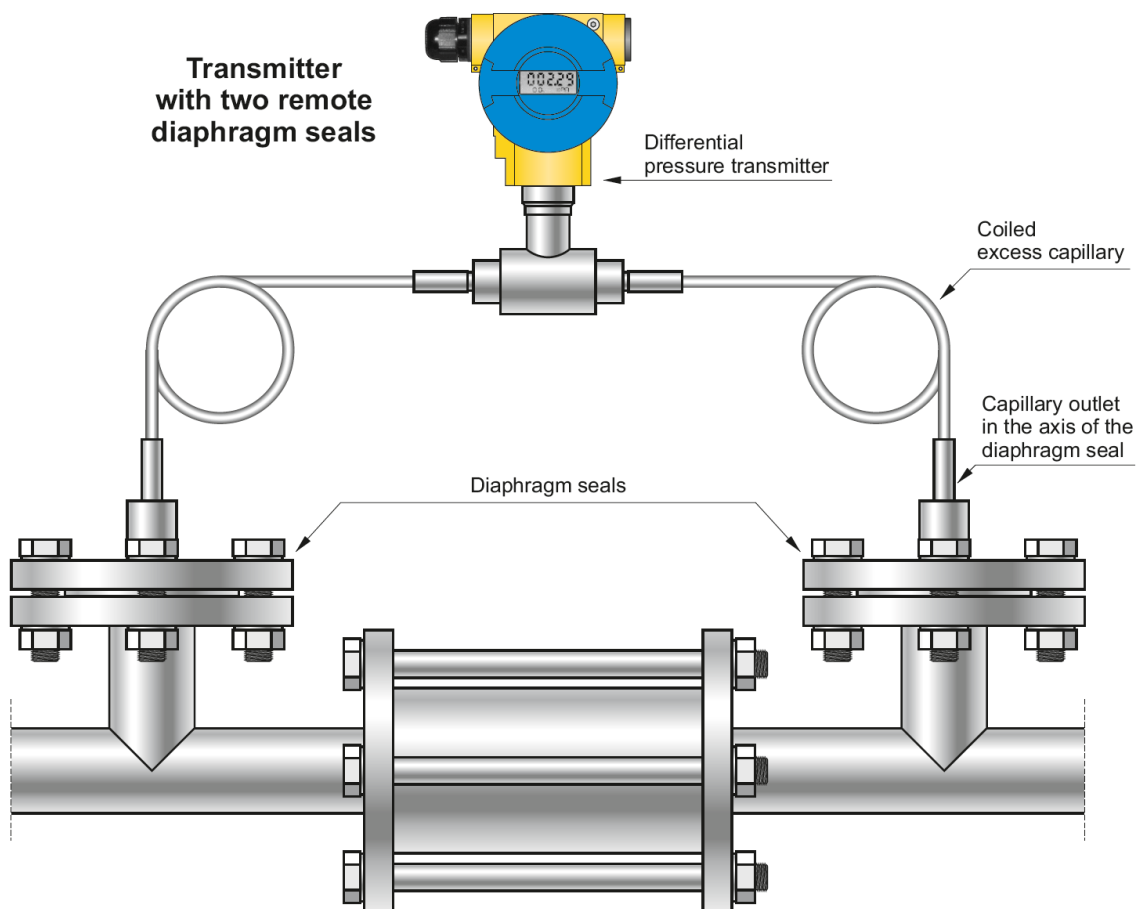


# SMART DIFFERENTIAL PRESSURE TRANSMITTER WITH TWO DIAPHRAGM SEALS MODEL BDPT3251



- Digital PROFIBUS PA signal
- 4...20 mA output signal + HART protocol
- Accuracy 0.1%
- ATEX certificates (intrinsic safety, explosion proof)
- Fully welded sensor guarantees tightness of oil system for many years
- Ability to configure measuring range locally



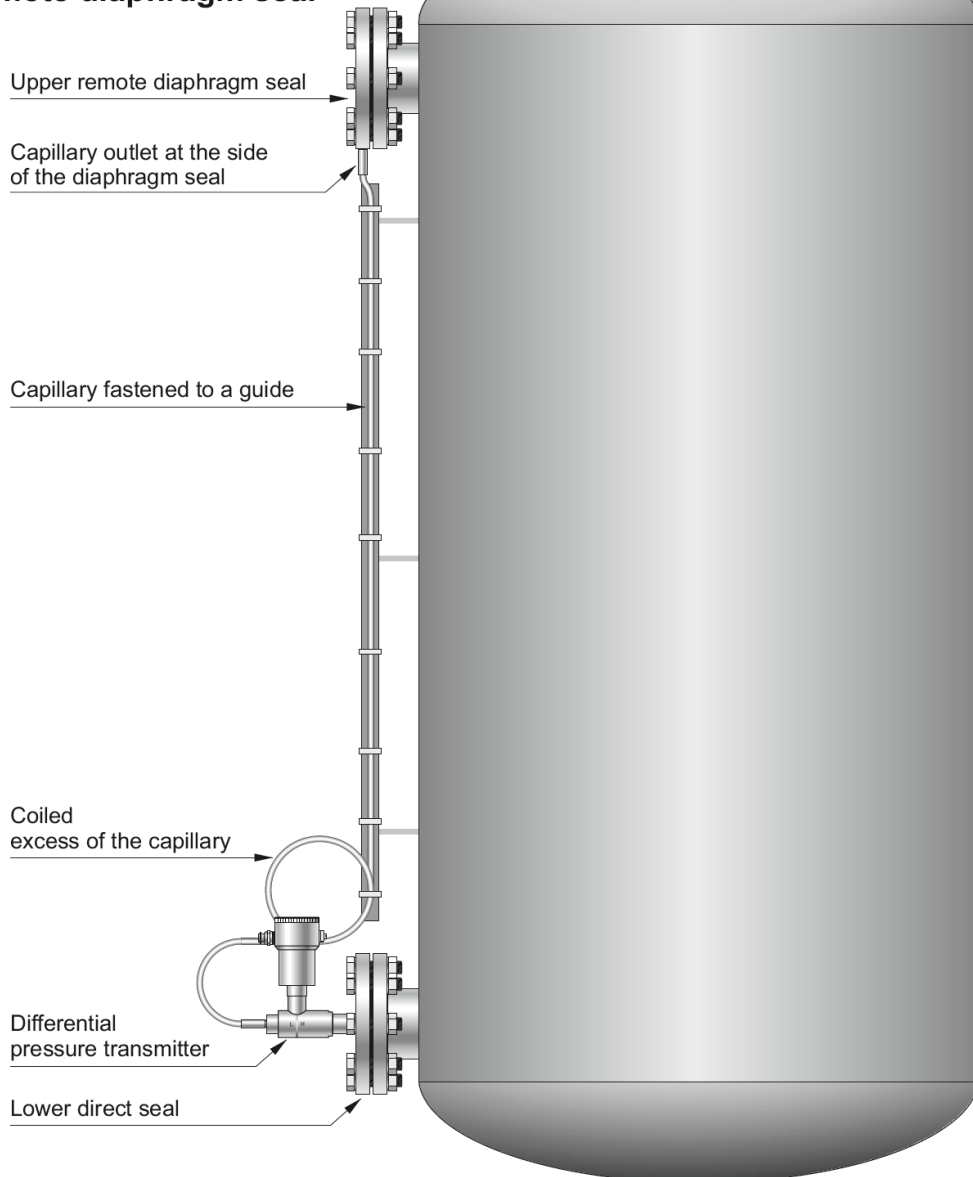
Example of a filter loss measurement

### Recommendations

The version of the transmitter with two remote diaphragm seals is recommended for the measurement of pressure differences when the hydrostatic pressure of the manometric fluid in the capillaries (which depends on the vertical spacing of the seals) is significantly less than the measuring range of the transmitter. The best metrological results are obtained when the applied

capillaries are identical, as short as possible, and terminated with identical seals. At such a configuration additional temperature errors, related to the remote sealing, affect both of the measurement chambers of the differential pressure transmitter in the same way, and thus cancel each other out.

**Transmitter with two types of diaphragm seal: one – direct diaphragm seal and the other – remote diaphragm seal**



**Example of measurement of the level in a pressure tank**

**Recommendations**

The transmitter with a direct diaphragm seal (connected to the positive measurement chamber) and a remote diaphragm seal (connected to the negative chamber) is recommended for hydrostatic measurements of: levels, densities, phase boundaries and pressure differences (with differentiated height of pulse source points\*).

In such a configuration, at ambient temperature changes, two opposite phenomena appear concurrently.

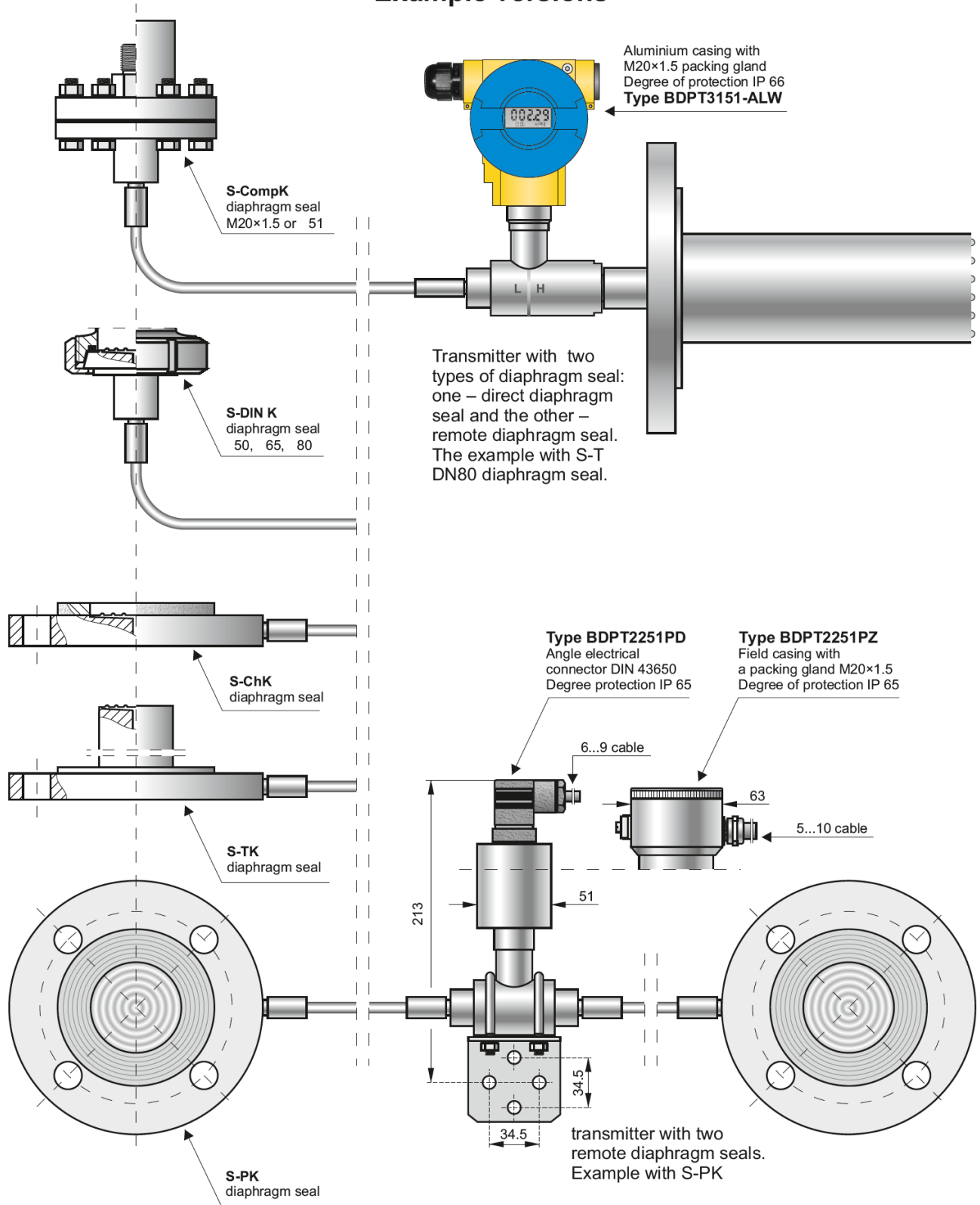
Thermal expansion causes the change in the volume (and hence also the change in density) of the manometric fluid in the capillary, which results in a change of the hydrostatic pressure related to the vertical spacing of the seals.

\* The difference in height of pulse source points, at which the hydrostatic pressure of the manometric fluid is comparable to or greater than the range of the transmitter.

This phenomenon is counteracted by the elastic reaction of the diaphragm of the upper diaphragm seal, which is displaced by the change in volume of manometric fluid. Based on tests and experiments, the BASI transmitters are provided with carefully selected seal diaphragms, which guarantee compensation of the errors resulted from the ambient temperature changes.

The best metrological results are obtained using assembly, which include DN 80, DN 100, A 109 and S-Comp diaphragm seals or S-Mazut, S-DIN and S-Clamp diaphragm seals with a diameter of at least 65 mm, where the length of the capillary is  $(1..1.3) \times$  (vertical spacing of seals). It is recommended using identical diaphragm seals at the both upper and lower connection points.

## Example versions



Note: The appropriate configuration of the complete set of pressure transmitter, diaphragm seals and capillaries, as well as the proper selection of manometric fluid, depends on several factors, including the physical and chemical properties, temperature range of the medium, the vertical spacing of the diaphragm seals, the measuring range, static pressure range, range of ambient temperatures and the technical specifications for mechanical connection of the diaphragm seals to the pressure devices.

## Application and construction

The differential pressure transmitter is applicable to the measurement of pressure differences of: gases, vapours and liquids in cases where it is necessary to use seals and the pressure pulse source points may be several metres apart. Typical applications include the hydrostatic measurement of: levels in closed tanks, densities and phase boundaries, and the measurement of a filter loss, pressure differences between media in pasteurisers etc. The available range of the diaphragm seals allows measurement at great majority of media. The active element is a piezoresistant silicon sensor separated from the medium by a distance sealing system. The special design of the measuring unit means that it can withstand pressure surges and overloads of up to 40 bar. The electronic circuits are enclosed in a casing with a degree of protection IP 65 or IP66.

## Configuration

The settings of the following metrological parameters can be changed:

- the units of pressure in which the range is configured,
- start and end points of the range, time constant,
- inverted characteristic (output signal  $20 \div 4$  mA).

## Communication

The transmitter is configured and calibrated using a BHC-03 communicator, some other communicators (HART) or a PC using an RS-HART converter and BASI RAPORT 2 configuration software.

The data interchange with the transmitter enables the users the transmitter identification, as well as reading of the currently measured differential pressure value, output current and percent of range width.

## Measuring ranges

Nominal measuring range (FSO)	Minimum set range	Vertical spacing of diaphragm seals	Maximum set range width, considering the actual vertical spacing of the diaphragm seals (m)	Static pressure limit
-160...160 mbar	0.1 m H <sub>2</sub> O	≤ 1.7 m	$[1.6 + (\text{vertical spacing of seals} \times 0.94)]$ m H <sub>2</sub> O	40 bar
-0.5...0.5 bar	0.5 m H <sub>2</sub> O	≤ 6 m	$[5 + (\text{vertical spacing of seals} \times 1.04)]$ m H <sub>2</sub> O	40 bar
-1.6...2 bar	1.5 m H <sub>2</sub> O	≤ 15 m	$[20 + (\text{vertical spacing of seals} \times 1.04)]$ m H <sub>2</sub> O	40 bar
-1.6...16 bar	1 bar	≤ 15 m	16 bar	40 bar

CAUTION: The maximum vertical diaphragm seal spacing shown in the table applies to level measurement, ensuring that it is possible to set the zero point of the transmitter when the tank is empty. For measurements of density or phase boundaries (in the sugar, chemical or refinery industries) the vertical spacing of the diaphragm seals can be larger.

## Metrological parameters

**Accuracy** ±0.1% (FSO)

The other parameters as given in the sheet for the smart differential pressure transmitter BDPT3251ALW/BDPT2251

**Sealing effect errors** – as given in the relevant diaphragm seal sheet in chapter III (Diaphragm Seals), concerning the distance seal.

NOTE: The additional absolute zero error due to ambient temperature can be compensated by configuring the transmitter, seals and capillaries in accordance with the recommendations on pages II/ 20 and II/ 21.

**Electrical parameters** – as given in the sheet for the BDPT3251ALW/BDPT2251 differential pressure transmitter.

## Operating conditions

**Operating temperature range (ambient temperature)** -25...85°C  
BDPT3251ALW-EEX/BDPT2251-EEX -25...80°C

**Medium temperature range** – as given in the appropriate diaphragm seal sheet (remote seal)

**Special versions, certificates:**

**EExia** – ATEX Intrinsic safety

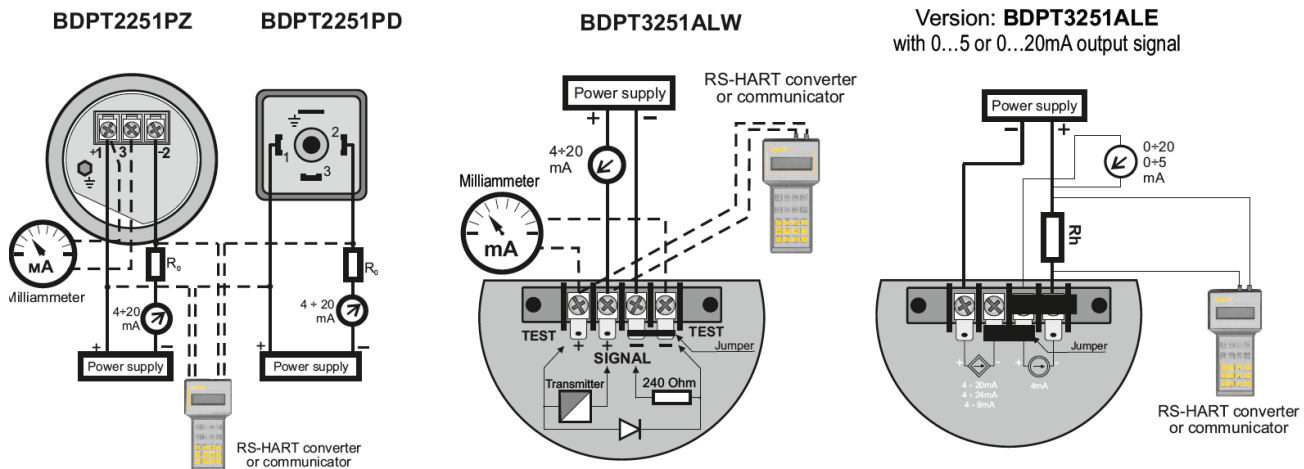
**EExd** – ATEX explosion proof

**100 bar, 160 bar** – static pressure limit – 100 bar or 160 bar

**Non-standard basic range** – on request

**Others**

## Electrical diagrams for transmitters with HART protocol



## SMART DIFFERENTIAL PRESSURE TRANSMITTER BDPT3251AL/Profibus PA/W

### Construction

The transmitter electronic system performs the digital processing of measurement and generates the output signal with the communication module according to Profibus PA standard. The transmitter function performance bases on profile 3.0 of Profibus PA standard.

The casing is made of high-pressure casting of aluminium alloy, IP-65 rated. The casing design allows using a local liquid crystal graphical display, 90° turn of display, 0–355° turn of casing relative to the sensor, and the choice of direction at cable insertion.

The measuring ranges, according to the table, page II/ 23.

### Communication

The communication with the transmitter is achieved in two ways:

- ♥ cyclic – the transmitter sends primary measured value (4 bytes IEEE754) and status containing the information on the current state of transmitter and measurement validity (1 byte).
- ♥ acyclic – this way of communication is used to device configuration and to read both primary measured value and the status.

### Configuration

Full configuration of transmitter settings, adjustment of the display mode, transmitter zeroing and calibration in relation to pressure standards proceeds with the PDM (Process Device Manager) software, by Siemens. The EED program library, worked out by Aplisens for cooperation with this transmitter, is helpful in the configuration.

Other commercial configuration software (e.g. Commuwin by Endress and Hauser, DTM/FDT tools) make transmitter configuration possible in the range of basic commands.

Enclosed to BDPT3251AL/Profibus PA is GSD file comprising the description of the transmitter basic properties such as transmission rate, type and format of input data, list of additional functions. GSD file is necessary for the software serving as a device for network configuration and makes the correct connection the appliance to Profibus network possible. The universal file GSD, designed for standard pressure transmitters made according to profile at revision 3 Profibus standard, may also be applicable to BDPT3251AL/Profibus PA.

The pressure transmitter BDPT3251AL/Profibus PA does not have the hardware address switch This address may be adjusted with accessible configuration software.

### Measurements in the areas under explosion hazard

For pressure measurements in the areas under explosion hazard the Atex intrinsically safe transmitters,  $\text{Ex} \text{I 1/2G EExia IIB/T5}$  are available

### Metrological parameters

Accuracy  $\leq \pm 0.1\%$  (FSO)

Other parameters: as for BDPT3251-ALW.

Sealing effect errors: as given on the relevant diaphragm seal sheet in chapter Diaphragm Seals, in relation to the distance seal

NOTE: The additional absolute zero error due to ambient temperature can be compensated by configuring the transmitter, diaphragm seals and capillaries in accordance with the recommendations on pages II/ 20, II/ 21.

### Electrical parameters

Power supply (from DP/PA coupler )

10,5 28V DC

12,05 28V DC - when display illumination

switched on

Power supply from intrinsically safe coupler according to FISCO requirements.

$V_i = 17,5\text{VDC}$

$I_i = 0,38\text{A}$  for IIB

$I_i = 0,36\text{A}$  for IIC

Current consumption

14mA

### Output parameters

**Output signal** Digital communication signal Profibus – PA (according to EN 50170)

**PA function** slave

**Physical layer** IEC61158-2

**Transmission range** 31,25kBit/S

**Modulation** Manchester II

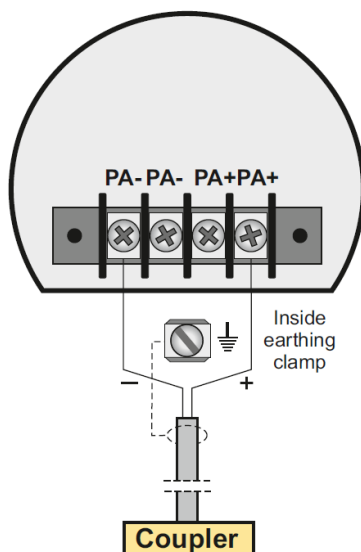
### Operating conditions

**Operating temperature range (ambient temp.):** –25..85°C

**EEx version:** –25..65°C

**Medium temperature range:** as given on the appropriate diaphragm seal

### Electrical diagrams



(See next page)

### Examples:

#### Ordering code to BDPT2251:

Smart differential pressure transmitter BDPT2251, nominal measuring range -1,6÷2 bar, on the (+) side a DN80 PN40 direct diaphragm seal, 100mm tube, on the (-) side a DN80 PN40 remote diaphragm seal, capillary length 8m.

**BDPT2251PD / -1,6÷ 2 bar/ (+) S-T DN80; T=100mm/ (-)S-PK DN80; K=8mm**

#### Ordering code to BDPT3251-ALW:

Smart differential pressure transmitter BDPT3251-ALW with display, nominal measuring range -0,5÷ +0,5 bar, with two remote diaphragm seals, capillaries length 2x K=2,5m

**BDPT3251-ALW / -0,5÷ 0,5bar/ (+) S-PK DN80; K=2,5m/ (-)S-PK DN80/ K=2,5m**

#### Ordering code to BDPT3251AL/ProfibusPA:

Smart differential pressure transmitter BDPT3251AL/ProfibusPA, nominal measuring range -0,5÷ +0,5 bar, with two remote diaphragm seals, capillaries length 2x K=2,5m

**BDPT3251AL/Profibus PA / -0,5÷ 0,5/ (+) S-PK DN80; K=2,5m/ (-)S-PK DN80; K=2,5m**

### Ordering procedure



### Ordering procedure BDPT3251

Model	Codes	Description										
BDPT3251		Smart differential pressure transmitter.										
Casing Output signal,	ALW..... ALE..... AL/Profibus PA..... AL/Profibus PA/W..... ALW/SS.....	Aluminum housing, IP66/IP67, with display, output 4–20mA + Hart Aluminium housing, IP66/IP67, with display, output 4–20mA + Hart 0 – 20mA+ Hart, 0 – 5mA+ Hart, Aluminium housing, IP66/IP67, without display, output Profibus PA Aluminium housing, IP66/IP67, with display, output Profibus PA 316ss stainless steel housing, IP66/IP67, with display, output 4–20mA + Hart										
Versions, Certificates*  (*) more than one option is available	/EEx ia..... /EEx d..... /100bar..... /160bar.....	Ex II 1/2G Exia IIC T4/T5 Ga/Gb, II 1 D Exia IIIC T105C Da I M1 Ex ia I Ma ( only version with SS housing) (not available for ALE) for Profibus PA version Ex II 1/2G EExia IIB T5 Ex II 1/2G Exia/d IIC T5/T6 Ex II 1/2D Exia/t IIIC T85C/T100C Da/Da (not available for ALE version) Static pressure limit – 100bar Static pressure limit – 160bar										
Nominal measuring range  (* not-standard ranges available on request)	-160+160mbar..... -0.5+0.5bar..... -1.6+2bar..... -1.6+16bar.....	<table border="1"> <thead> <tr> <th>Range</th> <th>min set range</th> </tr> </thead> <tbody> <tr> <td>-160+160mbar (-16+16kPa)</td> <td>0,1 mH<sub>2</sub>O</td> </tr> <tr> <td>-0.5+0.5bar (-50+50kPa)</td> <td>0,5mH<sub>2</sub>O</td> </tr> <tr> <td>-1.6+2bar (-160+200kPa)</td> <td>1,5mH<sub>2</sub>O</td> </tr> <tr> <td>-1.6+16bar (-160+1600kPa)</td> <td>1bar</td> </tr> </tbody> </table>	Range	min set range	-160+160mbar (-16+16kPa)	0,1 mH <sub>2</sub> O	-0.5+0.5bar (-50+50kPa)	0,5mH <sub>2</sub> O	-1.6+2bar (-160+200kPa)	1,5mH <sub>2</sub> O	-1.6+16bar (-160+1600kPa)	1bar
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-1.6+16bar (-160+1600kPa)	1bar											
Measuring setrange	/... .. [ required units] □ □ □ □ □ □ □ □	Start and end of calibrated range in relation to 4mA and 20mA output										
Process connections	/(+). K=..... /(-). K=.....	Direct diaphragm seal or remote diaphragm seal mounted on the (+) side of the transmitter- code as given in the relevant diaphragm seal sheet Capillary length on (+) side of transmitter Remote diaphragm seal mounted on the (-) side of the transmitter – code as given in the relevant diaphragm seal sheet ( chapter III – seals) Capillary length on (-) side of transmitter										
Electrical connection	(without marking)..... /US.....	Packing gland M20x1,5 Thread 1/2NPT Female										
Accessories	/FI25.....	Mounting bracket type FI25 for 2" pipe, material 304ss										
Other specification	/.....	Description of required parameters										

### Ordering procedure BDPT2251

Model	Codes	Description										
BDPT2251		Smart differential pressure transmitter.										
Casing Output signal,	PD..... PZ..... PZ/316.....	Housing IP65 with DIN43650 connector, without display, output 4–20mA +Hart, packing gland M20x1,5. 304SS housing, IP66/IP67, without display, output 4–20mA + Hart packing gland M20x1,5 304SS housing, IP66, without display, output 4–20mA + Hart										
Versions, Certificates*  (*) more than one option is available	/EExia..... /100bar..... /160bar.....	II 1/2G Ex ia IIC T4/T5/T6Ga/Gb I M1 Ex ia I Ma II 1D Ex ia IIIC T110°C Static pressure limit – 100bar Static pressure limit – 160bar										
Nominal measuring range  (* not-standard ranges available on request)	-160+160mbar..... -0.5+0.5bar..... -1.6+2bar..... -1.6+16bar.....	<table border="1"> <thead> <tr> <th>Range</th> <th>min set range</th> </tr> </thead> <tbody> <tr> <td>-160+160mbar (-16+16kPa)</td> <td>0,1 mH<sub>2</sub>O</td> </tr> <tr> <td>-0.5+0.5bar (-50+50kPa)</td> <td>0,5mH<sub>2</sub>O</td> </tr> <tr> <td>-1.6+2bar (-160+200kPa)</td> <td>1,5mH<sub>2</sub>O</td> </tr> <tr> <td>-1.6+16bar (-160+1600kPa)</td> <td>1bar</td> </tr> </tbody> </table>	Range	min set range	-160+160mbar (-16+16kPa)	0,1 mH <sub>2</sub> O	-0.5+0.5bar (-50+50kPa)	0,5mH <sub>2</sub> O	-1.6+2bar (-160+200kPa)	1,5mH <sub>2</sub> O	-1.6+16bar (-160+1600kPa)	1bar
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-160+160mbar (-16+16kPa)	0,1 mH <sub>2</sub> O											
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-1.6+2bar (-160+200kPa)	1,5mH <sub>2</sub> O											
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Measuring setrange	/... .. [ required units] □ □ □ □ □ □ □ □	Start and end of calibrated range in relation to 4mA and 20mA output										
Process connections	/(+). K=..... /(-). K=.....	Direct diaphragm seal or remote diaphragm seal connected to the (+) side of the transmitter- code as given in the relevant diaphragm seal sheet Capillary length on (+) side of transmitter Remote diaphragm seal connected to the (-) side of the transmitter – code as given in the relevant diaphragm seal sheet ( chapter III – seals) Capillary length on (-) side of transmitter										
Electrical connection	(without marking)..... /US.....	Packing gland M20x1,5 Thread 1/2NPT Female										
Accessories	/FI25.....	Mounting bracket type FI25 for 2" pipe is included, material 304ss										



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Smart Differential Pressure Transmitter BDPT3251-R

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