

**1 YEAR**  
WARRANTY

**Ω OMEGA®**

# User's Manual



**Shop online at  
[omega.com](http://omega.com) <sup>SM</sup>**

**E-mail: [info@omega.com](mailto:info@omega.com)  
For latest product manuals:  
[www.omegamanual.info](http://www.omegamanual.info)**

## FMC-5000 Series Coriolis Mass Flowmeters



Servicing North America:

**U.S.A.  
Headquarters:**

Omega Engineering, Inc.  
Toll-Free: 1-800-826-6342 (USA & Canada only)  
Customer Service: 1-800-622-2378 (USA & Canada only)  
Engineering Service: 1-800-872-9436 (USA & Canada only)  
Tel: (203) 359-1660 Fax: (203) 359-7700  
E-mail: info@omega.com

For Other Locations Visit  
[omega.com/worldwide](http://omega.com/worldwide)



**This manual includes the structure, principle, specifications, usage, applicable scope and precautions of the Mass Flowmeter sensor and transmitter. Be sure to read the manual before installation and operation. For more details about the product, please contact Omega.**

**If this transmitter has explosion-proof certification, no one is allowed to replace parts and components without authorization.**

**CAUTION:** To reduce the risk of ignition of hazardous atmospheres, disconnect the equipment supply circuit before opening. Keep assembly tightly closed when in operation.

**WARNING:** To Reduce The Risk Of Ignition Of Hazardous Atmospheres, Conduit Runs Must Have a Sealing Fitting Connected Within 18 in. of the Enclosure.

---

## FMC-5000 Series Mass Flowmeter

|  |           |
|--|-----------|
| CAUTION:.....  | 3         |
| <b>1. General .....</b>                                    | <b>5</b>  |
| 1.1 Introduction .....                                     | 5         |
| 1.2 Principle .....  | 5         |
| 1.3 Features .....   | 6         |
| <b>2. Technical Specifications.....</b>                    | <b>7</b>  |
| 2.1 Main Technical Specifications.....                     | 7         |
| 2.2 Specification of Function .....                        | 11        |
| 2.3 Environment Limitation.....                            | 12        |
| 2.4 Outlines and Dimensions.....                           | 13        |
| 2.5 Weights .....  | 14        |
| <b>3. Installation.....</b>                                | <b>15</b> |
| 3.1 Brief .....  | 15        |
| 3.2 Installation .....                                     | 15        |
| 3.3 Direction .....  | 17        |
| 3.4 Sensor Installation.....                               | 18        |
| 3.5 Wiring .....   | 18        |
| 3.6 Start-up .....   | 20        |
| <b>4. Power Supply and Signal Output Wiring.....</b>       | <b>21</b> |
| 4.1 Power Wiring.....                                      | 21        |
| 4.2 Current Output Wiring .....                            | 22        |
| 4.3 Pulse Output Wiring.....                               | 23        |
| 4.4 RS485 Output Wiring.....                               | 24        |
| <b>5. Configuration .....</b>                              | <b>25</b> |
| 5.1 General.....   | 25        |
| 5.2 Configuration Parameter .....                          | 25        |
| 5.3 Calibration.....                                       | 27        |
| <b>6. Pressure Loss .....</b>                              | <b>29</b> |
| <b>7. Trouble Shooting.....</b>                            | <b>34</b> |
| 7.1 Overview.....  | 34        |
| 7.2 Diagnostic Tool .....                                  | 34        |
| 7.3 Sensor .....   | 35        |
| 7.4 Power and connection.....                              | 35        |
| <b>8. Explosion-proof (Optional).....</b>                  | <b>36</b> |
| 8.1 The explosion-proof grades of FMC Coriolis Meter ..... | 36        |

---

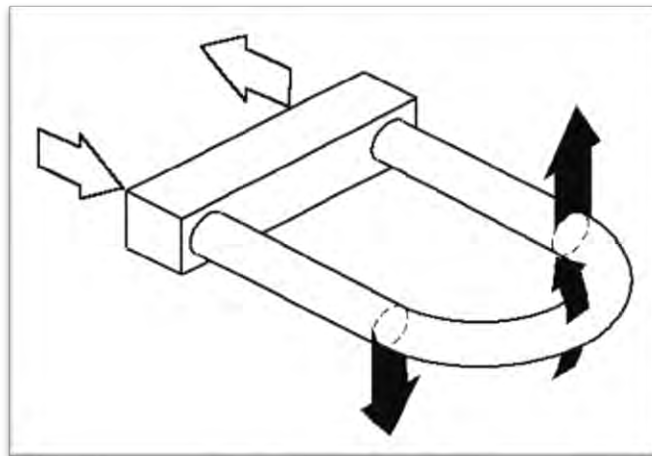
# 1. General

## 1.1 Introduction

FMC-5000 Series Coriolis Mass Flowmeter (here after FMC Coriolis Meter) is designed according to the Coriolis Force Principle. It is widely used for the process detecting and custody transfer/fiscal unit in many industries such as petroleum, petro-chemical, chemical industry, pharmacy, paper making, food, energy, and so on. As an advanced flow and density measurement instrument, it is widely used in the measurement of Liquids, Gas and Slurries.

## 1.2 Principle

FMC Coriolis Meter is designed according to the principle of Coriolis force. Under the alternating current effect, the electromagnetic coils mounted on the measuring tube will make two parallel measuring tubes vibrating at a certain fixed frequency. Whenever mass (either liquid or air) flows through the measuring tubes, Coriolis force is generated, causing a “bending” or “deflection” in the top of the tubes. This deflection is sensed as a phase shift between two electronic pick-ups mounted on the tubes. The degree of phase shift is directly proportional to the mass flow within the tubes. The mass flow rate can be calculated by detecting the phase shift of the tubes.



The vibration frequency of measuring tube is determined by the total mass of measuring tube and inner mass flow. The vibration frequency of measuring tube changes over the changes of mass flow density. Thus, the flow density can be calculated.

Working together with the measuring circuit, the temperature sensor mounted on the measuring tubes can obtain the real-time temperature value.

---

## **1.3 Features**

Compared to traditional flow measurement methods, FMC Coriolis Meters have the following obvious advantages:

1.3.1 Ability to directly measure the mass flow rate in the measuring tubes without any conversions, which avoids intermediate measurement errors. The mass flow is measured with high accuracy, good repeatability and a wide turndown ratio.

1.3.2 A wide range of flows, such as the steady uniform flows of common viscosity fluids, high viscosity fluids, non-Newtonian fluid, slurries containing solid components and liquids containing a little air.

1.3.3 With little vibration, the measuring tube can be regarded as no-moving parts, which will reduce the meter maintenance, and ensure the stability and long life.

1.3.4 Besides the mass flow measurement, density, temperature and even consistency can also be measured and output.

## 2. Technical Specifications

### 2.1 Main Technical Specifications

Table1: Main Technical Specifications

|                       |   |
|-----------------------|---|
| DN(mm)                | 15 ~ 200  |
| Medium                | Liquid, Gas, Slurry   |
| Type / Medium Temp.   | Integrate type: ( -50 ~ 125) °C<br>Remote type: ( -50 ~ 200) °C (-R Option)<br>Remote type with high temp: ( -50 ~ 300) °C (Custom) |
| Sensor                | Micro-bend type   |
| Certification         | Ex-proof (Optional)   |
| Power Supply          | 18-36V dc (Standard), 85-265V ac (Optional)   |
| Output Port           | RS485   |
| Pressure (MPa)        | 1.6 MPa (Standard)<br>2.5, 4.0 or 6.3 (Optional)  |
| Output Signal         | 4~20mA, pulse   |
| Accuracy              | 0.1%, 0.2%, 0.5% (Depending on Model)   |
| Digital Communication | RS-485 Modbus (Standard), HART (Optional)   |
| Hygienic Type         | Sanitary Flange Option  |
| Process Connection    | 150# ANSI (Standard)<br>DIN or JIS (Optional)   |

#### 2.1.1 Flow Range

Table 3: Flow Range of Micro-bend type sensor (for Liquid)

| DN (mm) | Allowable Flow Range (kg/h) | Normal Flow Range for Accuracy 0.1% (kg/h) | Normal Flow Range for Accuracy 0.2% (kg/h) | Normal Flow Range for Accuracy 0.5% (kg/h) | Stability of Zero Point (kg/h) |
|---------|-----------------------------|--|--|--|--------------------------------|
| 15      | 20~3000                     | 200~3000                                   | 150~3000                                   | 100~3000                                   | 0.09                           |
| 25      | 80~8000                     | 600~8000                                   | 400~8000                                   | 300~8000                                   | 0.25                           |
| 40      | 240~24000                   | 2400~24000                                 | 1200~24000                                 | 1000~24000                                 | 1                              |
| 50      | 500~45000                   | 5000~45000                                 | 2500~45000                                 | 2000~45000                                 | 2                              |
| 80      | 800~120000                  | 8000~120000                                | 7000~120000                                | 6000~120000                                | 3.5                            |
| 100     | 1500~200000                 | 18000~200000                               | 12000~200000                               | 10000~200000                               | 7                              |
| 150     | 5000~500000                 | 50000~500000                               | 35000~500000                               | 30000~500000                               | 23                             |
| 200     | 10000~1000000               | 100000~1000000                             | 70000~1000000                              | 50000~1000000                              | 45                             |

Table 4: Flow Range for gas mass flow (Air)

| DN (mm) | Measurable Flow Range (kg/h) | Flow Range with Accuracy 0.5% (kg/h) | Stability of Zero Point (kg/h) |
|---------|------------------------------|--------------------------------------|--------------------------------|
| 15      | 15 ~ 3000                    | 75 ~ 3000                            | 0.12                           |
| 25      | 40 ~ 8000                    | 200 ~ 8000                           | 0.32                           |
| 40      | 160 ~ 32000                  | 800 ~ 32000                          | 1.2                            |
| 50      | 250 ~ 50000                  | 1250 ~ 50000                         | 2                              |
| 80      | 700 ~ 140000                 | 3500 ~ 140000                        | 6                              |
| 100     | 1000 ~ 200000                | 5000 ~ 200000                        | 8                              |
| 150     | 2500 ~ 500000                | 12500 ~ 500000                       | 20                             |

Table 5: Flow range of Volume for Air under standard temperature and pressure condition (hereafter called "standard condition")

| DN (mm) | Start Flow (Nm <sup>3</sup> /h) | Flow Range with Accuracy 0.5% (Nm <sup>3</sup> /h) | Stability of Zero Point(Nm <sup>3</sup> /h) |
|---------|---------------------------------|--|---|
| 15      | 12.50                           | 62.5 ~ 2500.0                                      | 0.11  |
| 25      | 33.33                           | 166.7 ~ 6666.7                                     | 0.28  |
| 40      | 133.33                          | 666.7 ~ 26666.7                                    | 1   |
| 50      | 208.33                          | 1041.7 ~ 41666.7                                   | 1.6   |
| 80      | 583.33                          | 2916.7 ~ 116666.7                                  | 5   |
| 100     | 833.33                          | 4166.7 ~ 166666.7                                  | 6.7   |
| 150     | 2083.33                         | 10416.7 ~ 416666.7                                 | 18  |



Table 6: Flow rate factor for calculating medium speed

In many cases, we need to know the flow rate of the medium while using the FMC Coriolis Meter for Air measurement. Connection size reducing is common for mass flow meter Air measurement applications, thus the flow rate of the FMC Coriolis Meter needs to be checked according to the formula below:

$$\text{Inside Medium Flow Rate} = \frac{\text{Volume Flowrate under working condition}}{\text{Flow Rate Factor}}$$

|                  |       |       |       |       |       |       |       |       |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| DN (mm)          | 15    | 25    | 40    | 50    | 80    | 100   | 150   | 200   |
| Flow Rate Factor | 0.362 | 1.558 | 1.634 | 3.535 | 8.338 | 15.89 | 26.15 | 58.84 |

Note:

- ◆ The Gaseous medium flow velocity is usually much higher than liquid when measured by a flow meter, so there will be noise caused by gas medium and tube wall of flow meter under high speed gas flow and if the noise become large enough, the signal of flow meter will be influenced, so **please use FMC Coriolis Meter for gaseous medium measurement at speed less than 1/3 Mach (110m/s)!**

## ◆ Please use FMC Coriolis Meters for Gas with a pressure drop no more than 0.2Mpa!

### 2.1.2 Accuracy, Basic error and Repeatability

Table 7: Mass flow measurement accuracy

|               |        |        |        |
|---------------|--------|--------|--------|
| Accuracy      | 0.1%   | 0.2%   | 0.5%   |
| Basic error   | ±0.10% | ±0.20% | ±0.50% |
| Repeatability | ±0.05% | ±0.10% | ±0.25% |

Accuracy is calculated based on the water measurement under the condition of +20°C ~ 25°C and 0.1MPa ~ 0.2MPa.

$$\text{Accuracy} = \frac{\text{Stability of Zero Point}}{\text{Instantaneous Flow}} \times 100\%$$

---

### 2.1.3 Density Measuring

Table 8

|               |                            |
|---------------|----------------------------|
| Density Range | (0.2~3.0)g/cm <sup>3</sup> |
| Basic Error   | ±0.002g/cm <sup>3</sup>    |
| Repeatability | ±0.001g/cm <sup>3</sup>    |

### 2.1.4 Temperature Measuring

Table 9

|             |               |   |
|-------------|---------------|---|
| Temperature | (-50~+125)°C  | Integrated Type                           |
| Range       | (-50~+200)°C  | Separate Type                             |
|             | (-50~+300)°C  | High Temperature Separate Type (Optional) |
|             | (-125~+125)°C | Low Temperature Separate Type (Optional)  |
| Basic Error | ≤±1.0°C       |   |

---

## 2.2 Specification of Function

### 2.2.1 Current Output

4-20mA Passive Current Output can be configured to indicate the mass flow, volume flow, density or water ratio.

Table 10

|  |                |
|--|----------------|
| Output Range                           | (4 ~ 20) mA    |
| Resolution                             | 0.000244mA     |
| Basic Error                            | 0.2%F. S       |
| Temperature Influence                  | ±0.005%F. S/°C |
| External resistor should be 250 ~ 600Ω |                |

### 2.2.2 Pulse Output

Active Pulse Output can be configured to indicate the mass flow, volume flow, density or water ratio.

Table 11

|                                 |                |
|---------------------------------|----------------|
| Output Range                    | (0 ~ 10) kHz   |
| Resolution                      | 0.152Hz        |
| Basic Error                     | ±0.075%        |
| Temperature Influence           | ±0.001%F. S/°C |
| Capability of Outrange is 12kHz |                |

### 2.2.3 Low Flow Cut-off

When the mass flow value is lower than the value of Low Flow Cutoff, the FMC Coriolis Meter will output flow rate of zero, and the totalizer will stop accumulating. The value of Low Flow Cutoff is usually set to be 1% of the maximum flow rate.

### 2.2.4 RS485 Output

RS485 output is compatible to the RTU mode of MODBUS protocol. For details, please contact Omega.

---

## 2.3 Environment Limitation

### 2.3.1 Environment vibration

Table 12

|                          |                            |
|--------------------------|----------------------------|
| Frequency Range          | (10~2000) Hz               |
| Maximum Acceleration     | 2g (19.6m/s <sup>2</sup> ) |
| Maximum Vibration Cycles | 50                         |

### 2.3.2 Environment temperature

Table 13

|                     |              |
|---------------------|--------------|
| Working Temperature | (-40~+55) °C |
| Storage Temperature | (-40~+70) °C |

### 2.3.3 Environment humidity

Table 14

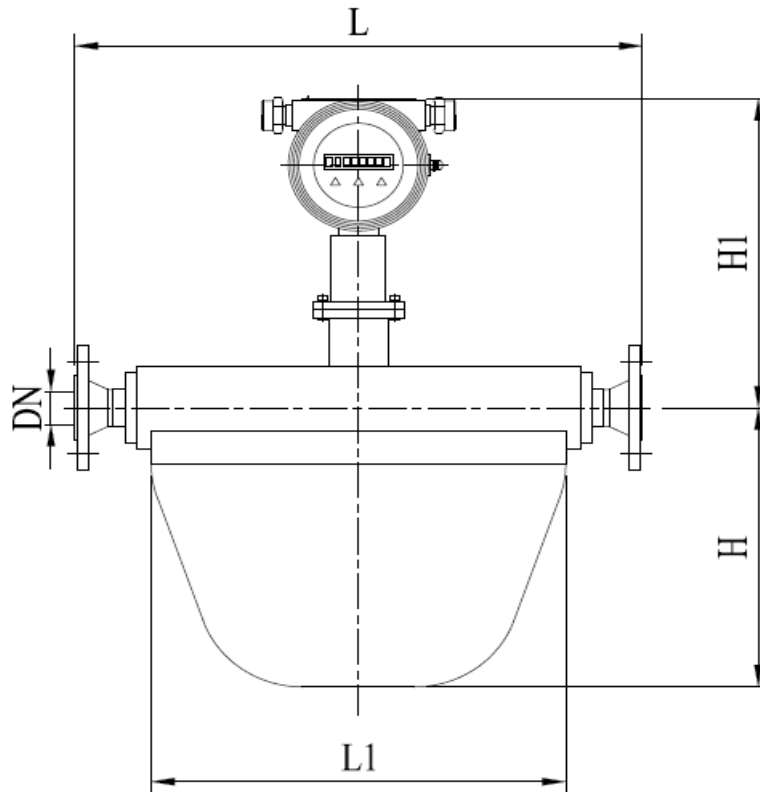
|                  |      |                          |
|------------------|------|--------------------------|
| Working Humidity | <90% | +25°C<br>No condensation |
| Storage Humidity | <95% |                          |

### 2.3.4 Enclosure Grade: IP65

### 2.3.5 Power Consumption

The normal power consumption for flow meter is 10W, and the max. Power consumption is 15W.

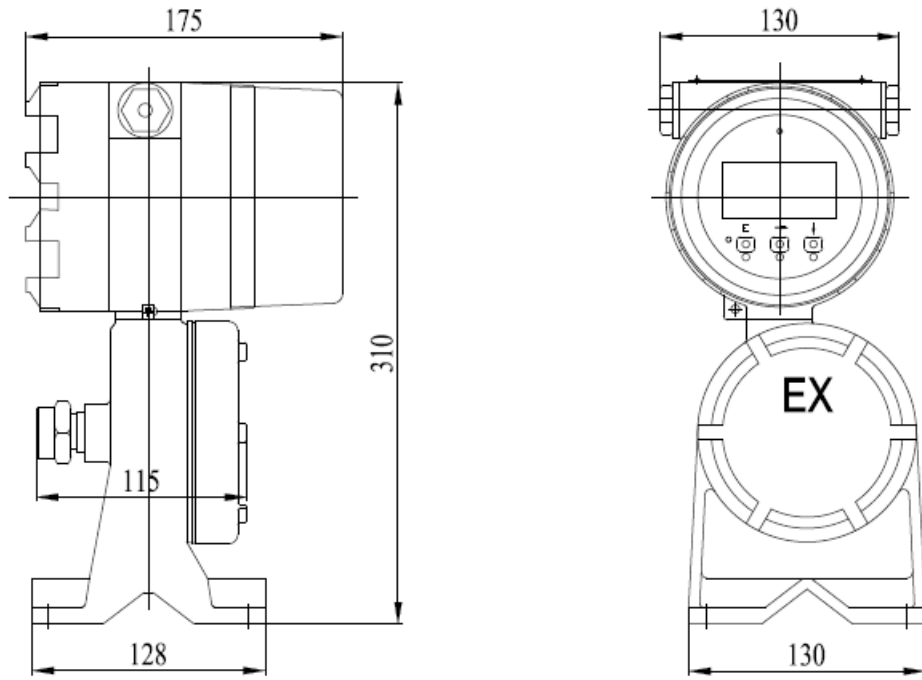
## 2.4 Outlines and Dimensions



**Micro-bend Type**

**Table16: Dimensions of Micro-bend type Unit: mm**

| FMC- | DN  | L      |        | $\Delta L$<br>(mm) | L1   | H    | H1      |        |
|------|-----|--------|--------|--------------------|------|------|---------|--------|
|      |     | <40Mpa | >63Mpa |                    |      |      | Compact | Remote |
| 015  | 15  | 400    | 414    | $\pm 1.5$          | 280  | 191  | 298     | 213    |
| 025  | 25  | 500    | 536    | $\pm 2.5$          | 360  | 258  | 302     | 218    |
| 040  | 40  | 600    | 634    |                    | 460  | 306  | 315     | 230    |
| 050  | 50  | 800    | 828    |                    | 640  | 410  | 325     | 240    |
| 080  | 80  | 900    | 928    |                    | 700  | 495  | 350     | 265    |
| 100  | 100 | 1130   | 1156   | $\pm 3.5$          | 860  | 663  | 370     | 285    |
| 150  | 150 | 1450   | 1490   |                    | 1200 | 902  | 400     | 316    |
| 200  | 200 | 1800   | 1844   |                    | 1450 | 1170 | 426     | 342    |



**Drawing 6: Dimensions for remote type transmitter (unit: mm)**

## 2.5 Weights

Table 17: net weights

Unit: kg

|                 |    |    |    |    |    |     |     |     |
|-----------------|----|----|----|----|----|-----|-----|-----|
| DN ( mm )       | 15 | 25 | 40 | 50 | 80 | 100 | 150 | 200 |
| Micro-bend type | 12 | 15 | 25 | 38 | 78 | 135 | 265 | 430 |

*Note: transmitter for remote type is 5kg extra.*

---

## 3. Installation

### 3.1 Brief

#### 3.1.1 Pre-installation

This section offers instructions for installation, wiring, operation, and trouble-shooting. The user must read this manual carefully before installation and operation, because improper installation may cause incorrect measurement and even damage the flow meter.

#### 3.1.2 Safety

**When the flow meter is going to be installed in the dangerous area, please confirm that the flow meter's explosion-proof class is consistent with the environmental requirements in order to avoid the potential danger.**

**Make sure that the power is shut off to avoid electric shock when installing the transmitter.**

**Follow the installation and operation instructions to ensure the safe operation.**

#### 3.1.3 Components

FMC Coriolis Meter is made up of a sensor (measuring tubes) and a transmitter, which can be installed integrally or separately. When FMC Coriolis Meter is installed separately, the sensor and transmitter should be connected by special Nine-Core Cable.

## 3.2 Installation

### 3.2.1 Installation Process

- Step 1: Location: Determine the sensor installation location, which should take the installation area, pipeline, transmitter location and valves into account.
- Step 2: Direction: Determine the sensor installation direction in the pipeline.
- Step 3: Installation: Install the sensor and transmitter in the pipeline.
- Step 4: Connection: When FMC Coriolis Meter is installed separately; the sensor and transmitter should be connected by special Nine-Core Cable.
- Step 5: Start-up.

### 3.2.2 Position selection

- The sensor should be placed away from interference sources (such as a pump) which may cause pipe mechanical vibration. If sensors are used in series along the same line, care must

---

be taken to avoid the mutual influence due to vibration resonance. The distance between sensors should be no less than 2 meters.

- When installing the sensor, pay attention to the expansion and contraction of the process pipeline due to temperature changes. It is strongly recommended that the sensor not be installed near an expansion joint of the process pipeline. Otherwise, the pipe expansion and contraction of the pipeline will bring about transverse stress which will affect the sensor's zero which will affect the measurement accuracy.
- The sensor should be placed at least 5M away from industrial electromagnetic interference sources such as large power motors and transformers.
- The sensor should be placed in the position where its measuring tube is always filled with fluids and a certain pressure at the outlet is maintained, thus it should be placed in a lower position of the pipeline.
- Basic requirement: Install the FMC Coriolis Meter in a lower position of the pipeline so that the fluid can fill the sensor during the process of zero-point calibration and operation. The transmitter should be installed in the environment with temperature from -40~+55 °C and humidity <90%.
- Dangerous area: Please confirm the explosion-proof class indicated in the nameplate of FMC Coriolis Meter matches the application environment regulation before installation.
- Straight pipe: The FMC Coriolis Meter does not require the special straight pipe upstream or downstream. However, if more than one mass flow transmitters are installed in the same pipe, please ensure the length of pipe between any two sets is more than 2 meters.

### 3.2.3 Maximum length of cable: shown in Table 22

| Cable Model              | Cable Specification         | Max. Length |
|--------------------------|-----------------------------|-------------|
| Special Nine-Core Cable  | Special                     | 300m        |
| Current Power Line       | 18AWG(0.8mm <sup>2</sup> )  | 300m        |
| RS485 Communication Line | 22AWG(0.35mm <sup>2</sup> ) | 300m        |



### 3.2.4 Working temperature of sensor: shown in Table 23

|  |               |
|--|---------------|
| Integral Type                                | (-50~+125) °C |
| Separate Type (-R)                           | (-50~+200) °C |
| High temperature Separate Type<br>(Optional) | (-50~+300) °C |

### 3.2.5 Valve

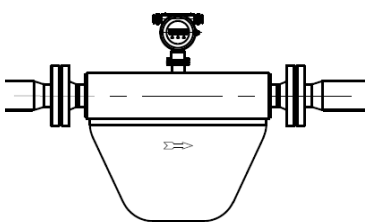
It is necessary to conduct the zero-point calibration once the installation is completed. The downstream stop valve must be closed before zero-point calibration, and then close the upstream stop valve.

## 3.3 Direction

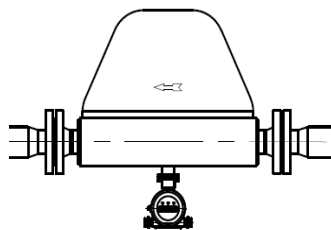
### 3.3.1 Basic requirement:

The FMC Coriolis Meter should be installed in the orientation that can ensure the measuring tube is filled with the medium being measured.

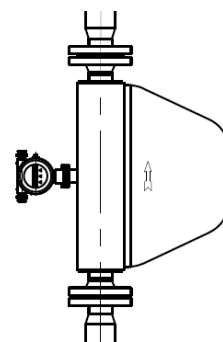
For horizontal installation, the measuring tube should be installed under the pipe when the process medium is liquid or slurry (shown on Drawing 9) and on top of the pipe when the process medium is gas (shown on Drawing 10). For vertical installation, the measuring tube would be installed besides the pipe when the process medium is liquid, slurry or gas (shown on Drawing 11)



Drawing 9



Drawing 10



Drawing 11

---

### 3.3.2 Flow direction:

There is **flow direction arrow** that indicates the proper flow direction on the front of the sensor, install the FMC Coriolis Meter accordingly.

For vertical installation, if the process medium is liquid or slurry, the flow direction should be from down-to-up; if the process medium is gas, the flow direction can be either down-to-up or up-to-down. The transmitter can be mounted with 90° rotation according to the requirement of installation.

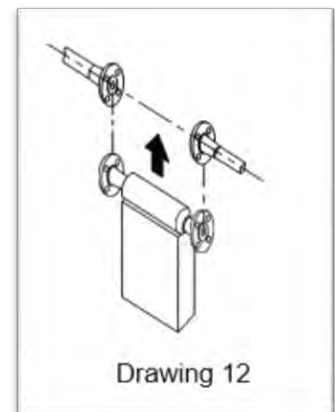
## 3.4 Sensor Installation

### 3.4.1 Basic requirements:

The installation of the FMC Coriolis Meter should be in a straight line. Meanwhile, do not support the pipeline with FMC Coriolis Meter. (As shown in Drawing 12)

### 3.4.2 Installation of the FMC Coriolis Meter 6" or larger:

It is better to support the sensor of FMC Coriolis Meter using rubber connectors as the buffer.



## 3.5 Wiring

### 3.5.1 Basic requirements:

If the sensor of FMC Coriolis Meter is installed integrally with the transmitter, it will be OK that the power of transmitter is connected. If the sensor of FMC Coriolis Meter is installed separately from the transmitter, it will be required that the transmitter is connected with sensor through special nine-core cable. If the FMC Coriolis Meter 6" (DN150mm) or larger is installed, it is required that the drive-amplifier of sensor is supplied with separate power.

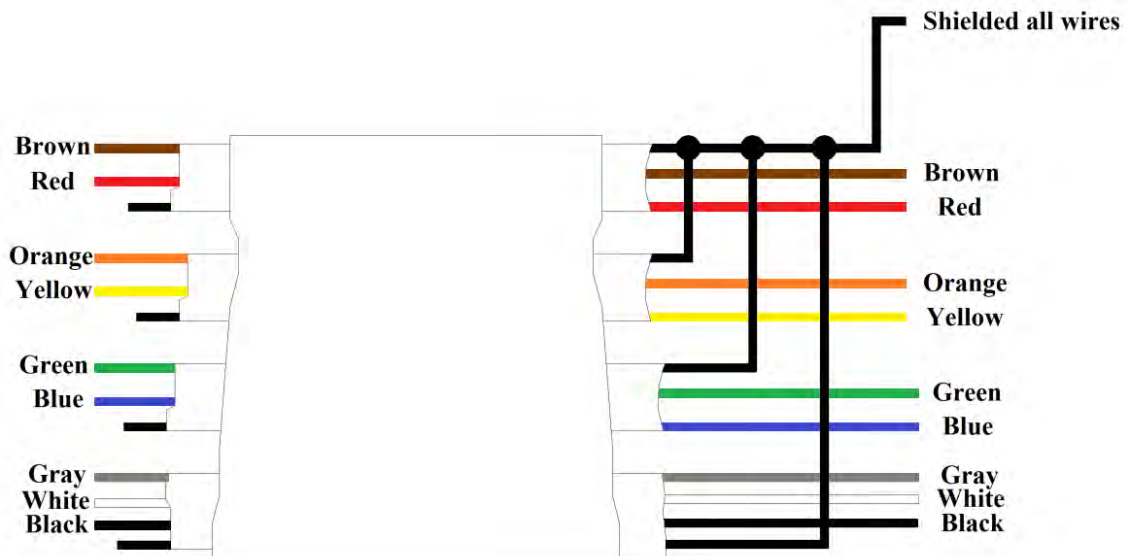
### 3.5.2 Junction box

If the sensor and the transmitter are installed separately, the sensor and transmitter have been respectively matched with junction box for connecting the special nine-core cable.

### 3.5.3 Cable connection

If the sensor and the transmitter are installed separately, signal lines are 9-core cables between transmitters and mass flow sensors.

Table 24: cables and functions



| Line NO. | Line Color | Function                 |
|----------|------------|--------------------------|
| 1        | brown      | The left coil+           |
| 2        | red        | The left coil-           |
| 3        | orange     | The right coil+          |
| 4        | yellow     | The right coil-          |
| 5        | green      | Driving coil+            |
| 6        | blue       | Driving coil-            |
| 7        | Gray       | Temperature+             |
| 8        | white      | Temperature-             |
| 9        | black      | Temperature Compensation |



**Cut off power before connecting cables. The power voltage must match that indicated in the junction box of the transmitter and the ground wire must be well grounded to ensure its intrinsic safety performance.**

---

#### 3.5.4 Grounding

Both of the sensor and the transmitter have to be grounded correctly, otherwise a measurement error will occur and the FMC Coriolis Meter may not work. If the pipeline is grounded, the transmitter can be grounded through the pipeline; if the pipeline is not grounded, the transmitter should be grounded independently.

#### 3.5.5 Power line wiring

The transmitter can be supplied with 18-36V dc (Standard) or 85-265V ac (Optional). The power line more than 0.8mm<sup>2</sup> is recommended and the maximum length of power line should be 300m. For FMC Coriolis Meter 6" or larger, a separate driver amplifier is required to be supplied for power.

### **3.6 Start-up**

#### 3.6.1 Zero-point calibration

Zero-point calibration supplies the base point for the flow meter. After the first installation or reinstallation, Zero-point calibration is required for the FMC Coriolis Meter. Before zero-point calibration, close the valve downstream of the flow sensor to make sure that no fluid is flowing through the pipe. The sensor should be filled with process fluid whose temperature change should not exceed  $\pm 10^{\circ}\text{C}$ . If the flow meter is zeroed when fluids are flowing through, its measurement will appear much smaller. At that time, stop using the meter or re-zero it before use.

#### 3.6.2 Instrument coefficient

Each FMC Coriolis Meter has its own instrument coefficients, which has been set before delivery and shown on the calibration report. So the user does not need to set instrument coefficients except if either the sensor or the transmitter is replaced. All the coefficients that can be found on the calibration report are also printed on the name plate. Generally, the sensor and the transmitter are coupled, and the coefficient has been input into the transmitter. The meter can be used without additional change.

## 4. Power Supply and Signal Output Wiring

### 4.1 Power Wiring

#### 4.1.1 The basic requirement:

The transmitter can be connected to the AC or the DC power.

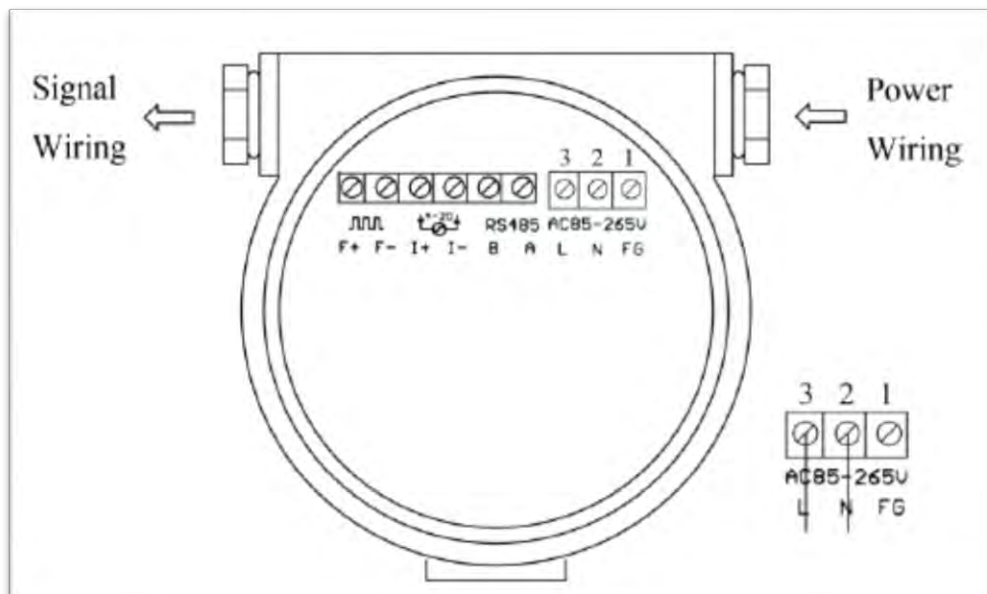
Table 25

|                  |                       |               |
|------------------|-----------------------|---------------|
| AC (85 to 265) V | Power Consume: Normal | 10 W, MAX 15W |
| DC (18 to 30) V  | Power Consume: Normal | 10 W, MAX 15W |

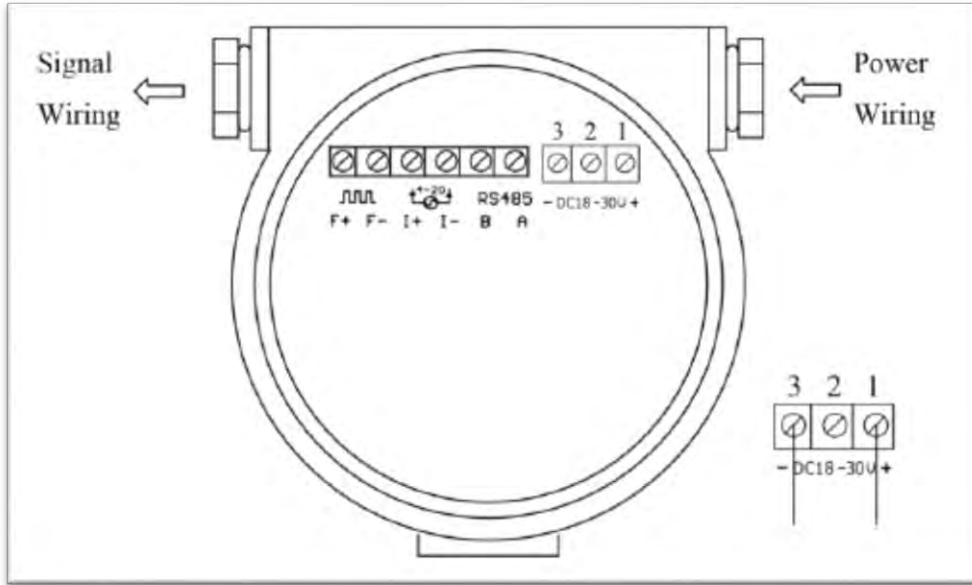
#### 4.1.2 Power Cable

The power cable should be a 2-core cable and 20 gauge minimum.

The maximum length of the power cable is 300m.



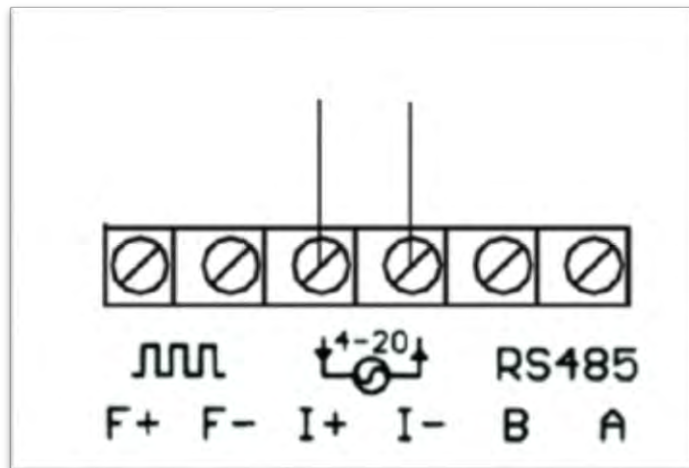
Drawing 13: AC Power Wiring



Drawing 14: DC Power Wiring

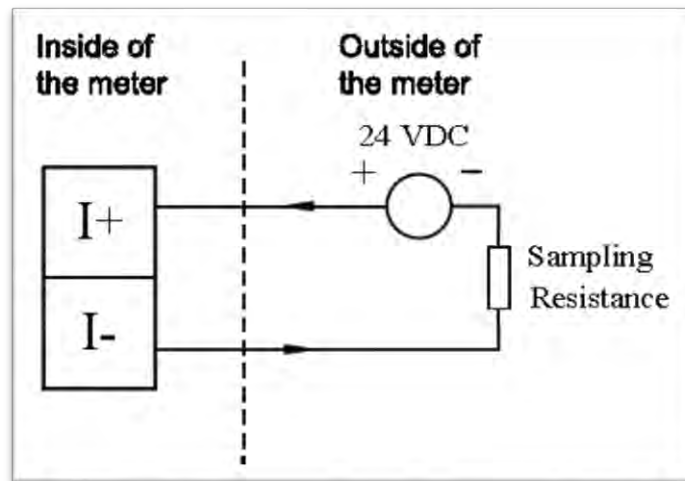
## 4.2 Current Output Wiring

- 4~20mA output can be configured to mass flow, volume flow, density or water ratio.
- The cable should be 2-core cable and 24 gauge minimum.
- The factory default current output is passive current output.



Drawing 15

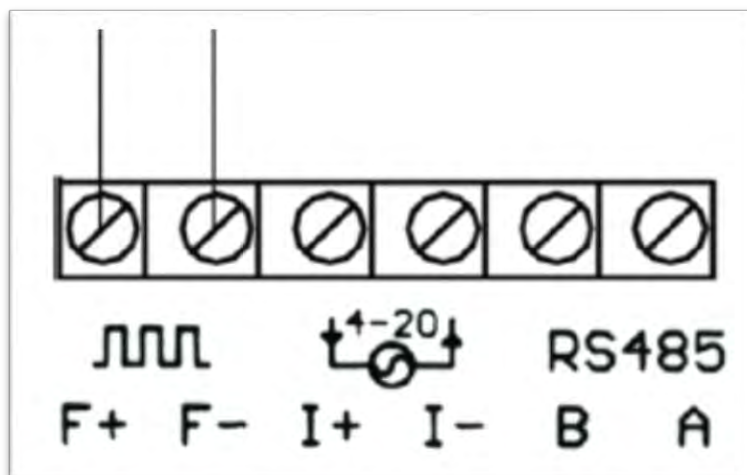
The outer wiring of passive current output is as the figure shows below:



Drawing 16

### 4.3 Pulse Output Wiring

- Active pulse output can be configured to mass flow, volume flow, density or water ratio.
- The cable should be 2-core cable and 24 gauge minimum. The maximum length of output line is 150m.

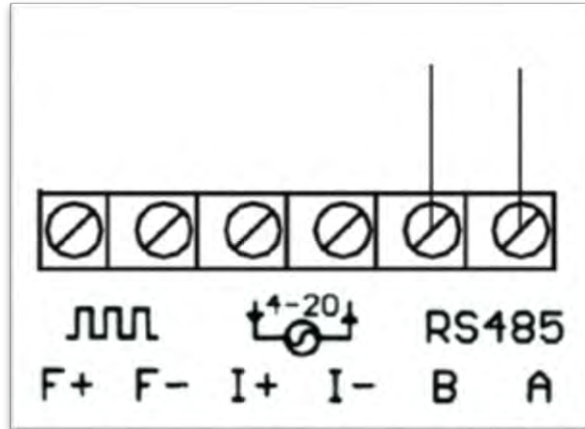


Drawing 17

---

#### 4.4 RS485 Output Wiring

RS485 output is compatible to RTU mode of MODBUS protocol. The maximum length of output line is  $\leq 300\text{m}$ .



Drawing 18

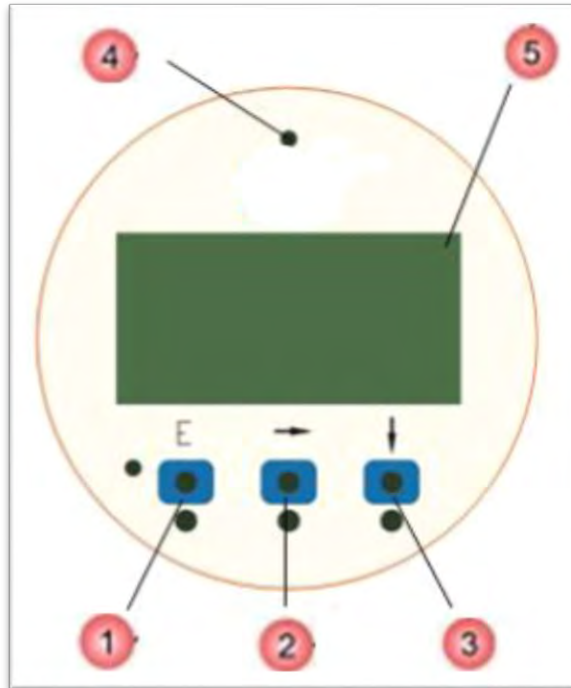


## 5. Configuration

### 5.1 General

Please use the operation panel of transmitter to set the configuration, such as basic configuration parameters, zero calibration, cutoff value of low flow and output range of current frequency, etc.

The face plate of the transmitter is shown in Drawing 19.



Drawing 19

| No. | Notes                         |
|-----|-------------------------------|
| 1   | E key: enter                  |
| 2   | → key: move curse or return   |
| 3   | ↓ key: page down              |
| 4   | OLED light for working status |
| 5   | Two-line LCD                  |

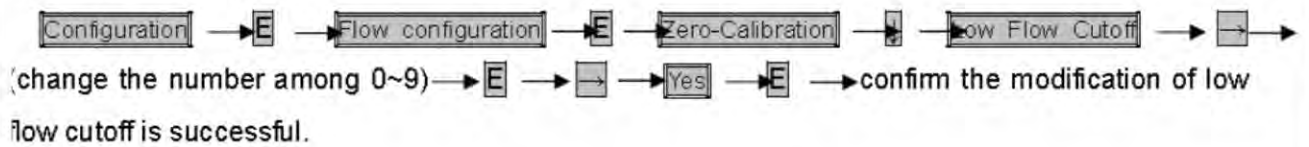
### 5.2 Configuration Parameter

**(Note: Default Password: “000000”)**

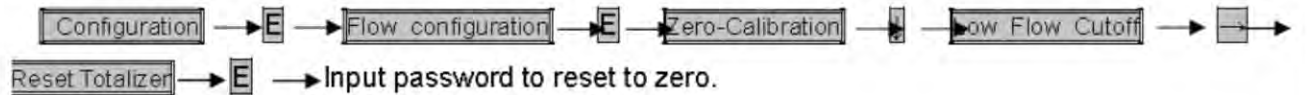
Please review or set the configuration parameters according to the following indications (press

↓ to turn a page and press → to move the position of cursor or return):

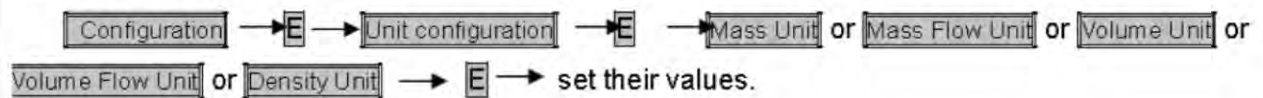
### 3.2.1 Low Flow Cutoff



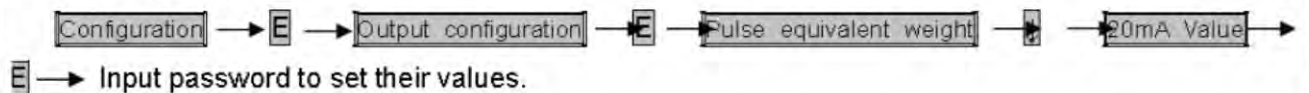
### 3.2.2 Reset Totalizer



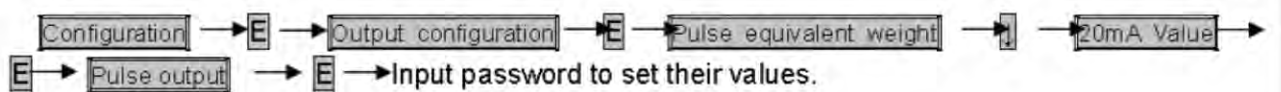
### 3.2.3 Measurement Unit



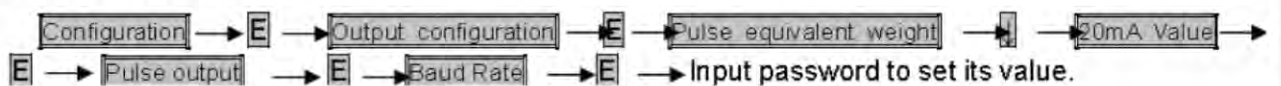
### 3.2.4 Current Output



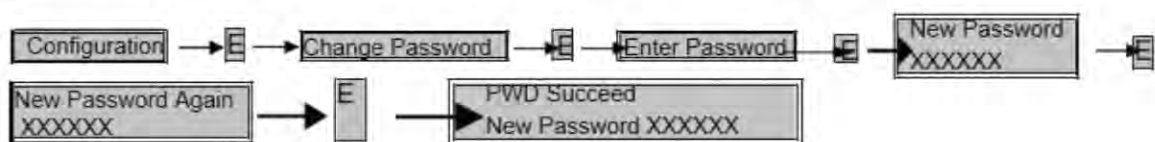
### 6.2.5 Pulse Output



### 6.2.6 RS485Output



### 6.2.7 Change Password



**Notice: If you forget your password, you **MUST** call an Omega flow engineer to reset it!!!**

---

## 5.3 Calibration

Generally speaking, the FMC Coriolis Meter does not need field calibration because it has been calibrated before delivery.

Each FMC Coriolis Meter has its own instrumental coefficient, including one flow coefficient and four density coefficients (high density D1, high period K1, low density D2 and low period K2), which will be shown in Nameplate of Sensor or Calibration certificate.

The sensor and transmitter are usually delivered as a pair and instrumental coefficient has been set in the transmitter so the user does not need to change.

### 5.3.1 Zero Calibration

Zero calibration provides the reference point for the flow meter. It is necessary to conduct the zero calibration whenever the FMC Coriolis Meter installation is performed.

After installation, **the FMC Coriolis Meter should be powered at least 30 minutes for warm-up and then pass flow through the flow meter until the temperature of FMC Coriolis Meter is same as working temperature of fluid.** Afterward, close the downstream valve, make the fluid pass through the flow meter under normal temperature, density and pressure and then close the upstream valve to assure the sensor is full of liquid during the process of zero calibration.

**Notice: Each zero calibration lasts 30s and must repeat at least *10* times.**

---

### 5.3.2 Flow Calibration

The mass measured by the FMC Coriolis Meter is resulted from the multiplication of detected signals' time difference between two circuits and flow calibration factor. If the accuracy is not up to grade after long-term service, please modify the flow calibration factor according to the following formula:

$$K1=K0 \times [1+ (M-Mt) / Mt] =K0 \times M/Mt$$

Note:

|    |                                  |
|----|----------------------------------|
| K1 | New flow calibration factor,     |
| K0 | Old flow calibration factor,     |
| M  | Total mass flow of Master Meter, |
| Mt | Total mass flow of Tested Meter. |

## 6. Pressure Loss

The pressure loss of FMC Coriolis Meter can be checked on the following Pressure Loss Charts (including pressure loss, flow, and viscosity parameters).

When the viscosity is between two adjacent pressure loss lines, the pressure loss can be calculated with following formula:

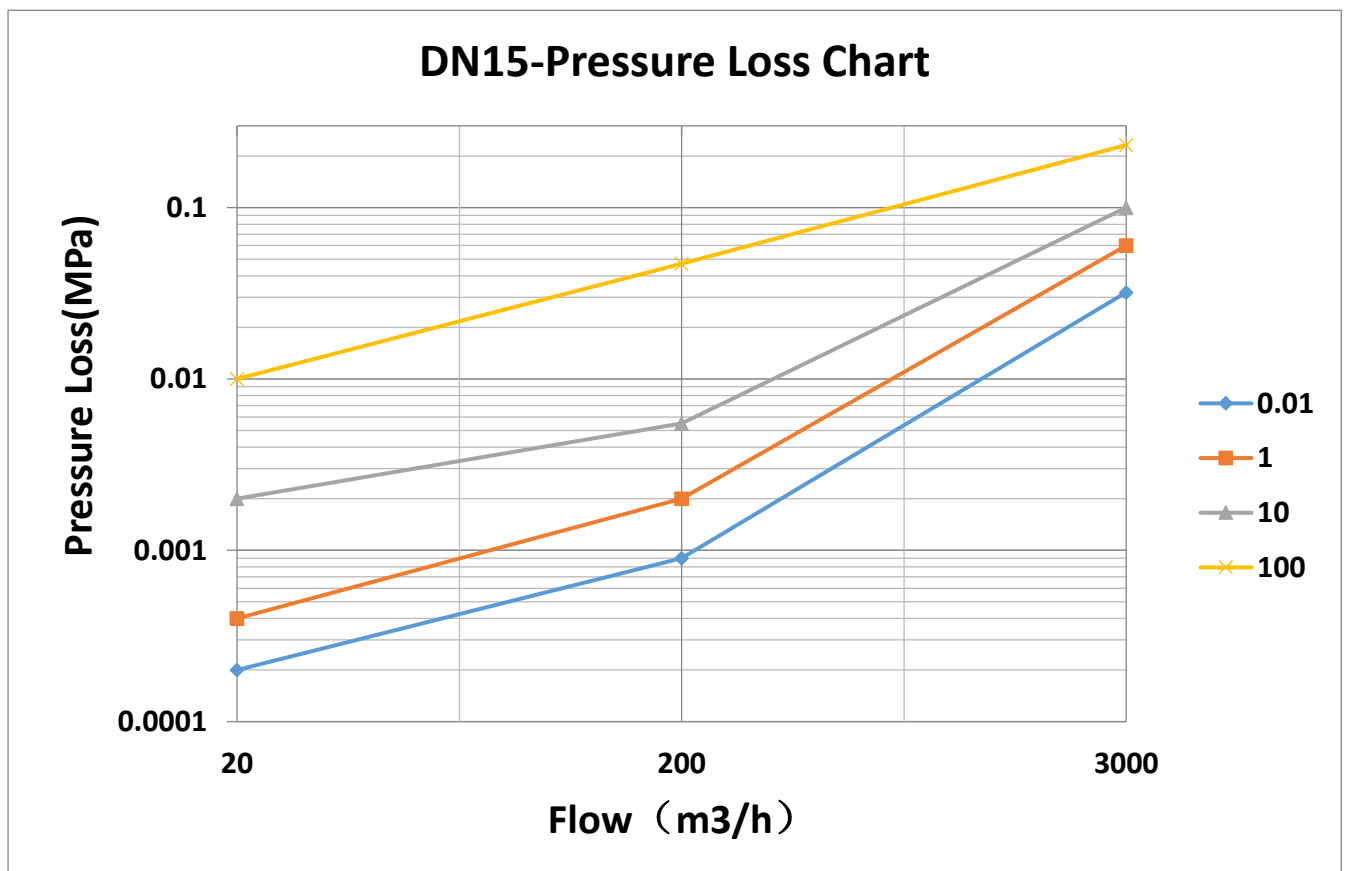
$$\Delta P = \Delta P_1 + \frac{\Delta P_2 - \Delta P_1}{\mu_2 - \mu_1} \times (\mu - \mu_1)$$

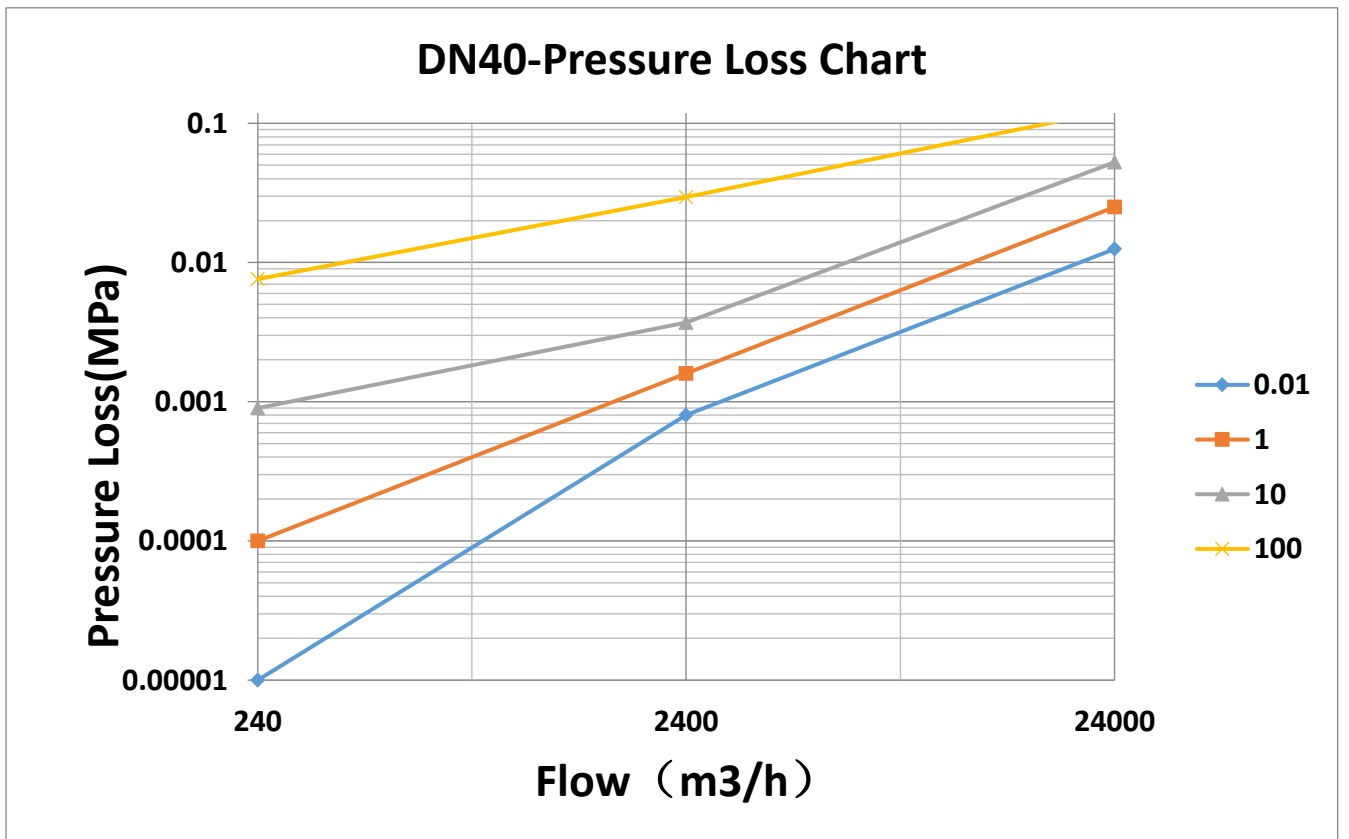
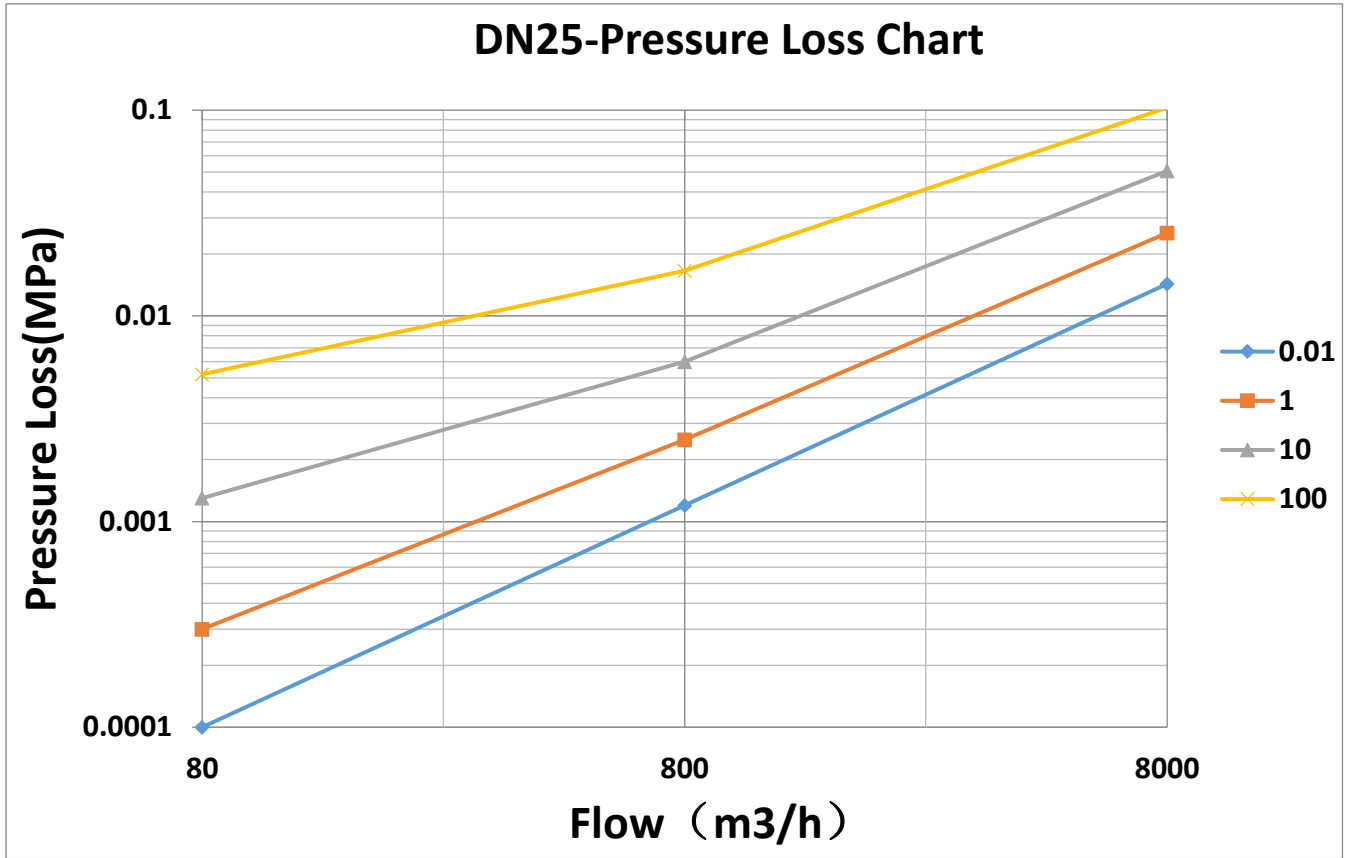
Note:

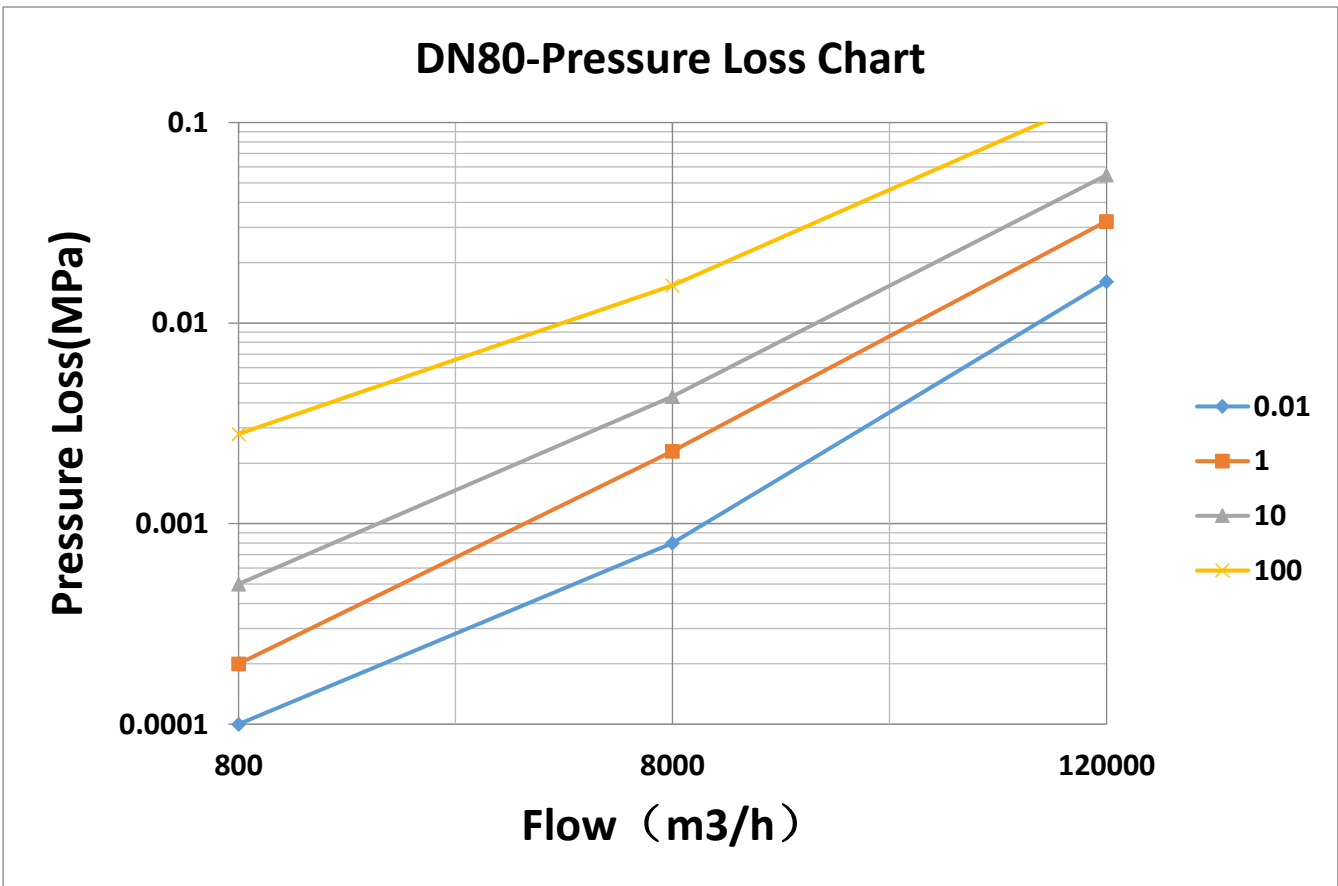
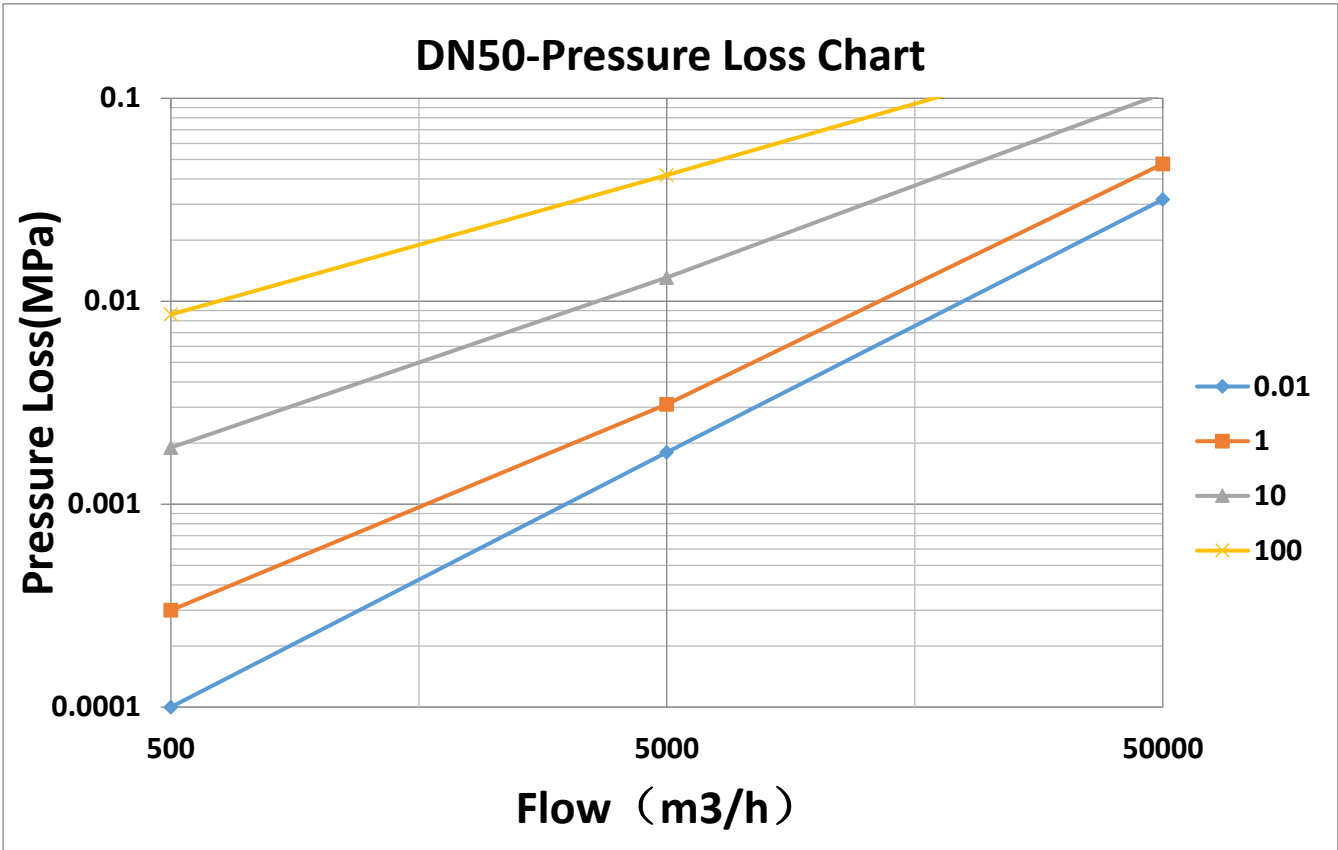
- The mass flow value can be converted to the volume flow value with followed formula:

$$\text{Volume flow rate} = \text{Mass flow rate} / \text{Density}$$

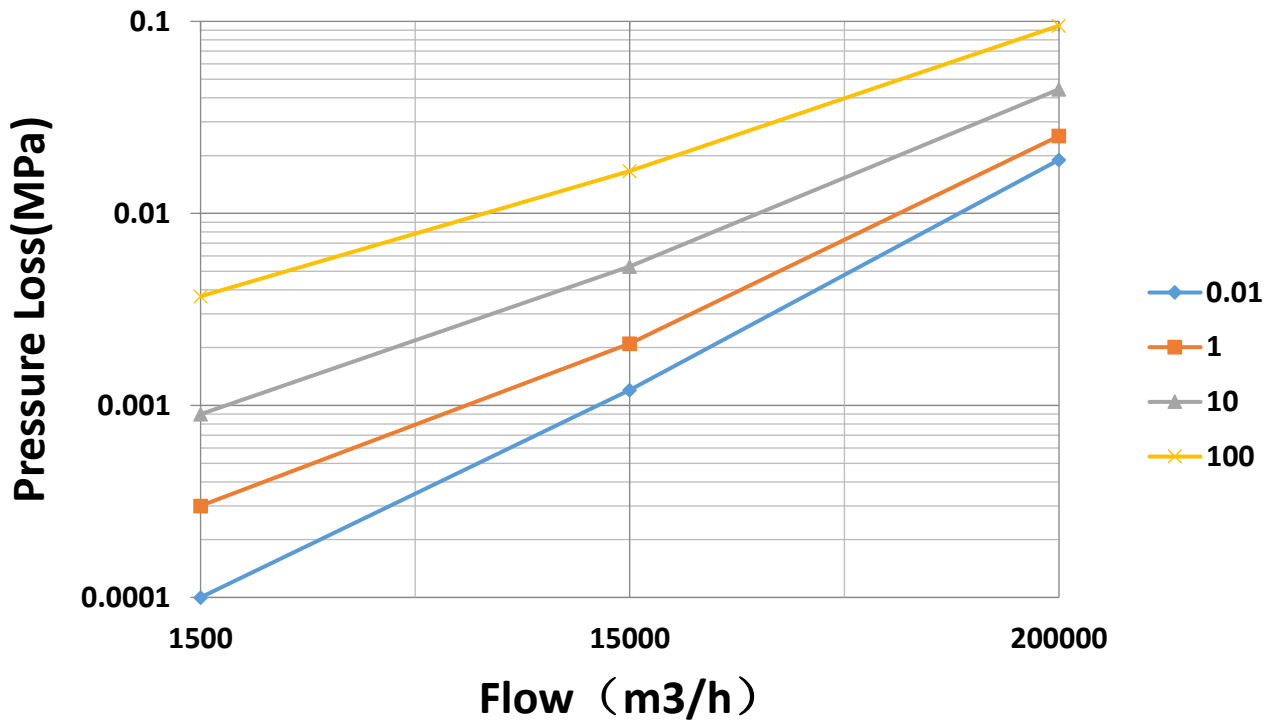
- Follow is the pressure loss for different size flow meter



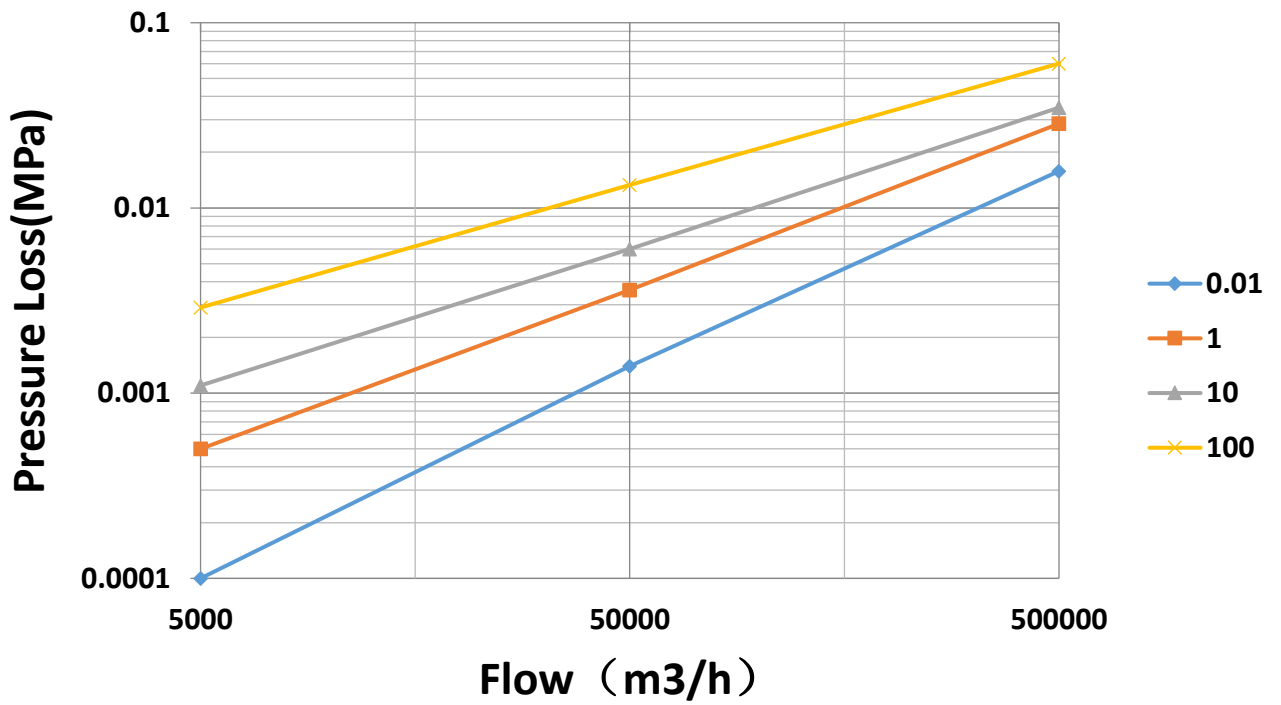




### DN100-Pressure Loss Chart

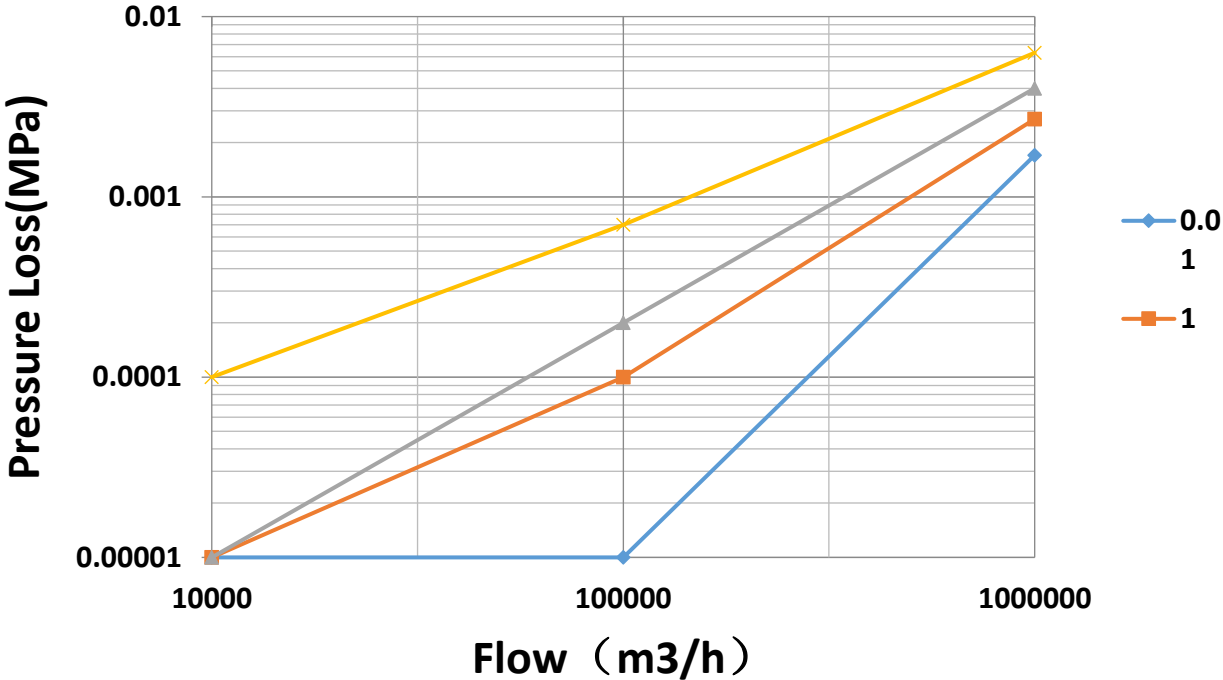


### DN150-Pressure Loss Chart





**DN200-Pressure Loss Chart**



---

## 7. Trouble Shooting

### 7.1 Overview

Upon first installation and operation, if there is an abnormal working phenomenon, the user should determine the causes.

Generally speaking, the causes may one of two kinds: flow meter or application causes. Application problems are usually complex. Fluctuation measurement error caused by the process or medium status changes, should be analyzed according to the actual application. This chapter mainly focuses on the causes and troubleshooting of flow meter system malfunctions.

### 7.2 Diagnostic Tool

For flow meter fault diagnosis, the user can check the OLED indicator and LCD displays, OLED lights of different colors and brightness contrast on the panel, which represent the working condition of flow meter. Meanwhile, LCD displays can show the self-diagnostic alarm information of the transmitter, which is useful for defining the malfunctions.

In addition, it is necessary to use handheld digital multi-meter when testing the static resistance values and cables of the sensor.

The proportion of light and dark shown by OLED indicator represents the working condition of the flow meter.

Table 27

| OLED condition | Working condition |
|----------------|-------------------|
| Green light    | Normal Operation  |
| Red light      | Error             |

---

### 7.3 Sensor

When testing a malfunction of the flow meter, first test the coils resistance according to Table 26 and check if their values are within the normal range.

Table 26

| Loop        | Line color     | Sensor port | Normal resistance range |
|-------------|----------------|-------------|-------------------------|
| Left coil   | Brown, red     | 1, 2        | (60~75) $\Omega$        |
| Right coil  | Orange, yellow | 3, 4        | (60~75) $\Omega$        |
| Drive coil  | Blue, green    | 5, 6        | (6~30) $\Omega$         |
| Temperature | Gray, white    | 7, 8        | (75~175) $\Omega$       |
| Temperature | Gray, black    | 7, 9        | (75~175) $\Omega$       |

### 7.4 Power and connection

Initial installation of electricity power should be checked to ensure the following:

Choose the correct voltage for power supply, connect the power cable correctly, open insulating layer of two ends of the cable and connect them firmly;

AC Power cable should not be connected through the same output as the signal cables;

Transmitter should be grounded firmly and the earth resistance should be less than 1  $\Omega$ , (use the copper wire 10 gauge minimum).

---

## 8. Explosion-proof (Optional)

### 8.1 The explosion-proof grades of FMC Coriolis Meter Table 28

| FMC Coriolis Meter-Model | Explosion-proof Grade                         |
|--------------------------|---|
| Integrate Type           | Exdib II CT4~T6( II C contains hydrogen only) |

- The ambient temperature range is (-40~+55) °C.
- The FMC-5000 Series Coriolis Meter contains the grounding terminal which must be grounded when put into service.
- The user should not change the electric parameters and standard model of explosion-proof parts in the sensor.
- The cable jacket can be divided into two kinds of  $\phi 8.5\text{mm}$  and  $\phi 12\text{mm}$  according to the inner hole of cable gasket ring while the outside diameters of cables are respectively  $\phi 8\text{mm}\sim\phi 8.5\text{mm}$  and  $\phi 8.5\text{mm}\sim\phi 12\text{mm}$ . Please change the cable and gasket ring once they age or wear out.
- Do not use in environment that will corrode/erode the aluminum alloy.
- Be sure that the maintenance or repair is in a safe place without flammable gaseous.
- The relationship between working temperature of medium and maximum surface temperature of flow meter body are as follows:

Table 29

| ITEM                | T3    | T4    | T5    | T6   |
|---------------------|-------|-------|-------|------|
| Working temperature | 200°C | 135°C | 100°C | 85°C |
| Surface temperature | 195°C | 130°C | 95°C  | 80°C |

M-5621/0217

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY

DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA For current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 2016 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.

# Where Do I Find Everything I Need for Process Measurement and Control? **OMEGA...Of Course!** *Shop online at [omega.com](http://omega.com)<sup>SM</sup>*

## **TEMPERATURE**

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

## **PRESSURE, STRAIN AND FORCE**

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gages
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

## **FLOW/LEVEL**

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

## **pH/CONDUCTIVITY**

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

## **DATA ACQUISITION**

- ☑ Communications-Based Acquisition Systems
- ☑ Data Logging Systems
- ☑ Wireless Sensors, Transmitters, & Receivers
- ☑ Signal Conditioners
- ☑ Data Acquisition Software

## **HEATERS**

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

## **ENVIRONMENTAL MONITORING AND CONTROL**

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments