bürkert
FLUID CONTROL SYSTEMS

Mass Flow Controller (MFC) for Gases

Type 8712 can be combined with…

- Direct flow measurement for nominal flow rates from 10 ml_N/min to 80 l_N/min (N_2) in MEMS technology

- High accuracy and repeatability

- Protection class IP65

- Optional field bus
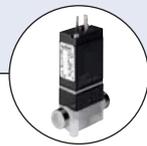
Type 8619
Multichannel program controller

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

Type 8712 controls the mass flow of gases that is relevant for most applications in process technology. 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.

Due to the fact that the sensor is directly placed in the bypass channel a very short settling 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 8712 can optionally be calibrated for two different gases, the user is able to switch between these two gases. As the control element, a proportional valve working at low friction guarantees a high sensitivity and a good 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:

- Pharmaceutical industry
- Food and beverage
- Environmental technology
- Heat treatment

Technische Daten	
Nominal flow range [1] (Q_{nom})	0.01 ml_N/min [2] to 80 l_N/min (N_2)
Turn-down ratio	1:50, wider span on request
Operating gas	Neutral, non-contaminated gases, others available on request
Calibration gas	Operating gas or air with correcting function
Max. operating pressure (inlet pressure)	Up to max. 10 bar (145psi), 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 (after 1 min warm up time)	±0.8% o.R. ±0.3% F.S. (o.R.: of reading; F.S.: of full scale)
Repeatability	±0.1% F.S.
Settling time ($t_{95\%}$)	<300ms
Materials Body Housing Seals	Stainless steel PC (Polycarbonate) FKM, EPDM (others on request)
Port connection	G 1/4", NPT 1/4" or compression fitting
Control valve Valve orifice k_{Vs} value	Normally closed 0.05 to 4 mm 0.00006 to 0.32 m³/h
Electr. connection Additionally with fieldbus:	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
Operating voltage	24V DC
Voltage tolerance	±10%
Residual ripple	<2%
Power consumption	3.5–14 W (depending on version)

[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.

Technical data

Technical data (cont.)	
Set point (signal setting) Feed impedance	0–5V, 0–10V, 0–20 mA or 4–20 mA >20 k Ω (voltage) <300 Ω (current)
Output signal (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
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 [mm] (without fitting)	See drawings on p. 6–8
Total weight	1200 g (Valve internally)
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. Start Autotune 2. Not assigned, Switch between gases when cal. for two gases 3. Not assigned
Binary outputs (Default, other functions programmable)	Two relay outputs 1. Limit (desired value can not be achieved) 2. Error (e.g. sensor fault) Load capacity: max. 60 V, 1 A, 60 VA

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

Measuring Principle
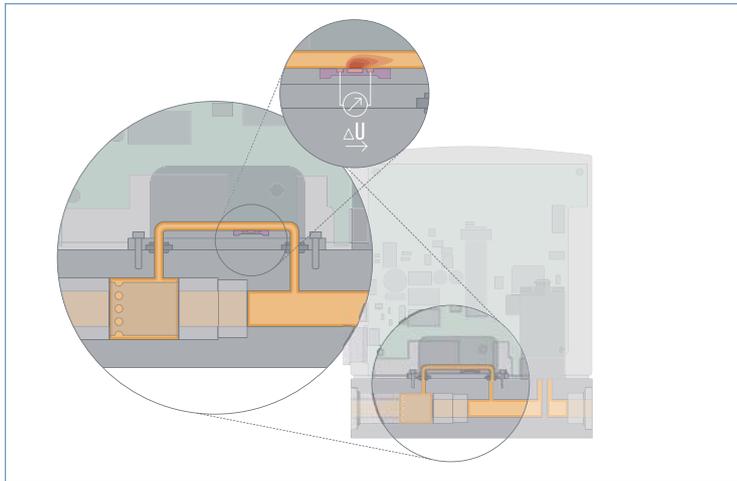
The actual flow rate is detected by a sensor. This operates according to a thermal principle which has the advantage of providing the mass flow which is independent on pressure and temperature.

A small part of the total gas stream is diverted into a small, specifically designed bypassing channel whitch 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.

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. 9 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.

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

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 0m 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 [3]	
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 www.buerkert.com

Accessories for Fieldbus	PROFIBUS DP (B-codiert)	DeviceNet/ CAN-open (A-codiert)
M12-Plug [4]	918 198	917 115
M12-socket (coupling) [4]	918 447	917 116
Y-junction [4]	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 www.buerkert.com	

[3] The adapters serve mainly for initial operation or diagnosis. Those are not obligatory for continuous operation.
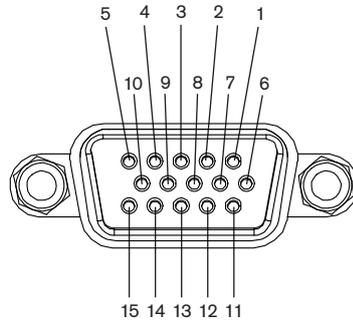
[4] The two M12 connectors as listed above cannot be used together on the same side of the Y-junction. At least one of the two M12 connection needs to be a prefabricated cable which uses typiclly a thinner connector.
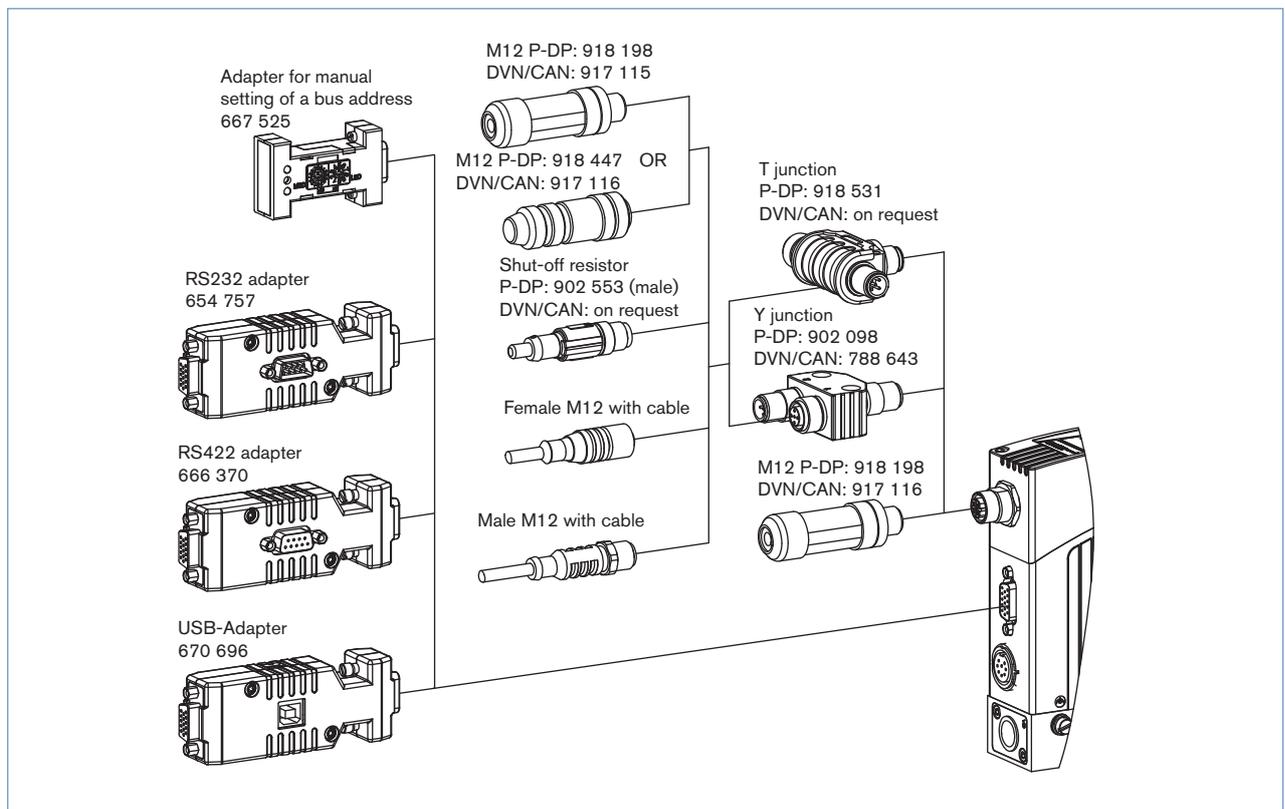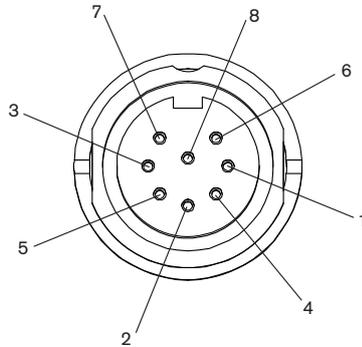
Pin Assignment
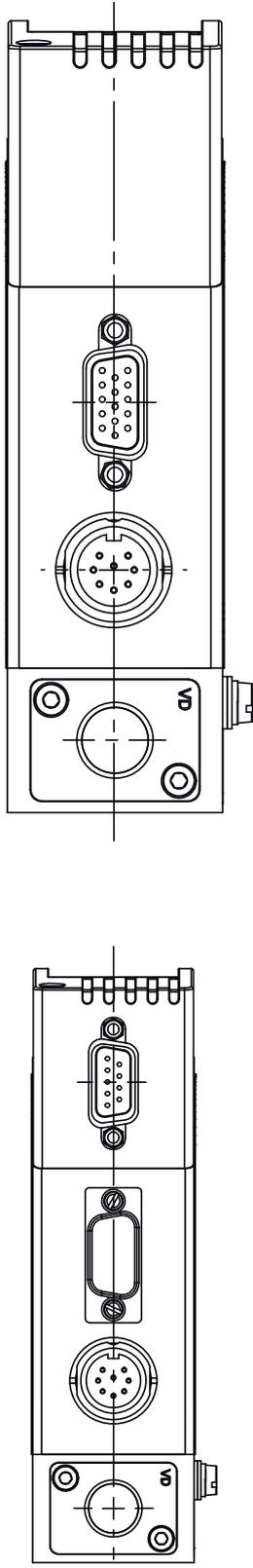
Socket D-Sub HD15	Pin	Assignment	
		Analogue Control	Bus control
	1	Set value input +	N.C. [5]
	2	Set value input GND	N.C.
	3	Actual value output +	N.C.
	4	Binary input 2	
	5	12V-Output (only for internal company use)	
	6	RS232 TxD (direct connection to computer)	
	7	Binary input 1	
	8	GND (for binary 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)	

[5] 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.
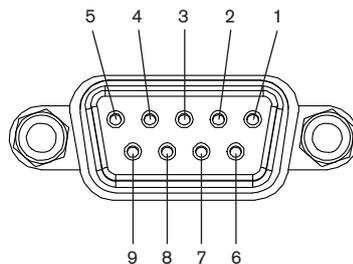
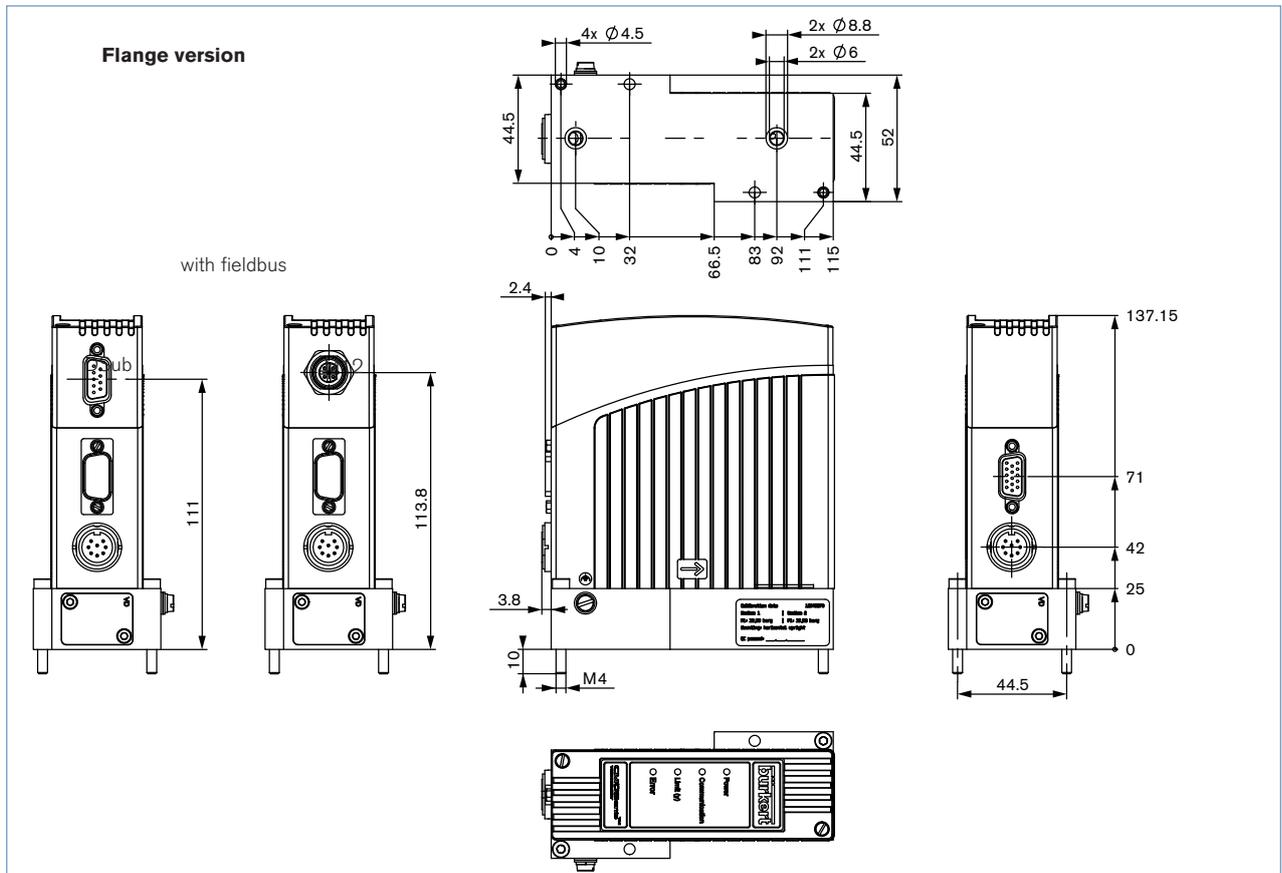| Socket M16, round, 8-pin	Pin	Assignment
	1	24V-Supply +
	2	Relay 1 – reference contact
	3	Relay 2 – reference contact
	4	Relay 1 – normally closed contact
	5	Relay 1 – normally open contact
	6	24V-Supply GND
	7	Relay 2 – normally open contact
	8	Relay 2 – normally closed contact

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.

bürkert

Pin Assignment *(continued)*
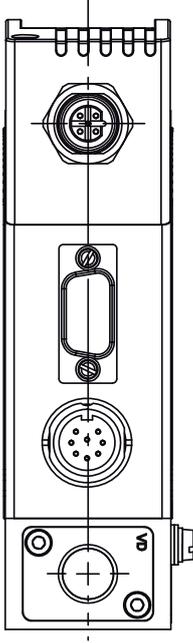
PROFIBUS DP – socket B-coded M12 (DPV1 max. 12 Mbaud)	Pin	Assignment
	1	VDD (only for termination resistor)
	2	RxD/TxD – N (A-line)
	3	DGND
	4	RxD/TxD – P (B-line)
	5	N.C.

DeviceNet/ CANopen – Plug A-coded M12	Pin	Assignment
	1	Shield
	2	N.C. [6]
	3	DGND
	4	CAN_H
	5	CAN_L

[6] 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]

Standard version

with fieldbus

D-sub

2x M4 - 10 deep

23

3.8

97

2.4

137

111

111.5

A

12.5

12

115

A

12

71

42

25

1.9

29.2

37

3.9

Mass A
G 1/4
NPT 1/4

Flange version

with fieldbus

sub

4x Ø 4.5

2x Ø 8.8

2x Ø 6

44.5

44.5

52

0 4 10 32 66.5 83 92 111 115

2.4

111

113.8

3.8

10

M4

137.15

71

42

25

0

44.5
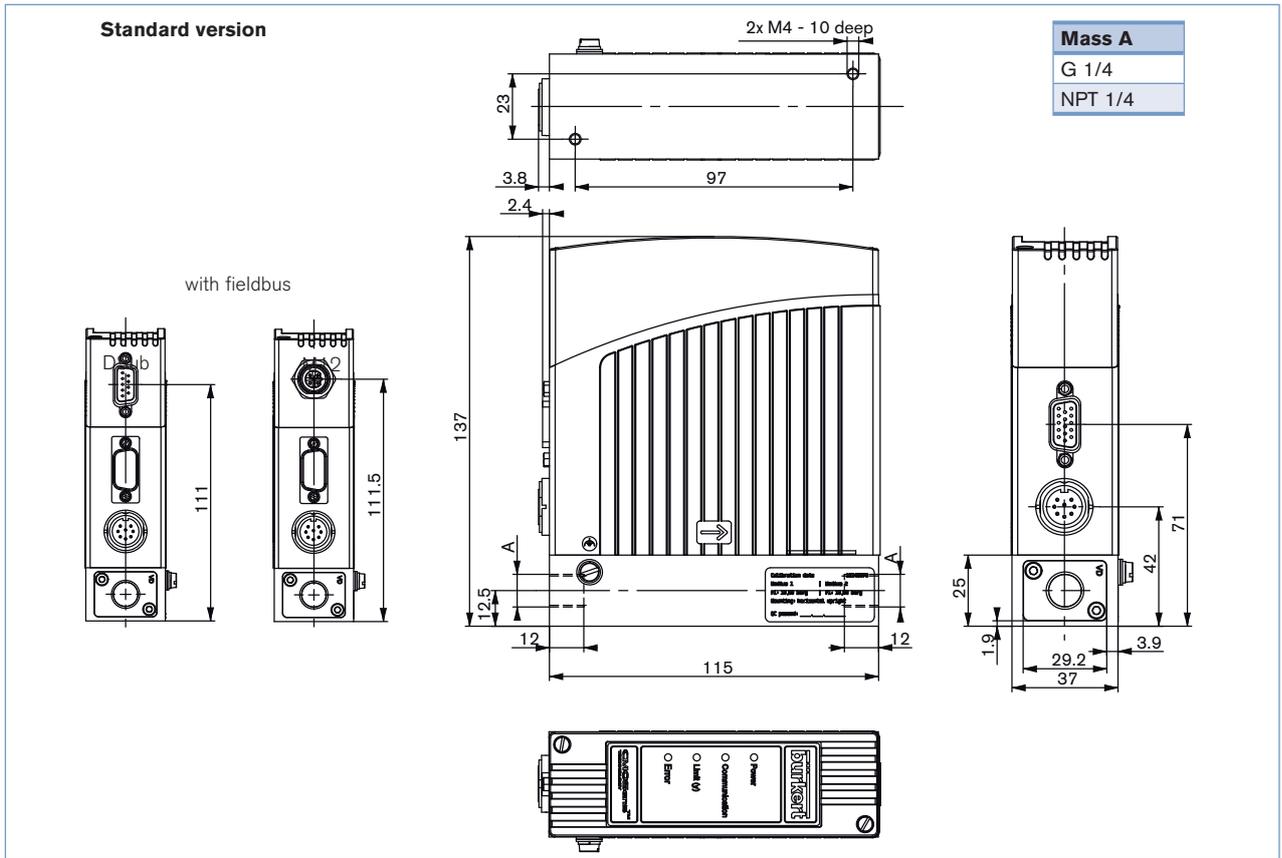
Dimensions [mm] *(continued)*

Version with external valve

Mass A
G 1/4
NPT 1/4

Variants of fieldbus connectors please see on previous pages.
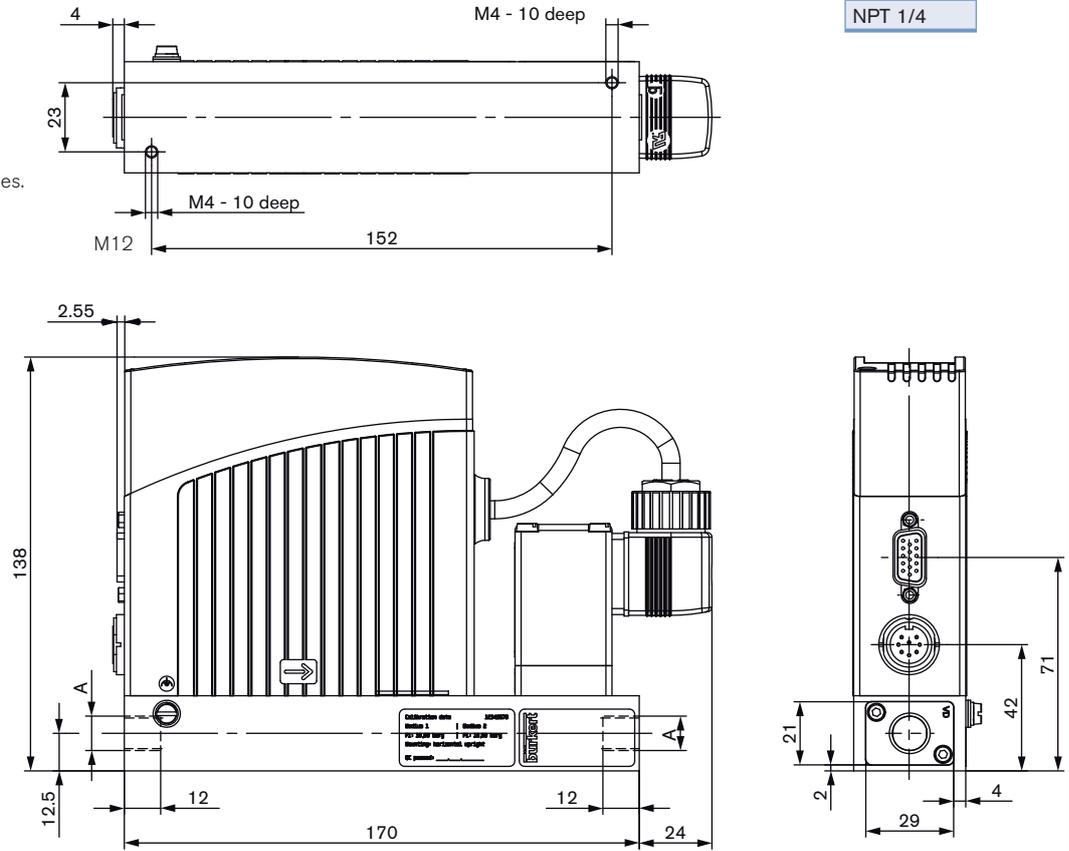
4

M4 - 10 deep

23

M4 - 10 deep

M12

152

2.55

138

A

12.5

12

170

12

24

A

21

2

29

4

42

71

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^3 [7]
Gas temperature [°C or °F]	[ ] °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 [7]	☐ l_S/min (slpm) [8]
	[ ] Max.	☐ 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	☐ Aluminium	☐ Stainless steel
Housing	☐ Plastic	☐ Metal (not with type 8712/8702 and not with fieldbus)
Seal	☐ FKM	☐ EPDM

Electrical data

Signals for set point   with standard signal   with fieldbus

and actual value

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	

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

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