Mass flow controller (MFC)/mass flow meter (MFM) for gases

- Nominal flow range from 0.010 IN/min to 160 IN/min (re. nitrogen)
- High accuracy in measurement and repeat accuracy
- Very fast response times
- Easy device exchange due to configuration memory
- Optional: USP Class VI, FDA, EC 1935 compliant

Product variants described in the data sheet may differ from the product presentation and description.

Can be combined with

Type 7011 ▸
Direct-acting 2/2-way plunger valve

Type 6013 ▸
Plunger valve 2/2-way direct-acting

Type 0330 ▸
Direct-acting 2/2 or 3/2-way pivoted armature valve

Type ME43 ▸
Fieldbus gateway

Type ME63 ▸
Industrial Ethernet gateway, IP65/IP67/IP69k

Type ME61 ▸
EDIP process display

Type ME66 ▸
Passive junction box, IP65/ IP67/ IP69k

Type description

The Type 8741 mass flow controller (MFC)/mass flowmeter (MFM) for gases is suitable for a variety of applications and is available with industrial Ethernet, analogue or fieldbus interfaces. The variant with CANopen-based Bürkert Systembus (büS) is suitable for integration into existing CANopen networks or - in combination with the Type ME43 fieldbus gateway - for integration into all common industry standards for Industrial Ethernet and/or fieldbus. The latter option is tailor-made for applications with many control loops. Up to 32 MFCs or MFMs can be connected to one fieldbus gateway. Type ME43 transmits the internal CANopen-based communication to Industrial Ethernet and fieldbus standards. The mass flow controller/ mass flow meter Type 8741 can be switched at any time between büS and CANopen communication. Type 8741 can be configured as an MFM or an MFC according to demand. Furthermore, a Modbus RTU variant is also available. Optionally, up to four calibration curves can be stored in the device. The thermal MEMS sensor is located directly in the gas stream and therefore achieves very fast response times. As the actuator, a Bürkert direct-acting proportional valve guarantees high response sensitivity.

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Visit product website ▸

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1. General technical data

Product properties	
Dimensions	Further information can be found in chapter "4. Dimensions" on page 6.
Material	
Seal	FKM or EPDM (depending on gas)
Housing	PC (polycarbonate)
Base block	Aluminium or stainless steel 1.4404/316L
Wetted parts	Stainless steel 1.4310/302, 1.4113/434, 1.4305/303
Total weight	Approx. 500 g (aluminium base block)
Configuration management	Further information can be found in chapter "8.3. Configuration management for easy device replacement" on page 22.
LED display [1.]	RGB LED according to NAMUR NE107
Performance data	
Nominal flow range (Q_N) [2.]	10 ml...160 l_N/min (N_2) [2.]
Operating pressure [3.]	MFM: max. 25 bar MFC: max. 25 bar (the maximum operating pressure depends on medium and nominal valve size)
Measuring accuracy [4.]	± 0.8 % MV [5.] ± 0.3 % FS [6.] (under calibration conditions and after warm-up time to achieve the best measuring conditions)
Repeatability	± 0.1 % FS
Turndown ratio	1:50, optionally 1:100
Settling time (MFC)/Response time (MFM) (t95)	< 300 ms
Actuator (proportional valve)	
Valve position	Normally closed
Nominal diameter	0.05...8 mm
K_{VS} value range	0.00006...1.1 m^3/h
Electrical data	
Operating voltage	24 V DC
Power consumption [7.]	1...3 W (as MFM) Max. 3...19.5 W (as MFC, depending on the type of proportional valve)
Residual ripple	± 2 %
Voltage tolerance	± 10 %
Electrical connection	
büS/CANopen variant	Terminal strip, 4-pin
Analogue variant	D-Sub plug, 9-pin [8.] or terminal strip, 6-pin
Industrial Ethernet variant	2 x RJ45 socket (switch) [9.]
Modbus RTU variant	D-Sub plug, 9-pin
Medium data	
Operating medium	Neutral, pure gases (others on request) Further information can be found in chapter "6.2. Nominal flow rate of typical gases" on page 19.
Calibration medium	Operating medium or air
Medium temperature	- 10 °C...+ 70 °C (- 10 °C...+ 60 °C with oxygen)
Product connections	
Analogue interface	4...20 mA, 0...20 mA, 0...10 V or 0...5 V Input impedance: > 20 kΩ (voltage) resp. < 300 Ω (current) Maximum current: 10 mA (voltage output) Maximum load: 400 Ω (current output)
Digital communication interface	büS/CANopen, Modbus RS-485/RTU list 0 and list 1, Industrial Ethernet: EtherCAT®, EtherNet/IP, Modbus TCP, PROFINET
Port connection	G ¼, NPT ¼, sub-base, compression fitting or vacuum fitting, clamp connection (others on request)
Approvals and conformities	
Material certificate	Material certificate 3.1 (on request)
North America (USA/Canada)	Further information can be found in chapter "2.4. North America (USA/Canada)" on page 5.
Foods and beverages/Hygiene	Further information can be found in chapter "2.5. Foods and beverages/Hygiene" on page 6.

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Oxygen	Further information can be found in chapter "2.6. Oxygen" on page 6.
Environment and installation	
Installation position	Horizontal or vertical
Storage temperature	-10 °C...+70 °C
Relative air humidity	Max. 95 % at +55 °C, non-condensing
Degree of protection	IP20
Ambient temperature	-10 °C...+50 °C (higher temperatures on request)
Accessories	
Software	Bürkert Communicator Further information can be found in chapter "8.1. Bürkert Communicator software" on page 21.

1.) For a detailed description of LED colours see **operating instructions Type 8741** ▸
2.) Index N: flow rates with respect to 1.013 bar abs and 0 °C
3.) Overpressure to atmospheric pressure
4.) If the operating medium differs from the calibration medium, the actual measuring accuracy may deviate from the specified value. If the operating medium is natural gas, the measuring accuracy depends on the composition of the natural gas, which can vary depending on origin and season.
5.) Of measured value
6.) Of full scale
7.) Information based on the typical power consumption (at +23 °C ambient temperature, nominal flow rate and 30 min closed-loop control mode). The specifications according to UL 61010-1 may deviate (see **operating instructions Type 8741** ▸).
8.) An additional digital input and a relay output are available for the analogue variant with D-Sub, 9-pin.
9.) Supply voltage via separate terminal strip

2. Approvals and conformities

2.1. General notes

Note:

- The approvals and conformities listed below must be stated when making enquiries. This is the only way to ensure that the product complies with all required specifications.
- Not all available variants can be supplied with the below mentioned approvals or conformities.

2.2. Conformity

In accordance with the Declaration of Conformity, the product is compliant with the EU Directives.

2.3. Standards

The applied standards which are used to demonstrate compliance with the EU Directives are listed in the EU-Type Examination Certificate and/or the EU Declaration of Conformity.

2.4. North America (USA/Canada)

Approval	Description
c UL us LISTED	**Optional: UL Listed for the USA and Canada** The products are UL Listed for the USA and Canada according to: • UL 61010-1 (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 1: General Requirements) • CAN/CSA-C22.2 No. 61010-1

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2.5. Foods and beverages/Hygiene

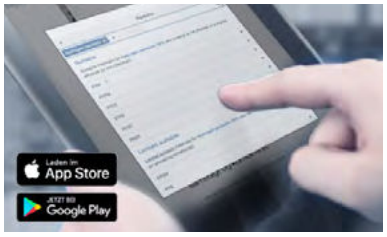
Conformity	Description
FDA	**FDA – Code of Federal Regulations (valid for variable code PL02, PL03)** All wetted materials are compliant with the Code of Federal Regulations published by the FDA (Food and Drug Administration, USA) according to the manufacturer's declaration.
USP	**United States Pharmacopeial Convention (USP) (valid for variable code PL04)** All wetted materials are biocompatible according to the manufacturer's declaration.
	EC Regulation 1935/2004 of the European Parliament and of the Council (valid for variable code PL01, PL02) All wetted materials are compliant with EC Regulation 1935/2004/EC according to the manufacturer's declaration.

2.6. Oxygen

Conformity	Description
O_2	**Optional: Suitability for oxygen (valid for the variable code NL02)** The products are suitable for use with gaseous oxygen, according to the manufacturer's declaration.

3. Materials

3.1. Bürkert resistApp



Bürkert resistApp – Chemical Resistance Chart

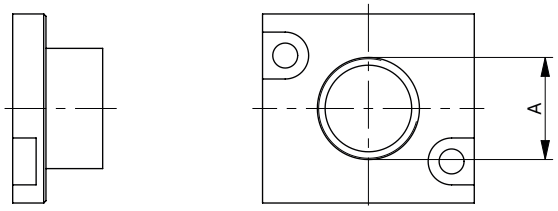
You want to ensure the reliability and durability of the materials in your individual application case? Verify your combination of media and materials on our website or in our resistApp.

Start chemical resistance check

4. Dimensions

4.1. Threaded variant connections

Small nominal flow rates, with internal thread

Dimensions	Thread (A)	Thread depth [mm]
	G ¼, NPT ¼,	12
	G ⅛, NPT ⅛	12

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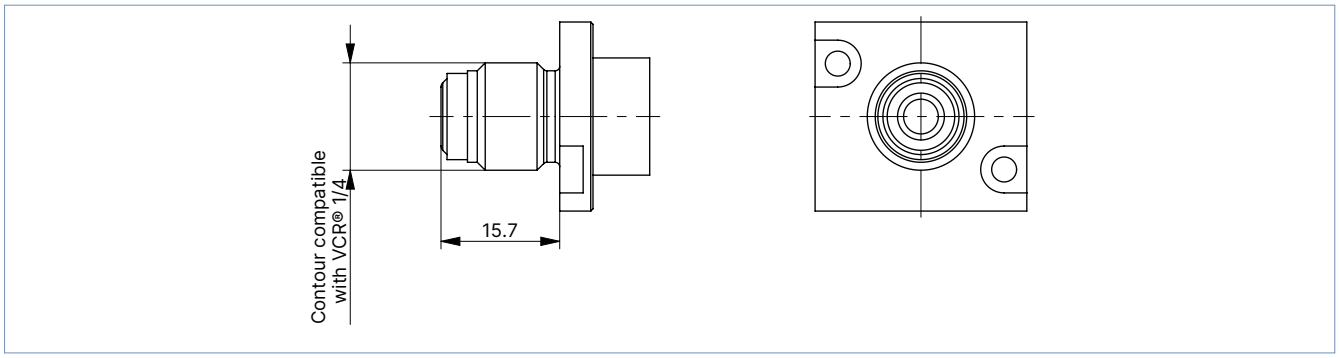
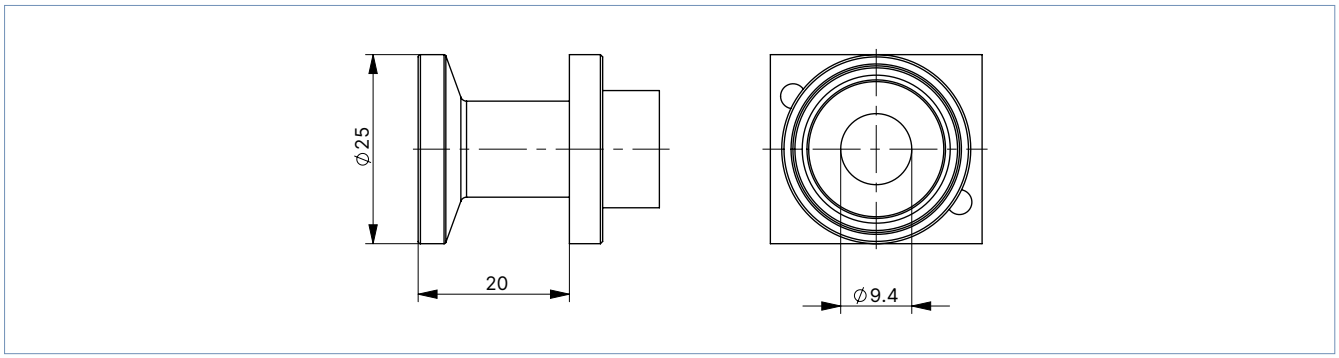
Small nominal flow rates, compatible with VCR®

Note:
Dimensions in mm



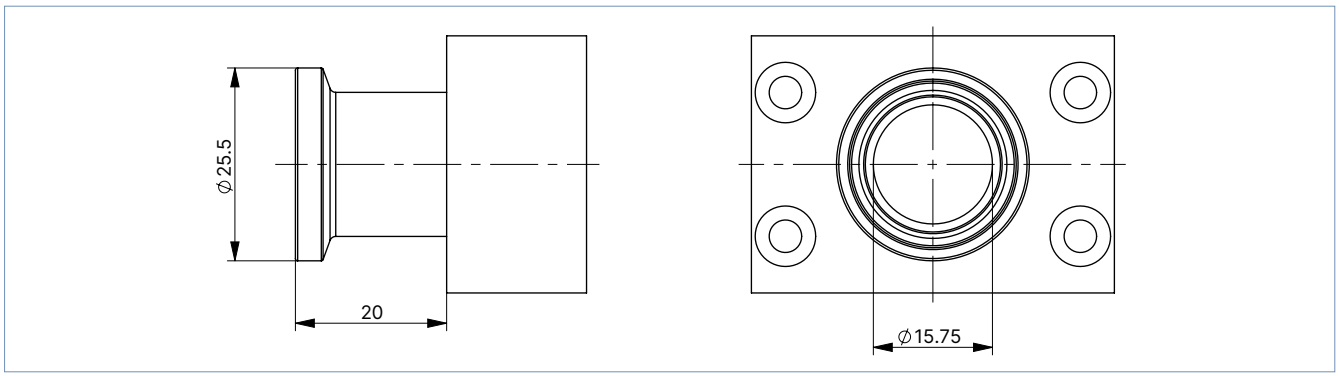
Small nominal flow rates, with clamp connection DN 15...½"

Note:
Dimensions in mm



Small nominal flow rates, with clamp connection DN 20...¾"

Note:
Dimensions in mm



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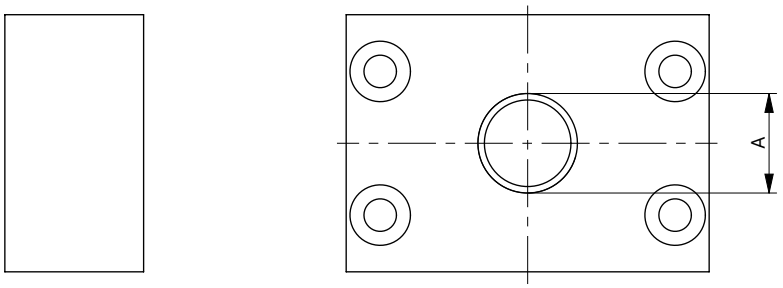
Large nominal flow rates, with internal thread

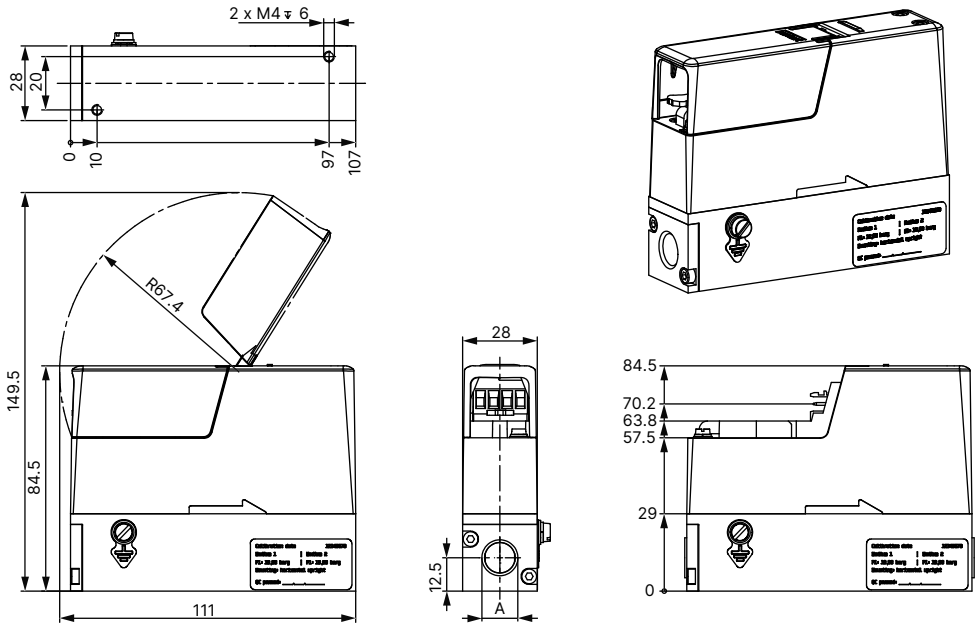
Dimensions	Thread (A)	Thread depth [mm]
	G ¼	12
	NPT ¼	11
	G ⅜	12
	NPT ⅜	11
	G ½	15
	NPT ½	14
	G ¾	16
	NPT ¾	15

4.2. Variant with büS/CANopen interface

MFC with valve Type 2871/MFM

Variant with base block C0...C4 for small nominal flow rates

Note:
Dimensions in mm



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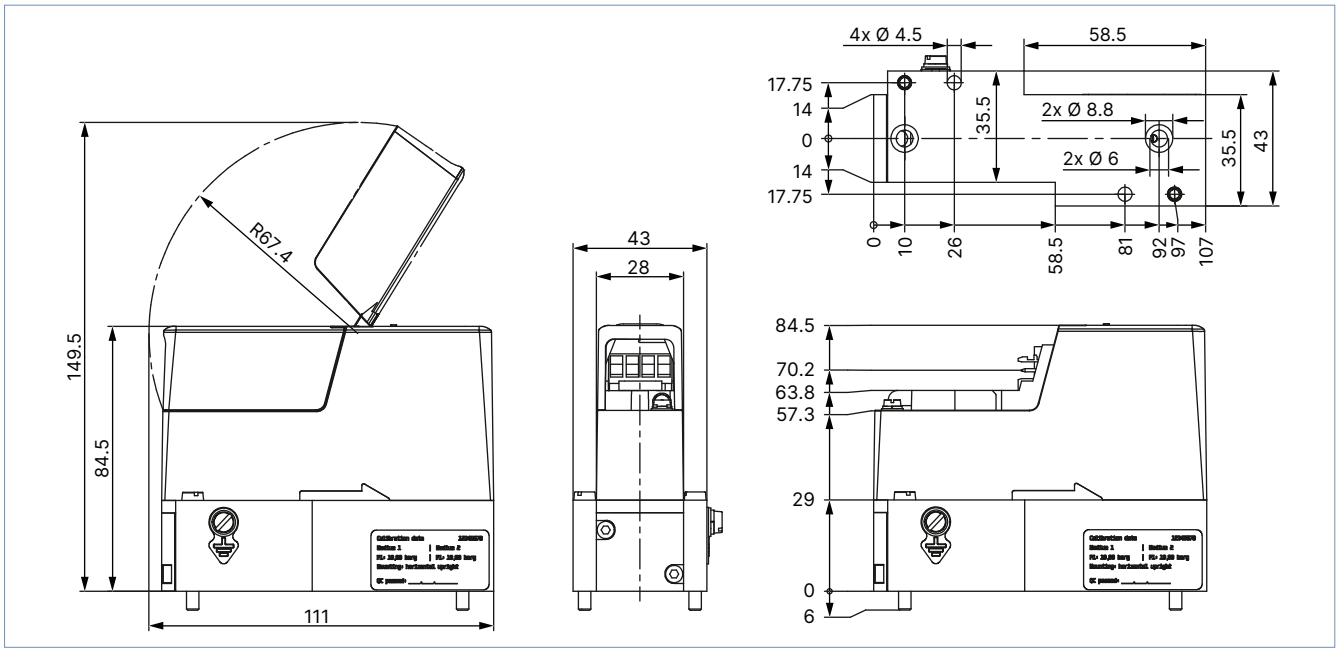
Sub-base variant

Note:
Dimensions in mm



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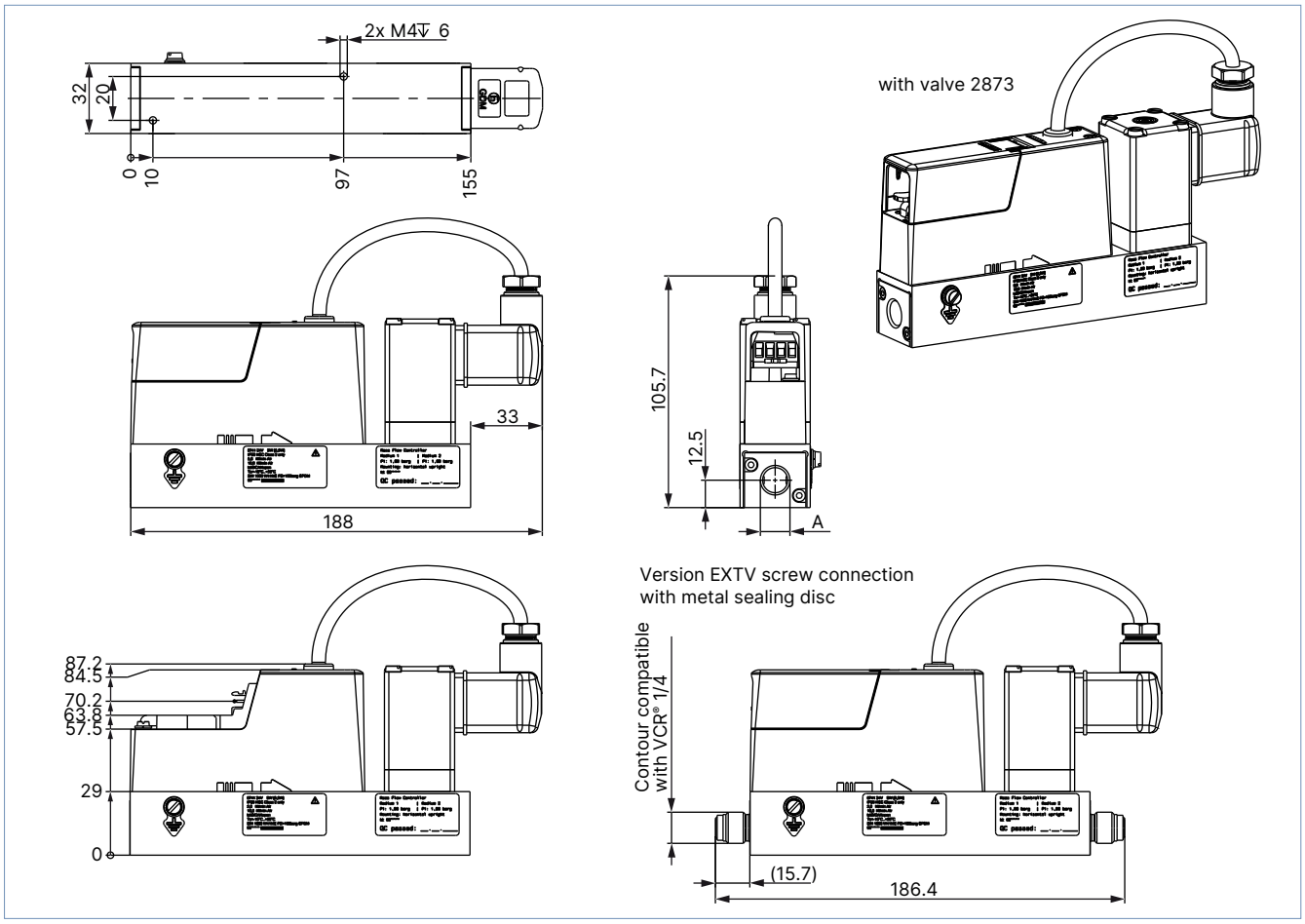
MFC with valve Type 2873

Variant with base block C...C4 for small nominal flow rates

Note:
Dimensions in mm



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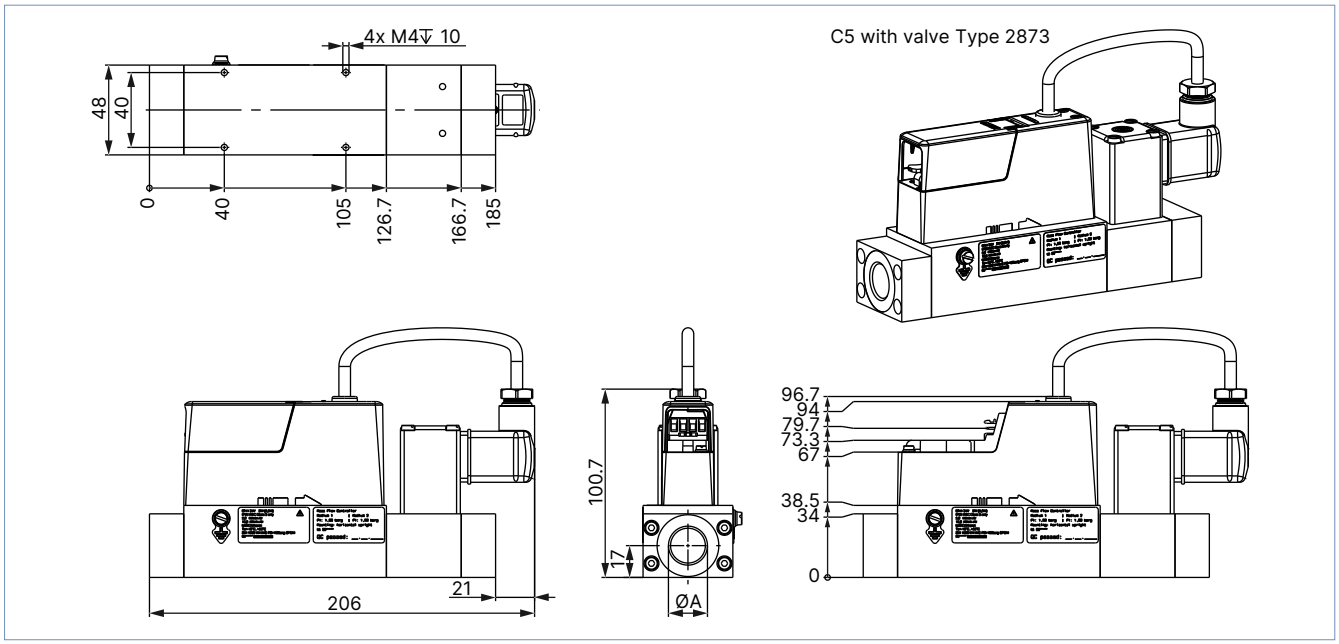
Variant with base block C5 for large nominal flow rates

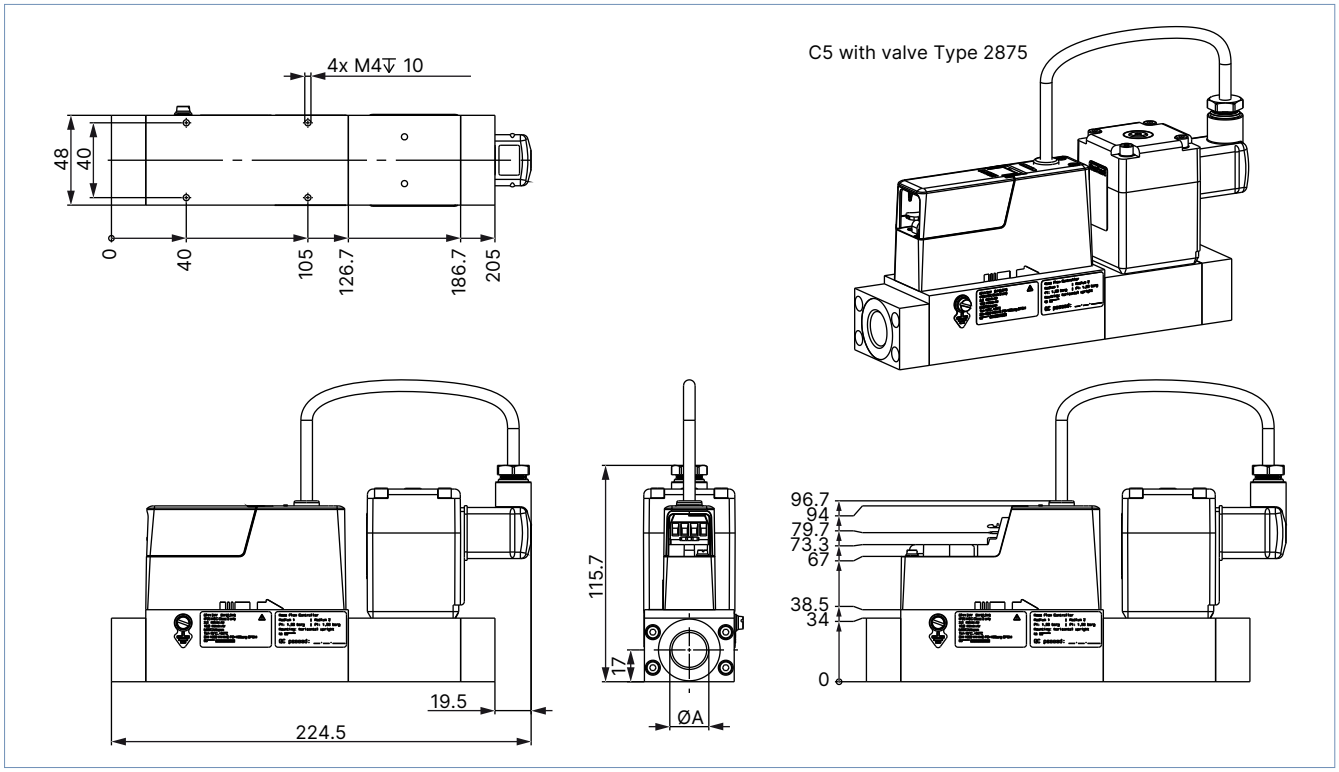
Note:
Dimensions in mm



MFC with valve Type 2873

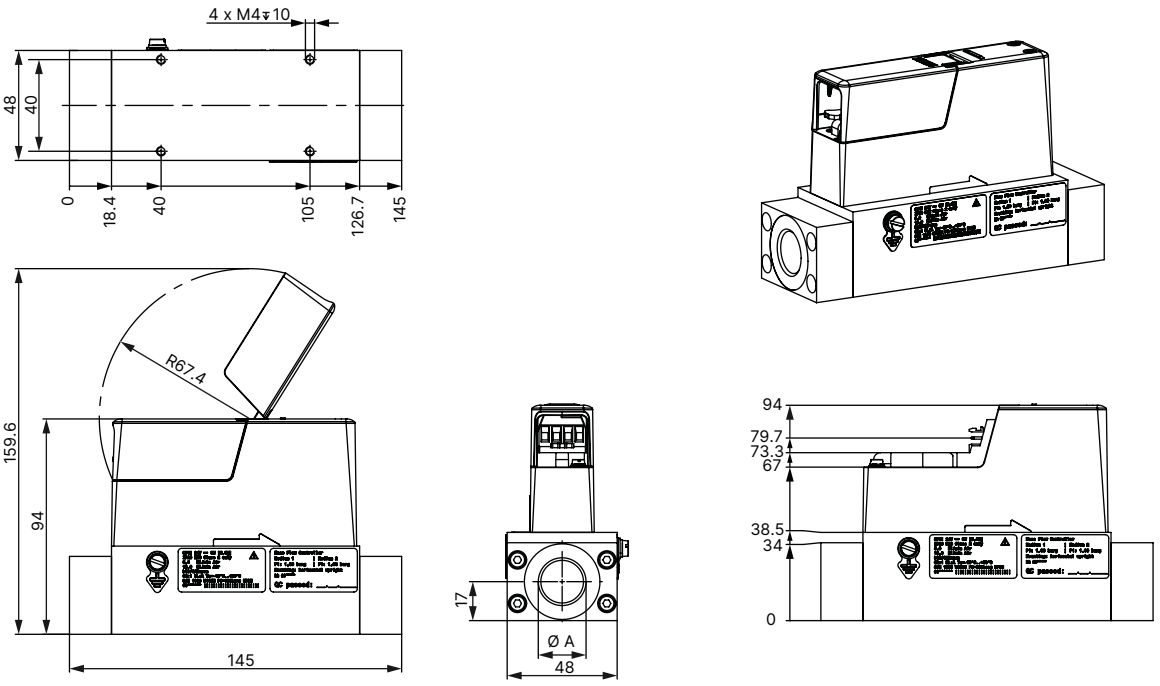
Variant with base block C5 for large nominal flow rates

Note:
Dimensions in mm



Variant with base block C5 for large nominal flow rates

Note:
Dimensions in mm

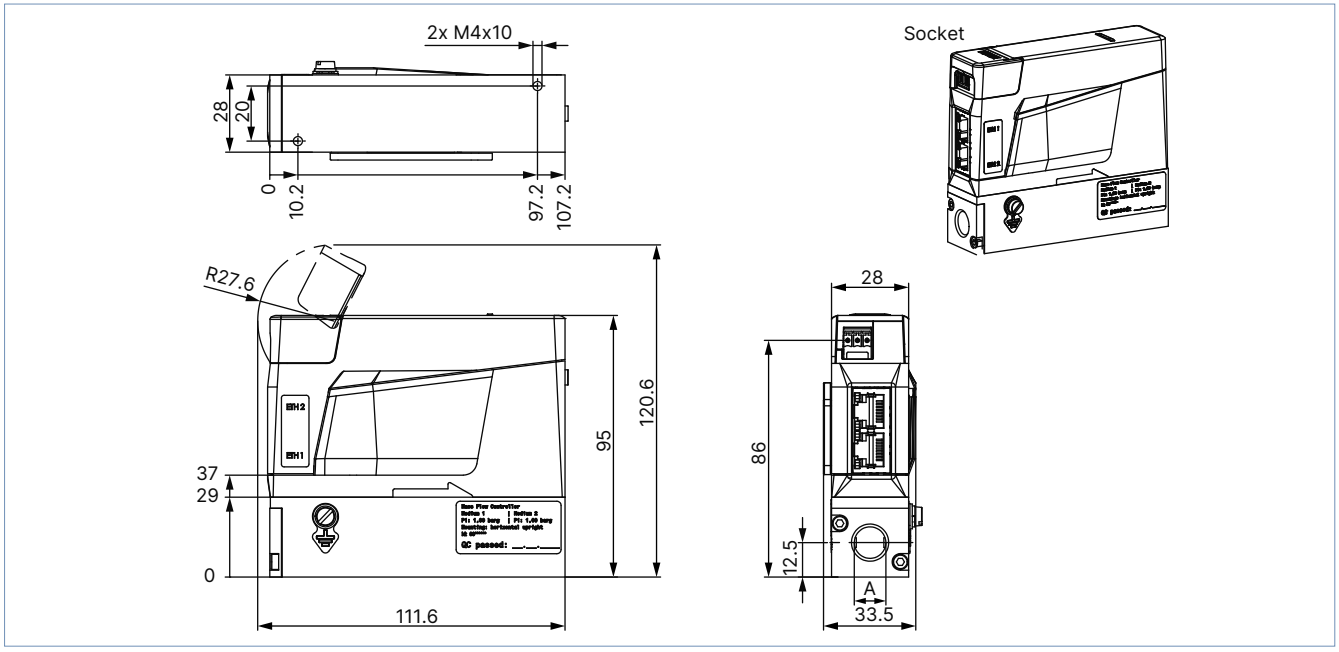


4.3. Variant with analogue interface or Industrial Ethernet interface

MFC with valve Type 2871/MFM

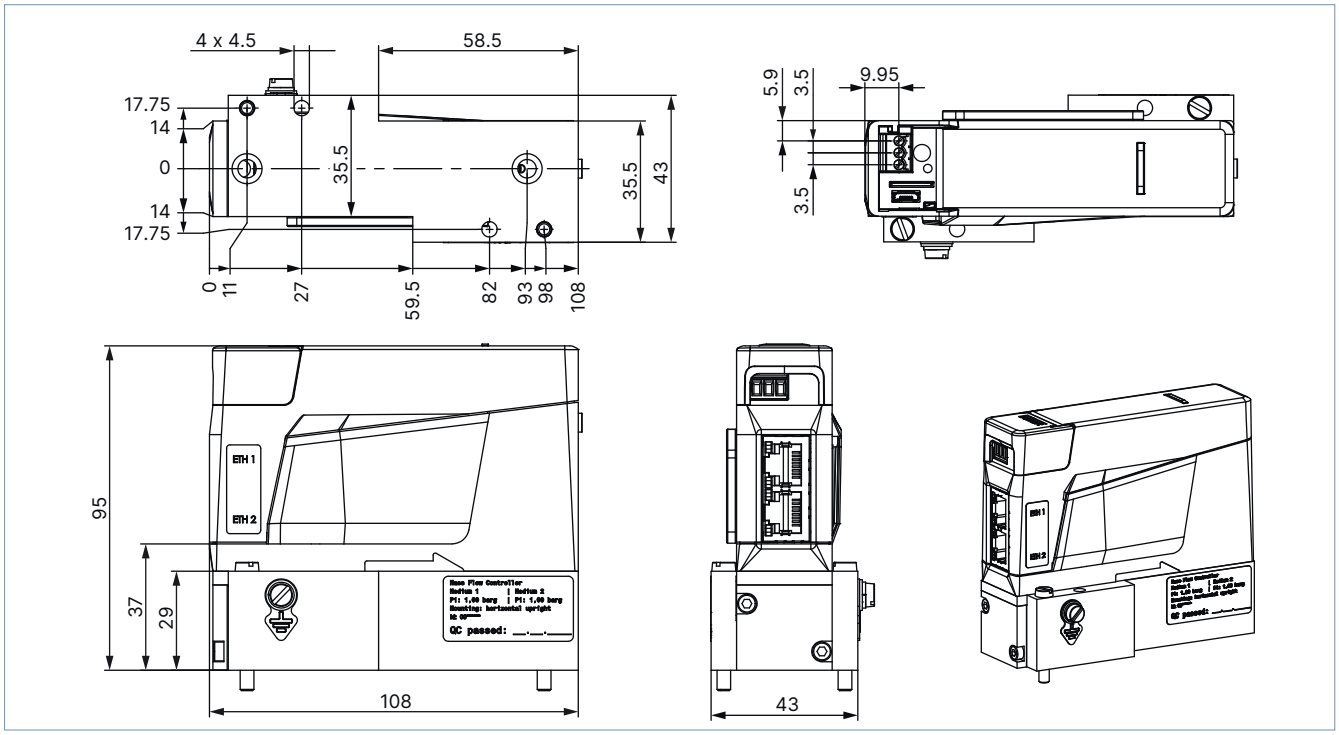
Variant with base block C0...C4 for small nominal flow rates

Note:
Dimensions in mm



Sub-base variant

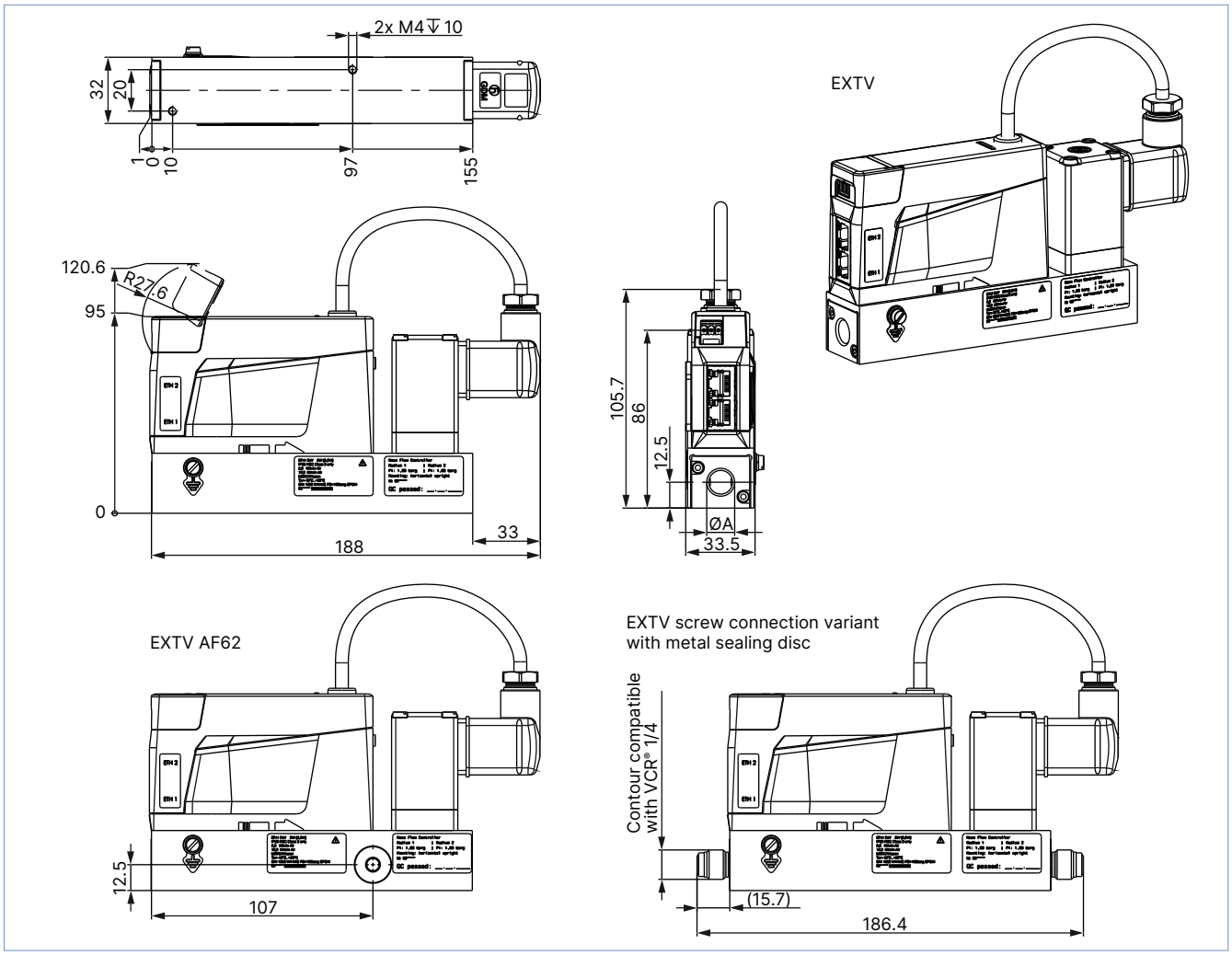
Note:
Dimensions in mm



MFC with valve Type 2873

Variant with base block C0...C4 for small nominal flow rates

Note:
Dimensions in mm



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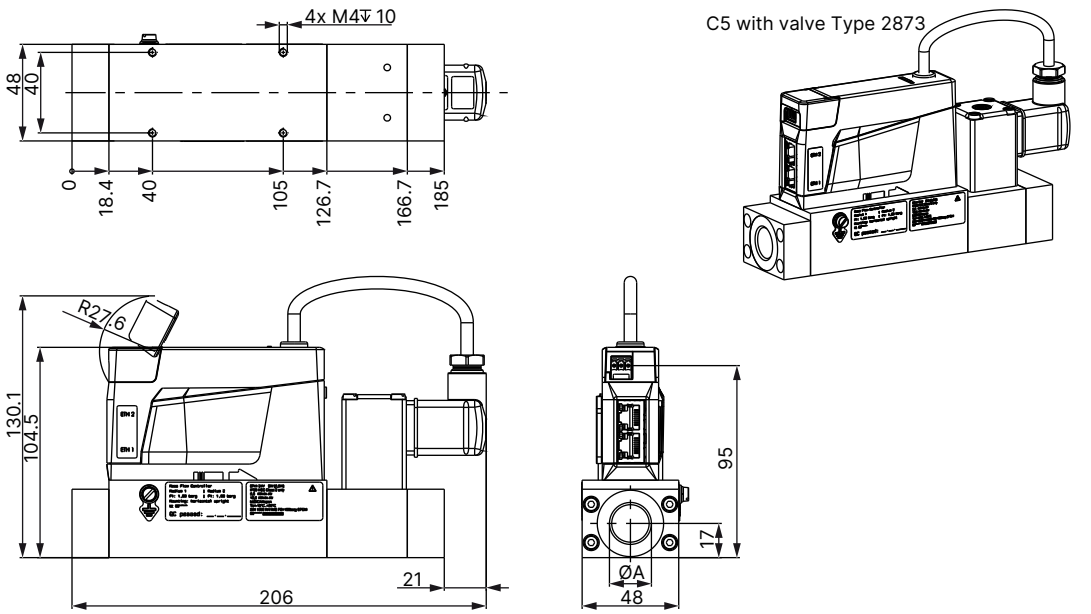
Variant with base block C5 for large nominal flow rates

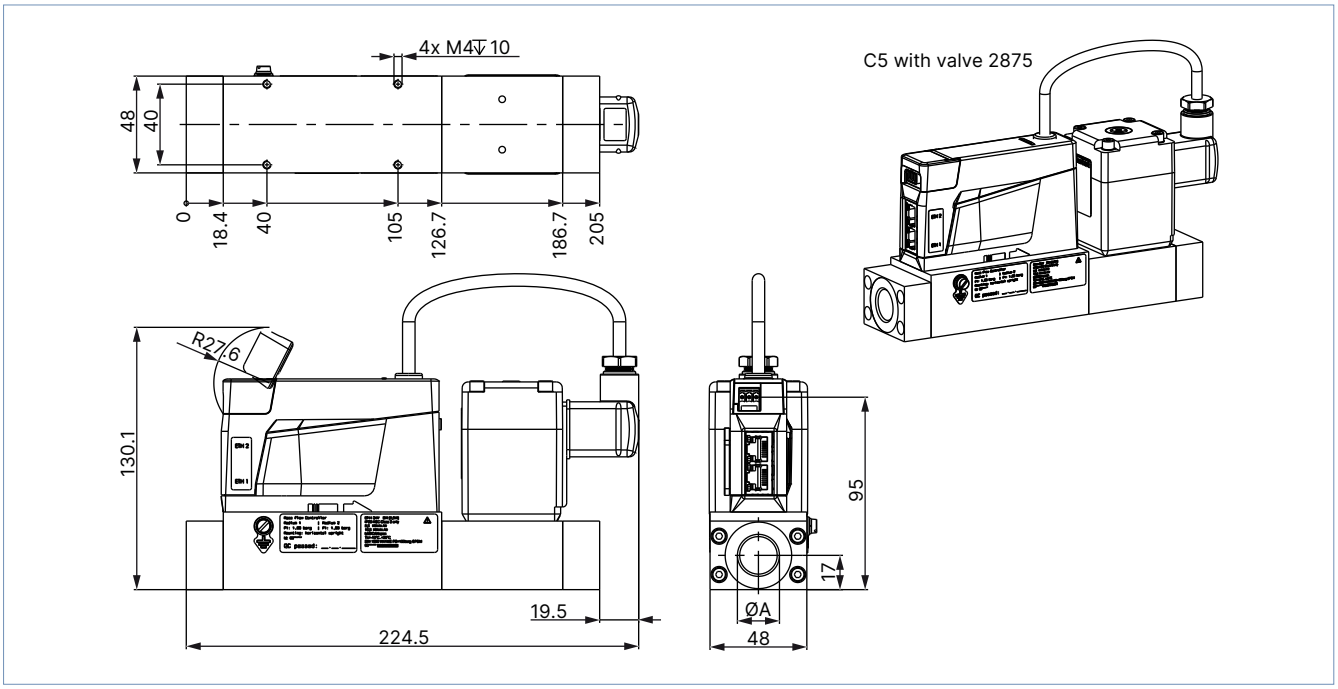
Note:
Dimensions in mm



MFC with valve Type 2875

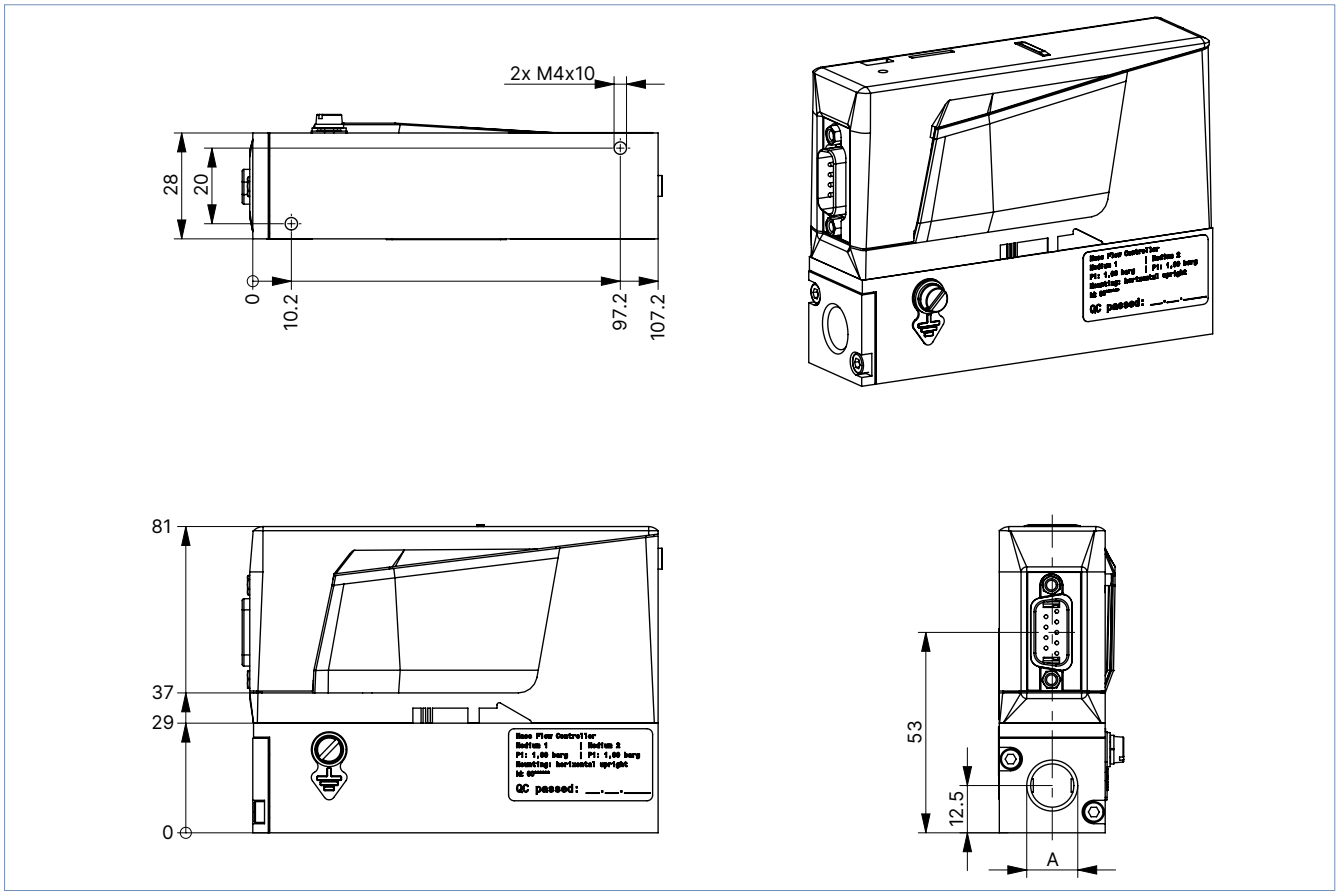
Variant with base block C5 for large nominal flow rates

Note:
Dimensions in mm



4.4. Modbus RTU variant

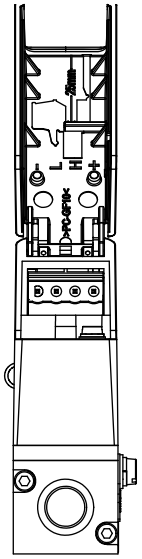
Note:
Dimensions in mm

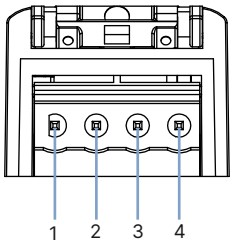


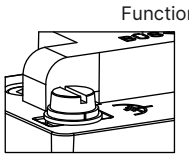
5. Product connections

5.1. Communication

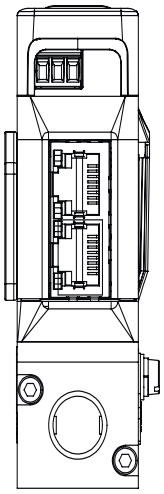
büS/CANopen

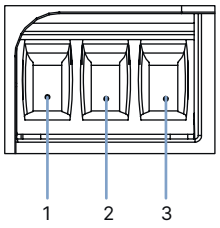


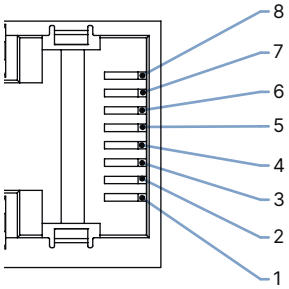
Terminal strip, 4-pin	Pin	Assignment
	1	DGND
	2	CAN_L
	3	CAN_H
	4	24 V

M3 screw	
	When using Bürkert büS cables, the following colour coding applies: • Red: 24 V • Blue: CAN_L • White: CAN_H • Black: GND

Industrial Ethernet



Terminal strip, 3-pin	Pin	Assignment
	1	FE (functional earth)
	2	DGND
	3	24 V

RJ45 socket	Pin	Assignment
	1	TX +
	2	TX –
	3	RX +
	4	Not connected
	5	Not connected
	6	RX –
	7	Not connected
	8	Not connected
	Housing	Shielding

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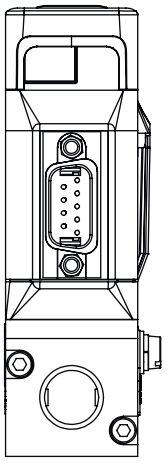
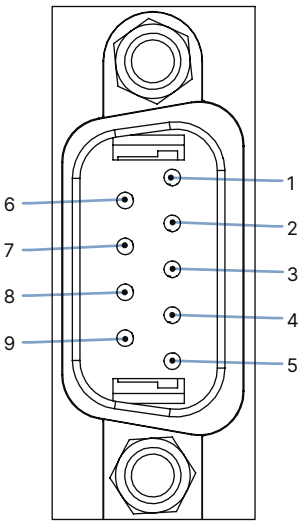
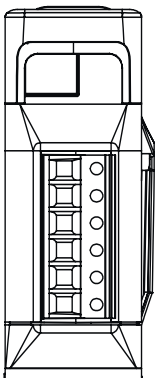
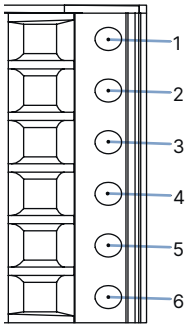
Analogue

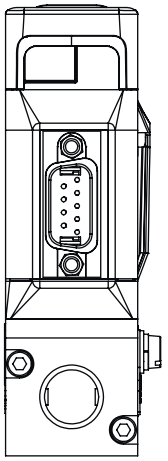


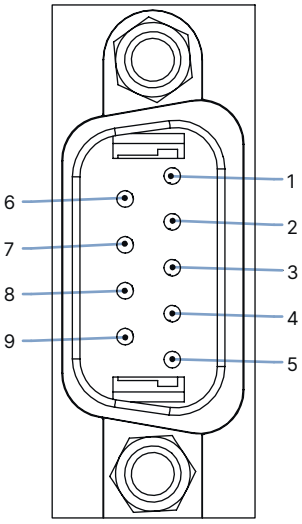
D-Sub plug, 9-pin	Pin	Assignment
	1	Digital input
	2	GND (for supply voltage and digital input)
	3	24 V
	4	Relay, normally closed contact
	5	Relay, reference contact
	6	Set-point value input +
	7	Set-point value input GND
	8	Actual value output +
	9	Actual value output GND
	Housing	Shielding



Terminal strip, 6-pin	Pin	Assignment
	1	24 V
	2	GND
	3	Set-point value input +
	4	Set-point value input GND
	5	Actual value output +
	6	Actual value output GND

Modbus RTU

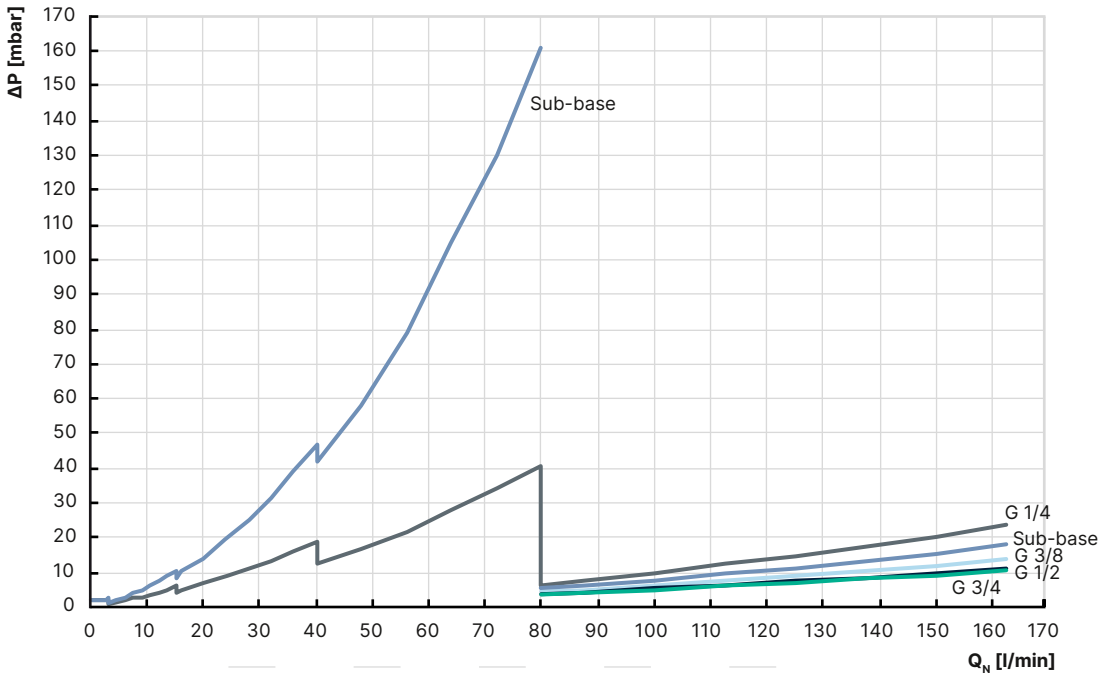


D-Sub plug, 9-pin	Pin	Assignment
	1	Not connected
	2	GND
	3	24 V
	4	Not connected
	5	Not connected
	6	RS-485-Y
	7	RS-485-Z
	8	RS-485-B
	9	RS-485-A
	Housing	Shielding

6. Performance specifications

6.1. MFM pressure loss diagram

The diagram shows an example of the pressure loss curves with air flowing through. To determine the pressure loss of other gases, the corresponding air equivalent must first be calculated and the base block used for the other gas must be taken into account.



Formula for calculating the pressure loss in an MFM:

$$\Delta P_{Gas} = \Delta P_{Air} \sqrt{\frac{\rho_{N\,Gas}}{\rho_{N\,Air}}}$$

6.2. Nominal flow rate of typical gases

Note:

- All values refer to 1.013 bar abs and 273.15 K (0 °C) (Index N).
- Other gases and gas mixtures are possible on request.

Gas	Min. Q_N [l/min]	Max. Q_N [l/min]
Acetylene	0.01	65
Helium	0.01	1000
Carbon dioxide	0.02	80
Air	0.01	160
Methane	0.01	160
Oxygen	0.01	160
Nitrogen	0.01	160
Hydrogen	0.01	1000
Propane	0.03	44

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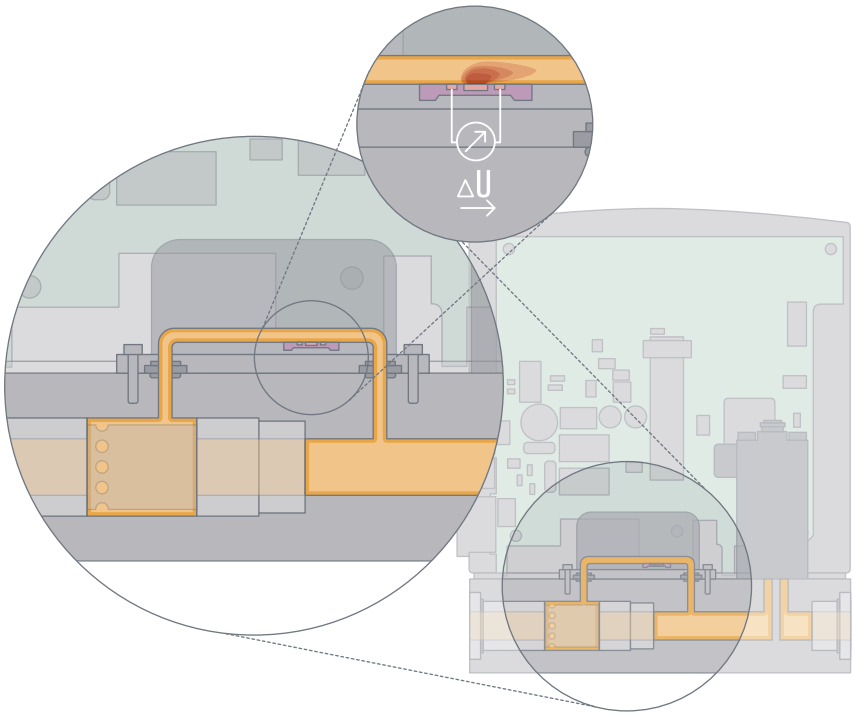
7. Product operation

7.1. Measurement principle

The measured values are recorded in a secondary channel. A laminar flow element in the main channel creates a slight pressure drop. A part of the gas flow is thereby directed into the secondary channel. The sensor located there records the mass flow as a temperature difference. The measurement is performed in a specially shaped flow channel whose wall contains a silicon chip with an etched membrane. A heating resistor and 2 temperature sensors, one upstream and one downstream, are attached on this membrane.
If the heating resistor is fed with a constant voltage, the differential voltage of the temperature sensors indicates the flow rate of the gas flowing over the chip.



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8. Product accessories

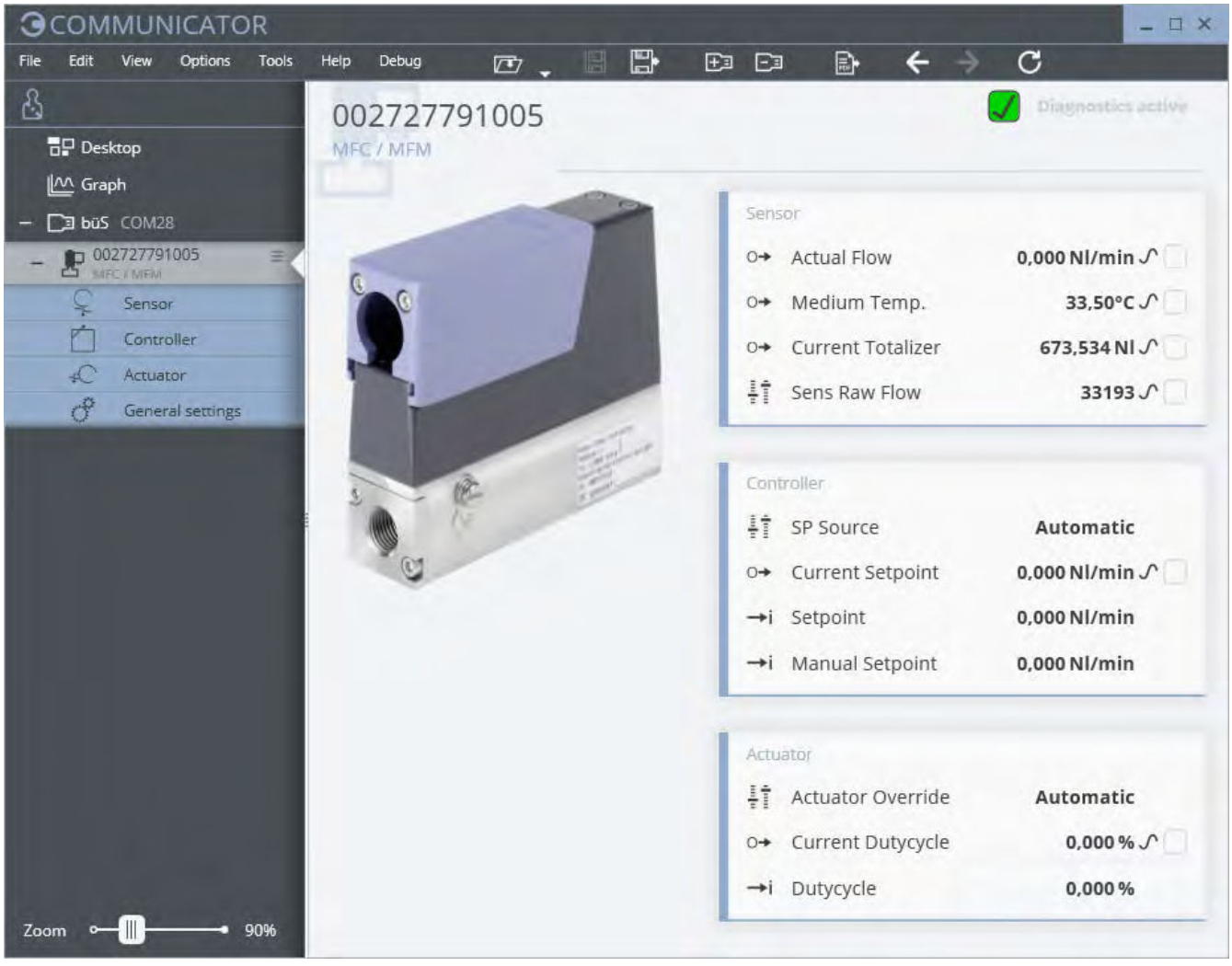
8.1. Bürkert Communicator software

Note:
The corresponding communication software can be downloaded from the website **Type 8920** ▶.

The Bürkert Communicator is the most important software component of the EDIP (Efficient Device Integration Platform). Various features of this universal tool simplify the configuration and parametrisation of devices equipped with a digital CANopen-based interface. With this tool, the user has a complete overview of cyclic process values as well as acyclic diagnostic data. The integrated graphical programming environment enables the creation of decentralised sub-system control functions. The connection to the PC is established with a USB-büS interface set. The adapter is available as an accessory (see "9.5. Ordering chart accessories" on page 23).

The Bürkert Communicator enables:

- Configuration, parametrisation and diagnosis of EDIP devices / networks
- Switching between defined gases
- Easy and comfortable mapping of cyclic values
- Graphic display, monitoring and storage of process values
- Firmware update of the connected EDIP devices
- Saving and restoring device configurations
- Zero-point adjustment in case of changed ambient conditions
- Guided re-calibration routine



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8.2. Connecting Type 8741 with the Bürkert Communicator software

The Bürkert Communicator software interface is based on CANopen. An appropriate bus termination is mandatory.

- Type 8741 Analogue, Industrial Ethernet resp. Modbus RTU:
  - Activate the switchable terminating resistor on the büS stick.
  - The device is connected via the device's micro USB socket (USB-büS interface set 2 contains the necessary accessories).
- Type 8741 büS/CANopen:
  - Activate the switchable terminating resistor on the büS stick. Exception: if the device is already integrated in a properly terminated bus network, the terminating resistor must not be activated.
  - The device is connected via the 4-pin terminal strip (USB-büS interface Set 1 contains the necessary accessories).

Note: no external power supply must be connected to the micro USB socket. The device must be provided with power as described in chapter "5. Product connections" on page 17.

8.3. Configuration management for easy device replacement

Depending on the electrical connection of the MFC, the following options are available for device replacement:

- If a device needs to be replaced, the memory card can be removed from the defective device and can be inserted into the new device. This transfers all data from the device to be replaced to the new device. The memory card is available as an accessory and must be ordered separately (see "9.5. Ordering chart accessories" on page 23).
- Option for Type 8741 büS/CANopen: the device is exchanged via the configuration provider of the higher-level gateway control (ME43 or ME63). This requires a memory card in the gateway. The memory card is available as an accessory and must be ordered separately (see "9.5. Ordering chart accessories" on page 23).

In order to successfully exchange the device, it is necessary that both the new device and the device to be replaced have the same article number.

8.4. Web server for Industrial Ethernet variant

The Industrial Ethernet-based devices (except for the EtherCAT® protocol) from software version A.13.00.00 onwards have an integrated web server. The server can be accessed via a web browser by entering the device's IP address (factory setting IP192.168.1.100).

9. Ordering information

9.1. Bürkert eShop

Bürkert eShop – Easy ordering and quick delivery

You want to find your desired Bürkert product or spare part quickly and order directly? Our online shop is available for you 24/7. Sign up and enjoy all the benefits.

Order online now

9.2. Recommendation regarding product selection

Note:
Use the Product Enquiry Form (see "9.4. Bürkert Product Enquiry Form" on page 23) for information on the device layout and send it to us once completed.

For the proper choice of the actuator orifice within the MFC, you need to know not only the required maximum flow rate Q_N but also the pressure values directly upstream and downstream of the MFC (p_1, p_2) at Q_N. These are often not identical to the inlet and outlet pressure of the entire system, because there are usually additional flow resistances (pipework, additional shut-off valves, nozzles, etc.) both upstream and downstream of the MFC.
Use the Product Enquiry Form to indicate the pressures directly upstream and downstream of the MFC. If the pressure values are unknown or not accessible to measurement, estimates are to be made by taking into account the approximate pressure drops over the flow resistors upstream and downstream of the MFC at Q_N. The maximum expected inlet pressure $p_{1\,max}$ must be specified to ensure the tight-closing function of the actuator in all operating states.

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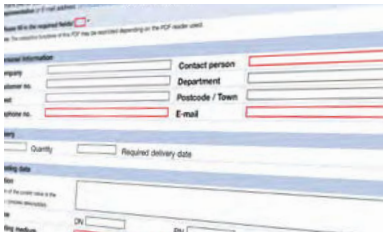
9.3. Bürkert product filter

Bürkert product filter – Get quickly to the right product

You want to select products comfortably based on your technical requirements?
Use the Bürkert product filter and find suitable articles for your application quickly and easily.

Try out our product filter

9.4. Bürkert Product Enquiry Form



Bürkert Product Enquiry Form – Your enquiry quickly and compactly

Would you like to make a specific product enquiry based on your technical requirements? Use our Product Enquiry Form for this purpose. There you will find all the relevant information for your Bürkert contact. This will enable us to provide you with the best possible advice.

Fill out the form now

9.5. Ordering chart accessories

Description	Article number.
General accessories	
USB-büS interface set 1 (Type 8923) for connection to the Bürkert Communicator software: includes connection cable (M12 and micro USB), stick with integrated terminating resistor, power supply and software	772426
USB-büS interface set 2 (Type 8923) for connection to the Bürkert Communicator software: includes büS stick, connection cable to M12 plug, M12 connection cable on micro USB for the büS service interface and Y-distributor, cable length: 0.7 m	772551
Power supply unit Phoenix Class2 (Type 1573), 85...240 V AC/24 V DC, 1.25 A, NEC Class 2 (UL 1310)	772438
Power supply unit for standard rail (Type 1573), 100...240 V AC/24 V DC, 1 A, NEC Class 2 (UL 1310)	772361
Power supply unit for standard rail (Type 1573), 100...240 V AC/24 V DC, 2 A, NEC Class 2 (UL 1310)	772362
Power supply unit for standard rail (Type 1573), 100...240 V AC/24 V DC, 4 A	772363
Memory card	On request
Device description files for software interfaces	Download from **Type 8745** ▶
Bürkert Communicator software	Download from **Type 8920** ▶
For Type 8741 büS/CANopen	
Terminal strip, 4-pin (included in the scope of delivery)	565876
Terminal strip, 4-pin with integrated 120 Ω resistor for büS connection	566066
büS cable, 50 m	772413
büS cable, 100 m	772414
LabVIEW device driver	On request
For Type 8741 Analogue	
Terminal strip, 6-pin (standard for Type 8741, included in the scope of delivery of the corresponding analogue variant)	On request
D-sub adapter cable, on strand, cable length: 5 m	580882
D-sub adapter cable, on strand, cable length: 10 m	580883

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