Mass Flow Meter and Controller
for gases

Flow
Pressure
Level
Temperature
measurement
monitoring
control

- Direct indication
- Digital indication
- Bypass measuring for generating laminar flow

Model:
MAS
MFC

Fields of application:

The KOBOLD MAS model mass flow meter makes very precise measurements of the mass flow rate of gases in different measuring ranges from 0 - 10 Ncm³/min to 0 - 500 Nl/min nitrogen. The operation of the meter is based on the calorimetric principle. For indication of 98 % of the actual flow, the response time is 2 s. The meter may be installed in any position.
In contrast with most volumetric flowmeters, no temperature or pressure correction is required.
This means that the MAS model is ideally suited for almost every gas flow application. Typical industrial applications are process control, laboratory measuring tasks, OEM applications, gas indication panels, leakage and filter monitoring.

The MAS is available either with analog output only, or in addition with digital indication. The 3½-position LCD display is infinitely rotatable through 180°. It is also available upon request with a 1.5 m long connection cable for wall mounting. Glass-fibre-reinforced nylon or stainless steel may be used in the manufacture of wetted parts. Packing materials is FPM (Kalrez or Neopron upon request). The MAS model may be operated with 12-15 VDC (24 VDC optional). MAS 5100 or MAS 8100 are recommended as power supplies. Typically, a 0-5 VDC (or 4-20 mA optional) analog signal is available as output signal. This allows recording, data storage, and control functions to be implemented.

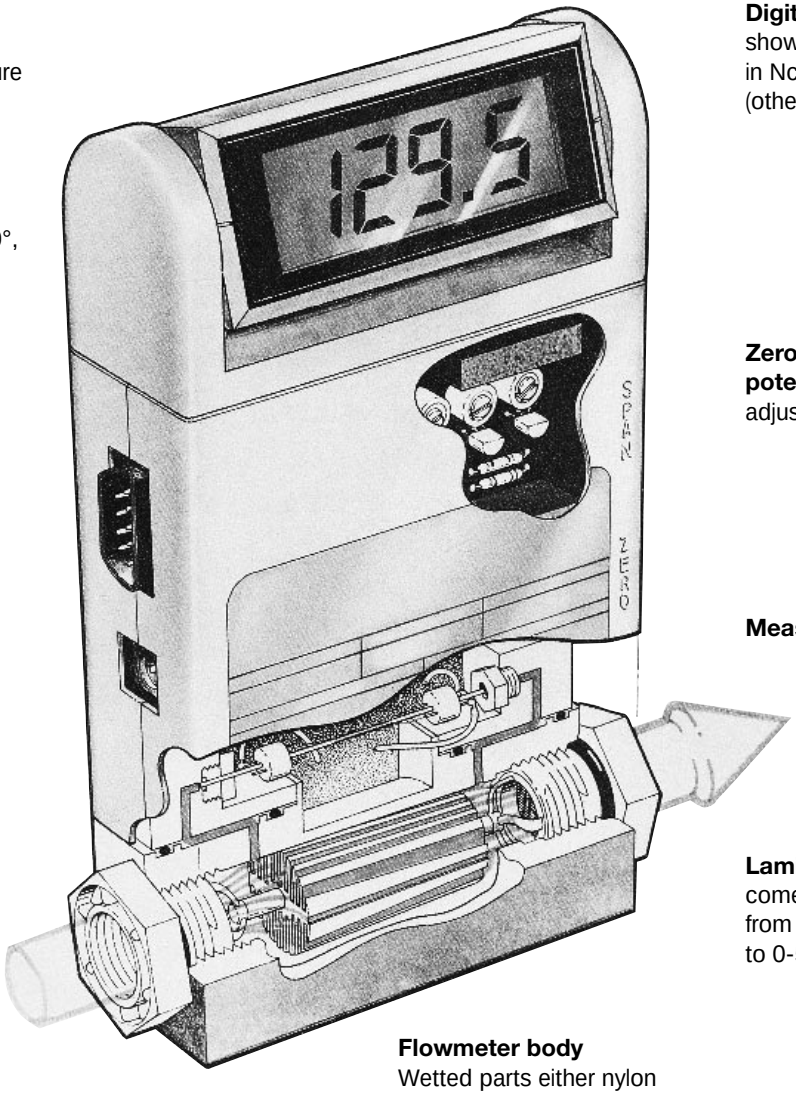
Design

Direct indication of mass flow rate
No temperature or pressure correction needed

Tilting indicator
May be tilted through 180°, 9 adjustments

Output plug connector
9 Pin »D« Sub-type, Output signal 0-5 V DC or 4-20 mA optional analog output

Mains plug
Input voltage 12 or 24 V DC



Digital indicator
shows the mass flow rate in Ncm³/min or Nl/min (other units upon request)

Zero-point and span potentiometers
adjustable from outside

Measuring tube

Laminar flow bypass
comes in 13 ranges from 0-10 Ncm³/min to 0-500 Nl/min

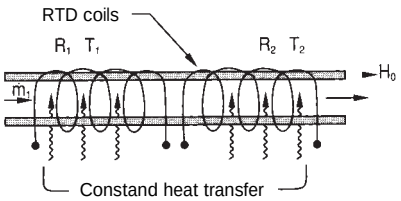
Pipe unions
with ¼“ FNPT or ¼“ Swagelok connections

Flowmeter body
Wetted parts either nylon or steel

Theory of operation:

The medium flows through the bypass measuring system. The resulting differential pressure between P1 and P2 causes a small amount of gas to flow through the overhead measuring tube. The separation ratio is constant.

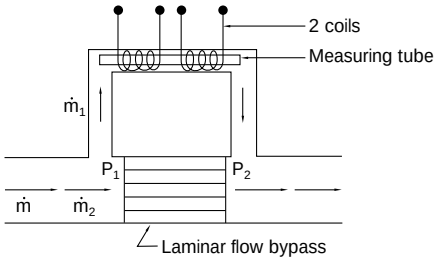
Two resistance temperature detectors (RTD elements) transferring a constant amount of heat to the gas stream are mounted on the measuring tube. Under flow conditions, the gas molecules absorb and transport the heat away. This gives rise to a temperature difference between the two detector coils, which causes a change in resistance in the detector coils, whereby R1 <> R2. The electronics converts the signal for indication. The temperature difference increases as the flow increases.



Measuring tube design

Special advantages:

- Direct mass flow measurement
- No pressure or temperature correction needed
- Large measuring range
- Negligible pressure loss
- May be fitted in any position
- High degree of repeatability
- Analog output 0 - 5 VDC, 4 - 20 mA, optional



Flow diagram

Order numbers

Nylon version					Stainless steel version					
Meas. range Ncm³/min N_2	**Press. loss max. mbar**	**Connection int. thread**	**with digital indication**	**without dig. indication**	**Meas. range Ncm³/min N_2**	**Press. loss max. mbar**	**Swagelok connection**	**Case size**	**with digital indication**	**without dig. indication**
0-10	1	1/4“ NPT	**MAS-1001**	**MAS-2001**	0-10	6	1/4“	L	**MAS-3001**	**MAS-4001**
0-20	1	1/4“ NPT	**MAS-1002**	**MAS-2002**	0-20	6	1/4“	L	**MAS-3002**	**MAS-4002**
0-50	1	1/4“ NPT	**MAS-1003**	**MAS-2003**	0-50	6	1/4“	L	**MAS-3003**	**MAS-4003**
0-100	1	1/4“ NPT	**MAS-1004**	**MAS-2004**	0-100	6	1/4“	L	**MAS-3004**	**MAS-4004**
0-200	1	1/4“ NPT	**MAS-1005**	**MAS-2005**	0-200	6	1/4“	L	**MAS-3005**	**MAS-4005**
0-500	1	1/4“ NPT	**MAS-1006**	**MAS-2006**	0-500	6	1/4“	L	**MAS-3006**	**MAS-4006**
Nl / min N_2					**Nl / min N_2**					
0-1	1	1/4“ NPT	**MAS-1007**	**MAS-2007**	0-1	6	1/4“	L	**MAS-3007**	**MAS-4007**
0-2	6	1/4“ NPT	**MAS-1008**	**MAS-2008**	0-2	6	1/4“	L	**MAS-3008**	**MAS-4008**
0-5	6	1/4“ NPT	**MAS-1009**	**MAS-2009**	0-5	6	1/4“	L	**MAS-3009**	**MAS-4009**
0-10	6	1/4“ NPT	**MAS-1010**	**MAS-2010**	0-10	105	1/4“	L	**MAS-3010**	**MAS-4010**
0-20	25	1/4“ NPT	**MAS-1011**	**MAS-2011**	0-15	105	1/4“	L	**MAS-3011**	**MAS-4011**
0-30	47	1/4“ NPT	**MAS-1012**	**MAS-2012**	0-20	40	3/8“	M	**MAS-3012**	**MAS-4012**
0-40	88	1/4“ NPT	**MAS-1013**	**MAS-2013**	0-30	60	3/8“	M	**MAS-3013**	**MAS-4013**
Accessoires					0-50	80	3/8“	M	**MAS-3014**	**MAS-4014**
MAS-5000	Connector power supply 110 VAC, output 12 VDC				0-100	105	1/2“	M	**MAS-3015**	**MAS-4015**
MAS-5100	Connector power supply 230 VAC, output 12 VDC				0-100	6	1/2“	H	**MAS-3016**	**MAS-4016**
Options (append letter to order no.)					0-200	6	1/2“	H	**MAS-3017**	**MAS-4017**
Option **“A“**	Analog output 4 - 20 mA				0-300	140	1/2“	H	**MAS-3018**	**MAS-4018**
Option **“C1“**	Swagelok 1/4“ (for nylon version)				0-400	140	1/2“	H	**MAS-3019**	**MAS-4019**
Option **“C2“**	Swagelok 1/2“ (for nylon version)				0-500	140	1/2“	H	**MAS-3020**	**MAS-4020**
Option **“V2“**	Supply voltage 24 VDC									
Option **“RD“**	Separate digital indicator with 1,5 m lead									

Technical details

Field of application: suited only for dry, oil-free gases

Measuring accuracy: ± 1,5 % f.s.
(with calibrated performance characteristics, otherwise observe pressure and temperature coefficients)

Option: ± 1 % v. f.s.
(only to 0-100 Ncm³/min. measuring range with stainless steel case)

Standard calibration: 1013,25 mbar abs., 0° C
option: to customer specification

Temperature coefficient: 0,15 % f.s. / °C

Pressure coefficient: 0,3 % f.s. / bar

Reproducibility: ± 0,5 % f.s.

Response time (within 20 - 100 % of measuring range):
2 s until 98 % of actual flow rate is indicated

Max. medium, and ambient temperature: 50° C

Max. working pressure: nylon: 10 bar
stainless steel: 35 bar

Installation position: any

Gas density: 1 x 10^{-4} cm³ / s He (nylon)
1 x 10^{-7} cm³ / s He (stainl. steel case)

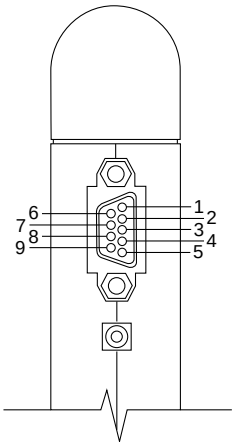
Wetted parts: 5 % either glass-fibre-reinforced nylon or stainless steel material no. 1.4401

Seals: FPM (Kaltrez, Neopren)

Supply voltage: 12 - 15 VDC, 24 VDC optional

Output: linear 0 - 5 VDC (load min. 2000 Ω)
option: 4 - 20 mA
(burden max. 500 Ω)

Connection diagram



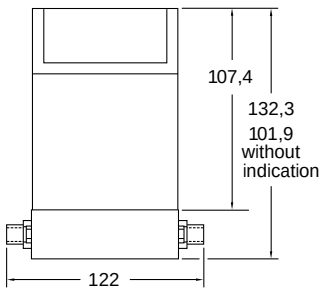
PIN NO. FUNCTION

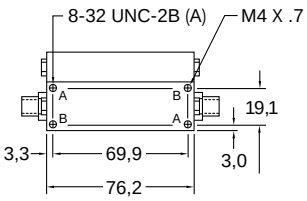
1 No connection
2 Flow rate signal ground
3 0 bis 5 VDC flow rate signal
4 + mains supply (12 oder 24 VDC) *1 *2
5 External display signal
6 External display ground
7 Mains supply ground
8 Analog output 4 to 20 mA ground
9 Analog output 4 to 20 mA signal

*1 Devices powered with 24 VDC only, when the 24 V feature is built in, otherwise damage may be caused by overvoltage.
*2 Do not connect if the device is already supplied from the mains socket.

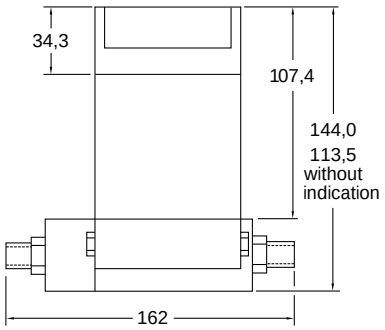
Dimensions:

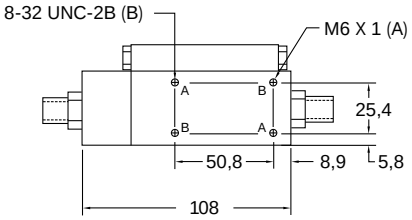
Case L (stainless steel)



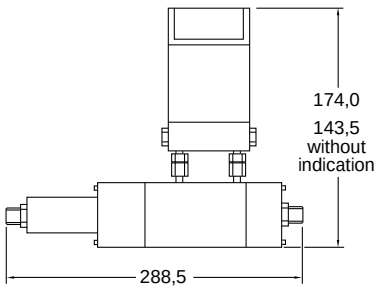


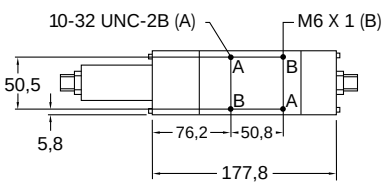
Case M (stainless steel)





Case H (stainless steel)





Fiedls of application:

n addition to accurately measuring the gas flow rate, it is also necessary to maintain a constant flow rate with varying inlet or outlet pressures in many processes.

This has been achieved heretofore by connecting a controlling system with electronic controller and control valve at the outlet side.

The new model MFC mass flow controller is a compact device composed of mass flow meter, controller and valve. The user is thus provided with a controlling system that maintains a constant flow rate over a wide range, independent of variations in pressure and temperature.

Theory of operation:

The medium flows through the MAS mass flow meter, which measures the actual flow rate.

The control electronics compares the measured value with the setpoint value. When deviations occur, the control electronics outputs an altered actuating signal to the built-in proportional valve which changes the passage opening, thereby maintaining a constant flow rate.

The desired flow rate (setpoint value) may be adjusted with a built-in potentiometer or via an external 0-5 VDC (4-20 mA optional) signal.

Technical details:

Field of application: suited only for dry, oil-free gases

Measuring accuracy: ± 1,5 % f.s.
(with 10-100 % of flow rate range)

Reproducibility: ± 0,25 % f.s.

Temperature coefficient: 0,8 % f.s. / °C

Pressure coefficient: 0,07 % f.s. / bar

Response time (within 20-100 % of measuring range):
1 s until 63 % of actual flow rate is indicated

Max., medium, and ambient temperature: 50°C

Max. medium pressure: nylon: 10 bar

Gas density: ambient: 1 x 10^{-4} cm^3 / s
valve: not suitable as shut-off valve

Material: case: 10 % glass-fibre-reinforced nylon
Swagelok: stainless steel
seal: FPM

Control range: 2-100 % of measuring range
(valve closes below 2 %)

Supply voltage: 24 VDC

Output: 0-5 VDC (load min. 2000 Ω)
option: 4-20 mA (burden max. 1000 Ω)

Control signal: 0-5 VDC or 4-20 mA, adjustable

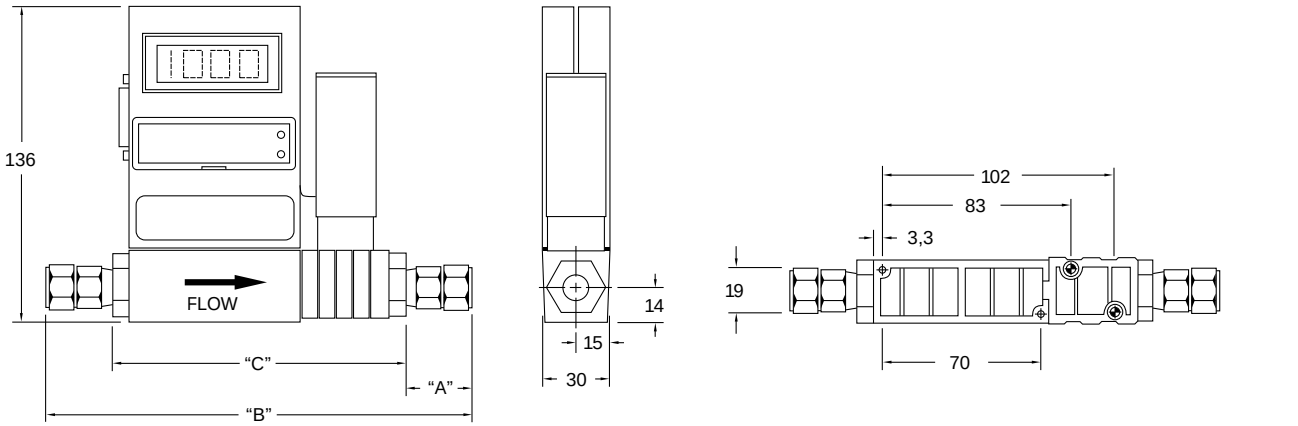
Order numbers

Nylon version				
Meas. range Ncm³/min N_2	**Min. required diff. pressure**	**Connection internal thread**	**with digital indication**	**without dig. indication**
0-10	0,35 bar	¼“ NPT	**MFC-5101**	**MFC-5201**
0-20	0,35 bar	¼“ NPT	**MFC-5102**	**MFC-5202**
0-50	0,35 bar	¼“ NPT	**MFC-5103**	**MFC-5203**
0-100	0,35 bar	¼“ NPT	**MFC-5104**	**MFC-5204**
0-200	0,35 bar	¼“ NPT	**MFC-5105**	**MFC-5205**
0-500	0,35 bar	¼“ NPT	**MFC-5106**	**MFC-5206**
Nl / min N_2				
0-1	0,55 bar	¼“ NPT	**MFC-5107**	**MFC-5207**
0-2	0,55 bar	¼“ NPT	**MFC-5108**	**MFC-5208**
0-5	0,55 bar	¼“ NPT	**MFC-5109**	**MFC-5209**
0-10	1,00 bar	¼“ NPT	**MFC-5110**	**MFC-5210**
0-20	1,38 bar	¼“ NPT	**MFC-5111**	**MFC-5211**
0-30	1,38 bar	¼“ NPT	**MFC-5112**	**MFC-5212**
0-40	1,38 bar	¼“ NPT	**MFC-5113**	**MFC-5213**
0-50	1,38 bar	¼“ NPT	**MFC-5114**	**MFC-5214**

Accessoires	
MAS-8100	Connector power supply, 230 VAC, output 24 VDC

Options (append letter to order no.)	
Option **“C1“**	Swagelok ⅛“
Option **“C2“**	Swagelok ¼“

MFC dimensions (mm)



Connection	"A"	"B"	"C"
⅛" Swagelok	29	186	128
¼" Swagelok	28	184	128
¼" NPT	-	-	128