



## Mass Flow Meter (MFM) for Gases

- Direct flow measurement for nominal flow rates from 10 ml<sub>N</sub>/min to 80 l<sub>N</sub>/min (N<sub>2</sub>) in MEMS technology
- High accuracy and repeatability
- Protection class IP65
- Optional field bus

Type 8702 can be combined with...



**Type 8619**

Multichannel  
program controller



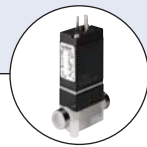
**Type 0330**

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 of the pressure and the temperature.

The digital mass flow meter Type 8702 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 fast response time of the MFM is reached. The actual flow is given as an analog output signal or could be read out over fieldbus communication.

Type 8702 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
- Packaging and foodstuff industry
- Environmental technology
- Pharmaceutical
- Biotechnology

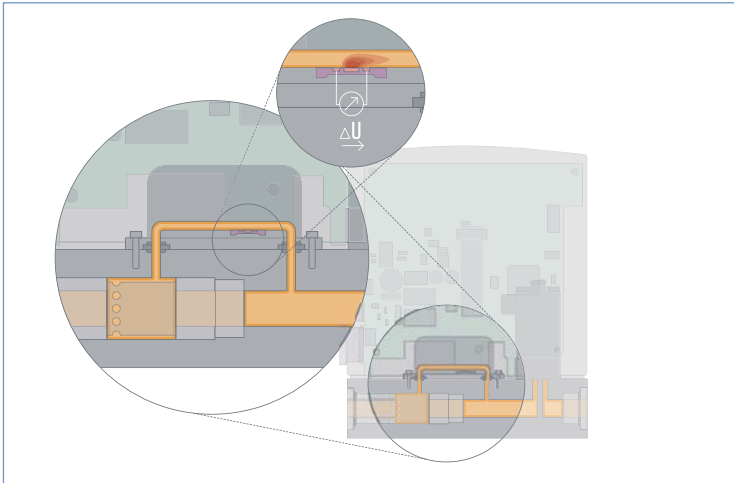
Technische Daten			
<b>Nominal flow range</b> <sup>1)</sup> (Q <sub>nom</sub> )	0.01 to 80 l <sub>N</sub> /min <sup>2)</sup> (ref. to N <sub>2</sub> )	<b>Power consumption</b>	max. 2.5 W (analog communicator) to 5 W (digital communicator)
<b>Turn-down ratio</b>	1:50, wider span on request	<b>Output signal</b> (signal output) Max. current, volt. output Max. load, current output	0–5 V, 0–10 V, 0–20 mA or 4–20 mA 10 mA 600 Ω
<b>Operating gas</b>	Neutral, non-contaminated gases, others available on request	<b>Digital communication</b> via adapter possible:	RS232, Modbus RTU (via RS interface) RS485, RS422 or USB (see accessories table on p. 3)
<b>Calibration gas</b>	Operating gas or air with correcting function	<b>Fieldbus option</b>	PROFIBUS-DP, DeviceNet, CANopen (D-Sub HD15 covered with sealed plate with fieldbus MFC)
<b>Max. operating pressure</b> (Inlet pressure)	Up to max. 10 bar (145psi), depending on the orifice of the valve	<b>Type of protection</b> (with connected cables)	IP65
<b>Gas temperature</b>	-10 to +70°C (-10 to +60°C with oxygen)	<b>Dimensions [mm]</b> (without fitting)	See drawings on p. 7–8
<b>Ambient temperature</b>	-10 to +50°C	<b>Total weight</b>	1000 g
<b>Accuracy</b> (after 1 min warm up time)	±0.8% o.R. ±0.3% F.S. (o.R.; F.S.: of full scale)	<b>Mounting position</b>	Horizontal or vertical
<b>Repeatability</b>	±0.1% F.S.	<b>Light emitting diodes</b> (Default, other functions program- mable)	Indication for Power, Communication, Limit, Error
<b>Settling time</b> (t <sub>95%</sub> )	<300ms	<b>Binary inputs</b> (Default, other functions program- mable)	Three various functions programmable
<b>Materials</b>	Body Stainless steel Housing PC (Polycarbonate) Seals FKM, EPDM (others on request)	<b>Binary outputs</b> (Default, other functions program- mable)	Two relay outputs 1. Limit (Q <sub>nom</sub> almost reached) 2. Error (i.e. sensor fault) Load capacity: max. 60 V, 1 A, 60 VA
<b>Port connection</b>	G 1/4", NPT 1/4" or compression fitting		
<b>Electr. connection</b>	Socket M16, round, 8-pin and socket D-Sub HD15, 15-pin With PROFIBUS-DP: Socket M12 5-pin (for IP65) or D-Sub 9-pin With DeviceNet/CANopen: Plug M12 5-pin (for IP65) or D-Sub 9-pin		
Additionally with fieldbus:			
<b>Operating voltage</b>	24V DC		
<b>Voltage tolerance</b>	±10%		
<b>Residual ripple</b>	<2%		

<sup>1)</sup> 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.

<sup>2)</sup> 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.

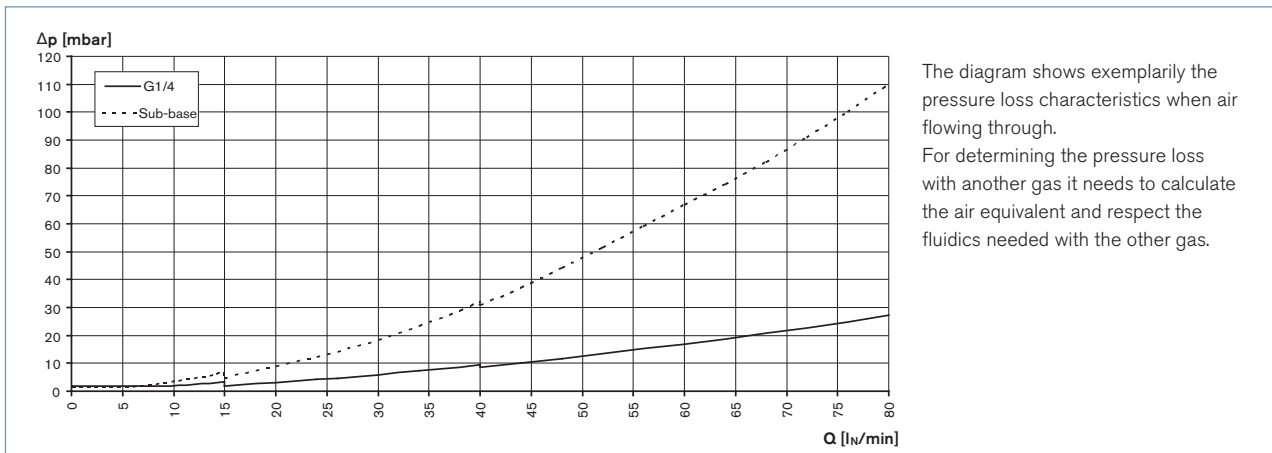
## Measuring Principle



The actual flow rate is detected directly by a sensor placed in a bypass channel. This operates according to a thermal principle which has the advantage of providing the mass flow which is independent of 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 <sub>N</sub> /min]	Max. $Q_{nom}$ [l <sub>N</sub> /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.

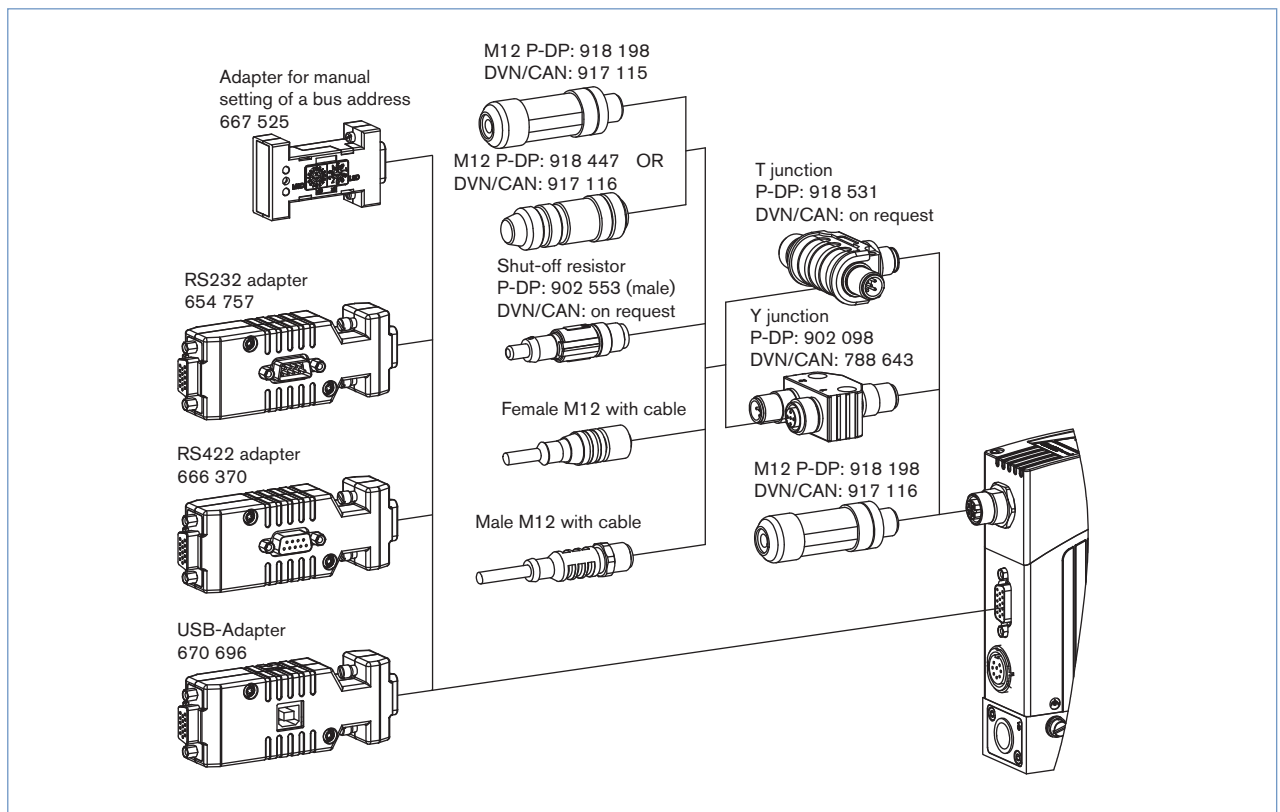
▶ Please use the form on page 8 for the information about your specific requirements..

Ordering Chart for Accessories

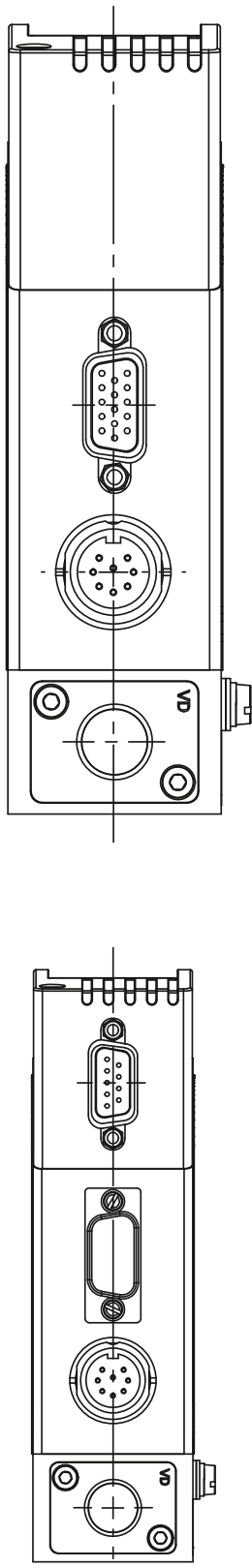
Article	Item No.	
<b>Connectors/Cables</b>		
Round plug M16 8-pin (solder connection)	918 299	
Round plug M16 8-pin with 5m cable	787 733	
Round plug M16 8-pin with 10m cable	787 734	
Plug D-Sub HD15 15-pin with 5m cable	787 735	
Plug D-Sub HD15 15-pin with 10m cable	787 736	
<b>Adapters <sup>3)</sup></b>		
RS232 adapter for connection to a computer, connection with an extension cable (item no. 917 039)	654 757	
Extension cable for RS232 9-pin socket/plug 2 m	917 039	
RS422-Adapter (RS485 compatible)	666 370	
USB-Adapter (Version 1.1, USB socket type B)	670 696	
USB connection cable 2 m	772 299	
Adapter for manual setting of bus address	667 525	
Software MassFlowCommunicator	Download unter <a href="http://www.buerkert.com">www.buerkert.com</a>	
<b>Accessories for Fieldbus</b>	<b>PROFIBUS DP (B-codiert)</b>	<b>DeviceNet/ CAN-open (A-codiert)</b>
M12-Plug <sup>4)</sup>	918 198	917 115
M12-socket (coupling) <sup>4)</sup>	918 447	917 116
Y-junction <sup>4)</sup>	902 098	788 643
T-junction	918 531	(auf Anfrage)
Shut-off resistor	902 553	(auf Anfrage)
GSD-Datei (PROFIBUS), EDS-Datei (DeviceNet, CANopen)	Download unter <a href="http://www.buerkert.com">www.buerkert.com</a> (unter Typ 8712)	

<sup>3)</sup> The adapters serve mainly for initial operation or diagnosis. Those are not obligatory for continuous operation.

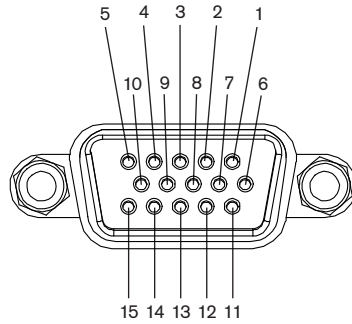
<sup>4)</sup> The two M12 connectors as listed above cannot be used together on the same side of the Y-junction. At least one of the two M12 connection needs to be a prefabricated cable which uses typically a thinner connector.



Pin Assignment



Socket D-Sub HD15



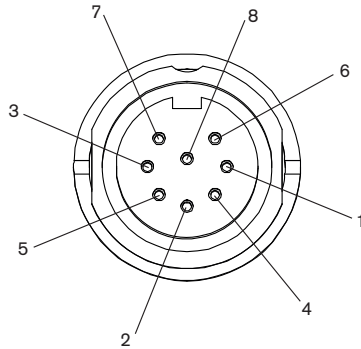
Pin	Assignment	
	Analogue Control	Bus control
1	N.C.	N.C. <sup>5)</sup>
2	N.C.	N.C.
3	Actual value output +	N.C.
4	Binary input 2	
5	12V-Output (only for internal company use)	
6	RS232 TxD (direct connection to computer)	
7	Binary input 1	
8	GND (for binary inputs)	
9	only company internal use (do not connect!)	
10	12V-Output (only for internal company use)	
11	12V-Output (only for internal company use)	
12	Binary input 3	
13	Actual value output GND	N.C.
14	RS232 RxD (direct connection to computer)	
15	DGND (for RS232-interface)	

<sup>5)</sup>N.C.: not connected (not used)

Note:

- Optional Pin 1 and 2 with bus version as transmitter input possible
- The cable length for RS232/ flow value signal is limited to 30 meters.

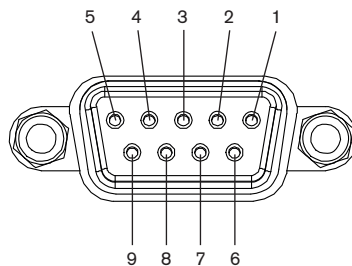
Socket M16, round, 8-pin



Pin	Assignment
1	24V-Supply +
2	Relay 1 – reference contact
3	Relay 2 – reference contact
4	Relay 1 – normally closed contact
5	Relay 1 – normally open contact
6	24V-Supply GND
7	Relay 2 – normally open contact
8	Relay 2 – normally closed contact

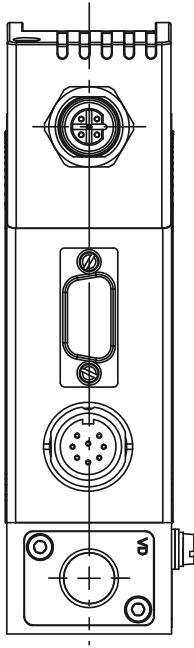
Socket D-Sub 9-pin

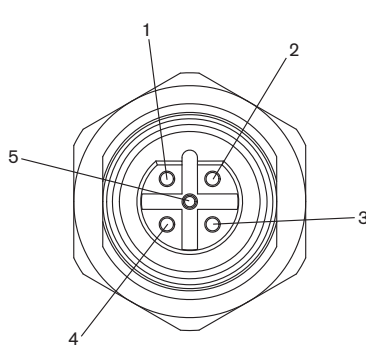
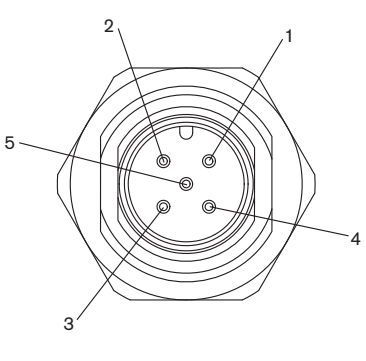
(only with fieldbus version)



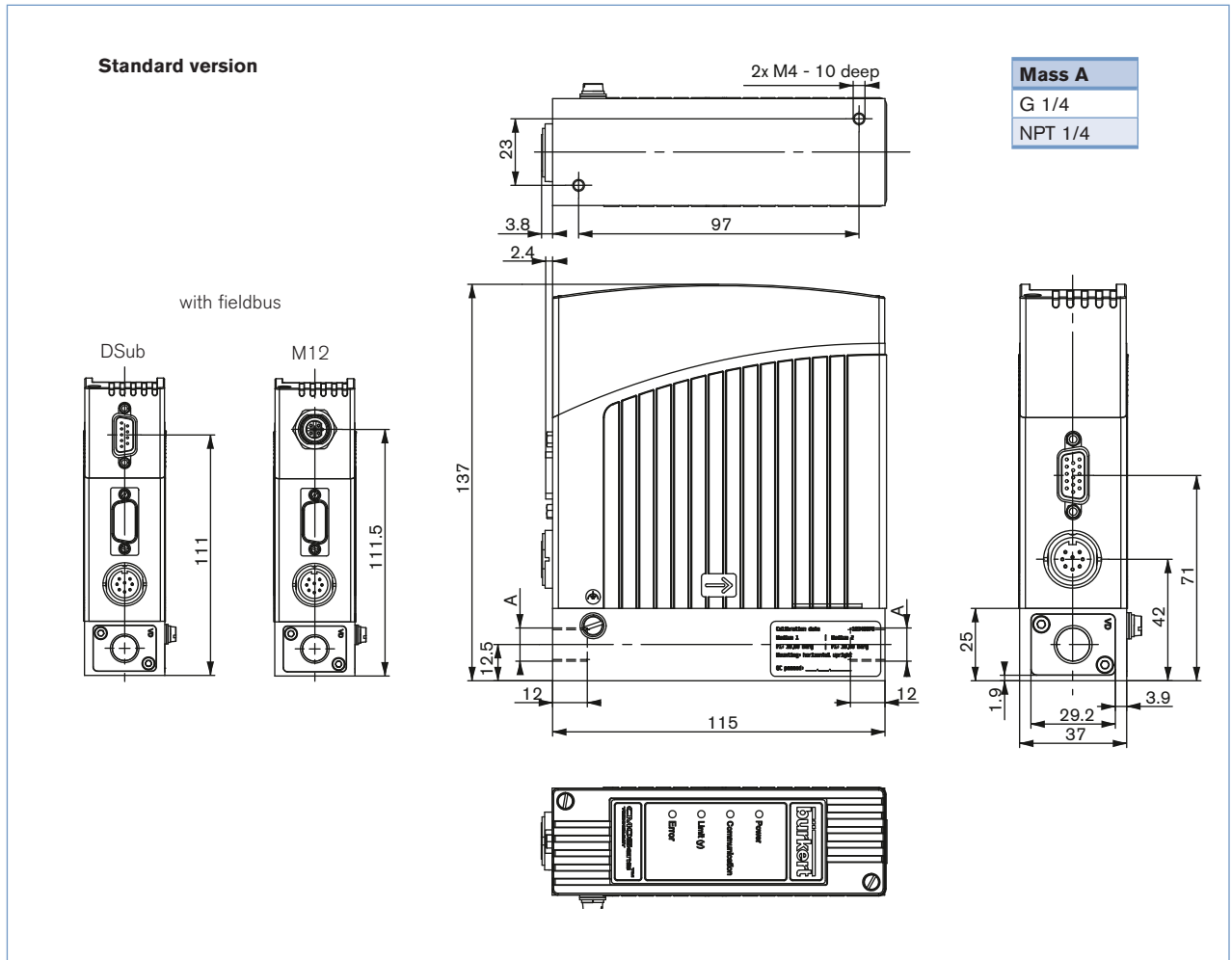
Pin	Assignment	
	PROFIBUS DP	DeviceNet/ CANopen
1	Shield	Shield
2	N.C.	CAN-L data line
3	RxD/TxD - P (B-line)	GND
4	RTS (control signal for repeater)	N.C.
5	GND	N.C.
6	VDD (only for termination resistor)	N.C.
7	N.C.	CAN-H data line
8	RxD/TxD - N (A-line)	N.C.
9	N.C.	N.C.

Pin Assignment (continued)

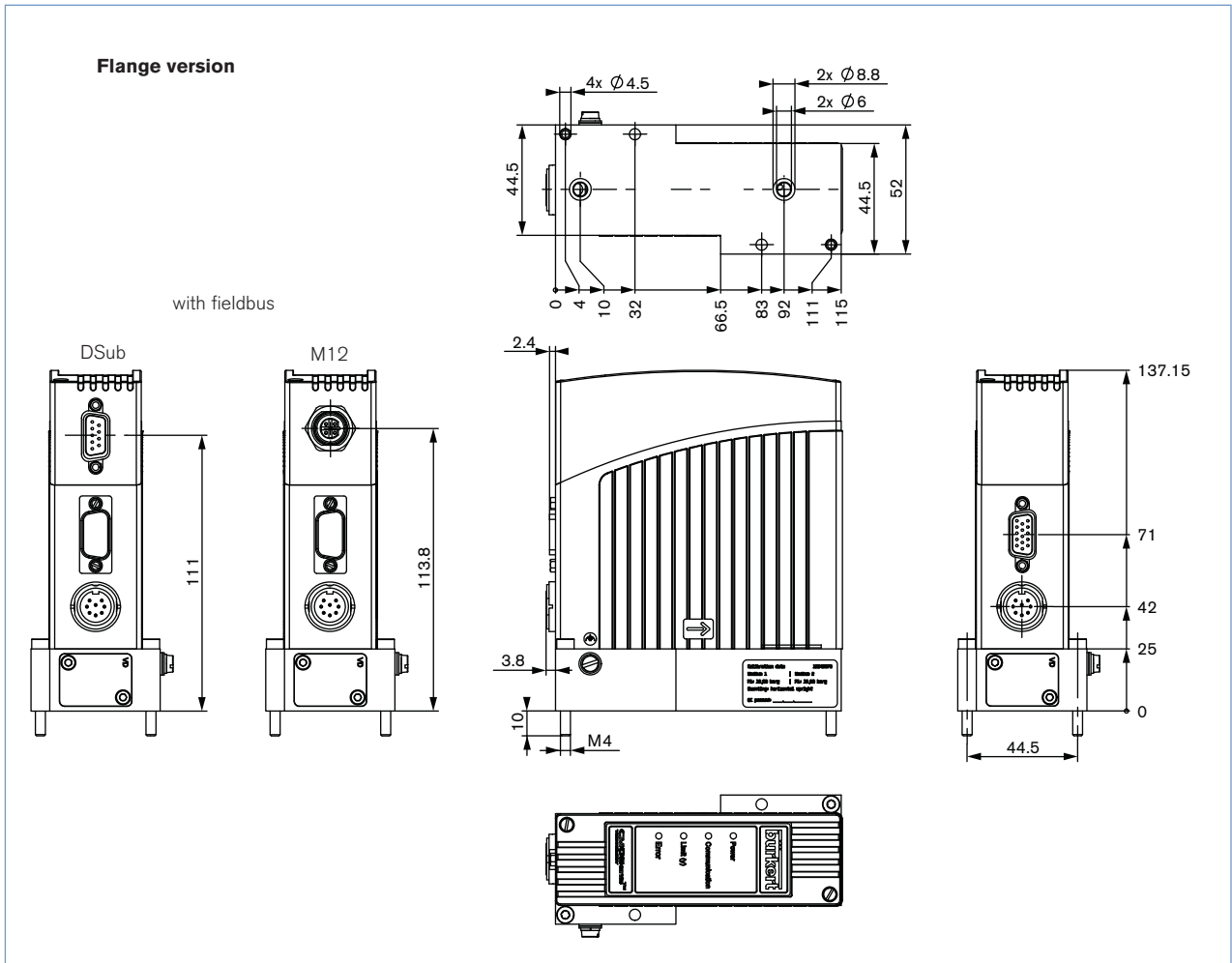


PROFIBUS DP – socket B-coded M12 (DPV1 max. 12 Mbaud)	Pin	Assignment
	1	VDD (only for termination resistor)
	2	RxD/TxD – N (A-line)
	3	DGND
	4	RxD/TxD – P (B-line)
	5	N.C.
DeviceNet/ CANopen – Plug A-coded M12	Pin	Assignment
	1	Shield
	2	N.C. <sup>6)</sup>
	3	DGND
	4	CAN_H
	5	CAN_L
		<sup>6)</sup> Optional configuration with 24V DC possible for power supply via fieldbus connector. With this no power supply connection on round M16 plug needed.

Dimensions [mm]



Dimensions [mm] (continued)



**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/m<sup>3</sup> <sup>7)</sup>

Gas temperature [°C or °F]  °C     °F

Moisture content  g/m<sup>3</sup>

Abrasive components/solid particles  no     yes, as follows:

**Fluidic data**

Flow range Q<sub>nom</sub>  Min.     l<sub>N</sub>/min <sup>7)</sup>     l<sub>S</sub>/min (slpm) <sup>8)</sup>  
 Max.     m<sub>N</sub><sup>3</sup>/h <sup>7)</sup>     kg/h  
 cm<sub>N</sub><sup>3</sup>/min <sup>7)</sup>     cm<sub>S</sub><sup>3</sup>/min (sccm) <sup>8)</sup>  
 l<sub>N</sub>/h <sup>7)</sup>     l<sub>S</sub>/h <sup>8)</sup>

Inlet pressure at Q<sub>nom</sub> <sup>9)</sup>    p<sub>1</sub> =  bar(g) ■

Outlet pressure at Q<sub>nom</sub>    p<sub>2</sub> =  bar(g) ■

Max. inlet pressure P<sub>1max</sub>     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  Aluminium     Stainless steel

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

Seal  FKM     EPDM

**Electrical data**

Signals for set point and actual value	<b>with standard signal</b>		<b>with fieldbus</b>	
	Setpoint	actual value		
	<input type="checkbox"/> 0-5 V	<input type="checkbox"/> 0-5 V	<input type="checkbox"/> PROFIBUS DP	<input type="checkbox"/> M12
	<input type="checkbox"/> 0-10 V	<input type="checkbox"/> 0-10 V	<input type="checkbox"/> DeviceNet	<input type="checkbox"/> D-Sub
	<input type="checkbox"/> 0-20 mA	<input type="checkbox"/> 0-20 mA	<input type="checkbox"/> CANopen	(only for type 8712/8702)
	<input type="checkbox"/> 4-20 mA			

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