

266 HART

Pressure transmitters



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

The Company

We are an established world force in the design and manufacture of measurement products for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

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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 all the 266 models with exception done for the 266Cxx and 266Jxx (multivariable version).

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 differential pressure, gauge and absolute pressure, flow and liquid level is provided, in the even most difficult and hazardous industrial environments. Model 266 can be configured to provide specific industrial output signals according to 4...20mA with HART digital communication.

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 UE 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

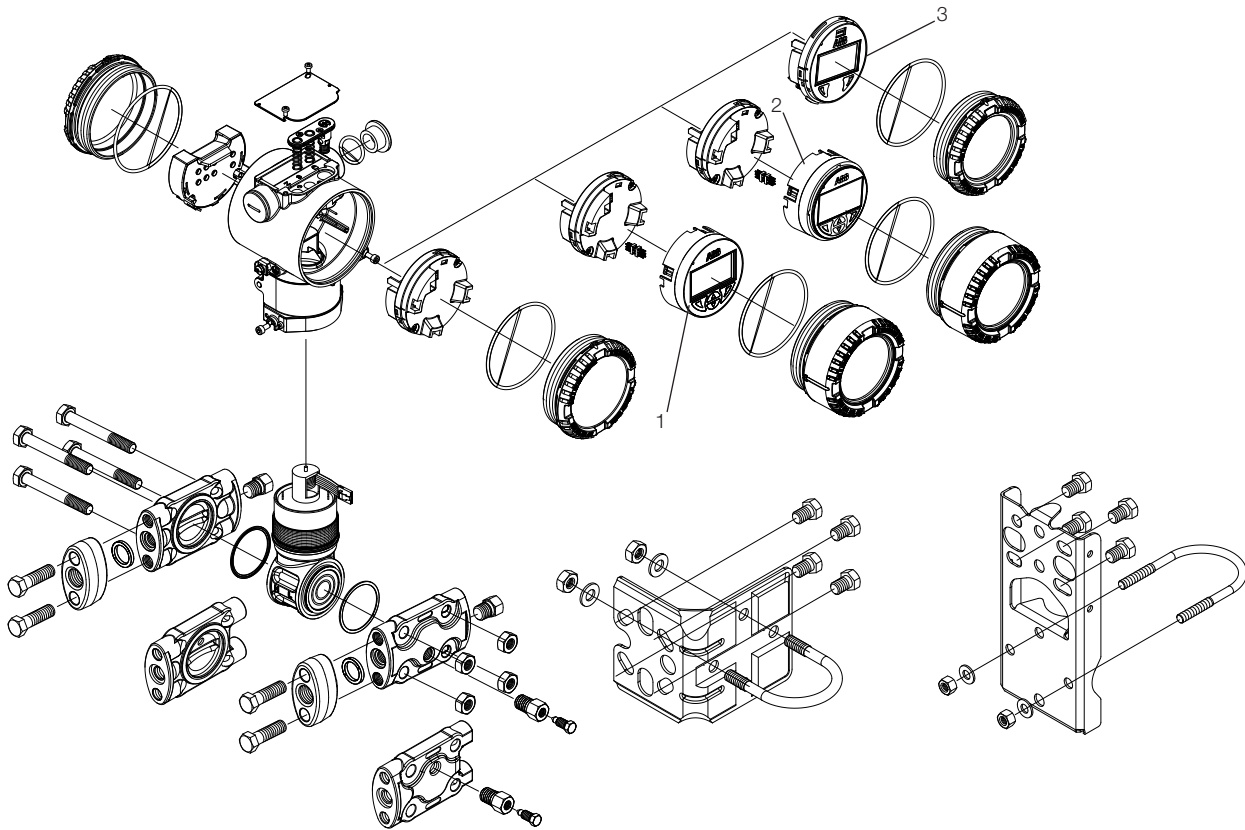


Figure 1: Differential pressure transmitter components

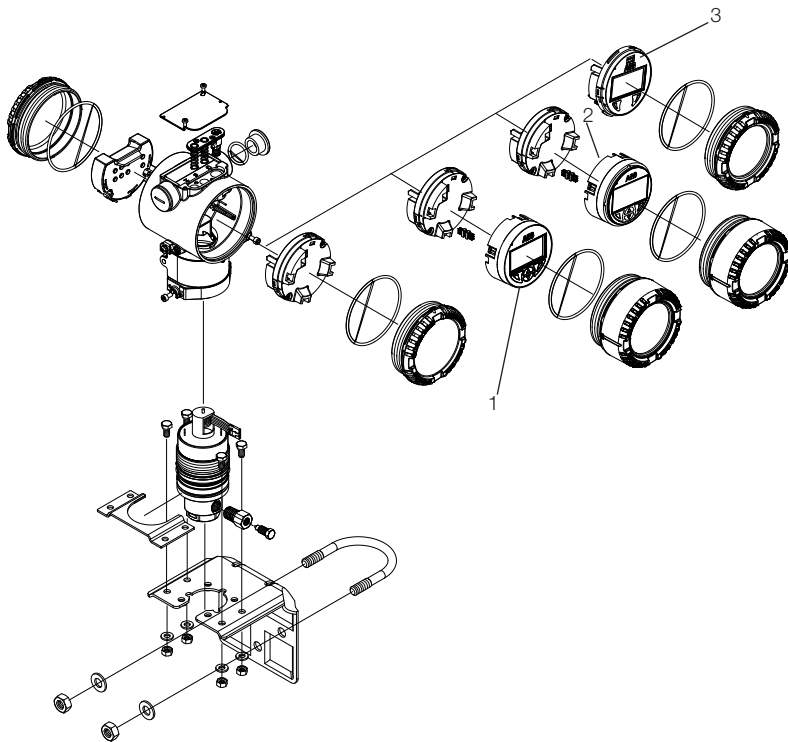


Figure 2: Gauge / absolute pressure transmitter components

- 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. These two pictures show only two different kinds of 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 3. 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*.

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

- FM09ATEX0023X or IECEx FME 16.0002X (Ex d)
- FM09ATEX0024X or IECEx FME 16.0003X (Ex ia)
- FM09ATEX0025X or IECEx FME 16.0004X (Ex ic) (Ex nA)

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

The certification plate (ref.A) shown here may also be issued for:

- ABB-APR, 32425 Minden, Germany. CE-Identification number of the notified bodies to Pressure Equipment Directive: 0045, to ATEX certification: 0044, to IECEx certification: DE/TUN/QAR06.0012/01.
- ABB India Limited, 560058 Bangalore, India. CE-Identification number of the notified bodies to ATEX certification: 1725.
- ABB Engineering Limited, Shanghai 201319, P.R. China. CE-Identification number of the notified bodies to ATEX certification: 1725.

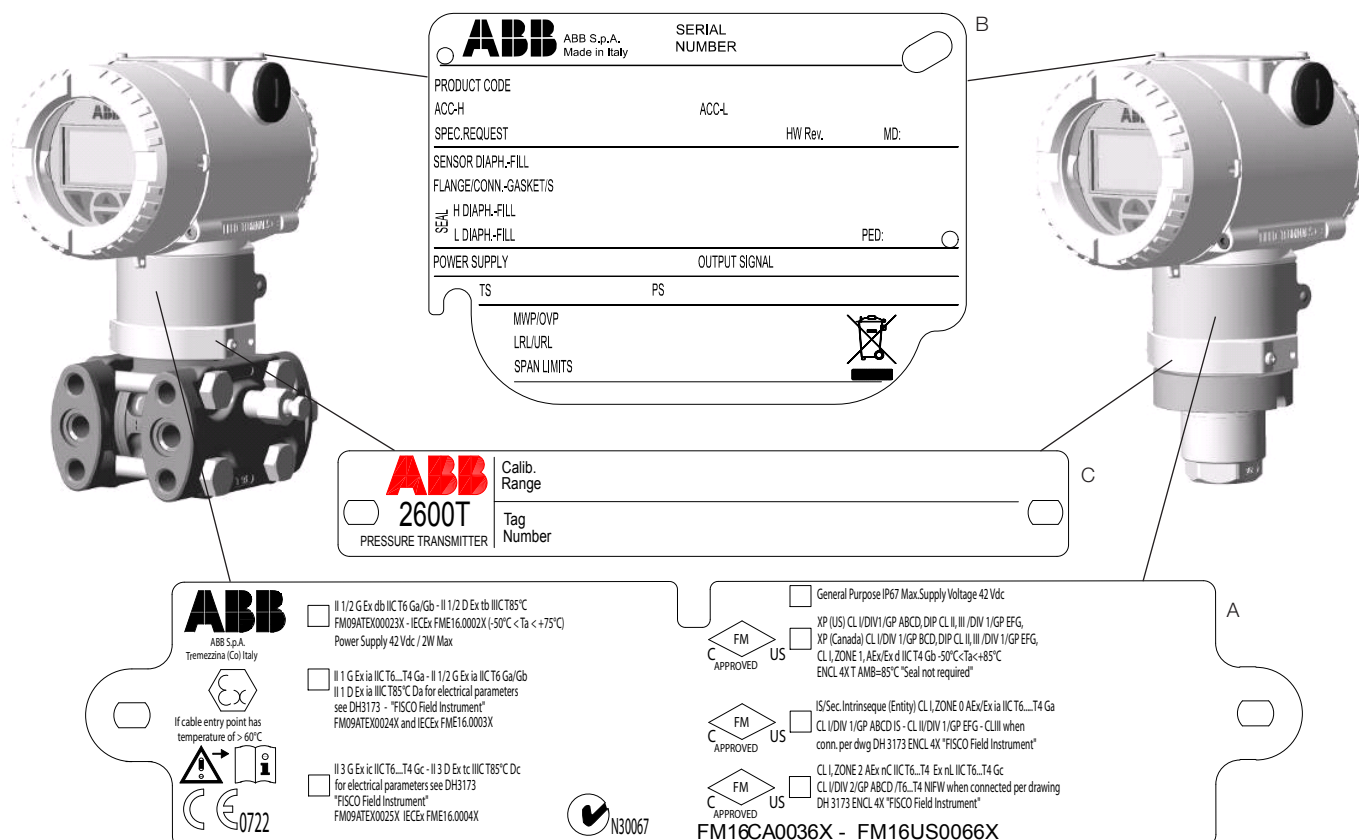


Figure 3: Product identification

* 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 4) 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.



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

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.

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. The 266 Pressure Transmitter Line can have the following certifications:

ATEX INTRINSIC SAFETY

- II 1 G Ex ia IIC T6...T4 Ga IP67
- II 1/2 G Ex ia IIC T6...T4 Ga/Gb; IP67
- II 1 D Ex ia IIIC T85°C Da; IP67
- II 1/2 D Ex ia IIIC T85°C Da; IP67

ATEX EXPLOSION PROOF

- II 1/2 G Ex db IIC T6 Ga/Gb Ta = -50°C to +75°C; IP67
- II 1/2 D Ex tb IIIC T85°C Db Ta = -50°C to +75°C; IP67

ATEX TYPE “N” / EUROPE:

- II 3 G Ex ic IIC T6...T4 Gc IP67
- II 3 D Ex tc IIIC T85°C Dc IP67

COMBINED ATEX, ATEX FM and FM Canada:

- See detailed classifications

FM Approvals US and FM Approvals Canada:

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

IEC (Ex):

- See detailed classifications

NEPSI INTRINSIC SAFETY/CHINA approval Ex ia IIC T4-T6

NEPSI FLAMEPROOF/CHINA approval Ex d IIC T6

INMETRO BRAZIL - based on ATEX

TECHNICAL REGULATION CUSTOM UNION for Russia, Kazakhstan, Belarus - based on EAC

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).


ABB ABB S.p.A. Made in Italy		SERIAL NUMBER	
PRODUCT CODE			
ACC-H	ACC-L		
SPEC.REQUEST	HW Rev.	MD:	
SENSOR DIAPH.-FILL			
FLANGE/CONN.-GASKETS			
H DIAPH.-FILL			PED:
L DIAPH.-FILL			
POWER SUPPLY		OUTPUT SIGNAL	
TS	PS		
MWP/OVP			
LRL/JRL			
SPAN LIMITS			

Figure 5: 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.

5.5 Mounting a DP sensor transmitter (266DSH/266MST/266RST/266DRH/266MRT/266RRT)

The pressure transmitter models 266DSH, 266MST and 266RST can be mounted directly on the manifold. A mounting bracket for wall or pipe mounting (2" pipe) is also available as an accessory. For models 266DRH, 266MRT and 266RRT always mounting brackets should be used. Ideally, the pressure transmitter should be mounted in a vertical position to prevent subsequent zero shifts.

Important. If the transmitter is installed inclined with respect to the vertical, the filling liquid exerts hydrostatic pressure on the measuring diaphragm, resulting in a zero shift. In such an event, the zero point can be corrected via the zero push-button or via the "set PV to zero" command. Please refer to the [configuration section] for further details. For transmitters without diaphragm seals, please read the following considerations on the Vent/Drain valves in the following relevant paragraph.

Attention – Potential damage to transmitter. In case of a High Static differential pressure transmitter (266DSH.x.H) please always open the equalization valve of the manifold (if installed) before applying pressure to the transmitter. High Static pressure can damage the sensor causing a zero shift and a serious decrease of the total performance in terms of accuracy. In this case, please perform a full sensor trim.

It is important to mount the transmitter and to lay the process piping so that gas bubbles, when measuring liquids, or condensate when measuring gases, will flow back to the process and not enter the transmitter measuring chamber. Optional Vent/drain valves (code V1/V2/V3) on the transmitter are located on the sensor flanges.

The transmitter has to be positioned so that these drain/vent valves will be located higher than the taps on liquid service in order to allow the venting of entrapped gas or below the taps on gas service in order to allow the air to vent off or condensate to drain off. For safety reasons, take care of the drain/vent valves position so that when the process fluid is removed during the drain/vent operation it is directed down and away from technicians. It is recommended to mount the transmitter to prevent this possible source of damage for unskilled operators.



Figure 6: Drain/vent valves configuration (respectively V1, V2, V3)

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

Important. In case of a High Static differential pressure transmitter, please notice that the Vent/Drain valves can be configured only on the process axis (V1).

5.5.1 Bracket mounting (optional)

Different mounting brackets are available please refer to the relevant installation drawing below:

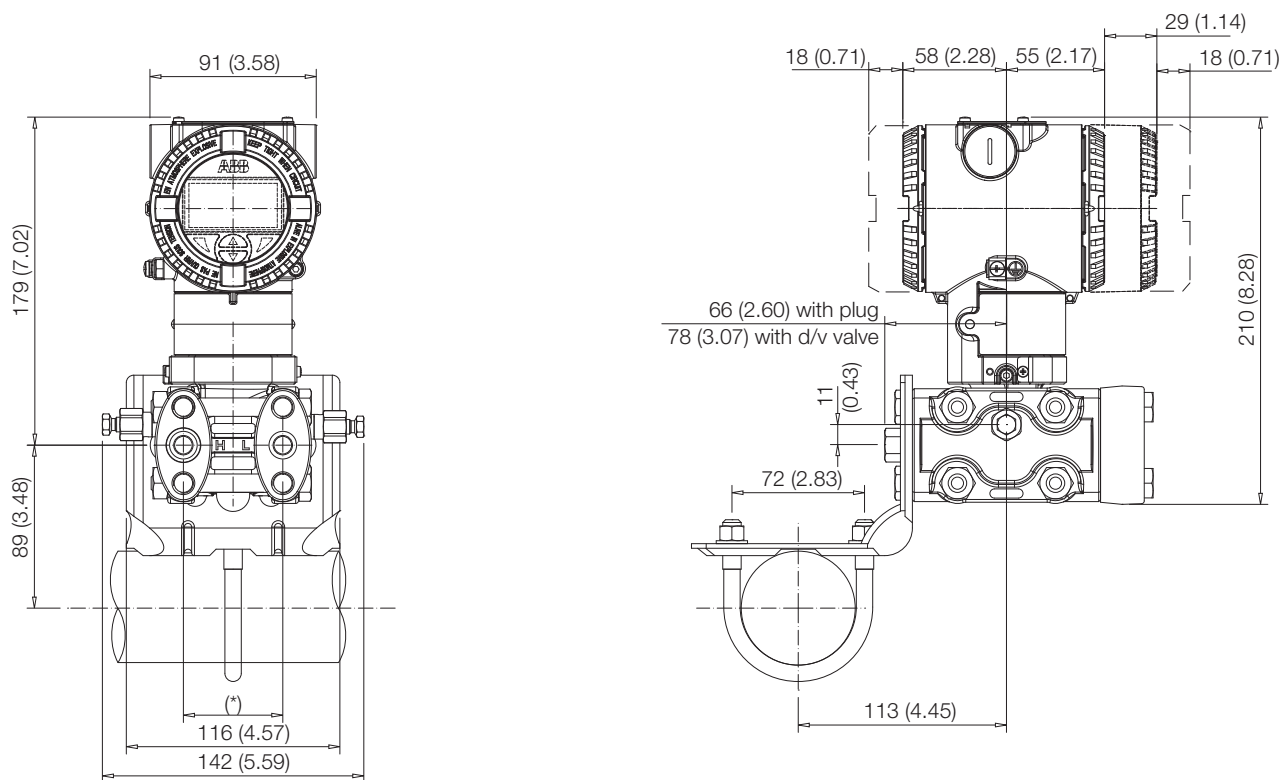


Figure 7: Differential Pressure Style transmitter with barrel housing installed on a horizontal pipe with optional bracket (B2)

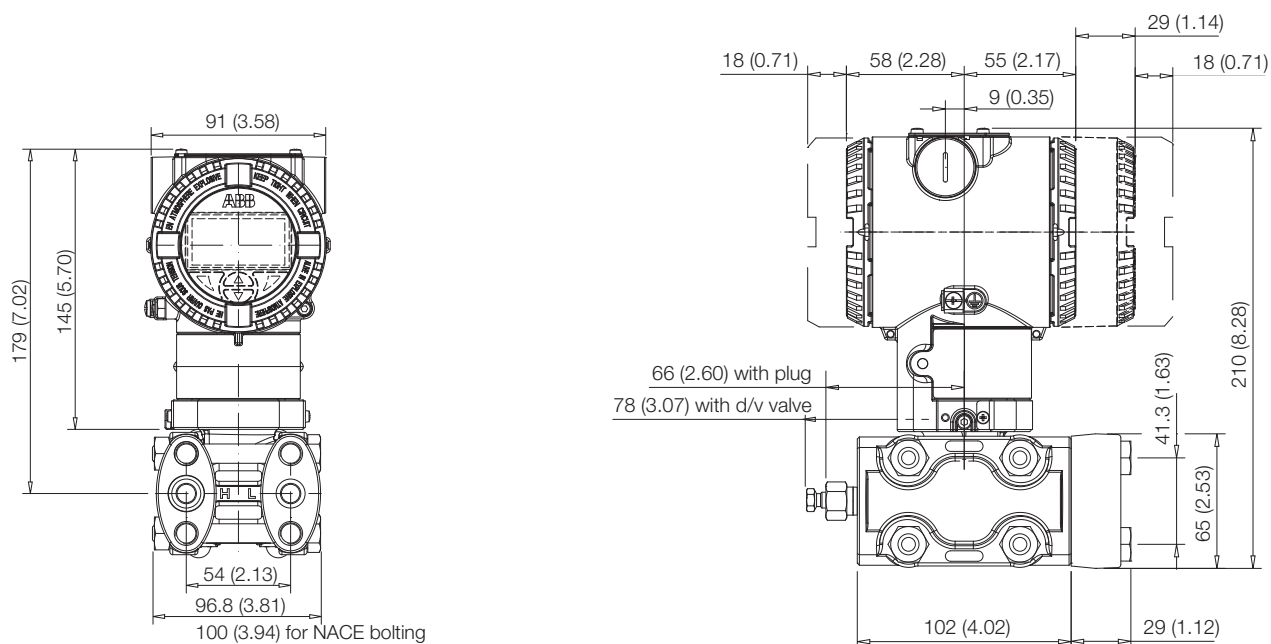


Figure 8: Differential Pressure Style transmitter (High Static option)

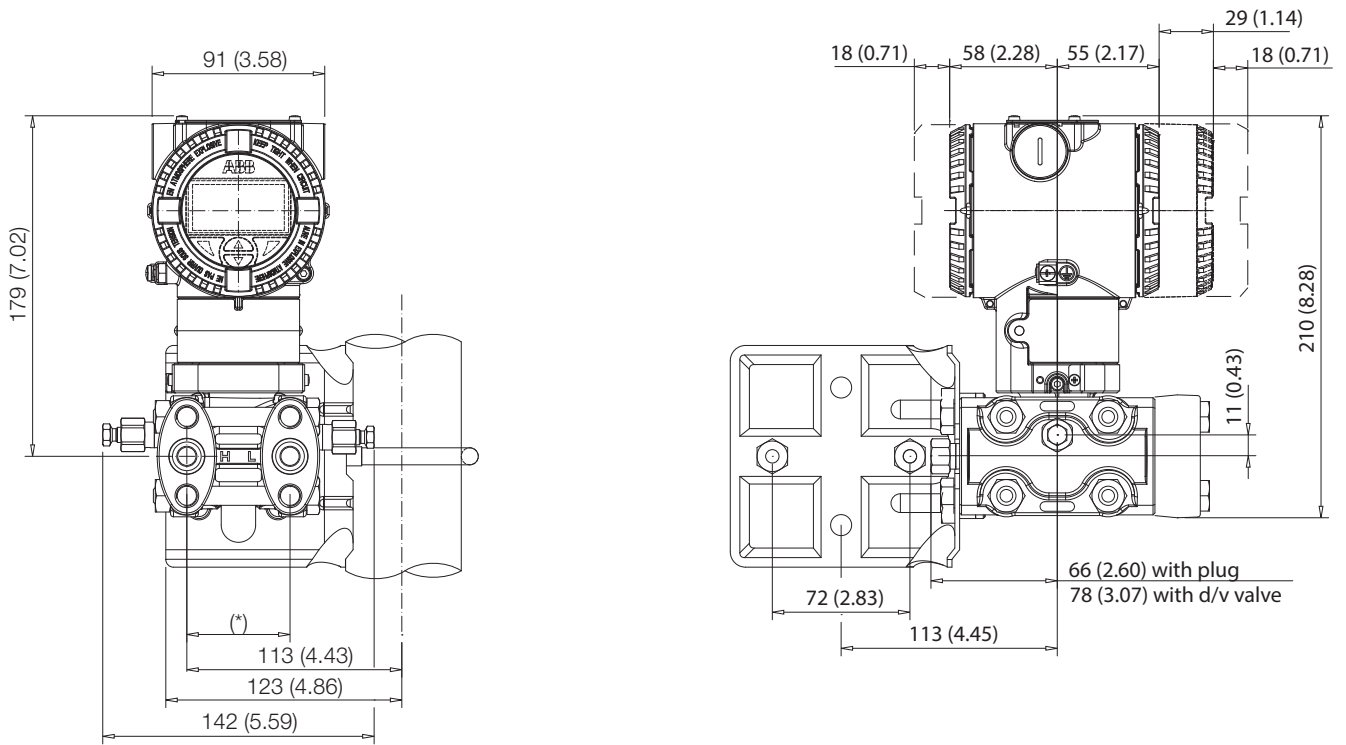


Figure 9: Differential Pressure Style transmitter with barrel housing installed on a vertical pipe with optional bracket (B2)

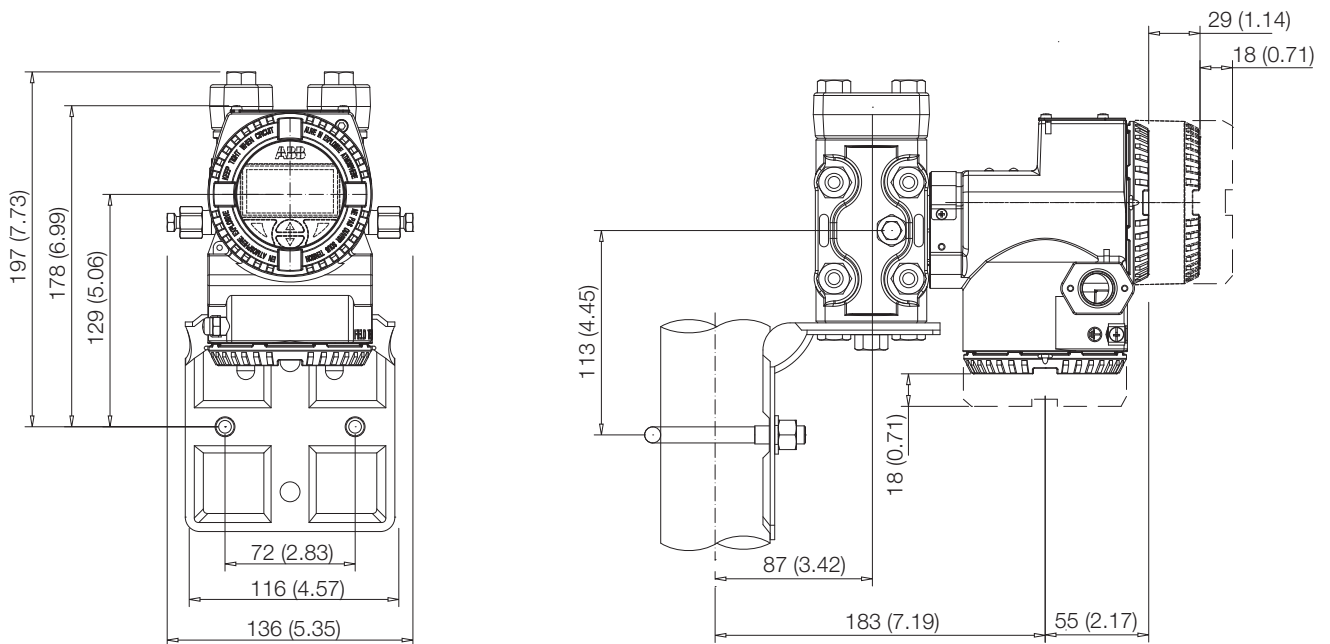


Figure 10: Differential Pressure Style transmitter with DIN housing installed on a Vertical pipe with optional bracket (B2) installation for AIR/GAS measurements

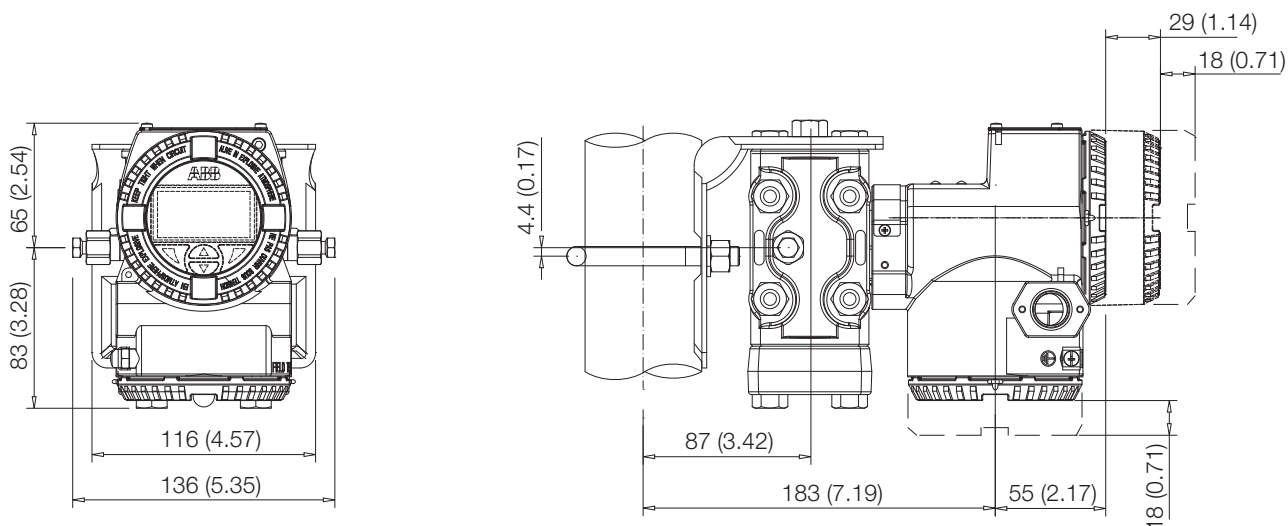


Figure 11: Differential Pressure Style transmitter with barrel housing and Kynar inserts installed on a horizontal pipe with optional bracket (B2)

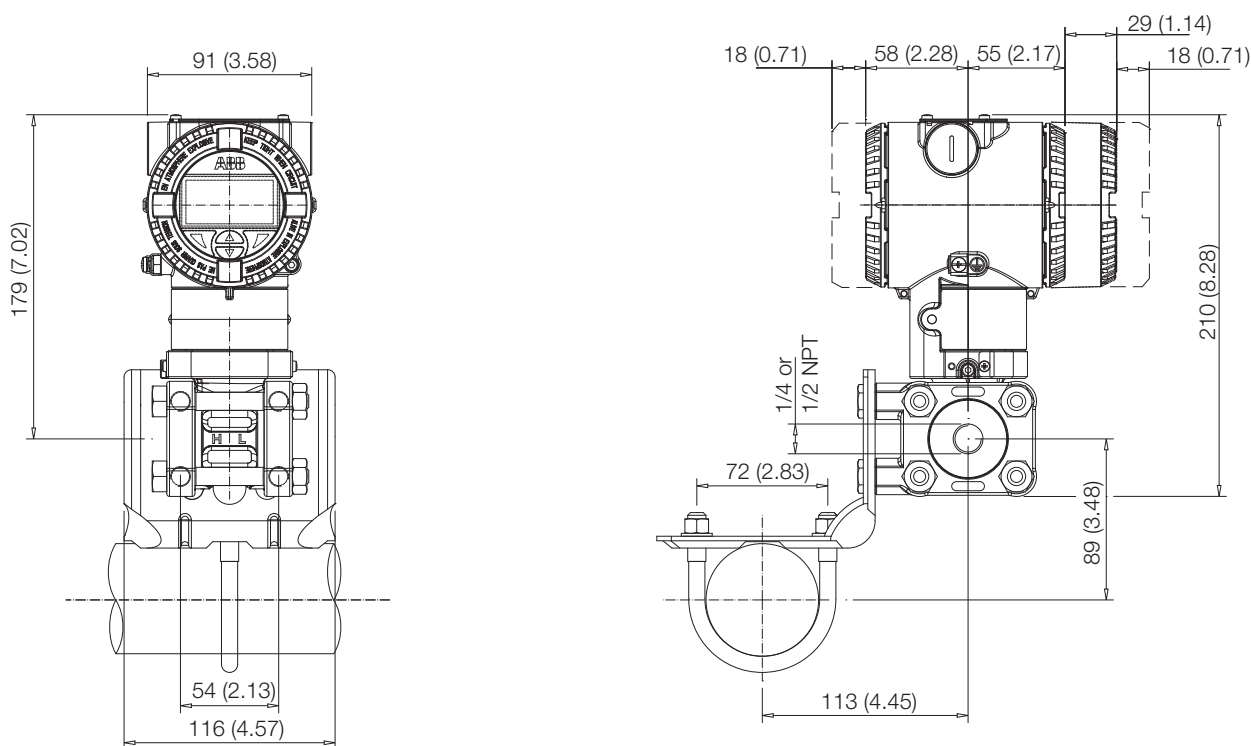


Figure 12: Differential Pressure Style transmitter with barrel housing and Kynar inserts installed on a vertical pipe with optional bracket (B2)

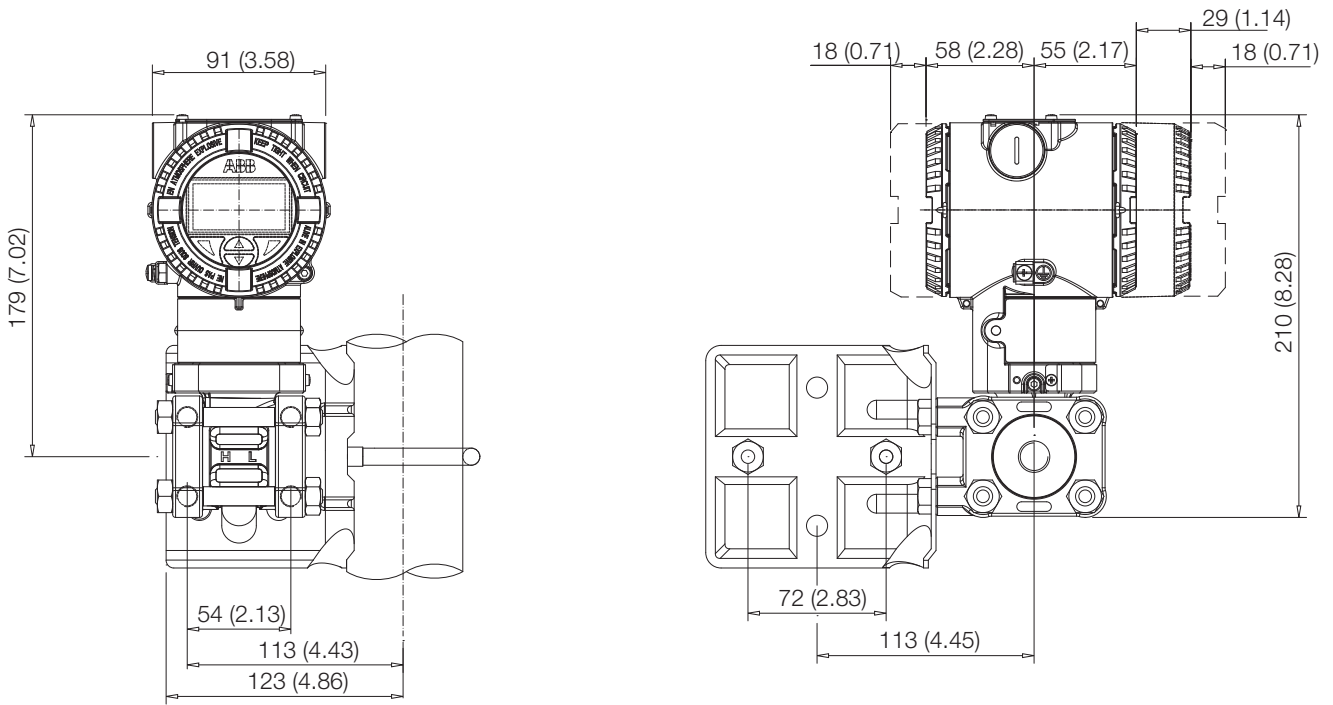


Figure 13: Differential Pressure Style transmitter with barrel housing and Kynar inserts installed on a vertical pipe with optional bracket (B2)

5.5.2 B2 Pipe and wall mounting bracket details

All the bolts and nuts supplied are necessary for the installation on pipe. In case of panel or wall installation, the U-bolt and the U-bolt nuts and washers will not have to be used.

The bolts for panel mounting are not within the scope of supply.

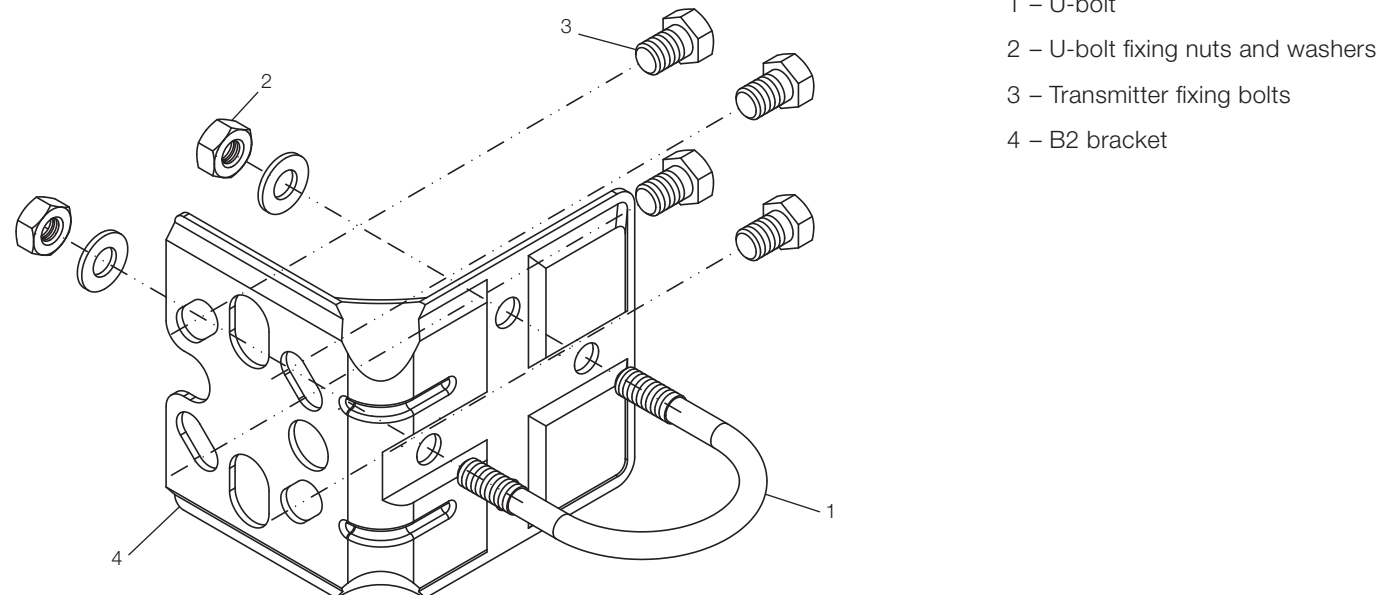


Figure 14: Pipe and wall mounting bracket kit (B2)

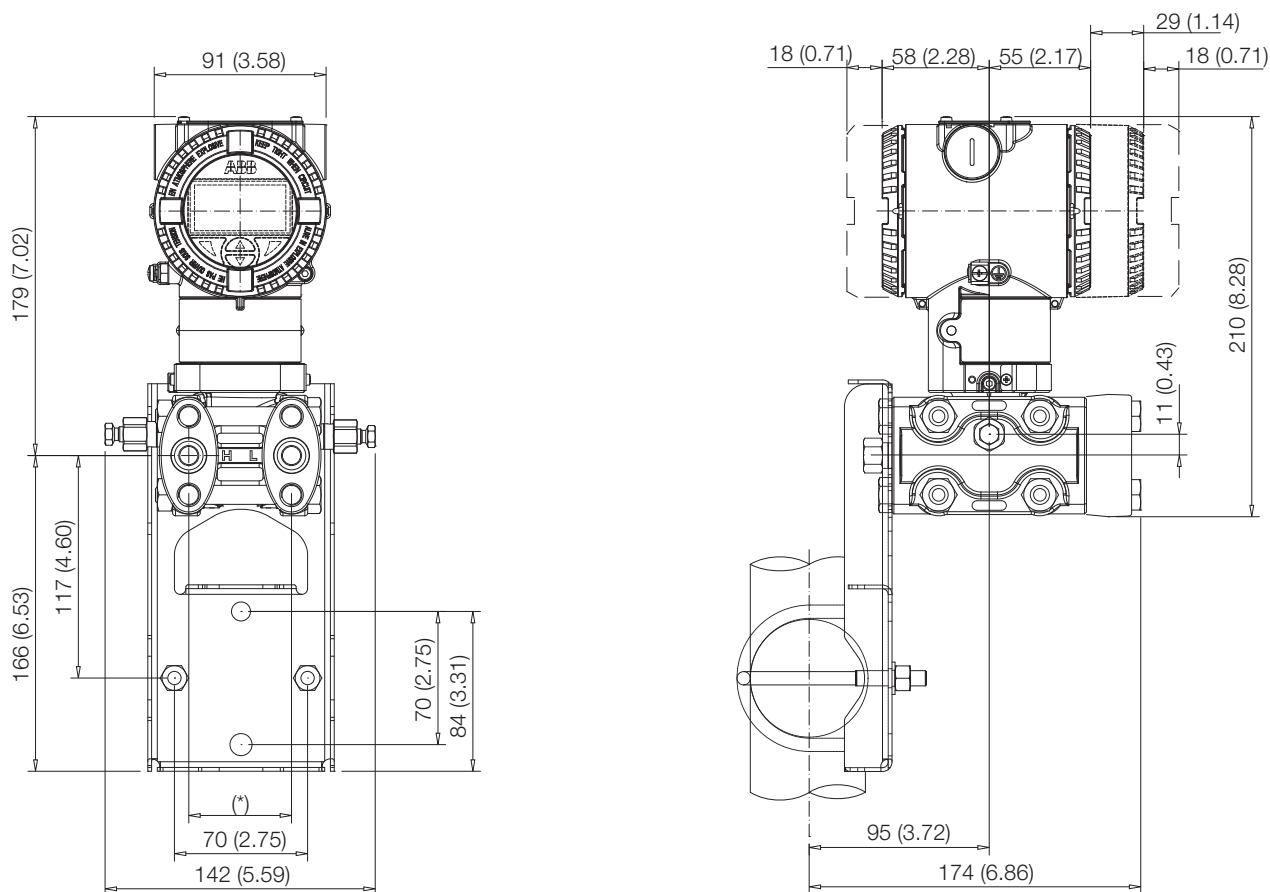
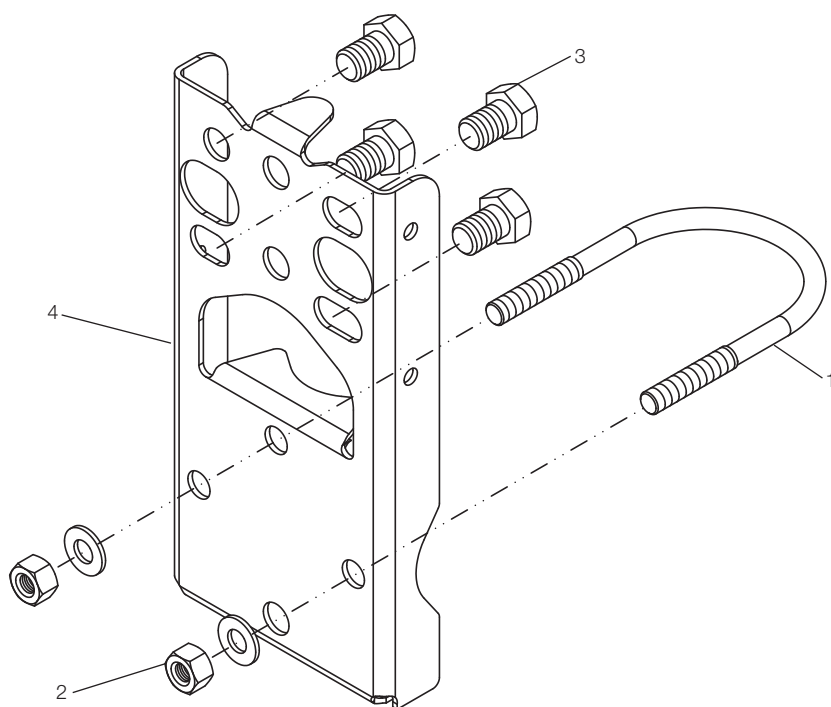


Figure 15: Differential Pressure Style transmitter with barrel housing installed on a box pipe with optional bracket for SST housing (B5)

5.5.3 B5 Flat type bracket details



- 1 – U-bolt
- 2 – U-bolt fixing nuts and washers
- 3 – Transmitter fixing bolts
- 4 – B5 bracket

Figure 16: Flat type mounting bracket kit (B5)

5.6 Mounting a P style pressure transmitter (266Gxx, 266Axx, 266Hxx, 266Nxx)

The pressure transmitter can be mounted directly on the manifold.

A mounting bracket for wall or pipe mounting (2" pipe) is also available as an accessory.

Ideally, the pressure transmitter should be mounted in a vertical position to prevent subsequent zero shifts.

Important. If the transmitter is installed inclined with respect to the vertical, the filling liquid exerts hydrostatic pressure on the measuring diaphragm, resulting in a zero shift. In such an event, the zero point can be corrected via the zero push-button or via the "set PV to zero" command. Please refer to the [configuration section] for further details. For transmitters without diaphragm seals the Vent / Drain considerations below should be taken into consideration.

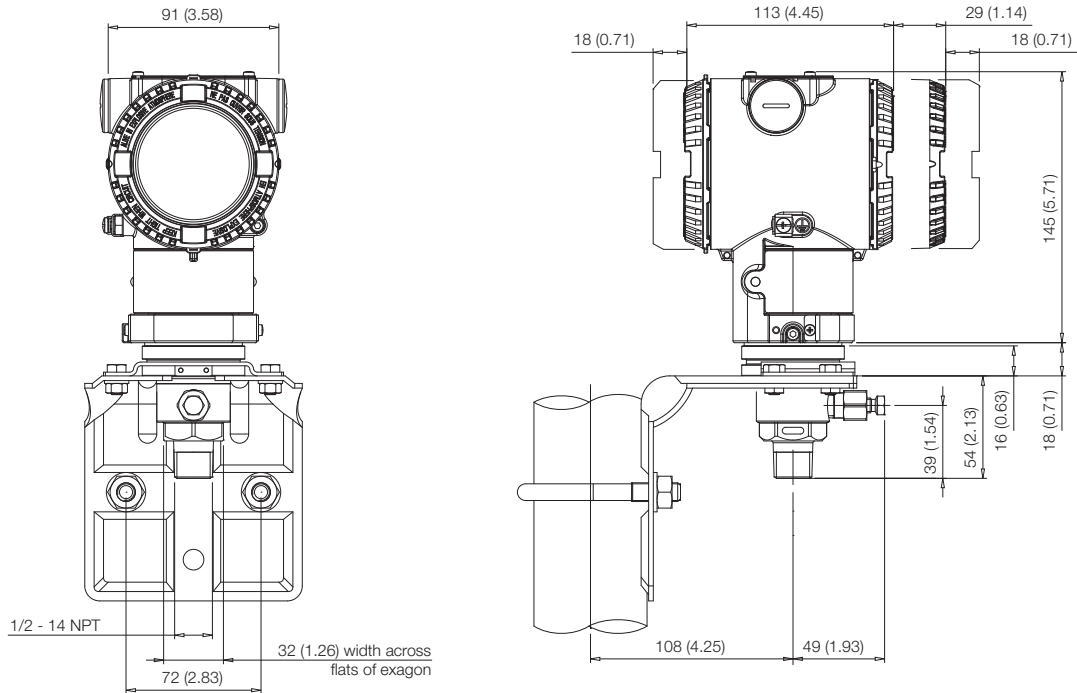


Figure 17: Model 266H or 266N High overload resistant P-Style transmitter with 1/2-14 NPT male process connection and barrel housing installed on a 2" pipe with optional bracket (B6 carbon steel or B7 Stainless Steel 316L)

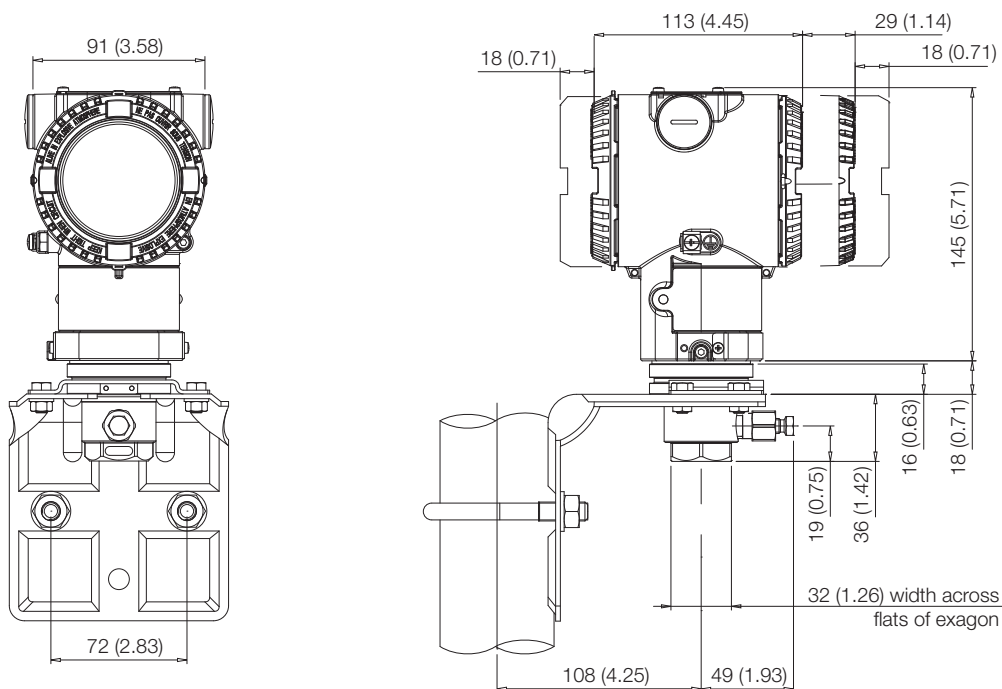


Figure 18: Model 266H or 266N High overload resistant P-Style transmitter with 1/2-14 NPT female process connection and barrel housing installed on a 2" pipe with optional bracket (B6 carbon steel or B7 Stainless Steel 316L)

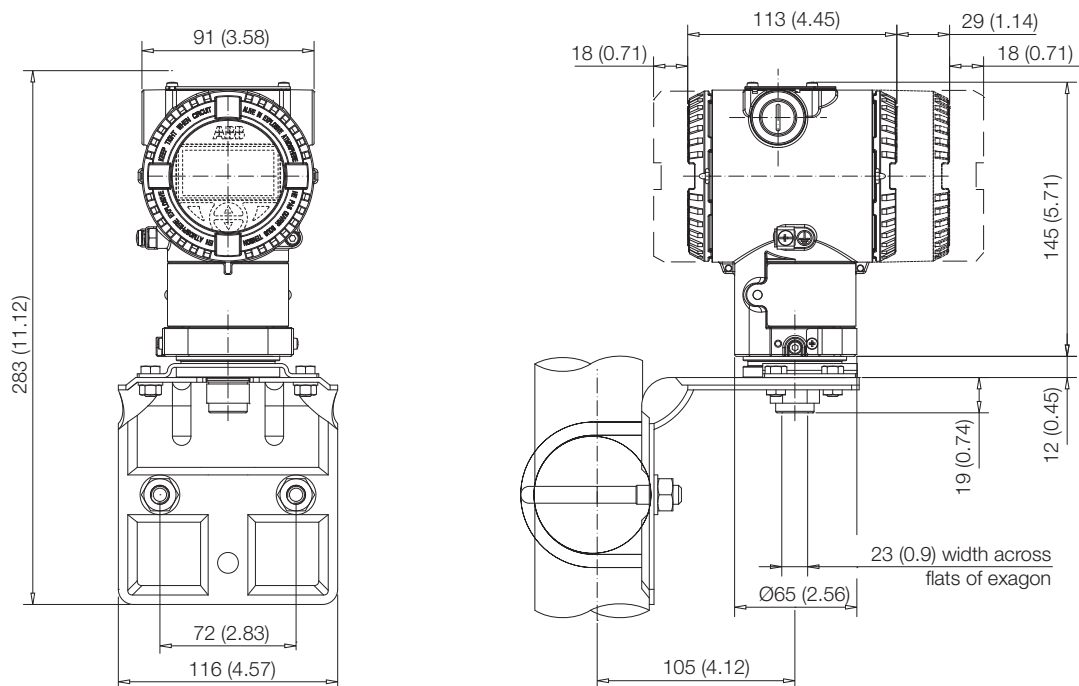


Figure 19: Model 266H or 266N High overload resistant P-Style transmitter with sensor Z with barrel housing installed on a 2" pipe with optional bracket (B6 carbon steel or B7 Stainless Steel 316L)

Attention – Potential damage to transmitter. In case of an HART gauge pressure transmitter with 1050 bar/15000 psi sensor range (266HSH.Z or 266GSH.Z) and 1/4" NPT process connection, please always perform sensor low trimming to remove possible zero shift and a prevent serious decrease of the total performance in terms of accuracy. Sensor low trim can be performed via LCD, DTM or handheld terminals.

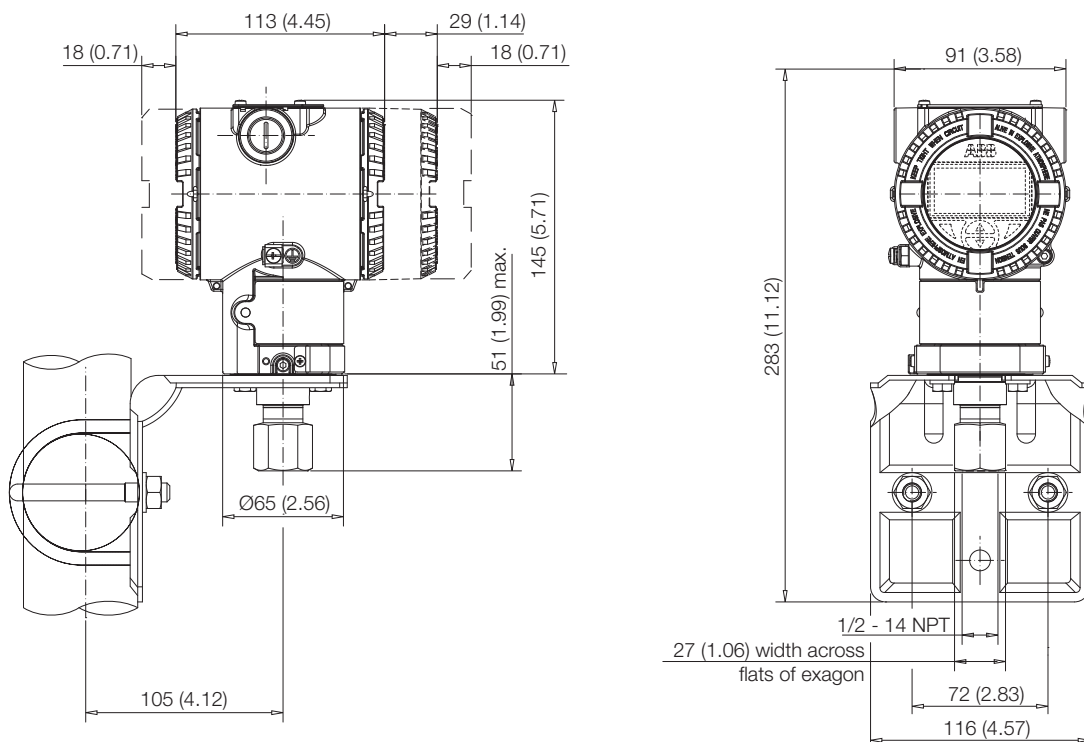


Figure 20: Model 266G or 266A P-Style transmitter with barrel housing installed on a 2" pipe with optional bracket (B6 carbon steel or B7 Stainless Steel 316L)

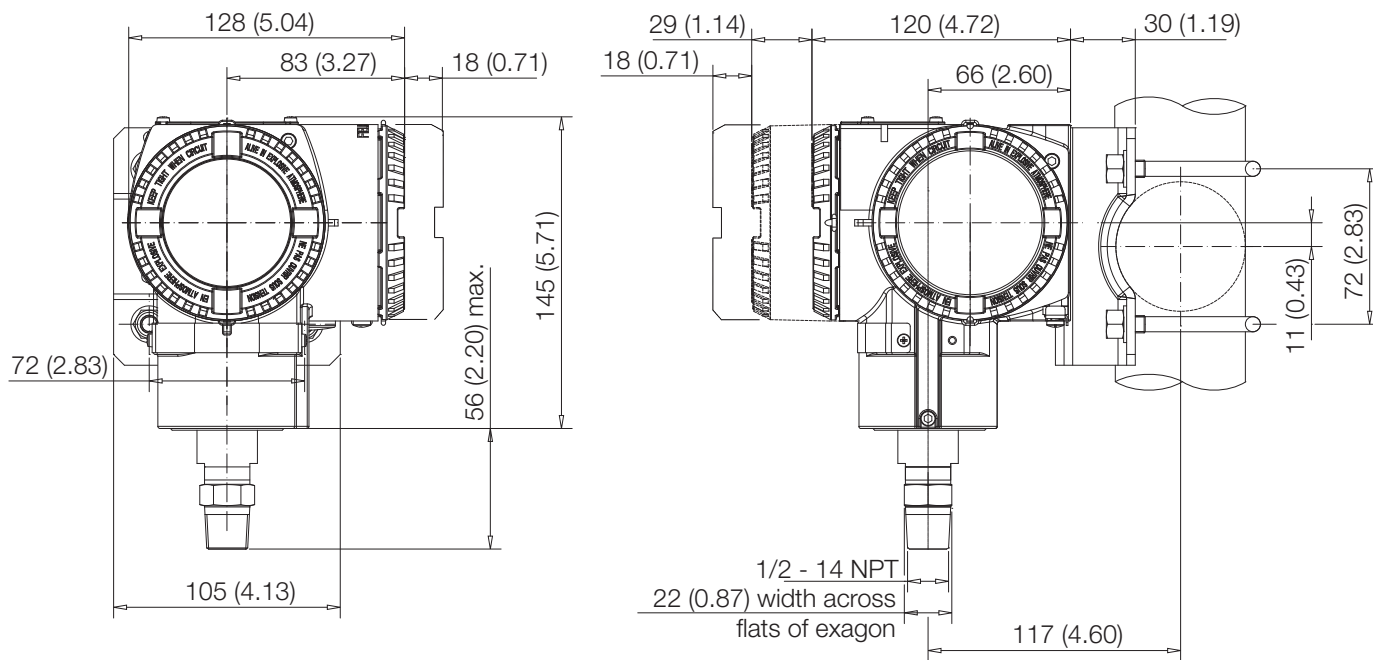
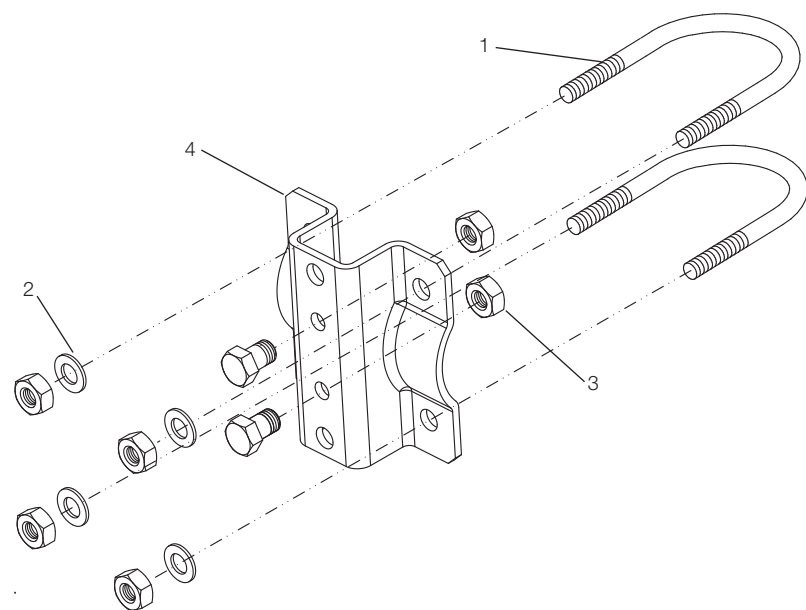


Figure 23: Model 266G or 266A P-Style transmitter with DIN housing installed on a 2" pipe with optional bracket (B7 Stainless Steel 316L)

5.6.2 B7 DIN Housing bracket details



- 1 – U-bolt
- 2 – U-bolt fixing bolt and washer
- 3 – Transmitter fixing bolts
- 4 – B7 bracket

Figure 24: Pipe and wall mounting bracket kit (B7) for P style transmitter with DIN housing

5.7 Transmitter housing rotation

To improve field access to the wiring or the visibility of the optional LCD meter, the transmitter housing may be rotated through 360° and fixed in any position. A stop prevents the housing from being turned too far. In order to proceed with housing rotation, the housing stop tang-screw has to be unscrewed by approximately 1 rotation (do not pull it out) and, once the desired position has been reached, retightened.

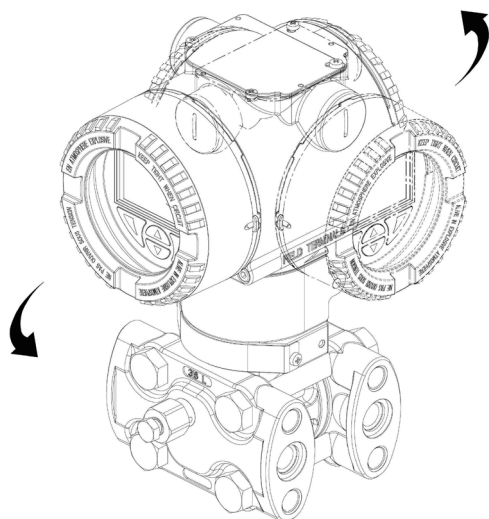


Figure 25: Housing rotation

5.8 Integral display rotation

In case an optional integral display meter is installed, it is possible to mount the display in four different positions rotated clockwise or counterclockwise with 90° steps. To rotate the LCD, simply open the windowed cover (Hazardous area prescriptions must be respected), pull-out the display housing from the communication board.. Reposition the LCD connector according to the new desired position. Push back the LCD module on the communication board. Be sure that the 4 plastic fixing locks are properly in place.

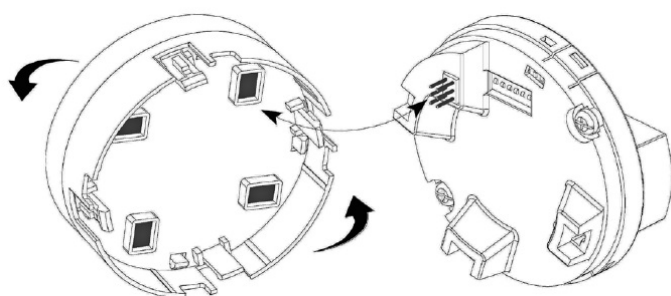


Figure 26: Display rotation

5.9 Display removal

To remove the LCD it is necessary to gently grab the entire component from the lower plastic as shown by the picture here below.

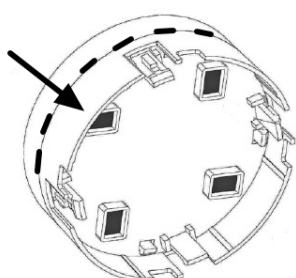


Figure 27: Grabbing area for display removal

In case of LS display the removal procedure requires a specific grabbing tool included within spare units, codified with DR3071/DR3072

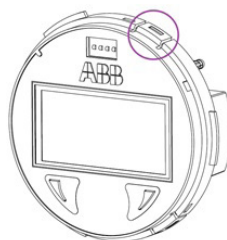


Figure 28: Grabbing area for LS display removal

5.10 Impulse piping connection for standard instruments

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

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

Caution. Process leaks may cause harm or result in death. Install and tighten process connectors and all accessories (including manifolds) before applying pressure. In case of toxic or otherwise dangerous process fluid, take any precautions as recommended in the relevant Material Safety Data Sheet when draining or venting. Use only a 12 mm (15/32") hexagonal spanner to tighten the bracket bolts.

5.11 Process connections considerations

266 differential pressure transmitter process connections on the transmitter flange are 1/4 - 18 NPT, with a centers distance of 54mm (2.13in) between the connections. The process connections on the transmitter flange are on centers to allow direct mounting to a three-valve or five-valve manifold.

Flange adapter unions with 1/2 - 14 NPT connections are available as an option. Rotate one or both of the flange adapters to attain connection centers of 51mm (2.01in), 54mm (2.13in) or 57mm (2.24in).

To install adapters, perform the following procedure:

1. Position the adapters with the O-ring in place.
2. Bolt the adapters to the transmitter using the bolts supplied.
3. Tighten the bolts to a torque value of 25Nm (stainless steel bolts) or 15Nm (for Stainless steel NACE bolts).

Deviations for models 266Mxx, 266Rxx and for PTFE O-rings: pretightening hand-tight. Pretightening to 10 Nm. Final tightening to 50 Nm.

For model 266PSx, 266VSx and 266RSx, it is only possible to have one adapter, with low pressure side flange without process connection and drain/vent valve.

For high static model (266DSH.x.H) tighten the bolts to a torque value of 40 Nm (regardless of the material of the bolts used). In case of PTFE O-rings, pretightening to 10Nm and final tightening to 50 Nm.

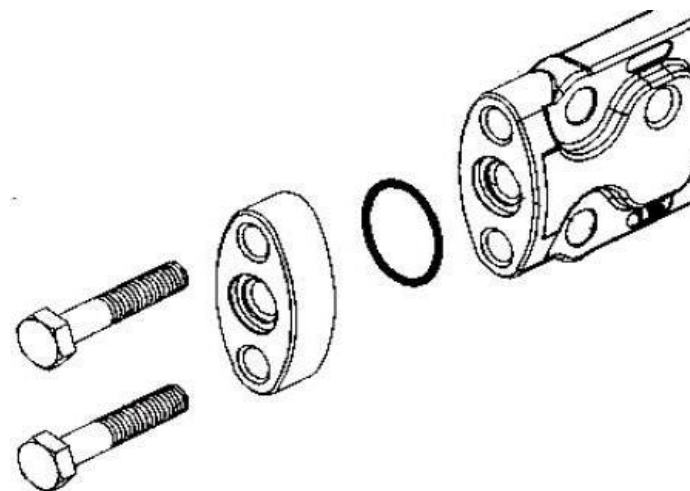


Figure 29: Adapter

Important. For 266MST with MWP 60MPa/600bar/8700psi (order-code A) the maximum allowable pressure for directly flanged-on shut-off devices (manifolds) and other directly flanged elements is limited to 41,3MPa (413 bar/5988,5 psi).

5.12 Kynar inserts connection

When connecting Pressure transmitters equipped with kynar inserts tighten the bolts to 15 Nm max.

5.13 Screw torques for models 266MSx and 266RSx with Kynar inserts

The following procedures apply to process flange screws and nuts:

Pretightening to 2 Nm (working crosswise).

Pretightening to 10 Nm (working crosswise) and then tightening by a tightening angle of 180°, working in two stages of 90° for each screw, and working crosswise.



Figure 30: Kynar insert

5.14 Installation recommendations

Impulse piping configuration depends on the specific measurement application.

5.14.1 Steam (condensable vapor) or clean liquids flow measurement

- Place taps to the side of the line.
- Mount beside or below the taps.
- Mount the drain/vent valve upward.
- In case of steam application fill the vertical section of the connecting lines with a compatible fluid through the filling tees.

The process fluid must enter the transmitter primary:

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

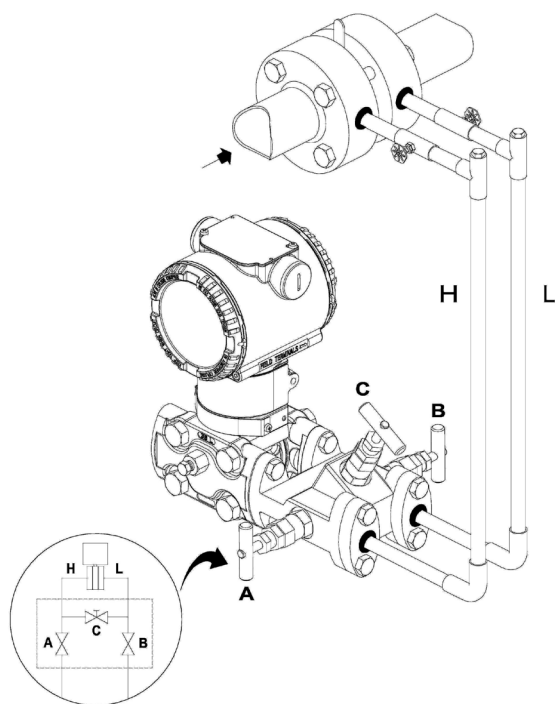


Figure 31: Steam or clean liquid flow measurement (transmitter and manifold)

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

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

The process fluid must enter the transmitter primary:

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

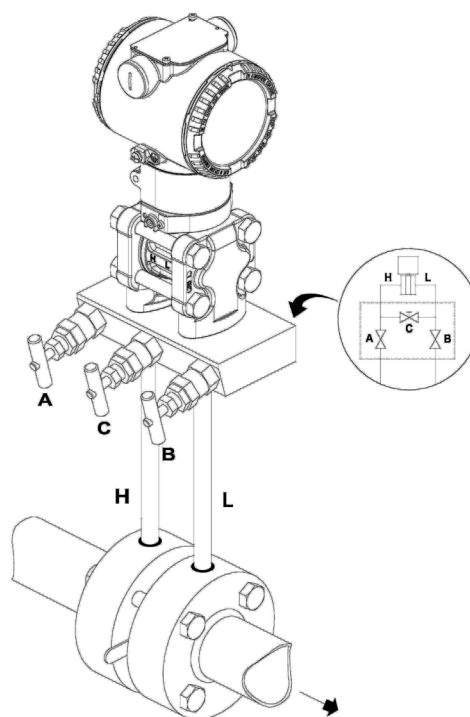


Figure 32: Gas or liquid flow measurement (transmitter and manifold)

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

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

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

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

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

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

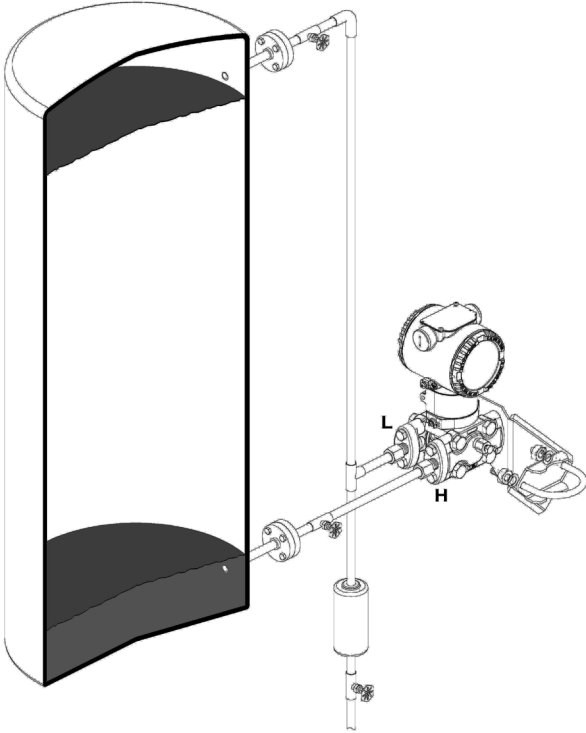


Figure 33: Level measurement on closed tank with dry leg

5.14.4 Liquid level measurement with closed tanks and condensable fluids (wet leg)

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the + (H) side of the transmitter to the bottom of the tank.
- Connect the - (L) side of the transmitter to the upper part of the tank.
- Fill the vertical section of the connecting line to the upper part of the tank with a compatible liquid through the dedicated filling tee.

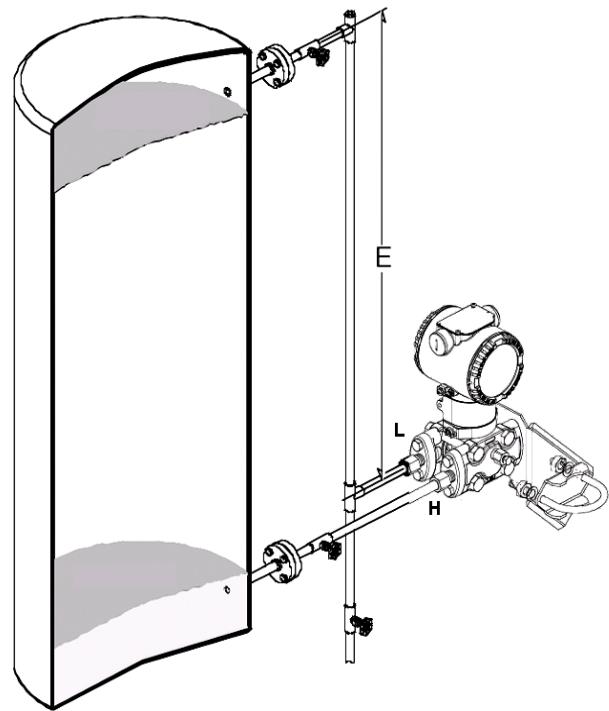


Figure 34: Level measurement on closed tank with wet leg

5.14.5 Liquid level measurement with open tanks

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

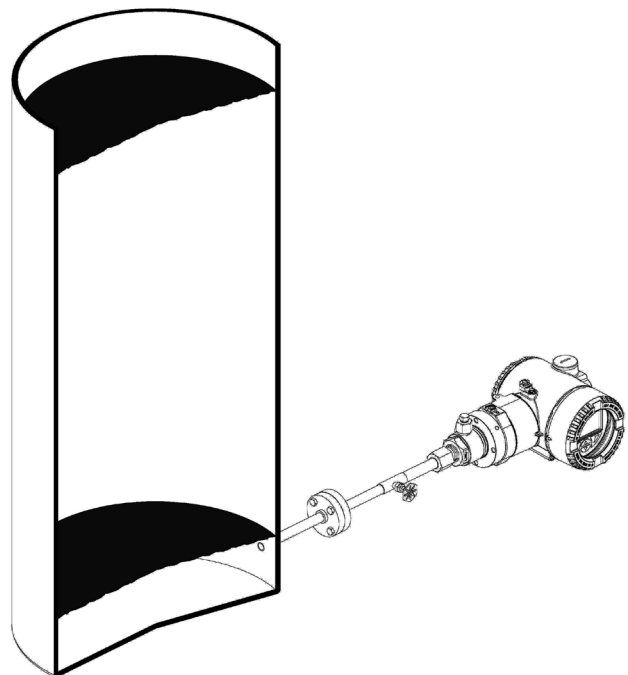


Figure 35: Level measurement on open tank with P style transmitter

5.14.6 Pressure or absolute pressure measurement of a tank

- Place the taps in the upper part of the tank.
- Mount the transmitter above the elevation of the process tap (both pressure and differential pressure transmitter can be used).
- Connect the transmitter to the tank.

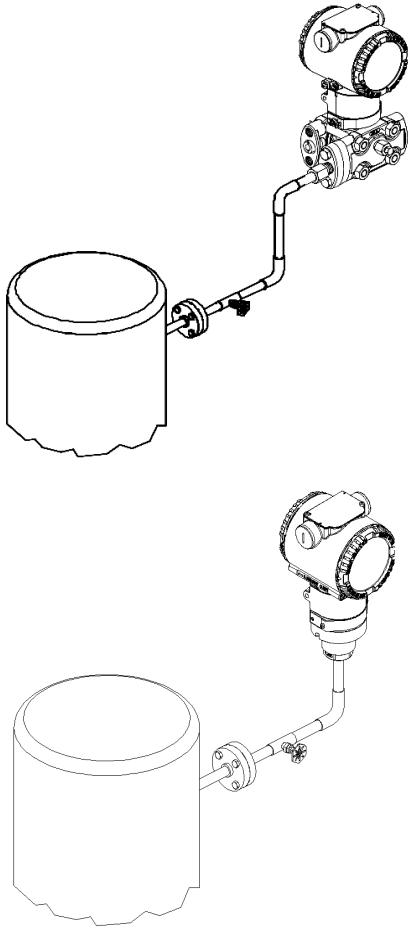


Figure 36: Gauge or absolute pressure measurement on a tank

5.14.7 Pressure or absolute pressure measurement of a liquid in a pipe

- Place the tap at the side of the line.
- Mount the transmitter (both pressure and differential pressure transmitters) beside or below the tap for clean fluids, above the tap for dirty fluids.
- Connect the + (H) side of the transmitter to the pipe.

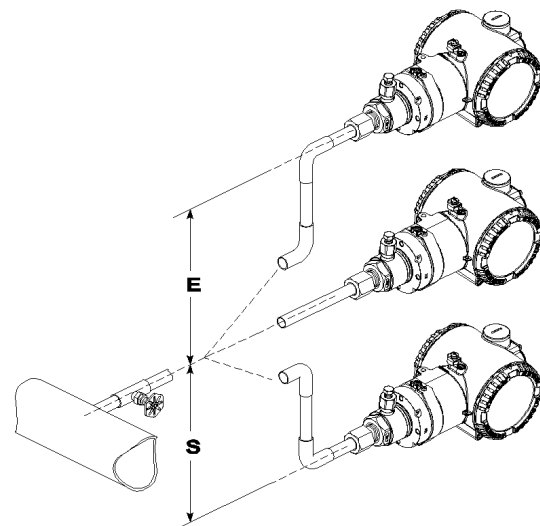
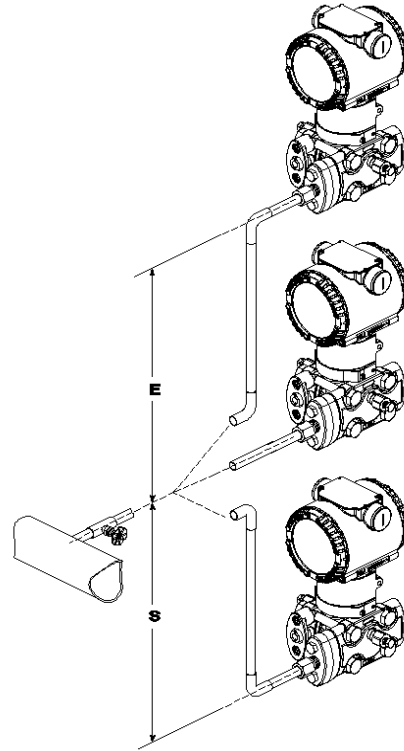


Figure 37: Gauge or absolute pressure measurement of a liquid in a pipe. (E: elevation S: suppression)

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

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

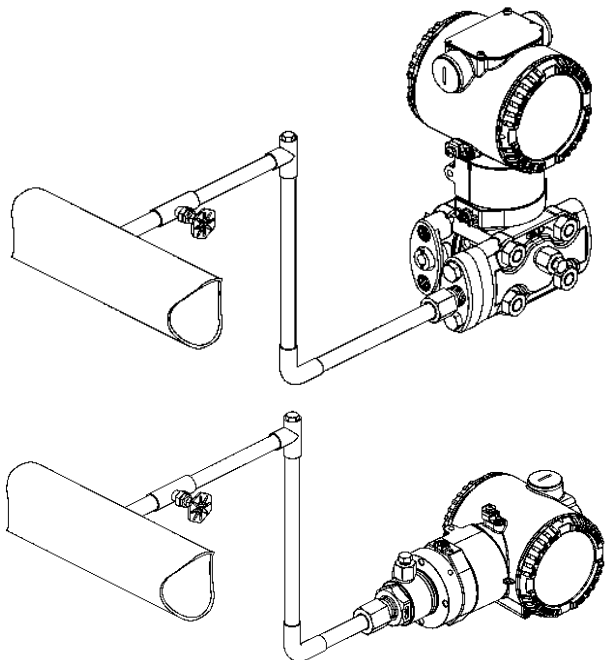


Figure 38: Gauge or absolute pressure measurement of condensable vapor

5.14.9 Pressure or absolute pressure measurement of a gas in a pipe

- Place the tap at the top or side of the line.
- Mount the transmitter (both pressure and differential pressure transmitter) beside or above the tap.
- Connect the transmitter to the pipe.

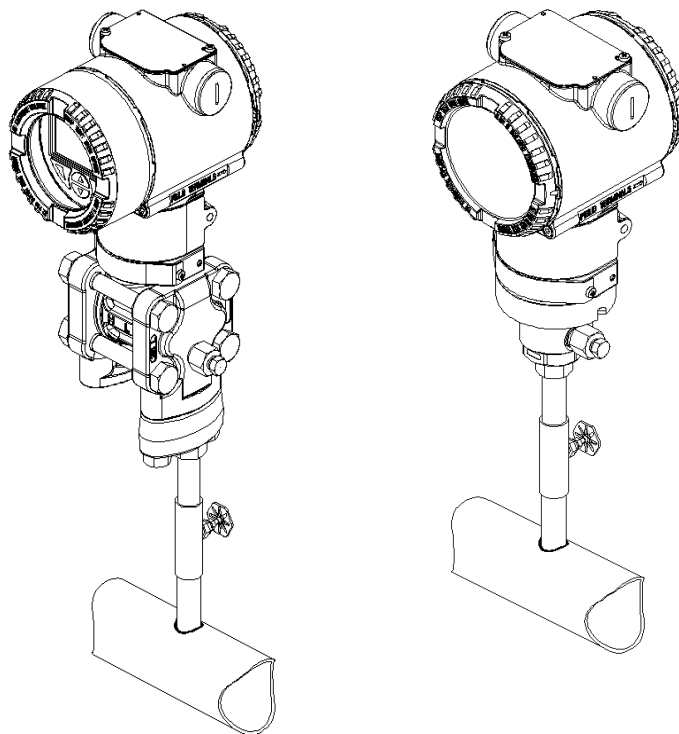


Figure 39: Gauge or absolute pressure measurement of gas in a pipe

6 Transmitter wiring

Warning - General risks. Observe the applicable regulations governing electrical installation. Connections must only be established in a dead-voltage state. Since the transmitter has no switch-off elements, overvoltage protection devices, lightning protection, and voltage separation capacity must be provided at the plant (overvoltage/lightning protection is optional). Check that the existing operating voltage corresponds to the voltage indicated on the name plate. The same lines are used for both the power supply and output signal. In case the surge protection option is present and the transmitter is installed in a Hazardous area, the transmitter has to be power supplied from a voltage source isolated from mains (galvanic separation). Furthermore the potential equalization for the entire powering cable must be guaranteed since the intrinsic safety circuit of the transmitter is grounded.

Electrical shock can result in death or serious injury. Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Do NOT make electrical connections unless the electrical code designation stamped on the transmitter data plate agrees with the classification of the area in which the transmitter is to be installed. Failure to comply with this warning can result in fire or explosion.

6.1 Cable connection

Depending on the design supplied, the electrical connection is established via a cable entry, M20 x 1.5 or 1/2-14 NPT thread. Connectors related to different protocols are available on request. The screw terminals are suitable for wire cross sections of up to 2.5 mm² (AWG 14).

Important. With Category 3 transmitters for use in "Zone 2", a qualified cable gland for this type of protection must be installed by the customer (see the section "Hazardous Area Consideration"). A threads is located in the electronics housing for this purpose. For transmitters with "Flameproof enclosure" (Ex d) type of protection, the housing cover must be secured using the locking screw. The screw plug that may have been supplied with the transmitter must be sealed at the plant using Molykote DX.

The installer assumes responsibility for any other type of sealing medium used. At this point, we wish to draw your attention to the fact that increased force will be required to unscrew the housing cover after an interval of several weeks.

This is not caused by the threads, but instead is due solely to the type of gasket.

6.2 Analogue output (HART) transmitter wiring

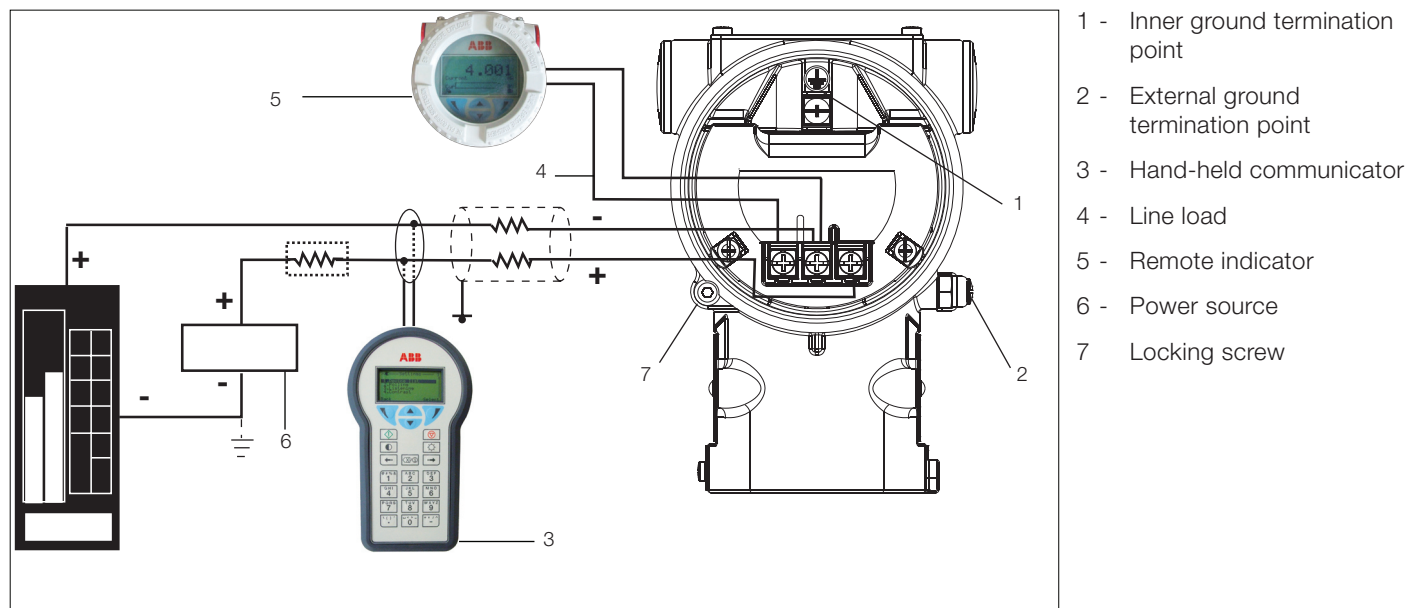


Figure 40: HART transmitter connection scheme

HART hand-held communicator may be connected at any wiring termination point in the loop, providing the minimum resistance is 250 ohm. If this is less than 250 ohm, additional resistance should be added to allow communications. The handheld terminal is connected between the resistor and transmitter, not between the resistor and power source.

6.3 Supply requirement

For signal/power connection use twisted, stranded pairs of wiring no 18 to 22 AWG / 0.8 to 0.35mm² ø 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.

The 4 to 20 mA dc output signal and the dc power supply to the transmitter are carried from the same pairs of wires.

The transmitter operates from 10.5 to 42 V DC with no load and is protected against reverse polarity connection

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:

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

Where:

L = Line length in meters

R = Total resistance in Ω (ohms)

C = Line capacitance in pF/m

C_f = 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.

6.4 Wiring procedure

Follow these steps to wire the transmitter:

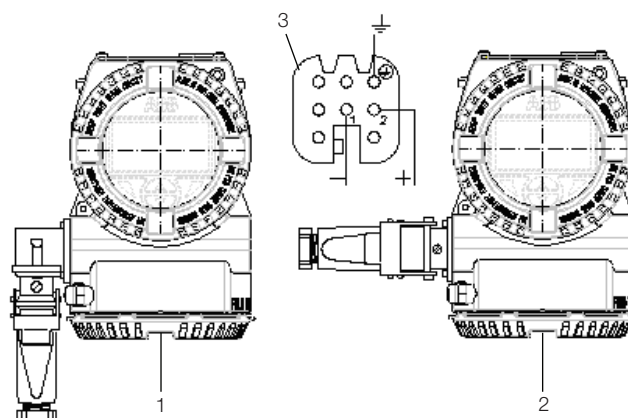
- Remove the temporary plastic cap from one of the two electrical connection ports located at both sides in the upper part of the transmitter housing.
- These connection ports may have a 1/2 inch internal NPT-F or M20 threads. Various adaptors and bushings can be fitted to these threads to comply with plant wiring (conduit) standards.
- Remove the housing cover of the “field terminals” side. See the indication on housing. In an Explosion-Proof/Flame-Proof installation, do not remove the transmitter covers when power is applied to the unit.
- Run the cable through the cable gland and the open port.
- Connect the positive lead to the + terminal, and the negative lead to the – terminal.
- Plug and seal the electrical ports. Make sure that when the installation has been completed, the electrical ports are properly sealed against entry of rain and/or corrosive vapors and gases.

Warning - General risks. Cable, cable gland and unused port plug must be in accordance with the intended type of protection (e.g. intrinsically safe, explosion proof, etc.) and degree of protection (e.g. IP6x according to IEC EN 60529 or NEMA 4x). See also the addendum for “EX SAFETY” ASPECTS AND “IP” PROTECTION. In particular, for explosion proof installation, remove the red temporary plastic cap and plug the unused opening with a plug certified for explosion containment.

- If applicable, install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.
- Before reassembling covers, the integrity of the cover O-rings must be checked. If damaged they must be replaced with an original spare part. A slight grease layer should be applied for proper lubrication.
- Put back the housing cover, turn it to seat O-ring into the housing and then continue to hand tighten until the cover contacts the housing metal-to-metal. In Ex-d (Explosion Proof) installation, lock the cover rotation by turning the set nut (use the 2mm Allen key supplied with the instrument).

6.5 Electrical connection via connectors

6.5.1 Harting connector (HART output versions) on DIN housing



- 1 - DIN Housing with Harting angle connector
- 2 - DIN Housing with Harting straight connector
- 3 - Harting Han 8D socket insert for mating plug supplied (view of sockets)

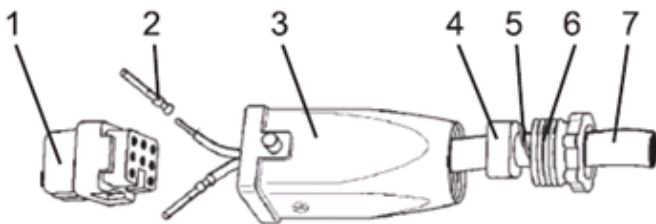
Figure 41: Harting HAN straight and angle connection connectors

6.5.2 Assembling and connecting the socket connector

The socket connector for connecting the cable is supplied unassembled as an accessory for the transmitter.

- The contacts (2) are crimped or soldered onto the cable ends (wire cross section of 0.75 ... 1 mm² (AWG 18 ... AWG 17)), from which approx. 1.5 ... 2 cm (0.59 ... 0.79 inch) of the sleeve and approx. 8 mm (0.32 inch) of the insulation have been stripped; they are then inserted into the socket (1) from the rear.
- Slide the set screw (6), clamping ring (5), gasket (4), and housing (3) onto the cable in the order indicated before assembly (you may have to adjust the gasket (4) to fit the cable diameter).

Important. Before you press the contacts completely into the socket, check the connection points again. Incorrectly inserted contacts can be removed by using a press-out tool (part no.: 0949 813), or a standard ballpoint pen as a makeshift tool. Please observe the connection diagram included with the plug.



- 1 - Socket
- 2 - Contact
- 3 - Housing
- 4 - Gasket (can be cut)
- 5 - Clamping ring
- 6 - PG 11 set screw
- 7 - Cable (diameter 5 - 11 mm or 0.20 - 0.43 inch)

Figure 42: Socket connector components

6.6 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.

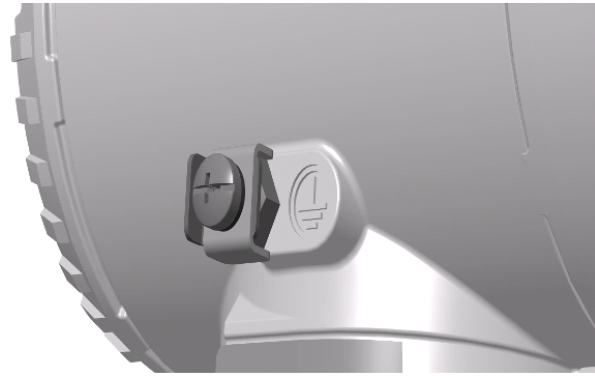


Figure 43: Ground connection on transmitter housing

6.7 Surge protector equipped terminal block (optional)

The pressure transmitter housing with surge protector (code S2) inside the terminal board must be connected using the grounding terminal (PE), by means of a short connection with the equipotential bonding.

Equipotential bonding conductor must to have 4.00mm² of maximum cross-section.

Important. Test voltage withstand capability can no longer be ensured when this protective circuit is used.

6.8 Common mode voltages

266 pressure transmitter operates within the specified levels of accuracy for common-mode voltages of up to 250V between lines and housing grounded.

7 Commissioning

Once the transmitter has been installed, it is put into operation by switching on the operating voltage.

Check the following before switching on the operating voltage:

- Process connections
- Electrical connection
- The impulse line/s and the measuring chamber of the measuring equipment must be completely filled with the measuring medium.

The transmitter can then be put into operation. To do this, the shut-off valves must be actuated in the following sequence (in the default setting, all valves are closed).

(Differential models) 266Dxx or 266Mxx

- Open the shut-off valves on the pressure tap connection.
- Open the pressure equalization valve of the manifold.
- Open the positive shut-off valve (on the manifold).
- Open the negative shut-off valve (on the manifold).
- Close the pressure equalization valve.

To put the transmitter out of operation, carry out the steps in reverse order.

(Gauge & Absolute models) 266Gxx, 266Axx, 266Hxx, 266Nxx, 266Pxx, 266Vxx, 266Rxx

- Open the shut-off valve on the pressure tap connection.
- Open the positive shut-off valve.

To put the transmitter out of operation, carry out the steps in reverse order.

Important. For the absolute pressure transmitters model 266ASx, 266NSx, 266RSx or 266VSx with sensor range C, F or G, please be aware that the measuring equipment will have been overloaded by the atmospheric pressure due to the long periods of transport and storage involved.

For this reason, you will need to allow a starting time of approx. 30 minutes for 266Vxx, 266Rxx and 266Nxx models and approx. 3 hours for 266Axx models after commissioning, until the sensor has stabilized to such an extent that the specified accuracy can be maintained.

If, when using “intrinsically safe” transmitters, an ammeter is connected to the output circuit or a modem is connected in parallel while there is a risk of explosion, the sums of the capacitances and inductances of all circuits, including the transmitter (see EC-type-examination certificate) must be equal to or less than the permissible capacitances and inductances of the intrinsically safe signal circuit (see EC-type-examination certificate for the supply unit).

Only passive or explosion-proof devices or indicators may be connected. If the output signal stabilizes only slowly, it is likely that a large damping time constant has been set on the transmitter.

7.1 Analogue and HART Communication models

If the pressure applied falls within the values indicated on the name plate, the output current will be between 4 and 20 mA. If the pressure applied falls outside the set range, the output current will be between 3.5 mA and 4 mA if the range is undershot or between 20 mA and 22.5 mA if the range is overshot (depending on the respective configuration).

7.2 Standard setting for normal operation 3.8 mA / 20.5 mA

In order to prevent errors in flow rate measurements (266Dxx and 266Mxx) in the lower range, it is possible to set a “cut off point” and/or a “lin./sq. root transition point” via the optional LCD integral displays with keypad or via the graphical user interface (DTM).

Unless otherwise specified, the “lin./sq. root transition point” is set to 5% and the “cutoff” to 6% of the flow rate end value by the manufacturer; A current that is < 4 mA or > 20 mA may also indicate that the microprocessor has detected an internal error. In this case the alarm output can be configured both via the local LCD with keypad, via an external Hart hand held terminal (ABB DHH805) or via a DTM based configuration tool (Asset Vision).

7.3 Standard setting for error detection (alarm) 3.7 mA / 21 mA

The graphical user interface (DTM) or the LCD integral display (if installed) can be used to diagnose the error.

Important. A brief interruption in the power supply results in initialization of the electronics (program restarts).

Important. Alarm current

- Lower limit: 3.6 mA (configurable from 3.6 to 4 mA)
- Upper limit: 21 mA (configurable from 20 to 23 mA, limited to 22 mA for HART Safety; apply for electronics release 7.1.15 or later)

Factory setting: high alarm current (21.0 mA)

7.4 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.

7.4.1 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 3 at chapter 4) by releasing the holding screw lying on the bottom left corner.
- Use a suitable screwdriver to press the switch down fully.
- Then turn the switch clockwise by 90°.

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

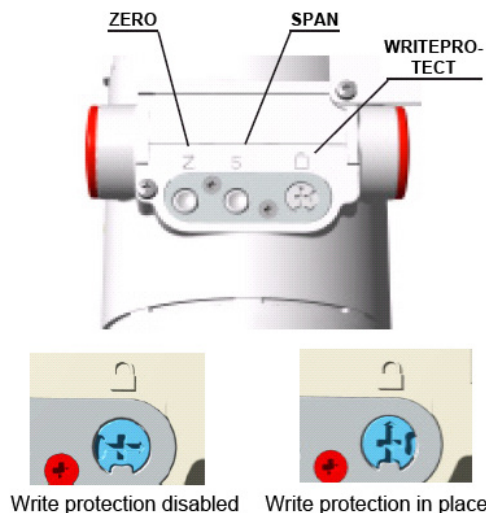


Figure 44: Write-protection pushbutton

7.4.2 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.

7.5 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.

7.6 Set lower range value

- Apply the lower range value pressure (4 mA) 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) or the “Zero” command on the connection board of the pressure transmitter for few seconds. The output signal will be set to 4 mA. The span will remain unchanged.

Important. Setting the lower range value by using the push buttons is possible if the write protection is not enabled.

7.7 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).

Important. The procedure described above does not affect the physical pressure shown; it only corrects the analog output signal. For this reason, the analog output signal may differ from the physical pressure (PV Value) shown on the digital display or the communication tool. To avoid this discrepancy, correct the zero position shift (zero shift) via the PV-BIAS/OFF-SET functionality.

7.8 Installing/Removing the external push buttons (option R1)

- Loosen the screws that fix the nameplate plate and slide the plate to gain access to the local adjustments.
- Loosen the push buttons assembly screws (1) holding down the plastic element which is spring loaded.
- Remove the gasket (3) which is positioned below the pushbutton plastic cover (2).
- The three push buttons (4) and the relevant springs (5) can now be removed from their seat.

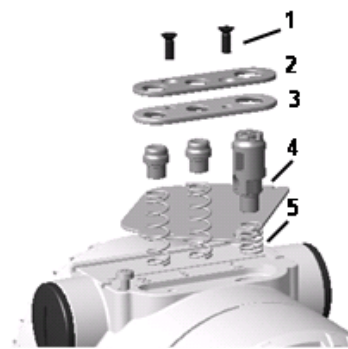


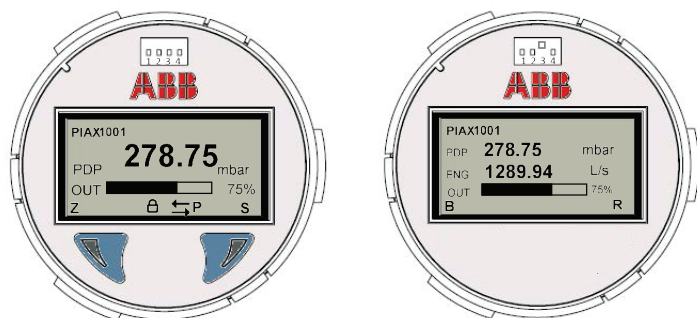
Figure 45: External pushbutton assembly components

Important. In case of electronics upgrade from Standard to Advanced HART (refer to chapter 10.6), 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.

7.9 Local display

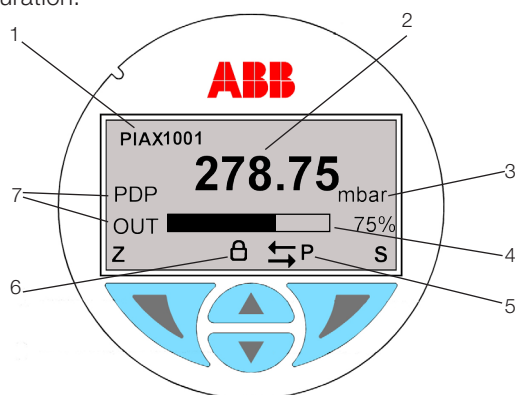
According to selected HART functionality and LCD display option, 266 pressure transmitter is equipped with different display type. Hereafter the possible variants.

- For HART transmitters with standard functionality (output code 7) two different integrated LCD displays are available, as shown in the following figures. On the left is the version without selecting option "R1" which feature on-board Zero and Span buttons. On the right is the version if selecting option "R1" without on-board buttons which are functionally replaced by the Z and S push buttons located under the nameplate (with dip switch 3 up, Zero and Span buttons act as set PV Bias and Reset PV Bias respectively, for both version).



For HART transmitters with advanced HART functionality or Safety HART certified to IEC 61508 (output code 1 or 8) the LCD can be with integrated keypad or with TTG (Through-The-Glass) activated keypad, having same appearance as follows and with buttons used for menu-controlled configuration.

All displays feature a LCD dot matrix for clear visualizations. Here after a possible view according to selected transmitter configuration.



The HART short tag (1) is shown in the upper left corner by maximum 8 characters.

The value (2) is displayed with 5 digits, sign and decimal point, for one line visualization or with 8 digits, sign and decimal point, for two lines visualization.

The engineering unit (3) can be anyone of HART list.

A bargraph (4) also provide a different format of indication with relevant percentage for a selectable variable.

The polarity symbol (5) is displayed when high/low pressure sides of a differential pressure transmitter are configured to work as "reverse" action, via HART command. Once the transmitter is connected to the process, it is possible to change via software the polarity of the process connection instead than mechanically reverse the impulse lines.

The lock symbol (6) appears when the write protection is enabled or either the local operation has been disabled or the device lock has been activated via relevant HART commands.

The ID of variables (7) is a kind of acronym which identifies the variable currently displayed, with following possibilities.

ID	Description
PDP	Pressure value before transfer function/linearization
ENG	Measured value after transfer function (scaled output)
OUT	Analog current value in mA
PV%	Analog output in percentage of calibrated range
TZ1	Counter of totalizer 1
TZ2	Counter of totalizer 2
BCH	Batch counter
ST	Sensor teperature
SP	Static Pressure
HMI	Measured value after dispaly scaling (HMI transfer function and scaling)

7.10 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) and shall be removed as per instructions listed at paragraph 5.9
- LS display installation shall be performed carefully plugging-in transducer 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.

7.11 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.

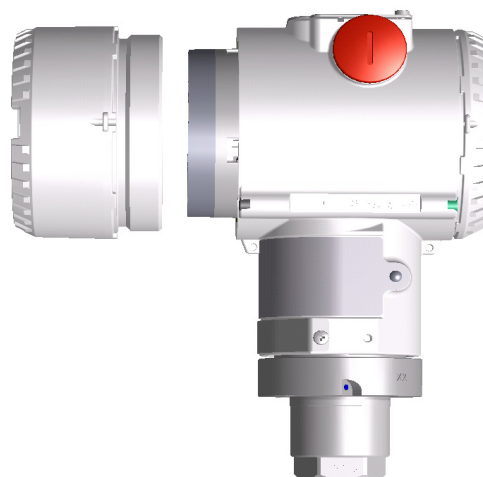


Figure 46: Windowed front cover and LCD display

8 Operation

8.1 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.

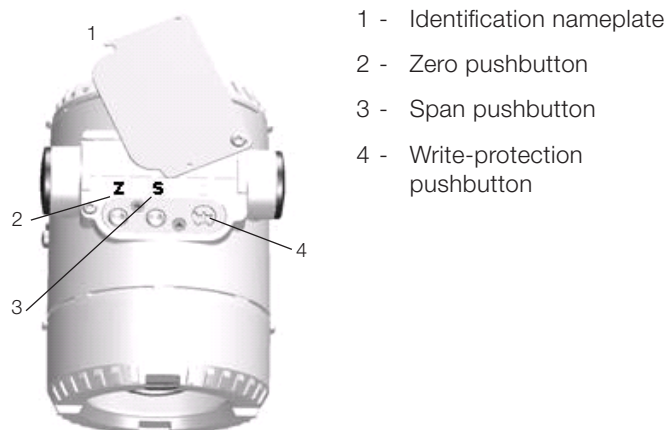


Figure 47: Pushbutton functionalities

8.2 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.

8.3 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).

8.4 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:

The first pressure value (e.g., 0 mbar) is always assigned to the 4 mA signal (or 0%), while the second pressure value (e.g., 400 mbar) is always assigned to the 20 mA signal (or 100%). To change the transmitter ranging apply the pressure for the “lower range value” and “upper range value” to the measuring equipment. Make sure that the measuring limits are not exceeded.

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.

Important. In case of the 266 transmitter for absolute pressure (266Vxx, 266Rxx, 266Axx and 266Nxx) with a measuring range less than or equal 650 mbar abs., please be aware that the measuring equipment will have been overloaded by the atmospheric pressure due to the long periods of transport and storage involved. For this reason, you will need to allow a starting time of approx. 30 minutes for 266Vxx, 266Rxx and 266Nxx models and 3 hours for 266Axx models after commissioning, until the sensor has stabilized to such an extent that the specified accuracy can be maintained.

8.5 LRV and URV configuration (4 ... 20 mA ranging)

- 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.

Important. This configuration procedure only changes the 4 ... 20 mA current signal; it does not affect the physical process pressure (PV value) also shown on the digital display or user interface. To avoid potential discrepancies, you can use follow the procedure below. After performing a correction, you must check the device configuration.

8.6 HMI as feedback of the local push button operations

As consequence of the operations described in the section 8.5, 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
! Oper Done	The push button operation has been successfully executed
! Proc Too Low	The Pressure measured in input is too low and not acceptable for the requested operation
! Proc Too High	The Pressure measured in input is too high and not acceptable for the requested operation
! New URV Error	The Zero (Z) operation cannot be accepted because the URV would be shifted outside the Upper Sensor limit
! Span Error	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
! Oper Disabled	The push button operation has been refused because the Write Protection is enabled.
! LRV Too Low	New LRV is too low and not acceptable for the requested operation
LRV Too High	New LRV is too high low and not acceptable for the requested operation
URV Too Low	New URV is too low and not acceptable for the requested operation
URV Too High	New URV is too high and not acceptable for the requested operation
Armed	Device is armed to accept HART command 73 "Find Device". This message can be triggered only during the device wakeup operation

8.7 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 output current to 4 mA, 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, which become respectively associated to B and R letters in the lower corners, as shown in figure 48b.

Important. For Standard HART version, after releasing Z and S buttons (on LCD or external) during range values configuration or PV to zero bias/Reset PV bias setting, the transmitter displays a message to confirm or abort the operation, showing Yes and No in the bottom corners of the display. Proceed accordingly by acting on the corresponding button: Z for NO and S for YES.

8.8 Hardware settings

8.8.1 Advanced HART

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

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

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

Switch 4 and 5 are for Fail Low/Fail High selection.

Switch 6: not used.

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

Replace mode (switches 1 and 2)

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

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

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

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

AFTER ANY REPLACE OPERATION MOVE DOWN IN "0" POSITION THE RELEVANT SWITCHES.

Push buttons mode (switch 3)

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

Fail mode (switch 4 and 5)

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

Dip switch 5:

on "0" position the output is driven upscale (High alarm 21mA)

on "1" position the output is driven downscale (Low alarm 3.6mA)

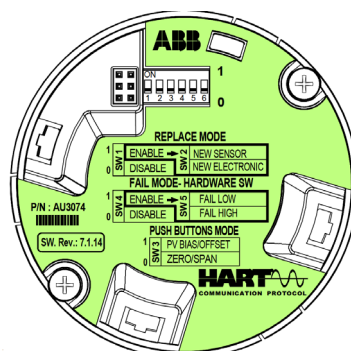


Figure 48a: Dip switches position on Advanced HART communication board

8.8.2 Standard HART

Standard HART protocol is available on 266Dxx, 266Hxx (with the exception of ranges V and Z), 266Nxx. Standard HART version of 266 features 4 dip switches on the integrated LCD display.

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

Switch 3 identifies the external push buttons functionalities: Zero/Span adjustments or PV Bias-Offset / PV Bias Reset (Z and S letters in the lower corners of display change respectively to B and R).

Switch 4 allows user to enable the write protection.

Dip switch functions are as follows:

Fail mode (switch 1 and 2)

By moving dip switch 1 in up position, operator can enable hardware failure direction functionality of dip switch 2. Hardware failure direction selection cannot be modified through LCD, HART Handheld terminals or DTM.

If the user wants to modify the factory-defined parameter for the fail safe output condition in case of transmitter failure, it is necessary to put dip switch 2 in up position. Consequently, the output will go Downscale. Here below fail safe values:

in down position the output is driven upscale (High alarm 21mA)

in up position the output is driven downscale (Low alarm 3.6mA)

Push buttons mode (switch 3)

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

Write lock (switch 4)

If the user wants to protect the configuration from unauthorized writing, dip switch 4 has to be moved up in up position. Dip switch 4 is unused when option R1 is selected for Standard HART version and the write protection is by external button.

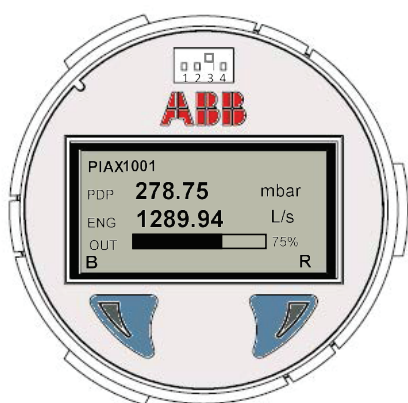


Figure 48a: Dip switches on integrated LCD display with on-board buttons and dip switch 3 “up”

Important. Integrated LCD display available for Standard HART version can feature the Zero and Span push buttons. If the Standard HART version is selected in association with option R1, the Zero, Span and Write Protect buttons are installed in the factory below instrument identification plate, as shown in figure 45.

8.9 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.

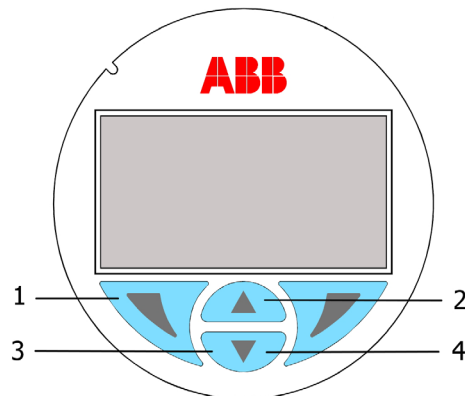


Figure 49: Display keypad of L1 and L5 LCD display options

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.

8.10 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.

8.11 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 calibrate 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.

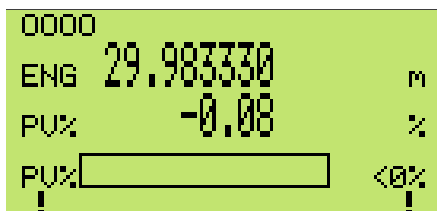
Important. Do not operate TTG display (L5 option) for 30 seconds after transmitter power-on. During this period of time, the transmitter is calibrating the capacitive switches.

8.12 Activation procedure for LCDs

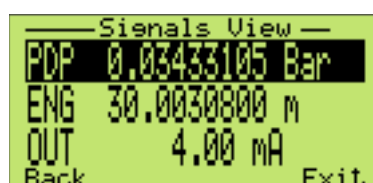
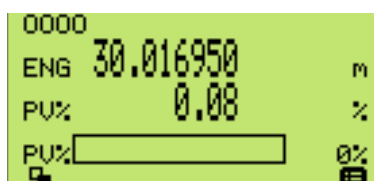
The LCD displays L1 and L5 selectable for Advanced HART and Safety HART versions features 4 push buttons (see figure 49) that allow the navigation through the various functions.

- 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.



For Standard HART version, to access to configuration menu press simultaneously the Z and S buttons, on-board of LS display or external under the nameplate, two icons will appear at the bottom corners of the display. 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.



8.13 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).

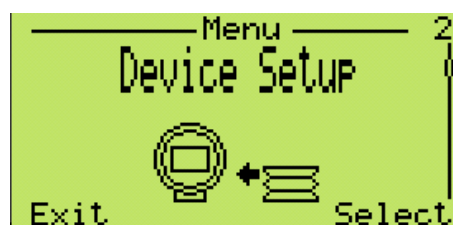
Important. After 30 seconds without action on on-board buttons or external Z/S pushbuttons, the Standard HART transmitter automatically exit the configuration menu.

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) ►.

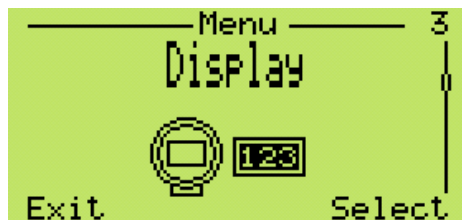
Follow the instruction on the screen to perform the configuration of the different parameters.



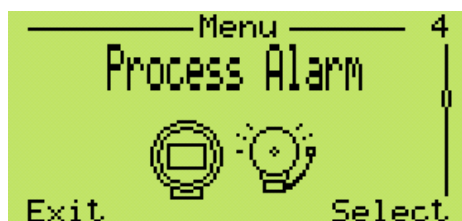
This menu allows the verification and the parameterization of the basic configuration of the 266 pressure transmitter. The menu driven structure will guide you to the choice of the interface language, the tag number configuration, the engineering units, the URV and LRV (Upper range value and lower range 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) 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.



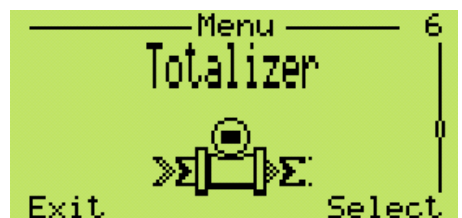
This menu allows the set-up of different functions relevant to the display itself. The menu driven structure will guide you through the choice of some functional aspects as the display language and contrast. Moreover, it is possible to choose in details what you want to see on the display: one or two 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 parameterization of the process alarm. The menu driven structure will guide you through the choice of the fail safe functions such as the saturation limits, the fail level (upscale or downscale) and the fails safe type which is set as software at the factory. Software fail safe type means that fail direction can be set via DD, DTM or display. If hardware is selected, the software settings are disabled and user has to use the dip switches on the electronic board.



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).



This menu allows the set-up of the on-board totalizer. To have the totalizer running, a flow unit must be selected in advance and then it must be placed in "run" status. Different modes can be selected:

Normal: standard totalization for the forward flow rate.

- Batch: this kind of setting can be used on totalizer 1 only. You need to set a pre-defined value. When totalization reaches that value, the totalizer will re-start from zero and the batch number increases by one.

- Forward/Reverse: totalizer 1 will monitor the forward flow, whereas totalizer 2 the reverse flow.
- Forward – Reverse: the value you will see on the display by applying this mode is the difference between forward and reverse flow rate.
- Forward + Reverse: the value you will see on the display by applying this mode is the sum of forward and reverse flow rate.

Another important setting is the conversion factor which is to be used if the totalized unit is not directly related to the scaled one (i.e. m³/h totalized in kg). Conversion factor is basically a multiplier.

User will be able to add/ change/delete the password as well as to reset all totalizers.



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).

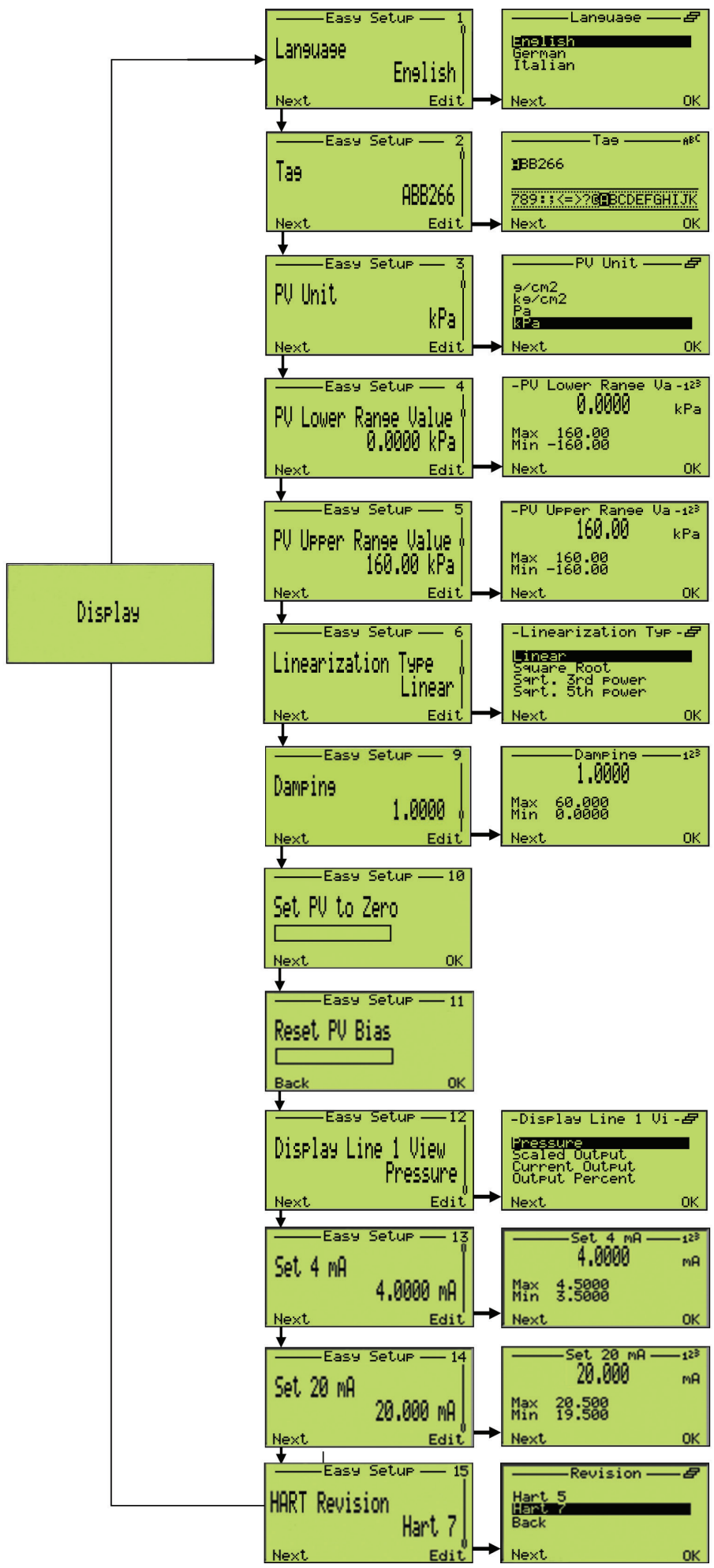


This menu gives you all information about the device. The menu driven structure will show you what is the sensor type, the hardware and software revisions, the high and low sensor limits as well as the minimum applicable span.

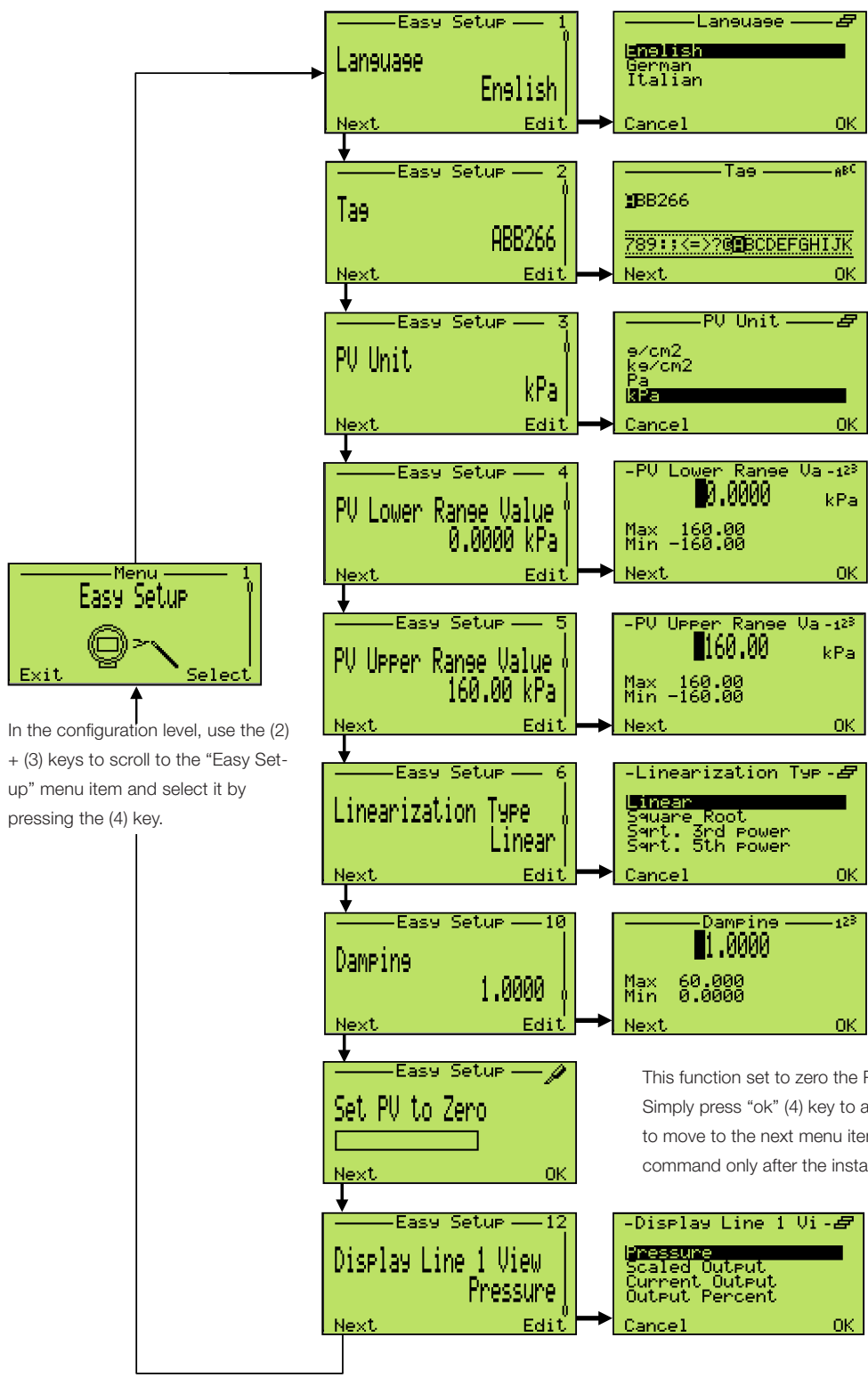


The last section of this structured and driven menu gives you the possibility of changing the communication tag and the MULTI-DROP mode with HART address numbers of the device. From software release rev. 7.2.1 it also allowed to select the HART revision between HART 5 and HART 7.

8.13.1 Easy Set-up -Standard HART version



8.13.2 Easy Set-up - Advanced HART and Safety HART versions



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.

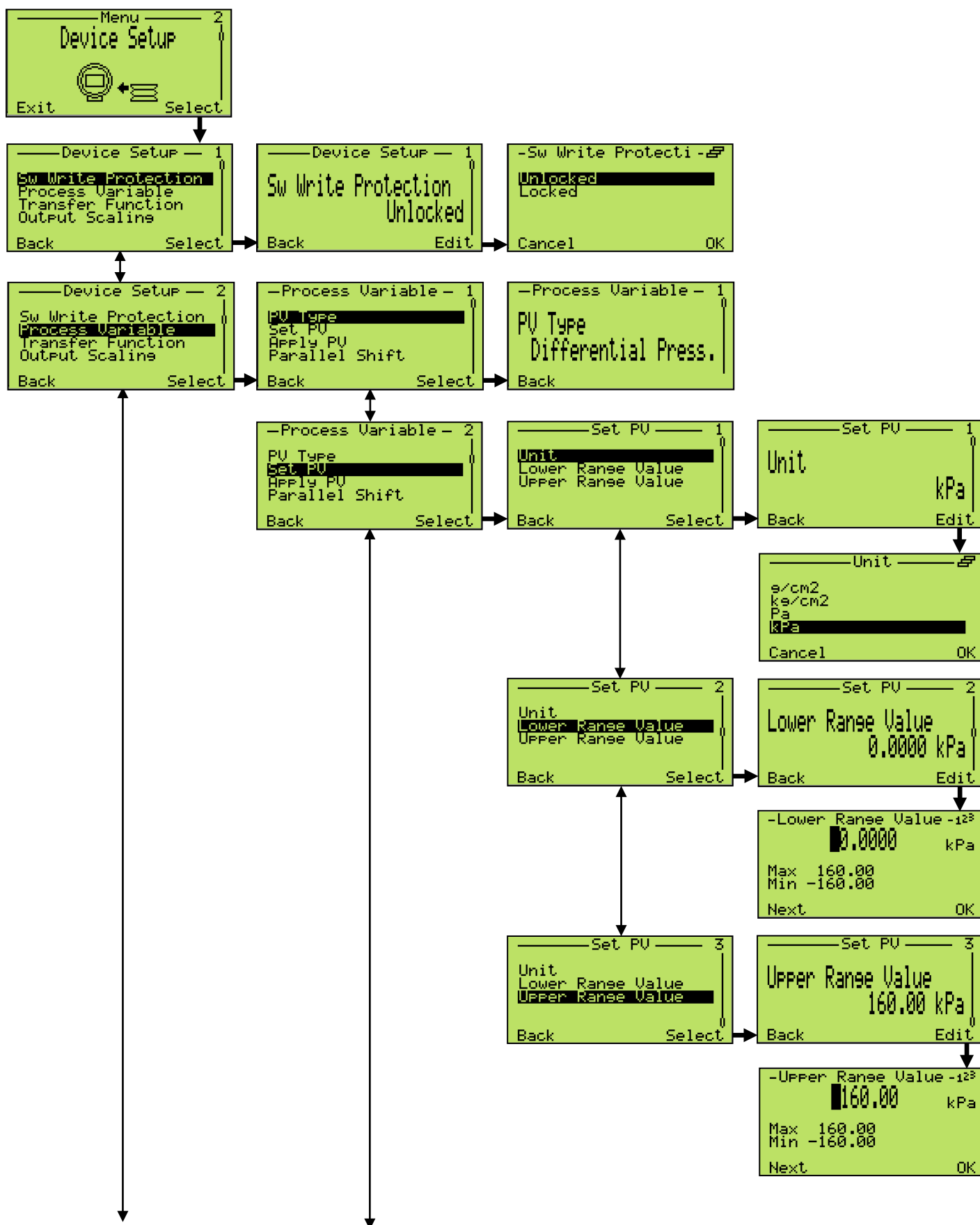
Press the (4) key and select the transfer function from the list with (2) + (3). After entering the settings, press the "ok" (1) key to move to the next menu item.

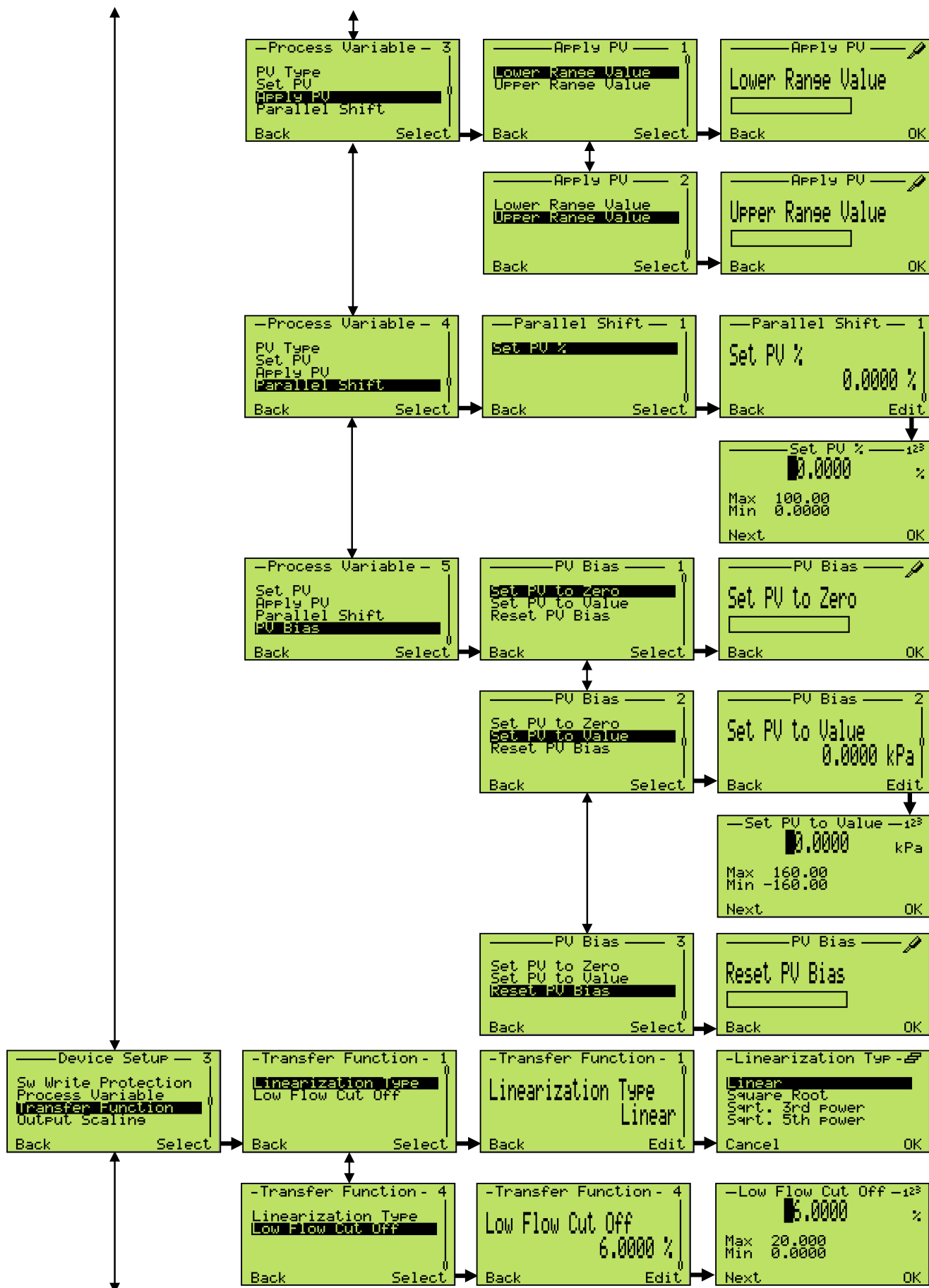
Press the (4) key and set the damping. After entering the settings, press the (1) key to move to the next menu item.

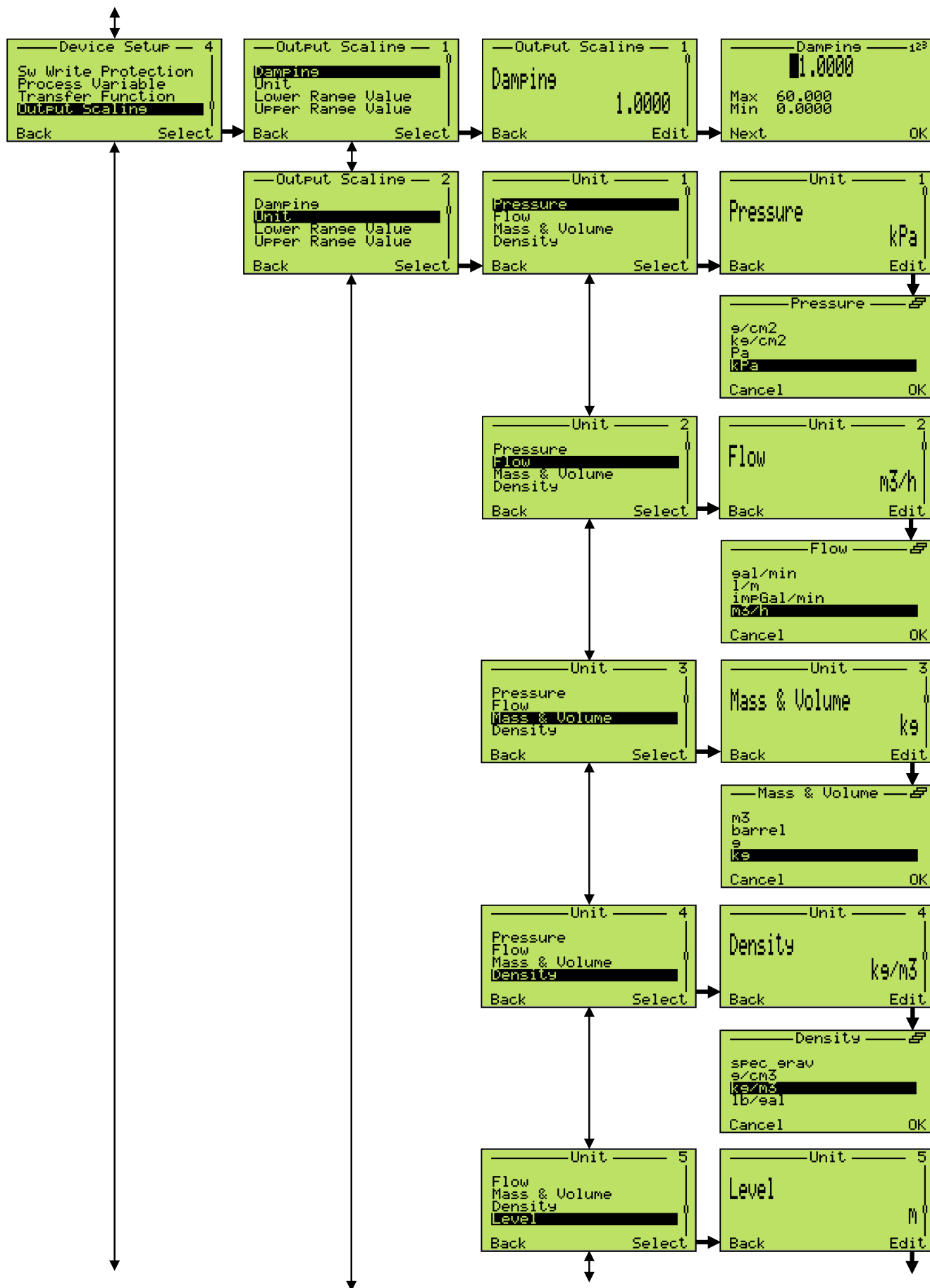
This function set to zero the PV value and to 4 mA the analogue output. Simply press "ok" (4) key to activate the PV to zero function. Press Next (1) key to move to the next menu item. ABB suggest user should perform this specific command only after the installation and configuration phases are complete

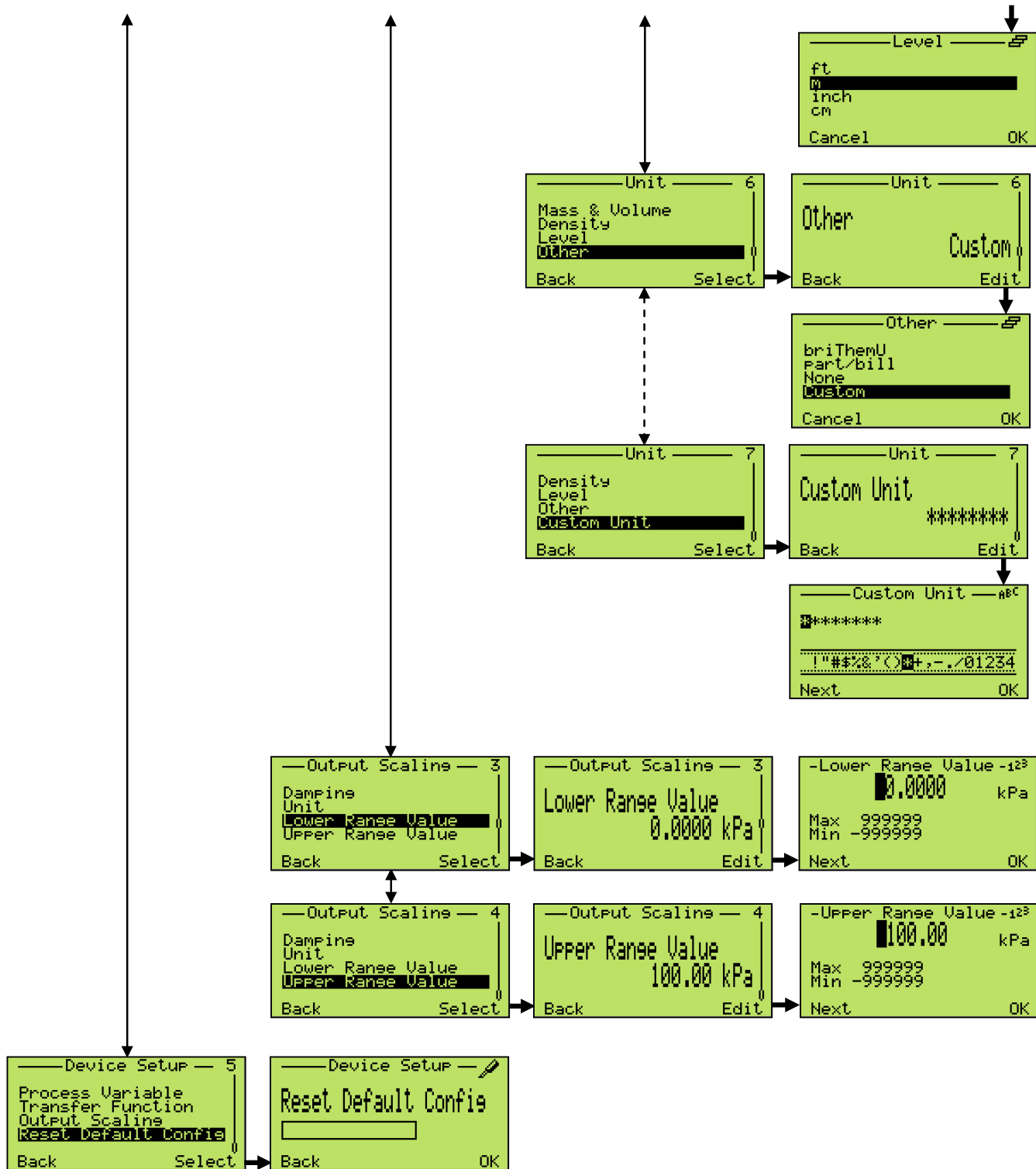
This function allows the selection of the LCD visualization. Select between the list and confirm with "ok" (1) key.

8.13.3 Device Set-up

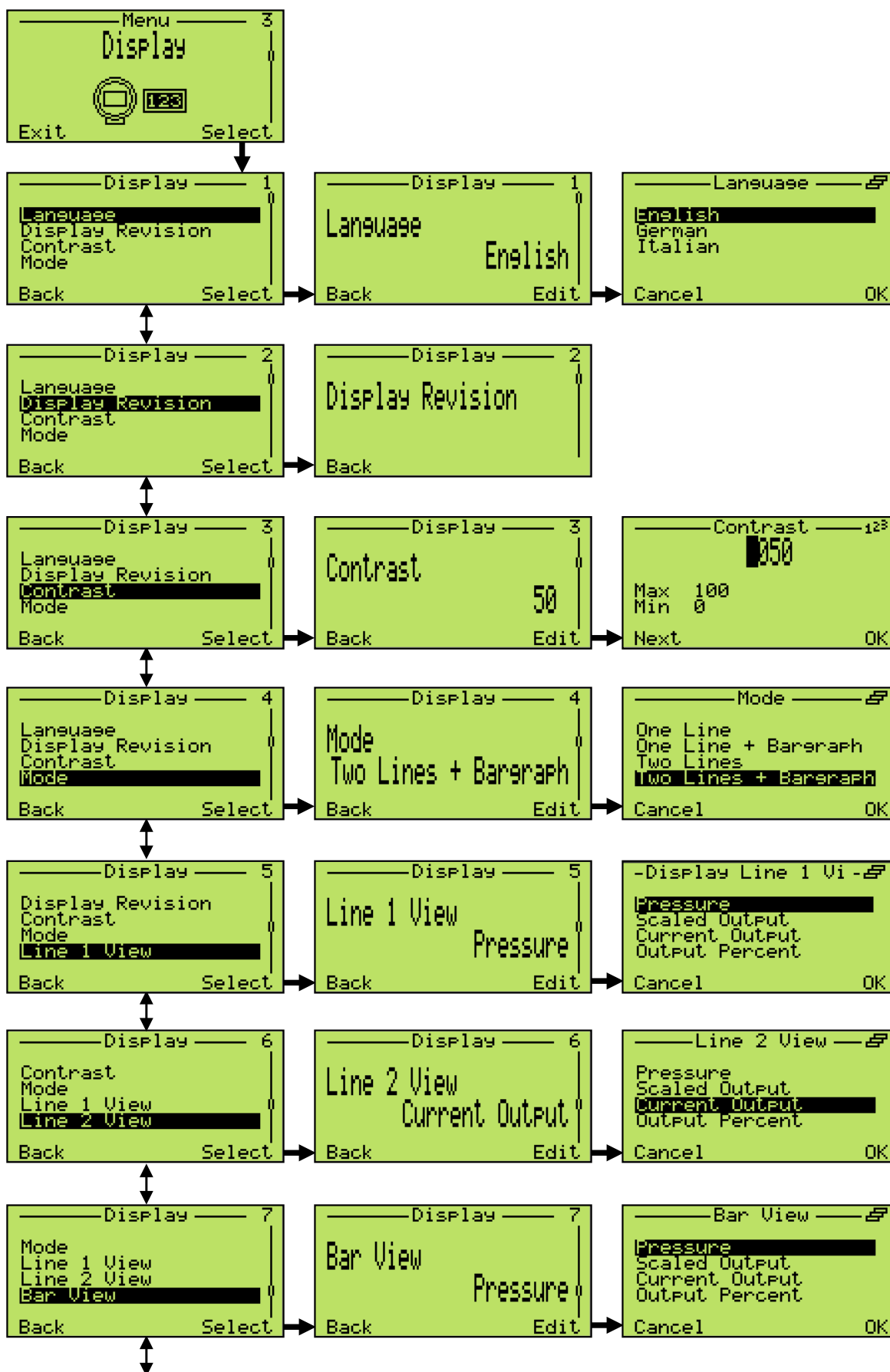


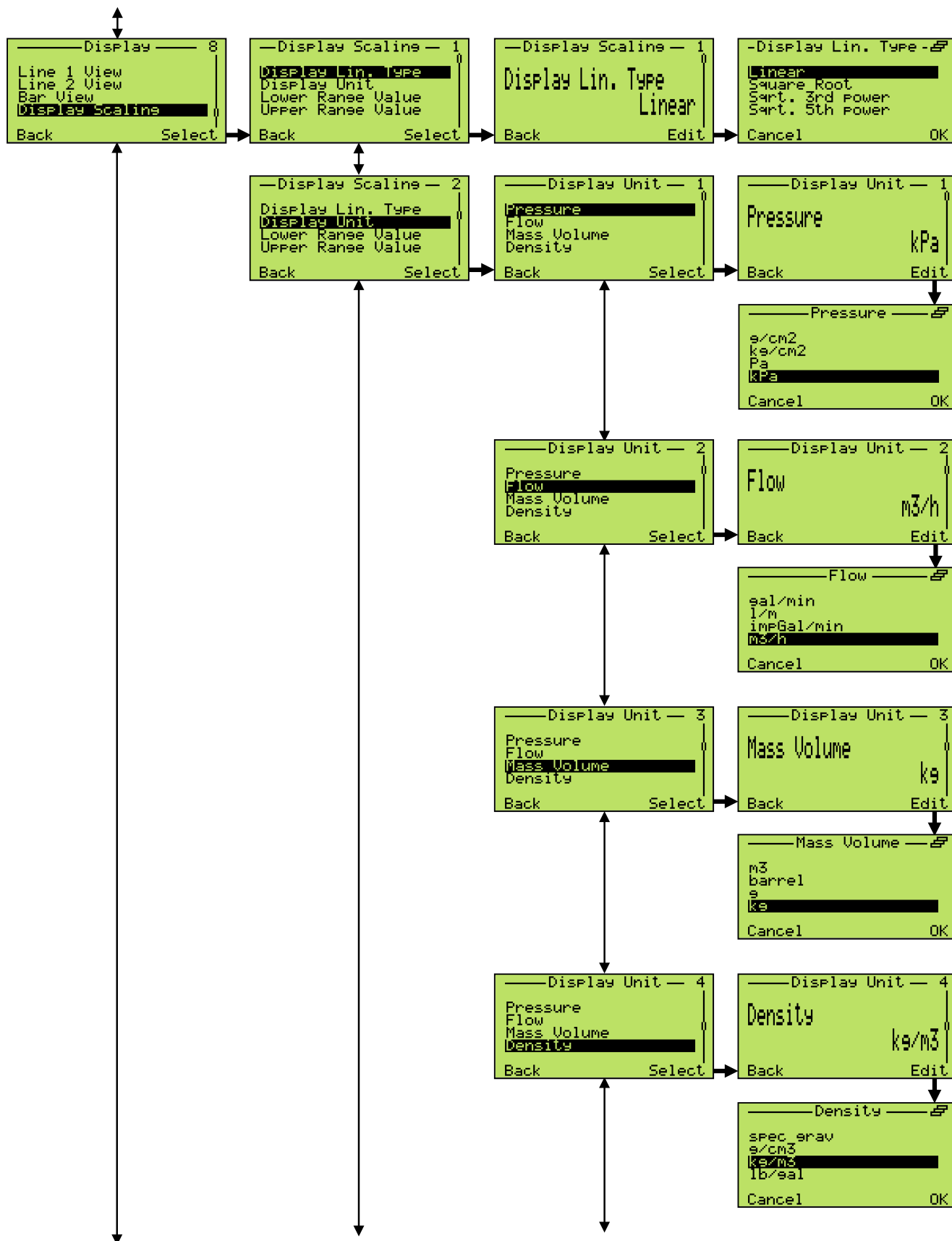


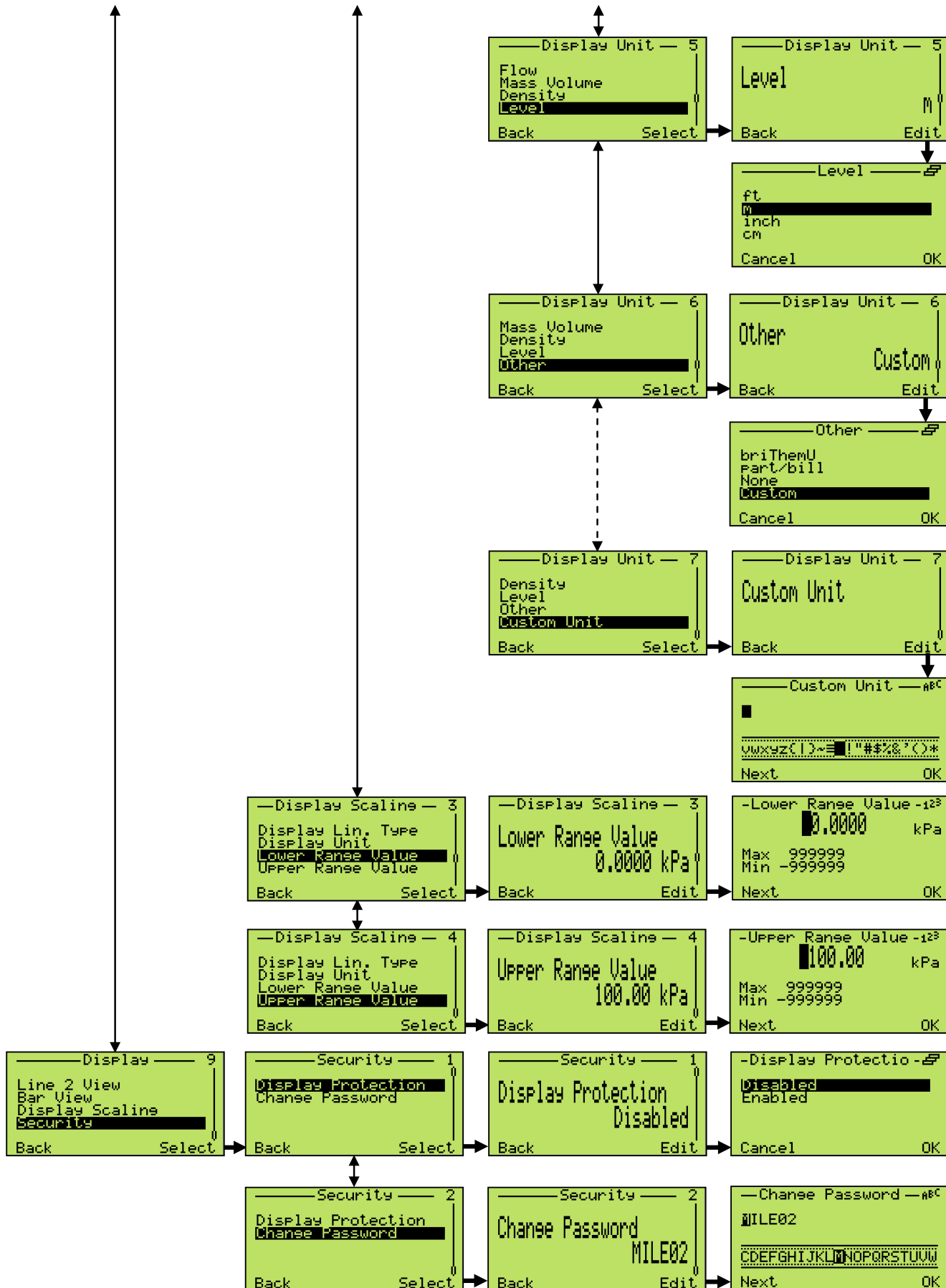




8.13.4 Display



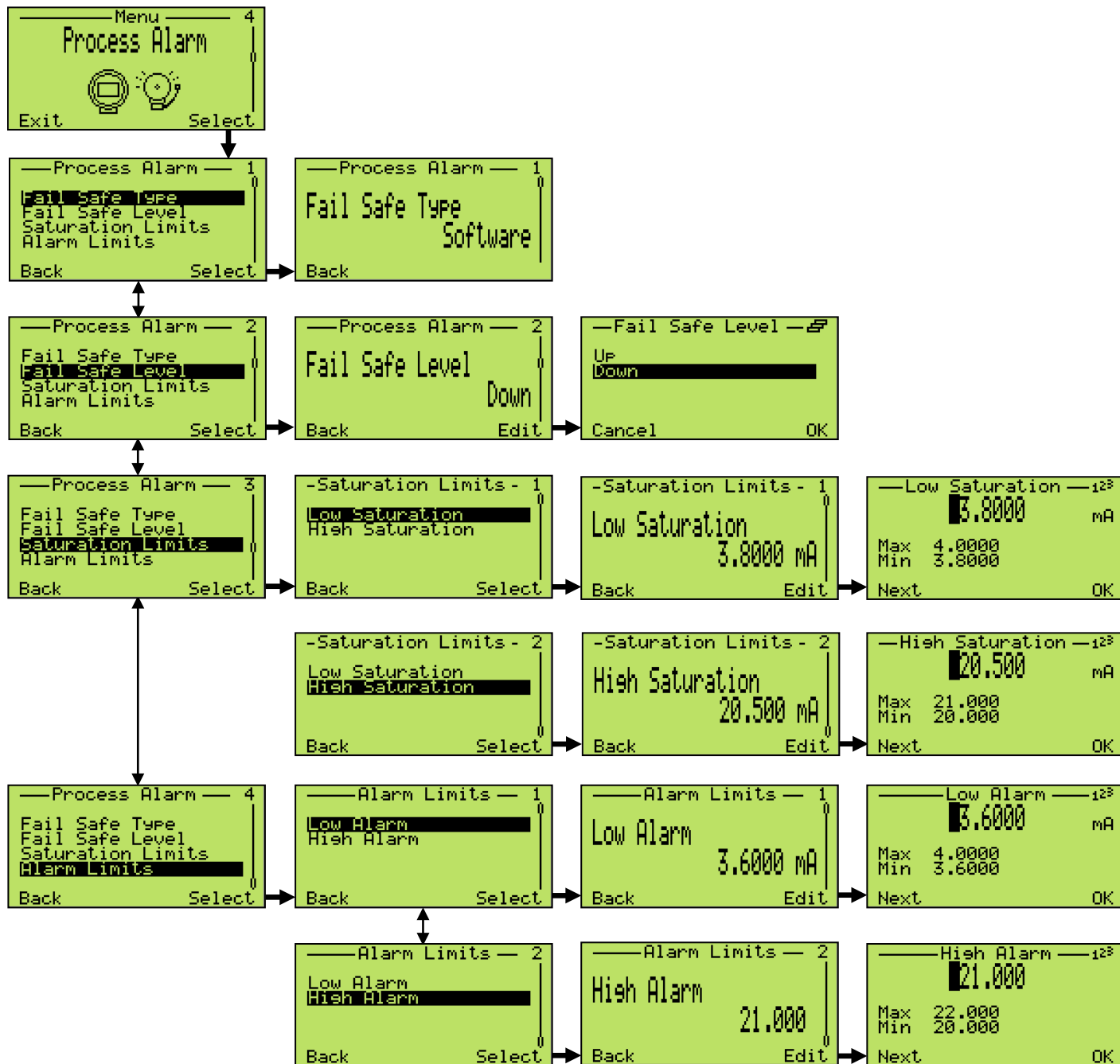




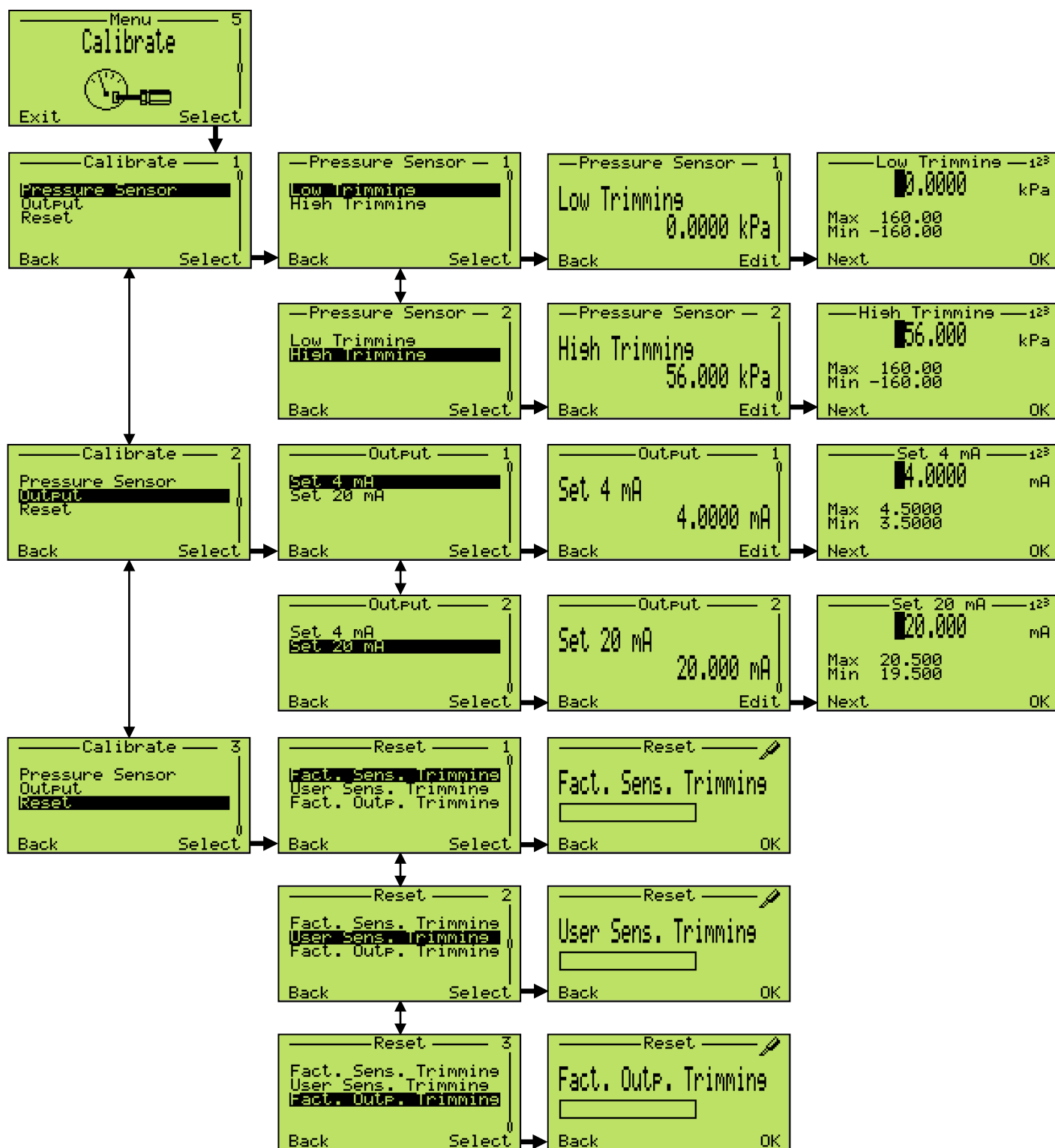
8.13.5 Process Alarm

This menu allows the complete configuration of the analogue output in case of saturation and alarm. The output signal will range from 4 to 20 mA in case the process variable is within the calibrated span limits. In case the process variable (PV) will be below the LRV (lower range value) the signal will be driven to the “Low Saturation” limit (which is configurable), in case the PV will be above the URV (upper range value) the signal will be driven to the “High Saturation” limit (which is configurable too).

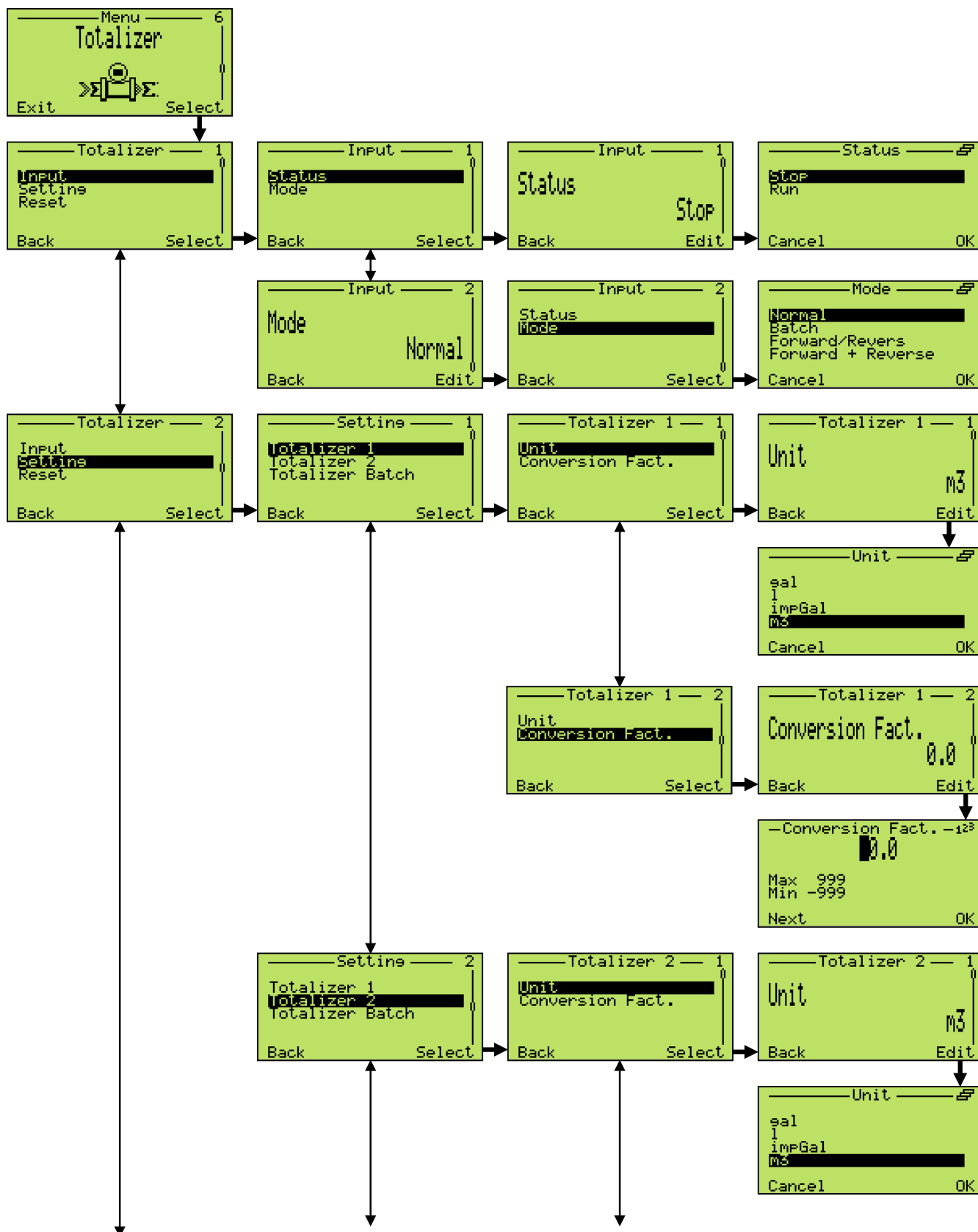
In case the transmitter diagnostic detects a failure the signal will be driven upscale or downscale according to the user preferences (the failure direction is selected via the dip switch 4 and 5 on the communication board). The exact value to which the signal will be driven can be configured via the above menu (Alarm limits). As a convention the Low Alarm limit must be < the Low Saturation limit and the High Alarm limit must be > than the High Saturation limit.

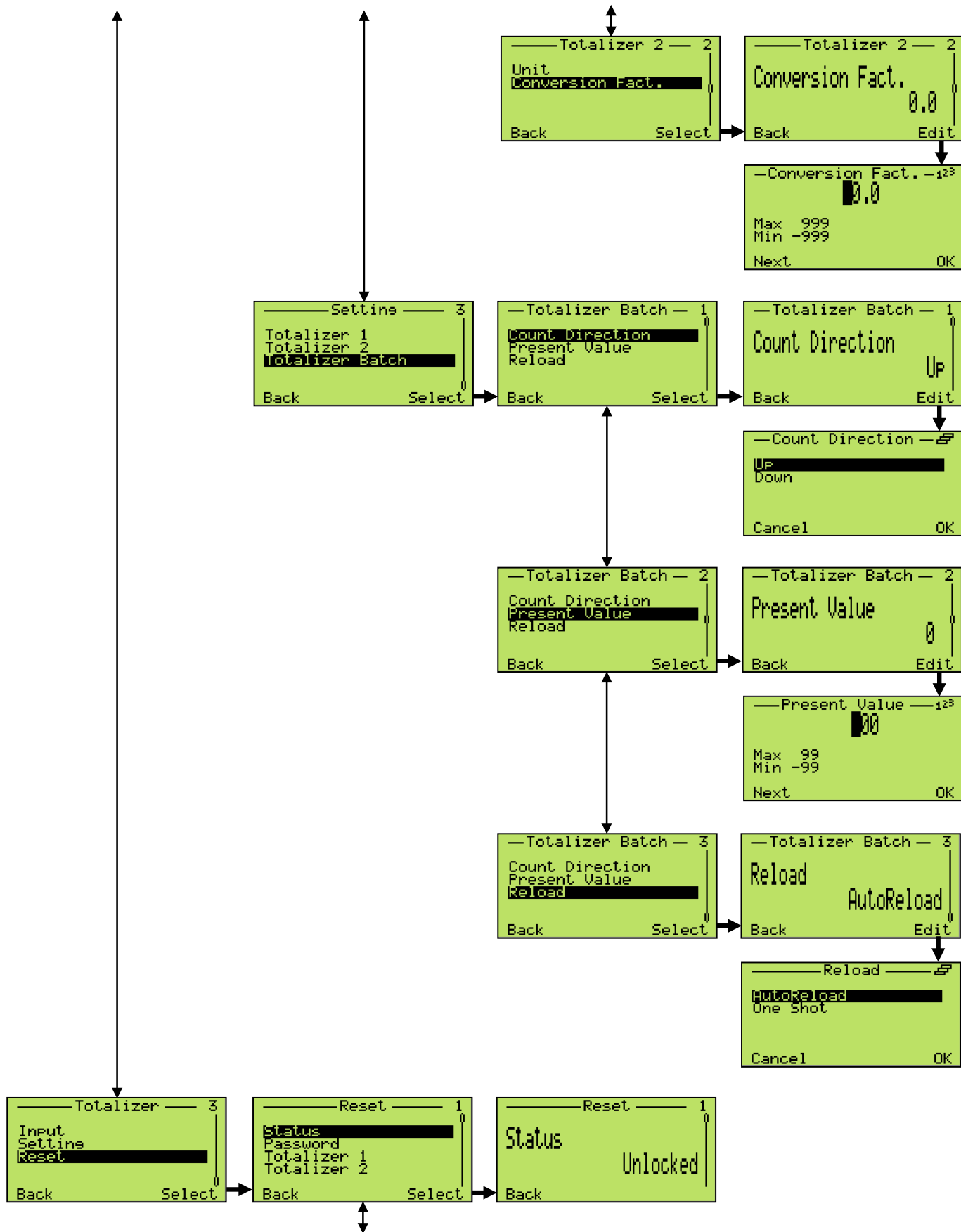


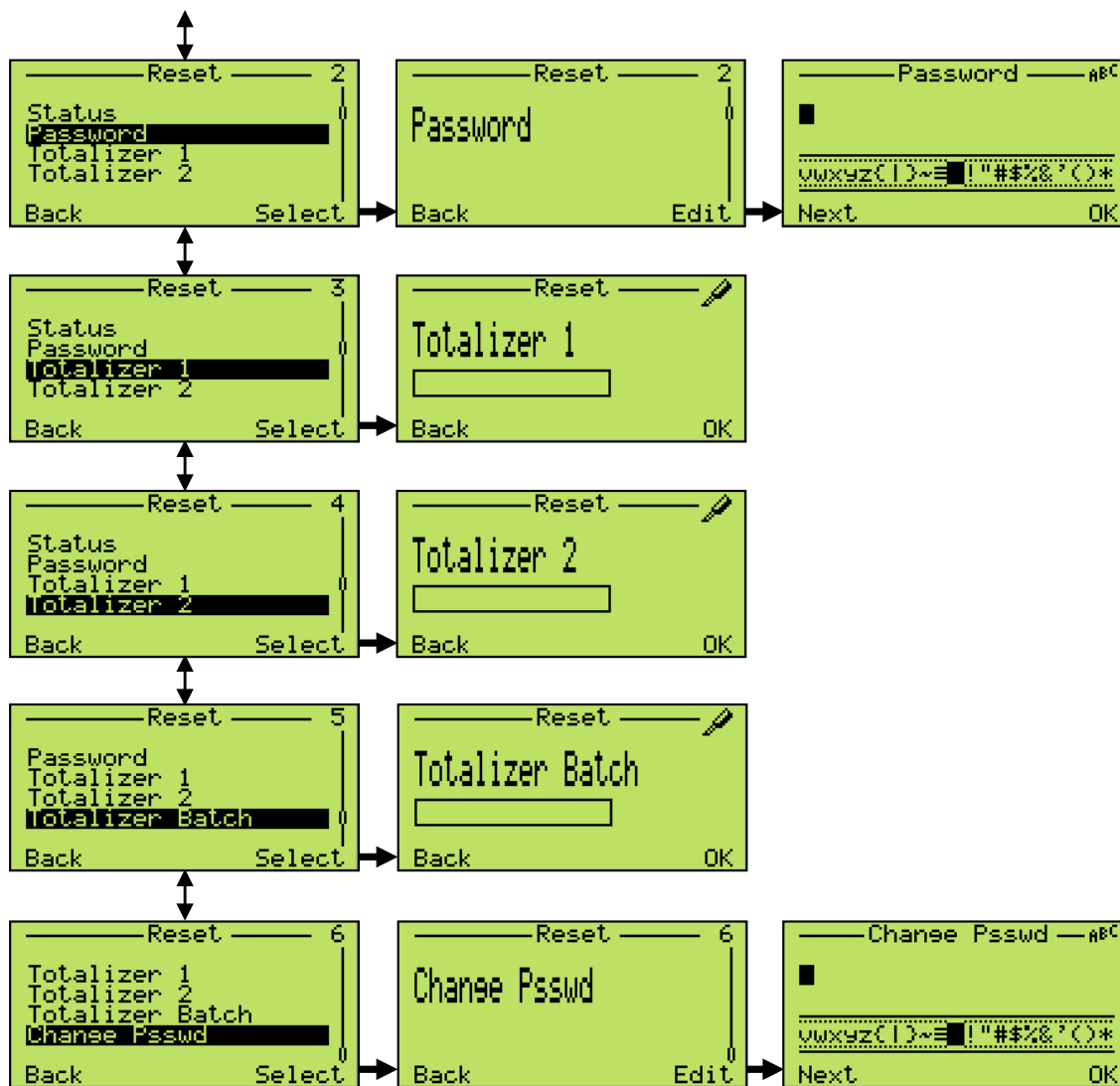
8.13.6 Calibrate



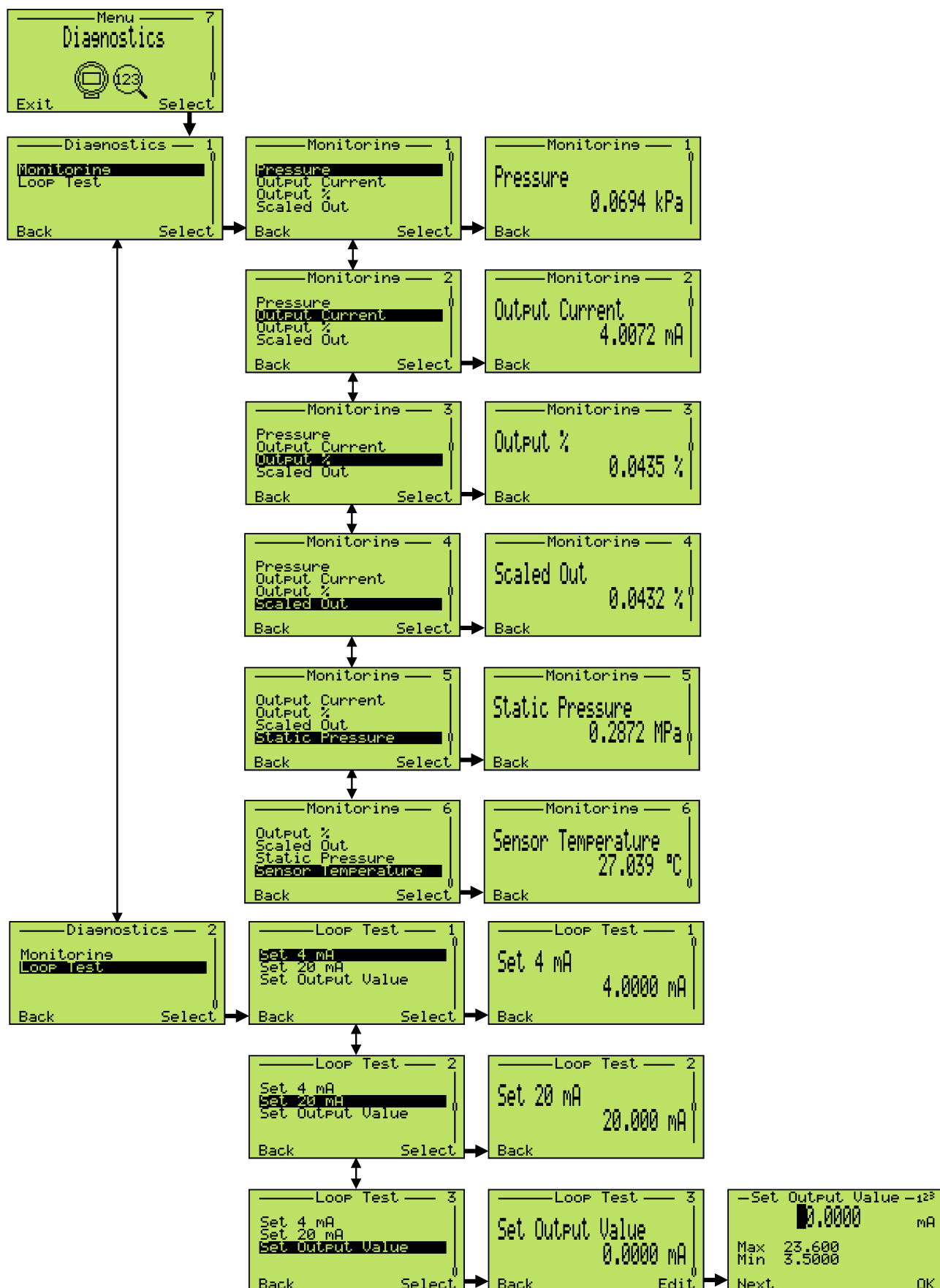
8.13.7 Totalizer



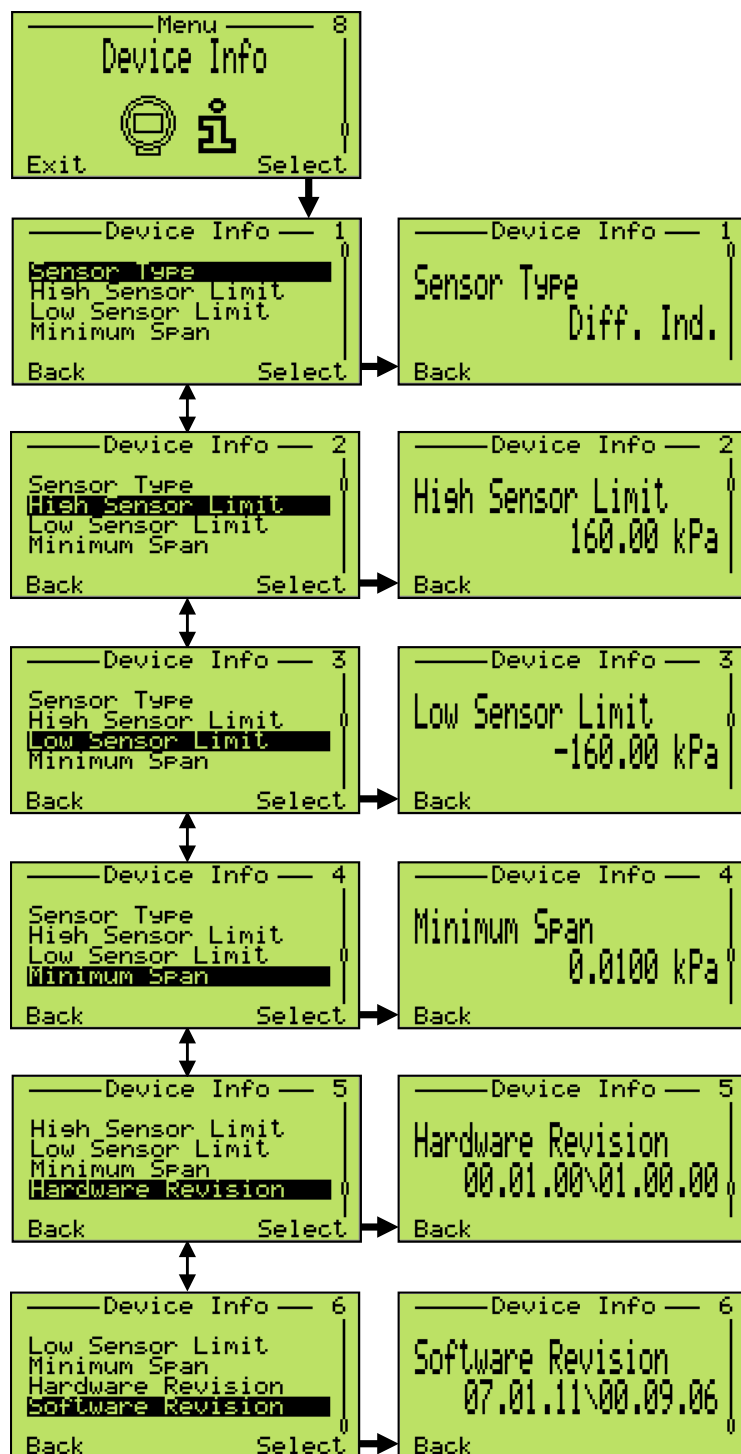




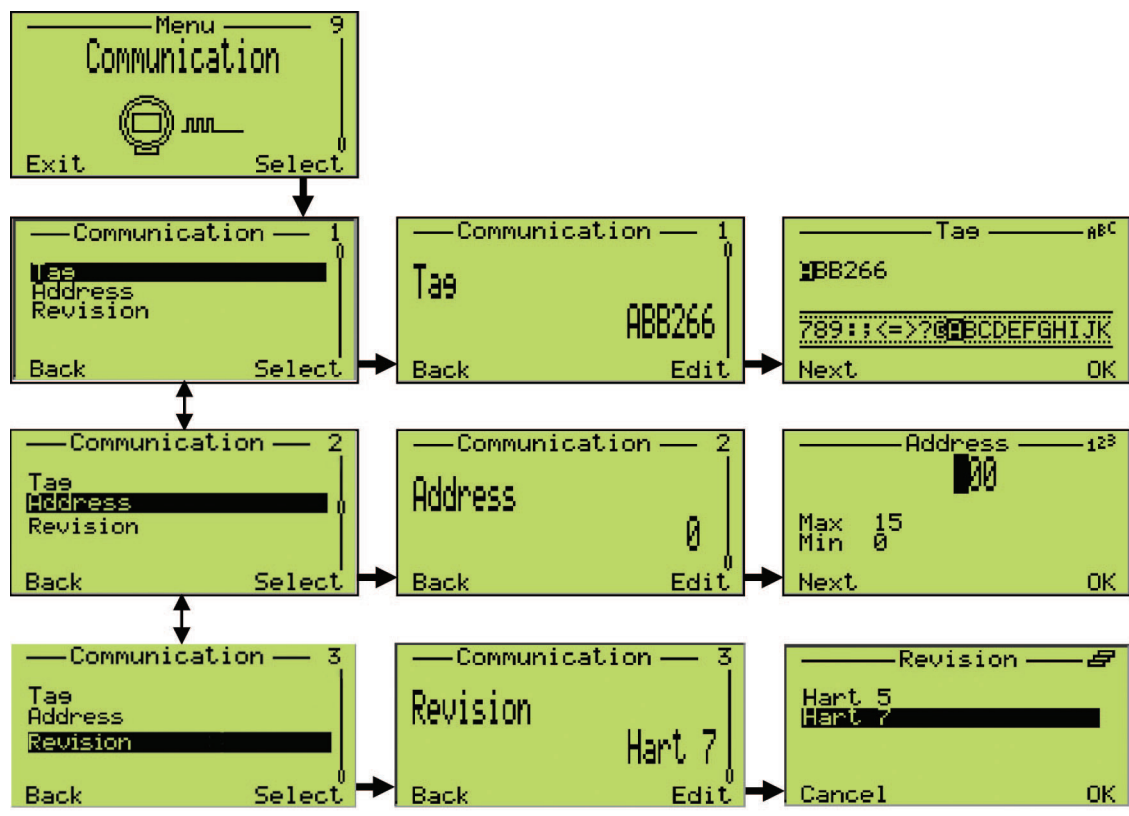
8.13.8 Diagnostics



8.13.9 Device Info



8.13.10 Communication



8.14 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.

8.15 Transfer function

The 266 Pressure Transmitter provides a selection of output functions, as follows:

- Linear for differential, gauge and absolute pressure or level measurements.
- Sq. Root (x) for flow measurements using restriction type primary element, like orifice plate, integral orifice, Venturi or Dall tube and similar.
- Sq. Root (x3) for open channel flow measurements using rectangular or trapezoidal weir.
- Sq. Root (x5) for open channel flow measurements using V-notch (triangular) weir.
- Bidirectional Flow.
- Custom linearization table.
- Cylindrical lying tank.
- Spherical tank.

These output functions can be activated using a Configuration Tool (Digital LCD Integral Display, Hand Held Communicator or PC based software as Asset Vision Basic). The transfer function can be applied to the analog signal 4 to 20 mA only or also to the indication (in engineering units).vant operating instruction.

8.15.1 Linear

Using this function, the relationship between the input (measured value), expressed in % of the calibrated span and the output is linear (i.e.: at 0% input, corresponds 0% output - 4mA, at 100% input corresponds 100% output - 20mA).

No further settings are possible here.

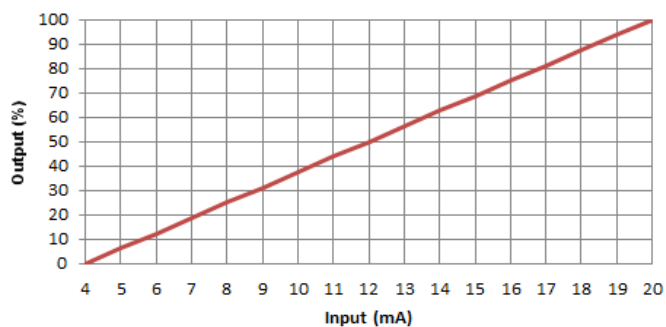


Figure 50: Linear output

8.15.2 Square root

Using this function, the relation between the indicator scale / output value and the input value is square root.

To avoid the extremely high gain errors with the input value approaching 4 mA, the indicator scale / output value is equal to Zero Point up to a programmable CUTOFF value. Cutoff value can be customized between 0% and 20%, referred to the indicator scale / output range; default value is 6%.

The indicator scale / output value can then be linear with proper slope and intercept zero up to a programmable LIN POINT value. The linearization point value could either be 0% or in between 5% and 20% referred to the indicator scale / output range; default value is 5%. Square root transfer function is finally applied.

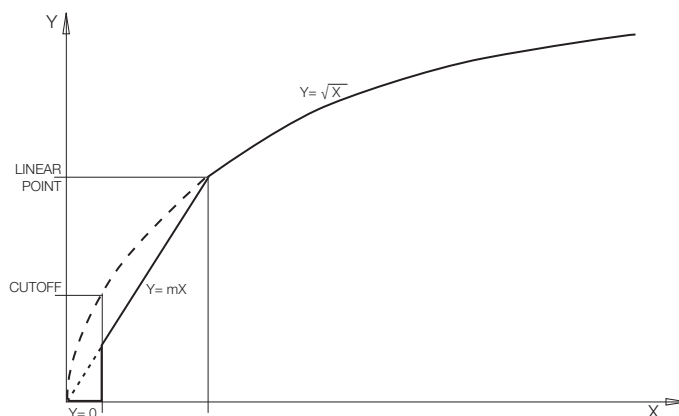


Figure 51: Square-Root transfer functions

8.15.3 Square root to the 3rd power

The x3 Square root Transfer function can be used for open channel (see figures on the right) flow measurement using ISO 1438 rectangular weirs (Hamilton Smith, Kindsvater-Carter, Rehbock formulas) or trapezoidal weirs (Cippoletti formulas) and ISO 1438 Venturi flumes. In these types of devices the relationship between the flow and the developed head h (the differential pressure measured by the transmitter) is proportional to $h^{3/2}$ or square root of h^3 .

Other types of Venturi or Parshall flume do not follow this relationship. Using this function, the output is proportional to the square root of the third power of the input signal in % of the calibrated span: the instrument gives an output proportional to the rate of flow calculated using the above mentioned formulas.

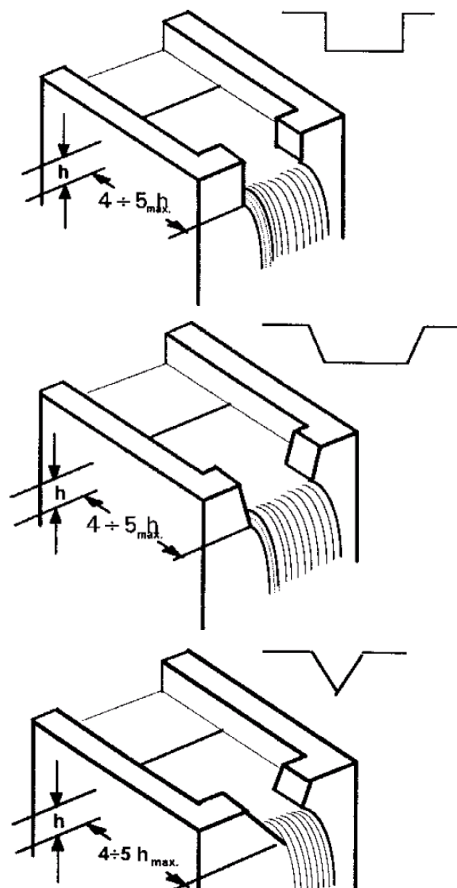


Figure 52: Tanks (respectively rectangular weir, trapezoidal weir and V-notch weir)

8.15.4 Square root to the 5th power

The x5 Square root Transfer function can be used for open channel flow measurement using ISO 1438 V-notch (triangular) weirs (see figure on the right) where the relationship between the flow and the developed head h (the differential pressure measured by the transmitter) is proportional to $h^{5/2}$ or square root of h^5 .

Using this function, the output (in % of the span) is proportional to the square root of the fifth power of the input signal in % of the calibrated span: the instrument (it gives an output proportional to the rate of flow calculated using the Kingswater-Shen formula).

8.15.5 Custom linearization curve

The custom linearization curve transfer function it is used typically for volumetric level measurement in tanks with an irregular shape. It can be registered to a freely identifiable transfer function with a maximum of 22 base points. The first point is always the zero point, the last is always the final value. Neither of these points can be altered.

A maximum of 20 points can be freely entered in between.

These points have to be defined by extrapolating the tank filling table data and reducing them to 22 points. Once identified the 22 points they will need to be uploaded into the device by either using an HART hand held terminal or a proper configuration software like Asset Vision Basic.

8.15.6 Bidirectional Flow (to be used when the transmitter is connected to a bidirectional flow element)

The bidirectional function, applied to the transmitter input (x) expressed in percentage of the calibrated span, has the following form:

$$\text{Output} = \frac{1}{2} + \frac{1}{2} \text{sign}(x) \cdot x^{\frac{1}{2}}$$

where “ x ” and “Output” should be normalized in the range 0 to 1 for calculation purpose, with the following Output meaning:

- Output = 0 means Analog out 4 mA;
- Output = 1 means Analog out 20 mA.

This function can be used for flow measurement purpose when the flow is in both the directions and the primary elements are designed to perform this type of measure.

As an example, if we have a bidirectional flow measurement application with the following data:

Max reverse flow rate:	-100 l/h
Max flow rate:	+100 l/h

The differential pressure generated by the flow primary is for the maximum flow rate 2500 mmH₂O, for the max reverse flow rate 2500 mmH₂O.

The transmitter will have to be configured as follows:

Calibrated span:	4mA = LRV = -2500mmH ₂ O
	20mA = URV = +2500mmH ₂ O

Transfer function: Bidirectional flow

Once configured as above the transmitter will deliver:

flowrate 100 l/h reverse:	output= 4 mA
no flowrate:	output= 12 mA
Flow rate 100 l/h:	output= 20 mA

8.15.7 Cylindric lying tank

This function is used to measure the volumetric level into a cylindrical horizontal tank with flat ends.

The transmitter calculates the volume from the measured filling level.

8.15.8 Spherical Tank

This function is used to measure the volumetric level into a spherical tank.

The transmitter calculates the volume from the measured filling level.

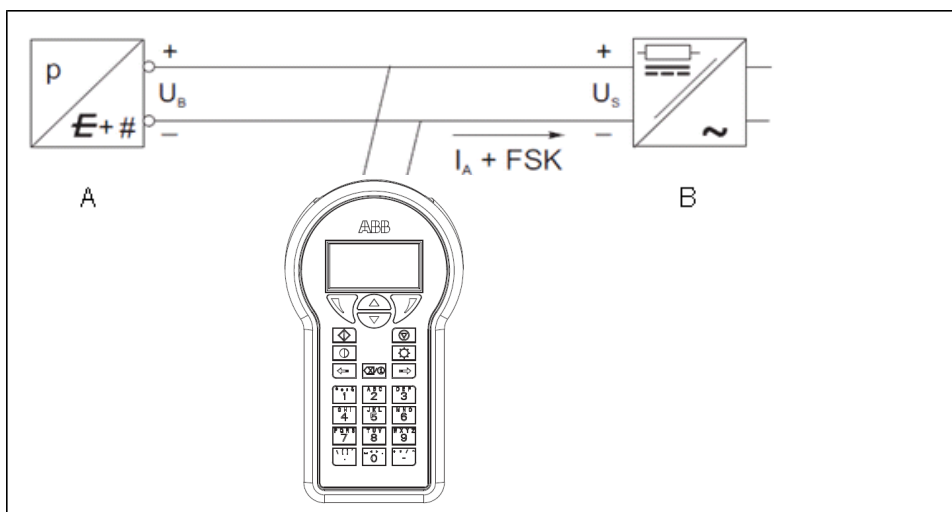
8.16 Configuration with the PC/laptop or handheld terminal

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.

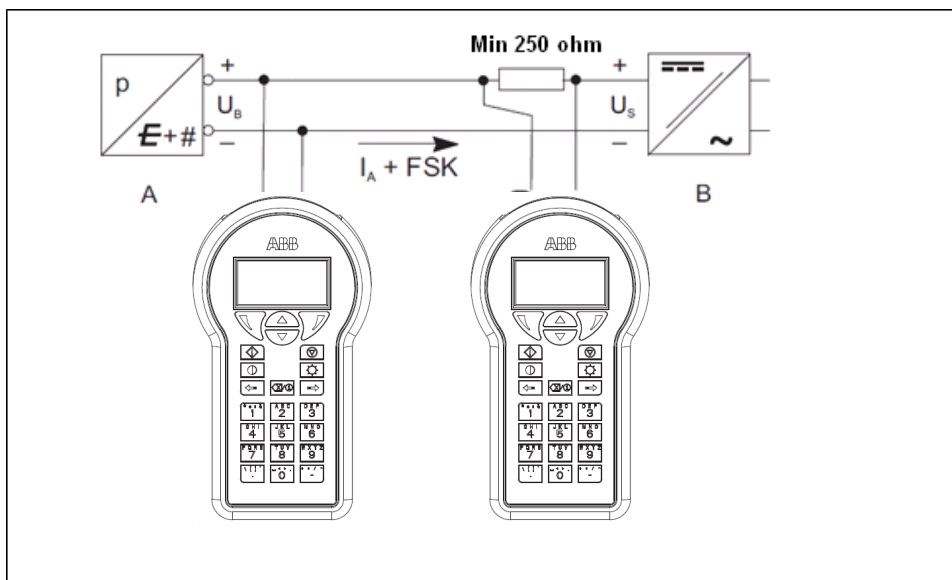
- Hand Held terminals like the ABB 691HT, ABB DHH800-MFC, Emerson Process 375 and 475 provided the 266 EDD has been downloaded and enabled in the terminal.
- ABB Asset Vision Basic, a new free of charge software configurator downloadable at www.abb.com/Instrumentation.
- Any DTM based software for HART 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 53: Communication setup with handheld terminal



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

Figure 54: 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”.

8.17 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.

8.18 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

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

8.20 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: <ul style="list-style-type: none"> – HART burst mode – correcting Custom unit visualization on LCD Improvements: <ul style="list-style-type: none"> – 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	

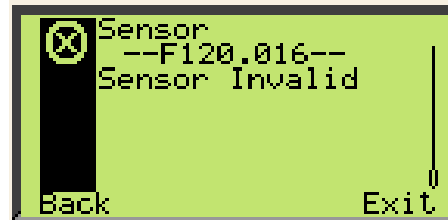
Intermediate releases for internal tests not published

9 Error messages

9.1 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



9.2 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 outpt 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

Note for the calibration of the current output by the user.

For 266 Transmitters with SW.-Rev. \leq 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".

– 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

– 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

10 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.

10.1 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.

10.2 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.

10.3 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.

10.4 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 and 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.

10.5 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.

10.6 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.

11 Hazardous Area considerations

11.1 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.

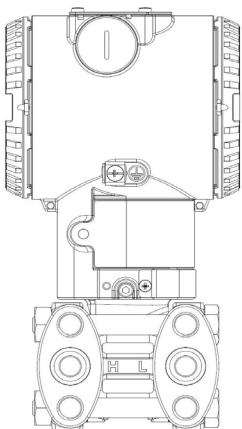
The other marking refers to the protection type used according to relevant EN standards:

- 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

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

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

Application with Gas

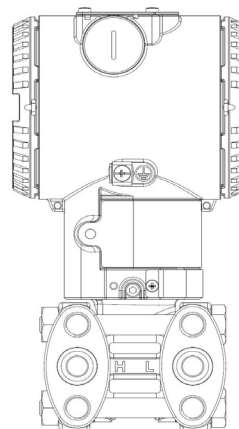


Zone 0

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:

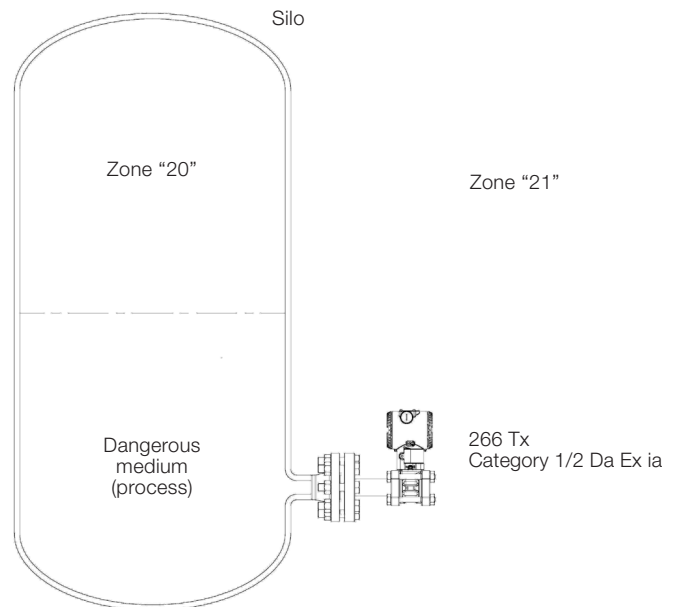
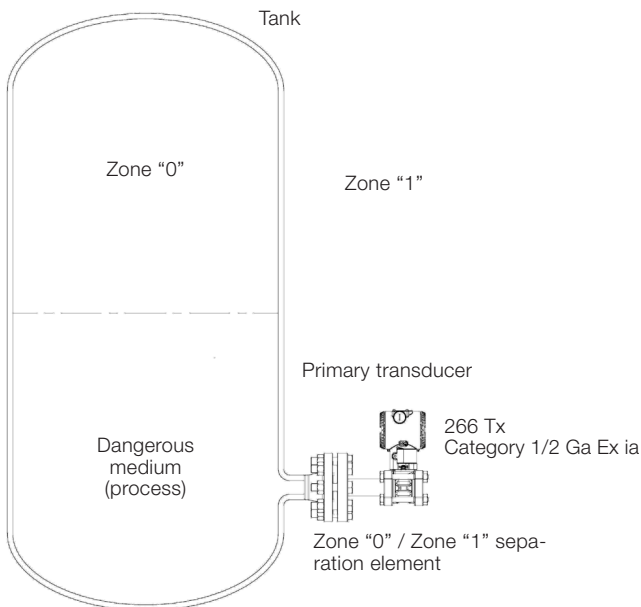
- Ex ia: Intrinsic safety, protection level “a”
- IIC: Gas group
- T4: Temperature class of the transmitter (corresponding to 135°C max) with a Ta from -50°C to +85°C
- T5: Temperature class of the transmitter (corresponding to 100°C max) with a Ta from -50°C to +40°C
- T6: Temperature class of the transmitter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

Application with Dust



Note: the transmitter can be connected to either [ib] or [ia] supply (associated apparatus) certified [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]

Note for “Primary transducer”: see the certification for exceptions

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

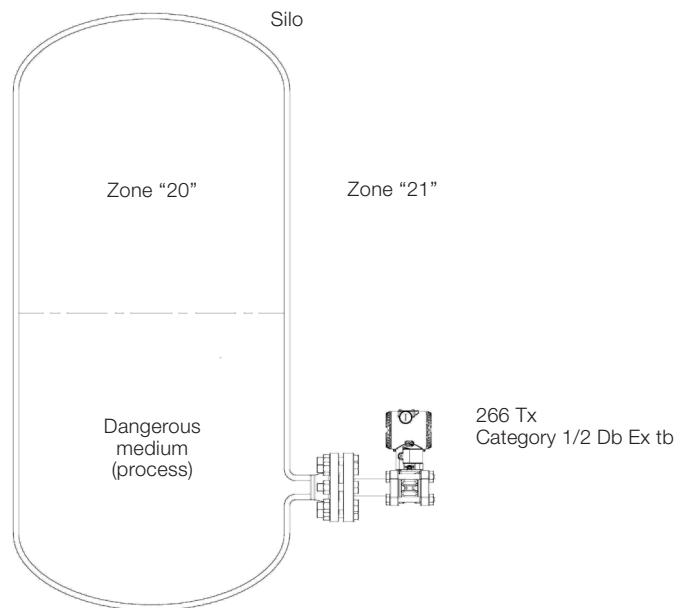
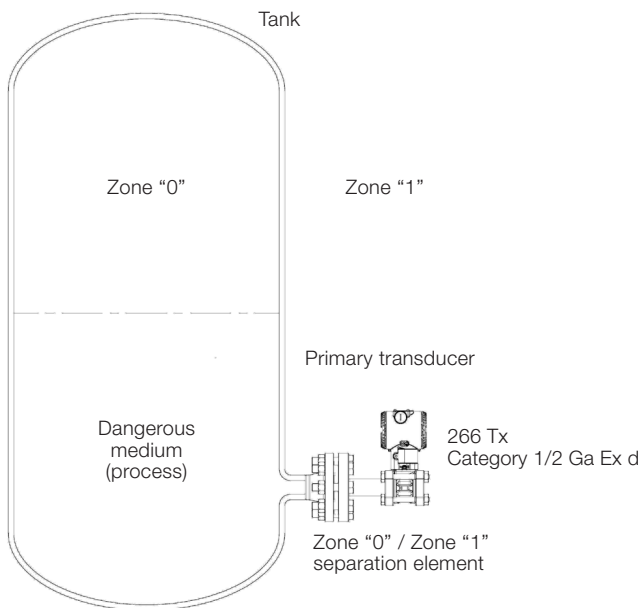
About the applications, this transmitter can be used in Zone “0” (Gas) classified areas (continuous hazard) with its “process part” only, whereas the remaining part of the transmitter, i.e. its enclosure, can be used in Zone 1 (Gas), only (see sketch below). Reason of this is the process part of the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

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.

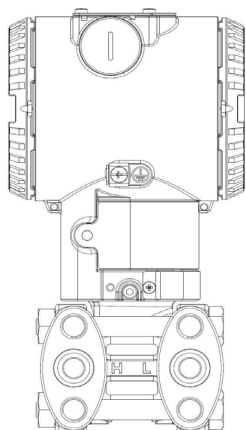
About the applications, this transmitter can be used in Zone 2 (Gas) (unlikely/infrequent hazard) as it shown on the following sketch (left side).

- 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).

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

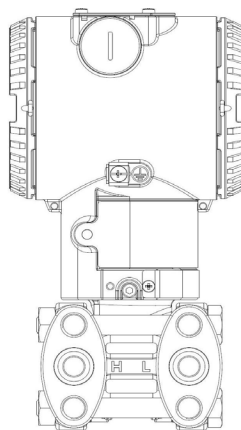
Application with Gas



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 - 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.

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

HART Version with “L5” option (display TTG)

U_i= 30Vdc Ci= 5nF Li= uH

Temperature Class - Gas	Temperature Class - Dust	Minimum amb. °C	Maximum amb. °C	I _{max} mA	Power W
T4	T135°C	-50°C	+60°C	100	0,75
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)

U_i= 17,5 Vdc I_i= 360 mA P_i= 2,52 W Ci= 5nF Li= 10 uH

Temperature Class - Gas	Temperature Class - Dust	Minimum amb. °C	Maximum amb. °C
T4	T135°C	-50°C	+60°C
T5	T100°C	-50°C	+56°C
T6	T85°C	-50°C	+44°C

FF / FISCO Version with “L5” option (display TTG)

U_i= 17,5 Vdc I_i= 380 mA P_i= 5,32 W Ci= 5nF Li= 10 uH

Temperature Class - Gas	Temperature Class - Dust	Minimum amb. °C	Maximum amb. °C
T4	T135°C	-50°C	+60°C
T5	T100°C	-50°C	+56°C
T6	T85°C	-50°C	+44°C

11.2 Ex Safety aspects and IP Protection (North America)

11.2.1 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).

11.2.2 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.



TROUBLE SHEET

WARRANTY REPAIR REPAIR ORDER

Rejection or discrepancy Reports copy attached not available

- IDENTIFICATION**

Customer _____
Purchase order No _____
Plant _____
Name of person to contact _____
Instrument Tag No _____
Model _____
Serial Number _____

- OPERATING CONDITIONS**

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

- REASON FOR RETURN**

- DANGEROUS FLUIDS**

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

Trouble found during: Installation Commissioning Maintenance
 At start up On service

Shipping information for the return of the equipment

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

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

Date _____ Signature _____ Originator _____



RETURN REPORT – No.: _____

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

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

Decontamination declaration - EQUIPMENT RETURNED FOR REPAIR, CALIBRATION OR CREDIT

From _____

Description _____

Return authorization no. _____

Model number _____

Serial number _____

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

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

Signed _____
Name _____
Position _____
Date _____

ABB S.p.A

Process Automation Division

Uffici Commerciali / Sales Office:

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e-mail: abb.instrumentation@it.abb.com

Products and customer support

ABB's portfolio for valve automation:

- Continuous electrical actuators and pneumatic actuators
- Electro-pneumatic, pneumatic, and digital positioners
- I/P signal converters

ABB's pressure measurement:

- Absolute, gauge and differential pressure transmitters
- IEC 61508 SIL2/3 certified pressure transmitters and switches
- Multivariable transmitters
- Interface level/density transmitters
- Pressure measurement remote seals
- Pressure measurement accessories
- Pneumatic pressure transmitters

ABB's temperature measurement:

- Universal temperature sensors
- High-temperature sensors
- Temperature sensors for sanitary applications
- Mineral isolated temperature sensors
- Thermowells
- Temperature transmitters
- IEC 61508 SIL2/3 certified temperature sensors and transmitters

ABB's portfolio of recorders and controllers:

- Process controllers and indicators
- Videographic recorders
- Paper chart recorders
- Field mountable indicators and controllers

ABB's portfolio of level measurement:

- Magnetic level gauges
- Magnetostrictive and guided wave radar level transmitters
- Laser and scanner level transmitters
- Ultrasonic, capacitance and vibrating fork level transmitters and switches
- Rotating paddle and thermal dispersion level switches
- IEC 61508 SIL2/3 certified level transmitters

ABB's portfolio of device management:

- Fieldbus and wireless solutions
- Scalable asset & device management
- Asset vision software
- Mobility handhelds

Customer support

We provide a comprehensive after sales service via a Worldwide Service Organization.

Contact one of the following offices for details on your nearest Service and Repair Centre.

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ABB Engineering (Shanghai) Ltd.

No. 4528, Kangxin Highway, Pudong New District,
Shanghai 201319 - P.R. China
Tel: +86 21 6105 6666
Fax +86 21 6105 6677

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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