Pressure sensor M01

Sensors

KEY FEATURES

• Compact and robust design for use in harsh environments
• Pressure transmitter for mobile hydraulics, alternative drives (H2, CNG, LPG) and industrial sectors
• Maximum flexibility through modular design, customization and individualization possible
• Designed for OEM needs
• With ECE type approval
• UL Recognized

TECHNICAL DATA

• Pressure ranges from 0…0.25 bar to 0…10 bar (relative and absolute) *
• Pressure ranges from 0…10 bar to 0…2000 bar (relative)
• Overload pressure at least 2X nominal pressure
• Media temperatures up to 150 °C / 302 °F
• Ingress Protection Rating up to IP6K9K
• CAN enabled: CANopen, J1939, STW proprietary
• All common analog output signals available

ACCESSORIES

• Optional software package for CAN interface setting parameters

* Pressure range on request
### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Pressure range</th>
<th>0 ... 0.25 bar to 0 ... 2000 bar, other ranges available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure reference</td>
<td>( \text{relative } R ) (gauge G) / ( \text{absolute } A )^*1</td>
</tr>
<tr>
<td>Standard pressure range</td>
<td>0.25 bar 0.4 bar 1 bar 1.6 bar 4 bar 10 bar</td>
</tr>
<tr>
<td>Overload pressure (per DIN EN 60770-1)</td>
<td>0.63 bar 1 bar 2.5 bar 2.5 bar 10 bar 20 bar</td>
</tr>
<tr>
<td>Bursting pressure (per DIN EN 60770-1)</td>
<td>0.75 bar 1.2 bar 3 bar 3 bar 12 bar 30 bar</td>
</tr>
<tr>
<td>Media temperature</td>
<td>(-40 \ldots +85 \degree C / -40 \ldots +185 \degree F)</td>
</tr>
<tr>
<td>Operating and storage temperature</td>
<td>(-40 \ldots +85 \degree C / -40 \ldots +185 \degree F)</td>
</tr>
<tr>
<td>Material with medium contact</td>
<td>Stainless Steel AISI 630 (DIN 1.4542) and Silicon</td>
</tr>
<tr>
<td>Overall accuracy at operating temperature</td>
<td>(\leq 1.0 % \text{FS} (0 \ldots +85 \degree C) / (32 \ldots +257 \degree F))</td>
</tr>
<tr>
<td>Thereof linearity, pressure hysteresis and repeatability (Linearization with limit point setting)</td>
<td>(&lt; 0.25 % \text{FS})</td>
</tr>
<tr>
<td>Material wetted parts and housing</td>
<td>Stainless Steel AISI 630 (DIN 1.4542), AISI 316 L (DIN 1.4435) on request</td>
</tr>
<tr>
<td>Material connector</td>
<td>glass-fiber reinforced plastic (PBT) or AISI 304 (DIN 1.4301)</td>
</tr>
<tr>
<td>Installation torque</td>
<td>max. 35 Nm</td>
</tr>
<tr>
<td>Long-term stability</td>
<td>(&lt; 0.2 % \text{FS} \text{ p.a.})</td>
</tr>
<tr>
<td>Voltage supply (DC)</td>
<td>(U_{\text{VCC}}: 9 \ldots 36 \text{ V})</td>
</tr>
<tr>
<td></td>
<td>(U_{\text{VCC}}: 14 \ldots 36 \text{ V}) (for transmitter with 0 ... 10 V voltage output)</td>
</tr>
<tr>
<td></td>
<td>(U_{\text{VCC}}: 5 \text{ V } \pm 10 %) (for transmitter with ratiometric output)</td>
</tr>
</tbody>
</table>

*1 Pressure range on request  
*2 For common-rail applications
# TECHNICAL DATA

<table>
<thead>
<tr>
<th>CAN</th>
<th>Sampling Rate</th>
<th>1000 Samples/s (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Digital Filter</td>
<td>averaging adjustable</td>
</tr>
<tr>
<td></td>
<td>Output protocol</td>
<td>STW-CAN, CANopen, SAE J1939</td>
</tr>
<tr>
<td></td>
<td>Electrical connection</td>
<td>M12 connector, DIN Bayonet (per DIN 72585), DT04 4-pole, cable output</td>
</tr>
<tr>
<td>Analog</td>
<td>Output signal</td>
<td>4...20 mA (2-wire technique), 0/4...20 mA (3-wire technique), 0...10 V, 0...5 V, 1...6 V, 10...90 % VCC (ratiometric output) Other output signals on request</td>
</tr>
<tr>
<td></td>
<td>Electrical connection</td>
<td>M12 connector, DIN bayonet (per DIN 72585); DT04 4-pole; DT04 3-pole, AMP-SuperSeal 1.5; cable output Other connectors on request</td>
</tr>
<tr>
<td></td>
<td>Electrical protection</td>
<td>Short circuit protected, signal on GND/VCC and inverse polarity protection (not at ratiometric output)</td>
</tr>
<tr>
<td></td>
<td>Pressure connection</td>
<td>G 1/4, 1/4 NPT, G 1/4 with manometer pin, SAE04 (7/16-20UNF), SAE06 (9/16-18UNF), other pressure connectors on request, possible limitations of the pressure range</td>
</tr>
<tr>
<td></td>
<td>Protection class</td>
<td>IP6K7 or IP6K9K (depends on the electrical connection)</td>
</tr>
</tbody>
</table>

### Functional safety

Pressure switch M01 (analog and CAN) | Acc. DIN EN ISO 13849-1: Performance Level b  
Cat. = B  
MTTF_d = High  
DC = None  
CCF = Not relevant
TECHNICAL DRAWINGS AND PIN ASSIGNMENTS

Pressure connection

1/4 NPT per "Nominal width for US-standard bevelled pipe thread NPT"

G 1/4, DIN 3852 T 11 (Form E)

1/4 NPT according to EN837-1 (formerly DIN 16288)

G 1/4 according to EN837-1 (formerly DIN 16288)

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Electrical connection, protection class IP per IEC 60529

Cable output IP69K (Oil-resistant cable on request)

CAN + Analog

Bayonet connector
DIN 72585, 4-pole, IP6K7

Connector
DT04-4P, 4-pole, IP6K7

Circular plug-in connector
M12x1, 5-pole, IP6K7

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M12x1, 5-pole, IP6K7

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Connector
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Circular plug-in connector
M12x1, 5-pole, IP6K7

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**TECHNICAL DRAWINGS AND PIN ASSIGNMENTS**

### Pressure connection

<table>
<thead>
<tr>
<th>Connector for</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMP-SuperSeal 1.5</td>
</tr>
<tr>
<td>3-pole, IP6K7</td>
</tr>
</tbody>
</table>

**Analog**

**Recommended terminal layout**

<table>
<thead>
<tr>
<th>2-wire technique</th>
<th>3-wire technique</th>
</tr>
</thead>
</table>

**Current output load**

\[ R_L \leq \frac{U_{VCC} - 9 \text{ V}}{0.02 \text{ A}} \]

for \( U_{VCC} \geq 24 \text{ V} \) additionally

\[ R_L \geq \frac{U_{VCC} - 24 \text{ V}}{0.048 \text{ A}} \]

**Voltage output load:**

\( R_L \geq 10 \text{ k}\Omega \)
### QUALIFICATION

**Conformity**

CE, UL

E1: All vehicle types with a 12 V resp. 24 V - electrical wiring and battery (−) at the body

### DETAILED QUALIFICATIONS

#### EMC industrial (CE)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Emission 150 kHz to 30 MHz conducted, 30 MHz to 1GHz, group 1 class B</td>
<td>EN 61000-6-3 residential, commercial and light-industrial environments</td>
</tr>
<tr>
<td>Electromagnetic immunity</td>
<td>EN 61000-6-2 industrial environments</td>
</tr>
<tr>
<td>ESD: 330 Ω / 150 pF; contact: +/-4 kV, air: +/-8 kV</td>
<td>EN 61000-4-2</td>
</tr>
<tr>
<td>RF immunity: 80-2700 MHz, 10 V/m, 3 m, hor./vert.</td>
<td>EN 61000-4-3</td>
</tr>
<tr>
<td>Burst: 5/90 ns, 5 kHz; signal wire.: +/-1 kV, power supply wire: +/-2 kV</td>
<td>EN 61000-4-4</td>
</tr>
<tr>
<td>Surge: 1,2/50 µs; symm., asymm.: +/-0,5 kV</td>
<td>EN 61000-4-5</td>
</tr>
<tr>
<td>Conducted. RF immunity: 0,15-80 MHz, 10 V, 80 % AM sine 1kHz</td>
<td>EN 61000-4-6</td>
</tr>
</tbody>
</table>

#### FCC, 47 CFR Part 15, Subpart B

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent to FCC Docket 92-152</td>
<td>Confirmation</td>
</tr>
</tbody>
</table>

#### EMC automotive

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF emission 150 kHz to 3 GHz, 1m, 120 kHz bandwidth</td>
<td>DIN EN 55025:2003-11, IEC/CISPR 25:2002</td>
</tr>
<tr>
<td>RF immunity: stripline: 0,01 MHz-400 MHz, 200 V/m, 80 % AM sine with 1kHz; antenna: 400 MHz - 2 GHz, 50 V/m, PM tON, 577 µs, period 4600 µs</td>
<td>ISO 11452-5:2002-04, ISO 11452-2:2000-03</td>
</tr>
<tr>
<td>Road vehicles, electrical disturbances, test pulse (power supply wires):</td>
<td>ISO 7637-2:2004-09</td>
</tr>
<tr>
<td>Pulse 1: -600 V, 5000 pulses</td>
<td></td>
</tr>
<tr>
<td>• Pulse 2a: +50 V, 5000 pulses, 2 Ω</td>
<td></td>
</tr>
<tr>
<td>• Pulse 2b: +20 V, 10 pulses</td>
<td></td>
</tr>
<tr>
<td>• Pulse 3a: -200 V, 1 h</td>
<td></td>
</tr>
<tr>
<td>• Pulse 3b: +200 V, 1 h</td>
<td></td>
</tr>
<tr>
<td>• Pulse 4: -16 V, 2 pulses</td>
<td></td>
</tr>
<tr>
<td>• Pulse 5: 62 V, 400 ms, 2 Ω, 1 pulse</td>
<td></td>
</tr>
</tbody>
</table>
## Qualification

### EMC Automotive

- **Road vehicles, electrical disturbances, test pulses (data wires):**
  - Pulse a: -80 V, 1 h
  - Pulse b: +80 V, 1 h

- **Radio disturbance for protection of receivers used on board vehicles, boats and large devices:** 0.15 MHz to 108 MHz

- **Electrostatic discharge:**
  - 2 kΩ / 330 pF, 2 kΩ / 150 pF
  - Contact: +/−8 kV, air: +/−15 kV

- **Packaging and handling (contact: +/−8 kV):**

### Climatic and Mechanical Tests

#### Temperature Range

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 °C / -40 °F</td>
<td>+125 °C / +257 °F</td>
</tr>
</tbody>
</table>

#### Thermal-Cycling Test

- **Test a:** -40 °C / -40 °F and 125 °C / 257 °F; 10 cycles; retaining of limit temperature for 1 h; temperature change rate 30 sec., active
- **Test b:** -50 °C / -58 °F and 125 °C / 257 °F; 216 cycles; retaining of limit temperature for 0.5 h; temperature change rate 30 sec., passive
- **Test nb:** -40 °C / -40 °F and 125 °C / 257 °F; 10 cycles; retaining of limit temperature for 1 h; temperature change rate 3 K/min., active

#### Cold Test

- -40 °C / -40 °F, duration: 96 h, active

#### Dry Heat

- +125 °C / 257 °F, duration: 96 h, active

#### Damp Heat

- Steady state: 21 days at 40 °C / 104 °F and 96 % r.F.
- 25 °C / 77 °F to 55 °C / 131 °F; 6 cycles each 24 h, active

### Climatic and Mechanical Tests

- **Free fall:** 1 m free fall on iron plate, 6 axes
- **Degree of protection (water/dust):** IP6K7 and IP69K; depending on connector type
- **Vibration (sinusoidal):** 20 g, test with temperature variation, 5-2000-5 Hz, 1 oct/min., -40 °C...+125 °C / -40 °F...257 °F, 3 K/min, tv=15 min, tw=60 min, 2 temp. cycles/axis (∼3×5 h)
- **Shock:** 50 g / 11 ms; sine; 3 shocks per axis; not active
- **Shock:** 500 g, 1-2 ms, 18 shocks, 6/axis
- **Bump:** 30 g / 6 ms, sine, 1000 bumps per axis
- **Salt mist, cyclic (sodium chloride solution):** 5 % NaCl, 4 cycles a 24 h, 35 °C / 95 °F, 2 h/22 h
- **Immersion and splash:** gasoline, diesel, degreaser, antifreezing agent, afterwards drying at 125 °C / 257 °F for 48 h
- **Chemical resistance:** diesel, motor oil, hydraulic oil, gear oil, bio-diesel, E10, urea "Caelo" afterwards drying at 70 °C / 158 °F for 48 h
- **Ice-water shock test**
- **Flowing mixed gas corrosion test:** sulfur dioxide SO2, hydrogen sulfide H2S, nitrogen dioxide NO2, chlorine Cl2
## ORDER CODES

<table>
<thead>
<tr>
<th>Units</th>
<th>Reference</th>
<th>Output</th>
<th>Pressure Connection</th>
<th>Electrical Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar</td>
<td>Gauge</td>
<td>4-20 mA (2-wire-technique)</td>
<td>G 1/4”</td>
<td>M12 (Plastic)</td>
</tr>
<tr>
<td>PSI</td>
<td>Absolute (≤10 bar)</td>
<td>0-20 mA (3-wire-technique)</td>
<td>1/4” NPT</td>
<td>DT04 (4-Pole)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-20 mA (3-wire-technique)</td>
<td>G 1/4” with manometer</td>
<td>DT04 (3-Pole)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...10 V</td>
<td>SAE 04 (7/16-20 UNF with cone)</td>
<td>M12 (Steel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...5 V</td>
<td>SAE 04 (7/16-20 UNF with o-ring)</td>
<td>Custom (Specific)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1...6 V</td>
<td>SAE 06 (9/16-18 UNF with o-ring)</td>
<td>Custom (Specific)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10...90% VCC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CANopen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAE J1939</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>STW-CAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Custom (Specific)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>