

EX-FLOW

Ex-Proof (ATEX II 2 G) 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 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.

> EX-FLOW series for hazardous areas

The Mass Flow Meters of the EX-FLOW series are of rugged design for gas flow applications in hazardous environments. The intrinsically safe measuring head is tested according to ATEX 100a Directive 94/9/EC and approved under EC-Type Examination Number: KEMA 01ATEX1172, protection II 2 G Ex ib IIC T4. This stands for:

II 2 G	= ATEX group and category
Ex ib IIC T4	= CENELEC marking
ib	= intrinsically safe Zone 1
IIC	= highest gas group with a minimum ignition energy of 20 μ J, with gases such as acetylene or hydrogen
T4	= max. surface temperature of 135°C

The housing of the electronics compartment is rated to IP65. Mass Flow Meters can be supplied in ranges starting from 0,16...8 ml_n/min up to 11000 m³/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/h air-equivalent.

> Mass Flow Controllers for every application

The control valve can be furnished as an integral part of an EX-FLOW MFC, or as a separate component. It is a proportional, electromagnetic control valve with 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 and the so-called Vary-P valve with a pressure rating of 400 or 700 bar, that can cope with up to 400 bar Δ P. These valves will be equipped with explosion proof certified coils. There are two options:

- Coil XB: protection II 1 G/D Ex ia IIC T6
- Coil XC: protection II 2 G/D Ex e mb II T4

The electrical connection of flow meter and control valve to the safe E-7000 readout system (located in the safe zone) is achieved via separate cables. The readout system contains a controller function pc-board to complete the control loop.

> General EX-FLOW features

- ◆ ATEX approval Cat.2, Zone 1
- ◆ weatherproof IP65 housing
- ◆ flow ranges from 0,16...8 ml_n/min up to 220...11000 m³/h
- ◆ optional: low- Δ P versions up to 4...200 l_n/min
- ◆ pressure ratings up to 700 bar

> Fields of application

- ◆ Process gas measurement or control in (petro-) chemical industries
- ◆ Fuel cell technology
- ◆ Gas distribution systems
- ◆ Hydrogenation processes
- ◆ Gas consumption measurement for internal accounting
- ◆ Heating or biogas production



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> Technical specifications

Measurement / control system

Accuracy (incl. linearity)	: standard: $\pm 1\%$ FS;
(based on actual calibration)	other on request
	(for flow > 1000 m ³ /h contact factory)
Turndown	: 1 : 50 (2 ... 100%)
Repeatability	: < 0,2% Rd
Time constant	: 5 seconds
Operating temperature	: EX-FLOW sensor: -10...+70°C;
	XB-coil: -40...+ 65°C
	XC-coil: -40...+ 65°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 μ m 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

Signal circuit	: in type of explosion protection intrinsic
	safety Ex ib IIC, only for connection to a
	certified intrinsically safe circuit with the
	following maximum values:
	U _i = 28 V, I _i = 98 mA, P _i = 686 mW
	The effective internal capacitance between:
	Terminals 1 and 3: C _i = 1 nF;
	Terminals 2 and housing: C _i = 120 nF;
	Effective internal inductance: L _i = 0,1 mH
Output signal	: 15...20 mA (linear)
	Terminal connection, cable gland M12x1,5
XB-coil (II 1 G/D Ex ia IIC T6)	: Coil voltage max. 28 V/110mA;
	295 Ohm at 20°C, cable gland PG9
XC-coil (II 2 G/D Ex e mb II T4)	: Coil voltage max. 24 V;
	65 Ohm at 20°C, cable gland M16x1,5;
	P _{max} = 9W at 20°C

Technical specifications subject to change without notice.

Related drawing 9.27.002D. No modifications permitted without approval of authorised person.

> Models and flow ranges

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

Model	min. flow	max. flow
F-110CX	0,16...8 ml _v /min	0,2...10 ml _v /min
F-111BX	0,2...10 ml _v /min	0,4...20 l _v /min
F-111AX	0,1...5 l _v /min	2...100 l _v /min
F-112AX	0,2...10 l _v /min	5...250 l _v /min
F-113AX	2...100 l _v /min	25...1250 l _v /min
F-116AX	0,4...20 m ³ /h	4...200 m ³ /h
F-116BX	1...50 m ³ /h	10...500 m ³ /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-106AX/F-107AX/F-117AX	0,4...20 m ³ /h	4...200 m ³ /h
F-106BX/F-107BX/F-117BX	1...50 m ³ /h	10...500 m ³ /h
F-106CX/F-107CX/F-117CX	2...100 m ³ /h	20...1000 m ³ /h
F-106DX/F-107DX/F-117DX	3,6...180 m ³ /h	36...1800 m ³ /h
F-106EX	8...400 m ³ /h	80...4000 m ³ /h
F-106FX	14...700 m ³ /h	140...7000 m ³ /h
F-106GX	22...1100 m ³ /h	220...11000 m ³ /h

Mass Flow Controllers (MFC); PN64 / PN100

Model	min. flow	max. flow
F-200CX/F-210CX	0,2...10 ml _v /min	0,2...10 ml _v /min
F-201CX/F-211CX	0,22...11 ml _v /min	0,4...20 l _v /min
F-201AX/F-211AX	0,1...5 l _v /min	2...100 l _v /min
F-202AX/F-212AX	0,2...10 l _v /min	5...250 l _v /min
F-203AX/F-213AX	2...100 l _v /min	25...1250 l _v /min
F-206AX/F-216AX	0,4...20 m ³ /h	4...200 m ³ /h
F-206BX/F-216BX	1...50 m ³ /h	10...500 m ³ /h

Contact factory for max. Kv-values (depending of coil type)

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

Model	min. flow	max. flow
F-230MX	0,2...10 ml _v /min	10...500 ml _v /min
F-231MX	10...500 ml _v /min	0,2...10 l _v /min
F-232MX	0,2...10 l _v /min	2...100 l _v /min

For ranges of 700 bar rated MFCs please contact factory



F-106AX Ex-proof Mass Flow Meter for high flow ranges


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