

DTR.PYRT.ALW.02



INSTALLATION, OPERATION AND MAINTENANCE MANUAL

SMART TEMPERATURE TRANSMITTERS





Type: PYRT-2000/ALW, PYRT-2000/ALW/D
and PYRT-2000/ALW/IS

Edition A


January 2013

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Symbols used

Symbol	Description
	Warning - Installer to proceed strictly in accordance with the information contained within this manual in order to ensure the safe and full functionality of the item.
	Denotes information applicable during installation and operation of all listed products.
	Denotes information essential to Ex (hazardous area) certified products.
	Denotes information on disposal of used equipment.


BASIC REQUIREMENTS AND SAFE USE



- **The manufacturer is not responsible for any damage to property or personnel resulting from incorrect installation, failure to maintain the product in a suitable condition, or use of the product other than for its intended purpose.**
- Installation should be carried out by qualified personnel having the necessary qualifications and experience to install electrical equipment and temperature measuring devices. The installer is responsible for performing the installation in accordance with these instructions and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- The device should be configured appropriately for its intended application. Incorrect configuration may cause erroneous functioning, leading to damage to the device or the equipment/processes it is monitoring.
- In pressurised systems where these items may be fitted there exists a possible hazard to personnel, therefore all safety and protection requirements must be observed during installation, operation and inspections.
- If a product is deemed to not functioning correctly it should be removed and returned to the manufacturer or other authorised organisation for repair.



- In order to minimise the risk of malfunction and associated risks to personnel, the device is not to be installed or used in excessively arduous conditions where the following hazards or conditions may exist:
- Risk of mechanical impacts, excessive shocks and/or vibration;
- Excessive ambient temperature fluctuation,
- Condensation of water vapour, large accumulations of dust, icing/freezing.



Installation of Exi and Exd certified versions should be carried out in accordance with the latest hazardous area installation regulations and standards.

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

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1. INTRODUCTION

1.1. This manual covers the **PYRT-2000/ALW** Smart temperature transmitters available in safe area, flameproof (Exd) and intrinsically safe (Exi) versions and contains all the necessary information and guidelines to explain the functionality, and how to install and correctly put them to work.

The information contained within the initial main section of the manual (sections 1 – 14) is to be read as common for all of the transmitter's forms.

1.2. For Flameproof (Exd) certified versions, Appendix Exd at the rear of this manual should be read in conjunction with the main section.



1.3. For Intrinsically Safe (Exi) certified versions, Appendix Exi at the rear of this manual should be read in conjunction with the main section.

2. DELIVERED EQUIPMENT

Transmitters are delivered in single and/or multiple packs.

A single batch of transmitters will be supplied with a copy of this manual (more can be supplied on application) If requested at the ordering stage Calibration Certificates for each transmitter or a common Certificate Of Conformity can be supplied and will accompany the goods.

Non order specific documentation/certificates such as ATEX, SIL 1, PED etc. would be provided when applicable.

3. APPLICATIONS AND MAIN FEATURES

3.1. The **PYRT-2000/ALW** smart temperature transmitters are designed to measure temperatures accurately and reliably in arduous industrial conditions and hazardous areas where explosive gases or dust could be present.

3.2. The **PYRT-2000/ALW** transmitters can be supplied fitted with either a 3 wire PT100 RTD or type K (nickel chrome/nickel aluminium) thermocouple – to be selected by the purchaser to suit the application.

3.3. The **PYRT-2000/ALW** transmitters have as a minimum the following characteristics and functions:

- a. Two wire power supply (4 - 20mA current loop).
- b. Digital signal processing (filtration, linearisation and compensation).
- c. Configuration options, locally from internal buttons, programmer or remotely (HART protocol).
- d. Autodiagnostic system.
- e. Temperature compensation against ambient temperature fluctuations.
- f. Galvanically isolated inputs and outputs.

4. IDENTIFYING DETAILS AND ORDERING PROCEDURE

4.1. Identifying Details

Every transmitter is fitted with an information plate containing as a minimum the following information:

- a. Manufacturer's name
- b. CE mark
- c. Transmitter type: PYRT-2000/ALW
- d. Basic range
- e. Set range
- f. Power supply voltage
- g. Output signal
- h. Year of manufacture and unique serial number

4.1.1. The **PYRT-2000/ALW/IS** transmitter Intrinsically Safe Certified (Exi) version has additional markings as detailed in **Appendix Exi**.

4.1.2. The **PYRT-2000/ALW/D** transmitter Flameproof Certified (Exd) version has additional markings as detailed in **Appendix Exd**.

4.2. Ordering code

PYRT-2000/ALW/ / / L = mm / / ÷ °C/

Certification: D = Exd IS = Exi
A = Non Ex Certified

Probe Type: 1 = Std 2 = Extended head (+150°C)

Probe Length: L = xxx mm

Element Type: P = PT100 K = Type K Thermocouple

Calibrated Range

Burnout signal: 1 = Upscale (23mA) 2 = Downscale (3.8mA)

Option suffixes: SS = 316L st. steel case.
IP67 = IP67 (increased ingress protection – standard in Exd version).
AL = Wall-mounting bracket.
ALS = Wall-mounting bracket, 316 st. steel.
SGA = Adjustable insertion compression gland, ½" BSPP.
SGB = Adjustable insertion compression gland, ½" NPT.

Example: Temperature transmitter PYRT-2000/ALW / certification Exi / probe type: extended head / probe length: 250mm / element type: PT100 RTD / Calibrated range: 0 - 300 °C / alarm signal: 23 mA / 316L stainless steel case.

PYRT-2000/ALW/ IS / 2 / L=250 mm / P / 0 – 300°C / 23 mA / SS

Note : Flameproof Exd model must be supplied with thermowell, see Fig 6 on page 21 for examples.

5. TECHNICAL DATA

5.1. Electrical parameters

Power supply (safe area version) : 12 * - 55 VDC

Note: For power supply details applicable to the Intrinsically Safe (Exi) and Flameproof (Exd) versions refer to their respective Appendices at the rear of the document.

Output signal 4 - 20mA + Hart Rev.5.1

Communication Enabled via a 4-20mA signal and Hart transmission using PC with PYRT-2000/ALW configuration software installed.

Resistance for communication (Hart) 250-1100Ω, min 240Ω

Load resistance $R_o[\Omega] = \frac{U_{sup}[V]-12V^*}{0.023A}$

Load resistance for Intrinsically Safe version – refer to "Appendix Exi"

*) 15 V for transmitters with display backlight.

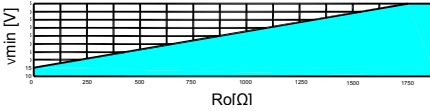
The minimum supply voltage to the transmitter may be calculated using the below formulas:



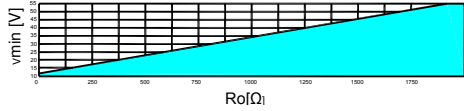
- $U_{min} = 12 + 0.023 \times R_o$ [V] with LCD display backlight switched on. (see also graph below)
- $U_{min} = 15 + 0.023 \times R_o$ [V] with LCD display backlight switched off. (see also graph below)

Intrinsically Safe certified models are supplied with display backlight turned off, though this can be switched on by the user if desired.

$U_{min} = f(R_o)$ with display backlight on



$U_{min} = f(R_o)$ with display backlight off.



Supply voltage in relation to current loop resistance

For correct functioning remain under graph line in shaded/coloured area.

Insulation test voltages

500 VAC or 750 VDC, see Point 8.3.

Over voltage protection

See Point 8.3.

List of current alarms

Alarm Type	Value of Alarm Current
NORMAL LOW	3.75 mA
NORMAL HIGH	21.6 mA
NAMUR LOW	3.6 mA
NAMUR HIGH	21.0 mA

Alarm Type	Value of Alarm Current
CUSTOM (value of alarm current is defined by user)	Value of alarm current in range 3.6 mA - 23 mA
LAST VALUE (transmitter does not update analogue exit)	Alarm current value is equal to the current value in the time preceding the event which giving an alarm.

5.2. Metrological parameters.

Additional voltage damping 0 - 30s

Total error of transmitter (digital value) $\pm (0.05+0.05\% \cdot z+0.001 \cdot |t|)$ °C for PT100 element
 $\pm (0.5+0.05\% \cdot z)$ °C for type K thermocouple and $t \leq 375^\circ\text{C}$
 $\pm (0.5 + 0.05\% \cdot z + 0.002 \cdot (t-375))$ °C for type K thermocouple and $t > 375^\circ\text{C}$

Additional analogue output error $\pm 0.04\% \cdot z$

Where:

|t| - modulus of measured temperature in °C

t - the value of measured temperature in °C

z - the range width of transmitter in °C

5.3. Measurement ranges.

Sensor type	Min. measuring range	Nominal range	Calibrated range
PT100 RTD	10 °C	- 200 to 550 °C	0 to 100 °C
Type K Thermocouple	10 °C	- 40 to 550 °C	0 to 300 °C

* Recommended for applications subjected higher levels of vibration or shock.

5.4. Operating conditions.

Ambient temperature range -40°C to 85°C

Note: For the ambient temperature ranges applicable to the Intrinsically Safe (Exi) and Flameproof (Exd) versions, refer to their respective Appendices at the rear of this document.

Relative humidity	:	Up to 98%	
Medium temperature range	:	PT100	- 200 to 550°C
	:	Type K thermocouple	- 40 to 550°C
Thermal compensation range	:	-25 to 75°C	

5.4.1. Electromagnetic Compatibility (EMC)

Complies with EN 61326-1.2 for industrial applications

Electrostatic Discharge Immunity (ESD):

EN 61000-4-2; S3 level: contact ±6KV, air ±8KV; Criterion A

Conducted Radio Frequency:

EN 61000-4-6; 0.15 to 80MHz, 10V; Criterion A

Radiated electromagnetic Field:

EN 61000-4-3; 80 to 2,000MHz – 10V/m; 2,000 to 2,700MHz – 1V/m; Criterion A

Electrical Fast Transient (Burst Immunity)

EN 61000-4-4; ± 2KV power supply port/earth, ± 1KV signal port/earth; Criterion A

Electrical Slow Transient (Surge Immunity):

EN 61000-4-5; ±0.5KV (±1KV) 0,5KV differential mode, 1KV common mode; Criterion B

5.4.2. Electromagnetic Compatibility, emission:

According to CISPR16-1, CISPR 16-2, class B, antenna distance 3 metres, quasi-peak measuring:

Radiated emission: 0.15 to 30MHz, 80-52dBµV/m;
30 to 2,000MHz, <54dBµV/m

Conducted emission: 0.01 to 0.15MHz, 96-50dBµV/m;
0.15 to 0.35MHz, 60-50dBµV/m;
0.35 to 30MHz, <50dBµV/m

5.4.3. Climatic immunity: dry heat, cold, humidity, salt mist:

Dry heat: EN 60068-2-2, test B; (T = 70°C, RH = Max 55%)

Cold: EN 60068-2-1, test A; (T = -25°C)

Damp heat cycle: EN 60068-2-30, test D ; (T = 55°C, RH = min 95%, 24Hr) x 2

5.4.4. Mechanical immunity

Shock: EN 60068-2-27, 50g/11ms

Vibration: EN 60068-2-6, test Fc; up to 1.6mm for 2 to 25Hz, up to 4g for 25 to 100Hz

5.4.5. Insulation Resistance

>100 MΩ @110V transmitters with gas arresters

>100 MΩ @750V DC transmitters without gas arresters (Exi certified applications)

5.4.6. High voltage test

75V AC, or 110V DC, 1min, transmitters with gas arresters

500V AC, or 750V DC, 1min, transmitters without gas arresters (Exi certified applications)

5.4.7. Enclosure ingress protection to EN60529.

Exia and safe area versions IP 66 (with IP67 option).
Exd version is rated IP67 as standard.

5.5. Construction materials

Housing: Aluminium alloy, with high quality corrosion resistant epoxy painted finish in blue to RAL 5015 or 316L stainless steel.

Sensing probe & fittings: 316 stainless steel

6. DESIGN.

6.1. Measurement Principles.

An electrical signal produced by the measuring sensor (PT100 RTD or type K thermocouple) in the probe is fed into the analogue-digital converter. The produced digital signal is inputted to an optoelectronic galvanic barrier and the microcontroller which reads these measured values and using built-in algorithms calculates an exact value of the temperature. The calculated value is indicated on the integral LCD display which can be user configured (see point 9.2.5). The digital value of the measured temperature is converted to a 4 – 20mA analogue output signal. An integral BELL 202 modem and implemented communication stack HART Rev.5.1 enables communication with the converter via a PC and appropriate software or hand held communicator.

The transmitter's output is fitted with a radio-noise filter and other elements protecting against Electrostatic Discharge (ESD).

For a block diagram of the transmitter processes see Figure 1 on page 16.

The transmitter is configured to carry out analysis and monitoring of the measuring processes to ensure the accuracy is maintained within the specified tolerances and in the event of discrepancies an error message is displayed on the LCD display and an alarm current generated in the current loop (the nature of this alarm current is determined by the configuration).

The produced analogue output is galvanically isolated from the power supply thus reducing the susceptibility to interference and offering increased safety on the hazardous area certified models.

6.2. Construction

The basic components of the transmitter are: Housing, sensing probe (and optional thermowell) with process connection, measuring sensor and electronic modules converting the signal from measuring sensor into a unified amplified analogue output signal.

6.2.1. Transmitter housing

The transmitter housing is supplied in either high pressure cast aluminium alloy with a baked epoxy paint finish or 316L steel. The housing consists of a main enclosure, two screwed access covers (one with glass viewing window), 2 x electrical entries (one fitted with plug) threaded either M20 x 1.5 or ½" NPT. Internally the housing is divided into two chambers by way of a separator which is part of the casting. The casing is also equipped with internal and external earth terminals.

6.2.2. Electronics PCB and LCD display

The transmitter signal conditioning electronics and LCD display are mounted in a small polycarbonate case and fitted into the larger of two internal chambers behind the access cover with the viewing window. The board and display can be rotated +/- 180° in 90° increments (see Fig 4). A connection board fitted with screw terminals (as fig. 2a) together with interference filters and other protection items are fitted in the other chamber.

6.2.3. Sensing probe, process connections and thermowells.

The sensing probe is fabricated from 6mm OD 316 stainless steel and can be supplied with fixed or adjustable position threaded connections in ½" BSPP or ½" NPT (other options available to customer's requirements).

Thermowells can be manufactured from barstock, one piece forgings or fabricated from pipe and are all available with either a threaded, flanged, weld in or hygienic style process connection. Solid drilled and forged thermowells are generally used in environments with high temperatures, pressures and flows, whereas fabricated thermowells are generally used in tanks or low intensity environments.

Depending upon your process, thermowells can be manufactured from a wide range of materials including 316 stainless steel, Inconel® 600, Monel® 400, Hastelloy® C276 and Hastelloy® C22.

See Fig 6 for typical examples of sensing probes and thermowells.

7. INSTALLATION OF TRANSMITTERS

The PYRT–2000ALW transmitters can be installed in any orientation as this does not effect functionality or accuracy.

When installing care should be taken to ensure the electronics housing is not subjected to direct heat streams that may exceed the maximum permitted ambient temperature.

Suitable thermal deflectors should be incorporated or the transmitters should be mounted in such a way that the housing is not directly in the heat flow.



When installing transmitters certified for use in hazardous areas (i.e. Exi or Exd) particular care must be taken to ensure the housing is not exposed to direct heat streams that not only allow the transmitter to exceed it's operational limitations but also to exceed the housing surface temperature limitations governed by it's hazardous area certification. Refer to the transmitter certification label and Appendices at the rear of this document for details of these temperatures.

8. ELECTRICAL CONNECTION

8.1. General recommendations

8.1.1. It is recommended that the electrical connection to the transmitter is made via screened twisted pair cabling. The signal wires should not be run alongside network power supply cables or near to equipment that draws high levels of electrical current.

Any associated equipment used in conjunction with the transmitters should be equally resistant to electromagnetic interference from the transmission lines in accordance with compatibility requirements. It is also recommended to have EMC filters on the primary side of the transformers, power supplies used for the transmitters and apparatus used in conjunction with them.

8.1.2. Water ingress or residual moisture within the transmitter housing can cause component failure or electrical faults and should be prohibited from occurring.



Any cable gland used must meet IP66 sealing as a minimum (on standard IP66 housings) and must be fitted in accordance with the manufacturer's instructions to maintain the integrity of the housing. Obviously Exd certified transmitters must also have equally certified glands fitted. When cabling it is recommended a small loop is made prior to the gland to prevent any liquids running down the cable to the gland.

8.2. Electrical connections



Details of the electrical connection methods are detailed in Fig's 2a – 2d.

The transmitter is supplied with a 240Ω resistor permanently fitted in series in the transmitter's current circuit that is linked out with a jumper between the "SIGNAL –" and "TEST –" connections as shown in Fig's 2a and 2b. This jumper should be removed when the resistance in the current loop is less than 250Ω.

8.3. Protection from excess voltage

8.3.1. The transmitters may be at risk of over voltage caused by connection faults or atmospheric electrical discharge.

Over voltage protection across the signal wiring is provided by transient voltage suppression (TVS) diodes are installed in all versions of the transmitter (see the table, column 2).

8.3.2. In order to protect against over voltage between the signal wires and the housing or earth (not prevented by the TVS diodes connected between the signal wires), additional protection is provided in the form of plasma surge arresters (see the table, column 3).

Additional external similar protection devices may be incorporated by the installer in cases such as when signal wiring is run over an excessive distance. In this instance it would be advantageous to fit additional protection near the transmitter (or inside it if the transmitter is non Ex certified), and another near connection points to other items in the same current loop.

Internal protection of transmitters:

1	2	3
Type of transmitter	Protection between signal wires (TVS diodes) – permitted voltage	Protection between signal wires and earth and/or casing – type of protection, permitted voltage
Safe area version	68V DC	Plasma surge arresters - 100V DC
Exd version	68V DC	Not applicable
Exi version	39VDC	Not applicable

8.3.3. The voltage in the protection devices must not exceed the maximum permitted values given in columns 2 and 3 of the table.

i The insulation test voltages (500V AC or 750V DC) given in 5.1.1 refer to transmitters plasma surge arresters - such protection is not incorporated in Intrinsically Safe Exi versions of these transmitters.

8.4. Earthing

The transmitters are supplied fitted with internal and external earth terminals.

9. SETTING AND REGULATION

9.1. Measurement ranges - definitions

9.1.1. Nominal range

The maximum overall temperature range the transmitter can measure is referred to as “**nominal range**” (see nominal ranges in section 5.3).

The internal characteristic conversion curve for the nominal range is coded within the transmitter’s memory.

This conversion curve is referenced by the transmitter when making any adjustments which affect the output signal.

9.1.2. Set range

The “**set (calibrated) range**” is the temperature span that is configured to equal the analogue output of 4 – 20mA (or 20 – 4mA when the conversion curve is inverted).

This set range may cover the whole of the nominal range or only a part of it.

The transmitter may be set to any range within the nominal range of temperature values, subject to the restrictions set out in the table in section 5.3.

9.1.3. Default range.

Where a specific set range has not been stated at the ordering stage then we would supply them with our standard default set ranges as under:

For transmitter with PT100 sensor: 0 – 100°C

For transmitter with type K thermocouple: 0 – 300°C

9.2. Configuration and Calibration

9.2.1. The transmitter has facilities which enable measurement and identification parameters to be set and altered. The configurable parameters relating to the output are as follows:

- a. Lower range value (LRV) of the set range
- b. Upper range value (URV) of the set range
- c. Unit
- d. Time constant
- e. Type of characteristic curve: linear or radical
- f. Decimal index

9.2.2. Identification parameters not related to the output signal includes the following: 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, sensing module number.

The process of setting the parameters listed in 9.2.1 and 9.2.2 is referred to “**Configuration**”.

9.2.3. Remote configuration of transmitters

Configuration and calibration of the transmitter can be implemented via the dedicated PYRT-2000/ALW configuration software or using library EDDL software (via PC with Hart/RS232 converter).

Details of the Hart/RS232 converter can be found on the Hart/RS232/01 Converter information sheet.

When carrying out remote calibration one of the arrangements as detailed in Fig. 2a - 2d should be adopted.

9.2.4. Local configuration of transmitters

When local configuration is enabled the operator can carry out adjustments using the push buttons below the LCD display (accessed by unscrewing the glazed cover).



Note: This adjustment method must not be attempted in a hazardous area without ensuring there are no explosive gases or dusts present by way of a suitable monitor or detector.

To enter the local adjustment mode, press and hold any button (the buttons are marked [↑] [↓] [■]) for approximately 4 seconds after which the term “EXIT” should appear on the LCD display. Should this not occur then the local transmitter configuration option has not been enabled and is locked out. Enabling of the local buttons is carried out via the HART software and PC (see HART command → 132.133). If after carrying this out there is still no response and the transmitter local buttons cannot be enabled then the manufacturer should be contacted.

With “EXIT” being displayed, using the [↑] [↓] buttons for 1 sec. will allow navigation through the MENU, whilst pressing [■] for 1 sec. will confirm the Exit instruction and cancel the local entry mode.

Holding in the [↑] [↓] buttons will permit automatic scrolling through the MENU structure, each step being displayed for 0.3 of a second.

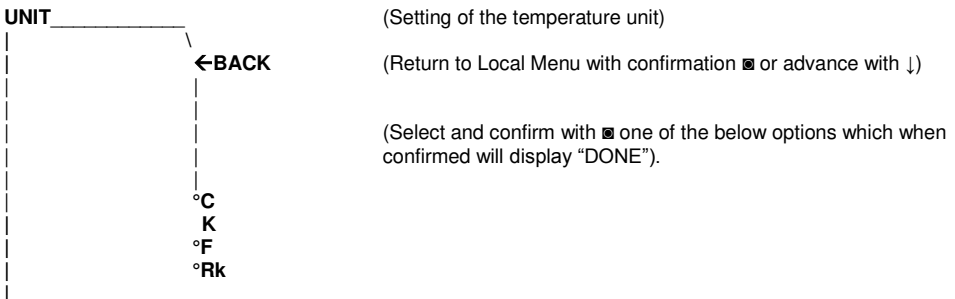
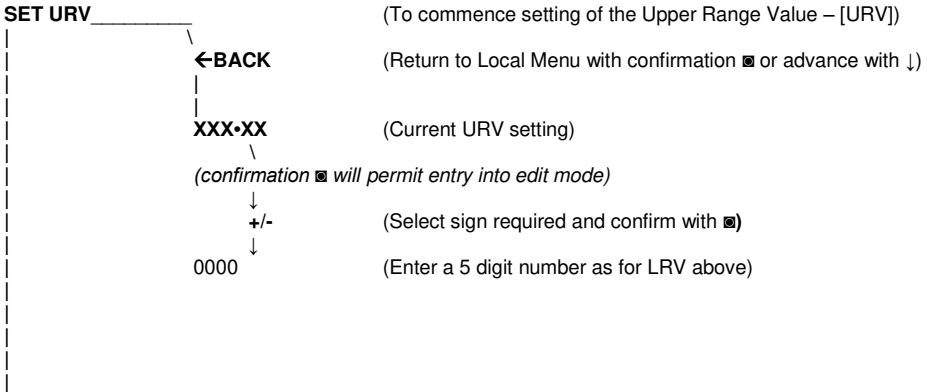
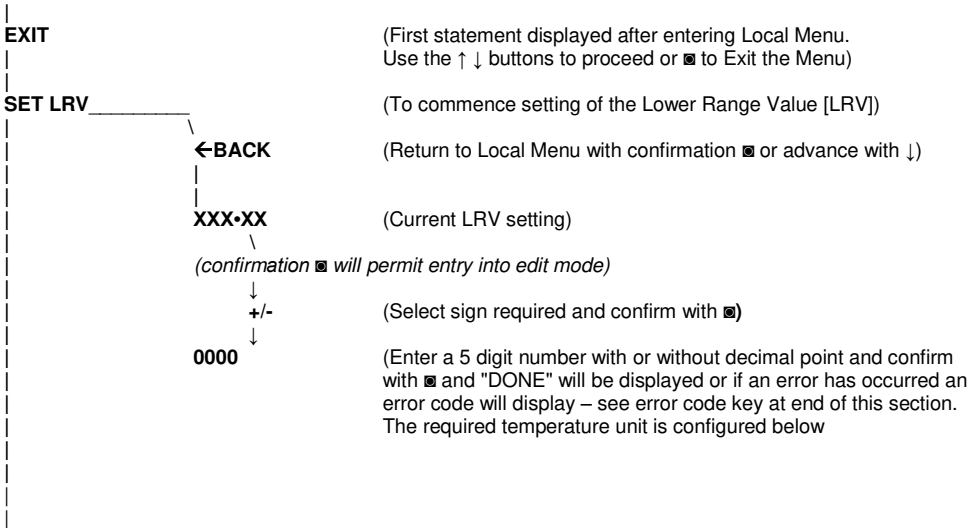
Pressing the [↑] button navigates up the MENU tree's structure.

Pressing the [↓] button navigates down the MENU tree's structure.

Pressing [■] confirms a function selection/parameter change.

If the buttons are not operated whilst in the MENU for 2 minutes, then the transmitter will automatically exit the MENU mode and the display will revert to the measured process variable.

9.2.4.1 Details of the MENU structure



DAMPING

←BACK

0 [S]
 2 [S]
 5 [S]
 10 [S]
 30 [S]

(Setting a response time delay)

(Return to Local Menu with confirmation or advance with ↓)(Select and confirm with one of the below options which when confirmed will display "DONE").**TRANSFER**

←BACK

LINEAR
SQRT
SQRTX^3
SQRTX^5
SPECIAL
SQUARE

(Setting of the current output mathematical form)

(Return to Local Menu with confirmation or advance with ↓)(Select and confirm with one of the below options which when confirmed will display "DONE").

(Linear)
 (Square root)
 (Square root with X^3)
 (Square root with X^5)
 (User's)
 (Square)

LCD1VARIABLE

←BACK

CURRENT
PERCENT

(Type of the process variable displayed on LCD1)

(Return to Local Menu with confirmation or advance with ↓)(Select and confirm with one of the below options which when confirmed will display "DONE").

(Output value in mA)
 (Output value in %)

LCD2VARIABLE

←BACK

(Type of the process variable displayed on LCD2 – main display)

(Return to Local Menu with confirmation or advance with ↓)

(Select and confirm with one of the below options which when confirmed will display "DONE").

TEMPERATURE

(The process temperature numerical value will be displayed on LCD2).

USER

(The selected process units will be displayed on LCD2)

UNIT

(The current unit or selected process unit and process temperature numerical value will be alternately displayed on LCD2)

NO UNIT

(The LCD2 display will not display any information).

LCD2 DP

←BACK

(The process variable decimal point position on LCD2)

(Return to Local Menu with confirmation or advance with ↓)

(Select and confirm with one of the below options which when confirmed will display "DONE").

XXXXX•

XXXX•X

XXX•XX

XX•XXX

•XXXXX

FACTORY

←BACK

(Return transmitter to factory default settings)

(Return to Local Menu with confirmation or advance with ↓)

(Select and confirm with the below which when confirmed will display "DONE").

RECALL

RESET

←BACK



(Reboot the transmitter programme)

(Return to Local Menu with confirmation or advance with ↓)

(Select and confirm with the below which when confirmed will display "DONE").

RESET

For transmitters meeting the requirements of EN 12405-1 (MID) for gas measurement.

MID_WP _____ 	\ ←BACK ON OFF	(Enable/disable the modification parameters associated with MID) (Return to Local Menu with confirmation  or advance with ↓) (Select and confirm with  the one of the below options which when confirmed will display "DONE"). (Activates the MID measuring parameters) (Deactivates the MID measuring parameters)
--	--	--

Local Menu, error code definitions.

Whilst configuring the transmitter via the local menu buttons any errors made when carrying this out are identified by error codes displayed on the main LCD2 display. These codes are explained below:

ERR_L07 (in_write_protected_mode) This error code will display when attempting to access the Local Menu via the buttons with the transmitter 'in write protected' mode. This can be overcome via the PYRT-2000/ALW configuration software or the library EDDL software.

Default settings-:

- Local Menu option Enabled
- Write protection Disabled

ERR_L09 [applied_process_too_high]. This error code will display when applied process temperature is lower than the set LRV figure. Zeroing or re-setting the LRV may be necessary.

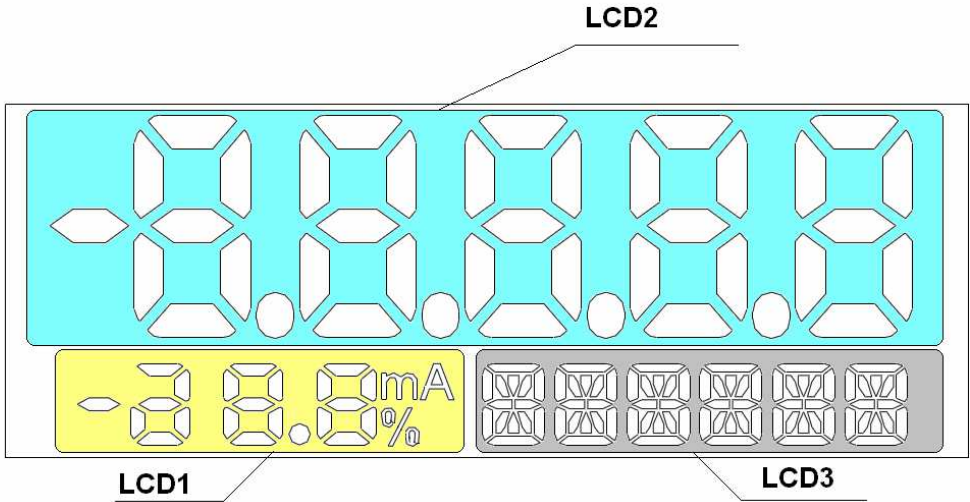
ERR_L10 [applied_process_too_low]. This error code will display when applied process temperature is higher than the set URV figure. Zeroing or re-setting the URV may be necessary.

ERR_L14 [span_too_small]. This error code will display when the "set (calibration) range" is less than the minimum permitted i.e. <10°C

ERR_L16 [access_restricted]. This error will display when an attempt is made to access the Local Menu via the local buttons without them being enabled hence local configuration is not possible. This can be overcome via the PYRT-2000/ALW configuration software or the library EDDL software.
(Note: Local Menu access enabled is the factory default).

9.2.5. Setting up the local LCD display

The LCD display can be configured to suit the user's requirements. Changes to the display options are available via the Local Menu buttons or remote PC and software. If required the display can be disabled, this can only be carried out via the remote software link.



The LCD display is made up of 3 LCD displays as under:

- **LCD1** – The small lower left display which can indicate the current value within the 4 – 20mA current loop or percentage of the set “calibrated” range.
- **LCD2** – The main upper display to provide the read out of the process temperature as the defined by the set “calibrated range and units of measurement. This display is also utilised when making configuration changes.
- **LCD3** – The small lower right display is primarily for continuous indication of the units of measurement. This display is also used when accessing the Local Menu to implement configuration changes and to display the error codes as listed on the previous page.
- **Display backlighting** – The display is equipped with a backlight which can be turned on and off via a jumper on the electronic board. Fig. 5 shows how to position this link.



After any configuration work the transmitter should be “write protected” using command HART [247].

Whilst carrying out configuration work or changes the transmitter output should not be connected into a control scheme to avoid unintentional system actions or accidents.

The “write protect” function is accessible via the “PYRT-2000/ALW Configuration” software or the DD or DMT program libraries.

9.3. Calibration.

The transmitter can be calibrated by inputting reference values relative to the type of sensor fitted (i.e. PT100 RTD or Type K thermocouple) and checked against the scale or the current output 4 - 20 (20 - 4) mA.

The calibration points need not be equal to the upper and lower limit of the nominal range of the type of sensor element fitted, but it is recommended they are close to the upper and lower points of the set "calibration" range. The width of the calibration range should not be less than the minimum width of the setting range. Calibration can be carried out by methods as detailed in points 9.2.3.

10. INSPECTIONS AND SPARE PARTS

10.1. Periodic inspections

Scheduled periodic inspection should be carried out based on the nature of the installation and the location of the transmitter, this to be determined by the user.

During these inspections, the process connection of the sensing probe and/or thermowell should be checked for secureness and leaks, the electrical connections should be checked to ensure they are still maintaining a full ingress seal, are correctly tightened, and the gaskets/packing glands have not deteriorated.

Check the characteristic conversion curve by following the procedures for "Calibration" and, where appropriate, "Configuration".

10.2. Unscheduled inspections

If the transmitters are installed in a location where they may be exposed to mechanical damage, hydraulic impulses, over voltage or other hazards – extra-ordinary inspections should be carried out as required.



In the event of there being no output signal in the circuitry or the value is incorrect, initially check the continuity of the circuit and the terminal connections.

Thereafter check that the supply voltage is present and within the required range, and that the load in the circuit is greater than 250Ω

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 integrity of the electrical circuitry is proven, then the operation of the transmitter should be checked.

10.3. Spare parts.

Parts of the transmitter which may be subject to wear or damage and require replacement: Cover and packing gland gaskets.



Other listed parts, due to the specific features and requirements of the hazardous area certification (when applicable), may be replaced only by the manufacturer or by an organisation authorised by the manufacturer.

11. PACKING, STORAGE AND TRANSPORT.

The transmitters should be packed singly in such a way as to protect them from damage during transportation and secured against moving.

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

Any mode of transport may be used provided the packed items are carried within an enclosed, weatherproof vehicle/vessel.

12. GUARANTEE

The manufacturer guarantees the proper operation of the transmitters for a period of 24 months from the date of purchase and servicing. 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.

13. ADDITIONAL INFORMATION

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

14. FIGURES.

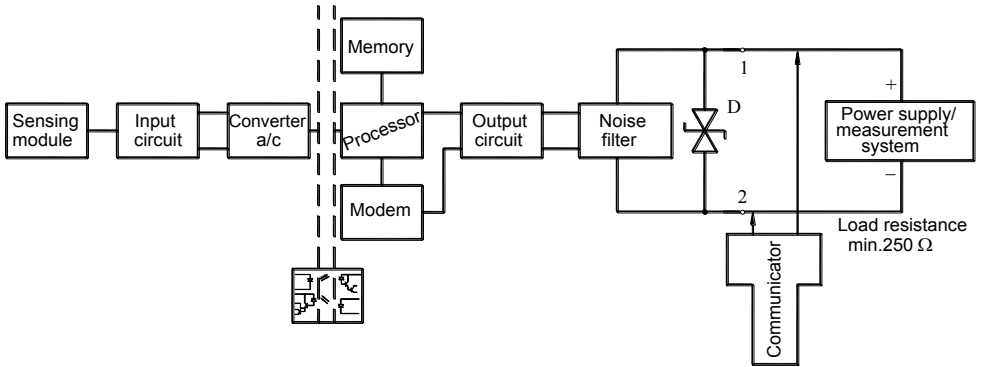


Fig.1. PYRT-2000/ALW transmitter – block diagram.

When configuring or making adjustments to the transmitter the resistance in the current loop should be greater than 250Ω. The transmitter is fitted with a 240Ω resistor across terminals “SIGNAL –” and “TEST –” and linked out with a jumper. This link is to be removed should the load in the loop be less than 250Ω, and replaced once configuration has been completed. Alternative methods of connection are detailed below. Whilst ensuring the minimum resistance in the current loop, care should be taken that in doing so that the minimum operating voltage is still maintained (see Point 5.1.).



Electrical schematic examples Fig's 2a – 2d

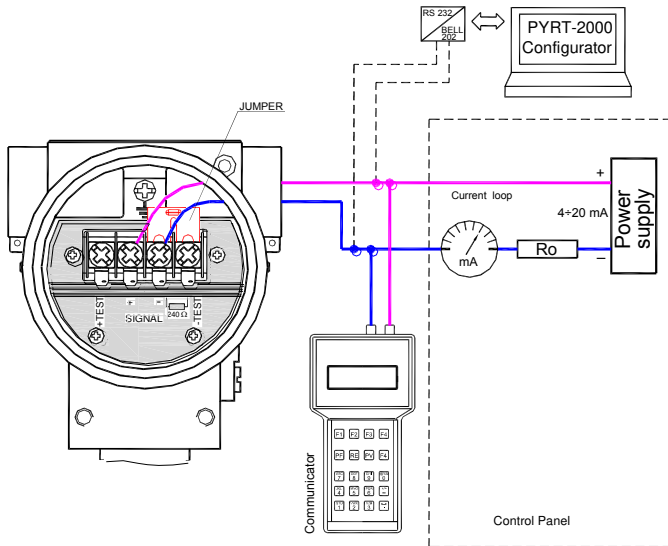


Fig.2a. Connection arrangement with the power supply derived from a PSU in a remote control panel and the PC (and/or local hand held communicator) connections as part of the loop, with the resistance in the loop being greater than 250Ω.

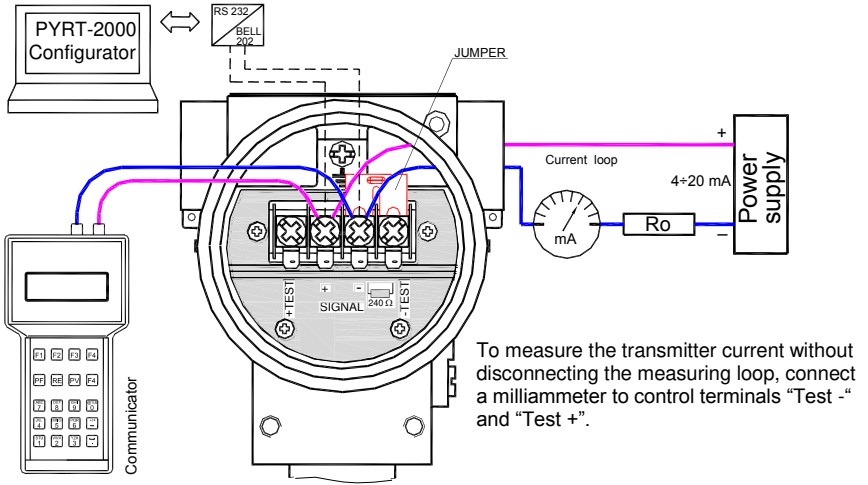


Fig.2b. Connection arrangement with the power supply, PC and/or communicator connections all made at the transmitter terminals, with the resistance in the loop being greater than 250Ω.

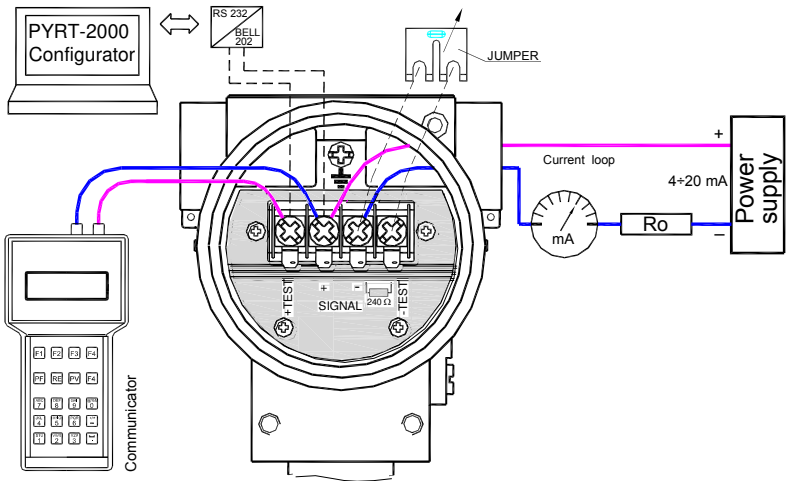


Fig.2c. Connection arrangement with the power supply, PC and/or communicator connections all made at the transmitter terminals, with the resistance in the loop being less than 250Ω.

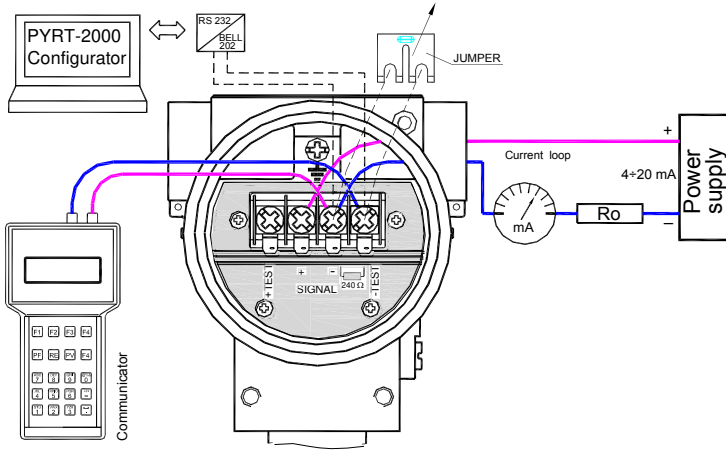


Fig.2d. Connection arrangement with the power supply, PC and/or communicator connections all made at the transmitter terminals, with the resistance in the loop being less than 250Ω.

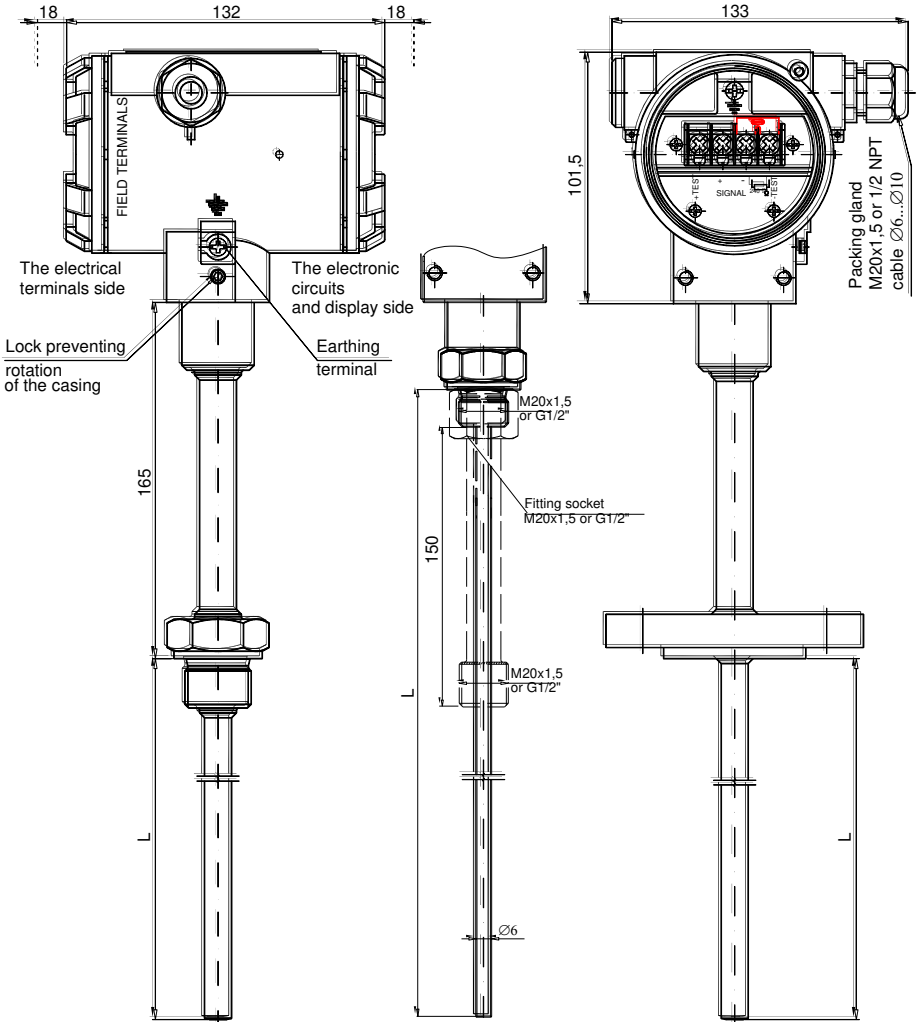


Fig.3. PYRT-2000/ALW Smart Temperature Transmitter

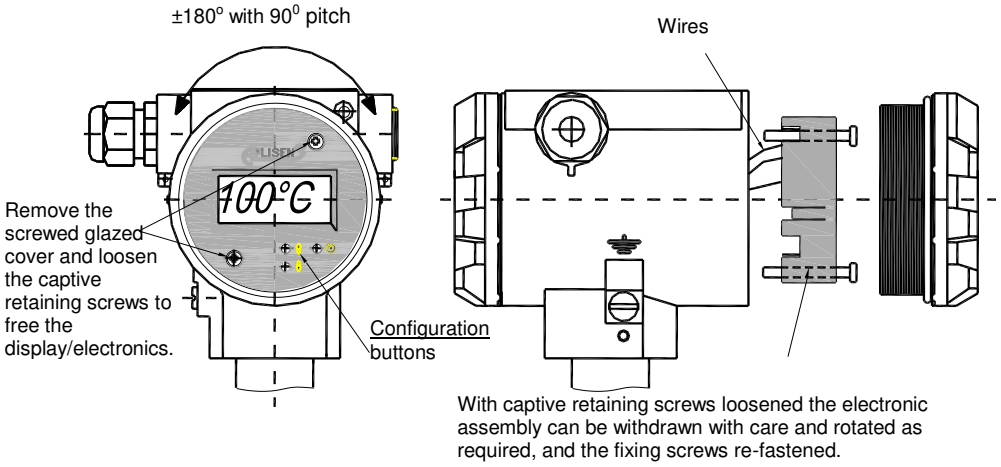


Fig.4. PYRT-2000/ALW display rotation and configuration buttons view.



Jumper in radial position (as shown in photo) – back lighting OFF; Jumper in circular position – back lighting ON.

Fig. 5. Rear view of electronic/display module

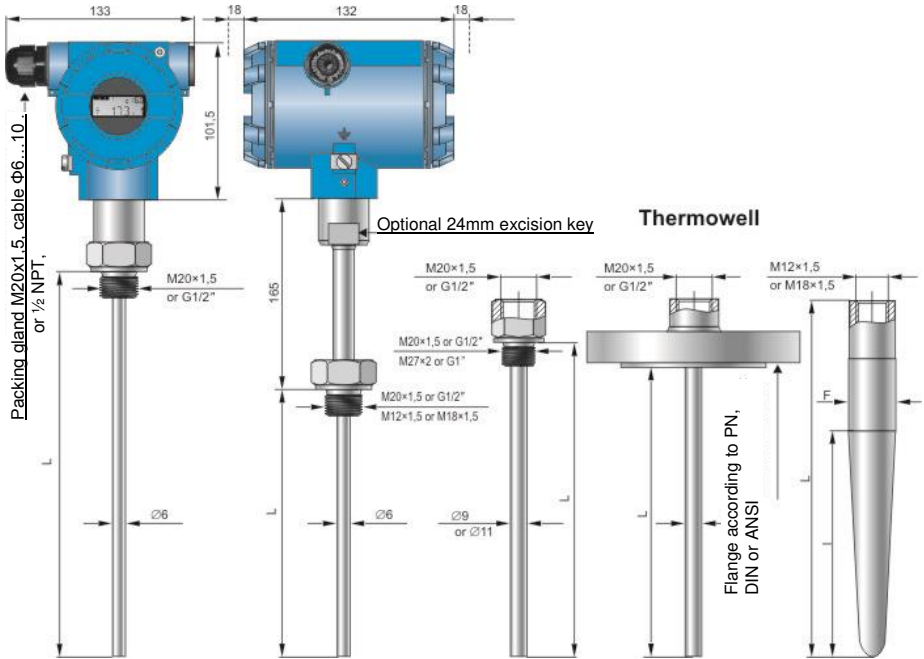
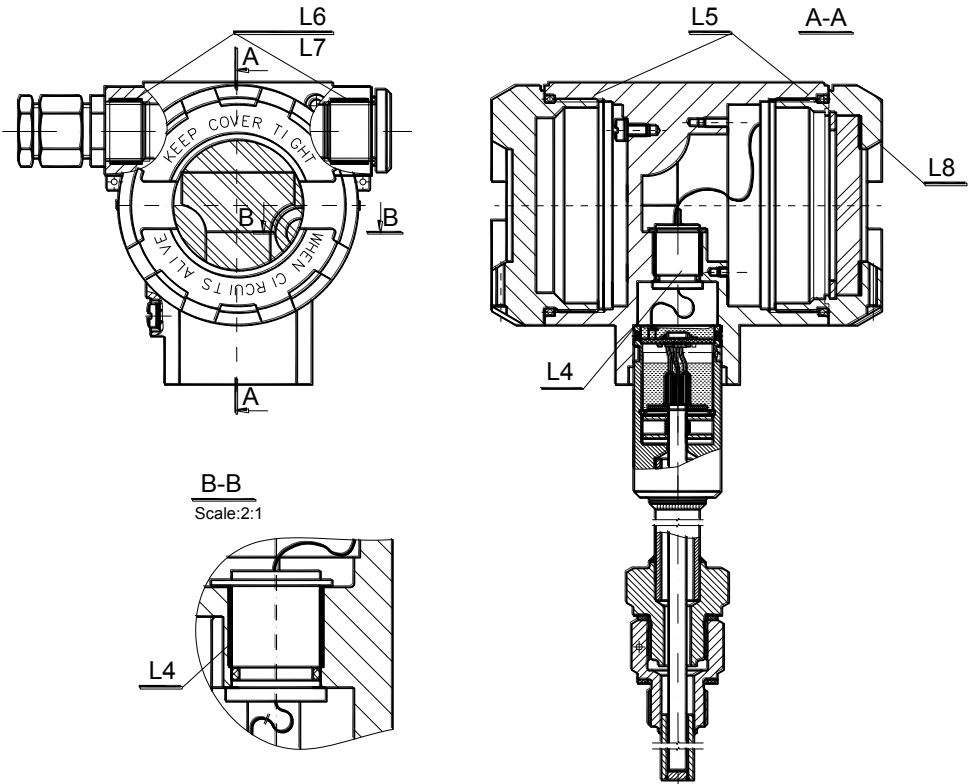


Fig.6. Sensing probe types and typical thermowell styles.



MINIMUM WIDTH OF JOINT AND MAXIMUM GAP FOR GROUP IIC ENCLOSURES						
Nr	width of joint (min. real) L [mm]	diameter		D-d [mm]	quantity of joint	minimum according to PN-EN 60079-1:2008
		D [mm]	d [mm]			
L4	13,3	O15 ^{+0,027}	O15 ^{-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.7. The flameproof joints/flamepaths of PYRT-2000/ALW temperature transmitter.

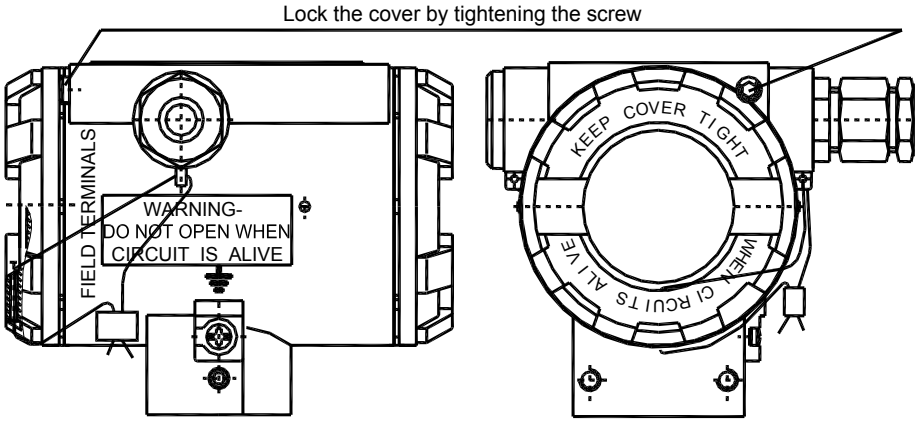


Fig.8. How to fit a leaded (tamperproof) seal.

I. APPENDIX Exd



PYRT-2000/ALW/D TEMPERATURE TRANSMITTER Exd VERSION

1. Introduction

1.1. This appendix applies to the PYRT-2000/ALW/D Exd certified transmitter only, with markings on the rating plate as shown in Point 3 and denoted Exd in the product certificate.

1.2. The appendix contains supplementary information relating to the Exd (flameproof) versions of mentioned transmitters.

During the installation and use of Exd certified transmitters, reference should be made to the Installation, Operation and Maintenance Manual **DTR.PYRT.ALW.02** and this **Appendix Exd**.

2. Use of PYRT-2000/ALW/D 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 50303:2000

2.2. The transmitters may be installed in designated hazardous areas where the explosion hazard is caused by dust or ignitable gas, and the certification level as stated below meets the area safety requirements:

I M2 Ex ia/d I Mb (316 st. steel enclosure version)



II 1/2G Ex d/ia IIC T* Ga/Gb
II 1/2D, Ex ia/t IIIC T* Da/Db
-40°C ≤ Ta ≤ +45°C/ +75°C

KDB

T* - temperature class for transmitter (for gases) or a maximum surface temperature (for dust) derived in clauses 5.3 and 5.4.

2.3 Transmitter category and hazard areas.

The category 1/2G, contained within the rating, means that the transmitter may be installed within a type 1 or 2 hazard zone. The process connections may be connected to a process/area that is designated as Zone 0 (see the diagram on following page at point 5.3 for an example).

3. Identifying marks.

Flameproof transmitters will have a rating plate containing the information specified in paragraph 4.1 of this manual and also stating at least the following:

- CE mark and number of notified unit, mark.
- Designation of flameproof protection design, certificate number.
- Power supply.
- Process connection.
- Year of manufacture.
- Temperature use range.

4. User information.

Together with the ordered transmitters, the user will receive:

- a) Product Certificate
- b) Declaration of conformity
- c) Copy of certificate – on request
- d) Installation, Operation and Maintenance Manual **DTR.PYRT.ALW.02** with **Appendix Exd**

5. Power supply and installation of the transmitter.

5.1. The transmitter connections should only be carried out after reading this manual.

The electrical connection to the transmitter should be carried out as detailed in point 6 of this appendix.

The electrical installation work should be carried out by suitably qualified personnel and in accordance with the recognised applicable electrical installation standards.

5.2. The power supply should be derived from a dc source having a maximum output of 45V. The power supply unit should have fully isolated inputs and outputs, with the input voltage not exceeding 250Vac.

The integrity of the power supply installation is the responsibility of the installer.

5.3. Calculating the temperature class of the transmitter.

5.3.1. After installing the transmitter the temperature class should be calculated.

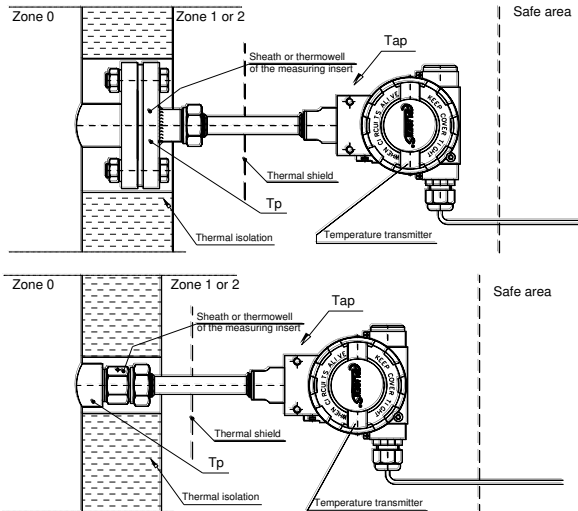
This can be done using the formula as detailed in 5.4 below requiring the hottest surface temperature on the transmitter, usually the sensor fitting (Tp) and maximum expected ambient temperature.



- 5.3.2. When the process temperature exceeds the installation ambient temperature it can be solely used to determine the temperature class of the transmitter or the maximum surface temperature Tp. The potential maximum surface temperature can be estimated in relation to the known rise in ambient temperature.



- 5.3.3. If the other elements of the plant have or may have a temperature higher than the highest temperature (Tp) seen at the transmitter, these must also be checked to ensure plant hazardous area safety is maintained.



5.4. Calculation of the transmitter temperature class T* for gas and the maximum surface temperature.



1. To determine the temperature class of the transmitter for the gas or the maximum temperature for combustible dust depending on the temperature Tp from the formula:

$$T^* \geq T_p + 0,1T_p + 5K \text{ for class T3 - T6}$$

$$T^* \geq T_p + 0,1T_p + 10K \text{ for class T1, T2}$$

2. To determine the maximum surface temperature transmitter for combustible dust from the formula:

$$T^* \geq T_p + 0,1T_p$$

3. The following table contains the values of permissible ambient temperature depending on the temperature Tp and temperature class of the transmitter.

Tp [°C]	Temperature class and ambient temperature Ta [°C]	
Tp ≤ 75°C	T6 and Ta = 45°C T5 and Ta = 75°C	
Tp > 75°C	T4 and T5	Ta = 70°C
	T3 and T2	Ta = 65°C
	T1	Ta = 60°C

Tp- transmitter temperature measured in clause 5.3

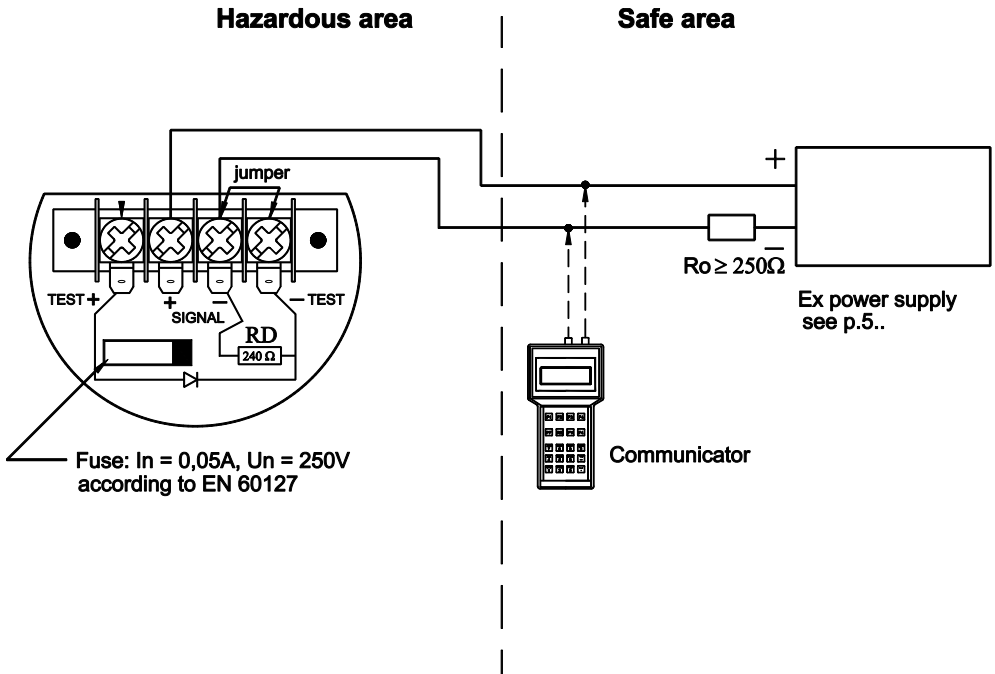
In the event of a significant increase in the process maximum temperature, the maximum surface temperature (Tp) must be carried out again and the temperature class re-evaluated.

- 5.5. Particular care should be taken when installing the transmitter to avoid any impact strikes during the installation process.
- 5.6. The electrical entry to the transmitter is via 2 x threaded holes, either in M20 x 1.5 or 1/2 NPT.
- 5.7. As standard, transmitters are supplied without cable glands but with a plastic transit plug in one and a certified blanking plug in the other. Examples of recommended certified cable glands and plugs are shown in Table 1 and Table 2 on the following page, though the final selection is the installer's decision.
- i** 5.8. Cabling to the transmitter should be carried out in screened or if there is no possibility of RFI/EMI unscreened cable suitably mechanically protected for the installation and waterproof. A typical acceptable cable is "LIYCY 2x1mm", however it is up to the installer to make the final selection dependent on the site conditions and wiring requirements of the installation.
- 5.9. The installation and putting to work of these transmitters must be carried out strictly in accordance with all of the current standards and regulations for hazardous area installations and Exd certified equipment such as that stated at point 2.1 and also: EN600079-14, EN60079-17.
- i** 5.10. During servicing, as a minimum checks should be made to ensure the access covers are fully fastened, as are the cable glands and plugs, and that the cables are securely held in the glands. The housing and process line should be checked for any mechanical damage, and the fitted rating plate for legibility. During maintenance it is recommended that the threads of the covers be lubricated with non-acid vaseline.



The ambient temperature should not exceed 80°C as this could damage components or cause transmitter failure.

6. Wiring connections to Exd transmitter type PYRT-2000/ALW/D





Never remove the transmitter access covers whilst in the hazardous area unless the area has been made safe and a gas detector utilised to cut the electrical supply in the event of gas being detected.



To carry out calibration and configuration changes within the transmitter in the hazardous area, a remote PC and configuration software should be utilised and connections made to the transmitter as detailed in Fig's 2a – 2d.



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 authorised organisation for repair assessment and work.

Table 1 Examples of recommended cable glands.

Type of packing glands	Producer	Screw	Feature	Other marking	Note
501/423	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	
501/421	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	
ICG 623	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	
501/453	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	*
501/453/RAC	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	*
501/453/Universal	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	*
ICG 653	HAWKE	M20x1,5	Exd IIC	dimension OS, O, A	*
8163/2-A2F	STAHL	M20x1.5	Exd IIC		
A2F, A2FRC, SS2K	CMP-Products	M20x1,5	Exd IIC		
E1FW, E1FX/Z, E2FW, E2FX/Z	CMP-Products	M20x1,5	Exd IIC		*
T3CDS, T3CDSPB	CMP-Products	M20x1,5	Exd IIC		*
PX2K, PXSS2K, PX2KX, PXB2KX	CMP-Products	M20x1,5	Exd IIC		*

Table 2. Examples of recommended plugs

Type of plug	Producer	Screw	Feature	Other marking	Note
	AGRO AG	M20x1,5	Exd IIC		
475	HAWKE	M20x1,5	Exd IIC		
477	HAWKE	M20x1,5	Exd IIC		

*) for special cable only.

II. APPENDIX Exi.



PYRT-2000/ALWIS TEMPERATURE TRANSMITTER

Exi VERSION

1. Introduction

1.1. This Appendix applies to the PYRT-2000/ALW/IS Exi certified transmitter only, with markings on the rating plate as shown in Point 3 and denoted Exi in the product certificate.

1.2. The appendix contains supplementary information relating to the Exi (intrinsically safe) versions of these transmitters.

During the installation and use of Exi transmitters, reference should be made to the Installation, Operation and Maintenance Manual **DTR.PYRT.ALW.02** and this **Appendix Exi**.

2. Use of PYRT-2000/ALW/IS transmitters in hazardous areas.

2.1. The transmitters are produced in accordance with the requirements of the following standards:

EN 60079-0:2009, EN 60079-11:2007, EN 60079-26:2007, EN 61241-11:2006, EN 50303:2000.

2.2. The transmitters may be installed in designated hazardous areas where the explosion hazard is caused by dust or ignitable gas, and the certification level as stated below meets the area safety requirements.

II 1/2G Ex ia IIC T4/T5/T6 Ga/Gb



I M1 Ex ia I Ma (316 st. steel enclosure version)

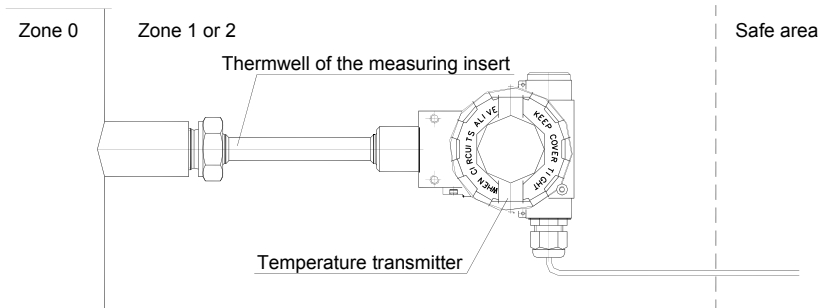
II 1D Ex ia IIIC T105°C Da

FTZÜ

(the temperature class (T rating) of transmitter depends on the measured process temperature)

2.3. Transmitter category and hazard areas

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



3. Identifying marks..

Intrinsically safe transmitters will have a rating plate containing the information specified at point 4.1 of this manual and also stating at least the following:



- CE mark and number of notified unit.
- Designation of explosion protection design, certificate number.
- Values of parameters such as. Ui, li, Ci, Li.
- Year of manufacture.

4. User information.

Together with the ordered transmitters, the user will receive:

- Product Certificate,
- Declaration of conformity
- Copy of certificate – on request
- Installation, Operation and Maintenance Manual DTR.PYRT.ALW.02 with Appendix Exi.

5. Power supply and installation ambient temperature parameters



The transmitters must be powered via correctly selected Exi intrinsically safe zener barriers/galvanic isolators. The parameters of these barrier/isolators should not exceed the figures as stated in points 5.1 – 5.3.

The applicable Temperature class T4, T5, or T6 depends on the input power and maximum ambient temperature – see points 5.1 - 5.3. The ambient temperature range is reduced to $T_a = -20^\circ\text{C}$ to $+60^\circ\text{C}$ if the devices is installed as group I M1 equipment (mining).

Connections to the transmitter are made via integral terminals and cable glands which maintain the IP rating of the housing. Additionally, in dust hazard applications the cable glands must be suitably certified for that hazard.

5.1. - For power supply with “linear” output characteristics

$U_i = 30\text{V}$ $I_i = 0,1\text{A}$ $P_i = 0,75\text{W}$ $T_a \leq 80^\circ\text{C}$ and T4, $T_a \leq 70^\circ\text{C}$ and T5, $P_i = 0,5\text{W}$ $T_a \leq 45^\circ\text{C}$ and T6

Example of a power supply source with “linear” output characteristics

$U_o = 28\text{V}$ $I_o = 0.093\text{A}$ $R_w = 300\Omega$.

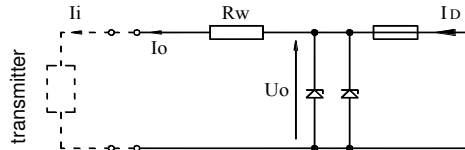


Fig.1. Power supply from a source with “linear” characteristic

5.2. – For power supply with “trapezoidal” output characteristics

$U_i = 24\text{V}$ $I_i = 50\text{mA}$ $P_i = 0,6\text{W}$ $T_a \leq 80^\circ\text{C}$ and T5 and $P_i = 0,5\text{W}$ $T_a \leq 45^\circ\text{C}$ and T6

Example of power supply source with “trapezoidal” characteristics (see Fig. 2).

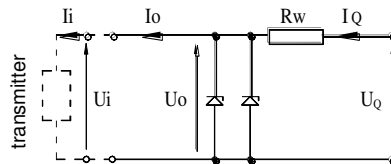


Fig. 2. Power supply from a source with “trapezoidal” characteristic

If $U_o < \frac{U_Q}{2}$ then parameters U_q , I_o , P_o are interrelated as follows:

$$U_Q = \frac{4P_0}{I_0}, \quad R_w = \frac{U_Q}{I_0}, \quad P_0 = \frac{U_0(U_Q - U_0)}{R_w} \quad \text{for } U_0 \leq 1/2U_Q$$

5.3. - For power supply with “rectangular” output characteristics

$U_i = 24\text{V}$ $I_i = 25\text{mA}$ $P_i = 0,6\text{W}$ $T_a \leq 80^\circ\text{C}$ and T5

The supply from a power source with “rectangular” output characteristics means that the voltage of the Exi 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 Exi device with protection level “ib”.

Example of practical provision of power supply.

- use a stabilised power supply with $U_o=24\text{V}$ with protection level “ib” and current limited to $I_o=25\text{mA}$.

5.4. Input inductance and capacity: $C_i = 20\text{nF}$, $L_i = 1,1\text{mH}$

5.5. Supply voltage min.: 13.5VDC **

5.6. Load resistance:

a) From 28V linear supply

$$R_o \text{ max } [\Omega] = \frac{28\text{V} - 13.5\text{V}^{**} - (300\Omega \cdot 0.02\text{A})}{0,023\text{A}} \quad \text{for a transmitter with display back lighting off.}$$

b) From a source with "trapezoidal" or "rectangular" characteristic supply

$$R_o \text{ max } [\Omega] = \frac{U_{zas} - 13.5\text{V}^{**}}{0,023\text{A}}$$

*) barrier resistance

**) 16,5V for a transmitter with the display back lighting on.

5.7. Temperature

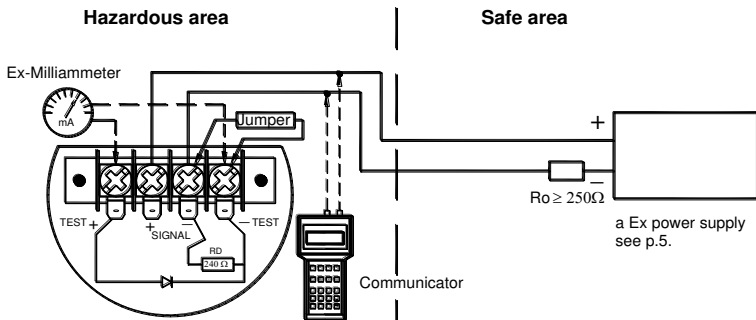
The maximum surface temperature at any point on the transmitter including any part of the sensing probe or thermowell must not exceed the temperatures values related to the "T" rating as stated in EN 60079-0:2012 (Explosive atmospheres. Equipment. General Requirements).

Additionally the housing temperature should not exceed the maximum temperature value T_a as defined both in the intrinsically safe certification document and point 5 of this Appendix Exi.

6. Wiring connections to Exi transmitter PYRT-2000/ALW/IS.



The transmitter and other devices in the measuring loop should be connected in accordance with correct relevant electrical installation and hazardous area installation standards.



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.



The transmitter is fitted with a communication resistor $R_D = 240\Omega$ across terminals "Signal -" and "Test -" to ensure the minimum loop load.

As standard the transmitter is supplied with this resistor linked out of circuit via a jumper link. The resistor is required when communicating with the transmitter locally (from its terminals) and $R_o < 250\Omega$, in which case the jumper link should be removed.



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 authorised organisation for repair assessment and work.