
# EX-FLOW

Ex-Protected Mass Flow Meters and Controllers for Gases

Bronkhorst®

## 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.
This intrinsically safe measuring head is IECEx and ATEX tested and can be used up to Zone 1 or EPL Gb flammable gas atmospheres with an ambient temperature up to +70°C with marking II 2 G Ex ib IIC T4 Gb.

**Certifications**

| | |
|---|---|
| EU | ATEX KEMA 01ATEX1172 |
| WW | IECEx DEK14.0060 |
| JP | TIIS 検・第TC21584号 |
| KOR | KCs 제2019-048293-01-1호 |

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 $m^3_n$/h $N_2$-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 7,5…375 $m^3_n$/h $N_2$-equivalent.

## Mass Flow Controllers for every application

The control valve can be furnished as an integral part of an EX-FLOW Mass Flow Controller (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 ΔP. All valves are equipped with explosion protected certified coils, available in two executions:

- Coil type XB: protection method "intrinsically safe"; rated for use up to Zone 0/20 in Gas and Dust Ex-atmospheres with marking: II 1 G D Ex ia ta IIC // IIIC T6 T80ºC Ga Da.
- Coil type XC: protection method "increased safety"; rated for use up to Zone 1/21 Gas and Dust Ex-atmospheres with marking: II 2 G D Ex eb tb IIC // IIIC T4 T130ºC. (Equivalent IECEx Gb Db rating on request)

The electrical connection of flow meter and control valve to the 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.

## Power supply and readout

An EX-FLOW MFM or MFC should be connected to an E-8000 Series power supply / readout system with certified and integrated intrinsically safe galvanic isolation inputs and outputs. This unit must be installed in the safe area. The actual configuration is of an on request modular build, according to the number and execution of the instruments to be connected.

## General EX-FLOW features

- Typical Ex-system rating: ATEX Equipment Category 2, Zone 1 (Gas) or IECEx EPL Gb
- Flow ranges from 0,16…8 $ml_n$/min up to 220…11000 $m^3_n$/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


Example of a multi-channel E-8000 power supply/readout system (to be located in the safe area)


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

## Technical specifications

| Measurement / control system | |
|---|---|
| Accuracy (incl. linearity)<br>(based on actual calibration) | standard: ±1% FS; other on request<br>(for flow > 1000 $m^3_n$/h contact factory) |
| Turndown | 1 : 50 (2…100%) |
| Repeatability | < ±0,2% Rd |
| Time constant | 5 seconds |
| Operating temperature | EX-FLOW sensor: -10…+70°C;<br>XB-coil: -40…+ 65°C<br>XC-coil: -40…+ 65°C |
| Temperature sensitivity | zero: < ±0,05% FS/°C;<br>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%<br>at 1 bar, typical $N_2$ |
| Warm-up time | 30 min. for optimum accuracy;<br>2 min for accuracy ± 2% FS |

| Mechanical parts | |
|---|---|
| Material (wetted parts) | stainless steel 316L or comparable |
| Process connections | compression type or face seal couplings;<br>wafer type on series F-106;<br>DIN or ANSI flanges on series F-107 |
| Seals | standard: Viton®<br>options: EPDM, FFKM (Kalrez®), FDA and USP Class VI approved compounds |
| Ingress protection (housing) | IP65 |

| Electrical properties | |
|---|---|
| Output signal | 15…20 mA (linear)<br>Terminal connection, cable gland M16x1,5 |
| I/O signals via PS/Readout<br>(located in safe area) | analog: 0…5 Vdc, 0…10 Vdc, 0…20 mA, 4…20 mA;<br>digital: RS232, PROFIBUS DP, DeviceNet™, Modbus RTU or ASCII, PROFINET, EtherCAT®, FLOW- BUS |
| XB-coil | Coil voltage max. 28 V/110mA;<br>295 Ohm at 20°C, cable gland M20x1,5 |
| XC-coil | Coil voltage max. 24 V;<br>65 Ohm at 20°C, cable gland M20x1,5;<br>Pmax = 9W at 20°C |

*Technical specifications subject to change without notice.*
*Related drawing 9.27.002N. No modifications permitted without approval of authorised person.*

## Models and flow ranges (based on $N_2$)

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

| Model | min. flow | max. flow |
|---|---|---|
| F-110CX | 0,15…7,5 $ml_n$/min | 0,19…9,5 $ml_n$/min |
| F-111BX | 0,3…15 $ml_n$/min | 0,4…20 $l_n$/min |
| F-111AX | 0,1…5 $l_n$/min | 2…100 $l_n$/min |
| F-112AX | 0,8…40 $l_n$/min | 5…250 $l_n$/min |
| F-113AX | 4…200 $l_n$/min | 25…1250 $l_n$/min |
| F-116AX | 0,4…20 $m^3_n$/h | 4…200 $m^3_n$/h |
| F-116BX | 1…50 $m^3_n$/h | 7,5…375 $m^3_n$/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-106AX/F-107AX/F-117AX | 0,4…20 $m^3_n$/h | 4…200 $m^3_n$/h |
| F-106BX/F-107BX/F-117BX | 1…50 $m^3_n$/h | 10…500 $m^3_n$/h |
| F-106CX/F-107CX/F-117CX | 2…100 $m^3_n$/h | 20…1000 $m^3_n$/h |
| F-106DX/F-107DX/F-117DX | 3,6…180 $m^3_n$/h | 36…1800 $m^3_n$/h |
| F-106EX | 8…400 $m^3_n$/h | 80…4000 $m^3_n$/h |
| F-106FX | 14…700 $m^3_n$/h | 140…7000 $m^3_n$/h |
| F-106GX | 22…1100 $m^3_n$/h | 220…11000 $m^3_n$/h |

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

| Model | min. flow | max. flow |
|---|---|---|
| F-200CX/F-210CX | 0,19…9,5 $ml_n$/min | 0,19…9,5 $ml_n$/min |
| F-201CX/F-211CX | 0,3…15 $ml_n$/min | 0,4…20 $l_n$/min |
| F-201AX/F-211AX | 0,1…5 $l_n$/min | 2…100 $l_n$/min |
| F-202AX/F-212AX | 0,6…30 $l_n$/min | 5…250 $l_n$/min |
| F-203AX/F-213AX | 4…200 $l_n$/min | 25…1250 $l_n$/min |
| F-206AX/F-216AX | 0,4…20 $m^3_n$/h | 4…200 $m^3_n$/h |
| F-206BX/F-216BX | 1…50 $m^3_n$/h | 7,5…375 $m^3_n$/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 $ml_n$/min | 10…500 $ml_n$/min |
| F-231MX | 10…500 $ml_n$/min | 0,2…10 $l_n$/min |
| F-232MX | 0,2…10 $l_n$/min | 2…100 $l_n$/min |

*For ranges of 700 bar rated MFCs please contact factory.*

F-112AX Mass Flow Meter

F-202AX Mass Flow Controller

F-107CX Mass Flow Meter for high flow ranges (flanged type)

## Model number identification

| F | - | N | | N | | NAA | - | HEE | - | NN | - | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

### Base

| | |
|---|---|
| 0 | Valve only |
| 1 | Meter |
| 2 | Controller |

### Pressure rating

| | |
|---|---|
| 0 | 64 bar |
| 1 | 100 bar |
| 2 | 200 bar |
| 3 | 400 bar |
| 4 | 700 bar |

### Ranges

| | |
|---|---|
| **for Flow Meters** | |
| 0CX | 0…0,75 / 0…9,5 $ml_n$/min |
| 1BX/1CX | 0…15 / 0…20000 $ml_n$/min |
| 1AX | 0…5 / 0…100 $l_n$/min |
| 2AX | 0…40 / 0…250 $l_n$/min |
| 3AX | 0…200 / 0…1250 $l_n$/min |
| 6AX/7AX | 0…20 / 0…200 $m^3_n$/h |
| 6BX/7BX | 0…50 / 0…500 $m^3_n$/h |
| 6CX/7CX | 0…100 / 0…1000 $m^3_n$/h |
| 6DX/7DX | 0…180 / 0…1800 $m^3_n$/h |
| 6EX | 0…400 / 0…4000 $m^3_n$/h |
| 6FX | 0…700 / 0…7000 $m^3_n$/h |
| 6GX | 0…1100 / 0…11000 $m^3_n$/h |
| **for PN64/PN100 Flow Controllers** | |
| 0CX | 0…9,5 $ml_n$/min |
| 1CX | 0…15 / 0…20000 $ml_n$/min |
| 1AX | 0…5 / 0…100 $l_n$/min |
| 2AX | 0…30 / 0…250 $l_n$/min |
| 3AX | 0…200 / 0…1250 $l_n$/min |
| 6AX | 0…20 / 0…200 $m^3_n$/h |
| 6BX | 0…50 / 0…375 $m^3_n$/h |
| **for PN400 Flow Controllers** | |
| 0MX | 0…10 / 0…500 $ml_n$/min |
| 1MX | 0…0,5 / 0…10 $l_n$/min |
| 2MX | 0…10 / 0…100 $l_n$/min |

### Connections (in/out)

| | |
|---|---|
| 1 | ⅛" OD compression type |
| 2 | ¼" OD compression type |
| 3 | 6 mm OD compression type |
| 4 | 12 mm OD compression type |
| 5 | ½" OD compression type |
| 6 | 20 mm OD compression type |
| 8 | ¼" Face seal male |
| 9 | other |

### Mounting between flanges

| | | |
|---|---|---|
| 01 | mounting betw. flange | DIN PN10 |
| 02 | mounting betw. flange | DIN PN16 |
| 03 | mounting betw. flange | DIN PN40 |
| 06 | mounting betw. flange | ANSI 150 lbs |
| 07 | mounting betw. flange | ANSI 300 lbs |
| 13 | Flanged connections | DIN PN40 |
| 15 | Flanged connections | DIN PN100 |
| 26 | Flanged connections | ANSI 150 lbs |
| 27 | Flanged connections | ANSI 300 lbs |
| 28 | Flanged connections | ANSI 600 lbs |
| 99 | other | |

### Internal seals

| | |
|---|---|
| V | Viton® |
| E | EPDM |
| K | Kalrez® (FFKM) |

Bronkhorst®

Bronkhorst High-Tech designs and manufactures innovative instruments and subsystems for low-flow measurement and control for use in laboratories, machinery and industry. Driven by a strong sense of sustainability and with many years of experience, we offer an extensive range of (mass) flow meters and controllers for gases and liquids, based on thermal, Coriolis and ultrasonic measuring principles. Our global sales and service network provides local support in more than 40 countries. Discover Bronkhorst®!

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