

EL-Flow

Termisk massflödesmätare för gaser från Bronkhorst High-Tech

Mäter och reglerar från 0,014 ml/min till 1670 l/h

Enkel

- Mäter alltid rätt flöde oavsett tryck och temperatur
- Snabb respons, 1-2 s.
- Inga krav på raksträckor
- Okänslig för vibrationer
- Temperaturer från -10 till +70°C
- Analogt bör- och ärvärde, samt RS232-kommunikation
- Lab-version

Ekonomisk

- Enkelt montage med Swagelok-kopplingar, därmed låg installationskostnad
- Medieberörda delar i 316L
- Klarar tryck upp till 400 bar
- Low-delta-P versionen för låga tryck eller aggressiva gaser
- Upp till 8 kalibreringskurvor kan lagras i instrumentet
- Profibus, DeviceNet, Modbus

Noggrann

- +/- 0,5% av avläst värde +/- 0,1% full skala



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> Technical specifications

Measurement / control system

Accuracy (incl. linearity)	: standard: $\pm 0,8\%$ Rd plus $\pm 0,2\%$ FS; optional: $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS
(based on actual calibration)	($\pm 1\%$ FS for ranges 3...5 ml _l /min; $\pm 2\%$ FS for ranges < 3 ml _l /min)
Turndown	: 1 : 50 (in digital mode up to 1:187,5)
Repeatability	: < 0,2% Rd
Settling time (controller)	: standard: 1...2 seconds option: down to 500 msec
Control stability	: < $\pm 0,1\%$ FS (typical for 1 l _l /min N ₂)
Operating temperature	: -10...+70°C
Temperature sensitivity	: zero: < 0,05% FS/°C; span: < 0,05% Rd/°C
Pressure sensitivity	: 0,1%/bar typical N ₂ ; 0,01%/bar typical H ₂
Leak integrity, outboard	: tested < 2 x 10 ⁻⁹ mbar l/s He
Attitude sensitivity	: max. error at 90° off horizontal 0,2% 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
Surface quality (wetted parts)	: Ra = 0,8 μm typical
Process connections	: compression type or face seal couplings
Seals	: standard: Viton; options: EPDM, Kalrez (FFKM)
Ingress protection (housing)	: IP40

Electrical properties

Power supply	: +15...24 Vdc
Power consumption	: meter: 70 mA; controller: max. 320 mA; add 50 mA for Profibus, if applicable
Analog output/command	: 0...5 (10) Vdc or 0 (4)...20 mA (sourcing output)
Digital communication	: standard: RS232 options: Profibus-DP [®] , DeviceNet [™] , Modbus-RTU, FLOW-BUS
Electrical connection	
Analog/RS232	: 9-pin D-connector (male);
Profibus-DP [®]	: bus: 9-pin D-connector (female); power: 9-pin D-connector (male);
DeviceNet [™]	: 5-pin M12-connector (male);
Modbus-RTU/FLOW-BUS	: RJ45 modular jack

Technical specifications and dimensions subject to change without notice.



F-111B Mass Flow Meter

> Models and flow ranges (based on Air)

Mass Flow Meters (MFM); PN100 (pressure rating 100 bar)

Model	min. flow	max. flow
F-110C	0,014...0,7 ml _l /min	0,06...9 ml _l /min
F-111B	0,16...8 ml _l /min	0,16...25 l _l /min
F-111AC	0,4...20 l _l /min	0,6...100 l _l /min
F-112AC	0,8...40 l _l /min	1,4...250 l _l /min
F-113AC	4...200 l _l /min	8...1670 l _l /min

For ranges of 200 or 400 bar rated MFMs see model number identification.

Mass Flow Controllers (MFC); PN64 / PN100

Model	min. flow	max. flow
F-200CV/F-210CV ¹⁾	0,014...0,7 ml _l /min	0,06...9 ml _l /min
F-201CV/F-211CV ¹⁾	0,16...8 ml _l /min	0,16...25 l _l /min
F-201AV/F-211AV ¹⁾	0,4...20 l _l /min	0,6...100 l _l /min
F-202AV/F-212AV ²⁾	0,8...40 l _l /min	1,4...250 l _l /min
F-203AV/F-213AV ³⁾	4...200 l _l /min	8...1670 l _l /min

¹⁾ K_v-max = 6,6 x 10⁻²

²⁾ K_v-max = 0,4

³⁾ K_v-max = 1,5

MFCs for high-pressure / high-ΔP applications; PN400

Model	min. flow	max. flow
F-230M	0,2...10 ml _l /min	10...500 ml _l /min
F-231M	10...500 ml _l /min	0,2...10 l _l /min
F-232M	0,2...10 l _l /min	2...100 l _l /min

> 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 by heating elements. Consequently the measured temperatures T₁ and T₂ 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.

