

# DATASHEET F-231MI

## IN-FLOW F-231MI

Industrial Style High-Pressure Mass Flow Controller for Gases



### Industrial Style Gas Mass Flow Controllers for High Pressure / High Delta-P

Bronkhorst® model F-231MI Mass Flow Controllers (MFCs) are suited for accurate measurement and control of flow ranges between 10...500 ml<sub>n</sub>/min and 0,2...10 l<sub>n</sub>/min with an operating pressure up to 350 bar and max. 350 bar pressure difference (ΔP). The MFC consists of a thermal mass flow sensor, a precise control valve and a microprocessor based pc-board with signal and fieldbus conversion. As a function of a setpoint value, the flow controller swiftly adjusts the desired flow rate. The IN-FLOW model is of rugged design (IP65) for use in industrial environments or even Zone 2 hazardous areas, with optional ATEX Cat. 3 or FM Class I, Div. 2 approval.

IN-FLOW series are equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response. The main digital pc-board contains all of the general functions needed for measurement and control. In addition to the standard RS232 output the instruments also offer analog I/O. As an option, an on-board interface can be mounted to provide CANopen®, DeviceNet™, EtherCAT®, PROFIBUS DP, PROFINET, Modbus RTU, ASCII or TCP/IP, EtherNet/IP, POWERLINK or FLOW-BUS protocols.

### Technical specifications

#### Measurement / control system

|  |   |
|--|---|
| Flow range (intermediate ranges available)               | min. 10...500 ml <sub>n</sub> /min<br>max. 0,2...10 l <sub>n</sub> /min<br>(based on N <sub>2</sub> ) |
| Accuracy (incl. linearity) (based on actual calibration) | ±0,5% Rd plus ±0,1% FS  |
| Repeatability  | < 0,2 % RD  |
| Turndown ratio   | 1:50  |
| Multi fluid capability                                   | Storage of max. 8 calibration curves  |
| Settling time (in control, typical)                      | 2 ... 4 sec.  |
| Control stability  | < ± 0,1 % FS  |
| Operating temperature                                    | -10 ... +70 °C<br>for ATEX cat. 3 and FM Class 1 Div 2 : 0...50°C                                     |
| Temperature sensitivity                                  | zero: < 0,05% FS/°C; span: < 0,05% Rd/°C  |
| Pressure sensitivity                                     | 0,1% Rd/bar typical N <sub>2</sub> ; 0,01% Rd/bar typical H <sub>2</sub>                              |
| Leak integrity, outboard                                 | 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 N <sub>2</sub>                                |
| 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                   |
| Pressure rating (PN)    | 350 bar abs  |
| Min. ΔP                 | 6 bar dif.   |
| Max. ΔP                 | up to 350 bar dif.                                   |
| Process connections     | compression type or face seal couplings              |
| Seals                   | standard: FKM/Viton®;<br>options: EPDM, FFKM/Kalrez® |
| Ingress protection      | IP65   |

## Electrical properties

|                        |  |                |                |                    |
|------------------------|--|----------------|----------------|--------------------|
| Power supply           | +15 ... 24 Vdc   |                |                |                    |
| Max. power consumption | Supply   | at voltage I/O | at current I/O | extra for fieldbus |
|                        | 15 V   | 290 mA         | 320 mA         | <75 mA             |
|                        | 24 V   | 200 mA         | 215 mA         | <50 mA             |
| Analog output          | 0...5 (10) Vdc or 0 (4)...20 mA (sourcing output)  |                |                |                    |
| Digital communication  | standard: RS232;<br>options: CANopen®, DeviceNet™, EtherCAT®, PROFIBUS DP, PROFINET, Modbus RTU, ASCII or TCP/IP, EtherNet/IP, POWERLINK or FLOW-BUS |                |                |                    |

## Electrical connection

|   |   |
|---|---|
| Analog/RS232                            | 8 DIN (male);   |
| PROFIBUS DP                             | bus: 5-pin M12 (female);<br>power: 8 DIN (male);  |
| CANopen® / DeviceNet™                   | 5-pin M12 (male);   |
| FLOW-BUS/Modbus-RTU/ASCII               | 5-pin M12 (male)  |
| Modbus TCP / EtherNet/IP /<br>POWERLINK | bus: 2 x 5-pin M12 (female) (in/out);<br>power: 8 DIN (male);                                       |
| EtherCAT®/ PROFINET                     | bus: 2 x 5-pin M12 (female) (in/out);<br>power: 8 DIN (male)  |
| IEC 61010-1                             | IEC-61010-1:2010 including national deviations for UL (61010-1:2012) and CSA (C22.2 No. 61010-1-12) |

## Control valve options

### External actuator options to be connected to the controller

### Certification for hazardous areas

### Approvals / certificates

Technical specifications subject to change without notice.

For dimensional drawings and hook-up diagrams please visit the [product page](#) on our [website](#)

## Recommended accessories



**E-8000 SERIES**

### Digital Readout / Control Systems

Bright, wide angle, 1.8" display (TFT technology)  
User friendly operation, menu driven with 4 push buttons



**BRIGHT SERIES**

### Compact Local R/C Module

Bright, wide angle, 1.8" display  
User friendly operation  
Indication/operation/configuration



**PIPS SERIES**

### Plug-in Power Supply

For lab-style or industrial devices  
Interchangeable plugs (Euro, UK, USA, Australian, IEC) for mains connection

## Related products



**IN-FLOW F-230MI**

Min. flow 0,2...10 ml/min  
Max. flow 10...500 ml/min  
Pressure /  $\Delta P$  up to 350 bar  
Compact IP65 design  
High accuracy and repeatability



**IN-FLOW F-232MI**

Min. flow 0,2...10 l/min  
Max. flow 2...100 l/min  
Pressure /  $\Delta P$  up to 350 bar  
Compact IP65 design  
High accuracy and repeatability



**IN-FLOW F-131MI**

Min. flow 0,3 ... 15 ml/min  
Max. flow 0,4 ... 20 l/min  
Pressure rating 400 bar  
Compact IP65 design  
High accuracy

