Emerson, Micro Motion introduction

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Flow Custody Transfer Approvals Manager

EMERSON

Who We Are

Emerson is a global leader in automation technology and software. We help customers in critical industries, like energy, chemical, power and renewables, life sciences and factory automation, operate more sustainably while improving productivity, energy security and reliability.

OUR BUSINESS GROUPS

SOFTWARE AND CONTROL

- AspenTech
- Process Systems & Software
- Test & Measurement

INTELLIGENT DEVICES

- Measurement Solutions
- Final Control
- Discrete Automation
- Safety & Productivity

OUR PURPOSE

We drive innovation that makes the world healthier, safer, smarter and more sustainable.

OUR VALUES

Integrity
Safety & Quality
Support Our People
Customer Focus
Continuous Improvement
Collaboration
Innovation

OUR CAUSES

Planet
Humanity
Champion
Inclusion
Future

For more than 50 years, we've been a leader in measurement instrumentation.

We offer the industry's most extensive portfolio of measurement devices to take our customers' business to bold new heights.

Measurement Solutions Provides the Industry's Most Comprehensive Instrumentation Portfolio

INSTRUMENTS

Coriolis

Vortex

Electromagnetic

DP Flow

Pervasive Sensing

Corrosion & Erosion Monitoring

Ultrasonic

Core Pressure

Temperature

Level

High Integrity

Liquid & Gas Analysis

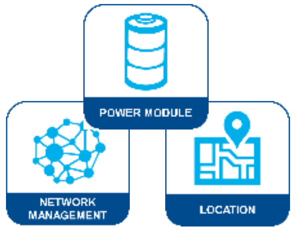
Flame & Gas Detection

SOLUTIONS

Integrated Systems

Tank Gauging

Plantweb Insight



Marine Systems

SERVICES

Plan & Design
- Site Audits & Consulting
- STO Project Management
- FEED

Improve & Modernize
- Turnaround Management
- Digital Transformation Implementation

Operate & Maintain
- Long-term Service Agreements
- Certification
- Critical Spare Management
- Repairs

Train & Develop
- Local Facilities
- On-Site Training
- Custom Courses

Measurement Solutions Delivers Unmatched Global Capabilities

17,000+ EMPLOYEES

31 MANUFACTURING PLANTS

840 INVENTION DISCLOSURES IN LAST 5 YEARS

750+ CERTIFIED SERVICE ENGINEERS

OPERATING IN **150** COUNTRIES

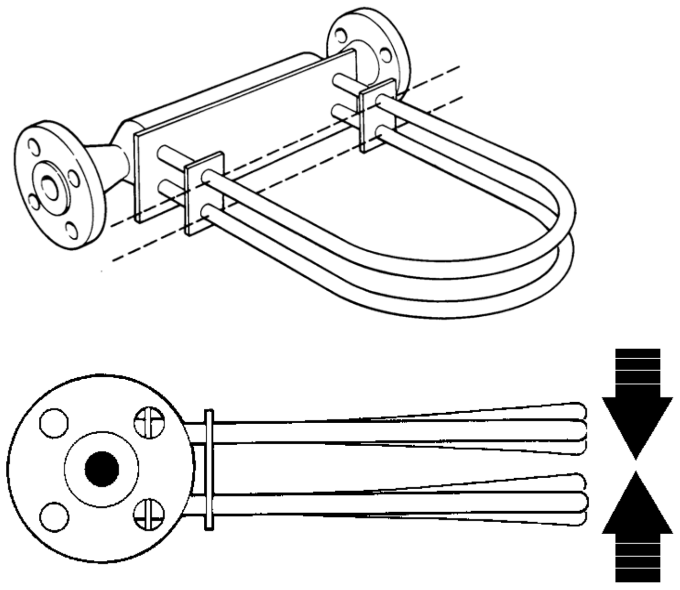
19+ Billion Wireless Operating Hours

3 SYSTEMS & SOLUTIONS INTEGRATION CENTERS

3,200+ CUSTOMER CARE AND SALES ENGINEERS

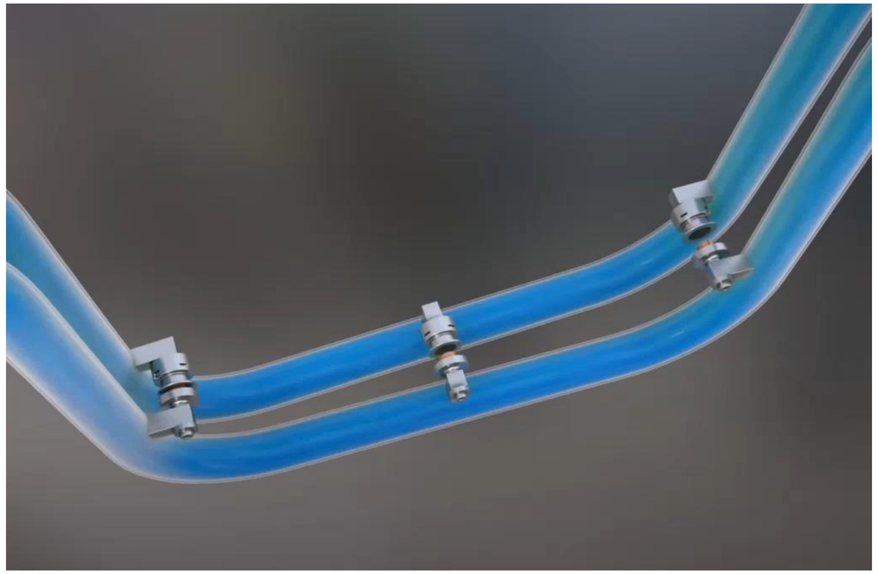
PERSONALIZED DIGITALCUSTOMER EXPERIENCE

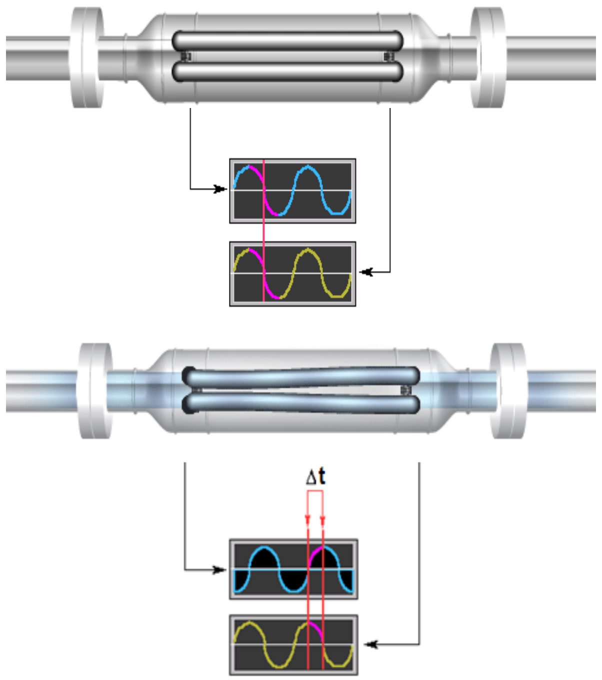
Coriolis Flow Meter – Basic Principles

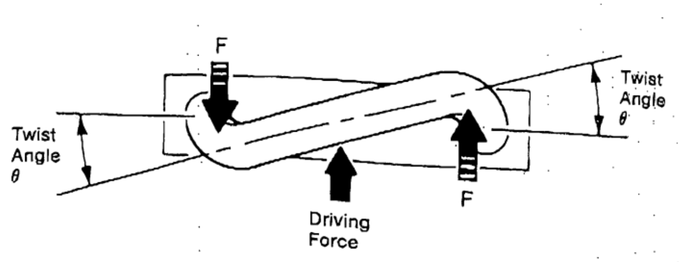


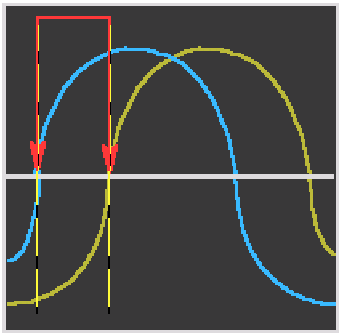
No Flow

Flow









Main Influences on Coriolis Flow Meter

Most common effects for a Coriolis meter:

Temperature

Elasticity or Stiffness of the tubes

↑T ↓S ↑Δt

Compensation is (-)
Using on-board RTD

Relationship becomes nonlinear for common materials at cryogenic conditions (316 SS)

Pressure

Complex change of the tubes

↑P ↓Δt

Compensation is (+)
Using external P input

Relationship is Linear for common material (316 SS)

Zero Stability

Behavior under no flow conditions

Independent of flow medium and operating conditions

Sets the Q_{min} for a specific accuracy class

Minimize effect by following manufacturer recommendations

Compressibility

Compressible fluids apply force on the tube

$$E_m = SF \frac{1}{2}\left(\frac{2\,\pi\,f}{c}\,r\right)^2 * 100\%$$

f - the natural frequency of the Coriolis tube vibration,
r - the inner radius of the Coriolis tubes,
c - the speed of sound in a measured fluid,
SF - a scale factor

Source: *Hemb and Kutin*

$Em \propto f$

$Em \propto r$

$Em \propto 1/c$

Gas Metering

Main Influences on Coriolis Flow Meter

Most common effects for a Coriolis meter:

Temperature

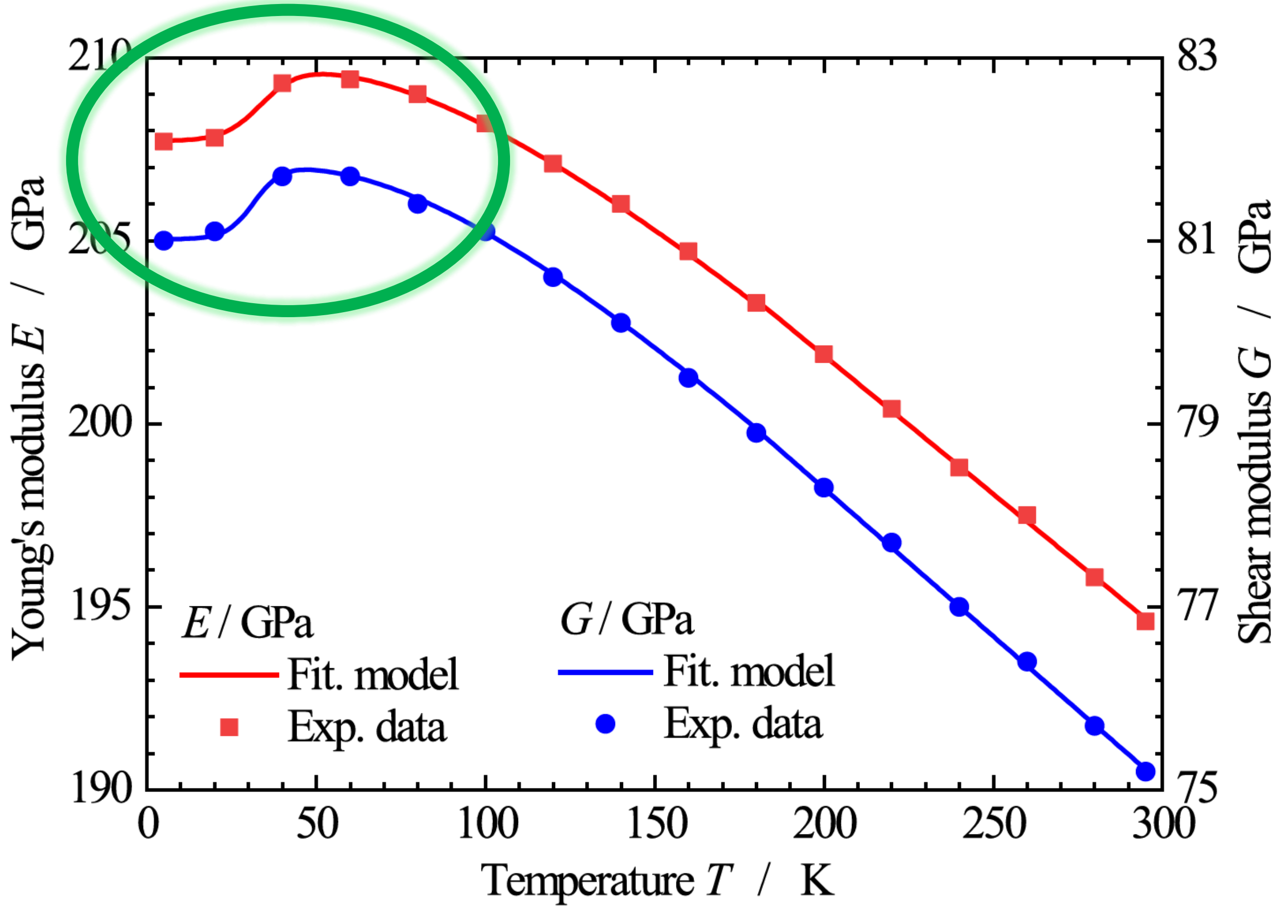
Elasticity or Stiffness of the tubes

⬆T ⬇S ⬆Δt

Compensation is (-)

Using on-board RTD

Relationship becomes nonlinear for common materials at cryogenic conditions (316 SS)



Patented method, Density correction model

Applicable for LH2, LN2, LHe, ...

Temperature

Elasticity or Stiffness of the tubes

$\uparrow T \ \downarrow S \ \uparrow \Delta t$

Compensation is (-)

Using on-board RTD

Relationship becomes nonlinear for common materials at cryogenic conditions (316 SS)

P

t

Known product

Density

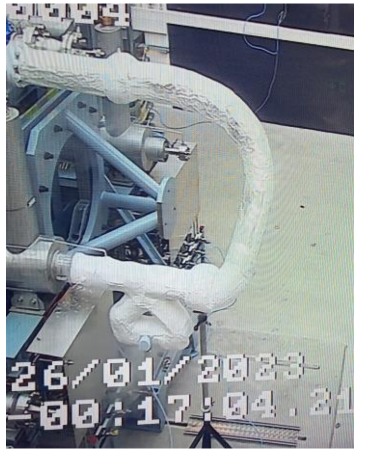
ρ_f

Direct mass measurement in ultra-cryo (-253C) conditions

- Independent assessment of the method uncertainty by VSL during EMPIR [20IND11 MetHyInfra] project

"This study indicates that, the achievable base standard uncertainty for LH2 mass flow rate measurement by a CMF lies within range 0.2% – 0.5 % relative"

MetHyInfra



Water transferability concept

How dose it work?

Perform Water Calibration

Take into account effects at your application

Ready for your application

Fundamental temperature correction

Investigated pressure correction

Zero Stability

Known VoS correction

FCF determination

Water
1-2 bara
20-23 ºC

U<0,03%
(k=2)

Correction have been tested through the last 30 years

Your media
XXX bara
XXX ºC

U According PDS

Is it accepted? (Legal part)

OIML Certificate

OIML Member State
The Netherlands

Number R137/2012-A-NL1-23.06 revision 1
Project number 3794851
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Provisions for performing initial and subsequent verification

A water calibration can be accepted based on the NMi procedure C-SP-HW-280 for Custody Transfer in gas applications performing:

- a zero-mass flow setting at the water calibration facility;
- a mass flow accuracy test at the water calibration facility.

A zero-mass flow verification can also be used for subsequent verifications.
The NMi procedure C-SP-HW-280 is described based on factory tests, as it has been proven that the mass accuracy on water is representative for mass accuracy on gases.

EU-type examination certificate

Number **T10020** revision 15
Project number 2864411
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Conditions for Conformity Assessment

- Verification procedure
  For the initial verification the NMi procedure C-SP-HW-280 can be applied with the title 'Procedure C-SP-HW-280 for the MID conformity assessment for the Micro Motion Flow meter when used for custody transfer in gas applications (annex MI-002) and liquid applications (annex MI-005)'.

  The initial verification can be based on:
  - a water calibration, which includes:
    - a zero-mass flow setting at the water calibration facility
    - a mass flow test
  - In the field:
    - a zero-mass flow setting, if needed
    - a zero-mass flow verification

CryoMet, 24GRD07 Acknowledgement

Metrology for reliable liquefied energy gases measurement

- LH_2 measurement standards for flow meters, ortho/para isomeric composition & temperature usable in field conditions.

The project (CryoMet, 24GRD07) has received funding from the European Partnership on Metrology, co-financed from the European Union’s Horizon Europe Research and Innovation Programme and by the Participating States. This project has received funding from the Ministry of Economic Affairs of the Netherlands.

Coordinator

9 NMIs/DIs

4 Universities

3 R&D institutes

1 Accr. lab

2 Equipment manufacturers

Thank You

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