bürkert
FLUID CONTROL SYSTEMS

Mass Flow Meter (MFM) for Gases

- Inline MFM for full scale rates from 20 l_N/min to 1500 l_N/min; 1/4" to 3/4"
- High accuracy
- Short response time
- Optional fieldbus

Type 8006 can be combined with…

Type 8619
Multichannel program controller

Type 0330
3/2-way valve

Type 6013
2/2-way 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 8006 uses an inline sensor based on the thermal principle (see the description on page 2) located directly in the main channel. Due to the fact that the sensor is directly in the main channel a very short response time of the MFM is reached. Another benefit of this main stream measurement is that it is less sensitive to contamination. The actual flow is given as an analog output signal or could be read out over fieldbus communication. Type 8006 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 gas 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 measurements in:

- Heat treating processes
- Test benches
- Packaging
- Food and beverage processes
- Environmental technology

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
Turn-down ratio	1:50 [3]
Operating gas	Neutral, non-contaminated gases, others available on request
Calibration gas	Operating gas or air with correcting function
Max. operating pressure (Inlet pressure)	10 bar, up to 25 bar (N_2, air, argon)
Gas temperature	-10 to +70°C (-10 to +60°C with oxygen)
Ambient temperature	-10 to +45°C
Accuracy (after 15 min warm up time)	±1.5% o.R. ±0.3% F.S. (o.R.: of reading; F.S.: of full scale)
Repeatability	±0.1% F.S.
Response time ($t_{95\%}$)	<500 ms
Materials	
Body	Aluminium (black anodized) or stainless steel
Housing	Aluminium (coated)
Seals	FKM, EPDM

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)
Electr. connection	Socket M16, round, 8-pin and socket D-Sub HD15, 15-pin
Additionally with fieldbus:	With PROFIBUS-DP: Socket M12 5-pin or D-Sub 9-pin With DeviceNet/CANopen: Plug M12 5-pin or D-Sub 9-pin
Operating voltage	24V DC
Voltage tolerance	±10%
Residual ripple	< 2%
Power consumption	3,5 - 10 W, with fieldbus: 4 -12,5 W (acc. to the version)
Output signal (flow value)	0–5 V, 0–10 V, 0–20 mA or 4–20 mA
Max. current voltage output	10 mA
Max. load current output	600 Ω

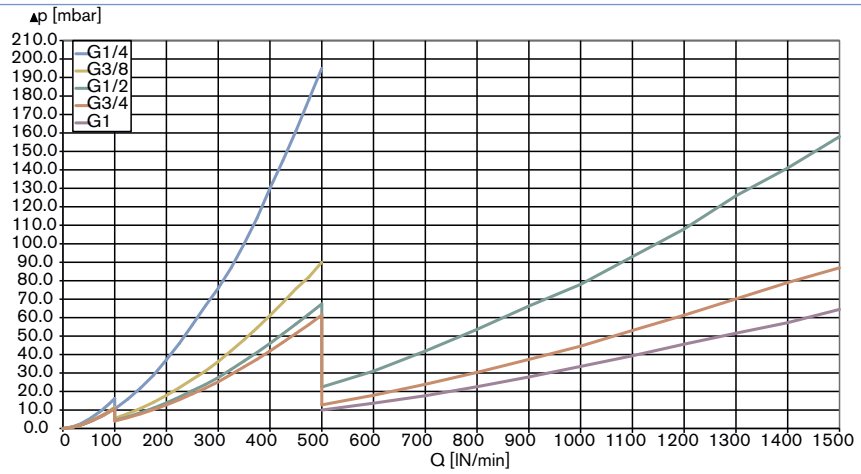
[1] The nominal flow value is the max. flow value calibrated which can be measured. The nominal flow range defines the range of nominal flow rates (full scale values) possible.
[2] Index N: Flow rates referred to 1.013 bar and 0° C.
Alternatively there is an Index S available which refers to 1.013 bar and 20° C
[3] With vertical installation and flow downwards the turn-down ratio is 1:10

DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015

Technical data (cont.)	
Digital communication via adapter possible:	RS232, Modbus RTU (via RS interface) RS485, RS422 or USB (see accessories table on p. 3)
Fieldbus option	PROFIBUS DP, DeviceNet, CANopen (D-Sub HD15 covered with sealed plate with fieldbus MFC)
Type of protection (with connected cables)	IP65
Dimensions	See drawings on p. 6
Total weight (Example standard block)	1.2 kg (Al) 3.0 kg (VA)

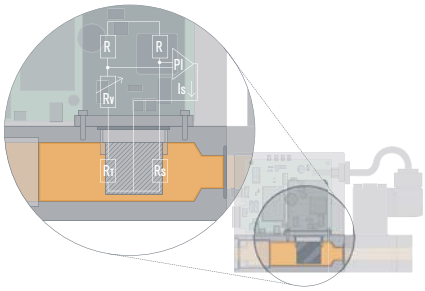
Mounting position	Horizontal or vertical
Light emitting diodes (Default, other functions programmable)	Indication for 1. Power 3. Limit 2. Communication 4. Error
Binary inputs (Default, other functions programmable)	Three: 1. not assigned 2. not assigned 3. not assigned
Binary outputs (Default, other 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

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} [l_N/min]	Max. Q_{nom} [l_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.

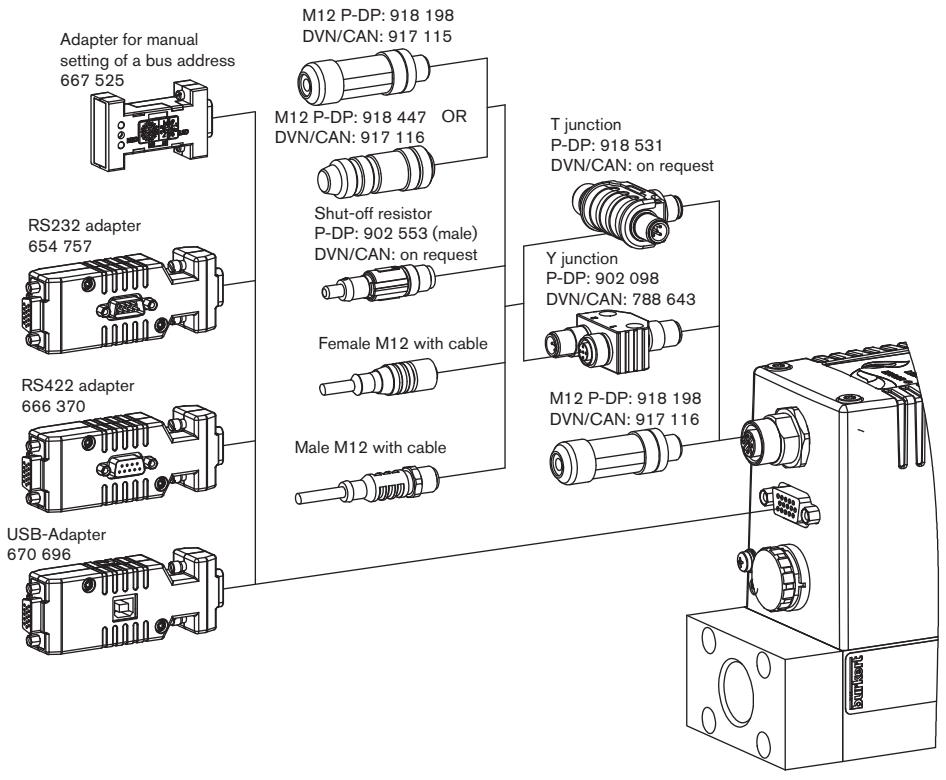
DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015

Ordering Chart for Accessories

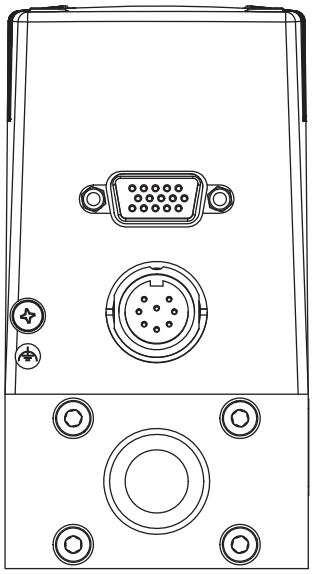
Article	Item No.	
Connectors / Cables		
Round plug M16 8-pin (Solder connection)	918 299	
Round plug M16 8-pin with 5m cable	787 733	
Round plug M16 8-pin with 10m cable	787 734	
Plug D-Sub HD15 15-pin with 5m cable	787 735	
Plug D-Sub HD15 15-pin with 10m cable	787 736	
Adapters [4]		
RS232 adapter 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.

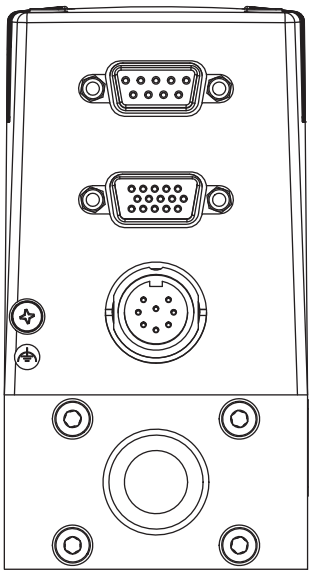
[5] The two M12 connectors as listed above cannot be used together on the same side of the Y-junction. At least one of the two M12 connection needs to be an overmoulded cable which uses typically a thinner connector.



Pin Assignment

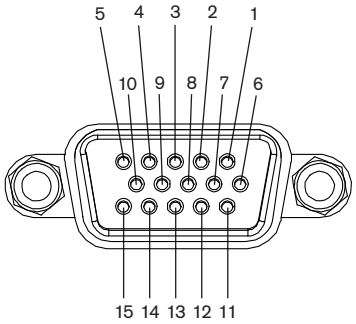


Standard



Fieldbus D-SUB

Socket D-Sub HD15

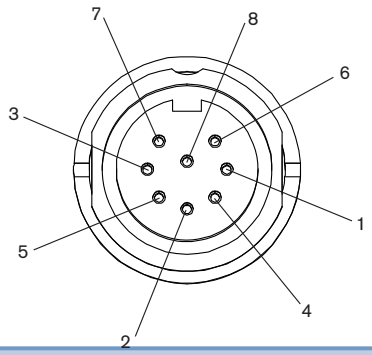


Pin	Assignment	
	Analog Version	**Bus Version**
1	N.C. [6]	N.C.
2	N.C.	N.C.
3	Actual value output +	N.C.
4	Binary input 2	
5	12V-Output (only for factory use)	
6	RS232 TxD (direct connection to computer)	
7	Binary input 1	
8	GND (for binary inputs)	
9	only for factory use (do not connect!)	
10	12V-Output (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)

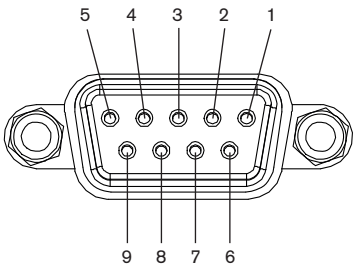
Note:
- Optional Pin 1 and 2 with bus version as transmitter input possible
- The cable length for RS232/ Setpoint and flow value signal is limited to 30 meters.

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

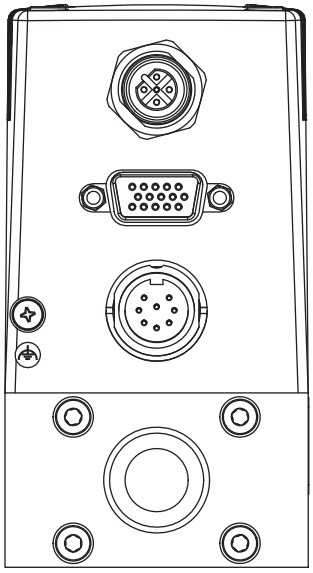
Socket D-Sub 9-pin
(only with fieldbus version)



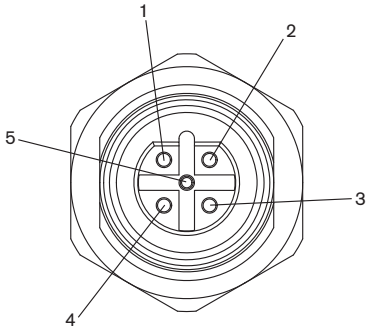
Pin	Assignment	
	PROFIBUS DP	**DeviceNet/ CANopen**
1	Shield	Shield
2	N.C.	CAN-L data line
3	RxD/TxD - P (B-line)	GND
4	RTS (control signal for repeater)	N.C.
5	GND	N.C.
6	VDD (only for termination resistor)	N.C.
7	N.C.	CAN-H data line
8	RxD/TxD - N (A-line)	N.C.
9	N.C.	N.C.

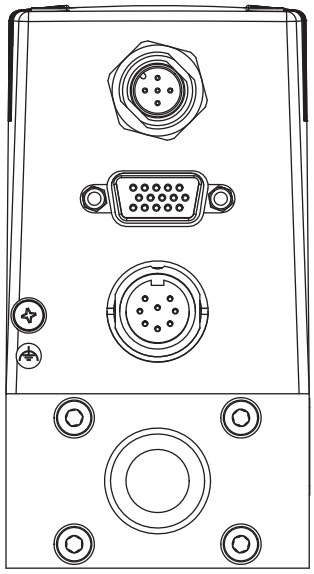
DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015

Pin Assignment *(continued)*

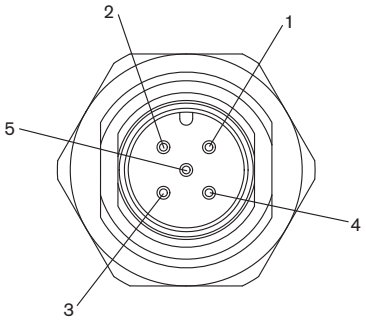


M12 Profibus

PROFIBUS DP (DPV1 max. 12 Mbaud) – Socket B-coded M12	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.



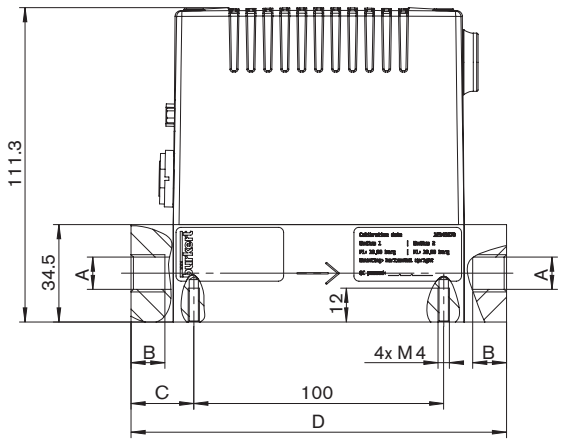
M12 DeviceNet

DeviceNet/ CANopen – Plug A-coded M12	Pin	Assignment
	1	Shield
	2	N.C. [7)]
	3	DGND
	4	CAN_H
	5	CAN_L

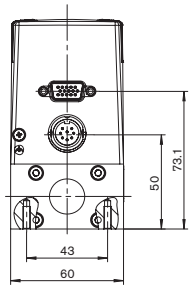
[7)] Optional configuration with 24V DC possible for power supply via fieldbus connector. With this no power supply connection on round M16 plug allowed.

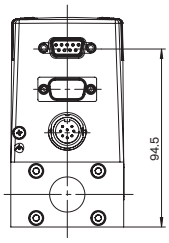
DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015

Dimensions [mm]

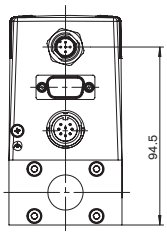


A	B	C	D
G 1/4; NPT 1/4	10	22.25	133
G 3/8; NPT 3/8	10	22.25	133
G 1/2; NPT 1/2	13	27.25	143
G 3/4; NPT 3/4	14	27.25	143

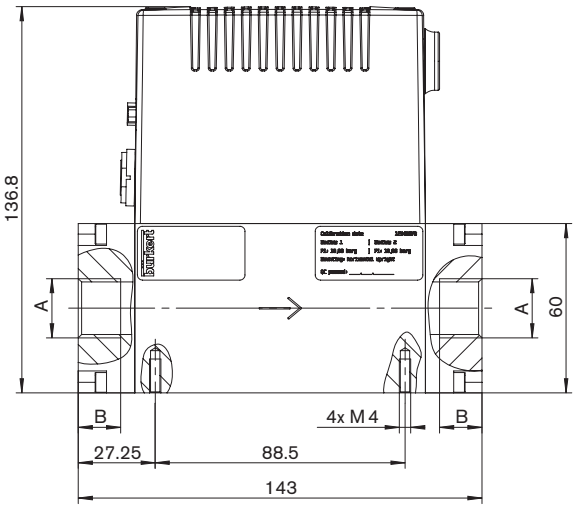




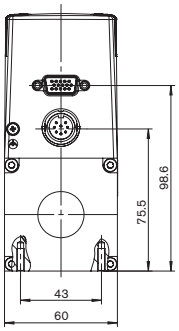
Fieldbus:
BUSB: D-SUB

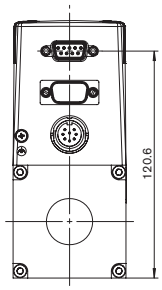


Fieldbus:
BUSB: M12

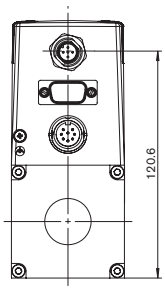


A	B
G 3/8; NPT 3/8	12
G 1/2; NPT 1/2	14
G 3/4; NPT 3/4	15





Fieldbus:
BUSB: D-SUB



Fieldbus:
BUSB: M12

DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015

bürkert

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**

Fluid data

Type of gas (or gas proportion in mixtures)

Density kg/m³ 8)

Gas temperature °C °F

Moisture content g/m³

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: ☐ 0-5 V ☐ 0-10 V ☐ 0-20 mA ☐ 4-20 mA

Actual value: ☐ 0-5 V ☐ 0-10 V ☐ 0-20 mA ☐ 4-20 mA

With fieldbus

☐ PROFIBUS DP ☐ D-Sub

☐ 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

reset form

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

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

1501/3_EU-en_00891901

DTS 1000017532 EN Version: G Status: RL (released | freigegeben | validé) printed: 29.01.2015