Multiplelabs
Turnkey Laboratories Solutions

Analytical®
Technologies Limited

LNG Mass Flowmeter

EPCC / PRODUCTS / APPLICATION / SOFTWARE / ACCESSORIES / CONSUMABLES / SERVICES

Analytical Technologies Limited

An ISO 9001 Certified Company

www.analyticalgroup.net

Introduction :

LNG Mass Flowmeter is a new type of high precision flow and density measuring instrument developed by our company. Our company has introduced foreign leading technology and developed it according to the principle of Coriolis force (multi-variable digital processing measurement technology). It can directly measure the fluid mass flow in the closed pipeline as a high precision mass flowmeter (which is of great significance to the control of the production process, such as energy metering and chemical reactions, etc.)

Features :

- It can directly measure the fluid mass flow in the closed pipeline as a high precision mass flowmeter (which is of great significance to the control of the production process, such as energy metering and chemical reactions, etc.).
- It can directly measure the working density of the medium as a high-precision online density meter.
- It uses measurement technology (multi-variable digital processing measurement technology). The application of strengthens the signal filtering, greatly improves the sensitivity and accuracy of signal measurement, speeds up the response time of the system, and makes the measurement more reliable.
- The adoption of measurement technology makes the system composition more flexible and convenient.In many cases,flow converters are not required. And a complete flow measurement system can be composed of modules and sensors. Such as CNG, LNG dispenser system,quantitative control system,measurement system of flow or density unit parameters, etc.
- High measurement accuracy.Generally the measurement accuracy of mass flow can reach 0.1%~0.2%. The density measurement resolution can reach 0.002~0.02g/cm³. The measurement error of temperatu e is less than 0.5 degrees.
- It has density, temperature measure nent function, which can be derived from medium concentration measurement fun ction (two-component medium).
- Installation requirements are not high (no requirements for upstream and downstream straight pipe sections). The sensor has no mechanical moving parts and operates reliably.
- Wide range of applications. One sensor can be used for multiple media.

Principles:

When a mass point in a tube with P as a fixed point (rotation center) for rotational motion moves toward or away from the rotational center, an inertial force will be generated. The principle is shown in Figure 1.1.

In Figure 1.1,a particle with a mass of δm moves to the right in the pipe at a constant speed υ. The pipe rotates around a fixed point P with an angular velocity of ω. At this point, this particle will gain two components of acceleration.

1. Normal acceleration αr (centripetal acceleration). Its magnitude is equal to ω2r, and its direction is towards point P.

2. Tangential acceleration αt (Coriolis acceleration). Its magnitude is equal to 2ωυ,and its direction is perpendicular to αr. The force generated by the tangential acceleration is called the Coriolis force, and Fc = 2ωυδm. In the figure, the fluid δm=ρA×Δχ, so the Coriolis force can be expressed as:

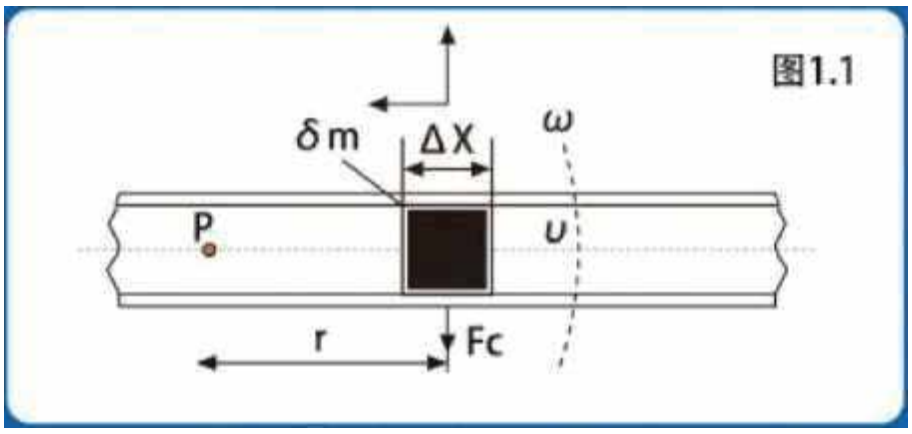
$\Delta Fc = 2\omega\upsilon \times \delta m = 2\omega \times \upsilon \times \rho \times A \times \Delta\chi$

$= 2\omega \times \delta qm \times \Delta\chi$

In the formula, A: the cross-sectional area of the pipeline

$\delta qm = \delta dm/dt = \upsilon \rho A$

For a specific rotating pipe,its frequency characteristics are determined.Δ Fc depends only on δ qm.Therefore,mass flow can be measured by directly or indirectly measuring the Coriolis force. The Coriolis principle mass flowmeter works according to the above principle.



LNG Mass Flowmeter :

In fact, the flow sensor does not perform rotational motion, but the pipe vibrates. The schematic diagram is shown in Figure 1.2, Figure 1.3, and Figure 1.4. Both ends of a curved pipe are fixed. Apply a vibration force (according to the resonant frequency of the pipe) to the pipe at the middle position of the two fixed points to make it vibrate at its natural frequency w with the fixed point as the axis. When there is no fluid flow in the pipe, the pipe isonly subjected to the external vibration force, and the two halves of the pipe vibrate in the same direction and have no phase difference. When there is fluid flow, affected by the Coriolis force Fc of the medium flowing in the pipe (The Coriolis forces Fl and F2 in the two halves of the pipeline are equal in magnitude and opposite in direction as shown in Figure 1.2) the two halves of the pipe twist in opposite directions, resulting in a phase difference (Figure 1.3,Figure 1.4). The phase difference is proportional to the mass flow. The design of the sensor is to convert the measurement of the Coriolis force into the measurement of the phase time difference on both sides of the vibrating tube, which is the working principle of the Coriolis mass flowmeter.

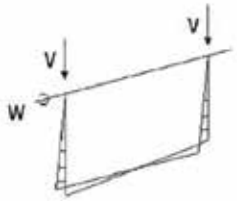


Fig.1.3

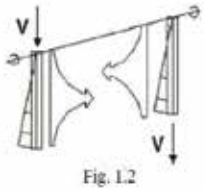


Fig. 1.2

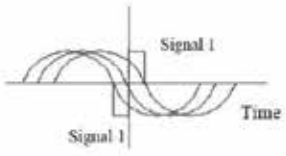


Fig. 1.4

Basic Parameters:

DensityMeasurement Range	0 ~5g/cm³
Flow Measurement accuracy	±0.1 ~0.2%
Repeatability	±0.05 ~0.1 %
Pipe Diameter	DN3-DN200
Measuring Medium	In addition to homogeneous fluids of normal viscosity, it can also measure high-viscosity fluids (such as honey, oil slurries, etc.). It can measure not only the fluid parameters of a single solution, but also multiphase flows.
Medium Temperature	50-200°C -200~200°C High temperature can be customized
Material	Wetted parts are 316L stainless steel. Housing 304 is stainless steel
Work Pressure	Conventional 4MPa. High pressure can be customized
Power Supply	Adaptive power. 18~36VDC/85~265VAC. Power is not less than 15W
Explosion-proof Grade	Exd (ib) IICT6Gb
Signal Output	Pulse output, 4-20mA current output, RS485 output HART optional
Measurement Display	Instantaneous flow, cumulative flow, density and temperature
Sensor protection Class	IP67

Measuring range

Model	Nominal Diameter (mm)	Flow Range （Kg/h）
CMF – 003	3	0~150~180
CMF – 006	6	0~480~960
CMF – 010	10	0~1800~2100
CMF – 015	15	0 ~3600~4500
CMF – 020	20	0 ~6000~7200
CMF – 025	25	0~9600~72000
CMF – 032	32	0~18000~21000
CMF- 040	40	0~30000~36000
CMF – 050	50	0~48000~60000
CMF – 080	80	0~150000~180000
CMF-100	100	0~240000~280000
CMF-150	150	0~480000~600000
CMF-200	200	0~900000~1200000

Product Structure

Sensor structure： The CMF mass flow meter sensor consists of a measuring tube, a measuring tube driving device,a position detector,a supporting structure,a temperature sensor, a housing, and etc.

1 Support structure: The measuring tube is fixed on the support structure as the vibration axis of the vibration system.

2 Measuring tube (vibration tube): It consists of two parallel elbows.

3 Position detector: It is used to detect the twisting change of the measuring tube.

4 Driving device: It generates electromagnetic force, which is used to drive the measuring tube to vibrate at a frequency close to the resonant frequency.

5 Housing: It protects the measuring tube, driving device and detection device

Single converter is a field type signal conversion instrument used with mass flow sensor. It is installed in a shell with explosion-proof function, and is mainly composed of a basic converter a display unit, and a signal output unit. It can display the working status of the instrument, measure the flow, density and temperature ; calculate the flow accumulation; and transmit the measurement signal over a long distance.

The working status of the instrument is displayed: phase difference, the working frequency of the vibrating tube,its working temperature,the detection signal amplitude, and the drive gain signal.

Instrument measurement parameters display ： mass flow, volume flow, mass flow accumulation, medium working density, medium working temperature, instrument working time.

Converter

Main technical parameters

Working Power	18-36VDC 85-265VAC	Explosion-proof Grade	Exd (ib) IICT6Gb
Power	7W (24VDQ/15W (220VAC)	Protection	IP67
Working Temperature	-40 ~ 60°C	Dimensions	125x80x92
Relative Humidity	Less than 95%	Electrical Interface	M20X1.5

Installation and dimensions of sensor

• Basic requirements for sensor installation

1 . When installing the CMF mass flow meter sensor, the flow direction mark of the sensor should be consistent with the fluid flow direction.

2 . Coriolis mass flowmeter is a flow meter that works according to the vibration principle of the measuring tube. Therefore, when the sensor is installed, the relevant pipelines should be firmly supported to avoid vibration of the instrument and related pipelines.