



# mini CORI-FLOW™ Series ML120

(Ultra) Low Flow Coriolis Mass Flow Meters / Controllers

## Introduction

**mini CORI-FLOW™** series by Bronkhorst® are precise and compact Mass Flow Meters and Controllers, based on the Coriolis measuring principle. Designed to cover the needs of the (ultra) low flow market, there is a range of models to overlap flow ranges from 5 g/h up to 300 kg/h (full scale values), each offering “multi-range” functionality: factory calibrated ranges can be rescaled by the user, maintaining the original accuracy specs. As a result of this, customers are able to reduce the variety of instruments and thus reduce the cost of ownership.

## Superior Coriolis flow sensor

Instruments of the **mini CORI-FLOW™** series contain a uniquely shaped, single loop sensor tube, forming part of an oscillating system, providing superior flow measurement performance. When a fluid flows through the tube, Coriolis forces cause a variable phase shift, which is detected by sensors and fed into the integrally mounted pc-board. The resulting output signal is strictly proportional to the real mass flow rate. Coriolis mass flow measurement is fast, accurate, easy to install and inherently bi-directional. The **mini CORI-FLOW™** features density and temperature of the fluid as secondary outputs.

## mini CORI-FLOW™ Series ML120

Bronkhorst® designed the new ML120 to offer highest performance at the world's lowest flow rates to be measured with a Coriolis instrument: from 0,05...5 g/h up to 2...200 g/h. The ML120, comprising both a Mass Flow Meter (MFM) and a Mass Flow Controller (MFC), feature smallest physical dimensions and lowest internal volume. The new Coriolis sensor shows little to no variance over a long period of operation, thus reducing the system downtime. The MFC contains a microprocessor based pc-board with signal and fieldbus conversion and a PID controller for mass flow control by means of the integrated piezoelectric control valve. The flow controller only requires (less than) 1 second settling time. This makes the Coriolis MFC an ideal device for fast, repetitive dosing and filling processes for precursors, additives, solvents, etc.

## Fields of application

Applications can be found in compound semiconductor processing, in solar cell and FPD technology, in food and pharmaceutical industries, in medical, microchemical or analytical installations, in calibration laboratories, amongst many others.



## Features of the Coriolis principle

- > Direct mass flow measurement, independent of fluid properties
- > Fast response
- > High accuracy
- > Additional density and temperature outputs
- > Bi-directional measurement

## Benefits of the ML120

- > Lowest flow ranges on the market (Coriolis principle):  
from 50 mg/h up to 200 g/h
- > Very small internal volume
- > Compact, space saving design
- > Easy to install (low risk of gas bubble inclusion)
- > Integrated digital controller for accurate flow or batch delivery
- > Excellent repeatability and long-term stability
- > Multi-range: easy on site re-ranging via digital interface
- > Fieldbus connection options:  
EtherCAT®, Modbus, DeviceNet™, PROFIBUS DP, FLOW-BUS, PROFINET
- > Saves expensive fluids at repetitive dosing and filling processes
- > Reduced downtime: no recalibration required after fluid change
- > No periodical recalibration required

# Technical specifications

## Flow ranges

<b>Minimum full scale</b>	5 g/h
<b>Nominal flow</b>	100 g/h
<b>Maximum full scale</b>	200 g/h
<b>Minimum flow</b>	50 mg/h
<b>Rangeability</b>	MFM 1:4000; MFC $\geq$ 1:100

## Performance

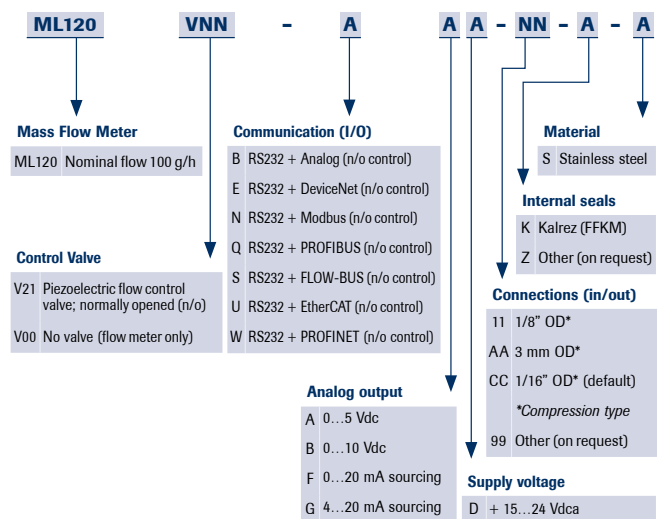
<b>Mass flow accuracy</b>	Liquid: $\pm 0,2\%$ of rate; Gas: $\pm 0,5\%$ of rate
<b>Repeatability</b>	$\pm 0,05\%$ of rate $\pm 1/2$ (ZS* x 100/flow)% based on digital output
<b>Warm-up time</b>	approx. $1/2$ hour after power up for optimum performance
<b>Zero stability (ZS)*</b>	$< \pm 10$ mg/h
<b>Density accuracy</b>	$< \pm 5$ kg/m <sup>3</sup>
<b>Temperature accuracy</b>	$\pm 0,5$ °C
<b>Temperature effect**</b>	on zero: $< 3$ mg/h/°C; on span: $< 0,005\%$ Rd/°C; self heating (at zero flow): $< 10$ °C
<b>Mounting***</b>	Any position, attitude sensitivity negligible
<b>Device temperature</b>	0...70 °C
<b>Response time, meter (t98%)</b>	$\leq 200$ msec
<b>Settling time, controller</b>	$\pm 1$ s ( $< 2\%$ of setpoint)

\* Guaranteed at constant temperature and for unchanging process and environment conditions.

\*\* Depends on flow rate, heat capacity fluid, T<sub>amb</sub>, T<sub>fluid</sub> and cooling capacity.

\*\*\* To be rigidly bolted to a stiff and heavy mass or construction for guaranteed zero stability. External shocks or vibrations should be avoided.

## Model number identification



## Mechanical parts

<b>Material (wetted parts)</b>	Stainless steel 316L or comparable
<b>Sensor</b>	Single tube, DN 0.25; frequency 170 Hz $\pm 20$ Hz
<b>Process connections (welded)</b>	Compression type or face seal couplings
<b>Seals</b>	Kalrez®
<b>Ingress protection (housing)</b>	IP40
<b>Valve</b>	Piezoelectric + metal plunger
<b>Leak integrity</b>	MFM: Outboard $< 2 \times 10^{-9}$ mbar l/s He MFC: Outboard $< 2 \times 10^{-8}$ mbar l/s He
<b>Pressure rating</b>	MFM: 200 bara; MFC: 5 bara (higher on request)

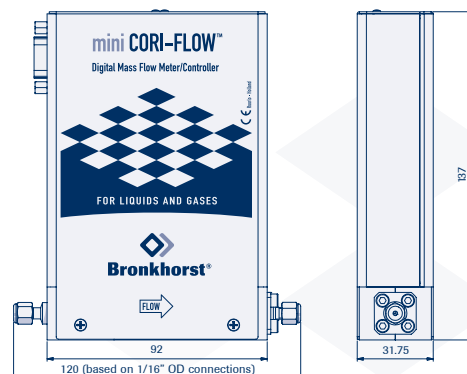
## Electrical properties

<b>Power supply</b>	+15...24 Vdc $\pm 10\%$ Max. ripple recommended: 50 mV tt
<b>Power consumption</b>	MFM: max. 2,5 W MFC: max. 3 W
<b>Analog output</b>	0...5 (10) Vdc, min. load impedance $> 2$ k $\Omega$ ; 0 (4)...20 mA (sourcing), max. load impedance $< 375$ $\Omega$
<b>Analog setpoint</b>	0...5 (10) Vdc, min. load impedance $> 100$ k $\Omega$ ; 0 (4)...20 mA, load impedance $\sim 250$ $\Omega$
<b>Digital communication</b>	Standard RS232; Options: PROFIBUS DP, DeviceNet™, Modbus RTU/ASCII, FLOW-BUS, EtherCAT®, PROFINET

## Electrical connections

<b>Analog/RS232</b>	9-pin D-connector (male)
<b>PROFIBUS DP</b>	bus: 9-pin D-connector (female); power: 9-pin male D-connector (male)
<b>DeviceNet™</b>	5-pin M12 connector (male)
<b>Modbus (RTU/ASCII)/FLOW-BUS</b>	RJ45 modular jack
<b>EtherCAT®/PROFINET</b>	2 x RJ45 modular jack (in/out)

## Dimensions (in mm)



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

