ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION

266CRH / 266CRT, 266CSH / 266CST

Multivariable pressure transmitter

With Modbus communication

Measurement made easy

Introduction

The multivariable transmitters in the 266CRH/CRT, 266CSH/CST are used for differential pressure flow measurements.
Apart from pressure- and / or temperature-dependent changes to the density of the fluid, the parameters such as the discharge coefficient, thermal expansion of pipelines and primary device and the Reynolds number are also corrected. It can also be used for DP level measurement if density compensation is necessary due to process temperature changes.
This could make any level measurement much more reliable.

In addition to high precision, the multivariable 266 also offers the advantage that only a single device needs to be used for the measuring point instead of several transmitters and a flow calculator.

For more information

Additional documentation on 266CRH / 266CRT, 266CSH / 266CST is available for download free of charge at www.abb.com/pressure.
Alternatively simply scan this code:

Table of contents

1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference.
Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.
For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.
The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times.
The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠ WARNING

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠ CAUTION

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word ***'NOTICE'*** indicates possible material damage.

Note

'**Note**' indicates useful or important information about the product.

Intended use

The 266CRH / 266CRT, 266CSH / 266CST multivariable pressure transmitters measure the level or the mass flow of gases, vapors, and liquids in the process industry.
For information on measuring ranges and permissible overload, refer to **Operating limits 266CRx** on page 87 und **Operating limits 266CSx** on page 88.

The device has been designed for use exclusively within the technical limit values indicated on the identification plate and in the data sheets.

Prior to using the devices with corrosive or abrasive media, the owner must check the level of resistance of all parts that come into contact with the process liquid.
ABB would be pleased to provide support in the selection of suitable materials, however we can assume no liability whatsoever.

Improper use

The following are considered to be instances of improper use of the device:

- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

Notes on data safety

This product is designed to be connected to and to communicate information and data via a network interface.
It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).
Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and / or theft of data or information.
ABB Automation Products GmbH and its affiliates are not liable for damages and / or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and / or theft of data or information.

Warranty provisions

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 liability for any resulting damage. This renders the manufacturer's warranty null and void.

Manufacturer's address

ABB Automation Products GmbH
Measurement & Analytics
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

Customer service center
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com

2 Use in potentially explosive atmospheres

Ex marking

Devices in hazardous atmospheres with or without integrated digital display.

ATEX / IECEx

Ex-marking	
Type of protection	'Ex d' – flameproof (enclosure)
ATEX (Code E2)	
II 1/2G db IIC T6 Ga/Gb	
II 1/2D Ex tb IIIC T85°C Db	
IECEx (Code E9)	
Ex db IIC T6 Ga/Gb	
Ex tb IIIC T85 °C Db	
Type examination certificate	**ATEX (Code E2)**
	FM09AATEX0023X
	IECEx (Code E9)
	IECEx FME 16.0002X

Ex-marking	
Type of protection	'Ex n' – non-sparking and 'Ex t' – enclosure
ATEX (Code E3)	
II 3 G Ex nA IIC T4 ... T6 Gc IP67	
II 3 D Ex tc IIIC T85°C Dc IP67	
IECEx (Code ER)	
Ex nA IIC T4 ... T6 Gc IP67	
Ex tc IIIC T85°C Dc	
Type examination certificate	**ATEX (Code E3)**
	FM09AATEX0025X
	IECEx (Code ER)
	IECEx FME 16.0004X

FM (USA and Canada)

Ex-marking	
Type of protection	**Explosion proof**
Explosion proof (US):	
Class I, Division 1, Groups ABCD, T5 for Ta = −50 °C to +85 °C	
Explosion proof (Canada):	
Class I, Division 1, Groups BCD, T5 for Ta = −50 °C to +85 °C	
Dust Ignition Proof (US / Canada):	
Class II, III Division 1, Groups EFG, T5 for Ta = −50 °C to +85 °C	
Type of protection	**Flame-proof**
Flame-proof (US):	
Class I, Zone 1, AEx d, IIC, T4 for Ta = −50 °C to +85 °C	
Flame-proof (Canada):	
Class I, Zone 1, Ex d, IIC, T4 for Ta = −50 °C to +85 °C	
Type of protection	**Non-Incendive**
Class I, Division 2, Groups ABCD, T*	
Type of protection	**Non Sparking**
Non Sparking (US and Canada):	
Class I, Zone 2, (A)Ex nA IIC T*	
FM approvals	**USA (code ET)**
	FM16US0066X
	Canada (code ET)
	FM16CA0036X
Type 4X, IP67 for all above markings.	

T* Temperature class T is dependent on the maximum input current and the maximum ambient temperature per table **Temperature class definitions** on page 11.

Combined ATEX, FM and IECEx approvals

Code EN = E2+E9+E3+ER+ET

Ex explosion protection aspects (Europe and International)

According to ATEX Directive (European Directive 2014/34/EU) and applicable European standards which assure compliance with Essential Safety Requirements, the following ratings apply to the transmitters with or without integrated digital display.

- EN 60079-0: Explosive atmospheres – Part 0: Equipment - General requirements
- EN 60079-1: Explosive atmospheres – Part 1: Equipment protection by flame-proof enclosures 'd'
- EN 60079-15: Explosive atmospheres – Part 15: Equipment protection by type of protection 'n'
- EN 60079-26: Explosive atmospheres – Part 26: Equipment with Equipment Protection Level (EPL) 'Ga'

The transmitters are certified for the following gas groups, categories, and media in dangerous atmosphere, temperature classes, and types of protection. The sketches located below are examples of applications.

Type of protection: 'Ex d' Certifications ATEX (Code E2) and IECEx (Code E9)

Code E2 Ex-Marking ATEX	
II 1/2G db IIC T6 Ga/Gb	
and	
II 1/2D Ex tb IIIC T85°C Db	
FM Approvals Certificate	FM09ATEX0023X

The meaning of the ATEX code is as follows:

- II: Equipment Group for hazardous surface areas (not mines)
- 1/2: Category – This means the transmitter is suitable for use in the partition to category 1 (e.g., sensor category 1 / transmitter category 2) (see application sketch).
- G: Gas (dangerous media)
- D: Dust (dangerous media)
- Ex d: Flame-proof enclosure
- IIC: Explosion group gases
- T6: Temperature class of the transmitter (corresponds to 85 °C maximum) with an ambient temperature from −50 to 75 °C.
- Ex tb: Dust protected Flame-proof enclosure
- IIIC : Explosion Group 'dust'
- T85 °C: Maximum surface temperature of the transmitter housing at an ambient temperature Ta from −50 to 75 °C for dust (not for gas) with a dust layer up to 50 mm thick
- IP 67: For protection type, the first characteristic numeral indicates the protection of the integrated electronics against ingress of solid foreign objects including dusts. The assigned '6' means a dust-tight enclosure (no ingress of dust). The second characteristic numeral indicates the protection of the integrated electronics against ingress of water.
  The assigned '7'means a water-protected enclosure against a temporary immersion in water under standardized conditions of pressure and time.

Note

The number printed by the CE mark on the safety label identifies the Notified Body which has responsibility for the surveillance of the production (QAN = Quality assessment notification).

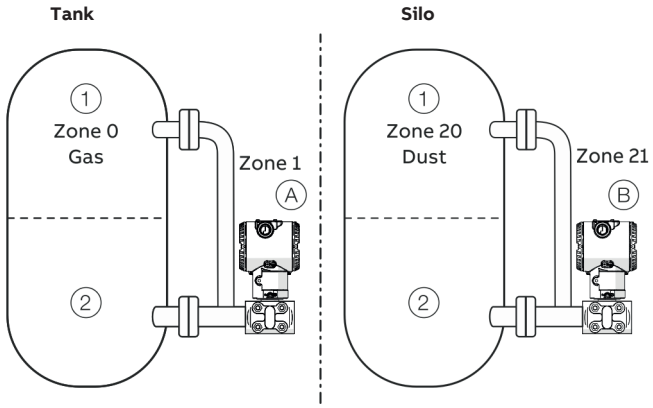
… 2 Use in potentially explosive atmospheres

… Ex explosion protection aspects (Europe and International)

Code E9 Ex-Marking IECEx	
Ex db IIC T6 Ga/Gb	
and	
Ex tb IIIC T85 °C Db	
FM Approvals Certificate	IECEx FME 16.0002X

Meaning of the IECEx rating code is as follows:

- Ex d: Flame-proof enclosure
- IIC: Explosion group gases
- T6: Temperature class of the transmitter (corresponds to 85 °C maximum) with an ambient temperature from −50 to 75 °C.
- Ex tb: Dust protected Flame-proof enclosure
- IIIC : Explosion Group ‘dust’
- T85 °C: Maximum surface temperature of the transmitter housing at an ambient temperature Ta from −50 to 75 °C for dust (not for gas) with a dust layer up to 50 mm thick
- IP 67: For protection type, the first characteristic numeral indicates the protection of the integrated electronics against ingress of solid foreign objects including dusts. The assigned ‘6’ means a dust-tight enclosure (no ingress of dust). The second characteristic numeral indicates the protection of the integrated electronics against ingress of water.
  The assigned ‘7’ means a water-protected enclosure against a temporary immersion in water under standardized conditions of pressure and time.



Ⓐ 266 transmitter, category 1/2 G, Ex d
Ⓑ 266 transmitter, category 1/2 D
① Tank or silo for gas or dust
② Dangerous medium (process)

Note

Only the ‘process measuring part’ of this transmitter can be connected to zone 0 (gas) / zone 20 (dust); the remaining parts of the transmitter, for example, it's enclosure, can only be used on zone 1 (gas) / zone 21 (dust).

Figure 1: Examples of gas and dust application zone separations

Type of Protection: 'Ex n' Certifications ATEX (Code E3) and IECEx (Code ER)

Code E3 Ex-Marking ATEX	
II 3 G Ex nA IIC T4 ... T6 Gc IP67 and II 3 D Ex tc IIIC T85°C Dc IP67	
FM Approvals Certificate:	FM09ATEX0025X,
Electrical Data:	U = 30 V DC, I = 25 mA, C = 17 nF, L = 0.22 mH

The meaning of the ATEX code is as follows:

- II: Equipment Group for hazardous surface areas (not mines)
- 3: Category of equipment protection.
- G: Gas (dangerous media)
- D: Dust (dangerous media)
- Ex nA: Non Sparking
- IIC: Explosion group gases
- T4: Temperature class of the transmitter (which corresponds to 135 °C Max) with Ta= −50 to 85 °C
- T5: Temperature class of the transmitter (which corresponds to 100 °C Max) with Ta= −50 to 40 °C
- T6: Temperature class of the transmitter (which corresponds to 85 °C Max) with Ta= −50 to 40 °C
- Ex tc: Dust protected Flame-proof enclosure
- IIIC : Explosion Group 'dust'
- T85 °C: Maximum surface temperature of the transmitter housing at an ambient temperature Ta from −50 to 75 °C for dust (not for gas) with a dust layer up to 50 mm thick
- IP 67: For protection type, the first characteristic numeral indicates the protection of the integrated electronics against ingress of solid foreign objects including dusts. The assigned '6' means a dust-tight enclosure (no ingress of dust). The second characteristic numeral indicates the protection of the integrated electronics against ingress of water.
  The assigned '7'means a water-protected enclosure against a temporary immersion in water under standardized conditions of pressure and time.

Code E3 Ex-Marking IECEx	
Ex nA IIC T4 ... T6 Gc IP67 and Ex tc IIIC T85°C Dc	
FM Approvals Certificate:	IECEX FME16.0004X

The meaning of the IECEx rating code is as follows:

- Ex nA: Non Sparking
- IIC: Explosion group gases
- T6: Temperature class of the transmitter (corresponds to 85 °C maximum) with an ambient temperature from −50 to 85 °C.
- Ex tc: Dust protected Flame-proof enclosure
- IIIC : Explosion Group 'dust'
- T85 °C: Maximum surface temperature of the transmitter housing at an ambient temperature Ta from −50 to 75 °C for dust (not for gas) with a dust layer up to 50 mm thick
- IP67: For protection type, the first characteristic numeral indicates the protection of the integrated electronics against ingress of solid foreign objects including dusts. The assigned '6' means a dust-tight enclosure (no ingress of dust). The second characteristic numeral indicates the protection of the integrated electronics against ingress of water.
  The assigned '7'means a water-protected enclosure against a temporary immersion in water under standardized conditions of pressure and time.

⚠ WARNING

- When installed, power must be supplied to the transmitter by a voltage limiting device which will prevent the rated voltage of 30 V DC being exceeded.
- The temperature sensor circuit (Pt100) must be connected in accordance with the requirements of the FM certificate.

… 2 Use in potentially explosive atmospheres

Ex Explosion protection aspects (United States and Canada)

According to Factory Mutual standards for the assurance of fundamental safety requirements in the United States of America. Ratings are with or without integrated digital display.

- FM 3600: 'Approval Standard for Electrical Equipment for use in Hazardous (Classified) Locations, General Requirements'.
- FM 3611: 'Approval Standard for Non-Incendive Electrical Equipment for Use in Class I and II, Division 2 and Class III Division 1 and 2 Hazardous (Classified) Locations'.
- FM 3615: 'Approval Standard for Explosion-proof Electrical Equipment General Requirements'.
- FM 3810: 'Approval Standard for Electrical Equipment for Measurement, Control and Laboratory Use'.
- NEMA 250: 'Enclosures for Electrical Equipment (1000 Volts Maximum)'.

According to CSA standards for the assurance of fundamental safety requirements in Canada. Ratings are with or without integrated digital display.

- C22.2 No 142-M1987: 'Process Control Equipment Industrial Products.
- C22.2 No 213-M1987: 'Non-incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations Industrial Products'.
- C22.2 No 30: 'Explosion-Proof Enclosures for Use in Class I Hazardous Locations Industrial Products'.
- C22.2 No 25: 'Enclosures for Use in Class II Groups E, F and G Hazardous Locations'.
- CSA-C22.2 No 94-M91: 'Special Purpose Enclosures Industrial Products'.
- ANSI/ISA 12.27.01: 'Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible measuring medium'.

Type of protection: 'Explosion-proof' Certification (Code ET)

The 266 transmitters have FM certification for the following hazardous location protections:

Code ET ratings	
Explosionproof (US)	Class I, Division 1, Groups ABCD, T5 for Ta = −50 °C to +85 °C
Flame-proof (US)	Class I, Zone 1, AEx d, IIC, T4 for Ta = −50 °C to +85 °C
Explosionproof (Canada):	Class I, Division 1, Groups BCD, T5 for Ta = −50 °C to +85 °C
Flame-proof (Canada)	Class I, Zone 1, Ex d, IIC, T4 for Ta = −50 °C to +85 °C
Dust Ignition Proof (US and Canada)	Class II, III Division 1, Groups EFG, T5 for Ta = −50 °C to +85 °C
FM Approvals Certificate	**USA:** FM16US0066X
	Canada: FM16CA0036X

Type of protection: 'explosion proof' Certification (Code ET)

The 266 transmitters have FM certification for the following hazardous location protections:

Code ET ratings	
Non-Incendive (US and Canada)	Class I, Division 2, Groups ABCD, T* in accordance with Non-Incendive field wiring requirements for hazardous (classified)
Non Sparking (US and Canada)	Class I, Zone 2, (A)Ex nA IIC T* in accordance with Non-Incendive field wiring requirements for hazardous (classified)

T* Temperature class T is dependent on the maximum input current and the maximum ambient temperature per table **Temperature class definitions**

- Type 4X applications Indoors/Outdoors
- 'Seal' per ANSI/ISA 12.27.01 as indicated in the certificates

Temperature class definitions

Tclass	T_{amb} min.	T_{amb} max.	U_{max}	I_{max}	Power
T4	−50 °C	85 °C	30 V	100 mA	0.75 W
T4	−50 °C	70 °C	30 V	160 mA	1.00 W
T5	−50 °C	40 °C	30 V	100 mA	1.75 W
T6	−50 °C	40 °C	30 V	50 mA	0.40 W

⚠ WARNING

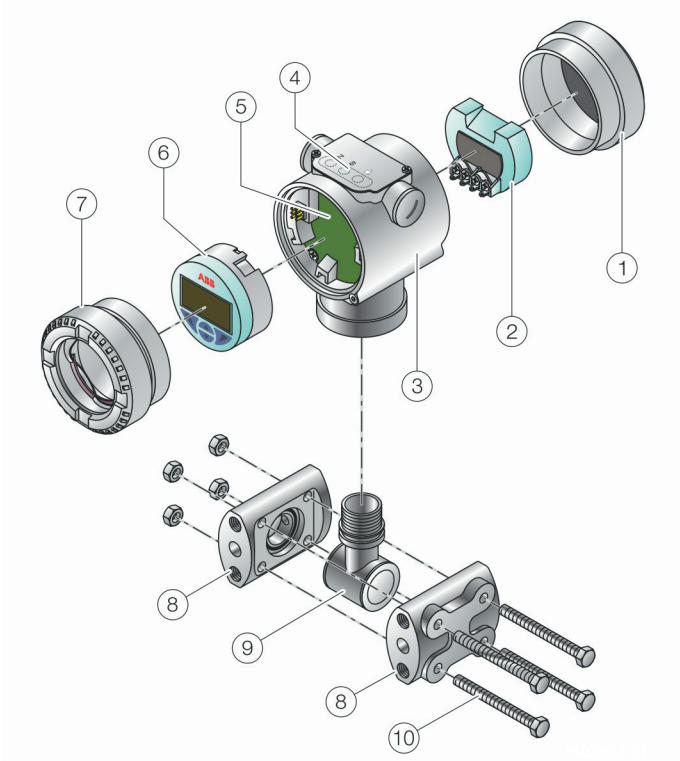
- When installed, power must be supplied to the transmitter by a voltage limiting device which will prevent the rated voltage of 30 V DC being exceeded.
- The temperature sensor circuit (Pt100) must be connected in accordance with the requirements of the FM certificate.

Note

When the temperature under rated conditions is higher than 60 °C at the entry point or 60 °C at the branching point of the conductors, the temperature specification of the selected cable and cable gland shall be in compliance with the actual measured temperature.

3 Design and function

Components of the pressure transmitter



1. Housing cover (terminal compartment)
2. Secondary electronics
3. Transmitter housing
4. Operating buttons
5. Transmitter electronics
6. LCD display (option)
7. Housing cover
8. Flanges (process connection)
9. Pressure sensor
10. Flange screws and nuts

Figure 2: Device overview (example)

Product description

The 266Cxx multivariable pressure transmitters measure the mass flow of gases, vapors, and liquids in accordance with the differential pressure procedure and the level of the liquids in the process industry. These transmitters supplies a digital output signal with Modbus protocol.

Simultaneously and with high accuracy they measure differential pressure, static pressure and with a Pt100 in four-wire technology, they also measure the process temperature.

The differential pressure measuring ranges are scaled from 1 to 2000 kPa. The measuring ranges for static pressure are 0.6 to 2 MPa, 10 MPa and 41 MPa.

The transmitters can be overloaded on one side to the respective upper measuring range value of the static pressure.

Measuring range limits and span limits

The data sheets for the Series 2600T multivariable transmitters contain all the information concerning the measuring range and measuring span of the individual models, as well as the sensor code.

The following terminology is used for the different parameters:

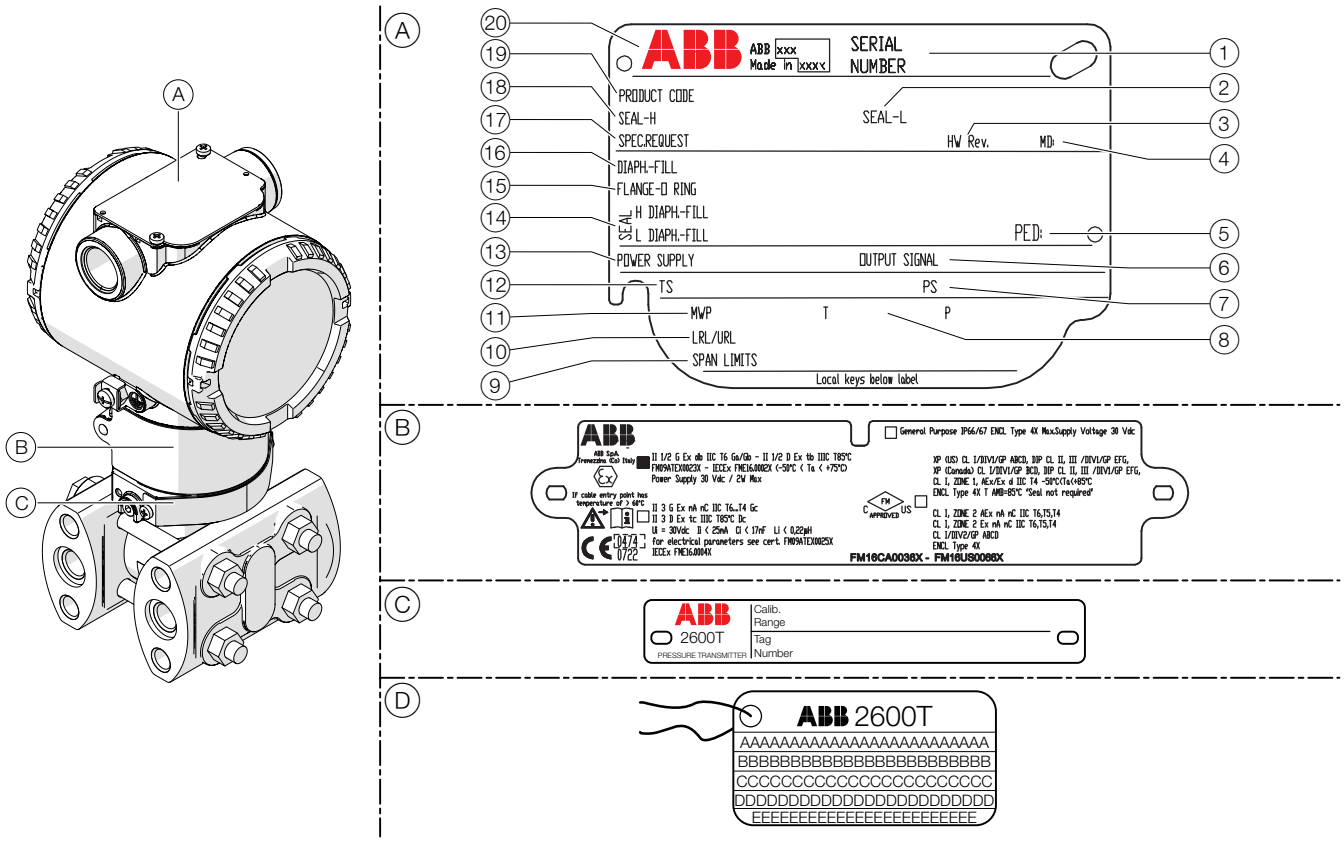
Abbreviation	Description
URL	Measuring range upper limit of a specific sensor. The highest measured value that can be measured by the transmitter.
LRL	Lower Range Limit of a specific sensor. The lowest measured value that can be measured by the transmitter.
URV	Upper Range Value. The highest measured value to which the transmitter is calibrated.
LRV	Lower Range Value. The lowest measured value to which the transmitter is calibrated.
SPAN	Measuring span. The algebraic difference between the start of the measuring range and the end of the measuring range. The smallest span is the smallest value that can be selected without impairing the specified measuring accuracy.
TURN DOWN RATIO	Span ratio. The ration between the maximum span and the calibrated span.

The measuring transmitter can be calibrated to any measuring range between LRL and URL with the following restrictions.

- LRL ≤ LRV ≤ (URL - CAL SPAN)
- CAL SPAN ≥ MIN SPAN
- URV ≤ URL

4 Product identification

Name plate



(A) Name plate
(B) Special data plate with Ex-marking
(C) Plate with measuring point tagging (tag number)
(D) Tag plate with customer data made from stainless steel (optional)
(1) Serial number
(2) Low side diaphragm seal order code
(3) Hardware version
(4) Date of manufacture
(5) Identification code with reference to the Pressure Equipment Directive (SEP or Fluidgroup)
(6) Output signal
(7) Permissible pressure (static)
(8) Static pressure sensor range
(9) Set span
(10) Lower to measuring range upper limit (LRL to URL)
(11) Permissible ambient temperature range
(12) Temperature span
(13) Power supply
(14) Diaphragm seal filling liquid
(15) Range of process connection and gasket material
(16) Sensor filling liquid
(17) Special customer request
(18) High side diaphragm seal order code
(19) Device type / order code / additional order code
(20) Manufacturer logo and address

Figure 3: Types and tag plates (example)

Note

The device can optionally be delivered with a tag plate (D) made from stainless steel and fastened with wire. Customer specific text that has been specified in the purchase order is laser printed on the tag plate.
For this, 4 lines of 32 characters each are provided.

… 4 Product identification

… Name plate

The device is identified via the signs (plates) presented in **Figure 3**.

Rating plate Ⓐ
The rating plate provides information including the model number, maximum working pressure, range and span limits, power supply, output signal, diaphragm material, filling fluid, serial number, maximum permissible operating pressure (PS), and maximum permissible temperature (TS). Please specify the serial number when submitting inquiries to the ABB customer service department.

The device can be used as a pressure accessory (category III) as defined by the Pressure Equipment Directive 2014/68/EU. In this case, you will find the number of the notified body that has verified compliance next to the CE mark.

CE identification number of the notified body for the Pressure Equipment Directive: 0045.

Certification plate Ⓑ
The certification plate is on the transmitter and indicates whether the device is designed for general use or for use in hazardous areas.

The certification plate shown has been issued for ABBAPR, 32425 Minden, Germany with the following numbers:
FM09AATEX0023X or IECEx FME 16.0002X (Ex d)
FM09AATEX0025X or IECEx FME 16.0004X (Ex n)

CE identification number of the notified body for ATEX approval: 0044.

Note
- For ambient temperatures −40 to 85 °C (−40 to 185 °F) the information based on the temperature classes in the associated certificates, must be complied with.
- The temperature sensor circuit (Pt100) and the digital output (pulse / limit value output) must be connected in accordance with the requirements of the Ex certificate.

Additional plate Ⓒ
An additional plate specifies the measuring point number of the customer and the calibration range.

Marking according to Pressure Equipment Directive

Devices with PS > 200 bar (20 MPa)
Devices with a permissible pressure of PS > 200 bar (20 MPa) have been tested for conformity by the Technical Supervisory Association TÜV NORD (0045) in accordance with module H and can be used for liquids of group 1 (PED: 1G).

The name plate contains the following designations: PED: 1G.

Devices with PS ≤ 200 bar (20 MPa)
Devices with a permissible pressure PS ≤ 200 bar (20 MPa) conform to sec. 3 para. (3) and have not been tested for conformity. The devices have been constructed and manufactured according to sound engineering practice (SEP).

The CE mark on the device does not apply for the Pressure Equipment Directive.

The name plate then contains the following identification codes: PED: SEP.

Scope of delivery

- Multivariable transmitter model 266Cxx.
- This operating instruction, calibration protocol, and possibly optionally requested certificates in an envelope.
- Hexagon socket wrench for unscrewing the fastening screws of the housing.
- Additional parts as specified in the purchase order:
  - ½ in-NPT-f adapter with appropriate seals
  - Fastening accessories
  - Accessories for the electrical connection

5 Transport and storage

Transport safety instructions

Observe the following instructions:

- Do not expose the device to humidity during transport. Pack the device accordingly.
- Pack the device so that it is protected against vibrations during transport, for example, by using air-cushioned packing.

Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.
All claims for damages must be submitted to the shipper without delay and before installation.

Identification

Identify the device in accordance with the instructions in **Product identification** on page 13 to ensure it is the right device.

Handling

Special precautionary measures are not required for handling of the device. However, standard procedures must be complied with.

Storing the device

Bear the following points in mind when storing devices:

- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

Ambient conditions

Models 266Cxx – Transport and storage	
Ambient temperature range	–50 to 85 °C (–58 to 185 °F)
	With integrated digital display (LCD):
	–40 to 85 °C (–40 to 185 °F)
Relative humidity	Up to 75 %

Returning devices

For the return of devices, follow the instructions in **Repair** on page 82.

6 Installation

Mounting

Before installing the pressure transmitter, check whether the device design meets the requirements of the measuring point from a measurement technology and safety specifications point of view.

This applies in respect of the:

- Measuring range
- Overload resistance
- Temperature
- Explosion protection
- 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, separating diaphragm, etc.

In addition, the relevant directives, regulations, standards, and accident prevention regulations must be observed (e. g., EN 61140, EN 61010, IEC 60364, EN 60079-14, DIN 19216, VDI/VDE 3511 Bl.5, etc.).

Measurement accuracy is largely dependent on correct installation of the transmitter and, if applicable, the associated impulse line(s).

As far as possible, the measuring setup should be free from critical ambient conditions such as large variations in temperature, vibrations, or shocks.

Note
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.

IP rating
The housing of the 266CRH / 266CRT, 266CSH / 266CST pressure transmitters satisfies the requirements of IP degree of protection IP 66 / IP 67 (NEMA 4X) in accordance with IEC 60529.

The **first** digit indicates the protection of the integrated electronics against penetration of foreign objects, including dust.

- The digit '**6**' means that the housing is dust tight (for example dust cannot penetrate).

The **second** digit indicates the protection of the integrated electronics against the penetration of water.

- The digit '**6**' means that the housing is watertight and can even withstand a strong water jet under the specified conditions.
- The digit '**7**' means that the housing is watertight and can be temporarily immersed at a specified pressure and for a specific time, without water penetrating.

Factory settings
The pressure transmitter is factory configured according to the customer's order specifications.
Under normal conditions no additional settings are required.
The typical configuration includes:

- Number of the measuring point tag
- Calibrated span
- Configuration of the flow or liquid level calculation
- Configuration of the LCD display

Venting / draining transmitters without diaphragm seals

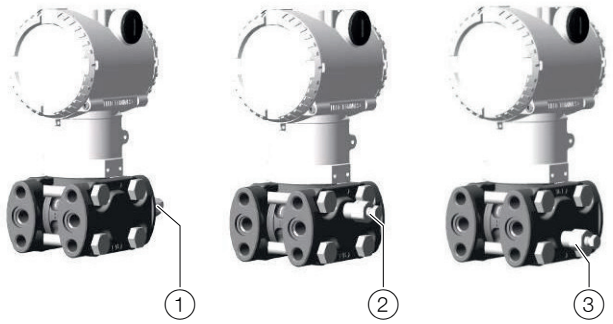
⚠ WARNING

Damage to health / danger of death due to leaking measuring medium!

Measuring medium can leak from the vent valve / drain valve during venting or draining.

To avoid any danger due to leaking measuring medium, please observe the following points:

- Wear protective clothing suited for the measuring medium during venting or draining.
- Safely collect any leaking measuring medium and dispose of it in an environmentally safe manner.



① Valve on the process axis
② Flange side valve on top
③ Flange side valve on the bottom

Figure 4: Possible positions of vent / drain valve

For transmitters without diaphragm sealers the following instructions on venting and draining must be complied with. It is important to attach the transmitter in such a manner and to layout the process line in such a manner that gas bubbles in liquid measurements can be routed back into the process and not get in to the measuring chambers.

The optional vent / drain valves on the transmitter are attached on the measuring cell flanges. Align the transmitter so that these vent / drain valves are arranged above the tap points for liquid measurement, so that gas can escape upward. For gas measurements align the transmitter so that the vent / drain valves are arranged below the tap points, so that air or condensate can drain.

Mounting position

The pressure transmitter can be attached directly on a valve manifold provided for flange installation.
Optionally a fastening bracket for wall or pipe installation (2 in pipe) is available as an accessory.

For models 266CRx fastening brackets must always be used. Ideally the pressure transmitter must be mounted in such a manner that the separating diaphragms are standing vertical, to avoid later zero point offsets.

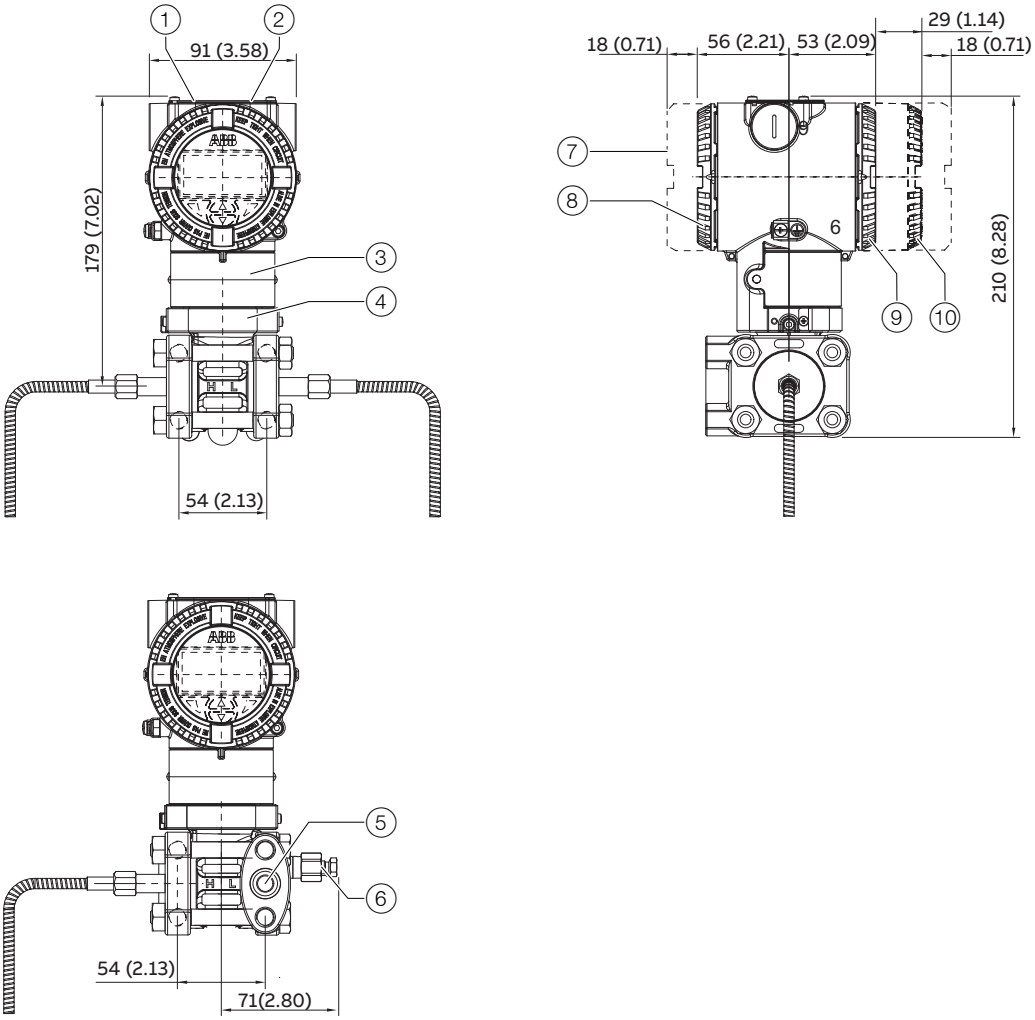
Note

If the pressure transmitters are mounted with an inclination that is not vertical, the filling fluid exerts hydrostatic pressure on the measuring diaphragm, which causes a zero point offset.
In this case the zero point can be adjusted via the zero point button or with the command ‘Set PV to Zero’. See **Overview of parameters on the configuration level** on page 49.

… 6 Installation

Mounting dimensions – Model 266CRx

Transmitter with barrel housing



1. Push buttons
2. Name plate
3. Certification plate
4. Optional plate (code I2)
5. Process connection
6. Vent / drain valve
7. Space for removing the cover
8. Terminal side
9. Electronics side
10. LCD display housing cover

Figure 5: Barrel housing, Dimensions in mm (in)

Note

In the case of models with just one remote seal, the threaded connection (¼-18 NPT directly or ½-14 NPT using adapter) of the standard process flange, the gasket groove, and the gasket comply with IEC 61518.

The screw-on thread for attaching the adapter flange to the process flange is $^{7}/_{16}$-20 UNF.

Transmitter with barrel housing and mounting bracket, for vertical or horizontal mounting on 60 mm (2 in) pipe

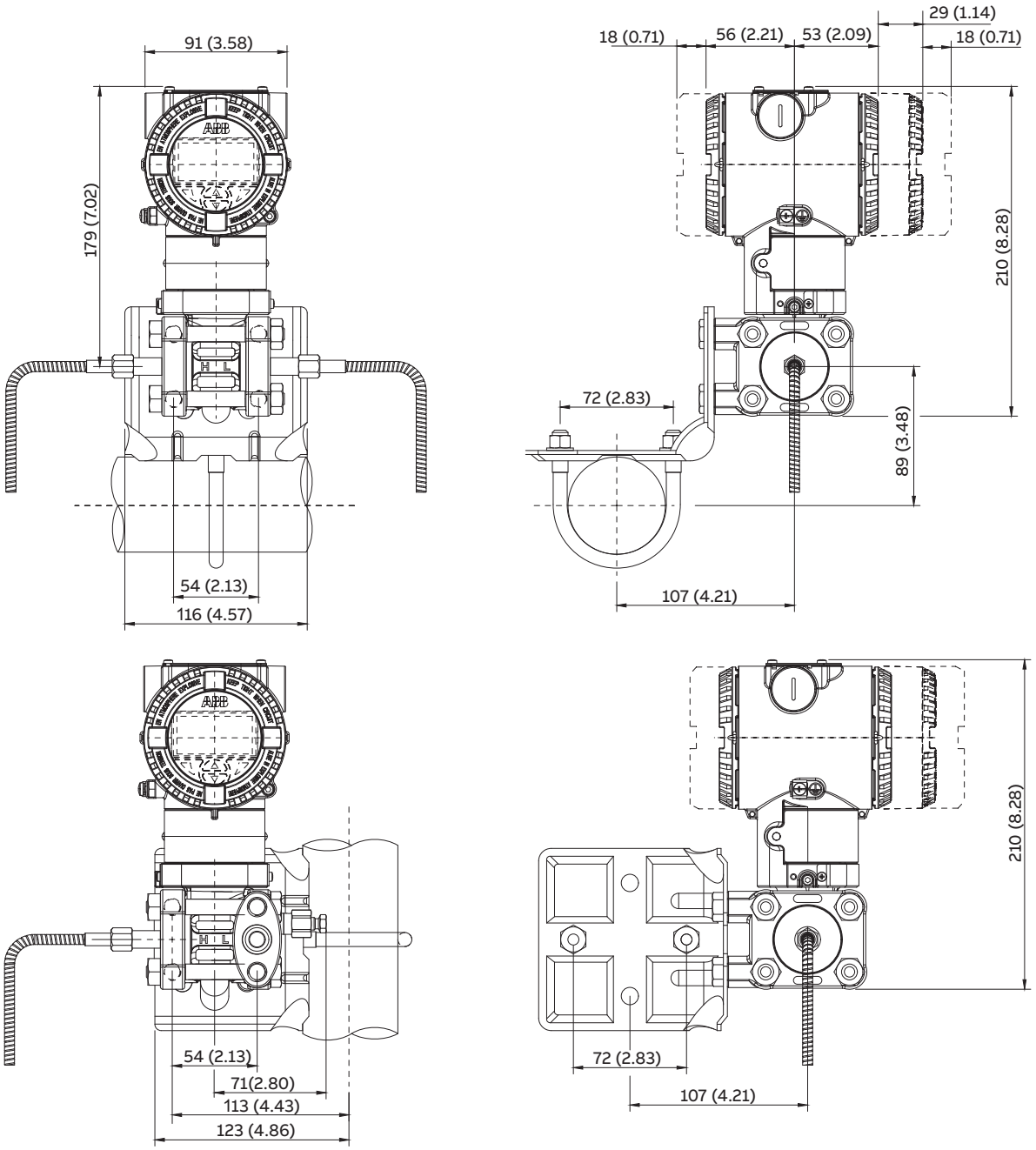


Figure 6: Pipe mounting - barrel housing, Dimensions in mm (in)

… 6 Installation

… Mounting dimensions – Model 266CRx

Transmitter with barrel housing and flat bracket, for vertical or horizontal mounting on 60 mm (2 in) pipe

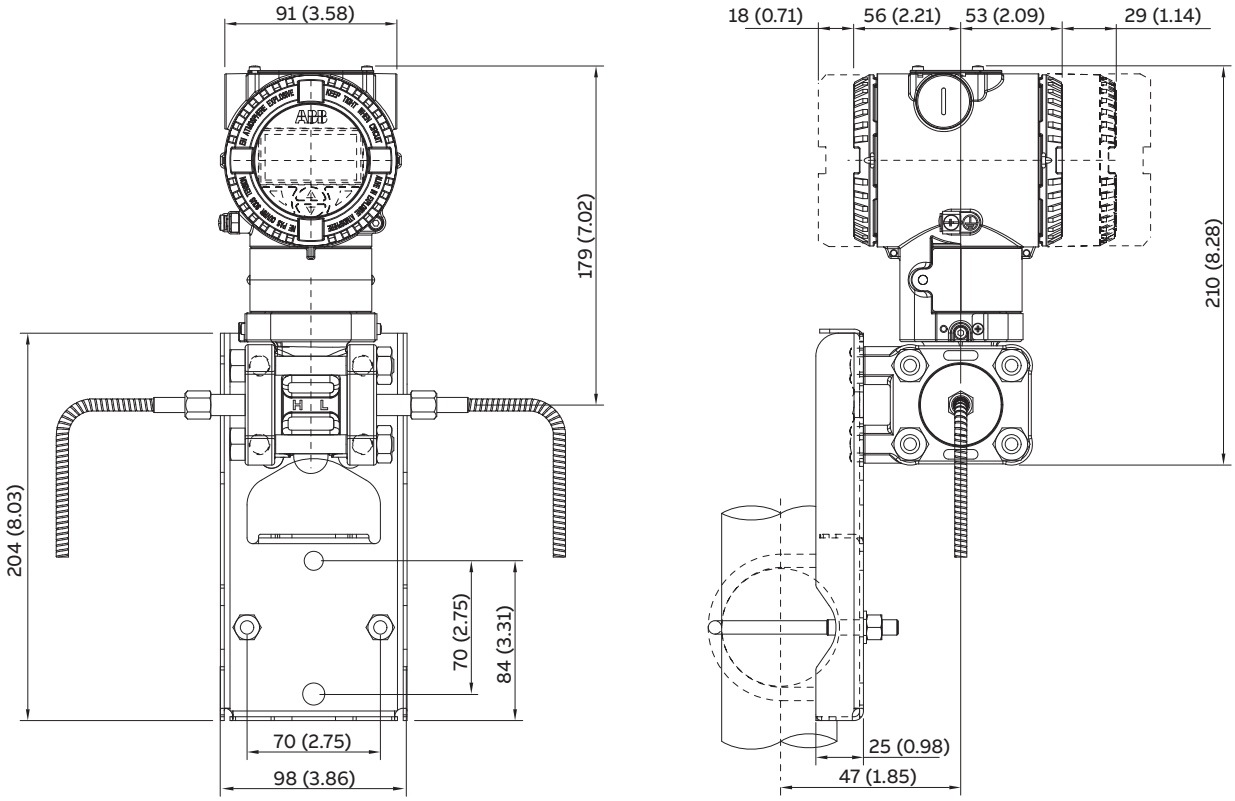
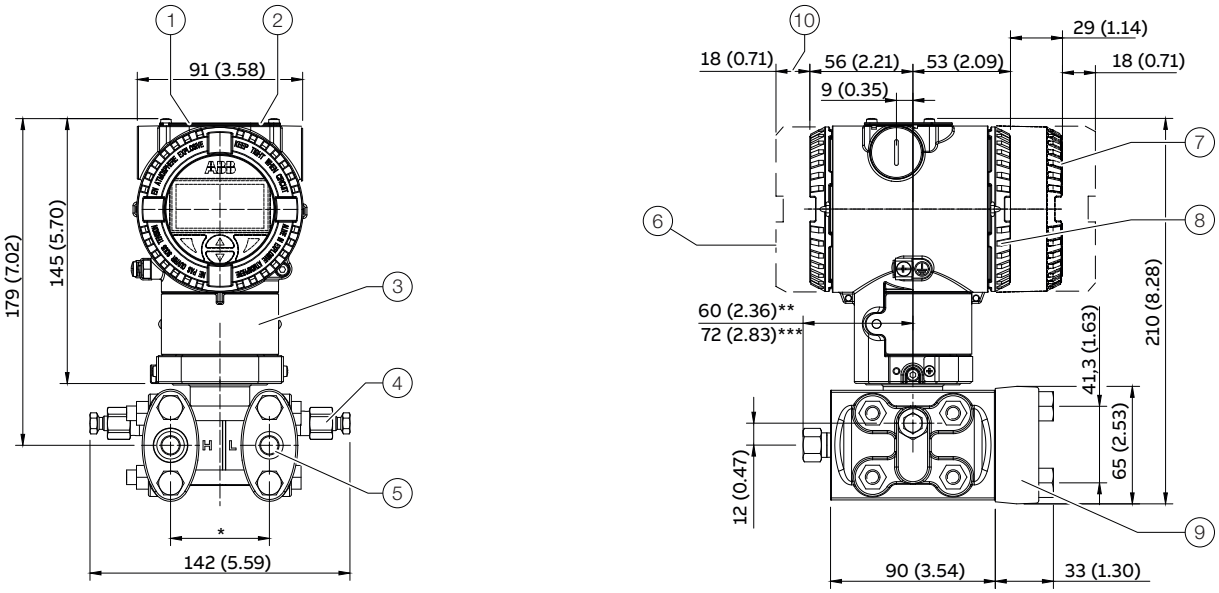


Figure 7: Flat bracket for pipe mounting – barrel housing, Dimensions in mm (in)

Mounting dimensions – Model 266CSx

Transmitter with barrel housing – horizontal flanges



1. Push buttons
2. Name plate
3. Certification plate
4. Vent / drain valve
5. Process connection
6. Terminal side
7. LCD display housing cover
8. Electronics side
9. Process flange adapter
10. Space for removing the cover

* 54 mm (2.13 in) via ¼-18 NPT process flanges;
51 mm (2.01 in), 54 mm (2.13 in) or 57 mm (2.24 in) via ½-14 NPT adapter flanges.

Note
Process connection and seal groove satisfy IEC 161518.
Thread for attaching adapter flanges or other components (for example manifold) on the process flange: $^{7}/_{16}$-20 UNF.

** With screw plug

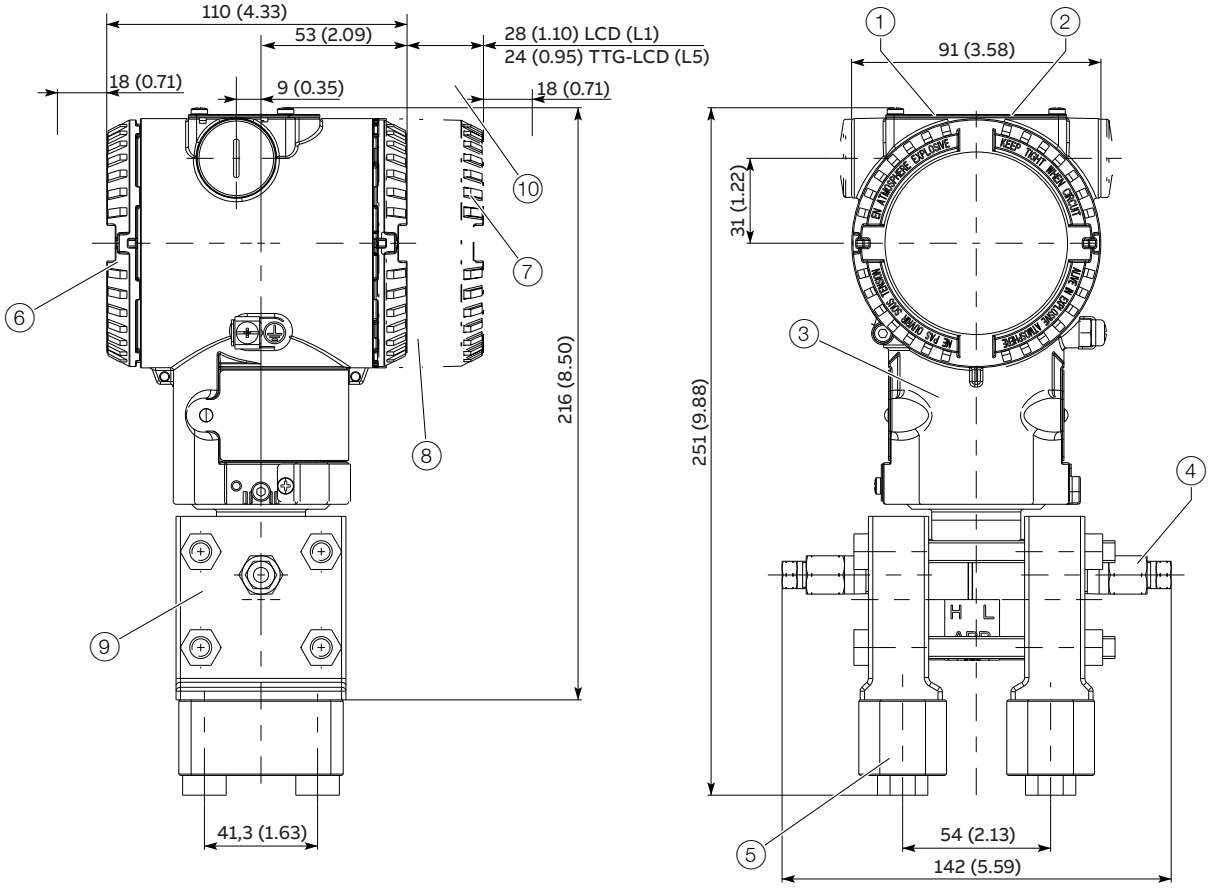
*** With vent / drain valve

Figure 8: Barrel housing – horizontal flanges, Dimensions in mm (in)

… 6 Installation

… Mounting dimensions – Model 266CSx

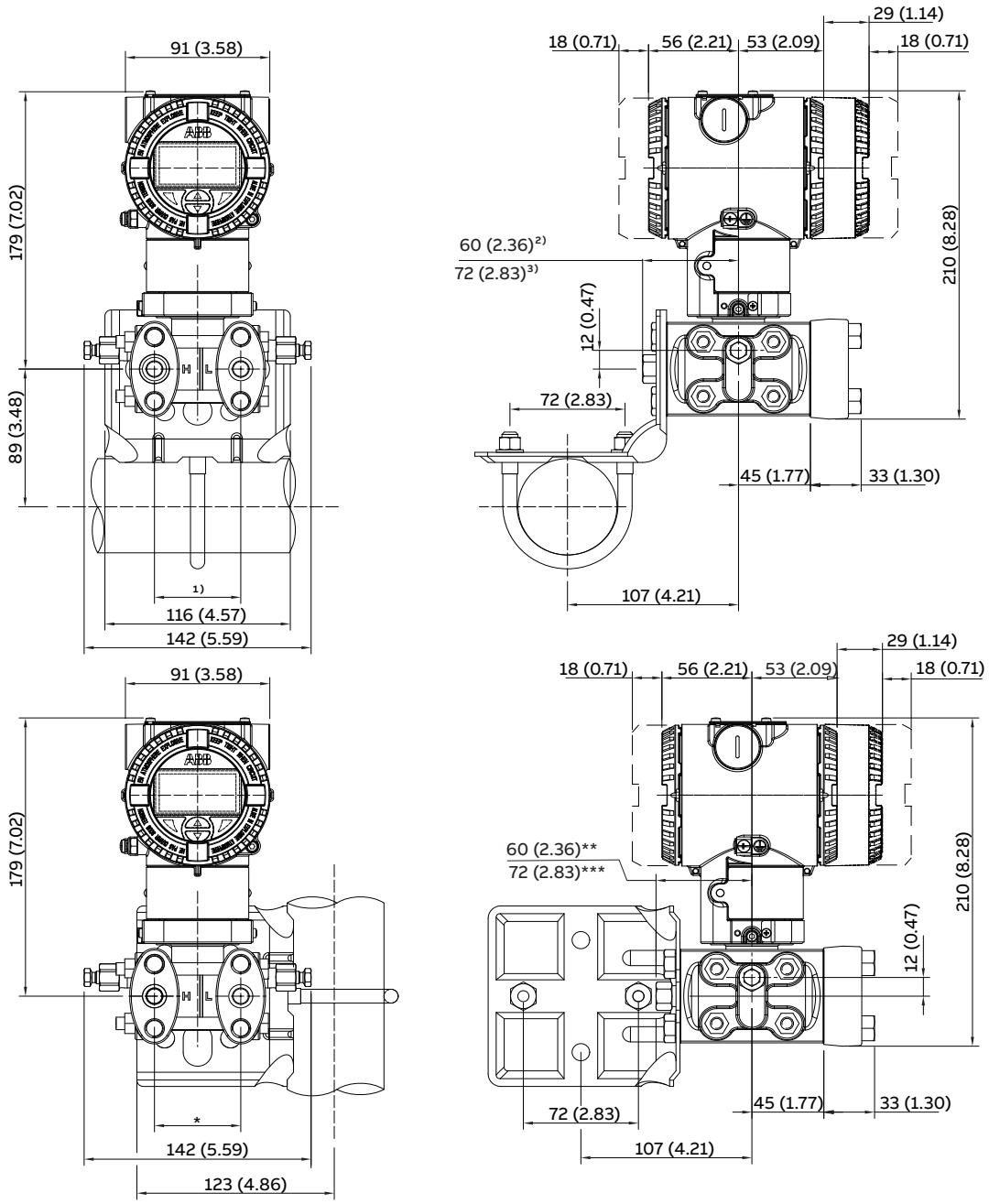
Transmitter with barrel housing – vertical flanges



1. Push buttons
2. Name plate
3. Certification plate
4. Vent / drain valve
5. Process connection
6. Terminal side
7. LCD display housing cover
8. Electronics side
9. Process flange adapter
10. Space for removing the cover

Figure 9: Barrel housing – vertical flanges, Dimensions in mm (in)

Transmitter with mounting bracket, for vertical or horizontal mounting on 60 mm (2 in) pipe pipe



* 54 mm (2,13 in) via ¼-18 NPT process flanges;
51 mm (2,01 in), 54 mm (2,13 in) or 57 mm (2.24 in) via ½-14 NPT adapter flanges.

Note
Process connection and seal groove satisfy IEC 161518.
Thread for attaching adapter flanges or other components (for example manifold) on the process flange: $^{7}/_{16}$-20 UNF.

** With screw plug

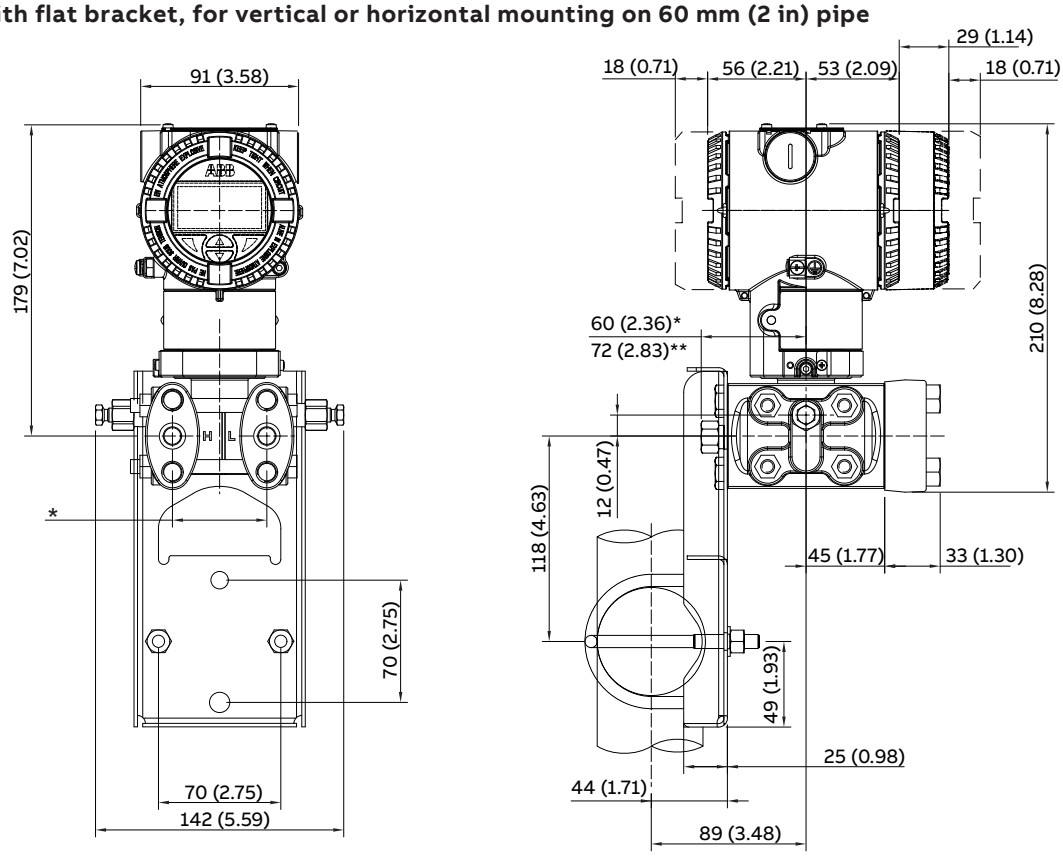
*** With vent / drain valve

Figure 10: Pipe mounting – barrel housing, Dimensions in mm (in)

… 6 Installation

… Mounting dimensions – Model 266CSx

Transmitter with flat bracket, for vertical or horizontal mounting on 60 mm (2 in) pipe



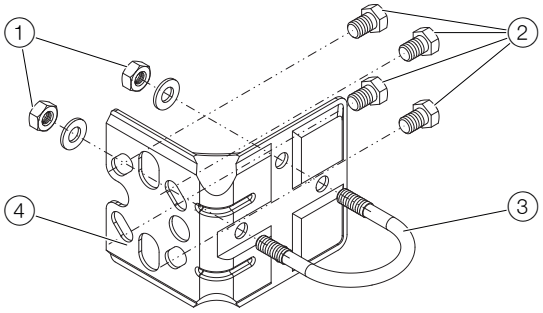
* With screw plug

** With vent / drain valve

Figure 11: Flat bracket for pipe mounting – barrel housing, Dimensions in mm (in)

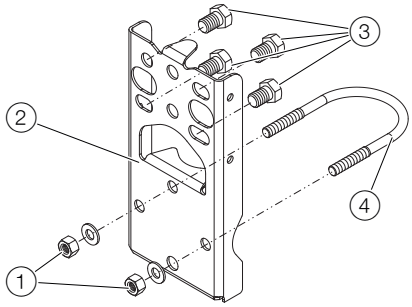
Installation via (optional) mounting brackets

With the mounting brackets available the transmitter can be mounted in different positions.



① Washers and nuts for fastening the U-bolt
② Mounting screws for the transmitter
③ U-bolt
④ Mounting bracket

Figure 12: Detail view of the mounting bracket, B2, for pipe and wall installation



① Washers and nuts for fastening the U-bolt
② Mounting bracket in flange design, B5
③ Mounting screws for the transmitter
④ U-bolt

Figure 13: Detail view of the mounting bracket, B5

Opening and closing the housing

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!

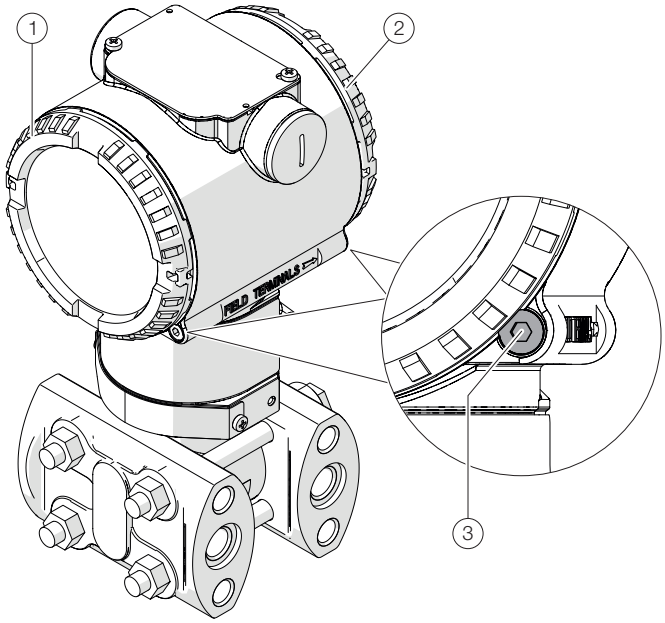
Before opening the transmitter housing or the terminal box, note the following points:

- Check that a valid fire permit is available.
- Make sure that there is no explosion hazard.
- Before opening the device, switch off the power supply and wait for t > 2 minutes.

NOTICE

Impairment of the IP rating

- Check the O-ring gasket for damage and replace it if necessary before closing the housing cover.
- Check that the O-ring gasket is properly seated when closing the housing cover.



(1) Housing cover (electronic / LCD display)
(2) Housing cover (terminal compartment)
(3) Cover lock screw

Figure 14: Cover lock (example)

To open the housing, release the cover lock by screwing in the screw (3).
After closing the housing, lock the housing cover by unscrewing the screw (3).

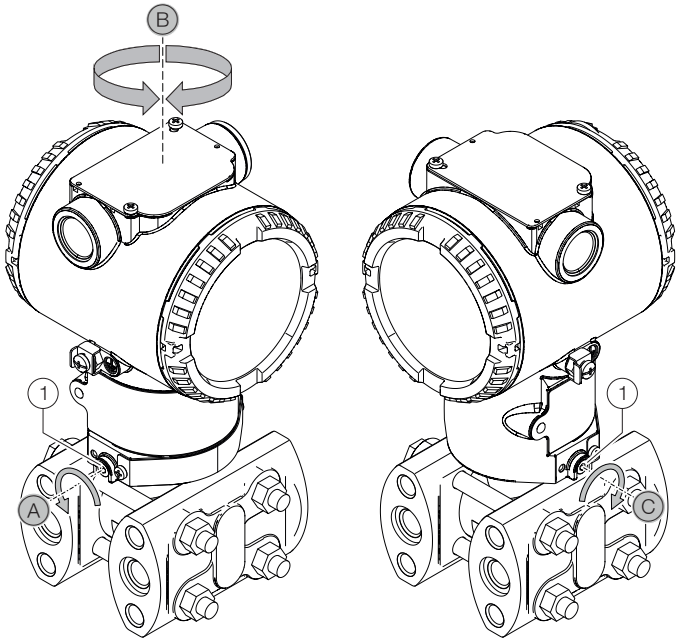
Adjusting the transmitter position

Transmitter housing

⚠ DANGER

Damaging the device carries a risk of explosion!

Never disconnect the transmitter housing from the sensor. Only loosen the screws shown when rotating the transmitter housing!



(1) Fixing screw

Figure 15: Rotating housing

To improve access to electrical connections and for better visibility of the optional LCD display in the field, the transmitter housing can be rotated through 360°. A stop prevents the housing from being turned too far.

To rotate the housing, perform the following steps:

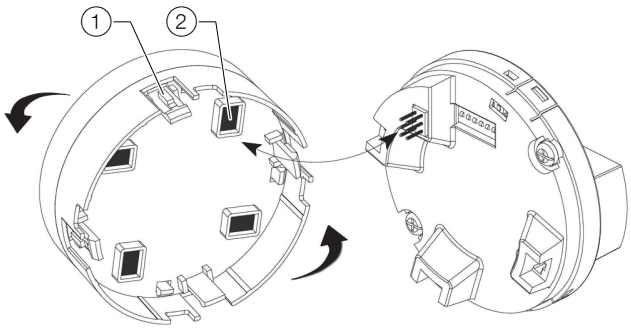
(A) Loosen the fixing screw approx. one revolution (do not remove it).
(B) Rotate the transmitter housing into the desired position.
(C) Retighten the fixing screw.

… 6 Installation

… Adjusting the transmitter position

Rotate the LCD display

If the device has an integral LCD display, this can be mounted in four different positions, each of which can be rotated through 90°.



① Fixing locks
② Display connector

Figure 16: Rotating the LCD display

To rotate the LCD display, perform the following steps:

1. Open the windowed cover (ensuring compliance with special requirements for hazardous areas), Refer to **Opening and closing the housing** on page 25.
2. Pull the LCD display out of the electronics module.
3. Reposition the LCD display connector accordingly.
4. Plug the LCD display back into the electronics module, checking that the 4 plastic fixing locks are securely in place.
5. Close the windowed cover.

Connecting impulse lines

⚠ WARNING

Bodily injury!

Leaks in the process lines can result in death or severe injuries.

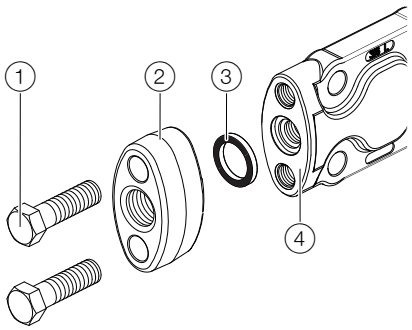
- Install and seal process connections and all accessory elements (including valve blocks) before the charging the device with pressure.
- For applications with toxic or hazardous substances prior to venting or draining, take all precautionary measures that are recommended in the respective safety data sheet.
- Only tighten the screws of the fastening accessories with a size 12 mm ($^{15}/_{32}$ in) hexagon socket wrench.

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

- The impulse lines must be as short as possible and have no sharp bends
- Lay the impulse lines so that no deposits can accumulate in them. Gradients should not be less than approx. 8 % (ascending or descending)
- The impulse lines should be blown through with compressed air or, better still, flushed through with the medium prior to connection
- With wet legs, the liquid in both lines must be at the same level
- With vaporous measuring media, measures must be taken to prevent steam entering the measuring chambers of the measuring cell and causing overheating
- It may be necessary to use condensate vessels or similar with small measuring spans and vaporous media
- If you are using condensate vessels (steam measurement), you should ensure that the vessels are at the same elevation in the differential pressure piping
- As far as possible, keep both impulse lines at the same temperature
- Completely depressurize the impulse lines if the medium is a liquid
- Lay the impulse lines so that gas bubbles (when measuring liquids) or condensate (when measuring gases) can flow back into the process line
- Ensure that the impulse lines are connected correctly (connection of high-pressure and low-pressure sides to the measuring cell, gaskets, etc.)
- All connections must be secure and tight
- Lay the impulse lines so that the medium cannot be blown out over the measuring cell

For more details please read the operating instruction section **Mounting**.

Process connections



1 Screws
2 Flange adapter
3 O-ring
4 Transmitter connection flange

Figure 17: Process connection

On the flange of the 266 multivariable transmitter there are ¼ to 18 NPT process connections with middle point spacings of 54 mm (2.13 in). The process connections on the flange enable direct attachment of 3 elements or 5 element valve manifolds. Optionally flange adapters with ½ to 14 NPT connections are available. By turning one or both adapters, middle point spacing of 51 mm (2.01 in), 54 mm (2.13 in) or 57 mm (2.24 in) is possible.

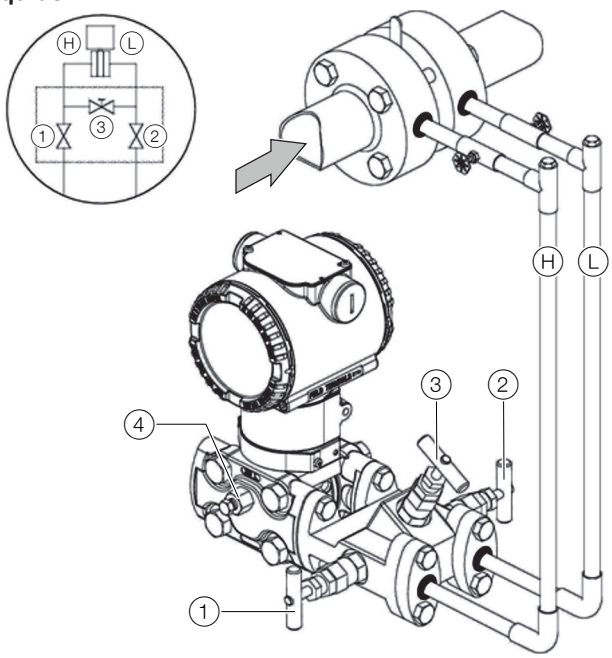
Mount the adapters as follows:

1. Correctly position the adapters with inserted O-ring.
2. Screw the adapters on the transmitter connection flange with the provided screws.
   Tighten the screws as follows: Preliminary tightening hand tight, preliminary tightening with 10 Nm, final tightening with 50 Nm.

Mounting recommendations

The arrangement of the impulse lines depends on the respective measurement application.

Flow measurement of steam (condensible vapor) or clean liquids



H High pressure side
L Low pressure side
1 High-pressure valve
2 Low pressure valve
3 Equalizing valve
4 Vent / Drain valve

Figure 18: Steam flow measurement

- Place taps to the side of the process line.
- For liquid measurements, mount the transmitter next to or underneath the taps, for steam measurements underneath the taps.
- Mount the vent / drain valve pointing upward.
- For steam applications, fill the vertical section of the impulse lines with a compatible fluid through the appropriate filling connections.

The height of the liquid column between process line and transmitter must be the same on the high pressure side and the low pressure side, so that an accurate measurement is ensured. For implementation of this requirement it can be practical for steam measurements, to use the impulse lines condensate tanks.

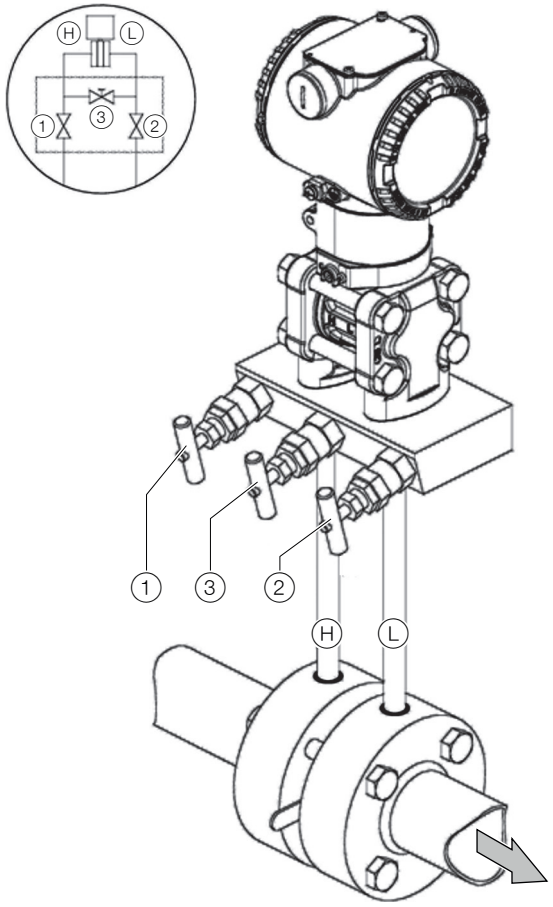
… 6 Installation

… Mounting recommendations

To commission the transmitter, operate the valves in the following sequence:

1. Open the equalizing valve.
2. Close the low pressure valve and high pressure valve.
3. Open the primary shutoff valves.
4. Slowly open the high pressure valve so that the measuring medium can flow into the measuring cell on both sides.
5. Vent or drain the measuring cell and close the valves.
6. Open the low pressure valve and close the equalizing valve.

Flow measurement of gas or liquid with solids in suspension



(H) High pressure side
(L) Low pressure side
(1) High-pressure valve
(2) Low pressure valve
(3) Equalizing valve

Figure 19: Flow measurement of gases or liquids

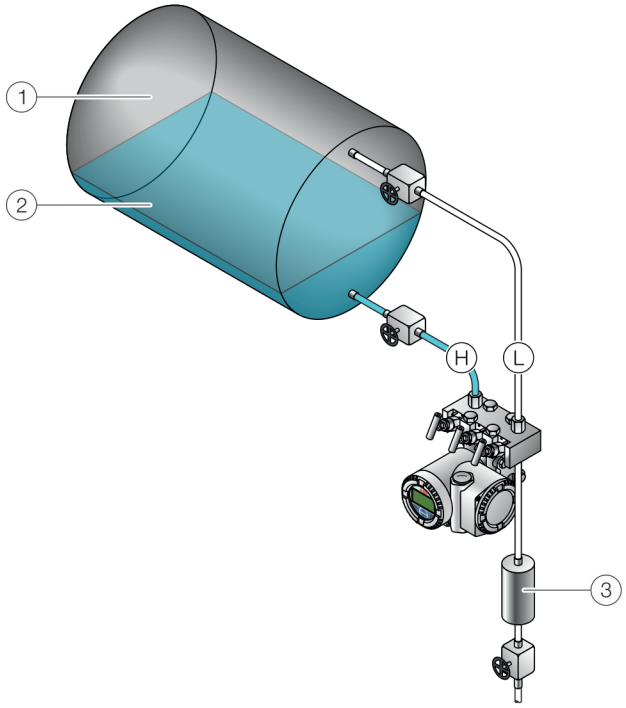
- Place taps above or to the side of the line.
- Mount the transmitter above the taps.

To commission the transmitter, operate the valves in the following sequence:

1. Open the equalizing valve.
2. Close the low pressure valve and high pressure valve.
3. Open the primary shutoff valves.
4. Slowly open the high pressure valve so that the measuring medium can flow into the measuring cell on both sides.
5. Vent or drain the measuring cell and close the valves.
6. Open the low pressure valve and close the equalizing valve.

Fill level measurement on closed tanks

Non-condensing measuring medium (dry leg)

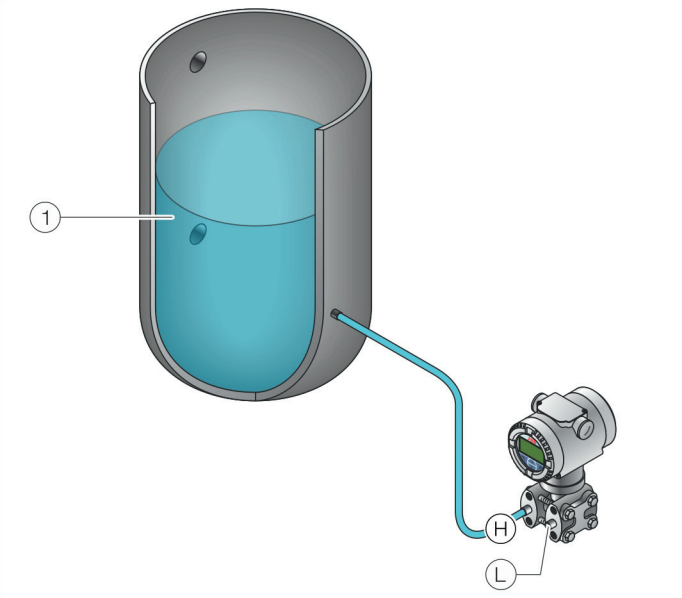


(H) High pressure sid
(L) Low pressure side
(1) Gas
(2) Liquid
(3) Condensate trap

Figure 20: Level measurement on closed tanks (dry leg)

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the high pressure side '+' of the transmitter to the bottom of the tank.
- Connect the low pressure side '–' of the transmitter to the top of the tank, above the maximum level.

Fill level measurement on open tanks with fluids



(H) High pressure side
(L) Low pressure side
(1) Liquid

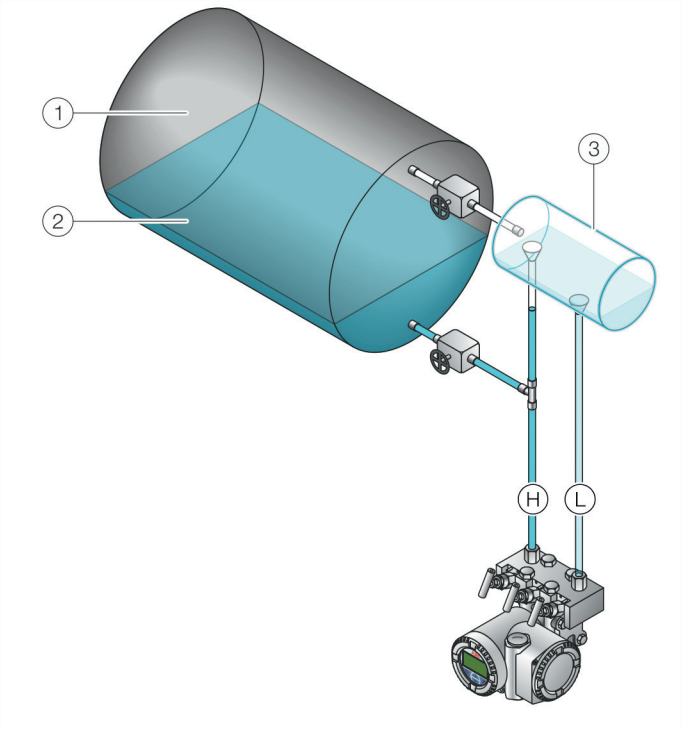
Figure 21: Level measurement on open tanks

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the high pressure side '+' of the transmitter to the bottom of the tank.
- Leave the low pressure side '–' of the transmitter open to the atmosphere.

… 6 Installation

… Mounting recommendations

Fill level measurement on the steam boiler (drum water level)



H High pressure side
L Low pressure side
1 Gas
2 Liquid
3 Condensate vessel

Figure 22: Level measurement on the steam boiler

- Mount the transmitter at the same height or below the lowest level to be measured.
- Connect the high pressure side '+' of the transmitter to the bottom of the tank.
- The low pressure side '–' of the transmitter up at the tank. Above the maximum level, connect using a condensate vessel.
- Use the condensate vessel to ensure that the impulse line of the low pressure side is always filled with liquid (condensate) at a constant height.

Temperature measurement

- Mount the temperature sensor in the downstream pipe of the primary element.
- Consider the downstream straight pipe requirements.
- If there is a significant difference between the temperature of the measuring medium and the ambient temperature, the measuring error caused by heat conduction must be minimized by insulating the installation location accordingly.
- Use class 'A' sensors to maximize accuracy.
- The lengths of the protective tubes should be 15 to 20 times the diameter of the protective tube for gas measurements and 3 to 5 times the diameter of the protective tube for liquid measurements.

Electrical connections

Safety instructions for electrical installation

⚠ DANGER

Explosion hazard

Improper installation and commissioning of the device carries a risk of explosion.

- For use in potentially explosive atmospheres, observe the information in **Use in potentially explosive atmospheres** on page 6!

⚠ DANGER

Explosion hazard

If the type of protection specified on the certification plate does not agree with the requirements imposed on the implementation site, explosions or fires can be triggered.

- In this case the transmitter must NOT be connected electrically.

⚠ WARNING

Risk of injury due to live parts.

Improper work on the electrical connections can result in electric shock.

- Connect the device only with the power supply switched off.
- Observe the applicable standards and regulations for the electrical connection.

NOTICE

Damage to components!

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 before touching electronic components.

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.

The electrical connection information in this manual must be observed; otherwise, the IP rating may be adversely affected. Ground the measurement system according to requirements.

General

The relevant directives must be complied with for the electrical installation!

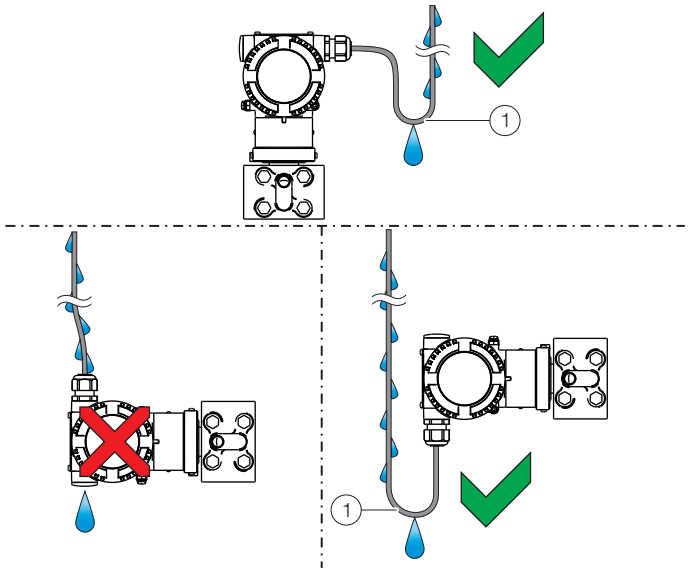
Because the transmitter cannot be switched off, surge protection devices, lightning protection, or grid disconnect possibilities must be provided at the plant.

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

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

Installing the connecting cables

Ensure that a drip loop (water trap) is used when installing the connecting cables for the sensor.
If necessary, rotate the transmitter housing accordingly.



(1) Drip loop

Figure 23: Installing the connecting cables

… 6 Installation

… Electrical connections

Cable entries

The electrical connection is made via cable entries with a ½ in NPT or M20 ×1.5 thread.

Note

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

Cable entries with an M20 × 1.5 thread

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

Cable entries with a ½ in NPT thread

The supplied transport sealing plugs do not have IP rating 4X / IP 67 and are not approved for use in potentially explosive atmospheres.

The transport sealing plugs must be replaced with suitable cable glands or sealing plugs during device installation.
When selecting the cable glands or sealing plugs, make sure they have the required IP rating and explosion protection!
To offer IP rating 4X / IP 67, the cable glands / sealing plugs must be screwed in using a suitable sealing compound.

Cable entrie for PT100 temperature sensor

A metal cable gland should always be used for the Pt100 cable since a shielded cable is used.
Connect the shielding within the metal cable gland!
To offer IP rating 4X / IP 67, the cable glands / sealing plugs must be screwed in using a suitable sealing compound.

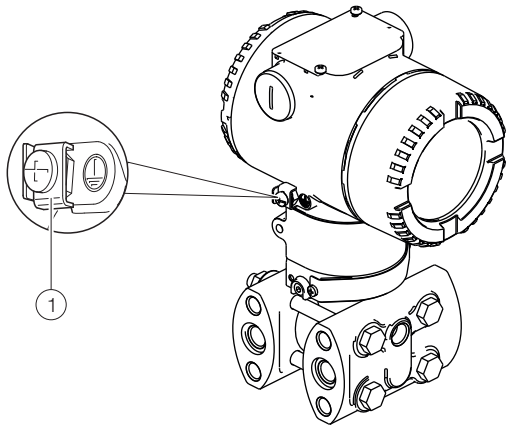
Safety instructions for use in Division 1

Conduit requirements for Div. 1 installations are not addressed in this procedure.

To avoid creating a hazardous situation, ensure compliance with the applicable standards, regulations, and recommendations for installation in the country of use. Resistance thermometer installation in classified Div. 1 areas should only be performed by technicians knowledgeable about explosion protection.

Explosionproof and flameproof installations require explosion-proof conduit and poured seals or flameproof rated cable and cable glands, respectively.

Grounding



① Ground terminal

Figure 24: Ground terminal on transmitter housing

The pressure transmitter housing should be grounded in accordance with national and local electrical codes.
The 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 Ω.

Electrical connection

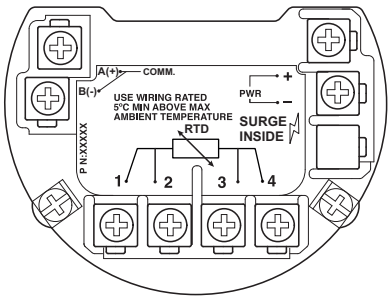


Figure 25: Terminals

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

Note – Connection of a Pt100 temperature sensor
For the purpose of simulation, a 178 Ω resistor [206 °C (402.8 °F)] with 2 jumpers has been installed between the terminals for the Pt100 connection.

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

Electrical data for inputs and outputs

Devices with Modbus communication	
Terminals	PWR + / PWR –
Supply voltage	10.5 to 30 V DC

Note
For current draw requirements see **Figure 26**.
For power consumption based on specific supply voltages see **Figure 27**.

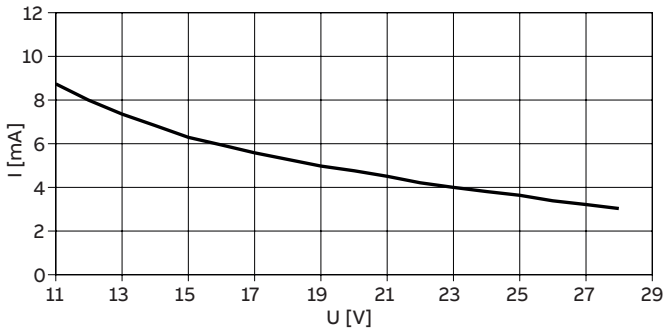


Figure 26: Supply current chart

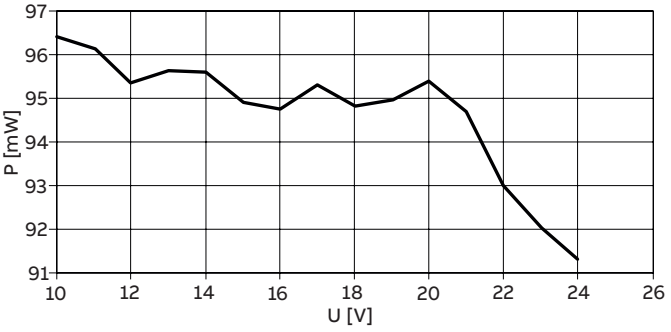
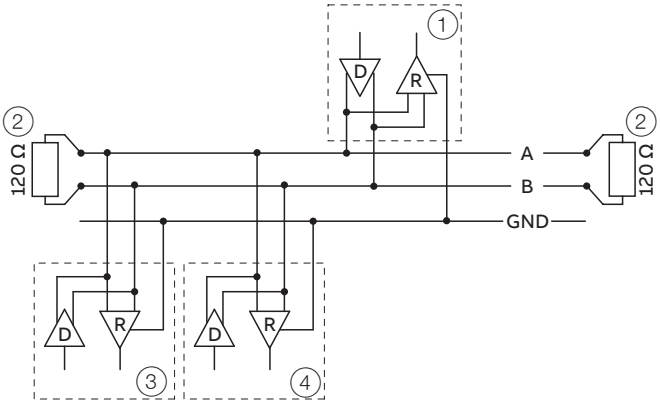


Figure 27: Power consumption chart

Modbus communication

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

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



1 Modbus master
2 Terminating resistor
3 Modbus slave 1
4 Modbus slave n to 32

Figure 28: Modbus network (example)

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

… 6 Installation

… Electrical connections

Cable specification

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

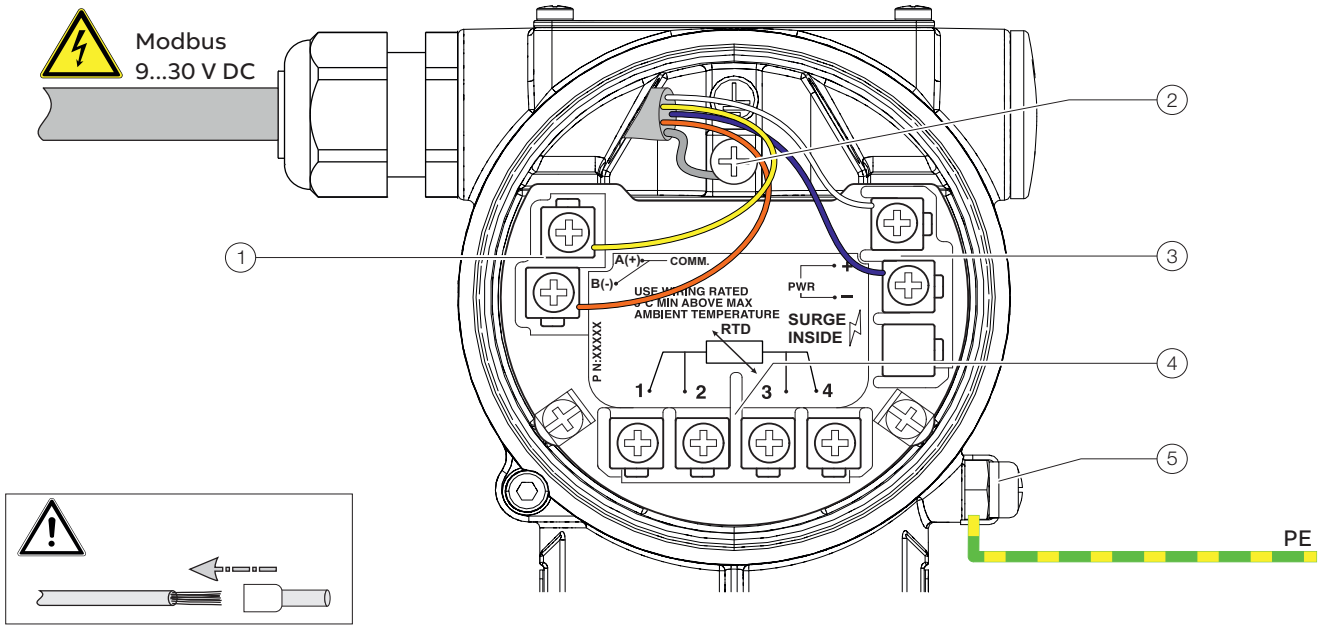
- At a baud rate of 9600 and with a conductor cross section of at least 0.14 mm^2 (AWG 26), the maximum length is 1000 m (3280 ft).
- If a 4-core cable is used in a 2-wire system, the maximum length must be halved.
- The spur lines must be short (maximum of 20 m [66 ft]).
- When using a distributor with 'n' connections, the maximum length of each branch is calculated as follows: 40 m (131 ft) divided by 'n'.

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

- Up to 6 m (20 ft): cable with standard shielding or twisted-pair cable.
- Up to 300 m (984 ft): double twisted-pair cable with overall foil shielding and integrated earth cable.
- Up to 1200 m (3937 ft): double twisted-pair cable with individual foil shielding and integrated earth cables. Example: Belden 9729 or equivalent cable.

A category 5 cable can be used for Modbus RS485 up to a maximum length of 600 m (1968 ft). For the symmetrical pairs in RS485 systems, a surge impedance of more than 100 Ω is preferred, especially at a baud rate of 19200 and above.

Connection on the device



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

Figure 29: Connection on the device (example)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class. Follow the instructions in **Opening and closing the housing** on page 25 to open and close the housing safely.

Note

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

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

To connect the pressure transmitter, observe the following instructions:

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

7 Commissioning

Safety instructions

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

General Notes

Once the pressure transmitter has been installed, it is put into operation by switching on the operating voltage.
Prior to switching on the operating voltage check:

- Process connections
- Electrical connection
- Complete filling of the impulse line and measuring chamber of the measuring cell with the measuring medium.

The transmitter can then be put into operation.
To do this, the valves must be actuated in the following order (in home position, all valves are closed):

1. Open the shut-off valves on the pressure tap connection (if present).
2. Open the pressure equalization valve of the valve block.
3. Open the shut-off valve of the high pressure side (H) on the valve block.
4. Open the shut-off valve on the low pressure side (L) on the valve manifold.
5. Close the pressure equalization valve.

Decommissioning is executed in the reverse sequence.

Note
If the output signal stabilizes only slowly, it is likely that a large damping time constant has been set on the transmitter.

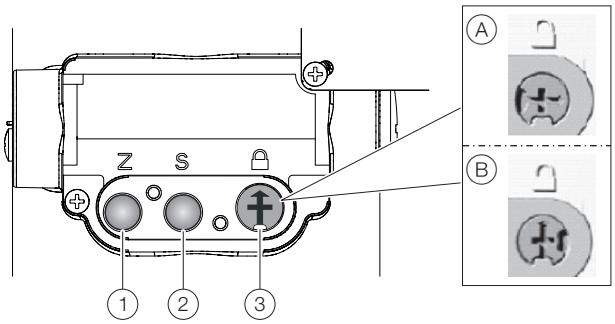
Zero point correction following installation

NOTICE

Material damage due to a magnetic field!
The use of magnetic screwdrivers results in damage of components.

- Do not use a magnetic screwdriver to operate the buttons.

Once the transmitter has been installed, it is advisable to check the zero point and correct it if necessary.



① Zero
② Span
③ Write protection switch

Figure 30: Operating buttons, write protection turn switch

Setting precalibrated devices

Note
266Cxx transmitters do not support this function if the 'Level measurement' calculation function has been activated. In this case, the correction must be made using the optional LCD indicator or the DTM.

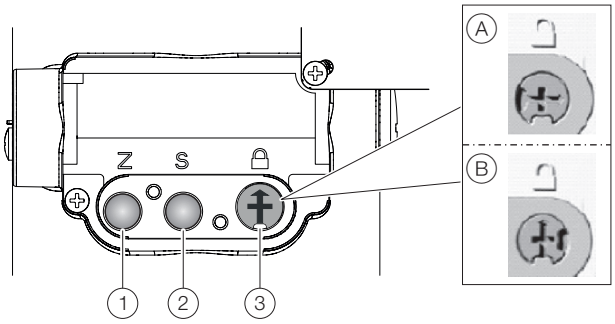
- For this purpose, the DIP switch on the electronics board must be set to position '0', see **DIP switches on the secondary electronics** on page 38.

A PV Bias / Offset correction can be performed via the local push buttons as follows:

1. Separate the transmitter from the process and equalize the pressure in the two measuring chambers by adjusting the bypass valve in the manifold.
2. Check the transmitter output signal:
- If it is PV = 0, zero point correction is not required.
- If the output is not at zero, proceed as follows:
3. Unscrew the screws attaching the name plate to the top of the transmitter housing.
4. Rotate the name plate so that the push buttons can be accessed.
5. Check that the write protection rotary switch is set to write enable.
6. Press and hold down the zero button (Z) on the top of the transmitter for at least 3 seconds.
- The output signal switches to PV = 0 and the message 'OPER DONE' appears on the LCD display (if there is one).
- If nothing happens, check the write protection rotary switch.
  It is probably set to write protection. For all other diagnosis notices, refer to the instructions.
7. As soon as zero point correction is complete, reconnect the transmitter to the process.
8. Open the pressure equalization valve on the manifold.
9. Open the shut-off valve of high-pressure side.
10. Open the pressure equalization valve on the manifold.
11. Open the shut-off valve on the low-pressure side.

Hardware settings

Write protection switch



① Zero
② Span
③ Write protection switch

Figure 31: Operating buttons, write protection turn switch

The write protection prevents unauthorized users from overwriting the configuration data.

- With activated write protection the operating buttons '0% (Z)' and '100 % (S)' have no function.
- A change of parameters with the integral LCD indicator, via a handheld terminal, or the user interface (DTM) are not possible either.

However, the configuration data can be read out via the graphic user interface (DTM) or a comparable communication tool. If needed the operating device can also be sealed with a lead seal.

Write protection can be activated as follows (see also the symbols on the plate).

1. Remove the nameplate by releasing the holding screw lying on the bottom left corner
2. Use a suitable screwdriver to press the switch all the way down.
3. Turn the switch 90° clockwise.

Note
To deactivate write protection, press the switch down slightly and then turn it counterclockwise 90°.

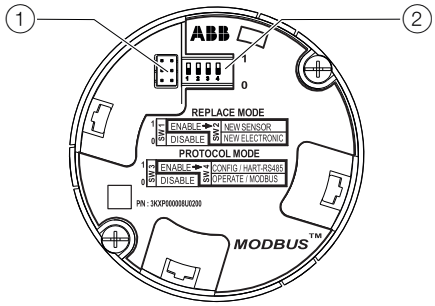
Note
The product has an ABB service account that can be disabled with this write protection switch.

… 7 Commissioning

… Hardware settings

DIP switches on the secondary electronics

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



(1) Interface for LCD indicator and service port
(2) DIP switches

Figure 32: Communication board Modbus

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

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

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

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

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

Protocol mode (DIP switches 3 and 4)
By default, DIP switch 3 is in position 0.

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

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

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

… 7 Commissioning

Parameterization of the device

The transmitter is delivered preconfigured according to the information provided when placing the order.
However, should a change to the configuration be necessary (because measuring point data has changed since the original plans were drawn up, for example), the following options are available:

- Menu-led configuration of the transmitter with the integral LCD display
- Configuration using a PC / Laptop with graphical user interface (DTM). How to use these tools to make the configuration settings is described in the corresponding related documentation.

Factory settings

The transmitters calibrated in the factory to the measuring range specified by the customer. The calibrated measuring range and the measuring point tag are specified on an additional labeling plate.
If nothing is specified by the customer in this regard, the transmitter will be delivered with a standard configuration, that contains the following parameters (among others).

Parameter	Factory setting
Measuring range start (LRV)	Zero
Measuring range end (URV)	Upper measuring range limit (URL)
Transmission function for the output	Mass flow
Damping	1 second
Presentation of the optional LCD display	Process value PV (1-place) and bar diagram of the output signal

Each of the parameters listed here can be easily set via the optional LCD display with operating menu, or the Device Type Manager (DTM).

Configuration without integrated LCD display

Note
The configuration possibilities described below are only possible for the models 266Cxx with flow calculation or without calculation function.

The correction of the mounting position and reset of bias are set directly on the transmitter via the operating buttons. These operating buttons are arranged under the rating plate.
In order to operate the device locally, unscrew the fixing screws of the rating plate, and swing the name plate clockwise to the side.

NOTICE

Material damage due to a magnetic field!
The use of magnetic screwdrivers results in damage of components.

- Do not use a magnetic screwdriver to operate the buttons.

The transmitter has been calibrated by the manufacturer based on the order information. The set measuring range start and measuring range end are specified on the name plate.

For the connection, ensure that liquid residues (for gaseous test materials) or air bubbles (for liquid test materials) are not in the impulse line; because that can cause measurement errors in the test.

It is recommended to set the damping to the value ‘zero’.
For correction of mounting position and static pressure influence see .
A reset to factory setting of differential pressure can be done with operating button ‘S’.

… 7 Commissioning

Configuration via the LCD indicator with the operating buttons (optional)

Note

For a detailed description of the individual parameters and menus on the configuration level, please refer to **Overview of parameters on the configuration level** on page 49.

The LCD display is only used for visualization of the measured values and for configuration of the display and of the transmitter.

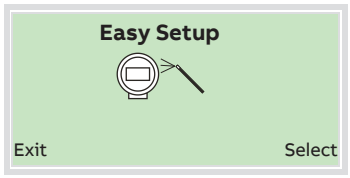
In addition, diagnostics messages are displayed.

Parameterization via the 'Easy Setup' menu function

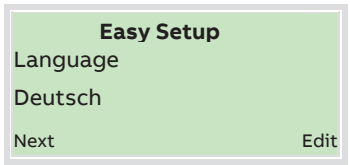
The device can be factory parameterized to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.

The setting of the most current parameters is summarized in the 'Easy Setup' menu.

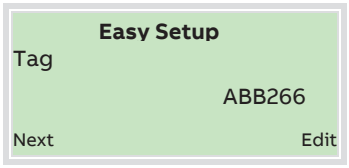
1. Press the operating key and keep it depressed until both symbols are shown left and right in the lower process display.
2. Change to the configuration level with .



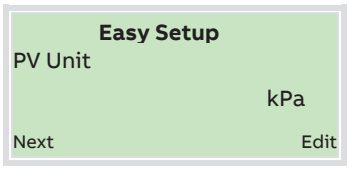
3. Use or to select 'Easy Setup'.
4. Confirm the selection with .



5. Use to call up edit mode.
6. Use or to select the desired language.
7. Confirm the selection with .
8. Go to the next menu item with .



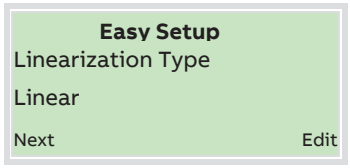
9. Use to call up edit mode.
10. Enter the desired measurement point code
11. Confirm the selection with .
12. Go to the next menu item with .



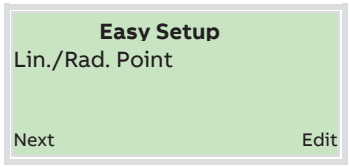
13. Use to call up edit mode.
14. Use or to select the desired unit.
15. Confirm the selection with .
16. Go to the next menu item with .

17. Use to call up edit mode.
18. Use or to set the start of the measurement range (LRV).
19. Confirm the selection with .
20. Go to the next menu item with .

21. Use to call up edit mode.
22. Use or to set the end of the measuring range (URV).
23. Confirm the selection with .
24. Go to the next menu item with .

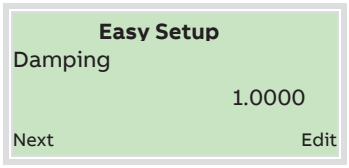


25. Use ▽ to call up edit mode.
26. Use △ or ▽ to select the desired transmission function.
27. Confirm the selection with ▽.
28. Go to the next menu item with ◁.

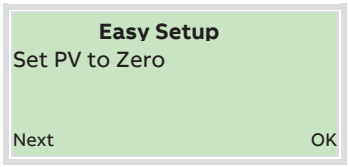


29. Use ▽ to call up edit mode.
30. Use △ or ▽ to select the desired Lin./Rad. transition.
31. Confirm the selection with ▽.
32. Go to the next menu item with ◁.

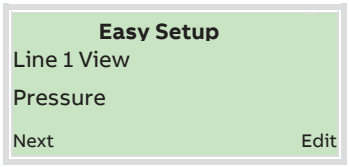
33. Use ▽ to call up edit mode.
34. Use △ or ▽ to select the desired low flow cut off.
35. Confirm the selection with ▽.
36. Go to the next menu item with ◁.



37. Use ▽ to call up edit mode.
38. Use △ or ▽ to select the desired damping.
39. Confirm the selection with ▽.
40. Go to the next menu item with ◁.



41. Use ▽ to call up edit mode.
42. Use ▽ to start automatic correction of the install position.
43. Go to the next menu item with ◁.



44. Use ▽ to call up edit mode.
45. Use △ or ▽ to select the desired value for display in the first line of the LCD display.
46. Confirm the selection with ▽.

… 7 Commissioning

Configuration with the PC / laptop

The 266Cxx multivariable transmitters can be configured with the aid of the following devices:

- ABB Asset Vision Basic, a free-of-charge software configurator, that can be downloaded at www.abb.com/measurement.
- Software for configuration of field devices, with the prerequisite that it is compatible with DTM.

With the graphic user interface (DTM) all configuration possibilities are available. The procedure for program installation is described in the appropriate installation manual delivered with the software.
The transmitter can be configured, read out and tested via the program. With the aid of the integrated database a configuration can also be executed in offline mode. Each configuration step is subject to a plausibility check. For each point of the program a context sensitive help can be called via 'F1'.
Immediately after receipt of the transmitter or after changing the configuration, we recommend that back up the existing configuration on a separate data medium under 'Save in database'.
Operating instructions for the program 'Asset Vision Basic' are provided in the appropriate user manual.

A RS485 interface will be needed for communication between PC and transmitter.

- The driver for this interface must support a COM port.
- The communication DTM (for example 'ABB HART Communication Servicepoint') must be set to the same COM port as the RS485 interface.
- The baud rate for configuration of the transmitter is fixed to 9600 baud and must be set to the same value inside the communication DTM.
- The communication protocol of the transmitter has to be set to 'CONFIG/HART-RS485' with dip switch, HMI menu or Modbus Master.

For operating with a Modbus master after configuration must the transmitter be set back to 'OPERATE/MODBUS' with the DTM, HMI or dip switches.

Modbus connection of 2600T (266xxx-MV Modbus®) via USB / RS 485-converter to PC/laptop

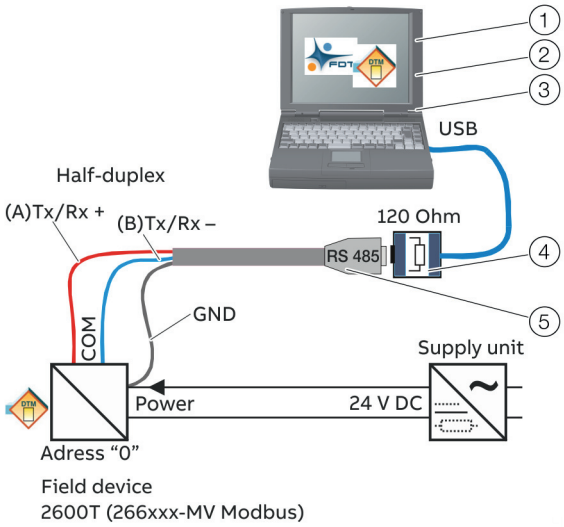


Figure 33: Modbus connection special for 2600T (266xxx-MV Modbus®)

	Description	Ordering number	Data sheet
1	**DTM and DAT200**	9820027	DS/DTM/DAT200
	Device DTM and Asset Vision Basic - driver and device management tool for configuration and parameterization of intelligent field devices.		
2	**CommDTM**	Not in ABB scope of delivery	
	Communication DTM for the USB / RS 485 converter. Recommendation: CodeWrights HARTCommDTM		
3	**DTM MV266xxx-MV Modbus**	9820027	DS/DTM/DAT200
	Device DTM of 2600T (266xxx-MV Modbus®) • Part of the DTM500 bundle • Driver for the configuration and parameterization of the field device		
4	**USB / RS 485 converter**	Not in ABB scope of delivery	
	At the end on the MODBUS interface with 120 Ω-resistance between '(A)Tx/Rx+' / '(B)Tx/Rx–'		
5	**RS 485 cable**	Not in ABB scope of delivery	
	Half-duplex wiring with (A)Tx/Rx+, (B)Tx/Rx– and GND • Connect 'Tx+' und "Rx+' • Connect 'TX–' and 'Rx–'		

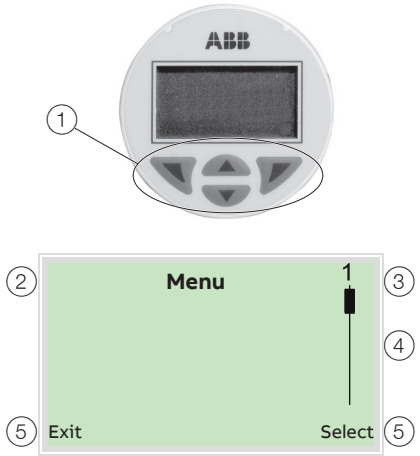
Before starting configuration via DTM, the transmitter function must be switched from 'Operate' to 'Configuration' mode (using the 3 buttons on the device).

8 Operation

Safety instructions

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

Menu navigation



1. Operating buttons for menu navigation
2. Menu name display
3. Menu number display
4. Marker for indicating relative position within the menu
5. Display showing the current functions of the and operating buttons

Figure 34: LCD display

The LCD indicator has capacitive operating buttons. These enable you to control the device through the closed housing cover.

Note
The transmitter automatically calibrates the capacitive buttons on a regular basis. If the cover is opened during operation, the sensitivity of the buttons is firstly increased to enable operating errors to occur. The button sensitivity will return to normal during the next automatic calibration.

You can use the or operating buttons to browse through the menu or select a number or character within a parameter value.
Different functions can be assigned to the and operating buttons. The function (5) that is currently assigned to them is shown on the LCD display.

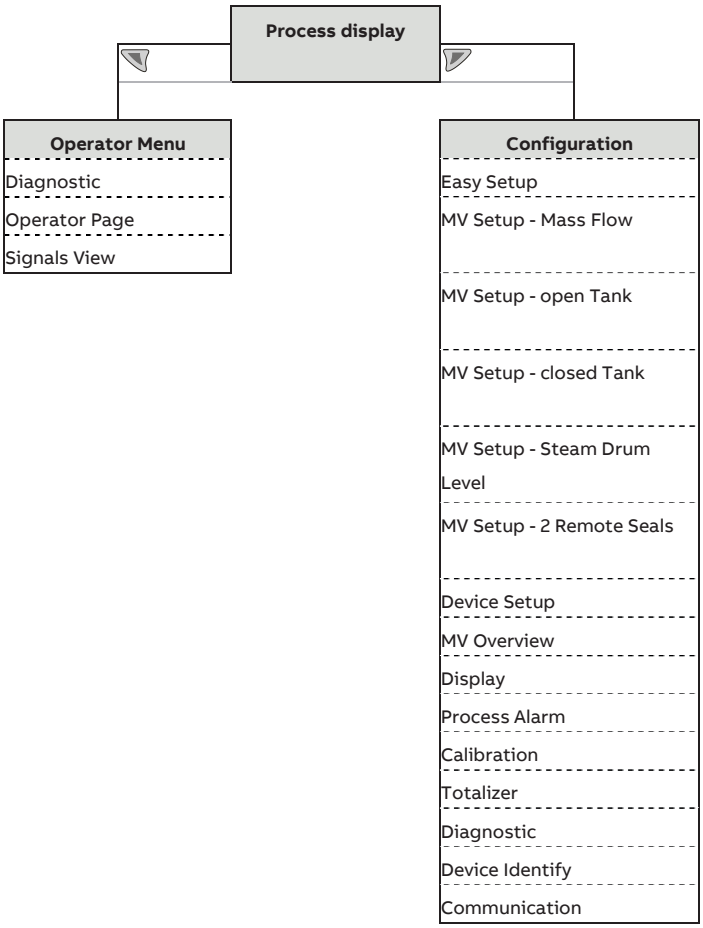
Control button functions

	Meaning
Exit	Exit menu
Back	Go back one submenu
Cancel	Cancel a parameter entry
Next	Select the next position for entering numerical and alphanumeric values

	Meaning
Select	Select submenu / parameter
Edit	Edit parameter
OK	Save parameter entered

… 8 Operation

Menu levels

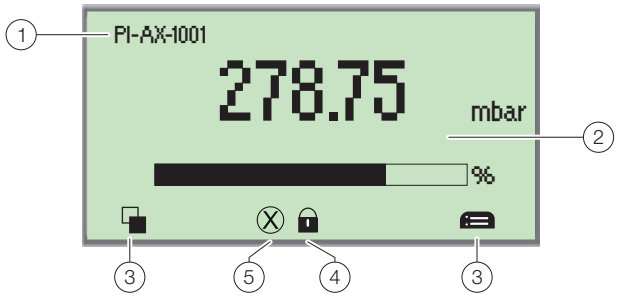


Process display
The process display shows the current process values.
There are two menu levels under the process display.

Information level (Operator Menu)
The information level contains the parameters and information that are relevant for the operator.
The device configuration cannot be changed on this level.

Configuration level (Configuration)
The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level. For detailed information on the parameters, see .

Process display



1 Measuring point tag
2 Current process values
3 'Button function' icon
4 'Parameterization protected' icon
5 Diagnostics message

Figure 35: Process display (example)

The process display appears on the LCD display when the device is switched on. It shows information about the device and current process values.
The way in which the current process values are shown can be adjusted on the configuration level.
The symbols at the bottom of the process display are used to indicate the functions of the operating buttons and , in addition to other information.

Symbol	Description
	Call up information level.
	Call up configuration level.
	The device is protected against changes of the parameter settings.

Activation of the operating menu
To access the operating menu, it must first be activated.

Standard LCD indicator (option L1)
For devices with standard LCD indicator, unscrew the housing cover with sight glass to obtain access to the display. When used in hazardous areas, always comply with the relevant directives before the housing is opened.
Activate the operating button to call up the configuration level. Activate the operating button to call up the information level.

LCD indicator with TTG technology (option L5)
For devices with LCD indicators with TTG technology, activation can occur without opening the housing cover of the transmitter. The capacitive pickups that a person is taping with their finger on the glass over the appropriate operating button and triggers the appropriate command.
When the transmitter is switched on, the operating interface automatically calibrates its sensitivity. Consequently to ensure trouble-free function of the operating interface with TTG function, the housing cover must be correctly screwed down when switching on the device.
If in the meantime the housing cover has been removed, to gain access to the electronics module, we recommend that you switch the energy supply off and then on again, as soon as the housing cover with the sight glass has been correctly screwed down.

Activation of the operating menu is executed as described:

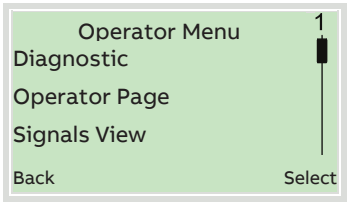
1. Press the upper, middle operating button and hold it until two symbols appear in the lower left and right in the display.
2. Within 1 second activate the operating button below the right symbol to call up the configuration level, or left activate the operating button to call up the information level.

Notice
If the contrast is out of adjustment to the extent that the display can no longer be read, the factory settings can be restored by simultaneous activation of the operating buttons and .

Switching to the information level (operator menu)

On the information level, the operator menu can be used to display diagnostic information and choose which operator pages to display.

1. Use to go to the information level.



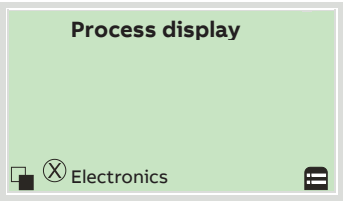
2. Use or select a submenu.
3. Confirm the selection with .

Menu	Description
... / Operator Menu	
Diagnostic	Display of the current alarms and messages.
Operator Page	Switches to the process display.
Signals View	Selects the 'Signals View' submenu (only for service purposes).

… 8 Operation

Error messages on the LCD display

In the event of an error, a message consisting of a symbol and text (for example Electronics) appears at the bottom of the process screen.
The text displayed provides information about the area in which the error has occurred.



The error messages are divided into four groups in accordance with the NAMUR classification scheme.
The group assignment can only be changed using a DTM or EDD:

Symbol	Description
	Error / failure
	Function check
	Outside of the specification
	Maintenance required

The error messages are also divided into the following areas:

Area	Description
Process	Diagnostic messages that refer to the process and display impairments or states.
Sensor	Alarms that indicate problems with the measuring cell.
Electronics	Errors in the device electronics are displayed.
Configuration	Missing or faulty configuration of the transmitter is detected.

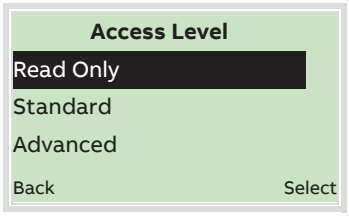
Note
For a detailed description of errors and troubleshooting instructions, please see **Diagnosis / error messages** on page 76.

Switching to the configuration level (parameterization)

Note
For security reasons it is recommended, to set a password.

The device parameters can be displayed and changed on the configuration level.

1. Use  to switch to the configuration level.

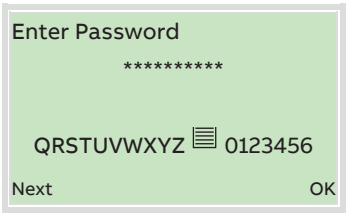


2. Select the desired level of access using / .
3. Confirm the selection with  .

Note
There are three levels of access. A password can be defined for level ‘Standard’.
There is no factory default password.

Access Level	Description
Read Only	All parameters are locked. Parameters are read only and cannot be modified.
Standard	All the parameters can be altered.
Service	Only Customer Service has access to the Service menu.

Once you have logged on to the corresponding access level, you can edit or reset the password. Reset (status 'no password defined') by selecting ▤ as a password.



4. Enter the corresponding password. No password is preset in the factory settings. Users can switch to the configuration level without entering a password.
   The selected access level remains active for 3 minutes. Within this time period you can toggle between the process display and the configuration level without re-entering the password.
5. Use ◤ to confirm the password.

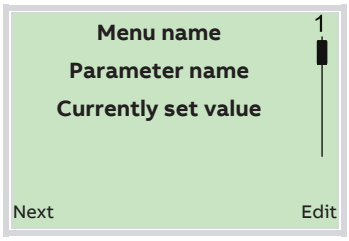
The LCD display now indicates the first menu item on the configuration level.

6. Select a menu using ▲ / ▼.
7. Confirm the selection with ◤.

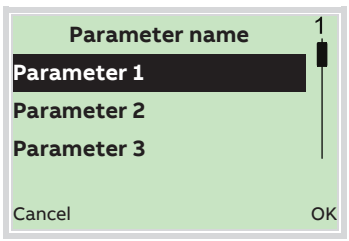
Selecting and changing parameters

Entry from table

When an entry is made from a table, a value is selected from a list of parameter values.



1. Select the parameters you want to set in the menu.
2. Use ◤ to call up the list of available parameter values. The parameter value that is currently set is highlighted.

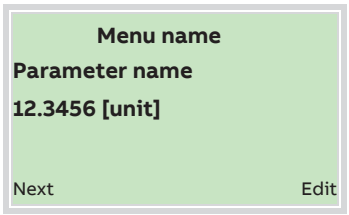


3. Select the desired value using ▲ / ▼.
4. Confirm the selection with ◤.

This concludes the procedure for selecting a parameter value.

Numerical entry

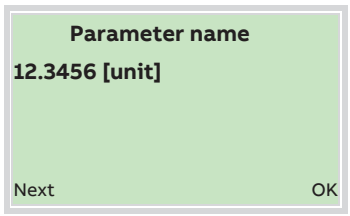
When a numerical entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use ◤ to call up the parameter for editing. The decimal place that is currently selected is highlighted.

… 8 Operation

… Selecting and changing parameters

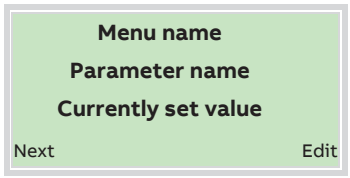


3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

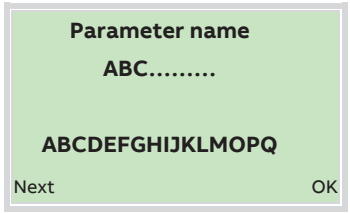
This concludes the procedure for changing a parameter value.

Alphanumeric entry

When an alphanumeric entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use to call up the parameter for editing. The decimal place that is currently selected is highlighted.



3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

This concludes the procedure for changing a parameter value.

Exiting the setup

For some menu items, values must be entered. If you don't want to change the parameter, you can exit the menu as described below.

1. Pressing (Next) repeatedly moves the cursor to the right. Once the cursor reaches the end position, 'Cancel' is displayed in the lower right of the screen.
2. terminates editing and exits the menu item. Use to return to the start.

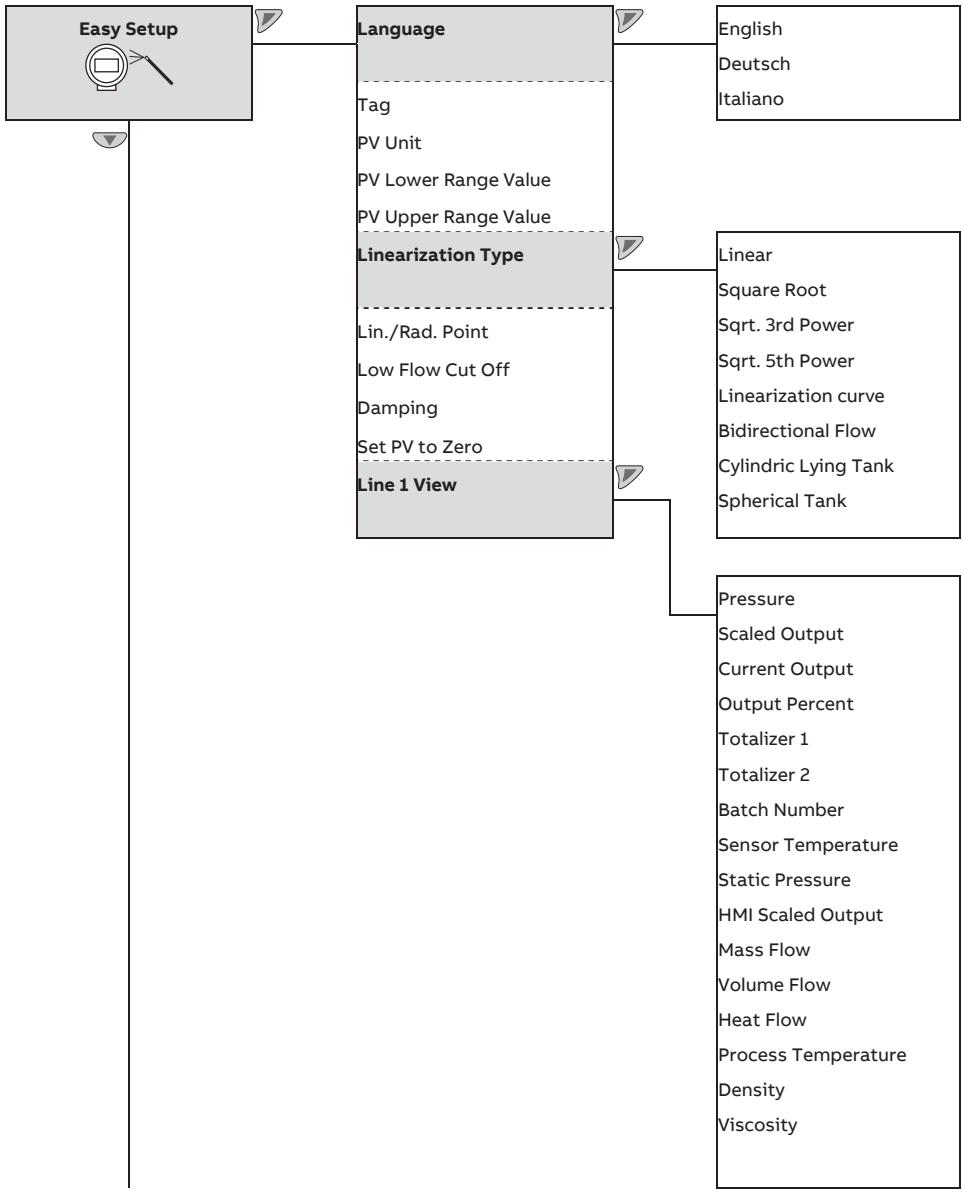
Note

The LCD display automatically returns to the process display three minutes after the last button has been actuated.

Overview of parameters on the configuration level

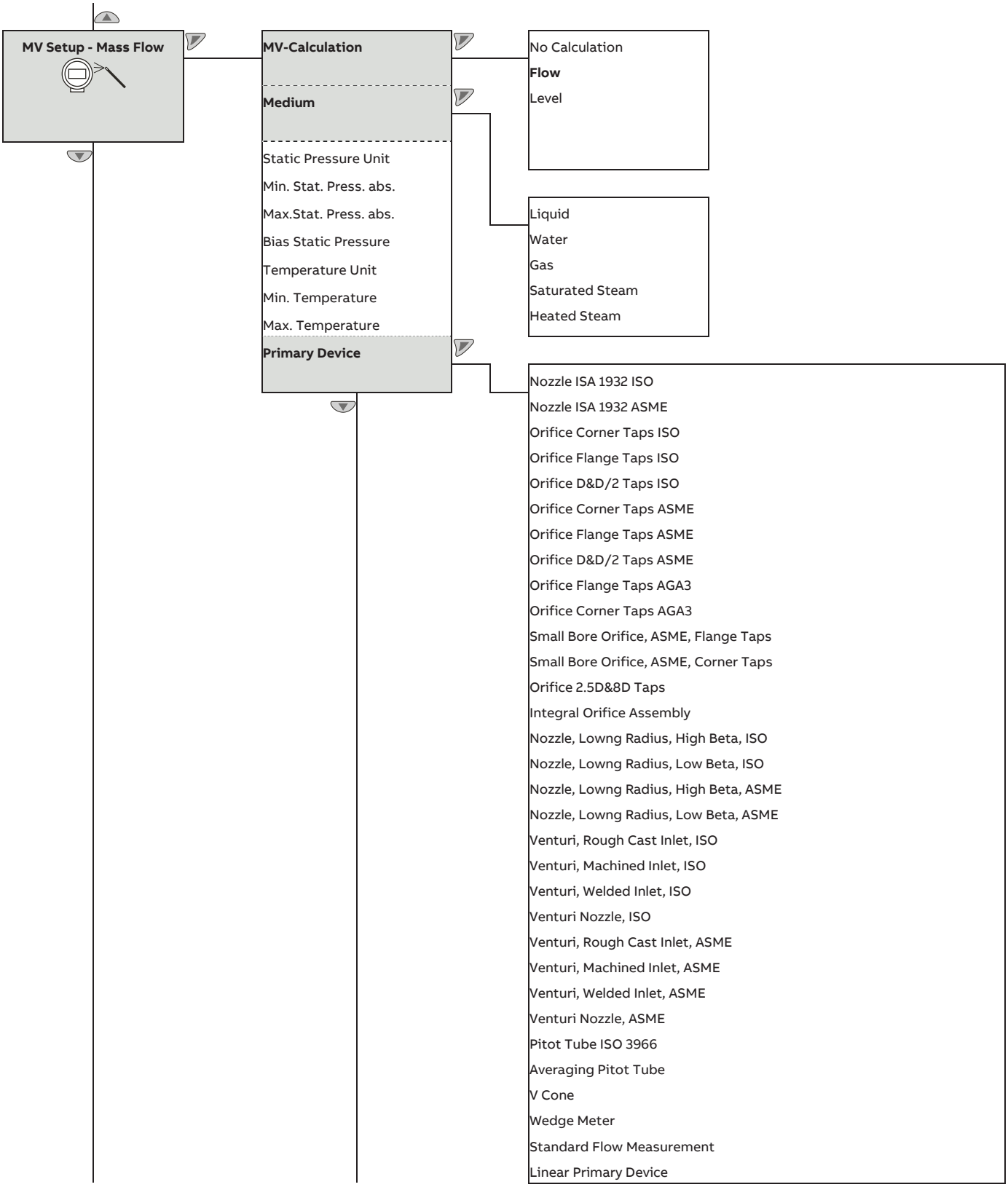
Note

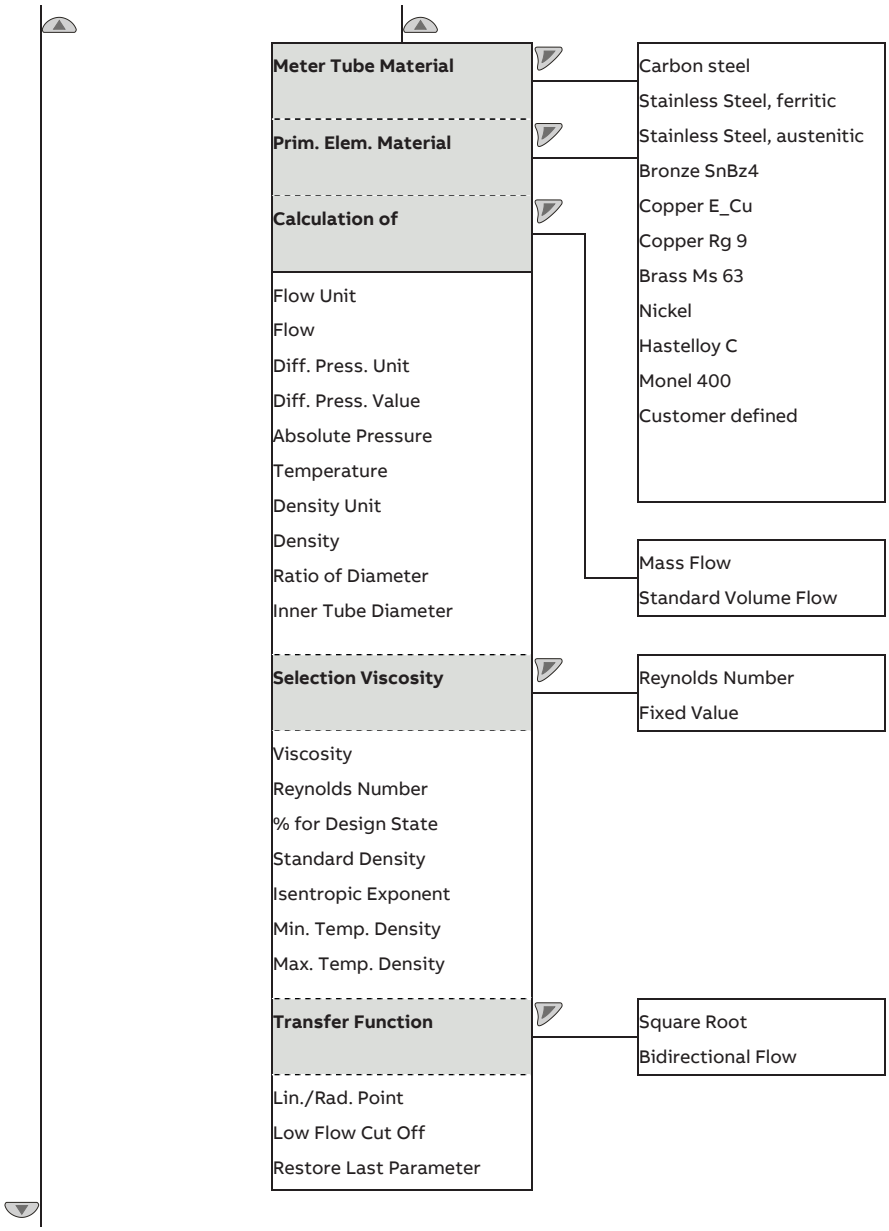
This overview of parameters shows all the menus and parameters available on the device. Depending on the version and configuration of the device, not all of the menus and parameters may be visible in it.



… 8 Operation

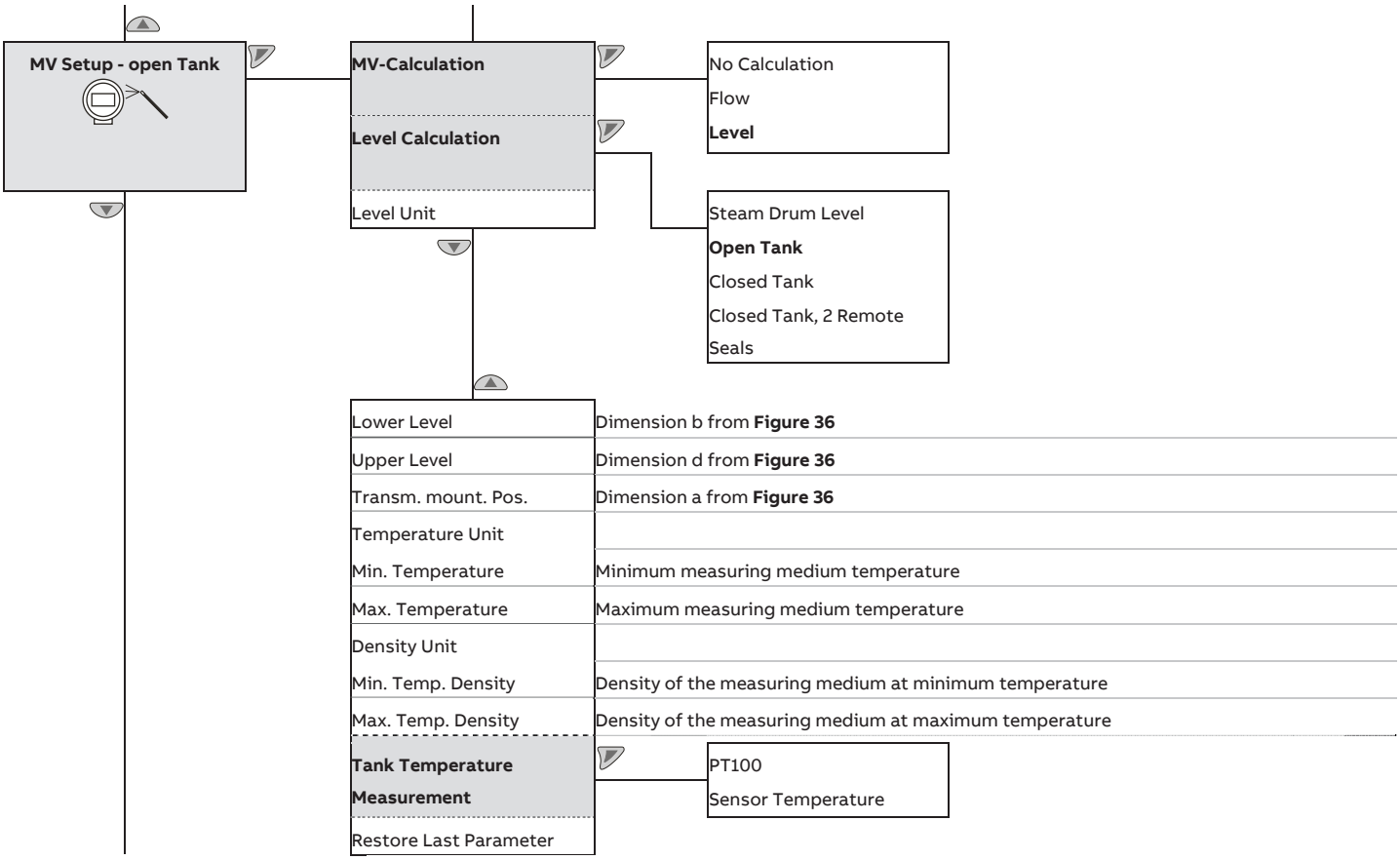
… Overview of parameters on the configuration level

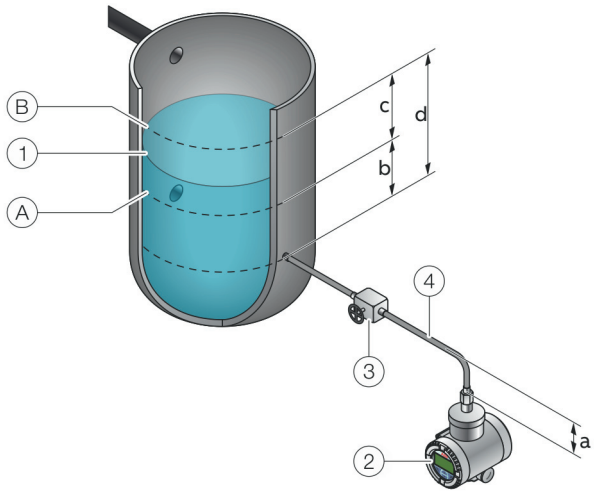



Meter Tube Material
Prim. Elem. Material
Calculation of
Flow Unit
Flow
Diff. Press. Unit
Diff. Press. Value
Absolute Pressure
Temperature
Density Unit
Density
Ratio of Diameter
Inner Tube Diameter
Selection Viscosity
Viscosity
Reynolds Number
% for Design State
Standard Density
Isentropic Exponent
Min. Temp. Density
Max. Temp. Density
Transfer Function
Lin./Rad. Point
Low Flow Cut Off
Restore Last Parameter
Carbon steel
Stainless Steel, ferritic
Stainless Steel, austenitic
Bronze SnBz4
Copper E_Cu
Copper Rg 9
Brass Ms 63
Nickel
Hastelloy C
Monel 400
Customer defined
Mass Flow
Standard Volume Flow
Reynolds Number
Fixed Value
Square Root
Bidirectional Flow

… 8 Operation

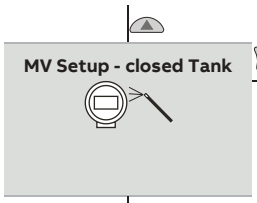
… Overview of parameters on the configuration level





(A) The lower fill level to be measured
(B) The higher fill level to be measured
(1) Fill level
(2) Pressure transmitter
(3) Shutoff valve
(4) Impulse line

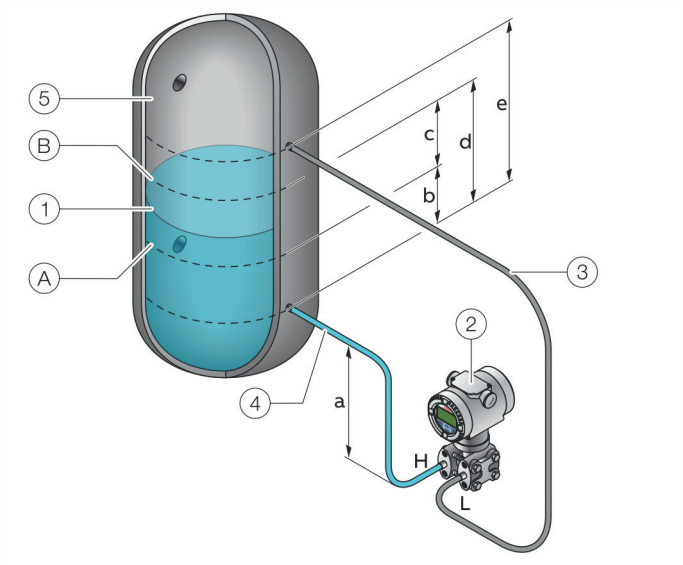
Figure 36: Diagram – 'Level measurement - open tank'



MV-Calculation	No Calculation Flow **Level**
Level Calculation	
Level Unit	Steam Drum Level Open Tank **Closed Tank** Closed Tank, 2 Remote Seals
Lower Level	Dimension b from **Figure 37**
Upper Level	Dimension d from **Figure 37**
Distance process Connection	Dimension e from **Figure 37**
Transm. mount. Pos.	Dimension a from **Figure 37**
Temperature Unit	
Min. Temperature	Minimum measuring medium temperature
Max. Temperature	Maximum measuring medium temperature
Density Unit	
Min. Temp. Density	Density of the measuring medium at minimum temperature
Max. Temp. Density	Density of the measuring medium at maximum temperature
Temperature Gas Density	Reference temperature for specification of the gas density, for example 0 C for 'std. conditions'
Static Pressure Unit	
Pressure Gas Density	Reference pressure for specification of gas density, for example 1.013 bar for 'standard conditions'
Gas Density	Gas density for the reference conditions specified above
Tube Temperature	PT100 Sensor Temperature Fixed Value
Value Condensate Temperature	
Restore Last Parameter	

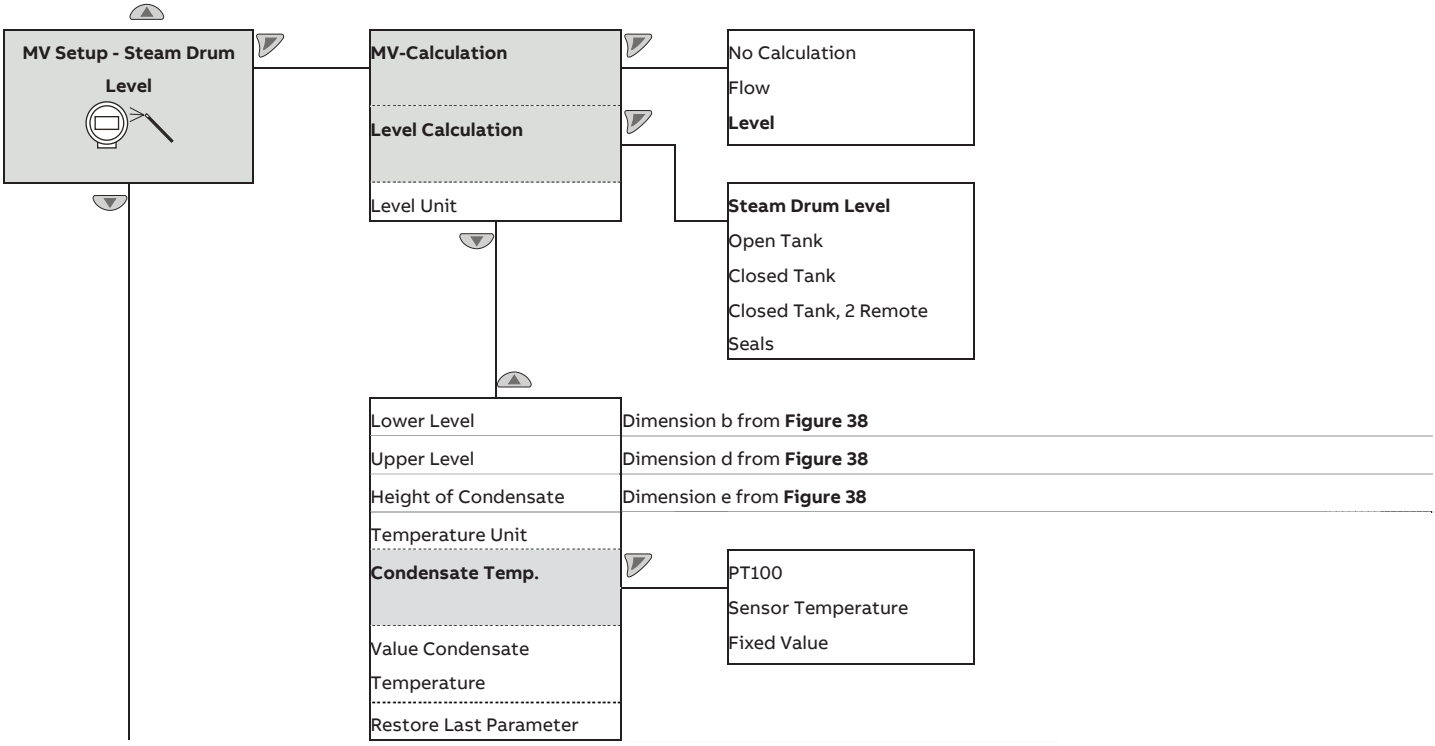
… 8 Operation

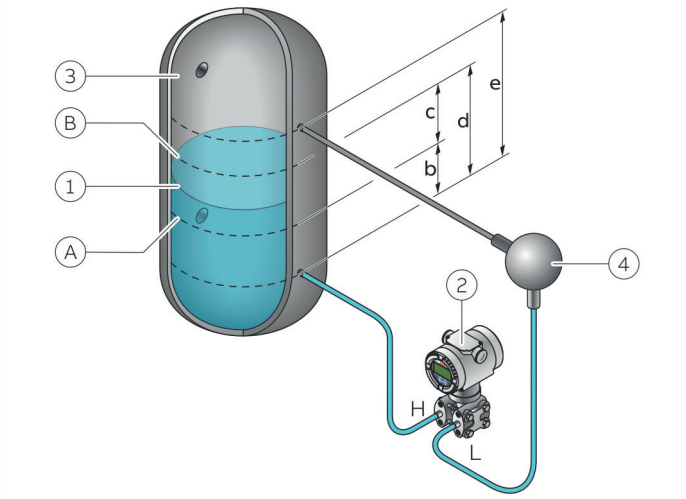
… Overview of parameters on the configuration level



(A) The lower fill level to be measured
(B) The higher fill level to be measured
(1) Fill level
(2) Pressure transmitter
(3) Low pressure impulse line
(4) High pressure impulse line
(5) Gas above the liquid line

Figure 37: Diagram – 'Level measurement – closed tank'



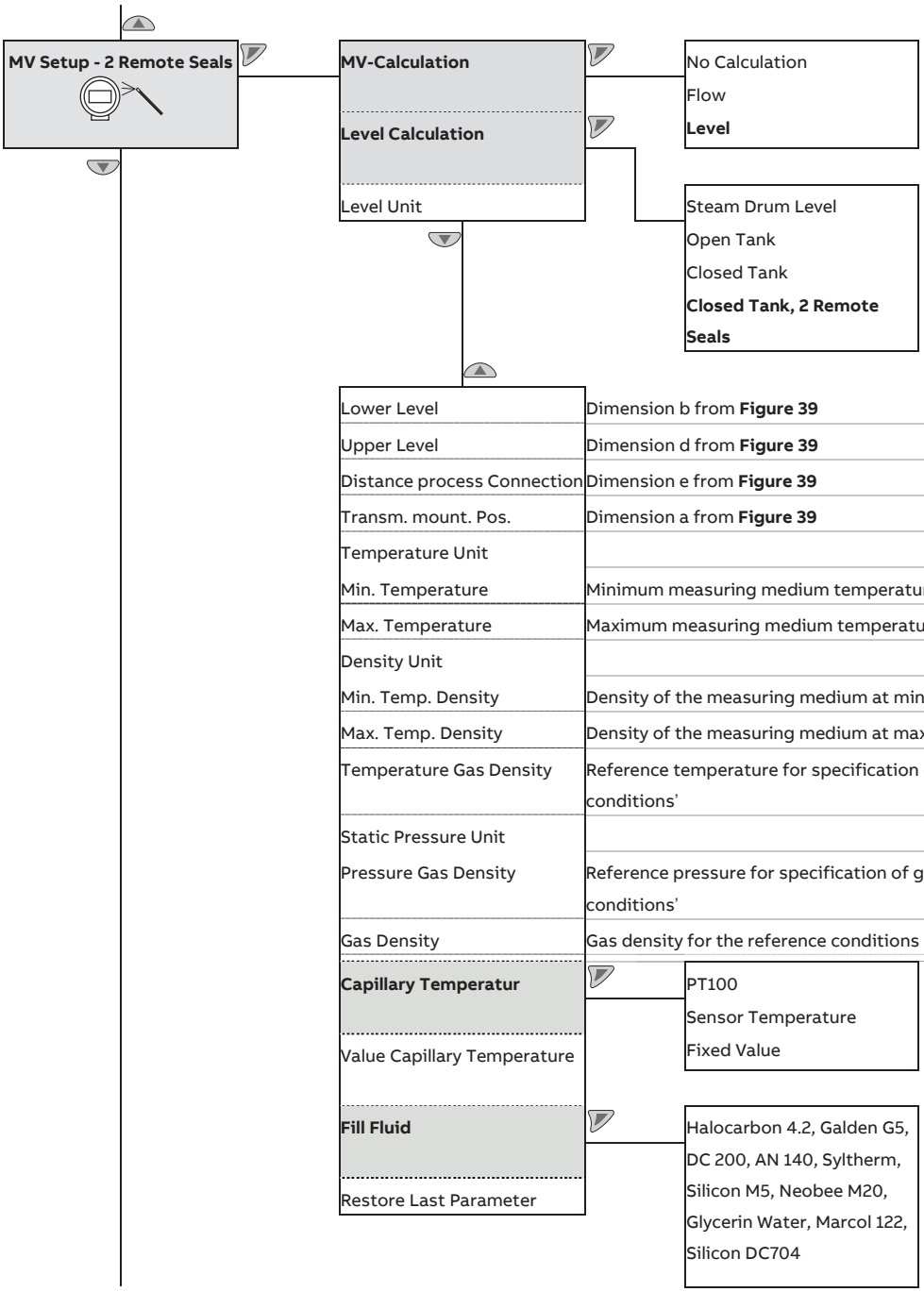


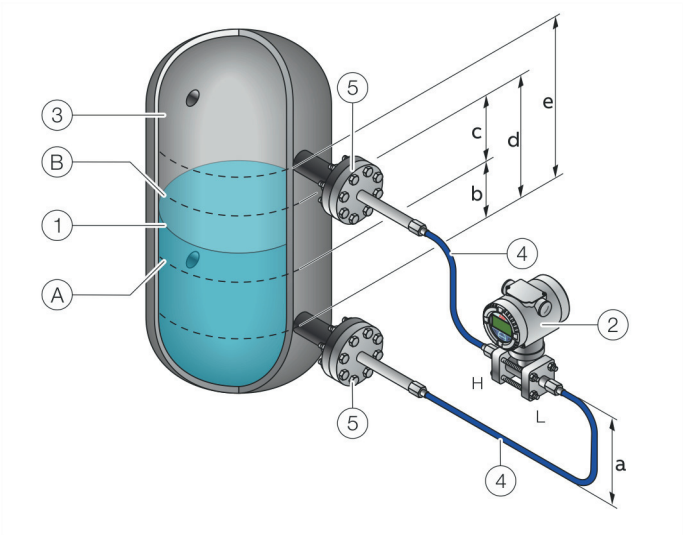
(A) The lower fill level to be measured
(B) The higher fill level to be measured
(1) Fill level
(2) Pressure transmitter
(3) Gas above the liquid
(4) Condensate tank

Figure 38: Level measurement on the steam boilers (drum water level)

… 8 Operation

… Overview of parameters on the configuration level



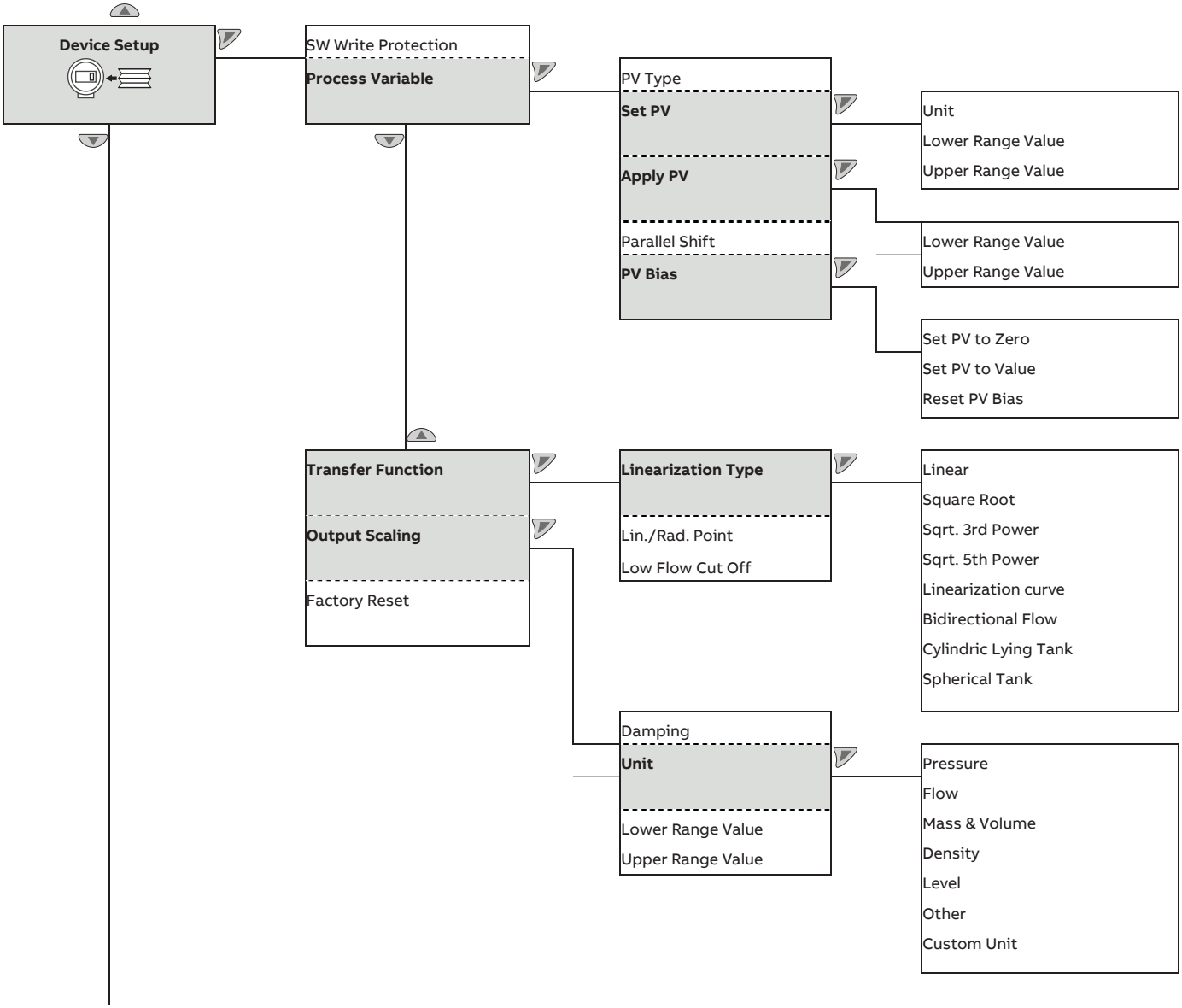


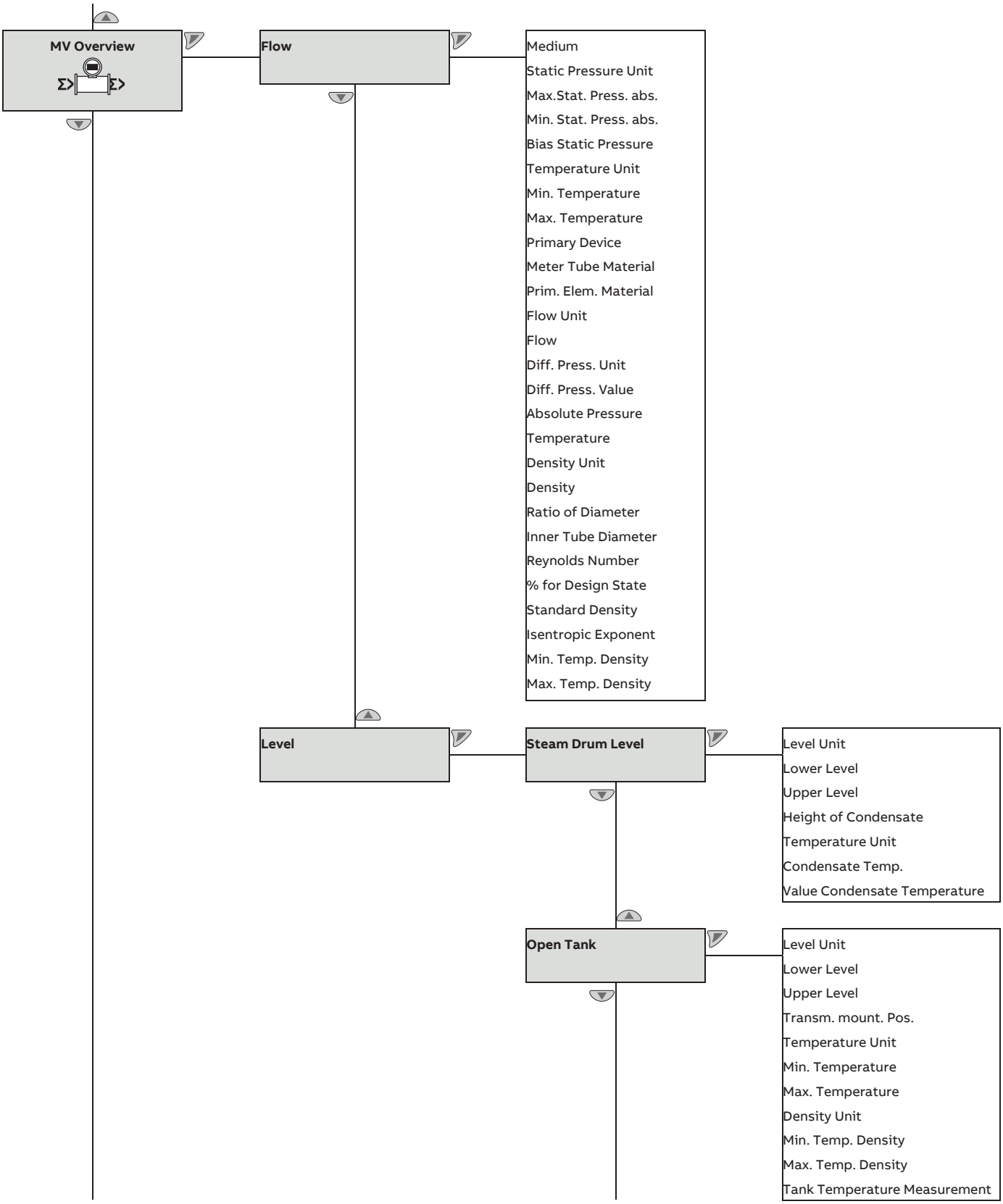
(A) The lower fill level to be measured
(B) The higher fill level to be measured
(1) Liquid level
(2) Pressure transmitter
(3) Gas above the fluid
(4) Capillary tube
(5) Diaphragm seal with capillary tube connection

Figure 39: Level measurement with closed tanks with two diaphragm seals

… 8 Operation

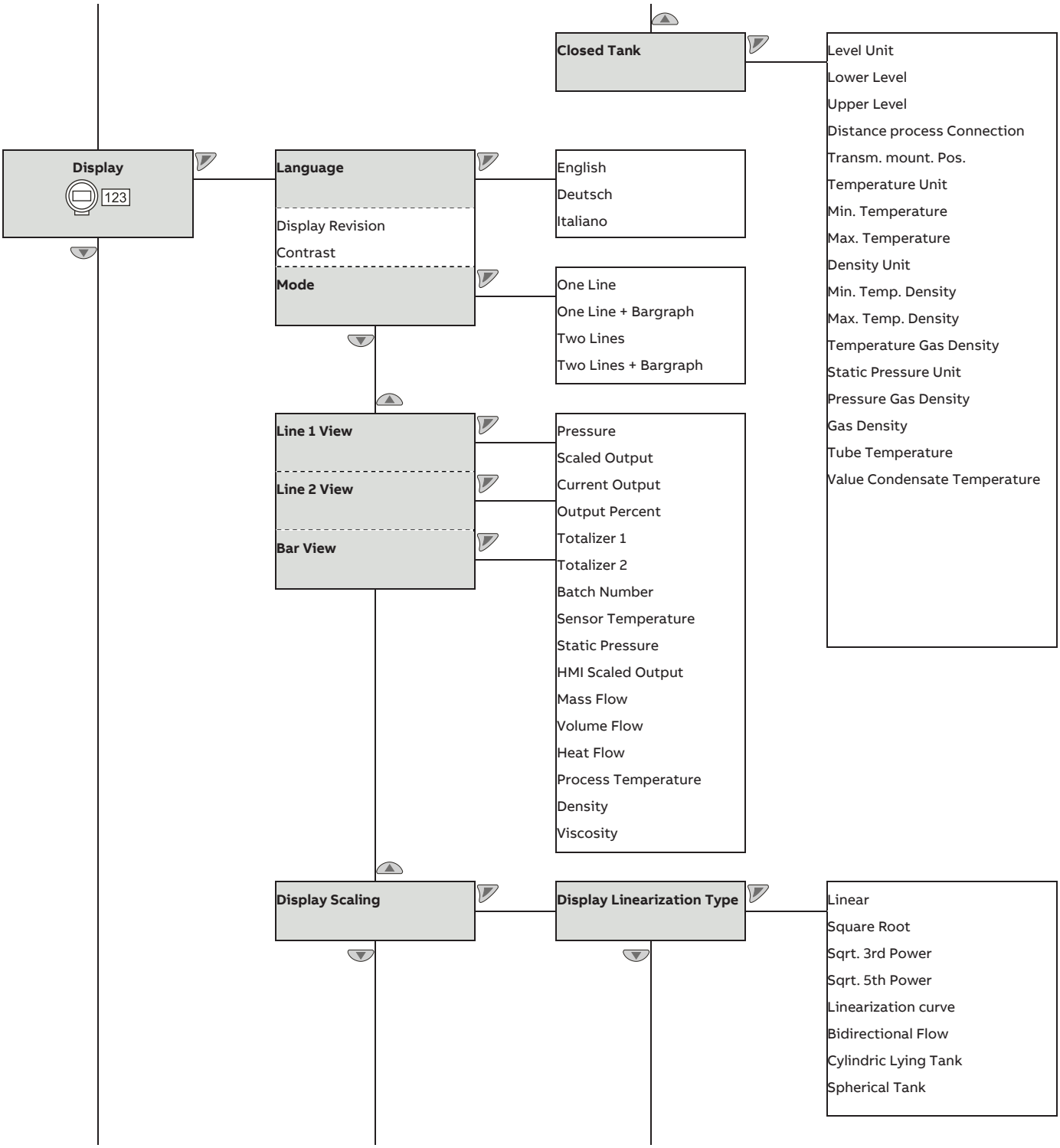
… Overview of parameters on the configuration level

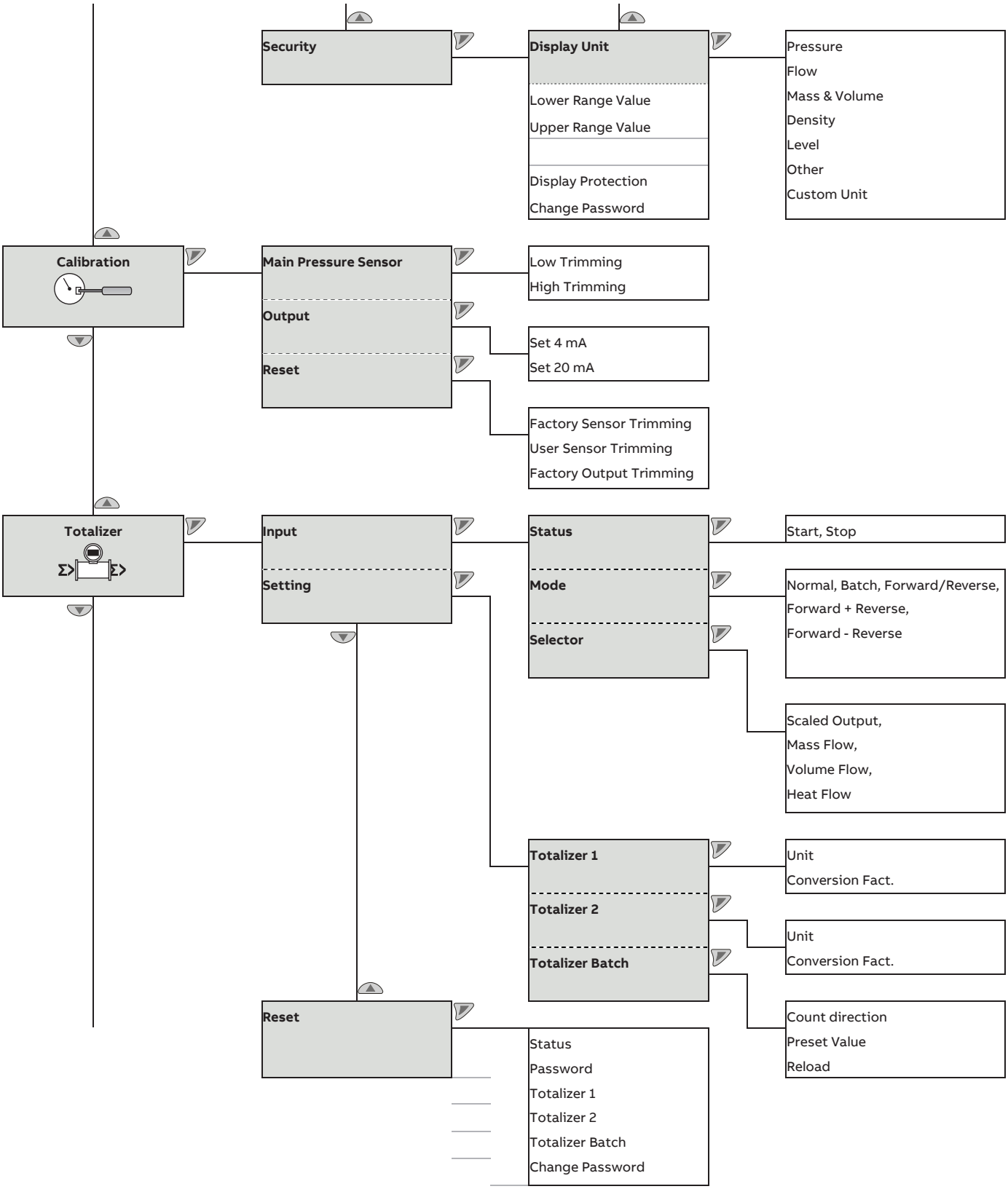



MV Overview
Flow
Medium
Static Pressure Unit
Max.Stat. Press. abs.
Min. Stat. Press. abs.
Bias Static Pressure
Temperature Unit
Min. Temperature
Max. Temperature
Primary Device
Meter Tube Material
Prim. Elem. Material
Flow Unit
Flow
Diff. Press. Unit
Diff. Press. Value
Absolute Pressure
Temperature
Density Unit
Density
Ratio of Diameter
Inner Tube Diameter
Reynolds Number
% for Design State
Standard Density
Isentropic Exponent
Min. Temp. Density
Max. Temp. Density
Level
Steam Drum Level
Level Unit
Lower Level
Upper Level
Height of Condensate
Temperature Unit
Condensate Temp.
Value Condensate Temperature
Open Tank
Level Unit
Lower Level
Upper Level
Transm. mount. Pos.
Temperature Unit
Min. Temperature
Max. Temperature
Density Unit
Min. Temp. Density
Max. Temp. Density
Tank Temperature Measurement

… 8 Operation

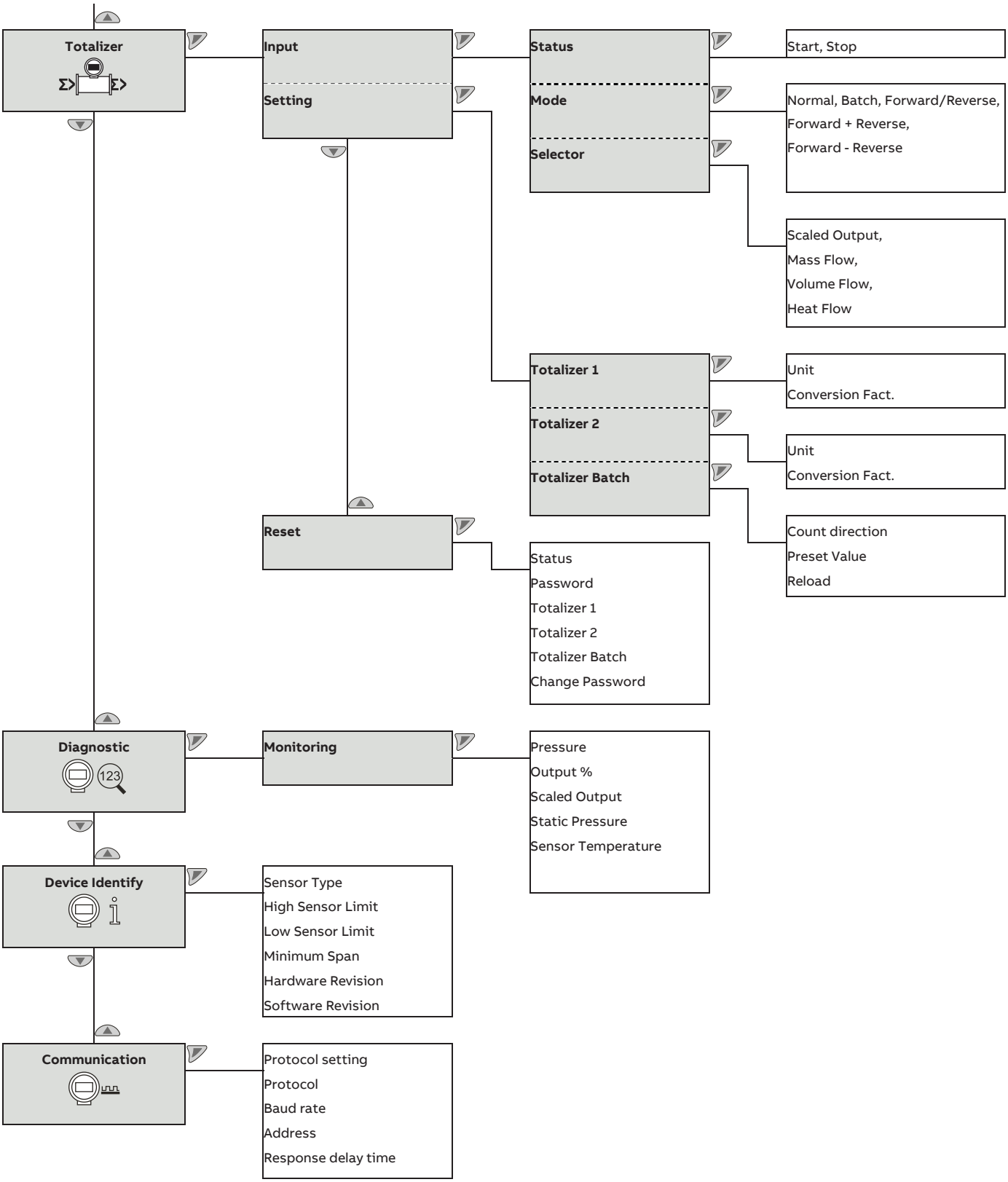
… Overview of parameters on the configuration level




Security
Display Unit
Lower Range Value
Upper Range Value
Display Protection
Change Password
Pressure
Flow
Mass & Volume
Density
Level
Other
Custom Unit
Calibration
Main Pressure Sensor
Output
Reset
Low Trimming
High Trimming
Set 4 mA
Set 20 mA
Factory Sensor Trimming
User Sensor Trimming
Factory Output Trimming
Totalizer
Input
Setting
Status
Mode
Selector
Start, Stop
Normal, Batch, Forward/Reverse,
Forward + Reverse,
Forward - Reverse
Scaled Output,
Mass Flow,
Volume Flow,
Heat Flow
Totalizer 1
Totalizer 2
Totalizer Batch
Unit
Conversion Fact.
Unit
Conversion Fact.
Count direction
Preset Value
Reload
Reset
Status
Password
Totalizer 1
Totalizer 2
Totalizer Batch
Change Password

… 8 Operation

… Overview of parameters on the configuration level



Damping and transmission function

Damping

If the output signal of the pressure transmitter is conditionally irregular due to the process it can be electrically smoothed (damped).
The additional time constant can be set in increments of 0.0001 seconds to a value between 0 and 60 seconds.
The damping has no influence whatsoever on the digitally displayed measured value in the physical unit. It only acts on the values that are derived from this, such as the analog output current, the free process variable, the input signal for the controller, etc.
The damping can be set locally via the LCD display or the Device Type Manager (DTM).

Transmission function

In the evaluation of the output signal of the multivariable transmitters, you must bear in mind that these devices can work with different transmission functions.

For the 266Cxx without calculation function can be set:

- Linear for measurements of differential pressure or fill level
- Square root (x) for flow measurements in accordance with the differential pressure procedure with throttle elements such as orifices, nozzles, Venturi / swirl tubes and similar items
- Square root (x3) for flow measurements in open chutes with rectangular or trapezoidal measurement weir
- Square root (x5) for flow measurements in open chutes with V-measurement weir (triangular weir)
- Bidirectional for flow measurements with bidirectional characteristic curve
- With customer-specific linearization table.
- For cylindrical, horizontal tanks
- For spherical tanks

For 266Cxx multivariable transmitters, set for mass flow measurement, the following functions are possible:

- Square root (x) for differential pressure flow measuring with throttle elements
- Bidirectional for flow measurements with bidirectional characteristic curve

In addition, all characteristic curves are influenced by the pressure-dependent and temperature-dependent status correction.

For 266Cxx multivariable transmitters set for level measurement, the following functions are possible:

- Linear
- With customer-specific linearization table
- For cylindrical, horizontal tanks
- For spherical tanks

Moreover, all characteristic curves are influenced by the temperature-dependent, for drum water level measurement, also pressure-dependent, density correction.

The output transmission functions can be activated via the LCD display or the Device Type Manager (DTM).

… 8 Operation

… Damping and transmission function

Description of the transition function

Linear

When using this function the relationship between the input value (measured value) in % of the calibrated measurement span and the output linear (i.e.: The input value of 0% corresponds to an output value of 0% = 4 mA, the input value of 100% corresponds to an output value of 100% = 20 mA). Additional settings are not possible here.

Square root

With this function the output (in % of the measuring span) is proportional to the square root in % of the set measuring span (i.e.: The device outputs an analog output signal that behaves proportionally to the flow rate). It is possible to use the complete square root function.

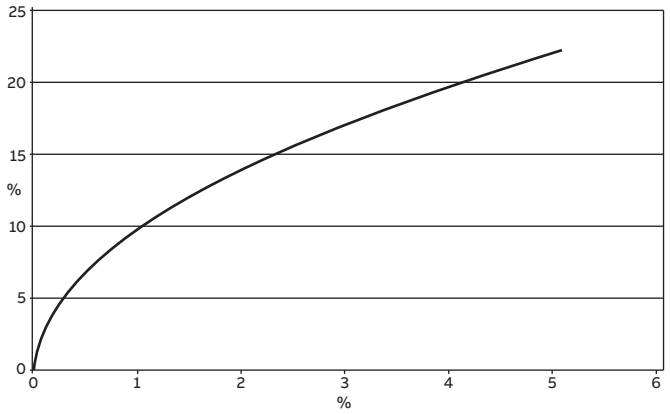
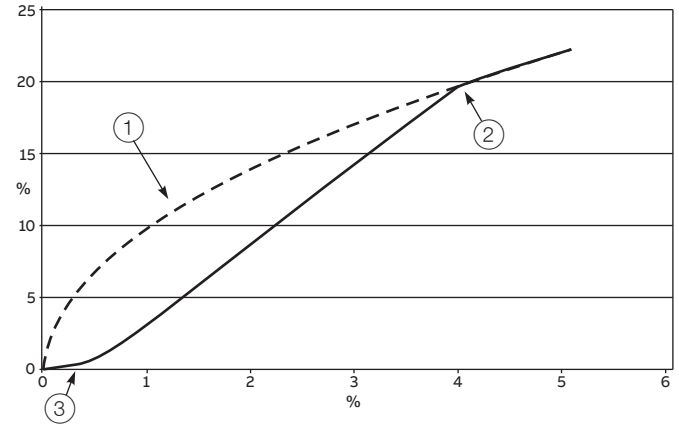


Figure 40: Square root function (complete)

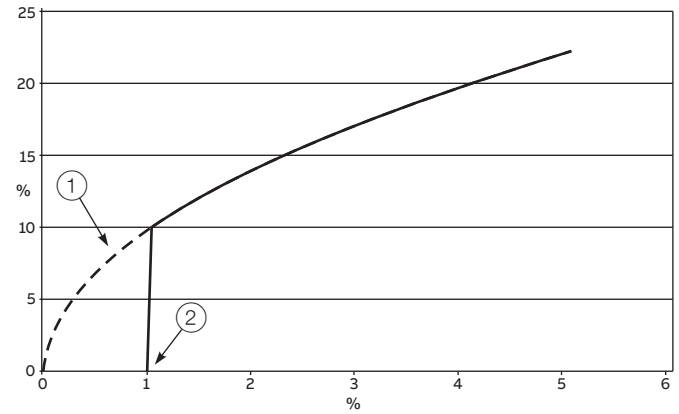
In order to avoid the high gains occurring in the vicinity of the zero point, the transmitter works linear with a gradient of 1 to an input value of 0.5% of the set measuring span, and then continues linear to the activation point of the square root function, adjustable between 5% and 20% of the output. This function enables a more stable output signal close to the zero point and avoids errors due to the high gain associated with the square root.
The standard setting is 5% of the upper range value of the flow.



1 Square root function
3 Initial gradient = 1
2 Activation point square root function, programmable

Figure 41: Square root function with activation point

For leak flow volume suppression for small input signals close to the zero point the transmitter output is set to zero until reaching an adjustable activation point between 0% and 20%. This function ensures the stability for flow measurements.
The default setting is 6% of the upper range value of the flow.



1 Square root function
2 Activation point leak flow volume suppression, programmable

Figure 42: Square root function with leak flow volume suppression

Square root to the third power

The square root transmission function of x3 can be used for flow measurements in open chutes (see Figure 43 and Figure 44) with rectangular measuring weirs or trapezoidal measuring weirs, as well as Venturi flumes in accordance with ISO 1438. For these devices the relationship between flow and dammed up height h (differential pressure measured by the transmitter) is proportional to h3/2 or to the square root of h3. For other Venturi flumes or Parshall flumes this relationship is not right. For this function the output (in % of the measuring span) is proportional to the square root to the third power of the input signal in % of the set measuring span. With the aid of the formulas cited, the device provides an output signal that is proportional to the flow rate.

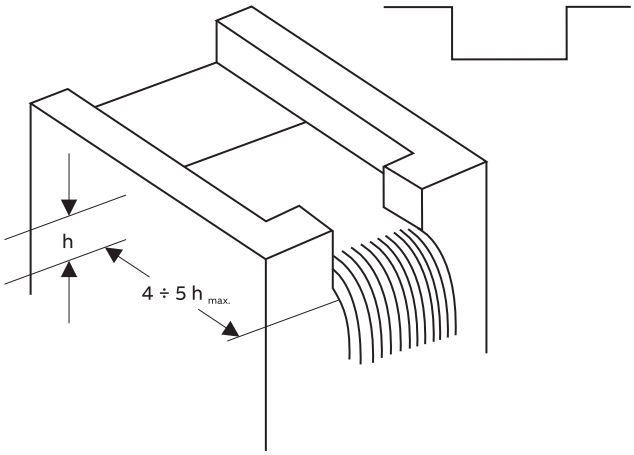


Figure 43: Rectangular measuring weir

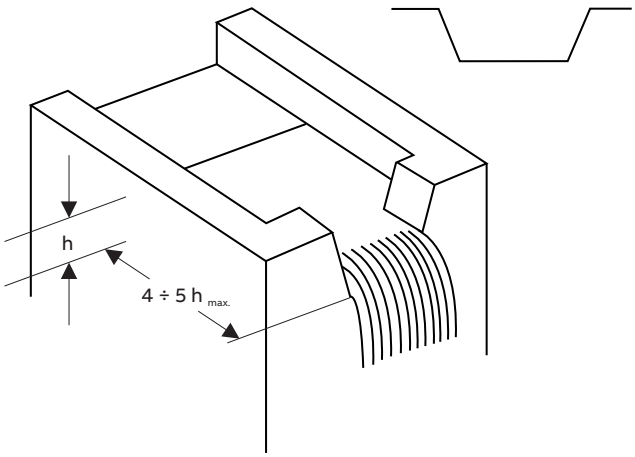


Figure 44: Trapezoidal weir

Square root to the fifth power

The square root transmission function of x5 can be used for flow measurements in open flumes of V measuring weirs (triangular weirs) in accordance with ISO 14398 (see Figure 45); the relationship between flow and dammed up height h (differential pressure measured by the transmitter) is proportional to h5/2 or to the square root of h5.

With this function the output in % of measuring span is proportional to the square root to the fifth power of the input signal in % of the set measuring span. The device delivers an output signal that behaves proportionally to the calculated flow rate.

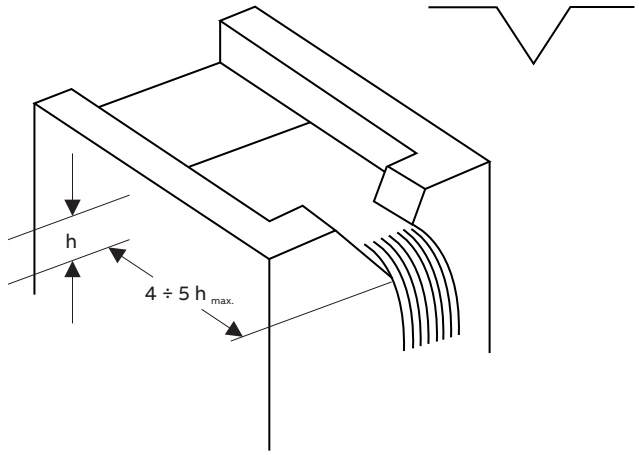


Figure 45: V measuring weir

Customer-specific linearizaton characteristic curve

The transmission function with a customer-specific linearization curve is normally used for volume measurement in tanks with unusual shapes. There is an assignment to a freely-definable transmission characteristic curve with a maximum of 22 reference points. The first reference point is always the zero point, the last is the upper range value. These two reference points cannot be changed. In between a maximum of 20 points can be freely entered.

These max. 22 points are defined by extrapolating the tank fill data.

After they are determined, the 22 reference points are loaded into the device, via a HART handheld terminal or via an appropriate configuration program such as ‘Asset Vision Basic’.

… 8 Operation

Interface description

Communication parameters

For communication to work properly, the transmission mode (and serial port parameters) must be the same for all devices on a Modbus serial line.

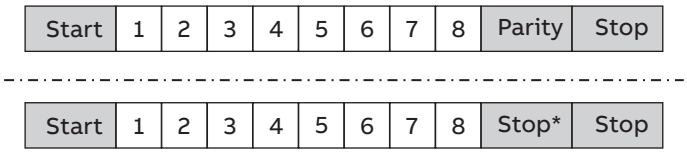
The default communications parameters are set to:

- Baud Rate: 9600 baud
- Data Bits: 8 (fixed)
- Parity: None
- Stop Bits: 2 (fixed)

Modbus RTU mode requires each data byte to be 11 bits (refer to **Figure 1**).
Bits per Byte:

- 1 start bit
- 8 data bits, least significant bit sent first
- 1 bit for parity completion
- 1 stop bit

RTU mode (with parity checking)



RTU mode (with no parity)

Figure 1: Modbus RTU bit sequence

* When no parity is selected (default for the 266) the parity completion bit is replaced by another stop bit.

The parity bit can be set from NONE to EVEN or ODD parity. The transmitter automatically adjusts the number of stop bits. Figure 2 depicts a typical Modbus message format.

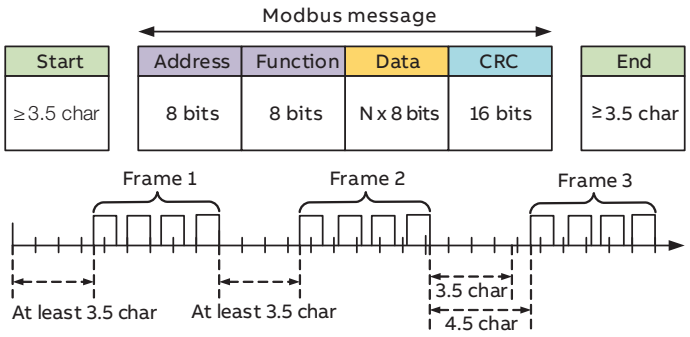


Figure 2: Sample Modbus message frame

Message part	Description
Start	Indicates the quiet time before a data transfer
Address	In the request frame, this is the device being addressed. In the response frame, this is the device answering the request.
Function	In the request frame, this is the command byte. It presents the device with a read or write sequence. In the response frame, this could be echoed or could be returned as an error code.
Data	In the request frame, the data is held in the beginning register and read along with the number of consecutive registers. In the response frame, this is the data being read.
CRC	Indicates a data validity test of the data being sent.
End	Indicates the end characters

Available units

For certain parameters, it is possible to choose among the following units.

Note

The 'Code' column indicates the value to which the corresponding parameter must be set, for exmaple using the communications interface.

Table 1: Pressure units

Selection	Code	Description
inH2O (68°F)	1	Inches of water column at 68 °F
inHg	2	Inches of mercury
ftH2O	3	Feet of water column
mmH2O (68°F)	4	Millimeters of water column at 68 °F
mmHg	5	Millimeters of Mercury
psi	6	Pounds per square inch
bar	7	Bar
mbar	8	Millibar
g/cm2	9	Grams per square centimeter
kg/cm2	10	Kilograms per square centimeter
Pa	11	Pascal
kPa	12	Kilopascal
Torr	13	Torr
atm	14	Atmospheres
inH2O (60°F)	145	Inches of water column at 60 °F
MPa	237	Megapascal
inH2O (4°C)	238	Inches of water column at 4 °C
mmH2O (4°C)	239	Millimeters of water column at 4 °C

Table 2: Temperature units

Selection	Code	Description
°C	32	Degrees Celsius
°F	33	Degrees Fahrenheit
°R	34	Degrees Rankine
K	35	Kelvin

Table 3: Units for the mass flow

Selection	Code	Description
g/s	70	Grams per Second
g/min	71	Grams per Minute
g/h	72	Grams per Hour
kg/s	73	Kilograms per Second
kg/min	74	Kilograms per Minute
kg/h	75	Kilograms per Hour
kg/d	76	Kilograms per Day
t/min	77	Tons per Minute
t/h	78	Tons per Hour
t/d	79	Tons per Day
lb/s	80	Pounds per Second
lb/min	81	Pounds per Minute
lb/h	82	Pounds per Hour
lb/d	83	Pounds per Day
STon/min	84	Short tons per Minute
STon/h	85	Short tons per Hour
STon/d	86	Short tons per Day
LTon/h	87	Long tons per Hour
LTon/d	88	Long tons per Day

Table 4: Units for the volume flow

Selection	Code	Description
ft^3/min	15	Cubic Feet per Minute
gal/min	16	US Gallons per Minute
L/min	17	Liters per Minute
Impgal/min	18	UK Gallons per Minute
m^3/h	19	Cubic Meters per Hour
gal/s	22	US Gallons per Second
Mgal/d	23	US Millon Gallons per Day
L/s	24	Liters per Second
ML/d	25	Million Liters per Day
ft^3/s	26	Cubic Feet per Second
ft^3/d	27	Cubic Feet per Day
m^3/s	28	Cubic Meters per Second
m^3/d	29	Cubic Meters per Day
ImpGal/h	30	UK Gallons per Hour
ImpGal/d	31	UK Gallons per Day

continued on next page

… 8 Operation

… Interface description

Table 4: Units for the volume flow (continued)

Selection	Code	Description
Nm^3/h	121	Norm Cubic Meters per Hour
NL/h	122	Norm Liters per Hour
SCFM	123	Standard Cubic Feet per Minute
ft^3/h	130	Cubic Feet per Hour
m^3/min	131	Cubic Meters per Minute
bls/s	132	Barrels per Second
bls/min	133	Barrels per Minute
bls/h	134	Barrels per Hour
bls/d	135	Barrels per Day
gal/h	136	US Gallons per Hour
ImpGal/s	137	UK Gallons per Second
L/h	138	Liters per Hour
gal/d	235	US Gallons per Day

Table 5: Heat flow units

Selection	Code	Description
kW	127	Kilowatt
hp	129	Horse Power
Mcal/h	140	Megacalorie per hour
MJ/h	141	Megajoule per hour
Btuth/h	142	British thermal unit per hour

Table 6: Level units

Selection	Code	Description
ft	44	Feet
m	45	Meter
in	47	Inch
cm	48	Centimeter
mm	49	Millimeter

Table 7: Volume units

Selection	Code	Description
Gal	40	Gallons
L	41	Liters
ImpGal	42	Imperial Gallons
m3	43	Cubic Meters
Bbl	46	Barrels
Bushel	110	Bushel
yd3	111	Cubic Yards
ft3	112	Cubic Feet
in3	113	Cubic Inches
bbl(liq)	124	Liquid Barrel
Nm3	166	Normal Cubic Feet
NL	167	Normal Liter
CSF	168	Standard Cubic Feet
hl	236	Hectoliters

Table 8: Units for the totalizer

Selection	Code	Description
Gal	40	Gallons
L	41	Liters
ImpGal	42	Imperial Gallons
m3	43	Cubic Meters
Bbl	46	Barrels
g	60	Gram
kg	61	Kilograms
T	62	Metric Tons
lb	63	Pounds
STon	64	Short Tons
LTon	65	Long Tons
Bushel	110	Bushel
yd3	111	Cubic Yards
ft3	112	Cubic Feet
in3	113	Cubic Inches
bbl(liq)	124	Liquid Barrel
oz	125	Ounce
Nm3	166	Normal Cubic Feet
NL	167	Normal Liter
CSF	168	Standard Cubic Feet
hl	236	Hectoliters
Special	253	Special Unit

Modbus register tables

All registers in this document are referenced to one.
The Modbus messages are referenced to zero.
This means that the number of the mapped register is one higher than the number that is sent in a Modbus message frame.

There is a difference between function code 3 and function code 4:

- Function code 4 can be executed in less time than function code 3. Function code 4 is meant to access the process parameters, which possibly could be polled in a low cycle time (>100ms). Therefore, the data of the parameters is held in an internal buffer, which has a low access time.
- Function code 3 should be used to access parameters non-cyclic or with a high cycle time (>seconds).

By reading or writing 32 bit or 16 bit registers 4 or 2 bytes are transmitted. If a parameter has a datatype which uses less bytes than that, the data is transmitted in the lower data bytes of the Modbus message frame. The data bytes, that are not used, are set to zero.
To access the following parameters the device mode must be set to ‘Operate’.

… 8 Operation

… Interface description

16 / 32 bit–Register

Address		Parameter	Data type			Function code
32 bit	16 bit			Read	Write (32 bit)	Write (16 bit)
21	401 402	Differential Pressure (DP)	Float	04	–	–
22	403 404	Pressure (P)	Float	04	–	–
23	405 406	Process Temperature	Float	04	–	–
24	407 408	MV Primary Value Normal Volume Flow, Mass Flow or Level	Float	04	–	–
25	409 410	MV Secondary Value Volume Flow (flow) or Volume (level)	Float	04	–	–
26	411 412	Diagnosis Main See **Application of the Diagnosis Main and Main 2 Registers** on page 75.	Usign32	03, 04	–	–
27	414	Diagnosis Main 2 See **Application of the Diagnosis Main and Main 2 Registers** on page 75.	Using16	03, 04	–	–
28	415 416	Empty	Using16	03, 04	–	–
41	441 442	Upper Calibration Point DP	Float	03	06, 16	16
42	443 444	Lower Calibration Point DP	Float	03	06, 16	16
43	445 446	Upper Calibration Point P	Float	03	06, 16	16
44	447 448	Lower Calibration Point P	Float	03	06, 16	16
45	450	Calibration Unit Pressure (P)	Usign16	03	06, 16	06, 16
46	451 452	Upper Calibration Point	Float	03	06, 16	16
47	453 454	Lower Calibration Point	Float	03	06, 16	16
48	456	Calibration Unit T	Usign16	03	06, 16	06, 16
49	458 459	MV Tertiary Value Heat Transfer Rate (flow) or Mass (level)	Float	03	–	–
51	461 462	Damping Time Constant DP	Float	03	06, 16	16
52	465 466	Damping Time Constant T	Float	03	06, 16	16

Address		Parameter	Data type			Function code
32 bit	16 bit			Read	Write (32 bit)	Write (16 bit)
–	468	Balance Oblique Sensor	Usign8	03	–	06, 16
–	481	Differential Pressure Unit (DP)	Usign8	03	–	06, 16
–	482	Pressure Unit (P)	Usign8	03	–	06, 16
–	483	Process Temperature Unit	Usign8	03	–	06, 16
–	484	MV Primary Value Unit	Usign8	03	–	06, 16
–	485	MV Secondary Value Unit Volume Flow (flow) or Volume (level)	Usign8	03	–	06, 16
–	486	MV Tertiary Value Unit Heat Transfer Rate (flow) or Mass (level)	Usign8	03	–	06, 16
–	491	Factory Reset	Usign16	03	–	06, 16
–	492	Write Lock	Usign16	03	–	06, 16
–	493	MV Block On/Off	Usign8	03	–	06, 16
–	501	Device Mode • 0: Operate/Modbus • 1: Configure/HART–RS485	Usign8	03	–	06, 16
–	502	Baud Rate • 1: 1200 Baud • 2: 2400 Baud • 3: 4800 Baud • 4: 9600 Baud • 5: 19200 Baud • 6: 38400 Baud • 7: 57600 Baud • 8: 115200 Baud	Usign8	03	–	06, 16
–	503	Bus Address 0 to 247	Usign8	03	–	06, 16
–	504	Response Delay Time 0 to 200 ms	Usign8	03	–	06, 16
–	505	Parity Bit • 0: No Parity Bit • 1: Even Parity Bit • 2: Odd Parity Bit	Usign8	03	–	06, 16
–	505	Device Mode settings • 0: Enabled • 1: Disabled	Usign8	03	–	–
–	601	Totalizer Mode	Usign8	03	–	06, 16
–	602	Totalizer (not used)	Usign8	03	–	06, 16
–	603	Totalizer Input Selector	Usign8	03	–	06, 16
–	604	Totalizer Batch Count Direction	Usign8	03	–	06, 16
121	605 606	Totalizer Batch Preset Value	Float	03	06, 16	16

… 8 Operation

… Interface description

Address		Parameter	Data type			Function code
32 bit	16 bit			Read	Write (32 bit)	Write (16 bit)
–	607	Totalizer Batch Mode Setup	Usign8	03	–	06, 16
122	608	Totalizer 1 Unit	Usign8	03	–	06, 16
123	609	Totalizer 1 Unit Conversion Factor	Float	03	06, 16	16
	610					
–	611	Totalizer 1 Unit Custom Text [0 to 1]	Usign16	03	–	06, 16
–	612	Totalizer 1 Unit Custom Text [2 to 3]	Usign16	03	–	06, 16
–	613	Totalizer 1 Unit Custom Text [4 to 5]	Usign16	03	–	06, 16
–	614	Totalizer 1 Unit Custom Text [6 to 7]	Usign16	03	–	06, 16
124	615	Totalizer 2 Unit	Usign8	03	–	06, 16
125	616	Totalizer 2 Unit Conversion Factor	Float	03	06, 16	16
	617					
–	618	Totalizer 2 Unit Custom Text[0 to 1]	Usign16	03	–	06, 16
–	619	Totalizer 2 Unit Custom Text[2 to 3]	Usign16	03	–	06, 16
–	620	Totalizer 2 Unit Custom Text[4 to 5]	Usign16	03	–	06, 16
–	621	Totalizer 2 Unit Custom Text[6 to 7]	Usign16	03	–	06, 16
126	622	Totalizer 1 Value	Float	04	–	–
	623					
127	624	Totalizer 2 Value	Float	04	–	–
	625					
128	626	Batch Value	Float	04	–	–
	627					
–	628	Totalizer Password Operation	Usign8	–	–	06, 16
–	629	Totalizer Password [0 to 1]	Usign16	–	–	06, 16
–	630	Totalizer Password [2 to 3]	Usign16	–	–	06, 16
–	631	Totalizer Password [4 to 5]	Usign16	–	–	06, 16
–	632	Totalizer Reset	Usign8	03	–	06, 16
–	633	Totalizer Status	Usign8	03	–	06, 16
–	634	Totalizer Protection Status	Usign8	03	–	–

Optional text on display

An optional text will be shown automatically on the display with sending data to the registers 1001 to 1008. It allows displaying strings in two lines written via MODBUS. The first text line is filed from register 1001 to 1004, the second text line is filed from register 1005 to 1008.
It is possible to write all 8 registers in an access with the function WriteMultipleRegister (16).

The optional text lines can be disabled with the display menu an option 'USER TEXT'.

Address		Parameter	Data type			Function code
32 bit	16 bit			Read	Write (32 bit)	Write (16 bit)
–	1001	User Text Line 1 Sign 1 & 2	Usign16	03	–	06, 16
–	1002	User Text Line 1 Sign 3 & 4	Usign16	03	–	06, 16
–	1003	User Text Line 1 Sign 5 & 6	Usign16	03	–	06, 16
–	1004	User Text Line 1 Sign 7	Usign16	03	–	06, 16
–	1005	User Text Line 2 Sign 1 & 2	Usign16	03	–	06, 16
–	1006	User Text Line 2 Sign 3 & 4	Usign16	03	–	06, 16
–	1007	User Text Line 2 Sign 5 & 6	Usign16	03	–	06, 16
–	1008	User Text Line 2 Sign 7	Usign16	03	–	06, 16

… 8 Operation

… Interface description

Coil Register

Address	Parameter	Function code		Diagnosis condition
		Read	Write	
1	Diagnosis Main[0] bit 0	01, 02	–	Differential pressure sensor fail
2	Diagnosis Main[0] bit 1	01, 02	–	Static pressure sensor fail
3	Diagnosis Main[0] bit 2	01, 02	–	Sensor temperature fail
4	Diagnosis Main[0] bit 3	01, 02	–	Process temperature sensor fail
5	Diagnosis Main[0] bit 4	01, 02	–	Differential Pressure Sensor out of Limits
6	Diagnosis Main[0] bit 5	01, 02	–	Static Pressure Sensor out of Limits
7	Diagnosis Main[0] bit 6	01, 02	–	Sensor temperature out of limit
8	Diagnosis Main[0] bit 7	01, 02	–	Process Temperature out of Limits
11	Diagnosis Main[1] bit 2	01, 02	–	Differential Pressure Sensor out of Range
12	Diagnosis Main[1] bit 3	01, 02	–	Static Pressure Sensor out of Range
13	Diagnosis Main[1] bit 4	01, 02	–	Process Temperature out of Range
14	Diagnosis Main[1] bit 5	01, 02	–	Fourth sensor out of Range
17	Diagnosis Main[2] bit 0	01, 02	–	Sensor invalid
18	Diagnosis Main[2] bit 1	01, 02	–	Sensor memory fail
19	Diagnosis Main[2] bit 2	01, 02	–	Non–Volatile memory burn error
20	Diagnosis Main[2] bit 3	01, 02	–	Electronic Interface error
21	Diagnosis Main[2] bit 4	01, 02	–	Electronic Interface communication error
24	Diagnosis Main[2] bit 7	01, 02	–	Memory failure
25	Diagnosis Main[3] bit 0	01, 02	–	Non–Volatile memory burn error
26	Diagnosis Main[3] bit 1	01, 02	–	Non–Volatile storage active
27	Diagnosis Main[3] bit 2	01, 02	–	Non–Volatile checking active
31	Diagnosis Main[3] bit 6	01, 02	–	Input simulation active
32	Diagnosis Main[3] bit 7	01, 02	–	Max. Working pressure exceeded
33	Diagnosis Main2[0] bit 0	01, 02	–	Pressure over range
37	Diagnosis Main2[0] bit 4	01, 02	–	Electronic Diagnosis warning
38	Diagnosis Main2[0] bit 5	01, 02	–	Configuration error
39	Diagnosis Main2[0] bit 6	01, 02	–	PILD output
40	Diagnosis Main2[0] bit 7	01, 02	–	Changed operating conditions
41	Diagnosis Main2[1] bit 0	01, 02	–	Electronic Diagnosis alarm
42	Diagnosis Main2[1] bit 1	01, 02	–	Electronic Temperature error
43	Diagnosis Main2[1] bit 2	01, 02	–	Replace info
44	Diagnosis Main2[1] bit 3	01, 02	–	Multivariable Calculation out of Range
46	Diagnosis Main2[1] bit 5	01, 02	–	Multivariable Input out of range
47	Diagnosis Main2[1] bit 6	01, 02	–	Multivariable Input invalid
48	Diagnosis Main2[1] bit 7	01, 02	–	Wrong flow direction

Application of the Diagnosis Main and Main 2 Registers

The **266CRH / 266CRT, 266CSH /** 266CST has two 'Diagnosis' (Diagnosis Main and Main 2). The Diagnosis Main register (Address 411, 412) each containing 16 bits.
The Diagnosis Main 2 register (Address 413) containing 16 bits.
Each bit represents an error.
The registers are structured as follows:

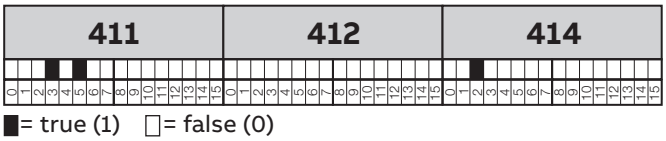


Figure 3: Diagnosis Main Register (Example, 16-bit Register)

The bit position is assigned to the errors in accordance with the 'Bit' column in the table **Diagnosis codes**.
The following assignment applies to the example in **Figure 3**:

Register / Bit	Fault message
411 Bit 3	Process temperature out of range
411 Bit 5	Differential pressure sensor out of range
414 Bit 2	Multivariable input out of range

Diagnosis codes

Register Address	Bit	Error
411	0	–
	1	–
	2	Fourth sensor out of range
	3	Process temperature out of range
	4	Static pressure sensor out of range
	5	Differential pressure sensor out of range
	6	–
	7	–
	8	Process temperature out of limits
	9	Sensor temperature out of limit
	10	Static pressure sensor out of limits
	11	Differential pressure sensor out of limits
	12	Process temperature sensor fail
	13	Sensor temperature fail
	14	Static pressure sensor fail
	15	Differential pressure sensor fail

Diagnosis codes

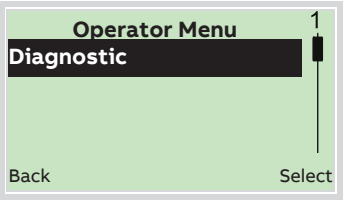
Register Address	Bit	Error
412	0	Maximum working pressure exceeded
	1	Input simulation active
	2	–
	3	–
	4	–
	5	Non-Volatile checking active
	6	Non-Volatile storage active
	7	Non-Volatile memory burn error
	8	Memory failure
	9	–
	10	–
	11	Electronic Interface communication error
	12	Electronic Interface error
	13	Non-Volatile memory burn error
	14	Sensor memory fail
	15	Sensor invalid
414	0	Wrong flow direction
	1	Multivariable input invalid
	2	Multivariable input out of range
	3	–
	4	Multivariable calculation out of range
	5	Replace info
	6	Electronic temperature error
	7	Electronic diagnosis alarm
	8	Changed operating conditions
	9	PILD output
	10	Configuration error
	11	Electronic diagnosis warning
	12	–
	13	–
	14	–
	15	Pressure overrange

9 Diagnosis / error messages

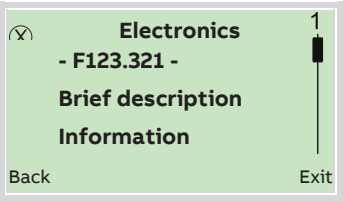
Calling up the error description

Additional details about the error that has occurred can be called up on the information level.

1. Use to switch to the information level (Operator Menu).



2. Use / to select the submenu ‘Diagnostic’.
3. Confirm the selection with .



The error message is shown on the display according to priority.
The first line shows the area in which the error has occurred.
The second line shows the unique error number. It is made up of the priority (Fxxx) and the error position (.xxx)
The next lines show a brief description of the error and information on how to remedy it.
You absolutely need to scroll the display further to read the error message in more detail.

Note
For a detailed description of the error messages and information on troubleshooting, see the following pages.

Error states and alarms

Error code	Displayed message	Possible cause	Recommended measure
C042.046	Default Value as Process Value	Substitute value for differential pressure active.	The calculation will be executed with the substitute value for differential pressure.
		The last valid value for differential pressure active.	The calculation will be executed with the last valid value for differential pressure.
		The calculation will be executed with the substitute value for absolute pressure.	The calculation will be executed with the substitute value for absolute pressure.
		Last valid value for absolute pressure active.	The calculation will be executed with the last valid value for absolute pressure.
		The calculation will be executed with the substitute value for process temperature.	The calculation will be executed with the substitute value for process temperature.
		Last valid value for process temperature active.	The calculation will be executed with the last valid value for process temperature.
		Substitute value for line temperature active.	The calculation will be executed with the substitute value for line temperature.
		Last valid value for line temperature active.	The calculation will be executed with the last valid value for line temperature.
C056.047	Wrong Process Condition for Flow	Wrong direction for root calculation.	Check process connections for the flow measurement in one direction.
		Wrong aggregate status of the measuring medium.	Check the aggregate status of the measuring medium.
C088.030	Input Simulation Active	The P-dP-value generated on the output is derived from the value simulated on the input.	Use the Device Type Manager (DTM) to switch the device back into the normal mode (end input simulation).
		The static pressure value generated on the output is derived from the value simulated on the input.	
		The sensor temperature value generated on the output is derived from the value simulated on the input.	
F099.007	Process Temperature out of Limits	Wrong PT100 connection, line break or deviating process conditions.	Check the Pt100 connections and process conditions.
F100.005	Static Pressure Out of Limits	The static pressure of the process exceeds the limits of the measuring cell. An overshoot of the static pressure can reduce accuracy, mechanically damage the membrane, and make a calibration or replacement necessary. A wrong transmitter model may have been selected.	You must check whether the pressure transmitter is suitable for the process conditions. It is likely that a different transmitter type is required.
F102.004	P-dP Out Of Limits	The measuring range has not been calculated correctly or the wrong transmitter model has been selected.	You must check whether the pressure transmitter is suitable for the process conditions. It is likely that a different transmitter type is required.
F104.032	Pressure Overrange	This effect may have been induced by other devices in the process (valves, etc.). A pressure range overshoot can result in reduced accuracy or mechanical damage of the diaphragm material and can make calibration or replacement necessary.	You must check whether the pressure transmitter is suitable for the process conditions. It is possible that a different transmitter type is required.

… 9 Diagnosis / error messages

… Error states and alarms

Error code	Displayed message	Possible cause	Recommended measure
F109.003	Process Temperature Sensor Fail	A/D converter error of the temperature sensor.	Check the connection of the temperature electronics. Temperature electronics must be replaced if the problem persists.
		Wire break of wrong Pt100 connection.	Check the Pt100 connections and process conditions.
		The reference voltage for the temperature measurement is not correct.	The PCB for the temperature measurement should be replaced.
		The difference between the main channel and the reference measurement is outside of tolerance.	
F110.002	Sensor Temperature Fail	Error in the current circuit for scanning the temperature.	The measuring cell must be replaced.
F112.001	Static Pressure Sensor Fail	Error in the current circuit for scanning the static pressure.	The measuring cell must be replaced.
F114.000	P-dP Sensor Fail	Mechanical damage on the measuring cell. Measuring cell loses filling fluid, diaphragm is torn, sensor damaged.	The measuring cell must be replaced.
F116.023	Electronic Memory Failure	Electronic memory is damaged.	The electronics must be replaced.
F118.017	Sensor Memory Fail	Measuring cell memory damaged.	The measuring cell must be replaced.
F120.016	Sensor Invalid	The measuring cell signal is not updated correctly due to an electronics error, a measuring cell error or a poorly connected measuring cell cable.	Check the cable connection and replace measuring cell if the problem persists.
		The model / the version of the measuring cell is no longer compatible with the connected version of the electronics.	The measuring cell must be replaced.
M014.037	Configuration Error	See the operating manual for possible cause of the error.	Use the Device Type Manager (DTM) to correct the configuration.
M016.039	PILD-Changed Op. Conditions	The process conditions have changed to such an extent that new settings are required for the PILD algorithm.	New training is required for this new process condition.
M018.038	PILD Output	Both impulse lines between the measuring cell and the process are either clogged or closed by valves.	Check valves and impulse line. If required, clean the impulse lines and start PILD training.
		The impulse line between the pressure measuring cell and the process is either clogged on the high pressure side or closed by valves.	
		The impulse line between the pressure measuring cell and the process is either clogged on the low pressure side or closed by valves.	
		One of the impulse lines between the pressure measuring cell and the process is either clogged or closed by valves.	

Error code	Displayed message	Possible cause	Recommended measure
M020.042	Replace Info	The electronics or the measuring cell have been replaced, but replacement mode has not been executed.	Execute replacement mode: Place switch SW 1 of the electronics in position 1 = activate replacement mode. With switch SW 2 select whether measuring cell or the electronics have been replaced. Switch device off and on. Return switch SW 1 of the electronics to position 0.
		The electronics or the measuring cell has been replaced and replacement mode for a new measuring cell must be executed.	Execute replacement mode: Only the data of the electronics can be copied into the measuring cell. Place switch SW 1 on (1) to activate replacement mode 1 - with switch SW2 select new measuring cell (1). Switch device off and on. Place switch SW 1 on (0) to deactivate replacement mode.
		The electronics or the measuring cell has been replaced, replacement mode has been activated, but in the wrong direction (SW 2 = 0).	Change replacement direction (if possible). Switch SW 1 is already in position (1), replacement mode is activated. Switch SW 2 to position (1) for 'new measuring cell'. Switch device off and on. Place switch SW 1 is position (0) to deactivate replacement mode.
M022.041	Electronic Temperature Out of Limits	The electronics temperature underranges the permissible lower limit value. Error in the current circuit for scanning the temperature.	The electronics should be replaced as soon as possible.
		The temperature of the electronics exceeds its upper limit value. Error in the current circuit for scanning the temperature.	
M024.036	Power Supply Warning	The energy supply of the device is close to the lower permissible limit.	Check the voltage on the connection terminal block and for values outside of the valid range check the external energy supply.
		The energy supply of the device is close to the permissible high limit.	
M026.024	NV Electronic Memory Burn Error	Writing to non-volatile memory was not successful.	The electronics module should be replaced as soon as possible.
M028.018	NV Sensor Memory Burn Error	Writing to non-volatile memory of the measuring cell was not successful.	The measuring cell should be replaced as soon as possible.
M030.020	Electronic Interface Error	Data exchange between measuring cell and electronics is faulty.	Switch transmitter off and back on again. Check whether error persists. If yes, replace electronics module as soon as possible.
S040.045	MV Input Value out of Range	Differential pressure input value outside of the range.	Check the value of the differential pressure.
		Static pressure input value outside of the range.	Check the value of the static pressure.
		Temperature range outside of the range.	Check the value of the temperature.

… 9 Diagnosis / error messages

… Error states and alarms

Error code	Displayed message	Possible cause	Recommended measure
S044.043	MV Calculation out of Range	Flow is outside of the range.	Compare the settings of the multivariable configuration with the process conditions.
		The volume flow is outside of the range.	
		The heat flow is outside of the range.	
		The calculated fill height is outside of the range.	
		The volume is outside of the range.	
		The mass is outside of the range.	
S052.031	Max operating pressure Exceeded	The static pressure of the process increases the maximum permissible operating pressure for the transmitter. Exceeding the maximum operating pressure can entail mechanical damage on the process connections (flanges, pipes, etc.) or cause dangerous situations.	You must check whether the pressure transmitter is suitable for the process conditions.
S054.006	Sensor Temperature Out of Limits	The temperature of the process environment influences the pressure transmitter. Excess temperatures can reduce accuracy, impair device components, and make a calibration or replacement necessary.	You must check whether the pressure transmitter is suitable for the process conditions. A different type of installation could be necessary, for example use of diaphragm seals.

10 Maintenance

Safety instructions

⚠ WARNING

Bodily injury!
Transmitters with explosion protection must be either repaired by the manufacturer or approved by a certified expert after the repair.

- Comply with the relevant safety regulations and take the appropriate safety precautions before, during, and after repair work.

⚠ WARNING

Bodily injury!
The device can be operated at high pressure and with aggressive media. Any medium that squirts out can cause severe injuries.

- Depressurize the pipeline/tank before opening the transmitter connection.

NOTICE

Damage to components!
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 before touching electronic components.

General

If pressure transmitters are used as intended under normal operating conditions, no maintenance is required.
It suffices if the measuring range start and/or the spat are checked at specific intervals – depending on the operating conditions. If deposits are expected to accumulate in the measuring cell, the measuring cell should be cleaned on a regular basis, in accordance with the operating conditions.
Preferably the measuring cell should be cleaned in a workshop.

Note
For transmitters in safety-relevant applications in accordance with IEC 61508, verification in accordance with the paragraph ‘Acceptance test’ in chapter ‘Functional safety in accordance with IEC 61508’ is prescribed at fixed time intervals.

Repair and maintenance tasks must only be executed by employees of an authorized customer service organization.
For replacement and repair of individual components use original parts.

Measuring cell of the multivariable transmitter

Normally the measuring cell of the transmitter is essentially maintenance-free.
Nevertheless the following should be checked regularly:

- The gaskets of connected lines must be intact. There must not be any visible cracks on the process flanges.
- There must be no leaks at the connection points between sensor and flange and on the vent / drain valves.
- The screws on the process flanges must not show any corrosion.

If defects are detected in the inspection described above, the parts in question must be replaced with original spare parts. If information on spare parts is required, contact an ABB office or refer to the spare parts list. If spare parts are used that are not original parts, the guarantee is invalidated.

Cleaning

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the seals.
To avoid static charge, a damp cloth must be used for cleaning.

11 Repair

Safety instructions

⚠ WARNING

Bodily injury!
Transmitters with explosion protection must be either repaired by the manufacturer or approved by a certified expert after the repair.

- Comply with the relevant safety regulations and take the appropriate safety precautions before, during, and after repair work.

⚠ WARNING

Bodily injury!
The device can be operated at high pressure and with aggressive media. Any medium that squirts out can cause severe injuries.

- Depressurize the pipeline/tank before opening the transmitter connection.

⚠ WARNING

Potential danger if device is disassembled incorrectly!
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.

- Carefully read the instructions in **Safety**, **Mounting**, and **Electrical connections**, and perform the specified steps in reverse order.

NOTICE

Damage to components!
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 before touching electronic components.

Spare parts

Repair and maintenance activities may only be performed by authorized customer service personnel.
When replacing or repairing individual components, use original spare parts.

Note
Spare parts can be ordered from ABB Service:
Please contact Customer Center Service acc. to page 5 for nearest service location.

Opening and closing the housing

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 25 to open and close the housing safely.

After tasks on the transmitter housing, for devices with ‘Ex d’ type of protection strictly ensure that the housing cover is safeguarded again.
To do this, a safety screw (hexagon socket screw) is provided on both facing sides of the electronics housing, at the bottom.

Mounting / dismounting the operating button unit

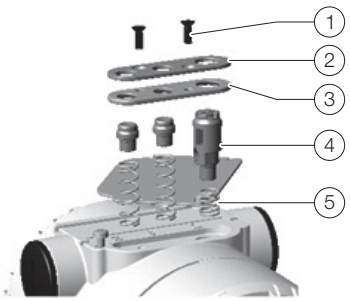


Figure 4: Operating button unit

1. Unscrew the fastening screws of the name plate and swing the name plate to the side to obtain access to the local operating elements.
2. Unscrew the fastening screws (1) of the button unit that hold the spring-loaded plastic part.
3. Remove the seal (3) that is located below the plastic cover of the button unit.
4. Now the three operating buttons (4) and the springs (5) can be taken out.

Mounting / dismounting the LCD display

Refer to **Opening and closing the housing** on page 25 and **Rotate the LCD display** on page 26.

1. On the side of the electronics module / LCD display, unscrew the housing cover.
2. Fit on the LCD display. Depending on the install position of the multivariable transmitter, the LCD display can be fit on in four different positions. Consequently it can be rotated by ± 90° or ± 180°.
3. Screw on the housing cover hand tight.

Removing / installing the process flange

1. Unscrew the fastening screws of the process flanges in cross pattern (hexagon socket wrench AF 13 mm (0.51 in).
2. Carefully take off the process flanges so that the separating diaphragms are not damaged.
3. Clean the separating diaphragms, and if necessary the process flanges with a soft brush and a suitable cleaning agent.

NOTICE

Potential damage to parts!

Components can be damaged using the wrong cleaning tools.

- Do not use any sharp-edged or pointed tools.

4. Insert new O-rings into the process flanges.
5. Fit the process flanges onto the measuring cell.
   The flange surfaces of both process flanges must be positioned in one plane and at right angles to the electronics housing (vertical process flanges are the exception).
6. Check the thread of the screws for the process flanges for ease of movement. To do this, screw on the nuts by hand to the screw head. If this is not possible, use new screws and nuts.
7. Lubricate the screw thread and the seat of the threaded union, for example with 'Anti-Seize AS 040 P' (supplier: WEICON GmbH & Co.KG, Münster, Germany).

Note

For the oil-free and grease-free version, after installation of the process flange, the measuring chambers must be cleaned again.

8. Installation of the process flanges:
   - First tighten the screws / nuts of the process flanges with a torque wrench to a pre-tightening torque of MJ = 2 Nm (0.2 kpm), working in a cross pattern.
   - Then tighten the screws / nuts of the process flanges with a pre-tightening torque of MJ = 10 Nm (1.0 kpm), working in a cross pattern.
   - Retighten all screws / nuts (in a cross pattern), this time with a total tightening angle of αA = 180°; in two steps, 90° for each step.
     Some transmitters have size M10 screws. Tighten these screws with a total tightening angle of αA = 270°; in three steps, 90° each step.

… 11 Repair

… Removing / installing the process flange

Replacing the measuring cell

1. Disconnect the transmitter from the process via the valve manifold or the shut-off valves.
2. Open the vent valves to vent the measuring cell.
3. Disconnect the energy supply and the wiring supply to the transmitter.
4. Unscrew and remove the 4 fastening screws (Figure 5, Pos. ①), with which the transmitter is bolted onto the fastening bracket or valve manifold.

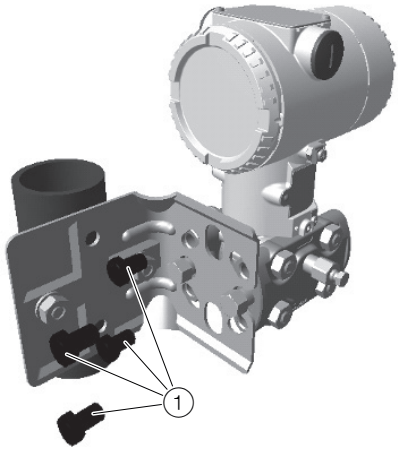


Figure 5: Fastening screws

5. Open the housing cover of the electronics side, unscrew both fastening screws (Figure 6, Pos. ②) and pull out the electronics module.

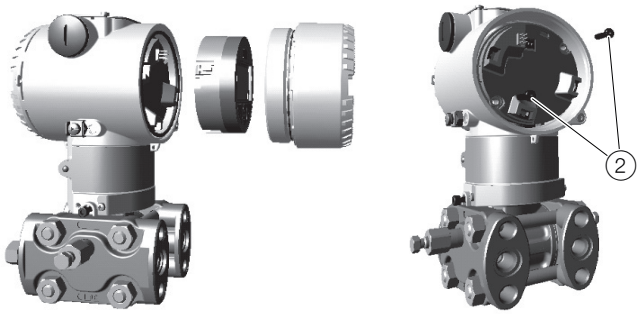


Figure 6: Housing cover / electronic module

6. The electronics module is connected via a ribbon cable with connector to the measuring cell; carefully unplug this connector from the electronics module.
7. Unscrew the electronics housing of the pressure transmitter. To do this, unscrew the fixing screws (Figure 7, Pos. ③), so that the housing can be turned.
8. Turn the electronics housing counterclockwise (Figure 7, Pos. Ⓐ) until it can be taken off (Figure 7, Pos. Ⓑ).

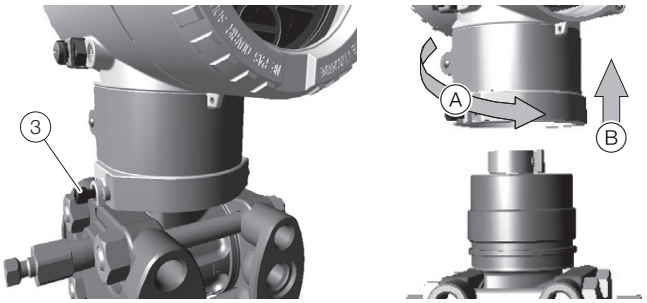


Figure 7: Electronic housing

9. Unscrew the fastening screws of the measuring cell and remove the process flanges.
10. After each dismounting, the O-rings (Figure 8, Pos. ④) must be replaced.

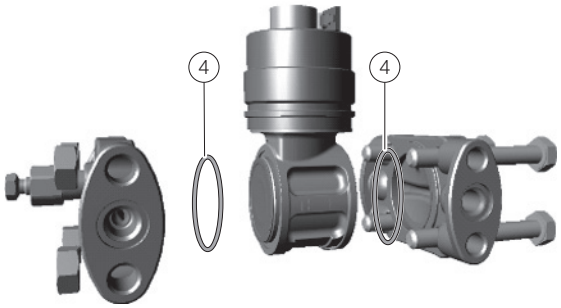


Figure 8: Process flanges

11. Attach the flanges. To do this, executed the steps described above in the reverse sequence.

When the transmitter is reassembled, it can be reconfigured. The 266 transmitter is equipped with a self-adjustment function and thus applies the previous configuration data automatically.

12. Before the transmitter is switched on again, place the DIP switches 1 and 2 (Figure 8, Pos. ⑤) in the upper position. Connect the transmitter to the energy supply and wait for 10 seconds; then return the DIP switches 1 and 2 to the lower position.

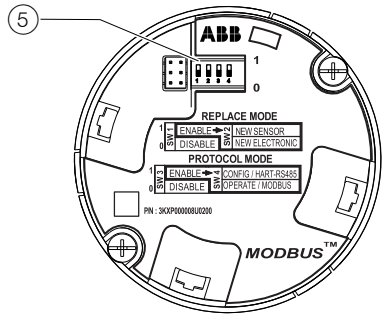


Figure 9: DIP switches

13. Screw the transmitter onto its fastening bracket and onto the valve manifold. To correct a possible zero point offset, we recommend that you execute the 'PV-BIAS' function. See **Zero point correction following installation** on page 36.

12 Dismounting and disposal

Dismounting

⚠ WARNING

Risk of injury due to process conditions.

The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when dismantling the device.

- If necessary, wear suited personal protective equipment during disassembly.
- Before disassembly, make sure that the process conditions do not pose any safety risks.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Bear the following points in mind when dismantling the device:

- Switch off the power supply.
- Disconnect electrical connections.
- Allow the device / piping to cool and depressurize and empty. Collect any escaping medium and dispose of it in accordance with environmental guidelines.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notices in **Returning devices** on page 15.

… 12 Dismounting and disposal

Disposal

Note

Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following points in mind when disposing of them:

- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, our Service can take care of its pick-up and disposal for a fee.

13 Specification

Note
The device data sheet is available in the ABB download area at www.abb.com/pressure.

Operating limits 266CRx

Note
See also data sheet DS/S26 for information on other possible restrictions based on diaphragm seal versions.

Pressure limits

Gauge pressure limits

The transmitter models 266CRX can operate without damage within the following overpressure limits:

Sensors	Filling fluid	Gauge pressure limits
C to N	Silicone oil	0.07 kPa abs., 0.7 mbar abs., 0.5 mm Hg and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected
C to N	Fluorocarbon (Galden™)	17.5 kPa abs., 175 mbar abs., 131 mmHg and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected

Static pressure limits

The transmitter models 266CRX can operate within the specifications with the following overpressure limits:

Sensors	Filling fluid	Static pressure limits
C to N	Silicone oil	3.5 kPa abs., 35 mbar abs., 0.5 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected
C to N	Carbon fluoride (Galden™)	17.5 kPa abs., 175 mbar abs., 2.5 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected

The overpressure limits and upper static pressure limits can be lowered by means of the nominal pressure of the diaphragm seal flange; see remote seal data sheet DS/S26.

Test pressure

The transmitters can withstand a pressure test with the following line pressure without leaking:

Model	Test pressure
266CRX	1.5 × nominal pressure (static pressure limit) simultaneously on both sides*

* Or double the value of the pressure sensor flange pressure rating, depending on which value is less. Meets hydrostatic test requirements of ANSI/ISA-S 82.03.

Temperature limits °C (°F)

Environment

This is the operating temperature.

All models	Ambient temperature limits
Silicone oil	−40 and 85 °C (−40 and 185 °F)
Fluorocarbon (Galden™)	−40 and 85 °C (−40 and 185 °F)

All models	Ambient temperature limits
Integral LCD display*	−40 and 85 °C (−40 and 185 °F)
Viton® gasket	−20 and 85 °C (−4 and 185 °F)
PTFE gasket	−20 and 85 °C (−4 and 185 °F)

* If may no longer be possible to read the LCD display clearly below −20 °C (−4 °F) and above 70 °C (158 °F).

Note
For applications in potentially explosive environments, the temperature range specified on the certificate / approval which depends upon the type of protection sought shall apply.

Process

All models	Process temperature limits
Silicone oil	−40 and 121 °C (−40 and 250 °F)*
Fluorocarbon (Galden™)	−40 and 121 °C (−40 and 250 °F)**
Viton® gasket	−20 and 121 °C (−4 and 250 °F)
PTFE gasket	−20 and 85 °C (−4 and 185 °F)

* 85 °C (185 °F) for applications under 10 kPa, 100 mbar abs., 1.45 psia up to 3.5 kPa abs., 35 mbar abs., 0.5 psia

** 85 °C (185 °F) for applications below atmospheric pressure up to 17.5 kPa abs., 175 mbar abs., 2.5 psia

… 13 Specification

… Operating limits 266CRx

The table below contains the specifications for diaphragm seal filling fluids when used in transmitters with (a) diaphragm seal(s).

Filling fluid (application)	Process temperature and pressure limits			
	T_{max} °C (°F) @ Pabs > than	P_{min} mbar abs (mm Hg)	T_{max} °C (°F) @ P_{min}	T_{min} °C (°F)
Silicone oil DC 200 10 cSt	250 (480) @ 385 mbar	0.7 (0.5)	130 (266)	−40 (−40)
Silicone oil Baysilone PD5 5 cSt	250 (480) @ 900 mbar	0.7 (0.5)	45 (123)	−85 (−121)
Fluorocarbon Galden G5™ (oxygen applications)	160 (320) @ 1 bar	2.1 (1.52)	60 (140)	−20 (−4)
Silicone oil (high-temperature applications)	375 (707) @ 1 bar	0.7 (0.5)	220 (328)	−10 (14)
Mineral oil Esso Marcol 122™ (food and beverage, sanitary applications) with FDA approval	250 (480) @ 630 mbar	0.7 (0.5)	110 (230)	−6 (21)

Flushing ring gasket material	Process limits		
	Pressure (max.)	Temperature	P x T
Garlock®	6.9 MPa, 69 bar, 1000 psi	−73 and 204 °C (−100 and 400 °F)	250000 (°F x psi)
Graphite	2.5 MPa, 25 bar, 362 psi	−100 and 380 °C (−148 and 716 °F)	
PTFE	6 MPa, 60 bar, 870 psi	−100 and 250 °C (−148 and 482 °F)	

Operating limits 266CSx

Pressure limits

Gauge pressure limits

The transmitter models 266CSX can operate without damage within the following overpressure limits:

Sensors	Filling fluid	Gauge pressure limits
A	Silicone oil	0.5 kPa abs., 5 mbar abs., 0.07 psia and 0.6 MPa, 6 bar, 87 psi or 2 MPa, 20 bar, 290 psi depending on code variant selected*
A	Fluorocarbon (Galden)	17.5 kPa abs., 175 mbar abs., 2.5 psia and 0.6 MPa, 6 bar, 87 psi or 2 MPa, 20 bar, 290 psi depending on code variant selected*
C to N	Silicone oil	0.5 kPa abs., 5 mbar abs., 0.07 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected*
C to N	Fluorocarbon (Galden)	17.5 kPa abs., 175 mbar abs., 2.5 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected*

* 1 MPa, 10 bar, 145 psi for Kynar-PVDF

Static pressure limits

The transmitter models 266CSX can operate within the specifications with the following limits:

Sensors	Filling fluid	Static pressure limits
A	Silicone oil	3.5 kPa abs., 35 mbar abs., 0.5 psia and 0.6 MPa, 6 bar, 87 psi or 2 MPa, 20 bar, 290 psi depending on code variant selected*
A	Fluorocarbon (Galden)	17.5 kPa abs., 175 mbar abs., 2.5 psia and 0.6 MPa, 6 bar, 87 psi or 2 MPa, 20 bar, 290 psi depending on code variant selected*
C to N	Silicone oil	3.5 kPa abs., 35 mbar abs., 0.5 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected*
C to N	Fluorocarbon (Galden)	17.5 kPa abs., 175 mbar abs., 2.5 psia and 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5,945 psi depending on code variant selected*

* 1 MPa, 10 bar, 145 psi for Kynar-PVDF

Test pressure

The transmitters can withstand a pressure test with the following line pressure without leaking:

Model	Test pressure
266CSX	1.5 x nominal pressure (static pressure limit) simultaneously on both sides*

* Meets hydrostatic test requirements of ANSI/ISA-S 82.03.

Temperature limits °C (°F)

Environment

This is the operating temperature.

All models	Ambient temperature limits
Silicone oil	−40 and 85 °C (−40 and 185 °F)
Fluorocarbon (Galden™)	−40 and 85 °C (−40 and 185 °F)

All models	Ambient temperature limits
Integrated digital display (LCD)*	−40 and 85 °C (−40 and 185 °F)
Viton™ gasket	−20 and 85 °C (−4 and 185 °F)
PTFE gasket	−20 and 85 °C (−4 and 185 °F)

* If may no longer be possible to read the digital display (LCD) clearly below −20 °C (−4 °F) and above 70 °C (158 °F).

Note

For applications in potentially explosive environments, the temperature specified on the certificate / approval which depends upon the type of protection sought shall apply.

Process

All models	Process temperature limits
Silicone oil	−40 and 121 °C (−40 and 250 °F)*
Fluorocarbon (Galden™)	−40 and 121 °C (−40 and 250 °F)**
Viton™ gasket	−20 and 121 °C (−4 and 250 °F)
PTFE gasket	−20 and 85 °C (−4 and 185 °F)

* 85 °C (185 °F) for applications under 10 kPa, 100 mbar abs., 1.45 psia up to 3.5 kPa abs., 35 mbar abs., 0.5 psia

** 85 °C (185 °F) for applications below atmospheric pressure up to 17.5 kPa abs., 175 mbar abs., 2.5 psia

14 Additional documents

Note

All documentation, declarations of conformity, and certificates are available in ABB's download area.
www.abb.com/pressure

15 Appendix

Return form

Statement on the contamination of devices and components

Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.
Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

Customer details:

Company:

Address:

Contact person: Telephone:

Fax: Email:

Device details:

Type: Serial no.:

Reason for the return/description of the defect:

Was this device used in conjunction with substances which pose a threat or risk to health?

☐ Yes ☐ No

If yes, which type of contamination (please place an X next to the applicable items):

☐ biological ☐ corrosive / irritating ☐ combustible (highly / extremely combustible)

☐ toxic ☐ explosive ☐ other toxic substances

☐ radioactive

Which substances have come into contact with the device?

1.

2.

3.

We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date Signature and company stamp

Trademarks

Modbus is a registered trademark of the Modbus Organization

Garlock is a registered trademark of Garlock Sealing Technologies LLC

Galden is a Montefluos trademark

Neobee M 20 is a Stepan Company trademark

Syltherm is a Dow Chemical Company trademark

ABB Limited
Measurement & Analytics
Howard Road, St. Neots
Cambridgeshire, PE19 8EU
UK
Tel: +44 (0)870 600 6122
Fax: +44 (0)1480 213 339
Email: enquiries.mp.uk@gb.abb.com

ABB Inc.
Measurement & Analytics
125 E. County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB Automation Products GmbH
Measurement & Analytics
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

ABB S.p.A.
Measurement & Analytics
Via Luigi Vaccani 4
22016 Tremezzina (CO)
Italy
Tel: +39 0344 58111
Email: abb.instrumentation@it.abb.com

abb.com/pressure

3KXP400009R4201

OI/266CXX/MODBUS-EN Rev. A 07.2018