

Analytical Market

Mass flow and pressure measurement and control



Bronkhorst®

An introduction to Bronkhorst®

Bronkhorst High-Tech B.V., the European leader in Thermal Mass Flow Meters /Controllers and Electronic Pressure Controllers, has over 35 years experience in designing and manufacturing precise and reliable measurement and control devices. With the widest range of instruments available on the market Bronkhorst offers innovative solutions for many different applications across a great many different markets. Our instruments are manufactured

to customer specifications with models that are suitable for use in Laboratory, Industrial and Hazardous Area environments. In addition, the company provides tailor-made, complete fluid control solutions for O.E.M. systems.

Bronkhorst has a wealth of knowledge and an enviable worldwide reputation within the analytical market. In this leaflet we will illustrate that by presenting some typical applications.

Applications in the analytical market



Analytical laboratory (Photo: Westfalen AG)

Bronkhorst offers:

- Precise and fast responsive Mass Flow Controllers for **Gases**, e.g. for ICP purge, plasma and Collision/Reaction Cell gas control.
- Accurate and compact low flow **Liquid** solutions, e.g. pumpcontrol for NanoLC, UHPLC, HPLC.
- Mixing/blending and dilution of Gases and **Vapors**, for sample preparation and/or calibration of analytical equipment e.g. Mass Spectrometer calibration.
- Customised Manifold **Solutions** for flow-pressure control at the injector side of a GC or for flow control at the detector side of a GC or in an FID detector.

Coriolis mass flow meters / controllers for liquids and gases

Bronkhorst offers a series of instruments providing highest accuracy of mass flow metering for liquids and gases. (mini) CORI-FLOW™ utilises patented, advanced Coriolis type mass flow sensors to achieve unsurpassed performance, even with changing operating conditions in pressure, temperature, density, conductivity and viscosity. The devices are offered with or without integral control valve and analog and digital communication. The electronic control function forms part of the normal circuitry in the flow meter. The instruments can be offered in ranges from 5 g/h up to 600 kg/h (full-scale values). The maximum operating pressure for the instruments is 100 bar in SS316 construction or up to 590 bar with Hastelloy sensor.

(mini) CORI-FLOW™ is used in various analytical applications for instance in combination with **HPLC pumps**, verifying the pump performance or even close-coupled with a pump, accepting analog or digital signals defining the required mass flow rate.



Coriolis Mass Flow instruments



Mass flow meters / controllers for gases

Bronkhorst® Mass Flow Meters / Controllers are available in the widest range offered on the market for flows from 0...1 ml_n/min up to 0...400 m³_n/h and from low operating pressures (vacuum) up to 700 bar.

Bronkhorst® Mass Flow Controllers excel in:

- **stability**
- **maintainability**
- **quality**

The unique control valve is modular in construction and therefore user replaceable. For analytical applications, Bronkhorst® EL-FLOW MFC's have been used for **control of gases such as Hydrogen, Helium, Argon and Oxygen**, and flow meters of our LOW-ΔP-FLOW series have been used for **environmental and pollution monitoring**.

Both series are available with analog and digital in-/output.

The digital instruments have a basic pc-board, containing all of the general functions needed for measurement and control. In addition to the standard RS-232 output the instruments also offer analog I/O. Furthermore, an integrated interface board provides DeviceNet™, PROFIBUS DP, PROFINET, Modbus, EtherCAT® or FLOW-BUS protocols. The latter is a fieldbus based RS-485, specifically designed by Bronkhorst for their mass flow metering and control solutions, and with which the company already has over ten years of experience with digital communication.

Mass flow meters / controllers for liquids

Bronkhorst offers Mass Flow Meters and Controllers for liquids in ranges between 0...75 mg/h and 0...20 kg/h (water equivalent). The LIQUI-FLOW™ Series are compact instruments, only requiring a small differential pressure. Furthermore the LIQUI-FLOW™ Series feature:

- **fast and accurate measuring signal;**
- **insensitivity to mounting position;**
- **very small internal volume.**

In parallel with the mass flow controllers for gases, LIQUI-FLOW™ instruments are available with analog (0 - 5/10 Vdc or 0/4 - 20 mA) and digital (RS232) communication, with optional on-board fieldbus interface to PROFIBUS DP, DeviceNet™, Modbus or FLOW-BUS.

Flow control is achieved by integrating a control valve onto the body of the liquid flow meter. This control valve has a purge connection on top of the sleeve that enables easy elimination of air or gas when starting up the system. The electronic control function forms part of the normal circuitry in the liquid flow meter, so the need for an external controller is eliminated.

LIQUI-FLOW™ is typically used for generating gaseous mixtures with very small, very precise concentrations of vapour. **These test gases can be used for calibrating gas chromatographs or mass spectrometers (moisture analysis)**. For evaporation of non-water-like liquids, we recommend to use (mini) CORI-FLOW™ flow meters.



Digital Mass Flow Controller for gases, model F-201CV



Digital Mass Flow Controller/Meter for liquids



Controlled Evaporation Mixing (CEM) concept for vapour flow control



Customised manifold solutions for mass flow and pressure

The MANI-FLOW series originate from the demand of O.E.M. customers to design an economical solution to combine various functions into one compact device for integration into automated measurement systems. A single compact manifold can be populated with one or more mass flow or pressure sensor modules together with control valves, two- or three-way valves, shut-off valves, filters or any other functional module as per customer's request. The specifications are always agreed in collaboration with the customer including such details as aluminium or stainless steel construction, gas connection via female thread or indeed special connections if desired. Benefits of the MANI-FLOW series are:

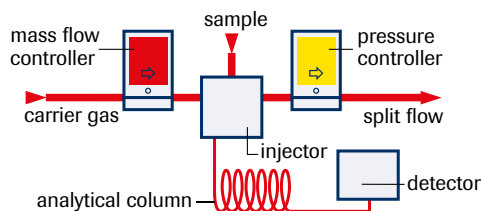
- **Compact assembly ensures space efficiency**
- **Economical solution, low cost of ownership**
- **Combination of functions on one manifold (i.e. tubeless construction) reduces potential leak points**
- **Modular construction enables easy exchange of functional modules**
- **Pre-tested "Plug and Perform" units, reducing custom testing requirements.**

Examples of analytical applications for the MANI-FLOW series as well as the micro-fluidic IQ⁺FLOW series (described hereafter) are **flow-pressure control at the injector side of a GC, flow control at the detector side of a GC or in an FID detector, control of collisional and reactive gases in a Collision/Reaction Cell in an ICP-MS.**

Micro fluidic mass flow and pressure meters / controllers

Equipment manufacturers are looking for compact solutions to monitor or control the gas flow or pressure in their system. Previously, conventional mass flow and pressure meters and controllers have needed a footprint of 1.5", as for instance specified in the NeSSI™ system. Now, Bronkhorst has developed the IQ⁺FLOW mass flow sensor. Due to the use of micro solid state technology (MEMS), Bronkhorst has been able to halve the footprint dimension to 0.75", thereby realizing the ultra compact flow and pressure controllers. IQ⁺FLOW series feature:

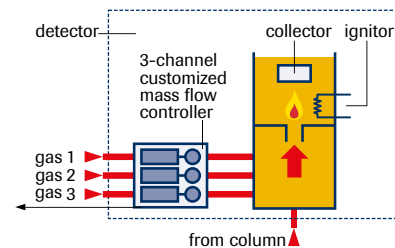
- **Very stable Zero, due to the thermally balanced chip-sensor**
- **Analog and digital (RS232) communication**
- **The same benefits of bespoke manifold solutions as mentioned for the MANI-FLOW series, with only difference that IQ⁺FLOW is ultracompact!**



Split flow control in GC application



Example of a customised manifold solution;
3-channel Mass Flow Control



Supply of gas mixture to FID detector



Example of a tailor-made micro-fluidic manifold
solution; flow-pressure control combination



World's smallest mass flow controller and pressure controller

