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FLUID CONTROL SYSTEMS

Mass Flow Meter (MFM)

- Nominal flow ranges from 20 lN/min up to 2500 lN/min

- High accuracy

- Fast response time

- Protection class IP65

- Optional: Fieldbus interface

Type 8006 can be combined with…

Type 8619
Multichannel program controller

Type 0330
3/2-way valve

Type 6013
2/2-way valve

The mass flow meter (MFM) type 8006 is suited for measuring the mass flow of high gas flows. The thermal inline sensor is located directly in the gas stream and therefore reaches very fast response times.

Type 8006 can optionally be calibrated for two different gases; the user can switch between these two gases. As electrical interfaces both, analog standard signals and fieldbuses are available.

The MFM type 8006 is especially designed for use in harsh environments due to a low sensitivity to contamination and the high protection class.

Technical Data			
Nominal flow range [1] **(Q_{nom})**	20 to 2500 l_N/min [2], N_2 equivalent see table on page 2, higher flows on request	**Port connection**	G 1/4, 3/8, 1/2, 3/4, 1 NPT 1/4, 3/8, 1/2, 3/4, 1 With compression fittings (see p. 7)
Turn-down ratio	1:50 [3]		
Operating gas	Neutral, non-contaminated gases, others available on request	**Electr. connection** Additionally with:	Socket M16, round, 8-pin and socket D-Sub HD15, 15-pin
Calibration gas	Operating gas or air with correcting function	-PROFIBUS-DP:	Socket M12 5-pin or D-Sub 9-pin
Max. operating pressure (Inlet pressure)	10 bar, up to 25 bar (N_2, air, argon)	-DeviceNet/CANopen: with RS485 version only:	Plug M12 5-pin or D-Sub 9-pin Plug D-Sub 9-pin
Gas temperature	-10 to +70°C (-10 to +60°C with oxygen)	**Operating voltage**	24V DC
Ambient temperature	-10 to +45°C (higher temperatures on request)	**Voltage tolerance**	±10%
		Residual ripple	< 2%
Accuracy (after 15 min warm up time)	±1.5% o.R. ±0.3% F.S. (o.R.: of reading; F.S.: of full scale)	**Power consumption**	3,5 - 10 W, with fieldbus: 4 -12,5 W (acc. to the version)
Repeatability	±0.1% F.S.	**Type of protection** (with connected cables)	IP65
Response time ($t_{95\%}$)	<500 ms		
Materials		**Dimensions**	See drawings on p. 6
Body	Aluminium (black anodized) or stainless steel	**Total weight** (Example standard block)	1.2 kg (Al) 3.0 kg (VA)
Housing	Aluminium (coated)	**Mounting position**	Horizontal or vertical
Seals	FKM, EPDM	**Light emitting diodes** (Default, other functions programmable)	Indication for 1. Power 3. Limit 2. Communication 4. Error

[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.
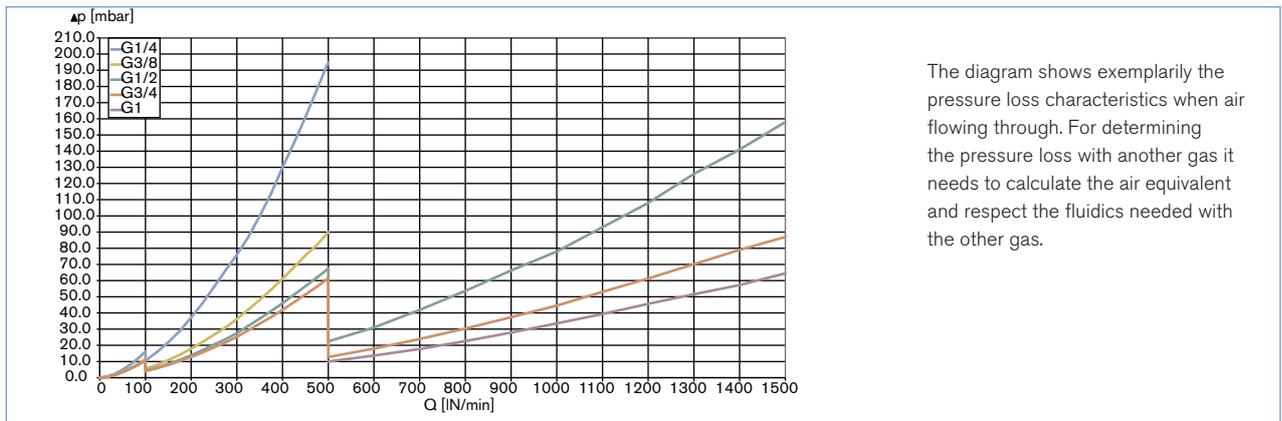[2] Index N: Flow rates referred to 1.013 bar and 0° C.
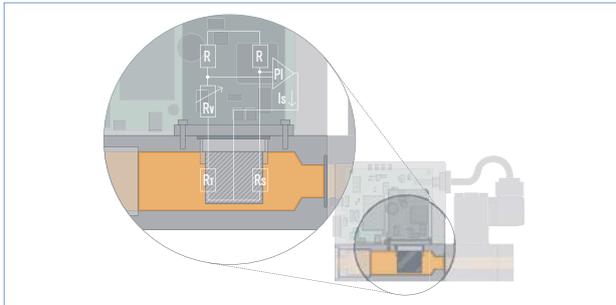 Alternatively there is an Index S available which refers to 1.013 bar and 20° C
[3] With vertical installation and flow downwards the turn-down ratio is 1:10

Technical Data *(cont.)*

Device variant	Analog signal version	Fieldbus version	RS485 version (only D-Sub, 9-pin)
Analog communication Output signal (actual flow) 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	None	None
Fieldbus option (D-Sub HD15 covered with sealed plate for, pins for analogue inputs/outputs not connected)	None	PROFIBUS-DP, DeviceNet, CANopen	Modbus RTU (via RS interface)
Digital communication via adapter possible:	RS232 (supports Modbus RTU) RS485, RS422 or USB		RS485, RS422 USB
Binary inputs (Default, other functions programmable)	Three: 1. not assigned 2. not assigned 3. not assigned		One: not assigned
Binary outputs (Default, other functions programmable)	Two relay outputs 1. Limit (Q_{Nom} almost reached) 2. Error (e.g. sensor fault) Load capacity: max. 60 V, 1 A, 60 VA		One relay output 1. Limit (Q_{Nom} almost reached) Load capacity: max. 25 V, 1 A, 25 VA

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.

Measuring Principle

This sensor works as a hot-film anemometer in the so-called CTA operational mode (Constant Temperature Anemometer). To do this, two resistors with precisely specified temperature coefficients located directly in the media flow and three resistors located outside the flow are connected together to form a bridge.
The first resistor in the gas flow (R_T) measures the fluid temperature, while the second, low-value resistor (R_S) is heated so that it is maintained at a fixed, predefined over-temperature with respect to the fluid temperature.

Nominal Flow Ranges of Typical Gases
(Other gases on request)

Gas	Min. Q_{nom} [I_N/min]	Max. Q_{nom} [I_N/min]
Acetylene	20	975
Ammonia	20	1250
Argon	20	1500
Carbon dioxide	20	800
Air	20	2500
Methane	20	750
Propane	20	400
Oxygen	20	2500
Nitrogen	20	2500

The heating current required to maintain this is a measure of the heat being removed by the flowing gas, and represents the primary measurement.

An adequate flow conditioning within the MFM and the calibration with high-quality flow standards ensure that the mass of gas flowing per time unit can be derived from the primary signal with high accuracy.

Notes Regarding the Configuration

The decisive factors for the perfect functioning of an MFM within the application are the fluid compatibility, the max. 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 questionnaire on page 7 contains the relevant fluid specification. Please use in this way the experience of Burkert engineers already in the design phase and provide us with a copy of the questionnaire containing the data of your application together with your inquiry or order.**

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Ordering Chart for Accessories

Article	Item No.
Connectors / Cables	
Round plug M16 8-pin (Solder connection)	918 299
Round plug M16 8-pin with 5 m cable	787 733
Round plug M16 8-pin with 1 0 m 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
Adapters [4]	
RS232 adapter for connection to a computer, connection with an extension cable (Item no. 917039)	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 bus adresse settings (instad of SW)	667 525
Software MassFlowCommunicator	Download from www.buerkert.com

| Accessories for Fieldbus	PROFIBUS DP (B-coded)	DeviceNet/ CANopen (A-coded)
M12-Plug [5]	918 198	917 115
M12-socket [5]	918 447	917 116
Y-junction [5]	902 098	788 643
T-junction	918 531	(on request)
Terminating resistor	902 553	(on request)
GSD-File (PROFIBUS), EDS-File (DeviceNet, CANopen)	Download from www.buerkert.com	

[4] The adapters serve mainly for initial operation or diagnosis. Those are not obligatory for continuous operation.

[5] 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.
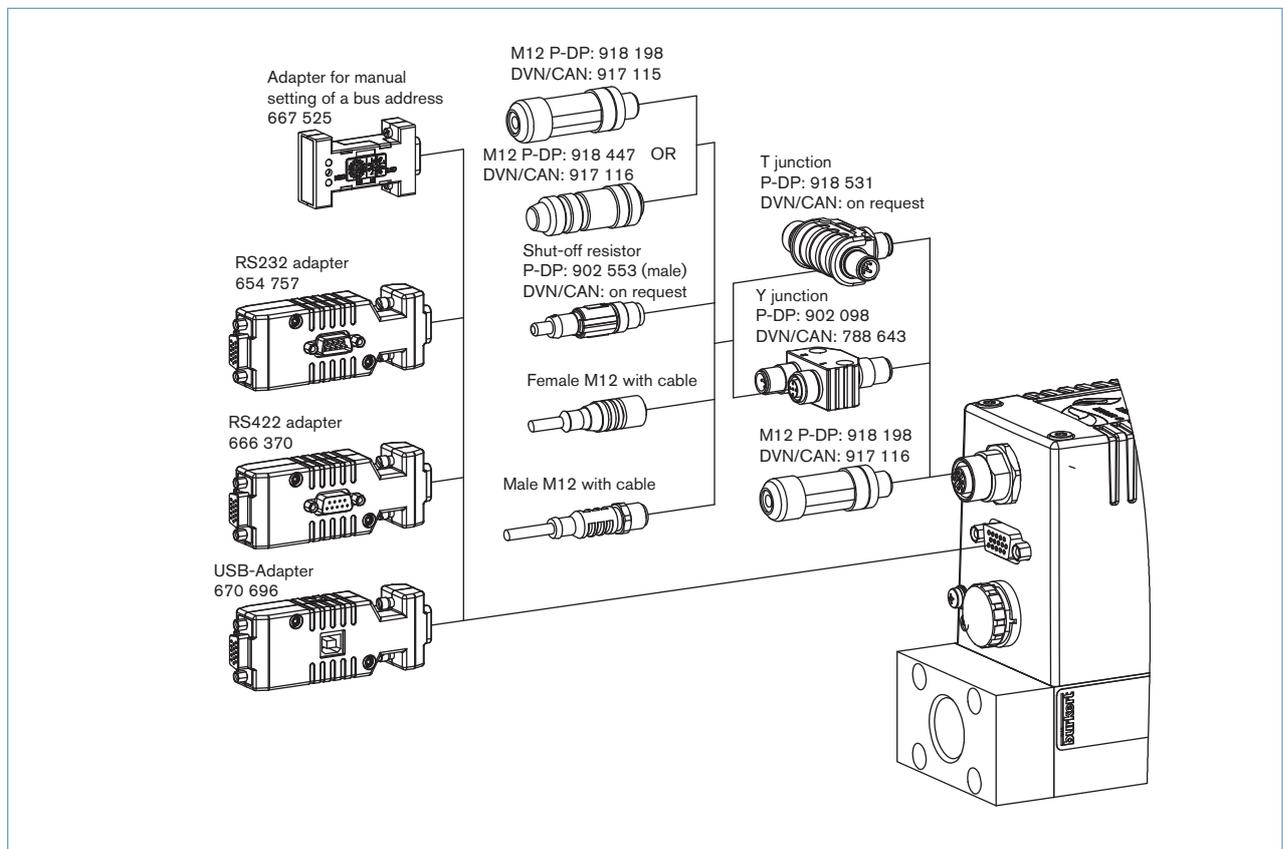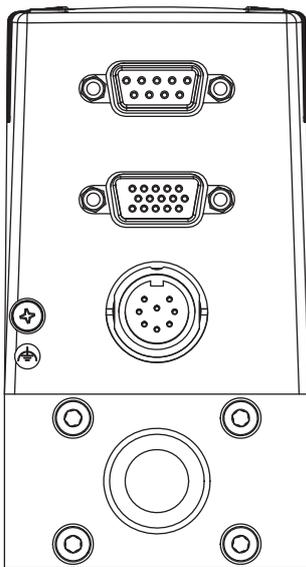
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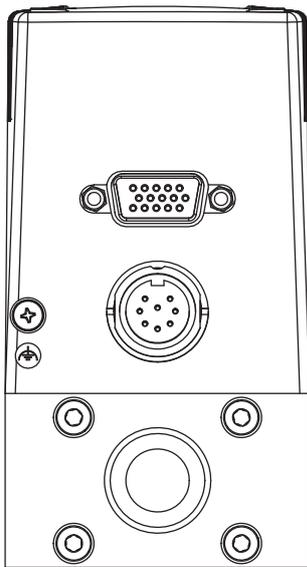
Pin Assignment

Standard

Fieldbus D-SUB
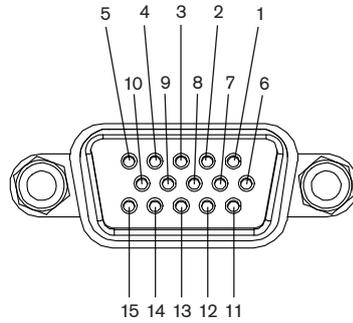
Socket D-Sub HD15	Pin	Assignment	
		Analog Version	**Bus Version**
	1	N.C. [6]	N.C.
	2	N.C.	N.C.
	3	Actual value output +	N.C.
	4	Binary input 2	
	5	12V-Output (only for factory use)	
	6	RS232 TxD (direct connection to computer)	
	7	Binary input 1	
	8	GND (for binary inputs)	
	9	only for factory use (do not connect!)	
	10	12V-Output (only for factory use)	
	11	12V-Output (only for factory use)	
	12	Binary input 3	
	13	Actual value output GND	N.C.
	14	RS232 RxD (direct connection to computer)	
	15	DGND (for RS232-interface)	

[6] N.C.: not connected (not used)
Note:
– Optional Pin 1 and 2 with bus version as transmitter input possible
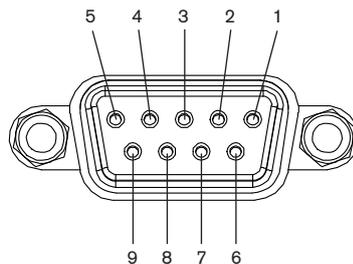– The cable length for RS232/ Setpoint and flow value signal is limited to 30 meters.
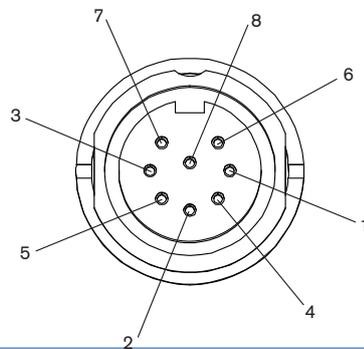
Socket M16, round, 8-pin	Pin	Assignment
	1	24V-Supply +
	2	Relay 1 – reference contact
	3	Relay 2 – reference contact
	4	Relay 1 – Normally closed contact
	5	Relay 1 – Normally open contact
	6	24V-Supply GND
	7	Relay 2 – Normally open contact
	8	Relay 2 – Normally closed contact

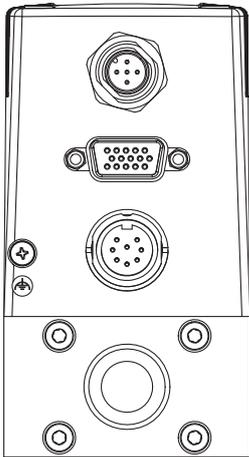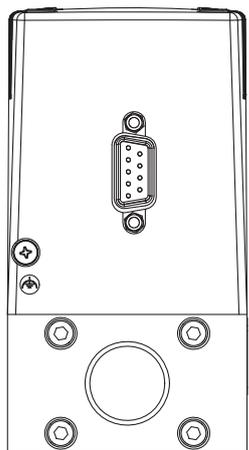| Socket D-Sub 9-pin (only with fieldbus version)	Pin	Assignment	
		PROFIBUS DP	**DeviceNet/ CANopen**
	1	Shield	Shield
	2	N.C.	CAN-L data line
	3	RxD/TxD - P (B-line)	GND
	4	RTS (control signal for repeater)	N.C.
	5	GND	N.C.
	6	VDD (only for termination resistor)	N.C.
	7	N.C.	CAN-H data line
	8	RxD/TxD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

Pin Assignment *(continued)*
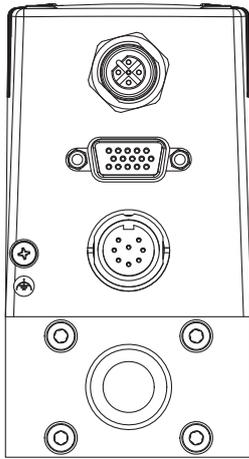
M12 Profibus

M12 DeviceNet

RS485 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.
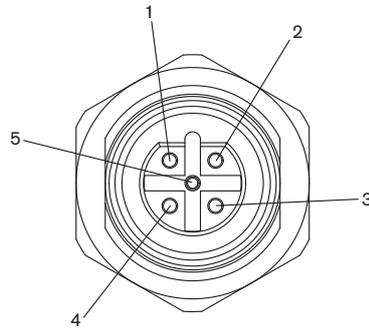
DeviceNet/ CANopen – Plug A-coded M12	Pin	Assignment
	1	Shield
	2	N.C. [7]
	3	DGND
	4	CAN_H
	5	CAN_L
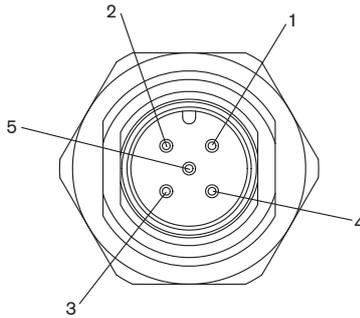
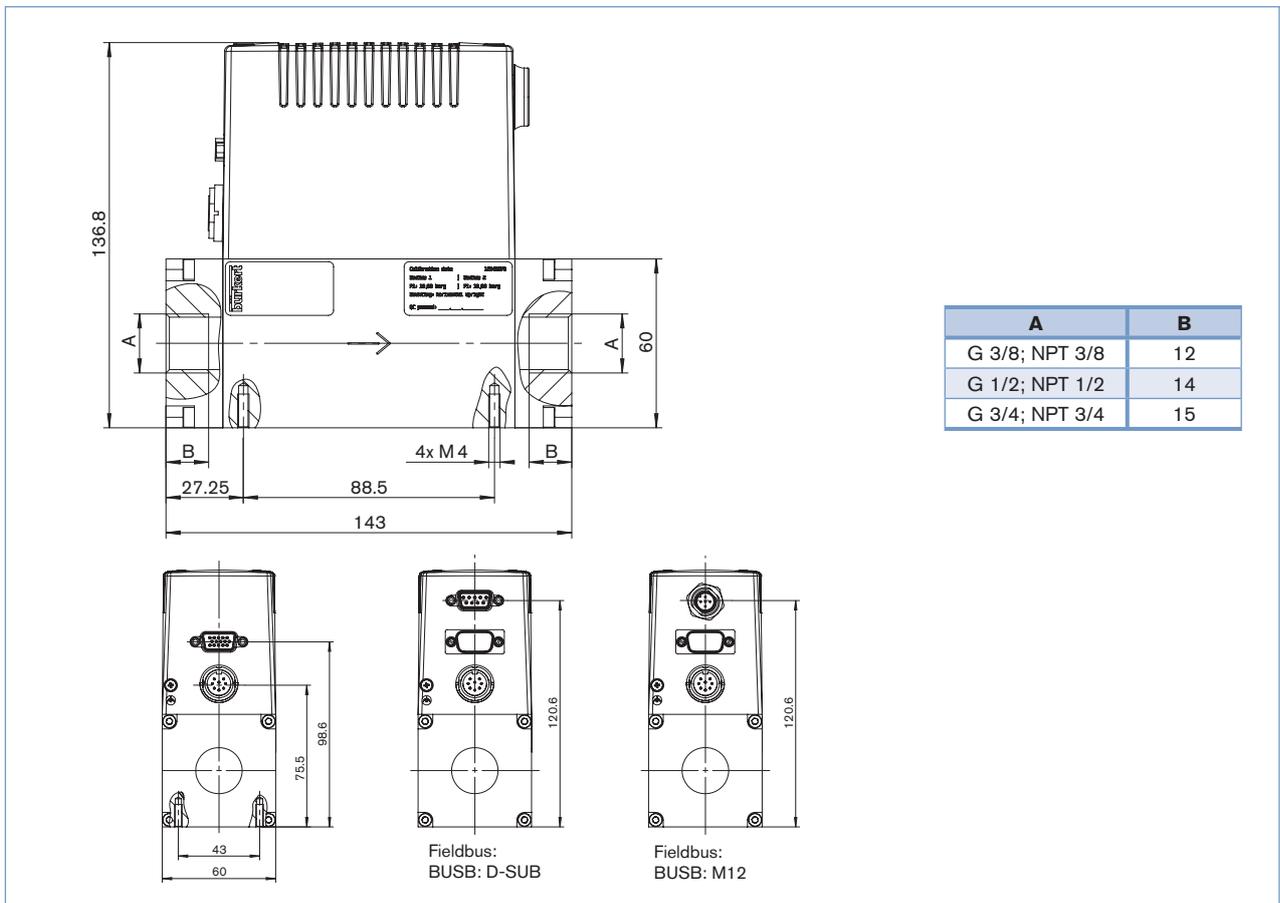[7] Optional configuration with 24V DC possible for power supply via fieldbus connector. With this no power supply connection on round M16 plug needed.
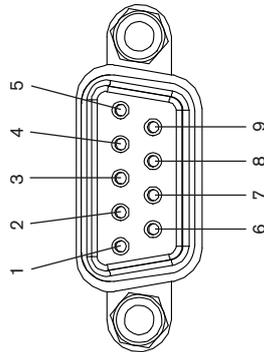
Plug D-Sub 9-pin	Pin	Assignment
	1	Binary input (related to GND Pin 2)
	2	GND
	3	Power supply +24V DC
	4	Relay, normally opened
	5	Relay, normally closed
	6	TX+ (RS485-Y) – bridge with pin 9 at half duplex
	7	TX- (RS485-Z) – bridge with pin 8 at half duplex
	8	RX- (RS485-B)
	9	RX+ (RS485-A)

Dimensions [mm]

A	B	C	D
G 1/4; NPT 1/4	10	22.25	133
G 3/8; NPT 3/8	10	22.25	133
G 1/2; NPT 1/2	13	27.25	143
G 3/4; NPT 3/4	14	27.25	143

Fieldbus:
BUSB: D-SUB

Fieldbus:
BUSB: M12

A	B
G 3/8; NPT 3/8	12
G 1/2; NPT 1/2	14
G 3/4; NPT 3/4	15

Fieldbus:
BUSB: D-SUB

Fieldbus:
BUSB: M12
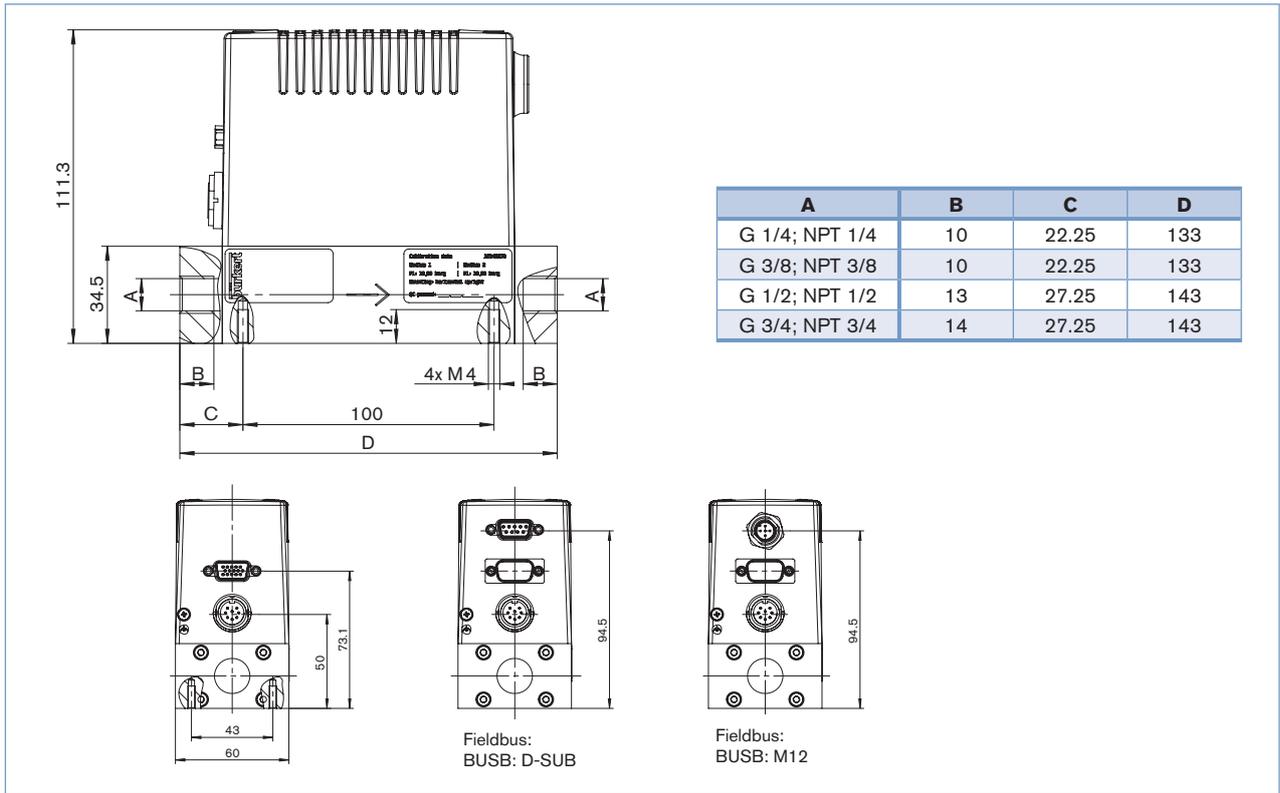
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MFC/MFM Applications – Request for Quotation

▶ **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

Fluid data

Type of gas (or gas proportion in mixtures)		
Density		kg/m^{3} [8]
Gas temperature		°C ___ °F
Moisture content		g/m^3
Abrasive components/solid particles	☐ no	☐ yes, as follows:

Fluidic data

Flow range Q_{nom}   Min. ☐ l_N/min [8]   ☐ l_S/min (slpm) [9]

Max. ☐ m_N^3/h [8]   ☐ kg/h

☐ cm_N^3/min [8]   ☐ cm_S^3/min (sccm) [9]

☐ l_N/h [8]   ☐ l_S/h [9]

Inlet pressure at Q_{nom} [10] $p_1 =$ _____ 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)

☐ 3/8" G-thread (DIN ISO 228/1)   ☐ 3/8" NPT-thread (ANSI B1.2)

☐ 1/2" G-thread (DIN ISO 228/1)   ☐ 1/2" NPT-thread (ANSI B1.2)

☐ 3/4" G-thread (DIN ISO 228/1)   ☐ 3/4" NPT-thread (ANSI B1.2)

☐ with screw-in fitting

_____ mm Pipeline (external Ø)

_____ inch Pipeline (external Ø)

Installation   ☐ horizontal, valve upright (standard)   ☐ horizontal, valve on side

☐ vertical, flow upwards   ☐ vertical, flow downwards

Ambient temperature   _____ °C

Material data

Body (base block)	☐ Aluminium (anodised)	☐ Stainless steel
Seal material	☐ FKM	☐ EPDM

Electrical data

Signals for set point and actual value	**Standard signal** Setpoint / Actual value	**with fieldbus**	**with RS485**
	☐ 0-5 V ☐ 0-20 mA	☐ PROFIBUS DP ☐ D-Sub	☐ D-Sub
	☐ 0-10 V ☐ 4-20 mA	☐ DeviceNet ☐ M12	
		☐ CANopen	

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

8) at: 1,013 bar(a) and 0°C   9) at: 1.013 bar (a) and 20°C   10) matches with calibration pressure

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Subject to alteration.

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