

EL-FLOW®

Thermal Mass Flow Meters and Controllers for Gases

> Introduction

Bronkhorst High-Tech B.V., the European market leader in thermal Mass Flow Meters/Controllers and Electronic Pressure Controllers, has 25 years experience in designing and manufacturing precise and reliable measurement and control devices. With a wide range of instruments, Bronkhorst High-Tech is offering innovative solutions for many different applications in many different markets. The instruments are made to customers' specification, in various styles, suitable for use in laboratory, industrial environment, hazardous areas, semiconductor processing or analytical equipment.

> EL-FLOW® series for Laboratory and Instrumentation

EL-FLOW® series Mass Flow Meters and Controllers for gas applications have a housing designed for laboratory and clean processing conditions. The instruments are truly unique in their capability to measure and control flow ranges between 0...1 sccm and 0...1800 slpm with pressure rating between vacuum and 6,000 psi – all in one range of instruments. This versatility in flow ranges and in operating conditions has ensured that the EL-FLOW® series remains our most popular and field proven of instruments.

> State of the art digital design

Today's EL-FLOW® series are standard equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response (settling times down to 200 msec). The basic digital pc-board contains all of the general functions needed for measurement and control. The latest EL-FLOW® design features Multi Gas / Multi Range functionality, providing (OEM-) customers with optimal flexibility and process efficiency. 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 or FLOW-BUS protocols. The latter is a fieldbus based RS485, specifically designed by Bronkhorst High-Tech for their mass flow metering and control solutions, and with which the company has already over ten years of experience with digital communication.

> Mass Flow Controllers for every application

The control valve can be furnished as integral part of an EL-FLOW® MFC, or as separate component. It is a proportional, electromagnetic



control valve with extremely fast and smooth control characteristics. With reference to the specific field of application there are different series of control valves. There is a standard direct acting valve for common applications, a pilot operated valve for high flow rates, the so-called Vary-P valve that can cope with up to 6,000 psi ΔP and a bellows valve for applications with very low differential pressure.

> General EL-FLOW® features

- ◆ fast response, excellent repeatability
- ◆ high accuracy
- ◆ pressure ratings up to 6,000 psi
- ◆ optional metal sealed and downported constructions

> Digital features

- ◆ DeviceNet™, PROFIBUS-DP®, Modbus-RTU or FLOW-BUS slave; RS232 interface
- ◆ Multi Gas / Multi Range
- ◆ alarm and counter functions

> Fields of application

- ◆ Semiconductor processing
- ◆ Analysis and environmental measurements
- ◆ Burner control
- ◆ Surface treatment installations
- ◆ Process control in food, pharmaceutical and (petro-) chemical industries.



Bronkhorst®
HIGH-TECH

> Technical specifications

Measurement / control system

Accuracy (incl. linearity)	: standard: $\pm 0.8\%$ Rd plus $\pm 0.2\%$ FS;
(based on actual calibration)	on request: $\pm 0.5\%$ Rd plus $\pm 0.1\%$ FS;
	($\pm 1\%$ FS for ranges $< 0-10$ sccm)
Turndown	: 1 : 50 (2 ... 100%)
Repeatability	: $< 0.2\%$ Rd
Settling time (controller)	: standard: 1...2 seconds
	option: down to 200 msec
Operating temperature	: $-10...+70^{\circ}\text{C}$
Temperature sensitivity	: zero: $< 0.05\%$ FS/ $^{\circ}\text{C}$; span: $< 0.05\%$ Rd/ $^{\circ}\text{C}$
Leak integrity	: tested $< 2 \times 10^{-9}$ mbar l/s He
Attitude sensitivity	: max. error at 90° off horizontal 0.2%
	at 1 atmosphere, typical N2
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 = $0.8 \mu\text{m}$ typical
Process connections	: compression type or face seal couplings
Seals	: standard: Viton; options: EPDM, FFKM (Kalrez)
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 subject to change without notice.



> Models and flow ranges

Mass Flow Meters (MFM); PN100 (pressure rating 1,500 psi)

Model	min. flow	max. flow
F-110C	0.02...1 sccm	0.24...12 sccm
F-111B	0.16...8 sccm	0.6...30 slpm
F-111AC	0.4...20 slpm	2...100 slpm
F-112AC	8...40 slpm	7.6...380 slpm
F-113AC	4...200 slpm	36...1800 slpm

Mass Flow Meters (MFM); PN200 / PN400

Model	min. flow	max. flow
F-120M/F-130M	0.1...5 sccm	0.4...20 sccm
F-121M/F-131M	0.2...10 sccm	0.6...30 slpm
F-122M/F-132M	0.4...20 slpm	6...300 slpm
F-123M/F-133M	3.2...160 slpm	30...1500 slpm

Mass Flow Controllers (MFC); PN64 / PN100

Model	min. flow	max. flow
F-200CV/F-210CV ¹⁾	0.02...1 sccm	0.24...12 sccm
F-201CV/F-211CV ¹⁾	0.24...12 sccm	0.6...30 slpm
F-201AV/F-211AV ¹⁾	0.4...20 slpm	2...100 slpm
F-202AV/F-212AV ²⁾	8...40 slpm	7.6...380 slpm
F-203AV/F-213AV ³⁾	4...200 slpm	36...1800 slpm

¹⁾ $K_v\text{-max} = 6.6 \times 10^{-2}$

²⁾ $K_v\text{-max} = 0.4$

³⁾ $K_v\text{-max} = 1.5$

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

Model	min. flow	max. flow
F-230M	0.2...10 sccm	14...700 sccm
F-231M	6...300 sccm	0.26...13 slpm
F-232M	0.14...7 slpm	2...100 slpm




Bronkhorst[®]
 HIGH-TECH