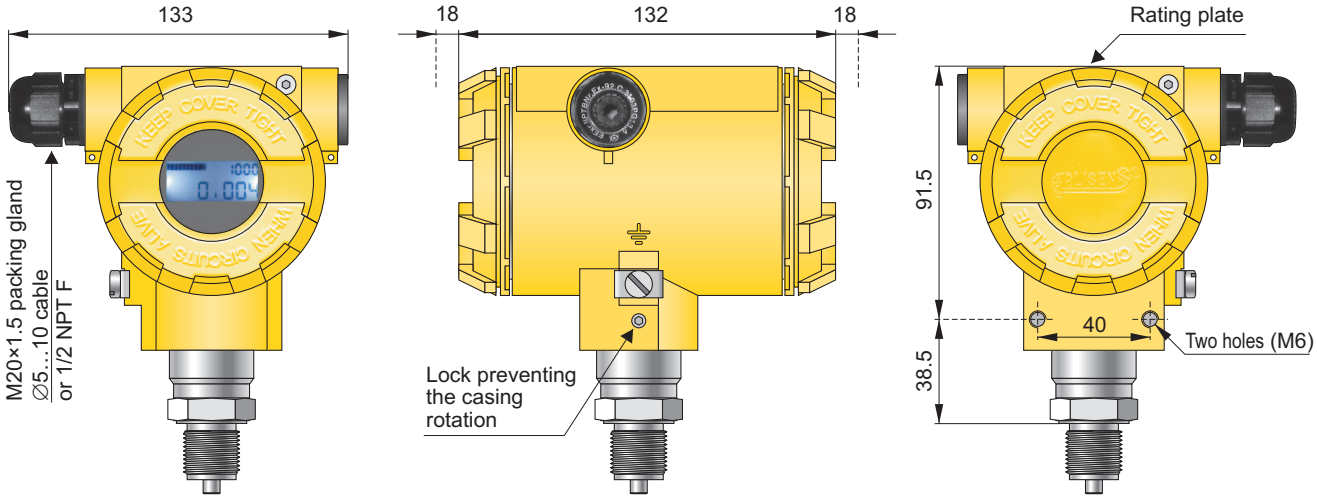
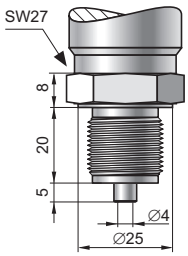
SMART PRESSURE TRANSMITTER APC-2000ALW

HART COMMUNICATION PROTOCOL

- ✓ **Digital PROFIBUS PA signal**
- ✓ **4…20 mA, 0…20 mA or 0…5 mA output signal + HART protocol**
- ✓ **Programmable range, zero shift, characteristic and damping ratio with local panel keys**
- ✓ **ATEX Intrinsic safety**
- ✓ **ATEX Explosion – proof**
- ✓ **SIL 2 certificate** NEW
- ✓ **Marine certificate - DNV** NEW
- ✓ **PED Conformity (97/23/EC)**
- ✓ **Accuracy 0.075%**
- ✓ **Rangeability 100:1**



Process connections

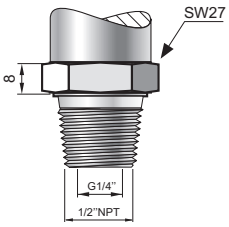


G1/2 type
G1/2″, ∅4 hole

M type
M20×1.5, ∅4 hole

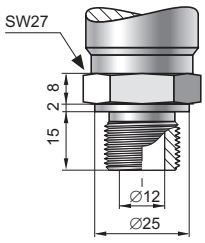
Wetted parts material: **316Lss**

Application
Applicable to measurement the pressure of uncontaminated gases, vapours and liquids.



1/2"NPT type
1/2"NPT, internal thread G1/4"

Wetted parts materials:
316Lss – standard

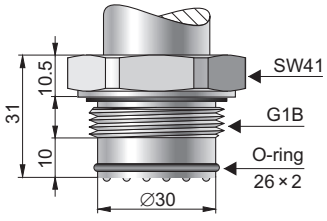


GP type
G1/2″, ∅12 hole

P type
M20×1.5, ∅12 hole

Wetted parts materials: **316Lss – standard**
Hastelloy C-276

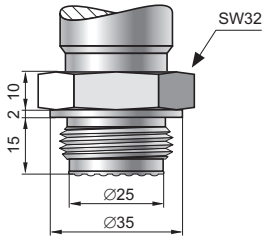
Application
Applicable to measurement the pressure Of viscous and contaminated media.
Max. measuring range 0…300 bar.



CG1 type
G1″ with flush diaphragm
Wetted parts material:
316Lss – standard
Hastelloy C-276

Application
Applicable to measurement the pressure of dusty gases, and viscous or solidifying liquids at the measuring ranges from –100…100 mbar to 0…70 bar.

The transmitters with flush diagram are applied in food industry and pharmaceutical industry in aseptic systems. Using of Aplisens fitting sockets with a seal upstream the connection shank thread (see page 64) is recommended.



CM30×2 type
M30×2 with flush diaphragm
Wetted parts materials:
316Lss – standard
Hastelloy C-276

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

Version APC-2000ALW

- ☑ 4…20 mA output signal + HART protocol or digital Profibus PA signal (description page 7)
- ☑ Possibilities of the adjusting both zero point and of the start and end of the measuring range, characteristic ete.with the display panel keys
- ☑ Configurable display 5 digits with illumination (working temperature range –40…+85°C)
- ☑ ATEX Intrinsic safety Ex II 1/2G Ex ia IIC T4/T5
- ☑ ATEX Explosion – proof Ex II 1/2G Exia/d IIC T6/T5 II 1/2D ExiaD 20/tD A21 T85/T100

Version APC-2000ALE

- ☑ 0…20 mA, 0…5 mA, 4…20 mA, output signal + HART protocol
- ☑ Possibilities of the of the adjusting both start and end of the measuring range according to set pressure with the display panel keys
- ☑ Configurable display (LCD) 3½ digits (working temperature range –40…+85°C)
- ☑ No EEx or Profibus PA

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 KAP-03, KAP-03Ex communicator,
- some other Hart type communicators,(*)
- a PC using an RS-Hart converter and Raport-01 configuration software. Along with the Raport-01, the SECTIONAL LINEARIZATION software is supplied. The software enables leading of the 21-point, non-linear user's characteristic into the transmitter.

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

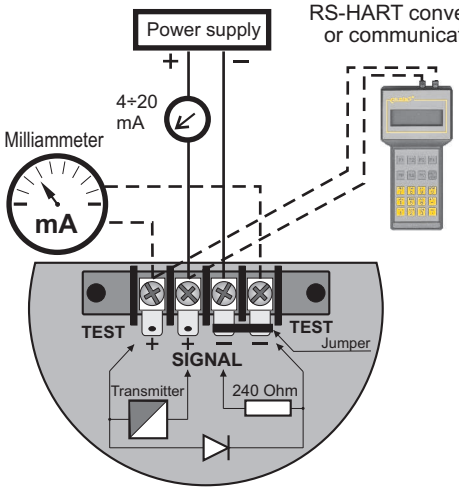
The data interchange with the transmitter enables the users to:
- ♦ identify the transmitter;
- ♦ configure the output parameters:
  - – measurement units and the values of the start points and end points at the measurement range;
  - – damping time constant;
  - – conversion characteristic (inversion, 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

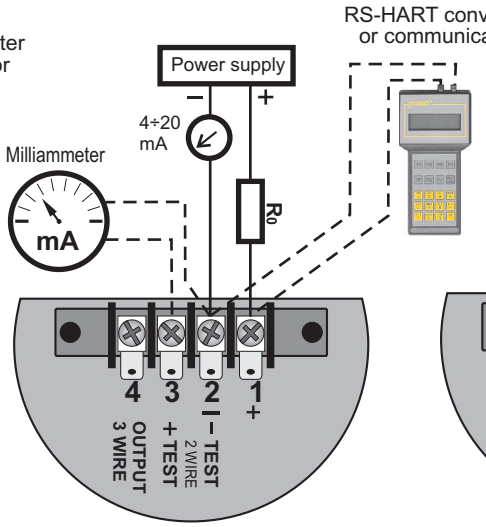
The transmitter can be installed directly on the installation. An universal mounting bracket is provided to transmitter fitting on 2″ pipe (the AL mounting bracket, see page 65). When the pressure of steam or other hot media is measured, a siphon or impulse line should be used. The needle valve placed 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.

Electrical diagrams for transmitters with HART protocol

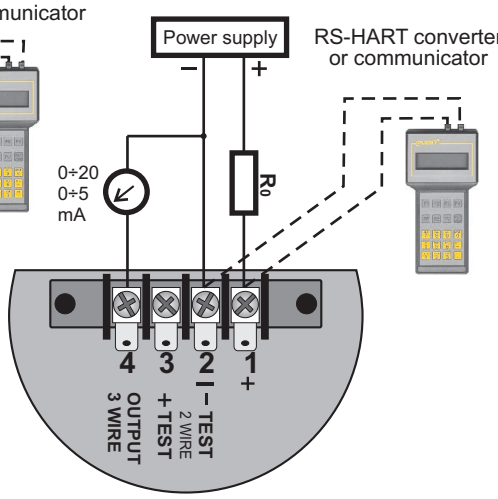
Version: **APC-2000ALW**



Version: **APC-2000ALE**
with 4…20mA output signal



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



Measuring ranges

No.	Nominal measuring range (FSO)		Minimum set range		Rangeability	Overpressure limit (without hysteresis)**	
1	0…1000bar	(0…100MPa)	10bar	(1MPa)	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…16MPa)	1,6bar	(160kPa)	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…600kPa)	300 mbar	(30 kPa)	23:1	14 bar	(1.4 MPa)
8	0...2 bar	(0...200 kPa)	100 mbar	(10 kPa)	20:1	4 bar	(400 kPa)
9	0...1 bar	(0...100 kPa)	50 mbar	(5 kPa)	20:1	2 bar	(200 kPa)
10	-0.5...0.5 bar	(-50...50 kPa)	50 mbar	(5 kPa)	20:1	2 bar	(200 kPa)
11	0...0.25 bar	(0...25 kPa)	25 mbar	(2.5 kPa)	10:1	1 bar	(100 kPa)
12	-100...100 mbar	(-10...10 kPa)	20 mbar	(2 kPa)	10:1	1 bar	(100 kPa)
13	-15...70 mbar*	(-1.5...7 kPa)	5 mbar	(0.5 kPa)	17:1	0.5 bar	(50 kPa)
14	-7...7 mbar*	(-700...700 Pa)	1 mbar	(0.1 kPa)	14:1	0.5 bar	(50 kPa)
15	0...1.3 bar abs	(0...130 kPa abs)	50 mbar abs	(5 kPa abs)	26:1	2 bar	(200 kPa)
16	0...7 bar abs	(0...7 MPa abs)	0.07 bar abs	(7 kPa abs)	100:1	14 bar	(1.4 MPa)
17	0...25 bar abs	(0...2.5 MPa abs)	0.25 bar abs	(25 kPa abs)	100:1	50 bar	(5 MPa)
18	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**

****overpressure limit can be different for version according to PED norm** N° 97/23/EC

Technical data

Metrological parameters

Accuracy ≤ ±0.075% of the calibrated range (0,16% for range 14)

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

Thermal error < ±0.08% (FSO) / 10°C (0.1% for ranges 12, 13, 14)
max. ±0.25% (FSO) in the whole compensation range (0.4% for ranges 12, 13,14)

Thermal compensation range -25...80°C (-5…65°C - range 14)
-40...80°C – special version

Additional electronic damping 0...60 s

Error due to supply voltage changes 0.002% (FSO) / V

Electrical parameters

Power supply 12...55 V DC (Ex ia 13,5...28 V)
(Ex d 13,5…45V)

Additional voltage drop when display illumination switched on 3 V

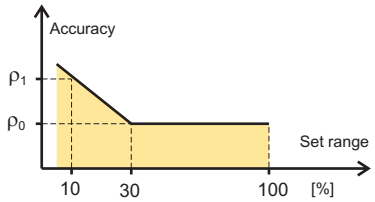
Output signal 4...20 mA, two wire transmission
APC-2000ALE: 0…20 or 0…5, 4…20 [mA]

Loadresistance $R[\Omega] \le \frac{U_{sup}[V] - 12V^{*}}{0{,}02A} \cdot 0.85$

∗ - 15 V when display illumination switched on

Resistance required for communication 250...1100 Ω

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

Materials

Wetted parts and diaphragms: 316Lss or Hastelloy C 276

Casing: Aluminium

Option: 316SS

- NACE MR – 01 – 75 compatible

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 the use of 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

Special versions, certificates

◊ Extended compensation range **-40...80°C**

◊ Extended compensation range **-60...50°C**

◊ **Ex ia** – ATEX Intrinsic safety (ALW only)

◊ **Ex d** – ATEX Explosion proof (ALW only) only for pressure ≥250mbar

◊ **PED** – European Pressure Equipment Directive N° 97/23/EC, category IV (max. pressure 400 bar).

◊ **Tlen** – transmitter designed to measure of oxygen (only type G1/2 or M process connection)

◊ **Hastelloy** – wetted parts made of Hastelloy C 276 (only type GP, P and CM30×2 process connection) without ranges 13 and 14

◊ **SIL2 –** Functional Safety. According to IEC 61508/61511 Device with Declaration of SIL2 for use in safety related applications up to SIL2

◊ **MR –** Marine certificate – DNV

◊ **SS -** Housing material 316ss

◊ **Others**

SMART PRESSURE TRANSMITTER APC-2000AL/Profibus PA

Application and construction

The APC-2000AL/Profibus PA pressure transmitter is intended for the measurement of the pressure, underpressure and overpressure 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 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 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 4 or, optionally, with Aplisens diaphragm seal.

The measuring ranges, according to the table, page 6.

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 areas under explosion hazard

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

Technical data

Metrological parameters, materials of process connection, diaphragms and casing, and operating conditions – see the description page 6.

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=17,5VDC
Ii=0,38A for IIB
Ii=0,36A for IIC

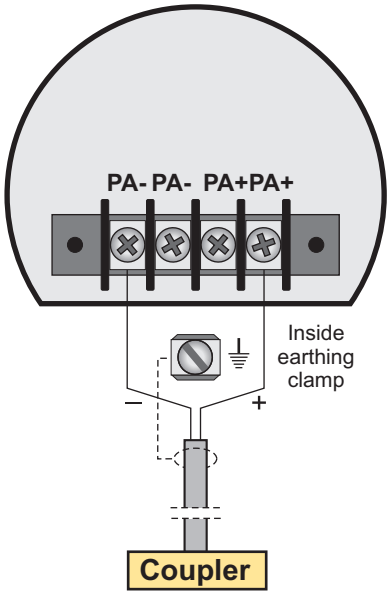
Current consumption 14mA

Output parameters

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

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

Electrical diagram



Ordering procedure

See next page

Example 1: Pressure transmitter with display, output 4..20mA + HART, version EExia, nominal measuring range 0..7bar, calibrated range 0..6bar, process connection M20x1,5, electrical connection gland M20x1,5.

APC-2000ALW/EExia/0..7bar/0..6bar/M

Example 2: Pressure transmitter with display, output 4..20mA + HART, version EExia, version PED, nominal measuring range 0..25bar, calibrated range 0..16bar, process connection G1/2", electrical connection 1/2NPT F, mounting bracket for 2" pipe

APC-2000ALW/EExia/PED/0..25bar/0..16bar/G1/2/US/AL

Example 3: Pressure transmitter with display, Profibus PA, version EExia, nominal measuring range 0..7bar, calibrat ed range 0..6bar, process connection flange diaphragm seal DN50PN40 , electrical connection M20x1,5,

APC-2000AL/Profibus PA/W/EExia/0..7bar/0..6bar/S-P DN50.

Model	Code	Description
APC-2000		Smart pressure transmitter.
Casing, output signal, ⇒	ALW……. ALE……. AL/Profibus PA……. AL/Profibus PA/W……. ALW/SS……	Aluminum housing, IP66, with display, output 4–20mA + Hart Aluminium housing, IP66, with display, output 4–20mA + Hart 0 – 20mA+ Hart, 0 – 5mA+ Hart, Aluminium housing, IP66, without display, output Profibus PA Aluminium housing, IP66, with display, output Profibus PA Stainless steel housing, IP66, with display, output 4-20mA + Hart
Versions, certificates* *) more than one option is available	/Exia…… /Exd…… /Safety…… /MR…… /PED…… /Tlen…… /-60…+50C…… /-40…+80C……	Ex II 1/2G Exia IIC T5 (not available for ALE version). for Profibus PA version Ex II 1/2G EExia IIB T5 Ex II 1/2G Exia/d IIC T5/T6 Ex II 1/2D ExiaD 20/tD A21T85/T100 , for pressure >250mbar (not available for ALE, AL/Profibus PA, AL.ProFibus PA/W, ALW/SS). Packing gland available for request. SIL2- Functional Safety certificate (version with ATEX avaliable from IX 2010) Marine certificate - DNV European Pressure Equipment Directive N° 97/23/EC, category IV For oxygen service (sensor filled with Fluorolube fluid), only M and G1/2 conn. Extended thermal compensation range -60 ÷ 50°C Extended thermal compensation range -40 ÷ 80°C

Nominal measuring range	Range	Min. set range
/0÷1000bar**……	0÷1000bar (0÷100MPa)	10bar (1MPa)
/0÷300bar……	0÷300bar (0÷30MPa)	3bar (300kPa)
/0÷160bar**……	0÷160bar (0÷16MPa)	1,6 bar (160kPa)
/0÷70bar……	0÷70bar (0÷7MPa)	0,7bar (70kPa)
/0÷25bar……	0÷.25bar (0÷2,5MPa)	0,25bar (25kPa)
/0÷7bar……	0÷7bar (0÷700KPa)	0,07bar(7kPa)
/0÷2bar……	0÷2bar (0÷200kPa)	100mbar (10kPa)
/0÷1bar……	0÷1bar (0÷100kPa)	50mbar (5kPa)
/0÷0,25bar……	0÷0,25bar (0÷25kPa)	25mbar (2.5kPa)
/-0.5÷ +0.5bar……	-0,5÷0,5bar (-50÷50kPa)	50mbar (5kPa)
/-1÷6bar……	-1÷6bar (-100÷600kPa)	300mbar (30kPa)
/-100÷100mbar……	-100÷100mbar (-10÷10kPa)	20mbar (2kPa)
/-15÷70mbar……	-15÷70mbar (-1,5÷70kPa)	5mbar (0.5kPa)
/-7÷7mbar……	-7÷7 mbar (-700÷700Pa)	1mbar (0.1kPa)
/0÷1.3bar ABS……	0÷1.3bar absolute pressure (0÷130kPa abs)	50mbar abs (5kPa abs)
/0÷7barABS……	0÷7bar absolute pressure (0÷700kPa abs)	0,07bar abs (7kPa abs)
/0÷25barABS……	0÷25bar absolute pressure (0÷2.5MPa abs)	0.25bar abs (25kPa abs)
/0÷70bar ABS……	0÷70bar absolute pressure (0÷7MPa abs)	0.7bar abs (70kPa abs)

**) non-standard ranges available on request

Measuring set range	/…÷… [required units]	Start and end of calibrated range in relation to 4mA and 20mA output
Process connections ⇒	/M…… /G1/2”…… /P…… /P (Hastelloy)…… /GP…… /GP (Hastelloy)…… /CM30x2…… /CM30x2 (Hastelloy)…… /CG1”…… /CG1/2”…… /1/2”NPT M…… /1/2”NPT F…… /code of diaphragm seal ……	Thread M20x1,5 (male) with Ø4hole, wetted parts SS316L Thread G1/2” (male) with Ø4hole , wetted parts SS316L Thread M20x1,5 (male) with Ø12hole, wetted parts SS316L Thread M20x1,5 (male) with Ø12hole, wetted parts Hastelloy C 276 Thread G1/2” (male) with Ø12hole , wetted parts SS316L Thread G1/2” (male) with Ø12hole , wetted parts Hastelloy C 276 Thread M30x2 with flush diaphragm, wetted parts SS316L Thread M30x2 with flush diaphragm, wetted parts Hastelloy C 276 Thread G1” with flush diaphragm, wetted parts SS316L Thread G1/2” with flush diaphragm, wetted parts SS316L Thread ½”NPT Male, wetted parts SS316L Thread M20x1,5 with adapter to ½”NPT Female, wetted parts SS316L Diaphragm seal (see chapter of diaphragm seals)
Electrical connection ⇒	*(without marking)*…… /US……	Packing gland M20x1,5 Thread 1/2NPT Female
Accessories ⇒	/AL……	Mounting bracket type AL. for 2” pipe, material zinced steel
Other specification	/……	Description of required parameters (e.g. non-standard process connection G3/4”, M22x1.5)

The most typical specification is marked by “⇒” mark.