

Datasheet F-201CS

Mass Flow Controller with Electrical Shut-Off Valve

> Introduction

Bronkhorst® model F-201CS 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 digital electronics with signal processing, PID control and optional fieldbus conversion. Additionally, the F-201CS features an integrated, electrical shut-off valve. As a function of a setpoint value, the flow controller swiftly adjusts the desired flow rate. The mass flow, expressed in normal litres or millilitres 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.



EL-FLOW Mass Flow Controller model F-201CS

> Technical specifications

Measurement / control system

Accuracy (incl. linearity) (Based on actual calibration)	: $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS
Turndown	: 1 : 50
Multiple fluid capability	: storage of max. 8 calibration curves
Repeatability	: $< \pm 0,2\%$ Rd
Settling time (controller)	: 1...2 seconds; option: down to 500 msec
Max. Kv-value	: $4,4 \times 10^{-2}$
Control stability	: $\leq \pm 0,1\%$ FS (typical for 1 l _n /min N ₂)
Temperature range	: -10...+70°C
Temperature sensitivity (nominal range)	: zero: $< \pm 0,05\%$ FS/°C; span: $< \pm 0,05\%$ Rd/°C
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 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	: 10 bar abs
Max. ΔP	: 3 bar dif.
Process connections	: compression type or face seal male
Seals	: standard : Viton; options: EPDM, Kalrez (N/C shut-off only)
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

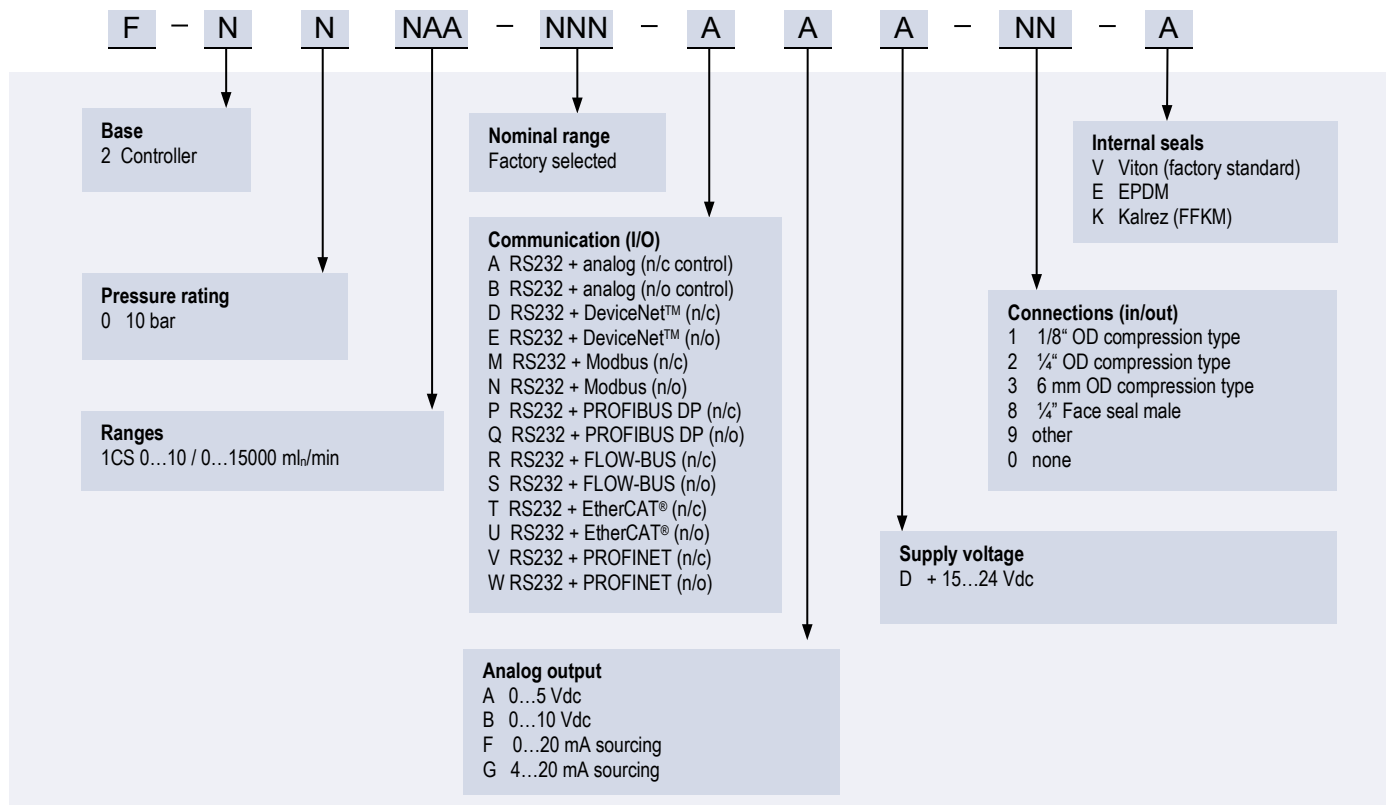
Power supply (MFC)	: +15...24 Vdc $\pm 10\%$
Power consumption (MFC)	: max. 320 mA (at15V); max. 215 mA (at 24V); add 50 mA for Profibus, if applicable
Analog output (0...100%)	: 0...5 (10) Vdc, min. load impedance $> 2 \text{ k}\Omega$; 0 (4)...20 mA (sourcing), max. load impedance $< 375 \Omega$
Analog setpoint (0...100%)	: 0...5 (10) Vdc, min. load impedance $> 100 \text{ k}\Omega$; 0 (4)...20 mA, load impedance $\sim 250 \Omega$
Digital communication	: standard RS232 ; options: PROFIBUS DP, DeviceNet™, EtherCAT®, Modbus RTU/ASCII, FLOW-BUS
Shut-off valve (N/C)	: +24 Vdc, 3 W; using a shut-off control adapter reduces the power consumption

> Ranges (based on Air)

Model	minimum	nominal	maximum
F-201CS-020	0,2...10 ml _n /min	0,2...20 ml _n /min	0,2...30 ml _n /min
F-201CS-050	0,4...20 ml _n /min	0,4...50 ml _n /min	0,4...75 ml _n /min
F-201CS-100	0,8...40 ml _n /min	0,8...100 ml _n /min	0,8...150 ml _n /min
F-201CS-200	1,6...80 ml _n /min	1,6...200 ml _n /min	1,6...300 ml _n /min
F-201CS-500	4...200 ml _n /min	4...500 ml _n /min	4...750 ml _n /min
F-201CS-1K0	8...400 ml _n /min	8...1000 ml _n /min	8...1500 ml _n /min
F-201CS-2K0	16...800 ml _n /min	16...2000 ml _n /min	16...3000 ml _n /min
F-201CS-5K0	0,04...2 l _n /min	0,04...5 l _n /min	0,04...7,5 l _n /min
F-201CS-10K	0,08...4 l _n /min	0,08...10 l _n /min	0,08...15 l _n /min

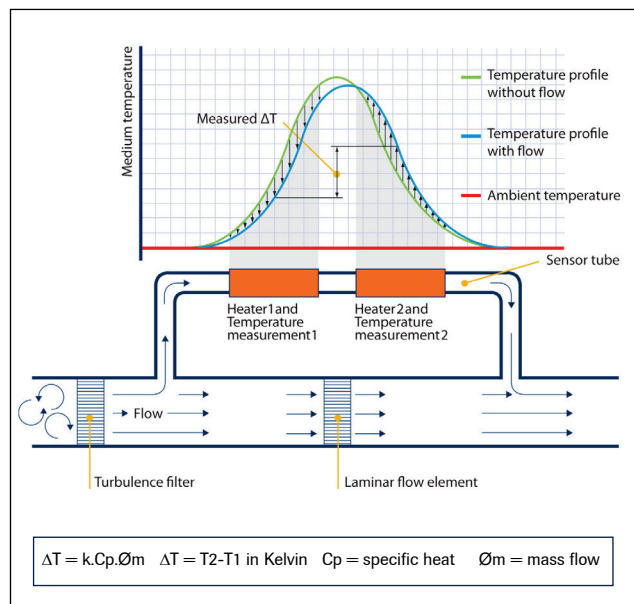
Intermediate ranges are available

> Model number identification



> Thermal mass flow measuring principle

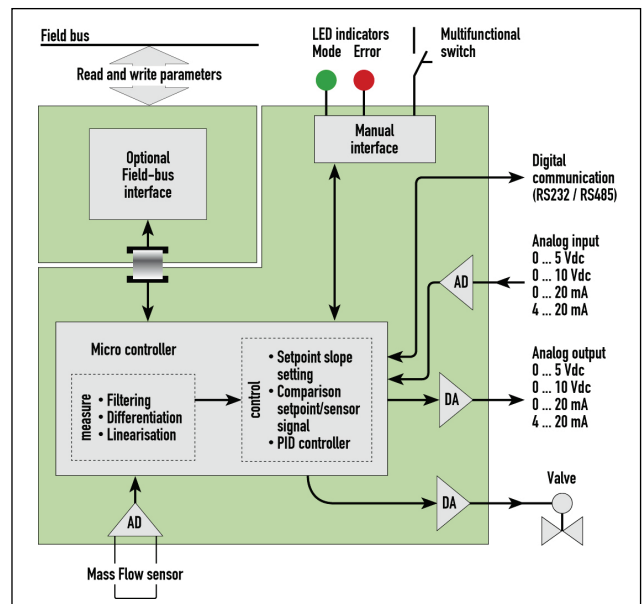
The heart of the thermal mass flow meter/controller is a sensor that consists of a stainless steel capillary tube with resistance thermometer elements. A part of the gas is redirected through this bypass style sensor, and is warmed up by heating elements. Consequently the measured temperatures T_1 and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

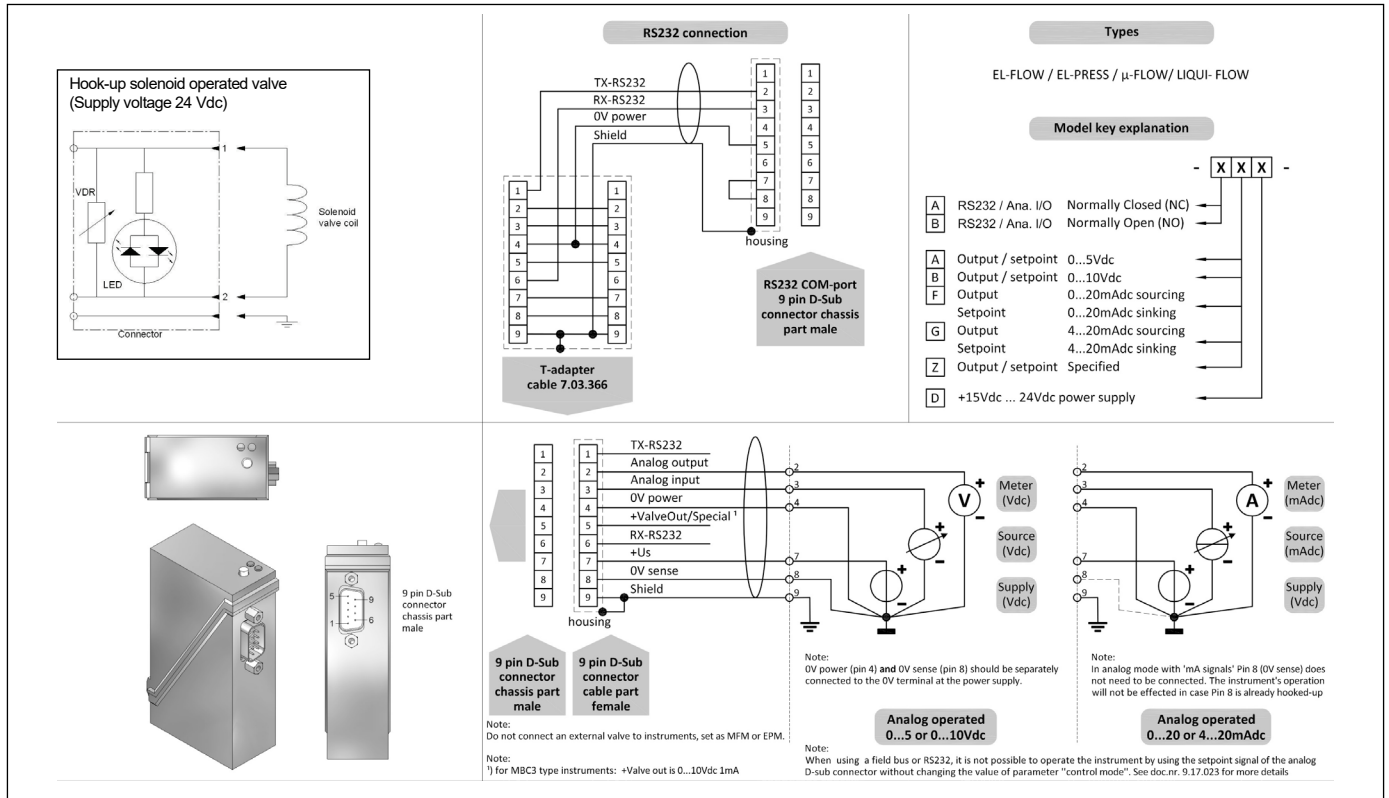
> State of the art digital design

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 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™, PROFIBUS DP, PROFINET, Modbus RTU/ASCII, EtherCAT® or FLOW-BUS protocols.



Functional scheme of the digital PC-board

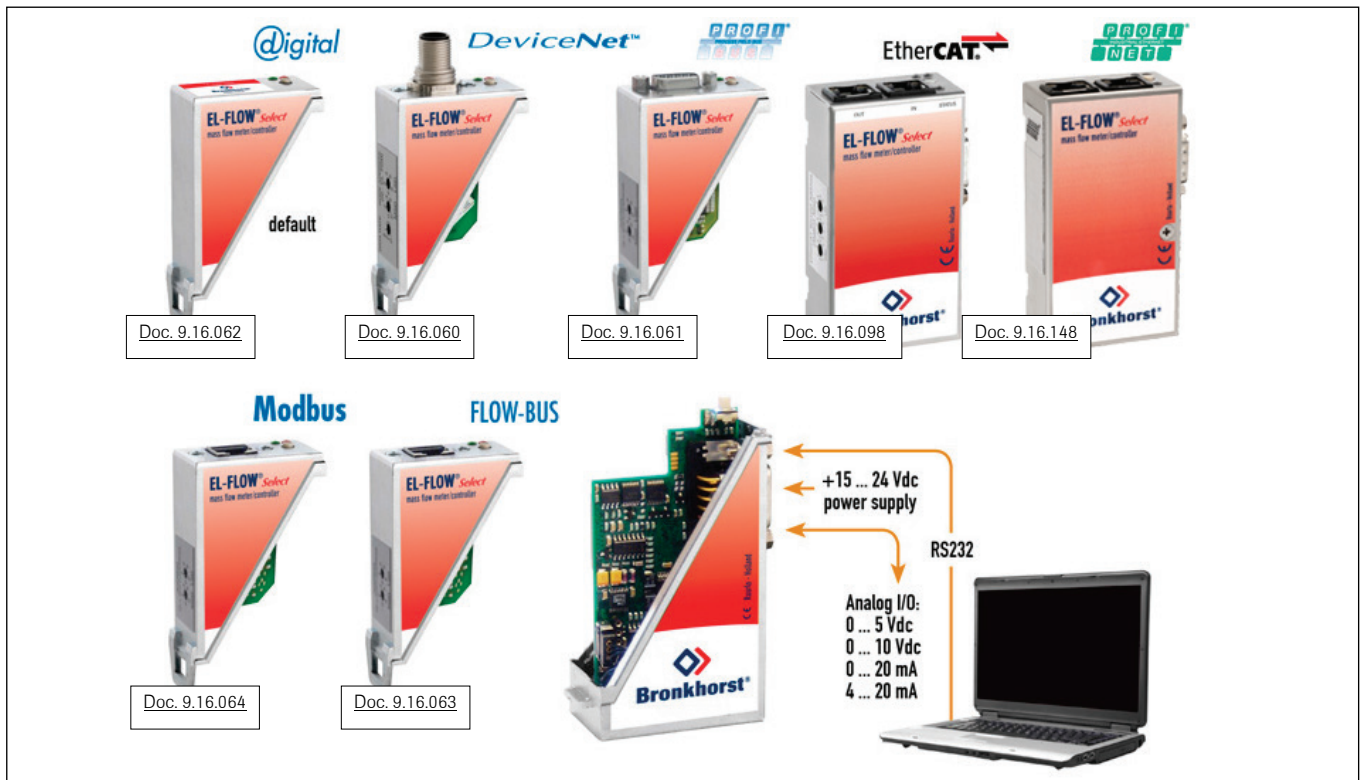
> Hook-up diagram for analog or RS232 communication



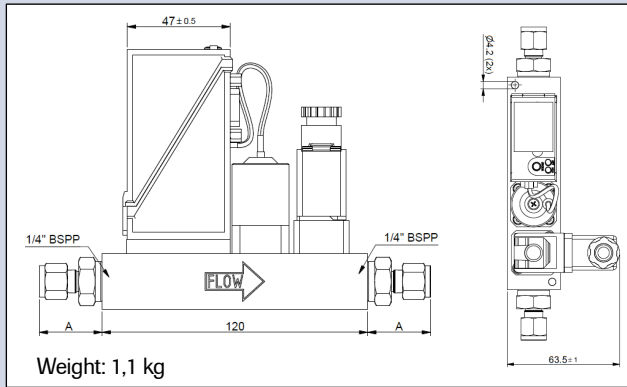
Note: For switching the shut-off valve by fieldbus, Bronkhorst offers various solutions: using a split-cable or alternatively a shut-off control adapter with 'holding voltage principle'. Please consult factory or contact your local distributor.

> 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.



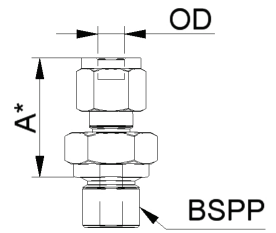
> Dimensions (mm) and weight (kg)



Dimension table adapters (RS-type)

Compression type	1/4"BSPP	Size A
adapter 3 mm OD		26.1
adapter 6 mm OD		28.4
adapter 8 mm OD		29.4
adapter 10 mm OD		30.2
adapter 1/8" OD		26.1
adapter 1/4" OD		28.4
adapter 3/8" OD		29.9
Face-seal male		
adapter 1/4" inlet		23.2
O-ring face seal		
adapter 1/4" inlet		19.8

Compression type



*) Dimension A is typical finger-tight.

> 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"> - IN-LINE filters for protection against particulates 	
<ul style="list-style-type: none"> - BRIGHT compact local Readout/Control modules - E-8000 Power Supply/Readout Systems 	
<ul style="list-style-type: none"> - Interconnecting cables for power and analog/digital communication - PiPS Plug-in Power Supply 	
<ul style="list-style-type: none"> - Shut-off Control Adapter with 'holding voltage principle' 	

> Alternatives

<ul style="list-style-type: none"> - EL-FLOW series MFC for gases 	
<ul style="list-style-type: none"> - LOW-ΔP-FLOW series MFC for low pressure drop applications or corrosive gas service 	
<ul style="list-style-type: none"> - Pre-assembled multi-channel solutions: series FLOW-SMS 	

