



CHEMICAL MARKET

(Ultra) low flow Coriolis competence



Bronkhorst[®]

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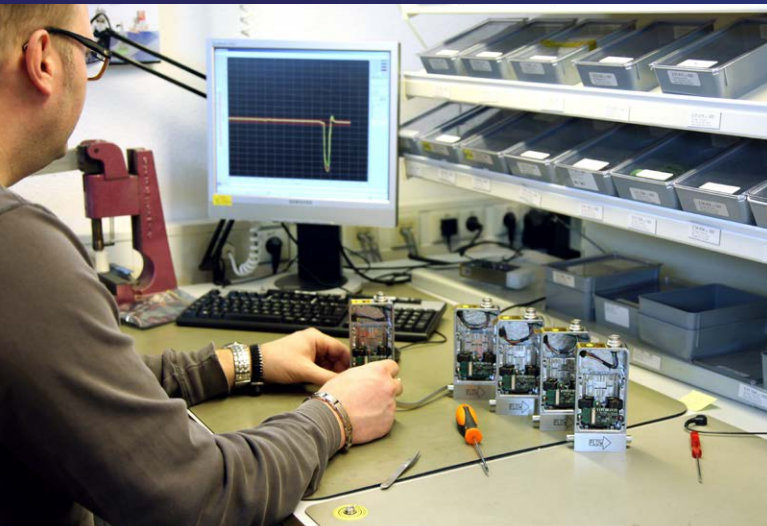
Bronkhorst® specializes in compact Mass Flow Meters and Controllers, based on the Coriolis principle. These instruments are able to measure and control a flow of 0,1 g/h up to 600 kg/h.

They are suitable for numerous applications within industrial, chemical and laboratory environments. Combined with a (gear) pump or (shut-off) valve, compact liquid mass flow dosing systems can be offered as an alternative to gravimetric or volumetric filling and dosing methods.

Bronkhorst® is a supplier to many of the world's biggest and most respected chemical companies.

Our Coriolis Mass Flow Meters and Controllers are used in various applications:

- Dosing a platinum catalyst into a process plant;
- Liquified petroleum gas measurement in a research laboratory as a preliminary test for production;
- Dosing a cleaning agent (e.g. H₂O₂) into water to prevent or reduce nucleation in wash water;
- Dosage of perfume into baby nappies or into small vials;
- Dosing of supercritical fluids (e.g. CO₂) into reactors.



Customer first

Bronkhorst® not only delivers instruments, but also a total solution. Our global perspective with local focus ensures that our international distributor network is able to provide on-site support and discuss the best solution to any given application. This ethos also includes product adjustments to ensure that the finer details of your application will always be met with a bespoke solution if necessary.



Round the clock support

Bronkhorst® is a worldwide organization with its Head Office located in Ruurlo, The Netherlands. The Customer Service Department offers 'seven days a week' support to customers in every corner of the world. Our specialist teams are available to you to fulfill the needs of pre- and aftersales support, on-site inspection & calibration and start-up assistance.



Experience of existing customers

Bronkhorst® instruments are used all over the world, for a wide variety of applications. To give an impression of just some of the processes in the chemical market that have been significantly improved, three companies share their experiences.

“They provide us with a total solution”



Dieter Ulrichs

R&D Project leader at Taminco

“We are using instruments of Bronkhorst® since 2007. We use the instruments in various applications in our R&D lab, for example for measuring and controlling flows of amines and ethoxylates. Often we combine the CORI-FLOW™ and mini CORI-FLOW™ instruments with Badger Meter valves. We are very satisfied with the instruments, because they measure liquid flow independent of its properties. In the ever changing environment of an R&D lab this is an important advantage. Because we often measure and control hazardous chemicals, we need to have access to the right technical equipment. This is not a problem at all for Bronkhorst®; they provide us with a total solution.”

“We use the instruments for dosing small quantities”



Senior Process Engineer

at Nippon Shokubai Europe

“We are very satisfied with the instruments of Bronkhorst®. We have been using M14 mini CORI-FLOW™ meters since 4 years and we have not had any problems. We use the instruments for dosing small quantities of chemicals accurately. The major advantage for Nippon Shokubai Europe is that the instruments are very compact and can be combined with Bronkhorst® tubing based on/off valves. The size of a dosing panel based on other suppliers equipment will be at least five times larger than the mini CORI-FLOW™ based dosing panel. The mini CORI-FLOW™ based dosing panels will give a better overview for the operators.”

“Very low flow, accurate dosing and short times are often important”



Felix Broens

CEO and founder of Convergence Industry

“We, Convergence Industry, are specialized in developing customized measurement and control systems. Very low flows, accurate dosing and short times are often important for our customers. For a large European producer of pet products we developed an automatic batch-dosing process to produce anti-flee fluids with. Bronkhorst® provided us with instruments which are able to dose multiple fluids and results in short production times. This increases the production capacity of the customer. Because of a dosing accuracy of 0,5% and an automatically controlled production line, the quality of the process increases significantly. Without the instruments of Bronkhorst®, this won't be possible.”



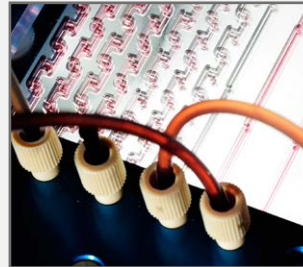
Applications

A Coriolis mass flow device is capable of measuring or controlling almost every kind of fluid without recalibration between fluids. This makes the Bronkhorst® (mini) CORI-FLOW™ series suitable for a very wide variety of applications. To illustrate this, we have selected three examples of typical processes in the chemical industry: a chemistry reactor, a process for the production of insulation and a test system for catalysts. Furthermore, (mini) CORI-FLOW™ instruments are now used by some of the world's biggest and most respected chemical companies adding increased value to traditional production processes such as plastics (polymers) and gasoline; processes that have all been significantly improved.



➤ More applications

In addition to the applications described on these pages, our instruments are successfully applied in many other systems and processes. You will find more examples on our website: www.bronkhorst.com.



Precise control of the input for continuous flow micro-reactors



Flow Chemistry Reactors

Flowid specializes in controlling the chemistry of a chemical process, solutions that are critical in terms of safety and quality of the process. To gain the best control of the chemistry, accuracy is very important for Flowid and for their very precise input of flow they choose to work with mini CORI-FLOW™. Using Bronkhorst® instruments results in them achieving significantly better controllability of their chemical processes based upon the following benefits:

High accuracy (0,2% reading) and unsurpassed repeatability

The intrinsic design of (mini) CORI-FLOW™ sensors ensures that they are highly stable, extremely accurate and with their high level of repeatability they ensure the reliable and constant end-result for Flowid.

Very stable control

A (mini) CORI-FLOW™ sensor is able to control the addition of, for example, 10 grams of reactive chemical over the period of an hour during which the flow will be equally divided over time and with precise start and stop points.

Exclusive low-flow sensor

mini CORI-FLOW™ sensors are unique within the field of low- to ultra-low flow measurement and control and, specifically with their ability to control a flow of less than 1 gram per hour, the process of Flowid is significantly improved.



*A perfect mix-composition
is very important for
Kingspan Insulation*

Insulation panels

One of the main activities of Kingspan Insulation is to produce insulation panels for roofs, walls and floors. An essential part of this production process is to maintain a highly accurate and stable mainstream. Furthermore, the additives introduced into this mainstream need to be dosed with very high accuracy. This combination of balanced control ensures the best quality of end-product for Kingspan and for this purpose a close, open collaboration with Bronkhorst® was established. The two companies analysed the full production process and soon identified the main issue. Due to the limitations of past technology the installed combination of large sensors and pumps were unable to accurately control towards the bottom end of their range. By replacing these and using (mini) CORI-FLOW™ sensors Kingspan was able to improve total product quality and realized a number of additional benefits over and above straight forward flow control:

Increased productivity

By using (mini) CORI-FLOW™ sensors, Kingspan Insulation obtained a very fast response time to changes within the flow regime. This resulted in the possibility to increase productivity whilst maintaining the very high quality of the panel.

Decreased rejection rate

Having introduced the Bronkhorst® solution, the overall quality of the end-product was increased significantly. The level of the rejected end-product has been decreased to a minimum as has the wastage of raw materials.



Test system for catalysts

The main activity of the chemistry department of a German University is to test catalysts for chemical substance conversions. Hereby a catalyst increases the speed of a chemical reaction. By doing this, catalysts change the kinetics of chemical reactions without changing their thermodynamic properties. They speed up the forward and reverse reaction at the same rate thereby maintaining the equilibrium of the reaction at all times. To dose and mix the liquids, the University uses three mini CORI-FLOW™ mass flow meters that directly control three HPLC pumps. These systems provide the University with the following benefits:

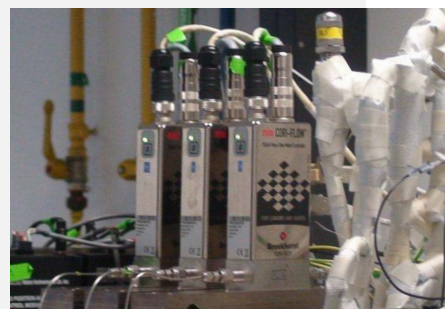
Controlling the flow rate

By using mini CORI-FLOW™ instruments the University is able to very accurately control the flow rate across the full range of 0,4...20 g/h; a 1:50 ratio.

Measure temperature, density and mass flow

By utilizing the on-board temperature and density measurements as well as the mass flow, the University can corroborate whether the fluid is a liquid or a gas thereby providing an important double-check on both the chemistry and process safety in addition to ensuring that the pumps are operating under the correct conditions.

*mini CORI-FLOW™ sensors directly
control the HPLC pumps*



The benefits of CORI-FLOW™

Bronkhorst® Coriolis Mass Flow Meters and Controllers are known for their high accuracy, repeatability and employability for multiple fluids. They behave like scales for flowing mass. Besides this they provide, fast response and a capability to measure and optionally control very low flow rates. Looking specifically at the chemical market, the benefits below are important.



Convenience of change

With a (mini) CORI-FLOW™ it is possible to use the same sensor for multiple processes. Simply configure the software settings and start working. (mini) CORI-FLOW™ gives the following benefits:

- Pumps, valves and sensors can easily be combined by the user;
- Different tests require different setups. A (mini) CORI-FLOW™ is able to be applied to a whole host of different processes.

One sensor, all fluids

Changing instrument combinations to perform various different tests requires a sensor that is compatible with numerous different fluids. This feature is crucial to the success of (mini) CORI-FLOW™ as without any changes to the sensor the user is indeed able to use the same instrument for multiple different tests. This will ensure:

- Convenience to work with several fluids without changing the instrument;
- A reduction in inventory as proven by some of the most well-known chemical companies across the world;
- Increased accuracy across phase change boundaries.



Software: One for all

Should the customer wish to work with multiple Bronkhorst® instruments in just one process, they can use the (free) Bronkhorst® software. This software ensures the opportunity to control as many instruments as desired in a straight forward, user friendly program. Your benefits:

- A Freeware program especially developed for controlling mini CORI-FLOW™;
- The opportunity to rerange the instruments to a desired flow rate;
- Software that gives insight into process dynamics and -parameters, such as mass flow, temperature, density, controller output and (batch)counter.

Bronkhorst® FlowWare, free software tools

For the convenience of their customers, Bronkhorst® developed various software tools, to support the operation of their digital mass flow meters and controllers.

These software tools are suitable for operation by personal computer and available free of charge.

> FlowDDE

Interface between digital instruments and Windows software.

> FlowView

FlowView is an application to easily operate Bronkhorst® digital instruments and readout units (E-8000 series).

> FlowPlot

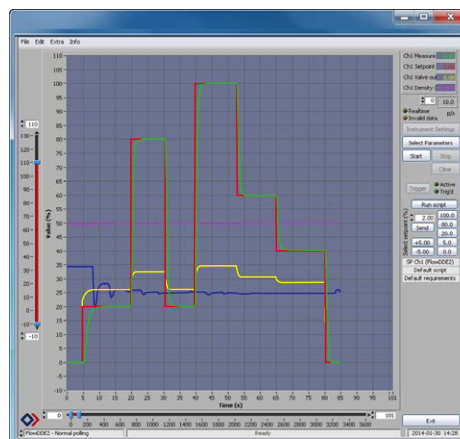
Software tool for monitoring and optimizing digital instruments.

- Free software program for monitoring and service purposes on Bronkhorst® digital instruments and readout units.
- Good insight into the dynamic behaviour of meters and controllers and thus the process.
- Allows adjustment of the controller, alarm and counter settings.
- FlowPlot has benefitted a great many users when first establishing a new experiment or process. The graphical representation of so many measured parameters simultaneously, e.g. flow, temperature, density, etc is a useful visual tool at the point of set-up.

- Density (100% = 2000 kg/m³ - 0% = 0 kg/m³)
- Temperature (percentage = °C)
- Setpoint (wanted value; 100% = FS = capacity)
- Measure (actual flow; 100% = FS = capacity)
- Controller output value

Typical functions

- **Re-ranging mini CORI-FLOW™ instruments**
Coriolis instruments are very linear, therefore the instruments can be rescaled at any desired value within the specifications of the instrument.
- **Optimizing (PID) controller settings**
The products of Bronkhorst® have an integrated PID controller. Therefore it is possible to control valves and pumps directly. With FlowPlot it is possible to optimize these setting to your personal preferences. In addition it is also possible to save your personal preferences. This can be very useful if you would like to use one MFC for several processes.
- **Printing a hardcopy of graphs**
Share your results with colleagues and/or customers.
- **Data logging to comma separated files**
All parameters can be logged, therefore you will have an excellent traceability of your process. This is very useful when it comes to quality assurance.
- **Batch counter settings**
The Bronkhorst® Coriolis instruments are equipped with the CORI-FILL™ technology. With the integrated counter function it is possible to perform highly accurate batch dosages. The counter function also ensures that the actuator will react as soon as the batch has been reached. Normally several components would be needed to achieve this. By using CORI-FILL™ you will have this functionality in one component, in one assembly and from one supplier, without the need of complex programming of additional hardware.



This screen shows the selected parameter value sizes as a function of the time to get an impression of the dynamic flow (and other parameter) behavior.

Coriolis Mass Flow Meters and Controllers for Gases and Liquids



mini CORI-FLOW™ series

Compact Coriolis Mass Flow Meter / Mass Flow Controller for liquids and gases. Both analog and digital output. Housing according to IP65 classification. World's smallest, lowest flow Coriolis Mass Flow Controller!

Flow ranges from 0-5 g/h up to 0-300 kg/h.



Pump Controlled Liquid Dosing

Compact solution consisting of a virtually pulse-free pump, mechanically and electrically coupled to a Coriolis Mass Flow Meter. True mass flow dosage, continuous or batch process, independent of the fluid's physical properties, ambient temperature and back pressure.



CORI-FILL™ Technology

Very fast and accurate gas and liquid batching solutions using a Coriolis Mass Flow Meter in combination with a valve or pump. Compact systems with minimized internal volume for filling processes.

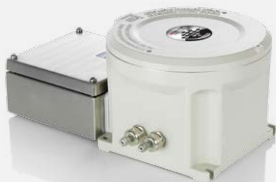
Flow ranges from 0-5 g/h up to 0-600 kg/h.



CORI-FLOW™ series

Precision Mass Flow Meters and Controllers based on Coriolis measuring principle. Housing according to IP65 classification. With analog or digital output. Metal sealed Meter, Controller either metal or elastomer sealed.

Flow ranges from 0-500 g/h up to 0-600 kg/h.



mini CORI-FLOW™ Ex d series

Low flow Coriolis Mass Flow Meter for liquids and gases with IECEx and ATEX Zone 1 approval. Both analog and digital output. Optional flow control by close-coupled valve or pump.

Flow ranges from 0-5 g/h up to 0-30 kg/h.

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