GENERAL

Transmitter PD6DM is suitable for measurement of gauge / vacuum, differential pressure, for flow measurements with aggressive, hot or high-viscosity media, gases, vapours and liquids, as well as for hydrostatic level measurements. Spans between 10 up to 6000 mbar are available. The nominal pressure for the measuring cells is PN140. The output is a standardized 4...20 mA signal, proportional to the applied differential pressure or flow or level (e.g. in a horizontal cylindrical container).

The microprocessor controlled electronics work on the two wire principle. Transmitter energization is by means of a DC voltage.

DESCRIPTION

Transmitter PD6DM comprises the measuring cell, two process flanges with seals and the electronics housing. Connected to each of these process flanges is a liquid filled capillary, which provides the connection to the sealing diaphragm. The flat sealing diaphragm is welded or brazed into a ring carrier. Depending on the respective positions of sealing diaphragm and transmitter, the diaphragm can be supplied with different length of capillary tube.

Pressure transfer is achieved by different types of oil, which are sealed under vacuum into the system. Process flanges are of:
- Stainless steel
- Diaphragm material is available in:
  - Stainless steel 316 L (1.4435)
  - Stainless steel, PTFE coated
  - Hastelloy C
  - Tantalum

Microprocessor controlled electronics provide high-precision signal processing and monitoring, from the sensor to the signal output. Measuring cell monitoring, which is possible with silicone sensor technology, offers outstanding safety for industrial processes.

Electronics and terminal compartment are hermetically separated, i.e. with the terminal compartment open, the electronics remain protected from environmental contamination. All parameter are adjustable by means of four push-buttons, or with an external hand-held control unit.

Transmitter PD6DM can be supplied with a digital indicator, retrofitting is possible.

Depending on the measuring cell span, a turn down of 100 : 1 is possible. This means for example, that the 160 mbar cell is adjustable downwards to a span of 1.6 mbar.

OPERATING PRINCIPLE

Function of measuring cell
The measuring cell consists of a piezoresistive silicone measuring element and a body with two metallic isolating diaphragms. The compartment between the two diaphragms is filled with silicone oil. Any changes in the differential pressure causes a displacement of the sealing diaphragms and is transferred to the sensing element, which in cause changes its bridge resistance. The resistive change is being measured and processed.

Self monitoring
The measuring element on the silicone diaphragm is designed as a piezoresistive strain gauge, which can be monitored accordingly. The microprocessor monitors continuously corresponding values and provides an alarm signal in case of discrepancy.

- The alarm acts on the analogue output signal and can be set for upscale, downside or off (keeping the process value).

1) increased conformity error
TECHNICAL DATA

INPUT

MEASURING CELLS PN 140

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>4E</th>
<th>4G</th>
<th>4K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal range</td>
<td>160</td>
<td>1,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Span</td>
<td>-160...+150</td>
<td>-1,000...+950</td>
<td>-6,000...+5,700</td>
</tr>
<tr>
<td>Nominal pressure</td>
<td>PN 140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filling medium</td>
<td>Silicone oil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(All values in mbar)

FILLING LIQUID ISOLATING DIAPHRAGM

Selecting the filling liquid for isolating diaphragms depends from pressure and temperature conditions of the process. Second criteria is immunity of the filling liquid with the process. Details see tabel filling liquids.

Static pressure
up to max. PN of corresponding measuring cell.

Static pressure effect
With symmetrical load 0.2 % / 100 bar for span start and span.

Minimum pressure
>10 mbar abs.

Overload limit: PN

PROCESS MEDIA

liquids and gases (aggressive and corrosive media with suitable material selection)

MATERIALS

Isolating diaphragm diaphragm
- ANSI SS 316 L (no 1.4435)
- Hastelloy C
- Tantalum
- Stainless steel PTFE coated

Flange body
- ANSI SS 316 Ti (no 1.4571)

Bolts and nuts for process flange
- ANSI SS 316 Ti (no 1.4571)

Process flange
- ANSI SS 316 Ti (no 1.4571)

Table 1: Filling liquids

<table>
<thead>
<tr>
<th>Filling liquids for isolating diaphragm</th>
<th>Mediumtemp. at 50 mbar ≤ pabs ≤ 1 bar</th>
<th>Mediumtemp. at pabs ≥ 1 bar</th>
<th>Max. difference in height</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone il</td>
<td>-40 up to +180 °C</td>
<td>-40 up to +200 °C</td>
<td>max. 7 m</td>
<td>Standard, Food and beverage</td>
</tr>
<tr>
<td>High temperature oil</td>
<td>-10 up to +200 °C</td>
<td>-10 up to +350 °C</td>
<td></td>
<td>Inert oil</td>
</tr>
<tr>
<td>Fluorolube</td>
<td>-40 up to 80 °C</td>
<td>-40 up to +175 °C</td>
<td></td>
<td>Food and beverage</td>
</tr>
<tr>
<td>Glycerin</td>
<td>-</td>
<td>+15 up to +200 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>-10 up to +120 °C</td>
<td>-10 up to +200 °C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMALLEST SPANS

Based upon the thermal expansion of the filling liquid, isolating diaphragms cause an additional temperature effect with measurement. Following points should be considered for selection.
- Nominal width determs diameter of sealing diaphragm.
- Large diameter of diaphragm results in smaller temperature effect.
- Small spans require large diameter to minimize temperature effects.

TEMPERATURE EFFECTS

Main temperature effect depends mainly from the process temperature adjacent to the sealing diaphragms. Capillary tubes will be influenced by the ambient temperature at the measuring site.
- Effect for silicone oil per meter length of capillary tube (both sides), 0.12 mbar /10 K.
- Total temperature coefficient T<sub>r</sub> results from the addition of effects of sealing diaphragm and effects of capillary tubes.
- Both capillaries must have similar length to minimize asymmetrical effects.

MOUNTING HINTS FOR CAPILLARY TUBES

- If a transmitter is mounted above the lower measuring point, the maximum difference in height (see tab filling liquids) must not be exceeded.
- Larger heights lead to an interruption of the liquid column in the capillary tubes and destroy the measuring system.

OUTPUT SIGNAL

Standard signal 4...20 mA

Output current limiting: 20.5 mA

Lowest value 3.8 mA (4 mA adjustable)
For alarm selectable 3.6 mA, 21.5 mA; „keep value”

Ripple: ≤ ±0.25 % fsd

HART protocol U<sub>rp</sub>< 200 mV (47 Hz to 125 kHz) and U<sub>mr</sub>< 2.2 mV (500 Hz to 10 kHz)
CHARACTERISTIC

- Proportional to applied differential pressure or
- Proportional to flow rate or
- Proportional to level in a cylindrical tank or
- Proportional to level free programmable

Conformity: < 0.1% terminal based for nominal span of cell up to TD 10:1
For TD 100:1 conformity error
\[ \text{error} = \pm 0.1\% \times \frac{0.1 \times \text{nominal value}}{\text{set span}} \]
(Hysteresis and reproducibility included)

Long term drift: 0.1 % / å
Fig. 3 Isolating diaphragm to DIN 2501

MAXIMUM LOAD

\[ R_{\text{Load}} = \frac{U_{\text{Supply}} - 115}{0.023} - R_{\text{Load}} [\Omega] \]

Load effect: <0.01% per 100Ω

DYNAMIC RESPONSE

Average delay: depending from cell 0.5 ... 2 s
Rise time: depending from cell and span, 0.4 ... 1.6 s

Damping
0 .. 16 s adjustable per switch, per SW up to 40 s adjustable

POWER SUPPLY

SUPPLY VOLTAGE
11.5...45 VDC
11.5...30 VDC with EEx

Supply voltage effect
< 0.1 % from 11.5...45 VDC

Ripple of supply
no effect for \( U_{\text{nom}} \leq \pm 5 \% \) within the nominal supply range

EXPLOSION PROTECTION

Protection type
EEx ia IIC T4/T6 Zone 1

Certificate of conformity
KEMA No. E x 97.D.2523 X

Installation
Transmitter in zone 1 hazarded area

ENVIRONMENTAL CONDITIONS

TEMPERATURE LIMITS
Operation: -40 °C...+85 °C
Storage: -50 °C...+100 °C

Temperature effect on span start and span
Without sealing diaphragm!
\[ \pm 0.02 \% / 10 \text{ K} \text{ within } -10 \text{ bis } +60 \text{ °C} \]
and
\[ \pm 0.1\% / 0 \text{ K} \text{ from } -40 \text{ to } -10 \text{ °C} \]
and
\[ +60 \text{ to } 85 \text{ °C} \]

HUMIDITY
100% r.H., no condensation

HOUSING PROTECTION
IP 65 to DIN 40050

PROCESS COUPLING
via sealing diaphragm

ELECTRICAL CONNECTION
Screw terminals for 2.5 mm² via cable gland

MOUNTING
Pipe or wall mounting possible by means of a mounting bracket fig. 6 and mounting hints fig. 2.

WEIGHT
Sealing diaphragm see tab. 2 plus approx. 4 kg transmitter weight

MOUNTING POSITION
Process flanges vertical
(Mounting bracket 9404-290-01031 on a horizontal pipe leads to horizontal process flanges; thus horizontal outlet of capillary tubes, corresponding adjustment of zero necessary).

Tab. 2 Dimensions sealing diaphragm

<table>
<thead>
<tr>
<th>Type</th>
<th>Pipe Flange</th>
<th>DN mm</th>
<th>PN bar</th>
<th>D mm</th>
<th>b mm</th>
<th>dM mm</th>
<th>TK [mbar/10K]</th>
<th>Min. mounting-distance [mm]</th>
<th>A mm</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 2501</td>
<td>50</td>
<td>16/400</td>
<td>102</td>
<td>20</td>
<td>46</td>
<td>+0.5</td>
<td>70</td>
<td>+0.1</td>
<td>130</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td></td>
<td>138</td>
<td></td>
<td>70</td>
<td>+0.1</td>
<td></td>
<td></td>
<td></td>
<td>4.6</td>
</tr>
<tr>
<td>DIN 11851</td>
<td>50</td>
<td>25</td>
<td>68</td>
<td>19</td>
<td>46</td>
<td>+0.5</td>
<td>70</td>
<td>+0.1</td>
<td>120</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td></td>
<td>86</td>
<td>21</td>
<td>52</td>
<td>+0.2</td>
<td></td>
<td></td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td></td>
<td>100</td>
<td>25</td>
<td>71.5</td>
<td>+0.1</td>
<td></td>
<td></td>
<td></td>
<td>5.1</td>
</tr>
<tr>
<td>Clamp</td>
<td>2&quot;</td>
<td>40</td>
<td>64</td>
<td></td>
<td>45</td>
<td>+0.5</td>
<td>69</td>
<td>+0.1</td>
<td>100</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>3&quot;</td>
<td></td>
<td>91</td>
<td></td>
<td>71.5</td>
<td>+0.1</td>
<td></td>
<td></td>
<td></td>
<td>2.4</td>
</tr>
</tbody>
</table>

VIBRATION
\[ \leq 0.1 \% \]
(to DIN IEC 68, part 2-6, referred to sensor span 6000 mbar)

ELECTROMAGNETIC COMPATIBILITY
Fulfills EN 50082-2 and NAMUR with 30 V/m
Tests to IEC 801-1 up to 801-6
Electromagnetic radiation to EN 50081-1
CE - labelled

GENERAL

HOUSING FOR ELECTRONICS
Di-cast aluminium AlSi 12, free of copper, with fully chromated surface, epoxy polyester coated, seals of NBR.
ORDERING STRUCTURE

Version with HART protocol
- no display, non EEx 5
- EEx ia IIC T4/T6 6
- with LCD display, non EEx 7
- with LCD display, EEx ia IIC T4/T6 8

Cell, nominal value
- Nominal pressure: 160 mbar 160 mbar
- 1000 mbar
- 6000 mbar

Calibration / unit
- Calibrated from 0...nominal value of cell in mbar/bar, linear
- Calibrated from 0...nominal value of cell in kPa/Mpa, linear
- Calibrated from 0...nominal value of cell in mm H2O, linear
- Calibrated from 0...nominal value of cell in inch H2O, linear
- Calibrated from 0...nominal value of cell in kgf/cm, linear
- Calibrated from 0...nominal value of cell in psi, linear

Start, span in clear text, e.g.: %, linear/square root/cylindrical

Process flange:
- material: stainless steel 1.4435
- Flange diameter: DN 50, PN 16/400
- Flange diameter: DN 80, PN 16/400

Hygienic flange
- Diaphragm: Stainl. steel 1.4435, DIN 11851, DN 50, with nut
- Diaphragm: Stainl. steel 1.4435, DIN 11851, DN 65, with nut
- Diaphragm: Stainl. steel 1.4435, DIN 11851, DN 80, with nut
- Diaphragm: Stainl. steel 1.4435, Clamp 2"
- Diaphragm: Stainl. steel 1.4435, Clamp 3"

Diaphragm material
- Stainless steel 1.4435 (DN 50 / DN 80)
- Tantalum (DN 80)
- Hastelloy C 276 (DN 80)
- Stainless steel PTFE coated

Filling media
- Silicone oil
- Vegetable oil
- High temperature oil
- Glycerine
- Fluorolube

Length of capillaries
- 1 m
- 2 m
- 4 m
- 8 m

Missing codes will be given in effect of orders.

ACCESSORIES
Instructions for PD5/6
Further documentation
Instructions PD5/6 with HART 5.1

FITTINGS
Mounting bracket for wall- and pipe mounting
- Screws: 7/16 - 20 UNF
- Material: stainless steel 9404-290-01031

Fig. 5 Electrical connections

Fig. 6 Mounting bracket