

APLISENS

**MANUFACTURE OF PRESSURE TRANSMITTERS
AND CONTROL INSTRUMENTS**

USER'S MANUAL

PRESSURE TRANSMITTERS

type PC-29A, PC-29B – Exi - version

PC-29 – normal - version

DIFFERENTIAL PRESSURE TRANSMITTERS

type PR-29A, PR-29B – Exi - version

PR-29 – normal - version

HYDROSTATIC LEVEL PROBES

type PC-29PA, PC-29PB – Exi - version

PC-29P – normal - version

WARSAW SEPTEMBER 2010

Symbols used

Symbol	Description
	Warning to proceed strictly in accordance with the information contained in the documentation in order to ensure the safety and full functionality of the device.
	Information particularly useful during installation and operation of the device.
	Information particularly useful during installation and operation of a type Ex device.
	Pressure transmitters should be scrapped and utilized in accordance with the WEEE Directive (2002/96 /WE) in matter of used electric and electronic equipment

BASIC REQUIREMENTS AND SAFE USE



- **The manufacturer will not be liable for damage resulting from incorrect installation, failure to maintain the device in a suitable technical condition, or use of the device other than for its intended purpose.**
- Installation should be carried out by qualified staff having the required authorizations to install electrical and pressure-measuring devices. The installer is responsible for performing the installation in accordance with these instructions and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- Installation should be carried out by qualified staff having the required authorizations to install electrical and pressure-measuring devices. The installer is responsible for performing the installation in accordance with these instructions and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- If a device is not functioning correctly, disconnect it and send it for repair to the manufacturer or to a firm authorized by the manufacturer.



In order to minimize the risk of malfunction and associated risks to staff, the device is not to be installed or used in particularly unfavourable conditions, where the following dangers occur:

- possibility of mechanical impacts, excessive shocks and vibration;
- excessive temperature fluctuation, exposure to direct sunlight;
- condensation of water vapour, dust, icing.



Installation of intrinsic safety versions should be performed with particular care, in accordance with the regulations and standards applicable to that type of installation.

The User's Manual contains the transmitter parameters which were correct at the time of going to press.

The manufacturer reserves the right to make changes (not having a negative impact on the operational and metrological parameters of the products) without updating the contents of the technical manual.

A current version of the User's Manual, as well as declarations of compliance, can be found at www.aplisens.pl.

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I. APPENDIX Ex.02



PC-29A/XX/YY, PC-29B/XX/YY – PRESSURE TRANSMITTER,
 PC-29PA/YY, PC-29PB/YY – TRANSMITTER – LEVEL PROBE
 PR-29A/XX/YY, PR-29B/XX/YY – DIFFERENTIAL PRESSURE TRANSMITTER
 Exi VERSIONS according to ATEX

1. Introduction

1.1. The „Appendix Ex.02” to DTR.PC.PR-29.02(ENG) applies to PC-29A/XX/YY, PC-29B/XX/YY, PC-29PA/YY, PC-29PB/YY and PR-29A/XX/YY, PR-29B/XX/YY transmitters in Exi version according to ATEX, marked on the rating plate as shown in 2.2. and signed “Exi” in the Product Certificate, only.

1.2. The appendix contains supplementary information relating to the Exi version transmitters. During installation and use of the Exi transmitters, reference should be made to DTR.PC.PR-29.02(ENG) in conjunction with “Appendix Ex.02”.

2. Using of transmitters showed in point 1 in danger zones

2.1. Above transmitters are produced in accordance with the requirements of the following standards: EN 60079-0:2009, EN 50303:2000, EN 60079-26:2007, EN 60079-11:2007

2.2. The transmitters may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:



II 1/2G Ex ia IIC T6/T5 Ga/Gb (for PC-29B, PC-29PB, PR-29B)

II 1/2G Ex ia IIB T6/T5 Ga/Gb (for PC-29A, PC-29PA, PR-29A)

I M1 Ex ia I Ma

FTZU 10ATEX 0295X

3. Identifying marks.

Intrinsically safe transmitters (Exi version) must have a rating plate containing the information specified in paragraph 4 of DTR.PC.PR-29.02(ENG) and also at least the following:

- CE mark and the notified unit number: 1453, mark
- designation of explosion protection design, certificate number
- values of parameters such as: Ui, li, Ci, Li
- manufacture year and serial number.,

4. Consignment contents

Together with the transmitter are delivered:



- a) „Product certificate, which is also as the warranty card
- b) Declaration of Conformity,
- c) Certificate copy– on request
- d) „User’s Manual signed „DTR.PC.PR-29.02(ENG)”.

Items b), c), d) are available at www.aplisens.pl

5. Permissible input parameters



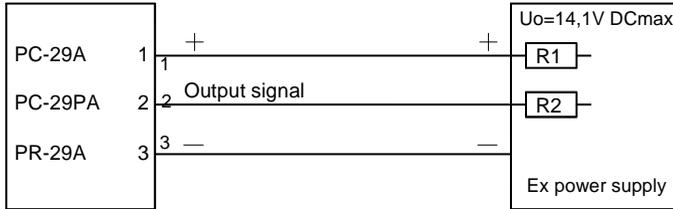
The transmitters should be powered via the power supplier and measurement devices provided with the relevant intrinsic-safe certificates. The parameters of their outputs to the danger zone should not exceed the limit power supply parameters specified below for the transmitters:

Output signal of Exi power supply in case of short-circuit should be smaller than 0.2A.
 Power supply with a “linear” characteristic - example.

5.1. Power supply PC-29A, PC-29PA, PR-29A and group IIB

- for circuit of power supply - terminals 1 - 3: $U_i = 14,1V$ DC, $I_i = 0,2A$, $P_i = 0,7W$, for $-40^\circ C \leq T_a \leq 80^\circ C$ and T5
 $U_i = 14,1V$ DC, $I_i = 0,14A$, $P_i = 0,7W$, for $-40^\circ C \leq T_a \leq 40^\circ C$ and T6
 $C_i = 210nF$, $L_i = 0,25mH$

- for circuit of output signal – terminals 2 - 3: $U_o = 14,1VDC$ $I_o = 200mA$, $P_o = 0,7W$
 $L_o = 3,5mH$, $C_o = 2,4\mu F$



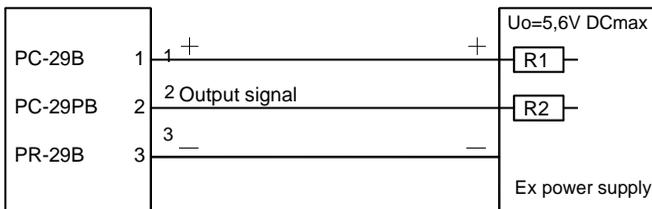
R_1, R_2 – infallible resistors in loop of power supply: $R_1 = 80\Omega$ min., $4W$ min., $R_2 = 680\Omega$, $1W$ min.
 Power supply with a "linear" characteristic - example.

Fig.1

5.2. Power supply PC-29B, PC-29PB, PR-29B - group IIC,

- for circuit of power supply - terminals 1 - 3: $U_i = 5,6V$ DC, $I_i = 0,2A$, $P_i = 0,56W$, for $-40^\circ C \leq T_a \leq 80^\circ C$ and T5
 $U_i = 5,6V$ DC, $I_i = 0,2A$, $P_i = 0,56W$, for $-40^\circ C \leq T_a \leq 40^\circ C$ and T6
 $C_i = 7,5\mu F$, $L_i = 0,25mH$

- for circuit of output signal – terminals 2 - 3: $U_o = 5,6VDC$ $I_o = 0,2A$, $P_o = 0,56W$
 $L_o = 0,55mH$, $C_o = 40\mu F$



R_1, R_2 – infallible resistors in loop of power supply: $R_1 = 30\Omega$ min, $2W$ min, $R_2 = 680\Omega$, $0,25W$ min.
 Power supply with a "linear" characteristic - example.

Fig.2

5.2. Special conditions for safe use:

Ambient temperature range $-40^\circ C \leq T_a \leq 80^\circ C$ for temperature class T5
 and $-40^\circ C \leq T_a \leq 40^\circ C$ for temperature class T6

The equipment will not meet the 500v rms isolation test required by EN 600079-11:2007.

This must be taken into account when installing the equipment.

6. How to connect Exi transmitters.

The transmitter and other devices in the measuring loop should be connected in accordance with the intrinsic-safety and explosion-safety regulations and the conditions for use in dangerous areas.

Failure to observe the intrinsic-safety regulations can cause explosion and the resulting hazard to people.

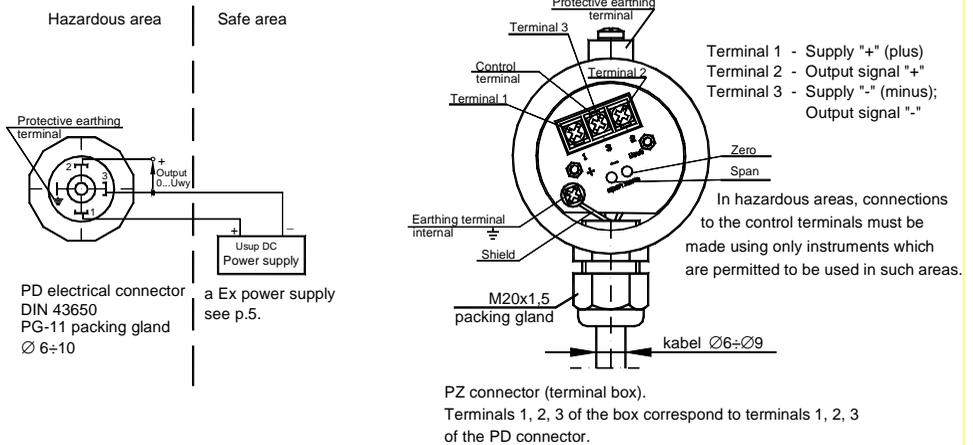


Fig.3

PD and PZ connectors are connected as above; the PK connector is connected as shown in Fig.1 in DTR.PC.PR-29.02(ENG) page 15.



It is not allowed to repair or otherwise interfere with the transmitter's electrical circuits in any way.

Damage and possible repair can be assessed and done by the manufactures or another authorized party only

II. APPENDIX Ex.03

PC-29A/XX/YY, PC-29B/XX/YY – PRESSURE TRANSMITTER,
 PC-29PA/YY, PC-29PB/YY – TRANSMITTER – LEVEL PROBE
 PR-29A/XX/YY, PR-29B/XX/YY – DIFFERENTIAL PRESSURE TRANSMITTER
 Exi VERSIONS according to IECEx

1. Introduction

1.1. The „Appendix Ex.03” to DTR.PC.PR-29.02(ENG) applies to PC-29A/XX/YY, PC-29B/XX/YY, PC-29PA/YY, PC-29PB/YY and PR-29A/XX/YY, PR-29B/XX/YY transmitters in Exi version according to IECEx, marked on the rating plate as shown in 2.2. and signed “Exi” in the Product Certificate, only.

1.2. The appendix contains supplementary information relating to the Exi version transmitters. During installation and use of the Exi transmitters, reference should be made to DTR.PC.PR-29.02(ENG) in conjunction with “Appendix Ex.03”.

2. Using of transmitters showed in point 1 in danger zones

2.1. The transmitters are produced in accordance with the requirements of the following standards: IEC 60079-0:2007-10, IEC 60079-26:2006, IEC 60079-11:2006.

2.2. The transmitters may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:

Ex ia IIC T6/T5, Ga/Gb (only for type PC-29B, PC-29PB, PR-29B)

Ex ia IIB T6/T5, Ga/Gb (only for type PC-29A, PC-29PA, PR-29A)

Ex ia I Ma (for all types)

IECEx FTZU 11.0004X

3. Identifying marks.

Intrinsically safe transmitters (Exi version) must have a rating plate containing the information specified in paragraph 4 of DTR.PC.PR-29.02(ENG) and also at least the following:

- designation of explosion protection design, certificate number
- values of parameters such as: Ui, li, Ci, Li
- manufacture year and serial number.,

4. Consignment contents

Together with the transmitter are delivered:

- a) „Product certificate, which is also as the warranty card
- b) Declaration of Conformity,
- c) Certificate copy– on request
- d) „User’s Manual signed „DTR.PC.PR-29.02(ENG)”.

Items b), c), d) are available at www.aplisens.pl

5. Permissible input parameters

The transmitters should be powered via the power supplier and measurement devices provided with the relevant intrinsic-safe certificates. The parameters of their outputs to the danger zone should not exceed the limit power supply parameters specified below for the transmitters:

Output signal of Exi power supply in case of short-circuit should be smaller than 0.2A.

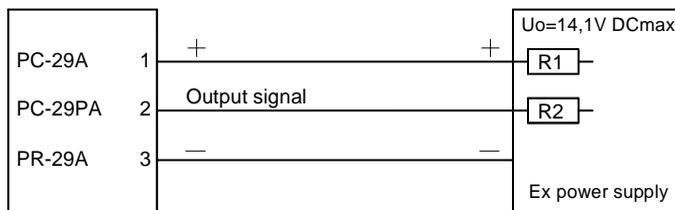
Power supply with a “linear” characteristic - example.



5.1. Power supply PC-29A, PC-29PA, PR-29A and group IIB

- for circuit of power supply - terminals 1 - 3: $U_i = 14,1V$ DC, $I_i = 0,2A$, $P_i = 0,7W$, for $-40^{\circ}C \leq T_a \leq 80^{\circ}C$ and T5
 $U_i = 14,1V$ DC, $I_i = 0,14A$, $P_i = 0,7W$, for $-40^{\circ}C \leq T_a \leq 40^{\circ}C$ and T6
 $C_i = 210nF$, $L_i = 0,25mH$

- for circuit of output signal – terminals 2 - 3: $U_o = 14,1VDC$ $I_o = 0,2A$, $P_o = 0,7W$
 $L_o = 3,5mH$, $C_o = 2,4\mu F$



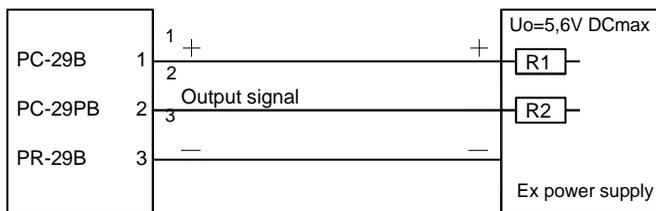
R_1, R_2 – infallible resistors in loop of power supply: $R_1 = 80\Omega$ min., $4W$ min., $R_2 = 680\Omega$, $1W$ min.
 Power supply with a "linear" characteristic - example.

Fig.1

5.2. Power supply PC-29B, PC-29PB, PR-29B - group IIC

- for circuit of power supply - terminals 1 - 3: $U_i = 5,6V$ DC, $I_i = 0,2A$, $P_i = 0,56W$, for $-40^{\circ}C \leq T_a \leq 80^{\circ}C$ and T5
 $U_i = 5,6V$ DC, $I_i = 0,2A$, $P_i = 0,56W$, for $-40^{\circ}C \leq T_a \leq 40^{\circ}C$ and T6
 $C_i = 7,5\mu F$, $L_i = 0,25mH$

- for circuit of output signal – terminals 2 - 3: $U_o = 5,6V$ DC $I_o = 0,2A$, $P_o = 0,56W$
 $L_o = 0,55mH$, $C_o = 40\mu F$



R_1, R_2 – infallible resistors in loop of power supply: $R_1 = 30\Omega$ min, $2W$ min, $R_2 = 680\Omega$, $0,25W$ min.
 Power supply with a "linear" characteristic - example.

Fig.2

5.2. Special conditions for safe use:

Ambient temperature range $-40^{\circ}C \leq T_a \leq 80^{\circ}C$ for temperature class T5
 and $-40^{\circ}C \leq T_a \leq 40^{\circ}C$ for temperature class T6

The equipment will not meet the 500V rms isolation test required by EN 600079-11:2007.

This must be taken into account when installing the equipment.

6. How to connect Exi transmitters: PC-29A/XX/YY, PC-29B/XX/YY, PC-29PA/YY, PC-29PB/YY i PR-29A/XX/YY, PR-29B/XX/YY

- acc. to p.6 DTR.PC.PR-29.02(ENG). Appendix Ex.02

1. INTRODUCTION

1.1. This user's manual is intended for electronic pressure transmitters users:

- a) pressure transmitters type: **PC-29, PC-29A, PC-29B**.
- b) transmitters – level probes type: **PC-29P, PC-29PA, PC-29PB**.
- c) differential pressure transmitters type: **PR-29, PR-29A, PR-29B**.

Above-mentioned transmitters due to the use and supply parameters can be divided into the following groups:

- pressure transmitters in standard version: **PC-29, PC-29P, PR-29**.
- pressure transmitters in Exi version and nominal power supply 12V DC (limiting 5,5V...14,1VDC):
PC-29A, PC-29PA, PR-29A.
- pressure transmitters in Exi version and nominal power supply 4,5V DC (limiting 3,3V...5,6V):
PC-29B, PC-29PB, PR-29B.

User's manual containing the data and guidelines necessary to understand the functioning of the transmitters and how to operate them.

1.2. The transmitters comply with the requirements of EU directives as shown on the plate and with the relevant Declaration of Conformity.



1.4. Data on **PC-29A, PC-29B, PR-29A, PR-29B** transmitters and **PC-29PA, PC-29PB** probes in Exi versions according to ATEX covered by the common EC-type test certificate **FTZU FTZU 10ATEX 0295X** are contained in the appendix designated: **DTR.PC.PR-29.02(ENG). Appendix Ex.02**. During installation and use of transmitters and probes in Exi version, reference should be made to **DTR.PC.PR-29.02(ENG)** in conjunction with **Appendix Ex.02**.



1.5. Data on **PC-29A, PC-29B, PR-29A, PR-29B** transmitters and **PC-29PA, PC-29PB** probes in Exi versions according to IECEx covered by certificate **IECEx FTZU 11.0004X**. are contained in the appendix designated: **DTR.PC.PR-29.02(ENG). Appendix Ex.03**. During installation and use of transmitters and probes in Exi version, reference should be made to **DTR.PC.PR-29.02(ENG)** in conjunction with **Appendix Ex.03**.

2. USER MATERIALS

Transmitters are delivered in single and/or multiple packs.

A transmitter is delivered together with a "Product Certificate" which is as a guarantee card also.

A batch of transmitters is supplied together with the User's Manual.

At the customer's request, a "Declaration of Compliance" and/or Certificate will be supplied.

(These documents are also published at the www.aplisens.pl).

3. APPLICATIONS AND MAIN FEATURES

3.1. The **PC-29, PC-29A, PC-29B** pressure transmitters are designed to measure gauge pressure, vacuum pressure and absolute pressure of gases, vapours and liquids (including corrosive).



3.2. The **PR-29, PR-29A, PR-29B** differential pressure transmitters are used to measure liquid levels in closed tanks, with static pressure of up to 25MPa or 32MPa for special version and to measure differential pressure at filters, orifices and others.

3.3. The **PC-29, PC-29A, PC-29B** and **PR-29, PR-29A, PR-29B** transmitters can be fitted with a range of additional process connectors, enabling them to be used in a conditions variety, such as dense media, reactive media, high and low temperature etc.

Data on these connectors can be found in the catalogue cards "DIAPHRAGM SEALS".

3.4. For depth measurements in open tanks, the transmitters are fitted with sensing modules with an extension tube, and are referred to as the **PC-29P, PC-29PA, PC-29PB level probes** fig.9 - (for details see Section 12).

3.5. The transmitters and probes generate output signal voltage using three-wire transmission.

4. IDENTIFYING MARKS.

4.1. Every transmitter and probe carries a rating plate containing at least the following information: CE mark, manufacturer name, type, process connections, electrical connections, serial number, measurement range, output signal, power supply voltage.

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4.2. **PC-29A, PC-29B, PR-29A, PR-29B** transmitters and **PC-29PA, PC-29PB** probes in Exi version, in accordance with the ATEX directive, have additional marks as described in **DTR.PC.PR-29.02(ENG) Appendix Ex.02** paragraph 3.

4.3. **PC-29A, PC-29B, PR-29A, PR-29B** transmitters and **PC-29PA, PC-29PB** probes in Exi version, in accordance with the IECEx directive, have additional marks as described in **DTR.PC.PR-29.02(ENG) Appendix Ex.03** paragraph 3

4.4. The designations to be used when ordering can be found in the Catalogue Cards.

5. TECHNICAL DATA

5.1. Measurement ranges and metrological parameters

5.1.1.PC-29, PC-29A, PC-29B. Measurement ranges and metrological parameters

The **PC-29, PC-29A, PC-29B** transmitters can be produced with any desired range in the interval:
 0...10mbar÷0...1000bar (over pressure, under pressure)
 400mbar ÷ 80bar (absolute pressure).

Recommended standard ranges:

over, under pressure (0÷ -1; -0,4; -0,1; 0,1; 0,4; 1; 2,5; 6; 10; 16; 25; 60; 160; 250; 400; 600; 1000) bar
 absolute pressure (0 ÷ 0,4; 1; 2,5; 6; 10; 16; 25; 60)bar

Table 1	Measurement range		
	100 mbar	400 mbar	0...1 bar ÷ 1000 bar
Overpressure limit (repeatable, no hysteresis)	1 bar	2,5 bar	4 x range max 1200bar
Damaging overpressure	2 bar	5 bar	8 x range max 2000 bar
Accuracy	0,3%	0,2%	(0,16 %-special version)
Thermal error	typically 0,3% / 10° C;	max 0,4% / 10° C	typically 0,2% /10° C; max 0,3% /10° C
Long term stability	0,2 % / year	0,1 % / year	
Hysteresis and repeatability	0,05%		
Error due to supply voltage changes	0,05%/1V		

5.1.2.PR-29, PR-29A, PR-29B. Measurement ranges and metrological parameters

The **PR-29, PR-29A, PR-29B** transmitters can be produced with any desired range in the interval
 1,6mbar to 25 bar

Recommended ranges: (0,4; 1; 2,5; 6; 10; 16; 25)bar
 (-0,1...0,1); (-1...1) bar

Table 2	Measurement range			
	100mbar	1bar	2bar	25bar
Static pressure limit Overpressure limit (repeatable, no hysteresis)	250bar (option 320 bar) (40bar for P-type connector)			
Accuracy	0,4%	0,25%		
Long term stability	0,2 % / year	0,1 % / year		
Thermal error / 10°C	typically - 0,3%, max - 0,4%	typically - 0,2%, max - 0,3%		
Zero shift error for static pressure *	0,1% / 10bar			

*- This error can be eliminated by zeroing the transmitter in static pressure conditions with zero differential pressure.

5.2. Electrical parameters

5.2.1. Power supply



Power supply of PC-29A, PC-29B, 29A PR-, PR-29B transmitters and PC-29PA, PC-29PB level probes in intrinsically safe versions must comply with the conditions according to „DTR.PC.PR-29.02(ENG) Appendix Ex.02” or “Appendix Ex.03” , with the relationship between the value of supply voltage and the maximum value of the output signal according to the table below.

Type of transmitter	Power supply	Permissible, maximum value of output signal
PC-29A, PC-29PA, PR-29A (Exi version)	- normal 12V DC - limiting 5,5 ÷ 14,1V DC	The real value of the power supply minus 3V DC
PC-29B, PC-29PB, PR-29B (Exi version)	- normal 4,5V DC - limiting 3,3 ÷ 5,6V DC	The real value of the power supply minus 1V DC
Current consumption	about 2mA	

Power supply of transmitters and probes in non intrinsically safe versions

Type of transmitter	Power supply	Permissible, maximum value of output signal
PC-29, PC-29P, PR-29	- normal 12V DC - limiting 3,3 ÷ 14,1V DC	The real value of the power supply minus 1V DC
PC-29, PC-29P, PR-29 (special version)	20 – 29VDC	5V, 10V

Current consumption - about 2mA.

5.2.2. Output signals:

- typical: 0 ÷ 1V, 0 ÷ 2V, 0 ÷ 3,3V, 0,5 ÷ 4,5V, 0 ÷ 5,5, 0 ÷ 5V, 0 ÷ 10V.
- Another values of output signals by arrangement.

The limit values of the output signal may be in the range from -0.5 V DC to the max. value according to the 5.2.1 point.

5.2.3. Time constant:

- Time constants in the standard:
- for PC-29... - 20msek.
 - for PR-29... - 50msek.

Other values for the time constant on request.

- 5.2.4. Load resistance** $R [\Omega] \geq 20k\Omega$
Voltage for insulation strength testing 500 VAC or 750 VDC.
Excess voltage protection see p.9.5.

5.3. Permitted Environmental Conditions

Ambient temperature limit -40 ÷ 80°C,



(Operating temperature range for intrinsic-safe versions in accordance with Appendix Ex.02 or Appendix Ex.03)

- Process temperature limit -40 ÷ 120°C – for direct measurement,
over 120°C, only with the use of a diaphragm seal radiator, looped siphon tube or impulse line
- Relative humidity 0 ÷ 95%
- Vibration during operation max 4g
- Exposure to direct sunlight not recommended causing strong transmitter warming.

5.4. Construction materials

Diaphragm	Stainless steel 316L (00H17N14M2)
Sensing module	Stainless steel 316L (00H17N14M2)
Casing for electronic parts	Steel pipe, 304 (0H18N9)
PZ-type terminal box	Thick steel pipe, 304 (0H18N9)
Angular connector, DIN 43650, PD type	itamide
P-type connector	Stainless steel 316L (00H17N14M2)
C-type connector	Stainless steel 316 (H17N14M2)
Liquid filling the interior of the sensing module	Silicone oil, chemically inactive liquid for measurement of oxygen.
Cable shield in PK connector	Polyurethane, special version – teflon

5.5. Pressure connectors

5.5.1. PC-29A, PC-29B. Pressure connectors

M-type connector with M20x1.5 thread (fig.3a).
 P-type connector with M20x1.5 thread (fig.4a).
 CM30x2 or CM20x1.5-type connector with flush diaphragm (fig.5a).
 RM-type connector with M20x1.5 thread and radiator.
 G1/2 -type connector with G1/2" thread (fig.6a).
 GP -type connector with G1/2" thread
 CG1/2 -type connector with G1/2" thread and flush diaphragm (fig.6c).
 CG1-type connector with G1" thread and flush diaphragm (fig.6e).
 RG-type connector with G1/2" thread and radiator
 W-type connector (mining connector)
 other connection types by arrangement

5.5.2. PR-29A, PR-29B. Pressure connectors

P-type connectors with M20x1.5 thread - fig. 1, 2, 3.
 C-type connector to mount together with a valve manifold - fig.3.
 Diaphragm seal connectors: see the "Information Cards" for the diaphragm seals.

5.6. Electrical connectors and ingress protection rating of case

PD-type electrical connector, DIN 43650, PG-11 packing gland. IP65 rated (*PN-EN 60529:2003*)
 PZ-type terminal box, M20x1,5 packing gland. IP66 rated (*PN-EN 60529:2003*)
 PK-type cable connector. IP67 rated (*PN-EN 60529:2003*)

6. CONSTRUCTION. ELECTRICAL CONNECTIONS

6.1. Measurement Principles

The **PC-29**, **PC-29A**, **PC-29B** pressure transmitters, **PR-29**, **PR-29A**, **PR-29B** differential pressure transmitters and the **PC-29P**, **PC-29PA**, **PC-29PB** level probes operate by converting changes in the piezoresistive bridge, which are proportional to the measured pressure, into a standard current or voltage output signal.

The active sensing device is a silicon diaphragm with diffused piezoresistors, separated from the medium by an isolating diaphragm and manometric oil.

6.2. Construction.

The basic component of the transmitter and probe is the sensing module, in which the input pressure is converted into a electrical signal. The sensing modules are fitted with pressure-transmitting connectors (see p. 5.6).

The second element of the transmitter is an electronic unit which amplifies and standardizes the output signal. This is fitted with potentiometers which can be used to set the zero and the range positions.

The casing of the transmitters, made from $\varnothing 27$ pipe, is permanently mounted on the sensing module.7
 On the other side is mounted a electrical connector.

For the measurement of dense, chemically reactive, or high-temperature media, the transmitters are fitted additionally with various types of diaphragm seal connectors, depending on the type of medium and environmental conditions (details can be found in the catalogue cards "DIAPHRAGM SEALS").

6.3. Casing, Electrical Connections

6.3.1. The transmitters and the probes with PD-type electrical connector and PG-11 packing gland (fig. 1b). PD-connector is screwed to casing. By unscrewing and removing the connector, can be gained access to the potentiometers used to the zero and range setting.

6.3.2. The transmitters and the probes may be fitted with a **PK** cable connector (fig.1c), mounted similarly to the **PD** connector. The body of the connector contains a permanently fixed and sealed cable of standard length 3m (other lengths can be produced to order). The cable contains a capillary which connects one side of the measuring diaphragm to the atmosphere.

6.3.3. **PZ** type connector has a terminal box permanently mounted with the casing (figure 2). The box is closed with a lid. Mounted, on the inside, a terminal block equipped is with additional control terminals, connected to 1, 2 and 3 terminals.

PZ type connector has an internal, and in Exi version also external earthing terminal.

7. PLACE OF INSTALLATION OF TRANSMITTERS

7.1. General note

7.1.1. The transmitters can be installed both indoors and outdoors. It is recommended that transmitters intended for outdoor use be placed in a box or under cover.

There is no need for a cover in the case of transmitters with **PZ** and **PK** type connectors.

7.1.2. The place of installation should be chosen in such a way as to allow access to the device and to protect it from mechanical damage. In planning the installation of the transmitter and configuration of the impulse lines, attention should be paid to the following requirements:

- The impulse lines should be as short as possible, with a sufficiently large cross-section, and free of sharp bends, in order to prevent blockages;
- Where the medium is a gas, the transmitters should be installed above the measuring point, so that condensation flows down towards the site of the pressure measurement; where the medium is a liquid or where a protective liquid is used, the transmitters should be installed below the place where the pressure measurement is taken;
- The impulse lines should be inclined at a gradient of at least 10cm/m
- The levels of filling liquid in the impulse lines should be equal or kept constant difference,.,
- The configuration of the impulse lines and the valve connection system should be chosen with regard to the measurement conditions and to requirements such as the need to reset the transmitters in position and the need for access to the impulse lines during water or gas removal and flushing



7.1.3. Where there is a risk of heavy objects hitting the instrument (resulting, in extreme cases, in a part of the system with transducers being torn off and medium leakage), appropriate means of protection should be applied for safety reasons and to avoid the possibility of sparking or other, more appropriate location should be selected for the transmitter.

7.2. Low Ambient Temperature



When the solidification point of the liquid whose pressure is being measured is greater than the ambient temperature, steps should be taken to protect the measurement apparatus from freezing effects.

This is particularly important in the case open-air installations. Protection by filling the impulse lines with a ethylene glycol and water mixture, or another liquid whose solidification point does not exceed the ambient temperature is obtained. The transmitter case and lines thermal insulation protects from short exposure to low temperatures only. Where the temperature is very low, the transmitter and impulse lines should be heated.

7.3. High Medium Temperature.

The transmitters may be used to measure media with temperatures of up to 120°C.

To protect the sensing module from temperatures in excess of 120°C, suitably long impulse lines are used to disperse the heat and to lower the temperature of the module.

Where it is not possible to use impulse lines of the required length, transmitters with remote diaphragm seals should be used (see catalogue cards "DIAPHRAGM SEALS").



Data as per Appendix Ex.02 or Appendix Ex.03 apply for the Exi version.

7.4. Mechanical Vibration, Corrosive Media

7.4.1. Transmitters should correctly work with vibrations with amplitudes to 1,6 mm and accelerations to 4g. If strong vibrations are carried via the pressure line and disturb of measuring, use should be made of elastic pulse lines or transmitters with a remote diaphragm seal.

7.4.2. Transmitters should not be installed in places where the diaphragm, made of 316L steel (00H17N14M2), would be subject to corrosion by the medium being measured



If possible, transmitters with diaphragms made of Hastelloy C276 should be used, or other means of protection applied (e.g. in the form of a separating liquid) or transmitters with diaphragm seals adapted for measuring aggressive mediums according to catalogue cards "DIAPHRAGM SEALS") should be used.

8. INSTALLATION AND MECHANICAL CONNECTIONS.

8.1. The **PC-29, PC-29A, PC-29B** transmitters can be mounted directly on rigid impulse lines.

Where connectors are used as in figures 3a, 4a, 5a, 6a, 6c, 6e it is recommended that connection sockets be used as shown in figure.3b, 4b, 5b, 6b or 5c, 6d, 6f.

Where the connectors are as in figures 4a, 5a and 6c, 6e rectangular gaskets are used with each transmitter.

The socket shown as in figure 5c, 6d and 6f can be obtained from the manufacturer.

The material of the seal is selected based on the pressure value and the type and temperature of the medium.

If the pressure is applied via a flexible plastic tube, the transmitter should be mounted on a support with Red Ø6-M reduction.

In case of metal pipes, the used connections should comply with PN-82/M-42306.

The types of the impulse tubes are to be selected depending on the measured value of the pressure and the medium temperature.

8.2. The **PR-29, PR-29A, PR-29B**, transmitters can be mounted directly on rigid impulse lines.

To connect the basic versions of transmitters, with two M20 x 1.5 stubs (P-type connector), one can use (for example) straight connecting elements with nuts.

If the pressure is carried via a flexible plastic tube, use an reduction elements "Red Ø6-M" (M20x1,5 / Ø6).

The transmitters with connecting cover (C-type connector) are designed for installation on 3-valve or 5-valve manifolds, to a 2" pipe or to a flat surface using an fastener C2 (figure 12) or "U" (figure 13).

8.3. The transmitters can operate in any position.

When installed on an object with a high-temperature medium, it is advantageous to mount the transmitter in a horizontal position with the packing gland pointing downwards or to the side, in such a way that the transmitter is kept away from the stream of rising hot air.

Examples of the use of Aplsens assembly components to isolate the transmitters from high temperature media are shown in figure 14.

The horizontal assembly should be apply in case of transmitters with radiators.

When the measurement range is small, the reading can be affected by the position of the transmitter and by the configuration of the impulse lines and the way in which they are filled with liquid.

This error can be corrected using the zero-setting function.

8.4. In selecting assembly components, it may be helpful to consult information on Aplsens connection elements, reduction elements, sockets, valves, reduction clamps and signal tubes.

Information on this subject can be found in the catalogue cards "FITTING ACCESSORIES"

Pressure may be transmitted to the installed device only after checking that it has a measurement range which properly corresponds to the value of the measured pressure, that gaskets have been properly selected and fitted, and the connector has been properly screwed tight.

Attempts to undo the screws or fixing connector pipes on a transmitter under pressure may cause the medium to leak and create hazards for the personnel.



When disassembling the transmitter, it is necessary to disconnect it from the process pressure or bring the pressure to atmospheric level, and to take particular care and precautions in case of media which are highly reactive, caustic, explosive or otherwise hazardous to personnel.

If necessary, rinse out this part of the system.

Transmitters with flange diaphragm seals are to be installed on the corresponding counter flanges on the facility.



It is recommended that the user matches the screw joints material to the pressure, temperature, flange material and seal to ensure tightness of the flange joint in the expected operating conditions.

Coarse-threaded screws complying with ISO 261 are to be used for flanges used in the transmitters.

Additional data concerning the diaphragm seals are specified in the catalogue cards "DIAPHRAGM SEALS".

9. ELECTRICAL CONNECTION

9.1. General recommendations

It is recommended that twisted pair cabling be used for the signal lines. If the transmitter and signal line are subject to a large amount of electromagnetic interference, then screened twisted pair cable should be used. The signal wires should not run alongside network power supply cables or near to large electrically-powered devices.

The devices used together with the transmitters should be resistant to electromagnetic interference from the transmission line in accordance with compatibility requirements.

It is also beneficial to use anti-interference filters on the primary side of the transformers, the power supplies used for the transmitters and apparatus used in conjunction with them.

9.2. Connections for transmitters with PD-type connector

The transmitters and the probes fitted with PD type connectors are to be connected as shown in diag.1a.

To make the connections, remove the terminal block from the contact pins together with its cover.

Then remove the block from its cover, levering it off with the end of a screwdriver inserted into the slot provided for this purpose. Connect the wires to the block.

i Where the isolation of the wires in the packing gland is ineffective (for example, when single wires are used) the opening of the gland should be carefully sealed with an elastic sealing compound to obtain IP65 ingress protection. It is useful to form the segment of the signal wire leading to the PG-11 packing gland into a protective loop to prevent condensation from running down in the direction of the gland.

9.3. Connections for transmitters with PK-type connector.

The transmitters with PK connector should be connected via a terminal box, in which the transmitter's cable is joined to the remainder of the signal line.

The terminal box must not be completely airtight, as the transmitter must be able to "breathe" through a capillary in the connector cable.

9.4. Connections for transmitters with terminal box (PZ-type connector).

The transmitters with PZ-type connectors should be connected by linking the signal wires to a terminal block, as shown in figure 2. Carefully screw in the cover and cork of the packing gland, making sure that the wire is tightly packed. Where necessary, the packing gland should be further sealed as described in 9.2.

9.5. Protection from excess voltage

Protection from excess voltage between the wires of the transmission line is provided by TVS diodes installed in all types of transmitter. In transmitters with PZ connections, in standard additional arresters are installed.

9.6. Earthing

Transmitters with PD or PK connections have a neutral cable (connected to the casing), which can be used only as a functional earthing. It should not be used for protective grounding or as a compensation connection. If the transmitter has, through the pressure connection, a good plating connection to properly grounded a metal pipe or tank, additional ground is not necessary. Transmitters with PZ connection are fitted with internal and external earth terminals, to which can be connected a protective or compensatory cables.

10. SETTING OF ZERO POSITION AND MEASUREMENT RANGE

The transmitter is factory regulated for the measurement range stated in the order.

After it has been installed, it may become necessary for the zero position to be changed.

The way of gaining access to the control knob is described in 6.3.

To perform the regulation, connect and power the transmitter in accordance with its technical parameters.

Supply a pressure equal to the lower limit of the measurement range, and make the output signal equal to 0V by turning the "zero" potentiometer. Turn the knob to the right to increase, and to the left to reduce the output signal.

After the zero position has been set, supply a pressure equal to the upper limit of the range, and use the "range" potentiometer to make the output voltage equal U_{out} .

Recheck the zero position, and repeat the procedure if necessary.

Most of the pressure transmitters measures the pressure in relation to atmospheric pressure, for those applications to zero adjustment is should be given atmospheric pressure to the measuring transmitter diaphragm and make the necessary adjustments. When adjusting the "zero" for the other performances of transmitters, such as transmitters with the shifted of measuring signal, or the absolute pressure transmitters, to zero regulations is necessary to use the appropriate pressure.

i Potentiometers can be used to shift the zero position and the range by up to 10%, without altering the setting.

11. SERVICES AND SPARE PARTS

11.1. Periodic service

Periodic service should be made in accordance with the regulations to which the user is subject

During inspection, the pressure connectors should be checked for loose connections and leaks, the electrical connectors should be checked with regard to tightness and the state of the gaskets, and the diaphragm seals should be checked for tarnishing and corrosion. The conversion curve should also be verified.

11.2. Unscheduled services

If the transmitters or probes are installed in a location where they may be exposed to mechanical damage, excess pressure, hydraulic impulses or excess voltage, or the diaphragm may be in danger from sedimentation, crystallization or erosion, inspections should be carried out as required.

i The diaphragm should be inspected and cleaned, the protective diodes should be checked for shorting, and the conversion curve should be verified.

Where it is found that the signal in the transmission line is absent or its value is incorrect, a check should be made on the line and its terminal connections. Check whether the values of the supply voltage and load resistance are correct. If the line is in order, check the operation of the transmitter.

After checks have been made, take steps to eliminate the faults detected.

11.3. Cleaning the Diaphragm Seal, Overloading Damage.

11.3.1. Sediment and dirt which have formed on the diaphragm in the course of operation must not be removed by mechanical means, as this may damage both the diaphragm and the transmitter itself.

The only permitted method is the dissolving of sediment.



The transmitters with the M-type or G1 / 2 connectors, can be mounted a choke pressure. Before cleaning the membrane, the pressure choke should be removed(Fig. 3a and 6a).

11.3.2. Sometimes transmitters malfunction due to damage caused by overloading, e.g. in case of:



- application of excessive pressure;
- freezing or solidification of the medium;
- action of a hard object, such as a screwdriver, on the diaphragm

11.4. Spare parts

The following transmitter parts may need replacing due to damage or normal wear:

PD connector – terminal block with angular cover and seal, connector base with seal, rating plate, case.

PK connector – the entire connector.

PZ connector – cover seal and packing gland.

In the Exi version, the user may replace only the terminal block with angular shield and the seal in the PD connector, or the seal and packing gland in the PZ connector.

i Other parts, due to their special characteristics and anti-explosive requirements, may be replaced only by the manufacturer or an authorized firm.

12.5.3. Earthing.

The probes with PD and PK connectors, if excess voltage protection is fitted, the probe's extension tube should be earthed.

The **PC-29PA**, **PC-29PB** probes with PZ connectors should be earthed via the internal or external earth terminal.

The **PC-29** probes with PZ connectors should be earthed via the internal earth terminal.

13. PACKING, STORAGE AND TRANSPORT

13.1. The transmitters should be packed singly or in sets, in such a way as to protect them from damage during transportation.

The transmitters should be stored in multiple packs under cover, in a place free of vapours and reactive substances, with an air temperature between +5°C and +40°C, and relative humidity of not more than 85%.

Transmitters with uncovered diaphragm or seal connectors, stored without packaging, should have covers to prevent damage to the diaphragm.

During transportation, the transmitters should be packed and secured so as to prevent them from shifting.

Any means of transport may be used, provided direct atmospheric effects are eliminated.

13.2. The probes are individually packed. Individually packed probes are bound in packages containing several probes. Storage and transport as above.

14. GUARANTEE

14.1 The manufacturer guarantees the proper operation of the transmitters for a period of 24 months from the date of purchase and servicing provided under the guarantee and following the guarantee period. In the case of special versions, the guarantee period shall be agreed by the manufacturer and the user, but shall not be less than 12 months.

14.2. The manufacturer guarantees the proper operation of the **PC-29**, **PC-29PA**, **PC-29PB** probes for a period of 12 months, as well as servicing provided under the guarantee and following the guarantee period.

15. ADDITIONAL INFORMATION

The manufacturer reserves the right to make constructional and technological changes which do not lower the quality of the transmitters and probes.

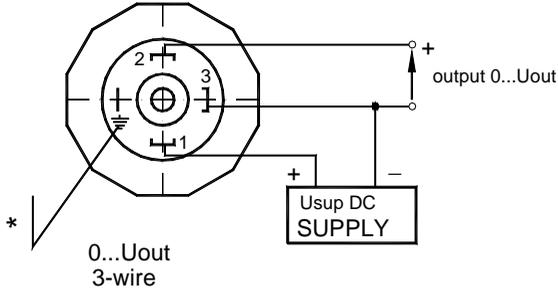
15.1. Related documents

Catalogue Cards "Diaphragm seals"

15.2. Related standards

PN-EN 60529:2003	Degrees of protection provided by enclosures (IP Code)
PN-EN 61010-1:2004	Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements
PN-82/M-42306	Screwed connectors of pressure gauges
PN-81/M-42009	Automatics and industrial measurements. The packing, the storage and transport of devices. General requirements
PN-EN 1092-1:2004 (U)	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories. – Part 1: Steel flanges.
Standards for Exi version	See – „Appendix Ex.02" or „Appendix Ex.03"

16. FIGURES



*) Functional earth terminal not to be used as a protective terminal.

Fig.1a. Wiring diagram transmitters and probes (Not applicable Exi version)

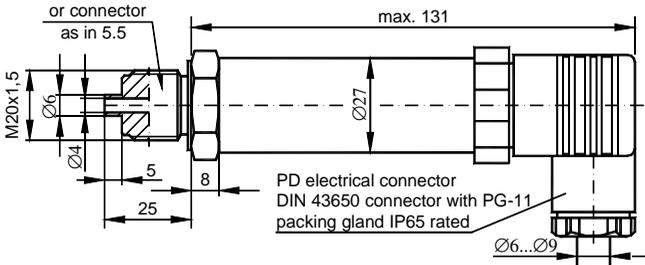


Fig.1b. PC-29, PC-29A, PC-29B transmitter with PD connector

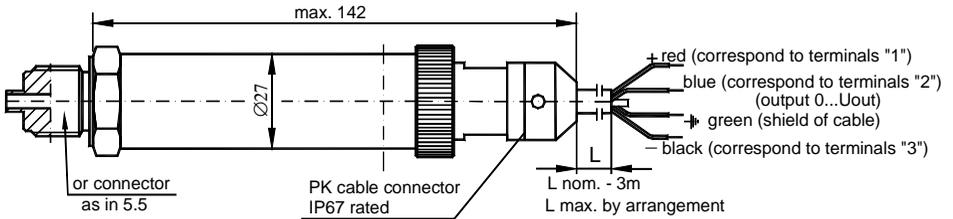


Fig.1c. PC-29, PC-29A, PC-29B transmitter with PK connector

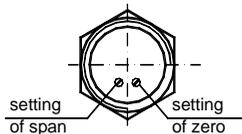
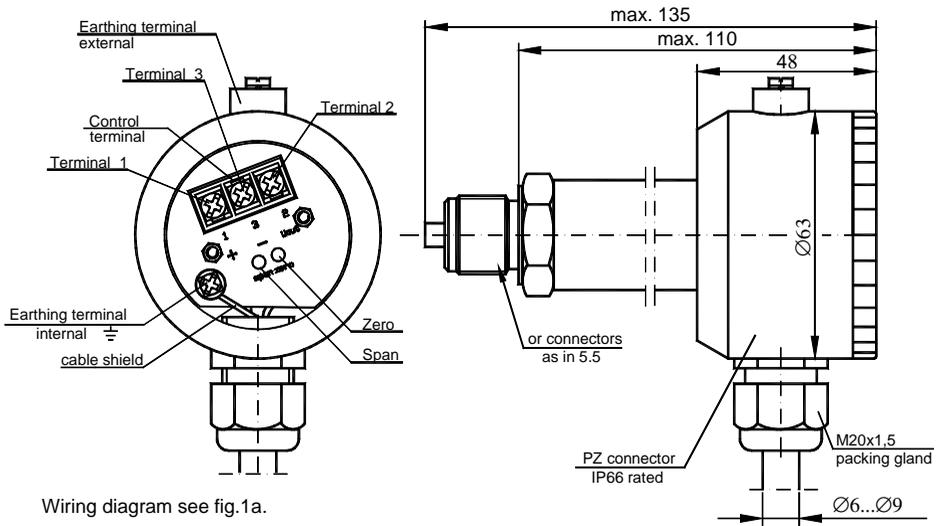


Fig.1e. View of potentiometers of zero and span (PD, PK)

Fig.1. PC-29, PC-29A, PC-29B transmitters with PD, PK connectors: dimensions and methods of connection



Wiring diagram see fig.1 a.

Sign of terminals

- Terminal 1 - Supply "+" (plus)
- Terminal 2 - Output signal "+"
- Terminal 3 - Supply "-" (minus); output signal "-"

Fig.2. PC-29, PC-29A, PC-29B transmitters with PZ. Dimensions

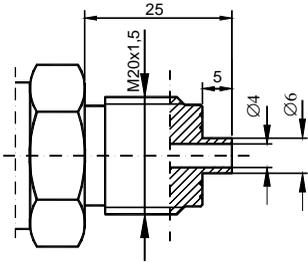


Fig.3a. M-type connector with M20x1.5 thread

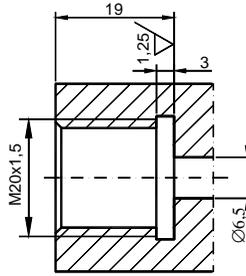


Fig.3b. Socket for M-type connector.

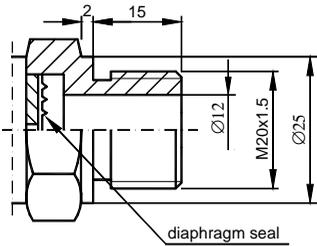


Fig.4a. P-type connector with M20x1.5 thread

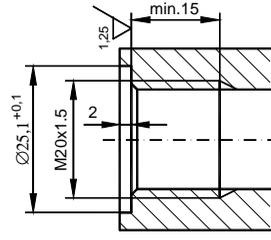


Fig.4b. Socket for P-type connector.

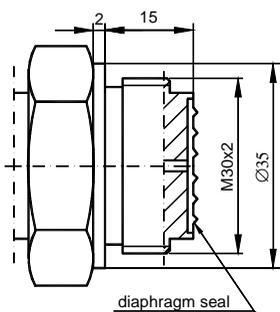


Fig.5a. CM30x2-type connector with flush diaphragm with M30x2 thread

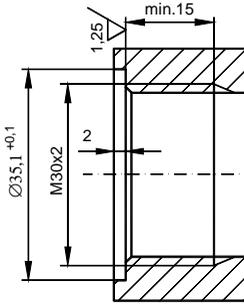


Fig.5b. Socket for CM30x2-type connector

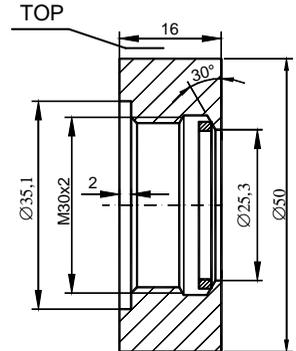


Fig.5c. Weldable fitting ring for CM30x2-type connector
Sealing: teflon

Order code Socket CM30x2



The ring in Fig.5c must be welded in place with the word TOP upwards

Fig.3. M-type connector with M20x1.5 thread

Fig.4. P-type connector with M20x1.5 thread

Fig.5. CM30x2-type connector with flush diaphragm with M30x2 thread

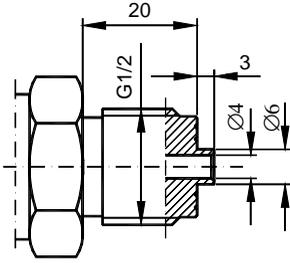


Fig.6a. G1/2-type connector with G1/2" thread

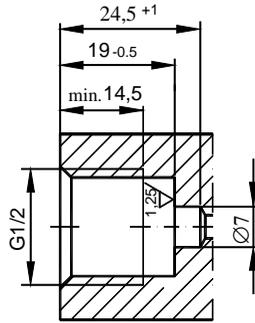


Fig.6b. Socket for G1/2-type connector

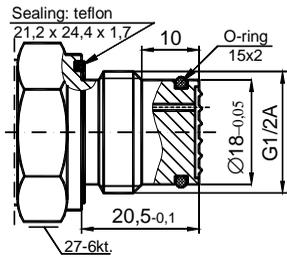


Fig.6c. CG1/2 -type connector with flush diaphragm with G1/2" thread

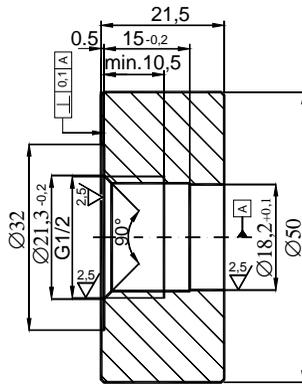


Fig.6d. Weldable fitting ring for CG1/2 - type connector
Order code Socket CG1/2

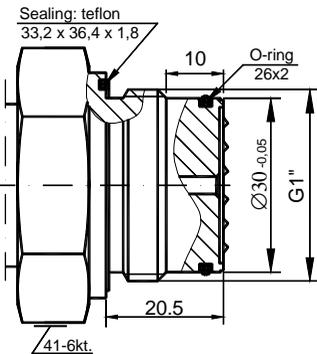


Fig.6e. CG1-type connector with flush diaphragm with G1" thread

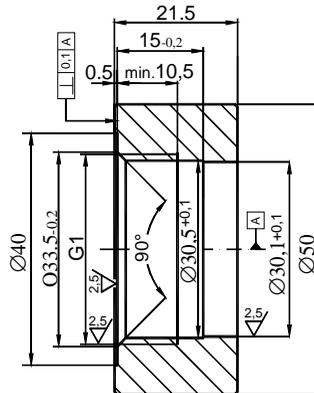


Fig.6f. Weldable fitting ring for CG1 - type connector
Order code Socket CG1

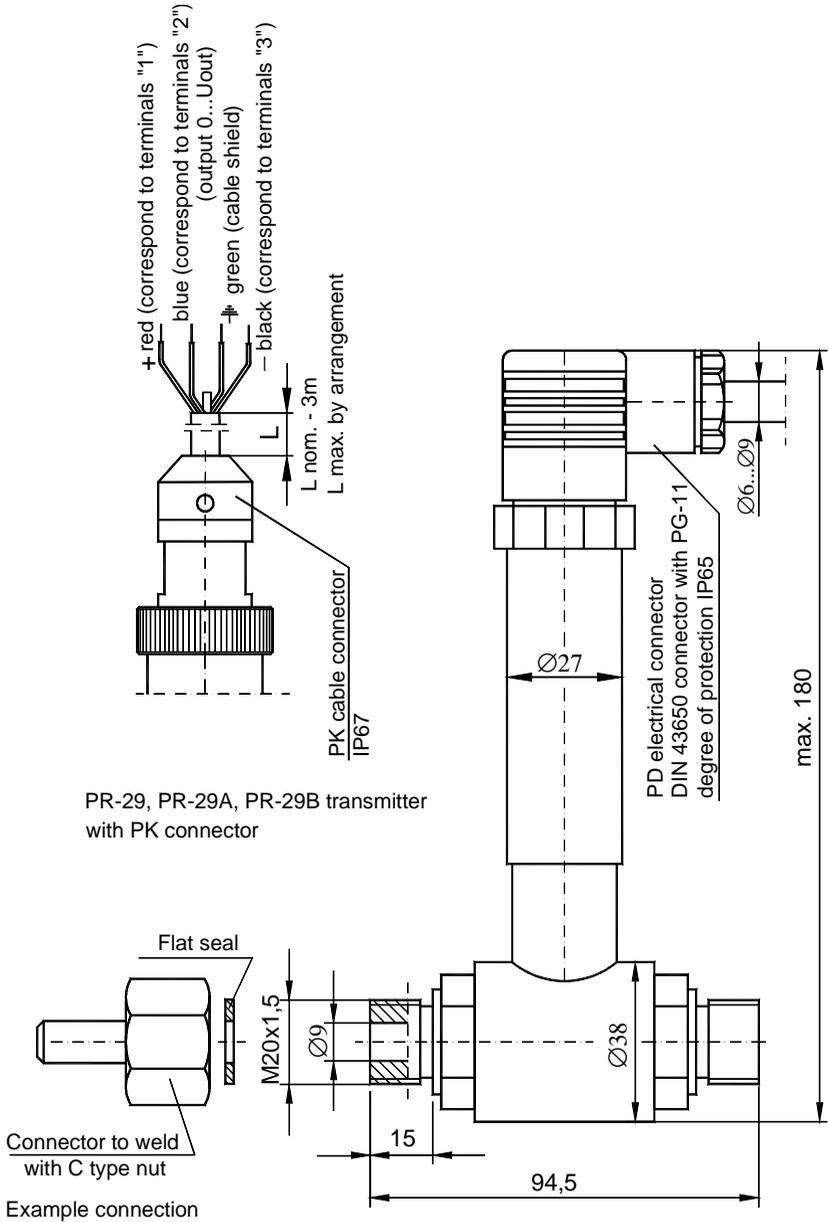


Fig.7. PR-29, PR-29A, PR-29B differential pressure transmitter with PD, PK connectors Dimensions.

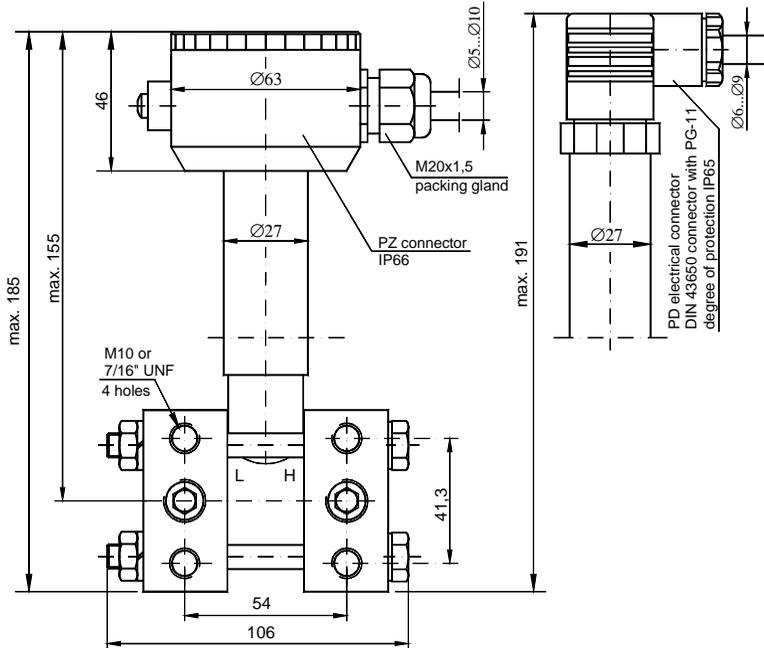


Fig.8. PR-29, PR-29A, PR-29B differential pressure transmitter with C-type process connection to be mounted together with valve manifold

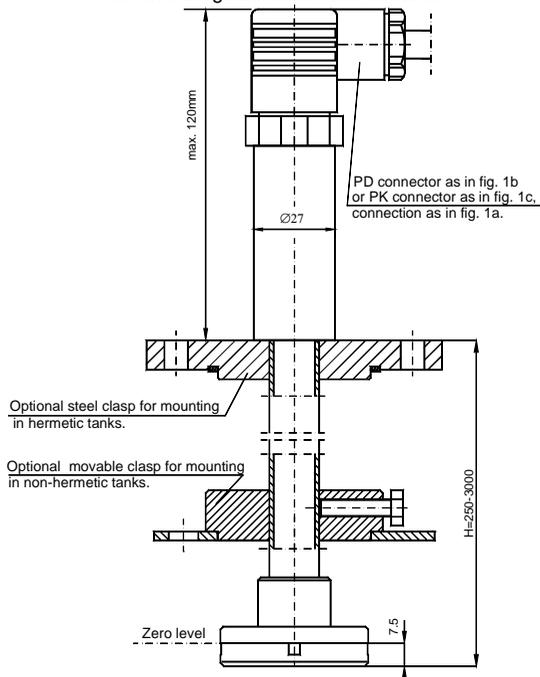


Fig.9. PC-29P, PC-29PA, PC-29PB level probes

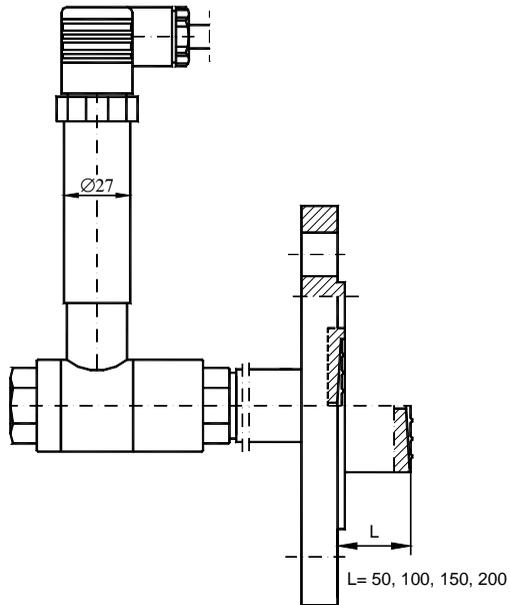


Fig.10. PR-29, PR-29A, PR-29B differential pressure transmitter with a single direct diaphragm seal

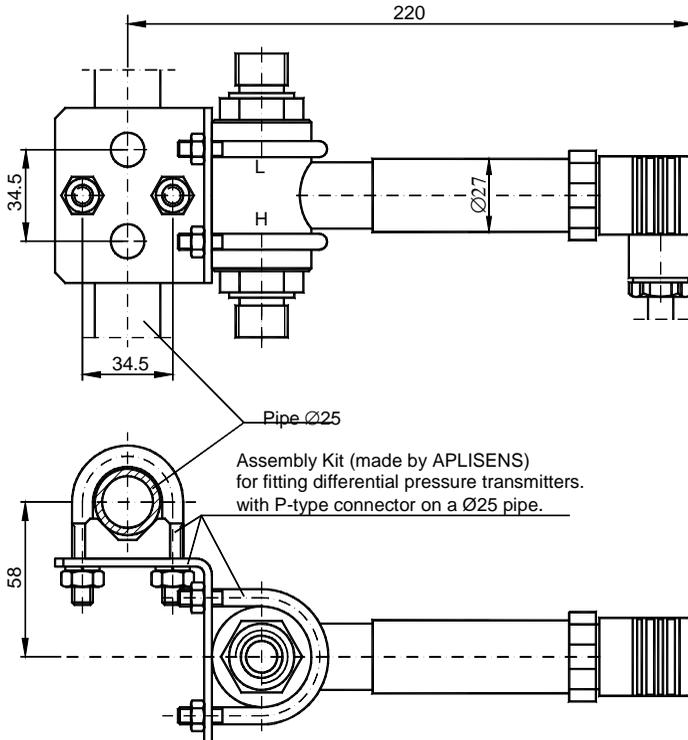


Fig.11. Example: how to install the PR-29, PR-29A, PR-29B differential pressure transmitter

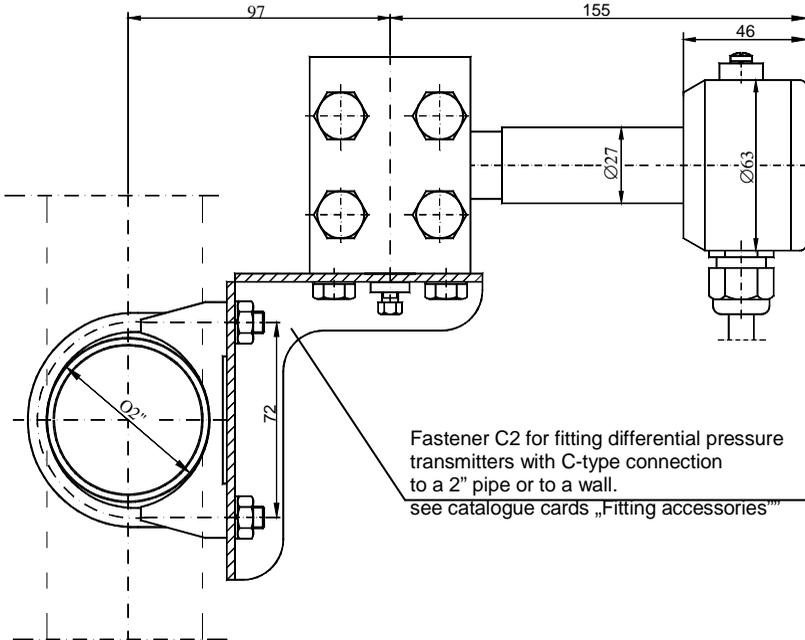


Fig.12. Example: how to install the PR-29, PR-29A, PR-29B transmitter on a vertical or horizontal pipe.

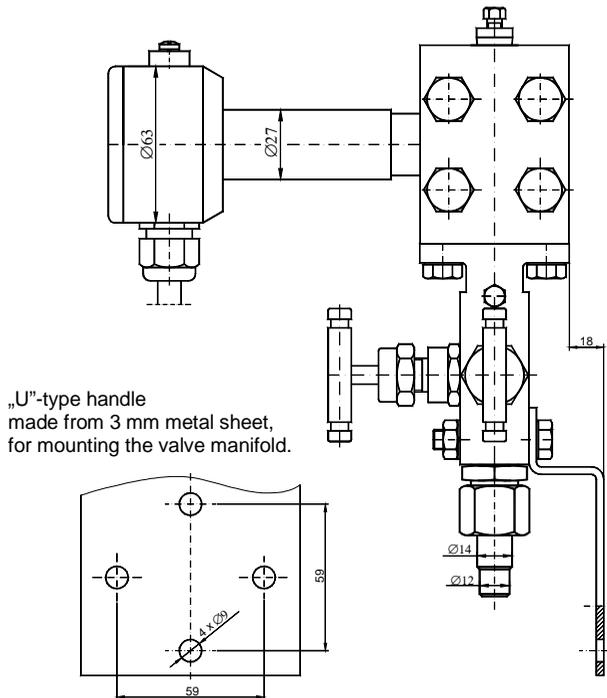


Fig.13. Example: how to install the PR-29, PR-29A, PR-29B transmitter with a valve manifold to a wall

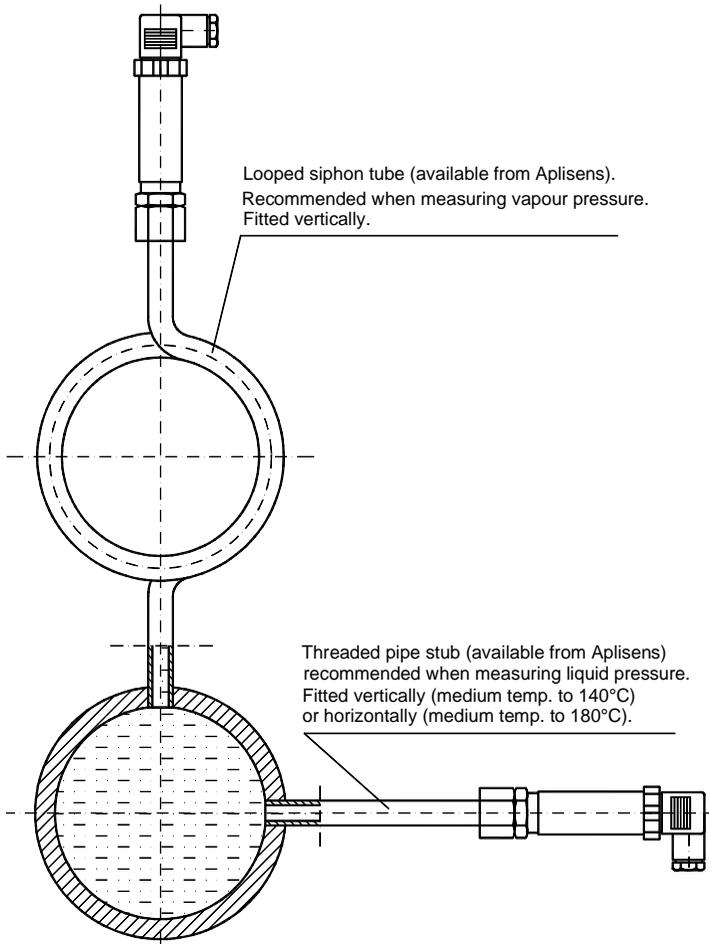


Fig.14. Possible methods of isolating the transmitter from high temperatures

