



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



Solutions

Technical Information

CNGmass

Coriolis Mass Flow Measuring System

For fueling with Compressed Natural Gas (CNG)



Applications

The Coriolis measuring principle works independently of the physical fluid properties.

- Specially designed flowmeter for fueling vehicles with CNG (compressed natural gas)
- Fluid temperature up to +125 °C
- Process pressures up to 350 bar
- Mass flow measurement up to 150 kg/min

Approvals for hazardous area:

- ATEX, FM, CSA

Connection to common control systems:

- MODBUS RS485

Your benefits

The Promass measuring devices allow you record multiple process variables (mass/density/temperature) simultaneously during operation for diverse process conditions.

The **transmitter concept** comprises:

- ToF-Tool/FieldTool Package for onsite operation and diagnosis
- Very low energy consumption

The **Promass sensors**, tried and tested in over 100,000 applications, offer:

- Space-saving and compact design
- Insensitivity to vibrations thanks to balanced twin-tube measuring system
- Easy installation without taking inlet or outlet runs into account

Function and system design

Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces always occur in a system where translational (linear) and rotational movements are superimposed simultaneously.

$$F_C = 2 \cdot \Delta m (v \cdot \omega)$$

F_C = Coriolis force

Δm = moving mass

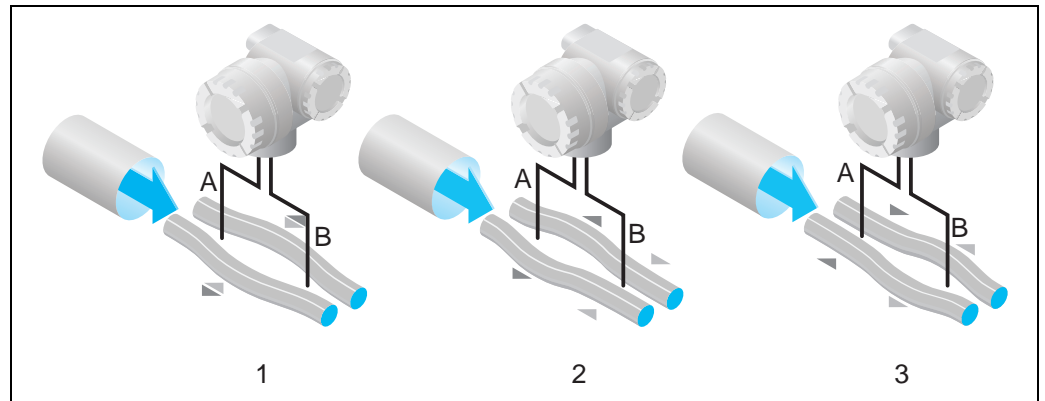
ω = rotational velocity

v = radial velocity in rotating or oscillating system

The size of the Coriolis force depends on the moving mass Δm , its velocity v in the system, and thus the mass flow. Instead of a constant rotational velocity ω , Promass uses oscillation.

In the sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations (see illustration):

- At zero flow, in other words when the fluid is at a standstill, the two tubes oscillate in phase (1).
- Mass flow causes deceleration of the tube oscillation at the inlet (2) and acceleration at the outlet (3).



The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes. The measuring principle works independently of temperature, pressure, viscosity, conductivity and flow profile.

Density measurement

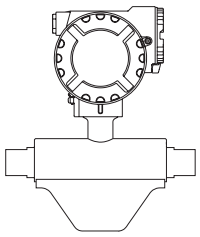
The measuring tubes are always excited at their resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tubes and fluid) results in a corresponding, automatic adjustment in the exciter frequency. Resonance frequency is thus a function of fluid density. The microprocessor utilizes this relationship to obtain a density signal.

Temperature measurement

To make calculations to compensate for temperature effects, the temperature of the measuring tubes is measured. This signal corresponds to the process temperature and is also available as an output signal.

Measuring system The measuring system consists of the transmitter and sensor which together form a mechanical unit.

Measuring system

<p>CNGmass</p>  <p>A0000979</p>	<ul style="list-style-type: none"> ■ Without onsite operation ■ Configuration via MODBUS RS485 and "ToF Tool - FieldTool Package" ■ Limiting medium pressure range max. 350 bar ■ Ambient temperature range: -40 to +60 °C
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Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube which record differences in the pipe oscillation geometry during flow)
- Volume flow (measured from the mass flow and density)
- Fluid density (proportional to the resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring ranges **Measuring ranges for Compressed Natural Gas (CNG), non-custody transfer operation.**

DN	m_{\min} to m_{\max}
15	...80 kg/min
25	...150 kg/min



Note!
The values of the corresponding custody transfer certificate apply for custody transfer operation.

Operable flow range 1:100

Output

Output signal

Pulse / frequency output:

- Passive
- Galvanically isolated
- Open Collector
- Max. 30 V DC
- Max. 250 mA
- Frequency output: end frequency 100 to 5000 Hz, on/off ratio 1:1
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.1 to 1000 ms)

Status output:

- Passive
- Open Collector
- Max. 30 V DC
- Max. 250 mA

MODBUS interface:

- MODBUS device type: slave
- Address range: 1 to 247
- Functions codes supported: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Physical interface: RS485 in accordance with standard EIA/TIA-485
- Baud rates supported: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Transmission mode: RTU or ASCII
- Response time = typically 5 ms

Signal on alarm

Pulse / frequency output:
 Failsafe mode can be selected

Status output:
 Assignment can be selected

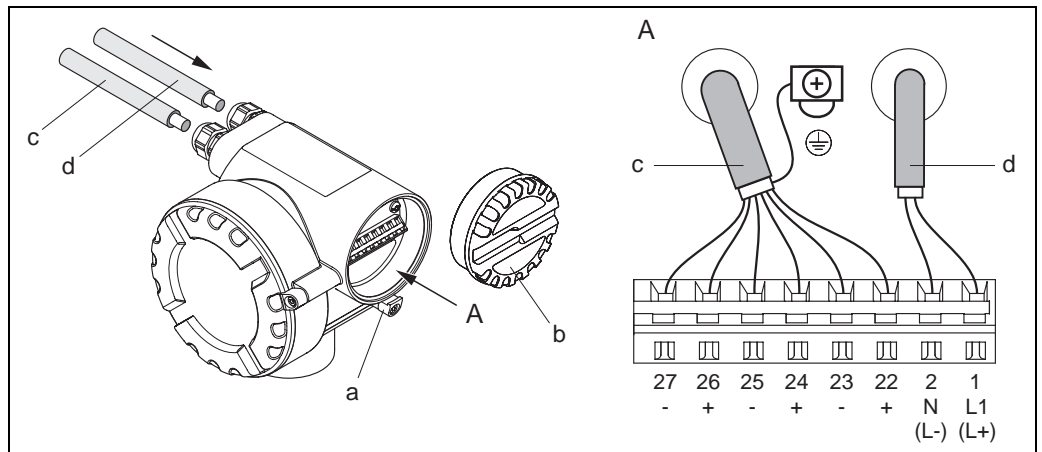
MODBUS RS485:
 Failsafe mode can be selected

Galvanic isolation

All circuits for outputs and power supply are galvanically isolated from each other.

Power supply

Electrical connection, measuring unit



Connecting the transmitter, cable cross-section: max. 2.5 mm²

- A View A
- a Safety claw
- b Terminal compartment cover
- c Signal cable: terminal Nos. 22-27
 (shield for Modbus RS485 is mandatory; shield for pulse, frequency and status outputs is not required, but recommended)
- d Cable for power supply: 20 to 28 V AC, 10 to 30 V DC
 Terminal No. 1: L1 for AC, L+ for DC
 Terminal No. 2: N for AC, L- for DC

Electrical connection, terminal assignment

CNGmass

Order version	Terminal No. (inputs/outputs)		
	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
8FF**_*****N	Pulse/frequency/status output 2	Pulse/frequency/status output 1	MODBUS RS485

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