burkert
FLUID CONTROL SYSTEMS

Mass Flow Controller (MFC) for Gases

- Bypass MFC with capillary technology for nominal flow rates from 5 ml_N/min to 15 l_N/min
- Applicable for aggressive gases
- Fieldbus option

Type 8710 can be combined with...

Type 8619
Multichannel program controllerr

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

Type 6013
2/2-way solenoid valve

Type 8710 controls the mass flow of gases through a sensor element which is not in direct contact with the gas itself. The measured value provided by the sensor (see the description on page 2) will be compared in the digital control electronics with the predefined set point according to the signal; if a control difference is present, the control value output to the proportional valve will be modified using a PI control algorithm. In this way, the mass flow can be maintained at a fixed value or a predefined profile can be followed, regardless of pressure variations or other changes in the system.

The control element, a proportional valve working at low friction, guarantees a high sensitivity and a excellent control characteristics of the unit. The MassFlowCommunicator software can be used for parameterisation and diagnosis.
Typical application areas are gas dosing or rather the production of gas mixtures in:

- Heat treating,
- Melting treatment,
- Environmental technology,
- Material coating

Technical data

Full scale ranges[1] (Q_{nom})	5 to 15000 ml_N/min[2] N_2 equivalent
Control range	1:50
Operating gases	Neutral, or aggressive gases
Calibration gas	Operating gas or air with conversion factor
Max. operating pressure (Inlet pressure)	10 bar (145 psi), depending on the orifice of the valve
Medium temperature	-10 to +70°C (-10 to +60°C for oxygen)
Ambient temperature	-10 to +50°C, others on request
Accuracy	±1.5% o.R. ±0.3% F.S. (after 30min. warm-up time)
Repeatability	±0.1% F.S.
Settling time ($t_{95\%}$)	<3 s
Materials Body Housing Seals	 Stainless steel PC (Polycarbonate) or metal FKM, EPDM, FFKM
Port connections	NPT 1/4, G 1/4, Screw-in fitting or sub-base, others on request
Control valve (proportional valve) Valve orifice k_{VS}-value	Normally closed 0.05 to 2.0 mm 0.00006 to 0.09 m^3/h
Electr. connection	D-Sub plug 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	Max. 3.5-10 W (depends on proportional vale)
Input signal Input impedance	0-5 V, 0-10 V, 0-20 mA or 4-20 mA > 20 kΩ (voltage), < 300 Ω (current)
Output signal Max. current (voltage output) Max. load (current output)	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 and 6
Total weight	ca. 850 g (stainless steel)
Mounting position	Horizontal or vertical
Light emitting diode display (default, other allocations possible)	Indication for Power, Limit (with analog signals) / Communication (with fieldbus), Error
Binary input (default, other functions possible)	Two 1. Start autotune 2. Not assigned
Binary output (default, other functions possible)	One relay-output for 1. setpoint not reached, Max. load: 25V, 1A, 25VA

[1] The nominal flow value is the max. flow value calibrated which can be controlled. 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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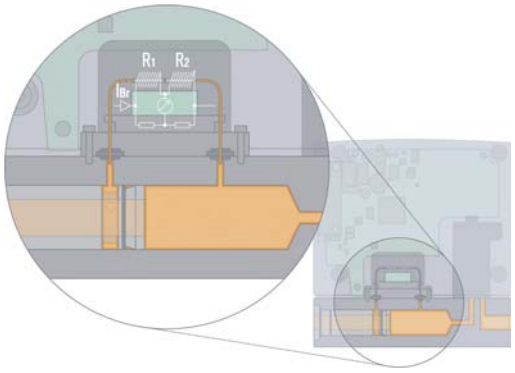
Measuring principle



The measurement is based on the bypass principle. A laminar flow element in the main channel generates a small pressure drop. This drives a small flow, proportional to the main flow, through the bypass (sensor tube).

Two heating resistors, which are connected in a measuring bridge, are wounded on this stainless steel tube. In the zero-flow state, the bridge is balanced, but with flow, heat is transported in the flow direction and the bridge becomes unbalanced.

The dynamics of the measurement is limited by the tube walls, which act as a thermal barrier. Through use of suitable software in the controller, response times are obtained (in the range of a few seconds) that are adequate for a wide range of applications.

With contaminated gases we recommend to install filter elements upstream. This avoids changes in the division ratio between main flow and sensor tube, as well as changes in the heat transmission caused by deposits on the walls of the sensor tube.

With these sensors even aggressive gases can be controlled, because all essential parts in contact with the gas are fabricated in stainless steel. With this sensor principle it is also possible to convert between different gases.

$Q(Gas) = f \times Q(N_2)$

gas	factor f
N_2	1.00
Luft	1.00
O_2	0.98
H_2	1.01
Ar	1.4
He	1.42
CO_2	0.77

By using the gas factors it is possible that the accuracy is not within the datasheet specification.
For applications which need high accuracy it is recommended to calibrate under application conditions.

The compatibility of the sealing materials of the MFCs should be checked before use with another gas.

Notes regarding the selection of the unit

For the proper choice of the actuator orifice within the MFC, not only the required maximum flow rate Q_{nom}, but also the pressure values *directly* before and after the MFC (p_1, p_2) at this flow rate Q_{nom} should be known. In general, these pressures are not the same as the overall inlet and outlet pressures of the whole plant, because usually there are additional flow resistors (tubing, additional shut-off valves, nozzles etc.) present both before and after the controller.

Please use the request for quotation form on p. 5 to indicate the pressures *directly* before and after the MFC. If these should be unknown or not accessible to a measurement, estimates are to be made by taking into account the approximate pressure drops over the flow resistors before and after the MFC, respectively, at a flow rate of Q_{nom}.
In addition, please quote the maximum inlet pressure p_{1max} to be encountered. This data is needed to make sure the actuator is able to provide a close-tight function within all the specified modes of operation.

The request for quotation form on page 7 contains the relevant fluid specification. Please use in this way the experience of Bürkert engineers already in the design phase and provide us with a copy of the request containing the data of your application together with your inquiry or order.

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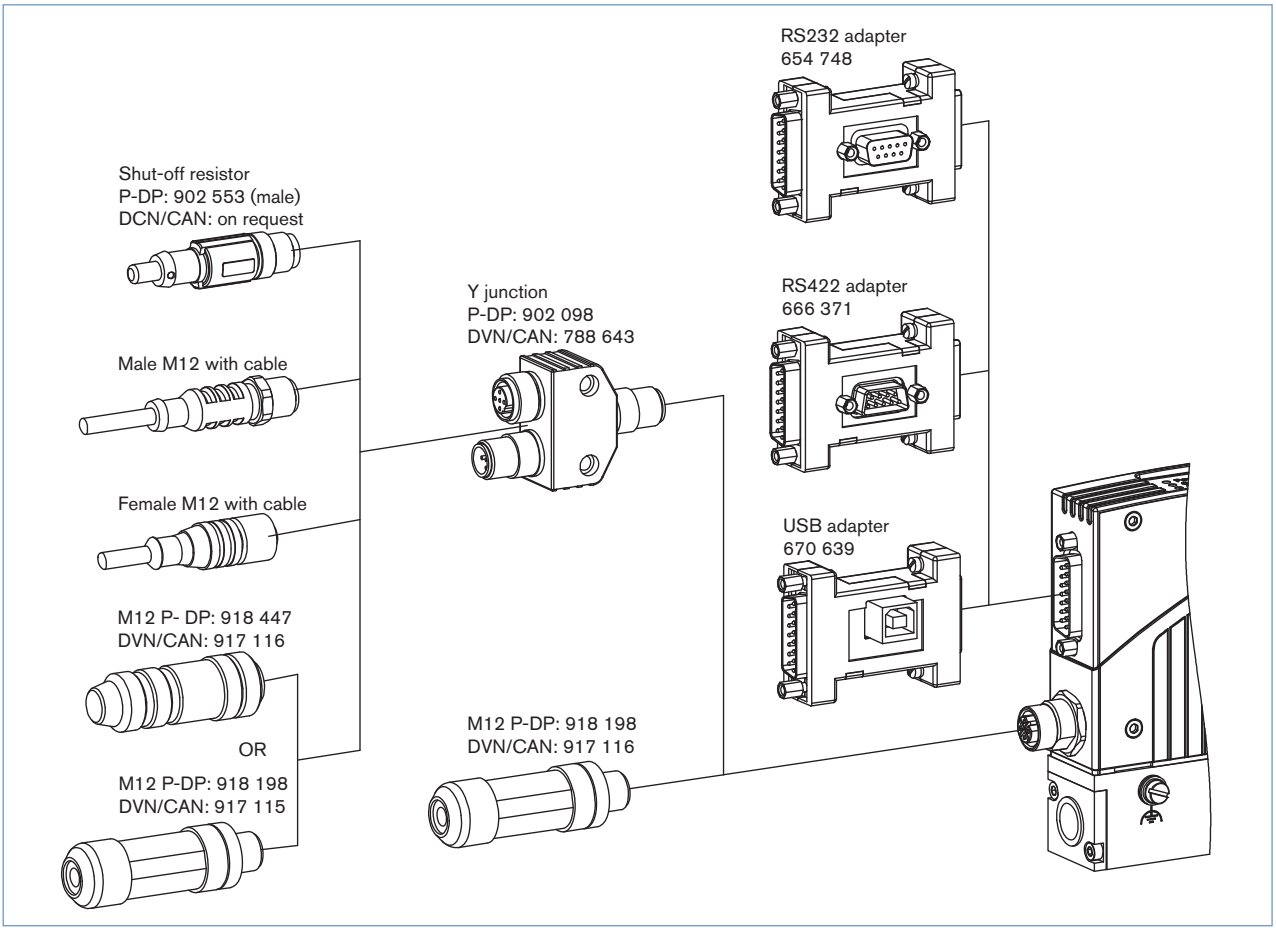
Ordering Chart for Accessories

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	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 (coupling) [4]	918 447	917 116
Y-junction [4]	902 098	788 643
Shut-off 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 connections needs to be a prefabricated cable which uses typically a thinner connector.



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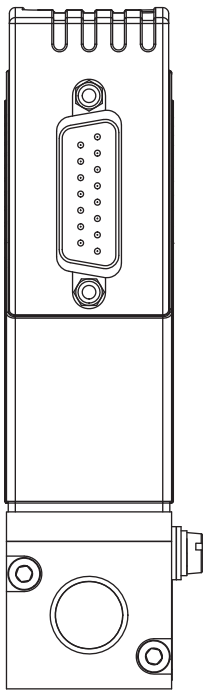
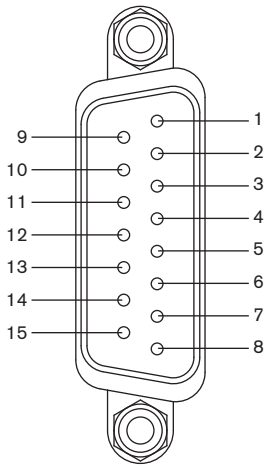
Pin Assignment



Plug D-Sub, 15-pin	Pin	Assignment	
		Analogue Control	Bus control
	1	Relay – normally closed	
	2	Relay – normally open	
	3	Relay – middle contact	
	4	GND for 24V-Supply and Binary inputs	
	5	24V-Supply +	
	6	Only for internal company use	
	7	Set value input GND	N.C. [5]
	8	Set value input +	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]	

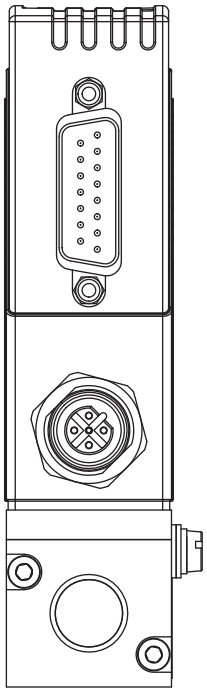


[5] N.C.: not connected (not used)

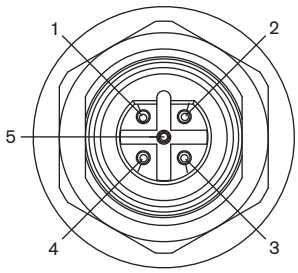
Note:
– Optional Pin 7 and 8 with bus version as transmitter input possible
– The cable length for RS232/ Setpoint and actual value signal is limited to 30 meters.

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

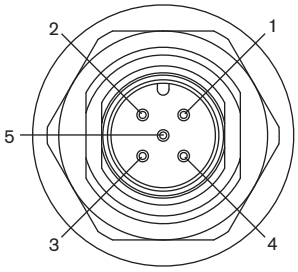
With Fieldbus Version:



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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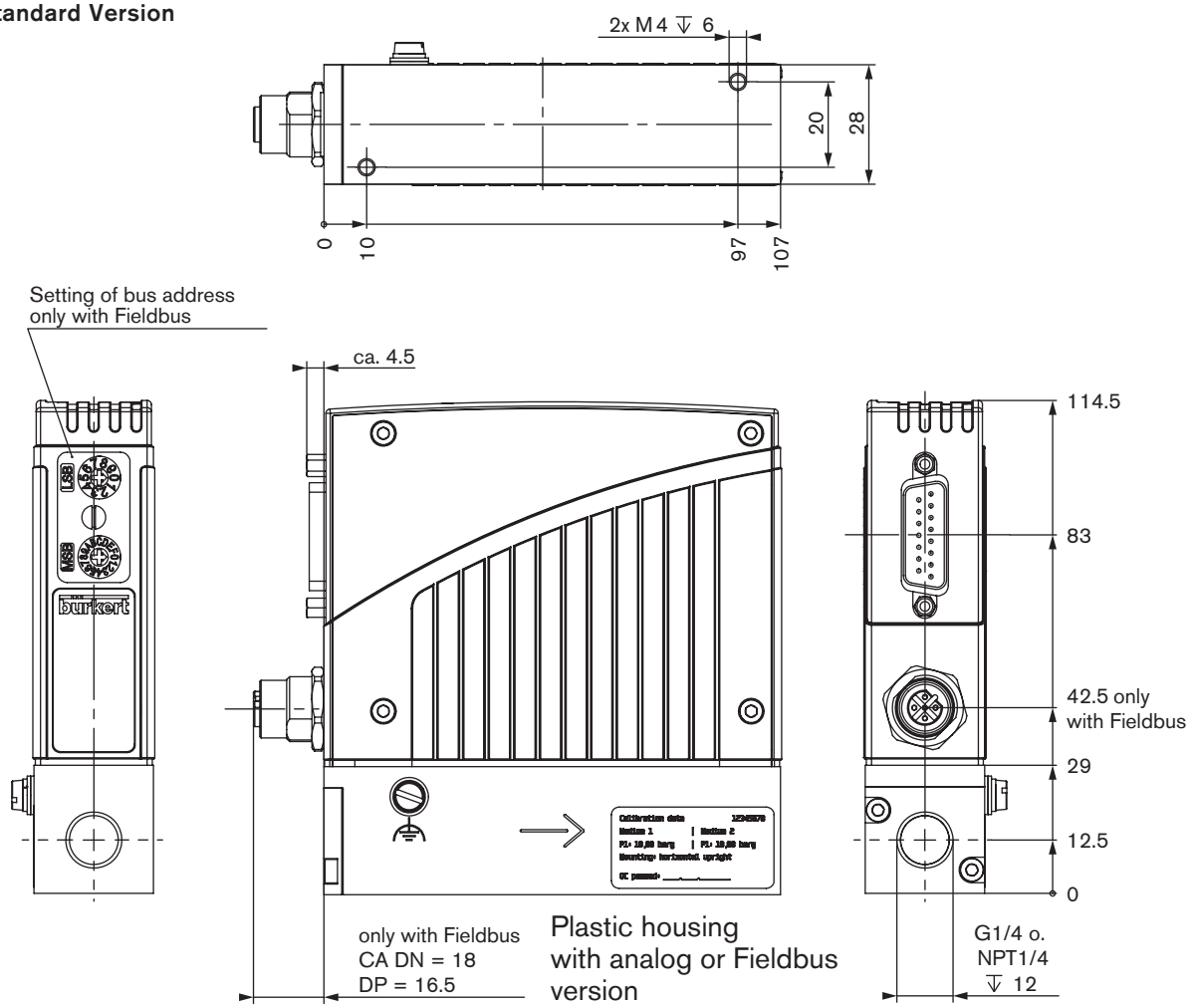
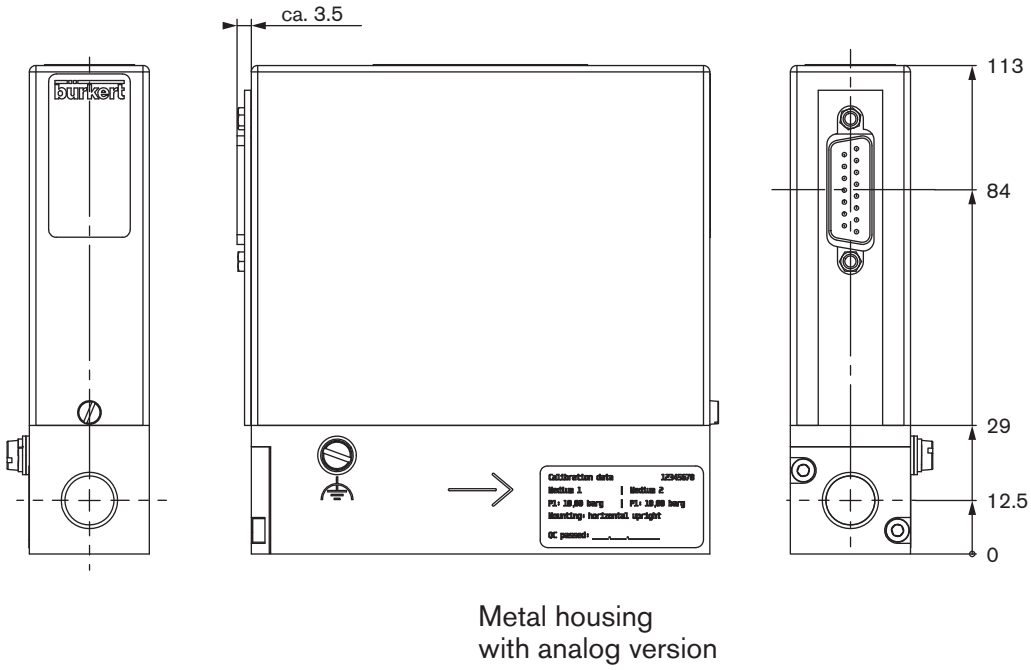
Dimensions [mm]

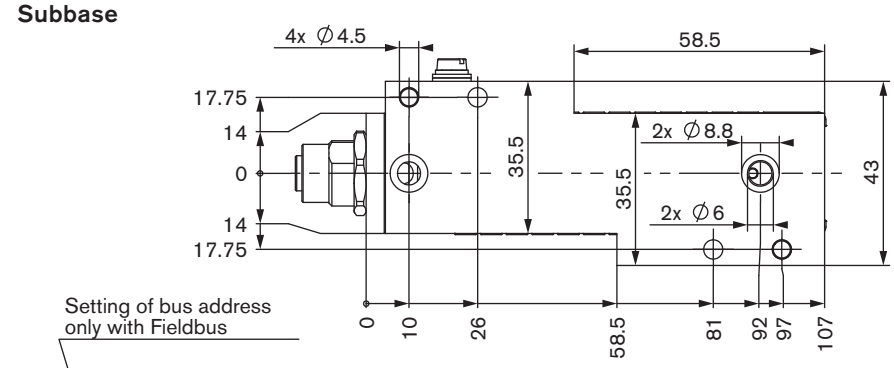
Standard Version

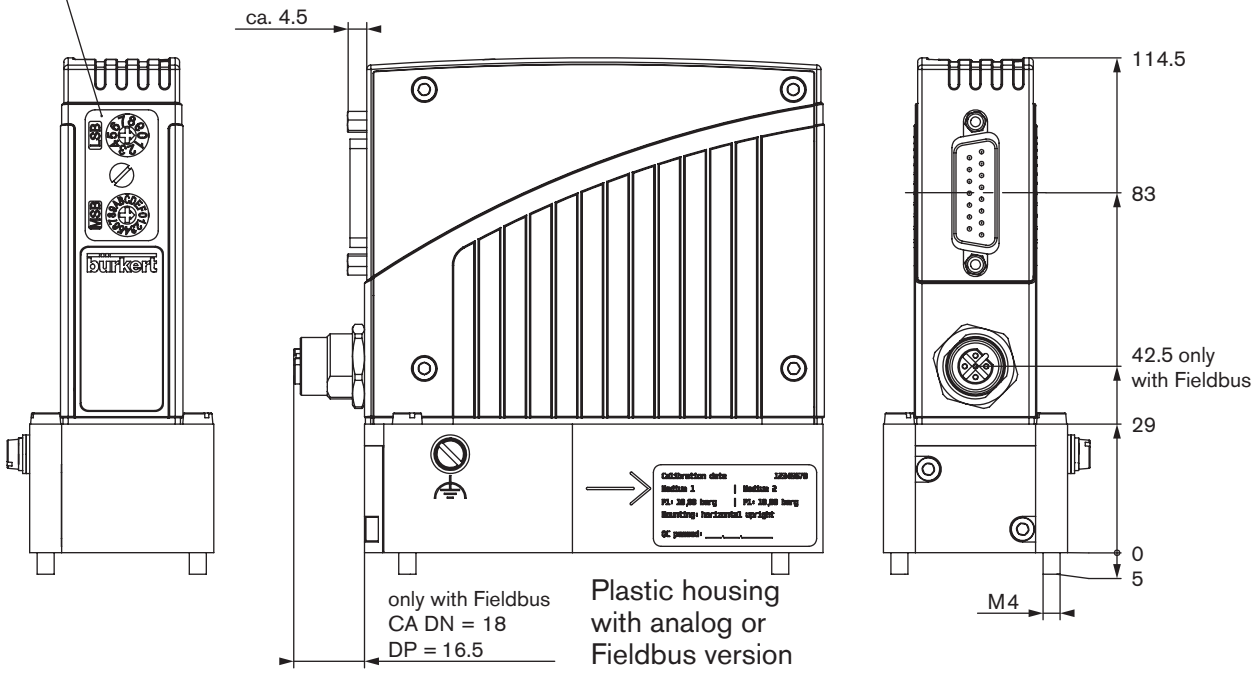


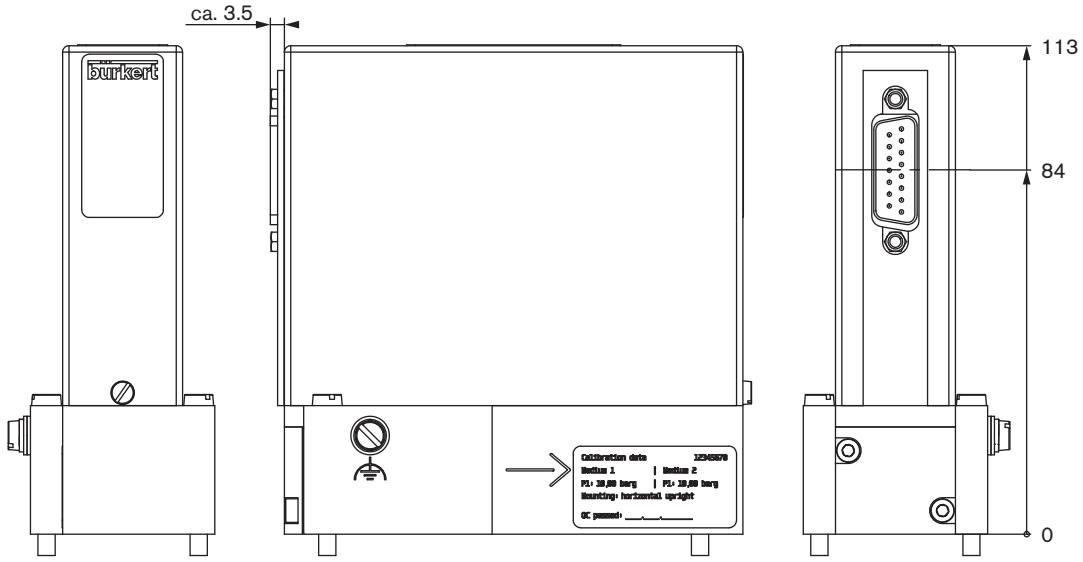


Dimensions [mm]

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 (acc. to specification for pipeline)
- mm Pipeline (external Ø)
- inch Pipeline (external Ø)

☐ Flange version

Installation

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

Ambient temperature °C

Material data

Body ☐ Stainless steel

Housing ☐ Plastic ☐ Metal (not with type 8712/8702 and not with fieldbus)

Seal ☐ FKM ☐ EPDM ☐ FFKM

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 ☐ M12
☐ DeviceNet ☐ D-Sub
☐ CANopen (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

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

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