

## Mass Flow Controller (MFC) for Gases



- Bypass MFC with capillary technology for nominal flow rates from 5 ml<sub>N</sub>/min to 10 l<sub>N</sub>/min
- Applicable for aggressive gases
- Fieldbus option

Type 8710 can be combined with...



**Type 1150**

Multi-channel program controller



**Type 0330**

3/2 or 2/2-way solenoid valve



**Type 6013**

2/2-way solenoid valve



**MassFlowCommunicator**

Communications software

Type 8710 controls the mass flow of gases through a sensor element which is not in direct contact with the gas itself. 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. 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 8710 can optionally be calibrated for two different gases, the user is able to switch between these two gases.

The control element, a proportional valve working at low friction, guaran-

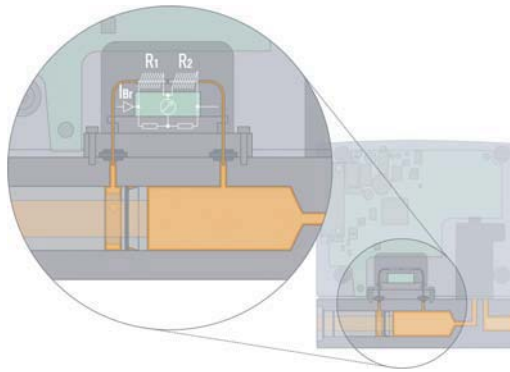
tees a high sensitivity and a good control characteristics of the unit. Typical application areas are gas dosing or rather the production of gas mixtures in:

- Heat treatment,
- Metal melting treatment,
- Environmental technology,
- Material coating and
- Fuel cell technology.

Technical data	
<b>Full scale ranges<sup>1)</sup></b> (Q <sub>nom</sub> )	5 to 10,000 ml <sub>N</sub> /min N <sub>2</sub> equivalent
<b>Operating media</b>	neutral, or aggressive gases, others on request
<b>Max. operating pressure</b> (inlet pressure)	10 bar (145 psi), depending on the orifice of the valve
<b>Calibration medium</b>	operating gas or air with conversion factor
<b>Medium temperature</b>	-10 to +70°C
<b>Ambient temperature</b>	-10 to +50°C
<b>Accuracy</b> (after 30 min. warm up time)	±1.5% o.R. ±0.3% F.S.
<b>Linearity</b>	±0.1% F.S.
<b>Repeatability</b>	±0.1% F.S.
<b>Control range</b>	1:50
<b>Settling time (t<sub>95%</sub>)</b>	<3 s
<b>Body material</b>	stainless steel
<b>Electr. housing material</b>	PC (Polycarbonate)
<b>Sealing material</b>	FKM, EPDM, FFKM
<b>Port connections</b>	NPT 1/4, G 1/4, screw-in fitting or sub-base, others on request
<b>Control valve</b> (proportional valve) valve orifice k <sub>vS</sub> -value	normally closed 0.05 to 2.0 mm 0.00006 to 0.09 m <sup>3</sup> /h
<b>Electr. connection</b>	Sub-D plug 15-pin M12 plug 5-pin (DeviceNet, CANopen) M12 socket, 5-pin (PROFIBUS DP)
<b>Power supply</b>	24V DC
<b>Voltage tolerance</b>	±10 %
<b>Residual ripple</b>	<2 %
<b>Power consumption</b>	max. 7.5 W, max. 10 W (Fieldbus version)
<b>Setpoint</b> Feed impedance	0-5 V, 0-10 V, 0-20 mA or 4-20 mA > 20 kΩ (voltage), < 300 Ω (current)
<b>Output signal</b> 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
<b>Digital communication</b>	PROFIBUS DP, DeviceNet, CANopen, RS232/485 (RS Interface only with adapter)
<b>Protection class</b>	IP40
<b>Dimensions [mm]</b>	see drawings
<b>Total weight</b>	ca. 850 g (stainless steel)
<b>Mounting position</b>	horizontal or vertical
<b>Light emitting diode display</b> (default, other allocations possible)	indication for Power, Limit (with analog signals) / Communication (with fieldbus), Error
<b>Binary input</b> (default, other functions possible)	two 1. start autotune 2. not assigned
<b>Binary output</b> (default, other functions possible)	one relay-output for 1. setpoint not reached max. load: 25V, 1A, 25VA

<sup>1)</sup> at standard conditions 1.013 bar (a) and 0°C

## Measuring principle



The measurement is based on the bypass principle. A laminar flow element in the main channel generates a small pressure drop. This drives a small flow, proportional to the main flow, through the bypass (sensor tube).

Two heater resistors, which are connected in a measuring bridge, are wound on this stainless steel tube. In the zero-flow state, the bridge is balanced, but with flow, heat is transported in the flow direction and the bridge becomes unbalanced.

The dynamics of the measurement is limited by the tube walls, which act as a thermal barrier. Through use of suitable software in the controller, response times are obtained (in the range of a few seconds) that are adequate for a wide range of applications.

With contaminated media we recommend to install filter elements upstream. This avoids changes in the division ratio between main flow and sensor tube, as well as changes in the heat transmission caused by deposits on the walls of the sensor tube.

With these sensors even aggressive gases can be controlled, because all essential parts in contact with the medium are fabricated in stainless steel. With this sensor principle it is also possible to convert between different gases.

$$Q(\text{Gas}) = f \times Q(\text{N}_2)$$

gas	factor f
N <sub>2</sub>	1.00
Luft	1.00
O <sub>2</sub>	0.98
H <sub>2</sub>	1.01
Ar	1.4
He	1.42
CO <sub>2</sub>	0.77

By using the gas factors it is possible that the accuracy is not within the datasheet specification. For applications which need high accuracy it is recommended to calibrate under application conditions.

The compatibility of the sealing materials of the MFCs should be checked before use with another gas.

## Notes regarding the selection of the unit

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. 5 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.

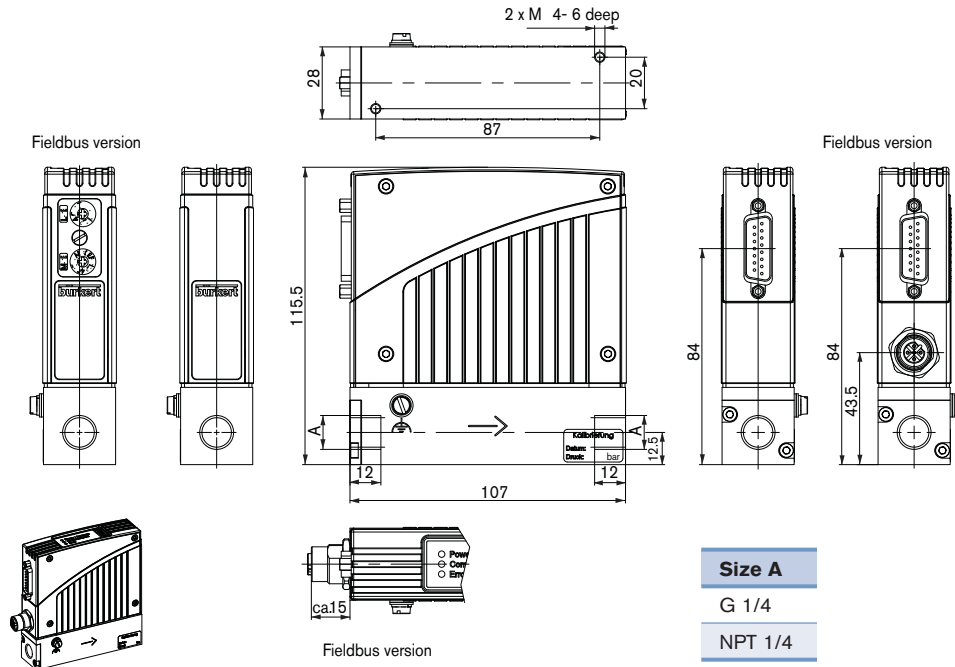
► **The request for quotation form on page 5 contains the relevant fluid specification. Please use in this way the experience of Bürkert engineers already in the design phase and provide us with a copy of the request containing the data of your application together with your inquiry or order.**

## Ordering table for accessories (connectors are not included in the delivery)

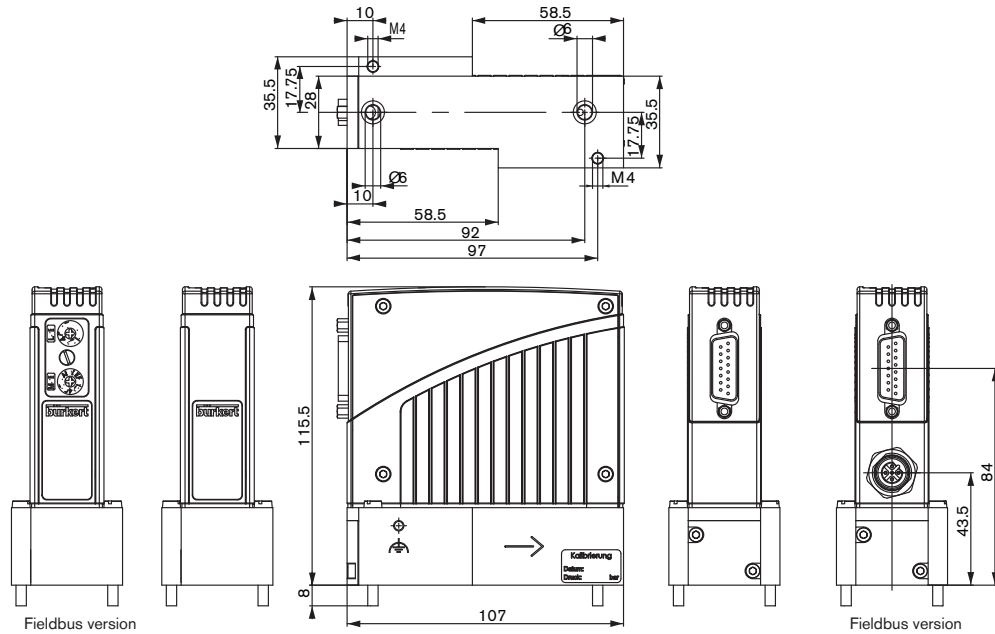
Article	Item no.
<b>15-pin electrical connection</b>	
Sub-D socket 15-pin solder connection	918 274
Sub-D hood for Sub-D socket, with screw locking	918 408
Sub-D socket 15-pin with 5m cable, ass. on one side	787 737
Sub-D socket 15-pin with 10m cable, ass. on one side	787 738
<b>PROFIBUS DP</b>	
M12 socket direct	918 198
M12 socket (coupling) direct	918 447
PROFIBUS T-connector	902 098
<b>Adapter</b>	
RS232 Adapter	654 748
RS485 Adapter	654 538
PC cable for RS232 9-pin socket/plug 2m	917 039
USB Adapter	670 639
Communication software MassFlowCommunicator	Info at <a href="http://www.burkert.com">www.burkert.com</a>

Dimensions [mm]

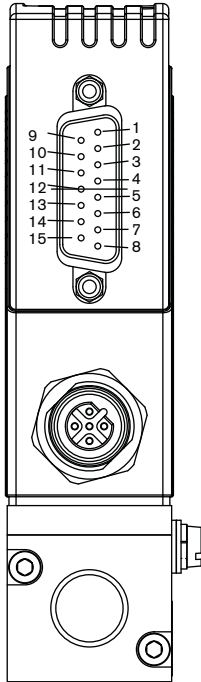
Standard version



Sub-base version



## Pin Assignment



## Sub-D plug 15-pin

Pin	Connection
1	Relay output - NC contact
2	Relay output - NO contact
3	Relay output - C contact
4	GND 24 -V-supply and binary inputs
5	24 V supply +
6	8 V output (For factory use only!)
7	Setpoint input GND
8	Setpoint input +
9	Process value output GND
10	Process value output +
11	DGND (for RS232)
12	Binary input 1
13	Binary input 2
14	RS232 RxD (without driver)
15	RS232 TxD (without driver)

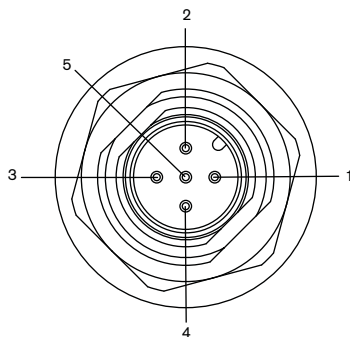
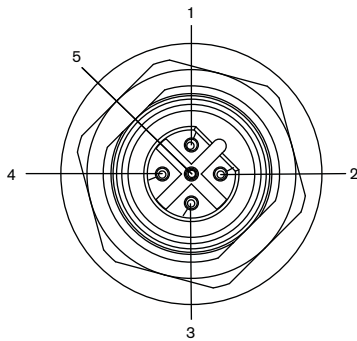
## Only with fieldbus

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

Pin	Connection
1	VDD
2	RxD / TxD - N (A-line)
3	DGND
4	RxD / TxD - P (B-line)
5	not used

## DeviceNet, CANopen – plug M12

Pin	Belegung
1	Shield
2	not used
3	DGND
4	CAN_H
5	CAN_L



**Note**  
You can fill out the fields directly in the PDF file before printing out the form.

**MFC/MFM applications - request for quotation**

▶ Please fill out and send to your nearest Bürkert sales centre\* together with your inquiry or order

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>1)</sup>

Medium temperature [°C or °F]    °C    °F

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

Abrasive components / solid particles    no    yes as follows

**Fluidic data**

Maximum flow Q<sub>nom</sub>    l<sub>N</sub>/min <sup>1)</sup>    cm<sub>N</sub><sup>3</sup>/min <sup>1)</sup>  
 m<sub>N</sub><sup>3</sup>/h <sup>1)</sup>    cm<sub>S</sub><sup>3</sup>/min (sccm) <sup>2)</sup>  
 kg/h    l<sub>S</sub>/min (slpm) <sup>2)</sup>

Minimum flow Q<sub>nom</sub>    l<sub>N</sub>/min <sup>1)</sup>    cm<sub>N</sub><sup>3</sup>/min <sup>1)</sup>  
 m<sub>N</sub><sup>3</sup>/h <sup>1)</sup>    cm<sub>S</sub><sup>3</sup>/min (sccm) <sup>2)</sup>  
 kg/h    l<sub>S</sub>/min (slpm) <sup>2)</sup>

Inlet pressure at Q<sub>nenn</sub>   p<sub>1</sub> =  barg ■

Outlet pressure at Q<sub>nenn</sub>   p<sub>2</sub> =  barg ■

Max. inlet pressure p<sub>1max</sub>    barg ■

Pipe run (external-Ø)    metric, mm    imperial, inch

MFC/MFM- port connection    without screw-in fitting  
 1/4" thread G-thread (DIN ISO 228/1)  
 1/4" thread NPT-thread (ANSI B1.2)  
 with screw-in fitting  
 sub-base version

Ambient temperature    °C

**Material data**

Sealing material    FKM    EPDM    FFKM

**Electrical data**

<b>Output/Input signal</b>	<b>Standard signal</b>	<b>with Fieldbus</b>
	Output	
	<input type="checkbox"/> 0-5 V	<input type="checkbox"/> PROFIBUS-DP
	<input type="checkbox"/> 0-10 V	<input type="checkbox"/> DeviceNet
	<input type="checkbox"/> 0-20 mA	<input type="checkbox"/> CANopen
	<input type="checkbox"/> 4-20 mA	
	Input	
	<input type="checkbox"/> 0-5 V	
	<input type="checkbox"/> 0-10 V	
	<input type="checkbox"/> 0-20 mA	
	<input type="checkbox"/> 4-20 mA	

■ Please quote all pressure values as overpressures with respect to atmospheric pressure [barg]

1) at: 1.013 bar (a) and 0°C

2) at: 1.013 bar (a) and 20°C

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

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