PMA

Transmitter P 31
Compact series

Two-wire transmitter with 4...20 mA output
Three-wire transmitter with 0...10 V output

Sensing element with thin-film poly-silicon strain gauge, thus:
- no moving mechanical parts
- excellent long-term stability
- high reproducibility

Pressure ranges graduated to DIN 16128
Overload limit of 4x measuring span

Version with damping device
External smooth separating diaphragm
Diaphragm and process coupling of stainless steel
Stainless steel housing, protection mode IP65

PROFILE
The transmitter P31 converts the applied pressure spans of 0...1 bar to 0...400 bar into a pressure-proportional standard signal of 4...20 mA or 0...10 V.

DESCRIPTION
The pressure-sensitive element is a silicon substrate with a vacuum-deposited thin-film strain gauge bridge of poly-silicon. Because of its small dimensions, the sensor features good behaviour with pulsating pressure media and vibrations.

The elasticity of silicon ensures very good reproducibility and hysteresis as well as an overload limit of 4x span (max. 600 bar). Because of their high natural frequency, silicon sensors are also suitable for measuring fast pressure changes.

Transmitter P31 has a stainless steel process coupling with an external separating diaphragm. The silicon sensing element is mounted behind the diaphragm, and the space between is filled with silicone oil. The process coupling is threaded G 1/4 A or M20 x 1,5 for an elastomer FPM seal or metal seal to DIN 3852.

There are two versions of the coupling: with or without a built-in damping device. Damping is provided by a baffle installed in the content side. Versions ≥ 40 bar also have a protective plate in front of the separating diaphragm.

Transmitter P31 is designed for rough environments, and the very compact stainless steel housing has protection type IP65.

The damped version is recommended for applications involving incompressible media in which pressure peaks exceeding the maximum pressure range are likely. Such peaks can be caused for instance by pumps, fast shut-off valves, solenoid valves, hydraulic actuators, etc.

Transmitter P31 is designed for rough environments, and the very compact stainless steel housing has protection type IP65.

The electronics of the transmitter P31 work on the two-wire or three-wire principle, and form a single entity together with the pressure sensor. The specified measuring range (see ordering data) is factory-set for an output signal of 4...20 mA or 0...10 V.

A DC voltage supply is used for energization.

Electrical connections are made via an angled connector to DIN 43 650, type C, with a Pg7 cable entry and screw terminals.

PRINCIPLE OF OPERATION
The process pressure is applied to the sensor (1, Fig. 1), where it acts on a semi-conductor strain gauge bridge. The resistance change of the bridge results in a pressure-proportional output signal from the bridge.

The bridge draws its power supply from a constant voltage source (2).

The output signal of the bridge is connected to the output terminals via the amplifier and the output stage (3). Two different electronic versions are available, namely two-wire 4...20 mA and three-wire 0...10 V. The output signals are factory-set with a tolerance for the initial value and end value (see technical data).

The diode (4) provides protection against reversed polarity of the supply, whereas diode (5) clips smaller voltage peaks.

An external 12...30 V DC supply at terminals 1 and 2 energizes the two-wire electronics of the transmitter; an external 15...30 V DC supply at terminals 3 and 2 energizes the three-wire electronics of the transmitter.
Fig. 1 Block diagram

TECHNICAL DATA

INPUT

Spans

Gauge pressure
1 to 400 bar (see ordering data)

Span start: preset

Span end: preset

Overload limit
4 x span, max. pressure 600 bar (static overload)

Overload effect: < 0,1% of span

Process media: gases and liquids

Materials wetted by process
Stainless steel
Diaphragm: 1.4435 (X2 CrNiMo 1810)
Coupling: 1.4301 (X5 CrNi 189)

Filling medium: silicone oil

OUTPUT

Output signal
4...20 mA (two-wire)
0...10 V (three-wire) [0 V = 20 mV]

Characteristic: linear

Conformity: ≤ 0,6% of span (terminal based)

Tolerance
Start/end value ≤ 0,4% of span

Load
Two-wire 4...20 mA:
\[ R_L = \frac{U - 12 V}{0,02 A} \]
U_s = supply voltage

Three-wire 0...10 V: > 5 kΩ

Settling time
approx. 2 ms without damping device
approx. 5 ms with damping device ≤ 25 bar
approx. 3 ms with damping device ≥ 40 bar

POWER SUPPLY

Transmitter supply
12...30 V DC (two-wire)
15...30 V DC (three-wire)

Effect of supply voltage
≤ 0,3% between 12 and 30 V DC (two-wire)
≤ 0,3% between 15 and 30 V DC (three-wire)

ENVIRONMENTAL CONDITIONS

Ambient temperature limits
-25...+70 °C

Process temperature limits
-25...+70 °C

Temperature effect on span start
Typically 0,2%/10 K of span
max. 0,5%/10 K of span

Temperature effect on span
Typically 0,2%/10 K, max. 0,4%/10 K of span

Storage temperature: -40...+80 °C

Climatic category
Class 4 Z (with Z = 70 °C) to VDI/VDE 3540 (corresponds with HSC to DIN 40 040)

Shock and vibration
Shock test Eb: to DIN IEC 68-2-29
Vibration test Fc: to DIN IEC 68-2-6

ELECTROMAGNETIC COMPATIBILITY

Complies with EN 50081-1 and EN 50082-2

GENERAL

Materials
Housing: stainless steel 1.4301
Connector: polyamide

Mode of protection
Housing: IP 65 to DIN 40 050 (IEC 529)

Process connection
G 1/2 A or M20 x 1,5

Sealing to DIN 3852
Either with the FPM (Viton) elastomer
sealing ring supplied with the transmitter
or
with metal sealing ring Form D,
A 21 x 26 mm φ to DIN 7603 (not supplied)

Electrical connection
Connector, DIN 43 650, type C. Pg7,
screw terminals for 1,5 mm²

Mounting position: Not critical

Mounting method
Threaded coupling G 1/2 A or
M20 x 1,5

Mounting torque error: typical <0,3%

Weight: approx. 0,18 kg

Operating instructions
9499 040 41801

Accessories: 1 operating instruction
Fig. 2 Dimensions (mm) and electrical connections

<table>
<thead>
<tr>
<th>Two wire</th>
<th>Three wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = output (+)</td>
<td>1 = output (+)</td>
</tr>
<tr>
<td>2 = output (-)</td>
<td>2 = output/supply (-)</td>
</tr>
<tr>
<td>3 = N.C.</td>
<td>3 = supply (+)</td>
</tr>
<tr>
<td>(♀) = measurement</td>
<td>(♀) = measurement</td>
</tr>
<tr>
<td>earth</td>
<td>earth</td>
</tr>
</tbody>
</table>

* + 4 mm on version with mechanical damping and measuring span ≥ 40 bar

<table>
<thead>
<tr>
<th>Gauge pressure</th>
<th>Measuring ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>0... 1.0 bar</td>
<td>05</td>
</tr>
<tr>
<td>0... 1.6 bar</td>
<td>06</td>
</tr>
<tr>
<td>0... 2.5 bar</td>
<td>07</td>
</tr>
<tr>
<td>0... 4 bar</td>
<td>08</td>
</tr>
<tr>
<td>0... 6 bar</td>
<td>09</td>
</tr>
<tr>
<td>0... 10 bar</td>
<td>10</td>
</tr>
</tbody>
</table>

Coupling without damping

| 0... 16 bar | 11 |
| 0... 25 bar | 12 |
| 0... 40 bar | 13 |
| 0... 60 bar | 14 |
| 0... 100 bar | 15 |
| 0... 160 bar | 16 |
| 0... 250 bar | 17 |
| 0... 320 bar | 18 |
| 0... 400 bar | 19 |

Transmitter P 31

| Process conn. G ¼ A, metal seal | 6 |
| Process conn. M20 x 1.5, metal seal | 7 |
| Process conn. G ¼ A, FPM seal | 8 |
| Process conn. M20 x 1.5, FPM seal | 9 |

Two-wire version, output 4...20 mA
Three-wire version, output 0...10 V

<table>
<thead>
<tr>
<th>Gauge pressure</th>
<th>Measuring ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>0... 6 bar</td>
<td>59</td>
</tr>
<tr>
<td>0... 10 bar</td>
<td>60</td>
</tr>
</tbody>
</table>

Coupling with damping device

| 0... 16 bar | 61 |
| 0... 25 bar | 62 |
| 0... 40 bar | 63 |
| 0... 60 bar | 64 |
| 0... 100 bar | 65 |
| 0... 160 bar | 66 |
| 0... 250 bar | 67 |
| 0... 320 bar | 68 |
| 0... 400 bar | 69 |