Schneider Electric Coriolis Overview

Javier Lopera, Stephanie Brandenburg - Flow Offer Manager – April 2020

Agenda

- Coriolis Mass Flow Basics
- SE Coriolis Offer
- Applications
- Gap Fill- New Offer
- Q&A

Coriolis Mass Flow Basics

Why do we measure mass flow?

Mass flow is a **primary unit of flow** measurement.

Mass flow is unaffected by:

- **Viscosity**
- **Density**
- **Conductivity**
- **Pressure**
- **Temperature**

SE Process Instrumentation has a Coriolis Mass flow heritage since 1988

Traditionally, mass flow has been measured indirectly, by measuring **volumetric flow** via:
MagFlow, DP flow, Turbine meter, Vortex, Ultrasonic or other … and then combine this with **temperature and density** to calculate mass flow. (Indirect measurement methods commonly result in significant higher errors: volumetric flow error x temperature error x density error x …)

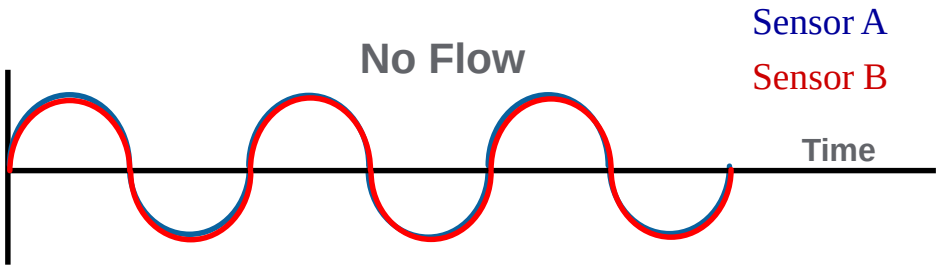
SE Process Instrumentation's Coriolis flow transmitters handle measurements that cause other Coriolis meters to fail. They overcome problems associated with entrained gases, empty tube conditions or flash-prone fluids and fully realize the promise of Coriolis measurement to achieve high accuracy, eliminate downtime and keep profits flowing.

Coriolis Mass Flow Basics

Coriolis force used for flow

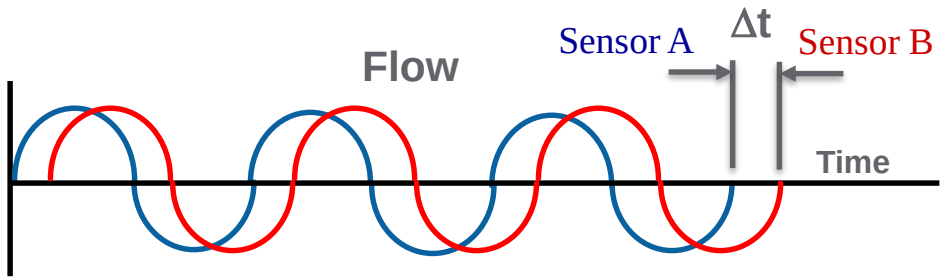
Coriolis Mass Flow Basics

Coriolis mass flow explained



With **No flow there is no Coriolis force** and the movement of the tubes is symmetric.

When there is mass flowing thru the tubes there is a reactive force which is opposite on each side of the tubes. These forces let the tubes **swap out of phase**.



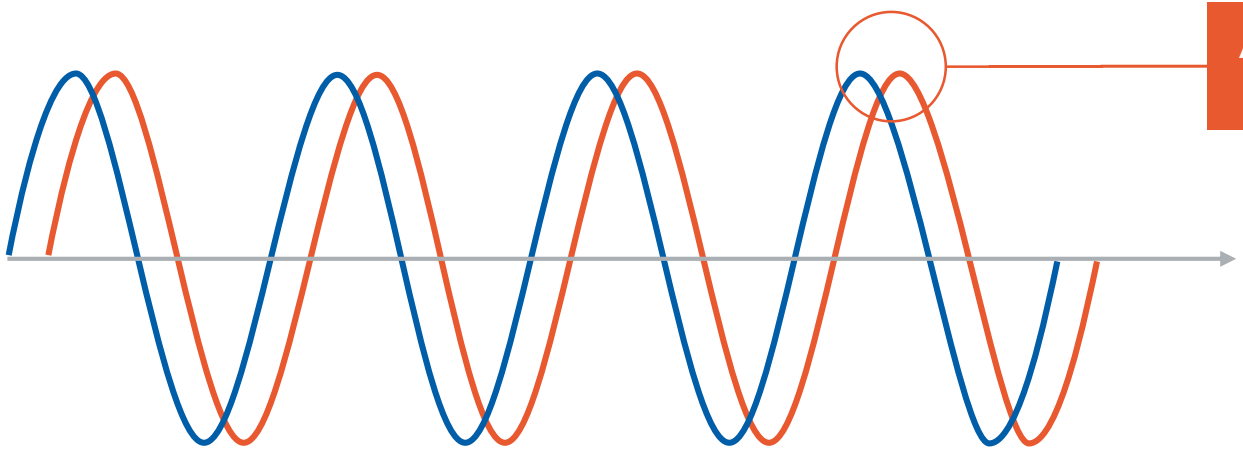
The **degree of phase-shift is directly proportional to the mass flow rate** of the fluid.
More mass flow means a bigger degree of phase-shift. Typically no mass flow of gases.

- Most Coriolis Mass flow meters are based on **2 parallel tubes**.
- These are connected on flanges and are driven by an exciter into motion.
- Two sensors are measuring the frequency on opposite sides of the tube.

Coriolis Mass Flow Straight Tubes

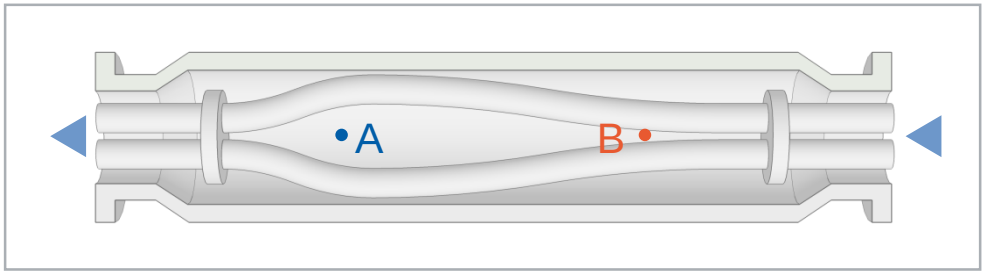
Working Principle

Flow + Driver Oscillation



As Mass flow rate increases
Time shift increases

The Coriolis mass flowmeter is a bi-directional instrument

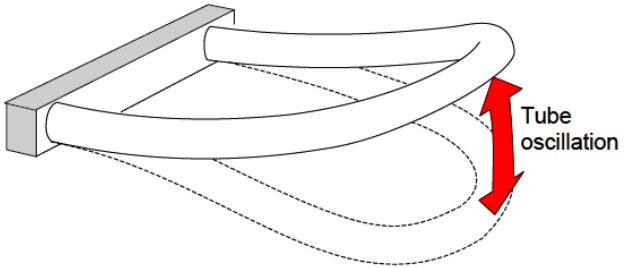


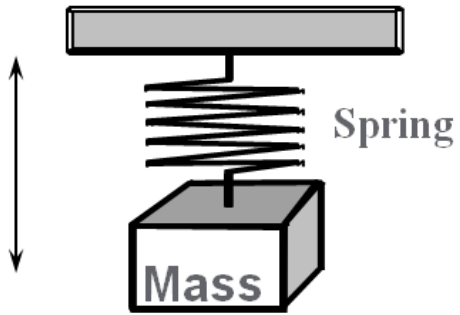
Coriolis Flow basics

Density measurement explained

- But there is more! **Density**
- Coriolis sensor tube is a cantilevered spring and mass assembly
- This is similar to **the single spring, single-mass dynamic system** shown here
- This dynamic system has **a natural oscillation frequency** described by:

$$fn = \frac{1}{2\pi}\sqrt{\frac{k(spring)}{m(tube) + m(fluid)}}$$

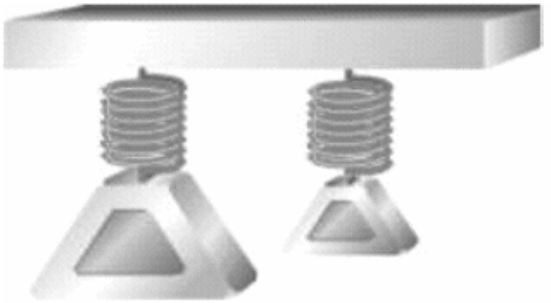




Coriolis flowmeters can be used as Density meters

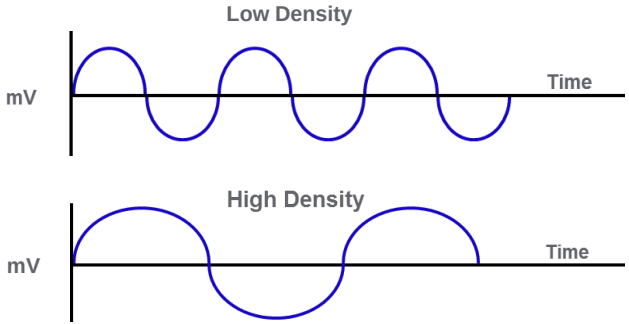
Coriolis Flow basics

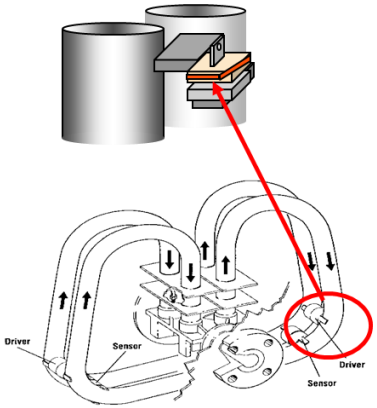
Density measurement explained



- Different **Density's** have different natural oscillation frequencies.
- **Low density;** High oscillation frequency
- **High density;** Low oscillation frequency

- During the measurement the tubes come into their own resonance frequency. This then coupled to the mass of the tubes + the mass of the fluid, the Coriolis flowmeter can also measure the density of the fluid.



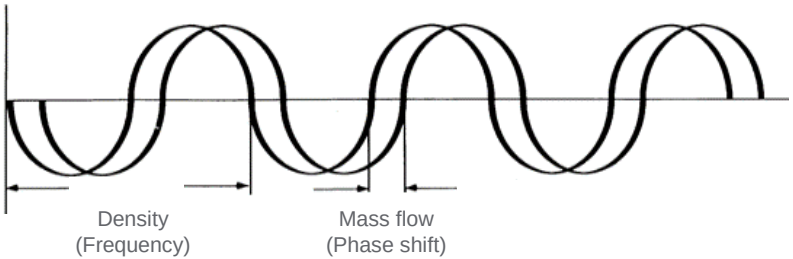


Coriolis flowmeters measures Massflow and Density

Coriolis Mass Flow Basics

Key Takeaways

- Density comes from the drive (or natural oscillation) frequency
  - Coriolis meters are not typically used to measure gas density
- Density is independent of the mass flow measurement



- Mass flow measurement is independent of density measurement (liquids, gas and 2-phase)
  - No gas/gas flow measurements (only liquid/liquid, liquid/gas or liquid/solid)
- For two components that don’t dissolve (e.g. air/water or oil/water) … we use total density
  - Density of each component must be different and programmed along with temperature coefficients
  - Then we calculate the composition of fluid A and B

Coriolis Mass Flow Portfolio

Coriolis Mass Flow Portfolio

What does SE Process Instrumentation offer?

For a good Coriolis measurement you need:

- A Great flow tube:
  - No pressure loss
  - No influences from external vibrations
  - No flow splitting
  - Rugged, robust and reliable design

- An intelligent transmitter:
  - Full Digital design
  - Digital Signal Processor (DSP) for highest precision
  - Fast response time
  - Intelligent self diagnosis for flowmeter sensors and transmitter
  - Absolute zero stability
  - Robust with entrained gas

CFS10 / CFS20 flow tube

CFT51 transmitter

Coriolis Mass Flow Tubes

CFS10 flow tube design

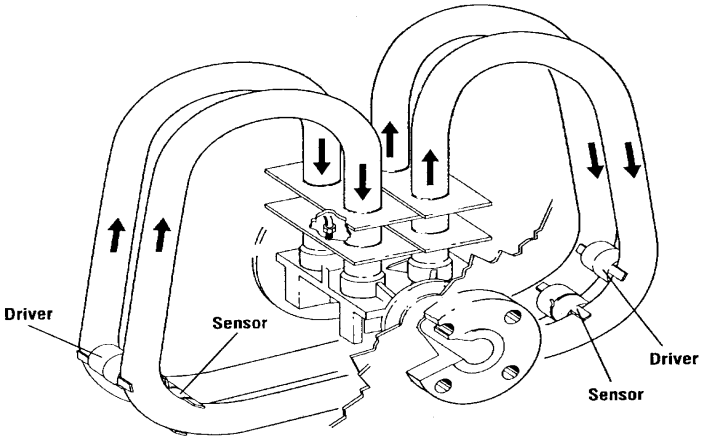
The CFS10 single path design ideal for shear sensitive fluids and in applications requiring positive cleaning

- **Full size inner diameter, same as line size**
  - No fluid acceleration within flow tube
  - Less flow velocities minimizes abrasion problems
  - Minimize risk of blockage
  - Low Pressure loss
  - Self draining and venting
- **Thick Wall tubes**
  - Mechanical strong
  - High pressure capability
  - Tolerant to pit corrosion
  - Tolerant to erosion

Rule of Thumb:

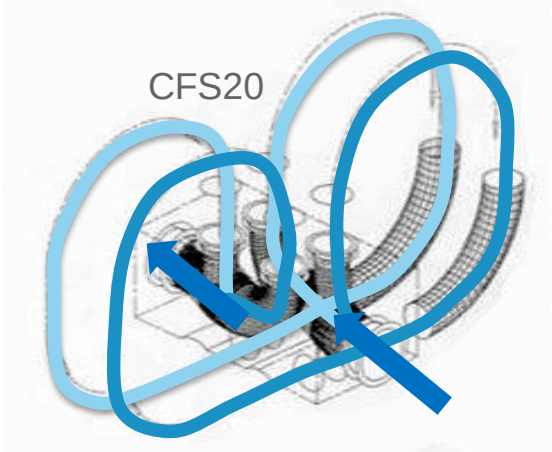
Double wall thickness provide
4x mechanical strength
7x the corrosion resistance

- These flow tubes comply with the 3-A standards for use in sanitary applications and is self-draining. They are suited for general Food & Beverage and Pharmaceutical Industry applications.



Coriolis Mass Flow Tubes

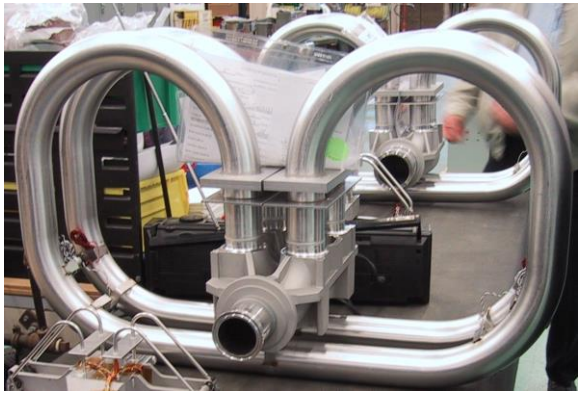
CFS20 parallel flow tube design



Parallel loop arrangement:

- The parallel or split flow allows for a higher flow capacity
- **With Anti-Phase Drive and Synchronous Demodulation**
  for wider measurement range and higher accuracy than traditional meter

- **Thick Wall tubes**
  - Mechanical strong
  - High pressure capability
  - Tolerant to pit corrosion
  - Tolerant to erosion



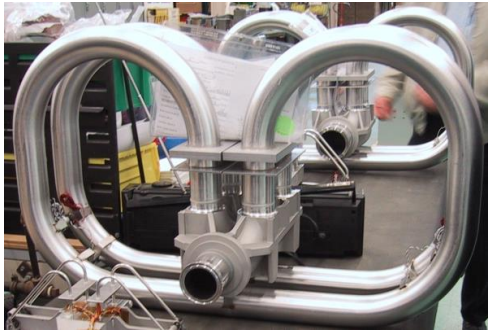
Rule of Thumb:

Double wall thickness provide
4x mechanical strength
7x the corrosion resistance

Coriolis Mass Flow Tubes

What can we offer?

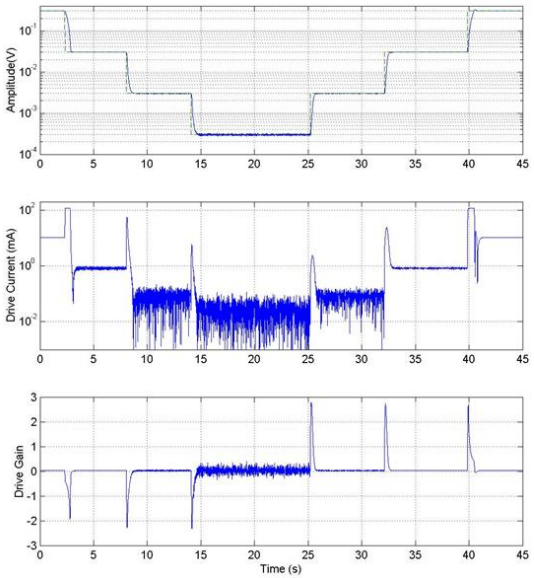
Feature	CFS10	CFS20
Serial / Parallel flow path	✓ / -	- / ✓
Size DN / Size Inch	3, 6, 15, 20, 35, 40, 50 1/8, ¼, ½, ¾, 1, 1½, 2	40, 80 1 ½, 3
Materials	AISI Type 316L Stainless Steel & Nickel Alloy (Hastelloy C)	
Flange Pressure rating PN / Pressure rating Class	40, 100 150, 300, 600	
Process Temperature / Pressure Limits	–200 to +180°C (–328 to +356°F) up to 217 barg (3150 psig)	
Continuous 2 phase	✓	
Start / Finish Empty	✓	
Remote distance	1000 ft (300 meters)	
Certificates	FM, CSA, ATEX, IECEx, EAC, INMETRO, KOSHA, NACE, 3A	
Connections	NPT, Flange, Tri-Clamp & DIN11851	Flange, Tri-Clamp & DIN11851
Options	Bidirectional Flow, Custody Transfer, Cryogenic Applications	



Schneider Electric Coriolis basics

CFT51 Coriolis All digital transmitter

- **Patented 2-phase flow capability**
  - Allows measurements from empty (Gas) to full pipe (Liquid) or of 2 different liquids (for example oil and water) or entrained air applications
  - Batching from empty tube
  - Elimination of flowtube stalling
- **Patented flowtube verification and control**
  - Improved measurement accuracies of the measurements
  - Improved flow tube control during start up (20 sec typical down to 2 sec)
  - Amplitude reduced to 10%, 1% and 0.1% of normal
  - Good response to set-point change
  - Can maintain operation at Very low amplitudes:0.1% = 0.0005mm
  - Wide variation in drive gain, including negative gain

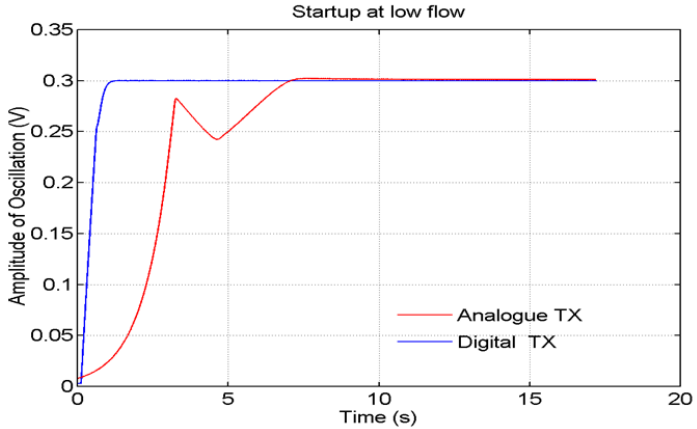


CFT51 a Schneider Electric Patent

Foxboro Coriolis basics

CFT51 Coriolis All digital transmitter

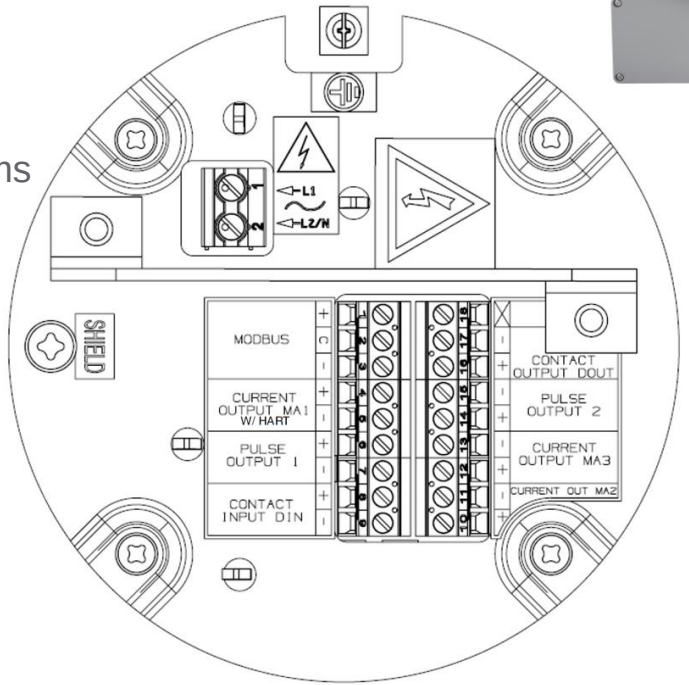
- Patented 2-phase flow capability
- Patented flowtube verification
- All Digital transmitter design
- **Fastest Real response time in the industry < 35ms**
  - Analog transmitter has a slow start
  - CTF51 uses a sophisticated non-linear control algorithm.
  - CTF51 avoids flowtube stalling, even with entrained air.
  - Start-up time reduced from 10-30s (analogue) to 2s (digital) for 1” flowtube



Foxboro Coriolis basics

CFT51 Coriolis All digital transmitter

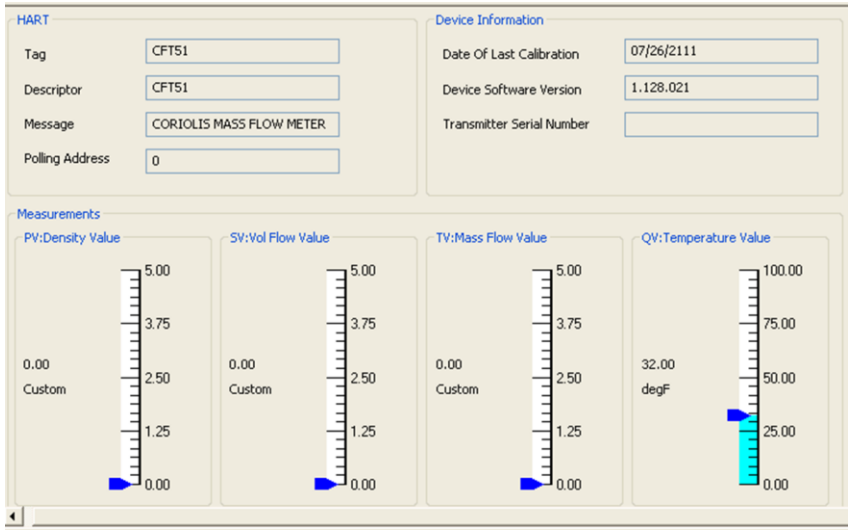
- Patented 2-phase flow capability
- Patented flowtube verification
- Fastest Real response time in the industry < 35ms
- **Multiple programmable Outputs;**
  - 2x pulse output
  - 2x 4-20mA (1x HART 7)
  - Modbus
  - Input and output contacts



Foxboro Coriolis basics

CFT51 Coriolis All digital transmitter

- Patented 2-phase flow capability
- Patented flowtube verification
- Fastest Real response time in the industry < 35ms
- Multiple programmable Outputs;
- **Certified HART and Modbus DTM**



Current Coriolis Applications

SE Coriolis For Truck Loading / Off-Loading Applications

CFT51 Coriolis All digital transmitter – A game changer

- Patented 2-phase flow capability:
  - Allows measurements from empty (Gas) to full pipe (Liquid) or of 2 different liquids (for example oil and water) or entrained air applications
  - Batching from empty tube
  - Elimination of flowtube stalling
- Fastest Real response time in the industry < 35ms
- Multiple programmable Outputs

CFT51 Concentration Measurement

Coriolis flowmeter enhancement

- A new concentration feature is now implemented in all CFT51's, in combination with any flowtube CFS10, CFS20.
- This measurement uses the measured density and temperature to calculate the percentage of a component in a mixture or solution.
- Can measure BRIX (Sucrose, HFCS-42/55), BAUME, % solute and alcohol (ethanol) are selectable, as well as more general types of calculations. Determine the percentage by mass or by volume of components defined by the customer.

Target Accounts:

- Food and Beverage, distilleries, specialty chemicals, sugar related companies, pulp and paper

Benefits and Value:

- Considerable cost savings vs laboratory analysis
- Continuous- real-time data
- Simplifies control
- Custom capability for proprietary fluids

Coriolis For Custody Transfer and Sanitary Applications

CFT51 Coriolis All digital transmitter – A game changer

- Patented 2-phase flow capability
  - Batching from empty tube
  - Elimination of flowtube stalling
- Patented flowtube verification
- **NTEP** certification
- **3A Approved** design, Sanitary end connections

Target Accounts:

- Dairy processing plants, ethanol/bio fuels, food and beverage, liquid fertilizers

Coriolis Mass Flow Applications

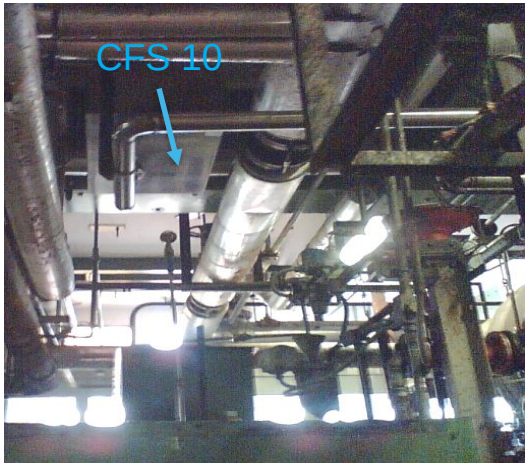
Chemical: Batching/ Dosing

Caustic Soda suspension with 10 to 30% Air bubbles

Temperature: 50 – 65 °C (122 - 149 °F)

Pressure: 0.5 – 1 bar (7 - 15 psi)

Viscosity: approx.: 1000 cp



Thixotropic behaviour:
Certain fluids (e.g. Tomato ketchup) that are thick or viscous under static conditions will flow (become thin, less viscous) over time when shaken, agitated, sheared or otherwise stressed (time dependent viscosity). After a time they return to a more viscous state.

SE Coriolis For Upstream Oil and Gas

CFT51 Coriolis All digital transmitter – A game changer

- Patented 2-phase flow capability
- Patented flowtube verification

- Compliant with API MPMS 5.6 and 20.2 (Liquids CT and Allocation)
- Compliant with AGA Report NO. 11 (Natural Gas measurement)

- Certified Modbus/HART DTM

CFS 10

CFS 20

Coriolis Portfolio Gap Filling Project – Launch Q3 2020

Coriolis – Flow Sensors

Model CFS300A

General Purpose

- Twin straight tube flowmeter
- 1/2”, 1”, 1.5”, 2” / SST
- Accuracy ±0.15% of MV + zero stab.
- Max pressure 100 bar / 1450 psi
- Max temperature 130˚C / 266˚F
- Hazardous area, hygienic, and custody transfer approvals
- FF, Profibus, Modbus, HART 7
- Best price / performance ratio
- Compares to Emerson’s R-Series

Model CFS400A

Large Sizes

- Twin or quad straight tube
- 4”, 6”, 10” and 16”
- Duplex and Super Duplex
- Accuracy ±0.10% of MV + zero stab.
- Max pressure 180 bar / 2610 psi
- Max temperature 130˚C / 266˚F
- Hazardous area, hygienic and custody transfer approvals

Model CFS700A

Exotic Material

- Single straight tube flowmeter
- SST, Hastelloy C, Titanium, Tantalum
- 7 sizes: 1/8”…3”
- Max pressure 100 bar / 1450 psi
- Max temperature 150°C / 302°F
- Accuracy ±0.10% of MV + zero stab.
- Hazardous area, hygienic and custody transfer approvals
- Best for demanding applications

Coriolis – Transmitter

Model CFT34A

- Standard converter (transmitter) for CFS300A, CFS400A and CFS700A
- Compact or field mounting up to 20 m / 65.6 ft
- Easy to use menu-driven programming in multiple languages
- Push button, optical and infrared operation options
- Backlit high-definition LCD display with up to 8 decimals (0.00000000)
- Displays flow rate/totals in mass/volume, velocity, temperature, 2 phase flow, sensor/tube/strain/driver data, operating hours, concentration
- Communications; Foundation Fieldbus, Profibus PA/DP, Modbus RTU and HART 7, PROFINET IO (Q4 2017), Modbus RS485 (Q2 2018)
- Concentration; ˚Brix, ˚Baume, ˚Plato, alcohol, NaOH, API
- Hazardous area, custody transfer, and SIL 2/3 approvals (future)
- Entrained Gas Management (EGM™) - the flowmeter maintains operation over a wide range of gas fractions and complex flow conditions

Future Portfolio

Flowtubes

General purpose

CFS300A

Q3 '20 Launch

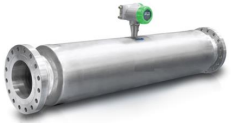
- ½ to 2” [3”]
- Inline design
- Sanitary certified
- Economical solution

O&G
Chem
F&B

Standard flow and density measurement

CFS400A

Q3 '20 Launch



- 4”, 6”, 10”, 16”
- Sanitary option
- Duplex

O&G
Chem
F&B

Pipeline transfer
Custody transfer
Fruit juice transfer

High End applications

CFS10 / CFS20

- Single or dual flowpath
- 1/8” - 2” / 1 ½” - 3”
- Hastelloy
- Global Sanitary certs

O&G
Chem
F&B

Oil/gas extraction
Custody transfer
Truck unloading

CFS700A

Q3 '20 Launch

- 3/8, ½, 1, 1½, 2”
- Hastelloy, Tantalum, …
- Single Straight tube

Chem

Aggressive fluids applications (chlorine, hydrofluoric acid)

Next Gen

TBD

- Compact design
- Same performance as CFT51/CFS10 and better

O&G
Chem
F&B

Batching
Truck unloading
Custody transfer

New Product Overviews

CFS300A offers a feature and performance rich flowmeter

General Purpose applications

➢ Twin-Straight Tube design with optimized flow splitter

- The design has being optimized for performance and capacity while producing a low pressure drop.

➢ Simple Installation

- Straight tube design simplifies installation versus other design types and lowers labor and material costs during installation.

➢ Excellent Price-Performance Ratio

- Innovative design provides a competitive price and can compete with larger meters as it has a smaller pressure drop.

➢ Entrained Gas Performance

- CFS300A with CFT34A transmitter excel in challenging entrained gas conditions and complex flow processes.

CFS300A

General Purpose Applications

Overview

- Twin straight tube flowmeter
- Available in Stainless Steel
- 4 sizes: ½”, 1”, 1.5” and 2”
- Optimized flow splitter gives low pressure drop
- Max pressure 1450 psi /100 bar
- Max process temp. 266F / 130C
- Max flow rate 170,000 kg/h / 6,235 lb/min
- Accuracy +/- 0.15% of MV + zero instability
- PED approved secondary containment 1450 psi/ 100 bar
- Hazardous area, custody transfer and hygienic approvals
- Best price/ Performance ratio

Industries

- General industry
- Energy
- Petrochemical
- F&B
- Paper

Applications

- mixing, batching, dosing
- Fuel consumption
- Concentration measurement in soft drinks
- Truck/Tanker offloading
- Gas measurement
- Alcohol measurement
- Process control

Use CFS300A for applications where Emerson’s R-Series would be spec’d

Value

- Best price / performance ratio in class
- Dual straight tube with optimized flow splitter produces lo pressure drop
- Competes usually with one size bigger leading to LOWER costs
- Easier to install than bent tube meters, smaller footprint
- Advanced Entrained Gas Management, meter maintains operation over a wide range of flow conditions

Go-to-Market Strategy for CFS300A

The CFS300A is targeted as a feature and performance rich product range in the low to mid price band.

Target Applications:
- Process control and standard applications where accuracy >0.15% is accepted and
- Mass flow is the primary measurable variable

Target Industries:
- Chemical
- F&B
- Utility

Ideal for:
- Portable installations on rail tankers, trucks, ships and mobile rigs where vibration is present
- Medium viscosity Low viscous fluids and slurries at 500…1000 mPas / cP
- Gas measurements even below 10 kg/m³ / 0.6243 lb/ft³ operating density
- Applications with entrained gas

- Competes in the growth sector of Dual Straight Tube meters and General Purpose meter
- Alternative to Emerson's R-Series

Coriolis Competition

	EMERSON	E+H	Schneider Electric	Schneider Electric
Model	R Series Coriolis	**Promass E 300 / 500**	CFS10	CFS20
Liquid accuracy / Repeatability	Up to +/- 0.4% of rate (+/- 0.2% of rate)	+/- 0.15% of rate (+/- 0.1% option)	+/-0.1% of rate	+/-0.1% of rate
Gas accuracy / Repeatability	Up to +/- 0.75% of rate (+/- 0.5% of rate)	+/- 0.75% of rate	+/- 0.5% of rate	+/- 0.5% of rate
Density accuracy / Repeatability	Up to +/- 0.003 g/cm3 (+/- 0.0015 g/cm3)	0.5 (kg/m3)	+/- 0.0005 g/cm3	+/- 0.0005 g/cm3
Line size	¼" to 2" (DN8 to DN50)	3/8" to 3" (DN8 to DN80)	1/8" to 2" (DN6 to DN50)	1 ½" to 3" (DN40 to DN80)
Operating Pressure	Up to 1450 psi (100barg)	Up to 1450 psi (100bar)	Up to 2600 psi (179barg) SS end connection, Up to 3150 psi (217 barg) with nickel allow end connection	
Operating Temperature	-148 to 302 F (-100 to 150 C)	-40 to 302 F (-40 to 150 C)	-328 to 356 F (-200 to 180 C)	-328 to 356 F (-200 to 180 C)
Electronics	mA, frequency, Discrete, HART, Modbus, Ethernet/IP, Profinet, FF	HART, Profibus PA, FF, Modbus, WLAN		
Highlights	Low-footprint, drainable flow meters suited for general purpose applications. Low cost		The CFS10 single path design ideal for shear sensitive fluids, and in applications requiring positive cleaning	• Highly accurate liquid/gas flow w/o stalling, density and temperature measurement • 10x faster start-up than conventional Coriolis meters • Highly accurate batches, starting from empty tube • Dual-phase performance

Coriolis Competition

	Micro Motion (EMERSON)	Micro Motion (EMERSON)	E&H	E&H	Schneider Electric
Model	**R- Series**	**F- Series**	**Promass E 300 / 500**	**Promass F 300 /500**	**CFS300A**
Liquid accuracy (Mass Flow)	Up to +/- 0.5% of rate (+/- 0.4% option)	+/-0.1… 0.2% of rate	+/- 0.15% of rate (+/- 0.1% option)	+/-0.1% (0.05% option)	+/-0.15% of rate
Gas accuracy (Mass Flow)	Up to +/- 0.75% of rate (+/- 0.5% of rate)	+/- 0.5% of rate	+/- 0.75% of rate	+/- 0.35% of rate	+/- 0.35% of rate
Flange Sizes	1/2" to 3" (DN15 to DN50)	1/2" to 3" (DN15 to DN50)	3/8" to 3" (DN8 to DN80)	3/8" to 10" (DN8 to DN250)	½" to 4" (DN15 to DN100)
Maximum flow rate (lb/m)	100 – 3200	100- 10000	73 – 6615	73-80833	239-6250
Density range (kg/m3)	0 -5000	0-3000	0 -5000	0-5000	400-2500
Density accuracy (kg/m3)	+/-10 (+/-3 option)	+/- 0.5 - +/- 2	0.5	10	S15:+/-5 / S25-50: +/-2
Nominal Pressure	Up to 1450 psi (100bar), Option for 2300 psi(159 bar)	Up to 1450 psi(100 bar), Option for 6250 psi(431 bar)	Up to 1450 psi (100bar)	Up to 1450 psi(100 bar)	Up to 1450 psi (100bar)
Operating Temperature	-148 to 302 F (-100 to 150 C)	-148 to 399 F (-100 to 204C), option -40 to 662 F (-40 to 350 C)	-40 to 302 F (-40 to 150 C)	-58 to 302 F (-50 to 150C), option -320 to 662 F (-196 to 350 C)	-40 to 266 F (-40 to 130 C)
Tube Design	Twin bent	Twin bent	Twin bent	Twin bent	Twin Straight
Wetted Material	316L SS	316L SS / C22	904L SS	904L SS / 316L SS/ C22	316L SS / 318L SS
Flowtube Housing Rating	58 psi or 166 psi(4 bar or 11 bar)	64 psi or 257 psi(4.4 bar or 17.7 bar)	232 psi / 16 bar	145 psi/10 bar or 580 psi/40bar	913 psi or 1450 psi(63 bar or 100 bar)
Secondary Containment	No	Yes	Yes	Yes	Yes
Electronics	HART, Profibus PA/DP, FF, Modbus	HART, Profibus PA/DP, FF, Modbus, Profinet IO	HART, Profibus PA, FF, Modbus, WLAN	HART, Profibus PA, FF, Modbus, Profinet IO, WLAN	HART, Profibus PA/DP, FF, Modbus, Profinet IO
Gas Entrainment Capability	No	Yes with 5700	No	No	Yes

CFS400A reliable measurement applications

High Capacity and High Pressure

➢ Large Size Twin/Four Straight Tube design with optimized flow splitter

- The design has being optimized for performance and capacity while producing a low pressure drop.
- Design includes a PED approved secondary containment up to 2176 psi / 150 bar

➢ Simple Installation

- Straight tube design simplifies installation versus other design types and lowers labor and material costs during installation. Smaller installation footprint than bent tubes.

➢ Custody Transfer Approvals and Pressure Compensation

- CT certs approved for liquids(other than water) and gases and wide variety of regional CT approvals. Includes
- internal pressure compensation for superior accuracy and reliability.

➢ Entrained Gas Performance

- CFS400A with CFT34A transmitter excel in challenging entrained gas conditions and complex flow processes.

CFS400A

Large Flow Capacity with integral pressure compensation

Overview

- Twin or Quad straight tube flowmeter
- Available in Duplex and Stainless Steel
- 4 sizes: 4”, 6”, 10” and 16”
- Optimized flow splitter gives low pressure drop
- Max pressure 2610 psi /180 bar
- Max process temp. 266F / 130C
- Max flow rate 169,021 lb/min / 4,600,000 kg/h
- Accuracy +/- 0.10% of MV + zero instability
- PED approved secondary containment 2175 psi/ 150 bar
- Hazardous area and hygienic approvals
- Best for Bulk transfer of liquids and gases

Industries

- Oil and Gas
- Petro Chemical
- Power
- Chemical
- F&B

Applications

- Custody transfer of hydrocarbons
- Replacement for PD or Turbine meters
- Measurement skids
- Alternative to Ultrasonic
- Rail road car unloading

Value

- Highest safety factor with approved secondary containment up to 2176 psi / 150 bar
- Only large flow capacity meter with integral pressure compensation
- Easier to install than bent shape tubes, smaller footprint
- Custody transfer approved for liquids and gases
- Low pressure drop with four or dual straight tube meter
- Best Price / Performance ratio in class

CFS400A

Benefits over Bent Tube Coriolis Meters

- Straight tube design provides compact installation envelope
- Installed in the same way as a section of pipe
- Does not require additional support or groundworks
- Large bent tube flowmeters have a shorter length than large straight tube flowmeters, but require a deeper installation envelope
- Bent Tubes often need costly additional engineering to install

SE - Straight Tube

Bent Tube

Go-to-Market Strategy for CFS400A

The CFS400A is targeted at oil and gas industries for custody transfer and fiscal measurement.

- Competition is not only against Coriolis instruments but also ultrasonic and traditional turbine and PD instruments

- The large sizes (4”, 6”, 10” & 16” / DN100, DN150, DN250 & DN400) target Emerson’s Micro Motion, E+H, Rheonik, and Cameron

Focus messaging of CFS400A on:
- Ease of installation
- Accuracy
- Reliability
- Many communication options
- Low pressure drop
- Pressure compensation for density

- Positioned for the growing Dual and Quad Straight Tube markets

Coriolis Competition

	Micro Motion (EMERSON)	E&H	E&H	Schneider Electric
Model	**Elite High Capacity**	**Promass 4”-10”**	**Promass X300/500**	**CFS400A**
Liquid accuracy (Mass Flow)	+/- 0.1% of rate (+/- 0.05% option)	+/- 0.1% of rate (+/- 0.05% option)	+/- 0.1% of rate (+/- 0.05% option)	+/- 0.1% of rate (+/- 0.05% option)
Gas accuracy (Mass Flow)	+/- 0.35% of rate	+/- 0.35% of rate	+/- 0.35% of rate	+/- 0.35% of rate
Flange Sizes	4” to 12” (DN100 to DN300)	4” to 10” (DN100 to DN250)	12” to 16” (DN300 to DN400)	4” to 16” (DN100 to DN400)
Maximum flow rate (lb/m)	15000-120000	12867-80833	150700	15433-169000, CT 8083-91860
Density range (kg/m3)	Up to 5000	0- 5000	Up to 5000	400-3000
Density accuracy (%)	+/-2 (option +/- 0.5) liquids only	+/- 10 std, +/- 1 special	+/- 10 std, +/- 1 special	+/- 1 (On site +/- 2)
Nominal Pressure	Up to 1479 psi (102 bar)	Up to 1450 psi(100 bar)	Up to 1450 psi(100 bar)	Up to 2610 psi (180bar)
Operating Temperature	-400 to 662 F (-240 to 350 C)	-58 to 382 F (-50 to 200C)	-58 to 356 F (-50 to 180)	-49 to 266 F (-45 to 130 C)
Tube Design	Twin bent	Twin bent	4 bent	2 &4 Straight
Wetted Material	316L SS and C22 on 4” and 6” only	316L SS and C22 on 4” and 6”	316L SS	316L SS / Duplex and Super Duplex
Flowtube Housing Rating	250 psi (19 bar)	145 -232 psi (10 – 16 bar)	87 psi (6 bar)	2175 psi (150 bar)
Secondary Containment	No	No	No	Yes

Coriolis Competition

	Micro Motion (EMERSON)	E&H	E&H	Schneider Electric
Model	**Elite High Capacity**	**Promass 4”-10”**	**Promass X300/500**	**CFS400A**
Electronics	HART, Profibus PA/DP, FF, Modbus, Profinet IO	HART, Profibus PA/DP, FF, Modbus, Profinet IO, WLAN	HART, Profibus PA/DP, FF, Modbus, WLAN	HART, Profibus PA/DP, FF, Modbus, Profinet IO
Gas Entrainment Capability	Yes with 5700 transmitter	Yes, with Proline 300% 500 transmitter only	Yes, with Proline 300% 500 transmitter only	Yes

CFS700A High-Performance Flow meter

Advanced Applications

➢ Single Straight Tube design w/o flow splitter

- The innovative design offers lowers pressure drop.
- Design includes a PED approved secondary containment up to 1450 psi / 100 bar

➢ Simple Installation

- Straight tube design simplifies installation versus other design types and lowers labor and material costs during installation. Smaller installation footprint than bent tubes.

➢ Only Single Straight tube in 4 Materials

- CFS700A is ideal for harsh and challenging applications and is offered in four materials: titanium, tantalum,
- Hastelloy C22 and Duplex Stainless Steel.

➢ Entrained Gas Performance

- CFS700A with CFT34A transmitter excel in challenging entrained gas conditions and complex flow processes.

CFS700A

High Performance Applications and Harsh Environments

Overview

- Single straight tube flowmeter
- Stainless Steel, Hastelloy C, Titanium and Tantalum
- 7 sizes: 1/8” to 3”
- Max pressure 1450 psi /100 bar
- Max process temp. 302F / 150C
- Max flow rate 20,567 lb/min / 560,000 kg/h
- Accuracy +/- 0.10% of MV + zero instability
- PED approved secondary containment 1450 psi/ 100 bar
- Hazardous area, custody transfer approvals and hygienic approvals
- Best for demanding applications

Industries

- Petro Chemical
- Chemical
- Pharmaceutical
- Pulp and paper

Applications

- Batching
- Corrosive fluids
- Slurries with abrasive solids
- Custody transfer
- Concentration measurements requiring hygienic stds

Value

- Lowest pressure drop with single straight tube without flow splitter
- Material flexibility (4 materials) for harsh process conditions
- Highest safety factor with PED approved secondary containment
- Easier to install than bent tubes
- Unique Custody transfer approvals with titanium flow tubes

Go-to-Market Strategy for CFS700A

The CFS700A is targeted at high performance applications

Target Industries:
- Chemical
- Pharmaceutical
- F&B industries

Target Applications:
- Applications with entrained gases
- Hygienic applications requiring high performance
- Viscous and highly viscous fluids (slurries) applications
- Applications requiring self draining
- Applications where low pressure drop is required
- Corrosive media applications

- Meter with Advanced Entrained Gas Management

- The meter with Titanium tube is Custody Transfer approved for liquids according to MID MI-005 and OIML R117.

Coriolis Competition

	Micro Motion (EMERSON)	E&H	E&H	Schneider Electric
Model	**T-Series**	**Promass I**	**Promass H**	**CFS700A**
Liquid accuracy (Mass Flow)	+/- 0.15% of rate	+/- 0.1% of rate	+/- 0.1% of rate (Flat)	+/- 0.1% of rate (Ti &CT: 0.1% Flat)
Gas accuracy (Mass Flow)	+/- 0.5% of rate	+/- 0.5% of rate	+/- 0.5% of rate	+/- 0.35% of rate
Flange Sizes	1/2" to 1.5" (DN10 to DN40)	1/2" to 3" (DN15 to DN80)	3/8" to 2" (DN8 to DN50)	1/2" to 4" (DN10 to DN100)
Maximum flow rate (lb/m)	25-3200	73.5-6617	73.5-2573	45-20577
Density range (kg/m3)	0- 5000	0- 5000	0- 5000	400-2500
Density accuracy (kg/m3)	+/-2	+/- 20 std,(wide range option: +/-4 / reference conditions: +/-0.5)	+/- 10 std, (Option +/- 2)	+/- 2 (On site +/- 0.5)
Nominal Pressure	1450 psi (100 bar)	1450 psi (100 bar)	Up to 580 psi(40 bar)	SS/C22/Ta 50 bar / 725 psi Ti 100 bar / 1450 psi
Operating Temperature	-400 to 662 F (-240 to 350 C)	-58 to 382 F (-50 to 200C)	Zirconium: -58 to 401 F (-50 to 205C), Tantalum: -58 to 302F (-50 to 150C)	Ti: -40F – 302F(-40-150C), other mat. 32-212F(0-100C)
Tube Design	Single Straight	Single Straight	Slightly bent single tube	Single Straight
Wetted Material	Titanium	Titanium	Zirconium 702 / R 60702 Tantalum 2.5 W	SS Duplex / C22 / /Ti / Tantalum 10W
Flowtube Housing Rating	100 bar / 1450 psi Purge: 50 bar / 725 psi	40 bar / 580 psi	NW 08-25 / 3/8"-1":: 25 bar / 362 psi NW 40-/50 / 3/8"-11/2"-2:": 16 bar / 232 psi Burst Pressure 170 - 85 bar / 2465 – 1232 psi	SS & Ta: 63 bar / 910 psi Ti: 100 bar / 1450 psi
Secondary Containment	No	Yes	No, Max case pressure	Yes (PED &CRN)

Coriolis Competition

	Micro Motion (EMERSON)	E&H	E&H	Schneider Electric
Model	**T-Series**	**Promass I**	**Promass H**	**CFS700A**
Electronics	HART, Profibus PA/DP, FF, Modbus, Profinet IO	HART, Profibus PA/DP, FF, Modbus, Profinet IO, WLAN	HART, Profibus PA/DP, FF, Modbus	HART, Profibus PA/DP, FF, Modbus, Profinet IO
Gas Entrainment Capability	No	No	No	Yes
Pricing				

Key strategic markets and opportunities

Broad Applications – High Performance – Custody Transfer – Simple Installation

End Customers

- Coriolis Plus offers a one stop shop for All Coriolis needs.
- Key industries include oil and gas, petrochemical, food and beverage, energy
- Straight and “in-line” flowtubes are simple to install and have small footprint.
- Products can be used for fiscal and custody transfer applications.
- Offer performs well in 2-phase conditions

Integrators/Skid Manufacturers

- Integrators and manufacturers in the beverage, dairy and oil and gas can integrate the flowmeter readily for skid/custom solutions.
- NAMUR approved lay-lengths and Hazardous area approvals.
- NACE compliance facilitates integration to API/AGA compliant installations.

Questions?


Life Is On
Schneider
Electric