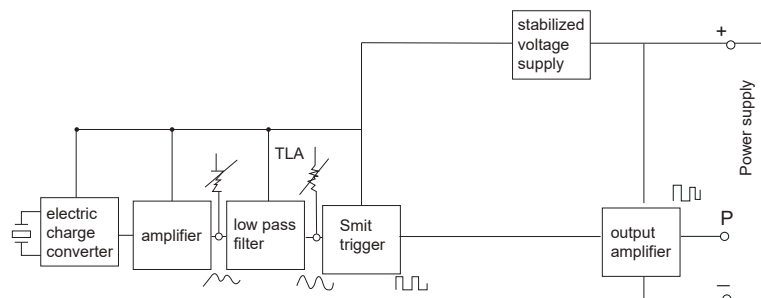
Strouhal number is an important coefficient of Vortex flow meter, in certain Reynolds number range, Strouhal number is nearly constant. As the Dia at the right side, in the plain part of curve  $St=0.17$ , the releasing frequency is direct proportion to flow rate. From the measuring frequency f we can get flow rate v, and through v we get volume flow rate. FM11 Series Vortex flow meter is one kind of strain type of Vortex Street Flow Indicator, the swirl releasing frequency of the sensor is measured through detecting the piezoelectric element inside of sensor(probe).



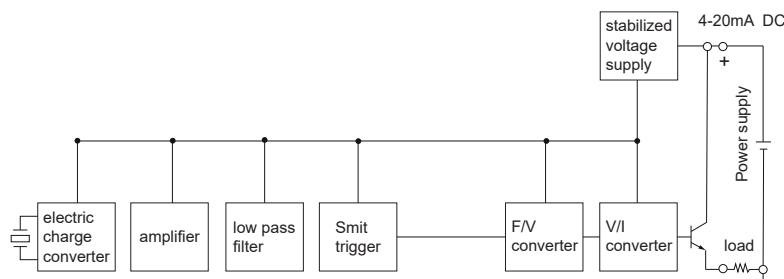
## Convertor Circuits

Convertor process the enlargement, wave filter, shaping of the weak signal ( mussy sine wave ) which is detected by detecting components, output pulse signal which is direct proportion to flow rate or transfer to standard 4-20mA signal. The convert circuit of FM11 Series Vortex Flow meter is shown in figure 1, figure 2.

A circuit block diagram(pulse output):



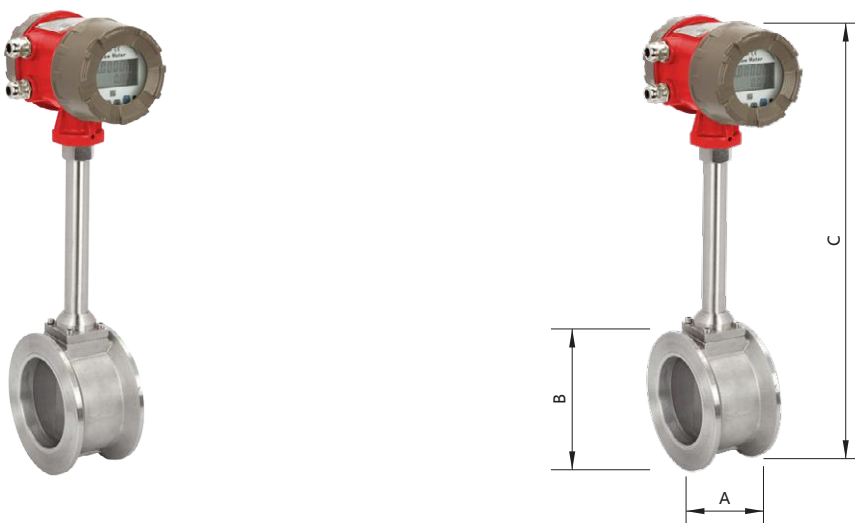
A circuit block diagram(Analog output):



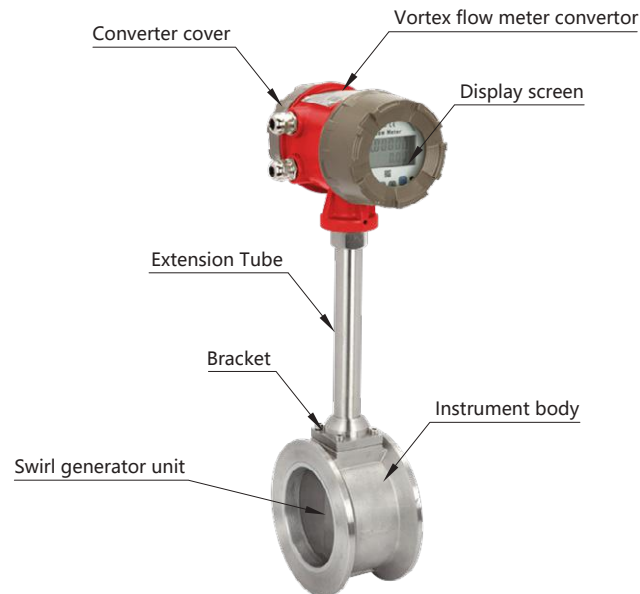
## FM11 Vortex flow meter technical parameter

1. No moving parts, simple structure, easy to install and maintain.
2. Sensor outputs a pulse signal, the actual frequency and the measured fluid flow is linear, zero drift, performance is very stable, institutional forms, there are pipes, plug-flow sensor form.
3. High precision, normally, it is  $\pm 1.0\%$  for liquid,  $\pm 1.5\%$  for gas measuring.
4. A wide range of measurement range, in the range of Reynolds numbers within  $2 \times 10^{44} \sim 7 \times 10^6$ , up to 1:20, plug-turndown ratio of up to 1:25.
5. Pressure loss is small (about orifice flow meter 1/4 to 1/2), are energy-saving flow meter.
6. Using interference cancellation circuit and vibration sensor head, with a certain resistance to environmental vibration performance.
7. Ultra-low-power micro-processing technology, a lithium battery can use more than one year 3.6V10AH.
8. There are software instrument coefficient nonlinear correction, improve the measurement accuracy.
9. Cumulative traffic using EEPROM power-down protection, protection longer than 10 years
10. Plug-in vortex flow meter can measure media temperatures up to 250°C degrees Celsius.

## FM11 Vortex flow meter dimension drawing



## Vortex Flow meter Constitution



## Vortex flow meter technical parameters

Fluid Measured	Saturated vapour, steam-gas, general gas, liquid ( avoid multiphase flow )
Measuring Precision	Liquid: 1.0; gas: 1.5
Repetitiveness	Liquid: 0.3%; gas: 0.5%
Measuring Range	Gas: 7m/s ~ 40m/s; Liquid: 0.7m/s ~ 7m/s
Working Pressure	Standard is 1.6Mpa, 2.5-4.0 Mpa, customized
Fluid Temperature	-40°C ~ 250°C ( normal type ) ; 100°C ~ 350°C ( high temperature type )
Housing Material	Stainless steel 304
Output Signal	Pulse signal ( three-wire system, low electrical level $\leq 1V$ , high electrical level $\geq 4V$ ) ; 4-20mA ; RS485 interface
Power Supply	24VDC(or 12VDC) , lithium battery
Ambient temperature	-35°C ~ 60°C ( without LCD ) ; -5°C ~ 60°C ( with LCD )
Relative humidity	5 ~ 95%
IP grade	IP65
Electrical connection	M20×1.5 (With cable clamping nut assemblies)
Explosion proof type	Non-explosion proof, explosion proof optional

## Selection table

## Vortex flow meter

	<b>A: Clamping Type; B: Flange connection type</b>											
	<b>A: Liquid; B: Gas; C: Steam</b>											
	** eg. 80 means DN80											
	<b>A: Double power supply(24VDC/12VDC, 3.6V Li battery); B: 3.6V Li battery; C: 24VDC/12VDC</b>											
	<b>A: With digital display housing; B: Without</b>											
	<b>A: Without output; B: Pulse output; C: 4-20mA; D: RS485</b>											
	<b>A: 304; B: 316L; C: Other material</b>											
	<b>A: ≤280°C; B: ≤350°C</b>											
	<b>A: 4.0MPa; B: 2.5MPa; C: 1.6MPa</b>											
	<b>A: IP65</b>											
	<b>A: Non-explosion proof; E: Explosion proof</b>											
Product series	Installation type	Measuring medium	Nominal diameter	Power supply	Housing	Output	Sensor body material	Fluid temperature	Nominal pressure class	IP grade	Ex-proof grade	
FM11	-□	□	□□	□	□	□	□	□	□	□	□	

## Note

- Vortex Flow meter is one kind of speed type of flow indicator, the stability of swirl separating is influenced by flow rate, therefore, when installing Vortex Street Flow meter we must allocate enough straight-pipeline-section at upstream and downstream for shaping the flow pattern ;
- Vortex Street Flow Indicator is not suitable for measuring flow of too low reynolds number. Generally reynolds number required is above  $2 \times 10^5$
- When swirl generating, the partial pressure inside of the tube decreases obviously, when measuring liquid, the partial pressure down to the saturated vapor pressure whi liquid temperature corresponding to, it will conduct cavitation phenomenon, and bring damage on piezoelectric element or make the machine not working in normal state, thus when installing or using the Vortex Street Flow Indicator, this point need to be noted.
- To corretly choose Vortex Street Flow Indicator type, the following parameter should be known:  
Fluid name, constituent, causticity, abrasiveness etc:
  - Minimum, common, maximum flow rate in working mode;
  - Minimum, common, maximum working pressure;
  - Minimum, common, maximum working temperature;
  - Viscosity in working mode;
  - For gas, we need to know relative humidity of gas;
  - Flow feature in tube: stable flow, changeable flow, pulse flow, liquid-gas flow, gas-solid flow, or liquid-liquid flow etc.;
  - Fluid state: Clean or easy to crystallize, easy to dirty or contain attachments, etc;
  - Installation condition and environment;
  - Explosion-proof or not.