Short-form of Operating Instructions for 266 pressure transmitters

2600T Series Pressure Transmitters Engineered solutions for all applications

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1. Introduction

1.1 General

This document provides basic instruction for the installation and commissioning of the ABB 2600T pressure transmitter. This transmitter is connected to a process by means of impulse lines and can measure Pressure, Differential pressure or Absolute pressure. The measurement is transmitted to a control system by means of a 4-20 mA signal with a superimposed digital signal (Hart) or by means of a digital transmission protocols (PROFIBUS or FOUNDATION Fieldbus or MODBUS).

The measure can also be indicated by means of one of the (optional) local or remote displays. Instructions for preliminary checks, proper transmitter location, installation, wiring, power-up and zero calibration (trimming) of the transmitter are listed in the following chapters. In order to assure operator and plant safety it is essential that the installation is carried out by personnel suitably trained on the local applicable codes on hazardous location, functional safety, electrical wiring and mechanical piping.

Please read these instructions carefully before installing the transmitter. The protection provided by the equipment may be impaired if the equipment is used in a manner not specified.

1.2 Supplementary documentation

For further information, please refer to the following documents:

DS/266XX_X

DS/2101130

DS/2101131

Pressure Transmitter Datasheets

DS/S26

Remote Seal Datasheet

IM/266

2105216MN

266 Pressure Transmitter Instruction Manual

IM/S26

Remote Seal Instruction Manual

All the addendum and other documents downloadable from www.abb.com/pressure

1.3 Use of instructions

Danger – <Serious damage to health/risk to life>. This message indicates that an imminent risk is present. Failure to avoid this will result in death or serious injury.

Caution – <Minor injuries>. This message indicates a potentially dangerous situation. Failure to avoid this could result in minor injuries. This may also be used for property damage warnings.

Important. This message indicates operator tips or particularly useful information. It does not indicate a dangerous or damaging situation.

Warning – <Bodily injury>. This message indicates a potentially dangerous situation. Failure to avoid this could result in death or serious injury.

Attention – <Property damage>. This message indicates a potentially damaging situation. Failure to avoid this could result in damage to the product or its surrounding area.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all Warning and Caution notices.

1.4 Health and safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given. Any deviation from these instructions, will transfer the complete liability to the user.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

1.5 Product identification

The instrument is identified by the data plates shown in Figure 1. The certification plate (ref. A): contains the certification related parameters for use in Hazardous area. The Nameplate (ref.B) provides information concerning the model code, maximum working pressure, range and span limits, power supply, output signal, diaphragms material, fill fluid, range limit, serial number, maximum process working pressure (PS) and temperature (TS).

Please refer to the serial number when making enquiries to ABB service department.

The optional additional SST Tag plate (ref. C - code I2) also provides customer tag number and calibrated range. The instrument may be used as a pressure accessory (category III) as defined by the Pressure Equipment Directive 97/23/EC. In this case, near the CE mark, you will find the number of the notified body (0474) that have verified the compliance. 266 pressure transmitters are in compliance with EMC 2004/108/CE*.

The certification plate (ref.A) shown here is issued by ABB S.p.A, 22016 Lenno, Italy, with the numbers:

- FM09ATEX0023X or IECEx FME 09.0002X (Ex d)
- FM09ATEX0024X or IECEx FME 09.0003X (Ex ia)
- FM09ATEX0025X or IECEx FME 09.0004X (Ex nL). Only for Modbus communication protocol (Ex nA)

CE-Identification number of the notified bodies to Pressure Equipment Directive: 0474, to ATEX certification: 0722, to IECEx certification: IT/ CES/QAR07.0001/02.

The certification plate (ref.A) shown here may also be issued for ABB-APR, 32425 Minden, Germany, with the numbers:

- FM09ATEX0068X or IECEx FME 09.0002X (Ex d)
- FM09ATEX0069X or IECEx FME 09.0003X (Ex ia)
- FM09ATEX0070X or IECEx FME 09.0004X (Ex nL)

CE-Identification number of the notified bodies to Pressure Equipment Directive: 0045, to ATEX certification: 0044, to IECEx certification: DE/ TUN/QAR06.0012/01.

The same certification plate (ref.A) can be issued for ABB India Limited, Racecourse Rd Bangalore, India with the numbers:

- FM11ATEX0035X (Ex ia)
- FM11ATEX0036X (Ex d)
- FM11ATEX0037X (Ex nL)

CE-Identification number of the notified bodies to ATEX certification: 0359.

ABB Engineering Limited, Shanghai 201319, P.R. China, can issue this certification plate (ref. A), as well. The numbers are:

- FM11ATEX0046X or IECEx FMG 11.0019X (Ex ia)
- FM11ATEX0047X or IECEx FMG 11.0018X (Ex d)
- FM11ATEX0048X or IECEx FMG 11.0020X (Ex nL)

CE-Identification number of the notified bodies to ATEX certification: 1725.

ABB Inc., 7051 Industrial Blvd, Bartlesville, OK 74006, United States with the numbers:

- FM09ATEX0023X or IECEx FME 09.0002X (Ex d)
- FM09ATEX0025X or IECEx FME 09.0004X. Only for

Modbus communication protocol (Ex nA Ex nC)

CE-Identification number of the notified bodies to ATEX certification: 0518, to IECEx certification: CA/CSA/ QAR06.0010/05.

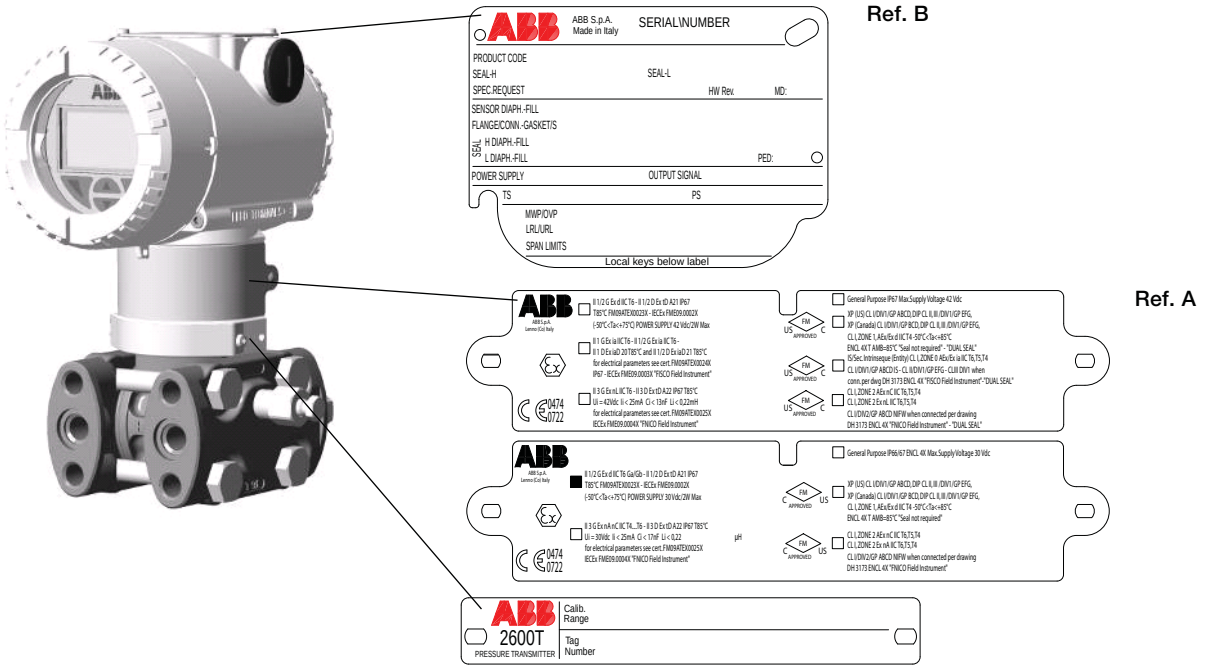


Figure 1: Product identify

*** C and F sensors on gauge and absolute pressure transmitters are in compliance with IEC61000-4-6 with B criteria**

2 Safety

2.1 General

Read this instruction carefully prior to installation and commissioning. For reasons of clarity, the instructions do not contain all details on all types of product and do therefore not take into account every conceivable case of assembly, operation or maintenance. If you want further information or if special problems arise which are not treated in detail in the instructions, please ask the manufacturer for the necessary information.

Moreover we would like to point out that the content of these instructions is neither part of nor provided for changing a previous or existing agreement, promise or legal relationship.

All obligations of ABB Instrumentation result from the respective sales contract which also comprises the complete and solely valid warranty clauses. Such contractual warranty clauses will neither be limited nor extended by the content of these instructions.

Observe warning signs at packaging, etc.

For assembly, electrical connection, commissioning and maintenance of the transmitter, only qualified and authorized specialists are to be employed, because they are experienced in the assembly, electrical connection, commissioning and operation of the transmitter or similar devices holding the necessary qualifications for their job, e.g.:

- Training or instruction and/or authorization to operate and maintain devices/systems according to the safety engineering standard for electric circuits, high pressures and aggressive media.
- Training or instruction according to the safety engineering standard regarding maintenance and use of adequate safety systems.

For the sake of your own safety, we draw your attention to the fact that for the electrical connection, only sufficiently isolated tools acc. to EN 60 900 may be used.

Furthermore consider the following regulations:

- The pertinent safety regulations concerning the construction and operation of electrical installations, e.g. the rule regarding technical working material (safety rule for instruments), have to be observed.
- The pertinent standards.
- The regulations and recommendations relating to explosion protection if explosion-proof transmitters are to be installed.
- The safety recommendation if installed in a SIL loop as described in the Safety Manual (please look at the end of this manual)

The device can be operated with high pressure and aggressive media. Serious injury and/or considerable material damage can therefore be caused when this device is handled incorrectly. Please observe the pertinent national rules when using pressure transmitters.

2.2 Transportation

After final calibration, the instrument is packed in a carton intended to provide protection from physical damage.

2.3 Handling

The instrument does not require any special precautions during handling although normal good practice should be observed.

2.4 Storage

The instrument does not require any special treatment if stored as dispatched and within the specified ambient conditions. There is no limit to the storage period, although the terms of guarantee remain as agreed with the Company and as given in the order acknowledgement.

2.5 Special conditions for safe use in potentially explosive environments

- When the manufacturer of the equipment has not marked the type of protection on the safety label, the user shall, on installation, permanently mark the label with the type of protection used. Once the type of protection has been marked it shall not be changed.
- The user must ensure the materials selected (identified in the model number code) when the equipment was ordered, shall not be subject to environmental conditions, such as existing or foreseeable aggressive substances, which might adversely affect the materials of the equipment
- The equipment enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

3 Installation

3.1 General

Warning.

For installation in Hazardous Areas, i.e. areas with dangerous concentrations of e.g. gases or dusts that may explode if ignited, the installation must be carried out in accordance with relative standards either EN 60079-14 and/or with local authority regulations, for the relevant type of protection adopted.

In order to ensure operator safety and plant safety it is essential that installation is carried out by suitably trained personnel according to the technical data provided in the specification for the relevant model. To find out the "Operative limits" please refer to the dedicated chapter of the instruction manual and datasheets.

The transmitter should not be installed where it may be subjected to mechanical and thermal stresses or where it may be attacked by existing or foreseeable aggressive substances. ABB cannot guarantee that a construction material is suited to a particular process fluid under all possible process conditions. Fill fluids and wet parts materials selection is under user's full responsibility.

Caution. Proper location of the transmitter with respect to the process pipe will depend upon the service for which the instrument is used. Care should be exercised to identify correct process connections.

Important. In differential pressure transmitters the high side is marked with "H" or "+" and low side with "L" or "–".

Before mounting the transmitter, check whether the model meets the measurement and safety requirements of the measuring point, e.g., with regard to materials, pressure rating, temperature, explosion protection and operating voltage. The relevant recommendations, regulations, standards and the rules for prevention of accidents must also be observed!

Measurement accuracy is largely dependent upon correct installation of the transmitter and the related measurement piping. The measuring set-up should be screened as much as possible from critical ambient conditions such as major temperature variations, vibration and shock. For example, if ambient conditions may change considerably as a result of locating the transmitter near a building structure, this may influence the measurement quality!

3.2 Transmitter

The transmitter can be flanged directly to the shut-off valve. A mounting bracket for wall or pipe mounting (2" pipe) available as an accessory. Mount the transmitter in such a way that the process flange axes are vertical (horizontal in case of barrel-type aluminum housing) in order to avoid zero shifts.

If the transmitter is installed at an incline, the hydrostatic pressure of the filling fluid would exert pressure on the measuring diaphragm and thus cause a zero shift! A zero point correction would then be necessary. Pressure transmitters can be mounted in any position. Seal unconnected process connections on the sensor with the enclosed screw plugs (1/4-18 NPT). For this purpose, use your officially approved sealing material.

3.3 Hazardous area considerations

The transmitter must be installed in hazardous area only if it is properly certified. The certification plate is permanently fixed on the neck of the transmitter top housing.

The 266 Pressure Transmitter Line can have the following certifications:

ATEX INTRINSIC SAFETY

- II 1 G Ex ia IIC T4/T5/T6 and II 1/2 G Ex ia IIC T4/T5/T6
- II 1 D Ex iaD 20 T85°C and II 1/2 D Ex iaD 21 T85°C

ATEX EXPLOSION PROOF

- II 1/2 G Ex d IIC T6 and II 1/2 D Ex tD A21 IP67 T85°C

ATEX TYPE "N" / EUROPE:

- II 3 G Ex nL IIC T4/T5/T6 and II 3 D Ex tD A22 IP67 T85°C
- II 3 G Ex nA IIC T4/T5/T6 and II 3 D Ex tD A22 IP67 T85°C (Modbus version communication only)

COMBINED ATEX, ATEX FM and FM Canada

- See detailed classifications

FM Approvals US and FM Approvals Canada:

- Explosionproof (US): Class I, Div. 1, Groups A, B, C, D
- Explosionproof (Canada): Class I, Div. 1, Groups B, C, D
- Dust ignitionproof: Class II, Div. 1, Groups E, F, G
- Nonincendive: Class I, Div. 2, Groups A, B, C, D
- Intrinsically safe: Class I, II, III, Div. 1, Groups A, B, C, D, E, F, G
- Class I, Zone 0, AEx ia IIC T6/T4 (FM US)
- Class I, Zone 0, Ex ia IIC T6/T4 (FM Canada)
- Class I, Zone 2, A Ex nC IIC T6/T4 (FM US and Canada) (Modbus version communication only)
- Class I, Zone 2, A Ex nA IIC T6/T4 (FM US and Canada) (Modbus version communication only)

IEC (Ex):

- See detailed classifications

INTRINSIC SAFETY/CHINA

- NEPSI approval Ex ia IIC T4-T6

FLAMEPROOF/CHINA

- NEPSI approval Ex d IIC T6

GOST (Russia), GOST (Kazakistan), Inmetro (Brazil)

- based on ATEX.

Warning. Explosion-proof transmitters must be either repaired by the manufacturer or approved by a certified expert following repair work. Observe the relevant safety precautions before, during and after repair work.

3.4 Pressure Equipment Directive (PED) (97/23/CE)

3.4.1 Devices with PS >200 bar

Devices with a permissible pressure PS >200 bar have been subject to a conformity validation. The data label includes the following specifications:

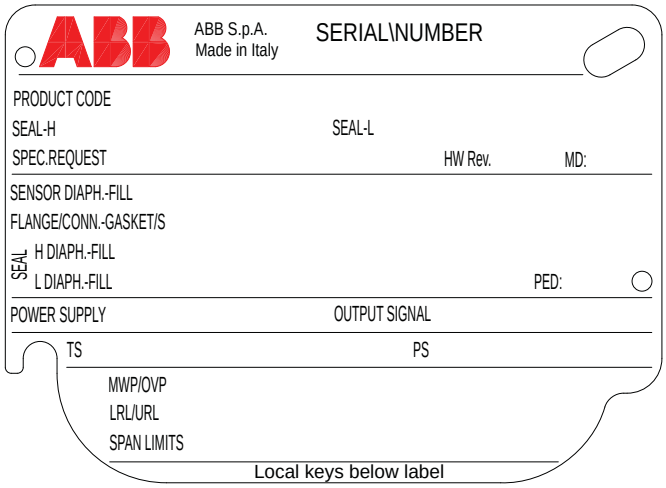


Figure 2: 266 nameplate with PED data

3.4.1 Devices with PS <200 bar

Devices with a permissible pressure PS <200 bar correspond to article 3 paragraph (3). They have not been subject to a conformity validation. These instruments were designed and manufactured acc. to SEP Sound Engineering Practices.

3.5 Transmitter housing rotation

To improve field access to the wiring or the visibility of the optional LCD meter, the transmitter housing may be rotated through 360° and fixed in any position. A stop prevents the housing from being turned too far.

In order to proceed with housing rotation, the housing stop tang- screw has to be unscrewed by approximately 1 rotation (do not pull it out) and, once the desired position has been reached, retightened.

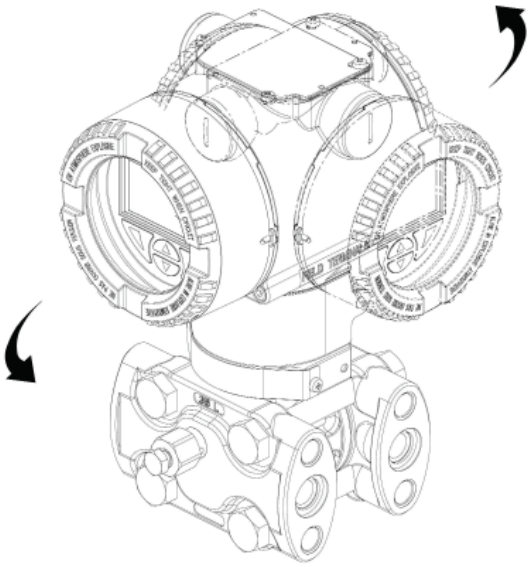


Figure 3: Housing rotation

3.6 Integral display rotation

In case an optional integral display meter is installed, it is possible to mount the display in four different positions rotated clockwise or counterclockwise with 90° steps.

To rotate the LCD, simply open the windowed cover (Hazardous area prescriptions must be respected), pull-out the display housing from the communication board. Reposition the LCD connector according to the new desired position. Push back the LCD module on the communication board. Be sure that the 4 plastic fixing locks are properly in place.

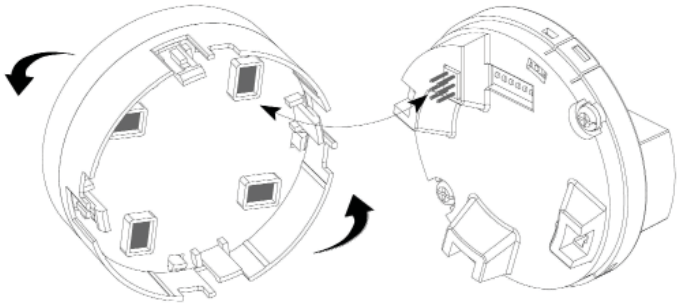


Figure 4: LCD rotation

3.7 Impulse piping connection for standard instruments

In order for the pipes to be laid correctly, the following points must be observed:

- The measuring pipes must be as short as possible and free from sharp bends.
- Lay the impulse piping in such a way that no deposits can accumulate in them. Gradients should not be less than approx. 8 % (ascending or descending).
- The measuring pipes should be blown through with com pressed air or, better yet, flushed through with the measuring medium before connection.
- Where a fluid/vaporous measuring medium is being used, the liquid in both measuring pipes must be at the same level. If a separating liquid is being used, both measuring pipes must be filled to the same level (266Dx and 266Mx).
- Although it is not absolutely necessary to use balancing vessels with vaporous measuring media, measures must be taken to prevent steam entering the measuring chambers of the measuring equipment (266Dx and 266Mx).
- It may be necessary to use condensate vessels, etc., with small spans and vaporous measuring media (266Dx and 266Mx).
- If using condensate vessels (steam measurement), you should ensure that the vessels are at the same elevation in the differential pressure piping (266Dx and 266Mx).
- As far as possible, keep both impulse lines at the same temperature (266Dx and 266Mx).
- Completely depressurize the impulse lines if the medium is a fluid.
- Lay the impulse lines in such a way that gas bubbles (when measuring fluids) or condensate (when measuring gases) can flow back into the process line.

- Ensure that the impulse lines are connected correctly (High and Low pressure sides connected to measuring equipment, seals, etc.).
- Make sure the connection is tight.
- Lay the impulse line in such a way that prevents the medium from being blown out over the measuring equipment.

3.8 Electrical connection

The relevant guidelines must be observed during the electrical installation! Since the transmitter has no switch-off elements, it is important to provide the possibility of disconnecting the power main or providing over-current protection devices on the system side (over voltage protection may be selected as a transmitter option).

An open cover does not provide a protection against accidental contact. Do not touch any conductive components.

Check that the existing operating voltage corresponds to that indicated on the type plate. For power supply and output signal, the same lines are used. Use the enclosed connection diagram!

The electrical connection is made via cable entry 1/2-14 NPT or M 20 x 1.5 (or via optional plug Han 8 U).

Important. The red plugs are to be removed when the transmitter is installed in Hazardous area. They are not explosion proof certified products.

To ensure the Type 4X and IP 67 degree of protection for transmitter according to Canadian Standard CSA, the conduit must be screwed into the housing 1/2" NPT female using a suitable sealing compound. The blanking plug has been sealed with Molykote DX, the use of any other sealing compound is done so at owners own risk.

3.8.1 Electrical requirements – HART

The transmitter operates on a minimum voltage of 10.5 Vdc to a maximum of 42 Vdc and is protected against polarity inversion.

Installing optional devices the minimum voltage increases to:

— 10.5 Vdc with no option or with integral digital display links

— 12.3 Vdc with surge protection

The total loop resistance is the sum of the resistance of all elements of the loop, including wiring, conditioning resistor, safety barriers and additional indicators (excluding the equivalent resistance of the transmitter). Where a configuration device (HART), such as the Hand Held Communicator or a Modem is likely to be used, a resistance of 250 ohm minimum should be present between the power supply and the point of insertion of these devices, to allow communication.

Several types of safety barriers, either passive or active, can be satisfactorily used in conjunction with the Smart 2600T transmitter. Nevertheless, in case of use of active barriers, check with the supplier if the model is suitable for use with smart transmitters allowing the connection of the configuration devices in the "safe" or non-hazardous area.

3.8.2 Electrical requirements – PROFIBUS PA

PROFIBUS-PA transmitters are provided for the connection to segment couplers DP/PA. The permissible voltage at the terminals is DC 9 - 32 V (9 - 17,5 V for FISCO). The current is approx. 15 mA (average; sending). A shielded cable is recommended. Contacting of the shield is done in the metal screwing. The transmitter must be grounded; the shield must be grounded as well only at one point. For further information, please refer to PROFIBUS PA installation guide. When operating with an Ex-segment coupler, the max number of devices may be reduced by a time-dependent current limitation. The output signal of the transmitter is transferred digitally according to IEC 61158-2. The instrument is compliant to Profile 3.02. Its Identification No. is 3450 HEX. During cyclic data traffic, the OUT variable is transmitted. It is composed of the output value and 1 byte status information. The output value is transmitted with 4 bytes as IEEE-754 Floating-Point-Type.

3.8.3 Electrical requirements – FOUNDATION Fieldbus

Foundation Fieldbus transmitters are provided for the connection to H1 BUS. The permissible voltage at the terminals is DC 9 - 32 V (9 - 17,5 V for FISCO). The current is approx. 15 mA (average; sending). A shielded cable is recommended. Contacting of the shield is done in the metal screwing. The transmitter must be grounded; the shield must be grounded as well only at one point. For further information, please refer to FOUNDATION Fieldbus installation guide. When operating with an Ex-application, the maximum number of devices may be reduced by a time-dependent current limitation. The output signal of the transmitter is transferred digitally according to IEC 61158-2. FF transmitter is registered as link master device according to FF specification Version 1.7. There are different ways of displaying and performing configuration on Fieldbus FOUNDATION devices. DD (Device Description) and DD methods allow transmitter configuration and data displaying across platforms.

3.8.4 Electrical requirements – Modbus

The transmitter operates on a minimum voltage of 10 Vdc to a maximum of 30 Vdc and is protected against polarity inversion.

Installing optional devices the minimum voltage increases to:

— 10 Vdc with no option or with integral digital display links

— 12.3 Vdc with surge protection

3.9 Protective conductor / grounding

The transmitter operates within the specified accuracy with common mode voltages between the signal lines and the housing up to 250 V. In order to fulfill the requirements of the low-voltage guidelines and the relevant EN 61010 rules for the installation of electrical components, the housing must be provided with a protective circuit (e.g. grounding, protective conductor) if voltages of >150 VDC could occur. A connection terminal is available for grounding (PE) on the transmitter exterior and also in the plug. Both terminals are electrically interconnected.

3.10 Transmitter with integrated Surge Protector

Use a short wire to connect the transmitter housing via the earthing connection (PE) to potential equalization. Potential equalization (max. 4 mm² or 12AWG) is necessary over the entire wiring.

3.11 Wiring

3.11.1 General Transmitter Wiring

Follow these steps to wire the transmitter:

- Remove the cap from one of the two electrical connection ports located at both sides in the upper part of the transmitter housing.
- These connection ports have a 1/2 inch internal NPT threads. Various adaptors and bushings can be fitted to these threads to comply with plant wiring (conduit) standards.
- Remove the housing cover of “field terminals”, side. In an Explosion-Proof/Flame-Proof installation, do not remove the transmitter covers when power is applied to the unit.
- Run wiring through the open port and connect the positive lead to the + terminal, and the negative lead to the – terminal.

Important. Do not connect the power across the Test terminals. Power could damage the test diode in the test connection.

- Plug and seal the electrical ports. Make sure that when the installation has been completed, these openings are properly sealed against entry of rain and corrosive vapors and gases. In particular, for Ex-d (Explosion Proof) installation, plug the unused opening with a plug suitable/ certified for explosion containment.
- If applicable, install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.
- Put back the housing cover, turn it to seat O-ring into the housing and then continue to hand tighten until the cover contacts the housing metal-to-metal. In Ex-d (Explosion Proof) installation, lock the cover rotation by turning the set nut (use the 2 mm Allen key supplied with the instrument).

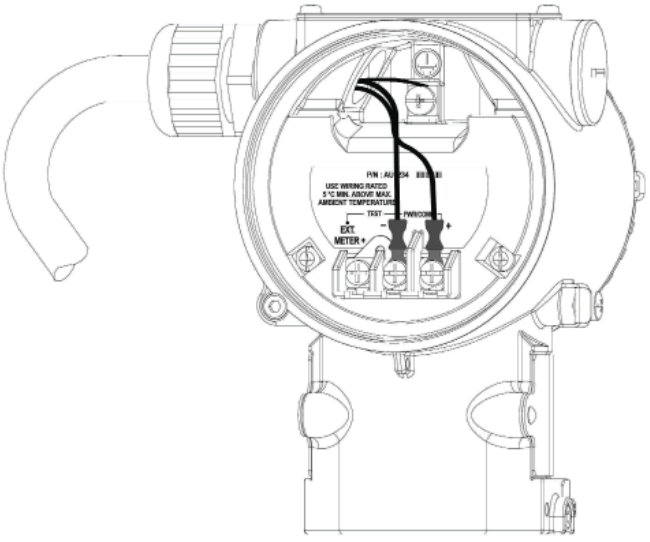


Figure 5: 266 HART terminal block

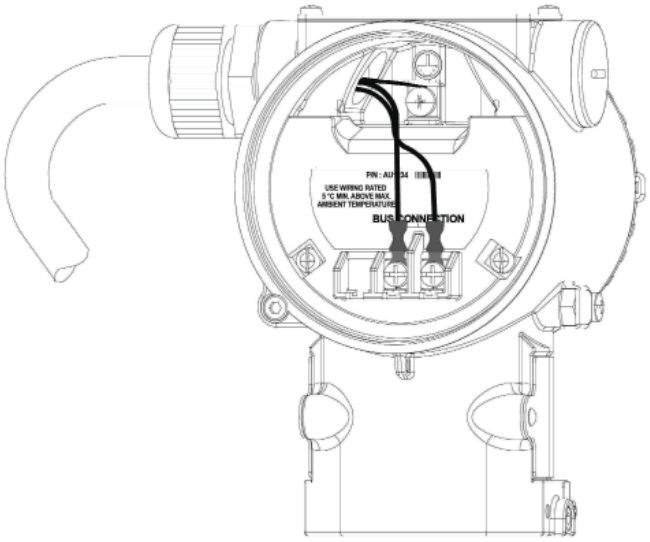


Figure 6: 266 PROFIBUS PA / FOUNDATION Fieldbus terminal block

3.11.2 MODBUS Transmitter Wiring

Proceed as follows to wire the transmitter:

— Unscrew the transport screw plug from one of the two cable entries located on both sides in the upper part of the transmitter housing

— These cable entries have a 1/2 inch NPT or M20 x 1.5 female thread. Various adaptors and bushings can be fitted to these threads to comply with plant wiring (conduit) standards

Danger. Risk to life due to explosion! In an explosion-proof/ flameproof installation in a hazardous area, the housing cover on the cable connection area must not be removed when the voltage is connected due to the risk of spark formation causing an explosion.

Before removing the housing cover, disconnect the equipment from the supply voltage and take suitable measures to prevent reconnection.

— Remove the housing cover from the cable connection area

— Run the connecting cable through the opening and connect the (+) PWR wire to the (+) PWR terminal and the (–) PWR wire to the (–) PWR terminal

— Connect the A(+) COMM wire to the A(+) COMM terminal.

— Run the temperature sensor cable (if there is one) through the second cable entry and connect it to the designated terminals

Important. Do not connect the supply voltage across the test terminals. It could damage the test diode in the test connection.

— Plug and seal the cable entries. Make sure that when the installation has been completed, these openings are properly sealed to prevent the entry of rain and corrosive vapours and gases. In particular, for “Ex d” (flameproof enclosure) installations, plug unused openings with a plug suitable sealing plug that has been certified for explosion protection

— If applicable, install the connecting cable with a drip loop. Arrange the drip loop so the lower part is located below the cable entry and the transmitter housing

— Replace the housing cover on the cable connection area and tighten it by hand until the cover contacts the housing metal-to-metal. To prevent the cover from turning, in “Ex d” (flameproof enclosure) installations, lock it by turning the locking screw / hex-head screw anti-clockwise with the 2 mm Allen key supplied with the device.

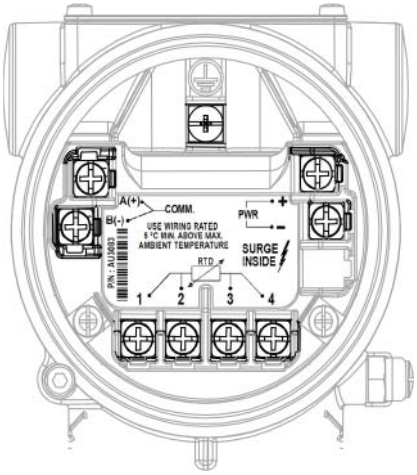


Figure 7: MODBUS Electrical Connection

4 Transmitter configuration

4.1 Output 4...20 mA/HART communication

Use power supply units or batteries which ensure a permanent operating voltage of DC 10,5 V ...42 V for the transmitter. Consider the resistance of the signal receiver (e.g. display) is looped into the signal circuit and the max. current of 20 ... 22mA, caused by over modulating.

We recommend using screened, pair wise twisted signal cables. Do not place these cables close to other cables (with inductive load) or close to other electrical devices.

4.2 Minimum configuration hints for PROFIBUS PA transmitters

The minimum configuration for having AI working needs at least the following settings:

Pressure Transducer Block:

- SCALE_IN: Calibration range (Eng. Units for pressure only)
- LIN_TYPE: Linear, Square Root, Cylindrical Lying Container, Spherical Container, Square Root 3° pow, Square Root 5° pow, Bidirectional Flow and 22 points table.

Analog Input Block:

- OUT_SCALE: Output range (all allowed Eng. Units)
- PV_SCALE = OUT_SCALE

4.3 Minimum configuration hints for FOUNDATION Fieldbus transmitters

The minimum configuration for having AI working and/or moving out from the Out Of Service (OOS) mode needs at least the following settings:

- CHANNEL: 1=pressure; 2=sensor temperature; 3=static pressure
- XD_SCALE: Calibration range (Units for pressure only)
- OUT_SCALE: Output range (all allowed Eng. Units)
- L_TYPE: Direct, Indirect or Square Root

Important. For more detailed information about configuration and troubleshooting of FOUNDATION Fieldbus devices, please refer to the complete "Operating Instruction" available online at www.abb.com.

If the AI Block cannot be removed from OOS mode, please refer to the below table:

Possible causes	Solution
The target mode is set to OOS	Set the target mode to something different by OOS
The Configuration Error bit is set in the BLOCK_ERR	CHANNEL different by 0 Set L_Type correctly Set XD_SCALE unit = TPB Primary Value Range Unit
The RESOURCE BLOCK is not in AUTO mode	Set the Target Mode of the RESOURCE BLOCK to AUTO mode
The Block is not scheduled	Design the FB Application correctly and download it to the devices

4.4 Minimum configuration hints for MODBUS transmitters

The Modbus transmitter is delivered configured according to the information provided when the order is placed. However, editing specific configuration parameters is possible using the following options:

— Menu-led configuration of the transmitter with the integral LCD display

— Configuration using a handheld terminal

— Configuration using a PC/laptop with graphical user interface (DTM)

Refer to the corresponding related documentation for information on how to use these tools to make configuration setting changes.

For Modbus calibration at any level see appropriate Operating Instructions.

4.5 Set the PV to Zero (for Profibus and FOUNDATION Fieldbus)

After configuring the transmitters according to the communication protocol, it is necessary to set the PV value to zero.

This operation is typically used for correction of the mounting position and other influences (line pressure effects).

To carry out this correction the transmitter should be pressure-free, (the connections should be pressure-free or short-circuited).

The PV value can be zeroed by using "set PV to Zero" inside DTM or EDD parameterization menus.

4.6 How to set the zero

The following procedures do not affect the physical pressure shown (PV VALUE); they only correct the analog output signal. For this reason, the analog output signal may differ from the physical pressure value (PV) shown on the digital display or the communication tool. In case the plant procedure requires to correct this, set the communication board dip switch nr.3 in 1 (up) position before performing the below procedures.

4.6.1 Zero based calibrated devices

(eg. 4 .. 20 mA = 0 .. 250 mbar)

The below procedure has not to be followed when dealing with absolute pressure transmitters (266Axx/VxH/NxH/RxT)

1. Insulate the transmitter from the process and vent the transmitter measuring chamber/s to atmosphere.
2. Check the output signal of the transmitter, if it is at 4 mA (or PV= 0) you do not need to re-zero the transmitter; if the output is not at zero follow the below procedure:

   Unscrew the data plate fixing screw on the top of the transmitter housing.

   Rotate the data plate to get access to the push buttons.

   Be sure that the write protection rotating switch is set to write enable.

   Push the zero (Z) button on top of the transmitter for at least 3 seconds.

   The output will go to 4 mA, and if the Integral Display is present, the message "OPER DONE" will appear. If nothing happens check the write protection rotating switch, it is probably set to write disable. In case of other diagnostic messages, refer to the instruction.
3. Once the "Zero" operation has been accomplished the transmitter needs to be reconnected to the process.
4. Close the vent / drain valves that may have been opened
5. Open the insulation valve/s (in case of differential pressure transmitters please follow the following sequence:

open high pressure side insulation valve,

open low pressure side insulation valve,

close equalizing valve.

4.6.2 Absolute pressure transmitter re-zeroing

Absolute pressure transmitter rezeroing is only possible when a vacuum pressure generator is available. It is strongly recommended to refer to the integral manual before proceeding.

4.6.3 Non-zero based calibrated devices

(eg 4 .. 20 mA = - 100 .. 100 mbar)

1. Insulate the transmitter from the process and vent the transmitter measuring chamber/s to atmosphere.
2. Apply the lower range value pressure (4 mA) from the process or from a pressure generator. The pressure must be stable and applied with a high level of accuracy < 0.05 % (observing the set damping value).
3. Check the output signal of the transmitter, if it is at 4 mA (or PV= 0) you do not need to re-zero the transmitter; if the output is not at zero follow the below procedure:

   Unscrew the data plate fixing screw on the top of transmitter housing.

   Rotate the data plate to get access to the push buttons.

   Be sure that the write protection rotating switch is set to write enable.

   Push the zero (Z) button on top of the transmitter for at least 3 seconds.

   The output will go to 4 mA, and if the Integral Display is present, the message “OPER DONE” will appear. If nothing happens check the write protection rotating switch, it is probably set to write disable. In case of other diagnostic messages, please refer to the instruction.
4. Once the “Zero” operation has been accomplished the transmitter needs to be reconnected to the process.
5. Close the vent / drain valves that may have been opened
6. Open the insulation valve/s (in case of differential pressure transmitters please follow the following sequence:

   open high pressure side insulation valve,
   open low pressure insulation valve,
   close equalizing valve.

Important. It is not necessary to remove the cover for this procedure (Dip switch are already factory set).

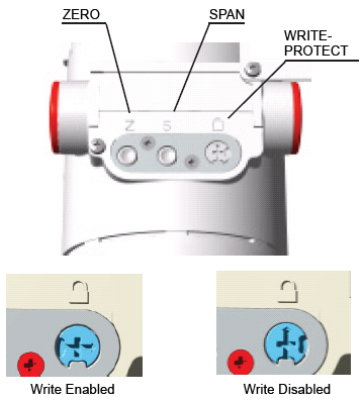


Figure 8: External pushbuttons

4.7 Hardware Settings

4.7.1 Advanced Hart

There are 6 dip switches located on this kind of secondary electronics.

Switch 1 and 2 allow the REPLACE MODE for sensor or secondary electronics.

Switch 3 identifies the external push buttons functionalities: Zero/Span adjustments or PV Bias-Offset / PV Bias Reset.

Switch 4 and 5 are for Fail Low/Fail High selection. Switch 6: not used.

The electronic label clearly explains how to perform all the possible selection, but please remember that all the operations with the dip switches should be carried out when the transmitter is powered off so as to upload new configurations at instrument start-up.

Replace mode (switch 1 and 2)

Usually switches 1 and 2 are down in “0” position. They are moved when a replace operation is required.

Switch 1 up in “1” position is required before power up the transmitter, when user needs to replace the electronics or the sensor.

Switch 2 down in “0” position allows the replace of the secondary electronics. It must be moved in this position before power up the transmitter.

Switch 2 up in “1” position indicates that a new sensor has been installed.

AFTER ANY REPLACE OPERATION IT IS RECOMMENDED TO MOVE DOWN IN “0” POSITION THE RELEVANT SWITCHES.

Push buttons mode (switch 3)

Dip switch 3 is set at the factory on “0” position. This means that the external push buttons perform the zero/span adjustments. If the user puts this switch on “1” position, the zero push buttons will modify the PV Bias-Offset and the span push button will reset the PV Bias-Offset value.

Fail mode (switch 4 and 5)

Should the user modify the factory-defined parameters for the fail safe output condition in case of transmitter failure, it is necessary to enable the modification by putting dip switch 4 on “1” position. Consequently, it is necessary to choose whether the output has to go Upscale or Downscale. Dip switch 5:

on “0” position the output is High (22mA)

on “1” position the output is Low (3,7mA)

4.7.2 Standard Hart

Standard HART protocol is available on 266DSH, 266PSH, 266VSH, 266HSH (with the exception of ranges V and Z), 266NSH (and the relevant direct-mounted or remote diaphragm seal versions) as well as on 266DHH and 266DLH. Standard HART protocol connection board features 4 dip switches.

Switch 1 and 2 are for Fail Low/Fail High selection.

Switch 3 identifies the external push buttons functionalities: Zero/Span adjustments or PV Bias-Offset / PV Bias Reset.

Switch 4 allows user to enable the write protection. Dip switch functions are the same as here above.

In addition, 266 standard HART connection board can the Zero and Span pushbuttons (in case not configured during the codification process). This buttons work exactly like the external ones located under the instrument stainless steel nameplate and they can perform Zero and Span adjustments as well as PV Bias and Offset (if the proper dip switch is positioned correctly).

4.7.3 PROFIBUS PA

There are 3 dip switches located on this kind of secondary electronics (as indicated by the figure); they are used for settings when integral display is not available.

Switch 1 and 2 allow the REPLACE MODE for sensor or secondary electronics.

Switch 3 identifies the external push buttons functionalities: Zero/Span adjustments or PV Bias-Offset / PV Bias Reset.

The electronic label clearly explains how to perform all the possible selection, but please remember that all the operations with the dip switches should be carried out when the transmitter is powered off so as to upload new configurations at instrument start-up.

Replace mode (switch 1 and 2)

Usually switches 1 and 2 are down in “0” position. They are moved when a replace operation is required.

Switch 1 up in “1” position is required before power up the transmitter, when user needs to replace the electronics or the sensor.

Switch 2 down in “0” position allows the replace of the secondary electronics. It must be moved in this position before power up the transmitter.

Switch 2 up in “1” position indicates that a new sensor has been installed.

AFTER ANY REPLACE OPERATION IT IS RECOMMENDED TO MOVE DOWN IN “0” POSITION THE RELEVANT SWITCHES.

Push buttons mode (switch 3)

Dip switch 3 is set at the factory on “0” position. This means that the external push buttons perform the zero/span adjustments. If the user puts this switch on “1” position, the zero push buttons will modify the PV Bias-Offset and the span push button will reset the PV Bias-Offset value.

4.7.4 FOUNDATION Fieldbus

There are 4 dip switches located on this kind of secondary electronics (as indicated by the figure); they are used for settings when integral display is not available.

Switch 1 and 2 allow the REPLACE MODE for sensor or secondary electronics.

Switch 3 identifies the external push buttons functionalities: Zero/Span adjustments or PV Bias-Offset / PV Bias Reset.

Switch 4 for performing the Simulation mode. The electronic label clearly explains how to perform all the possible selection, but please remember that all the operations with the dip switches should be carried out when the transmitter is powered off so as to upload new configurations at instrument start-up.

Replace mode (switch 1 and 2)

Usually switches 1 and 2 are down in “0” position. They are moved when a replace operation is required. Switch 1 up in “1” position is required before power up the transmitter, when user needs to replace the electronics or the sensor.

Switch 2 down in “0” position allows the replace of the secondary electronics. It must be moved in this position before power up the transmitter. Switch 2 up in “1” position indicates that a new sensor has been installed.

AFTER ANY REPLACE OPERATION IT IS RECOMMENDED TO MOVE DOWN IN “0” POSITION THE RELEVANT SWITCHES.

Push buttons mode (switch 3)

Dip switch 3 is set at the factory on “0” position. This means that the external push buttons perform the zero/span adjustments. If the user puts this switch on “1” position, the zero push buttons will modify the PV Bias-Offset and the span push button will reset the PV Bias-Offset value.

Simulation mode (switch 4)

Dip switch 4 in “1” position enables the Simulation mode. This feature is available in order to initialize all the parameters requiring a well defined value, with the default values congruent to the connected sensor type/model. This operation can be performed before powering on the device. Many variables of the AI and TPB are properly set with values strictly related to the connected transducer type.

4.7.5 MODBUS

Dip switch 5

For the Modbus configured transmitter, Dip switch 5 will be used for device write protection. If dip switch 5 is in the ON position, the device will be in write protect mode and will not accept write commands. The state of the dip switch 5 can be set before or after power is provided and also during operation of the device. Refer to table below.

Dip Switch 5 positions	Resulting effect
ON	Writing to the device is not allowed. Editing capabilities using the HMI will not be present. Dip switches 1-4 usage is disabled.
OFF	Writing to the device is allowed. Editing using HMI is also allowed.

Dip Switch 5 operation

4.8 Easy set-up

The easy set-up procedure is made possible thanks to the intuitive HMI, connected on the transmitter communication board. To navigate the 266 HMI please follow the various

indications that will appear on the bottom of the display.

To facilitate commissioning the 266 HMI has the capability to run a sequence of predefined setup steps with the main configuration settings. When you start the Easy Setup you must continue up to the end to exit.

4.8.1 To start the Easy Set-up

Navigate the Digital LCD Integral Display menu, push the button on the right under the LCD display.

4.8.2 Define the language

If the desired language is different from the indicated language select Edit then scroll the desired language (see the following table) with the up and down keys and confirm with OK. Select Next to continue.

English German Italian French Spanish

4.8.3 Insert tag

If the Tag number of the instrument is different from the value set in the factory, use this part of the easy set-up menu to change it.

4.8.4 Define the PV Unit

If the desired Process Variable Unit is different from the indicated, select Edit then scroll the desired unit (see the following table) with the up and down keys and confirm with OK. Select Next to continue.

mbar	millibar
mmH2O°C	millimeter of water at 4 degrees Celsius
g/cm2	grams per square centimeter
inH2O°F	inches of water at 68 degrees Fahrenheit (20°C)
Kg/cm2	kilo grams per square centimeter
inHg°C	inches of mercury at 0 degrees Celsius
Pa	pascal
ftH2O°F	feet of water at 68 degrees Fahrenheit
kPa	kilopascal
mmH2O°F	millimeter of water at 68 degrees Fahrenheit
torr	torr
mmHg°C	millimeter of mercury at 0 degrees Celsius
atm	atmosphere
psi	pounds per square inch
MPa	Megapascal
bar	bars
inH2O°C	inches of water at 4 degrees Celsius

4.8.5 Define the PV Lower Range Value (LRV)

If the desired LRV is different from the indicated select Edit, scroll the desired value for the digit in reverse color with the up and down keys and confirm with Next. Repeat the operation for the seven digits and confirm with OK. Select Next to continue.

4.8.6 Define the PV Upper Range Value (URV)

If the desired URV is different from the indicated select Edit, scroll the desired value for the digit in reverse color with the up and down keys and confirm with Next. Repeat the operation for the seven digits and confirm with OK. Select Next to continue.

4.8.7 Define the linearization type

If the desired linearization type is different from the indicated select Edit then scroll the desired linearization type (see the following table) with the up and down keys and confirm with OK. Select Next to continue.

4.8.8 Define the SQRT linear point

If the desired SQRT linear point is different from the indicated select Edit, scroll the desired value with the up and down keys and confirm with Next. Repeat the operation for the five digits and confirm with OK. Select Next to continue.

4.8.9 Define the low flow cut off

If the desired low flow cut off for a flow transfer function is different from the indicated select Edit, scroll the desired value for the digit in reverse colour with the up and down keys and confirm with Next. Repeat the operation for the five digits and confirm with OK. Select Next to continue.

Important. In case of PA or FF pressure transmitters, please consider as mandatory the following steps.

4.8.10 Define the OUT unit

If the desired out up unit is different from the indicated, select Edit then scroll the desired unit (all allowed Eng. Units) with the up and down keys and confirm with OK. Select Next to continue.

4.8.11 Define the OUT Lower Range Value (LRV)

If the desired LRV is different from the indicated select Edit, scroll the desired value for the digit in reverse color with the up and down keys and confirm with Next. Repeat the operation for the seven digits and confirm with OK. Select Next to continue.

4.8.12 Define the OUT Upper Range Value (URV)

If the desired URV is different from the indicated select Edit, scroll the desired value for the digit in reverse color with the up and down keys and confirm with Next. Repeat the operation for the seven digits and confirm with OK. Select Next to continue.

4.8.13 Define the damping

If the desired damping is different from the indicated value change it with the up and down keys and confirm with OK.

4.8.14 Set PV to zero

In case a zero scaling is required apply the pressure for the zero and select OK. Wait for the auto-set end (the bar graph will indicate the working progress). Select Next to continue.

4.8.15 Define Hmi line 1 view

By using this parameter you can chose what to see on the first line of the Human Machine Interface. To change the value to be shown, select Edit, scroll the desired value for the digit in reverse color with the up and down keys and confirm with Next.

Important. The minimum and maximum allowed values are indicated on the display.

5 Application

5.1 Steam (condensable vapor) or clean liquids flow measurement

- Place taps to the side of the line.
- Mount beside or below the taps.
- Mount the drain/vent valve upward.

In case of steam application fill the vertical section of the connecting lines with a compatible fluid through the dedicated filling tees because the process fluid must enter the transmitter measuring chambers.

Then:

- Open equalizing valve (C);
- Close low pressure (B) and high pressure (A) valves;
- Open gate valves;
- Slowly open high pressure (A) valve to admit process fluid to both sides of primary;
- Vent or drain the primary unit and then close the valves;
- Open the (B) valve and close the equalizing valve.

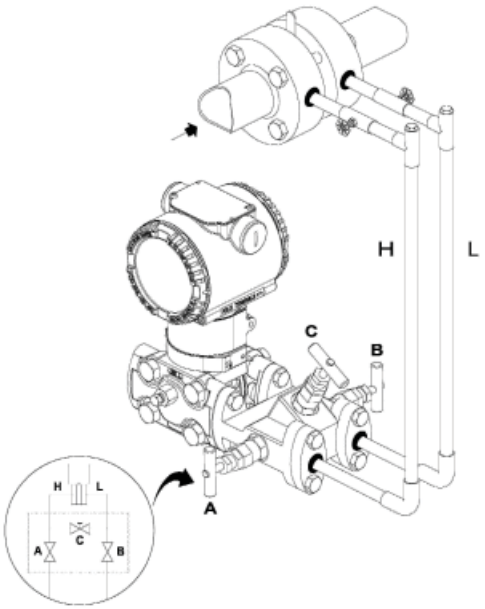


Figure 9: Steam or clean liquid flow measurement

5.2 Gas or liquid (with solids in suspension) flow measurement

- Place the taps to the top or side of the line.
- Mount the transmitter above the taps.

The process fluid must enter the transmitter primary:

- Open equalizing valve (C),
- Close low pressure (B) and high pressure (A) valves,
- Open gate valves,
- Slowly open high pressure (A) valve to admit process fluid to both sides of primary,
- Vent or drain the primary unit and then close the valves,
- Open the (B) valve and close the equalizing valve.

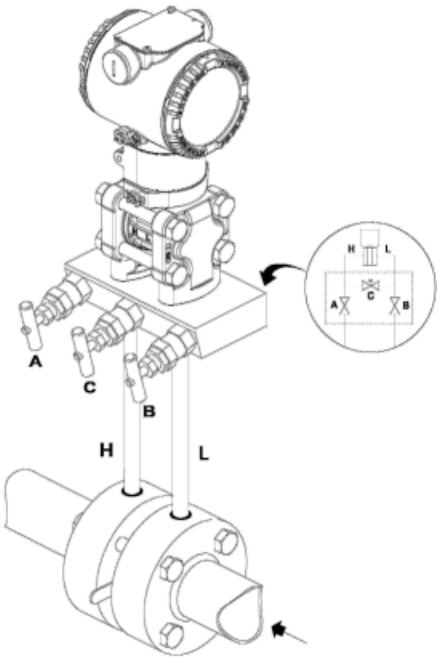


Figure 10: Gas or liquid flow measurement

Caution. Manifolds can be supplied both mounted on pressure transmitters and loose. In case of integral mounting, consider that:

- All adjustments should be carried out by qualified personnel with the valve without pressure.
- End connections must not be removed from the body.
- Do not use handle wrenches or extensions to operate the valves.
- Head units must not be removed once installed.
- Do not cover or remove body marking.

Important. The maximum working temperature of the whole assembly (manifold and instrument) corresponds to the temperature limit of the pressure transmitter.

Important. When the manifold is assembled to a 2600T pressure transmitter with NACE compliance A4-50 Stainless Steel bolts (available on request), please note that the maximum working pressure is limited to 210 bar (3045 psi).

5.3 Liquid level measurements on closed tanks and non condensable fluids (dry leg)

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the + (H) side of the transmitter to the bottom of the tank.
- Connect the - (L) side of the transmitter to the upper part of the tank, above the maximum level of the tank.

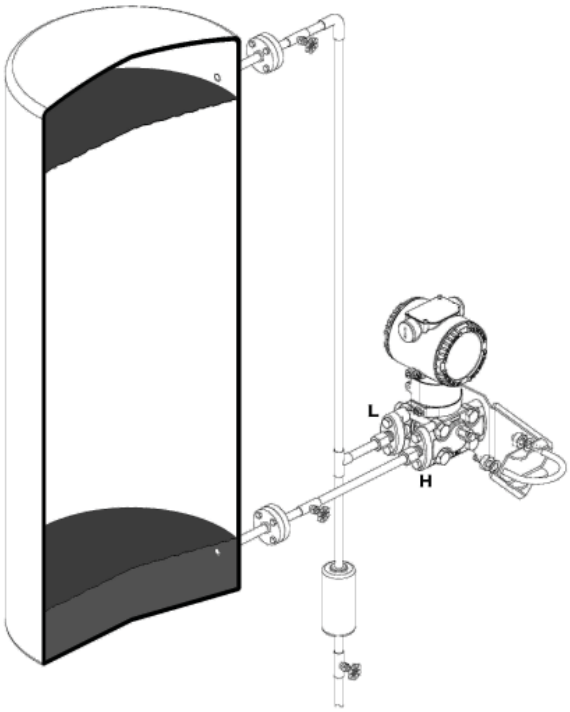


Figure 11: Level measurement on closed tank with dry leg

5.4 Liquid level measurement with open tanks

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the + (H) side of the transmitter to the bottom of the tank.
- Vent the "–" (L) side of the transmitter to the atmosphere (in this case a gauge pressure is shown; the (L) side is already vented to the atmosphere).

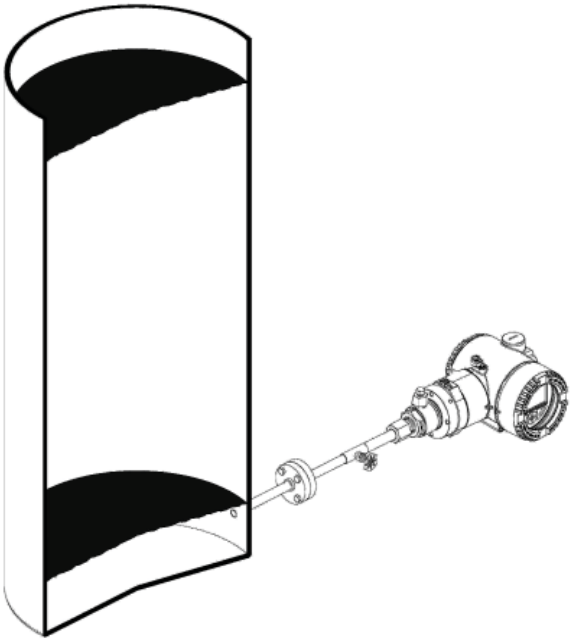


Figure 12: Level measurement on open tank with P style transmitter

5.5 Pressure or absolute pressure measurement of a condensable vapor in a pipe

- Place the tap at the side of the line.
- Mount the transmitter below the tap.
- Connect the + (H) side of the transmitter to the pipe.
- Fill the vertical section of the connecting line to the tap with a compatible liquid through the dedicated filling tee.

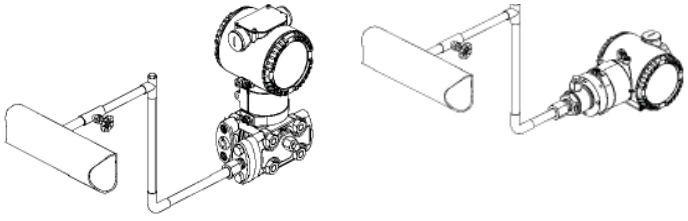


Figure 13: Pressure measurement with DP and P style transmitters

6 Diaphragm seals

6.1 Seals handling

– Diaphragm seals equipped transmitters require a particular attention during handling and installation to avoid damaging the device.

– For capillary equipped transmitters (gauge or differential) avoid lifting the device by gripping the capillary.

– Avoid excessively bending the capillary, the maximum bending radius is12,5 cm (5 inches).

– The diaphragm surface is delicate and could be damaged.

Therefore, leave the diaphragm protection covers in place until the final installation and when the protection has been removed, avoid placing the seal with the diaphragm in contact with a hard surface.

6.2 Seals installation

Before proceeding with the installation be sure that the diaphragm seal MWP (Maximum Working Pressure limit) is in compliance with the mating process connection.

The diaphragm seal MWP is written on the transmitter main nameplate (MWP for differential pressure transmitters, OVP for gauge and absolute pressure transmitters). Check that the fill fluid type and temperature limit is in compliance with your environmental/process conditions. The transmitter has been delivered with wetted materials according to the model number specified on the nameplate. Before proceeding with the installation consider wetted material process compatibility.

If you are installing a diaphragm seal which requires a gasket (S26CN, S26F, S26J, S26M, S26P, S26R, S26S, S26U, S26V, S26W) be sure

to use a suitable gasket for your process fluid, check that the temperature and pressure limit are compatible with your application.

Properly position the gasket so that it does not press down the diaphragm. A gasket not properly installed may affect the transmitter measurement. When installing flushing rings make sure that the gasket is properly aligned on the gasket sealing surface.

6.3 Bolt torqueing

During the installation of flanged or wafer type seals the bolts have to be torqued to the specific flange and gasket requirements. The torque requirement is a function of the gasket and bolts material.

6.4 Vacuum application consideration

When installing remote diaphragm seals in application working below the atmospheric pressure, check that the fill fluid curves are in compliance with your application. The transmitter must be located below or at the bottom process tap. In case of doubts please refer to the integral instruction manual that can be downloaded at www.abb. com/pressure or refer to your ABB Instrumentation dealer.

6.5 Wafer (pancake) seals (model S26W)

Wafer seals installation requires the user to apply a blind flange to connect the seal to the process, the type, size and material of the blind flange must be in compliance with the mating process connection counter flange.

6.6 Off-line threaded and flanged seals (models S26T and S26M)

The upper and lower housing is preassembled at the factory. When connecting the S26T off-line threaded seal to the process pipe, do not over tighten the seal. Torque value should be in compliance with ANSI B1.20.1 or applicable torque requirements for pipe connections.

In case the lower housing needs to be disassembled from the upper housing, when reassembling be sure to replace the gasket with a new gasket of the same type (see spare part list for part number).

The bolts should be tighten to 25 Nm.

6.7 Saddle and Socket seals (model S26V)

Saddle and Socket seals are delivered with all the parts necessary to perform a correct installation.

The lower housing has to be welded to the process pipe.

When welding the lower housing to the process pipe, the upper housing has to be removed.

The upper housing can be installed on the lower housing when it has cooled down.

Before positioning the upper housing be sure that the gasket has been properly placed in its seat.

Bolts torque value for socket and saddle seal is 20 Nm.

6.8 Sanitary seals (model S26S)

ABB sanitary seals may be supplied with a 3A symbol which is printed on the seal body. To properly install 3A approved seals please refer to the integral version of the instruction manual that can be downloaded from www.abb.com/pressure.

6.9 Threaded seals for Pulp&Paper (model S26K)

Threaded seals for Pulp&Paper should be installed considering the proper torqueing value which is a function of the thread type.

7 Hazardous Area considerations

7.1 Ex Safety aspects and IP Protection (Europe)

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and relative European Standards which can assure compliance with Essential Safety Requirements, i.e., EN 60079-0 (General requirements) EN 60079-1 (Flameproof enclosures “d”) EN 60079-11 (Equipment protection by intrinsic safety “i”) EN 60079-26 (Equipment with equipment protection level -EPL- Ga) EN 61241-0 (General requirements) EN 61241-1 (Protection by enclosures “tD”) EN 61241- 11 (Protection by intrinsic safety”iD”) the pressure transmitters of the 2600T SERIES have been certified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.

a) Certificate ATEX II 1 G Ex ia IIC T4/T5/T6 and II 1 D Ex iaD 20 T85°C

FM Approvals certificate number

FM09ATEX0024X (Lenno products)

FM09ATEX0069X (Minden products)

FM11ATEX0035X (Bangalore products)

FM11ATEX0046X (Shanghai products)

The meaning of ATEX code is as follows:

- II: Group for surface areas (not mines)
- 1: Category
- G: Gas (dangerous media)
- D: Dust (dangerous media)
- T85°C: Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) +40°C for Dust (not Gas) with a dust layer up to 50 mm depth.

Certificate IECEx Ex ia IIC T4/T5/T6 and Ex iaD 20 T85°C FISCO, IP67

IECEx certificate number

IECEx FME 09.0003X (Lenno and Minden products)

ECEx FMG 11.0019X (Shanghai products)

Important. The number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production.

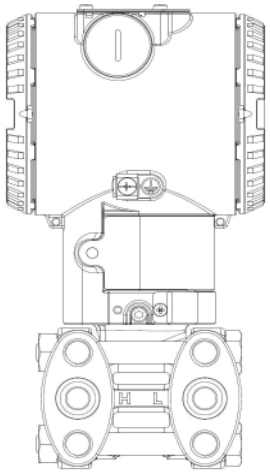
The other marking refers to the protection type used according to relevant EN standards:

- Ex ia: Intrinsic safety, protection level “a”
- IIC: Gas group
- T4: Temperature class of the transmitter (corresponding to 135°C max) with a Ta from -50°C to +85°C
- T5: Temperature class of the transmitter (corresponding to 100°C max) with a Ta from -50°C to +40°C
- T6: Temperature class of the transmitter (corresponding to 85°C max) with a Ta from -50°C to +40°C

About the applications, this transmitter can be used in “Zone 0” (Gas) and “Zone 20” (Dust) classified areas (continuous hazard) as it is shown on the following sketches.

Application for pressure transmitter Ex ia categories 1G and 1D

Application with Gas

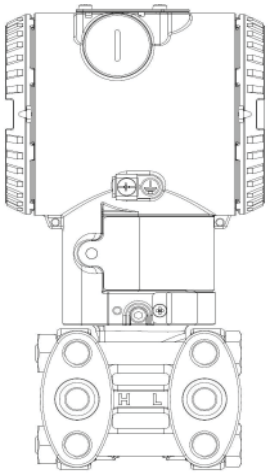


Zone 0

266 Tx Category 1G Ex ia

Note: the transmitter must be connected to a supply (associated apparatus) certified [Ex ia]

Application with Dust



Zone 20

266 Tx Category 1D IP6x (Ex ia)

Note: the protection is mainly assured by the “IP” degree associated to the low power from supply. This can either be [ia] or [ib] certified [Ex ia]

b) Certificate ATEX II 1/2 G Ex ia IIC T4/T5/T6 and II 1/2 D Ex iaD 21 T85°C

FM Approvals certificate number

FM09ATEX0024X (Lenno products)

FM09ATEX0069X (Minden products)

FM11ATEX0035X (Bangalore products)

FM11ATEX0046X (Shanghai products)

Important. This ATEX Category depends on the application (see below) and also on the intrinsic safety level of the transmitter supply (associated apparatus) which can sometimes suitably be [ib] instead of [ia]. As it is well known, the level of an intrinsic safety system is determined by the lowest level of the various apparatus used, i.e., in the case of [ib] supply, the system takes over this level of protection.

The meaning of ATEX code is as follows:

- II: Group for surface areas (not mines)
- 1/2: Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch).
- G: Gas (dangerous media)
- D: Dust (dangerous media)
- T85°C: Maximum surface temperature of the transmitter enclosure with a Ta from -50°C to +40°C for Dust (not Gas) with a dust layer up to 50 mm depth. T85°C: as before for Dust for a Ta +85°C.

Certificate IECEx Ex ia IIC T4/T5/T6 and Ex iaD 21 T85°C, FISCO, IP67

IECEx certificate number

IECEx FME 09.0003X (Lenno and Minden products)

IECEx FMG 11.0019X (Shanghai products)

The other marking refers to the protection type used according to relevant EN standards:

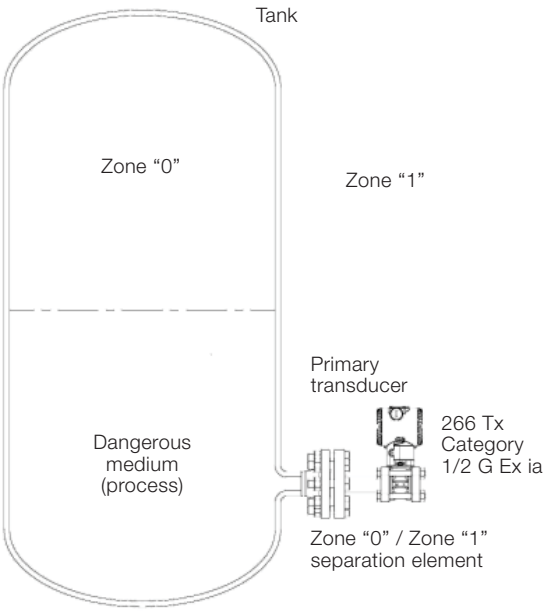
- Ex ia: Intrinsic safety, protection level “a”
- IIC: Gas group
- T4: Temperature class of the transmitter (corresponding to 135°C max) with a Ta from -50°C to +85°C
- T5: Temperature class of the transmitter (corresponding to 100°C max) with a Ta from -50°C to +40°C
- T6: Temperature class of the transmitter (corresponding to 85°C max) with a Ta from -50°C to +40°C

About the applications, this transmitter can be used in Zone “0” (Gas) classified areas (continuous hazard) with its “process part” only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (normally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the

EN 60079-26 and EN 60079-1. About Dust application, the transmitter is suitable for “Zone 21” according to the EN 61241-0 and EN 61241-11 as it is shown on the relevant part of the sketches.

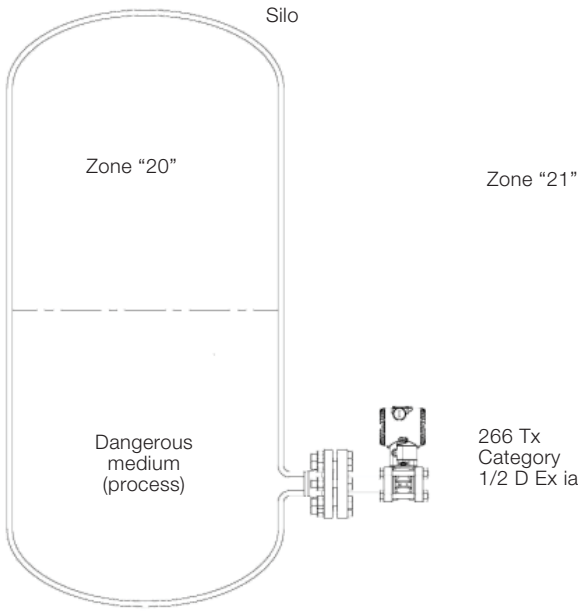
Application for pressure transmitter Ex ia categories 1/2G and 1/2D

Application with Gas



Note: the transmitter can be connected to either [ib] or [ia] supply (associated apparatus) certified [Ex ia]
Note for “Primary transducer”: see the certification for exceptions

Application with Dust



Note: the protection is mainly assured by the “IP” degree associated to the low power from supply. This can either be [ia] or [ib]

c) Certificate ATEX II 1/2 G Ex d IIC T6

ATEX II 1/2 D Ex tD A21 IP67 T85°C (-50°C ≤ Ta ≤+75°C)

FM Approvals Certificate number

FM09ATEX0023X (Lenno products)

FM09ATEX0023X (Bartlesville products)

FM09ATEX0068X (Minden products)

FM11ATEX0036X (Bangalore products)

FM11ATEX0047X (Shanghai products)

The meaning of ATEX code is as follows:

- II: Group for surface areas (not mines)
- 1/2: Category - It means that only a part of the transmitter complies with category 1 and a second part complies with category 2 (see next application sketch).
- G: Gas (dangerous media)
- D: Dust (dangerous media)
- T85°C: Maximum surface temperature of the transmitter enclosure with a Ta (ambient temperature) +75°C for Dust (not Gas) with a dust layer up to 50 mm depth.

Important. The number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production.

Certificate IECEx Ex d IIC T6, Ex tD A21 T85°C, Ta= -50°C to +75°C

IECEx certificate number

IECEx FME 09.0002X (Lenno, Bartlesville and Minden products)

IECEx FMG 11.0018X (Shanghai products)

Important. When installed this transmitter must be supplied by a voltage limiting device which will prevent the rated voltage of 42 V d.c. being exceeded (for Modbus protocol maximum voltage 30 V).

The other marking refers to the protection type used according to relevant EN Standards:

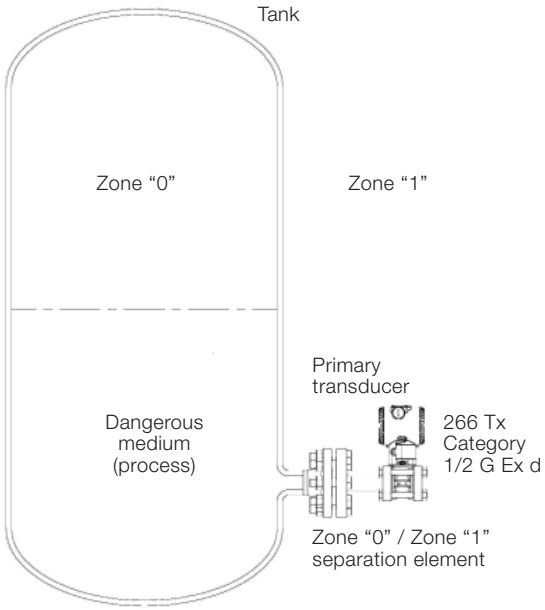
- Ex d: Explosion proof
- IIC: Gas group
- T6: Temperature class of the transmitter (corresponding to 85°C max) with a Ta from -50°C to +75°C.

About the applications, this transmitter can be used in Zone “0” (Gas) classified areas (continuous hazard) with its “process part” only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the transmitter (normally called primary transducer) that provides inside separation elements to seal off the electrical sensor from the continuously hazardous process, according to the EN 60079-26 and EN 60079-1.

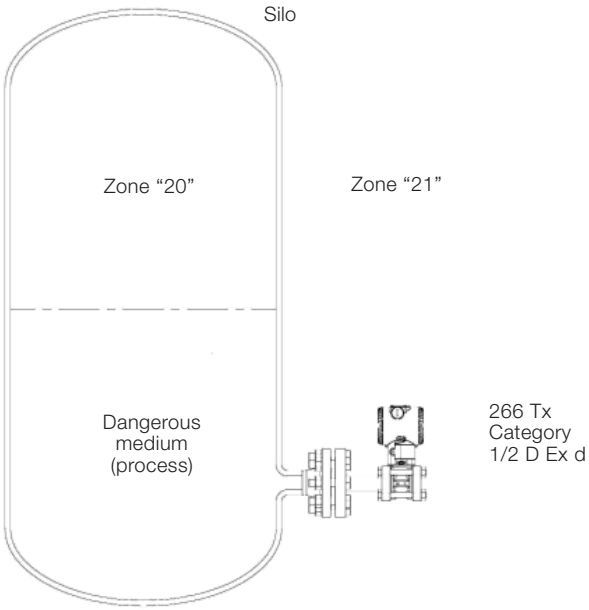
About Dust application, the transmitter is suitable for “Zone 21” according to the EN 61241-1 as it is shown on the relevant part of the sketches.

Application for pressure transmitter Ex d categories 1/2G and 1/2D

Application with Gas



Application with Dust



IP code

About the degree of protection provided by the enclosure of the pressure transmitter, the 2600T SERIES has been certified IP67 according to EN 60529 standard. The first characteristic numeral indicates the protection of the inside electronics against ingress of solid foreign objects including dusts.

The assigned “6” means an enclosure dust-tight (no ingress of dust).

The second characteristic numeral indicates the protection of the inside electronics against ingress of water.

The assigned “7”means an enclosure water-protected against a temporary immersion in water under standardized conditions of pressure and time.

According to ATEX Directive (European Directive 94/9/EC of 23 March 1994) and relative Standards which can assure compliance with Essential Safety Requirements, i.e., EN 60079-0 (General requirements) EN 60079-15 (Specification for electrical apparatus with type of protection “n”) EN 61241-0 (General requirements), the pressure transmitters of the 2600T SERIES have been certified for the following group, categories, media of dangerous atmosphere, temperature classes, types of protection. Examples of application are also shown below by simple sketches.

d) Certificate ATEX II 3 G Ex nL IIC T4/T5/T6

(for T4 = -50°C ≤ Ta ≤+85°C),

(for T5 and T6 = -50°C ≤ Ta ≤+40°C) and II 3D Ex tD A22 IP67 T85°C).

II 3 G Ex nA IIC T4/T5/T6 and II 3 D Ex tD A22 IP67 T85°C (Modbus only)

FM Approvals Certificate number

FM09ATEX0025X (Lenno products)

FM09ATEX0025X (Bartlesville products - Modbus only)

FM09ATEX0070X (Minden products)

FM11ATEX0037X (Bangalore products)

FM11ATEX0048X (Shanghai products)

The meaning of ATEX code is as follows:

- II 3G Ex nL IIC T4/T5/T6 (for T4 = -50°C < Ta < +85°C) (for T5 and T6 = -50°C < Ta < +40°C) /
- Modbus marking II 3 G Ex nA IIC T4/T5/T6
- II: Group for surface areas (not mines)
- 3: Category of equipment
- G: Gas (Dangerous media)
- Ex nL: type of protection “n” with “energy limitation” technique
- Ex nA: type of protection “No sparking”
- IIC: gas group
- T4: Temperature class of the transmitter (which corresponds to 135°C max) with a Ta from -50°C to +85°C
- T5: Temperature class of the transmitter (which corresponds to 100°C max) with a Ta from -50°C to +40°C
- T6: Temperature class of the transmitter (which corresponds to 85°C max) with a Ta from -50°C to +40°C

Important. It is the technical support for the ABB Declaration of Conformity

Important. When installed this transmitter must be supplied by a voltage limiting device which will prevent the rated voltage of 42 V d.c. being exceeded (for Modbus protocol maximum voltage 30 V).

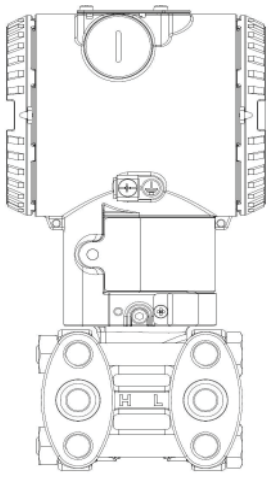
About the applications, this transmitter can be used in Zone 2 (Gas) (unlikely/infrequent hazard) as it shown on the following sketch (left side)

- II 3D Ex tD A22 IP67 T85°C
- II: Group for surface areas (not mines)
- 3: Category of equipment
- D: Gas (Dangerous media)
- Ex tD: type of protection “tD” means protection by enclosure technique
- A22: for zone 22 (tested acc. to method A of EN61241-0)
- IP67: degree of protection of the transmitter acc. EN60529
- T85°C: Maximum surface temperature of the transmitter enclosure with a Ta from -50°C to +40°C for Dust (not Gas).

About the applications, this transmitter can be used in Zone 22 (Dust) (unlikely/infrequent hazard) as it shown on the following sketch (right side)

Application for pressure transmitter Ex nL categories 3G and 3D

Application with Gas

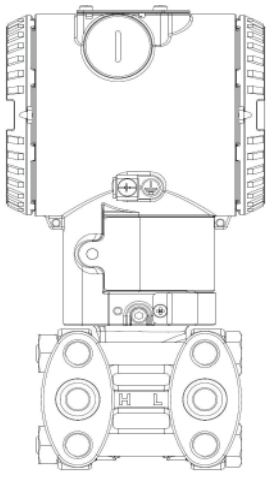


Zone 2

266 Tx Category 3G Ex nL

Note: the transmitter must be connected to a supply with 42V d.c. max output voltage as above indicated. The Ii of the transmitter is less than 25 mA.

Application with Dust



Zone 22

266 Tx Category 3D IP6x (Ex nL)

Note: the protection is mainly assured by the “IP” degree associated to the low power from supply.

Important. **Note for pressure transmitter with combined approval.** Before installation of the Transmitter, the customer should permanent mark his chosen Protection Concept on the safety label. The transmitter can only be used with according to this Protection Concept for the whole life. If two or more types of protection box (on safety label) are permanent marked, the pressure transmitter must be removed from hazardous classified locations. The selected Type of Protection is allowed to be changed only by manufacturer after a new satisfactory assessment.

7.1.1 Entities for “L5” option (display with TTG technology)

HART Version with “L5” option (display TTG)					
Ui= 30 Vdc Ci= 5 nF Li= uH					
Temperature Class - Gas	**Temperature Class - Dust**	**Minimum amb. °C**	**Maximum amb. °C**	**Imax mA**	**Power W**
T4	T135 °C	-50 °C	+60 °C	100	0.75
T4	T135 °C	-50 °C	+60 °C	160	1
T5	T100 °C	-50 °C	+56 °C	100	1.75
T6	T85 °C	-50 °C	+44 °C	50	0.4

PROFIBUS Version with “L5” option (display TTG)			
Ui= 17.5 Vdc Ii= 360 mA Pi= 2.52 W Ci= 5nF Li= 10 uH			
Temperature Class - Gas	**Temperature Class - Dust**	**Minimum amb. °C**	**Maximum amb. °C**
T4	T135 °C	-50 °C	+60 °C
T5	T100 °C	-50 °C	+56 °C
T6	T85 °C	-50 °C	+44 °C

FF / FISCO Version with “L5” option (display TTG)			
Ui= 17.5 Vdc Ii= 380 mA Pi= 5.32 W Ci= 5nF Li= 10 uH			
Temperature Class - Gas	**Temperature Class - Dust**	**Minimum amb. °C**	**Maximum amb. °C**
T4	T135 °C	-50 °C	+60 °C
T5	T100 °C	-50 °C	+56 °C
T6	T85 °C	-50 °C	+44 °C

7.2 Ex Safety aspects and IP Protection (North America)

7.2.1 Applicable standards

According to FM Approvals Standards which can assure compliance with Essential Safety Requirements

FM 3600: Electrical Equipment for use in Hazardous (Classified) Locations, General Requirements.

FM 3610: Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, and Class I, Zone 0 & 1 Hazardous (Classified) Locations.

FM 3611: Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III Division 1 and 2 Hazardous (Classified) Locations.

FM 3615: Explosionproof Electrical Equipment.

FM 3810: Electrical and Electronic Test, Measuring and Process Control Equipment.

NEMA 250: Enclosure for Electrical Equipment (1000 Volts Maximum)

7.2.2 Classifications

The 2600T Series pressure transmitters have been certified by FM Approvals for the following Class, Divisions and Gas groups, hazardous classified locations, temperature class and types of protection.

- Explosionproof (US) for Class I, Division 1, Groups A, B, C and D, hazardous (classified) locations.
- Explosionproof (Canada) for Class I, Division 1, Groups B, C and D, hazardous (classified) locations.
- Dust Ignition proof for Class II, III Division 1, Groups E, F and G, hazardous (classified) locations.
- Suitable for Class II, III, Division 2, Groups F and G, hazardous (classified) locations.
- NonIncendive for Class I, Division 2, Groups A, B, C and D, in accordance with Nonincendive field wiring requirements for hazardous (classified) locations.
- Intrinsically Safe for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F, and G in accordance with Entity requirements for hazardous (classified) locations.
- Temperature class T4 to T6 (dependent on the maximum input current and the maximum ambient temperature).
- Ambient Temperature range -40°C to +85°C (dependent on the maximum input current and the maximum temperature class).
- Electrical Supply range Minimum 10.5 Volts, Maximum 42 Volts (dependent on the type of protection, maximum ambient temperature, maximum temperature class and communication protocol).
- Type 4X applications Indoors/Outdoors.

For a correct installation in field of 2600T Series pressure transmitters please see the related control drawing.

Note that the associated apparatus must be FM approved.

8 Safety manual (Rev. I)

Additional instruction for IEC61508 certified device (ONLY for digits 8 or T under “output” options)

8.1 Safety philosophy

The 266 Pressure Transmitters are field devices designed according to the requirements of the standard IEC61508 for the Safety Related Systems. Standard currently used focus on individual parts of all the safe instrumentation used to implement a safety function. The IEC61508 defines requirements related to all the system that normally comprises initiating devices, logic solver and final elements. It also introduces the concept of Safety lifecycle defining the sequence of activities involved in the implementation of the safety instrumented system from conception through decommissioning. For a single component it is not correct to define a SIL level. The term SIL (Safety Integrity Level) refers to the complete safety loop therefore the single device shall be designed in order to be suitable to achieve the desired SIL level in the entire Safety Loop.

8.2 Application

The 266 Pressure Transmitters are intended to be applied for safety relevant application in the process industry. They are suitable to be used in SIL2 applications when applied as single channel and in SIL3 applications when applied with a double channel with architecture 1oo2. Special attention has to be given to the separation of safety and non safety relevant use.

8.3 Physical environment

The transmitters are designed for use in industrial field environments and must be operated within the specified environmental limits as indicated in the Transmitter Data Sheet.

8.4 Role and responsibilities

All the people, departments and organizations involved in the life-cycle phases which are responsible for carrying out and reviewing the applicable overall, E/E/PES (Electrical/Electronic/Programmable Electronic System) or software safety lifecycle phases of a Safety Instrumented System shall be identified. All those specified as responsible for management of functional safety activities shall be informed of the responsibilities assigned. All persons involved in any overall, E/E/PES or software safety lifecycle activity, including management activities, should have the appropriate training, technical knowledge, experience and qualifications relevant to the specific duties they have to perform.

8.5 Management of functional safety

For each application the installer or the owner of a safety system must prepare a Safety Planning which must be updated throughout the Safety Life-cycle of the Safety Instrumented System. The safety planning shall include the Safety instrumentation management. The requirements for the management of functional safety shall run in parallel with the overall safety lifecycle phases.

Safety Planning.

The Safety Planning shall consider:

- policies and strategies for achieving safety;
- safety life-cycle activities to be applied, including names of responsible persons and departments;
- procedures relevant to the various life-cycle phases;
- audits and procedures for follow up.

8.6 Information requirements (to be made available by the plant owner)

The information shall comprehensively describe the system installation and its use in order that all phases of the overall safety lifecycles, the management of functional safety, verification and the functional safety assessment can be effectively performed.

8.7 Overall safety life-cycle information

The overall safety lifecycle shall be used as the basis for claiming conformance to the standard IEC61508. The lifecycle phases consider all the activities related to the Safety Instrumented System (SIS) from the initial concept through design, implementation, operation and maintenance to decommissioning.

8.8 Applicable laws and standards

All applicable general Laws and Standards related to the allowed operations of the equipment, as EU-Directives shall be collected. The plant owner shall produce a Regulatory Requirements List document.

8.9 System safety requirement assignment I/O system response time

The total system response time is determined by the following elements:

- Sensor detection time,
- Logic solver time;
- Actuator response time;

The total system response time must be less than the process safety time. To ensure a safe operation of the system, the scan rate of each section of the logic solver multiplied by the number of channels shall be taken into account together with the safety time of actuator and sensor response time.

8.10 System structure

System configuration drawings shall be available to describe the equipment and interfaces required for a complete operational system. The system must be fully operational before start-up.

8.11 Safety requirement allocation

Each safety function, with its associated safety integrity requirement, shall be allocated to the designated safety related systems taking into account the risk reductions achieved by the other technology safety- related systems and external risk reduction facilities, so the necessary risk reduction for that safety function is achieved. The allocation indicated shall be done in such a way that all safety functions are allocated and the safety integrity requirements are met for each safety function.

8.12 Safety routines

Safety additional requirements may be defined in order to ensure the correct functionality of sequences in the Safety Instrumented System.

8.13 Commissioning

8.13.1 Overall system functionnality

The activity to validate the required safety functionality of the system together with the pressure transmitter according to the Safety Requirement Specification is the Pre-Startup Acceptance test.

8.13.2 Faults outside the functional safety

The redundant algorithms and the electronics are designed to detect all the internal hardware faults therefore the transmitter diagnostic is not able to detect faults related to the process and to the installation configuration. In the following table the known weaknesses resulting from the transducer FMEA (Failure Mode and Effect Analysis) are listed.

- Assembled material at the pipes of the transmitter, blockage of pipe.
- Application outside specified temperature range.
- Excess of temperature
- Assembled gas at the transmitter, if the transmitter is mounted above the process line
- Overload pressure, high peak pressure pulses in process lines
- Penetration of hydrogen, diaphragm crack in applications with hydrogen process medium.
- Thin walled diaphragm, leaky diaphragm in applications with abrasive medium.
- Thin walled diaphragm, leaky diaphragm in applications with corrosive medium.
- Higher diaphragm stiffness, crack in application with contamination of metal ions
- Mechanical damage through cleaning, damage of the coating, corrosion.

8.13.3 Other considerations

The alarm levels of the transmitter (down-scale or up-scale) can be selected by the user. As default all the 266 devices are configured with up-scale alarm. For some faults (e.g. crystal breakdown), the output will latch at 3.6 mA even if the up scale alarm level is selected.

8.14 Architecture description and principle of operation

The instrument consists of two main functional units:

- Primary unit
- Secondary unit

The pressure transducer unit includes the process interface, the sensor and the front-end electronics; the Secondary Unit includes the electronics, the terminal block and the housing. The two units are mechanically coupled by a threaded joint.

8.15 Principle of operation

The principle of operation is as follows. In the primary unit the process fluid (liquid, gas or vapour) exerts pressure on to the sensor via flexible, corrosion-resistant isolating diaphragms and capillary tubing containing the fill fluid. As the sensor detects the pressure changes, it simultaneously produces variations of the primary physical value depending on the sensor technology (capacitive, inductive or piezoresistive).

The signal is then converted in the front-end electronics in a digital form and the raw values are computed by a microcontroller to a precise primary output linearization, compensating for the combined effects of sensor non linearity, of static pressure and temperature changes on the basis of the “mapped” parameters calculate in the manufacturing process and stored in the memory of the Front End electronics.

Calculations follow independent flows and they are compared in the microcontroller in order to validate the output pressure signal. If a difference between the two measurements is detected the analog output is driven to a safety condition. The measured values and the sensor parameters are transferred via a standard serial digital communication to the secondary unit where the communication board is fitted. The output data value is converted into a pulse-width signal that is filtered and that activates the 4-20 mA transmitter. The bi-directional, digital communication using the standard “HART” protocol is implemented as part of this unit. Internal diagnostics algorithms are implemented to check correctness and validity of all processing variables and the correct working of memories. The output stage is also checked by reading back the analog output signal and by reading the power supply voltage. The feedback loop is obtained by an additional A/D converter put at the end of the output stage, which translates the 4-20 mA signal into a digital form suitable to be compared by the microcontroller.

8.16 Commissioning and configuration issues

The transmitter is considered in safety condition (normal operating mode) when the write protect switch placed outside the transmitter housing below the metallic nameplate is in Write Protect. In that condition all kind of configurations of the device are disabled.

8.17 Operating mode enabling and disabling

Operating mode can be enabled/disabled depending on the switch position. It is also possible to put the device in write protect condition by a dedicated HART command. In any case the switch position has the priority on the software command.

8.18 Proof tests

Safe undetected faults could occur during the operation of the transmitters. These failures do not affect the transmitter operations. To maintain the claimed Safety Integrity Level (SIL 2) a proof test procedure is requested every 10 years.

The proof tests consist in the following operations:

- Switch off the device.
- Assure that the Write Protect Mode switch is in Write Protect condition.

– Power-on the transmitter: the transmitter performs automatically a self-test that consists in the operations below:

  ROM test

  RAM test

  Test of the analog output stage and of the feedback A/D converter

  Test of the power supply voltage

  Non volatile memory test

– Apply pressure up to 50% of the calibrated range and check the output value. It shall be within the stated safety accuracy (2% of sensor range).

In case the tests would fail the transmitter will drive the output to the alarm values. In this case a correction action consists in the re-calibration of the D/A converter. In case the normal functionality will be not re-established, the transmitter shall be considered failed and not possible to use.

8.19 Safety-related parameters for HART digital communication IEC 61508 SIL2 certified transmitters

The Safety 266 pressure transmitter product meets the SIL2 requirements of IEC 61508 in low as well as high demand mode of operation. The total PFD in low demand mode for 10 years proof test interval in the worst case is less than the 35% of the range defined in IEC 61508-1. The relevant numbers are stated in the table below.

	266DXX, 266VXX, 266PXX, 266HXX, 266NXX	266MXX, 266CXX, 266JXX, 266RXX (range R)	266MXX, 266CXX, 266JXX, 266RXX (except range R)	266GXX, 266AXX	266GXX, 266AXX (only range C and F sold before May 2012)	266GXX, 266HXX (only range Z)
λdd	2.62E-07	4.11E-07	3.94E-07	4.05E-07	4.13E-07	3.72E-07
λdu	6.82E-08	6.87E-08	6.85E-08	6.85E-08	6.90E-08	8.06E-08
λsd	3.37E-07	2.07E-45	2.07E-39	2.07E-40	2.07E-40	2.50E-07
λsu	3.01E-07	3.55E-07	3.53E-07	3.42E-07	3.18E-07	3.46E-07
HFT	0	0	0	0	0	0
T1	1 year / 10 years (8760h / 87600h)					
SFF	92.95 %	93.63 %	93.51 %	93.51 %	93.37 %	92.32 %
Total Failure Rate	9.68E-07	1.08E-06	1.06E-06	1.06E-06	1.06E-04	1.049E-06
MTBF	118	106	108	108	110	109
MTTR	8 hours					
DC	D: 79 %	D: 86 %	D: 85 %	D: 86 %	D: 86 %	D: 82 %
	C: 53 %	C: 41 %	C: 40 %	C: 41 %	C: 43 %	S: 42 %
PFD (1 year)	2.99E-04	3.01E-04	3.00E-04	3.00E-04	3.02E-04	3.53E-04
PFH (1 year)	6.82E-08	6.87E-08	6.85E-08	6.85E-08	6.90E-08	8.06E-08
PFD (10 years)	2.98E-03	3.00E-03	2.99E-03	2.99E-03	3.01E-03	3.52E-03
PFH (10 years)	6.82E-08	6.87E-08	6.85E-08	6.85E-08	6.90E-08	8.06E-08
Testing time	< 20 s	< 20 s	< 20 s	< 5 s	< 70 s	< 20 s
ROM check time	< 30 s	< 30 s	< 30 s	< 30 s	< 70 s	< 30 s

Important. A diaphragm-seal-equipped pressure transmitter features different safety parameters if compared to the abovementioned ones. The intrinsic safety failure rates of diaphragm seal should be added to the ones of the pressure transmitter (as per above table). The values represent the worst case and may be slightly different (nearly negligible) depending on the type of diaphragm seal. As a reference, you may want to consider the below value:

	One diaphragm seal configuration	Two diaphragm seal configuration
λdd	0.46E-07	0.92E-07
λdu	1.38E-08	2.75E-08
λs	0	0

Note. The above failure rates have to be added to the transmitter ones in case you selected a transmitter equipped with one or two diaphragm seals. The above table shows the dangerous failures only because the diaphragm seal system does not generate any safe failure. In order to calculate the Safety Failure Fraction (SFF) and Diagnostic Coverage (DC) of a diaphragm-seal-equipped pressure transmitter, please use the following formulas:

$$SFF = \frac{\lambda s + \lambda dd}{\lambda d + \lambda s} \qquad DC = \frac{\lambda dd}{\lambda dd + \lambda du}$$

Important. Values listed here above and instructions given in chapter 12 are valid only for HART digital communication and 4 ... 20 mA IEC 61508 SIL2 certified pressure transmitters (digits T and 8 under the “Output” option within product codes). Therefore safety instructions cannot be considered as valid in case the transmitter features Standard or Advanced HART (digits H, 1, L, 7), PROFIBUS PA (digits P, 2) or FOUNDATION Fieldbus (digits F, 3) communication protocols.

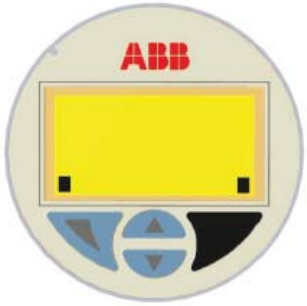
HMI Keypad Activation

Attivazione tramite tastiera HMI

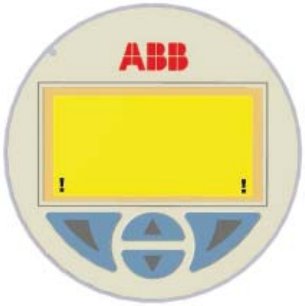
HMI Aktivierung

Activation du clavier de l'HMI

- Push the central upper key until two small icons appear on the bottom corners of the display
- Premere il tasto centrale superiore fino a quando si visualizzano due piccole icone agli angoli inferiori del display
- Die mittlere obere Taste betätigen bis in beiden unteren Ecken des Displays zwei Symbole erscheinen.
- Appuyer sur la touche supérieure centrale jusqu'à l'apparition de deux petites icônes dans les coins inférieurs de l'écran.



- To navigate the menu, push the right side key and follow the instructions on the HMI
- Per navigare nel menu, premere il tasto sul lato destro e seguire le istruzioni dell'HMI
- Um im Menü zu navigieren, die ganz rechte Taste betätigen und dann entsprechend der angezeigten Hinweise vorgehen.
- Pour naviguer dans le menu, appuyer sur la touche de droite et suivre les instructions sur l'IHM.



- Activation failed
- Attivazione fallita
- Aktivierung nicht erfolgreich
- Échec de l'activation

Important.

- With the TTG version, removing the windowed cover is not necessary.
- Con la versione TTG, non è necessario rimuovere il coperchio frontale con oblò.
- Bei Anzeigern mit TTG-Option muss der Gehäusedeckel zur Betätigung der Tasten nicht entfernt werden.
- Avec la version TTG, il n'est pas nécessaire de retirer le couvercle à fenêtre.

Important.

- If the contrast setting renders the display illegible, press the left and right buttons at the same time to restore the factory setting.
- Se le impostazioni del contrasto rendono il display illeggibile, premere i pulsanti destro e sinistro contemporaneamente per ripristinare le impostazioni di fabbrica.
- Sollte der Kontrast so verstellt sein, dass die Anzeige nicht mehr lesbar ist, kann durch die gleichzeitige Betätigung der linken und der rechten Taste die Werkseinstellung wieder hergestellt werden.
- Si les réglages du contraste rendent l'écran illisible, appuyer simultanément sur les boutons gauche et droit pour restaurer les réglages d'usine.

TROUBLE SHEET

WARRANTY REPAIR ☐ ☐ REPAIR ORDER

Rejection or discrepancy Reports	*copy attached* ☐	*not available* ☐

- **IDENTIFICATION**

Customer _____

Purchase order No _____

Plant _____

Name of person to contact _____

Instrument Tag No _____

Model _____

Serial Number _____

- **OPERATING CONDITIONS**

Specify location, environmental conditions, type of service and approximate number of operating hours or date of installation if known

- **REASON FOR RETURN**

- **DANGEROUS FLUIDS**

In case of toxic or otherwise dangerous fluid, please attach the relevant Material Safety Data Sheet

Trouble found during. Installation ☐ Commissioning ☐ Maintenance ☐
At start up ☐ On service ☐

Shipping information for the return of the equipment

Material returned for factory repair should be sent to the nearest ABB Service Center; transportation charges prepaid by the Purchaser

Please enclose this sheet duty completed to cover letter and packing list

Date _____ Signature _____ Originator _____

ABB S.p.A
Process Automation Division
Sales Office: Via Statale, 113 - 22016 Lenno (CO) Italy
Tel. +39 0344 58 111
Fax +39 0344 56 278
e-mail: abb.instrumentation@it.abb.com

RETURN REPORT – No.: _ _ _ _ _ _ _ _

***) Please always fill in. Otherwise the case will not be handled as return**

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH (C.O.S.H.H.)

Decontamination declaration - EQUIPMENT RETURNED FOR REPAIR, CALIBRATION OR CREDIT

From _____

_____

_____

Description _____

Return authorization no. _____

Model number _____

Serial number _____

A)	*The above equipment has not been in contact with any material which is hazardous to health.*
B)	*The above equipment has been in contact with the material(s) noted below but that it has now been completely de-contaminated and is now safe to handle and dismantle without any special precautions. Material(s) which have been in contact with this equipment:*
C)	*If A) or B) are not applicable full instructions for the safe handling of this equipment **for disposal** must be supplied.*

***Please delete A), B) or C) above** as applicable, complete the signature section below, then send the completed declaration either with the returned items, or by fax for the attention of the Calibration & Repair Centre..*
Note – no action to examine or repair equipment will be undertaken until a valid COSHH declaration has been received, completed by an authorized officer of the end user company.

Signed _____

Name _____

Position _____

Date _____

ABB S.p.A
Process Automation Division
Uffici Commerciali / *Sales Office:*
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for a better world™