

# μ-FLOW

Series L01 / L02 Digital Mass Flow Meters / Controllers for Liquids

## > Introduction

Bronkhorst High-Tech B.V. has been the pioneer in the field of micro to low flow liquid metering instruments based on a thermal measuring principle. A wealth of experience has been gathered over the past 30 years, which has resulted in three product series that cover Full Scale flow ranges from 30 mg/h up to 20 kg/h.

## > From MICRO- to NANO-flow ranges

Today's market for liquid flow meters tends to develop into the very small flow ranges – even into nano-flow ranges. With the thermal liquid mass flow meters / controllers of the μ-FLOW Series, Bronkhorst High-Tech offers the solution for this complicated task. The compact L01 series can be supplied in ranges from 25...500 nanolitres per minute (1,5...30 mg/h) up to 0,1...2 g/h with a pressure rating up to 400 bar. For even higher pressures, up to 1000 bar (15000 psi), the L02 series can be offered for 7,5...150 mg/h up to 22,5...450 mg/h (based on H<sub>2</sub>O). In addition to the standard RS232 output the instruments also offer analog I/O. Moreover, an optional interface to Profibus-DP®, DeviceNet™, Modbus, EtherCat® or FLOW-BUS can be integrated.

## > μ-FLOW series L01 / L02

The μ-FLOW L01/L02 mass flow meter is basically a straight sensor tube without any moving parts or built-in obstructions. The heater/sensor assembly utilises the heat transfer principle and is arranged around the tube. Upon flow, the ΔT is sensed by the upstream and downstream temperature sensors and this ΔT is a function of both the flow-rate and heat capacity of the liquid to be measured.

## > Liquid flow control

Flow control is achieved by integrating a control valve onto the body of the liquid flow meter. This control valve, with a pressure rating of 100 bar, has a purge connection on top of the sleeve that enables easy elimination of air or gas when starting up the system. The electronic control function forms part of the normal circuitry in the liquid flow meter, so the need for an external controller is eliminated.



## > General features μ-FLOW series L01 / L02

- ◆ fast and accurate measuring signal
- ◆ insensitive to mounting position
- ◆ very small internal volume (sensor: 1,5...33 μl)
- ◆ stainless steel sensor
- ◆ pressure rating of 100 bar for flow controllers up to 1000 bar for flow meters
- ◆ suitable for liquids with low boiling points
- ◆ for laboratory and OEM applications

## > Digital features

- ◆ DeviceNet™, Profibus-DP®, Modbus, EtherCat® or FLOW-BUS slave
- ◆ RS232 interface
- ◆ alarm and counter functions

## > Fields of application

- ◆ Semiconductor industry
- ◆ HPLC applications
- ◆ Chemical industry
- ◆ Food & Pharmaceutical industry
- ◆ Analytical laboratories

## > Technical specifications

### Measurement / control system

Accuracy, standard (based on actual calibration)	: ±2% FS
Turndown	: 1 : 20 (5 ... 100%)
Reproducibility	: ±0,2% FS typical H <sub>2</sub> O
Settling time (controller)	: 2...4 seconds
Operating temperature	: 5 ... 50°C
Temperature sensitivity	: ±0,2% FS/°C
Attitude sensitivity	: negligible
Warm-up time	: approx. 10 min. for accuracy ±2% FS

### Mechanical parts

Material (wetted parts)	: L01: stainless steel 316L; L02: duplex steel
Process connections	: 30...100 mg/h: 10-32 UNF female only; >100 mg/h: 10-32 UNF female, 1/16" or 1/8" OD compression; other on request.
Purge connection (controller)	: 1/16" OD compression type
Seals	: meter: all metal controller: Kalrez-6375; other on request
Weight	: meter: 0,2 kg; controller: 0,3 kg
Ingress protection (housing)	: IP40; other on request

### Electrical properties

Power supply	: + 15 ... 24 Vdc
Power consumption	: meter: 100 mA; controller: 350 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 option: Profibus-DP®, DeviceNet™, Modbus, EtherCat®, 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);
EtherCat®	: 2 x RJ45 modular jack (in/out)
Modbus/FLOW-BUS	: RJ45 modular jack

Technical specifications subject to change without notice.

## > Models and flow ranges

### Liquid Mass Flow Meters; PN400 (pressure rating 400 bar)

Model	min. flow	max. flow
L01	1,5 ... 30 mg/h	0,1 ... 2 g/h

### Liquid Mass Flow Meters; PN1000 (pressure rating 1000 bar)

Model	min. flow	max. flow
L02	7,5 ... 150 mg/h	22,5 ... 450 mg/h

### Liquid Mass Flow Controllers; PN100 (pressure rating 100 bar)

Model	min. flow	max. flow
L01V12	5 ... 100 mg/h	0,1 ... 2 g/h

Indicated ranges are based on fluids with thermal properties similar to H<sub>2</sub>O / IPA

### Calibration

References	: Verified by NKO, the Dutch calibration organisation, and traceable to Dutch and international standards.
Liquids	: Standard calibration fluids: H <sub>2</sub> O or IPA (Isopropyl Alcohol); for other liquids apply to factory.
System	: Precision laboratory balances.



L01 Mass Flow Meter for ultra low liquid flow ranges