DTR.PYRP.PYRD.ALW.03*(ENG)*

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

SMART PRESSURE TRANSMITTER
type: **PYRP-2000ALW, PYRP-2000/ALWD & PYRP-2000ALW/IS**

SMART DIFFERENTIAL PRESSURE TRANSMITTER
type: **PYRD-2000ALW, PYRD-2000/ALWD, PYRD-2000ALW/IS, PYRD-2200ALW, PYRD-2200/ALWD, PYRD-2200ALW/IS, PYRD-2000GALW & PYRD-2000GALW/IS**

SMART LEVEL PROBE
type: **PYRL-2000YALW, PYRL-2000YALW/IS & PYRL-2000Y/ALWD**

SMART LEVEL TRANSMITTER
type: **PYRL-2000ALW/L…, PYRL-2000ALW/L…/IS,**

Edition D

June 2015

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Symbols used

Symbol	Description
	Denotes critical Instructions/information that the installer must regard closely and proceed strictly in accordance with to ensure the safe and correct functionality of the device.
	Denotes useful general information for installation and operation of the device.
	Denotes useful general information for installation and operation of the Ex certified device.
	Denotes disposal advice of the device or components.

BASIC REQUIREMENTS AND SAFE USE

- **The manufacturer is not liable for any damage resulting from incorrect installation, failure to maintain the device in a suitably functional condition, or use of the device other than for its intended purpose.**
- Installation should be carried out by qualified personnel having the necessary qualifications to install electrical and pressure measuring devices. The installer is responsible for performing the installation in accordance with this document and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- The device should be configured appropriately for the purpose for which it is to be used. Incorrect configuration may cause erroneous functioning, leading to damage to the device or an accident.
- In systems with pressure transmitters there exists, in case of leakage, a risk to personnel on the side where the medium is under pressure. All safety and protection requirements must be observed during installation, operation and inspections.
- If a device is not functioning correctly, disconnect it and send it for repair to the manufacturer or to a firm authorised by the manufacturer.

In order to minimise the risk of malfunction and associated risks to personnel, the device is not to be installed or used in particularly hostile conditions, where the following risks occur:

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

Installation of Ex certified versions should be carried out with particular care, in accordance with the regulations and standards applicable to that type of installation.

The manufacturer reserves the right to make changes (not having an adverse effect on the operational parameters of the products) without updating the contents of this document.

CONTENTS

I. APPENDIX Exd.ATEX

CE 0359

PYRP–2000/ALWD PRESSURE TRANSMITTER,
PYRD-2000/ALWD, PYRD-2200/ALWD,
DIFFERENTIAL PRESSURE TRANSMITTERS,
PYRL-2000Y/ALWD LEVEL PROBE,

Exd VERSION in accordance with ATEX directive

1. Introduction.

1.1. This “Appendix Exd.ATEX” applies to transmitters of types PYRP-2000/ALWD, PYRD-2000/ALWD, PYRD-2200/ALWD and PYRD-2000Y/ALWD in Exd versions only, marked on the information plate as shown in P.3 below and denoted Exd in the product certificate.

1.2. The appendix contains supplementary information relating to the Exd (flameproof) versions in accordance with the relevant ATEX directive.
During installation and use of Exd transmitters, reference should be made to this document, **DTR.PYRP.PYRD.ALW.03*(ENG)* with special attention to this section, “Appendix Exd.ATEX”.**

2. Use of transmitters in hazardous areas.

2.1. The transmitters are produced in accordance with the requirements of the following standards:
EN 60079-0:2009, EN 60079-1:2007, EN 60079-11:2012, EN 60079-26:2007, EN 60079-31:2009.

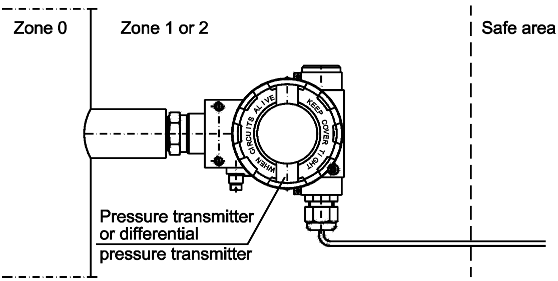
2.2. The transmitters may be installed in designated hazardous areas, in accordance with the rating of the explosion protection design:

I M2 Ex d ia I Mb **(1.4401 (316) st. steel housing version)**
II 1/2G Ex ia/d IIC T6/T5 Ga/Gb
II 1/2D Ex ia/t IIIC T85ºC/T100ºC Da/Db
KDB 12 ATEX 0009X

marking T6 and T85 applies to range -40°C <Ta ≤ 45°C
marking T5 and T100 applies to range -40°C <Ta ≤ 75°C

2.3. Transmitter category and hazard areas.

The category 1/2G, contained within the rating means that the transmitter may be installed in a Zone 1 or 2 area. Additionally the transmitter can be connected to a process designated as Zone 0 (see the diagram below for an example).



3. Identifying marks.

Flameproof transmitters must have an information plate containing the information specified in P.4 of DTR.PYRP.PYRD.ALW.03*(ENG)* and also at least the following:

- CE mark and number of notified unit: Ex mark;
- Designation of explosion protection design, certificate number;
- Supply voltage;
- Designation of a process connection;
- Year of manufacture;
- Temperature use range.

In place of XX letters in product information plate will be written the pressure connection type symbol.

4. Supplied Documentation.

Together with the transmitters, the following is/can be provided:
a) Declaration of conformity (on request);
b) Copy of hazardous area certification (when applicable);
c) Calibration certificate (on request);
d) User's Manual referenced: DTR.PYRP.PYRD.ALW.03*(ENG)* with Appendix Exd.ATEX

5. Power supply and usage of the transmitters.

5.1. The transmitter connections should only be made after the reading and understanding of this section.
Electrical supply to the transmitter should be carried out in accordance with P 6 (page 5) of this Appendix. Electrical installation of transmitters should be made in accordance the relevant standard electrical engineering requirements and only be carried out by personnel with the necessary knowledge and experience of hazardous area installations and codes of practice.
Earth clamps must be used to earth transmitters. In the event that transmitters are securely in contact with structural metal parts or pipes which are connected to the equipotential bonding system, then the additional earthing is not required.

5.2. Transmitters should be supplied from DC power source up to a maximum of 45V. Power supplies incorporating transformers should have primary and secondary windings that have galvanic isolation greater than 250Vac. The responsibility for providing a power supply in accordance with above requirements rests with the user or installer.

5.3. Transmitters can be used in ambient temperatures (Ta) between -40ºC < **Ta** ≤ 45ºC for **class T6** or between -40ºC < **Ta** ≤ 75ºC for **T5**.

5.4. Care must be taken during installation and use to ensure the transmitter sensor diaphragm is not subjected to any damage. The diaphragm is made from either 316 stainless steel or Hastelloy thin foil and must not be subjected to a damaging medium or application.

5.5. When locating the transmitter, particularly the cast aluminium alloy housing version, its selected position should be such that it cannot be accidentally struck or incur physical damage.

5.6. The transmitter casing is provided with 2 entries to facilitate the fitting of packing glands in either M20 x 1.5 or ½" NPT.

5.7. As standard, flameproof transmitters are supplied with 1 x certified blanking plug and 1 x nylon plug for transit purposes, to be removed when fitting the correctly selected certified cable gland. Recommended certified packing glands and plugs are listed in Table's 1 and 2 on page 6 though other glands/plugs can be used provided they meet the certification requirements.

5.8. Wiring to/from transmitters should be carried out in screened/shielded cable to protect from airborne (RFI) or cable borne (EMC) interference and suitably protected against moisture and impact to suit the particular environment.

5.9. The general principles for the installation, wiring and operation of Exd certified transmitters should be in accordance with the principles and relating standards for Exd certified equipment as stated in Point 2.1 (page 3) and also: EN600079-14, EN60079-17.

5.10. During periodic servicing the transmitter access covers and cable glands should be checked for tightness and the fastening of the cable into the glands checked. The casing and process supply line must be inspected for mechanical damage, and the transmitter rating plate for legibility. Periodic checks should also be made of the diaphragm, which should not show evidence of any damage.
During maintenance it is recommended that threads on the covers be lubricated with non-acid vaseline.

The transmitter must not be subjected to an ambient temperature of greater than 80ºC to avoid damage to the internal components.

6. The electrical connection way of transmitter’s series: PYRP-2000/ALWD, PYRD-2000/ALWD, PYRD-2200/ALWD and PYRD-2000Y/ALWD in Exd version.

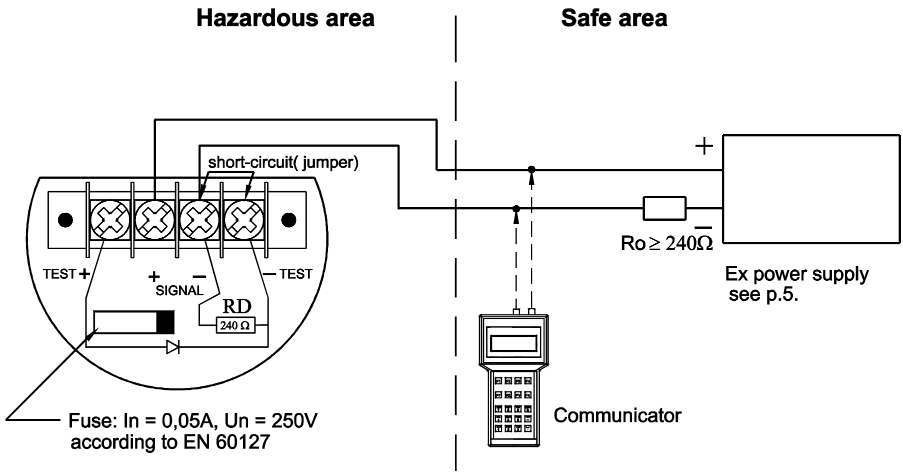


Fig. 2.

When making calibration or other parameter adjustments with a HART communicator from a safe area the communicator should be connected across the wiring from the transmitter (SIGNAL+) and (SIGNAL-) terminals.
A 240Ω resistor is permanently fitted across terminals (SIGNAL-) and (TEST-) and is linked out via a jumper link as default. In the event of the impedance in the current loop being less than 240Ω then the resistor jumper should be temporarily removed whilst the communicator is being used.
On completion, the jumper should be replaced.

In a hazardous area, the covers transmitter covers for any reason whilst it is electrically live.

No repairs or modifications to the transmitter’s electronic internals should be attempted by the user as this will invalidate the certification and warranty. The unit should be returned to the manufacturer or an organisation approved by the manufacturer for repair assessment and work.

Table 1. Acceptable cable glands (examples only)

Type	Producer	Screw	Feature	Other marking	No of certificate	
501/423	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0056X	
501/421	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0056X	
ICG 623	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0058X	
501/453	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0056X	*
501/453/RAC	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0056X	*
501/453/Universal	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0057X	*
ICG 653	HAWKE	M20x1.5	Exd IIC	dimension OS, O, A	Baseefa 06 ATEX 0058X	*
8163/2-A2F	STAHL	M20x1.5	EXd IIC		SIRA06ATEX1188X	
A2F, A2FRC, SS2K	CMP-Products	M20x1.5	Exd IIC		SIRA06ATEX1097X	
E1FW, E1FX/Z, E2FW, E2FX/Z	CMP-Products	M20x1.5	Exd IIC		SIRA06ATEX1097X	*
T3CDS, T3CDSPB	CMP-Products	M20x1.5	Exd IIC		SIRA06ATEX1283X	*
PX2K, PXSS2K, PX2KX, PXB2KX	CMP-Products	M20x1.5	Exd IIC		SIRA06ATEX1097X	*

Table 2. Accepted plugs (examples only)

Type	Producer	Screw	Feature	Other marking	No certificate	
	AGRO AG	M20x1.5	Exd IIC			
475	HAWKE	M20x1.5	Exd IIC			
477	HAWKE	M20x1.5	Exd IIC			

**) for special cable only.*

Special conditions for safe use:

1. Permissible gap of joint marked in documentation by L4 is smaller than specified defined in EN 60079-1:2007 and cannot exceed values specified in manual instruction Fig. 20.
2. When replacing parts within the enclosure use only those specified in the descriptive documentation.

II. APPENDIX Exi.ATEX

CE 0359

PYRP–2000ALW/IS PRESSURE TRANSMITTER,
PYRD–2000ALW/IS, PYRD–2200ALW/IS, PYRD–2000GALW/IS,
PYRD–2000ALW/L…/IS, PYRD-2200ALW/L…/IS
DIFFERENTIAL PRESSURE TRANSMITTERS,
PYRL–2000YALW/IS LEVEL PROBE,
PYRL–2000ALW/L…/IS LEVEL TANSMITTER

Exi VERSION in accordance with ATEX directive

1. Introduction

1.1. This “Appendix Exi.ATEX” applies to transmitters of types PYRP–2000ALW/IS, PYRD–2000ALW/IS, PYRD–2200ALW/IS, PYRD–2000GALW/IS, PYRL–2000YALW/IS, PYRP–2000ALW/L…/IS, PYRD–2000ALW/L…/IS, PYRD–2200ALW/L…/IS and PYRL–2000ALW/L…/IS in Exi versions only, marked on the information plate as shown in P.2.2 below and denoted Exi in the Product Certificate.

1.2. The appendix contains supplementary information relating to the Exi versions compatible with ATEX directive of mentioned transmitters.
During installation and use of Exi transmitters, reference should be made to **DTR.PYRP.PYRD.ALW.03*(ENG)* with special attention to this section, “Appendix Exi.ATEX”.**

2. Use of transmitters in hazardous areas.

2.1. The transmitters are produced in accordance with the requirements of the following standards: EN 60079-0:2012, EN 60079-26:2007, EN 60079-11:2012, EN 50303:2000.

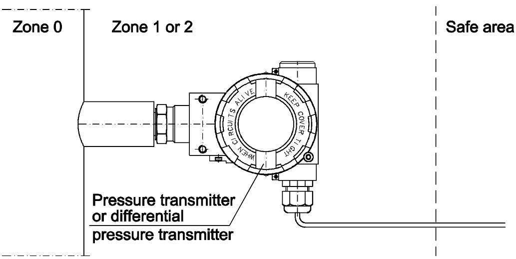
2.2. The transmitters may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:

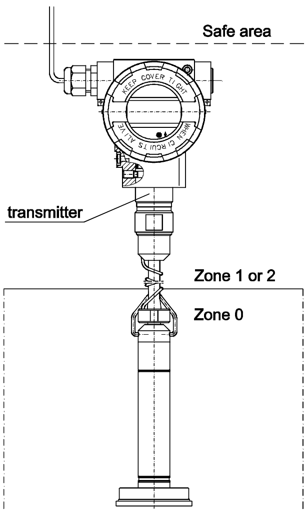
II 1/2G Ex ia IIC T5/T6 Ga/Gb
II 1/2G Ex ia IIB T5/T6 Ga/Gb **(Teflon covered cable version)**
II 1D Ex ia IIIC T105°C Da
I M1 Ex ia I Ma **(1.4401 (316) st. steel housing version)**

FTZÚ 11 ATEX 0281X

2.3. Transmitter category and hazard areas

The category 1/2G, contained within the rating means that the transmitter may be installed in a Zone 1 or 2 area. Additionally the the transmitter can be connected to a process designated as Zone 0 (see example diagrams below).





3. Identifying marks.

Intrinsically safe transmitters must have an information plate containing the information specified in P.4 of DTR.PYRP.PYRD.ALW.03*(ENG)* and also at least the following:

- CE mark and number of notified unit: ⟨Ex⟩ mark;
- Designation of explosion protection design, certificate number;
- Values of parameters such as: Ui, Ii, Pi, Ci, Li;
- Year of manufacture;
- Text: "Version SA" - seperate power supply for transmitters with surge arresters. Power supply must be separate to earth.

4. Supplied Documentation.

Together with the transmitters, the following is/can be provided:

a) Declaration of conformity (on request);
b) Copy of hazardous area certification (when applicable);
c) Calibration certificate (on request);
d) User's Manual referenced: DTR.PYRP.PYRD.ALW.03*(ENG)* with Appendix Exi.ATEX

5. Permitted input parameters (based on data from the FTZÚ 11 ATEX 0281X certificate, and certification documentation).

⚠ The transmitters should be powered via approved intrinsically safe barriers / galvanic isolators. The parameters of their outputs to the hazardous area should not exceed the limit power supply parameters for the below specified transmitters.

5.1. For power supply with a linear output characteristic;

Ui = 30V Ii = 0.1A Pi = 0.75W -40 ºC≤Ta≤40ºC and T6, -40 ºC≤Ta≤80ºC and T5

Power supply with a linear characteristic may be e.g. a typical barrier with parameters;

Uo = 28V Io = 0.093A Rw = 300Ω.

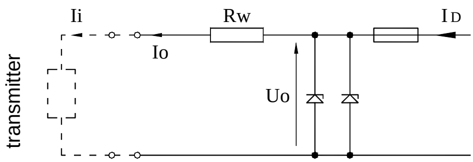


Fig.1. Power supply from a source with linear characteristic.

5.2. For power supply with a trapezial output characteristic;

Ui = 24V Ii = 50mA Pi = 0.7W -40ºC ≤Ta ≤ 80ºC and T5

Example of power supply from a source with trapezial characteristic (see Fig. 2).

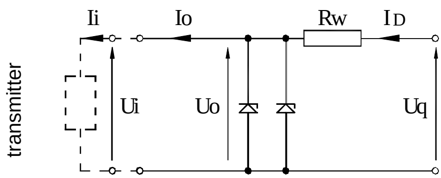


Fig. 2. Power supply from a source with trapezial characteristic.

If $Uo < \frac{Uq}{2}$ then parameters Uq, Io, Po are interrelated as follows:

$$Uq = \frac{4Po}{Io}, \quad Rw = \frac{Uq}{Io}, \quad Po = \frac{Uo(Uq - Uo)}{Rw} \quad \text{for } Uo \le ½Uq$$

5.3. For power supply with a rectangular output characteristic;

Ui = 24V Ii = 25mA Pi = 0.6W -40ºC ≤Ta ≤ 40ºC and T6, -40ºC ≤Ta ≤ 80ºC and T5

Ui = 24V Ii = 50mA Pi = 1.2W -40ºC ≤Ta ≤ 70ºC i T5

The supply of power from a source with a rectangular characteristic means that the voltage of the Ex power supply remains constant until current limitation activates.
The protection level of power supplies with a rectangular characteristic is normally “ib”.
The transmitter powered from such a supply is also an Ex device with protection level “ib”.
Example of practical provision of power supply.
– use a stabilised power supply with Uo=24V with protection level “ib” and current limited to Io = 25mA.

5.4. Input inductance and capacity

Ci = 2.5nF, Li = 18µH

5.5. Supply voltage min.: 10.5VDC

5.6. Load resistance:

- from 28V linear supply

$$Ro\ max\ [\Omega] = \frac{28V - 10.5V - (300\Omega^* \cdot 0.0225A)}{0.0225A}$$

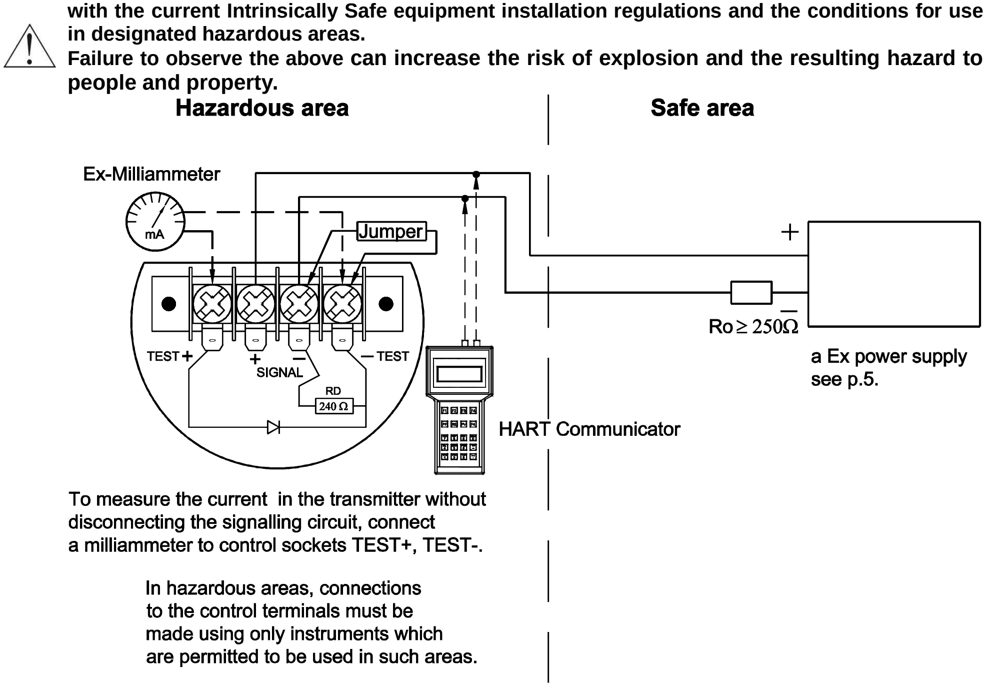
- from a source with trapezial or rectangular characteristic supply

$$Ro\ max\ [\Omega] = \frac{Usup. - 10.5V}{0.0225A}$$

**) barrier resistance.*

6. The electrical connection of Exi transmitters

The transmitter and other devices in the measuring loop should be connected in accordance with the current Intrinsically Safe equipment installation regulations and the conditions for use in designated hazardous areas.
Failure to observe the above can increase the risk of explosion and the resulting hazard to people and property.



i

When making calibration or other parameter adjustments with a local HART communicator, connection should be made to terminals (SIGNAL+) and (SIGNAL-).
A 240Ω resistor is permanently fitted across terminals (SIGNAL-) and (TEST-) and is linked out via a jumper link as default. In the event of the impedance in the current loop being less than 240Ω then the resistor jumper should be temporarily removed whilst the communicator is being used.
On completion, the jumper should be replaced.

i

If the temperature of the process medium exceeds Ta, then connection to the transmitter should be made via suitable lengths of impulse tubing, syphon loops or diaphragms seals must be used.
The transmitter working temperature (Tp) must conform to $T_p \le T_a$.

Special conditions/notes for safe use:

The version of transmitter fitted a surge arrester, (marked as "Version SA" on the transmitter information plate) does not meet the requirements of Section 10.3 of the EN 60079-11:2012 (500Vrms). This must be taken into account when installing the equipment.

No repairs or modifications to the transmitter's electronic internals should be attempted by the user as this will invalidate the certification and warranty. The unit should be returned to the manufacturer or an organisation approved by the manufacturer for repair assessment and work.

III. APPENDIX Exi.IECEx

PYRP–2000ALW/IS PRESSURE TRANSMITTER,
PYRD–2000ALW/IS, PYRD–2200ALW/IS, PYRD–2000GALW/IS,
PYRD–2000ALW/L…/IS, PYRD-2200ALW/L…/IS
DIFFERENTIAL PRESSURE TRANSMITTERS,
PYRL–2000YALW/IS LEVEL PROBE,
PYRL–2000ALW/L…/IS LEVEL TANSMITTER

Exi VERSION in accordance with IECEx certificate

2. Introduction

1.1. This "Appendix Exi.ATEX" applies to transmitters of types PYRP–2000ALW/IS, PYRD–2000ALW/IS, PYRD–2200ALW/IS, PYRD–2000GALW/IS, PYRL–2000YALW/IS, PYRP–2000ALW/L…/IS, PYRD–2000ALW/L…/IS, PYRD–2200ALW/L…/IS and PYRL–2000ALW/L…/IS in Exi versions only, marked on the information plate as shown in P.2.2 below and denoted Exi in the Product Certificate.

1.2. The appendix contains supplementary information relating to the Exi versions compatible with requirements IECEx of mentioned transmitters.
During installation and use of Exi transmitters, reference should be made to **DTR.PYRP.PYRD.ALW.03*(ENG)* with special attention to this section, "Appendix Exi.IECEx".**

2. Use of transmitters in hazardous areas.

2.1. The transmitters are produced in accordance with the requirements of the following standards:
IEC 60079-0:2011 ed. 6.0, IEC 60079-26:2006 ed. 2.0, EN 60079-11:2011 ed. 6.0.

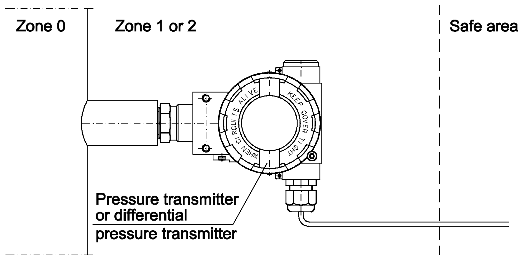
2.2. The transmitters may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:

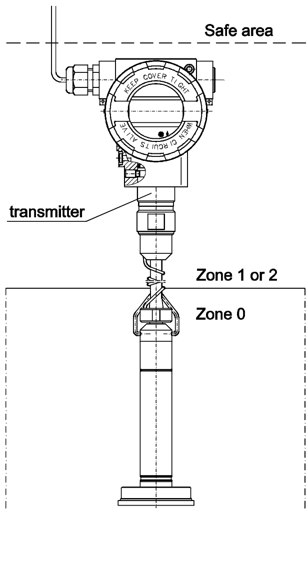
Ex ia IIC T5/T6 Ga/Gb
Ex ia IIB T5/T6 Ga/Gb **(Teflon covered cable version)**
Ex ia IIIC T105°C Da
Ex ia I Ma **(1.4401 (316) st. steel housing version)**

IECEx FTZÚ 15.0028X

2.3. Equipment protection level (EPL) and hazard areas

Equipment protection level (EPL) Ga/Gb, contained within the rating means that the transmitter may be installed in a Zone 1 or 2 area. Additionally the the transmitter can be connected to a process designated as Zone 0 (see example diagrams below).





3. Identifying marks.

Intrinsically safe transmitters must have an information plate containing the information specified in P.4 of DTR.PYRP.PYRD.ALW.03*(ENG*) and also at least the following:

- Designation of explosion protection design, certificate number;
- Values of parameters such as: Ui, Ii, Pi, Ci, Li;
- Year of manufacture;
- Text: "Version SA" - seperate power supply for transmitters with surge arresters. Power supply must be separate to earth.

4. Supplied Documentation.

Together with the transmitters, the following is/can be provided:

a) Copy of hazardous area certification (when applicable);
b) Calibration certificate (on request);
c) User's Manual referenced: DTR.PYRP.PYRD.ALW.03*(ENG)* with Appendix Exi.IECEx

5. Permitted input parameters (based on data from the IECEx FTZÚ 15.0028X certificate, and certification documentation).

⚠ The transmitters should be powered via approved intrinsically safe barriers / galvanic isolators. The parameters of their outputs to the hazardous area should not exceed the limit power supply parameters for the below specified transmitters.

5.1. For power supply with a linear output characteristic;

Ui = 30V Ii = 0.1A Pi = 0.75W -40 ºC≤Ta≤40ºC and T6, -40 ºC≤Ta≤80ºC and T5
Power supply with a linear characteristic may be e.g. a typical barrier with parameters;
Uo = 28V Io = 0.093A Rw = 300Ω.

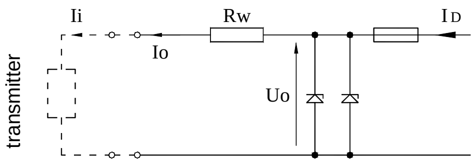


Fig.1. Power supply from a source with linear characteristic.

5.2. For power supply with a trapezial output characteristic;

Ui = 24V Ii = 50mA Pi = 0.7W -40ºC ≤Ta ≤ 80ºC and T5

Example of power supply from a source with trapezial characteristic (see Fig. 2).

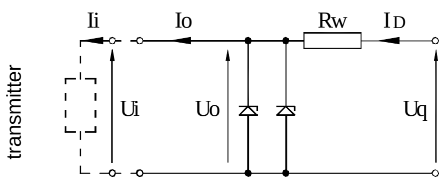


Fig. 2. Power supply from a source with trapezial characteristic.

If $U_o < \frac{U_q}{2}$ then parameters Uq, Io, Po are interrelated as follows:

$$U_q = \frac{4P_o}{I_o}, \qquad R_w = \frac{U_q}{I_o}, \qquad P_o = \frac{U_o(U_q - U_o)}{R_w} \quad \text{for } U_o \le \tfrac{1}{2}U_q$$

5.3. For power supply with a rectangular output characteristic;

Ui = 24V Ii = 25mA Pi = 0.6W -40ºC ≤Ta ≤ 40ºC and T6, -40ºC ≤Ta ≤ 80ºC and T5
Ui = 24V Ii = 50mA Pi = 1.2W -40ºC ≤Ta ≤ 70ºC i T5

The supply of power from a source with a rectangular characteristic means that the voltage of the Ex power supply remains constant until current limitation activates.
The protection level of power supplies with a rectangular characteristic is normally “ib”.
The transmitter powered from such a supply is also an Ex device with protection level “ib”.
Example of practical provision of power supply.
– use a stabilised power supply with Uo=24V with protection level “ib” and current limited to Io = 25mA.

5.4. Input inductance and capacity

Ci = 2.5nF, Li = 18µH

5.5. Supply voltage min.: 10.5VDC

5.6. Load resistance:

- from 28V linear supply

$$\text{Ro max } [\Omega] = \frac{28V - 10.5V - (300\Omega^* \cdot 0.0225A)}{0.0225A}$$

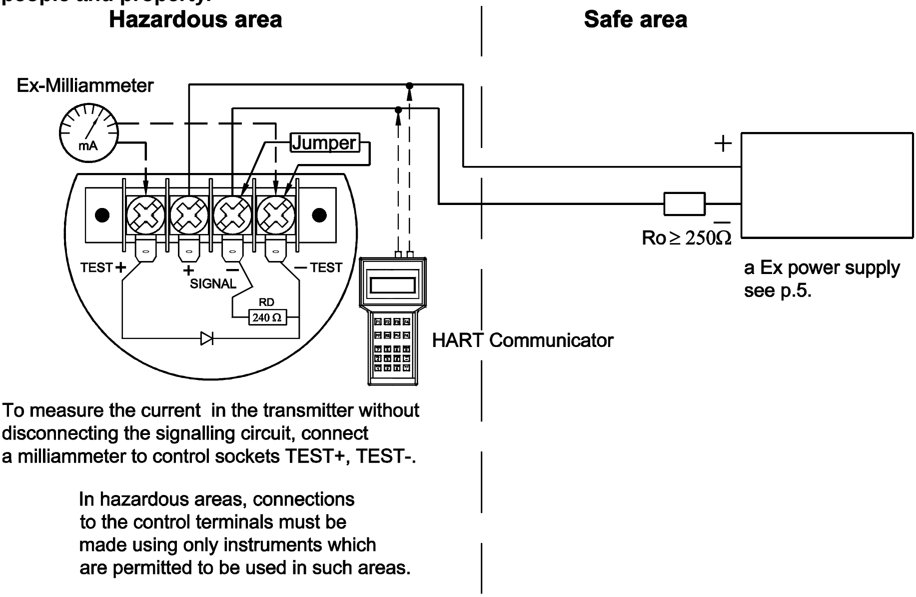
- from a source with trapezial or rectangular characteristic supply

$$\text{Ro max } [\Omega] = \frac{\text{Usup.} - 10.5V}{0.0225A}$$

**) barrier resistance.*

6. The electrical connection of Exi transmitters

The transmitter and other devices in the measuring loop should be connected in accordance with the current Intrinsically Safe equipment installation regulations and the conditions for use in designated hazardous areas.
Failure to observe the above can increase the risk of explosion and the resulting hazard to people and property.



To measure the current in the transmitter without disconnecting the signalling circuit, connect a milliammeter to control sockets TEST+, TEST-.

In hazardous areas, connections to the control terminals must be made using only instruments which are permitted to be used in such areas.

When making calibration or other parameter adjustments with a local HART communicator, connection should be made to terminals (SIGNAL+) and (SIGNAL-).
A 240Ω resistor is permanently fitted across terminals (SIGNAL-) and (TEST-) and is linked out via a jumper link as default. In the event of the impedance in the current loop being less than 240Ω then the resistor jumper should be temporarily removed whilst the communicator is being used.
On completion, the jumper should be replaced.

If the temperature of the process medium exceeds Ta, then connection to the transmitter should be made via suitable lengths of impulse tubing, syphon loops or diaphragms seals must be used.
The transmitter working temperature (Tp) must conform to $T_p \leq T_a$.

Special conditions/notes for safe use:

The version of transmitter fitted a surge arrester, (marked as "Version SA" on the transmitter information plate) does not meet the requirements of Section 10.3 of the IEC 60079-11:2011 (500Vrms). This must be taken into account when installing the equipment.

No repairs or modifications to the transmitter's electronic internals should be attempted by the user as this will invalidate the certification and warranty. The unit should be returned to the manufacturer or an organisation approved by the manufacturer for repair assessment and work.

IV. FEATURES, INSTALLATION AND MAINTENANCE OF TRANSMITTERS

1. INTRODUCTION

1.1. This manual covers the installation and operation of **PYRP-2000ALW** smart pressure transmitters, **PYRD-2000ALW**, **PYRD-2200ALW, PYRD-2000GALW, PYRD-2000ALW/L, PYRD-2200ALW/L** smart differential pressure transmitters, **PYRD-2000YALW** smart level probe, **PYRP-2000ALW/L** smart level transmitter and their Intrinsically Safe and Flameproof (explosion-proof) versions.

It provides the necessary data and guidelines to understand the functioning of the transmitters and how to operate them in a correct and safe manner

1.2. Technical data for the diaphragm/chemical seals is detailed in separate literature (contact Pyropress Sales Office).

1.3. The transmitters comply with EU directives as stated on the label affixed to the body of the transmitter and to the relevant Declaration of Conformity.

1.4. Additional data relating to Ex certified versions of these transmitters is contained in Appendix I for Flameproof Exd and Appendix II or Appendix III for Intrinsically Safe Exia.
During installation and operation of Exd or Exia certified transmitters, close adherence should be made to this document and the relevant Appendices as stated.

2. SUPPLIED DOCUMENTATION

Together with the transmitters, the following is/can be provided:
a) Declaration of conformity (on request);
b) Copy of hazardous area certification (when applicable);
c) Calibration certificate (on request);
d) User's Manual referenced: DTR.PYRP.PYRD.ALW.03*(ENG)*.

3. APPLICATIONS AND MAIN FEATURES

3.1. The **PYRP...** smart pressure transmitters are designed to measure gauge pressure, vacuum pressure and absolute pressure of gases, vapours and liquids (including corrosive substances).
Differential pressure transmitters type **PYRD…** are used to measure liquid levels in closed tanks, with static pressure up to 25MPa, or 32MPa for special versions and to measure differential pressure across constrictions such as filters and orifices.

3.2. The transmitters may be fitted with a range of types of process connectors, which enables them to be used in a variety of conditions such as thick or highly reactive media, high and low temperatures, etc.

3.3. The transmitters generate a 4...20mA output signal and a digital HART signal in a two-wire system (current loop). The use of smart electronics enables regulation of the zero point, the measurement range, damping, radical conversion characteristic and other functions using a local hand held communicator or from a PC using a HART/RS232 or HART/USB/Bluetooth Converter and the users configuration software (or "Raport 2" configuration software available from Pyropress).

4. IDENTIFYING MARKS / ORDERING PROCEDURE

4.1. Each transmitter is fitted with a marking plate detailing the following as minimum: CE mark, manufacturer name, transmitter type, serial number, pressure range, static pressure limit, output signal, power supply voltage. Version types and the method of specifying the desired product are described in the relevant sales literature.

4.2. Flameproof (Exd) and Intrinsically Safe (Exia) and transmitters have additional markings as detailed in their relevant attached appendices I or II respectively.

5. TECHNICAL DATA.

5.1. Common parameters

5.1.1. Electrical parameters

Power supply voltages:

- Standard versions	10 - 55V DC	
- Exd versions	13.5* - 45V DC	see Appendix I Exd.ATEX
- Exia versions	10.5 - 30V DC	see Appendix II Exi.ATEX

**) Note: When backlight is on this causes a voltage drop of 3V.*

Output signal 4 - 20mA + HART rev.5.1

Communication with the transmitter to check its configuration parameters is carried out via HART transmission protocol and signal of 4-20mA. This can be enabled either using a suitable HART hand held communicator; HART/RS232 converter; HART/USB/Bluetooth Converter; or an alternative converter, PC computer and configuration software can be used.

Resistance for communication (HART) min 240Ω

Load resistance $R_o[\Omega] = \frac{Usup[V] - 10V^*}{0.0225A}$

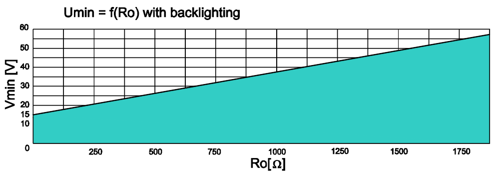
The maximum length of the connection cable 1500M

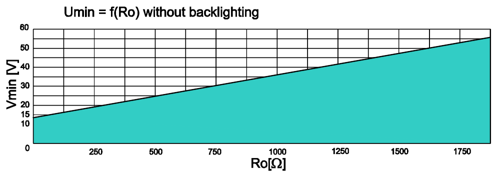
Value of the minimum supply voltage transmitters in standard version should be calculated from:

i U_{supply} min. = 10* + 0.0225·Ro [V]

Ro [Ω] is a total resistance of the measuring line (current loop)

*) *for oter versions use the following voltages in the formula: 10.5 V for Exi versions and 13.5V or 16.5V for Exd versions.*





Correct working value to be within the grid area above the shaded area.

Output updating time 500 msecs

Additional electronic damping 0...30 secs

5.1.2. Construction materials

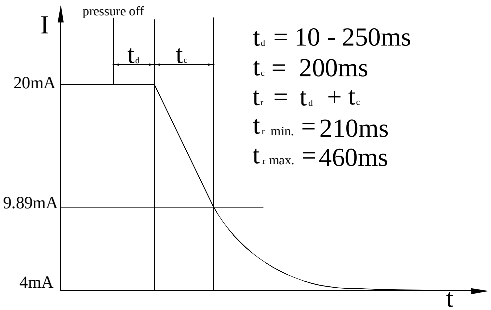
Diaphragm seal for PYRP...	Stainless steel 1.4404/1.4435 (316L) or Hastelloy C276
Diaphragm seal for PYRD...	Stainless steel 1.4404/1.4435 (316L) or Hastelloy C276
Sensing module	Stainless steel 1.4404 (316L)
Liquid filling the interior the sensing module	Silicone oil - std (for Oxygen service a chemically inert liquid is used).
Connections for PYRP...	Stainless steel 1.4404 (316L) or Hastelloy C276 only for P, GC, T and N2 (up to 40 Bar)
'C' type process block and connectors for PYRD...	Stainless steel 1.4404 (316L)
Electronics casing	High pressure cast of aluminium alloy, lacquered with chemical resistant oxide enamel, colour blue (RAL 5015) or 1.4401 (316)

Materials available for diaphragm seals are detailed in the separate relevant data sheets for these accessories.

5.1.3. Enclosure ingress protection

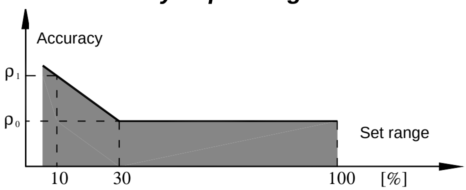
IP 66 or IP 67 in accordance with EN 60529.
IP 65 in accordance with EN 60529 when fitted a type PD (DIN 43650) electrical connection.

5.1.4. Response time on pressure change.



PYRP... and PYRD... transmitters with 4 – 20mA output, response time on pressure change 'tr' length of measuring cycle 0,5secs, damping = 0.

5.1.5. Accuracy depending on the set range



ρ_0 – error for nominal measuring range (0...100%FSO)
ρ_1 - error for range (0...10%FSO)
$\rho_1 = 2 \times \rho_0$

5.2. PYRP-2000ALW Measurement ranges and performance parameters.

5.2.1. PYRP..., Measurement ranges

Range No	Nominal measuring range (FSO)	Minimum set range	Rangeability /Turndown	Overpressure limit (without hysteresis)
30	0 - 1000 Bar (0 - 100 MPa)	10 Bar (1 MPa)	100:1	1200 Bar (120 MPa)
27	0 - 300 Bar (0 - 30 MPa)	3 Bar (300 kPa)	100:1	450 Bar (45 MPa)
25	0 -160 Bar (0 - 16 MPa)	1.6 Bar (160 kPa)	100:1	450 Bar (45 MPa)
23	0 - 70 Bar (0 - 7 MPa)	0.7 Bar (70 kPa)	100:1	140 Bar (14 MPa)
20	0 - 25 Bar (0 – 2.5 MPa)	0.25 Bar (25 kPa)	100:1	50 Bar (5 MPa)
17	0 - 7 Bar (0 – 0.7 MPa)	0.07 Bar (7 kPa)	100:1	14 Bar (1.4 MPa)
48	-1 to 7 Bar (-100 to 700 kPa)	0.07 Bar (7 kPa)	114:1	14 Bar (1.4 MPa)
13	0 - 2 Bar (0 - 200 kPa)	100 mBar (10 kPa)	20:1	4 Bar (400 kPa)
11	0 - 1 Bar (0 - 100 kPa)	50 mBar (5 kPa)	20:1	2 Bar (200 kPa)
47	-0.5 to 0,5 Bar (-50 to 50 kPa)	50 mBar (5 kPa)	20:1	2 Bar (200 kPa)
08	0 – 0.25 Bar (0 - 25 kPa)	25 mBar (2.5 kPa)	10:1	1 Bar (100 kPa)
45	-100 to 100 mBar (-10 to 10 kPa)	20 mBar (2 kPa)	10:1	1 Bar (100 kPa)
43*	-15 to 70 mBar (-15 to 7 kPa)	5 mBar (0.5 kPa)	17:1	0.5 Bar (50 kPa)
52	0 - 1.3 Bar abs (0 - 130 kPa abs)	100 mBar abs (10 kPa abs)	13:1	2 Bar (200 kPa)
53	0 - 7 Bar abs (0 - 7 MPa abs)	100 mBar abs (10 kPa abs)	70:1	14 Bar (1.4 MPa)
54	0 - 25 Bar abs (0 - 2.5 MPa abs)	0.25 Bar abs (25 kPa abs)	100:1	50 Bar (5 MPa)
55	0 - 70 Bar abs (0 - 7 MPa abs)	0.7 Bar abs (70 kPa abs)	100:1	140 Bar (14 MPa)
* - Not available with Exd certification or with diaphragm/chemical seal.				

5.2.2. PYRP... Permitted environmental conditions

Operating temperature range -40ºC to +85ºC

For temperature range of Flameproof (Exd) certified models refer to Appendix I Exd.ATEX
For temperature range of Intrinsically Safe (Exia) certified models refer to Appendix II Exi.ATEX
For temperature range of Intrinsically Safe (Exia) certified models refer to Appendix II Exi.IECEx

Process temperature range	-40º to +120ºC when directly mounted via process connection. For temperatures in excess of 120ºC, connection via a length of impulse/transmission tubing to allow cooling or a diaphragm seal/separator should be incorporated.
Thermal compensation range	-25º to +80ºC (-40 to +80ºC available on request)
Relative humidity	0 - 98% condensing

For transmitters fitted with diaphragm seals, please refer to the relevant diaphragm seal data sheets.

5.2.3. PYRP..., Performance parameters

Accuracy	max ± 0.075% for the nominal range (0.16% for range 52)
Long term stability	≤ accuracy / 3 years (for the nominal measuring range) or ≤ 2 x accuracy / 5 years (for the nominal measuring range)
Error due to supply voltage changes	max ± 0.002%(FSO)/1V
Thermal error	max ± 0.05%(FSO)/10ºC max ± 0.1% FSO/10ºC for ranges 43 and 45.
Thermal error for the whole thermal compensation range	max ± 0.25%(FSO) (max ± 0.4% FSO/10ºC for ranges 43 and 45.

5.2.4. PYRP..., Pressure Connections

- M-type connection having M20x1.5 thread – see Figure 6a;
- P-type connection having M20x1.5 thread – see Figure 7a;
- T-type connection having flush diaphragm – see Figure 8a;
- GB -type connection having G½ thread – see Figure 9a;
- GC -type connection having G½ thread;
- GD-type connection having G1” thread and flush diaphragm – see Figure 9e;
- RM-type connection having M20x1.5 thread and radiator;
- RP-type connection having M20x1.5 thread and radiator;
- GA-type connection having G¼ thread;
- N2-type connection having ½" NPT M thread;
- F2-type connection having ½” NPT F thread;
- R½-type connection having R½ tread;
- GF-type connection with G½ thread and flush diaphragm;
- Other connection types by arrangement.

5.3. PYRD-2000ALW, PYRD-2000ALW/L, PYRD-2200ALW, PYRD-2200ALW/L Measurement ranges and performance parameters.

5.3.1. PYRD-2000ALW, PYRD-2000ALW/L, Measurement ranges

N°	Nominal measuring range (FSO)	Minimum set range	Rangeability /Turndown	Over Pressure Limit	Static Pressure Limit
23	0 - 70 Bar (0 -7 MPa)	7 Bar (700 kPa)	10:1	250, 320 Bar (40 Bar for P-type connection)	
19	0 - 16 Bar (0 - 1,6 MPa)	1.6 Bar (160 kPa)	10:1		
14	0 - 2.5 Bar (0 - 250 kPa)	0.2 Bar (20 kPa)	12.5:1		
11	0 - 1 Bar (0 - 100 kPa)	50 mBar (5 kPa)	20:1		
08	0 - 0.25 Bar (0 - 25 kPa)	10 mBar (1 kPa)	25:1		
47	-0.5 to 0.5 Bar (-50 to 50 kPa)	0.1 Bar (10 kPa)	10:1		
45	-100 to 100 mBar (-10 to 10 kPa)	10 mBar (1 kPa)	20:1		
42	-5 to 70 mBar (-0.5 - 7 kPa)	4 mBar (0.4 kPa)	18:1		
44	-20 to 20 mBar (-2 to 2 kPa)	2 mBar (0.2 kPa)	20:1	20 Bar	

5.3.2. PYRD-2200ALW, PYRD-2200ALW/L, Measurement ranges

Nominal range (FSO)	Minimum set range	Vertical spacing of diaphragm seals.	Maximum configurable range dependent on the actual vertical spacing of diaphragm seals (m)	Static pressure limit
-160 to 160 mBar	0.1 mH2O	≤ 1,7m	[1.6+(vertical spacing of sealsx94)]mH$_2$O	40 Bar
-0.5 - 0.5 Bar	0.5 mH2O	≤ 6m	[5+(vertical spacing of sealsx1.04)]mH$_2$O	40 Bar
-1.6 - 2 Bar	1.5 mH2O	≤ 15m	[20+(vertical spacing of sealsx1.04)]mH2O	40 Bar
-1.6 - 16 Bar	1Bar	≤ 15m	16Bar	40 Bar

The maximum vertical diaphragm seal spacing shown in the table applies to level measurement, ensuring that it is possible to set the zero point of the transmitter when the tank is empty.
For measurements of density or phase boundaries (e.g. sugar industry, chemical industry or refineries etc) the vertical spacing of the diaphragm seals may be larger.

5.3.3. PYRD... Permitted environmental conditions

Operating temperature range -25º to +85ºC

Operating temperature range for intrinsic-safe versions in accordance with Appendix Exi.ATEX or Appendix Exi.IECEx.

Operating temperature range for flameproof versions in accordance with Appendix Exd.ATEX.

.

Process temperature range -25º to +120ºC.
Thermal compensation range -25º to +80ºC
Relative humidity Max. 98% condensing

For transmitters fitted with diaphragm seals, please refer to the relevant diaphragm seal data sheets.

5.3.4. PYRD-2000ALW, PYRD-2000ALW/L, PYRD-2200ALW, PYRD-2200ALW/L, Performance parameters

Accuracy	± 0,075% (FSO) for the PYRD-2000ALW nominal range ± 0.01% (FSO) for the PYRD-2000ALW nominal range No. 44 ± 0.01% (FSO) for the PYRD-2200ALW
Long term stability	≤ accuracy / 3 years
Error due to supply voltage changes	± 0.002% (FSO)/1V
Thermal error	± 0.05% (FSO)/10ºC for range no's 08,11,14,19,23,42,45,47 ± 0.08% (FSO)/10ºC for range no 44
Thermal error for the whole thermal compensation range	± 0.3%(FSO)
Zero shift error for static pressure*	± 0.08% (FSO)/10Bar (for range no's 19, 45) ± 0.01% (FSO)/10Bar (for range no's 14, 08, 47) ± 0.03% (FSO)/10Bar (for range no's 23, 45, 42)
Cut-off on radical characteristic curve	up to 10% of flow.

**) zeroing in static pressure conditions with zero differential pressure eliminates this error.*

5.3.5. PYRD-2000ALW, PYRD-2000ALW/L, Pressure Connections

PYRD-2000ALW, PYRD-2000ALW/L – C-type connection to mount together with a valve manifold see Fig.10.
PYRD-2000ALW, PYRD-2000ALW/L with single direct diaphragm seal – as in the example (Fig.11) or with other diaphragm seals in accordance with the separate diaphragm seal literature.

5.3.6. PYRD-2200ALW, PYRD-2200ALW/L, Pressure Connections - diaphragm seals

see separate diaphragm seal literature.

5.4. PYRD–2000GALW, *Measurement ranges and performance parameters.*

5.4.1 PYRD–2000GALW Measurement ranges

N°	Nominal range (FSO)	Minimum set range	Overpressure limit	Static pressure limit
1	0 - 25 mBar (0 - 2500Pa)	1 mBar (100 Pa)	1 Bar	350 mBar
2	-2.5 to 2.5mBar (-250 to 250Pa)	0.2 mBar (20 Pa)	350 mBar	350 mBar
3	-7 to 7 mBar (-700 to 700Pa)	1 mBar (100 Pa)	350 mBar	350 mBar
4	-25 to 25 mBar (-2500 to 2500Pa)	5 mBar (500 Pa)	1 Bar	1 Bar
5	-100 to 100mBar (-10 to 10Pa)	20 mBar (2 kPa)	1 Bar	1 Bar

5.4.2. PYRD-2000GALW Permitted environmental conditions

Operating temperature range -30º to +85ºC

Operating temperature range for Intrinsically Safe versions in accordance with Appendix Exi.ATEX or Appendix Exi.IECEx.

Thermal compensation range -10º to +70ºC
Relative humidity Max. 98% condensing

5.4.3. PYRD–2000GALW. Performance parameters.

Nominal range	0 - 25 mBar	-2.5 to 2.5 mBar	-7 to 7 mBar	-25 to 25 mBar	-100 to 100 mBar
Accuracy	≤ ± 0.075 %	≤ ± 0.16 %	≤ ± 0.1 %	≤ ± 0.1 %	≤ ± 0.075 %
Thermal error	± 0.1 % (FSO)/ 10ºC, max ± 0.4 % (FSO) for the whole thermal compensation range				
Thermal compensation range	-10º to 70ºC				
Additional electronic damping	0 - 60 seconds				

5.4.4. PYRD–2000GALW Construction materials

M20x1.5/∅6x1 adapter	Brass
Valve manifold	1.4404 (316L) st steel
Valve manifold adapter	1.4404 (316L) st steel
¼ NPT connection	Brass, 1.4404 (316L) or galvanized St3S carbon steel

(Other materials as given in 5.1.2 for PYRD...)

5.4.5. PYRD–2000GALW Pressure Connections

- Connections to suit 6mm OD flexible (non metallic) tubing.
- Valve manifold adapter or ¼ NPT connection (see P. 8.3 and Fig.18).

5.5. PYRD–2000YALW - Measurement ranges and performance parameters.

5.5.1. PYRD–2000YALW Measurement ranges.

No.	1	2
Nominal range	0 to – 6000 mmH_2O	0 to – 1600 mmH_2O
Minimum set range	600 mmH_2O	160 mmH_2O
Static pressure limit	40 Bar	

5.5.2. PYRD–2000YALW Permitted environmental conditions

Operating conditions as in section 5.3.3 for PYRD…

5.5.3. PYRD–2000YALW Performance parameters.

Nominal range N°	1	2
Accuracy for nominal range	± 0.16 %	± 0.2 %
Accuracy for minimum range	± 0.5 %	± 0.6 %
Temperature error	0.4 % for temperatures -25º to +80ºC	
Zero shift error from static pressure *	0.08 % / 10 Bar	0.1 % / 10 Bar

** zeroing in static pressure conditions with zero differential pressure eliminates this error;*

Medium density range – up to 1.1 g/cm^3 – (standard version)
– over 1.1 g/cm^3 – (special version on supplied upon application)

5.6. PYRP–2000ALW/L…. Measurement ranges and performance parameters.

5.6.1. PYRP–2000ALW/L…level transmitter - Measurement ranges.

No.	1	2	3
Nominal range (FSO)	0...20m H_2O	0...10m H_2O	0...2,5m H_2O
Minimum set range	2m H_2O	1m H_2O	0,5m H_2O
Possibility of zero shift	0...18m H_2O	0...9m H_2O	0...2m H_2O
Overpressure limit	0...200m H_2O	0...100m H_2O	0...500m H_2O

5.6.2. PYRP–2000ALW/L…level transmitter - Permitted environmental conditions

Operating conditions as in section 5.2.2 for PYRP…

5.6.3. PYRP–2000ALW/L…level transmitter - Operational parameters.

Accuracy	± 0.16% (FSO) for the PYRP-2000ALW nominal range
Long term stability	≤ accuracy / 2 years
Error due to supply voltage changes	± 0.002% (FSO)/1V
Thermal error	± 0.1% (FSO)/10ºC

5.6.4. PYRP–2000ALW/L…. level transmitter - Pressure Connections

- SG-25 sensor;
- SG-25S sensor;
- SG-25C sensor;
- SG-25S-tytan sensor;
- SG-16 sensor.

5.6.5. PYRP–2000ALW/L…. pressure, level transmitter.

Pressure range	see P. 5.2.1
Metrological	see P. 5.2.3
Pressure connections	see P. 5.2.5

5.7. Common Environmental parameters

5.7.1. Electromagnetic Compatibility (EMC), Immunity

Criterion according to EN 61326-1.2

Electrostatic Discharge (ESD):
EN 61000-4-2
level 3,
contact ±6kV
air ±8kV
Criterion A

Conducted Radio Frequency:
EN 61000-4-6
0.15… 80MHz, 10V
Criterion A

Radiated Electromagnetic Field:
EN 61000-4-3
80… 2 000MHz – 10V/m
… 2 700MHz – 1V/m
Criterion A

Electrical Fast Transient (Burst):
EN 61000-4-4
± 1kV
Criterion A

Electrical Slow Transient (Surge):
EN 61000-4-5
± 1kV
Criterion B

5.7.2. Electromagnetic Compatibility, emission

Criterion according to CISPR16-1, CISPR 16-2, class B

Radiated Emission:
Distance from antenna: 3m
limits quasi-peak:
0.15 … 30MHz, 80-52dBµV/m;
30 … 2000MHz, <54dBµV/m
Conducted Emission:
limits quasi-peak:
0.01 - 0.150MHz, 96-50dBµV/m;
0.150 - 0.350MHz, 60-50dBµV/m;
0.35 - 30MHz, <50dBµV/m

5.7.3. Climatic Immunity

Temperature:
EN 60068-2-1, EN 60068-2-2
hot: T = 55ºC, RH = max 55%
cold: T = -25ºC,

Damp Heat Cycle:
EN 60068-2-30,
(T = 55°C, RH = min 95%, 24h)x2

Salt Mist:
5% NaCl, pH 6,5 … 7.2 at 20ºC
T = 40ºC, RH = min 93%, 28 days

5.7.4. Mechanical Immunity

Shocks:
EN 60068-2-27
50g/11ms

Sinusoidal Vibrations:
EN 60068-2-6, test Fc
do 1.6mm, 2 … 25Hz
do 4g for 25 …100Hz

5.7.5. Electrical Isolation

>100 MΩ @750V DC Ex
>100 MΩ @110V DC normal.

5.7.6. Insulation Strength

550V AC or 750V DC, 1min
Ex, marine
75VAC or 110V DC, 1min
normal

5.7.7. Enclosure Ingress Protection

EN 60529
IP 66 - Standard for Exia or non Ex.
(IP67 on request)
IP67 - Exd

6. CONSTRUCTION

6.1. Principle of measurement and Electronic system construction

The electrical signal from the sensor which is proportional to the pressure is sent to a digital analog input and converted to a digital signal. The digital signal is transmitted through an optoelectronic galvanic barrier to conditioning module. The main plate microcontroller reads measured values and using internal algorithms calculates the exact value of pressure and temperature. The calculated value of the process variable is displayed on the integrated LCD screen, which can be configured as needed. The digital value of the measured pressure signal is converted to an analogue 4 - 20 mA signal. A built-in modem BELL 202 and HART rev5.1 communication stack enables communication with the transmitter via a converter HART/RS232 attached to a PC and software, or via communicator. The electrical output of transmitter is equipped with a suppression filter and surge protective elements. The block circuit of the transmitter is shown at Fig 1. The transmitter has continual self diagnostics (checking sensor integrity and the accuracy of calculations), and in the event of an error or failure, an error message/number is displayed on the LCD display, and the alarm current is fed to the loop (upscale or downscale depending on configuration selected by the user). The sensor electronics is galvanically separated from the conditioning electronics which reduces susceptibility to interference and increased safety in Intrinsically Safe and Flameproof applications.

6.2. Transmitter enclosure/housing.

The transmitter enclosures are made of die-cast aluminium alloy or stainless steel and consist of a body and two screwed covers (display and electrical connection), one of which is equipped with a glass viewing window. The enclosure provides two holes on the cable entries with thread M20 x 1.5 or ½ NPT (the unused entry is sealed with an appropriate plug). Internally, the housing is made up of two chambers separated by an electrical culvert. Electrical earthing is provided by way of 2 x earth terminals i.e. 1 x internal and 1 x external.

6.3. Main electronics plate with display

The conditioning electronics with LCD display is housed within a polycarbonate case and is located in the larger internal chamber. The display can be rotated through 345° in 15° increments to ensure the read out can be easily viewed regardless of the mounting orientation of the transmitter (in case of the Exd transmitters rotation of the display is limited to 180°, in ±90° steps) (see Fig 4).
The protective devices and EMC filter is located the smaller 2nd chamber.

6.4 Measuring head

The measuring head is a measuring unit equipped with a silicon membrane sensor. The sensor is placed in a silicone oil-filled space enclosed, on one side of the culvert with the leads insulated in glass on the other side of the separating membrane which separates the sensor from the medium (**PYRD…** transmitters have a two separated membranes). Measuring heads are equipped with process connections as at Fig. 6a, 7a, 8a or other. **PYRD…** transmitters measuring head has two process connections type P or C connection (Fig. 10) for assembly to a manifold. The measuring head of **PYRD-2000GALW** is designed to measure low gas pressures which have an overpressure limit of 100kPa (or 35kPa). The standard light duty version of this transmitter is supplied with process connections to accept flexible (non metallic) Ø6x1mm tubing, and in heavy duty/industrial versions with a pressure block and adapters as Fig.18.

6.5. Diaphragm/Chemical Seals

For pressure measurement of viscous, chemically reactive or hot process mediums, the transmitter may be additionally fitted with various types of diaphragm seal.
The diaphragm seal transmits the process pressure via an inert fluid fill between the diaphragm of the seal and the diaphragm of the transmitter. When remote diaphragm seals are fitted, the pressure between the diaphragm seal and the transmitter is via a filled capillary. The seal's construction is dependent on the process medium properties and the application operating conditions.
The **PYRD-2000YALW** smart level probe is provided as standard with a diaphragm seal and flange to fixing on to a tank.

7. PLACE OF INSTALLATION

7.1. General recommendations

7.1.1. The smart pressure transmitter and differential pressure transmitter can be installed both indoors and outdoors.

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 damage to the transmitter thorough impact (which can result in extreme cases of the transmitter being separated from the connecting pipework thus permitting leakage of medium), appropriate means of protection should be applied for obvious safety reasons and to avoid the possibility of sparking caused during impact. If the transmitter cannot be suitably protected then an alternative mounting location should be sought.

7.1.4. Attention should also be paid to possible installation faults which may lead to measurement errors, such as loose connections, sediment blockage in lines which are too narrow, gas bubbles in a liquid line or liquid column in a gas line etc.

7.2. Low Ambient Temperature.

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

This is particularly pertinent in unheated installations where the climate can expose the instruments and associated pipework to near or below 0ºC temperatures.
Protection is obtained by filling the impulse lines with a mixture of ethylene glycol and water, or another liquid whose solidification point does not exceed the ambient temperature. Thermal insulation can protect the transmitter casing and lines only from brief exposure to low temperatures. Where the temperature is very low, the transmitter and impulse lines should be heated.

7.3. High Medium Temperature.

The transmitters may be used on process temperatures of up to 120ºC. Where process temperatures exceed this figure 120ºC, they should be connected via a suitable length of impulse piping to disperse the heat and to lower the temperature at the transmitter inlet.
Where it is not possible to use impulse piping then separation between the transmitter and heat source can be achieved by use of remote diaphragm seals (see separate seal product data or contact Pyropress)

Data as per Appendix Exi.ATEX or Appendix Exi.IECEx apply for the Ex version and Appendix Exd.ATEX apply for the Exd version.

7.4. Mechanical Vibration shocks. Corrosive Media.

7.4.1. Transmitters will function correctly when subjected to vibrations amplitude levels of up to 1.6 mm and acceleration up to 4g. If excessive vibration is present in pressure connecting pipework this can detrimentally affect the measuring performance, therefore to alleviate this eventuality flexible tubing (pressure permitting) should be used, or a remote diaphragm seal.

7.4.2. Transmitters with 316L stainless steel diaphragms should not be used where the medium is incompatible with that material. In that instance Hastelloy C276 diaphragm option should be adopted (provided this option is compatible with the process medium) or other means of protection applied such as diaphragm seals. (see separate data sheets for these items or contact Pyropress).

8. INSTALLATION AND MECHANICAL CONNECTIONS

These transmitters can be installed in any orientation/position.
When installed on or adjacent to equipment emitting high temperatures, it recommended that the transmitter is not mounted directly above the equipment thus in the convected hot air stream.
The transmitter should be mounted away from this upwardly convected heat either to the side or below.
For small measurement ranges, the reading can be affected by the transmitter position, and by the impulse lines configuration, or the way in which they are filled with liquid. This error can be corrected using the zero-setting function.

8.1. PYRP... (Pressure) - Installation and Connections

8.1.1. These transmitters can be mounted directly on to rigid impulse lines.
For used connections as in Figures 5a, 6a and 7a, it is recommended that connection sockets be used as shown in Figure 6b, 7b, 8b or 8c. It is recommended that sockets denoted “Socket GD” and “Socket GF” Fig. 9 are used for GD and GF connections, respectively.

Additionally there are adapters for standard DIN50, (DIN40, DIN25, Clamp2”, Clamp1.5”, Clamp1”) type connections provided for transmitters for aseptic conditions using transmitters with T (30mm x 2 connection).

There are gaskets provided for every transmitter with P, T, GD, GF and GC type connections.
The gasket material is selected based on the pressure value, temperature and the type of the process medium.
8.1.2. If the pressure is applied via a flexible plastic tube, the transmitter should be mounted on a support with Red Ø6-M reducer fitting. (See adapters under separate literature or contact Pyropress)
The types of the impulse tubes (Fig. 25) should be selected depending on the system pressures and the temperatures.

8.1.3. Tighten the transmitter in the socket with a torque suitable for the type of the gasket used and the pressure measured.

8.1.4. The transmitter can be installed using a universal mounting bracket “AL” which facilitates the mounting in any position on a wall, support or a horizontal or vertical pipe Ø35... Ø65 (Fig. 17).

8.2. PYRD... (Differential Pressure) - Installation and Connections

8.2.1. These transmitters can be mounted directly on rigid/metallic impulse lines.
To connect the non manifold/basic version of the transmitter having 2 x ¼” NPT female connections (i.e. “N2” connection) this can be carried out using ¼” NPT - OD pipe compression fittings and matching sized tubing.
If flexible tubing is used then the transmitter should be mounted on a secure structure such as pipework, wall, or bulkhead etc.

8.2.2. The **PYRD-2000ALW, PYRD-2000ALW/L** and **PYRD-2200ALW, PYRD-2200ALW/L** can be installed using the Ø25 Fastener (Fig.12) on an ø25 pipe or on a flat surface using the angle bracket.

8.2.3. The **PYRD-2000ALW, PYRD-2000ALW/L** with manifold flange connection block (i.e. “C” connection) (Fig.10) are designed for mounting on 3 or 5 valve manifold or to a 2” pipe or flat surface using the dedicated manifold mounting bracket/tray type “C-2” (Fig.13, Fig.14).

8.3. PYRD-2000GALW. Installation and Connections

8.3.1. The standard/light duty version of the PYRD-2000GALW transmitter can be mounted on a wall, panel or other secure structure via the mounting bracket (“FI 25”) (Fig. 18). The transmitter is fitted with connections which suit Ø6 x 1 flexible tubing.
These transmitters should be installed in a vertical orientation. Where there is a significant difference between the height at which the transmitter is mounted and the height of the measured pressure source, the reading may fluctuate depending on the temperature difference between the impulse lines. This effect can be reduced by ensuring that the impulse lines run side by side.

8.3.2. The **PYRD-2000GALW** transmitter in heavy duty/industrial form would be fitted with an adapter (Fig.18) creating a C-type manifold connection block, designed for installation on a 3 or 5 valve manifold.
Pyropress can also supply transmitters with these valves ready mounted.

8.4. PYRL-2000YALW…. Installation and Connections

The **PYRL-2000YALW** level probes are designed for level measurement within closed tanks with access via the top of the tank, see Fig.19 and 10.2.9. These level probes should be installed in a vertical position only.

8.5. PYRL-2000ALW/L…. Installation and Connections

PYRL-2000ALW/L…. level assemblies are designed for liquid level measurement of tanks, wells, reservoirs or other applications where a solid probe type level transmitter may not be suitable.
The transmitter sensor can either be suspended in the measured medium or lie on the bottom of the tank/vessel via the integral sealed, liquid tight cable which can be retained/secured to the top of the vessel using the accessory "SG" cable hanger, and can be terminated in a local junction box of the users supply or the "PP" junction box of Pyropress supply. When a particularly long cable is fitted (20M +) it is recommended the sensor and cable weight is suspended via a steel cable connected to the lug attached to the sensor. Should the sensor be immersed in a flowing liquid or be subject to turbulence, it should be located within a protective PVC or similar tube (not Pyropress supply).

⚠ When installating the type SG-25S sensor (Ø 60mm flush diaphragm for liquids containing contaminates or suspensions/solids) the diaphragm protector plate must be removed before insertion into the liquid.
During the installation process care should be taken to avoid mechanical shocks or impacts on the sensor.
When the cable option with the additional PTFE (Teflon) covering is used, it should be additionally suspended via a steel cable attached to the lug, i.e. stress should not be applied to the PTFE sleeve.

Transmitters with flange diaphragm seals are to be installed on the corresponding counter flanges on the facility.
It is recommended that the installer 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.
Screws complying with ISO 261 are to be used for flanges used in the **PYRP...** and **PYRD...** transmitters.

9. ELECTRICAL CONNECTION

9.1. General recommendations

9.1.1. It is recommended that twisted pair cabling be used for the signal lines. If the transmitter and signal line are subject to a high level of electromagnetic interference, then screened pair cables should be used.
The transmitter wires should not be run adjacent to power supply cables or near large electrically powered devices that may induce interference in the wiring.
Other equipment used with the transmitters in the scheme 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 transformers, power supplies used for the transmitters and apparatus used in conjunction with them.

9.1.2. Any moisture within the transmitter can obviously cause malfunction or failure.
When the sealing of the wires within the cable gland is ineffective (for example, when single wires are used) the orifice of the gland should be carefully sealed with a suitable sealing compound to obtain IP66 protection.

Additionally, prior to the entry of the cable into the gland it is recommended a loop in the cable is made to prevent condensation from running down the cable towards the gland.

9.2. Electrical connections

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Electrical connection options to the transmitters are as detailed in Fig. 2a – 2d.
A 240Ω resistor is permanently fitted in series in the transmitter's current circuit and is linked out via a jumper link across terminals (SIGNAL-) and (TEST-) as indicated in Fig.2a and 2b. When the resistance in the current loop is less than 240Ω the jumper link should be removed when using the HART communication method.

9.3. Protection from over voltage

9.3.1. The transmitters may be at risk of over voltage caused by connection faults or atmospheric electrical discharge.
Protection from over voltage between the wires of the transmission line is provided by TVS diodes installed in all types of transmitter (see the table, column 2).
9.3.2. In order to protect against over voltage between the transmission line and the casing or earth (not prevented by the diodes connected between the transmission wires), additional protection is provided in the form of plasma surge arresters (see the table, column 3).
Also external protective devices may be used. When the transmission lines are lengthy, it is advantageous to use one protective device near the transmitter (or inside it), and another near entry points to other devices used in conjunction with it.

Internal protection of transmitters:

1	2	3
Type of transmitter	Protection between wires (TVS diodes) – nominal voltage	Protection between wires and earth and/or casing – type of protection, nominal voltage
PYRP..., PYRD...	68V DC (39V DC for Exi version)	Plasma surge arresters - 230V DC (Not applicable to Exi version).

9.3.3. The voltage in the protective elements must not exceed the maximum permitted values given in columns 2 and 3 of the table. Protection via surge arresters are fitted to Intrinsically Safe (Exi) models and identified as such on the fitted information plate as "Version SA".

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The insulation test voltages (500V AC or 750V DC) given in 5.1.1 refer to transmitters plasma surge arresters – this protection is not used in Intrinsically Safe Exi certified transmitters.

9.4. Earthing

The transmitters are fitted with internal and external earth terminals.

10. SETTING AND REGULATION

The transmitters are factory calibrated to the range stated in the customers order or to the nominal range.
After installation, the transmitter's zero-point may move and require resetting.
This particularly applies on low measurement ranges, where the impulse lines are filled with a separating liquid or where remote diaphragm seals are fitted.

10.1. Transmitter Range Definitions

10.1.1. The maximum range of pressure, or differential pressure, which the transmitter can measure, is called the **"nominal range"** (for specifications of nominal ranges see section 5.2.1, 5.3.1, 5.3.2, 5.4.1, 5.5.1).
The span of the nominal range is described as the difference between the upper and lower limits.
The internal characteristic conversion curve for the nominal range is coded in the transmitter's memory.
This is the reference curve used when making any adjustments which affect the transmitter's output signal.

10.1.2. When the transmitter is in use the term **"set range"** is used. The set range is the range whose lower end point corresponds to an output current of 4mA and whose upper end point corresponds to a current of 20mA (or 20mA and 4mA respectively when the conversion curve is inverted).
The set range may cover the whole of the nominal range or only a part of it.
The width of the set range is the difference between its upper and lower end-points.
The transmitter may be set to any range within the nominal range of pressure values, subject to the restrictions set out in the table in section 5.2.1, 5.3.1, 5.3.2, 5.4.1, and 5.5.1.

10.2. Configuration and Calibration

10.2.1. The transmitter has features which enable measurement and identification parameters to be set and altered. The configurable parameters effecting the transmitter's output current include the following:

a) units of measurement which are expressed on the display;
b) upper end point of the set range;
c) lower end point of the set range;
d) time constant;
e) type of characteristic curve: linear or radical.

The following parameters cannot be altered:

f) upper limit of the nominal range;
g) lower limit of the nominal range;
h) minimum range.

10.2.2. Other identification parameters, not affecting the output signal, include: device address, device type code, factory identification code, factory device code, number of preambles (3-20), UCS, TSD, program version, electronics version, flags, serial number, label tag, description tag, date tag, message, record number and sensing module number.
The process of setting the above parameters is referred to **"Configuration".**

10.2.3. The transmitter can have the zero reset when under pressurise by following the **"pressure zeroing"** procedure. This may be necessary to compensate for zero shift due to a change in position during the transmitter installation.
The transmitter may also be **calibrated**, by taking readings with the input pressure controlled using a standard device. These process and zero-point adjustments are called **"Calibration".**

10.2.4. Configuration and Calibration of the transmitter can be carried out using via HART local hand held communicators or a PC with HART/RS232 converter and HART software (or the transmitter dedicated 'Raport 2' software).
Together with the "Raport 2" configuration software there is "INTERVAL LINEARIZATION" software supplied to enable the input of 21 point nonlinear functional characteristics to the transmitter.

10.2.5. TRANSMITTER CONFIGURATION WITH USING ITS BUTTONS AND LOCAL MENU

10.2.5.1. Local menu - structure. Local configuration of transmitters.

When the buttons below the display on the transmitter are activated (i.e. not locked) they are available to carry out setting changes.. Access to the buttons is obtained by unscrewing the side cover. At that time it is also possible to change the display position (see fig 4).
To enter change local settings mode, press and hold any of the three buttons for a minimum of 4s. If after doing this error message ERR_L16 is displayed then local configuration of the transmitter is switched off. To unlock and permit local configuration a local HART communicator or remote communication from a PC and HART software would be required (see –> HART command 132, 133).

The navigation buttons are designated with symbols: [↑] [↓] [◙]

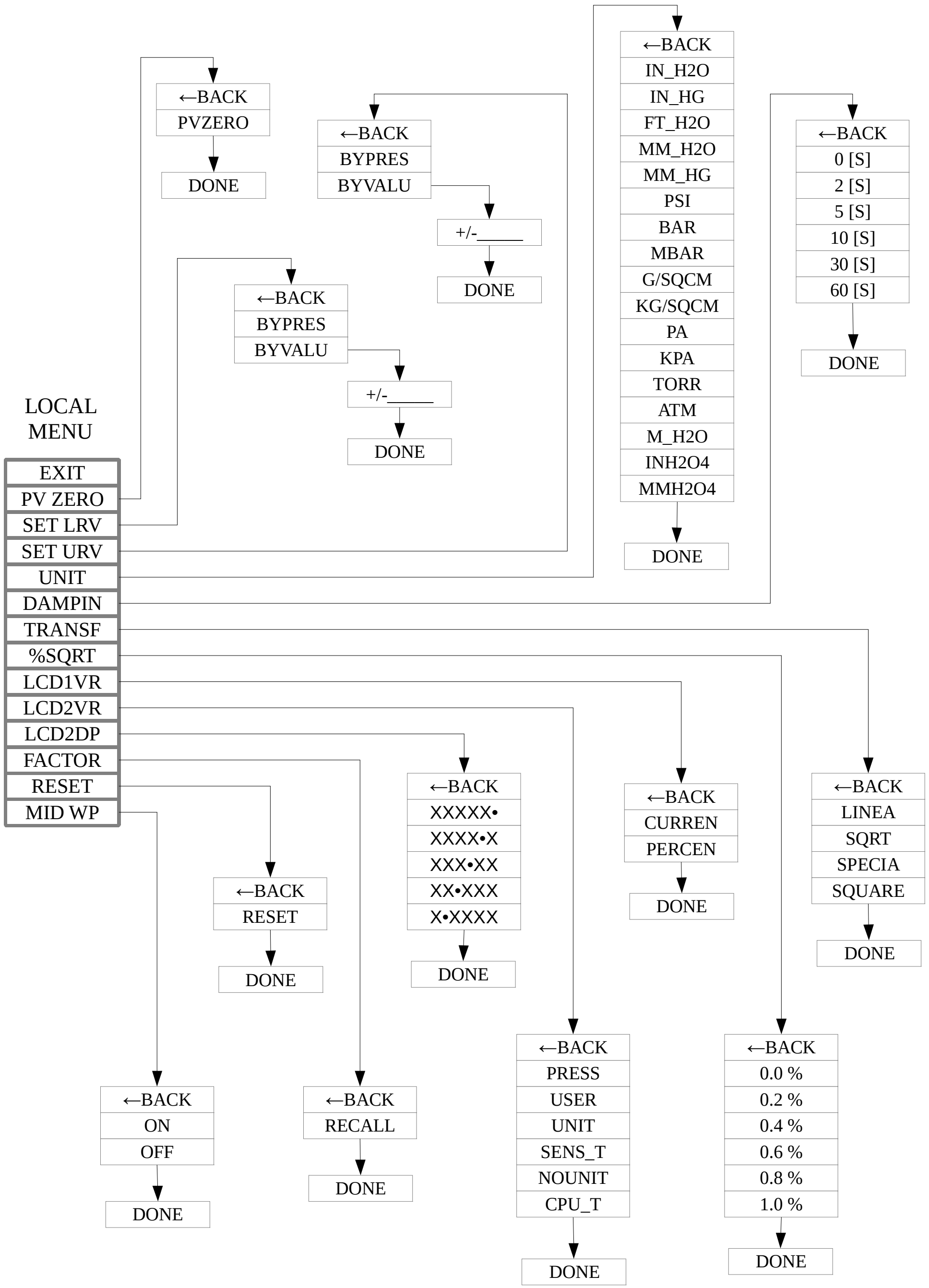
After pressing any of the buttons for 4 seconds **"EXIT"** will appear on the display.

Confirming this by holding button [◙] for 1 sec will leave the local change MENU. By not confirming i.e. taking no action, then navigation within the MENU to facilitate parameter changes is accessed.

Pressing button [↑] moves up in tree's structure MENU
Pressing button [↓] moves down in tree's structure MENU
Pressing [◙] confirms the change.

If there is no user activity within the menu for more than 2 minutes then the transmitter will automatically exit from the menu and reset the display of the process variable.

The method of navigation through the commands in the menu structure is detailed on the following pages.


LOCAL MENU
EXIT
PV ZERO
SET LRV
SET URV
UNIT
DAMPIN
TRANSF
%SQRT
LCD1VR
LCD2VR
LCD2DP
FACTOR
RESET
MID WP
←BACK
PVZERO
DONE
←BACK
BYPRES
BYVALU
+/-______
DONE
←BACK
BYPRES
BYVALU
+/-______
DONE
←BACK
IN_H2O
IN_HG
FT_H2O
MM_H2O
MM_HG
PSI
BAR
MBAR
G/SQCM
KG/SQCM
PA
KPA
TORR
ATM
M_H2O
INH2O4
MMH2O4
DONE
←BACK
0 [S]
2 [S]
5 [S]
10 [S]
30 [S]
60 [S]
DONE
←BACK
LINEA
SQRT
SPECIA
SQUARE
DONE
←BACK
0.0 %
0.2 %
0.4 %
0.6 %
0.8 %
1.0 %
DONE
←BACK
CURREN
PERCEN
DONE
←BACK
PRESS
USER
UNIT
SENS_T
NOUNIT
CPU_T
DONE
←BACK
XXXXX•
XXXX•X
XXX•XX
XX•XXX
X•XXXX
DONE
←BACK
RECALL
DONE
←BACK
RESET
DONE
←BACK
ON
OFF
DONE

Select the desired pressure units by using the [↓] or [↑] buttons and confirm by pressing the [◙] key.
After confirmation the transmitter will display "DONE" or report an error number. Seelcting "← BACK" will move back up one level in the menu.

Descriptions:

Local Menu	Submenu	Notice
EXIT		Exits the local Menu back to transmitter normal operation
PVZERO		pressure zeroing
SETLRV		setting the lower end of the set range, and confirmed with the [◙] button - (no change of span)
	BYPRES	setting by inputting of pressure
	BYVALU	setting by inputting of value
	+/-______	select and confirm required +/- sign, then input in sequence, digit after digit, 5 digital numbers with point or without decimal point. After pressuring the confirmation button "DONE" will be displayed (or an error number). The parameter will be displayed as "UNIT".
SETURV		setting the upper end of the set range, and confirm with the [◙] button.
UNIT		menu process variable units
	IN_H2O	inches of water at a temperature of 20ºC
	IN_HG	inches of mercury at a temperature of 20ºC
	FT_H2O	foot of water a temperature of 20ºC
	MM_H2O	mm of water at a temperature of 20ºC
	MM_HG	mm of mercury at 0ºC
	MBAR	millibar
	G/SQCM	grams per square centimetres
	KG/SQCM	kilogram per square centimetres, ('technical atmosphere')
	KPA	kilopascal
	TORR	tor (mm Hg)
	ATM	physical atmosphere
	M_H2O	meter of water at 4ºC
	MPA	Megapascal
	INH2O4	inch of water at a temperature of 4ºC
	MMH2O4	mm of water at 4ºC
DAMPIN		setting of the damping of the process variable
TRANSF		setting of the current output mathematical form
	LINEAR	linear
	SQRT	square root
	SPECIA	user's special
	SQUARE	square
%SQRT		square root characteristic cut-of point setting
LCD1VR		assigning a process variable to LCD1
	CURREN	LCD1 will display measured process in mA in current loop
	PERCEN	LCD1 will display measured process in %
LCD2VR		assigning a process variable to LCD2
	PRESS	LCD2 will display the pressure value in units
	USER	LCD2 will display the user's units. Setting of the user range and record of the user units can be made using a PC or HART communicator, see → HART command No. 244.245.
	UNIT	LCD2 will display the measured process in default unit/user's unit alternately with process variable will displayed on LCD2
	SENS_T	LCD2 will display the temperature at the pressure sensor in ºC
	NOUNIT	LCD2 will not display the default unit/user's chosen unit alternately with process variable.
	CPU_T	LCD2 will display the current temperature of the transmitter CPU in ºC
LCD2DP		setting the decimal point position on LCD2. In an instance where the value cannot be displayed correctly due to the position of the decimal point, this is indicated by four flashing dots • • • • •. To rectify this you

		must enter to the local menu setting and move the decimal point as required to the right.
FACTOR		resets to factory default settings (removes current and pressure calibrations)
RESET		reboots the transmitter
MID_WP *		blocking records / change the parameters associated with transmitter metrology
	ON	switch on blocking
	OFF	switch of blocking

*) *for transmitters since 2011.*

10.2.5.2. Local Menu, error reports.

During configuration changes via the Local Menu, LCD2 options will be displayed on the screen.
The error display initiates in the event of an entered unrecognised command in the Local Menu.
The definitions of the error codes are detailed below:

ERR_L07 [in_write_protected_mode]. Error will occur when an attempt is made to change setting in Local Menu, but the transmitter is protected.. To implement changes of settings via the Local Menu, the transmitter must have Local Menu Service switched on as well as Protection Before Record switched off. This can be carried out with a local hand held communicator, or via a PC with EDDL program library or “RAPORT 2” software

- default setting:
  Local Menu Service switched on
  Protection Before Record switched off

ERR_L09 [applied_process_too_high]. Will be displayed when the inputted pressure parameter exceeds the admissable value. Zeroing or range setting verification is necessary.

ERR_L10 [applied_process_too_low]. Will be displayed when the inputted pressure parameter is under the admissable value. Zeroing or range setting verification is necessary.

ERR_L14 [span_too_small]. Will be displayed when inputted set range span is smaller than the minimum set range as stated in the range tables 5.2.1, 5.3.1, 5.3.2 and 5.4.1.

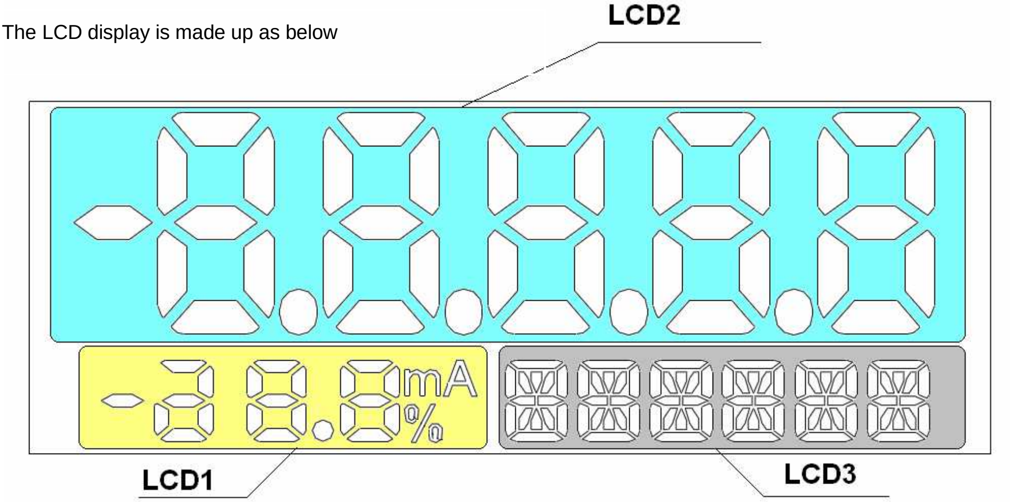
ERR_L16 [access_restricted]. Error will occur when the Local Menu Service is switched off, and the user tries to access the menu. This can be carried out with a local hand held communicator, or via a PC with EDDL program library or “RAPORT 2” software.
NOTE! ‘ERR_L16’ will also displayed by attempting to zero an absolute transmitter .

WNG_L14 [WARNING!, new Lower Range Value Pushed !] Error will be displayed when a change to the upper range setting (URV) causes a change of the lower range setting (LRV).

10.2.6. View local LCD display

Changes of the display options in the local MENU are possible using the transmitter buttons, remotely via a HART communicator or with a PC and appropriate software. If required, the display can be also be disabled via the HART communicator or with a PC (not via the local buttons).

The LCD display is made up as below



There 3 main displays are visible:

- **LCD1** – the current or percentage of range display as configured by the user.
- **LCD2** – the measured pressure digital value; the calibrated pressure value in units configured by the user; the MENU options and other information or error numbers. When the digital pressure value or calibrated pressure value display option is selected, the sign "–" will be displayed before the value. The decimal point position can be set by the user in local MENU or remotely. The selected pressure unit or user's unit would be displayed. The transmitter maybe rescaled to the users individual range requirements. This is carried out using a communicator or PC software to write the corresponding lower and upper values of range, and to write the unit name. After activating the user mode the rescale value will be visible on display.
- **LCD3** – information display. During normal operation it is designed for continuous display of the configured units or the user units. In the event of an error in the transmitter's operation, it displays an error number. In local manual mode the display shows setting options. It also displays errors related to the implementation of commands in the local menu.
- **Display backlighting** – The local display is equipped with a backlight, enabled by a jumper on the electronic board as shown in Figure 5 (only for transmitters in Exd versions).

The display can be rotated, how to do this is detailed in Figure 4 and Figure 4a for Exd versions.

Warning!

Exceeding the basic transmitter measuring range by over 50% either above or below the configured range is indicated by " o V E r " or " u n d E r " on the LCD2 display. Such situation is encountered most often on an overloaded differential pressure transmitter caused by a high static pressure when compared to the differential pressure range with a blockage or a leak in one of the sides (LP or HP).

After configuration it is important to protect the transmitter using command HART [247]. This prevents accidental or intentional changes to the transmitter while in operation. The protection function is accessible with a KAP-03 communicator, "Raport's" software, or DD/DMT program libraries.

10.2.7. Remote configuration

Remote configuration is possible with HART communicator or PC and software. The measuring circuit should be made in accordance with the Fig's 2a, 2b or 2c.

10.2.8. Configuration of the PYRD-2200ALW transmitters to measure the level, density of liquid and phase boundary

To simplify the mathematical operations we introduce the density coefficient of the medium Xρ.

$$X\rho = \frac{\rho_{medium}\ [g/cm^3]}{\rho_{water\ at\ 4^oC}\ [g/cm^3]}$$

Since the density of water at 4ºC is 1g/cm^3, the **density coefficient Xρ is numerically equal to the density of the medium expressed in g/cm^3**. To determine the hydrostatic pressure of a column of liquid in mm H_2O, it is sufficient to multiply the height of column [mm] by the density coefficient of the liquid Xρ. Since it is easy to determine the hydrostatic pressure in mm H_2O and the transmitter can be configured those units, in the descriptions of measurement methods given below we will make use of pressures expressed in mm H_2O and the density coefficient Xρ.

Configuration of the PYRD-2200ALW transmitter to measure the level of liquid in a tank

The measurement task:

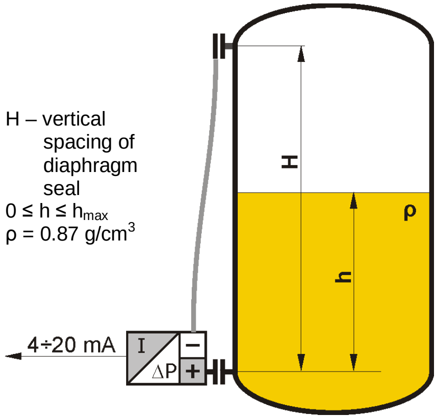
To convert a variation in the level of liquid with density ρ=0.87 g/cm^3 between 0 and h_{max} to the variation in the output signal from 4 to 20 mA.

1. Install the transmitter in its working position on an empty tank.
2. Make the electrical connections of the transmitter, providing for the ability to use HART communication.
3. Connect HART communicator, identify the transmitter and select the "configuration" function.
4. On the configuration menu select the "Reranging" procedure.
5. On the "Reranging" menu:
   a. Change the units of measurement to mm H_2O at 4ºC;
   b. Enter the values for the start (Xρ $\times h_{min}$ [mm]) and end (Xρ $\times h_{max}$ [mm]) of the measurement range, namely 0 and (0.87 h_{max} [mm]) respectively;
   c. To compensate for the hydrostatic pressure of the manometric fluid, the start of the measurement range should be set using regulated pressure; when subject to the action of only the manometric fluid (empty tank) the transmitter will shift the start and end-points of the range, compensating for the value of that pressure.

H – vertical spacing of diaphragm seal

$0 \leq h \leq h_{max}$

ρ = 0.87 g/cm^3



When the transmitter has been configured in this way it is ready to be used to carry out the given measurement task.

If it is not possible to empty the tank to configure the transmitter, the hydrostatic pressure of the manometric fluid should be calculated by multiplying the vertical spacing of the diaphragm seals by the density coefficient of the oil in the capillaries. The pressure should be taken into account when entering the values for the start and end of the range:

Start [mm H_2O] = -H [mm]$\times X\rho_{oil}$

End [mm H_2O] = h_{max} [mm] $\times X\rho_{measurement\ liquid}$ – H [mm] $\times X\rho_{oil}$

ρ_{oil} for DC-550 oil is equal to 1.068 g/cm^3

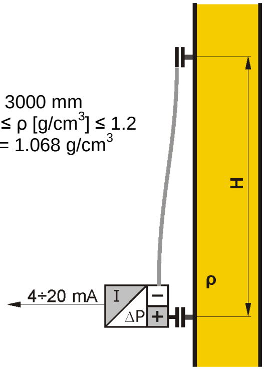
ρ_{oil} for AK-20 oil is equal to 0.945 g/cm^3

Configuration of the PYRD-2200ALW transmitter to measure density of liquid

The measurement task:

To convert a variation in liquid density from ρ_{min} = 0.6 g/cm^3 to ρ_{max} = 1.2 g/cm^3 to a variation in the output signal from 4 to 20 mA, with the vertical spacing of the diaphragm seals equal to H = 3000 mm. The sealing system is filled with DC-550 oil with density ρ_{oil} = 1.068 g/cm^3.

1. Calculate the value of the start of the range as follows: $H_{[mm]} \times (X\rho_{min} - X\rho_{oil}) = 3000 \times (0.6 - 1.068) = -1404$ [mm H_2O]
2. Calculate the value of the end of the range as follows: $H_{[mm]} \times (X\rho_{max} - X\rho_{oil}) = 3000 \times (1.2 - 1.068) = 396$ [mm H_2O]
3. Set the zero point of the transmitter with the diaphragm seals positioned at same level.
4. Install the transmitter in its working position.
5. Make the electrical connections to the transmitter.
6. Connect the HART communicator, identify the transmitter and select the "configuration" function.
7. On the configuration menu select "Reranging" procedure.
8. On the "Reranging" menu:
   a. Change the measurement unit to mm H_2O at 4ºC;
   b. Enter the calculated values for the start (-1404) and end (396) of the range.



When the transmitter has been configured in this way it is ready to be used to carry out given measurement task.

Note: If it is possible to fill the space between the seals with liquid whose density corresponds to the start of the measurement range, the start of the range of the transmitter can be set using regulated pressure.

Measurement of phase boundary

The height of the phase boundary of liquids of different densities is determined by measuring the average density of the medium between the seals.

Example:

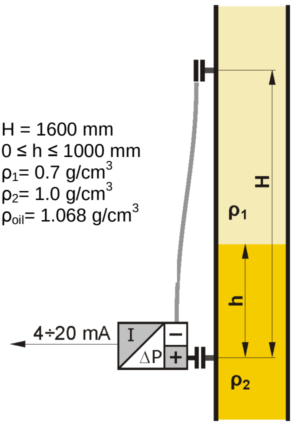
Calculate the measurement range start and end points for an PYRD-2200 transmitter configured to measure phase boundary height in the range 0-1000 mm between liquids of density ρ_1 = 0.7 g/cm^3 and ρ_2 = 1.0 g/cm^3, where the vertical spacing of the seals H = 1600 mm. The sealing system uses DC-550 oil with a density of 1.068 g/cm^3.

To determine the start of the measurement range, calculate the pressure difference at the transmitter when the tank is filled with the lighter liquid only:

1600 [mm]$\times$(0.7 – 1.068) = -588.8 [mm H_2O]

To determine the end-point of the range, add the increase in pressure resulting from the appearance of a 1 meter column of the heavier liquid:

-588.8 [mm H_2O] + (1.0 – 0.7)$\times$1000 [mm] = -288.8 [mm H_2O]



Additional remarks

The settings of the transmitter can be adjusted with reference to laboratory results from density measurements carried out on samples of the liquid being measured. This is most often necessary when the measurement takes place in a pipeline segment where the flow velocity of the measured liquid reaches several m/s.

Increasing the vertical spacing of the diaphragm seals widens the range and often improves measurement accuracy.

In planning the spacing of the diaphragm seals, ensure that the pressure difference at the transmitter lies within the basic range.

The maximum vertical spacing of the diaphragm seals (H) depends on the transmitter's basic range and the boundary values for the density of the measured liquid (ρ_{min}; ρ_{max}).

If $\rho_{min} < \rho_{oil} < \rho_{max}$, the seal spacing H should satisfy the following connections:

$$H\,[mm] \leq \frac{\text{lower boundary of range [mm } H_2O]}{X\rho_{min} - X\rho_{oil}}$$

$$H\,[mm] \leq \frac{\text{upper boundary of range [mm } H_2O]}{X\rho_{max} - X\rho_{oil}}$$

Example:

Determine the maximum vertical spacing of the seals for the PYRD-2200 / -10…10 kPa transmitter when measuring the density of liquid between 0.6 and 1.2 g/cm^3. The sealing system uses AK-20 silicone oil with a density of 0.945 g/cm^3.

The lower boundary of the range of the transmitter is: -10 kPa = -1020 mm H_2O

$$H\,[mm] \leq \frac{-1020}{0,6 - 0,945} \Rightarrow H\,[mm] \leq \frac{-1020}{-0,345} \Rightarrow$$

$$H\,[mm] \leq 2957$$

The upper boundary of the range of the transmitter is: +10 kPa = 1020 mm H_2O

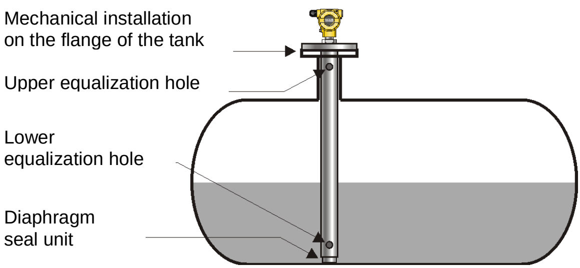
$$H\,[mm] \leq \frac{1020}{1,2 - 0,945} \Rightarrow H\,[mm] \leq \frac{1020}{0,255} \Rightarrow$$

$$H\,[mm] \leq 4000$$

In the example, both conditions are satisfied when the spacing of the seals is not more than 2957 mm.

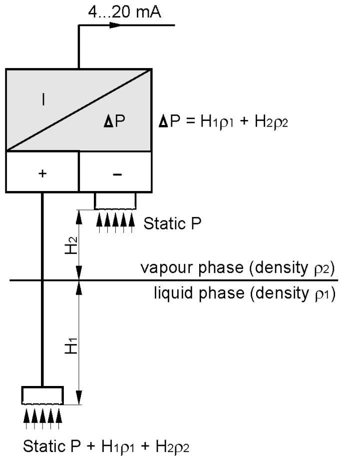
10.2.9. Configuration of the PYRD-2000YALW smart level probes

Measurement is carried out using a PYRD-2000 differential pressure transmitter, enabling compensation for static pressure in the tank. The value processed is just the hydrostatic pressure of the medium measured at the level of diaphragm of the lower seal. This pressure is the sum of the hydrostatic pressures of the liquid and vapour phases of the medium. In most practical measurement situations the density of the vapour phase is negligibly small, and therefore the measured hydrostatic pressure relates only to the height of the liquid phase column and can be taken as representing the level of the surface of the liquid phase. For media where the density of the vapour phase is significant (e.g. propane) the level found by the method described can be treated as the theoretical level of the liquid level obtained by adding the actual liquid phase to the condensed vapour phase.



Configuration example:

To convert a rise in the level of liquid with density 0.87 from 0 to 3200 mm to a current change from 4 to 20 mA.



1. Install the transmitter in working position, place the seal at the appropriate height (tank empty).
2. Calculate the width of the measurement range in mm H_2O (4ºC): 3200 mm×0.87 g/cm^3 = 2784 mm H_2O.
3. Using the communicator, set the transmitter to use the units mm H_2O at 4ºC.
4. To determine the start of the measurement range, read off via communicator the hydrostatic pressure produced by the manometric fluid in the capillary (e.g. -4250 mm H_2O).
5. To determine the end-point of the measurement range, add the value -4250 mm H_2O and the width of the measurement range -4250 mm H_2O + 2784 mm H_2O = -1466 mm H_2O.
6. Using the communicator enter the calculated start (-4250 mm H_2O) and end-point (-1466 mm H_2O) of the measurement range and send as a block to the transmitter. After receiving these parameters the transmitter will perform measurements as required.

10.2.10. Configuration of the PYRD-2000ALW transmitters for the flow measurement across an orifice.

Orifice flow meters are based on the square root output signal from the differential pressure transmitters.
To archive this function you should:

- Install the PYRD-2000 ALW transmitter for flow measurement across the orifice plate;
- Zero the transmitter either via the local buttons as P10.2.5 or remotely using a PC and HART configuration software.
- Set the square root output function transmitter signal and the cutoff point [in % FS either via the local buttons (up to 1% only) as P 10.2.5 or remotely using a PC and HART configuration software.
- For transmitters with software from 1.9 version, the cutoff point setting means, that, when the pressure is increasing from 0 to set cutoff point (n%FS), the output signal is zero (4mA), but in the setting cutoff point and above the transmitter output signal passes to the square root output for the current transmitter output, and to the linear output for the HART transmitter output. If the pressure on orifice falls below the n%FS setting minus 0.2% (hysteresis), the output signal will revert to zero (4mA). The cutoff operation algorithm on the analog output signal example is shown below.

Description:

I [mA] – analog output signal; loop current [4-20 mA] or A [%];
n% - cutoff point at square root output transmitter signal;
PV or Z [%] - axis of the process variable in user unit or in percent of the set range;
LRV – Lower Range Value; the lower value of the pressure set range (corresponds to the 4 mA current output signal);
URV – Upper Range Value; the upper value of the pressure set range (corresponds to the 20 mA current output signal).

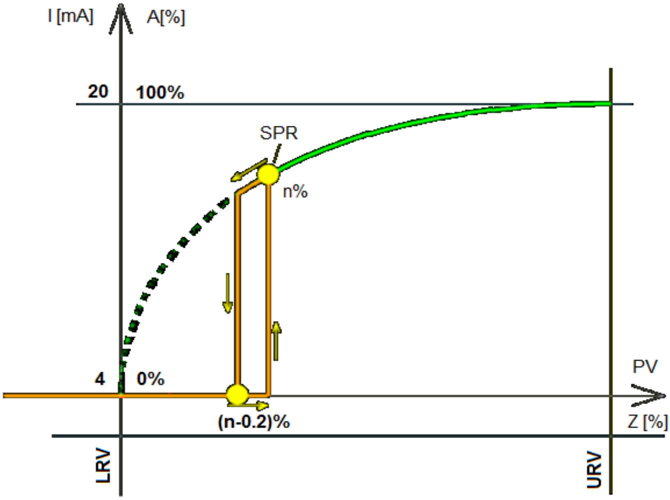


Fig. PYRD-2000ALW transmitter analog output signal with setting cutoff point in n%.

The device configuration example:
Transmitter configuration parameters

- Nominal range 0 - 100 kPa
- Set range 0 - 50 kPa
- Cutoff 5% of the set range

Assemble the measuring system in accordance with Fig 2 and run user's HART config. software or Raport 2 according to IO.RAPORT2:

- Set the zero of the transmitter – tab page: Basic Commands → Zeroing;
- Set the width of the set range the transmitter to a value of 0 - 50 kPa - tab page: Common Parameters → Lower Range Value and Upper Range Value
- Set the square root output signal of transmitter – tab page: Common Parameters → Transfer Function;
- Enter 5 in the parameter area inflection point – tab page: Common Parameters → Start point rad;
- Save the data to the transmitter (button: Write Parameters).

The cutoff function will be implemented at 5% of set range with pressure increase and to 4.8% of set range with a pressure decrease

10.3. Alarms.

Alarm indication is provided via a low (downscale) or high (upscale) mA signal into the current loop in the event of the transmitter exceeding limits of correct operation or the non-functioning of some of its components. The menu contains the following alarms: HART modem error, ADC error (error of A /D converter), EEPROM error, error of the oscillator, DS33 error (checks the accuracy of floating point calculations). These errors are indicated to the system by creating in the transmitter output alarm current line: 22mA (high alarm) or 3.6mA (low alarm), and signalling an error code on the display. The alarm current of 3.6 (low) or 22mA (high) can be set using the HART configuration software, or the preferred alarm mode and mA output level should be stated at the transmitter ordering stage. Exceeding of the nominal pressure range of over 50% is indicated on the transmitter display by code E0256 and pre-determined alarm current in the measuring line; exceeding of the measuring ranges in MID pressure transmitters is described in MID Appendix.

11. INSPECTIONS AND SPARE PARTS.

11.1. Periodic service

Periodic inspections should be made in accordance with the regulations to which the installation 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, cable glands, and the diaphragm seals should be checked for deterioration and corrosion.
Check the characteristic conversion curve by following the procedures for “Calibration” and, where appropriate, “Configuration”.

11.2. Other services

If the transmitters are installed in a location where they may be exposed to mechanical damage, over pressure, hydraulic impulses or over voltage, or where the diaphragm may be susceptible to sedimentation, crystallisation or erosion, inspections should be carried out as required.
Where it is discovered that there is no output signal or is reading incorrectly, a check of the electrical connections and wiring should be made.
Check whether the values of the supply voltage and load resistance are correct.
If a communicator is connected to the power supply line of the transmitter, a fault in the line may be indicated by the message “No response” or “Check connection”.
If the circuit is in order, check the operation of the transmitter.

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.

11.3.2. A transmitter malfunction can also be caused by overloading, e.g. for reasons of:

- Over pressure;
- Freezing or solidification of the medium;
- Impact of a hard object, such as a screwdriver, on the diaphragm.

Usually in such cases this is indicated by the transmitter output current falling below 4mA or rising above 20mA, and failing to respond to the input pressure (depending on how the alarm function was set).

11.4. Spare parts.

Parts of the transmitter which may be subject to wear or damage and require replacement: cover gasket.

Other listed parts, due to the specific features and requirements of explosion-protected devices, may be replaced only by the manufacturer or by a firm authorized by the manufacturer.

12. PACKING, STORAGE AND TRANSPORT.

The transmitters should be packed in such a way as to protect them from damage during transportation and secured so as to prevent them from moving.
The transmitters should be stored under cover, in a place free of vapours and corrosive substances, with temperature and humidity not exceed the limits specified in P. 5.2.2 for PYRP… or P. 5.3.3 and 5.4.2 for PYRD….
Transmitters with uncovered diaphragm or seal connectors, stored without packaging, should have protective 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. GUARANTEE.

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. SCRAPPING, DISPOSAL.

Waste or damaged transmitters should be dismantled and disposed of in accordance with Directive (2002/96/EC) on waste electrical and electronic equipment (WEEE) or returned to the manufacturer.

15. ADDITIONAL INFORMATION.

The manufacturer reserves the right to make constructional and technological changes which do not negatively impact the quality or performance of the transmitters.

15.1. Related documents.

- IO.KAP-03.02 – Communicator User's Manual.
- IO.RAPORT 2 – "Raport 2" software and HART/RS232 converter User's Manual.
- DTR.HB.01 – HART/USB/Bluetooth converter User's Manual.
- „INTERVAL LINEARIZATION" software.

16. FIGURES.

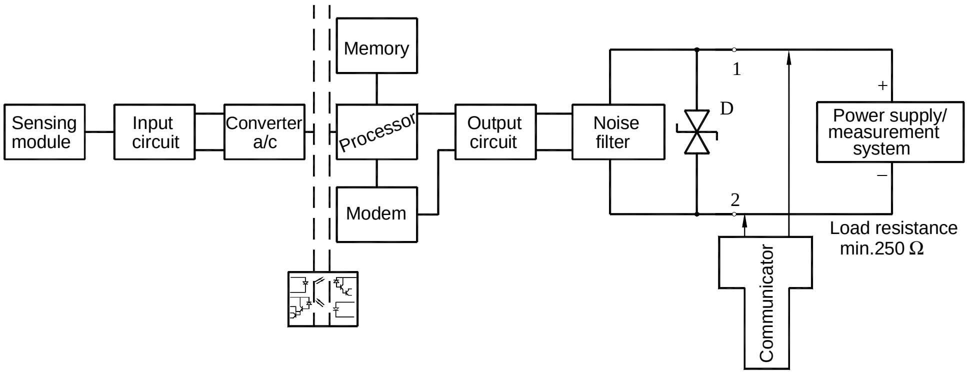


Fig. 1. Transmitter – block diagram.

Communicator or converter/PC electrical connections to transmitter measuring lines.

When communicating with the transmitter the resistance in the measuring loop must be at least 250Ω.
A resistor is supplied fitted to the transmitter should the circuit not ordinarily exceed this value. The resistor is taken out of circuit via a jumper link which can be removed when the resistor is required to be in circuit. The communicator or PC connection methods are detailed in the below diagrams. Whilst ensuring the minimum impedance is present in the loop, it must be ensured that sufficient voltage is maintained to power the loop. **(see P.5.1.1)**

Connection method to the transmitter

Connect as shown in Fig. 2a. If it is necessary to enable communication with the transmitter, a communicator or converter/PC can also be connected.
Optional connection configurations to communication devices are shown below.

Communicator or converter/PC connections at a local control cabinet

To enable communication with a transmitter at a distant location via connections at local control cabinet or similar, make sure that the resistance Ro from the point of connection of the communicator to the power supply source lies within the range of 250-1100 Ω. If necessary an additional resistance can be integrated into the line. Connect the communicator or converter/PC as shown in Fig. 2a.

Fig. 2. Transmitter Electrical Connection Methodology

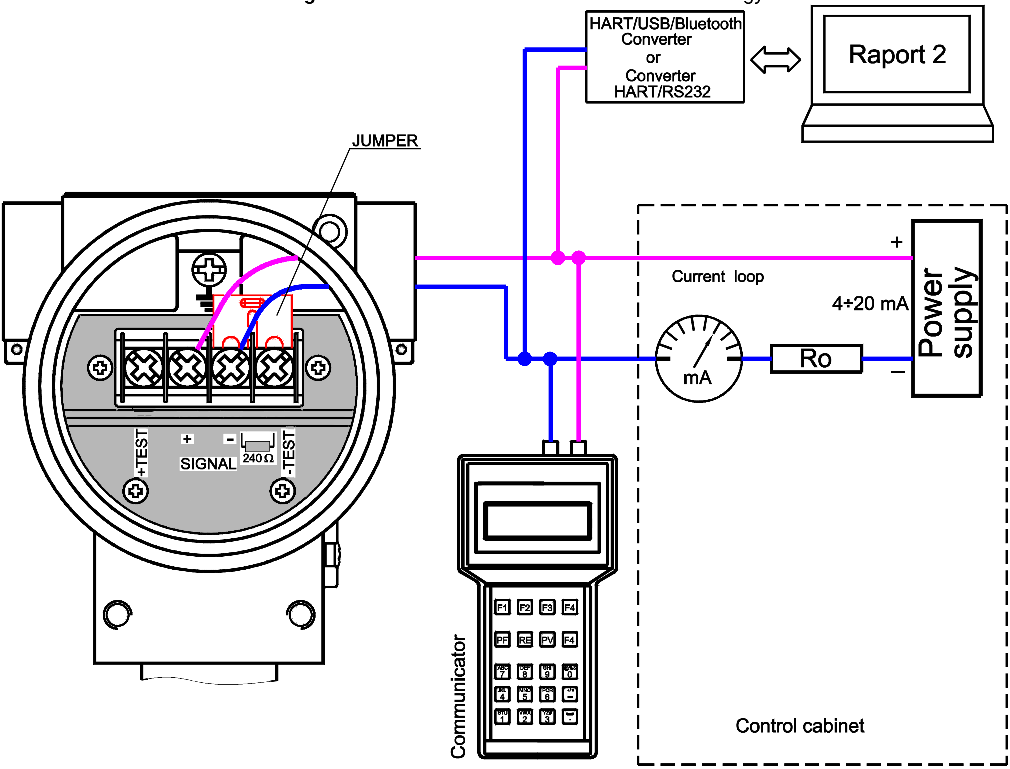


Fig.2a. Connecting a transmitter and communicator or PC to the current loop from connections within a remote control cabinet (when the resistance in the current loop **is greater than 250Ω).**

Communicator or converter/PC connection local to the transmitter's terminals

To enable local communication by connecting a communicator or converter/PC to the transmitter's terminals, ensure the resistance Ro between the transmitter's and the power supply is between 250-1100 Ω. If so, connect the communicator or converter/PC to the terminals (SIGNAL +) (SIGNAL -) as shown in Fig. 2b.

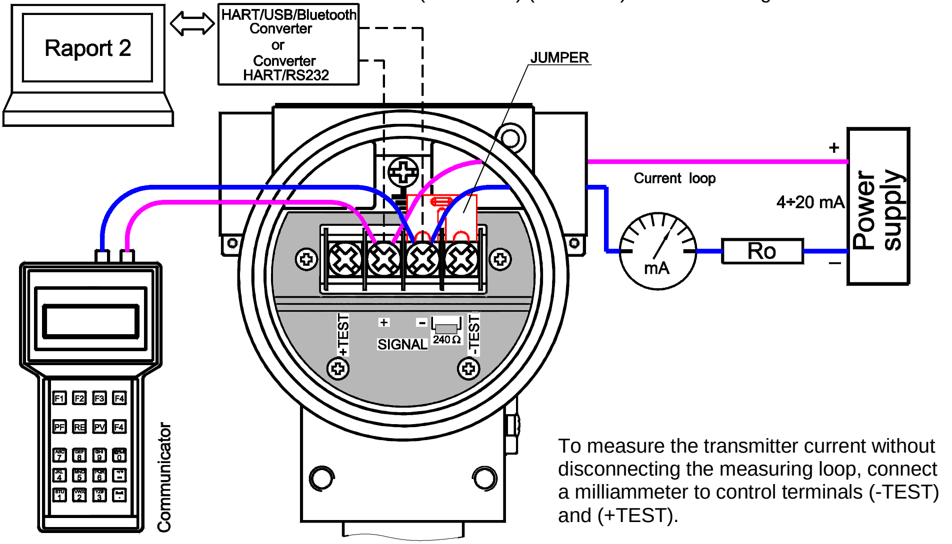


Fig.2b. Local connection of communicator or PC to the transmitter terminals (SIGNAL+) and (SIGNAL-) (when resistance in the current loop **is greater than 250Ω**).

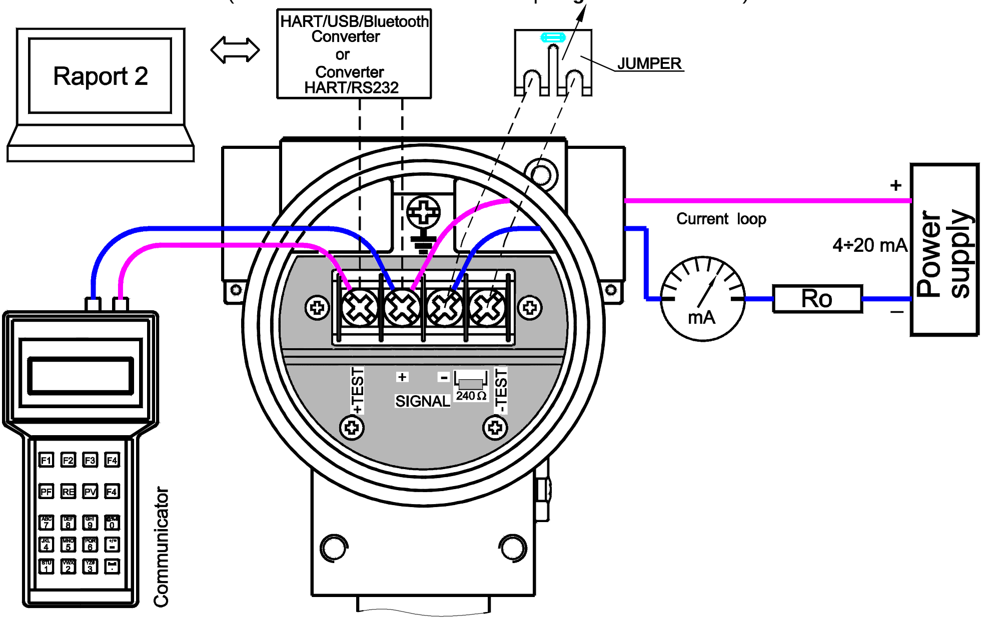


Fig.2c. Local connection of communicator or PC to the transmitter terminals (SIGNAL+) (TEST+) (when resistance in the current loop **is less than 250Ω - jumper removed**).

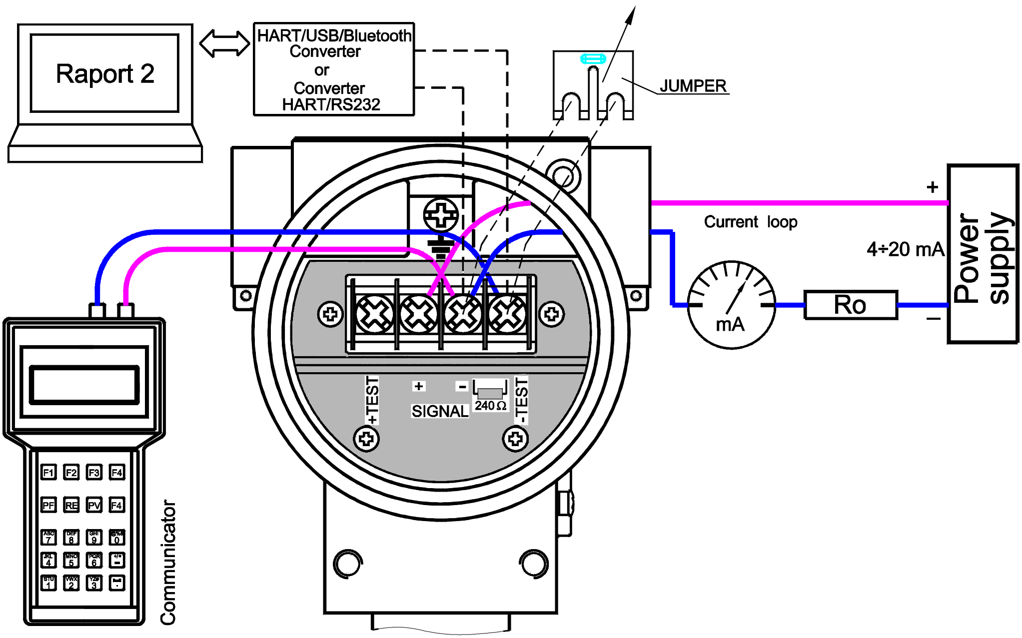


Fig.2d. Local connection of communicator or PC to the transmitter terminals (SIGNAL-) (TEST-)
(when resistance in the current loop **is less than 250Ω - jumper removed**).

If Ro in current loop is less than 250Ω then the fitted 240Ω resistor needs to be brought into the circuit by removing the jumper link from (SIGNAL-) and (TEST-) terminals.
After the communication is complete the jumper link should be re-fitted across the above terminals.

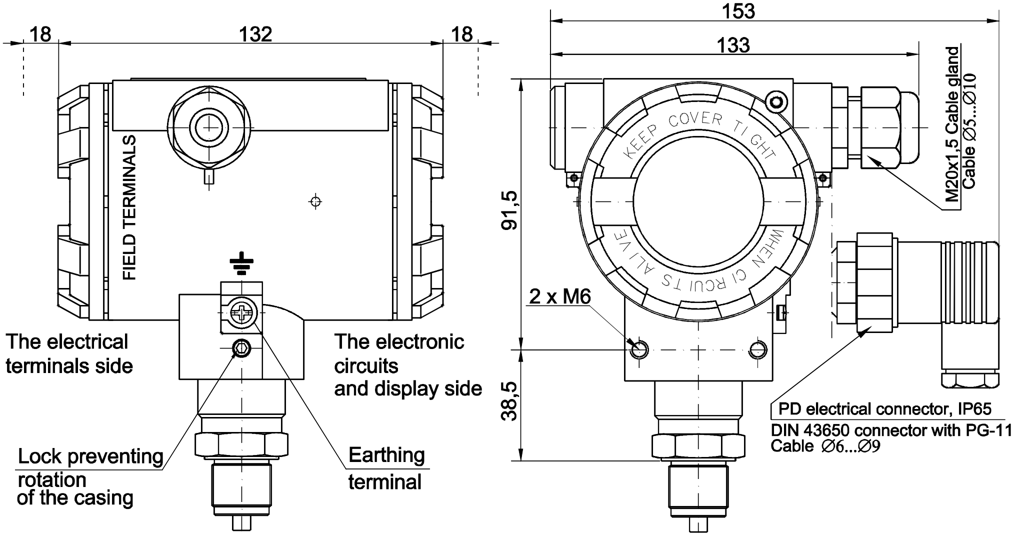


Fig. 3. PYRP-2000ALW smart pressure transmitter.

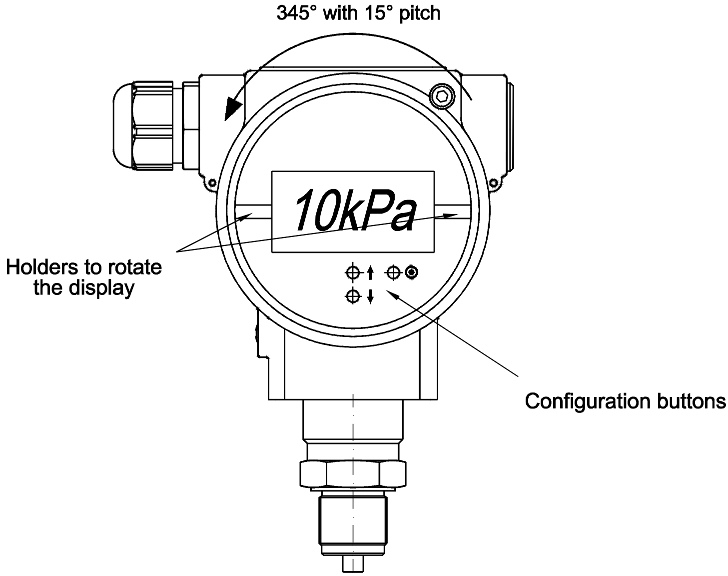


Fig. 4. LCD display rotation details and configuration buttons location.

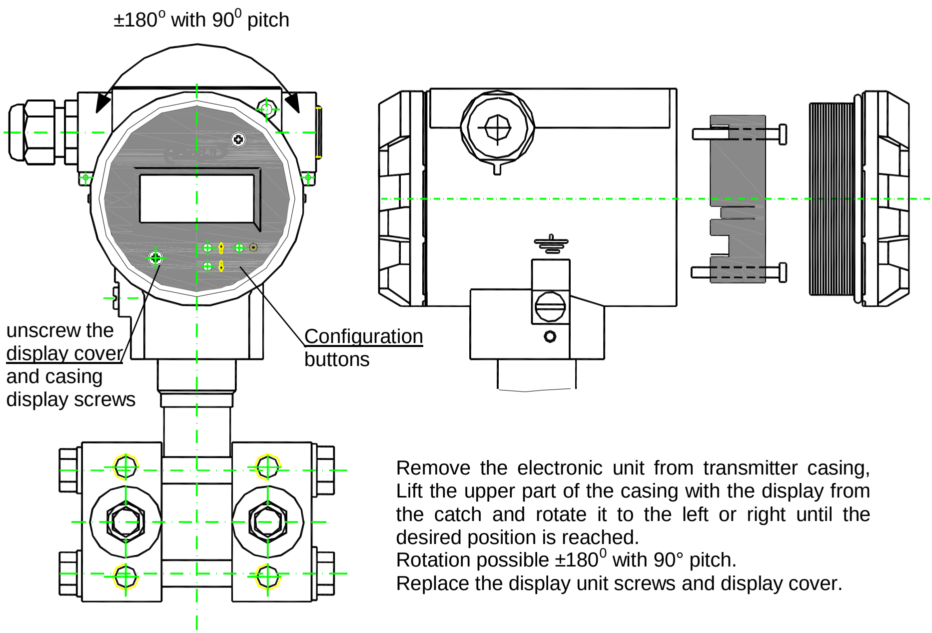
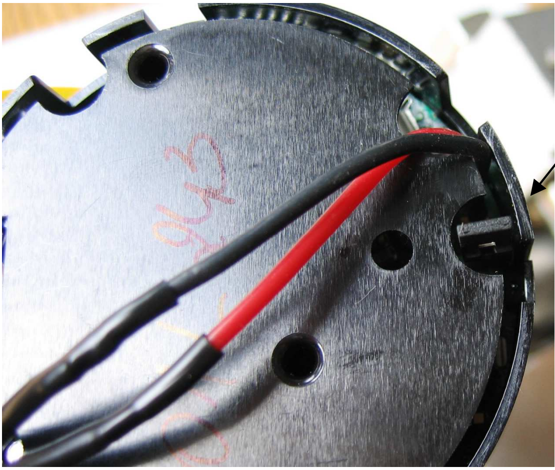


Fig. 4a. Display rotation detail and configuration buttons for PYRP..., PYRD.... in Exd versions.



With jumper in radial position (as shown in photo) – the back lighting is off; with jumper in circular position – the back lighting is on.

Fig. 5. View of the back lighting jumper on transmitter electronics board *for PYRP..., PYRD.... in Exd versions* (unit display from rear).

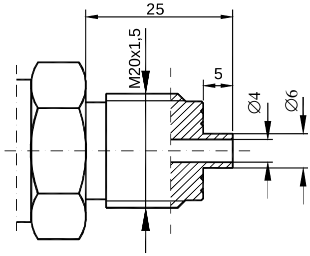


Fig.6a. ‘M’ connection.
(M20 x 1.5 thread)

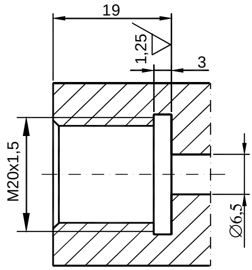


Fig.6b. Socket for ‘M’ connection.

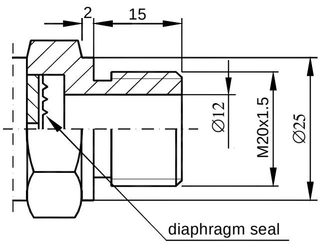


Fig.7a. ‘P’ connection.
(M20 x 1.5 thread)

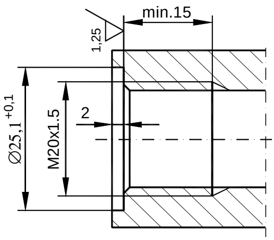


Fig.7b. Socket for ‘P’ connection.

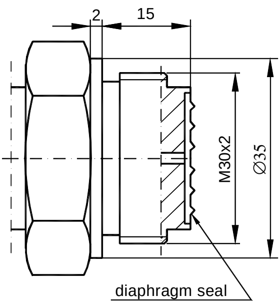


Fig.8a. ‘T’ connection with flush diaphragm.
(M30 x 2 thread)

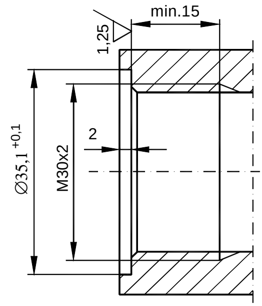


Fig.8b. Socket for ‘T’ connection.

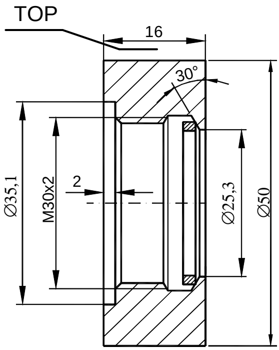


Fig.8c. Socket for ‘T’ connection.
Sealing: Teflon
Order code “Socket T”

i The ring in Fig. 8c has to be welded in place with the word TOP upper most.

Fig. 6. ‘M’ connection having M20 x 1.5 thread.
Fig. 7. ‘P’ connection with M20 x 1.5 thread.
Fig. 8. ‘T’ connection with flush diaphragm with M30 x 2 thread.

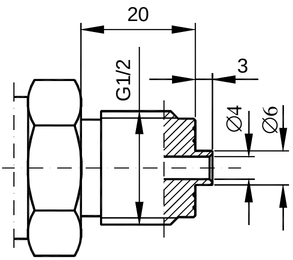


Fig.9a. GB type connector with G½" thread,

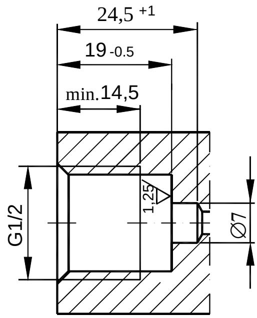


Fig.9b. Socket for G½ type connector.

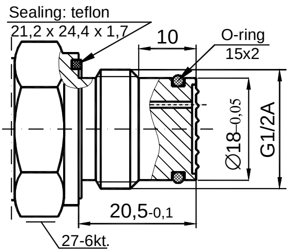


Fig.9c. GF type connector, flush diaphragm with G½" thread.

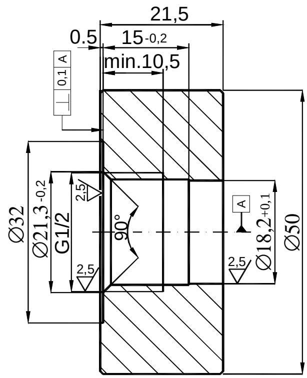


Fig.9d. Socket for GF type connector
Order code "Socket GF"

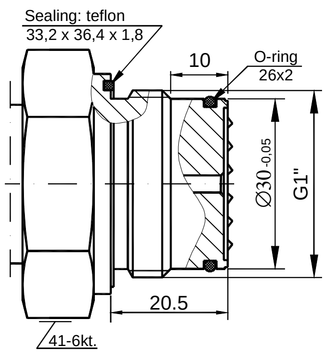


Fig.9e. GD type connector, flush diaphragm with G1" thread.

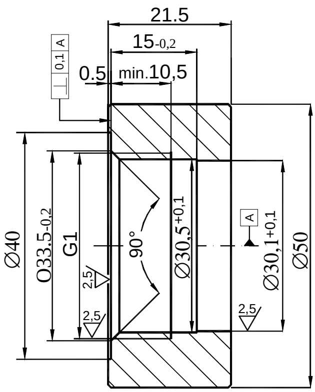


Fig.9f. Socket for GD - type connector.
Order code "Socket GD"

Fig. 9. Process connection sizes G½" and G1".

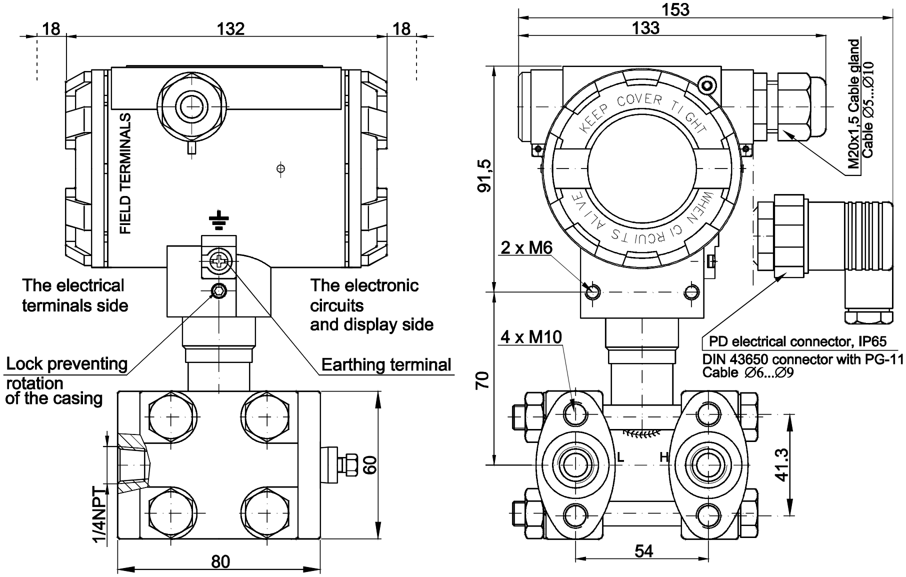


Fig. 10. PYRD-2000ALW differential pressure transmitter with C type manifold pressure block.

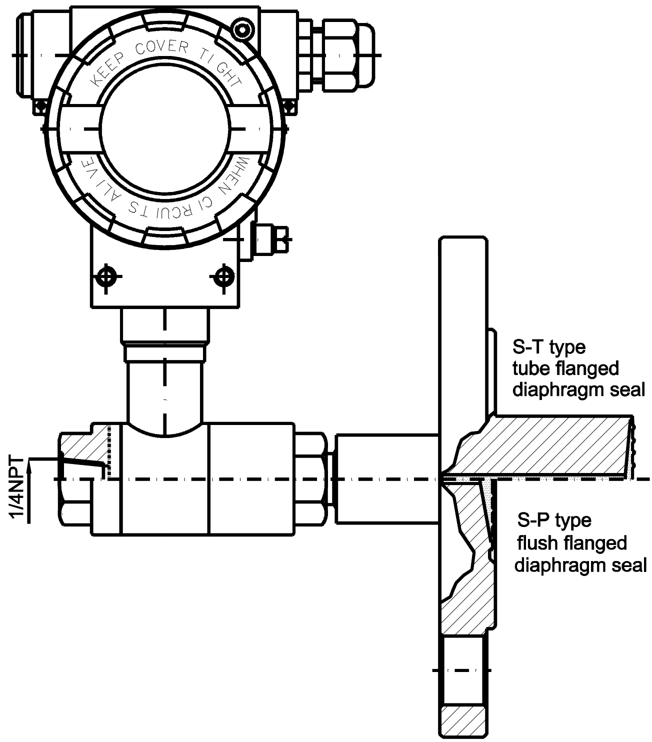
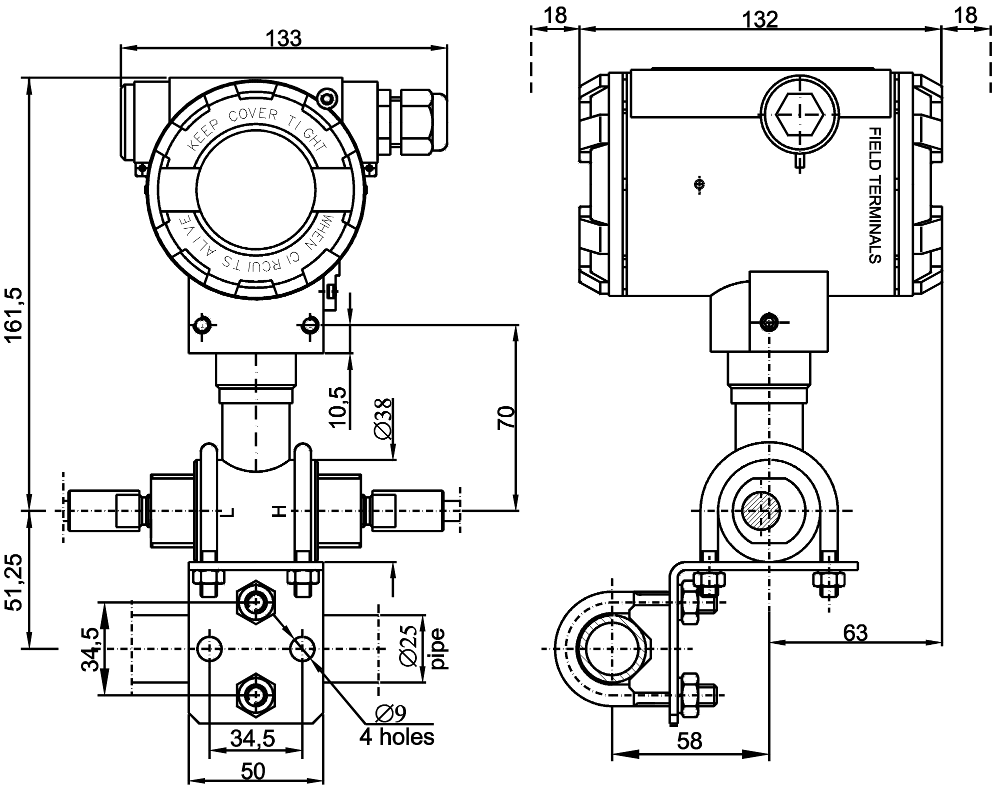


Fig. 11. PYRD-2000ALW differential pressure transmitter with a single direct diaphragm seal (example).



Assembly Kit ("Mounting bracket ∅25") for fitting differential pressure transmitters with N2 type connection on a ∅25 pipe.

Fig. 12. Example: Installing the PYRD-2200ALW transmitters with N2 process conn's and remote diaphragm seals (not shown).

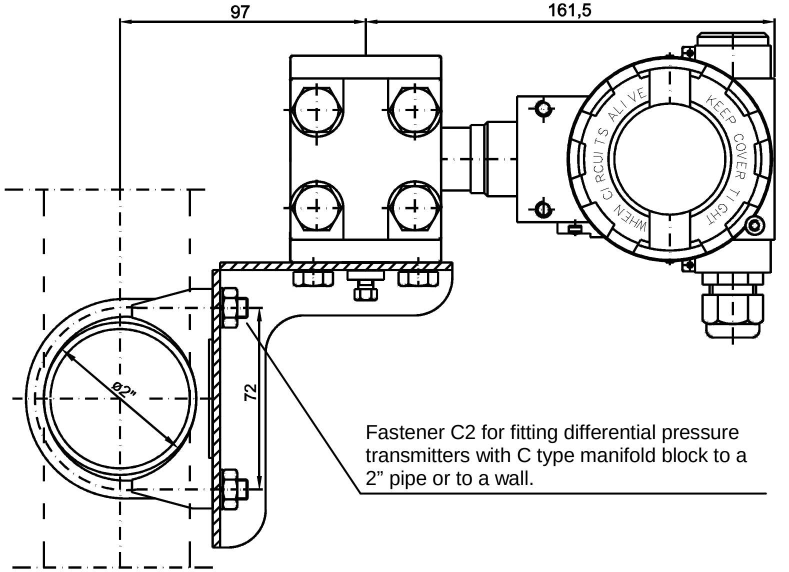


Fig. 13. Example: Installing the PYRD-2000ALW transmitter on a vertical or horizontal pipe**.**

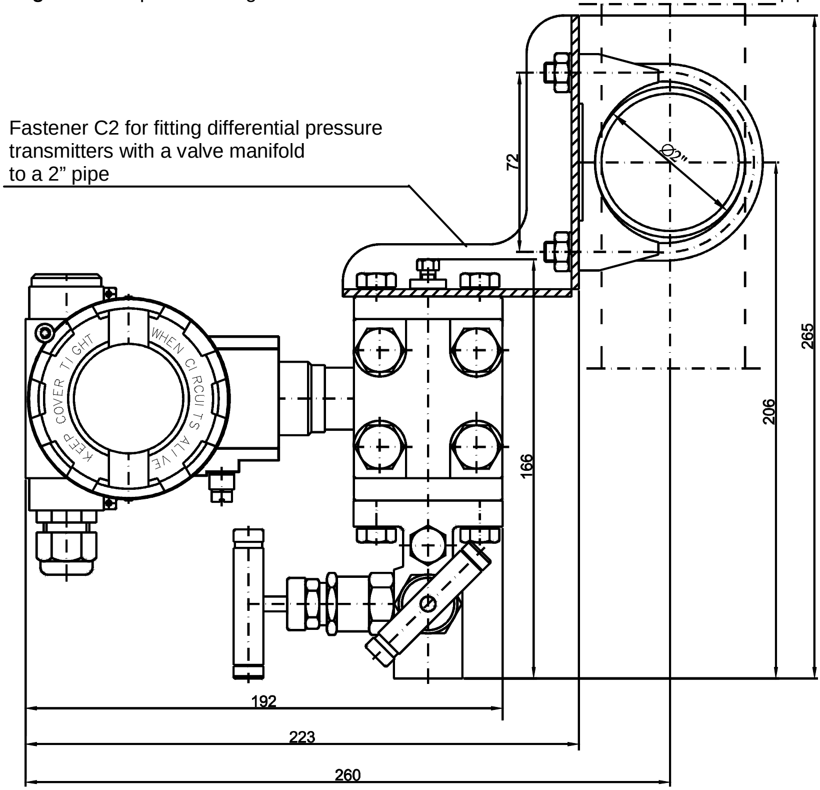


Fig. 14. Example: Installing the PYRD-2000ALW transmitter with a valve manifold to a 2” pipe.

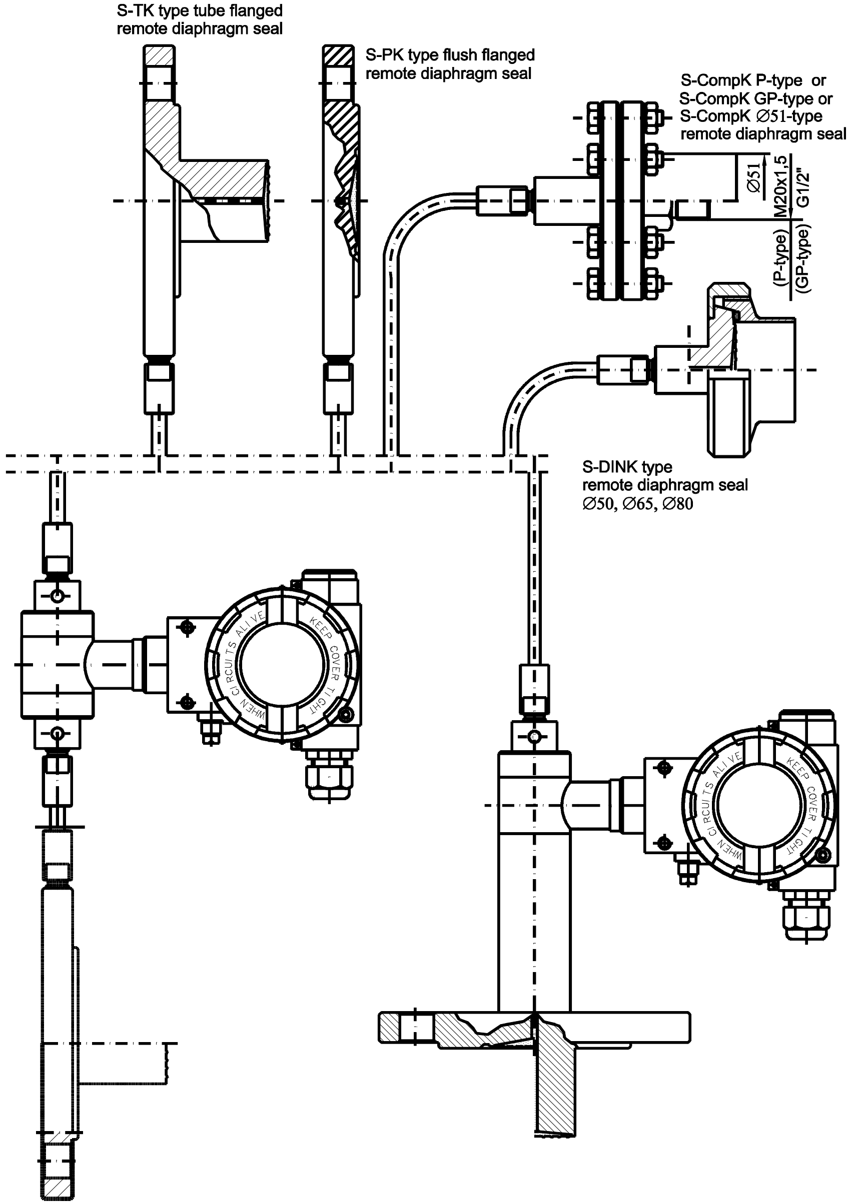


Fig. 15. PYRD-2200ALW differential pressure transmitter with two remote diaphragm seals (examples).

Fig. 16. PYRD-2200ALW differential pressure transmitter with direct and remote diaphragm seal (examples).

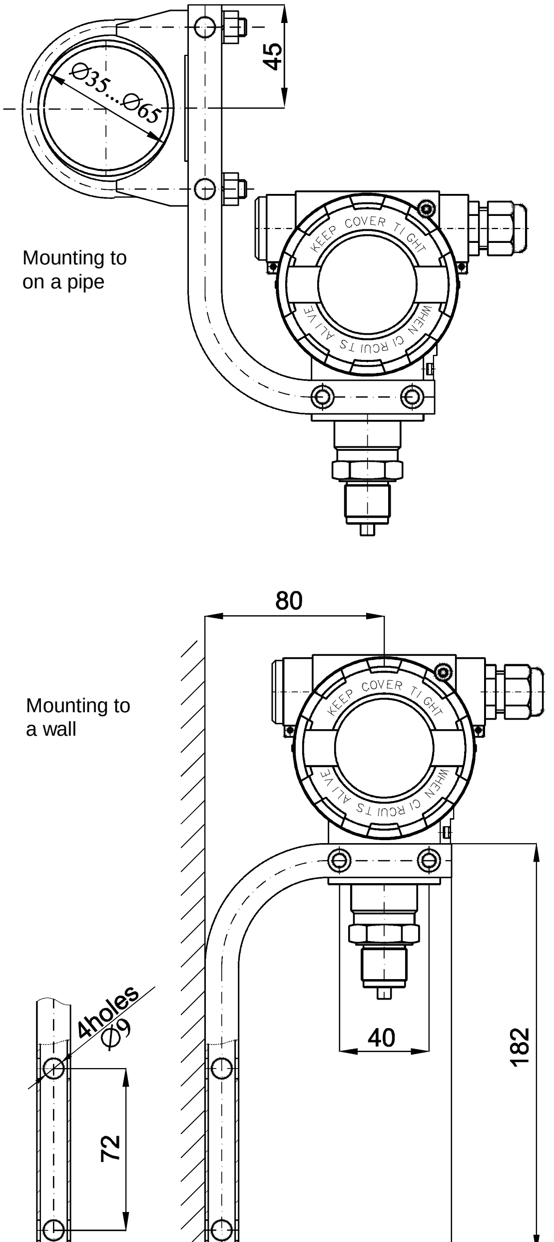


Fig. 17. Example: Installing transmitter on universal bracket

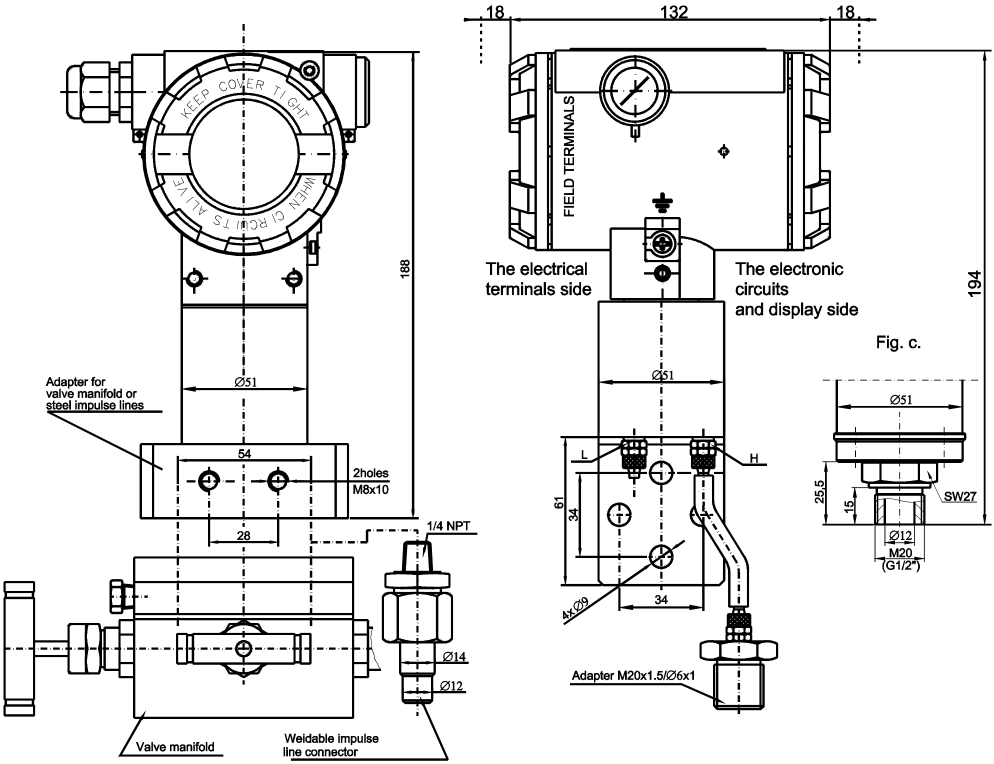


Fig. 18. PYRD-2000GALW smart differential pressure transmitter for low ranges.

a) PYRD-2000GALW transmitter – industrial/heavy duty version with C type process connection mounted together with a valve manifold or weldable impulse line connectors.

b) PYRD-2000GALW transmitter – light duty version with flexible tube – thread process connection.

c) PYRD-2000GALW transmitter – with GC or P type process connection (G½” or M20 x 1.5 thread).

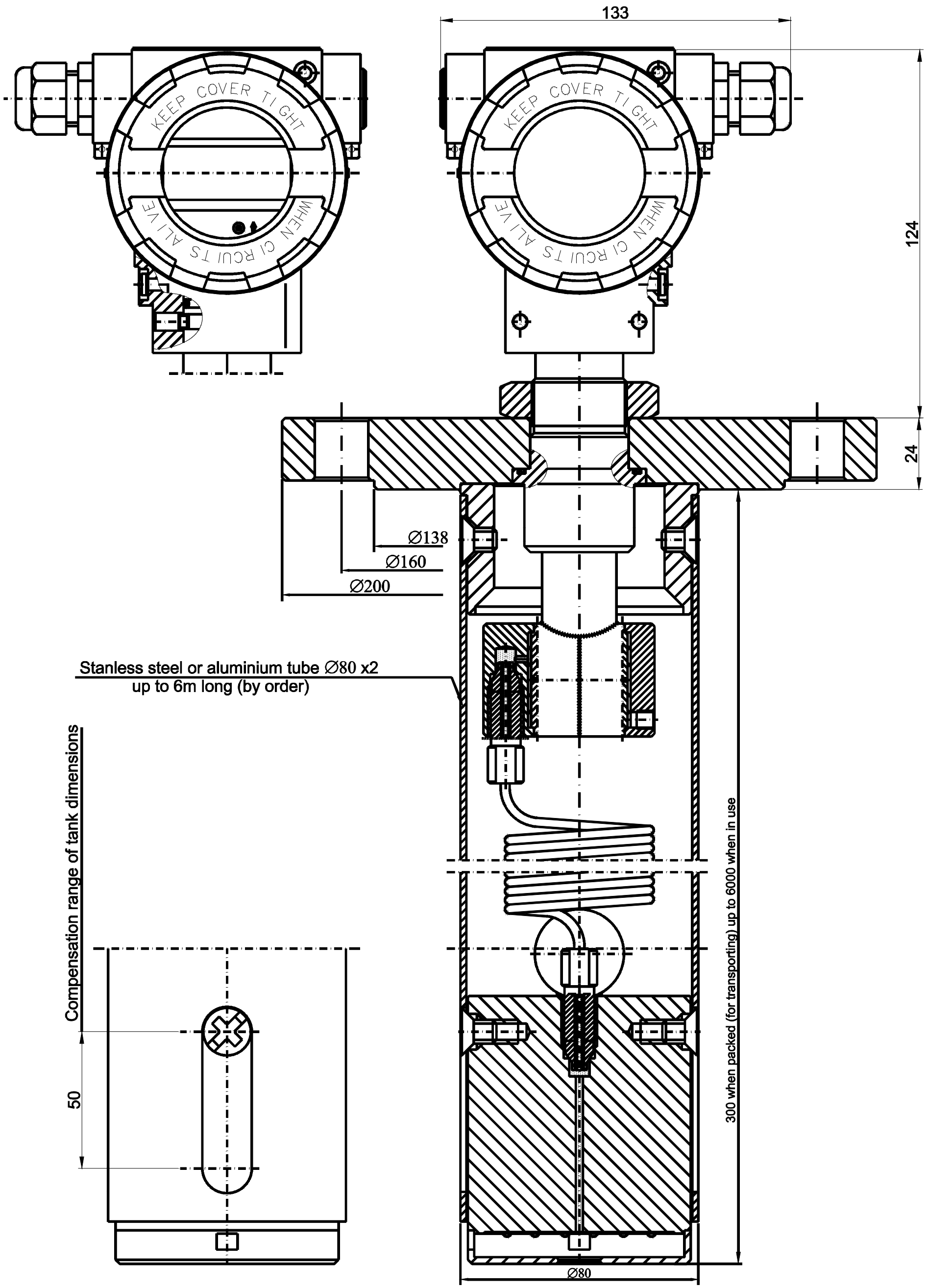
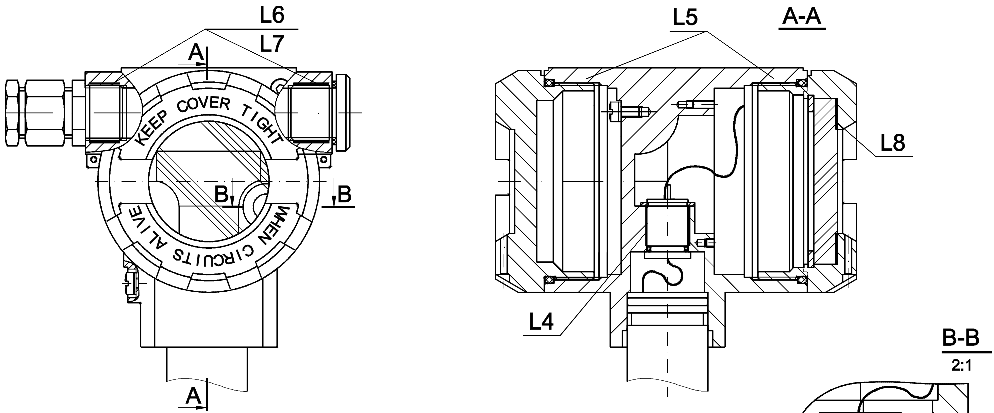
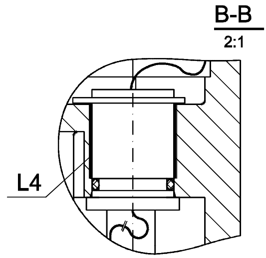


Fig. 19. PYRL–2000YALW smart level probe for pressurised tanks.





N°	width of joint (min. real) L mm	diameter D mm	d mm	D-d mm	quantity of joint	minimum according to PN-EN 60079-1:2004(U)
	MINIMUM WIDTH OF JOINT AND MAXIMUM GAP FOR GROUP IIC ENCLOSURES					
L4	13,2	$\varnothing 15^{+0,027}$	$\varnothing 15^{-0,040}_{-0,070}$	0,097	2	width of joint min.12,5
L5	12	M72x1,5	M72x1,5		2	min.5 threads engaged(8)
L6	9	M20x1,5	M20x1,5		2	min.5 threads engaged(6)
L7	12,7	1/2NPT	1/2NPT		2	min.6 threads engaged
L8	10				1	cemented joints width of joint min.10

Fig. 20. The flameproof joints (flamepaths).

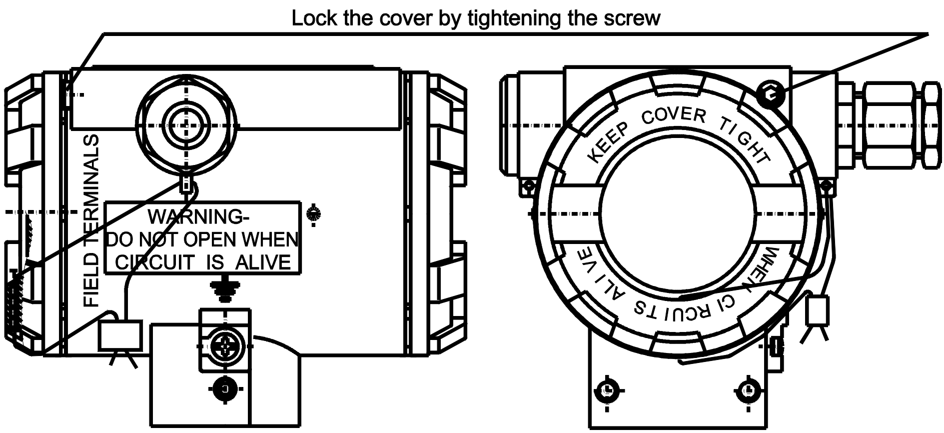


Fig. 21. How to fit the transmitter with a tamperproof lead seal.

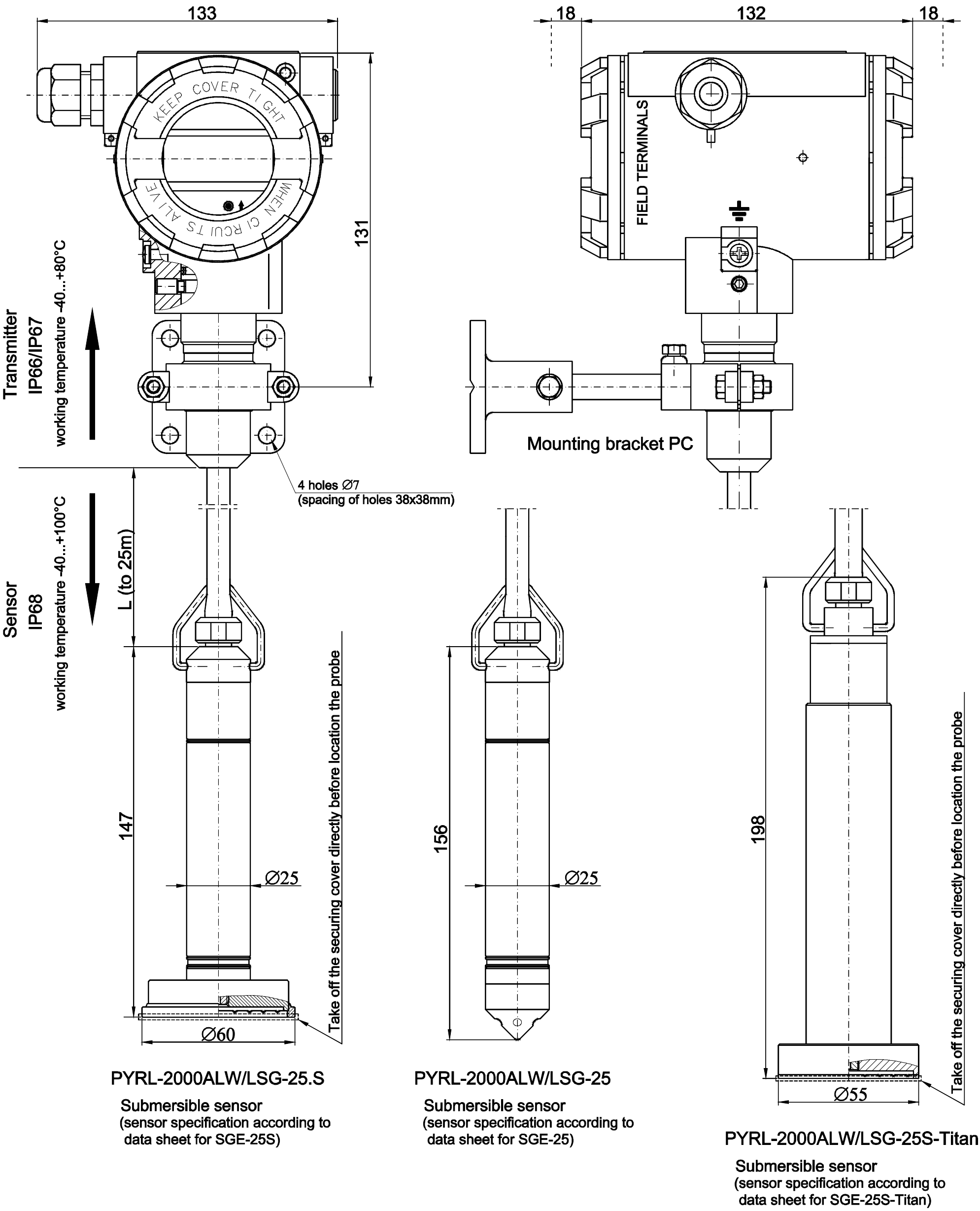
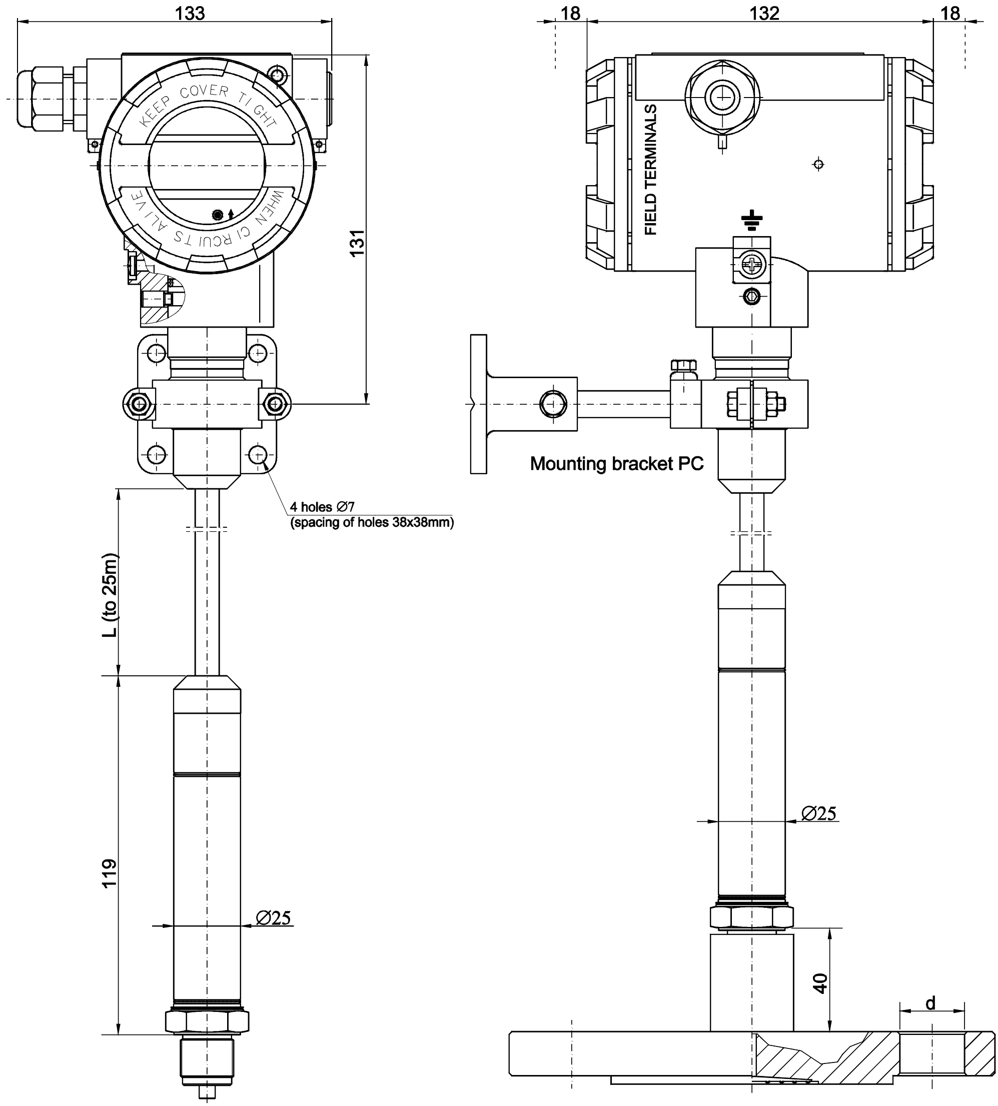


Fig. 22. PYRL–2000ALW/LSG… & PYRL–2000ALW/LSG…/IS smart level transmitters.



PYRP-2000ALW/LM

Transmtter with M type sensor

PYRP-2000ALW/LSP

Transmtter with SP type diaphragm seal

Fig. 23. PYRP–2000ALW/LM, PYRP–2000ALW/LM/IS, PYRP–2000ALW/LSP, PYRP–2000ALW/LSP/IS smart pressure or level transmitters.

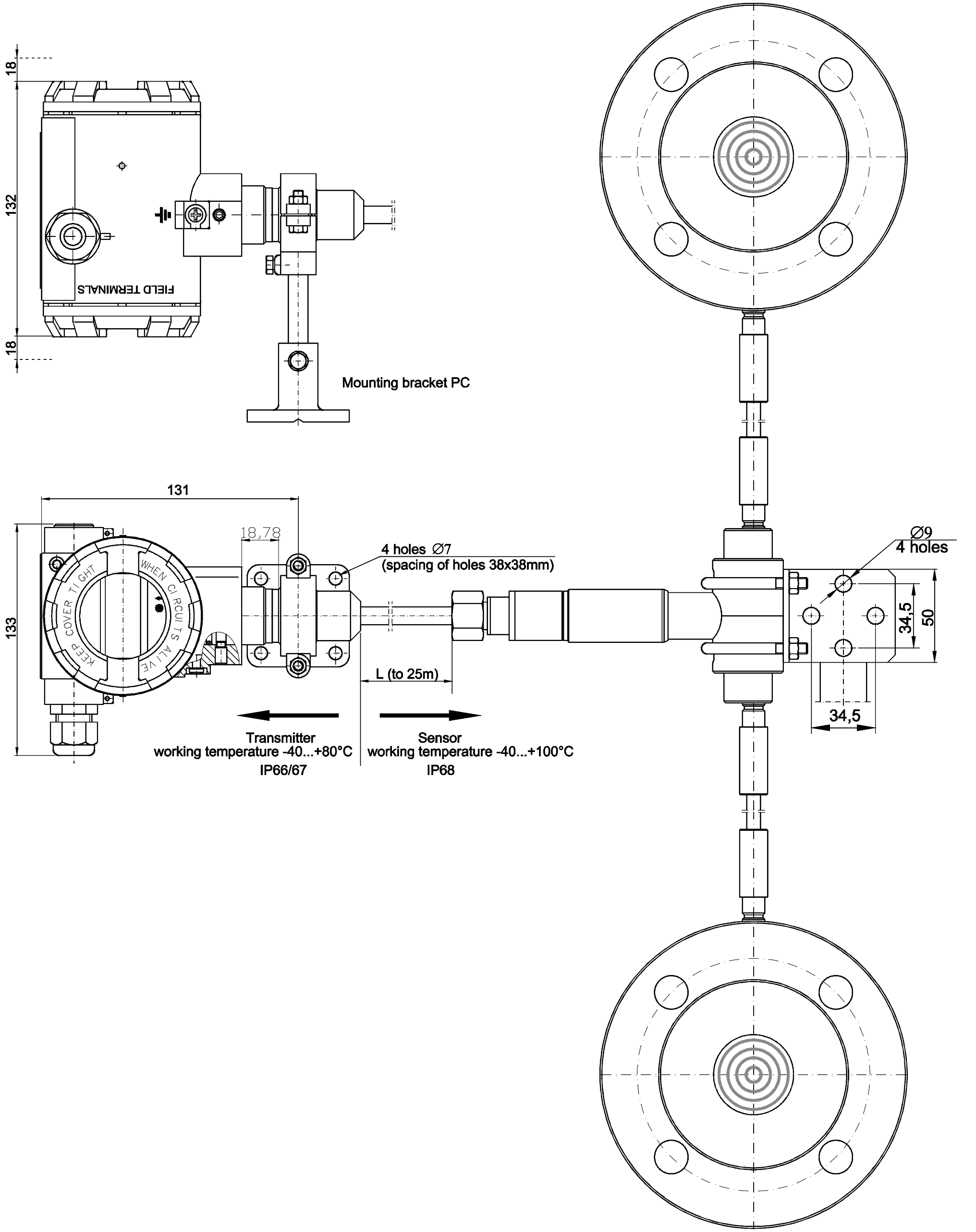


Fig. 24. Example PYRD-2200ALW/L & PYRD-2200ALW/L/IS differential pressure transmitter with remote diaphragm

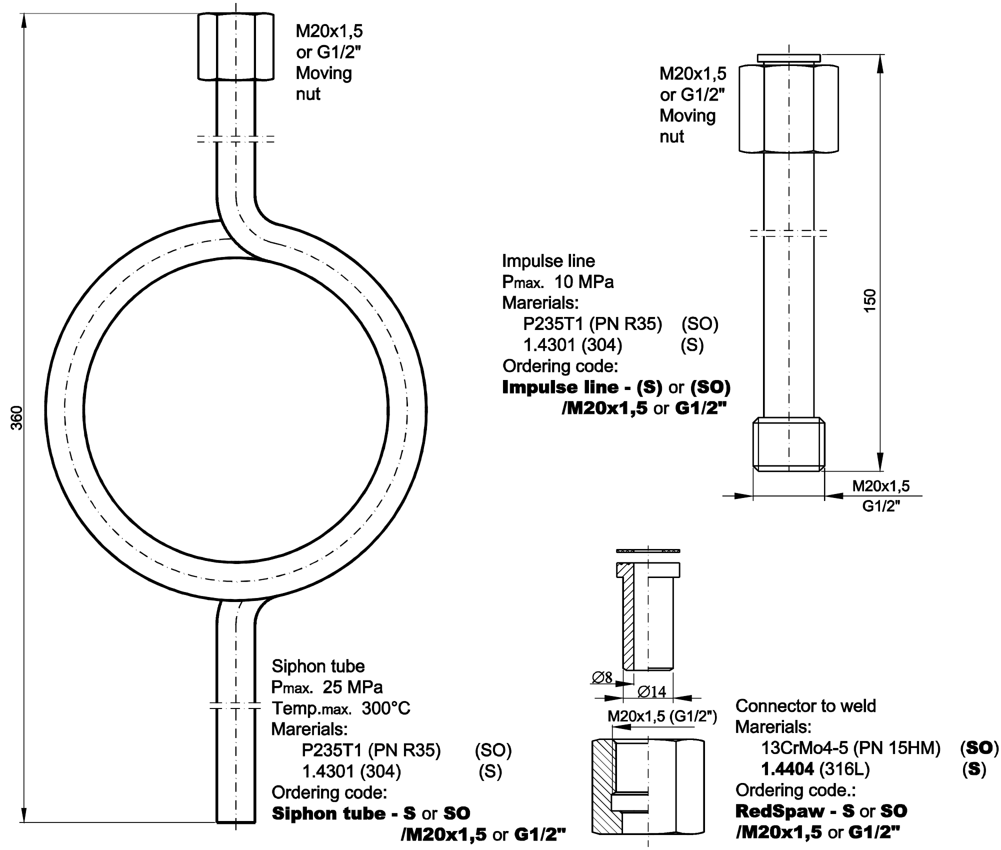


Fig. 25. Additional accessories for fitting of pressure transmitters.