

# Datasheet M13

## Coriolis Mass Flow Meter for Liquids and Gases

### > Introduction

Bronkhorst® model M13 **mini CORI-FLOW™** Mass Flow Meters (MFMs) are precise and compact instruments, based on the Coriolis measuring principle, designed to cover the needs of the low flow market. The MFMs offer “multi-range” functionality: factory calibrated ranges can be rescaled by the user, maintaining the original accuracy specs. The instruments are equipped with a robust IP65 weatherproof housing and are optionally available with ATEX approval for use in Zone 2 hazardous areas. The MFM contains a microprocessor based pc-board with signal and fieldbus conversion and a PID controller for optional mass flow control by means of a separately mounted control valve or pump. The mass flow is provided as analog signal or digitally via RS232 or optional fieldbus. The flow range and wetted materials are determined depending of the type of fluid and the process conditions of the application.



**mini CORI-FLOW Coriolis Mass Flow Meter model M13**

### > Technical specifications

#### Flow ranges

Minimum full scale	: 50 g/h
Nominal flow	: 1000 g/h
Maximum full scale	: 2000 g/h
Minimum flow	: 1 g/h
Rangeability MFM	: 1:100

#### Performance

Mass flow accuracy liquids	: $\pm 0,2\%$ of rate
Mass flow accuracy gases	: $\pm 0,5\%$ of rate
Repeatability	: $\pm 0,05\%$ of rate $\pm 1/2$ (ZS* x 100/flow)% based on digital output
Warm-up time	: approx. 30 min. after power up
Zero stability (ZS)*	: $< \pm 0,2$ g/h
Density accuracy	: $< \pm 5$ kg/m <sup>3</sup>
Temperature accuracy	: $\pm 0,5$ °C
Temperature effect**	: Zero drift: $\pm 0,02$ g/h/°C Span drift: $\pm 0,001\%$ Rd./°C Initial heating (at zero flow): $\leq 15$ °C
Mounting***	: Any position, attitude sensitivity negligible
Device temperature	: 0...70°C; for ATEX Cat.3, Zone 2 max. 50°C
Response time, meter (t98%)	: 0,2 s

\* 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.

#### Mechanical parts

Material (wetted parts)	: Stainless steel 316L or comparable Optional: Hastelloy-C22
Housing	: Stainless steel 430F
Sensor	: Single tube, DN 0.5
Process connections (welded)	: Compression type or face seal couplings
Seals	: Metal
Ingress protection (housing)	: IP65 (weatherproof)
Leak integrity	: Outboard $< 2 \times 10^{-9}$ mbar l/s He
Pressure rating	: 200 bar; higher on request

#### Electrical properties

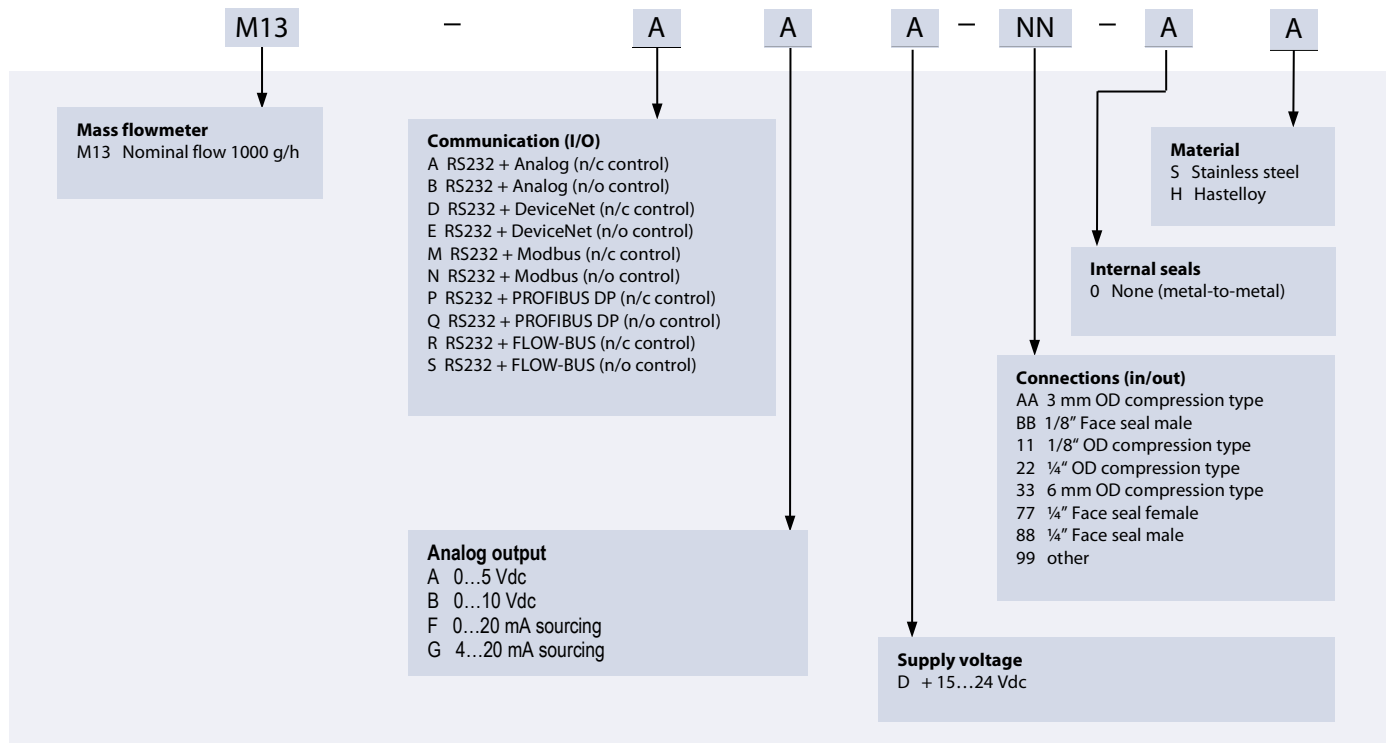
Power supply	: +15...24 Vdc $\pm 10\%$ Max. ripple recommended: 50 mV tt
Power consumption	: 3 W
Analog output	: 0...5 (10) Vdc, min. load impedance $> 2$ k $\Omega$ ; 0 (4)...20 mA (sourcing), max. load impedance $< 375$ $\Omega$
Analog setpoint (for MFM + control valve/pump)	: 0...5 (10) Vdc, min.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

#### Electrical connections

Analog/RS232	: 8-pin DIN male
Profibus-DP	: bus: 5-pin M12 female; power: 8-pin DIN male
DeviceNet/Modbus/FLOW-BUS	: 5-pin M12 male

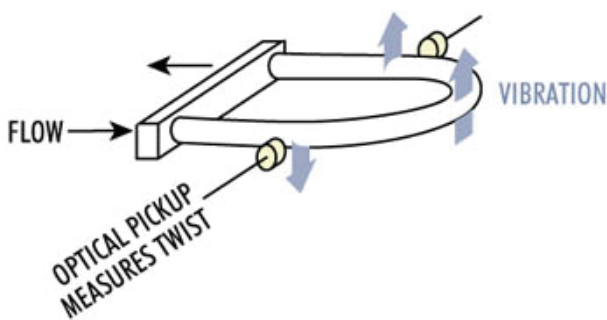
Although all specifications in this datasheet are believed to be accurate, the right is reserved to make changes without notice or obligation.

## > Model number identification



## > Coriolis principle of operation

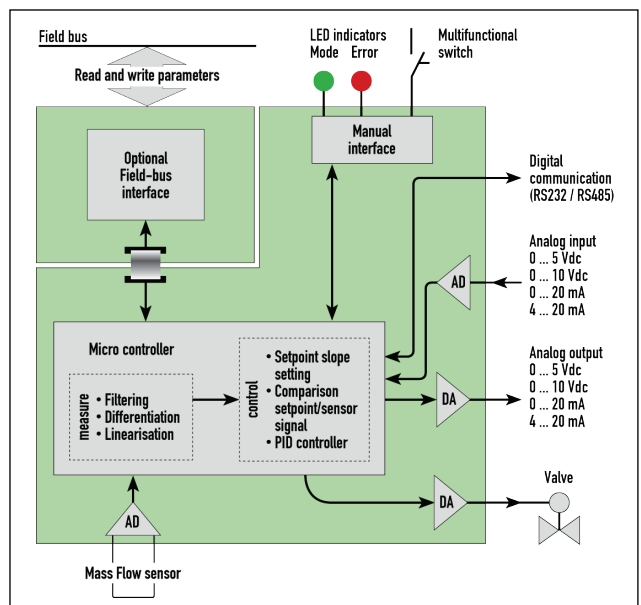
Instruments of the **mini CORI-FLOW™** series are based on the *Coriolis effect*: a fluid flows through a uniquely shaped, single loop sensor tube, forming part of an oscillating system. Coriolis forces cause a variable phase shift, which is detected by sensors and fed into the integrally mounted pc-board.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



Schematic of a Coriolis flow sensor

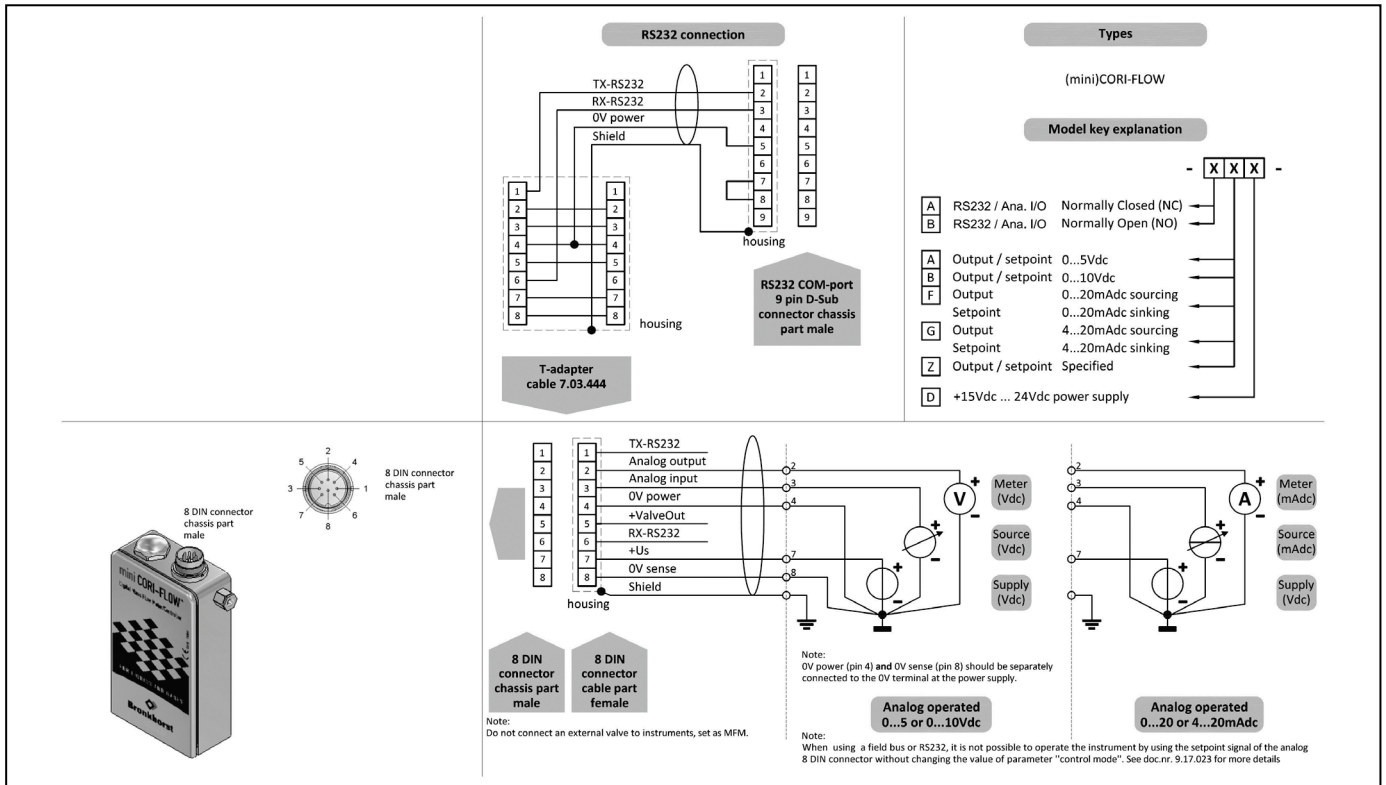
## > State of the art digital design

**mini CORI-FLOW™** series are equipped with a digital pc-board, offering high accuracy, excellent temperature stability and fast response. The basic digital pc-board contains all of the general functions needed for measurement and control. 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.



Functional scheme of the digital PC-board

## > Hook-up diagram for analog or RS232 communication

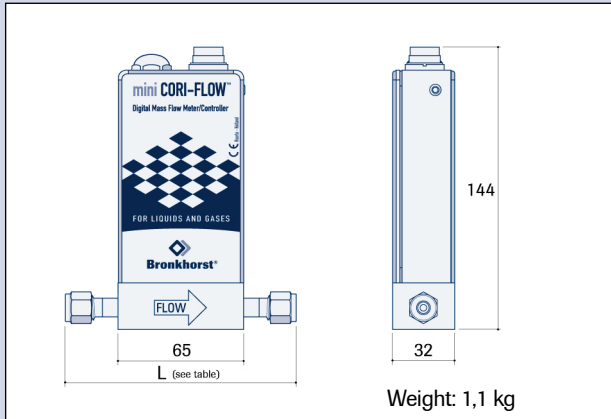


## > Hook-up diagrams for fieldbus communication

For the available fieldbus options we refer to the various hook-up diagrams as indicated below. If you are viewing this datasheet in digital format, you may use the hyperlink to each of the drawings. Otherwise please visit the download section on <http://www.bronkhorst.com> or contact our local representatives.



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



Length (L) including adapters

Compression type	Size L (in mm)
adapter 3 mm OD	116
adapter 6 mm OD	118
adapter 1/8" OD	115
adapter 1/4" OD	118

Face-seal male	Size L (in mm)
adapter 1/4"	106

## > Options and accessories

- Free software support for operation, monitoring, optimizing or to interface between digital instruments and windows software.	
- BRIGHT compact local Readout/Control module - E-8000 Power Supply	
- Interconnecting cables for power and analog/digital communication - PiPS Plug-in Power Supply	
- Heavy mass body and vibration-dampeners	
- Impact protection cover for ATEX Zone 2 applications	

## > Alternatives

- Model M12 <b>mini CORI-FLOW™</b> Mass Flow Meter (flow rates from 0,1 upto 200 g/h)	
- Model M14 <b>mini CORI-FLOW™</b> Mass Flow Meter (flow rates from 0,03 upto 30 kg/h)	
- Model M13V10I / M13V11I / M13V14I <b>mini CORI-FLOW™</b> Mass Flow Controller (flow rates from 1 upto 2000 g/h)	
- Model XM13 <b>mini CORI-FLOW™ Ex d</b> Mass Flow Meter for ATEX Zone 1 (flow rates from 1 upto 2000 g/h)	

