BASI

SMART DIFFERENTIAL PRESSURE TRANSMITTER BDPT3251

(with HART® Protocol)

- **HART® Protocol**
- **Digital PROFIBUS PA signal**
- **±0.065% (0,04%) inaccuracy and non-linearity**
- **Rangeability 100:1**
- **0 - 1mbar (0,1kPa) to -100 - 100 bar**
- **Up to 420 bar static pressure**
- **Automatic temperature compensation**
- **4 - 20mA output**
- **True non-interactive zero and span**
- **Local zero and span adjustment**
- **LCD indicator**
- **Adjustable damping**
- **Indication in engineering units**
- **AISI 316L or Hasteloy**
- **Gold plated diaphragm**
- **Capable in handling most process fluids**
- **Small and light weight**
- **Weather-proof housing IP67**
- **SIL 2 certificate**
- **Marine certificate**
- **Intrinsically safe**
- **Explosion proof**
- **ATEX directive 94/9/EC**

GENERAL DESCRIPTIONS

BASI Model BDPT3251 Smart Differential Pressure Transmitter. Designed for process control applications, these 2-wire transmitters generate a 4-20mA signal proportional or characterized to the applied pressure. This signal can be transmitted over a pair of twisted wires through long distances (limited only by the wire resistance and load). Remarkable features of the transmitters are its ±0.04% inaccuracy and non-linearity, 100:1 rangeability, compactness and light weight.

The pressures are directly applied to the isolating diaphragm that provide isolation and resistance against process fluid corrosion. Being microprocessor based, the electronic circuit is extremely versatile and accurate. Combined with the sensor precision, it provides the high accuracy and rangeability.

Transmitter performance is improved by continuous monitoring of the sensor temperature and corresponding corrections.

A local display permits easy reading and writing of data.

TECHNICAL SPECIFICATIONS
Functional Specifications

Process fluid	: Liquid, gas or vapor
Range	: 0-1mbar (0,1kPa) to -100 - 100bar (10MPa)
Output signal	: Two-wire 4-20,20-4 mA & HART® Protocol
Power supply	: 16 - 42 VDC (intrinsically safe 16-30VDC)
Load limitation	: 0 - 600Ω for 24VDC
Indicator	: 2 line 5 digit LCD indicator
Hazardous area	: IP67 weather-proof, and Intrinsic-safety type Exia II CT6, Flame-proof Exd II CT6
Certificate	: ATEX
Zero and span	: Non-interactive local adjustment
Ambient.temp	: -40 to 85°C
Process.temp	: -40 to 121°C
Storage.temp	: -46 to 110°C
Turn-on time	: Performs within specifications in less than 120 milliseconds after power is applied.
Humidity limits	: 0 - 100% RH
Damping adj.	: Adjustable
Configuration	: By pushbutton on the transmitter or HHT, PC using HART® Protocol

Performance Specifications

Resolution	: ±0.01%
Inaccuracy	: ±0.065%, (0,04%)
Temperature effect	: ± 0,065%/FS/10°C
Power supply effect	: Negligible between 14,5 and 45 VDC
Mounting position effect	: Any position. No span effect.

Physical Specifications

Electrical connection	: ½"-14NPTF, M20 x 1,5
Process connection	: G½, M20, G½ NPT
Wetted parts	: AISI 316L or Hasteloy
Filling fluid	: Silicone oil
Electronic housing	: Injected aluminum with polyester painting (RAL 5014) NEMA 4X, IP67
Identification plate	: 304 SST
Approximate weight	: 3,5 kg
Mounting	: Directly supported by piping or optionally with mounting bracket for 2" pipes or with direct or remote seals.

CE

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M20×1.5 packing gland
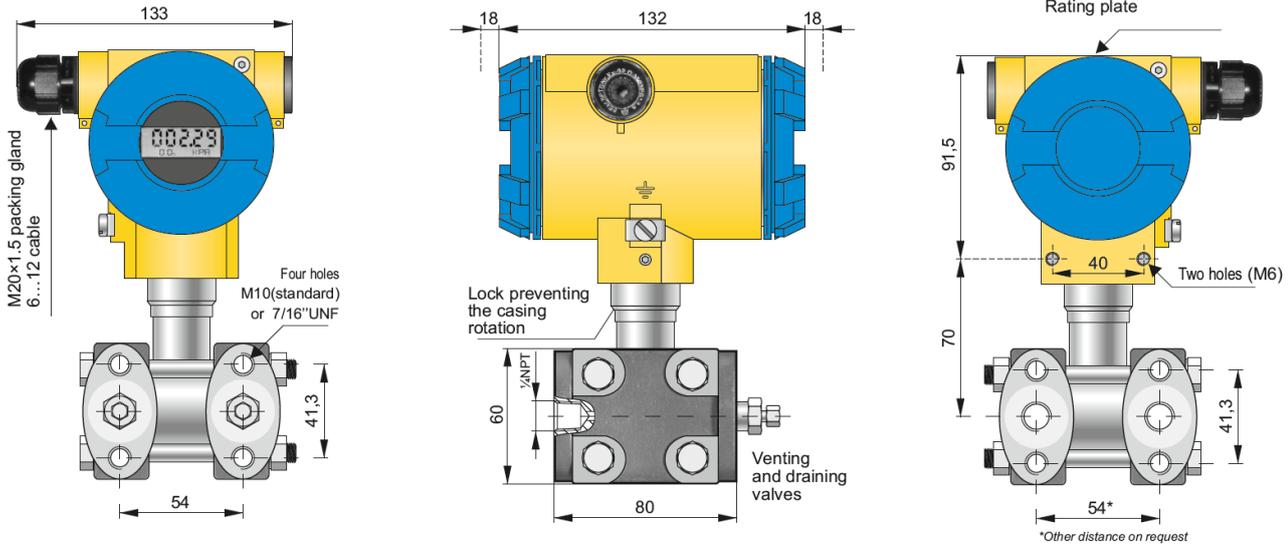6…12 cable

Four holes
M10(standard)
or 7/16''UNF

41,3

54

18   132   18

Lock preventing
the casing
rotation

¼NPT

60

80

Venting
and draining
valves

Rating plate

91,5

40   Two holes (M6)

70

41,3

54*

*Other distance on request

Transmitter **BDPT3251-ALW** – version with **type C** process connection
to be mounted together with a valve manifold

176

SW27   2 15   9   M20×1.5

94.5

Transmitter **BDPT3251-ALW**
Version with **P type** process connection.

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¼NPT

Transmitter **BDPT3251-ALW**
Version with **PN type** process connection.

Transmitter **BDPT3251-ALW**
Version with direct or
remote diaphragm seal.

Application and construction

The BDPT3251 transmitter is applicable to the measurement of differential pressure of gases, vapours and liquids. The active element is a piezoresistant silicon sensor separat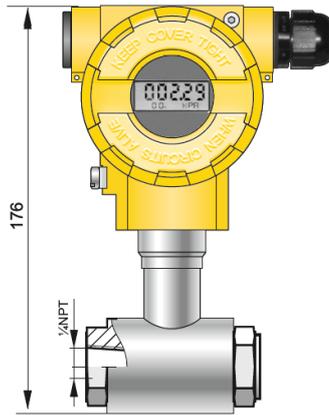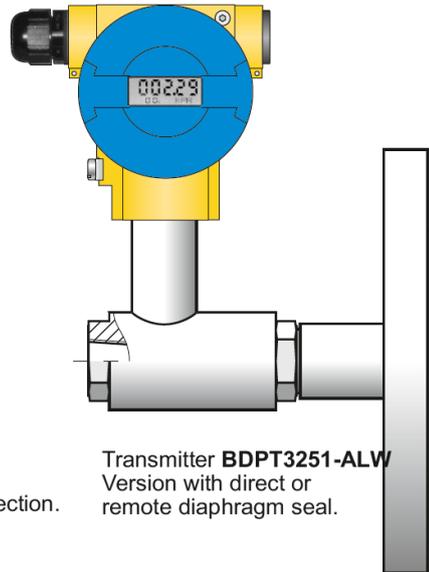ed from the medium by separating diaphragms and a specially selected type of manometric fluid. The special design of the active sensing element ensures that it is able to withstand pressure surges and overloads of up to 250/320/420 bar.The casing is made of aluminium alloy cast or 316SS stainles steel, degree of protection IP66/IP67. The design of the casing enables the use of a local display, rotation of the display by 90°, rotation of the casing by 0–355° relative to the sensor, and a choice of cable direction.

Communication and configuration

The communication standard for data interchange with the transmitter is the Hart protocol.

Communication with the transmitter is carried out with:

– a BHC-03, BHC-03Ex communicator,

– some other Hart type communicators,(*)

– a PC using an HART/USB/Bluetooth converter and Raport 2 configuration software.

(*) .eddl files available from BASI

The data interchange with the transmitter enables the users to:
⊆ identify the transmitter,
⊆ configure the output parameters:
  – measurement units and the values of the start points and end points at the measurement range;
  – damping time constant;
  – conversion characteristic (inversion, user's non-linear characteristic);
⊆ read the currently measured pressure value of the output current and the percentage output control level;
⊆ force an output current with a set value;
calibrate the transmitter in relation to a model pressure

Installation

The transmitter with **P or PN type** process connection is not heavy, so can be installed without additional mounting bracket on application. For fitting in any desired position we recommend an universal BASI mounting bracket for 2″ pipe (AL mounting bracket). The version with **C type** process connections can be fitted directly to a 3- or 5- valve manifold. We recommend factory-mounted transmitters with VM type valve manifold A transmitter without a valve manifold can be fitted in any position on a 2″ pipe or on a wall using the C-2″ mounting bracket When the special process connections are required for the measurement of specific media levels in closed tanks (e.g. in the sugar and chemical industries) the transmitter is fitted with an BASI diaphragm seal. Sets of differential pressure transmitters with diaphragm seals are described in detail in other catalogue.

Measuring ranges

No.	Nominal measuring range(FSO)*		Minimum set range		Rangeability	Overpressure limit/ static pressure limit
1	0...70 bar	(0...7MPa)	7 bar	(700kPa)	10:1	exception: 70 bar for P type
2	0...16 bar	(0...1,6MPa)	1,6 bar	(160kPa)	10:1	
3	0...2,5 bar	(0...250kPa)	0,2 bar	(20kPa)	12,5:1	250 bar ,320bar, 420 bar
4	0...1 bar	(0...100kPa)	50mbar	(5kPa)	20:1	(40 bar for P type
5	0...0,25 bar	(0...25 kPa)	10mbar	(1kPa)	25:1	Process connection)
6	-0,5...0,5 bar	(-50...50kPa)	0,1 bar	(10kPa)	10:1	(250 bar for PED version)
7	-100...100mbar	(-10...10kPa)	10mbar	(1kPa)	20:1	
8	-5...70mbar	(-0,5...7kPa)	4mbar	(0,4kPa)	18:1	
9	-20...20 mbar	(-2...2kPa)	2mbar	(0,2kPa)	20:1	20 bar(10bar for PED version)

special nominal ranges on request.

Technical data

Metrological parameters

Accuracy   ⊗±0.075% of calibrated range
⊗±0.1% of calibrated range (range no. 9)

Long term stability   ⊗accuracy for 3 years
(for the nominal measuring range)

Thermal error   for ranges no 1-8   ⊗±0.05% (FSO) / 10°C
for ranges no 9   ⊗±0.08% (FSO) / 10°C
max. ±0.3% (FSO) in temperature range -25...80°C
special version for ranges no 1-8   ⊗±0.03% (FSO) / 10°C
max. ±0.1% (FSO) in temperature range -25...80°C

Thermal compensation range   -25...80°C

Zero shift error for static pressure

0.01% (FSO) / 10 bar for range 3, 4, 5, 6

0.03% (FSO) / 10 bar for range 1, 7, 8

0.08% (FSO) / 10 bar for ranges 2, 7

Zeroing the transmitter in conditions of static pressure can eliminate this error.

Additional electronic damping   0...60 s
Error due to supply voltage changes 0.002% (FSO) / V

Electrical parameters

Power supply:
model BDPT3251-ALW   12...55 V DC   (Ex ia 13,5...28 V)
(Ex d 13,5...45V)

model BDPT3251-ALE   12...36 V DC

Additional voltage drop when display illumination switched on   3V
Output signal   4...20 mA, two wire transmission
BDPT3251-ALE: 0...20 or 0...5, 4...20 [mA]

Load resistance $R[\Omega] \leq \dfrac{U_{sup}[V]-12V^*}{0,02A} \, 0.85$

∗-15V when display illumination switched on
**Resistance required for communication** 250...1100 Ω

Materials

Wetted parts: type P, PN process connection: 316Lss

type P(H) process connection: Hastelloy C276

type C process connection 316ss

Diaphragms: 316Lss, Hastelloy C 276, Au

Casing: Aluminium
Option: 316SS
Material of window: polycarbonate glass, hardened glass

Operating conditions

Operating temperature range (ambient temp.)	-25...85°C
Exi version	-25…80°C
Exd version	-25…75°C
Medium temperature range	-25...120°C

over 120°C – measurement with the use of impulse line or diaphragm seals

up to 100°C PED version

CAUTION: the medium must not be allowed to freeze in the impulse line or close to the process connection of the transmitter

Accuracy depending on the set range
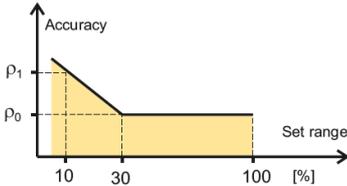
ρ_0 – error for nominal measuring range (0...100% FSO)
ρ_1 – error for range 0...10% FSO
$\rho_1 = 2 \times \rho_0$
Numerical error values are given in the technical data under metrological parameters

SMART DIFFERENTIAL PRESSURE TRANSMITTER
BDPT3251AL/Profibus PA

Application and 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 measuring ranges, according to the table, page II/ 3.

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 BASI 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, ⟨Ex⟩ II 1/2G Exia IIB T5 are available

Technical data

Metrological parameters, measuring range, materials of process connection, diaphragms and casing, and operating conditions – see the description pages II/ 3, II/ 4.
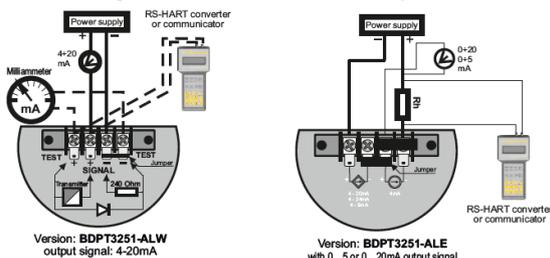
Electrical parameters

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.
Vi=15VDC
Ii=0,38A for IIB
Current consumption 14mA

Output parameters

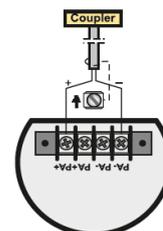|	
Output signal	Digital communication signal Profibus – PA (according to EN 50170)
PA function	slave
Physical layer	IEC61158-2
Transmission range	31,25kBit/S
Modulation	Manchester II

Electrical diagrams

Electrical diagrams for transmitters with HART protocol

Transmitters with Profibus PA

Version: **BDPT3251-ALW**
output signal: 4-20mA

Version: **BDPT3251-ALE**
with 0...5 or 0...20mA output signal

Ordering procedure

Model	Code	Description
BDPT3251		Smart differential pressure transmitter.
Casing, Output signal, ⇒	ALW…………………………………………………………	Aluminum housing, IP66/IP67, with display, output 4−20mA + Hart
	ALE…………………………………………………………	Special version 0 − 20mA+ Hart, 0 − 5mA+ Hart,
	AL./Profibus PA…………………………………………………	Aluminium housing, IP66, without display, output Profibus PA
	AL./Profibus PA/W……………………………………………	Aluminium housing, IP66/IP67, with display, output Profibus PA
	ALW/SS………………………………………………………	Stainless steel housing, IP66/IP67, with display, output 4-20mA + Hart

Versions, Certificates*	/EEx ia………………………………………………	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 avaliable for ALE) for Profibus PA version Ex II 1/2G EExia IIB T5
	/EE xd………………………………………………	Ex II 1/2G Exia/d IIC T5/T6 Ga/Gb Ex II 1/2D Exia/t IIIC T85/T100 Da/Db, for pressure >250mbar (not avaliable for ALE AL/Profibus PA, AL./Profibus PA/W,).Packing gland available on request.
*) more than one option is available	/PED…………………………………………………	European Pressure Equipment Directive N° 97/23/EC, category IV
	/Tlen…………………………………………………	For oxygen service (sensor filled with Fluorolube fluid)
	/320bar………………………………………………	Static pressure 320bar /only for C process connection, standard is 250bar/, option not available in PED version.
	/420bar………………………………………………	Static pressure 420bar /option not available in PED version/.
	/Safety………………………………………………	SIL2 Functional Safety certificate
	/MR……………………………………………………	Marine certificate - DNV

Nominal measuring range		Range	min set range
	/0÷70bar…………………………………	0÷70bar (0÷7000KPa)	7bar (700kPa)
	/0÷16bar…………………………………	0÷16bar (0÷1600KPa)	1,6bar (160kPa)
	/0÷2,5bar…………………………………	0÷2,5bar (0÷250kPa)	0,2bar (20kPa)
	/0÷1bar……………………………………	0÷1bar (0÷100kPa)	50mbar (5kPa)
	/0÷0,25bar………………………………	0÷.0,25bar (0÷25kPa)	10mbar (1kPa)
	/-0,5÷ +0,5bar……………………………	-0,5÷0,5bar (-50÷50kPa)	0.1bar (10kPa)
	/-0,1÷ +0,1bar……………………………	-0,1÷0,1bar (-10÷10kPa)	10mbar (1kPa)
	/-5÷70mbar………………………………	-5÷70mbar (-0.5÷7kPa)	4mbar (0.4kPa)
	/0÷70bar…………………………………	0÷70bar (0÷7MPa)	7bar (700kPa)
	/-20÷20mbar………………………………	-20÷20mbar (-2 ÷2 kPa)	2 mbar (0.2 kPa)

Measuring set range	/…÷... [required units]	Calibrated range in relation to 4mA and 20mA output

Process connections	⇒ /C…………………………………	Thread 1/4NPT F on the cover flanges, diaphragms material 316Lss, cover flanges material SS316. Allows mounting with a valve manifold. Process connection of cover flange: M10(standard)/ 7/16UNF(option)-C(7/16)
	/C(H)………………………………	Thread 1/4NPT F on the cover flanges, diaphragms material Hastelloy C276 , cover flanges material SS316. Allows mounting with a valve manifold. Process connection of cover flange: M10(standard)/ 7/16UNF(option)-C(H,7/16)
	/C(Au)………………………………	Thread 1/4NPT F on the cover flanges, gold plated diaphragm, cover flanges material SS316 . Awaliable with range no.4 Allows mounting with a valve manifold. Process connection of cover flange: M10(standard)/ 7/16UNF(option)-C(Au,7/16)
	/P………………………………………	Thread M20x1,5 (male), wetted parts material SS316L
	/PN……………………………………	Thread 1/4"NPT (female), wetted parts material SS316L
	/P..(H)………………………………	Thread M20x1,5 (male), wetted parts material Hastelloy C276
	/code of diaphragm seal…………	Diaphragm seal (see chapter of diaphragm seals) mounted on Hi side of transmitter, Lo side 1/4NPT Female

Gasket (only in C process connection)	⇒ (without marking)………………	FPM Viton,
	NBR…………………………………	NBR (for oxygen service)

Electrical connection	⇒ (without marking)……………	Packing gland M20x1,5
	/US…………………………………	Thread 1/2NPT Female

Accessories **	⇒ /C-2"……………………	Mounting bracket for 2" pipe (to C process conn.), mat. zinced steel
	/C-2"(SS)………………	Mounting bracket for 2" pipe (to C process conn.), mat. Stainless Steel
	/FI25……………………	Mounting bracket for 2" pipe (to P process conn.), mat. stainless steel
	/RedSpaw P…………	Connector to weld impulse pipes dia. 12 and 14 mm , material 15HM(SO) or SS 316(S) . Only process connection P type,
	/RedSpaw C…………	Connector to weld impulse pipes dia. 12 and 14 mm, material 15HM. Only process connection C type.
**) more than one option is available	/Red d/P. ½"…………	Adapter for differential pressure transmitters with C type process connection, output thre ad 1/2NPT F. Material 316 LSS
	/ST………………………	Stainless Steel plate riveted to the housing
	/MT……………………	Stainless Steel Tag plate mounted on wire

Other specification	/…………………	Description of required parameters

The most typical specification is marked by "⇒" mark.