

# Datasheet F-136AI

## High Pressure Mass Flow Meter for Gases

### > Introduction

Bronkhorst® model F-136AI Mass Flow Meters (MFM) are suited for precise measurement of virtually all conventional process gases. The MFM consists of a thermal mass flow sensor and a microprocessor based pc-board with signal and fieldbus conversion and a PID controller for optional mass flow control by means of a separately mounted control valve. The IN-FLOW model is of rugged design (IP65) for use at high pressure (up to 400 bar) 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 normal cubic metres per hour, is provided as analog signal or digitally via RS232 or fieldbus. The flow range and wetted materials are determined depending of the type of gas and the process conditions of the application.

### > Technical specifications

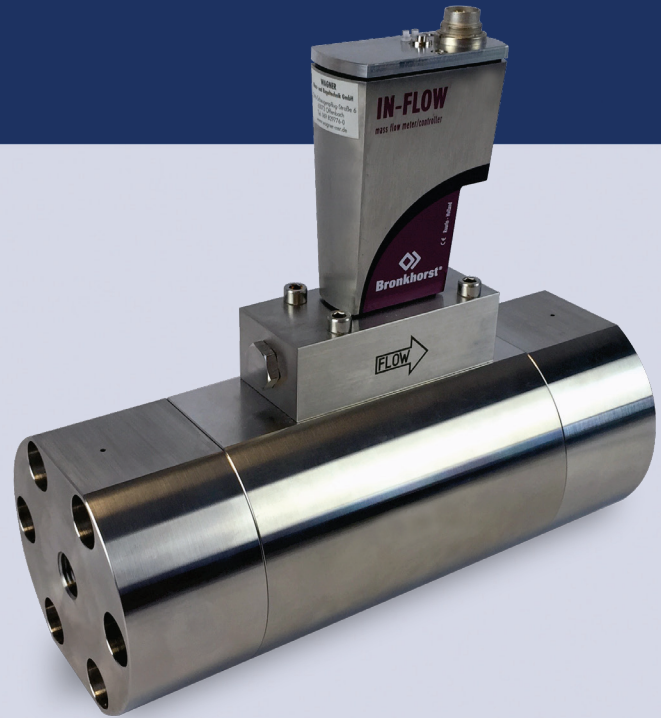
#### Measurement / control system

Accuracy (incl. linearity)	: $\pm 1\%$ FS
(Based on actual calibration)	
Turndown	: 1 : 50
Multiple fluid capability	: storage of max. 8 calibration curves
Repeatability	: $< \pm 0,2\%$ Rd
Response time	: typical 0,5 sec
(SEMI-E17-00-0600-0307R)	
Temperature range	: -10...+70°C
	for ATEX cat. 3 0...50°C
Temperature sensitivity	: zero: $< \pm 0,05\%$ FS/°C;
(nominal range)	span: $< \pm 0,05\%$ 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)	: $< 2 \times 10^{-9}$ mbar l/s He
Attitude sensitivity	: max. error at 90° off horizontal 0,2% FS
	at 1 bar, typical N <sub>2</sub>
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
Pressure rating	: 400 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 Meter model F-136AI

#### Electrical properties

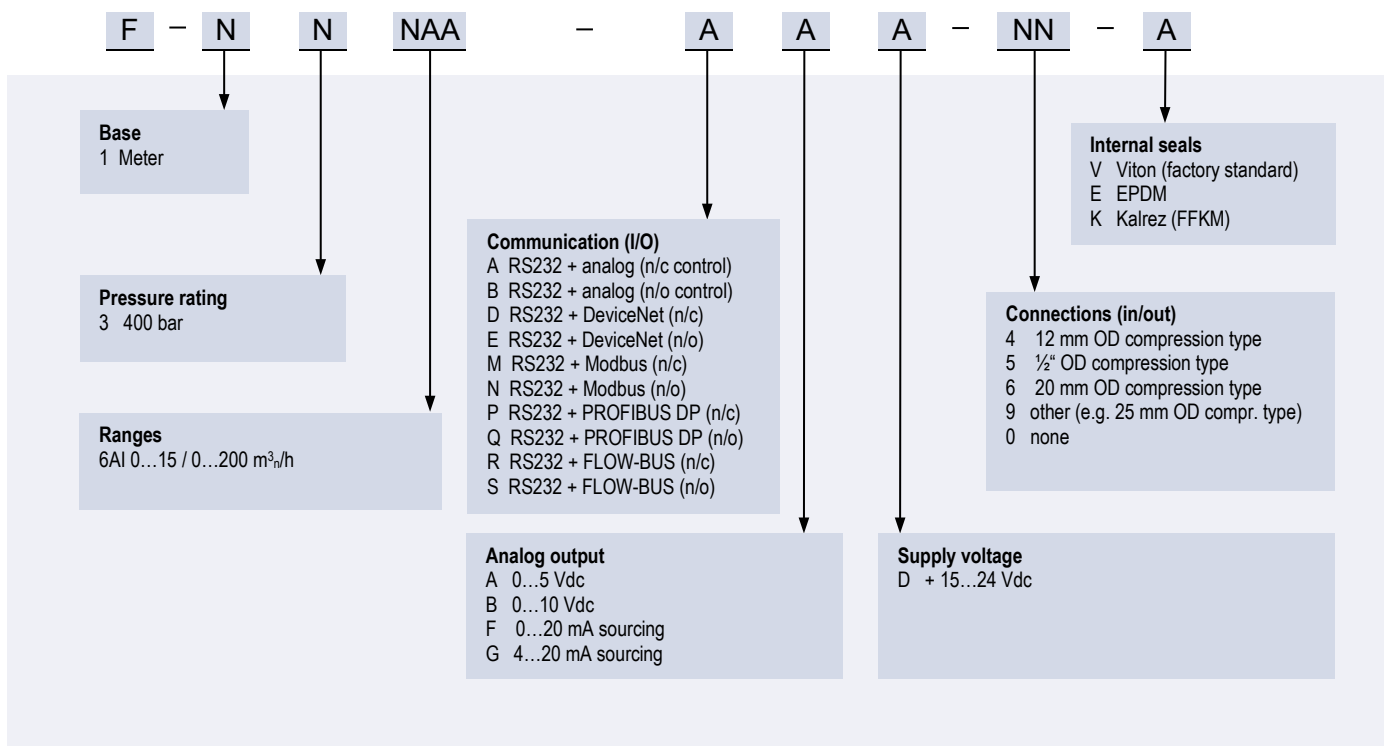
Power supply	: +15...24 Vdc $\pm 10\%$
Power consumption	: Supply at voltage I/O at current I/O
(based on N/C valve)	15 V 290 mA 320 mA
	24 V 200 mA 215 mA
Extra for fieldbus:	PROFIBUS DP: add 53 mA (15 V supply) or 30 mA (24 V supply)
(if applicable)	DeviceNet™: add 48 mA (24 V supply)
Analog output (0...100%)	: 0...5 (10) Vdc, min. load impedance $> 2$ k $\Omega$ ;
	0 (4)...20 mA (sourcing), max. load impedance $< 375$ $\Omega$
Analog setpoint (0...100%)	: 0...5 (10) Vdc, min. load impedance $> 100$ k $\Omega$ ;
(for MFM + control valve)	0 (4)...20 mA, load impedance $\sim 250$ $\Omega$
Digital communication	: standard RS232 ; options: PROFIBUS DP,
	DeviceNet™, Modbus-RTU/ASCII, FLOW-BUS

### > Ranges (based on Air)

Model	minimum	maximum
F-136AI	0,3...15 m <sup>3</sup> /h	4...200 m <sup>3</sup> /h

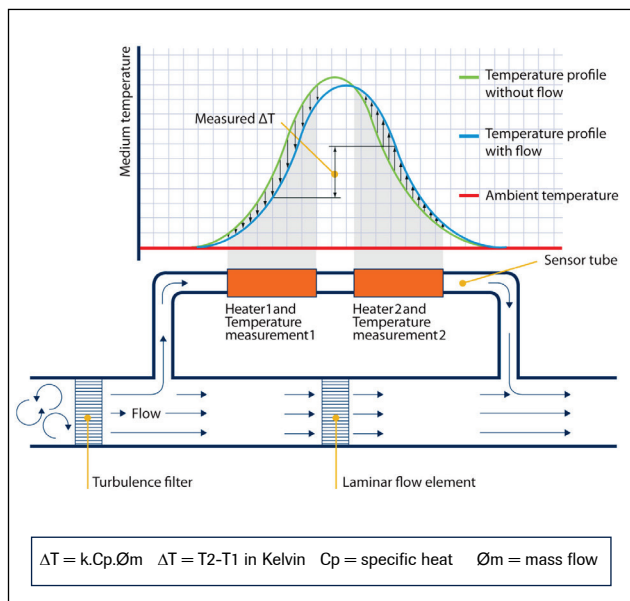
*Intermediate ranges are available*

## > Model number identification



## > Thermal mass flow measuring principle

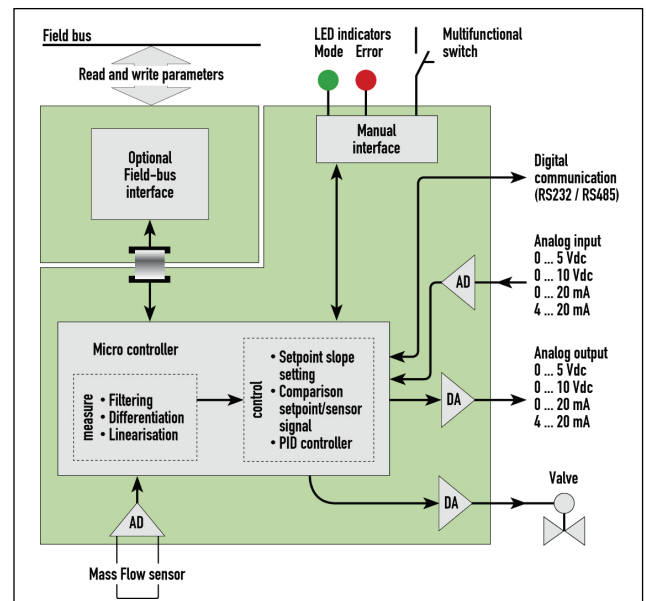
The heart of the thermal mass flow meter/controller is the sensor, that consists of a stainless steel capillary tube with resistance thermometer elements. A part of the gas flows through this bypass sensor, and is warmed up heating elements. Consequently the measured temperatures  $T_1$  and  $T_2$  drift apart. The temperature difference is directly proportional to mass flow through the sensor. In the main channel Bronkhorst 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

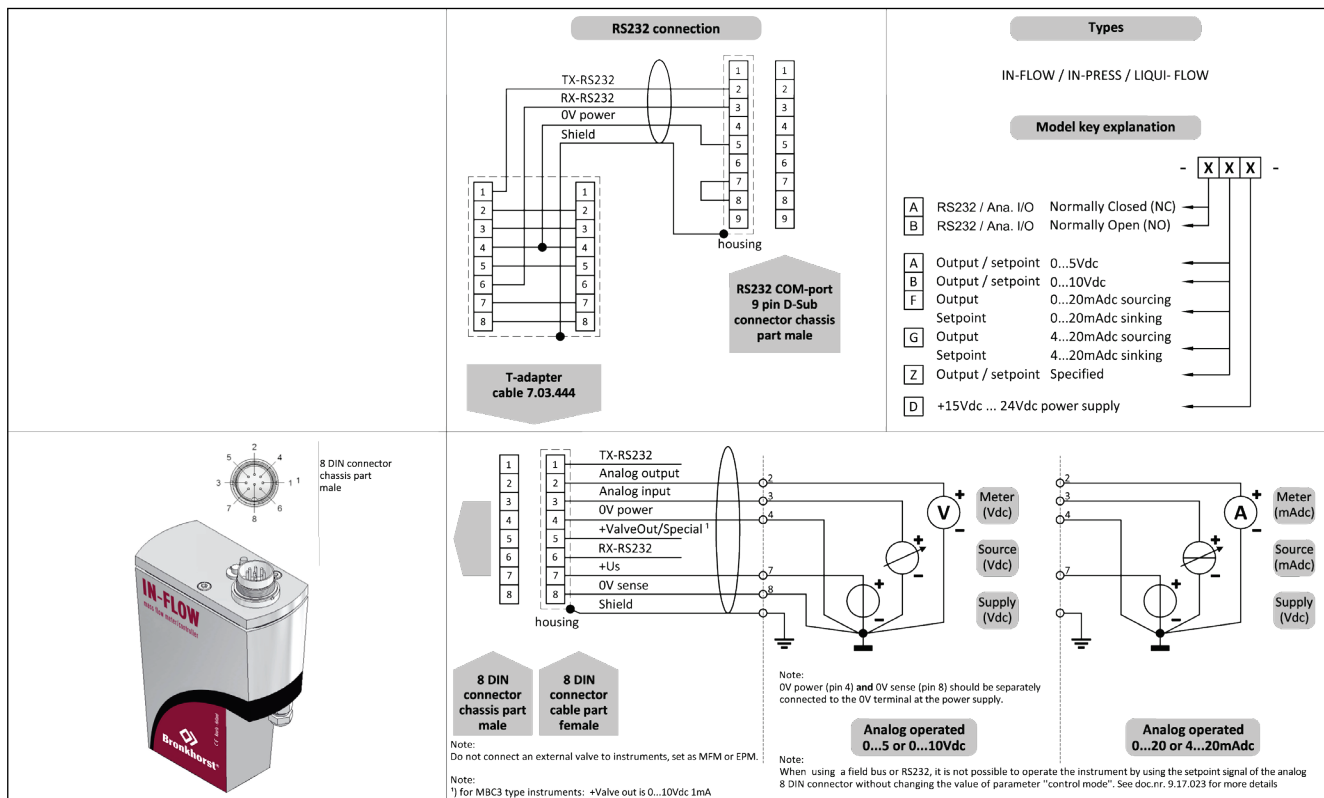
## > State of the art digital design

Today's IN-FLOW series are equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response. 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™, PROFIBUS DP, Modbus-RTU/ASCII or FLOW-BUS protocols.



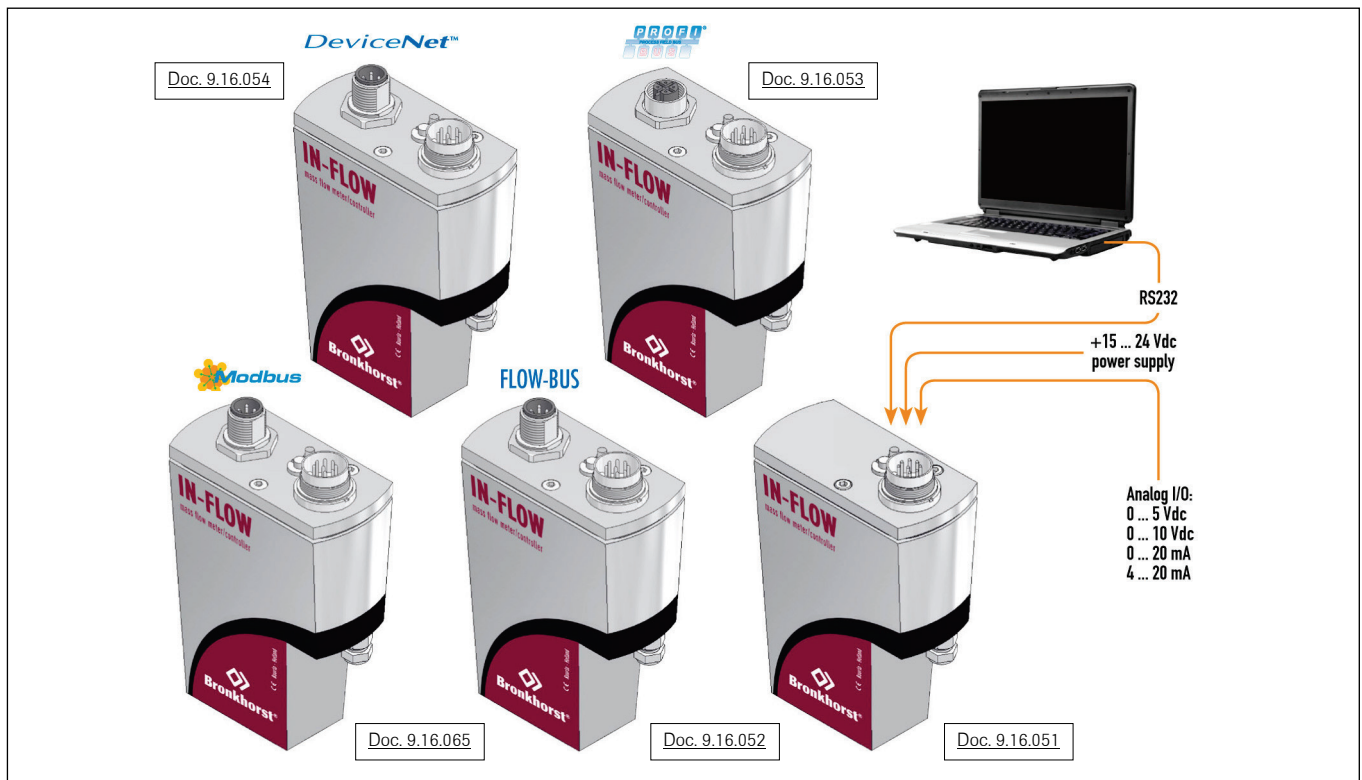
Functional scheme of the digital PC-board

## > Hook-up diagram for analog or RS232 communication

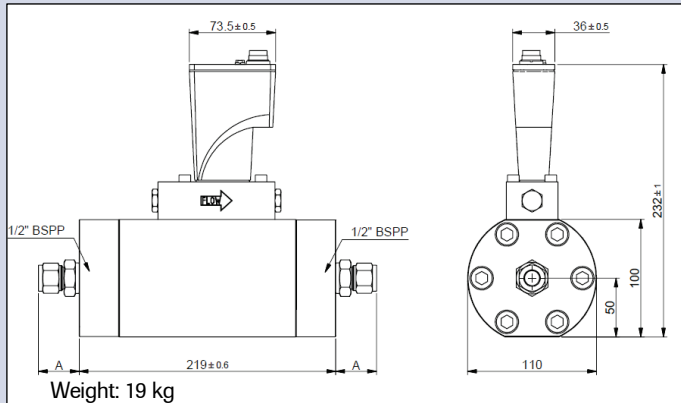


## > Hook-up diagrams for fieldbus communication

For the available fieldbus options we refer to the various hook-up diagrams as indicated below. If you are viewing this datasheet in digital format, you may use the hyperlink to each of the drawings. Otherwise please visit the download section on [www.bronkhorst.com](http://www.bronkhorst.com) or contact our local representatives.



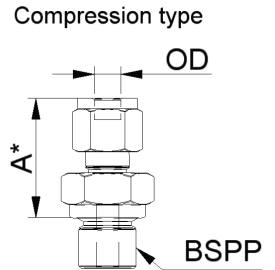
## > Dimensions (mm) and weight (kg)



Dimension table adapters (RS-type)

Compression type	1/2"BSPP	
		Size A
adapter 10 mm OD		31.0
adapter 12 mm OD		33.5
adapter 20 mm OD		36.5
adapter 25 mm OD		42.0
adapter 3/8" OD		30.7
adapter 1/2" OD		33.5
adapter 3/4" OD		34.8

Face-seal male	1/2"BSPP	
		A
adapter 1/2" inlet		27.6
adapter 3/4" inlet		36.5



\*) Dimension A is typical finger-tight.

## > Options and accessories

<ul style="list-style-type: none"> <li>- Free software support for operation, monitoring, optimizing or to interface between digital instruments and windows software.</li> </ul>	
<ul style="list-style-type: none"> <li>- BRIGHT compact local Readout/Control module</li> <li>- E-8000 Power Supply</li> </ul>	
<ul style="list-style-type: none"> <li>- Interconnecting cables for power and analog/digital communication</li> <li>- PiPS Plug-in Power Supply</li> </ul>	
<ul style="list-style-type: none"> <li>- Optional ATEX Zone 2 Cat. 3 protection. Hereto we will furnish extra cover(s) for mechanical impact protection (see pictures), including applicable certificate(s).</li> </ul>	



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