Mass Flowmeter
for gases

- Measuring range:
  0 - 10 Nml/min ... 0 - 500 Nl/min
- Accuracy: ±1.5% of full scale
- \( P_{\text{max}} \) 35 bar; \( t_{\text{max}} \) 50 °C
- Analogue output:
  0 - 5 V or 4 - 20 mA
- Digital display
- Material: Nylon®, stainless steel
- Bypass measuring system laminar flow

KOBOLD companies worldwide:
ARGENTINA, AUSTRALIA, AUSTRIA, BELGIUM, BULGARIA, CANADA, CHILE, CHINA, COLOMBIA, CZECHIA, EGYPT, FRANCE, GERMANY, GREAT BRITAIN, HUNGARY, INDIA, INDONESIA, ITALY, MALAYSIA, MEXICO, NETHERLANDS, PERU, POLAND, REPUBLIC OF KOREA, ROMANIA, SINGAPORE, SPAIN, SWITZERLAND, TAIWAN, THAILAND, TUNISIA, TURKEY, USA, VIETNAM
Fields of Application

The KOBOLD MAS model mass flowmeter makes very precise measurements of the mass flow rate of gases in different measuring ranges from 0-10 Nml/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 analogue output only, or in addition with digital indication. The 3½-digit LCD display is infinitely rotatable through 180°. Glass-fibre-reinforced Nylon® or stainless steel may be used in the manufacture of wetted parts. Seal materials is FPM (Kalrez or Neoprene upon request).

The MAS model may be operated with 12-15 VDC (24 VDC optional). MAS-5015 or MAS-5000 are recommended as power supplies.

Typically, a 0-5 VDC (or 4-20 mA optional) analogue signal is available as output signal. This allows recording, data storage, and control functions to be implemented.

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.

Design

- Tilting indicator may be tilted through 180°, 9 adjustments
- Output connector 9 Pin “D“ Sub-type, Output signal 0-5 VDC or 4-20 mA optional analogue output
- Mains plug Input voltage 12 VDC or 24 VDC
- Pipe unions possible with ¼” FNPT or ¼“ Swagelok connections
- Flowmeter body wetted parts either Nylon® or steel

Digital display shows the mass flow rate in Nml/min or Nl/min. (other units upon request)

Zero-point and span potentiometers adjustable from outside

Theory of Operation

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Measuring tube design

Flow diagram
Mass Flowmeter Model: MAS

Technical Details

Field of application: suited only for dry, oil-free gases
Measuring accuracy: ±1.5% of full scale (with calibrated performance characteristics, otherwise observe pressure and temperature coefficients)
Option: ±1 % of full scale (only to 0-100 Nml/min measuring range with stainless steel case)
Standard calibration: 1013.25 mbar abs., 0 °C
Temperature coefficient: 0.15% of full scale /°C
Pressure coefficient: 0.3% of full scale / bar
Repeatability: ± 0.5% of full scale
Response time: 800 ms time constant; 6 s (typical) to within ±2% of final value over 25-100% of full scale
Max. medium, and ambient temperature: 50 °C
Max. operating pressure: Nylon®: 10 bar stainless steel: 35 bar
Installation position: any
Gas leak rate: 1 x 10⁻⁴ ml/s He (Nylon®)
1 x 10⁻⁷ ml/s He (st. steel case)
Wetted parts: 5% either glass-fibre-reinforced Nylon® or stainless steel material no. 1.4401
Seals: FPM (others upon request)
Supply voltage: 12-15 VDC, 24 VDC optional
Output: linear 0 - 5 VDC (load min. 2000 Ω) option: 4 - 20 mA (load max. 500 Ω)

Dimensions [mm]

Case L (Stainless steel and Nylon®)

Case M (Stainless steel)

Case H (Stainless steel)

Connection diagram

PIN No. function

1 No connection
2 Flow rate signal ground
3 0 - 5 VDC, flow rate signal
4 + mains supply (12 or 24 VDC) ¹²
5 External display signal
6 External display ground
7 Mains supply ground
8 Analogue output 4 - 20 mA ground
9 Analogue output 4 - 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.

No responsibility taken for errors; subject to change without prior notice.
**Mass Flowmeter** Model: MAS

**Order details Nylon® version** (example: MAS-1002 00 V2 0)

<table>
<thead>
<tr>
<th>Measuring range for N₂</th>
<th>Max. pressure loss</th>
<th>Case size</th>
<th>Model with display</th>
<th>Model with counter</th>
<th>Model without display</th>
<th>Connection</th>
<th>Voltage supply</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20 Nm³/min</td>
<td>1 mbar</td>
<td>L</td>
<td>MAS-3001</td>
<td>MAS-3101</td>
<td>MAS-4001</td>
<td>0 = ¼&quot; NPT female</td>
<td>00 = 12 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>V2 = 24 V&lt;sub&gt;dc&lt;/sub&gt;</td>
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<tr>
<td>0 - 50 Nm³/min</td>
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<td>L</td>
<td>MAS-3002</td>
<td>MAS-3102</td>
<td>MAS-4002</td>
<td>C1 = Swagelok ¼&quot;</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
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<tr>
<td>0 - 100 Nm³/min</td>
<td>1 mbar</td>
<td>L</td>
<td>MAS-3003</td>
<td>MAS-3103</td>
<td>MAS-4003</td>
<td>C2 = Swagelok ¼&quot;</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
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<td>0 - 200 Nm³/min</td>
<td>1 mbar</td>
<td>L</td>
<td>MAS-3004</td>
<td>MAS-3104</td>
<td>MAS-4004</td>
<td>C3 = Swagelok ¼&quot;</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
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<tr>
<td>0 - 500 Nm³/min</td>
<td>1 mbar</td>
<td>L</td>
<td>MAS-3005</td>
<td>MAS-3105</td>
<td>MAS-4005</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
<td></td>
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<tr>
<td>0 - 1 Nl/min</td>
<td>1 mbar</td>
<td>L</td>
<td>MAS-3006</td>
<td>MAS-3106</td>
<td>MAS-4006</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
<td></td>
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<tr>
<td>0 - 2 Nl/min</td>
<td>6 mbar</td>
<td>L</td>
<td>MAS-3007</td>
<td>MAS-3107</td>
<td>MAS-4007</td>
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<td>A = 4–20 mA</td>
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<tr>
<td>0 - 5 Nl/min</td>
<td>6 mbar</td>
<td>L</td>
<td>MAS-3008</td>
<td>MAS-3108</td>
<td>MAS-4008</td>
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<tr>
<td>0 - 10 Nl/min</td>
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<td>MAS-3009</td>
<td>MAS-3109</td>
<td>MAS-4009</td>
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<tr>
<td>0 - 20 Nl/min</td>
<td>6 mbar</td>
<td>L</td>
<td>MAS-3010</td>
<td>MAS-3110</td>
<td>MAS-4010</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
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<tr>
<td>0 - 50 Nl/min</td>
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<td>MAS-3111</td>
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<td>0 - 100 Nl/min</td>
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<tr>
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<td>105 mbar</td>
<td>L</td>
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<td>MAS-3115</td>
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<tr>
<td>0 - 100 Nl/min</td>
<td>6 mbar</td>
<td>L</td>
<td>MAS-3016</td>
<td>MAS-3116</td>
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<tr>
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<td>L</td>
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<td>MAS-3117</td>
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<tr>
<td>0 - 300 Nl/min</td>
<td>140 mbar</td>
<td>L</td>
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<td>MAS-3118</td>
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<td>A = 4–20 mA</td>
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<tr>
<td>0 - 400 Nl/min</td>
<td>140 mbar</td>
<td>L</td>
<td>MAS-3019</td>
<td>MAS-3119</td>
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<tr>
<td>0 - 500 Nl/min</td>
<td>140 mbar</td>
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<td>MAS-3020</td>
<td>MAS-3120</td>
<td>MAS-4020</td>
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<tr>
<td>0 - 100 Nl/min</td>
<td>105 mbar</td>
<td>M</td>
<td>MAS-3016</td>
<td>MAS-3116</td>
<td>MAS-4016</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
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<tr>
<td>0 - 500 Nl/min</td>
<td>140 mbar</td>
<td>M</td>
<td>MAS-3021</td>
<td>MAS-3121</td>
<td>MAS-4021</td>
<td>0 = 0–5 V&lt;sub&gt;dc&lt;/sub&gt;</td>
<td>A = 4–20 mA</td>
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</tbody>
</table>

When placing an order, please specify detailed service conditions (type of gas, flow rate, pressure, temperature etc.)

**Accessories: Connector power supply**

<table>
<thead>
<tr>
<th>Model</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS-5000</td>
<td>110 V&lt;sub&gt;ac&lt;/sub&gt;</td>
<td>12 V&lt;sub&gt;dc&lt;/sub&gt; / 1.9 W</td>
</tr>
<tr>
<td>MAS-5015</td>
<td>230 V&lt;sub&gt;ac&lt;/sub&gt;</td>
<td>15 V&lt;sub&gt;dc&lt;/sub&gt; / 6 W</td>
</tr>
<tr>
<td>MAS-5024</td>
<td>90–264 V&lt;sub&gt;ac&lt;/sub&gt;</td>
<td>24 V&lt;sub&gt;dc&lt;/sub&gt; / 12 W</td>
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</tbody>
</table>