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INNOVATIVE CONTROL

# DATA SHEET


# VORTEX FLOWMETER

## Model: VFM-110

Type : B

The **VFM-110** Vortex Flowmeter is a high-performance instrument designed for accurate measurement of liquids, gases, and steam across a wide range of industrial applications. Operating on the principle of the Von Kármán vortex street, the meter utilizes a bluff body (shedder bar) to generate vortices in the flow stream. The frequency of these vortices is directly proportional to the flow velocity, enabling precise calculation of volumetric and mass flow rates. Its robust construction, high reliability, and minimal maintenance requirements make it suitable for demanding environments such as power generation, petrochemical plants, water treatment facilities, and process industries

Brent Adler®
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Website : www.brentadler.com
Email : info@brentadler.com

Datasheet

## Vortex Flow Meter
## VFM-110

The VFM-110 vortex flow meter is a kind of velocity flow meter, which is designed based on the research and design of the Karman vortex principle. It is mainly used for flow measurement of medium fluid in industrial pipelines, such as gas, steam, or liquid, and other media. Flow control and metering. The VFM-110 vortex flow meter can realize the following functions according to different types: measure the temperature, pressure, instantaneous flow, and cumulative flow of the industrial pipeline medium fluid, and has pulse output, (4~20)mA analog signal output, RS485 communication (Modbus RTU protocol), IoT GPRS and other functions.

### Applications

- Energy industry
- Chemical industry
- Environmental Industry
- Metallurgy
- Textile
- Steel
- Pharmaceutical
- Paper-making

### Features

Vortex Flow Meter

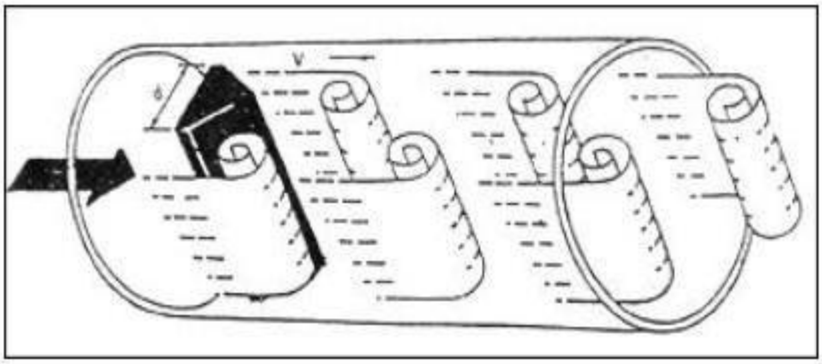
- Ability to measure flow accurately and reliably.
- The main body of the product has no moving parts, high reliability, long-term stability, simple structure and easy maintenance;
- The output of the sensor is pulse frequency, its frequency is linear with the actual flow rate of the measured fluid, the zero point has no drift, and the performance is very stable.
- Various structural forms, including pipeline type, insertion type flow sensor and other forms;
- High accuracy, the measurement accuracy of conventional liquid is ±1.0%; the measurement

accuracy of gas is ±1.5%;

- The pressure loss is small (about 1/4~1/2 of the orifice flow meter), which belongs to the energy-saving flow meter;
- The installation method is flexible, and it can be installed horizontally, vertically or inclined at different angles according to the different process pipelines on site;
- The circuit adopts multiple protection modes, anti-surge and strong adaptability;
- The high-precision probe adopts the piezoelectric wafer vortex sensor, and the signal is stable.

## Principle

The vortex flow meter is a velocity flow meter produced according to the Karman vortex principle, which can be used for the measurement and metering of conventional gases, steam, and liquids. The vortex flow meter has high precision and a wide range ratio, and there are no moving parts in use, which can improve mechanical stability and reduce maintenance. The vortex street is almost not affected by the temperature, pressure, and composition of the medium when measuring the volume of the working condition, so it is convenient for the calibration and production of the instrument, so the vortex flow meter is widely used in production and life.



If a triangular column-type vortex generator is set in the fluid, regular vortices are generated alternately from both sides of the vortex generator. This kind of vortex is called the Karman vortex, and the vortex columns are arranged asymmetrically downstream of the vortex generator. The vortex street is produced according to this principle. The vortex is generated by the generator, and the high-sensitivity sensor detects the number of vortexes. The number of vortexes generated within a certain range is proportional to the flow rate, so the flow rate can be calculated by a precision processor.
In a vortex flow meter, the relationship between the flow rate and the number of vortices generated can be the following formula:

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

Q: The working condition volume flow of the measured medium, the company uses m³/h as the unit.

f: The frequency of the number of vortices generated by the generator, the company uses Hz as the unit.

K: Refers to the calculated or calibrated flow coefficient, which represents how many frequency signals there are per cubic meter. This coefficient is generally obtained by calibration.

Standard table method calibration coefficient K formula:

$$K = \frac{\text{Checkedmeterflow}Q_C}{\text{Standard meter flow}Q_S} \times K_{\text{Coefficient of the checked meter}}$$

(this formula can also be used for flow correction)

## Parameters

| Basic Parameters | |
|---|---|
| Items | Main parameters |
| Nominal diameter (mm) | 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 300-1000 (plug-in) |
| Pressure Resistance | Flange clamp installation:<br>DN15~DN50, pressure 4.0MPa;<br>DN65~DN100, withstand pressure 2.5MPa<br>Above DN125, pressure resistance 1.6MPa<br>Flange connection:<br>DN15~DN50, pressure resistance 2.5MPa;<br>DN65~DN300, withstand pressure 1.6MPa |
| Conditions of Use | Medium temperature:<br>normal temperature type: (-40～100)℃; medium temperature type: (-40～250)℃; high temperature type: (-40～330)℃<br>Ambient temperature: (-20～55)℃<br>Relative humidity: 5% to 90%<br>Atmospheric pressure: (86～106)kPa |
| Material | Body: 304<br>Totalizer housing: Die-cast aluminum |
| Allowable vibration acceleration | Piezoelectric: 0.2g |
| Accuracy | Flow: ±1.0%,±1.5%; plug-in type: ±2.5%R<br>Temperature: ±0.8℃<br>Pressure: ±0.3%FS |
| Turndown ratio | 1:10～1:25 |
| Supply voltage | Sensor: DC +24V<br>Transmitter: DC +24V<br>Battery powered type: 3.6V battery |
| Output signal | Pulse output, (4～20)mA current, RS485Modbus-RTU protocol) |
| Pressure loss coefficient | Conform to JB/T9249 standard Cd≤2.4 |

| | |
|---|---|
| Protection grade | IP65 |
| Electrical Interface | M20*1.5 Cable Gland or NPT1/2 Cable Gland |
| Applicable medium | Gas, liquid, steam |
| Transmission distance | Three-wire pulse output type: ≤300m;<br>Two-wire standard current output type (4～20) mA: ≤1500m, load resistance ≤500Ω;<br>RS485: ≤1200m. |

| Vortex Accuracy Grade | | | | | |
|---|---|---|---|---|---|
| Accuracy grade | | 1 | 1.5 | 2 | 2.5 |
| Maximum influence error | $q_t \le q < q_{max}$ | ±1.0% | ±1.5% | ±2.0% | ±2.5% |
| | $q_{min} \le q < q_t$ | ±2.0% | ±3.0% | ±4.0% | ±5.0% |
| Note: The boundary flow refers to 0.2qmax | | | | | |

Vortex Flow Sensor Operating Condition Flow Reference Range Table Under Reference Conditions

| Size (mm) | Liquid | | Gas | | |
|---|---|---|---|---|---|
| | Measuring range ($m^3/h$) | Output frequency range (Hz) | Measuring range ($m^3/h$) | Output frequency range (Hz) | Expand scope ($m^3/h$) |
| 15 | 0.5~5 | 35~600 | 3~10 | 300~1240 | 3~13 |
| 20 | 0.6~10 | 29~420 | 6~24 | 220~1250 | 6~30 |
| 25 | 1.2~16 | 21~210 | 9~48 | 190~1140 | 8.8~52 |
| 32 | 1.8~20 | 18~264 | 10~100 | 156~1080 | 10~170 |
| 40 | 2~40 | 10~200 | 27~150 | 140~1040 | 27~205 |
| 50 | 3~60 | 8~160 | 40~320 | 94~1020 | 35~380 |
| 65 | 4~85 | 6~120 | 60~480 | 94~910 | 60~700 |
| 80 | 6.5~130 | 4.1~82 | 90~720 | 55~690 | 86~1100 |
| 100 | 15~220 | 4.7~69 | 150~1050 | 42~536 | 133~1700 |
| 125 | 20~350 | 3.2~57 | 200~2200 | 38~475 | 150~2800 |
| 150 | 30~450 | 2.8~43 | 350~2500 | 33~380 | 347~4000 |
| 200 | 45~800 | 2~31 | 600~4000 | 22~315 | 560~8000 |
| 250 | 65~1250 | 1.5~25 | 900~7000 | 18~221 | 890~11000 |
| 300 | 95~2000 | 1.2~24 | 1400~11000 | 16~213 | 1360~18000 |
| (300) | 100~1500 | 5.5~87 | 1560~15600 | 85~880 | / |
| (400) | 180~3000 | 5.5~87 | 2750~27000 | 85~880 | / |
| (500) | 300~4500 | 5.5~87 | 4300~43000 | 85~880 | / |
| (600) | 450~6500 | 5.5~88 | 6100~61000 | 85~880 | / |
| (800) | 750~10000 | 5.5~88 | 11000~110000 | 85~880 | / |
| (1000) | 1200~17000 | 5.8~88 | 17000~170000 | 85~880 | / |

**Note:**

The measuring flow range of different caliber meters will be different. In the process of meter selection, the meter must be selected according to the flow range. The most taboo is to choose the meter according to the thickness of the pipe. The biggest disadvantage of choosing an instrument according to the pipeline is that it is easy to cause measurement errors due to insufficient flow.

The flow range of the vortex flow meter is determined based on the flow rate of the working condition, so the flow rate is converted into the flow rate of the working condition when selecting the meter, and then compared with the flow range table, the common flow rate should be in the middle range of the meter measurement as much as possible.

**Reference conditions:**

Gas: Air at normal temperature and pressure, t=20°C, P=101.32kPa (absolute pressure), ρ=1.205 kg/m3.
Liquid: normal temperature water, t=20℃, ρ=998.2kg/m3.

**Working condition flow** refers to the volume of the medium passing through the pipeline measured by the instrument, which is the medium under working conditions. For example, gas can be compressed. When there is pressure in the pipeline, the compressed volume of the gas is the working condition flow. The working condition flow will change as the working environment changes.

**Standard condition flow** refers to the volume of the medium under standard atmospheric pressure and 0°C (or 20°C) standard, when the compressed gas is released into the standard condition environment, the converted volume. The standard flow will not change in any environment.

The volume measured by the vortex flow meter is the working condition volume, and the standard condition volume can only be obtained after temperature and pressure compensation. Generally, when it is used for trade measurement, the standard condition is mainly used for gas, and the mass measurement is usually used for steam.

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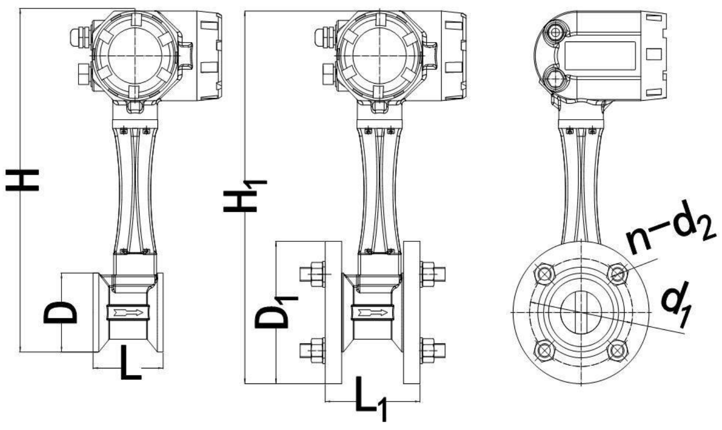
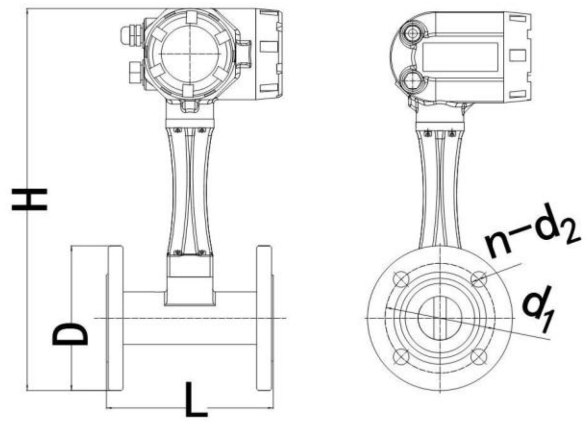
## Dimension




Flange and clamp connection fig. 1




Flange connection fig. 2

Flange and clamp connection ordinary on-site display dimensions table 1

| Size | Pressure MPa | Common L(mm) | Common $L_1$(mm) | D mm | $D_1$ mm | H mm | $H_1$ mm | $d_1$ mm | $d_2$ mm | n Number of holes |
|---|---|---|---|---|---|---|---|---|---|---|
| DN15 | 0~4.0 | 70 | 95 | 55 | 100 | 366 | 393 | 78 | 14 | 3 |
| DN20 | | 70 | 95 | 55 | 100 | 366 | 393 | 78 | 14 | 3 |
| DN25 | | 70 | 95 | 55 | 100 | 366 | 393 | 78 | 14 | 3 |
| DN32 | | 70 | 95 | 55 | 100 | 366 | 393 | 78 | 14 | 3 |
| DN40 | | 85 | 113 | 80 | 140 | 378 | 405 | 105 | 18 | 4 |
| DN50 | | 85 | 113 | 90 | 145 | 387 | 418 | 115 | 18 | 4 |
| DN65 | 0~1.6 | 85 | 113 | 105 | 165 | 402 | 438 | 130 | 18 | 4 |
| DN80 | | 85 | 113 | 120 | 180 | 417 | 453 | 145 | 18 | 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DN100 | | 85 | 113 | 140 | 210 | 437 | 478 | 175 | 18 | 6 |
| DN125 | | 85 | 119 | 165 | 235 | 462 | 503 | 200 | 18 | 8 |
| DN150 | | 100 | 132 | 194 | 270 | 489 | 533 | 230 | 22 | 8 |
| DN200 | | 100 | 132 | 248 | 325 | 541 | 588 | 285 | 22 | 8 |
| DN250 | | 115 | 151 | 300 | 375 | 592 | 638 | 330 | 24 | 10 |
| DN300 | | 130 | 166 | 350 | 425 | 642 | 688 | 380 | 24 | 10 |

**Note:**

①The above dimensions are clamped without temperature and pressure compensation, the error is ±2mm, and the length L/L1 of the temperature and pressure compensation size DN15-DN32 is increased by 15mm;

② Medium and high temperature (≥100°C), the height is increased by 30mm (one heat sink).

Flange connection ordinary on-site display dimensions table 2

| Size mm | Pressure MPa | L (mm) | D (mm) | H (mm) | d1 (mm) | d2 (mm) | n Number of holes |
|---|---|---|---|---|---|---|---|
| DN10 | 0~4.0 | 170 | 90 | 395 | 60 | 14 | 4 |
| DN15 | | 170 | 95 | 397 | 65 | 14 | 4 |
| DN20 | | 170 | 105 | 402 | 75 | 14 | 4 |
| DN25 | | 170 | 115 | 407 | 85 | 14 | 4 |
| DN32 | | 170 | 140 | 420 | 100 | 18 | 4 |
| DN40 | | 170 | 150 | 425 | 110 | 18 | 4 |
| DN50 | | 170 | 165 | 432 | 125 | 18 | 4 |
| DN65 | 0~1.6 | 190 | 185 | 455 | 145 | 18 | 8 |
| DN80 | | 190 | 200 | 470 | 160 | 18 | 8 |
| DN100 | | 200 | 220 | 490 | 180 | 18 | 8 |
| DN125 | | 200 | 250 | 520 | 210 | 18 | 8 |
| DN150 | | 200 | 285 | 550 | 240 | 22 | 8 |
| DN200 | | 200 | 340 | 605 | 295 | 22 | 12 |
| DN250 | | 240 | 405 | 665 | 355 | 26 | 12 |
| DN300 | | 240 | 460 | 715 | 410 | 26 | 12 |

Note: For medium and high temperature (≥100°C), the height should be increased by 30mm (one heat sink).

## Ordering code

| VFM-110-XXX-B -S1-I1-M2-J7-F1-D0-P3-T1-IP1 | | | | | | Description |
|---|---|---|---|---|---|---|
| VFM-110 | - | - | - | - | - | |
| Pipe size | XXX-B | | | | | DN25-DN300 |
| Sensor type | S1 | | | | | Piezoelectric sensor |
| | S2 | | | | | Capacitive sensor |
| Installation | | I1 | | | | Flange connection type (the order defaults to 304 material, other materials are remarked) |
| | | I2 | | | | Flange mounting type (the flange is made of carbon steel, and the body is made of 304) |
| | | I3 | | | | Simple plug-in type (body: 304 carbon steel welded base) |
| | | I4 | | | | Ball valve plug-in type (body: 304 carbon steel ball valve plus base) |
| | | I5 | | | | Threaded connection (internal thread + 1, external thread + 0) |
| | | I6 | | | | Clamp connection |
| Medium | | | M2 | | | Gas (all units converted to Nm3/h) |
| | | | M3 | | | Steam (saturated steam, superheated steam) |
| Accuracy | | | | J7 | | 1.5% (steam, gas) |
| | | | | J9 | | 2.5% (plug-in type) |
| Amplifier type | | | | | F1 | Three-wire system (24V pulse output without display/sensor/frequency output (24V power supply)) |
| | | | | | F2 | Second-wire current (24V power supply, 4-20mA current output, LCD display) |
| | | | | | F3 | Battery Ordinary (3.6V lithium battery / dual power supply + pulse output on-site LCD display (dual power supply + D) ) |
| | | | | | F4 | 24V power supply integrated (PT temperature and pressure compensation integrated, 4-20mA current/pulse output) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | F5 | | | | | | | 24V power supply integrated (T temperature compensation, 4-20mA current/pulse output) |
| | F6 | | | | | | | 24V power supply integrated (P pressure compensation, 4-20mA current/pulse output) |
| | F7 | | | | | | | 3.6V battery, integrated (PT temperature and pressure compensation integrated, pulse output) |
| | F8 | | | | | | | 3.6V battery, integrated (T temperature compensation, pulse output) |
| | F9 | | | | | | | 3.6V battery, integrated (P pressure compensation, pulse output) |
| | F10 | | | | | | | 24V/3.6V battery power supply integrated (PT temperature and pressure compensation integrated, 4-20mA current/pulse output) |
| | F11 | | | | | | | 24V/3.6V battery power supply integrated (T temperature compensation, 4-20mA current/pulse output) |
| | F12 | | | | | | | 24V/3.6V battery power supply integrated (P pressure compensation, 4-20mA current/pulse output) |
| Communication output | | D0 | | | | | | No communication output |
| | | D2 | | | | | | RS485 |
| | | D3 | | | | | | Hart |
| Pressure | | | P3 | | | | | 1.6 MPa |
| | | | P4 | | | | | 2.5 MPa |
| | | | P5 | | | | | 4.0 MPa |
| | | | PZ | | | | | Other nominal pressure |
| Temperature resistance | | | | T1 | | | | Normal temperature (-40-100) ℃ |
| | | | | T2 | | | | Medium temperature (-40-250) ℃ |
| | | | | T3 | | | | High temperature (-40-330) ℃ |
| | | | | T4 | | | | High temperature (-40-400) ℃ |
| Protection grade | | | | | IP1 | | | IP65 |