

Mass Flow Controller (MFC) for Gases



Type 8711 can be combined with...



Type 8619

Multichannel
program controller



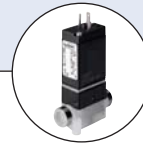
Type 0330

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

- Direct flow measurement for nominal flow rates from 10 ml_N/min to 80 l_N/min (N₂) in MEMS technology
- High accuracy and repeatability
- Short settling time
- Optional fieldbus

Type 8711 controls the mass flow of gases that is relevant for most applications in process technologies. The measured value provided by the chip 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. Due to the fact that the sensor is directly in contact with the gas a very fast response time of the MFC is reached. 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. Type 8711 can optionally be calibrated for two different gases, the user is able to switch between these two gases.

As control element a direct-acting proportional valve guarantees a high sensitivity and a good control characteristics of the MFC. The MassFlowCommunicator software can be used for parameterisation and diagnosis. Typical application areas are gas dosing or rather the production of gas mixtures in:

- Test benches
- Bio reactors
- Heat treatment
- Material coating
- Burner controls
- Fuel cell technology

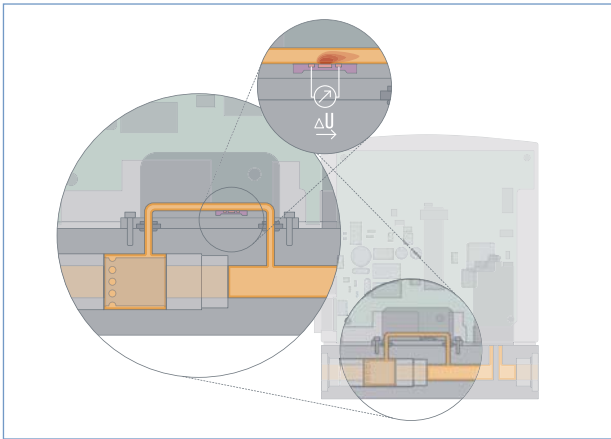
Technical Data	
Nominal flow range¹⁾ (Q _{nominal})	10 ml _N /min ²⁾ to 80 l _N /min (N ₂), see table on p. 2
Turn-down ratio	1:50, higher turn-down ratio on request
Operating gas	Neutral, non-contaminated gases, on request
Calibration gas	Operating gas or air with conversion factor
Max. operating pressure (Inlet pressure)	10 bar (145 psi) depending on the orifice of the valve
Gas temperature	-10 to +70°C (-10 to +60°C with oxygen)
Ambient temperature	-10 to +50°C
Accuracy	±0.8% o.R. ±0.3% F.S. (after 1 min. warm up time)
Repeatability	±0.1% F.S.
Settling time (t95%)	< 300 ms
Materials	
Body	Aluminium or stainless steel
Housing	PC (Polycarbonate) or metal
Seals	FKM, EPDM
Port connection	NPT 1/4, G 1/4, screw-in fitting or flange, others on request
Regulating unit (Proportional Valve)	
Valve orifice	Normally closed
k _{VS} value	0.05 to 4.0 mm 0.00006 to 0.32 m ³ /h
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	Max. 3.5–14 W (depending on proportional valve used)
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)	0–5 V, 0–10 V, 0–20 mA or 4–20 mA
Max. load (current)	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 5–7
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. Start Autotune 2. not assigned
Binary output	
(default functions, other functions programmable)	A relay output for: 1. Limit (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

Measuring Principle



The actual flow rate is detected by a sensor. This 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.

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 Configuration

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. 8 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.

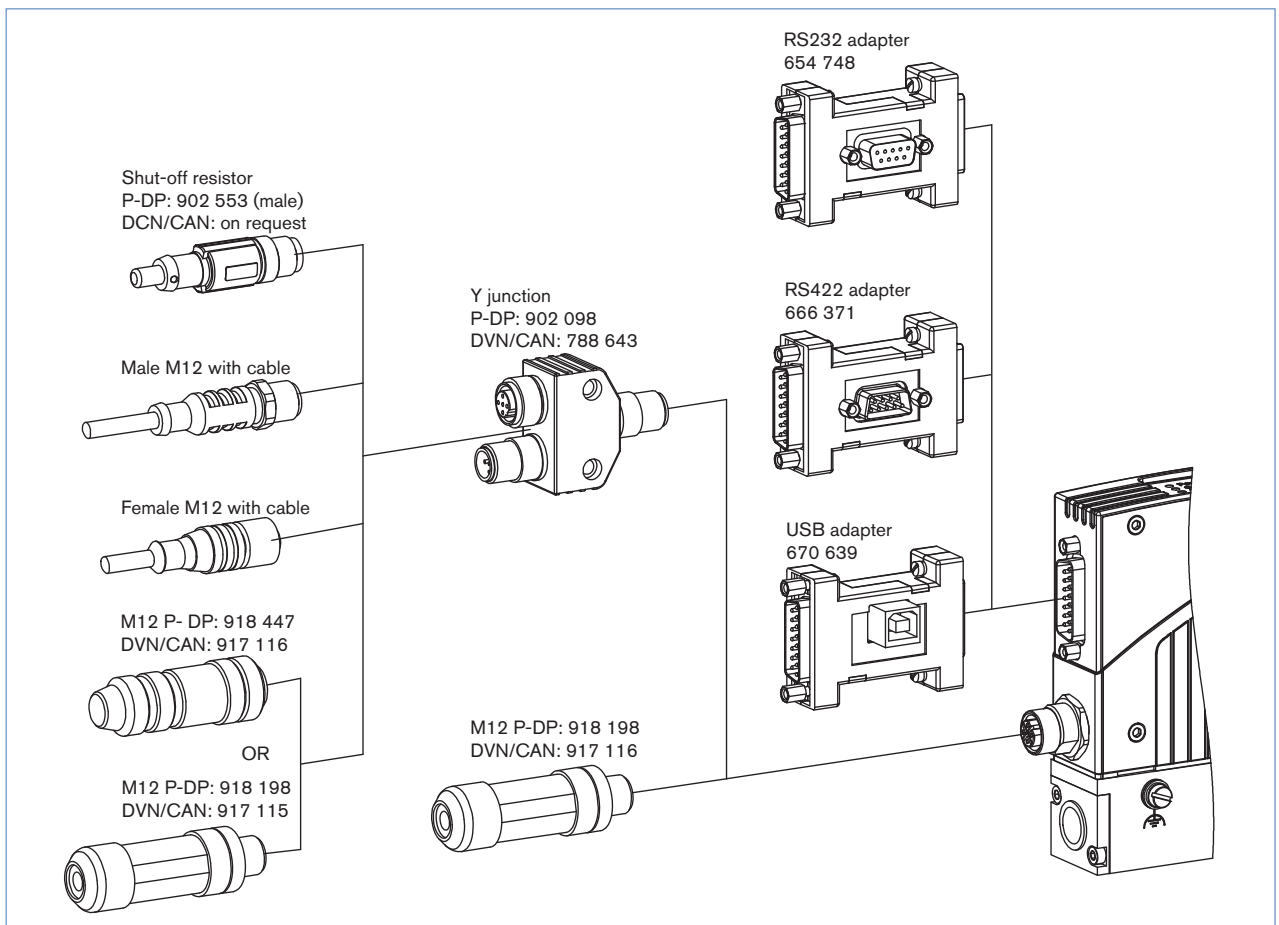
▶ **The request form on page 8 contains the relevant fluid specification. Using the experience of Bürkert engineers already in the design phase provide us with a copy of the request containing the necessary data together with your inquiry or order.**

Ordering Chart for Accessories

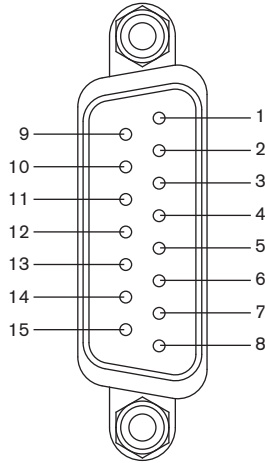
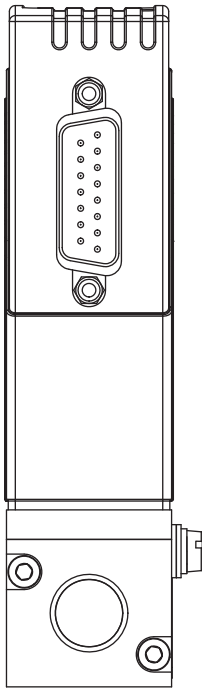
Article	Item No.	
Connections/Cables		
Socket D-Sub 15-pin solder connection	918 274	
Hood for D-Sub socket, with screw locking	918 408	
Socket D-Sub 15-pin with 5m cable	787 737	
Socket D-Sub 15-pin with 10m cable	787 738	
Adapters ³⁾		
RS232 adapter	654 748	
PC extension cable for RS232 9-pin socket/plug 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 connection needs to be a prefabricated cable which uses typically a thinner connector.



Pin Assignment



Plug D-Sub, 15-pin

Pin	Assignment	
	Analogue Control	Bus control
1	Relay – normally closed	
2	Relay – normally opened	
3	Relay – middle contact	
4	GND for 24V-Supply and Binary inputs	
5	24V-Supply +	
6	12V-Output (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)

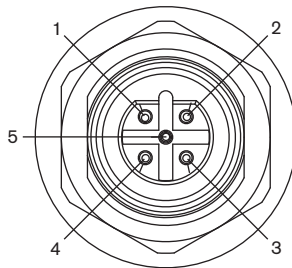
Note:

– 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.

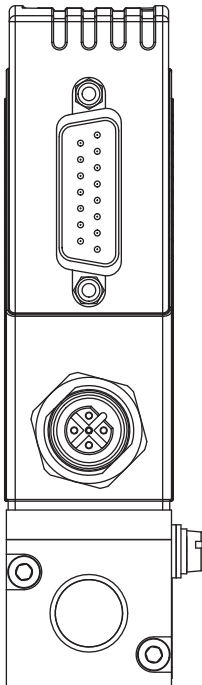
⁶⁾ Driving RS232 interface only by RS232 adapter including an adaption of TTL levels

With Fieldbus Version:

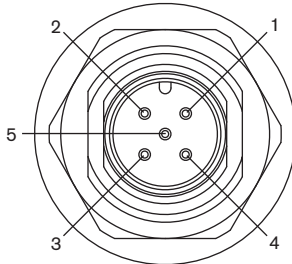
PROFIBUS DP – socket B-coded M12 (DPV1 max. 12 Mbaud)



Pin	Assignment
1	VDD (only for termination resistor)
2	RxD/ TxD – N (A-Line)
3	DGND
4	RxD/ TxD – P (B-Line)
5	C (4)

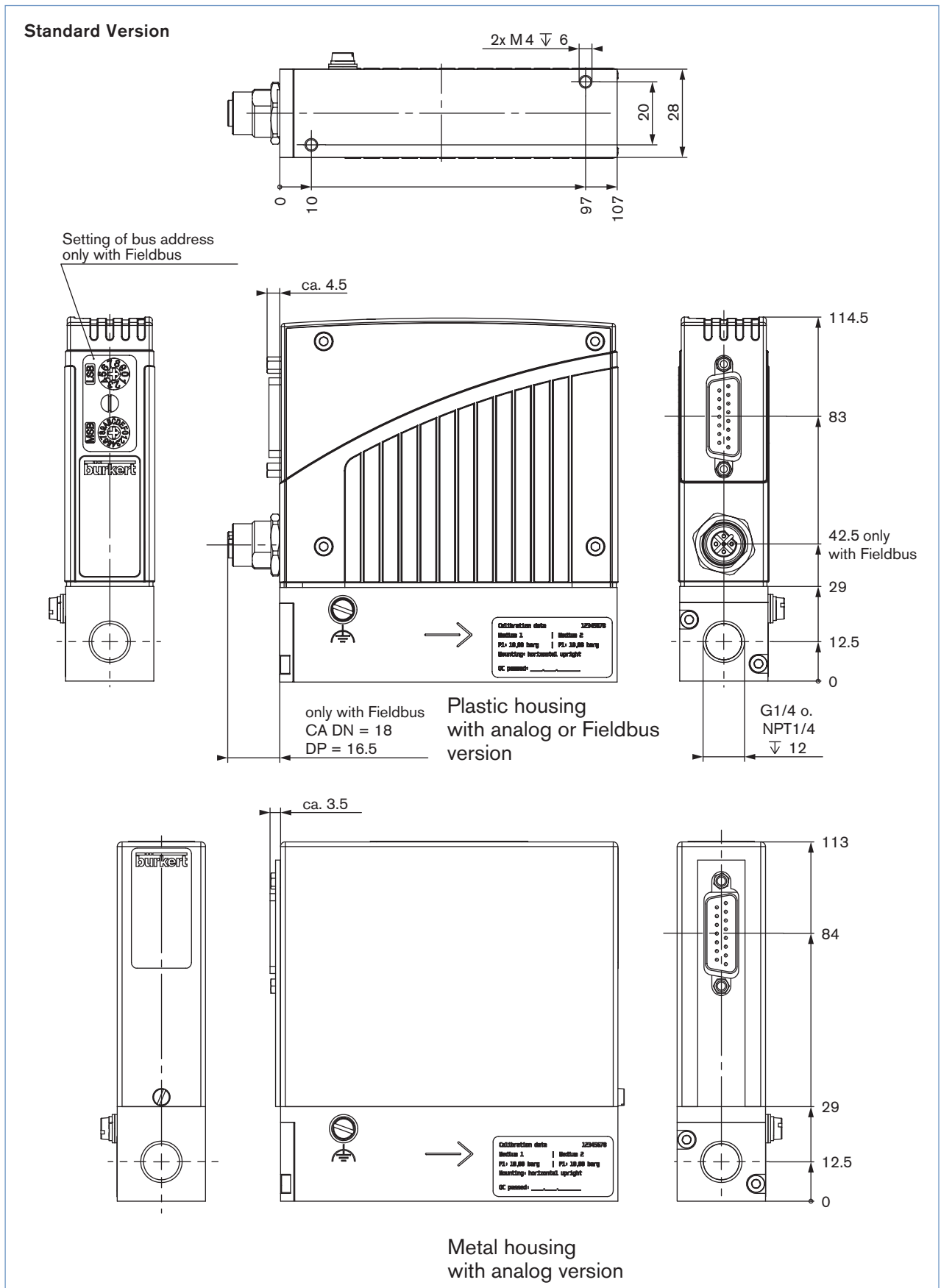


DeviceNet, CANopen – Plug M12

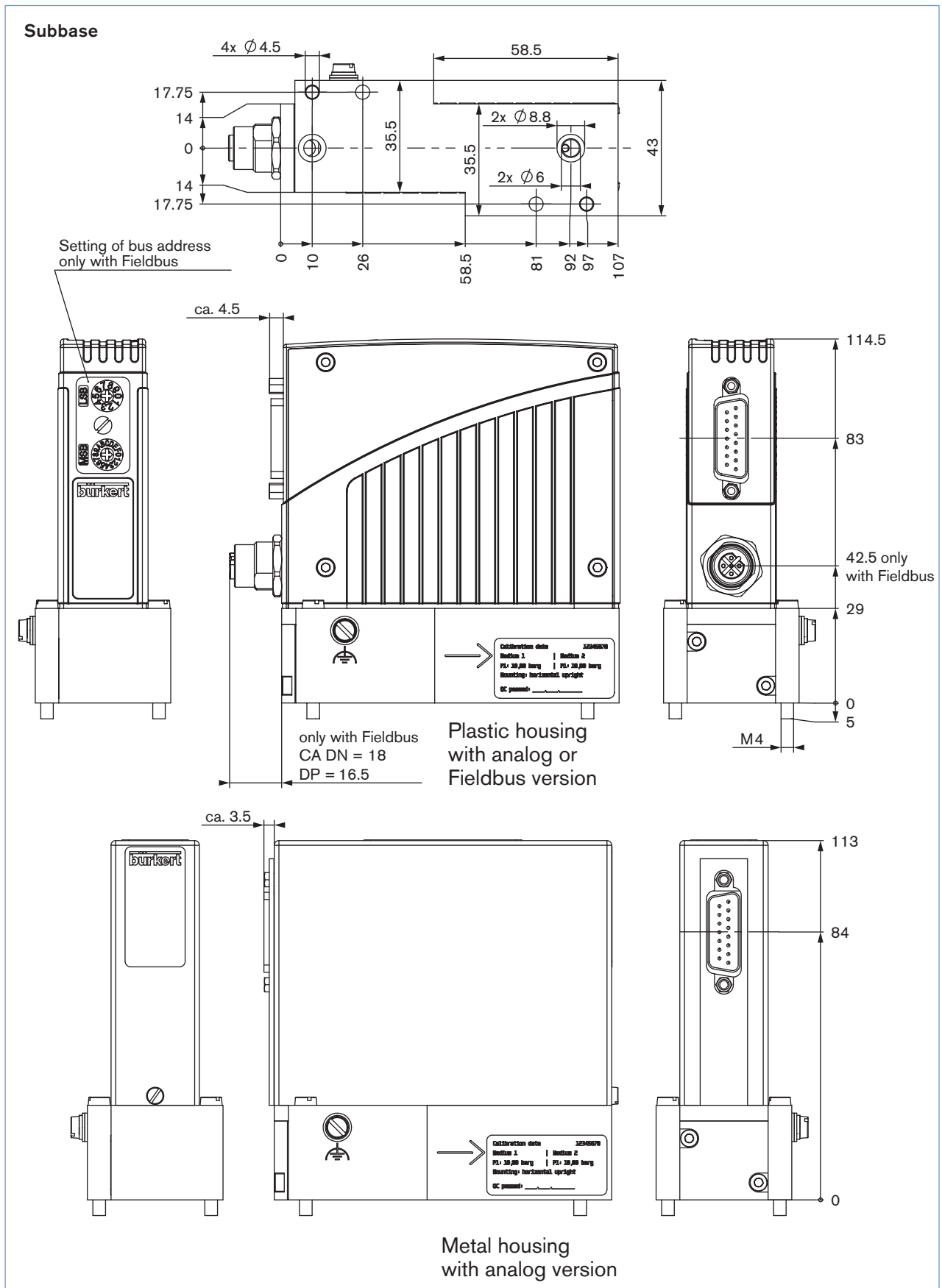


Pin	Assignment
1	Shield
2	N.C. ⁷⁾
3	DGND
4	CAN_H
5	CAN_L

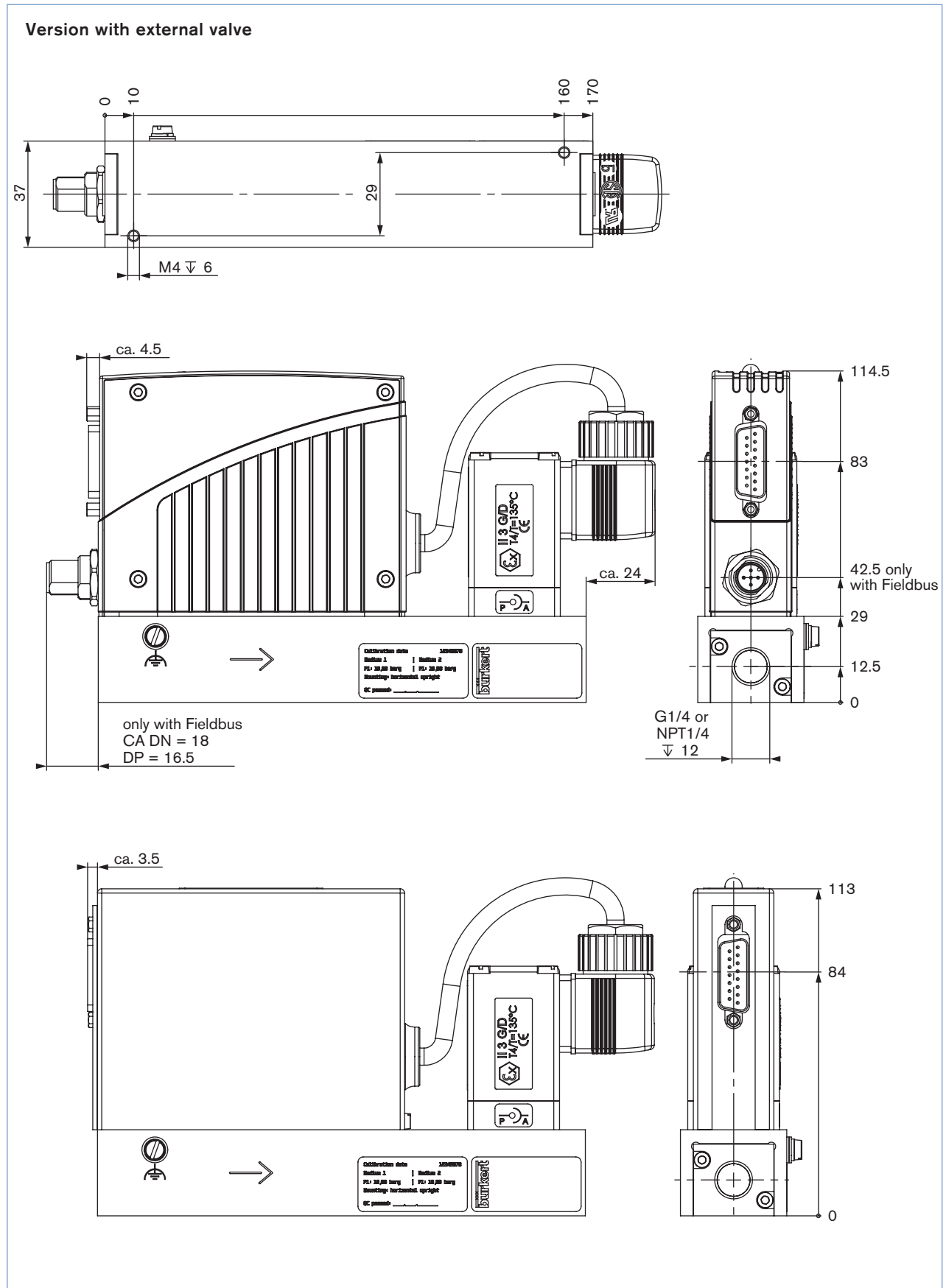
Dimensions [mm]



Dimensions [mm]



Dimensions [mm]



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 ⁸⁾

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}

<input type="text"/> Min.	<input type="checkbox"/> l _N /min ⁸⁾	<input type="checkbox"/> l _S /min (slpm) ⁹⁾
<input type="text"/> Max.	<input type="checkbox"/> m _N ³ /h ⁸⁾	<input type="checkbox"/> kg/h
	<input type="checkbox"/> cm _N ³ /min ⁸⁾	<input type="checkbox"/> cm _S ³ /min (sccm) ⁹⁾
	<input type="checkbox"/> l _N /h ⁸⁾	<input type="checkbox"/> 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)

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 base Aluminium Stainless steel

Body 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		with fieldbus	
	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	<input type="checkbox"/> 4-20 mA			

■ 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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