

# 266HSH Modbus Transmitter

## Pressure/Temperature Multivariable



Engineered solutions for all applications

Measurement made easy

—

266 models

### Introduction

The 2600T family provides comprehensive range of top quality pressure measurement products, specifically designed to meet the widest range of applications ranging from arduous conditions in offshore oil and gas to the laboratory environment of the pharmaceutical industry.

### For more information

Further publications for 2600T series pressure products are available for free download from [www.abb.com/pressure](http://www.abb.com/pressure)



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Operating Instruction  
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[OI/266HSHMT-EN](#)

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# 1 Introduction

## 1.1 Instruction manual structure

The present manual provides information on installing, operating, troubleshooting the 266 pressure transmitter. Every section of the present manual is specifically dedicated to the specific phase of the transmitter lifecycle starting from the receipt of the transmitter and its identification, passing to the installation, to the electrical connections, to the configuration and to the troubleshooting and maintenance operations.

## 1.2 Models covered by this manual

The present manual can be used for the Modbus 266 pressure model.

## 1.3 Product description

The pressure transmitters model 266 is a modular range of field mounted, microprocessor based electronic transmitters, using multiple sensor technologies. Accurate and reliable measurement of gauge pressure in the even most difficult and hazardous industrial environments.

# 2 Safety

## 2.1 General safety information

The “Safety” section provides an overview of the safety aspects to be observed for operation of the device.

The device has been constructed in accordance with the state of the art and is operationally safe. It has been tested and left the factory in perfect working conditions. The information in the manual, as well as the applicable documentation and certificates, must be observed and followed in order to maintain this condition throughout the period of operation.

Full compliance with the general safety requirements must be observed during operation of the device. In addition to the general information, the individual sections in the manual contain descriptions of processes or procedural instructions with specific safety information.

Only by observing all of the safety information can you reduce to the minimum the risk of hazards for personnel and/or environment. These instructions are intended as an overview and do not contain detailed information on all available models or every conceivable event that may occur during setup, operation, and maintenance work.

For additional information, or in the event of specific problems not covered in detail by these operating instructions, please contact the manufacturer. In addition, ABB declares that the contents of this manual are not part of any prior or existing agreements, commitments, or legal relationships; nor are they intended to amend these.

All obligations of ABB arise from the conditions of the relevant sales agreement, which also contains the solely binding warranty regulations in full. These contractual warranty provisions are neither extended nor limited by the information provided in this manual.

**Caution.** Only qualified and authorized specialist personnel should be charged with installation, electrical connection, commissioning, and maintenance of the transmitter. Qualified personnel are persons who have experience in installation, electrical wiring connection, commissioning, and operation of the transmitter or similar devices, and hold the necessary qualifications such as:

- Training or instruction, i.e., authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures, and aggressive media
- Training or instruction in accordance with safety engineering standards regarding maintenance and use of adequate safety systems.

For safety reasons, ABB draws your attention to the fact that only sufficiently insulated tools conforming to EN 60900 may be used.

Since the transmitter may form part of a safety chain, we recommend replacing the device immediately if any defects are detected. In case of use in Hazardous Area non sparking tools only must be employed.

In addition, you must observe the relevant safety regulations regarding the installation and operation of electrical systems, and the relevant standards, regulations and guidelines about explosion protection.

**Warning.** The device can be operated at high levels of pressure and with aggressive media. As a result, serious injury or significant property damage may occur if this device is operated incorrectly.

## 2.2 Improper use

It is prohibited to use the device for the following purposes:

- As a climbing aid, e.g., for mounting purposes.
- As a support for external loads, e.g., as a support for pipes.
- Adding material, e.g., by painting over the name plate or welding/soldering on parts.
- Removing material, e.g., by drilling the housing.

Repairs, alterations and enhancements, or the installation of replacement parts are only permissible as far as these are described in the manual. Approval by ABB must be requested for any activities beyond this scope. Repairs performed by ABB-authorized centers are excluded from this.

## 2.3 Technical limit values

The device is designed for use exclusively within the values stated on the name plates and within the technical limit values specified on the data sheets.

The following technical limit values must be observed:

- The Maximum Working Pressure may not be exceeded.
- The Maximum ambient operating temperature may not be exceeded.
- The Maximum process temperature may not be exceeded.
- The enclosure method of protection type must be observed.

## 2.4 Warranty provision

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations, releases the manufacturer from any liability for any resulting damage. This makes the manufacturer's warranty null and void.

## 2.5 Use of instruction

**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.

## 2.6 Operator liability

Prior to using corrosive and abrasive materials for measurement purposes, the operator must check the level of resistance of all parts coming into contact with the materials to be measured.

ABB will gladly support you in selecting the materials, but cannot accept any liability in doing so.

The operators must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices.

## 2.7 Qualified personnel

Installation, commissioning, and maintenance of the device may only be performed by trained specialist personnel who have been authorized by the plant operator. The specialist personnel must have read and understood the manual and comply with its instructions.

## 2.8 Returning devices

Use the original packaging or suitably secure shipping package if you need to return the device for repair or recalibration purposes. Fill out the return form (see the end of the document) and include this with the device.

According to guidelines and other local laws for hazardous materials, the owner of hazardous waste is responsible for its disposal. The owner must observe the proper regulations for shipping purposes.

All devices sent back to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

## 2.9 Disposal

ABB actively promotes environmental awareness and has an operational management system that meets the requirements of ISO 9001:2015, ISO 14001:2015, and OHSAS 18001:2007. Our products and solutions are intended to have minimum impact on the environment and persons during manufacturing, storage, transport, use and disposal.

This includes the environmentally friendly use of natural resources. ABB conducts an open dialog with the public through its publications.

This product/solution is manufactured from materials that can be reused by specialist recycling companies.

## 2.10 Information on WEEE Directive 2012/19/EU (Waste Electrical and Electronic Equipment)

This product or solution is subject to the WEEE Directive 2012/19/EU or corresponding national laws. Starting from August 15th 2018, electrical and electronic equipment marked with the crossed-out wheeled bin symbol may not be disposed as unsorted municipal waste. Waste of electrical and electronic equipment (WEEE) shall be treated separately using the national collection framework available to customers for the return, recycling and treatment of WEEE.

Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials. ABB can accept and dispose of returns for a fee.

## 2.11 Transport and storage

- After unpacking the pressure transmitter, check the device for transport damage.
- Check the packaging material for accessories.
- During intermediate storage or transport, store the pressure transmitter in the original packaging only.

For information on permissible ambient conditions for storage and transport, see paragraph "4.4 Storage" and product datasheet. Although there is no limit on the duration of storage, the warranty conditions stipulated on the order acknowledgment from the supplier still apply.

## 2.12 Safety information for electrical installation

Electrical connections may only be established by authorized specialist personnel in accordance with the electrical circuit diagrams. The electrical connection information in the manual must be observed; otherwise, the applicable protection type may be affected. Ground the measurement system according to requirements.

## 2.13 Safety information for inspection and maintenance

**Warning – Risk to persons.** There is no EMC protection or protection against accidental contact when the housing cover is open. There are electric circuits within the housing which are dangerous if touched. Therefore, the auxiliary power must be switched off before opening the housing cover.

**Warning – Risk to persons.** The device can be operated at high pressure and with aggressive media. Any process media released may cause severe injuries. Depressurize the pipeline/tank before opening the transmitter connection.

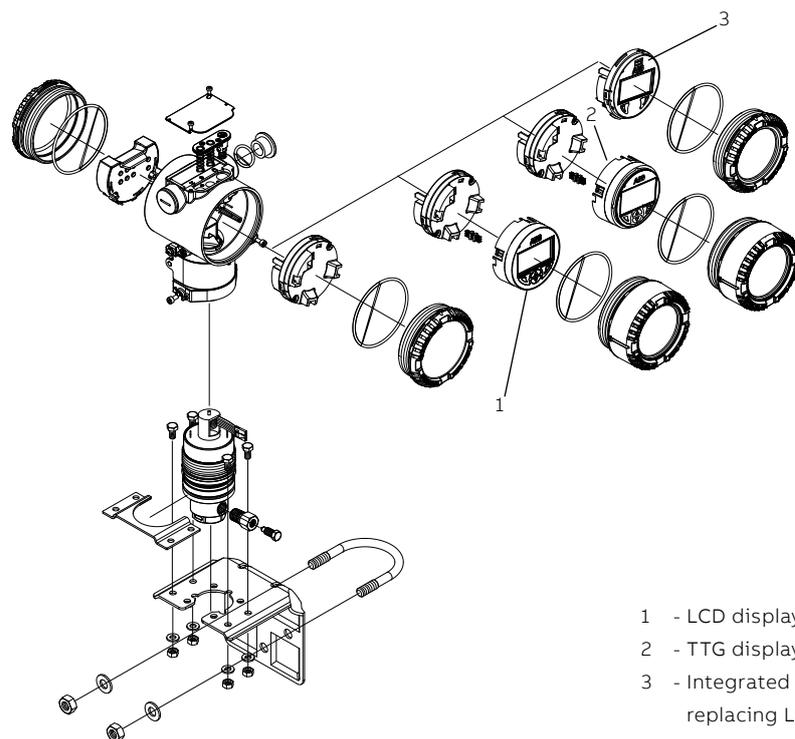
Corrective maintenance work may only be performed by trained personnel.

- Before removing the device, depressurize it and any adjacent lines or containers.
- Check whether hazardous materials have been used as materials to be measured before opening the device. Residual amounts of hazardous substances may still be present in the device and could escape when the device is opened.
- Within the scope of operator responsibility, check the following as part of a regular inspection:
  - Pressure-bearing walls/lining of the pressure device
  - Measurement-related function
  - Leak-tightness
  - Wear (corrosion)

### 3 Transmitter overview

#### 3.1 Transmitter components overview

Figure 1: Differential pressure transmitter components



- 1 - LCD display with keypad (L1 option)
- 2 - TTG display with keypad (L5 option)
- 3 - Integrated digital LCD display (LS option replacing L9 option PHASED OUT)

Important. This picture shows transmitters equipped with Barrel type housing. Please consider that DIN housings are available.

### 3.2 Range & Span consideration

The 2600T Transmitter Specification Sheets provide all information concerning the Range and Span limits in relation to the model and the sensor code.

The terminology currently used to define the various parameters is as follows:

URL: Upper Range Limit of a specific sensor. The highest value of the measured value that the transmitter can be adjusted to measure.

LRL: Lower Range Limit of a specific sensor. The lowest value of the measured value that the transmitter can be adjusted to measure.

URV: Upper Range Value. The highest value of the measured value to which the transmitter is calibrated.

LRV: Lower Range Value. The lowest value of the measured value to which the transmitter is calibrated.

SPAN: The algebraic difference between the Upper and Lower Range Values. The minimum span is the minimum value that can be used without degradation of the specified performance.

TD: (or Turn Down Ratio) is the ratio between the maximum span and the calibrated span.

The transmitter can be calibrated with any range between the LRL and the URL with the following limitations:

$$\text{LRL} \leq \text{LRV} \leq (\text{URL} - \text{CAL SPAN})$$

$$\text{CAL SPAN} \geq \text{MIN SPAN}$$

$$\text{URV} \leq \text{URL}$$

## 4 Opening the box

### 4.1 Identification

The instrument is identified by the data plates shown in Figure 2. The certification plate (ref. A): contains the certification related parameters for use in Hazardous area.

The Nameplate (ref. B), always made of AISI 316 ss, 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).

The Tag plate, instead, provides customer tag number and calibrated range.

Both certification and tag plates are supplied self-adhesive attached to the electronics housing, as standard. Option I2 allows to select these plates as metal AISI 316 ss fastened to the electronics housing with rivets.

The instrument may be used as a pressure accessory (category III) as defined by the Pressure Equipment Directive 2014/68/EU. 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\*.

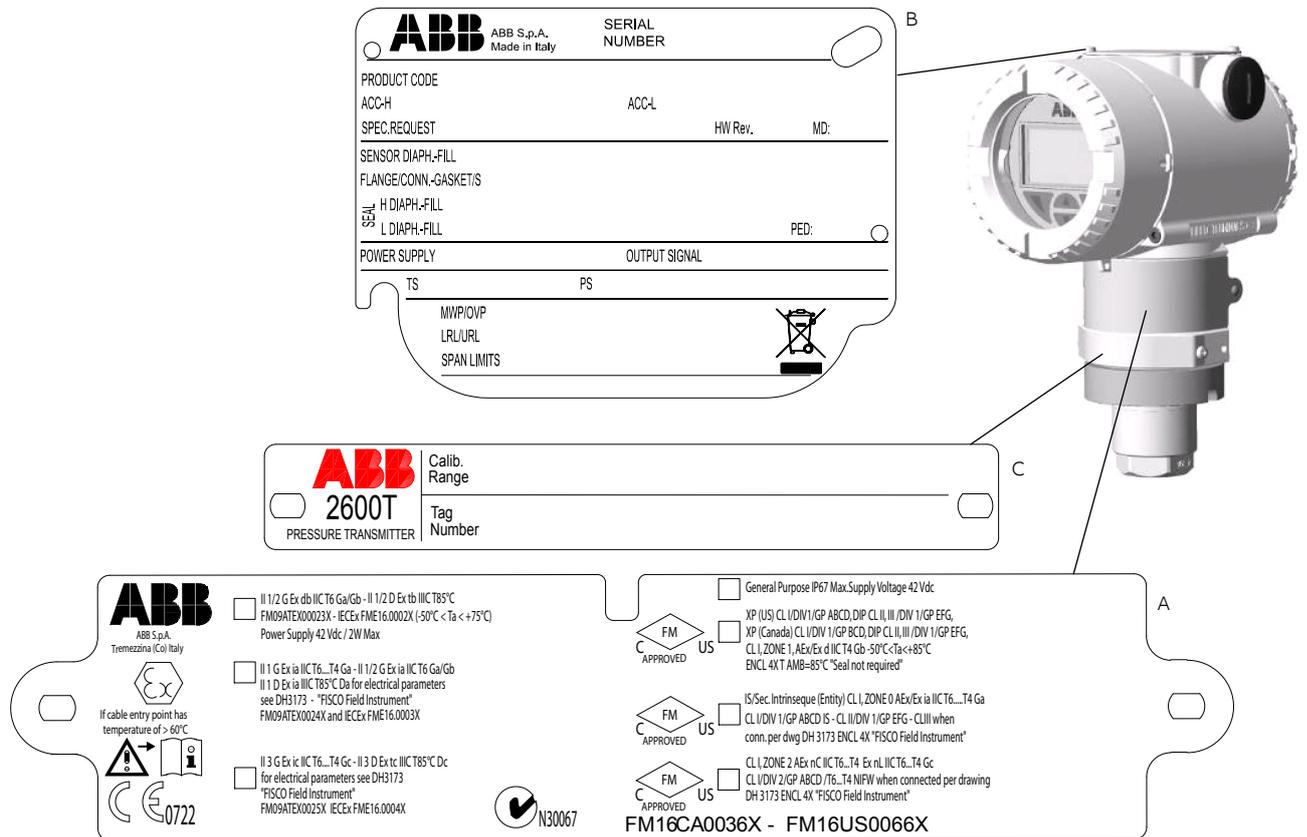


Figure 2: Product identification

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

### 4.2 Optional wired-on SST plate (I1)

The 266 transmitter can be supplied with the optional “Wired On Stainless Steel plate” (figure 3) which is permanently laser printed with a custom text specified in phase of order. The available space consists in 4 lines with 32 characters per line.

The plate will be connected to the transmitter with a Stainless Steel wire.

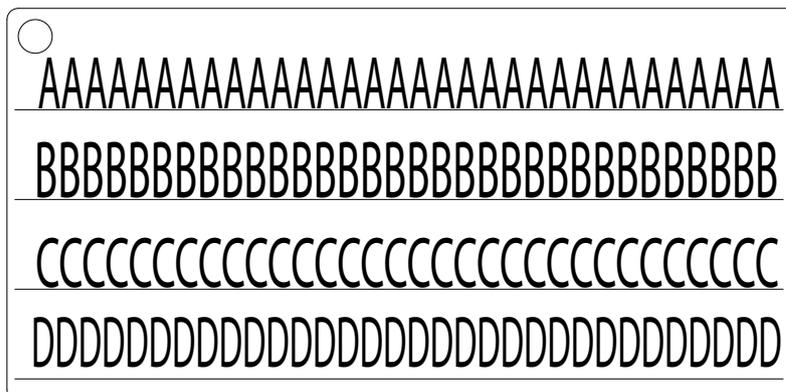
### 4.3 Handling

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

### 4.4 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.

Figure 3: 4-line layout of the optional wired-on Stainless Steel plate



# 5 Mounting

## 5.1 General

Study these installation instructions carefully before proceeding. Failure to observe the warnings and instructions may cause a malfunction or personal hazard. Before installing the transmitter, check whether the device design meets the requirements of the measuring point from a measurement technology and safety point of view.

This applies in respect of the:

- Explosion protection certification
- Measuring range
- Gauge pressure stability
- Temperature (Ambient and Process)
- Operating voltage

The suitability of the materials must be checked as regards their resistance to the media. This applies in respect of the:

- Gasket
- Process connection, isolating diaphragm, etc.

In addition, the relevant directives, regulations, standards, and accident prevention regulations must be observed (e.g., VDE/VDI 3512, DIN 19210, VBG, Elex V, etc.). Measurement accuracy is largely dependent on correct installation of the pressure transmitter and, if applicable, the associated measuring pipe(s). As far as possible, the measuring setup should be free from critical ambient conditions such as large variations in temperature, vibrations, or shocks.

Important. If unfavorable ambient conditions cannot be avoided for reasons relating to building structure, measurement technology, or other issues, the measurement quality may be affected. If a remote seal with capillary tube is installed on the transmitter, the additional operating instructions for remote seals and the related data sheets must be observed.

## 5.2 IP protection & designation

The housings for 266 transmitters are certified as conforming to protection type IP66 / IP67 (according to IEC 60529) or NEMA 4X (according to NEMA 250).

The first number indicates the type of protection the integrated electronics have against the entry of foreign bodies, including dust.

“6” means that the housing is dust-proof (i.e., no ingress of dust).

The second number indicates the type of protection the housing has against the entry of water.

“6” means that the housing is protected against water; specifically, powerful jets of water under standardized conditions.

“7” means that the housing is protected against water; specifically, against the effects of temporary immersion in water under standardized water pressure and temporal conditions.

## 5.3 Mounting the transmitter

### 5.3.1 Transmitter factory configuration consideration

The 266 pressure transmitter in your hands has been factory calibrated to reflect the published declared performance specification; no further calibration is required in normal condition. ABB typically configures 266 pressure transmitters according to the user requirements. A typical configuration includes:

- TAG number
- Calibrated span
- Output linearization
- LCD display configuration

### 5.3.2 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.

Warning - General Risk for model 266 used in zone 0. The 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.

## 5.4 Pressure Equipment Directive (PED) (2014/68/EU)

### 5.4.1 Devices with PS >200

Devices with a permissible pressure PS >200 bar have been subject to a conformity validation. The data label includes the following specifications: Pressure Equipment Directive (PED) (2014/68/EU).

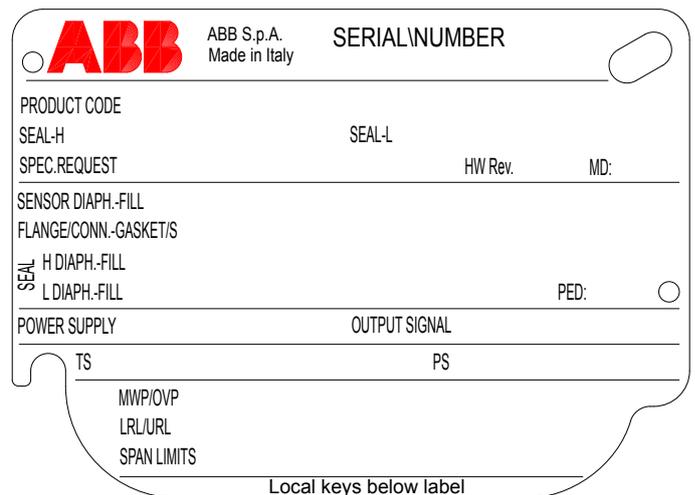


Figure 4: 266 nameplate with PED data

### 5.4.2 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.

### 5.4.3 B6 and B7 Barrel housing bracket details

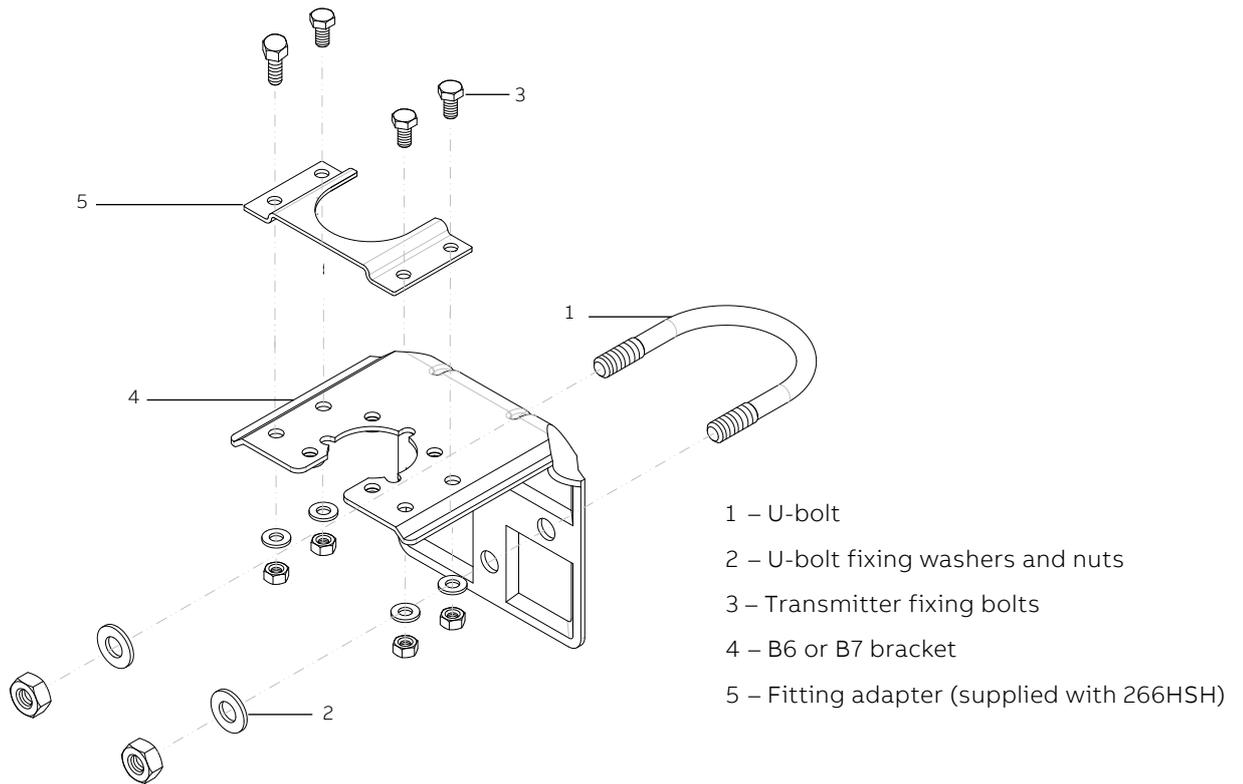


Figure 5: Pipe and wall mounting bracket kits for P style transmitter with Barrel housing

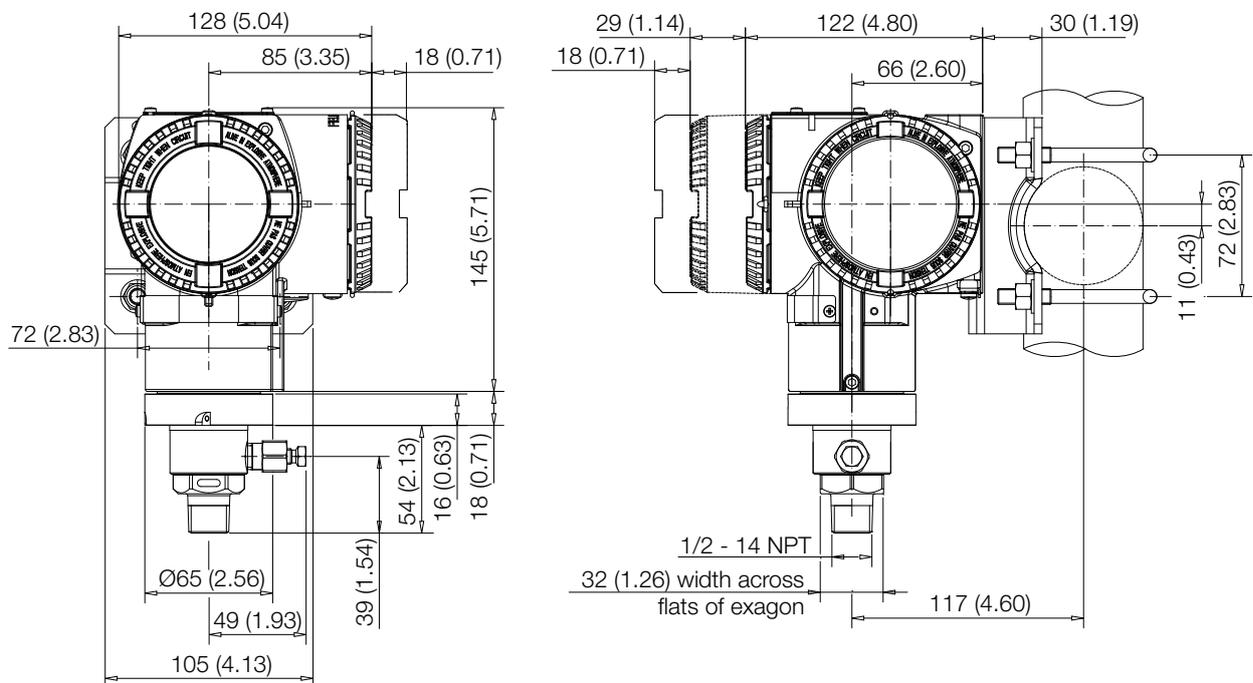


Figure 6: Model 266H or 266N Hi overload resistant P-Style transmitter with DIN housing installed on a 2" pipe with optional bracket (B7 Stainless Steel 316L)

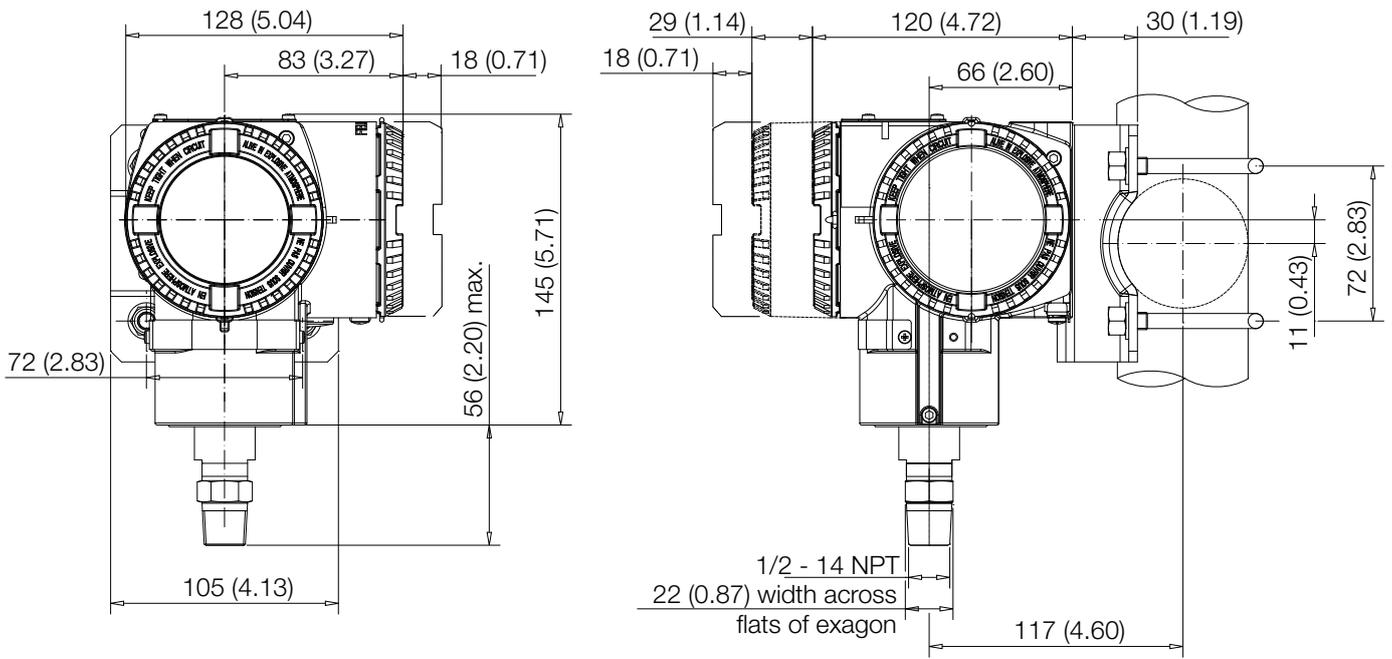


Figure 7: Model 266G or 266A P-Style transmitter with DIN housing installed on a 2" pipe with optional bracket (B7 Stainless Steel 316L)

#### 5.4.4 B7 DIN Housing bracket details

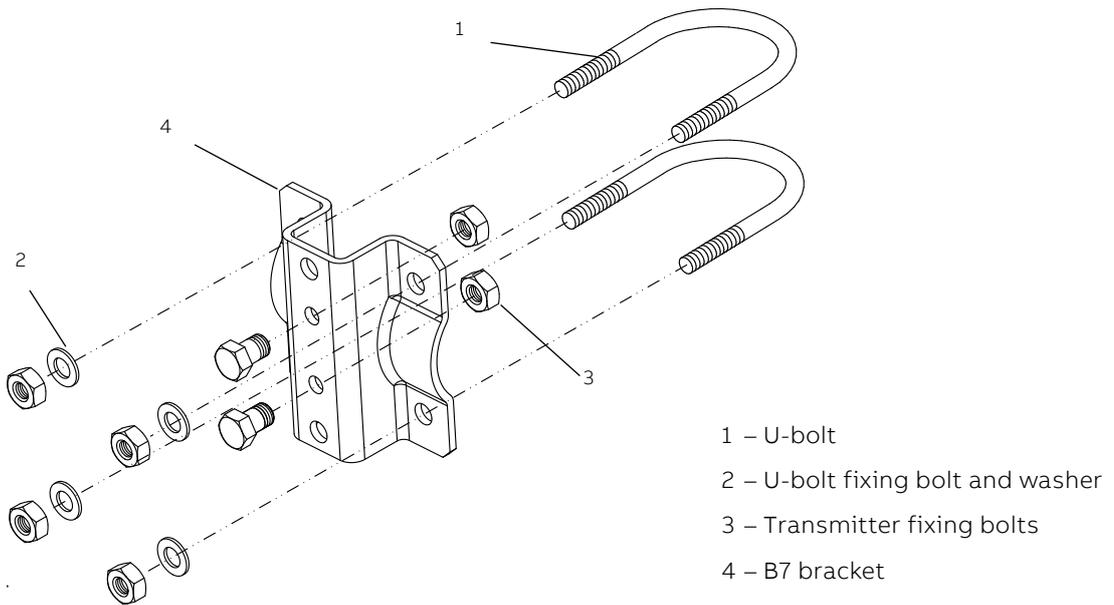


Figure 8: Pipe and wall mounting bracket kit (B7) for P style transmitter with DIN housing

## 6 Setup

### 6.1 Temperature measurement

- Mount the temperature sensor in the downstream pipe of the primary element.
- Consider the downstream straight pipe requirements.
- If there is a significant difference between the temperature of the measuring medium and the ambient temperature, the measuring error caused by heat conduction must be minimized by insulating the installation location accordingly.
- Use class “A” sensors to maximize accuracy.

### 6.2 General information

The relevant directives must be complied with for the electrical installation! Because the transmitter cannot be switched off, surge protection devices, lightning protection, or grid disconnect possibilities must be provided at the plant.

Check that the existing supply voltage corresponds to that indicated on the rating plate. The same lines are used for both the power supply and the output signal.

If an optional surge protector is provided and if the transmitter is used in a hazardous area, energy must only be supplied via a voltage source with electrical isolation from the grid. Because the inherently safe power circuits of the transmitter are grounded, a sufficient equipotential bonding must be ensured for the entire supply line.

#### 8.6.3 Installing the connecting cables

Ensure that a drip loop (water trap) is used when installing the connecting cables for the sensor.

If necessary, rotate the transmitter housing accordingly..

### NOTICE

If cable glands are not used, the red transport screw plugs must be replaced with suitable screw plugs when the transmitter is installed. This is because the transport screw plugs are not certified as protected against explosion. This requirement is particularly relevant in hazardous areas

### Cable entries with an M20 x 1.5 thread

Devices with an M20 x 1.5 thread are optional supplied with factory-installed cable glands and sealing plugs.

### Cable entries with a 1/2” NPT thread

The supplied transport sealing plugs do not have IP rating 4X / IP67 and are not approved for use in potentially explosive atmospheres.

The transport sealing plugs must be replaced with suitable cable glands or sealing plugs during device installation. When selecting the cable glands or sealing plugs, make sure they have the required IP rating and explosion protection!

To offer IP rating 4X / IP67, the cable glands / sealing plugs must be screwed in using a suitable sealing compound.

### Cable entry for PT100 temperature sensor

A metal cable gland should always be used for the Pt100 cable since a shielded cable is used.

Connect the shielding within the metal cable gland! To offer IP rating 4X / IP67, the cable glands / sealing plugs must be screwed in using a suitable sealing compound.

### Safety instructions for use in Division 1

Conduit requirements for Div. 1 installations are not addressed in this procedure. To avoid creating a hazardous situation, ensure compliance with the applicable standards, regulations, and recommendations for installation in the country of use. Resistance thermometer installation in classified Div. 1

### 6.4 Supply requirement

For signal/power connection use twisted, stranded pairs of wiring no 18 to 22 AWG / 0.8 to 0.35mm<sup>2</sup>  $\varnothing$  up to 5,000 feet (1500 meters). Longer loops require larger wire.

If a shielded wire is used, the shield should be grounded only at one end, not both ends. In case of wiring at transmitter end, use the terminal located inside the housing marked with the appropriate sign.

For Ex ia and other intrinsically safe approval power supply must not exceed 30 V DC.

Minimum operating voltage increase to 12.3 V DC with optional surge protector or to 10.8 V DC with optional conformity to NAMUR NE 21 (2004).

For maximum power supply voltage please refer to the top identification plate of the transmitter.

The actual possible line length of the electrical circuit depends on the total capacitance and resistance, and can be estimated using the following formula:

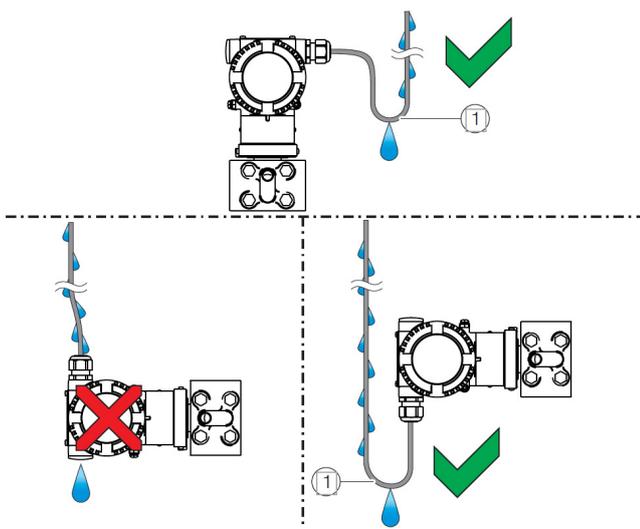


Fig. 9: Installing the connecting cables

1. Drip loop

### 6.3 Cable entries

The electrical connection is made via cable entries with a 1/2” NPT or M20 x 1.5 thread.

$$L = \frac{65 \times 10^6}{R \times C} - \frac{C_f + 10000}{C}$$

Where:

L = Line length in meters

R = Total resistance in  $\Omega$  (ohms)

C = Line capacitance in pF/m

C<sub>f</sub> = Maximum internal capacitance of the HART field devices located in the circuit, in pF

Avoid routing cables with other electrical cables (with inductive load, etc.) or near large electrical equipment.

## 6.5 Grounding

Pressure transmitter housing should be grounded or earthed in accordance with national and local electrical codes. Ground connection is mandatory for surge protector equipped devices in order to ensure proper functioning.

Protective grounding terminals (PE) are available outside and/or inside the housing of the transmitter. Both ground terminals are electrically connected and it up to the user to decide which one to use. The most effective transmitter case grounding method is direct connection to earth ground with impedance equal or less of 5 ohm.



## 6.6 Electrical connection

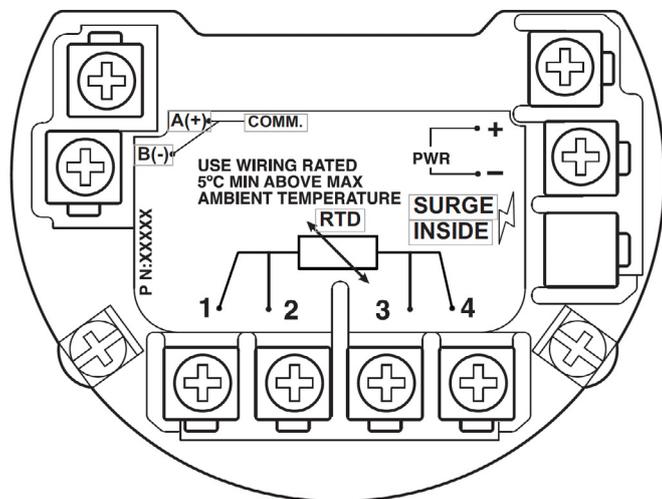


Fig. 10: Terminals

Terminal	Function/comment
PWR+	Power supply
PWR-	
A (+)	Modbus interface RS485
B (-)	
1, 2, 3, 4	Terminals for connecting the Pt100 resistance thermometer

### i NOTICE

#### Connection of a Pt100 temperature sensor

For the purpose of simulation, a 178  $\Omega$  resistor (206 °C / 402.8 °F) with 2 jumpers has been installed between the terminals for the Pt100 connection.

This resistor (including the jumpers in the case of 4-wire connections) must be removed before connecting the Pt100. If a Pt100 is not connected, the resistor must not be removed.

## 6.7 Electrical data for inputs and outputs

### Devices with Modbus communication

Terminals	PWR + / PWR -
Supply Voltage	10.5 ... 30 V DC

### i NOTICE

For current draw requirements see Fig. 25.

For power consumption based on specific supply voltages see Fig. 26.

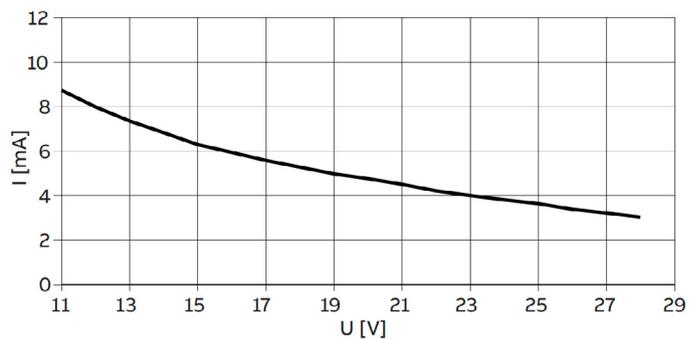


Fig. 11 Supply Current Chart

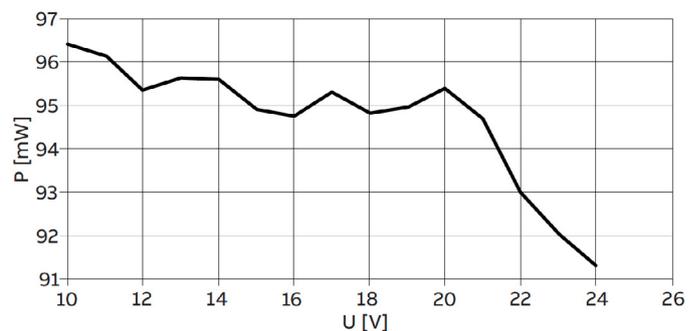
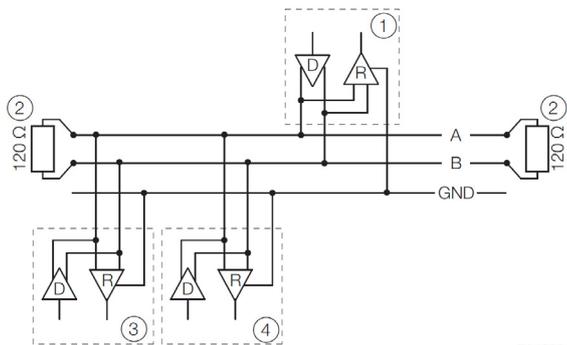


Fig. 12 Power Consumption Chart

### i NOTICE

The Modbus protocol is not secure, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Using the Modbus protocol allows devices made by different manufacturers to exchange information via the same communication bus, without the need for any special interface devices to be used. Up to 32 devices can be connected on one Modbus line. The Modbus network can be expanded using repeaters.



Modbus network (example)

- ① Modbus master
- ② Terminating resistor
- ③ Modbus slave 1
- ④ Modbus slave n ... 32

## Modbus

Configuration (HART-RS485)	Via an RS485 interface in connection with Asset Vision Basic (DAT200) a HART communication DTM and a corresponding Device Type Manager (DTM)
Operating (Modbus communication)	Modbus RTU – 2-wire half-duplex RS485 serial connection
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps.
Parity	None, even, odd Factory setting: none
Typical response time	< 100 milliseconds
Response delay time	0 ... 200 milliseconds Factory setting: 50 milliseconds
Device address	1 ... 247 Factory setting: 247
Register address offset	One base

## Cable specification

The maximum permissible length depends on the baud rate, the cable (diameter, capacity and surge impedance), the number of loads in the device chain, and the network configuration (2-core or 4-core).

- At a baud rate of 9600 and with a conductor cross section of at least 0.14 mm<sup>2</sup> (AWG 26), the maximum length is 1000 m (3280 ft).

- If a 4-core cable is used in a 2-wire system, the maximum length must be halved.

- The spur lines must be short (maximum of 20 m [66ft]).

- When using a distributor with “n” connections, the maximum length of each branch is calculated as follows: 40 m (131 ft) divided by “n”.

The maximum cable length depends on the type of cable used. The following standard values apply:

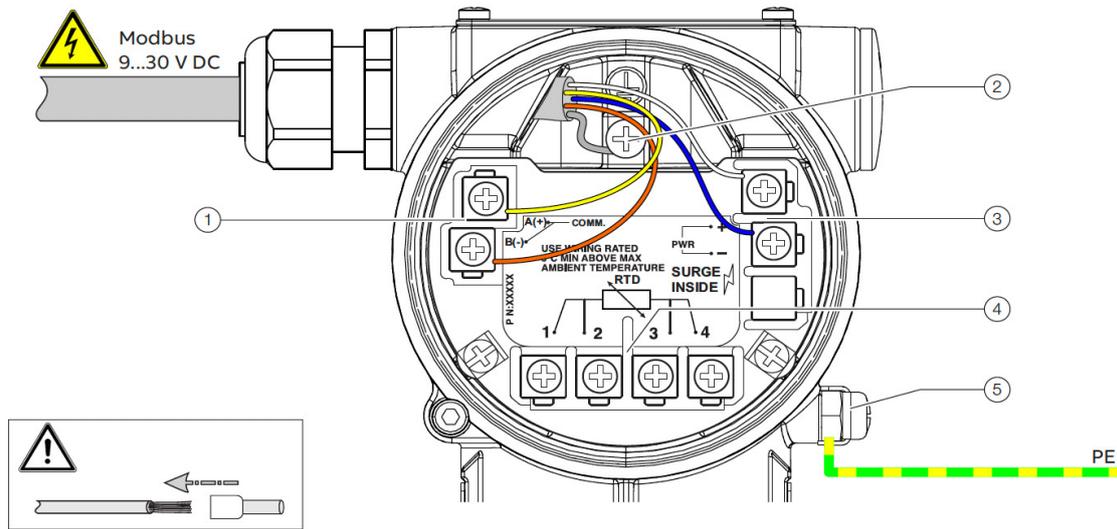
- Up to 6 m (20 ft): cable with standard shielding or twisted-pair cable.

- Up to 300 m (984 ft): double twisted-pair cable with overall foil shielding and integrated earth cable.

- Up to 1200 m (3937 ft): double twisted-pair cable with individual foil shielding and integrated earth cables.

Example: Belden 9729 or equivalent cable.

A category 5 cable can be used for Modbus RS485 up to a maximum length of 600 m (1968 ft). For the symmetrical pairs in RS485 systems, a surge impedance of more than 100 Ω is preferred, especially at a baud rate of 19,200 and above.



**Figure 13:** Connection on the device (example), PE = potential equalization

- ① Terminals for Modbus interface ② Terminal for PE / Cable Shield ③ Terminals for power supply ④ Terminals for Pt100 resistance thermometer ⑤ Ground terminal

## i NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class. Follow the instructions in chapter 'Opening and closing the transmitter housing' on page 17 to open and close the housing safely.

## i NOTICE

— Observe the power supply limit values in accordance with the information on the name plate.  
 — Observe the voltage drop for large cable lengths and small conductor cross-sections. The voltage at the terminals of the device may not fall below the minimum value required in accordance with the information on the name plate.

The power supply is connected to terminal PWR + and PWR -, as stated on the name plate.

To connect the pressure transmitter, observe the following instructions:

- Lead the cable for the power supply and the Modbus connection into the terminal box.
- Lead the temperature sensor cable (if there is one) through the second cable entry and connect it to the designated terminals.
- Connect the cables in accordance with the electrical connection diagram. Connect the cable shields to the designated ground terminal in the terminal box.
- Connect the potential equalization (PE) on the ground terminal to the terminal box.
- Use wire end ferrules when connecting.

## 6.8 Write Protection

Write protection prevents the configuration data from being overwritten by unauthorized users.

If write protection is enabled, the “Z” and “S” buttons (both internal or external) are disabled. However, it is still possible to read out the configuration data using the graphical user interface (DTM) or another, similar communication tool. The control unit may be leaded if required.

7.3.1 Write protection activation via external push button  
When the instrument features the external non-intrusive push buttons (digit R1 within instrument code), the write protection function can be performed as follows:

- Remove the identification plate (see figure 17) by releasing the holding screw lying on the bottom left corner.
- Use a suitable screwdriver to press the switch down fully. (see figure 14)
- Then turn the switch clockwise by 90°.

**Important.** To deactivate the switch, push it down slightly and then turn counterclockwise by 90°.

### 6.8.1 Write protection activation via dip switch

Standard instruments do not feature the external, non-intrusive Zero, Span and Write Protection push buttons. To activate this function it is necessary to proceed as detailed below:

- Remove instrument cover and the integrated digital LCD display (if installed).
- On the connection board, place dip switch 4 in “up” position.

## 6.9 Correcting the lower range value / zero shift

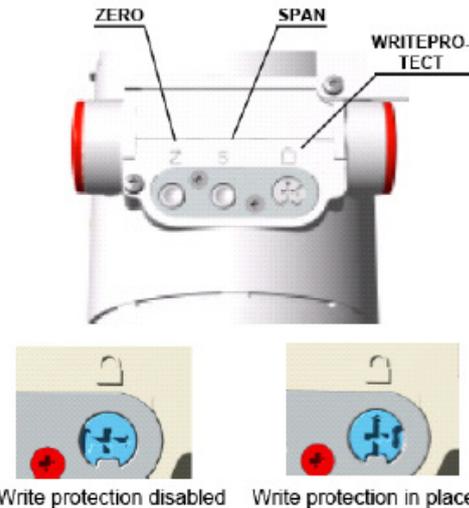
During installation of the transmitter, transmitter, zero shifts caused by mounting (e.g., a slightly oblique mounting position due to a remote seal, etc.) may occur; these must be corrected.

**Important.** The transmitter must have reached its operating temperature (approx. 5 min. after startup, if the transmitter has already reached the ambient temperature) in order to perform zero shift correction. The correction must be made at dp (or p) = 0.

**Important.** The button unit must be available for this purpose (option R1). In case external push buttons are not available, act on the connection board directly by depressing with a screwdriver the dedicated internal push buttons. Operating the buttons using a magnetic screwdriver is not permitted because it may generate some interferences with the magnetic pickup system.

### Set Lower Range Value

- Apply the lower range value pressure from the process or from a pressure transducer. The pressure must be stable and applied with a high level of accuracy <<0.05% (observing the set damping value)
- Press the “Z” button (external pushbutton - option R1)



**Figure 14: Pushbutton functionalities**

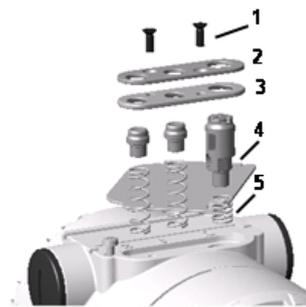
## 6.10 Correct the zero shift

The zero shift caused by the installation may be cancelled in different ways:

- Pressing the “Z” button (under the identification plate on the top of the transmitter, if present) or the “Zero” internal button (on the connection board) for few seconds will cause the output to go at 4 mA.
- It is also possible to align the digital PV value to zero.

To accomplish it raise the dip sw. 3 on the communication board to the up (1) position and press the zero button. This functionality will align the PV digital value to 0 and if the calibrated span it is zero based, the output will go at 4 mA.

- Using the optional LCD with keypad (“Configuration of the pressure transmitter using the integral LCD HMI” for further information).



**Figure 15: External pushbutton assembly components**

**Important.** In case of electronics change to Standard to Advanced HART (refer to chapter 9.6), external, non-intrusive push buttons can be installed (if not selected with the option R1) by ordering the commercial code DR1014. Please refer to local ABB representative.

## 6.11 Installing/Removing the LCD display

- Unscrew the housing cover of the communication board/LCD side.

Important. With an Ex d / Flameproof design, please refer to the section “Securing the housing cover in flameproof areas”.

- L1/L5 display versions can be installed in different positions (90° rotations)
- LS display installation shall be performed carefully plugging in sensor connections

Important. Retighten the housing cover until it is hand-tight. If necessary, refer to the section “Securing the housing cover in flameproof areas”.

Important. Picture shows L1/L5 display versions. LS windowed cover is dimensionally different (short) but features the same threads and requires the same installation practices.

## 6.12 Securing the housing cover in flameproof areas

Each of the front faces of the electronics housing features a locking screw (hex-head socket screw) on the bottom side.

- Install the housing cover to the housing by hand-tightening it.
- Turn the locking screw counterclockwise to secure the housing cover. This involves unscrewing the screw until the screw head stops at the housing cover.



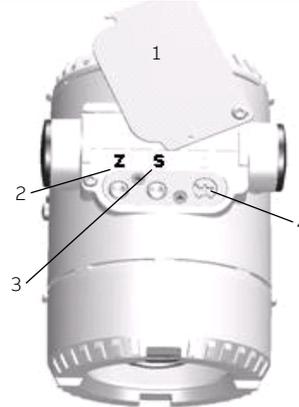
Figure 16: Windowed front cover and LCD display

## 7 Operation

### 7.1 Local push buttons functionality (option R1)

266 transmitters allow local adjustments via the on-board non intrusive push buttons, when selected. The push buttons are located under the identification nameplate. To gain access to the local adjustments release the fixing screws of the nameplate and rotate clockwise the identification plate.

Warning - Potential damage to parts. Operating the control buttons with a magnetic screwdriver is not permitted.



- 1 - Identification nameplate
- 2 - Zero pushbutton
- 3 - Span pushbutton
- 4 - Write-protection pushbutton

Figure 17: Pushbutton functionalities

### 7.2 Factory settings

Transmitters are calibrated at the factory to full span (0 to URL) or according to the customer’s span if specified. The calibrated range is provided on the name plate whereas the tag number on the additional tag plate. The calibrated range and tag number are provided on the name plate. If this data has not been specified, the transmitter will be delivered with the following configuration:

Parameter	Factory setting
Lower Range Value (LRV) (4 mA)	Zero
Upper Range Value (URV) (20 mA)	Upper Range Limit (URL)
Output transfer function	Linear
Damping	1 second
Transmitter failure (alarm)	Upscale (21 mA)
Optional LCD HMI scale	1 line PV and output signal bargraph

Important. All of the configurable parameters here on the left can easily be modified either via the optional LCD HMI, with a HART handheld terminal or a compatible software solution. Information regarding flange type and material, O-ring materials, and filling liquid type is stored inside the non-volatile memory of the device.

### 7.3 Configuration types

Pressure transmitters can be configured as follows:

- Configuration of the parameters for the lower and upper range values (via Zero and Span push buttons), without an integral LCD HMI.
- Configuration of the pressure transmitter using the integral LCD HMI with keypad (menu-controlled).
- Configuration with a handheld terminal.
- Configuration using a PC/laptop via the graphical user interface (DTM).

## 7.4 Configuring the transmitter without an integral LCD HMI

The “lower range value” and “span” parameters can be set directly on the transmitter using the external or internal push buttons.

The transmitter has been calibrated by the manufacturer based on the order information. The tag plate contains information on the “lower range value” and “upper range value” set. In general, the following applies:

Important. Reducing station with adjustable pressure and reference displays can be used as pressure generators.

When making the connection, please ensure that there are no residual fluids (for gaseous testing materials) or air bubbles (for fluid testing materials) in the impulse lines, since these can lead to errors during inspection. Any potential measuring error for the pressure generator should be at least three times smaller than the desired measuring error for the transmitter. It is recommended that the damping is set to 1 second.

## 7.5 LRV and URV configuration

- Apply the pressure for the “lower range value” and wait approx. 30 s until it has stabilized.
- Press the “Z” button (internal or external) for at least 5 seconds. This sets the output current to 4 mA.
- Apply the pressure for the “upper range value” and wait approx. 30 s until it has stabilized.
- Press the “S” button (internal or external) for at least 5 seconds. This sets the output current to 20 mA.
- If required, reset the damping to its original value.
- Record the new settings. The respective parameter will be stored in the non-volatile memory 10 seconds after the “Z” or “S” buttons are last pressed.

## 7.6 HMI as feedback of the local push button operations

As consequence of the operations described in the section 6, when the Z or S buttons are released, the feedback of the executed operation is displayed in the bottom of the LCD (same position as per diagnostic messages):

Message	Description
<b>! Oper Done</b>	The push button operation has been successfully executed
<b>! Proc Too Low</b>	The Pressure measured in input is too low and not acceptable for the requested operation
<b>! Proc Too High</b>	The Pressure measured in input is too high and not acceptable for the requested operation
<b>! New URV Error</b>	The Zero (Z) operation cannot be accepted because the URV would be shifted outside the Upper Sensor limit
<b>! Span Error</b>	The Span (S) operation cannot be accepted because the new URV would be too close to the LRV and their difference lower than the Minimum Span value
<b>! Oper Disabled</b>	The push button operation has been refused because the Write Protection is enabled.
<b>! LRV Too Low</b>	New LRV is too low and not acceptable for the requested operation
<b>LRV Too High</b>	New LRV is too high low and not acceptable for the requested operation
<b>URV Too Low</b>	New URV is too low and not acceptable for the requested operation
<b>URV Too High</b>	New URV is too high and not acceptable for the requested operation
<b>Armed</b>	Device is armed to accept HART command 73 “Find Device”. This message can be triggered only during the device wakeup operation

## 7.7 Correction of zero shift caused by installation with PV Zero Bias / Offset

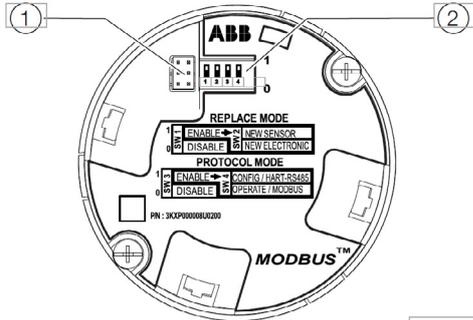
- Raise the dip switch 3 in 1 (up) position.
- Press the “Z” button. This sets the digital PV value will be set to 0 (zero).
- To reset the PV zero bias setting, press the “S” button.

Important. When the transmitter has been rezeroed following the above procedure, a zero bias/offset value is applied and stored in the transmitter memory.

Important. This action can be performed both by using the external, non-intrusive push buttons (option R1) and the on-board buttons of the integrated LCD display.

## i NOTICE

Always disconnect the device from the power supply before making changes to DIP switches. The device must then be restarted for the new configurations to be loaded.



**Fig. 18: Communication board Modbus**  
 ① Interface for LCD indicator and service port ② DIP switches

DIP switch	Function
SW 1.1	<p>REPLACE MODE (transfer system data)</p> <p>On (1): Enable: Replacement mode active</p> <p>On (2): Disable: Replacement mode deactivated</p>
SW 1.2	<p>REPLACE MODE (data transfer direction)</p> <p>On (1): New sensor: When replacing sensor</p> <p>Off (0): New electronic: When replacing secondary electronics</p>
SW 1.3	<p>PROTOCOL MODE</p> <p>On (1) Enable: Selection of communication protocol via SW 1.4</p> <p>Off (0) Disable: Selection of communication protocol via LCD display, DTM or Modbus</p>
SW 1.4	<p>PROTOCOL MODE</p> <p>On (1) Configure/HART-RS485: Parameterization via DTM Operate/Modbus:</p> <p>Off (0) Transfer of process data via Modbus communication to the master.</p>

The secondary electronics is located behind the front housing cover. The LCD indicator may have to be removed to provide access to the DIP switches. The DIP switches are used to make settings if an LCD display is not present. The interface for the LCD indicator is also used as the service port for device configuration.

## Replace mode (DIP switches 1 and 2)

In normal mode the DIP switches 1 and 2 are in position 0. If a replacement procedure is necessary, they will be activated.

- When replacing the electronics or the sensor, disconnect the power supply and move DIP switch 1 to position 1.
- When replacing the secondary electronics, disconnect the power supply and move DIP switch 2 to position 0.
- The sensor can be replaced when DIP switch 2 is in position 1

## i NOTICE

We recommend resetting the corresponding DIP switch to position 0 after each replace operation.

## Protocol mode (DIP switches 3 and 4)

By default, DIP switch 3 is in position 0.

- The communications protocol is then selected via the integrated LCD indicator, the DTM or Modbus communication.
- In position 1, the communications protocol is selected using DIP switch 4 only.

DIP switch 4 is in position 0 by default and is active only if DIP switch 4 is in position 1.

- In position 0, the communications protocol is set to “Operate/Modbus”. This setting is intended for standard operation as a Modbus device.
- In position 1, “Configure/HART-RS485,” a DTM is needed for the parameterization of the device. Communication with a Modbus master is not possible in this setting.

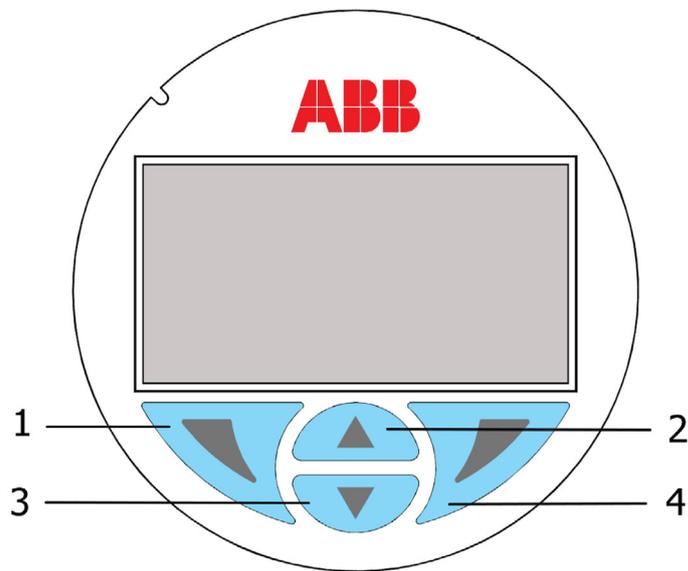


Figure 19: Display keypad of L1 and L5 LCD display options

The keys (1) ◀, (4) ▶, (2) ▲ and (3) ▼ are available for the menu-controlled configuration.

- The menu/submenu name is shown at top of LCD display.
- The number/line of the currently selected menu item is displayed in the upper right of the LCD display.
- A scroll bar is located on the right edge of the LCD display which shows the relative position of the currently selected menu item within the menu.
- Both of the keys (1) ◀ and (4) ▶ can have various functions. The meaning of these buttons is displayed below in the LCD display above the respective button.
- You can browse through the menu or select a number within a parameter value using both keys (2) ▲ and (3) ▼. The button (4) ▶ selects the desired menu item.

Button (1) functionalities	Meaning
Exit	Exit menu
Back	Back one submenu
Cancel	Exit without saving selected parameter value
Next	Select next position for entering numerical values or letters

Button (4) functionalities	Meaning
Select	Select submenu/parameter
Edit	Edit parameter
Ok	Save selected parameter and display stored parameter value

The integrated LCD display (LS option) is located in the housing compartment with windowed cover of 266 Standard HART version. It can be used to visualize the process measured variables as well as to configure the transmitter as allowed only by the relevant “Easy Setup menu” which is the only menu available for Standard HART version.

Configuration is performed by the on-board buttons which are present when option “R1” is not selected or by external Z and S push buttons under nameplate when “R1” is selected. In addition, diagnostic information is provided.

### 7.8 LCD (L1 and LS option) activation considerations

Gain access to the display by unscrewing the windowed cover. Please observe the Hazardous area prescription before proceeding with the cover removal. For activation, see below.

### 7.9 Through The Glass (TTG) (L5 option) activation considerations

The TTG technology allows the user to activate the keypad on HMI without the need of opening the windowed cover of the transmitter. The capacitive pick-ups detect the presence of a finger in front of the respective button activating the specific command. At the transmitter power-on the HMI automatically calibrates its sensitivity, it is mandatory for proper functioning of the TTG HMI that the cover is properly tightened at power-on.

In case the cover has been removed to access the communication board, it is recommended to power off and power-on again the transmitter once the windowed cover has been set in place and properly tightened.

Important. Do not operate TTG display (L5 option) for 30 seconds after transmitter power-on. During this period of time, the transmitter is calibrating the capacitive switches.

## 7.10 Configuration of the pressure transmitter using the optional LCD HMI with keypad (menu-controlled)

The integral LCD option (L1 or L5 option) is connected on the 266 Advanced HART communication board. It can be used to visualize the process measured variables as well as to configure the display and the transmitter.

In addition, diagnostic information is provided. To access the functionality of the HMI an activation procedure needs to be carried out. The keypad activation procedure is different between the TTG (Through-The-Glass) L5 option and the conventional L1 option integral LCD.

### 7.11 Activation procedure for LCDs

The LCD displays L1 and L5 features 4 push buttons (see figure 19) that allow the navigation through the various functions.

- Press simultaneously the buttons (2) ▲ and (3) ▼ until two icons will appear at the bottom corners of the display.
- Press the button (4) ► under the right icon within one second to access the HMI menu or press the left button (1) ◀ to access the instantaneous diagnostic messages.

For TTG display, in case of pressing not correct the following display will appear with “!” marks in the corners.



Press then for 2 s. the right button or external S pushbutton to access the menu or press the left button or external Z pushbutton to access signals view or diagnostic messages. Without action on buttons associated to bottom icons after few seconds the transmitter return to normal operation displaying letters in the corners.



### 7.12 HMI menu structure

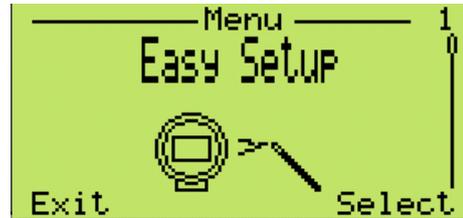
Standard HART version features only the Easy Setup menu in a dedicated structure, different from other HART versions. Once accessed the menu should be completed until the last step HART Revision is reached, then to return to the normal display view. For each step follow the instructions on the screen and consider that for alfa/ numeric parameters it is required to move digit by digit until the right bottom corner display OK. Pressing the right on-board button or the external S pushbutton the operation is confirmed, while pressing the left on-board button or the external Z pushbutton the display change to CANCEL to abort the operation by the associated button (right/S).

Important. After 30 seconds without action on on-board buttons or external Z/S pushbuttons, the Standard HART transmitter automatically exit the configuration menu.

For Advanced HART and Safety HART versions the HMI menu is divided in the following sections which can be selected by acting on the keys (2) ▲ and (3) ▼, once on the display the desired sub-menu icon will be visualized, confirm your selection with the [SELECT] key (4) ►.

Follow the instruction on the screen to perform the configuration of the different parameters.

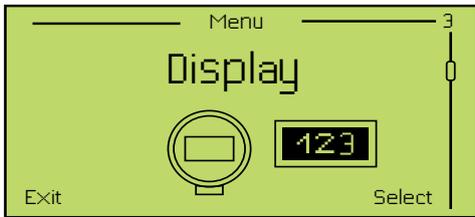
This menu allows the verification and the parameterization of the basic configuration of the 266 pressure transmitter. The menu driven structure will guide you to the choice of the interface language, the tag number configuration, the engineering units, the URV and LRV (Upper range value and lower range value), the transfer function (linear or square root) the damping time, the auto set zero (set the input measured value to 4 mA and the PV value to 0), the display visualization mode (the value that need to be visualized on the LCD).



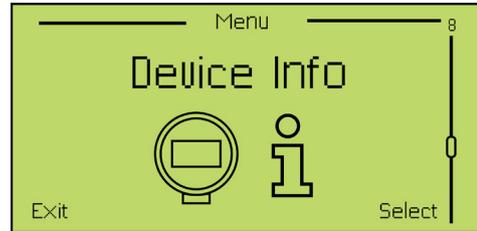
This menu allows the verification and the parameterization of the entire device. The menu driven structure includes the write protection enabling, process variable settings (unit, LRV and URV), transfer function selection (linearization type and low flow cut-off) and output scaling (unit according to the measurement and LRV/URV). The last selectable sub-menu allows user to reset all the parameters to the default configuration.



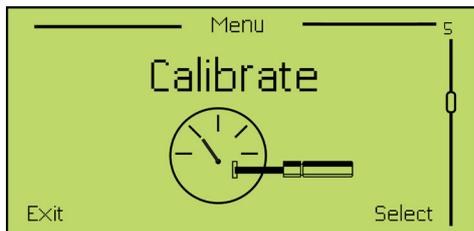
This menu allows the set-up of different functions relevant to the display itself. The menu driven structure will guide you through the choice of some functional aspects as the display language and contrast. Moreover, it is possible to choose in details what you want to see on the display: one or two lines with or without bargraph. Inside this menu there is the possibility of setting a protection password (security) and the display scaling (linearization type, unit, LRV, URV). Display revision number available.



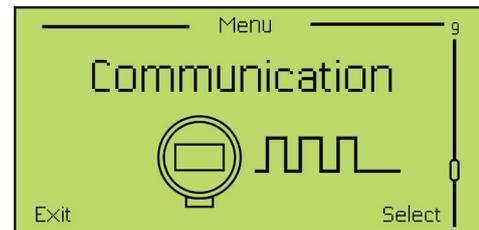
This menu allows the set up of different functions relevant to the display itself. The menu driven structure will guide you through the choice of some functional aspects as the display language and contrast. Moreover, it is possible to choose in details what you want to see on the display: one or two lines with or without bar graph. Inside this menu there is the possibility of setting a protection password (security) and the display scaling linearization type, unit, LRV, URV). Display revision number available.



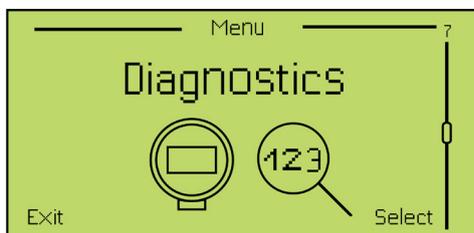
This menu gives you all information about the device. The menu driven structure will show you what is the sensor type, the hardware and software revisions, the high and low sensor limits as well as the minimum applicable span.



This menu allows the local calibration of the instrument. The menu driven structure will guide you through the choice of pressure sensor trimming (low or high), the output setting (set to 4 or 20 mA) and at the end you can reset these parameters (to factory sensor trimming, to user sensor trimming or to factory output trimming).



The last section of this structured and driven menu gives you the possibility of changing the communication tag and the MULTI-DROP mode with HART address numbers of the device.



This menu allows you to monitor diagnostics messages related to pressure variable, output current, output percentage, scaled output, static and sensor pressure. The menu driven structure will also guide you through the loop test (set 4 and 20 mA and set the output value).



## Easy Setup

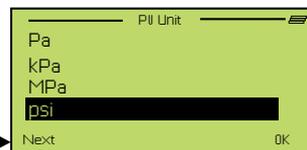
In the configuration level, use the (2) + (3) keys to scroll to the “Easy Set-up” menu item and select it by pressing the (4) key.



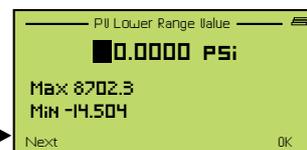
Press key (4) and select the language. After entering the settings, press key (1) to move to the next menu item.



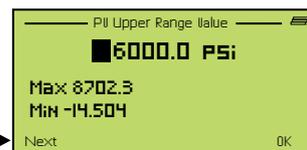
Once in the alphabetic menu use Next (1) key to position the cursor on the character that you want to change. Scroll the character list with (2) + (3), once on the selected one press “next” key (1) once completed press “ok” (4).



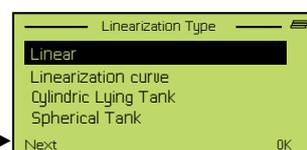
Press the (4) key Scroll the eng. units list with (2) + (3) and select with (4) key. Press the (1) key to move to the next menu item.



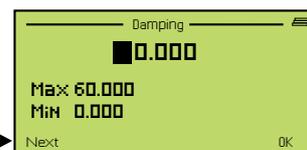
Press the (4) key and set LRV value. After entering the settings, press the (1) key to move to the next menu item.



Press the (4) key and set LRV value. After entering the settings, press the (1) key to move to the next menu item.



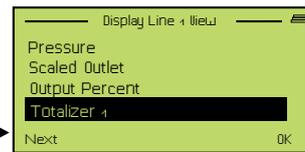
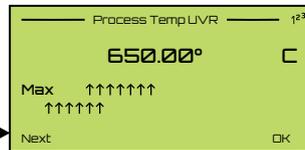
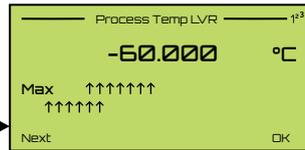
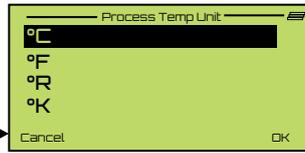
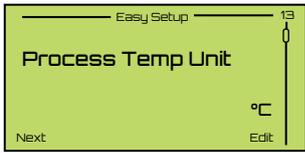
Press the (4) key and select the transfer function from the list with (2) + (3). After entering the settings, press the “ok” (1) key to move to the next menu item.



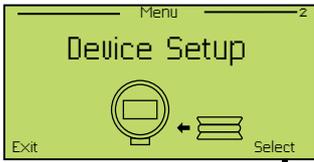
Press the (4) key and set the damping. After entering the settings, press the (1) key to move to the next menu item.



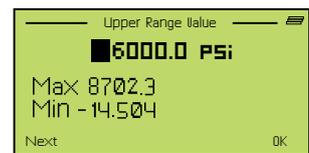
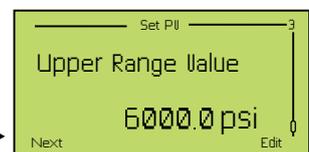
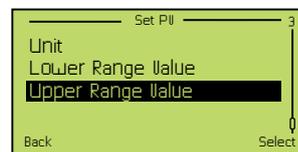
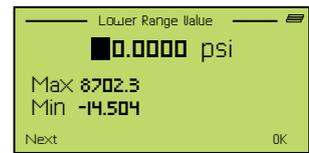
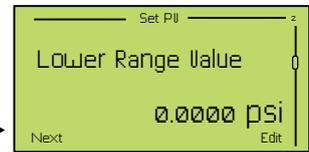
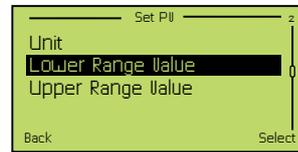
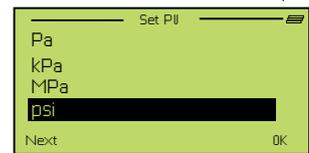
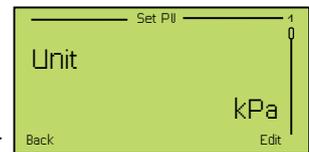
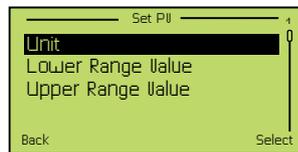
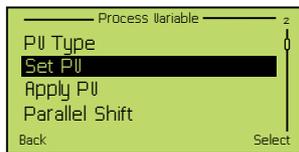
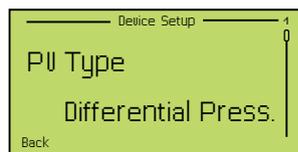
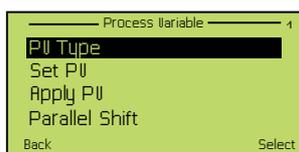
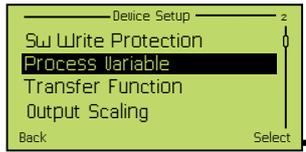
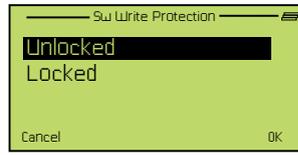
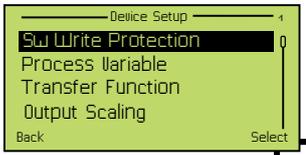
This function set to zero the PV value and to 4 mA the analogue output. Simply press “ok” (4) key to activate the PV to zero function. Press Next (1) key to move to the next menu item. ABB suggest user should perform this specific command only after the installation and configuration phases are complete

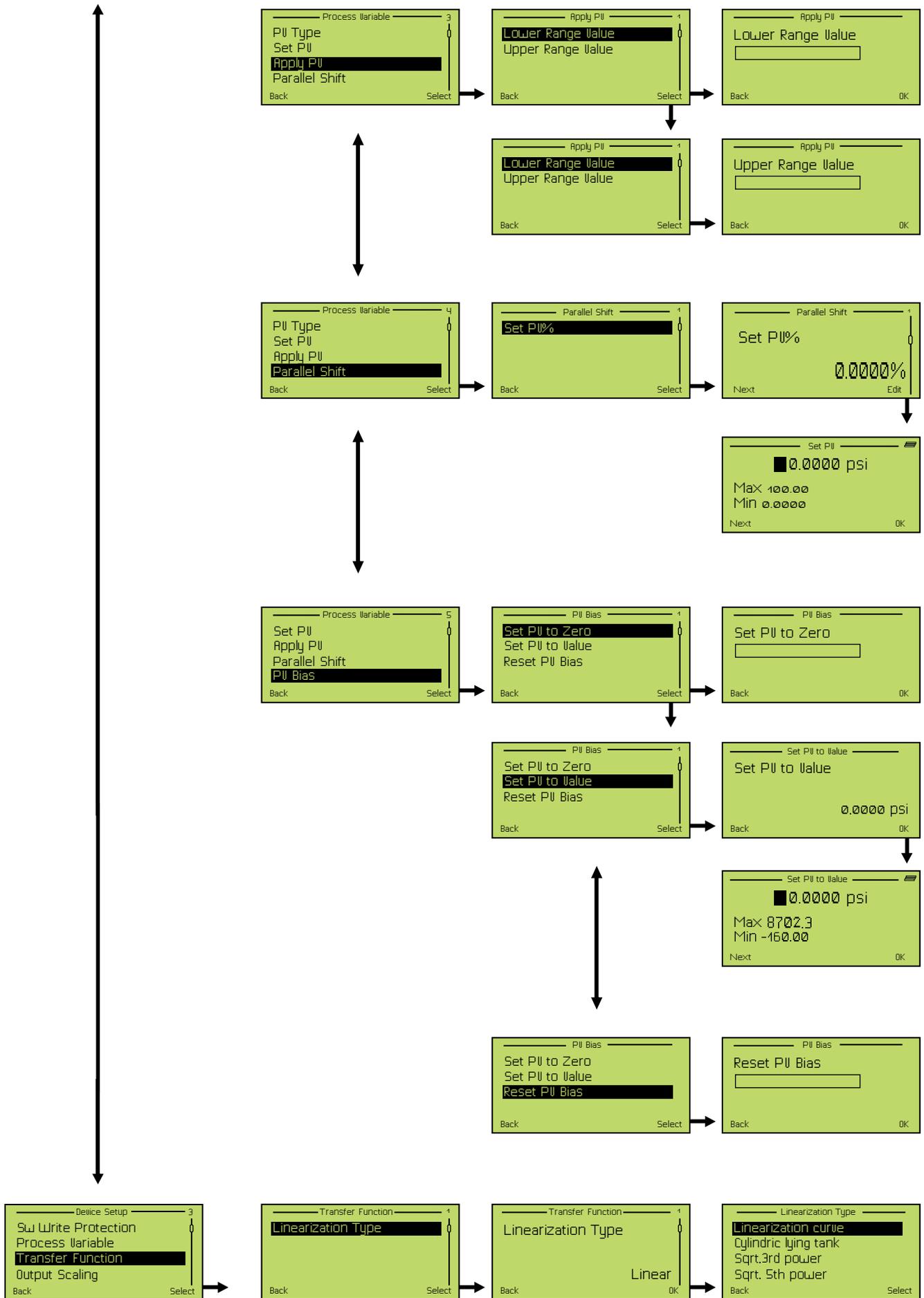


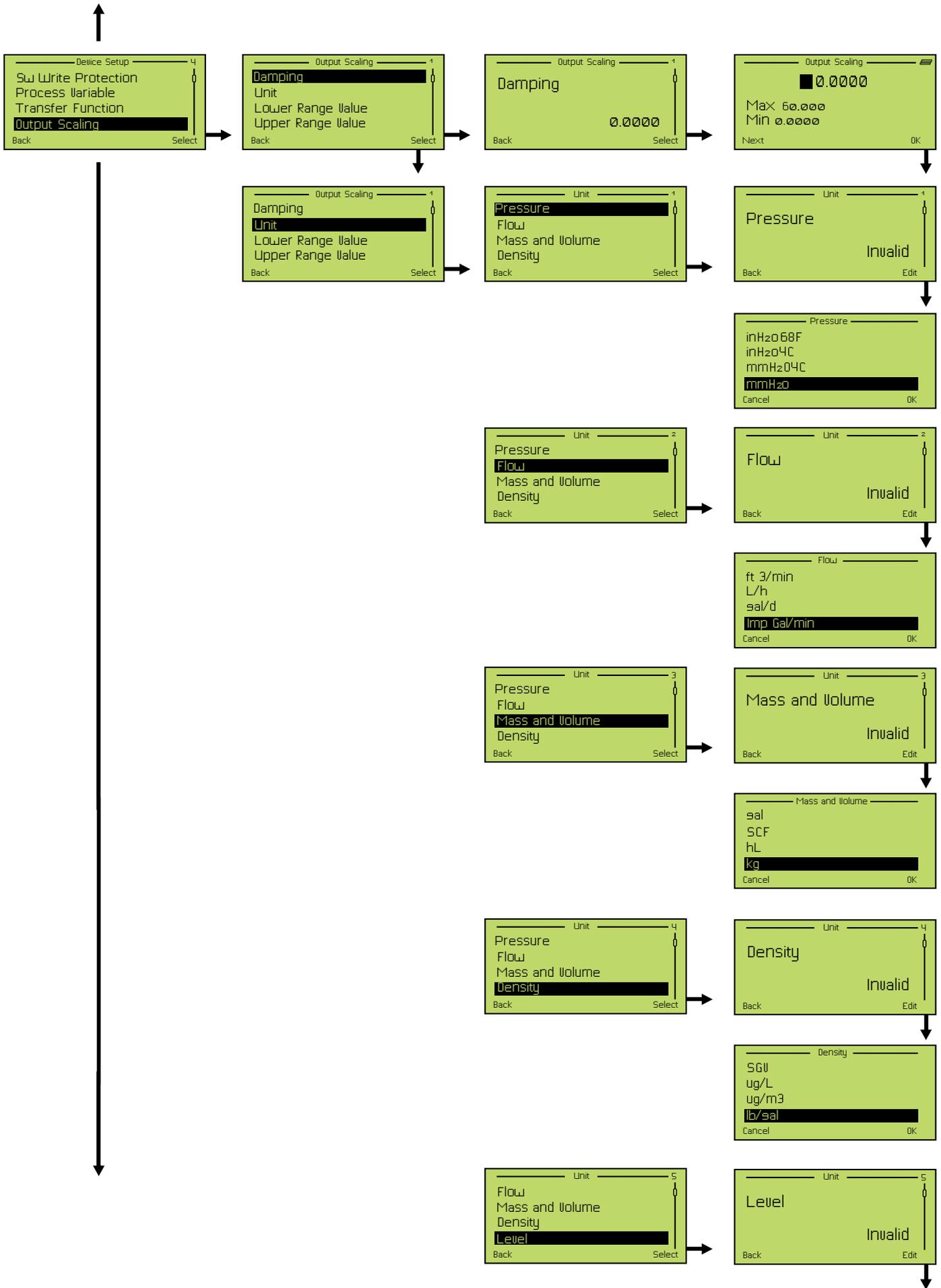
This function allows the selection of the LCD visualization. Select between the list and confirm with “ok” (1) key.

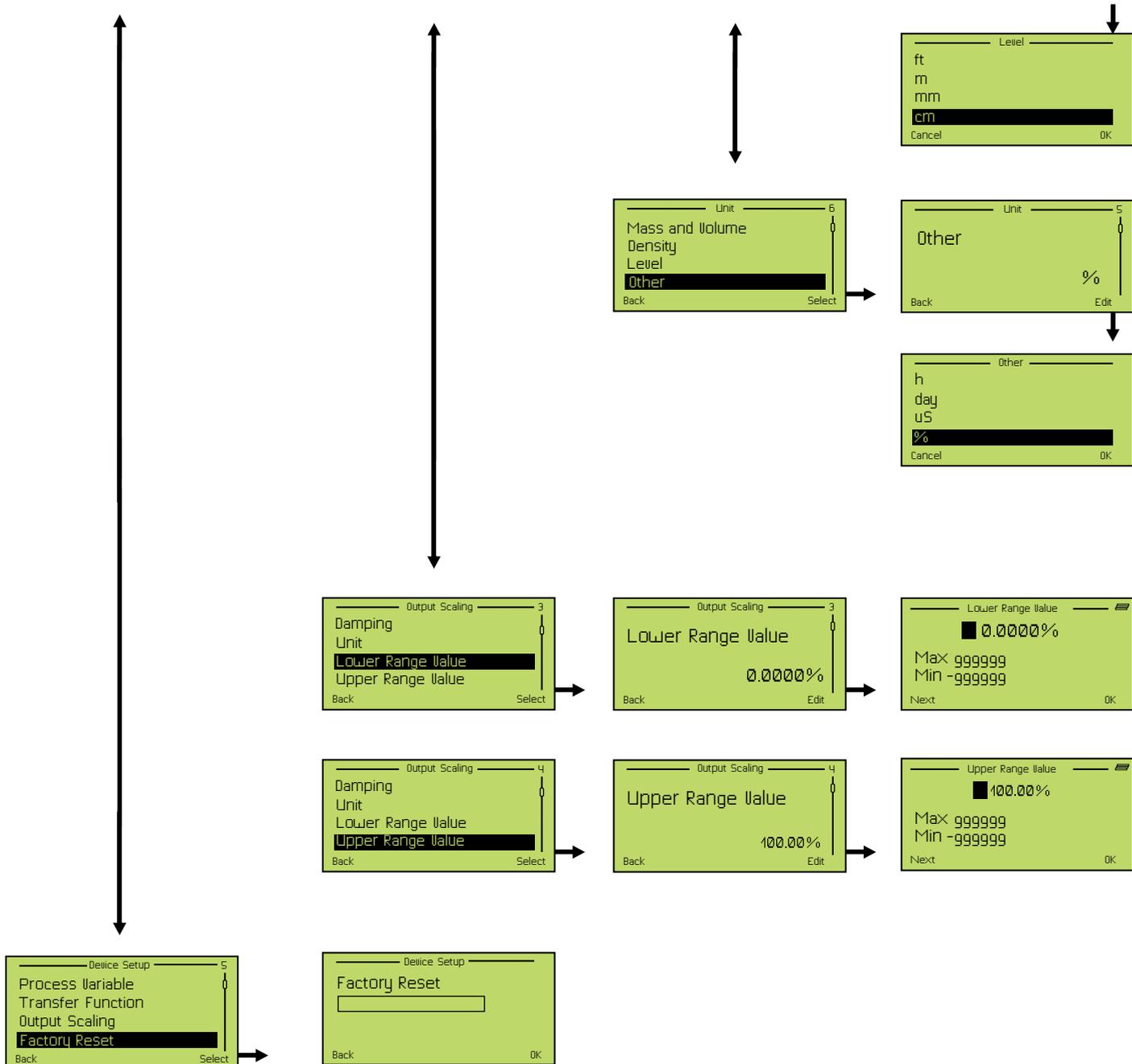


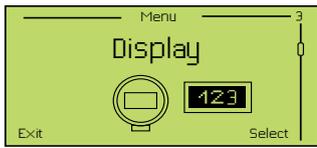
- Device Setup**
- SW Write Protection
  - Process Variable
  - Transfer Function
  - Output Scaling
  - Factory Reset







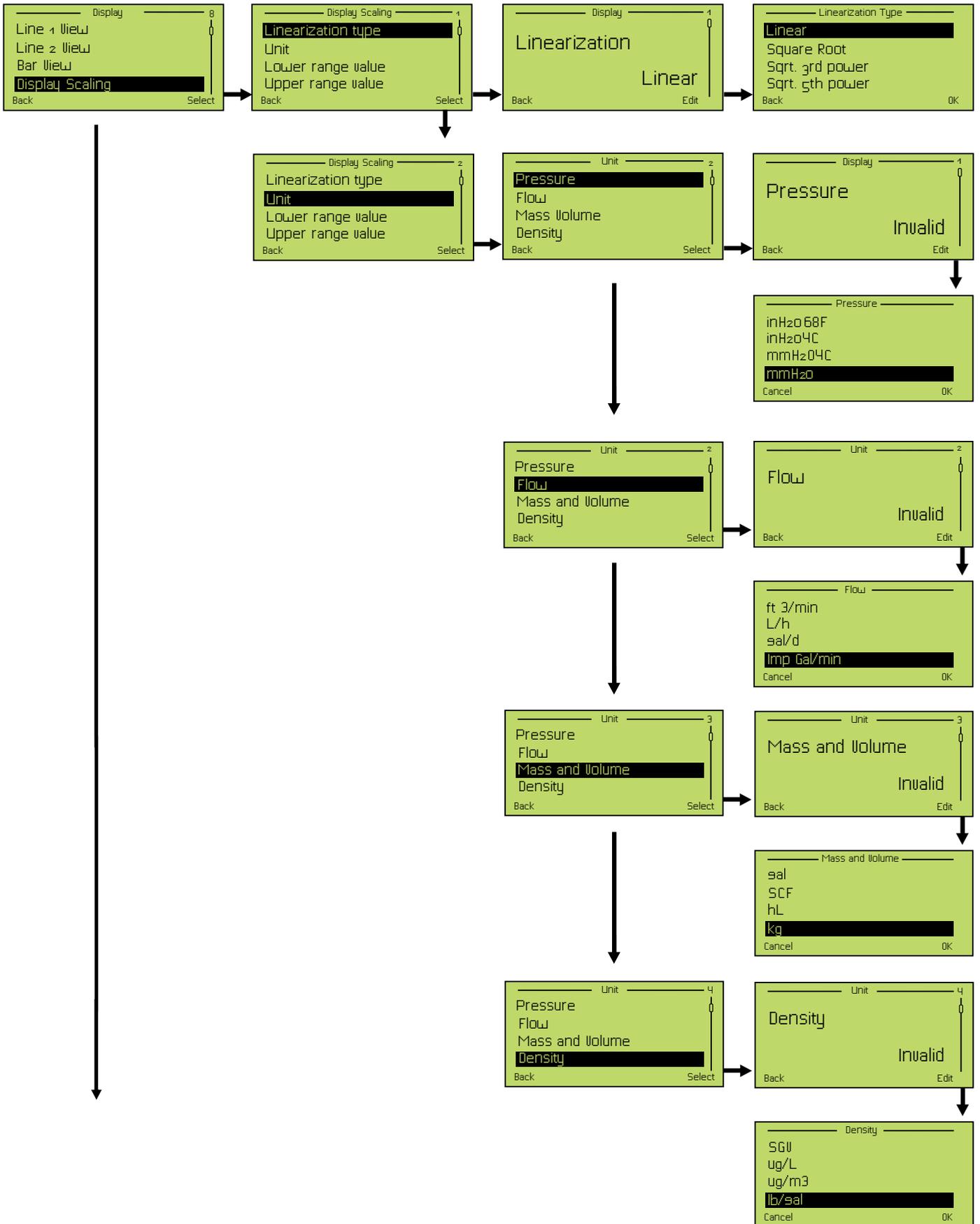


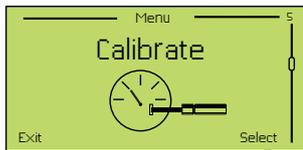


### Display Menu

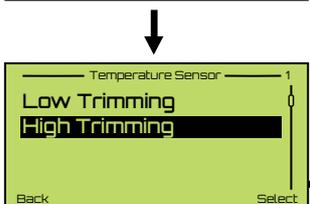
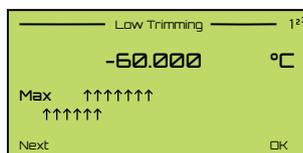
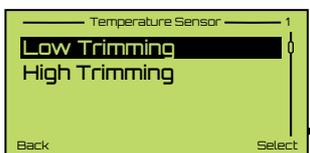
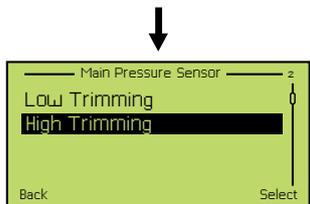
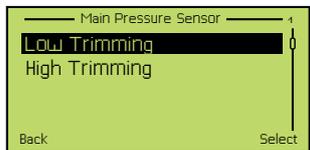
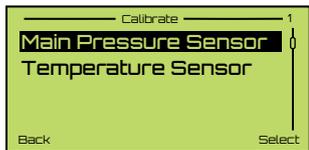
- Language
- Display Revision
- Contrast
- Mode
- Line 1 View
- Line 2 View
- Bar View

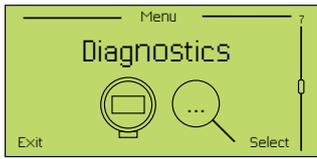




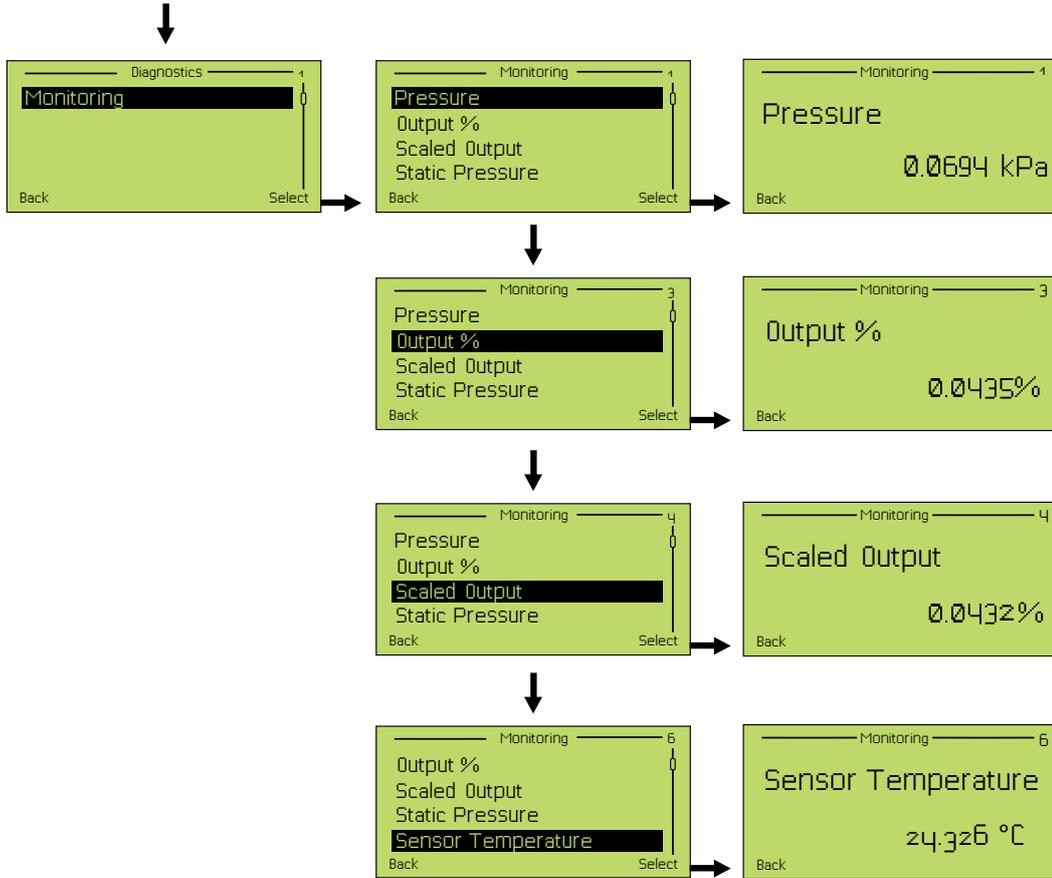


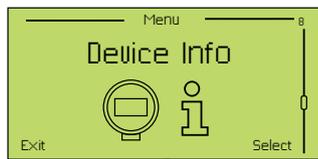
**Calibrate**  
 - Main Pressure Sensor  
 - Temperature Sensor





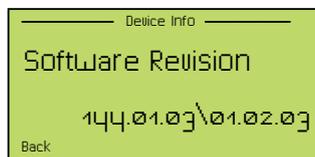
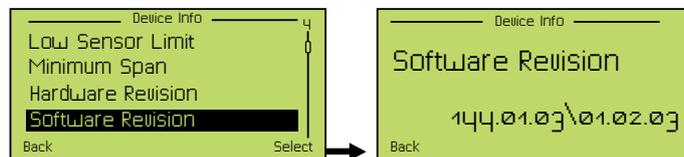
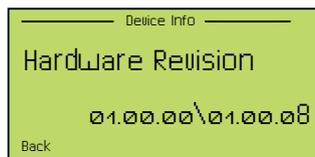
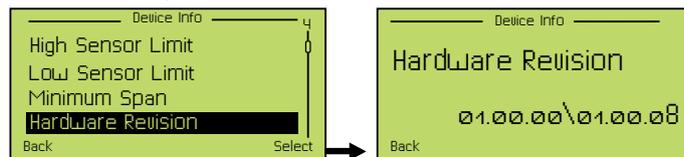
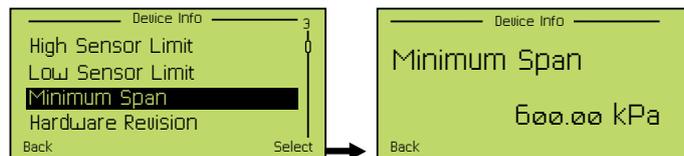
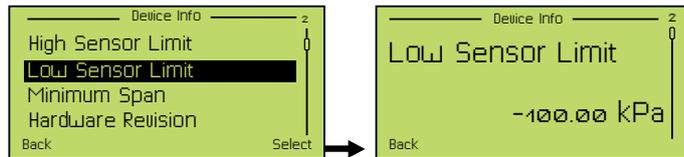
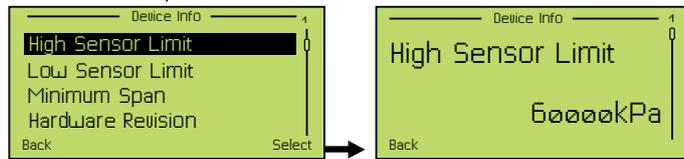
### Diagnostics - Monitoring





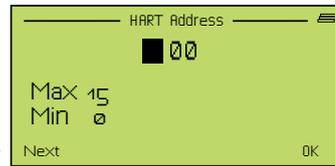
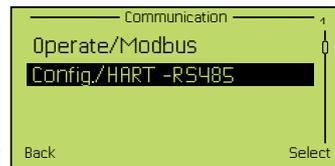
### Device Info

- High Sensor Limit
- Low Sensor Limit
- Minimum Span
- Hardware Revision
- Software Revision





**Communication**  
 - Protocol Settings  
 - Protocol  
 - HART Address



### 7.13 Damping (DAMPING)

Pressure transmitter output signals that are noisy as a result of the process can be smoothed (damped) electrically.

The additional time constant can be set between 0 s and 60 s in increments of 0.0001 s. Damping does not affect the value shown on the digital display as a physical unit. It only affects the parameters derived from this, such as the analog output current, free process variable, input signal for the controller, and so on.

The damping adjustment can be performed in different ways:

— Via the the local HMI:

Enter the menu: > Device Setup > Output Scaling > Damping.

Set the damping to the desired value.

— Via the Asset Vision Basic Software:

See Asset Vision Software Operating Instructions.

— Via the Hand Held Terminal:

See relevant operating instruction

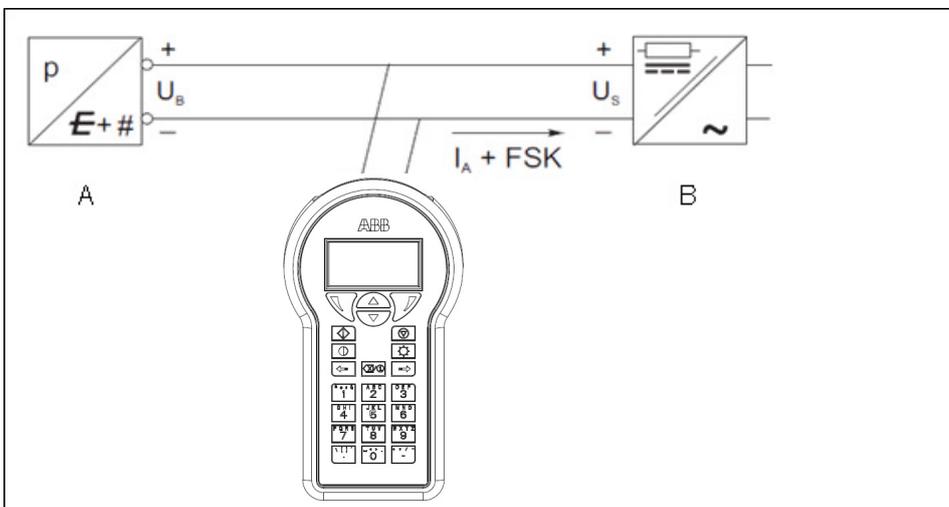
## 7.14 Configuration with the PC/laptop or handheld terminal

A graphical user interface (DTM) is required for configuration of the transmitter via PC or laptop. For operating instructions, please refer to the software description.

The 266 transmitters can be configured by either one of the following device.

- Hand Held terminals like the ABB 691HT, ABB DHH800-MFC, Emerson Process 375 and 475 provided the 266 EDD has been downloaded and enabled in the terminal.
- ABB Asset Vision Basic, a new free of charge software configurator downloadable at [www.abb.com/Instrumentation](http://www.abb.com/Instrumentation).
- Any DTM based software for HART instruments configuration provided it is compatible with EDD or DTM.

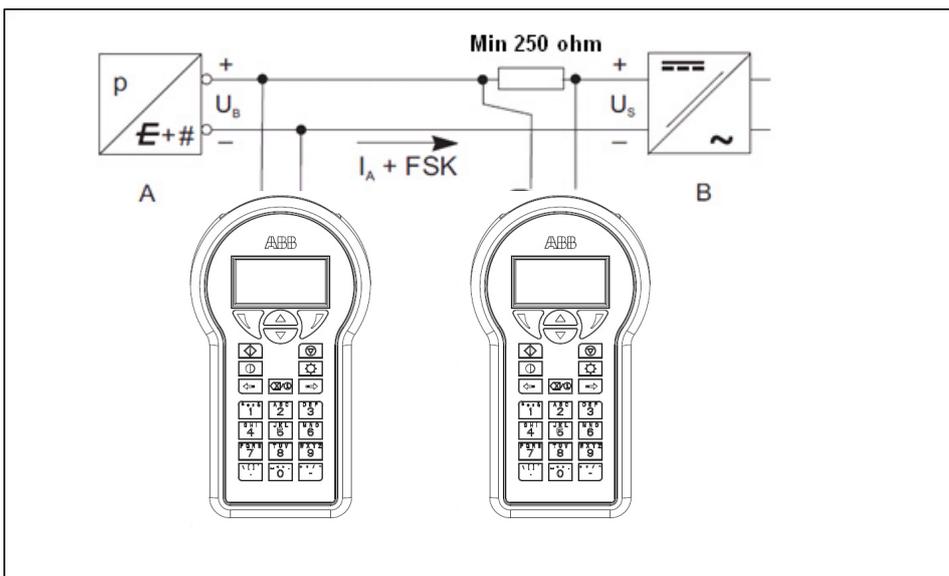
You can use a handheld terminal to read out or configure/calibrate the transmitter. If a communication resistor is installed in the connected supply unit, you can clamp the handheld terminal directly along the 4 ... 20 mA line. If no communication resistor is present (min. 250 Ω), you will need to install one in the line. The handheld terminal is connected between the resistor and transmitter, not between the resistor and supply unit.



A - Transmitter

B - Supply unit (communication resistor not provided in supply unit)

Figure 20: Communication setup with handheld terminal



A - Transmitter

B - Supply unit (communication resistor not provided in supply unit)

Figure 21: Connection examples with communication resistor in the connection line

For additional information, refer to the operating instructions included with the handheld terminal.

If the transmitter has been configured in the factory according to customer specifications for the measuring point, all you have to do is mount the transmitter as prescribed (to correct potential zero shifts, refer to the section “Correcting the zero shift”), and switch it on. The measuring point will now be ready for use.

If, however, you wish to make changes to the configuration, a handheld terminal or - preferably - a graphical user interface (DTM) is required. This DTM tool renders the device fully configurable. It supports both the HART protocol and PROFIBUS PA fieldbus protocol, and can be run on a PC or laptop, or as part of an automation system. Where FOUNDATION Fieldbus is concerned, the device description (DD), which can be loaded onto various configuration tools, is required for configuration purposes.

Refer to the installation manual provided with the software for the steps required to install the operating tool. The most important parameters can be set via the path “Parametrize\_Differential Pressure Measurement”.

The program offers the option of configuring, polling, and testing the transmitter.

In addition, offline configuration can be performed by means of an internal database.

Each configuration step is subject to a plausibility check. You can call up context-sensitive help at any time by pressing the “F1” key. Immediately after you have received the transmitter or before you change the configuration, we recommend that you save the existing configuration data to a separate data storage medium, via the path “File\_Save”.

### 7.15 Configuration with the graphical user interface (DTM) - System requirements

- Operating control program (e.g., ABB Asset Vision Basic version 1.00.17 or higher)
- DTM (Device Type Manager; graphical user interface)
- Operating system (depending on the respective control program)

To operate the Asset Vision Basic please refer to the relevant operating instruction.

### 7.16 Standard and Advanced HART: functionality

266 Pressure Transmitters can be codified with:

- Advanced HART and 4 to 20 mA
- Standard HART and 4 to 20 mA
- HART and 4 to 20 mA Safety, certified to IEC 61508

Advanced and Standard HART feature some differences in terms of functionality.

Functionality	266 Advanced HART	266 Standard HART
Configuration via HMI	On board	Not available
SIL certified	On board	Not available
PILD	On board	On board
Trend	On board	Not available
Totalizer	On board	On board
Service Port	On board	Not available
Electronic replacement	On board	Not available

### 7.15 Advanced HART software revision history

Revision		Description	Release date
From	To		
	7.1.11	First release	09/2009
7.1.11	7.1.12	Bug Fixing: <ul style="list-style-type: none"> <li>— microbar and millitor units added</li> <li>— HART command 35 bug fixed. By HART specificaiton #35 unit should not be set pv unit</li> <li>— if the local indicator was not mounted, only one operation via push buttons was performed</li> <li>— MWP diagnosis classification become Maintenance instead of Off-Specification</li> </ul> Improvements: <ul style="list-style-type: none"> <li>— replacement functionality improved</li> <li>— internal improvements to reduce factory configuration</li> <li>— more/stronger checks about process variables goodness</li> <li>— HART response time reduced (30%)</li> </ul>	06/2010
7.1.12	7.1.14	Improvements: <ul style="list-style-type: none"> <li>— factory configuration speeded up</li> <li>— service detailed diagnosis implemented</li> </ul>	01/2011
7.1.14	7.1.15	Bug Fixing: <ul style="list-style-type: none"> <li>— sensor trimming via local display was performend only in kPa</li> <li>— diagnosis “Replace Error” no more shown</li> <li>— unit strings on display (Nm3, bbl, t) were wrong</li> </ul> New Features: <ul style="list-style-type: none"> <li>— new language (French &amp; Spanish) on local indicator</li> <li>— sensor polarity inversion</li> </ul>	01/2013
7.1.15	7.2.1	HART 7 implementation	11/2015
7.1.15	7.1.16 (HART 5)	New Features: <ul style="list-style-type: none"> <li>— Temperature alarm enabled by user</li> <li>— oscillation alarm control</li> <li>— switching of alarm for wrong power supply</li> </ul>	10/2018
7.2.1	7.2.2 (HART 7)		

## 7.17 Standard HART software revision history

Revision		Description	Release date
From	To		
	7.1.50	First release	02/2013
	7.1.51	Internal release not published	
	7.1.52	Internal release not published	
7.1.52	7.1.53	Bug Fixing: — HART burst mode — correcting Custom unit visualization on LCD Improvements: — boot loader performance — HART secondary response code — Electronics temperature reading	01/2014
7.1.53	7.1.54	Integrated LCD firmware integration	07/2014
7.1.54	7.1.55	Bug fixing on EEPROM	10/2014
7.1.55	7.1.56	Obsolete Microprocessor replacement	06/2016
7.1.56	7.2.50	HART 7 Introduction	10/2016
7.1.56	7.1.74 (HART 5)	Several bug fixing	10/2018
7.2.50	7.2.54 (HART 7)	Several bug fixing and certification HART burst mode removed	

Intermediate releases for internal tests not published

## 8 Error messages

### 8.1 LCD Display messages

The LCD HMI in case of transmitter errors or malfunctioning is capable of displaying specific error/fault messages to help the user in identifying the problem and resolve it. In case of an alarm, a message consisting of an icon and text appears at the bottom of the process display, as shown hereafter. Use the (1) key to call up the information level. Use the “Diagnostics” menu to call up the error description with a help text. In the error description, the error number is displayed in the second line (M028.018). Two further lines are used to describe the error. The device status is divided into four groups. The message text beside this icon in the display provides information about where to look for the error. There are the following areas: Electronic, Sensor, Configuration, Operating and Process.

Icon	Description
	Error / Failure
	Functional check (e.g. during simulation)
	Out of Spec (e.g. operating with empty meter pipe)
	Maintenance required



## 8.2 Error states and alarms

### — Communication Board / Electronic related error messages.

Error message	Tx LCD message	Possible cause	Suggested action	Tx response
F116.023	Electronic Memory Failure	Electronic memory corrupted.	The electronic must be replaced.	Analog Signal to Alarm
F108.040	Output ReadBack Failure	The output circuit could be broken or not correctly calibrated.	A DAC (digital to output converter) trimming should be performed and if the error persists the communication board must be replaced.	Analog Signal to Alarm
M030.020	Electronic Interface Error	Data exchange between the sensor and the electronic is incorrect.	Power off and on the transmitter and check if the error persists. If yes replace the communication board as soon as possible.	no effect
M026.024	NV Electronic Memory Burn Error	Writings to the electronic non-Volatile Memory has not been successful.	The communication board should be replaced as soon as possible.	no effect
F106.035	Unreliable Output Current	The D to A converter is not properly Calibrated/Trimmed.	Perform an Output Trimming and if the error persists the communication board must be replaced. (see NOTE below)	Analog Signal to Alarm
F106.035	Unreliable Output Current	The Device is not properly configured.	Check the device configuration.	Analog Signal to Alarm
C090.033	Analog Output Fixed	The analog output for the Primary Variable is derived by the value simulated in input.	Use a HART configurator (DTM - Hand held) to place device back in to normal operating mode (Remove the analog output simulation).	no effect

### — Sensor related error messages

Error message	Tx LCD message	Possible cause	Suggested action	Tx response
F120.016	Sensor Invalid	The sensor signal is not being updated correctly as a result of an electronics failure, sensor error or a poorly connected sensor cable.	Check cable connection, check sensor and if problem persists, the sensor must be replaced.	Analog Signal to Alarm
F120.016	Sensor Invalid	The sensor model/version is no longer compatible with the connected electronic version.	The sensor must be replaced.	Analog Signal to Alarm
F118.017	Sensor Memory Fail	Sensor memory corrupted.	The sensor must be replaced.	Analog Signal to Alarm
F114.000	P-dP Sensor Fail	Mechanical damage to the sensor. Loss of fill fluid from the cell, ruptured diaphragm, broken sensor.	The sensor must be replaced.	Analog Signal to Alarm
F112.001	Static Pressure Sensor Fail	The circuitry for the sampling of the static pressure has failed.	The sensor must be replaced.	Analog Signal to Alarm
F110.002	Sensor Temperature Fail	The circuitry for the sampling of the temperature has failed.	The sensor must be replaced.	Analog Signal to Alarm
M028.018	NV Sensor Memory Burn Error	Writings to the sensor non-Volatile Memory was not successful.	The sensor should be replaced as soon as possible.	no effect

Note for the calibration of the current output by the user. For 266 Transmitters with SW.-Rev. </= 7.1.15 and alarm current setting to 'low alarm' The calibration of the current output by the user requires to perform the calibration procedure with a suitable configuration tool (DTM, EDD, FIM) and to finalize the procedure by saving the process with "save configuration as default".

— Configuration related error messages.

Error message	Tx LCD message	Possible cause	Suggested action	Tx response
C088.030	Input Simulation Active	The P-dP Value produced in output is derived by the value simulated in input.	Use a HART configurator (DTM - Hand held) to place device back in to normal operating mode (Remove the input simulation).	no effect
C088.030	Input Simulation Active	The Static Pressure Value produced in output is derived by the value simulated in input.	Use a HART configurator (DTM - Hand held) to place device back in to normal operating mode (Remove the input simulation).	no effect
C088.030	Input Simulation Active	The Sensor Temperature Value produced in output is derived by the value simulated in input.	Use a HART configurator (DTM - Hand held) to place device back in to normal operating mode (Remove the input simulation).	no effect
M014.037	Configuration Error	Refer to the Instruction manual to understand the possible cause of this error.	Use a HART configurator (DTM - Hand held) to correct the configuration.	no effect
M020.042	Replace Info	The Electronics or the Sensor have been changed but the replacement operation has not been executed.	The replacement operation must be executed: Move the SW 1 of the electronics in position 1 = Enable replace mode -Select the SW 2 the element that has been changed between new Sensor or new electronics -Power Cycle the device -Move the SW 1 of the electronics in position 0.	no effect
M020.042	Replace Info	The Electronics or the Sensor have been changed and a replacement operation for a new sensor has to be executed.	The replacement operation must be executed: Only the data of the electronics can be copied into the sensor-Move the SW 1 to Enable replace mode (1)-Select with the SW 2 to New Sensor (1)-Power Cycle the device-Move the SW 1 to Disable replace mode (0).	no effect
M020.042	Replace Info	The Electronics or the Sensor have been changed.  The replacement has been enabled but with a wrong direction (SW 2 = 0).	Change the replacement direction (if possible)- The SW 1 is already set to Enable replace mode (1)-Select with the SW 2 to New Sensor (1)-Power Cycle the device-Move the SW 1 to Disable replace mode (0).	no effect

— Operation related error messages

Error message	Tx LCD message	Possible cause	Suggested action	Tx response
M024.036	Power Supply Warning	The Device Power Supply is close to the lowest acceptable limit.	Check the Voltage at the terminal block and if it is not within the valid range check the external power supply.	no effect
M024.036	Power Supply Warning	The Device Power Supply is close to the highest acceptable limit.	Check the Voltage at the terminal block and if it is not within the valid range check the external power supply.	no effect
M022.041	Electronic Temperature Out of Limits	The Electronics temperature is out of its lower acceptable limit . The circuitry for the sampling of the Electronics Temperature has failed.	The Electronics should be replaced as soon as possible.	no effect
M022.041	Electronic Temperature Out of Limits	The Electronics temperature is out for its Higher acceptable limit. The circuitry for the sampling of the Electronics Temperature has failed.	The Electronics should be replaced as soon as possible.	no effect

— Process related error messages.

Error message	Tx LCD message	Possible cause	Suggested action	Tx response
F104.032	Pressure Overrange	This effect could be produced by other equipment on the process, (valves.....). Exceeding the pressure range can cause reduced accuracy or mechanical damage to the diaphragm material and may require calibration/ replacement.	The compatibility of pressure transmitter model and process conditions has to be checked. A different transmitter type could be required.	no effect
F102.004	P-dP Out Of Limits	The measurement range has not been correctly calculated OR an incorrect transducer model has been selected.	The compatibility of pressure transmitter model and process conditions has to be checked. Probably a different transmitter type is required.	no effect
F100.005	Static Pressure Out of Limits	The static pressure of the process exceeds the limit of the sensor. Exceeding the Static Pressure can reduce accuracy, mechanically damage the diaphragm and may require calibration/replacement. An incorrect transducer model could have been selected.	The compatibility of pressure transmitter model and process conditions has to be checked. Probably a different transmitter type is required.	no effect
S054.006	Sensor Temperature Out of Limits	The temperature of the process environment affects the pressure transmitter; Excess temperature can reduce accuracy, degrade device components and may require calibration/replacement.	The compatibility of pressure transmitter model and process conditions has to be checked. A different installation type could be required e.g. use of remote seals.	no effect
S052.031	Max Working Pressure Exceeded	The static pressure of the process exceeds the max working Pressure supported by the transmitter. Exceeding the Max Working Pressure can mechanically damage the process connections (flanges, pipes....) and/or be dangerous.	The compatibility of pressure transmitter model and process conditions has to be checked.	no effect
F098.034	Analog Output Saturated	The analog output for the Primary Variable is beyond its Low scaling limit and no longer represents the true applied process. The Analog Output (4-20 mA) is saturated to the configured Saturation Limit Low.	Adjust the Saturation Limit or the working range if possible.	no effect
F098.034	Analog Output Saturated	The analog output for the Primary Variable is beyond its High scaling limit and no longer represents the true applied process. The Analog Output (4-20 mA) is saturated to the configured Saturation Limit High.	Adjust the Saturation Limit or the working range if possible.	no effect
M018.038	PILD Output	One (HIGH or LOW) or both connections between the pressure sensor and the process is blocked either by plugging or closed valves.	Check valves and impulse line. Clean impulse line if necessary and initiate PILD training.	no effect
M016.039	PILD-Changed Op. Conditions	Process conditions have changed to an extent that new settings for the PILD algorithm are needed.	A new Training is necessary for this new process condition.	no effect

## 9 Maintenance

If transmitters are used as intended under normal operating conditions, no maintenance is required. It is sufficient to check the output signal at regular intervals (in accordance with the operating conditions), as described in the instructions in the section “Operation resp. Configuration of the transmitter”. If deposits are expected to accumulate, the measuring equipment should be cleaned on a regular basis, in accordance with the operating conditions. Cleaning should ideally be carried out in a workshop.

Important. In case of aggressive environment and any critical condition, ABB recommends to check O-rings periodically. In case of damage, user shall replace them with original spare parts.

Repair and maintenance activities may only be performed by authorized customer service personnel.

When replacing or repairing individual components, original spare parts must be used.

Attention – Potential damage to parts. The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines). Make sure that the static electricity in your body is discharged when touching electronic components. If a remote seal is mounted on the measuring equipment, it must not be removed (please refer to the dedicated document).

Warning – <Bodily injury>. 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. Only disassemble the transmitter to the extent necessary for cleaning, inspection, repairs, and replacement of damaged components.

### 9.1 Returns and removal

Defective transmitters sent to the repairs department must, wherever possible, be accompanied by your own description of the fault and its underlying cause.

Warning – General risks. Before removing or disassembling the device, check for hazardous process conditions such as pressure on the device, high temperatures, aggressive or toxic media, and so on. Read the instructions in the sections “Safety” and “Electrical connection”, and perform the steps outlined there in reverse order.

### 9.2 Pressure transmitter sensor

Essentially maintenance is not required for the transmitter sensor. Anyway the following items should be checked periodically:

- Check the integrity of the pressure boundary (no cracks should be visible on the process connection or on the process flanges.

- Check that there is no leakage from the sensor/ flange interface or from the vent/drain valves.
- The process flanges bolts (for 266DSx/MSx/PSx/VSx/RSx models) should not show excessive rust.

In case one of the check points above fails, please replace the damaged part with an original spare part.

The use of non original spare parts makes the warranty void. In case you want ABB to perform the repair, please send back the transmitter to your local ABB office complete with the return form that you find in this manual appendix and include it with the device.

### 9.3 Removing/Installing the process flanges

1. Slacken the process flange screws by working on each in a crosswise manner (hexagon head, SW 17 mm (0.67inch) for 266DS/266PS/266VS or SW 13 mm (0.51 inch) / SW 17 mm (0.67 inch) for 266MS/266RS).
2. Carefully remove the process flange, making sure that the isolating diaphragms are not damaged in the process.
3. Use a soft brush and a suitable solvent to clean the isolating diaphragms and - if necessary - the process flange.
4. Insert the new process flange O-rings in the process flange.
5. Attach the process flange to the measuring cell.

The surfaces of both process flanges must be at the same level and at a right angle to the electronics housing (with the exception of vertical process flanges).

6. Check that the process flange screw thread can move freely: Manually turn the nut until it reaches the screw head. If this is not possible, use new screws and nuts.
7. Lubricate the screw thread and seats of the screw connection.
8. While performing the preliminary and final tightening of the bolts, please act in a crosswise manner.

Attention – Potential damage to parts. Do not use sharp or pointed tools.

Do not damage the insulating diaphragms.

Important. In the case of oil and grease-free designs, clean the measuring chambers again if necessary once the process flange has been installed.

— Respect the below table indications for reinstalling the process flanges.

Transmitter model and range			Procedure
266DSH / PSH / VSH	Viton Gaskets	All bolting	Use a torque wrench to tighten the bolts to a torque of 25 Nm.
	PTFE Gaskets	Carbon Steel NACE and Stainless Steel	Use a torque wrench to tighten the process flange nuts to a torque of 40 Nm, let the flange stabilize for an hour, unscrew the nuts and tighten again to 25 Nm.
		Stainless Steel NACE	Use a torque wrench to tighten the process flange nuts to a torque of 25 Nm, let the flange stabilize for an hour and perform the final tightening to 25 Nm.
266DSH.x.H (High static option)	Viton Gaskets	All bolting	Use a torque wrench to tighten the bolts to a torque of 31 Nm.
	PTFE Gaskets	All bolting	Use a torque wrench to tighten the process flange nuts to a torque of 40 Nm, let the flange stabilize for an hour, unscrew the nuts and tighten again to 31 Nm.
266DSH range A (1KPa)	All gaskets	All bolting	Use a torque wrench to tighten the process flange screws/nuts to a torque of 14 Nm. Please be aware that in case of bottom work disassembly and reassembly the original performances can not be guarantee anymore.
266DSH / 266PSH with Kynar inserts	All gaskets	All bolting	Use a torque wrench to tighten the process flange screws/nuts to a torque of 15 Nm
266MSx / 266RSx MWP ≤ 41Mpa / 410bar / 5945 psi	All gaskets	All bolting	First, use a torque wrench to tighten the process flange screws/nuts to a joining torque of — MJ = 2 Nm (0.2 kpm), working in a crosswise manner. — Then tighten them with a torque MJ = 10 Nm (1.0 kpm), working in a crosswise manner — Then tighten them fully by turning each nut or screw again (in a crosswise manner) by the tightening angle A = 180°, working in two stages of 90° each. Some transmitter versions are using screws with size M10. If this screws are used the tightening angle A = 270°, working in three stages of 90° each.
266MSx / 266RSx MWP 60Mpa / 600bar / 8700 psi	Perbunan	All bolting	First, use a torque wrench to tighten the process flange screws/nuts to a joining torque of — MJ = 2 Nm (0,2 kpm), working in a crosswise manner. — Then tighten them with a torque MJ = 10 Nm (1,0 kpm), working in a crosswise manner — Then tighten them fully by turning each nut or screw again (in a crosswise manner) by the tightening angle A = 180°, working in two stages of 90° each.

#### 9.4 Pressure transducer replacement

If the pressure transducer needs to be replaced proceed as follows:

1. Insulate the transmitter from the process by acting on the manifolds or on the insulation valves.
2. Open the vent valves to allow sensor depressurization.
3. Disconnect the power supply and disconnect the wiring.
4. Disconnect the transmitter from the bracket unscrewing the fixing bolts.
5. Open the communication board compartment cover.
6. The communication board is connected to the sensor via a flat cable and a connector. Remove the communication board and gently disconnect the connector.
7. Release the tang screw until nd rotate the housing until its complete removal.
8. Unscrew the fixing bolts from the transducer and remove the process flanges.
9. The orings placed between the diaphragm and the flange (Viton or PTFE) must be replaced after every disassembly.
10. Reassemble the flanges following the steps above in reverse order.

11. The 266 can reconfigure itself with the previous configured parameters thanks to the auto-configuration functionality.
12. Before powering on the transmitter raise dip-switches 1 and 2 in up position. Connect the transmitter to power supply, wait ten seconds and lower dip-switched 1 and 2.
13. After installing the transmitter on the bracket and connecting it to the manifold, perform a PV zero bias.

#### 9.5 Electronic replacement

If the electronic module needs to be replaced proceed as follows:

1. Insulate the transmitter from the process by acting on the manifolds or on the insulation valves.
2. Open the vent valves to allow sensor depressurization.
3. Disconnect the power supply and disconnect the wiring.
4. Open the communication board compartment cover and remove the LCD display (if installed).
5. Remove the communication board and gently disconnect the connector.
6. Connect the sensor flat cable to the new electronic module with dip switch 1 in up position.
7. Connect the transmitter to power supply, wait ten

seconds and lower dip-switch 1 to 0 position. 266 can reconfigure itself with the previous configured parameters thanks to the auto-configuration functionality.

## 9.6 Electronic upgrade from Standard to Advanced HART

Attention. In case of electronic upgrade from Standard to Advanced HART it is necessary to perform a full transmitter reconfiguration since all customized data will be lost.

To upgrade the electronic module, proceed as follows:

1. Follow all points listed in the previous paragraph from 1 to 5.
2. Connect the larger flat to the new electronic which have to feature dip-switches 1 and 2 in up position.
3. Connect the transmitter to power supply, wait ten seconds and lower dip-switched 1 and 2.

## 10 Hazardous Area considerations

### 10.1 Ex Safety aspects and IP Protection (Europe)

According to ATEX Directive (European Directive 2014/34/EU 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") 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 Ga and II 1 D Ex ia IIIC T85°C Da

FM Approvals certificate number

FM09ATEX0024X (Tremezzina, Minden, Bangalore and 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 ia IIIC T85°C Da

IECEx certificate number

IECEx FME 16.0003X (Tremezzina, Minden, Bangalore, Shanghai products)

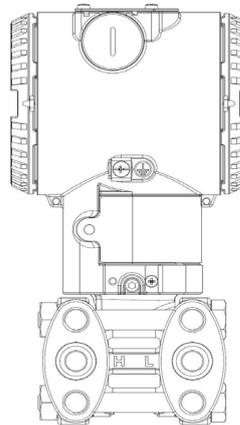
Important. The number close to the CE marking of the transmitter safety label identifies the Notified Body which has responsibility for the surveillance of the production.

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

### Application for pressure transmitter Ex ia categories 1Ga and 1Da

Application with Gas

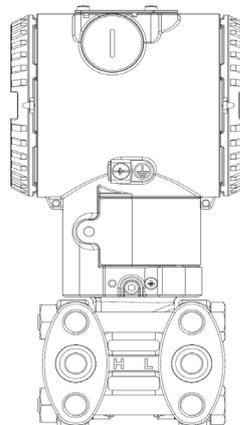


Zone 0

266 Tx Category 1Ga Ex ia

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

Application with Dust



Zone 20

266 Tx Category 1Da 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 Ga and II 1/2 D Ex ia IIIC T85°C Da

FM Approvals certificate number

FM09ATEX0024X (Tremezzina, Minden, Bangalore and 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 ia IIIC T85°C Da

IECEx certificate number

IECEx FME 16.0003X (Tremezzina, Minden, Bangalore, Shanghai products)

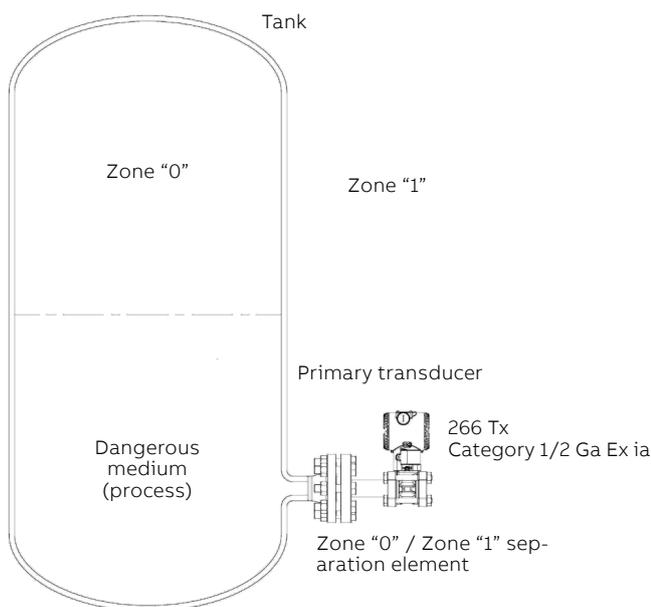
The other marking refers to the protection type used according to relevant EN standards:

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

**Application for pressure transmitter Ex ia categories 1/2Ga and 1/2Da**

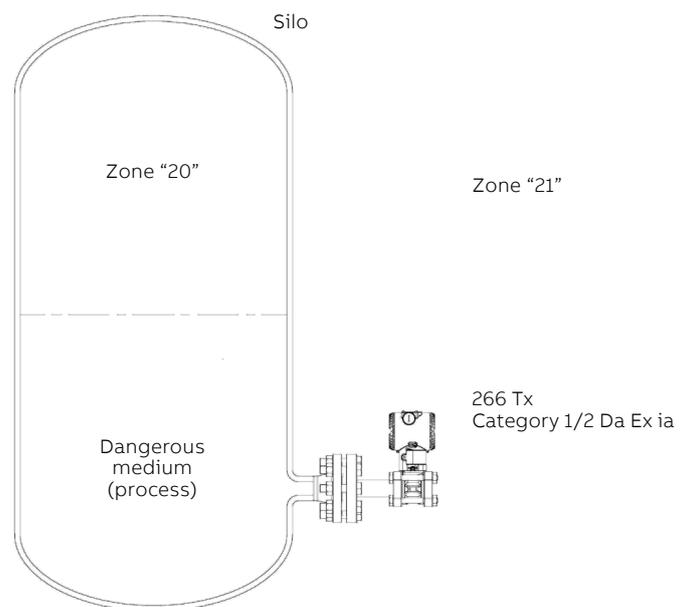
Application with Gas



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 db IIC T6 Ga/Gb and II 1/2 D Ex tb IIIC T85°C Db

Ta = -50°C to +75°C – IP67

FM Approvals Certificate number

FM09ATEX0023X (Tremezzina, Minden, Bangalore and 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 db IIC T6 Ga/Gb and Ex tb IIIC T85°C Db, Ta= -50°C to +75°C - IP67

IECEx certificate number

IECEx FME 16.0002X (Tremezzina, Minden and Shanghai products)

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

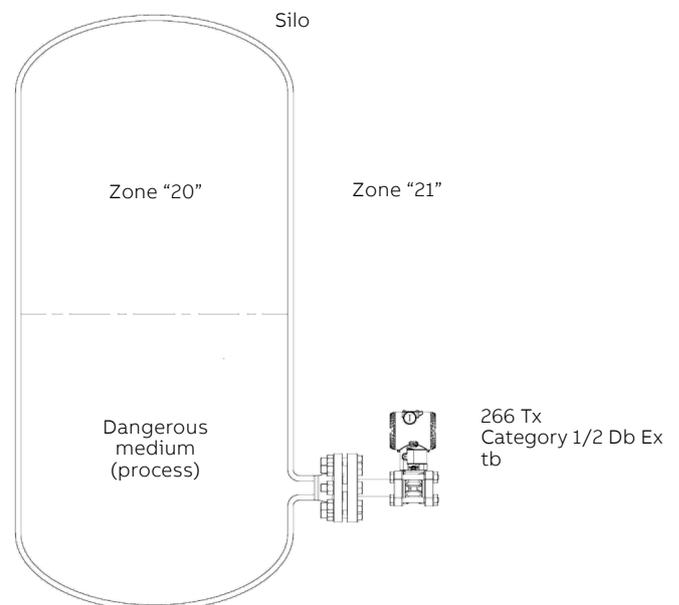
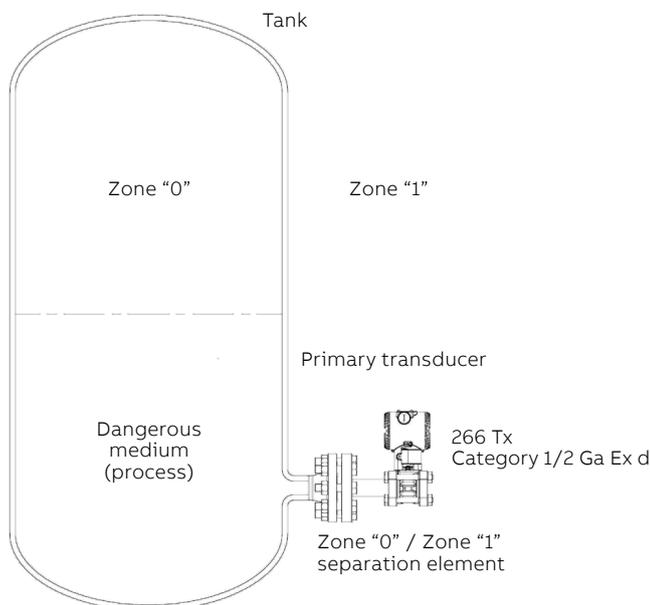
About the applications, this transmitter can be used in Zone “0” (Gas) classified areas (continuous hazard) with its “process part” only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the 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 60079-1.

About Dust application, the transmitter is suitable for “Zone 21” according to the EN 60079-1 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 2014/34/ EU 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”), 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 ic IIC T4/T5/T6 Gc IP67 and II 3 D Ex tc IIIC T85°C Dc

Ta = -50°C to +75°C - IP67

FM Approvals Certificate number

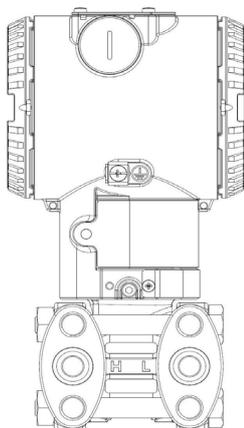
FM09ATEX0025X (Tremezzina, Minden, Bangalore and Shanghai products)

The meaning of ATEX code is as follows :

- II: Group for surface areas (not mines)
- 3: Category of equipment
- G: Gas (Dangerous media)
- Ex nL: type of protection “n” with “energy limitation”
- 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

### Application for pressure transmitter Ex ic categories 3Gc and 3Dc

Application with Gas

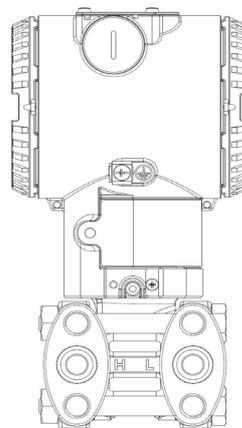


Zone 2

266 Tx Category 3Gc Ex ic

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 3Dc IP6x Ex tc

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

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.

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 tc: type of protection “tc” means protection by enclosure technique
- 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).

Important - Note for pressure transmitter with combined approval. Before installation of the Transmitter, the customer should permanently 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.

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

HART Version with “L5” option (display TTG)					
Ui= 30Vdc Ci= 5nF Li= uH					
Temperature	Temperature	Minimum	Maximum	Imax	Power
Class - Gas	Class - Dust	amb. °C	amb. °C	mA	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 li= 380 mA Pi= 2,52 W Ci= 5nF Li= 10 uH			
Temperature	Temperature	Minimum	Maximum
Class - Gas	Class - Dust	amb. °C	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 li= 380 mA Pi= 5,32 W Ci= 5nF Li= 10 uH			
Temperature	Temperature	Minimum	Maximum
Class - Gas	Class - Dust	amb. °C	amb. °C
T4	T135°C	-50°C	+60°C
T5	T100°C	-50°C	+56°C
T6	T85°C	-50°C	+44°C

## 10.2 Ex Safety aspects and IP Protection (North America)

### 10.2.1 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).

### 10.2.2 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.

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