



IQ+FLOW[®]

Micro Fluidic Mass Flow and Pressure
Meters/Controllers with high intrinsic quality



› Introduction

Bronkhorst High-Tech B.V., the European market leader in thermal Mass Flow Meters/Controllers and Electronic Pressure Controllers, has many years of experience in designing and manufacturing precise and reliable measurement and control devices. With a wide range of instruments, Bronkhorst offers innovative solutions for many different applications in many different markets. The instruments are made to customers' specification, in various styles, suitable for use in laboratory, industrial environment, hazardous areas, semiconductor or analytical installations.

› Micro fluidic concept

The use of micro fluidic devices for research and analytical purposes has some important advantages. Firstly, because the internal volumes within the instruments are very small, the analysis will be faster and the amount of reagents and analytes used can be reduced.

The latter is especially significant for expensive reagents. Furthermore, the physical dimensions are much smaller than those of conventional devices. This enables Life Sciences system integrators to downscale the size, inherently reducing the costs of ownership of their equipment. Also, the availability of compact and lightweight instruments could lead to the development of portable systems.

› World's smallest Mass Flow / Pressure Controllers

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, and in close co-operation with the Netherlands organisation for applied scientific research TNO, Bronkhorst has developed the IQ+FLOW mass flow sensor. Due to the use of micro system technology (MST), Bronkhorst has been able to halve the footprint dimension to 0,75", thereby realising ultra compact flow controllers for flow rates from 0,2 to 5000 ml_r/min and pressure controllers for 0,01 to 10 bar.

› High intrinsic quality, featuring...

- ◆ Compact assembly ensures space efficiency
- ◆ Reduction of wetted surfaces
- ◆ Economical solution, low cost of ownership
- ◆ Analog or digital communication
- ◆ Top-mount modules; easily accessible
- ◆ Pre-tested "Plug and Play" manifold assemblies, reducing custom testing requirements



Actual size



IQ+FLOW Downported MFC



IQ+FLOW Pressure Controller

Technical specifications

Operating conditions

Media	dry, clean and non-corrosive gases (default); pressure meters/controllers with media-isolated sensor offer wide media compatibility
Operating temperature	5...50°C
Max. operating pressure	10 barg

Performance mass flow meter/controller - IQF(D)

Flow ranges	min. 0,2...10 ml _v /min / max. 0,1...5 l _v /min (storage of max. 8 calibration curves)
Accuracy flow sensor (based on actual calibration)	< ±1,5% RD + ±0,5% FS
Repeatability	for flows < 20 ml _v /min: < ±0,5% FS for flows > 20 ml _v /min: < ±0,5% RD
Settling time (in control)	τ98% down to 300 msec, 700 msec typical
Pressure drop flow meter	20 mbarD based on 1 l _v /min Air at 0 barg
Temperature sensitivity	span: 0,2% RD/°C; zero: 0,01 ml _v /min/°C
Leak integrity (outboard)	1 × 10 ⁻⁸ mbarl/sec He
Attitude sensitivity	max. error at 90° off horizontal 0,5 ml _v /min at 1 bar, typical N ₂

Performance pressure meter/controller - IOP(D)

Pressure ranges (abs/gauge)	min. 0,01...0,5 bar / max. 0,2...10 bar
Accuracy pressure sensor	< ±0,5% FS
Repeatability	< ±0,2% FS
Response time sensor	τ95% 5 msec
Temperature sensitivity	span: 0.1% RD/°C; zero: 0,05% FS/°C
Leak integrity (outboard)	1 x 10 ⁻⁶ mbar.l/sec He
Attitude sensitivity	negligible

Mechanical parts

Material of construction (wetted parts)	body: aluminium or stainless steel SS316L; chip sensor (flow or pressure): Si, SiO _x , epoxy, aluminium; media-isolated sensor (pressure): SS316L
Process connections (optional)	10-32 UNF threaded internal nut with 1/16" ferrule (SS316 or Peek); ½" or ⅝" OD compression type
Seals	standard: FKM/Viton®; option: FKM/Viton® o-rings with FFKM/Kalrez® plunger
Weight	approx. 0.2 kg
Ingress protection	IP40

Electrical specifications

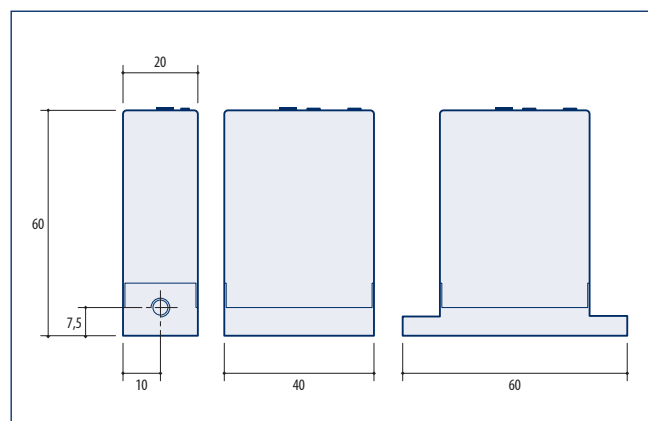
Readout sample time	2 msec
Power supply	+15...+24 Vdc, 50 mA for meter; add 50 mA for control valve
Output/Setpoint	
Single-channel	0...5 (10) Vdc or 0 (4)...20 mA (sourcing output) and RS232, RS485 (Modbus RTU/ASCII or FLOW-BUS)
Multi-channel	RS232, RS485 (Modbus RTU)
Rotary switches (multi-channel only)	for bus and address selection
Electrical connection	RJ45 modular jack

Technical specifications and dimensions subject to change without notice.

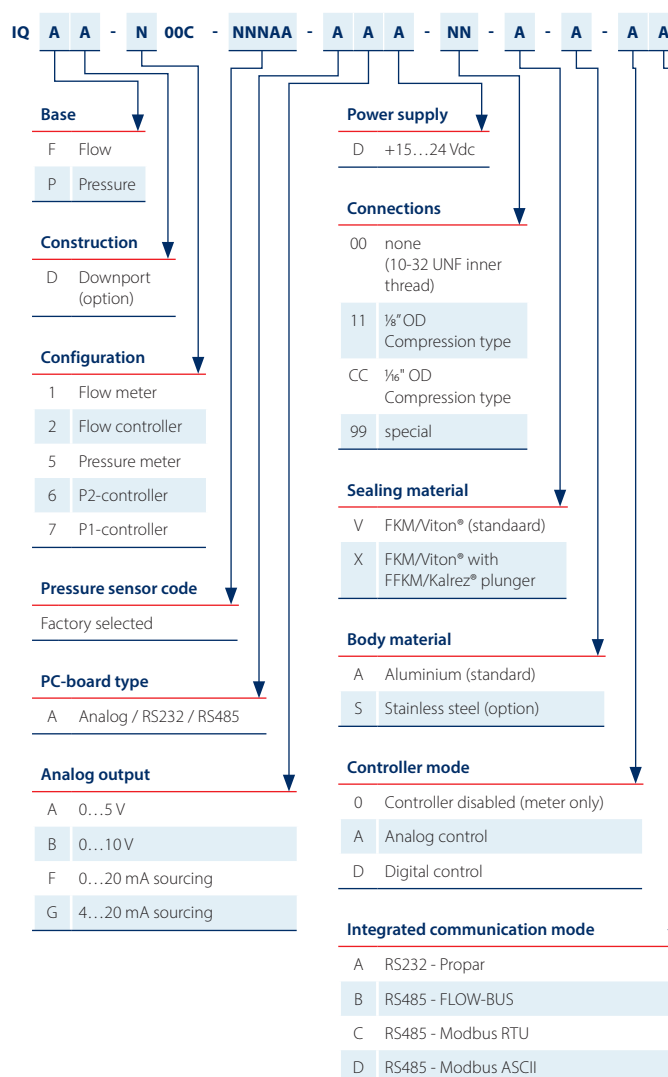
➤ **High accuracy and control performance**

IQ*FLOW Mass Flow Meters and Controllers are sophisticated microprocessor-based instruments offering high accuracy and repeatability. Up to 8 calibration curves can be stored on the instrument, eliminating the need to recalibrate the device for different gases. The PID controller, integrated on the pc-board, ensures highly stable control and, as an option, allows adjustment of the settling time down to 300 msec, for processes that require fast response times.

➤ Dimensions (mm)



➤ Model number identification (1-channel)



› Multi-channel solutions

Thanks to the modular concept of the IQ*FLOW series, multiple channel arrangements can be realised on one compact manifold, with one multi-channel digital pc-board (per 3 channels) in one housing.

› Customer specific designs

A core philosophy of Bronkhorst is to form close working links and collaborations with Original Equipment Manufacturers OEMs to ensure optimised integration of our instruments within their own equipment. Most often this results in a bespoke design in which multiple channels and/or various functions are combined into one micro fluidic system.

The IQ*FLOW concept offers the following functional modules within the 0,75" footprint:



Flow sensor; gas flow ranges from 10 to 5000 sccm (Full Scale values)



Pressure sensor; pressure ranges from 0,5 to 10 bar abs/gauge (FS)



Control valve
Electrical shut-off valve



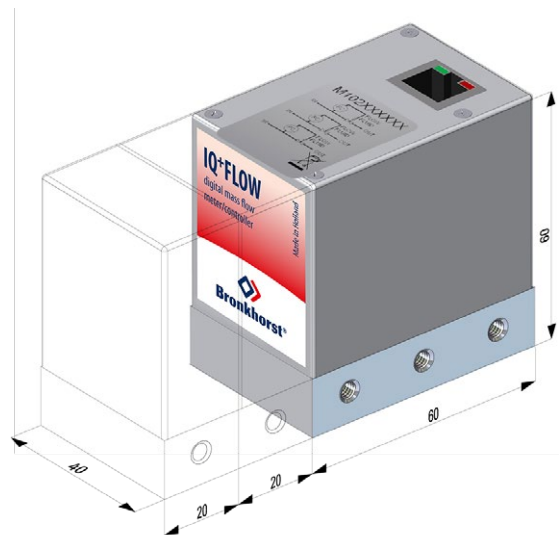
Filter



Pneumatic shut-off valve

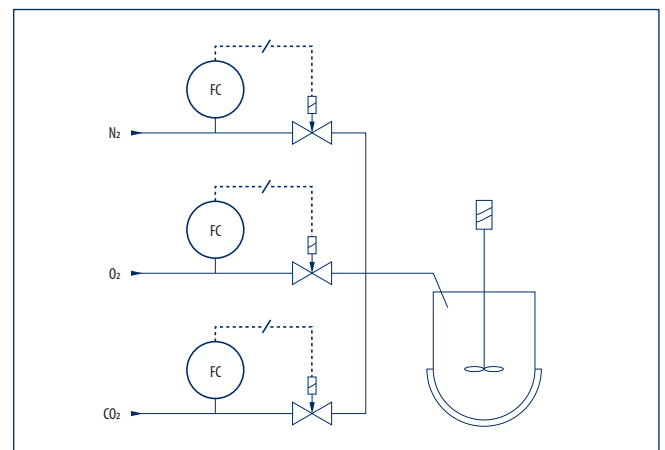
A combination of these modules can be mounted on a compact manifold, in line with a customers' requirements, and following open design discussions. Further possibilities might include either an aluminium or a stainless steel manifold with perhaps female inlet/outlet ports that could be suitable for either gas or liquid.

As there are truly an infinite number of possible solutions we highly recommend you to contact Bronkhorst to discuss your application.



› Bioreactor applications

Bioreactors and fermenters play a vital role in pharmaceutical research for vaccine and medicine development. Other bioreactor applications are the preparation of fermented foods and drinks, biofuel, bio-based materials and life science. Oxygen, nitrogen, carbon dioxide and air are supplied to control the pH and dissolved oxygen level in the reactor chamber and hereby, controlling bacterial or cell growth. For optimum results, each gas flow needs to be controlled reliably and accurately, which requires Mass Flow Controllers. Small table-top sized models are used in R&D settings and for parallel experiments. IQ*FLOW multi-channel mass flow control solutions provide the world's smallest footprint and overall size for bioreactor flow control, allowing for weight reduction, easy electronic integration at the lowest cost per flow channel.



3-channel Mass Flow Controller with pharmaceutical capsules to illustrate the compactness of this flow control solution

> Analytical applications

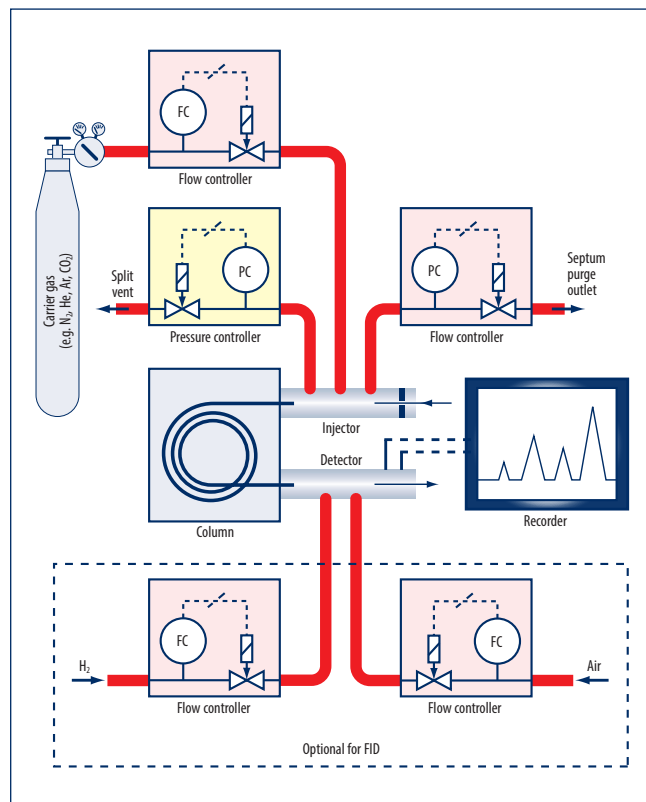
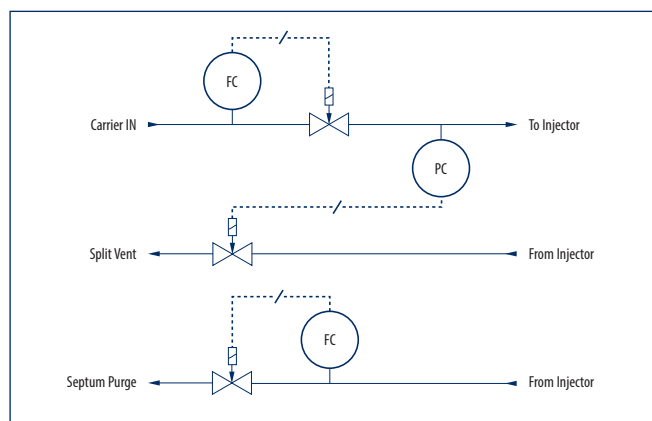
Examples of analytical applications based on the ultra compact modules with a footprint of 0,75" are:

- ◆ Flow - Pressure control at the injector side of a GC
- ◆ Flow control at the detector side of a GC or HPLC
- ◆ Flow control in an FID (Flame Ionisation Detector)

The schematic diagram illustrates the set-up of a typical GC system. Below you will find just two of many solutions for using the modular IQ*FLOW concept for analytical applications.

Gas Chromatography (GC)

Gas chromatography involves a sample being vapourised and injected into a chromatographic column. The sample is transported through the column by an inert carrier gas flow and led into a detector. The detector responds to the various chemical compounds of the sample. To optimize GC separations the pressure at the inlet of the column can be programmed, making use of a pressure controller.



Flame Ionisation Detector (FID)

An FID is a highly sensitive detector for the analysis of organic compounds. The effluent from the column is mixed with H₂ and air, and ignited. The sensor measures the current resulting from the pyrolysis (decomposition by the use of heat).

