Coriolis Mass Flow Meter

1. Introduction

HG-CMFI Coriolis Mass Flow Meters patented and developed by our company are the leading meters for precision flow measurement. And with good reason, HG meters offer the most accurate measurement available for virtually any process fluid, while exhibiting exceptionally low pressure drop.

HG meters are designed for unsurpassed performance in even the harshest operating environments. They have no moving parts, and any special mounting or flow conditioning requirements. Every HG meter is available with stainless steel wetted parts and a wide variety of process connections to meet your every need.

2. Measuring Principle

Coriolis Mass Flow meter also known as an inertial flow meter is a device that measures mass flow rate of a fluid traveling through a tube. The mass flow rate is the mass of the fluid traveling past a fixed point per unit time.

The mass flow meter does not measure the volume per unit time (e.g., cubic meters per second) passing through the device; it measures the mass per unit time (e.g., kilograms per second) flowing through the device. Volumetric flow rate is the mass flow rate divided by the fluid density. If the density is constant, then the relationship is simple. If the fluid has varying density, then the relationship is not simple. The density of the fluid may change with temperature, pressure, or composition, for example. The fluid may also be a combination of phases such as a fluid with entrained bubbles.

When the fluid is flowing, it is led through two parallel tubes. An actuator induces a vibration of the tubes. The two parallel tubes are counter-vibrating, to make the measuring device less sensitive to outside vibrations. The actual frequency of the vibration depends on the size of the mass flow meter, and ranges from 80 to 1000 vibrations per second. The amplitude of the vibration is too small to be seen, but it can be felt by touch.

When no fluid is flowing, the vibration of the two tubes is symmetrical ,resulting in zero flow indindication. When there is mass flow, there is some twisting of the tubes. The arm through which fluid flows away from the axis of rotation must exert a force on the fluid to increase its angular momentum, so it is lagging behind the overall vibration. The arm through which fluid is pushed back towards the axis of rotation must exert a force on the fluid to decrease the fluid's angular momentum again; hence that arm leads the overall vibration.

The inlet arm and the outlet arm vibrate with the same frequency as the overall vibration, but when there is mass flow the two vibrations are out of sync: the inlet arm is behind, the outlet arm is ahead. The two vibrations are shifted in phase with respect to each other, and the degree of phase-shift is a measure for the amount of mass that is flowing through the tubes.

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3. Technical Specifications

3.1 Technical Specifications

Table of Technical Specifications (Table 1)

Titles	Technical Specifications
Mass flow accuracy	±[0.2% +（zero stability /flow rate×100%）]
Mass flow repeatability	±(1/2) ×[0.2% +（zero stability /flow rate×100%）]
Density range	0.2 g/cm^3～3.5g/cm^3
Density accuracy	±0.002g/cm^3
Temperature range	-60～+200 deg C
Temperature accuracy	±1%
Current output	4mA～20mA
Frequency/pulse output	0Hz～10kHz
Contact capacity of a Batch Control relay	24V/0.1A
Contact Type	normally open (normally close available for special order)

3.2 Basic Parameters

Parameters of Working Conditions (Table 2)

Titles	Parameters
Temperature range of fluid	-40～+200 deg C
Ambient temperature	0～+40 deg C
Environmental humidity	≤90% RH, non condensation
Atmospheric pressure	86kPa～106kPa
Power supply of transmitters	Power supply Voltage: AC(220±10%)V,(50±5%)Hz Composite Voltage: DC (24±10%) V
Power	＜15W

Specifications (Table 3)

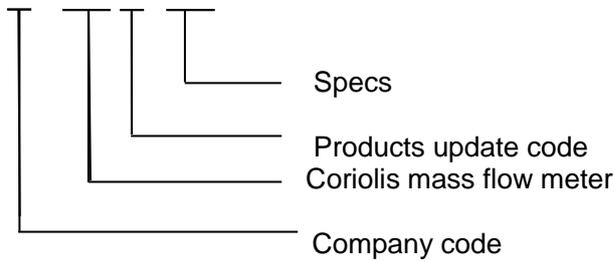| Specs	Line Sizes (mm)	Flow Range (t/h)	Calibration Range (t/h)	Max. Working Pressure (MPa)	Zero Stability (t/hr)	Velocity Parameter (h m/t s)
DN1	1	0~0.04	0.004~0.04	30.0	0.0000080	353.7
DN3	3	0~0.35	0.035~0.35	30.0	0.000067	39.3
DN6	6	0~0.7	0.07~0.7	30.0	0.00016	19.65
DN10	10	0～1.2	0.12～1.2	30.0	0.0002	4.912
DN15	15	0～6.4	0.64～6.4	4.0	0.0011	2.183
DN25	25	0～16	1.6～16	4.0	0.002	0.902
DN40	40	0～40	4～40	4.0	0.003	0.334
DN50	50	0～65	6.5～65	4.0	0.006	0.197
DN80	80	0～160	16～160	2.5	0.01	0.0873
DN100	100	0～250	25～250	2.5	0.015	0.0544
DN150	150	0~550	55~550	2.5	0.03	0.0239

3.3 Explosion-proof Identification Code

Table of Explosion-proof identification code (Table 4)

Form of Explosion-proof	Identification Code
Intrinsic safety	Exib[ib]IIBT4GB
Compound	Exdib[ib]IICT6GB

4. Structure
4.1 Classification

Model: HG-CMF I- DNXX

Specs

Products update code

Coriolis mass flow meter

Company code

Products specs are divided to eleven types based on nominal line sizes: DN1. DN3, DN6, DN10, DN15, DN25, DN40, DN50, DN80, DN100, DN150 (units: mm).

4.2 Components

Figure 1 Sensors (primary meter)

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Figure 2 Intrinsic Safety Transmitter   Figure 3 Compound Transmitters and Sensor
   (Secondary Meter)

   Every meter consists of two parts: the sensor (primary meter) and the transmitter (secondary meter).
      The sensor (primary meter) is the mechanical part of the mass flow meter. There are a vibrator, two displacement sensors and a temperature sensor in it.
      The transmitter (secondary meter) is the display part of the meter. There are power supply, analog circuits, digital circuits, display, and output circuits and so on in it. Its foundational functions are receiving and regulating the electrical signal from sensors, directly getting mass flow, temperature and density after regulating, and calculating volume flow and other needed parameters from known parameters. It can display, output, store and transmit. There is a diode safety barrier in transmitters; the function of the diode safety barrier is safeguard to explosion.
      As the composite explosion-proof flow meter, the sensor (primary meter) is intrinsic safety; the transmitter (secondary meter) is explosion isolated. The sensor and the transmitter may all operate under hazardous area.
      As the intrinsic safety flow meter, the sensor (primary meter) can operate under hazardous area, the transmitter (secondary meter) must only operate under prescriptive safety area (see section 3.2), forbidden to operate under hazardous area.