# VORTEX FLOW METER
# S-VTX

**Instruction Manual**
Version 21

# CONTENT

Thank you for purchasing the digital Vortex flow meter.
To ensure correct use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

## • Safety and Modification Precautions

| | |
|---|---|
|  | Indicates safety attentions which are dangerous. |
|  | Indicates safety attentions which are needed to pay attention to. |
|  | Indicates safety attentions which are forbidden. |

Error operation in case of ignoring the tips might cause the personal injury, or damage to the instrument and property.

**Select explosion-proof instrument for explosive environment application**

Confirm whether the nameplate of instrument has the identifiers of explosion-proof certification and temperature class, the instrument can't be used in explosive environment without those identifiers.

**The explosion-proof temperature class of instrument must meet the explosion-proof and temperature of environmental requirements on site**

When the instrument is used in explosion-proof environment, make sure that the explosion-proof certification and temperature class of instrument meet to the requir-ements on site.

**No opening while working in explosive environment**

Before wiring, please power instrument off.

**The protection class of instrument must meet the working condition requirements on site**

The requirement of protection class on site should be under, or the same as the protection class of instrument to ensure that the instrument is working fine.

**If doubting that the instrument in the event of failure, please do not operate it**

If there are something wrong with the instrument or it had been damaged, please contact us.

**■ Digital Vortex flow meters are thoroughly tested at the factory before shipment.**

When these instruments are delivered, perform a visual check to make sure that no damage occured during shipment.

**■Transportation and Storage Precautions**

If the instrument is to be stored for a long period of time after delivery, please follow below points.

The instrument should be stored in original packing.

The instrument need to be stored in the place where will not be exposed to rain or water.

Temperature: -40 to +60℃

Humidity: 5 to 100% RH

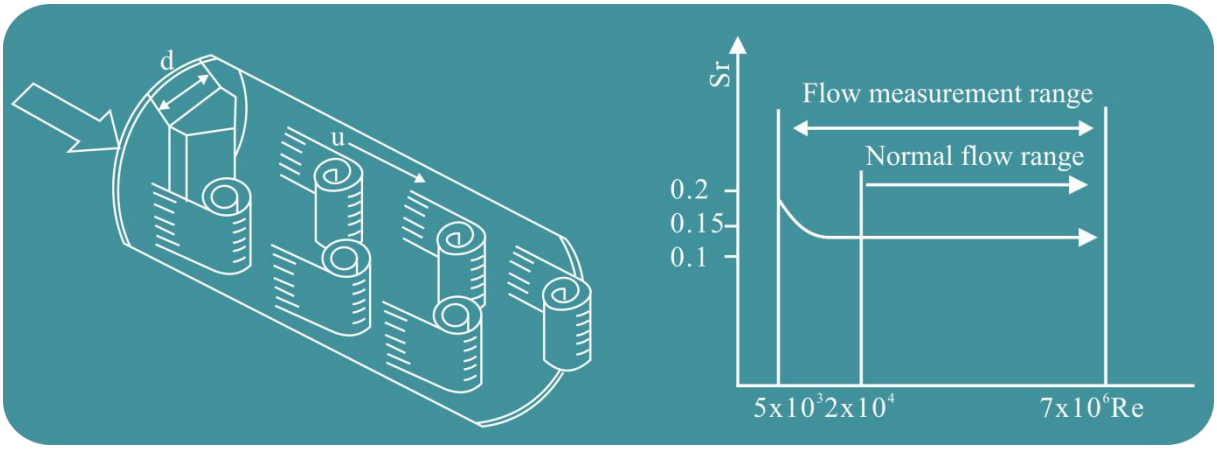
## 1. Introduction

### 1.1 Principle

Setting a triangular prism vortex generator in the flow meter, regular vortex will be generated at both the sides of triangular prism, which is called Karman swirl. As showed on the drawing 1.1, vortex are arranged regularly at the downstream of vortex generator. Suppose the vortex generation frequency is F,

the average flow velocity of medium is V, d is the width of the surface of triangular prism incident flow, and D for the nominal diameter of flow meter. Then we get the computation formula:

$$f = Sr \frac{\overline{V}}{(1 \sim 1.25d/D)\, d}$$




### 1.2 Basic Parameters

| | | |
|---|---|---|
| Measured Medium | Liquid, Gas, Steam | |
| Medium Temp. | -40 ～ + 250℃; 40 ～ + 350℃ (high temperature type) | |
| Nominal Pressure | 0.6MPa, 1.0MPa, 1.6MPa, 2.5MPa, 4.0MPa | |
| Accuracy | ±1.0% (Flange/Wafer)<br>±1.5% (Insertion type) | |
| Flow Range | Liquid:0.4-7.0m/s;<br>Gas:4.0-60.0m/s;<br>Steam:5.0-70.0m/s | |
| Specifications | DN15-DN300 (flange/wafer type)<br>DN80-DN2000 (insertion type)<br>DN15-DN100 (thread/sanitary type) | |
| Material | SS304 (standard) SS316 (optional) | |
| Reynolds Number | Normal 2x104~7x106 | |
| Resistance Coefficient | Cd≦2.6 | |
| Vibration Acceleration Allowed | ≦0.2g | |
| IEP ATEX | IIG Exia IICT5 Ga | |
| Ambient Condition | Ambient Temp. | -40℃~65℃ (Non ex-proof site)<br>-20℃~55℃ (Ex-proof site) |

| | | |
|---|---|---|
| | Relative Humidity | ≦85% |
| | Pressure | 86-106kPa |
| Power Supply | DC12-30V or 3.6V lithium battery powered | |
| Signal Output | 4-20mA, Pulse | |
| Communication | RS485 Modbus or HART | |

### 1.3 Flow Range

Table 1 Liquid and Air Flow Range Table ($m^3/h$)

| Nominal DN(mm) | Liquid ($m^3/h$) | | Air ($m^3/h$) | |
|---|---|---|---|---|
| | Standard Range | Extended Range | Standard Range | Extended Range |
| 15 | 0.8-6 | 0.5-8 | 6-40 | 5-50 |
| 20 | 1-8 | 0.5-12 | 8-50 | 6-60 |
| 25 | 1.5-12 | 0.8-16 | 10-80 | 8-120 |
| 32 | 2-20 | 1.5-25 | 15-150 | 10-200 |
| 40 | 2.5-30 | 2-40 | 25-200 | 20-300 |
| 50 | 3-50 | 2.5-60 | 30-300 | 25-500 |
| 65 | 5-80 | 4-100 | 50-500 | 40-800 |
| 80 | 8-120 | 6-160 | 80-800 | 60-1200 |
| 100 | 12-200 | 8-250 | 120-1200 | 100-2000 |
| 125 | 20-300 | 12-400 | 160-1600 | 150-3000 |
| 150 | 30-400 | 18-600 | 250-2500 | 200-4000 |
| 200 | 50-800 | 30-1200 | 400-4000 | 350-8000 |
| 250 | 80-1200 | 40-1600 | 600-6000 | 500-12000 |
| 300 | 100-1600 | 60-2500 | 1000-10000 | 600-16000 |
| 400 | 200-3000 | 120-5000 | 1600-16000 | 1000-25000 |
| 500 | 300-5000 | 200-8000 | 2500-25000 | 1600-40000 |
| 600 | 500-8000 | 300-10000 | 4000-40000 | 2500-60000 |

Table 2 Saturated Steam Mass Flow Range Table (kg/h)

| Absolute Pressure (MPa) | | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 |
|---|---|---|---|---|---|---|---|---|
| Temperature (℃) | | 120.2 | 133.5 | 143.62 | 151.84 | 158.94 | 164.96 | 170.41 |
| Density (kg/m3) | | 1.129 | 1.651 | 2.163 | 2.669 | 3.17 | 3.667 | 4.162 |
| DN15 | Qmin | 5.645 | 8.255 | 10.815 | 13.345 | 15.85 | 18.335 | 20.81 |
| | Qmax | 56.45 | 82.55 | 108.15 | 133.45 | 158.5 | 183.35 | 208.1 |
| DN20 | Qmin | 6.774 | 9.906 | 12.978 | 16.014 | 19.02 | 22.002 | 24.972 |
| | Qmax | 67.74 | 99.06 | 129.78 | 160.14 | 190.2 | 220.02 | 249.72 |
| DN25 | Qmin | 9.032 | 13.208 | 17.304 | 21.352 | 25.36 | 29.336 | 33.296 |
| | Qmax | 135.48 | 198.12 | 259.56 | 320.28 | 380.4 | 440.04 | 499.44 |
| DN32 | Qmin | 20.322 | 29.718 | 38.934 | 48.042 | 57.06 | 66.006 | 74.916 |
| | Qmax | 203.22 | 297.18 | 389.34 | 480.42 | 570.6 | 660.06 | 749.16 |
| DN40 | Qmin | 22.58 | 33.02 | 43.26 | 53.38 | 63.4 | 73.34 | 83.24 |
| | Qmax | 338.7 | 495.3 | 648.9 | 800.7 | 951 | 1100.1 | 1248.6 |
| DN50 | Qmin | 28.225 | 41.275 | 54.075 | 66.725 | 79.25 | 91.675 | 104.05 |
| | Qmax | 564.5 | 825.5 | 1081.5 | 1334.5 | 1585 | 1833.5 | 2081 |
| DN65 | Qmin | 45.16 | 66.04 | 86.52 | 106.76 | 126.8 | 146.68 | 166.48 |
| | Qmax | 903.2 | 1320.8 | 1730.4 | 2135.2 | 2536 | 2933.6 | 3329.6 |
| DN80 | Qmin | 67.74 | 99.06 | 129.78 | 160.14 | 190.2 | 220.02 | 249.72 |
| | Qmax | 1354.8 | 1981.2 | 2595.6 | 3202.8 | 3804 | 4400.4 | 4994.4 |
| DN100 | Qmin | 112.9 | 165.1 | 216.3 | 266.9 | 317 | 366.7 | 416.2 |
| | Qmax | 2258 | 3302 | 4326 | 5338 | 6340 | 7334 | 8324 |
| DN125 | Qmin | 169.35 | 247.65 | 324.45 | 400.35 | 475.5 | 550.05 | 624.3 |
| | Qmax | 3387 | 4953 | 6489 | 8007 | 9510 | 11001 | 12486 |
| DN150 | Qmin | 225.8 | 330.2 | 432.6 | 533.8 | 634 | 733.4 | 832.4 |
| | Qmax | 4516 | 6604 | 8652 | 10676 | 12680 | 14668 | 16648 |
| DN200 | Qmin | 395.15 | 577.85 | 757.05 | 934.15 | 1109.5 | 1283.45 | 1456.7 |
| | Qmax | 9032 | 13208 | 17304 | 21352 | 25360 | 29336 | 33296 |
| DN250 | Qmin | 564.5 | 825.5 | 1081.5 | 1334.5 | 1585 | 1833.5 | 2081 |
| | Qmax | 13548 | 19812 | 25956 | 32028 | 38040 | 44004 | 49944 |
| DN300 | Qmin | 677.4 | 990.6 | 1297.8 | 1601.4 | 1902 | 2200.2 | 2497.2 |
| | Qmax | 18064 | 26416 | 34608 | 42704 | 50720 | 58672 | 66592 |

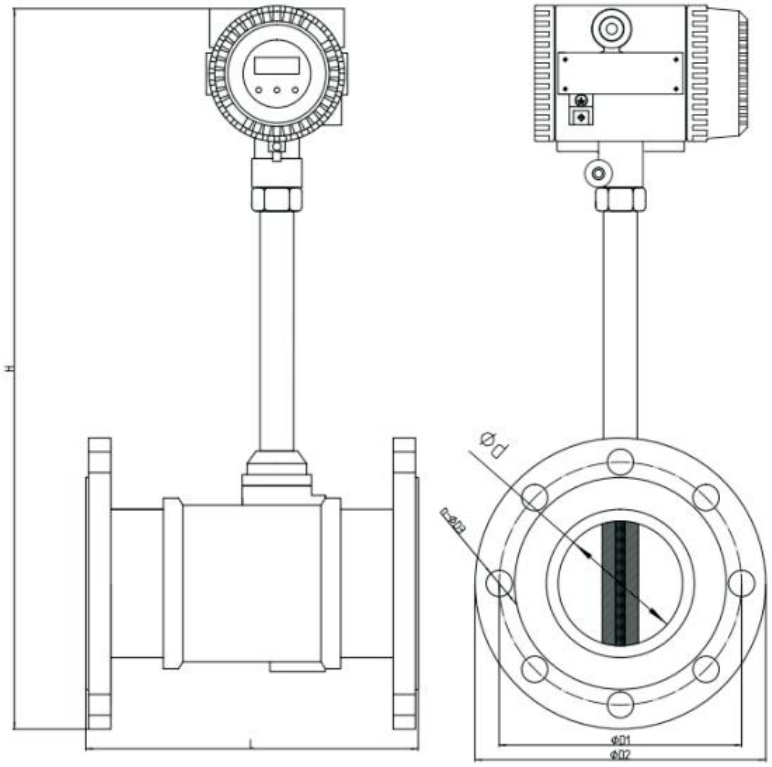
| Absolute Pressure (MPa) | | 0.9 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 |
|---|---|---|---|---|---|---|---|---|
| Temperature (℃) | | 175.36 | 179.68 | 187.96 | 195.04 | 201.37 | 207.11 | 212.37 |
| Density ($kg/m^3$) | | 4.665 | 5.147 | 6.127 | 7.106 | 8.085 | 9.065 | 10.05 |
| DN15 | Qmin | 23.325 | 25.735 | 30.635 | 35.53 | 40.425 | 45.325 | 50.25 |
| | Qmax | 233.25 | 257.35 | 306.35 | 355.3 | 404.25 | 453.25 | 502.5 |
| DN20 | Qmin | 27.99 | 30.882 | 36.762 | 42.636 | 48.51 | 54.39 | 60.3 |
| | Qmax | 279.9 | 308.82 | 367.62 | 426.36 | 485.1 | 543.9 | 603 |
| DN25 | Qmin | 37.32 | 41.176 | 49.016 | 56.848 | 64.68 | 72.52 | 80.4 |
| | Qmax | 559.8 | 617.64 | 735.24 | 852.72 | 970.2 | 1087.8 | 1206 |
| DN32 | Qmin | 83.97 | 92.646 | 110.286 | 127.908 | 145.53 | 163.17 | 180.9 |
| | Qmax | 839.7 | 926.46 | 1102.86 | 1279.08 | 1455.3 | 1631.7 | 1809 |
| DN40 | Qmin | 93.3 | 102.94 | 122.54 | 142.12 | 161.7 | 181.3 | 201 |
| | Qmax | 1399.5 | 1544.1 | 1838.1 | 2131.8 | 2425.5 | 2719.5 | 3015 |
| DN50 | Qmin | 116.625 | 128.675 | 153.175 | 177.65 | 202.125 | 226.625 | 251.25 |
| | Qmax | 2332.5 | 2573.5 | 3063.5 | 3553 | 4042.5 | 4532.5 | 5025 |
| DN65 | Qmin | 186.6 | 205.88 | 245.08 | 284.24 | 323.4 | 362.6 | 402 |
| | Qmax | 3732 | 4117.6 | 4901.6 | 5684.8 | 6468 | 7252 | 8040 |
| DN80 | Qmin | 279.9 | 308.82 | 367.62 | 426.36 | 485.1 | 543.9 | 603 |
| | Qmax | 5598 | 6176.4 | 7352.4 | 8527.2 | 9702 | 10878 | 12060 |
| DN100 | Qmin | 466.5 | 514.7 | 612.7 | 710.6 | 808.5 | 906.5 | 1005 |
| | Qmax | 9330 | 10294 | 12254 | 14212 | 16170 | 18130 | 20100 |
| DN125 | Qmin | 699.75 | 772.05 | 919.05 | 1065.9 | 1212.75 | 1359.75 | 1507.5 |
| | Qmax | 13995 | 15441 | 18381 | 21318 | 24255 | 27195 | 30150 |
| DN150 | Qmin | 933 | 1029.4 | 1225.4 | 1421.2 | 1617 | 1813 | 2010 |
| | Qmax | 18660 | 20588 | 24508 | 28424 | 32340 | 36260 | 40200 |
| DN200 | Qmin | 1632.75 | 1801.45 | 2144.45 | 2487.1 | 2829.75 | 3172.75 | 3517.5 |
| | Qmax | 37320 | 41176 | 49016 | 56848 | 64680 | 72520 | 80400 |
| DN250 | Qmin | 2332.5 | 2573.5 | 3063.5 | 3553 | 4042.5 | 4532.5 | 5025 |
| | Qmax | 55980 | 61764 | 73524 | 85272 | 97020 | 108780 | 120600 |
| DN300 | Qmin | 2799 | 3088.2 | 3676.2 | 4263.6 | 4851 | 5439 | 6030 |
| | Qmax | 74640 | 82352 | 98032 | 113696 | 129360 | 145040 | 160800 |

Table 3 Superheated Steam Density & Relative Temperature and Pressure (Kg/m³)

| Absolute Pressure (MPa) | Temperature（℃） | | | | | |
|---|---|---|---|---|---|---|
| | 150 | 200 | 250 | 300 | 350 | 400 |
| 0.1 | 0.52 | 0.46 | 0.42 | 0.38 | | |
| 0.15 | 0.78 | 0.70 | 0.62 | 0.57 | 0.52 | 0.49 |
| 0.2 | 1.04 | 0.93 | 0.83 | 0.76 | 0.69 | 0.65 |
| 0.25 | 1.31 | 1.16 | 1.04 | 0.95 | 0.87 | 0.81 |
| 0.33 | 1.58 | 1.39 | 1.25 | 1.14 | 1.05 | 0.97 |
| 0.35 | 1.85 | 1.63 | 1.46 | 1.33 | 1.22 | 1.13 |
| 0.4 | 2.12 | 1.87 | 1.68 | 1.52 | 1.40 | 1.29 |
| 0.5 | - | 2.35 | 2.11 | 1.91 | 1.75 | 1.62 |
| 0.6 | - | 2.84 | 2.54 | 2.30 | 2.11 | 1.95 |
| 0.7 | - | 3.33 | 2.97 | 2.69 | 2.46 | 2.27 |
| 0.8 | - | 3.83 | 3.41 | 3.08 | 2.82 | 2.60 |
| 1.0 | - | 4.86 | 4.30 | 3.88 | 3.54 | 3.26 |
| 1.2 | - | 5.91 | 5.20 | 4.67 | 4.26 | 3.92 |
| 1.5 | - | 7.55 | 6.58 | 5.89 | 5.36 | 4.93 |
| 2.0 | - | - | 8.968 | 7.97 | 7.21 | 6.62 |
| 2.5 | - | - | 11.5 | 10.1 | 9.11 | 8.33 |
| 3.0 | - | - | 14.2 | 12.3 | 11.1 | 10.1 |
| 3.5 | - | - | 17.0 | 14.6 | 13.0 | 11.8 |
| 4.0 | - | - | - | 17.0 | 15.1 | 13.6 |

## 1.4 Dimension

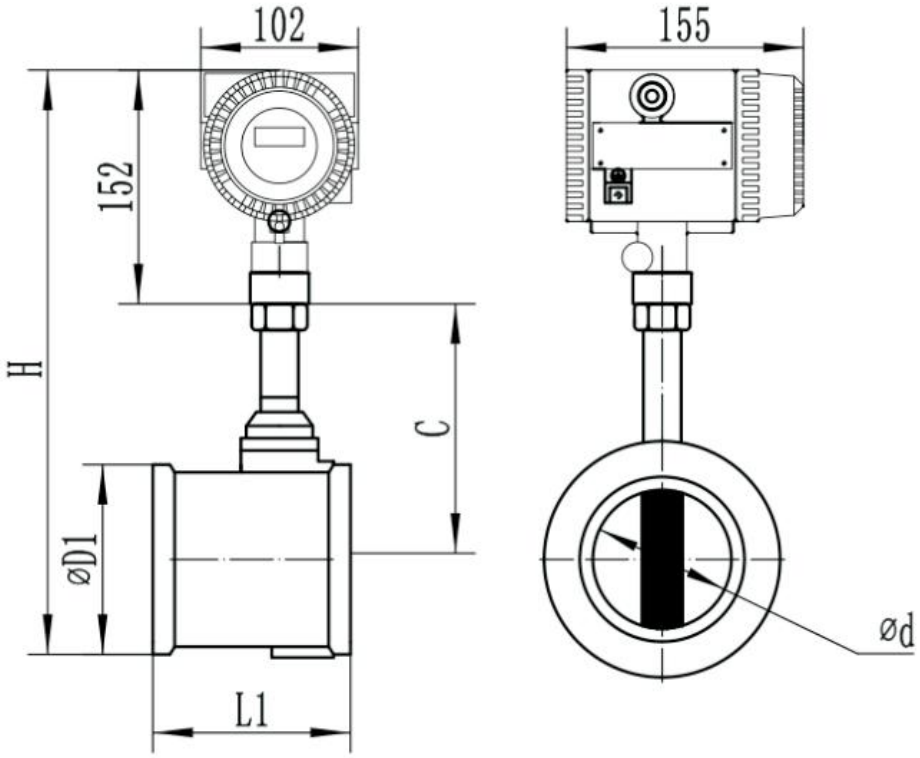
### 1.4.1 Flange Connection Type (DIN PN16 as reference)




DIN PN16 Flange Connection Dimension

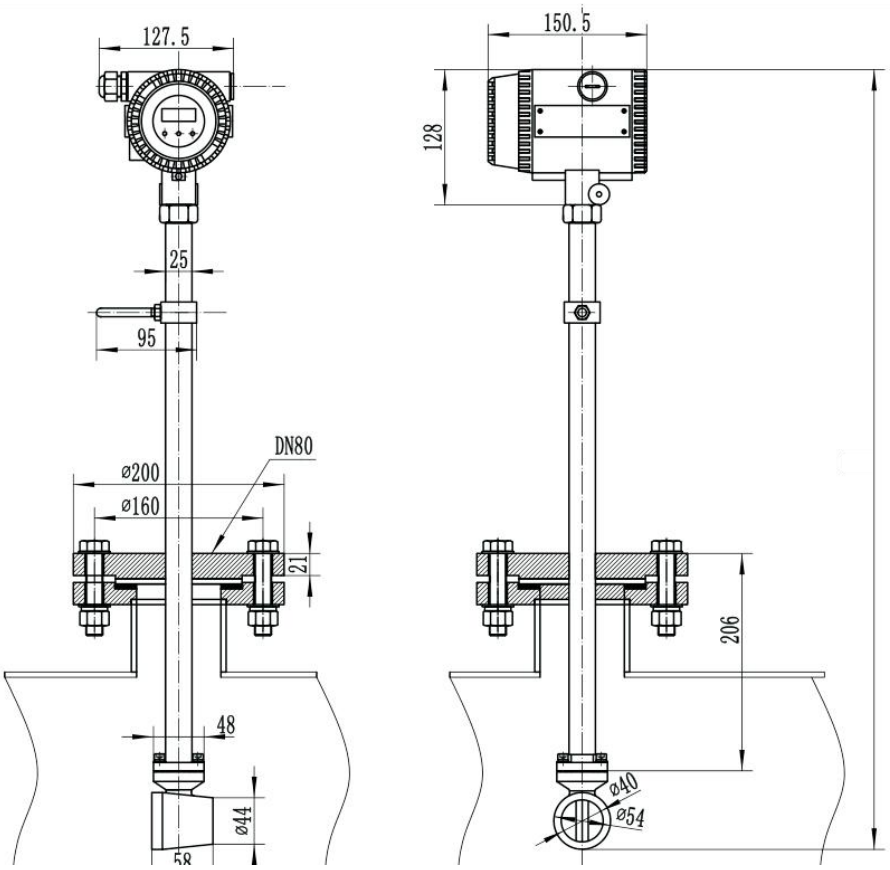
| Size | L | H | d | D1 | D2 | n-D3 |
|---|---|---|---|---|---|---|
| DN15 | 170 | 440 | 15 | 65 | 95 | 4-ϕ14 |
| DN20 | 170 | 445 | 20 | 75 | 105 | 4-ϕ14 |
| DN25 | 170 | 450 | 26 | 85 | 115 | 4-ϕ14 |
| DN32 | 170 | 462 | 32 | 100 | 140 | 4-ϕ18 |
| DN40 | 190 | 465 | 38 | 110 | 150 | 4-ϕ18 |
| DN50 | 190 | 473 | 48 | 125 | 165 | 4-ϕ18 |
| DN65 | 220 | 487 | 62 | 145 | 185 | 4-ϕ18 |
| DN80 | 220 | 500 | 73 | 160 | 200 | 8-ϕ18 |
| DN100 | 240 | 533 | 95 | 180 | 220 | 8-ϕ18 |
| DN125 | 260 | 560 | 118 | 210 | 250 | 8-ϕ18 |
| DN150 | 280 | 608 | 140 | 240 | 285 | 8-ϕ22 |
| DN200 | 300 | 640 | 200 | 295 | 340 | 12-ϕ22 |
| DN250 | 360 | 705 | 250 | 355 | 405 | 12-ϕ26 |
| DN300 | 400 | 752 | 300 | 410 | 460 | 12-ϕ26 |

### 1.4.2 Wafer Connection Type

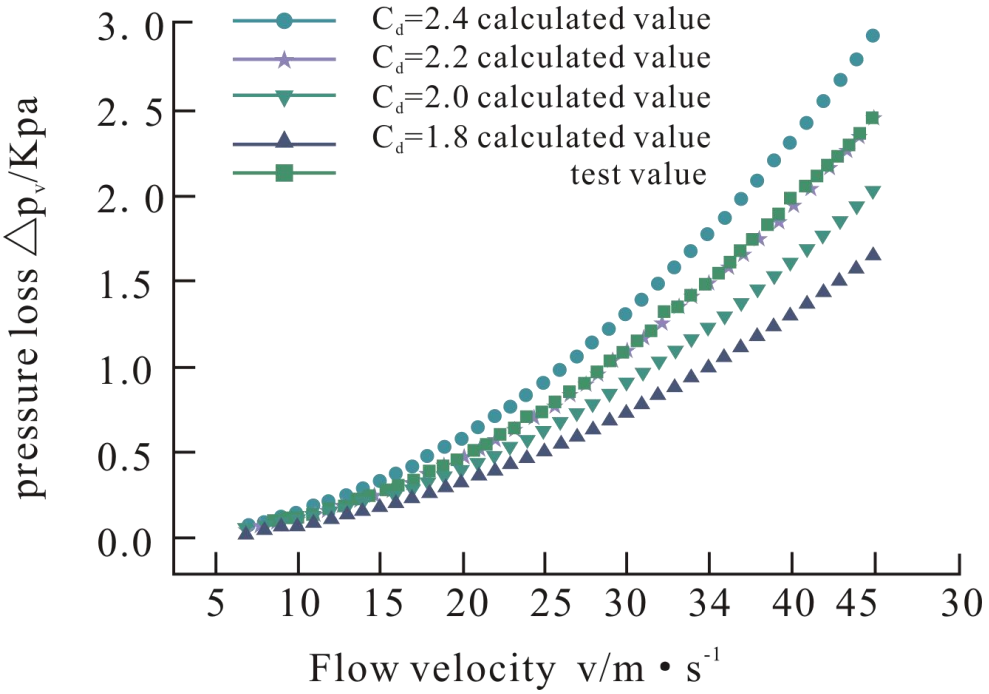



| Size | L1 | D1 | d | C |
|---|---|---|---|---|
| DN15 | 65 | 65 | 15 | 240.5 |
| DN20 | 65 | 65 | 20 | 240.5 |
| DN25 | 65 | 65 | 26 | 240.5 |
| DN32 | 65 | 65 | 32 | 240.5 |
| DN40 | 80 | 76 | 38 | 237 |
| DN50 | 80 | 88 | 48 | 237 |
| DN65 | 92 | 101 | 62 | 242.5 |
| DN80 | 100 | 112 | 73 | 247 |
| DN100 | 124 | 134 | 95 | 271 |
| DN125 | 145 | 158 | 118 | 284 |
| DN150 | 165 | 180 | 140 | 313 |
| DN200 | 195 | 247 | 200 | 319.5 |
| DN250 | 115 | 300 | 250 | 348 |
| DN300 | 130 | 347 | 300 | 369.5 |

### 1.4.3 Insertion Type




## 1.5 Pressure Loss



## 2. Installation

Caution

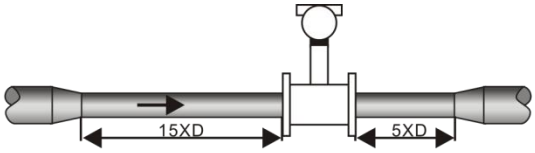
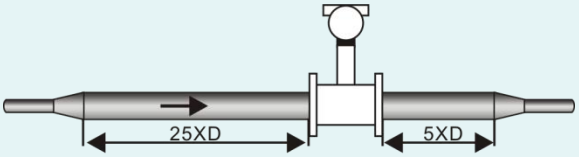
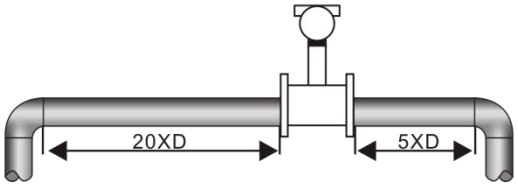
●Installation of the vortex flow meter must be performed by expert engineer or skilled personnel.
●Be careful that no damage is caused to people through accidentally dropping.
●When the vortex flow meter is processing with hot mediums like hot fluid or steam, be careful not to get burnt.
●All procedures relating to installation must comply with the installation requirements.
●Suggest to select an area subject to minimize mechanical vibration. If the flow meter is subject to vibrations, it is recommended to provide pipeline supports.
●No collision by hard subject, when the flow sensor is being installed, otherwise the accuracy will be influenced, even the flow meter will be damaged.

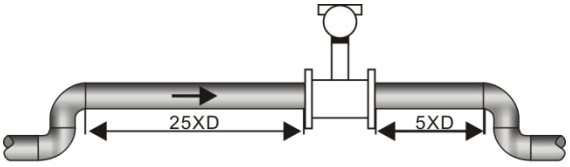
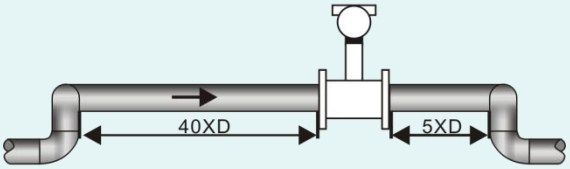
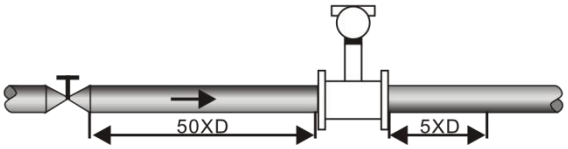
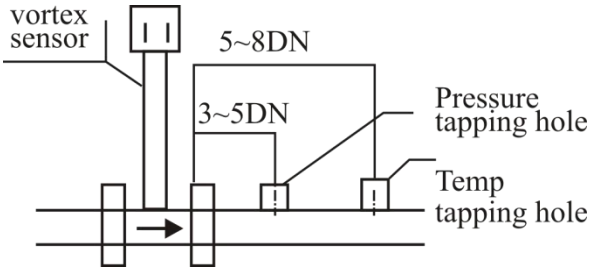
### 2.1 Flange / Wafer Type Installation

● Installation Direction

Horizontal or Vertical (The flow direction should always be upwards while vertical installation )

● Straight Pipe Length Recommendation (D: Nominal Diameter mm)

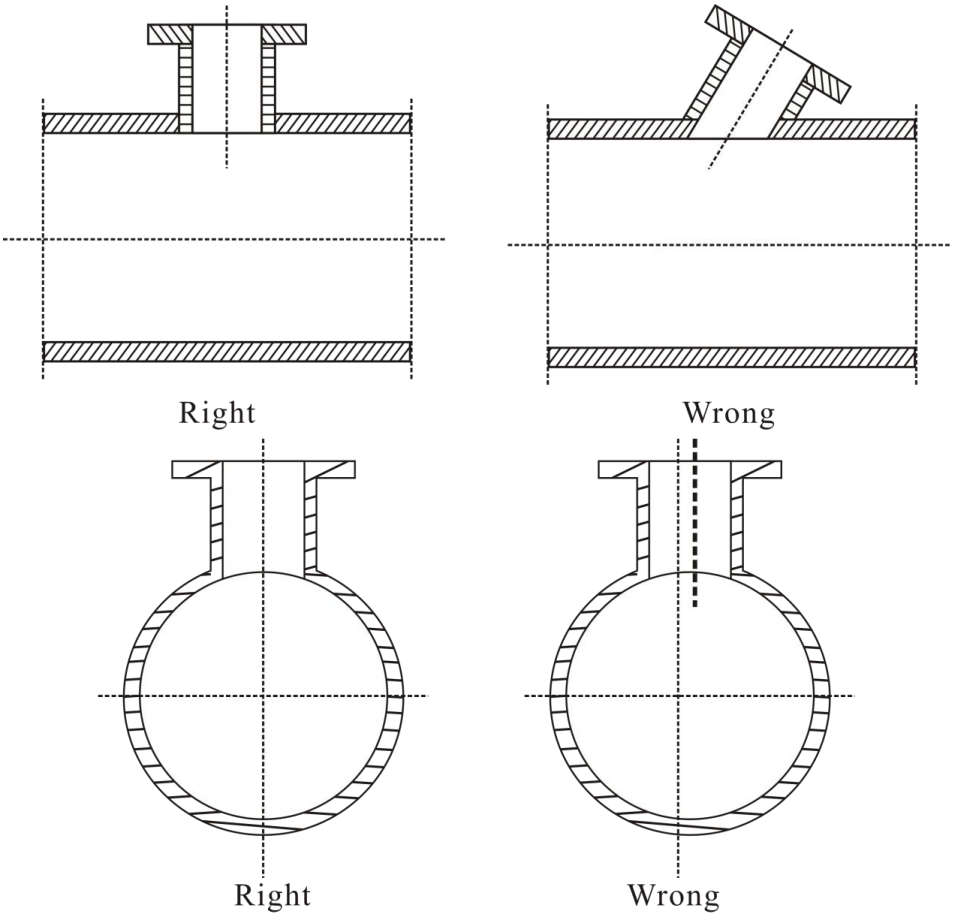
| Description | Figure |
|---|---|
| Concentric reducers pipeline |  |
| Concentric expansion pipeline |  |
| Single quarter bend |  |

| Description | Figure |
|---|---|
| Two quarter bends on the same surface |  |
| Two quarter bends on the different surface |  |
| Regulating valve,half-open gate |  |
| Valve position | Flow regulating valve must be installed at the downstream of flow sensor. |
| Pressure and temperature taps (for remote type vortex flow meter with T&P compensation only)<br>Remote type vortex flow meter with pressure and temperature compensation need to place pressure and temperature tap according to the requirement.Install pressure tapping point at 3-5D downstream of flow sensor and temperature taking point at 5-8D downstream of flow sensor. |  |
| Vibration<br>Flow sensor should be not installed on a strong vibration pipeline | If install the flow sensor on a vibration pipeline, there are following methods to decrease the disturbing of vibration:<br>Installing a fixed support on pipeline at 2D upstream of flow meter.<br>At the condition of meeting the straight length, install a hosepipe as a transmission. |
| High temperature pipeline | If the heat preservation not good, the flow meter should be installed downward<br>vertical. |

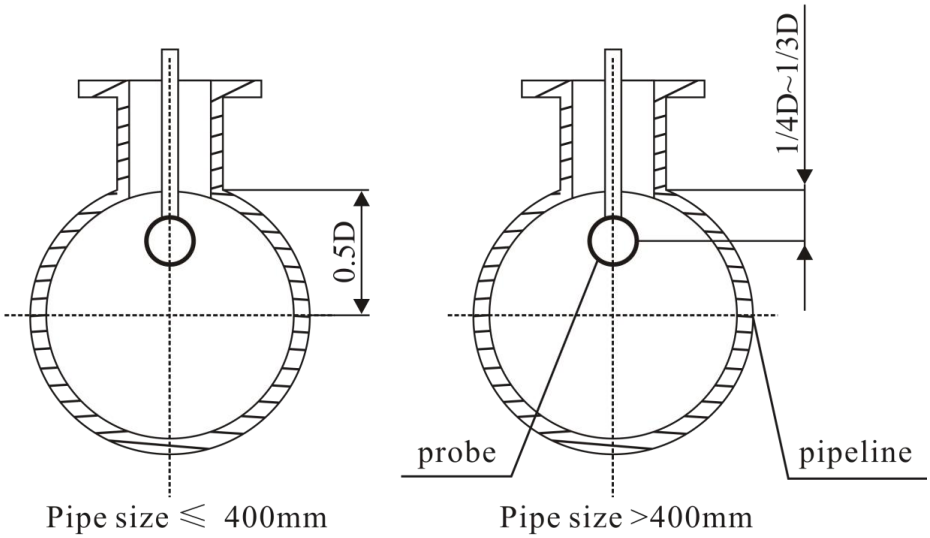
If the length of upstream can not meet the requirement, suggest to install a flow regulator at the upstream pipeline.

### 2.2 Insertion Type Installation

| | |
|---|---|
| Straight Pipe Length Recommendation | Upstream ≧ 15D, Downstream ≧ 5D |
| Installation Steps | 1. Open a Φ100mm round hole in the pipeline. The periphery of the hole should be free of burrs to ensure the vortex probe pass smoothly. |
| | 2. Weld the connection base at the round hole of the pipeline. Pay attention to the vertical direction during welding. After welding, the axis is required to intersect the axis of the pipeline positively, and the extension line of the flange short pipe passes through the center of the pipeline. (Refer to Pic 2.2.1) |
| | 3. Please follow below insertion length requirement Pipe size ≤DN400mm, insertion length 1/2D<br>Pipe size > DN400mm, insertion length 1/4D-1/3D (D=pipe size)<br>(Refer to Pic 2.2.2) |
| | 4. The connection between the flanges should be equipped with gaskets.<br>Rubber plates for normal temperature, heat- resistant materials such as asbestos plates for high temperature. |
| | 5. Installation and disassembling methods at the condition of hot tapping (with ball valve)<br>Take disassembling as example, while disassembling, loosen the fixing screw on the lock nut, then loosen the lock nut. Pull the insertion rod upwards until the probe is at the limit position on the upper part of the ball valve, (at this time the ball valve can be closed exactly). Then remove the fixing bolts of the upper connecting flange, and then gently take off the flow meter.<br>The installation steps of the flow meter at the condition of hot tapping is reverse to above steps. |




Pic.2.2.1 Correct mounting position of connection base




Pic.2.2.2 Insertion Depth

● Attention for installation

1.The flow direction must be same as the flow indication rod, strictly forbidden to wrench the flow rod;

2. Removing burr and welding slag.

## 3. Wiring

Warning

●The wiring of the vortex flow meter must be performed by expert engineer or skilled personnel. Before wiring, check that no voltage is applied to the power cable. The supply voltage is within the range of the instrument.

**Grounding**


**Terminal boards**

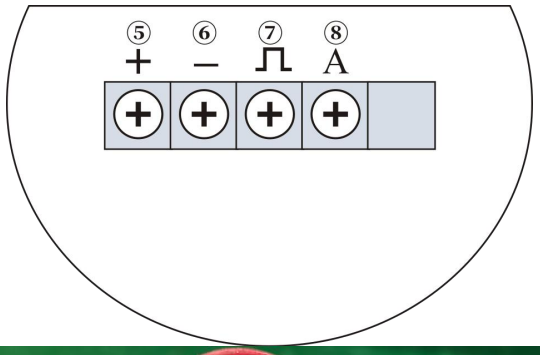
According to different functions there are four types of terminal boards:

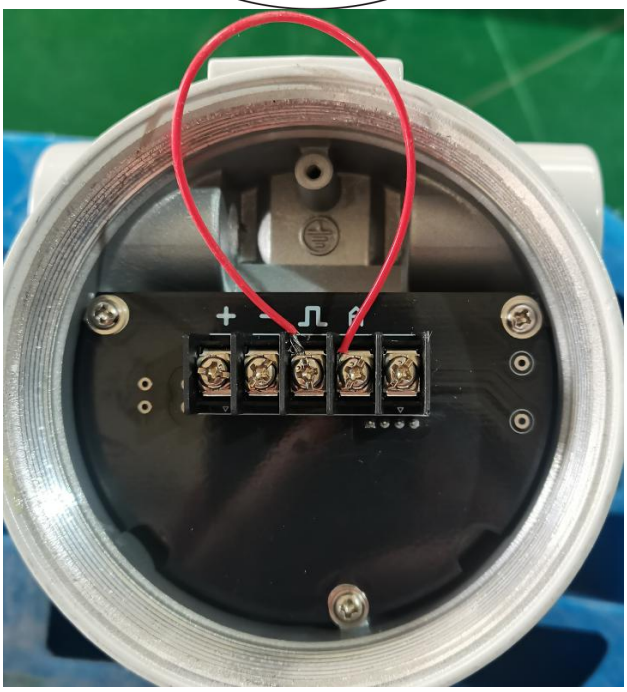
① Normal type without compensation, 4-20mA+Pulse+HART
② Normal type without compensation, 4-20mA+Pulse+RS485
③ With compensation, 4-20mA+Pulse+HART
④ With compensation, 4-20mA+Pulse+RS485

**Note**

The pulse output is of "MOS" type and a PLC is needed which has a NPN input.
L'uscita ad impulsi è di tipo " MOS " ed è necessario un PLC con ingresso NPN.

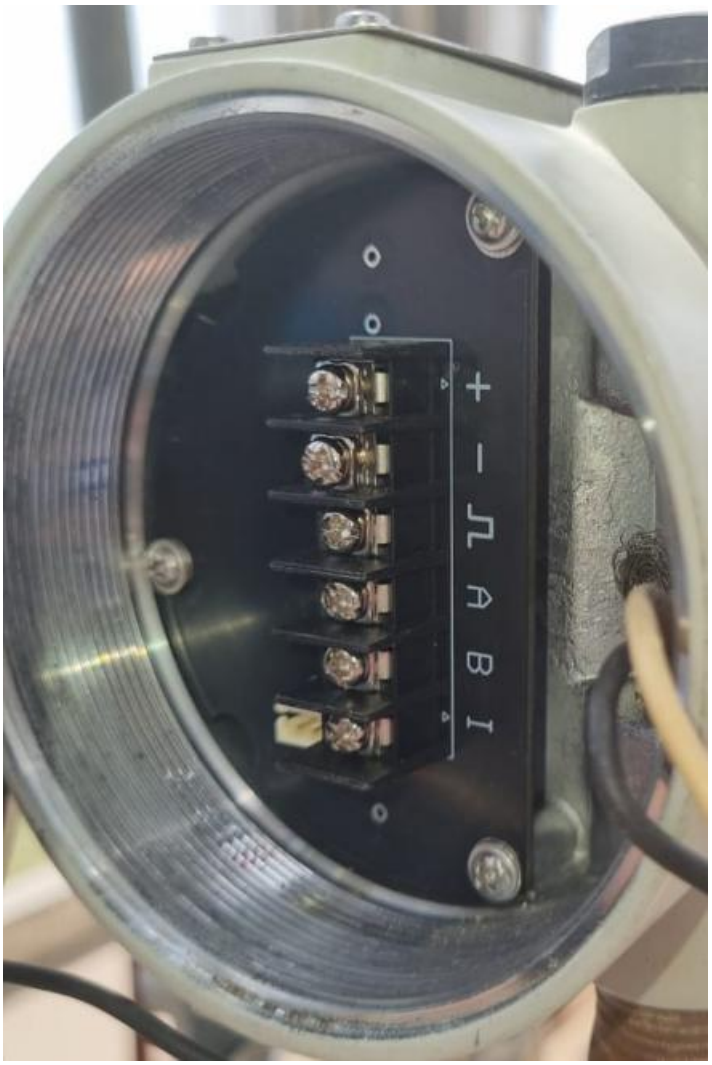
## 1.1 Normal Type Without Compensation, 4-20mA (passive) + Pulse (Output NPN) + HART



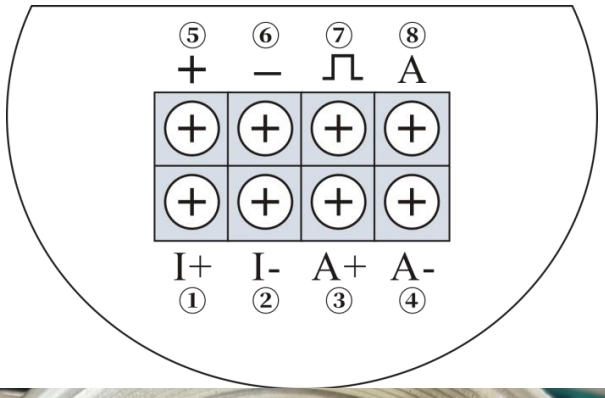
| Connection | Description |
|---|---|
| Power Supply (two wire) | DC24V + → +<br>DC24V - → - |
| 4-20mA (passive) | 4-20mA + → +<br>4-20mA - → - |
| Pulse (Output NPN) | Pulse + → **П ( represent ⎍ )**<br>Pulse - → -<br>Short circuit “**П**” and “A”<br>Note: Terminal “A” is mainly used for short circuit, if short circuit “**П**” and “**A**”, there’s no need to add external resistor. |
| HART | “+” and “-” |

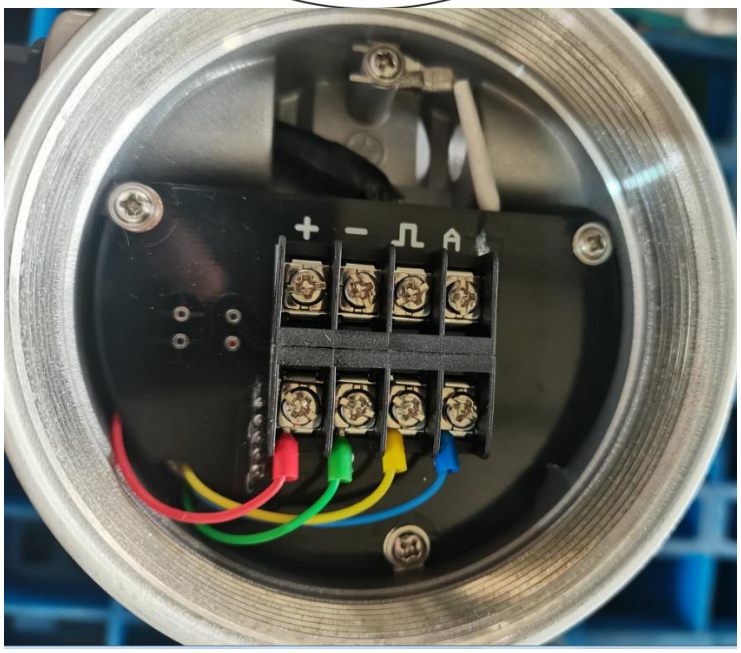
## 1.2 Normal Type Without Compensation, 4-20mA (passive) + Pulse (Output NPN) + RS485




| Connection | Description |
|---|---|
| Power Supply | DC24V + → + <br> DC24V - → - |
| 4-20mA (passive) | 4-20mA + → I (Io) <br> 4-20mA - → - |
| Pulse (Output NPN) | Pulse + → Π ( represent ⎍ ) <br> Pulse - → - |
| RS485 | RS485 + → A <br> RS485 - → B |

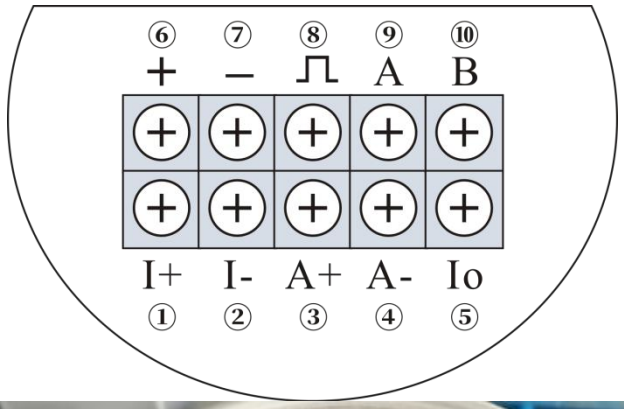
## 1.3 With Compensation,
## 4-20mA (passive) + Pulse (Output NPN) + HART

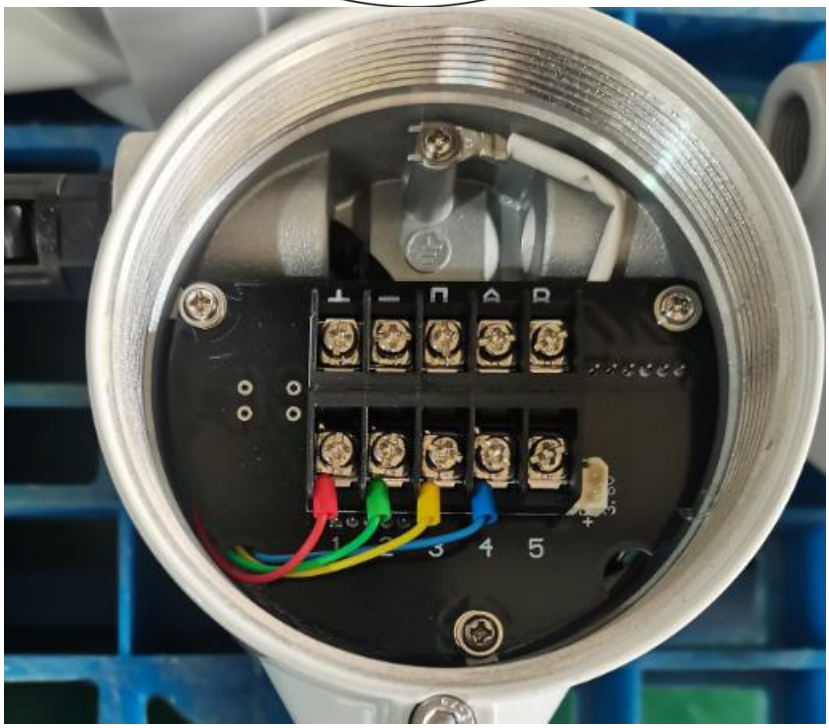



| Connection | Description |
|---|---|
| Power Supply (two wire) | DC24V + → +<br>DC24V - → - |
| 4-20mA (passive) | 4-20mA + → +<br>4-20mA - → - |
| Pulse (Output NPN) | Pulse + → **П ( represent ⎍ )**<br>Pulse - → -<br>Short circuit **П** and A<br>Note: Terminal "A" is mainly used for short circuit, if short circuit "**П**" and "A", there's no need to add external resistor. |
| HART | "+" and "-" |

## 1.4 With Compensation,
## 4-20mA (passive) + Pulse (Output NPN) + RS485



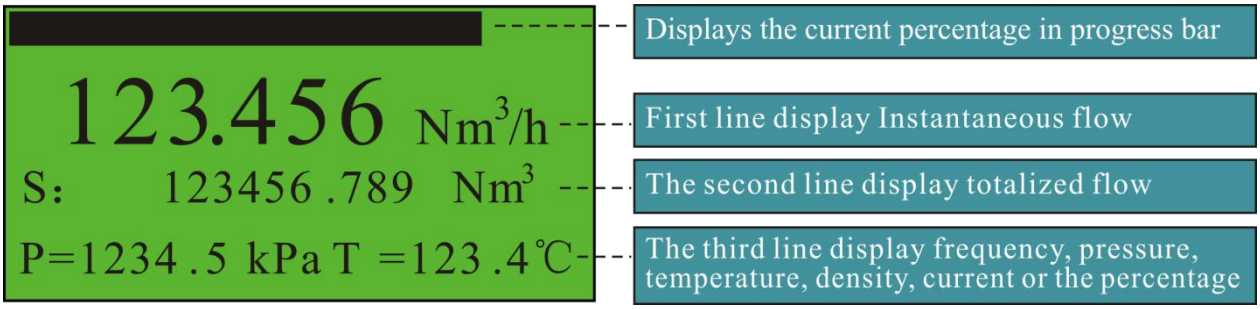
| Connection | Description |
|---|---|
| Power Supply | DC24V + → +<br>DC24V - → - |
| 4-20mA (passive) | 4-20mA + → **5 ( Io)**<br>4-20mA - → - |
| Pulse (Output NPN) | Pulse + → **Π ( represent ⎍ )**<br>Pulse - → - |
| RS485 | RS485 + → **A**<br>RS485 - → B |

## 4. Operation

Warning

- Do not open the cover with wet hands.
- When opening the cover, wait for more than 2 minutes after turning off the power.

### 4.1 Display Configuration




**Notes:**

▲If the pressure sensor is set to "automatic acquisition" mode, when pressure sensor failure is detected, the corresponding value will be replaced by the manual setting value (the value set in basic menu "Gauge Pre. KPa") and the value will flash on display.

▲If the temperature sensor is set to "automatic acquisition" mode, when temperature sensor failure is detected, the corresponding value will be replaced by manual setting value (the value set in basic menu "Temperature")and the value will flash on display.

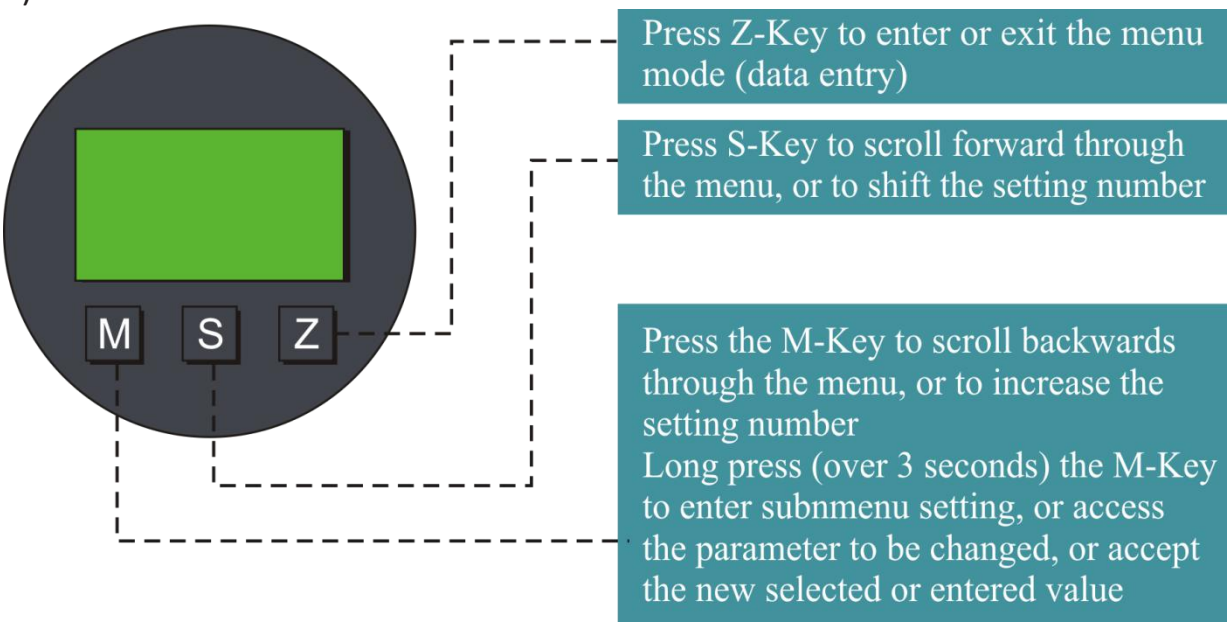
▲When the flow mode is set as "Sat_Steam (P)", it means saturated steam with pressure compensation only. At this time temperature value will display as "----" which means the acquisition of temperature sensor is not activated.

▲When the flow mode is set as "Sat_Steam (T)", it means saturated steam with temperature compensation only. At this time pressure value will display as "----" which means the acquisition of pressure sensor is not activated.

You can press KEY-M to change the third line display variables. Use indicator to distinguish between different display variables shows in the second line.

### 4.2 Data Setting Method

Data setting can be performed with the three keys on the front panel (M, S and Z).




◆ Enter or Exit Menu Mode

**Enter Menu Mode**

In the operating mode, press the "Z" key to enter the menu mode (data entry).

Exit Menu Mode

In the menu mode, press the "Z" key to back to the operating mode.

◆ **Data Entry Method**

Press M-Key for 2 seconds to enter setting, and the menu options will start flashing.

Short press M-Key or S-Key to scroll backwards or forwards the menu.

Press M-Key for 2 seconds to save (access) the parameter.

## 5. Menu List

### 5.1 Basic Function

Menus settings have been done by our engineer. In normal case do not suggest user to change menu by themselves which may cause the meter work improperly.

| Menu | Description | Setting method |
|---|---|---|
| Contrast | 1~5<br>Normal set as 3. | Menu Selection |
| Protection | ON / OFF | Press “M” button for 2 seconds to change |
| Min Alarm(%) | Set low alarm value. Unit: % | Direct Input |
| Max Alarm(%) | Set high alarm value. Unit: % | Direct Input |
| Meter Size | View meter size setting. | Read Only |
| Flow mode | Liquid Qv: Liquid volume Liquid Qm: Liquid mass Gas Qv: Gas volume<br>Gas Qm: Gas mass Steam Qv: Steam volume Steam(P/T): Steam mass<br>Sat_Steam(T): Saturated steam mass (temperature compensation)<br>Sat_Steam(P): Saturated steam mass (pressure compensation) | Menu Selection |
| Unit-Qv<br>Unit-Qm | Volume units supported: Nm3/h, $Nm^3/m$, $Nm^3/s$, l/s, l/m, l/h, $m^3/s$, $m^3/m$, $m^3/h$, $m^3/d$, Scf/s, Scf/m, Scf/h, cf/s, cf/m, cf/h, USG/s, USG /m, USG /h, UKG/s, UKG /m, UKG /h, bbl/h, bbl/d<br>Mass units supported : g/s ，g/m，g/h，kg/s，kg/m，kg/h，kg/d， t/m，t/h，t/d， lb/h，lb/d<br>Note: accumulative flow unit based on the instant flow unit. | Menu Selection |
| Range 100% | Set the Qmax value for selected flow mode (= 20 mA) | Direct Input |
| Density (kg/ $m^3$) Density (g/c $m^3$) | Set gas density (unit: $Kg/m^3$) Set liquid density (unit: g/cm3) | Direct Input |
| Gauge Pre.(KPa) | Use for gas or steam measure. Unit: kPa. | Direct Input |

| | | |
|---|---|---|
| Temperature (℃) | Use for gas or steam measure. Unit: ℃. | Direct Input |
| PV Cutoff (%) | Range: 0% ~ 20% | Direct Input |
| Damping | Range: 0 ~ 64S | Direct Input |
| Disp. Point | Set the first line display point, can be 0,1,2, 3. | Menu Selection |
| Display Mode | Set display mode. | Menu Selection |
| Totalizer reset | When Lcd display "Yes", long press M-Key to reset the totalizer and overflow counter. | Menu Selection |
| Number of totalizer overflows | Display of the number of totalizer overflows;<br>1 overflow = 10,000,000 | Read Only |
| K-Factor | View the K-Factor. | Read Only |

## ■ Flow Unit & Total Flow Unit Relation

| Flow Unit | Total Flow Unit |
|---|---|
| $Nm^3/h$，$Nm^3/m$，$Nm^3/s$ | $Nm^3$ |
| $m^3/d$，$m^3/h$，$m^3/m$，$m^3/s$ | $m^3$ |
| l/h，l/m，l/s | L |
| Scf/s，Scf/m，Scf/h， | Scf |
| cf/s，cf/m，cf/h， | cf |
| USG/s，USG /m，USG /h， | USG |
| UKG/s，UKG /m，UKG /h， | UKG |
| bbl/h，bbl/d， | bbl |
| g/h，g/m，g/s | g |
| kg/d，kg/h，kg/m，kg/s | kg |
| t/d，t/h，t/m | t |
| lb/h，lb/d | lb |

## 5.2 Advanced Function (Password Protection)

Below menus are for expert engineers only. All settings had been done properly during flow meter calibration in factory. Do not suggest user to change any of the settings which may cause flow meter work improperly.

| Menu | | Description | Password | Setting Method |
|---|---|---|---|---|
| M51 | Signal Monitor | LCD display:<br>450.00 This is the PGA gain.<br>CH2 CH2 is signal channel. | ****50 | Read Only |
| M52 | Meter Size | Options:<br>15mm, 20mm, 25mm, 32mm, 40mm, 50mm, 65mm, 80mm, 100mm, 125mm, 150mm, 200mm, 250mm, 300mm, 350mm, 400mm, 450mm, 500mm, 600mm; | | Menu Selection |
| M53 | Fluid Type | Options: Gas, or Liquid. | | Menu Selection |
| M54 | Low Flow Limit | According to the meter size and measuring media, set the corresponding low limit of the flow. The unit of 'Low Flow Limit' is fixed as $m^3/h$. | | Direct Input |
| M55 | High Flow Limit | The 'High Flow Limit' defaults to 10 times the 'Low Flow Limit', the actual measurement of the upper limit of 2.5 times the set value. The unit of 'High Flow Limit' is fixed as $m^3/h$. When the actual required range ratio exceeds 20: 1, can manually modify the 'High Flow Limit'. | | Direct Input |
| M56 | Max AMP. | Between 200 and 1000 suggested. Typically about 400. | | Direct Input |

| | | | | |
|---|---|---|---|---|
| M57 | K-Factor | Set average calibration k-Factor (1/$m^3$)<br>Means how many pulses corresponding to | | Direct Input |
| M58 | Pulse Factor Unit | Options: $m^3$, N $m^3$, t, kg, Scf, cf, USG, UKG, bbl, lb. | | Menu Selection |
| M59 | Pulse Factor | Set the number of output pulses corresponding to one 'Pulse Factor Unit'.<br>Note: If you want to output the original pulse, set 'K-factor [57]' and 'Pulse factor [59]' to the same value, and 'Pulse Factor Unit [58]' must set to $m^3$. | | Direct Input |
| | | | | |
| M60 | K-Factor Trim Fi<br>K-Factor Trim Yi | Five-point K-Factor correction.<br>Where Fi is the reference frequency, Yi is the correction coefficient K.<br>i=1,2,3,4,5. | ****60 | Direct Input |
| M61 | Frequency Factor | The reference frequency value of the five-point correction is multiplied by the frequency factor, and then the new reference frequency value of the correction point is obtained.Normally, this value should be 1.When calibrated with water, for gas measurements, you can set the coefficient so that the five-point correction factor remains in effect. | ****61 | Direct Input |

| | | | | |
|---|---|---|---|---|
| M62 | AMP. Channel | There are CH_1, CH_2, CH_3 three options.<br>CH_3 gain maximum<br>CH_1 gain minimum<br>Note:<br>CH2 generally used for liquid measurement, which corresponds to the configuration software, select X1 and X2.CH_3 generally used for gas measurement, which corresponds to the configuration software, select X1, X2 and X3. | ****62 | Menu Selection |
| M63 | Work Mode | There are F_1, F_2, F_3, F_4 four options.<br>F_1: Anti-vibration Mode<br>F_2: Normal Mode<br>F_3: Turbine Mode<br>F_4: Test Mode<br><br>Note:<br>Generally choose F_2. | ****63 | Menu Selection |
| M40 | Trim 4mA | Steps:<br>1.Press M-Key for 2 seconds, enter trim;<br>2.Short press M-key to decrease current. Press S-Key to increase current. Stepping is 16 microamperes.<br>3.Press M-Key for 2 seconds to save new trim value.<br>Or press Z-Key to exit without saving. | ****40 | |
| M41 | Trim 20mA | | | |
| M70 | Temp. Measure | Temperature acquisition mode setting.<br>Options: Manual, or Auto.<br>Manual: Temperature uses the input reference value.<br>Auto: Temperature is automatic acquisition, should be use external Pt1000 or Pt100. | ****70 | Menu Selection |

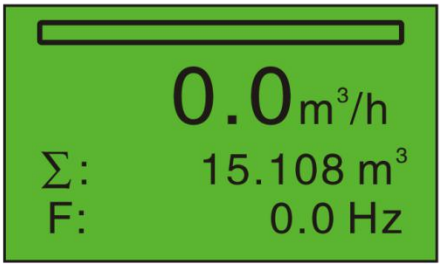
| | | | | |
|---|---|---|---|---|
| M71 | Pressure Measure | Pressure acquisition mode setting.<br>Options: manual, or auto.<br>Manual: If select manual, the pressure value will be replaced by the manual setting value (the value set in basic menu “Gauge Pre. Kpa”).<br>Auto: If select auto, pressure value is by automatic acquisition, need to connect with external pressure sensor. | | Menu Selection |
| M72 | Temperature Low Trim | Enter the lower calibration resistance value.<br>unit: ohm.<br>Use standard resistance as input.<br>For example: 1000 for Pt1000, or 100 for Pt100. | | Direct Input |
| M73 | Temperature Low Trim | Enter the high calibration resistance value.<br>unit: ohm.<br>Use standard resistance as input.<br>For example: 2500 for Pt1000, or 250 for Pt100. | | Direct Input |
| M74 | Pressure Low Trim | Enter the calibration reference pressure value.<br>Unit: KPa.<br>Apply the standard pressure to the sensor.<br>For example: 0 KPa | | Direct Input |
| M75 | Pressure High Trim | Enter the calibration reference pressure value.<br>Unit: KPa.<br>Apply the standard pressure to the sensor.<br>For example: 1000 KPa | | Direct Input |

| | | | | |
|---|---|---|---|---|
| M76 | Pre. Cutoff | Set the low pressure cutoff value.<br>Unit: KPa.<br>If the measured pressure value is less than 'Pre.<br>Cutoff', the pressure will be set to 0 kPa. | | Direct Input |
| M77 | Set Pre. Bias | Set the pressure bias value. Unit: Kpa.<br>Enter the current actual pressure value to achieve bias.<br>The pressure value will be set as the entered value. | | Direct Input |
| | | | | |
| M38 | Min Pre. (Kpa) | This parameter is only used for steam mass measurement.<br>In the steam mass measurement mode, if the pressure is less than the set 'minimum pressure value' when the pressure compensation is activated, the flow will automatically return to zero. | ****38 | Direct Input |
| M39 | Min Temp. (℃) | This parameter is only used for steam mass measurement.<br>In the steam mass measurement mode, if the temperature is less than the set 'minimum temperature value' when the temperature compensation is activated, the flow will automatically return to zero. | ****38 | Direct Input |
| | | | | |
| M11 | Version | To view the embedded software version. | ****11 | Read Only |
| M12 | Max Frequency | The internal conversion frequency value corresponds to the 'High Flow Limit'. | | Read Only |

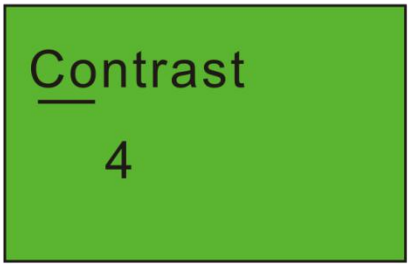
| | | | | |
|---|---|---|---|---|
| M13 | Min Frequency | The internal conversion frequency value corresponds to the 'Low Flow Limit'. | | Read Only |
| | | | | |
| M90 | Modbus Addr. | 1 ~ 247 | ****90 | Direct Input |
| M91 | Modbus Baud. | "9600", "4800" , "2400" , "1200" , "600" | | Menu Selection |
| | | | | |
| M111 | Total Preset | Used to directly set the current total flow value. | ****111 | Direct Input |
| | | | | |
| M721 | Temp. Data X0;<br>Temp. Data Y0;<br>Temp. Data X1;<br>Temp. Data Y1; | You can directly view and modify the temperature sensor calibration values.<br>Temp. Data X0 and Temp. Data X1 are internal ADC measurements.<br>Temp. Data Y0[73] and Temp. Data Y1[74] are the input calibration value. | ****721 | Direct Input |
| M741 | Pre. Data X0;<br>Pre. Data Y0;<br>Pre. Data X1;<br>Pre. Data Y1; | You can directly view and modify the pressure sensor calibration values.<br>Pre. Data X0 and Pre. Data X1 are internal ADC measurements.<br>Pre. Data Y0[75] and Pre. Data Y1[76] are the input calibration value. | ****741 | Direct Input |

## ● How to adjust the LCD contrast?

Power on display

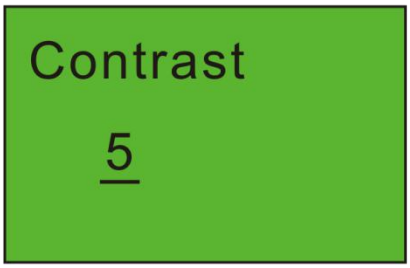



Press "Z" button, and then press "S" button to find menu "Contrast"




Press "M" button for 2 seconds to enter into this menu, press "S" button to choose the options.

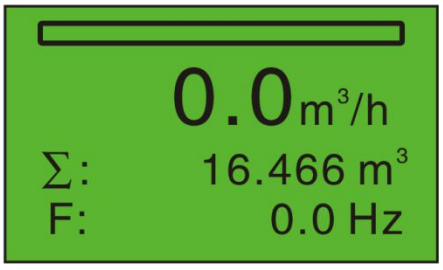
Default is "4", max number is "5".



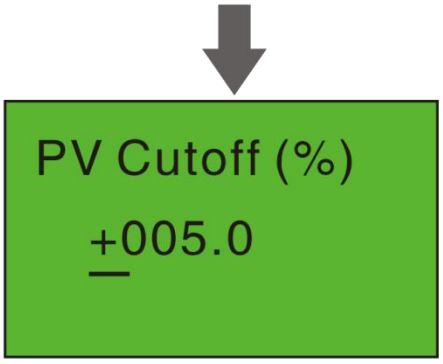

Press "M" button for 2 seconds to save the settings, and then press "Z" button to back to main display.

## ● How to set low flow cutoff?

Power on display



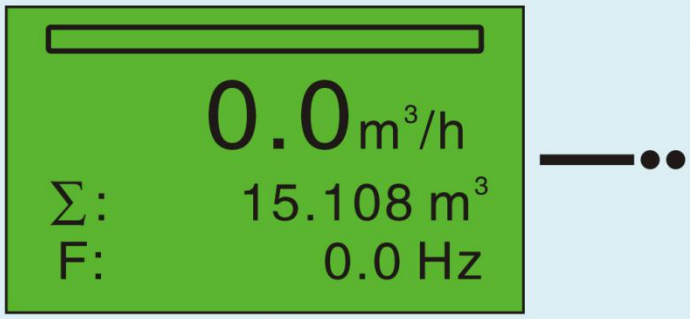

Press "Z" button and then press "S" button to find menu "PV Cutoff (%)"
Press "M" button for 2 seconds to enter this menu, Default value is 5.0.



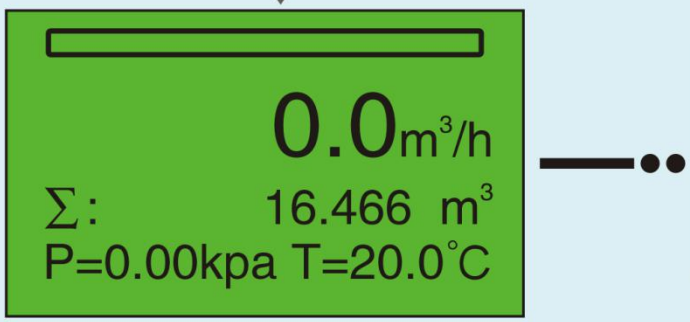

Press "S" button to move cursor and "M" button to set value you need.
Then Press "M" button for 2 seconds to save settings, and then press "Z" button to back to main display.

## ● How to check frequency, temperature, pressure, flow percentage value etc?

Power on display can check the frequency on the bottom line.

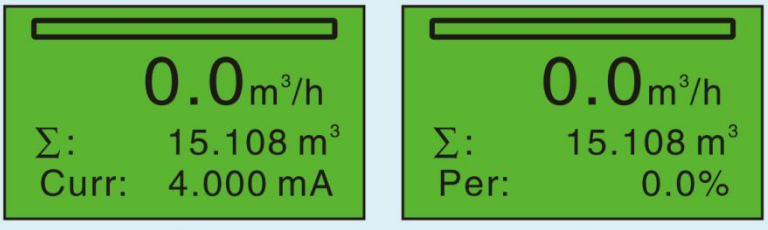



Press “M” button for 2 seconds, it can display pressure, temperature value.




Press “M” to check density, current and flow percentage value etc.

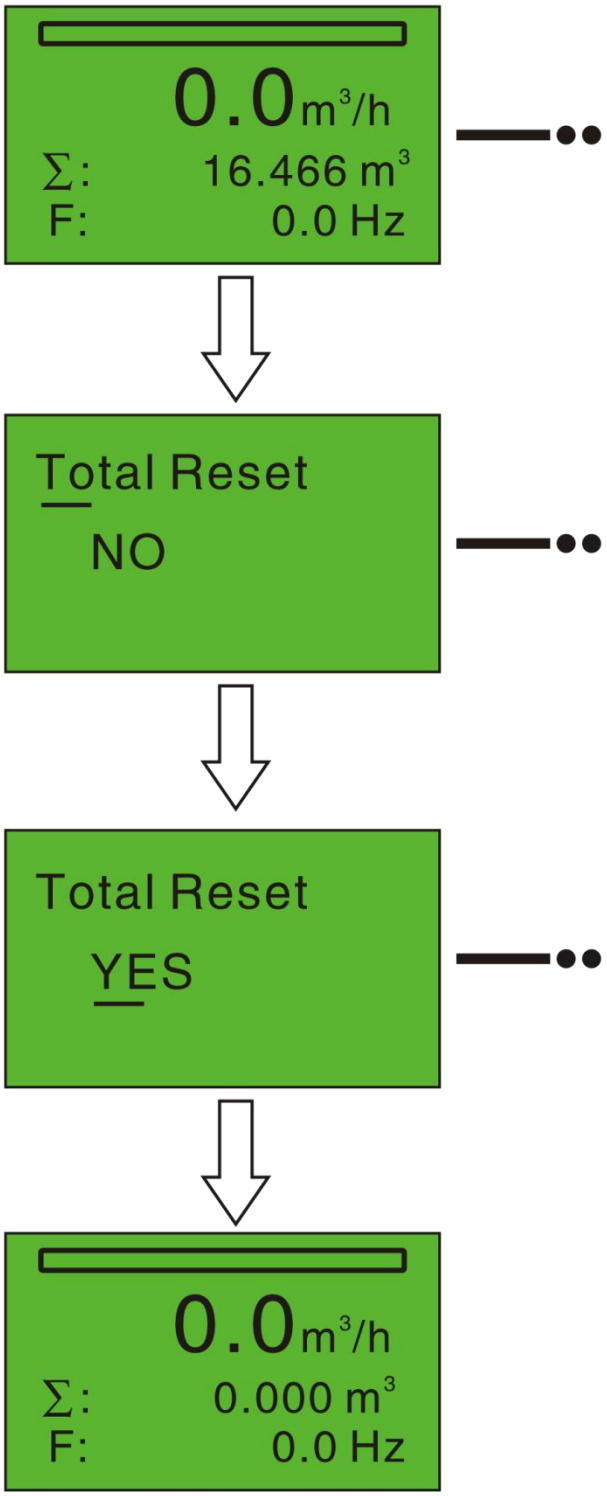

① ② ③




④ ⑤

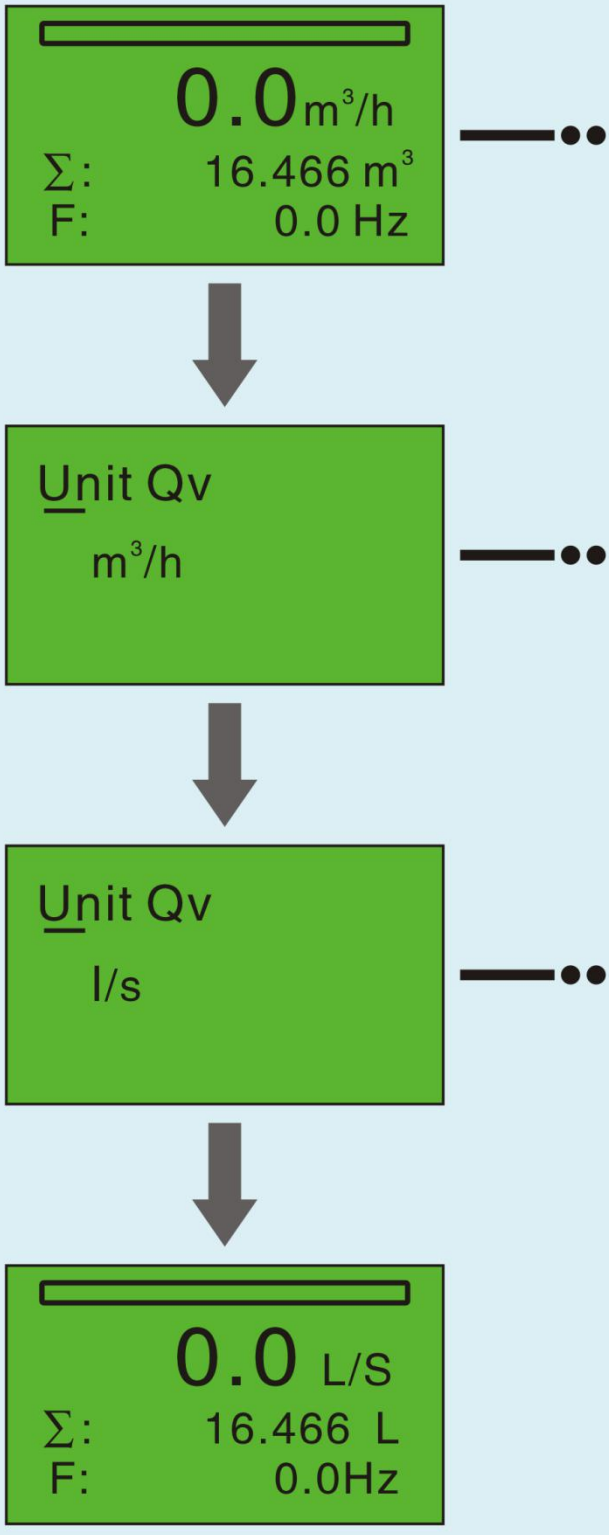
## How to clear total flow?

Power on display
For example, total flow value is 16.466m$^3$.



## ● How to change flow unit ? (Take an example, change volume flow unit from $m^3/h$ to L/s)

Power on display




Press “Z” button, and then press “S” button to find menu “Unit Qv” ( this is to set volume flow unit)

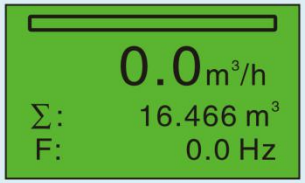
Press “M” button for 2 seconds enter this menu, press “S” button to find menu “L/S”

Press “M” button for 2 seconds to save settings.

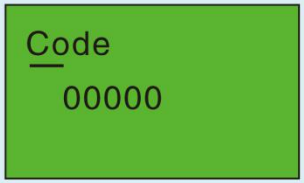
Press “Z” button to exit menu and back to main display.

## ● How to set pulse parameters?

Power on display

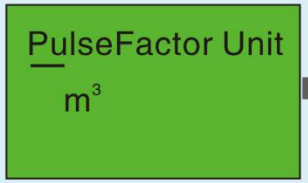



Press “Z” button and then Press “S” button to find menu “Code”

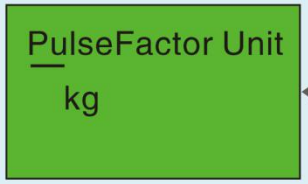



Press “M” button for 2 seconds to enter this menu, and then press “S” button move cursor and press “M” button set number “00050”.


Press “M” button for 2 seconds to enter. Press “S” button to find menu “PulseFactor Unit” (Default is m³)

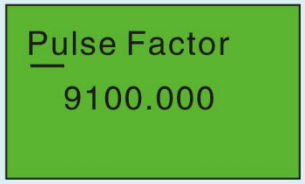



For example, if need to change to “kg”, Press “M” button for 2 seconds to enter this menu, and press “S” button to change to “kg”

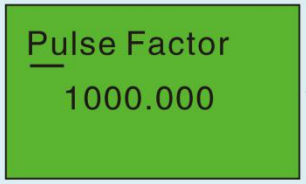



Press “M” button for 2 seconds tosave settings.

And then press “S” button to find the next menu “Pulse Factor”




Press “M” button for 2 seconds to enter this menu, press “S” button to move cursor and press “M” button to set values. For example change to “1000”

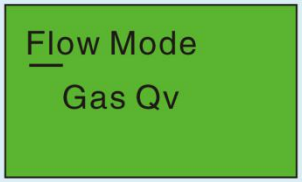



Press “M” button for 2 seconds to save settings and press “Z” button to exist and back to main display.

## ● How to adjust the medium type? (For example, change gas flow to liquid flow)

Power on display

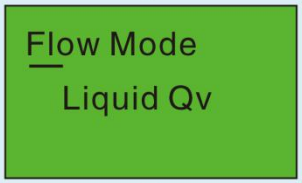

Press “Z” button, and then press “S” button to find menu “Flow Mode”




Options in this menu:

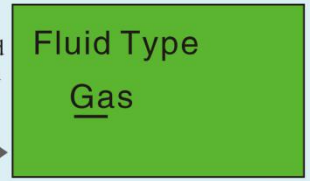
| Flow Mode | Description |
|---|---|
| Gas Qv | Gas volume flow |
| Gas Qm | Gas mass flow |
| Steam Qv | Steam volume flow |
| Steam (P/T) | Steam mass flow with both temperature and pressure compensation |
| Sat_Steam(T) | Saturated steam mass flow with temperature compensation only |
| Sat_Steam(P) | Saturated steam mass flow with pressure compensation only |
| Liquid Qv | Liquid volume flow |
| Liquid Qm | Liquid mass flow |

Press “M” button for 2 seconds to enter this menu and press “S” button to choose “Liquid Qv”

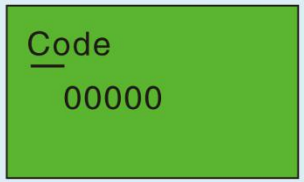



Press “M” button for 2 seconds to save settings. Press “S” button to find menu “Unit Qv” ( for liquid Qv flow unit need in volume flow unit) Set “Unit Qv” as “m³/h”.

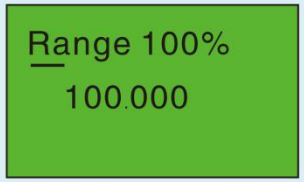

Press “M” button for 2 seconds to save and then press “S” button to find menu “Fluid Type”




Press “M” button for 2 seconds to enter this menu, and then press “S” button to move cursor and press “M” button to set number “00050”.




Press “S” button to find menu “Code”

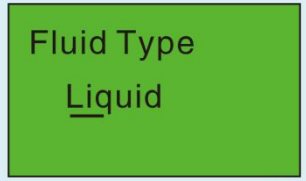



Press “S” button to find menu “Range 100%” and set according to the recommend flow range for your medium type.


Options in this menu

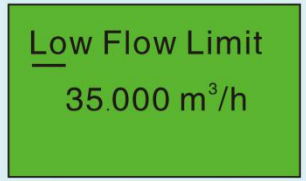
| Fluid Type | Description |
|---|---|
| Gas | For gas, and steam |
| Liquid | For liquid flow |

Press “M” button for 2 seconds enter this menu, and press “S” button to choose “Liquid”




Press “M” button for 2 seconds to save settings.

Then Press “S” button to find “Low Flow Limit”




Set the number according to the min flow of your medium type and size correctly.

| | | |
|---|---|---|
| Leakage | 1) The pressure in the pipe is too high<br>2) The nominal pressure of the sensor is incorrectly selected<br>3) The seal is damaged<br>4) The sensor is corroded | 1) Adjust the pipe pressure and change the installation position<br>2) Choose a higher nominal pressure sensor<br>3) Replace the gasket<br>4) Take anti-corrosion and protection measures |
| Abnormal Noise | 1) The flow rate is too high, causing strong tremor<br>2) Cavitation phenomenon occurs | 1) Adjust the flow or replace a large-caliber instrument<br>2) Adjust the flow rate and increase the liquid pressure |

## 6.Trouble Shooting

| Fault | Reason | Solution |
|---|---|---|
| Measurement Error | 1) Straight pipe section is not enough<br>2) Supply voltage changes too much<br>3) The instrument exceeds the verification period<br>4) The inner diameter of the flow meter and the pipe are quite different<br>5) The installation is not concentric or the gasket is protruding into the flow tube<br>6) The sensor is stained or damaged<br>7) There is two-phase flow or pulsating flow<br>8) There is leakage in the pipeline | 1) Lengthen the straight pipe section or install a regulator<br>2) Check the power supply<br>3) Timely inspection<br>4) Check the piping inner diameter to correct the meter coefficient<br>5) Adjust and install, rest the gasket<br>6) Clean or replace the sensor<br>7) Eliminate two-phase flow or pulsating flow<br>8) Eliminate leakage |
| Unstable/ Irregular Output signal | 1) There is a strong electrical interference signal<br>2) The sensor is stained or damp, and the sensitivity is reduced<br>3) The sensor is damaged or the lead is not in contact<br>4) Two-phase flow or pulsating flow<br>5) The impact of pipeline vibration<br>6) Unstable process<br>7) The sensor installation is not concentric or the gasket protrudes into the tube<br>8) Upstream and downstream valve disturbance<br>9)The pipe is not fully filled with fluid<br>10) The vortex generator has windings<br>11) There is cavitation phenomenon | 1) Strengthen shielding and grounding<br>2) Clean or replace the sensor<br>3) Check the sensor and lead<br>4) Strengthen process management and eliminate two phases flow or pulsating flow<br>5) Take measures to reduce vibration<br>6) Adjust the installation position<br>7) Check the installation and correct the inner diameter of the gasket<br>8) Lengthen straight pipe section or install adjuster<br>9) Installation location and method of replacing the sensor<br>10) Eliminate entanglement<br>11) Reduce the flow rate and increase the pressure in the pipe |

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