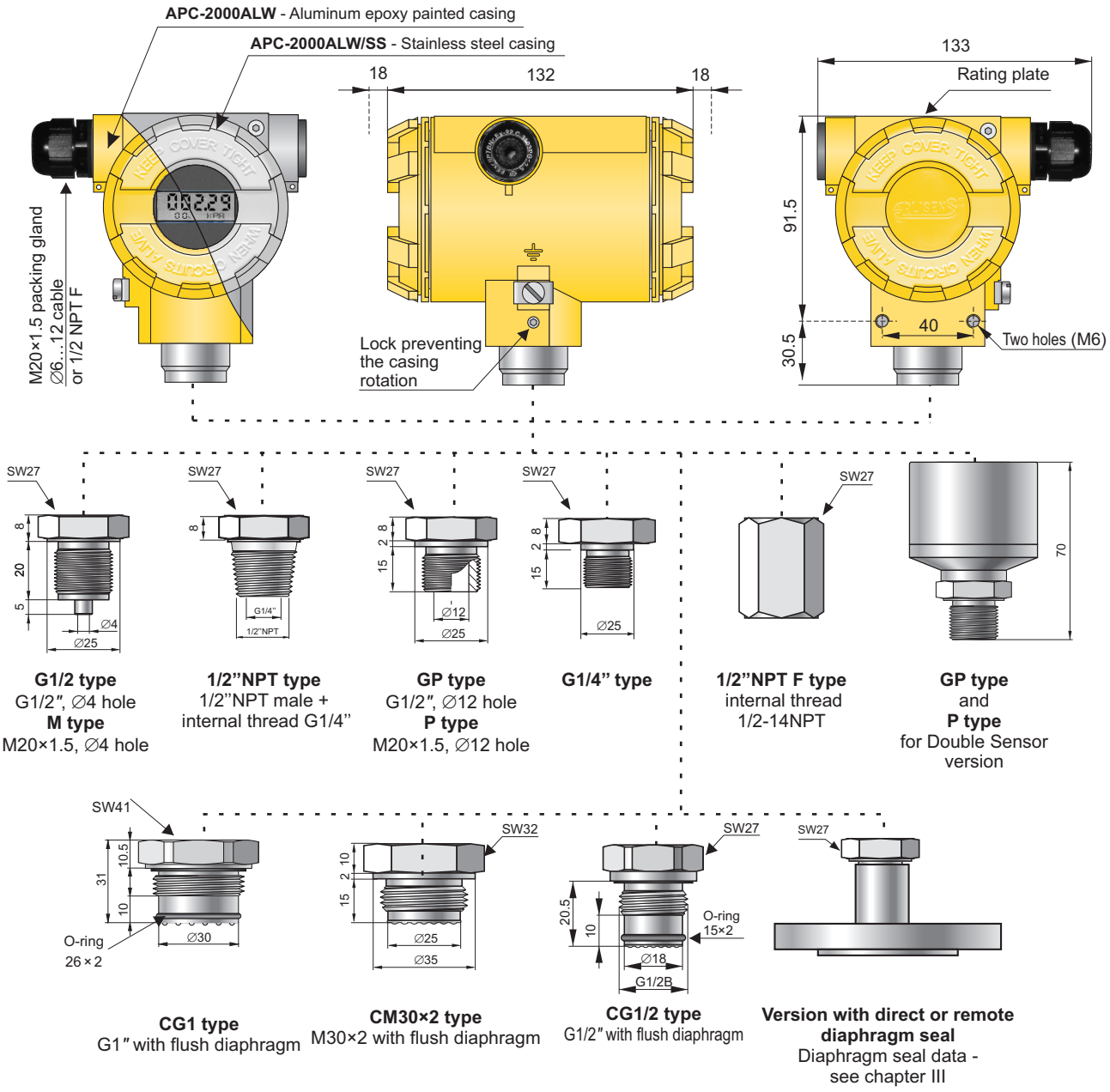
SMART PRESSURE TRANSMITTER
APC-2000ALW

HART COMMUNICATION PROTOCOL

- ✓ 4…20 mA, 0…20 mA or 0…5 mA output signal + HART protocol
- ✓ Digital PROFIBUS PA signal
- ✓ Display with backlight
- ✓ Programmable range, zero shift, characteristic and damping ratio with local panel keys
- ✓ Intrinsic safety certificate (ATEX, IECEx)
- ✓ Explosion proof certificate (ATEX, IECEx)
- ✓ SIL 2 certificate
- ✓ Marine certificate – DNV, BV
- ✓ PED Conformity (97/23/EC)
- ✓ Accuracy 0,075% (0,05% on request)
- ✓ Gold plated diaphragm (Au)
- ✓ MID (Measuring Instruments Directive) – certificate acc. to 2004/22/WE directive and OIML R140:2007 recommendations.

now 5 years warranty



Application and construction

Smart pressure transmitters are applicable to the measurement of the pressure, underpressure and absolute pressure of gases, vapours and liquids. The active sensing element is a piezoresistant silicon sensor separated from the medium by a diaphragm and by specially selected type of manometric liquid. 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.

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

Communication with the transmitter is carried out with:

– a KAP-03, KAP-03Ex communicator
– some other Hart type communicators,(*)
– a PC using an HART/USB/Bluetooth converter and Raport 2 configuration software.

(*) .eddl files available on www.aplisens.com.

The data interchange with the transmitter enables 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 can be installed directly on the installation. An universal mounting bracket is provided to transmitter fitting on 2″ pipe (the AL mounting bracket, see page IV/ 5). When the pressure of steam or other hot media is measured, a siphon or impulse line should be used. The needle valve placed upstream the transmitter simplifies installation process and enables the zero point adjustment or the transmitter replacement. When the special process connections are required for the measurement of levels and pressures (e.g. at food and chemical industries), the transmitter is provided with an Aplisens diaphragm seal. Installing accessories and a full scope of diaphragm seals are described in detail in the further part of the catalogue. The transmitter's electrical connections should be performed with twisted cable. The place for the communicator should be assigned before the communicator installation.

Measuring ranges

No.	Nominal measuring range (FSO)		Minimum set range		Rangeability	Overpressure limit (without hysteresis)***	
1	0…1000bar	(0…100 MPa)	10bar	(1 MPa)	100:1	1200 bar	(120 MPa)
2	0…300 bar	(0…30 MPa)	3 bar	(300 kPa)	100:1	450 bar	(45 MPa)
3	0…160 bar	(0…16 MPa)	1,6 bar	(160 kPa)	100:1	450 bar	(45 MPa)
4	0...70 bar	(0...7 MPa)	0,7 bar	(70 kPa)	100:1	140 bar	(14 MPa)
5	0...25 bar	(0...2,5 MPa)	0,25 bar	(25 kPa)	100:1	50 bar	(5 MPa)
6	0...7 bar	(0...0,7 MPa)	0,07 bar	(7 kPa)	100:1	14 bar	(1,4 MPa)
7	-1…6bar	(-100…600 kPa)	0,07 bar	(7 kPa)	100:1	14 bar	(1,4 MPa)
8	-1…1,5bar	(-100…150 kPa)	0,12 bar	(12 kPa)	20:1	4 bar	(400 kPa)
9	0...2 bar	(0...200 kPa)	100 mbar	(10 kPa)	20:1	4 bar	(400 kPa)
10	0...1 bar	(0...100 kPa)	50 mbar	(5 kPa)	20:1	2 bar	(200 kPa)
11	-0,5...0,5 bar	(-50...50 kPa)	50 mbar	(5 kPa)	20:1	2 bar	(200 kPa)
12	0...0,25 bar	(0...25 kPa)	25 mbar	(2,5 kPa)	10:1	1 bar	(100 kPa)
13	-100...100 mbar	(-10...10 kPa)	20 mbar	(2 kPa)	10:1	1 bar	(100 kPa)
14	-15...70 mbar *	(-1,5...7 kPa)	5 mbar	(0,5 kPa)	17:1	0.5 bar	(50 kPa)
15	-25…25 mbar */**	(-2,5...2,5 kPa)	2 mbar	(0,2 kPa)	25:1	1 bar	(100 kPa)
16	-7…7 mbar */**	(-0,7..0,7 kPa)	1 mbar	(0,1 kPa)	14:1	1 bar	(100 kPa)
17	0...1,3 bar abs	(0...130 kPa abs)	100 mbar abs	(10 kPa abs)	13:1	2 bar	(200 kPa)
18	0...7 bar abs	(0...0,7 MPa abs)	100 mbar abs	(10 kPa abs)	70:1	14 bar	(1,4 MPa)
19	0...25 bar abs	(0...2,5 MPa abs)	0,25 bar abs	(25 kPa abs)	100:1	50 bar	(5 MPa)
20	0...70 bar abs	(0...7 MPa abs)	0,7 bar abs	(70 kPa abs)	100:1	140 bar	(14 MPa)

* *only for tranmitters without diaphragm seal; not available in Exd version*
** *only for fransmitters in Double Sensor version*
*** *overpressure limit can be different for version according to PED norm No. 97/23/EC*

Technical data

Metrological parameters

Accuracy ≤ ±0,075% of the calibrated range (≤ ±0,1% for range no. 16)
Special version: ≤ ±0,05% of the calibrated range

Long-term stability (for the nominal measuring range) ≤ accuracy for 3 years
≤ 2 x accuracy for 5 years
Double Sensor version: ≤ accuracy for 6 years

Thermal error < ±0,05% (FSO) / 10°C (0,1% for ranges no. 13, 14, 16)
max. ±0.25% (FSO) in the whole compensation range (0,4% for ranges no. 13, 14, 16)

Thermal compensation range -25...80°C
Special version: -40...80°C

Additional electronic damping 0...60 s

Error due to supply voltage changes 0,002% (FSO) / V

Electrical parameters

Power supply: 12...55 VDC
special version: 10…55VDC
(Ex ia:10,5...28 VDC; Ex d: 13,5…45 VDC)

Additional voltage drop when display illumination switched on 3 V

Output signal 4...20 mA, two wire transmission
special version: 0…20 or 0…5, 4…20 [mA]

Load resistance

$$R[\Omega] \le \frac{U_{sup}[V] - 10V^{*}}{0{,}0225A}$$

∗ - 13 V when display illumination switched on

Resistance required for communication min. 240 Ω

Materials

Wetted parts and diaphragms: 316Lss, Hastelloy C 276, Au

Casing: Aluminium, 316SS

Material of window: polycarbonate glass, hardened glass

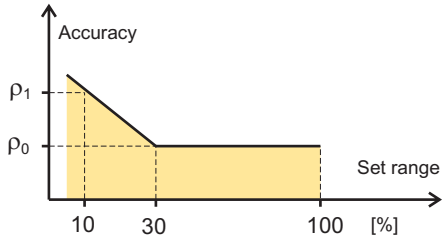
Operating conditions

Operating temperature range (ambient temp.)	-40...85°C
Exi version	-40…80°C
Exd version	-40…75°C
Medium temperature range	-40...120°C

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

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 PRESSURE TRANSMITTER APC-2000ALW version with MID

Application

Smart pressure transmitter APC-2000ALW MID is applicable to the measurement of the pressure and absolute pressure in application designed according to directive 2004/22/EC (MID), harmonized standard PN-EN12405-1:2005 + A2:2010 and recommendation OIML R140:2007. Device subcomponent suitable for custody transfer measurement of gas with MID approval. Mechanical construction and installation of the transmitter enclosure shall comply with the transmitter APC-2000ALW are described on page I/ 3 of catalogue. Pressure transmitters APC-2000ALW MID are produced only with nominal ranges according to the table. Transmitter due to factory blockade of transmitter's configuration cannot be configurable by user. Electrical connection of the transmitter is according to drawing on page I/ 3. Available are only terminals SIGNAL + and SIGNAL -. Note! For custody transfer applications, the cover clamp screws have to be locked with seal wire.

Metrological parameters

Max. permissible error according to EN12405-1 (calculated in relation to the measured value)

- in reference conditions	≤ 0,2%
- nominal operating conditions	≤ 0,5%
special version	≤ 0,3%
Long-term stability	< 0,5% / 5 years
Operating temperature range	-25...55°C
Power supply	13,5...28 VDC

MID Parts Cerfificate No. 27/12

Measuring ranges

Nominal measuring range		Overpressure limit (without hysteresis)	
10÷100 bar ABS	(1÷10 MPa ABS)	450 bar	(45 MPa)
2÷20 bar ABS	(0,2÷2 MPa ABS)	50 bar	(5 MPa)
2÷20 bar	(0,2÷2 MPa)	50 bar	(5 MPa)
0,9÷7 bar ABS	(0,09÷0,7 MPa ABS)	14 bar	(1,4 MPa)
0,9÷7 bar	(0,09÷0,7 MPa)	14 bar	(1,4 MPa)

Ordering procedure

Model	Code	Description
APC-2000		Smart pressure transmitter
Casing, output signal	/ALW	Aluminum housing, IP66/IP67, with display, output 4-20mA + Hart
	/MID	**MID** – certificate acc. to 2004/22/EC directive and OIML R140:2007 recommendations
Versions, certificates	/Exia	Ex II 1/2G Exia IIC T4/T5 Ga/Gb , II 1 D Exia IIIC T105C Da
Nominal measuring range	/10÷100 bar ABS	10÷100 bar ABS (10÷100 MPa ABS)
	/2÷20 bar ABS	2÷20 bar ABS (0,2÷2 MPa ABS)
	/2÷20 bar	2÷20 bar (0,2÷2 MPa)
	/0,9÷7 bar ABS	0,9÷7 bar ABS (0,09÷7 MPa ABS)
	/0,9÷7 bar	0,9÷7 bar (0,09÷7 MPa)
Process connections	/M	Thread M20x1,5 (male) with Ø4 hole, wetted parts SS316L
	/G1/2	Thread G1/2'' (male) with Ø4 hole, wetted parts SS316L
	/G1/2(Au)	Thread G1/2'' (male) with Ø4 hole, gold plated diaphragm
	/P	Thread M20x1,5 (male) with Ø12 hole, wetted parts SS316L
	/GP	Thread G1/2'' (male) with Ø12 hole, wetted parts SS316L
	/1/2"NPTM	Thread 1/2''NPT Male, wetted parts SS316L
	/1/2"NPTF	Thread M20x1,5 with adapter to 1/2"NPT Female, wetted parts SS316L
Electrical connection	(without marking)	Packing gland M20x1,5
	/US	Thread 1/2"NPT Female
Accessories	/AL	Mounting bracket type AL for 2" pipe, material zinced steel
	/AL(SS)	Mounting bracket type AL for 2" pipe, material stainless steel
	/ST	Stainless Steel plate riveted to the housing
	/MT	Stainless Steel Tag plate mounted on wire

Example 1: Pressure transmitter with display, output 4...20mA + HART, version Exia, nominal measuring range 10...70bar, process connection G1/2'', electrical connection gland M20x1,5 , according to MID standard.

APC-2000ALW/MID/Exia/10..70bar/G1/2'

SMART PRESSURE TRANSMITTER APC-2000AL
with Profibus PA protocol

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 casing is made of high-pressure casting of aluminium alloy, IP-66/IP67 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 APC-2000AL/Profibus PA transmitter is produced with process connections described on page I/ 2 or, optionally, with Aplisens diaphragm seal.

The measuring ranges, according to the table, page I/ 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 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 APC-2000AL/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 APC-2000AL/Profibus PA. The pressure transmitter APC-2000AL/Profibus PA does not have the hardware address switch. This address may be adjusted with accessible configuration software.

Measurements in the hazardous areas

For pressure measurements in the areas under explosion hazard the Atex intrinsically safe transmitters, Ex II 1/2G Ex ia IIB T5 Ga/Gb are available

Technical data

Metrological parameters, materials of process connection, diaphragms and casing, and operating conditions – see the description page I/ 4.

Output parameters

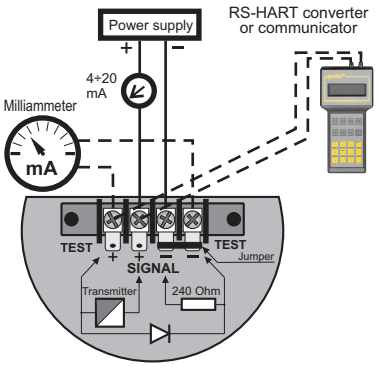
Output signal – Digital communication signal Profibus – PA (according to EN 50170)

PA function	slave
Physical layer	IEC61158-2
Transmission rate	31,25kBit/S

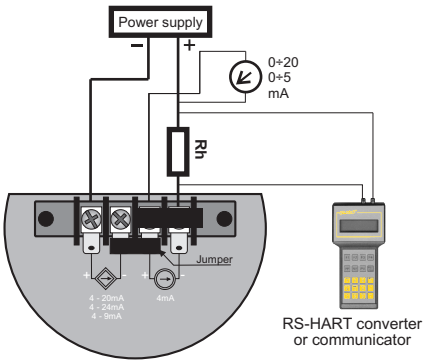
Electrical parameters

Power supply (from DP/PA coupler)
10,5…28 VDC
12,5…28 VDC - when display illumination switched on.
Current consumption 14 mA

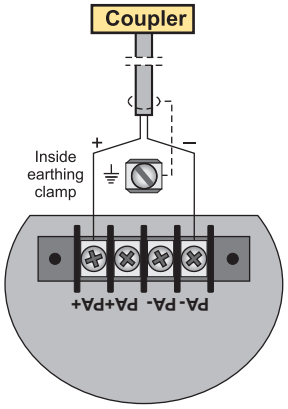
Electrical diagrams for transmitters



Version: **APC-2000ALW**
output signal: 4-20mA



Version: **APC-2000ALE**
with 0…5 or 0…20mA output signal



Version: **APC-2000AL/ProfibusPA**

Ordering procedure

Model	Code	Description
APC-2000		Smart pressure transmitter
Casing, output signal	/ALW	Aluminum housing, IP66/IP67, with display, output 4-20mA + Hart
	/ALE	Aluminum housing, IP66/IP67, with display, output, 0-20mA + Hart, 0-5mA + Hart Exia and Exd version not available
	/AL/Profibus PA	Aluminum housing, IP66/IP67, without display, output Profibus PA Exd version not available
	/AL/Profibus PA/W	Aluminum housing, IP66/IP67, with display, output Profibus PA Exd version not available
	/ALW/SS	Stainless steel housing, IP66/IP67, with display, output 4-20mA + Hart
Versions, certificates	/Exia	II 1/2G Ex ia IIC T4/T5 Ga/Gb II 1 D Ex ia IIIC T105°C Da I M1 Ex ia I Ma (only version with SS housing) IECEx Ex ia IIC T4/T5 Ga/Gb Ex ia IIIC T105°C Da Ex ia I Ma (only version with SS housing) II 1/2G Ex ia IIB T5 Ga/Gb (for Profibus PA version)
	/Exd	II 1/2G Ex ia/d IIC T5/T6 Ga/Gb II 1/2D Ex ia/t IIIC T85°C /T100°C Da/Db I M2 Exd ia I Mb IECEx Ex ia/d IIC T5/T6 Ga/Gb Ex ia/t IIIC T85°C /T100°C Da/Db Exd ia I Mb Packing gland available on request not available for ranges no. 14÷16
	/Safety	Functional Safety certificate according to EN 61508/61511 not available for ranges no. 14÷16
	/PED	European Pressure Equipment Directive N° 97/23/EC, category IV
	/DS	Double Sensor version - transmitter with ultra-stability (only ranges no. 13÷16)
	/0,05%	Accuracy ≤ ±0,05%
	/MR	Marine certificate – DNV, BV
more than one option is available	/Tlen	For oxygen service (sensor filled with Fluorolube fluid), only M and G1/2 connection
	/-60…+50°C	Extended thermal compensation range -60 ÷ 50°

Nominal measuring range	Range	Min. set range
/0÷1000 bar*	0÷1000 bar (0÷100 MPa)	10 bar (1 MPa)
/0÷300 bar	0÷300 bar (0÷30 MPa)	3 bar (300 kPa)
/0÷160 bar*	0÷160 bar (0÷16 MPa)	1,6 bar (160 kPa)
/0÷70 bar	0÷70 bar (0÷7 MPa)	0,7 bar (70 kPa)
/0÷25 bar	0÷25 bar (0÷2,5 MPa)	0,25 bar (25 kPa)
/0÷7 bar	0÷7 bar (0÷700 kPa)	0,07 bar (7 kPa)
/-1÷6 bar	-1÷6 bar (-100÷600 kPa)	700 mbar (70 kPa)
/-1÷1,5 bar	-1÷1,5 bar (-100÷150 kPa)	700 mbar (70 kPa)
/0÷2 bar	0÷2 bar (0÷200 kPa)	100 mbar (10 kPa)
/0÷1 bar	0÷1 bar (0÷100 kPa)	50 mbar (5 kPa)
/-0,5÷ +0,5 bar	-0,5÷0,5 bar (-50÷50k Pa)	50 mbar (5 kPa)
/0÷0,25 bar	0÷0,25 bar (0÷25 kPa)	25 mbar (2,5 kPa)
/-100÷100 mbar	-100÷100mbar (-10÷10 kPa)	20 mbar (2 kPa)
/-15÷70 mbar	-15÷70 mbar (-1,5÷7 kPa)	5 mbar (0,5 kPa)
/-25÷25 mbar	-25÷25 mbar (-2,5÷2,5 kPa)	2 mbar (0,2 kPa)
/-7÷7 mbar	-7÷7 mbar (-0,7÷0,7 kPa)	1 mbar (0,1 kPa)
/0÷1,3 bar ABS	0÷1,3 bar absolute pressure (0÷130 kPa ABS)	50 mbar ABS (5 kPa ABS)
/0÷7 bar ABS	0÷7 bar absolute pressure (0÷700 kPa ABS)	70 mbar ABS (7 kPa ABS)
/0÷25 bar ABS	0÷25 bar absolute pressure (0÷2,5 MPa ABS)	0,25 bar ABS (25 kPa ABS)
/0÷70 bar ABS	0÷70 bar absolute pressure (0÷7 MPa ABS)	0,7 bar ABS (70 kPa ABS)

*) non-standard ranges available on request

Measuring set range	/…÷… [required units]	Calibrated range in relation to 4mA and 20mA output
Process connections	/M	Thread M20x1,5 (male) with Ø4 hole, wetted parts SS316L
	/M(Au)	Thread M20x1,5 (male) with Ø4 hole, gold plated diaphragm (range no. 1, 2, 3, 4)
	/G1/2	Thread G1/2'' (male) with Ø4 hole, wetted parts SS316L
	/G1/2(Au)	Thread G1/2'' (male) with Ø4 hole, gold plated diaphragm (range no. 1, 2, 3, 4)
	/G1/4	Thread G1/4'' (male), wetted parts SS316L (Pressure limits: min. 10mbar / max. 400bar)
	/P	Thread M20x1,5 (male) with Ø12 hole, wetted parts SS316L
	/P(Hastelloy)	Thread M20x1,5 (male) with Ø12 hole, wetted parts Hastelloy C 276
	/GP	Thread G1/2'' (male) with Ø12 hole, wetted parts SS316L
	/GP(Hastelloy)	Thread G1/2'' (male) with Ø12 hole, wetted parts Hastelloy C 276 Not available with range no. 1, 2
	/CM30x2	Thread M30x2 with flush diaphragm, wetted parts SS316L (Pressure limits: min. 0,1bar / max. 70bar)
	/CM30x2(Hastelloy)	Thread M30x2 with flush diaphragm, wetted parts Hastelloy C 276 (Pressure limits: min. 0,1bar / max. 70bar)
	/CG1"	Thread G1'' with flush diaphragm, wetted parts SS316L (Pressure limits: min. 0,1bar / max. 70bar)
	CG1"(Hastelloy)	Thread G1'' with flush diaphragm, wetted parts Hastelloy C 276 (Pressure limits: min. 0,1bar / max. 70bar)
	/CG1/2"	Thread G1/2'' with flush diaphragm, wetted parts SS316L (Pressure limits: min. 2,5bar / max. 300bar)
	/1/2"NPTM	Thread 1/2''NPT Male, wetted parts SS316L
	/1/2"NPTF	Thread M20x1,5 with adapter to 1/2"NPT Female, wetted parts SS316L
	/code of diaphragm seal	Diaphragm seal (see chapter of diaphragm seals)
Electrical connection	(without marking)	Packing gland M20x1,5
	/US	Thread 1/2"NPT Female
Accessories	/AL	Mounting bracket type AL for 2" pipe, material zinced steel
	/AL(SS)	Mounting bracket type AL for 2" pipe, material stainless steel
	/ST	Stainless Steel plate riveted to the housing
	/MT	Stainless Steel Tag plate mounted on wire
Other specification	/	Description of required parameters (e.g. non-standard pr. connection G3/4", M22x1,5)