

Datasheet F-111CM

Metal Sealed Mass Meter for Gases

> Introduction

Bronkhorst High-Tech model F-111CM Metal Sealed Mass Flow Meters (MFMs) are specifically designed to suit high purity applications. 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 mass flow, expressed in normal millilitres or litres per minute or 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.



EL-FLOW Metal Sealed Mass Flow Meter model F-111CM

> Technical specifications

Measurement / control system

Accuracy (incl. linearity) (Based on actual calibration)	: $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS
Turndown	: 1 : 50 (in digital mode up to 1:187,5)
Multiple fluid capability	: • storage of max. 8 calibration curves • optional Multi Gas / Multi Range functionality up to 1500 psig (10 bar)
Repeatability	: $< \pm 0,2\%$ Rd
Temperature range	: $-10 \dots +70^\circ\text{C}$
Temperature sensitivity (nominal range)	: zero: $< \pm 0,05\%$ FS/ $^\circ\text{C}$; span: $< \pm 0,05\%$ Rd/ $^\circ\text{C}$
Leak integrity (outboard)	: $< 2 \times 10^{-11}$ Pa.m ³ /s He
Attitude sensitivity	: max. error at 90° off horizontal 0,2% FS at 1 bar, typical N ₂
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	: 100 bar abs
Process connections	: $\frac{1}{4}$ " face seal male
Seals (outboard)	: full metal, stainless steel 316L
Seals (internal)	: Kalrez 6375
Ingress protection (housing)	: IP40

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

Electrical properties

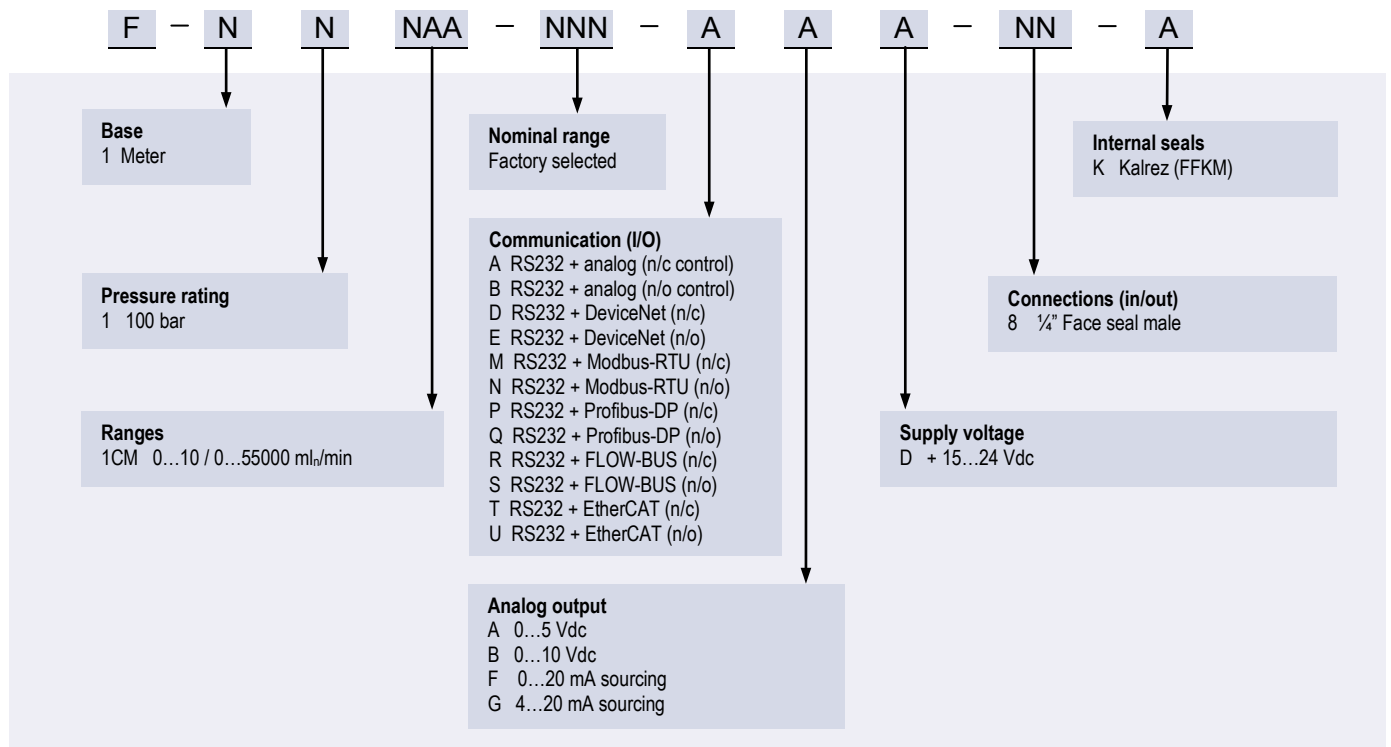
Power supply (single rail)	: $+15 \dots 24$ Vdc $\pm 10\%$
Power consumption	: max. 320 mA; add 50 mA for Profibus-DP [®] , if applicable
Analog output	: 0...5 (10) Vdc, min. load impedance > 2 k Ω 0 (4)...20 mA (sourcing), max. load impedance < 375 Ω
Analog setpoint (for MFM + control valve)	: 0...5 (10) Vdc, min. load impedance > 100 k Ω 0 (4)...20 mA, load impedance ~ 250 Ω
Digital communication	: standard RS232 ; options: Profibus-DP [®] , DeviceNet [™] , Modbus, EtherCAT [®] , FLOW-BUS

> Ranges (based on Air)

Model	minimum	nominal	maximum
F-111CM-010	0,2...10 sccm	0,2...10 sccm	0,2...20 sccm
F-111CM-020	0,2...10 sccm	0,16...20 sccm	0,16...30 sccm
F-111CV-050	0,4...20 sccm	0,4...50 sccm	0,4...60 sccm
F-111CV-100	0,8...40 sccm	0,8...100 sccm	0,8...120 sccm
F-111CV-200	1,6...80 sccm	1,6...200 sccm	1,6...230 sccm
F-111CV-500	4...200 sccm	4...500 sccm	4...600 sccm
F-111CV-1K0	8...400 sccm	8...1000 sccm	8...1100 sccm
F-111CV-2K0	16...800 sccm	16...2000 sccm	16...2200 sccm
F-111CV-5K0	0,04...2 slm	0,04...5 slm	0,04...5,5 slm
F-111CV-10K	0,08...4 slm	0,08...10 slm	0,08...12 slm
F-111CV-20K	0,16...8 slm	0,16...20 slm	0,16...20 slm
F-111CV-40K	0,4...20 slm	0,32...40 slm	0,32...55 slm

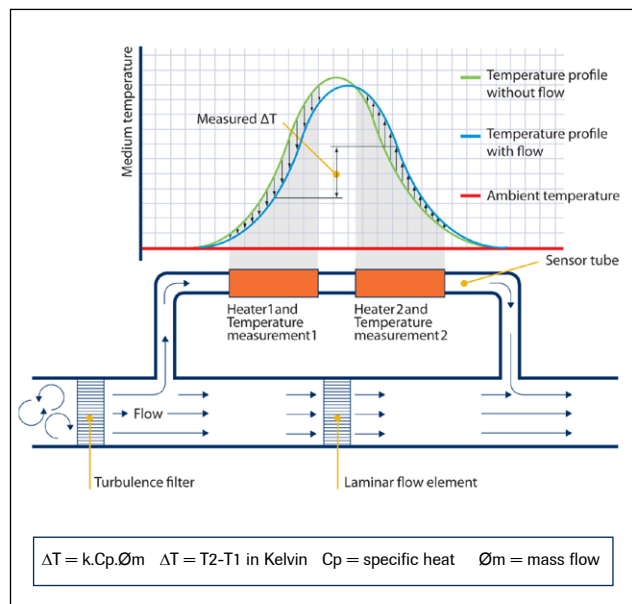
Intermediate ranges are available

> Model number identification



> Thermal mass flow measuring principle

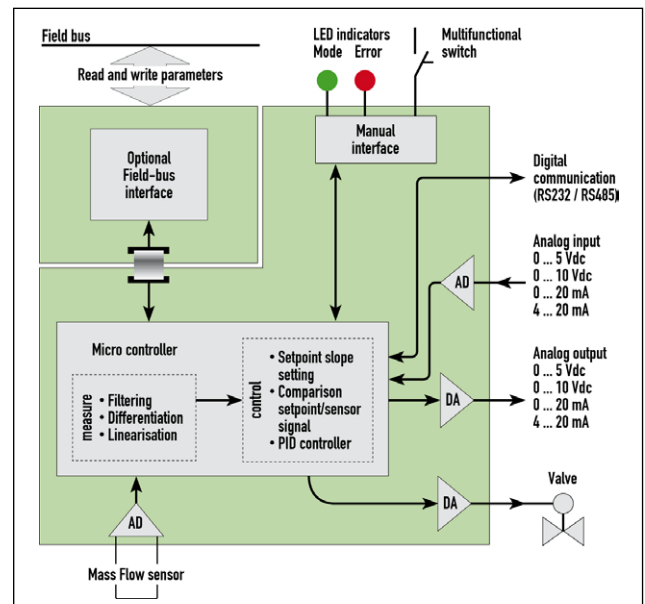
The heart of the thermal mass flow meter/controller is the sensor, that consists of a stainless steel capillary tube with resistance thermometer elements. A part of the gas flows through this bypass sensor, and is warmed up heating elements. Consequently the measured temperatures T_1 and T_2 drift apart.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

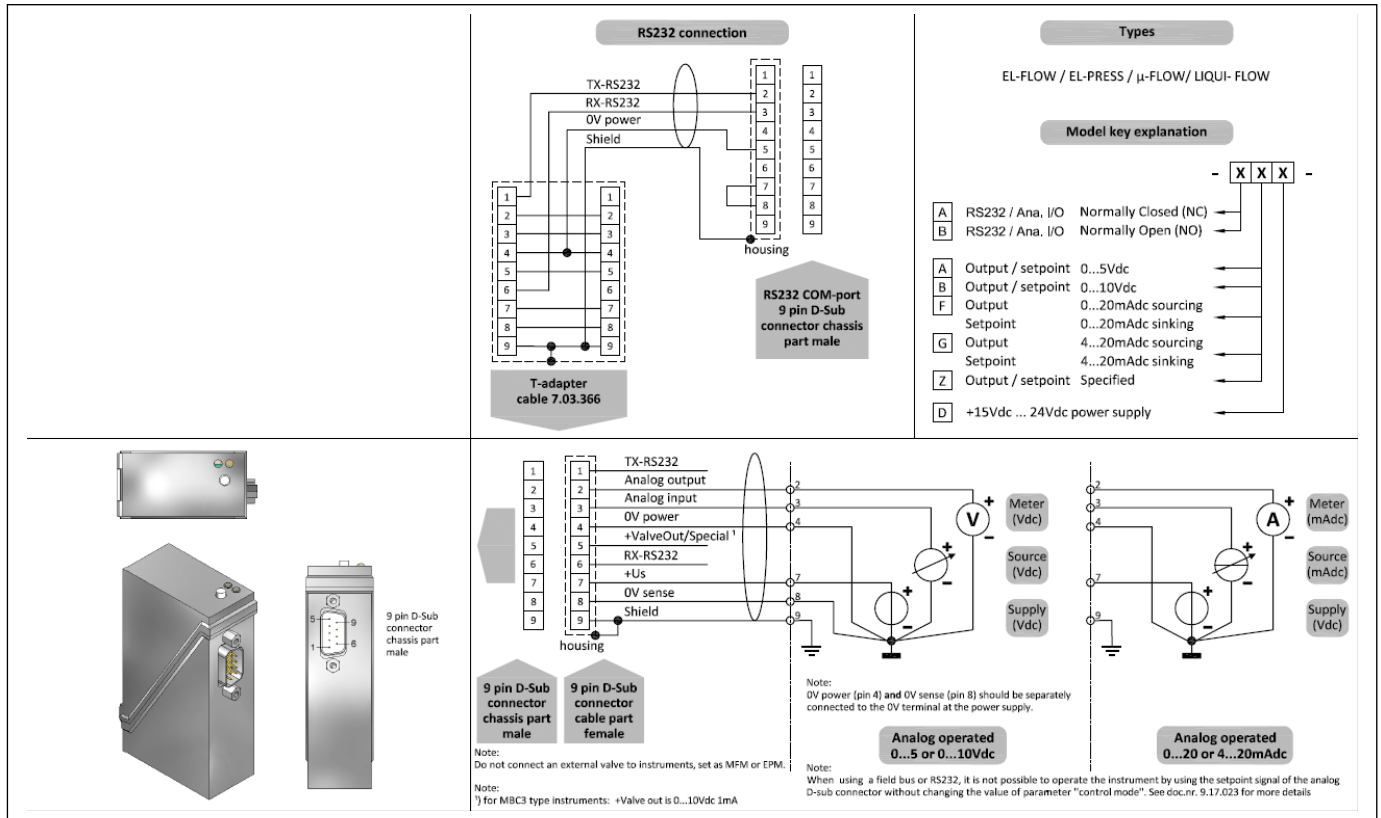
> State of the art digital design

Today's EL-FLOW[®] series are equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response (settling times t_{98} down to 600 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[™], Profibus-DP[®], Modbus-RTU/ASCII, EtherCAT[®] or FLOW-BUS protocols.



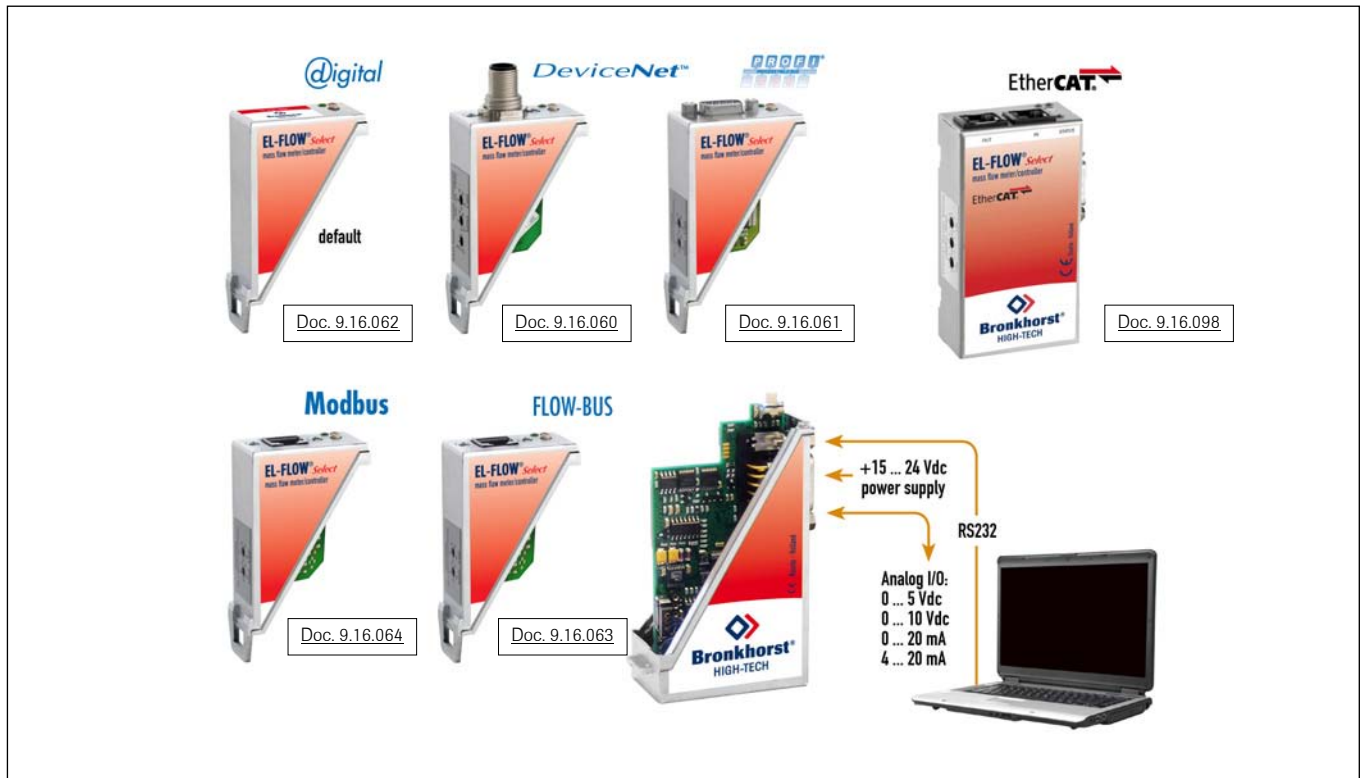
Functional scheme of the digital PC-board

> Hook-up diagram for analog or RS232 communication

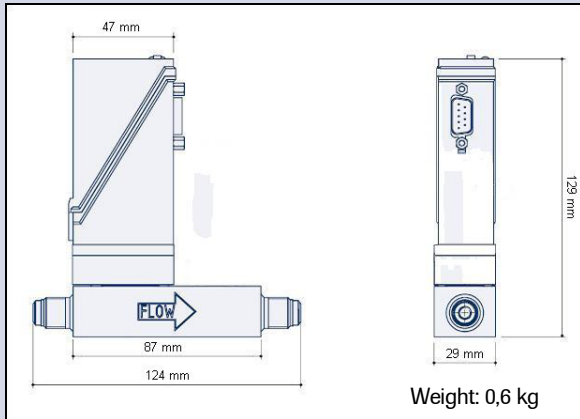


> Hook-up diagrams for fieldbus communication




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 or contact our local representatives.




> Dimensions (mm) and weight (kg)



> Options and accessories

<ul style="list-style-type: none"> - Multi-Gas / Multi-Range option, with free configuration software. - Free software support for operation, monitoring, optimizing or to interface between digital instruments and windows software. 	
<ul style="list-style-type: none"> - BRIGHT compact local Readout/Control modules - E-5700 / E-7000 Power Supply 	
<ul style="list-style-type: none"> - Interconnecting cables for power and analog/digital communication - PiPS Plug-in Power Supply 	

> Alternatives

<ul style="list-style-type: none"> - Metal Sealed Mass Flow Controller (MFC) 	
<ul style="list-style-type: none"> - EL-FLOW Select series, elastomer sealed Mass Flow Meter (MFM) - LOW-ΔP-FLOW series, elastomer sealed MFM for low pressure drop applications or corrosive gas service 	