

IN-FLOW

Industrial Style Digital Mass Flow Meters and Controllers for Gases

> Introduction

Bronkhorst High-Tech B.V., the European market 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 a wide range of instruments, Bronkhorst High-Tech is offering 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.

> IN-FLOW series for Industrial Environments

The Mass Flow Meters of the IN-FLOW series are of rugged design (IP65) for use in pilot and production plants in industrial environments. Mass Flow Meters can be supplied in ranges starting from 0,02...1 ml_n/min up to 11000 m³_n/h air-equivalent, with pressure rating between vacuum and 700 bar. In combination with control valves, either integrated or separate, Mass Flow Controllers can be offered up to 10...500 m³_n/h air-equivalent. The instruments of the IN-FLOW series are now available with ATEX approval for use in Zone 2 hazardous areas.

> Multi-Bus Technology

Bronkhorst High-Tech developed their latest digital instruments according to the "multi-bus" principle. The basic pc-board on the instrument contains all of the general functions needed for measurement and control. It has analog I/O-signals and also an RS232 connection as a standard feature. In addition to this there is the possibility of integrating an interface board with DeviceNet™, Profibus-DP®, Modbus-RTU or FLOW-BUS protocol. The latter is a fieldbus based RS485, specifically designed by Bronkhorst High-Tech for their mass flow metering and control solutions, and through which the company already has over ten years of experience with digital communication.

> Mass Flow Controllers for every application

The control valve can be furnished as integral part of an IN-FLOW MFC, or as separate component. It is a proportional, electromagnetic control valve with extremely fast and smooth control characteristics. With reference to the specific field of application there are different series of control valves. There is a standard



direct acting valve for common applications, a pilot operated valve for high flow rates, the so-called Vary-P valve with pressure rating 400 or 700 bar, that can cope with up to 400 bar ΔP and a bellows valve for applications with very low differential pressure.

> General IN-FLOW features

- ◆ weatherproof IP65 housing
- ◆ ATEX approval Cat.3, Zone 2
- ◆ fast response, excellent repeatability
- ◆ flow ranges from 0,02...1 ml_n/min up to 220...11000 m³_n/h
- ◆ pressure ratings up to 700 bar

> Digital features

- ◆ DeviceNet™, PROFIBUS-DP®, Modbus-RTU or FLOW-BUS slave
- ◆ RS232 interface
- ◆ other fieldbus options on request
- ◆ alarm and counter functions

> Fields of application

- ◆ Process gas measurement or control in food, pharmaceutical and (petro-) chemical industries, in fermentation installations and in fuel cell technology
- ◆ Sample gas measurement
- ◆ Burner control
- ◆ Gas consumption measurement for internal accounting
- ◆ Making of defined gas mixtures



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> Technical specifications

Measurement / control system

Accuracy (incl. linearity) (based on actual calibration)	: standard: $\pm 0,8\%$ Rd plus $\pm 0,2\%$ FS; on request: $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS; ($\pm 1\%$ FS for ranges < 0-10 ml _n /min; for flow > 1000 m ³ _n /h contact factory)
Turndown	: 1 : 50 (2 ... 100%)
Repeatability	: < 0,2% Rd
Settling time (controller)	: standard: 1...2 seconds option: down to 200 msec
Operating temperature	: -10...+70°C; for ATEX Cat.3 max. 50°C
Temperature sensitivity	: zero: < 0,05% FS/°C; span: < 0,05% Rd/°C
Leak integrity	: tested < 2 x 10 ⁻⁹ mbar l/s He
Attitude sensitivity	: max. error at 90° off horizontal 0,2% at 1 bar, typical N2
Warm-up time	: 30 min. for optimum accuracy 2 min for accuracy $\pm 2\%$ FS

Mechanical parts

Material (wetted parts)	: stainless steel 316L or comparable
Surface quality (wetted parts)	: Ra = 0,8 µm typical
Process connections	: compression type or face seal couplings; wafer type on series F-106; DIN or ANSI flanges on series F-107
Seals	: standard: Viton options: EPDM, FFKM (Kalrez)
Ingress protection (housing)	: IP65

Electrical properties

Power supply	: +15...24 Vdc
Power consumption	: meter: 70 mA; controller: max. 320 mA; add 50 mA for Profibus, if applicable
Analog output/command	: 0...5 (10) Vdc or 0 (4)...20 mA (sourcing output)
Digital communication	: standard: RS232 options: Profibus-DP®, DeviceNet™, Modbus-RTU, FLOW-BUS
Electrical connection	
Analog/RS232	: 8 DIN male;
Profibus-DP®	: bus: 5-pin M12 female; power: 8 DIN male
DeviceNet™	: 5-pin M12 male
Modbus-RTU/FLOW-BUS	: 5-pin M12 male

Technical specifications subject to change without notice.



F-201CI Compact IP65 Mass Flow Controller for low flow ranges

> Models and flow ranges

Mass Flow Meters (MFM); PN100 (pressure rating 100 bar)

Model	min. flow	max. flow
F-110CI	0,02...1 ml _n /min	0,24...12 ml _n /min
F-111BI	0,16...8 ml _n /min	0,6...30 l _n /min
F-111AI	0,4...20 l _n /min	2...100 l _n /min
F-112AI	0,8...40 l _n /min	7,6...380 l _n /min
F-113AI	4...200 l _n /min	36...1800 l _n /min
F-116AI	0,4...200 m ³ _n /h	4...200 m ³ _n /h
F-116BI	1...50 m ³ _n /h	10...500 m ³ _n /h

For ranges of 200, 400 or 700 bar rated MFMs please contact factory

High-Flow MFMs; PN10 / PN16 / PN25 / PN40 / PN100

Model	min. flow	max. flow
F-106AI/F-107AI/F-117AI	0,4...20 m ³ _n /h	4...200 m ³ _n /h
F-106BI/F-107BI/F-117BI	1...50 m ³ _n /h	10...500 m ³ _n /h
F-106CI/F-107CI/F-117CI	2...100 m ³ _n /h	20...1000 m ³ _n /h
F-106DI/F-107DI/F-117DI	3,6...180 m ³ _n /h	36...1800 m ³ _n /h
F-106EI	8...400 m ³ _n /h	80...4000 m ³ _n /h
F-106FI	14...700 m ³ _n /h	140...7000 m ³ _n /h
F-106GI	22...1100 m ³ _n /h	220...11000 m ³ _n /h

Mass Flow Controllers (MFC); PN64 / PN100

Model	min. flow	max. flow
F-200CI/F-210CI ¹⁾	0,2...10 ml _n /min	0,24...12 ml _n /min
F-201CI/F-211CI ¹⁾	0,24...12 ml _n /min	0,6...30 l _n /min
F-201AI/F-211AI ¹⁾	0,4...20 l _n /min	2...100 l _n /min
F-202AI/F-212AI ²⁾	0,8...40 l _n /min	7,6...380 l _n /min
F-203AI/F-213AI ³⁾	4...200 l _n /min	36...1800 l _n /min
F-206AI/F-216AI ³⁾	0,4...200 m ³ _n /h	4...200 m ³ _n /h
F-206BI/F-216BI ⁴⁾	1...50 m ³ _n /h	10...500 m ³ _n /h

¹⁾ K_v-max = 6,6x10⁻² ²⁾ K_v-max = 0,4 ³⁾ K_v-max = 1,5 ⁴⁾ K_v-max = 6,0

MFCs for high-pressure / high-ΔP applications; PN400

Model	min. flow	max. flow
F-230MI	0,2...10 ml _n /min	14...700 ml _n /min
F-231MI	6...300 ml _n /min	0,26...13 l _n /min
F-232MI	0,14...7 l _n /min	2...100 l _n /min

For ranges of 700 bar rated MFCs please contact factory.



F-107BI Mass Flow Meter for high flow ranges


Bronkhorst®
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Nijverheidsstraat 1a, NL-7261 AK Ruurlo The Netherlands
T +31(0)573 45 88 00 F +31(0)573 45 88 08 I www.bronkhorst.com E info@bronkhorst.com

