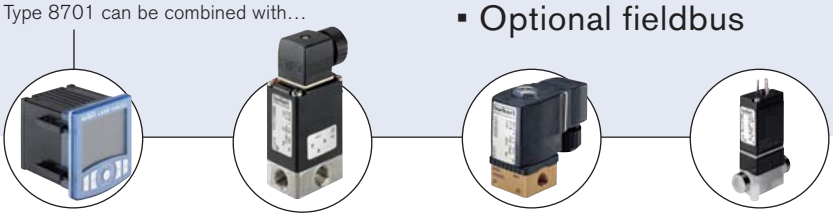
bürkert
FLUID CONTROL SYSTEMS

Mass Flow Meter (MFM) for Gases

- Direct flow measurement for nominal flow rates from 10 ml_N/min to 80 l_N/min (N_2) in MEMS technology
- High accuracy
- Short response time
- Optional fieldbus

Type 8701 can be combined with…



Type 8619
Multichannel program controller

Type 0330
2/2 or 3/2-way solenoid valve

Type 6013
2/2-way solenoid valve

Type 6606
2/2 or 3/2-way solenoid valve

Mass flow meters are used in process technology for the direct measurement of the mass flow of gases. In case of volumetric flow meters, it is necessary to measure the temperature and the pressure either the density, because gases change their density or rather their volume depending on the pressure. The measurement of the mass flow, on the other hand, is independent on pressure and the temperature.

The digital mass flow meter Type 8701 uses a sensor on silicon chip basis (see the description on page 2) located directly in the bypass channel. Due to the fact that the sensor is directly in the bypass channel a very short response time of the MFM is reached. The actual flow is given as an analog output signal or could be read out over RS communication.

Type 8701 can optionally be calibrated for two different gases, the user is able to switch between these two gases. The materials of the parts that come into contact with the medium are selected according to customer specification so that the unit can be operated with the complete range of standard process gases.
The MassFlowCommunicator software can be used for parameterisation and diagnosis.

Typical application areas are gas flow measurement in
- Test benches
- Environmental technology
- Medical technology and
- Analytical instruments

Technical Data	
Nominal flow range[1] (Q_{nom})	10 ml_N/min [2] to 80 l_N/min (N_2), see table on p. 2
Span	1:50 (2-100%), higher span on request
Operating gas	Neutral, non-contaminated gases, others on request
Calibration gas	Operating gas or air with conversion factor
Max. operating pressure (Inlet pressure)	10 bar (145 psi)
Gas temperature	-10 to +70°C (-10 to +60°C with oxygen)
Ambient temperature	-10 to +50°C
Accuracy (after 1 min. warm up time)	±0.8% o.R. (of reading) ±0.3% F.S. (of full scale)
Repeatability	±0.1% F.S.
Response time ($t_{95\%}$)	< 300 ms
Materials Body Housing Seals	 Aluminium or stainless steel PC (Polycarbonate) or metal FKM, EPDM
Port connection	NPT 1/4, G 1/4, screw-in fitting or flange, others on request
Electr. connection Additionally with fieldbus:	Plug D-Sub 15-pin with PROFIBUS DP: Socket M12 5-pin with DeviceNet, CANopen: Socket M12 5-pin
Power supply	24V DC

Voltage tolerance	±10%
Residual ripple	< 2%
Power consumption	2.5 W / 5 W (with fieldbus)
Output signal (process value) Max. current (voltage) Max. load (current)	0–5 V, 0–10 V, 0–20 mA or 4–20 mA 10 mA 600 Ω
Digital communication via adapter possible:	RS232, Modbus RTU (via RS adapter) RS485, RS422 or USB (see accessories table on p. 3)
Fieldbus option	PROFIBUS DP, DeviceNet, CANopen
Protection class	IP40
Dimensions [mm]	see drawings on pages 5 to 6
Total weight	ca. 500 g (aluminium body)
Installation	horizontal or vertical
Light emitting diodes (default functions, other functions programmable)	Indication for power, Limit (with analog signals) / Communication (with fieldbus) and error
Binary inputs (default functions, other functions programmable)	Two 1. not assigned 2. not assigned
Binary output (default functions, other functions programmable)	A relay output for: 1. Limit (actual value close to Q_{nom}) Max. Load: 25V, 1A, 25VA

[1] The nominal flow value is the max. flow value calibrated which can be measured. The nominal flow range defines the range of nominal flow rates (full scale values) possible.
[2] Index N: Flow rates referred to 1.013 bar and 0° C.
Alternatively there is an Index S available which refers to 1.013 bar and 20° C

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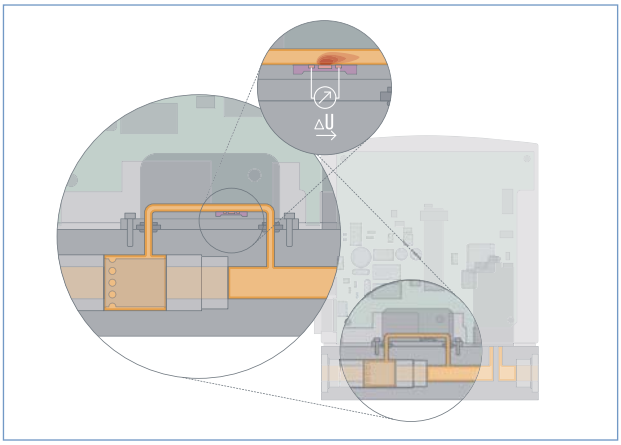
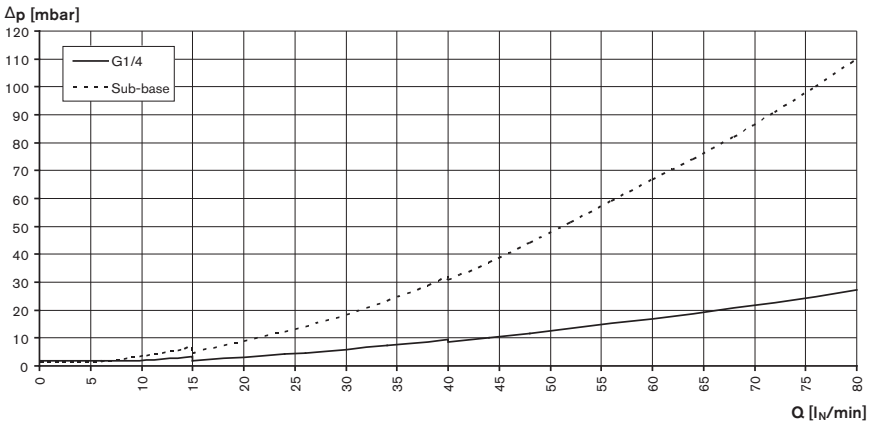
Measuring Principle



The mass flow sensor operates according to a thermal principle which has the advantage of providing the mass flow which is independent on pressure and temperature.

A small part of the total gas stream is diverted into a small, specifically designed bypassing channel which ensures laminar flow conditions. The sensor element is a chip immersed into the wall of this flow channel. The chip, produced in MEMS technology, contains a heating resistor and two temperature sensors (thermopiles) which are arranged symmetrically upstream and downstream of the heater. The differential voltage of the thermopiles is a measure of the mass flow rate passing the flow sensor. The calibration procedure effectuates a unique assignment of the sensor signal to the total flow rate through the device.

Pressure Loss Diagram (ref. to air, with 250µm inlet filter)



The diagram shows exemplarily the pressure loss characteristics when air flowing through.
For determining the pressure loss with another gas it needs to calculate the air equivalent and respect the fluidics needed with the other gas.

Nominal Flow Range of Typical Gases

(Other gases on request)

Gas	Min. Q_{nom} [l_N/min]	Max. Q_{nom} [l_N/min]
Argon	0.01	80
Helium	0.01	500
Carbon dioxide	0.02	40
Air	0.01	80
Methane	0.01	80
Oxygen	0.01	80
Nitrogen	0.01	80
Hydrogen	0.01	500

Notes regarding the selection of the unit

The decisive factors for the perfect functioning of an MFM within the application are the fluid compatibility, the normal inlet pressure and the correct choice of the flow meter range. The pressure drop over the MFM depends on the flow rate and the operating pressure.

The request for quotation form on page 7 contains the relevant fluid specification.

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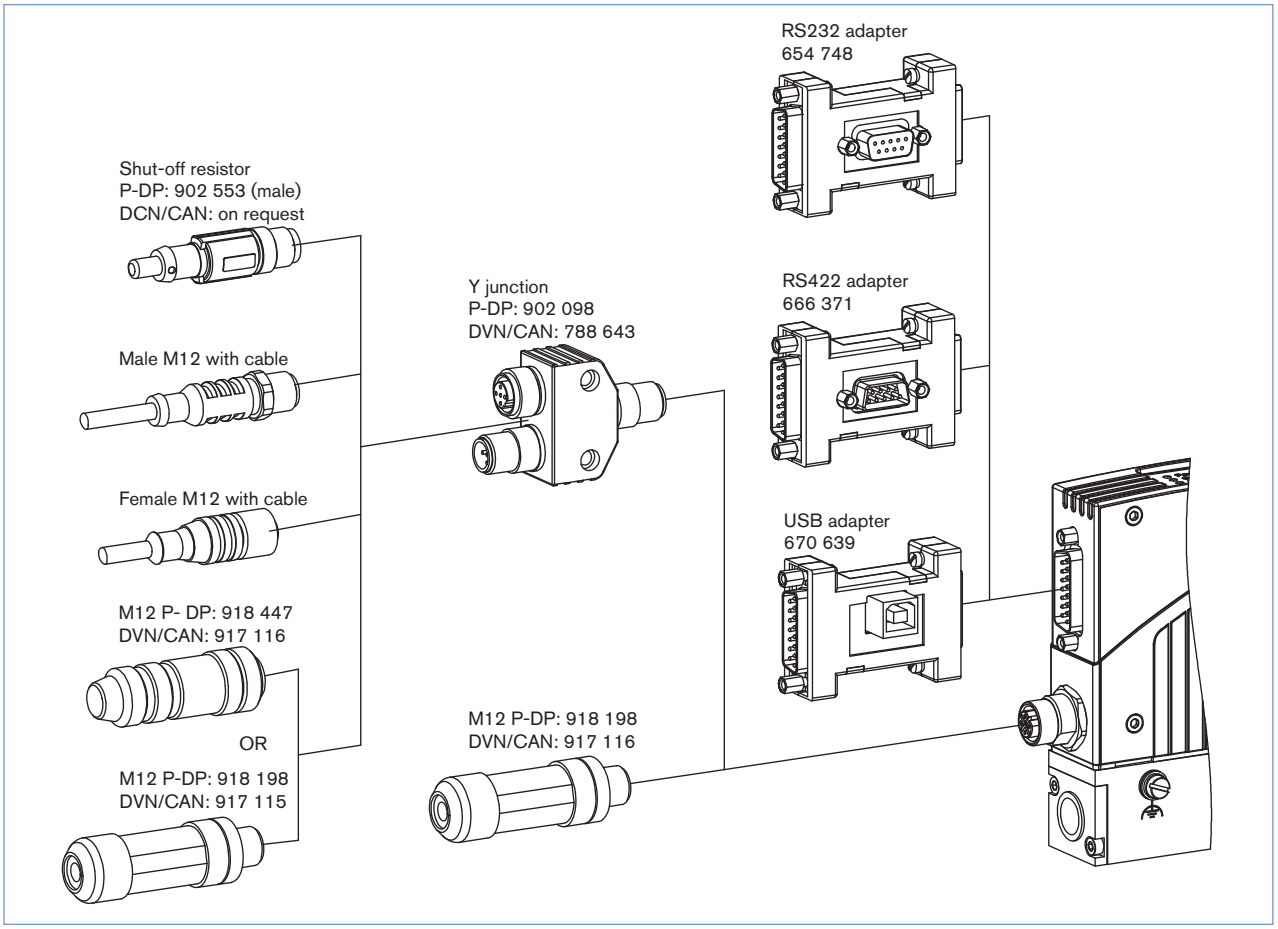
Ordering Chart for Accessories

Article	Item No.	
Connections/Cables		
Socket D-Sub 15-pin solder connection	918 274	
Hood for D-Sub socket, with screw locking	918 408	
Socket D-Sub 15-pin with 5m cable	787 737	
Socket D-Sub 15-pin with 10m cable	787 738	
Adapters [3]		
RS232 adapter (for connection of a PC, in combination with the PC cable)	654 748	
PC extension cable for RS232 9-pin socket/plug 2 m	917 039	
RS422 adapter (RS485 compatible)	666 371	
USB adapter (Version 1.1, USB socket type B)	670 639	
USB connection cable 2 m	772 299	
Communication software MassFlowCommunicator	Download from www.buerkert.com	
Accessories for Fieldbus	**PROFIBUS DP (B-coded)**	**DeviceNet, CANopen (A-coded)**
Plug M12 [4]	918 198	917 115
Socket M12 [4]	918 447	917 116
Y-junction [4]	902 098	788 643
Terminating resistor	902 553	(on request)
GSD-File (PROFIBUS), EDS-File (DeviceNet, CANopen)	Download from www.buerkert.com	

[3] The adapters serve mainly for initial operation or diagnosis. Those are not obligatory for continuous operation.
[4] The two M12 connectors as listed above cannot be used together on the same side of the Y-junction.
At least one of the two M12 connection needs to be an overmoulded cable which uses typically a thinner connector.
A T-junction cannot be used together with this type of MFM.



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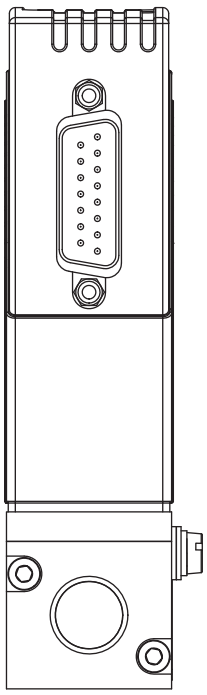
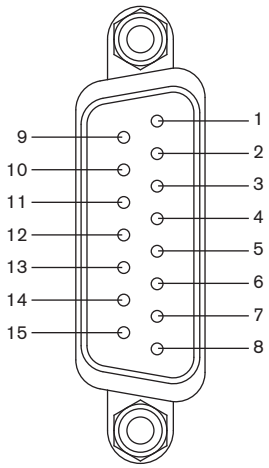
Pin Assignment



Plug D-Sub, 15-pin	Pin	Assignment	
		Analogue Control	Bus control
	1	Relay – normally closed contact	
	2	Relay – normally open contact	
	3	Relay – reference	
	4	GND for 24V Supply and binary inputs	
	5	24V supply +	
	6	12V output (only for factory use)	
	7	N.C.	N.C. [5]
	8	N.C.	N.C.
	9	Actual value output GND	N.C.
	10	Actual value output +	N.C.
	11	DGND (for RS232) [6]	
	12	Binary input 1	
	13	Binary input 2	
	14	RS232 RxD (without driver) [6]	
	15	RS232 TxD (without driver) [6]	

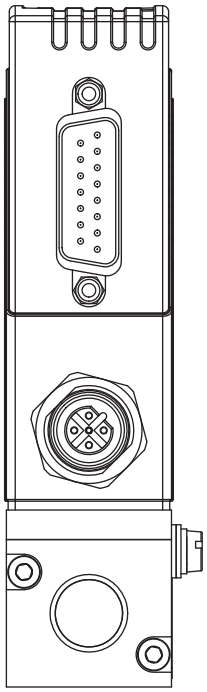


[5] N.C.: not connected (not used)

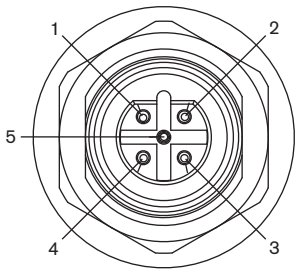
Note:
– Optional Pin 7 and 8 with bus version as transmitter input possible
– The cable length for RS232/ Setpoint and actual value signal is limited to 30 meters.

[6] Driving RS232 interface only by RS232 adapter including an adaption of TTL levels

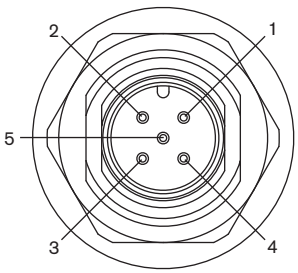
With Fieldbus Version:



PROFIBUS DP – Socket B-coded M12 (DPV1 max. 12 MBaud)	Pin	Assignment
	1	VDD (only for termination resistor)
	2	RxD/ TxD – N (A-Line)
	3	DGND
	4	RxD/ TxD – P (B-Line)
	5	N.C.



DeviceNet, CANopen – Plug M12	Pin	Assignment
	1	Shield
	2	N.C.
	3	DGND
	4	CAN_H
	5	CAN_L



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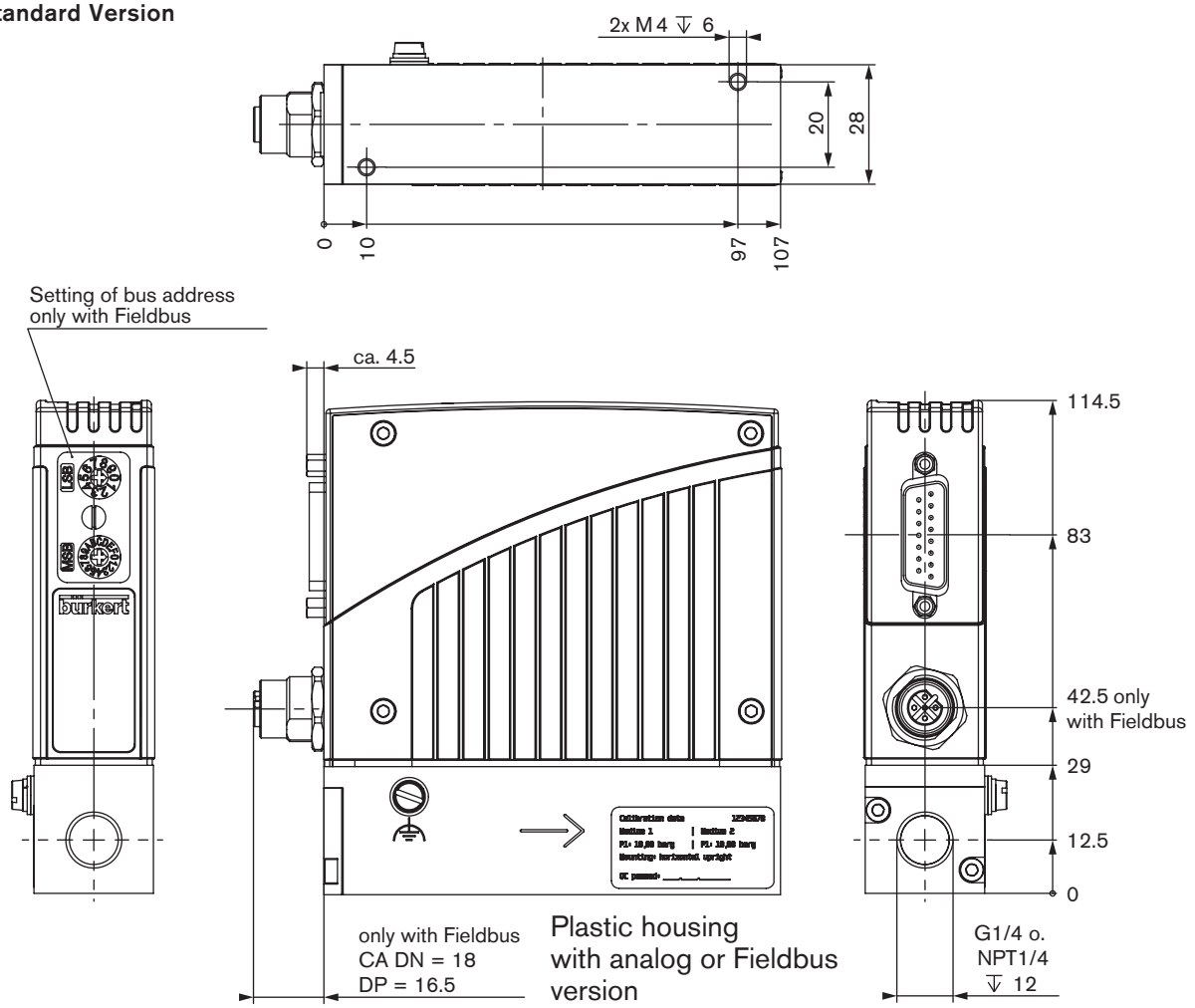
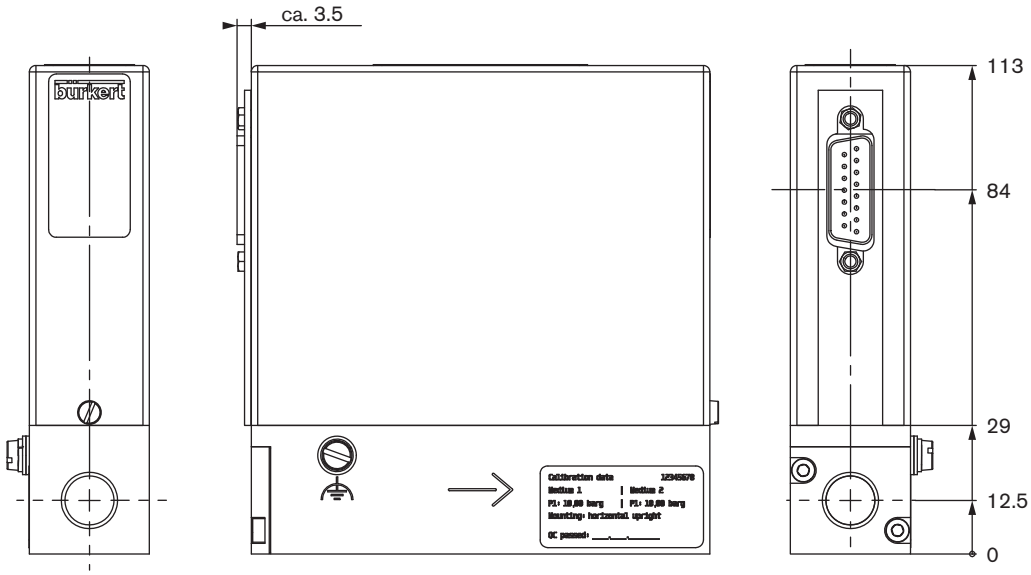
Dimensions [mm]

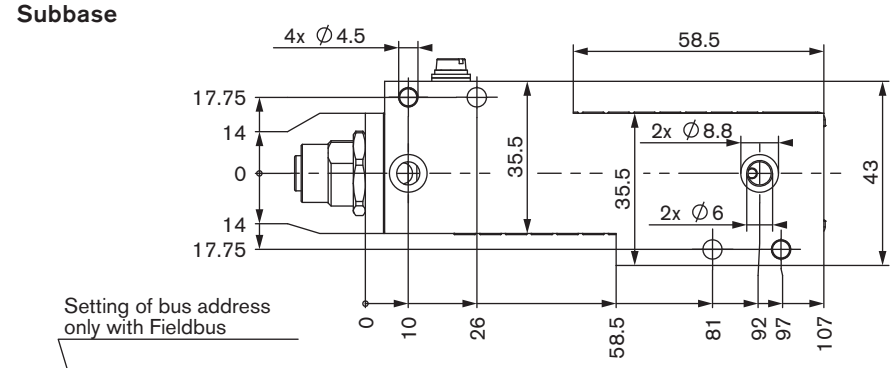
Standard Version

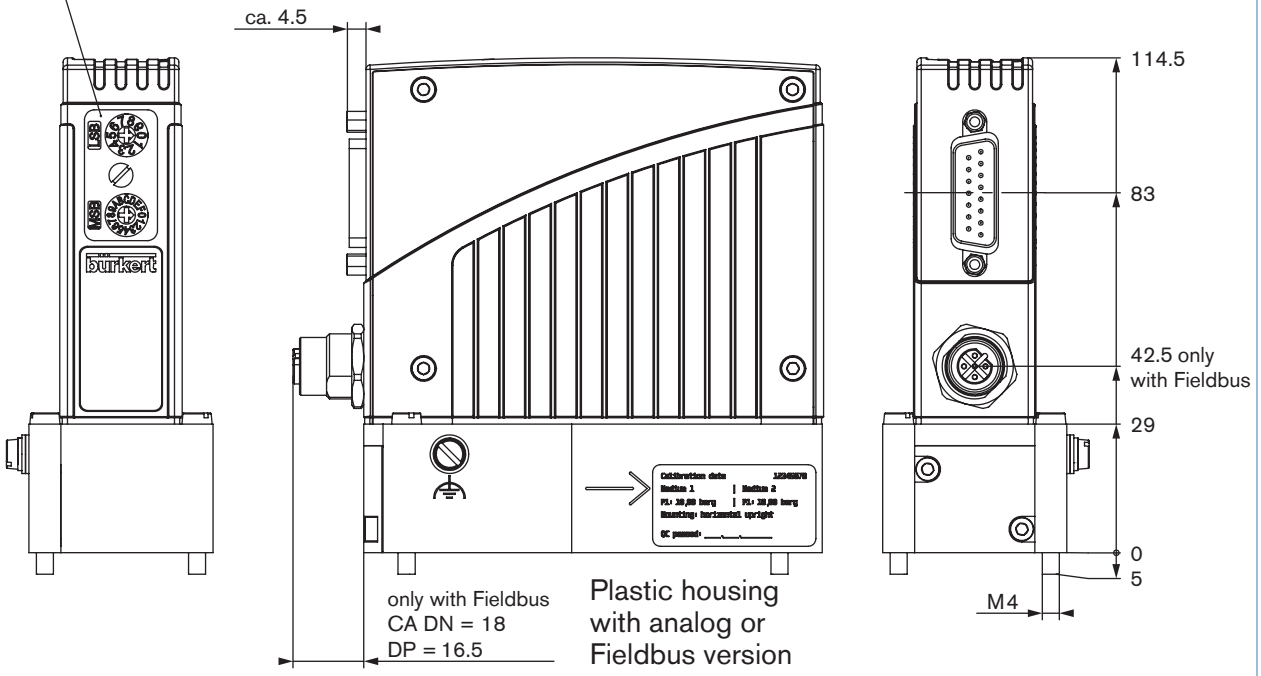


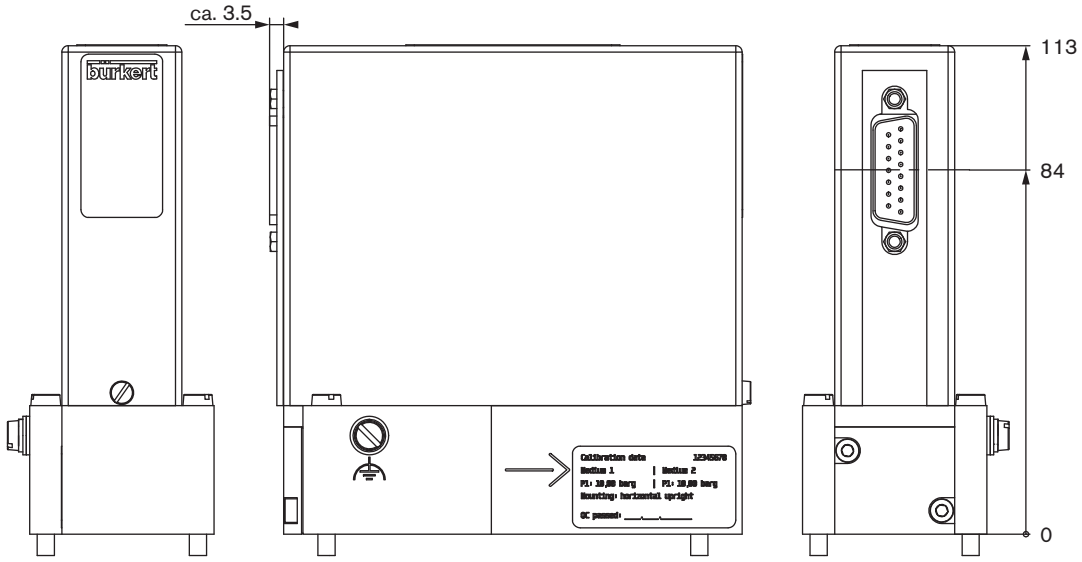


Dimensions [mm]

Subbase







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Note

You can fill out the fields directly in the PDF file before printing out the form.

MFC/MFM-applications – Request for quotation

Please complete and send to your nearest Bürkert sales centre

Company	Contact person
Customer No	Department
Address	Tel./Fax
Postcode/Town	E-mail

☐ MFC-Application ☐ MFM-Application ☐ Quantity ☐ Required delivery date

Medium data

Type of gas (or gas proportion in mixtures)

Density kg/m³ 7)

Gas temperature [°C or °F] °C °F

Moisture content g/m³

Abrasive components/solid particles ☐ no ☐ yes, as follows:

Fluidic data

Flow range Q_{nom} Min. / Max.

☐ l_N/min 7) ☐ l_S/min (slpm) 8)
☐ m_N^3/h 7) ☐ kg/h
☐ cm_N^3/min 7) ☐ cm_S^3/min (sccm) 8)
☐ l_N/h 7) ☐ l_S/h 8)

Inlet pressure at Q_{nom} 9) p_1= bar(g) ■

Outlet pressure at Q_{nom} p_2= bar(g) ■

Max. inlet pressure p_{1max} bar(g) ■

MFC/MFM port connection

☐ without screw-in fitting
- ☐ 1/4" G-thread (DIN ISO 228/1)
- ☐ 1/4" NPT-thread (ANSI B1.2)

☐ with screw-in fitting
- ☐ mm pipe (external Ø)
- ☐ inch pipe (external Ø)

☐ Flange version

Installation

☐ horizontal
☐ vertical, flow upwards ☐ vertical, flow downwards

Ambient temperature °C

Material data

Body	☐ Stainless steel	☐ Aluminium
Housing	☐ Plastic	☐ Metal (not with type 8712/8702 and not with fieldbus)
Seal	☐ FKM	☐ EPDM

Electrical data

Signals for set point and actual value

with standard signal

Setpoint	actual value
☐ 0-5 V	☐ 0-5 V
☐ 0-10 V	☐ 0-10 V
☐ 0-20 mA	☐ 0-20 mA
☐ 4-20 mA	☐ 4-20 mA

with fieldbus

☐ PROFIBUS DP
☐ DeviceNet
☐ CANopen

☐ M12
☐ D-Sub
(only for type 8712/8702)

■ Please quote all pressure values as overpressures with respect to atmospheric pressure bar(ü)

reset form

7) at: 1,013 bar(a) and 0°C 8) at: 1.013 bar (a) and 20°C 9) matches with calibration pressure

To find your nearest Bürkert facility, click on the orange box → www.buerkert.com

In case of special application conditions, please consult for advice.

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