

# EX-FLOW

## Ex-Proof 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, 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 114 Directive 2014/34/EU and approved under EC-Type Examination Number: KEMA 01ATEX1172, protection II 2 G Ex ib IIC T4 Gb. This stands for:

marking according to ATEX directive: II 2 G

II = ATEX equipment group  
2 = ATEX equipment category  
G = ATEX flammable gas/vapour substances

marking according to IEC/EN standard: Ex ib IIC T4 Gb

ib = intrinsically safe Zone 1  
IIC = highest gas group with a minimum ignition energy of 20  $\mu$ J, with gases such as acetylene or hydrogen  
T4 = max. surface temperature of 135°C  
Gb = IEC equipment protection level

Other certifications:

IECEX = IECEX DEK14.0060  
TIIS = 検・第TC21584号 (Japanese certification)

The housing of the electronics compartment is rated to IP65. Mass Flow Meters can be supplied in ranges starting from 0,16...8 ml<sub>n</sub>/min up to 11000 m<sup>3</sup><sub>n</sub>/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 m<sup>3</sup><sub>n</sub>/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  $\Delta$ P. These valves will be equipped with explosion proof certified coils. There are two options:

Coil XB: protection II 1 G Ex ia IIC T6  
protection II 1 D Ex ta IIIC T80°C

Coil XC: protection II 2 G Ex eb IIC T4  
protection II 2 D Ex tb IIIC T130°C

Coils have only ATEX certification.

The electrical connection of flow meter and control valve to the safe power supply/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
- ◆ Flow ranges from 0,16...8 ml<sub>n</sub>/min up to 220...11000 m<sup>3</sup><sub>n</sub>/h
- ◆ 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



**Bronkhorst®**

## > Technical specifications

### Measurement / control system

Accuracy (incl. linearity)	: standard: $\pm 1\%$ FS;
(based on actual calibration)	other on request
	(for flow > 1000 m <sup>3</sup> / <sub>n</sub> /h contact factory)
Turndown	: 1 : 50 (2 ... 100%)
Repeatability	: < $\pm 0,2\%$ 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: $\leq \pm 0,05\%$ FS/°C;
	span: $\leq \pm 0,05\%$ Rd/°C
Leak integrity	: tested < 2 x 10 <sup>-9</sup> 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
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	: type of explosion protection: intrinsic safety Ex ib IIC, only for connection to a certified intrinsically safe circuit with the following maximum values:
	U <sub>i</sub> = 28 V, I <sub>i</sub> = 98 mA, P <sub>i</sub> = 686 mW
	The effective internal capacitance between: Terminals 1 and 3: C <sub>i</sub> = 1 nF;
	Effective internal inductance: L <sub>i</sub> = 0,3 mH
Output signal	: 15...20 mA (linear)
	Terminal connection, cable gland M16x1,5
XB-coil	: Coil voltage max. 28 V/110mA;
	295 Ohm at 20°C, cable gland M20x1,5
XC-coil	: Coil voltage max. 24 V;
	65 Ohm at 20°C, cable gland M20x1,5;
	P <sub>max</sub> = 9W at 20°C

Technical specifications subject to change without notice.

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

## > Models and flow ranges (based on Air)

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

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

### Mass Flow Controllers (MFC); PN64 / PN100

Model	min. flow	max. flow
F-200CX/F-210CX	0,2...10 ml <sub>n</sub> /min	0,2...10 ml <sub>n</sub> /min
F-201CX/F-211CX	0,22...11 ml <sub>n</sub> /min	0,4...20 l <sub>n</sub> /min
F-201AX/F-211AX	0,1...5 l <sub>n</sub> /min	2...100 l <sub>n</sub> /min
F-202AX/F-212AX	0,2...10 l <sub>n</sub> /min	5...250 l <sub>n</sub> /min
F-203AX/F-213AX	2...100 l <sub>n</sub> /min	25...1250 l <sub>n</sub> /min
F-206AX/F-216AX	0,4...20 m <sup>3</sup> / <sub>n</sub> /h	4...200 m <sup>3</sup> / <sub>n</sub> /h
F-206BX/F-216BX	1...50 m <sup>3</sup> / <sub>n</sub> /h	10...500 m <sup>3</sup> / <sub>n</sub> /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 <sub>n</sub> /min	10...500 ml <sub>n</sub> /min
F-231MX	10...500 ml <sub>n</sub> /min	0,2...10 l <sub>n</sub> /min
F-232MX	0,2...10 l <sub>n</sub> /min	2...100 l <sub>n</sub> /min

For ranges of 700 bar rated MFCs please contact factory



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

