

# Datasheet F-201CX / F-211CX

## Ex-Proof Mass Flow Controllers for Gases

### > Introduction

Bronkhorst® EX-FLOW Mass Flow Controllers (MFCs) models F-201CX and F-211CX are suited for precise gas flow control in ATEX Zone 1 hazardous areas. The flow meter part and the control valve of the MFC should be connected (via separate cables) to a power supply with galvanic isolation / preamplifier / readout system (located in the safe zone) which contains a controller board to complete the control loop. The control valve receives its input from the controller board and immediately responds to any deviation between the output signal from the flow sensor and the setpoint signal. 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.

The intrinsically safe measuring head is tested according to ATEX 114 Directive 2014/34/EC and approved under EC-Type Examination Number: KEMA 01ATEX1172, protection II 2 G Ex ib IIC T4 Gb.

The intrinsically safe valve coils are explosion proof certified and available in two options (ATEX certification only):

- Coil XB : protection II 1 G Ex ia IIC T6  
protection II 1 D Ex ta IIIC T80°C
- Coil XC : protection II 2 G Ex eb IIC T4  
protection II 2 D Ex tb IIIC T130°C

### > Technical specifications

#### Measurement / control system

Accuracy (incl. linearity; based on actual calibration)	: ±1% FS
Turndown	: 1 : 50 (2 ... 100%)
Repeatability	: < ± 0,2% Rd
Time constant	: 5 seconds
Control stability	: ≤ ± 0,1% FS (typical for 1 l <sub>v</sub> /min N <sub>2</sub> )
Operating temperature	: EX-FLOW sensor: -10...+70°C; XB-coil: -40...+65°C XC-coil: -40...+65°C
Temperature sensitivity	: zero: < ± 0,05% FS/°C; span: < ± 0,05% Rd/°C
Leak integrity	: < 2 x 10 <sup>-9</sup> 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 ± 2% FS

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



EX-FLOW Mass Flow Controller model F-201CX / F-211CX

#### Mechanical parts

Material (wetted parts)	: stainless steel 316L or comparable
Pressure rating	: 64 bar for model F-201CX; 100 bar for model F-211CX
Process connections	: compression type or face seal couplings;
Seals	: standard : Viton®; options: EPDM, FFKM (Kalrez®)
Ingress protection (housing)	: IP65

#### Electrical properties

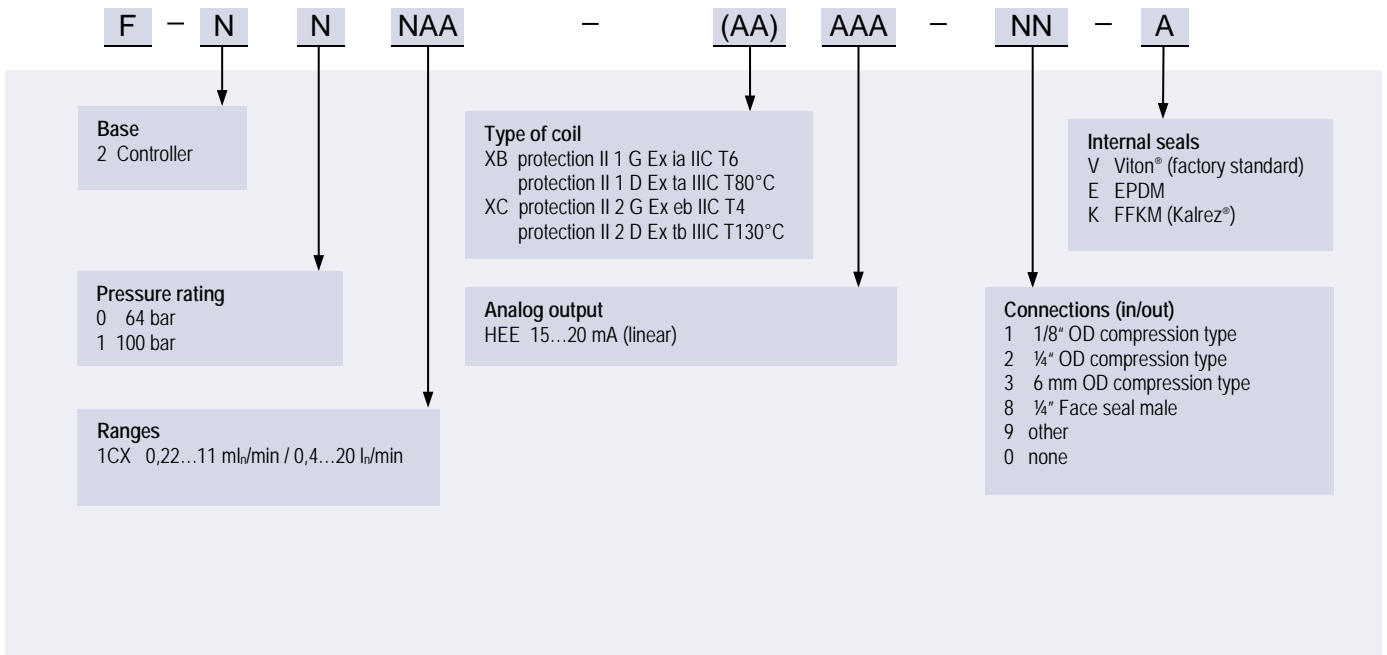
Signal circuit	: in type of explosion protection intrinsic safety Ex ib IIC, only for connection to a certified intrinsically safe circuit with the following maximum values: U <sub>i</sub> = 28 V, I <sub>i</sub> = 98 mA, P <sub>i</sub> = 686 mW The effective internal capacitance between: Terminals 1 and 3: C <sub>i</sub> = 1 nF; Effective internal inductance: L <sub>i</sub> = 0,3 mH
Output signal	: 15...20 mA (linear) Terminal connection, cable gland M16x1,5
XB-coil	: Coil voltage max. 28 V/110 mA; 295 Ohm at 20°C, cable gland M20x1,5
XC-coil	: Coil voltage max. 24 V; 65 Ohm at 20°C, cable gland M20x1,5; P <sub>max</sub> = 9 W at 20°C

### > Ranges (based on Air)

Model	minimum	maximum
F-201CX / F-211CX	0,22...11 ml <sub>v</sub> /min	0,4...20 l <sub>v</sub> /min

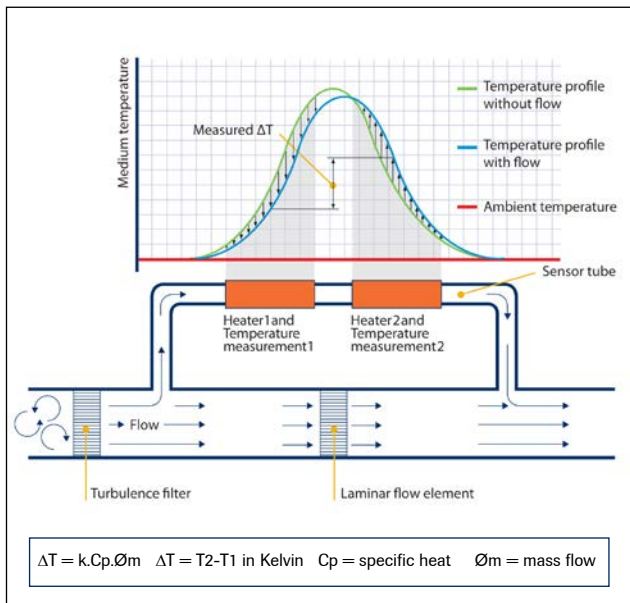
*Intermediate ranges are available*

## > Model number identification



## > Thermal mass flow measuring principle

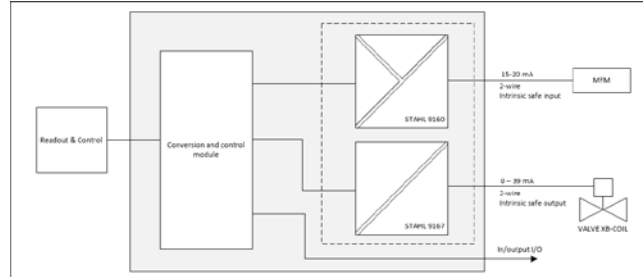
The heart of the thermal mass flow meter/controller is the sensor, that consists of a stainless steel capillary tube with resistance thermometer elements. A part of the gas flows through this bypass sensor, and is warmed up heating elements. Consequently the measured temperatures  $T_1$  and  $T_2$ 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



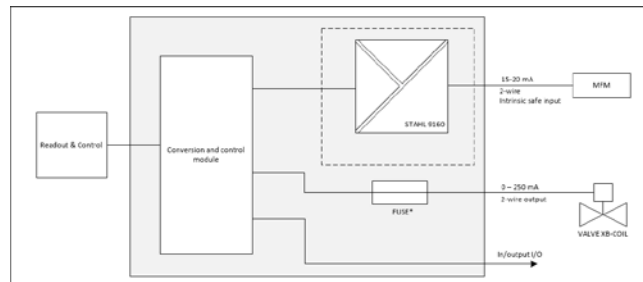
Functional scheme of the thermal mass flow sensor

## > EX-FLOW system set-up

An EX-FLOW mass flow control system consists of a flow metering part, a control valve and a power supply/readout unit. The latter contains the signal conversion, controller function, power supply with galvanic separation and optional safety barrier. For XB and XC coils the functional scheme is slightly different:



Connection using XB-coil (Ex I transmitter Stahl 9167 required)

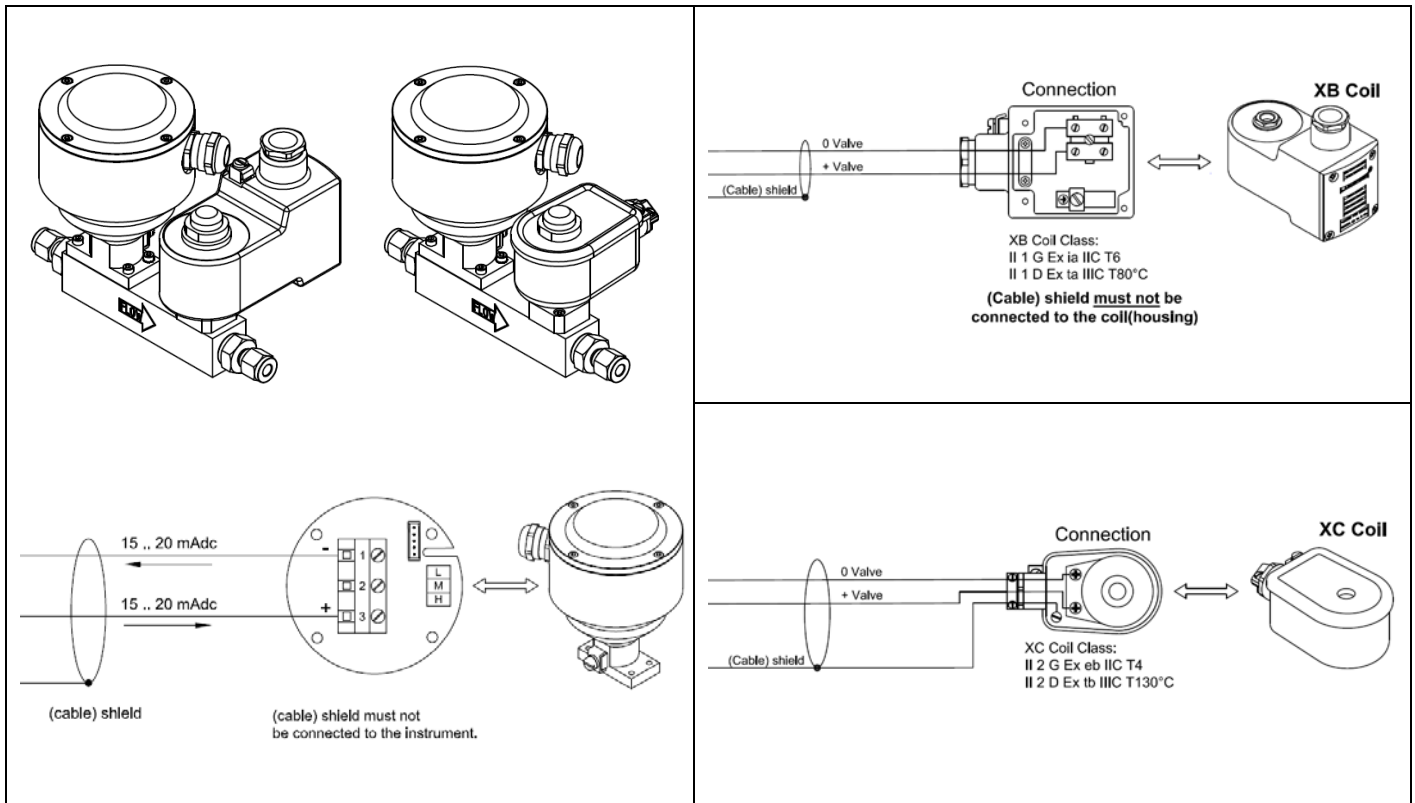


Connection using XC-coil (no safety barrier required)

\*Module is provided with a 400 mA fuse according to IEC 60127-3 to meet the special conditions for safe use of the applied valve coil.

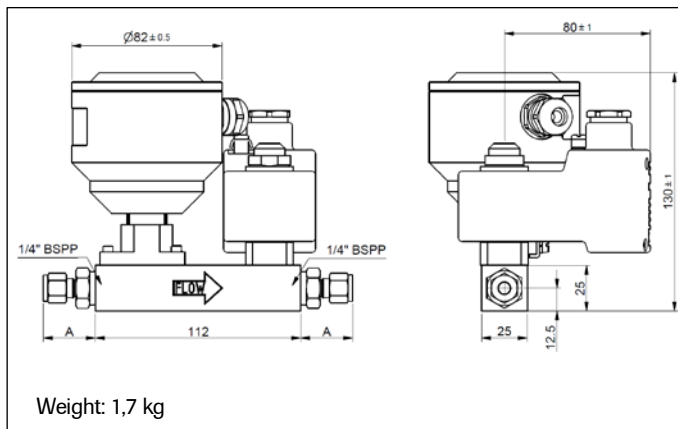
An optional front panel for flow indication, totalization and alarms completes the EX-FLOW system.

## > Hook-up diagram measuring head X100, XB-coil and XC-coil

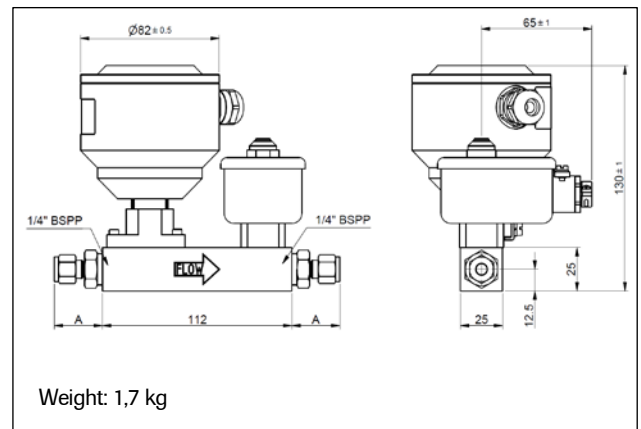


## > Dimensions (mm) and weights (kg)

F-201CX / F-211CX with XB coil



F-201CX / F-211CX with XC coil



## > Dimension table adapters (RS-type)

			(Size A in mm)
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	12 mm	OD	32.5
adapter	1/8"	OD	26.1
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

- IN-LINE filters for protection against particulates	
- E-8000 Power Supply/Readout	
- Interconnecting cables	

## > Alternatives

- EX-FLOW model F-111BX, Ex-Proof Mass Flow Meter for min. 0,2 ... 10 ml <sub>r</sub> /min and max. 0,4 ... 20 l <sub>r</sub> /min	
- EX-FLOW model F-200CX / F210CX, Ex-Proof Mass Flow Controller for min. 0,2 ... 10 ml <sub>r</sub> /min and max. 0,2 ... 10 ml <sub>r</sub> /min	
- EX-FLOW model F-201AX / F-211AX, Ex-Proof Mass Flow Controller for min. 0,1 ... 5 l <sub>r</sub> /min and max. 2 ... 100 l <sub>r</sub> /min	
- IN-FLOW model F-201CI / F-211CI, IP65 protected Mass Flow Controller, with optional ATEX approval for Zone 2, for min. 0,16 ... 8 ml <sub>r</sub> /min and max. 0,16 ... 25 l <sub>r</sub> /min	

Related drawing 9.27.080C. No modifications permitted without approval of authorised person.