

CORI-FILL™

Coriolis Mass Flow Meter Based
Compact Fluid Dosage Assembly



Fulfilling your needs

This is CORI-FILL™

Introduction

Bronkhorst® manufactures Coriolis Mass Flow Meters and Controllers for gases and liquids. The CORI-FLOW™ product range offers true mass flow in a range from 20 g/h up to 600 kg/h. The compact mini CORI-FLOW™ Series are designed for capacities from 20 mg/h up to 300 kg/h. Both mini CORI-FLOW™ and CORI-FLOW™ instruments can be combined with an actuator:

- shut-off valve for short time batch sequences (down to < 0.1 sec.)
- proportional valve for accurately controlled longer duration batch sequences
- (gear) pump for long time accurate controlled batch sequences without the need of pressurized vessels

Compact Fluid Dosing Assemblies

Each Compact Fluid Dosing Assembly consists of a Coriolis Mass Flow Meter of the mini CORI-FLOW™ or CORI-FLOW™ series and a valve or a (gear) pump. The onboard PID-controller of the flow meter will be optimized for controlling the valve or the (gear) pump and enables an immediate start of dosage after connecting power and fluid accessories. Just enter the desired flow or batch at the operation module (or remotely by computer) and the compact unit will dose true mass flow, for example independent of ambient temperature and back pressure.

Using the integrated CORI-FILL™ technology, the Coriolis meter's totalizer is capable of highly accurate batch dosage. It also ensures the actuator will react as soon as the batch has been reached. Normally several components would be needed to achieve this:

- flowmeter
- valve/pump
- batchcounting module/PLC
- software handling these items

CORI-FILL™ offers all this functionality in one component, in one assembly and from one supplier, without the need of complex programming of additional hardware.

Applications

CORI-FILL™ has been successfully applied for dosage of additives, fragrances, flavours, colourants and sterilization fluid (H_2O_2)

Features

- > Batch dosing with CORI-FLOW™ using
 - Shut-off valve
 - Proportional valve or pump
- > Fast totalizer
- > Automatic overrun correction
- > P-controller on batch counter
- > Compact dosing solution
- > Attractive alternative to weighing scales
- > Simultaneous dosing of compounds; therefore:
- > Reduction of total production time
- > Positive and negative flow totalization (bi-directional)



mini CORI-FLOW™ and shut-off valve assembly for batching

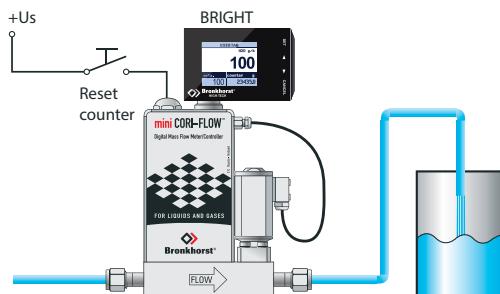


Specifications

Flow ranges	50 mg/h...600 kg/h FS, several models with different flow ranges
Pressure range	up to 200 bara (depending on flow meter and actuator type and fluid dynamic viscosity)
Temperature	0...70 °C (higher on request)
Accuracy	<ul style="list-style-type: none"> 0.5%* or better for dosage of mass (e.g. kg/g) 1 %* or better for dosage of volume (e.g. l/ml) <p>*) under laboratory conditions using mini CORI-FLOW™. Total accuracy depends on application environment and used equipment</p>
Fluid connections	1/8" OD, 1/4" OD, 6 mm OD compression type (other on request)
Totalizer sampling time	20 msec.
Electrical connections (M10 and M50 series)	Binder Circular 8-pin for RS232, power supply and analog signals (for operation and configuration)
Optional fieldbus	PROFIBUS DP, DeviceNet™, Modbus-RTU, FLOW-BUS
Power	+15Vdc/+24Vdc depending on actuator

Local operation

- > Via E-8000 R/C-panel or BRIGHT R/C-module
- > Indication of:
 - measured value (direct or %) and setpoint
 - totalized flow (mass or volume)
- > Batch control
- > Alarm functions
- > Desired flow/batch to be set through:
 - Keyboard on operation module,
 - Analog 0...5(10) V / 0(4)...20 mA or
 - Digital communication by RS232 or optional fieldbus



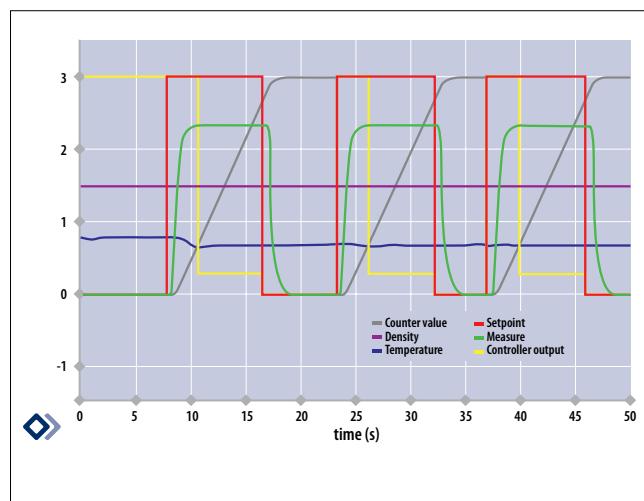
Batch control with optional local Readout/Control module



CORI-FILL™ Technology

CORI-FILL™ with shut-off valves

All CORI-FLOW™ instruments are capable of operating with both +24Vdc electric shut-off valves and pneumatic valves. Electric valves can be operated within a special power saving mode to reduce energy consumption and minimize temperature increase thereby reducing the risk of fluid evaporation.



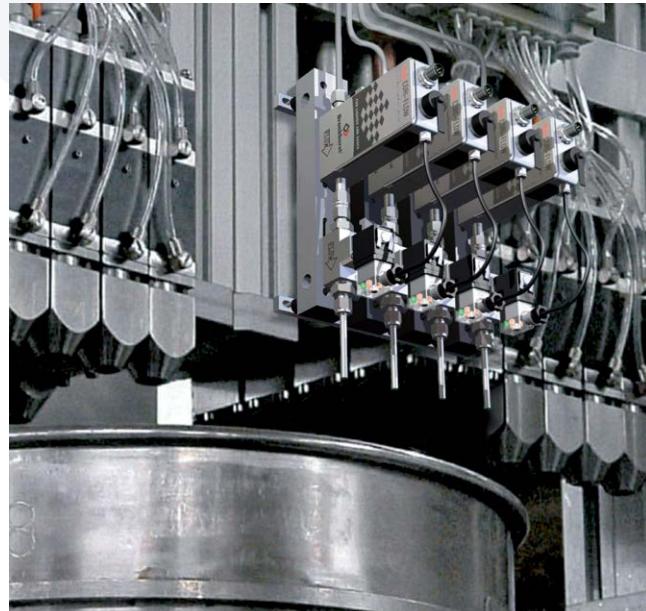
Typical response curve

CORI-FILL™ technology includes an automatic overrun correction on batch dosing. After just a few doses the accuracy will be optimized (see picture of simulation above). Physical delays and pressure disturbances which might cause under- or over-runs will be automatically compensated.

Benefits

- Less supply pressure needed as for proportional valves due to large orifices
- Fast (down to < 0.1 sec. dosing time)
- Accurate after overrun compensation (will need a few batches to run first). Depends on special convergence factor for totalizer "Counter gain" which determines how strong the counter needs to compensate for overruns and underruns
- Cost effective

You Tube A CORI-FILL™ example video can be found at: www.bronkhorst.com/cori-fill-example



4-Channel filling process



CORI-FILL™ with proportional valves and pumps

All CORI-FLOW™ instruments are capable of operating with proportional valves or (gear) pumps using the integrated PID-controller. Thanks to CORI-FILL™ technology, all batch counters now have an extra P-controller to make the valve close or make the pump stop smoothly as soon as the batch total is reached.

Benefits

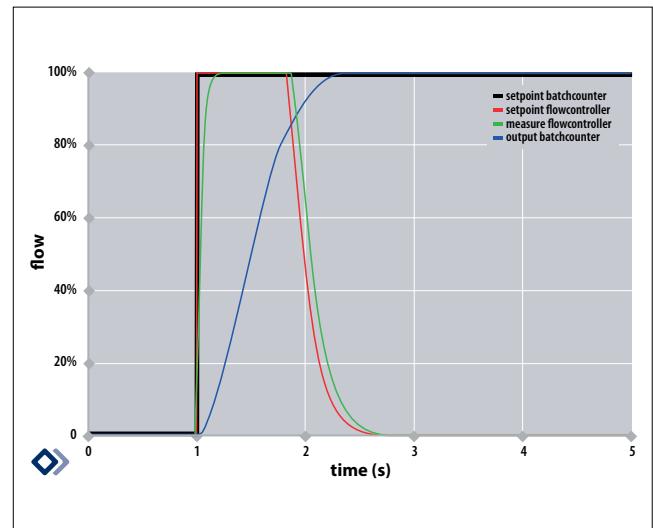
- "First time right" batch (no overrun correction needed)
- Suitable for longer dosing times (> approx. 3 seconds)
- Also applicable for pump control



Liquid dosing system consisting of a mini CORI-FLOW™ Mass Flow Meter, close-coupled to a gear pump.



CORI-FLOW™ Mass Flow Controller



Typical response curve

Volume flow

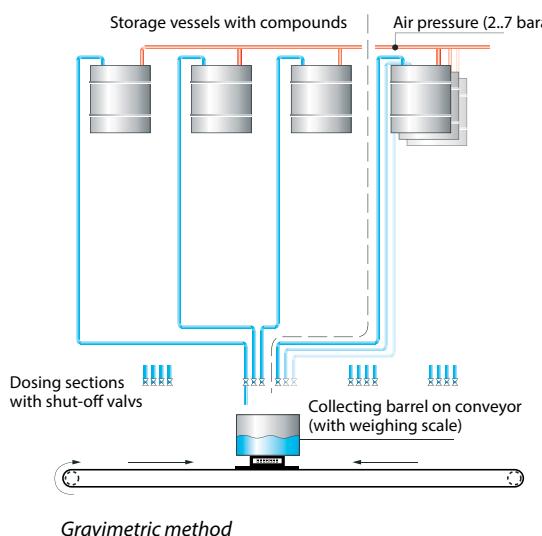
mini CORI-FLOW™ instruments (M10-series only) can measure density. By compensating with this on-line measured density, the instruments are capable of indicating volume flow, instead of mass flow. Using CORI-FILL™ technology, the operator can use, if desired, such a flow regime to totalize and fulfill volumetric recipes in litres or millilitres.

CORI-FILL™ Alternative to gravimetric method

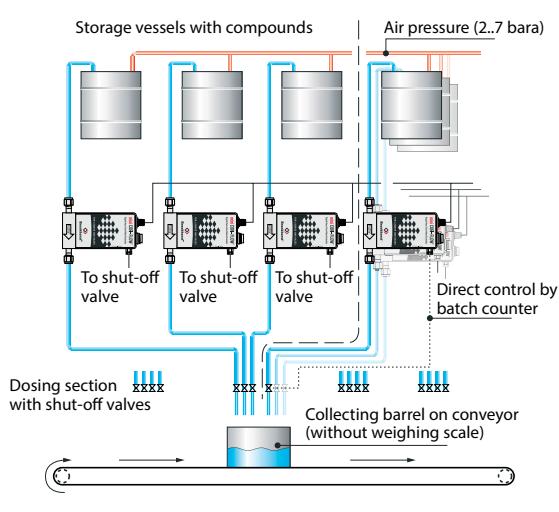
Existing applications using weighing scales (the gravimetric method)

Traditionally, dosage of mass/volume is achieved by using a shut-off valve with a weighing scale/balance. The weighing scale is located under a valve outlet nozzle and, after a zeroing procedure, the valve will open. The weighing scale will send a signal to PLC or control unit and when the batch has been reached the valve will close.

Eventually the weighing scale will move to another valve for the next compound to be dosed. This is a very time consuming process whereby all compounds are dosed one by one. CORI-FILL™ can offer the solution to shorten this production process. Many compounds can be dosed simultaneously, saving both a lot of time and money.



Gravimetric method



CORI-FILL™ method

Improved dosing applications using Coriolis instruments with CORI-FILL™ technology

To overcome the limitations of the gravimetric method to shorten production time and to improve the quality of the final product, (mini) CORI-FLOW™ instruments can be used.

Thanks to the CORI-FILL™ technology with integrated batch counters and the facility to directly operate connected shut-off valves, the (mini) CORI-FLOW™ instrument is capable of dosing the exact desired amount of compound into the collecting vessel.

It's also possible to use many instruments for simultaneous dosing and there is no need for repeated "no-flow" for zeroing purposes. Just a short reset command to each Coriolis instrument is enough to start the next batch. The amount to be dosed can be easily preset by programming the batch counter via a fieldbus connection. Batching can be fast and accurate, comparable to that of weighing scales. The (mini) CORI-FLOW™ instruments have the facility for highly accurate and fast dosage by operating directly shut-off valves.

Thanks to their small footprint it is possible to mount the (mini) CORI-FLOW™ instruments as a compact system close to the shut-off valves. This will avoid dead volume and will improve reaction time and accuracy (no delay-effects in long flow-line possible).

Benefits

- > Shorter production times, due to simultaneous dosing of compounds
- > Better product results, thanks to less evaporation of volatile fluids
- > No smell due to evaporation when dosed into open storage vessels, needed for weighing scales
- > No problems with allergens due to separated dosing lines
- > Compact solution, due to small footprint, without long lengths of tubing between flow meter and valve or pump
- > Reduced risk of gas enclosure in tubing causing delay effects
- > High accuracy due to Coriolis technique and compact assembly
- > Fast response times (down to < 0.1 sec.)
- > Less overhead for PLC/operating system thanks to CORI-FILL™ technology using integrated batch counter and direct actuator control



Examples

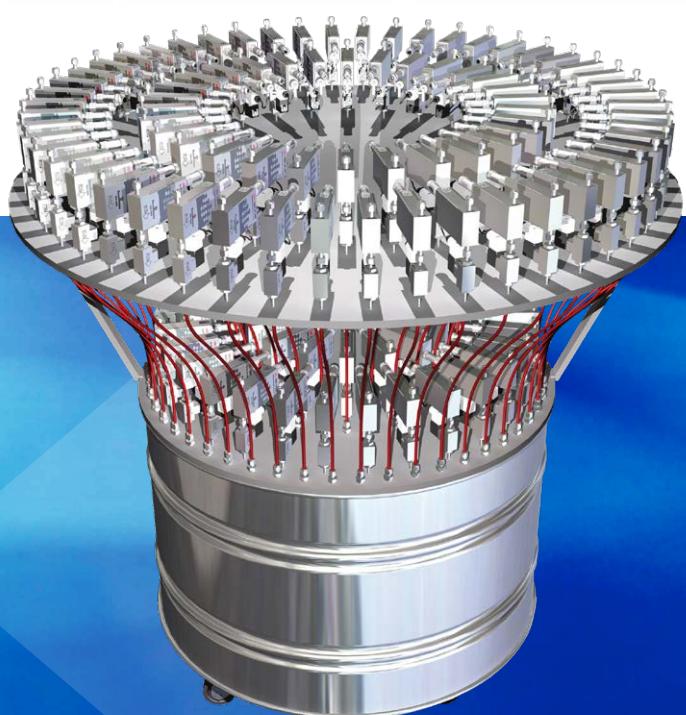
M14 with integrated shut-off valve, dosing 5 gram into a cup with a flow speed of 30 kg/h water takes 0.6 seconds and giving highly accurate and reproducible results.

Testing of pumps or batching with pumps with pulsating flows is possible now thanks to **CORI-FILL™** technology.

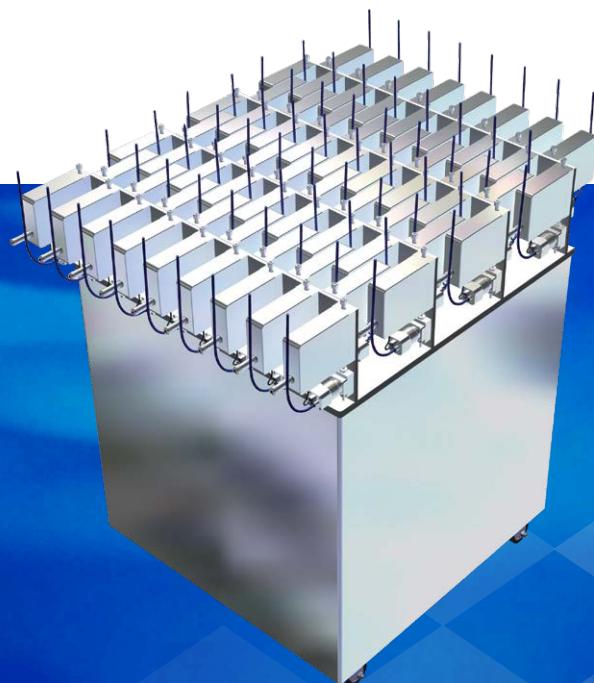
The very fast and accurate batch counter will be able to integrate also very pulsating or fluctuating flows. This also can make weighing scales superfluous. When a piston pump pulsates with max. 2...3 pulses per second, the totalized flow can be integrated with approx. 1% accuracy.

Minimum batch-size for filling is approx. 50 ug. When filled in 0.9 second, flow speed should be: $(0.050 / 0.9) \times 3600 \text{ sec.} = 200 \text{ mg/h}$ (filling time and flow speed are adjustable).

Using our standard instruments, maximum flow speed is about 1000 kg/h. This enables filling of 278 gram in 1 second or 16.68 kg per minute. For higher flow rates please consult factory.



*Concept for new generation filling systems using 125
CORI-FILL™ systems (30 kg/h) on a drum ($\varnothing 1 \text{ m}$)*



*Concept for new generation filling systems using 68
CORI-FILL™ systems (500 kg/h) on a 1 m^2 meter container*



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