

# Datasheet F-202AI

## Mass Flow Controller for Gases

### > Introduction

High-Tech model F-202AI Mass Flow Controllers (MFCs) are suited for precise control of virtually all conventional process gases. The MFC consists of a thermal mass flow sensor, a precise control valve and a microprocessor based PID controller 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 approval. The mass flow, expressed in normal litres per minute or per hour, is provided as analog signal or digitally via RS232 or fieldbus. The flow range, wetted materials and orifice size for the control valve are determined depending of the type of gas and the process conditions of the application.

### > Technical specifications

#### Measurement / control system

|                               |                                                                                |
|-------------------------------|--------------------------------------------------------------------------------|
| Accuracy (incl. linearity)    | : $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS                                           |
| (Based on actual calibration) |                                                                                |
| Turndown                      | : 1 : 50 (in digital mode up to 1:187,5)                                       |
| Multiple fluid capability     | : storage of max. 8 calibration curves                                         |
| Repeatability                 | : $\leq \pm 0,2\%$ Rd                                                          |
| Settling time (controller)    | : 2...4 seconds                                                                |
| Control stability             | : $\leq \pm 0,1\%$ FS                                                          |
| Kv-value                      | : 0,04...0,4                                                                   |
| Temperature range             | : -10...+70°C<br>for ATEX cat. 3 max. 50°C                                     |
| Temperature sensitivity       | : zero: $\leq \pm 0,05\%$ FS/°C;                                               |
| (nominal range)               | span: $\leq \pm 0,05\%$ 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)     | : $\leq 2 \times 10^{-9}$ mbar l/s He                                          |
| Attitude sensitivity          | : max. error at 90° off horizontal 0,2% FS<br>at 1 bar, typical N <sub>2</sub> |
| Warm-up time                  | : 30 min. for optimum accuracy<br>2 min. for accuracy $\pm 2\%$ FS             |

#### Mechanical parts

|                              |                                           |
|------------------------------|-------------------------------------------|
| Material (wetted parts)      | : stainless steel 316L or comparable      |
| Pressure rating              | : 64 bar abs                              |
| Process connections          | : compression type or face seal male      |
| Seals                        | : standard : Viton; options: EPDM, Kalrez |
| Ingress protection (housing) | : IP65                                    |

*Although all specifications in this datasheet are believed to be accurate, the right is reserved to make changes without notice or obligation.*

#### IN-FLOW Mass Flow Controller model F-202AI

#### Electrical properties

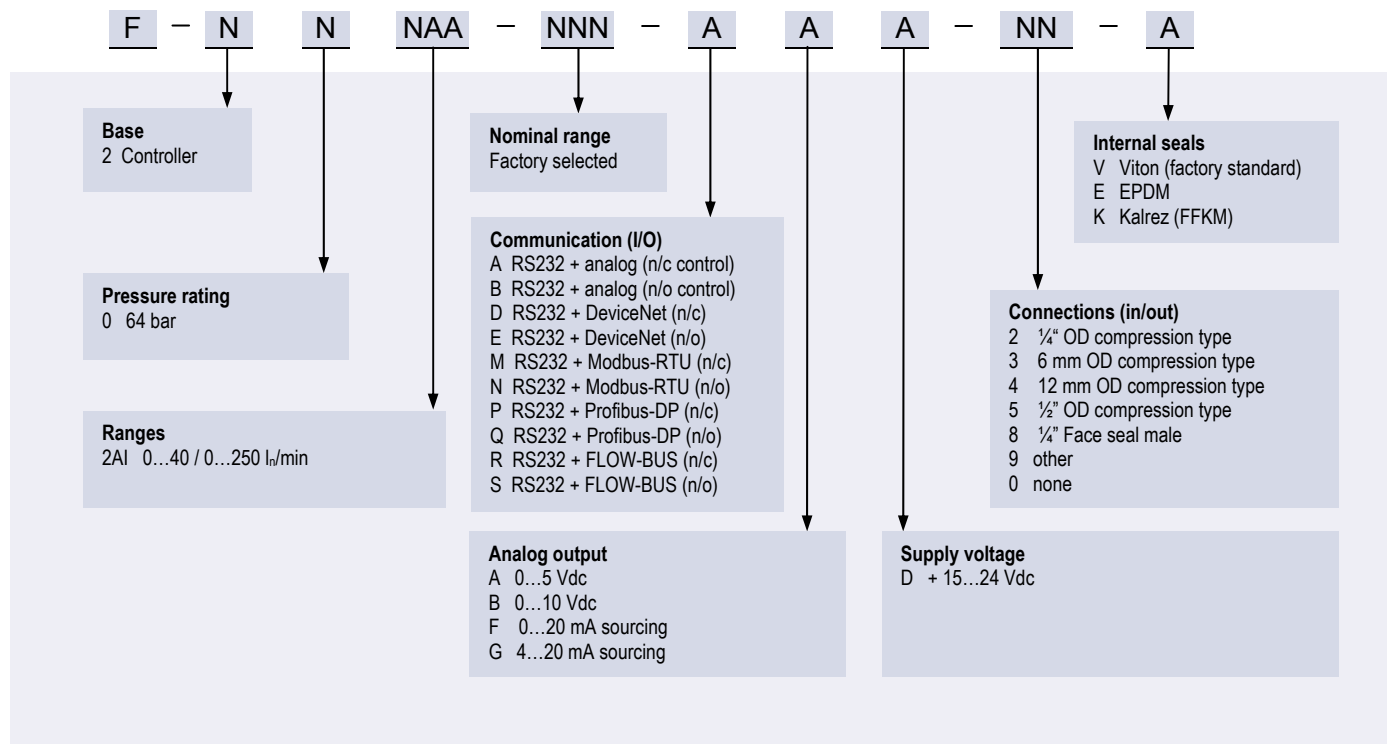
|                       |                                                                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Power supply          | : +15...24 Vdc $\pm 10\%$                                                                                                     |
| Power consumption     | : max. 320 mA;<br>add 50 mA for Profibus, if applicable                                                                       |
| Analog output         | : 0...5 (10) Vdc, min. load impedance $> 2 \text{ k}\Omega$ ;<br>0 (4)...20 mA (sourcing), max. load impedance $< 375 \Omega$ |
| Analog setpoint       | : 0...5 (10) Vdc, min. load impedance $> 100 \text{ k}\Omega$ ;<br>0 (4)...20 mA, load impedance $\sim 250 \Omega$            |
| Digital communication | : standard RS232 ; options: Profibus-DP®, DeviceNet™, Modbus-RTU, FLOW-BUS                                                    |

### > Ranges (based on Air)

| Model       | minimum                      | nominal                       | maximum                       |
|-------------|------------------------------|-------------------------------|-------------------------------|
| F-202AI-M10 | 0,8...40 l <sub>n</sub> /min | 0,8...100 l <sub>n</sub> /min | 0,8...150 l <sub>n</sub> /min |
| F-202AI-M20 | 1,4...70 l <sub>n</sub> /min | 1,4...200 l <sub>n</sub> /min | 1,4...250 l <sub>n</sub> /min |

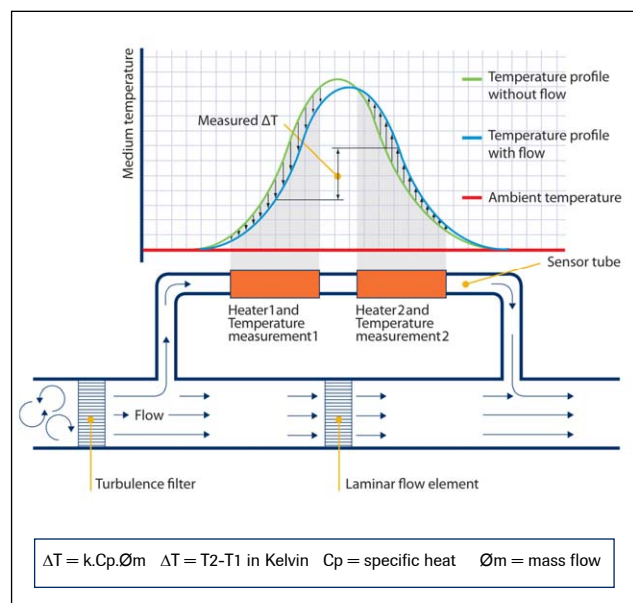
*Intermediate ranges are available*

## > Model number identification



## > Thermal mass flow measuring principle

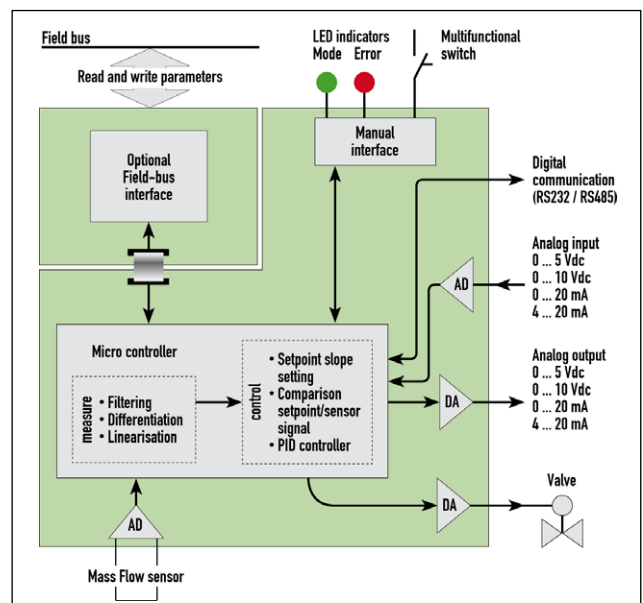
The heart of the thermal mass flow meter/controller is the sensor, that consists of a stainless steel capillary tube with resistance thermometer elements. A part of the gas flows through this bypass sensor, and is warmed up heating elements. Consequently the measured temperatures  $T_1$  and  $T_2$  drift apart. The temperature difference is directly proportional to mass flow through the sensor. In the main channel High-Tech applies a patented laminar flow element consisting of a stack of stainless steel discs with precision-etched flow channels. Thanks to the perfect flow-split the sensor output is proportional to the total mass flow rate.



Functional scheme of the thermal mass flow sensor

## > State of the art digital design

Today's IN-FLOW<sup>®</sup> series are equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response (settling times  $t_{98}$  down to 500 msec). The basic 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. Furthermore, an integrated interface board provides DeviceNet<sup>™</sup>, Profibus-DP<sup>®</sup>, Modbus-RTU or FLOW-BUS protocols.



Functional scheme of the digital PC-board

> Hook-up diagram for analog or RS232 communication

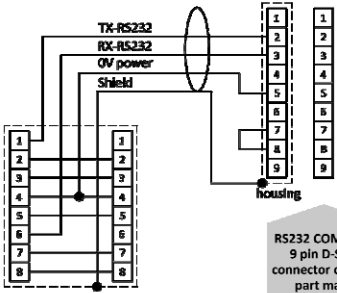


8 DIN connector chassis part male



IN-FLOW digital

RS232 connection



TX-RS232  
RX-RS232  
OV power  
Shield

housing

RS232 COM-port  
9 pin D-Sub  
connector chassis  
part male

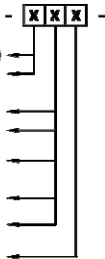
T-adapter  
cable 7.03.444

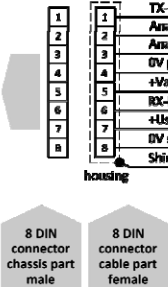
Types

IN-FLOW / IN-PRESS / LIQUID-FLOW

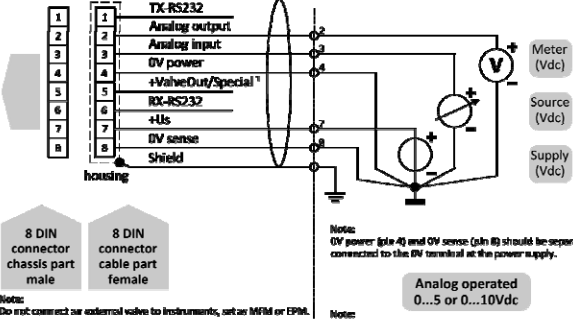
Model key explanation

|   |                               |                      |
|---|-------------------------------|----------------------|
| A | RS232 / Ana. I/O              | Normally Closed (NC) |
| B | RS232 / Ana. I/O              | Normally Open (NO)   |
| A | Output / setpoint             | 0...5Vdc             |
| B | Output / setpoint             | 0...10Vdc            |
| F | Output                        | 0...20mAdc sourcing  |
| G | Setpoint                      | 0...20mAdc sinking   |
| G | Output                        | 4...20mAdc sourcing  |
| Z | Setpoint                      | 4...20mAdc sinking   |
| Z | Output / setpoint             | Specified            |
| D | +15Vdc ... 24Vdc power supply |                      |





8 DIN connector cable part female

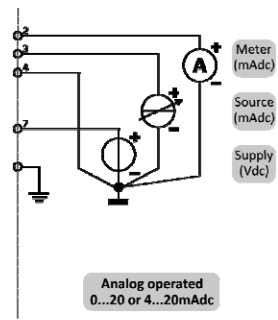


TX-RS232  
Analog output  
Analog input  
OV power  
+ValveOut/Special<sup>1</sup>  
RX-RS232  
+Us  
OV sense  
Shield

housing

Notes:  
OV power (pin 4) and OV sense (pin 8) should be separately connected to the OV terminal at the power supply.

Analog operated  
0...5 or 0...10Vdc



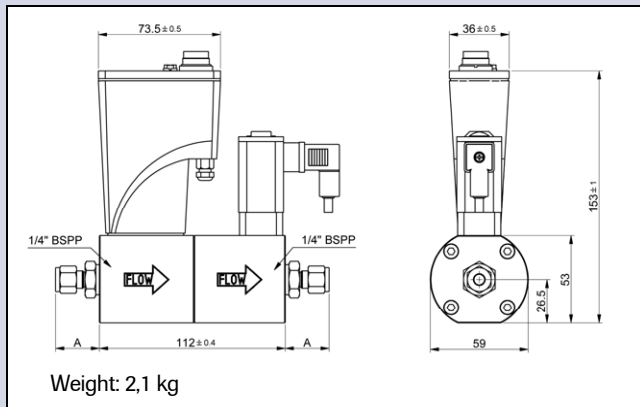
TX-RS232  
Analog output  
Analog input  
OV power  
+ValveOut/Special<sup>1</sup>  
RX-RS232  
+Us  
OV sense  
Shield

housing

Notes:  
When using a field bus or RS232, it is not possible to operate the instrument by using the setpoint signal of the analog 8 DIN connector without changing the value of parameter "control mode". See doc.nr. 9.17.023 for more details.

Analog operated  
0...20 or 4...20mA

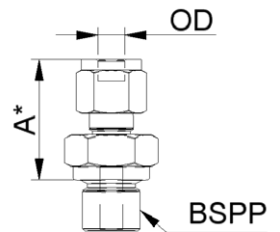
## > Dimensions (mm) and weight (kg)



Dimension table adapters (RS-type)

| Compression type |             | 1/4\"BSP | Size A |
|------------------|-------------|----------|--------|
| adapter          | 6 mm OD     |          | 28.4   |
| adapter          | 8 mm OD     |          | 29.4   |
| adapter          | 10 mm OD    |          | 30.2   |
| adapter          | 12 mm OD    |          | 32.5   |
| adapter          | 1/4\" OD    |          | 28.4   |
| adapter          | 3/8\" OD    |          | 29.9   |
| adapter          | 1/2\" OD    |          | 32.7   |
| Face-seal male   |             |          | Size A |
| adapter          | 1/4\" inlet |          | 23.2   |

Compression type



\*) Dimension A is typical finger-tight.

## > Options and accessories

|                                                                                                                                                                       |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| - Free software support for operation, monitoring, optimizing or to interface between digital instruments and windows software.                                       |  |
| - IN-LINE filters for protection against particulates                                                                                                                 |  |
| - BRIGHT compact local Readout/Control module<br>- E-5700 / E-7000 Power Supply                                                                                       |  |
| - Interconnecting cables for power and analog/digital communication<br>- PiPS Plug-in Power Supply                                                                    |  |
| - Optional ATEX Zone 2 Cat. 3 protection. Hereto we will furnish extra cover(s) for mechanical impact protection (see pictures), including applicable certificate(s). |  |

## > Alternatives

|                                                                                                                                                |  |
|------------------------------------------------------------------------------------------------------------------------------------------------|--|
| - LOW-ΔP-FLOW series MFC or MFM with bellows operated control valve (F-004 series) for low pressure drop applications or corrosive gas service |  |
| - IN-FLOW <sup>CTA</sup> direct (no by-pass), industrial (IP65) Mass Flow Controller                                                           |  |

По вопросам продаж и поддержки обращайтесь:

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Барнаул (3852)73-04-60  
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