The Analytical Market

Mass flow and pressure control

Bronkhorst®
HIGH-TECH

Bronkhorst High-Tech headquarters, The Netherlands

> An introduction to Bronkhorst High-Tech

Bronkhorst High-Tech BV, the European leader in Thermal Mass Flow Meters / Controllers and Electronic Pressure Controllers, has 25 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 High-Tech has a wealth of knowledge and an enviable world-wide reputation within the innovative analytical market.

> Applications in the analytical market

Bronkhorst High-Tech offers:

- precise and fast response Mass Flow Controllers for gases, e.g. for **ICP and AA Mass Spectrometer purge, plasma and additional gas control.**
- accurate and compact ultra low flow liquid control for **high pressure liquid chromatography (HPLC).**
- fast acting and highly repeatable gas pressure and flow control for **gas chromatography (GC).**
- Mixing / blending and dilution of gases for **sample preparation and/or calibration of analytical equipment.**

Analytical laboratory (Photo: Westfalen AG)

> Bronkhorst world wide support

Bronkhorst High-Tech is a truly worldwide organisation with its Head Office located in the town of Ruurlo in The Netherlands. With a total headcount now exceeding 250 employees, it is impressive that 45 of these are involved with R&D, 100 in manufacture and 40 involved with after-sales service and customer care. In actual fact, the Customer Service Department offers “round-the-clock” support, seven days a week, to customers in every corner of the world.

Our specialist teams are available to you to ensure pre- and post sales support with diverse needs, such as application advice, on-site inspection & calibration and start-up assistance.

In addition to the Veenendaal sales office in The Netherlands there are branch offices in Great Britain, France, Switzerland, Northern Germany and the USA whereby local expertise and service is offered. Bronkhorst High-Tech has also built up an extensive complimentary network of distributors and service stations across the rest of Europe and, indeed, yet further representation in such countries as China, Japan, Australia, New Zealand, Canada, Israel, India, South Africa, Brazil and Korea.

On-site technical support by Customer Service specialist

Round the clock support line +31(0)573 45 88 39

> Mass flow meters / controllers for gases

Bronkhorst High-Tech Mass Flow Meters/Controllers are available in the widest range offered on the market with flows from 0...1 ml_n/min up to 0...400 m^3_n/h and from low operating pressures (vacuum) up to 700 bar. Bronkhorst High-Tech Mass Flow Controllers excel in:

- stability
- maintainability
- quality

The unique control valve is modular in construction and therefore user replaceable. For analytical applications, Bronkhorst High-Tech 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®, Modbus or FLOW-BUS protocols. The latter is a fieldbus based RS-485, specifically designed by Bronkhorst High-Tech for their mass flow metering and control solutions, and with which the company already has over ten years of experience with digital communication.

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

> Mass flow meters/ controllers for liquids

Bronkhorst High-Tech offers Mass Flow Meters and Controllers for liquids in ranges between 0 ... 30 mg/h **(0 … 500 nanolitres per minute!)** 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:

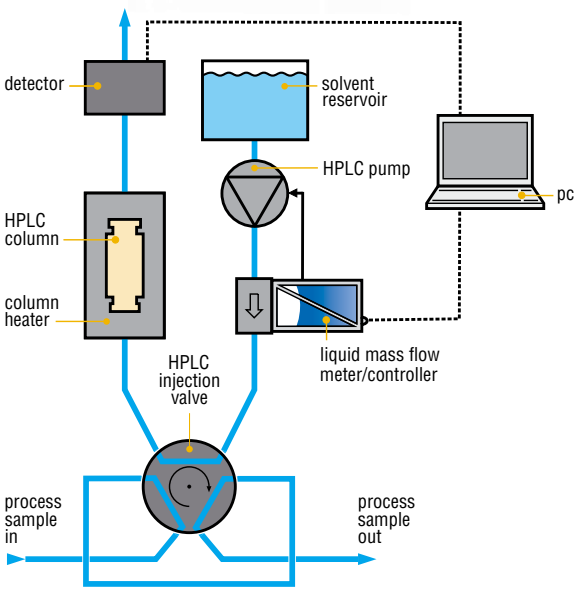
- fast and accurate measuring signal;
- insensitivity to mounting position;
- very small internal volume.

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®, DeviceNetTM, 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 used in analytical applications 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. Furthermore LIQUI-FLOW is 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).**

Digital Mass Flow Controller for liquids, model L13V02



Liquid flow control in HPLC system

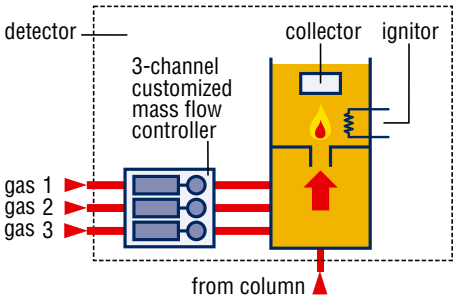
> Customised manifold solutions for mass flow and pressure

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 great many solutions have now been designed and manufactured since the launch of the concept back in 1996. 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 Play" 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.**

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

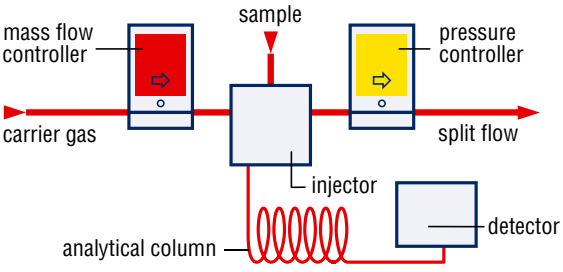


Supply of gas mixture to FID detector

> 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 High-Tech 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 tailor-made micro-fluidic manifold solution;
flow-pressure control combination

World's smallest mass flow controller and pressure controller

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