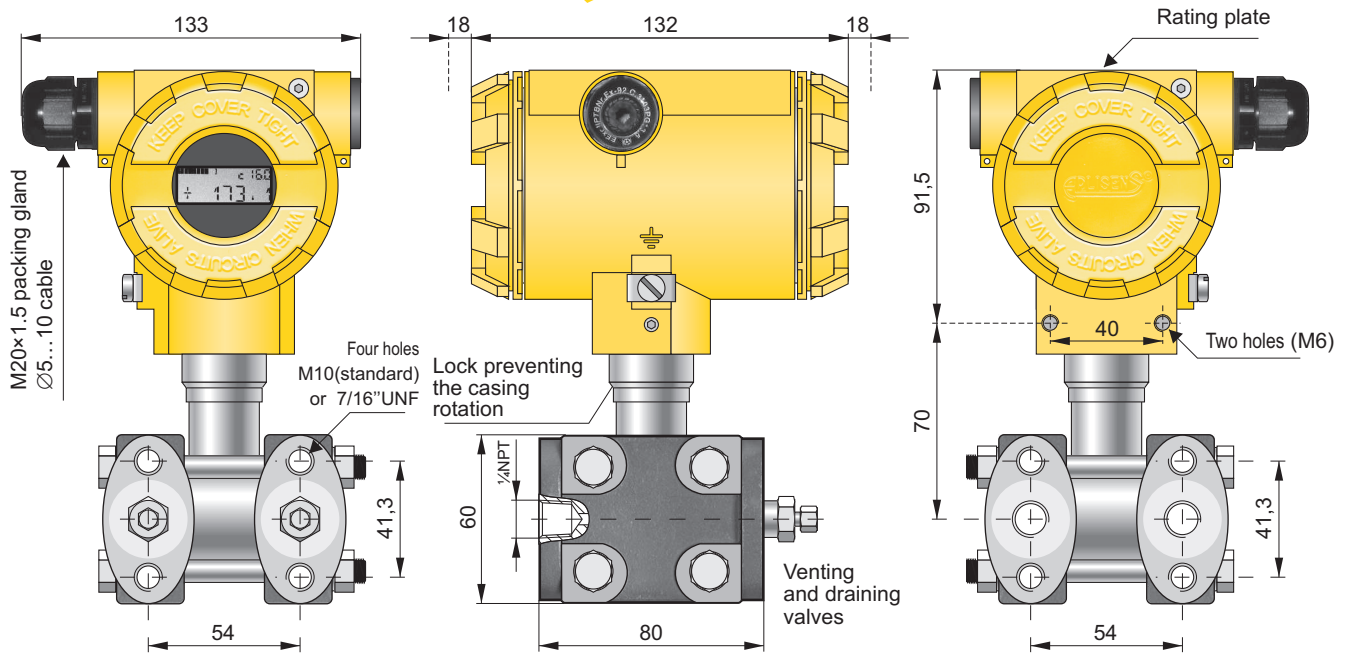


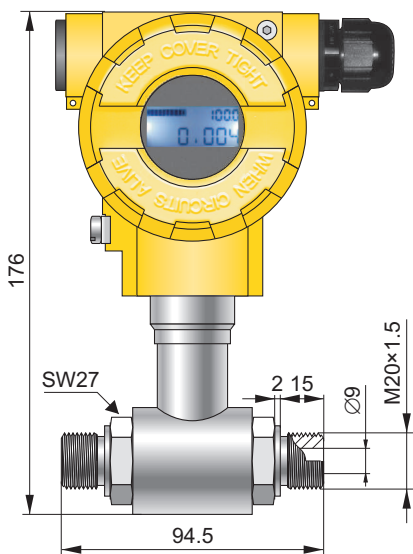
SMART DIFFERENTIAL PRESSURE TRANSMITTER APR-2000ALW



- ✓ Digital PROFIBUS PA signal
- ✓ 4...20 mA, 0...20 mA or 0...5 mA output signal + HART protocol
- ✓ ATEX Intrinsic safety
- ✓ ATEX Explosion proof
- ✓ PED Conformity (97/23/EC)
- ✓ Programmable zero range, shift, characteristic and damping ratio with local panel keys
- ✓ Static pressure limit up to 420bar
- ✓ Accuracy 0.075%
- ✓ Hastelloy diaphragms
- ✓ SIL 2 certificate **NEW**
- ✓ Marine certificate - DNV **NEW**

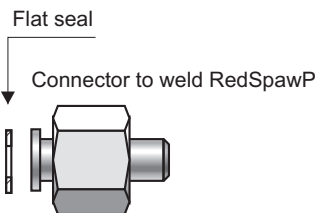


Transmitter **APR-2000ALW** – version with **type C** process connection to be mounted together with a valve manifold



Application and construction

The APR-2000ALW transmitter is applicable to the measurement of differential pressure of gases, vapours and liquids. The active element is a piezoresistant silicon sensor separated 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.



Example connection of impulse line

Transmitter **APR-2000ALW**
Version with **P type** process connection. Static pressure limit 40 bar

The casing is made of aluminium alloy cast or 316SS stainless 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 casing for the electronic parts is produced in three different versions:

Version APR-2000ALW



- ☑ 4...20 mA output signal + HART protocol or digital Profibus PA signal (description page 23)
- ☑ Possibilities of the adjusting both zero point and of the start and end of the measuring range, characteristic 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 APR-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 communicator,
- some other Hart type communicators (*)
- a PC using an RS-Hart converter and Raport-01 configuration software. Along with the Raport-01, the 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

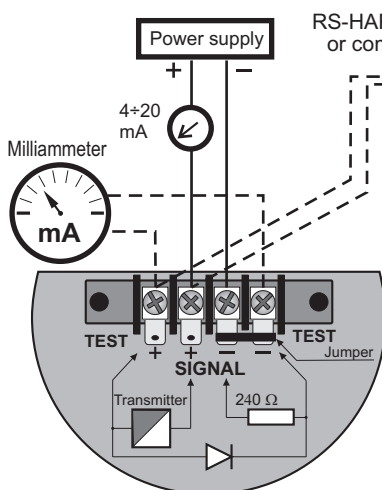
The transmitter with **P type** process connection is not heavy, so it can be fitted directly onto impulse lines. For fitting in any desired position we recommend an universal Aplisens mounting bracket for 2" pipe (AL mounting bracket, see page 65).

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 (page 62). 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 (page 65).

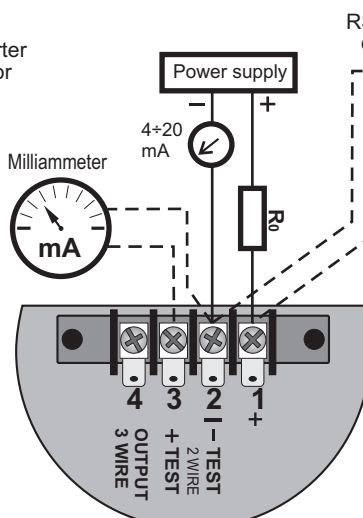
When the special process connections are required for the measurement of specific media levels in closed tanks (e.g. in the sugar and chemical industries) the transmitter is fitted with an Aplisens diaphragm seal. Sets of differential pressure transmitters with diaphragm seals are described in detail in the further part of the catalogue.

Electrical diagrams for transmitters with HART protocol

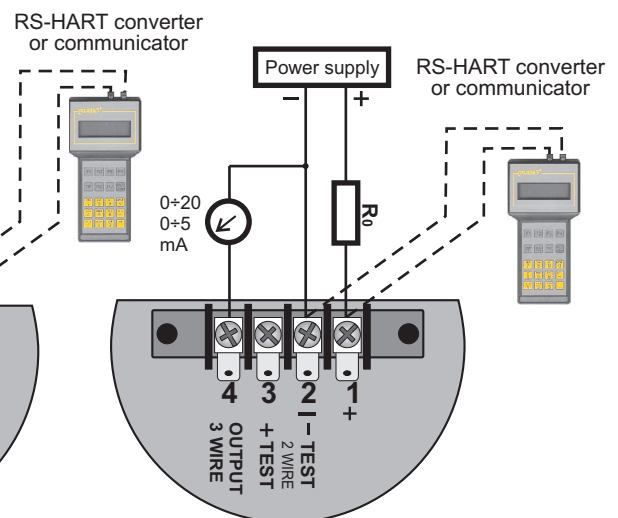
Version: APR-2000ALW



Version: APR-2000ALE with 4...20mA output signal



Version: APR-2000ALE with 0...5 or 0...20mA output signal



Measuring ranges

No.	Nominal measuring range(FSO)	Minimum set range	Rangeability	Overpressure limit/ static pressure limit
1	0...16 bar (0...1,6Mpa)	1,6 bar (160kPa)	10:1	250 bar / (320, 420 bar option) (40 bar for P type Process connection) (250 bar for PED version)
2	0...2,5 bar (0...250kPa)	0,25 bar (25kPa)	10:1	
3	0...1 bar (0...100kPa)	70mbar (7kPa)	14:1	
4	0...0,25 bar (0...25 kPa)	10mbar (1kPa)	25:1	
5	-100...100mbar (-10...10kPa)	4mbar (0,4kPa)	50:1	
6	-5...70mbar (-0,5...7kPa)	4mbar (0,4kPa)	18:1	
7	-0,5...0,5 bar (-50...50kPa)	0,1 bar (10kPa)	10:1	
8	-25...25 mbar (-2,5...2,5kPa)	2,5mbar (0,25kPa)	20:1	20 bar

Technical data

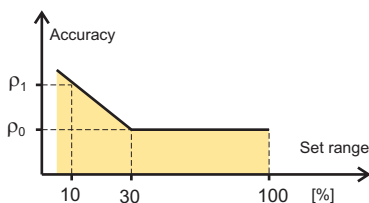
Metrological parameters

Accuracy	$\leq \pm 0.075\%$ of calibrated range $\leq \pm 0.1\%$ of calibrated range
Long term stability (for the nominal measuring range)	\leq accuracy for 3 years
Thermal error	$\leq \pm 0.08\%$ (FSO) / 10°C max. $\pm 0.3\%$ (FSO) in the whole compensation temperature range
Thermal compensation range	-25...80°C
Zero shift error for static pressure	0.01% (FSO) / 10 bar for range 3, 4 0.03% (FSO) / 10 bar for range 5, 6, 0.08% (FSO) / 10 bar for ranges 1, 2, 7, 8
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	12...55 V DC (Ex ia 13,5...28 V) (Ex d 13,5...45V)
Additional voltage drop when display illumination switched on	3V
Output signal	4...20 mA, two wire transmission APC-2000ALE: 0...20 or 0...5, 4...20 [mA]
Load resistance	$R[\Omega] \leq \frac{U_{sup}[V] - 12V^*}{0,02A} \cdot 0,85$
*-15V 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: type P process connection	316Lss
type C process connection	316ss
Diaphragms:	Hastelloy C 276
Casing:	Aluminium
	Option: 316SS
	- NACE MR – 01 – 75 compatible

Operating conditions

Operating temperature range (ambient temp.)	-25...85°C
EEx version	-25...80°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

Special versions, certificates

- ◇ **Ex ia** – Atex Intrinsic safety
- ◇ **Ex d** – Atex explosion proof
- ◇ **PED** – European Pressure Equipment Directive N° 97/23/EC
- ◇ **320 bar** - static pressure limit: 320 bar (not for PED version)
- ◇ **420 bar** - static pressure limit: 420 bar (not for PED version)
- ◇ **Tlen** – transmitter designed for oxygen
- ◇ **Special range:** -1,6...2bar
-1,6...16bar
- ◇ **Thermal compensation** from -40°C
- ◇ **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 DIFFERENTIAL PRESSURE TRANSMITTER APR-2000AL/Profibus PA

Application and construction

The APR-2000AL/Profibus PA transmitter is applicable for the measurement of differential pressure of gases, vapours and liquids. The active element is a piezoresistant silicon sensor separated from the medium by separating diaphragms and a specially selected type of manometric fluid. The special design of the active sensing element gives the element the pressure or overload impact strength of up to 250 or 320 bar.

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 APR-2000AL/Profibus Pa transmitter is produced with P-type or C-type process connections or, optionally, with Aplisens diaphragm seal.

The measuring ranges, according to the table, page 22

Communication

The communication with the transmitter is achieved in two ways:

- ◆ cyclic – the transmitter sends primary measured value (4 bytes IEEEE754) 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 APR-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 APR-2000AL/Profibus PA.

The pressure transmitter APR-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, $\text{Ex} \text{ II } 1/2\text{G EExia IIB/T5}$ are available

Technical data

Metrological parameters, materials of process connection, diaphragms and casing, and operating conditions – see the description page 22.

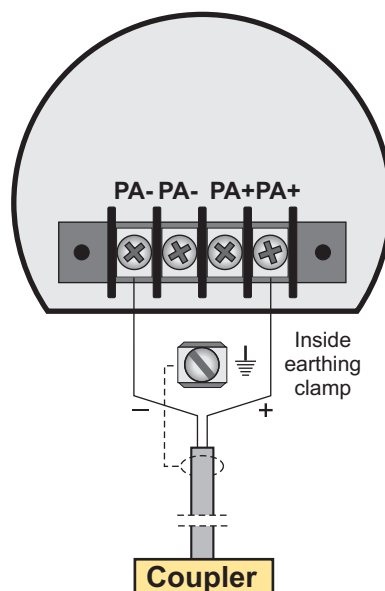
Electrical parameters

Power supply (from DP/PA coupler)
 10,5 \pm 28V DC
 12.05 \pm 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

Electrical diagrams



Ordering procedure

Model	Code	Description																		
APR-2000		Smart differential pressure transmitter.																		
Casing, Output signal,	⇒ ALW.....	Aluminum housing, IP66, with display, output 4–20mA + Hart																		
	ALE.....	Aluminium housing, IP66, with display, output 4–20mA + Hart 0 – 20mA+ Hart, 0 – 5mA+ Hart,																		
	AL/Profibus PA.....	Aluminium housing, IP66, without display, output Profibus PA																		
	AL/Profibus PA/W.....	Aluminium housing, IP66, with display, output Profibus PA																		
	ALW/SS.....	Stainless steel housing, IP66, with display, output 4-20mA + Hart																		
Versions, Certificates* (*) more than one option is available	/EEx ia.....	Ex II 1/2G Exia IIC T5 (not available for ALE version) for Profibus PA EExII1/2G EExia IIB/T5																		
	/EEx xd.....	Ex II 1/2G Exia/d IIC T5/T6 Ex II 1/2D Exia/D 20/ID A21T85/T100 (not available for ALE version, ALW/SS)																		
	/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	/0÷16bar.....	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Range</th> <th style="width: 50%;">min set range</th> </tr> </thead> <tbody> <tr> <td>0÷16bar (0÷1600kPa)</td> <td>1,6bar (160kPa)</td> </tr> <tr> <td>0÷2,5bar (0÷250kPa)</td> <td>0,2bar (20kPa)</td> </tr> <tr> <td>0÷1bar (0÷100kPa)</td> <td>70mbar (7kPa)</td> </tr> <tr> <td>0÷0,25bar (0÷25kPa)</td> <td>10mbar (1kPa)</td> </tr> <tr> <td>-0,5÷+0,5bar (-50÷50kPa)</td> <td>0.1bar (10kPa)</td> </tr> <tr> <td>-0,1÷+0,1bar (-10÷10kPa)</td> <td>4mbar (0.4kPa)</td> </tr> <tr> <td>-5÷70mbar (-1.5÷70kPa)</td> <td>4mbar (0.4kPa)</td> </tr> <tr> <td>-25÷25mbar (-2,5÷2,5kPa)</td> <td>2,5mbar (0.25kPa)</td> </tr> </tbody> </table>	Range	min set range	0÷16bar (0÷1600kPa)	1,6bar (160kPa)	0÷2,5bar (0÷250kPa)	0,2bar (20kPa)	0÷1bar (0÷100kPa)	70mbar (7kPa)	0÷0,25bar (0÷25kPa)	10mbar (1kPa)	-0,5÷+0,5bar (-50÷50kPa)	0.1bar (10kPa)	-0,1÷+0,1bar (-10÷10kPa)	4mbar (0.4kPa)	-5÷70mbar (-1.5÷70kPa)	4mbar (0.4kPa)	-25÷25mbar (-2,5÷2,5kPa)	2,5mbar (0.25kPa)
	Range	min set range																		
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	-0,1÷+0,1bar (-10÷10kPa)	4mbar (0.4kPa)																		
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/0÷2,5bar.....																				
/0÷1bar.....																				
/0÷0,25bar.....																				
/-0,5÷ +0,5bar.....																				
/-0,1÷ +0,1bar.....																				
/-5÷70mbar.....																				
/-25÷25mbar.....																				
Measuring set range	/...÷... [required units]	Start and end of calibrated range in relation to 4mA and 20mA output																		
Process connections	⇒ /C.....	Thread 1/4NPT F on the cover flanges, diaphragms material Hastelloy C 276, cover flanges material SS316. Allows mounting with a valve manifold.																		
	/P.....	Thread M20x1,5 (male) with Ø9hole, diaphragms material Hastelloy C 276, wetted parts SS316L																		
	/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 ** (**) more than one option is available	⇒ /C-2".....	Mounting bracket for 2" pipe (to C process conn.), mat. zincd 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.																		
	/Red d/P ½".....	Adapter for differential pressure transmitters with C type process connection, output thread 1/2NPT F. Material 316 LSS																		
Other specification	/.....	Description of required parameters																		

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

Example 1: Differential pressure transmitter with display, output 4..20mA + HART, v ersion EExia, static pressure 320bar, nominal measuring range 0..2bar, calibrated range 0..1,6bar, process connection C, electrical connection gland M20x1,5, mounting bracket for 2" pipe

APR-2000ALW/EExia/320bar/0..2,5bar/0..1,6bar/C/C-2"

Example 3 Differential pressure transmitter with display, output 4..20mA + HART,nominal measuring range 0..1bar, calibrated range 0..1bar, process connection flange diaphragm seal DN80PN40 , electrical connection M20x1,5.

APR-2000ALW/0..1bar/0..1bar/S-P DN80

Note: Differential pressure transmitter APR-2000AL with two diaphragm seals is offered as a model APR-2200ALW (see page 38).